AKD PDMM™

User Guide

Edition December 2012, Revision B

Valid for Hardware Revision DB

Patents Pending

Part Number 903-200016-00

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Table of Contents

1 Welcome to AKD PDMM User Guide

Welcome to the AKD PDMM User Guide, a guide for installing, setting up, and using an AKD PDMM. Complete product documentation in pdf or online help format is included on your installation disk. Product manuals are also posted on the Kollmorgen website and are updated on the website as needed between releases. Check the website for the most current manuals.

The documentation available on the Kollmorgen website includes the following:

Related documents for the AKD PDMM series include:

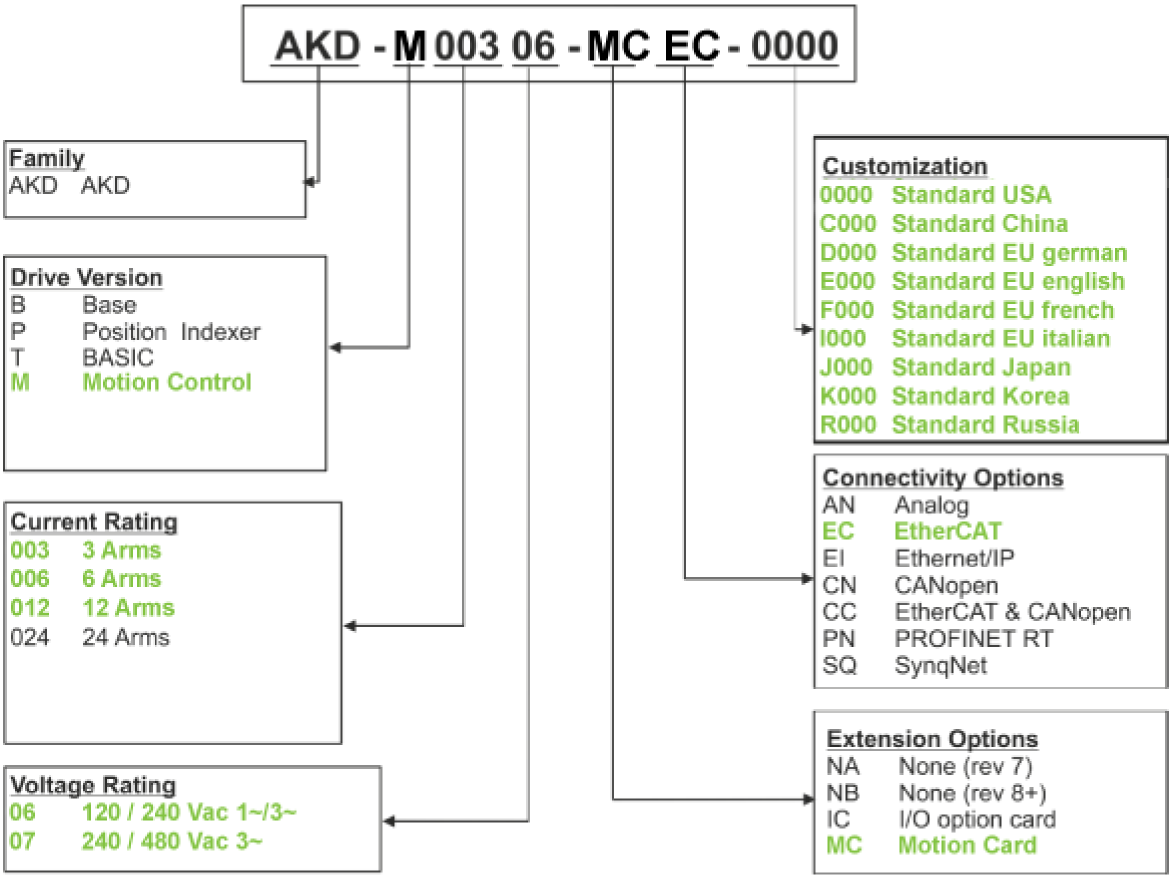
- *AKD PDMM Quick Start* (also provided in hard copy). This guide provides instructions for initial drive setup and connection to a network.
- *AKD PDMM Installation Manual* (also provided in hard copy for EU customers). This manual provides instructions for installation and drive setup.
- *AKD PDMM Users Manual*. This manual describes how to use your drive in common applications. It also provides tips for maximizing your system performance with the AKD PDMM.
- *Accessories Manual*. This manual provides documentation for accessories like cables and regen resistors used with AKD PDMM. Regional versions of this manual exist.

2 AKD PDMM Models

AKD PDMM drive models are available in a variety of combinations of features. The part number identifies the features included in your model.

NOTE AKD PDMM is only available for EtherCAT field busses.

The figure below shows part number identification for drive features. Features available in the AKD PDMM are marked bold green.



The customization code includes language version of printed material for European countries:

- D000 for German
- E000 for English
- F000 for French
- I000 for Italian

3 Software Setup

3.1 Install and Start the KAS IDE

Once the Kollmorgen Automation Suite Integrated Development Environment (KAS IDE) installation is complete, click the IDE icon to launch the program.

NOTE The KVB software used for developing an HMI display does not install with the KAS IDE and must be installed separately.

Begin a new project in the KAS IDE by selecting **File > New**. This will launch the **Add a New Controller** window.

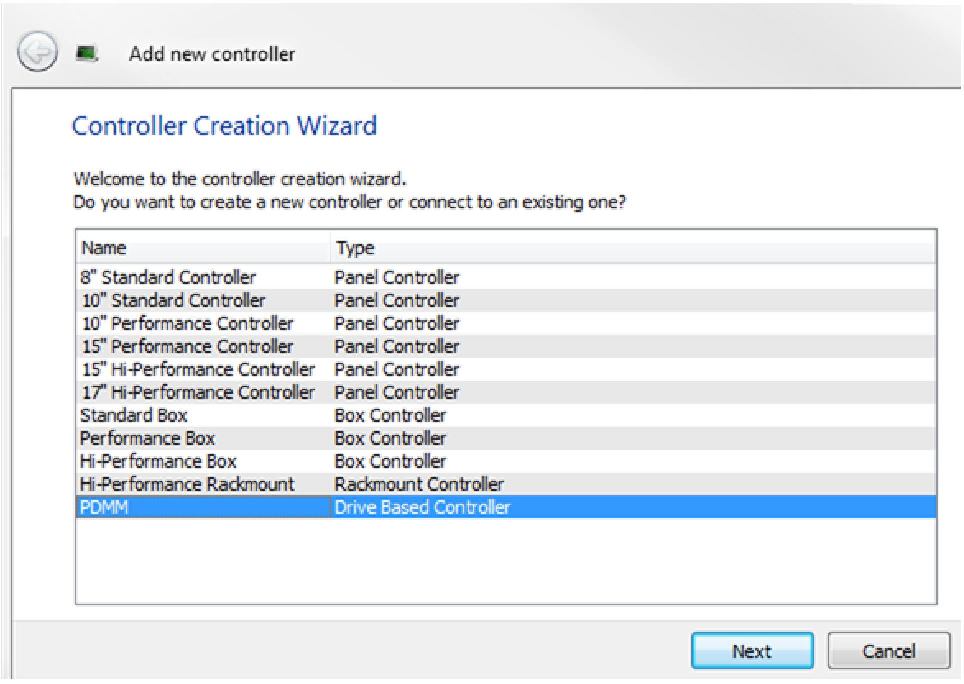


Figure 5-1: Add a New Controller

Select your AKD PDMM model from the list and click Next. You will then be prompted to select an application template:

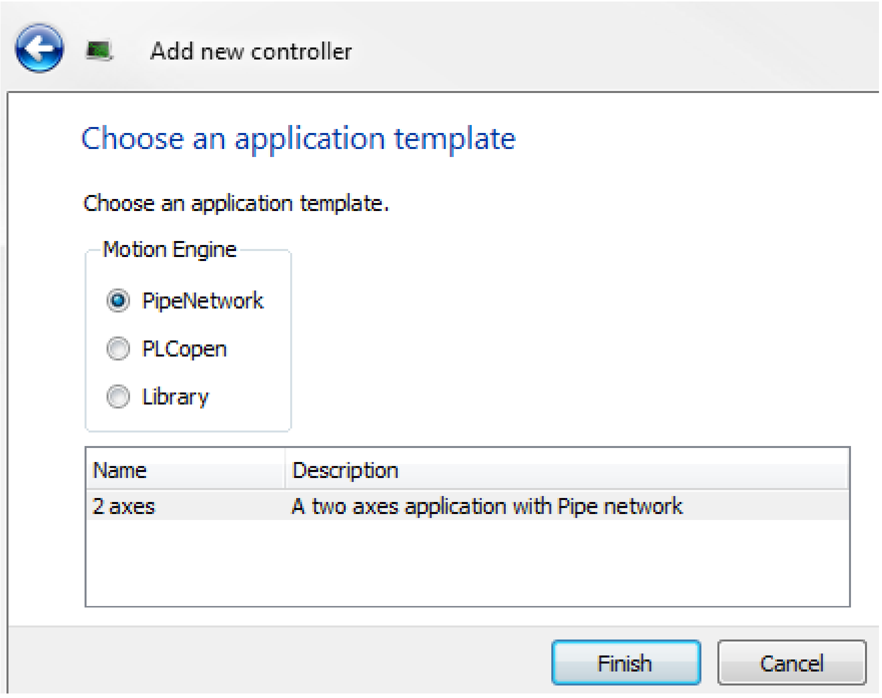


Figure 5-2: Select Application Template

Choose from PipeNetwork, PLCopen, or Library, and click Finish. The controller will then be added to the project view.

To associate the project with the IP address of the PDMM controller, right click on the Controller option in the Project View.

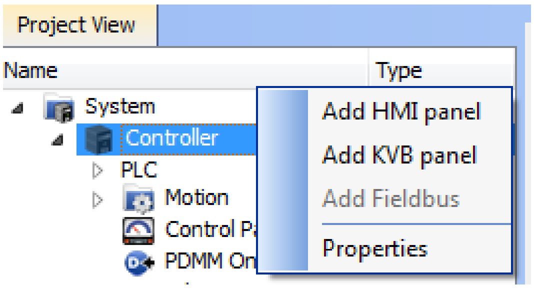


Figure 5-3: Controller Selection

Select Properties and the following screen appears:

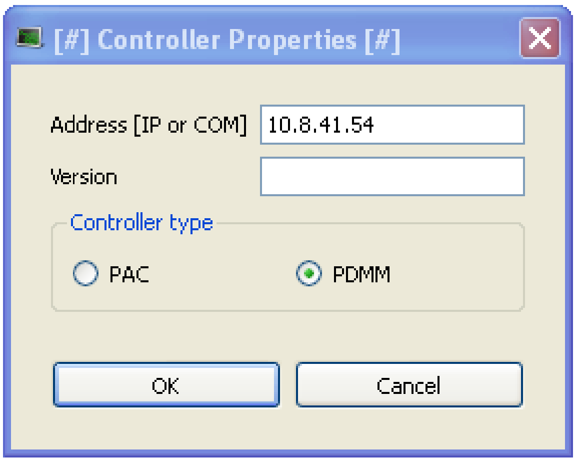


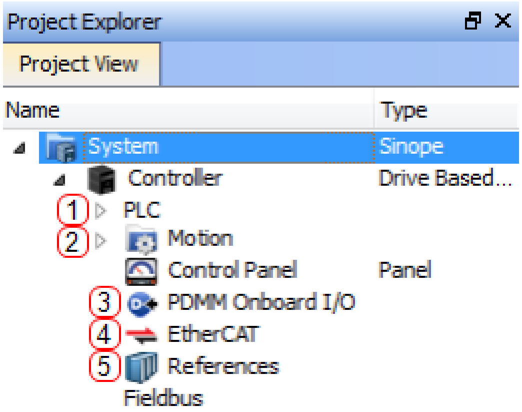
Figure 5-4: Controller Properties

Type in the IP address of the PDMM, set the Controller Type to PDMM and click OK.

3.2 KAS IDE Project View

The KAS IDE contains tools for configuring the EtherCAT network, setting up and tuning the drives, adding and configuring HMIs, and creating a PLC program. For more complete information see the KAS IDE User Guide.

Once a project (new or saved) is opened, the user can open a variety of items to build a project from the Project Explorer:



1. Create PLC Programs
2. Add Motion
3. Configure Resident I/O
4. Configure Drives and Remote I/O
5. Add Additional Reference Documents

Figure 5-5: Project View

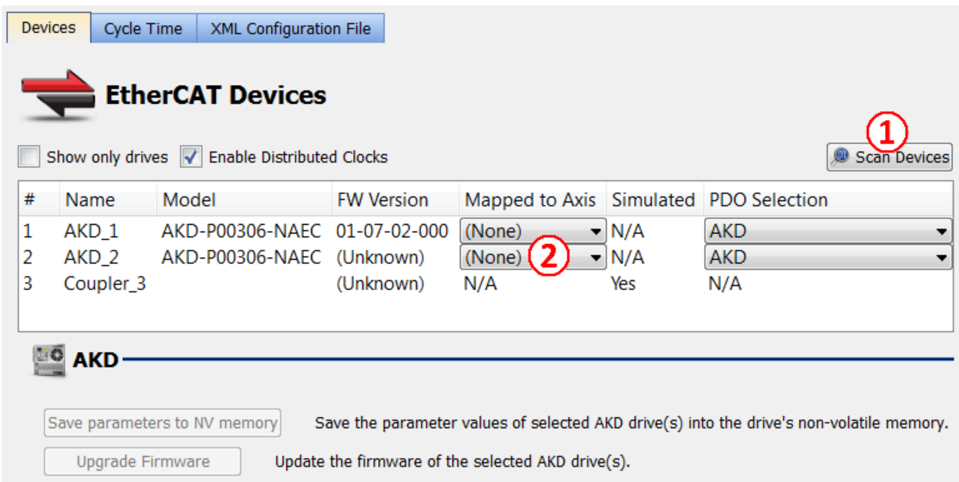
3.3 Configuring the Drives and Remote I/O

All drives, including the drive in the PDMM itself and the Remote I/O, can be configured by the IDE. In order to connect to an EtherCAT device you must first compile your project. After the project is compiled you must connect to the target:

1. Compile Project
2. Connect to Target

Figure 5-6: Compile and Connect

Next click on the EtherCAT item in the project view to bring up the EtherCAT Devices screen in the IDE workspace. Click on Scan Devices and the IDE will launch a view which automatically identifies your connected device(s). Click OK, to add these devices to the project.



1. Go to the EtherCAT Devices view and press Scan Devices
2. Mapped to Axis in the Application

Figure 5-7: Scan Devices & Mapped to Axis

The devices are added to the project view:

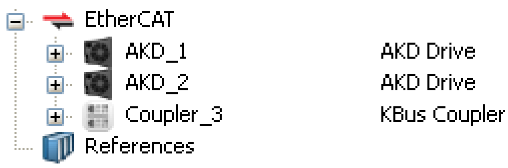


Figure 5-8: Devices Added to Project

To communicate directly with a drive without running a project, first compile and download the project:

Step 1: Compile Project

Step 2: Download Project

1. Compile Project
2. Download Project

Figure 5-9: Compile and Download

Online Configuration Mode must also be active. Click on the EtherCAT item in the project tree and then click on the OnlIne Configuration Mode button next to Scan Devices:

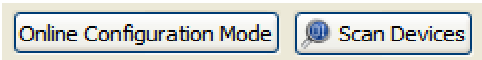


Figure 5-10: Online Configuration Mode

Online Configuration Mode is now active. To configure a particular item in the EtherCAT network, click on the item in the project tree. A set of screens will open in the work space that enable the user to completely configure the selected drive:

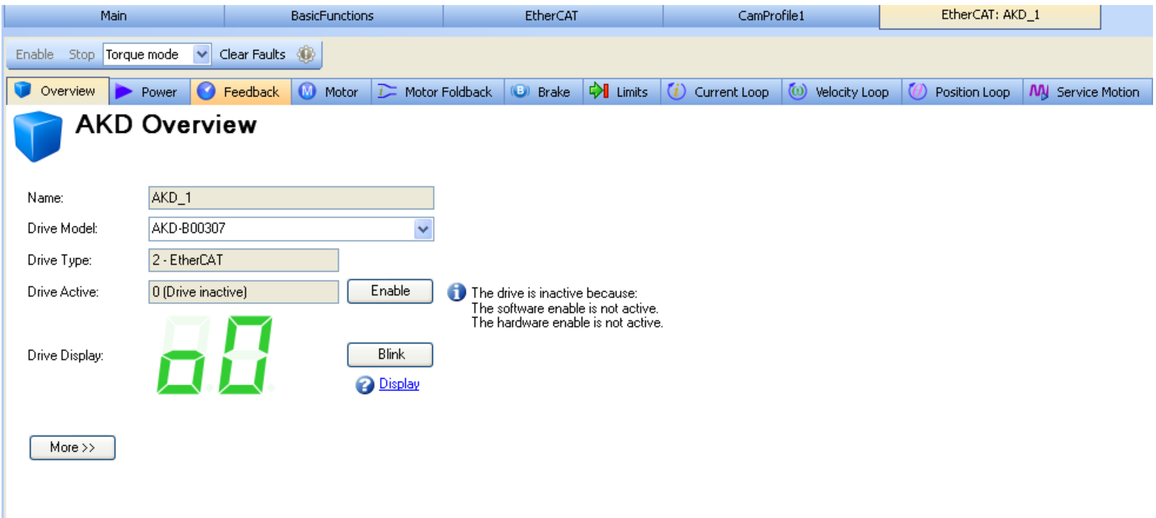


Figure 5-11: AKD GUI screens

Additionally, the setup wizard will guide you through a set of configuration steps:

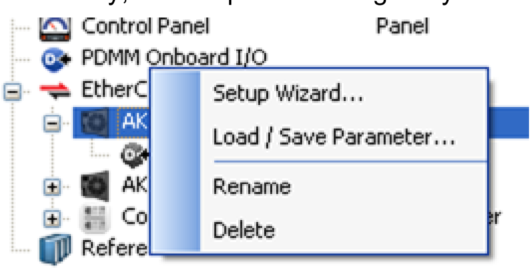
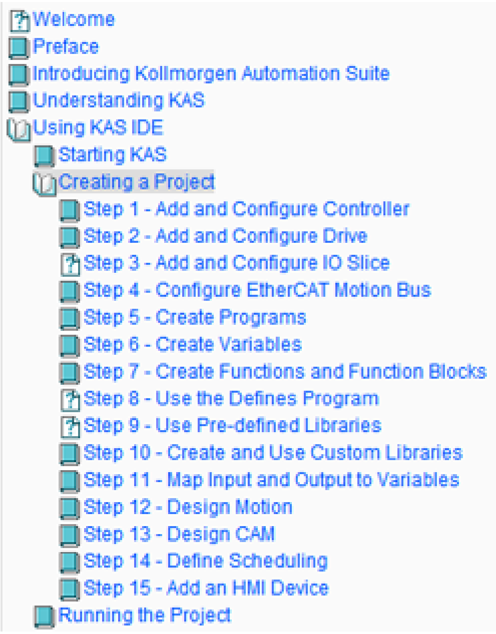


Figure 5-12: Setup Wizard

3.4 Where To Go From Here

Depending upon your need, you should either continue using this manual or use the KAS IDE web help.

- For more information about the KAS IDE embedded WorkBench views, see chapters Using Embedded Workbench Views (pg 29) through Using Parameters and the Terminal Screen (pg 114).
- For more information about programming your application and system, see the KAS IDE Online Help. The best place to start is *Using KAS IDE* > *Creating a Project* > *Steps 1 - 15*.



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4 Initial Drive Setup

4.1 Initial Drive Setup

The AKD PDMM Quick Start Guide provides details for initial drive setup. Initial drive setup consists of the following general steps:

Hardware Installation:

1. Install the drive on your conductive panel and connect the Protective Earth ground.
2. Connect the logic power you will need to operate all of the control logic to X1.
3. Connect the motor power to X2.
4. Connect the feedback to X10.
5. Connect the inputs and outputs you will be using on X7 and X8.
6. Bring AC power to the unit and connect AC power to X3 or X4.
7. Connect drive communications to X11.
8. Confirm that you can communicate with the drive and that your PC is linked to the AKD PDMM.

Software Installation and Drive Communication Setup:

1. Install and start the interface software (KAS IDE).
2. Set the drive IP address using the S1 and S2 switches.
3. Configure the drive using the **Setup Wizard**.

KAS IDE System Requirements

Required Components: Microsoft .NET Framework 2.0

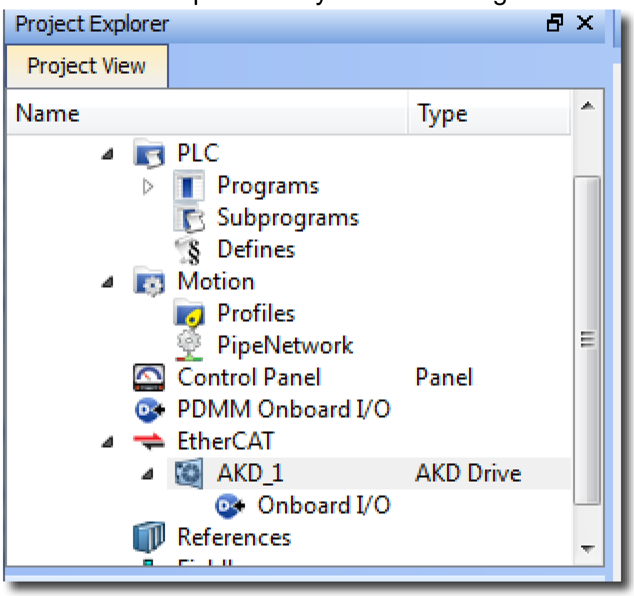
Supported Operating Systems:

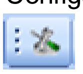
- Windows XP
- Windows Vista
- Windows 7

4.2 AKD PDMM Setup Wizard

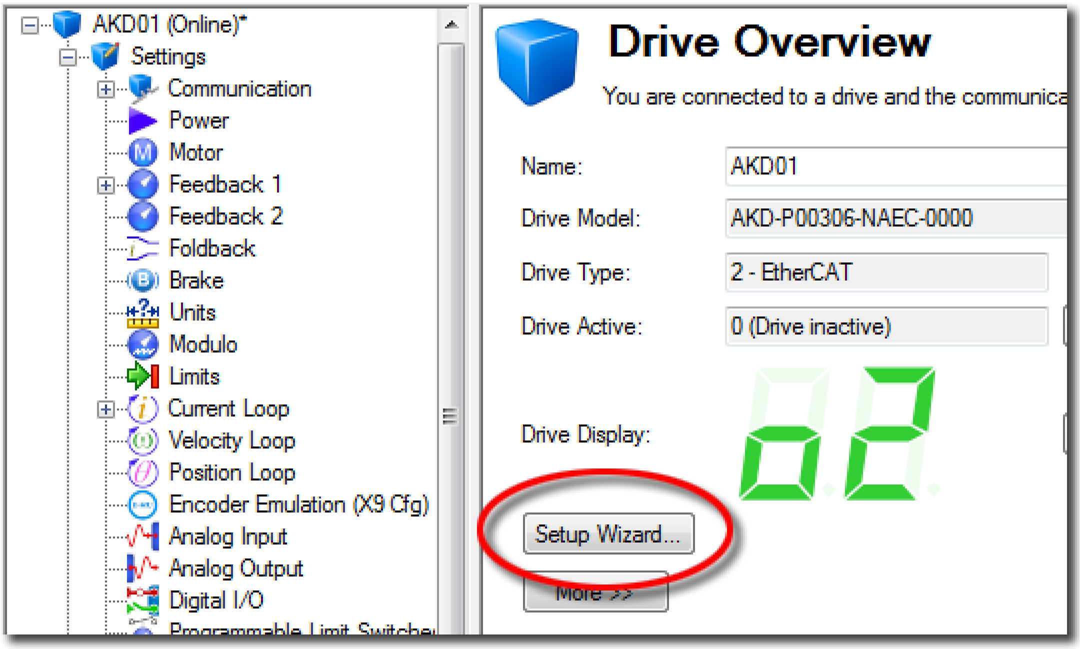
The Setup Wizard contains step-by-step instructions for configuring a drive for the first time and generating a simple test motion. You can access the Setup Wizard from the Drive Overview screen or by right clicking on the drive name.

1. Access the Setup Wizard by double-clicking on the drive name in the project view.



2. Enable Online Configuration mode from the toolbar, by pressing the “Toggle Online Configuration Mode” button. 

3. After the drive is connected, you can press the Setup Wizard button in the AKD Drive Overview screen

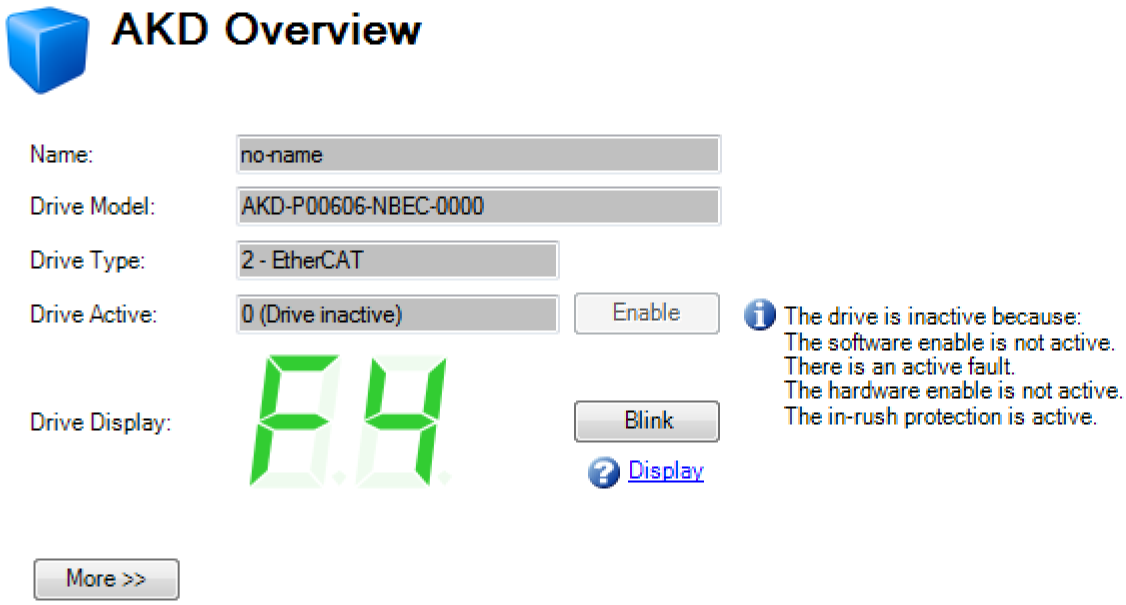


The Setup Wizard is useful during the initial setup. The wizard confirms your connection with the drive and leads you through a series of steps to quickly get your drive up and running. With plug and play feedback devices, several steps are skipped (feedback, brake) because the drive automatically configures these settings. For all systems, you can select the units you want to use, configure your operation mode, tune the system, and perform some simple jog moves within the wizard. After you are comfortable with the basic system setup, you can save your settings to the drive and exit the wizard.

5 Using Embedded Workbench Views

5.1 Drive Overview

Once your drive is connected, the **Overview** shows a summary of the drive that you are using.



You can view or edit the following information from the Overview window.

Button or Dialog Box	Description	Parameter
Name	Names each drive in use with a unique identifier.	DRV.NAME (pg 291)
Drive Model	Displays the model number of this drive. The model number is also on the label on the side of the drive. If you are offline, then you can change the type of drive that you are simulating.	DRV.INFO (pg 287)
Drive Type	Selects the operational fieldbus for your drive.	DRV.TYPE (pg 299)
Drive Active	The drive is active when it is enabled and also supplies voltage to the motor.	DRV.ACTIVE (pg 264)
Enable	Click **Enable** to turn on the power stage in the drive and apply voltage to the motor. This command may fail for many reasons; see "DRV.EN " (=> p. 281) for further details.	DRV.EN (pg 281)
Disable	Click Disable to turn off the power stage and remove the voltage applied to the motor.	DRV.DIS (pg 272)
Drive Display	This graphic replicates the two-digit seven-segment display located on the front face of the drive. The seven-segment display shows a code that indicates the state of the drive and any faults that may be present. EWV[1] shows a copy of what the drive display currently shows. A key to the display is here.	
Blink	Click Blink to force the display to alternate between the whole display being on and the whole display being off for 20 seconds. You can use this button to confirm that you are communicating with the correct drive hardware.	DRV.BLINKDISPLAY (pg 264)
Setup Wizard	The Setup wizard takes you through the essential configuration steps so that you can control the motor movement.	

[1]Embedded Workbench Views

Button or Dialog Box	Description	Parameter
More	Click **More** to display **Serial Number**, **Firmware Version**, **Cumulative On Time**	
Serial Number	This text box displays the unique serial number of the drive you are communicating with. The serial number is also shown on the label on the side of the drive.	DRV.INFO (pg 287)
Firmware Version	This text box displays the version of the firmware code running inside the drive.	DRV.VER (pg 300)
Cumulative On Time	This text box displays the cumulative time this drive has been powered on. When the drive is powered on, this value continues counting from the value it had when the drive was last turned off.	DRV.RUNTIME (pg 296)

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6 Configuring Drive Power

6.1 Power

6.1.1 Drive Setup for Power and Bus

The **Power** screen allows you to confirm Power Bus settings and accommodates external regeneration needs if required. Nothing is required for this screen if you have no regeneration requirements. Review the data on the screen to be certain the bus voltage is at the appropriate levels you expect (approximate input line AC voltage * 1.4). The other values are the appropriate limits for over voltage and under voltage for the particular drive. You can select the undervoltage fault mode to trigger either only when the drive is enabled or always.

From the **Power** screen, you can view and configure the drive power settings as follows:

Button or Dialog Box	Description	Parameter
Measured Bus Voltage	Reads the current DC bus voltage.	VBUS.VALUE (pg 448)
Over Voltage Fault Level	Reads the over voltage fault level.	VBUS.OVFTHRESH (pg 445)
Under Voltage Fault Level	Reads the under voltage fault level.	VBUS.UVFTHRESH (pg 447)
Under Voltage Fault Mode	Sets under voltage mode.	VBUS.UVMODE (pg 447)
Operating Voltage	Sets the operating voltage.	VBUS.HALFVOLT (pg 445)
Regen Resistor Type	Sets the regen resistor type to either **-1-External Regen** or **0-Internal Regen (if available)**.	REGEN.TYPE (pg 425)
Regen Power	Reads the regen power (only visible for external regen).	REGEN.POWER (pg 423)
External Regen Resistance	Sets the external, user-defined regen resistor resistance (only visible for external regen).	REGEN.REXT (pg 424)
External Regen Heat Up Time	Sets the external regen resistor thermal protection time constant (only visible for external regen).	REGEN.TEXT (pg 424)
External Regen Power	Sets the regen resistor's power fault level for an external regen resistor (only visible for external regen).	REGEN.WATTEXT (pg 426)

See Regeneration (pg 36) for more information about regen resistors and sizing regen resistors.

6.1.1.1 Operating Voltage

Operating voltage can be selected by the user to allow AKD PDMM-xxx07 (480Vac) drives to work on 240Vac input supplies.

The VBUS.HALFVOLT parameter has an effect on the following voltage-thresholds:

- DC-bus over-voltage threshold (see VBUS.OVFTHRESH (pg 445)).
- The regen-resistor enable/disable voltage thresholds.
- The inrush-relay enable/disable voltage thresholds.

A power-cycle is needed after changing the value and saving the parameter on the NV memory of the Drive, since the voltage thresholds mentioned above are read during the boot-sequence of the Drive.

6.1.1.2 Direct DC Mains Operation

Direct DC input is available on all standard AKD PDMM models. The DC input should be run into the AC input connection. Positive and negative DC lines should use L1 and L2 connections (polarity is not critical). L1 and L2 connections are found on either the X3 connector or the X4 connector depending on the model.

(see Mains Supply Connection (X3, X4) (pg 170) for more information on this connection).

The nominal level of DC voltage applied must be compatible with the voltage fault levels in the drive. You must also consider voltage variations in the DC power supply above and below the nominal value so that nuisance faults are avoided.

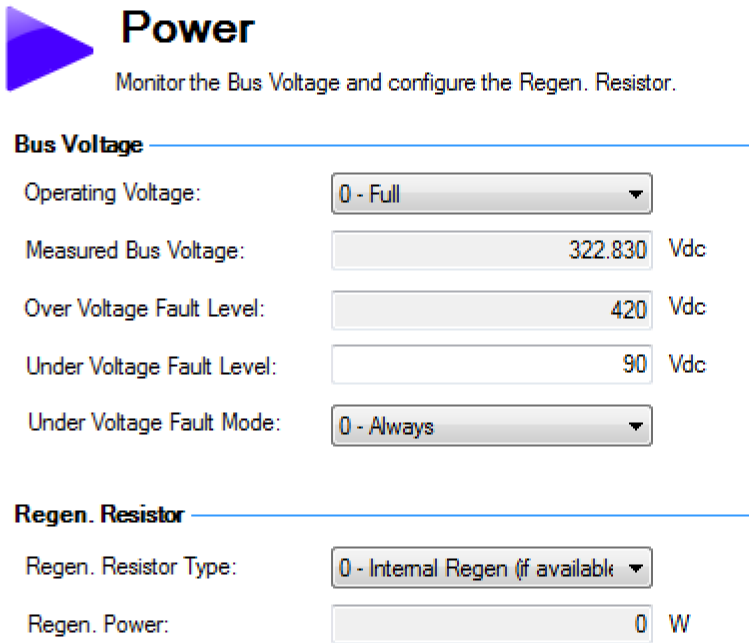
When you determine the maximum nominal DC voltage applied to the drive, you should also consider the regeneration circuit, in addition to the over voltage level. Running the drive slightly below the over voltage level is not possible because the drive does not have the capability to dissipate regenerated energy. This practice can also be harmful to the regen circuit. A good practice is not to exceed the nominal DC voltage produced by a standard AC installation. For the AKD PDMM-zzzzz06, 340 Vdc is the equivalent DC voltage for a 240 Vac supply and for the AKD PDMM-xxxxx07, 680 Vdc is the equivalent DC voltage for a 480 Vac supply.

The voltage fault levels are also shown in the **Power** screen and depend on the voltage level of drive used.

Voltage ranges are as follows:

Model	Under Voltage Level	Over Voltage Level
AKD PDMM-zzzz06	90 Vdc	420 Vdc
AKD-zzzz07	380 Vdc	840 Vdc

You can view bus voltage values in the **Power** screen as shown below:



6.2 Regeneration

6.2.1 Overview

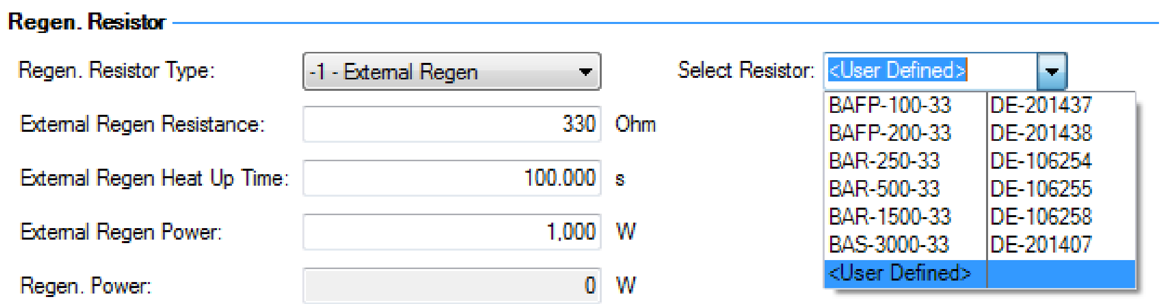
Regeneration, or "shunting", dissipates energy from the DC bus during deceleration of the motor load. During deceleration, the motor acts as a generator that pumps energy back into the system. If this energy is not dissipated, then the bus energy level can exceed acceptable levels (VBUS.OVFTHRESH (pg 445)). If the system exceeds the maximum bus voltage, then the drive generates an over voltage fault (F501) and shuts down. A regeneration resistor, or regen resistor, is an external device that dissipates excess energy and allows the drive to function normally during deceleration.

Follow these steps to determine the regen needs for your system and to configure the drive for regen:

1. Calculate motor peak and continuous regenerative energy and use this value to size the regen resistor.
2. Select a compatible regen resistor.
3. Configure regen parameter values in EWV[1].

6.2.2 Regen Resistor Options

In the **Power** screen, you can select from a variety of pre-sized regen resistors using the **Regen Resistor Type** box.



When you select -1-External Regen, the **Select resistor** box appears and contains the pre-sized resistors for your drive. Select the model regen resistor that you are using and the drive will populate the remainder of the fields. If you are using a nonstandard resistor, then choose **<User defined>** and fill in the appropriate values for your resistor.

NOTE If you use a nonstandard resistor, contact Kollmorgen™ technical support to confirm that the nonstandard resistor will work correctly with your system.

6.2.3 Calculating Motor Peak Energy and Regen Resistor Size

In order to determine whether or not your system requires a regen resistor, you must calculate the peak kinetic energy that the motor generates during deceleration and the continuous regeneration energy created by the motor. If this energy exceeds the drive capacity, then you need a regen resistor. In many cases, peak or continuous regenerated energy does not exceed the drive capacity and no regen resistor is needed.

The calculation for peak kinetic energy requires values for several factors that affect the generation of energy in a motion system:

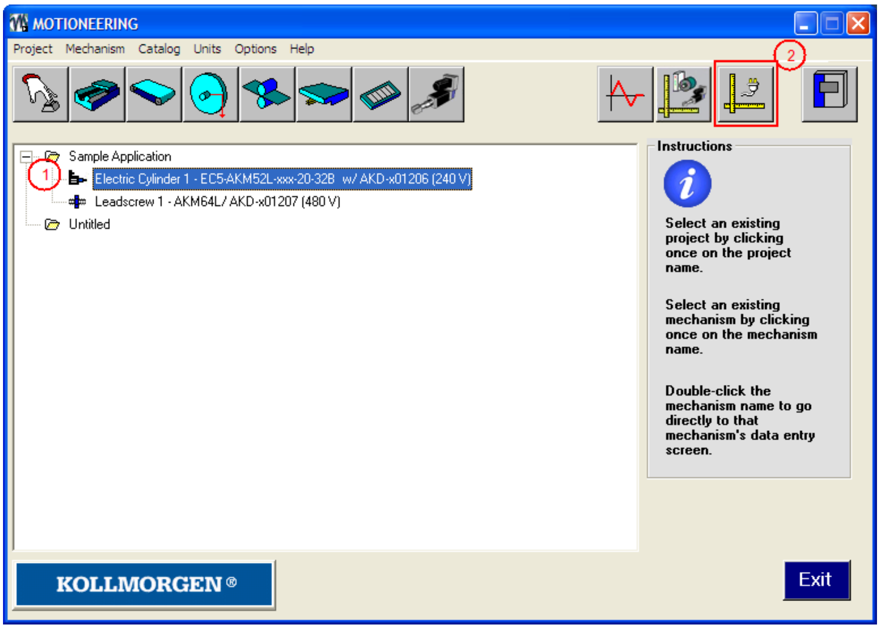
- Load inertia
- Motor inertia
- Motor speed from which deceleration occurs
- Time required to decelerate

[1] Embedded Workbench Views

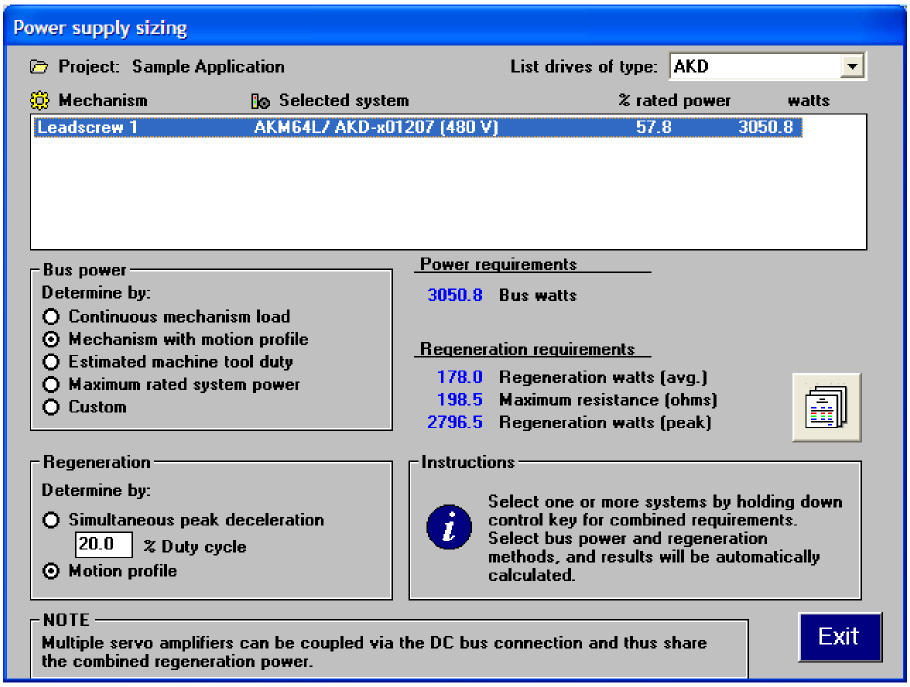
Regen resistor sizing information for your particular application can be calculated using the Motioneering® Application Engine. You can download this program here:

http://www.kollmorgen.com/website/com/eng/support/design_tools/motioneering.php

After you install and set up this program, highlight your application (1) and then click on the Power Supply Sizing icon (2).



The application then displays the regen sizing tool; see the application help for further sizing assistance.



6.2.4 Selecting a Compatible Regen Resistor

After you calculate the appropriate resistor size, compare the results with the capabilities of the drive and, if necessary, select an external regeneration resistor which matches these capabilities from the chart below. The resistors shown below are included in the KAS IDE setup. If you do not find a match for your application, please contact the Kollmorgen™ customer support team for further assistance.

NA Part Number	EU Part Number	Resistor Type	AKD PDM-M-x-00306	AKD PDM-M-x-00606	AKD PDM-M-x-01206	AKD PDM-M-x-02406	AKD PDM-M-x-00307	AKD PDM-M-x-00607	AKD PDM-M-x-01207	AKD PDM-M-x-02407
BAFP-100-33	DE-201437	External Resistor, 100 W, 33 ohms	x	x	x					
BAFP-200-33	DE-201438	External Resistor, 200 W, 33 ohms	x	x	x					
BAR-250-33	DE-106254	External Resistor, 250 W, 33 ohms	x	x	x		x	x	x	
BAR-500-33	DE-106255	External Resistor, 500 W, 33 ohms	x	x	x		x	x	x	
BAR-1500-33	DE-106258	External Resistor, 1500 W, 33 ohms	x	x	x		x	x	x	
BAS-3000-33	DE-201407	External Resistor, 3000 W, 33 ohms	x	x	x		x	x	x	
BAR-600-23	DE-200613	External Resistor, 600 W, 23 ohms								x
BAR-1000-23	DE-200614	External Resistor, 1000 W, 23 ohms								x
BAS-2000-23	DE-200615	External Resistor, 2000 W, 23 ohms								x
BAS-3000-23	DE-200616	External Resistor, 3000 W, 23 ohms								x
BAS-4000-23	DE-200617	External Resistor, 4000 W, 23 ohms								x
BAR-500-15	DE-201439	External Resistor, 500 W, 15 ohms				x				
BAR-1000-15	DE-201440	External Resistor, 1000 W, 15 ohms				x				
BAS-2000-15	DE-103871	External Resistor, 2000 W, 15 ohms				x				

NA Part Number	EU Part Number	Resistor Type	AKD PDM-M-x-00306	AKD PDM-M-x-00606	AKD PDM-M-x-01206	AKD PDM-M-x-02406	AKD PDM-M-x-00307	AKD PDM-M-x-00607	AKD PDM-M-x-01207	AKD PDM-M-x-02407
BAS-3000-15	DE-103872	External Resistor, 3000 W, 15 ohms				x				
BAS-6000-15	DE-103873	External Resistor, 6000 W, 15 ohms				x				

6.2.5 Configuring Regen Parameter Values

If you use an external regen resistor, then you must also include additional information about the regen resistor in the**Power** view. These values are automatically inserted in KAS IDE. The chart below summarizes these three additional values:

- **External Regen Resistance** (REGEN.REXT, ohms)
- **External Regen Heat Up Time** (REGEN.TEXT, seconds)
- **External Regen Power** (REGEN.WATTEXT, watts)

These parameters allow the regen resistor to function properly and dissipate power appropriately for your system.

NA Part Number	EU Part Number	Resistor Type (all resistors UL recognized)	Resistance ohms (REGEN.REXT)	Heat Up Time s (REGEN.TEXT)	Power Rating W (REGEN.WATTEXT)
BAFP-100-33	DE-201437	External Resistor, 100 W, 33 ohms	33	16.5	100
BAFP-200-33	DE-201438	External Resistor, 200 W, 33 ohms	33	27.5	200
BAR-250-33	DE-106254	External Resistor, 250 W, 33 ohms	33	22.0	250
BAR-500-33	DE-106255	External Resistor, 500 W, 33 ohms	33	33.0	500
BAR-1500-33	DE-106258	External Resistor, 1500 W, 33 ohms	33	25.7	1,500
BAS-3000-33	DE-201407	External Resistor, 3000 W, 33 ohms	33	77.0	3,000
BAR-600-23	DE-200613	External Resistor, 600 W, 23 ohms	23	27.5	600
BAR-1000-23	DE-200614	External Resistor, 1000 W, 23 ohms	23	27.5	1,000
BAS-2000-23	DE-200615	External Resistor, 2000 W, 23 ohms	23	77.0	2,000
BAS-3000-23	DE-200616	External Resistor, 3000 W, 23 ohms	23	84.3	3,000
BAS-4000-23	DE-200617	External Resistor, 4000 W, 23 ohms	23	77.0	4,000
BAR-500-15	DE-201439	External Resistor, 500 W, 15 ohms	15	33.0	500

NA Part Number	EU Part Number	Resistor Type (all resistors UL recognized)	Resistance ohms (REGEN.REXT)	Heat Up Time s (REGEN.TEXT)	Power Rating W (REGEN.WATTEXT)
BAR-1000-15	DE-201440	External Resistor, 1000 W, 15 ohms	15	27.5	1,000
BAS-2000-15	DE-103871	External Resistor, 2000 W, 15 ohms	15	77.0	2,000
BAS-3000-15	DE-103872	External Resistor, 3000 W, 15 ohms	15	84.3	3,000
BAS-6000-15	DE-103873	External Resistor, 6000 W, 15 ohms	15	91.7	6,000

Related Parameters

REGEN Parameters (pg 422)
VBUS.OVWTHRESH (pg 446)
VBUS.VALUE (pg 448)

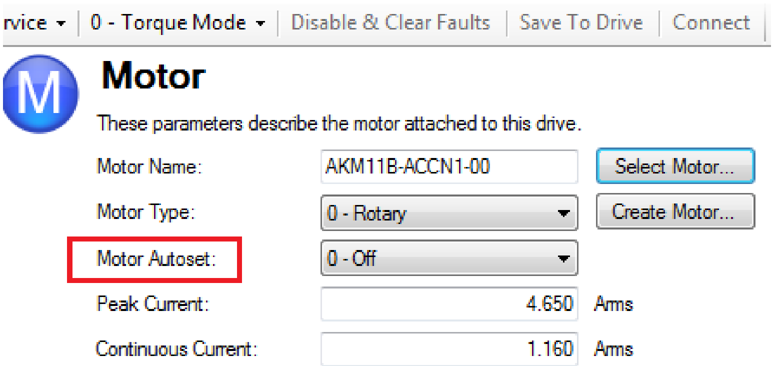
7 Configuring Motor Settings

7.1 Motor

7.1.1 Overview

The **Motor** screen is used to set up or confirm the parameters of the motor that is connected to the drive. In certain cases, based on the feedback type, the motor parameters will automatically be set. The drive will auto-detect feedback devices that are preset with the appropriate feedback and motor parameters when MOTOR.AUTOSET is set to 1 (default). The values the drive uses for commutation and current and velocity loop gains will be populated automatically.

If your motor does not have a plug and play feedback device, then you must turn off the motor autoset feature as shown in the screenshot below (MOTOR.AUTOSET = 0) and select the appropriate motor from the motor parameter database.



All of the appropriate Kollmorgen™ motors compatible with the AKD PDMM drive are contained in the motor database. For motors that are not listed, click **Select Motor** to open a custom motor view in which you can input the appropriate motor parameters.

7.1.2 Motor Setup

For SFD, Endat, and BiSS feedback devices, the drive will automatically be detected and the correct motor parameters will be automatically set in the AKD PDMM drive. If your motor is detected automatically, the parameters in the **Motor** view are shaded and not accessible. If you have a non-plug and play standard device (such as an incremental encoder or resolver), you can use this screen to enter the standard AKM, Cartridge motor, DDR, or DDL motor. Other motors can be entered using the **Custom Motor** selection and setting up the parameters (see section on non memory motors). Select the standard motor from the drop-down list and select **OK**. The AKD PDMM drive will now show all of the appropriate parameters needed for the motor to operate properly.

7.1.3 Using the Motor View

The **Motor** view displays parameters related to the specific motor attached to the drive as follows:

- Motor Name: The motor part number read from the autoset device, or the name from the motor database. When entering a custom motor name, the motor name should not contain any spaces.
- Motor Type: This field allows you to select the proper parameters for a rotary motor or a linear motor (linear motors are a future feature).
- Motor Autoset: This setting to allows the drive to automatically set up a plug and play motor (MOTOR.AUTOSET = 1). With **Motor Autoset** turned off (MOTOR.AUTOSET = 0), you can access the motor database to select a catalog or custom motor.

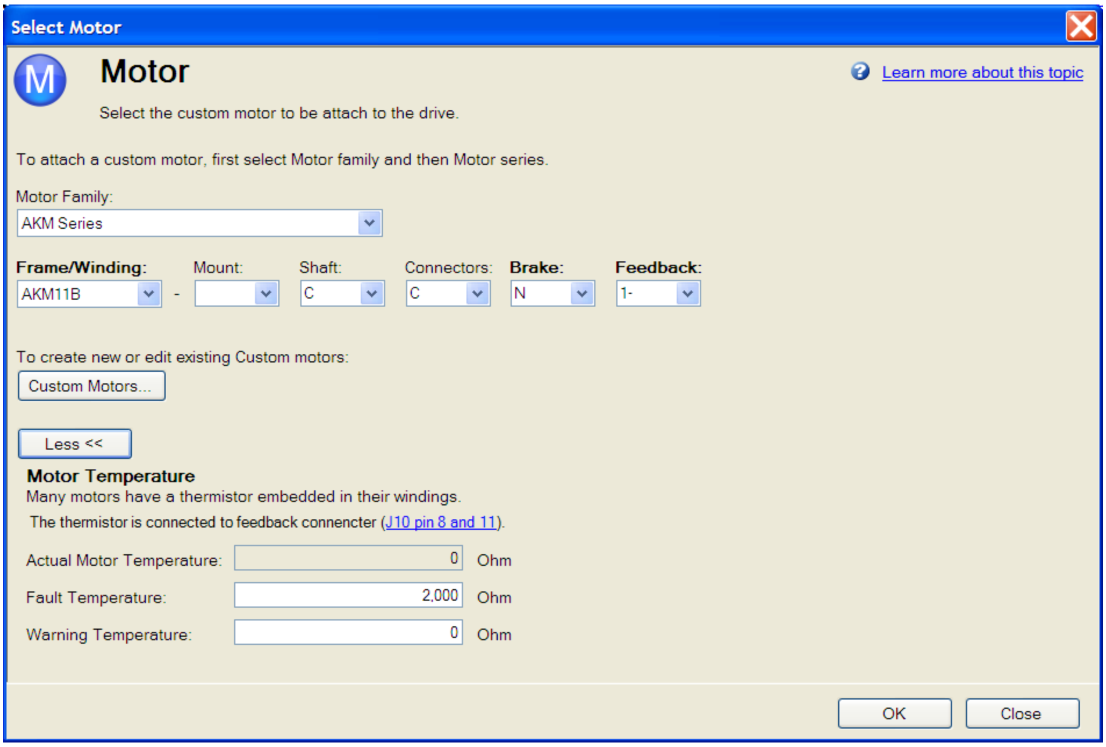
The next set of parameters displayed are specific to the electrical and mechanical characteristics of the motor connected to the AKD PDMM drive.

- Peak Current: Motor peak current rating in Amps rms.
- Continuous Current: Motor continuous current rating in Amps rms.
- Inertia: Motor rotor inertia in Kg-cm^2.
- Torque Constant: Motor torque contant in Nm/Arms.

- Inductance: Motor rated inductance in milliHenries
- Motor Poles: Number of motor poles.
- Maximum Speed: Motor maximum rated speed
- Motor Resistance: Motor winding resistance in Ohms.
- Maximum Voltage:Motor maximum rated voltage in Volts rms.
- Motor Phase: Motor phase offset (used to set motor commutation as required - for most devices this is set to 0).
- Coil Thermal Constant: Motor coil thermal time constant in mHz.

7.1.4 Selecting a Motor

The **Select Motor** button opens a screen in which you can configure a non-plug and play motor or custom motor.



When this screen is opened, KAS IDE displays by default the motor matched to the current motor name attached to the drive. KAS IDE searches matching motor as follows:

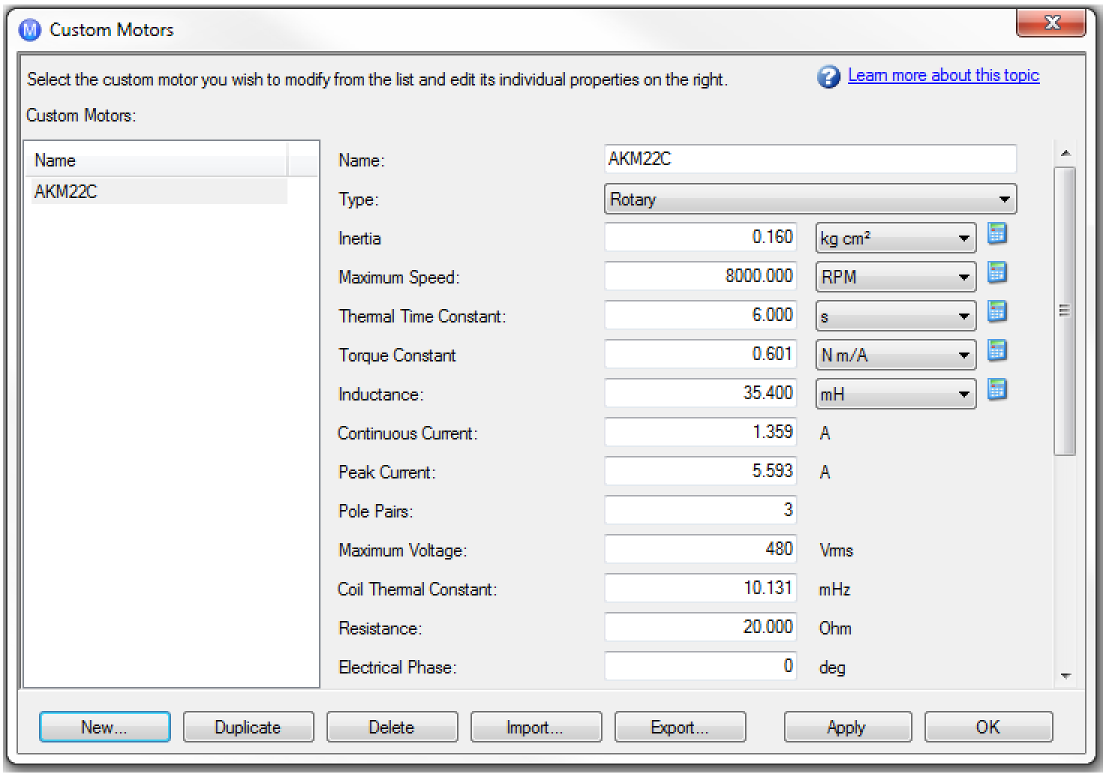
1. KAS IDE first checks the motor name with custom motors for a match.
2. If a match is not found, then KAS IDE checks the name with the standard motors database for a match.
3. If a match is not found, then an AKM motor is selected.

For non-plug and play motors, a database of catalog motors is available based on the different Kollmorgen™ motor families. When you select a motor family, a part number is displayed according to the selected motor family. You can change the part number as needed, and the complete motor name will be displayed according to your selection. This complete motor name is sent to drive. The portions of the part number labeled in bold are required values.

The **More/Less** button displays and hides motor temperature settings.

7.1.4.1 Configuring Custom Motors

From the Select Motor screen, click on **Custom Motor** to create and edit custom motors in the following screen:



In this view, you can import or export a motor parameter file, or create a custom motor of your choice. The appropriate parameters must be chosen as listed. Several of the parameters allow you to select an alternate unit of measure. When building a custom motor file, do not use blank spaces in the name you choose. Once you have configured one or more custom motors, if you select a custom motor from the list and click **OK**, then the selected custom motor will be displayed in the **Select Motor** screen.

The actions available in the custom motor screen include:

- **New**. Allows you to start a new custom motor (with default values) or load a catalog motor you may want to modify.
- **Duplicate**. Makes a copy of the highlighted motor in the custom motor list.
- **Delete**. Deletes the highlighted motor in the customer motor list.
- **Import**. Allows you to import a motor file (*.motor) from another location
- **Export**. Allows you to save the highlighted motor file (*.motor) to another location
- **Apply**. Accepts the values you have entered for the specific motor files you are entering.
- **OK**. Returns you to the **Motor Selection** screen.

When entering any of the motor data, be certain the units are correct. The AKD PDMM drive uses the motor parameters to set up the various feedback loops and limits associated with the motor selected.

Note that if you select a custom motor from the list and click **OK**, then that selected custom motor will be displayed in the Select Motor screen.

7.1.4.2 Validating Motor Parameters

When you click **OK** in the **Select Motor** screen, KAS IDE validates the range with the drive. If any error is found, an error screen is displayed. Click **Continue** to set the motor parameters in the drive. Click **Cancel** to close this screen.

If errors occur while setting the motor parameters, an error screen indicates which parameters require additional attention.

Related Parameters

MOTOR Parameters (pg 376)

7.2 Feedback 1

The Feedback view allows you to configure the primary position feedback device fitted to your motor.

When you select your feedback device from the Feedback Selection list, the appropriate feedback configuration choices appear below the dial.

7.2.1 Overview

The AKD PDMM offers a variety of feedback solutions, which allow you to optimize your system based on your specific machine needs. The available feedback options include resolver, SFD, sine-cosine encoder (Endat 2.1, BiSS, Hiperface), incremental encoder, as well as line-count, single, and absolute variations. Your motor model number will indicate the type of feedback that you have. With some incremental encoders, parameters are set up in the encoder itself, and the AKD PDMM drive recognizes the feedback automatically and sets up the drive accordingly. This automatic recognition is called "plug and play". Currently, SFD and Endat are plug and play encoders. Other feedback types require that you enter parameters manually.

The following table lists current support for primary and secondary feedback:

		Primary	Secondary
Resolver	Std & Multi pole	Yes	No
SFD		Yes	No
Incremental (Digital) Encoder	With Halls and Index	Yes	No
	No Halls with Index	Yes	Yes
	No Halls with No Index	Yes	Yes
Analog Sin/Cos Encoder	With Digital Halls	Yes	No
	With Digital Halls and Analog Index	No	No
	No Halls and No Index	Yes	No
EnDAT 2.1	Single & Multi Turn	Yes	No
EnDAT 2.2	All Digital	Yes	Yes
	Analog / Digital	Yes	No
BiSS	All Digital (Mode C)	Yes	No
	Analog / Digital	Yes	No
Hiperface	Analog / Digital; Single & Multi Turn	Yes	No
	All Digital	No	No

7.2.2 Using Feedback Options

Use the **Feedback** screen to set up your system to match the proper feedback device. By default, the drive uses the **Auto** setting to detect feedback devices. This setting allows the drive to test the feedback device to see if it is a recognized plug and play device. If the drive recognizes the device, then all the parameters for that device and motor are loaded into the drive. Both the feedback and the motor information are now present in the drive and the system is operable.

If the feedback is a non- plug and play device, then you can choose from the list of supported devices in **Feedback Selection** list and then enter the line count manually. The following sections describe each supported device available in the **Feedback Selection** list and the input information required to configure each device.

7.2.2.1 Auto

This is the default setting and is used to determine if a plug and play device is available. If a plug and play device is available, the **Auto** mode is replaced by the feedback device detected, along with the appropriate resolution settings.

7.2.2.2 Incremental Encoder

The incremental encoder is a non-plug and play device. Incremental encoders are available in a variety of line counts. If you select an incremental encoder option, the encoder resolution must be entered into the **Rotary Encoder Resolution** box. The units for this field are in counts per revolution, which is post-quadrature (multiplies the lines per revolution by 4).

7.2.2.3 Sine Encoder

Sine encoders are offered with different data communication protocols. These include Endat, BiSS, Hiperface, and others. A standard sine-cosine encoder with simple analog communication is not a plug and play device. As with the incremental encoder, the line count is entered in the **Rotary Encoder Resolution** box.

7.2.2.4 Endat 2.1, Endat 2.2

Endat-based sine are plug and play compatible, and the system will properly recognize these encoders. With the AKD PDMM set in **Auto**, this encoder type is detected and the feedback and motor parameters are loaded automatically.

7.2.2.5 BiSS

BiSS will be plug and play in a future release. Currently, the device is programmed with the motor and feedback information and once selected will sets up the feedback and motor parameters in the AKD PDMM.

7.2.2.6 Hiperface

Hiperface is a plug and play device that will be supported in a future release.

7.2.2.7 Resolver

The resolver feedback option is not plug and play. When selecting the resolver option, three specific parameters are set by default for the standard AKM resolver: phase lag, transformation ratio, and feedback poles. Currently,the AKD PDMM does not support non-Kollmorgen™ standard resolver options.

7.2.2.8 SFD

Smart Feedback Device (SFD) is Kollmorgen™'s most popular plug and play device. SFD allows for quick and easy setup from the **Auto** mode, which automatically configures the drive with the motor and feedback parameters.

7.3 Non-Plug and Play Feedback Devices

To set up a AKD PDMM drive with a non-plug and play feedback device (for example a resolver or an encoder), you must select a motor from the list of standard or custom motors or enter the motor parameters manually. Once the motor data is entered into KAS IDE, an initial set of parameters can be calculated and downloaded to the drive.

7.3.1 Parameters

The following parameters can be initialized to their default values or calculated from user-supplied motor data:

IL.KP	IL.LIMITN	VL.KP	PL.KI = 0 (Default Value)
IL.KFFACC	IL.LIMITP	VL.KI	PL.INTINMAX = 0.419 (Default Value)
IL.KBUSFF	IL.PWMFREQ	VL.LIMITN	PL.INTOUTMAX = 0.419 (Default Value)
IL.FRICTION	IL.KVFF	VL.LIMITP	MOTOR.IPEAK

IL.OFFSET	IL.FOLDFTHRESHU	VL.THRESH	MOTOR.ICONT
IL.INTEN	IL.FOLDWTHRESH	VL.KVFF	MOTOR.PITCH
IL.IVFB	IL.MFOLDD	PL.KP	MOTOR.POLES
IL.KPDRATIO	IL.MFOLDT	PL.KD = 0 (Default Value)	MOTOR.TYPE

7.3.2 Calculations

KAS IDE uses the following equations to calculate parameter values.

Current Loop

The current loop proportional gain (IL.KP) must be such that the current loop closed loop crossover frequency/bandwidth (BW) nominal is the lesser of 2000 Hz or (PWM Frequency/4).

Then, with this frequency:

IL.KP = 2*π*(desired bandwidth in Hz)*(motor L line-line in H)

Setting the D and Q components

Velocity Loop

VL.KP = (2*π*75)*(2*Jm/Kt) = 300*PI*Jm/Kt

VL.KI = 5

Slider Tuning

The slider tuning algorithm in KAS IDE currently uses the following algorithm.

Input - Motor Data

The values for inertia, Jm (Kg / cm2), and torque constant, Kt (Nm/A), are obtained from either the SFD or the motor model number that you select.

Constants

Velocity Loop Bandwidth – BW = The default value is 75Hz.

Input - Inertia Ratio – Q = The default is 1.

Output - Control Loop Gains

VL.KP = 2 * π * BW * Jm * (1+Q) * 0.0001/Kt

VL.KPI = BW*0.08 -1 (minimum of 1)

PL.KP = BW/5

7.4 Foldback

The foldback feature in the AKD PDMM protects both the motor and the drive from overheating. Two current foldback algorithms run in parallel in the drive: the drive foldback algorithm and the motor foldback algorithm. Each algorithm uses different sets of parameters. Each algorithm has its own foldback current limit, IL.DIFOLD (drive foldback) and IL.MIFOLD (motor foldback). The overall foldback current limit is the minimum of the two at any given moment.

IL.IFOLD = min (IL.DIFOLD, IL.MIFOLD).

Foldback is not the same as current limits. Instantaneous current limits for the drive are set by the positive peak current (IL.LIMITP) and negative peak current (IL.LIMITN) in the Limits view in EWV[1]. The foldback algorithms may reduce the current output to the motor in spite of the current limit settings.

7.4.1 Drive Foldback

The drive foldback algorithm monitors current feedback; since this is a monitoring function, the drive foldback parameters are not user configurable. If the current feedback exceeds the continuous current rating of the drive (DRV.ICONT), then the algorithm decreases the current to the DRV.ICONT level. For example, under a step command input condition, the foldback algorithm allows maximum peak current (DRV.IPEAK) output from the drive for a short period of time (up to IL.DFOLDD time), after which the drive begins an exponential foldback (with time constant of IL.DFOLDT) of the current to the drive's continuous current.

It takes a few seconds for the exponential decay to drop from the drive's peak current to its continuous level. A recovery time, when the feedback current is below DRV.ICONT level, is required to allow current above DRV.ICONT level again. A recovery time of IL.DFOLDR with 0 current allows the drive to apply DRV.IPEAK current for IL.DFOLDD time.

7.4.2 Setting up motor foldback

Motor foldback is set up automatically when using a plug and play motor or when a particular motor is selected from the EWV database.

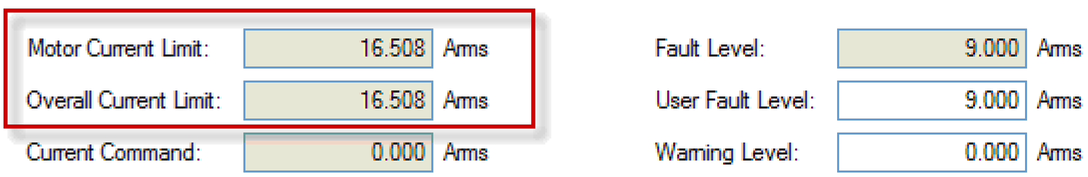
If you are using a custom motor, use the Motor view in EWV to set custom values needed for foldback configuration.The parameter entries required for the drive to apply motor foldback protection properly are coil thermal constant (MOTOR.CTFO), peak current of the motor (MOTOR.IPEAK), and continuous current of the motor (MOTOR.ICONT). These values are used to setup the algorithm for motor foldback.

7.4.3 Setting Fault and Warning Levels

The **Motor Current Limit** and **Overall Current Limit** boxes show status variables that are constantly updated by the foldback algorithm. As current is applied above the drive or motor continuous rating, the capacity for the application of peak current starts to decrease. The motor current limit and overall current limit are actively decreased. If the move profile requires less than continuous current rating for a period of time, the Motor Current Limit and Overall Current Limit begin to increase until they reach maximum foldback capacity once again.

When Motor Current Limit or Overall Current Limit < Warning Level, an n524 status warning is triggered. When Motor Current Limit or Overall Current Limit < Fault Level, an F524 fault is triggered and the drive power stage is disabled. The load then coasts to a stop.

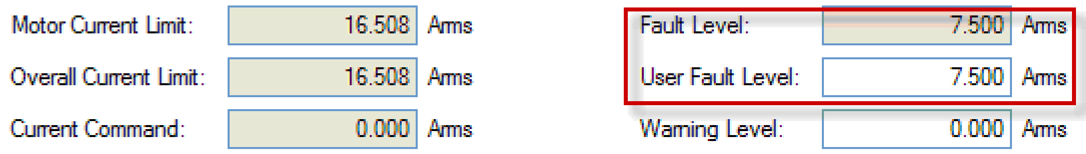
In the **Foldback** screen, setting the Warning Level to 0 turns off the warning feature. Otherwise, the Warning Level must be set above the Fault Level, but below the Motor Current Limit and Overall Current Limit to trigger a warning.



If User Fault Level is set above Fault Level, the User Fault Level will be ignored. The User Fault Level is used to increase the time the drive is operated in foldback mode without faulting. For instance if the default Fault Level is 9.000 Arms and a User Fault Level is set to 7.5 Arms, the Fault Level is changed to

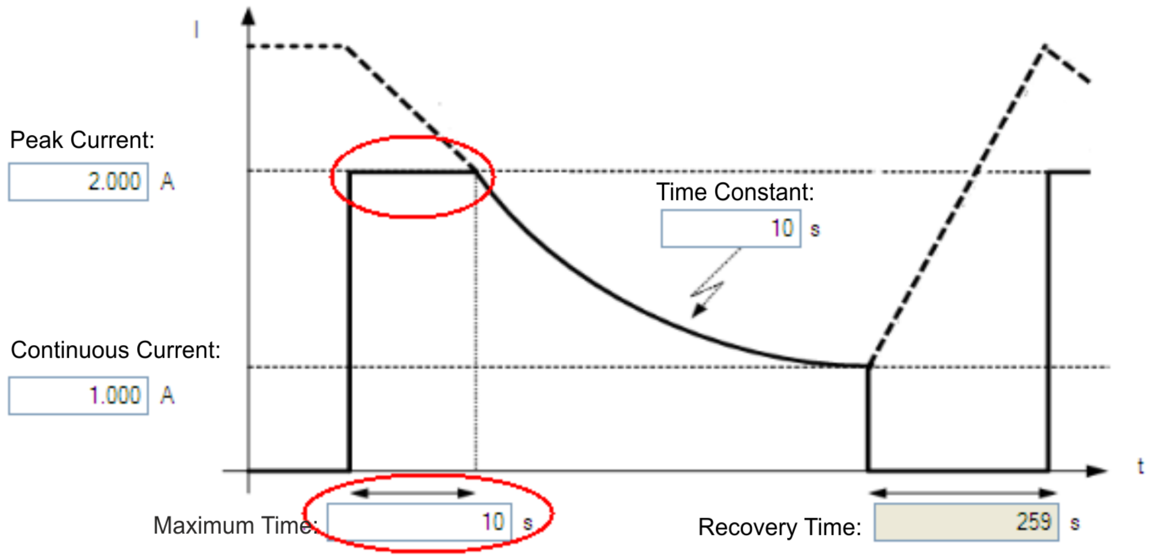
[1]Embedded Workbench Views

7.5 Arms. This configuration effectively increases the time that foldback will be applied to the drive before faulting.



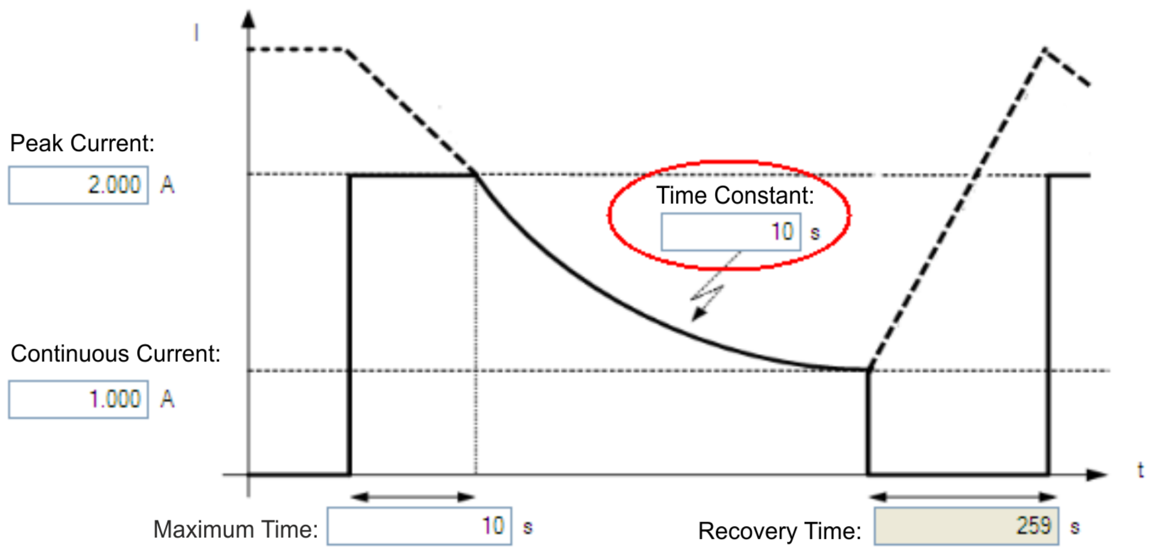
7.4.4 Motor Peak Current Time

Peak current (MOTOR.IPEAK) along with coil thermal constant (MOTOR.CTFO) are used to determine the maximum time the motor can sustain peak current. The maximum time (IL.MFOLDD) is displayed in the **Foldback** screen as shown below:



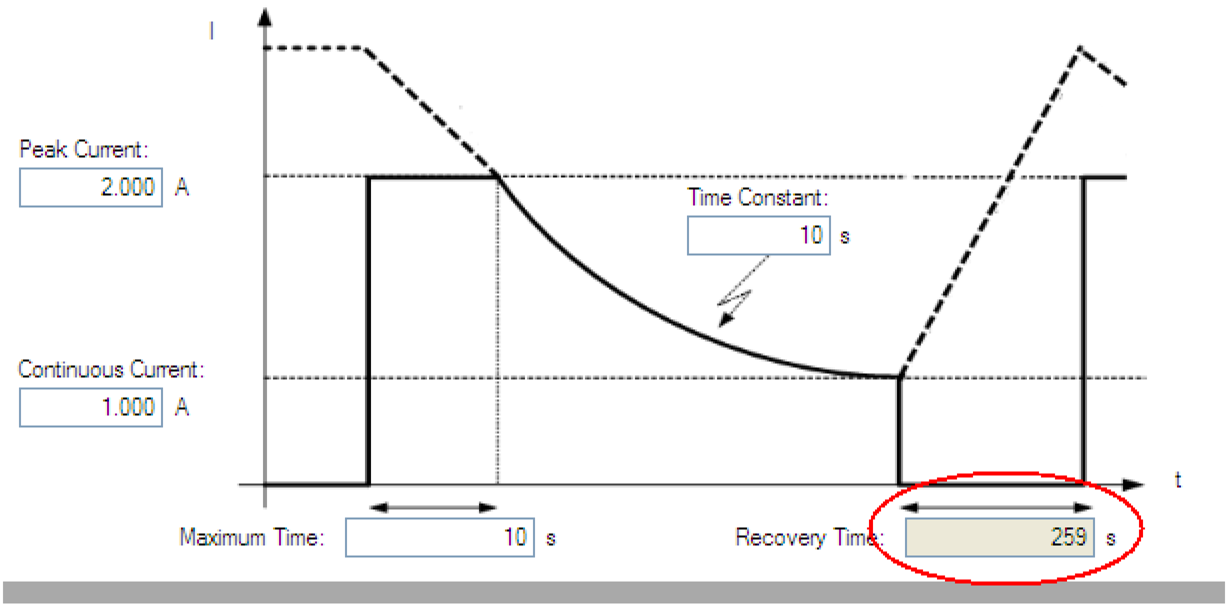
7.4.5 Motor Foldback Ramp

Once the maximum time for motor peak current has elapsed, if the move profile still demands peak current from AKD PDMM, the drive will exponentially lower the current applied to the motor. The Time Constant (IL.MFOLDT) dictates the profile. A smaller time constant represents a steeper decline in current applied to the motor.



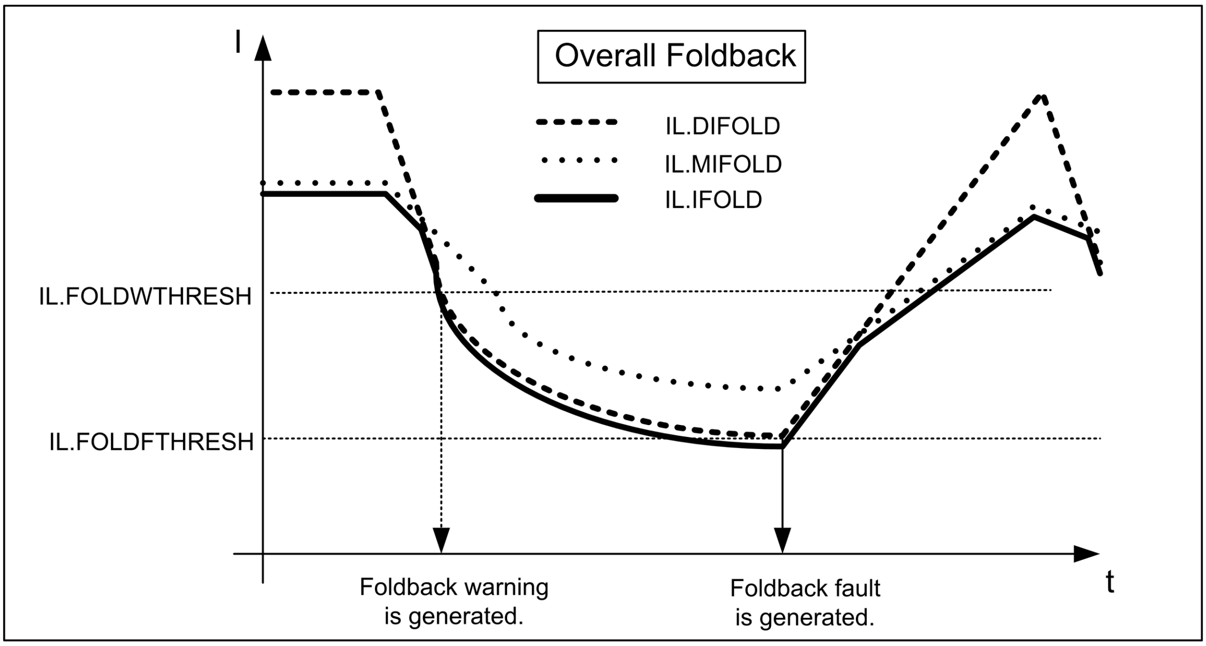
7.4.6 Motor Recovery

Once the peak motor current available has reached the continuous current of the motor, the motor needs Recovery Time (IL.MFOLDR) to cool down. Full Recovery Time (IL.MFOLDR) at 0 current is required for the motor to reach full maximum capacity in the shortest amount of time. The drive can command a current less than continuous current to continue driving the load, but the recovery time for full maximum capacity is increased.



7.4.7 Overall Foldback

The overall limit is the momentary minimum value between the drive foldback and the motor foldback. The overall foldback is shown in the diagram below. You can set the warning and the fault levels as shown in the diagram.



7.5 Brake

The brake output on connector X2 controls a mechanical brake that optionally may be fitted to a motor. The brake is applied and released relative to the **Drive Active** state of the drive. You can modify the release and apply delays using the parameters shown below.

Button or Dialog Box	Description	Parameter
Brake ControlState	Does this motor have a brake?	MOTOR.BRAKE
Brake Release Delay	The time between the drive being active and the brake being released.	MOTOR.TBRAKERLS
Brake Apply Delay	The time between the brake being applied and the drive not being active.	MOTOR.TBRAKEAPP

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7.6 Using Position Capture

7.6.1 Overview

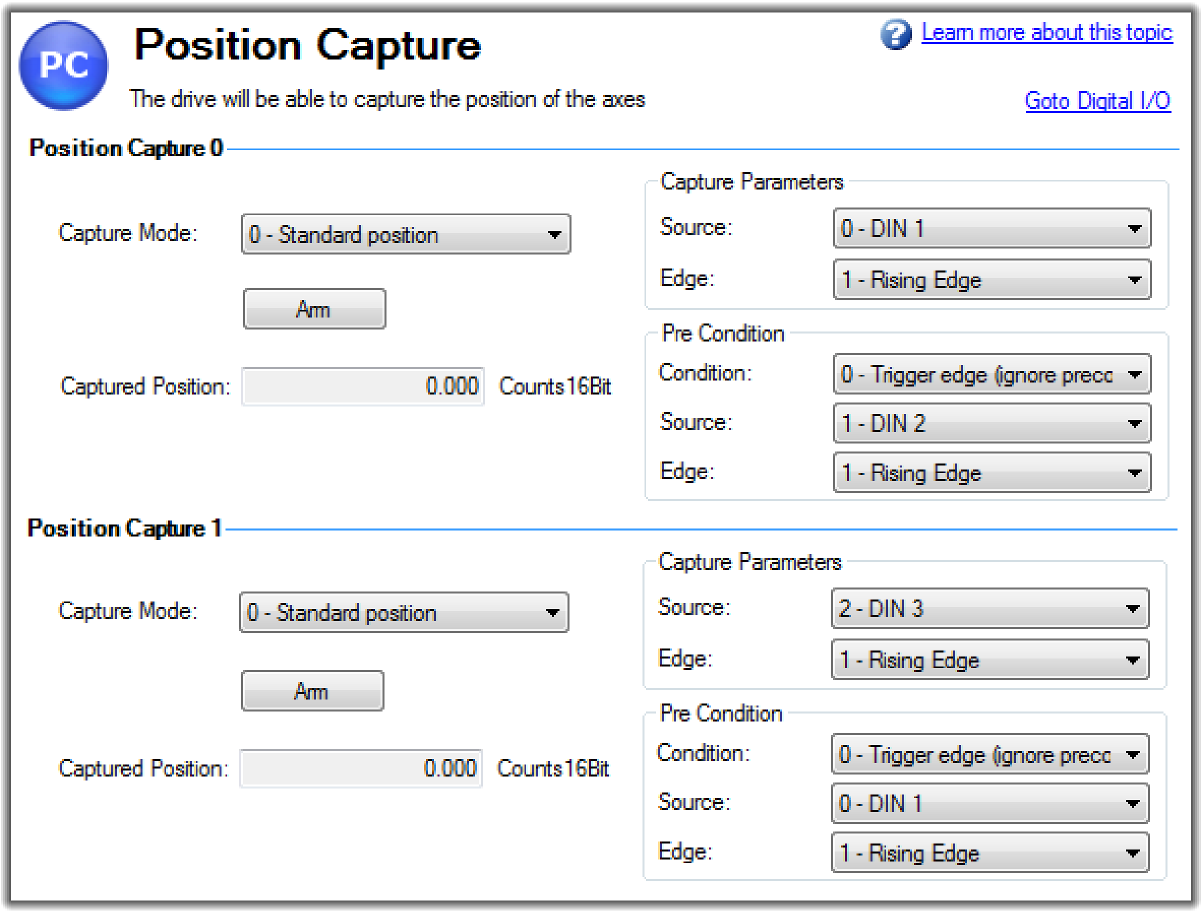
Position capture allows you to precisely determine what the motor position (or drive clock time) was when a specific event triggers. The AKD PDMM drive uses two independent captures, which operate similarly. The descriptions provided in this user guide refer to Capture 0, but also apply to Capture 1.

Position capture is used in precision environments, where the motor may be moving at very high velocities, an IO is triggered, and you must know exactly where the motor was when the event occurred. Homing algorithms often use position capture.

Position capture will capture the motor position (or drive clock time) when the capture trigger is activated. The position capture or drive lock time capture will happen in less than 3 microseconds of the input transition. This assumes the use of high speed input 1 or 2 with the filter turned off. The capture engine can be re-armed and ready for another capture in less than 62.6 microseconds. This capture engine allows the position capture to obtain more accurate results than those obtained using the scope or recorder clock.

7.6.2 Configuring Position Capture

To configure the position capture, select **Position Capture** from the **Settings** group:



Setting the Capture Source (CAP0.TRIGGER)

The capture source determines which input on the drive causes the position capture to trigger.

Capture Source Options:

Option	Description
0 - 6	These options trigger on the Digital Input 1 pin through Digital Input 7 pin, respectively.
7- 9	These options trigger on the X9 connector RS485 Input 1 pin through RS485 Input 3 pin, respectively.
10	This option triggers on the primary encoder index.

Setting the Capture Mode (CAP0.MODE)

The capture mode determines what information is saved on the drive when the capture triggers.

Capture mode options:

Option	Description
0 – Standard Position	Captures the motor position in drive units.
1 – Drive Internal Time	Captures the time of the trigger in ns.
2 – Distributed Clock Time	Captures the network (Ethercat) distributed clock time.
3 – Primary Encoder Signal	Captures the motor postion triggering on primary encoder index. This mode automatically rearms after each trigger.

If either **0 - Standard Position** or **3 - Primary Encoder Signal** is selected, delays may occur and are associated with feedback devices that are digital or interpolated .

Arming and Retrieving the Capture Value (CAP0.EN and CAP0.T)

CAP0.EN arms the capture and CAP0.T retrieves the capture value. Once you have configured the capture, you must arm it before it will trigger. Click **Arm** (1) to arm the capture.

Once the capture is armed, when it triggers, the captured value will be displayed below the Arm button (2).

Setting the Capture Edge (CAP0.EDGE)

The capture edge determines which input state change triggers the capture.

Capture Edge Options:

Option	Description
1 – Rising Edge	Captures when the input signal goes high, from a low state.
2 – Falling Edge	Captures when the input signal goes low, from a high state.
3 – Both Edges	Captures any time the input signal changes state.

Setting the Pre-Condition Event: (CAP0.EVENT)

The Capture Pre-Condition Event gives the user more flexibility in setting what conditions must be present for the Capture to trigger.

Event Option	Description
0 – No precondition	Capture triggers as soon as the capture edge occurs.
1 – Trigger Edge after precondition	Captures triggers only when the precondition occurs before the capture edge occurs.
2 – Trigger Edge while precondition = 1	Captures triggers only while the precondition is evaluated and is true while the capture edge occurs.
3 – Trigger Edge while precondition = 0	Captures triggers only while the precondition is evaluated and is false while the capture edge occurs.

Setting up a Pre-Condition for complex capture

Setting the Precondition Edge: (Terminal Command: CAP0.PREEDGE)

The pre-edge determines what input state change triggers the precondition. This feature operates the same as the capture edge described above.

Setting the Pre-Condition Select: (Terminal Command: CAP0.PRESELECT)

The preselect chooses what input source will trigger the precondition (based on the preedge setting, and the prefilter setting). This feature operates the same as the capture source described above.

7.6.3 Kollmorgen Test Reports

Position Capture test report based on performance testing by Kollmorgen:

```
Capture Accuracy with External Sensor
Drive: AKD-T00306-NBAN-000
Motor: AKM-21C
Feedback Type: Incremental type 2048 line encoder
Digital Input used: DIN1  (high speed input)
DIN1.FILTER = 0  (very important to set this to zero so filtering
does not delay the system response)
Sensor Used : IDC RP1 type mounted directly to the shaft. Common
industrial limit switch.
MOVE.RUNSPEED = 1000 RPM
With the motor running at above speed and the capture mechanism
armed, the drive was able to capture the position within 30-70
counts (.17 - .40 degree) of accuracy or 27.5 – 64.0 micro sec.
```

```
Capture Accuracy with Internal Index from encoder
Drive - AKD-T00606-NBAN-000
Motor-AKM22G
Feedback Type – Incremental Encoder 2048 lines
MOVE.RUNSPEED = 1000 RPM
With the motor running at above speed and the capture mechanism
armed, the drive was able to capture the position within 10-20
counts (.05 - .11 degree) of accuracy or 9.5 – 18.0 micro sec.
```

Related Parameters

CAP Parameters (pg 1)

8 Using AKD PDMM in a Vertical Axis

NOTE For firmware versions 1-06 and later.

The drive should be configured to execute a controlled stop action in the event of a disable command (DRV.DISMODE = 2 or 3). This allows the motor to stop and the brake to be applied before the drive stops holding up the axis and removes power. With a vertical axis application where the motor is equipped with a brake that is controlled by AKD PDMM, it is recommended to set up the axis to immediately apply the brake in the event of the drive disabling for any reason. By setting MOTOR.BRAKEIMM (pg 378) = 1 (default is 0=off) the brake will be applied immediately in the event of the drive disabling.

Drive disabling can occur as a result of:

- Hardware Enable removed
- Software Enable removed
- Safe Torque Off (STO) activated
- Fault Condition
- Controlled Stop Input – any input configured as (DINx.MODE = 13 controlled stop)

NOTE For a digital input initiated controlled stop (A fault that results in controlled stop. See Fault and Warning Messages (pg 135)), or a software disable that is configured for a controlled stop (see DRV.DISMODE (pg 273)), the brake will be applied at the end of the controlled stop.

It is still important to setup the brake delays. This can be done in the brake screen in EWV[1]. These brake delays are used to delay the disabling of the power stage when motion is stopped and the drive is disabled. This is only pertinent for Controlled Stop and Software Disable of the drive. This prevents a slight drop of the load between the disable and the brake engagement. In other cases (Fault, Hardware Enable, STO) hardware disconnection prevents AKD PDMM from delaying the disable.

There is an advanced setting for the Hardware Disable. A programmable delay is available on the HW Enable input so the drive can hold the load before the disable. With a vertical load some movement could occur when the drive is disabled with a hardware input because the power stage was disabled immediately, before the brake could apply. DRV.HWENDELAY (pg 285) is available which will delay the disabling of the power stage. During this delay time, the drive will apply the brake immediately and simultaneously attempt to follow normal disable procedures. The value is limited to a maximum of 167 ms. During this time, the drive will attempt to bring the load velocity to 0 RPM. If DRV.HWENDELAY = 0, the feature is off (this is default).

[1]Embedded Workbench Views

Vertical Application Desired Response	Customer Disable Condition	Configuration Needed	Parameter Settings Needed
Controlled stop when possible. If not possible, apply motor brake immediately.	Normal disable	Command CS using input. Do not disable power stage or command other disables until CS completes and brake applies.	DRV.DISMODE = 2. Controlled stop then disable. Set: DRV.DISTO , CS.VTHRESH , CS.DEC , CS.TO .
	E-stop, or safety condition		
	Fault CS	Do not disable power stage or command other disables until CS completes and brake applies.	
	Fault Dynamic Brake	N/A	N/A
	Fault Power stage disable	None	MOTOR.BRAKEIMM = 1
Controlled stop when possible. If not possible, dynamic brake.	Normal disable	Command CS using input. Do not disable power stage or command other disables until CS completes and brake applies.	DRV.DISMODE = 3. Controlled stop then disable. Set: DRV.DISTO , CS.VTHRESH , CS.DEC , CS.TO .
	E-stop, or safety condition		
	Fault CS	Do not disable power stage or command other disables until CS completes and brake applies.	
	Fault Dynamic Brake	N/A	N/A
	Fault Power stage disable	None	MOTOR.BRAKEIMM = 1

9 Configuring with Linear Motors

9.1 Connecting a DDL Motor to an AKD PDMM Drive

Before Connecting a DDL motor to an AKD PDMM drive, the following tasks must be accomplished:

- Integrate motor coil and magnet way onto a bearing structure so that the motor moves freely (rubber stops at the end of travel are recommended, especially during commissioning).
- Linear scale is integrated to the assembly and set up with the correct alignment and airgap to provide an appropriate sinusoidal or digital feedback signal.
- Determine the resolution of the Linear Scale in micrometers (microns) per cycle (this will be listed in the documentation of the linear scale).

Connect Hall sensor, Linear Scale, and motor temperature cables through the ACI-AKD PDMM cable assembly to the AKD PDMM's X10 Feedback Connector.

Connect the motor power leads to the AKD PDMM motor power connector X2 with the following connections:

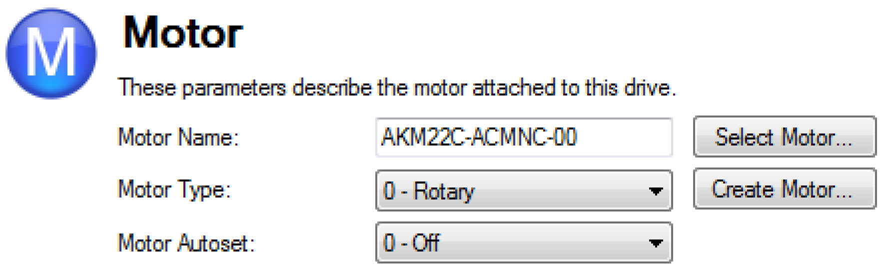
Red -> U

White -> V

Black -> W

Yellow / Green -> PE

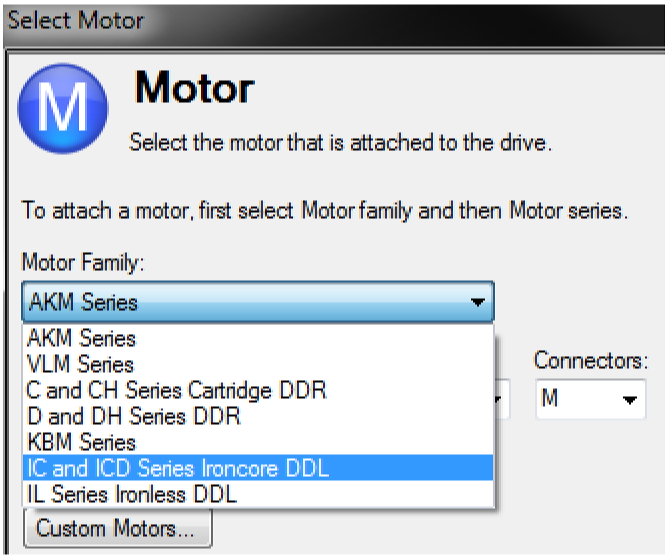
Apply 24 volt logic power to the AKD PDMM and launch KAS IDE from a computer to interface with the AKD PDMM drive. From the Motor view in EWV[1], click Select Motor.



NOTE If “Select Motor” is grayed out, Motor Autoset may need to be set to “0 –Off” to enable the Select Motor option.

On the Select Motor screen, for Motor Family select either **IC and ICD Series Ironcore DDL** or **IL Series Ironless DDL**. On the Select Motor screen for “Name” select the appropriate motor part number.

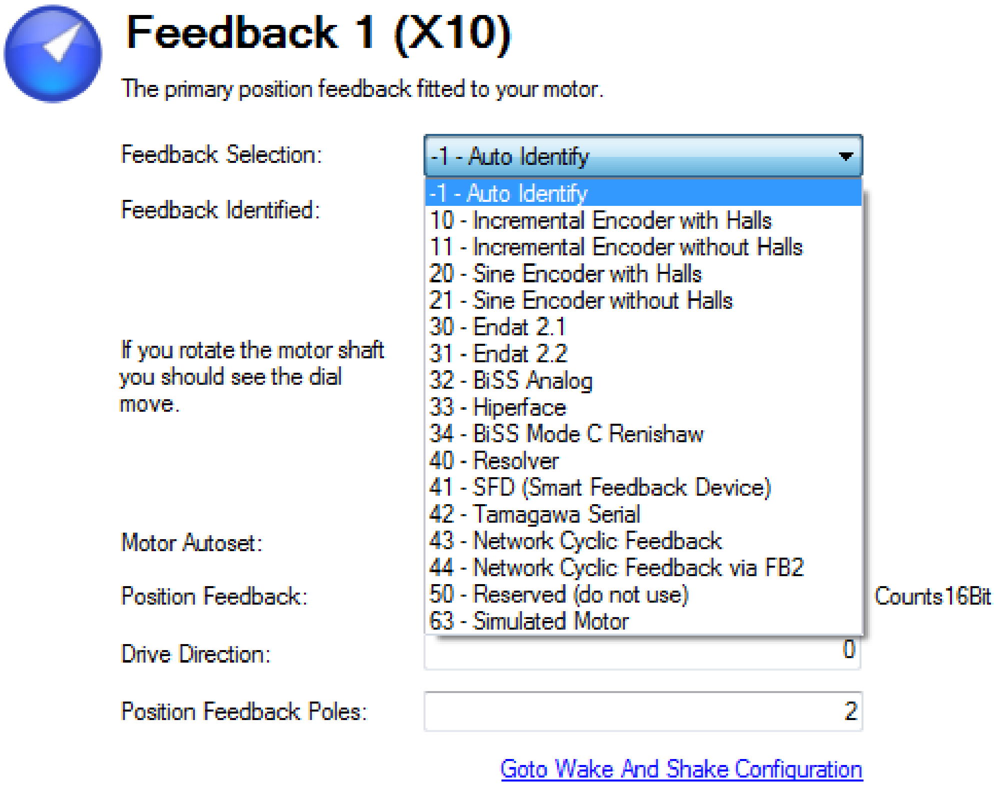
[1] Embedded Workbench Views



Click OK.

From the main tree, under Settings, select **Feedback 1**.

Under Feedback Selection, select either **10 – Incremental Encoder with Halls**, or **20 – Sine Encoder with Halls** to correspond to the Linear Scale that is integrated with the motor.



Using the resolution of the Linear Scale in Microns per cycle, the Sine Cycles/Magnet Pitch is determined. Use the following:

1. Take the reciprocal of resolution to get cycles per micron
2. Multiply by 1000 to get cycles per millimeter
3. Multiply by 32 millimeters per Magnet Pitch to get Sine Cycles/Magnet Pitch

For example, if the resolution of the Linear Scale is 40 microns per cycle, then the Sine Cycles/Magnet Pitch would be 800.

The Linear Scale phase direction must be verified. Watch the Feedback 1 screen in EWV. When the coil assembly is moved in the direction of the cable exit (think of pulling the coil by the cable), the Position Feedback should increase positively in value and in the motor graphic, the gray block should move to the right. If the direction is opposite, then the A+ and A- signals on the Linear Scale must be swapped to correct the phase direction.

The motor is now ready for velocity loop and position loop compensation.

10 Configuring General Drive Settings

10.1 Limits

This screen allows you view and modify the various drive limits.

Button or Dialog Box	Description	Parameter
Current Limits		
Positive Peak Current	The maximum positive current allowed.	IL.LIMITP (pg 361)
Negative Peak Current	The maximum negative current allowed.	IL.LIMITN (pg 360)
Velocity Limits		
Positive Speed Limit	The maximum speed allowed in the positive direction.	VL.LIMITP (pg 466)
Negative Speed Limit	The maximum speed allowed in the negative direction.	VL.LIMITN (pg 464)
Over Speed Limit	The threshold velocity for an over speed fault.	VL.THRESH (pg 468)
Position Limits		
Maximum Position Error	The maximum position error. If the position error PL.ERR is larger than PL.ERRFTHRESH, then the drive generates a fault	PL.ERRFTHRESH (pg 399)
Position Limit 0	The minimum position the drive can reach before generating a negative software position fault.	SWLS.LIMIT0 (pg 441)
Position Limit 1	The maximum position the drive can reach before generating a positive software position fault.	SWLS.LIMIT1 (pg 442)
Acceleration Limits		
Acceleration	The acceleration ramp used to profile some types of motion.	DRV.ACC (pg 262)
Deceleration	The deceleration ramp used to profile some types of motion.	DRV.DEC (pg 269)
Motor Limits	Motor limits are set through the Motor Foldback Screen (see Foldback (pg 47))	

10.1.1 Limits

The limits screen covers most of the basic system limits, including current, velocity, and position.

- **Current Limits:** The current limits are set based on the drive ratings. You can change these limits to be lower then the default values for the drive, however, this may effect the expected performance of your application.
- **Velocity Limits:** The velocity limits are set based on the motor ratings. You can modify these settings above the ratings of the motor if the application requires some overhead, but be aware the motor has mechanical limitations and may be damaged if run above those limits. It is best to leave these at the default ratings for the motor selected.
- **Position Limits:** The position limits can be set based on your specific machine application requirements. The Maximum Position Error can be set to cause a fault when the position error exceeds the value you insert here. Position Limit 0 is tied to the clockwise (positive) motor direction. As the motor reaches the position entered, the motor will stop and display a warning n107. Position Limit 1 is tied to the counterclockwise (negative) motor direction. As the motor reaches the position entered, the motor will stop and display a warning n108.
- **Acceleration Limits:** This field allows you to raise accelerations to give the system crisp moves. These limits default to a low value, so you may wish to change these after the mechanics and other sections of your system are defined.

10.2 Enable/Disable

10.2.1 Enable Modes

The AKD PDMM offers several options for hardware and software enables, as well as safe torque off (STO) to cover a variety of conditions.

Hardware Enable Mode

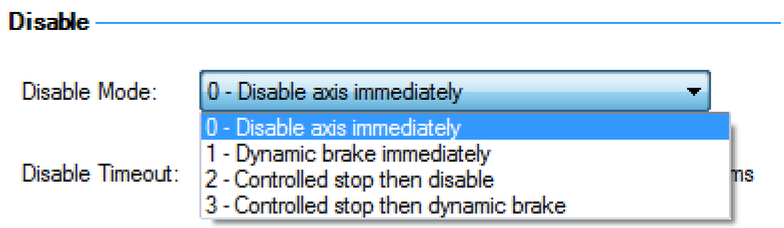
The AKD PDMM has two methods hardware enable methods. These methods are controlled by DRV.HWENMODE. Mode 0 allows for the drive to enable and clear faults on the rising edge of the hardware enable input. Mode 1 will NOT clear any faults on the rising edge of the hardware enable input, allowing you to review any current faults and manually clearing.

Software Enable Default

In addition, the Software Enable has two methods for enabling the AKD PDMM. These are controlled by DRV.ENDEFAULT. Default 0 leaves the software in the disabled state upon start-up. Default 1 enables the software upon start-up.

10.2.2 Disable Modes

Use DRV.DISMODE to select the method for stopping the drive.



Mode 0: Immediately disable drive.

With this condition, the drive will immediately disable the power stages and the driven motor will either coast to a stop or in the case of a vertical or overhung load axis, will fall abruptly. If a brake is present, the brake will be applied according to MOTOR.TBRAKEAPP. Using Digital Input mode 13, you can achieve a controlled stop as described in Mode 2.

Mode 1: Dynamic Brake to a stop.

In this situation, the drive will use the dynamic brake feature and stop motion quickly, and then disable the power stage. In most cases, the driven motor will stop quickly (pending the joules available and load circumstances). In the case of an overhung or vertical load, the driven motor will attempt to stop, but then will continue to allow the load to fall if no measures have been taken to secure the load.

Note: for Modes 2 and 3, you can access the Controlled stop section to set the values of the controlled stop deceleration rate, the velocity threshold, and time in velocity threshold to deactivate the drive.

Mode 2: Controlled stop, then disable.

In this mode, a controlled stop will take place based on a variety of parameters that you set. First, the driven motor will decelerate at a controlled rate (CS.DEC) until one of two things happens. 1) The motor reaches the velocity limit set (CS.VTHRESH) for a period of time (CS.TO), or 2) The drive emergency time out is reached (DRV.DSTO). Once either of these cases is reached, the power stage will be disabled (and brake applied if present)

Mode 3: Controlled stop, then dynamic brake.

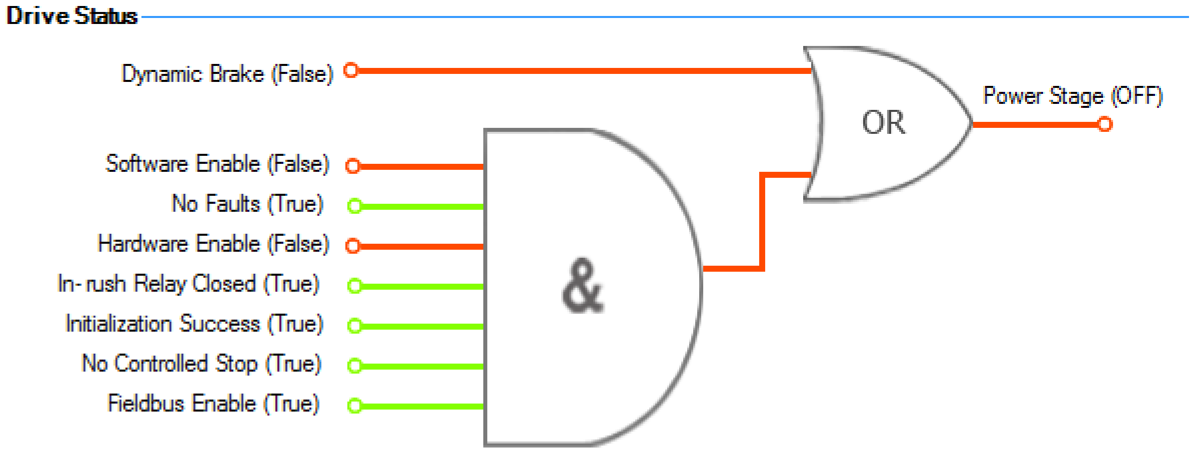
Similar to Mode 2, the motor will decelerate at a controlled rate (CS.DEC) until CS.VTHRESH is reached for a period of time (CS.TO). The drive will then dynamically brake and disable under the same conditions as described in Mode 2.

The Disable Timeout Setting determines the amount of time the drive will follow the disable mode before it deactivates the drive regardless of method chosen and alerts with an Emergency Timeout Fault.

All disable modes operate based on the type of disable command received. Any critical faults, hardware disable, or STO disable immediately turn off the power stage, and the motor will coast or free fall, depending on how the motor is secured.

10.2.3 Drive Status

The **Drive Status** area is displayed below the settings area and includes a graphical representation of drive active status with different sets of inputs. If the input or output is enabled, then it is shown in green; if the input or output is disabled, then it is shown in red. The inputs to the OR and & (AND) gates identify which conditions are true (green) or false (red) and follow the normal logic for & (AND) and OR gates. This diagram is useful in finding which input may be preventing the drive from being enabled. Click **More** to see the details of how the control stop is executed displayed both logically and graphically.



10.2.4 Controlled Stop

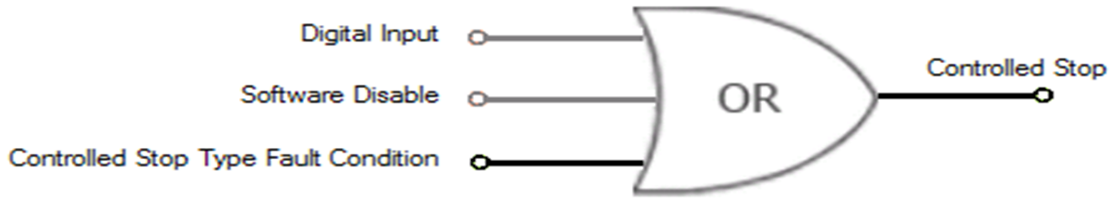
The Controlled Stop area displays values for parameters associated with controlled stop.

Button or Dialog Box	Description	Parameter
Velocity Threshold	Sets the velocity threshold for controlled stop process.	CS.VTHRESH (pg 240)
Velocity Threshold Timeout	Sets the velocity threshold, which is the time value for the drive velocity to be within CS.VTHRESH before the drive disables	CS.TO (pg 238)
Deceleration	Sets the deceleration value for the controlled stop process.	CS.DEC (pg 237)
Control stop Input	Displays the list of digital inputs configured to controlled stop mode separated by ','. When no controlled stop mode is configured, this box displays the message: **No CS Input Configured**. **Configure Input** link will opens the Digital I/O screen where you can configure the controlled stop mode.	

10.2.5 More/Less Button

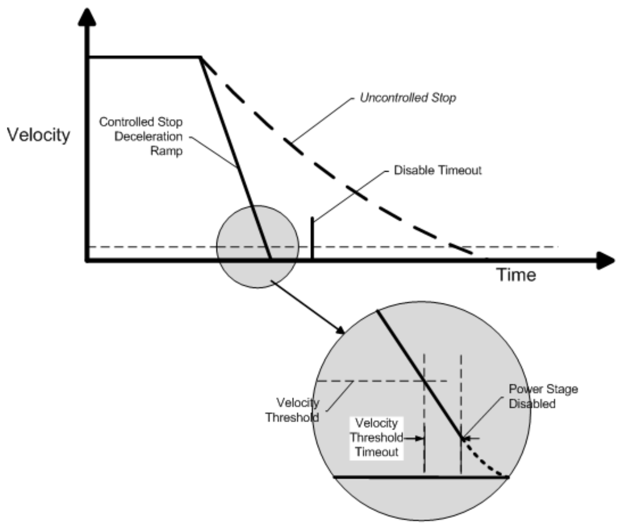
The **More** button reveals the status diagram for the controlled stop configuration. It also displays the block diagram for the control stop. Two block diagrams available: one for a brake fitted and another for no brake.

Control stop status diagram

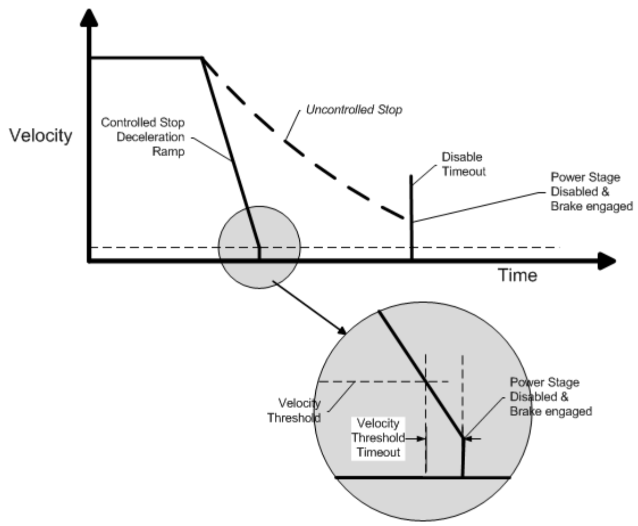


Controlled Stop Block Diagram

No brake configured



Brake configured



10.3 Controlled Stop

In a controlled stop, drive motion is brought to a standstill in a controlled manner. The drive commands a zero velocity from the motor. The motor decelerates at the prescribed deceleration value (CS.DEC (pg 237)).

A controlled stop can occur in three ways:

- The user configures a programmable digital input to mode 13 using DINx.MODE. For example, if DIN1.MODE 13 is applied, digital input 1 is set to controlled stop.

- Either a controller or the user (through the EWV[1] terminal window) initiates a software disable (DRV.DIS) command .
- A fault initiates a controlled stop from the drive. See Fault and Warning Messages (pg 135) for the faults which initiate a controlled stop.

The controlled stop mechanism is activated in the following cases:

1. DRV.DISMODE = 2 and user executes DRV.DIS from the terminal or EWV disable buttons.

   NOTE You must disable the drive in order to set DRV.DISMODE.

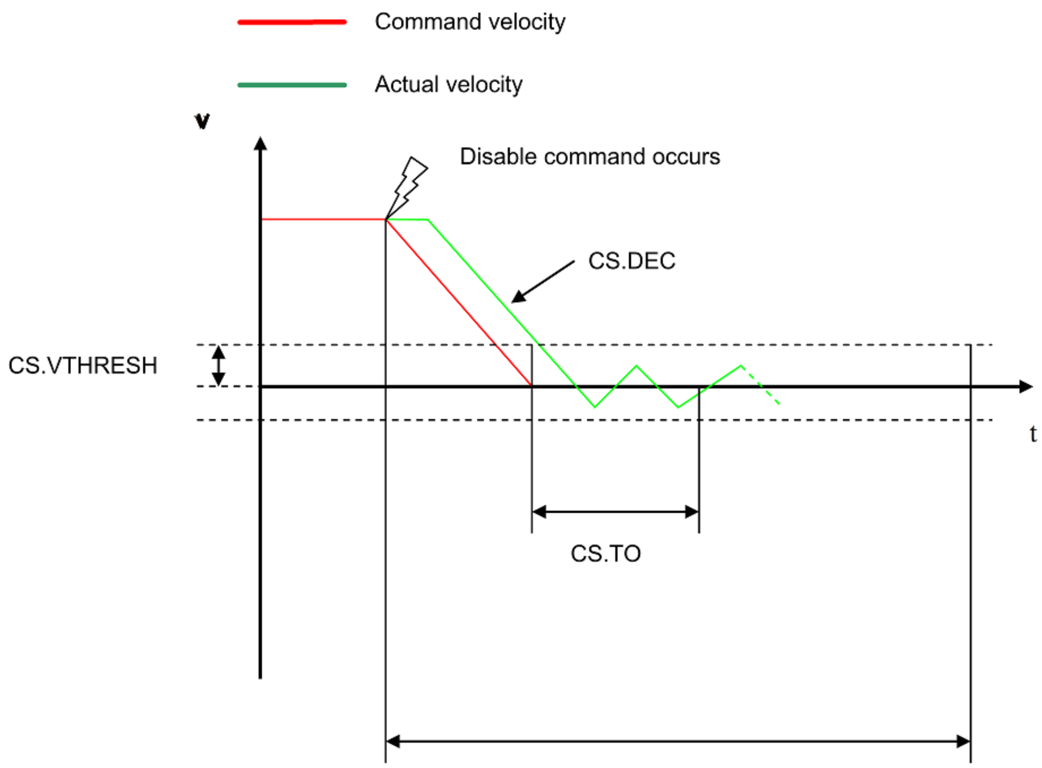
2. DRV.DISMODE = 2 and user executes DRV.DIS from a fieldbus connected to the drive.
3. A fault happens for which the reaction evolves controlled stop (CS). After the CS is executed, the drive disables.
4. A digital input mode (DINx.MODE) is set to 13. If the digital input state changes (active high or low according to DINx.INV) the CS is executed, and then the drive disables.
5. HW limit switch: A digital input is defined as a positive (negative) limit switch (DINx.MODE 18 or 19). When the limit switch is met, the CS mechanism starts running. In this case, the parameter DRV.DISTO is not active.
6. SW limit switch: SWLS defines an active SW limit. When the limit is met, the CS mechanism starts running. In this case, the parameter DRV.DISTO is not active.

Use the drive CS parameters to configure a controlled stop as follows:

1. CS.DEC: Deceleration ramp that is used for disable.
2. CS.VTHRESH: Velocity 0 threshold. The motor shaft is considered as stopped as soon as the actual velocity (filtered through a 10 Hz filter, such as VL.FBFILTER) is within ± CS.VTHRESH.
3. CS.TO: Velocity 0 time. The actual velocity must be consecutively within 0 ± CS.VTHRESH for the time CS.TO, before the drive completes the CS process. This value is used since the motor can overshoot out of the VEL0 window depending on the gains, deceleration ramp, motor inertia and so on.
4. DRV.DISTO: Disable time out. This parameter sets an overall and independent running check as to whether or not the drive can achieve the disable state. If the VEL0 window set in step 3 is too small, it is possible that the drive may never reach the end of the CS process. The DRV.DISTO parameter and functionality addresses this issue by disabling the drive after the DRV.DISTO time elapses, even if the CS process did not end.

Controlled Stop Diagram

[1]Embedded Workbench Views



When configuring the controlled stop feature, please note the following:

- If the HW limit switch is active and any of the other CS activated, the only difference will be that in this case the DRV.DISTO will limit the time before disabling the drive.
- If the value of DRV.OPMODE of the drive is current mode, the drive will not execute the CS but instead stop immediately.
- Set DRV.DISTO to an appropriate value that will allow the motor to decelerate from any velocity to 0 with DRV.DEC. This value must also allow the motor to afterwards remain within VL.FB for CS.TO consecutively within 0 ± CS.VTHRESH.

The drive issues a fault FF703 (pg 146) in case that the DRV.DISTO counter expires during a controlled stop procedure.

Related Parameters and Commands

CS Parameters (pg 236)

CS.STATE (pg 238): Reads the current state of controlled stop process (0 = controlled stop is not occurring. 1 = controlled stop is occurring).

DIN1.MODE TO DIN24.MODE (pg 247)

DRV.DIS (pg 272)

DRV.DISTO (pg 275)

DRV.DISMODE (pg 273)

Related topics:

Emergency Stop (pg 68)

1 Digital Inputs and Outputs

Fault and Warning Messages (pg 135)

10.4 Dynamic Braking

Dynamic braking is a method to slow a servo system by dissipating the mechanical energy in a resistor driven by the motor back EMF. The drive has a built in advanced dynamic braking mode which operates fully in hardware. When activated, the drive shorts the motor terminals in phase with the back EMF (q axis) but continues to operate the non-force producing current loop (d-axis) with 0 current. This action forces all of the dynamic braking current toward stopping the motor current and insures the fastest stopping of motor terminal current.

The drive hardware also limits the maximum dynamic braking motor terminal current via the DRV.DBILIMIT parameter to prevent the drive, motor, and customer load from encountering excessive currents/forces. When the current is not being limited, the mechanical energy is dissipated in the motor terminal resistance. When the current is being limited, energy is returned to the drive bus capacitors. When the amount of returned energy raises the bus capacitor voltage enough, the drive activates the regeneration control to start transferring the returned energy to the regen resistor. This resistor could be internal or external to the drive depending on drive model and drive wiring.

Whether and how the drive uses dynamic braking mode depends on the drive disable mode (DRV.DISMODE) setting.

10.4.1 Drive Regeneration

When the servo motor is slowing down at a rate faster than friction and motor losses would slow the motor, then mechanical energy can be returned to the drive. This returned energy initially drives the internal bus voltage upwards. When the returned energy is high enough, the regeneration control transfers the excess returned energy into the regeneration power resistor. If the regeneration control cannot fully handle the power returned (for example, because there is not a regen resistor present or its resistance value is too high), then the bus voltage will continue to rise and a bus over voltage fault will happen and disable the drive completely, which allows the motor to freewheel.

AKD PDMM-x00306 to AKD PDMM-x00606

These units do not have an internal regeneration resistor. In many applications machine friction, motor losses, and the limited bus capacitor energy absorption handles the application. But, depending on the exact application requirements, an external resistor can be connected.

AKD PDMM-x01206 to AKD PDMM-xzzz07

These units have an internal regeneration resistor plus the capability to connect an external resistor if higher power levels are needed.

Related Topics

See section *6.14 Dynamic Braking* in the *AKD PDMM Installation Manual* for detailed information on dynamic braking.

DRV.DISMODE (pg 273)

DRV.DBILIMIT (pg 268)

10.5 Emergency Stop

10.5.1 Stop / Emergency Stop / Emergency Off

The control functions Stop, Emergency Stop and Emergency Off are defined by IEC 60204. Notes for safety aspects of these functions can be found in ISO 13849 and IEC 62061.

NOTE	**The parameter DRV.DISMODE must be set to 2 to implement the different stop categories. Consult the *AKD PDMM User Guide* for configuring the parameter.**

WARNING	Functional safety, e.g. with hanging load (vertical axes), requires an additional mechanical brake which must be safely operated, for example by a safety control. Set parameter MOTOR.BRAKEIMM to 1 with vertical axes, to apply the motor holding brake (=> p. 1) immediately after faults or Hardware Disable.

10.5.1.1 Stop

The stop function shuts down the machine in normal operation. The stop function is defined by IEC 60204.

NOTE	The Stop Category must be determined by a risk evaluation of the machine.

Stop function must have priority over assigned start functions. The following stop categories are defined:

Stop Category 0

Shut-down by immediate switching-off the energy supply to the drive machinery (this is an uncontrolled shut-down). With the approved safety function STO (see page 1) the drive can be stopped using its internal electronics (IEC 61508 SIL2).

Stop Category 1

A controlled shut-down, whereby the energy supply to the drive machinery is maintained to perform the shut-down, and the energy supply is only interrupted when the shut-down has been completed.

Stop Category 2

A controlled shut-down, whereby the energy supply to the drive machinery is maintained.

Stop Category 0 and Stop Category 1 stops must be operable independently of the operating mode, whereby a Category 0 stop must have priority.

If necessary, provision must be made for the connection of protective devices and lock-outs. If applicable, the stop function must signal its status to the control logic. A reset of the stop function must not create a hazardous situation.

10.5.1.2 Emergency Stop

The Emergency Stop function is used for the fastest possible shutdown of the machine in a dangerous situation. The Emergency Stop function is defined by IEC 60204. Principles of emergency stop devices and functional aspects are defined in ISO 13850.

The Emergency Stop function will be triggered by the manual actions of a single person. It must be fully functional and available at all times. The user must understand instantly how to operate this mechanism (without consulting references or instructions).

NOTE	**The Stop Category for the Emergency Stop must be determined by a risk evaluation of the machine.**

In addition to the requirements for stop, the Emergency Stop must fulfil the following requirements:

- Emergency Stop must have priority over all other functions and controls in all operating modes.
- The energy supply to any drive machinery that could cause dangerous situations must be switched off as fast as possible, without causing any further hazards (Stop Category 0) or must be controlled in such a way, that any movement that causes danger, is stopped as fast as possible (Stop Category 1).
- The reset must not initiate a restart.

10.5.1.3 Emergency Off

The Emergency Off function is used to switch-off the electrical power supply of the machine. This is done to prevent users from any risk from electrical energy (for example electrical impact). Functional aspects for Emergency Off are defined in IEC 60364-5-53.

The Emergency Off function will be triggered by the manual actions of a single person.

NOTE	**The result of a risk evaluation of the machine determines the necessity for an Emergency Off function.**

Emergency Off is done by switching off the supply energy by electro-mechanical switching devices. This results in a category 0 stop. If this stop category is not possible in the application, then the Emergency Off function must be replaced by other measures (for example by protection against direct touching).

10.6 Under Voltage Fault Behavior

You can adjust the conditions for an under voltage fault using VBUS.UVMODE in the EWV Terminal (pg 115) View:

VBUS.UVMODE = 1 (default)

The drive will not report an under voltage fault unless the drive is enabled and VBUS.VALUE falls below VBUS.UVFTHRESH

VBUS.UVMODE = 0

The drive will report an under voltage condition any time VBUS.VALUE falls below VBUS.UVFTHRESH.

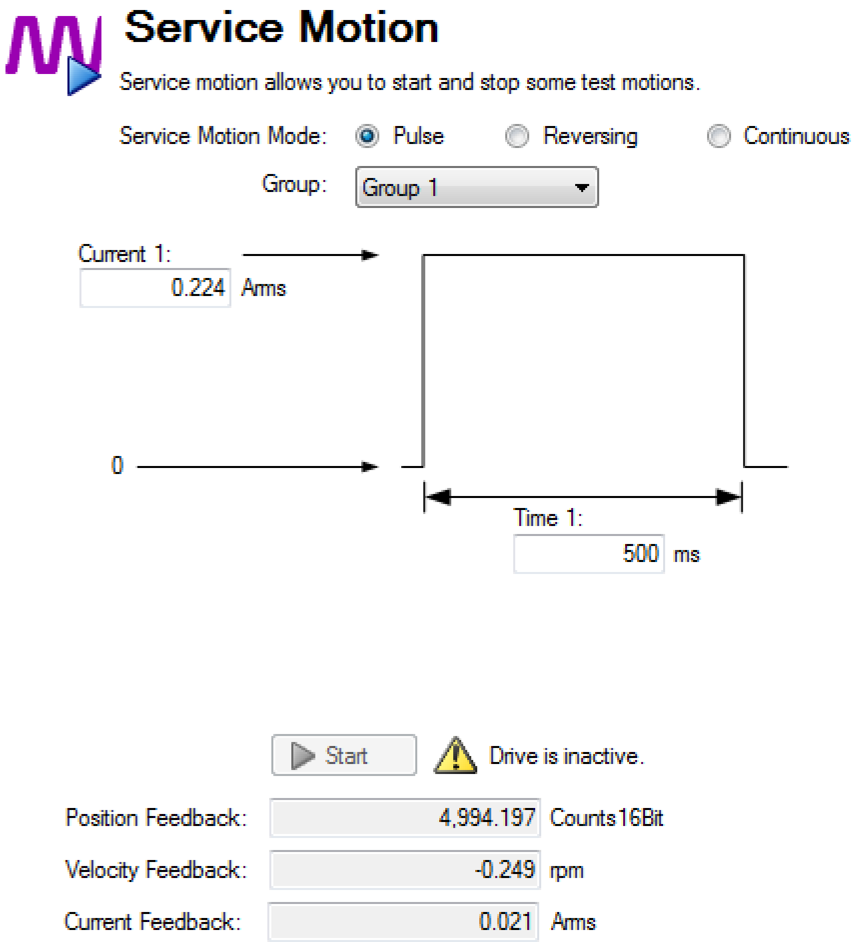
When an under voltage fault occurs, the drive is disabled and issues the following alerts:

- EWV alert: 502 Bus Under Voltage
- Drive LED alert: Left LED displays [F], right LED displays [u-V].\
- Fault relay output turns on.

11 Creating Motion

11.1 Service Motion

Service Motion allows you to set up simple motion (Command Source must be set to Mode 0 - Service). It is typically used during initial set up to exercise the system. It can be used to help troubleshoot the system, execute tuning, make repetative moves for verification of mechanical set up, or for other general simple motion needs. There are multiple ways to set up motion depending on the desired result in torque, velocity or position modes. In all modes, you can run a momentary pulse, set up reversing motion, or initiate continuous motion.



The chart below identifies the commands available on the **Sevice Motion** view:

Button or Dialog Box	Description
Pulse	Alternates between the commanded current or velocity and zero velocity. You can specify the time period between the commanded value and the return to zero. Setting a time to zero will generate a continuous command.
Reversing	Alternates between the two commanded values. You can specify the time the command will be held in each state.
Continuous	Runs the commanded current or velocity continuously.
Group	Selects parameter group to be used with service motion. Group 1 selects parameter group for SM.MODE 0, and group 2 selects parameter group for SM.MODE 2. See SM.MODE (pg 431) for more details.
Current 1/Current 2	Sets the two different currents.

Button or Dialog Box	Description
Time 1/Time 2	Sets the time for which the different commands are generated. Setting a time to zero generates a continuous command.
Start/Stop	Starts and stops the motion.
Position Feedback	Displays the present position of the motor.
Velocity Feedback	Displays the present velocity of the motor.
Current Feedback	Displays the present current of the motor.

Related Parameters

SM.I1 (pg 431)
SM.I2 (pg 431)
SM.I2 (pg 431)
SM.MOVE (pg 434)
SM.T1 (pg 434)
SM.T2 (pg 434)
SM.V1 (pg 435)
SM.V2 (pg 436)

11.2 Motion Profile Table

You can define acceleration, velocity, position, and jerk for drive motion tasks using the **Motion Profile Table** view shown below:

⚠CAUTION This is a beta feature. Please note that IL.KACCFF should be set to 0 when using this feature.

The **Motion Profile Table** view consists of three sections:

- Grid
- Graphical Representation
- Control Buttons

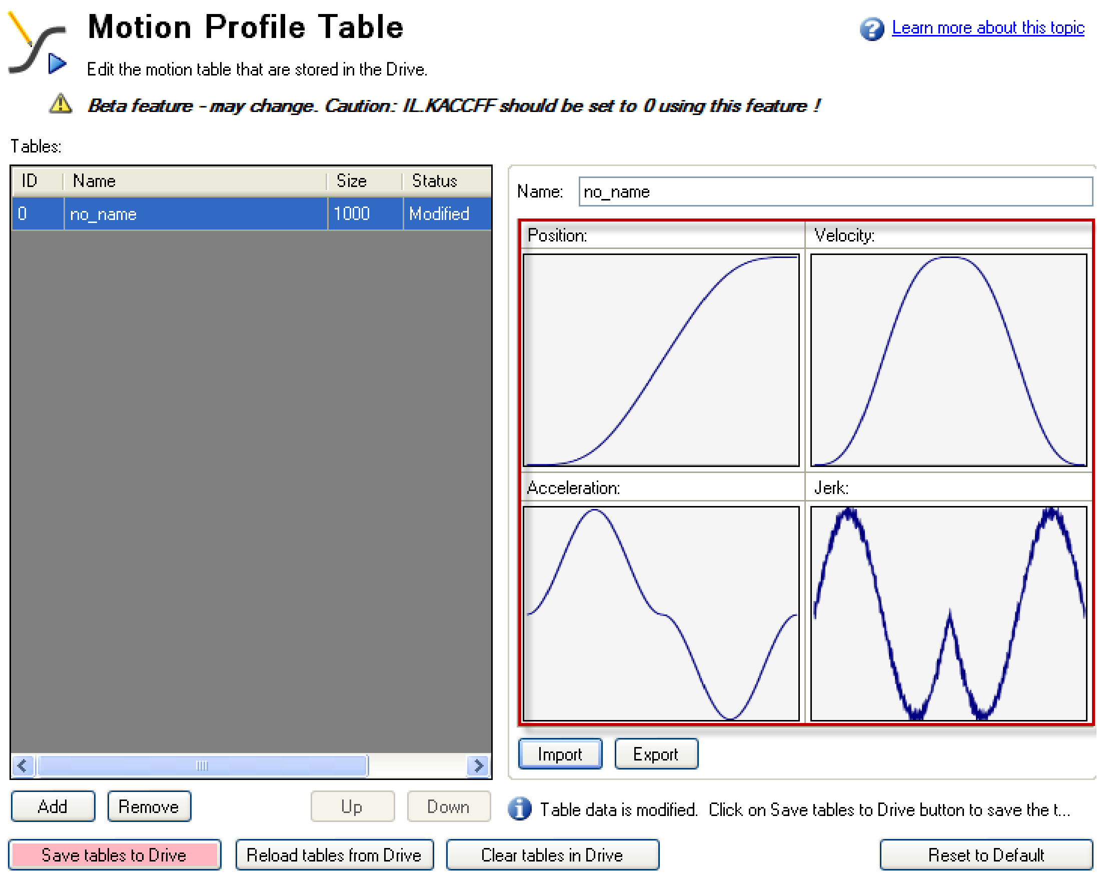
11.2.1 Grid

You can modify motion profile table data using the tables grid on the left side of the view and the Name text box on the right. All profile table data is displayed in the tables grid. This data includes:

- ID: indicates the unique ID number (0 to 7) of the profile table.
- Name: indicates the name of the profile table. By default, a profile table name is ‘no_name’. To edit the profile table name select one of the profile tables from the grid, and then change the profile table name by using the **Name** textbox .
- Size: indicates the total count of the profile table data.
- Status: indicates the current status of the profile table in the grid. Before saving a table into the drive, the status displays "Modified" and after saving the drive, the status displays "Sync". If you change the profile table name, then the status displays "Name Modified".

11.2.2 Graphical Representation

On the right side of the Motion Profile Table view, you can view graphical representations of acceleration, velocity, position, and jerk of the selected profile table. Graphs are plotted based on the given data of the profile table. See the screenshot below for typical graphical representations:



11.2.3 Control Buttons

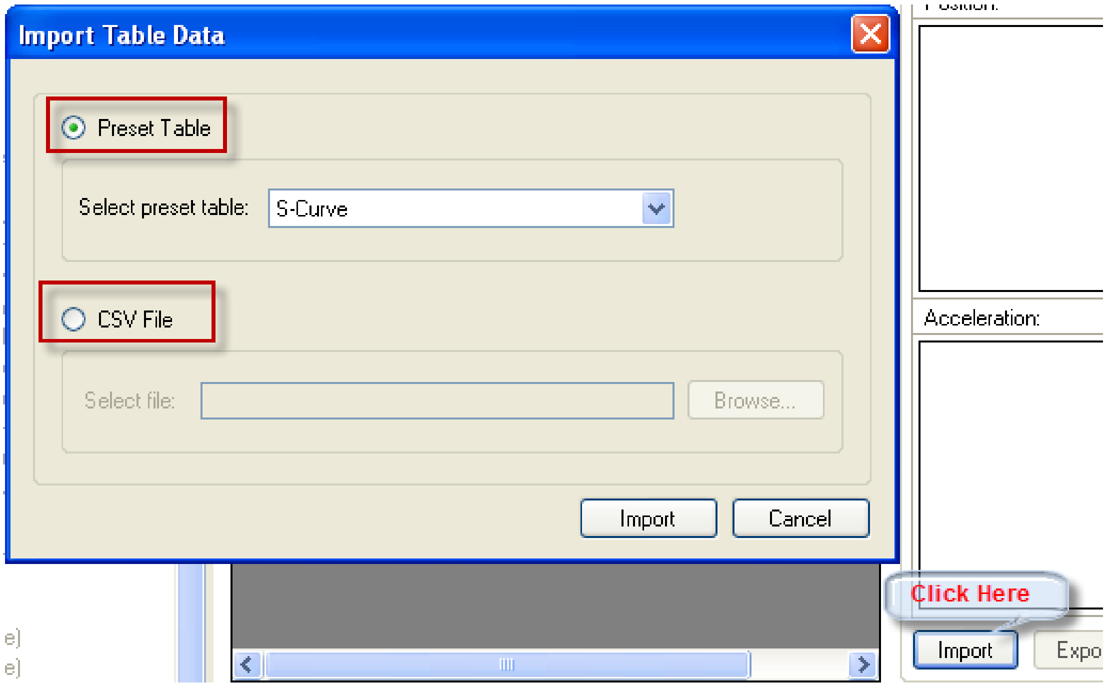
The control buttons at the bottom of the **Motion Profile Table** view allow you to manipulate motion profile tables and data as follows:

Control Button	Description
Add	Adds new profile tables. A new table has a size of zero when it is added to the grid. You can add a maximum of 8 profile tables, numbered 0 to 7.
Remove	Remove profile tables from the grid (in memory). If a profile table is in use by a motion task and you attempt to delete the profile table using the **Remove** button, then a caution message appears. The caution message shows the affected profile table ID and an option to either continue or not.
Up/Down	Moves profile table position either up or down in the grid list. If a profile table is in use by a motion task and you attempt to delete the profile table using the **Up** or **Down** buttons, a caution message appears. The caution message shows the affected profile table ID and an option to either continue or not.
Save tables to the Drive	Saves a newly added or modified valid profile table to the drive. The current representation in the grid is saved in the drive.
Reload tables from Drive	Reloads the table from the drive and overrides the table that is currently in memory.
Cancel	Cancel appears only when the reload operation is in progress. Click **Cancel** to cancel the profile table reloading operation.
Clear tables in Drive	Clears all the profile tables present in the drive.

Control Button	Description
Reset to Default Button	Loads the default table map into the memory. The current default map contains only one profile table (S-curve with 1,000 points).
Import	Imports the data from either preset tables within WorkBench or from an external .csv file. When you click **Import**, the **Import Table Data** popup screen appears and allows you to select the table size.
Export	Exports data to a .csv file.

11.2.3.1 Import Table Data

The **Import** button opens the **Import Table Data** screen shown below:



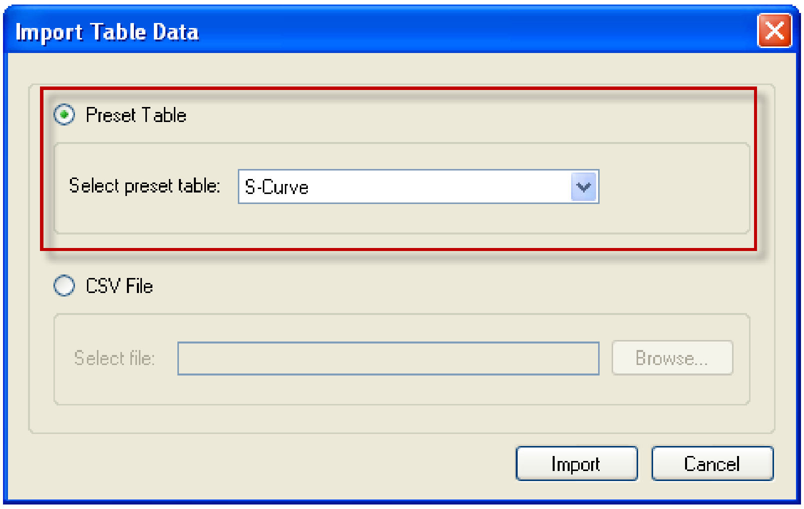
You have two options to provide inputs to the profile table:

- Preset Table
- CSV File

11.2.3.2 Importing data from Preset Table option

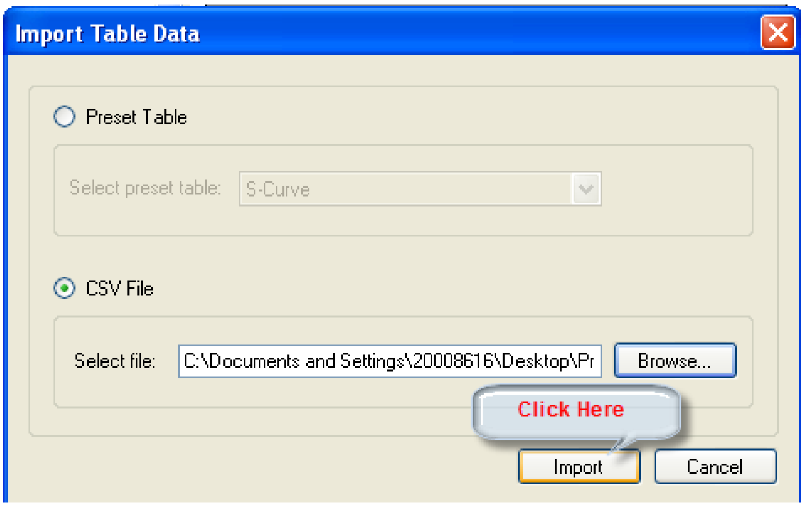
By default, the **Preset table** option is selected. You can select one of the preset tables from the **Select Preset Table**box. After selecting the source, click **Import**to complete the import of the data.

After import, the size of the profile table is shown in the grid and you can view the graphical representation of position, velocity, acceleration, and jerk based on the profile table data now loaded into the grid.



11.2.3.3 Importing data from an external CSV file

You also use the **CSV File** option to import the profile table data from an external .csv file. Select the **CSV File** option and then select the valid file using the browse button. After selecting the source file, click **Import** to complete the import of the data. A message indicates successful data import. After import, the size of the profile table is shown in the grid and you can view the graphical representation of position, velocity, acceleration, and jerk based on the profile table data now loaded into the grid.



If an invalid source or invalid format is selected, an "Invalid Data Format" message appears.

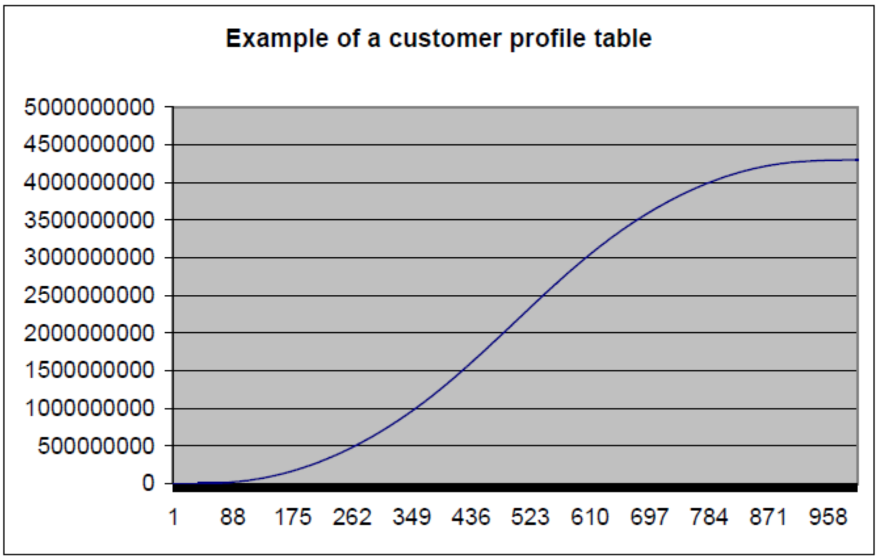
11.2.4 Motion Profile Table: Advanced

A motion profile table is a table of unit-less position values, which are the integral of the velocity profile during the acceleration and deceleration process of a motion task. A motion profile can be stored in the drive and used in order to accelerate and decelerate with a certain profile shape.

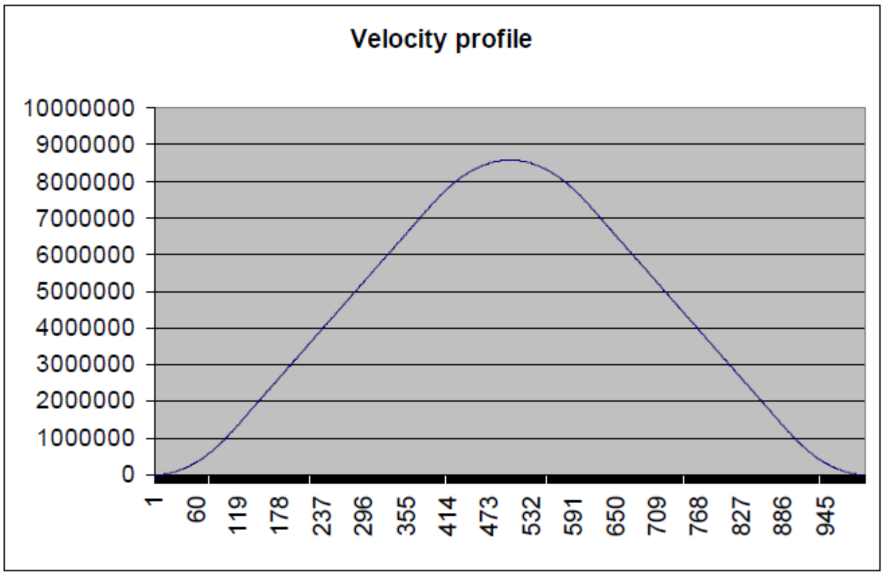
The motion profile table describes the shape of the acceleration process, but does not determine how fast the motion task accelerates or decelerates and which target velocity will be reached.

11.2.4.1 Example of a motion profile table

An example of a motion profile table is shown below:



The motion profile table is the integral of the velocity profile; the velocity profile during the acceleration and the deceleration process is shown below:



The derivative of the motion profile table is calculated using the following formula:

$$velocity\_profile\_value_n = customer\_profile\_entry_{n+1} - customer\_profile\_entry_n$$

11.2.4.2 Motion Profile Table Restrictions

Restrictions for motion profile tables include the following:

1. A motion profile table needs a reasonable number of entries (usually between 1,000-4,000 entries, depending on the acceleration and deceleration time of a motion task). If an acceleration or deceleration process takes more position-loop samples than half of the motion profile table entries, then the drive interpolates linearly between the single motion profile table entries.
2. The motion profile table should contain an even number of entries. The first point of the customer table starts with the value of 0 and the last point must contain the value of 2^{32}-1.
3. The motion profile table contains values in ascending order.
4. The following motion profile table entry must contain the value of nearly 2^{31}.

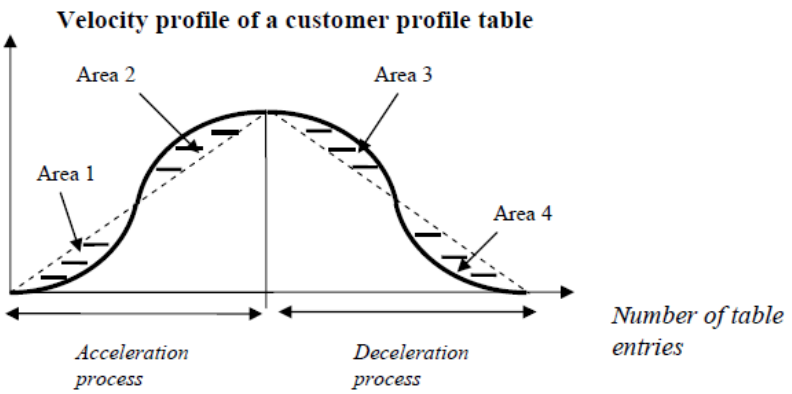
$$table\_entry = \frac{number\_of\_table\_points}{2} + 1$$

Example

Assume that a motion profile table contains 1,000 data points. In this case point 1000/2+1 = 501 must contain the value of 2^{31} = 2,147,483,648.

5. A motion profile table must also be symmetric during the acceleration and the deceleration process when a standard customer table motion task must be triggered.

To illustrate profile symmetry, the derivative of the motion profile table (velocity profile) is shown below; note the symmetry according to the velocity profile.

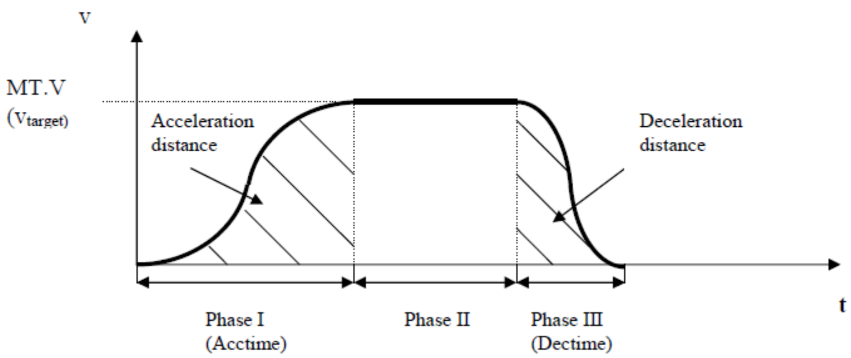


The left half of the curve describes the shape of the acceleration process of the motion task. The right half of the curve describes the shape of the deceleration process of the motion task. A symmetric motion profile table means that Area 1, Area 2, Area 3 and Area 4 have the same size.

11.2.4.3 Different methods of motion table motion tasking

General motion profile table explanations

The algorithm for handling the motion profile motion task are the same for both methods, the standard customer table motion task and the 1:1 customer table motion task. The diagram below illustrates a basic table profile algorithm. The figure shows a standard customer table motion task.

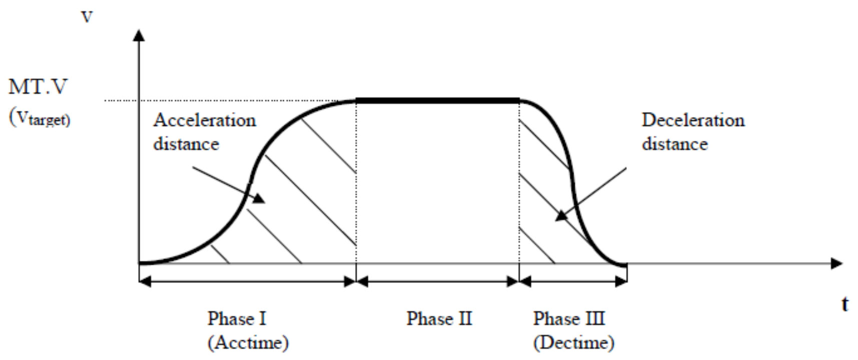


The drive calculates the acceleration time and deceleration time out of the given motion task parameters (see MT Parameters and Commands) with the assumption of a trapezoidal acceleration setting (MT.ACC and MT.DEC). The formulas are:

$$Acctime = \frac{MT.V}{MT.ACC} \quad ; \quad Dectime = \frac{MT.V}{MT.DEC}$$

11.2.4.4 Standard customer table motion task

The standard motion profile table motion task is displayed in the following figure:



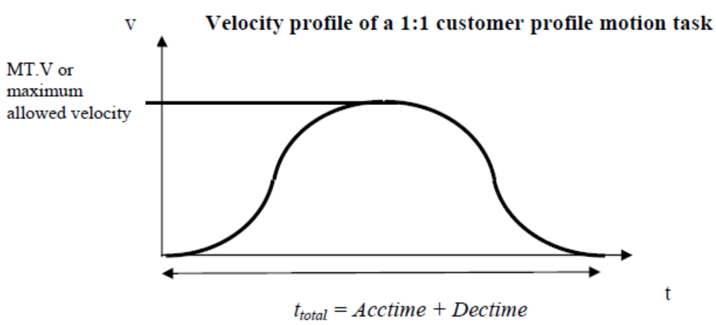
The standard handling for a stand-alone motion task, which means that this motion task does not trigger automatically a following motion task, can be separated in three different phases:

1. Phase I: The drive steps within a pre-calculated acceleration time through the first half of the motion profile table and reaches finally the requested target velocity of the motion task.
2. Phase II: The drive inserts a constant velocity phase and checks continuously if a brake-point has been crossed. The brake-point is naturally the target position minus the deceleration distance.
3. Phase III: The drive steps into the second half of the motion profile table and reaches finally the requested target position when the velocity becomes zero. The step into the second half of the motion profile table is a critical point and requires a symmetric table and the value of 231 at entry number_of_table_points / 2 + 1 as explained in the chapter Restrictions for a customer table.

11.2.4.5 1:1 customer table motion task

The 1:1 customer table motion task is basically very similar to the standard customer table motion task handling with just a few small differences.

1. The 1:1 customer table motion task does not step out of the table after an acceleration process and inserts a constant profile (Phase II in the chapter above). The 1:1 handling steps within a pre-calculated time through the whole table in one go and cover the required distance.
2. A change-on-the-fly from one motion task to another without finishing the first motion task is not possible for this mode.
3. The 1:1 profile does not use different acceleration and deceleration values. The AKD calculates the sum of the acceleration time and deceleration time and uses this total time (total¬= MT.V/DRV.ACC+MT.V/MT.DEC) for the motion task as explained in the following picture. In case that the acceleration + deceleration time is too small for moving a certain distance, which would lead into a too large peak-velocity, the total time will automatically be extended to the required value in order to not exceed the maximum allowed velocity (the minimum of MT.V or VL.LIMITP and VL.LIMITN).



Note that the motion task target velocity is only reached in case of a symmetric table (see chapter 1.2 for more details). The velocity will be different in case that the customer table is non-symmetric.

11.2.4.6 Setting up a motion profile motion task

It is recommended to set-up any motion task via the AKD Workbench PC software. The S-curve profile and the 1:1 profile will be selected via a drop-down menu.

It is also possible to select to adjust a motion task on a command line level with the help of the MT.xyz commands. There are 2 statements which are mentioned within this chapter:

- A trapezoidal acceleration, a 1:1 customer table motion task or a standard S-curve motion task will be selected via the bits 10 and 11 of the MT.CNTL command.
- The MT.TNUM parameter describes for each motion task, which table to use for the 1:1 customer table motion task or the standard S-curve motion task. The parameter MT.TNUM will be ignored in case that a trapezoidal motion task has been selected.

For more details please refer to the AKD Parameter and Command Reference documentation in the AKD Workbench help menu.

11.2.4.7 Drive reaction on impossible motion tasks

For all motion tasks, which use a motion profile table as the shape for the velocity profile, the motion task properties must be pre-calculated and it must be evaluated in advance, if a motion task can be handled without any problems or if some of the motion task parameters must be re-calculated automatically by the AKD.

An impossible motion task occurs when the user has not specified enough movement in order to accelerate to the motion task target velocity and to decelerate to velocity 0 without exceeding the distance to travel.

1:1 customer table motion task

As already described in chapter 2.3, it is not allowed activating a 1:1 profile motion task while another motion-task is currently running. A 1:1 customer table motion task must start from velocity 0.

When activating a 1:1 customer table motion task the AKD pre-calculates the expected peak-velocity and check is the velocity exceeds the minimum of the MT.V, VL.LIMITP and VL.LIMITN limitation.

The expected peak-velocity according to the figure above can be calculated via using the following formula:

$$v_{PeakExpected} = \frac{2 \cdot Distance\_to\_travel}{t_{total}}$$

The ‘distance to travel’ is defined in the motion task settings MT.P & MT.CNTL. In case that VPeakExpected exceeds the minimum of the MT.V, VL.LIMITP or VL.LIMITN setting, the AKD re-calculates ttotal in a way, that VPeakExpected does not exceed the velocity limitations.

The AKD accelerates and decelerates within the same time in case of a 1:1 profile and therefore different settings for MT.ACC and MT.DEC are not considered.

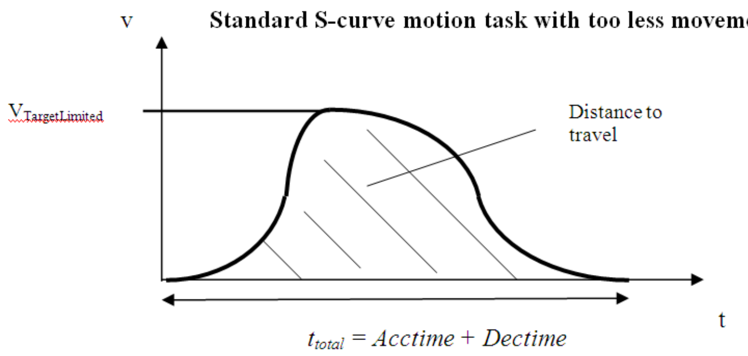
11.2.4.8 Standard customer table motion task

Starting from velocity 0 without change-on-the-fly to a following motion task

Similar to the considerations in chapter 4.1 the ‘distance to travel’ of a motion task is specified by the motion task settings MT.P & MT.CNTL. Furthermore the target velocity of the motion task (MT.V) and the acceleration and deceleration (MT.ACC and MT.DEC) are part of the motion task settings.

An impossible motion task setting would be, if there is not enough ‘distance to travel’ selected by the user in order to accelerate to the target velocity via the selected acceleration (internally converted to acceleration time) and deceleration (internally converted to deceleration time). In this case the AKD lowers the target velocity automatically to VTargetLimited and accelerates within the selected acceleration time to the limited target velocity and decelerates afterwards with the selected deceleration time to velocity 0.

The shape of the velocity profile will look like the following pictures with the assumption, that MT.ACC and MT.DEC have different values.



During a change on the fly condition

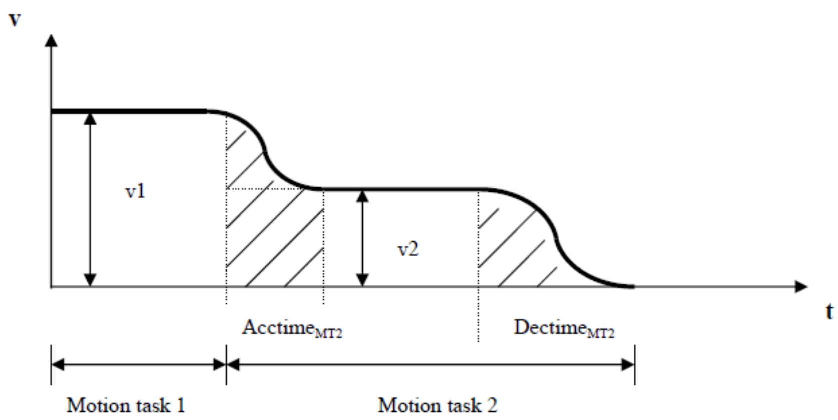
There are 2 different kinds of considerations within the AKD firmware for a change-on-the-fly condition.

- A change on the fly in the same direction (the target velocity of the previous and the following motion task have the same algebraic sign).
- A change on the fly in the opposite direction (the target velocity of the previous and the following motion task have a different algebraic sign).

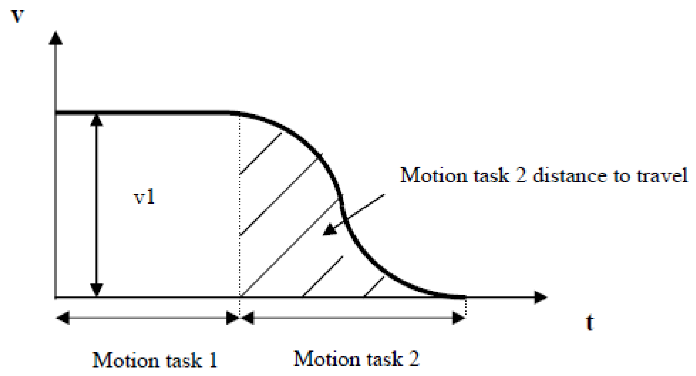
Since the shape of a customer table is unknown to the AKD, the Drive verifies in advance the validity of the motion task with the assumption of a symmetric motion profile table.

Movement to the same direction

The following figure displays a movement in the same direction, in this case in a positive direction.

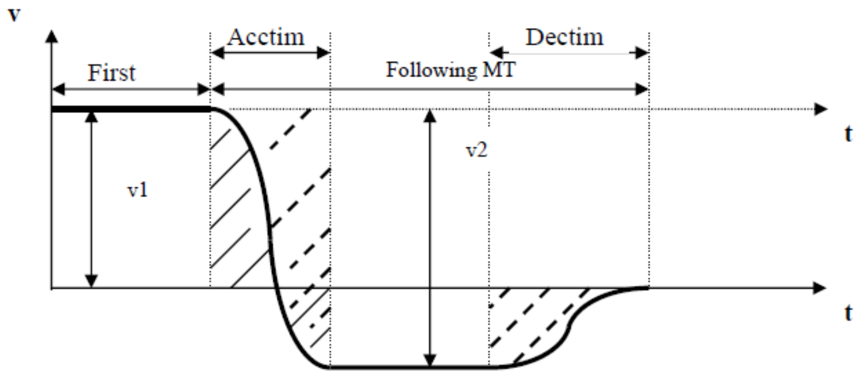


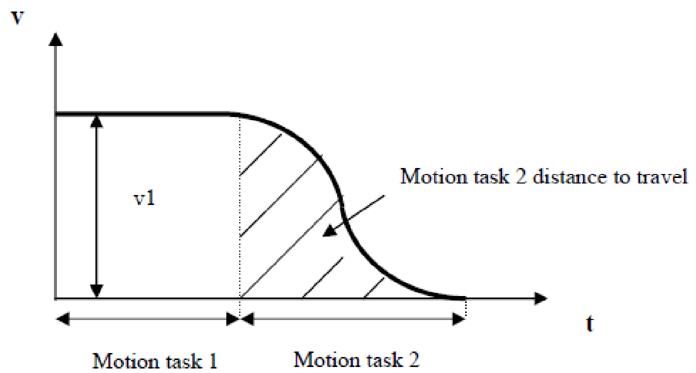
In case that the distance to the target position of the motion task 2 is smaller than distmin, the AKD generates a profile as shown in the next figure.



Movement in different directions

The switch on the fly from a positive velocity to a negative velocity is described in the next figure.





It is not possible to pre-calculate exactly the area, which is marked with solid lines of the following motion task since the shape of the motion profile table is unknown to the drive. This means that it is not possible to identify the movement in positive and negative direction during a change on the fly from v1 to v2. A criterion that a change on the fly will be executed by the drive is, if the total movement in negative direction of the following MT is larger than the area, which is marked with dashed lines. In this case it is ensured, that there will be definitely enough total movement of the MT in negative direction, because the motor moves during the acceleration from v1 to v2 also a bit in positive direction. The magnitude of v2 is in this case the ‘target velocity of MT1’ + ‘target velocity of MT2.'

The drive behaves as follows in case that the hatched area is smaller than the distance to travel negative direction:

1. The drives stops the first motion task with the assigned deceleration ramp.
2. Afterwards the following motion task is triggered automatically by the drive starting from velocity 0.

12 Tuning Your System

12.1 Introduction

Most servo systems require some level of tuning (setting up the desired response of the system usually with the load attached). This can be done through several methods available within EWV[1].

Slider Tuning - Slider tuning offers a very simplistic approach to tuning and can get you underway quickly. With this method, just the proportional and integral gains are adjusted based on the desired bandwidth you wish to achieve. You can take into account your load inertia if it is known. None of the Bi-quad filters are impacted by the slider tuning.

Performance Servo Tuner - This is an easy way to get a more sophisticated tuning accomplished. The details of how the PST works are included in the advanced section of this subject. However, the PST approach is a simple one-button solution that lets the system configure all of the tuning parameters for you. The PST is a robust solution to get your sytem tuned and ready to operate in a wide variety of mechanical configurations and loads.

Manual Tuning - Certain applications may require manual tuning where you set the gains and filters based on the specific performance you are looking for. You may also need to "tweak" the tuning that was set up in either the slider or the PST section to optimize your application performance.

12.2 Slider Tuning

This view allows you to vary the tuning of your drive using the slider.

12.2.1 Gentle, Medium, and Stiff

These buttons select three of the most common bandwidths:

- Gentle works in all but the most challenging situations.
- Medium is the default and works in most situations.
- Stiff works for unloaded motors.

12.2.2 The Slider

As you drag the slider to the right, the stiffness increases. In many situations, you cannot drag the slider fully to the right side because the system will become unstable.

12.2.3 Inertia Ratio

If you know the inertia ratio of your load, then entering it can improve the performance of your system. If you do not know the inertia of your load then EWV[2] will assume a ratio of 1:1, which will give good performance in many configurations. The inertia ratio is the ratio of your load with respect to the inertia of your motor.

12.3 Tuning Guide

12.3.1 Overview

This section covers tuning the velocity and position loops in the AKD PDMM. Servo tuning is the process of setting the various drive coefficients that are needed for the drive to optimally control the servo motor for your application. There are different ways to tune, and several are covered here. We will give you guidance on what the different methods of tuning are and when to use them.

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[1] Embedded Workbench Views
[2] Embedded Workbench Views

The AKD PDMM works in three major operation modes: torque, velocity, and position operation mode. No servo loop tuning is required for torque mode. Velocity loop and position loop tuning are covered below.

The AKD PDMM has an auto tuner that will provide the tuning that many applications will need. This section describes the tuning process and how to tune the AKD PDMM, specifically for cases where the user does not want to use the auto tuner.

Tuning in this section will focus on tuning in the time domain. This means that we will look at the velocity or position response vs. time as the criteria we use to decide how well tuned a control loop is tuned.

12.3.2 Determining Tuning Criteria

Choosing the proper specifications for a machine is a prerequisite for tuning. Unless you have a clear understanding of the type of performance needed to push the machine into production, the tuning process will cause more problems and headaches than it solves. Take time to layout ALL the requirements of the machine—nothing is too trivial to consider.

- Determine what the most important criteria are. The machine was likely designed and developed with a certain performance in mind. Include ALL performance criteria in the specification. Do not concern yourself with whether or not the criteria sound scientific. (i.e. If the motion needs to visibly look smooth, put it in the specification. If it can't have any noise, put it in the specification.) At the end of the development phase, the machine's performance should match the performance previously set in the specification. This will ensure that the machine meets its performance goals and that it is ready for production.
- Test the machine with realistic motion. Do not simply tune the machine to make short linear motion, when it will make long, s-curve motions in the real world. Unless you test the machine with realistic motion, there is no way to determine if it is ready for production.
- Determine some specific, quantitative criteria for identifying unacceptable motion. It's better to be able to tell when a motion is unacceptable than to try and figure out the exact point where acceptable motion becomes unacceptable. Here are some examples of motion criteria:
    a. +/– x position error counts during the entire motion.
    b. Settling within +/- x position error counts, within y milliseconds.
    c. Velocity tolerance of x% measured over y samples.
- DO NOT pick criteria based on what is the most popular technique of the day. It is important to focus on the things that will get the machine into production with reliable performance, based on fundamental understanding of the system.

After you have constructed a detailed servo performance specification, you are now ready to start tuning your system.

12.3.3 Before You Tune

In the worst case, if something goes wrong during tuning, the servo can run away violently. You need to make sure that the system is capable of safely dealing with a servo run away. The drive has several features that can make a servo run away safer:

- Make sure that the limit switches turn the drive off when tripped. If a complete run away occurs, the motor can move to a limit switch very quickly.
- Make sure the max motor speed is set accurately. If a complete run away occurs, the motor can reach max speed quickly and the drive will then disable.

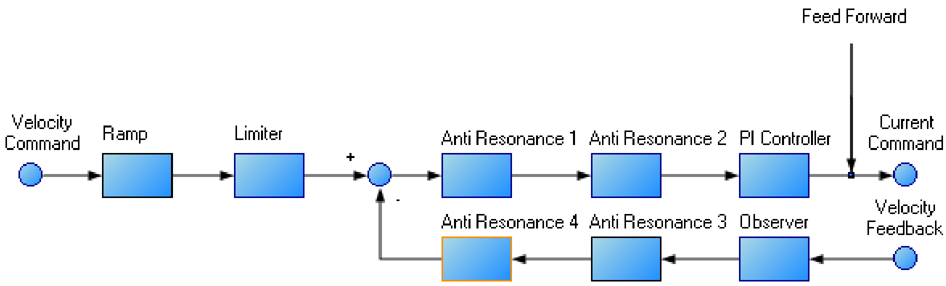
12.3.4 Closed Loop Tuning Methods

The closed loop control loop is responsible for the desired position and / or velocity (trajectory) of the motor and commanding the appropriate current to the motor to achieve that trajectory. The challenge in closed loop control loops is to make a system that not only follows the desired trajectory, but also is stable in all conditions and resist external forces, and do all of this at the same time.

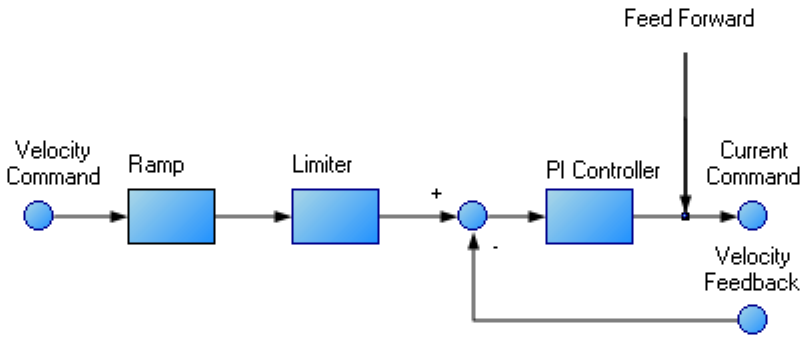
When in velocity operation mode, only the velocity loop is tuned. When in position operation mode, both the velocity and position loops must be tuned.

12.3.4.1 Tuning the Velocity Loop

The velocity loop on the AKD PDMM consists of a PI (proportional, integral) in series with two anti-resonance filters (ARF) in the forward path and two-anti resonance filters in series in the feedback path.

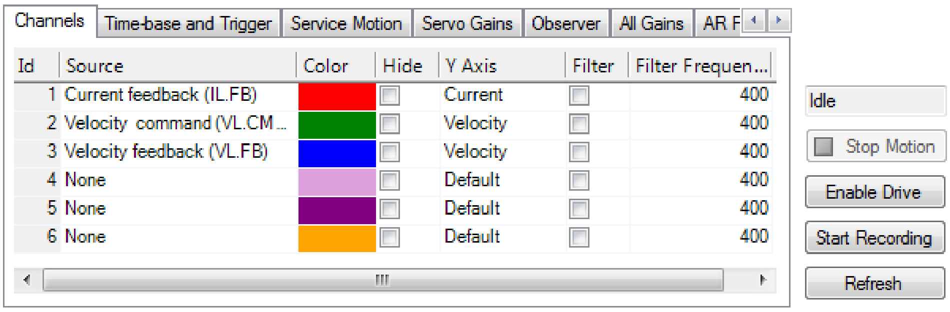


To perform basic tuning of the velocity loop, you can use just the PI block and set ARF1 and ARF2 to unity (no effect) and set the observer to 0 (no effect). Using just the PI block simplifies the process of tuning the velocity loop. To start tuning you can adjust the PI Controller block first. A simplified velocity loop without anti-resonant filters and observer is shown below. This is how you can think of the loop before the anti resonant filters and observer is used.



Procedure for simple velocity loop tuning:

1. Set DRV.OPMODE to velocity or position, as appropriate for your application. If DRV.OPMODE is set to position, set VL.KVFF to 1.0.
2. Set VL.KP to 0.
3. Set VL.KI to 0.
4. Set service motion to make a motion that is similar to the move speeds that will be used in the real application. Do not set the service motion to a speed higher than ½ of the maximum motor speed, to allow for safe overshoot during tuning. Set acceleration to an appropriate value for your application. Set service motion to reversing. Set time1 and time2 equal to 3 times the expected settling time for the system. 1.0 second is a reasonable value for time1 and time2, if you don't know the expected settling time.
5. Enable the drive and start the service motion. You should see no motion, as there are no velocity loop tuning gains at this point.
6. When adjusting VL.KP and VL.KI, below record VL.FB and VL.CMD. These are the traces that are used to determine the performance of the velocit loop.

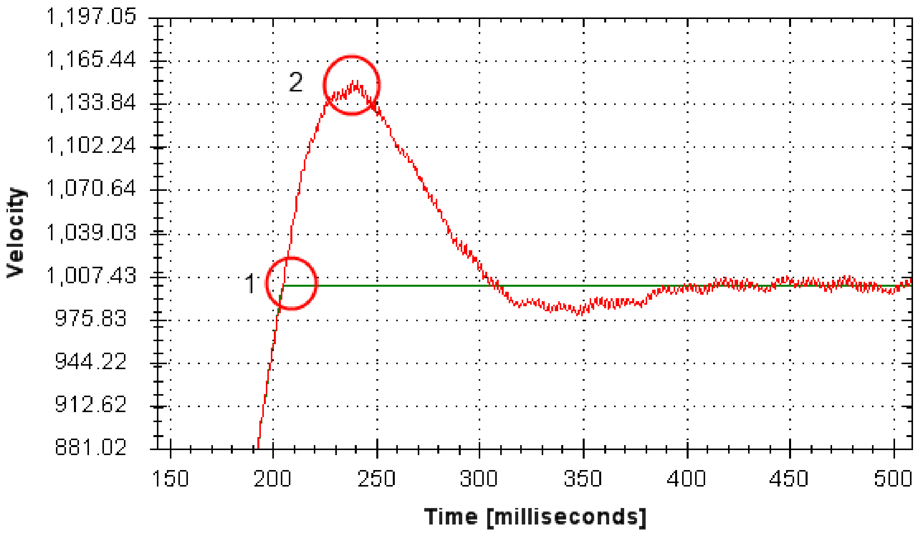


7. Adjust VL.KP. Keep increasing VL.KP by a factor of 2 until you either:

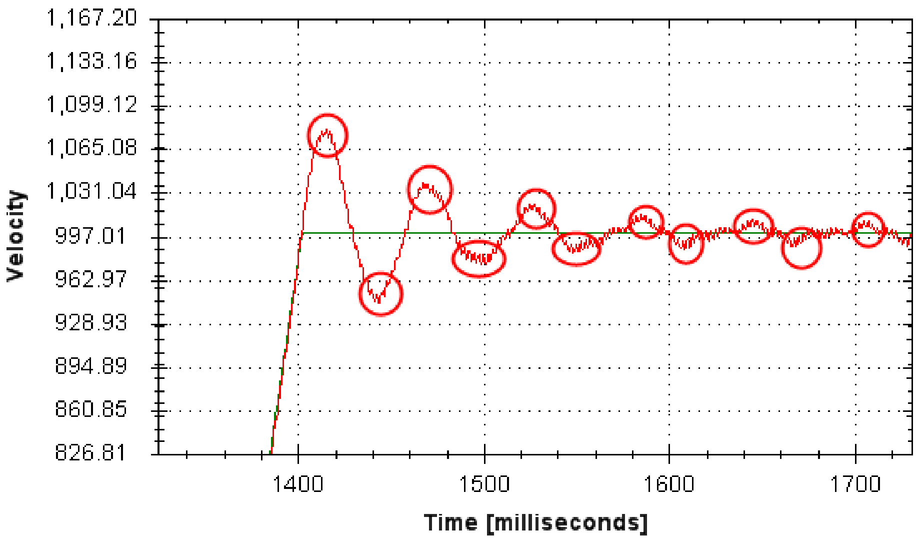
- Hear an objectionable noise from the system (buzzing, humming, etc) or
- See velocity overshoot. No velocity overshoot should be present when using only VL.KP.
- When you reach one of the limits above, decrease VL.KP to the value where there were no objectionable noises or overshoot.

8. Adjust VL.KI. Increase VL.KI by a factor of 1.5 until you either:

- Hear or see objectionable noise or shuddering from the system
- See > 15% overshoot
- Here is an example of 15% overshoot. This is zoomed in view of a service motion commanded to 1000 RPM (location 1), where the overshoot peaks at 1150 RPM (location 2).



- Here is an example of 11 overshoots. Each overshoot is shown by a red circle.



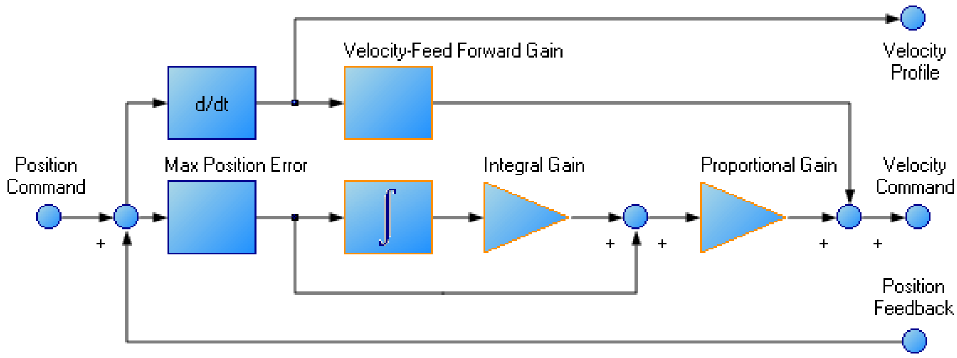
- When you reach one of the limits above, decrease VL.KI to the value where there were no objectionable noises or overshoot.

9. Stop the service motion

12.3.4.2 Tuning the Position Loop

The position loop is a second loop that builds upon a correctly tuned velocity loop to provide accurate control over position. The position loop is a simple element that consists of a PI loop. It is simplest to tune the P and I terms in the velocity loop and use only the P term in the position loop.

At most, use only three non-zero P and I terms from both the velocity loop and the position loop. One combination would be VL.KP, VL.KI, and PL.KP. Another valid combination would be VL.KP, PL.KP, and PL.KI. The VL.KP, VL.KI, and PL.KP combination is shown here.



Procedure for tuning position loop:

1. Set VL.KVFF to 1
2. Increase PL.KP until either:

- You see 25% overshoot, or
- You see > 3 overshoots, or
- You hear objectionable noises from the system.
- When you reach one of the limits above, decrease PL.KP to the value where there were no objectionable noises or overshoot.

12.3.5 Torque Feedforward Tuning Methods

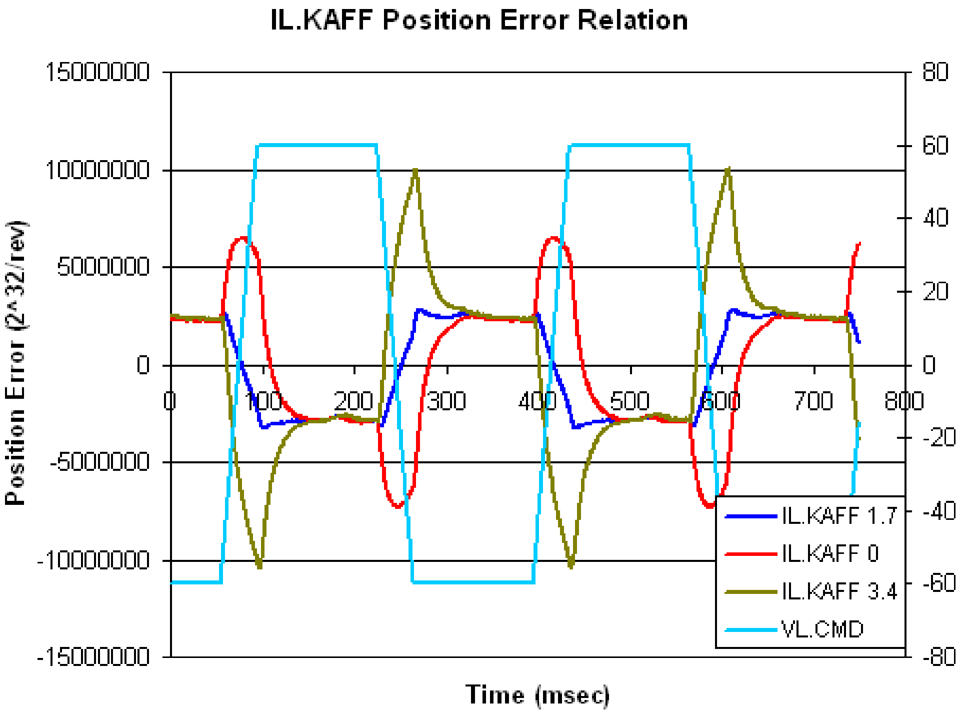
The torque based feedforward terms on the AKD PDMM effectively model the physics of your motor and allow the drive to command the appropriate current, even before the encoder has time to send data back to the drive. Torque based feedforward terms allow you to lower following error with virtually no stability penalty.

12.3.5.1 Shape Based Feedforward Tuning

To adjust IL.KAFF:

- Tune the VL.KP and VL.KI as shown above in the velocity loop tuning section. Set DRV.OPMODE to velocity (or set PL.KP and PL.KI to 0 and vl.kvff to 1).
- Set up a short, repeating service motion with accelerations that are representative of the moves you will use in your application (exact values for acceleration are not critical).
- Turn up IL.KAFF until the position error (PL.ERR) is proportional to the inverted velocity command. The adjustment of IL.KAFF will focus on removing bumps on acceleration and deceleration. The

picture below has an ideal value of IL.KAFF of 1.7.



12.3.6 Using Anti-Resonance Filters

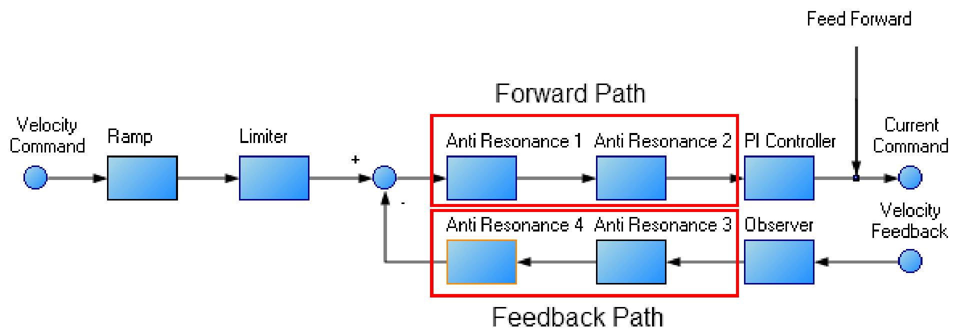
The AKD PDMM has four anti-resonance filters. Two filters are in the forward path and two are in the feedback path.

Similarities

- Both types are typically used to enhance stability and performance of the system.

Differences

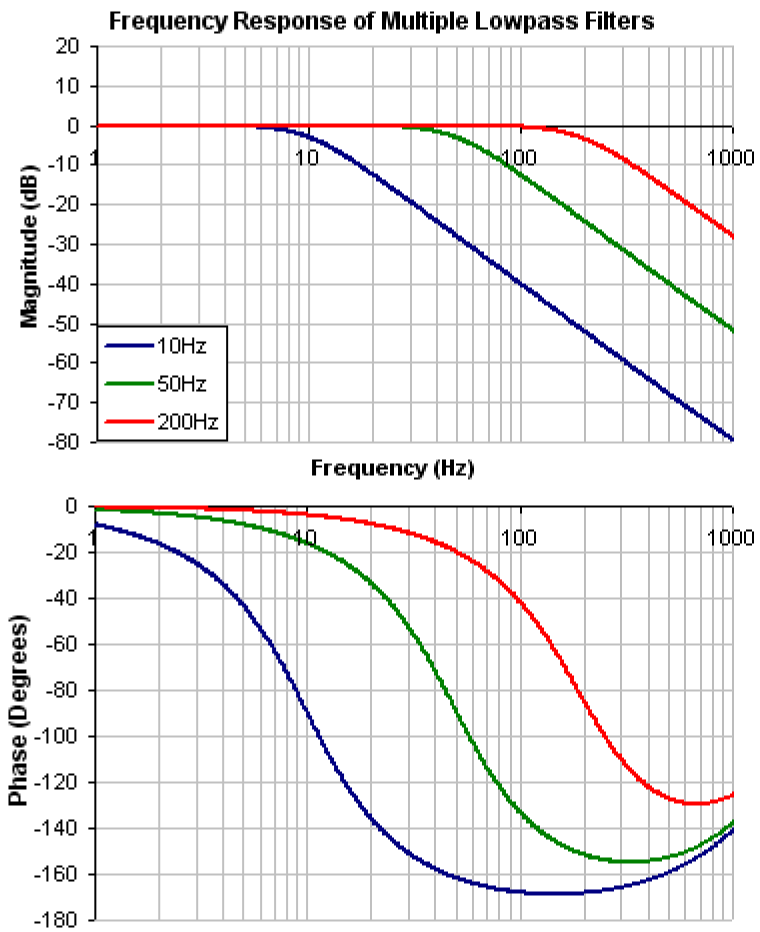
- Forward path filters result in higher phase lag in closed loop system response.
- Forward path filters limit spectrum from reaching the motor / feedback path filters only filter the feedback after it has been to the motor.



12.3.6.1 Types of Anti-Resonance Filters

Low Pass

A low pass filter allows signals through below a corner frequency and attenuates the signals above the same corner frequency. The behavior at the corner frequency can be specified with the low-spass Q.



To specify a lowpass filter, you must specify the frequency and Q for both the zero and pole on anti-resonance filter 1. To do this, see the following example using the terminal commands that sets:

- Filter Type = Biquad
- Zero frequency = 700 Hz (This is the Lowpass cutoff frequency)
- Zero Q = 0.707
- Pole frequency = 5000 Hz
- Pole Q = 0.707

VL.ARTYPE1 0

VL.ARZF1 700

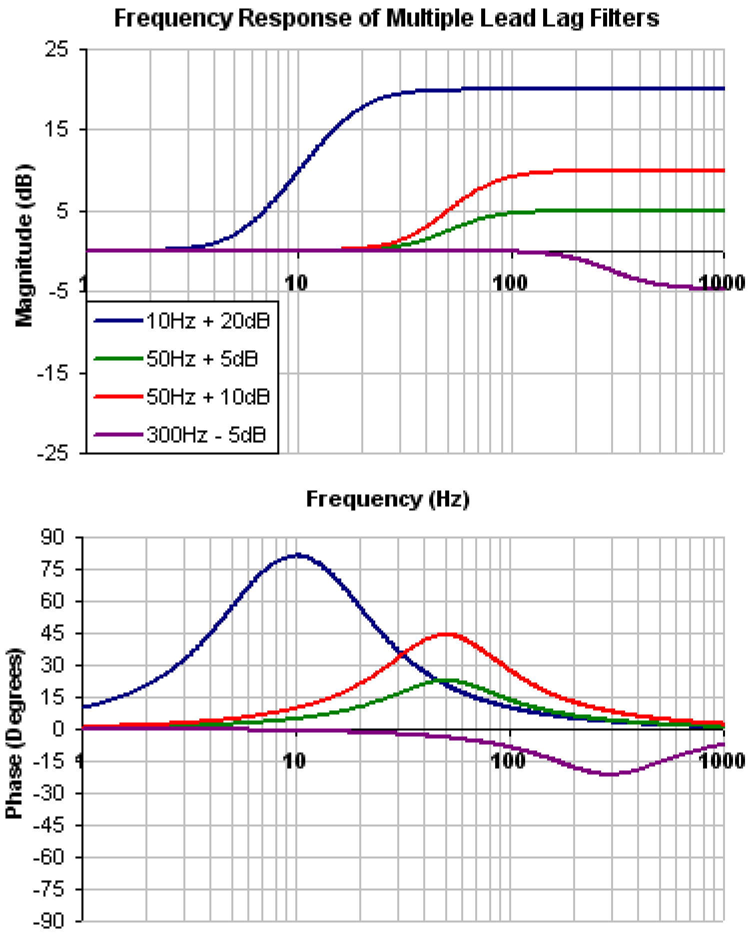
VL.ARZQ1 0.707

VL.ARPF1 5000

VL.ARPQ1 0.707

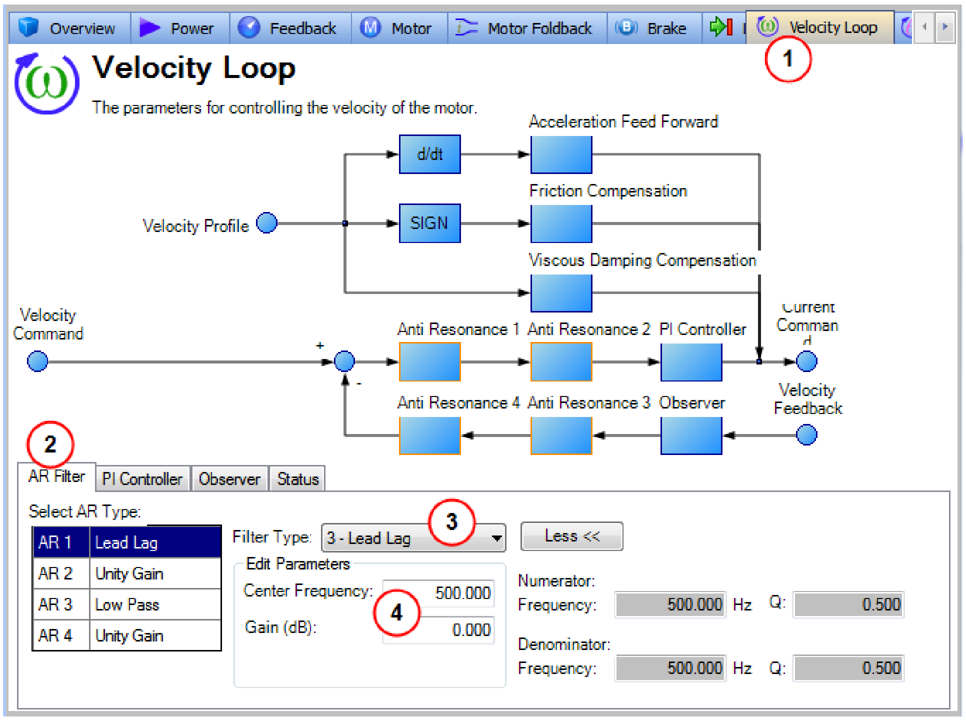
Lead Lag

A lead lag filter is a filter that has 0 dB gain at low frequencies and a gain that you specify at high frequencies. You also specify the frequency that the gain at which the transition occurs.



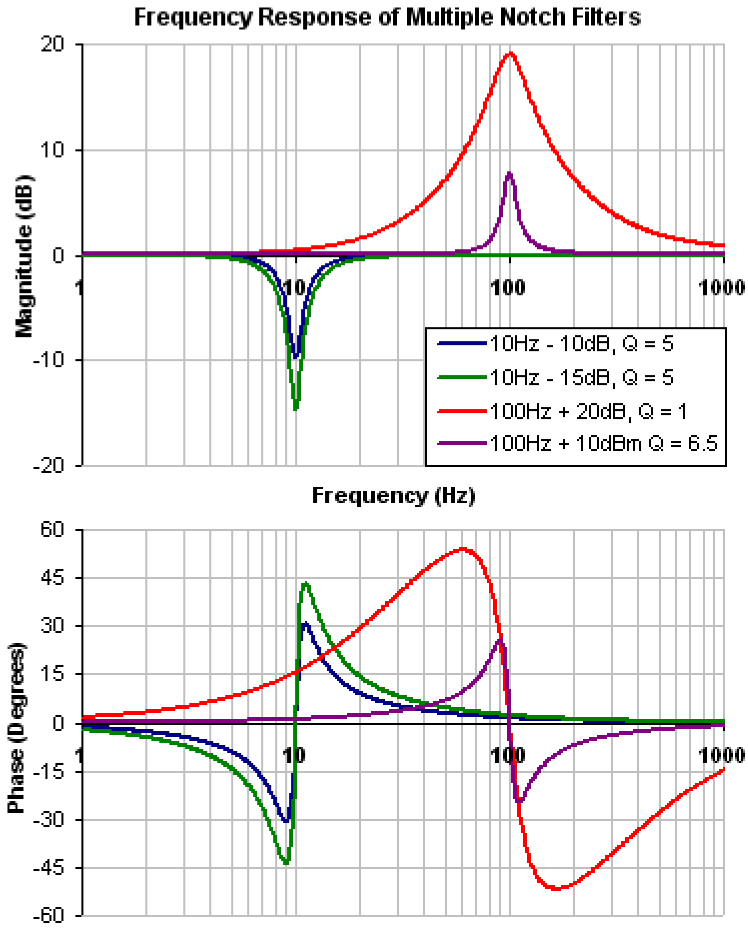
To specify a Lead Lag filter, you must specify the Center Frequency and high frequency Gain (dB). To do this, see the following example by clicking on the Velocity Loop:

Click on Velocity Loop tab (1), then select the AR1 Tab (2), using the Filter Type drop-down, select Lead Lag (3), lastly, enter the desired Center Frequency and Gain of the Lead Lag filter (4).



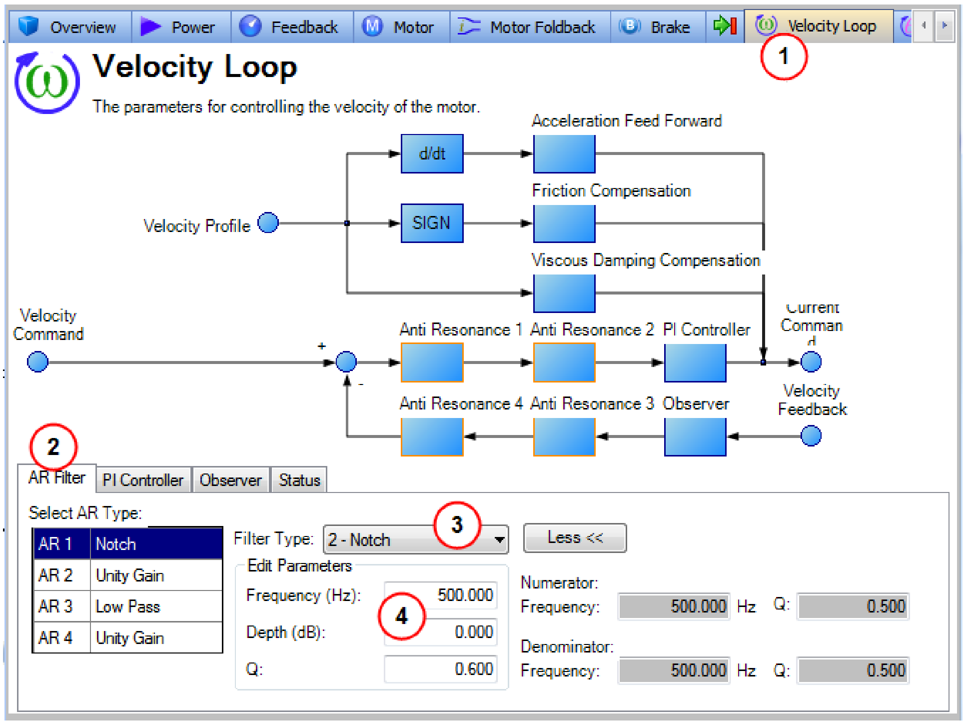
Notch

A notch filter changes gain at a specific frequency. You specify the frequency at which the gain change occurs (Frequency (Hz)), how wide of a frequency range the cut occurs (Q), and how much the gain changes (Notch Depth (dB)).



To specify a notch filter, you must specify the Frequency (Hz), Depth (dB) and Width (Q) of the notch. To do this, see the following example by clicking on the Velocity Loop:

Click on Velocity Loop (1), then select the AR1 Tab (2), using the Filter Type drop-down, select Notch (3), lastly, enter the desired Frequency, Depth and Q of the Notch filter (4).



Biquad

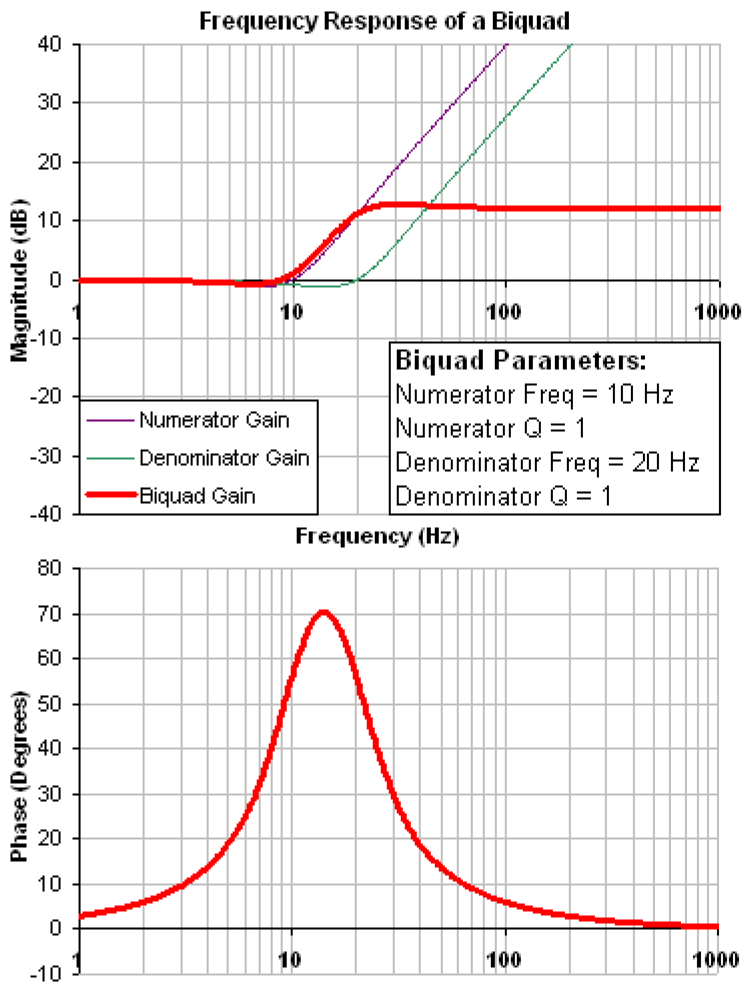
A biquad is a flexible filter that can be thought up as being made up of two simpler filters; a zero (numerator) and a pole (denominator). In fact, the pre-defined filters mentioned above are really just special cases of the biquad.

Both the zero (numerator) and the pole (denominator) have a flat frequency response at low frequencies and a rising frequency response at high frequencies. The transition frequency and damping must be specified for both the numerator and denominator.

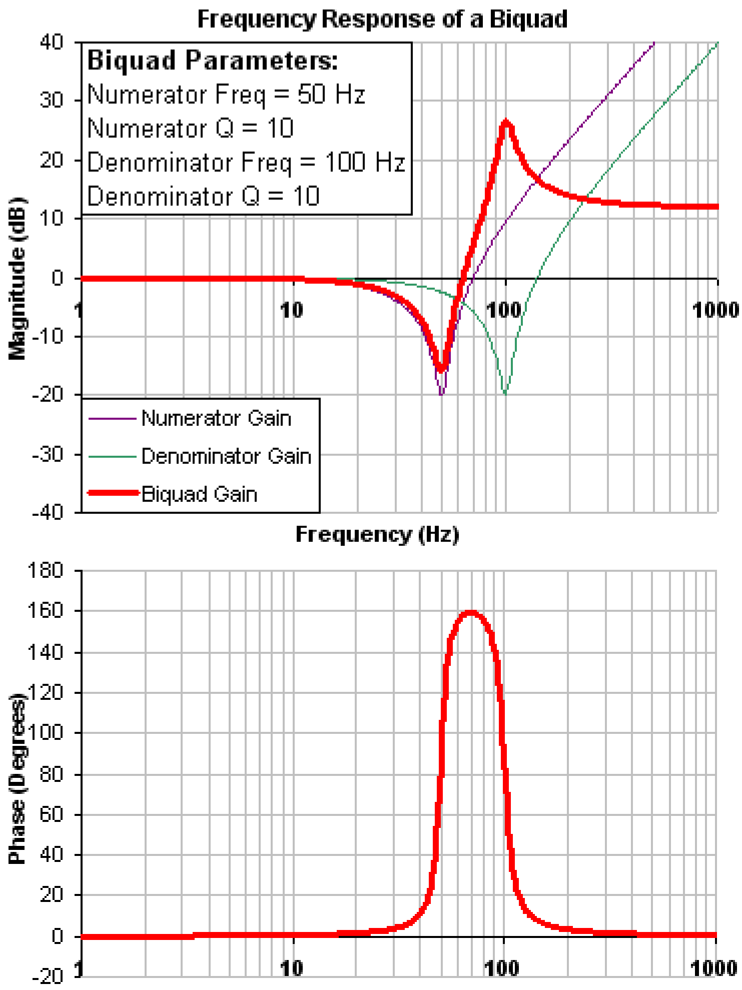
Analyzing the numerator and denominator, the frequency response calculation is simple:

If the numerator and denominator are plotted in dB, the biquad response is numerator – denominator. Understanding how the numerator and denominator work is crucial in understanding how a biquad frequency response is created.

Below is an example of a biquad filter similar to a Lead Lag filter type. To help understand how to determine the frequency response of the biquad, the numerator and denominator response have been plotted. If the denominator is subtracted from the numerator, the biquad response is the result.

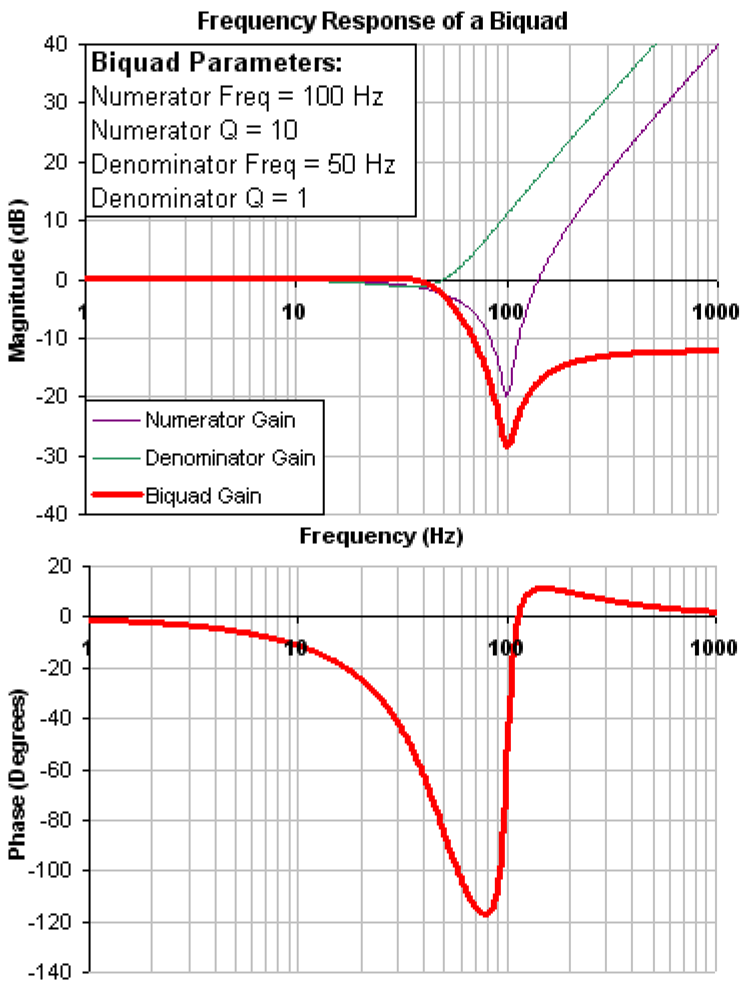


The biquad filter is very flexible, which allows custom filters to be designed. Below is an example of a resonance filter using a biquad. Notice how the high Q values affect the numerator and denominator. This gives a biquad frequency response similar to a mechanical resonance.



The previous two examples used a numerator frequency lower than the denominator frequency, yielding a positive gain in high frequencies. If the denominator frequency is lower than the numerator frequency, then high frequencies will have a negative gain.

Below is an example where the numerator frequency is higher than the denominator. Notice the high frequencies have a negative gain.



To specify a biquad filter, you must specify the frequency and Q for both the zero and the pole on anti-resonance filter 3. To do this, see the following example using the terminal commands that sets:

- Filter Type = Biquad
- Zero frequency = 100 Hz
- Zero Q = 0.7
- Pole frequency = 1000 Hz
- Pole Q = 0.8

VL.ARTYPE3 0

VL.ARZF3 100

VL.ARZQ3 0.7

VL.ARPF3 1000

VL.ARPQ3 0.8

12.3.6.2 Biquad Calculations

In the s-domain, the linear biquad response is calculated:

$$\text{Biquad Frequency Response} = \frac{s^2 + \frac{\omega_N}{Q_N}s + \omega_N^2}{s^2 + \frac{\omega_D}{Q_D}s + \omega_D^2}$$

To convert from idealized s-domain behavior to a more realistic z-domain behavior, we convert using a pole / zero transform. To calculate the frequency response for an individual frequency:

$$t = 62.5\mu\sec$$

$$N_{Rad} = 1-(2Q_N)^{-2}$$

$$N_{2Unscaled} = 1$$

$$if(N_{Rad} > 0): N_{1Unscaled} = -2e^{-2\omega_N\zeta_N t}\cos(\omega_N t\sqrt{1-\zeta^2})$$

$$if(N_{Rad} <= 0): N_{1Unscaled} = -2e^{-2\omega_N\zeta_N t}\cosh(\omega_N t\sqrt{1-\zeta^2})$$

$$N_{0Unscaled} = e^{-2\omega_N\zeta_N t}$$

$$D_{Rad} = 1-(2Q_D)^{-2}$$

$$D_2 = 1$$

$$if(D_{Rad} > 0): D_1 = -2e^{-2\omega_D\zeta_D t}\cos(\omega_D t\sqrt{1-\zeta^2})$$

$$if(D_{Rad} <= 0): D_1 = -2e^{-2\omega_D\zeta_D t}\cosh(\omega_D t\sqrt{1-\zeta^2})$$

$$D_0 = e^{-2\omega_D\zeta_D t}$$

$$N_{Scale} = \frac{N_{0Unscaled} + N_{1Unscaled} + N_{2Unscaled}}{D_0 + D_1 + D_2}$$

$$N_2 = N_{2Unscaled} / N_{Scale}$$

$$N_1 = N_{1Unscaled} / N_{Scale}$$

$$N_0 = N_{0Unscaled} / N_{Scale}$$

$$\angle_Z = \omega t = 2\pi * freq * t$$

$$Num_{Re} = N_2 Cos(2\angle_Z) + N_1 Cos(\angle_Z) + N_0$$

$$Num_{Im} = N_2 Sin(2\angle_Z) + N_1 Sin(\angle_Z)$$

$$Den_{Re} = D_2 Cos(2\angle_Z) + D_1 Cos(\angle_Z) + D_0$$

$$Den_{Im} = D_2 Sin(2\angle_Z) + D_1 Sin(\angle_Z)$$

$$Gain_{dB} = 20\log_{10}\left(\frac{\sqrt{Num_{Re}^{\,2} + Num_{Im}^{\,2}}}{\sqrt{Den_{Re}^{\,2} + Den_{Im}^{\,2}}}\right)$$

$$Phase_{deg} = \frac{180}{\pi}\left(\tan^{-1}\left(\frac{Num_{Re}}{Num_{Im}}\right) - \tan^{-1}\left(\frac{Den_{Re}}{Den_{Im}}\right)\right)$$

12.3.6.3 Common Uses Of Anti-Resonance Filters

Low pass filters in the feedback path. This is a common way to deal with noisy feedback sensors. When used in combination with noisy feedback sensors, significant reduction in audible noise can result.

Lead / lag filters in the forward path. This is a common way to achieve phase lead for control loops without exciting high frequency resonances.

Low pass filters in the forward path. This is a common way to limit high frequency energy from reaching a system that can not productively use energy at these high frequencies. This is also used to lower the effect of system resonances over a wide range of frequencies.

Notch filters are used to cancel system resonances. Notch filters are designed to be the opposite in amplitude of system resonances. Notch filters are applied to very specific frequencies, and therefore you must know your system resonance frequencies accurately to use them effectively.

13 Scope

13.1 Overview

The scope allows you to plot up to six different parameters from the drive. Use **Full View** and **Normal View** to toggle between the scope setup (normal) and a larger view of only the scope output (full). You can configure, save, and restore scope settings from the normal view. The lower right corner of the normal view also includes a box that indicates status and drive and scope control buttons (**Enable Drive**, **Start Recording**, and **Refresh**).

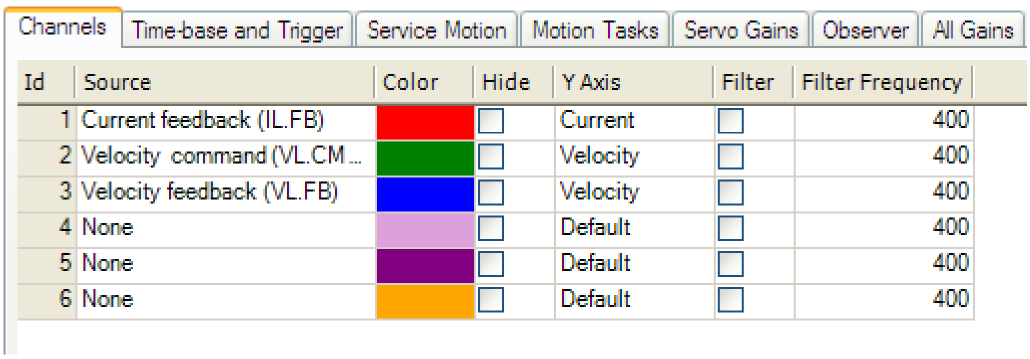
13.2 Using the Scope

You can set up scope plots using the tabs summarized below:

Tab	Function
Channels	Select data source, plot axes, and plot appearance.
Time Base and Trigger	Select how much data to record and when to start recording the data.
Servo Gains	Adjust the servo loop gains.
All Gains	View all current tuning gains in the drive and manually edit gains.
AR1, AR2, AR3, AR4	Adjust filter settings.
Save and Print	Save the plot as a raw data file or as an image file; email the plot; print the plot;open the data file in Excel.
Measure	Display basic data read from the plots.
Cursors	Turn on the cursors and view the data at the cursor positions.
Display	Pan, zoom, and control the grid and background color.

13.2.1 Scope Channels Tab

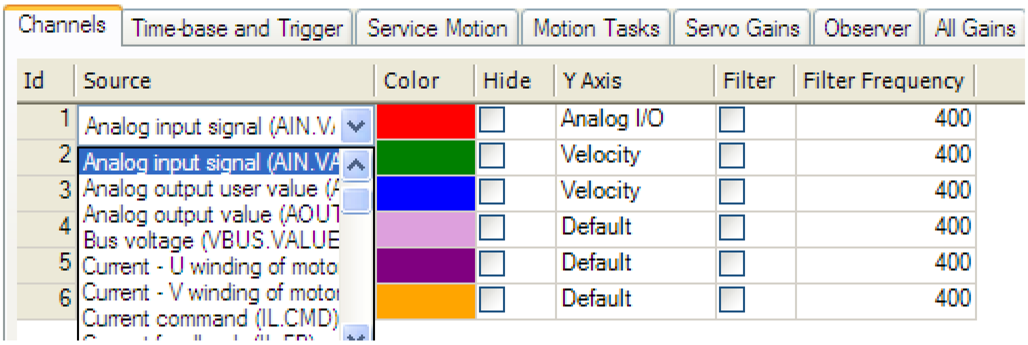
The **Channels** tab allows you to select and record up to six channels simultaneously. Select the data to record for each channel from the lists in the **Source**, **Color**, **Y-axis**, and **Filter** and **Filter Frequency** columns. Once a recording is shown on the scope screen, you can click **Hide** to remove a channel from the scope display.



13.2.1.1 Source Column

To set a channel to record, click the source you want to set and choose the appropriate channel. You can choose from None (no data is collected on that channel), preset trace types, or enter a user defined trace.

Choosing “<User Defined>” allows you to record data from pre-defined locations. These locations are provided by the factory to collect less common values.



13.2.1.2 Color Column

For valid sources, you can click on the color in the Color tab and choose a different color than the default, or create a custom color.

13.2.1.3 Hide Column

You can check the **Hide** box to hide a given plot trace. This feature can make it easier to focus on specific data as needed.

13.2.1.4 Y-Axis Column

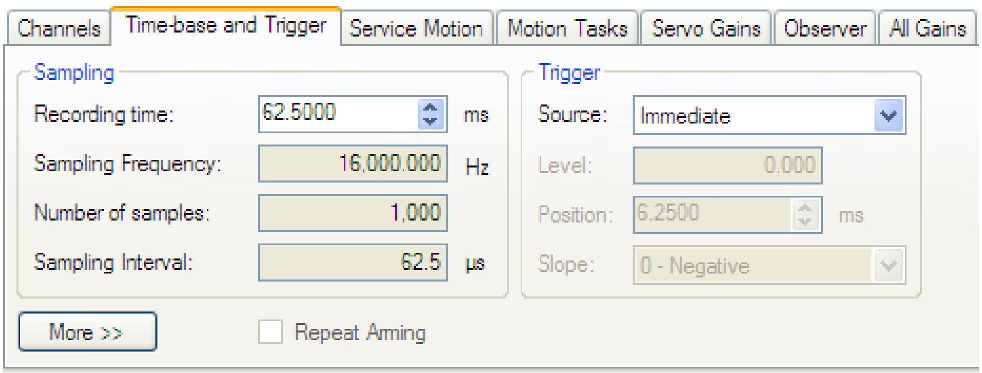
The Y-axis column allows you to choose on which Y-axis the channel will be displayed. Several predefined Y-axis groups exists. Click on the item in the column to change the label for the trace.

13.2.1.5 Filter and Filter Frequency Column

Check this box and use the frequency column to apply a low pass filter to the data collected. The filter is applied when the data is collected. It is not applied to data already collected if this is checked after the data is collected.

13.2.2 Scope Time-base and Trigger Tab

Use the **Time-base and Trigger** tab to select how much data to record and when to start (trigger) recording the data. You can set length of recording in ms and the sampling frequency in Hz. The number of samples is a calculated value displayed for reference.The trigger can be set to trigger immediately when you click **Start Recording** or to trigger when a specified value for a given signal is reached. The default **Time-base and Trigger** view specifies recording time, sampling frequency, and either an immediate trigger or a trigger based on a specified signal. Click the **More** button in this view to specify a given number of samples, sampling frequency, sampling interval, and access additional trigger options.

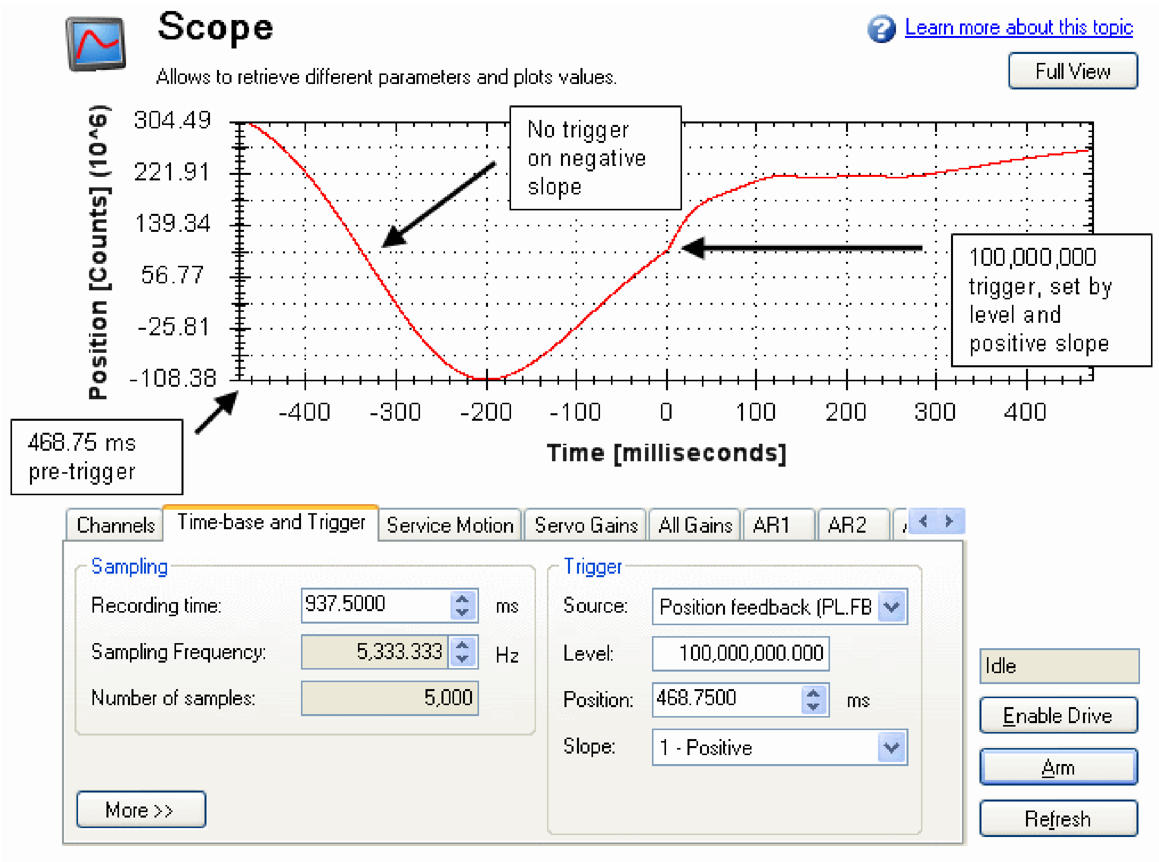


In this tab, you can set length of recording in ms and the sampling frequency in Hz. The number of samples is a calculated value displayed for reference. You can also choose the trigger source to be **Immediate** (triggers as soon as you click the **Start Recording** button) or to be one of many predefined sources.

If you choose a source other than **Immediate**, you can set the level, position, and slope for the trigger value.

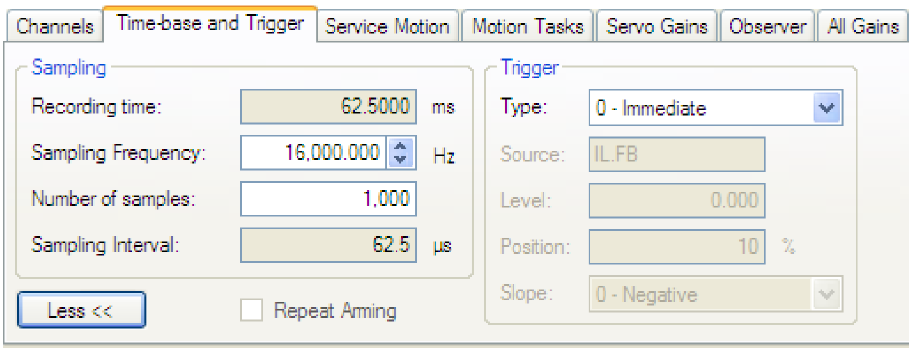
- Level sets the value of the source that triggers the recording to start.
- Position sets the amount of time that the scope displays before the trigger occurred.
- Slope sets whether the source data must pass the level value in a positive or negative direction.

An example of triggering is shown below:



13.2.2.1 Scope Time-base and Trigger, More View

Click **More** to display additional options for configuring the time-base and trigger.



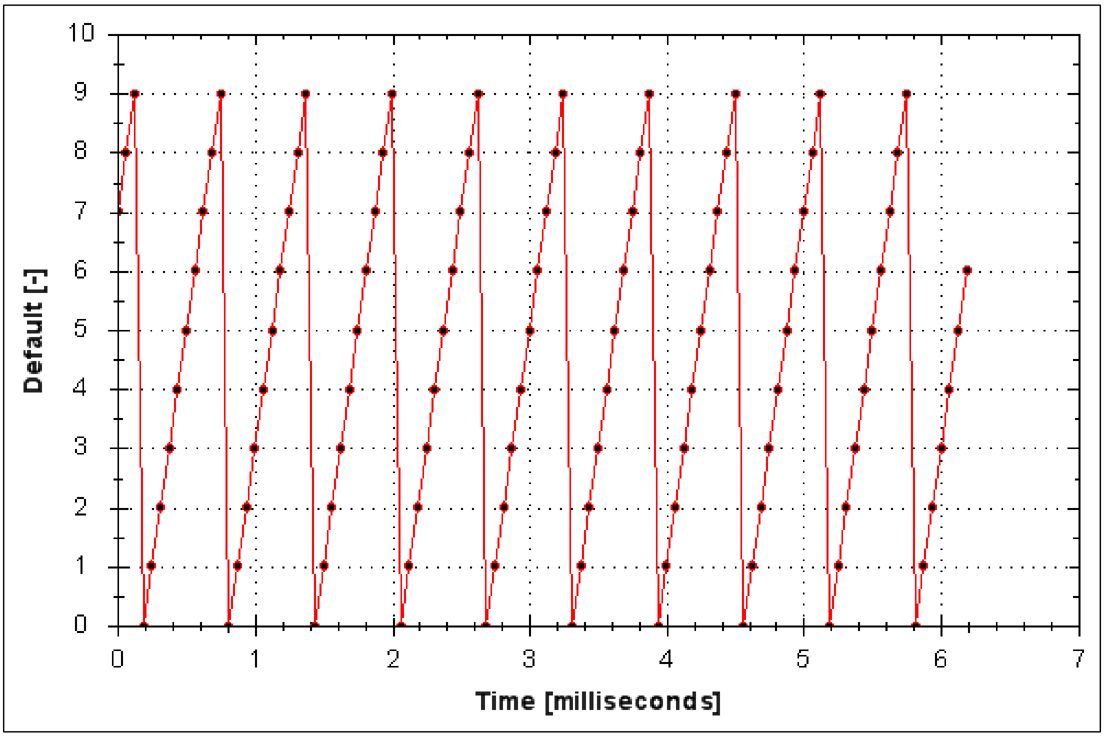
In the **Sampling** area of this view, you can specify the recording length by entering a sampling frequency and a number of samples. Here, the recording time is a calculated value displayed for reference.

What is triggering?

Triggering allows you to precisely control the start point of data collected in the scope. For example, if you are looking for a large spike, you can set the trigger to start the scope to begin recording when it sees the large spike. This section describes the triggering functionality of the scope.

Test Signal

As an example, it is useful to examine variations on a record of a test signal that generates a sawtooth signal. The signal starts at 0 and increases by one every drive sample (1/16,000 second) to a maximum of 9, and then returns to 0. This signal continues indefinitely. The record of this signal is shown below.



13.2.2.2 Trigger Type

The **Trigger** area in the **More** view offers more flexibility than the default view. You can specify four types of trigger types (REC.TRIGTYPE):

- **Immediate - 0**. This mode will start recording as soon as the recording command (REC.TRIG) is received by the drive.
- **Command / On Next Command – 1**. This trigger type lets you specify a trigger on the next telnet command received by the drive. This is useful in a telnet session via Hyperterminal (or a similar program).EWV[1] is constantly sending telnet commands, so this is not typically used in a EWV session.
- **Parameter / On Source Signal – 2**. This trigger type lets you specify a trigger source and set of conditions to trigger recording of data. This is very similar to the triggering used on oscilloscopes.
- **Boolean – 3**. This trigger type lets you trigger on a boolean (0 or 1), such as drive active status.

13.2.2.3 Trigger Position

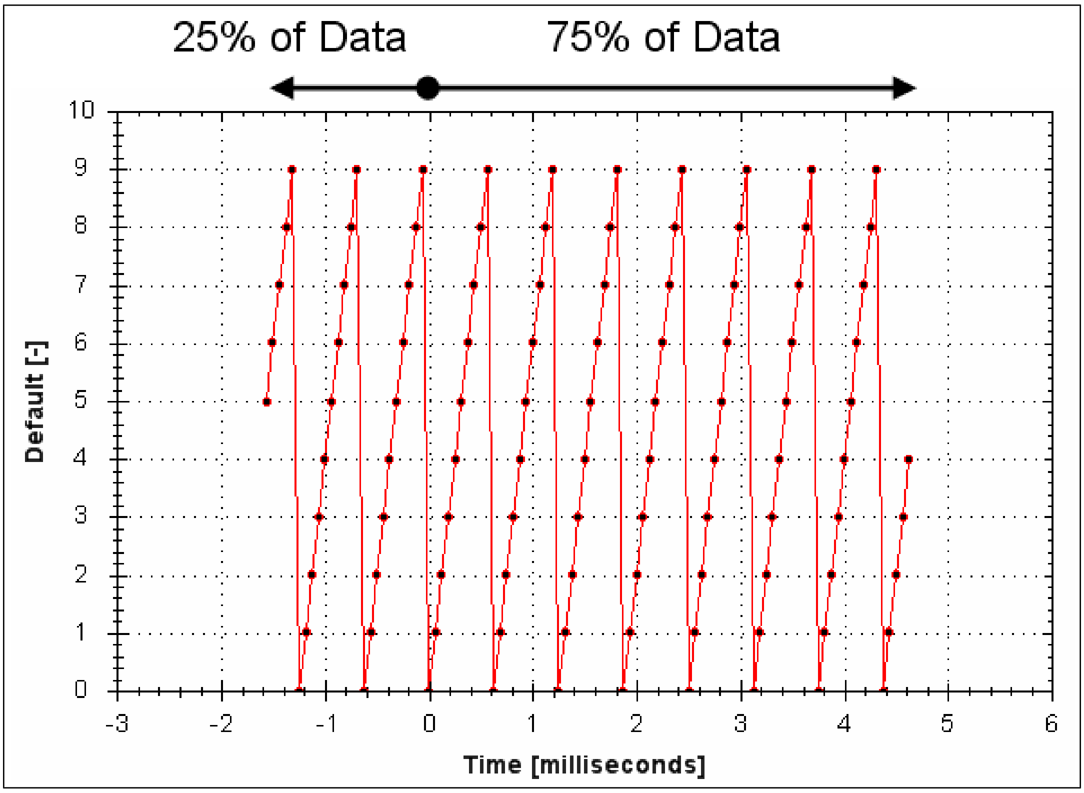
Trigger Position (REC.TRIGPOS) allows you to collect data that occurs before the trigger occurs. If you have a rare condition, you may want to see the conditions that led up to it. Trigger position lets you control how much signal is collected before the trigger condition occurred.

Trigger position is specified in units of percent (%). If you specify a trigger position of X% , X% of the data is before 0 ms in the data time and 100-X% (the rest of the data) is at or greater than 0 ms. In the picture below, trigger position is set to 25% (REC.TRIGPOS 25).

[1]Embedded Workbench Views

In the EWV scope, the 0 time point is clear. When collecting the data via REC.RETRIEVE or similar commands, the time is not returned, so some caution should be used when the trigger point is important to understand.

Trigger position is not used in trigger type “Immediate” (TRIGTYPE 0).



13.2.2.4 Trigger Value

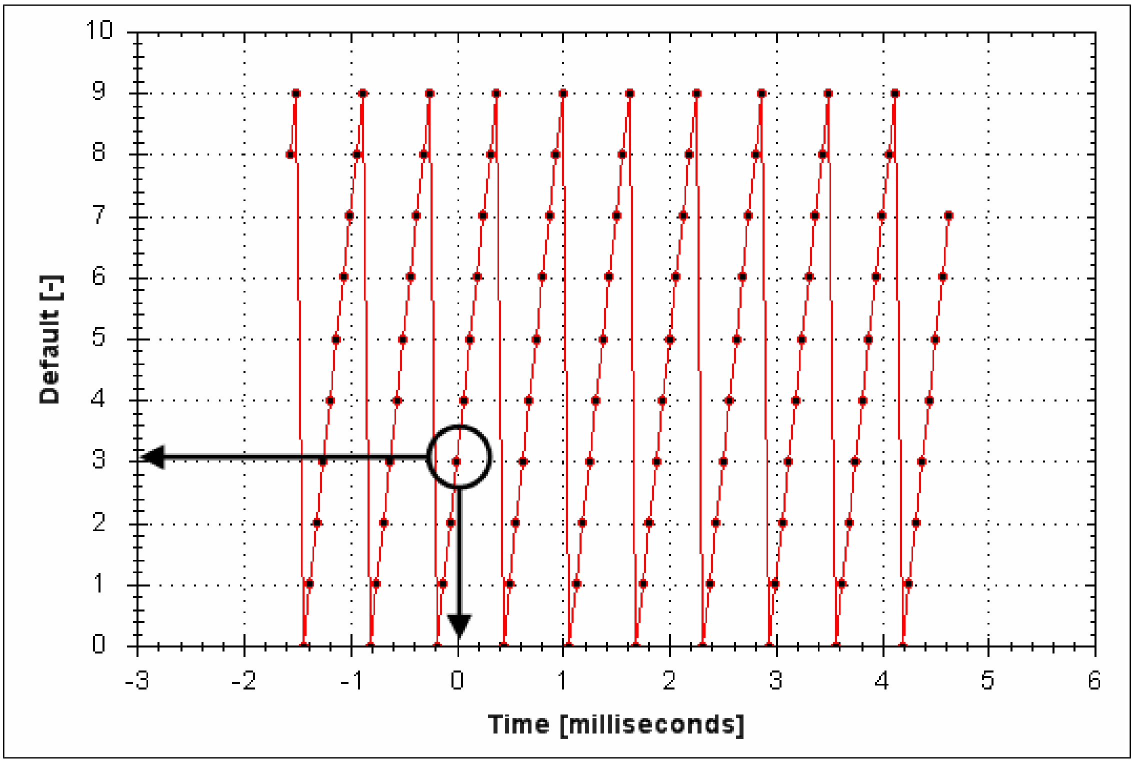
The trigger value (REC.TRIGVAL) specifies a target value that should trigger the recording to start. The trigger value is used in trigger type Parameter / On Next Signal only.

The trigger value is not used in the boolean trigger type. Use the trigger slope to set the polarity of the boolean trigger.

When the trigger slope is positive, the trigger value will trigger when:

- The trigger source is less than the trigger value in the previous recording sample
- The trigger source is greater than or equal to the trigger value in the current recording sample

Below is an example showing triggering of trigger value of 3 (REC.TRIGVAL 3) and positive trigger slope (REC.TRIGSLOPE 1). You can see that the recording triggers at time zero when the source reaches the value of 3.



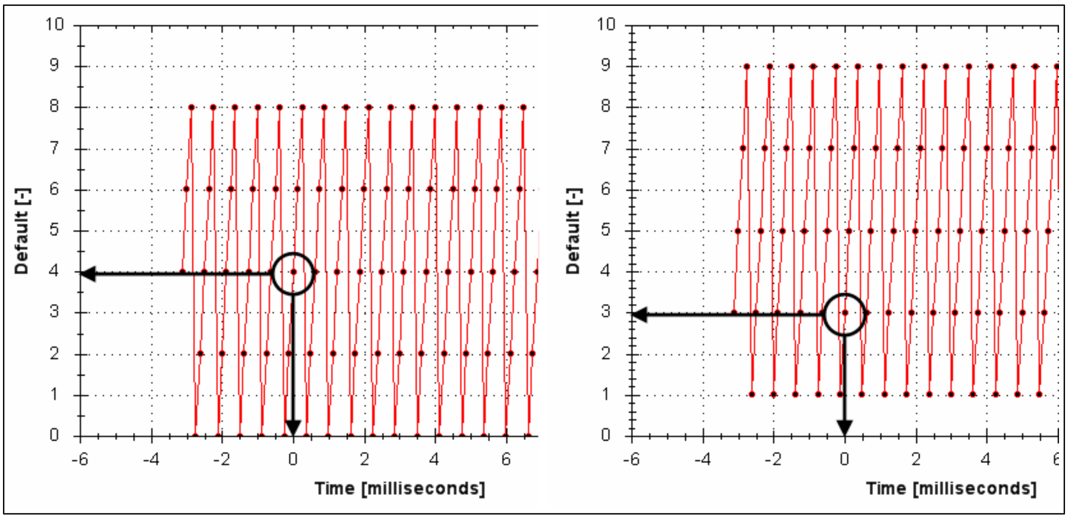
When the trigger slope is negative, the trigger value will trigger when:

- The trigger source is greater than the trigger value in the previous recording sample.
- The trigger source is less than or equal to the trigger value in the current recording sample.

13.2.2.5 Effects of Recorder Gap

When the recording rate is less than16,000 Hz (REC.GAP > 1), there can be some impact on the triggering of the recorder. When using pretriggering and a recording rate of less than 16,000 Hz, the trigger only evaluates every N samples, where N is the value of REC.GAP. Two effects result from this condition:

1. You cannot be sure of the moment that the recorder is triggered any closer than N samples. An example of this is shown below where the trigger value is set to 3, the trigger slope is positive and the recorder gap is 2. Both examples are the same data, but one instance collected and triggered on the odd data. The other example collected and triggered on the even data.



2. You can miss triggers, whose duration is less than N samples, where N is the value of REC.GAP. This is because the trigger is only evaluated every N samples.

A workaround for the above effects is available by setting the recorder trigger position to zero (REC.TRIGPOS 0). This eliminates conflicts between pretrigger and post-trigger timing and will guarantee trigger evaluation every sample, eliminating the cases above.

13.2.2.6 Trigger Slope

Trigger Slope specifies whether you trigger on a positive or negative change in the trigger source. The effect of the trigger slope is different for trigger type Boolean and On Next Signal modes.

Boolean Trigger Type

When using Boolean type:

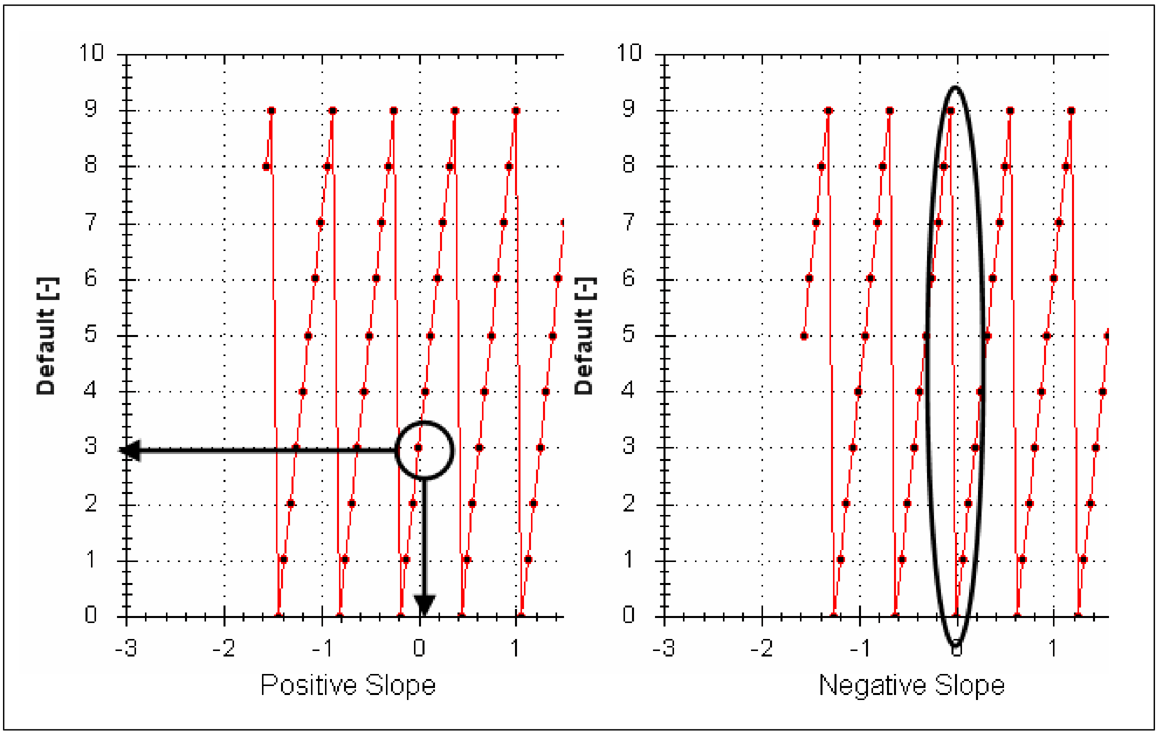
- A positive slope will trigger when the trigger source is 1
- A negative slope will trigger when the trigger source is 0

The boolean trigger type is a state trigger. There is no need to transition from 0 to 1 to trigger with the positive slope. If the trigger source is 1 from the start, the positive slope will immediately trigger.

On Next Signal Trigger Type

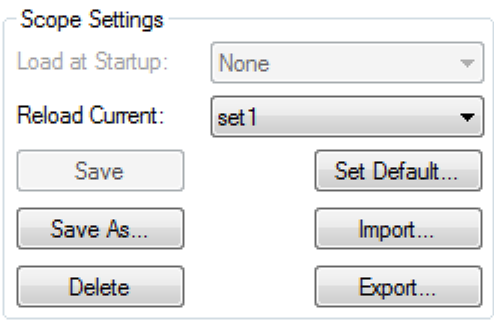
The “On Next Signal” trigger type allows you to specify if the recorder should trigger when the signal crosses the trigger level in the positive or negative direction. The signal only needs to reach the trigger level; it does not need to pass the trigger level.

In the examples below, the trigger value is set to 3 (REC.TRIGVAL 3.000). You can see that with positive slope, the trigger occurs exactly when the signal transitions from 2 to 3, because it reached 3. The negative slope case triggers when the signal transitions from 9 to 0, because it crossed 3 on the way.



13.3 Scope Settings

Scope settings are used to store and retrieve the scope parameters.You can save multiple settings, called "presets", under different names. You can save, delete, import, or export the presets. The settings are stored in EWV project file (default.wbproj) and settings are common to all the drives in EWV.

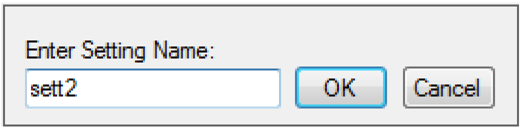


13.3.1 Load a setting (preset) to Scope screen

In Scope Settings section, the existing presets are listed in the **Select Setting** box. To load a setting to the scope screen, select the desired preset from the **Select Setting** list.

13.3.2 Create a new preset

1. Modify any scope parameters.
2. Select the **Settings** tab.
3. Click **Save As**. The following dialog is displayed:



4. Enter the setting name and click **OK**. The current settings are saved as a preset with the given name and displayed in the list.

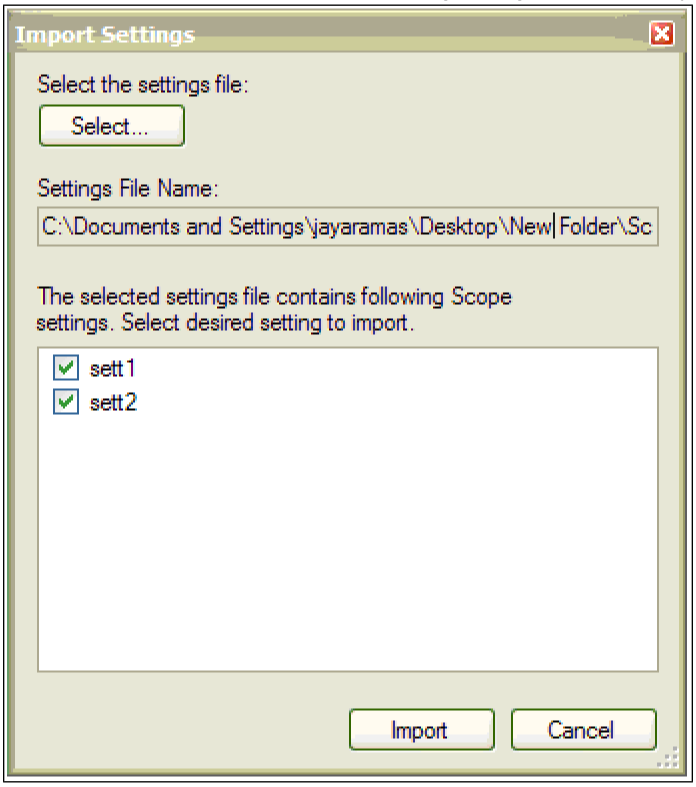
13.3.3 Save or delete preset

Save saves any modification to the open preset. **Delete** deletes the open preset.

13.3.4 Import preset

Import the presets contained in the selected settings file as follows:

1. Click on Import button and the following dialog will be displayed.

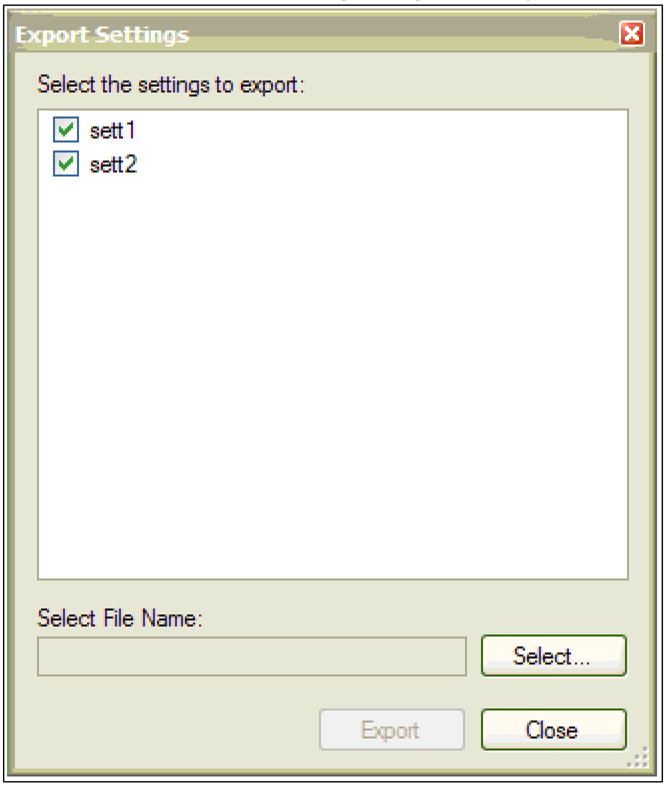


2. Select the settings file by clicking “Select…” button.
3. All the scope presets will be displayed contained in the selected settings file.
4. Select/Deselect the presets and then click on Import.
5. If preset name already exists in application the confirmation message will be shown to user to replace it or to ignore.

13.3.5 Export preset

Export a preset to a file as follows:

1. Click **Export** and the following dialog is displayed:



2. The existing presets are displayed and user can select/deselect the preset to export.
3. Select the file name to export.
4. Click **Export** to export the selected presets to a file.

13.3.6 Scope axis scaling and zooming

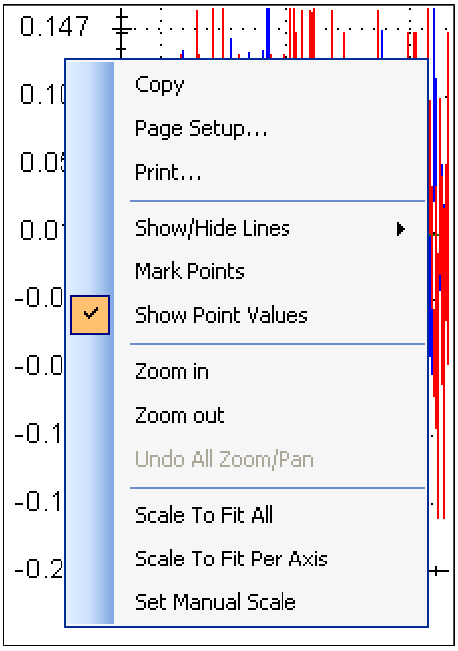
The scope provides two mechanisms for determining how you view the data:

- Scaling: you can choose the scale for the different axes.
- Zooming: you can choose a particular portion of the scope that you want to observe more in details, and then come back to previous scaling.

Two different scaling modes are provided on each axis:

- Manual: you can determine the minimum and maximum value of the axis (X or Y axis).
- Scale to fit: the program will compute a scale for this axis that will display all the curves bound to it (X or Y axis).

These functionalities are accessible through the contextual menu when right-clicking in the axis zone. A simple left-click in the axis zone will provide the manual range functionality. A supplementary functionality allows you to perform a scale to fit on all axes is also available, which allows a good overview.

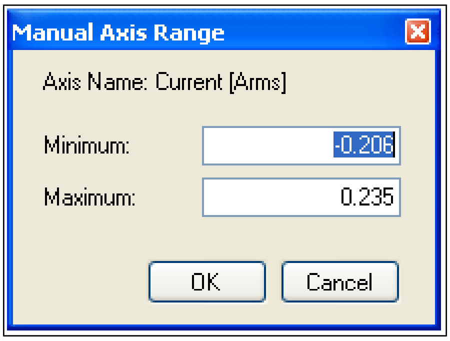


The zoom functionality allows you to navigate in a portion of the graphic. When you reset the zoom, the initial scales are shown.

In the display tab, when “Remember Axis Scale” is set, the scales of the axes are kept between two sequential recordings. You can fine tune the scale to visualize a particular behavior and record a second time and see the same behaviour without having to redo all the tuning. When not checked, a scale to fit all will be performed after each record. This setting is reseted when exiting EWV and should be explicitly set at next startup.

13.3.7 Manual range per axis

After recording data, right click anywhere on the y-axis and select **Set Manual Scale** to open a dialog box to set the range for the axis. Enter the Y-axis minimum value and Y-axis maximum value. Click **OK** to reset the Y-axis to new range.



13.3.8 Unit display on Y axis

The unit on the Y-axis is displayed if all scope signals units are identical for that Y-axis. If different units apply to different signals, the units are displayed as [-]. For example, if the velocity Y-axis has signals VL.FB and IL.CMD, then the unit displayed is [-], since the units for these parameters are different. If IL.CMD is hidden, then the correct unit for VL.FB, rpm, is displayed.

Related Parameters:

BODE Parameters (pg 222)

14 Using Parameters and the Terminal Screen

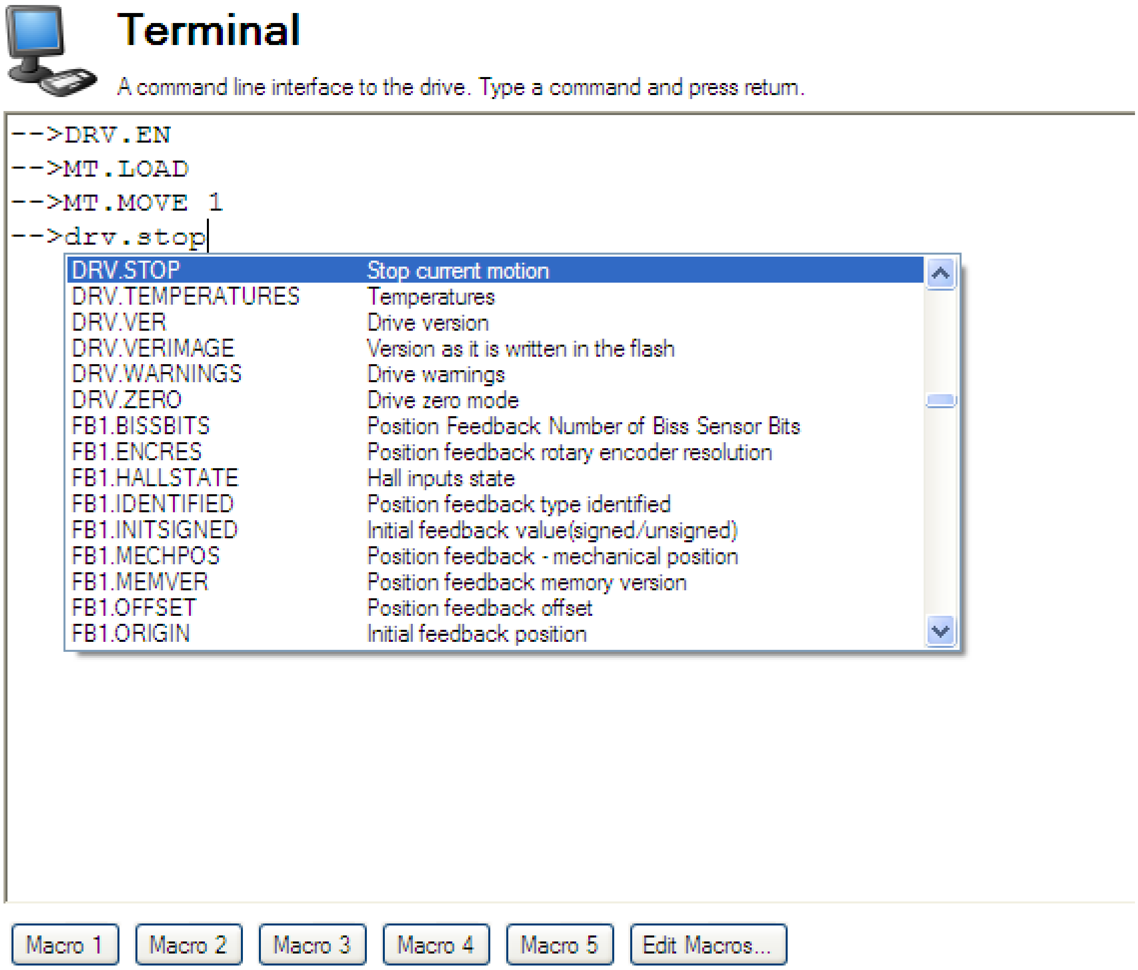
14.1 Terminal

14.1.1 Overview

The terminal mode provides a quick and easy way to issue commands to the drive directly. Typically used by "power users" who are familiar with the command set, the terminal mode can help in setup, troubleshooting, and other diagnostic actions. When using the terminal mode, EWV[1] shows the parameter and command set in a popup view and uses an autocomplete tool to help you select the proper parameter or command. Right-click in the command entry area to open a popup menu for editing commands and for clearing the screen. The terminal also provides a macro editor that allows a series of commands to be executed via a single command (called a macro). Macros are useful when you must frequently execute a sequence of commands.

14.1.2 Using the Terminal

Click Terminal in the navigation tree to issue parameters and commands in the terminal mode. You can enter parameters and commands at the prompt as shown in this example:



The terminal supports the following keyboard shortcuts:

Keyboard Shortcut	Description
F2	Executes the last command.
Up Arrow	Gets the previous command from the command history.

[1] Embedded Workbench Views

Keyboard Shortcut	Description
Down Arrow	Gets the next command from the command history.
CTRL+J	Shows the list of commands that the drive supports.
ESC	Hides the command list if command list is open. Clears the line if command list is not open.
Enter (Return)	Executes the current command. This command sends the text you have typed to the drive and then prints the text the drive returns on the next line.

14.1.3 Macros

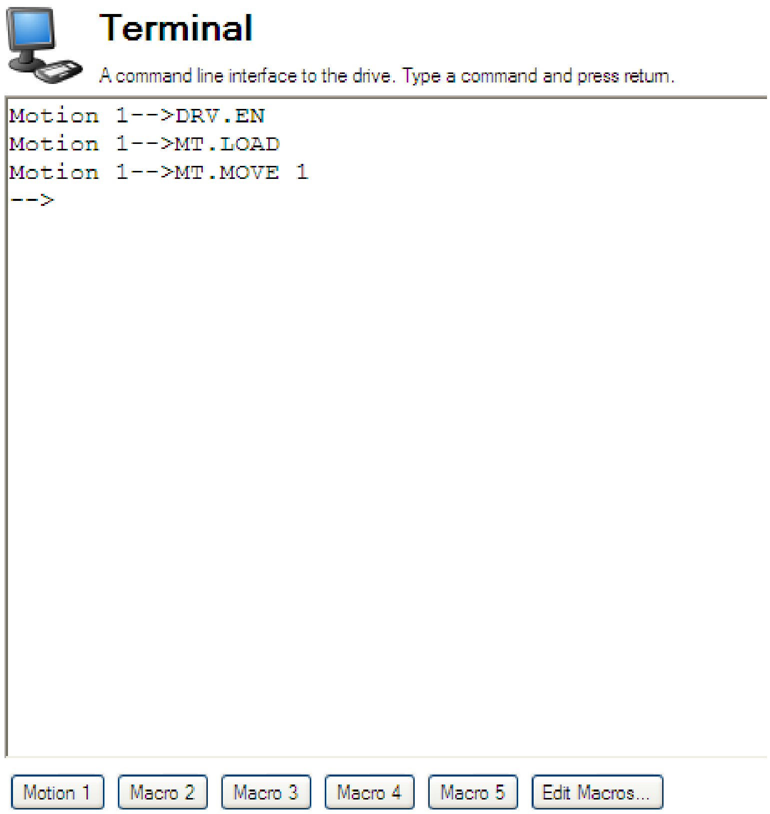
Macros are a short sequence of instructions that can be sent to the drive using a single button. You can create up to five macros within the terminal mode using the macro editor. Each of the macros can be given a name and will appear as a button below the Terminal screen area. When you select the button, the command set tied to that macro will appear in the Terminal area and the commands will be executed. If there are commands which are not entered correctly, the terminal screen area will indicate the errors.

You can access macros and the macro editor from the buttons are located at the bottom of the terminal screen. Click a macro button to execute the associated macro. The **Edit Macros** button opens the macro editor used to create and edit macros. You can also assign custom names to the macro buttons with this editor.

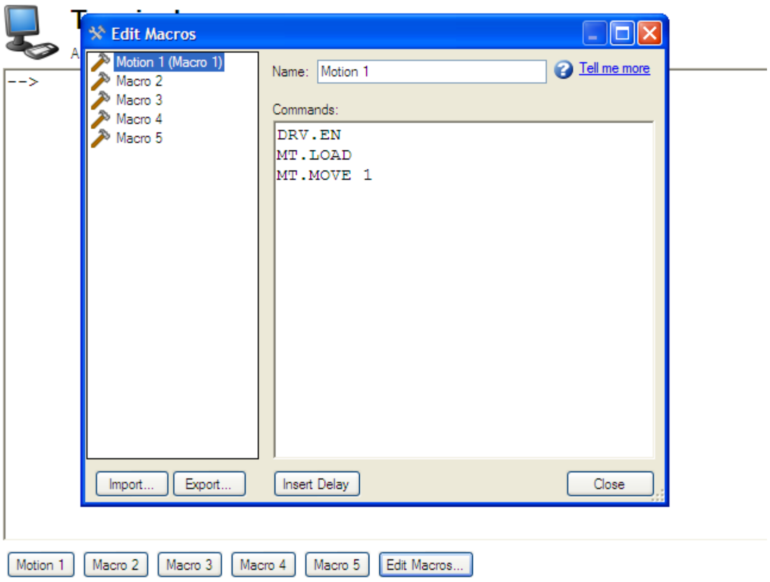
Creating a Macro from Terminal commands

You can create a macro from a sequence of terminal commands as follows:

1. Enter the sequence of commands.



2. Copy the sequence of commands, then click **Edit Macro**. Select a macro from the tree on the left, then paste the sequence of commands into the Commands area of the Edit Macros window.



3. Select **Save** to save your macro.

Macro Editor

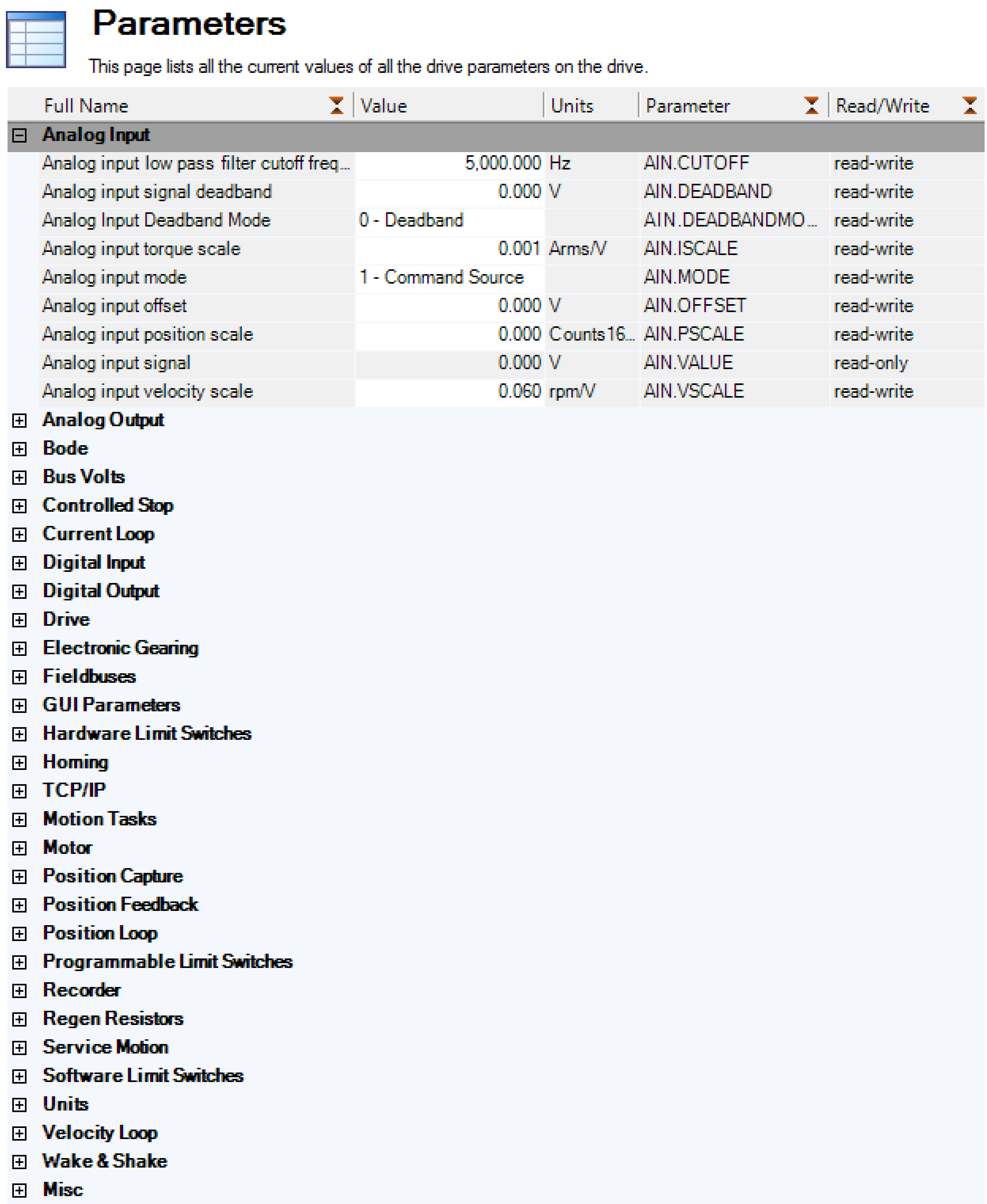
The macro editor allows you to create and modify up to five macros.EWV automatically saves the macros that you create. If you exit KAS IDE and then start KAS IDE again, the macros you defined will still be available.

To create or edit a macro from the editor, open the **Terminal** screen and click on **Edit Macros** (located at the bottom of the screen). Select the macro you wish to edit from the tree on the left, then use the features described below to build the macro. You can add comments in the macro after the ";" symbol.

Button or Dialog Box	Description
Name	Allows you to give each macro a unique name. This name will be shown on the button in the terminal view.
Commands	Displays the commands that are sent to the drive when you use this macro. The response from the drive is displayed in the terminal.
Import	Overwrites the selected macro with the contents of a macro file exported from another computer.
Export	Sends the selected macro to a text file to that you can import into KAS IDE running on another computer.
Insert Delay	Inserts a step into the macro that causes a delay for a specified number of milliseconds before continuing. A line that starts with #delay 5000 will pause the execution of the macro for 5000 milliseconds.
Close	Closes this window and returns to the terminal view.

14.2 Parameter List

This screen displays a list of the current values of all the parameters that the drive supports. You can sort some of the rows by clicking the column headers.



Parameters

This page lists all the current values of all the drive parameters on the drive.

Full Name	Value	Units	Parameter	Read/Write
Analog Input				
Analog input low pass filter cutoff freq...	5,000.000	Hz	AIN.CUTOFF	read-write
Analog input signal deadband	0.000	V	AIN.DEADBAND	read-write
Analog Input Deadband Mode	0 - Deadband		AIN.DEADBANDMO...	read-write
Analog input torque scale	0.001	Arms/V	AIN.ISCALE	read-write
Analog input mode	1 - Command Source		AIN.MODE	read-write
Analog input offset	0.000	V	AIN.OFFSET	read-write
Analog input position scale	0.000	Counts16...	AIN.PSCALE	read-write
Analog input signal	0.000	V	AIN.VALUE	read-only
Analog input velocity scale	0.060	rpm/V	AIN.VSCALE	read-write
Analog Output				
Bode				
Bus Volts				
Controlled Stop				
Current Loop				
Digital Input				
Digital Output				
Drive				
Electronic Gearing				
Fieldbuses				
GUI Parameters				
Hardware Limit Switches				
Homing				
TCP/IP				
Motion Tasks				
Motor				
Position Capture				
Position Feedback				
Position Loop				
Programmable Limit Switches				
Recorder				
Regen Resistors				
Service Motion				
Software Limit Switches				
Units				
Velocity Loop				
Wake & Shake				
Misc				

Button or Dialog Box	Description
Refresh	Reads all the parameters from the drive and update the contents of the table.
Print	Sends the data that you see on the screen to the printer.
eMail	Opens an email message and attaches a comma separated file to the email message.
More/Less	Adds two more columns to the table with the range and default values for each parameter.

14.3 Summary of Parameters and Commands

This table contains an alphabetical list of parameters and commands, with a brief description for each. The parameter name and description are linked to the parameter tables. Generally speaking, all parameters and commands are active in all opmodes, with the following exceptions:

Parameter or Command	Active in Opmodes
GEAR (all parameters and commands)	2 (position) only
HOME (all parameters and commands)	2 (position) only
MT (all parameters and commands)	2 (position) only
SM.I1, SM.I2	0 (torque) only
SM.V1, SM.V2	1 (velocity) only
SM.VPM1, SM.VPM2	2 (position) only
VL (all parameters and commands)	1 (velocity) and 2 (position) only

Parameter or Command	Type	Description
Analog Input (AIN)		
AIN.CUTOFF	NV	Sets the analog input low-pass filter cutoff frequency.
AIN.DEADBAND	NV	Sets the analog input signal deadband.
AIN.DEADBANDMODE	NV	Sets the analog input deadband mode.
AIN.ISCALE	NV	Sets the analog current scale factor.
AIN.MODE (Password Protected)	NV	Analog input mode.
AIN.OFFSET	NV	Sets the analog input offset.
AIN.PSCALE	NV	Sets the analog position scale factor.
AIN.VALUE	R/O	Reads the value of the analog input signal.
AIN.VSCALE	NV	Sets analog velocity scale factor.
AIN.ZERO	Command	Zeroes the analog input signal.
Analog Input 2 (AIN2)		
AIN2.DEADBAND (pg 1)	NV	Sets the analog input 2 signal deadband.
AIN2.DEADBANDMODE	NV	Sets the analog input 2 deadband mode.
AIN2.MODE	NV	Analog input 2 mode.
AIN2.OFFSET	NV	Sets the analog input 2 offset.
AIN2.VALUE	R/O	Reads the value of the analog input 2 signal.
AIN2.ZERO	Command	Zeroes the analog input 2 signal.
Analog Input/Output (AIO)		
AIO.ISCALE (pg 208)	NV	Sets the analog current scale factor.
AIO.VSCALE (pg 209)	NV	Sets velocity scale factor.
AIO.PSCALE (pg 208)	NV	Sets position scale factor.
Analog Output (AOUT)		
AOUT.CUTOFF (pg 212)	NV	Sets the analog output low-pass filter cutoff frequency.
AOUT.DEBUGADDR	NV	Sets the memory address to debug.
AOUT.DEBUGSCALE	NV	Sets the scale to be used for debug.
AOUT.ISCALE (pg 212)	NV	Sets the analog current scale factor.
AOUT.MODE (pg 213)	NV	Sets the analog output mode.
AOUT.OFFSET (pg 214)	NV	Sets the analog output offset.

Parameter or Command	Type	Description
AOUT.PSCALE (pg 214)	NV	Sets the analog position scale factor.
AOUT.VALUE (pg 215)	NV	Reads the analog output value.
AOUT.VALUEU (pg 216)	R/W	Sets the analog output value.
AOUT.VSCALE (pg 216)	NV	Sets the velocity scale factor for analog output.
Analog Output 2 (AOUT2)		
AOUT2.CUTOFF (pg 219)	NV	Sets the analog output 2 low-pass filter cutoff frequency.
AOUT2.MODE (pg 219)	NV	Sets the analog output 2 mode.
AOUT2.OFFSET (pg 220)	NV	Sets the analog output 2 offset.
AOUT2.VALUE (pg 220)	NV	Reads the analog output 2 value.
AOUT.VALUEU (pg 220)	R/W	Sets the analog output 2 value.
Bode plot (BODE)		
BODE.EXCITEGAP (pg 223)	R/W	Controls how often the excitation is updated.
BODE.FREQ (pg 223)	R/W	Sets the frequency of the sine excitation source.
BODE.IAMP (pg 224)	R/W	Sets current command value used during the Bode procedure.
BODE.IFLIMIT (pg 225)	R/W	Sets the current fault duration limit in seconds for the BODE.MODE 5 stability test.
BODE.IFTHRESH (pg 226)	R/W	Sets the current fault threshold for the BODE.MODE 5 stability test.
BODE.INJECTPOINT (pg 226)	R/W	Sets whether the excitation uses current or velocity excitation type.
BODE.MODE (pg 227)	R/W	Sets the mode of the excitation.
BODE.MODETIMER (pg 230)	R/W	Sets the watchdog timer of the excitation.
BODE.PRBDEPTH (pg 231)	R/W	Sets the length of the PRB signal before it repeats.
BODE.VAMP (pg 232)	R/W	Sets the amplitude of the excitation when in velocity mode.
BODE.VFLIMIT (pg 233)	R/W	Sets the velocity fault duration limit (seconds) for the BODE.MODE 5 stability test
BODE.VFTHRESH (pg 234)	R/W	Sets the current fault threshold for the BODE.MODE 5 stability test.
Capture (CAP)		
CAP0.EDGE, CAP1.EDGE	NV	Selects the capture edge.
CAP0.EN, CAP1.EN	NV	Enables or disables the related capture engine.
CAP0.EVENT, CAP1.EVENT	NV	Controls the precondition logic.
CAP0.FILTER, CAP1.FILTER	R/W	Controls the precondition logic.
CAP0.MODE, CAP1.MODE	NV	Selects the captured value.
CAP0.PLFB, CAP1.PLFB	R/O	Reads captured position value.
CAP0.PREEDGE, CAP1.PREEDGE	NV	Selects the capture precondition edge.
CAP0.PREFILTER, CAP1.PREFILTER	NV	Sets the filter for the precondition input source.

Parameter or Command	Type	Description
CAP0.PRESELECT, CAP1.PRESELECT	NV	Sets the precondition trigger.
CAP0.STATE, CAP1.STATE	R/O	Indicates whether or not trigger source was captured.
CAP0.T, CAP1.T	R/O	Reads time capture (if time capture was configured).
CAP0.TRIGGER, CAP1.TRIGGER	NV	Specifies the trigger source for the position capture.
Controlled Stop (CS)		
CS.DEC (pg 237)	NV	Sets the deceleration value for the controlled stop process.
CS.STATE (pg 238)	NV	Returns the internal status of the controlled stop process.
CS.TO (pg 238)	NV	Sets the time value for the drive velocity to be within CS.VTHRESH (pg 238).
CS.VTHRESH (pg 240)	NV	Sets the velocity threshold for the controlled stop.
Digital Input (DIN)		
DIN.HCMD1 TO DIN.HCMD4 (pg 242)	NV	A buffer of commands to be used in digital input "command buffer" mode.
DIN.LCMD1 to DIN.LCMD4 (pg 242)	NV	A buffer of commands to be used in digital input "command buffer" mode.
DIN.ROTARY (PG 243)	R/O	Reads the rotary knob value.
DIN.STATES (PG 244)	R/O	Reads the digital input states.
DIN1.FILTER TO DIN7.FILTER (pg 244)	R/W	Filter mode for digital inputs 1 to 7.
DIN1.INV TO DIN7.INV	R/W	Inverting the output voltage of the IO, when in the output direction.
DIN1.MODE TO DIN24.MODE (pg 247)	NV	Sets the digital input modes.
DIN1.PARAM TO DIN7.PARAM (pg 248)	R/W	Sets a value used as an extra parameter for digital inputs nodes.
DIN1.STATE TO DIN7.STATE (pg 249)	R/O	Reads a specific digital input state.
DIN21.FILTER to DIN32.FILTER (pg 251)	R/W	Filter mode for digital inputs 21 to 32.
DIN21.STATE to DIN32.STATE (pg 251)	R/O	Reads a specific digital input state.
DIO		
DIO9.INV to DIO11.INV	NV	Inverting the output voltage of the IO, when in the output direction.
DIO9.DIR to DIO11.DIR	NV	Changing direction of the IOs from the X9 connector.
Digital Output (DOUT)		
DOUT.CTRL (PG 254)	NV	Sets the source of digital outputs (firmware or fieldbus).
DOUT.RELAYMODE (pg 254)	R/W	Indicates faults relay mode.
DOUT.STATES (PG 255)	R/O	Reads the state of the two digital outputs.
DOUT1.MODE to DOUT19.MODE (pg 255)	NV	Sets the digital output mode.
DOUT1.PARAM AND DOUT2.PARAM (pg 256)	NV	Sets extra parameters for the digital outputs.

Parameter or Command	Type	Description
DOUT1.STATE AND DOUT2.STATE (pg 257)	R/O	Reads the digital output state.
DOUT1.STATEU AND DOUT2.STATEU (pg 257)	R/W	Sets the state of the digital output node.
DOUT21.STATE to DOUT32.STATE (pg 260)	R/O	Reads the digital output state.
DOUT21.STATEU to DOUT32.STATEU (pg 260)	R/W	Sets the state of the digital output node.
Drive (DRV)		
DRV.ACC	NV	Describes the acceleration ramp for the velocity loop.
DRV.ACTIVE (PG 264)	R/O	Reads the enable status of an axis.
DRV.BLINKDISPLAY (PG 264)	Command	Causes the display to blink for 10 seconds.
DRV.BOOTTIME (pg 265)	R/O	Returns the time when the current session booted up.
DRV.CLRFAULTHIST (PG 265)	Command	Clears the fault history log in the NV.
DRV.CLRFAULTS (PG 266)	Command	Tries to clear all active faults in the drive.
DRV.CMDDELAY (pg 266)	R/W	Issues a delay before next command is executed.
DRV.CMDSOURCE (PG 267)	NV	Sets the command source (service, fieldbus, analog input, gearing, digital, or Bode).
DRV.CRASHDUMP (pg 268)	Command	Retrieves diagnostic information after the drive crashes.
DRV.DBILIMIT (pg 268)	NV	Sets the maximum amplitude of the current for dynamic braking.
DRV.DEC (PG 269)	NV	Sets the deceleration value for the velocity loop.
DRV.DIFVAR (pg 270)	R/O	Lists all parameters which differ from their default value.
DRV.DIR (pg 271)	R/W	Changes drive direction.
DRV.DIS (PG 272)	Command	Disables the axis (software).
DRV.DISMODE (pg 273)	NV	Selects among disable immediately or stop and then disable options.
DRV.DISSOURCES (PG 274)	R/O	Returns the possible reason for a drive disable.
DRV.DISSOURCESMASK (pg 275)	R/O	Returns a bitmap of all bits in DRV.DISSOURCES that can be set to one on a given drive.
DRV.DISTO (pg 275)	R/W	Sets the emergency timeout
DRV.EMUEDIR (pg 276)	R/W	Sets the direction of the emulated encoder output (EEO) signal.
DRV.EMUEMODE (pg 277)	R/W	Sets the mode of the emulated encoder output (EEO) connector.
DRV.EMUEMTURN (pg 278)	R/W	Defines the location of the index pulse on the EEO (emulated encoder output) when DRV.EMUEMODE=2.
DRV.EMUEPULSEWIDTH (pg 279)		Sets the encoder output pulse width for modes 6 to 7.
DRV.EMUERES (pg 280)	R/W	Sets the resolution of the EEO (emulated encoder output).
DRV.EMUEZOFFSET (pg 280)	R/W	Sets the location of the EEO (emulated encoder output) index pulse (when DRV.EMUEMODE=1).
DRV.EN (PG 281)	Command	Enables the axis (software).

Parameter or Command	Type	Description
DRV.ENDEFAULT (pg 281)	R/W	Sets the default state of the software enable.
DRV.FAULTHIST (PG 282)	R/O	Reads the last 10 faults from NV memory.
DRV.FAULTS (PG 283)	R/O	Reads the active faults.
DRV.FAULT1 to DRV.FAULT10 (pg 282)	R/O	Location of fault codes for any active fault conditions.
DRV.HANDWHEEL	R/O	Reads the EEO input value.
DRV.HANDWHEELSRC (pg 284)	NV	Selects the feedback for handwheel operation.
DRV.HELP (PG 284)	R/O	Reads the minimum, maximum, and default values for a specific parameter or command.
DRV.HELPALL (pg 284)	R/O	Retrieves the minimum, maximum, default, and actual values for all available parameters and commands.
DRV.HWENABLE (pg 285)	R/O	Status of the hardware enable.
DRV.HWENDELAY (pg 285)	NV	Delay time between inactive Hardware Enable input and drive disable.
DRV.HWENMODE (pg 286)	R/W	Selects the action that the hardware enable digital input will perform.
DRV.ICONT (PG 287)	R/O	Reads the continuous rated current value.
DRV.INFO (PG 287)	R/O	Reads general information about the drive.
DRV.IPEAK (PG 288)	R/O	Reads the peak rated current value.
DRV.IZERO (pg 289)	R/W	Sets the current that will be used during the DRV.ZERO procedure.
DRV.LIST (PG 289)	R/O	Reads the list of available parameters and commands.
DRV.LOGICVOLTS (pg 289)	R/O	Reads the logic voltages.
DRV.NAME (PG 291)	NV	Sets and reads the name of the drive.
DRV.NVCHECK (pg 292)	R/O	NV Parameter Checksum
DRV.NVLIST (PG 292)	R/O	Lists the NV parameters and values from the RAM.
DRV.NVLOAD (pg 293)	W/O	Loads all data from the NV memory of the drive into the RAM parameters.
DRV.NVSAVE (PG 293)	Command	Saves the drive parameters from the RAM to the NV memory.
DRV.ONTIME (pg 293)	R/O	Returns how long the drive has been running since last power up.
DRV.OPMODE (PG 294)	NV	Sets the drive operation mode (current, velocity, or position).
DRV.READFORMAT (PG 295)	R/W	Sets the value returned to either decimal or hexadecimal.
DRV.RSTVAR (PG 295)	Command	Sets default values in the drive without re-booting the drive and without resetting the NV memory.
DRV.RUNTIME (PG 296)	R/O	Returns how long the drive has been running since first activated.
DRV.SETUPREQBITS (pg 296)	R/O	Reads the bitwise set status of parameters that must be set before the drive can be enabled.
DRV.SETUPREQLIST (pg 297)	R/O	Reads the list of parameters that must be set before the drive can be enabled.
DRV.STOP (PG 297)	Command	This command stops all drive motion.

Parameter or Command	Type	Description
DRV.TEMPERATURES (pg 298)	R/O	Reads the temperature of drive components.
DRV.TIME (pg 298)	R/W	A continuous time counter in the drive.
DRV.TYPE (pg 299)	R/O	Selects the operational fieldbus on CC drive models.
DRV.VER (PG 300)	R/O	Reads the drive version.
DRV.VERIMAGE (PG 300)	R/O	Returns the version data from each image.
DRV.WARNINGS (pg 301)	R/O	Reads the active warnings.
DRV.WARNING1 to DRV.WARNING10 (pg 301)	R/O	Location of fault codes for any active warning conditions.
DRV.ZERO (pg 302)	R/W	Sets the zero mode. The procedure is activated when the drive is enabled.
EtherNet/IP (EIP)		
EIP.CONNECTED (pg 304)	R/O	Returns state of EtherNet/IP connection.
EIP.POSUNIT (pg 304)	R/W	Unit scaling for Position values over EtherNet/IP.
EIP.PROFUNIT (pg 305)	R/W	Unit scaling for Velocity and Acceleration values over Eth-erNet/IP.
Fault (FAULT)		
FAULTx.ACTION (pg 307)	R/W	Gets/Sets the Fault Action for Fault 130, 131, 132, 134, 139, 451, and 702.
Feedback 1 (FB1)		
FB1.BISSBITS (pg 309)	NV	Specifies the number of Biss Sensor (Position) Bits for the BiSS Mode C encoder in use.
FB1.ENCRES (PG 309)	NV	Sets the resolution of the motor encoder.
FB1.HALLSTATE (PG 310)	R/O	Reads the Hall switch values (encoder feedback
FB1.HALLSTATEU (pg 311)	R/O	Reads the state of Hall switch U.
FB1.HALLSTATEV (pg 311)	R/O	Reads the state of Hall switch V.
FB1.HALLSTATEW (pg 311)	R/O	Reads the state of Hall switch W.
FB1.IDENTIFIED (PG 312)	R/O	Reads the type of feedback device used by the drive/motor.
FB1.INITSIGNED (pg 313)	NV	Sets initial feedback value as signed or unsigned.
FB1.MECHPOS (PG 313)	R/O	Reads the mechanical position.
FB1.MEMVER	R/O	Returns the memory feedback version.
FB1.OFFSET (pg 314)	NV	Sets position feedback offset.
FB1.ORIGIN (pg 315)	NV	Adds to the initial feedback position.
FB1.P (pg 316)	R/O	Reads position from the primary feedback.
FB1.PDIR	NV	Sets the counting direction for feedback channel 1.
FB1.PFIND (pg 316)	R/W	A procedure that allows the user to find the commutation angle for encoder feedback, which has no halls.
FB1.PFINDCMDU (pg 317)	R/W	Current value used during the phase finding procedure (PFB.PFIND=1)
FB1.POFFSET (pg 317)	NV	Sets the offset for primary feedback.
FB1.POLES (PG 318)	R/O	Reads the number of feedback poles.

Parameter or Command	Type	Description
FB1.PSCALE (pg 318)	R/W	Sets position scaling value for fieldbus transferred position objects.
FB1.PUNIT (pg 319)	NV	Sets the unit for FB1.P.
FB1.RESKTR (pg 319)	NV	Sets the resolver nominal transformation ratio.
FB1.RESREFPHASE (pg 320)	NV	Sets the electrical degrees of phase lag in the resolver.
FB1.SELECT	NV	Sets user entered type or identified type (–1).
FB1.TRACKINGCAL (pg 322)	NV	Controls tracking calibration algorithm.
FB1.USERBYTE0 to FB1.USERBYTE7 (pg 323)	R/W	Reads and writes data stored in two 32 bit words in the Endat feedback device.
FB1.USERDWORD0 to FB1.USERWORD1 (pg 324)	R/W	Reads and writes data stored in two 32 bit words in the Endat feedback device.
FB1.USERWORD1 to FB1.USERWORD3 (pg 325)	R/W	Reads and writes data stored in two 32 bit words in the Endat feedback device.
Feedback 2 (FB2)		
FB2.ENCRES	NV	Sets the secondary feedback (FB2) resolution (also defines resolution of virtual encoder in).
FB2.MODE	R/W	Sets the mode for the second feedback inputs, EEO connector (X9) and high speed opto inputs (pins 9 and 10 on X7).
FB2.P	R/O	Reads position from the secondary feedback.
FB2.PDIR	R/W	Sets the counting direction for feedback channel 2.
FB2.POFFSET	NV	Sets the offset for secondary feedback.
FB2.PUNIT	NV	Sets the unit for FB2.P.
FB2.SOURCE	R/W	Sets the source for the second feedback input. Choices are the EEO connectors (X9) which are RS485 inputs, or the X7 connector’s high speed opto inputs (pins 9 and 10).
Feedback 3 (FB3)		
FB3.MODE (pg 328)	NV	Selects the type of feedback connected to X9.
FB3.P (pg 328)	RO	Reads position from the tertiary feedback.
FB3.PDIR (pg 329)	NV	Sets the counting direction for feedback channel 3.
FB3.POFFSET (pg 329)	NV	Sets the offset for tertiary feedback.
FB3.PUNIT (pg 329)	NV	Sets the unit for FB3.P.
Fieldbus (FBUS)		
FBUS.PARAM1 TO FBUS.PARAM10 (pg 332)	NV	Set fieldbus specific meanings.
FBUS.PLLSTATE (pg 333)	R/O	Returns the status of the PLL
FBUS.PLLTHRESH (pg 334)	NV	Sets number of successful synchronized cycles needed to lock the PLL.
FBUS.PROTECTION (pg 335)	R/W	Controls which parameters are blocked from being accessed through telnet while a fieldbus is operational.
FBUS.SAMPLEPERIOD (pg 337)	NV	Sets fieldbus sample period.
FBUS.STATE (pg 338)	R/O	Reads the state of the fieldbus.
FBUS.SYNCACT (pg 338)	R/O	Reads actual distance from the desired sync distance.

Parameter or Command	Type	Description
FBUS.SYNCDIST (pg 338)	NV	Sets time target for synchronization.
FBUS.SYNCWND (pg 339)	NV	Sets symmetrically arranged window around the desired sync distance.
FBUS.TYPE (pg 339)	R/O	Shows the active fieldbus type.
Hardware Limit Switch (HWLS)		
HWLS.NEGSTATE (pg 347)	R/O	Reads the status of the negative hardware limit switch.
HWLS.POSSTATE (pg 347)	R/O	Reads the status of the positive hardware limit switch.
Current Loop (IL)		
IL.BUSFF (pg 349)	R/O	Displays the current feedforward value injected by the fieldbus.
IL.CMD (PG 349)	R/O	Reads the value of the q-component current command.
IL.CMDU (PG 349)	R/W	Sets the user current command.
IL.DIFOLD (PG 350)	R/O	Reads the drive foldback current limit.
IL.FB (PG 351)	R/O	Reads the actual value of the d-component current.
IL.FBSOURCE (pg 351)	R/W	Sets the feedback source for the current loop. Only applies when MOTOR.TYPE = 4.
IL.FF (pg 352)	R/O	Displays the current loop overall feedforward value.
IL.FOLDFTHRESH (PG 352)	NV	Reads the foldback fault level.
IL.FOLDFTHRESHU (pg 353)	NV	Sets the user value for the foldback fault level.
IL.FOLDWTHRESH (PG 353)	NV	Sets the foldback warning level.
IL.IFOLD (pg 355)	R/O	Reads the overall foldback current limit.
IL.IUFB (PG 355)	R/O	Reads the sigma-delta measured current in the u-winding of the motor.
IL.KACCFF (pg 356)	R/W	Sets current loop acceleration feedforward gain value
IL.KBUSFF (pg 357)	R/W	Current loops fieldbus injected feed-forward gain
IL.KP (PG 357)	NV	Sets the proportional gain of the q-component of the PI regulator.
IL.KPDRATIO (PG 358)	NV	Sets the proportional gain of the d-component current PI-regulator as a percentage of IL.KP
IL.KPLOOKUPINDEX (pg 358)	R/W	Sets the index into the Current Loop Gain Scheduling Table.
IL.KPLOOKUPVALUE (pg 359)	R/W	Sets the value of the current loop gain scheduling index.
IL.KPLOOKUPVALUES (pg 359)	R/W	Gets the Current Loop Gain Scheduling Table.
IL.KVFF (pg 360)	R/W	Current loop velocity feed-forward gain.
IL.LIMITN (PG 360)	NV	Sets the negative user (application-specific) current limit.
IL.LIMITP (PG 361)	NV	Sets the positive user (application-specific) current limit.
IL.MFOLDD (PG 362)	NV	Sets the motor foldback maximum time at motor peak current.
IL.MFOLDR (PG 362)	R/O	Sets the motor foldback recovery time.

Parameter or Command	Type	Description
IL.MFOLDT (PG 362)	NV	Sets the motor foldback time constant of the exponential current drop (foldback).
IL.MI2T (pg 363)	R/O	Motor I2t load.
IL.MI2TWTHRESH (pg 363)	NV	Motor I2t load warning threshold.
IL.MIFOLD (PG 364)	R/O	Sets the motor foldback current limit.
IL.MIMODE (pg 364)	NV	Motor protection mode.
IL.OFFSET (pg 365)	RW	A constant current command added to compensate for gravity.
IL.VCMD (PG 365)	R/O	Sets the output of the q-component PI regulator.
IL.VUFB (PG 366)	R/O	Reads the measured voltage on the u-winding of the motor.
IL.VVFB (PG 366)	R/O	Reads the measured voltage on the v-winding of the motor.
IP (Internet Protocol) Parameters		
IP.ADDRESS (pg 369)	NV	Gets/Sets the IP address of the drive.
IP.GATEWAY (pg 370)	NV	Gets/Sets the gateway IP of the drive.
IP.MODE (pg 371)	NV	Sets method of acquiring IP Address.
IP.RESET (pg 372)	Command	Implements new IP settings..
IP.SUBNET (pg 372)	NV	Gets/Sets the IP Subnet mask of the drive.
LOAD Parameters		
LOAD.INERTIA (pg 375)	NV	Sets the load inertia.

Motor Parameters		
MOTOR.AUTOSET (pg 377)	NV	Determines which drive parameters are calculated automatically.
MOTOR.BRAKE (PG 377)	NV	Sets the presence or absence of a motor brake.
MOTOR.BRAKEIMM (pg 378)	NV	Brake Immediately: in the case of a drive disable, apply the brake in all situations.
MOTOR.BRAKERLS (pg 378)	Command	Allows a user to release or apply the motor brake.
MOTOR.BRAKESTATE (pg 379)	R/O	Reads the actual status of the motor brake.
MOTOR.CTF0 (pg 380)	NV	Sets the thermal constant of the motor coil.
MOTOR.ICONT (PG 380)	NV	Sets the motor continuous current.
MOTOR.IDDATAVALID (pg 381)	R/O	Reports the status of the motor memory.
MOTOR.IMID (pg 381)	R/W	The direct-axis current set point used for induction machine closed-loop control.
MOTOR.IMTR (pg 382)	R/W	Rotor time constant.
MOTOR.INERTIA (PG 383)	NV	Sets the motor inertia.
MOTOR.IPEAK (PG 383)	NV	Sets the motor peak current.
MOTOR.KE (pg 384)		Sets the motor back EMF constant.
MOTOR.KT (PG 385)	NV	Sets the torque constant of the motor.
MOTOR.LQLL (PG 385)	NV	Sets the line-to-line motor Lq.
MOTOR.NAME (PG 386)	NV	Sets the motor name.
MOTOR.PHASE (PG 386)	NV	Sets the motor phase.
MOTOR.PITCH (PG 387)	NV	Sets the motor pitch.

MOTOR.POLES (PG 387)	NV	Sets the number of motor poles.
MOTOR.R (PG 388)	NV	Sets the stator winding resistance phase-phase in ohms.
MOTOR.RTYPE (pg 388)	NV	Defines the type of thermal resistor inside the motor.
MOTOR.TBRAKEAPP (PG 389)	NV	The delay time used for applying the motor brake.
MOTOR.TBRAKERLS (PG 389)	NV	The delay time used for releasing the motor brake.
MOTOR.TBRAKETO (pg 390)	NV	Brake apply timeout for vertical axis.
MOTOR.TEMP (pg 390)	R/O	Reads the motor temperature represented as the resistance of the motor PTC.
MOTOR.TEMPFAULT (pg 391)	NV	Sets the motor temperature fault level.
MOTOR.TEMPWARN (pg 391)	NV	Sets the motor temperature warning level.
MOTOR.TYPE (PG 392)	NV	Sets the motor type.
MOTOR.VMAX (PG 393)	NV	Sets the maximum motor speed.
MOTOR.VOLTMAX (PG 393)	NV	Sets the motor maximum voltage.
MOTOR.VOLTMIN (pg 394)	NV	Sets the minimum voltage for V/f control.
MOTOR.VOLTRATED (pg 395)	NV	Sets the motor rated voltage.
MOTOR.VRATED (pg 395)	NV	Sets the motor rated velocity (not maximum velocity).
Position Loop (PL)		
PL.CMD (PG 398)	NV	Reads the position command directly from the entry to the position loop.
PL.ERR (PG 398)	NV	Reads the position error present when the drive is controlling the position loop.
PL.ERRFTHRESH (pg 399)	NV	Sets the maximum position error.
PL.ERRMODE (pg 400)	R/W	Sets the type of following error warning and fault usage.
PL.ERRWTHRESH (pg 401)	NV	Sets the position error warning level.
PL.FB (PG 403)	R/O	Reads the position feedback value.
PL.FBSOURCE (pg 403)	NV	Sets the feedback source for the position loop.
PL.INTINMAX (PG 404)	NV	Limits the input of the position loop integrator by setting the input saturation.
PL.INTOUTMAX (PG 406)	NV	Limits the output of the position loop integrator by setting the output saturation.
PL.KI (PG 407)	NV	Sets the integral gain of the position loop.
PL.KP (PG 407)	NV	Sets the proportional gain of the position regulator PID loop.
PL.MODP1	R/W	Sets modulo range parameter.
PL.MODP2	R/W	Sets the beginning or end modulo range parameter.
PL.MODPDIR	R/W	Sets the direction for absolute motion tasks.
PL.MODPEN	R/W	Enables the modulo position.
Recorder (REC)		
REC.ACTIVE (PG 410)	R/O	Indicates if data recording is in progress (active).

REC.CH1 to REC.CH6 (pg 410)	R/W	Sets recording channels 1 to 6.
REC.DONE (PG 411)	R/O	Checks whether or not the recorder has finished recording.
REC.GAP (PG 411)	R/W	Specifies the gap between consecutive samples.
REC.NUMPOINTS (PG 411)	R/W	Sets the number of points to record.
REC.OFF (PG 412)	R/W	Turns the recorder OFF.
REC.RECPRMLIST (pg 412)	R/O	Reads the list of recordable parameters.
REC.RETRIEVE (PG 413)	R/O	Transfers all the recorded data to the communication channel.
REC.RETRIEVEDATA (pg 414)	R/W	Retrieves the recorded data without the header.
REC.RETRIEVEFRMT (pg 415)	R/W	Sets the format for recorded data output.
REC.RETRIEVEHDR (pg 415)	R/O	Retrieves the recorded header without the data.
REC.RETRIEVESIZE (pg 416)	R/W	Sets the number of samples that REC.RETRIEVEDATA returns.
REC.STOPTYPE (pg 416)	R/W	Sets the recorder stop type.
REC.TRIG (PG 417)	Command	Triggers the recorder.
REC.TRIGPARAM (pg 417)	R/W	Sets the parameter that triggers the recorder.
REC.TRIGPOS (pg 418)	R/W	Sets the trigger position in the recording buffer.
REC.TRIGPRMLIST (pg 419)	R/O	Reads the list of possible trigger parameters.
REC.TRIGSLOPE (PG 420)	R/W	Sets the trigger slope.
REC.TRIGTYPE (PG 420)	R/W	Sets the trigger type.
REC.TRIGVAL (PG 421)	R/W	Sets the trigger value.
Regen Resistor (REGEN)		
REGEN.POWER (PG 423)	R/O	Reads regen resistor's calculated power.
REGEN.POWERFILTERED (pg 423)	R/O	Returns a filtered version of REGEN.POWER .
REGEN.REXT (PG 424)	N/V	Sets the external, user-defined regen resistor resistance.
REGEN.TEXT (pg 424)	R/W	Sets the external regen resistor thermal protection time constant.
REGEN.TYPE (PG 425)	N/V	Sets the regen resistor type.
REGEN.WATTEXT (PG 426)	R/W	Sets the regen resistor's power fault level for an external regen resistor.
SD card (SD)		
SD.LOAD (pg 428)	Command	Loads the drive state (BASIC program and NV parameters) from the SD card to the AKD PDMM (AKD PDMMs equipped with IO option card only).
SD.SAVE (pg 428)	Command	Saves the drive state (BASIC program and NV parameters) to the SD card (AKD PDMMs equipped with IO option card only).
SD.STATUS (pg 429)	R/O	Reads the status of the SD card.
Service Motion (SM)		
SM.I1 (pg 431)	R/W	Sets service motion current 1; active in opmode 0 (torque) only.

SM.I2 (pg 431)	R/W	Sets service motion current 2; active in opmode 0 (torque) only.
SM.MODE (pg 431)	R/W	Sets the service motion mode.
SM.MOVE (pg 434)	Command	Starts the service motion.
SM.T1 (pg 434)	R/W	Sets the service motion time 1.
SM.T2 (pg 434)	R/W	Sets the service motion time 2.
SM.V1 (pg 435)	R/W	Sets service motion velocity 1; active in opmode 1 (velocity) and 2 (position).
SM.V2 (pg 436)	R/W	Sets service motion velocity 2; active in opmode 1 (velocity) and 2 (position).
STO		
STO.STATE (pg 439)	R/O	Returns the status of the safe torque off.
SWLS		
SWLS.EN (pg 441)	NV	Enables and disables software travel limit switches.
SWLS.LIMIT0 (pg 441)	NV	Sets the position of the software travel limit switch 0.
SWLS.LIMIT1 (pg 442)	NV	Sets the position of the software travel limit switch 0.
SWLS.STATE (pg 442)	R/O	Reads the actual status of software limit switches.
Bus Volatage (VBUS)		
VBUS.HALFVOLT (pg 445)	NV	Changing voltage thresholds for HV and MV Drives
VBUS.OVFTHRESH (pg 445)	R/O	Reads the over voltage fault level.
VBUS.OVWTHRESH (pg 446)	N/V	Sets voltage level for over voltage warning.
VBUS.RMSLIMIT (pg 446)	R/O	Reads the limit for the bus capacitors load.
VBUS.UVFTHRESH (pg 447)	R/O	Sets the under voltage fault level.
VBUS.UVMODE (pg 447)	NV	Indicates undervoltage (UV) mode.
VBUS.UVWTHRESH (pg 448)	NV	Sets voltage level for undervoltage warning.
VBUS.VALUE (pg 448)	R/O	Reads DC bus voltage.
Velocity Loop (VL)		
VL.ARPF1 TO VL.ARPF4 (pg 450)	R/W	Sets the natural frequency of the pole (denominator) of anti-resonance (AR) filters 1, 2, 3, and 4; active in opmodes 1 (velocity) and 2 (position) only.
VL.ARPQ1 TO VL.ARPQ4 (pg 451)	R/W	Sets the Q of the pole (denominator) of anti-resonance (AR) filter 1; active in opmodes 1 (velocity) and 2 (position) only.
VL.ARTYPE1 TO VL.ARTYPE4 (pg 452)	NV	Indicates the method used to calculate BiQuad coefficients; active in opmodes 1 (velocity) and 2 (position) only.
VL.ARZF1 TO VL.ARZF4 (pg 452)	R/W	Sets the natural frequency of the zero (numerator) of anti-resonance (AR)filter 1; active in opmodes 1 (velocity) and 2 (position) only.
VL.ARZQ1 TO VL.ARZQ4 (pg 453)	R/W	Sets the Q of the zero (numerator) of anti-resonance filter #1; active in opmodes 1 (velocity) and 2 (position) only.
VL.BUSFF (pg 454)	R/O	Displays the velocity loop feedforward value injected by the field-bus; active in opmodes 1 (velocity) and 2 (position) only.
VL.CMD (PG 455)	R/O	Reads the actual velocity command; active in opmodes 1 (velocity) and 2 (position) only.

VL.CMDU (PG 455)	R/W	Sets the user velocity command; active in opmodes 1 (velocity) and 2 (position) only.
VL.ERR (PG 456)	R/O	Sets the velocity error; active in opmodes 1 (velocity) and 2 (position) only.
VL.FB (PG 457)	R/O	Reads the velocity feedback; active in opmodes 1 (velocity) and 2 (position) only.
VL.FBFILTER (pg 457)	R/O	Filters VL.FB (pg 454) value; active in opmodes 1 (velocity) and 2 (position) only.
VL.FBSOURCE (pg 458)	NV	Sets feedback source for the velocity loop; active in opmodes 1 (velocity) and 2 (position) only.
VL.FBUNFILTERED (pg 458)	R/O	Reads the velocity feedback.
VL.FF (pg 459)	R/O	Displays the velocity loop overall feedforward value; active in opmodes 1 (velocity) and 2 (position) only.
VL.GENMODE (PG 459)	NV	Selects mode of velocity generation (Observer, d/dt); active in opmodes 1 (velocity) and 2 (position) only.
VL.KBUSFF (pg 460)	R/W	Sets the velocity loop acceleration feedforward gain value; active in opmodes 1 (velocity) and 2 (position) only.
VL.KI (pg 461)	NV	Sets the velocity loop integral gain for the PI controller; active in opmodes 1 (velocity) and 2 (position) only.
VL.KP (pg 462)	NV	Sets velocity loop proportional gain for the PI controller; active in opmodes 1 (velocity) and 2 (position) only.
VL.KVFF (pg 464)	R/W	Sets the velocity loop velocity feedforward gain value; active in opmodes 1 (velocity) and 2 (position) only.
VL.LIMITN (PG 464)	NV	Sets the velocity lower limit; active in opmodes 1 (velocity) and 2 (position) only.
VL.LIMITP (PG 466)	NV	Sets the velocity high limit; active in opmodes 1 (velocity) and 2 (position) only.
VL.LMJR (pg 466)	R/W	Sets the ratio of the estimated load moment of inertia relative to the motor moment of inertia; active in opmodes 1 (velocity) and 2 (position) only.
VL.MODEL (pg 467)	R/O	Reads the observer velocity signal; active in opmodes 1 (velocity) and 2 (position) only.
VL.OBSBW (pg 468)	NV	Sets the bandwidth of the observer in Hz.
VL.OBSMODE (pg 468)	NV	Sets the observer operating mode.
VL.THRESH (PG 468)	NV	Sets the over speed fault value; active in opmodes 1 (velocity) and 2 (position) only.
Wake and Shake (WS)		
WS.ARM	Command	Sets wake and shake to start at the next drive enable.
WS.CHECKMODE (pg 1)	R/W	Select the type of commutation check to execute after Wake and Shake finds a new commutation angle.
WS.CHECKT (pg 1)	R/W	Sets the amount of time a communication error must be present before an error is thrown.
WS.CHECKV (pg 1)	R/W	This parameter sets the velocity threshold which has to be exceeded to activate commutation monitoring.
WS.DISARM	Command	Cancels ARM requests and resets wake and shake to the IDLE state.
WS.DISTMAX	R/W	Sets maximum movement allowed for wake and shake.

WS.DISTMIN	R/W	Sets the minimum movement required for wake and shake.
WS.FREQ (pg 1)	R/W	Sets the sine frequency of excitation for WS.MODE 2.
WS.IMAX	R/W	Sets maximum current used for wake and shake.
WS.MODE	R/W	Sets the method used for wake and shake.
WS.NUMLOOPS	R/W	Sets the number of repetitions for wake and shake.
WS.STATE	R/O	Reads wake and shake status
WS.T	R/W	Sets wake and shake current-vector appliance time
WS.TDELAY1	NV	Delay for wake and shake timing
WS.TDELAY2	NV	Sets the delay for wake and shake timing.
WS.TDELAY3	NV	Sets the delay for wake and shake between loops in mode 0.
WS.TIRAMP (pg 1)	R/W	Sets the ramp time for the ramp up current in Wake & Shake mode 1.
WS.TSTANDSTILL (pg 1)	R/W	Sets the calming time of the motor for Wake & Shake mode 1.
WS.VTHRESH	NV	Defines the maximum allowed velocity for Wake & Shake

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15 Faults and Warnings

15.1 Fault and Warning Messages

When a fault occurs, the drive fault relay is opened, the output stage is switched off (motor loses all torque), or the load is dynamically braked. The specific drive behavior depends on the type of fault. The LED display on the front panel of the drive shows the number of the fault that occurred. If a warning is issued prior to the fault, the warning is shown on the LED and has the same number as the associated fault. Warnings do not trip the power stage of the drive or fault relay output.

The left side of the LED displays F for a fault or n for a warning. The right side displays the fault or warning number as follows: 1-0-1-[break]. The highest priority fault is displayed on the LED. Multiple faults may be present when a fault condition is occurring. Check the AKD PDMMEWV[1] Fault Screen or read the status of DRV.FAULTS through the controller or HMI for the entire list of faults.

Fault	Message/Warning	Cause	Remedy
F0		Reserved.	N/A
F101	Firmware type mismatch.	Installed firmware is not compatible with the drive hardware.	Load compatible firmware into the drive.
n101	The FPGA is a lab FPGA.	The FPGA is a lab version FPGA.	Load the released FPGA version that is compatible with the operational firmware.
F102	Resident firmware failed.	Software failure detected.	Restart drive. If issue persists, contact technical support.
n102	Operational FPGA is not a default FPGA.	The FPGA minor version is larger than the operational firmware default FPGA minor version	Load the released FPGA version that is compatible with the operational firmware.
F103	Resident FPGA failed.	Software failure detected. Load resident FPGA failure occurred (several cases according to flowchart, including incompatible image to FPGA type and fieldbus type).	Restart drive. If issue persists, contact technical support.
F104	Operational FPGA failed.	Software failure detected. Load operational FPGA failure occurred (several cases according to flowchart).	Restart drive. If issue persists, contact technical support.
F105	Non-volatile memory stamp invalid.	Non-volatile memory stamp is corrupted or invalid.	Reset the drive to default memory values using Parameter Load in EWV.
F106	Non-volatile memory data	Non-volatile memory data is corrupted or invalid. When this fault occurs after a firmware download, it is not an indication of a problem (clear the fault and perform a “save” to the drive).	Reset the drive to default memory values using Parameter Load in EWV.
n107	Positive switch limit exceeded.	Positive software position limit is exceeded.	Move the load away from the limits.

[1]Embedded Workbench Views

Fault	Message/Warning	Cause	Remedy
n108	Negative switch limit exceeded.	Negative software position limit is exceeded.	Move the load away from the limits.
F121	Homing error.	Drive did not finish homing sequence.	Check homing sensor, homing mode, and homing configuration.
F123 n123	Invalid motion task.	Invalid motion task.	Check motion task settings and parameters to make sure that the values entered will produce a valid motion task.
F125 n125	Synchronization lost.	The fieldbus lost synchronization.	Check fieldbus connection (X5 and X6 if you are using EtherCAT; X12 and X13 if you are using CANopen) or the settings of your EtherCAT or CANopen master.
F126 n126	Too much movement.	Too much movement was created during a Bode plot. Motor is unstable and is not following drive instructions.	Check that the system is closed loop stable. Refer to the system tuning guide.
F127	Incomplete emergency stop procedure.	Incomplete emergency stop procedure (problem with the emergency stop motion task).	Disconnect power from drive and check emergency stop procedure.
F128	MPOLES/FPOLES not an integer.	Ratio of motor poles to feedback poles must be a whole number.	Change to a compatible feedback device.
F129	Heartbeat lost.	Heartbeat lost.	Check CANopen cabling. Reduce bus load or increase the heartbeat update time.
F130	Secondary feedback supply over current.	5V power supply was shorted out on X9.	Check X9 connection.
F131	Secondary feedback A/B line break.	Problem in secondary feedback detected.	Check secondary feedback (X9 connection).
F132	Secondary feedback Z line break.	Problem in secondary feedback detected.	Check secondary feedback (X9 connection).
F133	Fault number changed to to F138. See F138 for details.		
F134	Secondary feedback illegal state.	Feedback signals were detected in an illegal combination.	Check X9 connection.
F135 n135	Homing is needed.	Attempt to issue motion task before the axis is homed. Axis must be homed before motion task can start.	Change opmode or home axis.
F136	Firmware and FPGA versions are not compatible	The FPGA version does not match the firmware FPGA version constants.	Load the FPGA version that is compatible with the firmware.

Fault	Message/Warning	Cause	Remedy
n137	Homing and feedback mis-match	The configured homing mode is not supported by the motor feedback type used.	Change homing mode.
F138	Instability during autotune	Drive current (IL.CMD) or velocity feedback (VL.FB) exceeds allowable limit (BODE.IFLIMIT or BODE.VFLIMIT). This fault only occurs in BODE.MODE 5. This fault often occurs when complex mechanics, belts, and compliant loads are present.	Change BODE.MODE if appro-priate. If BODE.MODE 5 is appropriate and the fault occurs at the end of an Autotuning, then the motor is not robustly stable. You can manually adjust Auto-tuner settings. Manual tuning may be required to make the motor stable.
F139	Target Position Overshot due to invalid Motion task acti-vation.	The drive cannot decelerate from its current speed to reach the end point of the second motion task without moving past it. Increase the decel-eration rate in the move or trigger the move earlier.	Change Motion task profile and clear fault with DRV.CLRFAULTS. Or change the value of FAULT13-9.ACTION = 1 to ignore this con-dition.
n140	VBUS.HALFVOLT has changed. Save the parameters and reboot the drive.	The user has changed the numerical value of VBUS.HAL-FVOLT. This change only takes effect after a DRV.NVSAVE command and after rebooting the AKD PDMM.	Save the parameters in the non-volatile memory via a DRV.NVSAVE command and turn off/on the 24[V] power supply in order to reboot the drive or restore the original stet-ting of VBUS.HALFVOLT.
n151	Not enough distance to move; motion exception.	For trapezoidal and customer table motion tasks: The target velocity specified in the motion task cannot be reached via using the selected accel-eration and deceleration since the distance to travel is not suf-ficient. For a 1:1 profile: The selected acceleration and deceleration will be extended since there is too much distance to travel and the motion task would exceed its maximum allowed velocity.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning. Check motion task settings and parameters to make sure that the values entered will produce a valid motion task.

Fault	Message/Warning	Cause	Remedy
n152	Not enough distance to move; following motion exception.	A new motion task activated, when one motion task is already active and the target position specified in the motion task parameters cannot be reached with specified target velocity, acceleration and deceleration parameters. The motion task will directly decelerate to into the target position or ramps down to velocity 0 and start another move to reach target position of the next motion task.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning. Check motion task settings and parameters to make sure that the values entered will produce a valid motion task.
n153	Velocity limit violation, exceeding max limit.	A new target velocity calculated internally due to an exception, and is being limited due to user velocity limit.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning. Check motion task target velocity settings and parameters to make sure that the values entered will not exceed the VL.LIMITP and VL.LIMITN setting.
n154	Following motion failed; check motion parameters.	Activation of the following motion task failed due to incompatible parameters, or motion task does not exist.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning. Check following motion task settings and parameters to make sure that the values entered will produce a valid motion task.
n156	Target position crossed due to stop command.	The motion task crosses the target position after triggering a DRV.STOP command. This situation can happen when processing a change-on-the-fly motion task and triggering a DRV.STOP command close to the target position of the currently running motion task.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
n157	Homing index pulse not found.	A homing mode with index detection is activated, and index pulse is not detected while moving across the range determined by the hardware limit switches.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
n158	Homing reference switch not found.	A homing mode with reference switch detection is activated and the reference switch is not detected while moving across the range determined by the hardware limit switches.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.

Fault	Message/Warning	Cause	Remedy
n159	Failed to set motion task parameters	Invalid motion task parameters assignment. This warning can appear upon an MT.SET command.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning. Check motion task settings and parameters.
n160	Motion task activation failed.	Activation of the motion task failed due to incompatible parameters, or motion task does not exist. This warning can appear upon an MT.MOVE command.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning. Check motion task settings and parameters to make sure that the values entered will produce a valid motion task.
n161	Homing procedure failed.	Homing error observed during the operation of homing procedure.	Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
n163	MT.NUM exceeds limit.	This warning appears with n160. This warning is triggered when you try to trigger a motion task > 128 (such as MT.MOVE 130).	Trigger only motion tasks between 0 and 128. Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
n164	Motion task is not initialized.	This warning appears with n160. This warning is triggered when you try to trigger a non-initialized motion task.	Initialize the motion task first before starting the task. Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
n165	Motion task target position is out.	This warning appears with n160. This warning is triggered when you try to trigger a motion task with an absolute target position outside of the selected modulo range (see also MT.CNTL).	Move the absolute target position of the motion task within the modulo range.Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
n168	Invalid bit combination in the motion task control word.	This warning appears with n160. This warning is triggered when you try to trigger a motion task with an invalid bit combination in the motion task control word (see also MT.CNTL).	Correct the MT.CNTL setting for the specific motion task. Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
n169	1:1 profile cannot be triggered on the fly.	This warning appears with n160. This warning is triggered when you try to trigger a 1:1 profile table motion task while another motion task is currently running.	1:1 profile table motion tasks should be started from velocity 0. Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.

Fault	Message/Warning	Cause	Remedy
n170	Customer profile table is not initialized.	This warning appears with n160. This warning is triggered when you try to trigger a motion task that uses a customer profile table for generating the velocity profile and when the selected profile table is empty (see MT.CNTL and MT.TNUM.	Change the MT.TNUM parameter for this specific motion task in order to use an initialized profile table. Activation of any new motion or using of DRV.CLRFAULTS will clear the warning.
F201	Internal RAM failed.	Hardware failure detected.	Restart drive. If issue persists, contact technical support.
F202	External RAM failed.	Hardware failure detected.	Restart drive. If issue persists, contact technical support.
F203	Code integrity failed.	Software failure detected. FPGA register access failure occurred.	Restart drive. If issue persists, contact technical support.
F245	External fault.	This fault is user generated and is caused by user settings.	Users can configure a digital input to trigger this fault (DINx.MODE = 10). The fault occurs according to this input setting. Clear the input to clear the fault.
F247	Bus voltage exceed allowed thresholds.	Hardware problem in bus measurement.	Troubleshoot and repair hardware problem.
F248	Option board EEPROM corrupted.	EEPROM failure detected.	Restart drive. If issue persists, exchange drive.
F249	Option board downstream checksum.	Communications with the I/O on the option board failed.	DRV.CLRFAULTS. If issue persists If issue persists, contact technical support.
F250	Option board upstream checksum.	Communications with the I/O on the option board failed.	DRV.CLRFAULTS. If issue persists If issue persists, contact technical support.
F251	Option board watchdog.	Communications with the I/O on the option board failed.	DRV.CLRFAULTS. If issue persists If issue persists, contact technical support.
F252	Firmware and option board FPGA types are not compatible.	The option board FPGA is not compatible with this hardware.	Download the correct firmware file for this drive.
F253	Firmware and option board FPGA versions are not compatible.	The version of the option board FPGA is not compatible with this firmware.	Download the correct firmware file for this drive.
F301 n301	Motor overheated.	Motor overheated.	Check ambient temperature. Check motor mounting heat sink capability
F302	Over speed.	Motor exceeded VL.THRESH value.	Increase VL.THRESH or lower velocity command.

Fault	Message/Warning	Cause	Remedy
F303	Runaway.	Motor did not follow command values.	Current command to the motor is too high for too long. Reduce servo gains, or reduce command trajectory aggressiveness.
F304 n304	Motor foldback.	Maximum motor power has been exceeded; the power has been limited to protect the motor	Motion is requiring too much power. Change move profile to reduce load on motor. Check for load jamming or sticking. Check that current limits are set correctly.
F305	Brake open circuit.	Motor brake open circuit. Fault threshold is 200 mA.	Check cabling and general functionality. For special low current brake applications, the F305 fault can be bypassed using the setting motor.brake = 100.
F306	Brake short circuit.	Motor brake short circuit.	Check cabling and general functionality.
F307	Brake closed during enable state.	Motor brake closed unexpectedly.	Check cabling and general functionality.
F308	Voltage exceeds motor rating.	Drive bus voltage exceeds the motor's defined voltage rating.	Make sure that the motor fits the driving rating.
F309	Motor I2t load. reduce load	Motor I2t load (IL.MI2T) has exceeded the warning threshold IL.MI2TWTHRESH. This warning can only be generated in the case that the motor protection mode IL.MIMODE has been set to 1.	Reduce the load of the drive by adjusting lower acceleration / deceleration ramps.
F312	Brake released when it should be applied.	Brake disengaged unexpectedly.	Check cabling and general functionality.
F401	Failed to set feedback type.	Feedback is not connected or wrong feedback type selected	Check primary feedback (X10 connection).
F402	Analog signal amplitude fault.	Analog signal amplitude is too low. Analog fault (resolver signal amplitude or sin/cos amplitude)	Check primary feedback (X10 connection), resolver and sine/cos encoder only.
F403	EnDat communication fault.	General communication problem with feedback.	Check primary feedback (X10 connection), EnDat only
F404	Hall error.	Hall sensor returns invalid Hall state (111, 000); either all Hall sensors are on or off. Legal Hall states are 001, 011, 010, 110, 100, and 101. This fault can be caused by a broken connection in any one of the Hall signals.	Check the feedback wiring; check all feedback connectors to ensure all pins are positioned correctly.

Fault	Message/Warning	Cause	Remedy
F405	BiSS watchdog fault.	Bad communication with the feedback device.	Check primary feedback (X10 connection), Biss only.
F406	BiSS multicycle fault.		
F407	BiSS sensor fault.		
F417	Broken wire in primary feedback.	In primary feedback, a broken wire was detected (incremental encoder signal amplitude).	Check feedback cable continuity.
F418	Primary feedback power supply.	Power supply fault for primary feedback.	Check primary feedback (X10 connection).
F419	Encoder init procedure failed	Phase find procedure did not complete successfully.	Check encoder wiring, reduce/balance motor load prior to phase finding.
F420	FB3 EnDat Communications Fault.	A communication error was detected with the EnDat 2.2 device connected to the X9 connector.	Check pinout and FB3 configuration and reconnect feedback. If problems persist, contact customer support.
F421	SFD position sensor fault	Sensor or sensor wiring failure inside motor.	Try resetting the fault. If it reappears return motor for repair.
F438 n439	Following error (numeric)	Motor did not follow command values. Motor exceeded maximum allowed position following error (numeric).	Check for increased load, jamming or sticking. Is position error set too low?
F439 n439	Following error (user).	Motor did not follow command values. Motor exceeded maximum allowed position following error (user).	Check feedback commutation setup and tuning parameters.
F450	Following error (presentation).	Motor did not follow command values. Motor exceeded maximum allowed position following error (presentation).	Check feedback commutation setup and tuning parameters.
F451 n451	Feedback battery fault.	The external battery voltage is too low. The F451 fault is generated if the AKD is not powered. The n451 warning is generated if the AKD is powered. This fault can be inhibited with FAULT451.ACTION.	Check or replace the external battery.

Fault	Message/Warning	Cause	Remedy
F453	Tamagawa communication fault (timeout).	Bad communication with the feedback device. Cabling or shielding fault, or internal feed-back failure.	Check the cabling to the drive and if the problem persists then return the feedback to the man-ufacturer for repair.
F454	Tamagawa communication fault (transfer incomplete).		
F456	Tamagawa communication fault (CRC).		
F457	Tamagawa communication fault (start timeout).		
F458	Tamagawa communication fault (UART Overrun).		
F459	Tamagawa communication fault (UART Framing).		
F460	Tamagawa encoder fault (over speed).	This fault is generated when the shaft is rotated above a maximum speed that can be maintained while the external battery is powered and the drive is powered off.	Reset the fault on the drive with DRV.CLRFAULTS.
F461	Tamagawa encoder fault (counting Error).	When the feedback is powered on the position (within one rev-olution) was incorrect because of a problem with the feedback device.	Reset the fault on the drive with DRV.CLRFAULTS, if the prob-lem persists then clean the feed-back code plate.
F462	Tamagawa encoder fault (counting overflow).	Multi-turn counter has over-flowed.	Reset the fault on the drive with DRV.CLRFAULTS.
F463	Feedback overheat fault.	The temperature of the encoder substrate exceeds overheating detection tem-perature during main power-on.	Reset the fault on the drive with DRV.CLRFAULTS after tem-perature of encoder is lowered.
F464	Tamagawa encoder fault (multi-turn error).	Any bit-jump occurs in the multi-turn signal during main power-on.	Return to the origin. Reset the fault on the drive with DRV.CLRFAULTS.
F480	Fieldbus command velocity too high.	Fieldbus command velocity exceeds VL.LIMITP.	Lower fieldbus command tra-jectory, or increase the value of VL.LIMITP.
F481	Fieldbus command velocity too low.	Fieldbus command velocity exceeds VL.LIMITN.	Increase fieldbus command tra-jectory, or decrease the value of VL.LIMITN.
F486	Motor velocity exceeds EMU-speed.	Motor velocity exceeds the maximum speed the emulated encoder output can generate.	Reduce value of DRV.EMU-EPULSEIDTH.
F493	Invalid commutation detected - motor accelerating in the wrong direction. Motor phase may be incorrect.	The velocity of the motor exceeded WS.CHECKV and the sign of the current was not equal to the sign of motor acceleration or the sign of motor velocity for a period of time larger than WS.CHECKT.	1. Check motor phase wiring 2. Re-configure wake and shake (if Mode 0 or 1 is used) 3. Re-run wake and shake to determine correct commutation angle

Fault	Message/Warning	Cause	Remedy
F501 n501	Bus over voltage.	Bus voltage too high. Usually, this problem is load related.	Reduce load or change motion profile. Check system regen capacity; add capacity if needed. Check mains voltage.
F502	Bus under voltage. Warning issued prior to fault.	Bus voltage below threshold value.	Check mains voltage.
F503 n503	Bus capacitor overload.	Single phase AC input on a drive only rated for three-phase input or excessive single-phase power load.	Check mains voltage.
F519	Regen short circuit.	Regen resistor short circuit.	Regen IGBT short circuit. Contact technical support.
F521 n521	Regen over power.	Too much power stored in regen resistor.	Either get larger regen resistor or use DC bus sharing to dissipate power.
F523	Bus over voltage FPGA	Bus over voltage hard fault.	Check mains voltage and check system brake capacity.
F524 n524	Drive foldback.	Maximum drive power has been exceeded. The power has been limited to protect the drive.	Motion requires too much power. Change profile to reduce load .
F525	Output over current.	Current exceeds drive peak.	Check for short or feedback faults.
F526	Current sensor short circuit.	Current sensor short circuit.	Restart drive. If issue persists, contact technical support.
F527	Iu current AD converter stuck.	Hardware failure detected.	Restart drive. If issue persists, contact technical support.
F528	Iv current AD converter stuck.	Hardware failure detected.	Restart drive. If issue persists, contact technical support.
F529	Iu current offset limit exceeded.	Hardware failure detected.	Restart drive. If issue persists, contact technical support.
F530	Iv current offset limit exceeded.	Hardware failure detected.	Restart drive. If issue persists, contact technical support.
F531	Power stage fault.	Hardware failure detected.	Restart drive. If issue persists, replace drive.

Fault	Message/Warning	Cause	Remedy
F532	Drive motor parameters setup incomplete.	Before a motor can be enabled, you must configure a minimum set of parameters. These parameters have not been configured.	Issue the command DRV.SETUPREQLIST to display the list of the parameters that you must configure. Configure these parameters either manually or automatically. You can manually configure these parameters in three ways: (1) set each parameter individually; (2) use the setup wizard to select the motor; or (3) select the motor type from the motor data base in the Motor window (MOTOR.AUTOSET must be set to 0 (off)). If you use the Motor window, you must first select the feedback type. If the motor has Biss Analog, Endat, or SFD feedback (feedback with memory), then these parameters are set automatically when MOTOR.AUTOSET is set to 1 (on).
F534	Failed to read motor parameters from feedback device.	Motor either does not have motor feedback memory, or the motor feedback memory is not programmed properly so the parameters cannot be read.	Try to read parameters again by clicking the **Disable** and **Clear Faults** button, or by issuing the DRV.CLRFAULTS command. If this attempt is not successful, then set MOTOR.AUTOSET to 0 (off) and program the parameters using the setup wizard or manually set up the parameters. If the motor has motor memory (Biss Analog, Endat, and SFD motors have motor memory), return the motor to have the memory programmed.
F535	Power-board over-temperature fail.	The power-board temperature sensor indicates more than 85 °C.	Reduce the load of the drive or ensure better cooling.
F601	Modbus data rate is too high.	Modbus controller data rate is too high.	Reduce data rate.
F602	Safe torque off.	Safe torque off function has been triggered.	Reapply supply voltage to STO if safe to do so.
n603	OPMODE incompatible with CMDSOURCE	This warning is generated when the drive is enabled and the gearing command source is selected at the same time as torque or velocity op-mode.	Select a different DRV.OPMODE andDRV.CMDSOURCE combination.

Fault	Message/Warning	Cause	Remedy
n604	EMUEMODE incompatible with DRV.HANDWHEELSRC.	Emulated encode mode is incompatible with the selected handwheel source.	Select a compatible emulated encode mode or change handwheel source.
F701	Fieldbus runtime.	Runtime communication fault.	Check fieldbus connections (X11), settings, and control unit.
F702 n702	Fieldbus communication lost.	All fieldbus communication was lost.	Check fieldbus connections (X11), settings, and control unit.
F703	Emergency timeout occurred while axis should disable	Motor did not stop in the timeout defined.	Change timeout value, change stop parameters, improve tuning.

15.2   Additional Error and Alarm Messages AKD PDMM-M

Faults/Errors and Warnings/Alerts are displayed in the 7 segment displays of the drive:

<table>
<tr><th>AKD PDMM two digits</th><th>AKD PDMM-M two + one digits</th></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>The two digits LED display indicates the AKD PDMM messages.
AKD PDMM fault messages are coded with "F", warnings are coded with "n" and are described in "Fault and Warning Messages" (=> p. 1)</td><td>The one digit LED indicates the PDMM messages of the AKD PDMM.
Error messages are coded with "E", alarms are coded with "A" and are described in the chapter below.</td></tr>
</table>

To simplify handling, the error and alarm handling process is consistent, so you can always apply the same recovery steps. When an error or alarm occurs, it is displayed to the one digit display, you can identify the error in the table below and follow the recommendations to fix the problem, clear the display, and resume machine operation.

Active errors and alarms can be cleared with the controller command ***ClearCtrlErrors***, (Note: non-clearable errors will remain).

When an Error or Alarm occurs, always check the controller log messages. The log messages will provide more details about the failure and the history of events leading up to the failure. From the log messages, you can determine the specifics about the cause of the failure to correct the underlying problem.

15.2.1 Errors

Error	Description	Cause	Remedy
E01	Critical temperature exceeded. PDMM operation is stopped, CPU will be put to sleep.	CPU temperature exceeded safe operating temperature limit.	Power-off. Check airflow and operating environment are within hardware specifications. Allow unit to cool before power-on.
E02	Out of memory. KAS runtime is stopping.	Memory leak, memory corrupted, or hardware memory failure.	Power-off/on. If problem is recurrent, check release notes for firmware updates or return hardware for repair.
E03	Fan failure.	CPU cooling fan was not able to operate properly.	Check temperature and monitor for High temp alarm (see A01). Return hardware for fan replacement.
E10	Firmware is corrupted.	Flash memory corrupted during firmware download or flash hardware failure.	Re-download firmware or boot into recovery mode, download. If the problem is recurrent, power-off/on. Check release notes for firmware updates. firmware, and power-off/on. If problem persists, return hardware for repair.
E11	Flash is corrupted, no filesystem is available.	At startup the filesystem could not be mounted on the flash.	Reset to factory defaults. If problem persists, return hardware for repair.

Error	Description	Cause	Remedy
E12	Not enough flash memory available.	Flash memory is full, unable to write to flash.	Clean-up the flash memory by removing log files, application programs, recipes, or other data files.
E13	Out of NVRAM space for retained variables.	NVRAM is full.	Change application to reduce the amount of retained variables.
E14	Reset to Factory Defaults failed.	Flash memory could not be formatted during a Reset to Factory Defaults procedure.	Try reset to factory defaults again from power-on. If problem persists, return hardware for repair.
E15	Cannot read/write files from/to a SD card.	SD card is not plugged-in or the filesystem is corrupt and cannot be mounted.	Insert a valid SD card or re-format the SD card using Settings->SD card->Format button.
E16	Not enough space available on the SD card.	SD card is full, unable to write to the SD card.	Clean-up SD card space by deleting files or re-format the card using Settings->SD card->Format button.
E20	Runtime plug-in, process, thread or application failed to start.	KAS runtime or application code failed to auto-start at boot.	Power-off/on. Reset to factory defaults. If problem is recurrent, check release notes for firmware updates or download firmware.
E21	Runtime plug-in, process, or thread failed to respond during operation.	KAS runtime code failed during normal operation.	Power-off/on. If problem is recurrent, check release notes for firmware updates.
E22	Fatal error in PLC program, application stopped.	Virtual machine failed to execute an instruction.	Re-compile application, download, and re-start.
E23	CPU is overloaded.	Either the motion engine cycle did not complete or the PLC program did not complete within the timeout period due to excessive CPU loading.	Stop the application or power-off/on. Reduce the sample rate, simplify the application, or reduce the application cycles and re-start the application.
E24	PLC application cannot be started	1. Maintenance operation is in progress. 2. Controller is in online config mode. 3. AKD PDMM Restore failed. 4. The IDE version of the compiled PLC code and controller runtime version do not match.	1. Check controller web-server home page for any maintenance operation in-progress. Wait for the operation to finish. 2. Connect to the controller with the IDE and disable online config mode. 3. Check EtherCAT network topology by using the Scan network button in the web-server's Restore tab. Correct the physical topology and re-execute an AKD PDMMrestore. 4. IDE version (only major.minor.micro) should match with runtime version. To correct, install the correct version of IDE or Runtime.

Error	Description	Cause	Remedy
E30	EtherCAT communication failure during operational mode.	EtherCAT network operation failed due to a network communciation error.	Check the EtherCAT network wiring and devices state. Re-start the application.
E31	EtherCAT communication failure during preop mode.	EtherCAT network operation failed due to a network communciation error.	Check the EtherCAT network wiring and devices state. Re-start the application.
E32	EtherCAT communication failure during bootstrap mode.	EtherCAT network operation failed due to a network communciation error.	Check the EtherCAT network wiring and devices state. Re-start the application.
E33	EtherCAT failed to initialize into operational mode.	EtherCAT network initialization failed due to a network communciation error.	Check the EtherCAT network wiring and devices state. Re-start the application.
E34	EtherCAT failed to initialize into preop mode.	EtherCAT network initialization failed due to a network communciation error.	Check the EtherCAT network wiring and devices state. Re-start the application.
E35	EtherCAT failed to initialize into bootstrap mode.	EtherCAT network initialization failed due to a network communciation error.	Check the EtherCAT network wiring and devices state. Re-start the application.
E36	EtherCAT failed to discover the expected devices.	EtherCAT network discovery failed due to a mismatch between the discovered and expected devices.	Check the EtherCAT devices and wiring order. Correct the device order wiring or re-scan the network, re-compile, and download the updated application. Re-start the application.
E37	EtherCAT failed to return to init state.	EtherCAT network initialization failed due to a network communciation error.	Check the EtherCAT network wiring and devices state. Re-start the application.
E50	Backup to SD card failed.	An unrecoverable error occurred during the backup operation.	Repeat the backup to SD card operation. If it fails again, replace the SD card.
E51	Restore from SD card failed..	An unrecoverable error occurred during the restore operation.	Do NOT reboot the PDMM! Repeat the restore operation. If it fails again, reset the PDMM to factory defaults. If problem persists, return hardware for repair.
E52	SD Backup files are missing or corrupt.	The restore operation failed due to missing, incomplete, or corrupt files on the SD card.	Perform a backup operation before the restore or use an SD card with valid backup files.
E53	AKD PDMM restore operation failed.	The restore operation failed due to improper or incomplete AKD PDMM configuration.	Check EtherCAT network topology by using the Scan network button in the web-server's Restore tab. Correct the physical topology and re-execute an AKD PDMM restore.

15.2.2 Alarms

Alarm	Description	Cause	Remedy
A01	High temperature exceeded	CPU temperature near the safe operating temperature limit.	Check airflow and operating environment are within hardware specifications.

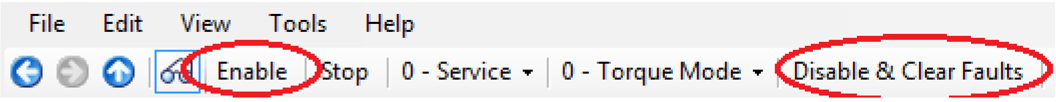
Alarm	Description	Cause	Remedy
A02	Low on memory.	Memory leak or corruption.	Power-off/on. If problem is recurrent, check release notes for firmware updates or return hardware for repair.
A04	Low input voltage	+24 volt input power is +19 volts or less.	Check power supply voltage and connection to the PDMM.
A12	Flash memory is low on free space.	Flash memory is almost full.	Clean-up the flash memory by removing log files, application programs, recipes, or other data files. Reset to factory defaults.
A21	Recoverable process or thread failed to respond during operation.	KAS non-runtime code failed during normal operation and was automatically restarted.	If problem is recurrent, power-off/on. Check release notes for firmware updates.
A23	CPU is overloaded		Reduce the sample rate, simplify the application, or reduce the application cycles.
A30	EtherCAT missed a send frame during operation mode.	EtherCAT master was unable to send a frame for one or more cycles.	Reduce the controller CPU load.
A38	EtherCAT missed a receive frame during operation mode.	EtherCAT master did not receive a frame for one or more cycles.	Check the EtherCAT network wiring and devices.
A40	Local digital IO missed a cyclic update	Local digital IO was not updated during a cycle or the updates are no longer synchronous.	Reduce the sample rate, simplify the application, or reduce the application cycles.

15.3 Clearing Faults

You can clear drive faults in three ways: 1. using the EWV[1] toolbar; 2. using the EWV Faults screen, 3. using an external digital signal. Clearing the fault automatically disables the drive (by issuing the DRV.DIS command). After the fault is cleared, you must then enable the drive again (by issuing the DRV.EN command). Using external digital signal, clearing the fault does not automatically disable the drive. Once the fault is cleared, the drive will immediately become enabled again when no fault conditions exist.

The external digital signal method is useful when the application does not require a field bus, therefore the controller cannot issue fieldbus commands (for example, DRV.EN). The fault clearing function is simpler in this case. The controller can clear a fault condition with a single output and no fieldbus command is required. The hardware enable input is still utilized for safety. Many machines are set to disable when a fault occurs, therefore, the enable circuit is connected only after the fault clear circuit is toggled.

1. Using the EWV toolbar. Click the **Clear Fault** button to clear the fault, then click the **Enable** button to enable the drive again.



2. Using an ASCII command. In EWV terminal screen, enter DRV.CLRFAULTS, then enter DRV.EN to enable the drive.
3. Using an external digital signal. First, provide a disable command to the drive, since this command is not automatically issued when the fault is cleared using an external digital signal. You must provide this disable command after the drive has disabled itself and before the clear fault command is issued in order for the clear fault command to be accepted.

Digital input mode 1 clears a fault condition. In the EWV terminal screen, enter DINx.MODE 1, with x set to the corresponding digital input number. See the Installation Manual (1 Digital Inputs (X7/X8) for digital input numbers and corresponding pin connections.

Example:

DIN2.MODE 1 sets digital input 2 (pin 9 on connector X7) to perform the clear fault function. Any free digital input shown in Table x can be set to mode 1 (Reset faults).

15.4 Parameter and Command Error Messages

Error Message	Meaning	Remedy	Occurrence
Error: Parameter or command was not found.	Parameter or command string was not recognized as a known command.	Check the entered string for accuracy. Consult the reference guide or enter DRV.LIST in the EWV[2] terminal screen to find valid parameters and commands.	General.
Error: Not a trigger parameter.	Parameter cannot be used for triggering the scope.	Use a different parameter as a trigger value.	Recorder parameters.
Error: Parameter not recordable.	Parameter cannot be scoped.	Do not scope this parameter.	Recorder parameters.

[1]Embedded Workbench Views
[2]Embedded Workbench Views

Error Message	Meaning	Remedy	Occurrence
Error: Wrong argument for parameter or command.	Argument was not accepted.	Check the entered argument for accuracy. Consult the reference guide or enter DRV.LIST in the EWV terminal screen to find valid parameter and command arguments.	General.
Error: No arguments allowed for parameter or command.	Parameter or command supports no arguments.	Enter parameter or command again with no arguments.	Commands and read-only parameters
Error: Too many arguments for parameter or command.	Too many arguments provided for this parameter or command.	Enter again with fewer arguments.	All parameters and commands with no or one argument.
Error: No float allowed.	Float number was entered, but only integer numbers are allowed.	Enter integer value instead.	All parameters and commands with integer arguments.
Error: Parameter or command is read-only.	Argument was not accepted because the parameter or command is read-only.	Enter again with no arguments.	Commands and all read-only parameters.
Error: Parameter is temporarily write protected.	Argument was not accepted because the parameter is currently read-only.	Check reference guide or KAS IDE help to determine if the parameter is read-only, read-write, or nonvolatile.	Some parameters that come from the Smart Feedback Device (SFD).
Error: Argument greater than maximum value.	Entered argument was beyond maximum value.	Enter a value that is within the allowable range. See reference guide or KAS IDE help for ranges.	Commands and read-write parameters.
Error: Too many characters in parameter or command.	Parameter or command string was too long.	Shorten string and enter again.	General.
Error: Argument less than minimum value.	Entered argument was too small.	Enter value that is within the limits.	Commands and read-write parameters.
Error: Argument is out of data range.	Entered argument was not withing the data range limits.	Enter value that is within the limits.	Commands and read-write parameters.
Error: Parameter or command is password protected.	Use of this parameter or command requires a password.	Contact technical support to obtain password. Enter valid password.	Password protected parameters and commands.
Error: Wrong operation mode for parameter or command.	Requested parameter or command cannot be performed in this operation mode.	Change to valid operation mode.	
Error: Drive enabled. Disable drive and continue.	Action can only be performed if drive is disabled.	Disable drive and repeat action.	

Error Message	Meaning	Remedy	Occurrence
Error: Drive disabled. Enable drive and continue.	Action can only be performed if drive is enabled.	Enable drive and repeat action.	
Error: Data value is invalid.	Entered data was not valid.	Provide valid data.	
Error: Argument must be an even number.	Argument is not an even number.	Enter a value divisible by two without remainder.	
Error: Argument must be an odd number.	Argument must be an odd number.	Enter a value not divisible by two with remainder.	
Error: Axis is not homed.	Axis is not homed.	Home axis and repeat action.	
Error: All recorder channels empty.	No data is specified to record.	Specify the data to be recorded and start again.	Recorder commands.
Error: Process already active.	Required action is already running.	Wait until action is finished and start again if needed.	
Error: Motor is currently in motion.	Action can only be performed if motor is not moving.	Stop motion and repeat action.	Motion tasks, service motion, and others.
Error: EEPROM is bad or does not exist.	EEPROM is damaged.	Restart drive. If fault persists, replace the drive and consult technical support.	
Error: Unknown board.			
Error: Fault exists.Correct fault condition and then clear faults.	A fault is present in the system.	Clear the fault, disable the drive, and then enable the drive again.	
Error: Cannot clear faults. Issue software or hardware disable first.		Clear hardware or software enable and repeat action.	
Error: EEPROM is busy.			
Error: Invalid motor/feedback poles ratio.			
Error: Unknown Fault.	Situation should not happen.	Clear fault. If fault recurs, consult technical support.	Unknown.
Error: Invalid motor/feedback poles ratio.			
Error: Invalid motion task parameter.			
Error: Invalid motion task number.			
Error: Invalid motion task velocity.			

Error Message	Meaning	Remedy	Occurrence
Error: Invalid motion task acceleration or deceleration.			
Error: Invalid motion task customer profile table number.			
Error: Invalid motion task following number.			
Error: Function not available for the active command source.			
Error: Invalid Bode plot mode for this function.			
Error: Invalid sine-sweep Bode plot mode.			
Error: Bode plot start frequency greater than or equal to end frequency.			
Error: Function not available while a controlled stop is in process.			
Error: Not enough memory available.			
Error: Function not available while a Bode-plot measurement is active.			
Error: Iu/Iv offset calculation not finished.			
Error: Buffer overflow.			
Error: Cannot save to EEPROM while inrush relay is closed.			
Error: Test mode is off.			
Error: Cannot change digital input mode. Issue software or hardware disable first.			

Error Message	Meaning	Remedy	Occurrence
Error: Internal drive procedure active: controlled stop, burn-in, phase find, or zero.			
Error: General motion fault.			

15.5 Unknown Fault

This fault message occurs when an undefined fault condition is encountered.

15.5.1 Remedies

1. Click **Clear Fault**.

16 Troubleshooting the AKD PDMM

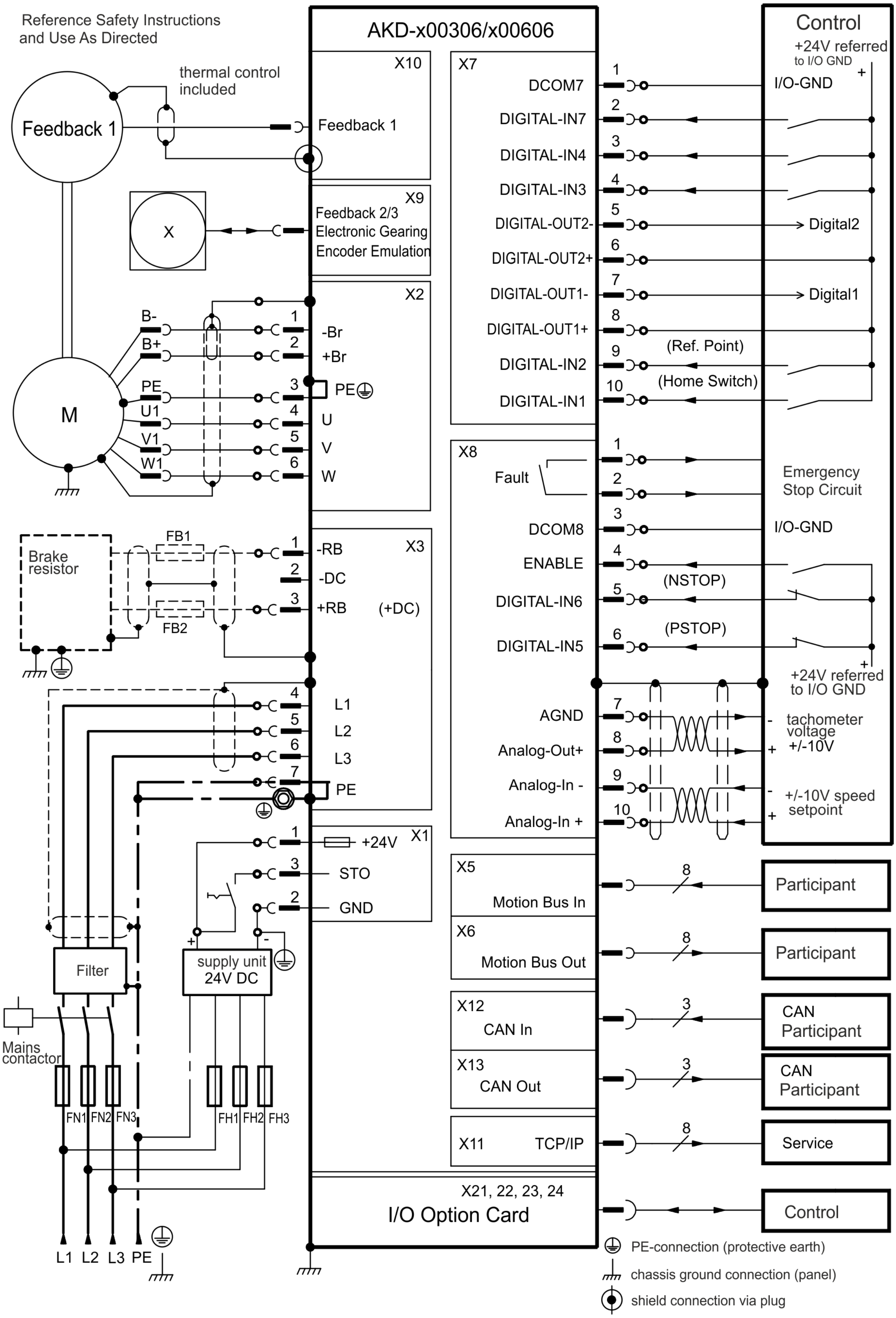
Drive problems occur for a variety of reasons, depending on the conditions in your installation. The causes of faults in multi-axis systems can be especially complex. If you cannot resolve a fault or other issue using the troubleshooting guidance presented below, customer support can give you further assistance.

Problem	Possible Causes	Remedy
HMI message: Communication fault	• wrong cable used, cable plugged into wrong position on drive or PC • wrong PC interface selected	• plug cable into the correct sockets on the drive and PC • select correct interface
Motor does not rotate	• drive not enabled • software enable not set • break in setpoint cable • motor phases swapped • brake not released • drive is mechanically blocked • motor pole no. set incorrectly • feedback set up incorrectly	• apply ENABLE signal • set software enable • check setpoint cable • correct motor phase sequence • check brake control • check mechanism • set motor pole no. • set up feedback correctly
Motor oscillates	• gain is too high (speed controller) • feedback cable shielding broken • AGND not wired up	• reduce VL.KP (speed controller) • replace feedback cable • join AGND to CNC-GND
Drive reports following error	• Irms or Ipeak set too low • current or velocity limits apply • accel/decel ramp is too long	• verify motor/drive sizing • verify that IL.LIMITN/P,VL.LI-MITN/P are not limiting the drive • reduce DRV.ACC/DRV.DEC
Motor overheating	• motor operating above its rating • motor current settings incorrect	• verify motor/drive sizing • verify motor continuous and peak current values are set correctly
Drive too soft	• Kp (speed controller) too low • Ki (speed controller) too low • filters set too high	• increase VL.KP (speed controller) • increase VL.KI (speed controller) • refer to documentation regarding reducing filtering (VL.AR*)
Drive runs roughly	• Kp (speed controller) too high • Ki (speed controller) too high • filters set too low	• reduce VL.KP (speed controller) • reduce VL.KI (speed controller) • refer to documentation regarding increasing filtering (VL.AR*)
During the installation, a dialog box saying “Please wait while the installer finishes determining your disk space requirements” appears and never disappears.	• MSI installer issue. • Harddisk space not sufficient	• Cancel the installation. Relaunch the installer (you may need to try several times, the problem is random). • Make sure that you have enough disk space on your hard disk (~500MB to allow Windows .NET update if necessary), if not make some space.

17 Connection Diagrams

17.1 Connection Diagram AKD PDMM-x00306, AKD PDMM-x00606

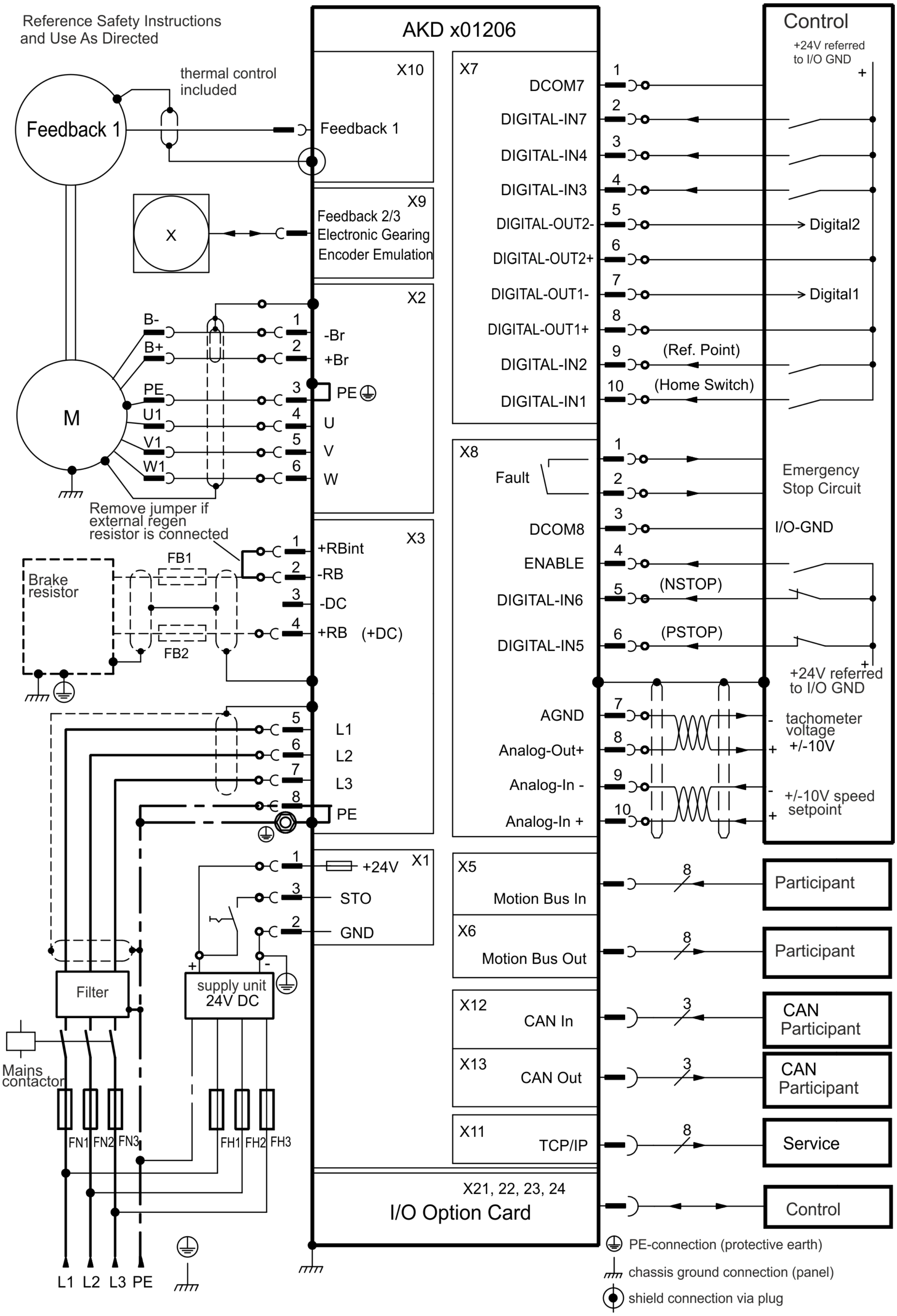
17.2 Wiring Diagram 3 to 6A (230V)



The I/O option is available for AKD-T drives only.

17.3 Connection Diagram AKD PDMM-x01206

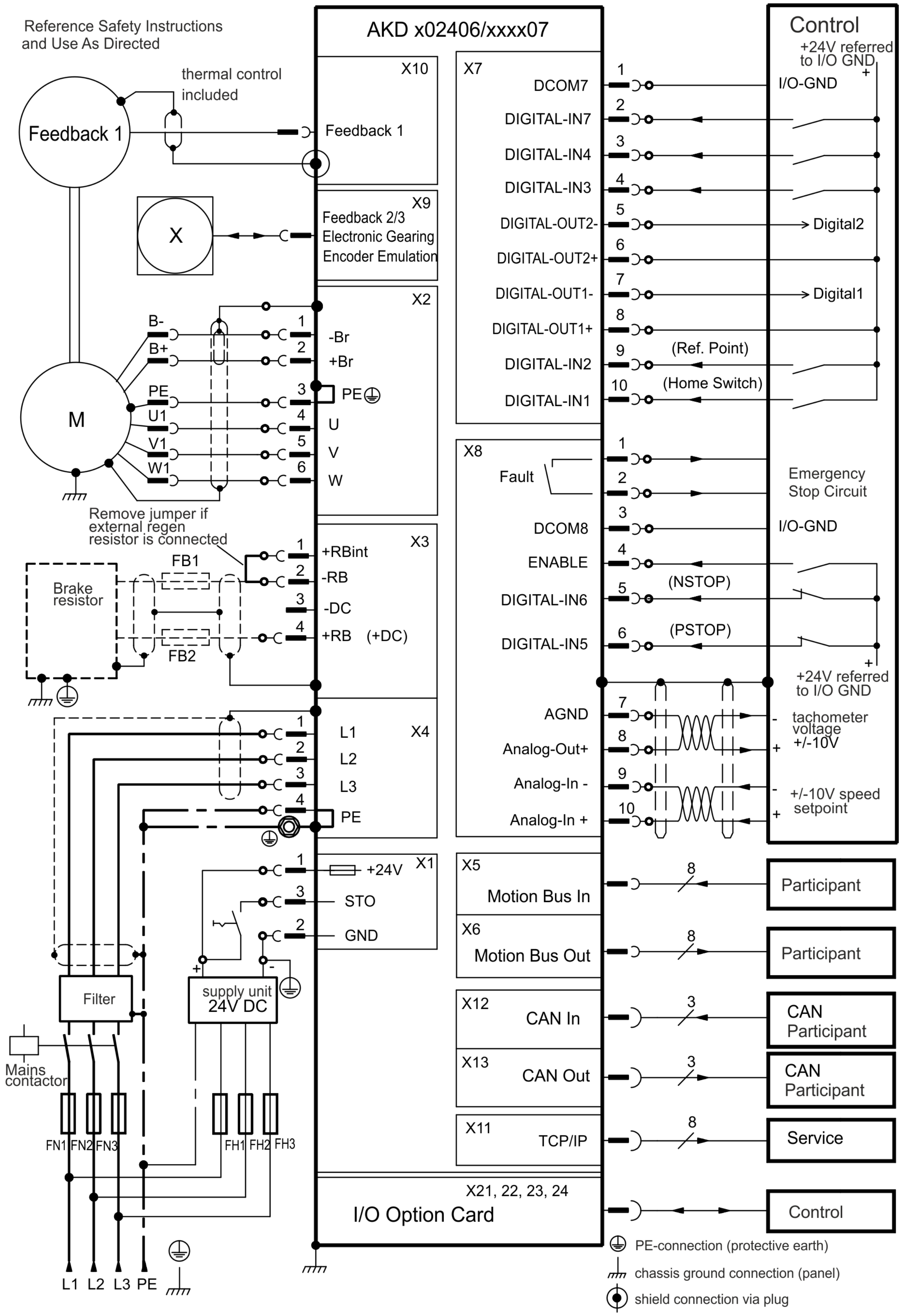
17.4 Wiring Diagram 12A (230V)



The I/O option is available for AKD-T drives only.

17.5 Connection Diagram AKD PDMM-x02406 and AKD PDMM-xzzz07

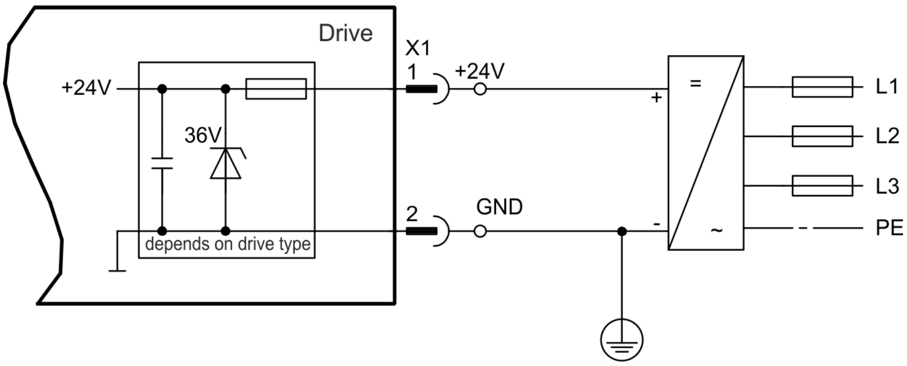
17.6 Wiring Diagram 24A (230V) and 3 to 24 A (480V)

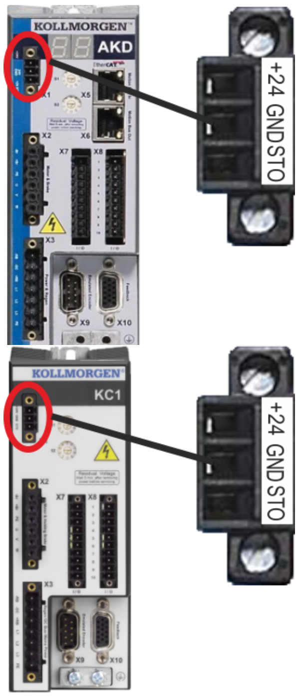


The I/O option is available for AKD-T drives only.

17.7   24 V Auxiliary Supply (X1)

The following diagram describes external 24 Vdc power supply, electrically isolated, for example, via an isolating transformer. The required current rating depends on the use of motor brake and option card   ).





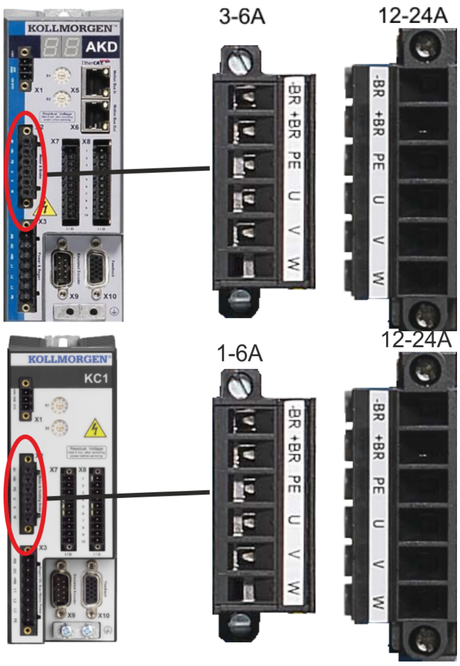
Pin	Signal	Description
1	+24	+24 Vdc Auxiliary voltage
2	GND	24V Supply GND
3	STO	STO enable (Safe Torque Off)

17.8 Motor Connection

Together with the motor supply cable and motor winding, the power output of the drive forms an oscillating circuit. Characteristics such as cable capacity, cable length, motor inductance, and frequency determine the maximum voltage in the system.

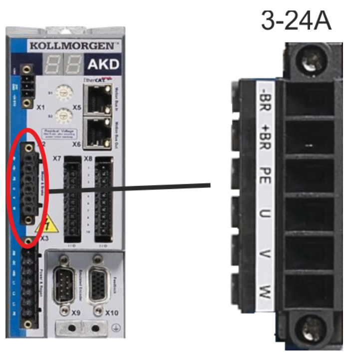
NOTICE	**The dynamic voltage rise can lead to a reduction in the motor operating life and, on unsuitable motors, to flashovers in the motor winding.** • **Only install motors with insulation class F (acc. to IEC60085) or above.** • **Only install cables that meet the requirements .**

Connector X2 AKD PDMM-xzzz06



Pin	Signal	Description
1	-BR	Motor holding brake, negative
2	+BR	Motor holding brake, positive
3	PE	Protective earth (motor housing)
4	U	Motor phase U
5	V	Motor phase V
6	W	Motor phase W

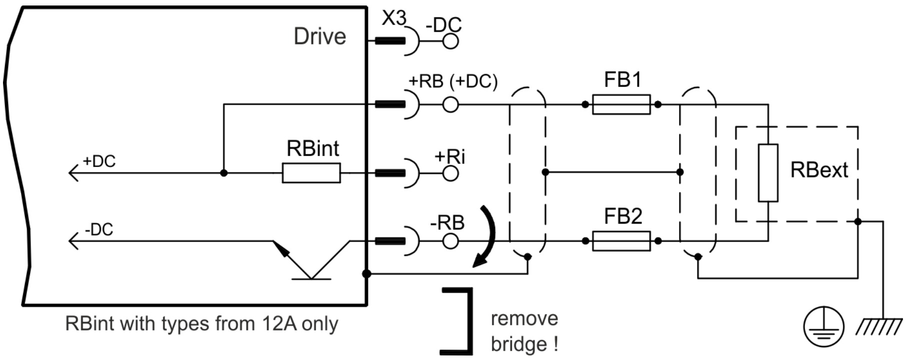
Connector X2 AKD PDMM-xzzz07

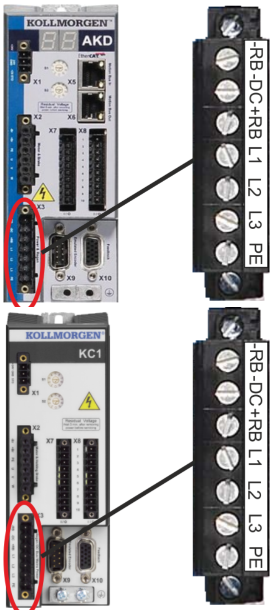


Pin	Signal	Description
1	-BR	Motor holding brake, negative
2	+BR	Motor holding brake, positive
3	PE	Protective earth (motor housing)
4	U	Motor phase U
5	V	Motor phase V
6	W	Motor phase W

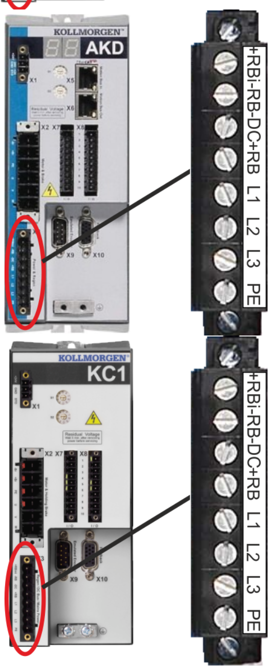
17.9 External Regen Resistor (X3)

For technical data on the brake circuit . Fusing (such as fusible cut-outs) to be provided by the user .

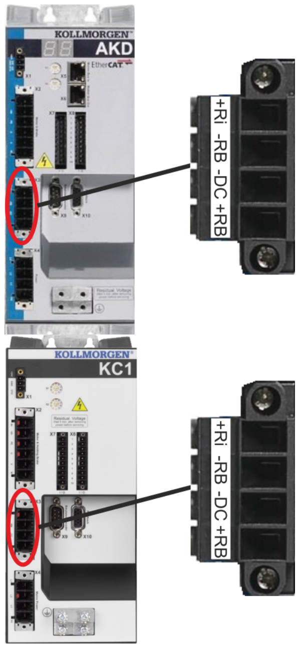




AKD PDMM-x00106x00306 to AKD PDMM-x00606 (X3)		
Pin	Signal	Description
1	-RB	External Regen Resistor negative
3	+RB	External Regen Resistor positive



AKD PDMM-x01206 (X3)		
Pin	Signal	Description
1	+Rbint	Internal RegenResistor positive
2	-RB	External RegenResistor negative
4	+RB	External RegenResistor positive

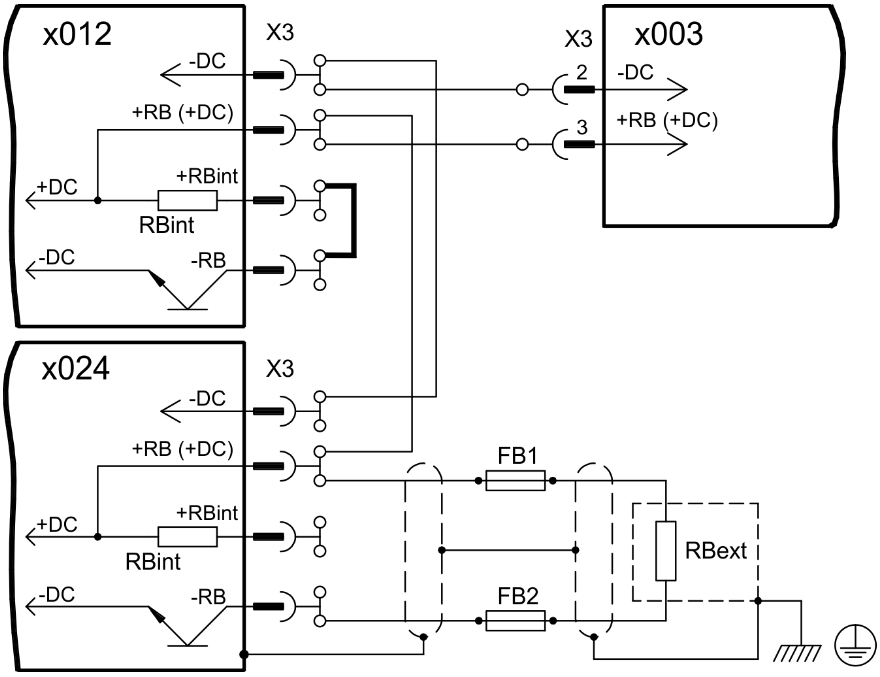


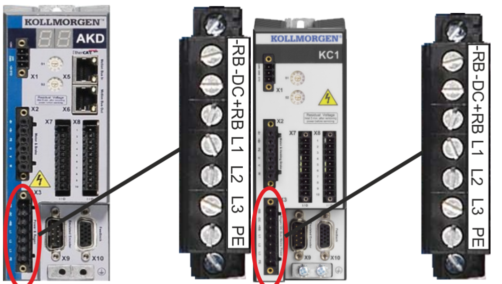
AKD PDMM-x02406 & AKD PDMM-xzzz07 (X3)		
Pin	Signal	Description
2	-RB	External RegenResistor negative
4	+RB	External RegenResistor positive

17.10 DC Bus Link (X3)

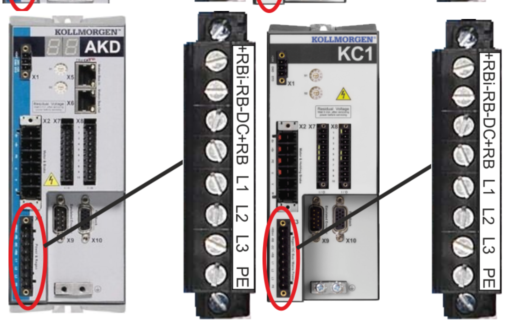
The DC bus link can be connected in parallel so that the regen power is divided between all the drives that are connected to the same DC bus link circuit.
Every drive must have it's own power connection to mains voltage, even if the DC bus link is used.

NOTICE	**The drive can be destroyed if DC bus link voltages are different. Only drives with mains supply from the same mains (identical mains phases and voltage) may be connected by the DC bus link. Use unshielded single cores with a maximum length of 200 mm. Use shielded cables for longer lengths.**

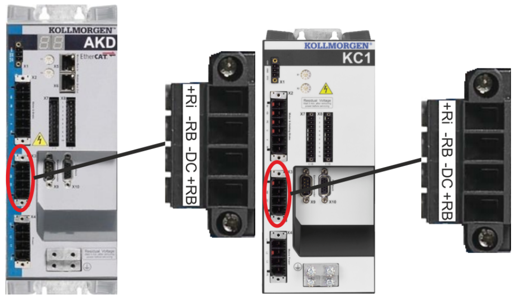




AKD PDMM-x00106x00306 to AKD PDMM-x00606 (X3)		
Pin	Signal	Description
2	-DC	DC-Link Bus negative
3	+DC (+RB)	DC-Link Bus positive



AKD PDMM-x01206 (X3)		
Pin	Signal	Description
3	-DC	DC-Link Bus negative
4	+DC (+RB)	DC-Link Bus positive

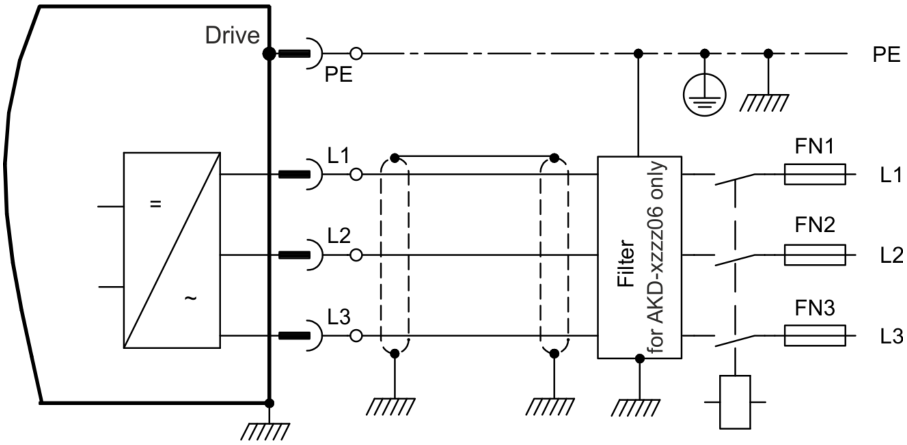


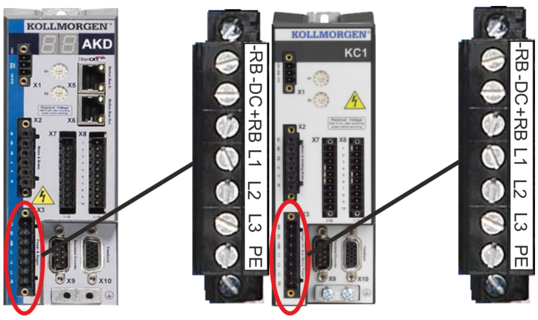
AKD PDMM-x02406 & AKD PDMM-xzzz07 (X3)		
Pin	Signal	Description
3	-DC	DC-Link Bus negative
4	+DC (+RB)	DC-Link Bus positive

17.11 Mains Supply Connection (X3, X4)

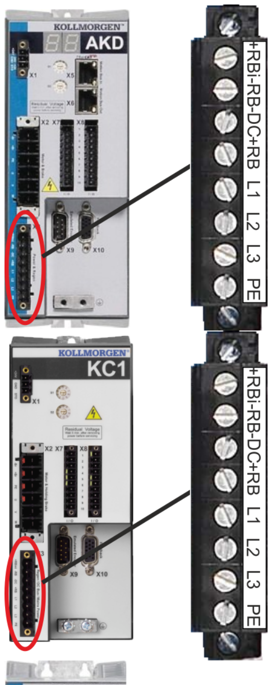
17.11.1 Three Phase connection (all AKD PDMM types)

- Directly to 3-phase supply network, supply networks => p. 1
- Filtering for AKD PDMM-xzzz06 to be provided by the user.
- Fusing (such as fusible cut-outs) to be provided by the user .

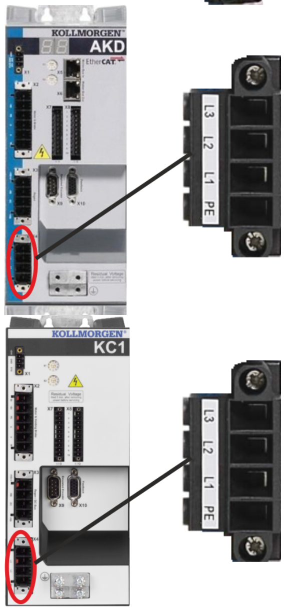




AKD PDMM-x00106x00306 to AKD PDMM-x00606 (X3)		
Pin	Signal	Description
4	L1	Line 1
5	L2	Line 2
6	L3	Line 3
7	PE	Protective Earth



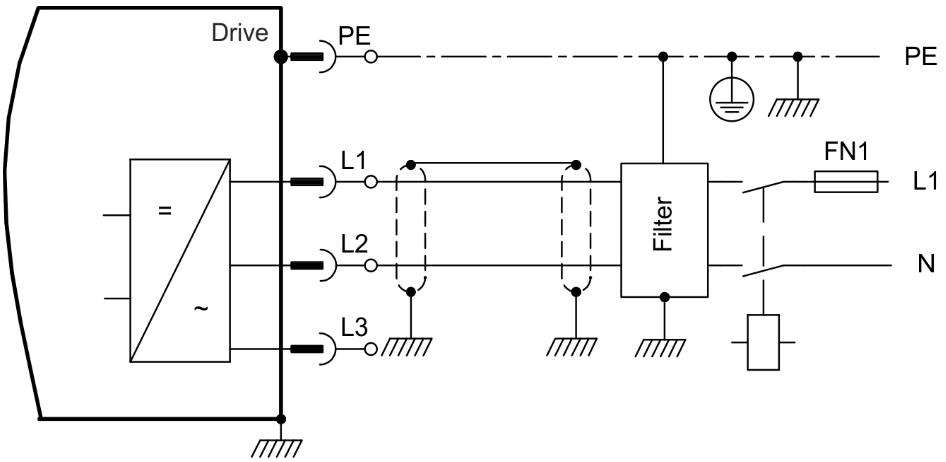
AKD PDMM-x01206 (X3)		
Pin	Signal	Description
5	L1	Line 1
6	L2	Line 2
7	L3	Line 3
8	PE	Protective Earth

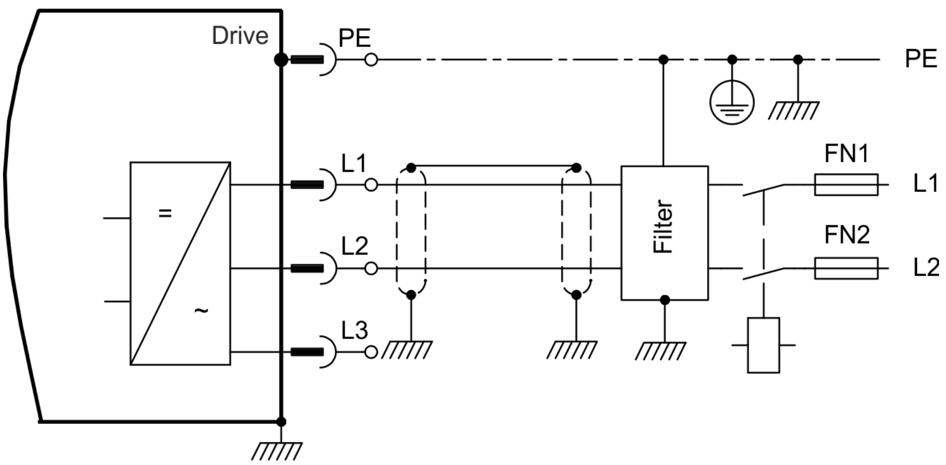


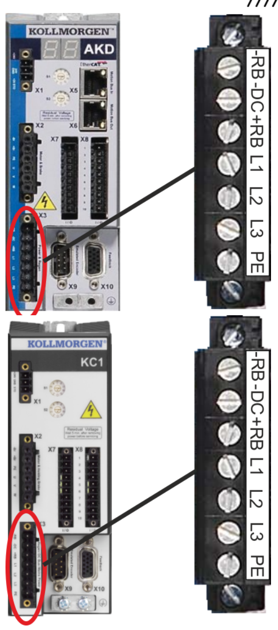
AKD PDMM-x02406 & AKD PDMM-xzzz07 (X4)		
Pin	Signal	Description
1	L1	Line 1
2	L2	Line 2
3	L3	Line 3
4	PE	Protective Earth

17.11.2 Single phase connection (AKD PDMM-x00106x00306 to AKD PDMM-x01206 only)

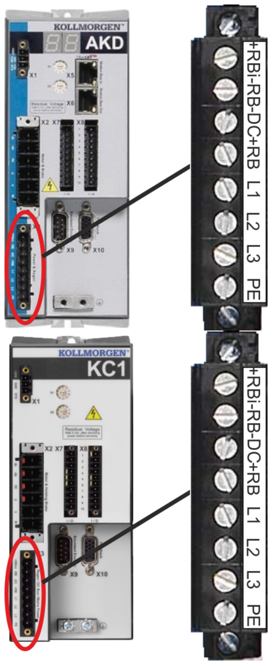
- Directly to single-phase supply network (120 V$_{-10\%}$ to 240 V$^{+10\%}$) with neutral line or Directly to two-phase supply network (120 V$_{-10\%}$ to 240 V$^{+10\%}$) without neutral line
- Supply networks
- Leave L3 open circuit
- Filtering to be provided by the user.
- Fusing (such as fusible cut-outs) to be provided by the user







AKD PDMM-x00106x00306 to AKD PDMM-x00606 (X3)		
Pin	Signal	Description
4	L1	Line 1
5	L2 (N)	Neutral or Line 2
7	PE	Protective Earth



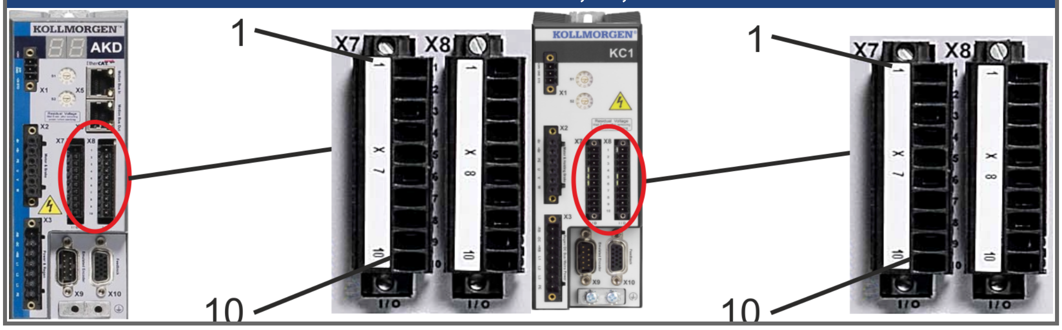
AKD PDMM-x01206 (X3)		
Pin	Signal	Description
5	L1	Line 1
6	L2 (N)	Neutral or Line 2
8	PE	Protective Earth

17.12 I/O Connection

17.12.1 I/O Connectors X7 and X8 (all AKD PDMM variants)

Standard digital and analog I/O signals are connected to X7 and X8.

AKD PDMM-B, -P, -T



Conn.	Pin	Signal	Abbreviation	Function	Wiring Diagram
X7	1	Digital Common X7	DCOM7	Common line for X7 pins 2, 3, 4, 9, 10	=> S. 1
X7	2	Digital Input 7	DIGITAL-IN 7	Programmable	
X7	3	Digital Input 4	DIGITAL-IN 4	Programmable	
X7	4	Digital Input 3	DIGITAL-IN 3	Programmable	
X7	5	Digital Output 2-	DIGITAL-OUT2-	Programmable	=> S. 1
X7	6	Digital Output 2+	DIGITAL-OUT2+	Programmable	
X7	7	Digital Output 1-	DIGITAL-OUT1-	Programmable	
X7	8	Digital Output 1+	DIGITAL-OUT1+	Programmable	
X7	9	Digital Input 2	DIGITAL-IN 2	Programmable, high speed	=> S. 1
X7	10	Digital Input 1	DIGITAL-IN 1	Programmable, high speed	

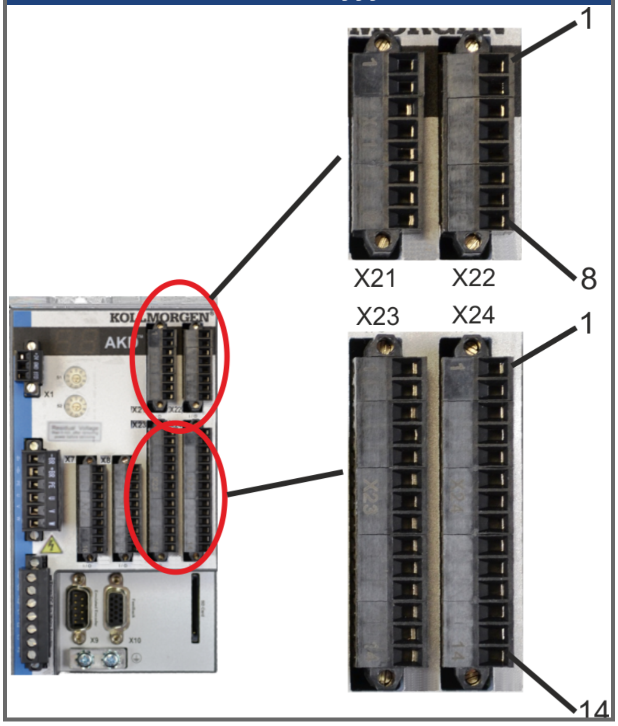
Conn.	Pin	Signal	Abbreviation	Function	Wiring Diagram
X8	1	Fault Relay Output	Fault Relay Output	Fault Relay Output	=> p. 1
X8	2	Fault Relay Output	Fault Relay Output	Fault Relay Output	
X8	3	Digital Common X8	DCOM8	Common line for X8 pins 4, 5, 6	=> S. 1
X8	4	Digital Input 8	DIGITAL-IN 8	Output stage enable, not programmable	
X8	5	Digital Input 6	DIGITAL-IN 6	Programmable	
X8	6	Digital Input 5	DIGITAL-IN 5	Programmable	
X8	7	Analog Ground	AGND	Analog GND	=> p. 178
X8	8	Analog Output +	Analog-Out	Actual velocity voltage	
X8	9	Analog Input -	Analog-In-	Velocity set point	=> p. 179
X8	10	Analog Input +	Analog-In+		

Digital common lines for X7 and X8 are not common to each other.
The DCOMx line should be connected to the 0V of the I/O supply when using sensors of type "Source" with digital inputs.
The DCOMx line should be connected to the 24V of the I/O supply when using sensors of type "Sink" with digital inputs.

17.12.2 I/O Connectors X21, X22, X23 and X24 (AKD-T with I/O option card only)

The I/O option card offers four additional connectors X21, X22, X23, X24 for I/O signals.

AKD PDMM-xyyyzz-IC



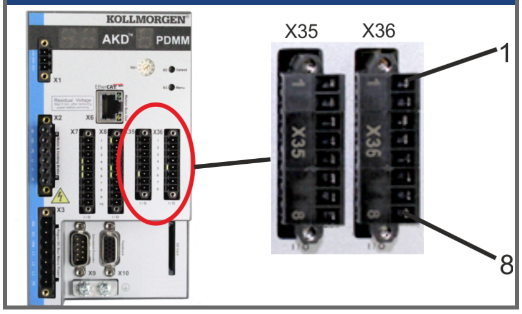
Conn.	Pin	Signal	Abbreviation	Function	Wiring Diagram
X21	1	Digital Input 21	DIGITAL-IN 21	Programmable	
X21	2	Digital Input 22	DIGITAL-IN 22	Programmable	
X21	3	Digital Input 23	DIGITAL-IN 23	Programmable	
X21	4	Digital Common X21/1_3	DCOM21.1_3	Common line for X21 pins 1, 2, 3	
X21	5	Digital Input 24	DIGITAL-IN 24	Programmable	=> p. 1
X21	6	Digital Input 25	DIGITAL-IN 25	Programmable	
X21	7	Digital Input 26	DIGITAL-IN 26	Programmable	
X21	8	Digital Common X21/5_7	DCOM21.5_7	Common line for X21 pins 5, 6, 7	
X22	1	Digital Input 27	DIGITAL-IN 27	Programmable	
X22	2	Digital Input 28	DIGITAL-IN 28	Programmable	
X22	3	Digital Input 29	DIGITAL-IN 29	Programmable	
X22	4	Digital Common X22/1_3	DCOM22.1_3	Common line for X22 pins 1, 2, 3	
X22	5	Digital Input 30	DIGITAL-IN 30	Programmable	=> p. 1
X22	6	Digital Input 31	DIGITAL-IN 31	Programmable	
X22	7	Digital Input 32	DIGITAL-IN 32	Programmable	
X22	8	Digital Common X22/5_7	DCOM22.5_7	Common line for X22 pins 5, 6, 7	

Conn.	Pin	Signal	Abbreviation	Function	Wiring Diagram
X23	1	Analog Output 2 +	Analog-Out2	Programmable	=> p. 178
X23	2	reserved	n.c.	n.c.	
X23	3	Analog Ground	AGND	Programmable	
X23	4	reserved	n.c.	n.c.	
X23	5	Digital Output 21+	DIGITAL-OUT 21+	Programmable	=> S. 1
X23	6	Digital Output 21-	DIGITAL-OUT 21-	Programmable	
X23	7	Digital Output 22+	DIGITAL-OUT 22+	Programmable	
X23	8	Digital Output 22-	DIGITAL-OUT 22-	Programmable	
X23	9	Digital Output 23+	DIGITAL-OUT 23+	Programmable	
X23	10	Digital Output 23-	DIGITAL-OUT 23-	Programmable	
X23	11	Digital Output 24+	DIGITAL-OUT 24+	Programmable	
X23	12	Digital Output 24-	DIGITAL-OUT 24-	Programmable	
X23	13	Relay Output 25	DIGITAL-OUT 25	Programmable, relay	=> S. 1
X23	14	Relay Output 25	DIGITAL-OUT 25	Programmable, relay	
X24	1	Analog Input 2+	Analog-In2+	Programmable	=> p. 179
X24	2	Analog Input 2-	Analog-In2-	Programmable	
X24	3	Analog Ground	AGND	Programmable	
X24	4	reserved	n.c.	n.c.	
X24	5	Digital Output 26+	DIGITAL-OUT 26+	Programmable	=> S. 1
X24	6	Digital Output 26-	DIGITAL-OUT 26-	Programmable	
X24	7	Digital Output 27+	DIGITAL-OUT 27+	Programmable	
X24	8	Digital Output 27-	DIGITAL-OUT 27-	Programmable	
X24	9	Digital Output 28+	DIGITAL-OUT 28+	Programmable	
X24	10	Digital Output 28-	DIGITAL-OUT 28-	Programmable	
X24	11	Digital Output 29+	DIGITAL-OUT 29+	Programmable	
X24	12	Digital Output 29-	DIGITAL-OUT 29-	Programmable	
X24	13	Relay Output 30	DIGITAL-OUT 30	Programmable, relay	=> S. 1
X24	14	Relay Output 30	DIGITAL-OUT 30	Programmable, relay	

17.12.3 I/O Connectors X35 and X36 (AKD PDMM-M only)

AKD PDMM offers two additional connectors X35 and X36 for digital I/O signals.

AKD PDMM-M



Conn.	Pin	Signal	Abbreviation	Function	Wiring Diagram
X35	1	Digital Common X35	DCOM35	Common line for X35 pins 2, 3, 4	=> S. 1
X35	2	Digital Input 21	DIGITAL-IN 21	Programmable	
X35	3	Digital Input 22	DIGITAL-IN 22	Programmable	
X35	4	Digital Input 23	DIGITAL-IN 23	Programmable	
X35	5	n.c.	n.c.	-	-
X35	6	n.c.	n.c.	-	-
X35	7	Digital Output 21-	DIGITAL-OUT21-	Programmable	=> S. 1
X35	8	Digital Output 21+	DIGITAL-OUT21+	Programmable	
X36	1	Digital Common X36	DCOM36	Common line for X36 pins 2, 3, 4	=> S. 1
X36	2	Digital Input 24	DIGITAL-IN 24	Programmable	
X36	3	Digital Input 25	DIGITAL-IN 25	Programmable	
X36	4	Digital Input 26	DIGITAL-IN 26	Programmable	
X36	5	n.c.	n.c.	-	-
X36	6	n.c.	n.c.	-	-
X36	7	Digital Output 22-	DIGITAL-OUT22-	Programmable	=> S. 1
X36	8	Digital Output 22+	DIGITAL-OUT22+	Programmable	

Digital common lines for X35 and X36 are not common to each other.

The DCOMx line should be connected to the 0V of the I/O supply when using sensors of type "Source" with digital inputs.

The DCOMx line should be connected to the 24V of the I/O supply when using sensors of type "Sink" with digital inputs.

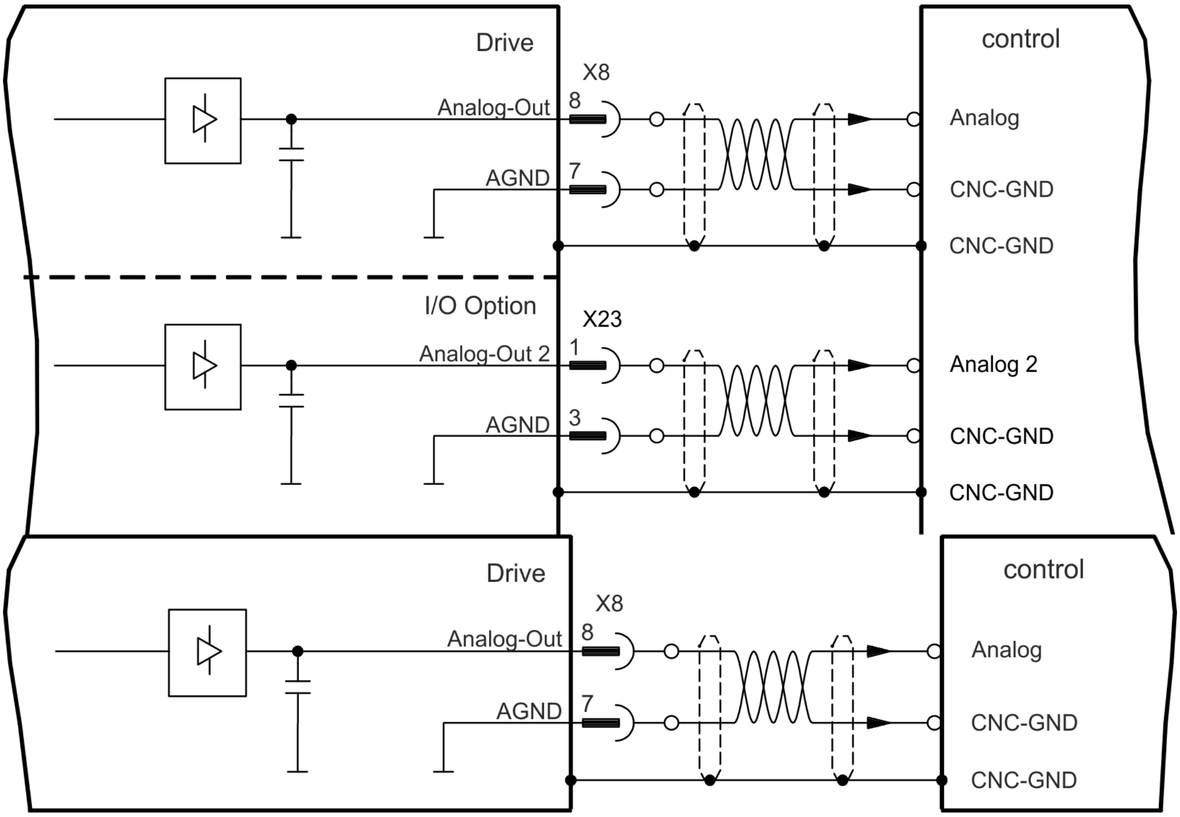
17.13 Analog Output (X8, X23)

Analog Outputs can be used to output converted analog values of digital measurements recorded in the drive. The standard drive offers one analog output on X8, drives with built-in I/O option card offer a second output on X23. A list of the pre-programmed functions is included in the EWV[1] setup software.

Technical characteristics

- Output voltage range referring to AGND: ±10 V
- Resolution: 16 Bit and fully monotonic
- Unadjusted offset: < 50 mV
- Offset drift typ: 250 µV/°C
- Gain or slope tolerance: +/- 3%
- Nonlinearity: < 0.1% of full scale or 10 mV
- Output impedance: 110 ohms
- Specification complies with IEC 61131-2 Table 11
- -3 dB Bandwidth: >8 kHz
- Maximum output current: 20 mA
- Capacitive load: any value but response speed limited by max Iout and by Rout
- Protected for short circuit to AGND

Analog Output Wiring Diagram



[1] Embedded Workbench Views

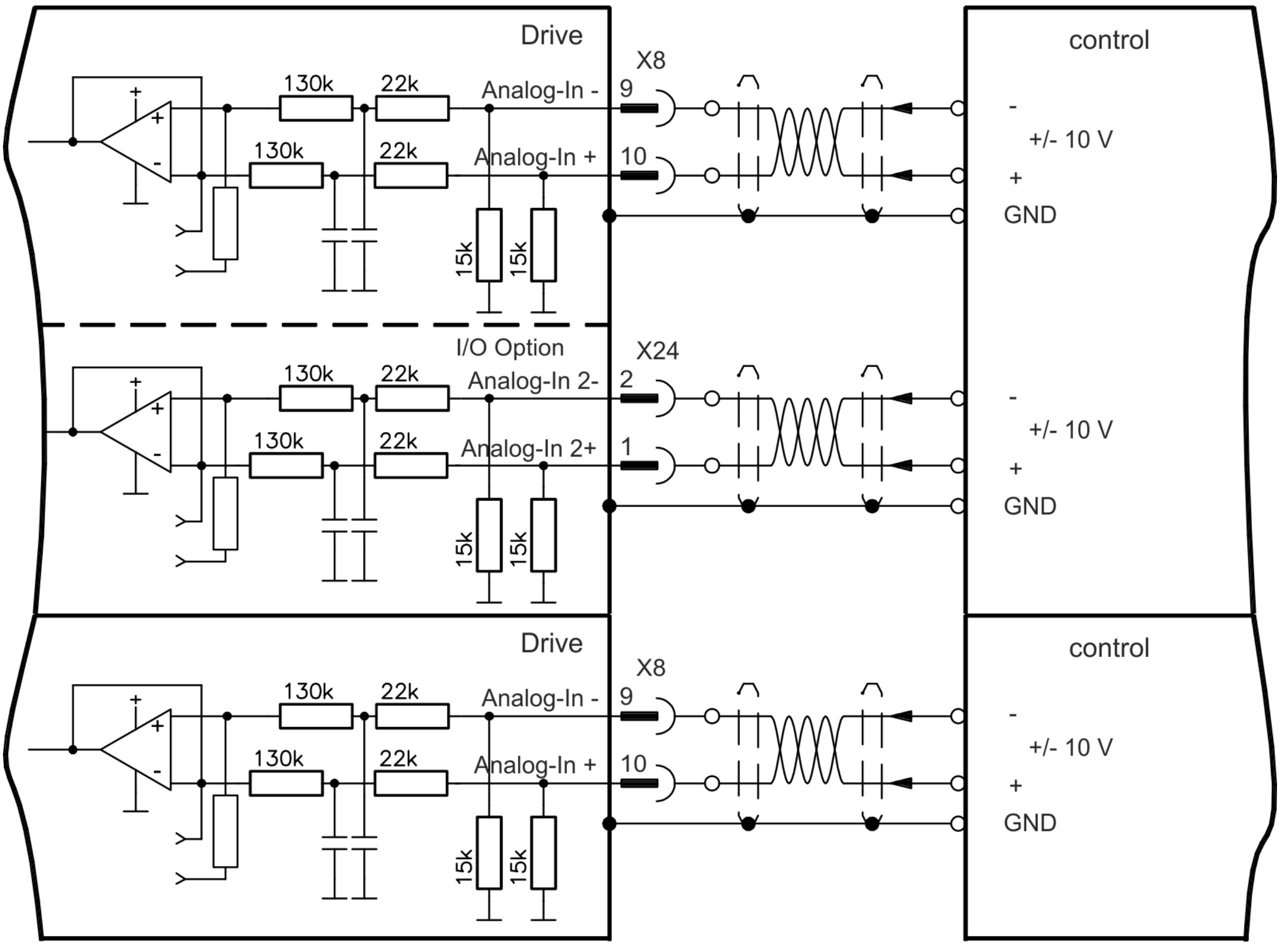
17.14 Analog Input (X8, X24)

The drive is fitted with differential inputs for analog torque, velocity, or position control. The standard drive offers one analog input on X8, drives with built-in I/O option card offer a second input on X24.

Technical characteristics

- Differential input voltage range: ± 12.5 V
- Maximum input voltage referring to I/O Return: -12.5, +16.0 V
- Resolution: 16 Bit and fully monotonic
- Unadjusted offset: < 50 mV
- Offset drift typ: 250 µV / ° C
- Gain or slope tolerance: +/- 3%
- Nonlinearity: < 0.1% of full scale or 12.5 mV
- Common Mode Rejection Ratio: > 30 dB at 60 Hz
- Input impedance: > 13k Ohms
- Signal to noise ratio referred to full scale:
  - AIN.CUTOFF = 3000 Hz: 14 bit
  - AIN.CUTOFF = 800 Hz: 16 bit

Analog Input Wiring Diagram



Application examples for set point input Analog-In:

- reduced-sensitivity input for setting-up/jog operation
- pre-control/override

Defining the direction of rotation

Standard setting: clockwise rotation of the motor shaft (looking at the shaft end) affected by positive voltage between terminal (+) and terminal (-)

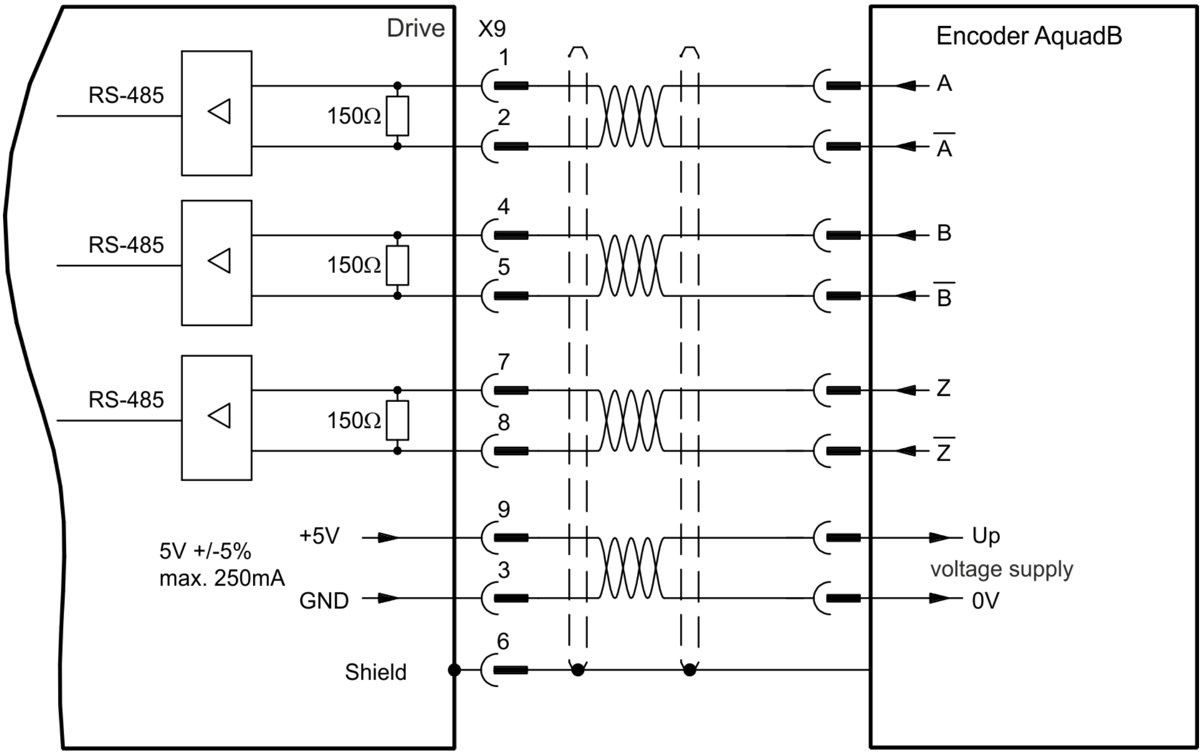
To reverse the direction of rotation, swap the connections to terminals +/-, or change the DRV.DIR parameter in the “Feedback 1” screen page.

17.15 Command encoder signal connection

17.15.1 Incremental encoder input 5 V (X9)

A 5 V A quad B encoder, or the encoder emulation output of another drive can be connected to this input and used as a commander encoder, dual loop feedback, gearing or camming input. Don't use for primary motor feedback connection!

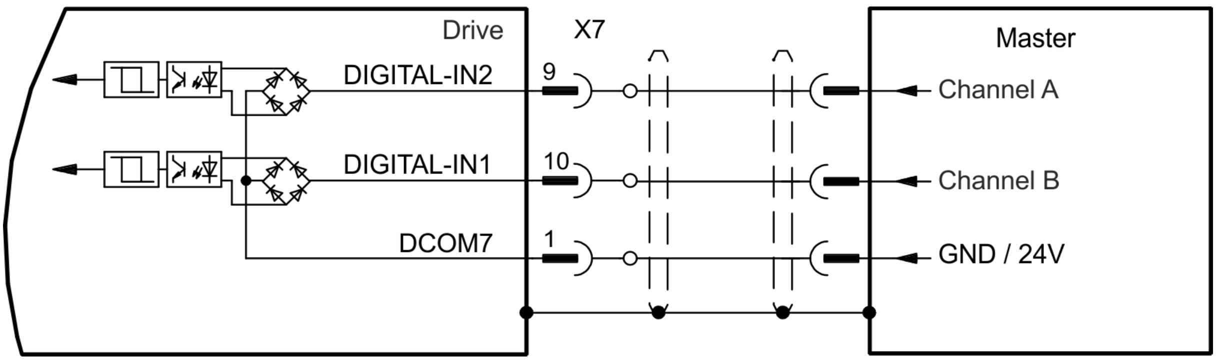
Connection Diagram



17.15.2 Incremental encoder input 24 V (X7)

A 24 V A quad B encoder can be connected to the digital inputs 1 and 2 and used as a commander encoder, dual loop feedback, gearing or camming input. Don't use for primary motor feedback connection!

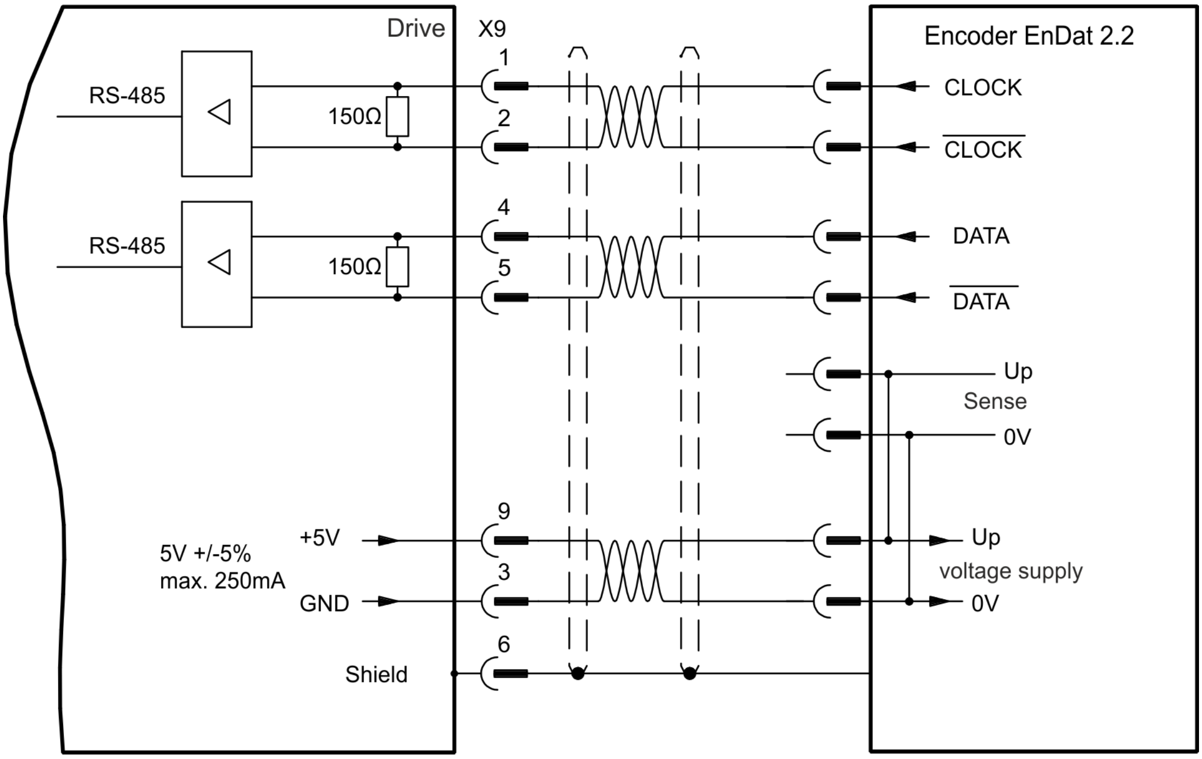
Connection Diagram



17.15.3 Encoder with EnDat 2.2 input 5 V (X9)

A single-turn or multi-turn encoder with EnDat 2.2 can be connected to this input and used as a commander encoder, dual loop feedback, gearing or camming input. Don't use for primary motor feedback connection!

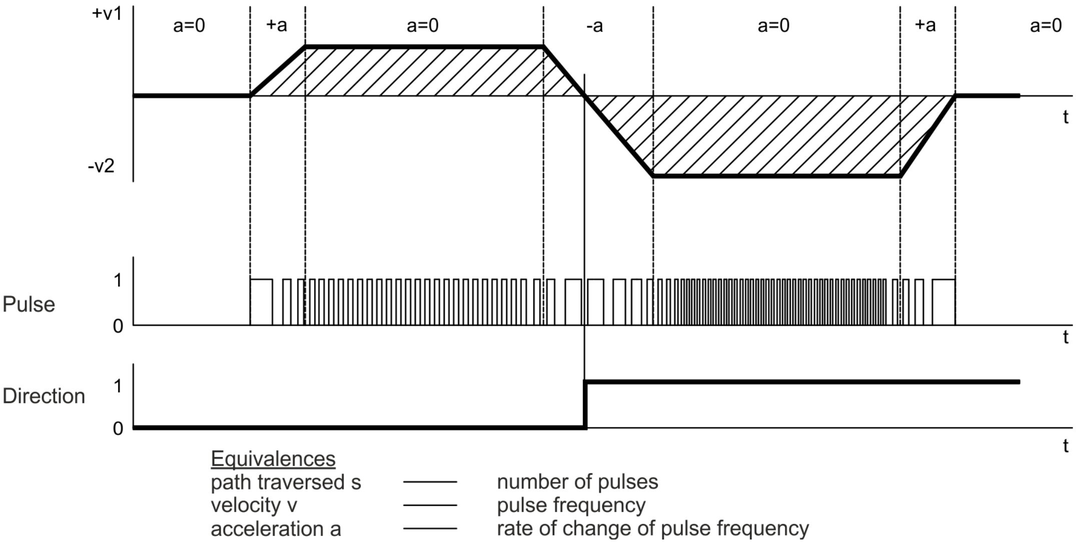
Connection Diagram



17.16 Pulse / Direction signal connection

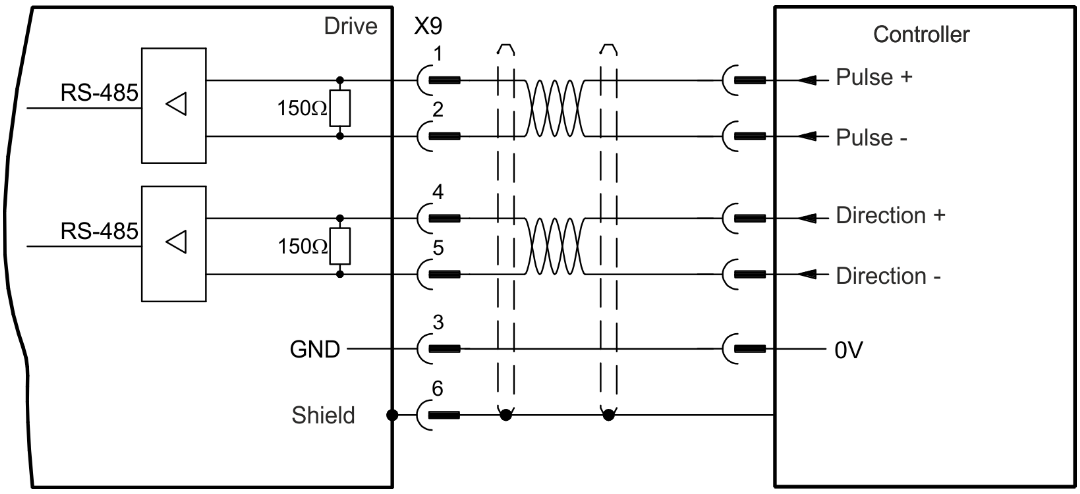
The drive can be connected to a stepper-motor controller. Set parameters for the drive with EWV[1]. The number of pulses can be adjusted, so that the drive can be adapted to match any stepper controller.

Speed profile and signal diagram



17.16.1 Pulse / Direction input 5 V (X9)

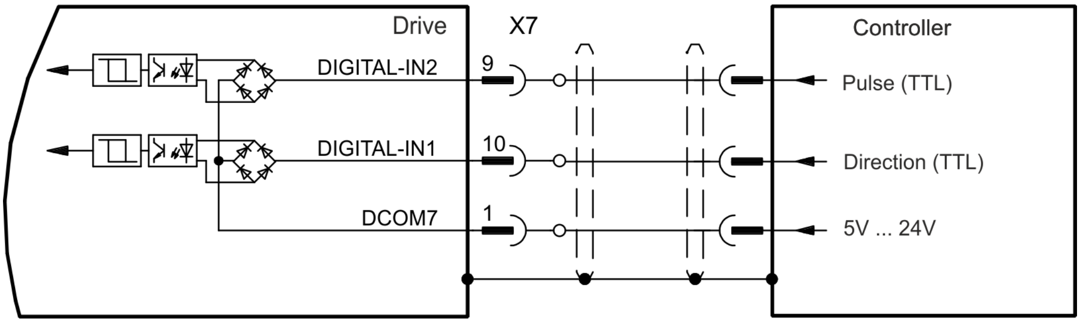
Connection to 5 V signal level stepper-motor controllers.



17.16.2 Pulse / Direction Input 5V (X7)

Connection industry standard 5V logic stepper-motor controllers with Pulse/Direction or Step/Direction outputs. Note that the X7 opto inputs can work with 5V up to 24V logic and so these inputs can be driven by 24V logic inputs as well.

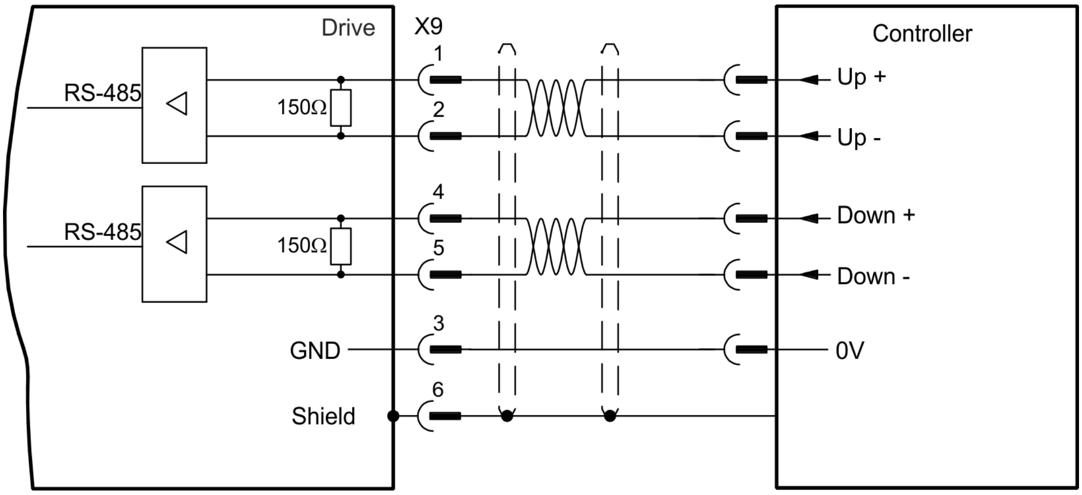
[1]Embedded Workbench Views



17.17 Up / Down signal connection

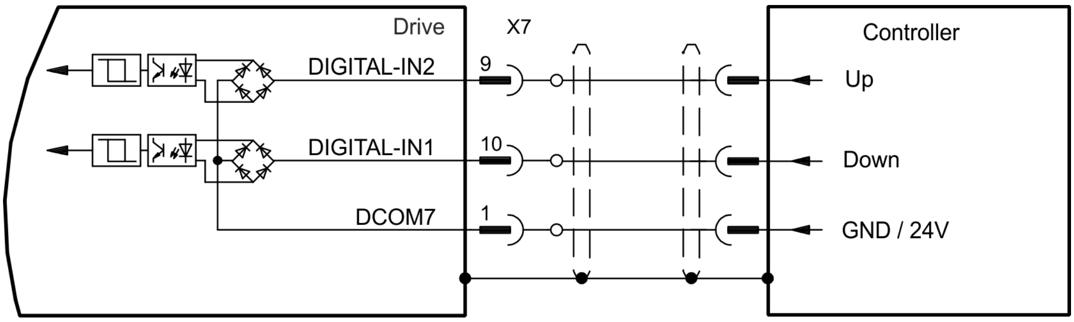
17.17.1 Up / Down input 5 V (X9)

The drive can be connected to a third-party controller which delivers 5 V up-down signals

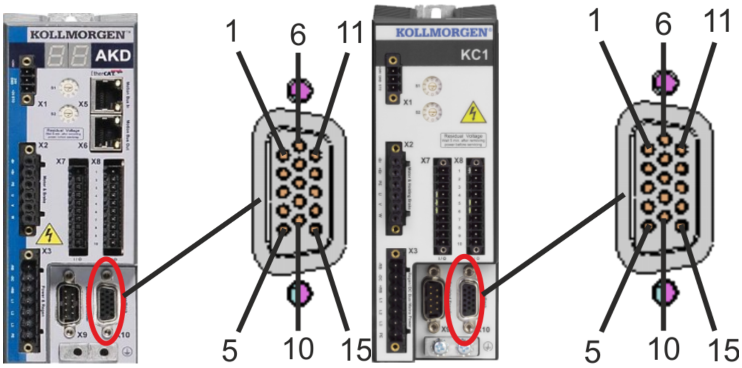


17.17.2 Up / Down input 24 V (X7)

The drive can be connected to a third-party controller which delivers 24 V up-down signals.



17.18 Feedback Connector (X10)



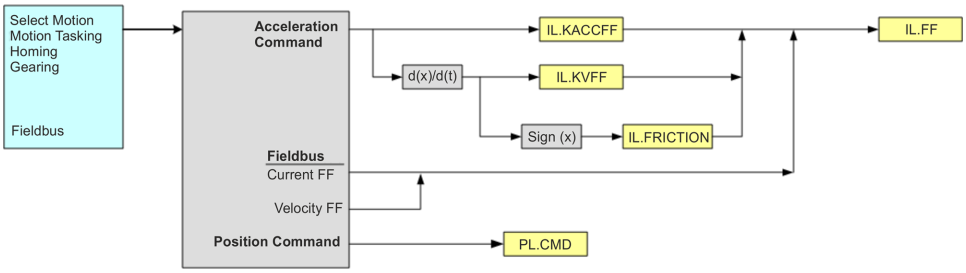
Pin	SFD	Resolver	BiSS A (analog)	BiSS C (digital)	EnDAT 2.1	EnDAT 2.2	Hiperface	Sine Encoder +Hall	Tamagawa Smart Abs	Incremental Encoder +Hall
1	-	-	-	-	-	-	-	Hall U	-	Hall U
2	-	-	CLOCK+	CLOCK+	CLOCK+	CLOCK+	-	Hall V	-	Hall V
3	-	-	CLOCK-	CLOCK-	CLOCK-	CLOCK-	-	Hall W	-	Hall W
4	SENSE+	-	SENSE+	SENSE+	SENSE+	SENSE+	SENSE+	SENSE+	SENSE+	SENSE+
5	SENSE-	-	SENSE-	SENSE-	SENSE-	SENSE-	SENSE-	SENSE-	SENSE-	SENSE-
6	COM+	R1 Ref+	DATA+	DATA+	DATA+	DATA+	DATA+	Zero+	SD+	Zero+
7	COM-	R2 Ref-	DATA-	DATA-	DATA-	DATA-	DATA-	Zero-	SD-	Zero-
8	-	Thermal control (PTC)								
9	-	Thermal control (PTC, GND)								
10	+5 V	-	+5 V	+5 V	+5 V	+5 V	+8 to +9 V	+5 V	+5 V	+5 V
11	0 V	-	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V
12	-	S1 SIN+	A+	-	A+	-	SIN+	A+	-	A+
13	-	S3 SIN-	A-	-	A-	-	SIN-	A-	-	A-
14	-	S2 COS+	B+	-	B+	-	COS+	B+	-	B+
15	-	S4 COS-	B-	-	B-	-	COS-	B-	-	B-

Pin	SFD	BiSS C (digital)	EnDAT 2.2	Tamagawa Smart Abs	Incremental Encoder +Hall
1	-	-	-	-	Hall U
2	-	CLOCK+	CLOCK+	-	Hall V
3	-	CLOCK-	CLOCK-	-	Hall W
4	SENSE+	SENSE+	SENSE+	SENSE+	SENSE+
5	SENSE-	SENSE-	SENSE-	SENSE-	SENSE-
6	COM+	DATA+	DATA+	SD+	Zero+
7	COM-	DATA-	DATA-	SD-	Zero-

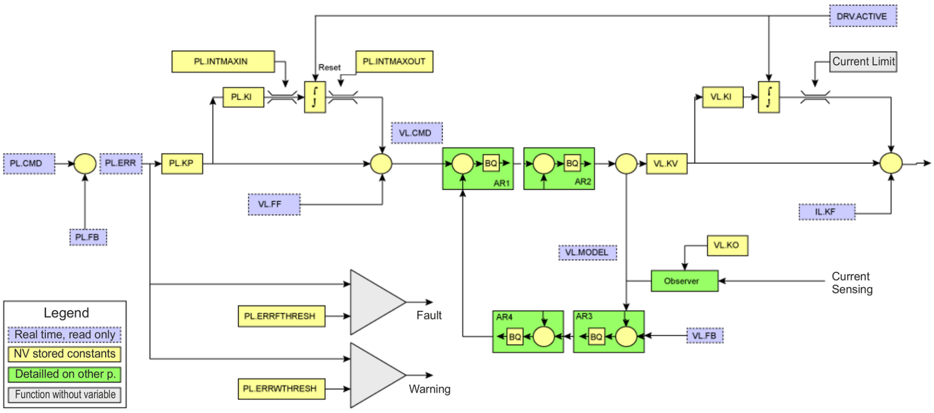
Pin	SFD	BiSS C (digital)	EnDAT 2.2	Tamagawa Smart Abs	Incremental Encoder +Hall
8	-	Thermal control (PTC)			
9	-	Thermal control (PTC)			
10	+5 V	+5 V	+5 V	+5 V	+5 V
11	0 V	0 V	0 V	0 V	0 V
12	-	-	-	-	A+
13	-	-	-	-	A-
14	-	-	-	-	B+
15	-	-	-	-	B-

18 Block Diagrams

18.1 Block Diagram for Current Loop



18.2 Block Diagram for Position/Velocity Loop



19 AKD PDMM Firmware

19.1 Check AKD PDMM Drive Firmware

To check AKD PDMM Firmware with KAS IDE:

1. Create a new project
2. Set the controller type and IP address
3. In the Project Explorer, double-click the **EtherCAT** node to open the EtherCAT Devices summary window
4. In the Devices tab, click the **Scan Devices** button
5. Choose the **Create...** option to map the physical device to a new device
6. If the version is not correct, continue following with the procedure below
7. Compile the project
8. Connect to the controller
9. Download the project to the controller
10. If the version is not correct, download the new firmware (click here) and follow with the next procedure.

19.2 Download AKD PDMM Drive Firmware

Component	Download
AKD PDMM Drive FW - Version: AKD-M-MCEC-V01-06-00-003.i00	4 MB

To upgrade AKD PDMM Firmware with KAS IDE, continue from the previous procedure as follows:

1. In the EtherCAT Devices summary window, deactivate the **Online Configuration Mode**
2. Select the drives to be updated with the same firmware
(Note that the FW download is limited to 16 drives at a time)
3. Click **Upgrade Firmware** button

⚠WARNING Give careful attention to any warning dialog that appears at this point. These warnings usually include important information about preventing damage to the drives.

4. Browse to select the new AKD firmware file
5. Click **Open** to start the updating procedure

19.3 AKD PDMM Firmware Update

Based on the FoE protocol, the AKD PDMM Firmware can be downloaded as follows:

1. Scan the devices and make sure all devices are created
2. Compile the project
3. Connect to the controller
4. Download the project to the controller
5. Open the **EtherCAT Devices** summary form
6. Select the drives to be updated with the same firmware
7. Click the Upgrade Firmware button

   ⚠WARNING Give careful attention to any warning dialog that appears at this point. These warnings usually include important information about preventing damage to the drives.

8. Browse to select the new AKD firmware file

9. Click **Open** to start the updating procedure

NOTE This procedure is not possible when applications are running and when the drive is in Online Configuration Mode.

During the firmware download, the AKD Firmware Update window displays a progress bar and the following messages are displayed:

- Uploading firmware to the drive
  During the download process, the drive LED displays [dL]. Additional codes may appear during the download; see 3.2 Display Codes for a description of codes related to the firmware download.
- Resetting the drive
- Firmware update is complete

⚠CAUTION While the firmware is downloading to your drive, do not remove the 24V logic power. If you remove the 24V logic power during a firmware download, a severe drive crash can occur. If a crash occurs, the drive will restart in a special mode and prompt you to reload the firmware.

20 About the Parameter and Command Reference Guide

This reference guide provides descriptive information about each parameter and command used in the drive firmware. Parameters and commands are used to configure the drive or to return status information from the drive using the EWV[1] terminal screen. The use of these parameters and commands to perform various drive functions is detailed in related sections of the AKD PDMM User Guide.

Drive parameter and command categories include the following:

A summary table of information for all parameters and commands is also available:

Summary of Parameters and Commands

For each parameter or command, this reference guide presents the following tables of information, followed by a description of the command, examples, and links to related information in the User Guide, as appropriate.

General Information	
Type	One of four types: • Command: Action or W/O command. • NV Parameter: R/W and stored in nonvolatile (NV) memory • R/W Parameter: Can be either read from or written to the drive. • R/O Parameter. Can only be read from the drive
Description	Brief description of the parameter or command and notes if the parameter or command is not active in all opmodes.
Units	Appropriate units (see Table of Units for unit descriptions)
Range	Permissible range; multiple ranges are sometimes present.
Default Value	Determined at setup process time or motor ID; otherwise set to 0.010.
Data Type	Integer, Boolean, Float, or String
See Also	Links to related information such as other parameters, block diagrams, schematics, or other sections of the product manual.
Start Version	The minimum firmware version number required to use the parameter or command

Fieldbus	Index/Subindex	Object Start Version
Fieldbus type, such as EtherCAT COE and CANopen .	Index/subindex values for the parameter or command. The index value may be linked to the Object Dictionary for each fieldbus, if the object dictionary contains more detailed information about the object.	The minimum firmware version number required to use the fieldbus.

[1] Embedded Workbench Views

Additional data types may include the following:

Type	Description
Error	Illegal type=0
b	Boolean
U8	8 x unsigned numbers
S8	8 x signed numbers
U16	16 x unsigned numbers
S16	16 x signed numbers
U32	32 x unsigned numbers
S32	32 x signed numbers
U64	64 x unsigned numbers
S64	64 x signed numbers

20.1 Parameter and Command Naming Conventions

Abbreviation	Term
ACC	Acceleration
APP	Apply
CLR	Clear
CS	Controlled Stop
I	Current
D	Current d-component
DEC	Deceleration
DIR	Direction
DIS	Disable
DIST	Distance
EMUE	Emulated encoder
EN	Enable
ERR	Error
F	Fault
FB	Feedback
FF	Feedforward
K	Gain
INT	Integrator
LIM	Limit
L	Loop
MAX	Maximum
MIN	Minimum
N	Negative
NV	Nonvolatile
P	Position, Proportional, Positive
RLS	Release
R	Resistance
STATE	Status, State, Stat
THRESH	Threshold

Abbreviation	Term
T	Time
TMAX	Timeout
U	User
V	Velocity, Volt
W	Warning

20.2 Summary of Parameters and Commands

This table contains an alphabetical list of parameters and commands, with a brief description for each. The parameter name and description are linked to the parameter tables. Generally speaking, all parameters and commands are active in all opmodes, with the following exceptions:

Parameter or Command	Active in Opmodes
GEAR (all parameters and commands)	2 (position) only
HOME (all parameters and commands)	2 (position) only
MT (all parameters and commands)	2 (position) only
SM.I1, SM.I2	0 (torque) only
SM.V1, SM.V2	1 (velocity) only
SM.VPM1, SM.VPM2	2 (position) only
VL (all parameters and commands)	1 (velocity) and 2 (position) only

Parameter or Command	Type	Description
Analog Input (AIN)		
AIN.CUTOFF	NV	Sets the analog input low-pass filter cutoff frequency.
AIN.DEADBAND	NV	Sets the analog input signal deadband.
AIN.DEADBANDMODE	NV	Sets the analog input deadband mode.
AIN.ISCALE	NV	Sets the analog current scale factor.
AIN.MODE (Password Protected)	NV	Analog input mode.
AIN.OFFSET	NV	Sets the analog input offset.
AIN.PSCALE	NV	Sets the analog position scale factor.
AIN.VALUE	R/O	Reads the value of the analog input signal.
AIN.VSCALE	NV	Sets analog velocity scale factor.
AIN.ZERO	Command	Zeroes the analog input signal.
Analog Input 2 (AIN2)		
AIN2.DEADBAND (pg 1)	NV	Sets the analog input 2 signal deadband.
AIN2.DEADBANDMODE	NV	Sets the analog input 2 deadband mode.
AIN2.MODE	NV	Analog input 2 mode.
AIN2.OFFSET	NV	Sets the analog input 2 offset.
AIN2.VALUE	R/O	Reads the value of the analog input 2 signal.
AIN2.ZERO	Command	Zeroes the analog input 2 signal.
Analog Input/Output (AIO)		
AIO.ISCALE (pg 208)	NV	Sets the analog current scale factor.
AIO.VSCALE (pg 209)	NV	Sets velocity scale factor.

Parameter or Command	Type	Description
AIO.PSCALE (pg 208)	NV	Sets position scale factor.
Analog Output (AOUT)		
AOUT.CUTOFF (pg 212)	NV	Sets the analog output low-pass filter cutoff frequency.
AOUT.DEBUGADDR	NV	Sets the memory address to debug.
AOUT.DEBUGSCALE	NV	Sets the scale to be used for debug.
AOUT.ISCALE (pg 212)	NV	Sets the analog current scale factor.
AOUT.MODE (pg 213)	NV	Sets the analog output mode.
AOUT.OFFSET (pg 214)	NV	Sets the analog output offset.
AOUT.PSCALE (pg 214)	NV	Sets the analog position scale factor.
AOUT.VALUE (pg 215)	NV	Reads the analog output value.
AOUT.VALUEU (pg 216)	R/W	Sets the analog output value.
AOUT.VSCALE (pg 216)	NV	Sets the velocity scale factor for analog output.
Analog Output 2 (AOUT2)		
AOUT2.CUTOFF (pg 219)	NV	Sets the analog output 2 low-pass filter cutoff frequency.
AOUT2.MODE (pg 219)	NV	Sets the analog output 2 mode.
AOUT2.OFFSET (pg 220)	NV	Sets the analog output 2 offset.
AOUT2.VALUE (pg 220)	NV	Reads the analog output 2 value.
AOUT.VALUEU (pg 220)	R/W	Sets the analog output 2 value.
Bode plot (BODE)		
BODE.EXCITEGAP (pg 223)	R/W	Controls how often the excitation is updated.
BODE.FREQ (pg 223)	R/W	Sets the frequency of the sine excitation source.
BODE.IAMP (pg 224)	R/W	Sets current command value used during the Bode procedure.
BODE.IFLIMIT (pg 225)	R/W	Sets the current fault duration limit in seconds for the BODE.MODE 5 stability test.
BODE.IFTHRESH (pg 226)	R/W	Sets the current fault threshold for the BODE.MODE 5 stability test.
BODE.INJECTPOINT (pg 226)	R/W	Sets whether the excitation uses current or velocity excitation type.
BODE.MODE (pg 227)	R/W	Sets the mode of the excitation.
BODE.MODETIMER (pg 230)	R/W	Sets the watchdog timer of the excitation.
BODE.PRBDEPTH (pg 231)	R/W	Sets the length of the PRB signal before it repeats.
BODE.VAMP (pg 232)	R/W	Sets the amplitude of the excitation when in velocity mode.
BODE.VFLIMIT (pg 233)	R/W	Sets the velocity fault duration limit (seconds) for the BODE.MODE 5 stability test
BODE.VFTHRESH (pg 234)	R/W	Sets the current fault threshold for the BODE.MODE 5 stability test.
Capture (CAP)		
CAP0.EDGE, CAP1.EDGE	NV	Selects the capture edge.
CAP0.EN, CAP1.EN	NV	Enables or disables the related capture engine.
CAP0.EVENT, CAP1.EVENT	NV	Controls the precondition logic.

Parameter or Command	Type	Description
CAP0.FILTER, CAP1.FILTER	R/W	Controls the precondition logic.
CAP0.MODE, CAP1.MODE	NV	Selects the captured value.
CAP0.PLFB, CAP1.PLFB	R/O	Reads captured position value.
CAP0.PREEDGE, CAP1.PREEDGE	NV	Selects the capture precondition edge.
CAP0.PREFILTER, CAP1.PREFILTER	NV	Sets the filter for the precondition input source.
CAP0.PRESELECT, CAP1.PRESELECT	NV	Sets the precondition trigger.
CAP0.STATE, CAP1.STATE	R/O	Indicates whether or not trigger source was captured.
CAP0.T, CAP1.T	R/O	Reads time capture (if time capture was configured).
CAP0.TRIGGER, CAP1.TRIGGER	NV	Specifies the trigger source for the position capture.
Controlled Stop (CS)		
CS.DEC (pg 237)	NV	Sets the deceleration value for the controlled stop process.
CS.STATE (pg 238)	NV	Returns the internal status of the controlled stop process.
CS.TO (pg 238)	NV	Sets the time value for the drive velocity to be within CS.VTHRESH (pg 238).
CS.VTHRESH (pg 240)	NV	Sets the velocity threshold for the controlled stop.
Digital Input (DIN)		
DIN.HCMD1 TO DIN.HCMD4 (pg 242)	NV	A buffer of commands to be used in digital input "command buffer" mode.
DIN.LCMD1 to DIN.LCMD4 (pg 242)	NV	A buffer of commands to be used in digital input "command buffer" mode.
DIN.ROTARY (PG 243)	R/O	Reads the rotary knob value.
DIN.STATES (PG 244)	R/O	Reads the digital input states.
DIN1.FILTER TO DIN7.FILTER (pg 244)	R/W	Filter mode for digital inputs 1 to 7.
DIN1.INV TO DIN7.INV	R/W	Inverting the output voltage of the IO, when in the output direction.
DIN1.MODE TO DIN24.MODE (pg 247)	NV	Sets the digital input modes.
DIN1.PARAM TO DIN7.PARAM (pg 248)	R/W	Sets a value used as an extra parameter for digital inputs nodes.
DIN1.STATE TO DIN7.STATE (pg 249)	R/O	Reads a specific digital input state.
DIN21.FILTER to DIN32.FILTER (pg 251)	R/W	Filter mode for digital inputs 21 to 32.
DIN21.STATE to DIN32.STATE (pg 251)	R/O	Reads a specific digital input state.
DIO		
DIO9.INV to DIO11.INV	NV	Inverting the output voltage of the IO, when in the output direction.
DIO9.DIR to DIO11.DIR	NV	Changing direction of the IOs from the X9 connector.

Parameter or Command	Type	Description
Digital Output (DOUT)		
DOUT.CTRL (PG 254)	NV	Sets the source of digital outputs (firmware or fieldbus).
DOUT.RELAYMODE (pg 254)	R/W	Indicates faults relay mode.
DOUT.STATES (PG 255)	R/O	Reads the state of the two digital outputs.
DOUT1.MODE to DOUT19.MODE (pg 255)	NV	Sets the digital output mode.
DOUT1.PARAM AND DOUT2.PARAM (pg 256)	NV	Sets extra parameters for the digital outputs.
DOUT1.STATE AND DOUT2.STATE (pg 257)	R/O	Reads the digital output state.
DOUT1.STATEU AND DOUT2.STATEU (pg 257)	R/W	Sets the state of the digital output node.
DOUT21.STATE to DOUT32.STATE (pg 260)	R/O	Reads the digital output state.
DOUT21.STATEU to DOUT32.STATEU (pg 260)	R/W	Sets the state of the digital output node.
Drive (DRV)		
DRV.ACC	NV	Describes the acceleration ramp for the velocity loop.
DRV.ACTIVE (PG 264)	R/O	Reads the enable status of an axis.
DRV.BLINKDISPLAY (PG 264)	Command	Causes the display to blink for 10 seconds.
DRV.BOOTTIME (pg 265)	R/O	Returns the time when the current session booted up.
DRV.CLRFAULTHIST (PG 265)	Command	Clears the fault history log in the NV.
DRV.CLRFAULTS (PG 266)	Command	Tries to clear all active faults in the drive.
DRV.CMDDELAY (pg 266)	R/W	Issues a delay before next command is executed.
DRV.CMDSOURCE (PG 267)	NV	Sets the command source (service, fieldbus, analog input, gear-ing, digital, or Bode).
DRV.CRASHDUMP (pg 268)	Command	Retrieves diagnostic information after the drive crashes.
DRV.DBILIMIT (pg 268)	NV	Sets the maximum amplitude of the current for dynamic braking.
DRV.DEC (PG 269)	NV	Sets the deceleration value for the velocity loop.
DRV.DIFVAR (pg 270)	R/O	Lists all parameters which differ from their default value.
DRV.DIR (pg 271)	R/W	Changes drive direction.
DRV.DIS (PG 272)	Command	Disables the axis (software).
DRV.DISMODE (pg 273)	NV	Selects among disable immediately or stop and then disable options.
DRV.DISSOURCES (PG 274)	R/O	Returns the possible reason for a drive disable.
DRV.DISSOURCESMASK (pg 275)	R/O	Returns a bitmap of all bits in DRV.DISSOURCES that can be set to one on a given drive.
DRV.DISTO (pg 275)	R/W	Sets the emergency timeout
DRV.EMUEDIR (pg 276)	R/W	Sets the direction of the emulated encoder output (EEO) signal.
DRV.EMUEMODE (pg 277)	R/W	Sets the mode of the emulated encoder output (EEO) con-nector.

Parameter or Command	Type	Description
DRV.EMUEMTURN (pg 278)	R/W	Defines the location of the index pulse on the EEO (emulated encoder output) when DRV.EMUEMODE=2.
DRV.EMUEPULSEWIDTH (pg 279)		Sets the encoder output pulse width for modes 6 to 7.
DRV.EMUERES (pg 280)	R/W	Sets the resolution of the EEO (emulated encoder output).
DRV.EMUEZOFFSET (pg 280)	R/W	Sets the location of the EEO (emulated encoder output) index pulse (when DRV.EMUEMODE=1).
DRV.EN (PG 281)	Command	Enables the axis (software).
DRV.ENDEFAULT (pg 281)	R/W	Sets the default state of the software enable.
DRV.FAULTHIST (PG 282)	R/O	Reads the last 10 faults from NV memory.
DRV.FAULTS (PG 283)	R/O	Reads the active faults.
DRV.FAULT1 to DRV.FAULT10 (pg 282)	R/O	Location of fault codes for any active fault conditions.
DRV.HANDWHEEL	R/O	Reads the EEO input value.
DRV.HANDWHEELSRC (pg 284)	NV	Selects the feedback for handwheel operation.
DRV.HELP (PG 284)	R/O	Reads the minimum, maximum, and default values for a specific parameter or command.
DRV.HELPALL (pg 284)	R/O	Retrieves the minimum, maximum, default, and actual values for all available parameters and commands.
DRV.HWENABLE (pg 285)	R/O	Status of the hardware enable.
DRV.HWENDELAY (pg 285)	NV	Delay time between inactive Hardware Enable input and drive disable.
DRV.HWENMODE (pg 286)	R/W	Selects the action that the hardware enable digital input will perform.
DRV.ICONT (PG 287)	R/O	Reads the continuous rated current value.
DRV.INFO (PG 287)	R/O	Reads general information about the drive.
DRV.IPEAK (PG 288)	R/O	Reads the peak rated current value.
DRV.IZERO (pg 289)	R/W	Sets the current that will be used during the DRV.ZERO procedure.
DRV.LIST (PG 289)	R/O	Reads the list of available parameters and commands.
DRV.LOGICVOLTS (pg 289)	R/O	Reads the logic voltages.
DRV.NAME (PG 291)	NV	Sets and reads the name of the drive.
DRV.NVCHECK (pg 292)	R/O	NV Parameter Checksum
DRV.NVLIST (PG 292)	R/O	Lists the NV parameters and values from the RAM.
DRV.NVLOAD (pg 293)	W/O	Loads all data from the NV memory of the drive into the RAM parameters.
DRV.NVSAVE (PG 293)	Command	Saves the drive parameters from the RAM to the NV memory.
DRV.ONTIME (pg 293)	R/O	Returns how long the drive has been running since last power up.
DRV.OPMODE (PG 294)	NV	Sets the drive operation mode (current, velocity, or position).
DRV.READFORMAT (PG 295)	R/W	Sets the value returned to either decimal or hexadecimal.

Parameter or Command	Type	Description
DRV.RSTVAR (PG 295)	Command	Sets default values in the drive without re-booting the drive and without resetting the NV memory.
DRV.RUNTIME (PG 296)	R/O	Returns how long the drive has been running since first activated.
DRV.SETUPREQBITS (pg 296)	R/O	Reads the bitwise set status of parameters that must be set before the drive can be enabled.
DRV.SETUPREQLIST (pg 297)	R/O	Reads the list of parameters that must be set before the drive can be enabled.
DRV.STOP (PG 297)	Command	This command stops all drive motion.
DRV.TEMPERATURES (pg 298)	R/O	Reads the temperature of drive components.
DRV.TIME (pg 298)	R/W	A continuous time counter in the drive.
DRV.TYPE (pg 299)	R/O	Selects the operational fieldbus on CC drive models.
DRV.VER (PG 300)	R/O	Reads the drive version.
DRV.VERIMAGE (PG 300)	R/O	Returns the version data from each image.
DRV.WARNINGS (pg 301)	R/O	Reads the active warnings.
DRV.WARNING1 to DRV.WARNING10 (pg 301)	R/O	Location of fault codes for any active warning conditions.
DRV.ZERO (pg 302)	R/W	Sets the zero mode. The procedure is activated when the drive is enabled.
EtherNet/IP (EIP)		
EIP.CONNECTED (pg 304)	R/O	Returns state of EtherNet/IP connection.
EIP.POSUNIT (pg 304)	R/W	Unit scaling for Position values over EtherNet/IP.
EIP.PROFUNIT (pg 305)	R/W	Unit scaling for Velocity and Acceleration values over EtherNet/IP.
Fault (FAULT)		
FAULTx.ACTION (pg 307)	R/W	Gets/Sets the Fault Action for Fault 130, 131, 132, 134, 139, 451, and 702.
Feedback 1 (FB1)		
FB1.BISSBITS (pg 309)	NV	Specifies the number of Biss Sensor (Position) Bits for the BiSS Mode C encoder in use.
FB1.ENCRES (PG 309)	NV	Sets the resolution of the motor encoder.
FB1.HALLSTATE (PG 310)	R/O	Reads the Hall switch values (encoder feedback
FB1.HALLSTATEU (pg 311)	R/O	Reads the state of Hall switch U.
FB1.HALLSTATEV (pg 311)	R/O	Reads the state of Hall switch V.
FB1.HALLSTATEW (pg 311)	R/O	Reads the state of Hall switch W.
FB1.IDENTIFIED (PG 312)	R/O	Reads the type of feedback device used by the drive/motor.
FB1.INITSIGNED (pg 313)	NV	Sets initial feedback value as signed or unsigned.
FB1.MECHPOS (PG 313)	R/O	Reads the mechanical position.
FB1.MEMVER	R/O	Returns the memory feedback version.
FB1.OFFSET (pg 314)	NV	Sets position feedback offset.
FB1.ORIGIN (pg 315)	NV	Adds to the initial feedback position.

Parameter or Command	Type	Description
FB1.P (pg 316)	R/O	Reads position from the primary feedback.
FB1.PDIR	NV	Sets the counting direction for feedback channel 1.
FB1.PFIND (pg 316)	R/W	A procedure that allows the user to find the commutation angle for encoder feedback, which has no halls.
FB1.PFINDCMDU (pg 317)	R/W	Current value used during the phase finding procedure (PFB.PFIND=1)
FB1.POFFSET (pg 317)	NV	Sets the offset for primary feedback.
FB1.POLES (PG 318)	R/O	Reads the number of feedback poles.
FB1.PSCALE (pg 318)	R/W	Sets position scaling value for fieldbus transferred position objects.
FB1.PUNIT (pg 319)	NV	Sets the unit for FB1.P.
FB1.RESKTR (pg 319)	NV	Sets the resolver nominal transformation ratio.
FB1.RESREFPHASE (pg 320)	NV	Sets the electrical degrees of phase lag in the resolver.
FB1.SELECT	NV	Sets user entered type or identified type (–1).
FB1.TRACKINGCAL (pg 322)	NV	Controls tracking calibration algorithm.
FB1.USERBYTE0 to FB1.USERBYTE7 (pg 323)	R/W	Reads and writes data stored in two 32 bit words in the Endat feedback device.
FB1.USERDWORD0 to FB1.USERWORD1 (pg 324)	R/W	Reads and writes data stored in two 32 bit words in the Endat feedback device.
FB1.USERWORD1 to FB1.USERWORD3 (pg 325)	R/W	Reads and writes data stored in two 32 bit words in the Endat feedback device.
Feedback 2 (FB2)		
FB2.ENCRES	NV	Sets the secondary feedback (FB2) resolution (also defines resolution of virtual encoder in).
FB2.MODE	R/W	Sets the mode for the second feedback inputs, EEO connector (X9) and high speed opto inputs (pins 9 and 10 on X7).
FB2.P	R/O	Reads position from the secondary feedback.
FB2.PDIR	R/W	Sets the counting direction for feedback channel 2.
FB2.POFFSET	NV	Sets the offset for secondary feedback.
FB2.PUNIT	NV	Sets the unit for FB2.P.
FB2.SOURCE	R/W	Sets the source for the second feedback input. Choices are the EEO connectors (X9) which are RS485 inputs, or the X7 connector's high speed opto inputs (pins 9 and 10).
Feedback 3 (FB3)		
FB3.MODE (pg 328)	NV	Selects the type of feedback connected to X9.
FB3.P (pg 328)	RO	Reads position from the tertiary feedback.
FB3.PDIR (pg 329)	NV	Sets the counting direction for feedback channel 3.
FB3.POFFSET (pg 329)	NV	Sets the offset for tertiary feedback.
FB3.PUNIT (pg 329)	NV	Sets the unit for FB3.P.
Fieldbus (FBUS)		
FBUS.PARAM1 TO FBUS.PARAM10 (pg 332)	NV	Set fieldbus specific meanings.

Parameter or Command	Type	Description
FBUS.PLLSTATE (pg 333)	R/O	Returns the status of the PLL
FBUS.PLLTHRESH (pg 334)	NV	Sets number of successful synchronized cycles needed to lock the PLL.
FBUS.PROTECTION (pg 335)	R/W	Controls which parameters are blocked from being accessed through telnet while a fieldbus is operational.
FBUS.SAMPLEPERIOD (pg 337)	NV	Sets fieldbus sample period.
FBUS.STATE (pg 338)	R/O	Reads the state of the fieldbus.
FBUS.SYNCACT (pg 338)	R/O	Reads actual distance from the desired sync distance.
FBUS.SYNCDIST (pg 338)	NV	Sets time target for synchronization.
FBUS.SYNCWND (pg 339)	NV	Sets symmetrically arranged window around the desired sync distance.
FBUS.TYPE (pg 339)	R/O	Shows the active fieldbus type.
Hardware Limit Switch (HWLS)		
HWLS.NEGSTATE (pg 347)	R/O	Reads the status of the negative hardware limit switch.
HWLS.POSSTATE (pg 347)	R/O	Reads the status of the positive hardware limit switch.
Current Loop (IL)		
IL.BUSFF (pg 349)	R/O	Displays the current feedforward value injected by the fieldbus.
IL.CMD (PG 349)	R/O	Reads the value of the q-component current command.
IL.CMDU (PG 349)	R/W	Sets the user current command.
IL.DIFOLD (PG 350)	R/O	Reads the drive foldback current limit.
IL.FB (PG 351)	R/O	Reads the actual value of the d-component current.
IL.FBSOURCE (pg 351)	R/W	Sets the feedback source for the current loop. Only applies when MOTOR.TYPE = 4.
IL.FF (pg 352)	R/O	Displays the current loop overall feedforward value.
IL.FOLDFTHRESH (PG 352)	NV	Reads the foldback fault level.
IL.FOLDFTHRESHU (pg 353)	NV	Sets the user value for the foldback fault level.
IL.FOLDWTHRESH (PG 353)	NV	Sets the foldback warning level.
IL.IFOLD (pg 355)	R/O	Reads the overall foldback current limit.
IL.IUFB (PG 355)	R/O	Reads the sigma-delta measured current in the u-winding of the motor.
IL.KACCFF (pg 356)	R/W	Sets current loop acceleration feedforward gain value
IL.KBUSFF (pg 357)	R/W	Current loops fieldbus injected feed-forward gain
IL.KP (PG 357)	NV	Sets the proportional gain of the q-component of the PI regulator.
IL.KPDRATIO (PG 358)	NV	Sets the proportional gain of the d-component current PI-regulator as a percentage of IL.KP
IL.KPLOOKUPINDEX (pg 358)	R/W	Sets the index into the Current Loop Gain Scheduling Table.
IL.KPLOOKUPVALUE (pg 359)	R/W	Sets the value of the current loop gain scheduling index.

Parameter or Command	Type	Description
IL.KPLOOKUPVALUES (pg 359)	R/W	Gets the Current Loop Gain Scheduling Table.
IL.KVFF (pg 360)	R/W	Current loop velocity feed-forward gain.
IL.LIMITN (PG 360)	NV	Sets the negative user (application-specific) current limit.
IL.LIMITP (PG 361)	NV	Sets the positive user (application-specific) current limit.
IL.MFOLDD (PG 362)	NV	Sets the motor foldback maximum time at motor peak current.
IL.MFOLDR (PG 362)	R/O	Sets the motor foldback recovery time.
IL.MFOLDT (PG 362)	NV	Sets the motor foldback time constant of the exponential current drop (foldback).
IL.MI2T (pg 363)	R/O	Motor I2t load.
IL.MI2TWTHRESH (pg 363)	NV	Motor I2t load warning threshold.
IL.MIFOLD (PG 364)	R/O	Sets the motor foldback current limit.
IL.MIMODE (pg 364)	NV	Motor protection mode.
IL.OFFSET (pg 365)	RW	A constant current command added to compensate for gravity.
IL.VCMD (PG 365)	R/O	Sets the output of the q-component PI regulator.
IL.VUFB (PG 366)	R/O	Reads the measured voltage on the u-winding of the motor.
IL.VVFB (PG 366)	R/O	Reads the measured voltage on the v-winding of the motor.
IP (Internet Protocol) Parameters		
IP.ADDRESS (pg 369)	NV	Gets/Sets the IP address of the drive.
IP.GATEWAY (pg 370)	NV	Gets/Sets the gateway IP of the drive.
IP.MODE (pg 371)	NV	Sets method of acquiring IP Address.
IP.RESET (pg 372)	Command	Implements new IP settings..
IP.SUBNET (pg 372)	NV	Gets/Sets the IP Subnet mask of the drive.
LOAD Parameters		
LOAD.INERTIA (pg 375)	NV	Sets the load inertia.

Motor Parameters		
MOTOR.AUTOSET (pg 377)	NV	Determines which drive parameters are calculated automatically.
MOTOR.BRAKE (PG 377)	NV	Sets the presence or absence of a motor brake.
MOTOR.BRAKEIMM (pg 378)	NV	Brake Immediately: in the case of a drive disable, apply the brake in all situations.
MOTOR.BRAKERLS (pg 378)	Command	Allows a user to release or apply the motor brake.
MOTOR.BRAKESTATE (pg 379)	R/O	Reads the actual status of the motor brake.
MOTOR.CTF0 (pg 380)	NV	Sets the thermal constant of the motor coil.
MOTOR.ICONT (PG 380)	NV	Sets the motor continuous current.
MOTOR.IDDATAVALID (pg 381)	R/O	Reports the status of the motor memory.
MOTOR.IMID (pg 381)	R/W	The direct-axis current set point used for induction machine closed-loop control.
MOTOR.IMTR (pg 382)	R/W	Rotor time constant.
MOTOR.INERTIA (PG 383)	NV	Sets the motor inertia.
MOTOR.IPEAK (PG 383)	NV	Sets the motor peak current.

MOTOR.KE (pg 384)		Sets the motor back EMF constant.
MOTOR.KT (PG 385)	NV	Sets the torque constant of the motor.
MOTOR.LQLL (PG 385)	NV	Sets the line-to-line motor Lq.
MOTOR.NAME (PG 386)	NV	Sets the motor name.
MOTOR.PHASE (PG 386)	NV	Sets the motor phase.
MOTOR.PITCH (PG 387)	NV	Sets the motor pitch.
MOTOR.POLES (PG 387)	NV	Sets the number of motor poles.
MOTOR.R (PG 388)	NV	Sets the stator winding resistance phase-phase in ohms.
MOTOR.RTYPE (pg 388)	NV	Defines the type of thermal resistor inside the motor.
MOTOR.TBRAKEAPP (PG 389)	NV	The delay time used for applying the motor brake.
MOTOR.TBRAKERLS (PG 389)	NV	The delay time used for releasing the motor brake.
MOTOR.TBRAKETO (pg 390)	NV	Brake apply timeout for vertical axis.
MOTOR.TEMP (pg 390)	R/O	Reads the motor temperature represented as the resistance of the motor PTC.
MOTOR.TEMPFAULT (pg 391)	NV	Sets the motor temperature fault level.
MOTOR.TEMPWARN (pg 391)	NV	Sets the motor temperature warning level.
MOTOR.TYPE (PG 392)	NV	Sets the motor type.
MOTOR.VMAX (PG 393)	NV	Sets the maximum motor speed.
MOTOR.VOLTMAX (PG 393)	NV	Sets the motor maximum voltage.
MOTOR.VOLTMIN (pg 394)	NV	Sets the minimum voltage for V/f control.
MOTOR.VOLTRATED (pg 395)	NV	Sets the motor rated voltage.
MOTOR.VRATED (pg 395)	NV	Sets the motor rated velocity (not maximum velocity).
Position Loop (PL)		
PL.CMD (PG 398)	NV	Reads the position command directly from the entry to the position loop.
PL.ERR (PG 398)	NV	Reads the position error present when the drive is controlling the position loop.
PL.ERRFTHRESH (pg 399)	NV	Sets the maximum position error.
PL.ERRMODE (pg 400)	R/W	Sets the type of following error warning and fault usage.
PL.ERRWTHRESH (pg 401)	NV	Sets the position error warning level.
PL.FB (PG 403)	R/O	Reads the position feedback value.
PL.FBSOURCE (pg 403)	NV	Sets the feedback source for the position loop.
PL.INTINMAX (PG 404)	NV	Limits the input of the position loop integrator by setting the input saturation.
PL.INTOUTMAX (PG 406)	NV	Limits the output of the position loop integrator by setting the output saturation.
PL.KI (PG 407)	NV	Sets the integral gain of the position loop.
PL.KP (PG 407)	NV	Sets the proportional gain of the position regulator PID loop.
PL.MODP1	R/W	Sets modulo range parameter.

PL.MODP2	R/W	Sets the beginning or end modulo range parameter.
PL.MODPDIR	R/W	Sets the direction for absolute motion tasks.
PL.MODPEN	R/W	Enables the modulo position.
Recorder (REC)		
REC.ACTIVE (PG 410)	R/O	Indicates if data recording is in progress (active).
REC.CH1 to REC.CH6 (pg 410)	R/W	Sets recording channels 1 to 6.
REC.DONE (PG 411)	R/O	Checks whether or not the recorder has finished recording.
REC.GAP (PG 411)	R/W	Specifies the gap between consecutive samples.
REC.NUMPOINTS (PG 411)	R/W	Sets the number of points to record.
REC.OFF (PG 412)	R/W	Turns the recorder OFF.
REC.RECPRMLIST (pg 412)	R/O	Reads the list of recordable parameters.
REC.RETRIEVE (PG 413)	R/O	Transfers all the recorded data to the communication channel.
REC.RETRIEVEDATA (pg 414)	R/W	Retrieves the recorded data without the header.
REC.RETRIEVEFRMT (pg 415)	R/W	Sets the format for recorded data output.
REC.RETRIEVEHDR (pg 415)	R/O	Retrieves the recorded header without the data.
REC.RETRIEVESIZE (pg 416)	R/W	Sets the number of samples that REC.RETRIEVEDATA returns.
REC.STOPTYPE (pg 416)	R/W	Sets the recorder stop type.
REC.TRIG (PG 417)	Command	Triggers the recorder.
REC.TRIGPARAM (pg 417)	R/W	Sets the parameter that triggers the recorder.
REC.TRIGPOS (pg 418)	R/W	Sets the trigger position in the recording buffer.
REC.TRIGPRMLIST (pg 419)	R/O	Reads the list of possible trigger parameters.
REC.TRIGSLOPE (PG 420)	R/W	Sets the trigger slope.
REC.TRIGTYPE (PG 420)	R/W	Sets the trigger type.
REC.TRIGVAL (PG 421)	R/W	Sets the trigger value.
Regen Resistor (REGEN)		
REGEN.POWER (PG 423)	R/O	Reads regen resistor's calculated power.
REGEN.POWERFILTERED (pg 423)	R/O	Returns a filtered version of REGEN.POWER .
REGEN.REXT (PG 424)	N/V	Sets the external, user-defined regen resistor resistance.
REGEN.TEXT (pg 424)	R/W	Sets the external regen resistor thermal protection time constant.
REGEN.TYPE (PG 425)	N/V	Sets the regen resistor type.
REGEN.WATTEXT (PG 426)	R/W	Sets the regen resistor's power fault level for an external regen resistor.
SD card (SD)		
SD.LOAD (pg 428)	Command	Loads the drive state (BASIC program and NV parameters) from the SD card to the AKD PDMM (AKD PDMMs equipped with IO option card only).

SD.SAVE (pg 428)	Command	Saves the drive state (BASIC program and NV parameters) to the SD card (AKD PDMMs equipped with IO option card only).
SD.STATUS (pg 429)	R/O	Reads the status of the SD card.
Service Motion (SM)		
SM.I1 (pg 431)	R/W	Sets service motion current 1; active in opmode 0 (torque) only.
SM.I2 (pg 431)	R/W	Sets service motion current 2; active in opmode 0 (torque) only.
SM.MODE (pg 431)	R/W	Sets the service motion mode.
SM.MOVE (pg 434)	Command	Starts the service motion.
SM.T1 (pg 434)	R/W	Sets the service motion time 1.
SM.T2 (pg 434)	R/W	Sets the service motion time 2.
SM.V1 (pg 435)	R/W	Sets service motion velocity 1; active in opmode 1 (velocity) and 2 (position).
SM.V2 (pg 436)	R/W	Sets service motion velocity 2; active in opmode 1 (velocity) and 2 (position).
STO		
STO.STATE (pg 439)	R/O	Returns the status of the safe torque off.
SWLS		
SWLS.EN (pg 441)	NV	Enables and disables software travel limit switches.
SWLS.LIMIT0 (pg 441)	NV	Sets the position of the software travel limit switch 0.
SWLS.LIMIT1 (pg 442)	NV	Sets the position of the software travel limit switch 0.
SWLS.STATE (pg 442)	R/O	Reads the actual status of software limit switches.
Bus Volatage (VBUS)		
VBUS.HALFVOLT (pg 445)	NV	Changing voltage thresholds for HV and MV Drives
VBUS.OVFTHRESH (pg 445)	R/O	Reads the over voltage fault level.
VBUS.OVWTHRESH (pg 446)	N/V	Sets voltage level for over voltage warning.
VBUS.RMSLIMIT (pg 446)	R/O	Reads the limit for the bus capacitors load.
VBUS.UVFTHRESH (pg 447)	R/O	Sets the under voltage fault level.
VBUS.UVMODE (pg 447)	NV	Indicates undervoltage (UV) mode.
VBUS.UVWTHRESH (pg 448)	NV	Sets voltage level for undervoltage warning.
VBUS.VALUE (pg 448)	R/O	Reads DC bus voltage.
Velocity Loop (VL)		
VL.ARPF1 TO VL.ARPF4 (pg 450)	R/W	Sets the natural frequency of the pole (denominator) of anti-resonance (AR) filters 1, 2, 3, and 4; active in opmodes 1 (velocity) and 2 (position) only.
VL.ARPQ1 TO VL.ARPQ4 (pg 451)	R/W	Sets the Q of the pole (denominator) of anti-resonance (AR) filter 1; active in opmodes 1 (velocity) and 2 (position) only.
VL.ARTYPE1 TO VL.ARTYPE4 (pg 452)	NV	Indicates the method used to calculate BiQuad coefficients; active in opmodes 1 (velocity) and 2 (position) only.
VL.ARZF1 TO VL.ARZF4 (pg 452)	R/W	Sets the natural frequency of the zero (numerator) of anti-resonance (AR)filter 1; active in opmodes 1 (velocity) and 2 (position) only.

VL.ARZQ1 TO VL.ARZQ4 (pg 453)	R/W	Sets the Q of the zero (numerator) of anti-resonance filter #1; active in opmodes 1 (velocity) and 2 (position) only.
VL.BUSFF (pg 454)	R/O	Displays the velocity loop feedforward value injected by the field-bus; active in opmodes 1 (velocity) and 2 (position) only.
VL.CMD (PG 455)	R/O	Reads the actual velocity command; active in opmodes 1 (velocity) and 2 (position) only.
VL.CMDU (PG 455)	R/W	Sets the user velocity command; active in opmodes 1 (velocity) and 2 (position) only.
VL.ERR (PG 456)	R/O	Sets the velocity error; active in opmodes 1 (velocity) and 2 (position) only.
VL.FB (PG 457)	R/O	Reads the velocity feedback; active in opmodes 1 (velocity) and 2 (position) only.
VL.FBFILTER (pg 457)	R/O	Filters VL.FB (pg 454) value; active in opmodes 1 (velocity) and 2 (position) only.
VL.FBSOURCE (pg 458)	NV	Sets feedback source for the velocity loop; active in opmodes 1 (velocity) and 2 (position) only.
VL.FBUNFILTERED (pg 458)	R/O	Reads the velocity feedback.
VL.FF (pg 459)	R/O	Displays the velocity loop overall feedforward value; active in opmodes 1 (velocity) and 2 (position) only.
VL.GENMODE (PG 459)	NV	Selects mode of velocity generation (Observer, d/dt); active in opmodes 1 (velocity) and 2 (position) only.
VL.KBUSFF (pg 460)	R/W	Sets the velocity loop acceleration feedforward gain value; active in opmodes 1 (velocity) and 2 (position) only.
VL.KI (pg 461)	NV	Sets the velocity loop integral gain for the PI controller; active in opmodes 1 (velocity) and 2 (position) only.
VL.KP (pg 462)	NV	Sets velocity loop proportional gain for the PI controller; active in opmodes 1 (velocity) and 2 (position) only.
VL.KVFF (pg 464)	R/W	Sets the velocity loop velocity feedforward gain value; active in opmodes 1 (velocity) and 2 (position) only.
VL.LIMITN (PG 464)	NV	Sets the velocity lower limit; active in opmodes 1 (velocity) and 2 (position) only.
VL.LIMITP (PG 466)	NV	Sets the velocity high limit; active in opmodes 1 (velocity) and 2 (position) only.
VL.LMJR (pg 466)	R/W	Sets the ratio of the estimated load moment of inertia relative to the motor moment of inertia; active in opmodes 1 (velocity) and 2 (position) only.
VL.MODEL (pg 467)	R/O	Reads the observer velocity signal; active in opmodes 1 (velocity) and 2 (position) only.
VL.OBSBW (pg 468)	NV	Sets the bandwidth of the observer in Hz.
VL.OBSMODE (pg 468)	NV	Sets the observer operating mode.
VL.THRESH (PG 468)	NV	Sets the over speed fault value; active in opmodes 1 (velocity) and 2 (position) only.
Wake and Shake (WS)		
WS.ARM	Command	Sets wake and shake to start at the next drive enable.
WS.CHECKMODE (pg 1)	R/W	Select the type of commutation check to execute after Wake and Shake finds a new commutation angle.
WS.CHECKT (pg 1)	R/W	Sets the amount of time a communication error must be present before an error is thrown.

WS.CHECKV (pg 1)	R/W	This parameter sets the velocity threshold which has to be exceeded to activate commutation monitoring.
WS.DISARM	Command	Cancels ARM requests and resets wake and shake to the IDLE state.
WS.DISTMAX	R/W	Sets maximum movement allowed for wake and shake.
WS.DISTMIN	R/W	Sets the minimum movement required for wake and shake.
WS.FREQ (pg 1)	R/W	Sets the sine frequency of excitation for WS.MODE 2.
WS.IMAX	R/W	Sets maximum current used for wake and shake.
WS.MODE	R/W	Sets the method used for wake and shake.
WS.NUMLOOPS	R/W	Sets the number of repetitions for wake and shake.
WS.STATE	R/O	Reads wake and shake status
WS.T	R/W	Sets wake and shake current-vector appliance time
WS.TDELAY1	NV	Delay for wake and shake timing
WS.TDELAY2	NV	Sets the delay for wake and shake timing.
WS.TDELAY3	NV	Sets the delay for wake and shake between loops in mode 0.
WS.TIRAMP (pg 1)	R/W	Sets the ramp time for the ramp up current in Wake & Shake mode 1.
WS.TSTANDSTILL (pg 1)	R/W	Sets the calming time of the motor for Wake & Shake mode 1.
WS.VTHRESH	NV	Defines the maximum allowed velocity for Wake & Shake

21 AIO Parameters

This section describes the AIO parameters.

21.1 AIO.ISCALE

General Information	
Type	NV Parameter
Description	Sets the analog current scale factor.
Units	A/V
Range	0.001 to 22.4 A/V
Default Value	0.001 A/V
Data Type	Float
See Also	Analog Input Block Diagram
Start Version End Version	M_01-00-00-000 M_01-01-01-000

Fieldbus Information

Description

AIO.ISCALE sets the analog current scale factor that scales the following:

- The analog input (AIN.VALUE) for DRV.OPMODE (pg 294) = 0 (analog torque mode), DRV.CMDSOURCE = 3 (analog).
- The analog output (AOUT.VALUE (pg 215)) for AOUT.MODE (pg 213) = 5 or 6. The value entered is the motor current per 1 V of analog input or output. This value may be either higher or lower than 100%, but the actual analog I/O will be limited by the application current limit (IL.LIMITN and IL.LIMITP).

21.2 AIO.PSCALE

General Information	
Type	NV Parameter
Description	Sets position scale factor.
Units	Rotary: counts/V,rad/V, deg/V, 16-bit counts/V Linear: counts/V, mm/V, um/V, 16-bit counts/V
Range	Rotary: 1 to 9,223,372,036,854,775 counts/V 0 to 13,493,026.816 rad/V 0 to 773,094,113.280 deg/V 0 to 140,737,488,355.327 16-bit counts/V Linear: 1 to 9,223,372,036,854,775 counts/V 0 to 2147483.648 mm/V 0 to 2147483648.000 um/V 0 to 140737488355.327 16-bit counts/V

General Information	
Default Value	Rotary: 1 counts/V 0 rad/V 0 deg/V 0 16-bit counts/V Linear: 1 count/V 0 rad/V 0 deg/V 0 counts16 bit/V
Data Type	Float
See Also	Analog Input Block Diagram
Start Version End Version	M_01-00-00-000 M_01-01-01-000

Fieldbus Information

Description

AIO.PSCALE is an analog position scale factor that scales:

1. The analog input (AIN.VALUE) for DRV.OPMODE (pg 294) = 2 , DRV.CMDSOURCE (pg 267) = 3 (analog position mode)

2. The analog output (AOUT.VALUE (pg 215)) for AOUT.MODE (pg 213) = 6, or 7. (actual position or position error) per 10 V of analog input or output.

21.3 AIO.VSCALE

General Information	
Type	NV Parameter
Description	Sets velocity scale factor.
Units	Rotary: rpm/V, rps/V, (deg/s)/V, (rad/s)/V Linear: counts/s/V, (mm/s)/V, (um/s)/V
Range	Rotary: 0.060 to 60,000 rpm/V 0.001 to 1,000 rps/V 0.359 to 360,000 (deg/s)/V 0.006 to 6,283.186 (rad/s)/V Linear: 0.001 to 1.000 counts/s/V 0.001*MOTOR.PITCH (pg 387) to 1,000.000*MOTOR.PITCH (pg 387) (mm/s)/V 0.998*MOTOR.PITCH (pg 387) to 1,000,000.000*MOTOR.PITCH (pg 387) (um/s)/V

General Information	
Default Value	Rotary: 0.060 rpm/V 0.001 rps/V 0.359 (deg/s)/V 0.006 (rad/s)/V Linear: 0.001 counts/s/V 0.001*MOTOR.PITCH (pg 387) (mm/s)/V 0.998*MOTOR.PITCH (pg 387) (um/s)/V
Data Type	Float
See Also	Analog Input Block Diagram
Start Version End Version	M_01-00-00-000 M_01-01-01-000

Variants Supported

Description

AIO.VSCALE is an analog velocity scale factor that scales:

- The analog input (AIN.VALUE) for DRV.OPMODE = 2 (analog velocity mode)
- The analog output (AOUT.VALUE) for AOUT.MODE = 1, 3, or 7. The value entered is the motor velocity per 10 V of analog input or output. This value may be either higher or lower than the application velocity limit (VL.LIMITP or VL.LIMITN), but the actual analog I/O will be limited by VL.LIMITP or VL.LIMITN.

22 AOUT Parameters

This section describes the AOUT parameters.

22.1 AOUT.CUTOFF

General Information	
Type	NV Parameter
Description	Sets the analog output low-pass filter cutoff frequency.
Units	Hz
Range	0 to 10,000 Hz
Default Value	0 Hz
Data Type	Float
See Also	Analog Output
Start Version	M_01-04-01

Fieldbus Information

Description

AOUT.CUTOFF sets the cutoff frequency in Hz for a single-pole low-pass filter on the Analog Output.

A value of 0 Hz will turn off the filter and will allow all frequencies to pass through.

The filter can be used with all modes of Analog Output.

Related Topics

Analog Output (pg 1)

22.2 AOUT.ISCALE

General Information	
Type	NV Parameter
Description	Sets the analog current scale factor.
Units	A/V
Range	0.001 to 22.4 A/V
Default Value	0.001 to 22.4 A/V
Data Type	Float
See Also	AOUT.VALUE (pg 215)
Start Version	M_01-01-01-000

Fieldbus Information

Description

AOUT.ISCALE sets the analog current scale factor that scales the analog output (AOUT.VALUE) for AOUT.MODE = 4 or 5. The value entered is the motor current per 10 V of analog input or output. This value may be either higher or lower than 100%, but the actual analog I/O will be limited by the application current limit (IL.LIMITN (pg 360) and IL.LIMITP (pg 361)).

Related Topics

Analog Output (pg 1)

22.3 AOUT.MODE

General Information	
Type	NV Parameter
Description	Sets the analog output mode.
Units	N/A
Range	0 to 11
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

SynqNet Information	
Range	12

Fieldbus Information

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	3470h/1	M_01-00-00-000

Description

AOUT.MODE sets the analog output functionality.

AOUT.MODE	Description
0	User variable. The analog output signal is determined by the user (using AOUT.VALUEU).
1	Actual velocity. The analog signal describes the current velocity value (VL.FB).
2	Velocity error. The analog signal describes the velocity error value.
3	Velocity command. The analog signal describes the velocity command value.
4	Actual current. The analog signal describes the actual current value.
5	Current command. The analog signal describes the current command value.
6	Actual position. The analog signal describes the current position value.
7	Position error. The analog signal describes the position error value.
8	Triangle wave. The analog signal is a triangle wave (sawtooth pattern).
9	Debug mode. In this mode the user can define a drive variable to monitor via the analog output (AOUT.VALUEU).
10	Unfiltered Velocity (VL.FBUNFILTERED)
11	Filtered Velocity - 10Hz Lowpass (VL.FBFILTER)

Example

You can use AOUT.MODE and AOUT.VALUEU to configure an output signal as follows:

```
-->AOUT.MODE 0
-->AOUT.VALUEU 5
-->AOUT.VALUEU 4.33
```

Related Topics

Analog Output (pg 1)

22.4 AOUT.OFFSET

General Information	
Type	NV Parameter
Description	Sets the analog output off-set.
Units	V
Range	-10 to +10 V
Default Value	0 V
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus Information

Description

This parameter sets the analog output offset.

Related Topics

Analog Output (pg 1)

22.5 AOUT.PSCALE

General Information	
Type	NV Parameter
Description	Sets the analog position scale factor.
Units	Rotary: counts/V,rad/V, deg/V, 16-bit counts/V Linear: counts/V, mm/V, µm/V, 16-bit counts/V
Range	Rotary: 1 to 9,223,372,036,854,775 counts/V 0 to 13,493,026.816 rad/V 0 to 773,094,113.280 deg/V 0 to 140,737,488,355.327 16-bit counts/V Linear: 1 to 9,223,372,036,854,775 counts/V 0 to 2,147,483.648 mm/V 0 to 2,147,483,648.000 µm/V 0 to 140,737,488,355.327 16-bit counts/V

General Information	
Default Value	Rotary: 1 counts/V 0 rad/V 0 deg/V 0 16-bit counts/V Linear: 1 counts/V 0 rad/V 0 deg/V 0 counts16 bit/V
Data Type	Float
See Also	AOUT.VALUE (pg 215)
Start Version	M_01-01-01-000

Fieldbus Information

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	3471h/0	M_01-00-00-000

Description

AOUT.PSCALE is an analog position scale factor that scales the analog output (AOUT.VALUE (pg 215)) for AOUT.MODE (pg 213) = 6, or 7 (actual position or position error) per 10 V of analog input or output.

Related Topics

Analog Output (pg 1)

22.6 AOUT.VALUE

General Information	
Type	R/O Parameter
Description	Reads the analog output value.
Units	V
Range	–10 to +10 V
Default Value	0
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus Information

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	3470h/2	M_01-00-00-000

Description

AOUT.VALUE reads the analog output value.

Related Topics

Analog Output (pg 1)

22.7 AOUT.VALUEU

General Information	
Type	R/W Parameter
Description	Sets the analog output value.
Units	V
Range	–10 to +10 V
Default Value	0
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus Information

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	3470h/3	M_01-00-00-000

Description

AOUT.VALUEU reads/writes the analog output value when AOUT.MODE (pg 213) = 0 (analog output signal is determined by the user).

Related Topics

Analog Output (pg 1)

22.8 AOUT.VSCALE

General Information	
Type	NV Parameter
Description	Sets the velocity scale factor for analog output.
Units	Depends on UNIT.VROTARY or UNIT.ACCLINEAR Rotary: rpm/V, rps/V, (deg/s)/V, [(custom units)/s]/V, (rad/s)/V Linear: counts/s/V, (mm/s)/V, (µm/s)/V, [(custom units)/s]/V

General Information	
Range	Rotary: 0.060 to 60,000 rpm/V 0.001 to 1,000 rps/V 0.359 to 360,000 (deg/s)/V 0.005 to 5,000 [(custom units)/s]/V 0.006 to 6,283.186 (rad/s)/V Linear: 0.001 to 1.000 counts/s/V 0.001*MOTOR.PITCH to 1,000.000*MOTOR.PITCH (mm/s)/V 0.998*MOTOR.PITCH to 1,000,000.000*MOTOR.PITCH(µm/s)/V 0.005 to 5,000 [(custom units)/s]/V
Default Value	Rotary: 0.060 rpm/V 0.001 rps/V 0.359 (deg/s)/V 0.005 [(custom units)/s]/V 0.006 (rad/s)/V Linear: 0.001 counts/s/V 0.001*MOTOR.PITCH (mm/s)/V 0.998*MOTOR.PITCH (µm/s)/V 0.005 [(custom units)/s]/V
Data Type	Float
See Also	AOUT.VALUE
Start Version	M_01-00-00-000

Variants Supported

Fieldbus Information

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	3470h/5	M_01-00-00-000

Description

AOUT.VSCALE is an analog velocity scale factor that scales the analog output (AOUT.VALUE) for AOUT.MODE = 1, 2, or 3. The value entered is the motor velocity per 10 V of analog output. This value may be either higher or lower than the application velocity limit (VL.LIMITP or VL.LIMITN), but the actual analog I/O will be limited by VL.LIMITP or VL.LIMITN.

Related Topics

Analog Output (pg 1)

23 AOUT2 Parameters

This section describes the AOUT2 parameters.

23.1 AOUT2.CUTOFF

General Information	
Type	NV Parameter
Description	Sets the analog output 2 low-pass filter cutoff frequency.
Units	Hz
Range	0 to 10,000 Hz
Default Value	0 Hz
Data Type	Float
See Also	Analog Output
Start Version	M_01-06-03-000

Description

AOUT2.CUTOFF sets the cutoff frequency in Hz for a single-pole low-pass filter on the Analog Output 2.

A value of 0 Hz will turn off the filter and will allow all frequencies to pass through.

The filter can be used with all modes of Analog Output 2.

Related Topics

1 Analog Output

23.2 AOUT2.MODE

General Information	
Type	NV Parameter
Description	Sets the analog output 2 mode.
Units	N/A
Range	0
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-06-03-000

Description

AOUT2.MODE sets the analog output functionality.

Mode 0: User variable. The analog output 2 signal is determined by the user (using AOUT.VALUEU (pg 220)).

Example

You can use AOUT.MODE and AOUT.VALUEU to configure an output signal as follows:

```
-->AOUT.MODE 0
-->AOUT.VALUEU 5
-->AOUT.VALUEU 4.33
```

Related Topics

1 Analog Output

23.3 AOUT2.OFFSET

General Information	
Type	NV Parameter
Description	Sets the analog output 2 offset.
Units	V
Range	-10 to +10 V
Default Value	0 V
Data Type	Float
See Also	N/A
Start Version	M_01-06-03-000

Description

This parameter sets the analog output 2 offset.

Related Topics

1 Analog Output

23.4 AOUT2.VALUE

General Information	
Type	R/O Parameter
Description	Reads the analog output 2 value.
Units	V
Range	–10 to +10 V
Default Value	0
Data Type	Float
See Also	N/A
Start Version	M_01-06-03-000

Description

AOUT2.VALUE reads the analog output 2 value.

Related Topics

1 Analog Output

23.5 AOUT.VALUEU

General Information	
Type	R/W Parameter
Description	Sets the analog output 2 value.
Units	V
Range	–10 to +10 V

General Information	
Default Value	0
Data Type	Float
See Also	N/A
Start Version	M_01-06-03-000

Description

AOUT2.VALUEU reads/writes the analog output 2 value when AOUT2.MODE (pg 219) = 0 (analog output signal is determined by the user).

Related Topics

1 Analog Output

24 BODE Parameters

This section describes the BODE parameters.

24.1 BODE.EXCITEGAP

General Information	
Type	R/W Parameter
Description	Controls how often the excitation is updated.
Units	Drive samples
Range	1 to 255 drive samples
Default Value	2 drive samples
Data Type	N/A
See Also	BODE.MODE (pg 227)
Start Version	M_01-00-00-000

Description

BODE.EXCITEGAP controls how often the excitation is updated. The excitation is updated every n drive samples, where n is BODE.EXCITEGAP. For example, if BODE.EXCITEGAP = 2, then the excitation is updated every 2/(16,000 Hz) = 1/8,000 Hz = 0.000125 sec. When measuring a system, update the excitation only as often as the data is recorded.

Example

Set excitation update rate to 8,000 Hz:

```
-->BODE.EXCITEGAP 2
```

Set excitation update rate to 4,000 Hz:

```
-->BODE.EXCITEGAP 4
```

Get excitation update rate (already set to 8000 Hz):

```
-->BODE.EXCITEGAP 2
```

Related Topics

1 Using the PST | 1 Using the Performance Servo Tuner: Advanced

Scope (pg 103)

1.2.1.5 Bode (set command source)

1 Settings (set command source)

F126 (pg 136)

Error: Invalid Bode plot mode for this function. (pg 154) and other errors)

24.2 BODE.FREQ

General Information	
Type	R/W Parameter
Description	Sets the frequency of the sine excitation source.
Units	Hz
Range	0 to 8,000 Hz
Default Value	0 Hz
Data Type	Float
See Also	BODE.MODE (pg 227) BODE.INJECTPOINT (pg 226), BODE.IAMP, BODE.VAMP (pg 232)

General Information	
Start Version	M_01-00-00-000

Description

BODE.FREQ sets the frequency of the sine excitation source in Hz. The sine excitation source is used to take frequency response measurements of a system.

Example

Setting up a sine excitation source of 0.2 A at 50 Hz:

```
-->BODE.INJECTPOINT 1
-->BODE.IAMP 0.2
-->BODE.FREQ 50.0
-->BODE.MODE 2
```

Related Topics

1 Using the PST

1 Using the Performance Servo Tuner: Advanced

Scope (pg 103)

1.2.1.5 Bode (set command source)

1 Settings (set command source)

F126 (pg 136)

Error: Invalid Bode plot mode for this function. (pg 154) (and others)

24.3 BODE.IAMP

General Information	
Type	R/W Parameter
Description	Sets current command value used during the Bode procedure.
Units	A
Range	+/- Combined drive and motor current limit
Default Value	0.2 A
Data Type	Float
See Also	BODE.INJECTPOINT (pg 226), BODE.FREQ (pg 223)
Start Version	M_01-00-00-000

Description

BODE.IAMP sets the amplitude of the excitation when in current mode as set in BODE.INJECTPOINT. When using BODE.MODE (pg 227) = 1 and BODE.INJECTPOINT (pg 226) = 1, this parameter will determine the level of noise injected to commanded current value.

Example

Set the excitation current to 0.2 A:

```
-->BODE.IAMP 0.2
```

Get the excitation current (already set to 0.2 A):

```
-->BODE.IAMP 0.200 [A]
```

Related Topics

1 Using the PST

Using the Autotuner: Advanced

Scope (pg 103)

1.2.1.5 Bode (set command source)

1 Settings (set command source)

F126 (pg 136)

Error: Invalid Bode plot mode for this function. (pg 154) (and others)

24.4 BODE.IFLIMIT

General Information	
Type	R/W Parameter
Description	Sets the current fault duration limit in seconds for the BODE.MODE 5 stability test.
Units	s
Range	0.001 to 60.000
Default Value	0
Data Type	Decimal
See Also	BODE.MODE (pg 227),BODE.MODETIMER (pg 230), BODE.IFTHRESH (pg 226), BODE.VFLIMIT (pg 233), BODE.VFTHRESH (pg 234)
Start Version	M_01-02-10-000

Description

When BODE.MODE is set to 5, the firmware monitors the drive current (IL.CMD (pg 349)). When IL.CMD goes above BODE.IFTHRESH (pg 226), an internal counter records the length of time IL.CMD was above BODE.IFTHRESH. If the internal counter reaches BODE.IFLIMIT, Fault 133 – Instability during Autotune will be generated.

The smaller BODE.IFLIMIT, the quicker Fault 133 will be generated when IL.CMD exceeds BODE.IFLIMIT.

Example

Set BODE.IFTHRESH to 6 Amps:

```
-->BODE.IFTHRESH 6
```

Set BODE.IFLIMIT to 0.500 seconds:

```
-->BODE.IFLIMIT 0.5
```

Set BODE.MODE to 5 to enable stability detection:

```
BODE.MODE 5
```

Related Topics

1 Using the PST

Using the Autotuner: Advanced

F133 (pg 136)

24.5 BODE.IFTHRESH

General Information	
Type	R/W Parameter
Description	Sets the current fault threshold for the BODE.MODE 5 stability test.
Units	A
Range	0.001 to DRV.IPEAK or MOTOR.IPEAK (whichever is lowest) A
Default Value	0 A
Data Type	Decimal
See Also	BODE.MODE (pg 227),BODE.MODETIMER (pg 230), BODE.VFLIMIT (pg 233), BODE.VFTHRESH (pg 234) , BODE.IFLIMIT (pg 225)
Start Version	M_01-02-10-000

Description

When BODE.MODE (pg 227) is set to 5, the firmware monitors the drive current (IL.CMD (pg 349)). When IL.CMD goes above BODE.IFTHRESH, an internal counter records the length of time IL.CMD was above BODE.IFTHRESH. If the internal counter reaches BODE.IFLIMIT (pg 225), Fault 133 (Instability during Autotune) is generated.

Example

Set BODE.IFTHRESH to 6 Amps:

```
-->BODE.IFTHRESH 6
```

Set BODE.IFLIMIT to 0.500 seconds:

```
-->BODE.IFLIMIT 0.5
```

Set BODE.MODE to 5 to enable stability detection:

```
BODE.MODE 5
```

Related Topics

1 Using the PST

Using the Autotuner: Advanced

F133 (pg 136)

24.6 BODE.INJECTPOINT

General Information	
Type	R/W Parameter
Description	Sets whether the excitation uses current or velocity excitation type.
Units	N/A
Range	0 to 2
Default Value	0
Data Type	Integer
See Also	BODE.IAMP (pg 224), BODE.MODE (pg 227), BODE.VAMP (pg 232)
Start Version	M_01-00-00-000

Description

BODE.INJECTPOINT sets whether the excitation uses current or velocity excitation type.

BODE.INJECTPOINT	Description
0	None
1	Current
2	Velocity

Example

Set BODE.INJECTPOINT to current:

```
-->BODE.INJECTPOINT 1
```

Get BODE.INJECTPOINT (already set to current):

```
-->BODE.INJECTPOINT 1
```

Related Topics

1 Using the PST

Using the Autotuner: Advanced

Scope (pg 103)

1.2.1.5 Bode (set command source)

1 Settings (set command source)

F126 (pg 136)

Error: Invalid Bode plot mode for this function. (pg 154) and others)

24.7 BODE.MODE

General Information	
Type	R/W Parameter
Description	Sets the mode of the excitation.
Units	N/A
Range	0 to 4
Default Value	0
Data Type	Integer
See Also	BODE.INJECTPOINT (pg 226)BODE.VAMP (pg 232)
Start Version	M_01-00-00-000

Description

BODE.MODE sets the mode of the excitation. The excitation can be set to the modes shown in the table below. BODE.MODE is always set to **None** when Ethernet communication is disconnected. The peak amplitude of the excitation is set by either BODE.IAMP or BODE.VAMP (depending on BODE.INJECTPOINT).

BODE.MODE is subject to a watchdog timer (BODE.MODETIMER) as follows:

- If BODE.MODETIMER is 0, then BODE.MODE is not affected.
- If BODE.MODETIMER is set to a value greater than 0, then BODE.MODE will be set to 0 (None) after the BODE.MODETIMER time milliseconds.
- If BODE.MODE is a nonzero value, and you reset BODE.MODE to another nonzero value, you will reset the watchdog timer. This mechanism is intended to turn off the excitation signal if you lose communication with the drive.

BODE.MODE	Description	Comments
0	None	Turns all excitation off
1	PRB	Uses Pseudo Random Binary (PRB) excitation. PRB is a signal that is always +/- peak amplitude, varying only in phase. PRB excitation results in a flat excitation frequency spectrum. PRB results in a high peak excitation amplitude, which can help minimize friction in a frequency response test. PRB excitation repeats every (2^BODE.PRBDEPTH) / BODE.EXCITEGAP drive samples. This repetition can be used to reveal the effects of friction.
2	Sine	Uses Sine excitation
3	Noise	Uses random noise excitation. Noise is a random number generator that varies between +/- peak amplitude.
4	Offset	Sets a torque offset equal to BODE.IAMP

Example

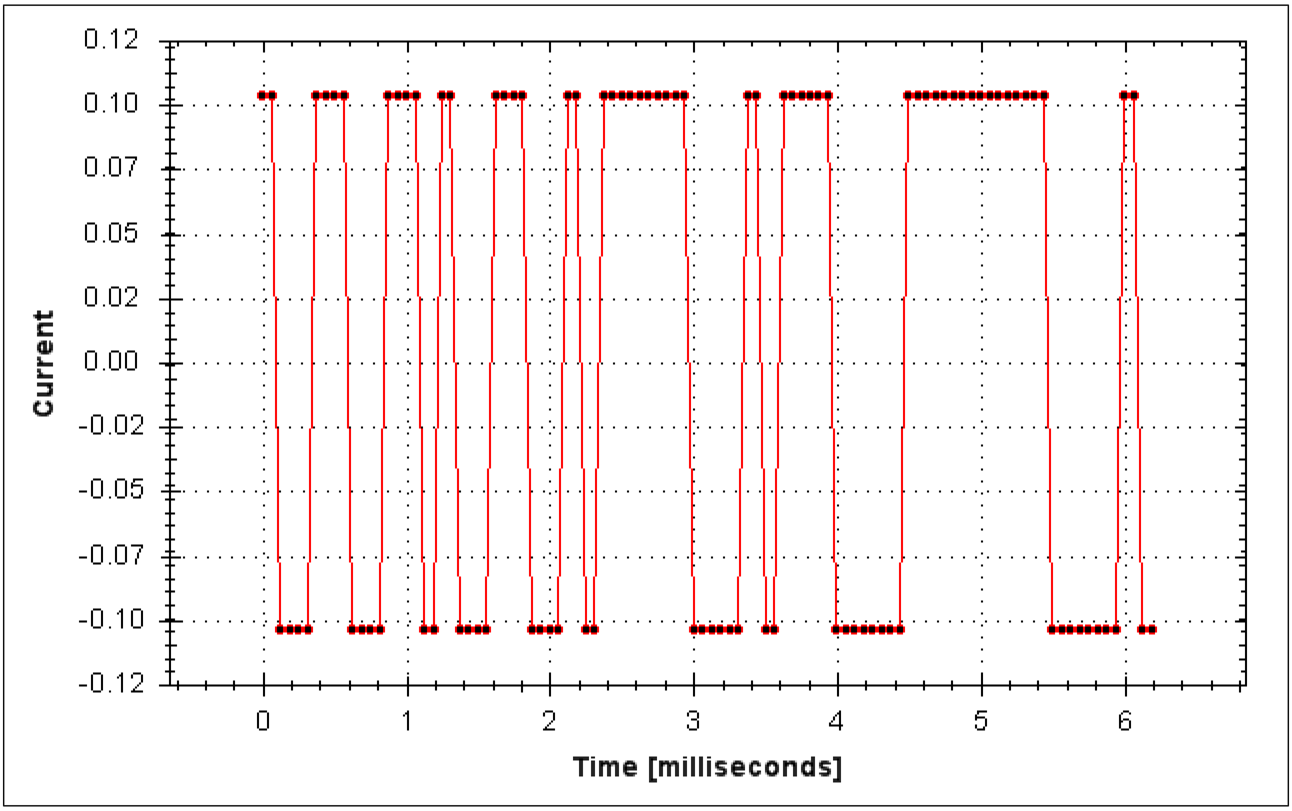
Set BODE.MODE to PRB:

```
-->BODE.MODE 1
```

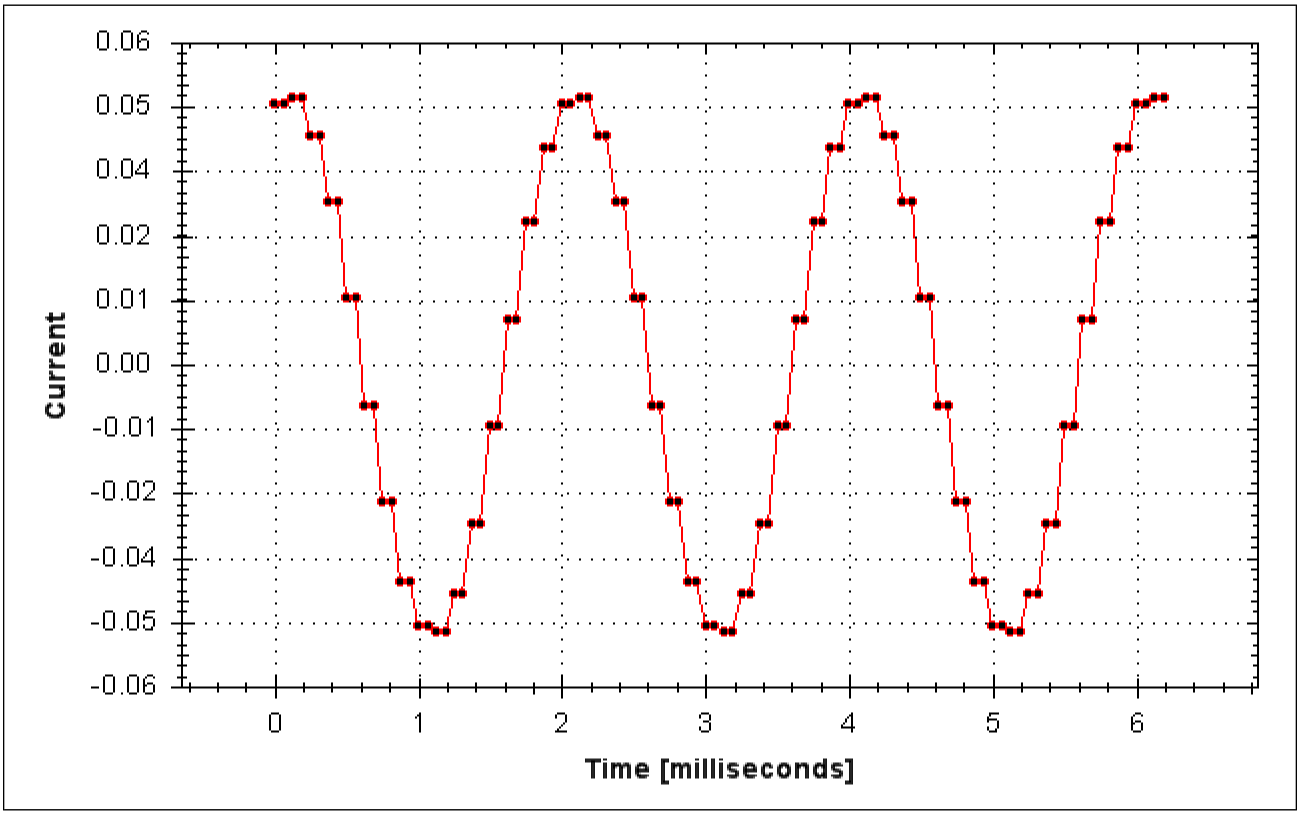
Get BODE.MODE (already set to PRB):

```
-->BODE.MODE 1
```

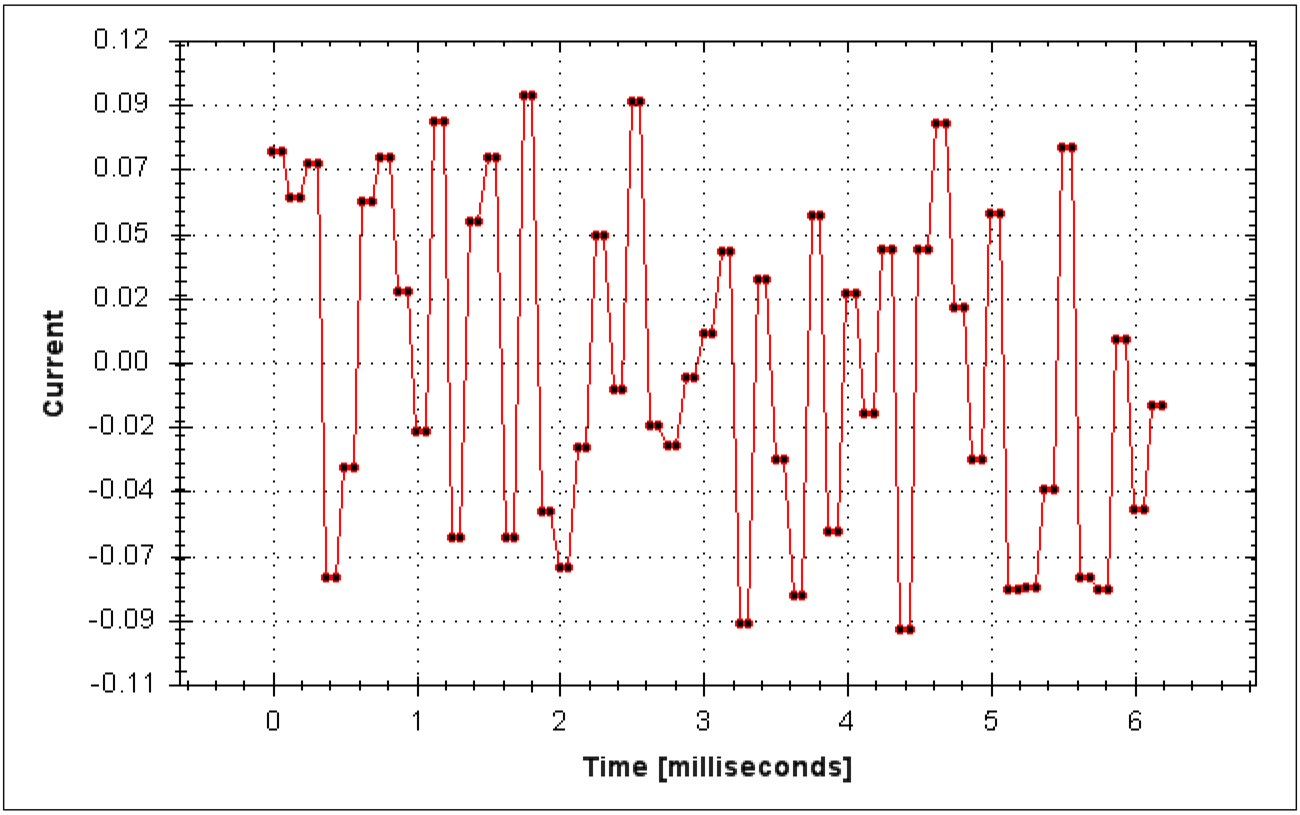
PRB excitation:



Sine excitation:



Noise excitation:



Related Topics

Using the PST

Using the Autotuner: Advanced

Scope (pg 103)
1.2.1.5 Bode (set command source)
1 Settings (set command source)
F126 (pg 136)
Error: Invalid Bode plot mode for this function. (pg 154) and others)

24.8 BODE.MODETIMER

General Information	
Type	R/W Parameter
Description	Sets the watchdog timer of the excitation.
Units	ms
Range	0 to 268,435,456
Default Value	0
Data Type	Integer
See Also	BODE.MODE (pg 227)
Start Version	M_1-03-00-000

Variants Supported

Fieldbus Information

Description

BODE.MODETIMER sets the watchdog timer for the excitation. This watchdog is used to automatically turn off the excitation of the system if communication is lost. It is highly recommended that you use the watchdog for any excitation measurements. The EWV Performance Servo Tuner and Bode tool automatically use these values, requiring no action from you.

If the BODE.MODETIMER is a nonzero value, the Bode watchdog is enabled. BODE.MODE will be set to 0 (None) after the BODE.MODETIMER value elapses. To reset the watchdog timer, reset BODE.MODE to a nonzero value.

BODE.MODETIMER	Comments
0	BODE.MODE is left at the value you set it to.
> 0	Uses pseudo random binary (PRB) excitation. PRB is a signal that is always +/- peak amplitude, varying only in phase. PRB excitation results in a flat excitation frequency spectrum. PRB also results in a high peak excitation amplitude, which can help minimize friction in a frequency response test. PRB excitation repeats every (2^BODE.PRBDEPTH)/BODE.EXCITEGAP drive samples. This repetition can be used to reveal the effects of friction.

Example

Disable BODE.MODETIMER:

-->BODE.MODETIMER //

Set to 0 to disable the watchdog

0

-->BODE.MODE // Observe starting state of the Bode mode

0

-->BODE.MODE 1 // Set Bode mode to PRB

-->BODE.MODE // Observe Bode mode state is the same after 0.5 seconds

1

-->BODE.MODE // Observe Bode mode state is the same after 10 seconds

1

Enable BODE.MODETIMER:

-->BODE.MODETIMER 1000 // Set watchdog to 1 second

-->BODE.MODE 1 // Set Bode mode to PRB

-->BODE.MODE // Observe Bode mode state is the same after 0.5 seconds

1

-->BODE.MODE // Observe Bode mode state has been set to zero after 1.0 seconds

0

Enable and reenable BODE.MODETIMER:

-->BODE.MODETIMER 2500 // Set watchdog to 2.5 seconds

-->BODE.MODE 1 // Set Bode mode to PRB

-->BODE.MODE // Observe Bode mode state is the same after 1.5 seconds

1

-->BODE.MODE 1 // Set Bode mode to PRB, resetting the watchdog timer to the original 2.5 second value

set above.

-->BODE.MODE // Observe Bode mode state is the same after 3.0 seconds after the original enabling of BODE.MODE 1

-->BODE.MODE // Observe Bode mode state has been set to zero after 4.0 seconds after the original enabling

of BODE.MODE

0

Related Topics

1 Using the Autotuner

Using the Autotuner: Advanced

Scope (pg 103)

1.2.1.5 Bode (set command source)

1 Settings (set command source)

F126 (pg 136)

Error: Invalid Bode plot mode for this function. (pg 154) and others)

24.9 BODE.PRBDEPTH

General Information	
Type	R/W Parameter

General Information	
Description	Sets the length of the PRB signal before it repeats.
Units	NA
Range	4 to 19
Default Value	19
Data Type	Integer
See Also	BODE.MODE (pg 227), BODE.INJECTPOINT (pg 226), BODE.IAMP (pg 224), BODE.VAMP (pg 232)
Start Version	M_01-00-00-000

Variants Supported

Fieldbus Information

Description

BODE.PRBDEPTH sets the length of the PRB signal before it repeats. This applies only when BODE.MODE = PRB. The PRB excitation will repeat after (2^BODE.PRBDEPTH) / BODE.EXCITEGAP drive samples.

Example

Set BODE.PRBDEPTH to 19:

```
-->BODE.PRBDEPTH 19
```

Get BODE.PRBDEPTH (already set to 19):

```
-->BODE.PRBDEPTH 19
```

Related Topics

1 Using the PST

Using the Autotuner: Advanced

Scope (pg 103)

1.2.1.5 Bode (set command source)

1 Settings (set command source)

F126 (pg 136)

Error: Invalid Bode plot mode for this function. (pg 154) and others)

24.10 BODE.VAMP

General Information	
Type	R/W Parameter
Description	Sets the amplitude of the excitation when in velocity mode.
Units	Rotary: rpm, rps, deg/s, rad/s Linear: counts/s, mm/s, µm/s

General Information	
Range	Rotary: 0.000 to 15,000.000 rpm 0.000 to 250.000 rps 0.000 to 90,000.000 degree/s 0.000 to 1,570.796 rad/s Linear: 0.000 to 1,073,741,824,000.000 counts/s 0.000 to 8,000.000 mm/s 0.000 to 8,000,000.000 µm/s
Default Value	0
Data Type	Float
See Also	BODE.MODE (pg 227), BODE.INJECTPOINT (pg 226)
Start Version	M_01-00-00-000

Variants Supported

Fieldbus Information

Description

BODE.VAMP sets the amplitude of the excitation when in velocity mode as set in BODE.I-NJECTPOINT.

Example

Set the excitation velocity to 100 RPM

```
-->BODE.VAMP 100
```

Get the excitation velocity(already set to 100 RPM)

```
-->BODE.VAMP
```

100.000 [rpm]

Related Topics

1 Using the PST

Using the Autotuner: Advanced

Scope (pg 103)

1.2.1.5 Bode (set command source)

1 Settings (set command source)

F126 (pg 136)

Error: Invalid Bode plot mode for this function. (pg 154) and others)

24.11 BODE.VFLIMIT

General Information	
Type	R/W Parameter
Description	Sets the velocity fault duration limit (seconds) for the BODE.MODE 5 stability test
Units	s

General Information	
Range	0.001 to 60.000
Default Value	0
Data Type	Decimal
See Also	BODE.MODE, BODE.MODETIMER, BODE.IFLIMIT, BODE.IFTHRESH, BODE.VFTHRESH
Start Version	M_01-02-10-000

Variants Supported

Fieldbus Information

Description

When BODE.MODE is set to 5, the firmware monitors the drive feedback velocity VL.FB. When VL.FB goes above BODE.VFTHRESH, an internal counter records the length of time VL.FB was above BODE.VFTHRESH. If the internal counter reaches BODE.VFLIMIT, Fault 133 – Instability during Autotune will be generated.

The smaller BODE.VFLIMIT, the quicker Fault 133 will be generated when VL.FB exceeds BODE.VFLIMIT.

Example

Set BODE.VFTHRESH to 10 RPM:

```
-->BODE.VFTHRESH 10
```

Set BODE.VFLIMIT to 0.500 seconds

```
-->BODE.VFLIMIT 0.5
```

Set BODE.MODE to 5 to enable stability detection

```
-->BODE.MODE 5
```

Related Topics

1 Using the PST

Using the Autotuner: Advanced

F133 (pg 136)

24.12 BODE.VFTHRESH

General Information	
Type	R/W Parameter
Description	Sets the current fault threshold for the BODE.MODE 5 stability test.
Units	Rotary: rpm, rps, deg/s, rad/s Linear: counts/s, mm/s, µm/s

General Information	
Range	Rotary: 0.000 to 15,000.000 rpm 0.000 to 250.000 rps 0.000 to 90,000.000 deg/s 0.000 to 1,570.796 rad/s Linear: 0.000 to 1,073,741,824,000.000 counts/s 0.000 to 8,000.000 mm/s 0.000 to 8,000,000.000 µm/s 0.000 to 1,250.000 custom units/s
Default Value	0
Data Type	Decimal
See Also	BODE.MODE, BODE.MODETIMER, BODE.IFLIMIT, BODE.IFTHRESH, BODE.VFLIMIT
Start Version	M_01-02-10-000

Variants Supported

Fieldbus Information

Description

When BODE.MODE is set to 5, the firmware monitors the drive feedback velocity VL.FB. When VL.FB goes above BODE.VFTHRESH, an internal counter records the length of time VL.FB was above BODE.VFTHRESH. If the internal counter reaches BODE.VFLIMIT, Fault 133 – Instability during Autotune will be generated.

The smaller BODE.VFLIMIT, the quicker Fault 133 will be generated when VL.FB exceeds BODE.VFLIMIT.

Example

Set BODE.VFTHRESH to 10 RPM:

```
-->BODE.VFTHRESH 10
```

Set BODE.VFLIMIT to 0.500 seconds:

```
-->BODE.VFLIMIT 0.5
```

Set BODE.MODE to 5 to enable stability detection:

```
-->BODE.MODE 5
```

Related Topics

1 Using the PST

Using the Autotuner: Advanced

F133 (pg 136)

25 CS Parameters

Controlled stop (CS) parameters set the values for the controlled stop process.

25.1 CS.DEC

General Information	
Type	NV Parameter
Description	Sets the deceleration value for the controlled stop process.
Units	Rotary: rps/s, rpm/s, deg/s^2, rad/s^2 Linear: counts/s^2, mm/s^2, µm/s^2
Range	Rotary: 0.002 to 833,333.333 rps/s 0.112 to 50,000,000.000 rpm/s 0.009 to 300,000,000.000 deg/s^2 0.012 to 5,235,987.968 rad/s^2 Linear: 16,000.000 to 3,579,139,408,000.000 counts/s^2 0.031*MOTOR.PITCH (pg 387) to 833333.333*MOTOR.PITCH (pg 387) mm/s^2 30.994*MOTOR.PITCH (pg 387) to 833333333.333*MOTOR.PITCH (pg 387) µm/s^2
Default Value	Rotary: 166.669 rps/s 10,000.000 rpm/s 60,000.000 deg/s^2 1,047.2 rad/s^2 Linear: 715,840,000.000 counts/s^2 166.714*MOTOR.PITCH (pg 387)MOTOR.PITCH (pg 387) mm/s^2 166,714.191*MOTOR.PITCH (pg 387)MOTOR.PITCH (pg 387) µm/s^2
Data Type	Float
See Also	CS.VTHRESH (pg 240), CS.TO (pg 238), DRV.DIS, DIN1.MODE TO DIN24.MODE (pg 247), DRV.DISMODE (pg 273), DRV.DISSOURCES (pg 274)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	3440h/1	M_01-00-00-000

Description

This parameter sets the deceleration value for the controlled stop process.

Related Topics

Controlled Stop (pg 65)

1 Digital Inputs and Outputs (Digital input mode 13)

Fault and Warning Messages (pg 135) (this table indicates faults for which a controlled stop occurs)

25.2 CS.STATE

General Information	
Type	R/O Parameter
Description	Returns the internal status of the controlled stop process.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	CS.DEC (pg 237), CS.VTHRESH (pg 240), CS.TO (pg 238)DRV.DISMODE (pg 273), DRV.DISSOURCES (pg 274)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	3441h/0	M_01-00-00-000

Description

CS.STATE returns the internal state machine value of the controlled stop.

0 = controlled stop is not occurring.

1 = controlled stop is occurring

Related Topics

Controlled Stop (pg 65)

1 Digital Inputs and Outputs (Digital input mode 13)

Fault and Warning Messages (pg 135) (this table indicates faults for which a controlled stop occurs)

25.3 CS.TO

General Information	
Type	NV Parameter
Description	Sets the time value for the drive velocity to be within CS.VTHRESH (pg 240).
Units	ms
Range	1 to 30,000 ms
Default Value	6 ms
Data Type	Integer
See Also	CS.DEC (pg 237), CS.VTHRESH (pg 240), CS.STATE, DRV.DIS, DIN1.MODE TO DIN24.MODE (pg 247), DRV.DISMODE (pg 273), DRV.DISSOURCES (pg 274)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	3440h/3	M_01-00-00-000

Description

CS.TO is the time value for the drive velocity to be within CS.VTHRESH (pg 240) before the drive disables.

Example

Set time value to 100 ms:

```
-->CS.TO 100
```

Related Topics

Controlled Stop (pg 65)

1 Digital Inputs and Outputs (Digital input mode 13)

Fault and Warning Messages (pg 135) (this table indicates faults for which a controlled stop occurs)

25.4 CS.VTHRESH

General Information	
Type	NV Parameter
Description	Sets the velocity threshold for the controlled stop.
Units	rpm, rps, deg/s
Range	Rotary: 0.000 to 15,000.000 rpm 0.000 to 250.000 rps 0.000 to 90,000.000 deg/s 0.000 to 1,570.796 rad/s Linear: 0.000 to 1,073,741,824,000.000 counts/s 0.000 to 8,000.000 mm/s 0.000 to 8,000,000.000 µm/s
Default Value	5 rpm
Data Type	Float
See Also	CS.DEC (pg 237), CS.TO (pg 238), CS.STATE (pg 238), DRV.DIS (pg 272), DIN1.MODE TO DIN24.MODE (pg 247), DRV.DISMODE (pg 273), DRV.DISSOURCES (pg 274)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT and CANopen	3440h/2	M_01-00-00-000

Description

CS.VTHRESH is the velocity threshold for the controlled stop algorithm.

Example

Set velocity threshold for controlled stop at 100 rpm:

```
-->CS.VTHRESH 100
```

Related Topics

Controlled Stop (pg 65)

1 Digital Inputs and Outputs (Digital input mode 13)

Fault and Warning Messages (pg 135) (this table indicates faults for which a controlled stop occurs)

26 DIN Parameters

This section describes the DIN parameters.

26.1 DIN.HCMD1 TO DIN.HCMD4

General Information	
Type	NV parameter
Description	A buffer of commands to be used in digital input "command buffer" mode.
Units	None
Range	A string of up to 128 characters
Default Value	<Empty>
Data Type	String
See Also	DINx.MODE, DINx.PARAM, DIN.LCMDx
Start Version	M_01-02-08-000

Description

DIN.HCMDx sets the string of commands to be used in the digital input mode command buffer. Digital input mode **9-Command buffer** can execute four different sets of command buffers.

Each set of command buffers contains two buffers:

- High buffer: Executes upon a rising edge of a digital input.
- Low buffer: Executes upon a falling edge of a digital input.

DIN.HCMDx sets the string for the four high buffers (depending on x).

Example

Set the command buffer mode to digital input 1:

```
DIN1.MODE 9
```

Set the first sets of buffers to digital input 1:

```
DIN1.PARAM 1
```

Set the command DRV.OPMODE 0 to the high buffer:

```
DIN.HCMD1 DRV.OPMODE 1
```

Now, upon a rising edge in digital input 1, the drive mode is 1.

Related Topics

Command Buffer

1 Digital Inputs and Outputs

26.2 DIN.LCMD1 to DIN.LCMD4

General Information	
Type	NV parameter
Description	A buffer of commands to be used in digital input "command buffer" mode.
Units	N/A
Range	A string of up to 128 characters
Default Value	Empty
Data Type	String
See Also	DIN1.MODE TO DIN24.MODE (pg 247), DIN1.PARAM TO DIN7.PARAM (pg 248), DIN.HCMD1 TO DIN.HCMD4 (pg 242)
Start Version	M_01-02-08-000

Description

DIN.LCMDx sets the string of commands to be used in the digital input mode command buffer. Digital input mode **9-Command buffer** can execute four different sets of command buffers.

Each set of command buffers contains two buffers:

- High buffer: Executes upon a rising edge of a digital input.
- Low buffer: Executes upon a falling edge of a digital input.

DIN.LCMDx sets the string for the four "low" buffers, depending on x.

Example

Set the command buffer mode to digital input 1:

```
DIN1.MODE 9
```

Set the first sets of buffers to digital input 1:

```
DIN1.PARAM 1
```

Set the command DRV.OPMODE 0 to the "low buffer":

```
DIN.LCMD1 DRV.OPMODE 0
```

Now, upon a falling edge in digital input 1, the drive mode is 0.

Related Topics

Command Buffer

1 Digital Inputs and Outputs

26.3 DIN.ROTARY

General Information	
Type	R/O Parameter
Description	Reads the rotary knob value.
Units	N/A
Range	0 to 99
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DIN.ROTARY reads the rotary knob value.

Related Topics

1 Digital Inputs and Outputs

26.4 DIN.STATES

General Information	
Type	R/O Parameter
Description	Reads the digital input states.
Units	N/A
Range	0000000 to 1111111
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

DIN.STATES reads the states of the seven digital inputs. The leftmost bit represents digital input 1 (DIN1) and the rightmost bit represents digital input 7 (DIN7).

Related Topics

1 Digital Inputs and Outputs

26.5 DIN1.FILTER TO DIN7.FILTER

General Information	
Type	R/W Parameter
Description	Filter mode for digital inputs 1 to 7.
Units	N/A

General Information	
Range	0 to 3
Default Value	1 for DIN1 and DIN2 2 for DIN3 to DIN7
Data Type	Integer
See Also	N/A
Start Version	M_01-03-07-000

Description

This parameter sets the digital input filter configuration for channel x when followed with the values defined below. DINx.FILTER retrieves this information when not followed by data.

Value	Description
DINX.FILTER 0	The drive digital input channel detects all input signals with an input pulse width of ≥ 40 ns (no filtering applied).
DINX.FILTER 1	The drive digital input channel detects all input signals with an input pulse width of ≥ 10.24 µs, ± 0.64 µs (fast filter applied).
DINX.FILTER 2	The drive digital input channel detects all input signals with an input pulse width of ≥ 163 µs, ± 10.24 µs (standard filter applied).
DINX.FILTER 3	The drive digital input channel detects all input signals with an input pulse width of ≥ 2.62 ms, ± 0.16384 ms (slow filter applied).

Related Topics

Digital Inputs and Outputs

26.6 DIN1.INV to DIN7.INV

General Information	
Type	RW Parameter
Description	Sets the indicated polarity of a digital input mode.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Boolean
See Also	N/A
Start Version	M_01-00-00-000

Description

Sets the indicated polarity of a digital input mode.

Example

```
DIN1.INV = 0 : Input is active high.
DIN1.INV = 1 : Input is active low.
```

Related Topics

Digital Inputs and Outputs

26.7 DIN1.MODE TO DIN24.MODE

General Information	
Type	R/W Parameter
Description	Sets the digital input modes.
Units	N/A
Range	0 to 24
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

AKD SynqNet Information	
Range	0

AKD BASIC Information	
Range	0, 1, 13, 18, 19

Fieldbus	Index/Subindex		Object Start Version
EtherCAT COE and CANopen	3562h/0	DIN1.MODE	M_01-00-00-000
	3565h/0	DIN2.MODE	
	3568h/0	DIN3.MODE	
	356Bh /0	DIN4.MODE	
	36F6h /0	DIN5.MODE	
	36F9h /0	DIN6.MODE	
	36FCh /0	DIN7.MODE	
	60FDh /0	DIN1.MODE TO DIN7.MODE	

Description

This parameter sets the functionality of the digital inputs 1 through 7. Digital inputs and corresponding X7 and X8 pin connectors are described in the *AKD PDMM Installation Manual*, section 8.16.4, Digital Inputs. The table below summarizes the digital input modes; for detailed descriptions of each mode, see Digital Inputs and Outputs (pg 1).

DINx.MODE	Description	Task
0	No function; off	0 - None
1	Fault reset	1 - Background
2	Start motion task (use DINx.PARAM for this task)	2 - 1 KHz
6	Start jog	6 - Background
7	Reserved	7 - None
8	Zero latch	8 - Background
9	Command buffer	9 - Background

DINx.MODE	Description	Task
10	Control fault relay	10 - Background
11	Home reference	11 - 1 kHz
12	Reserved	12 - None
13	Controlled stop (see Controlled Stop (pg 65))	13 - 1 kHz
14	Reserved	14 - None
15	Quick stop	15 - Background
17	Activate electronic gear position shift	17 - Background
18	Positive limit switch	18 - 4 kHz
19	Negative limit switch	19 - 4kHz
20	Brake release	20 - Background
21	Current limit	21 - 4 kHz
22	Opmode and Command Source switch	22 - Background
23	Change algebraic sign of the measured analog input voltage.	23 - 1 kHz
24	Reserved	24 - 1 kHz

Related Topics

Command Buffer

1 Digital Inputs and Outputs

1.3 Digital Inputs (includes detailed description of each input mode and examples)

Controlled Stop (pg 65)

Clearing Faults (pg 151)

F245 (pg 140)

CS Parameters (pg 236)

26.8 DIN1.PARAM TO DIN7.PARAM

General Information	
Type	R/W Parameter
Description	Sets a value used as an extra parameter for digital inputs nodes.
Units	N/A
Range	-9,223,372,036,854,775,000 to +9,223,372,036,854,775,000 **Note:** Varies based on DINx.MODE. See below.
Default Value	0
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter sets a value that is used as an extra parameter for digital inputs nodes.

Example

The digital input mode "Start motion task" is used to start a motion task. This mode uses an extra parameter as the ID of the motion task to be started.

Range

DINx.PARAM is used for various Digital Input modes. This causes the parameter's range to change based on the current Digital Input mode selected with the corresponding DINx.MODE

Listed below are the possible ranges for each Digital input mode.

If an input mode is not listed, then the default range above is used.

Input Mode	Min	Max	Notes
2	0	128	
6	Velocity Min	Velocity Max	This value changes based on user selected velocity units.
9	0	4	
17	Position Min	Position Max	This value changes based on user selected position units.
21	0	DRV.IPEAK	This value changes based on the specific AKD PDMMs drive limits.
22	0	32	See Digital Input Mode 22 for details.
23	0	2056	See Digital Input Mode 23 for details.

Dependency on DINx.MODE

Typically, the user can set DINx.PARAM before the corresponding DINx.MODE is set. However, if DINx.PARAM is set before DINx.MODE is set, and the value of DINx.PARAM is outside the new DINx.MODE's range, then DINx.PARAM will be set to zero.

Example:

DIN1.MODE is set to 0 by default

DIN1.PARAM is set to 200

DIN1.MODE is changed to 2 (execute motion taks)

200 is larger than the maximum for DIN1.MODE 2, so DIN1.PARAM will be set to 0 to prevent errors.

Related Topics

1 Digital Inputs and Outputs

26.9 DIN1.STATE TO DIN7.STATE

General Information	
Type	R/O Parameter
Description	Reads a specific digital input state.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DIN1.STATE to DIN7.STATE reads the state of one digital input according to the number identified in the command.

Related Topics

1 Digital Inputs and Outputs

26.10 DIN9.STATE to DIN11.STATE

General Information	
Type	NV Parameter
Description	Shows on selected pin if signal is high or low.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-05-00-000

Description

This parameter allows the user to see the actual level of the input signal, when the IO is set to input mode. Parameter value is 0 if signal is low and 1 if signal is high. DIOx.INV can affect the value in this register.

This parameter can be read at any time. The value is only guaranteed to correspond to the output on the X9 connector when DRV.EMUEMODE is set to 10 and the DIOX.DIR is 0.

Related Topics

DRV.EMUEMODE (pg 277)

26.11 DIN21.FILTER to DIN32.FILTER

General Information	
Type	R/W Parameter
Description	Filter mode for digital inputs 21 to 32.
Units	N/A
Range	0 to 3
Default Value	2
Data Type	Integer
See Also	N/A
Start Version	M_01-03-07-000

Description

This parameter sets the digital input filter configuration for channel x when followed with the values defined below. DINx.FILTER retrieves this information when not followed by data.

Value	Description
DINX.FILTER 0	The drive digital input channel detects all input signals with an input pulse width of ≥ 40 ns (no filtering applied).
DINX.FILTER 1	The drive digital input channel detects all input signals with an input pulse width of ≥ 10.24 µs, ± 0.64 µs (fast filter applied).
DINX.FILTER 2	The drive digital input channel detects all input signals with an input pulse width of ≥ 163 µs, ± 10.24 µs (standard filter applied).
DINX.FILTER 3	The drive digital input channel detects all input signals with an input pulse width of ≥ 2.62 ms, ± 0.16384 ms (slow filter applied).

Related Topics

Digital Inputs and Outputs

26.12 DIN21.STATE to DIN32.STATE

General Information	
Type	R/O Parameter
Description	Reads a specific digital input state.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DIN21.STATE to DIN32.STATE reads the state of one digital input according to the number identified in the command.

Related Topics

1 Digital Inputs and Outputs

27 DOUT Parameters

This section describes the DOUT parameters.

27.1 DOUT.CTRL

General Information	
Type	NV Parameter
Description	Sets the source of digital outputs (firmware or field-bus).
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Boolean
See Also	N/A
Start Version	M_01-00-00-000

SynqNet Information	
Range	1

Description

DOUT.CTRL sets the source of the digital outputs:

0 = Firmware controlled

1 = Fieldbus controlled

Related Topics

1.4 Digital Outputs

27.2 DOUT.RELAYMODE

General Information	
Type	R/W Parameter
Description	Indicates faults relay mode.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DOUT.RELAYMODE indicates the faults relay mode as follows:

If DOUT.RELAYMODE= 0 and faults exist, then the relay is open.

If DOUT.RELAYMODE= 0 and faults do not exist, then the relay is closed.

If DOUT.RELAYMODE = 1 and the drive is disabled, then the relay is open.

If DOUT.RELAYMODE = 1 and the drive is enabled, then the relay is closed.

Related Topics

1.4 Digital Outputs

27.3 DOUT.STATES

General Information	
Type	R/O Parameter
Description	Reads the state of the two digital outputs.
Units	N/A
Range	0 to 11
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Description

DOUT.STATES reads the states of the two digital outputs. The rightmost bit represents DOUT2 and the leftmost bit represents DOUT1.

Related Topics

1.4 Digital Outputs

27.4 DOUT1.MODE to DOUT19.MODE

General Information	
Type	NV Parameter
Description	Sets the digital output mode.
Units	N/A
Range	0 to 19
Default Value	0
Data Type	Integer
See Also	DOUT1.PARAM AND DOUT2.PARAM (pg 256)
Start Version	M_01-04-02-000

AKD BASIC Information	
Range	0, 8, 10, 11, 15

Description

DOUTx.MODE sets the functionality of the digital outputs. The table below summarizes the digital output modes; for detailed descriptions of each mode, see Digital Inputs and Outputs.

DOUTx.MODE	Description
0	User (default = 0)
1	Mains ready
2	Software limit switch reached
3	Move complete

DOUTx.MODE	Description
4	In position
5	Position greater than x
6	Position less than x
7	Drive produced warning
8	Drive enabled
9	Reserved
10	Motor brake
11	Drive produced fault
12	Absolute velocity greater than x
13	Absolute velocity less than x
14	Homing complete
15	PLS.STATE bits or connected
16	Description Command buffer Active
17	Mt in Position
19	Encoder Z pulse
20	No Controlled Stop Active
21	Fault Disabling Power Stage

Related Topics

1.4 Digital Outputs

27.5 DOUT1.PARAM AND DOUT2.PARAM

General Information	
Type	NV Parameter
Description	Sets extra parameters for the digital outputs.
Units	N/A
Range	0 **Note:** Range changes based on Digital Output Mode. See below.
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DOUT1.PARAM and DOUT2.PARAM set the extra parameter needed for the digital outputs calculations, respectively.

Range

DOUTx.PARAM is used for various Digital Output modes. This causes the parameter's range to change based on the current Digital Output mode selected with the corresponding DOUTx.MODE.

Below is a list of the possible range for each Digital Output Mode.

If an output mode is not listed, then the default range of 0 is used.

Input Mode	Min	Max	Notes
4	Position Min	Position Max	This value changes based on user selected position units.
5	Position Min	Position Max	This value changes based on user selected position units.
6	Position Min	Position Max	This value changes based on user selected position units.
12	0	Velocity Max	This value changes based on user selected velocity units.
13	0	Velocity Max	This value changes based on user selected velocity units.

Dependency on DOUTx.MODE

Since the default range of DOUTx.PARAM does not allow a user to enter a value, DOUTx.MODE must be set to a mode which uses DOUTx.PARAM before a value can be set.

Each time DOUTx.MODE is changed, DOUTx.PARAM is automatically set to zero to prevent unintended interactions.

Related Topics

1.4 Digital Outputs

27.6 DOUT1.STATE AND DOUT2.STATE

General Information	
Type	R/O Parameter
Description	Reads the digital output state.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DOUT1.STATE and DOUT2.STATE read the state of one digital output according to the value stated in the command.

Related Topics

1.4 Digital Outputs

27.7 DOUT1.STATEU AND DOUT2.STATEU

General Information	
Type	R/W Parameter
Description	Sets the state of the digital output node.

General Information	
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-01-01-000

Description

DOUT1.STATEU and DOUT2.STATEU set the state of the digital output node as follows:

0 = deactivated

1 = activated

DOUT1.STATEU and DOUT2.STATEU are used when DOUT1.MODE to DOUT19.MODE (pg 255) = 0 (user mode).

Related Topics

1.4 Digital Outputs

27.8 DOUT9.STATE to DOUT11.STATE

General Information	
Type	NV parameter
Description	Shows on selected pin if signal is high or low.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-05-00-000

Description

This parameter allows the user to see the actual level of the output signal, when the IO is set to output mode. Parameter value is 0 if signal is low and 1 if signal is high. DIOx.INV can affect the signals driven onto the X9 connector.

This parameter can be read at any time. The value is only guaranteed to correspond to the output on the X9 connector when DRV.EMUEMODE is set to 10 and the DIOX.DIR is 0.

Related Topics

DOUT9.STATEU to DOUT11.STATEU (pg 259)

DRV.EMUEMODE (pg 277)

27.9 DOUT9.STATEU to DOUT11.STATEU

General Information	
Type	NV Parameter
Description	Allows user to set level of selected pin to high or low.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-05-00-000

Description

This parameter allows the user to set the level of the output signal, when the IO is set to output mode. Parameter value is 0 if signal is low and 1 if signal is high. DIOx.INV can affect the signals driven onto the X9 connector.

This parameter can be written at any time. The value is only guaranteed to correspond to the output on the X9 connector when DRV.EMUEMODE is set to 10 and the DIOX.DIR is 0.

Example

The following settings set the direction for the differential signals on pin 4 and 5, so that the output will have a high level signal.

First set the following settings:

DRV.EMUEMODE 10

DIO10.DIR 1

DOUT10.STATEU 1

Then change the level of the signal:

DOUT.STATEU 0

or

DIO10.INV

Note: Inverting the signal will also alter the signal in input mode.

Related Topics

DOUT9.STATEU to DOUT11.STATEU

DRV.EMUEMODE (pg 277)

27.10 DOUT21.STATE to DOUT32.STATE

General Information	
Type	R/O Parameter
Description	Reads the digital output state.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DOUTx.STATE reads the state of one digital output according to the value stated in the command.

Related Topics

1.4 Digital Outputs

27.11 DOUT21.STATEU to DOUT32.STATEU

General Information	
Type	R/W Parameter
Description	Sets the state of the digital output node.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-01-01-000

Description

DOUTx.STATEU sets the state of the digital output node as follows:

0 = deactivated

1 = activated

DOUTx.STATEU is used when DOUT1.MODE to DOUT19.MODE (pg 255) = 0 (user mode).

Related Topics

1.4 Digital Outputs

28 DRV Parameters

This section describes the DRV parameters.

28.1 DRV.ACC

General Information	
Type	NV Parameter

General Information	
Description	Describes the acceleration ramp for the velocity loop.
Units	Depends on or Rotary: rps/s, rpm/s, deg/s², (custom units)/s², rad/s² Linear: counts/s², mm/s², µm/s², (custom units)/s²
Range	Note: The range and default values of (custom units)/s² units depend on the values of PIN and POUT. The range and default values listed in this table are derived from the default values of PIN and POUT. Rotary: 0.002 to 833,333.333 rps/s 0.112 to 50,000,000.000 rpm/s 0.009 to 300,000,000.000 deg/s² 0.155 to 4,166,666.752 (custom units)/s² 0.012 to 5,235,987.968 rad/s² Linear: 16,000.000 to 3,579,139,408,000.000 counts/s² 0.031*MOTOR.PITCH (pg 387) to 833,333.333*MOTOR.PITCH (pg 387) mm/s² 30.995*MOTOR.PITCH (pg 387) to 2,147,483.647*MOTOR.PITCH (pg 387) µm/s² 0.155 to 2,147,483.647 (custom units)/s²
Default Value	Note: The range and default values of (custom units)/s² units depend on the values of PIN and POUT. The range and default values listed in this table are derived from the default values of PIN and POUT. Rotary: 166.669 rps/s 10,000.000 rpm/s 60,000.000 deg/s² 833.333 (custom units)/s² 1,047.2 rad/s² Linear: 715,840,000.000 counts/s² 166.714*MOTOR.PITCH (pg 387) mm/s² 166,714.191*MOTOR.PITCH (pg 387) µm/s² 833.571 (custom units)/s²
Data Type	Float
See Also	DRV.DEC (pg 269), ,
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

Describes the acceleration ramp for the velocity central loop.

Related Topics

10.1 Limits

28.2 DRV.ACTIVE

General Information	
Type	R/O Parameter
Description	Reads the enable status of an axis.
Units	N/A
Range	0, 1, 3
Default Value	N/A
Data Type	Integer
See Also	DRV.EN (pg 281),DRV.DISSOURCES (pg 274)
Start Version	M_01-00-00-000

Description

DRV.ACTIVE reads the enable status of an axis as follows:

- DRV.ACTIVE = 0 drive disabled
- DRV.ACTIVE = 1 drive enabled
- DRV.ACTIVE = 3 drive enabled and in dynamic brake mode

There is no state 2.

When the drive is in state 3, the drive display shows a blinking decimal point.

If an axis is not enabled (DRV.ACTIVE is 0), but DRV.EN (pg 281) is 1 and the hardware enable is high, read the value of DRV.DISSOURCES (pg 274) to query the reason that the drive is not enabled.

Related Topics

10.2 Enable/Disable

28.3 DRV.BLINKDISPLAY

General Information	
Type	Command
Description	Causes the display to blink for 10 seconds.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.BLINKDISPLAY causes the drive display located on the front of the drive to blink for 10 seconds.

This command allows the user to identify the drive that is currently communicating with EWV[1].

28.4 DRV.BOOTTIME

General Information	
Type	R/O
Description	Returns the time when the current session booted up.
Units	Days:Hours:Minutes:Seconds
Range	N/A
Default Value	N/A
Data Type	String
Start Version	M_01-06-05-000

Description

DRV.BOOTTIME returns the time that the current session started running.This time includes total amount of time from all previous sessions.

This keyword can be used with DRV.RUNTIME to determine the length of time the drive has been running since it was last power cycled.

Session Time = DRV.RUNTIME – DRV.BOOTTIME

Related Topics

DRV.RUNTIME (pg 296)

28.5 DRV.CLRFAULTHIST

General Information	
Type	Command
Description	Clears the fault history log in the NV.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.FAULTHIST (pg 282)
Start Version	M_01-00-00-000

Description

DRV.CLRFAULTHIST clears the fault history from the nonvolatile memory of the drive.

This command erases all faults returned by DRV.FAULTHIST (pg 282).

[1]Embedded Workbench Views

28.6 DRV.CLRFAULTS

General Information	
Type	Command
Description	Tries to clear all active faults in the drive.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.FAULTS (pg 283), DRV.EN (pg 281), DRV.DIS (pg 272)
Start Version	M_01-00-00-000

Description

When DRV.CLRFAULTS is sent, the drive will try to clear all active faults. When a fault occurs, the fault is registered in the drive fault handler. DRV.CLRFAULTS clears the fault from the drive fault handler. However, if the fault still exists in the system, DRV.CLRFAULTS fails and the fault is re-registered in the fault handler.

If the DRV.CLRFAULTS succeeds, then the reply to DRV.FAULTS states that no faults exist. If the condition that triggered the fault is still present, the fault condition will remain. SeeFault and Warning Messages (pg 135) for details regarding the behavior of individual faults.

Note that executing a drive disable (DRV.DIS (pg 272)) followed by a drive enable (DRV.EN (pg 281)) has the same effect as executing DRV.CLRFAULTS.

Related Topics

Clearing Faults (pg 151)

28.7 DRV.CMDDELAY

General Information	
Type	Command
Description	Issues a delay before next command is executed.
Units	ms
Range	0 to 5,000 ms
Default Value	0 ms
Data Type	Float
See Also	N/A
Start Version	M_01-03-00-000

Description

This parameter is used when drive commands are used in a script and a delay is needed between the execution of two consecutive commands. DRV.CMDDELAY creates a delay in the execution of drive commands. In the period of time specified, no commands are executed. This feature is especially useful for command buffers.t

Example

If the script is:

```
DRV.EN
IL.CMDU 0.1
```

then DRV.CMDDELAY is used between the two entries to delay execution 5 ms until the drive is enabled:

```
DRV.EN
DRV.CMDDELAY 5
IL.CMDU 0.1
```

Related Topics

28.8 DRV.CMDSOURCE

General Information	
Type	NV Parameter
Description	Sets the command source (service, fieldbus, analog input, gearing, digital, or Bode).
Units	N/A
Range	0 to 5
Default Value	0
Data Type	Integer
See Also	DRV.OPMODE (pg 294)
Start Version	M_01-00-00-000

AKD PDMM SynqNet Information	
Range	0

AKD BASIC Information	
Range	0, 3, 5

Description

DRV.CMDSOURCE specifies the source of the command to the drive. DRV.OPMODE (pg 294) sets the operation mode to the relevant control loop.

DRV.CMDSOURCE values can be set as follows:

Value	Description
0	Service, TCP/IP command
1	Fieldbus command
2	Gearing command
3	Analog command
5	Program command

If DRV.CMDSOURCE is set to 5 then DRV.OPMODE must be set to 3.

DRV.CMDSOURCE can be changed while the drive is enabled or disabled. If you use the terminal to change the operation mode, then it is recommended that you disable the drive before changing the command source.

⚠WARNING If you change DRV.CMDSOURCE from the terminal while the drive is enabled, the system may experience a step change in command.

Example

To set the command source to the TCP/IP channel and the operation mode to velocity:

```
-->DRV.CMDSOURCE 0
-->DRV.OPMODE 1
```

Related Topics

28.9 DRV.CRASHDUMP

General Information	
Type	Command
Description	Retrieves diagnostic information after the drive crashes.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	N/A
Start Version	M_01-00-00-000

Description

Drives rarely crash, but if a crash occurs, information that can help diagnose the cause of a crash is saved to the nonvolatile (NV) memory within the drive. After the drive is restarted, you can use the DRV.CRASHDUMP command to retrieve this diagnostic information, which can be emailed to Kollmorgen for further support.

If the drive crashes (display flashes an F and three bars), it saves the diagnostic information to a specific block of the drive NV memory. The DRV.CRASHDUMP command then prints the diagnostic information from this NV memory block. Subsequent crash conditions will overwrite the NV memory block. Since the NV memory block is overwritten, but never erased, the DRV.CRASHDUMP command always shows the diagnostic information for the most recent crash.

28.10 DRV.DBILIMIT

General Information	
Type	NV Parameter
Description	Sets the maximum amplitude of the current for dynamic braking.
Units	Arms
Range	0 to minimum of drive peak current (DRV.IPEAK) and motor peak current (MOTOR.IPEAK).
Default Value	Minimum of drive continuous current (DRV.ICONT) and motor continuous current (MOTOR.ICONT).
Data Type	Float
See Also	DRV.DISMODE (pg 273)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter sets the maximum amplitude of the current for dynamic braking.

Example

Setting DRV.DBILIMIT to 2 limits the dynamic brake current to 2 Arms.

Related Topics

10.3 Controlled Stop

25 CS Parameters

10.4 Dynamic Braking

28.11 DRV.DEC

General Information	
Type	NV Parameter
Description	Sets the deceleration value for the velocity loop.
Units	Depends on or Rotary: rps/s, rpm/s, deg/s², (custom units)/s², rad/s² Linear: counts/s², mm/s², µm/s², (custom units)/s²
Range	Rotary: 0.002 to 833,333.333 rps/s 0.112 to 50,000,000.000 rpm/s 0.009 to 300,000,000.000 deg/s² 0.155 to 4,166,666.752 (custom units)/s² 0.012 to 5,235,987.968 rad/s² Linear: 16,000.000 to 3,579,139,408,000.000 counts/s² 0.031*MOTOR.PITCH to 833,333.333*MOTOR.PITCH mm/s² 30.994*MOTOR.PITCH to 833,333,333.333*MOTOR.PITCH µm/s² 0.155 to 4,166,666.667 (custom units)/s²
Default Value	Rotary: 166.669 rps/s 10,000.000 rpm/s 60,000.000 deg/s² 833.333 (custom units)/s² 1,047.2 rad/s² Linear: 715,840,000.000 counts/s² 166.71*MOTOR.PITCH4MOTOR.PITCH (pg 387) mm/s² 166,714.191*MOTOR.PITCHMOTOR.PITCH (pg 387) µm/s² 833.571 (custom units)/s²

General Information	
Data Type	Float
See Also	DRV.ACC (pg 262), , , DRV.OPMODE (pg 294)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

DRV.DEC sets the deceleration value for the velocity loop command (VL.CMDU (pg 455)) and for the analog

velocity command (). The operation mode (DRV.OPMODE (pg 294)) must be set to velocity mode for this command to function.

Related Topics

10.3 Controlled Stop

10.1 Limits

28.12 DRV.DIFVAR

General Information	
Type	R/O
Description	Lists all parameters which differ from their default value.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
Start Version	M_01-05-01-000

Description

This parameter displays all parameters which have different values than their default setting. The actual value of each parameter is directly shown after the command name and the corresponding default value is then shown in brackets.

This command also shows differences in parameters which hold a string, such as DRV.NAME.

Example

```
-->DRV.DIFVAR
DRV.EMUEMODE 10 (0)
DRV.NAME MyDrive(no-name)
FB1.ENCRES 0(1024)
IL.KP 50.009(24.811)
PL.KP 99.998(49.999)
VL.KP 0.108(0.000)
```

28.13 DRV.DIR

General Information	
Type	R/W Parameter
Description	Changes drive direction.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

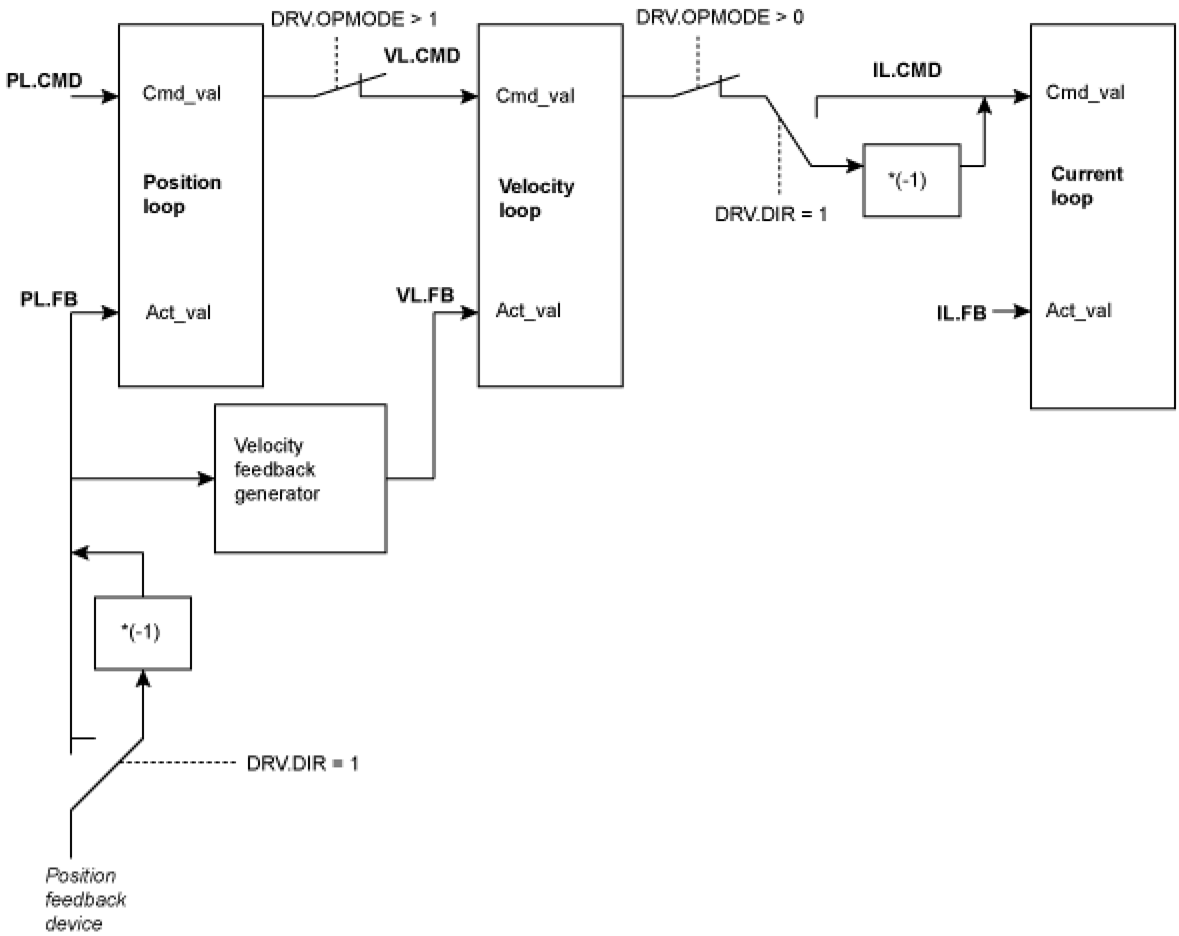
Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	352Ah/0	M_01-00-00-000

Description

DRV.DIR changes the direction of the motor by changing the algebraic sign of the current command and position feedback value according to the figure below.

Note the following when using DRV.DIR:

- You can only change the DRV.DIR command when the drive is disabled.
- The drive status changes to "Axis not homed" as soon as the DRV.DIR parameter changes value (see DRV.MOTIONSTAT).
- You must verify the settings of the hardware limit switches. If necessary, switch the positive and negative hardware limit switches by swapping the wires at the digital inputs.



28.14 DRV.DIS

General Information	
Type	Command
Description	Disables the axis (software).
Units	N/A
Range	N/A
Default Value	Analog drive software enabled. All other types of drive software disabled.
Data Type	N/A
See Also	DRV.EN (pg 281), DRV.DISSOURCES (pg 274), DRV.ACTIVE (pg 264), DRV.DISMODE (pg 273), DRV.DISTO (pg 275)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

DRV.DIS issues a software disable to the drive. The method by which the drive will be disabled (either immediately or with a ramp down first) is controlled by DRV.DISMODE (pg 273).

By querying the value of DRV.ACTIVE (pg 264), you can check whether the drive is currently enabled or disabled.

By querying the value of DRV.DISSOURCES (pg 274), you can check whether the software enable bit is high (software enabled was issued by executing DRV.EN) or the software enable bit is low (software disable was issued by executing DRV.DIS).

If DRV.DIS is commanded the emergency timeout is started. If the drive does not disable or activate dynamic brake within DRV.DISTO (pg 275), fault "F703" (=> p. 146) is reported.

Related Topics

15.3 Clearing Faults

10.3 Controlled Stop

28.15 DRV.DISMODE

General Information	
Type	NV Parameter
Description	Selects among disable immediately or stop and then disable options.
Units	N/A
Range	0 to 3
Default Value	0
Data Type	Integer
See Also	DRV.DBILIMIT (pg 268) ,DRV.DISTO (pg 275), CS.VTHRESH (pg 240)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

SynqNet Information	
Range	0 to 2

Description

DRV.DISMODE sets the drive reaction to a DRV.DIS (pg 272) command.

NOTE You must disable the drive in order to set DRV.DISMODE.

Value	Behavior
0	Disable axis immediately.
1	Use dynamic brake to ramp down. The drive remains in the dynamic brake state after the motor has stopped. The drive is disabled in the sense that it does not close the control loop and cannot perform a motion, but PWM stays active.
2	Use a controlled stop to ramp down and then disable the drive.
3	Use a controlled stop to ramp down, and then use dynamic brake. The drive remains in the dynamic brake state after the motor has stopped. The drive is disabled in the sense that it does not close the control loop and cannot perform a motion, but PWM stays active.

In all cases described above, if a brake is configured (MOTOR.BRAKE (pg 377)), the brake closes if VL.FB (pg 457) drops below CS.VTHRESH (pg 240).

⚠WARNING Be careful with vertical loads when modifying this parameter. Coordinate this parameter's correct setting properly with the drive brake settings. If these settings are not coordinated, then vertical loads may have no stopping or holding force when the drive is disabled and the load could fall.

Related Topics

10.3 Controlled Stop

25 CS Parameters

10.4 Dynamic Braking

28.16 DRV.DISSOURCES

General Information	
Type	R/O Parameter
Description	Returns the possible reason for a drive disable.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	Integer
See Also	DRV.ACTIVE, DRV.FAULTS, DRV.EN, DRV.DIS
Start Version	M_01-00-00-000

Description

DRV.DISSOURCES is a bitwise parameter that returns the status of possible causes of a drive disable. If this parameter is 0, then the drive is enabled.

The return value specific bits are as follows:

Bit	Status and Response
0	Software disable (execute DRV.EN to issue software enable)
1	Fault exists (read DRV.FAULTS to get the active faults)
2	Hardware disable (remote enable input is low)
3	In-rush disable (the in-rush relay is opened)
4	Initialization disable (the drive did not finish the initialization process)
5	Controlled stop disable from a digital input.
6	Field Bus requested disable (SynqNet and EtherNet/IP only)
7	AKD-C requested disable (AKD-N only)

Related Topics

Controlled Stop (pg 65)

28.17 DRV.DISSOURCESMASK

General Information	
Type	R/O parameter
Description	Returns a bitmap of all bits in DRV.DISSOURCES that can be set to one on a given drive.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	Integer
Start Version	M_01-07-00-000

Description

DRV.DISSOURCESMASK is a bitwise parameter that returns all possible causes of a drive disable. If a bit is set, the drive can be disabled for this reason.

The return value specific bits are as follows:

Bit	Status and Response
0	Software triggered disable
1	Fault exists
2	Hardware Enable input inactive
3	In-rush relay state prevents enable
4	Initialization not complete
5	Controlled stop requested from digital input
6	Field bus requested disable
7	AKD-C requested disable (AKD-N only)
8	Pre-charge successful (AKD-C only)

For most AKD models, this parameter will return the value 63.

For EtherNet/IP and SynqNet version of the drive, the parameter will return the value 127.

For AKD-N, this parameter will return the value 179.

For AKD-C, this parameter will return the value 286.

Related Topics

DRV.DISSOURCES (pg 274)

28.18 DRV.DISTO

General Information	
Type	R/W Parameter
Description	Sets the emergency timeout
Units	ms
Range	0 to 120,000 ms
Default Value	1,000 ms
Data Type	U32
See Also	DRV.DIS (pg 272), DRV.DISMODE (pg 273)

General Information	
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This timer starts when DRV.DIS (pg 272) is issued (regardless of the DRV.DIS (pg 272) origin). After this timeout elapses, the actual state of the drive is compared to the DRV.DISMODE (pg 273) setting. If the actual state does not match the DRV.DISMODE (pg 273) setting, a fault is reported and the hardware immediately executes the DRV.DISMODE setting (for instance, disable or activate dynamic brake). Setting DRV.DISTO to 0 will disable the timeout.

Related Topics

10.3 Controlled Stop

28.19 DRV.EMUECHECKSPEED

General Information	
Type	TBD
Description	Enable / disable motor velocity vs. maximum emulated encoder velocity monitoring function. See Fault F486 for details.
Units	None
Range	0 to 1
Default Value	0 (disabled)
Data Type	Boolean
See Also	DRV.EMUEMODE (pg 277)
Start Version	

Description

Enables comparison of the current motor velocity against the maximum speed the emulated encoder output can generate. The maximum speed is based on lines/rev (DRV.EMUERES) and the pulse width (DRV.EMUEPULSEWIDTH). If the motor velocity exceeds this speed, fault F486 is raised.

Related Topics

28.20 DRV.EMUEDIR

General Information	
Type	R/W Parameter
Description	Sets the direction of the emulated encoder output (EEO) signal.
Units	N/A

General Information	
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	DRV.EMUEMODE (pg 277)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter allows the user to change the direction of the emulated encoder output. DRV.DIR (pg 271) also affects the output direction (through an XOR, "exclusive or", operation). The drive uses DRV.DIR (pg 271) and DRV.EMUEDIR to decide the direction of the emulated encoder output. If DRV.DIR (pg 271) and DRV.EMUEDIR have the same value, then DRV.EMUEDIR is set to 0 (meaning an increase in the motor feedback will result an increase of the encoder emulation output and vice-versa). If these parameters have different values, then DRV.EMUEDIR is set to 1 (meaning an increase in the motor feedback will result in a decrease of the encoder emulation output and vice-versa).

28.21 DRV.EMUEMODE

General Information	
Type	R/W Parameter
Description	Sets the mode of the emulated encoder output (EEO) connector.
Units	N/A
Range	0 to 11
Default Value	0
Data Type	Integer
See Also	DRV.EMUERES (pg 280), DRV.EMUEZOFFSET (pg 280), DRV.EMUE-MTURN (pg 278)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

When the emulated encoder output (EEO) is configured to generate an absolute index pulse (DRV.EMUEMODE is 2, 7 or 9) this parameter and DRV.EMUEZOFFSET define the location of the Z pulse. DRV.EMUEMTURN is used to define which turn of the position range the Z pulse is located. DRV.EMUEZOFFSET is used to define the position of the Z pulse within one revolution.

This parameter sets the EEO connector to act as either an input or output as follows.

Setting	Function
0 (rec-ommended)	Input (see to select the type of inputs the secondary feedback will accept)
1	EEO Output, A/B with once per rev index
2	EEO Output, A/B with absolute index pulse.
3	Input, A/B signals (Deprecated)
4	Input, step and direction signals (Deprecated)
5	Input, CW/CCW (Up/Down) Signals (Deprecated)
6	Step/Dir with one Z-pulse/rev
7	Step/Dir with one absolute Z-pulse (depends on DRV.EMUEOFFSET and DRV.EMUETURN)
8	CW/CCW output with one Z-pulse/rev
9	CW/CCW output with one absoulte Z-pulse (depends on DRV.EMUEOFFSET and DRV.EMUETURN)
10	Allows the X9 connector to be used as a General Purpose I/O or SynqNet fieldbus controlled I/O
11	FB3 Input (Tertiary feedback is reported with FB3.P (pg 328)). Use FB3.MODE (pg 328) to select the feedback type.

Modes 3 to 5 are backwards compatible but deprecated. Refer to and instead.

NOTE

If you are using multi-turn or single tune absolute feedback devices the Z pulse from generated by the EEO will always be aligned with the same mechanical position of the of the primary feedback position. If you are using an incremental feedback device then the origin of the primary feedback is not at the same mechanical position each time the drive powers up.

Related Topics

28.22 DRV.EMUEMTURN

General Information	
Type	R/W Parameter
Description	Defines the location of the index pulse on the EEO (emulated encoder output) when DRV.EMUEMODE=2.
Units	revolutions
Range	0 to 4,294,967,295
Default Value	0
Data Type	Integer
See Also	DRV.EMUEMODE (pg 277), DRV.EMUERES (pg 280)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

When the emulated encoder output (EEO) is configured to generate an absolute index pulse (DRV.EMUEMODE is 2, 7 or 9) this parameter and DRV.EMUEZOFFSET define the location of the Z pulse. DRV.EMUEMTURN is used to define which turn of the position range the Z pulse is located. DRV.EMUEZOFFSET is used to define the position of the Z pulse within one revolution.

Note: If you are using multi-turn or single tune absolute feedback devices the Z pulse from generated by the EEO will always be aligned with the same mechanical position of the of the primary feedback position. If you are using an incremental feedback device then the origin of the primary feedback is not at the same mechanical position each time the drive powers up.

Related Topics

28.23 DRV.EMUEPULSEWIDTH

General Information	
Type	TBD
Description	Sets the encoder output pulse width for modes 6 to 7.
Units	us(microseconds)
Range	4.08 us to 2621.48 us
Default Value	4.08 us
Data Type	Float
See Also	DRV.EMUEMODE (pg 277)
Start Version	

Description

EMU Encoder Out Pulse Width Register

Sets pulse width for CW/CCW and Step and Direction modes. This parameter does not effect the A quad B mode. To calculate emuOutPulseWidth:

(Desired pulse width -40 nsec)/520 nsec

Requirement		DSFPGA-03-306
Bits	Bits	Description
11:0	emuOutPulseWidth	Read/Write 12 bit unsigned number minimum resolution is 520 nsec. Reset state – 0
15:12		reserved

- Register is in counts (12 bit)
- Register * 520ns + 40ns is the actual pulse with.
- Register = 1 = pulse width is 560ns = 0.56us (minimum value)
- For each register increment the pulse width is raised by 0.52us

Example

```
50 usecs pulse width
emuOutPulseWidth = (50 usecs - 40 nsec)/520 nsec = 96
actual pulse = 96*520 nsec + 40 nsec = 49.88 usecs.
```

Related Topics

28.24 DRV.EMUERES

General Information	
Type	R/W Parameter
Description	Sets the resolution of the EEO (emulated encoder output).
Units	lines/rev (when DRV.EMUEMODE (pg 277) = 1, 2, or 3) counts/rev (when DRV.EMUEMODE (pg 277) = 4 or 5)
Range	0 to 16,777,215 lines per revolution
Default Value	0 lines per revolution
Data Type	Integer
See Also	DRV.EMUEMODE (pg 277)
Start Version	M_01-00-00-000 (resolution increased from 65,535 to 16,777,215 in M_01-04-00-000)

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter sets the emulated encoder (EEO) resolution. DRV.EMUERES also defines how many lines are output for one revolution of the primary feedback (when this port is configured as an output), or how many lines will be considered a full revolution of the handwheel (when this port is configured as an input).

Related Topics

28.25 DRV.EMUEZOFFSET

General Information	
Type	R/W Parameter
Description	Sets the location of the EEO (emulated encoder output) index pulse (when DRV.EMUEMODE=1).
Units	1/65536 rev
Range	0 to 65535 rev
Default Value	0 rev
Data Type	Integer
See Also	DRV.EMUEMODE (pg 277), DRV.EMUEMTURN (pg 278)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

When emulated encoder output (EEO) multiturn is selected (DRV.EMUEMODE (pg 277)=1), this parameter is used by itself to define the position if the Z pulse within one revolution.When the primary feedback position (within a revolution) equals this value, an index pulse will output.

Also, if DRV.EMUEMODE=1 then this parameter is used in conjunction with DRV.EMUE-MTURN.

When the EEO is configured to generate an absolute index pulse (DRV.EMUEMODE is 2, 7 or 9) this parameter and DRV.EMUEZOFFSET define the location of the Z pulse. DRV.EMUE-MTURN is used to define which turn of the position range the Z pulse is located and DRV.EMU-EZOFFSET is used to define the position of the Z pulse within one revolution.

Note: If you are using multi-turn or single tune absolute feedback devices the Z pulse from generated by the EEO will always be aligned with the same mechanical position of the of the primary feedback position. If you are using an incremental feedback device then the origin of the primary feedback is not at the same mechanical position each time the drive powers up.

Related Topics

28.26 DRV.EN

General Information	
Type	Command
Description	Enables the axis (software).
Units	N/A
Range	N/A
Default Value	Analog drive software is enabled. All other types of drive software are disabled.
Data Type	N/A
See Also	DRV.DIS (pg 272), DRV.DISSOURCES (pg 274) DRV.ACTIVE (pg 264)
Start Version	M_01-00-00-000

Description

DRV.EN issues a software enable to the drive. You can query the value of DRV.ACTIVE (pg 264) to check whether the drive is currently enabled or disabled.

You can also query the value of DRV.DISSOURCES (pg 274) to check whether the software enable bit is high (software enabled was issued by executing DRV.EN) or the software enable bit is low (software disable was issued by executing DRV.DIS). If the drive software enable bit is low and DRV.EN is executed, then drive faults are automatically cleared during the software enable process.

Related Topics

15.3 Clearing Faults

10.2 Enable/Disable

28.27 DRV.ENDEFAULT

General Information	
Type	R/W Parameter
Description	Sets the default state of the software enable.
Units	N/A

General Information	
Range	0 to 1
Default Value	0
Data Type	Boolean
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV. ENDEFAULT sets the default state of the software enable on power up for drives without fieldbuses (DRV.CMDSOURCE other than 1).

NOTE It is recommended to not use this parameter with a BASIC program (keep DRV.ENDEFAULT = 0 / default value). Instead set DRV.SWENABLE = 1 at the beginning of the BASIC program.

Related Topics

Enable/Disable (pg 63)

28.28 DRV.FAULTHIST

General Information	
Type	R/O Parameter
Description	Reads the last 10 faults from NV memory.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.FAULTS (pg 283), DRV.CLRFAULTHIST (pg 265)
Start Version	M_01-00-00-000

Description

DRV.FAULTHISTORY returns the last 50 faults that occurred in the drive. The faults are shown with their fault number (which matches the one displayed on the drive display) and a time stamp that indicates when they last occurred.

Issue a DRV.CLRFAULTHIST (pg 265) to clear this fault log.

28.29 DRV.FAULT1 to DRV.FAULT10

General Information	
Type	R/O
Description	Location of fault codes for any active fault conditions.
Units	N/A
Range	Any supported fault code or 0.

General Information	
Default Value	N/A
Data Type	Integer
Start Version	tbd

Description

These parameters are holding registers where any active faults will be kept. A value of zero represents that no fault is present. Non-zero values correspond to specific fault codes in the drive (see fault and warning messages). The registers are populated in the order of when the fault occurs (DRV.FAULT1, DRV.FAULT2, DRV.FAULT3, and so on).

Notes:

- If DRV.FAULT1 value is 0, then the drive does not have any faults.
- Only active faults are shown. This is not a fault history.
- These registers are an alternative to the string type parameter DRV.FAULTLIST so that fieldbusses and AKD BASIC users have easier access to the details of the faults in the drive.
- Warnings are not shown in the registers, only faults.

Related Topics

| DRV.ACTIVE | DRV.WARNING1 to DRV.WARNING10 (pg 301)

28.30 DRV.FAULTS

General Information	
Type	R/O Parameter
Description	Reads the active faults.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.CLRFAULTS (pg 266), DRV.FAULTHIST (pg 282), DRV.CLRFAULTHIST (pg 265)
Start Version	M_01-00-00-000

Description

DRV.FAULTS returns a list of all currently active faults in the system, preceded by their fault number which matches the number displayed on the drive display.

To clear the faults, either issue a DRV.CLRFAULTS or issue a DRV.DIS followed by DRV.EN.

If no active faults are in the system, then after executing DRV.CLRFAULTS the value read by DRV.FAULTS is "No faults active".

Example

```
-->DRV.FAULTS
502: Bus under voltage.
-->
```

28.31 DRV.HANDWHEELSRC

General Information	
Type	NV Parameter
Description	Selects the feedback for handwheel operation.
Units	None
Range	2-3
Default Value	2
Data Type	U8
See Also	N/A
Start Version	M_01-05-08-000

Description

This command sets the feedback which will be used as the handwheel source. If the selected Feedback is incompatible with the selected emulated encoder mode, a warning will be displayed.

Feedback 3 is only supported on drives with model numbers similar to AKD PDMM-x-xxxxx-NBxx-xxxx and will only work with Endat 2.2 multiturn encoder.

28.32 DRV.HELP

General Information	
Type	R/O Parameter
Description	Reads the minimum, maximum, and default values for a specific parameter or command.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter returns more information about a specific parameter or command.

In most cases, except special parameters, this command tells you the minimum, maximum, default, and actual value of a parameter. Exceptions are commands that do not have these values (such as DRV.EN (pg 281)) or information commands (such as DRV.VER (pg 300)).

Related Topics

Terminal (pg 115)

28.33 DRV.HELPALL

General Information	
Type	R/O Parameter
Description	Retrieves the minimum, maximum, default, and actual values for all available parameters and commands.

General Information	
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter retrieves all information about all parameters and commands in the firmware. In most cases, DRV.HELPALL returns the minimum, maximum, default, and actual value for each parameter and command. Exceptions include parameters and commands that do not have these values (such as DRV.EN (pg 281)) or pure INFO commands (such as DRV.VER (pg 300)).

Related Topics

Terminal (pg 115)

28.34 DRV.HWENABLE

General Information	
Type	R/O
Description	Status of the hardware enable.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
Start Version	tbd

Description

Status of the Hardware Enable.

0 - not enabled

1 - enabled

Notes: This parameter reflects the status of the hardware enable only, not if the status of the power stage. The status of the power stage enable is determined by DRV.ACITVE.

Related Topics

DRV.DISSOURCES (pg 274) | DRV.ACTIVE

28.35 DRV.HWENDELAY

General Information	
Type	NV Parameter
Description	Delay time between inactive Hardware Enable input and drive disable.

General Information	
Units	Milliseconds
Range	0 to 167 ms
Default Value	0 ms
Data Type	Integer
Start Version	01-05-08-000

Description

By default, when the Hardware Disable input deactivates, the drive is immediately disabled. However, on a vertical axis this may allow the load to drop slightly before the brake is applied.

To ensure that the brake is applied before the power stage is disabled, set DRV.HWENDELAY to a value which allows the brake to apply fully.

While the brake is applying, the drive will also attempt to decelerate the motor using the standard drive disable settings such as DRV.DISMODE, CS.DEC, CS.VTHRESH and CS.TO.

NOTE Prior to version 01-05-08-000, the brake would only apply when velocity dropped below CS.VTHRESH or MOTOR.TBRAKETO expired. Starting with 01-05-08-000, the brake will now apply immediately when the Hardware Enable Input line is deactivated.

Related Topics

DRV.DISMODE (pg 273) | CS.DEC (pg 237) | CS.VTHRESH (pg 240) | CS.TO (pg 238) | MOTOR.TBRAKEAPP (pg 389)

28.36 DRV.HWENMODE

General Information	
Type	R/W Parameter
Description	Selects the action that the hardware enable digital input will perform.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-03-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-03-00-000

Description

This parameter selects the action that the hardware enable digital input will perform.

0 = The rising edge of the hardware enable will clear the drive faults.

1 = The rising edge of the hardware enable will not clear the drive faults.

The high/low state of the hardware enable is always used to control the active enable state of the drive.

Related Topics

10.2 Enable/Disable

28.37 DRV.ICONT

General Information	
Type	R/O Parameter
Description	Reads the continuous rated current value.
Units	Arms
Range	N/A
Default Value	N/A
Data Type	Float
See Also	DRV.IPEAK (pg 288)
Start Version	M_01-00-00-000

Description

DRV.ICONT returns the drive continuous rated current in Arms.

28.38 DRV.INFO

General Information	
Type	R/O Parameter
Description	Reads general information about the drive.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.INFO returns general information about the drive.

Example

```
Advanced Kollmorgen™ Drive
--------------------------------------------------------------------
---
Drive model : AKD-P00306-NACC-0000
Drive type : Position Indexer
Continuous current : 3.000 Arms
Peak current: 9.000 Arms
Voltage : 120/240 Vac
Option Board : Not applicable
Connectivity : EtherCAT
```

```
Product serial number: R-0939-00048
Hardware version : --
Mac address: 00-23-1B-00-50-F1
Processor ID: 0xE5040003

Firmware version: M_01-04-16-000_Z_2011-09-12_14-03-45_AP
Operational image : M_01-04-16-000_Z_2011-09-12_14-03-45_AP
Resident image : R_00-00-28-000
Revision : 19074
Source Location: local

FPGA Version: FP0003_0103_00_00
Operational image : FP0003_0103_00_00
Resident image : FPB003_0100_00_00
Size: 1600

Control board serial number : 4-0921-00196
Part number : 0
Revision : 7
Board ID : Standard

Power board serial number : 4-0922-00156
Part number : 0

TCP/IP IP address : 169.254.250.241
Subnet mask : 255.255.0.0
Default gateway : 0.0.0.0
DHCP server : 0.0.0.0

Temporary fieldbus type : EtherCAT
FPGA size : 1600
```

28.39 DRV.IPEAK

General Information	
Type	R/O Parameter
Description	Reads the peak rated current value.
Units	Arms
Range	N/A
Default Value	N/A
Data Type	Float
See Also	DRV.ICONT (pg 287)
Start Version	M_01-00-00-000

Description

DRV.IPEAK returns the drive peak rated current in Arms.

Related Topics

7.4 Foldback

28.40 DRV.IZERO

General Information	
Type	NV Parameter
Description	Sets the current that will be used during the DRV.ZERO procedure.
Units	Arms
Range	Drive peak current to 0 Arms
Default Value	0 Arms
Data Type	Float
See Also	DRV.ZERO (pg 302)
Start Version	M_01-00-00-000

Description

This parameter sets the current that is used during the DRV.ZERO (pg 302) procedure.

28.41 DRV.LIST

General Information	
Type	R/O Parameter
Description	Reads the list of available parameters and commands.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.LIST reads the list of available commands and parameters from the drive.

To filter this list, enter DRV.LIST followed by the prefix of the commands and parameters that you wish to display.

Example

Return a list of all available commands in the system:

```
-->DRV.LIST
```

Return all commands with the prefix DRV:

```
-->DRV.LIST DRV
```

28.42 DRV.LOGICVOLTS

General Information	
Type	R/O Parameter
Description	Reads the logic voltages.

General Information	
Units	mv , Ω
Range	N/A
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.LOGICVOLTS reads the logic voltages data of 1.2 V, 2.5 V, 3.3 V, 5 V, 12 V, –12 V, and 3.3 AV.

Example

Below is an example of the output for this command:

```
ch0 = 1.2V    : 1211 mv
ch1 = 2.5V      :2488 mv
ch2 = 3.3V      :3274 mv
ch3 = 5V        :4950 mv
ch4 = 12V     :11892 mv
ch5 = -12V     :-11912 mv
ch6 = 3.3AV    :3300 mv
ch7 = R ohm    :100000 ohm
```

28.43 DRV.MEMADDR

General Information	
Type	R/W Parameter
Description	Sets the read and write address.
Units	N/A
Range	N/A
Default Value	U8
Data Type	N/A
See Also	DRV.MEMDATA (pg 291)
Start Version	M_01-00-00-000

Description

DRV.MEMADDR sets the address that is used by DRV.MEMDATA. The input can be either an internal parameter of the drive or any direct address from the DSP address space (SDRAM, internal RAM, or asynchronous memory). The input value can be either decimal or hexadecimal with 0x prefix.

Type extension can be one of the following:

U8,S8,U16,S16,U32,S32,U64,S64.

Examples

Setting to an internal parameter:

```
-->DRV.MEMADDR CCommandHandler.Debug1
```

Setting to an internal address:

```
-->DRV.MEMADDR 0xffabcde.u16
```

28.44 DRV.MEMDATA

General Information	
Type	R/W Parameter
Description	Sets or reads a value from an internal address.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.MEMADDR (pg 290)
Start Version	M_01-00-00-000

Description

DRV.MEMDATA reads a value from the address that was set by DRV.MEMADDR (pg 290) or writes a value to this address. The input value can be either decimal or hexadecimal with 0x prefix.

Examples

Read a value from internal address:

```
-->DRV.MEMDATA 01
```

Write a hexadecimal value to an internal address:

```
-->DRV.MEMADDR 0x01
```

28.45 DRV.NAME

General Information	
Type	NV Parameter
Description	Sets and reads the name of the drive.
Units	N/A
Range	N/A
Default Value	No-Name
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

You can assign a unique name to any drive under the following conditions:

- Only use ASCII characters
- Max length of 10 characters
- No spaces in name

This name is one way to identify the drive in a multiple drive network (for instance, in a TCP/IP network on which multiple drives reside).

From the terminal screen, DRV.NAME returns the name of the drive as ASCII characters.

28.46 DRV.NVCHECK

General Information	
Type	R/O Parameter
Description	NV Parameter Check-sum
Units	None
Range	N/A
Default Value	N/A
Data Type	Integer
See Also	DRV.NVLIST
Start Version	M_01-04-12-000

Fieldbus	Index/Subindex	Object Start Version
EtherCat COE and CANopen	2019h/0	M_01-04-12-000

Description

DRV.NVCHECK returns a checksum of all the drives NV parameters. This parameter can be used to detect changes in parameters.

In some applications a master device needs to confirm the AKD PDMM drive contains an expected set of drive parameters. Reading and checking all the drive parameters individually is viable but this would be a long process involving many reads over the network. DRV.NVCHECK is a checksum on all the NV parameters and this parameter can be read in a single transaction. DRV.NVCHECK will return the same number if all the drive parameters match. If any of the drive parameters are changed then DRV.NVCHECK will return a different value.

28.47 DRV.NVLIST

General Information	
Type	R/O Parameter
Description	Lists the NV parameters and values from the RAM.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.NVLIST lists all the drive parameters that reside in NV memory.

The list includes each parameter name, followed by its current value from the RAM.

28.48 DRV.NVLOAD

General Information	
Type	R/O Parameter
Description	Loads all data from the NV memory of the drive into the RAM parameters.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.NVLOAD DRV.NVLIST
Start Version	M_01-00-00-000

Description

DRV.NVLOAD loads all data from the NV memory of the drive into the RAM parameters.

28.49 DRV.NVSAVE

General Information	
Type	Command
Description	Saves the drive parameters from the RAM to the NV memory.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.RSTVAR (pg 295)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

DRV.NVSAVE saves the current drive parameter values from the RAM to the NV memory.

The drive parameters that were saved to the NV are read from the NV on the next drive boot, causing the values to be automatically set to the saved values on every drive boot.

Executing DRV.RSTVAR does not modify the values of the NV, but instead sets the drive values in RAM to their defaults.

28.50 DRV.ONTIME

General Information	
Type	R/O Parameter
Description	Returns how long the drive has been running since last power up.
Units	Days:Hours:Minutes:Seconds
Range	N/A

General Information	
Default Value	N/A
Data Type	String
See Also	Returns how long the drive has been running since first activated. (pg 296)
Start Version	M_01-00-00-000

Description

This parameter returns the length of time that the drive has been running for the current session (since the last power up).

28.51 DRV.OPMODE

General Information	
Type	NV Parameter
Description	Sets the drive operation mode (current, velocity, or position).
Units	N/A
Range	0 to 2
Default Value	0
Data Type	Integer
See Also	DRV.CMDSOURCE (pg 267)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

DRV.OPMODE specifies the operation mode of the drive. You must also use DRV.CMDSOURCE to set the source of the command to the drive.

The operation mode values can be set as follows:

Mode	Description
0	Current (torque) operation mode
1	Velocity operation mode
2	Position operation mode

DRV.OPMODE can be changed while the drive is enabled or disabled. If you are using the terminal to change the operation mode, then it is recommended that you disable the drive before changing the operation mode. If you change the operation mode from the terminal while the drive is enabled, the system may experience a step change in demand.

Example

Set the source of the command to a TCP/IP channel and the desired operation mode to velocity:

```
-->DRV.CMDSOURCE 0
-->DRV.OPMODE 1
```

Related Topics

10.3 Controlled Stop

1 Current Loop

1 Velocity Loop

1 Position Loop

28.52 DRV.READFORMAT

General Information	
Type	R/W Parameter
Description	Sets the value returned to either decimal or hexadecimal.
Units	N/A
Range	10 or 16
Default Value	10
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.READFORMAT sets the return values type to either decimal or hexadecimal.

Format	Description
10	Sets the read values to decimal format
16	Sets the read values to hexadecimal format

28.53 DRV.RSTVAR

General Information	
Type	Command
Description	Sets default values in the drive without re-booting the drive and without resetting the NV memory.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	
Start Version	M_01-00-00-000

Description

DRV.RSTVAR causes the drive to return to the default values without the need to re-boot the drive first and without resetting the NV memory. Use DRV.RSTVAR to return to the default settings and recover a working drive.

28.54 DRV.RUNTIME

General Information	
Type	R/O Parameter
Description	Returns how long the drive has been running since first activated.
Units	Days:Hours:Minutes:Seconds
Range	N/A
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.RUNTIME returns the length of time that the drive has been running since it was first activated. This time includes the current session and the total amount of time from all previous sessions.

28.55 DRV.SETUPREQBITS

General Information	
Type	R/O Parameter
Description	Reads the bitwise set status of parameters that must be set before the drive can be enabled.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.SETUPREQLIST (pg 297), MOTOR.AUTOSET (pg 377)
Start Version	M_01-00-00-000

Description

This parameter returns the bitwise set status of parameters that needs to be set up before the drive can be enabled. Only when this parameter returns 0 can the drive be enabled.

Parameter	Bits
IL.KP	0x00000001
MOTOR.IPEAK	0x00000002
MOTOR.ICONT	0x00000004
MOTOR.VMAX	0x00000008
MOTOR.POLES	0x00000010
MOTOR.PHASE	0x00000020

Please note that if MOTOR.AUTOSET (pg 377) is set to 1 (parameters automatically calculated from motor ID data), then all values in the list will be initialized from the feedback device. Otherwise, the parameters must be set manually.

28.56 DRV.SETUPREQLIST

General Information	
Type	R/O Parameters
Description	Reads the list of parameters that must be set before the drive can be enabled.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	DRV.SETUPREQBITS (pg 296), MOTOR.AUTOSET (pg 377)
Start Version	M_01-00-00-000

Description

This parameter returns the list of parameters that must be set before the drive can be enabled and also whether or not each one of those parameters is set. Only when all commands have value of 0 can the drive be enabled.

Please note that if MOTOR.AUTOSET (pg 377) is set to 1 (parameters automatically calculated from motor ID data), then all values in the list will be initialized from the feedback device. Otherwise, the parameters must be set manually.

Example

```
-->DRV.SETUPREQLIST
IL.KP 0
MOTOR.ICONT 0
MOTOR.IPEAK 0
MOTOR.POLES 0
-->
```

28.57 DRV.STOP

General Information	
Type	Command
Description	This command stops all drive motion.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This command stops all drive motion.

28.58 DRV.TEMPERATURES

General Information	
Type	R/O Parameter
Description	Reads the temperature of drive components.
Units	°C
Range	55 to 125 °C
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0 /0	M_01-00-00-000

Description

DRV.TEMPERATURES reads the temperature in different parts of the drive (power and control boards). The temperature is read from temperature sensors located in the drive.

Example

Below is an example of the output for this command :

```
Control Temperature: 39 °C
Power1  Temperature: 31 °C
Power2  Temperature: Sensor does not exist.
Power3  Temperature: Sensor does not exist.
```

28.59 DRV.TIME

General Information	
Type	R/W
Description	A continuous time counter in the drive.
Units	Milliseconds
Range	0 to 4294967295 (~ 49 days)
Default Value	N/A
Data Type	Integer
Start Version	tbd

Description

A continuous time counter in the drive. The timer starts at zero and counts up until it rolls over. If a new value is written to the timer, it continues to count up starting at the written value. The DRV.TIME value is set to zero when the AKD BASIC is powered on.

Related Topics

DRV.RUNTIME (pg 296) | WHEN.DRV.TIME

28.60 DRV.TYPE

General Information	
Type	R/O on analog, EtherCAT and CANopen models R/W on the CC drive model.
Description	Selects the operational fieldbus on CC drive models.
Units	N/A
Range	0 to 7
Default Value	2
Data Type	Integer
See Also	FBUS.TYPE (pg 339), DRV.INFO (pg 287)
Start Version	M_01-03-00-000

Description

DRV.TYPE allows you to select the operational fieldbus for your drive. This parameter is read-write on the CC drive models and read-only on the analog, EtherCAT, and CANopen drive models. To change the operational fieldbus of your drive:

1. Set DRV.TYPE to one of the following values:

   0 = Analog (no EtherCAT or CANopen) with no position indexer functionality.

   1 = Analog (no EtherCAT or CANopen) with position indexer functionality.

   2 = EtherCAT

   3 = CANopen

   4 = SynqNet

   5 = EtherNet/IP

   6 = BASIC Langauge (not fieldbus)

   7 = Profinet
2. Save the parameters to the NV memory on the drive by issuing the DRV.NVSAVE command
3. Power cycle the 24 V supply to the drive. When the drive has finished powering up, it will be working with the new selection.

Changing DRV.TYPE does not immediately change the type of the drive fieldbus selection. You must power cycle the drive to start the drive with the selected functionality.

You cannot use EtherCAT and CANopen at the same time. Use FBUS.TYPE or DRV.INFO to identify the fieldbus currently in use.

DRV.TYPE does not change if you use DRV.RSTVAR.

Related Topics

AKD PDMM Models (pg 19)

28.61 DRV.VER

General Information	
Type	R/O Parameter
Description	Reads the drive version.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.VER reads both FPGA and firmware versions.

The version data presented is hard coded in the firmware code.

Example

Below is an example of the output for this command:

```
Danaher Motion - Digital Servo Drive
-------------------------------------
FPGA version : FP0004_0001_00_07
Firmware Version : M_0-0-15_T_2009-01-19_10-36-28_IR
```

28.62 DRV.VERIMAGE

General Information	
Type	R/O Parameter
Description	Returns the version data from each image.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.VERIMAGE reads the versions of the different images in the drive. This parameter returns the version data from each image .i00 file.

Example

Below is an example of the output for this parameter:

```
Danaher Motion - Digital Servo Drive
------------------------------------
```

```
Resident Firmware: R_0-0-11
Operational Firmware: M_0-0-15
Resident FPGA: FPB004_0001_00_07
Operational FPGA : FP0004_0001_00_07
```

28.63 DRV.WARNING1 to DRV.WARNING10

General Information	
Type	R/O
Description	Location of fault codes for any active warning conditions.
Units	N/A
Range	Any supported fault code or 0
Default Value	N/A
Data Type	Integer
Start Version	tbd

Description

These parameters are holding registers where any active warnings will be displayed. A value of zero represents that no warning is present. Non-zero values correspond to specific warning codes in the drive (see fault and warning messages). The registers are populated in the order of when the warning occurs (DRV.WARNING1, DRV.WARNING2, DRV.WARNING3, and so on).

Notes:

- If DRV.WARNING1 value is 0, then the drive does not have any faults.
- Only active warnings are shown. This is not a warning history.
- These registers are an alternative to the string type parameter DRV.WARNINGS so that fieldbuses and AKD BASIC user programs have integer-type parameters to access to the details of the warnings in the drive.
- Faults are not shown in the registers, only warnings.

Related Topics

DRV.FAULT1 to DRV.FAULT10 (pg 282) |

28.64 DRV.WARNINGS

General Information	
Type	R/O Parameter
Description	Reads the active warnings.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A

General Information	
See Also	N/A
Start Version	M_01-00-00-000

Description

DRV.WARNINGS returns a list of all currently active warnings in the system.

28.65 DRV.ZERO

General Information	
Type	R/W Parameter
Description	Sets the zero mode. The procedure is activated when the drive is enabled.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	DRV.IZERO (pg 289)
Start Version	M_01-00-00-000

Description

The zero procedure is a sequence in which phase commutation is initialized. During this procedure, the motor is held at a certain known electrical position (by applying a current defined by DRV.IZERO (pg 289)). After the motor rests at this position, the commutation angle is calculated and set automatically.

29 EIP Parameters

This section describes the EIP parameters.

29.1 EIP.CONNECTED

General Information	
Type	R/O Parameter
Description	Returns state of EtherNet/IP connection.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer

Fieldbus Information

Description

Returns state of EtherNet/IP connection.

Value	Description
0	Not connected
1	Connected

Related Topics

EtherNet/IP View (pg 1)

29.2 EIP.POSUNIT

General Information	
Type	R/W
Description	Unit scaling for Position values over EtherNet/IP.
Units	N/A
Range	0 to 4,294,967,295
Default Value	65536
Data Type	Integer
Start Version	M_01-05-00-000

Description

Position values are scaled according to the Ethernet/IP Position Controller Device standard. One “Position Units” scaling value is defined, which gives the number of actual position feedback counts (at 32 bits per revolution) equal to one position unit.

From Workbench, this scaling parameter is visible in the Ethernet/IP screen or as EIP.POSUNIT in the terminal. From Ethernet/IP, this value can be accessed at attribute 0x04 Position Units of the Position Controller object.

The default value is 2^16 = 65536, which provides 2^32 / 2^16 = 2^16 counts per revolution. A value of 1 would provide 2^32 / 1 = 2^32 counts per revolution.

Related Topics

EIP.PROFUNIT (pg 305)

29.3 EIP.PROFUNIT

General Information	
Type	R/W
Description	Unit scaling for Velocity and Acceleration values over EtherNet/IP.
Units	N/A
Range	0 to 4,294,967,295
Default Value	65536
Data Type	Integer
Start Version	M_01-05-00-000

Description

Velocity and Acceleration values are scaled according to the EtherNet/IP Position Controller Device standard. One “Profile Units” scaling value is defined, which affects both velocity and acceleration.

For velocity values, Profile Units gives the number of actual position feedback counts (at 32 bits per revolution) per second equal to one velocity unit. For acceleration values, Profile Units gives the number of actual position feedback counts (at 32 bits per revolution) per second^2 equal to one acceleration unit.

From Workbench, this scaling parameter is visible in the EtherNet/IP screen or as EIP.PROFUNIT in the terminal. From EtherNet/IP, this value can be accessed at attribute 0x05 Profile Units of the Position Controller object.

The default value is 2^16 = 65536, which provides 2^32 / 2^16 = 2^16 counts per second per revolution. A value of 1 would provide 2^32 / 1 = 2^32 counts per second per revolution.

Related Topics

EIP.POSUNIT (pg 304)

30 FAULT Parameters

This section describes the FAULT parameters.

30.1 FAULTx.ACTION

General Information	
Type	R/W
Description	Gets/Sets the Fault Action for Fault 130, 131, 132, 134, 139, 451, and 702.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
Start Version	M_01-04-16-000

Description

This Parameter determines the action the drive should take when Fault 130, 131, 132, 134, 139, 451, or 702 occurs.

Parameter Value	Drive Action
0	Disable Ampllifier
1	Ignore (fault will not be reported)

31 FB1 Parameters

This section describes the FB1 parameters.

31.1 FB1.BISSBITS

General Information	
Type	NV Parameter
Description	Specifies the number of Biss Sensor (Position) Bits for the BiSS Mode C encoder in use.
Units	bits
Range	0 to 64 bits
Default Value	32 bits
Data Type	Integer
See Also	FB1.SELECT (pg 320), FB1.IDENTIFIED (pg 312)
Start Version	M_01-01-00-100 and M_01-01-03-000

Description

FB1.BISSBITS specifies the number of BiSS sensor (position) bits for the BiSS Mode C encoder in use. Typically the value is either 26 or 32 for a BiSS Mode C Renishaw encoder. The required value for this parameter is provided by the feedback device manufacturer for the particular device being used.

Related Topics

Feedback 1 (pg 45)

31.2 FB1.ENCRES

General Information	
Type	Depends on FB1.IDENTIFIED. See table in description below.
Description	Sets the resolution of the motor encoder.
Units	Encoder counts
Range	0 to 2^{32}-1
Default Value	1,024
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter sets or gets the resolution of the motor encoder (encoder feedback systems only) in number of counts per revolution for a rotary motor and the number of encoder pitches per motor pole pitch for a linear motor. The number of encoder counts per revolution is obtained by multiplying the motor catalog resolution in units of PPR by four. For example, for a 1024 PPR resolution motor, the number of encoder counts per revolution is 1024*4 = 4096. For this motor FB1.ENCRES must be set to 4096.

For linear motors, the value of FB1.ENCRES is set to the number of encoder pitches per motor pole pitch. For a motor with 32 mm pole pitch, and a 40 µm encoder pitch, the value for FB1.-ENCRES should be set to 32 mm/40 µm = 800.

Depending on the value of FB1.IDENTIFIED, FB1.ENCRES changes between read-only and read-write. The following table lists the FB1.IDENTIFIED values and FB1.ENCRES's corresponding type.

FB1.IDENTIFIED value	FB1.ENCRES type
10 (Incremental encoder)	R/W
11 (Incremental encoder, no halls)	R/W
20 (Sine encoder)	R/W
21 (Sine encoder, no halls)	R/W
30 (Endat 2.1)	R/O
31 (Endat 2.2)	R/O
32 (biSS)	R/O
33 (hiperface)	R/O
34 (biSS Mode C)	R/W
40 (Resolver)	R/W
41 (sfd)	R/O
42 (Tamagawa)	R/O

Related Topics

7.2 Feedback 1

31.3 FB1.HALLSTATE

General Information	
Type	R/O Parameter
Description	Reads the Hall switch values (encoder feed-back only).
Units	Binary
Range	0 0 0 to 1 1 1
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Description

FB1.HALLSTATE reads the Hall switch values (encoder feedback only).

Related Topics

Feedback 1 (pg 45)

31.4 FB1.HALLSTATEU

General Information	
Type	R/O Parameter
Description	Reads the state of Hall switch U.
Units	N/A
Range	0 and 1
Default Value	1
Data Type	Integer
See Also	FB1.HALLSTATE (pg 310)
Start Version	M_01-03-07-000

Description

FB1.HALLSTATEU reads the state of Hall switch U.

Related Topics

Feedback 1 (pg 45)

31.5 FB1.HALLSTATEV

General Information	
Type	R/O Parameter
Description	Reads the state of Hall switch V.
Units	N/A
Range	0 and 1
Default Value	1
Data Type	Integer
See Also	FB1.HALLSTATE (pg 310)
Start Version	M_01-03-07-000

Description

FB1.HALLSTATEV reads the state of Hall switch V.

Related Topics

Feedback 1 (pg 45)

31.6 FB1.HALLSTATEW

General Information	
Type	R/O Parameter
Description	Reads the state of Hall switch W.
Units	N/A
Range	0 and 1

General Information	
Default Value	1
Data Type	Integer
See Also	FB1.HALLSTATE (pg 310)
Start Version	M_01-03-07-000

Description

FB1.HALLSTATEW reads the state of Hall switch W.

Related Topics

Feedback 1 (pg 45)

31.7 FB1.IDENTIFIED

General Information	
Type	R/O Parameter
Description	Reads the type of feedback device used by the drive/motor.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	Integer
See Also	FB1.SELECT
Start Version	M_01-00-00-000

Description

This parameter is set according to FB1.SELECT on drive power up if FB1.SELECT is not –1; otherwise the parameter value is read from the drive memory.

Type	Description
0	Unknown
10	Incremental encoder with A/B Quad, marker pulse and Hall
11	Incremental encoder with A/B Quad, marker pulse and no Hall
20	Sine Encoder , with marker pulse and Hall
21	Sine encoder , with marker pulse & No Halls
30	EnDat 2.1 with Sine Cosine
31	EnDat 2.2
32	BiSS with Sine Cosine
33	HIPERFACE
34	BiSS Mode C Renishaw
40	Resolver
41	SFD
42	Tamagawa

Related Topics

Feedback 1 (pg 45)

31.8 FB1.INITSIGNED

General Information	
Type	NV Parameter
Description	Sets initial feedback value as signed or unsigned.
Units	N/A
Range	0 to 1
Default Value	1
Data Type	Integer
See Also	FB1.ORIGIN
Start Version	M_01-00-00-000

Description

This parameter sets whether the initial value of the feedback read from the feedback device will be set as a signed or as an unsigned value.

0 = Unsigned

1 = Signed

The drive internal process for the feedback initialization is as follows:

1. Reads the position feedback.
2. Adds the origin to the feedback.
3. Determines modulo from Step 2 by the actual feedback bits.
4. Sets the position feedback sign according to FB1.INITSIGNED.

Related Topics

Feedback 1 (pg 45)

31.9 FB1.MECHPOS

General Information	
Type	R/O Parameter
Description	Reads the mechanical position.
Units	counts
Range	0 to 4,294,967,295 counts
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

FB1.MECHPOS reads the mechanical angle which is equal to the lower 32 bits in the 64-bit position feedback word.

Related Topics

Feedback 1 (pg 45)

31.10 FB1.MEMVER

General Information	
Type	R/O Parameter
Description	Returns the memory feedback version.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

FB1.MEMVER returns the memory feedback version (only applicable for feedbacks with memory).

Related Topics

Feedback 1 (pg 45)

31.11 FB1.OFFSET

General Information	
Type	NV-Parameter
Description	Sets position feedback offset.
Units	Rotary: counts, rad, deg, 16-bit counts Linear: counts, mm, µm, 16-bit counts
Range	Rotary: -5,123,372,000,000,005.000 to 5,123,372,000,000,005.000 counts -7495.067 to 7495.067 rad -429,436.096 to 429,436.096 deg -78,176,452.637 to 78,176,452.636 16-bit counts Linear: -5,123,372,000,000,005.000 to 5,123,372,000,000,005.000 counts -1192.878*MOTOR.PITCH (pg 387) to 1192.878*MOTOR.PITCH mm -1192877.952*MOTOR.PITCH to 1192877.952*MOTOR.PITCH µm -78176452.637 to 78176452.636 16-bit counts
Default Value	0
Data Type	Float
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	3533h/0	M_01-00-00-000

Description

FB1.OFFSET is a value added to the position feedback (PL.FB (pg 403)).

Example

If PL.FB is 10 deg and FB1.OFFSET is set to –10 deg, then the next read of PL.FB will return ~0 deg.

Related Topics

Feedback 1 (pg 45) | PL.FB (pg 403)

31.12 FB1.ORIGIN

General Information	
Type	NV Parameter
Description	Adds to the initial feedback position.
Units	Depends on or Rotary: counts, rad, deg, custom units, 16-bit counts Linear: counts, mm, µm, custom units, 16-bit counts
Range	Rotary: 0.000 to 5,123,372,000,000.000 counts 0.000 to 7,495.067 rad 0.000 to 429,436.096 deg 0.000 to 5,964.390 custom units 0.000 to 78,176,452.636 16-bit counts Linear: 0.000 to 5,123,372,000,000.000 counts 0.000 to 1,192.878 mm 0.000 to 1,192,877.952 µm 0.000 to 5,964.390 custom units 0.000 to 78,176,452.636 counts16 Bit
Default Value	0 counts
Data Type	Float
See Also	FB1.INITSIGNED
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

FB1.ORIGIN is a value that is added to the feedback device position. Initial value and modulo are determined from the number of bits of the feedback:

Initial position value = (<feedback from device> + FB1.ORIGIN) modulo <number of feedback bits>

The number of feedback bits is set according to the feedback type. For memory feedbacks it is the number of feedback bits; for none memory it is always single turn.

The drive internal process for the feedback initialization is as follows:

1. Reads the position feedback.
2. Adds the origin to the feedback.
3. Determines modulo from Step 2 by the actual feedback bits.
4. Sets the position feedback sign according to FB1.INITSIGNED.

Example

This example uses set to 2 (degrees)

It also assumes that the drive is connected to a single turn feedback device with memory.

FB1.ORIGIN is set to 22 and saved into NV memory.

Drive boots and reads from feedback device position 340 degrees. According to the description section above, calculation will be:

(340 + 22) modulo 360 = 2 degrees.

Therefore the initial feedback value will be set to 2 degrees.

Related Topics

7.2 Feedback 1

31.13 FB1.P

General Information	
Type	R/O Parameter
Description	Reads position from the primary feedback.
Units	Depends on FB1.UNIT counts or custom units.
Range	N/A
Default Value	N/A
Data Type	S64
Start Version	M_01-05-08-000

Description

This parameter reads the position of the primary feedback device connected to X10. The position can be read as counts or in customer units. This is the raw position read back from the device. The output format is 32:32, the upper 32 bits represent the multi-turns and the lower 32 bits represent the position of the feedback.

Related Topics

Feedback 1 (pg 45) | FB1.PUNIT (pg 319) | FB1.PIN | FB1.POUT

31.14 FB1.PFIND

General Information	
Type	R/W Parameter
Description	A procedure that allows the user to find the commutation angle for encoder feedback, which has no halls.
Units	NA
Range	0, 1
Default Value	0

General Information	
Data Type	Integer
See Also	FB1.PFINDCMDU (pg 317)
Start Version	M_01-00-00-000

Description

A procedure that allows the user to find the commutation angle for encoder feedback (which has no Halls).

Related Topics

Feedback 1 (pg 45)

31.15 FB1.PFINDCMDU

General Information	
Type	R/W Parameter
Description	Current value used during the phase finding procedure (PFB.PFIND=1)
Units	A
Range	0 to DRV.IPEAK
Default Value	0
Data Type	Float
See Also	PFB.PFIND
Start Version	M_01-00-00-000

Description

FB1.PFINDCMDU sets the current value used during the phase finding procedure.

Related Topics

Feedback 1 (pg 45)

31.16 FB1.POFFSET

General Information	
Type	NV-Parameter
Description	Sets the offset for primary feedback.
Units	counts, custom units
Range	-5,123,372,000,000,005.000 to 5,123,372,000,000,005.000 counts or -10,485,760.000 to 10,485,760.000 custom units
Default Value	0
Data Type	S64
See Also	N/A
Start Version	M_01-05-11-000

Description

FB1.POFFSET is the value added to the primary feedback position (FB1.P (pg 316)).

Example

If FB1.P is 10000 counts and FB1.POFFSET is set to –10000 counts, then the next read of FB1.P will return ~0 counts.

31.17 FB1.POLES

General Information	
Type	R/W Parameter
Description	Reads the number of feedback poles.
Units	N/A
Range	2 to 128
Default Value	2
Data Type	Integer
See Also	MOTOR.POLES
Start Version	M_01-00-00-000

Description

FB1.POLES sets the number of individual poles in the feedback device. This variable is used for the commutation function, as well as for velocity feedback scaling, and represents the number of individual poles (not pole pairs). The division value of motor poles (MOTOR.POLES) and feedback poles (FB1.POLES) must be an integer when moving drive to enable, otherwise a fault is issued.

Related Topics

Feedback 1 (pg 45)

31.18 FB1.PSCALE

General Information	
Type	R/W Parameter
Description	Sets position scaling value for fieldbus transferred position objects.
Units	N/A
Range	0 to 32
Default Value	20
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

Position values transfered over fieldbus are converted from native 64-bit values to a maximum 32-bit position value. This parameter sets the resolution/revolution of position values back to the controller.

FB1.PSCALE determines the counts per revolution of position values delivered by fieldbus. The default value is 20, which yields 2^20 counts/revolution. This scaling is used for CAN PDOs 6064 (Position Actual Value) and 60F4 (Following Error Actual Value).

Example

The drive always works internally with 64-bit position values. The drive internal 64-bit actual position should contain the following value:

0x0000.0023.1234.ABCD

The lower 32 bits represent the mechanical angle of the feedback. The upper 32 bits represent the number of turns.

FB1.PSCALE = 20

The 32-bit position is: 0x0231234A

FB1.PSCALE = 16

The 32-bit position is: 0x00231234

Related Topics

Feedback 1 (pg 45)

31.19 FB1.PUNIT

General Information	
Type	NV Parameter
Description	Sets the unit for FB1.P.
Units	N/A
Range	0, 3
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-05-11-000

Description

FB1.UNIT sets the position unit for FB1.P.

Value	Description
0	Counts (32.32 format)
3	(FB1.PIN/FB1.POUT) per revolution.

Related Topics

FB1.P (pg 316)

31.20 FB1.RESKTR

General Information	
Type	NV Parameter
Description	Sets the resolver nominal transformation ratio.
Units	N/A
Range	0.001 to 50.000
Default Value	0.5
Data Type	Float

General Information	
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter sets the resolver nominal transformation ratio. It affects the resolver excitation output amplitude.

The value can be obtained from the resolver data sheet.

Related Topics

Feedback 1 (pg 45)

31.21 FB1.RESREFPHASE

General Information	
Type	NV Parameter
Description	Sets the electrical degrees of phase lag in the resolver.
Units	electrical degrees
Range	-180 to 180°
Default Value	-2°
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter sets the electrical degrees of phase lag in the resolver.

See the motor resolver datasheet for the value for this parameter .

Related Topics

Feedback 1 (pg 45)

31.22 FB1.SELECT

General Information	
Type	NV Parameter
Description	Sets user entered type or identified type (–1).
Units	N/A
Range	–1, 10, 20, 30, 31, 32, 40, 41, 42
Default Value	–1
Data Type	Integer
See Also	FB1.IDENTIFIED
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

FB1.SELECT sets the feedback type manually (see FB1.IDENTIFIED) or allows the drive to automatically identify the feedback type on power up.

FB1 5V Power Supply Notes:

If FB1.SELECT = -1, the 5V power supply will only turn on during the initialization phase. If the feedback type cannot be automatically detected, the 5V power supply will be turned off, and remain off until a DRV.CLRFAULTS is issued (which will re-start the FB1 initialization), OR FB1.SELECT is manually set to a specific feedback type.

When FB1.SELECT is manually set to a specific feedback type, the FB1 5V power supply will remain on, unless a short is detected. This is useful for encoder types that may require calibration.

FB1.SELECT Input Values

Input Value	Description
–1	The drive automatically identifies the type of feedback as part of the power up process. Setting this value does not modify FB1.IDENTIFIED, unless it is saved in the NV memory for the next power up. If a feedback with memory is connected to the drive, the value of FB1.IDENTIFIED is set automatically to the feedback identified and all parameters read from the feedback are set according to the values read from the feedback. If no feedback is connected or a feedback with no memory is connected, the value of FB1.IDENTIFIED is set to 0 (no feedback identified) and all values normally read from the feedback are read from NV memory (if stored in NV) otherwise they are set to the default values.
10	Manually sets the type to incremental encoder. This input sets the value of FB1.IDENTIFIED to 10. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified).
20	Manually sets the type to sine encoder. This input sets the value of FB1.IDENTIFIED to 20. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified).
30	Manually sets the type to Endat 2.1. This input sets the value of FB1.IDENTIFIED to 30. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified).
31	Manually sets the type to Endat 2.2. This input sets the value of FB1.IDENTIFIED to 31. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified).
32	Manually sets the type to BiSS. This input sets the value of FB1.IDENTIFIED to 32. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified).
33	Manually sets the type to Hiperface. This input sets the value of FB1.IDENTIFIED to 33. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified). Note that all Hiperface feedback types are supported by the AKD PDMM. This includes SEL/SEK 37, SEL/SEK 52, SKM/SKS 36, SRS/SRM 50, SRS/SRM 60, SEK 90, SEK160, and SEK 260. The AKD PDMM drive will support any new Hiperface device, since any new device will be released with a label type of 0xFF. Devices with this label type have all of the pertinent information to configure these devices (number of single turn bits, number of multi-turn bits, and number of sine/cosine periods) stored in their memory. The AKD PDMM is able to read this information, and automatically configure the drive for proper operation. Note that the devices SEK 90, SEK 160, and SEK 260 are label type 0xFF.

Input Value	Description
40	Manually sets the type to resolver. This input sets the value of FB1.IDENTIFIED to 40. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified).
41	Manually sets the type to SFD. This input sets the value of FB1.IDENTIFIED to 41. If the feedback setting fails, FB1.IDENTIFIED is automatically set to 0 (no feedback identified).

FB1.SELECT Feedback Types

Type	Description
0	Unknown
10	Incremental encoder with A/B Quad, marker pulse and Hall
11	Incremental encoder with A/B Quad, marker pulse and no Hall
20	Sine Encoder , with marker pulse and Hall
21	Sine encoder , with marker pulse & No Halls
30	EnDat 2.1 with Sine Cosine
31	EnDat 2.2
32	BiSS with Sine Cosine
33	HIPERFACE
34	BiSS Mode C Renishaw
40	Resolver
41	SFD
42	Tamagawa

Related Topics

7.2 Feedback 1

31.23 FB1.TRACKINGCAL

General Information	
Type	NV Parameter
Description	Controls tracking calibration algorithm.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter turns the tracking calibration algorithm on or off for sine-cosine or resolver.

0 = Tracking calibration is off.

1 = Tracking calibration is on.

Related Topics

Feedback 1 (pg 45)

31.24 FB1.USERBYTE0 to FB1.USERBYTE7

General Information	
Type	R/W
Description	Reads and writes data stored in two 32 bit words in the Endat feedback device.
Units	N/A
Range	0 to 255
Default Value	0
Data Type	Integer
Start Version	M_01-05-08-000

Description

FB1.USERBYTE, FB1.USERWORD, and FB1.USERDWORD share two 32bit words in the Endat feedback device. These three parameters offer different ways to store and access the data stored in these two 32bit words. The table below defines each parameters function. The values are automatically stored non-volatile in the feedback device.

Parameter	Bits	Attributes
FB1.USERBYTE0 to FB1.USERBYTE7	8 bit	signed or unsigned char
FB1.USERWORD0 to FB1.USERWORD3	16 bit	signed or unsigned short
FB1.USERDWORD0 to FB1.USERDWORD1	32 bit	singed or unsigned int

The parameters overlap each other in the following way:

<table>
<tr><td>BYTE0</td><td>BYTE1</td><td>BYTE2</td><td>BYTE3</td><td>BYTE4</td><td>BYTE5</td><td>BYTE6</td><td>BYT7</td></tr>
<tr><td colspan="2">WORD0</td><td colspan="2">WORD1</td><td colspan="2">WORD2</td><td colspan="2">WORD3</td></tr>
<tr><td colspan="4">DWORD0</td><td colspan="4">DWORD1</td></tr>
</table>

For example, if BYTE1 is modified, WORD0 and DWORD0 are modified as well.

Example

```
-->FB1.USERDWORD1 65536
-->FB1.USERBYTE1
0
-->FB1.USERBYTE2
1
-->FB1.USERBYTE3
0

-->FB1.USERBYTE3 1 (write to the highest byte of FB1.USERDWORD0)
-->FB1.USERDWORD0
16842752
-->FB1.USERWORD0
0
-->FB1.USERWORD1
257
```

Related Topics

Feedback 1 (pg 45) | FB1.USERWORD1 to FB1.USERWORD3 (pg 325) | FB1.USE-RDWORD0 to FB1.USERWORD1 (pg 324)

31.25 FB1.USERDWORD0 to FB1.USERWORD1

General Information	
Type	R/W
Description	Reads and writes data stored in two 32 bit words in the Endat feedback device.
Units	N/A
Range	0 to 4,294,967,295
Default Value	0
Data Type	Integer
Start Version	M_01-05-08-000

Description

FB1.USERBYTE, FB1.USERWORD, and FB1.USERDWORD share two 32bit words in the Endat feedback device. These three parameters offer different ways to store and access the data stored in these two 32bit words. The table below defines each parameters function. The values are automatically stored non-volatile in the feedback device.

Parameter	Bits	Attributes
FB1.USERBYTE0 to FB1.USERBYTE7	8 bit	signed or unsigned char
FB1.USERWORD0 to FB1.USERWORD3	16 bit	signed or unsigned short
FB1.USERDWORD0 to FB1.USERDWORD1	32 bit	singed or unsigned int

The parameters overlap each other in the following way:

<table>
<tr><td>BYTE0</td><td>BYTE1</td><td>BYTE2</td><td>BYTE3</td><td>BYTE4</td><td>BYTE5</td><td>BYTE6</td><td>BYT7</td></tr>
<tr><td colspan="2">WORD0</td><td colspan="2">WORD1</td><td colspan="2">WORD2</td><td colspan="2">WORD3</td></tr>
<tr><td colspan="4">DWORD0</td><td colspan="4">DWORD1</td></tr>
</table>

For example, if BYTE1 is modified, WORD0 and DWORD0 are modified as well.

Example

```
-->FB1.USERDWORD1 65536
-->FB1.USERBYTE1
0
-->FB1.USERBYTE2
1
-->FB1.USERBYTE3
0

-->FB1.USERBYTE3 1 (write to the highest byte of FB1.USERDWORD0)
-->FB1.USERDWORD0
16842752
-->FB1.USERWORD0
0
-->FB1.USERWORD1
257
```

Related Topics

Feedback 1 (pg 45) | FB1.USERBYTE0 to FB1.USERBYTE7 (pg 323) | FB1.USERWORD1 to FB1.USERWORD3 (pg 325)

31.26 FB1.USERWORD1 to FB1.USERWORD3

General Information	
Type	R/W
Description	Reads and writes data stored in two 32 bit words in the Endat feedback device.
Units	N/A
Range	0 to 65,535
Default Value	0
Data Type	Integer
Start Version	M_01-05-08-000

Description

FB1.USERBYTE, FB1.USERWORD, and FB1.USERDWORD share two 32bit words in the Endat feedback device. These three parameters offer different ways to store and access the data stored in these two 32bit words. The table below defines each parameters function. The values are automatically stored non-volatile in the feedback device.

Parameter	Bits	Attributes
FB1.USERBYTE0 to FB1.USERBYTE7	8 bit	signed or unsigned char
FB1.USERWORD0 to FB1.USERWORD3	16 bit	signed or unsigned short
FB1.USERDWORD0 to FB1.USERDWORD1	32 bit	singed or unsigned int

The parameters overlap each other in the following way:

<table>
<tr><td>BYTE0</td><td>BYTE1</td><td>BYTE2</td><td>BYTE3</td><td>BYTE4</td><td>BYTE5</td><td>BYTE6</td><td>BYT7</td></tr>
<tr><td colspan="2">WORD0</td><td colspan="2">WORD1</td><td colspan="2">WORD2</td><td colspan="2">WORD3</td></tr>
<tr><td colspan="4">DWORD0</td><td colspan="4">DWORD1</td></tr>
</table>

For example, if BYTE1 is modified, WORD0 and DWORD0 are modified as well.

Example

```
-->FB1.USERDWORD1 65536
-->FB1.USERBYTE1
0
-->FB1.USERBYTE2
1
-->FB1.USERBYTE3
0

-->FB1.USERBYTE3 1 (write to the highest byte of FB1.USERDWORD0)
-->FB1.USERDWORD0
16842752
-->FB1.USERWORD0
0
-->FB1.USERWORD1
257
```

Related Topics

Feedback 1 (pg 45) | FB1.USERBYTE0 to FB1.USERBYTE7 (pg 323) | FB1.USERDWORD0 to FB1.USERWORD1 (pg 324)

32 FB3 Parameters

This section describes the FB3 parameters.

32.1 FB3.MODE

General Information	
Type	NV Parameter
Description	Selects the type of feedback connected to X9.
Units	N/A
Range	0
Default Value	0
Data Type	Integer
See Also	NA
Start Version	M_01-04-15-000

Description

This parameter selects the type of feedback connected to X9. The position is reported as the tertiary feedback position, by FB3.P.

Value	Feedback
0	Endat 2.2 Feedback Device

This parameter is only supported on drives with model numbers similar to AKD PDMM-x-xxxxx-NBxx-xxxx.

32.2 FB3.P

General Information	
Type	R/O Parameter
Description	Reads position from the tertiary feedback.
Units	Depends on FB3.UNIT counts or custom units.
Range	N/A
Default Value	N/A
Data Type	S64
See Also	N/A
Start Version	M_01-04-15-000

Description

This parameter reads the position back from the tertiary feedback device that is connected to X9, when DRV.EMUEMODE = 11. The position can be read as 64-bit singed count or in customer units. Values read by this parameter depend on FB3.Dir and FB3.OFFSET.

This parameter is only supported on drives with model numbers similar to AKD PDMM-x-xyyzz-NBxx-yyzz and will only work with Endat 2.2 multiturn encoder. The output format is 32:32 the upper 32 bits represents the multiturns and the lower 32 bits for position of the feedback.

Related Topics

DRV.EMUEMODE (pg 277) | FB3.PUNIT (pg 329) | FB3.PIN | FB3.POUT | FB3.PDIR (pg 329) |

32.3 FB3.PDIR

General Information	
Type	NV-Parameter
Description	Sets the counting direction for feedback channel 3.
Units	None
Range	0 to 1
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-05-11-000

Description

FB3.PDIR will change the sign and with it the direction of feedback channel 3.

Example

If position feedback = 35,185.932 and you set:

--> FB3.PDIR 1

then position feedback = -35,185.932

32.4 FB3.POFFSET

General Information	
Type	NV-Parameter
Description	Sets the offset for tertiary feedback.
Units	counts, custom units
Range	-5,123,372,000,000,005.000 to 5,123,372,000,000,005.000 counts or -10,485,760.000 to 10,485,760.000 custom units
Default Value	0
Data Type	S64
See Also	N/A
Start Version	M_01-05-11-000

Description

FB3.POFFSET is the value added to the primary feedback position (FB3.P (pg 328)).

Example

If FB3.P is 10000 counts and FB3.POFFSET is set to –10000 counts, then the next read of FB3.P will return ~0 counts.

32.5 FB3.PUNIT

General Information	
Type	NV Parameter
Description	Sets the unit for FB3.P.

General Information	
Units	N/A
Range	0, 3
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-05-11-000

Description

FB3.UNIT sets the position unit for FB3.P.

Value	Description
0	Counts (32.32 format)
3	(FB3.PIN/FB3.POUT) per revolution.

Related Topics

FB3.P (pg 328)

33 FBUS Parameters

This section describes the FBUS parameters.

33.1 FBUS.PARAM1 TO FBUS.PARAM10

General Information	
Type	NV Parameter
Description	Set fieldbus specific meanings.
Units	N/A
Range	See table below.
Default Value	See table below.
Data Type	Unsigned 32
See Also	CANbus Communication Manual, EtherCAT Communication Manual
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex				Object Start Version
EtherCAT COE and CANopen	36E5h /0	FBUS.PARAM01	36EAh /0	FBUS.PARAM06	M_01-00-00-000
	36E6h /0	FBUS.PARAM02	36Ebh /0	FBUS.PARAM07	
	36E7h /0	FBUS.PARAM03	36ECh /0	FBUS.PARAM08	
	36E8h /0	FBUS.PARAM04	36EDh /0	FBUS.PARAM09	
	36E9h /0	FBUS.PARAM05	36EEh /0	FBUS.PARAM10	

Parameter	Range	
	EtherCAT COE	CANopen
FBUS.PARAM01	N/A	125; 250; 500; 1000
FBUS.PARAM02	0 to 1	0 to 1
FBUS.PARAM03	1,001 to 65,535	N/A
FBUS.PARAM04	0 to 1	0 to 1
FBUS.PARAM05	0 to 1	0 to 1

Parameter	Default Value	
	EtherCAT COE	CANopen
FBUS.PARAM01	N/A	125
FBUS.PARAM02	1	0
FBUS.PARAM03	0	N/A
FBUS.PARAM04	1	0
FBUS.PARAM05	0	0

Description

FBUS.PARAM01 sets the baud rate for the CANbus. Supported baud rates are 125, 250, 500 and 1000 kBaud.

FBUS.PARAM02 switches the phase locked loop (PLL) for synchronized use: 0 = OFF, 1 = ON

FBUS.PARAM03 sets the configured station alias for EtherCAT.

FBUS.PARAM04 switches the surveillance of SYNC-signals: 0 = OFF, 1 = ON

FBUS.PARAM05 is used to configure some special behaviors of the DS402.

FBUS.PARAM06 - FBUS.PARAM10 are reserved.

FBUS.PARAM04 Additional Notes

FBUS.PARAM04 enables (1) or disables(0) the synchronization supervision of the CAN or EtherCAT fieldbus.

Default values:

- CAN: disabled (0)
- EtherCAT: enabled (1)

The synchronization supervision is active when:

- FBUS.PARAM04 = 1
- The first CANopen Sync message or first EtherCAT frame was received.

When more than three CANopen sync messages or seven EtherCAT frames have not been received, and the drive is enabled, fault F125 (pg 136), "Synchronization lost", occurs.

FBUS.PARAM05 Additional Notes

Bit 0 configures the behavior of DS402 state machine in case of fault resets.

- **Bit 0 = 1**: Faults can only be reset using DS402 control word bit 7.
- **Bit 0 = 0**: The reset can also be done via telnet or digital input and the DS402 state machine reflects this condition.
- **Bit 1 = 1**: The state of the hardware enable does not change the state machine state Operation Enable.
- **Bit 1 = 0**: If the state Operation Enable or Switched on is active it falls back to the state switched On Disabled, if the Hardware enable goes to 0.
- **Bit 2 = 1**: Workbench/Telnet can software enable the drive when CAN-open/EtherCAT are operational.
- **Bit 2 = 0**: Workbench/Telnet can switch the DS402-state machine to the state “Switched On” (enable the power stage), if the former state was “Switched on Disabled.” This requires the hardware enable to be set to 1.
- **Bit 3 = 1**: DS402-state machine is not influenced, if the software-enable is taken away via Telnet.
- **Bit 3 = 0**: DS402-state machine is influenced, if the software-enable is taken away via Telnet.
- **Bit 4 = 0**: Position scaling for DS402-parameters is done dependent on UNIT.PIN.
- **Bit 4 = 1**: Position scaling for DS402-parameters is done dependent on DS402-scaling parameters via objects 6091 / 6092. Velocity scaling via 204c.
- **Bit 5 = 0**: EtherCAT: The setting of the rotary switches define the station alias address. If the setting is 0, FBUS.PARAM03 can be used.
- **Bit 5 = 1**: EtherCAT: The setting of the rotary switches define the station alias address, if FBUS. PARAM03 is on 0 else FBUS.PARAM03 is used to store the station alias address.

33.2 FBUS.PLLSTATE

General Information	
Type	R/O Parameter

General Information	
Description	Returns the status of the PLL
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	FBUS.PARAM1 TO FBUS.PARAM10 (pg 332), Fieldbus documentation
Start Version	M_01-02-00-000

Description

FBUS.PLLSTATE returns the status of the phase locked loop (PLL). The PLL states are as follows:

PLL State	Description
PLL not activated	This state is set using FBUS.PARAM02. Not each fieldbus or operation mode needs synchronization.
PLL activated, but unlocked	The PLL is activated but has not yet been locked successfully. This state is related to the fieldbus master, as well as to the fieldbus mode of operation.
PLL activated and locked	PLL is fully operational and locked

For more information, see the *AKD PDMM CANopen Manual*, Phase Locked Loop.

33.3 FBUS.PLLTHRESH

General Information	
Type	NV Parameter
Description	Sets number of successful synchronized cycles needed to lock the PLL.
Units	N/A
Range	0 to 10,000
Default Value	0
Data Type	Integer, U32
See Also	Appendix B: Fieldbus Manuals
Start Version	M_01-00-00-000

Description

This parameter sets number of successful synchronized cycles needed to lock the PLL.

33.4 FBUS.PROTECTION

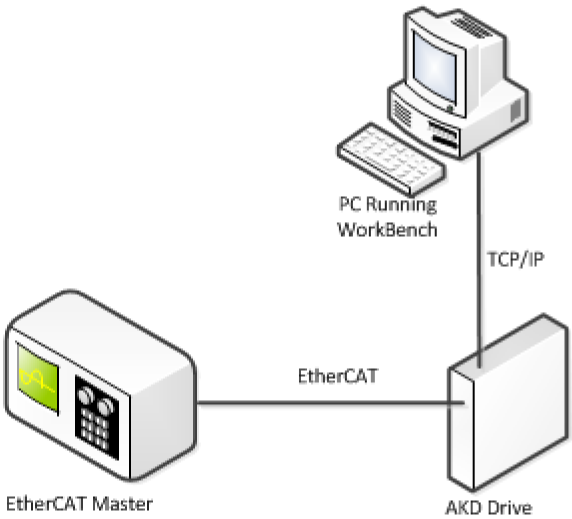
General Information	
Type	R/W Parameter
Description	Controls which parameters are blocked from being accessed through telnet while a fieldbus is operational.
Units	N/A
Range	0 to 2
Default Value	0
Data Type	Integer
Start Version	M_01-08-00-000

Fieldbus Information

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	3498h/0	M_01-08-00-000

Description

When an AKD PDMM is a slave node on a fieldbus (for example an AKD PDMM is connected to an EtherCAT master) and EWV[1] is simultaneously connected to an AKD PDMM via a service channel, then you have several options on how you would like the AKD PDMM to respond to commands from each of the channels.



When the fieldbus is operational the AKD PDMM uses the FBUS.PROTECTION parameter to allow the user to select how commands from EWV, or any other device sending commands to the drive through a service channel, should be handled. EWV can use either of two service channels: Telnet or ASCII SDO. Both service channels are affected identically by FBUS.PROTECTION.

The following table shows the available options. If the fieldbus is not connected or not started, then parameters executed through a service channel will not be blocked.

Value	Description
0	**Motion and Tuning Commands Allowed** - Commands that would interfere with motion are allowed. Gain and IO configuration changes are allowed.

[1]Embedded Workbench Views

Value	Description
1	**Block Motion but Allow Tuning Commands** - Commands that would interfere with motion are blocked. Gain and I/O configuration changes are allowed.
2	**Block Motion and Tuning Commands** - Commands that would interfere with motion are blocked. These parameters would still allow their current state to be read.

DRV.HELP will include the [Blocked] attribute to indicate whether a parameter is being blocked. For example, if FBUS.PROTECTION is 0 and the network is operational, the following help will be shown.

```
-->DRV.HELP DRV.EN
Help for: DRV.EN [ActionCommand] [Blocked]
-->
```

If you attempt to execute a blocked parameter the following error would display.

```
-->DRV.EN
Error: [0008] Command blocked.
```

All write or command functions of a parameter will be blocked by FBUS.PROTECTION. FBUS.PROTECTION will not block the read function of any parameter.

When the fieldbus is operational, FBUS.PROTECTION is always blocked, but can be edited through the fieldbus. This ensures that the protection level can only be modified by the fieldbus when it is in control.

If a parameter is blocked through telnet, it will be accessible through the fieldbus. For example, SDO's in the case of CANopen or EtherCAT.

Parameters Affected by FBUS.PROTECTION

This table shows how the blocked attribute affects the following parameters in each state of FBUS.PROTECTION. This table is true only if FBUS.STATE = 5 (operational).

FBUS.PROTECTION	0 - Block Nothing	1 - Block Motion Commands	2 - Block All
DRV.EN DRV.DIS		[Blocked]	[Blocked]
FBUS.PROTECTION		[Blocked]	[Blocked]
DRV.OPMODE DRV.CMDSOURCE		[Blocked]	[Blocked]
DRV.STOP DRV.CLRFAULTS		[Blocked]	[Blocked]
HOME.MODE HOME.ACC DRV.ACC DRV.DEC IL.LIMITN IL.LIMITP SM.MOVE MT.MOVE HOME.MOVE SM.MOVE			[Blocked]
PL.KP VL.KP VL.KI			[Blocked]
DINx.MODE DOUTx.MODE AINx.MODE AOUTx.MODE			[Blocked]

Related Topics

FBUS.STATE

33.5 FBUS.REMOTE

General Information	
Type	R/W Parameter
Description	Changes or shows the control of the drive (fieldbus master/tel-net)
Units	N/A
Range	0 to 1
Default Value	0
Data Type	U8
See Also	Fieldbus ManualsPL.FBSOURCE (pg 403)
Start Version	M_01-05-06-000

Description

DS402 (CAN/EtherCAT):

With this parameter the bit 9 (remote) of the DS402-status word can be set directly via Telnet to show the DS402-master-system that the control is removed. The master has to react on that.

33.6 FBUS.SAMPLEPERIOD

General Information	
Type	NV Parameter
Description	Sets fieldbus sample period.
Units	Whole multiples of MTS 250 µs
Range	4 to 128 and value must be a power of 4
Default Value	32 = 2 ms
Data Type	U8
See Also	Appendix B: Fieldbus Manuals
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter sets the fieldbus cycle time. It is normally written in the startup phase of the field busses via the object 60C2 subindex 1 (interpolation time units) and 2 (interpolation time index), where the index stands for a power of 10 seconds (for instance, -3 stands for milliseconds) and the units are the counts of these units. Kollmorgen recommends the following standard cycle rates, 250 us (4), 500 us (8), 1 ms (16), 2 ms (32), 4 ms (64).

33.7 FBUS.STATE

General Information	
Type	R/O
Description	Reads the state of the fieldbus.
Units	N/A
Range	Depends on fieldbus. See table below.
Default Value	Depends on fieldbus. See table below.
Data Type	Integer
Start Version	M_01-08-00-000

Description

FBUS.STATE returns the current state of the fieldbus. The value returned is dependent upon the fieldbus being used.

Value	CANopen over CAN	CANopen over EtherCAT
-1	Not connected	Not connected
0	Init.	-
1	N/A	Init.
2	N/A	Pre-operational
3	-	Boot
4	Stopped	Safe-operational
5	Operational	-
8	-	Operational
127	Pre-operational	-

33.8 FBUS.SYNCACT

General Information	
Type	R/O Parameter
Description	Reads actual distance from the desired sync distance.
Units	ns
Range	0 to 250,000 ns
Default Value	0 ns
Data Type	Integer, U 32
See Also	Appendix B: Fieldbus Manuals
Start Version	M_01-00-00-000

Description

This parameter reads actual distance from the desired sync distance.

33.9 FBUS.SYNCDIST

General Information	
Type	NV Parameter

General Information	
Description	Sets time target for synchronization.
Units	ns
Range	0 to 250,000 ns
Default Value	100,000 ns
Data Type	Integer, U32
See Also	Appendix B: Fieldbus Manuals
Start Version	M_01-00-00-000

Description

This parameter sets time target for synchronization.

33.10 FBUS.SYNCWND

General Information	
Type	NV Parameter
Description	Sets symmetrically arranged window around the desired sync distance.
Units	ns
Range	0 to 1,000,000 ns
Default Value	50,000 ns
Data Type	Integer, U2
See Also	Appendix B: Fieldbus Manuals
Start Version	M_01-00-00-000

Description

This parameter sets symmetrically arranged window around the desired sync distance.

33.11 FBUS.TYPE

General Information	
Type	R/O Parameter
Description	Shows the active fieldbus type.
Units	N/A
Range	0 to 5
Default Value	0
Data Type	U8
See Also	Fieldbus Manuals
Start Version	M_01-00-00-000

Description

FBUS.TYPE shows the active fieldbus type.

0 = Analog

1 = SynqNet

2 = EtherCAT

3 = CANopen

4 = EthernetIP

5 = Profinet

34 GUI Parameters

GUI parameters are used within EWV[1] for data reporting and data storage.

[1] Embedded Workbench Views

34.1 GUI.DISPLAY

General Information	
Type	R/O Parameter
Description	Reads drive display data.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	Display
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter reports to the GUI what the drive currently is displaying. For all GUI commands, the data is compressed and formatted for the GUI, not for the user.

34.2 GUI.PARAM01

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483,647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.3 GUI.PARAM02

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483,647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.4 GUI.PARAM03

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.5 GUI.PARAM04

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.6 GUI.PARAM05

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.7 GUI.PARAM06

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.8 GUI.PARAM07

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.9 GUI.PARAM08

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer

General Information	
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.10 GUI.PARAM09

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

34.11 GUI.PARAM10

General Information	
Type	NV Parameter
Description	Used by the GUI to store data.
Units	N/A
Range	2,147,483,648 to 2,147,483, 647
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

The GUI uses this parameter to store data. Only the GUI can modify this data (not the user).

35 HWLS Parameters

This section describes the HWLS parameters.

35.1 HWLS.NEGSTATE

General Information	
Type	R/O Parameter
Description	Reads the status of the negative hardware limit switch.
Units	0 to 1
Range	N/A
Default Value	Integer
Data Type	HWLS.POSSTATE (pg 347)
See Also	N/A
Start Version	M_01-00-00-000

Description

HWLS.NEGSTATE reads the status of the negative HW limit switch as follows:

0 = Low

1 = High

Related Topics

35.2 HWLS.POSSTATE

General Information	
Type	R/O Parameter
Description	Reads the status of the positive hardware limit switch.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	HWLS.NEGSTATE (pg 347)
Start Version	M_01-00-00-000

Description

HWLS.POSSTATE reads the status of the positive hardware limit switch as follows:

0 = Low

1 = High

Related Topics

36 IL Parameters

This section describes the IL parameters.

36.1 IL.BUSFF

General Information	
Type	R/O Parameter
Description	Displays the current feedforward value injected by the field-bus.
Units	Arms
Range	N/A
Default Value	N/A
Data Type	Float
See Also	IL.KBUSFF (pg 357)
Start Version	M_01-00-00-000

Description

This parameter displays the current feedforward value injected by the fieldbus.

Related Topics

1 Current Loop

36.2 IL.CMD

General Information	
Type	R/O Parameter
Description	Reads the value of the q-component current command.
Units	Arms
Range	± Drive peak current (DRV.IPEAK)
Default Value	N/A
Data Type	Float
See Also	DRV.IPEAK (pg 288)
Start Version	M_01-00-00-000

Description

IL.CMD displays the q-component current command value of the current loop after any limitation (such as a parameter setting or I^2t calculation).

IL.CMD is limited also by motor peak current, IL.LIMITN (pg 360) and IL.LIMITP (pg 361).

Related Topics

1 Current Loop

36.3 IL.CMDU

General Information	
Type	R/W Parameter

General Information	
Description	Sets the user current command.
Units	Arms
Range	Minimum range value = maximum of IL.LIMITN and -MOTOR.IPEAK Maximum range value = minimum of IL.LIMITP and MOTOR.IPEAK
Default Value	0 Arms
Data Type	Float
See Also	DRV.IPEAK (pg 288), DRV.OPMODE (pg 294),DRV.CMDSOURCE (pg 267)
Start Version	M_01-00-00-000

Description

This parameter sets the user current command value.

The current command value, which is provided to the current loop (IL.CMD), can be limited further using a parameter setting or I^2t calculation. IL.CMDU is limited also by motor peak current, IL.LIMITN (pg 360) and IL.LIMITP (pg 361).

Related Topics

1 Current Loop

36.4 IL.DIFOLD

General Information	
Type	R/O Parameter
Description	Reads the drive foldback current limit.
Units	Arms
Range	0 to 2,147,483.647 Arms
Default Value	N/A
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

IL.DIFOLD is the output of the drive foldback algorithm. It is an artificial current, which can be higher or lower than the drive peak current (DRV.IPEAK). When IL.DIFOLD is lower than the existing current limit (such as IL.LIMITP (pg 361)), it becomes the active current limit.

IL.DIFOLD decreases when the actual current is higher than drive continuous current and increases (up to a certain level) when the actual current is lower than drive continuous current.

Related Topics

1 Current Loop

36.5 IL.FB

General Information	
Type	R/O Parameter
Description	Reads the actual value of the d-component current.
Units	Arms
Range	± Drive peak current (DRV.IPEAK)
Default Value	N/A
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter reads the measured, de-rotated actual current value of the motor.

Note: Internally the resolution of the current scale is 20130 increments. For an AKD PDMM with a peak current of 9 amps, the current resolution applied is 9/20130 = .447 mA. For a 48 amp peak current drive, the resolution is 48/20130 = 2.38 mA. The current scaling is hard coded and cannot be changed by decreasing the peak current settings in the drive.

Related Topics

1 Current Loop

36.6 IL.FBSOURCE

General Information	
Type	R/W
Description	Sets the feedback source for the current loop. Only applies when MOTOR.TYPE = 4.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
Start Version	M_01-08-00-000

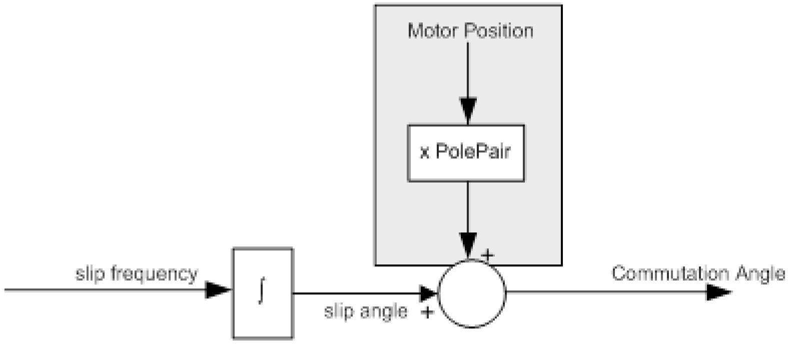
Description

This parameter selects the feedback source that current loop use for commutation angle calculation.

0 = Primary feedback

1 = Secondary feedback

For induction motor closed loop control the commutation angle is set as shown in the following figure.



Related Topics

MOTOR.TYPE (pg 392)

36.7 IL.FF

General Information	
Type	R/O Parameter
Description	Displays the current loop overall feedforward value
Units	Arms
Range	N/A
Default Value	N/A
Data Type	Float
See Also	IL.KBUSFF (pg 357), IL.KVFF (pg 360), IL.OFFSET (pg 365), IL.FRICTION (pg 354), IL.KACCFF (pg 356)
Start Version	M_01-00-00-000

Description

This parameter displays the current loop overall feedforward value.

Related Topics

1 Current Loop

36.8 IL.FOLDFTHRESH

General Information	
Type	R/O Parameter
Description	Reads the foldback fault level.
Units	Arms
Range	0 to 500 Arms
Default Value	Drive peak current (DRV.IPEAK)
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

IL.FOLDFTHRESH is the fault level of the current foldback algorithm. If IL.IFOLD (pg 355) drops below the value for IL.FOLDFTHRESH, then a fault is generated and the drive is disabled.

To avoid reaching the current foldback fault level, set IL.FOLDFTHRESHU well below the continuous current value for both the drive and the motor or set the IL.FOLDFTHRESHU value to zero.

Related Topics

1 Current Loop

36.9 IL.FOLDFTHRESHU

General Information	
Type	NV Parameter
Description	Sets the user value for the foldback fault level.
Units	Arms
Range	0 to 500 Arms
Default Value	Drive peak current (DRV.IPEAK)
Data Type	Float
See Also	IL.FOLDFTHRESH (pg 352), Foldback (pg 47)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

IL.FOLDFTHRESHU is the fault level of the current foldback algorithm. The value of IL.FOLDFTHRESH is the minimum of DRV.IPEAK (pg 288), MOTOR.IPEAK (pg 383), and IL.FOLDFTHRESHU.

Related Topics

1 Current Loop

36.10 IL.FOLDWTHRESH

General Information	
Type	NV Parameter
Description	Sets the foldback warning level.
Units	Arms
Range	0 to 500 Arms

General Information	
Default Value	0 A
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

IL.FOLDWTHRESH is the warning level of the current foldback algorithm. When IL.IFOLD (pg 355) drops **below** IL.FOLDWTHRESH a warning is generated.

To ensure that the current foldback warning level is never reached, IL.FOLDWTHRESH should be set well below the continuous current value for both the drive and the motor. You can also set the IL.FOLDFTHRESH (pg 352) value to zero.

Related Topics

1 Current Loop

36.11 IL.FRICTION

General Information	
Type	R/W Parameter
Description	Sets friction compensation value.
Units	A
Range	0 to the minimum of user positive current limit (IL.LIMITP) and motor peak current (MOTOR.IPEAK).IL.LIMITP (pg 361)
Default Value	0
Data Type	Float
See Also	IL.FF
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

Position command derivative sign is multiplied by this value to be injected to the current command.

NOTE IL.FRICTION is active in Position and Velocity modes (DRV.OPMODE = 1, 2), but not active in Torque mode (DRV.OPMODE = 0).

Related Topics

1 Current Loop

36.12 IL.IFOLD

General Information	
Type	R/O Parameter
Description	Reads the overall foldback current limit.
Units	A
Range	0 to 2,147,483.647 A
Default Value	N/A
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

Two current foldback algorithms run in parallel in the drive: the drive foldback algorithm and the motor foldback algorithm. Each algorithm uses different sets of parameters.

Each algorithm has its own foldback current limit, IL.DIFOLD and IL.MIFOLD. The overall foldback current limit is the minimum of the two at any given moment.

`IL.IFOLD = min (IL.DIFOLD, IL.MIFOLD).`

IL.DIFOLD is an artificial current, which can be higher or lower than the drive or motor peak current. When IL.IFOLD becomes lower than the existing current limit (such as IL.LIMITP (pg 361)), it becomes the active current limit.

Related Topics

1 Current Loop

36.13 IL.IUFB

General Information	
Type	R/O Parameter
Description	Reads the sigma-delta measured current in the u-winding of the motor.
Units	A
Range	± Drive peak current (DRV.IPEAK)
Default Value	N/A
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter displays the measured current in the u-winding of the motor.

Related Topics

1 Current Loop

36.14 IL.IVFB

General Information	
Type	R/O Parameter
Description	Sets the sigma-delta measured current in the u-winding of the motor.
Units	A
Range	± Drive peak current (DRV.IPEAK)
Default Value	0 A
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Description

IL.IVFB is an offset value that is added to the measured current in the u-winding of the motor. This value is used for compensating for an error in the current measurement. The drive measures 256 times the current in the u-winding when powering-up the drive. Afterwards, the drive calculates the average value of the measured current and uses this value for the offset value.

Related Topics

1 Current Loop

36.15 IL.KACCFF

General Information	
Type	R/W Parameter
Description	Sets current loop acceleration feedforward gain value
Units	mArms/(rad/s²)
Range	0.0 to 2.0 mArms/(rad/s²)
Default Value	0 mArms/(rad/s²)
Data Type	Float
See Also	IL.FF (pg 352)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This value sets the gain for the acceleration feedforward (a scaled second derivative of the position command is added to the current command value) .

This parameter is valid only in the position mode (DRV.OPMODE = 2).

Related Topics

1 Current Loop

36.16 IL.KBUSFF

General Information	
Type	NV Parameter
Description	Current loops fieldbus injected feed-forward gain
Units	NA
Range	0 to 2
Default Value	0
Data Type	Float
See Also	IL.FF (pg 352), IL.BUSFF (pg 349)
Start Version	M_01-00-00-000

Description

This parameter scales the feedforward term added by the fieldbus to the current command. The nominal feedforward value can be multiplied by this gain value.

This parameter is only used in the position mode (DRV.OPMODE = 2).

Related Topics

1 Current Loop

36.17 IL.KP

General Information	
Type	NV Parameter
Description	Sets the proportional gain of the q-component of the PI regulator.
Units	V/A
Range	0 to 2,000 V/A
Default Value	Read from the motor or, if no memory, 50.009 V/A
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

IL.KP is used to modify the proportional gain of the PI-loop that controls the q-component of the current.

Related Topics

1 Current Loop

36.18 IL.KPDRATIO

General Information	
Type	NV Parameter
Description	Sets the proportional gain of the d-component current PI-regulator as a percentage of IL.KP
Units	N/A
Range	0 to 100
Default Value	1
Data Type	Float
See Also	IL.KP (pg 357)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter modifies the proportional gain of the PI-loop, which controls the d-component of the current.

Related Topics

1 Current Loop

36.19 IL.KPLOOKUPINDEX

General Information	
Type	R/W Parameter
Description	Sets the index into the Current Loop Gain Scheduling Table.
Units	N/A
Range	0 to 255
Default Value	0
Data Type	Integer
See Also	IL.KPLOOKUPVALUE (pg 359)IL.KPLOOKUPVALUES (pg 359)IL.KP (pg 357)
Start Version	M_01-04-00-000

Description

This parameter sets the index into the Current Loop Gain Scheduling Table. The table is 256 records long, spanning 0 A to 1.62 * DRV.IPEAK.

To determine the level of current that corresponds to a table index, use the following equation:

```
IL.CMD = (Table Index /157) * DRV.IPEAK
```

Related Topics

Current Loop

36.20 IL.KPLOOKUPVALUE

General Information	
Type	R/W Parameter
Description	Sets the value of the current loop gain scheduling index.
Units	%
Range	0 to 100.000%
Default Value	0
Data Type	Float
See Also	IL.KPLOOKUPINDEX (pg 358)IL.KPLOOKUPVALUES (pg 359)IL.KP (pg 357)
Start Version	M_01-04-00-000

Description

This parameter sets the value at the current index into the Current Loop Gain Scheduling Table. The table is 256 records long, spanning 0 A to 1.62 * DRV.IPEAK. The value can range from 0% to 100% and determines what percentage of IL.KP will be applied to the current loop.

To determine what level of current corresponds to a table index, use the following equation:

```
IL.CMD = (Table Index/157) * DRV.IPEAK
```

Example

Assume:

DRV.IPEAK = 9 A

IL.KPLOOKUPINDEX = 100

IL.KPLOOKUPVALUE = 50

IL.KP = 240

When IL.CMD = 100/157 * 9 = 5.73 A, IL.KP will not be 240, but will be 50% * 240 = 120.

Related Topics

Current Loop

36.21 IL.KPLOOKUPVALUES

General Information	
Type	R/W Parameter
Description	Gets the Current Loop Gain Scheduling Table.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	Table
See Also	IL.KPLOOKUPINDEX (pg 358), IL.KPLOOKUPVALUE (pg 359)IL.KP (pg 357)
Start Version	M_01-04-00-000

Description

Retrieves the Current Loop Gain Scheduling Table in a comma delimited table.

This table is 256 records long, and the table will return values in the following format:

```
-->IL.KPLOOKUPVALUES
Index Value
0, 100.000
1, 100.000
2, 100.000
3, 100.000
4, 100.000
5, 100.000
6, 100.000
7, 100.000
8, 100.000
9, 100.000
10, 100.000
```

Related Topics

Current Loop

36.22 IL.KVFF

General Information	
Type	R/W
Description	Current loop velocity feed-forward gain.
Units	N/A
Range	0 to 2
Default Value	0
Data Type	Float
See Also	IL.FF (pg 352)
Start Version	M_01-00-00-000

Description

This parameter sets the gain for the velocity loop feedforward. The nominal feedforward value can be multiplied by this gain value.

This parameter is only used in position mode (DRV.OPMODE (pg 294) = 2).

Related Topics

1 Current Loop

36.23 IL.LIMITN

General Information	
Type	NV Parameter
Description	Sets the negative user (application-specific) current limit.
Units	A

General Information	
Range	Negative drive peak current (DRV.IPEAK) to 0 A
Default Value	Negative drive peak current (DRV.IPEAK)
Data Type	Float
See Also	IL.LIMITP (pg 361)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter sets the negative user limit clamp value of the torqueproducing q-component current command (IL.CMD (pg 349)). The current command is additionally limited by the motor peak current setting (MOTOR.IPEAK (pg 383)) and by the present value of the foldback I²t peak motor current protection.

Related Topics

1 Current Loop

36.24 IL.LIMITP

General Information	
Type	NV Parameter
Description	Sets the positive user (application-specific) current limit.
Units	A
Range	0 A to drive peak current (DRV.IPEAK)
Default Value	Drive peak current (DRV.IPEAK)
Data Type	Float
See Also	IL.LIMITN (pg 360)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter sets the positive user limit clamp value of the torque-producing q-component current command (IL.CMD (pg 349)). The current command is additionally limited by the motor peak current setting (MOTOR.IPEAK (pg 383)) and by the present value of the foldback I²t peak motor current protection.

Related Topics

1 Current Loop

36.25 IL.MFOLDD

General Information	
Type	R/O Parameter
Description	Sets the motor foldback maximum time at motor peak current.
Units	s
Range	0.1 to 2400 s
Default Value	10 s
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Description

IL.MFOLDD sets the maximum time allowed for the motor to remain at peak current before starting to fold towards the motor continuous current. When at motor peak current, IL.MFOLDD is the amount of time before the foldback algorithm starts to reduce the current.

Related Topics

1 Current Loop

36.26 IL.MFOLDR

General Information	
Type	R/O Parameter
Description	Sets the motor foldback recovery time.
Units	s
Range	0.1 to 65,535 s
Default Value	Calculated from other foldback parameters.
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Description

IL.MFOLDR sets the recovery time for the motor foldback algorithm. If 0 current is applied for at least the recovery time duration, it is possible to apply motor peak current for the duration of IL.MFOLDD time.

The IL.MFOLDR value is automatically calculated from other foldback parameters.

Related Topics

1 Current Loop

36.27 IL.MFOLDT

General Information	
Type	R/O Parameter

General Information	
Description	Sets the motor foldback time constant of the exponential current drop (foldback).
Units	s
Range	0.1 to 2,400 s
Default Value	10 s
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Description

IL.MFOLDT sets the time constant of the exponential drop (foldback) of the current towards motor continuous current.

Related Topics

1 Current Loop

36.28 IL.MI2T

General Information	
Type	R/O parameter
Description	Motor I2t load.
Units	%
Range	0 to 100%
Default Value	N/A
Data Type	Float
See Also	IL.MIMODE, IL.MI2TWTHRESH (pg 363)
Start Version	M_01-04-01-000

Description

This parameter returns the motor I2t load in percent. The supplied current will be limited by IL.MIFOLD to MOTOR.ICONT case that the load reaches a value of 100%. The current limit IL.MIFOLD will be restored to MOTOR.IPEAK in case that the load falls under 95%.

Related Topics

1 Motor I2t algorithm

36.29 IL.MI2TWTHRESH

General Information	
Type	NV Parameter
Description	Motor I2t load warning threshold.
Units	%

General Information	
Range	0 to 100%
Default Value	N/A
Data Type	Integer
See Also	IL.MIMODE, IL.MI2T (pg 363)
Start Version	M_01-04-01-000

Description

This parameter defines a warning threshold for the IL.MI2T value. A warning n309 will be generated as soon as the IL.MI2T exceeds the IL.MI2TWTHRESH value. The warning n309 will be cleared as soon as IL.MI2T falls below the threshold.

Related Topics

Foldback (pg 47)

36.30 IL.MIFOLD

General Information	
Type	R/O Parameter
Description	Sets the motor foldback current limit.
Units	A
Range	0 to 2147483.647 A
Default Value	N/A
Data Type	Float
See Also	Foldback
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

IL.MIFOLD sets the output of the motor foldback algorithm. It is an artificial current, which can be higher or lower than the motor peak current. When IL.MIFOLD becomes lower than the existing current limit (IL.LIMITP (pg 361)) it becomes the active current limit.

IL.MIFOLD decreases when the actual current is higher than motor continuous current and increases (up to a certain level) when the actual current is lower than the motor continuous current.

Related Topics

1 Current Loop

36.31 IL.MIMODE

General Information	
Type	NV parameter

General Information	
Description	Motor protection mode.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	IL.MI2T (pg 363), IL.MI2TWTHRESH (pg 363)
Start Version	M_01-04-01-000

Description

This parameter determines the method of the motor protection.

0 – The motor foldback mechanism is responsible for protecting the motor from overload.

1 – The motor I2t mechanism is responsible for protecting the motor from overload.

Related Topics

Foldback (pg 47)

36.32 IL.OFFSET

General Information	
Type	RW Parameter
Description	A constant current command added to compensate for gravity.
Units	A
Range	[IL.LIMITN (pg 360) to IL.LIMITP (pg 361)
Default Value	0 A
Data Type	Float
See Also	IL.FF
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This value is added to the overall current loop feedforward value.

Related Topics

1 Current Loop

36.33 IL.VCMD

General Information	
Type	R/O Parameter

General Information	
Description	Sets the output of the q-component PI regulator.
Units	Vrms
Range	0 Vrms to bus voltage
Default Value	N/A
Data Type	Integer
See Also	IL.VDCMD
Start Version	M_01-00-00-000

Description

Sets the output of the current loop that controls the q-component of the current.

Related Topics

1 Current Loop

36.34 IL.VUFB

General Information	
Type	R/O Parameter
Description	Reads the measured voltage on the u-winding of the motor.
Units	V
Range	–1200*VBusScale to +1200*VBusScale
Default Value	N/A
Data Type	Integer
See Also	IL.VVFB (pg 366)
Start Version	M_01-00-00-000

Description

Reads the measured voltage on the u-winding of the motor.

Related Topics

1 Current Loop

36.35 IL.VVFB

General Information	
Type	R/O Parameter
Description	Reads the measured voltage on the v-winding of the motor.
Units	V
Range	–1200*VBusScale to +1200*VBusScale
Default Value	N/A
Data Type	Integer

General Information	
See Also	IL.VUFB (pg 366)
Start Version	M_01-00-00-000

Description

The range for this parameter depends on whether the drive model is an MV/240 Vac or an HV/480 Vac.

The VBusScale parameter sets the drive model:

MV/240 Vac: VBusScale = 1

HV/480 Vac: VBusScale = 2

VBusScale is used for multiple parameter ranges that are model dependent, such as IL.KP.

Related Topics

1 Current Loop

37 IP Parameters

This section describes the IP parameters.

37.1 IP.ADDRESS

General Information	
Type	NV Parameter
Description	Gets/Sets the IP address of the drive.
Units	N/A
Range	0.0.0.0 to 255.255.255.255
Default Value	0.0.0.0
Data Type	IP Address
See Also	
Start Version	M_01-04-05-000

Description

This Parameter sets the IP address of the drive. If this parameter has not been set by the user, it will return 0.0.0.0.

By default, DHCP is active, and the drive will acquire an IP Address on its own. When the drive is in DHCP mode, IP.ADDRESS will return 0.0.0.0.

Notes:

- Even when the drive is in DHCP, the actual IP Address will not be returned using this command. The value the user has stored will be returned.
- IP.ADDRESS will only be used by the drive when IP.MODE = 1

If manually setting the IP.ADDRESS, the IP.SUBNET and IP.GATEWAYmust be set up. After the IP.RESET command is issued, the new IP settings will be active only if IP.MODE has been set to 1.

Recovering communications with a drive on an un-reachable IP address

Sometimes a drive may be configured for an IP Address, and the drive needs to be taken off-line, and bench tested, or otherwise used outside of its saved IP Settings. If IP.MODE has been set to 1 (using software defined static IP) the drive will boot up on an IP Address that may be unreachable with the host computer’s settings.

If the IP address prevents communication the IP settings can be reset to default by the following procedure:

- Set both rotary switches to 0
- Hold down button B1 (top-side of drive) for 5 seconds.

The display will flash 0.0.0.0 and then attempt to discover an address by DHCP. Without removing logic power from the drive, use Workbench to connect to the drive, reconfigure the IP address settings as desired, and store the values to non-volatile memory.

Related Topics

IP.GATEWAY

IP.RESET

IP.SUBNET

IP.MODE

37.2 IP.GATEWAY

General Information	
Type	NV Parameter
Description	Gets/Sets the gateway IP of the drive.
Units	N/A
Range	0.0.0.0 to 255.255.255.255
Default Value	0.0.0.0
Data Type	IP Address
See Also	Communicating with the Drive
Start Version	M_01-04-05-000

Description

This Parameter sets the Gateway IP of the drive. This parameter determines what IP the drive can communicate with outside of its current subnet.

By default, DHCP is active, and the drive will acquire an IP Address on its own. When the drive is in DHCP mode, IP.GATEWAY will return 0.0.0.0.

Notes:

- When the drive is in DHCP, the actual IP GATEWAY will not be returned using this command. The value the user has stored will be returned.
- IP.GATEWAY will only be used by the drive when IP.MODE = 1

If manually setting the IP.ADDRESS (pg 369), the IP.SUBNET and IP.GATEWAY must be set up. After the IP.RESET (pg 372) command is issued, the new IP settings will be active only if IP.MODE (pg 371) has been set to 1.

Recovering communications with a drive on an un-reachable IP address

Sometimes a drive may be configured for an IP Address, and the drive needs to be taken offline, and bench tested, or otherwise used outside of its saved IP Settings. If IP.MODE has been set to 1 (using software defined static IP) the drive will boot up on an IP Address that may be unreachable with the host computer's settings.

If the IP address prevents communication the IP settings can be reset to default by the following procedure:

- Set both rotary switches to 0
- Hold down button B1 (top-side of drive) for 5 seconds.

The display will flash 0.0.0.0 and then attempt to discover an address by DHCP. Without removing logic power from the drive, use Workbench to connect to the drive, reconfigure the IP address settings as desired, and store the values to non-volatile memory.

Related Topics

IP.ADDRESS (pg 369)

IP.RESET (pg 372)

IP.SUBNET (pg 372)

IP.MODE (pg 371)

37.3 IP.MODE

General Information	
Type	NV Parameter
Description	Sets method of acquiring IP Address.
Units	N/A
Range	0 to 2
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-04-013-000

Description

This command determines which method of acquiring an IP Address the drive will take.

NOTE Mode 0 and Mode 1 contain multiple methods of acquiring an IP Address. In these modes each method will be implemented in the order they are listed below until an IP Address is acquired

The drive will attempt to acquire a new IP Address as soon as the IP.RESET (pg 372) command is issued.

IP Mode	Mode of Acquiring IP Address
0	Rotary Switches, DHCP, Auto IP
1	IP.ADDRESS, IP.SUBNET, IP.GATEWAY
2	DHCP, Auto IP

Recovering communications with a drive on an un-reachable IP address

Sometimes a drive may be configured for an IP Address, and the drive needs to be taken offline, and bench tested, or otherwise used outside of its saved IP Settings. If IP.MODE has been set to 1 (using software defined static IP), the drive will boot up on an IP Address that may be unreachable with the host computer’s settings.

If the IP address prevents communication the IP settings can be reset to default by the following procedure:

- Set both rotary switches to 0
- Hold down button B1 (top-side of drive) for 5 seconds.

The display will flash 0.0.0.0 and then attempt to discover an address by DHCP. Without removing logic power from the drive, use Workbench to connect to the drive, reconfigure the IP address settings as desired, and store the values to non-volatile memory.

Related Topics

IP.ADDRESS (pg 369)

IP.GATEWAY (pg 370)

IP.RESET (pg 372)

IP.SUBNET (pg 372)

37.4 IP.RESET

General Information	
Type	Command
Description	Implements new IP settings.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	Communicating with the Drive
Start Version	M_01-04-05-000

Description

When this command is issued a new IP will be acquired using IP.MODE (pg 371) to select what method is used.

Notes:

- When issuing this command, it is likely the connection to the drive will be severed, and a new connection will need to be made.
- IP.RESET will return an error if issued while the drive is enabled. IP.RESET is allowed when drive is disabled, or in dynamic braking mode.
- Ensure all values of IP.ADDRESS (pg 369), IP.SUBNET (pg 372), and IP.GATEWAY (pg 370) are configured if using IP.MODE 1

Recovering communications with a drive on an un-reachable IP address

Sometimes a drive may be configured for an IP Address, and the drive needs to be taken off-line, and bench tested, or otherwise used outside of its saved IP Settings. If IP.MODE has been set to 1 (using software defined static IP), the drive will boot up on an IP Address that may be unreachable with the host computer’s settings.

If the IP address prevents communication the IP settings can be reset to default by the following procedure:

- Set both rotary switches to 0
- Hold down button B1 (top-side of drive) for 5 seconds.

The display will flash 0.0.0.0 and then attempt to discover an address by DHCP. Without removing logic power from the drive, use Workbench to connect to the drive, reconfigure the IP address settings as desired, and store the values to non-volatile memory.

Related Topics

IP.ADDRESS (pg 369)

IP.GATEWAY (pg 370)

IP.SUBNET (pg 372)

IP.MODE

37.5 IP.SUBNET

General Information	
Type	NV Parameter

General Information	
Description	Gets/Sets the IP Subnet mask of the drive.
Units	N/A
Range	0.0.0.0 to 255.255.255.255
Default Value	0.0.0.0
Data Type	IP Address
See Also	
Start Version	M_01-04-05-000

Description

This Parameter sets the IP Subnet mask of the drive. This parameter determines what IP addresses the drive will be allowed to communicate with.

By default, DHCP is active, and the drive will acquire an IP Address on its own. When the drive is in DHCP mode, IP.SUBNET will return 0.0.0.0.

Notes:

- When the drive is in DHCP, the actual IP Subnet mask will not be returned using this command. The value the user has stored will be returned.
- IP.SUBNET will only be used by the drive when IP.MODE = 1

If manually setting the IP.ADDRESS, the IP.SUBNET and IP.GATEWAYmust be set up. After the IP.RESET command is issued, the new IP settings will be active only if IP.MODE has been set to 1.

Recovering communications with a drive on an un-reachable IP address

Sometimes a drive may be configured for an IP Address, and the drive needs to be taken off-line, and bench tested, or otherwise used outside of its saved IP Settings. If IP.MODE has been set to 1 (using software defined static IP) the drive will boot up on an IP Address that may be unreachable with the host computer's settings.

If the IP address prevents communication the IP settings can be reset to default by the following procedure:

- Set both rotary switches to 0
- Hold down button B1 (top-side of drive) for 5 seconds.

The display will flash 0.0.0.0 and then attempt to discover an address by DHCP. Without removing logic power from the drive, use Workbench to connect to the drive, reconfigure the IP address settings as desired, and store the values to non-volatile memory.

Related Topics

IP.ADDRESS

IP.GATEWAY

IP.RESET

37.3 IP.MODE

38 LOAD-Parameter

This section describes the LOAD parameters.

38.1 LOAD.INERTIA

General Information	
Type	NV Parameter
Description	Sets the load inertia.
Units	kgcm² for rotary motors kg for linear motors
Range	1 to 1,000,000 kgcm² or kg
Default Value	0 kgcm² or kg
Data Type	Float
See Also	N/A
Start Version	M_01-03-06-000

Description

LOAD.INERTIA sets the load inertia.

Related Topics

Motor (pg 42)

39 MOTOR Parameters

This section describes the MOTOR parameters.

39.1 MOTOR.AUTOSET

General Information	
Type	NV Parameter
Description	Determines which drive parameters are calculated automatically.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Boolean
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter determines whether or not certain drive parameters (for example, IL.KP or MOTOR.POLES) are calculated automatically. A value of 1 causes the parameters to be automatically calculated from the motor ID data (read from memory-supporting feedback devices, such as SFD, Endat, and BISS). Automatically calculated parameters are read-only. A value of 0 disables the automatic calculation and you must set the parameters manually. Manually set parameters are read-write.

Related Topics

7.1 Motor

39.2 MOTOR.BRAKE

General Information	
Type	NV Parameter
Description	Sets the presence or absence of a motor brake.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Boolean
See Also	N/A
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

The MOTOR.BRAKE parameter notifies the firmware whether a brake exists or not. It does not apply or release the brake. If a brake is found to be present, the firmware considers hardware indications regarding the brake circuits (such as open circuit or short circuit). If a brake does not exist, then the firmware ignores the hardware indications since they are irrelevant.

Value	Status
0	Motor brake does not exist.
1	Motor brake exists and brake hardware circuitry checks are enabled.

Enabling the MOTOR.BRAKE (value set to 1) when no motor brake exists creates a fault.

The motor brake is polled every 16 ms.

Related Topics

7.1 Motor

39.3 MOTOR.BRAKEIMM

General Information	
Type	NV Parameter
Description	Brake Immediately: in the case of a drive disable, apply the brake in all situations.
Units	N/A
Range	0 to 1
Default Value	0 (Inactive)
Data Type	Boolean
See Also	N/A
Start Version	M_01-05-11-000

Description

With the standard configuration, when the drive disables, the brake will not apply until velocity falls below CS.VTHRESH for CS.TO milliseconds. However, in some machines (such as a vertical axis) the brake should be applied immediately whenever the drive disables.

To ensure that the brake is applied immediately after any disable (due to fault, disable command, etc), set MOTOR.BRAKEIMM = 1.

Related Topics

Motor (pg 42) | CS.VTHRESH (pg 240) | CS.TO (pg 238) | MOTOR.TBRAKETO (pg 390) | DRV.DISTO (pg 275)

39.4 MOTOR.BRAKERLS

General Information	
Type	Command
Description	Allows a user to release or apply the motor brake.
Units	N/A
Range	0 to 2

General Information	
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	3450h/0	M_01-00-00-000

Description

This command allows a user to release or apply the motor brake.

0 = Drive controls the brake.

1 = Brake is released.

2 = Brake is applied.

NOTE A digital input mode is also used for the same purpose. The two mechanisms are independent.

NOTE The CANopen-object 0x345A sub 1/2 can be used to control the brake state. See CANopen manual on kollmorgen.com. (Functionality starts with firmware 1.7.4.0)

Related Topics

Motor (pg 42)

39.5 MOTOR.BRAKESTATE

General Information	
Type	R/O Parameter
Description	Reads the actual status of the motor brake.
Units	N/A
Range	Brake released or not present. Brake applied.
Default Value	Brake applied or not present.
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter reads the actual status of the motor brake and can only show two states:

1 = Brake released or not present

2 = Brake applied

Related Topics

Motor (pg 42)

39.6 MOTOR.CTF0

General Information	
Type	NV Parameter
Description	Sets the thermal constant of the motor coil.
Units	mHz
Range	0.265 to 16,000 mHz
Default Value	10 mHz
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the thermal constant of the motor coil, which is the break frequency of a single-pole low-pass filter model of the thermal dynamics of the motor coil.

This parameter, together with MOTOR.IPEAK (pg 383) and MOTOR.ICONT (pg 380), determine the motor foldback parameters IL.MFOLDD (pg 362),IL.MFOLDT (pg 362), and IL.MFOLDR (pg 362).

Calculating MOTOR.CTF0

Given a motor coil/winding thermal time constant T in seconds, then:

```
MOTOR.CTF0 = 1/(2πT)
```

Related Topics

7.1 Motor

39.7 MOTOR.ICONT

General Information	
Type	NV Parameter
Description	Sets the motor continuous current.
Units	A
Range	0.1 to 500 A
Default Value	1.0 A
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

AKD BASIC Information	
Type	R/W

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the motor continuous current.

Related Topics

7.1 Motor

39.8 MOTOR.IDDATAVALID

General Information	
Type	R/O Parameter
Description	Reports the status of the motor memory.
Units	N/A
Range	N/A
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-02-00-000

Description

MOTOR.IDDATAVALID reports the status of the motor memory status.

The valid values for this keyword are the following:

Value	Description
0	Error in identification
1	Success in identification
2	Identification in process
3	Identification not started yet
4	Success recognizing feedback, but failed to varify OEM data integrity

Related Topics

Motor (pg 42)

39.9 MOTOR.IMID

General Information	
Type	R/W
Description	The direct-axis current set point used for induction machine closed-loop control.
Units	Arms
Range	0 to DRIVE.IPEAK
Default Value	0
Data Type	Float
Start Version	M_01-08-00-000

Description

The value of IL.IMID can be estimated using the motor name plate information.

The following rule should generally be used:

$$I_{d,rms} \cong I_R * \sqrt{1 - (\cos\varphi)^2 * 0.8}$$

In which $\mathbf{I_d}$ is the value for IL.IMID, the preset rotor flux building current, $\mathbf{I_r}$ is the name plate phase current, **cosϕ** is the name plate power factor at rated and operation, and **0.8** is an empirical factor (accounts for the angle error due to voltage drop on the leakage induction).

Related Topics

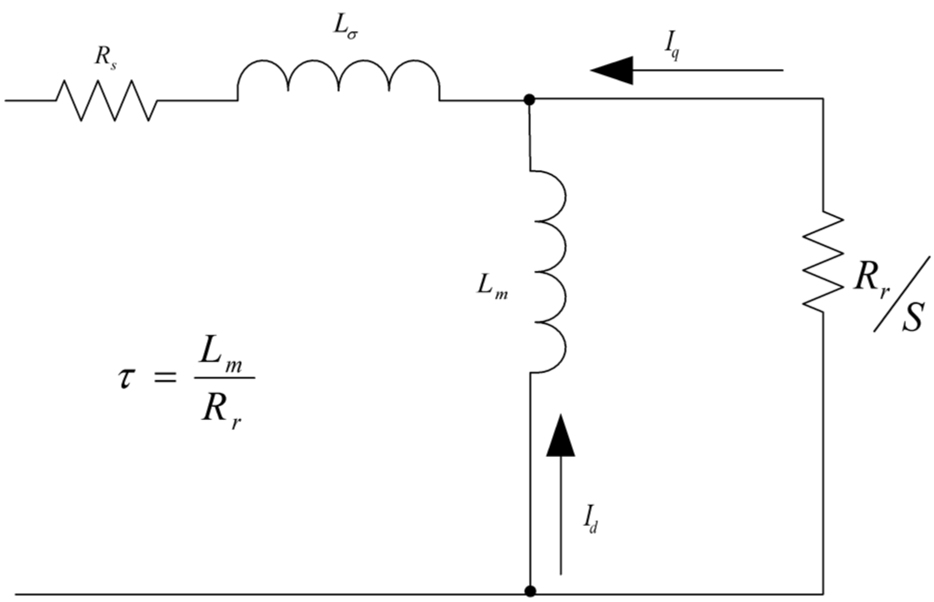
Motor (pg 42)

39.10 MOTOR.IMTR

General Information	
Type	R/W
Description	Rotor time constant.
Units	Ms
Range	1 to 16,000
Default Value	100
Data Type	Integer
Start Version	M_01-08-00-000

Description

The rotor time constant is calculated as the ratio between rotor magnetizing inductance L_m and rotor resistance R_r from the following equivalent circuit of an induction machine.



Alternatively, the rotor time constant can be estimated from the rated current, magnetizing current (MOTOR.IMID (pg 381)) and rated slip frequency as follows:

$$\tau = \frac{\sqrt{I_{s,rms}{}^2 - I_{d,rms}{}^2}}{I_{d,rms} * \omega_{slip}}$$

where $I_{s,rms}$ is the rated current, $I_{d,rms}$ is the rated magnetizing current, and ω_{slip} is the rated slip frequency in rad/s.

NOTE τ is in seconds for the above formulas. It needs to converted to ms for the MOTOR.IMTR setting:
MOTOR.IMTR(ms) = τ*1000

Related Topics

Motor (pg 42)

39.11 MOTOR.INERTIA

General Information	
Type	NV Parameter
Description	Sets the motor inertia.
Units	kgcm² for rotary motors kg for linear motors
Range	1 to 200,000 kgcm² or kg
Default Value	100 kgcm² or kg
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter sets the motor inertia.

Related Topics

7.1 Motor

39.12 MOTOR.IPEAK

General Information	
Type	NV Parameter
Description	Sets the motor peak current.
Units	mA
Range	0.200 to 1,000 A

General Information	
Default Value	2.000 A
Data Type	Float
See Also	IL.LIMITP (pg 361), IL.LIMITN (pg 360)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter configures the drive for the motor's peak, instantaneous-rated current. MOTOR.IPEAK is used to limit clamp the magnitude of the torque producing q-component current command (IL.CMD (pg 349)).

Related Topics

7.1 Motor

39.13 MOTOR.KE

General Information	
Type	NV Parameter
Description	Sets the motor back EMF constant.
Units	Vpeak/krpm for Rotary Motors Vpeak/m/s for Linear Motors
Range	0.0 to 100,000
Default Value	0
Data Type	Float
See Also	N/A
Start Version	M_01-03-06-000

Description

MOTOR.KE defines the back EMF constant for the motor. The back EMF constant defines how much voltage is generated at the motors coils. The relationship between MOTOR.KE and speed is described by the following equation:

```
Coil Voltage = MOTOR.KE * VL.FB
```

Where:

VL.FB is in units of krpm for rotary motors and in units of m/s for linear motors

Related Topics

Motor (pg 42)

39.14 MOTOR.KT

General Information	
Type	NV Parameter
Description	Sets the torque constant of the motor.
Units	Nm/A
Range	0.001 Nm/A to 1,000,000.000 Nm/A for rotary motors. 0.001 Nm/A to 1,000,000.000 N/A for linear motors.
Default Value	0.1 Nm/A
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is the torque constant of the motor in Nm/A.The value can be online checked according to the following equation:

$$Kt = 60 * \sqrt{3} * Ui / (2 * \pi * n)$$

Where:

Ui = induced voltage of the motor
n = actual rotor velocity

Related Topics

7.1 Motor

39.15 MOTOR.LQLL

General Information	
Type	NV Parameter
Description	Sets the line-to-line motor Lq.
Units	mH
Range	1 to 2^{32} H
Default Value	17.000 H
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the motor line-to-line inductance.

Related Topics

7.1 Motor

39.16 MOTOR.NAME

General Information	
Type	NV Parameter
Description	Sets the motor name.
Units	N/A
Range	11 chars
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter is used to set the motor name.

Related Topics

Motor (pg 42)

39.17 MOTOR.PHASE

General Information	
Type	NV Parameter
Description	Sets the motor phase.
Units	Electrical degrees
Range	0 to 360°
Default Value	0°
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter sets the motor phase.

Related Topics

7.1 Motor

39.18 MOTOR.PITCH

General Information	
Type	NV Parameter
Description	Sets the motor pitch.
Units	µm
Range	1,000 to 1,000,000 µm
Default Value	1.000 µm
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter defines the pole-to-pair pitch for the linear motor in micrometers.

Related Topics

Motor (pg 42)

39.19 MOTOR.POLES

General Information	
Type	NV Parameter
Description	Sets the number of motor poles.
Units	N/A
Range	0 to 128
Default Value	6
Data Type	Integer
See Also	FB1.POLES (pg 318)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

MOTOR.POLES sets the number of motor poles. This command is used for commutation control and represents the number of individual magnetic poles of the motor (not pole pairs). The division value of motor poles (MOTOR.POLES) and feedback poles (FB1.POLES) must be an integer when setting drive to enable, otherwise a fault is issued.

Related Topics

7.1 Motor

39.20 MOTOR.R

General Information	
Type	NV Parameter
Description	Sets the stator winding resistance phase-phase in ohms.
Units	Ω
Range	0.001 to 650 Ω
Default Value	10 Ω
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

MOTOR.R sets the stator winding resistance phase-to-phase in ohms.

Related Topics

7.1 Motor

39.21 MOTOR.RTYPE

General Information	
Type	NV Parameter
Description	Defines the type of thermal resistor inside the motor.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Boolean
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter defines the type of thermal resistor used inside of the motor to measures motor temperature.

0 = PTC

1 = NTC

Related Topics

Motor (pg 42)

39.22 MOTOR.TBRAKEAPP

General Information	
Type	NV Parameter
Description	The delay time used for applying the motor brake.
Units	ms
Range	0 to 1,000 ms
Default Value	75 ms
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the mechanical delay when applying the motor brake. MOTOR.TBRAKEAPP is a time delay that is applied when a brake exists and the drive is disabled at the end of a controlled stop. This delay lasts from the time that the brake is commanded to apply until the time that the drive is disabled.

This feature allows you to disable the drive and apply the brake on a vertical application without the load falling. Without this time delay, if you immediately disable the drive, then the load falls during the time needed for the brake to mechanically apply.

Related Topics

7.1 Motor

39.23 MOTOR.TBRAKERLS

General Information	
Type	NV Parameter
Description	The delay time used for releasing the motor brake.
Units	ms
Range	0 to 1,000 ms
Default Value	75 ms
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the mechanical delay when releasing the motor brake. MOTOR.TBRAKERLS is a time delay that is applied when a brake exists and the drive is enabled. When the drive is enabled, the brake is commanded to release and, during the MOTOR.TBRAKERLS period of time, the drive does not accept a motion command. This delay allows the brake to fully release before the drive begins a new motion.

Related Topics

7.1 Motor

39.24 MOTOR.TBRAKETO

General Information	
Type	NV Parameter
Description	Brake apply timeout for vertical axis.
Units	Milliseconds
Range	-1 to 30,000
Default Value	-1 (function disabled)
Data Type	Integer
See Also	CS.VTHRESH (pg 240), CS.TO (pg 238), DRV.DISTO (pg 275)
Start Version	01-05-07-000

Description

When a drive is disabled (due to user command, digital input, or fault), the brake will normally not be applied until velocity has fallen below CS.VTHRESH (pg 240). In some instances, such as a vertical axis, it may desirable to apply the brake regardless of velocity.

MOTOR.TBRAKETO sets the maximum time allowed to pass between drive disable and application of the motor brake. After this time, the brake will be applied even if velocity is higher than CS.VTHRESH (pg 240).

To disable the timer, set the value to -1.

NOTE Prior to version 01-05-07-000, this timeout was only applied when the Hardware Enable was deactivated and the default was 30,000. From 01-05-07-000 on this timeout is applied in all conditions and the default is -1.

39.25 MOTOR.TEMP

General Information	
Type	R/O Parameter
Description	Reads the motor temperature represented as the resistance of the motor PTC.
Units	Ω
Range	0 to 2^{32} Ω
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter is used to get the motor temperature which is represented as the resistance of the motor PTC.

Related Topics

7.1 Motor

39.26 MOTOR.TEMPFAULT

General Information	
Type	NV Parameter
Description	Sets the motor temperature fault level.
Units	Ω
Range	0 to 2,000,000,000 Ω
Default Value	0 Ω = switched off
Data Type	Integer
See Also	MOTOR.TEMP (pg 390)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the motor temperature fault level as a resistance threshold of the motor PTC.

A zero value prevents any warning from being issued.

Related Topics

7.1 Motor

39.27 MOTOR.TEMPWARN

General Information	
Type	NV Parameter
Description	Sets the motor temperature warning level.
Units	Ω
Range	0 to 2,000,000,000 Ω
Default Value	0 Ω = switched off
Data Type	Integer
See Also	MOTOR.TEMP (pg 390)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the motor temperature warning level as a resistance threshold of the motor PTC.

A zero value prevents any warning from being created.

Related Topics

7.1 Motor

39.28 MOTOR.TYPE

General Information	
Type	NV Parameter
Description	Sets the motor type.
Units	N/A
Range	0, 1, 2 ,4
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

MOTOR.TYPE sets the drive control algorithms to different motor types as follows:

0 = Rotary motor

1 = Linear motor

2 = Induction Motor V/f Open Loop Control

4 = Induction Motor Closed Loop Control

The following table shows which MOTOR parameters must be configured for either permanent magnet, induction motor v/f open loop, or induction motor closed loop motor types.

Keyword	Permanent Magnet	Induction Motor v/f Open Loop	Induction Motor Closed Loop
MOTOR.NAME (pg 386)	Yes	Yes	Yes
MOTOR.TYPE	Yes	Yes	Yes
MOTOR.AUTOSET (pg 377)	Yes	No	Yes
MOTOR.IPEAK (pg 383)	Yes	Yes	Yes
MOTOR.ICONT (pg 380)	Yes	Yes	Yes
MOTOR.INERTIA (pg 383)	Yes	Yes	Yes
MOTOR.KT (pg 385)	Yes	No	No
MOTOR.LQLL (pg 385)	Yes	No	Yes
MOTOR.POLES (pg 387)	Yes	Yes	Yes
MOTOR.VMAX (pg 393)	Yes	Yes	Yes
MOTOR.R (pg 388)	Yes	Yes	Yes

Keyword	Permanent Magnet	Induction Motor v/f Open Loop	Induction Motor Closed Loop
MOTOR.VOLTMAX (pg 393)	Yes	Yes	Yes
MOTOR.PHASE (pg 386)	Yes	No	No
MOTOR.CTF0 (pg 380)	Yes	Yes	Yes
MOTOR.KE (pg 384)	Yes	No	No
MOTOR.IMTR (pg 382)	No	No	Yes
MOTOR.IMID (pg 381)	No	No	Yes
MOTOR.VOLTRATED (pg 395)	No	Yes	No
MOTOR.VRATED (pg 395)	No	Yes	No
MOTOR.VOLTMIN (pg 394)	No	Yes	No

Related Topics

Motor (pg 42)

39.29 MOTOR.VMAX

General Information	
Type	NV Parameter
Description	Sets the maximum motor speed.
Units	rpm
Range	100 to 40,000 rpm
Default Value	3,000 rpm
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter is used to configure the maximum speed of the motor.

Related Topics

7.1 Motor

39.30 MOTOR.VOLTMAX

General Information	
Type	NV Parameter
Description	Sets the motor maximum volt-age.

General Information	
Units	Vrms
Range	110 to 900 Vrms
Default Value	230 Vrms
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter sets the maximum permissible motor voltage. For instance, if a motor that is rated for a 400 V supply is connected to the drive, then the MOTOR.VOLTMAX setting is 400. This value also sets regen resistor and over voltage thresholds in the drive to acceptable values for the motor so that the motor windings are not damaged.

Related Topics

7.1 Motor

39.31 MOTOR.VOLTMIN

General Information	
Type	NV Parameter
Description	Sets the minimum voltage for V/f control.
Units	%
Range	0 to 100%
Default Value	2%
Data Type	U16
See Also	MOTOR.VRATED (pg 395), MOTOR.VOLTRATED (pg 395)
Start Version	

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/3	M_01-00-00-000

Description

This parameter configures the drive for the induction motor's minimum voltage at standstill. It is given as a percentage (%) of the motor’s rated voltage. MOTOR.VOLTMIN is used to calculate the constant volts per Hertz characteristics of the drive and motor and should be set to a value that generates a current of about 40% of the rated current at standstill.

Related Topics

7.1 Motor

39.32 MOTOR.VOLTRATED

General Information	
Type	NV Parameter
Description	Sets the motor rated voltage.
Units	V
Range	50 to 1,000 V
Default Value	230 V
Data Type	U16
See Also	MOTOR.VRATED (pg 395), MOTOR.VOLTMIN (pg 394)
Start Version	M_01-03-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/2	M_01-03-00-000

Description

This parameter configures the drive for the induction motor's rated voltage as indicated on the nameplate.

MOTOR.VOLTRATED is used to calculate the constant Volts per Hertz characteristics of the drive and motor.

Related Topics

Motor (pg 42)

39.33 MOTOR.VRATED

General Information	
Type	NV Parameter
Description	Sets the motor rated velocity (not maximum velocity)
Units	Depends on or Rotary: rpm, rps, deg/s, custom units/s, rad/s Linear: counts/s, mm/s, µm/s, custom units/s
Range	Rotary: 0.000 to 15,000.000 rpm 0.000 to 250.000 rps 0.000 to 90,000.000 deg/s 0.000 to 1,250.000 custom units/s 0.000 to 1,570.796 rad/s Linear: 0.000 to 1,073,741,824,000.000 counts/s 0.000 to 8,000.000 mm/s 0.000 to 8,000,000.000 µm/s 0.000 to 1,250.000 custom units/s
Default Value	0 rpm

General Information	
Data Type	U16
See Also	MOTOR.VOLTRATED (pg 395), MOTOR.VOLTMIN (pg 394)
Start Version	M_01-03-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/1	M_01-03-00-000

Description

This parameter configures the drive for the rated velocity of the induction motor as indicated on the nameplate.

MOTOR.VRATED is used to calculate the constant volts per Hertz characteristics of the drive and motor.

Related Topics

Motor (pg 42)

40 PL Parameters

This section describes the PL parameters.

40.1 PL.CMD

General Information	
Type	R/O Parameter
Description	Reads the position command directly from the entry to the position loop.
Units	Depends on or Rotary: counts, rad, deg, (custom units), 16-bit counts Linear: counts, mm, µm, (custom units), 16-bit counts
Range	N/A
Default Value	N/A
Data Type	Float
See Also	PL.FB (pg 403)
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Description

PL.CMD reads the position command as it is received in the position loop entry.

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) | PL.ERRWTHRESH (pg 401)

1 Position Loop

40.2 PL.ERR

General Information	
Type	R/O Parameter
Description	Reads the position error present when the drive is controlling the position loop.
Units	counts, rad, deg, (custom units)
Range	N/A
Default Value	N/A
Data Type	Float
See Also	PL.FB (pg 403)
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0 /0	M_01-00-00-000

Description

PL.ERR reads the position error present when the drive is controlling the position loop. PL.ERR is the difference between the actual position of the motor shaft (PL.FB (pg 403)) and the commanded position of the drive (PL.CMD (pg 398)). If the drive is not in the position operating mode (DRV.OPMODE (pg 294) = 2), then the PL.ERR value is not generated by the drive and this parameter is read as 0.

AKD BASIC Notes

NOTE When you enable the position error interrupt (by setting INTR.PL.ERR=1), the Position Error fault is disabled. In situations where it would have occurred, a position error interrupt is generated instead.

Related Topics

PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) | PL.ERRWTHRESH (pg 401)

1 Position Loop

40.3 PL.ERRFTHRESH

General Information	
Type	NV Parameter
Description	Sets the maximum position error.
Units	Depends on or Rotary: counts, rad, deg, (custom units), 16-bit counts Linear: counts, mm, µm, (custom units), 16-bit counts
Range	Rotary: 0.000 to 5,123,372,000,000,005.000 counts 0.000 to 7,495,067.136 rad 0.000 to 429,436,076.032 deg 0.000 to 5,964,389.888 (custom units) 0.000 to 78,176,452,636.718 16-bit counts Linear: 0.000 to 5,123,372,000,000,005.000 counts 0.000 to 1,192,877.952*MOTOR.PITCH (pg 387) mm 0.000 to 1,192,878,014.464*MOTOR.PITCH (pg 387) µm 0.000 to 5,964,389.888 (custom units) 0.000 to 78,176,452,636.718 16-bit counts

General Information	
Default Value	Rotary: 42,949,672,960.000 counts 62.832 rad 3,600.000 deg 50.000 (custom units) 655,360.000 16-bit counts Linear: 42,949,672,960.000 counts 10.000*MOTOR.PITCHMOTOR.PITCH (pg 387)mm 10,000.000*MOTOR.PITCH µm 50.000 (custom units) 655,360.000 16-bit counts
Data Type	Float
See Also	PL.ERR
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0 /0	M_01-00-00-000

Description

This parameter sets the maximum position error. If the position error PL.ERR (pg 398) is larger than PL.ERRFTHRESH the drive generates a fault. If PL.ERRFTHRESH is set to 0, the maximum position error is ignored.

Example

Set position rotary units to 2 (degrees). Setting PL.ERRFTHRESH to 1000 states that is the position error is larger than 1000 degrees, the drive will generate a fault.

UNIT.PROTARY 2

PL.ERRFTHRESH 1000

Related Topics

PL.ERR (pg 398) | PL.ERRMODE (pg 400) | PL.ERRWTHRESH (pg 401)

1 Position Loop

40.4 PL.ERRMODE

General Information	
Type	NV Parameter
Description	Sets the type of following error warning and fault usage.
Units	0- Standard following error 1-Enhanced following error
Range	0 to 1

General Information	
Default Value	0
Data Type	Boolean
See Also	PL.ERR (pg 398), PL.ERRFTHRESH (pg 399), PL.ERRWTHRESH (pg 401)
Start Version	M_01-02-09-000

AKD BASIC Information	
Data Type	Integer

Description

PL.ERRMODE sets the type of following error warning and fault usage.

Mode 0 - following error magnitude fault

In Mode 0, the values of PL.ERRFTHRESH and PL.ERRWTHRESH are compared against the value of PL.ERR. If the absolute value of PL.ERR is larger than PL.ERRWTHRESH, then a warning is generated. If the absolute value of PL.ERR is larger than PL.ERRFTHRESH, then a fault is generated.

Mode 1 - deviation from predicted trajectory fault

In Mode 1, the values of PL.ERRFTHRESH and PL.ERRWTHRESH are compared against the following value:

<error> = abs(PL.ERR - [(VL.CMD – 1*VL.FF) / PL.KP])

If the absolute value of <error> is larger than PL.ERRWTHRESH for a consecutive period of 100 ms, then a warning is generated. If the absolute value of <error> is larger than PL.ERRFTHRESH for a consecutive period of 100 ms, then a fault is generated.

In mode 1, if PL.KI is not 0 then the following error prediction mechanism is turned off. When the drive is disabled, the following error limit tests are turned off and the warnings are cleared. A value of 0 in PL.ERRFTHRESH or PL.ERRWTHRESH disables the respective functionality.

Example

Assuming

PL.ERRMODE = 0, PL.ERRFTHRESH=1.2, PL.ERRWTHRESH=1, then PL.ERR reads 1.1.

In this case the warning is generated, but the fault is not.

Assuming PL.ERRMODE = 0, PL.ERRFTHRESH=1.2, PL.ERRWTHRESH=1, then PL.ERR reads 1.3.

In this case the warning is generated, as well as the fault.

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRWTHRESH (pg 401)

1 Position Loop

40.5 PL.ERRWTHRESH

General Information	
Type	NV Parameter
Description	Sets the position error warning level.

General Information	
Units	Depends on or Rotary: counts, rad, deg, (custom units), 16-bit counts Linear: counts, mm, µm, (custom units), 16-bit counts
Range	Rotary: 0.000 to 5,123,372,000,000,005.000 counts 0.000 to 7,495,067.136 rad 0.000 to 429,436,076.032 deg 0.000 to 5,964,389.888 (custom units) 0.000 to 78,176,452,636.718 16-bit counts Linear: 0.000 to 5,123,372,000,000,005.000 counts 0.000 to 1,192,877.952*MOTOR.PITCH (pg 387) mm 0.000 to 1,192,878,014.464*MOTOR.PITCH (pg 387) µm 0.000 to 5,964,389.888 (custom units) 0.000 to 78,176,452,636.718 16-bit counts
Default Value	0.000 deg
Data Type	Float
See Also	PL.ERR (pg 398)
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

If this value is not equal 0 and the position error PL.ERR (pg 398) is larger than this value, the drive will generate a warning.

If PL.ERRWTHRESH is set to 0 the warning is not issued.

Example

Set position rotary units to 2 degrees. If you set PL.ERRWTHRESH to 100 and the position error is larger than 100 degrees, then the drive will generate a warning.

UNIT.PROTARY 2

PL.ERRWTHRESH 100

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400)

1 Position Loop

40.6 PL.FB

General Information	
Type	R/O Parameter
Description	Reads the position feedback value.
Units	Depends on or Rotary: counts, rad, deg, (custom units), 16-bit counts Linear: counts, mm, µm, (custom units), 16-bit counts
Range	N/A
Default Value	N/A
Data Type	Float
See Also	FB1.OFFSET
Start Version	M_01-00-00-000

AKD BASIC Information	
Data Type	Integer

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

PL.FB returns the position feedback value.

Note that this value is not the pure feedback value read from the feedback device, but also includes the value of the FB1.OFFSET and an internal offset set automatically by the FW when a homing switch is actuated.

AKD BASIC Note

Note that this value is not the pure feedback value read from the feedback device, but also includes the value of the FB1.OFFSET and an internal offset set by the user. If a new value is written to MOVE.POSCOMMAND then PL.FB will be automatically changed such that PL.ERROR (the difference between them) is unchanged.

AKD BASIC Example

```
Print                      PL.FB, MOVE.POSCOMMAND
MOVE.POSCOMMAND = 0
Print                      PL.FB, MOVE.POSCOMMAND
```

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) | PL.ERRWTHRESH (pg 401)

1 Position Loop

40.7 PL.FBSOURCE

General Information	
Type	NV Parameter

General Information	
Description	Sets the feedback source for the position loop.
Units	N/A
Range	Range will differ depending on drive model. 0 to 1 (for AKD PDMM-x-xxxxx-NAxx-xxxx) 0 to 2 (for AKD PDMM-x-xxxxx-NBxx-xxxx)
Default Value	0
Data Type	Integer
See Also	VL.FBSOURCE
Start Version	M_01-00-00-000

Description

This parameter determines the feedback source that the position loop uses. A value of 0 for this parameter selects the primary feedback, a value of 1 selects the secondary feedback. If you use the secondary feedback as the source for the position loop, then FB2.MODE mode should be set as 0 (A/B signals). A/B signals are the only supported feedback type as secondary feedback into the position loop. Other settings for FB2.MODE are intended as pulse inputs or a gearing command when PL.FBSOURCE remains 0.

0	Primary Feedback connected to X10.
1	Secondary Feedback (DRV.HANDWHEEL) connected to X7 or X9.
2	Tertiary Feedback connected to X9 (only supported with AKD PDMM-x-xxxxx-NBxx-xxxx).

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) | PL.ERRWTHRESH (pg 401)

1 Position Loop

40.8 PL.INTINMAX

General Information	
Type	NV Parameter
Description	Limits the input of the position loop integrator by setting the input saturation.
Units	Depends on or Rotary: counts, rad, deg, (custom units), 16-bit counts Linear: counts, mm, µm, (custom units), 16-bit counts

General Information	
Range	Rotary: 0.000 to 18,446,744,073,709.000 counts 0.000 to 26,986.052 rad 0.000 to 1,546,188.288 deg 0.000 to 21,474.836 (custom units) 0.000 to 281,474,976.710 16-bit counts Linear: 0.000 to 18,446,744,073,709.000 counts 0.000 to 4,294.968*MOTOR.PITCH (pg 387) mm 0.000 to 4,294,967.296*MOTOR.PITCH (pg 387) µm 0.000 to 21,474.836 (custom units) 0.000 to 281,474,976.710 16-bit counts
Default Value	Rotary: 3,999,989,760.000 counts 5.852 rad 335.275 deg 4.657 (custom units) 61,035.000 16-bit counts Linear: 3,999,989,760.000 counts 0MOTOR.PITCH (pg 387) mm 9MOTOR.PITCH (pg 387) µm 4.657 (custom units) 61,035.000 16-bit counts
Data Type	Float
See Also	PL.FB
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/1	M_01-00-00-000

Description

PL.INTINMAX limits the input of the position loop integrator by setting the input saturation. When used in concert with PL.INSATOUT, this variable allows you to make the position loop integrator effective near the target position. Far from the target position, however,the integrator is not dominant in the loop dynamics.

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) | PL.ERRWTHRESH (pg 401)

1 Position Loop

40.9 PL.INTOUTMAX

General Information	
Type	NV Parameter
Description	Limits the output of the position loop integrator by setting the output saturation.
Units	Depends on or Rotary: counts, rad, deg, (custom units), 16-bit counts Linear: counts, mm, µm, (custom units), 16-bit counts
Range	Rotary: 0.000 to 18,446,744,073,709.000 counts 0.000 to 26,986.052 rad 0.000 to 1,546,188.288 deg 0.000 to 21,474.836 (custom units) 0.000 to 281,474,976.710 counts16 bit Linear: 0.000 to 18,446,744,073,709.000 counts 0.000 to 4,294.968*MOTOR.PITCH (pg 387) mm 0.000 to 4,294,967.296*MOTOR.PITCH µm 0.000 to 21,474.836 (custom units) 0.000 to 281,474,976.710 16-bit counts
Default Value	Rotary: 3,999,989,760.000 counts 5.852 rad 335.275 deg 4.657 (custom units) 61,035.000 16-bit counts Linear: 3,999,989,760.000 counts 0MOTOR.PITCH (pg 387) mm 9MOTOR.PITCH (pg 387) µm 4.657 (custom units) 61,035.000 16-bit counts
Data Type	Float
See Also	PL.INTINMAX
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/2	M_01-00-00-000

Description

PL.INTOUTMAX limits the output of the position loop integrator by setting the output saturation.

When used in concert with PL.INTINMAX, this variable allows you to make the position loop integrator effective near the target position. Far from the target position, however, the integrator is not dominant in the loop dynamics.

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) |
PL.ERRWTHRESH (pg 401)

1 Position Loop

40.10 PL.KI

General Information	
Type	NV Parameter
Description	Sets the integral gain of the position loop.
Units	Hz
Range	0 to 250 Hz
Default Value	0 Hz
Data Type	Float
See Also	PL.KP, PL.KD
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

PL.KI sets the integral gain of the position regulator PID loop.

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) |
PL.ERRWTHRESH (pg 401)

1 Position Loop

40.11 PL.KP

General Information	
Type	NV Parameter
Description	Sets the proportional gain of the position regulator PID loop.
Units	(rev/s)/rev
Range	0 to 2,147,483.008 (rev/s)/rev
Default Value	100 rps/rev
Data Type	Float
See Also	PL.KI (pg 407),
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

PL.KP sets the proportional gain of the position regulator PID loop.

Related Topics

PL.ERR (pg 398) | PL.ERRFTHRESH (pg 399) | PL.ERRMODE (pg 400) |
PL.ERRWTHRESH (pg 401)

1 Position Loop

41 REC Parameters

This section describes the REC parameters.

41.1 REC.ACTIVE

General Information	
Type	R/O Parameter
Description	Indicates if data recording is in progress (active).
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	REC.DONE (pg 411), REC.OFF (pg 412)
Start Version	M_01-00-00-000

Description

REC.ACTIVE indicates whether or not data recording is in progress. Recording is in progress if the trigger was met and the recorder is recording all data.

Related Topics

Scope (pg 103)

41.2 REC.CH1 to REC.CH6

General Information	
Type	R/W Parameter
Description	Sets recording channels 1 to 6.
Units	N/A
Range	N/A
Default Value	CH1 = IL.FB CH2 = IL.CMD CH3 = VL.FB CH4 = Empty CH5 = Empty CH6 = Empty
Data Type	String
See Also	REC.TRIG (pg 417)
Start Version	M_01-00-00-000

Description

REC.CHx specifies the recording channels.

There are 3 options to set the recording channels values:

- Set 0, CLR, or CLEAR. This setting clears the recording channel.
- Set one of the recordable commands. The list of recordable commands can be obtain by executing REC.RECPRMLIST (pg 412).
- Set an internal value or variable of the drive (same as for DRV.MEMADDR (pg 290) input).

Related Topics

Scope (pg 103)

41.3 REC.DONE

General Information	
Type	R/O Parameter
Description	Checks whether or not the recorder has finished recording.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	REC.ACTIVE, REC.OFF
Start Version	M_01-00-00-000

Description

REC.DONE indicates that the recorder has finished recording. This value is reset to 0 when the recorder trigger is set. The drive also resets this value when the recording has finished or when REC.OFF is executed.

Related Topics

Scope (pg 103)

41.4 REC.GAP

General Information	
Type	R/W Parameter
Description	Specifies the gap between consecutive samples.
Units	N/A
Range	1 to 65,535
Default Value	1
Data Type	Integer
See Also	REC.TRIG (pg 417)
Start Version	M_01-00-00-000

Description

REC.GAP specifies the gap between consecutive samples. The recording base rate is 16 kHz, thus a gap of 1 means that a sample is recorded every 62.5 µs.

Related Topics

Scope (pg 103)

41.5 REC.NUMPOINTS

General Information	
Type	R/W Parameter

General Information	
Description	Sets the number of points to record.
Units	N/A
Range	1 to 65,535
Default Value	1,000
Data Type	Integer
See Also	REC.TRIG (pg 417)
Start Version	M_01-00-00-000

Description

REC.NUMPOINTS specifies the number of points (samples) to record.

Related Topics

Scope (pg 103)

41.6 REC.OFF

General Information	
Type	R/W Parameter
Description	Turns the recorder OFF.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	REC.ACTIVE, REC.DONE
Start Version	M_01-00-00-000

Description

REC.OFF turns the recorder off. In order to set the recorder again, the recorder must first be armed and then a trigger set.

Related Topics

Scope (pg 103)

REC.READY

41.7 REC.RECPRMLIST

General Information	
Type	R/O Parameter
Description	Reads the list of recordable parameters.
Units	N/A
Range	N/A

General Information	
Default Value	N/A
Data Type	N/A
See Also	REC.CH1 to REC.CH6 (pg 410)
Start Version	M_01-00-00-000

Description

This command returns the list of recordable parameters. You can use a recordable parameter as an input to any of the recording channels.

Note that an internal address or a registered variable can be used as input to any of the channels in addition to the list.

Related Topics

Scope (pg 103)

41.8 REC.RETRIEVE

General Information	
Type	R/O Parameter
Description	Transfers all the recorded data to the communication channel.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	String
See Also	N/A
Start Version	M_01-00-00-000

Description

REC.RETRIEVE causes the drive to transfer all the recorded data to the communication channel.

Example

The following format is the retrieve reply format (for N samples, G sample gap, and M parameters, where M<=6):

```
Recording
<N>,<G>
<parameter name 1> … <parameter name M>
Value11 … Value1M
Value N1 …  ValueNM
```

Related Topics

Scope (pg 103)

41.9 REC.RETRIEVEDATA

General Information	
Type	R/W Parameter
Description	Retrieves the recorded data without the header.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	REC.RETRIEVE, REC.RETRIEVEHDR, REC.R-ETRIEVESIZE
Start Version	M_01-00-00-000

Description

REC.RETRIEVEDATA retrieves a section of recorded data according to REC.R-ETRIEVESIZE from the received index; if no index is received, the drive retrieves the data from next section. An index is supplied to enable multiple retrieves and to give better control on the buffer in case of overflow. If no index or a negative value is present, then the index is ignored.

EWV[1] uses this parameter to retrieve the data continuously for real time recoding.

The size of the data returned by this command depends on the number set by REC.R-ETRIEVESIZE.

Use REC.RETRIEVE for complete recording information view.

Notes:

- If REC.RETRIEVESIZE is larger than the buffer size, then it simply returns the whole buffer (no error).
- If the index is received, the data will be continuously returned starting from the given index (default starting index is 0).
- If the index is out of the bounds of the buffer, then it will be ignored.
- If recorder is active and REC.STOPTYPE==0, then this parameter returns an error.
- If REC.STOPTYPE==1, then this parameter returns the next section of data in the buffer (even if it reached the end of the buffer, it will return to the beginning of the buffer and add the data from index 0.)
- If REC.STOPTYPE==1 and the retrieve is too slow (gets overrun by the recorder), an overflow error message is returned instead of the retrieved data.
- If REC.STOPTYPE==0 and no index is received, continuously send the sections of data until the end of the buffer is reached. Then, return to the beginning of buffer and continue.
- A new REC.TRIG (pg 417) command automatically sets the index to 0.

Example

The following example retrieves data from index 100 in the size of 10 (hence places 100 to 109 in the buffer)

```
REC.NUMPOINTS 1000
REC.RETRIVESIZE 10
REC.TRIG
REC.RETRIEVEDATA 100
```

Related Topics

[1] Embedded Workbench Views

Scope (pg 103)

41.10 REC.RETRIEVEFRMT

General Information	
Type	R/W Parameter
Description	Sets the format for recorded data output.
Units	N/A
Range	0 to 1; 0 = Standard format, 1 = Internal format (high speed)
Default Value	1
Data Type	Integer
See Also	REC.RETRIEVE (pg 413), REC.RETRIEVEDATA (pg 414)
Start Version	M_01-00-00-000

Description

Recorded data is transferred to the communication channel in one of two formats: standard or internal high speed. The standard (slower) format cannot be used for continuous recording, but is more easily read. The high speed format allows continuous data recording (needed for auto-tuning). EWV[1] supports both formats.

Example

The following recorder data is in standard format:

```
10,1
IL.FB,VL.CMD,VL.FB
-0.086,0.000,2.661
0.000,0.000,3.605
0.029,0.000,-0.486
```

The following recorder data is in internal format:

```
10,1
IL.FB,VL.CMD,VL.FB
F3-0x56,F30x0,F30xA65
F30x0,F30x0,F30xE15
F30x1D,F30x0,F3-0x1E6
```

Related Topics

Scope (pg 103)

41.11 REC.RETRIEVEHDR

General Information	
Type	R/O Parameter
Description	Retrieves the recorded header without the data.
Units	N/A

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General Information	
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	REC.RETRIEVE, REC.RETRIEVEDATA
Start Version	M_01-00-00-000

Description

This command retrieves the recorded header without the data of the recording.

EWV[1] uses this parameter to retrieve the header once before continuously reading the data for RT recoding.

Use REC.RETRIEVE for complete recording information view.

Related Topics

Scope (pg 103)

41.12 REC.RETRIEVESIZE

General Information	
Type	R/W Parameter
Description	Sets the number of samples that REC.RETRIEVEDATA returns.
Units	recorder samples
Range	0 to 65,535 recorder samples
Default Value	1,000 recorder samples
Data Type	Integer
See Also	REC.RETRIEVEDATA (pg 414), REC.RETRIEVEHDR (pg 415)
Start Version	M_01-00-00-000

Description

This parameter sets the number of samples that REC.RETRIEVEDATA (pg 414) returns.

EWV[2] also uses this parameter to set the number of samples returned when retrieving the data continuously for RT recoding.

Use REC.RETRIEVE (pg 413) for the complete recording information view.

Related Topics

Scope (pg 103)

41.13 REC.STOPTYPE

General Information	
Type	R/W Parameter
Description	Sets the recorder stop type.

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[2] Embedded Workbench Views

General Information	
Units	N/A
Range	0 or 1
Default Value	0
Data Type	Integer
See Also	REC.RETRIEVEDATA, REC.R-ETRIEVESIZE
Start Version	M_01-00-00-000

Description

This parameter sets the stop type for the recording.

0 = Recorder runs, continuously filling the recording circular buffer.

1 = Recorder fills in the buffer once.

To stop RT recording, execute REC.OFF.

Related Topics

Scope (pg 103)

41.14 REC.TRIG

General Information	
Type	Command
Description	Triggers the recorder.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	REC.RETRIEVE, REC.OFF
Start Version	M_01-00-00-000

Description

REC.TRIG starts the trigger according to the trigger type defined by REC.TRIGTYPE.

REC.TRIG sets the value of REC.DONE to 0.

After calling REC.TRIG, the data that was recorded by previous recording is deleted and cannot be retrieved.

No REC parameters can be set after a call to REC.TRIG until the recorder has finished or until REC.OFF is executed.

Related Topics

Scope (pg 103)

41.15 REC.TRIGPARAM

General Information	
Type	R/W Parameter

General Information	
Description	Sets the parameter that triggers the recorder.
Units	N/A
Range	N/A
Default Value	IL.FB
Data Type	String
See Also	REC.TRIG
Start Version	M_01-00-00-000

Description

REC.TRIGPARAM sets the parameter on which the recorder triggers.

This parameter is only used when REC.TRIGTYPE = 2.

Input values are:

1. One of the set drive parameters list that can be set as a trigger. The available parameters for trigger are: PL.ERR (pg 398), PL.CMD, PL.FB, VL.CMD, VL.FB, IL.CMD, and IL.FB.
2. Internal value or variable of the drive (same as for DRV.MEMADDR input).

Related Topics

Scope (pg 103)

41.16 REC.TRIGPOS

General Information	
Type	R/W Parameter
Description	Sets the trigger position in the recording buffer.
Units	%
Range	1 to 100%
Default Value	10%
Data Type	Integer
See Also	REC.TRIG (pg 417), REC.NUMPOINTS (pg 411)
Start Version	M_01-00-00-000

Description

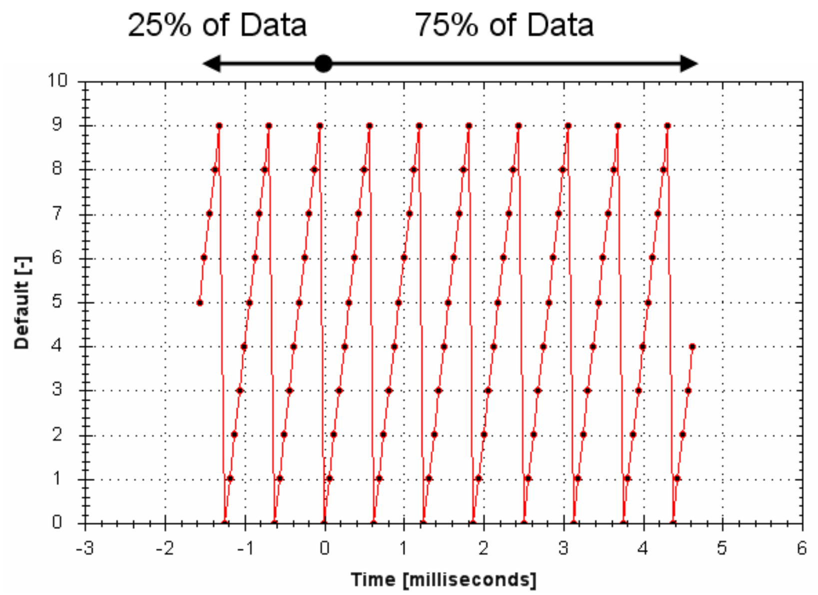
REC.TRIGPOS sets the trigger position in the recording buffer. The recording buffer size is defined by REC.NUMPOINTS. The input value is a percentage of the buffer (that is, a value of 25 means saving 25% of the buffer data before the trigger occurs and 75% after it occurs). This parameter is only used when REC.TRIGTYPE = 2 or 3.

Trigger Position

Trigger position (REC.TRIGPOS) allows you to collect data that occurs before the trigger occurs. In some instances, you may want to see the conditions prior to the trigger. Trigger position lets you control how much signal is collected before the trigger condition occurred .

Trigger position is specified in units of percent (%). If you specify a trigger position of x% , then x% of the data is before 0 ms in the data time and 100-x% (the rest of the data) is at or greater than 0 ms. In the figure below, the trigger position is set to 25% (REC.TRIGPOS 25).

In the EWV[1] scope, the 0 time point is clear. When collecting the data using REC.RETRIEVE or similar commands, the time is not returned, so some caution should be used when the trigger point is important to understand.



Related Topics

Scope (pg 103)

41.17 REC.TRIGPRMLIST

General Information	
Type	R/O Parameter
Description	Reads the list of possible trigger parameters.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	REC.TRIGPARAM
Start Version	M_01-00-00-000

Description

This command returns the list of trigger parameters. Each one of those parameters can serve as the trigger parameter (input to REC.TRIGPARAM).

Note that an internal address or a registered variable can be used as input to REC.TRIGPARAM in addition to the list that this parameter returns.

Related Topics

Scope (pg 103)

[1]Embedded Workbench Views

41.18 REC.TRIGSLOPE

General Information	
Type	R/W Parameter
Description	Sets the trigger slope.
Units	0 = Negative 1 = Positive
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	REC.TRIG, REC.NU-MPOINTS
Start Version	M_01-00-00-000

Description

REC.TRIGSLOPE sets the recorder trigger slope. This parameter is only used when REC.TRIGTYPE = 2 or 3.

Related Topics

Scope (pg 103)

41.19 REC.TRIGTYPE

General Information	
Type	R/W Parameter
Description	Sets the trigger type.
Units	0 = immediate 1 = command 2 = parameter 3 = boolean
Range	0 to 2
Default Value	0
Data Type	Integer
See Also	REC.TRIG (pg 417), REC.TRIGPARAM, REC.TRIGVAL, REC.TRIGSLOPE REC.TRIGPOS
Start Version	M_01-00-00-000

Description

REC.TRIGTYPE sets the type of trigger.

Input values are as follows:

Value	Description
0	Recording starts immediately
1	Recording starts on the next command executed through the TCP/IP. The trigger location in the buffer is set according to REC.TRIGPOS.

Value	Description
2	Recording starts per the values of REC.TRIGPARAM, REC.TRIGVAL, REC.TRIG-SLOPE, and REC.TRIGPOS.
3	Recording starts when the value of REC.TRIGPARAM is 0 for REC.TRIGSLOPE = 0 or 1 for REC.TRIGSLOPE = 1

Related Topics

Scope (pg 103)

41.20 REC.TRIGVAL

General Information	
Type	R/W Parameter
Description	Sets the trigger value.
Units	The units of the parameter are chosen according to the unit type.
Range	0 to 2
Default Value	0
Data Type	Integer
See Also	REC.TRIG (pg 417), REC.TRIGPARAM, REC.TRIGVAL, REC.TRIGSLOPE, REC.TRIGPOS
Start Version	M_01-00-00-000

Description

REC.TRIGVAL is the value that must be met by REC.TRIGPARAM for the trigger to occur. The units of this parameter are set according to the units of REC.TRIGPARAM.

Related Topics

Scope (pg 103)

42 REGEN Parameters

This section describes the REGEN parameters.

42.1 REGEN.POWER

General Information	
Type	R/O parameter
Description	Reads regen resistor's calculated power.
Units	Watt
Range	N/A
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

This parameter reads regen resistor's calculated power, which is determined as follows:

$(V^2 / R) * DutyCycle$

Related Topics

6.2 Regeneration

42.2 REGEN.POWERFILTERED

General Information	
Type	R/O parameter
Description	Returns a filtered version of REGEN.POWER .
Units	Watt
Range	0 to REGEN.WATTEXT
Default Value	0
Data Type	Integer
Start Version	M_01-07-01-000

Description

This parameter returns a filtered value of REGEN.POWER. A single order lowpass of 1/REGEN.TEXT Hz is applied to generate REGEN.POWERFILTERED.

If REGEN.POWERFILTERED exceeds the value of REGEN.WATTEXT, Fault 521 (Regen overpower) will be generated.

This keyword may be recorded in the scope screen for analysis.

Example

REGEN.TEXT = 10 (seconds)

Lowpass Filter Frequence = 1/10 seconds = 0.1 Hz

REGEN.POWERFILTERED = REGEN.POWER * 0.1Hz lowpass

Related Topics

REGEN.POWER (pg 423) | REGEN.TEXT (pg 424) | REGEN.WATTEXT (pg 426)

42.3 REGEN.REXT

General Information	
Type	NV Parameter
Description	Sets the external, user-defined regen resistor resistance.
Units	Ω
Range	0 to 255 Ω
Default Value	0 Ω
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

REGEN.REXT sets the external user-defined regen resistor resistance. This variable is needed for the regen resistor temperature estimation algorithm.

Related Topics

6.2 Regeneration

42.4 REGEN.TEXT

General Information	
Type	R/W Parameter
Description	Sets the external regen resistor thermal protection time constant.
Units	s
Range	0.1 to 1,200 s
Default Value	100 s
Data Type	Float
See Also	REGEN.WATTEXT (pg 426), REGEN.REXT (pg 424)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

REGEN.TEXT is a thermal time constant used to protect an external regeneration (regen) resistor from overheating and failing. Its value is the time-to-fault when input power steps from 0 to 150% of REGEN.WATTEXT (pg 426). The drive's regen resistor protection algorithm continuously calculates the power dissipated in the resistor and processes that power value through a single pole low pass filter to model the regen resistor's thermal inertia. When the filtered regen power on the output of the filter exceeds REGEN.WATTEXT, a fault occurs. REGEN.TEXT sets the time constant of this thermal inertia filter.

REGEN.TEXT can often be found directly on power resistor data sheets. On the data sheets, find the peak overload curve and then find the safe allowed time to be at 150% of the regen resistor's continuous power rating. Another way regen resistor peak overload capability is often specified is by giving the energy rating in joules of the resistor. If you have the energy rating E then:

REGEN.TEXT = (1.1)*((joule limit)/REGEN.WATTEXT)

Example

The external regen resistor is rated for 250 W continuous, is 33 ohm, and has a joule rating of 500 joules. To use this resistor, the drive settings become:

REGEN.TYPE = -1 (External Regen)

REGEN.REXT = 33

REGEN.WATTEXT = 250

REGEN.TEXT = (1.1)*(500 j)/(250 W) = 2.2 sec

Related Topics

6.2 Regeneration

42.5 REGEN.TYPE

General Information	
Type	NV Parameter
Function	Sets the regen resistor type.
WorkBench Location (Screen/Dialog Box)	Power/Regen Resistor Type
Units	N/A
Range	–1 to 0
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

You can specify a user-defined external regen resistor, select an internal regen resistor, or choose from a list of predefined regen resistors. The values for REGEN.TYPE are shown below:

Type	Description
–1	External user-defined regen resistor
0	Internal regen resistor

If you specify a user-defined regen resistor, then you must also define this resistor's resistance (REGEN.REXT), heatup time (REGEN.REXT), and power (REGEN.WATTEXT).

Related Topics

6.2 Regeneration

42.6 REGEN.WATTEXT

General Information	
Type	R/W parameter
Description	Sets the regen resistor's power fault level for an external regen resistor.
Units	W
Range	0 to 62,000 W
Default Value	1000 W
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

Sets the regen resistor's power fault level for an external regen resistor (when REGEN.TYPE = -1).

Above this fault level, the regen resistor's PWM wil be 0 and a fault will be issued.

Related Topics

6.2 Regeneration

43 SD Commands

This section describes commands for SD Card functions.

43.1 SD.LOAD

General Information	
Type	Command
Description	Loads the drive state (BASIC program and NV parameters)from the SD card to the AKD PDMM (AKD PDMMs equipped with IO option card only).
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
Start Version	M_01-06-03-000

Description

SD.LOAD will load the drive state from the SD card (if one exists) to the AKD PDMM. The files loaded to the drive include the BASIC binary file (program.bin) and the NV parameter file (drive.akd). These files must have these exact names or the drive will not recognize them.

Note that this command can only be executed when the drive is in the idle state (i.e. a program is not running) and the drive is disabled.

If a computer is not connected to the drive, the SD.LOAD command can also be issued using the rotary switches S1 and S2.

To load the SD drive state onto the AKD PDMM:

1. Set S1 to position 1
2. Set S2 to position 0
3. Hold down the B1 button on the top of the drive for 5 seconds.

NOTE While the load operation is completing the LED display will flash **Sd**. If an error occurs, the letter E followed by three numbers will flash on the display. See for a description of SD Errors.

Related Topics

SD.SAVE (pg 428)

43.2 SD.SAVE

General Information	
Type	Command
Description	Saves the drive state (BASIC program and NV parameters) to the SD card (AKD PDMMs equipped with IO option card only).
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
Start Version	M_01-06-03-000

Description

SD.SAVE will copy the state of a BASIC drive to the SD card (if one exists). The state of the drive consists of the BASIC binary file and NV parameters. Before an SD.Save is performed, the drive will perform a DRV.NVLOAD and return all of the drive parameters to their NV state. The DRV.NVLOAD is necessary in order to capture the NV parameter states for the parameter file(drive.akd). The files saved to the SD card include the BASIC binary file (program.bin) and the NV parameter file (drive.akd). In order for a drive to recognize and load these files, they must be named program.bin and drive.akd.

NOTE This command can only be executed when the drive is in the idle state (i.e. a program is not running) and the drive is disabled.

If a computer is not connected to the drive, the SD.SAVE command can also be issued using the rotary switches S1 and S2.

To save the drive state onto the SD card using rotary switches:

1. Set S1 to position 1
2. Set S2 to position 1
3. Hold down the B1 button on the top of the drive for 5 seconds.

NOTE While the load operation is completing the LED display will flash **Sd**. If an error occurs, the letter E followed by three numbers will flash on the display. See for a description of SD Errors.

Related Topics

SD.LOAD (pg 428)

43.3 SD.STATUS

General Information	
Type	R/O
Description	Reads the status of the SD card.
Units	N/A
Range	0 to 2
Default Value	0
Data Type	Integer
Start Version	M_01-06-03-000

Description

This parameter reads the status of the SD card.

Status	Description
0	Ready – an SD card is inserted into the drive and you can read and write to it.
1	Read Only – an SD card is inserted into the drive and the write protection tab on the card prohibits writes.
2	Not Inserted – an SD card is not inserted into the drive.

Related Topics

SD.LOAD (pg 428) | SD.SAVE (pg 428)

44 SM Parameters

This section describes the SM parameters.

44.1 SM.I1

General Information	
Type	NV Parameter
Description	Sets service motion current 1; active in opmode 0 (torque) only.
Units	A
Range	–Drive peak current to +Drive peak current
Default Value	0.025 · Drive peak current
Data Type	Float
See Also	SM.ACCTYPE, SM.I2, SM.MODE, SM.MOVE, SM.T1, SM.T2, SM.V1, SM.V2, SM.VPM1, SM.VPM2
Start Version	M_01-00-00-000

Description

SM.I1 defines the current that is used in service motion modes 0 and 1 (see SM.MODE (pg 431)).

Related Topics

Service Motion (pg 73)

44.2 SM.I2

General Information	
Type	NV Parameter
Description	Sets service motion current 2; active in opmode 0 (torque) only.
Units	A
Range	–Drive peak current to +Drive peak current
Default Value	0.025 · Drive peak current
Data Type	Float
See Also	SM.ACCTYPE, SM.I1, SM.MODE, SM.MOVE, SM.T1, SM.T2, SM.V1, SM.V2, SM.VPM1, SM.VPM2
Start Version	M_01-00-00-000

Description

SM.I2 defines the current that is used in service motion mode 1 (see SM.MODE (pg 431)).

Related Topics

Service Motion (pg 73)

44.3 SM.MODE

General Information	
Type	NV Parameter
Description	Sets the service motion mode.
Units	N/A

General Information	
Range	0 to 2
Default Value	0
Data Type	Integer
See Also	SM.I1 (pg 431), SM.I2 (pg 431), SM.MOVE (pg 434), SM.T1 (pg 434) SM.T2 (pg 434), SM.V1 (pg 435), SM.V2 (pg 436), DRV.ACC (pg 262)DRV.DEC (pg 269)
Start Version	M_01-01-00-000

Description

SM.MODE defines the mode of service motion for each loop. Two types of service motion are available :

- A constant motion in one direction (endless or for a certain amount of time).
- An alternating motion.

The possible modes for this parameter are described in the following table:

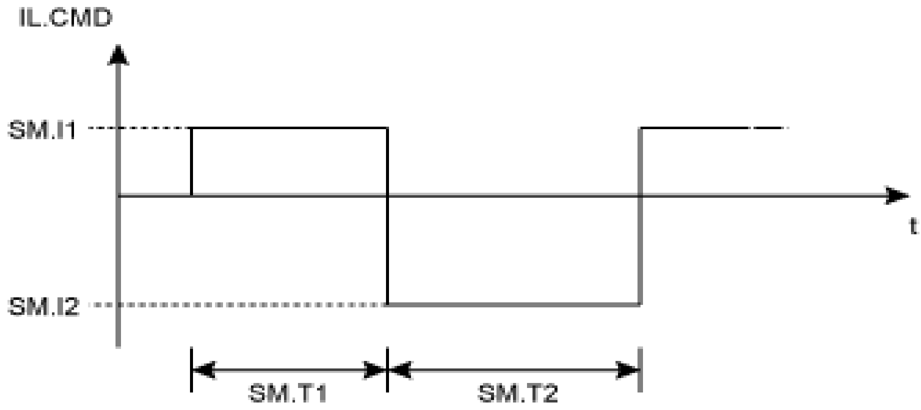
SM.MODE	Description	Requirements
0	Constant motion in closed current loop mode of operation. • DRV.OPMODE 0: The drive generates a constant current command value (SM.I1) for a certain amount of time (if SM.T1>0) or endless (if SM.T1=0). The drive will not generate any ramps in this mode of operation. • DRV.OPMODE 1 or 2: The drive generates a constant velocity command value (SM.V1) for a certain amount of time (if SM.T1>0) or endless (if SM.T1=0). The drive generates acceleration and deceleration ramps according to the DRV.ACC and DRV.DEC setting in this mode of operation. The service motion can be stopped by using the DRV.STOP command.	DRV.OPMODE = 0,1, or 2 DRV.CMDSOURCE = 0
1	• DRV.OPMODE 0: The drive generates a current command value (SM.I1) for a certain amount of time (SM.T1). Afterwards the drive generates a current command value (SM.I2) for another certain amount of time (SM.T2). This sequence is repeated as long as a DRV.STOP command occurs. The drive will not generate any ramps in this mode of operation. • DRV.OPMODE 1 or 2: The drive generates a velocity command value (SM.V1) for a certain amount of time (SM.T1). Afterwards the drive generates a velocity command value (SM.V2) for another certain amount of time (SM.T2). This sequence is repeated as long as a DRV.STOP command occurs. The drive will generate an acceleration and deceleration ramps according to the DRV.ACC and DRV.DEC setting in this mode of operation.	DRV.OPMODE = 0, 1, or 2 DRV.CMDSOURCE = 0

SM.MODE	Description	Requirements
2	This mode executes the same service motion as mode 0. However, the motion is described by SM.I2, SM.T2 and SM.V2. This enables a change on the fly and is mostly used under fieldbus control.	DRV.OPMODE = 0, 1, or 2 DRV.CMDSOURCE = 0

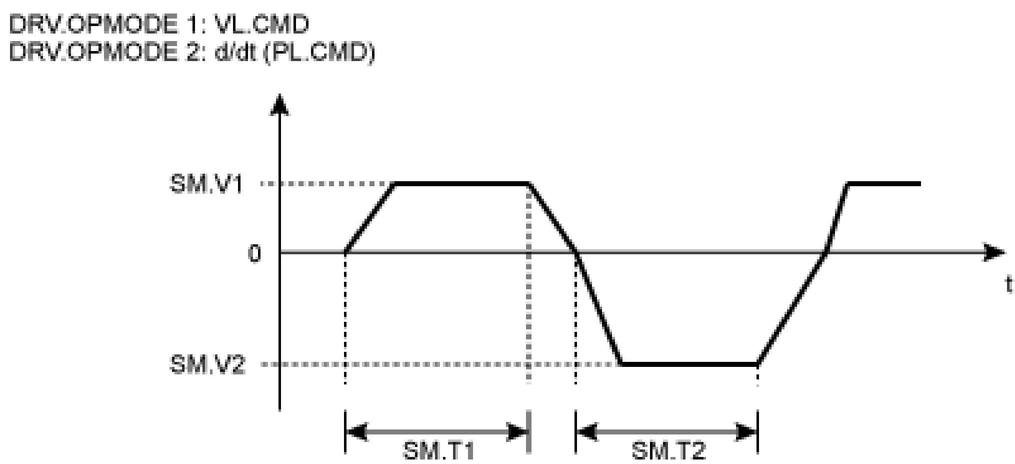
Ramps

The drive uses DRV.ACC and DRV.DEC for the ramps in DRV.OPMODE 1 (closed velocity) and 2 (closed position). The drive does not generate any ramps in service motion mode 0 and 1.

Service Motion for DRV.OPMODE 0 and SM.MODE 1



Service motion for DRV.OPMODE 1 or 2 and SM.MODE 1



The deceleration process from SM.V1 or SM.V2 to 0 is not included in SM.T1 and SM.T2, respectively. SM.T1 and SM.T2 start as soon as the command value has reached the velocity 0.

Related Topics

Service Motion (pg 73)

44.4 SM.MOVE

General Information	
Type	Command
Description	Starts the service motion.
Units	N/A
Range	N/A
Default Value	N/A
Data Type	N/A
See Also	SM.MODE
Start Version	M_01-00-00-000

Description

This command starts the service motion that has been selected by the SM.MODE parameter.

Related Topics

Service Motion (pg 73)

44.5 SM.T1

General Information	
Type	NV Parameter
Description	Sets the service motion time 1.
Units	ms
Range	0 to 65,535 ms
Default Value	500 ms
Data Type	Integer
See Also	SM.I1, SM.I2, SM.MODE, SM.MOVE, SM.T2, SM.V1, SM.V2, SM.VPM1, SM.VPM2
Start Version	M_01-00-00-000

Description

SM.T1 defines the time of the service motion that is used in all service motion modes (see SM.MODE). For an alternating service motion mode, SM.T1 may not be set to 0.

Related Topics

Service Motion (pg 73)

44.6 SM.T2

General Information	
Type	NV Parameter
Description	Sets the service motion time 2.
Units	ms
Range	0 to 65,535 ms

General Information	
Default Value	500 ms
Data Type	Integer
See Also	SM.I1, SM.I2, SM.MODE, SM.MOVE, SM.T1, SM.V1, SM.V2, SM.VPM1, SM.VPM2
Start Version	M_01-00-00-000

Description

SM.T2 defines the time of the service motion that is used in service motion modes 1, 3, and 5 (see SM.MODE).

Related Topics

Service Motion (pg 73)

44.7 SM.V1

General Information	
Type	NV Parameter
Description	Sets service motion velocity 1; active in opmode 1 (velocity) and 2 (position).
Units	Depends on or Rotary: rpm, rps, deg/s, custom units/s, rad/s Linear: Counts/s, mm/s, µm/s, custom units/s
Range	Rotary: -15,000.000 to 15,000.000 rpm -250.000 to 250.000 rps -90,000.000 to 90,000.000 deg/s -1,250.000 to 1,250.000 custom units/s -1,570.796 to 1,570.796 rad/s Linear: -1,073,741,824,000.000 to 1,073,741,824,000.000 counts/s -250.000*MOTOR.PITCH (pg 387) to 250.000*MOTOR.PITCH (pg 387) mm/s -250,000.000*MOTOR.PITCH (pg 387) to 250,000.000*MOTOR.PITCH (pg 387) µm/s -1,250.000 to 1,250.000 custom units/s
Default Value	Rotary: 60.000 rpm 1.000 rps 359.999 deg/s 5.000 custom units/s 6.283 rad/s Linear: 0.001 Counts/s 1.000*MOTOR.PITCH (pg 387) mm/s 999.998*MOTOR.PITCH (pg 387) µm/sec 5.000 custom units/s

General Information	
Data Type	Float
See Also	SM.I1, SM.I2, SM.MODE, SM.MOVE, SM.T1, SM.T2, SM.V2
Start Version	M_01-00-00-000

Description

SM.V1 defines the velocity that is used in service motion modes 0 and 1 (see SM.MODE (pg 431)) in the closed velocity and position mode of operation.

Related Topics

11.1 Service Motion

44.8 SM.V2

General Information	
Type	NV Parameter
Description	Sets service motion velocity 2; active in opmode 1 (velocity) and 2 (position).
Units	Depends on or Rotary: rpm, rps, deg/s, custom units/s, rad/s Linear: counts/s, mm/s, µm/s, custom units/s
Range	Rotary: -15,000.000 to 15,000.000 rpm -250.000 to 250.000 rps -90,000.000 to 90,000.000 deg/s -1,250.000 to 1,250.000 custom units/s -1,570.796 to 1,570.796 rad/s Linear: -1,073,741,824,000.000 to 1,073,741,824,000.000 counts/s -250.000*MOTOR.PITCH (pg 387) to 250.000*MOTOR.PITCH (pg 387) mm/s -250,000.000*MOTOR.PITCH (pg 387) to 250,000.000*MOTOR.PITCH (pg 387) µm/s -1,250.000 to 1,250.000 custom units/s
Default Value	Rotary: -60.000 rpm -1.000 rps -359.999 deg/s -5.000 custom units/s -6.283 rad/s Linear: -0.001 counts/s -1.000*MOTOR.PITCH (pg 387) mm/s -999.998*MOTOR.PITCH (pg 387) µm/sec -5.000 custom units/s
Data Type	Float
See Also	SM.I1, SM.I2, SM.MODE, SM.MOVE, SM.T1, SM.T2, SM.V1
Start Version	M_01-00-00-000

Description

SM.V2 defines the velocity that is used in service motion mode 1 (see SM.MODE) in the closed velocity and position mode of operation.

Related Topics

11.1 Service Motion

45 STO Parameters

This section describes the STO parameters.

45.1 STO.STATE

General Information	
Type	R/O Parameter
Description	Returns the status of the safe torque off.
Units	N/A
Range	0 to 1
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

STO.STATE returns the status of the safe torque off.

1 - Safe torque on (no safe torque off fault).

0 - Safe torque off (safe torque off fault).

Related Topics

10.1 Limits

46 SWLS Parameters

This section describes the SWLS parameters.

46.1 SWLS.EN

General Information	
Type	NV Parameter
Description	Enables and disables software travel limit switches.
Units	N/A
Range	0 to 3
Default Value	0
Data Type	U8
See Also	DRV.MOTIONSTAT
Start Version	M_01-00-00-000

Description

This parameter enables the software travel limit switches. The software limit switches are only active if the axis is homed.

Example

Bit 0 = 0: Disable SWLS.LIMIT0

Bit 0 = 1: Enable SWLS.LIMIT0

Bit 1 = 0: Disable SWLS.LIMIT1

Bit 1 = 1: Enable SWLS.LIMIT1

Related Topics

10.1 Limits

46.2 SWLS.LIMIT0

General Information	
Type	NV Parameter
Description	Sets the position of the software travel limit switch 0.
Units	Position units
Range	-9,007,199,254,740,992 to 9,007,199,254,740,991
Default Value	0
Data Type	S64
See Also	,
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/1	M_01-00-00-000

Description

This parameter sets the compare register for the software limit switch 0. This value can be either the lower or the upper software limit switch register, depending on the configuration of the software limit switches. Whichever switch is set largest is the positive limit switch; the other switch becomes the negative limit switch. These switches can be used in addition to hardware limit switches. The software limit switches are only active if the axis is homed. For more information about homing, please refer to the HOME Parameters and DRV.MOTIONSTAT.

Related Topics

10.1 Limits

46.3 SWLS.LIMIT1

General Information	
Type	NV Parameter
Description	Sets the position of the software travel limit switch 0.
Units	Position units
Range	-9,007,199,254,740,992 to 9,007,199,254,740,991
Default Value	1,048,576.000 counts, 16-bit (firmware versions M_01-02-00-000 and above) 68,719,476,736 counts (for firmware version M_01-01-00-000)
Data Type	S64
See Also	,
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/2	M_01-00-00-000

Description

This parameter sets the compare register for the software limit switch 1. This value can be either the lower or the upper software limit switch register, depending on the configuration of the software limit switches. Whichever switch is set largest is the positive limit switch; the other switch becomes the negative limit switch. These switches can be used in addition to hardware limit switches. The software limit switches are only active if the axis is homed. For more information about homing, please refer to the HOME Parameters and DRV.MOTIONSTAT.

Related Topics

10.1 Limits

46.4 SWLS.STATE

General Information	
Type	R/O Parameter
Description	Reads the actual status of software limit switches.
Units	N/A
Range	0 to 3
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter reads the status word of the software limit switches. The status word indicates the result of the compare between the software limit switch compare register and the actual position of the position loop.

Example

Bit 0 = 0: SWLS.LIMIT0 (pg 441) is not active.

Bit 0 = 1: SWLS.LIMIT0 is active.

Bit 1 = 0: SWLS.LIMIT1 (pg 442) is not active.

Bit 1 = 1: SWLS.LIMIT1 is active.

Bits 2 to 7 are currently not in use.

Related Topics

10.1 Limits

47 VBUS Parameters

This section describes the VBUS parameters.

47.1 VBUS.HALFVOLT

General Information	
Type	NV Parameter
Description	Changing voltage thresholds for HV and MV Drives
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-04-01-000

Description

This parameter is used in order to change some specific voltage thresholds in order to allow HV (high voltage) Drives working with MV (medium voltage) thresholds and to allow MV (medium voltage) Drives working with LV (low voltage) thresholds.

This parameter has an impact on the following voltage-thresholds:

1) DC-bus over-voltage threshold (see VBUS.OVFTHRESH).

2) The regen-resistor enable/disable voltage thresholds.

3) The inrush-relay enable/disable voltage thresholds.

A power-cycle is needed after changing the value of VBUS.HALFVOLT and after saving the parameter on the NV memory of the Drive, since the voltage thresholds mentioned above are read during the boot-sequence of the Drive.

The VBUS.HALFVOLT command takes only effect for a HV or MV Drive.

VBUS.HALFVOLT = 0: The original voltage thresholds are used for the functions mentioned above.

VBUS.HALFVOLT = 1: Setting the parameter to 1 on a HV Drive causes the AKD PDMM to use the voltage thresholds of a MV Drive for the functions mentioned above. Setting the parameter to 1 on a MV Drive causes the AKD PDMM to use the voltage thresholds of a LV Drive for the functions mentioned above.

The sequence must be as follows:

1) Change the value of VBUS.HALFVOLT.

2) Trigger a DRV.NVSAVE command.

3) Power cycle the Drive in order to activate the new configuration.

Note

The DC-bus under voltage fault threshold (see VBUS.UVFTHRESH) is a user selectable command. It means that the user is responsible for setting the under voltage threshold to a proper value in case that the AKD PDMM is supplied with a lower DC-bus voltage than the rated voltage.

47.2 VBUS.OVFTHRESH

General Information	
Type	R/O Parameter
Description	Reads the over voltage fault level.
Units	Vdc

General Information	
Range	0 to 900 Vdc
Default Value	N/A
Data Type	Integer
See Also	VBUS.UVFTHRESH
Start Version	M_01-00-00-000

Description

VBUS.OVFTHRESH reads the over voltage fault level for the DC bus.

This value is read from the drive EEPROM and varies according to the drive type.

Related Topics

Regeneration (pg 36)

47.3 VBUS.OVWTHRESH

General Information	
Type	NV Parameter
Description	Sets voltage level for over voltage warning.
Units	Vdc
Range	0 to 900 Vdc
Default Value	0 Vdc (warning disabled)
Data Type	U16
See Also	N/A
Start Version	M_01-00-00-000

Description

If VBUS.VALUE value exceeds VBUS.OVWTHRESH, then a warning is generated.

Related Topics

Regeneration (pg 36)

47.4 VBUS.RMSLIMIT

General Information	
Type	R/O Parameter
Description	Reads the limit for the bus capacitors load.
Units	Vrms
Range	N/A
Default Value	N/A
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter reads the limit of the bus capacitor load. When the bus capacitor loads exceeds this limit, the drive generates fault F503.

Excessive bus capacitor load may indicate a disconnected main supply phase.

Related Topics

Regeneration (pg 36)

47.5 VBUS.UVFTHRESH

General Information	
Type	R/W Parameter
Description	Sets the under voltage fault level.
Units	Vdc
Range	90 to 420 Vdc
Default Value	90 Vdc
Data Type	Integer
See Also	VBUS.OVFTHRESH
Start Version	M_01-00-00-000

Description

VBUS.UVFTHRESH sets the undervoltage fault level of the DC bus.

The default value is read from the EEPROM, but can by modified by the user and stored on the NV RAM. This value varies according to drive type.

Related Topics

Regeneration (pg 36)

47.6 VBUS.UVMODE

General Information	
Type	N/V Parameter
Description	Indicates undervoltage (UV) mode.
Units	N/A
Range	0 to 1
Default Value	1
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter indicates undervoltage (UV) mode.

When VBUS.UVMODE - 0, an undervoltage fault is issued whenever the DC bus goes below the undervoltage threshold.

When VBUS.UVMODE = 1, an undervoltage fault is issued whenever the DC bus goes below the under voltage threshold and the controller attempts to enable the drive (software or hardware enable).

Related Topics

Regeneration (pg 36)

47.7 VBUS.UVWTHRESH

General Information	
Type	NV Parameter
Description	Sets voltage level for undervoltage warning.
Units	Vdc
Range	0 to 900 Vdc
Default Value	10 volts above the default value of the under voltage fault threshold (VBUS.UVFTHRESH). The default value of VBUS.UVFTHRESH is hardware dependent.
Data Type	U16
See Also	VBUS.UVFTHRESH (pg 447)
Start Version	M_01-00-00-000

Description

If VBUS.VALUE value drops below VBUS.UVWTHRESH, then a warning is generated.

Related Topics

Regeneration (pg 36)

47.8 VBUS.VALUE

General Information	
Type	R/O Parameter
Description	Reads DC bus voltage.
Units	Vdc
Range	0 to 900 Vdc
Default Value	N/A
Data Type	Float
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

VBUS.VALUE reads the DC bus voltage.

Related Topics

6.2 Regeneration

48 VL Parameters

This section describes the VL parameters.

48.1 VL.ARPF1 TO VL.ARPF4

General Information	
Type	R/W Parameter
Description	Sets the natural frequency of the pole (denominator) of anti-resonance (AR) filters 1, 2, 3, and 4; active in opmodes 1 (velocity) and 2 (position) only.
Units	Hz
Range	5 to 5,000 Hz
Default Value	500 Hz
Data Type	Float
See Also	VL.ARPQ1 TO VL.ARPQ4 (pg 451), VL.ARZF1 TO VL.ARZF4 (pg 452), Sets the Q of the zero (numerator) of anti-resonance filter #1; active in opmodes 1 (velocity) and 2 (position) only. (pg 453)
Start Version	M_01-02-00-000

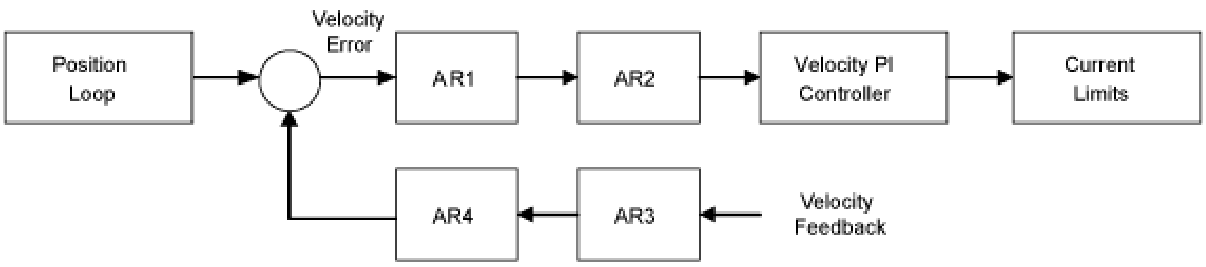
Fieldbus	Index/Subindex		Object Start Version
EtherCAT COE and CANopen	3406h/1	VL.ARPF1	M_01-02-00-000
	3406h/2	VL.ARPF2	
	3406h/3	VL.ARPF3	
	3406h/4	VL.ARPF4	

Description

VL.ARPF1 sets the natural frequency of the pole (denominator) of AR filter 1. This value is F_P in the approximate transfer function of the filter:

$$ARx(\mathbf{s}) = [\mathbf{s}^2/(2\pi F_Z)^2 + \mathbf{s}/(Q_Z 2\pi F_Z) + 1] / [\mathbf{s}^2/(2\pi F_P)^2 + \mathbf{s}/(Q_P 2\pi F_P) + 1]$$

The following block diagram describes the AR filter function; note that AR1 and AR2 are in the forward path, while AR3 and AR4 are applied to feedback:



AR1, AR2, AR3, and AR4 are used in velocity and position mode, but are disabled in torque mode.

Discrete time transfer function (applies to all AR filters)

The velocity loop compensation is actually implemented as a digital discrete time system function on the DSP. The continuous time transfer function is converted to the discrete time domain by a backward Euler mapping:

$$\mathbf{s} \approx (1-z^{-1})/t, \text{ where } t = 62.5\ \mu s$$

The poles are prewarped to F_P and the zeros are prewarped to F_Z.

Related Topics

1 Velocity Loop

48.2 VL.ARPQ1 TO VL.ARPQ4

General Information	
Type	R/W Parameter
Description	Sets the Q of the pole (denominator) of anti-resonance (AR) filter 1; active in opmodes 1 (velocity) and 2 (position) only.
Units	None
Range	0.2 to 20
Default Value	0.5
Data Type	Float
See Also	VL.ARPF1 TO VL.ARPF4 (pg 450), VL.ARZF1 TO VL.ARZF4 (pg 452), VL.ARZQ1 TO VL.ARZQ4 (pg 453)
Start Version	M_01-02-00-000

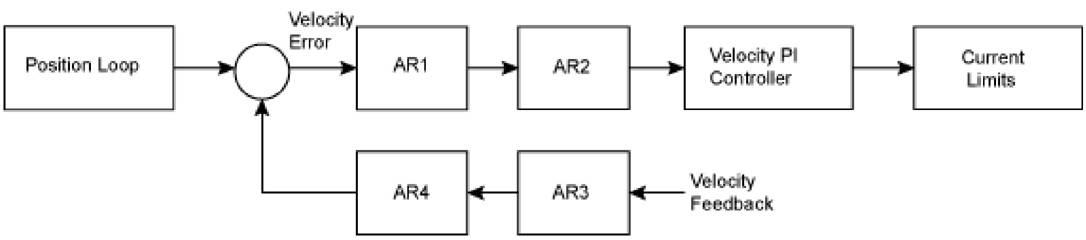
Fieldbus	Index/Subindex		Object Start Version
EtherCAT COE and CANopen	3406h/5	VL.ARPQ1	M_01-02-00-000
	3406h/6	VL.ARPQ2	
	3406h/7	VL.ARPQ3	
	3406h/8	VL.ARPQ4	

Description

VL.ARPQ1 sets the Q (quality factor) of the pole (denominator) of AR filter 1. This value is Q_P in the approximate transfer function of the filter:

$$ARx(\mathbf{s}) = [\mathbf{s}^2/(2\pi F_Z)^2+\mathbf{s}/(Q_Z 2\pi F_Z) + 1]/ [\mathbf{s}^2/(2\pi F_P)^2 +\mathbf{s}/(Q_P 2\pi F_P) + 1]$$

The following block diagram describes the AR filter function; note that AR1 and AR2 are in the forward path, while AR3 and AR4 are applied to feedback:



AR1, AR2, AR3, and AR4 are used in velocity and position mode, but are disabled in torque mode.

Discrete time transfer function (applies to all AR filters)

The velocity loop compensation is actually implemented as a digital discrete time system function on the DSP. The continuous time transfer function is converted to the discrete time domain by a backward Euler mapping:

$\mathbf{s} \approx (1-z^{-1})/t$, where $t = 62.5\ \mu s$

The poles are prewarped to F_P and the zeros are prewarped to F_Z.

Related Topics

1 Velocity Loop

48.3 VL.ARTYPE1 TO VL.ARTYPE4

General Information	
Type	NV Parameter
Description	Indicates the method used to calculate BiQuad coefficients; active in opmodes 1 (velocity) and 2 (position) only.
Units	N/A
Range	0
Default Value	0
Data Type	U8
See Also	N/A
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex		Object Start Version
EtherCAT COE and CANopen	/1	VL.ARTYPE1	M_01-02-00-000
	/2	VL.ARTYPE2	
	/3	VL.ARTYPE3	
	/4	VL.ARTYPE4	

Description

These parameters indicate the method used to calculate the biquad coefficients VL.ARPFx, VL.ARPQx, VL.ARZFx, and VL.ARZQx. A value of 0 indicates that the coefficients are set directly. This parameter has no effect on the filter itself, but is only used to determine the original design parameters. Currently, only the value of 0 is supported.

Related Topics

1 Velocity Loop

48.4 VL.ARZF1 TO VL.ARZF4

General Information	
Type	R/W Parameter
Description	Sets the natural frequency of the zero (numerator) of anti-resonance (AR)filter 1; active in opmodes 1 (velocity) and 2 (position) only.
Units	Hz
Range	5 to 5,000 Hz
Default Value	500 Hz
Data Type	Float
See Also	VL.ARPF1 TO VL.ARPF4 (pg 450),VL.ARPQ1 TO VL.ARPQ4 (pg 451), VL.ARZQ1 TO VL.ARZQ4 (pg 453)
Start Version	M_01-02-00-000

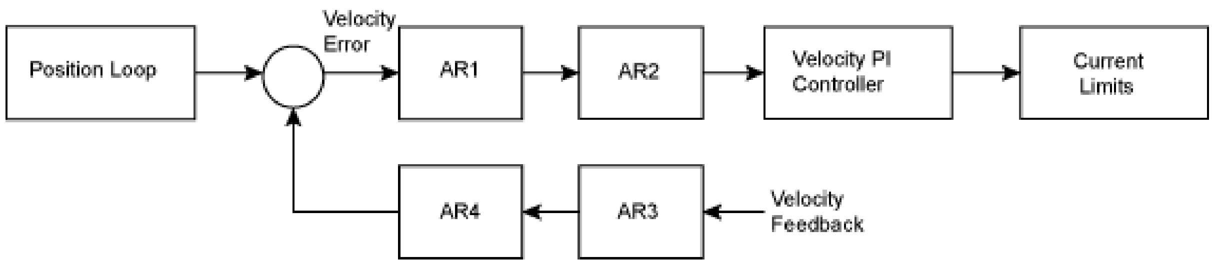
Fieldbus	Index/Subindex		Object Start Version
EtherCAT COE and CANopen	3406h/9	VL.ARZF1	M_01-02-00-000
	3406h/A	VL.ARZF2	
	3406h/B	VL.ARZF3	
	3406h/C	VL.ARZF4	

Description

VL.ARZF1 sets the natural frequency of the zero (numerator) of AR filter 1. This value is F_Z in the approximate transfer function of the filter:

$$ARx(\mathbf{s}) = [\mathbf{s}^2/(2\pi F_Z)^2 + \mathbf{s}/(Q_Z 2\pi F_Z) + 1] / [\mathbf{s}^2/(2\pi F_P)^2 + \mathbf{s}/(Q_P 2\pi F_P) + 1]$$

The following block diagram describes the AR filter function; note that AR1 and AR2 are in the forward path, while AR3 and AR4 are applied to feedback:



AR1, AR2, AR3, and AR4 are used in velocity and position mode, but are disabled in torque mode.

Discrete time transfer function (applies to all AR filters)

The velocity loop compensation is actually implemented as a digital discrete time system function on the DSP. The continuous time transfer function is converted to the discrete time domain by a backward Euler mapping:

$\mathbf{s} \approx (1-z^{-1})/t$, where t = 62.5 µs

The poles are prewarped to F_P and the zeros are prewarped to F_Z.

Related Topics

1 Velocity Loop

48.5 VL.ARZQ1 TO VL.ARZQ4

General Information	
Type	R/W Parameter
Description	Sets the Q of the zero (numerator) of anti-resonance filter #1; active in opmodes 1 (velocity) and 2 (position) only.
Units	N/A
Range	0.1 to 5
Default Value	0.5
Data Type	Float
See Also	VL.ARPF1 TO VL.ARPF4 (pg 450), VL.ARPQ1 TO VL.ARPQ4 (pg 451), VL.ARZF1 TO VL.ARZF4 (pg 452)
Start Version	M_01-02-00-000

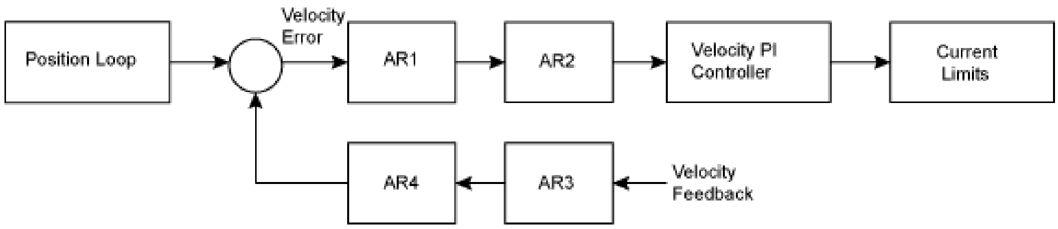
Fieldbus	Index/Subindex		Object Start Version
EtherCAT COE and CANopen	3406h/D	VL.ARZQ1	M_01-02-00-000
	3406h/E	VL.ARZQ2	
	3406h/F	VL.ARZQ3	
	3406h/10	VL.ARZQ4	

Description

VL.ARZQ1 sets the Q (quality factor) of the zero (numerator) of AR filter 1. This value is Q_Z in the approximate transfer function of the filter:

$AR1(\mathbf{s}) = [\mathbf{s}^2/(2\pi F_Z)^2 + \mathbf{s}/(Q_Z 2\pi F_Z) + 1] / [\mathbf{s}^2/(2\pi F_P)^2 + \mathbf{s}/(Q_P 2\pi F_P) + 1]$

The following block diagram describes the AR filter function; note that AR1 and AR2 are in the forward path, while AR3 and AR4 are applied to feedback:



AR1, AR2, AR3 and AR4 are used in velocity and position mode, but are disabled in torque mode.

Discrete time transfer function (applies to all AR filters)

The velocity loop compensation is actually implemented as a digital discrete time system function on the DSP. The continuous time transfer function is converted to the discrete time domain by a backward Euler mapping:

$\mathbf{s} \approx (1-z^{-1})/t$, where t = 62.5 µs.

The poles are prewarped to F_P and the zeros are prewarped to F_Z.

Related Topics

1 Velocity Loop

48.6 VL.BUSFF

General Information	
Type	R/O Parameter
Description	Displays the velocity loop feedforward value injected by the field-bus; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s
Range	0.0 to VL.LIMITP (pg 466)
Default Value	0.0
Data Type	Float
See Also	VL.FF (pg 459), VL.KBUSFF (pg 460)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter displays the velocity loop feedforward value injected by the fieldbus.

Related Topics

1 Velocity Loop

48.7 VL.CMD

General Information	
Type	R/O Parameter
Description	Reads the actual velocity command; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s
Range	N/A
Default Value	N/A
Data Type	Float
See Also	VL.FB (pg 457), VL.CMDU (pg 455), VL.LIMITP (pg 466), VL.LIMITN (pg 464)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

VL.CMD returns the actual velocity command as it is received in the velocity loop entry after all velocity limits (such as VL.LIMITN (pg 464) and VL.LIMITP (pg 466)). See velocity loop design diagram for more details.

Related Topics

1 Velocity Loop

1 Position Loop

18 Block Diagrams

48.8 VL.CMDU

General Information	
Type	R/W Parameter
Description	Sets the user velocity command; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, custom units/s, rad/s Linear: counts/s, mm/s, µm/s, custom units/s

General Information	
Range	Rotary -15,000.000 to 15,000.000 rpm -250.000 to 250.000 rps -90000.000 to 90000.000 deg/s -1250.000 to 1250.000 custom units/s -1570.796 to 1570.796 rad/s Linear -1,073,741,824,000.000 to 1,073,741,824,000.000 counts/s -8,000.000 to 8,000.000 mm/s -8,000,000.000 to 8,000,000.000 µm/s -1,250.000 to 1,250.000 custom units/s
Default Value	0
Data Type	Float
See Also	VL.FB (pg 457), VL.CMD (pg 455), DRV.OPMODE (pg 294), DRV.CMDSOURCE (pg 267), VL.LIMITN (pg 464), VL.LIMITP (pg 466)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

VL.CMDU sets the user velocity command.

When DRV.OPMODE (pg 294) is set to 1 (velocity loop) and DRV.CMDSOURCE (pg 267) is set to 0 (TCP/IP channel), then setting this value when the drive is enabled will cause the drive to rotate at the required velocity.

Related Topics

1 Velocity Loop

48.9 VL.ERR

General Information	
Type	R/O Parameter
Description	Sets the velocity error; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s
Range	N/A
Default Value	N/A
Data Type	Float
See Also	VL.CMD (pg 455), VL.FB (pg 457)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/4	M_01-00-00-000

Description

VL.ERR sets the velocity error. It is calculated in the velocity loop as the difference between VL.CMD (pg 455) and VL.FB (pg 457).

Related Topics

1 Velocity Loop

48.10 VL.FB

General Information	
Type	R/O Parameter
Description	Reads the velocity feedback; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s
Range	N/A
Default Value	N/A
Data Type	Float
See Also	VL.CMDU (pg 455)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0 /0	M_01-00-00-000

Description

VL.FB returns the velocity feedback as it is received in the velocity loop, after passing through Filter 3 and Filter 4.

Related Topics

1 Velocity Loop

48.11 VL.FBFILTER

General Information	
Type	R/O Parameter
Description	Filters VL.FB (pg 457) value; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s

General Information	
Range	N/A
Default Value	N/A
Data Type	Float
See Also	VL.FB (pg 457)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/1	M_01-00-00-000

Description

This parameter returns the same value as VL.FB (pg 457), filtered through a 10 Hz filter.

Related Topics

1 Velocity Loop

48.12 VL.FBSOURCE

General Information	
Type	NV Parameter
Description	Sets feedback source for the velocity loop; active in opmodes 1 (velocity) and 2 (position) only.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	PL.FBSOURCE (pg 403)
Start Version	M_01-00-00-000

Description

This parameter determines the feedback source to be used by the velocity loop. A value of 0 selects the primary feedback, and 1 selects the secondary feedback.

Related Topics

1 Velocity Loop

48.13 VL.FBUNFILTERED

General Information	
Type	R/O Parameter
Description	Reads the velocity feedback.

General Information	
Units	Depends on UNIT.VROTARY or UNIT.VLINEAR, UNIT.ACCLINEAR Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s
Range	N/A
Default Value	N/A
Data Type	Float
See Also	VL.FB (pg 457), VL.FBFILTER (pg 457)
Start Version	M_01-03-06-000

Description

VL.FBUNFILTERED reads the raw velocity feedback before any filters affect the value of this feedback.

Related Topics

Velocity Loop

48.14 VL.FF

General Information	
Type	R/O Parameter
Description	Displays the velocity loop overall feedforward value; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s
Range	0 to VL.LIMITP (pg 466)
Default Value	0
Data Type	Float
See Also	VL.KBUSFF (pg 460)
Start Version	M_01-00-00-000

Description

This parameter displays the velocity loop overall feedforward value.

Related Topics

1 Velocity Loop

VL.KVFF (pg 464)

48.15 VL.GENMODE

General Information	
Type	NV Parameter
Description	Selects mode of velocity generation (Observer, d/dt); active in opmodes 1 (velocity) and 2 (position) only.

General Information	
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-00-00-000

Description

This parameter is used to select the velocity generator mode.

Mode	Description
0	d/dt mode: The derivative of the mechanical angle of the drive is fed to a first order low pass.
1	Luenberger Observer mode

Related Topics

1 Velocity Loop

48.16 VL.KBUSFF

General Information	
Type	R/W Parameter
Description	Sets the velocity loop acceleration feedforward gain value; active in opmodes 1 (velocity) and 2 (position) only.
Units	NA
Range	0.0 to 2.0
Default Value	0.0
Data Type	Float
See Also	VL.BUSFF (pg 454)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen		M_01-00-00-000

Description

This parameter sets the gain for the acceleration feedforward (a scaled second derivative of the position command is added to the velocity command value).

The nominal feedforward value can be multiplied by this gain value.

This will have affect only when using position mode (DRV.OPMODE (pg 294) = 2).

Related Topics

1 Velocity Loop

48.17 VL.KI

General Information	
Type	NV Parameter
Description	Sets the velocity loop integral gain for the PI controller; active in opmodes 1 (velocity) and 2 (position) only.
Units	Hz
Range	0 to 1,000 Hz
Default Value	160 Hz
Data Type	Float
See Also	VL.KP (pg 462)
Start Version	M_01-00-00-000

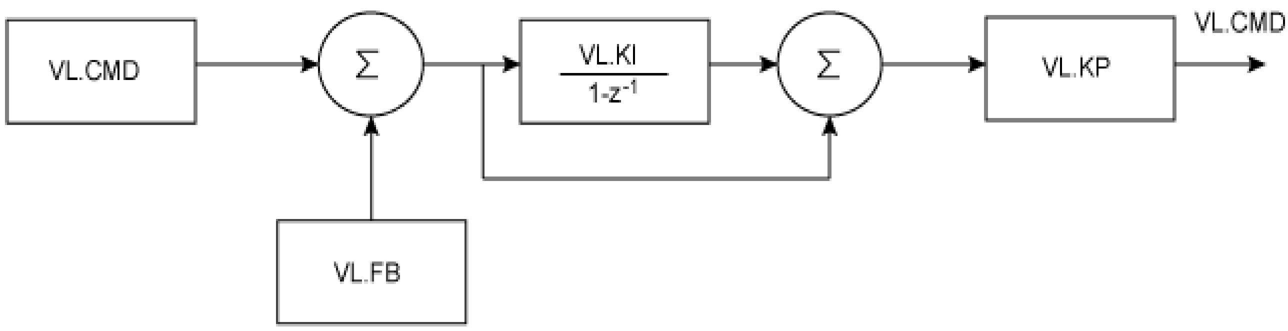
Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	354Dh/0	M_01-00-00-000

Description

VL.KI sets the integral gain of the velocity loop.

A factor of 2π is included in the time calculation, therefore a PI velocity loop with a constant error of 1 rps in which VL.KI is set to 160 and VL.KP (pg 462) is set to 1, will take (1000/160)*2π ms to increase the integral gain to 1. Therefore, the total gain is 2 at this time (see velocity loop structure below).

Velocity Loop Structure



Related Topics

1 Velocity Loop

48.18 VL.KO

General Information	
Type	R/W Parameter

General Information	
Description	Scales the observer velocity signal; active in opmodes 1 (velocity) and 2 (position) only.
Units	Internal
Range	0 to 65,535
Default Value	0
Data Type	Float
See Also	VL.MODEL (pg 467)
Start Version	M_01-00-01-000

Description

VL.KO is used to scale the observer model to match the load. When VL.KO is tuned properly, Reads the observer velocity signal; active in opmodes 1 (velocity) and 2 (position) only. (pg 467) will match VL.FB (pg 457), except when there is an unspecified offset between the two.

Related Topics

1 Velocity Loop

48.19 VL.KP

General Information	
Type	NV Parameter
Description	Sets velocity loop proportional gain for the PI controller; active in opmodes 1 (velocity) and 2 (position) only.
Units	A/(rad/sec)
Range	0.001 to 2,147,483.008
Default Value	1
Data Type	Float
See Also	VL.KI (pg 461)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	3548h/0	M_01-00-00-000

Description

VL.KP sets the proportional gain of the velocity loop.

The idealized velocity loop bandwidth in Hz is:

Rotary motor:

Bandwidth (Hz) = VL.KP *K_t/ (2π *J_m)

Where:

K_t= motor torque constant, in units of Nm/Arms

J_m = motor inertia, in units of kg*m²

Linear motor:

Bandwidth (Hz) = VL.KP * K_t / (Motor Pitch (mm) * J_m)

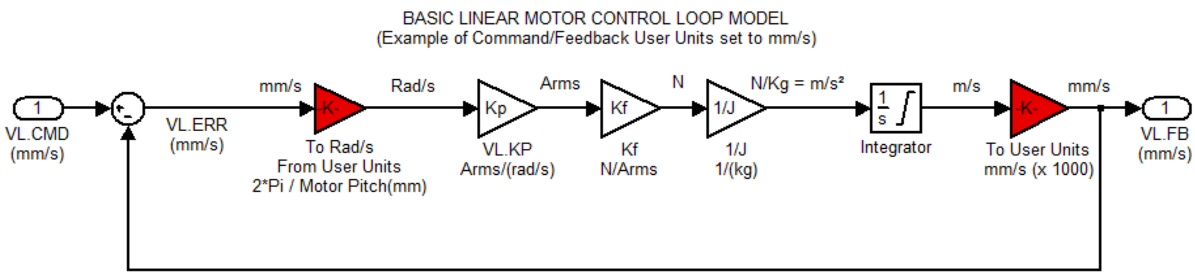
Where:

K_t= motor torque constant, in units of Nm/Arms

J_m = motor inertia, in units of kg

The drive uses the same control loop for both linear and rotary motors. VL.KP units are in Arms /(rad/s). If you want to tune in units of Arms/(mm/s), then you must manually convert the units.

The diagram below shows how linear motors are implemented at the control loop level.



The red blocks are automatically handled at the drive level.

2π radians is the linear equivalent of one full mechanical revolution of a rotary motor - and is equal to the MOTOR.PITCH of a linear motor.

Example

To convert VL.KP = 0.320 Arms/(rad/s) to Arms/(mm/s), where MOTOR.PITCH is 32 mm:

```
VL.KP = 0.320 Arm /rad/s * (2π rad / 32mm MOTOR.PITCH)
VL.KP = 0.32 * 2π / 32 = 0.063 Arms / (mm/s)
```

Related Topics

Velocity Controller Environment Block Diagram

48.20 VL.KVFF

General Information	
Type	R/W Parameter
Description	Sets the velocity loop velocity feedforward gain value; active in opmodes 1 (velocity) and 2 (position) only.
Units	NA
Range	0.0 to 2.0
Default Value	0.0
Data Type	Float
See Also	VL.FF (pg 459)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

This parameter sets the gain for the velocity feedforward (a scaled derivative of the position command is added to the velocity command value). The nominal feedforward value can be multiplied by this gain value.

This parameter is only used in the position mode (DRV.OPMODE (pg 294) = 2).

Related Topics

1 Velocity Loop

48.21 VL.LIMITN

General Information	
Type	NV Parameter
Description	Sets the velocity lower limit; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, custom units/s, rad/s Linear: counts/s, mm/s, µm/s, custom units/s
Range	Rotary: -15,000.000 to 0.000 rpm -250.000 to 0.000 rps -90,000.000 to 0.000 deg/s -1,250.000 to 0.000 custom units/s -1570.796 to 0.000 rad/s Linear: -1,073,741,824,000.000 to 0.000 counts/s -250.000*MOTOR.PITCH (pg 387) to 0.000 mm/s -250,000.000*MOTOR.PITCH (pg 387) to 0.000 µm/sec -1,250.000 to 0.000 custom units/s

General Information	
Default Value	Rotary: -3,000.000 rpm -50.000 rps -18,000.002 deg/s -250.000 (custom units)/s -314.159 rad/s Linear: -0.050 counts/s -50*MOTOR.PITCH (pg 387) mm/s -50,000.004*MOTOR.PITCH µm/sec -250.000 custom units/s
Data Type	Float
See Also	VL.LIMITP (pg 466), VL.CMD (pg 455)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

VL.LIMITN sets the velocity command negative limit.

If the input to the velocity loop is lower than VL.LIMITN, then the actual velocity command VL.CMD (pg 455) is limited by the value of VL.LIMITN.

Related Topics

1 Velocity Loop

48.22 VL.LIMITP

General Information	
Type	NV Parameter
Description	Sets the velocity high limit; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, custom units/s, rad/s Linear: counts/s, mm/s, µm/s, custom units/s
Range	Rotary: 0.000 to 15,000.000 rpm 0.000 to 250.000 rps 0.000 to 90,000.000 deg/s 0.000 to 1,250.000 custom units/s 0.000 to 1570.796 rad/s Linear: 0.000 to 1,073,741,824,000.000 counts/s 0.000 to 250.000*MOTOR.PITCH (pg 387) mm/sec 0.000 to 250,000.000*MOTOR.PITCH (pg 387) µm/s 0.000 to 1,250.000 custom units/s
Default Value	Rotary: 3,000.000 rpm 50.000 rps 18,000.002 deg/s 250.000 (custom units)/s 314.159 rad/s Linear: 0.050 counts/s 50.000*MOTOR.PITCH (pg 387) mm/sec 50,000.004*MOTOR.PITCH µm/sec 250.000 custom units/s
Data Type	Float
See Also	VL.LIMITN (pg 464), VL.CMD (pg 455)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CAN-open	/0	M_01-00-00-000

Description

VL.LIMITP sets the velocity command positive limit.

If the input to the velocity loop is higher than VL.LIMITP, then the actual velocity command VL.CMD (pg 455) is limited by the value of VL.LIMITP.

Related Topics

1 Velocity Loop

48.23 VL.LMJR

General Information	
Type	NV Parameter
Description	Sets the ratio of the estimated load moment of inertia relative to the motor moment of inertia; active in opmodes 1 (velocity) and 2 (position) only.
Units	NA
Range	0 to 100.0
Default Value	0
Data Type	Float
See Also	IL.FF (pg 352)
Start Version	M_01-00-00-000

Description

This parameter is used in the internal calculation of the current loop acceleration feed forward gain value.

Related Topics

1 Velocity Loop

48.24 VL.MODEL

General Information	
Type	R/O Parameter
Description	Reads the observer velocity signal; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on UNIT.VROTARY or UNIT.VLINEAR, UNIT.ACCLINEAR Rotary: rpm, rps, deg/s, (custom units)/s, rad/s Linear: counts/s, mm/s, µm/s, (custom units)/s
Range	N/A
Default Value	N/A
Data Type	Float
See Also	VL.FB (pg 457), VL.KO (pg 461)
Start Version	M_01-00-01-000

Description

VL.MODEL is the observer velocity output. When VL.KO (pg 461) is tuned properly, VL.MODEL will match VL.FB (pg 457), except when there is an unspecified offset between the two.

Related Topics

1 Velocity Loop

48.25 VL.OBSBW

General Information	
Type	NV Parameter
Description	Sets the bandwidth of the observer in Hz.
Units	Hz
Range	10 to 4,000 Hz
Default Value	30 Hz
Data Type	Float
See Also	N/A
Start Version	M_01-03-00-004

Description

This parameter sets the bandwidth of the observer in Hz. The observer passes the velocity feedback through a PID control loop that behaves like a low-pass filter with a bandwidth of VL.OBSBW.

Related Topics

1 Velocity Loop

48.26 VL.OBSMODE

General Information	
Type	NV Parameter
Description	Sets the observer operating mode.
Units	N/A
Range	0 to 1
Default Value	0
Data Type	Integer
See Also	N/A
Start Version	M_01-03-00-004

Description

This parameter sets the observer operating mode. When VL.OBSMODE = 0, the observer is not part of the control loop; that is, VL.FB is used as the velocity feedback signal to the velocity loop. When VL.OBSMODE = 1, the observer is part of the control loop; VL.MODEL is used as the velocity feedback signal.

Related Topics

1 Velocity Loop

48.27 VL.THRESH

General Information	
Type	NV Parameter

General Information	
Description	Sets the over speed fault value; active in opmodes 1 (velocity) and 2 (position) only.
Units	Depends on or Rotary: rpm, rps, deg/s, custom units/s, rad/s Linear: counts/s, mm/s, µm/s, custom units/s
Range	Rotary: 0.000 to 15,000.000 rpm 0.000 to 250.000 rps 0.000 to 90,000.000 deg/s 0.000 to 1,250.000 custom units/s 0.000 to 1,570.796 rad/s Linear: 0.000 to 1,073,741,824,000.000 counts/s 0.000 to 250.000*MOTOR.PITCH (pg 387) mm/s 0.000 to 250,000.000*MOTOR.PITCHMOTOR.PITCH (pg 387)µm/s 0.000 to 1,250.000 custom units/s
Default Value	Rotary: 3,600 rpm 60 rps 21,600.000 deg/s 300.000 custom units/s 376.991 rad/s Linear: 0.060 counts/s 60.000*MOTOR.PITCH (pg 387) mm/s 60,000.04*MOTOR.PITCHMOTOR.PITCH (pg 387)µm/s 300.000 custom units/s
Data Type	Float
See Also	VL.CMD (pg 455), VL.CMDU (pg 455)
Start Version	M_01-00-00-000

Fieldbus	Index/Subindex	Object Start Version
EtherCAT COE and CANopen	/0	M_01-00-00-000

Description

VL.THRESH sets the threshold for the velocity over which an over speed fault is generated.

The value is considered as an absolute value, hence it applies for both negative and positive velocities.

Example

VL.THRESH is set to 600 rpm. A velocity (VL.FB (pg 457)) of 700 rpm will generate an over speed fault.

Related Topics

1 Velocity Loop

49 Safety

49.1 Safety Instructions

DANGER	**During operation there are deadly hazards, with the possibility of death, severe injury or material damage. Do not open or touch the equipment during operation. Keep all covers and cabinet doors closed during operation. Touching the equipment is allowed during installation and commissioning for properly qualified persons only.** • **During operation, drives may have uncovered live components, depending on their level of enclosure protection.** • **Control and power connections may be live, even though the motor is not rotating.** • **Drives may have hot surfaces during operation. Heat sink can reach temperatures above 80°C.**
WARNING	**Electronic equipment can fail. The user is responsible for ensuring that, in the event of a failure of the servo amplifier, the drive is set to a state that is safe for both machinery and personnel, for instance with the aid of a mechanical brake.** **Drives with servo amplifiers and EtherCAT are remote-controlled machines. They can start to move at any time without previous warning. Take appropriate measures to ensure that the operating and service personnel is aware of this danger.** **Implement appropriate protective measures to ensure that any unintended start-up of the machines cannot result in dangerous situations for personnel or machinery. Software limit-switches are not a substitute for the hardware limit-switches in the machine.**
NOTICE	**Install the drive as described in the *Installation Manual*. Never break any of the electrical connections to the drive while it is live. This can result in destruction of the electronics**
NOTICE	**Do not connect the Ethernet line for the PC with the set up software to the EtherCAT interface X5/X6. The set up Ethernet cable must be connected to the service interface on X11**

49.2 Use as directed

Drives are components that are built into electrical plants or machines and can only be operated as integral components of these plants or machines. The manufacturer of the machine used with a drive must generate a risk assessment for the machine and take appropriate measures to ensure that unforeseen movements cannot cause personnel injury or property damage.

- Observe the chapters "Use as directed" and "Prohibited use" in the *AKD PDMM Installation Manual*.
- The EtherCAT interface serves only for the connection of the *AKD PDMM* to a master with EtherCAT connectivity.

49.3 Prohibited use

Other use than that described in chapter “Use as directed” is not intended and can lead to personnel injuries and equipment damage. The drive may not be used with a machine that does not comply with appropriate national directives or standards. The use of the drive in the following environments is also prohibited:

- potentially explosive areas
- environments with corrosive and/or electrically conductive acids, alkaline solutions, oils, vapors, dusts
- ships or offshore applications

The connectors X5 and X6 of the AKD PDMM EtherCAT drive may not be used for any ethernet protocol except EtherCAT (CoE, Can over EtherCAT).

50 EtherCAT Profile

50.1 Slave Register

The table below gives the addresses of individual registers in the FPGA memory. The data is provided in little-endian format, with the 'least significant byte' occupying the lowest address. A detailed description of all registers and FPGA memory locations is available in the "EtherCAT Slave Controller" description of the EtherCAT user organization (www.EtherCAT.org).

Adddress	Length (Byte)	Description	ZA ECAT*	ZA Drive*
0x0120	2	AL Control	R/W	R/O
0x0130	2	AL Status	R/O	R/W
0x0134	2	AL Status Code	R/O	R/W
0x0204	2	Interrupt Enable Register	R/O	R/W
0x0220	2	AL Event (IRQ Event)	R/W	R/O
0x0800	8	Sync Manager 0 (Mail Out Control Register)	R/W	R/O
0x0808	8	Sync Manager 1 (Mail In Control Register)	R/W	R/O
0x0810	8	Sync Manager 2 (Process data Output Control Register)	R/W	R/O
0x0818	8	Sync Manager 3 (Process data Input Control Register)	R/W	R/O
0x0820	8	Sync Manager 4	R/W	R/O
0x0828	8	Sync Manager 5	R/W	R/O
0x0830	8	Sync Manager 6	R/W	R/O
0x0838	8	Sync Manager 7	R/W	R/O
0x0840	8	Sync Manager 8	R/W	R/O
0x1100	Max. 64	ProOut Buffer (Process data Output, setpoints ECAT)	R/W	R/O
0x1140	Max. 64	ProIn (Process data Input, act. values ECAT)	R/O	R/W
0x1800	512	Mail Out Buffer (Object Channel Buffer ECAT, byte-length is specified in the device description file)	R/W	R/O
0x1C00	512	Mail In Buffer (Object Channel Buffer Drive, byte-length is specified in the device description file)	R/O	R/W

* ZA ECAT = Access mode EtherCAT

* ZA Drive = Access mode drive

50.2 AL Event (Interrupt Event) and Interrupt Enable

Communication between the drive and the EtherCAT FPGA can be interrupt-driven. The interrupt enable register and the AL event register are responsible for the EtherCAT interface interrupt functionality.

There are two events which lead also to a HW interrupt within the drive, the EEPROM emulation event and the SyncManager 2 event. The actual values of the drive (SyncManager 3 data) are written without any AL event request during each HW IRQ, e.g. triggered by a SyncManager 2 event. The Mailbox exchange between the master and the AKD PDMM is completely handled by polling the AL event register within the background task of the drive.

The drive activates individual EtherCAT interface events when the corresponding bit of the interrupt enable register is set to 1. When it is set to 0, the hardware interrupts for the specific events are deactivated.

50.2.1 Interrupt Enable Register (Address 0x0204:0x0205)

Parameter	Address	Bit	ZA Drive	ZA ECAT	Description
AL Control Event	0x204	0	R/W	R/O	Activation of AL control event for phase run-up
-	0x204	1	R/W	R/O	Reserved
Sync0 DC Distributed Clock	0x204	2	R/W	R/O	Activation of distributed clock (DC) sync 0 interrupts for entire communication
Sync1 DC Distributed Clock	0x204	3	R/W	R/O	Activation of distributed clock (DC) sync 1 interrupts for entire communication
SyncManager activation register change	0x204	4	R/W	R/O	Activation of ‘SyncManager activation register change’ IRQ.
EEPROM emulation event	0x204	5	R/W	R/O	Activation of the EEPROM emulation interrupts.
-	0x204	3 to 7	R/W	R/O	Reserved
Sync Manager 0 Event (Mail Out Event)	0x205	0	R/W	R/O	Activation of output event mailbox (SDO, Sync Manager 0) for object channel.
Sync Manager 1 Event (Mail In Event)	0x205	1	R/W	R/O	Activation of input event mailbox (SDO, Sync Manager 1) for object channel.
Sync Manager 2 Event (Pro Out Event)	0x205	2	R/W	R/O	Activation of output event process data (PDO, card's cyclical setpoints)
Sync Manager 3 Event (Pro In Event)	0x205	3	R/W	R/O	Activation of input event process data (PDO, drive's cyclical actual values)
-	0x205	4 to 7	R/W	R/O	Reserved

50.2.2 AL Event Request (Address 0x0220:0x0221)

When the relevant bit of the AL event request register is set to 1, the EtherCAT interface tells the drive which event it should process by the AKD PDMM.

Parameter	Address	Bit	ZA Drive	ZA ECAT	Description
AL Control Event	0x220	0	R/O	R/W	Processing of AL control event for phase run-up
Sync0 Distributed Clock (DC) Event	0x220	2	R/O	R/W	Processing of a distributed clock (DC) event
Sync1 Distributed Clock (DC) Event	0x220	3	R/O	R/W	Processing of a distributed clock (DC) event
SyncManager activation register change	0x220	4	R/O	R/W	The content of the SyncManager activation register has been changed.
EEPROM emulation event	0x220	5	R/O	R/W	Processing of an EEPROM emulation event in order to identify the AKD PDMM within the network.
-	0x220	6 to 7	R/O	R/W	Reserved
Sync Manager 0 Event	0x221	0	R/O	R/W	Mailbox request (SDO, Sync Manager 0) for object channel.
Sync Manager 1 Event	0x221	1	R/O	R/W	Mailbox response (SDO, Sync Manager 1) for object channel.
Sync Manager 2 Event	0x201	2	R/O	R/W	Process data output (PDO, card's cyclical setpoints)
Sync Manager 3 Event	0x201	3	R/O	R/W	Process data input (PDO, drive's cyclical actual values)
Sync Manager 4 –					
Sync Manager 7 Event	0x221	4 to 7	R/O	R/W	Reserved
Sync Manager 8 –					
Sync Manager 15 Event	0x222	0…7	R/O	R/W	Reserved

50.3 Phase Run-Up

The AL control, AL status and AL status code registers are responsible for communication phase run-up (also referred to as EtherCAT status change), for current status display and for any fault messages. The drive responds to every EtherCAT interface transition request made by the AL control register via the AL Status and AL Status Code registers. Any fault messages are displayed in the AL status code register.

A status change within the AL control register is polled within the AKD PDMM, which means that an AL control event does not lead to a HW interrupt within the drive.

50.3.1 AL Control (Address 0x0120:0x0121)

Parameter	Address	Bit	ZA Drive	ZA ECAT	Description
Status	0x120	3 to 0	R/O	W/O	0x01: Init Request
0x02: PreOperational Request					
0x03: Bootstrap Mode Request					
0x04: Safe Operational Request					
0x08: Operational Request					
Acknowledgement	0x120	4	R/O	W/O	0x00: No fault acknowledgement 0x01: Fault acknowledgement (positive edge)
Reserved	0x120	7 to 5	R/O	W/O	-
Applic. specific	0x120	15 to 8	R/O	W/O	-

50.3.2 AL Status (Address 0x0130:0x0131)

Parameter	Address	Bit	ZA Drive	ZA ECAT	Description
Status	0x130	3 to 0	W/O	R/O	0x01: Init
0x02: PreOperational					
0x03: Bootstrap Mode					
0x04: Safe Operational					
0x08: Operational					
Status change	0x130	4	W/O	R/O	0x00: Acknowledgement 0x01: Error, e.g. forbidden transition
Reserved	0x130	7 to 5	W/O	R/O	-
Applic. specific	0x130	15 to 8	W/O	R/O	-

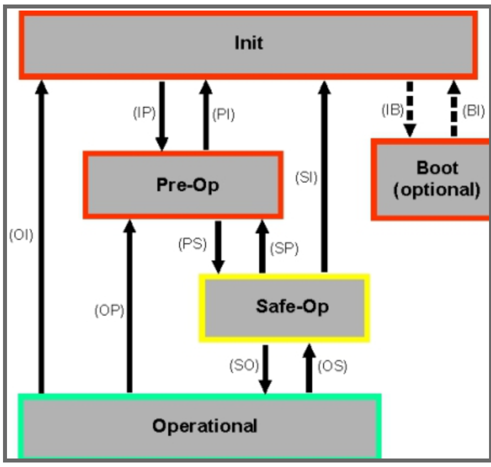
50.3.3 AL Status Code (Address 0x0134:0x0135)

Parameter	Address	Bit	ZA Drive	ZA ECAT	Description
Status	0x134	7 to 0	W/O	R/O	See table below
Status	0x135	7 to 0	W/O	R/O	See table below

Code	Description	Current Status (Status change)	Resulting Status
0x0000	No error	All	Current Status
0x0011	Invalid requested state change	I -> S, I -> O, P -> O, O -> B, S -> B, P -> B	Current Status + E
0x0017	Invalid sync manager configuration	I -> P, P -> S	Current Status + E

No other codes are supported.

50.3.4 EtherCAT communication phases



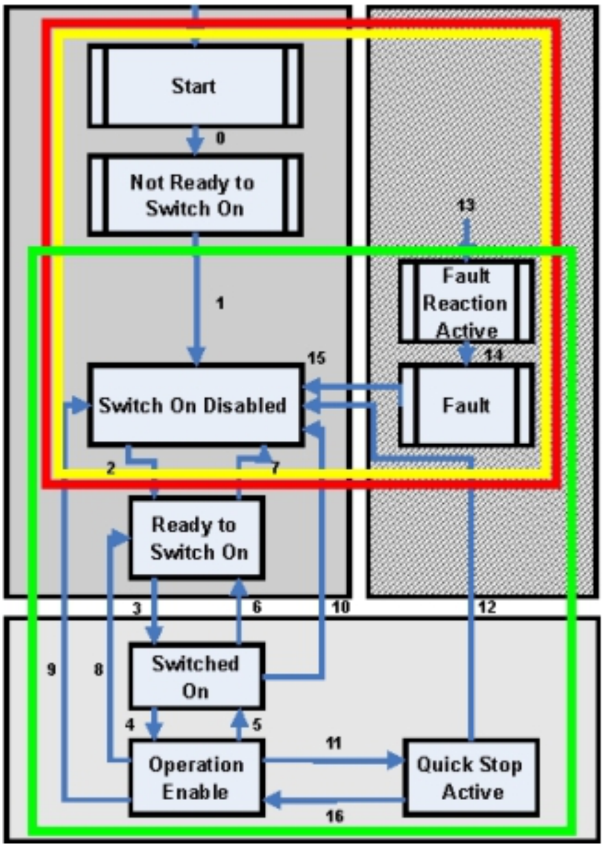
INIT: Initialization, no communication. EEPROM emulation will be activated. PRE-OP: Mailbox active, slave parameterization and startup parameters	
SAVE-OP: Cyclical actual values are transferred and the drive tries to synchronize. OPERATIONAL: Cyclical setpoints are processed, torque enable can be activated and the drive must be synchronized.	

Individual communication transitions

Transition	AL Control (Bit 3 to 0)	Description
(IB)	0x03	-
(BI)	-	-
(IP)	0x02	AKD PDMM reads the SyncManager 0 & 1 configuration and verifies the value of the start-address and the length. The AKD PDMM prepares itself for handling SyncManager 0 events.
(PI)	0x01	-
(PS)	0x04	AKD PDMM reads the SyncManager 2 & 3 configuration and verifies the value of the start-address and the length.
(SP)	0x02	-
(SI)	0x01	-
(SO)	0x08	The SnycManager 2 hardware interrupt will be enabled by the drive.
(OS)	0x04	Deactivation of SyncManager 2 hardware interrupt.
(OP)	0x02	Deactivation of SyncManager 2 hardware interrupt..
(OI)	0x01	Deactivation of SyncManager 2 hardware interrupt.

50.4 CANopen over EtherCAT (CoE) Status Machine

The status machine for the control and status words corresponds to the CANopen status machine in accordance with DS402. CANopen control and status words are captured in every instance of fixed PDO mapping (see chapter entitled ‘Fixed PDO Mapping‘, page).



50.4.1 Status Description

Status	Description
Not Ready to Switch On	The drive is not ready to switch on; the controller has not indicated readiness for service. The drive is still in the boot phase or in fault status.
Switch On Disable	In 'Switch On Disable' status, the amplifier cannot be enabled via the EtherCAT interface, because (for example) there is no connection to a power source.
Ready to Switch On	In 'Ready to Switch On' status, the drive can be enabled via the control word.
Switched On	In 'Switched On' status, the amplifier is enabled, but the setpoints of the Ether-CAT-interface are not yet transferred. The amplifier is idle, and a positive edge in bit 3 of the control word activates setpoint transfer (transition to 'Operation Ena-ble' status).
Operation Enable	In this status, the drive is enabled and setpoints are transferred from the Ether-CAT interface.
Quick Stop Active	The drive follows a quick stop ramp.
Fault Reaction Active	The drive responds to a fault with an emergency stop ramp.
Fault	A fault is pending, the drive is stopped and disabled.

50.4.2 Commands in the Control Word

Bit assignment in the control word

Bit	Name	Bit	Name
0	Switch on	8	Pause/halt
1	Disable Voltage	9	reserved
2	Quick Stop	10	reserved
3	Enable Operation	11	reserved
4	Operation mode specific	12	reserved
5	Operation mode specific	13	Manufacturer-specific
6	Operation mode specific	14	Manufacturer-specific
7	Reset Fault (only effective for faults)	15	Manufacturer-specific

Commands in the control word

Command	Bit 7 Fault Reset	Bit 3 Enable Operation	Bit 2 Quick Stop	Bit 1 Disable Voltage	Bit 0 Switch On	Transitions
Shutdown	X	X	1	1	0	2, 6, 8
Switch on	X	X	1	1	1	3
Disable Voltage	X	X	X	0	X	7, 9, 10, 12
Quick Stop	X	X	0	1	X	7, 10, 11
Disable Operation	X	0	1	1	1	5
Enable Operation	X	1	1	1	1	4, 16
Fault Reset	1	X	X	X	X	15

Bits labeled **X** are irrelevant. **0** and **1** indicate the status of individual bits.

Mode-dependent bits in the control word

The following table shows the mode-dependent bits in the control word. Only manufacturer-specific modes are supported at present. The individual modes are set by Object 6060h Modes of operation.

Operation mode	No	Bit 4	Bit 5	Bit 6
Profile Position Mode (pp)	01h	new_setpoint	change_set_immediately	absolute/relative
Profile Velocity Mode (pv)	03h	reserved	reserved	reserved
Profile Torque Mode (tq)	04h	reserved	reserved	reserved
Homing Mode (hm)	06h	homing_operation_start	reserved	reserved
Interpolated Position Mode (ip)	07h		reserved	reserved
Cyclic synchronous position mode	08h	reserved	reserved	reserved

Description of the remaining bits in the control word

Bit 8: (Pause) If Bit 8 is set, then the drive halts (pauses) in all modes. The setpoints (speed for homing or jogging, motion task number, setpoints for digital mode) for the individual modes are retained.

Bit 9,10: These bits are reserved for the drive profile (DS402).

Bit 13, 14, 15: These bits are manufacturer-specific, and reserved at present.

50.4.3 Status Machine Bits (status word)

Bit assignment in the status word

Bit	Name	Bit	Name
0	Ready to switch on	8	Manufacturer-specific (reserved)
1	Switched on	9	Remote (always 1)
2	Operation enable	10	Target reached
3	Fault	11	Internal limit active
4	Voltage enabled	12	Operation mode specific (reserved)
5	Quick stop	13	Operation mode specific (reserved)
6	Switch on disabled	14	Manufacturer-specific (reserved)
7	Warning	15	Manufacturer-specific (reserved)

States of the status machine

State	Bit 6 switch on disable	Bit 5 quick stop	Bit 3 fault	Bit 2 operation enable	Bit 1 switched on	Bit 0 ready to switch on
Not ready to switch on	0	X	0	0	0	0
Switch on disabled	1	X	0	0	0	0
Ready to switch on	0	1	0	0	0	1
Switched on	0	1	0	0	1	1
Operation enabled	0	1	0	1	1	1
Fault	0	X	1	0	0	0
Fault reaction active	0	X	1	1	1	1
Quick stop active	0	0	0	1	1	1

Bits labeled **X** are irrelevant. **0** and **1** indicate the status of individual bits.

Description of the remaining bits in the status word

Bit 4: voltage_enabled The DC-link voltage is present if this bit is set.

Bit 7: warning There are several possible reasons for Bit 7 being set and this warning being produced. The reason for this warning can be revealed by using the Object 20subindex manufacturer warnings.

Bit 9: remote is always set to 1, i.e. the drive can always communicate and be influenced via the RS232 - interface.

Bit 10: target_reached This is set when the drive has reached the target position.

Bit 11: internal_limit_active This bit specifies that a movement was or is limited. In different modes, different warnings cause the bit to be set.

50.5 Fixed PDO Mappings

Various ready-to-use mappings can be selected for cyclic data exchange via SDO’s of the object 0x1C12 and 0x1C13. Using object 0x1C12 subindex 1 (Sync Manager 2 assignment), a fixed mapping for the cyclic command values can be set with the values 0x1701, 0x1702,0x1720 to 0x1724. Using object 0x1C13 subindex 1 (Sync Manager 3 assignment), a fixed mapping for the cyclic actual values can be set via the data 0x1B01, 0x1B20 to 0x1B24.

The following sequence describes how to select the fixed command value mapping 0x1701 via SDO’s:

1. SDO write access to object 0x1C12Sub0 Data:0x00
2. SDO write access to object 0x1C12Sub1 Data:0x1701
3. SDO write access to object 0x1C12Sub0 Data:0x01

The following fixed mappings are supported:

Position interface:

0x1701	Position command value (4 bytes), Control word (2 bytes), total (6 bytes)
0x1720	Control Word (2 bytes), Interpolated position command value (4 bytes), Latch control word (2 bytes), Torque feed forward (2 bytes), Digital outputs (2 bytes)
0x1721	Interpolated position command value (4 bytes), Control Word (2 bytes), Torque feed forward (2 bytes)
0x1722	Control word (2 byte), Interpolated position command value (4 bytes), Latch control word (2 bytes), Torque feed forward (2 bytes), Digital outputs (2 bytes), max. torque (2 bytes)
0x1723	Control word (2 bytes), Interpolated position command value (4 bytes), Latch control word (2 bytes), Torque feed forward (2 bytes), Digital outputs (2 bytes), Reset of changed input information (2 bytes)
0x1724	Target position for cyclic synchronous position mode (4 bytes), Control word (2 byte), Torque feed forward (2 bytes)
0x1B01	Position actual value (4 bytes), Status word (2 bytes), total (6 bytes)
0x1B20	Position actual internal value (4 bytes), 2nd position feedback position (4 bytes), velocity actual value (4 bytes), digital inputs (4 bytes), following error (4 bytes), latch position positive (4 bytes), status word (2 bytes), torque actual value (2 bytes), latch status (2 bytes), analogue input value (2 bytes)
0x1B21	Position Actual Internal Value (4 bytes), Status word (2 bytes)
0x1B22	Position actual internal value (4 bytes), 2nd position feedback position (4 bytes), velocity actual value (4 bytes), digital inputs (4 bytes), following error (4 bytes), latch position negative (4 bytes), status word (2 bytes), torque actual value (2 bytes), latch status (2 bytes), analogue input value (2 bytes)
0x1B23	Position actual internal value (4 bytes), 2nd position feedback position (4 bytes), velocity actual value (4 bytes), digital inputs (4 bytes), following error (4 bytes), latch position positive / negative (4 bytes), status word (2 bytes), torque actual value (2 bytes), latch status (2 bytes), analogue input value (2 bytes)
0x1B24	Position actual value (4 bytes), status word (2 bytes)

Velocity interface:

0x1702	Velocity command value (4 bytes), Control word (2 bytes), total (6 bytes)
0x1B02	Position actual value (4 bytes), Status word (2 bytes), total (6 bytes)

The objects, which are mapped into the fixed PDOs can be read via the subindices 1 to n of the above indices. The number of mapped entries is available by reading subindex 0 of the above indices. Example: A read access to object 1702 sub 0 gives a value of 2, a read on subindex 1 gives 0x60ff0020, on subindex 2 0x60400010. The meaning of these numbers can be seen in the CANopen manual or the free-mapping example (=> p. 486.).

50.6 Flexible PDO Mappings

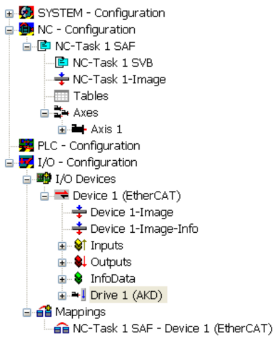
In addition to the fixed PDO - mapping the so-called flexible mapping of real-time obects is possible.

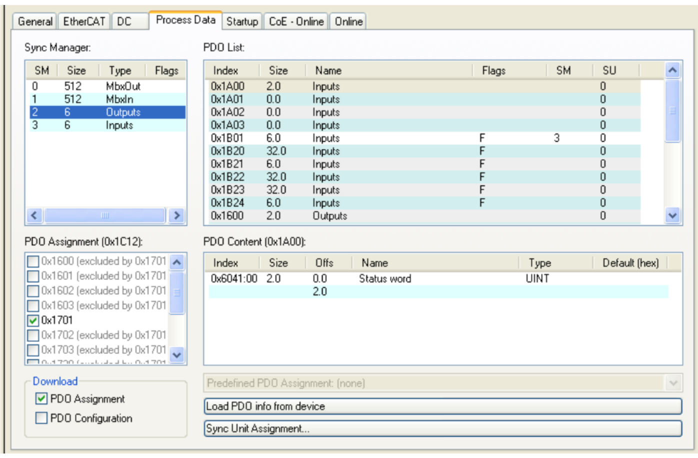
The configuration is similar to the described sequence for the fixed mappings:

1. The mapping selection is cleared (write 0 to object 0x1C12 sub 0 and 1C13 sub 0)
2. As the AKD PDMM - implementation is based on CANopen the real-time data are build from up to 4 PDOs with 8 bytes in both directions. These PDOs are built in the same way as in a CAN-drive with the objects 0x1600 - 0x1603 and 0x1A00 - 0x1A03. Unused PDOs must be cleared with writing 0 to the subindex 0.
3. SDO write access to object 0x1C12 sub 1 .. 4 with the PDOs (0x1600 .. 0x1603), that should be used in receive direction of the AKD PDMM (set point values).
4. SDO write access to object 0x1C13 sub 1 .. 4 with the PDOs (0x1A00 .. 0x1A03), that should be used in transmit direction of the AKD PDMM (actual values).
5. SDO write access to the objects 0x1C12 sub 0 and 0x1C13 sub 0 with the number of mapped PDOs in this direction.

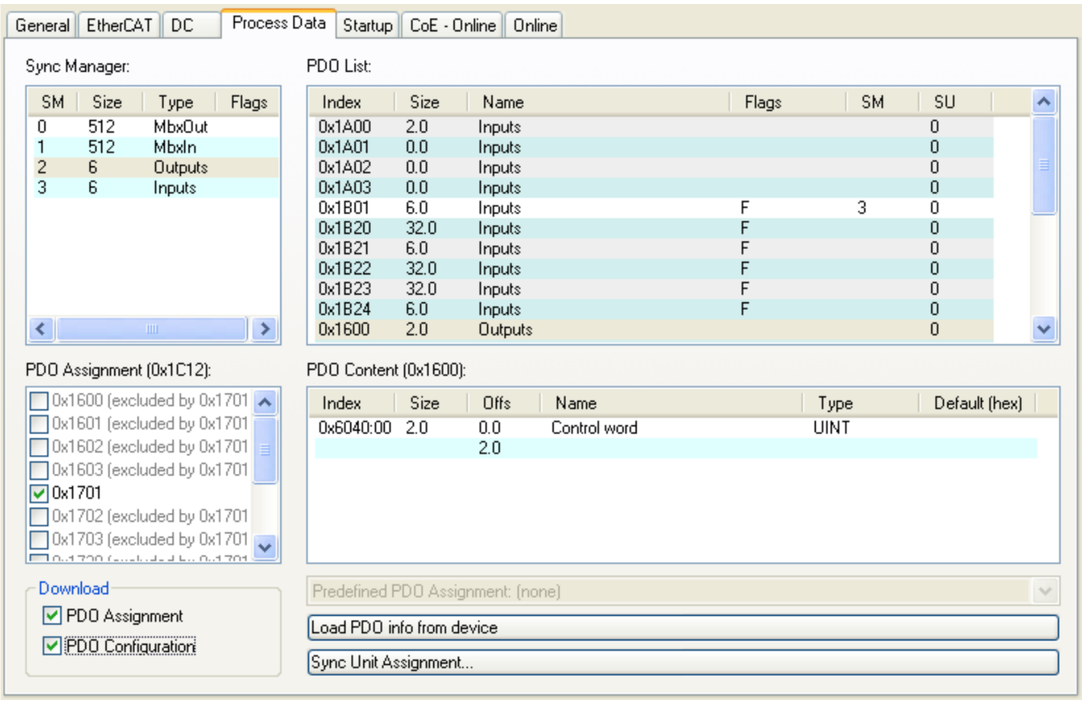
See an example in chapter "Flexible PDO Mappings" (=> p. 484) .

The cyclically used data are visible in the PDO-assignment window for the Inputs and Outputs of the Sync Managers. Default setting are the fixed PDOs 0x1701 and 0x1B01 (visible contents when selected in the PDO list).



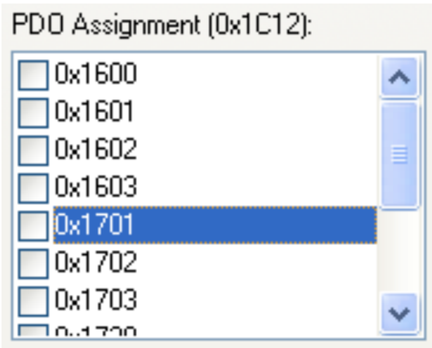


If the free mapping is required, the PDO configuration check box must be checked and changed.

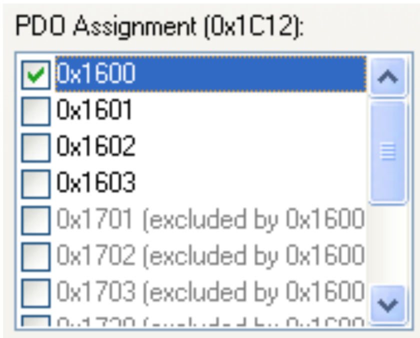


50.6.1 Example: Free PDO Mapping

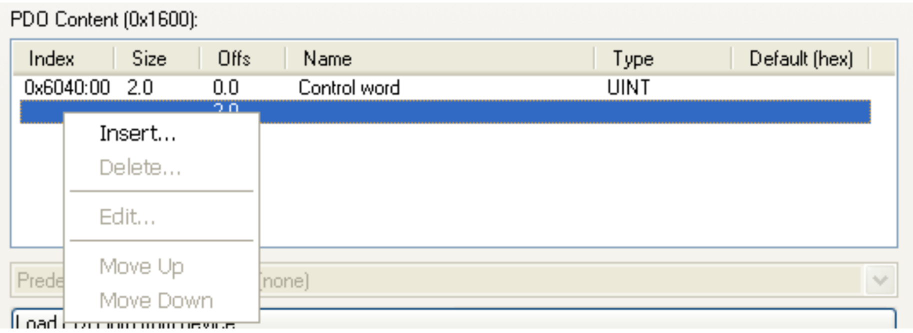
For the free mapping of the Outputs the fixed mapping 0x1701 has to be switched off and up to 4 free-mappable PDOs (0x1600-0x1603) can be used instead. The maximum number of bytes for each of these PDOs is 8.



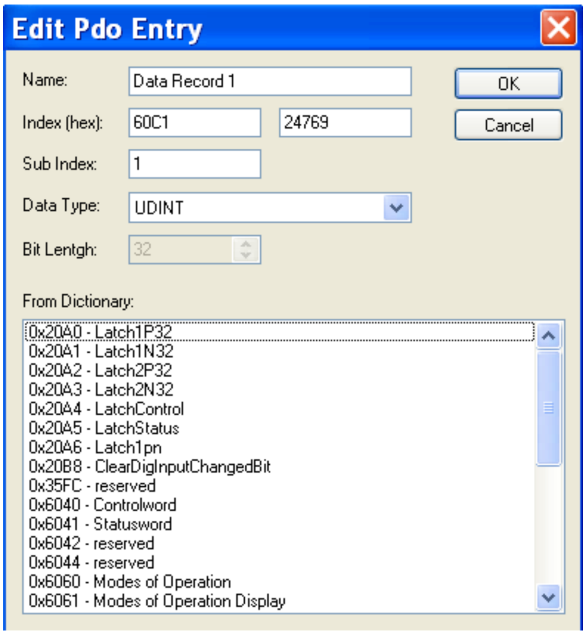
==========>

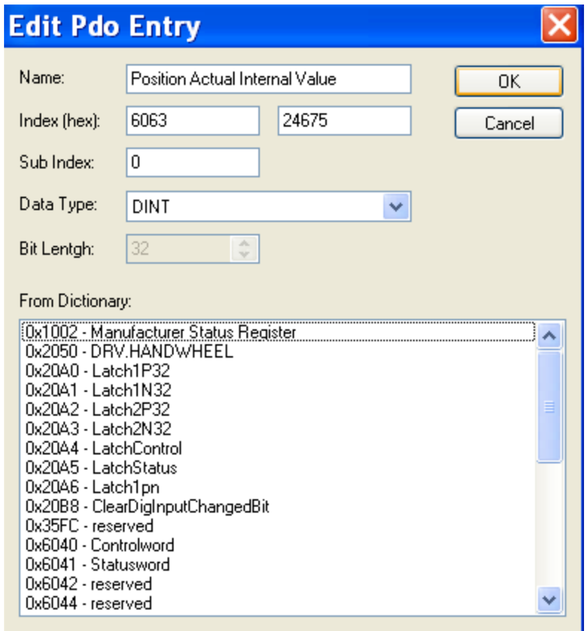


After that the default mapping of e.g. the PDO 0x1600 can be extended:



A list of possible objects for the mapping will be shown and a new entry can be chosen.

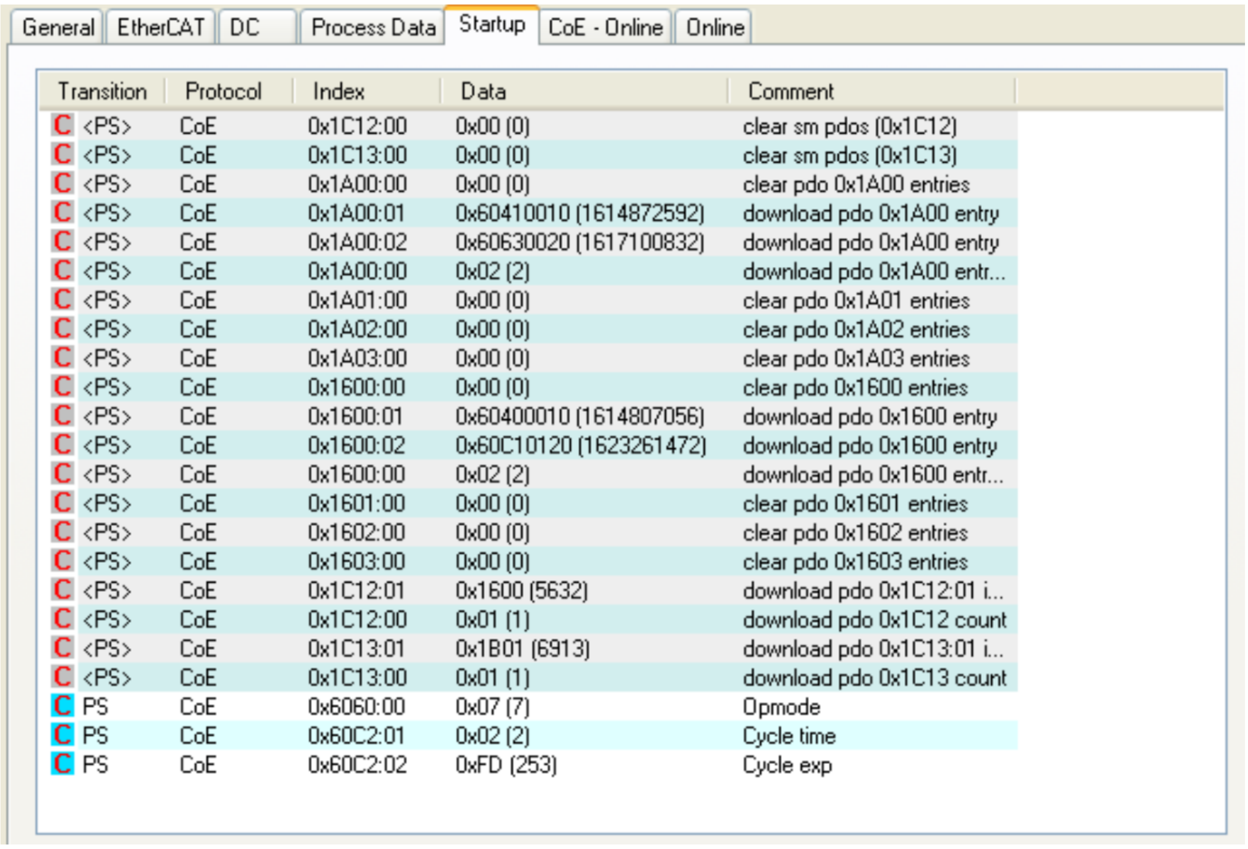




In this case the setpoint for the interpolated position
mode is selected.

The same is valid for the Tx-PDO-direction. Here the value of the actual internal position is selected.

This results in the startup-SDO-list for this sample free-mapped-configuration.

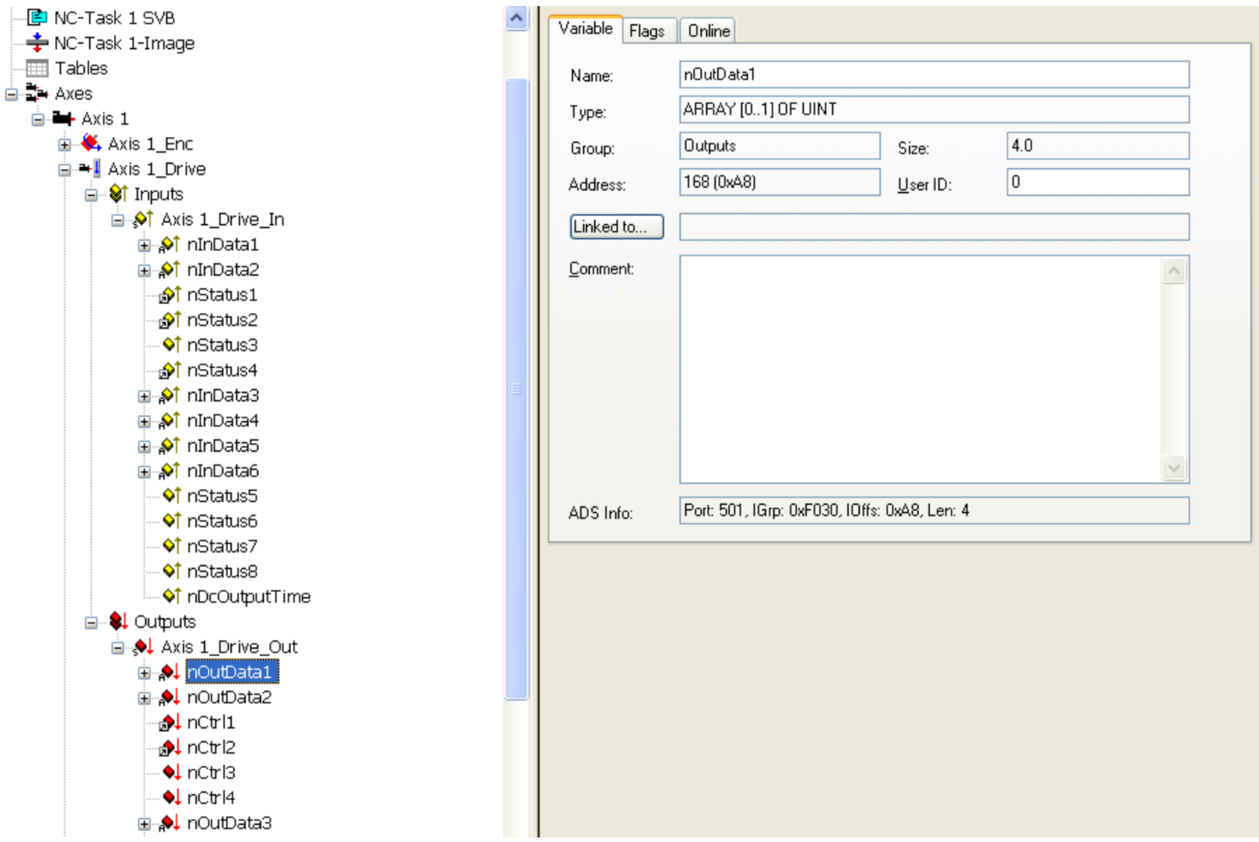


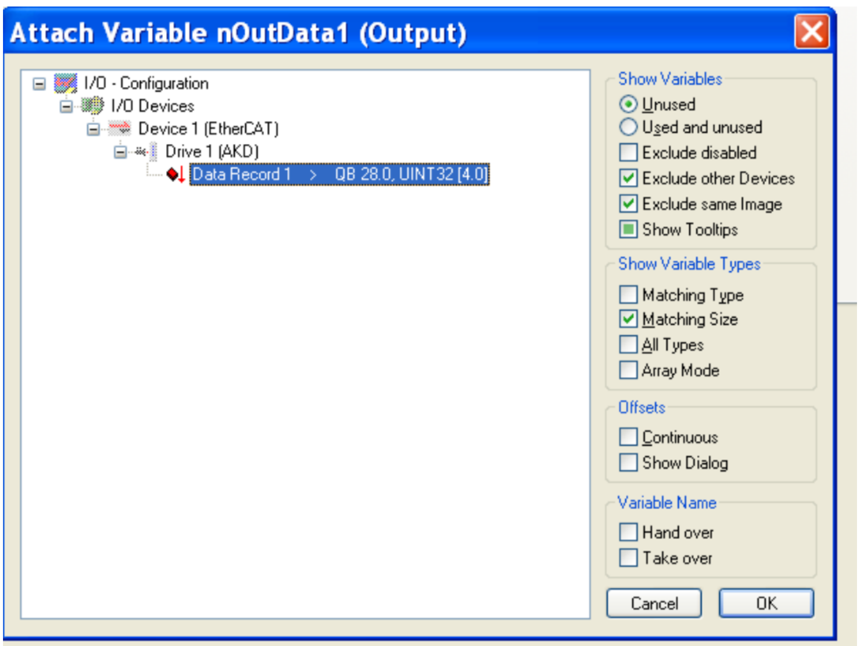
Transition	Protocol	Index	Data	Comment
<PS>	CoE	0x1C12:00	0x00 (0)	clear sm pdos (0x1C12)
<PS>	CoE	0x1C13:00	0x00 (0)	clear sm pdos (0x1C13)
<PS>	CoE	0x1A00:00	0x00 (0)	clear pdo 0x1A00 entries
<PS>	CoE	0x1A00:01	0x60410010 (1614872592)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:02	0x60630020 (1617100832)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:00	0x02 (2)	download pdo 0x1A00 entr...
<PS>	CoE	0x1A01:00	0x00 (0)	clear pdo 0x1A01 entries
<PS>	CoE	0x1A02:00	0x00 (0)	clear pdo 0x1A02 entries
<PS>	CoE	0x1A03:00	0x00 (0)	clear pdo 0x1A03 entries
<PS>	CoE	0x1600:00	0x00 (0)	clear pdo 0x1600 entries
<PS>	CoE	0x1600:01	0x60400010 (1614807056)	download pdo 0x1600 entry
<PS>	CoE	0x1600:02	0x60C10120 (1623261472)	download pdo 0x1600 entry
<PS>	CoE	0x1600:00	0x02 (2)	download pdo 0x1600 entr...
<PS>	CoE	0x1601:00	0x00 (0)	clear pdo 0x1601 entries
<PS>	CoE	0x1602:00	0x00 (0)	clear pdo 0x1602 entries
<PS>	CoE	0x1603:00	0x00 (0)	clear pdo 0x1603 entries
<PS>	CoE	0x1C12:01	0x1600 (5632)	download pdo 0x1C12:01 i...
<PS>	CoE	0x1C12:00	0x01 (1)	download pdo 0x1C12 count
<PS>	CoE	0x1C13:01	0x1B01 (6913)	download pdo 0x1C13:01 i...
<PS>	CoE	0x1C13:00	0x01 (1)	download pdo 0x1C13 count
PS	CoE	0x6060:00	0x07 (7)	Opmode
PS	CoE	0x60C2:01	0x02 (2)	Cycle time
PS	CoE	0x60C2:02	0xFD (253)	Cycle exp

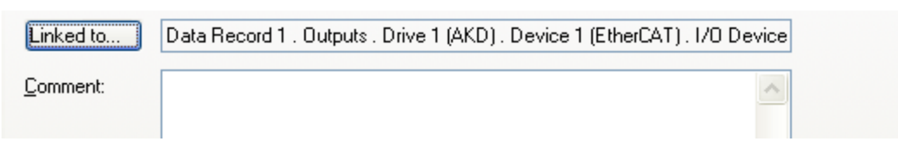
The meaning of the data(for example 0x60410010 in the mapping of 0x1A00 sub 1) is as follows:

- 0x6041 is the index of the DS402 status word
- 0x00 is the subindex of the DS402 status word
- 0x10 is the number of bits for this entry, i. e. 16 bits or 2 bytes.

If this shall be used in the NC, the interpolation set point position has to be linked from the axis to the NC-axis.

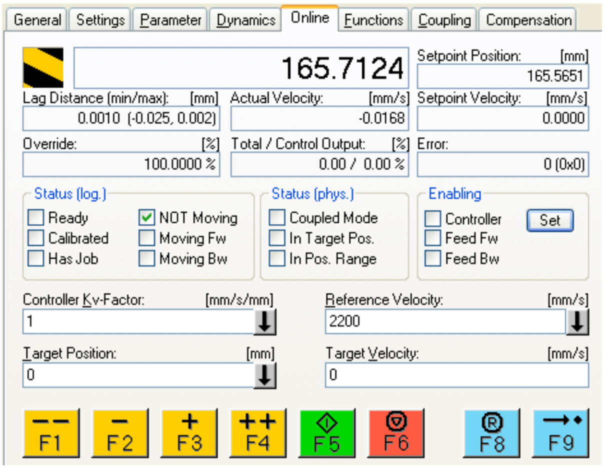




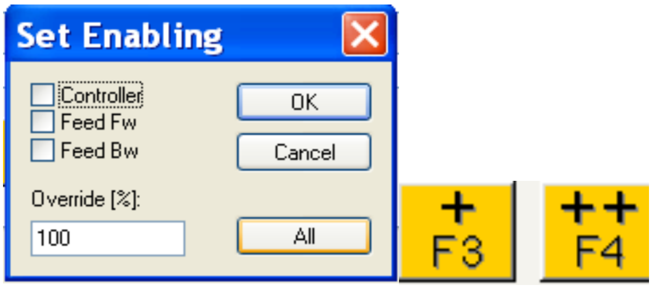


After doing this configuration the mapping can be activated as seen before in this document:

Now the NC-screen should show a position in the online window, which changes a bit in the last digits.



After enabling the power stage with the All-button, the drive can be moved via the jog-buttons or via the functions in the function menu.



50.7 Supported Cyclical Setpoint and Actual Values

Supported cyclical setpoint values

Name	CANopen object number	Data type	Description
Position command value	0x60C1 sub 1	INT32	Interpolation data record in IP-mode
Velocity command value	0x60FF sub 0	INT32	
CANopen control-word	0x6040 sub 0	UINT16	CANopen control word.
Latch Control word	0x20a4 sub 0	UINT16	
Torque feed forward	0x60B2 sub 0	INT16	
Digital outputs	0x60FE sub 1	UINT32	

Supported cyclical actual values

Name	CANopen object number	Data type	Description
Position actual internal value	0x6063 sub 0	INT32	
Velocity actual value	0x606c sub 0	INT32	
CANopen status-word	0x6041 sub 0	UINT16	CANopen status word.
Second position feedback	2050 sub 0	INT32	
Digital inputs	60FD sub 0	UINT32	
Following error actual value	60F4 sub 0	INT32	
Latch position positive edge	20a0 sub 0	INT32	
Torque actual value	6077 sub 0	INT16	
Latch status	20A5 sub 0	UINT16	
Analog input value	3470 sub 0	INT16	

50.8 Supported Operation Modes

CANopen mode of operation	AKD PDMM mode of operation	Description
Profile velocity	DRV.OPMODE 2 DRC.CMDSOURCE 1	0x6060Sub0 Data: 3 In this mode of operation the EtherCAT master sends cyclic velocity command values to the AKD PDMM.
Interpolated position	DRV.OPMODE 2 DRV.CMDSOURCE 1	0x6060Sub0 Data: 7 In this mode of operation the EtherCAT master sends cyclic position command values to the AKD PDMM. These command values are interpolated by the AKD PDMM according to the fieldbus sample rate.
Homing mode	DRV.OPMODE 2 DRV.CMDSOURCE 0	0x6060 sub 0 data : 6 In this mode an AKD PDMM-internal homing can be done.

50.9 Adjusting EtherCAT Cycle Time

The cycle time to be used in the drive for the cyclical setpoints and actual values can either be stored in the FBUS.SAMPLEPERIOD parameter in the amplifier or configured in the startup phase.

This takes place via SDO mailbox access to CANopen objects 60C2 subindex 1 and 2.

Subindex 2, known as the interpolation time index, defines the power of ten of the time value (e.g. -3 means 10-3 or milliseconds) while subindex 1, known as interpolation time units, gives the number of units (e.g. 4 means 4 units).

You can run a 2 ms cycle using various combinations. For example,

Index = -3, Units = 2
or
Index = -4, Units = 20 etc.

The FBUS.SAMPLEPERIOD parameter is counted in multiples of 62.5us microseconds within the device. This means, for example that 2 ms equates to FBUS.SAMPLEPERIOD value of 32.

50.10 Maximum Cycle Times depending on operation mode

The minimum cycle time for the drive is largely dependent on the drive configuration (second actual position value encoder latch functionality enabled and so on)

Interface	Cycle time AKD PDMM
Position	≥ 0.25 ms (≥ 250 µs)
Velocity	≥ 0.25 ms (≥ 250 µs)
Torque	≥ 0.25 ms (≥ 250 µs)

50.11 Synchronization

On all drives, the internal PLL is theoretically able to even out an average deviation of up to 4800 ppm in the cycle time provided by the master. The drive checks once per fieldbus cycle a counter within the drive internal FPGA, which is cleared by a Sync0 (Distributed clock) event. Depending of the counter value, the drive extends or decreases the 62.5 µs MTS signal within the drive by a maximum of 300 ns.

The theoretical maximum allowed deviation can be calculated by using the following formula:

$$max_{de}v = \frac{300[ns]}{62.5[\mu s]} \cdot 1{,}000{,}000 = 4800\ [ppm]$$

The synchronization functionality within the drive can be enabled via setting bit 0 of the FBUS.PARAM02 parameter to high. Therefore FBUS.PARAM02 must be set to the value of 1. Furthermore the distributed clock functionality must be enabled by the EtherCAT master in order to activate cyclic Sync0 events.

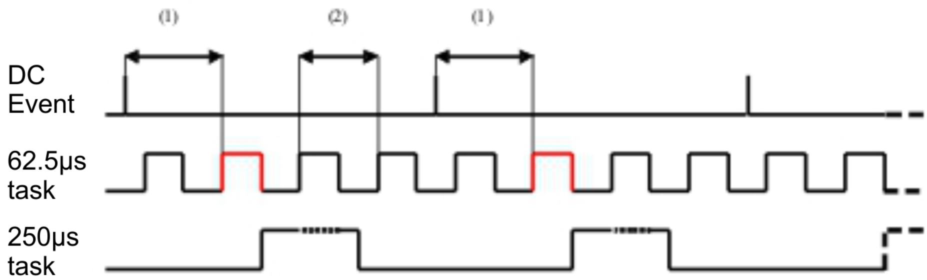
50.11.1 Synchronization behavior with distributed clocks (DC) enabled

When the EtherCAT master enables distributed clocks, a distributed clock (DC) event is created in the AKD PDMM once per fieldbus cycle. An assigned 62.5 µs real-time task in the AKD PDMM monitors the elapsed time between the DC events and the AKD PDMM System time and extends or reduces the 62.5 µs strobe to the CPU as necessary.

The following fieldbus parameters are used for the synchronization feature:

1. FBUS.SYNCDIST = Expected time delay of the AKD PDMM PLL-code to the DC event.
2. FBUS.SYNCACT = Actual time delay of the AKD PDMM PLL-code to the DC event.
3. FBUS.PLLTHRESH = Number of consecutive successful synchronized PLL cycles of the AKD PDMM before the Drive is considered as synchronized.
4. FBUS.SYNCWND = Synchronization window in which the AKD PDMM is considered to be synchronized. The Drive is considered synchronized as long as the following statement is true is true for FBUS.PLLTHRESH consecutive cycles:
   FBUS.SYNCDIST-FBUS.SYNCWND < FBUS.SYNCACT < FBUS.SYN-CDIST+FBUS.SYNCWND

Example with a 4kHz fieldbus sample rate:



Explanation:

The red-marked 62.5[µs] real-time task displays the AKD PDMM 62.5 µs real-time task within one fieldbus cycle which is responsible for calling the AKD PDMM PLL-code. The time delay (1) shows the actual delay to the previous DC event, which is ideally close to the adjusted FBUS.SYNCDIST parameter. Depending on (1) the AKD PDMM slightly extends or reduce the 62.5[µs] IRQ generation of the high-priority real-time task in order to either increase or decrease the measured time delay to the DC event (1) for the next PLL cycle. The time distance (2) shows the 62.5[µs] ± x[ms] realtime task of the AKD PDMM.

50.11.2 Synchronization behavior with distributed clocks (DC) disabled

The AKD PDMM fieldbus synchronization algorithm is similar to that used by Distributed Clocks. The difference is that the AKD PDMM synchronizes to a SyncManager2 event instead of the DC event. A SyncManager2 event is created when the EtherCAT Master sends a new package of command values to the drive while the network is in the Operational state. This occurs once per fieldbus cycle.

50.12 Latch Control Word and Latch Status Word

Latch Control word (2 Byte)

Bit	Value (bin)	Value (hex)	Description
0	00000000 00000001	zz01	Enable extern latch 1 (positive rise)
1	00000000 00000010	zz02	Enable extern latch 1 (negative rise)
2	00000000 00000100	zz04	Enable extern latch 2 (positive rise)
3	00000000 00001000	zz08	Enable extern latch 2 (negative rise)
4			
5-7			Reserve
8-12	00000001 00000000	01zz	Read external latch 1 (positive rise)
	00000010 00000000	02zz	Read external latch 1 (negative rise)
	00000011 00000000	03zz	Read external latch 2 (positive rise)
	00000100 00000000	04zz	Read external latch 2 (negative rise)
13-15			Reserve

Latch Status word (2 Byte)

Bit	Value (bin)	Value (hex)	Description
0	00000000 00000001	zz01	External latch 1 valid (positive rise)
1	00000000 00000010	zz02	External latch 1 valid (negative rise)
2	00000000 00000100	zz04	External latch 2 valid (positive rise)
3	00000000 00001000	zz08	External latch 2 valid (negative rise)
4			
5-7			Reserve
8-11	00000001 00000000	z1zz	Acknowledge value external latch 1 (positive rise)
	00000010 00000000	z2zz	Acknowledge value external latch 1 (negative rise)
	00000011 00000000	z3zz	Acknowledge value external latch 2 (positive rise)
	00000100 00000000	z4zz	Acknowledge value external latch 2 (negative rise)
12-15	00010000 00000000	1zzz	Zustand Digital Input 4
	00100000 00000000	2zzz	Zustand Digital Input 3
	01000000 00000000	4zzz	Zustand Digital Input 2
	10000000 00000000	8zzz	Zustand Digital Input 1

50.13 Mailbox Handling

With EtherCAT, acyclical data traffic (object channel or SDO channel) is called mailbox. This system is based around the master:

Mailbox Output:

The master (EtherCAT controller) sends data to the slave (drive). This is essentially a (read/write) request from the master. Mailbox output operates via Sync Manager 0.

Mailbox Input:

The slave (drive) sends data to the master (EtherCAT controller). The master reads the slave's response. Mailbox input operates via Sync Manager 1.

Timing diagram

The timing diagram illustrates the mailbox access process:

1. The EtherCAT master writes the mailbox request to the mail-out buffer.
2. On the next interrupt, the EtherCAT interface activates a Sync Manager 0 event (mailbox output event) in the AL event register.
3. The drive reads 16 bytes from the mail-out buffer and copies them to the internal mailbox output array.
4. The drive identifies new data in the internal mailbox output array and performs an SDO access to the object requested by the EtherCAT interface. The response from the drive is written to an internal mailbox input array.
5. The drive deletes all data in the internal mailbox output array so that a new mailbox access attempt can be made.
6. The drive copies the response telegram from the internal mailbox input array to the mail-in buffer of the EtherCAT interface.

50.13.1 Mailbox Output

An interrupt by the EtherCAT-interface with a Sync Manager 0 - Event starts a Mailbox Output Process. A 1 in the Mail Out Event-Bit of the AL Event register signalizes the drive, that the EtherCAT-interface wants to send a Mailbox message and that it has already stored the required data in the Mail Out Buffer. Now 16 Byte data are read by the drive with the IRQ process. The bytes are defined as follows

Address 0x1800								Address 0x180F							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CAN over EtherCAT specific data (CoE Header)								CAN specific data (standard CAN SDO)							

Byte 0	Length of the data (Low Byte)	
Byte 1	Length of the data (High Byte)	
Byte 2	Address (Low Byte)	
Byte 3	Address (High Byte)	
Byte 4	Bit 0 to 5: Channel Bit 6 to 7: Priority	
Byte 5	Bit 0 to 3: Type	1 = Reserved: ADS over EtherCAT 2 = Reserved: Ethernet over EtherCAT 3 = Can over EtherCAT…)
	Bit 4 to 7: Reserved	
Byte 6	PDO Number (with PDO transmissions only, Bit 0 = LSB of the PDO number, see Byte 7 for MSB)	
Byte 7	Bit 0: MSB of the PDO number, see Byte 6	
	Bit 1 to 3: Reserved	
	Bit 4 to 7: CoE specific type	0: Reserved
		1: Emergency message
		2: SDO request
		3: SDO answer
		4: TXPDO
		5: RxPDO
		6: Remote transmission request of a TxPDO
		7: Remote transmission request of a RxPDO
		8…15: reserved
Byte 8	Control-Byte in the CAN telegram:	
	write access:	0x23=4Byte, 0x27=3Byte, 0x2B=2Byte, 0x2F=1Byte
	read access:	0x40
Byte 9	Low Byte of the CAN object number (Index)	
Byte 10	High Byte of the CAN object number (Index)	
Byte 11	Subindex according to CANopen Specification for the drive	
Byte 12	Data with a write access (Low Byte)	
Byte 13	Data with a write access	
Byte 14	Data with a write access	
Byte 15	Data with a write access (High Byte)	

The drive answers every telegram with an answer in the Mailbox Input buffer.

50.13.2 Mailbox Input

The drive answers every CoE telegram with a 16 byte answer telegram in the Mailbox Input buffer. The bytes are defined as follows:

Address 0x1C00								Address 0x1C0F							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CAN over EtherCAT specific data (CoE Header)								CAN specific data (standard CAN SDO)							

Byte 0	Length of the data (Low Byte)	
Byte 1	Length of the data (High Byte)	
Byte 2	Address (Low Byte)	
Byte 3	Address (High Byte)	
Byte 4	Bit 0 to 5: Channel Bit 6 to 7: Priority	
Byte 5	Bit 0 to 3: Type	1 = Reserved: ADS over EtherCAT 2 = Reserved: Ethernet over EtherCAT 3 = Can over EtherCAT…)
	Bit 4 to 7: Reserved	
Byte 6	PDO Number (with PDO transmissions only, Bit 0 = LSB of the PDO number, see Byte 7 for MSB)	
Byte 7	Bit 0: MSB of the PDO number, see Byte 6	
	Bit 1 to 3: Reserved	
	Bit 4 to 7: CoE specific type	0: Reserved
		1: Emergency message
		2: SDO request
		3: SDO answer
		4: TXPDO
		5: RxPDO
		6: Remote transmission request of a TxPDO
		7: Remote transmission request of a RxPDO
		8…15: reserved
Byte 8	Control-Byte in the CAN telegram:	
	write access OK:	0x60
	read access OK + length of answer:	0x43 (4 Byte), 0x47 (3 Byte), 0x4B (2Byte), 0x4F (1Byte)
	error with read- or write access:	0x80
Byte 9	Low Byte of the CAN object number (Index)	
Byte 10	High Byte of the CAN object number (Index)	
Byte 11	Subindex according to CANopen Specification for Kollmorgen™ drive	
Byte 12	Data (Low Byte)	
Byte 13	Data	error code Fehlercode according to CANopen Specification in case of an error
Byte 14	Data	data value of the object in case of successfull read access
Byte 15	Data (High Byte)	

50.13.3 Example: Mailbox Access

In the example below, PDOs 0x1704 are mapped (see Chapter # “Fixed PDO Mappings”):

The master sends this mailbox output message:

Byte 0	0x0A	The next 10 Bytes contain data (Byte 2 to Byte 11)
Byte 1	0x00	The next 10 Bytes contain data (Byte 2 to Byte 11)
Byte 2	0x00	Address 0
Byte 3	0x00	Address 0
Byte 4	0x00	Channel 0 and Priority 0
Byte 5	0x03	CoE Object
Byte 6	0x00	PDO Number 0
Byte 7	0x20	PDO Number 0 and SDO-Request
Byte 8	0x2B	2 Byte write access
Byte 9	0x12	SDO-Object 0x1C12
Byte 10	0x1C	SDO-Object 0x1C12
Byte 11	0x01	Subindex 1
Byte 12	0x04	Data value 0x00001704
Byte 13	0x17	Data value 0x00001704
Byte 14	0x00	Data value 0x00001704
Byte 15	0x00	Data value 0x00001704

The drive returns the following message:

Byte 0	0x0E	The next 14 Bytes contain data (Byte 2 to Byte 15)
Byte 1	0x00	The next 14 Bytes contain data (Byte 2 to Byte 15)
Byte 2	0x00	Address 0
Byte 3	0x00	Address 0
Byte 4	0x00	Channel 0 and Priority 0
Byte 5	0x03	CoE Object
Byte 6	0x00	PDO Number 0
Byte 7	0x20	PDO Number 0 and SDO-Answer
Byte 8	0x60	Successful write access
Byte 9	0x12	SDO-Object 0x1C12
Byte 10	0x1C	SDO-Object 0x1C12
Byte 11	0x01	Subindex 1
Byte 12	0x00	Data value 0x00000000
Byte 13	0x00	Data value 0x00000000
Byte 14	0x00	Data value 0x00000000
Byte 15	0x00	Data value 0x00000000

50.14 Fieldbus Parameters

The AKD PDMM holds several fieldbus-specific, general purpose parameters. Some of them contain the following EtherCAT relevant data:

- **FBUS.PARAM02**: This parameter activates the synchronization feature of the AKD PDMM. The DC feature must be activated in order to allow the AKD PDMM to get synchronized with the master. A value of 1 enables the drive internal PLL functionality, a value of 0 deactivates this feature.
- **FBUS.PARAM03**: This parameter contains the Configured Station Alias address of the AKD PDMM. An EEPROM emulation write access to the Configured Station Alias address forces the AKD PDMM to store the drive parameters automatically using the DRV.NVSAVE command.
- **FBUS.PARAM04**: This parameter enables (1) or disables(0) the synchronization supervision of the CANOpen or EtherCAT fieldbus.
  Default values for this parameter are as follows:
  CANopen drive: disabled (0)
  EtherCAT drive: enabled (1)
  Synchronization supervision is active when FBUS.PARAM 04 = 1 and the first CANOpen Sync message or first EtherCAT frame is received. When more than three CANOpen sync messages or seven EtherCAT frames have not been received and the drive is enabled, fault F125 (“Synchronization lost“), occurs.

50.15 EEProm Content

AKD PDMM has a built-in emulated EEProm. This EEProm can be read by the EtherCAT master to get some information about drive properties, like PDO-information, drive name, serial numbers and communication-specific attributes.

They are organized in categories. There are two manufacturer-specific categories implemented in the AKD PDMM:

- Category 0x0800: Holds a string with the model type in the format AKD PDMM-P00000-NxxC-0000
- Category 0x0801: Holds the firmware version in the format 0x_xx-xx-yyy

Glossary

Term	Description
60° & 120° Hall Sequences	A method for decoding logic signals produced by Hall effect sensors installed in an electronically-switched three-phase brushless motor.
Absolute Encoder	The optical disk of the absolute encoder is designed to produce a digital word that distinguishes N distinct positions of the shaft. For example, if there are 8 tracks, the encoder is capable of producing 256 distinct positions or an angular resolution of 1.406 (360/256) degrees.
Absolute Move	A positioning movement which is referenced to a fixed original position. For example, if a stage is positioned at +500 mm, an absolute move to +300 mm would result in a move of 200 mm towards the origin (in the negative direction).
Acceleration	A change in velocity over time. Because velocity is a vector, it can change in two ways: a change in magnitude and/or a change in direction. In one dimension, acceleration is the rate at which something speeds up or slows down. However, more generally, acceleration is a vector quantity expressing the change with time of the velocity both in magnitude and in direction.
Accuracy	Accuracy is the distance between the actual position of a mechanical system and the expected position. It is typically specified in microns or arcsec per given travel for a deviation of $\pm 3\sigma$(sigma).
Actuator	Mechanical device for moving or controlling a mechanism or system. The actuator is usually a physical mechanism but it can also refer to an artificial agent/intelligent agent. In virtual instrumentation actuators and sensors are the hardware complements of virtual instruments. Computer programs of virtual instruments use actuators to act upon real world objects.
Almirant	Almirant is a read only type of screen offered to the end user to control Sinop.
AS Input	A safety feature in the drive to prevent servos from being restarted.
ASCII	Short for American Standard Code for Information Interchange. ASCII provides a one-to-one mapping between alphanumeric characters, and a digital one-byte word.
Astrolab	Astrolab is a Windows integrated design environment (IDE) containing all the tools and editors (based on the different IEC 61131 languages) that users need during the entire life cycle of the machine.
Auxiliary Encoder	Describes the feedback on the load to close the position loop in critical applications. See Encoder.
Backlash	The backlash is an error in positioning caused by the reversal of travel direction. It is caused by a clearance between the elements of the mechanical system. The backlash also affects the bidirectional repeatability. The backlash can be compensated by the position controller.
Bandwidth	In computer networking, bandwidth often refers to a data rate measured in bits/s, for example, network throughput. The reason for the connection of data rate with the term *bandwidth* is that the limit to the data rate of a physical communication link is related to its bandwidth in hertz.
Bandwidth	The frequency at which the small signal response of a servo system begins to drop off; stage performance is enhanced by increasing servo bandwidth, although structural resonances typically limit the achievable bandwidth.

Term	Description
Blackfin	Blackfin refers to a family of 16/32-bit microprocessors with built-in Digital Signal Processor (DSP) functionality, which is traditionally only accompanied by a small and power-efficient microcontroller. The result is a low-power, unified processor architecture that can run operating systems while simultaneously handling complex numeric tasks such as real time H.264 video encoding.
Brake Applied or Released	The two states of the braking system. A device for slowing or stopping the motion of amotor, or alternatively a device to restrain it from starting to move again.
Brushless servomotor	An "inside-out" DC motor, with a permanent magnet rotor, and electrical coils in the stator. Commutation of current in the windings is typically achieved via external switching transistors, and Hall-effect detectors. This avoids the limited life of brushes and their radiated EMI.
Busy/Free	AKD PDMM support only one connection at a time. If a connection is in use, then the drive is “busy.” If the connection is not use, then the drive is “free.”
CAM profiling	The position of a slave axis is mathematically linked to the position of a master axis. A good example of this would be in a system where two rotating drums turn at a given ration to each other. A more advanced case of electronic gearing is electronic camming. With electronic camming, a slave axis follows a profile that is a function of the master position. This profile need not be linear, but it must be a mathematical function.
CANopen	CANopen is a communication protocol and device profile specification for embedded systems used in automation for fieldbuses working in real-time
Cantilevered load	Any load not symmetrically mounted on a stage. Such loads exert torque moments upon the ways, and the resulting deformations can degrade accuracy
Caret	The term caret is also sometimes used in graphical user interface terminology where it means a text insertion point indicator, frequently represented by a blinking vertical bar. In this context, it may be used interchangeably with the word **cursor**, although the latter term is often reserved for a mouse pointer
Casting	see Typecasting item
Closed loop positioning	The use of feedback devices (encoders, resolvers, interferometers, etc.) to allow a motor to position a user payload accurately.
CmdGain	Sets the command gain for the command input.
CmdOffset	Sets the command offset for the command input.
CmdSrc	Selects Analog, PWM, or Command variable for command.
Coefficient of friction	This is defined as the ratio of the force required to move a given load to the magnitude of that load. Typical values for ball and crossed roller slides are 0.001 to 0.005.
COM	COM is the original name of the serial port interface. It might not only refer to physical ports, but also to virtual ports, such as ports created by Bluetooth or USB-to-Serial adapters.
Contactor	A contactor is an electrically controlled switch (relay) used for switching a power circuit. A contactor is activated by a control input which is a lower voltage / current than that which the contactor is switching. Unlike a circuit breaker a contractor is not intended to interrupt a short circuit current.
Custom	Refers to user modified or defined material (such as custom units or custom settings)
DeviceNet	DeviceNet is a communication protocol (based on Controller Area Network) used in the automation industry to interconnect control devices for data exchange. Typical applications as listed: information exchange, safety devices, and large I/O control networks

Term	Description
Drive	In electrical engineering, a drive is an electronic device to provide power to a motor or servo.
Driver	In computing and electronics, a driver is a software component allowing higher-level computer programs to interact with a computer hardware device. A driver typically communicates with the device through the computer bus or communications subsystem to which the hardware is connected.
Eccentricity	The eccentricity is the distance between the centring diameter of the baseplate and the centring diameter of the rotor. It is not dependent on the position.
Encoders	Generates an output signal that is directly proportional to the movement of the motor shaft. This signal is fed into the control circuitry in order to control the shaft position and speed. See also Optical encoders. The most common types are: • Incremental/Serial encoders • Hall effect sensors • Resolvers • Tachometer Generators
Encoder Counts	Used after quadrature decode.
Encoder Lines	Used before quadrature decode.
Environment	Environment objects are global objects that exist before the execution of the script. Typically, they are global objects of Astrolab that can be accessed from the script.
EtherCAT	"Ethernet for Control Automation Technology" EtherCAT is an open high performance Ethernet-based fieldbus system. The development goal of EtherCAT was to apply Ethernet to automation applications which require short data update times (also called cycle times) with low communication jitter (for synchronization purposes) and low hardware costs.
Ethernet	Ethernet is a large, diverse family of frame-based computer networking technologies that operate at many speeds for local area networks (LANs).
EtherNet/IP	An open industrial application layer protocol for industrial automation applications. The EtherNet/IP application layer protocol is based on the CIP layer.
Fast Input	The inputs are taken into account at each cycle depending on the system periodicity (for instance each Millisecond). Under certain circumstances this can be insufficient when we need more accuracy or if a quick respond from the system is required. To fill in the gap, a drive may have some fast input connections (generally one or two). When an event happens that triggers a Fast Input (e.g. when a sensor sends a rising edge), the detection of a signal occurs faster (which can be 1000-times more accurate than the system periodicity). Then the timestamp associated to this input can be provided to the IPC for taking the corrective actions.
Feedback Device	Some systems use a feedback device connected to the motor shaft or part of the driven mechanism to control the direction, acceleration and speed of the motor.
Fieldbus	A fieldbus is an industrial network system for real-time distributed control (e.g. CAN, Profibus, Sercos...). It is one of the ways to connect Instruments in a plant design.
Flatness of travel	Deviation from ideal straight line travel in a vertical plane, also referred to as vertical runout.

Term	Description
Frame	In networking dialect, a message is called a frame.
Front-end	In software design, the front-end is the part of a software system that interacts directly with the user.
FW	Firmware.
G.p.i.b.	A standardized protocol, analogous to RS-232, for transmitting digital information. Unlike RS-232, the GPIB interface (also called IEEE-488) transmits data in parallel, not serial format (one byte at a time).
Half step	An extended 8-cycle current switching sequence for stepping motors that doubles resolution, reduces noise, and improves resonant conditions.
Hall-effect sensor	Highly accurate, non-contact limit switch which detects the proximity of a magnet and provides a digital output to assure an accurate position reference. Typical repeatability of the NEAT Hall sensor is ±1-2 microns.
Holding torque	Stepping motors, when energized, hold position via a magnetic field. The holding torque is the maximum torque which can be generated before the rotor slips to the next pole location (7.2 degrees for 200 step/revolution steppers).
Home switch	Any of a variety of sensors which can be used to establish an accurate initial position. This may consist of a standard end-of-travel Hall sensor; a center position opto-interrupter with half-travel blocking vane; an index signal on a linear encoder; a shaft coupling mounted magnet with Hall sensor; or a once-per-revolution encoder index signal. Once-per-revolution sensors will usually require a logical or-ing with a linear signal if a unique home position is required.
Homing	The homing procedure allows, based on a position measurement, to set a position offset to the motor in order to ensure it is physically at the home position.
Horizontal Straightness	The horizontal straightness is a horizontal deviation from the straight line of travel. A horizontal straightness deviation in the travel of the X-axis will cause a positioning error in the Y direction.
Hysteresis Error	The hysteresis error is a deviation between the actual and the commanded position caused by elastic forces accumulated in the motion system. It affects the accuracy and the bidirectional repeatability.
HW	Hardware
Incremental encoder (Relative encoder)	The incremental encoder, sometimes called a relative encoder, is simpler in design than the absolute encoder. It consists of two tracks and two sensors whose outputs are called channels A and B. As the shaft rotates, pulse trains occur on these channels at a frequency proportional to the shaft speed, and the phase relationship between the signals yields the direction of rotation.
Incremental move	Positioning mode in which moves are referenced from the previously held position.
Index	Zero pulse (zero signal) of a hardware pin such as digital input or feedback pin.
Index Pulse	A single generated by a second track on the encoder emitter disk that occurs once per revolution, which can be used to indicate an absolute position of the motor shaft. Encoder manufacturers identify the index pulse using different terms such as index, marker, home position and zero reference.
Inductance	The tendency of a motor coil to store energy in a magnetic field. High speed stepping motor performance is inversely proportional to motor inductance.
Internet socket	An Internet socket (or commonly, a network socket or socket), is an end-point of a bidirectional process-to-process communication flow across an IP based network, such as the Internet. Each socket is mapped to an application process or thread. A socket is an interface between an application process or thread and the TCP/IP protocol stack provided by the operating system. The plug type is generally RJ-45.

Term	Description
Interrupt	An interrupt is an asynchronous signal from hardware indicating the need for attention or a synchronous event in software indicating the need for a change to another execution stream.
Intime	INtime software combines deterministic, hard real-time control with standard Windows operating systems (including Windows XP, Windows XP Embedded, Windows 2000 and Windows Server 2003) without requiring additional hardware. Intime was designed specifically to take advantage of the powerful capabilities of the x86 processor architecture. Therefore, you're real-time and non real-time applications run in separate virtual machines on a single computer, for cost-effective, reliable control that is easy to develop and maintain.
Jerk	In physics, jerk, is the rate of change of acceleration; more precisely, the derivative of acceleration with respect to time
Lead error	The deviation of a leadscrew from its nominal pitch. The error is often monotonic (linear), although periodic error and thermal expansion set limits to its predictability.
Limit switch	A sensor, typically Hall-effect, optical, eddy current, or mechanical, which is used to sense the end of travel of a linear motion assembly. In addition to preventing overtravel, it is frequently used to establish a precision reference.
Mechanical angle	Mechanical angle of the feedback (always between 0°…360°)
Mechanical angle	Mechanical angle of the feedback, always between 0° and 360°.
Microstepping	A technique which, instead of switching phase currents in a stepping motor on and off, sinusoidally varies the current in the two windings. This effectively increases the resolution from 200 steps per revolution to 2,000 (~10) or 10,000 (~50) micro-steps per revolution.
Modbus	Modbus is a serial communications protocol and is now the most commonly available means of connecting industrial electronic devices. Modbus is often used to connect a supervisory computer with a remote terminal unit in supervisory control and data acquisition (SCADA) systems. Versions of the Modbus protocol exist for serial port and Ethernet (it is widely used with TCP/IP over Ethernet)
Motion control	Motion control is a sub-field of automation, in which the position and/or velocity of machines are controlled using some type of device such as a hydraulic pump, linear actuator, or an electric motor, generally a servo. Motion control is an important part of robotics and CNC machine tools, however it is more complex than in the use of specialized machines, where the kinematics are usually simpler. The latter is often called General Motion Control (GMC). Motion control is widely used in the packaging, printing, textile and assembly industries
Motor Continuous Stall Current	The amount of current applied to a motor when the rotor is locked and results in the rated rated temperature rise.
Motor Peak Current	Peak current or amps peak is the highest current that can flow through the motor or amps peak = 1.41 X amps/phase (or amps RMS).
Nonvolatile	Information is stored in a specific memory to remain accessible even when the application has been powered off. The memory type is called NV (Non-Volatile Memory) also NVS (Non Volatile Storage).
Nut stiffness	The stiffness of a leadscrew/nut assembly, typically measured in Newtons per meter (N/m). This stiffness, together with the moving mass and duplex bearing stiffness, sets the primary natural frequency of a leadscrew-driven stage.

Term	Description
Online/Offline	Active or connected/inactive or disconnected.
Open loop positioning	A positioning technique, typically utilizing stepping motors, in which the controller issues a sequence of commands to the motor without any absolute means of detecting if the move has in fact been made. When the load and move velocity and acceleration are appropriately defined, open loop positioning is capable of extended operation without losing steps.
OpenGL	OpenGL (Open Graphics Library) is a standard specification defining a cross-language cross-platform API for writing applications that produce 2D and 3D computer graphics. The Softscope uses this API to implement graphical manipulations.
Optical encoder	A linear or angular position feedback device, typically providing incremental two channel information in quadrature format (sine or square waves with a 90 degree phase shift between each channel). Such two channel information allows simple counter circuits to function as absolute position indicators.
Orthogonality	The degree of perpendicularity, or squareness, between the two axes in an X-Y or X-Z table. This parameter is usually measured in arc-seconds or micro radians.
P-code	a P-code machine or pseudo-code machine is a specification of a CPU (Central Processing Unit) whose instructions are expected to be executed in software rather than in hardware. Programs that have been translated to p-code are executed (interpreted) by a software program that emulates the behavior of the CPU specification.
Periodicity	Motor systems having a reciprocating or oscillating motor that operates synchronously with the periodicity of the source which supplies the electrical energy. The period of execution of a pipe is the time spent between two successive computations of set values for the same pipe. The period of execution of a pipe is specified by the PERIOD parameter of the input pipe block.
Phase current	The rated current which a stepping motor requires to generate its rated holding torque. This value is usually based on unipolar (half-coil) operation. This choice of how the motor is wired has significant impact on performance.
Phase sequence	The specific sequence of coil current changes used to advance a stepping motor clockwise and counter-clockwise, in either full or half step modes.
Pitch	For lead-screws specified in British units, the number of full rotations required to advance the nut 1î. For example, a 5 pitch lead-screw has a lead of 0.200î. Metric screws are specified by lead only, in millimeters. The pitch is a rotation (angular deviation from the ideal straight line of travel) around an axis in the horizontal plane perpendicular to the direction of travel. For the X-axis travel, a pitch will cause an Abbé error in the X and Z directions An angular deviation possible in positioning systems, in which the table's leading edge rises or falls as the table translates along its direction of travel. This represents rotation around a horizontal axis, perpendicular to the direction of travel.
PLCopen	A vendor -and product- independent worldwide association active in Industrial Control and aiming at standardizing PLC file formats based on XML
Position counts	AKD PDMMscales this so that the low 32 bits are the position per revolution (mechanical or electrical?).
Pragma	A compiler directive communicating additional "pragmatic" information.

Term	Description
Precedence	In arithmetic and algebra, when a number or expression is both preceded and followed by a binary operation, a rule is required for which operation should be performed first. From the earliest use of mathematical notation, multiplication took precedence over addition, whichever side of a number it appeared on. Thus 3 + 4 × 5 = 5 × 4 + 3 = 23. To change the order of operations, we use parentheses (). Thus, if we want to force addition to precede multiplication, we write (3 + 4) × 5 = 35.
Primary Encoder	Describes the feedback mounted onto the motor the drive is controlling. The Primary Encoder is used to force commutation. See also Encoder.
Probe	See Softscope - Probe item
PROFIBUS	PROFIBUS (Process Fieldbus) is a standard for fieldbus communication in automation technology. PROFIBUS is the only fieldbus that can be used in equal measure in production automation and process automation and has since become a global market leader. Worldwide There are two variations of PROFIBUS; the most commonly used DP, and the lesser used PA variations: • PROFIBUS DP (Decentralized Peripherals) is used to operate sensors and actuators via a centralized controller in production technology. The many standard diagnostic options, in particular, are focused on here. Other areas of use include the connection of "distributed intelligence", i.e. the networking of multiple controllers to one another (similar to PROFIBUS FMS). Data rates up to 12 Mbit/s on twisted pair cables and/or fiber optics are possible. • PROFIBUS PA (Process Automation) is used to monitor measuring equipment via a process control system in process engineering. This PROFIBUS variant is ideal for explosion-hazardous areas (Ex-zone 0 and 1). Here, a weak current flows through bus lines in an intrinsically safe circuit so that explosive sparks are not created, even if a malfunction occurs. The disadvantage of this variant is the slower data transmission rate of 31.25 kbit/s.
Programming	The act of performing a sequence of instructions or commands.
Quasi-closed loop positioning	A technique using a stepping motor and encoder in which open loop moves are completed, after which an encoder/counter is checked and, if necessary, a small final move or moves is used to achieve the desired accuracy.
Radial Runout	The radial runout is the positioning error of a rotary table's centering diameter in the horizontal direction when the table is rotating in the horizontal plane.
Ramping	The gradual acceleration and deceleration of a stepping motor, essential if performance beyond the start/stop range is required. The slope of the ramp is a function of screw pitch, load, drive voltage and design, and motor.
Real-time computing	RTC is the study of hardware and software systems which are subject to a "real-time constraint" (i.e. operational deadlines from event to system response). By contrast, a non-real-time system is one for which there is no deadline, even if fast response or high performance is desired or even preferred. The needs of real-time software are often addressed in the context of real-time operating systems, and synchronous programming languages, which provide frameworks on which to build real-time application software. A real time system may be one where its application can be considered (within context) to be mission critical.

Term	Description
Reference Counting	In computer science, reference counting is a technique of storing the number of references, pointers, or handles to a resource such as an object or block of memory. It is typically used as a means of de-allocating objects which are no longer referenced.
Reference situation	Any situation that indicates that the home position has been found.
Reference switch	An adjustable hardware switch for indicating a home position.
Refresh	GUI command that re-loads the data from the drive and redraws the display.
Regen resistor	Regen Resistors are a necessity on all horizontal motion (bridge/trolley/monorail) applied Variable Speed drives. Power returns to the drive when the connected motor is driven in generator mode and is called regenerative power. This power is absorbed by charging the bus smoothing capacitor with the regen resistor consuming all that regenerative power exceeding the chargeable energy of the capacitor.
Relative encoder	See Incremental encoder.
Repeatability, bi-directional	The difference in absolute position reached when returning to a given position from the same direction. This value may mask significant amounts of backlash.
Repeatability, uni-directional	The difference in absolute position reached when returning to a given position from the opposing direction. This value is usually larger than the unidirectional repeatability.
Resolution	The resolution is the smallest possible movement that can be achieved by a system. It can be defined at the electronics, encoder and mechanics level. The distance a stage can be commanded to move in a single step. For servo systems, the basic increment produced by its optical encoder, or any other feedback device.
Resonance, midrange	A parasitic oscillation which is endemic to stepping motors, although frictional loads may mask its effect. It typically sets in from 5-15 revolutions per second, and can easily cause a loss of synchronization (stalling). All NEAT high speed micro-stepping drives effectively suppress this resonance.
Resonance, primary	The rotor inertia of a stepping motor, together with its spring-like holding torque, constitutes a basic spring-mass oscillator. In the absence of sufficient damping, stepping at certain frequencies may excite resonance in this system, or resonate with the stage or load, resulting in loss of synchrony. The addition of system damping, micro-stepping, or ramping through problematic speeds will usually eliminate this resonance.
Rising Edge	A rising edge is the transition of a digital signal from low to high. It is also named positive edge.
RJ-45	Internet plug type.
Roll	An angular deviation from an ideal straight line motion, in which the positioning table rotates around its axis of travel as it translates along that axis.
RS-232c	A popular protocol for transmitting digital data over two lines in a bit-serial format. RS-232C specifies signal levels, data formats, maximum transmission distance, etc.
Runtime	In computer science, runtime or run time describes the operation of a computer program, the duration of its execution, from beginning to termination (compare compile time).

Term	Description
Safe Torque Off	A safety feature in the drive to prevent servos from being restarted (STO).
Sensor	A sensor is a type of transducer that converts one type of energy to another for various purposes including measurement or information transfer.
Sercos	
Servo Drive	A servo drive is a special electric amplifier used to power electric servo motors. It monitors feedback signals from the motor and continually adjusts for deviation from expected behavior.
Servo Motor	A DC motor which produces a torque proportional to current. Precise positioning is achieved by linear or PWM (duty cycle) control of motor current or voltage, together with accurate monitoring of position via an external feedback device.
Setpoint	Setpoint is the target value that an automatic control system, for example PID controller, will aim to reach
Sinop	Sinop is a runtime engine issued from Astrolab and that provides a soft PLC and a motion controller via a graphical view of Axis movement with log messages
Softscope - Channel	A Channel is used by the softscope to acquire the evolution of a variable that is plugged into it
Softscope - Probe	A device that uses onboard instruments to gather and relay a variety of measurement to controllers from remote locations. Probes may return their data over radio links or be physically tethered to controllers or another device, or to collect and return physical samples
Softscope - Sampling	To acquire the variable's evolution, samples are taken at fixed intervals. The accuracy to create the trace depends on the resolution of the acquisition. The sampling frequency must be higher than 2 times the highest frequency in the input signal. This is called the Nyquist frequency. Theoretically it is possible to reconstruct the input signal with more than 2 samples per period. In practice, 10 to 20 samples per period are recommended to be able to examine the signal thoroughly
Softscope - Time base	The time base allows to set the speed at which all the lines for each channel are drawn, and is calibrated in milliseconds per division
Softscope - Trace	The trace is the resulting graph of a variable's evolution against time, with the more distant past on the left and the more recent past on the right
Stall speed	The maximum speed which a stepping motor, properly ramped, can achieve without loss of synchrony. This speed is a function of motor inductance, ramp slope, applied load, and drive voltage and design.
Start/stop speed	The maximum step rate which can be applied to a stationary stepping motor and still retain error-free performance. Also, the rate from which a stepping motor may be instantaneously stopped without overshooting. This is a function of the screw pitch, load, drive voltage and design, and motor.
Step rate	A type of motor featuring two or four stator coils and a toothed permanent magnet rotor, which moves through a small angle in response to a specific sequence of coil current changes.
Stepping motor	The frequency of coil current changes, or input pulse train, applied to a stepping motor, in pulses/second or hertz. For 200 step/revolution motors, the full step rate multiplied by 0.3 equals the rotation rate in R.P.M.
Straightness of travel	Deviation from straight line motion in a horizontal plane. Also referred to as horizontal runout. This error is usually traceable to an underlying angular error of the ways.

Term	Description
SynqNet	SynqNet is a digital machine control network. Built on the 100BT physical layer, SynqNet provides a synchronous real-time connection between motion controllers, servo drives, stepper drives, I/O modules, and custom devices
T.i.r.	This stands for Total Indicator Reading, which reflects the total absolute deviation from a mean value (versus a ± value which indicates the deviation from a nominal value).
Thermal Expansion	The thermal expansion is a change of the size and shape of a system when the temperature is modified. The amount of change is dependent on the size of the component, the degree of temperature change and the characteristics of the material.
Timestamp	A timestamp is a sequence of characters, denoting the date and/or time at which a certain event occurred.
Torque	A radially directed force, typically measured in inch-ounces, foot-lbs. or Newton-meters.
Typecasting	In computer science, type conversion or typecasting refers to changing an entity of one data type into another. This is done to take advantage of certain features of type hierarchies. For instance, values from a more limited set, such as integers, can be stored in a more compact format and later converted to a different format enabling operations not previously possible, such as division with several decimal places' worth of accuracy. There are two types of conversion: implicit and explicit. The term for implicit type conversion is coercion. The most common form of explicit type conversion is known as casting. Explicit type conversion can also be achieved with separately defined conversion routines such as an overloaded object constructor.
Velocity	A vector quantity whose magnitude is a body's speed and whose direction is the body's direction of motion. Both speed and direction are required to define it and measured in meters/second (m/s).
Wibu	Developed by WIBU-SYSTEMS AG, WibuKey is the way to protect DMS software
Wobble	To move or rotate with an uneven or rocking motion or unsteadily from side to side.
Yaw	The yaw is a rotation (angular deviation from the ideal straight line of travel) around the Z axis which is a vertical plane perpendicular to the direction of travel. For the X-axis travel, the yaw will cause an Abbé error in the X and Y directions. An angular deviation from ideal straight line motion, in which the positioning table rotates around the Z (vertical) axis as it translates along its travel axis.
Zero angle	Mechanical zero angle of the feedback = 0 degree.

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