Lexium 15 LP

Servo Drives

Programming manual

a brand of Schneider Electric

Telemecanique

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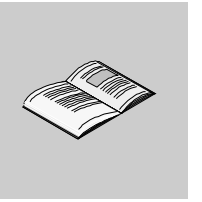
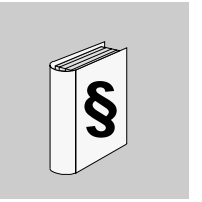


Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

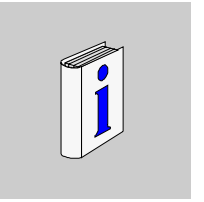
⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

About the Book



At a Glance

Document Scope

This booklet explains the installation and operation of the Unilink Commissioning Software for digital servo amplifiers.

- product overview
- motion control overview
- dialog screen layout
- axis commissioning checklist procedures
- error and warning messages
- troubleshooting

User Comments

We welcome your comments about this document. You can reach us by e-mail at techpub@schneider-electric.com

Introduction to the Servo Drive

1

At a Glance

Information

This chapter introduces the servo drive and gives an overview of the architecture for each application type.

What's in this Chapter?

This chapter contains the following topics:

Product Overview

What is Unillink?

Unilink Commissioning Software is an axis- commissioning tool for both single-axis and multi-axis motion control applications. With its graphical user interface and Windows dialogs, Unilink provides an easy point-and-click method for configuring parameters in a single-axis standalone system or in a multi-axis, fiber-optic SERCOS network.

What is a Servo Drive?

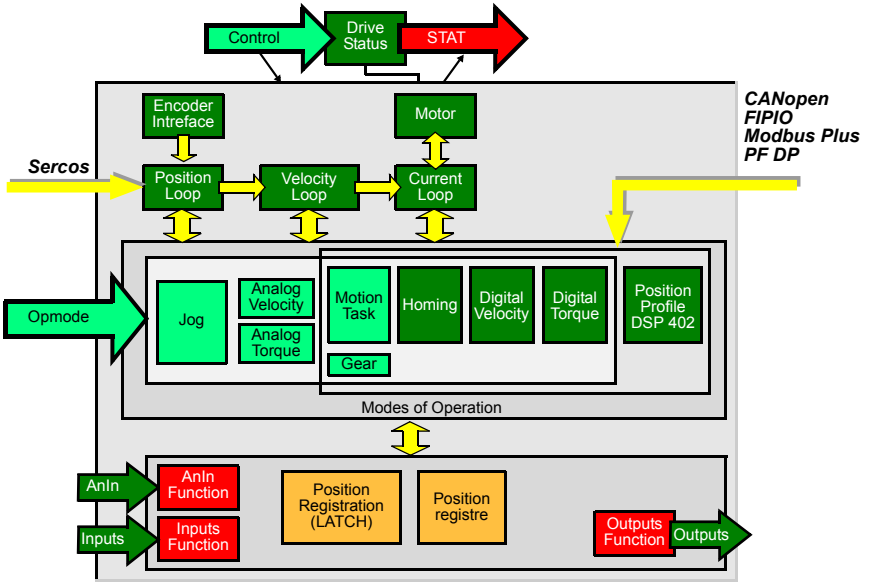
Lexium 15 servo drives are devices designed to control an AC synchronous motor for Motion Control applications. The device includes a power supply. For further information, please see the Lexium 15 Installation Manuals.

Control Functions

Lexium 15 control functions are:

- Servo loops: position, velocity, and current (torque).
- Motor interface including feedback.
- Encoder interface for master set point for gearing, or encoder emulation for Motion Controller.
- Modes of operation: some modes are set by the Unilink software, some are set by field buses.
- Digital I/O handlers: registration, start motion, and others.
- Analog I/O handlers: set points and thresholds.
- Position registration function (LATCH).
- Position register: axis' software limit, and digital output setting.

The following diagram shows the servo drive control functions:



⚠ WARNING

INJURY OR EQUIPMENT DAMAGE

Before installation and setup, read the Installation Manual for the servo amplifier. Incorrect handling of the servo amplifier can lead to personal injury or damaged devices.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

⚠ WARNING

UNFORSEEN MACHINE MOVEMENT

The machine manufacturer must perform a hazard analysis for the machine and must ensure that unforeseen movement of the machine is never a hazard to personnel or devices. Only if these measures are taken can the customization of online parameters by qualified staff be permitted.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

⚠ CAUTION

QUALIFIED PERSONNEL

Only properly qualified personnel are permitted to perform activities such as transport, installation, setup and maintenance. Properly qualified persons are those who are familiar with the transport, assembly, installation, setup and operation of the product, and who have the appropriate qualifications for their job.
The qualified personnel must know and observe:
IEC 364 and CENELEC HD 384 or DIN VDE 0100
IEC-Report 664 or DIN VDE 0110
National Accident Prevention Regulations or BGV A3.

Failure to follow this instruction can result in injury or equipment damage.

⚠ CAUTION

ALTERATION OF DATA SETS

Data sets stored on data media are not safe from undesirable alteration by third parties. After you have loaded a set of data, you should check all the parameters before enabling the servo amplifier.

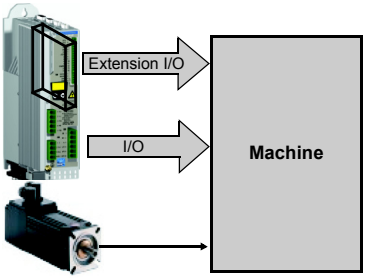
Failure to follow this instruction can result in injury or equipment damage.

Application Architectures

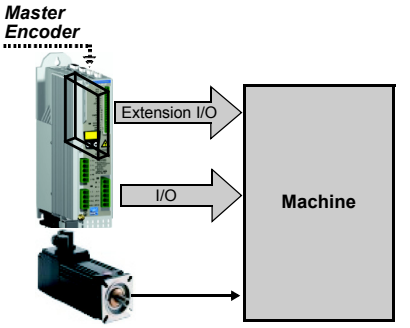
Single-Axis Motion Control

In a single axis system, UniLink runs on a computer (PC) connected to one drive. The communication is established via the RS232 interface.

The following diagrams show the architecture for single axis applications:



Single Axis Applications
For fast move sequences
with Motion Task

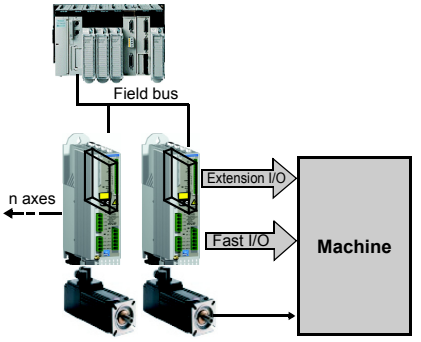


Master/Slave Gearing

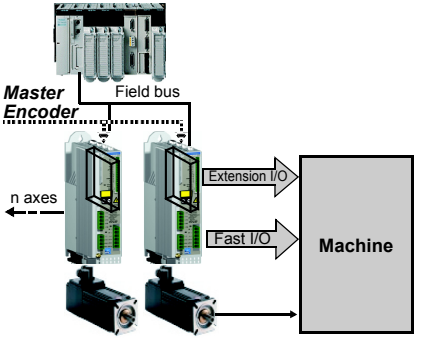
Multi-Axis Motion Control

In a multi-axis system, UniLink runs on a computer (PC) connected to one drive. The communication with the first drive is established via the RS232 interface. The other drives are connected to the first via a special cable (Y-shaped adapter) on the built-in CAN bus. This way, you can communicate with several drives without modifying the connections.

The following diagram shows the field bus connections for multi-axis applications:



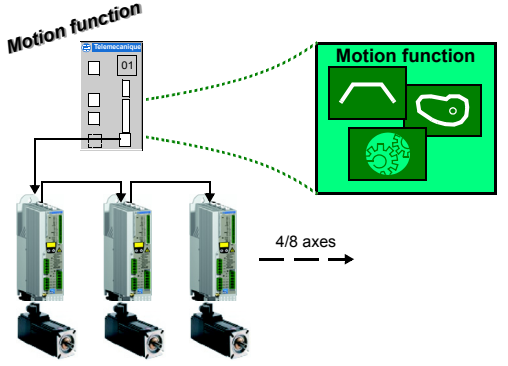
Coordinate Multi-Axes Applications
For fast move sequences
with Motion Task



Multi axes Master/Slave gearing
With hard wire master encoder

More efficient with CANopen and PLCopen Motion Function bloc libraries in Unity

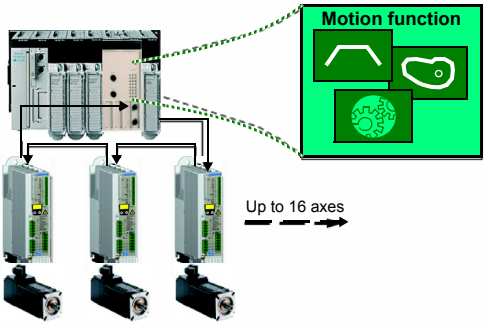
The following diagram shows the CANsync architecture for a stand-alone motion controller:



Multi-axes synchronised applications with CANsync Schneider standalone Motion Controller:

* Cam profile
* Multi-gearing
* Machine function blocks

The following diagram shows the SERCOS architecture for a PLC motion controller motion bus:



Multi-axes synchronised applications with Sercos Motion bus in TSX CSY 84/164/85 for Premium PLC:

* Cam profile
* Multi-gearing

CSY 85

* Linear interpolation
* Circular interpolation
* Trajectory editor

Tuning Your Axis with UniLink

During the configuration process, UniLink allows you to tune the servo motor for each axis quickly and efficiently. From UniLink, while online with an axis and its motor, you adjust servo parameter values (such as gains and limits) and execute them immediately. While watching and listening to the motor spin, you may use the UniLink oscilloscope to adjust and readjust these values until the motor reaches its best performance - optimum speed without oscillation and noise or anything else that would make the motor unstable. The changes made to the servo parameter values may be saved to the drive and the file.

UniLink dialogs step you through the complete startup phase of your programming projects. All the parameters of the drive can be saved in a separate file for each axis. Each drive file is a unique custom configuration for that drive and can be accessed offline (not connected to the drive) or online (connected to the drive).

Please see also the axis commissioning checklist procedures (See *Axis Commissioning Checklist Procedures, p. 58*).

Unilink Graphic User Interface

2

Unilink Graphic User Interface

At a Glance

This chapter describes the functions, use, and elements of the graphic user interface of the Unilink commissioning software.

What's in this Chapter?

This chapter contains the following sections:

2.1 Unilink Connection and Screen Layout

Unilink Connection and Screen Layout

At a Glance

Overview of connecting to Unilink (selecting online or offline mode) and of the screen layout.

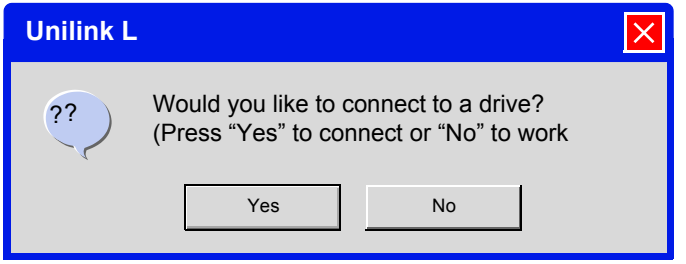
What's in this Section?

This section contains the following topics:

Selecting Online or Offline Mode

At a Glance

When you start Unilink, you can choose either to work online or offline.



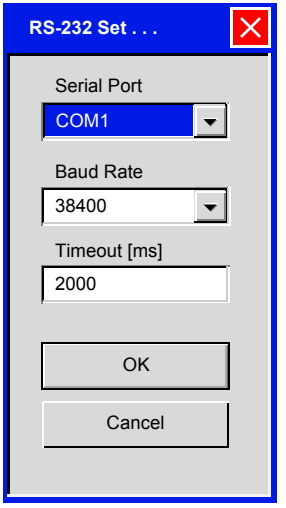
Online

If the software detects a connected servo drive, the Start screen is displayed. If this is the first time you have worked online, you must first set configuration parameters.

Select the communication system the servo drive is connected to:

Set the communication parameters:

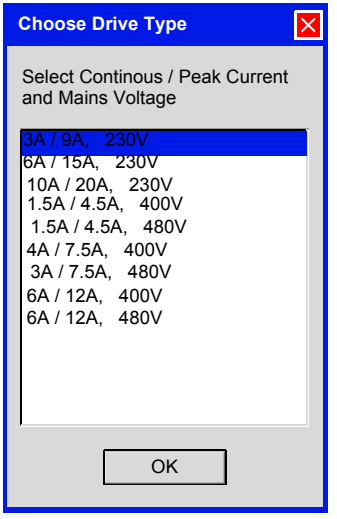
- Serial Port - COM1 to COM10
- Baud rate
- Timeout in ms



The software communicates with the parameters you have set, and if the parameters are correct, the software starts.

Offline

Even when no servo drive is connected, you can still use UniLink. To do this, select the amplifier servo drive type corresponding to your device and mains specification:



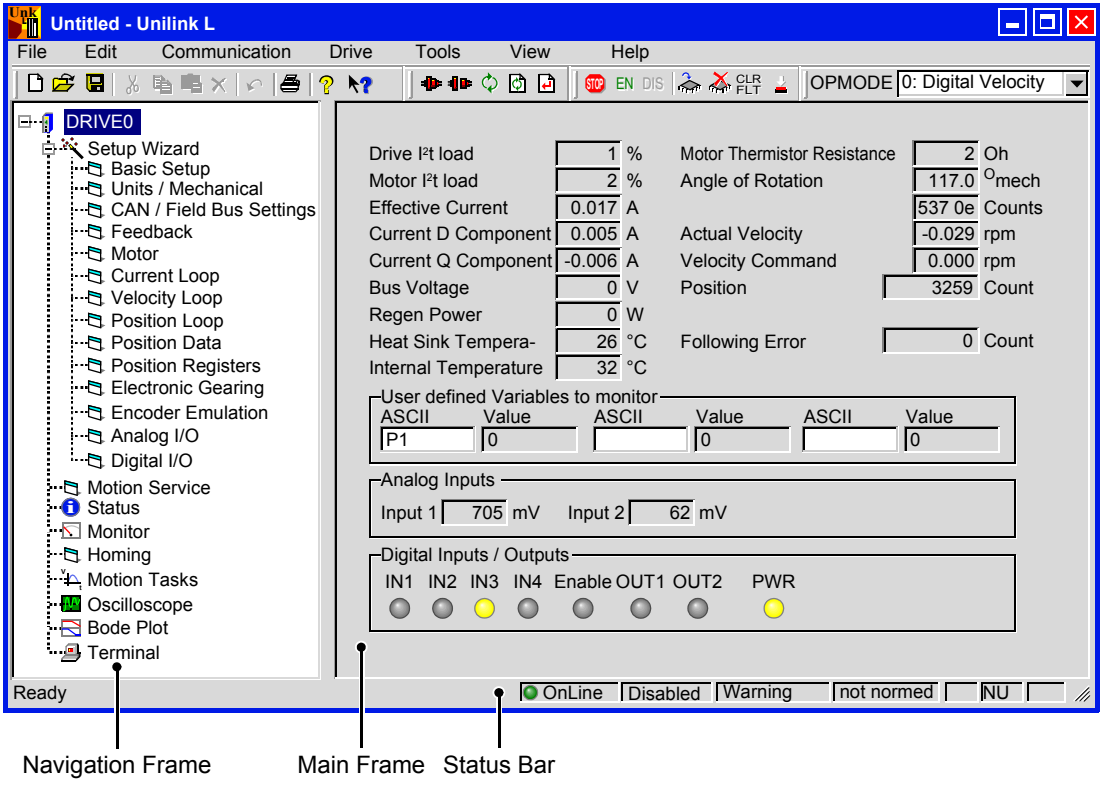
When you have selected the servo drive type, a default data set is loaded. This data can be modified and stored in an external file.

Note: Software functions and Unilink dialog boxes that are only available in online mode will not be selectable.

Screen Layout

At a Glance

General screen



Title bar

The name of the currently valid data set or servo drive and the program name are displayed in the title bar. If you are working offline and the data set has not yet been named, the text "Untitled" will be displayed.

Menu bar

The following table describes menu bar commands, and the corresponding toolbar buttons.

FILE	
New	A new data set is created for editing. The current data set is closed, and is not saved.
Open	A data set is read from the data medium (hard disk, floppy disk) and becomes the configuration currently in use. The servo amplifier must first be disabled.
Save	Saves the current data set in a file on your PC.
Save as	Saves the current data set in a file on your PC with a name you have chosen.
Print	Prints the current data set on your Windows standard printer.
Print preview	Displays a preview of the data set currently in use in the software prior to its printing.
Print setup	Changes the settings of your Windows standard printer.
Exit	Exits the program.

COMMUNICATION	
Connect	Connect to the servo drive.
Disconnect	Disconnect from the servo drive, software switches to offline mode.
Reload	Reloads all parameters and motor task data from the servo drive.
Refresh page settings	Refreshes the previous data of the current screen page with the new data set.
Apply page settings	Save the parameters of the current page to the RAM of the servo amplifier.
Select device	Select the Communication network.
Device parameters	Adjust the communication parameters.

DRIVE	
Stop	Stop movement in OPMODES 0, 2 and 8.
Enable	Enable the software for power outage stage
Disable	Disable the software for power outage stage.
Save to EEPROM	Save the current parameter set to the EEPROM of the servo amplifier.
Clear EEPROM	Restores the default parameter set to the EEPROM of the servo amplifier.
Reset	Hardware reset (COLDSTART)

DRIVE	
Clear Errors	Current error messages are cleared. The response to this clearance depends on the error: some errors may require a reboot, while others allow operation to continue.
Select OPMODE	Select the operation mode of the servo amplifier OPMODE (See *Modes of Operation, p. 75* for more information.

TOOLS	
Options **Select language**	Colour setup for the Bode Plot and Oscilloscope Select the language version of the software

VIEW	
Toolbar	Display or hide the Toolbar.
Status bar	Display or hide the Status Bar.

?	
Online HTML Help	Display the Online Help for the setup software. or software version information.
About	Display the version of the setup software.

Toolbar

The tool bar is composed of typical Windows-like buttons for the direct launch of simple function such as: New, Open, Save, Cut, Copy, Paste, Erase, Undo, Print, About, Help.

But also of specific buttons designed to launch advanced servo drive functions:

Icon	Function name	Corresponding ASCII Command	Description
	Connect	-	Connect to the servo amplifier.
	Disconnect	-	Disconnect from the servo amplifier. In this case, the software switches to offline mode. You can still work with the setup software, even if there is no servo amplifier connected. You can load a set of data from the hard disk (or any other data storage medium), work on it, and save it again. You cannot select the software functions and screen pages that are only used in online mode.
	Reload data from the drive	-	Reloads all parameters and motor task data from the servo drive.
	Refresh page settings	-	Refreshes the previous data of the actual screen page with the new data set.
	Apply page settings	-	Save the parameters of the actual page to the RAM of the servo drive.
	Stop	STOP	Stops the currently active service function in the OPMODES 0, 2 and 8. Movements in other OPMODES can only be stopped by using the "DISABLE" button.
EN	**Enable**	EN	Sets the software enable for the output stage. If the software enable and the hardware enable are set and no fault is present (i.e. the R1A/R1C contact is closed), then the output stage is enabled.

Icon	Function name	Corresponding ASCII Command	Description
	**Disable**	DIS	Sets the software disable. Parameters cannot be downloaded to the servo drive EEPROM while its output stage is enabled.
	**Save parameters to EEPROM**	SAVE	Non-volatile storage of the currently valid parameter set in the EEPROM of the servo amplifier. In this way you can permanently save all the parameter changes that you have made since the last switch-on/reset of the servo amplifier.
	**Clear EEPROM parameters**	RSTVAR	Restores the default parameter set to the EEPROM of the servo amplifier.
	**Clear Faults**	CLRFAULT	Clears current error messages. The response to the clearance depends on the error: some errors may require a reboot.
	**Reset**	COLDSTART	Software reset (warm boot) of the servo amplifier. The servo amplifier must be disabled. The current faults are cleared, the servo amplifier software is initialized and communications are re-established. This command has the same effect as turning the drive power off and then back on.

Status bar

The communication status between the servo drive and the setup software is indicated on the left side of this bar. On the right side of the status bar, the operation status (online/offline), the error status (warning or error) and several other status messages, such as homing status, are monitored.

Navigation frame

This tree manager structure links to all the screen pages that you need for setup, optimizing and monitoring of the servo amplifier. The selected screen is shown in the main frame.

The top level of the tree shows the name of the connected servo amplifier (DRIVE0 in the example).

Main frame

The main frame enables you to change parameters, monitor actual values of the servo amplifier and select functions.

2.2 Using Unilink Commissioning Software

Using Unilink Commissioning Software

At a Glance

This section contains some important information about using Unilink Commissioning Software.

What's in this Section?

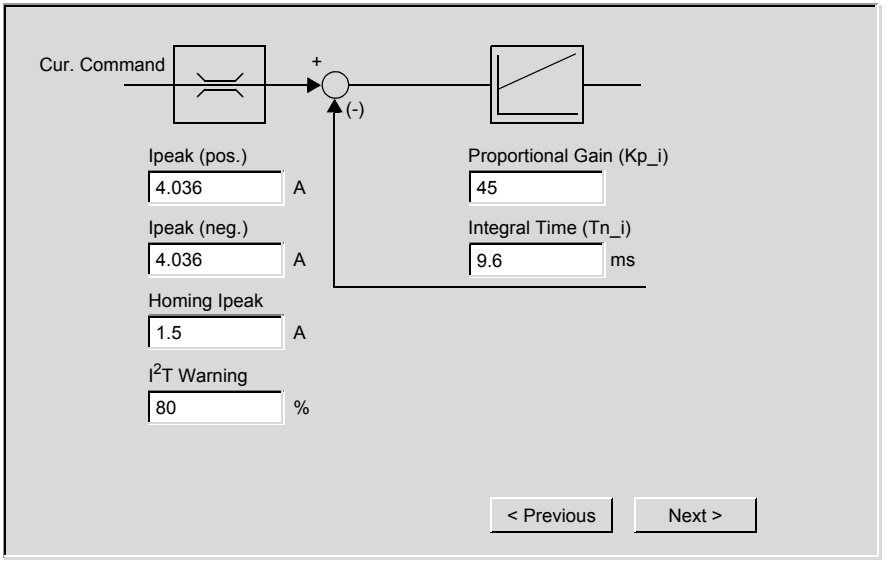
This section contains the following topics:

Using ASCII Commands in the Terminal Screen Page

At a Glance

Unilink Commissioning Software is a set of Windows screen pages for configuring parameters for the servo drive. You can set all the parameters shown either directly using the Unilink screen pages, or via fieldbus or by using ASCII commands on Terminal screen page.

For each Unilink parameter field, this manual will describe its function and the relevant ASCII command. An example is shown below for the parameter Ipeak (pos.):



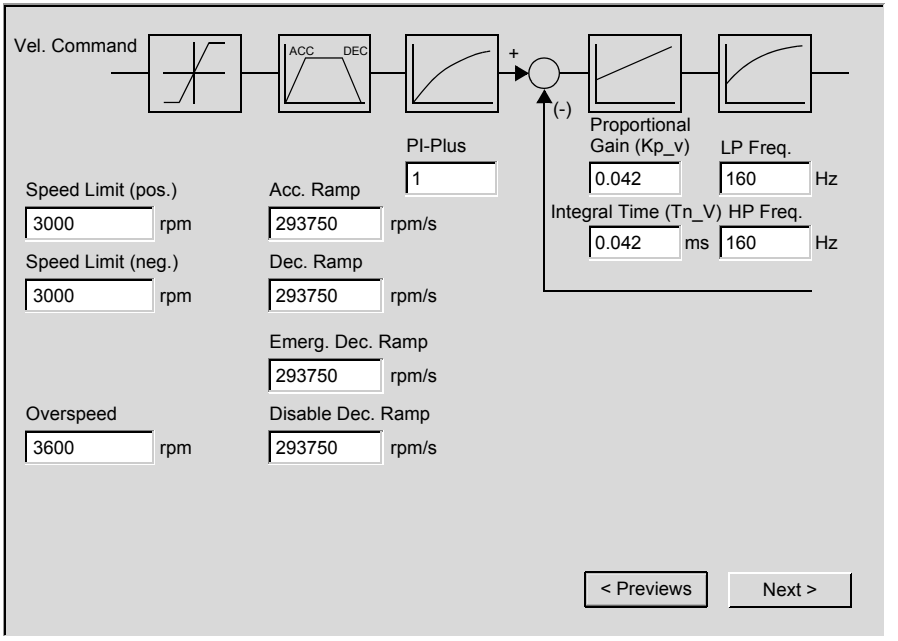
Ipeak (pos.)

ASPCII: **IPEAKP**	Default: IMAX Unit: Amperes Range: 0 - DIPEAK	valid for all OPMODES

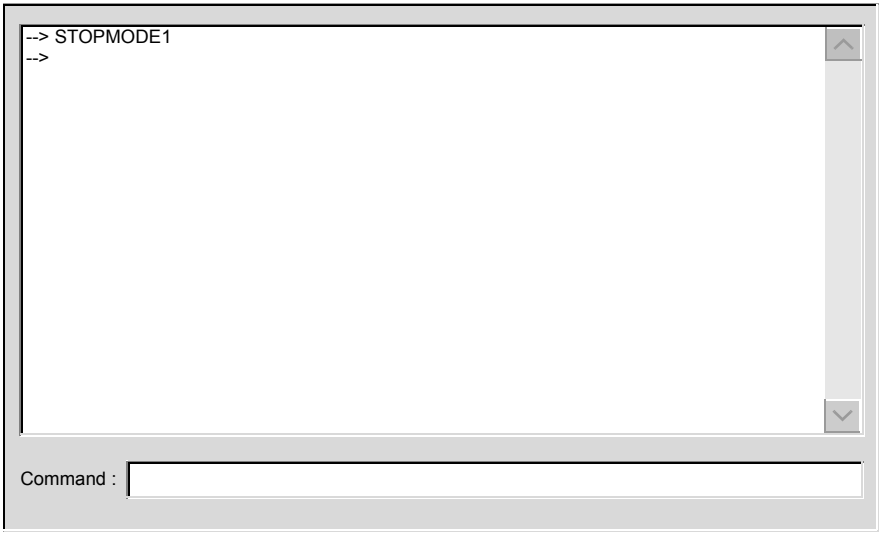
Sets the positive servo motor peak current (r.m.s. value).

Using Terminal-Only Commands

Not all parameters are accessible via the relevant Unilink screen pages. Some ASCII commands are ONLY accessible via the Unilink Terminal screen page. For example, the STOPMODE command is used to configure the way of disabling the drive output stage. STOPMODE at 0 means output stage is immediately disabled. STOPMODE at 1 means drives runs down to 0 following a deceleration ramp. The Velocity loop screen page allows you to set the disable deceleration ramp parameter.



However, you have to enter the STOPMODE command via the Terminal screen page.



The ASCII command list is described in detail in the ASCII Command List Manual.

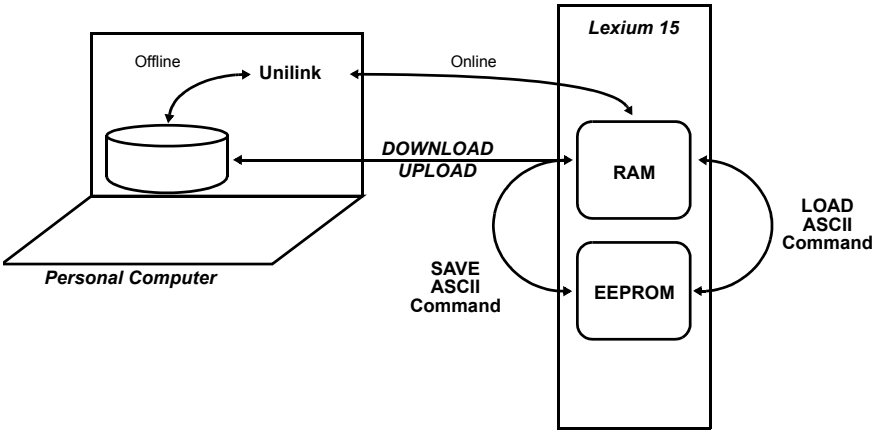
Device Parameters Management

At a Glance

Unilink commissioning software works in two modes:

- OFFLINE: the parameters are stored in a disk file. However, the parameters' value settings are not verified for consistency limits.
  This option is recommended for Motion Task programming.
- ONLINE: the parameters are stored in the servo drive RAM and their value settings are verified for consistency limits. During a DOWNLOAD operation, a complete consistency check is performed and values above those allowed are are cut off.

The servo drive is equipped with an EEPROM to enable parameters to be saved between power on / power off operations. To move information between both memories, the ASCII commands SAVE and LOAD may be used.

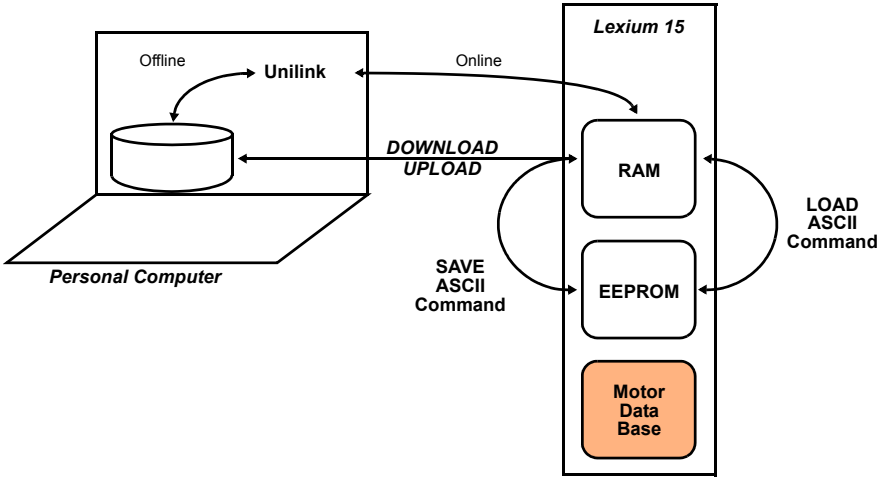


Motor Data Base File

At a Glance

Schneider Motor Range parameters are stored in Lexium 15 without an erasable memory.

This means that motor settings for the Schneider motor should only be set ONLINE.



2.3 Drive Setup Wizard

Drive Setup Wizard

At a Glance

Overview of the Drive Setup Wizard and the different screen pages included.

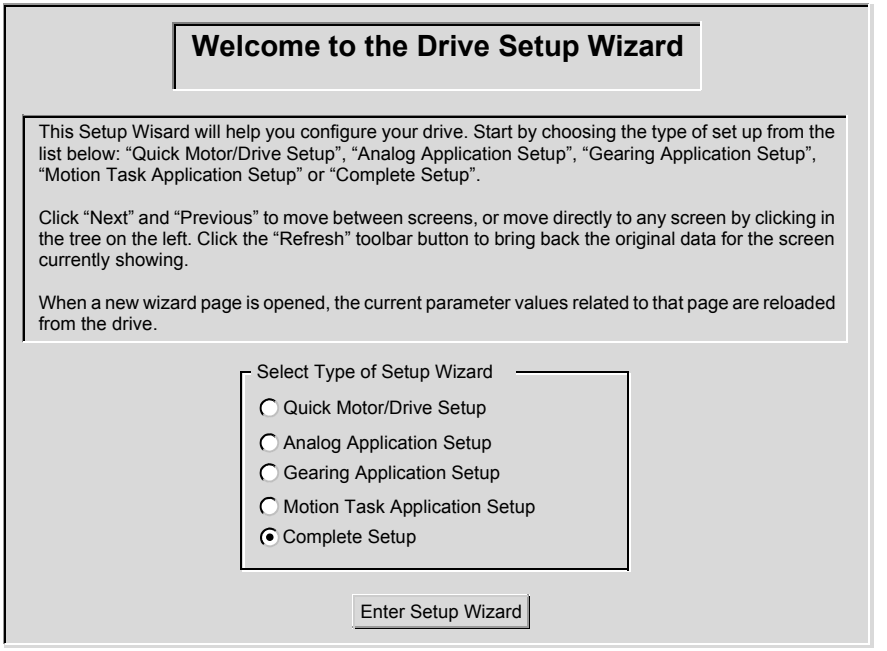
What's in this Section?

This section contains the following topics:

Overview of "Drive Setup Wizard"

At a Glance

The Drive Setup Wizard leads you through the necessary steps for configuring the servo drive:



Type of Setup Wizard

Select the setup type for your application:

- Quick Motor/Drive Setup (See *Overview of "Quick Motor/Drive Setup", p. 37*)
- Analog Application Setup (See *Overview of "Analog Application Setup", p. 40*)
- Gearing Application Setup (See *Overview of "Gearing Application Setup", p. 46*)
- Motion Task Application Setup (See *Overview of "Motion Task Application Setup", p. 51*)
- Complete Setup (See *Overview of "Complete Setup Wizard", p. 56*)

Depending on the setup type you select, only the screen pages relevant to that setup type are displayed.

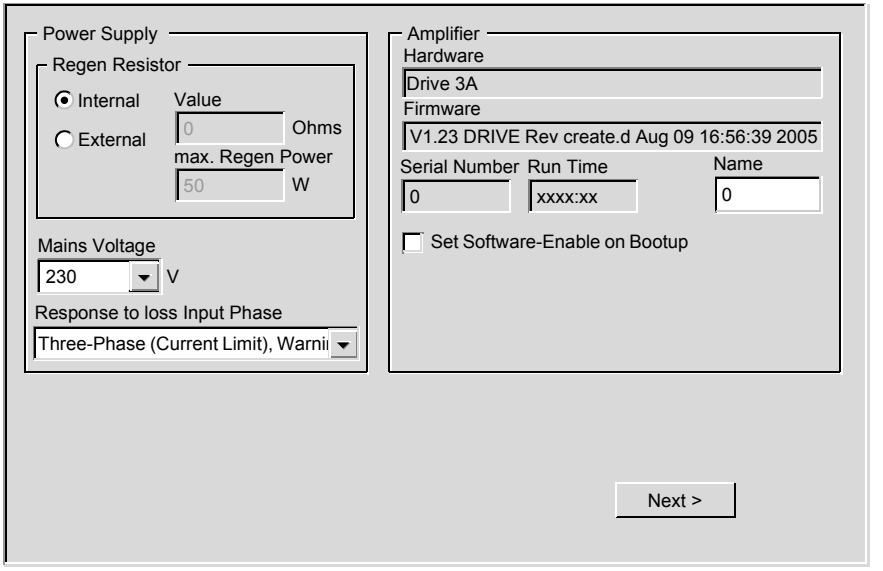
Overview of "Quick Motor/Drive Setup"

At a Glance

The Quick Motor/Drive Setup wizard guides you through the configuration of the servo drive, users' units and servo motor parameters.

Basic Setup

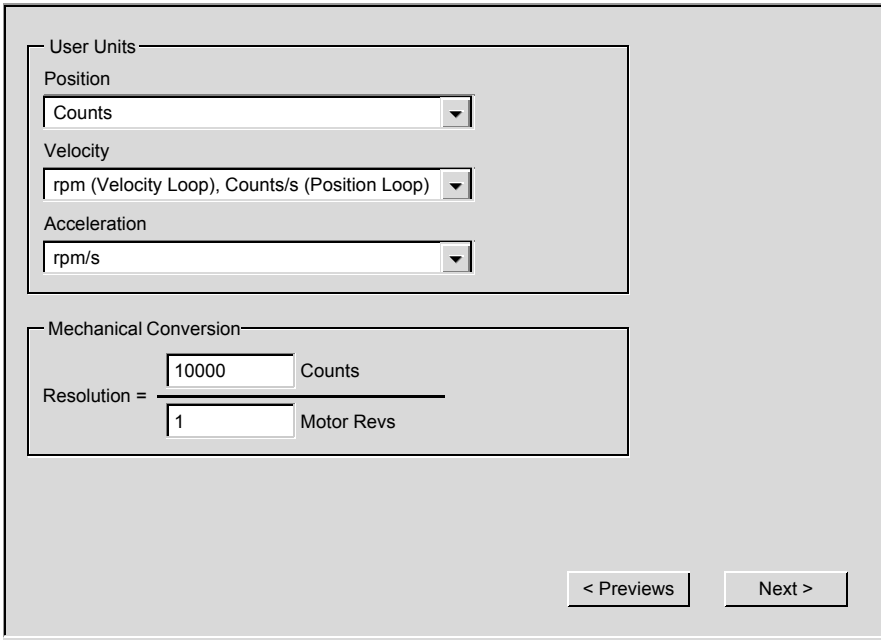
The Basic Setup screen enables you to configure the mains power supply characteristics and the servo amplifier identification:



This screen is described in detail in the Basic Setup section (See *Overview of "Basic Setup", p. 81*). Click "Next" to move to the next screen in the Setup Wizard.

Units/Mechanical

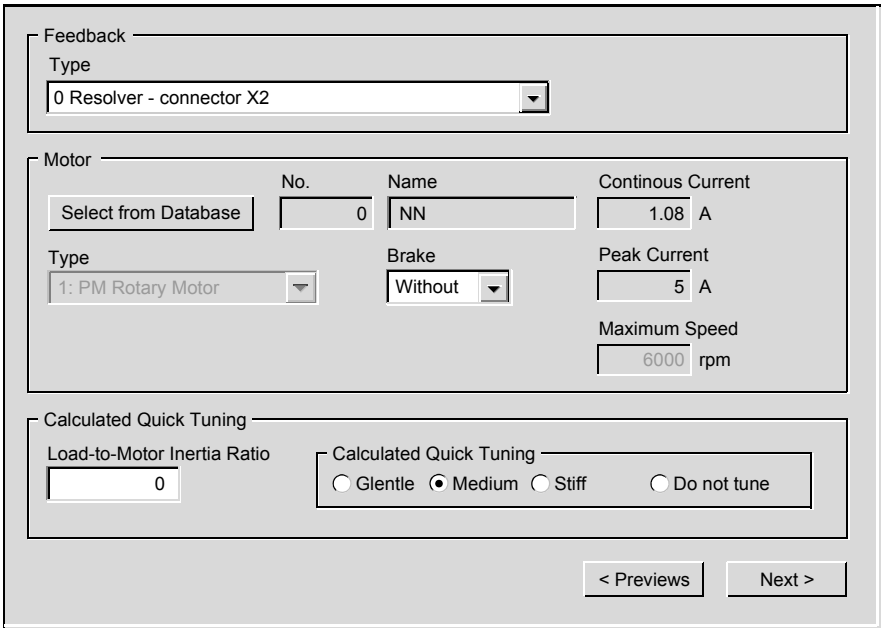
The Units/Mechanical screen enables you to define your preferred units and the mechanical conversion of your system. By defining these parameters you can easily configure the real motion of your axis.



This screen is described in detail in the Units/Mechanical section (See *Overview of "Units/Mechanical", p. 86*). Click "Next" to move to the next screen in the Setup Wizard.

Motor/Feedback

The Motor/Feedback screen enables you to define the feedback sensor used on your axis and the parameters of the servo motor, as well as the calculation of some predefined tuning coefficients.



This screen is described in detail in the Motor/Feedback section (See *Overview of the "Motor/Feedback" screen, p. 92*). Click "Finish" to end the Quick Motor/Drive Setup Wizard.

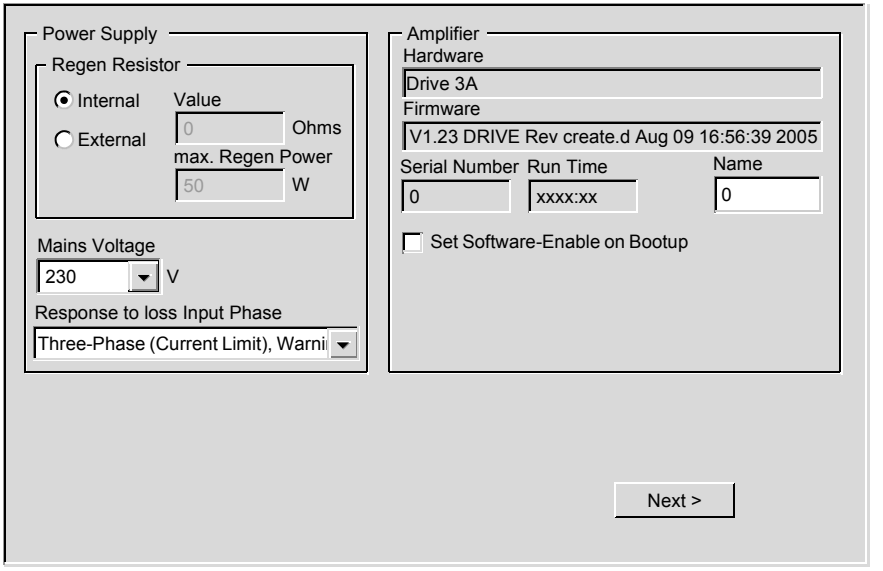
Overview of "Analog Application Setup"

At a Glance

The Analog Application Setup wizard guides you through the screens needed for the quick commissioning of your analogically controlled axis.

Basic Setup

The Basic Setup screen enables you to configure the mains power supply characteristics and the servo amplifier identification:



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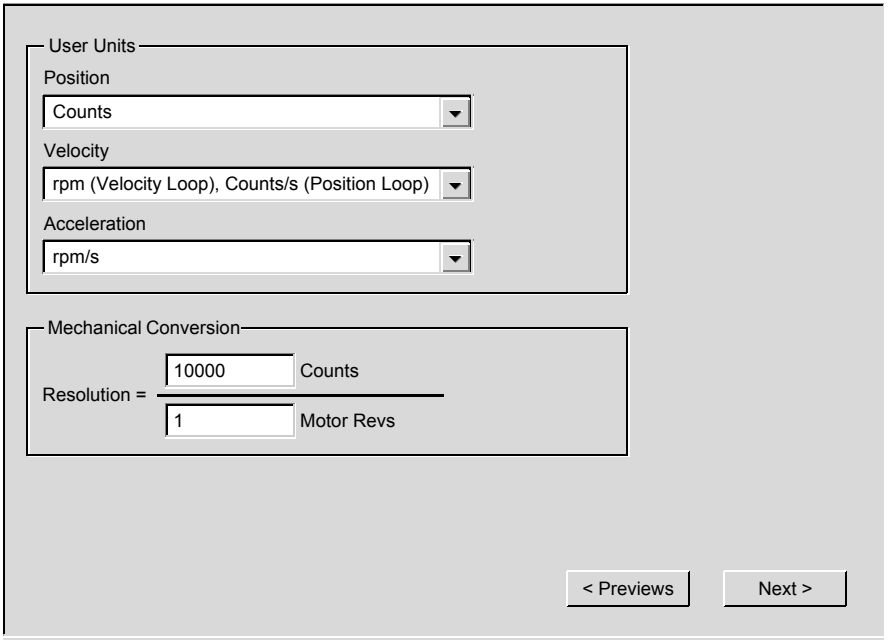

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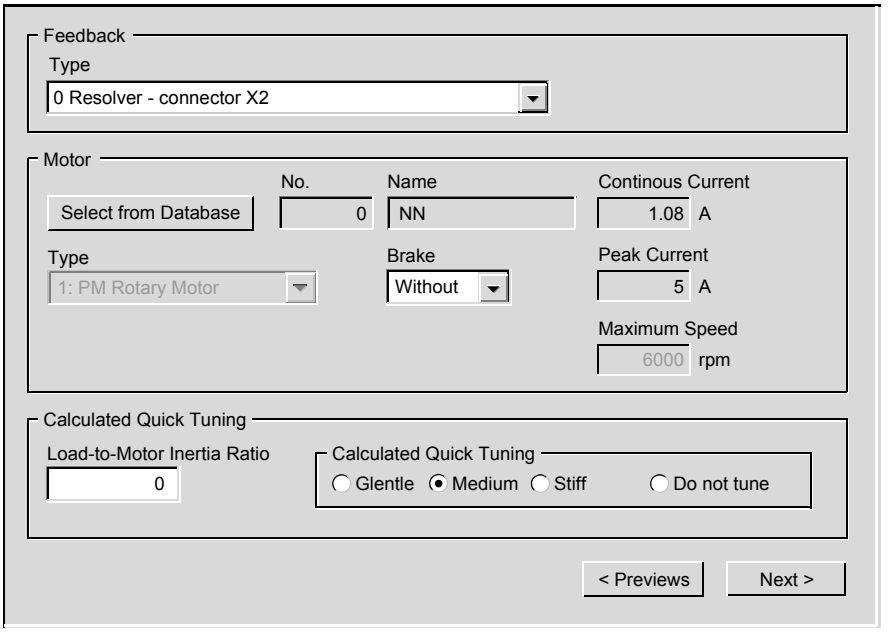
Motor/Feedback

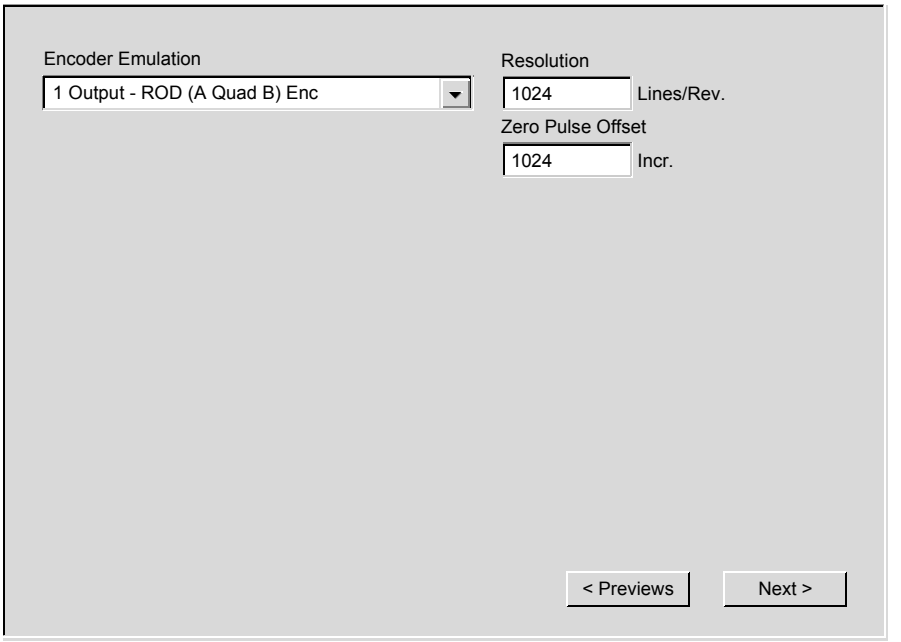
The Motor/Feedback screen enables you to define the feedback sensor used on your axis and the parameters of the servo motor, as well as the calculation of some predefined tuning coefficients.



This screen is described in detail in the Motor/Feedback section (See *Overview of the "Motor/Feedback" screen, p. 92*). Click "Next" to move to the next screen in the Setup Wizard.

Encoder Emulation

The Encoder Emulation screen enables the configuration of the encoder emulation connector (X5), as either an encoder emulation output (the actual servo drive will then be the master axis) or an encoder emulation input (the actual servo drive will be a slave axis).

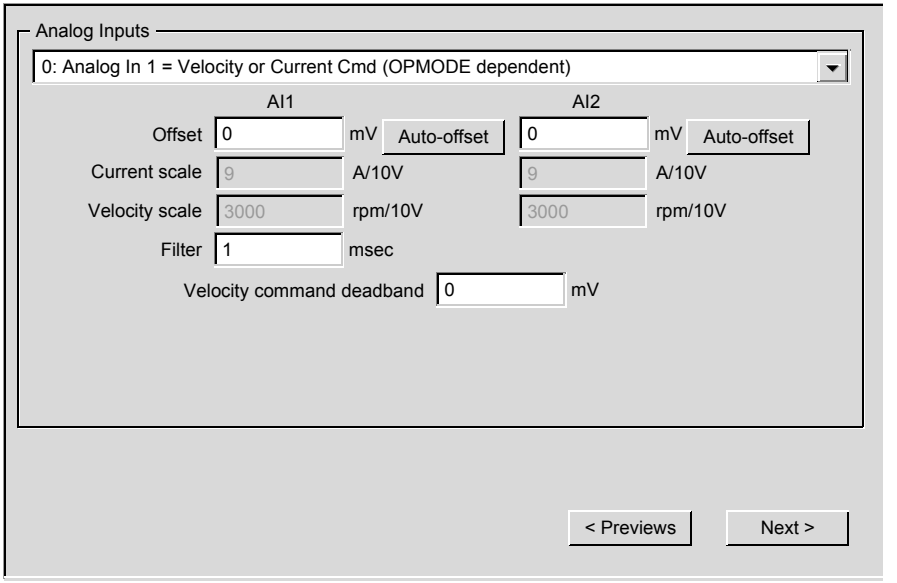


This screen is described in detail in the Encoder Emulation section (See *Overview of the "Encoder Emulation" screen, p. 141*). Click "Next" to move to the next screen in the Setup Wizard.

Analog Inputs

The Analog Input screen is dedicated to the configuration of the analog inputs of the servo drive. You can configure these inputs to control:

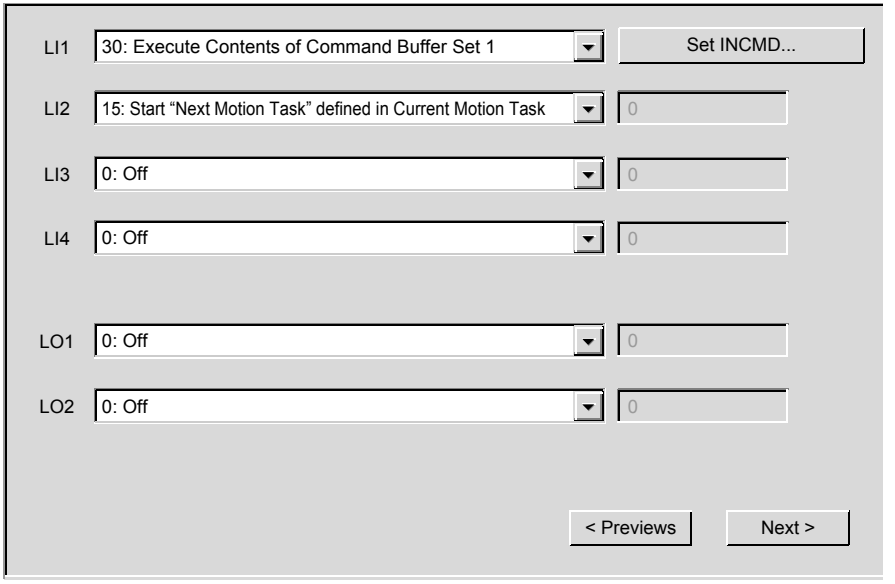
- Servo motor velocity
- Servo motor current
- Gearing ratio
- Digital input trigger level



These functions are declined in fourteen variations, which are all described in detail in the Analog Inputs section (See *Overview of the Analog Inputs Screen, p. 148*). Click "Next" to move to the next screen in the Setup Wizard.

Digital I/O

The Digital I/O screen enables you to configure the 4 logic inputs and the 2 logic outputs of the servo drive.



This screen is described in detail in the Digital I/O section (See *Digital I/O Overview, p. 158*). Click "Finish" to end the Analog Application Setup Wizard.

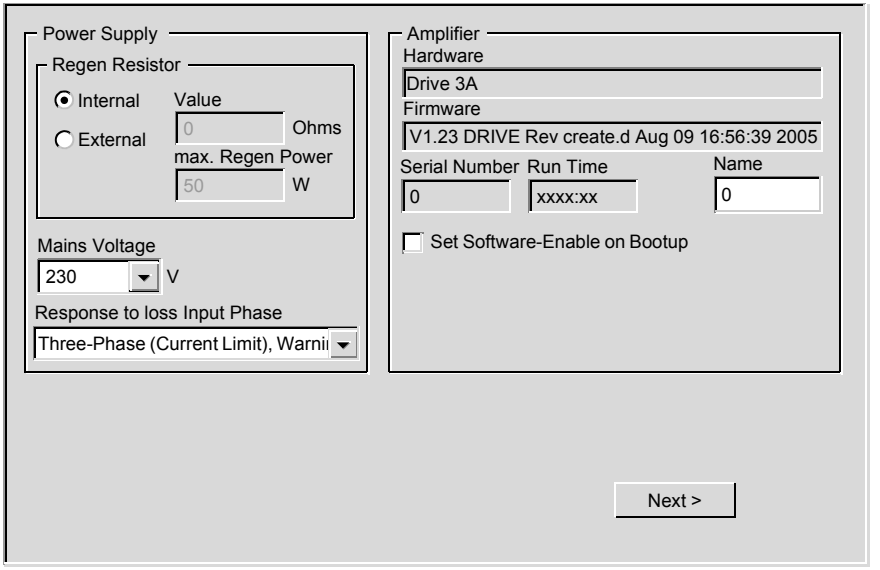
Overview of "Gearing Application Setup"

At a Glance

The Gearing Application Setup wizard guides you through the screens needed for quick commissioning of axis in a simple master/slave application.

Basic Setup

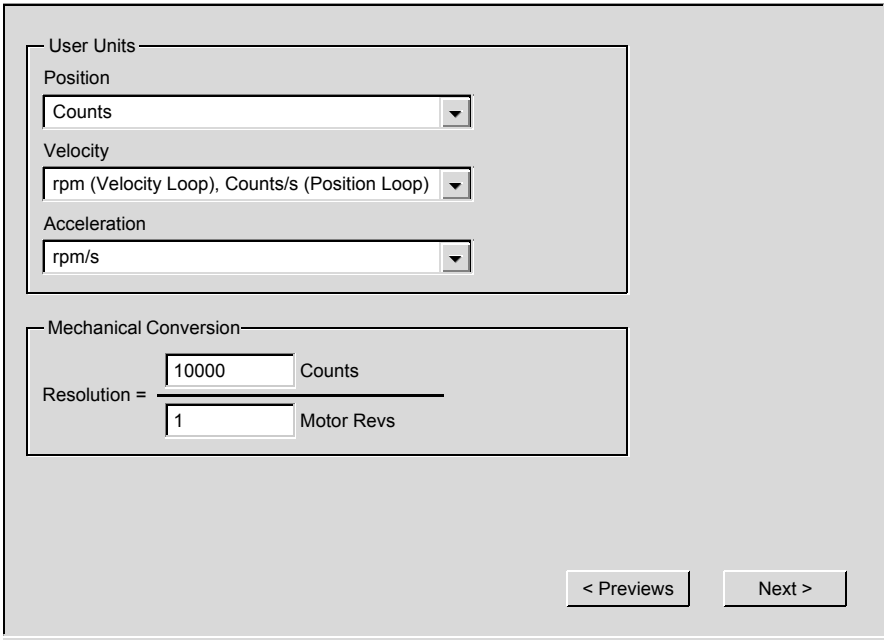
The Basic Setup screen enables you to configure the mains power supply characteristics and the servo amplifier identification:



This screen is described in detail in the Basic Setup section (See *Overview of "Basic Setup", p. 81*). Click "Next" to move to the next screen in the Setup Wizard.

Units/Mechanical

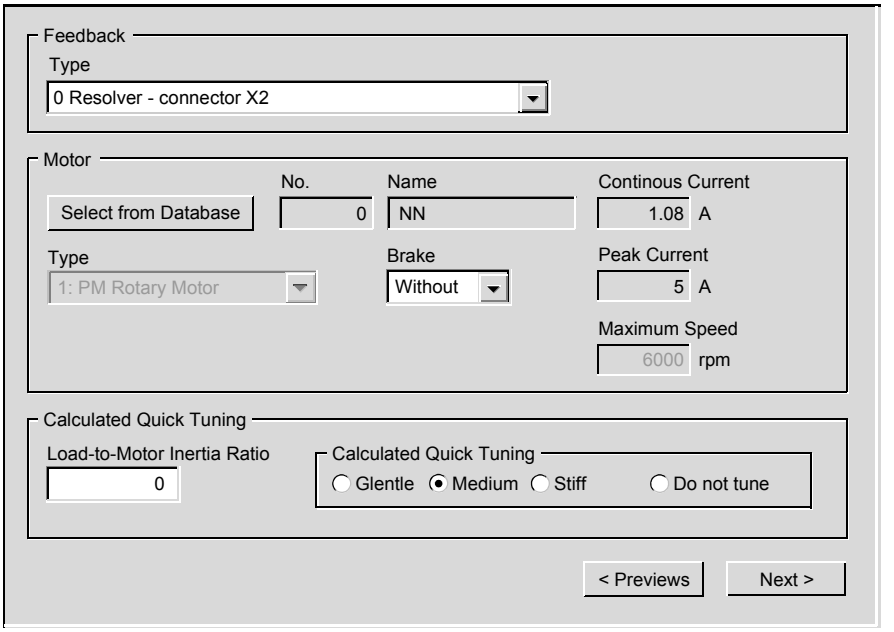
The Units/Mechanical screen enables you to define your preferred units and the mechanical conversion of your system. By defining these parameters you can easily configure the real motion of your axis.



This screen is described in detail in the Units/Mechanical section (See *Overview of "Units/Mechanical", p. 86*). Click "Next" to move to the next screen in the Setup Wizard.

Motor/Feedback

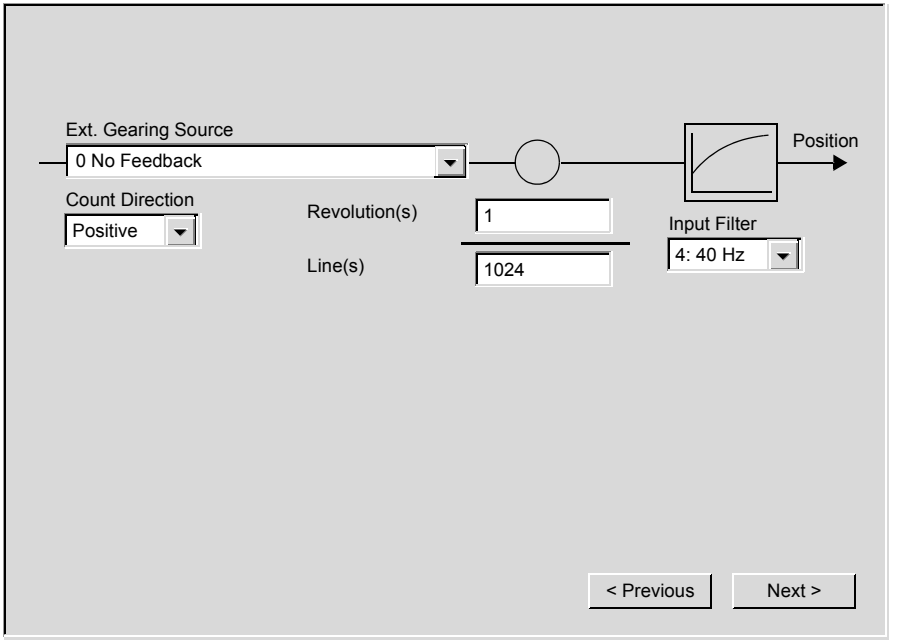
The Motor/Feedback screen enables you to define the feedback sensor used on your axis and the parameters of the servo motor, as well as the calculation of some predefined tuning coefficients.



This screen is described in detail in the Motor/Feedback section (See *Overview of the "Motor/Feedback" screen, p. 92*). Click "Next" to move to the next screen in the Setup Wizard.

Electronic Gearing

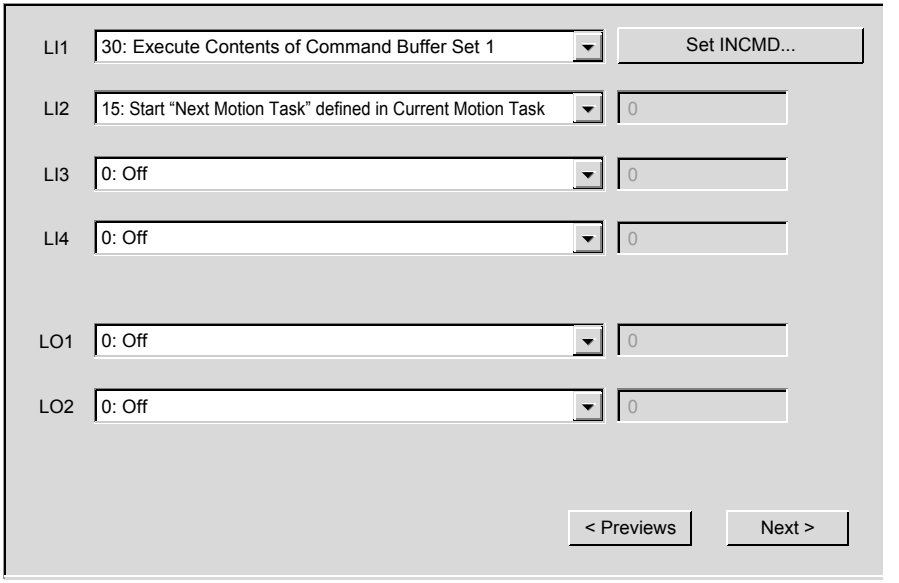
The Electronic Gearing screen enables the configuration of the encoder emulation connector (X5), in this case this connector is configured only as an encoder emulation input (the actual servo drive is a slave axis).



This screen is described in detail in the Electronic Gearing section (See *Overview of the "Electronic Gearing" screen, p. 136*). Click "Next" to move to the next screen in the Setup Wizard.

Digital I/O

The Digital I/O screen enables you to configure the 4 logic inputs and 2 logic outputs of the servo drive.



This screen is described in detail in the Digital I/O section (See *Digital I/O Overview, p. 158*). Click "Finish" to end the Gearing Application Setup Wizard.

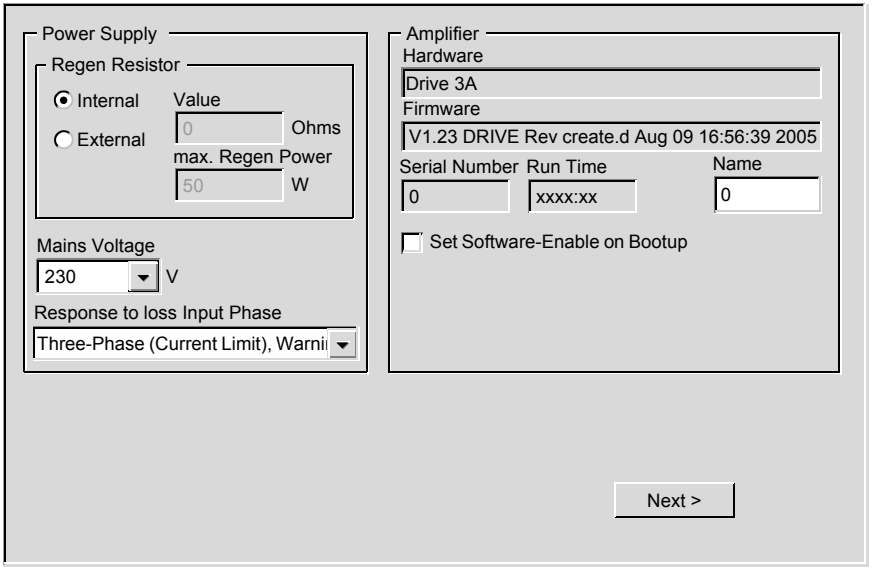
Overview of "Motion Task Application Setup"

At a Glance

The Motion Task Application Setup wizard guides you through the screens needed for quick commissioning of a motion task controlled application.

Basic Setup

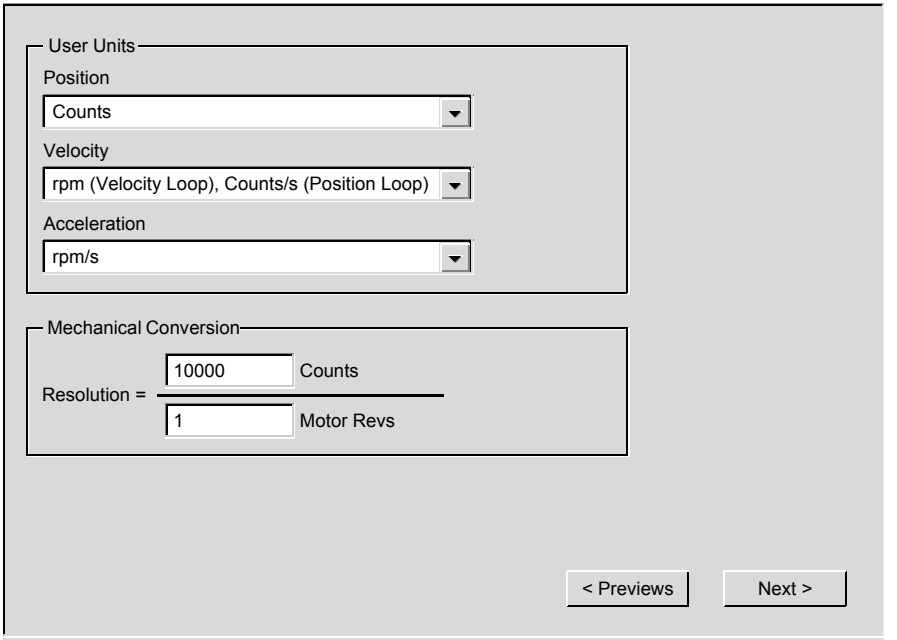
The Basic Setup screen enables you to configure the mains power supply characteristics and the servo amplifier identification:



This screen is described in detail in the Basic Setup section (See *Overview of "Basic Setup", p. 81*). Click "Next" to move to the next screen in the Setup Wizard.

Units/Mechanical

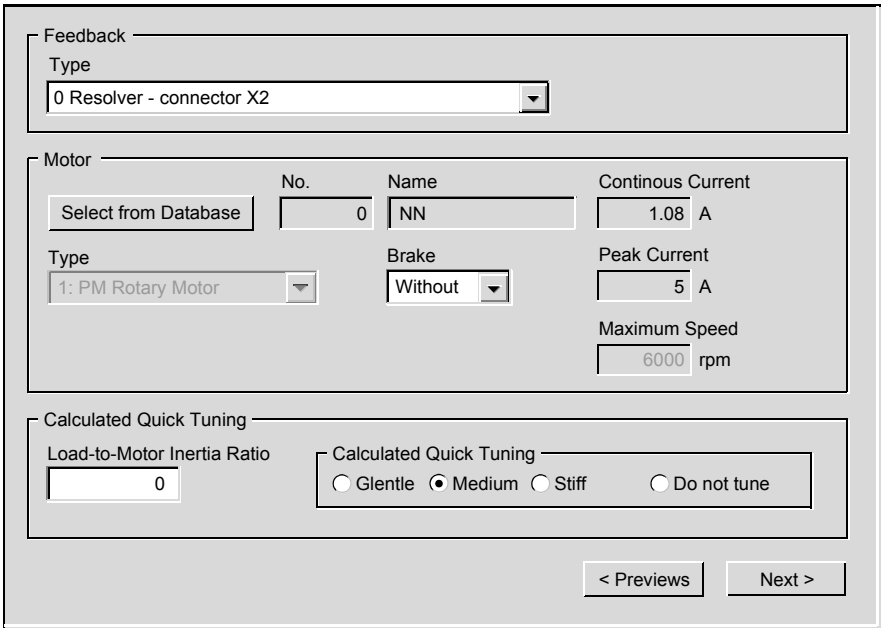
The Units/Mechanical screen enables you to define your preferred units and the mechanical conversion of your system. By defining these parameters you can easily configure the real motion of your axis.



This screen is described in detail in the Units/Mechanical section (See *Overview of "Units/Mechanical", p. 86*). Click "Next" to move to the next screen in the Setup Wizard.

Motor/Feedback

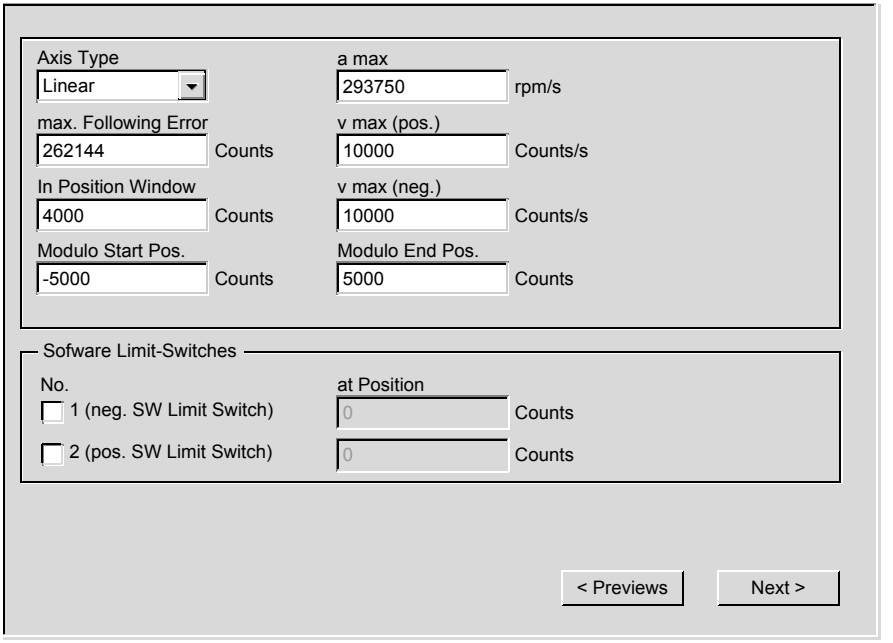
The Motor/Feedback screen enables you to define the feedback sensor used on your axis and the parameters of the servo motor, as well as the calculation of some predefined tuning coefficients.



This screen is described in detail in the Motor/Feedback section (See *Overview of the "Motor/Feedback" screen, p. 92*). Click "Next" to move to the next screen in the Setup Wizard.

Position Data

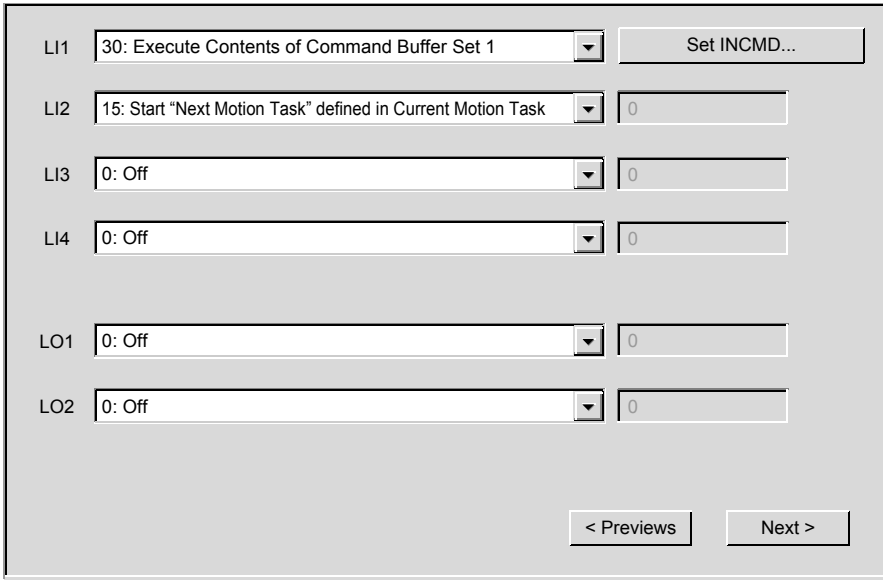
The Position Data screen enables the configuration of the parameters needed to configure the movement of your axis.



This screen is described in detail in the Position Data section (See *Overview of the "Position Data" Screen, p. 126*). Click "Next" to move to the next screen in the Setup Wizard.

Digital I/O

The Digital I/O screen enables you to configure the 4 logic inputs and 2 logic outputs of the servo drive.



This screen is described in detail in the Digital I/O section (See *Digital I/O Overview, p. 158*). Click "Finish" to end the Gearing Application Setup Wizard.

Overview of "Complete Setup Wizard"

At a Glance

If you select Complete Setup, you can configure parameters for all the setup screen pages.

The table below lists each of the screen pages in Complete Setup and directs you to the section which describes that screen.

Screen page	Section
Basic Setup	*Overview of "Basic Setup", p. 81*
Units / Mechanical	*Overview of "Units/Mechanical", p. 86*
CAN / Field Bus Settings	*Overview of "CAN Fieldbus Settings", p. 260*
Feedback	*Overview of the "Feedback" screen, p. 95*
Motor	*Overview of the "Motor" screen, p. 103*
Current Loop	*Overview of the "Current Loop" screen, p. 115*
Velocity Loop	*Introduction to the "Velocity Loop" screen, p. 117*
Position Loop	*Overview of the "Position Loop" screen , p. 123*
Position Data	*Overview of the "Position Data" Screen, p. 126*
Position Registers	*Overview of the "Position Registers" Screen, p. 132*
Electronic Gearing	*Overview of the "Electronic Gearing" screen, p. 136*
Encoder Emulation	*Overview of the "Encoder Emulation" screen, p. 141*
Analog Inputs	*Overview of the Analog Inputs Screen, p. 148*
Digital I/O	*Digital I/O Overview, p. 158*

Device Operation Handling

3

Device Operation Handling

At a Glance

This chapter describes the commissioning method, device state, and modes of operation of the Lexium 15 servo drive.

What's in this Chapter?

This chapter contains the following topics:

Axis Commissioning Checklist Procedures

General

This document provides you with strategies for the commissioning of the digital servo amplifier and the optimization of its control loops.

These strategies cannot be universally valid. You may have to develop your own strategy, depending the specification of your machine.

However, the sequences that are presented here will help you to understand the basic methodology.

Parameterization

⚠ CAUTION

The manufacturer of the machine must create a hazard analysis for the machine, and is responsible for the machine with regard to functional, mechanical and personnel safety. This applies particularly to the initiation of movements with the aid of commissioning-software functions. The commissioning of the servo drive with the aid of Setup software functions is only permitted in combination with an interlock device according to EN292-1, that operates directly on the drive circuitry.

Failure to follow this instruction can result in injury or equipment damage.

- the servo amplifier is installed, and all the necessary electrical connections have been made. See manual "Installation Guide for the Lexium 15x Series Amplifier"
- the 24V auxiliary supply and the 230...480V main power supply are switched off
- a personal computer, with the commissioning software installed, is connected
- an interlock device according to EN292-1 is connected
- the controls provide an LOW signal for the ENABLE input of the servo amplifier (Terminal X3/12), i.e. the servo amplifier is disabled.

Switch on auxiliary supply

Step	Action
1	**Switch on the 24V auxiliary supply for the servo amplifier.** LED display: X. XX (firmware version) R1A/R1C contact: open **After about 5 seconds:** LED display: YY. (amount of current, blinking point for CPU o.k.) R1A/R1C contact: closed
2	**Switch on personal computer.**
3	**Start commissioning software.**
4	**Click on the interface (COM1...COM10) that is used for communication with the servo amplifier.** The parameters are transmitted to the PC.
5	**Click on the radio button "SW-disable" at bottom right.** NO ENABLE now stands in the AXIS status field.

Basic settings

The servo amplifier remains disabled and the main power supply is switched off.

Step	Action
1	**Set up basic parameters (address, ballast details, line/mains supply voltage etc.):** ● click on the **BASIC SETUP** screen page (See *Overview of "Basic Setup", p. 81*) ● alter the fields, if necessary ● click on **APPLY**. 
2	**Select motor:** ● click on the **MOTOR** screen page. ● open the motor selection table, by clicking on the arrow in the field **NUMBER-Name** or "Select Motor from Database" button. See *Screen page "Motor", p. 102* for more information. ● click on the motor that is connected ● click on **APPLY**  ● answer the query about the brake ● answer the query "**Save to EEPROM/Reset**" with NO (the data are in the RAM and will be permanently saved later).
3	**Select feedback (resolver, encoder):** ● click on the **FEEDBACK** screen page. ● the values that are displayed correspond to the default data that you have loaded for the motor ● alter the fields, if necessary ● click on **APPLY**. 

Step	Action
4	**Set up the encoder emulation (ROD, SSI):** ● click on the **ENCODER EMULATION** screen page ● select the desired encoder emulation ● set up the corresponding parameters in the right half of the window ● click on **APPLY**. 
5	**Configure the analog inputs:** ● click on the **ANALOG INPUT** screen page ● select the desired ANALOG-FUNCTION ● Set the scaling relative to 10V for the analog input that is used ● click on **APPLY**. 
6	**Configure the digital inputs/outputs:** ● click on the **DIGITAL I/O** screen page. ● assign the required functions to the digital inputs (left half of window) and enter the auxiliary variable INxTRIG if it is necessary ● assign the required functions to the digital inputs (right half of window) and enter the auxiliary variable INxTRIG if it is necessary ● click on **APPLY**. 
7	**Save parameters:** ● click on the button  ● answer the query "**RESET AMPLIFIER**" with "**YES**".
8	Click on the radio button **SW-disable** at bottom right. "**NO ENABLE**" now stands in the AXIS status field.

Procedure to be followed

If you want to use the position control of the servo amplifier, then you must enter the specific parameters for your drive:

Step	Action
1	**Resolution:** ● click on the **UNITS/MECHANICAL** screen page. ● select units for position velocity and acceleration. Make sure that you select the appropriate unit for the axis type (see step 2) ● enter the denominator and numerator for the resolution. Here you adjust the path traversed by the load in positioning units (length unit for linear axes, or °mech. for rotary axes) to match the number of turns of the motor ● only integer entries are permitted. Example 1: Ratio = 3.333 mm / turn =>resolution =10000/3 µm/turn (all other path entries in µm) or =>resolution =10/3 mm/turn (all other path entries in mm) Example 2: Ratio = 180 °mech. /turn =>resolution =180/1 °mech. /turn (all other path entries in °mech) ● click on **APPLY**. 
2	**Axis type:** ● click on the **POSITION DATA** screen page ● select the **axis type** (linear or rotary).
3	**v_max:** ● enter the maximum traversing speed for the load that results from the resolution at the rated speed of the motor. The dimensional unit is derived from the resolution (°mech. /sec or length units/sec). You can define a positive and negative speed. Example 1: resolution =10000/3 µm/turn, number of motor turns = 3000 turns/min =>vmax =resolution * number of motor turns =10000/3 *3000 µm/min = 10 000 000 µm/min or =>vmax =resolution * number of motor turns = 10/3 * 3000 mm/min = 10 000 mm/min. Example 2: resolution = 180 °mech. /turn, number of motor turns = 3000 turns/min =>vmax =resolution * number of motor turns = 180 * 3000 °mech. /min = 9000 °mech. /s

Step	Action
4	**a_max or t_acc/dec_min:** ● enter the time or acceleration that the drive requires, with the **mechanically permissible** maximum acceleration, to accelerate from zero speed to vmax.
5	**In position:** ● enter the window for "**InPosition**". This value is used for the **InPosition** message ● the dimensional unit is derived from the resolution (°mech. or length unit). Typical value: e.g. approx. resolution * 1/100 turn.
6	**max. following error:** ● enter the window for the following error. This value is used for the message **FOLLOWING ERROR**. The dimensional unit is derived from the resolution (°mech. or length unit) Typical value: e.g. approx. resolution * 1/10 turn. ● click on **APPLY**. 
7	**Save parameters:** ● click on the button shown below  ● answer the query "**RESET AMPLIFIER**" with "**YES**".

Optimization of the control loops

The basic setup must be finished.

Step	Action
1	**OPMODE:** Set the OPMODE "1: Analog Velocity".
2	**Setp. function:** On screen page **ANALOG INPUTS**, set the analog input function to "0: Analog In 1 = Velocity or Current Cmd (OPMODE dependent)" (See *Overview of the Analog Inputs Screen, p. 148*for more information.)
3	**Save the parameters:** ● click on the button shown below  ● answer the query "**RESET AMPLIFIER**" with "**YES**".
4	**AI1:** Short-circuit the setpoint input 1 or apply 0V to it.
5	**OSCILLOSCOPE:** Channel1: v_act Channel2: I_act (screen page OSCILLOSCOPE)
6	**Reversing mode** Go to the screen page **OSCILLOSCOPE**/MOTION SERVICE/PARAMETER and set the parameters for reversing mode to values that are safe for your machine. In OSCILLOSCOPE mode, the positioning control loop is switched off.

⚠ CAUTION

During operation of the service function "Reversing mode" the analog setpoint input is switched off and the internal positioning control is disabled.
Make sure that the individual motion of the selected axis is possible without any hazard. For safety, only operate the ENABLE signal of the amplifier with an interlock switch, and check the EMERGENCY STOP function for this axis.

Failure to follow this instruction can result in injury or equipment damage.

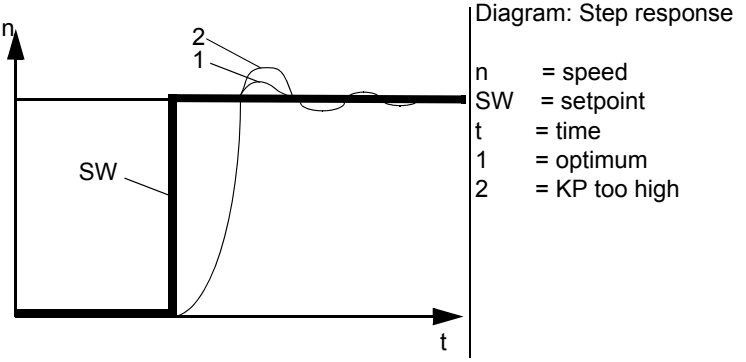
Optimizing the current controller

Screen page "Current Loop"

Step	Action
1	If a suitable amplifier-motor combination is used, the current controller will already have a stable setting for almost all applications.
2	**Ipeak:** ● reduce **Ipeak** to the **Irated** value of the motor (protection of the motor)
3	Power up
4	Provide the **analog setpoint:** ● AI1 = 0V
5	Enable the amplifier ● high signal at Enable input X3/12. In the AXIS status field: NO SW-EN ● click on the SW-Enable check box. ENABLE now stands in the AXIS status field. The motor now stands under speed control, with n=0 rpm. If the current controller is not stable in operation (motor oscillates with a frequency clearly above 500Hz), please contact our applications department.

Optimizing the speed controller

Step	Action
1	If the axis is drifting when amplifier is enabled: **SETP. -OFFSET :** ● Select OPMODE "1: Analog Velocity". ● Click on **ANALOG INPUT** screen page and select function "0: Analog In 1 = Velocity or Current Command (OPMODE dependent)". ● Apply 0V on AI1. ● Leave amplifier enabled. ● Alter the parameter Setp. -Offset until it stands still (or use the function AUTO-OFFSET).
2	**SETP. RAMP +/-:** ● Click on "Velocity loop" screen page The setpoint ramps are used to smooth the setpoint input (filter effect). ● Set the mechanical time constant for the complete system, i.e the rise time for the speed from 0 to n_{cmd}. As long as the ramps that are set are shorter than the mechanical response time for the complete system, the response speed will not be affected.
3	**LIMIT SPEED (negative or positive):** Set the desired final limit speed. It corresponds to the nominal speed.
4	**KP_v / Tn_v:** Increase KP_v until the motor starts to oscillate (audible, and visible on the oscilloscope) and then reduce KP_v again until the oscillations have definitely stopped and stability is assured. Use the motor-specific default value for Tn_v.

Step	Action
5	**Start reversing mode:** Reversing mode will create a square signal without acceleration. This is useful to optimize Kp_v, Tn_v and set some additional filters. ● Click on **OSCILLOSCOPE** screen page. ● Click on the "Motion Service" tab and select Reversing mode. ● Start the reversing mode (v1/v2 approx. +/-10% of n_{nom} for the motor). ● Observe the speed response on the oscilloscope. If the settings are correct, there must be a stable step response in both directions. Diagram: Step response 
6	**KP_v:** On the Oscilloscope "Tuning" tab, you can produce a fine tuning of the speed response by cautiously increasing KP_v. Aim: the smallest overshoot, but still retaining good damping. A larger total moment of inertia make it possible to use a larger value for KP.
7	**VELOCITY FILTERS** You can dampen out disturbances, such as a small amount of play in the gearing, by increasing the Velocity Filters to about 1/3 the value of Tn by using a low pass filter and a high pass filter. You can also set these filters on the **VELOCITY LOOP** screen page (See *Screen page "Velocity Loop", p. 117*) or or find more details on filters on the **BODEPLOT** screen page (See *"BODEPLOT" screen page., p. 248*)
8	**FEEDBACK:** You can further improve the smooth running by using FEEDBACK filters and modifying velocity observer, especially for small drives with a low torque.
9	**End reversing mode:** Finish the reversing using STOP mode.

Settings

Step	Action
1	● set up the correct, motor-specific value for Ipeak (current controller) again ● start up reversing mode again, and observe the step response. If there is any tendency to oscillation, reduce KP slightly ● save the present parameter set in the EEPROM ● click on the button shown below: 

Optimizing the position controller: Preparation

Preparation

Step	Action
1	**OPMODE:** Select OPMODE 8 (screen page AMPLIFIER)
2	**Set up Units:** Click on the **UNITS/MECHANICAL** screen page and specify units for the velocity, position and acceleration.
3	**Position the load in a middle position:** The aim is, to use the Jog Mode function to move the load to approximately the middle of the motion path. ● click on the **MOTION SERVICE** screen page ● check that the parameter s v (Jog Position motion task mode) is set to 1/10 of the preset speed limit vmax. ● click on **APPLY**.  ● start the function Jog Mode by clicking the buttons "+" or "-". and move the load to approximately the middle of the motion path.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>4</td><td>Set reference point:
● click on the HOMING screen page
● set the homing type
Start the homing run. When the reference point is set, the current position is set to the offset value.
● stop the homing run
● click on the check box "SW-disable" in the amplifier window.</td></tr>
<tr><td>5</td><td>Define test motion blocks:
● click on the MOTION TASK screen page
● select task 1 with a double click.
Enter the values from the table below, then select task 2 and enter the corresponding values.
<table><tr><th></th><th>Task 1</th><th>Task 2</th></tr><tr><td>Units type
s_cmd
v_cmd_source
v_cmd
t_acc_tot
t_dec_tot
ramp
next motion task
next number
motion blending
start condition
APPLY/OK</td><td>SI
REL setpoint
+10% of total path
digital
10% of vmax
10 * t_acc/dec_min
10 * t_acc/dec_min
trapeze

with
2
to target position a
immediately
click</td><td>SI
REL setpoint
- 10% of total path
digital
10% of vmax
10 * t_acc/dec_min
10 * t_acc/dec_min
trapeze

with
1
to target position a
immediately
click</td></tr></table></td></tr>
<tr><td>6</td><td>Save parameters:
● click on the button shown below:
 
● answer the query "RESET AMPLIFIER" with "YES".</td></tr>
</table>

Optimizing the position controller: Optimization

Optimization

⚠ CAUTION

The starting of motion tasks with the aid of commissioning-software functions is only permitted in combination with an interlock device according to EN292-1, that operates directly on the drive circuitry.

Failure to follow this instruction can result in injury or equipment damage.

Step	Action
1	**Start motion task:** ● click on the **MOTION TASK** screen page ● select motion task 1, click on "**START**", motion task 1 is started and, because of the definition of the motion task sequence, the drive moves in position-controlled reversing operation.
2	**Optimize parameters** (Click on the **OSCILLOSCOPE / Tuning Tab** screen page).
3	**VELOCITY FILTERS, FEEDBACK:** The speed controller is not used in OPMODES 4, 5 and 8. The position controller includes an integral speed controller, that takes on the preset parameters for VELOCITY FILTERS and FEEDBACK from the screen page **VELOCITY LOOP** (See *Screen page "Velocity Loop", p. 117*).
4	**Kp_v, Tn:** If KP_v is set too high, the position controller tends to oscillate. Use the value for the optimized speed controller for Kp_v. Tn should be 2...3 times as large as the Tn_v value for the optimized speed controller.
5	**Kp_p:** The acceleration behavior of the motor should be well damped (no tendency to oscillation) with a minimum following error. If Kp_p is larger, the tendency to oscillation increases. If it is smaller the following error increases and the drive becomes too soft. Vary KP_p until the desired response is achieved.
6	**Velocity:** The integral component of the control loop is in the position controller, not the speed controller, so no following error results at Jog Mode (pure proportional control). The following error that arises during acceleration is affected by the Velocity parameter. This error is smaller if the Velocity parameter is increased. If increasing FF does not produce any improvement, then you can increase Kp_v a little, to make the speed control loop somewhat stiffer.

Incorrect operation

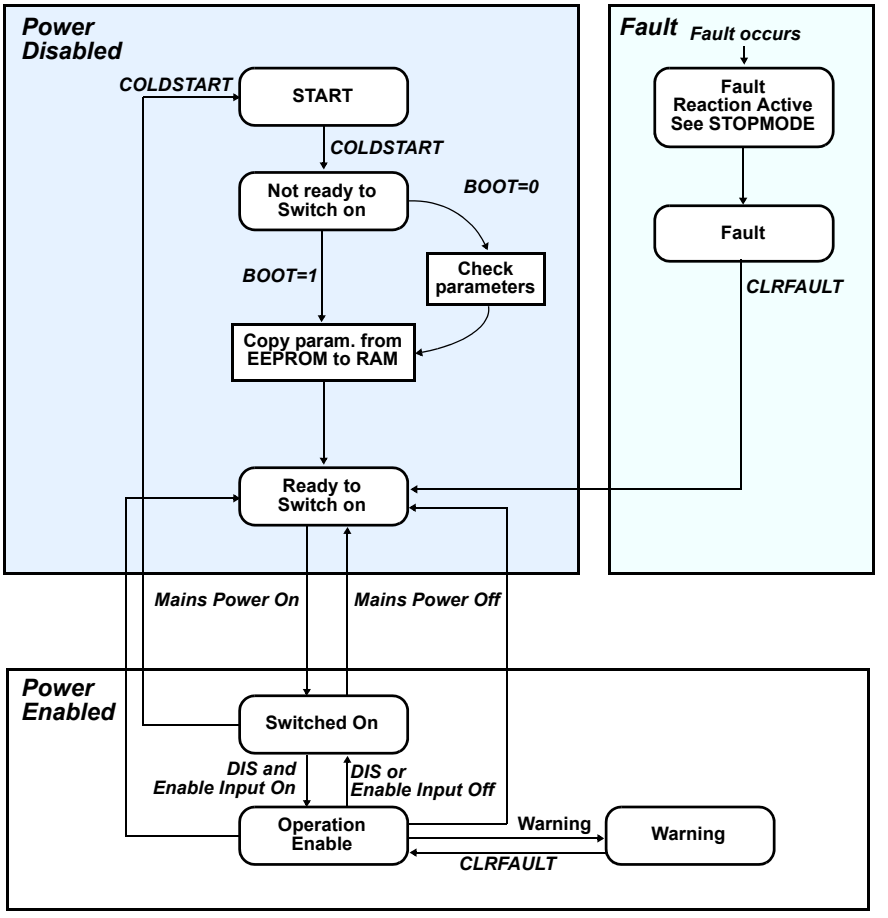
If the drive does not run satisfactorily under position control, first look for external causes such as:

- mechanical play in the transmission chain (limits the Kp_v)
- jamming or slip-stick effects
- self-resonant frequency of the mechanical system is too low
- poor damping, drive is too weakly dimensioned before trying to optimize the control loop again.

Device State Handling

At a Glance

Device state handling is illustrated in the diagram below:



Device States

Device State	Description
Ready to Switch On	Ready to accept Main Power On. No energy for motor. Brake is set (ON) if motor is equipped. Motion is not allowed. Led display is "xx" where xx is the device number for field bus.
Switched On	Main Power is On. No energy for motor. Brake is on if motor is equipped. Motion is not allowed. Led display is "Pxx" where xx is the device number for field bus.
Operation Enable	Main Power is On. Energy for motor. Brake is off if motor is equipped. Motion is not allowed. Led display is "Exx" where xx is the device number for field bus.
Fault Reaction Active	If a fault is detected the motor will be stopped. The motor is stopped depending on STOPMODE.
Fault	No energy for motor. Brake is on if motor is equipped. Led display is "fxx" where xx is the device number for field bus
Warning	Motor still controlled. Led display is "nxx" where xx is the device number for field bus.

ASCII Command List

You can use the ASCII commands below to

- To manage drive states behavior
- Clear faults, warnings
- Stop
- Save restore parameters

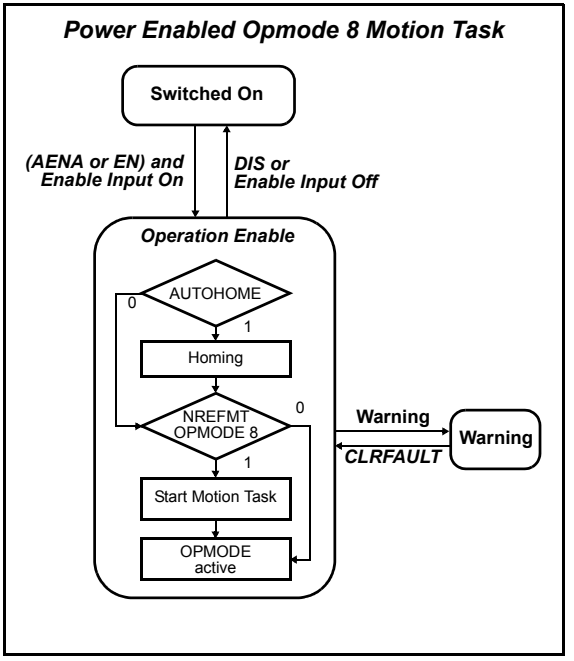
ASCII Command	Default Value	Description
ACTFAULT	1	Active Fault Mode
BOOT	0	Type of Boot Initialisation
CLRFAULT	-	Clear Drive Fault
CLRHR	-	Bit 5 of status register STAT is cleared
CLRWARN	0	Warning Mode
COLDSTART	-	Drive Reset
DECDIS	10	Deceleration used on Disable Output Stage
DECSTOP	10	Quick Stop - braking ramp for emergency situations
DIS	-	Software - Disable
EMRGTO	5000	Emergency time-out and stop mode
EN	-	Software - Enable
INPOS	-	Status of In-Position Signal
INPT	10	In-Position Delay
K	-	Kill (=Disable)
KEYLOCK	0	Locks the push buttons
LOAD	-	Load parameters from Serial EEPROM
MSG	0	Enable/Disable All Messages via RS232
PASSCNFG	0	Password Function
PASSX	0	Activate Password Function
PMODE	1	Line Phase Error Mode
REMOTE	-	Status of the Hardware Enable
RSTFW	0	Parameter of RSTVAR
RSTVAR	-	Restore variables (default values)
S	-	Stop Motor and Disable Drive
SAVE	-	Save Data in EEPROM
UVLTMODE	1	Undervoltage Mode

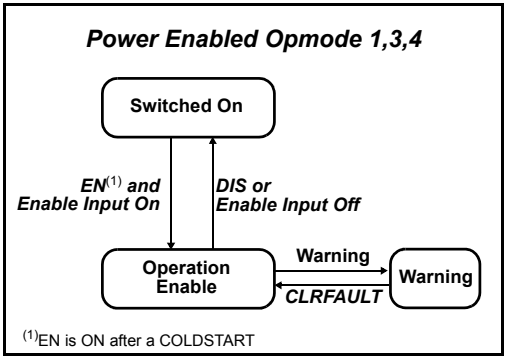
Modes of Operation

At a Glance

The Lexium 15 servo drive may be used in several servo control modes; which are called Modes Of Operation.

The Mode of Operation is selected automatically when the power is switched on, in accordance with the setting saved in the EEPROM as well as the AUTOHOME AND NREFMT objects.





Handling of Modes of Operation

Some modes of operation are handled by I/O and others by field buses:

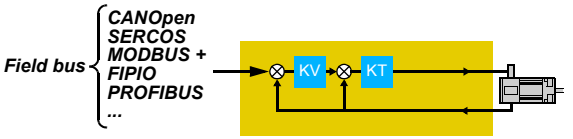
Lexium 15 LP/MP/HP	DSP 402 Number	Available	Unilink Number
CANopen DS 402 Modes of Operation			
No mode changed/no mode assigned	0	yes	N/A
Profile position mode (PP)	1	yes	N/A
Velocity mode	2		
Profile velocity mode (PV)	3	yes	N/A
Torque position mode (TQ)	4		
reserved	5		
Homing mode (HM)	6	yes	N/A
Interpolated position mode (IP)	7		
Cyclic sync position mode	8		
Cyclic sync velocity mode	9		
Cyclic sync torque mode	10		
reserved	+11 to +127		
Constructor			
Electrical gearing	F7h	yes	4
Jogging	F8h	yes	
Homing propietary	F9h	yes	
Trajectory (positioning specific mode)	FAh	yes	
Analog torque	FBh	yes	3
Analog speed	FCh	yes	1
Digital torque	FDh	yes	2
Digital speed	FEh	yes	0
Position	FFh	yes	8
Sercos		yes	6

The CANopen DSP 402 Modes of Operation will be described in Lexium 15 CANopen Manual.

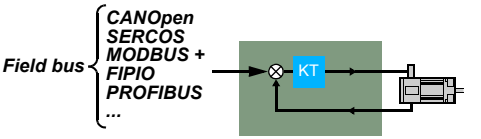
Constructor Modes of Operation

The diagram below illustrates the Constructor Mode of Operation

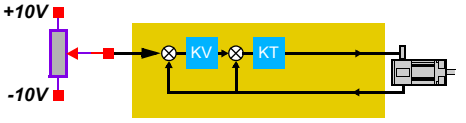
OPMODE 0: DIGITAL VELOCITY



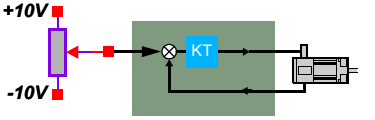
OPMODE 2: DIGITAL TORQUE



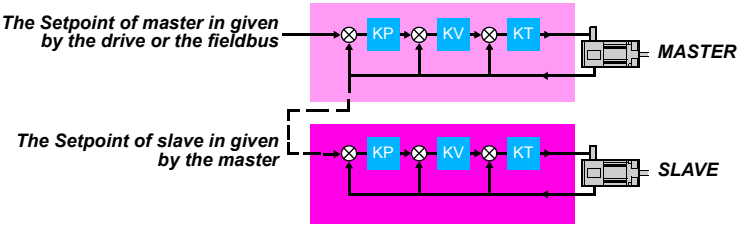
OPMODE 1: ANALOG VELOCITY



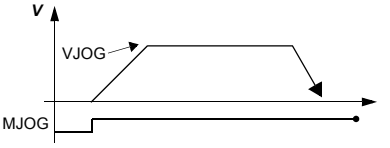
OPMODE 3: ANALOG TORQUE



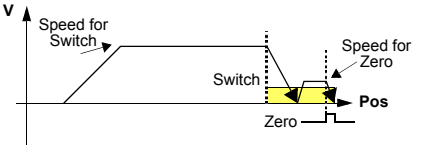
OPMODE 4: DIGITAL VELOCITY



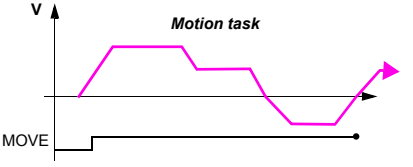
OPMODE F8h: Jog



OPMODE F9h: Homing



OPMODE FFh: Motion Task



Device Functions

4

Device Functions

At a Glance

This chapter describes all the parameters that can be accessed via the setup software.

What's in this Chapter?

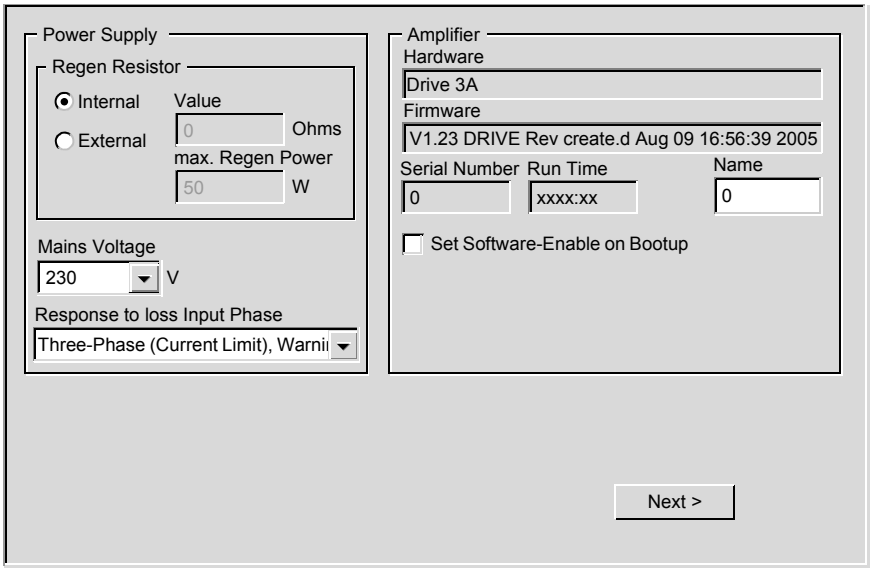
This chapter contains the following sections:

4.1 Screen page "Basic Setup"

Overview of "Basic Setup"

At a Glance

The Basic Setup page enables you to set power supply information and master data for the servo amplifier:



Regen resistor

ASCII: **PBALRES**	Default: 0 (internal) Unit: - Range: 0-200	Valid for all OPMODES

Preselection of the braking resistor. If you use an external braking resistor, select "External" here and enter the value of the resistor in the Value field in Ohms.

Regen power

ASCII: **PBALMAX**	Default: 20 W / 50 W Unit: W Range: -	Valid for all OPMODES

This parameter can be used to limit the continuous power dissipated in the braking resistor. If the actual value of the braking power exceeds the preset maximum value, then the braking resistor is switched off. This may trigger the fault message "Overvoltage" as a result. Change this value only when the amplifier is disabled.

⚠ WARNING

ELECTRICAL HAZARD

If the maximum value is too high, the braking resistor may be overloaded.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Mains Voltage

ASCII: **VBUSBAL**	Default: 1 Unit: -/Volt Range: 0 - 870	Valid for all OPMODES

This parameter is used to adjust the regen and switch-off levels of the servo amplifiers to suit the mains power supply voltage or the system conditions for multi-axis systems with parallel-connected DC-link circuits.

ID	Max. Mains Voltage	DC-link voltage (rated motor voltage / max. motor voltage)
1	230 V	310 V / 430 V
2	400 V	560 V / 750 V
3	480 V	675 V / 870 V

Single amplifier:

usually the setting taken is the mains supply voltage that is actually available. If the motor has a higher voltage rating than the DC-link voltage that occurs as a result of the available mains supply voltage, then you can raise the regen and switch-off levels by selecting the max. mains voltage that is permissible for the motor (see previous table).

Multi-axis systems with parallel-connected DC-link circuits:

in a system, the DC-link circuits of the servo amplifiers are usually connected in parallel (DC-bus). If motors with differing voltage ratings (which must be as high or higher than the actual DC-link voltage) are used, then each amplifier on the DC-bus must be set up for the motor with the lowest rated voltage. If the settings are not all the same, then the desired distribution of the regen power will not be achieved.

Response to Loss of Input Phase

ASCII: **PMODE**	Default: Three-phase (Current Limit), Warning n05 Unit: - Range: 0, 1, 2	Valid for all OPMODES

Handles the "Phase missing" message. Change this only while the amplifier is disabled, then reset amplifier.

ID	Function	Note
Single-phase (Current Limit)	No message	A missing mains supply phase is not evaluated. Operation is only possible on two phases. See the following table for voltage currents.
Three-phrase (Current Limit)	Warning	A missing mains supply phase is reported as a warning (display), and can be output on a digital output. The servo amplifier will not be disabled. See the following table for voltage currents.
Three-phrase	Error	A missing mains supply phase is reported as a fault (display), and can be output on a digital output. The servo amplifier is disabled and the R1A/R1C contact opened.

The following table shows the limited peak current for each of the three different voltages.

Servodrive	**LXM15L D13M3**	**D21M3**	**D28M3**	**U60N4**	**D10N4**	**D17N4**
Line Voltage	**Peak Current [A]**	**Peak Current [A]**	**Peak Current [A]**	**Peak Current [A]**	**Peak Current [A]**	**Peak Current [A]**
230 V	9	9	9	-	-	-
400 V	-	-	-	1.5	3	3
480 V	-	-	-	1.5	3	3

Hardware

ASCII: **HVER**	Default: - Unit: - Range: max 50 ASCII chars.	Valid for all OPMODES

Display the version and revision level of the servo amplifier hardware.

Firmware

ASCII: **VER**	Default: - Unit: - Range: max 50 ASCII chars.	Valid for all OPMODES

Displays the version and revision level of the servo amplifier firmware.

Serial number

ASCII: **SERIALNO**	Default: - Unit: - Range: 10 ASCII chars.	Valid for all OPMODES

Displays the servo amplifier serial number.

Run time

ASCII: **TRUN**	Default: - Unit: hhhhh:mm Range: 00000:00 to 99999:45	Valid for all OPMODES

Displays servo amplifier operational time, saved at 8 minute intervals. If the 24V supply is switched off, a maximum of 8 min. operational time will be unregistered.

Name

ASCII: **ALIAS**	DRIVE 0 Unit: - Range: max 8 ASCII chars.	Valid for all OPMODES

Here you can assign a name (8 chars max.) to the servo amplifier (e.g. X-AXIS). This makes it easier for you to associate the servo amplifier with a function within the system. The name is displayed in the setup software in the title bar of every screen page. In offline mode the name is an indication of the origin of the currently active data set.

Set Software-Enable on Bootup

ASCII: **AENA**	Default: blanks Unit: - Range: 0,1	Valid for all OPMODES

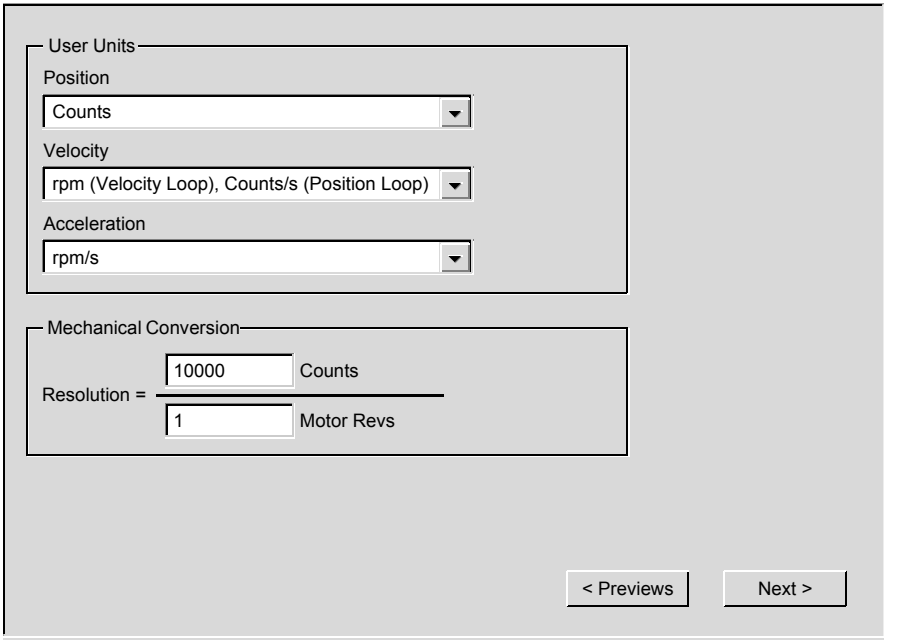
Select this option to enable the setup software when the servo amplifier is started. When using a digital setpoint (OPMODE=0, 2, 4 to 8), the software enable is set to the same state as AENA at power-on.

4.2 Screen page "Units/Mechanical"

Overview of "Units/Mechanical"

At a Glance

The Units/Mechanical page enables you to preselect the user units for all input fields in the setup software:



Position

ASCII: **PUNIT**	Default: 0 Unit: - Range: 0 - 13	Valid for all OPMODES

Definition of the global unit for all parameters dependent on position. The possible settings are as follows:

ID	Units	Note
0	Counts	Internal unit (specific application)
1	dm	unit=1 dm
2	cm	unit=1 cm
3	mm	unit=1 mm
4	100 µm	unit=0.1 mm
5	10 µm	unit=0.01 mm
6	µm	unit=1 µm
7	100 nm	unit=0.1 µm
8	10 nm	unit=0.01 µm
9	nm	unit=1 nm
10	100 nm	unit=0.1 nm
11	inch	unit=1"
12	mils	unit=1mils
13	degree	unit=1°

With the pulse counts setting, no path or distance unit can be displayed. In this case, it is possible to implement units specific to the application. These then depend solely on the resolution (See *Resolution, p. 90*) used.

Velocity

ASCII: **VUNIT**	Default: 0 Unit: - Range: 0 - 8	Valid for all OPMODES

Definition of the global unit for velocity and speed. This unit applies to all parameters, depending on the velocity/speed of the speed/position controller.

ID	Units	Note
0	Compatibility mode	Definition of speed in min^{-1}, definition of velocity in m/s
1	1/min	unit=min^{-1}
2	rad/s	unit=radians/s
3	°/s	unit=degrees/s
4	Pulses/250 µ s	unit=Pulses/250 µs
5	PUNIT/s	unit=PUNIT/s
6	PUNIT/min	unit=PUNIT/Min
9	1000*PUNIT/s	unit=1000*PUNIT/s
8	1000*PUNIT/min	unit=1000*PUNIt/Min

Note: 1. All parameters that are dependent on speed are normally defined in the form of fixed point numbers over 32 bits (with 3 decimal places). This is why many parameters (in particular 1000*PUNIT/s), cannot cover the entire speed range, according to the selected resolution. It is therefore necessary to make sure a suitable unit is selected, according to the application.
2. All parameters that are dependent on velocity are normally defined in the form of integers over 32 bits. This is why it is impossible to define a speed using a decimal number, particularly for Pulses/250 µs. settings. It is therefore necessary to make sure a suitable unit is selected, according to the application.

Acceleration

ASCII: **ACCUNIT**	Default: 0 Unit: - Range: 0 - 5	Valid for all OPMODES

Definition of the dimension unit for acceleration. This unit is used for the ramps of the path generator (internal motion blocks, OPMODE 8) and for the braking and acceleration ramps in velocity mode.

ID	Function	Note
0	ms->VLIM	Acceleration expressed in rise time (ms) to reach the desired speed
1	rad/s^2	Acceleration expressed in rad/s^2
2	rpm/s	Acceleration expressed in min^{-1} /s (rpm per sec)
3	PUNIT/s^2	Acceleration expressed in PUNIT/s^2
4	1000*PUNIT/s^2	Acceleration expressed in 1000*PUNIT/s^2
5	10^6*PUNIT/s^2	Acceleration expressed in 10^6*PUNIT/s^2

With the setting ms -> VLIM, it remains possible to select acceleration for the motion block in mm/s^2. If the setting is changed, all related braking and acceleration settings are converted internally in the unit currently selected.

The automatic adjustment of the parameters does not apply to internal motion blocks. The unit used for acceleration must therefore be defined before the first motion block is created. In the event of later modification, the acceleration and braking values for all motion blocks must be verified, and any necessary corrections made.

Note: If this parameter is changed the ACC, ACCR, DEC, DECR, DECSTOP, DECDIS parameters are updated (See *Introduction to the "Velocity Loop" screen, p. 117* for more information.) On the contrary, the motion tasks are not refreshed. So, before defining a motion task ACCUNIT has to be set in right manner. If ACCUNIT is changed later, all motion tasks have to be proofed or changed!

Resolution

ASCII: **PGEARI**	Default: 10000 Unit: µm Range: Long integer	Valid for all OPMODES
ASCII: **PGEARO**	Default: 1 Unit: µm Range: Long integer	Valid for all OPMODES

The PGEARI pararameter is used in conjunction with the PGEARO parameter to convert the internal position and speed from increments into user-defined units. The PGEARI parameter contains the number of user-defined units that are counted at PGEARO turns. The user decides which unit is used by the formula PGEARI/ PGEARO.

Example 1: If a band-conveyer moves 3cm by one turn of the rotor shaft and the operator wants to use the unit mm, the value of PGEARI/PGEARO must be 30000. It is advisable to set PGEARI=30000 and PGEARO=1. The position can now be adjusted in mm.If a gearing is connected previous to the band-conveyer with a ratio of 3:1, the user needs to set PGEARO=3. Odd-numbered values of the ratio are also possible (for example, 2.5:1). To do this, PGEARI must be multiplicated by 2 and PGEARO by 5.

Example 2: A motion task should be driven by a certain speed. Therefore Bit 13 of the motion task controllword o_c has to be set on 1. For that purpose the parameter o_v describes the target speed in the user-defined unit/sec. To get the target speed in SI-units use the following formula: o_v=10000; PGEARI=1000, PGEARO=1 n [rev*sec^-1] = o_v / (PGEARI/PGEARO).

PRBASE

ASCII: **PRBASE**	Default: 20 Unit: - Range: 1 - 32	Valid for all OPMODES

The parameter PGEARO is used in conjunction with the PGEARI parameter to convert the control loop position and speed from user-defined units into internal increments.

The PGEARO parameter contains in combination with PRBASE the number of increments that are moved if the path to be moved has a length of PGEARI.

The conversion is made according to the following formula:

Position[increments] = Position[user-defined unit] * PGEARO *2^PRBASE / PGEARI

Velocity[increments/250 µ s] = Velocity[user-defined unit] * PGEARO *2^PRBASE / (PGEARI * 4000)

If PGEARI = PGEARO * 2^PRBASE, then there will be no conversion from user-defined units into increments. In this case, the position and velocity must be given in increments.

Position: 1 turn = 2^PRBASE increments

Velocity: speed [rpm] * 2^PRBASE / (4000 *60)

The Lexium 15 LP works with an internal 64Bit variable for counting the number of turns of the rotor shaft and for the internal position resolution. The upper 32Bit are disposed for counting the number of turns, the lower 32 Bit are acting for the internal position resolution. External controller are working mostly with 32Bit variables. Therefore 32Bit of the 64Bit variable must be copied in an internal 32Bit variable.

PRBASE defines how many Bits of this 32 Bit variable are acting for the position resolution. The remaining Bits are used for counting the number of turns.

PRBASE=20:

20Bits are available for the internal position resolution. With the remaining 12 Bits, the Servostar can count 2^12=4096 =+/-2047 turns.

PRBASE=16:

16Bits are available for the internal position resolution. With the remaining 16 Bits, the Servostar can count 2^12=65536=+/-32767 turns.

Example:

Internal 64Bit variable: : 0x00000012 15E3A455

Number of turns Position

Internal 32Bit variable at PRBASE=20 : 0x01215E3A

Internal 32Bit variable at PRBASE=16 : 0x001215E3

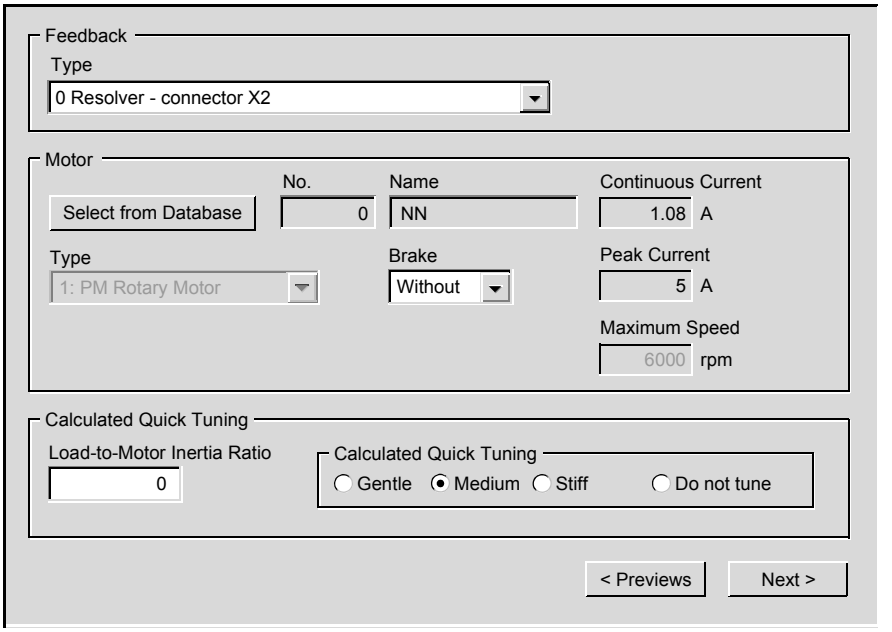
The function is only activated when the amplifier is switched off and then on again. (COLDSTART)PRBASE can be set only via the Terminal Screen.

4.3 Screen page "Motor/Feedback"

Overview of the "Motor/Feedback" screen

At a Glance

This screen page enables a simplified setting of the servo motor-related parameters. The quick setup of these parameters make the tuning of the servo motor/servo drive combination much easier:



Note: This screen page is only available if you choose one of the Quick Setup options from the Drive Setup Wizard.

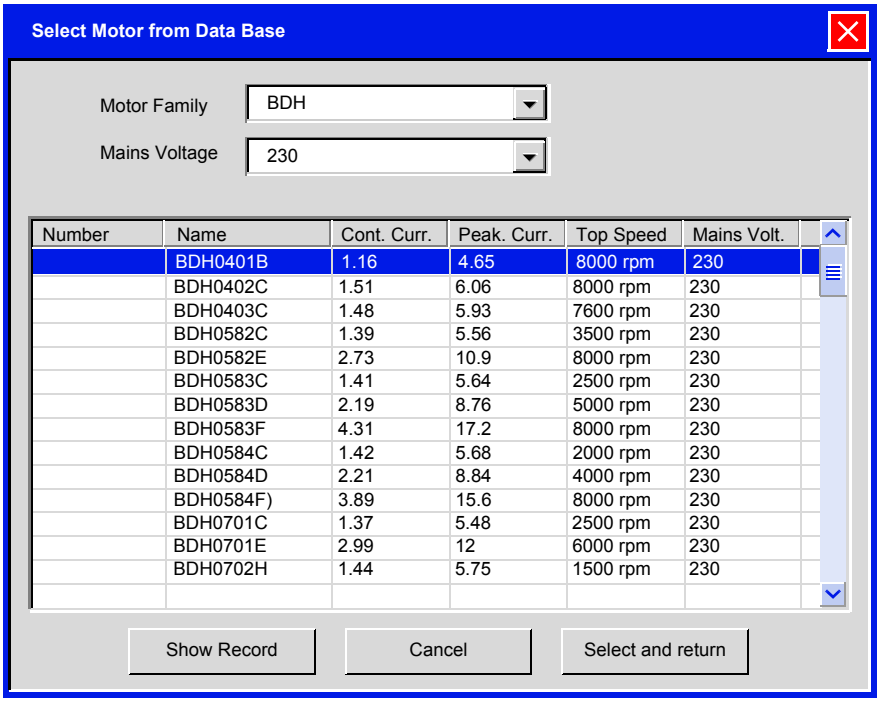
Feedback type

ASCII: **FBTYPE**	Default: 0 Unit: - Range: 0 - 19	valid for all OPMODES

Change this only while the amplifier is disabled, then reset amplifier. See *Feedback type, p. 96* for more information.

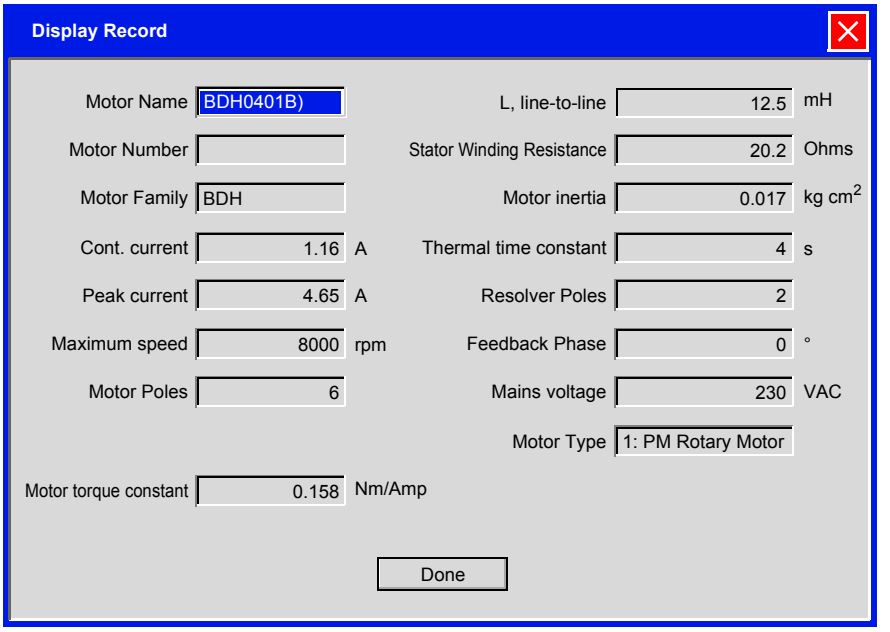
Select from Database

Click **Select from Database** to select a Motorbase Data File (MDB or CSV format) with pre-defined motor-related parameters.



Open the database to show the relevant records.

You can filter the record by Motor Family or by Mains Voltage. You can also view record parameters by clicking **Show Record**.



Select a record and click **Select and Return**. Record data is then sent to the corresponding parameters in the setup software.

Brake

ASCII: **MBRAKE**	Default: 0 Unit: - Range: 0,1	valid for all OPMODES

See Motor screen page (See *Overview of the "Motor" screen, p. 103*).

Load-to-Motor Inertia Ratio

This value is the basis for calculating the velocity loop gain parameter.

Desired Servo Performance

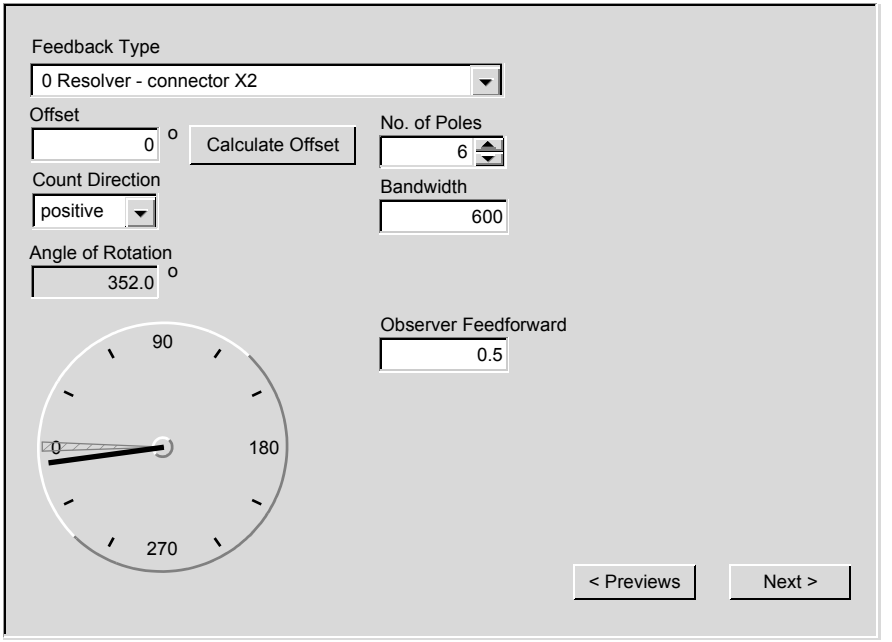
This category is used for calculating some parameters of the current loop. These preferences are used for the tuning of the current loop parameters as close as possible to the needs of your application.

4.4 Screen page "Feedback"

Overview of the "Feedback" screen

At a Glance

This screen enables you to fine-tune the configuration of the feedback sensor on the servo motor:



Feedback type

ASCII: **FBTYPE**	Default: 0 Unit: - Range: 0 - 19	valid for all OPMODES

Change this only while the amplifier is disabled, then reset amplifier.

ID	Function	Comments
0	Resolver	Data is loaded from the servo drive EEPROM via connector X2.
1	SinCos 5V	The value of the MPHASE (See *Offset, p. 97*) parameter is loaded from the servo drive EEPROM.
2	HIPERFACE® (Stegmann)	In the initialization phase, all the data that is loaded from the servo drive is stored in the encoder EEPROM via connector X1. This is: Offset compensation Sine (HISOFFS (See *HISOFFS, p. 98*)) Offset compensation Cosine (HICOFFS (See *HICOFFS, p. 98*)) Amplitude scaling (HIFACT1 (See *HIFACT1, p. 99*)) Motor number (MNUMBER (See *MNUMBER, p. 99*))
3	SinCos 12V	The value of the MPHASE parameter is loaded from the servo drive EEPROM via connector X1.
4	EnDat (Heidenhain)	In the initialization phase, all the data that is loaded from the servo drive is stored in the encoder EEPROM via connector X1. This is: Offset compensation Sine (HISOFFS (See *HISOFFS, p. 98*))) Offset compensation Cosine (HICOFFS (See *HICOFFS, p. 98*)) Amplitude scaling (HIFACT1 (See *HIFACT1, p. 99*)) Motor number (MNUMBER (See *MNUMBER, p. 99*))
5	SinCos with Hall	via connector X1
6	SinCos with Hall	via connector X1
7	SinCos 5V W & S	via connector X1
8	SinCos 12V W & S	via connector X1
9	SSI	via connector X5
10	sensorless	-
11	Hall only	-
12	RS422 & Hall	RS422 feedback device (A quad B) with Hall effect sensor. The parameter MPHASE (See *Offset, p. 97*) can compensate for misalignment of Hall sensors. To compensate for inverted Hall effect sensors, set MPHASE=180.

ID	Function	Comments
13	Digital encoder 5V	The value of the MPHASE (See *Offset, p. 97*) parameter is loaded from the servo drive EEPROM via connector X5.
14	Digital encoder 24V & Hall	via connector X3
15	Digital encoder 5V & Hall	via connector X1
16	Digital encoder 24V & W&S	via connector X3
17	Digital encoder 5V & W&S	via connector X1
18	Digital encoder 5V& Hall	via connector X5
19	Digital encoder 5V & W&S	via connector X5

Offset

ASCII: **MPHASE**	Default: 0° Unit: Electrical degrees Range: 0 - 360	valid for all OPMODES

Compensates for a mechanical position error of the resolver/encoder in the motor. Change this only while the amplifier is disabled. If an encoder with EnDat or Hiperface® is used as a feedback unit, the offset is automatically transmitted to the servo amplifier while the system is booting.

⚠ DANGER

An incorrect setting can cause the motor to run away, (even with an 0V setpoint).

Failure to follow this instruction will result in death or serious injury.

HICOFFS

ASCII: **HICOFFS**	Default: 0 Unit: mV Range: -1000 - 1000	valid for all OPMODES

The HICOFFS command sets the offset correction (in mV) for the cosine signal of the incremental track.

The command is only available when a sin/cos encoder has been selected as the feedback device (FBTYPE=2,4,7). Depending on the type of encoder used, the HICOFFS setting is stored in the EEPROM of the encoder (FBTYPE=2,4, command HSAVE).

When using an encoder without a parameter channel (FBTYPE=7), and thus without an internal EEPROM, this setting will be saved in the EEPROM of the amplifier (command SAVE).

HISOFFS

ASCII: **HISOFFS**	Default: 0 Unit: mV Range: -1000 - 1000	valid for all OPMODES

The HISOFFS command sets the offset correction (in mV) for the sine signal of the incremental track.

The command is only available when a sin/cos encoder has been selected as the feedback device (FBTYPE=2,4,7). Depending on the type of encoder used, the HISOFFS setting is stored in the EEPROM of the encoder (FBTYPE=2,4, command HSAVE).

When using an encoder without a parameter channel (FBTYPE=7), and thus without an internal EEPROM, this setting will be saved in the EEPROM of the amplifier (command SAVE).

HIFACT1

ASCII: **HIFACT1**	Default: 16384 Unit: - Range: 12000 - 19000	valid for all OPMODES

The HIFACT1 command sets the amplitude scaling for the sine signal of the absolute track (SinCoder). The amplitude scaling is for the value 16384 = 1.

The command is only available when a sin/cos encoder has been selected as the feedback device (FBTYPE=2,4,7). Depending on the type of encoder used, the HIFACT1 setting is stored in the EEPROM of the encoder (FBTYPE=2,4, command HSAVE).

When using an encoder without a parameter channel (FBTYPE=7), and thus without an internal EEPROM, this setting will be saved in the EEPROM of the amplifier (command SAVE).

MNUMBER

ASCII: **MNUMBER**	Default: 0 Unit: - Range: Integer	valid for all OPMODES

The command "MNUMBER nr" is used to load a motor data set with the number "nr" from the motor database.

If MNUMBER 0 is entered, then no data set will be loaded, but the variable MNUMBER will simply be set to 0.

This setting indicates a customer-specific motor data set.

Number of poles

ASCII: **MPOLES**	Default: 6 Unit: Poles Range: 0, 2, 4, 6,...256	Valid for all OPMODES

Select the number of motor poles. The current setpoint can be set for the operation of 2-pole to 32-pole motors. Change this only while the drive is disabled.

Count Direction

ASCII: **DIR**	Default: 21 Unit: - Range: 0 - 128	valid for OPMODES

This fixes the count direction of the motor shaft in reference to the polarity of the setpoint. Changing this value will affect Bit 0 of ASCII command DIR.

Positive = count direction CW = DIR Bit 0 set

Negative = count direction CCW = DIR Bit 0 reset

The DIR variable defines the count direction for feedback information.

The DIR variable can be considered as a 16-bit variable, whereby each single bit defines the count direction for different feedback units.

Setting a bit means a positive direction (cw), resetting a bit a negative direction (ccw).

- Bit 0 (0x01) count direction for FBTYPE unit (=1 positive direction)
- Bit 1 (0x02)
- Bit 2 (0x04) count direction for EXTPOS unit (=1 positive direction)
- Bit 3 (0x08)
- Bit 4 (0x10) count direction for GEARMODE unit (=1 positive direction)
- Bit 5 (0x20)
- Bit 6 (0x40) =1 inverse commutation

Make changes only while the amplifier is disabled and reset it (COLDSTART). This parameter is not available if a SERCOS interface is built-in.

After changing the count direction the hardware limit switches have to be exchanged.

Bandwidth

ASCII: **MRESBW**	Default: 300 Unit: mH Range: 50 - 2000	valid for all OPMODES

With a wide bandwidth, the drive will respond more rapidly to control-loop deviations => smaller following error. A very wide bandwidth only makes sense with low moments of inertia, low KP, and very high values of acceleration. A narrower bandwidth produces a filter effect. The speed and positional control are smoother (the encoder emulation is quieter as well).

Angle of Rotation

ASCII: **PRD**	Default: - Unit: Counts Range: 0 - 1048575	valid for all OPMODES

Displays the actual angle of rotation of the motor (only for speeds n < 20rpm) in °mech, with the counts referred to the mechanical zero point of the measuring system.

Observer Feedforward

ASCII: **VLO**	Default: 0.5 Unit: - Range: 0 - 30	valid for all OPMODES

This parameter generates a dynamic pre-control for the detection of current values (Luenberger observer), in particular for resolver feedback. It reduces phase slippage in the detection of the current value, so improving the stability of the speed control. For VLO = 1, the pre-control is optimal; for VLO = 0, the action is suppressed.

4.5 Screen page "Motor"

Screen page "Motor"

At a Glance

Overview of the different field values included in the "Motor" screen pages.

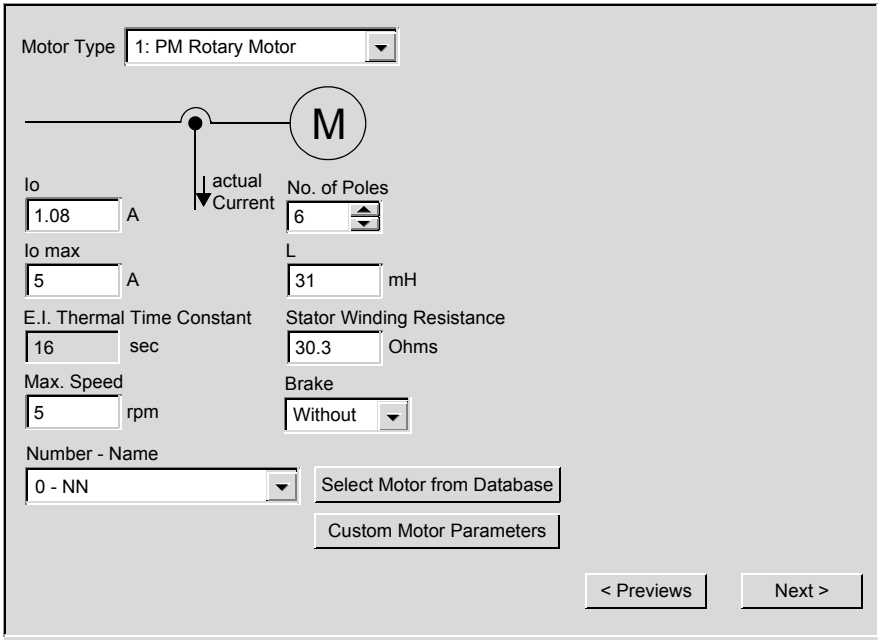
What's in this Section?

This section contains the following topics:

Overview of the "Motor" screen

At a Glance

All parameters that appear on this screen page are defined by the default values of the servo motor (internal database of drive). Most of the time, it is not necessary to modify them:



Motor type

ASCII: **MTYPE**	Default: 1 Unit: - Range: 1-4	Valid for all OPMODES

This parameter enables us to distinguish between synchronous rotary servo motors (MTYPE = 1) and synchronous linear (MTYPE = 2) servo motors.

Io

ASCII: **MICONT**	Default: servo drive continuous current Unit: Amperes Range: 10%...2* of continuous current	Valid for all OPMODES

The standstill current is the RMS current value that the servo motor requires at standstill to produce the standstill torque (defines the maximum value for the entry of Irms in the current controller).

Number of poles

ASCII: **MPOLES**	Default: 6 Unit: Poles Range: 0, 2, 4, 6,...256	Valid for all OPMODES

Select the number of motor poles. The current setpoint can be set for the operation of 2-pole to 32-pole motors. Change this only while the drive is disabled.

Io max

ASCII: **MIPEAK**	Default: servo drive peak current Unit: Ampere Range: 10%...2* of peak current	Valid for all OPMODES

In this field, set the maximum (peak) current. The peak current (RMS value) should not exceed four times the rated current of the servo motor. The actual value is also determined by the servo drive's peak current that is used (defines the maximum value for the entry of Ipeak in the current loop).

L

ASCII: **M**	Default: 1 mH Unit: mH Range: -	Valid for all OPMODES

In this field, set the inductance of the servo motor (phase-phase) You can take this value from the motor manual.

EL Thermal Time Constant

ASCII: **MTIME**	Default: 16 Unit: s Range: 1 - 600	Valid for all OPMODES

Motor-dependent time constant. This value is used to calculate the MIT2 value of the servo motor.

Stator Winding Resistance

ASCII: **MRS**	Default: 1 Unit: Ohm Range: 1 - 100	Valid for all OPMODES

The parameter describes the stator winding resistance phase-phase in Ohm.

Max. speed (n max)

ASCII: **MSPEED**	Default: 3000 rpm Unit: rpm Range: 0.0 - 12000.0	Valid for all OPMODES

Maximum authorized speed for the motor. Limit the possible entries for the VLIMP, VLIMN, and 5/6*VOSPD parameters in the Velocity Loop (See *Introduction to the "Velocity Loop" screen, p. 117*) screen page.

Number - Name

ASCII: **MDBLIST**	Default: - Unit: - Range: -	valid for all OPMODES

Select the desired motor from the motor database. The MDBLIST command returns the list of contents for the motor database (for the present combination of output stage + feedback). One motor database entry is displayed per line on the screen, in the following format: motor name, motor number, motor family, amplifier designation. The data is loaded once the motor has been selected.

If an encoder is used as a feedback device, the motor number will automatically be reported to the servo drive. Change this only while the drive is disabled.

Holding brake

ASCII: **MBRAKE**	Default: 0 Unit: - Range: 0,1	valid for all OPMODES

If you want to operate a 24 V holding brake in the motor directly from the servo drive, this parameter enables you to activate the brake function:

ID	Function	Meaning
0	Without	The brake function is disabled
1	With	If the brake function is enabled, then the output at the BRAKE (X9/2) terminal will be 24V if the ENABLE signal is present (brake off) and 0 V if the ENABLE signal is missing (brake activated).

See the Lexium 15 servo drive installation guides for the time/function relationship between the ENABLE signal, the speed setpoint, the speed value, and the braking force. This value should only be changed while the drive is disabled and should be followed by a reset.

⚠ WARNING

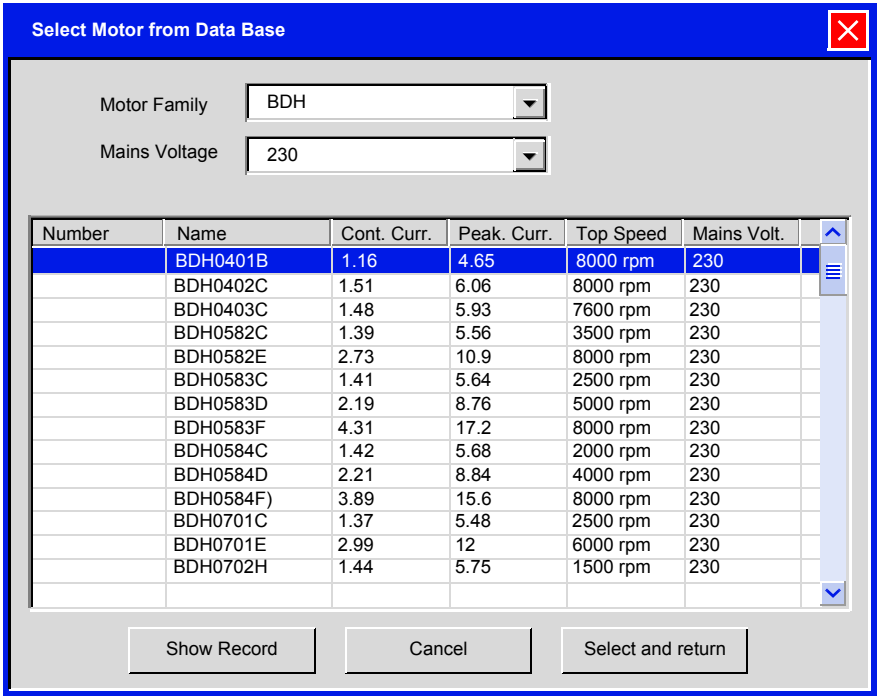
STATEMENT OF HAZARD

The holding brake function of the Lexium 15 LP does not ensure personnel safety. Operation of the brake in a manner that provides personnel safety requires an additional "make" contact in the brake circuit, and a suppressor device, such as a varistor, for the brake circuit. (See Lexium 15 LP Installation manual.).

Failure to follow this instruction can result in death, serious injury, or equipment damage.

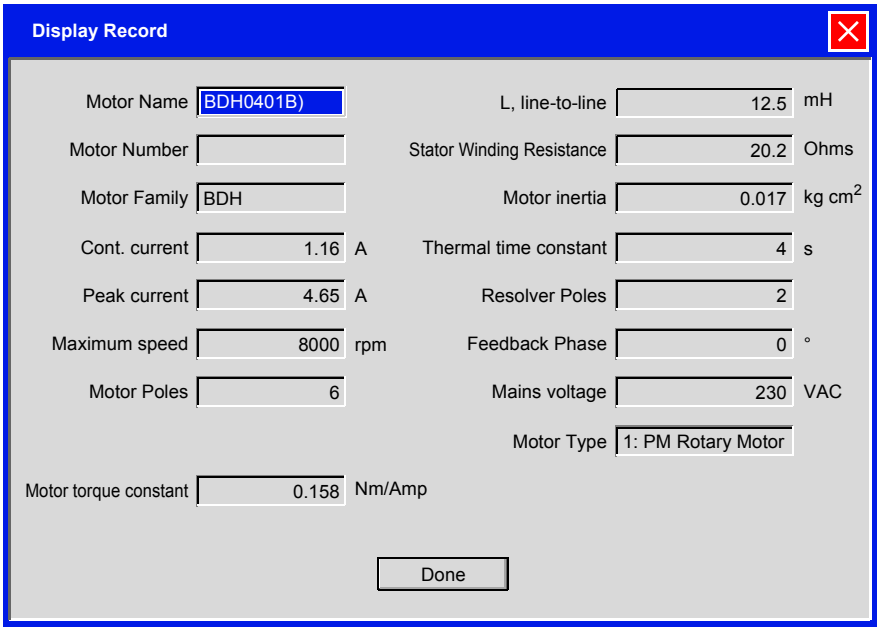
Select from Database

Click **Select from Database** to select a Motorbase Data File (MDB or CSV format) with pre-defined motor-related parameters.



Open the database to show the relevant records.

You can filter the record by Motor Family or by Mains Voltage. You can also view record parameters by clicking **Show Record**.



Select a record and click **Select and Return**. Record data is then sent to the corresponding parameters in the setup software.

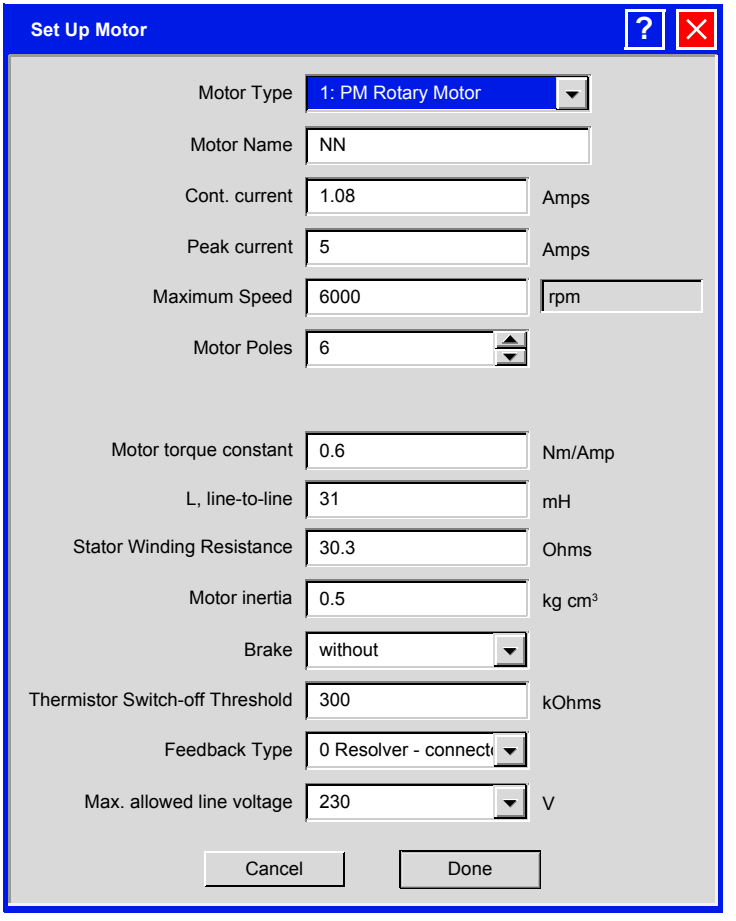
Custom Motor Parameters

Click **Custom Motor Parameters** to set parameters for a custom-specific motor. For more information, see *Overview of the "Set Up Motor" Screen, p. 109*

Overview of the "Set Up Motor" Screen

At a Glance

This screen enables you to set parameters for a customer-specific motor:



Motor type

ASCII: **MTYPE**	Default: 1 Unit: - Range: 1-2	Valid for all OPMODES

MTYPE sets the drive control algorithms to different motor types as follows:

MTYPE	**Meaning**
1	Permanent Magnet Rotary Servo Motor
2	Permanent Magnet Linear Servo Motor

Motor Name

ASCII: **MNAME**	Default: blank Unit: - Range: max 12 ASCII chars.	Valid for all OPMODES

The MNAME parameter is directly related to the motor number MNUMBER. If a customer-specific motor designation is to be defined, then this can be done with the MNAME command. When the motor name is altered, the motor number (MNUMBER) is set to 0, to indicate a customer-specific motor data set.

Io

ASCII: **MICONT**	Default: servo drive continuous current Unit: Amperes Range: 10%...2* of continuous current	Valid for all OPMODES

The standstill current is the RMS current value that the servo motor requires at standstill to produce the standstill torque (defines the maximum value for the entry of Irms in the current controller).

Io max

ASCII: **MIPEAK**	Default: servo drive peak current Unit: Ampere Range: 10% - 2* of peak current	Valid for all OPMODES

In this field, set the maximum (peak) current. The peak current (RMS value) should not exceed four times the rated current of the servo motor. The actual value is also determined by the servo drive's peak current that is used (defines the maximum value for the entry of Ipeak in the current loop).

Max. speed (n max)

ASCII: **MSPEED**	Default: 3000 rpm Unit: rpm Range: 0.0 - 12000.0	Valid for all OPMODES

Maximum authorized speed for the motor. Limit the possible entries for the VLIMP, VLIMN, and 5/6*VOSPD parameters in the Velocity screen page.

Number of poles

ASCII: **MPOLES**	Default: 6 Unit: Poles Range: 0, 2, 4, 6,...256	Valid for all OPMODES

Select the number of motor poles. The current setpoint can be set for the operation of 2-pole to 32-pole motors. Change this only while the drive is disabled.

Motor Torque Constant

ASCII: **MKT**	Default: 1.0 Unit: - Range: 0.0 - 10.0	Valid for all OPMODES

Use this parameter to set the torque constant of the motor in Nm/A. This parameter is used for sensorless control. You can check the value using the following equation: Kt = 60 * SQRT (3) * Ui / (2 * PI * n, where Ui is the induced voltage of the motor, and n is the actual rotor velocity.

L, line-to-line

ASCII: **ML**	Default: 1 Unit: mH Range: 0 - 100	Valid for all OPMODES

Use this parameter to set the stator inductance between phase and phase in mH.

Stator Winding Resistance

ASCII: **MRS**	Default: 1 Unit: Ohm Range: 1 - 100	Valid for all OPMODES

The parameter describes the stator winding resistance phase-phase in Ohm.

Motor Inertia

ASCII: **MJ**	Default: 3 Unit: kgcm^2 Range: 0.01 - 1000	Valid for all OPMODES

Use this parameter to set the motor inertia.

Holding brake

ASCII: **MBRAKE**	Default: 0 Unit: - Range: 0,1	valid for all OPMODES

If you want to operate a 24 V holding brake in the motor directly from the servo drive, this parameter enables you to activate the brake function:

ID	Function	Meaning
0	Without	The brake function is disabled
1	With	If the brake function is enabled, then the output at the BRAKE (X9/2) terminal will be 24V if the ENABLE signal is present (brake off) and 0 V if the ENABLE signal is missing (brake activated).

See the Lexium 15 LP Servo Drive Installation Guide for the time/function relationship between the ENABLE signal, the speed setpoint, the speed value, and the braking force. This value should only be changed while the drive is disabled and should be followed by a reset.

⚠ WARNING

ELECTRICAL HAZARD

The holding brake function of the Lexium 15 LP does not ensure personnel safety. Operation of the brake in a manner that provides personnel safety requires an additional "make" contact in the brake circuit, and a suppressor device, such as a varistor, for the brake circuit. (See Lexium 15 LP Installation manual.)

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Thermistor Switch-off Threshold

ASCII: **MAXTEMPM**	Default: 300 Unit: Ohm (Kohms) Range: 0.0 - 6000.0	Valid for all OPMODES

The temperature at which the motor switches off (defined by the resistance in kohms).

Feedback type

ASCII: **FBTYPE**	Default: 0 Unit: - Range: 0 - 19	valid for all OPMODES

Change this only while the amplifier is disabled, then reset amplifier. See *Feedback type, p. 96* for more information.

Mains Voltage

ASCII: **VBUSBAL**	Default: 1 Unit: -/Volt Range: 0 - 870	Valid for all OPMODES

This parameter is used to adjust the regen and switch-off levels of the servo amplifiers to suit the mains power supply voltage or the system conditions for multi-axis systems with parallel-connected DC-link circuits.

ID	Max. Mains Voltage	DC-link voltage (rated motor voltage / max. motor voltage)
1	230 V	310 V / 430 V
2	400 V	560 V / 750 V
3	480 V	675 V / 870 V

Single amplifier:

usually the setting taken is the mains supply voltage that is actually available. If the motor has a higher voltage rating than the DC-link voltage that occurs as a result of the available mains supply voltage, then you can raise the regen and switch-off levels by selecting the max. mains voltage that is permissible for the motor (see previous table).

Multi-axis systems with parallel-connected DC-link circuits:

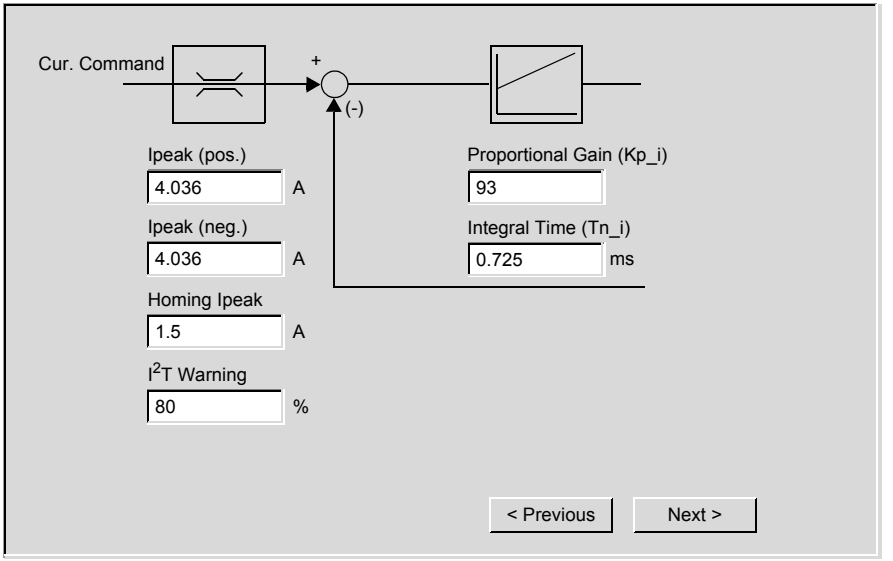
in a system, the DC-link circuits of the servo amplifiers are usually connected in parallel (DC-bus). If motors with differing voltage ratings (which must be as high or higher than the actual DC-link voltage) are used, then each amplifier on the DC-bus must be set up for the motor with the lowest rated voltage. If the settings are not all the same, then the desired distribution of the regen power will not be achieved.

4.6 Screen page "Current Loop"

Overview of the "Current Loop" screen

At a Glance

This screen page contains the parameters for tuning the current loop:



Cycle time of the current controller: 62.5 µs

Ipeak (pos.)

ASPCII: **IPEAK**	Default: IMAX Unit: Amperes Range: 0 - DIPEAK	valid for all OPMODES

Sets the positive servo motor peak current (r.m.s. value).

Ipeak (neg.)

ASPCII: **IPEAK**	Default: IMAX Unit: Amperes Range: 0 - DIPEAK	valid for all OPMODES

Sets the negative servo motor peak current (r.m.s. value).

Homing Ipeak

ASPCII: **REFIP**	Default: min(IPEAK,IPEAKN,DICONT/2) Unit: Amperes Range: 0.0 - min(IPEAK,IPEAKN)	valid for all OPMODES

Sets the peak current for homing to a stop. When Homing mode 7 is started (homing to a stop and searching for a zero mark), IPEAK, the normal value for peak current, is set to the value REFIP. When the homing movement is finished, the IPEAK parameter is reset to the previous (normal) value.

I^2t warning

ASCII: **I2TLIM**	Default: 80% Unit: % Range: 0 - 100	valid for all OPMODES

Sets the level, as a percentage value of the r.m.s. current, above which a message will be sent to a logic output (OxMODE=11). A warning, n01, appears in the display. If the I2TLIM value is too low, the message appears too soon and the drive is not fully utilized. If the I2TLIM value is too high, limiting occurs at the same time as the message.

Proportional Gain (Kp_i)

ASCII: **MLGQ**	Default: 1 Unit: - Range: 0.01 - 15.0	valid for all OPMODES

Determines the proportional gain of the current controller. Rule: at KP=1 and at a control deviation **I_cmd -I_act = peak armature current,** the rated motor voltage will be output.

Integral Time (Tn_i)

ASCII: **KTN**	Default: 0.6 ms Unit: ms Range: 0.2 - 2	valid for all OPMODES

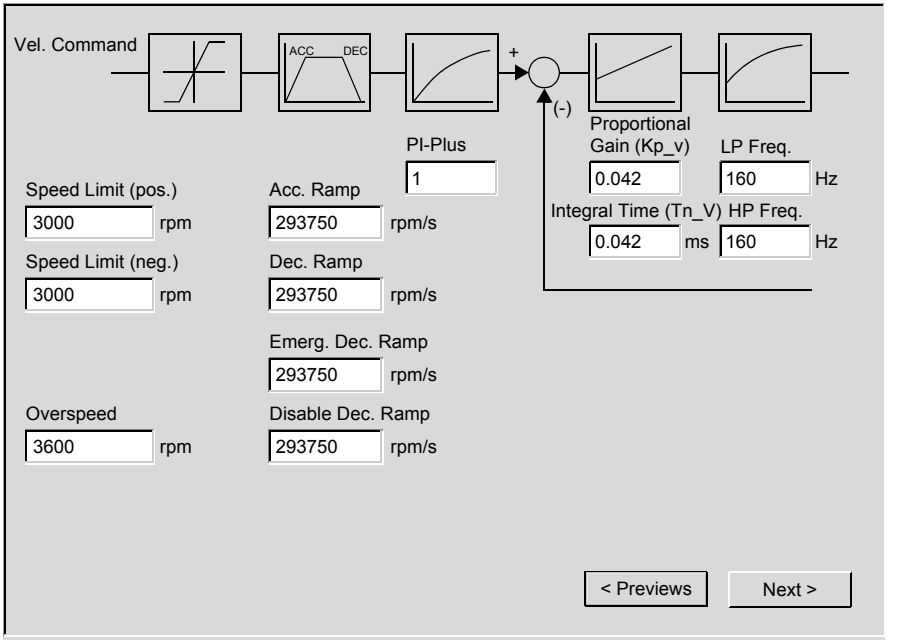
Determines the integral-action time (integration time constant) of the current controller.

4.7 Screen page "Velocity Loop"

Introduction to the "Velocity Loop" screen

At a Glance

This screen page contains parameters for tuning the velocity loop:



If the motor dataset is correct, you will not need to make changes here.

Cycle time of the speed controller: 250 µs

Speed Limit (pos.)

ASCII: **VLIMP**	Default: 3000 rpm Unit: rpm Range: 0.0 - MSPEED	valid for OPMODES 0+1

Sets the maximum velocity for the positive direction (velocity control loop) in units defined by VUNIT to limit the servo motor speed. When used with the VLIMN parameter, it sets a directionally-dependent rotational velocity limit for the servo motor. The maximum value also depends on the servo motor and feedback sensor used.

SpeedLimit (neg.)

ASCII: **VLIMN**	Default: 3000 rpm Unit: rpm Range: 0.0 - MSPEED	valid for OPMODES 0+1

Sets the maximum velocity for the negative direction (velocity control loop) in units defined by VUNIT. When used with the VLIMP parameter, it sets a directionally-dependent rotational velocity limit for the servo motor. The maximum value also depends on the servo motor and feedback sensor used.

Note: The VLIMN parameter must always be positive. The negative direction, and therefore the negative sign of this value, is implicitly attributed by the software.

Overspeed

ASCII: **VOSPD**	Default: 3600 rpm Unit: rpm Range: 0.0 - 1.2*MSPEED	valid for OPMODES

Determines the upper limit of the motor speed. If this limit is exceeded, the servo amplifier switches into the overspeed fault condition (error message F08) and its output stage is disabled.

Acc. Ramp

ASCII: **ACC**	Default: 3150 Unit: rpm Range: 3 - 126000	valid for OPMODES 0+1

This parameter gives either the acceleration value or the acceleration time to the speed limit (valid for both directions). The smaller the acceleration value is and the longer the time taken, the smoother and more favorable the acceleration. As long as the ramp time is less than the mechanically limited rise time of the system, the response time of the system will not be negatively affected. The ramp time settings are still effective if the limit-switches are activated.

Dec. Ramp

ASCII: **DEC**	Default: 3150 Unit: rpm Range: 3 - 126000	valid for OPMODES 0+1

This parameter gives either the deceleration value or the deceleration time of the speed limit (valid for both directions). The smaller the deceleration value is and the longer the time taken, the smoother and more favorable the deceleration.

As long as the ramp time is less than the mechanically limited fall time of the system, the response time of the system will not be negatively affected. In most cases the Acc. ramp and the Dec. ramp can be set to the same value.

The ramp time settings are still effective if the limit-switches are activated.

Velocity Standstill Threshold

ASCII: **VEL0)**	Default: 5 Unit: rpm Range: -	valid for all OPMODES

The VEL0 (Velocity "0") parameter defines the velocity threshold (in RPM) for the standstill signal. The standstill signal is required for the following functions:

1. Standstill signal in the status register DRVSTAT.

2. If the brake is configured (MBRAKE=1), then, if the output stage is disabled, first of all the velocity is reduced to 0, and the brake is only applied after the velocity has fallen below the standstill threshold.

3. If the ACTFAULT option is activated (active braking in the event of a fault), or the STOPMODE option (active braking if the output stage is disabled), then the standstill threshold defines the velocity below which the output stage will actually be disabled.

The Velocity Standstill Threshold can only be set through the Terminal Screen.

Emerg. Dec. Ramp

ASCII: **DECSTOP**	Default: 3150 Unit: rpm Range: 3 - 126000	valid for OPMODES

The braking ramp for emergency braking. In emergency braking situations, the internal setpoint moves to 0 using the preset DECSTOP ramp. The output stage is only disabled when the actual velocity has fallen below the standstill threshold (VEL0).

Emergency braking occurs in the following situations:
- amplifier fault (with ACTFAULT=1)
- contouring/following error
- threshold monitoring (fieldbus devices)
- contouring/following error
- hardware/software limit switch activated
- emergency stop function through the digital input (INxMODE=27)
- emergency stop function through the fieldbus (control word)

Disable Dec. Ramp

ASCII: **DECDIS**	Default: 3150 Unit: rpm Range: 3 - 126000	valid for OPMODES

When the output stage is disabled (when the hardware or software enable is removed), the internal velocity setpoint is set to 0, using the preset DECDIS ramp. The output stage is only disabled when the actual velocity has fallen below the standstill threshold (VEL0). The DECDIS ramp is only effective for motors with a configured brake (MBRAKE=1) or with the selection STOPMODE=1. With STOPMODE=0 the output stage is immediately disabled, and the drive coasts down.

PI-PLUS

ASCII: **GVFR**	Default: 1 Unit: - Range: 0.0 - 1.0	valid for OPMODES 0+1

This parameter only effects when the I-component is switched on (GVTN0).

With the default setting, the speed controller functions as a standard PI-controller with slight overshoot in the step response. If PI-PLUS is reduced to 0.65, the overshoot is avoided and the actual value approaches the setpoint slowly.

Proportional Gain (KP_v)

ASCII: **GV**	Default: 0.046 Unit: - Range: 0.001 - 369.2	valid for OPMODES 0+1

Determines the proportional gain (also known as AC-gain). Increase the value up to the level where the motor starts to oscillate, and then back it off until the oscillations have clearly stopped.

Integral Time (Tn_v)

ASCII: **GVTN**	Default: 10 ms Unit: ms Range: 0.0,GV/6.25 - 1000.0	valid for OPMODES 0+1

Determines the integration time constant. Smaller motors permit shorter integration times. Larger motors or high moments of inertia in the load usually require integration times of 20 ms or more. With Tn = 0 ms the integral-action component is inactive. If the Tn value is too low, the drive runs roughly or strongly overshoots with high inertia loads. If the Tn value is too high, the drive is too soft.

LP-Freq

ASCII: **ARLPF**	Default: 0 Unit: - Range: 0 - 4000	valid for all OPMODES

Sets the frequency limit for the low pass filter.

HP-Freq

ASCII: **ARHPF**	Default: 1000 Unit: - Range: 0 - 4000	valid for all OPMODES

Sets the frequency limit for the high pass filter.

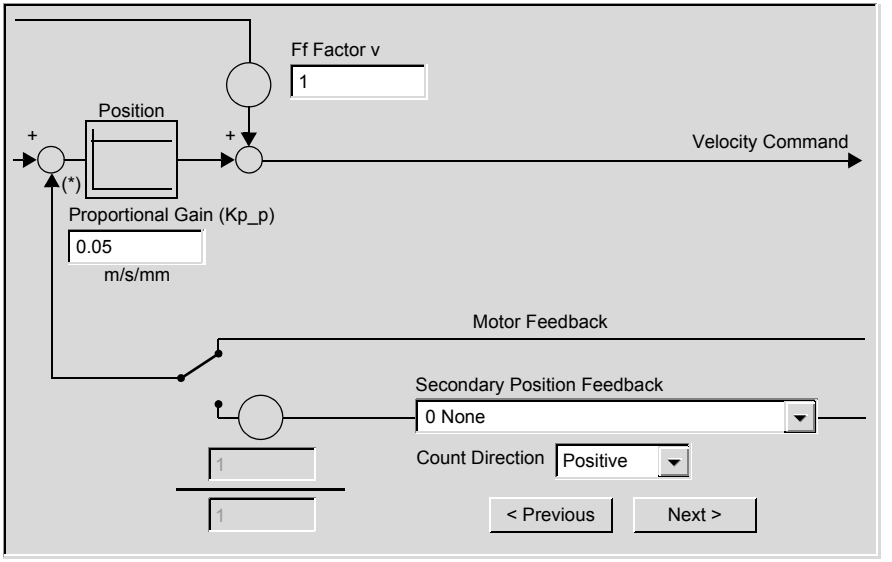
Low pass and high pass filters are described in *Overview of the "Bode plot" screen, p. 248*.

4.8 Screen page "Position Loop"

Overview of the "Position Loop" screen

At a Glance

Define position loop settings, such as whether the position control works with an external feedback system or with the motor-feedback system:



Cycle time of the position controller: 250 µ s

Proportional Gain (Kp_p)

ASCII: **GP**	Default: 0.15 Unit: (m/s)/m Range: 0.1 - 1000	valid for OPMODES 4,5,8

Determines the proportional gain of the position controller. Amplitude: speed in m/s at 1 mm position deviation.

Ff Factor

ASCII: **GPFFV**	Default: 1 Unit: - Range: 0 - 1000	valid for OPMODES 4,5,8

Determines the feed-forward factor for the position controller. Feed-forward is used to ease the task of the position controller. A better setting for the Ff-factor means a better utilization of the dynamic range of the position controller. The most favorable setting (usually about 1.0) depends on factors external to the drive, such as friction, dynamic resistance, and stiffness. If GPFFV is set too low, the drive lags. If GPFFV is set too high, the drive oversteers.

Secondary Position Feedback

ASCII: **EXTPOS**	Default: 0 Unit: - Range: 0 - 24	valid for all OPMODES

If EXTPOS is set to negative values the feedback is read and the position stored in PFB0. The position loop acts with the commutation feedback (FBTYPE). Example: EXTPOS = -6 The sinus/cosinus-Feedback(5V) is read. The position can be monitored by ASCII-command PFB0.

The input of the external feedback is withput in relation to the position control. EGEARI (See *Gear Ratio (nominator), p. 125*) and EGEARO (See *Gear Ratio (denominator), p. 125*) can be used to set the ratio:

- On all analog read position feedbacks EXTPOS=6,7,8,9 the position is calculated by the ENCLINES-setting and converted to the 32Bit/turn -format. The parameter EGEARI/EGEARO is used only for the gearing-factor. On EGEARI-feedback turn the motor makes EGEARO turns. **Example:** EGEARI=10,EGEARO=3 -> ratio 10 : 3
- On all digital read position feedbacks (EXTPOS=1...4) the parameter EGEARI are the numbers of feedback turns which corresponde to EGEARO numbers of motor turns.
  Example: An external digital encoder has 1024 pulses/turn, 1 feedback turn correspond to 3 motor turns. The settings are: EGEARI = 1024, EGEARO = 3

Resolution (denominator)

ASCII: **ENCLINES**	Default: 1000 Unit: - Range: 0 - 65535	valid for all OPMODES

ENCLINES sets the resolution (number of lines) of the sine encoder input channel. In case of rotary Motors it is the number of lines per revolution, in case of linear motors it is the number of lines per pole pitch. The ENCLINES data is stored in an ENDAT or Hiperface Encoder if this feedback is used. In this case during power up process the ENCLINES data is read automatically .

Gear Ratio (nominator)

ASCII: **EGEARO**	Default: 1 Unit: - Range: 0 - Long integer	valid for OPMODES 4 - 8

Sets the number of motor turns for one turn of an external feedback system.

Gear Ratio (denominator)

ASCII: **EGEARI**	Default: 1 Unit: - Range: 1 - Long integer	valid for OPMODES 4 - 8

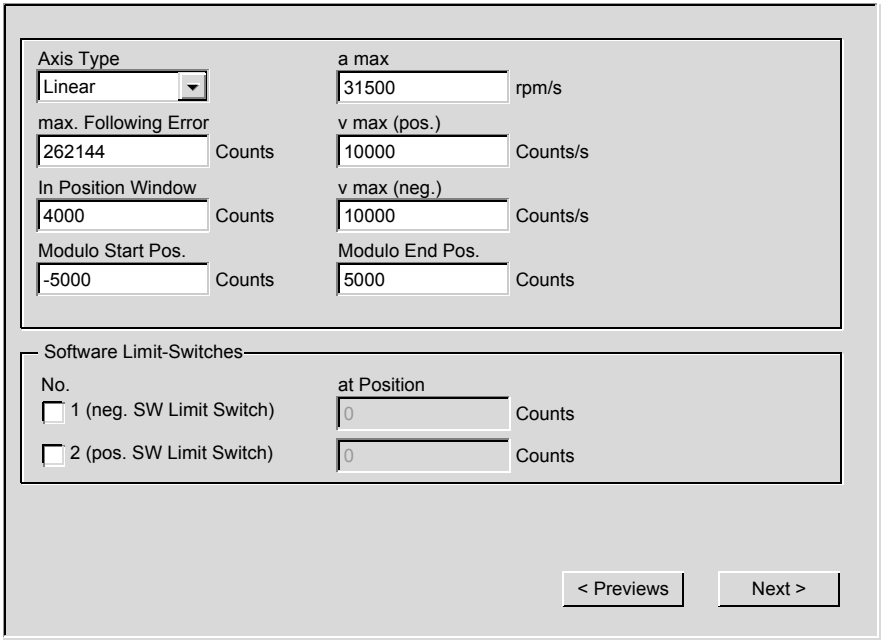
Sets the number of turn pulses for one turn of the external feedback system.

4.9 Screen page "Position data"

Overview of the "Position Data" Screen

At a Glance

This screen enables you to adjust the position control to suit the requirements of your application:



Axis Type

ASCII: **POSCNFG**	Default: 0 Unit: - Range: 0, 1	valid for OPMODE 8

Here you select whether the axis is to be operated as a linear or a modulo axis.

ID	Function	Comments
0	Linear	A linear axis is an axis with a **limited** range of travel. A linear axis moves within the traversing limits that are given by the software limit-switches, both absolutely and relatively. A reference point must be set.
1	Modulo	A modulo axis is an axis with **unlimited** travel. The software limit-switches have no significance in this case. **A modulo axis always makes a relative movement, even if the tasks are entered as absolute ones**. The actual position is set to zero with every start. A reference point is not required.

a max (Accceleration/ Deceleration)

ASCII: **PTMIN**	Default: 31500 Unit: ms or SI units Range: 3 - 126000	valid for OPMODE 8

A drive is always so dimensioned that it can provide more power than the application requires. This parameter determines the limit for the maximum mechanical acceleration time to v_max, that must not be exceeded by the drive. This time is simultaneously valid as the minimum limit for the entry Acceleration" (acceleration time from 0 to v_cmd) and Deceleration (braking time from v_cmd down to 0) for the motion tasks.

Depending on the type of acceleration unit that is configured, you can enter either the acceleration time period or an acceleration value in the drive selected.

max. Following Error

ASCII: **PEMAX**	Default: 262144 Unit: m Range: long integer	valid for OPMODE 4, 5, 8

The following error is the maximum difference (+/- window) between the position setpoint and the actual position that is permitted during processing. If the value leaves this window, then the position controller generates a warning or error message and brakes the drive using the emergency ramp.

v max (pos.) / (neg.)

ASCII: **PVMAXP (positive)**	Default: 10000 Unit: defined by VUNIT Range: 0 - VLIMN	valid for OPMODE 8
ASCII: **PVMAXN (negative)**	Default: 10000 Unit: defined by VUNIT Range: 0 - VLIMN	valid for OPMODE 8

This parameter is used to adjust the maximum speed of movement to suit the limits of the operative machinery. The calculation of the upper setting limit depends on the final limit speed of the drive. The value that is entered is used as a limit for the "v_cmd" entry in the motion tasks. During commissioning, you can limit the speed by using v_max (without changing the setting for the motion blocks). A lower value of v_max overrides the v_cmd of the motion tasks.

In Position Window

ASCII: **PEINPOS**	Default: 4000 Unit: defined by PUNIT Range: Long integer	valid for OPMODES 4,5,8

Sets the InPosition window. Determines at which distance from the set position the "InPosition" message should be reported.

modulo start pos.

ASCII: **SRND**	Default: -5000 Unit: - Range: -	Valid for OPMODES 4, 5, 8

This parameter is used to define the initial setting of the motion range for a modulo axis.

modulo end pos.

ASCII: **ERND**	Default: 5000 Unit: - Range: -	Valid for OPMODES 4, 5, 8

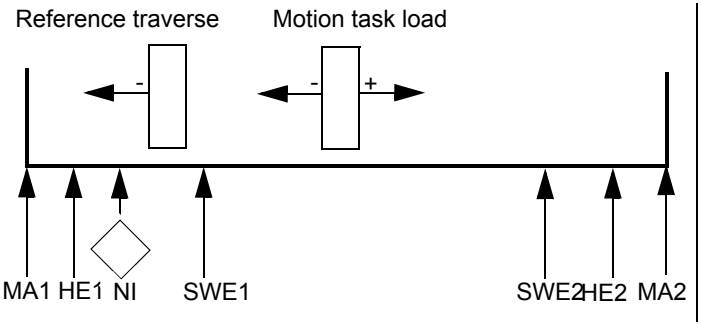
This parameter is used to define the end setting of the motion range for a modulo axis.

Software Limit Switches

The software limit-switches from part of the monitoring functions of the position controller.

SW limit-switch 1	The monitoring checks whether the actual position value is lower than the preset value; the negative direction of travel is now inhibited. You have to leave limit-switch 1 by moving in the positive direction.
SW limit-switch 2	The monitoring checks whether the actual position value is higher than the preset value; the positive direction of travel is now inhibited. You have to leave limit-switch 1 by moving in the negative direction.

The drive brakes with the emergency ramp, and remains at standstill under torque. The principle of positioning the software limit-switch can be seen in the diagram below:



Legend
MA1: Machine stop, left
HE1: Hardware limit switch, left
NI: Zero pulse initiator (reference)
SWE1: Software limit switch 1
SWE2: Software limit switch 2
HE2: Hardware limit switch, right
MA2: Machine stop, right
+: Positive count direction
-: Negative count direction

ASCII: **SWCNFG** (enabled)	Default: 0 Unit: - Range: 0 - 65536	valid for all OPMODES
ASCII: **SWEx** (position)	Default: 0 Unit: - Range: Long integer	valid for all OPMODES

4.10 Registration

Registration (LATCH)

At a Glance

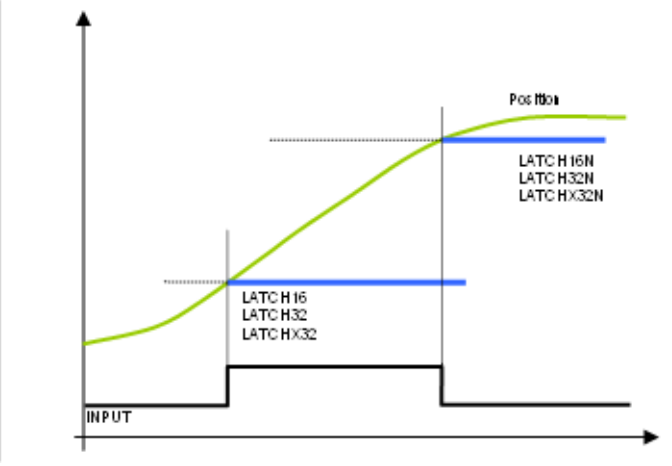
This servo drive function enables position measure captures in a internal register. registration is triggered by a configured digital input. Capture can be performed in either a rising edge or a falling edge:

	Motor encoder	External encoder
Rising edge	LATCH16 LATCH32	LATCHX16 LATCHX32
Falling edge	LATCH16N LATCH32N	LATCHX16N LATCHX32N

For more information, see Digital Edge (See *Digital I/O Overview, p. 158*).

Configuring LATCH

The value registered may be used in a motion task to execute a relative move.



LATCH Commands

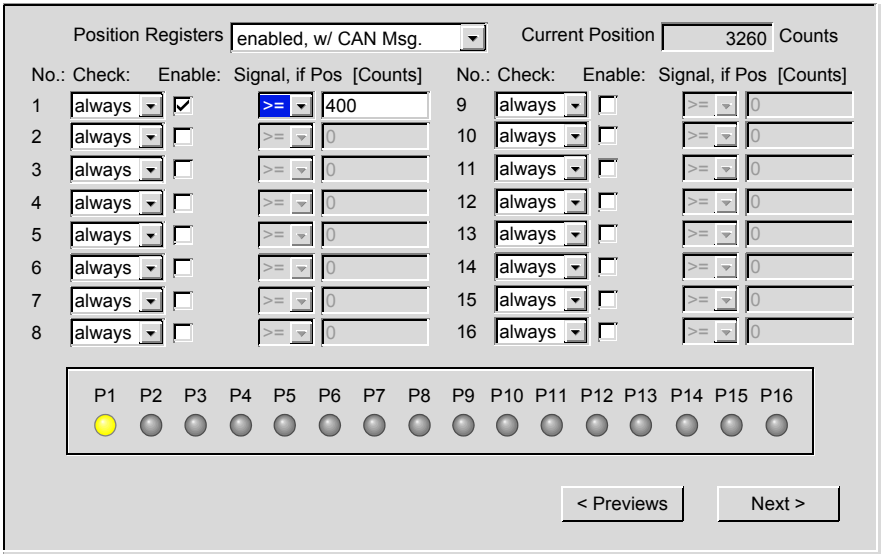
LATCH Commands	Short description
EXTLATCH	Selection of the Source of the Latch Inputs
LATCH16	Latched 16-bit Position (positive edge)
LATCH16N	Latched 16-bit Position (negative edge)
LATCH32	Latched 32-bit Position (positive edge)
LATCH32N	Latched 32-bit Position (negative edge)
LATCHX16	Latched external 16-bit Position (positive edge)
LATCHX16N	Latched external 16-bit Position (negative edge)
LATCHX32	Latched external 32-bit Position (positive edge)
LATCHX32N	Latched external 32-bit Position (negative edge)

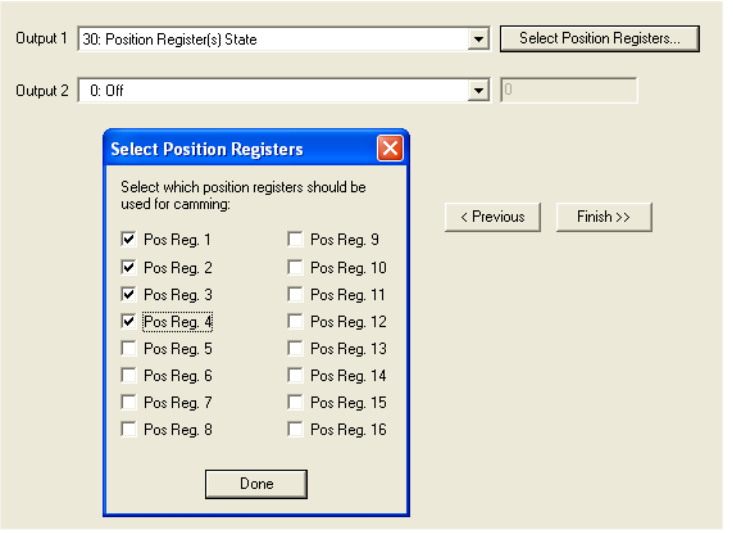
4.11 Screen page "Position Registers"

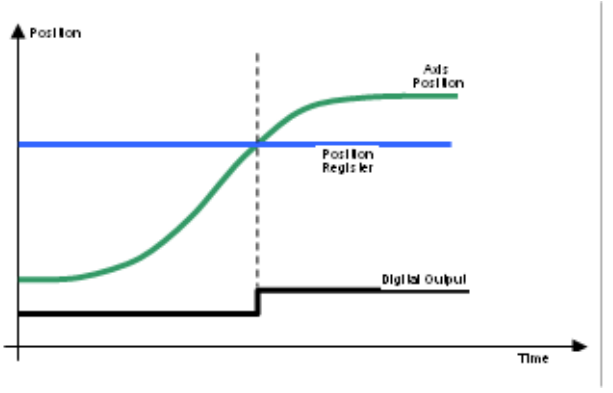
Overview of the "Position Registers" Screen

At a Glance

This screen page enables you to configure the monitoring of up to 16 position registers that enable you to set/reset digital output or axis software position limits:







The position registers are configured using 3 control variables. The position signals are indicated through a status variable. All control/status variables can be considered as 32-bit variables, whereby the lower 16 bits (bits 0 ... 15) are used for the configuration of the position registers P1 ... P16.

Position Registers

ASCII: **WPOS**	Default: 0 Unit: - Range: 0, 1, 2	valid for all OPMODES

The position registers operate in a deterministic manner: going above or below a position is detected and signaled within 1 millisecond.

The fast position registers are enabled through the WPOS configuration variable.

WPOS=0	Position register disabled.
WPOS=1	Position register enabled, no spontaneous CAN message on change of status.
WPOS=2	Position register enabled, spontaneous CAN message on change of status (this setting is only via CAN-Bus possible).

Changes of the WPOS variable between 0 and >0 can only be made offline (SAVE and COLSTART), although a change between 1 and 2 can be made online.

Current Position

ASCII: **PFB**	Default: - Unit: m Range: Long integer	valid for all OPMODES

The PFB command returns the actual value of the position (from the position control loop feedback).

Check

ASCII: **WPOSX**	Default: 0 Unit: - Range: 0 - 65535	valid for all OPMODES

Specify whether the position is monitored continuously or once. If you specify **Once**, the corresponding enable bit (WPOSE) is set to 0 when the position signal is generated, so that the monitoring is disabled for this position register.

Enable

ASCII: **WPOSE**	Default: 0 Unit: - Range: 0 - 65535	valid for all OPMODES

Enable or disable each of the sixteeen position registers.

Signal If

ASCII: **WPOSP**	Default: 0 Unit: - Range: 0 - 65535	valid for all OPMODES

Specify whether the position signal is generated on going above/beyond (overrun) the position, or below/behind (underrun) the position.

P1 - P16

ASCII: **P1...P16**	Default: 0 Unit: - Range: Long integer	valid for all OPMODES

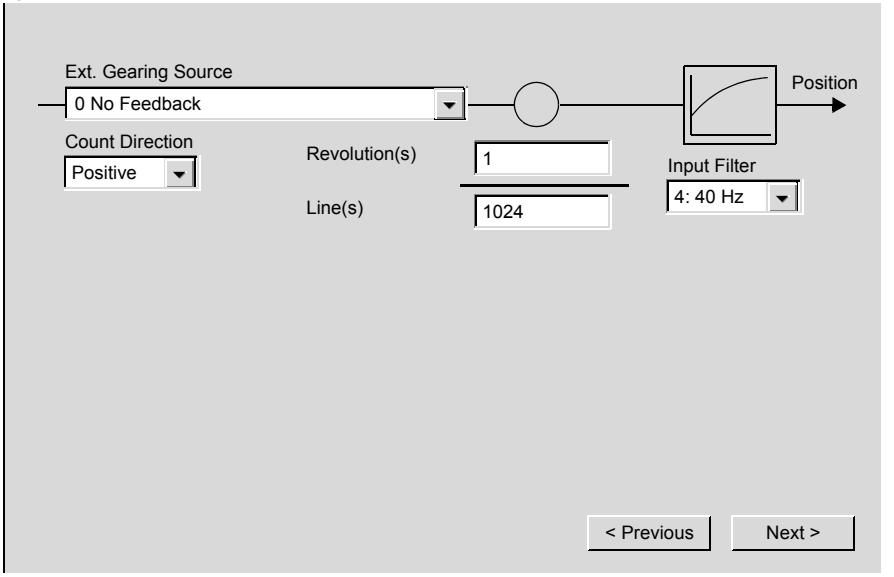
Contains the position values for the sixteen position thresholds.

4.12 Screen page "Electronic Gearing"

Overview of the "Electronic Gearing" screen

At a Glance

Select the gearing source and define the gear ratio for the position setpoint received by the servo amplifier:



The servo amplifier receives a position setpoint from another instrument (master servo amplifier, stepper motor control, encoder or similar) and controls the position of the motor shaft in synchronism with this master (control) signal.

Cycle time of the electrical gearing: 250s. A value averaged over 1000 s is used.

Ext. Gearing Source

ASCII: **GEARMODE**	Default: 0 Unit: - Range: 0 - 6	valid for OPMODE 4

The servo amplifier can be controlled through different interfaces and from various sources. For the connector pin assignments, see the Installation Manual.

ID	Function	Comments
0	No feedback	-
1	Pulse / direction Dig.I/O 24V (X3)	With a stepper motor control (pulse/direction, 24V signal level) connected to the digital inputs LI1/LI2, terminals X3/8, 9. An additional function assignment for the inputs is not necessary. Any assignments on the screen page "Digital I/O" will be ignored. LI1 (X3/8)= Direction (low=positive, high=negative), LI2 (X3/9) =Pulse
2	Encoder Follower Dig.I/O 24V (X3)	With an incremental encoder (track A/B, 24V signal level) connected to the digital inputs LI1/LI2, terminals X3/8, 9. Additional function assignment is not required for inputs. Any assignments on the screen page "Digital I/O" will be ignored. LI1 (X3/8) = A channel, LI2 (X3/9) = B channel.
3	Encoder Follower Dig.I/O 5V (X5)	With an incremental encoder connected to the X5 connector. X5/5 = A +, X5/4 = A -, X5/7 = B +, X5/6 = B - ENCMODE must be set to 0.
4	Pulse / direction, Dig.I/O 5V (X5)	With a stepper motor control (pulse/direction, 5V signal level) connected to connector X5. X5/5 = Pulse +, X5/4 = Pulse -, X5/7 = Direction +, X5/6 = Direction - ENCMODE must be set to 0.
5	SSI (X5)	SSI position is read via the X5 connector.
6	Sin/Cos Encoder 5V (X1)	With a sine/cosine encoder connected to connector X1. Only the zero crossing if the sine (cosine) signals are used. No analog processing takes place.
7	Sin/Cos Encoder 12V (X1)	With a sine/cosine encoder connected to connector X1. Only the zero crossing if the sine (cosine) signals are used. No analog processing takes place.
8	EnDAT-Encoder (X1)	The parameter channel of the encoder is read and the absolute position is transfered to the position register. ENCLINES is calculated automatically to the internal resolution of 20 Bit per rev of the encoder. This setting can be used in position mode under EXTPOS=1. The sine/cosine signals of the encoder are analog read. This increases the resolution significantly.

ID	Function	Comments
9	HIPERFACE-Encoder (X1)	The parameter channel of the encoder is read and the absolute position is transfered to the position register. ENCLINES is calculated automatically to the internal resolution of 20 Bit per rev of the encoder. This setting can be used in position mode under EXTPOS=1. The sine/cosine signals of the encoder are analog read. This increases the resolution significantly.

Count Direction

ASCII: **DIR**	Default: 21 Unit: - Range: 0 - 128	valid for OPMODES

This fixes the count direction of the motor shaft in reference to the polarity of the setpoint. Changing this value will affect Bit 4 of ASCII command DIR.

Positive = count direction CW = DIR Bit 4 set

Negative = count direction CCW = DIR Bit 4 reset

The DIR variable defines the count direction for feedback information.

The DIR variable can be considered as a 16-bit variable, whereby each single bit defines the count direction for different feedback units.

Setting a bit means a positive direction (cw), resetting a bit a negative direction (ccw).

- Bit 0 (0x01) count direction for FBTYPE unit (=1 positive direction)
- Bit 1 (0x02)
- Bit 2 (0x04) count direction for EXTPOS unit (=1 positive direction)
- Bit 3 (0x08)
- Bit 4 (0x10) count direction for GEARMODE unit (=1 positive direction)
- Bit 5 (0x20)
- Bit 6 (0x40) =1 inverse commutation

Make changes only while the amplifier is disabled and reset it (COLDSTART). This parameter is not available if a SERCOS interface is built-in.

After changing the count direction the hardware limit switches have to be exchanged.

Resolution (denominator)

ASCII: **ENCLINES**	Default: 1000 Unit: - Range: 0 - 65535	valid for all OPMODES

ENCLINES sets the resolution (number of lines) of the sine encoder input channel. In case of rotary Motors it is the number of lines per revolution, in case of linear motors it is the number of lines per pole pitch. The ENCLINES data is stored in an ENDAT or Hiperface Encoder if this feedback is used (GEARMODE 6 - 9). In this case during power up process the ENCLINES data is read automatically. Make changes only while the amplifier is disabled and reset it (COLDSTART).

Gear Ratio (nominator)

ASCII: **GEARO**	Default: 1 Unit: - Range: 0 - Long integer	valid for OPMODES 4 - 8

Sets the number of motor turns for one turn of an external feedback system.

Gear Ratio (denominator)

ASCII: **GEARI**	Default: 1024 Unit: - Range: 1 - Long integer	valid for OPMODES 4 - 8

Sets the number of turn pulses for one turn of the external feedback system.

Input Filter

ASCII: **GEARFILT**	Default: 4 Unit: - Range: 1 - 8	valid for OPMODE 4

The input filter is a second-order low-pass filter that smoothes the input position command signal. The GEARFILT command can be used to determine the corresponding frequency of the electronic gearing filter.

GEARFILT	**Frequency (Hz)**
1	318
2	159
3	80
4	40
5	20
6	10
7	5
8	2.5

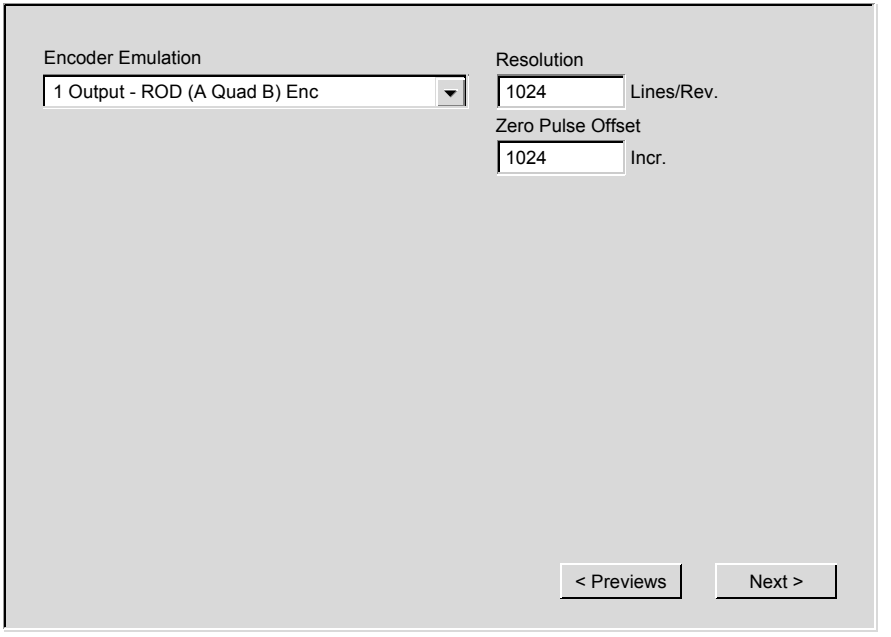
The filter should be used when necessary. However, because the filter introduces a delay to prevent the slave from following the master exactly during acceleration and deceleration, the filter should **only** be used when necessary. GEARFILT = 4 with 40 Hz cut-frequency is generally used.

4.13 Screen page "Encoder Emulation"

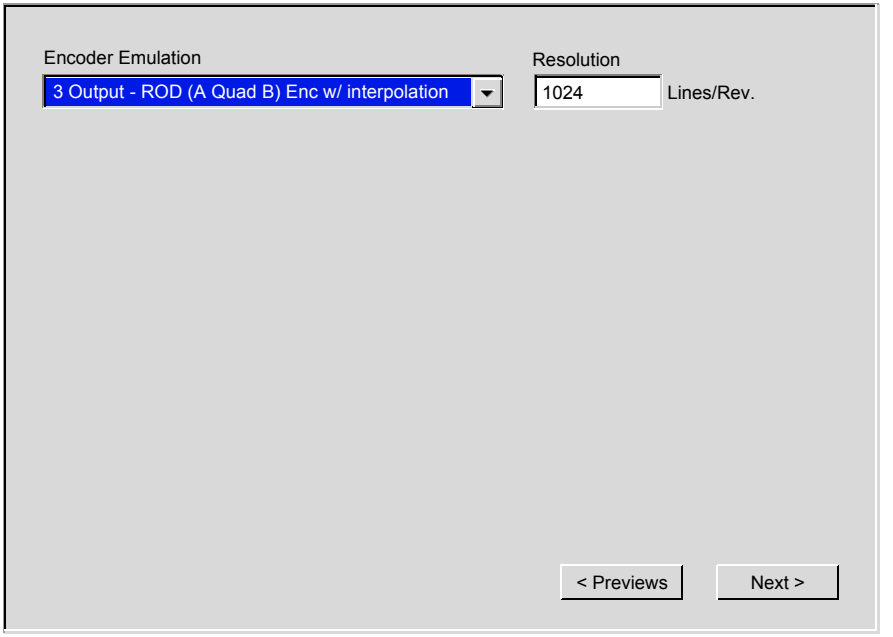
Overview of the "Encoder Emulation" screen

At a Glance

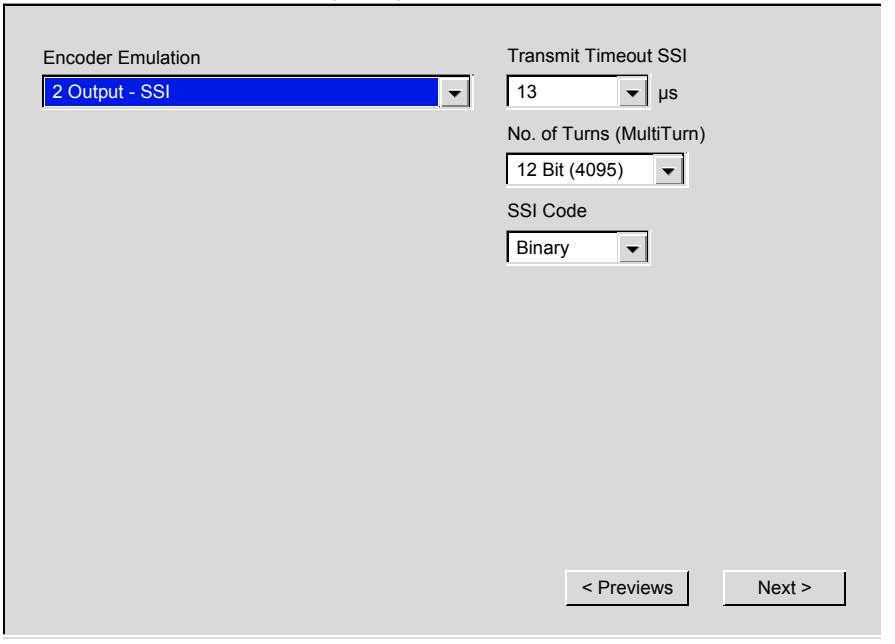
This screen enables you to define the encoder emulation. Different parameters are displayed depending on the type of output you select. Parameters for the ROD output are shown here:



Parameters for the ROD output with interpolation:



Different parameters are displayed if you select SSI as the output:



For information on wiring the Encoder Emulation Output on an X5 Connector, see the Lexium 15 LP Installation Manual.

Encoder emulation (X5)

ASCII: **ENCMODE**	Default: 0 Unit: - Range: 0, 1, 2, 3	valid for all OPMODES

Encoder emulation cycle time: 0.125 µs

Change this only while the amplifier is disabled.

ID	Function	Comments
0	Input	Used as an input.
1	ROD	Incremental encoder emulation In the servo amplifier, the position of the motor shaft is calculated from the cyclically absolute signals from the resolver or encoder. This information is used to create incremental-encoder compatible pulses (max. 250 kHz). Pulses are given out at the connector X5 as two signals A and B with a 90° electrical phase difference, and a zero pulse. **Exception:** If a Sincos (Stegmann) encoder is used as the feedback unit, then the output of the zero pulse is inhibited (data are invalid) until the zero pulse from the encoder has been received.
2	SSI	SSI-encoder emulation. In the servo amplifier, the position of the motor shaft is calculated from the cyclically absolute signals from the resolver or encoder. This information is used to create a position output in a format that is compatible with the standard SSI-absolute-encoder format. 24 bits are transmitted. **Radio button SINGLE TURN selected:** The upper 12 bits are fixed to ZERO, the lower 12 bits contain the position information. For 2-pole resolvers, the position value refers to the position within one turn of the motor, for 4-pole resolvers it is within half a turn, and for 6-pole resolvers it is within a third of a turn. **Exception:** If an encoder with Sincos (Stegmann) is used as the feedback unit, then the upper 12 bits are set to 1 (data invalid!) until a homing run is performed. **Radio button MULTI TURN selected:** The upper 12 bits contain the number of motor turns, the lower 12 bits contain the position information.
3	ROD with Interpolation	Digitization and interpolation of the sine encoder input signals (feedback) to TTL level incremental output. This function works properly only with sine encoder feedback systems. The parameter INTERPOLATION determines the multiplier for the number of lines of the feedback encoder per electrical motor rotation.

Resolution

ASCII: **ENCOUT**	Default: 1024 Unit: CPR Range: See table below	valid for all OPMODES

Determines the number of increments per turn that are output. Change this only while the amplifier is disabled.

	Increments per motor turn for feedback type =			
Resolution	**Resolver 2-poles**	**Resolver 4-poles**	**Resolver 6-poles**	**HIPERFACE/ EnDat**
256	256	512	768	256
512	512	1024	1536	512
1024	1024	2048	3072	1024
2048	-	-	-	2048
4096	-	-	-	4096
8192	-	-	-	8192 (to 3000 rpm.)*
16384	-	-	-	16384 to 1500 rpm.)

Note: Negative values are possible. If the motor turn positive ENCOUT pulses count negative. The resolution in the controls can be increased by quadruple evaluation of the increments.

Zero Pulse Offset

ASCII: **ENCZERO**	Default: 0 Unit: - Range: 0 - ENCOUT-1	valid for all OPMODES

Determines the position of the zero (marker) pulse when A=B=1. The entry is referred to the zero-crossing of the feedback unit over the range of one turn.

For example:

ENCOUT = 1024

ENCZERO = 256

The zero pulse is given out at the 90° position.

No. of Bits (Multi / Single Turn)

ASCII: **SSIRXD**	Default: 24 Unit: - Range: 1 - 33	valid for all OPMODES
ASCII: **SSIREVOL**	Default: 4 Unit: - Range: 0 - 4	valid for all OPMODES

The parameter SSIRXD sts the number of received SSI-bits, with SSIRXD=1 equal to one bit, SSIRXD=2 equal to two bits, and so on, up to maximum of 32 bits.

The parameter SSIREVOL sets the number of turns (MultiTurn) for SSI - Transmission. Change this only while the amplifier is disabled.

ID	Turns
0	16 bit (65535)
1	15 bit (32767)
2	14 bit (16383)
3	13 bit (8191)
4	12 bit (4095)

Transmit Timeout SSI

ASCII: **SSITOUT**	Default: 0 Unit: - Range: 0 - 1	valid for all OPMODES

The command SSITOUT sets the monoflop - timeout of the SSI - transmission.

ID	Function
0	13 µs
1	3 µs

SSI-Code

ASCII: **SSIGRAY**	Default: 0 Unit: - Range: 0 - 1	valid for all OPMODES

Determines whether the output is in binary or GRAY code. Change this only while the amplifier is disabled.

ID	Function
0	Binary
1	Gray

4.14 Screen page "Analog Inputs"

General overview of the "Analog Inputs" screen

At a Glance

Overview of the different fields contained in the "Analog Inputs" screen.

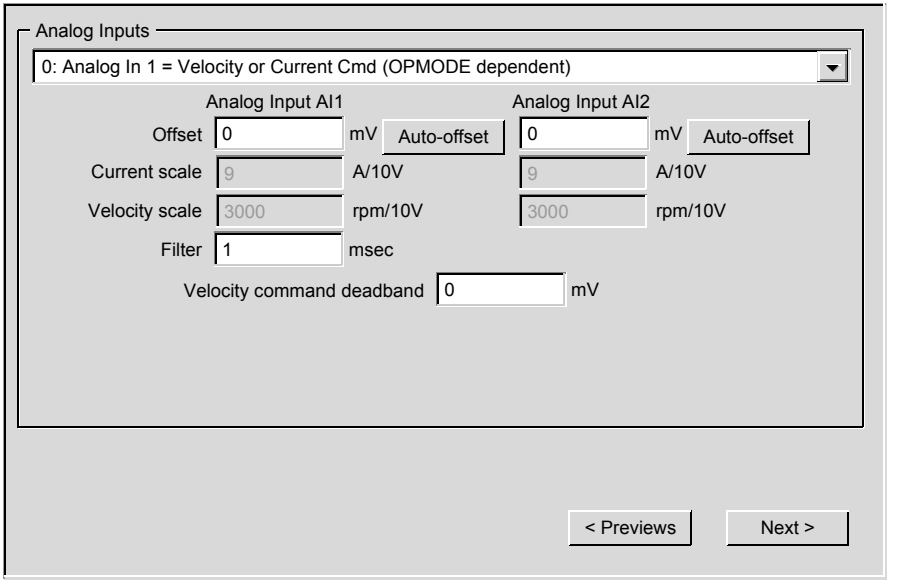
What's in this Section?

This section contains the following topics:

Overview of the Analog Inputs Screen

At a Glance

This screen enables you to configure Analog Inputs:



Cycle time of the Analog Input functions: 250 micro-seconds. Analog Input AI1 is read every 125 micro-seconds.

The actual values of the analog inputs are shown in the diagram of the connector X3.

Analog Inputs

Setpoint functions

ASCII: **ANCNFG**	Default: 0 Unit: - Range: 0 - 14	valid for all OPMODES

ID	Function
0	Analog Input 1 = Velocity or Current Cmd (OPMODE dependent)
1	Analog Input 1 = Velocity Cmd, Analog Input 2 = Current Command
2	Analog Input 1 = Velocity Cmd, Analog Input 2 = Current Feed Forward Scaling
3	Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Sys peak current
4	Analog Input 1 + Analog Input 2 = Velocity or Current (OPMODE dependent)
5	Analog Input 1 x Analog Input 2 = Velocity or Current Cmd (OPMODE dependant)
6	Analog Input 2 = Gearing ratio Cmd
7	Analog Input 1 = Current Cmd, Analog Input 2 = Max Sys Speed
8	Analog Input 1 = Position Command
9	Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Ferraris
10	Reserved
11	Analog Input 2 = adjust Digital Trigger Level (Direct)
12	Analog Input 2 = adjust Digital Trigger Level (After Rising Edge)
13	Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Sys Peak Current (Pos only)
14	Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Sys Peak Current (Neg only)

0: Analog Input 1 = Velocity or Current Cmd (OPMODE dependent)

The servo amplifier only uses the Analong Input 1 as velocity command or current command according to OPMODE value.

OPMODE	Analog Input 1 function	Analog Input 1 value
1: analog velocity	Velocity command	VSCALE1 * AI1
3: analog torque	Torque (Current) command	ISCALE1 * AI1

Additionally, function "switch-over Analog Input 1 to Analog Input 2" can be set. Then a LIx digital input allows switch between AI1 and AI2.

OPMODE	LIx	Analog Input Setting	Analog Input Value
1: analog velocity	HIGH	AI2 is active and set as velocity command	VSCALE2 * AI2
1: analog velocity	LOW	AI1 is active and set as velocity command	VSCALE1 * AI1
3: analog torque	HIGH	AI2 is active and set as current command	ISCALE2 * AI2
3: analog torque	LOW	AI1 is active and set as current command	1SCALE1 * AI1

To set up digital input LIx for this function, see Digital I/O (See *Digital Inputs LI1 / LI2 / LI3 / LI4, p. 159*) "Function 8 - An In 1 / An In 2"

1: Analog Input 1 = Velocity Cmd, Analog Input 2 = Current Command

The servo amplifier only uses one of the two analog inputs, depending on the setting of OPMODE.

vcmd = Scaling (AIx) * AIx

OPMODE	AI1 setting	AI2 setting
1: analog velocity	velocity cmd active & vcmd = VSCALE1 * AI1	inactive
3: analog torque	inactive	current (torque) command active & Icmd = ISCALE2 * AI2
all other settings	inactive	inactive

2: Analog Input 1 = Velocity Cmd, Analog Input 2 = Current Feed Forward Scaling

Analog Input 2 is used as current feed forward (OPMODE=0,1).

vcmd = VSCALE1 * AI1

Iffd = ISCALE2 * AI2

3: Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Sys peak current

The servo amplifier uses the Analog Input 1 as velocity command or current command according to OPMODE value. Analog Input 2 is used for limiting drive peak current (Ipeak1).

OPMODE	AI1 setting	AI1 value	AI2 function	AI1 value
1: analog velocity	Velocity command	VSCALE1 * AI1	Drive peak current limitation	Ipeak1=IPEAK * AI2 / 10V
3: analog torque	Current command	ISCALE1 * AI1		

IPEAK is the peak current set up for the application. For more details, see *Overview of the "Current Loop" screen, p. 115*.

If you use both Ipeak2 (see Digital I/O (See *Digital Inputs LI1 / LI2 / LI3 / LI4, p. 159*) "Function 18 - Ipeak2 x") and Ipeak1 setpoint function, the servo amplifier will set the lowest Ipeak value.

4: Analog Input 1 + Analog Input 2 = Velocity or Current (OPMODE dependent)

The servo amplifier uses the sum of both analog inputs, depending on the setting of OPMODE.

Xcmd = Scaling (AI1) * AI1 + Scaling (AI2) * AI2

OPMODE	AI1 + AI2 Description	AI1 + AI2 Value
1: analog velocity	velocity setpoint	VSCALE1 * AI1 + VSCALE2 * AI2
3: analog torque	current (torque) setpoint	ISCALE1 * AI1 + ISCALE2 * AI2
all other settings	inactive	-

5: Analog Input 1 x Analog Input 2 = Velocity or Current Cmd (OPMODE dependant)

The servo amplifier uses the product of both setpoint inputs, depending on the setting of OPMODE. The voltage on Analog Input 2 has the effect of a weighting factor for Analog Input 1, the scaling for Analog Input 2 is ineffective:

Xcmd = AI1 * Scaling (AI1) * AI2

OPMODE	AI1 . AI2 Description	AI1 . AI2 Value
1: analog velocity	velocity setpoint	(VSCALE1 * AI1) * AI2
3: analog torque	current (torque) setpoint	(ISCALE1 * AI1) * AI2
all other settings	inactive	-

6: Analog Input 2 = Gearing ratio Cmd

Correction of the gearing ratio (GEARO) of the electrical gearing through Analog Input 1 for OPMODE 4. Analog Input 1 is used as a speed (or torque) setpoint for OPMODE 1 (or 3).

GEAROeff = GEARO * (1 + VSCALE2 * AI2 / 1000)

VSCALE defines a correction factor in %

for example:

VSCALE2 = 20

for AI2 = 10V, GEAROeff = GEARO * 1,2

for AI2 = -10V, GEAROeff = GEARO * 0,8

for AI2 = 0V, GEAROeff = GEARO

7: Analog Input 1 = Current Cmd, Analog Input 2 = Max Sys Speed

OPMODE should be previously set to 3.

Analog input 1 is used as current command. Analog input 2 is used to set maximum motor velocity.

Icmd = ISCALE1 * AI1

nmax = VSCALE2 * AI2

Whatever Icmd value, motor velocity will never exceed nmax.

8: Analog Input 1 = Position Command

OPMODE 5 has to be set.

Analog input 1 is used as a analog position setpoint.

The working distance is defined by SRND (start position) and ERND (end position).

Analog input 1 = 0V Position = SRND

Analog input 1= +/-10V Position = ERND

In addition, homing can be performed independantly by starting a homing motion task (See *Overview of the "Motion Task" Screen, p. 229*) thanks to a digital input LIx (see Digital I/O (See *Digital Inputs LI1 / LI2 / LI3 / LI4, p. 159*) "Function 16 Start_MT no.2").

9: Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Ferraris

Analog Input 1 as velocity command when OPMODE=1 or as torque (current) command when OPMODE=3.

Analog Input 2 is used as a Ferraris sensor input (acceleration sensor) for implementing speed control using this sensor.

10: Reserved

11: Analog Input 2 = adjust Digital Trigger Level (Direct)

Change of an INxTRIG (x=1, 2, 3, 4) variable via the Analog Input 2. The corresponding Number (x) of the trigger variable is set by AN11NR. The range of the parameter change is defined by AN11RANGE.

The change of AI2 value occurs immediately (update time 1 to 10ms): INxTRIG will be changed whatever the LIx state.

For example:

ANCNFG=1	enabling analog input function 11
AN11NR=1	enabling IN1TRIG as LI1 input value to be changed
IN1TRIG=1000	setting IN1TRIG at 1000
AN11RANGE=500	setting Analog Input 2 range

at AI2 = 0V, IN1TRIG = 1000

at AI2 = 10V, IN1TRIG = 1500

at AI2 = -10V, IN1TRIG = 500

12: Analog Input 2 = adjust Digital Trigger Level (After Rising Edge)

Change of INxTRIG (x=1,2,3,4) variable via Analog Input 2. The corresponding number (x) of trigger variable is set by AN11NR. The range of the parameter change is defined by AN11RANGE. The change of AI2 value acts on INxTRIG after a rising edge on the selected LIx digital input.

13: Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Sys Peak Current (Pos only)

The servo amplifier uses the Analog Input 1 as velocity command or current command according to the OPMODE value. The absolute value of Analog Input 2 limits the positive current of the drive.

OPMODE	AI1 setting	AI1 value	AI2 function	AI2 value
1: analog velocity	Velocity command	VSCALE1 * AI1	Drive peak current limitation	IPEAK * abs(AI2) / 10V
3: analog torque	Current command	ISCALE1 * AI1		

The negative current is not affected.

In the positive direction, the acceleration current is limited, and in the negative direction, the deceleration current.

14: Analog Input 1 = Velocity or Current Cmd (OPMODE dependent), Analog Input 2 = Sys Peak Current (Neg only)

The servo amplifier uses the Analog Input 1 as velocity command or current command according to the OPMODE value. The absolute value of Analog Input 2 limits the negative current of the drive.

OPMODE	AI1 setting	AI1 value	AI2 function	AI2 value
1: analog velocity	Velocity command	VSCALE1 * AI1	Drive peak current limitation	- IPEAK * abs(AI2) / 10V
3: analog torque	Current command	ISCALE1 * AI1		

The positive current is not affected.

In the negative direction, the acceleration current is limited, and in the positive direction, the deceleration current.

Offset

ASCII: **ANOFFx**	Default: 0 Unit: mV Range: -10000 - 10000	valid for all OPMODES

Is used to compensate the offset voltages of CNC-controls and the analog inputs 1 (ANOFF1) or 2 (ANOFF2). Adjusts the axis to standstill while the setpoint = 0V.

Auto-Offset

ASCII: **ANZEROx**	Default: - Unit: - Range: -	valid for all OPMODES

This command carries out an automatic adjustment of the setpoint offset.
Conditions: analog inputs short-circuited, or 0V from the controls.

ANZERO1 command for Analog Input 1 & ANZERO2 command for Analog Input 2.

Scaling

ASCII: **VSCALEx**	Default: 3000 Unit: rpm/10V Range: -15000 - 15000	valid for OPMODE 1

Scaling of the velocity setpoint value. Input: xx rpm / 10 V

VSCALE1 parameter for Analog Input 1 & VSCALE 2 parameter for Analog Input 2.

ASCII: **ISCALEx**	Default: peak current Unit: A/10V Range: 0 - 30	valid for OPMODE 3

Scaling of the analog setpoint value. Input: xx A / 10 V

ISCALE1 parameter for Analog Input 1 & ISCALE 2 parameter for Analog Input 2.

Filter

ASCII: **AVZ1**	Default: 1 Unit: ms Range: 0.2 - 100.0	valid for OPMODE 1

You can enter a filter time constant here for Analog Input 1 (62.5s Update Rate, 1st order filter).

Velocity Command Deadband

ASCII: **ANDB**	Default: 0 mV Unit: mV Range: 0.0 - 10000.0	valid for OPMODES 1+3

This variable suppresses small analog input signals by setting a deadband zone in which signals are ignored. This function is useful with OPMODE=1 (without higher-level position control). Depending on the operating mode, this parameter applies to Analog Input 1 or Analog Input 2 (depending on which setpoint input is used as the source for the velocity value).

4.15 Screen page "Digital I/O"

Overview of "Digital I/O"

At a Glance

Overview of the different fields contained in the "Digital I/O" screen

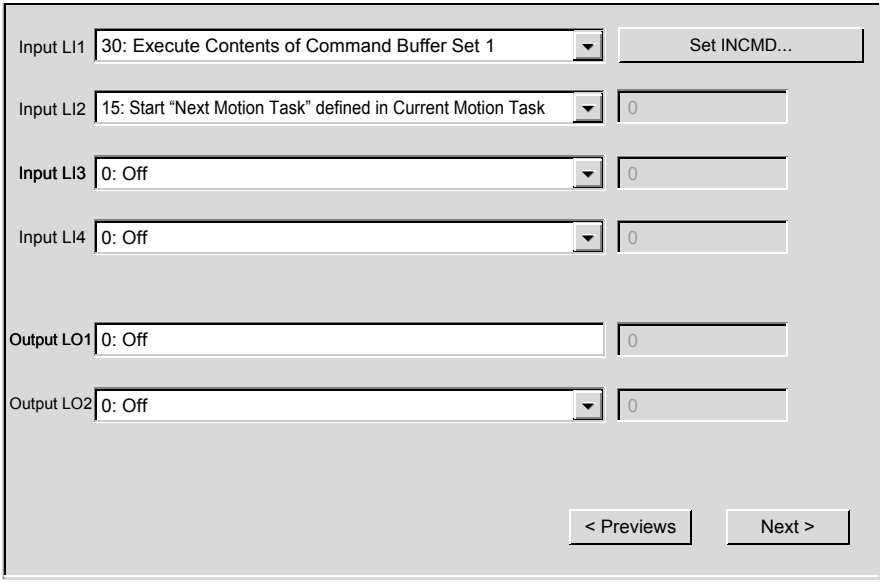
What's in this Section?

This section contains the following topics:

Digital I/O Overview

At a Glance

This screen page enables you to assign pre-defined functions to the digital inputs and outputs of the servo amplifier:



Cycle time of digital I/O functions: 1 ms The digital I/O states are displayed.

Digital Inputs LI1 / LI2 / LI3 / LI4

At a Glance

ASCII: **INxMODE**	Default: 0 Unit: - Range: 0- 43	valid for all OPMODES
ASCII: **INxTRIG**	Default: 0 Unit: - Range: 0- 43	valid for all OPMODES

The terminals LI1, LI2, LI3 & LI4 (X3/8,9,10,11, respectively) can be used in combination with internal functions. Each digital input is defined by INxMode and INxTRIG. INxMODE sets digital input function and INxTRIG sets digital input value. Change this only while the amplifier is disabled, then reset amplifier. (COLDSTART).

IN1MODE, IN1TRIG parameters for LI1, IN2MODE, IN2TRIG parameters for LI2, IN3MODE, IN3TRIG parameters for LI3 & IN4MODE, IN4TRIG parameters for LI4.

Here is the complete list of available function on each digital input:

				Function can be combined with			
INxMODE value	**Function**	**Active edge/ Level**	**Auxiliary value x INxTRIG**	**LI1 X3/8**	**LI2 X3/9**	**LI3 - PSTOP X3/10**	**LI4 - NSTOP X3/11**
0	Off	-	-	x	x	x	x
1	Reset Fault	↗	-	x		(1)	(1)
2	PSTOP (EOT Limit Switch)	-	-	(1)	(1)	x	x
3	NSTOP (EOT Limit Switch)	-	-	(1)	(1)	x	x
4	PSTOP+Integral Off (EOT Limit Switch)	-	-	(1)	(1)	x	x
5	NSTOP + Integral Off (EOT Limit Switch)	-	-	(1)	(1)	x	x
6	PSTOP+NSTOP (EOT Limit Switch)	-	-	(1)	(1)	x	(1)
7	P / NSTOP +Integral Off (EOT Limit Switch)	-	-	(1)	(1)	x	(1)
8	Change Command from Analog Input AI1 to Analog Input AI2	High/Low	-	x	x	x	x

				Function can be combined with			
INxMODE value	**Function**	**Active edge/ Level**	**Auxiliary value x INxTRIG**	**LI1 X3/8**	**LI2 X3/9**	**LI3 - PSTOP X3/10**	**LI4 - NSTOP X3/11**
9	Motion Task BCD Select Bit	↗	-	x	x	x	x
10	Integral Off	↗	-	x	x	x	x
11	Change Velocity to Torque Control	High/Low	-	x	x	x	x
12	Machine Home (Reference) Switch	↗	-	x	x	x	x
13	Change Emulation from ROD (A Quad B) Enc to SSI	High/Low	-	x	x	x	x
14	Clear Position Error or Network Node Guarding	↗	-	x	x	x	x
15	Start "Next Motion Task" Defined in Current Motion Task	Can be set	-	x	x	x	x
16	Start Motion Task No x (Level Triggered)	↗	Motion task no.	x	x	x	x
17	Start Motion Task Configured by BCD Select Bits	↗	-	x	x	x	x
18	Change System Peak Current to x	↗	% of Ipeak	x	x	x	x
19	Off	-	-	x	x	x	x
20	Jog Motor at x Speed	↗	Speed in rpm	x	x	x	x
21	Turn Off Under Voltage Monitoring	↗	-	x	x	x	x
22	Restart Current Motion Task	↗	-	x	x	x	x
23	Start Motion Task No x (Edge Triggered)	↗	Motion task no.	x	x	x	x
24	Change OPMODE A to B	↗	Opmode no.	x	x	x	x
25	Latch ROD (A Quad B) Enc Zero Pulse	↗	-	x	x	x	x
26	Latch Motor Position (High Speed)	↗		x	x		

				Function can be combined with			
INxMODE value	**Function**	**Active edge/ Level**	**Auxiliary value x INxTRIG**	**LI1 X3/8**	**LI2 X3/9**	**LI3 - PSTOP X3/10**	**LI4 - NSTOP X3/11**
9	Motion Task BCD Select Bit		-	x	x	x	x
10	Integral Off		-	x	x	x	x
11	Change Velocity to Torque Control	High/Low	-	x	x	x	x
12	Machine Home (Reference) Switch		-	x	x	x	x
13	Change Emulation from ROD (A Quad B) Enc to SSI	High/Low	-	x	x	x	x
14	Clear Position Error or Network Node Guarding		-	x	x	x	x
15	Start "Next Motion Task" Defined in Current Motion Task	Can be set	-	x	x	x	x
16	Start Motion Task No x (Level Triggered)		Motion task no.	x	x	x	x
17	Start Motion Task Configured by BCD Select Bits		-	x	x	x	x
18	Change System Peak Current to x		% of Ipeak	x	x	x	x
19	Off	-	-	x	x	x	x
20	Jog Motor at x Speed		Speed in rpm	x	x	x	x
21	Turn Off Under Voltage Monitoring		-	x	x	x	x
22	Restart Current Motion Task		-	x	x	x	x
23	Start Motion Task No x (Edge Triggered)		Motion task no.	x	x	x	x
24	Change OPMODE A to B		Opmode no.	x	x	x	x
25	Latch ROD (A Quad B) Enc Zero Pulse		-	x	x	x	x
26	Latch Motor Position (High Speed)			x	x		

				Function can be combined with			
INxMODE value	**Function**	**Active edge/ Level**	**Auxiliary value x INxTRIG**	**LI1 X3/8**	**LI2 X3/9**	**LI3 - PSTOP X3/10**	**LI4 - NSTOP X3/11**
9	Motion Task BCD Select Bit		-	x	x	x	x
10	Integral Off		-	x	x	x	x
11	Change Velocity to Torque Control	High/Low	-	x	x	x	x
12	Machine Home (Reference) Switch		-	x	x	x	x
13	Change Emulation from ROD (A Quad B) Enc to SSI	High/Low	-	x	x	x	x
14	Clear Position Error or Network Node Guarding		-	x	x	x	x
15	Start "Next Motion Task" Defined in Current Motion Task	Can be set	-	x	x	x	x
16	Start Motion Task No x (Level Triggered)		Motion task no.	x	x	x	x
17	Start Motion Task Configured by BCD Select Bits		-	x	x	x	x
18	Change System Peak Current to x		% of Ipeak	x	x	x	x
19	Off	-	-	x	x	x	x
20	Jog Motor at x Speed		Speed in rpm	x	x	x	x
21	Turn Off Under Voltage Monitoring		-	x	x	x	x
22	Restart Current Motion Task		-	x	x	x	x
23	Start Motion Task No x (Edge Triggered)		Motion task no.	x	x	x	x
24	Change OPMODE A to B		Opmode no.	x	x	x	x
25	Latch ROD (A Quad B) Enc Zero Pulse		-	x	x	x	x
26	Latch Motor Position (High Speed)			x	x		

				Function can be combined with			
INxMODE value	**Function**	**Active edge/ Level**	**Auxiliary value x INxTRIG**	**LI1 X3/8**	**LI2 X3/9**	**LI3 - PSTOP X3/10**	**LI4 - NSTOP X3/11**
27	Emergency Stop	↘ Low		x	x		x
28	Start Jogmode	-		x	x	x	x
29	Start Motion Task/Homing	-		x	x	x	x
30	Execute Contents of Command Buffer Set 1	High/Low		x	x	x	x
32	Release Motor Brake when Drive Disabled	↗	-	x	x	x	x
33	Execute Contents of Command Buffer Set 2	High/Low	-	x	x	x	x
34	Reserved	-					
35	Reserved	-					
36	Give Offset to Gearing Function	↗	-	x	x	x	x
37	Reserved	-					
38	Additional Enable for "Next Motion Task"	↗		x	x	x	x
39	Move Constant Velocity for Set Time	↗	Opmode no.	x	x	x	x
40	Additional HW Enable	High		x	x	x	x
41	Fast Emergency Stop	↘ Low		x	x	x	x
42	Turn On/Off Gearing	High/Low	-	x	x	x	x
43	Turn On/Off Gearing (with phase adjust from ramp up	High/Low	-	x	x	x	x

(1) At this INxMODE value, digital input is OFF. See Function 0 for explanation.

Description of Digital Input Function

0: Off

The state of Input 1 is read and can be used via a Fieldbus or SLOT card.

1: Reset

Software reset of the amplifier in the event of a fault. All the functions and displays are set to the initial status. Parameters that are not stored in the EEPROM are erased, the parameters stored in the EEPROM are loaded.

If any of the error messages F01, F02, F03, F05, F08, F13, F16 or F19 are present, then no software-reset will be carried out. Only the error message will be deleted. This means that, for example, the encoder output signals are stable and can continue to be evaluated by the controller.

When the input is HIGH while the auxiliary 24V supply is switched on, the drive waits, before the input is set to LOW. In this case, the first of the three display positions displays an "A".

2: PSTOP (EOT Limit Switch)

LOW level at selected input disables the positive direction (clockwise if DIR=1, counterclockwise if DIR=0). At the same time, a warning "n10" is displayed. If a negative edge is recognized while the motor is running, the drive stops the motor in OPMODE=0 (velocity control with setpoint zero) using the DECSTOP ramp (See *Emerg. Dec. Ramp, p. 120*). When the motor has stopped, the previous OPMODE is activated.

3: NSTOP (EOT Limit Switch)

LOW level at selected input disables the negative direction (clockwise if DIR=0, counterclockwise if DIR=1). At the same time, a warning "n11" is displayed. If a negative edge is recognized while the motor is running, the drive stops the motor in OPMODE=0 (velocity control with setpoint zero) using the DECSTOP ramp (See *Emerg. Dec. Ramp, p. 120*). When the motor has stopped, the previous OPMODE is activated.

4: PSTOP+Integral Off (EOT Limit Switch)

LOW level at selected input disables the positive direction (clockwise if DIR=1, counterclockwise if DIR=0). At the same time, a warning "n10" is displayed. If a negative edge is recognised while the motor is running, the drive stops the motor in OPMODE=0 (velocity control with setpoint zero) using the DECSTOP ramp (See *Emerg. Dec. Ramp, p. 120*)p. When the motor has stopped, the previous OPMODE is activated (without integral part in the velocity controller).

5: NSTOP + Integral Off (EOT Limit Switch)

LOW level at selected input disables the negative direction (counterclockwise if DIR=1, clockwise if DIR=0). At the same time, a warning "n11" is displayed. If a negative edge is recognised while the motor is running, the drive stops the motor in OPMODE=0 (velocity control with setpoint zero) using the DECSTOP ramp (See *Emerg. Dec. Ramp, p. 120*). When the motor has stopped, the previous OPMODE is activated (without integral part in the velocity controller).

6: PSTOP+NSTOP (EOT Limit Switch)

LOW level at LI3 input disables the positive and the negative direction. At the same time, a warning "n10" and "n11" is displayed. If a negative edge is recognised while the motor is running, the drive stops the motor in OPMODE=0 (velocity control with setpoint zero) using the DECSTOP ramp (See *Emerg. Dec. Ramp, p. 120*). When the motor has stopped, the previous OPMODE is activated.

7: P/NSTOP + Integral Off (EOT Limit Switch)

LOW level at LI3 disables the positive and the negative direction. At the same time, a warning "n10" and "n11" is displayed. If a negative edge is recognised while the motor is running, the drive stops the motor in OPMODE=0 (velocity control with setpoint zero) using the DECSTOP ramp (See *Emerg. Dec. Ramp, p. 120*). When the motor has stopped, the previous OPMODE is activated (without integral part in the velocity controller).

8: Change Command from Analog Input AI1 to Analog Input AI2

Switches over the setpoint inputs analog input 1/2 at ANCNFG (See *Setpoint functions, p. 149*) = 0. This function is only effective if the analog set-point function "0: Analog Input 1 = Velocity or Current Cmd (OPMODE dependent)" has been selected.

HIGH level at the input : analog input 2 (terminals X3/5,6) is active

LOW level at the input : analog input 1 (terminals X3/3,4) is active

9: Motion Task BCD Select Bit

Here you can select the motion tasks that are stored in the amplifier (numbers 1...7) or the homing (0). The motion task number is presented externally at the digital inputs as a logical word, with a width of max. 3 bits. An input is required to start the motion task (17, Start_MT I/O). If you wire up a reference switch (12, Reference) and (also) want to start a following task (15, Start_MT Next) externally, the number of inputs that are available for selecting the motion tasks will be further reduced.

Examples of possible assignments of the digital inputs for various applications:

Application	Motion task number: MSB ----------->LSB				Selectable motion task numbers
	LI4 function IN4MODE	LI3 function IN3MODE	LI2 function IN2MODE	LI1 function IN1MODE	
7 motion tasks + homing, without reference switch	Start_MT I/O IN4MODE=17	2^2 IN3MODE=9	2^1 IN2MODE=9	2^0 IN1MODE=9	0 to 7
3 motion tasks + homing, without reference switch. Start a following task that is defined in the motion task, using the setting "Start with I/O".	Start_MT Next IN4MODE=15	Start_MT I/O IN3MODE=17	2^1 IN2MODE=9	2^0 IN1MODE=9	0 to 3
3 motion tasks + homing, with reference switch.	2^1 IN4MODE=9	2^0 IN3MODE=9	Reference IN2MODE=12	Start_MT I/O IN1MODE=17	0 to 3
1 motion task + homing, with reference switch. Start a following task that is defined in the motion task, using the setting "Start with I/O".	Reference IN4MODE=9	Start_MT Next IN3MODE=15	2^0 IN2MODE=9	Start_MT I/O IN1MODE=17	0 to 1

10: Integral Off

Switches off the integral component of the speed controller, the P-gain remains at the set value, the current (rotational) speed feedback remains in operation.

11: Change Velocity to Torque Control

Bypasses the velocity controller. The analog setpoint is taken 1:1 as the setpoint for current control, i.e. change over from velocity control to current (torque) control.

HIGH-level at the input : torque control

LOW-level at the input : velocity control

Depending on OPMODE, it changes between OPMODE=0 (LOW) and OPMODE=2 (HIGH) or OPMODE=1 (LOW) and OPMODE=3 (HIGH).

12: Machine Home (Reference) Switch

Home/reference switch located on machine. This is useful when preparing a Homing with a switch in the machine. Please refer to *Overview of the "Homing" screen, p. 207* for more information.

13: Change Emulation from ROD (A QUAD B) Enc to SSI

Changeover of the encoder-emulation (position output) on connector X5.

HIGH level at the input: **SSI**-compatible position signals. (ENCMODE = 2)

LOW level at the input: **ROD**-compatible position signals. (ENCMODE = 1)

14: Clear Position Error or Network Node Guarding

Clears the warning for a following error (display no. 03) or for response monitoring (display no. 04).

15: Start "Next Motion Task" Defined in Current Motion Task

The next task, that is defined in the motion task by "Start with I/O" is started. The target position of the processing motion task must be reached before the next task can be started.

16: Start Motion Task No x (Level Triggered)

Start a motion task that is stored in the servo amplifier, by giving the motion task number (x) stored in the INxTRIG variable. After the function has been selected you can enter the motion task number. Motion task number "0" initiates homing/ reference traverse. A rising edge starts the motion task, a falling edge interrupts the motion instruction.

17: Start Motion Task Configured by BCD Select Bits

Start of the motion task that has the number that is presented, bit-coded, at the digital inputs (LI4/LI3/LI2/LI1, see Function 9, "Motion Task BCD Select Bit"). A rising edge starts the motion task, a falling edge interrupts the motion instruction.

18: Change System Peak Current to x

Switch over to a second (lower) peak value of current. Scaled as x (0...100) % of the peak current of the instrument. After the function has been selected you can enter the percentage value (stored in the INxTRIG variable). Make the conversion according to the following equation:

x = (IPEAK2 / IPEAK) * 100% => Ipeak2 = (x / 100%) * IPEAK

Can be implemented with an Analog Input Current Limition function. See *Analog Inputs, p. 149* Function 3. for more information.

19: Off

20: Jog Motor at x Speed (Position Motion Task Opmode)

Start of the setup mode "Constant velocity" with a defined speed.

By selecting the function, INxTRIG stores velocity value. A rising edge starts the motion, a falling edge cancels the motion. This function works in position control, so OPMODE=8 must be selected. The velocity is given in units of the position controller given by VUNIT; the sign selects the moving direction.

21: Turn Off Under Voltage Monitoring

Turns off the undervoltage monitoring function of the servo amplifier.

HIGH = off

LOW = on

22: Restart Current Motion Task

Continues the motion task that was previously interrupted by a STOP command.

23: Start Motion Task No x (Edge Triggered)

Starts a motion task that is stored in the amplifier, with definition of the motion task number. You can enter the motion task number x in INxTRIG. Motion task number "0" initiates homing/reference traverse. A rising edge starts the motion task.

Note: The motion task does not stop automatically if the start signal is removed!
The motion task must be stopped by:

- a falling edge on another digital input (configured with 16, Start_MT No x)
- the ASCII command STOP
- the STOP function via Bus or digital input

24: Change OPMODE A to B

Changeover of the operating mode (OPMODE). The numbers of the OPMODES that are to be changed over are entered in INxTRIG as a decimal number. You have to calculate this decimal value from a 2-byte hex value.

Bits 0 ... 7 of the hex value contain the number of the OPMODE to which the system changes when a falling edge is detected at the appropriate input; bits 8 ... 15 contain the number for the response to a rising edge.

When the controller is switched on, the OPMODE is set according to the input level.

For example:

Changeover between OPMODE 4 (LOW state) and OPMODE 8 (HIGH state) according to the state of the digital input LI1.

Function IN1MODE = 24

IN1TRIG=2052 (0804h)

LI1=LOW, OPMODE=4

LI1=HIGH, OPMODE=8

25: Latch ROD (A QUAD B) Enc Zero Pulse

A edge on this input latches the actual position. The position can be read by LATCHX32 (positive edge) or LATCHX32N (negative edge).

The actual 16-Bit position (absolute in one turn) can be read by LATCHX16 (positive edge) and LATCHX16N (negative edge). The status of the latching can be read by the equivalent bits of DRVSTAT.

The min. cycle time for a LOW/HIGH to HIGH/LOW transaction is 500s. The min. time between two latch pulses is 8 msec.The Latch function does not work with modulo axis (POSCNFG=1).

26: Latch Motor Position (High Speed)

An edge freezes the current position. The 32-bit value is stored in LATCHX32 (rising edge) or in LATCHX32N (falling edge). The 16-bit value is stored in LATCHX16 (rising edge) or in LATCHX16N (falling edge). Current status is coded on a status bit. The minimum detectable pulse rate for this input (high level/low level and low level/high level passage) is 500 ms. With CANopen, minimum pulse gap is 8 ms.

27: Emergency Stop

The LOW level initiates an emergency-stop phase: motion is cancelled and the drive stop process is initiated, in a velocity control (OPMODE=1), using emergency ramp DECSTOP. When motor stop is complete, the servo amplifier mode reverts to previous OPMODE.

28: Start Jogmode

Can be set up only via the Termina (See *Overview of the "Terminal" screen, p. 254*)l screen.

Only for OPMODE = 8, where the Firmware version is 0.73. A rising edge starts a jog mode with speed VJOG, a falling edge stops it.

29: Start MT I/O

Can be set up only via the Terminal (See *Overview of the "Terminal" screen, p. 254*) screen.

Start of the motion task that has the number that is presented, bit-coded, at the digital inputs (LI4 / LI3 / LI2 / LI1, see Function 9, Motion Task BCD Select Bit). A rising edge has no effect.

30: Execute Contents of Command Buffer Set 1

A positive or negative edge on the input LI1starts a command buffer. This command buffer contains separate ASCII objects, that are separated with semicolon (;).

The command buffer for the positive edge is INxHCMD, the command buffer for the negative edge is INxLCMD.The max. length of each buffer is 56 characters.

In case of a drive switch off and on, the drive automatically starts commands from INxHCMD (or INxLCMD) buffer if input level is HIGH (or LOW).

See *Configure Command Buffer, p. 187* for more information.

Note: Only one of the digital inputs can use the INxMODE=30 function.

32: Release Motor Brake when Drive Disabled

A rising edge at the input triggers the braking output of the amplifier. This function is only available while the amplifier is disabled. If an error message is active, the brake cannot be de-energized.

Note: `With suspended loads, this function will lead to slipping of the axis!`

33: Execute Contents of Command Buffer Set 2

A positive or negative edge on the input starts a command buffer. This command buffer contains separate ASCII objects, that are separated with semicolon (;).The results of the command are sent to the serial communication channel RS232.

The command buffer for the positive edge is INHxCMD, the command buffer for the negative edge is IN1xCMD. The max. length of each buffer is 56 characters.

In case of a drive switch off and on, the drive automatically starts commands from INxHCMD (or INxLCMD) buffer if input level is HIGH (or LOW).

Note: This mode cannot be used with grapical user interface software.

34: Reserved

35: Reserved

36: Give Offset to Gearing Function

This function is available when gearing mode is enabled and OPMODE =4.

Gearing mode OPMODE =4. A high signal on the digital input configured with this INxMODE adds a difference velocity to the gearing. This allows a simple synchronisation of two axes. The difference velocity is given by INxTRIG. The scaling is in 32Bit per revolution every 250s. The difference velocity (n) must be known, then the INxTRIG can be calculated:

INxTRIG = n [rpm]*2^32/(4000*60)

For example:

n = 500 [U/min]

INxTRIG = 500 * 2^32 / (4000*60) = 8947848:

37: Reserved

38: Additional Enable for "Next Motion Task"

Used in conjunction with INxMODE=15, this mode signals that the following task, that is defined in the motion task by "Start with I/O" can start. The following motion task is started when a rising edge on LIx input is detected and INxMODE=15 input is enabled.

39: Move Constant Velocity for Set Time

This function starts a constant velocity for a defined time. The parameters for velocity and time are given by INxTRIG. For more information, see *Configure Velocity Time, p. 189*.

40: Additional Hardware Enable

The digital input works as an additional ENABLE hardware input. The power stage is only enabled if this input has a high signal.

If you want to use this function for several inputs, configure the inputs in series. All inputs have to be high to enable the power stage.

41: Fast Emergency Stop

When LIx level is getting LOW, the drive stops the motor using the emergency ramp DECSTOP. If zero velocity is reached (V<VEL0), the power stage is disabled.

While stopping the motor, the 24 bit (0x01000000) in TRJSTAT is set. The input is read in the 250s task.

42: Turn On/Off Gearing

Available only in OPMODE = 4, this function is only practical with a slave axis.

A rising edge on the digital input starts the motion from 0 to the master speed and a falling edge changes the speed from master speed to 0. The ramp times can be set by ACCR for the acceleration and DECR for deceleration time.

43: Turn On/Off Gearing (with phase adjust from ramp up)

Available only in OPMODE = 4, this function is only practical with a slave axis.

A rising edge on the digital input starts the motion from 0 to the master speed and a falling edge changes the speed from master speed to 0. The ramp times can be set by ACCR for the acceleration and DECR for deceleration time unlike INxMODE = 42, in this mode the master position is latched at the rising edge of the input and the position delay caused by the ramp is compensated. INxTRIG offers the possibility of adding an position offset (in PGEARI units) to the latched position.

Digital Outputs LO1/LO2

Values

ASCII codes and values:

ASCII: **OxMODE**	Default: 0 Unit: - Range: 0 - 54	valid for all OPMODES
ASCII: **OxTRIG**	Default: 0 Unit: - Range: 0 - 54	valid for all OPMODES

You can combine the following standard pre-programmed functions with the digital outputs LO1 (O1MODE, terminal X3/13) or LO2 (O2MODE, terminal X3/14). Change this only while the amplifier is disabled + reset.

High functions:

The presence of the function that is set is indicated by a High signal on the corresponding interface terminal.

Low functions:

The presence of the function that is set is indicated by a Low signal on the corresponding interface terminal.

ID	Function	Logic	Auxiliary value OxTRIG
0	Off	-	-
1	Absolute value (Actual Velocity) < x	High	Speed (rpm)
2	Absolute value (Actual Velocity) > x	High	Speed (rpm)
3	Main Bus Voltage Charging	Low	-
4	Regen off	High	-
5	Software Limit Switch Reached	High	-
6	Present Motor Postion > x	High	Position (increments)
7	Within In-Position Window	High	-
8	Absolute value (Current) < x	High	Current (mA)
9	Absolute value (Current) > x	High	Current (mA)
10	Max Postion Error Exceeded	Low	-
11	Drive in Current Foldback (I^2t)	High	-
16	Next-In Position Reached	High	-
17	Error/Warning Present	High	-

ID	Function	Logic	Auxiliary value OxTRIG
18	Error Present	High	-
19	DC Bus Link > x	High	
20	DC Bus Link > x	High	
21	Drive Enabled	High	-
22	Zero Pulse	High	-
23	Expansion Card State	-	-
24	Drive Homed	High	-
30	Position Register(s) State	-	-
31	Voltage at Analog Input AI1 < x	High	mV
32	Voltage at Analog Input AI1 > x	High	mV
33	Voltage at Analog Input AI 2 < x	High	mV
34	Voltage at Analog Input AI2 > x	High	mV
35	Drive Internal Enable Active	High	-
36	Drive Status OR Bit Mask	High	-
37	Drive Status AND Bit Mask	High	-
38	Motion Status OR Bit Mask	High	-
39	Motion Status AND Bit Mask	High	-
40	Position Register OR Bit Mask	High	-
41	Position Register AND Bit Mask	High	-
42	Temperature Warning	High	-
43	Motion Direction	High	Speed (rpm)
44	abs (Velocity Actual - Velocity Cmd) < x	High	Speed (rpm)
45	abs (Velocity Actual - Velocity Cmd) > x	Low	Speed (rpm)
46	abs (Current Actual - Current Cmd) < x	Low	mA
47	abs (Current Actual - Current Cmd) > x	Low	mA
48	Drive Status NOR Bit Mask	High	-
49	Drive Status NAND Bit Mask	High	-
50	Motion Status NOR Bit Mask	High	-
51	Motion Status NAND Bit Mask	High	-
52	Position Register AND Bit Mask + delay	High	-
54	Prepared for moving	High	-

Description of Digital Output Functions

0:Off

No function assigned.

1: Absolute value (Actual Velocity) < x

As long as the absolute value for the motor velocity is lower than a preset value OxTRIG, a HIGH-signal will be output. After the function has been selected you can enter the velocity in rpm in OxTRIG.

The ouput is HIGH if V < OxTRIG and becomes LOW if V > OxTRIG + 0.01 * MSPEED.

2: Absolute value (Actual Velocity) > x

As long as the absolute value for the motor velocity is lower than a preset value OxTRIG, a HIGH-signal will be output. After the function has been selected you can enter the velocrpm in OxTRIG.The ouput is HIGH if V > OxTRIG and becomes LOW if V < OxTRIG + 0.01 * MSPEED.

3: Main Bus Voltage Charging

This signals the operational readiness of the amplifiers power output stage. After switching on the mains supply, LOx output level is LOW until the DC-link circuit is fully charged up. LOx output level is HIGH when the charging of the DC-link circuit is completed. If the DC-link voltage falls below VBUSMIN, then LOx output level becomes LOW. The "Undervoltage" monitoring is inactive.

4: Regen off

Signals if the preset Regen power (see *Overview of "Basic Setup", p. 81*) is exceeded.

5: Software Limit Switch Reached

Produces a HIGH-signal if a software limit-switch is reached (a preset function of the corresponding position register, set to "SW limit-switch 1" or "SW limit switch 2" - the function is defined in the screen page Position Data (See *Overview of the "Position Data" Screen, p. 126*). A motion task in the opposite direction resets the output.

6: Present Motor Position > x

If the position (angular position of the motor shaft) exceeds a preset value (auxiliary value "OxTRIG"), LOx output level is HIGH. After the function has been selected, you can enter the signaling position (in increments a number or fraction of motor turns N) as the auxiliary value "in OxTRIG". Make the calculation according to the following equation:

OxTRIG = 1048576 *N*increments

Maximum possible entry value: OxTRIG = 2^{31} = 2147483648, this corresponds to N = 2048

7: Within In-Position Window

When the target position for a motion task has been reached (the InPosition window PEINPOS), LOx output level becomes HIGH. A cable break will not be detected. The width of the InPosition window for all the valid motion tasks is entered in the "Position data" screen page.

If a sequence of motion tasks is performed one after another, then the signal for reaching the final position of the motion-task sequence will be output (target position of the last motion task).Signaling that the target position of each motion task has been reached, in a sequence of motion tasks, can be achieved with the function "16, Next_InPos".

8: Absolute Value (Current) < x

The output produces a HIGH-signal, as long as the absolute r.m.s. value of the actual current is lower than a defined value in mA (OxTRIG). After the function has been selected, you can enter the current value in OxTRIG.

9: Absolute Value (Current) > x

The output produces a HIGH-signal, as long as the absolute r.m.s. value of the actual current is higher than a defined value in mA (OxTRIG). After the function has been selected, you can enter the current value in OxTRIG.

10: Max Position Error Exceeded

If the position goes outside the preset contouring-error window, this is indicated by a LOW-signal. The width of the following error window (PEMAX) is entered in the screen page "Position" for all the valid motion tasks.

11: Drive in Current Foldback (I^2t)

If the preset I^2t monitoring threshold I2TLIM is reached (see *Overview of the "Current Loop" screen, p. 115*) this is indicated by a HIGH-signal.

16: Next in-Position Reached

The start of each motion task in an automatically executed sequence of motion tasks is signalled by an inversion of the output signal. The output produces a LOW signal at the start of the first motion task of the motion task sequence. The type of message can be set by IN2PM.

ASCII: IN2PM	Default: 0 Unit: - Range: 0, 1, 2	valid for all OPMODES

At the start of the first motion block (motion task), the "NextInPos" output is always set to 0. The response of the output during the execution of the motion block sequence depends on the configuration variable IN2PM.

- IN2PM=0 - the output is inverted at the start of the next block.
- IN2PM=1- the output is set to 0 at the start of a motion block, and set to HIGH at the end of a motion block.
- IN2PM=2 - the output is inverted at the end of a block.

With a sequence of motion blocks where the blocks are started immediately, only the IN2PM=0 or IN2PM=2 settings make sense. If the setting is IN2PM=1, the HIGH state is so short that it may not be registered at all by the external control system.

If a following task is started with the aid of an I/O (INxMODE=15), then the IN2PM=2 or IN2PM=1 setting should be used. With this setting, the end of a motion block is signaled by the HIGH state (IN2PM=1) or the change of state (IN2PM=2) at the "NextInPos" output. The external control system can then initialize the continuation of the motion task sequence via the "Start next task" input.

See *Digital Inputs LI1 / LI2 / LI3 / LI4, p. 159* Function Number 15 for more information.

17: Error/Warning Present

The output produces a HIGH-signal if an error or a warning message is signaled by the servoamplifier. A list of the error messages can be found under ERRCODE.

18: Error Present

The output produces a HIGH-signal if an error message is signaled by the servo amplifier. A list of the error messages can be found under ERRCODE.

19: DC Bus Link > x

LOx input level is HIGH if the actual value of the DC-link voltage is higher than a defined value in volts (OxTRIG). After the function has been selected, you can enter a voltage value in OxTRIG.

20: DC Bus Link < x

LOx input level is HIGH if the actual value of the DC-link voltage is lower than a defined value in volts (OxTRIG). After the function has been selected, you can enter a voltage value in OxTRIG.

21: Drive Enabled

LOx output level is HIGH if the servo amplifier is enabled.

To obtain the enable, the external Hardware Enable X3/12 signal must be present, the Enable status must be set in the setup software (or via the fieldbus interface) and no errors must be present that would cause an automatic internal disabling of the servo amplifier.

If this function is selected, the enable LOx output signal is HIGH, if the line voltage is applied and the charging of the link capacitors is completed. The drive is disabled, if the DC-link voltage wents under the threshold VBUSMIN.

22: Zero Pulse

The zero mark/pulse (HIGH-signal) is indicated by the encoder-emulation. This function is only useful at very low speeds.

23: Expansion Card State

Option not available.

24: Drive Homed

The output signals High, if a reference point is available. Reference traverse (homing) has been carried out, or a reference point has been set. See *Homing, p. 209* for more information.

30: Position Registers State

The state of the position registers is indicated by a HIGH-signal

31: Voltage at Analog Input AI1 < x

LOx output level is HIGH, if the analog input voltage at analog input AI1 is lower than the threshold of OxTRIG. The auxiliary variable OxTRIG is given in mV (with sign).

32: Voltage at Analog Input AI1 > x

LOx output level is HIGH, if the analog input voltage at analog input AI1 is higher than the threshold of OxTRIG. The auxiliary variable OxTRIG is given in mV (with sign).

33: Voltage at Analog Input AI2 < x

LOx output level is HIGH, if the analog input voltage at analog input AI2 is lower than the threshold of OxTRIG. The auxiliary variable OxTRIG is given in mV (with sign).

34: Voltage at Analog Input AI2 > x

LOx output level is HIGH, if the analog input voltage at analog input AI2 is higher than the threshold of OxTRIG. The auxiliary variable OxTRIG is given in mV (with sign).

35: Drive Internal Enable Active

The state of the internal enable signal is mirrored on LOx output.If the settings are: MBRAKE=0, STOPMODE=0 and ACTFAULT=0, the function is similar to OxMODE=21.

If one of the three variables is "1", LOx output changes to LOW, when the drives starts to dec to "0".

If OxMODE=21, LOx input level is LOW if the drive has stopped and has disabled the output stage.

36: Drive Status OR Bit Mask

This function makes an OR operation between the Bit-variable DRVSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for DRVSTAT, p. 191* for more information.

37: Drive Status AND Bit Mask

This function makes an AND operation between the Bit-variable DRVSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for DRVSTAT, p. 191* for more information.

38: Motion Status OR Bit Mask

This function makes an OR operation between the Bit-variable TRJSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for TRJSTAT, p. 190* for more information.

39: Motion Status AND Bit Mask

This function makes an AND operation between the Bit-variable TRJSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for TRJSTAT, p. 190* for more information.

40: Position Register OR Bit Mask

This function makes an OR operation between the Bit-variable POSRSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for POSRSTAT, p. 192* for more information.

41: Position Register AND Bit Mask

This function makes an AND operation between the Bit-variable POSRSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for POSRSTAT, p. 192* for more information.

42: Temperature Warning

This function enables a temperature warning.

The amplifier displays in real time Motor temperature, heatsink temperature and ambiant temperature. Those 3 temperature parameters can be read respectively by ASCII commands TEMPM, TEMPH and TEMPE.

If one of the three internal measured temperatures reaches the trip level, the digitaloutput is set to HIGH. After the selected delay time given in OxTRIG, the drive generates a error message and disables the output stage.

The delay time has the range 0...30000 msec and effects following temperatures:

- Motor temperature TEMPM, threshold MAXTEMPM
- Heatsink temperature TEMPH, Threshold MAXTEMPH
- Ambient temperature TEMPE, threshold MAXTEMPE

ASCII: TEMPM	Default: - Unit: Ohm Range: 0 - 100000	valid for all OPMODES

Displays the motor temperature in real time, in the form of the resistance of the temperature sensor (in ohms).

ASCII: MAXTEMPM	Default: 300 Unit: Ohm (KOhm) Range: 0 - 6000	valid for all OPMODES

Motor temperature switch off threshold. Defined by the resistance in KOhms. Entry to be done in KOhms.

ASCII: TEMPH	Default: - Unit: °C Range: -20 - +90	valid for all OPMODES

Displays the heatsink temperature in real time in °C.

ASCII: MAXTEMPH	Default: 70 Unit: °C Range: -20 - +90	valid for all OPMODES

Heat Sink Temperature Switch off Threshold. Exceeding this value will switch off the drive.

ASCII: TEMPE	Default: - Unit: °C Range: -20 - +90	valid for all OPMODES

Displays the internal drive temperature in real time in °C.

ASCII: MAXTEMPE	Default: 70 Unit: °C Range: 10 - 80	valid for all OPMODES

The drive temperature value for switching off the power stage and opening the R1A/R1C contact. If the drive temperature exceeds this value, the drive faults (F13).

43: Motion Direction

LOx output level is HIGH, if v_act < VEL0, and LOW if v_act > VEL0.

44: abs(Velocity Actual - Velocity Cmd) < x

LOx output level is HIGH if the absolute of the difference between the internal velocity command and the actual velocity is smaller than OxTRIG. OxTRIG value is given in valid velocity units (VUNIT).

45: abs(Velocity Actual - Velocity Cmd) > x)

LOx output level is HIGH if the absolute of the difference between the internal velocity command and the actual velocity is bigger than OxTRIG. OxTRIG value is given in valid velocity units (VUNIT).

46: abs(Current Actual - Current Cmd) < x)

LOx output level is HIGH if the absolute of the difference between current command and actual value is smaller than OxTRIG. OxTRIG value is given in mA.

47: abs(Current Actual - Current Cmd) > x)

LOx output level is HIGH if the absolute of the difference between current command and actual value is bigger than OxTRIG. OxTRIG value is given in mA.

48: Drive Status NOR Bit Mask

This function makes an inverted NOR operation between the Bit-variable DRVSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for DRVSTAT, p. 191* for more information.

49: Drive Status NAND Bit Mask

This function makes an inverted NAND operation between the Bit-variable DRVSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for DRVSTAT, p. 191* for more information.

50: Motion Status NOR Bit Mask

This function makes an inverted NOR operation between the Bit-variable TRJSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for TRJSTAT, p. 190* for more information.

51: Motion Status NAND Bit Mask

This function makes an inverted NAND operation between the Bit-variable TRJSTAT and a Bit mask given by OxTRIG. The result is present at the output selected. See *Configure Mask for TRJSTAT, p. 190* for more information.

52: Position Register AND Bit Mask + delay

Same as OxMODE = 41 with PTBASE * 250 s delay time

54: Prepare for moving

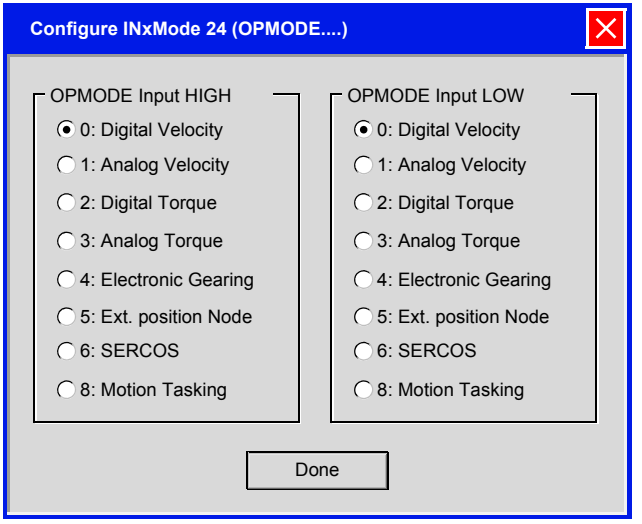
The output is high if all following conditions are true:

- software-enable set
- no error
- DC link loaded (VBUS > VBUSMIN)
- no contouring error (Warning n03)

Configure OPMODE

At a Glance

Define basic functions of the Servo amplifier for high input and for low input. This option is available when the digital input function INxMODE 24 is enabled.



OPMODE

ASCII: **OPMODE**	Default: 1 Unit: - Range: 0 - 8	Valid for all OPMODES

Set the basic function of the servo amplifier for your application here.

ID	Function	Comments
0	Velocity control -digital command Digital (rotational) velocity	There are two different ways to generate a velocity command: - RS232 Interface (J command) - Fieldbus Interface (PROFIBUS, CANopen, SERCOS, ModBus+, FIPIO Slot boards)
1	Velocity control -analog command Analog (rotational) velocity	1 The velocity setpoint is generated by the analog inputs AI1 & AI2. The configuration is done with ANCNFG and INxMODE=8.
2	Current control -digital command Digital torque	The current setpoint can be generated by: - RS232 Interface (T command) - Fieldbus Interface (PROFIBUS, CANopen, SERCOS, ModBus+, FIPIO Slot boards)
3	Current control -analog command Analog torque	The current command is generated by the analog inputs AI1 & AI2. The configuration is done with ANCNFG and INxMODE=8.
4	Electronic Gearing (Master/ Slave) Position: electr. gearing	The target position is generated by an external encoder. The type of the activated interface is selected by GEARMODE.
5	External Trajectory Position: ext. position nodes	The target position is generated by fieldbus (PROFIBUS, CANopen or ModBus+, FIPIO Slot board). The cycle time for writing the new position can be selected with the command PTBASE in 250s steps. The position controller brings the actual position to the new target postion in the selected time. When using ANCNFG=8, the target position is given by the analog input AI1. The analog voltage is read every 250s and is used as target position for the position controller. The scaling of the analog input voltage is done with SRND and ERND. Before this function is active, a homing move has to completed.
6	SERCOS control	Position control with SERCOS expansion card

ID	Function	Comments
7	reserved	reserved
8	Motion Tasks Position: motion blocks	This setting allows the starting of motion tasks and also the homing moves. See *Motion Task Parameters, p. 232* for more information.

⚠ DANGER

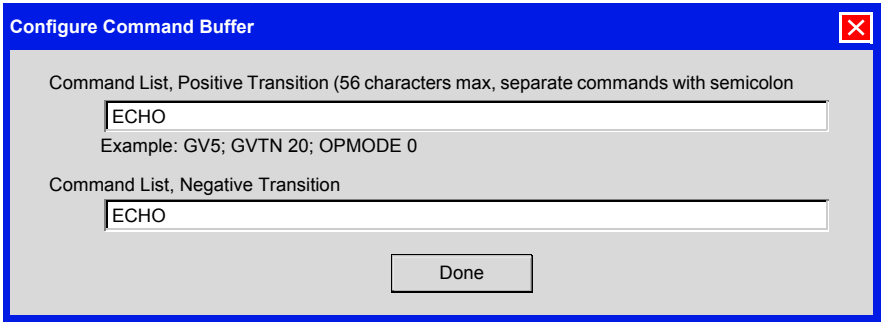
The OPMODE can be switched over while the drive is running. This could lead to dangerous acceleration. So only switch over OPMODE while the drive is running if the drive application allows it.

Failure to follow this instruction will result in death or serious injury.

Configure Command Buffer

At a Glance

Input of the ASCII command list for execution. Depending on the edge (positive or negative) of the input signal, the command lists can be different.



Command List, Positive Transition

ASCII: **INxHCMD**	Default: - Unit: - Range: -	Valid for all OPMODES

This function is available for LI1, LI2, LI3 and LI4 inputs (see *Digital Inputs LI1 / LI2 / LI3 / LI4, p. 159*, INxMODE=30 and 33).

The command IN1HCMD can be used to define an ASCII command sequence. This command sequence will always be carried out when a rising edge is detected at the input 1 that has been configured with the function IN1MODE=30,33.

A command sequence consists of individual ASCII commands, separated by a semicolon (;). The maximum length of this command sequence is 56 characters.

Example: IN1HCMD GV 10; GVTN 15

If a LOW/HIGH edge is detected, the gain of the velocity control loop is set to 10 and the integral action time is set to 15 msec.

Command List, Negative Transition

ASCII: **INxLCMD**	Default: - Unit: - Range: -	Valid for all OPMODES

This function is available for LI1, LI2, LI3 and LI4 inputs (see *Digital Inputs LI1 / LI2 / LI3 / LI4, p. 159*, INxMODE=30 and 33).

The command IN1LCMD can be used to define an ASCII command sequence. This command sequence will always be carried out when a falling edge is detected at the input 1 that has been configured with the function IN1MODE=30,33.

A command sequence consists of individual ASCII commands, separated by a semicolon (;) The maximum length of this command sequence is 56 characters.

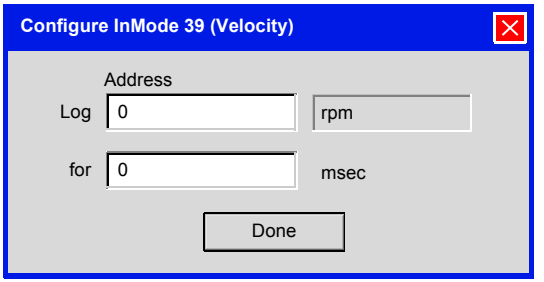
Example: IN1LCMD GV 5; GVTN 10

If a HIGH/LOW edge is detected, the gain of the velocity control loop is set to 5 and the integral action time is set to 10 msec.

Configure Velocity Time

At a Glance

Define parameters for velocity and time using the auxiliary variable x to start a constant velocity for a defined time.This function is available when you select INxMODE 39.



INxTRIG

ASCII: **INxTRIG**	Default: 1 Unit: - Range: long integer	Valid for all OPMODES

The velocity is given by the lower 16 bit (scaling by VUNIT), bit 15 is the sign and defines the moving direction and the time by the upper 16 bit (given in msec) of the help variable y.

A rising edge at LIx input changes the OPMODE value to 0 (digital velocity) and gives the velocity that is defined by INxTRIG.

After the defined time, or if a falling edge at LIx input is detected, the digital velocity setpoint is set to "0". After the actual velocity has reached "0" the OPMODE is automatically switched back to the previous one.

Example 1:

Velocity = 1000 rpm

time = 10 sec = 10000 msec

INxTRIG = 0x271003E8 = 553610002.

Example 2:

Velocity = -500 rpm

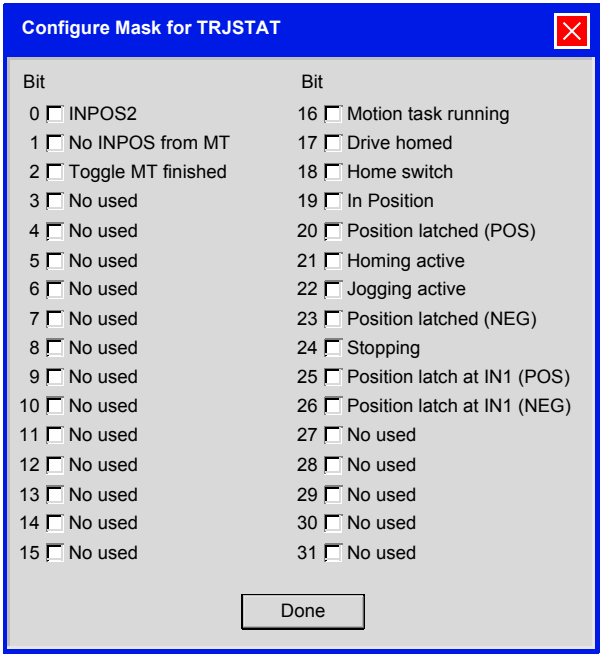
time = 10 msec

INxTRIG = 0x000afe0c = 720396

Configure Mask for TRJSTAT

At a Glance

The TRJSTAT command returns the internal status information in the form of a bit-variable. The returned value is in hexadecimal format. Select the information in the bit mask that you want to observe:



The status information 3...15 and 27...31 are primarily used for internal functions. Bits 0...2 and 16...26 can be used for external functions (control system).

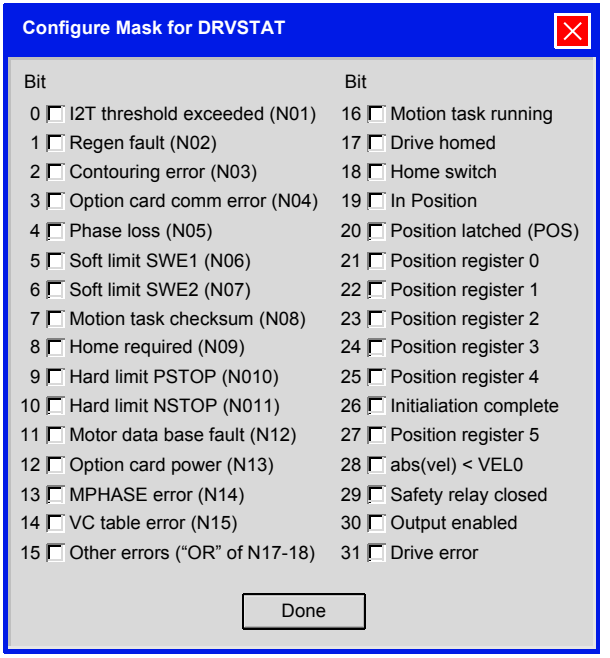
The bit mask is compared with the bit variable contents according to the selected logic (AND, OR, NAND, NOR). The digital output is set if the result is a logical 1.

This function is available when you select OxMODE 38/39/50/51 as the Digital Output.

Configure Mask for DRVSTAT

At a Glance

The DRVSTAT command returns the internal status information in the form of a bit-variable. The returned value is in hexadecimal format. Select the information in the bit mask that you want to observe:



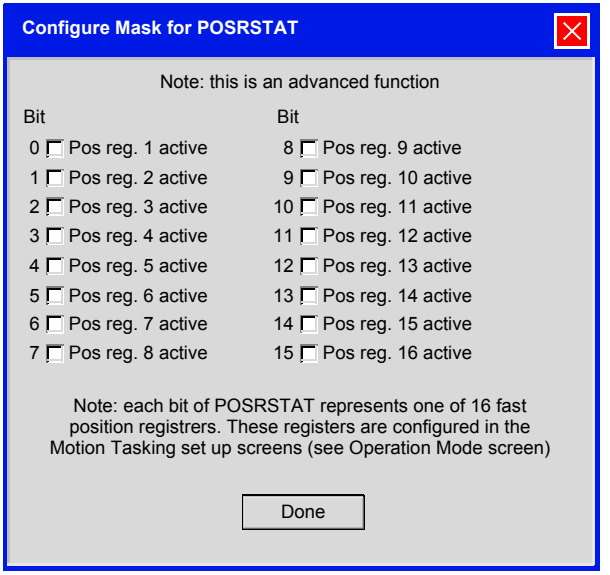
The bit mask is compared with the bit variable contents according to the selected logic (AND, OR, NAND, NOR). The digital output is set if the result is a logical 1.

This function is available when you select OxMODE 36/37/48/49 as the Digital Output.

Configure Mask for POSRSTAT

At a Glance

The POSRSTAT command returns the actual status of the fast position registers. The returned value is in hexadecimal format. Select the information in the bit mask that you want to observe:



The bit mask is compared with the bit variable contents according to the selected logic (AND, OR,). The digital output is set if the result is a logical 1.

The functionality of the position registers can be set on the screen page Position Registers.

This function is available when you select OxMODE 40/41 as the Digital Output.

4.16 Screen page "Motion Service"

Screen page "Motion Service"

At a Glance

Overview of the different field values included in the "Motion Service" screen page.

What's in this Section?

This section contains the following topics:

Jog mode

At a Glance

Jog mode is defined as an endless motion at a constant velocity, which is implemented by the internal position control loop . This type of operation can be started without a reference point being set. The hardware limit-switches are monitored. Software limit-switches are only monitored if a reference point has been set. Acceleration and deceleration ramps are taken from the settings for homing.

v

ASCII: **VJOG**	Default: 10000 Unit: in relation to VUNIT Range: -500008...500008	valid for OPMODE 8

Determines the velocity for jog mode. The sign that is entered determines the direction of movement. Before starting the jog mode, the velocity value must be entered. The scaling of the velocity is given in position control loop units, and depends on the **PGEARI** and **PGEARO** parameters.

F4

ASCII: **MJOG**	Default: - Unit: - Range: -	valid for OPMODE 8

MJOG starts the jog mode via the serial interface (OPMODE 8 only). The velocity in the jog mode is taken from VJOG (with sign). Acceleration and deceleration ramps are taken from the settings for homing (see **ACCR** and **DECR**).

⚠ CAUTION

STATEMENT OF HAZARD

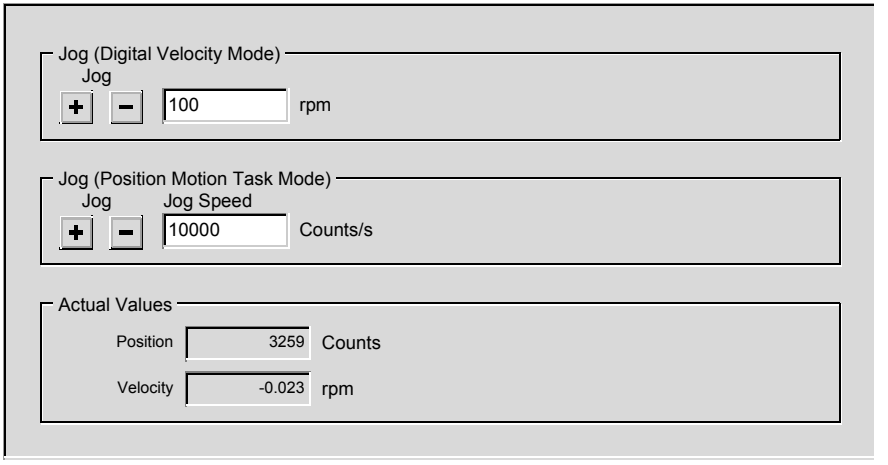
When the function "Jog mode" is started, the SW-enable is set automatically. The Function "Jog mode" is only started in OPMODE 8. However, the SW-enable is set in all OPMODES. The drive can therefore be accelerated by an analog setpoint that is applied, if the START command is executed in OPMODES1 or 3.

Failure to follow this instruction can result in injury or equipment damage.

Introduction to the "Motion Service" screen

At a Glance

This screen page enables you to set parameters to move the drive with constant speed (jog mode):



The drive moves with the preset speed when the + or – button is pressed. It stops when the button is released.

> **⚠ CAUTION**
>
> **RISK OF EQUIPMENT DAMAGE**
>
> The actual position of the load controls the subsequent positioning operations. The software limit-switches that were set as parameters are inactive, depending on the operation mode. The axis could move to the hardware limit-switch or the mechanical stop. There is a risk of damage.
>
> **Failure to follow this instruction can result in injury or equipment damage.**

Digital Velocity Mode

ASCII: **J**	Default: 0 Unit: rpm/ms Range: -15000.0 - 15000.0/ long integer	valid for OPMODE 0

Jog (digital velocity mode checks parameters in velocity controller)

The command "J <n> <t>" can be used to define a constant velocity <n> (in rpm) for a defined time <t> (in msec). If the <t> entry is missing, the drive runs continuously.

Position Motion Tasks Mode

ASCII: **VJOG**	Default: 0 Unit: - Range: -500008...500008	valid for OPMODE 8

Jog (position motion tasks mode checks parameters in position controller)

Jog mode in OPMODE 8.

Positive speed: **+**

Negative speed: **-**

Enter the speed (dimension: speed in position loop)

Actual Values - Counts

ASCII: **PFB**	Default: - Unit: m Range: Long integer	valid for all OPMODES

The PFB command returns the actual value of the position (from the position control loop feedback). The unit for the position value depends on the PGEARI, PGEARO and PRBASE settings.

PFB = Position * PGEARI / PGEARO, where:

Position = position value in increments, 1048576/turn for PRBASE=20, 65536/turn for PRBASE=16

If the resolution is set to 1 (PGEARI=PGEARO) then the PFB command provides internal units (counts).

Actual Values - Velocity

ASCII: **V**	Default: - Unit: rpm Range: -15000...15000	valid for OPMODE 8

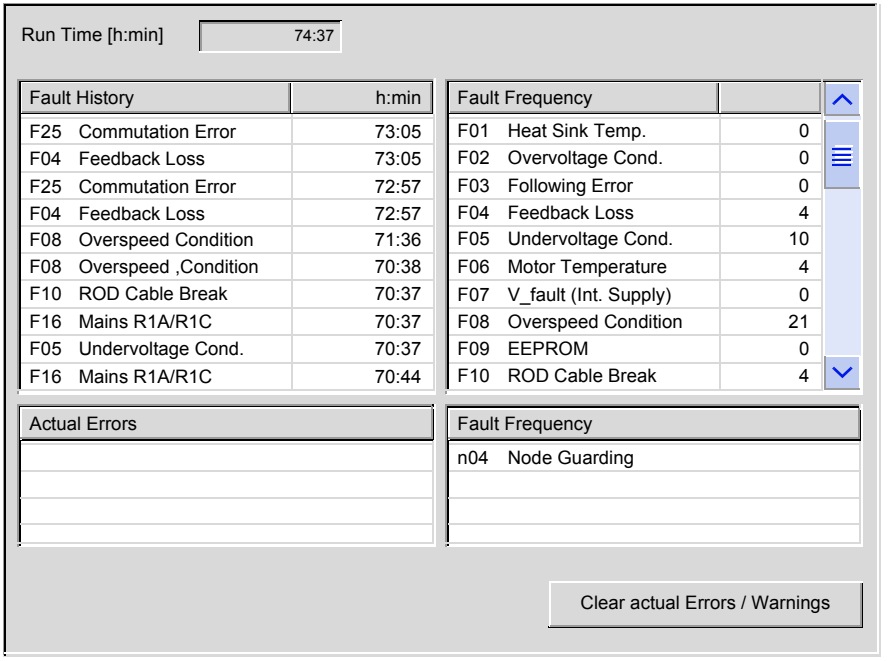
Motor velocity in real time.

4.17 Screen page "Status"

Introduction to the "Status" Screen

At a Glance

The actual error status and the run time monitor of the servo amplifier are displayed here:



On the top left pane is the error history with the time (run time) when the error occured. On the top right pane information about the frequency of every error is listed. Below these frames, the actual errors and warnings are listed.

By comparing the error status to the runtime status you can calculate when an error occurrs.

You can find a list of all warnings and error messages in the installation manual of the servo amplifier.

Run time

ASCII: **TRUN**	Default: - Unit: hhhhh:mm Range: 00000:00 - 99999:45	valid for all OPMODES

Display of the operational time of the servo amplifier, saved in EEPROM at 8 minute intervals. If the 24V supply is switched off, maximum 8 minutes of operation are unregistered.

Fault History

ASCII: **FLTHIST**	Default: - Unit: Fault Number / TRUN time Range: Last 10 faults and times	valid for all OPMODES

The last 10 faults that occurred are displayed, together with the time of their occurrence, referred to the operating hours.

Return data looks like n1 t1 n2 t2 ... n10 t10, where n is the fault number and t is the time of the event.

Fault Frequency

ASCII: **FLTCNT**	Default: - Unit: - Range: 0, 65535 per Fault Message	valid for all OPMODES

Display of the frequency of all faults that caused the servo amplifier to switch off. The command returns a list of 33 numbers:

1st number: total number of faults (Integer32)

2nd number number of occurrences of fault F01

3rd number number of occurrences of fault F02.....

33rd number number of occurrences of fault F32

Actual Errors

ASCII: **ERRCODE**	Default: - Unit: - Range: 0 .. 0xFFFFFFFF	valid for all OPMODES

Display of the errors presently being reported by the servo amplifier (corresponds to the error messages **Fxx** in the LED-display on the front panel of the amplifier). ERRCODE can be erased by resetting the drive or by using command CLRFAULT.

Actual Warnings

ASCII: **STATCODE**	Default: - Unit: - Range: -	valid for all OPMODES

Display of the warnings presently being reported by the servo amplifier (corresponds to the **nxx** warnings in the LED-display on the front panel of the amplifier).

Clear Errors/ Warnings

ASCII: **CLRFAULT**	Default: - Unit: - Range: -	valid for all OPMODES

Software-reset of the servo amplifierc command. **The servo amplifier must be disabled.**

Present errors are deleted, the firmware is re-initialized, and communication is re-established.

If only errors marked with an asterisk in the error listing are present, then the errors are cancelled, but no reset of the amplifier takes place.

Active Fault Mode

ASCII: **ACTFAULT**	Default: 1 Unit: - Range: 0, 1	valid for all OPMODES

The ACTFAULT command is used to specify the response of the drive if a fault occurs.

To set up ACTFAULT, you must use the Terminal Screen. Changes will be performed only while the amplifier is disabled and reset it (COLDSTART).

ACTFAULT=0: If a fault occurs, the output stage is immediately inhibited, the drive coasts down.

ACTFAULT=1: If a fault occurs, an Emergency Stop procedure is initiated, that consists of the following steps.

1. Switch over the controller mode to velocity control (OPMODE=0)

2. Change the braking ramp for the velocity control loop (DEC) to the emergency stop ramp (DECSTOP)

3. Set the internal velocity setpoint to 0 (before the ramp generator).

4. Start a timer (with time-out = 5 seconds)

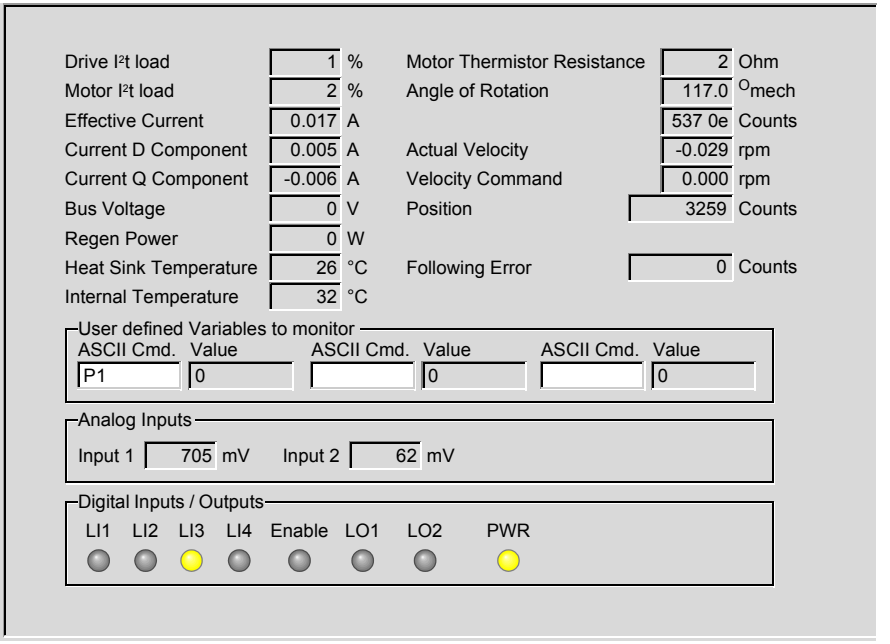
As soon as the internal velocity setpoint (after the ramp generator) has reached 0, the output stage is inhibited and the original controller mode is re-activated. This will also happen if the time-out occurs before the velocity setpoint has reached 0.

4.18 Screen page "Monitor"

Introduction to the "Monitor" Screen

At a Glance

This screen enables you to monitor the value of important parameters:



You can also choose to display three more parameters. Enter the ASCII names of the parameters you wish to display to see their values.

Drive I2t Load

ASCII: **DI2T**	Default: - Unit: % Range: 0 - 100	valid for all OPMODES

This variable returns the average current as a percentage of the continuous current (see DICONT). The average current is filtered with a time constant of 16 seconds.

Motor I2t Load

ASCII: **MI2T**	Default: - Unit: % Range: 0 - 100	valid for all OPMODES

This variable returns the average current as a percentage of the continuous current (see MICONT (See *Io, p. 104*) for more information). The average current is filtered with the time constant MTIME.

Effective Current

ASCII: **I**	Default: - Unit: Amperes Range: -	valid for all OPMODES

This variable returns the actual current value in amperes. This value is always positive.

Current D Component

ASCII: **ID**	Default: - Unit: Amperes Range: -	valid for all OPMODES

The D-axes component of the actual current value.

Current Q Component

ASCII: **IQ**	Default: - Unit: Amperes Range: -	valid for all OPMODES

The Q-axes component of the actual current value.

Bus Voltage

ASCII: **VBUS**	Default: - Unit: Volts Range: 0 - 900	valid for all OPMODES

The current voltage of the DC-bus.

Regen Power

ASCII: **PBAL**	Default: - Unit: W Range: 0 - 1500	valid for all OPMODES

The actual value of average regen power.

Heat Sink Temperature

ASCII: **TEMPH**	Default: - Unit: °C Range: -20 - 90	valid for all OPMODES

Displays the current heat sink temperature in °C.

Internal Temperature

ASCII: **TEMPE**	Default: - Unit: °C Range: -20 - 90	valid for all OPMODES

Displays the current internal temperature in °C.

Motor Thermistor Resistance

ASCII: **TEMPM**	Default: - Unit: Ohm Range: 0 - 10000	valid for all OPMODES

Indicates the motor temperature, in the form of the resistance of the temperature sensor (in ohms).

Angle of Rotation

ASCII: **PRD**	Default: - Unit: Counts Range: 0 - 1048575	valid for all OPMODES

The PRD command returns a 20-bit position (absolute within one turn) that is derived from the signals of the feedback device (FBTYPE (See *Feedback type, p. 96*)). Unlike the position from the position control loop, PFB, this position cannot be altered. PRD is not related to PRBASE.

Actual Velocity

ASCII: **V**	Default: - Unit: MUNIT Range: -15000...15000	valid for all OPMODES

Motor velocity in real time.

Velocity Command

ASCII: **VCMD**	Default: - Unit: MUNIT Range: -VMAX...VMAX	valid for all OPMODES

The VCMD variable contains the internal velocity setpoint (after the ramp generator) in RPM. Depending on the operating mode that is set (OPMODE=0), this value is either provided directly and digitally (fieldbus, slot card) or derived from the analog velocity setpoint (OPMODE=1).

For operating modes that do not use a velocity control loop (OPMODE=2, 3) the VCMD variable has the value V of the actual velocity.

Position

ASCII: **PFB**	Default: - Unit: m Range: Long integer	valid for all OPMODES

The PFB command returns the actual value of the position (from the position control loop feedback). For more information, see *Actual Values - Counts, p. 196*.

Following Error

ASCII: **PE**	Default: - Unit: m Range: Long integer	valid for all OPMODES

The following error OPMODE = 8 or contouring error OPMODE = 5 or 6 is the momentary difference between the position command and the actual position. It is displayed in the same units as the position control loop (PGEARI / PGEARO). See *max. Following Error, p. 127*for additional information.

4.19 Screen page "Homing"

General overview of the "Homing" screen

At a Glance

Overview of the different field values included in the "Homing" screen.

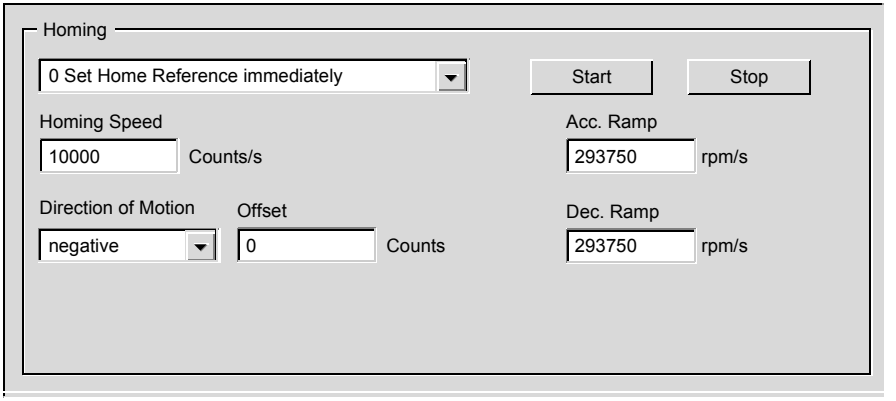
What's in this Section?

This section contains the following topics:

Overview of the "Homing" screen

At a Glance

Homing is an essential task, used to zero the drive for subsequent positioning operations. You can choose between various types of homing:



After homing, the drive reports "InPosition" and then enables the position controller in the servo amplifier.

⚠ CAUTION

Take care that the zero point of the machine (reference point) is in a position that permits the subsequent positioning operations. The software limit-switches that were set as parameters may be ineffective. The axis could move on to the hardware limit-switch or even the mechanical stop. There is a risk of damage. If the reference point (zero point of the machine) is approached with excessive velocity, for instance because of high moments of inertia, it may be overshot and, in the worst case, move on to the hardware limit-switch or even the mechanical stop. There is a risk of damage. The position controller cannot be operated without first making a reference traverse (homing). A homing/reference traverse must be made after the 24V auxiliary voltage has been switched on. The start signal must not be removed during homing. The start signal must remain present until the "InPosition" message appears.

Failure to follow this instruction can result in injury or equipment damage.

Start

ASCII: **MH**	Default: - Unit: - Range: -	valid for OPMODE 8

Click to start homing.

⚠ CAUTION

The SW-enable is set automatically when homing starts. Homing will only be started in OPMODE 8. However, the SW-enable is set in all OPMODES The drive can therefore be accelerated by an analog setpoint that is applied, if the START command is executed in OPMODES 1 or 3.

Failure to follow this instruction can result in injury or equipment damage.

Stop

ASCII: **STOP**	Default: - Unit: - Range: -	valid for all OPMODES

Click to stop (cancel) the homing. **The SW-enable remains set!**

Homing

ASCII: **NREF**	Default: 0 Unit: - Range: 0 - 20	valid for OPMODE 8

You can choose which type of reference traverse should be performed. A preset zero-point offset (screen page "Encoder" is taken into account for the position output and display.

Exception: homing 5, in this case the true current position is displayed.

Zero-point recognition: the reference point is set to the first zero-crossing point of the feedback unit (zero mark) after recognition of the reference switch transition. Two-pole resolvers and all encoders have just one zero-crossing per turn, so the positioning at the zero mark is unambiguous within a motor turn. For 4-pole resolvers there are two zero-crossings per turn, and for 6-pole resolvers there are three zero-crossings. If the transition of the reference switch lies very close to the zero-crossing point of the feedback unit, then the positioning to the zero mark can vary by one motor turn.

Note: the repetition accuracy of homing operations that are made without zero-point recognition depends on the traversing speed and the mechanical design of the reference switch or limit-switch.

For homing modes 1 and 3, a digital input must be configured as a zero-mark input (home position) (INxMODE=12 or I/O expansion card).

For homing modes 2 and 4, a digital input must be configured as a hardware limit switch.

For homing modes 1, 2, 3, 4, 5, and 7, the setting of the zero-pulse offset for the Encoder Equivalent Output (EEO) output is taken into account (the zero point is set so both the output of the zero pulse and the display of the zero position appear at zero-pulse offset).

Homing 0	Sets the current position point to the value of the Offset field setpoint. The motor does not run (the following error is lost).
Homing 1	Traverse to the reference switch with zero-mark recognition.
Homing 2	Move to hardware limit-switch, with zero-mark recognition. The reference point is set to the first zero-crossing of the feedback unit (NM, zero mark) beyond the limit-switch.
Homing 3	Move to reference switch, without zero-mark recognition. The reference point is set to the transition of the reference switch.
Homing 4	Move to hardware limit-switch, without zero-mark recognition. The reference point is set to the transition of the hardware limit-switch.
Homing 5	Move to the next zero-mark of the feedback unit. The reference point is set to the next zero-mark of the feedback unit.
Homing 6	Sets the reference point to the actual position (the following error is not lost).
Homing 7	Move to mechanical stop, with zero-mark recognition. The reference point is set to the first zero-crossing of the feedback unit (NM, zero mark) beyond mechanical stop.
Homing 8	Drives to an absolute SSI position. At the start of the homing run, a position is read from the SSI input (GEARMODE=5), converted according to the scaling factors GEARI and GEARO, as well as the reference offset, then used as the target position.
Homing 9	Move to mechanical stop, without zero-mark recognition. When the homing mode is started, the peak current limit threshold IPEAK is set to REFIP (peak current for the homing mode in A) in the direction given by DREF (DREF=0 positive, DREF=1 negative). When the drive moves the motor, the contouring error is monitored and if the error becomes higher than PEMAX / 2 (half of the contouring error window), this position is used to set the actual and the target position to ROFFS. The peak current of the drive is set back to the original value of IPEAK.

Direction of Motion

ASCII: **DREF**	Default: 0 Unit: - Range: 0, 1, 2, 16, 17, 18, 32, 33, 34	valid for OPMODE 8

The DREF parameter can be used to define the preferred direction of motion for a homing operation and for positioning with a modulo-axes. Bits 0..3 are used for homing, Bits 4..7 for modulo-axis (POSCNFG=1). If a homing mode with zero puls is selected DREF should be set to 2,18 or 34. The possible combinations are shown in the table.

ID	Homing	Modulo
0	Negative	Negative
1	Positive	Negative
2	Shortest distance	Negative
16	Negative	Positive
17	Positive	Positive
18	Shortest distance	Positive
32	Negative	Shortest distance
33	Positive	Shortest distance
34	Shortest distance	Shortest distance

Homing Speed

ASCII: **VREF**	Default: 1000 Unit: VUNIT Range: 0 - VLIMN/VLIMN	valid for OPMODE 8

Determines the velocity for the homing operation. The sign is automatically fixed by the direction of motion that is selected. The size is defined by **VUNIT**.

Accel. ramp

ASCII: **ACCR**	Default: 31500 Unit: ACCUNIT Range: 3 - 126000	valid for OPMODE 8

Acceleration ramp for jogging and homing with the internal position control loop. This variable defines the acceleration ramp used for jogging and homing with the internal position control loop. When starting the homing or jog mode, the ACCR acceleration ramp can (in some circumstances) be limited by the minimum acceleration time **PTMIN**. The size is defined by **ACCUNIT**.

Decel. ramp

ASCII: **DECR**	Default: 31500 Unit: ACCUNIT Range: 3 - 126000	valid for OPMODE 8

The DECR command defines the braking ramp for jog mode or homing with the internal position control loop. When starting the homing/jog mode, the DECR deceleration ramp can, in some circumstances, be limited by the minimum acceleration time **PTMIN**.The size is defined by **ACCUNIT**.

This deceleration ramp is only used if the operating mode allows it. For homing to a hardware limit-switch, the emergency ramp is used.

Offset

ASCII: **ROFFS**	Default: 0 Unit: m Range: long integer	valid for OPMODE 8

With the reference offset you can assign an absolute position value other than 0 to the reference point. With an offset for the reference position you are not actually making a physical change, but the offset is used as a reference value within the position control of the servo amplifier. Homing to the reference switch will then not finish at zero, but at the preset reference offset value. **The reference offset must be set before homing is started.** The scaling of the position depends on the settings for **PGEARI**, **PGEARO**, **PRBASE**. The reference offset is entered in m.

Homing Diagrams

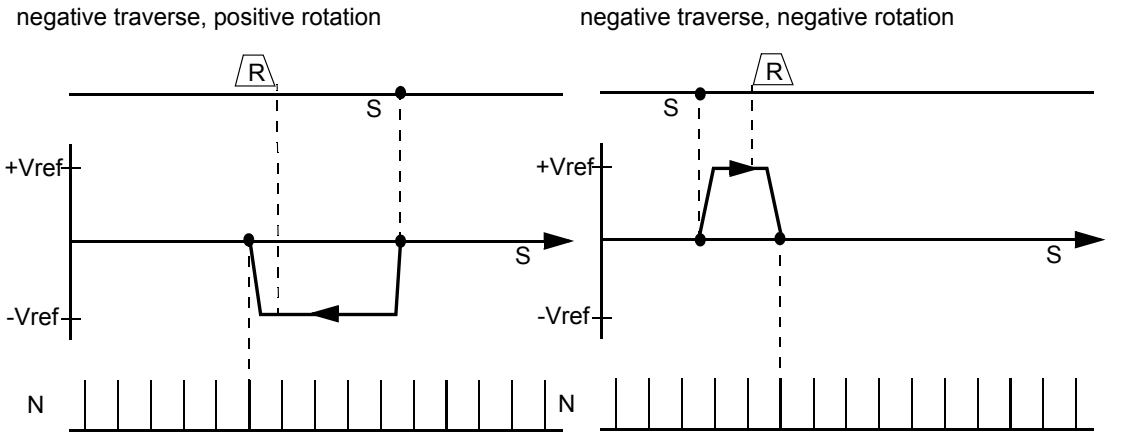
On the following pages you can find the paths traversed during homing types 1 to 7 for every possible initial situation (positive rotation, negative and positive directions of motion).

The meanings of the abbreviations in the diagrams are:

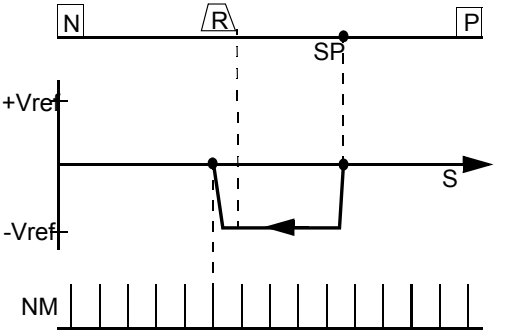
N	limit-switch NSTOP	**P**	limit-switch PSTOP	**SP**	start position
R	reference switch	**vref**	preset velocity	**NM**	zero mark of the resolver

Homing 1

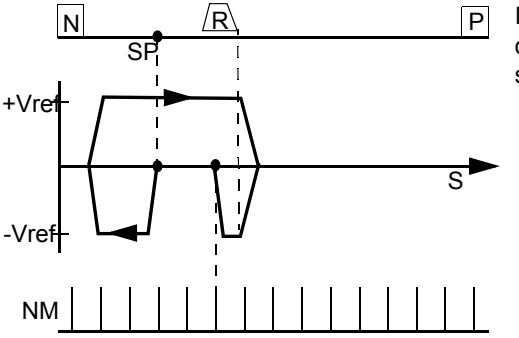
Diagrams Homing without limit switches, with homing switch, with feedback zero



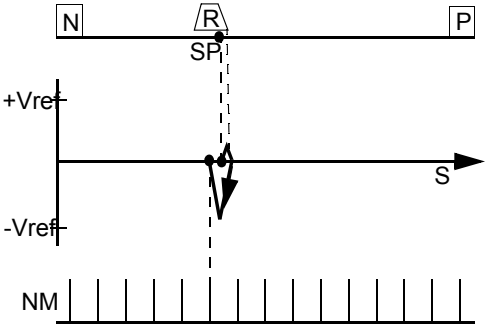
Homing with reference switch, negative direction of motion, positive rotation, with zero-mark.



Initial point in positive direction from reference switch



Initial point in negative direction from reference switch



Initial point at reference switch

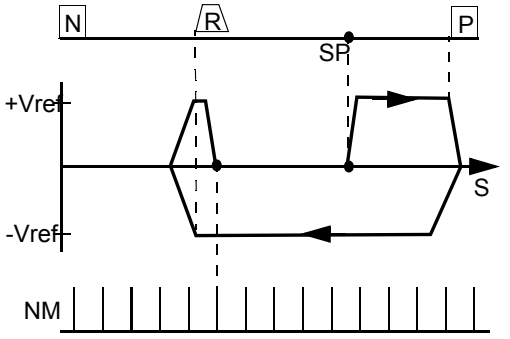
⚠ CAUTION

RISK OF EQUIPEMENT DAMAGE

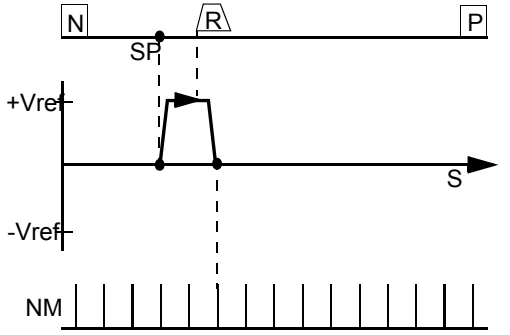
Before starting homing, check the safety of the system, since the load may move, even if the limit-switches are disconnected or defective.
The limit-switch functions 2, PSTOP and 3, NSTOP must be activated at digital inputs LI3 and LI4 to achieve the full homing functionality.

Failure to follow this instruction can result in injury or equipment damage.

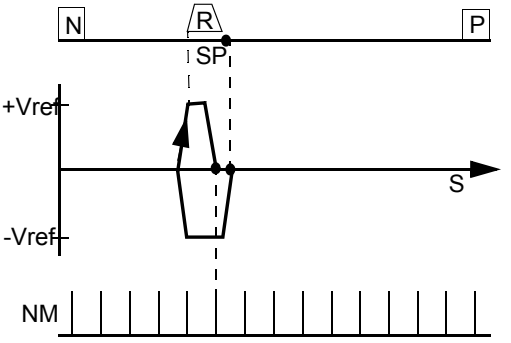
Homing with reference switch, positive direction of motion, positive rotation, with zero-mark.



Initial point in positive direction from reference switch



Initial point in negative direction from reference switch



Initial point at reference switch

⚠ CAUTION

RISK OF EQUIPEMENT DAMAGE

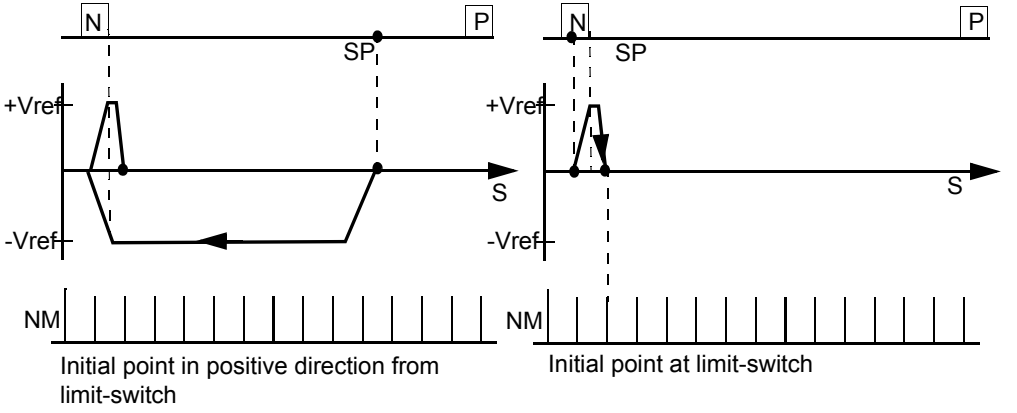
Before starting homing, check the safety of the system, since the load may move, even if the limit-switches are disconnected or defective.
The limit-switch functions 2, PSTOP and 3, NSTOP must be activated at digital inputs LI3 and LI4 to achieve the full homing functionality.

Failure to follow this instruction can result in injury or equipment damage.

Homing 2

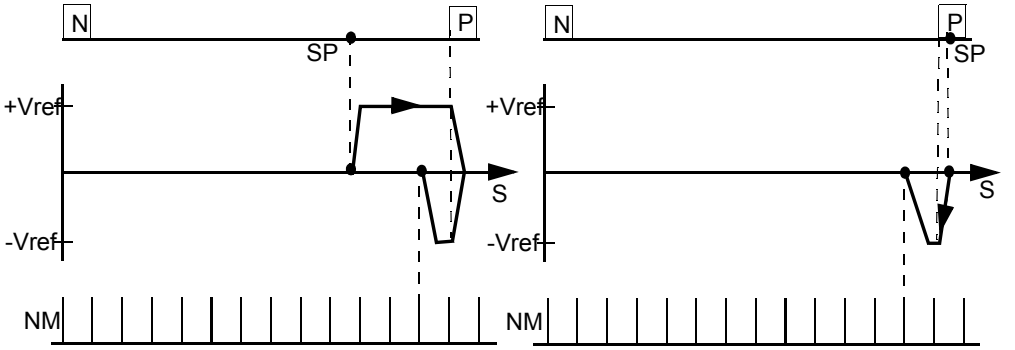
Diagrams

Homing with reference switch, **negative direction** of motion, positive rotation, with zero-mark.



Note: hardware limit-switches must be present and connected. The digital inputs LI3 and LI4 limit-switch functions 2, PSTOP and 3, NSTOP must be switched on.

Homing with reference switch, **positive direction** of motion, positive rotation, with zero mark.

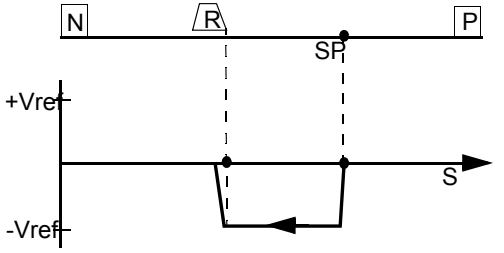


Note: hardware limit-switches must be present and connected. The digital inputs LI3 and LI4 limit-switch functions 2, PSTOP and 3, NSTOP must be switched on.

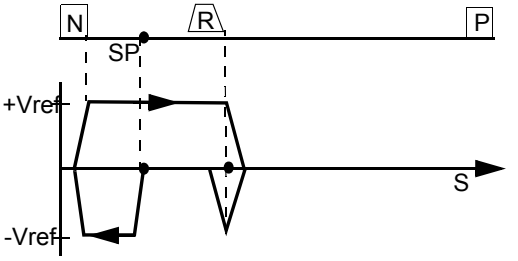
Homing 3

Diagrams

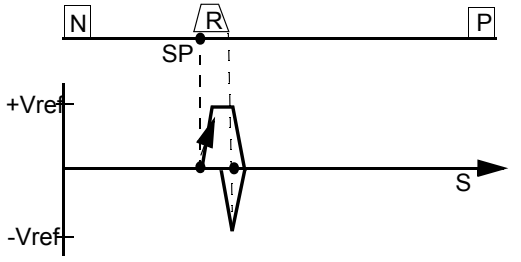
Homing with reference switch, **negative direction** of motion, positive rotation, without zero-mark.



Initial point in positive direction from reference switch



Initial point in negative direction from reference switch



Initial point at reference switch

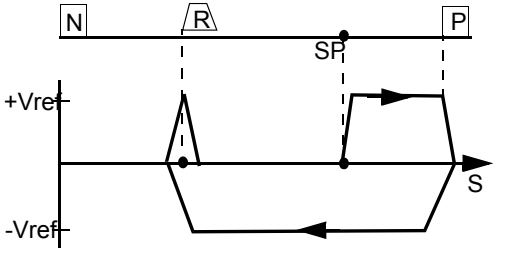
⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

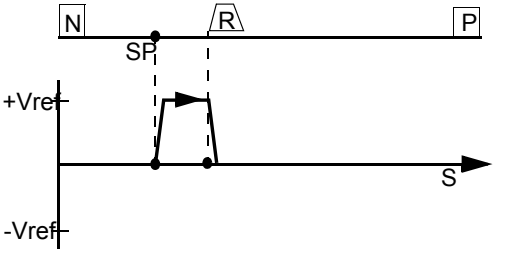
Before starting homing, check the safety of the system, since the load may move, even if the limit-switches are disconnected or defective.
The limit-switch functions 2, PSTOP and 3, NSTOP must be activated at digital inputs LI3 and LI4.

Failure to follow this instruction can result in injury or equipment damage.

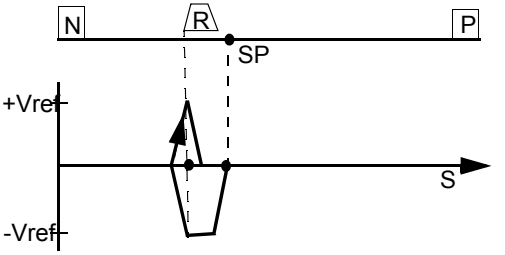
Homing with reference switch, **positive direction** of motion, positive rotation, without zero mark.



Initial point in positive direction from reference switch



Initial point in negative direction from reference switch



Initial point at reference switch

⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

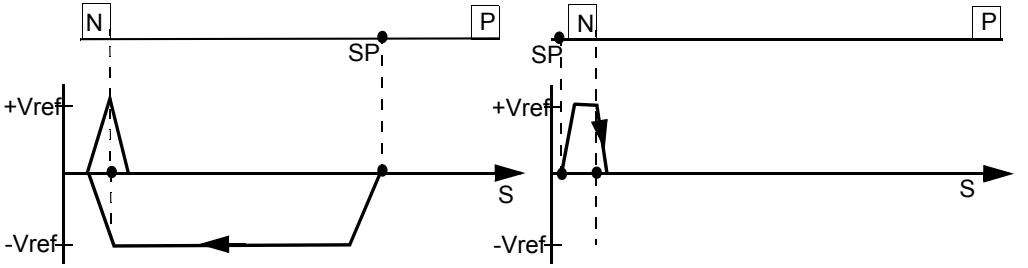
Before starting homing, check the safety of the system, since the load may move, even if the limit-switches are disconnected or defective.
The limit-switch functions 2, PSTOP and 3, NSTOP must be activated at digital inputs LI3 and LI4.

Failure to follow this instruction can result in injury or equipment damage.

Homing 4

Diagrams

Homing without reference switch, **negative direction** of motion, positive rotation, without zero mark.

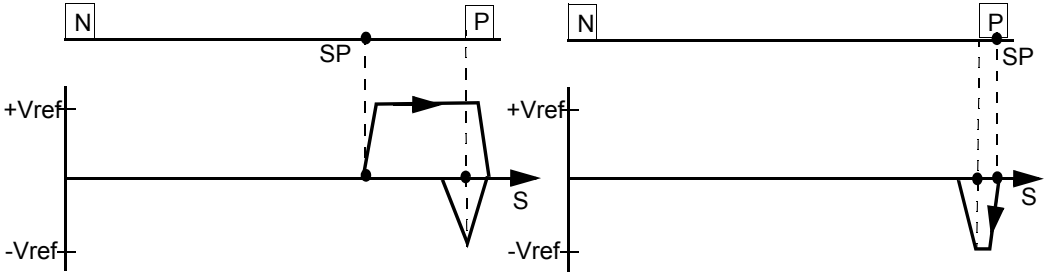


Initial point in positive direction from limit-switch

Initial point at limit-switch

Note: Hardware limit-switches must be present and connected. The LI3 and LI4 digital input limit-switch functions 2, PSTOP and 3, NSTOP must be switched on.

Homing without reference switch, **positive direction** of motion, positive rotation, without zero mark.



Initial point in negative direction from limit-switch

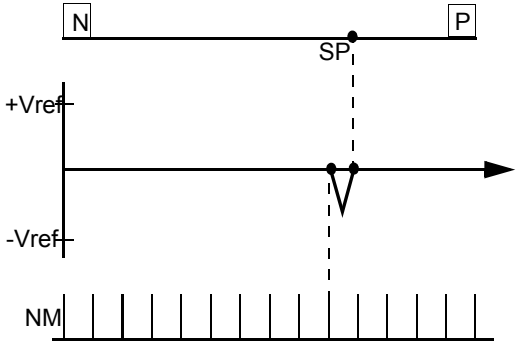
Initial point at limit-switch

Note: Hardware limit-switches must be present and connected. The LI3 and LI4 digital input limit-switch functions 2, PSTOP and 3, NSTOP must be switched on.

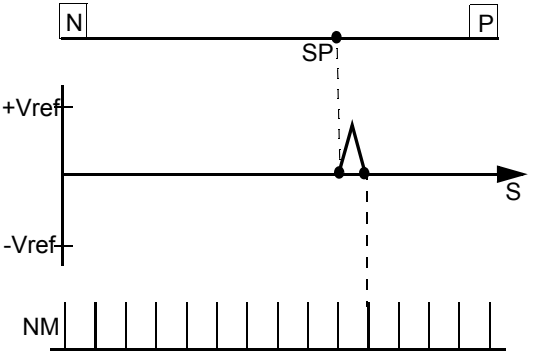
Homing 5

Diagram

Homing without reference switch, **negative direction** of motion, positive rotation, with zero mark.



Homing with reference switch, **positive direction** of motion, positive rotation, with zero mark.

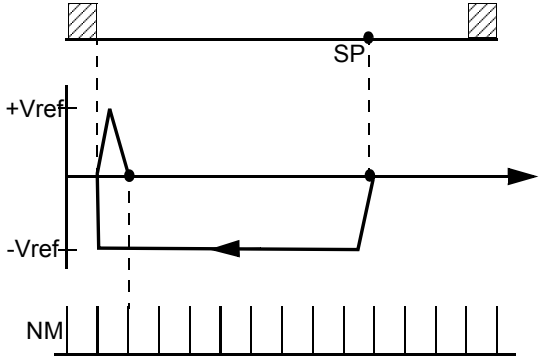


Note: behavior for successively repeated starts of Homing 5: the position controller can only hold the motor in the zero position by passing the zero mark by 1 count. On a repeated start of Homing 5, depending on the position (1 count in advance of or 1 count behind the zero-mark) and the count direction, the movement may be a full motor turn !

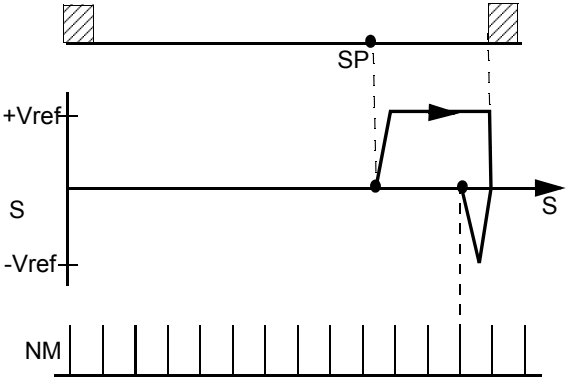
Homing 7

Diagrams

Homing to mechanical stop, **negative direction** of motion, positive rotation, with zero mark.



Homing to mechanical stop, **positive direction** of motion, positive rotation, with zero mark.



⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

Using this type of homing run can damage the mechanical stop on the machine.
The peak current Ipeak and the continuous current Irms are limited for the duration of the homing run.
A more severe limiting of the current is possible. Consult our applications department.

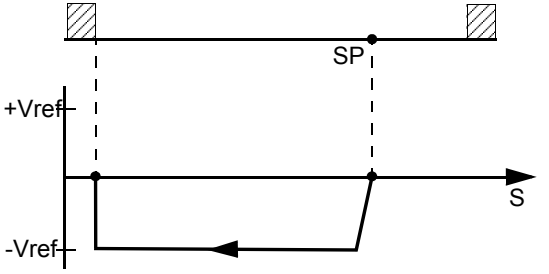
Failure to follow this instruction can result in injury or equipment damage.

Homing 9

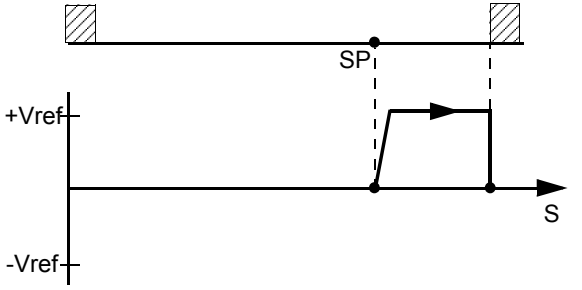
Diagrams

Mechanical stop, without limit switches, without homing switch, without feedback zero.

Homing to mechanical stop, **negative direction** of motion, positive rotation, without zero mark.



Homing to mechanical stop, **positive direction** of motion, positive rotation, without zero mark.



⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

Using this type of homing run can damage the mechanical stop on the machine. The peak current Ipeak and the continuous current Irms are limited for the duration of the homing run.
A more severe limiting of the current is possible. Consult our applications department.

Failure to follow this instruction can result in injury or equipment damage.

4.20 Screen page "Motion task parameters"

General overview of the "Motion task parameters" screen

At a Glance

Overview of the different field values included in the "Motion task parameters " screen page.

What's in this Section?

This section contains the following topics:

Overview of the "Motion Task" Screen

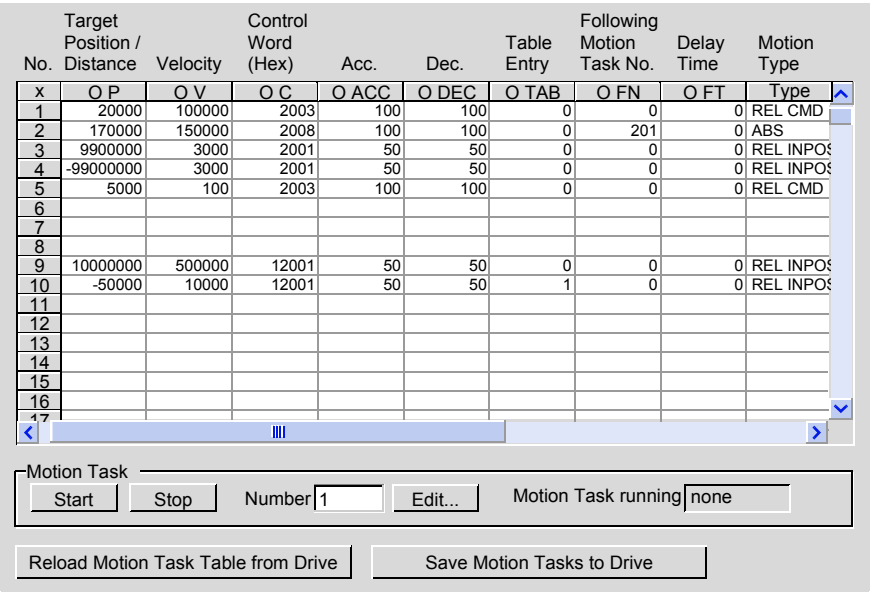
At a Glance

Motion Task is a Mode Of Operation 8 that allows the execution of a move sequence stored in the servo drive memory. Each move is called a Motion Task.

Depending on the Lexium 15 model you use, you can store several Motion Tasks in the RAM or EEPROM:

	EEPROM	**RAM**
Lexium 15 LP	180	75
Lexium 15 MP/HP	200	100

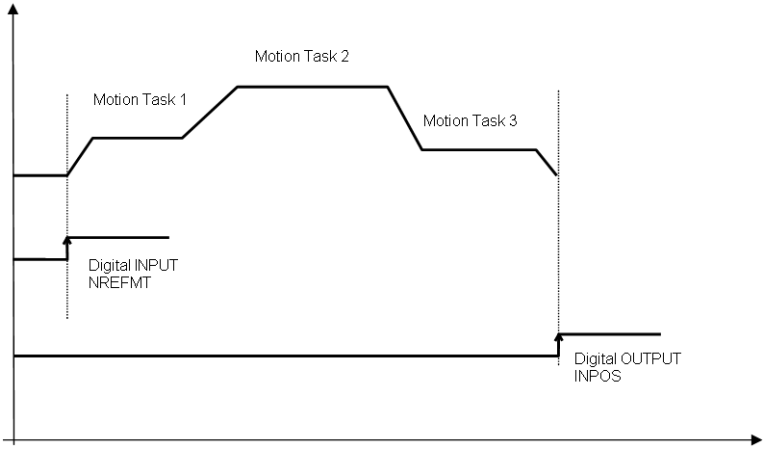
Each Motion Task is numbered; the number is used to start the sequence or to define the next execution:



A Motion Task may be started by a Digital Input or a field bus order.

The Motion Task may be started automatically in Operation Enable mode if AUTOHOME was set. The Motion Task number is declared by the NREFMT command.

The completion of the Motion Task or sequence of Motion Tasks is shown in the In_Position object, which can also be monitored by a Digital Output.



Number

Entry of a motion task number, to start the motion task from a PC.

Start

ASCII: **MOVE**	Default: -	valid for OPMODE 8

Start the motion task that has the number that can be seen in the NUMBER field. The amplifier must be enabled (input X3/12 has a High signal).

When using the Terminal screen, entering MOVE "x" means that the Servo amplifier will start motion task number "x', where the range of "x" is 0 - 300.

⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

The SW-enable is automatically set when the motion task starts. The motion task is only started in OPMODE8. However, the SW-enable is set in all OPMODES. The drive can therefore be accelerated by an analog setpoint that is applied, if the START command is executed in OPMODES1 or 3. The motion task is not started if the target position is beyond the defined SW-limit switches (warning messages n06/n07 and n08.

Failure to follow this instruction can result in injury or equipment damage.

Stop

ASCII: **STOP**	Default: -	valid for OPMODE 8

Stops the current motion task. The SW-enable remains set!

Edit

Enter a Motion task number and click Edit to set parameters for that motion task. The Motion Task Parameters dialog box is displayed.

Motion Task Table

You can use this table to directly enter all task parameters. The following commands are available:

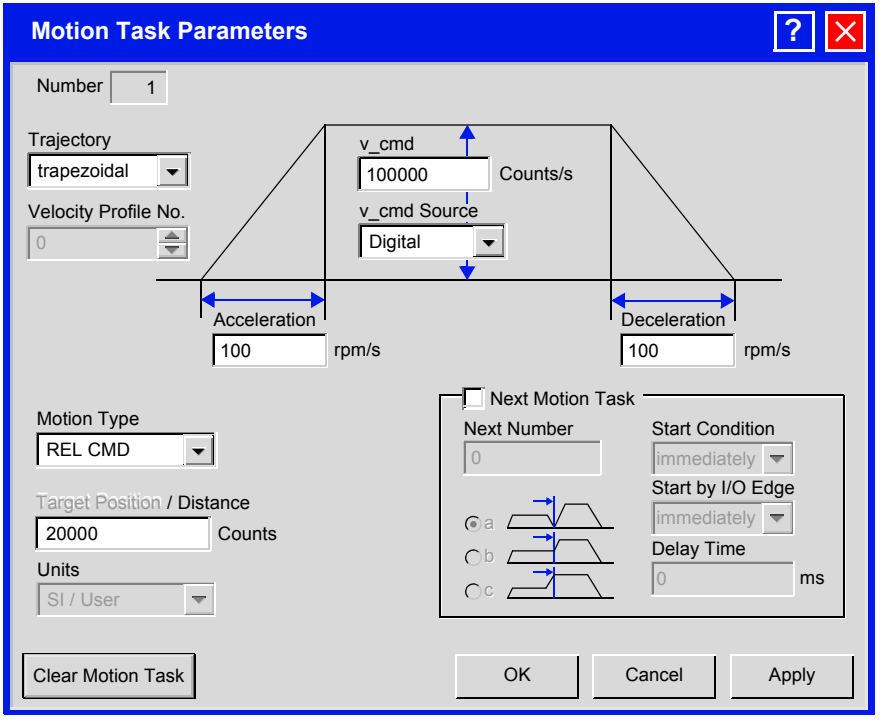
- Cut
- Copy
- Paste
- Delete

Clipboard operations can only be carried out on full lines, i.e. the line requird must be selected. A whole line or a single cell may be selected. Select a line by clicking on the line number or by using the <Shift><Space> key combinations (as in Excel). (All edit operations use standard Windows key combinations.)

Motion Task Parameters

At a Glance

The various elements of the **Motion Task Parameters** are described in the following paragraphs:



Number

Displays the active motion task number.

Trajectory

Determines which type of acceleration/braking ramp is used to carry out a motion task.

Trajectory	Description
Trapeze	The drive is given a constant linear acceleration/deceleration to the target speed.
Customer profile	The acceleration/braking ramps can be adjusted with a customer profile stored previously in the servo amplifier.
Sine	To limit any jolting, the drive is accelerated/decelerated within the acceleration time along an acceleration ramp without any disruptions. The resulting speed characteristic corresponds to a sine curve. The profile is stored in a table in the servo amplifier.

Velocity profile No.

Selection of a velocity profile from the table selected by trajectory. You can get more information on this topic from our Technical Help department.

Motion Type

This selection determines whether the motion task is interpreted as a relative or an absolute task.

ABS	movement to an absolute target position, relative to the reference point.
REL cmd	relative to last target (setpoint) position (in connection with motion block changeover: e.g. summing operation).
REL act	relative to actual position at start (in connection with motion block changeover: e.g. register control).
REL InPos	when the load is in the InPosition window: relative to last target position. When the load is not in the InPosition window: relative to actual position at start.
REL Latch pos.	Contact our Technical Help department.

In the setup software, the transmission of an absolute task to the RAM of the servo amplifier is prevented for axes of the ROTARY type.

Target Position/ Distance

Defines the distance or the target position, depending on the motion type.

Units (general)

Unit for path and speed entries. See screen page Units/Mechanical.

v_cmd

This parameter determines the velocity of movement for digital setpoint provision. If v_max is set to a value that is less than v_cmd at a later time, the position controller will use the smallest value.

v_cmd Source

The velocity can be defined in the motion block, or provided as an analog setpoint.

Digital	Setpoint provision in the v_cmd field.
Analog AI1	Analog setpoint provision at input Analog Input AI1 (terminals X3/3 - 4, scaling is used. This value read in at the start of the motion task.

Acceleration

This parameter determines the acceleration ramp steepness, depending on the selected units.

Deceleration

This parameter determines the deceleration ramp steepness, depending on the selected units.

Next Motion task

After the present task is finished, a new task will start automatically.

The "**In Position**" signal is only enabled when the last motion task (no further task) has been processed. You can use the function "16, Next-InPos" to generate a signal at one of the digital outputs when each target position within a sequence of motion tasks has been reached.

Next number

The number of the next task, which will be started automatically after the present task is finished.

Start condition

Immediately	The next task is started as soon as the target position is reached.
I/O	The next task is started by a signal at a digital input (one of the X3/8 - 11 terminals). This is only meaningful with "Motion Blending Type A". Condition: the digital input must have the function "15, Start_MT Next" assigned, and the target position must have been reached. You can preselect the logic with the "**Start with**" parameter.
Time	The next task is started with a defined delay after the target position has been reached. You can enter the delay time with the "Delay time" parameter. This is only meaningful with "Motion Blending Type A".
I/O or Time	The next task is started by a signal at a digital input (one of the X3/8 - 11 terminals) or after a defined delay. This is only meaningful with "Motion Blending Type A". The trigger is the event that occurs first (the start signal or the end of the delay time). Condition: the digital input must have the function "15, Start_MT Next" assigned, and the target position must have been reached. You can preselect the logic with the "Start with" parameter, and enter the delay time with the "Delay time" parameter.

Start by I/O edge

The logic for the digital input with function "15, Start_MT Next" assigned to it.

LOW-level: 0...07 V

HIGH-level: 12 ... 30 V / 7 mA

Timeout value (Delay time)

Delay time (in ms) between arrival at target position and start of next task.

Motion Blending

a	The drive brakes to a stop in the target position. The next motion task is started.
b	The drive moves at v_cmd of the present motion task to the target position, and accelerates through to v_cmd of the next task.
c	The changeover to the next task is brought so far forward that the v-cmd of the next task is already reached by the time the target of the present motion task is reached.

ASCII Command List

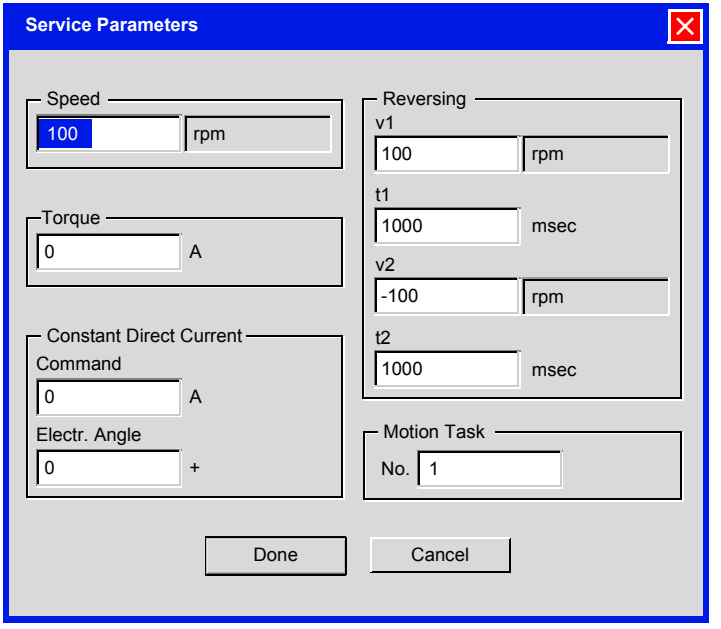
ASCII Command	Description
ACCUNIT	Type of acceleration command for the system
CLRORDER	Deleting a Motion Task
CONTINUE	Continue last position order
MOVE	Start Motion Task
MTMUX	Presetting for motion task that is processed later
NREFMT	Motion task automatic executed after homing
O_ACC1	Acceleration Time 1 for Motion Task 0
O_ACC2	Acceleration Time 2 for Motion Task 0
O_C	Control Variable for Motion Task 0
O_DEC1	Braking Time 1 for Motion Task 0
O_DEC2	Deceleration Time 2 for Motion Task 0
O_FN	Next Task Number for Motion Task 0
O_FT	Delay before Next Motion Task
O_P	Target Position/Path for Motion Task 0
O_V	Target Speed for Motion Task 0
OCOPY	Save/copy Motion Tasks
OLIST	List of Motion Task Data
ORDER	Set Motion Task Parameters
OVRIDE	Override Function for Motion Tasks
PTARGET	Last Target Position
PTEACH	Teach-In Function
PTMIN	Min. Acceleration Ramp for Motion Tasks
PVMAXN	Max. (Negative) Velocity for Position Control
SPSET	Enable for S-curve

4.21 Screen page "Service parameters"

Overview of the "Service Parameters" Screen

At a Glance

This screen enables you to set service function parameters. You access it via the Motion Service tab (See *Overview of the Oscilloscope - Motion Service Tab, p. 244*):



Service operation parameters

Settings of the parameters for the service functions.

Speed	Rotational speed	Speed (in rpm) for the function
Torque	Current	Current setpoint (in A) for the function
Constant Direct current	Command Electr. Angle	Current setpoint (in A) for the function phase angle of the electrical field
Reversing mode	v1 t1 v2 t2	speed (in rpm) for clockwise rotation duration (in ms) of the clockwise rotation speed (in rpm) for counterclockwise rotation duration (in ms) of the counterclockwise rotation
Motion Task	No	Parameters for the motion task must be entered in the screen page "Motion task parameters".

4.22 Screen page "Oscilloscope"

Screen page "Oscilloscope"

At a Glance

Overview of the different field values included in the "Oscilloscope" screen page.

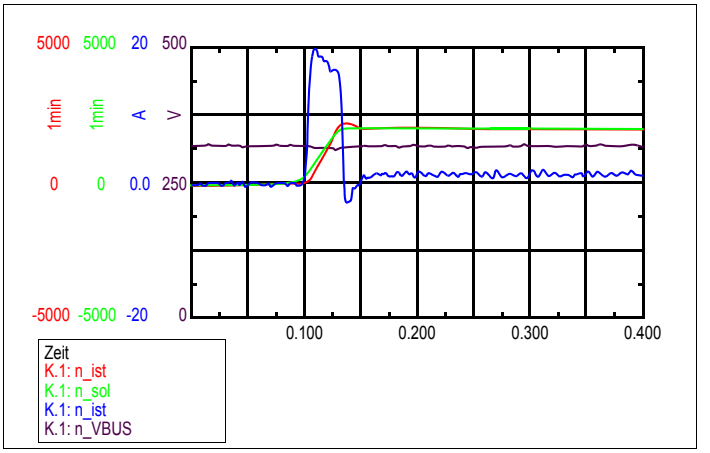
What's in this Section?

This section contains the following topics:

Overview of the "Oscilloscope" screen

At a Glance

Various value are graphically displayed in a diagram. You can display up to four variables simultaneously, as a function of time:



Cycle time for the measurement acquisition $\geq 250\,\mu s$.

The Oscilloscope screen contains five tabs that enable you to define the variables to display - Channels, Triggers, Recording, Motion Service, and Tuning.

Command buttons enable you to control the display.

Start

Start displaying the data.

Cancel/Stop

Stop displaying the data.

Refresh

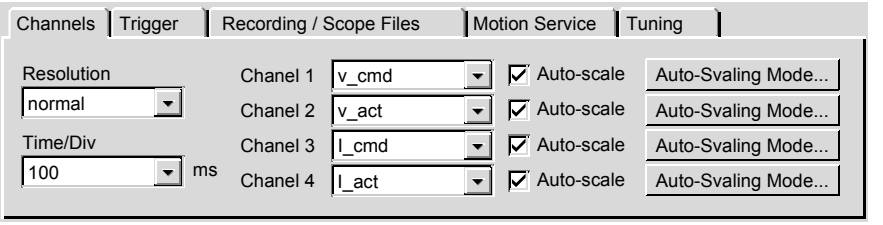
Reloads and displays the last recorded scope data from the servo amplifier, if it has not yet been deleted.

Restore Oscilloscope Defaults	Resets all functions of the screen page to the default values.
Cursor function (Mouse pointer)	When the curves are displayed (when reading the file, or beginning a save), a mouse click displays the values measured for the signals in the coordinates system for the time period selected. If the user clicks outside the coordinates system or clicks while holding down the SHIFT key, the values displayed are reset to 0.

Overview of the Oscilloscope - Channels Tab

At a Glance

Assign the displayed variables to the channels:



Cycle time for the measurement acquisition $\geq 250\,\mu$ s.

Resolution

The number of measured points per time unit (storage depth). Setting: fine, normal, coarse.

Time/Div

Scaling of the time axis. Select the time/division. Setting: 1 ...500 ms/div

Total length of the time axis: 8 * x ms/Div

Channel

The following variables can be selected:

I_act	Actual torque (current)	**I_CMD**	Torque setpoint
v_act	Actual speed	**v_CMD**	Setpoint speed
VBus	DC-link (bus) voltage	**FERROR**	Following error
Off	Unused channel	**User defined**	Manual entry

If you select "user-defined", you can display the value of an ASCII variable.

Auto-scale

For each channel, the range of measurement can be selected: automatically (Auto checkbox is active) or manually (Auto checkbox is inactive, and min./max. values have been entered).

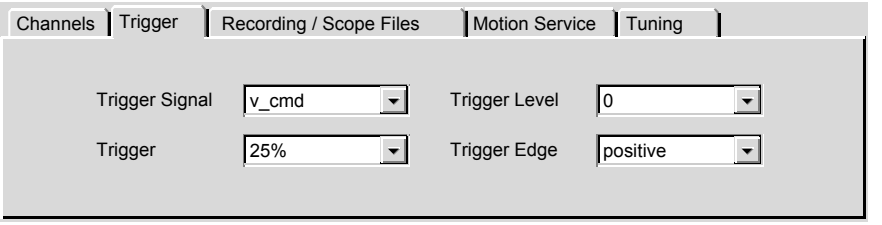
Auto-Scaling Mode

Select standard or min/max scaling.

Overview of the Oscilloscope - Triggers Tab

At a Glance

Set triggers:



Trigger signal

Speed and current variables may be used as trigger signals. In addition, "Direct" can be used for immediate (independent) triggering. Choosing "User-defined" allows an ASCII parameter to be entered manually.

Trigger position

Trigger setting X (time axis).

Trigger level

Trigger setting Y.

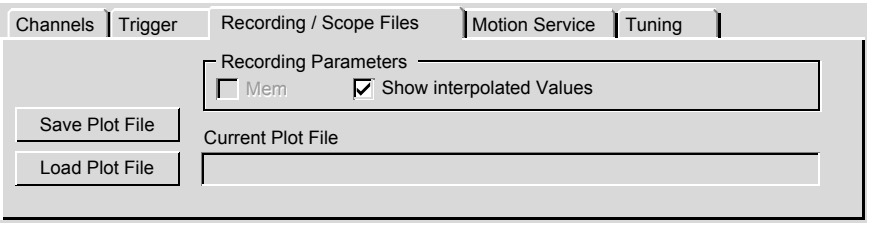
Trigger edge

Trigger on rising or falling edge.

Overview of the Oscilloscope - Recording Scope Files Tab

At a Glance

Record variable measurements:



Save Plot File

Saves the recorded measurements to a data medium in CSV format (to be evaluated with MS-Excel).

Load Plot File

Loads a CSV data file and displays the curves on the oscilloscope diagram.

Mem

If this is active when a new curve is recorded, the previous measurement is saved so a comparison can be made between the two measurements. The previous measurement curve is displayed in a darker color than the latest curve. The measurement range settings must be identical for both measurements. If not, the "Mem" checkbox is de-activated.

Show Interpolated Values

If the checkbox is activated, intermediate values between the mearured values are interpolated.

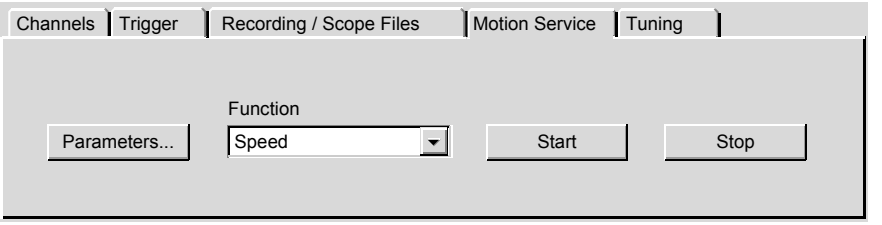
Current Plot File

Displays the filename and location of the currently-loaded CSV file.

Overview of the Oscilloscope - Motion Service Tab

At a Glance

Define service functions:



Functions

Select one of the service functions described below. Click on the "Parameter" button and set the corresponding parameter. (See the *Overview of the "Service Parameters" Screen, p. 236*.) Then start the function by using the START button. The function will continue to be performed until you click on the STOP button or press the function key F9.

Direct current	Apply a direct current to the motor with adjustable size and electrical field-vector angle. The changeover from speed control to current control is made automatically. Commutation is made independently of the feedback (resolver or similar). The motor locks into a preferred position.
Speed	Operates the drive at constant speed. An internal digital setpoint is provided (speed is adjustable).
Torque	Operates the drive with constant current. An internal digital setpoint is provided (current is adjustable). The changeover from speed control to current control is made automatically. Commutation is made independently of the feedback (resolver or similar).
Reversing	Operates the drive in reversing mode, with separately adjustable speed and reversing time for each direction of rotation.
Motion task	Starts the motion task that is selected in the screen page "Service Parameters".
Zero	Function used for feedback setting in conjunction with the positioning phase. This function can only be accessed in OPMODE2. **Caution**: When this function is in use, motor shaft goes into fallback position. This may cause a movement of + or - 60°.

Start (service)

Starts the service function selected.

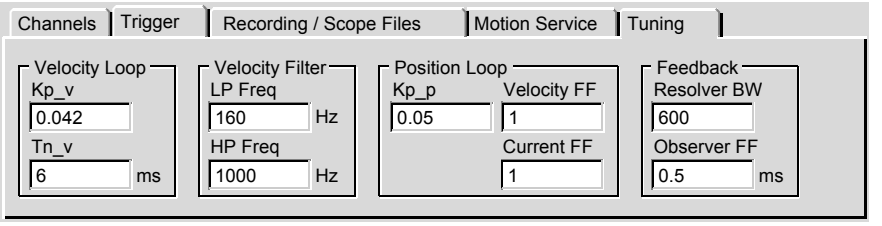
Stop (service)

Stops the service function selected.

Overview of the Oscilloscope - Tuning Tab

At a Glance

Some variables important for the control behavior are combined here. You can tune the servo amplifier without closing the oscilloscope screen page:



Proportional Gain (Kp_v)

ASCII: **GP**	Default: 0.046 Unit: - Range: 0.001 - 369.2	valid for OPMODES 0, 1

Determines the proportional gain (also known as AC-gain). Increase the value up to the level where the motor starts to oscillate, and then back it off until the oscillations have clearly stopped.

Integral Time (Tn_v)

ASCII: **GVTN**	Default: 10 Unit: ms Range: 0.0, GV/62.5 - 1000.0	valid for OPMODES 0,1

This variable determines the integration time constant. Smaller motors permit shorter integration times. Larger motors or high moments of inertia in the load usually require integration times of 20ms or more.

With Tn=0ms, the integral action component is inactive.

If the Tn value is too low, the drive runs roughly or strongly overshoots with high inertia loads. If theTn value is too high, the drive is too soft.

Velocity LP Freq.

ASCII: **ARLPF**	Default: 0 Unit: - Range: 0 - 4000	valid for all OPMODES

Frequency limit low pass filter

Velocity HP Freq.

ASCII: **ARHPF**	Default: 1000 Unit: - Range: 0 - 4000	valid for all OPMODES

Frequency limit high pass filter

The ARHPF and ARLPF commands are described in *"BODEPLOT" screen page., p. 248*.

Kp_p

ASCII: **GP**	Default: 0.1 Unit: (m/s)/m Range: 0.1 - 1000	valid for OPMODES 4,5,8

This variable is the proportional gain of the position control loop . If GP is set too low, the lag or settling time is too long and the drive is too soft. If GP is set too high, the drive oscillates.

Velocity FF

ASCII: **GPFFV**	Default: 1 Unit: - Range: 0 - 1000	valid for OPMODES 4,5,8

Determines the feed-forward factor for the position controller. Feed-forward is used to ease the task of the position controller. A better setting for the Ff-factor means a better utilization of the dynamic range of the position controller. The most favorable setting (usually about 1.0) depends on factors external to the drive, such as friction, dynamic resistance, and stiffness. If GPFFV is set too low, the drive lags. If GPFFV is set too high, the drive oversteers.

Current FF

ASCII: **GPFFT**	Default: 1 Unit: - Range: 0 - 1000	valid for OPMODES 4,5,8

Position control loop: feed forward for the current setpoint. This parameter must be set to minimize the following error. The parameter only has an effect on control structure in the following cases:

1.using table based motion task enabled with bit in O_C.

2.using sine squared acceleration and deceleration motion profiles.

If GV is changed after optimizing GPFFT, GPFFT has to be changed also inversely proportional.

Resolver BW

ASCII: **MRESBW**	Default: 300 Unit: Hz Range: 50 - 2000	valid for all OPMODES

MRESBW is a tuning parameter that sets the bandwidth (in Hz) of the inner control loop. A high value (>800 Hz) results in a fast (low phase lag) and noisy velocity signal. A low value (<400 Hz) results in a slow (higher phase lag) and smooth velocity signal. The value of 600 Hz is a compromise between phase lag and noise. The phase lag can be reduced by providing the acceleration feed forward signal (VLO = 1).With a wide bandwidth, the drive responds more rapidly to control loop deviations and there is a smaller following error (reduced lag). A very wide bandwidth only makes sense with low moments of inertia, low KP, and very high acceleration values. A narrower bandwidth produces a filter effect. The rotational velocity and positional control are smoother (encoder equivalent output is quieter as well).

Observer FF

ASCII: **VLO**	Default: 1.0 Unit: - Range: 0 - 30	valid for all OPMODES

This parameter generates a dynamic pre-control for the detection of current values (Luenberger monitor), in particular for resolver feedback. It reduces phase slippage in the detection of the current value, so improving the stability of the speed control. For VLO = 1, the pre-control is optimal; for VLO = 0, the action is suppressed.

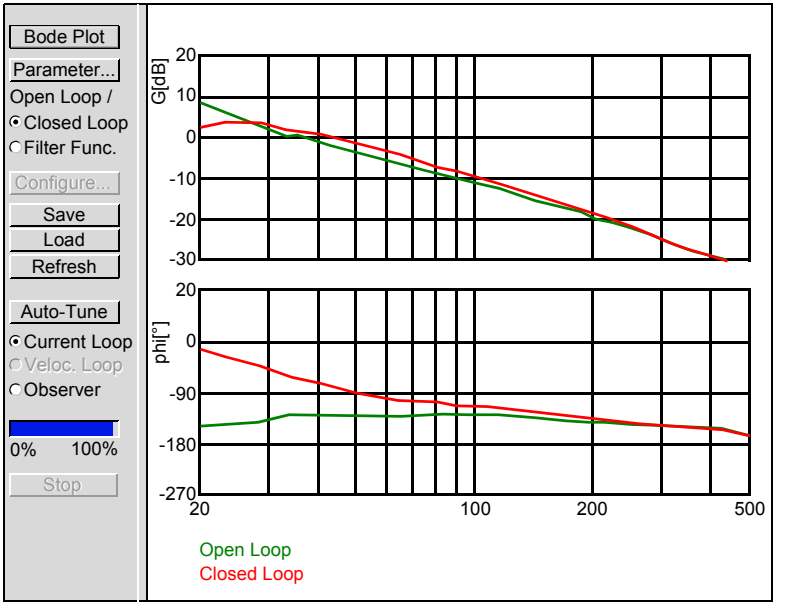
4.23 "BODEPLOT" screen page.

Overview of the "Bode plot" screen

At a Glance

This function should only be used by speed control engineers and technicians.

Use this screen to analyse and maximise the speed control loop, using the machine's mechanical specifications.



This screen displays the frequency response for speed control. The system is simulated using a sinusoid input variable. The output variable has identical frequency but different amplitude and is out of phase by several degrees.

The relation between frequency related amplitude (amplitude response) and frequency related phase shift (phase response) provides a full picture of the speed control loop's dynamic features.

Amplitude response

This graph shows amplitude in relation to frequency (Gain) on a log scale.

Phase Response

This graph shows phase shift in relation to frequency.

Open loop response

The following information is used to supply a qualitative description of the open loop response.

Parameter	Description
Phase margin	Differential between the characteristic curve phase and a -180° phase shift at cut-off frequency. Represents the frequency for a 0dB gain.
Gain margin	Differential between the characteristic amplitude and a gain of 0 dB for a -180° phase shift.

Closed loop response

The closed loop characteristics are defined using bandwidth and cut-off.

Notion	Description
Bandwidth	Represents frequency bandwidth for a -3dB attenuation.
Overshoot	Overshoot represents closed loop overshoot at maximum amplitude

Bode Plot Starts saving the data.

Note: This function should be used only by experts. The motion starts automatically and immediately as soon as confirmation request has been validated, using the internal setpoint provided.

Stop Stops saving the data.

Save Makes back-up of settings saved in a CSV file (can be used with MS-Excel).

Load Loads settings saved in a CSV file and displays corresponding curves.

Refresh Loads and displays latest settings saved.

Cursor function When a data series is displayed (when reading a file, or beginning a save), click once on the graph to display the values measured at a given point in time. Click once outside the graph to zero the display.

Parameters Displays the Bode Plot parameter page. Defines the frequency range and number of increments.

Filter Functions

Mechanical resonance may occur in general industrial machines. Resonance may cause instability of the velocity control loop which reduces dynamic performance (speed gain attenuation). Mechanical resonance comes from mechanical system rigidity : the use of belts & pulleys, gearboxes, linear guides, racks & pinions, screws, and elastic coupling makes the system more or less stiff.

Mechanical resonance can be corrected by increasing mechanics stiffness. System can also be improved by the use of electrical controllers such as filters.

There is 2 mechanical resonance areas : the first at a low frequency, typically between 100 and 500 Hz and a second at high frequency between 700 and 1400Hz

Most of the time in industrial situations, low frequency resonance problems occur. For high frequency resonance, contact our technical department.

The aim of using filters is to attenuate or move resonance frequencies out of the bandwidth used for your application.

Unilink L / Lexium 15 LP offers 3 filters :

Filters	**Description**
PID-T2	For standard mechanics (resonance frequency between 100 and 500Hz). Combination of a low-pass first order and high-pass first order.
1rst Order low pass	Useful for a very stiff mechanics (resonance over 500Hz)
Bi-Quad	For standard mechanics (resonance frequency between 100 and 500Hz). Combination of a low-pass second order and high-pass second order and ability to damp gain at resonance / anti-resonance frequencies

Four ASCII commands are used to set up each filter:

ASCII: **ARLPD**	Default: 0 Unit: - Range: 0...10	valid for all OPMODES

Damping low pass filter

ASCII: **ARLPF**	Default: 0 Unit: Hz Range: 0...4000	valid for all OPMODES

Frequency limit low pass filter

ASCII: **ARHPD**	Default: 0 Unit: - Range: 0...10	valid for all OPMODES

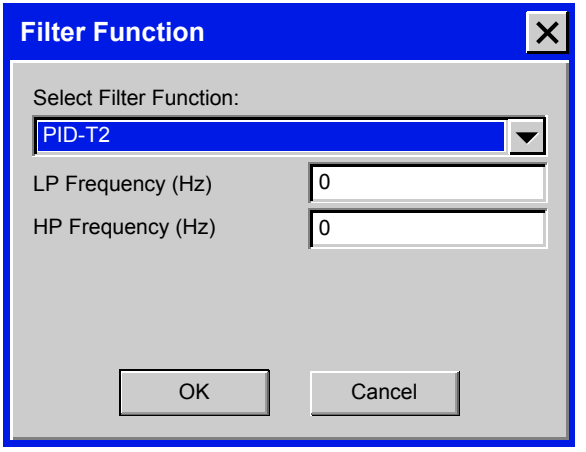
Damping high pass filter

ASCII: **ARHPF**	Default: 0 Unit: Hz Range: 0...4000	valid for all OPMODES

Frequency limit high pass filter

Before starting using the filter mode, a simulation in open/closed loop of your system should be done : it will give you indication of resonance frequencies of your system.

PID-T2 Filter

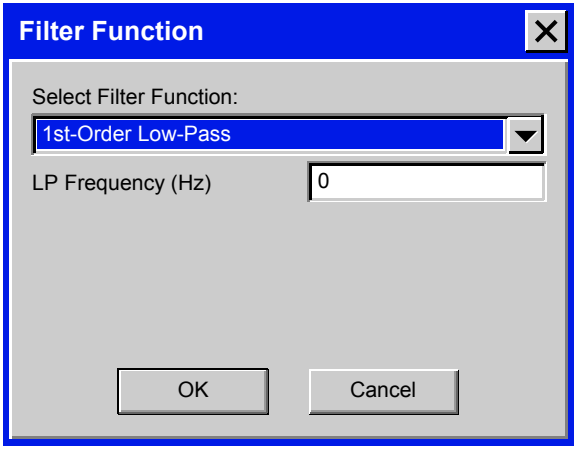


The LP frequency field will fill in ARLPF (anti-resonance frequency) and the HP frequency field will fill in ARHPF (resonance frequency).

Make sure that the ARLPD and ARHPD have been set to 0 (check using the Terminal screen)

Setting ARLPF and ARHPF to 0 disables the filter.

Low-pass Filter 1rst order

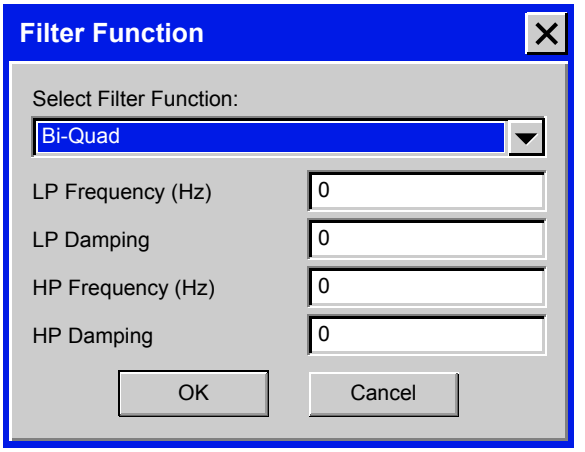


ASCII: **ARHPF**	Default: 0 Unit: Hz Range: 0...4000	valid for all OPMODES

LP frequency will fill in the ARLP2 parameter.

Setting ARLPD2 to 0 disables this filter.

Bi-Quad Filter



LP frequency field will fill in ARLPF (anti-resonance frequency) and HP frequency field will fill in ARHPF (resonance frequency).LP damping field will fill in ARLPD and HP damping field will fill in ARHPD. Setting all parameters to 0 disables the filter.

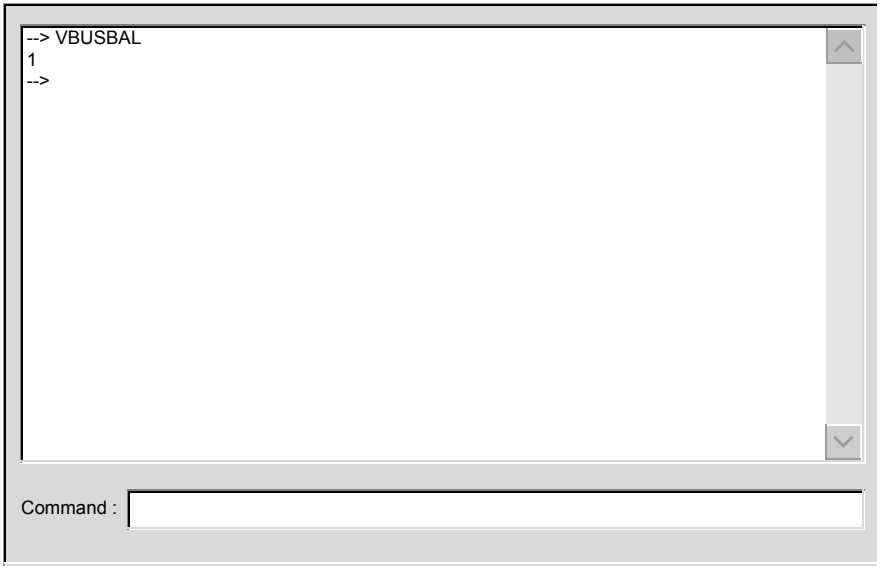
For further details on low-frequency resonance phenomena, please contact our technical department.

4.24 Screen page "Terminal"

Overview of the "Terminal" screen

At a Glance

Diagram:



Communication with the servo amplifier is made through ASCII commands. You can obtain a complete list of the commands from our application department.

Commands that are sent to the servo amplifier are marked by ->. The answers from the servo amplifier appear without any preceding characters.

When using this integrated terminal function, the following restrictions apply:

- The last 500 lines are displayed,
- The transmission from the servo amplifier to the PC is limited to a maximum of 1000 bytes per command,
- A watchdog timer limits the transmission time in both directions to a maximum of 3 sec.

If the number of characters is more than 1000, or the transmission time is more than 3 seconds, then the terminal reports a fault.

Command

Enter the ASCII command here, with the corresponding parameters. End the entry with RETURN or press the APPLY button to start the transmission.

Press the F3 function key to recall the last commands (max. 100 commands).

⚠ CAUTION
The terminal software should be used only by experts. in many instances, there will be no confirmation query. **Failure to follow this instruction can result in injury or equipment damage.**

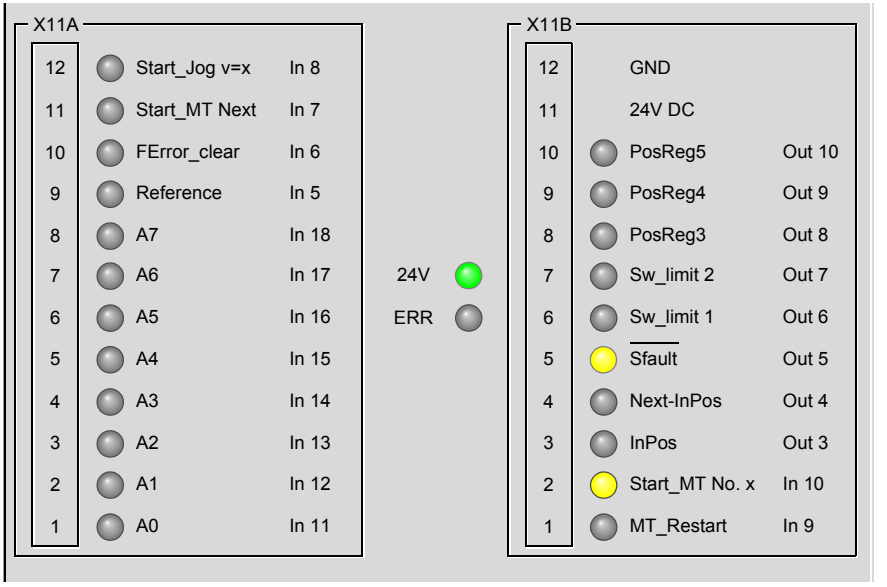
4.25 Screen page "I/O expansion"

Overview of the Screen Page "I/O Expansion"

At a Glance

I/O expansion card P/N: AM0INE001V000

This screen displays individual status of the 14 logic inputs and 8 logic outputs on the expansion card as well as overall status of the card. It is available only if an I/O Expansion card is inserted into the servo amplifier.



Start Jog v=x

Starting in jog mode at a given speed. After selecting the function, you can enter the speed in IN8TRIG. The sign of the auxiliary variable defines the direction. A rising edge starts the motion, a falling edge cancels it.

Start_MT Next

This task, which is defined in the motion task by "Start with I/O", is started. The target position of this motion task must be reached before the following task can be started.

FError_clear

Erases the error message or the supervisor's response.

Reference

Checks reference switch.

A7-0	Motion task number, Bit1 to Bit8
PosReg. 5-3	The preset function of the corresponding position register is indicated by a high signal. (the PosReg 1-2 function is defined in the "Position Data" screen only via ASCII).
S fault	Contouring-fault (low-active). The width of this error window is entered in the screen "Position" for all enabled motion tasks.
Next InPos.	The start of each motion task in an automatically executed sequence of motion tasks is signaled by an inversion of the output signal. The output produces a low signal at the start of the first motion task of the sequence.
In Pos	When the target position for a motion task has been reached, (InPosition window) a high signal is generated. A cable break will not be detected. The width of the "InPosition" window for all enabled motion tasks is entered in the screen "Position data".
Start_MT No x	Start of the motion task that has the number and bit code at the digital entry (A0 to A7). A rising edge starts the motion, a falling edge cancels it. You can also define how to stop the motion task: STOP command or a low level signal at the input.You can assign this function via Terminal screen.
MT_Restart	Restarts the motion task that had been stopped.
24V	Shows that 24V power supply for the expansion card is present.
Err.	Expansion card error message. The error may be due to the following reasons: no power supply, output overload or short-circuit.

Field Buses

5

Field Buses

At a Glance

This chapter describes how to configure the software for use with field buses.

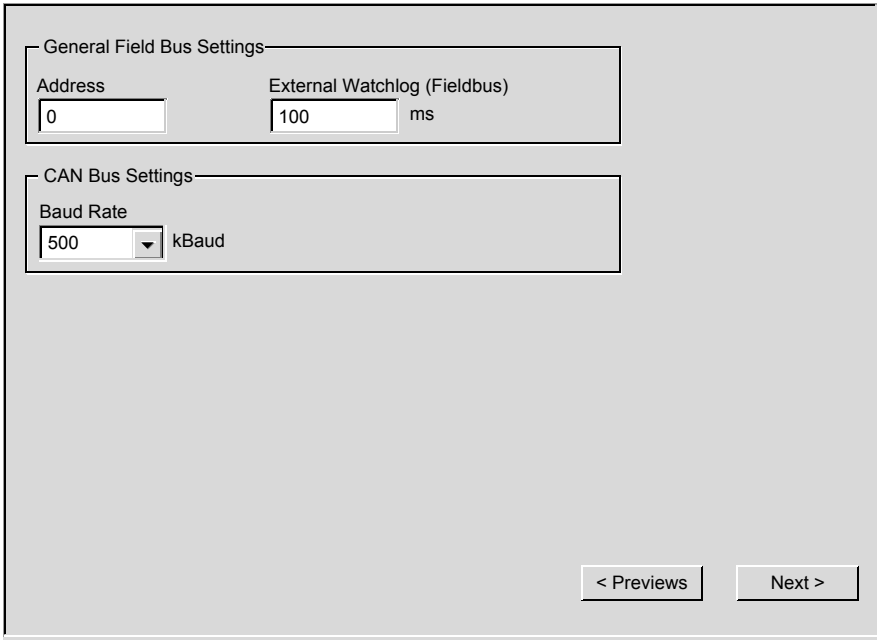
What's in this Chapter?

This chapter contains the following topics:

Overview of "CAN Fieldbus Settings"

At a Glance

You can customise the station address and baud rate in the fieldbus network here:



Address

ASCII: **ADDR**	Default: 0	Valid for all OPMODES

The entry is the station address (1...63) of the amplifier. This number is required by the fieldbus (CANopen, Profibus, SERCOS, etc.) and for the parameter setting of the servo amplifier in multi-axis systems for an unambiguous identification of the servo amplifier within the system. You can also use the keys on the front panel of the servo amplifier to set the station address (see Lexium 15 LP Installation Manual).

External Watchdog

ASCII: **EXTWD**	Default: 100 ms	Valid for all OPMODES

Definition of the watchdog period for the communication expansion card. This watchdog is only active when the value is greater than 0 and the output stage is enabled. If the preset duration is reached and the clock is not triggered, the warning message n04 (Response time monitoring) is generated, and the amplifier servo drive stops. The amplifier servo drive remains operational, and the output stage remains enabled. This warning message must be cleared using the CLRFAULT key in order for a new setpoint to be accepted.

Baud Rate

ASCII: **CBAUD**	Default: 500	Valid for all OPMODES

The transmission rate is required by the fieldbus (CANopen) and for the parameter setting of the amplifier servo drive in multi-axis systems.

CAN ASCII Commands

ASCII: **CBAUD**	Baud Rate CAN Bus
ASCII: **CUPDATE**	Program Update (CAN Bus)
ASCII: **DRVCNFG**	Configuration parameter for compatible behaviour
ASCII: **FB_LTF**	FB_LTF sets the CANopen specific Life Time Factor. It can be stored to the EEProm, if bit 3 of the parameter |DRVCNFG| is set to 1.
ASCII: **FB_TGUARD**	FB_TGUARD sets the CANopen network communication watchdog time. It can be stored to the EEPROM, if bit 3 of the parameter |DRVCNFG| is set to 1.
ASCII: **MAXSDO**	Number of Objects of the Parameter Channel
ASCII: **OBJCO**	Mirror CAN - Objects for debug
ASCII: **RXPDOxA**	RX-PDO x parameter selection, where x is a number between 1 and 4.
ASCII: **RXPDOxB**	RX-PDO x Mapping Settings, where x is a number between 1 and 4.
ASCII: **SCAN**	Detect CAN Stations
ASCII: **SYNCSRC**	Source for Fieldbus Synchronization
ASCII: **TXPDOxA**	TX-PDOx Mapping - Setup, where x is a number between 1 and 4.
ASCII: **TXPDOxB**	TX-PDOx Mapping - Setup, where x is a number between 1 and 4.

Fieldbus Availability

At a Glance

Fieldbus screen pages are available by connecting an extension card on Lexium 15 LP.

Fieldbus	Extension Card
Profibus DP	VW3 M3 301
FIPIO	AM0FIP001V000
Modbus	AM0MBP001V000
Sercos	AM0SER001V000

Please contact our technical department for relevant Fieldbus instructions.

Troubleshooting

6

Troubleshooting

At a Glance

This chapter describes how to troubleshoot Unilink commissioning software.

What's in this Chapter?

This chapter contains the following sections:

6.1 Troubleshooting

Troubleshooting

At a Glance

The following table should be understood as a "First-aid" box. There may be a wide variety of causes of any fault that occurs, depending on the conditions in your system. In multi-axis systems there may be several causes of a fault. Our applications department can give you further assistance with problems.

Fault	Possible causes	Measures to remove the cause of the fault
Fault message Communication fault	- Amplifier disabled - Cable plugged into wrong socket of the servo amplifier or PC - Wrong PC interface selected	- Use a null-modem cable - Plug the cable into the correct socket of the servo amplifier or PC - Select the correct interface
Motor doesn't rotate	- Amplifier disabled - Analog setpoint failed - Motor phases swapped - Brake not released - Drive is mechanically blocked - Motor pole number set incorrectly - Feedback set up incorrectly - Current limit activated (analog or digital I/O)	- Apply enable signal - Check PLC-program and cable - Correct motor phase sequence - Check cable and inverse diode - Check drive - Correct setting - Correct feedback setting - Correct current limitation
Motor oscillates	- Gain KP too high - Interference in feedback system - Analog-GND (ACOM) is not connected with the analog setpoint source	- Reduce KP (speed contr.) - Replace the feedback cable - Connect ACOM with setpoint source
Motor runs too soft	- Integral time Tn too high - Gain KP too low - PID-T2 too high	- Reduce Tn (speed contr.) - Increase KP (speed contr.) - Reduce PID-T2
Motor runs roughly	- Integral time Tn too low - Gain KP too high - PID-T2 too low	- Increase Tn (speed contr.) - Reduce KP (speed contr.) - Increase PID-T2

6.2 Error and warning messages

General overview of the "Error and warning messages"

At a Glance

Explanations and designations of the various warning and error messages.

What's in this Section?

This section contains the following topics:

Error Messages

At a Glance

Errors that occur are displayed as a coded error number in the LED-display on the front panel, and in the "Status" screen page. All error messages result in the R1A/ R1C contact being opened and the output stage of the amplifier being switched off (the motor loses all torque). The motor-holding brake is activated. Errors that are recognized by the mains supply monitoring are only reported after the servo amplifier has been enabled.

Number	Designation	Explanation
F01*	Heat sink temperature	The heat sink temperature is too high; the limit is set by the manufacturer to 80°C.
F02*	Overvoltage	Overvoltage in the DC-link circuit; the limit depends on the mains supply voltage.
F03*	Following error	Message from the position controller
F04	Feedback	Cable break, short-circuit, short to ground
F05*	Undervoltage	Undervoltage in DC-link; the limit is set by the manufacturer to 100V
F06	Motor temperature	Temperature sensor faulty or motor temperature too high; the limit is set by the manufacturer to 145°C.
F07	Auxiliary voltage	Internal auxiliary voltage not OK
F08*	Overspeed	Motor running away; the speed is higher than permitted.
F09	EEPROM	Checksum error
F10	Flash-EPROM	Checksum error
F11	Brake	Cable break, short-circuit, short to ground
F12	Motor phase	Motor phase missing (cable break or similar)
F13*	Internal temperature	Internal temperature too high
F14	Output stage	Fault in the power output stage
F15	I^2t max.	I^2t max. value exceeded
F16*	Mains R1A/R1C	2 or 3 supply phases missing
F17	A/D converter	Error in the analog-digital conversion
F18	Regen	Regen circuit faulty or incorrect setting
F19*	Main phase	A main supply phase is missing (can be switched off for 2-phase operation).
F20	Slot error	Hardware error on the expansion card

Number	Designation	Explanation
F21	Handling error	Software error on the expansion card
F22	Short circuit to earth	40/70 amps types only: short circuit to earth
F23	CAN bus off	CAN bus total communication error
F24	Warning	Error warning display
F25	Communication error	Commutation error
F26	Limit switch	Homing error (limit-switch reached)
F27	AS-Option	Operating error for AS-option
F28	Reserved	Reserved
F29	SERCOS	SERCOS error
F30	Emerg. Stop Timeout	Emergency-stop time exceeded
F31	Wrong Firmware-version	Wrong version of Firmware
F32	System fault	The software does not respond correctly.

* These error messages can be cancelled by the ASCII command CLRFAULT, without making a reset. If only these errors are present, and the RESET button or the I/O-function RESET is used, the CLRFAULT command is also all that is carried out.

Warning messages

At a Glance

Faults that occur, but do not cause a switch-off of the output stage of the amplifier (R1A/R1C contact remains closed), are displayed as a coded warning number in the LED-display on the front panel. They are also shown in the screen page "STATUS". Warnings that are recognized by the supply monitoring are only reported after the servo amplifier has been enabled.

Number	Designation	Explanation
n01	I^2t	Threshold I^2t exceeded
n02	Regen power	Preset regen power reached
n03*	S_fault	Exceeded preset following error window
n04*	Node guarding	Response monitoring (fieldbus) is active
n05	Mains phase missing	Supply phase missing
n06*	Sw limit- switch 1	Passed software limit-switch 1
n07*	Sw limit- switch 2	Passed software limit-switch 2
n08	Motion task error	A faulty motion task was started.
n09	No reference point	No reference point set at start of task
n10*	PSTOP	PSTOP limit-switch activated
n11*	NSTOP	NSTOP limit-switch activated
n12	Default values	only HIPERFACE®: Motor default values were loaded.
n13*	Expansion card	Expansion card not functioning correctly.
n14	SinCos	SinCos communication is not determined.
n15-n31	Reserved	Reserved
n32	Firmware beta version	The firmware is a beta version.

* These warning messages lead to a controlled shut-down of the drive (braking with the emergency ramp).

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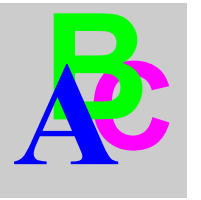

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