Unilink Software
Setup
General information

eng

Document set

Related Documents

Related Documentation for Multi-Axis Hardware:

- user guide for the Lexium 17S 890 USE 121 series servo amplifier
- user guide for the Lexium 17S HP 890 USE 123 series servo amplifier
- Lexium BPH series servo motors AMOMAN001U

Related Documentation for Single-Axis Hardware:

- user guide for the Lexium 17D 890 USE 120 series servo amplifier
- user guide for the Lexium 17D HP 890 USE 122 series servo amplifier
- Lexium BPH series servo motors AMOMAN001U

Other documentation:

- CanOpen manual (Lexium Motion tools CD)
- Modbus manual (Lexium Motion tools CD)
- Profibus DP manual (Lexium Motion tools CD)
- Fipio manual (Lexium Motion tools CD)

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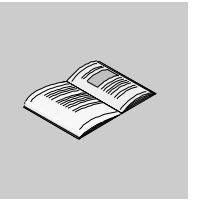
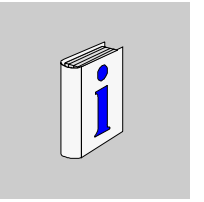


About the book



At a Glance

Document Scope

This booklet explains the installation and operation of the setup software UniLink for digital servo amplifiers.

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

	**CAUTION**
	Meaning: General warning - General instructions - mechanical hazard **Failure to observe this precaution can result in injury or equipment damage.**

	**DANGER**
	Meaning: Danger to personnel from electricity and its effects **Failure to observe this precaution will result in death or serious injury.**

User Comments

We welcome your comments about this document. You can reach us by e-mail at TECHCOMM@modicon.com

General information

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At a Glance

Information

This help system explains the installation and operation of the setup software UniLink for digital servo amplifiers.

What's in this chapter?

This chapter contains the following topics:

Directions for use

Setup software

The setup software is intended to be used for altering or storing the operational parameters for the digital servo amplifiers. The servo amplifier that is connected is commissioned with the aid of the software - whereby the drive can be directly controlled by the setup and service functions.

Due to the specific nature of PCs, these functions are cannot be deemed functionally safe without taking further measures. A PC program might be unexpectedly disturbed or stopped, so that in the event of a malfunction any movements that have already been initiated cannot be stopped from the PC.

CAUTION

The manufacturer of the machine must carry out a hazard analysis for the machine, and is responsible for the functional, mechanical and personnel safety aspects of the machine. This applies especially to the initiation of movements with the aid of functions in the commissioning software.
Only personnel who have extensive knowledge in the fields of drive technology and control technology are permitted to carry out online parameter setting of a drive that is running. Sets of data that are stored on data media are not safe from undesirable alteration by third parties. So after you have loaded a set of data, you must check all the parameters before enabling the servo amplifier.

Failure to observe this precaution can result in injury or equipment damage.

Servo amplifier

The BTB/RTO contact must be wired into the safety loop of the system. The safety loop, and the Stop and Emergency Stop functions must fulfill the requirements of EN60204, EN292 and VDI2853.

The servo amplifiers are components which are built into electrical equipment or machines, and can only be commissioned as integral components of such equipment.

The servo amplifier is to be used only on earthed three-phase industrial mains supply networks (TN-system, TT-system with earthed neutral point). The servo amplifiers must not be operated on power supply networks without an earth or with an asymmetrical earth.

If the servo amplifiers are used in residential areas, or in business or commercial premises, then additional filter measures must be implemented by the user.

The servo amplifier is only intended to drive specific brushless synchronous servomotors, with closed-loop control of torque, speed and/or position. The rated voltage of the motors must be at least as high as the DC-link voltage of the servo amplifier.

The servo amplifiers may only be operated in a closed switchgear cabinet, taking into account the ambient conditions defined in the installation manual.

Option -AS-, restart lock for personnel safety

The -AS- restart lock is exclusively intended to provide safety for personnel, by preventing the restart of a system. To achieve this personnel safety, the wiring of the safety circuits must meet the safety requirements of EN60204, EN292 and EN954-1.

The -AS- restart lock must **only** be activated:

- when the motor is no longer rotating (setpoint = 0V, speed = 0rpm, enable = 0V). Drives with a suspended load must have an additional safe mechanical blocking (e.g. by a motor-holding brake)
- when the monitoring contacts (KSO1/2 and BTB/RTO) for all servo amplifiers are wired into the control signal loop (to recognize a cable break).

The -AS- restart lock may **only** be controlled by a CNC if the control of the internal safety relay is arranged for redundant monitoring.

The -AS- restart lock must not be used if the drive is to be made inactive for the following reasons:

1. cleaning, maintenance and repair operations -
long inoperative periods.
In such cases, the entire system should be disconnected from the supply by the personnel, and secured (main switch).

2. emergency-stop situations.
In an emergency-stop situation, the main contactor is switched off (by the emergency-stop button or the BTB-contact in the safety circuit).

Product Overview

What is UniLink?

UniLink 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.

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.

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.

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. 29*).

Motion Control Overview

What is a Motion Control System?

A motion control system essentially comprises an intelligent motion controller that operates with other PLCs in a PLC environment to perform complex, specialized moves in one or more directions, or axes. These complex and specialized moves, which are needed in the automation of industrial tasks, are collectively known as motion. The automation of motion is known as **motion control**.

Motion control systems automate many different types of manufacturing activities — making cars, refining oil, weaving carpets, wrapping candy, warehousing toys, and so on. A motion controller runs a motion control system.

Closed Loop Servo Systems

In a servo system, feedback information - motor position and motor velocity is sent from the motor back to the servo amplifier. The servo amplifier analyzes the feedback, makes adjustments as needed, and generates new currents to bring the motor to the commanded velocity. This cycle constantly repeats itself in a closed loop. A closed loop that controls the position of the shaft or load is called a position loop. A closed loop that keeps the velocity of the motor on the commanded value is called a velocity loop.

Servo System Components

A servo system, in addition to the motion controller, consists of:

Servo motor	A servo motor moves mechanisms in a single axis of motion. Electrical motors are driven by magnetic fields. Motors have a stationary field generated by the magnets of the motor and a rotating or movable field called stator winding or armature. They operate on the principles of synchronous motors. All rotary motors have some type of bearing that supports the rotor at each end. Every motor has at least two magnetic motor poles, normally four or six. The servo amplifier generates the current in the stator so that a controllable torque is available at the shaft. The servo motors turn in two directions: positive and negative. Two forms of angular measurement are commonly used in motion control: degrees and radians, (360 degrees = 2π radians = one revolution). The servo amplifier operates with standard synchronous servo motors as well as with direct drive motors (rotary or linear). For more information about these motors see the motor manuals. **Motor Tuning** Tuning the motor is a fundamental task in achieving best system performance. To tune a motor, you must set up initial values for and adjust several motion parameters using UniLink. These parameter settings compensate for the difference between the actual motion and the commanded motion - getting the actual as close to the commanded as possible, with minimal oscillation and noise. This difference is called following error.

Load	The load is the mechanism and equipment that each motor drives. It is everything connected to the output shaft of a motor, including the shaft itself. A motor must be appropriately sized to its load to ensure the motor is powerful enough to carry out your automation tasks. A servo system delivers and converts motion to a load via one or more of the following mechanical techniques:
	• **direct drive**
	  ◦ motor connected to a rotating table
	• **screw drive**
	  ◦ motor connected to a lead screw carrying a slide (moving table)
	• **rack and pinion**
	  ◦ motor connected to a cogwheel that moves a rack
	• **belt and pulleys**
	  ◦ motor connected to rollers that move conveyor belts or chains and sprockets.

Feedback Device	Every closed-loop servo system needs at least one device to return feedback information from each motor (or load) to servo drive. Depending on the feedback device, feedback is transmitted back to the servo drive in the form of digital signals or analog signals. Two types of feedback devices are supported: • encoder (See *Feedback Device, p. 19*): returns analog or digital signals (optical) • resolver (See *Feedback Device, p. 19*): returns analog signals (magnetic).
Servo Drive / Amplifier	The servo drives comprise a three-phase, power supply, and high-performance control unit all housed in a single enclosure. The several control loops are performed totally digitally.

Feedback Device

At a Glance

Servo motors are available with these feedback units:

- resolver
- HIPERFACE® compatible Stegmann encoder
- ENDAT® compatible Heidenhain encoder.

In a closed-loop feedback system, the innermost loop is the commutation loop, which monitors the motor's rotor and ensures that it keeps spinning. Outer loops are:

- position loop
- velocity loop
- current loop

Velocity information and the velocity loop are derived from position information. The current loop is also known as a torque loop, since amplitude of the electrical current is directly proportional to torque.

Resolvers

The servo amplifier can use single (two poles) or multi-speed (multiple poles) resolver feedback to calculate primary position, velocity, and commutation information. A resolver can be thought of as a transformer whose output is unique for any given shaft position (an absolute position feedback). The transformer is driven with a sinewave reference signal. Two AC signals are returned from the resolver into the Sine and Cosine inputs. All three of these sinewave signals are low-level and susceptible to noise.

Encoders

Encoders direct pulses of light, from a light source at the motor or load, to photo detectors through an encoded disk. These light pulses are then converted into digital feedback information. There are two general types of encoders: rotary and linear. Rotary (rotating disk) encoders are typically mounted to the motor shaft. Linear encoders are typically mounted to the load.

The Motion Profile

At a Glance

Motion operations are universally embodied in a graph called the motion profile. Understanding and using motion profiles to define your motion application is an important part of achieving best system performance.

The motion profile plots one or more motion operations and measures it against time.

Commanded motion

The motion that is supposed to happen ideally and precisely, without error, when the motor executes a velocity or position command.

Actual motion

The motion that really happens in the motor, when a velocity or position command is executed.

Closing the Gap between Commanded and Actual

Best system performance is achieved when you can stabilize or "dampen" the difference or "close the gap" between the commanded motion and the actual motion. This difference is called following error. Stabilizing the servo system means setting the relevant parameters in the amplifier, to get as close to the commanded position as possible.

Basic Motion Profile Characteristics

Commanded and actual motion profile shapes have the following characteristics that are also universal to all motion operations:

Profile Characteristic	Meaning
Moving	Moving refers to the execution of a motion instruction that makes the motor move. The motor is considered moving for as long as the motion controller is commanding new positions. The point at which motion stops is known as the target position.
In Position	When a motion command stops executing, and the motor slows to within a few counts of its target position, the motor is considered to be stopped, or "**In position**". A range of positions, typically plotted in a motion profile, represents the "**In position**" status. This status is signaled when the motor gets close enough to the target position -- within its "**In position**" range that you have specified. An "**In position**" signal is often used to make sure the motor stops before the machinery continues its operation.

Limits and Ranges of Operation

At a Glance

Another important task in achieving best system performance is setting certain motion limits and ranges of operation to protect equipment from damage and to optimize operational efficiency.

Two Types of Settings

There are two types of settings for motion limits and ranges of operation:

- fault limits
- tolerance bands

Type of Setting	Meaning
Fault limit	Fault limits are settings that signal errors when certain limits on motor movement, such as speed and position, as well as electrical current, are exceeded. Fault limits are designed to protect equipment from damage and can cause the drive and motor to shut down. For example, every motion control system has hardware limit switches, which are used in the position loop to set a limit on how far the actual motor position can deviate from the commanded position before a fault is signaled. You may also program software limits. The difference, or gap, between commanded position and actual position is known as following error. Such a limit protects against motor runaway and stalling.
Tolerance band	Tolerance bands are set, and specify the safe, efficient physical ranges for the equipment. Some of these tolerance bands do the following: ● in the current loop, set a limit on the amount of electrical current to the drive and motor. This protects the motor from damage that would be caused by excessive current ● in the position loop, place a limit on how far the motor can travel in a positive or negative direction ● set a range of positions that are considered to be "**In position**". That is, this range specifies how far the motor can deviate from its commanded position and still be considered in the correct position.

Acceleration and Deceleration

At a Glance

If the servo amplifier is operated with motion tasks under position control, different acceleration/deceleration profiles can be chosen. The choice of profile depends on the mechanical structure of the machine and the required dynamical quality. If the machine tends to sway (e.g. robot arm), $sine^2$ would be the best choice. This reduces the excitation to sway. The disadvantage of this profile is the double up of the acceleration/deceleration time. If the machine is mechanically stiff and there are high requirements in dynamics, the linear profile should be chosen. This leads to a torque step at the beginning and the end of each acceleration/deceleration ramp.

Two Types of Acceleration and Deceleration

The following table describes the two fundamental acceleration and deceleration types: linear and exponential. A motion profile may accommodate a combination of these two types.

Accel / Decel Type.	Description
Linear	Linear is a rate of acceleration and deceleration that theoretically represents a steady speed-up and slow-down.
$Sine^2$	To limit any jolting, the drive is accelerated/decelerated within the acceleration time along an acceleration ramp without any discontinuities. The resulting speed characteristic corresponds to a $sine^2$ curve.

Software and hardware configuration

Operating System

Unilink runs on WINDOWS 95(c)/ 98/ ME/ 2000 or WINDOWS NT 4.0 (Service Pack 3 or later).

Unilink does not run on DOS, OS2 or WINDOWS 3.xx.
However, it can be used on an ASCII terminal (no user interface).

Configuration of the link: **9600 bauds, 8 data bits, 1 stop bit, no parity**.

Description of the software

The servo amplifier is adaptable to your machine. In the worst case, you will not be able to transfer parameters directly to the servo amplifier. Instead, this will have to be performed via a computer, using the setup software. The computer and servo amplifier are connected via a serial link (null-modem cable). Communication between the computer and the servo amplifier is achieved via the setup software.

It will be relatively simple to modify the parameters and see an immediate reaction on the servo amplifier, as this is permanently connected (online). All values (currently in operation), are simultaneously read from the servo amplifier then displayed on the screen of the computer (oscilloscope functions).

The servo amplifier automatically recognizes the modules (extension cards) that are added to it.

The Unilink software automatically recognizes the software version numbers of the drives. This document describes the different functions of the drive firmware accessible via Unilink for versions 4.2 or later.

You can save (archive) the data, then reload them. Data currently in use can be printed.

You are provided with default data, including all functional combinations between the servo amplifier and the motor.

With the default data provided, you will be able to control your servo amplifier without too many problems.

Hardware Configuration

With the hardware supply disabled, connect the PC interface (X6, RS232) of the servo amplifier to the PC serial interface using a three-wire cable **(do not use a null-modem type connection cable)**.

CAUTION

Only disconnect and connect the cable with the power supply off (amplifier and PC).

Failure to observe this precaution can result in injury or equipment damage.

The amplifier interface is electrically isolated by an optocoupler, and uses the same voltage as the CANopen interface.

Minimum configuration for the computer:

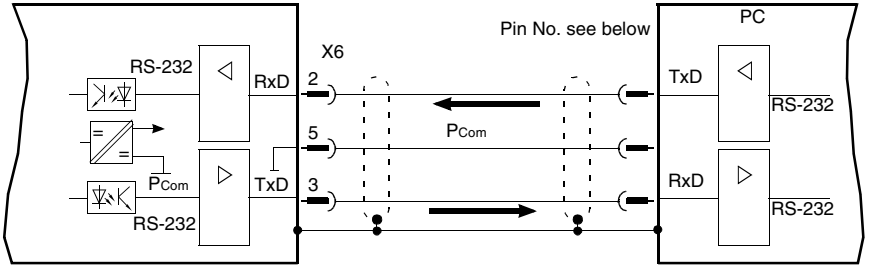
CPU	80486 or above
Operating System	WINDOWS 95(c)/ 98/ ME/ 2000/ NT 4.x
Graphics card	Color, WINDOWS compatible
Drives	Floppy disk drive Hard disk with 5Mb of free space CD-ROM drive for online documentation
RAM Memory	8Mb minimum
Link	One free serial link (COM1, COM2, COM3, COM4) This link must not be used by another software program or hardware device.

RS232 link, connection to the PC (X6)

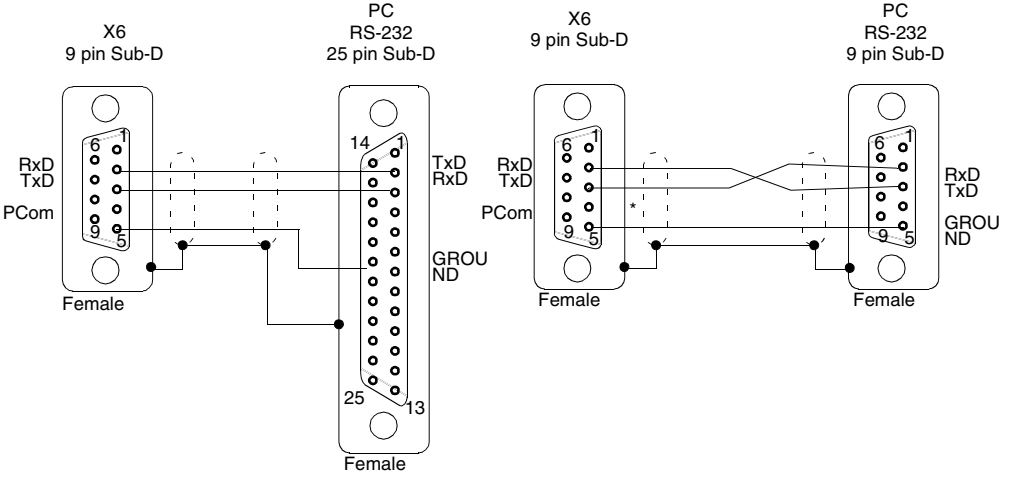
At a Glance

You can set the operation, position control and motion block parameters using the setup software from a standard PC.
With the hardware supply disabled, connect the PC interface (X6, RS232) of the servo amplifier to the PC serial interface using a three-wire cable **(do not use a null-modem type connection cable)**.
Before starting this operation, check there is no supply voltage. The interface, which is electrically isolated with optocouplers, uses the same voltage as the CANopen interface.

The interface is selected from the setup software.



Link between the PC and the servo amplifier (see illustration: component side of the built-in SubD connector, i.e. solder side).



Installing, Accessing, and Starting to Use UniLink

Installation

The following procedure helps you install UniLink on your computer.

Procedure to be followed

The following procedure shows you how to install UniLink:

Step	Action
1	Insert your Lexium Motion Tools CD into the CD drive of your computer.
2	Follow the easy software installation instructions.
3	When you are asked to choose a directory in which to install UniLink, select the default directory or specify another directory of your choice.
4	No errors should be reported during the installation process. If you receive an error message, repeat the installation procedure.

Access and Use

The following procedure shows you how to access and begin using UniLink:

Step	Action
1	Click on the **Unilink** shortcut icon on your desktop.
2	Follow the instructions in the online help topic for the UniLink access dialog box.
3	Choose whether to use UniLink **online** (connected to the drive) or **offline** (not connected to the drive), as follows: ● for online, select the communications port through which your drive is connected. The Amplifier dialog box then appears. The Amplifier dialog box provides access to other dialogs boxes ● for offline, click on the **Offline** button. You are then asked to download a data file. **Note:** only use the RS-232 serial cable to connect to the amplifier. Do not use the Modbus cable.
4	Begin using UniLink according to the remainder of the information in the UniLink access dialog, the Amplifier dialog and throughout the online help, in general.

Function keys

Overview of the functions of the different keys:

Function key	Function	Comment
F1	Help	Contextual help
F2	Reserved	Reserved
F3	Reserved	Reserved
F4	Jog mode	Starts the Jog Mode. The drive operates under the parameters that are pre-selected on the "Motion Tasks" page while the F4 key is pressed.
F5	DC	The drive operates under the parameters that are pre-selected on the "Oscilloscope/Service" pages.
F6	Speed	
F7	Torque	
F8	Reversing	
F9	Stop (OFF)	Brakes the motion. The response of the amplifier varies according to the operating mode in progress: **OPMODE=0** The amplifier brakes according to the preset braking ramp for the velocity loop (DEC). **OPMODE=2** The amplifier slows down. **OPMODE=8** Brakes the motion task in progress. The amplifier brakes according to the predefined braking ramp for the motion task.
F12	Disabled	Software disabled
Shift F12	Enabled	Software enabled

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 observe this precaution can result in injury or equipment damage.**

- the servo amplifier is installed, and all the necessary electrical connections have been made. See manual "User guide for the Lexium 17x 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 X3/15), i.e. the servo amplifier is disabled.

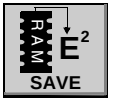
Switch on auxiliary supply

Step	Action
1	**Switch on the 24V auxiliary supply for the servo amplifier.** LED display: X. XX (firmware version) BTB/RTO contact: open **After about 5 seconds:** LED display: YY. (amount of current, blinking point for CPU o.k.) BTB/RTO contact: closed
2	**Switch on personal computer.**
3	**Start commissioning software.**
4	**Click on the interface (COM1, COM2, COM3 or COM4) 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.

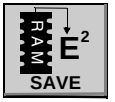
Step	Action
1	**Set up basic parameters (address, ballast details, line/mains supply voltage etc.):** ● click on the **SETTINGS** button above the picture of the motor ● alter the fields, if necessary ● click on **APPLY** and then on **OK**.
2	**Select motor:** ● click on the **MOTOR** button below the picture of the motor. ● open the motor selection table, by clicking on the arrow in the field **NUMBER-Reference** ● 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** button. ● 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** and then on **OK**.

Step	Action
4	**Set up the encoder emulation (ROD, SSI):** ● click on the **ENCODER CONNECTOR** button ● select the desired encoder emulation ● set up the corresponding parameters in the right half of the window ● click on **APPLY** and then on **OK**.
5	**Configure the analog inputs/outputs:** ● click on the **I/O ANALOG** button ● select the desired ANALOG-FUNCTION ● Set the scaling relative to 10V for the analog input that is used ● set up the required output signals for AN OUT 1 and AN OUT 2 ● click on **APPLY** and then on **OK**.
6	**Configure the digital inputs/outputs:** ● click on the **I/O DIGITAL** button. ● assign the required functions to the digital inputs (left half of window) and enter the auxiliary variable X if it is necessary ● assign the required functions to the digital inputs (right half of window) and enter the auxiliary variable X if it is necessary ● click on **APPLY** and then on **OK**.
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

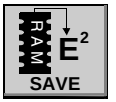
If you want to use the position control of the servo amplifier, then you must enter the specific parameters for your drive:

Step	Action
1	**Axis type:** ● click on the **POSITION** button ● click on the **POSITION DATA** button ● select the **axis type** (linear or rotary).
2	**Resolution:** ● 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)
3	**vmax:** ● 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). 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
4	**t_acc/dec_min:** ● enter the time in ms that the drive requires, with the **mechanically permissible** maximum acceleration, to accelerate from zero speed to vmax.

Step	Action
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.
7	**Save parameters:** ● click on the button shown below  ● answer the query "**RESET AMPLIFIER**" with "**YES**".

Optimization of the control loops

The basic setting must be finished.

Step	Action
1	**OPMODE:** Set the OPMODE "1,analog speed" (screen page AMPLIFIER)
2	**Setp. function:** Set the analog I/O-function to "0,Xsetp=An In 1" (screen page ANALOG-I/O)
3	**Save the parameters:** ● click on the button shown below  ● answer the query "**RESET AMPLIFIER**" with "**YES**".
4	**AN In 1:** Short-circuit the setpoint input 1 or apply 0V to it.
5	**OSCILLOSCOPE:** Channel1: n_act Channel2: I_act (screen page OSCILLOSCOPE)
6	**Reversing mode** Go to the screen page OSCILLOSCOPE/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 observe this precaution can result in injury or equipment damage.

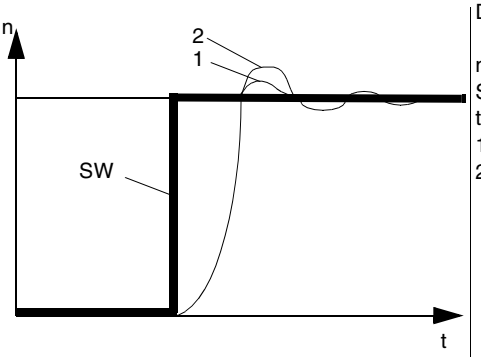
Optimizing the current controller

Screen page "current controller"

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:** ● an In 1 = 0V
5	Enable the amplifier ● high signal at Enable input X3/15. 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.

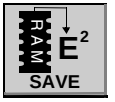
Optimizing the speed controller

Screen page "speed controller"

Step	Action
1	**SETP. -OFFSET :** Leave the amplifier enabled. If the axis is drifting, alter the parameter Setp. -Offset until it stands still (or use the function AUTO-OFFSET).
2	**SETP. RAMP +/-:** 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:** Set the desired final limit speed.
4	**KP/Tn:** Increase KP until the motor starts to oscillate (audible, and visible on the oscilloscope) and then reduce KP again until the oscillations have definitely stopped and stability is assured. Use the motor-specific default value for Tn.
5	**Start reversing mode:** Start the reversing mode (F8, 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  Diagram: Step response n = speed SW = setpoint t = time 1 = optimum 2 = KP too high
6	**KP:** You can produce a fine tuning of the speed response by cautiously increasing KP. 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	**PID-T2:** You can dampen out disturbances, such as a small amount of play in the gearing, by increasing PID-T2 to about 1/3 the value of Tn.

Step	Action
8	**FEEDBACK:** You can further improve the smooth running by using FEEDBACK, especially for small drives with a low torque.
9	**End reversing mode:** Finish the reversing mode operation (F9).

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

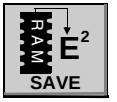
Step	Action
1	**OPMODE:** Select OPMODE 8 (screen page AMPLIFIER)
2	**Position the load in a middle position:** The aim is, to use the Jog Mode function to move the load to approximately the middle of the motion path. ● click on the "**POSITION**" button ● click on the "**HOMING**" button ● check that the parameter v (Jog Mode) is set to 1/10 of the preset speed limit vmax. The sign of "v" determines the direction. Alter the value if necessary, and click on "**APPLY**" ● start the function Jog Mode by using the function key F4 and move the load to approximately the middle of the motion path. **WARNING:** If the drive moves in the wrong direction, release the F4 function key and change the sign of the parameter "v" (Jog mode). Use F4 again to move the load to approximately the middle of the motion path.
3	**Set reference point:** ● 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.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>4</td><td>Define test motion blocks:
● click on the "POSITION" button
● click on the "POSITION DATA" button
● 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
acc./dec.
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
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
immediately
click</td></tr>
</table>
</td></tr>
<tr><td>5</td><td>Save parameters:
● click on the button shown below:



● answer the query "RESET AMPLIFIER" with "YES".</td></tr>
</table>

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 observe this precaution can result in injury or equipment damage.

Step	Action
1	**Start motion task:** ● click on the "**POSITION**" button ● 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 "**POSITION DATA**" button).
3	**PID-T2, 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 PID-T2 and FEEDBACK from the screen page "SPEED CONTROLLER".
4	**KP, Tn:** If KP is set too low, the position controller tends to oscillate. Use the value for the optimized speed controller for KP. Tn should be 2...3 times as large as the Tn value for the optimized speed controller.
5	**KV:** The acceleration behavior of the motor should be well damped (no tendency to oscillation) with a minimum following error. If KV is larger, the tendency to oscillation increases. If it is smaller the following error increases and the drive becomes too soft. Vary KV until the desired response is achieved.
6	**FF:** 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 FF parameter. This error is smaller if the FF parameter is increased. If increasing FF does not produce any improvement, then you can increase KP a little, to make the speed control loop somewhat stiffer.

Incorrect operation

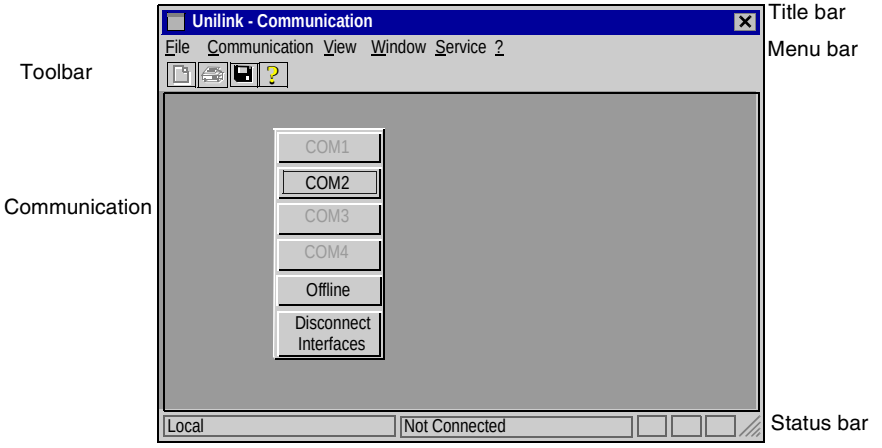
If the drive does not run satisfactorily under position control, first look for external causes such as:

- mechanical play in the transmission chain (limits the KP)
- 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.

Screen layout

At a Glance

General screen



Title bar

The program name, station address, and the name of the currently valid data set (drive) are displayed in the title bar. During offline operation, instead of the station address a number above 100 will be shown, possibly with the storage location (folder + file name) of the data set that has been loaded.

Toolbar

The typical Windows-style buttons can be used for a direct start of individual functions.

Status Bar

Current information about data communication is shown here.

Menu bar

FILE	
Open	A parameter and/or motion task data set is read from the data medium (hard disk, diskette) and becomes the configuration currently in use. For this, the amplifier must be disabled.
Close	The current data set is closed and not saved.
Save	Saves the current parameter or motion task data set to a data medium (hard disk, diskette) while keeping the file name, if the data set already has a name. If the data set has not yet got a name, you will be prompted to enter a name and storage location. You can save parameters and motion task data to one single file or to separate files.
Save as	Saves the current parameter or motion task data set to a data medium (hard disk, diskette). You will be prompted to enter a name and storage location.
Print	The current data set will be printed out. You can choose whether the print data are sent to the system printer or saved to a file.
Print preview / Print setup	Use these functions in the same way as for any other Windows software.
Exit	Terminates the program.

COMMUNICATION	
COM1 / COM2 / COM3 / COM4	If one of these interfaces (ports) is available for communication with a servo amplifier, which means that it is not used by other equipment or drivers, then the text label appears in full black and can be selected. Select this interface and use it for the connection to the servo amplifier.
Offline	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 (diskette), work on it, and save it again. The software functions and screen pages that only have a use in the online mode will not be selectable.
Disconnect interfaces	This deactivates the access to the setup software from interfaces COM1 and COM4. This function is important if, for instance, the servo amplifier is to be accessed from an external program, without closing the setup software.
Multidrive	With this function, you can establish connection to other amplifiers, that are connected via the CAN-bus with the amplifier that communicates via the RS232-interface with the PC. Therefore, all devices must have different addresses. This function should not be used in running field bus applications.

VIEW	
Toolbar Status bar	Switch to insert the toolbar (above) or the status bar (below) into the screen.

WINDOW	
Cascade / Tile vertically / Arrange icons	Use these functions in the same way as for any other Windows software.

SERVICE	
STOP (F9)	Brakes the motion. The response of the amplifier varies according to the operating mode in progress: **OPMODE=0** The amplifier brakes according to the preset braking ramp for the velocity loop (DEC). **OPMODE=2** The amplifier slows down. **OPMODE=8** Brakes the motion task in progress. The amplifier brakes according to the predefined braking ramp for the motion task. If the screen page "Oscilloscope/Service" is active, you can also start the service function from here.
? (Help function)	HTML help file.

Parameters and functions

2

Parameters and 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:

2.1 Screen page "Communication"

Screen page "Communication"

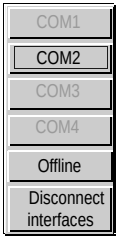
At a Glance

This dialog is the first dialog that appears when you start UniLink. It allows you to:

- communicate directly with the servo drive online, via the COM1 / COM2 / COM3 / COM4 and Drive Connect buttons,
- use the UniLink software offline, without connection to the drive, via the Offline button,
- scan the serial ports and the CAN bus to see what devices are networked and available.

COM1 / COM2 / COM3 and COM4

Diagram:



Click on one of these communication ports (the port that you are using on your PC) to transfer the parameter values from the drive to your PC. Then click on the drive connect button (described below) to connect online and communicate directly with the servo drive. If the port that you are using is available (not used by other equipment or programs) the name COM1, COM2, COM3 or COM4 appears black. Otherwise, the name appears gray.

Offline

Even when no drive is connected, you can still use UniLink. You can load axis commissioning data from the PC, work on it, and save it again. If you do not load data, the manufacturer's default settings (basic setup) will be applied. Software functions and UniLink dialogs that are only available in online mode will not be selectable.

You can open more than one data set for editing, by clicking on Offline again. The individual data sets are identified in the title bar by the designations AMPLIFIER 101, AMPLIFIER 102 and so on.

Instead of the axis address, a sequential number above 100 is displayed. If you have loaded an existing data set from the PC, then the folder name, data set name, and servo drive name will also be displayed.

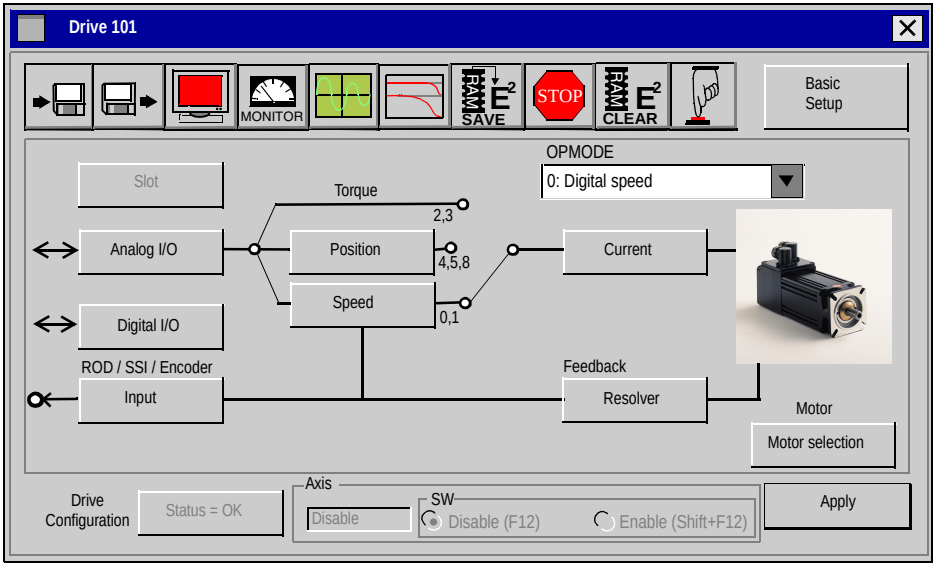
Disconnect interfaces

Deactivates the access to the setup software via the interfaces COM1 to COM4. This function is important, as in order for an external program to access the servo amplifier, the setup software must be active.

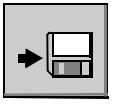
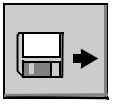
2.2 Screen page "Amplifier"

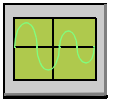
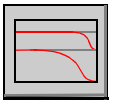
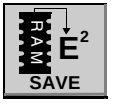
Overview of the functions of the "Amplifier"

At a Glance

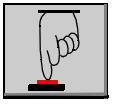


This screen page displays the control loops of the servo drive in a simplified block diagram. A click with the left mouse button on a button on the screen page calls up the corresponding function or screen page.

Button	Description
	Save the current parameter to data media (hard disk, diskette). You can save parameters and motion task data to one single file or to separate files.
	Load a control parameter file or a motion-block parameter file from data media (hard disk, diskette). For this, the amplifier must be disabled.

Button	Description
	Open the screen page "TERMINAL" for the direct input of ASCII commands (only for advanced users, and with the support of our application department).
	Open the screen page "ACTUAL VALUES" to display the actual drive status.
	Open the screen page "OSCILLOSCOPE/SERVICE" for the graphic display of the setpoint/actual values, and to access the service functions (reversing mode, const. speed etc.) for optimizing the amplifier.
	Open the screen page "BODEPLOT". When using a Bode plot generator, this page generates a graphic representation of the amplifier's behavior controls.
	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.

ASCII: **SAVE**	Default: -	Valid for all OPMODES

Button	Description
	Stop the currently active service function. This is the same as using the function key F9. Stop (cancel) motion functions in the OPMODES 0, 2 and 8. Movements in OPMODES 0 to 3 can only be stopped by using the "**DISABLE. (F12)**" button.
	Cancel all the parameters that have been set up, and load the manufacturer's default values.
	Performs a hardware reset.

ASCII: **COLDSTART**	Default: -	Valid for all OPMODES

Basic setup

Opens the screen page "BASIC SETUP".

Slot / Exp.x

Opens the screen page for the built-in expansion card (description: manual for the expansion card)

Analog I/O

Opens the screen page "ANALOG I/O"

Digital I/O

Opens the screen page "DIGITAL I/O"

Encoder Connector

Open the screen page "ENCODER"

OPMODE

ASCII: **OPMODE**	Default: 1	Valid for all OPMODES

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

ID	Function	Comments
0	Digital (rotational) speed	Speed control with digital setpoint
1	Analog (rotational) speed	Speed control with analog setpoint
2	Digital torque	Torque control with digital setpoint (speed controller has to be optimized)
3	Analog torque	Torque control with analog setpoint (speed controller has to be optimized)
4	Position: electr. gearing	Position control "Pulse follower"
5	Position: ext. position nodes	Position control interpolates external nodes
6	SERCOS position control	Position control with SERCOS expansion card
7	reserved	reserved
8	Position: motion blocks	Position control by stored motion blocks

	**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 observe this precaution will result in death or serious injury.**

Position

Opens the screen page "POSITION"

Speed

Open the screen page "SPEED"

Current

Opens the screen page "CURRENT"

Feedback

Opens the screen page "FEEDBACK"

Motor

Opens the screen page "MOTOR"

Status=OK/Fault

Open the screen page "DRIVE STATUS". If a fault is present, the text for the buttons will change.

Axis

The enable status of the amplifier is displayed:
Enable / Disable

Disable / Enable SW

ASCII: **DIS** (disable, F12)	Default: -	Valid for all OPMODES
ASCII: **EN** (enable, Shift F12)	Default: -	Valid for all OPMODES

Disables or enables the servo amplifiers via the software. This signal is logically "AND"-linked inside the servo amplifier with the hardware-enable (terminal X3/15).

	**DANGER** This function does not ensure personnel safety. To disable the servo amplifier in a way that ensures personnel safety, the enable signal (terminal X3/15) must be removed and the line (mains) power must be switched off, or Option -AS- must be used. **Failure to observe this precaution will result in death or serious injury.**

Exit

Ends the processing of the current parameter set. If you have made any changes, you will be asked if you want to save the data.

2.3 SLOT

Screen page "Slot"

At a Glance

The screen page depends on the built-in expansion card:

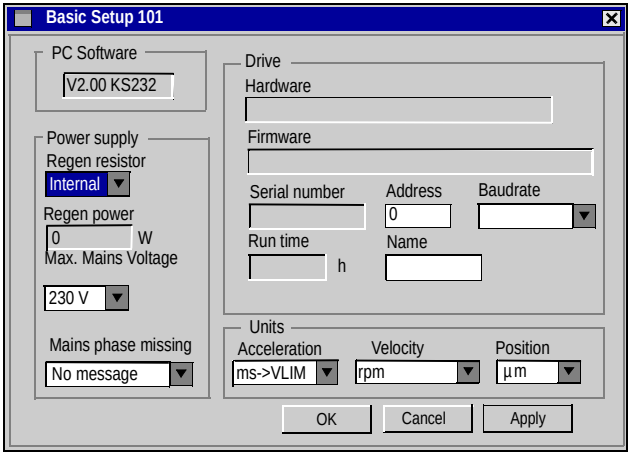
- I/O expansion card -I/O-14/08- (in preparation),
- SERCOS,
- PROFIBUS DP,
- FireWire (in preparation),
- Modbus Plus.

2.4 Screen page "Basic Setup"

Overview of "Basic Setup"

At a Glance

Diagram:



PC Software

Display the version and revision level of the current setup software.

Regen Resistor

ASCII: **PBALRES**	Default: 0 (internal)	Valid for all OPMODES

Preselection of the regen resistor. If you use an external regen resistor, set "1,external" here.

Regen Power

ASCII: **PBALMAX**	Default: 80 W / 200 W	Valid for all OPMODES

The limit for the continuous power of the regen resistor. Change this only while the amplifier is disabled.

Max. Mains Voltage

ASCII: **VBUSBAL**	Default: 1	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)
0	230 V	310 V / 430 V
1	400 V	560 V / 750 V
2	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 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.

Mains phase missing

ASCII: **PMODE**	Default: 1	Valid for all OPMODES

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

ID	Function	Note
0	No message	A missing mains supply phase is not evaluated. Operation is possible on two phases. The peak current for acceleration is limited to 4A.
1	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. The peak current for acceleration is limited to 4A.

ID	Function	Note
2	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 BTB/RTO contact opened.

Hardware

ASCII: **HVER**	Default: -	Valid for all OPMODES

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

Firmware

ASCII: **VER**	Default: -	Valid for all OPMODES

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

Serial number

ASCII: **SERIALNO**	Default: -	Valid for all OPMODES

Display the serial number of the servo amplifier.

Run time

ASCII: **TRUN**	Default: -	Valid for all OPMODES

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

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 DP, 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 (see User guide for the Lexium 17x series amplifier). The address is displayed in the setup software in the title bar of every screen page, as long as you are working online. In offline operation the display is not the actual station address, but a number above 100. In this way you can instantly recognize the offline mode. You can also use the keys on the front panel of the servo amplifier to set the station address (see Installation Manual).

Baudrate

ASCII: **CBAUD**	Default: 500 Kbit/s	Valid for all OPMODES

The entry is the transmission rate of the amplifier (10, 20, 50, 100, 125, 250, 333, 500, 666, 800, 1000 kbit/s). The transmission rate is required by the fieldbus (CANopen) and for the parameter setting of the servo amplifier in multi-axis systems (see Installation Manual). You can also use the keys on the front panel of the servo amplifier to set the baud rate (see Installation Manual).

Name

ASCII: **ALIAS**	Default: blanks	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.

Auto validation

ASCII: **AENA**	Default: 1	Valid for OPMODES 0, 2, 4-8

Definition of the SW status (Activation of the setpoint) on powering up the amplifier, or after pressing the RESET button to clear errors.

Ext. WD

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 stops. The amplifier remains operational, and the output stage remains enabled. This warning message must be cleared using the RESET key in order for a new setpoint to be accepted.

Acceleration

ASCII: **ACCUNIT**	Default: 0	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.

Speed

ASCII: **VUNIT**	Default: 0	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	Function	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/250µs	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 not possible to define a speed using a number with a decimal point, particularly for the setting Pulses/250 µs. It is therefore necessary to make sure a suitable unit is selected, according to the application.

Position

ASCII: **PUNIT**	Default: 0	Valid for all OPMODES

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

ID	Function	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

With the pulse 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** used.

2.5 Screen page "Motor"

Screen page "Motor"

At a Glance

Information and descriptions concerning the different fields of the "Motor" screen.

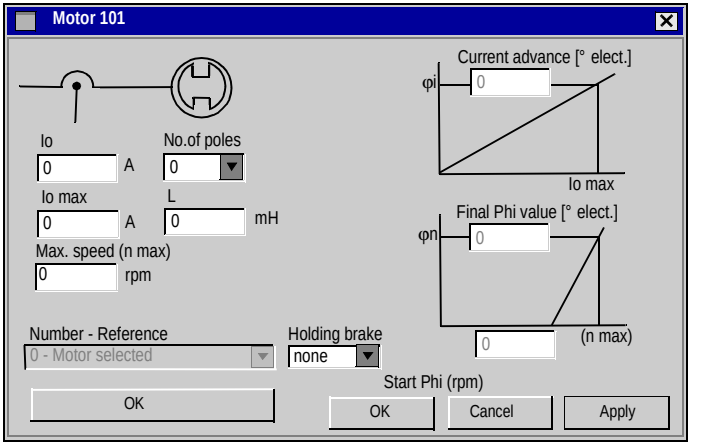
What's in this section?

This section contains the following topics:

Overview of the "Synchronous motor" screen

At a Glance

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



Motor type

This parameter enables us to distinguish between synchronous motors (MTYPE = 1) and asynchronous (MTYPE = 3) motors. If an asynchronous motor is selected, this screen page looks different.

ASCII: **MTYPE**	Default: 6	Valid for all OPMODES

Number of poles

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.

ASCII: **MPOLES**	Default: 6	Valid for all OPMODES

Io

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

ASCII: **MICONT**	Default: standstill current	Valid for all OPMODES

Io max

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

ASCII: **MIPEAK**	Default: peak current	Valid for all OPMODES

L

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

ASCII: **L**	Default: 0 mH	Valid for all OPMODES

Max. speed (n max)

Maximum authorized speed for the motor. Limit the possible entries for the SPEED LIMIT parameter in the SPEED screen page.

ASCII: **MSPEED**	Default: 3000 rpm	Valid for all OPMODES

Number - Reference

Select the desired motor from the motor database. 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.

The following motor-related parameters are automatically updated when you select a motor:

Screen page	**Parameters**
Basic Setup	Maximum mains voltage
Motor	Number of poles, Io, Io max, L, Maximum Speed, Current advance, Start Phi, Limit Phi, Brake
Feedback	Feedback Type, Number of Resolver Poles, Offset
Current	KP, Tn
Speed	KP, Tn, PID-T2, Feedback, Maximum Speed, Overspeed

ASCII: **MNAME**	Default: blanks	valid for all OPMODES
ASCII: **MNUMBER**	Default: 0	valid for all OPMODES

Holding brake

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).

ASCII: **MBRAKE**	Default: 0	valid for all OPMODES

See the Lexium 17Dx drive user 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.

Current Advance

In this field, enter a current-dependent phase advance, to make use of the reluctance torque for motors with magnets embedded in the rotor. This is for advanced users.

ASCII: **MTANGLP**	Default: 0	valid for all OPMODES

Limit Phi and Start Phi

The inductive phase shift between the motor current and the motor voltage can be compensated at high speeds. With the given voltage conditions, a higher torque can be achieved at the speed limit. Alternatively, the achievable speed limit can be increased by up to 30%. The phase shift is increased (depending on the motor speed) linearly from the Start Phi value up to the maximum speed of the motor. The phase shift correction is increased linearly from the Start Phi value and reaches the limit Phi value at maximum speed. The optimum setting depends on the motor type and the speed limit.

ASCII: **MVANGLB**	Default: 2400 rpm	valid for all OPMODES
ASCII: **MVANGLF**	Default: 20°	valid for all OPMODES

Motor unit

Define the motor speed parameters. If the unit 1/min (rpm) is used, the velocity/speed parameter settings are applied for VUNIT.

ASCII: **MUNIT**	Default: 0	valid for all OPMODES

Loading the data from a disk.

Load a motor database from a data medium (hard or floppy disk). In this case, the drive must be deactivated.

Overview of the "Asynchronous motor" screen

At a Glance

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

Motor type

This parameter is used to distinguish between synchronous motors (MTYPE=1) and asynchronous motors (MTYPE=3). If asynchronous-type is selected, the screen looks different.

ASCII: **MTYPE**	Default: 1	Valid for all OPMODES

Number of poles

Select 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 amplifier is disabled.

ASCII: **MPOLES**	Default: 6	Valid for all OPMODES

Io

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

ASCII: **MICONT**	Default: standstill current	Valid for all OPMODES

Io max

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

ASCII: **MIPEAK**	Default: peak current	Valid for all OPMODES

Rotor time constant

Defines the rotor time constant for the nominal load (Tr=Lh/Rr). Lh is the magnetization inductance of the axis, and Rr is the resistance of the rotor.

ASCII: **MTR**	Default: 200 ms	Valid for all OPMODES

Max. speed (n max)

This is the maximum speed of the motor. Limits are entered in the parameter "Speed limit" (screen page "Speed").

ASCII: **MSPEED**	Default: 3000 rpm	Valid for all OPMODES

Nominal speed

Nominal speed of the asynchronous motor. This defines the point above which a reduction in phase shift is applied. For example, if a 4-pole motor is to operate at 50Hz, the nominal speed must be set to 1500.

ASCII: **MVR**	Default: 3000 rpm	Valid for all OPMODES

Number - Reference

Select the desired motor from the motor database. 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 amplifier is disabled.

The parameters concerning the following motor are automatically updated when you select a motor.

Unilink dialog	**Parameters**
Basic Setup	Maximum mains voltage
Motor	Number of poles, Io, Io max, L, Maximum Speed, Current advance, Start Phi, Limit Phi, Brake
Feedback	Feedback Type, Number of Resolver Poles, Offset
Current	KP, Tn
Speed	KP, Tn, PID-T2, Feedback, Maximum Speed, Overspeed

ASCII: **MNAME**	Default: blanks	valid for all OPMODES
ASCII: **MNUMBER**	Default: 0 rpm	valid for all OPMODES

Holding brake

To operate a 24 V parking brake directly in the motor of a servo amplifier, select 0 (with). Otherwise, select 1 (without).

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).

ASCII: **MBRAKE**	Default: 0	valid for all OPMODES

See the Lexium 17Dx drive user guides for the time/function relationship between the ENABLE signal the speed setpoint, actual speed value, and the braking force. Change this only while the amplifier is disabled + reset.

Loading data to the disk

Load the file for the motor parameters of a drive (hard disk, floppy disk). For this, the amplifier can be disabled.

Motor unit

Define the motor speed value. If 1/min (rpm) is used, the speed parameter will apply to VUNIT.

ASCII: **MUNIT**	Default: 0	Valid for all OPMODES

Level of phase-shift

Defines the magnetization current for an asynchronous motor: in general, this value is 40% - 50% that of the direct current. The magnetization current remains at a constant speed, lower than that of the nominal speed of the motor. If the motor is operating at a speed greater than its nominal speed, this current is lowered in inverse proportion to this speed, by phase-shift reduction.

ASCII: **MIMR**	Default: 0 A	Valid for all OPMODES

Kp

Proportional (P) gain of the flux controller. This is implemented as the PI controller.

ASCII: **GF**	Default: 15	Valid for all OPMODES

Tn

Reinitialization (I) time for the flux controller. This is implemented as the PI controller.

ASCII: **GFTN**	Default: 50 ms	Valid for all OPMODES

Phase-shift correction factor

Correction factor for lowering phase-shift. This correction factor is used to compensate for the non-linearity of the inductance of the motor when the magnetization current is lowered, by increasing the speed during phase-shift reduction.

ASCII: **MCFW**	Default: 1.5	Valid for all OPMODES

Slippage correction factor

Correction factor for the time constant of the rotor (armature). This improves torque over the reduction range and the stationary range of phase-shift.

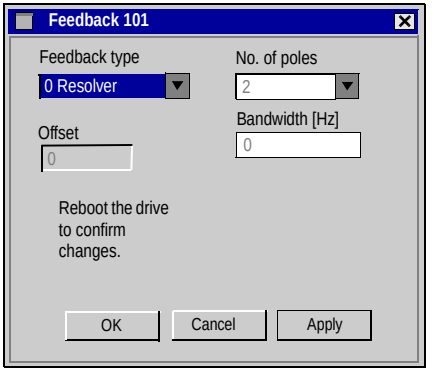
ASCII: **MCTR**	Default: 1.5	Valid for all OPMODES

2.6 Screen page "Feedback"

Overview of the "Feedback" screen

At a Glance

Diagram:



Feedback type

ASCII: **FBTYPE**	Default: 0	valid for all OPMODES

Change this only while the amplifier is disabled + reset.

ID	Function	Comments
0	Resolver	It is possible to connect 2, 4 or 6-pole resolvers to the servo amplifier. Cycle time 62.5 µs.
1	reserved	-
2	HIPERFACE®	Feedback from a high-resolution absolute encoder (single- or multi-turn) using HIPERFACE® compatible interface, e.g. SRS x0 / SRM x0 / SCS x0 / SCM x0 from Stegmann. Cycle time 125 µs.
3	Auto	The servo amplifier detects the connected feedback system automatically (Resolver, EnDat or Hiperface).
4	EnDat	Feedback from a high-resolution absolute encoder (single- or multi-turn) using EnDat-compatible interface, e.g. ECN 1313 / EQN 1325 from Heidenhain. Cycle time 125 µs.
5	reserved	-
6	SinCos EEP	Sine-cosine encoder. The offset data is loaded from the serial EEPROM.
7	SinCos W & S	Sine-cosine encoder. The offset data are detected by the servo amplifier.
8-15	reserved	-
16	Res & SinCos	Both feedback systems are installed. The drive starts running with the resolver feedback. After a short delay the feedback switches to SinCos W&S (ID 7).

No. of poles

ASCII: **MRESPOLES**	Default: 2	valid for all OPMODES

This parameter becomes effective only with resolver feedback (FBTYPE = 0 or 3). Standard resolvers have 2 poles. Change this only while the amplifier is disabled.

Resolver bandwidth

ASCII: **MRESBW**	Default: 600	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).

Offset

ASCII: **MPHASE**	Default: 0°	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 observe this precaution will result in death or serious injury.

Speed monitor

ASCII: **FILTMODE**	Default: 1	valid for all OPMODES

ID	Function	Note
0	OFF 16 kHz VL	16 kHz loop speed
1	OFF 4 kHz VL	TqFilter
2	ON 16 kHz VL	Speed monitor
3	ON 4 kHz VL	Speed monitor

Acceleration feedforward

ASCII: **VLO**	Default: 1.0	valid for all OPMODES

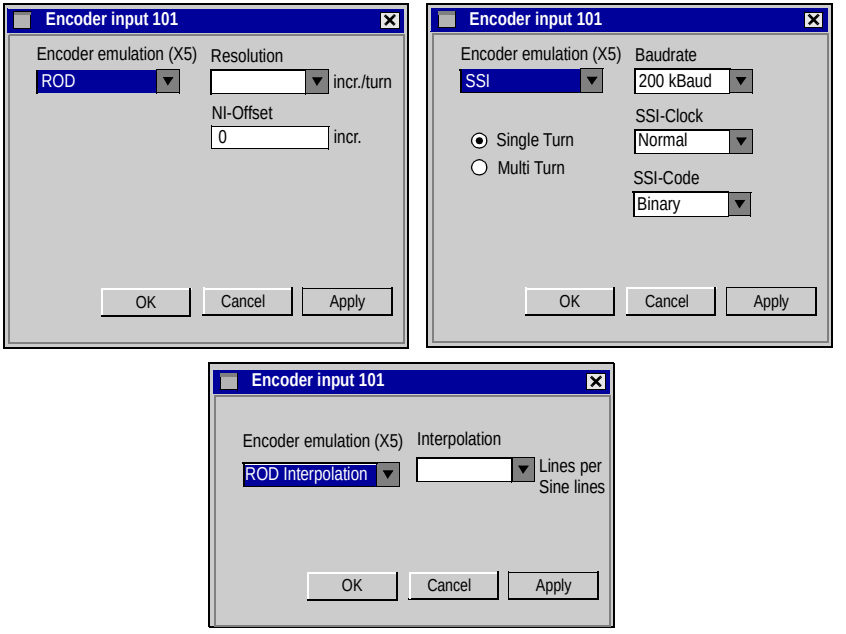
This parameter generates a dynamic pre-control for the detection of current values (Luenberger monitor), in particular for resolver feedback. It reduces phase slippage in the detection of the current value, so improving the stability of the speed control. For VLO = 1, the pre-control is optimal; for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

2.7 Screen page "Encoder Input"

Overview of the "Encoder Input" screen

At a Glance

Diagram:



Encoder emulation (X5)

Encoder emulation cycle time: 0.125µs

ASCII: **ENCMODE**	Default: 1	valid for all OPMODES

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/A and B/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 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 ROD

ASCII: **ENCOUT**	Default: 1024	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.)*

The resolution in the controls can be increased by quadruple evaluation of the increments.
* FIRMWARE / MHDA version 1.2 and higher.

NI-Offset

ASCII: **ENCZERO**	Default: 0	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.

Single Turn/ Multi Turn

ASCII: **SSIMODE**	Default: 0	valid for all OPMODES

Determines whether the output format is compatible to a single turn or multi turn SSI encoder. Change this only while the amplifier is disabled.

ID	**Function**
0	Single Turn
1	Multi Turn

Baudrate

ASCII: **SSIOUT**	Default: 0	valid for all OPMODES

Determines the serial transmission rate. Change this only while the amplifier is disabled.

ID	Function
0	200 kBaud
1	1.5 MBaud

SSI-Clock

ASCII: **SSIINV**	Default: 0	valid for all OPMODES

Determines whether the output level is normal, or inverted. Change this only while the amplifier is disabled.

ID	Function
0	Normal
1	Inverted

SSI-Code

ASCII: **SSIGRAY**	Default: 0	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

ROD Interpolation

ASCII: **ENCOUT**	Default: 16	valid for all OPMODES

Determines the multiplier for the number of lines of the feedback encoder per electrical motor rotation.
Maximum output pulse value: 400 000 pulses/second

2.8 Screen page "Analog I/O"

General overview of the "Analog I/O" screen

At a Glance

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

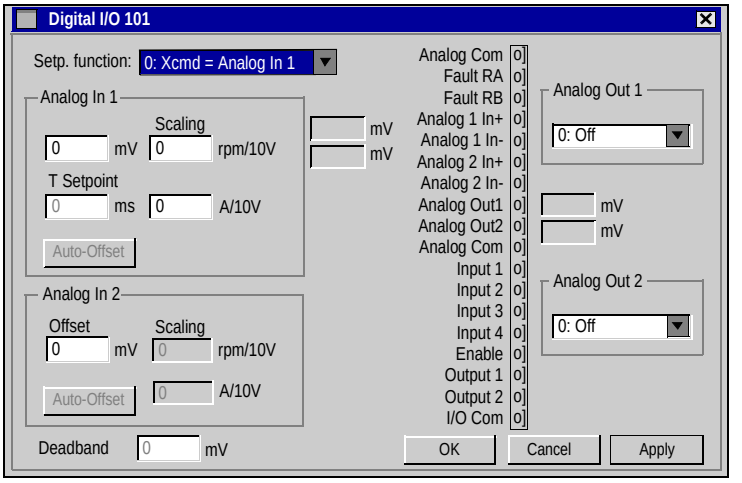
What's in this section?

This section contains the following topics:

Analog Inputs/Outputs "Analog I/Os"

At a Glance

Diagram:



Cycle time of the analog I/O-functions: 250 micro-seconds. An In 1 is read every 125 micro-seconds.

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

Analog inputs AN IN 1 / AN IN 2

Deadband

ASCII: **ANDB**	Default: 0 mV	valid for OPMODES 1+3

Suppresses small input signals. The function is useful with OPMODE1: analog speed (**without higher-level position control**)

Offset

ASCII: **ANOFFx**	Default: 0 mV	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.

Scaling

ASCII: **VSCALEx**	Default: 3000	valid for OPMODE 1

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

ASCII: **ISCALEx**	Default: peak current	valid for OPMODE 3

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

T Setpoint

ASCII: **AVZ1**	Default: 1 ms	valid for OPMODE 1

You can enter a filter time constant here, for An In 1 (clock rate 8 kHz, 1st order filter)

Auto-Offset

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

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

Setpoint functions

ASCII: **ANCNFG**	Default: 0	valid for all OPMODES

ID	Function
0	Xcmd = Analog In 1
1	vcmd = An In 1, Icmd = An In 2
2	vcmd = An In 1, Iffd = An In 2
3	Xcmd = An In 1, Ipeak = An In 2
4	Xcmd = An In 1 + An In 2
5	Xcmd = An In 1 * An In 2
6	Electric gear
7	Icmd = Setp.1 & Nmax = Setp.2
8	Pcmd = An In 1
9	Xcmd = An In 1, Ferraris = An In 2

0, Xcmd = Analog In 1
The servo amplifier only uses the An In 1, and operates in the mode that is set by the OPMODE parameter. The digital input function 8, An In 1/An In 2 can be used to change over to An In.

Xcmd = Scaling(An In 1) * An In 1

1, vcmd = An In 1, Icmd = An In 2
The servo amplifier only uses one of the two analog inputs, depending on the setting of OPMODE.

vcmd = Scaling (An In x) * An In x

OPMODE	AN In 1:	AN In 2:
1, analog speed	speed setpoint	inactive
3, analog torque	inactive	current (torque) setpoint
all other settings	inactive	inactive

2, vcmd = An In 1, Iffd = An In 2
An In 2 is used as current feed forward (OPMODE=0.1).

vcmd = Scaling(An In 1) * An In 1 Iff = Scaling(An In 2) * An In 2

3, Xcmd = An In 1, Ipeak1 = An In 2

The servo amplifier uses An In 1, depending on the setting of OPMODE. An In 2 is used for the limiting of the peak current of the instrument (Ipeak).

Ipeak = Ipeak *(An In 2 / 10 V) Xcmd = Scaling (An In 1) * An In 1

If you use the digital input function Ipeak2x as well as the setpoint function Ipeak1, the servo amplifier will use the lower of the two settings for Ipeak.

4, Xcmd = An In 1 + An In 2

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

Xcmd = Scaling (An In 1) * An In 1 + Scaling (An In 2) * An In 2

OPMODE	**An In 1 + An In 2**
1, analog speed	speed setpoint
3, analog torque	current (torque) setpoint
all other settings	inactive

5, Xcmd = An In 1 • An In 2

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

Xcmd = An In 1 * Scaling (An In 1) * An In 2

OPMODE	**An In 1 • An In 2**
1, analog speed	speed setpoint
3, analog torque	current (torque) setpoint
all other settings	inactive

6, electric gear

Correction of the gearing ratio (nominator y, GEARO) of the electrical gearing through An In 2 for OPMODE 4. An In 1 is used as a speed (or torque) setpoint for OPMODE 1 (or 3).

GEAROeff = GEARO * (1 + (An In 2*Scaling (An In 2)) / 100)

7, Icmd = Setp.1 & Nmax = Setp.2

The servo amplifier uses Setp.1 as current (or torque) setpoint. Setp.2 defines the maximum rotary speed.

Icmd = Scaling (Setp.1) * Setp.1 nmax = Scaling (Setp.2) * Setp.2

8, Pcmd = An In 1
Input 1 is used as position setpoint. For example, for adjusting a valve setting.

9, Xcmd = An In 1, Ferraris = An In 2
The servo amplifier uses the input 1 as current (torque) or speed setpoint, depending on the **OPMODE** parameters.
Input 2 is used as a Ferraris sensor input (acceleration sensor) for implementing speed control using this sensor.

Analog outputs AN OUT 1 / AN OUT 2

AN OUT 1/2

ASCII: **ANOUTx**	Default: 1	valid for OPMODES 1+3

The analog outputs 1 (ANOUT1, terminal X3/8) and 2 (ANOUT2, terminal X3/9) each provide various analog actual/setpoint values, depending on the selection in the commissioning software. Make changes only while the amplifier is disabled + reset. Output resistor 2.2kΩ . Resolution 10 bit.

ID	Function	Description
0	Off	inactive
1	v_Act	The speed monitor provides a DC voltage referred to AGND, analog to the actual speed.
2	I_act	The current monitor provides a DC voltage referred to AGND, analog to the actual current. The output is the actual in-phase current (active component Iq), which is nearly **proportional** to the **motor output torque**. Amplitude: +/-10 V for the +/- **preset peak current** (r.m.s. value) in the current controller
3	v_cmd	The output provides 10V referred to AGND for the internal speed setpoint. Amplitude :10V at the preset speed limit in the speed controller
4	I_cmd	The output provides 10V referred to AGND for the internal current setpoint (corresponds to the preset peak current at the output of the speed controller). Amplitude: +/-10 V for the +/- **preset peak current** (r.m.s. value) in the current controller
5	FError	The output provides 10V referred to AGND for the preset following error window.
6	Slot.	reserved by the expansion card

2.9 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

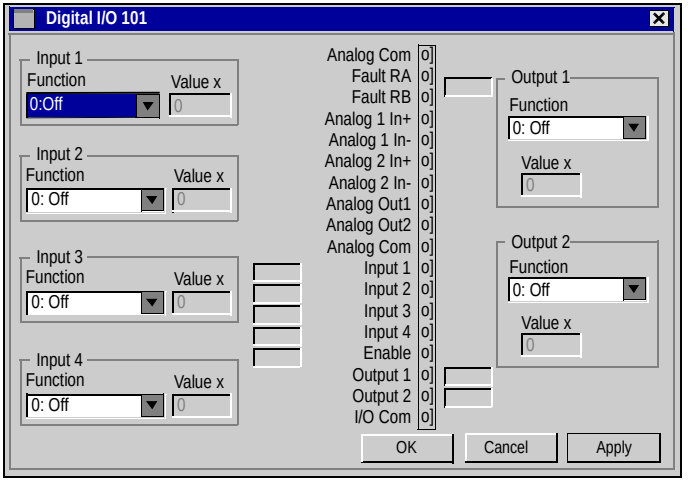
What's in this section?

This section contains the following topics:

Overview

At a Glance

Diagram:



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

Digital inputs DIGITAL-IN1 / DIGITAL-IN2 /PSTOP/NSTOP

At a Glance

ASCII: **INxMODE**	Default: 0	valid for all OPMODES
ASCII: **INxTRIG**	Default: 0	valid for all OPMODES

The terminals DIGITAL-IN1/2, PSTOP and NSTOP (X3/11,12,13,14) can be used in combination with internal functions. Change this only while the amplifier is disabled + reset.

				Function can be combined with			
ID	**Function**	**Active edge/ Level**	**Auxiliary value x INxTRIG**	**DIGITAL-IN1 X3/11 IN1MODE**	**DIGITAL-IN2 X3/12 IN2MODE**	**PSTOPX3/ 13 IN3MODE**	**NSTOPX3/ 14 IN3MODE**
0	Off	-	-	x	x	x	x
1	Reset	↗	-	x			
2	PSTOP	↘ Low	-			x	
3	NSTOP	↘ Low	-				x
4	PSTOP+Intg.Off	↘ Low	-			x	
5	NSTOP+Intg.Off	↘ Low	-				x
6	PSTOP+NSTOP	↘ Low	-			x	
7	P/Nstop+Intg.Off	↘ Low	-			x	
8	AnIn1 / AnIn2	High/Low	-	x	x	x	x
9	Mt_No_Bit	↗	-	x	x	x	x
10	Intg.Off	↗	-	x	x	x	x
11	v/Torq.Contr	High/Low	-	x	x	x	x
12	Reference	↗	-	x	x	x	x
13	ROD/SSI	High/Low	-	x	x	x	x
14	FError_clear	↗	-	x	x	x	x
15	Start_MT Next	Can be set	-	x	x	x	x
16	Start_MT No x	↗	Motion task no.	x	x	x	x
17	Start_MT I/O	↗	-	x	x	x	x
18	Ipeak2 x	↗	% of Ipeak	x	x	x	x

				Function can be combined with			
ID	**Function**	**Active edge/ Level**	**Auxiliary value x INxTRIG**	**DIGITAL-IN1 X3/11 IN1MODE**	**DIGITAL-IN2 X3/12 IN2MODE**	**PSTOPX3/ 13 IN3MODE**	**NSTOPX3/ 14 IN3MODE**
19	Macro_IRQ	↗	-		x		
20	Start_Jog v=x	↗	Speed in rpm	x	x	x	x
21	U_Mon.off	↗	-	x			
22	MT_Restart	↗	-	x	x		x
23	Start_No x	↗	Motion task no.	x	x	x	x
24	OPMODE A/B	↗	Opmode no.	x	x		x
25	Zero_latch	↗	-	x	x	x	x
26	Pos latch	↗			x		
27	Emerg. Stop	↘ Low		x	x		x
32	Brake	↗	-	x	x	x	x

Description of the digital inputs

0, Off
No function

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 controls.

2,PSTOP
Limit-switch function. A LOW signal on the input terminal PSTOP (terminal X3/13) inhibits the positive direction of rotation (clockwise, when looking at the motor shaft, at the A-end of the motor: parameter ROTARY DIRECTION positive). The motor brakes (with emergency ramp), and stands with the I-component under control, mechanical disconnection (stop) is not permitted.
A falling edge releases the brake, the 0V level disables the negative setpoint.

3,NSTOP
Limit-switch function. A LOW signal on the input terminal NSTOP (terminal X3/14) inhibits the negative direction of rotation (counterclockwise, when looking at the motor shaft, at the A-end of the motor: parameter ROTARY DIRECTION positive). The motor brakes (with emergency ramp), and stands **without the** I-component under proportional control, mechanical disconnection (stop) is permitted.
A falling edge releases the brake, the 0V level disables the positive setpoint.

4,PSTOP+Intg.Off
Limit-switch function. A LOW signal on the input terminal PSTOP (terminal X3/13) inhibits the positive direction of rotation (clockwise, when looking at the motor shaft, at the A-end of the motor: parameter ROTARY DIRECTION positive). The motor brakes (with emergency ramp), and stands **without the** I-component under proportional control, mechanical disconnection (stop) is permitted.
A falling edge releases the brake, the 0V level disables the negative setpoint.

5,NSTOP+Intg.Off
Limit-switch function. A LOW signal on the input terminal NSTOP (terminal X3/14) inhibits the negative direction of rotation (counterclockwise, when looking at the motor shaft, at the A-end of the motor: parameter ROTARY DIRECTION positive). The motor brakes (with emergency ramp), and stands without the I-component under proportional control, mechanical disconnection (stop) is permitted.
A falling edge releases the brake, the 0V level disables the positive setpoint.

6,PSTOP+NSTOP
Limit-switch function STOP, regardless of the direction of rotation. A LOW-Signal on the input terminal PSTOP (terminal X3/13) or NSTOP (terminal X3/14) inhibits both directions. The motor brakes (with emergency ramp), and stands with the I-component under control, mechanical disconnection (stop) is not permitted.
A falling edge releases the brake, the 0V level switches the internal speed setpoint to 0V.

7,P/Nstop+Intg.Off
Limit-switch function STOP, regardless of the direction of rotation. A LOW-Signal on the input terminal PSTOP (terminal X3/13) or NSTOP (terminal X3/14) inhibits both directions. The motor brakes (with emergency ramp), and stands **without the** I-component under proportional control, mechanical disconnection (stop) is permitted. A falling edge releases the brake, the 0V level switches the internal speed setpoint to 0V.

8,AnIn1 / AnIn2
Switches over the setpoint inputs An In 1/2 . This function is only effective if the analog setpoint function 0,Xcmd=An In 1 has been selected.

High level at the input: Setpoint input 2 (terminals X3/6, 7) is active.
Low level at the input: Setpoint input 1 (terminals X3/4, 5) is active.

9,MT_No_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**
	NSTOP	**PSTOP**	**DIGITAL-IN 2**	**DIGITAL-IN 1**	
7 motion tasks + homing, without reference switch	Start_MT I/O	2^2	2^1	2^0	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	Start_MT I/O	2^1	2^0	0 to 3

Application	Motion task number: MSB ----------->LSB				Selectable motion task numbers
	NSTOP	PSTOP	DIGITAL-IN 2	DIGITAL-IN 1	
3 motion tasks + homing, with reference switch.	2^1	2^0	Reference	Start_MT I/O	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	Start_MT Next	2^0	Start_MT I/O	0 to 1

10,Intg.Off
Switch off the integral component of the speed controller, the P-gain remains at the set value, the actual (rotational) speed feedback remains in operation.

11, v/Torq.Contr
Bypasses the speed controller. The analog setpoint is taken 1. 1. as the setpoint for current control, i.e. change over from speed control to current (torque) control.

High level at the input: torque control.
Low level at the input: speed control.

12,Reference
Reference Point cam (reference switch).

13,ROD/SSI
Changeover of the encoder-emulation (position output) on connector X5.
High level at the input: **SSI**-compatible position signals.
Low level at the input: **ROD**-compatible position signals.

14,FError_clear
Clears the warning of a following error (display no. 03) or the response monitoring (display no. 04).

15,Start_MT Next
The following task, that is defined in the motion task by "Start with I/O" is started. The target position of the present motion task must be reached before the following task can be started.

16,Start_MT No x
Start a motion task that is stored in the servo amplifier, by giving the motion task number. After the function has been selected you can enter the motion task number (auxiliary variable x). Motion task number "0" initiates homing/reference traverse. A rising edge starts the motion task, a falling edge interrupts the motion instruction.

17,Start_MT I/O
Start of the motion task that has the number that is presented, bit-coded, at the digital inputs (PSTOP/NSTOP/DIGITAL-IN1/DIGITAL-IN2, see function 9, MT_No_Bit). A rising edge starts the motion task, a falling edge interrupts the motion instruction.

18, Ipeak2 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 (auxiliary variable x). Make the conversion according to the following equation:

x = (Ipeak2 / Ipeak) * 100% => Ipeak2 = (x / 100%) * Ipeak

19,Macro_IRQ

Executes an interrupt routine.

20,Start_Jog v=x
Start of the setup mode "Jog Mode" with a defined speed. After selecting the function, you can enter the speed in the auxiliary variable "x". The sign of the auxiliary variable defines the direction. A rising edge starts the motion, a falling edge interrupts it.

21,U_Mon. off
Turns off the undervoltage monitoring function of the amplifier.

22,MT_Restart
Continues the motion task that was previously interrupted.

23,Start_No x
Starts a motion task that is stored in the amplifier, with definition of the motion task number. After the function has been selected you can enter the motion task number (auxiliary variable x). 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 of the setup software

24,OPMODE A/B
Changeover of the operating mode (OPMODE). The numbers of the OPMODES that are to be changed over are entered in the auxiliary variable "x" 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.
Example:
Preparation for the changeover between OPMODE 1 (LOW state) and OPMODE 2 (HIGH state) according to the state of the digital input DIGI-INI.
Function DIGI-IN1 = 24
2 Byte Hex value: "0801" => decimal value: "2049"
Auxiliary value "x" = 2049

25,Zero_latch
Sets the ROD "zero latch" zero pulse offset. The current position, depending on the ROD resolution that is set, is calculated at the rising edge and stored as "NI-Offset". This function is used to perform an automatic save of all parameters.

26,Pos latch
No function.

27,Emerg. Stop
The LOW level initiates an emergency-stop phase (motion is cancelled and the drive is stopped, using the EMERGENCY RAMP). Regardless of the OPMODE that is currently set, the speed controller is activated during the emergency-stop phase.

32,Brake
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!

Digital outputs DIGITAL-OUT1/DIGITAL-OUT2

Values

ASCII codes and values:

ASCII: **OxMODE**	Default: 0	valid for all OPMODES
ASCII: **OxTRIG**	Default: 0	valid for all OPMODES

You can combine the following standard pre-programmed functions with the digital outputs DIGITAL-OUT1 (O1MODE, terminal X3/16) or DIGITAL-OUT2 (O2MODE, terminal X3/17). 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	Abs(v_act)< x	High	Speed (rpm)
2	Abs(v_act)> x	High	Speed (rpm)
3	Mains-RTO	Low	-
4	Regen off	High	-
5	Sw_Limit	High	-
6	Pos. > x	High	Position (increments)
7	In Position	High	-
8	Abs(I)< x	High	Current (mA)
9	Abs(I)> x	High	Current (mA)
10	FError	Low	-
11	I^2t	High	-
12	Posreg. 1	High	-
13	Posreg. 2	High	-
14	Posreg. 3	High	-
15	Posreg. 4	High	-
16	Next-InPos	High	-
17	Error/Warn	High	-
18	Error	High	-

ID	Function	Logic	Auxiliary value OxTRIG
19	DC_Link > x	High	
20	DC_Link < x	High	
21	Enable	High	-
22	Zero Pulse	High	-
23	Reserved	-	-
24	Ref_OK	High	-
25-27	Reserved	-	-
28	Posreg. 0	High	-
29	Posreg. 5	High	-

Description of the digital outputs

0:Off
No function assigned.

1,Abs(v_act)< x
As long as the absolute value for the motor speed is lower than a preset value (auxiliary value "x"), a HIGH-signal will be output. After the function has been selected you can enter the speed in rev./min. as the auxiliary value x.

2,Abs(v_act)> x
As long as the absolute value for the motor speed is higher than a preset value (auxiliary value x), a HIGH-signal will be output. After the function has been selected you can enter the speed in rev./min. as the auxiliary value x.

3,Mains-RTO
This signals the operational readiness of the amplifiers power output stage. After switching on the mains supply, a LOW-signal is output until the DC-link circuit is fully charged up. A HIGH-signal is output when the charging of the DC-link circuit is finished. If the DC-link voltage falls below 100V, then 0V will be output. The "Undervoltage" monitoring is inactive.

4,Regen off
Signals if the preset Regen power (screen page "Basic Setup") is exceeded.

5,Sw_limit
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").

6,Pos. > x

If the position (angular position of the motor shaft) exceeds a preset value (auxiliary value "x") a HIGH-signal will be output. 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 "x". Make the calculation according to the following equation:

x = 1048576 *N*counts

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

7,In Position

When the target position for a motion task has been reached (the **InPosition** window), this is signaled by the output of a HIGH-signal. 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. This corresponds to the target position of the last motion task. The function 16, Next_InPos signals that the target position of each motion task has been reached in a sequence of motion tasks.

8,Abs(I)< x

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

9,Abs(I)> x

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

10,FError

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

11,I^2t

If the preset I^2t monitoring threshold is reached ("Current" screen page) this is indicated by a HIGH-signal.

12...15,Posreg.1...4

The preset function of the corresponding position register (the function is defined in the "Position Data" screen page) is indicated by a HIGH-signal

16,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 motion task sequence.

17,Error/Warn
The output produces a HIGH-signal if an error or a warning message is signaled by the servo amplifier.

18,Error
The output produces a HIGH-signal if an error message is signaled by the servo amplifier.

19,DC-Link> x
A HIGH-signal is output if the actual value of the DC-link voltage is higher than a defined value in volts (auxiliary value "x"). After the function has been selected, you can enter a voltage value as the auxiliary value x.

20,DC-Link< x
A HIGH-signal is output if the actual value of the DC-link voltage is lower than a defined value in volts (auxiliary value "x"). After the function has been selected, you can enter a voltage value as the auxiliary value x.

21,Enable
A HIGH-signal is output if the servo amplifier is enabled. To obtain the enable, the external Enable signal on terminal X3/15 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.

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

24,Ref_OK
The output signals High, if a reference point is available. Reference traverse (homing) has been carried out, or a reference point has been set.

28,Posreg. 0
The preset function of the corresponding position register is indicated by a HIGH-signal. Valid only with expansion card -I/0-14/08-.

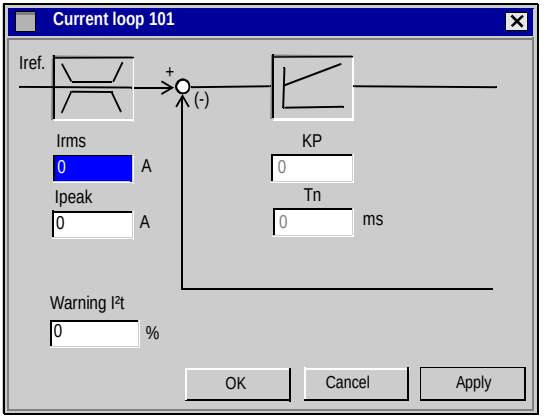
29,Posreg. 5
The preset function of the corresponding position register is indicated by a HIGH-signal. Valid only with expansion card -I/0-14/08-.

2.10 Screen page "Current"

Overview of the "Current" screen

At a Glance

Diagram:



Use the default values for the motor. Please do not make any alterations to the settings for the current controller unless they have been discussed with our Applications department.

Cycle time of the current controller: 62.5 µs

Irms

ASCII: **ICONT**	Default: 50 % of rated current	valid for all OPMODES

Sets the rated output current that is required. The adjustment is usually made to I_0, the standstill current for the motor that is connected. The value that can be entered is limited to the rated current of the amplifier or the standstill current of the motor Io (the lower of the two values). The function is used in the monitoring of the actual r.m.s. current that is drawn The limit that is set by the Irms-setting reacts after approx. T_{I2t} = 5 secs at maximum load. The calculations for current settings other than the rated values are made according to the equation:

$T_{I2T} = (I^2ms*15s) / (I^2peak - I^2rms)$

Ipeak

ASCII: **IPEAK**	Default: 50 % of peak current	valid for all OPMODES

Sets the required pulse current (r.m.s. value). The value that can be entered is limited to the rated peak current of the motor or amplifier (the lower of the two values).

I^2t warning

ASCII: **I2TLIM**	Default: 80 %	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 one of the programmable outputs DIGITAL-OUT1/2 (X3/16 or X3/17). A warning appears in the display.

KP

ASCII: **MLGQ**	Default: 1	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.

Tn

ASCII: **KTN**	Default: 0.6 ms	valid for all OPMODES

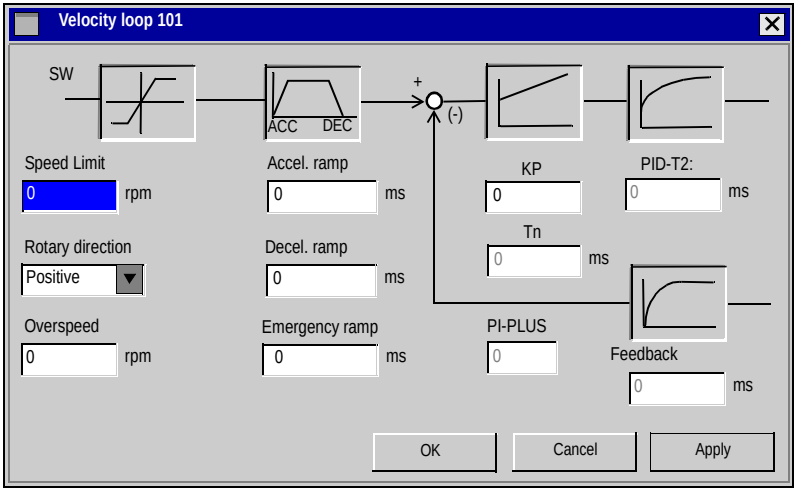
Determines the integral-action time (integration time constant) of the current controller.

2.11 Screen page "Speed"

Introduction to the "Speed" screen

At a Glance

Diagram:



Use the default values for the motor as a starting point for optimization.
Cycle time of the speed controller: 250 µs

SpeedLimit

ASCII: **VLIM**	Default: 3000 rpm	valid for OPMODES 0+1

Limits the motor speed. The maximum value also depends on the motor and encoder used.

Rotary direction

ASCII: **DIR**	Default: 1	valid for OPMODES

Fixes the direction of rotation of the motor shaft, referred to the polarity of the setpoint. Make changes only while the amplifier is disabled + reset. This parameter is not available, if a SERCOS interface is built-in.

After changing the rotary direction the hardware limit switches have to be exchanged.
Standard setting: right-hand (cw) rotation of the motor shaft (looking at the shaft end), with:

- positive voltage on terminal X3/4 (+) against terminal X3/5 (-) or,
- positive voltage on terminal X3/6 (+) against terminal X3/7 (-) or,

ID	Function
1	positive
2	negative

Setp. Ramp+

ASCII: **ACC**	Default: 10 ms	valid for OPMODES 0+1

Acceleration time to the speed limit (valid for both directions). The longer this time, 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.

Setp. Ramp-

ASCII: **DEC**	Default: 10 ms	valid for OPMODES 0+1

Braking time to the zero speed (valid for both directions). The longer this time, the smoother and more favorable the acceleration.
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 Setp. ramp+ and the Setp. ramp- can be set to the same value.
The ramp time settings are still effective if the limit-switches are activated.

Overspeed

ASCII: **VOSPD**	Default: 3600 rpm	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).

Emergency ramp

ASCII: **DECSTOP**	Default: 10 ms	valid for OPMODES

The braking ramp for emergency braking. This braking ramp is used if the message n03, following error or n04, response monitoring occurs. It is also used on the activation of a hardware or software limit-switch.

KP

ASCII: **GV**	Default: 1	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. Typical values for this setting are between 10 and 20.
Rule: at KP = 1 and a control deviation of **v_cmd -v_act =3000 rpm**, the instrument delivers the peak current.

Tn

ASCII: **GVTN**	Default: 10 ms	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.

PID-T2:

ASCII: **GVT2**	Default: 1 ms	valid for OPMODES

Affects the proportional gain (P-gain) at medium frequencies. It is often possible to improve the **damping** of the speed control loop by increasing PID-T2 to about Tn/3. The setting is made, if required, after the basic setting of KP and Tn.r.

Feedback

ASCII: **GVFBT**	Default: 0.4 ms	valid for OPMODES

If necessary, the time constant for the PT1-filter in the actual speed feedback (tachometer smoothing) can be altered. This may improve the step response and smoothness of running, particularly for very small, highly dynamic motors.

PI-PLUS

ASCII: **GVFR**	Default: 1	valid for OPMODES 0+1

This parameter only effects when the I-component is switched on (GVTN≠0).

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.

2.12 Screen page "Position"

Screen page "Position"

At a Glance

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

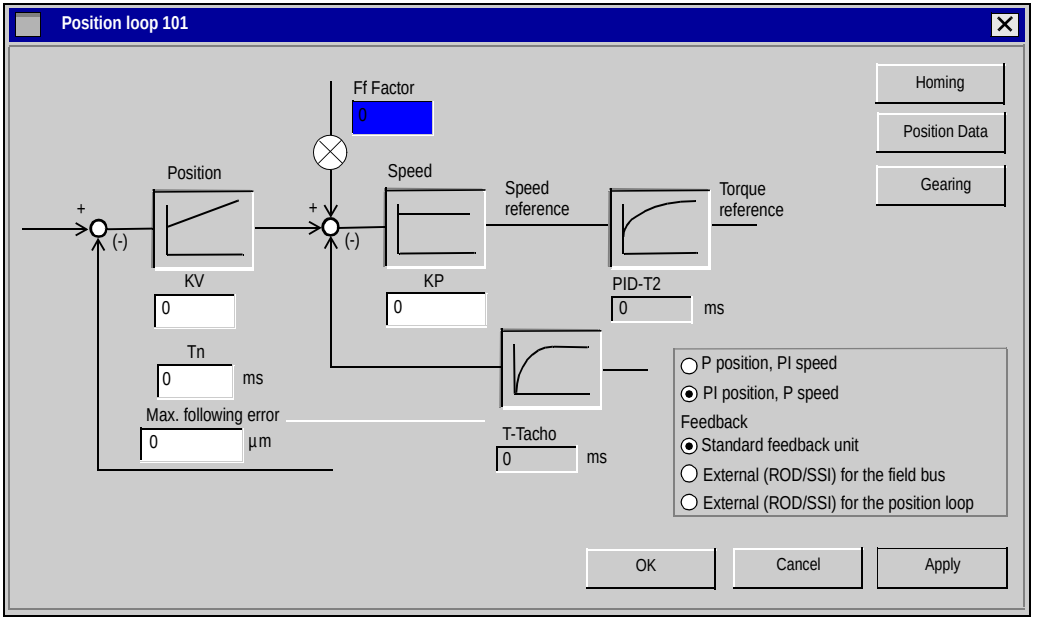
What's in this section?

This section contains the following topics:

Overview of the "Position" screen (PI)

At a Glance

Diagram:



Cycle time of the position controller: 250µs

Subscreens:

Position Data	Opens the "Position data" screen page
Homing	Opens the "Homing" screen page
Gearing	Opens the "Gearing" screen page

Ff Factor

ASCII: **GPFFV**	Default: 1	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.

KV

ASCII: **GP**	Default: 0,15	valid for OPMODES 4,5,8

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

Tn

ASCII: **GPTN**	Default: 10 ms	valid for OPMODES 4,5,8

Determines the integral-action time (integration time constant) for the position controller. Tn = 0 ms disconnects the Integral-action component.

max. Following Error

ASCII: **PEMAX**	Default: 262144	valid for OPMODES 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 an error message and brakes the drive, using the emergency ramp.

KP

ASCII: **GPV**	Default: 7	valid for OPMODES 4,5,8

Determines the proportional gain for the speed section of the controller. Increase the value up to the level where the motor starts to oscillate, and then back it off until the oscillations have clearly stopped. Typical values are the same as for the KP of the speed controller. Rule: as for the KP of the speed controller.

PID-T2: Displays the value from the "Speed" screen page.

Feedback Displays the value from the "Speed" screen page.

Mode / Position Response

ASCII: **EXTPOS**	Default: 0	valid for all OPMODES

Mode:
determines the type of position control loop (P/PI). With a P type position controller, this screen looks different.

Position response:
determines the feedback source for the position loop. For most applications, the commutation and position control data comes from the same source. This source is determined by the "Feedback" screen, and may be either a resolver or an Endat/ Hiperface encoder. In some cases, it is best to retrieve position data for commutation from another source. For such cases, the "Feedback type" parameter continues to be the source for the commutation, and the source for the position controller is determined by the "gearing" mode.

Standard Feedback
- the feedback type is defined by the "**Feedback**" parameter,
- it is not possible to read an encoder via X1 or X5.

External reading (ROD/SSI) for the field bus:
- the feedback type is defined by the "**Feedback**" parameter, the external encoder is defined by the "**Gearing**" mode.

External reading (ROD/SSI) for the position loop:
- impossible in this mode

Overview of the "Position" screen (P)

At a Glance

Cycle time of the position controller: 250 µs
Subscreens:

Position Data	Opens the "Position data" screen page
Homing	Opens the "Homing" screen page
Gearing	Opens the "Gearing" screen page

Ff Factor

ASCII: **GPFFV**	Default: 1	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.

KV

ASCII: **GP**	Default: 0,15	valid for OPMODES 4,5,8

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

max. Following Error

ASCII: **PEMAX**	Default: 262144	valid for OPMODES 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 an error message and brakes the drive, using the emergency ramp.

Mode / Position Response

ASCII: **EXTPOS**	Default: 0	valid for all OPMODES

Mode:
determines the type of position control loop (P/PI). With a P type position controller, this screen looks different.

Position response:
determines the feedback source for the position loop. For most applications, the commutation and position control data comes from the same source. This source is determined by the "Feedback" screen, and may be either a resolver or an Endat/ Hiperface encoder. In some cases, it is best to retrieve position data for commutation from another source. For such cases, the "Feedback type" parameter continues to be the source for the commutation, and the source for the position controller is determined by the "gearing" mode.

Standard Feedback
- the feedback type is defined by the "**Feedback**" parameter,
- it is not possible to read an encoder via X1 or X5.

External reading (ROD/SSI) for the field bus:
- the feedback type is defined by the "**Feedback**" parameter, the external encoder is defined by the "**Gearing**" mode.

External reading (ROD/SSI) for the position loop:
- the response type is determined by an external source via the "**electric gear**" parameter.

2.13 Screen page "Homing"

General overview of the "Homing" screen

At a Glance

Overview of the different field values included in the "Homing" screen.

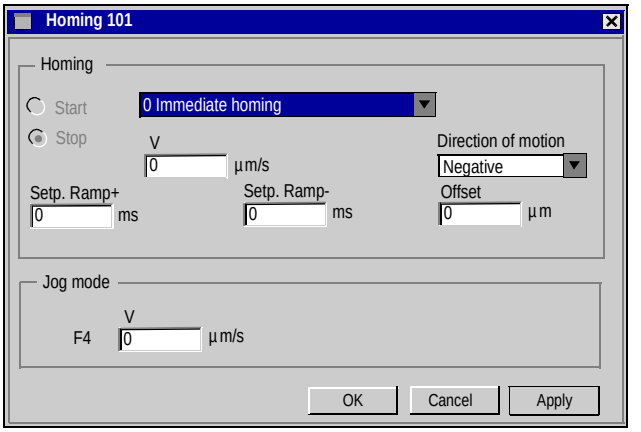
What's in this section?

This section contains the following topics:

Overview of the "Homing" screen

At a Glance

Diagram:



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 observe this precaution can result in injury or equipment damage.

Start

ASCII: **MH**	Default: -	valid for OPMODE 8

Radio button 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 observe this precaution can result in injury or equipment damage.

Stop

ASCII: **STOP**	Default: -	valid for all OPMODES

Radio button to start (cancel) the homing. **The SW-enable remains set!**

Homing

ASCII: **NREF**	Default: 0	valid for OPMODE 8

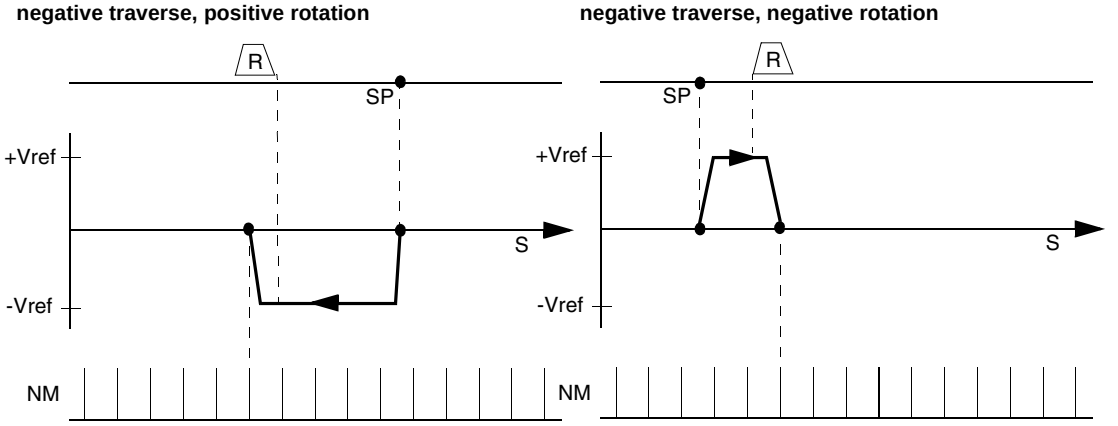
You can choose which type of reference traverse should be performed. A preset zero-point offset (screen page "Encoder" is taken into account for the position output and display.
Exception: homing 5, in this case the true current position is displayed.

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.

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.

In this case, a reference traverse can also be made without hardware limit-switches. The precondition is one of the initial situations shown below:



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=7), converted according to the scaling factors GEARI and GEARO, as well as the reference offset, then used as the target position.

On the following pages you can find the paths traversed during homing types 1 to 5 for every possible initial situation (positive rotation, negative and positive directions of motion).

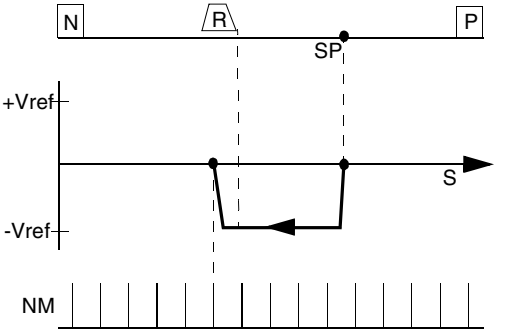
The meanings of the abbreviations in the drawings are:

N	limit-switch NSTOP	**P**	limit-switch PSTOP	**SP**	start position
R	reference switch	**vref**	preset velocity	**NM**	zero mark of the resolver

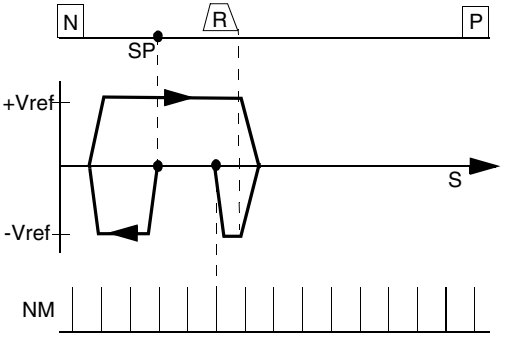
Homing 1

Diagrams

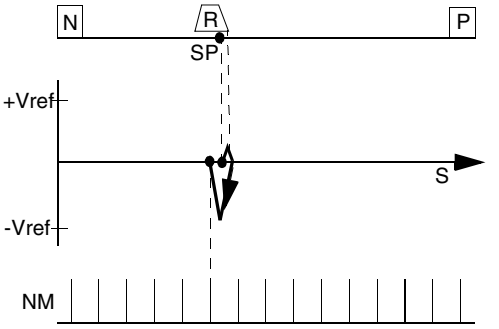
Homing with reference switch, negative direction of motion, positive rotation, with zero-mark.



Initial point in positive direction from reference switch



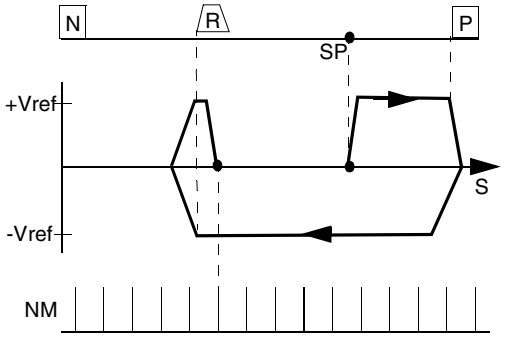
Initial point in negative direction from reference switch



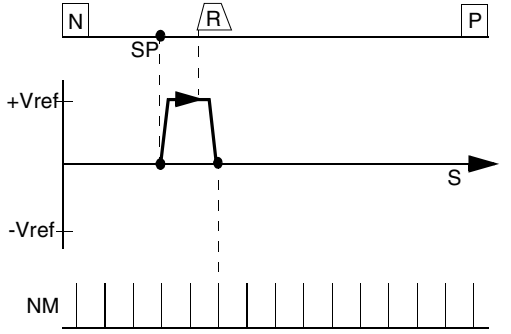
Initial point at reference switch

Note: 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 to achieve the full homing functionality.

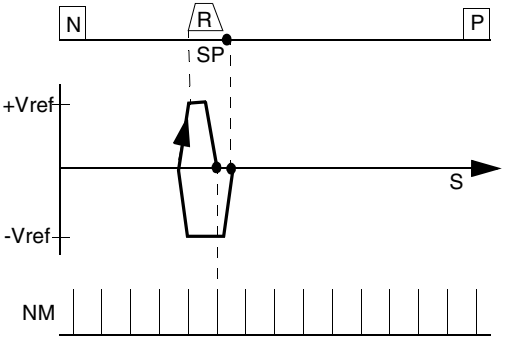
Homing with reference switch, positive direction of motion, positive rotation, with zero-mark.



Initial point in positive direction from reference switch



Initial point in negative direction from reference switch



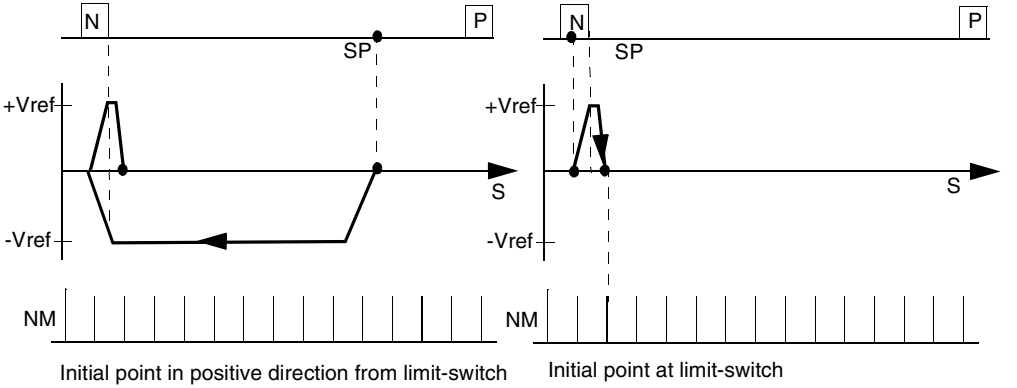
Initial point at reference switch

Note: 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 to achieve the full homing functionality.

Homing 2

Diagrams

Homing with reference switch, **negative direction** of motion, positive rotation, with zero-mark.

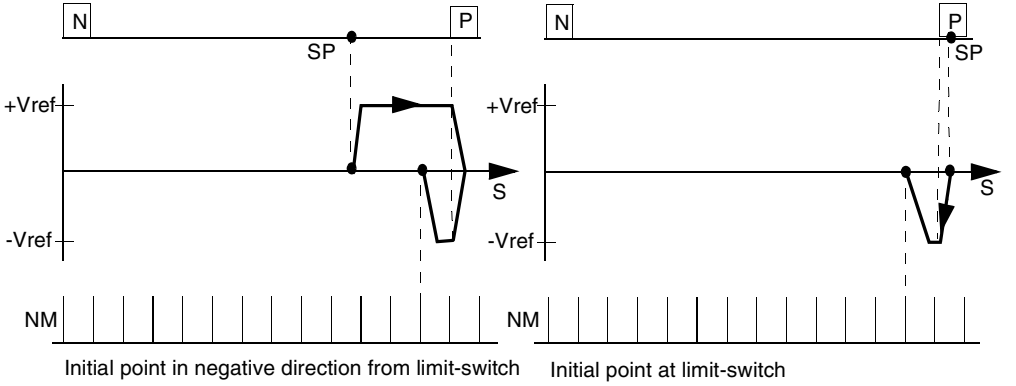


Initial point in positive direction from limit-switch

Initial point at limit-switch

Note: hardware limit-switches must be present and connected. The 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.



Initial point in negative direction from limit-switch

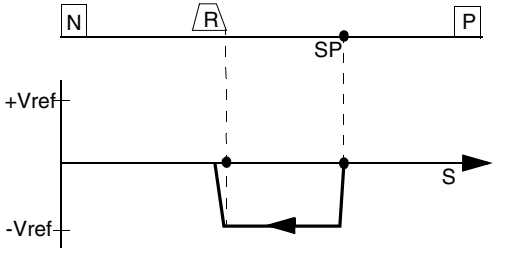
Initial point at limit-switch

Note: hardware limit-switches must be present and connected. The limit-switch functions 2, PSTOP and 3, NSTOP must be switched on.

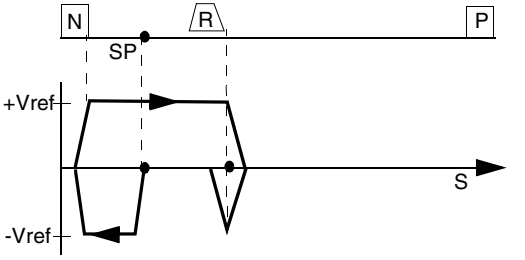
Homing 3

Diagrams

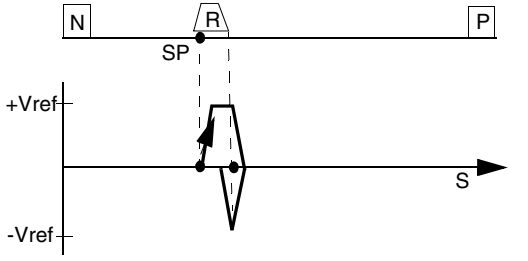
Homing with reference switch, **negative direction** of motion, positive rotation, without zero-mark.



Initial point in positive direction from reference switch



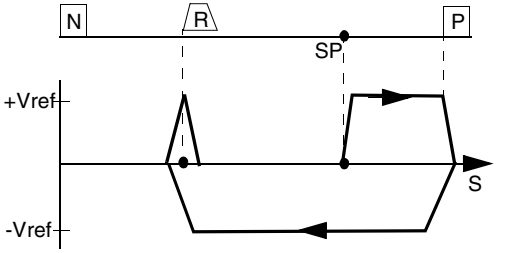
Initial point in negative direction from reference switch



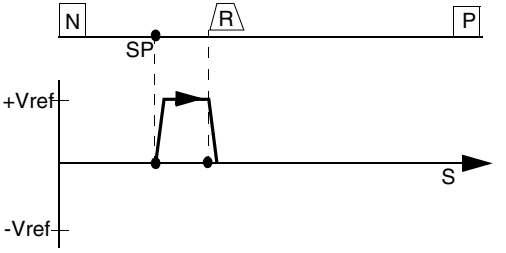
Initial point at reference switch

Note: 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 to achieve the full homing functionality.

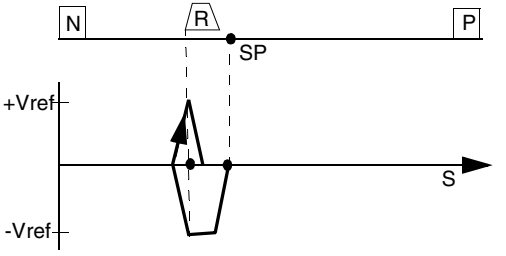
Homing with reference switch, **positive direction** of motion, positive rotation, without zero mark.



Initial point in positive direction from reference switch



Initial point in negative direction from reference switch



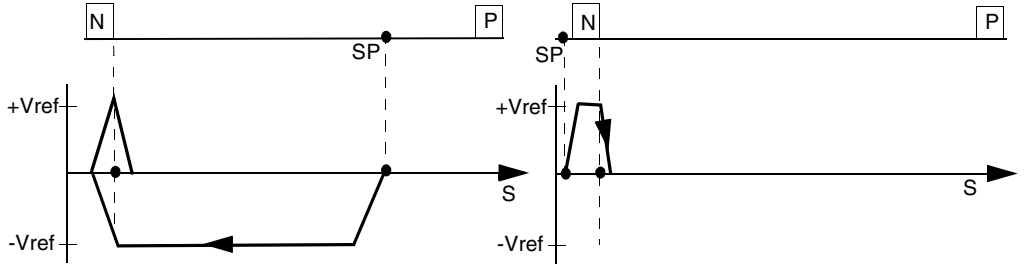
Initial point at reference switch

Note: 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 to achieve the full homing functionality.

Homing 4

Diagrams

Homing without reference switch, **negative direction** of motion, positive rotation, without zero mark.

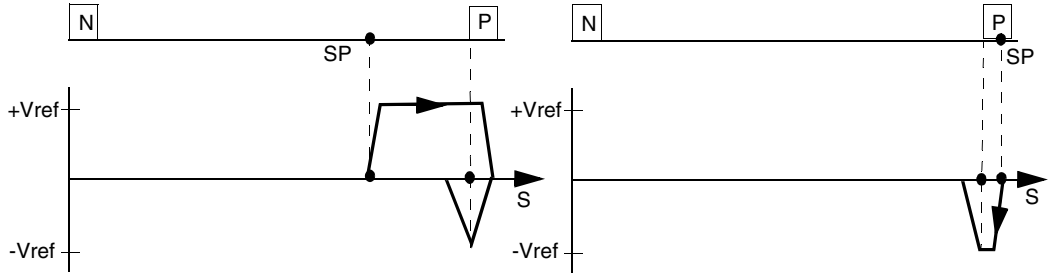


Initial point in positive direction from limit-switch

Initial point at limit-switch

Note: hardware limit-switches must be present and connected. The limit-switch functions 2, PSTOP and 3, NSTOP must be switched on.

Homing with reference switch, **positive direction** of motion, positive rotation, without zero mark.



Initial point in negative direction from limit-switch

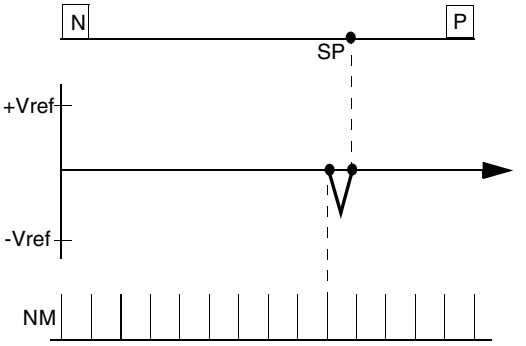
Initial point at limit-switch

Note: hardware limit-switches must be present and connected. The limit-switch functions 2, PSTOP and 3, NSTOP must be switched on.

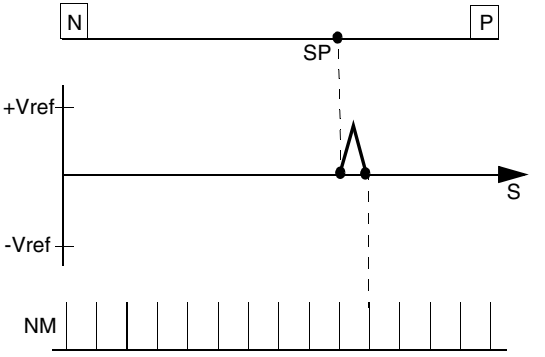
Homing 5

Diagram

Homing without reference switch, **negative direction** of motion, positive rotation, with zero mark.



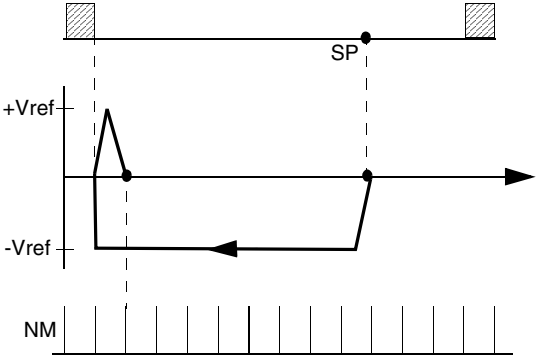
Homing with reference switch, **positive direction** of motion, positive rotation, with zero mark.



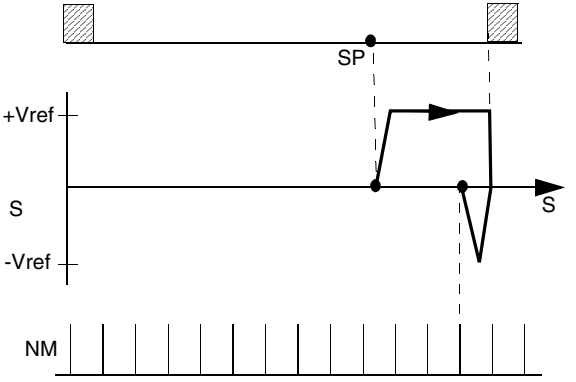
Note: behavior for successively repeated starts of Homing 5: the position controller can only hold the motor in the zero position by passing the zero mark by 1 count. On a repeated start of Homing 5, depending on the position (1 count in advance of or 1 count behind the zero-mark) and the count direction, the movement may be a full motor turn !

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.



Note: 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.

Direction of motion

ASCII: **DREF**	Default: 0	valid for OPMODE 8

Determines the direction of motion for homing. The setting "distance-dependent" is only relevant for Homing 5 (with one turn). In this case, the direction is chosen to give the shortest distance to the zero-mark.

ID	Function
0	Negative direction
1	Positive direction
2	Zoned distance

v (for homing)

ASCII: **VREF**	Default: 0	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: 10 ms	valid for OPMODE 8

Acceleration ramp for the homing operation. The size is defined by **ACCUNIT**. Entry in milliseconds (1 ... 32767 ms). The ramp is also valid for constant velocity mode.

Decel. ramp

ASCII: **DECR**	Default: 10 ms	valid for OPMODE 8

The deceleration (braking) ramp for homing. The size is defined by **ACCUNIT**. Entry in milliseconds (1 ... 32767 ms). The ramp is also valid for constant velocity mode. 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	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 size is defined by **PUNIT**. An alteration of the offset only takes effect after a new homing operation. The reference offset is entered in m. The parameter "Resolution" must be set correctly for your application.

Jog mode

At a Glance

Jog mode is defined as an endless motion at a constant velocity. 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: 0	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 size is defined by **VUNIT**.

F4

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

Start the jog mode by pressing the function key F4. The drive moves with the preset velocity in the direction which is indicated by the sign of the velocity for the jog mode "v", as long as the function key is pressed. If a communication error occurs while pressing the button, the drive stops with the emergency deceleration ramp.

CAUTION

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.

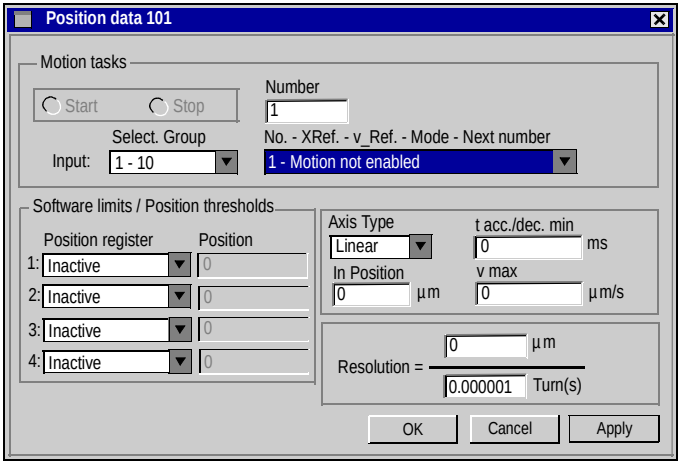
Failure to observe this precaution can result in injury or equipment damage.

2.14 Screen page "Position data"

Overview of the "Position data" screen

At a Glance

Diagram:



For each one of the positioning tasks you must define motion tasks. These motion tasks can be selected by a motion task number, and are stored in the servo amplifier.

Motion task	Stored in	Precondition for storing	Comments
0	RAM	None	Temporary buffer store for copying operations.
1...180	EEPROM	Power stage deactivated	Permanently stored
192...255	RAM	None	Volatile storage

When the servo amplifier is switched on, the RAM motion blocks 192. . .255 are automatically pre-loaded with the parameters of the motion blocks 1. . . 64.
Click on the motion task number in the scroll list to select the motion task. When a motion task has been selected, the "Motion Task Parameters" screen is displayed.

You can edit the values in the scroll list directly.

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 X3/15 has a High signal).

CAUTION

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 OPMODES 1 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 observe this precaution 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!

Axis Type

ASCII: **POSCNFG**	Default: 0	valid for OPMODE 8

Here you select whether the axis is to be operated as a linear or a rotary 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	Rotary	A rotary axis is an axis with **unlimited** travel. The software limit-switches have no significance in this case. **A rotary 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.

v max

ASCII: **PVMAX**	Default: 100	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_setp" 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_setp of the motion tasks.

t_acc/dec_min

ASCII: **PTMIN**	Default: 1 ms	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 "t_accel_tot" (acceleration time from 0 to v_setp) and "t_brake_tot" (braking time from v_setp 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 in the drive selected.

In Position

ASCII: **PEINPOS**	Default: 4000	valid for OPMODES 4,5,8

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

Position register

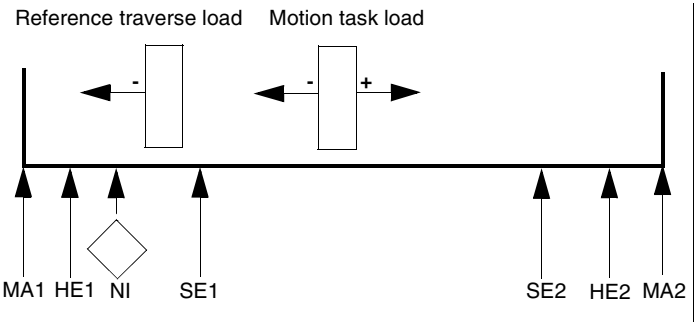
A programmable register that can have various functions assigned to it. Make changes only while the amplifier is disabled + reset.

		Position register			
Function	Comments	1 (SWE1)	2 (SWE2)	3 (SWE3)	4 (SWE4)
inactive	-	x	x	x	x
x<Position	Threshold for signal	x	x	x	x
x>Position	Threshold for signal	x	x	x	x
SW limit-switch 1	Limit switch function	x	-	-	-
SW limit-switch 2	Limit switch function	-	x	-	-

SW limit-switches 1 / 2:
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)
SE1: Software limit switch 1
SE2: Software limit switch 2
HE2: Hardware limit switch, right
MA2: Machine stop, right
+: Positive count direction
-: Negative count direction

ASCII: **SWCNFG** (enabled)	Default: 0	valid for all OPMODES
ASCII: **SWEx** (position)	Default: 0	valid for all OPMODES

Configuration variables for the position register. SWCNFG is a binary-coded bit-variable. It is transferred to the ASCII terminal programs as a decimal number.

Bit-variable SWCNFG					
Bit	**Value**	**Description**	**Bit**	**Value**	**Description**
2^0	0	Monitoring of SWE1 inactive	2^8	0	Monitoring of SWE3 inactive
	1	Monitoring of SWE1 active		1	Monitoring of SWE3 active
2^1	0	Signal for actual position > SWE1	2^9	0	Signal for actual position > SWE3
	1	Signal for actual position < SWE1		1	Signal for actual position < SWE3
2^2	0	SWE1 functions as signal threshold	2^{10}	0	Reserved
	1	SWE1 functions as SW limit-switch		1	
2^3	0	Reserved	2^{11}	0	Reserved
	1			1	
2^4	0	Monitoring of SWE2 inactive	2^{12}	0	Monitoring of SWE4 inactive
	1	Monitoring of SWE2 active		1	Monitoring of SWE4 active
2^5	0	Signal for actual position > SWE2	2^{13}	0	Signal for actual position > SWE4
	1	Signal for actual position < SWE2		1	Signal for actual position < SWE4
2^6	0	SWE2 functions as signal threshold	2^{14}	0	Reserved
	1	SWE2 functions as SW limit-switch		1	

Bit-variable SWCNFG					
Bit	**Value**	**Description**	**Bit**	**Value**	**Description**
2^7	0	Reserved	2^{15}	0	Reserved
	1			1	

Resolution

ASCII: **PGEARI**(numerator)	Default: 10000	valid for OPMODE 8
ASCII: **PGEARO**(denominator)	Default: 1	valid for OPMODE 8

The resolution can be defined at will through the entries for the numerator/ denominator. Make changes only while the amplifier is disabled + reset.
Examples:

-
  - An entry of 10000/1 produces a resolution of 10 mm/turn,
  - An entry of 10000/3 produces a resolution of 3.333 mm/turn,
- If the unit is in degrees:
  - Rotary table with geared motor, i = 31 (31 motor turns for one turn of the table),
  - The entry 360/31 provides operation with position entries in degrees, without rounding off.

The maximum range of movement is limited to +/- 2047 motor turns. If a larger range (+/- 32767) is required, please consult our applications department.

2.15 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.

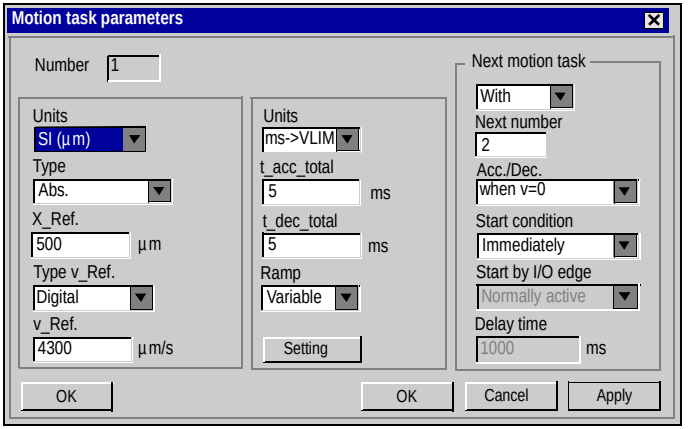
What's in this section?

This section contains the following topics:

Overview of the "Motion task parameters" screen

At a Glance

Diagram:



You can use the ASCII-terminal to completely define motion blocks, with the "ORDER" command. You can obtain further information about this command from our applications department.

Number

Displays the currently active motion task number.

Units (general)

Select the unit for path and speed entries.

Selection	Path	Velocity
Counts	x = 1048576 * N * Incr. with N = no. of motor turns, Nmax=+/- 2047	x = 140/32 * n * min * Incr. with n = rotational speed of the motor shaft
SI	µ m (position unit)	µ m (velocity unit)

Type

This selection determines whether the motion task is interpreted as a relative or an absolute task.

ABS	movement to an absolute target position, referred 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. Contact our Technical Help department.
	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.

s_cmd

This parameter determines the distance to be traveled.

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 An In 1	Analog setpoint provision at input An In 1 (terminals X3/4-5, scaling is used. This value read in at the start of the motion task.

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 smaller value.

Acceleration / Deceleration

Units (acceleration)

Select the unit for acceleration and ramp entries (m/s^2 in preparation).

ASCII: ACCUNIT	Default: 0	Valid for all OPMODES

t_acc_total

This parameter determines the acceleration time to v_cmd.

t_dec_total

This parameter determines the deceleration (braking) time from v_cmd to zero.

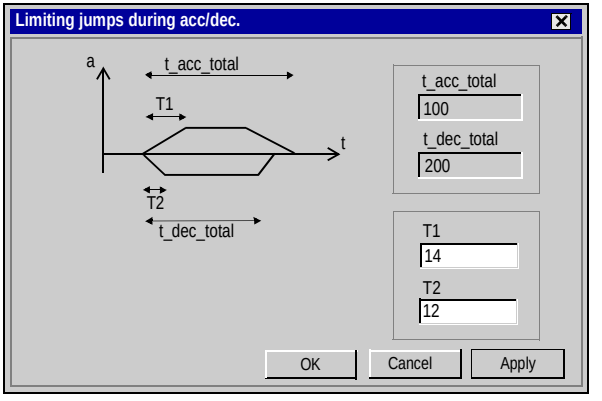
Ramp

Determines which type of acceleration/braking ramp should be used to carry out a motion task.

Trapeze	The drive is given a constant linear acceleration/deceleration to the target speed.
Sine^2	To limit any jolting, the drive is accelerated/decelerated within the acceleration time along an acceleration ramp without any discontinuities. The resulting speed characteristic corresponds to a sine^2 curve.
Variable	The acceleration/braking ramps can be adjusted (in preparation).

Setting

The setting for the rate-of-change limiting of the acceleration/braking ramps:



t_acc_total	Display of the total acceleration time.
t_dec_total	Display of the total deceleration (braking) time.

T1	Rate-of-change limiting the acceleration ramp, maximum is half the acceleration time.
T2	Rate-of-change limiting the deceleration ramp, maximum is half the deceleration time.

Next motion task

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.

Accel./decel.

Select the action to be taken when the target position for the present motion task is reached.

on v_act=0	The drive brakes to a stop in the target position. The next motion task is then started.
from target	The drive moves at v_cmd of the present motion task to the target position, and then accelerates through to v_cmd of the next task.
to target	The changeover to the next task is brought so far forwards, that the v_cmd of the next task is already achieved by the time the target of the present motion task has been reached.

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 terminals X3/11. . . 14). This is only meaningful with "Accel. /Decel to v=0". 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 "Accel. /Decel to v=0".

I/O or Time	The next task is started by a signal at a digital input (one of the terminals X3/11. . . 14) or after a defined delay. This is only meaningful with "Accel. /Decel to v=0". 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 that has the function "15, Start_MT Next" assigned to it.
LOW-level: 0...07 V
HIGH-level: 12 ... 30 V / 7 mA

Delay time

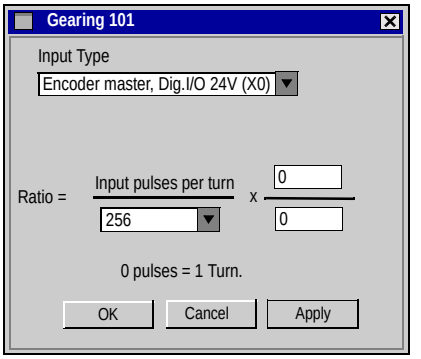
The entry (in ms) for the delay time between reaching the target position and starting the next task.

2.16 Screen page "Gearing"

Overview of the "Gearing" screen

At a Glance

Diagram:



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: 250 micro-seconds. A value averaged over 1000 s is used.

Input Type

ASCII: **GEARMODE**	Default: 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	Encoder , Dig.I/O 24V (X3)	With an incremental encoder (track A/B, 24V signal level) connected to the analog inputs INPUT ANA. 1/2, connector X3/11, 12. An additional function assignment for the inputs is not necessary. Any assignments on the screen page "Digital I/O" will be ignored.
1	Pulse / direction Dig.I/O 24V (X3)	With a stepper motor control (pulse/direction, 24V signal level) connected to the digital inputs DIGITAL-IN 1/2, terminals X3/11,12). An additional function assignment for the inputs is not necessary. Any assignments on the screen page "Digital I/O" will be ignored.
2	Reserved	-
3	5V (X5)	Set encoder emulation to "INPUT". With an incremental encoder (track A/B, 5V signal level) connected to connector X5. In this case, the incremental position signal from another amplifier can be used as the master signal.
4	Pulse / direction, 5V (X5)	Set encoder emulation to "INPUT". With a stepper motor control (pulse/direction, 5V signal level) connected to connector X5.
5	Reserved	Reserved
6	Sin/Cos Encoder (X1)	With a sine/cosine encoder connected to connector X1.

Ratio

ASCII: **ENCIN**(x)	Default: 4096	valid for OPMODE 4
ASCII: **GEARO**(y)	Default: 8192	valid for OPMODE 4
ASCII: **GEARI**(z)	Default: 8192	valid for OPMODE 4

You can use the entry fields in this equation to determine the transmission ratio:

$$\text{Ratio} = \frac{\text{Input pulses per turn}}{x} * \frac{y}{z}$$ (electr. gearing, correction factor through An In 2).

where: x = Normalization for the input pulses (256 ... actual no. of pulses)
y/z = ratio with y = -32768 ...+32767 and z = 1 ...32767

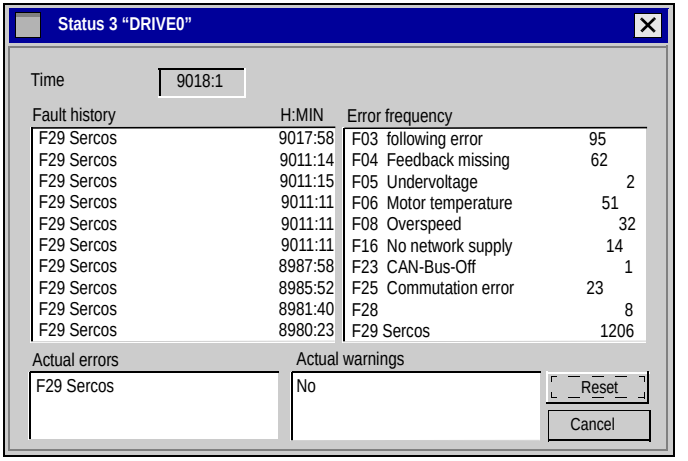
If you have any queries, please contact our applications department.

2.17 Screen page "Drive status"

Introduction to the "Drive status" screen

At a Glance

Diagram:



Run time

ASCII: **TRUN**	Default: -	valid for all OPMODES

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

Last 10 faults

ASCII: **FLTHIST**	Default: -	valid for all OPMODES

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

Rate of occurrence

ASCII: **FLTCNT**	Default: -	valid for all OPMODES

Display of the frequency of all faults that caused the servo amplifier to switch off.

Actual errors

ASCII: **ERRCODE**	Default: -	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).

Actual warnings

ASCII: **STATCODE**	Default: -	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).

Reset

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

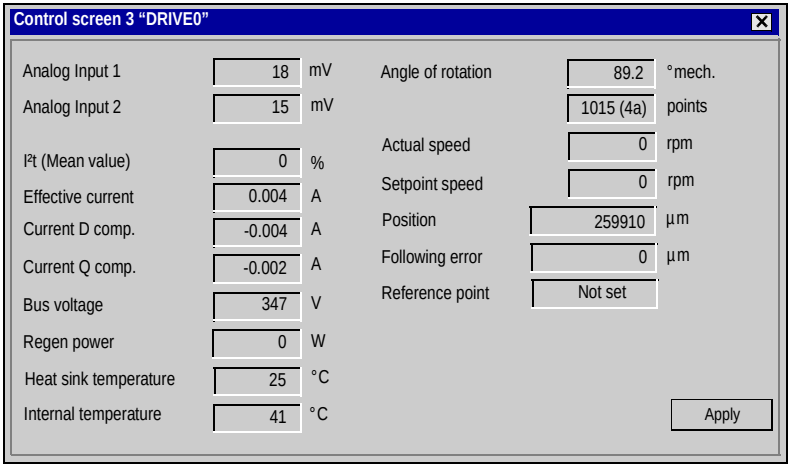
Software-reset of the servo amplifier. **The servo amplifier must be disabled.**
Present errors are deleted, the firmware is re-initialized, and communication is re-established.
If only errors marked with an asterisk in the error listing are present, then the errors are cancelled, but no reset of the amplifier takes place.

2.18 Screen page "Actual values"

Overview of the "Actual values" screen

At a Glance

Diagram:



Analog In 1/2

ASCII: **ANIN1**	Default: -	valid for all OPMODES
ASCII: **ANIN2**	Default: -	valid for all OPMODES

Displays the actual voltages (in mV) at the setpoint inputs.

I^2t (mean value)

ASCII: **I2T**	Default: -	valid for all OPMODES

The actual effective load is shown as % of the preset effective current Irms.

Effective current

ASCII: **I**	Default: -	valid for all OPMODES

This shows the value (in A) of the actual current indication (r.m.s. value, always positive).

Current (D-component)

ASCII: **ID**	Default: -	valid for all OPMODES

Shows the value (in A) of the current D-component (Id, reactive current).

Current (Q-component)

ASCII: **IQ**	Default: -	valid for all OPMODES

Shows the value (in A) of the current Q-component (Iq, active current). The sign that is displayed is negative in regenerative operation (motor under braking).

Bus voltage

ASCII: **VBUS**	Default: -	valid for all OPMODES

The DC-link (DC-bus) voltage produced by the amplifier is shown in V.

Regen power

ASCII: **PBAL**	Default: -	valid for all OPMODES

The mean value (calculated during 30s) of the regenerative power is shown in W.

Heat sink temperature

ASCII: **TEMPH**	Default: -	valid for all OPMODES

The temperature of the heat sink in the servo amplifier is shown in °C.

Internal temperature

ASCII: **TEMPE**	Default: -	valid for all OPMODES

The temperature inside the servo amplifier is shown in °C.

Angle of rotation

ASCII: **PRD**	Default: -	valid for all OPMODES

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

Actual speed

ASCII: **V**	Default: -	valid for all OPMODES

Displays the actual rotational speed of the motor in rpm.

Setpoint speed

ASCII: **VCMD**	Default: -	valid for all OPMODES

Displays the currently set speed in rpm.

Position

ASCII: **PFB**	Default: -	valid for all OPMODES

Shows the momentary position in user units (µm).

Following error

ASCII: **PE**	Default: -	valid for all OPMODES

Shows the momentary following error in user units (µm).

Reference point

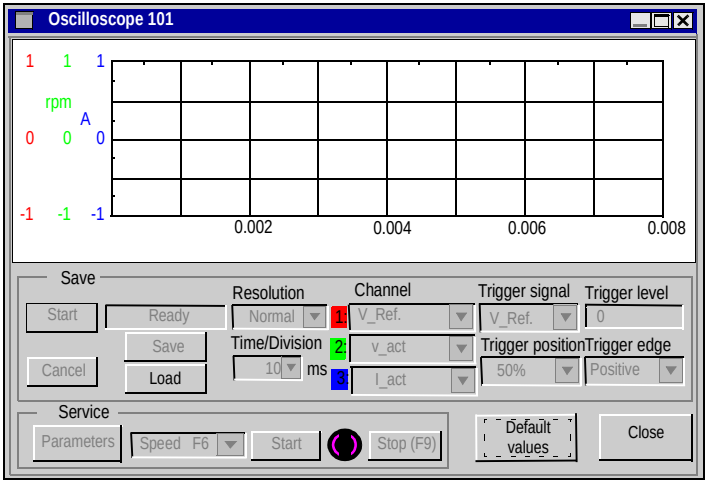
Shows whether a reference point is set, or not.

2.19 Screen page "Oscilloscope"

Overview of the "Oscilloscope" screen

At a Glance

Diagram:



Cycle time for the measurement acquisition ≥ 250µs.
Various value are graphically displayed in a diagram. You can display up to three variables simultaneously, as a function of time.

Start — Start saving the data.

Cancel — Stop saving the data.

Save — Saves the recorded measurements to a data medium in CSV format (to be evaluated with MS-Excel).

Load — Loads a CSV data file and displays the curves on the oscilloscope diagram.

Channel

Assignment of the displayed variables to the channels. At present, the following variables can be selected:

I_act	Actual torque (current)	**I_CMD**	Torque setpoint
v_act	Actual velocity	**v_CMD**	Velocity setpoint
VBus	DC-link (bus) voltage	**FERROR**	Following error
Off	Unused channel	**User defined**	Manual entry

Trigger level

Y-value for triggering.

Trigger position

X-value for triggering (time axis).

Trigger edge

Triggering on the rising or falling edge.

Trigger signal

The current and speed variables can be used as trigger signals. In addition, "Direct" can be used for immediate (independent) triggering. Choosing "User-defined" (User) allows an ASCII parameter to be entered manually.

Resolution

The number of measured points per time unit (storage depth). Setting: fine, normal, coarse.

Time/Division

Scaling of the time axis. Select the time/division. Setting: 1 ...500 ms/div

Total length of the time axis: 8 * x ms/Div

Service functions

Select one of the service functions described below. Click on the "Parameter" button and set the corresponding parameter. 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 rotor locks onto a stator pole.
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 "Entry of service parameters".

Start (service)

Starts the service function selected.

Stop (service)

Stops the service function selected.

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.

2.20 Screen page "Bode plot"

Overview of "Bode plot" screen

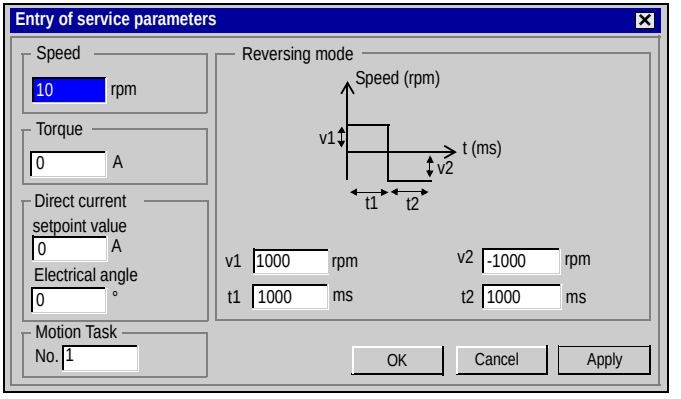
Overview	In preparation

2.21 Screen page "Service parameters"

Overview of the "Entry of service parameters" screen

At a Glance

Diagram:



Service operation parameters

Settings of the parameters for the service functions.

Direct current	Setpoint elect. angle	Current setpoint (in A) for the function phase angle of the electrical field
Speed	Rotational speed	Speed (in rpm) for the function
Torque	Current	Current setpoint (in A) for the function
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	No	Parameters for the motion task must be entered in the screen page "Motion task parameters".

2.22 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 200 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.

CAUTION

The terminal software should be used only by experts.

Failure to observe this precaution can result in injury or equipment damage.

2.23 Screen page "Modbus Plus"

Screen page "Modbus Plus"

At a Glance

Overview of the different field values included in the "Modbus Plus" screen page.

What's in this section?

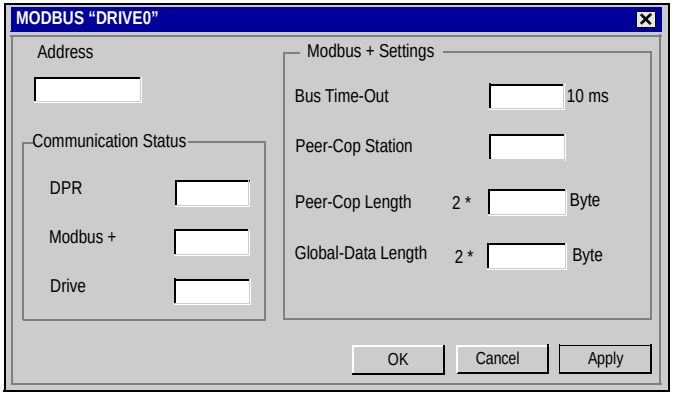
This section contains the following topics:

Screen page "Modbus Plus"

Different configuration parameters

The communication parameters may be configured in 2 ways:

- via the Unilink software terminal mode or via any terminal. Some ASCII commands are defined to allow these parameters to be read or modified,
- via the Modbus Plus screen of the Unilink software:



The following table describes different parameters in the "Modbus Plus" screen:

Parameter	ASCII command	Range	Defaul t value	Note
Address (*)	ADDR	1-63	1	Modbus+ node address (read only)
Bus Time-Out	TIMEMBP	0.01-60	1	In seconds. Incrementation of 10 ms
Peer-Cop Station	PEERCOPS	1-64	0	Must be different to the drive address. 0 : PEERCOP register not received
Peer-Cop Length	PEERCOP	0-9	0	Number of PEERCOP registers received o: no PEERCOP registers received
Global-Data Length	GDTX	0-18	0	Number of Global data registers transmitted. 0 : no Global data transmitted
DPR	DPRSTATE (1)			16 bit length
ModBus +	MBPSTATE (2)		0	16 bit length

Parameter	ASCII command	Range	Defaul t value	Note
Drive	MBPDRVST AT (3)	1-100	0	16 bit length

Legend:

- (*) The station address is entered in the Unilink basic setup screen.
- (1) DPRSTATE: Status in initialization phase
  DPRSTATE = 80: Message ready
- (2) MBPSTATE: Status read by Unilink,
  Updated by MBP card, it informs the drive of the MBP card status

Descriptions of the various MBPSTATE states:

Value of MBPSTATE	Description
0	Card not configured
1	Card in Run
2	Card not communicating
3	Network communication fault
4	DPRAM communication fault

Descriptions of the various MBPSTATE states:

Value of MBPSTATE	Description
0	Card not configured
1	Card in Run
2	Card not communicating
3	Network communication fault
4	DPRAM communication fault

- (3) MBPDRVSTAT: Status read by Unilink
  Updated by the drive, it informs the MBP card of the drive status.

Descriptions of the various MBPDRVSTAT states:

Value of MBPDRVSTAT	Description
1H	Drive ready
2H	Network communication fault
4H	DPRAM communication fault
8H MBTNTO (*)	Communication fault: network ignored

(*) MBPNTO = 0 communication fault reported to the drive.
MBPNTO = 1 communication fault ignored by the drive, it is accessible in write mode via the ASCII MBPDRVSTAT command.
Either MBPDRVSTAT = 8h for MBPNTO = 1

or MBPDRVSTAT = 0h for MBPNTO = 0

Procedure to be followed

The Modbus Plus Lexium communication is configured as follows:

Step	Action
1	Power up the drive. The network cable does not have to be connected.
2	Ensure the good working order of the Modbus Plus card option: The green diagnostics LED should flash regularly (6 flashes per second).
3	Launch the Unilink software or a terminal

Configuration of Address and TimeOut via Unilink or via a Terminal

Address Configuration

Note: an address should not be duplicated on the network and should be between 1 and 64.

Configuration via Unilink:

- configure the "Address" field using the station address in the basic screen of Unilink.

Configuration via a terminal:

- enter the terminal screen,
- enter the ADDR command <Address>,
- enter the ADDR command without parameters to check that the configuration has been correctly implemented.

TimeOut Configuration

Configuration via Unilink:

- configure the "Bus Time-Out" field with the selected value.

Configuration via a terminal:

- enter the terminal screen,
- enter the TIMEMBP command <Value in 0.01 sec.>,
- enter the TIMEMBP command without parameters to check that the configuration has been correctly implemented.

TimeOut represents:

- the maximum period of time during which a token is not received,
- the maximum period of time between 2 PEERCOPs being received.

When a TimeOut is detected, the drive faults.

Peer Cop Data

Peer Cop Configuration

Peer Cop data are the registers transmitted by the command station. The number of registers received by the drive can be configured by the user.

Peer Cop command data reception is confirmed by selecting a number of received Peer Cop register that is higher than 0 and configuring the command station address.

Configuration via Unilink

- Configure the "Peer-Cop Station" field with the command station address,
- Configure the "Peer-Cop Length" field with the number of received Peer Cop registers.

Configuration via a terminal

Selecting the number of a Peer Cop register

- Enter the terminal screen,
- Enter the PEERCOP command <Number of PeerCop registers>,
- Enter the PEERCOP command without parameters to check that the configuration has been correctly implemented.

Command station configuration

- Enter the PEERCOP command <Command station address>

Enter the PEERCOPS command without parameters to check that the configuration has been correctly implemented.

For example:

- If the number 2 is entered in the "Number of Peer Cop Registers" parameter of the drive and the PLC, only the STW and VCMD variables will be implemented by the drive.
- The configured number of Peer Cop registers should be adjusted in relation to the application requirements. The smallest possible number of Peer Cops should be used to optimize the network bandwidth and feed-through time of the Modbus Plus card. However, you are strongly advised to always use the STW command word.

If no Peer Cop data is received from the command station before the end of the specified wait time, the drive faults. It can still be accessed via messaging.

Common Parameter Management with Messaging

Writing parameters via Peer-Cop data exchanges is a priority for writing operations when messaging these same parameters.
If one of these common parameters has not been declared in Peer-Cop data exchange, it still remains accessible in writing via messaging.

Global data configuration via Unilink or via a terminal

Global data configuration

Updating global data is confirmed by selecting a number of Global data registers greater than 0.

Configuration via Unilink:

- configure the "Global-Data length" field with the number of registers.

Configuration via a terminal:

Selecting the number of Global data registers

- enter the terminal screen,
- enter the GDTX command <Number of Global data registers>,
- enter the GDTX command without parameters to check that the configuration has been correctly implemented.

Example:

- if the number 2 is entered in the "Number of Global data registers" drive and PLC parameters, only the ZSW and STATCODE variables will be updated by the drive,
- the number of configured Global data registers should be adjusted in relation to the application requirements. The smallest possible amount of global data must be used in order to optimize the network bandwidth and feed-through time of the Modbus Plus card.

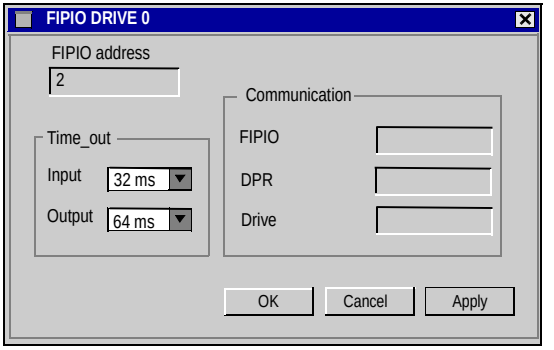
2.24 Screen page "FIPIO"

Screen page "FIPIO"

At a Glance

The communication parameters of the drive should be entered in the FIPIO screen of the Unilink software (except for the FIPIO address). This screen is accessible as soon as Unilink is connected to a drive with the FIPIO card option.

The FIPIO screen of the Unilink software:



The following table describes the various parameters of the "FIPIO" screen:

Parameter	ASCII command	Identifier	Value range	Fault	Access	Note
FIPIO address (1)	ADDR	-	1-62	1	Read	Node address
Input TimeOut(2)	TO_IN	413	20ms, 32ms, 64ms, 256ms, 1s, 4s	20 ms	Read Write	-
Output TimeOut(3)	TO_OUT	414	32ms, 64ms, 256ms, 1s, 4s	256 ms	Read Write	-
FIPIO	MBPSTATE (4)	-	-	0	Read	16 bit length
DPR	DPRSTATE (5)	-	-		Read	16 bit length
Drive	MBPDRVSTAT(6)	-	1-100	0	Read	16 bit length

The FIPIO address can also be configured using the dialogue box (display and push-button) on the front panel of the drive.
(1) The address is configured on the FIPIO bus using the "Basic Setup" screen in Unilink. Address settings possible from 1 to 62.

(2) **Input TimeOut**: maximum response time of drive

(3) **Output TimeOut**: maximum %QW refresh time

(4) **MBPSTATE**:
Status read by Unilink, updated by the FIPIO card, it informs the drive of the FIPIO card status
Description of the various MBPSTATE states:

0	Card not configured
1	Card in Run
2	Card not communicating (STOP)
3	Network communication fault
4	DPRAM communication fault

(5) **DPRSTATE** :

0	Initialization of the FIPIO card
80	Nominal phase: no message
81	Message received
82	Response transmitted

(6) **MBPDRVSTAT**:
The status is read by Unilink and updated by the drive. This enables the FIPIO card to be informed of the drive status, and is accessible in read only mode via the ASCII command MBPDRVSTAT.
Description of the various MBPSTATE states:

1H	Drive ready
2H	Network communication fault
4H	DPRAM communication fault
8H MBPNTO (*)	Communication fault: network ignored

(*) MBPNTO = 0 communication fault reported to the drive.
MBPNTO = 1 communication fault ignored by the drive, it is accessible in write mode via the ASCII MBPDRVSTAT command.
Either MBPDRVSTAT = 16#08 for MBPNTO = 1
or MBPDRVSTAT = 16#00 for MBPNTO = 0

2.25 Screen page "PROFIBUS"

Screen page "PROFIBUS"

At a Glance

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

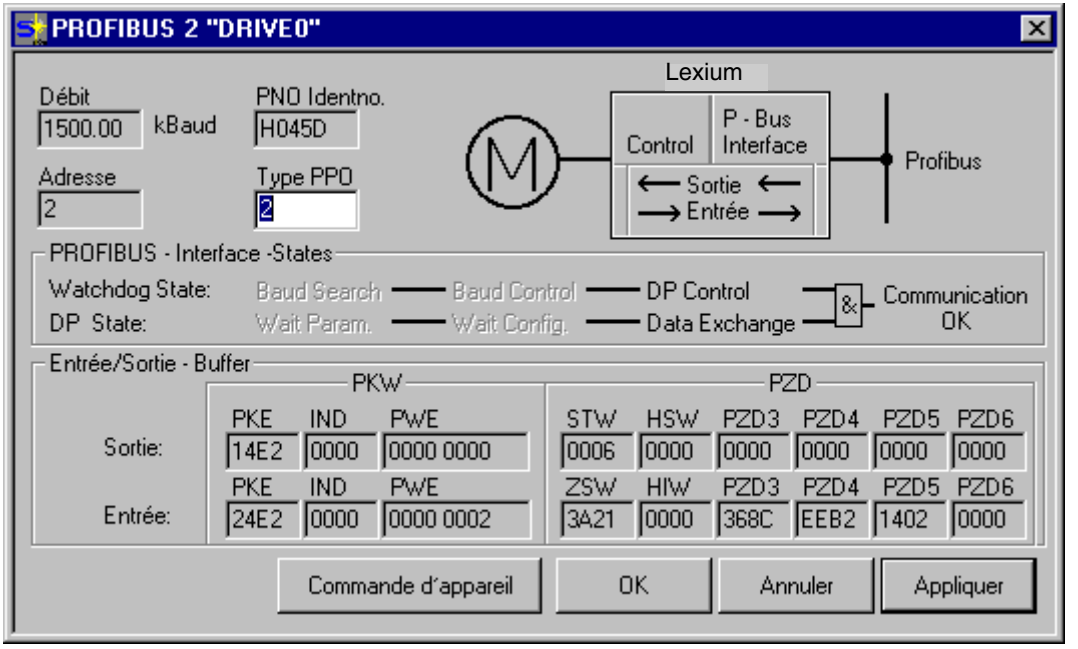
What's in this section?

This section contains the following topics:

Screen page "PROFIBUS"

At a Glance

This screen displays the states of control word (STW) and state word (ZSW) bits. The instrument state indicated by the state word is visible in the state machine. The actual state is displayed in black, all other states are displayed in gray. In addition, the previous state is indicated by the number of the corresponding arrow symbol displayed in bold.



Baudrate

The baudrate, indicated by the master (of the PROFIBUS network) is displayed here.

PNO Identification

The PNO identifier indicates the number of the servo amplifier in the identification listing of the PROFIBUS user architecture.

Address

Station address of the amplifier. This address is defined in the "Basic setup" screen.

PPO Typ (PPO Type)	The amplifier only takes the PPO-type 2 into account in the PROFIDRIVE profile.
BUS status	Displays the communication status of the bus. The data can be transmitted to the PROFIBUS only while the "Communication OK" message is displayed.
Input/Output-Buffer	Input/output data can only be transmitted when the monitoring threshold of the amplifier has been activated in the hardware configuration of the master. **Output** Last object received by the master. **Input** Last object sent by the master.

Screen page "PROFIBUS instrument control"

At a Glance

The following table describes the states and transitions of the instrument.
States:

Not ready for switch-on	The drive is not ready to be switched on. The software of the drive does not indicate the "Ready to operate" state (RTO).
Switch-on inhibited	The drive is not ready to be switched on. The parameters can be transmitted, the DC-link (DC-Bus) can be switched on, but motion functions cannot yet be executed.
Ready for switch-on	The voltage must be applied to the DC-link. The parameters can be transmitted, but motion functions cannot yet be executed.
Ready for operation (Ready To Operate - RTO)	The voltage must be applied to the DC-link. The parameters can be transmitted, but motion functions cannot yet be executed. The output stage is activated.
Operation enabled	No error is present. The output stage is activated, and motion functions can be executed.
Fast stop activated	The motor has been stopped using the emergency ramp. The output stage is activated, and motion functions can be executed.
Error response active/error	In the event of instrument-related errors, the drive changes to the "Error response active" state. In this state, the power stage is immediately switched off. After this error message, it changes to the "Error" state. This state can only be changed by the "Error-reset" bit command. To enable this, it is first necessary to have eliminated the cause of the error (see ASCII ERRCODE command).

State machine transitions:

Transition 0	event	Reset / 24V power supply activated.
	Action	Initialization started.
Transition 1	event	Initialization successfully completed, switch-on of drive inhibited.
	Action	None.
Transition 2	event	Bit 1 (voltage inhibited) and bit 2 (fast stop) set to 1 in the control word (command: switch-off), the voltage is present on the DC-link.
	Action	None.
Transition 3	event	Bit 0 (switch-on) also set to 1 (command: switch-on).
	Action	The output stage is activated and the motor is generating torque.
Transition 4	event	Bit 3 (operation enabled) also set to 1 (command: operation enabled).
	Action	Motion functions are activated according to the active operating mode.

Transition 5	event	Bit 3 cancelled (command: inhibited).
	Action	Motion functions are deactivated. The motor is slowed by the requisite ramp (according to the operating mode).
Transition 6	event	Bit 0 set to 0 (ready for switch-on).
	Action	The output stage is deactivated. The motor is not generating torque.
Transition 7	event	Bit 1 or bit 2 set to 0.
	Action	(command: "Fast stop" or "Voltage inhibited"
Transition 8	event	Bit 0 set to 0 (Operation activated -> ready for switch-on).
	Action	The output stage is deactivated and the motor loses its torque.
Transition 9	event	Bit 1 set to 0 (operation activated -> switch-on inhibited).
	Action	The output stage is deactivated and the motor loses its torque.
Transition 10	event	Bit 1 or 2 set to 0 (RTO -> switch-on inhibited).
	Action	The output stage is deactivated and the motor loses its torque.
Transition 11	event	Bit 2 set to 0 (operation activated -> fast stop).
	Action	The motor has been stopped using the emergency ramp. The output stage remains activated. The setpoints are cancelled (e.g. motion block number, digital setpoint).
Transition 12	event	Bit 1 set to 0 (Fast stop -> switch-on inhibited).
	Action	The output stage is deactivated and the motor loses its torque.
Transition 13	event	Error response active
	Action	The output stage is disabled and the motor loses its torque.
Transition 14	event	Error.
	Action	None.
Transition 15	event	Bit 7 set to 1 (Error -> switch-on inhibited).
	Action	Error acknowledged (with or without reset, depending on the error).
Transition 16	event	Bit 2 set to 1 (Fast stop -> operation activated).
	Action	Motion function reactivated.

The state transitions are assigned by internal events (for example, DC-link supply voltage cut off) and by the control word flags (bits 0, 1, 2, 3, 7).

2.26 Screen pages "SERCOS"

Screen pages "SERCOS"

At a Glance

Overview of the different field values included in the screen pages "SERCOS" and "SERCOS Service".

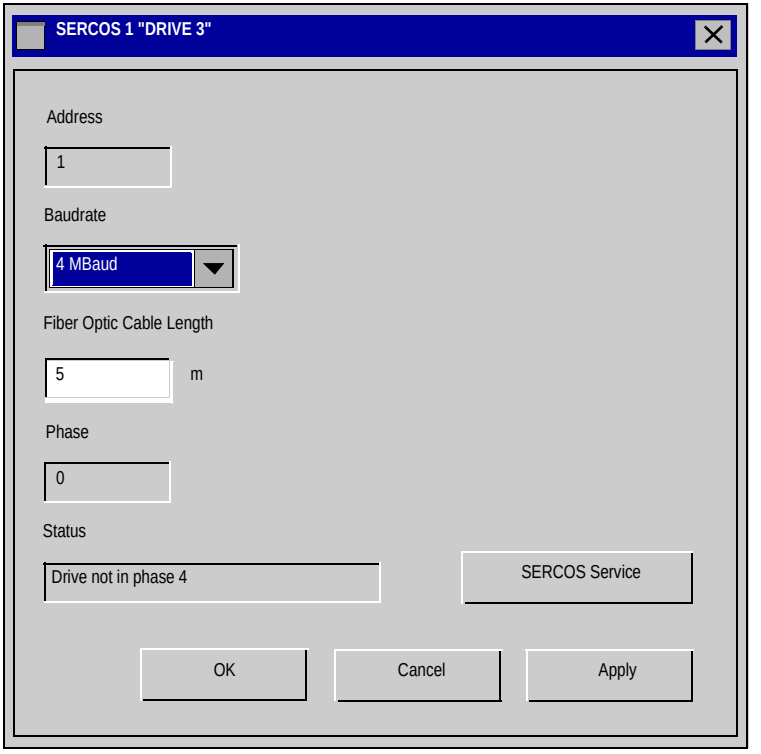
What's in this section?

This section contains the following topics:

Overview of the screen page "SERCOS"

At a Glance

Diagram:



Address

ASCII: **ADDR**	Default: 0	Valid for all OPMODES

The address marks the Sercos station address of the drive, within the Sercos communication. The address can be changed between 0 and 63 in the "Basic setup" screen. An address 0 designates the drive as a repeater on the Sercos ring.

Baud rate

ASCII: **SBAUD**	Default: 4MBaud	Valid for all OPMODES

In this field it is possible to set the Sercos baud rate. The default value is 4 Baud.

LWL length

ASCII: **SLEN**	Default: 5m	Valid for all OPMODES

Within this parameter it is possible to change the optical power of the transmit output of the drive, to the next station in the ring. The optical power can set for the length of plastic optical cable, in meters, from 1 to 45 meters. The default is 5 meters. If the optical power is not adjusted properly, there will be errors in the telegram transmission, and the red error LED on the drive will light. In normal communication, the green transmit and receive LED's will light (fiber-optic transmission diodes).

Phase

ASCII: **SPHAS**	Default: -	Valid for all OPMODES

This field displays the actual phase of the Sercos communication.

Status

ASCII: **SSTAT**	Default: -	Valid for all OPMODES

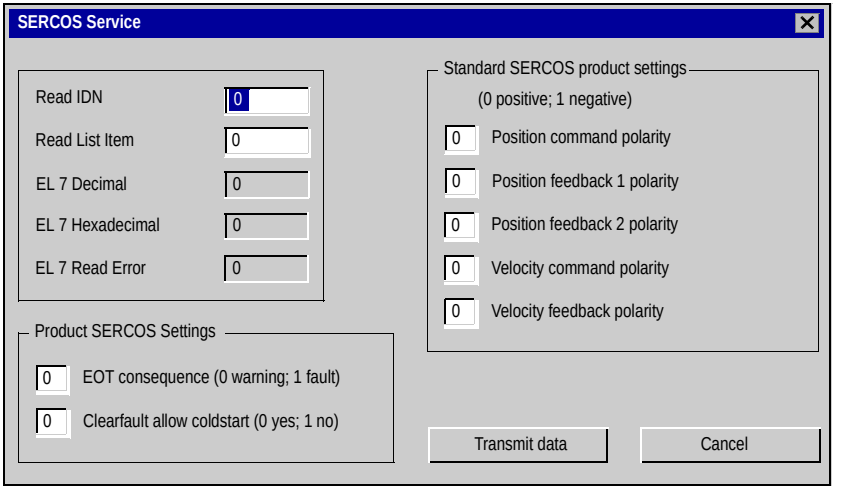
This field displays the actual status of the Sercos communication, according the Sercos status-word in text format.

SERCOS Service With this button it is possible to open the screen page "Sercos service".

"SERCOS Service" screen page

At a Glance

Diagram:



Read IDN

ASCII: **SERCOS**	Default: -	Valid for all OPMODES

Using this function, it is possible to read the special Sercos IDNs not represented by an ASCII parameter. The number of the IDN should be written into this field and data can be requested by activating the "Transmit Data" button.

Read List Item

ASCII: **SERCLIST**	Default: -	Valid for all OPMODES

This parameter may also be used to read IDN lists using the "Read IDN" function. For this, the requested list item must be chosen from this field before activating the "Read IDN" function.

EL 7 Dec EL 7 Hex

This field contains the result of the "Read IDN" function in decimal and hexadecimal format.

EL 7 Read Error

ASCII: **SERCERR**	Default: -	Valid for all OPMODES

This parameter will be set to 1 if the IDN number is not supported by the "Read IDN" list function.

Product Sercos Settings

EOT consequence (IDN P3015):
This parameter defines the consequence of the Hardware Limit Switch, if the corresponding digital inputs are set to the limit switches. If the hardware limit switch consequence is set to 0, then the Limit switch consequence is a warning. Otherwise, if the IDN P3015 is set to 1, then the switch consequence is a fault.

Clearfault allow coldstart (IDN P3016):
This parameter defines the consequence of the reset command (IDN 99; ASCII CLRFAULT), for faults which require a coldstart. If this IDN is set, faults which require a coldstart will not clear.

Standard Sercos Settings

Position polarity (IDN 55):
The position polarity parameter is used to invert the polarities of position data. Polarities are not inverted internally but externally, i.e. on the input and output of a closed loop system. The motor shaft turns clockwise when there is a positive position command difference and no inversion.

Feedback inversion 1:
This function enables the sign of the Feedback value 1 to be inverted.

Feedback inversion 2:
This function enables the sign of the Feedback value 2 to be inverted.

Velocity inversion (IDN 43):
The velocity inversion parameter enables the sign of velocity data to be inverted. The signs are not inverted internally but externally, i.e. on the input and output of a closed loop system. The motor axis turns clockwise when there is a positive velocity command and no inversion.

Velocity sign:
This function enables the sign of the velocity value to be reversed.

2.27 Screen page "I/O expansion"

Overview of the screen page "I/O expansion"

At a Glance	This screen displays individual status of the I/O 14/08 channels on the expansion card as well as overall status of the card.
PosReg.1-5	The preset function of the corresponding position register is indicated by a high signal. (the PosReg 1-4 function is defined in the "Position data, PosReg5" screen only via ASCII).
Ferreur	Contouring-error (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 Position	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.
MT_Restart	Restarts the motion task that had been stopped.
Start Jog v=x	Starting in jog mode at a given speed. After selecting the function, you can enter the speed in the auxiliary variable "x". 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.

A0-7	Motion task number, Bit1 to Bit8
Err.	Expansion card error message. The error may be due to the following reasons: no power supply, output overload or short-circuit.
24V	Shows that 24V power supply for the expansion card is present.

2.28 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 BTB/RTO 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 BTB/RTO	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
F21	Handling error	Software error on the expansion card

Number	Designation	Explanation
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 (BTB/RTO 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).

2.29 Troubleshooting

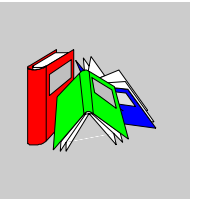
Troubleshooting

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 (AGND) is not connected with the analog setpoint source	- Reduce KP (speed contr.) - Replace the feedback cable - Connect AGND with setpoint source
Motor runs too soft	- Integral time Tn too high - Gain KP too low - PID-T2 too high - T-Tacho too high	- Reduce Tn (speed contr.) - Increase KP (speed contr.) - Reduce PID-T2 - Reduce T-Tacho
Motor runs roughly	- Integral time Tn too low - Gain KP too high - PID-T2 too low - T-Tacho too low	- Increase Tn (speed contr.) - Reduce KP (speed contr.) - Increase PID-T2 - Increase T-Tacho

Glossary



A

AGND Analog ground

B

BTB/RTO Ready to operate

C

CE Communauté Européenne (EC)

CLK Clock

Clock Clock signal.

COM Serial interface for a PC

Common mode voltage Disturbance amplitude that can be compensated for by a differential analog input.

Continuous power of the regen circuit Average power that can be dissipated in the regen circuit.

Counts	Internal count pulses, 1 pulse = $1/2^{20}$turn^{-1}.
Current controller	Regulates the difference between the current setpoint and the actual current to 0. Output: power-output voltage.

D

DC-link (bus) voltage	Rectified and smoothed power voltage.
DGND	Digital ground
DIN	Deutsches Institut für Normung (German standardization institute)
Disable	Removal of the ENABLE signal (0V or open).
Disk	Magnetic storage (diskette, hard disk)

E

Earth short	Electrically conductive connection between a phase and PE.
EEPROM	Electrically erasable/programmable memory in the servo amplifier. Data stored in EEPROM are not lost if the auxiliary voltage is switched off.
EMV	Electromagnetic compatibility
EN	European standard
Enable	Enable signal for the servo amplifier (+24V).

G

Gray Code — A binary code known as reflected, in which the change from term n to term n+1 is carried out by changing only a single digit, and so the code can be read unambiguously.

H

Holding brake — A brake in the motor, that can only be applied when the motor is at standstill.

I

IEC — International Electrotechnical Commission

Incremental encoder interface — Position indication through 2 signals with a 90° phase difference, not an absolute position output.

Ipeak, peak current — The r.m.s. value of the pulse current.

Irms, r.m.s. current — The r.m.s. value of a steady current.

ISO — International Standardization Organization

It threshold — Monitoring of the r.m.s. current that is actually drawn.

K

KP, P-gain — Proportional gain of a control loop.

L

LED — Light-emitting diode

Limit-switch — To limit the range of movement of the machine; implemented as an n.c. (break) contact.

M

Machine — The total assembly of parts or devices that are connected together, of which at least one is movable.

Mb — Megabyte

Monitor output — Output of an analog measurement.

Motion block — A group of data containing all the position parameters that are required for a motion task.

MS-DOS — Operating system for a PC

Multi-axis system — Machine with several independent drive axes.

N

NI — Zero pulse/mark

NSTOP — Limit-switch input for CCW rotation

O

Optocoupler Optical connection between two electrically independent systems.

P

P controller Control loop that has purely proportional response.

PC Personal Computer

PGND Ground for the interface

Phase shift Compensation for the lag between the electromagnetic and the magnetic field in the motor.

PID controller Control loop with proportional, integral and differential response.

PID-T2 Filter time constant for the speed controller output.

PLC Programmable Logic Controller

PLC Programmable Logic Controller

Position controller Regulates the difference between the position setpoint and the actual position to 0: Output: speed setpoint

PSTOP Limit-switch input for CW rotation

Pulse power of the regen circuit The maximum power that can be handled by the regen circuit.

R

RAM Volatile memory in the servo amplifier. Data that are stored in the RAM are lost when the auxiliary voltage is switched off.

Ramps	Limiting of the rate of change of the speed setpoint value.
RBallast	Regen resistor
RBext	External regen resistor
RBint	Internal regen resistor
Regen circuit	Converts superfluous (regenerative) energy that is fed back by the motor, during braking, into heat in the regen resistor.
RES	Resolver
Reset	New start of the microprocessor.
Reversing mode	Operating with a periodic change of direction.
ROD	Incremental encoder output
ROD interface	Incremental position output.

S

Servo amplifier	Instrument for controlling the torque, speed and position of a servomotor.
Short circuit	Electrically conductive connection between two phases.
Speed controller	Regulates the difference between the speed setpoint SW and the actual speed to 0. Output: current setpoint.
Speed limit	Maximal value for the speed normalization at +/- 10V.
SRAM	Static RAM
SSI	Synchronous serial interface
SSI interface	Cyclically absolute, serial position output.
SW/SETP	Set Point

T

T-tacho, tacho time constant — Filter time constant in the speed feedback of the control loop.

Tacho voltage — Voltage proportional to the actual speed.

Tn, integration time — Integral component of the control loop

U

UL — Underwriter Laboratory

V

V AC — Alternating (AC) voltage

V DC — DC voltage

VDE — Verein deutscher Elektrotechniker

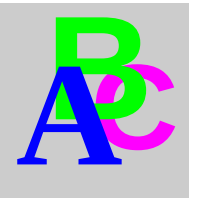
X

XGND — Ground for the 24V supply

Z

Zero pulse/mark — Produced by incremental encoders, once per turn, used to zero the machine.

Index



A

B

C

D

E

F

G

R

S

T

U

V

W

Z