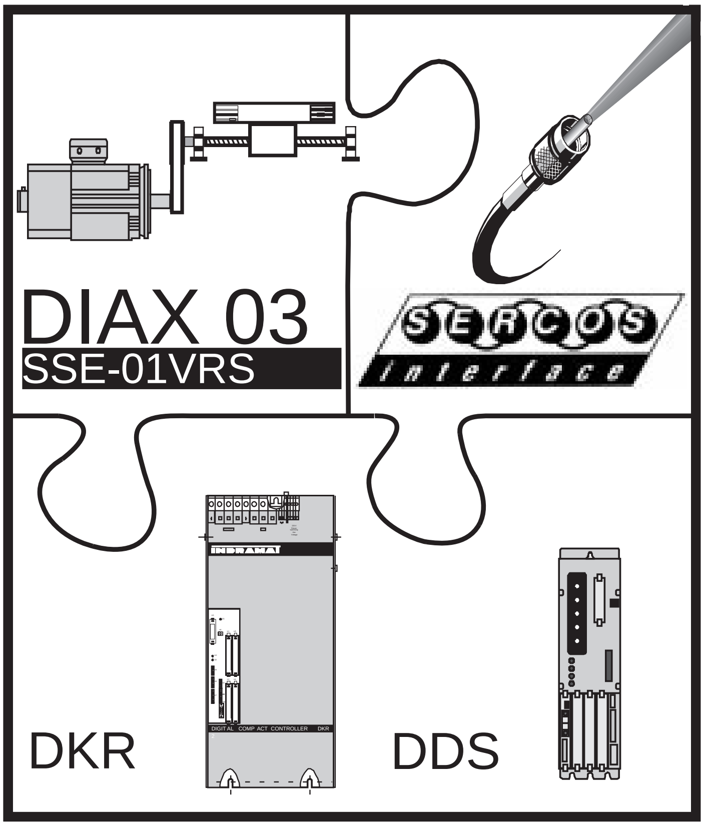

DIAX03

Drive With Servo Function

Functional description: SSE 01VRS

DOK-DIAX03-SSE-01VRS**-FKB1-EN-P

274819

Indramat

Title DIAX03 Drive With Servo Function

Type of Documentation Functional description

Documentation Type DOK-DIAX03-SSE-01VRS**-FKB1-EN-P

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- 209-0072-4312-00

What is the purpose of this documentation?

The following documentation describes the functions of the firmware FWA-DIAX03-SSE-01VRS.

This documentation serves trained maintenance personnel:

- as a working guide for installation of the digital AC servo drive via a SERCOS-compatible control system
- for parameterization of the drive controller
- for data security of the drive parameter
- for error diagnosis and error removal

Course of modifications

Document identification of previous and present output	Release Date	Remarks
DOK-DIAX03-SSE-01VRS**-FKB1-EN-P	09.96	First edition

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Liability

The content of the documentation and availability of the products are subject to change without notice.

Contents

1 System Overview

1.1 Range of Uses

DIAX03 is a family of digital, intelligent drives. DIAX03 offers solutions for applications in the following markets:

- Converting
- Printing
- Packaging
- General Industrial Automation

DIAX03 consists of:

- A standardized digital drive SERCOS interface
- Operation with the complete line of INDRAMAT motors
- Complete power range from 1kW to 100kW
- User-friendly software features
- Adaptability to various applications by configuring the drive with optional plug-in cards

1.2 Drive Controllers

The DIAX03 family consists of five drive controllers:

Modular Digital Servo Drives (Drive Controllers):

- DDS2.2
- DDS3.2

Digital Vector Drives for high performance and high horsepower applications:

- DKR2.1
- DKR3.1
- DKR4.1

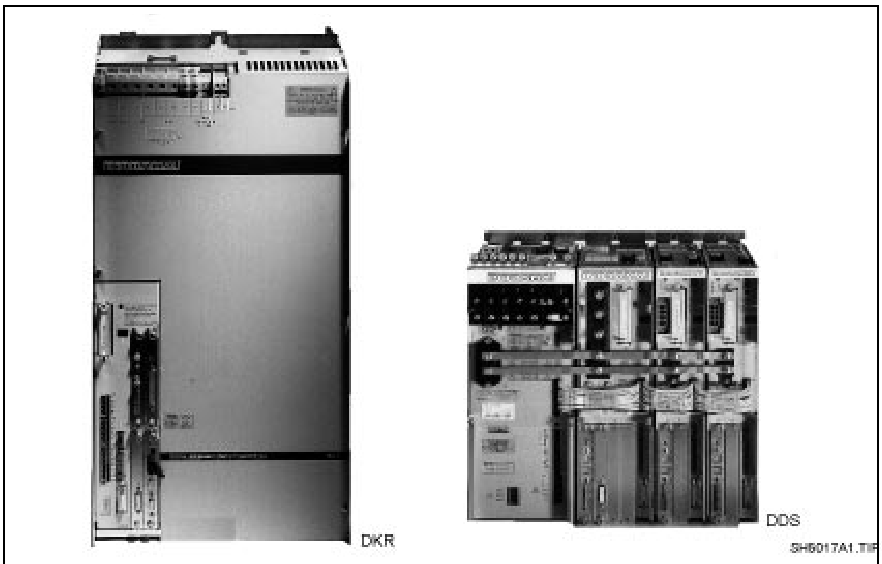


Fig. 1-1: Drive controllers

The type of digital drive used is stored in parameter **S-0-0140, Controller type**.

1.3 Motors

Rotary and linear motors can be driven with the DIAX03 drive family.

Rotary motors:	Linear motors:
MDD	LAR
MKD	LAF
2AD	LSF
ADF	
1MB	
MBW	

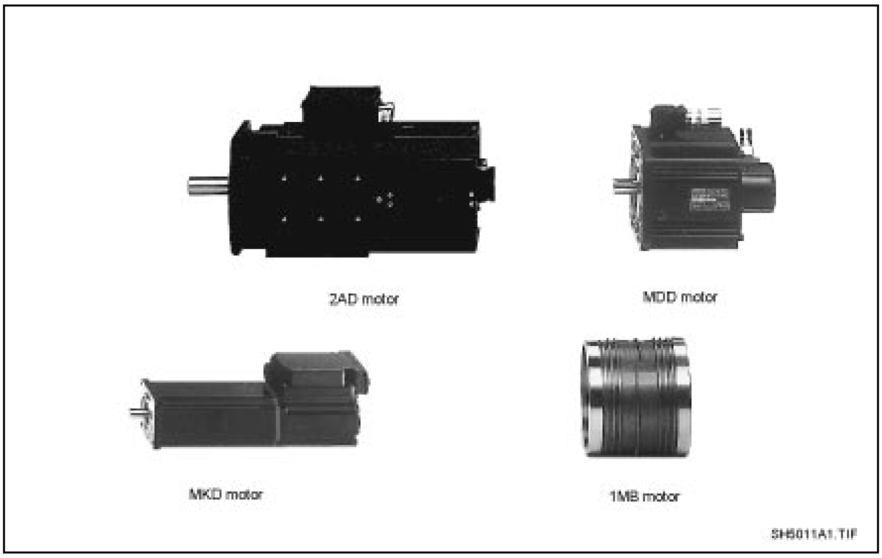


Fig. 1-2: Rotary motors

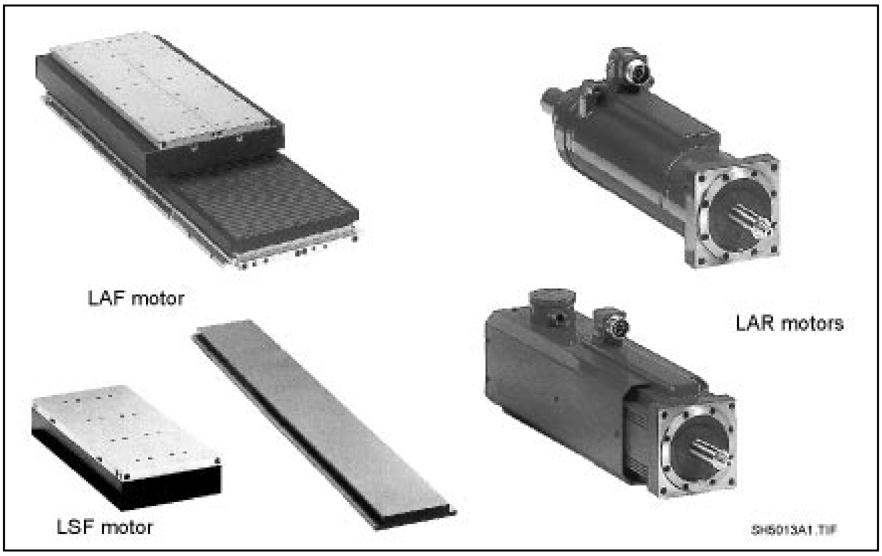


Fig. 1-3: Linear motors

The motor type used is stored in parameter **S-0-0141, Motor type**.

1.4 Firmware Overview

Within the DIAX03 family, there are three user-specific firmware variations:

- Drive with servo functionality
- Drive with main spindle functionality
- Drive with electronic line shafting functionality

The drive with electronic line shafting function (servo feature) is described in the following documentation.

The software version used is stored in the parameter **S-0-0030, Manufacturer version**.

1.5 Basic Operating Modes and General Features

Basic operating modes

- Torque mode
- Velocity mode
- Position mode
- Drive-interpolated position mode

General features

- Diagnostic possibilities
- Setting of torque/force limits
- Current limit
- Limiting the velocity
- Travel range limit
- Drive error reaction:
  - P-0-0119, Best Possible Deceleration
    Velocity command switched to zero
  - Best possible deceleration (torque disable)
  - P-0-0119, Best Possible Deceleration
    Velocity command switched to zero with ramp (slope) and filter
  - NC Response in Error Situation
  - Emergency stop feature
- Control loop settings
  - Load default feature
  - Acceleration feed forward
  - Velocity mix factor
  - Velocity preset control
- Language selection
- Drive interlock
- Drive halt
- Drive-controlled homing procedure

- Evaluating absolute measurement systems by setting absolute dimension
- Analog output
- Oscilloscope feature
- Measuring feature with:
  - Measuring signal actual feedback value 1/2
  - Measuring signal time
- Modulo feature

1.6 Additional Firmware Features: Drive With Servo Feature

- Axis error compensation
- Turnover consideration
- Positive stop drive procedure
- Frictional torque compensation

2 Safety Instructions for Electrical Drives

2.1 General

These instructions must be read and understood before the equipment is used to minimize the risk of personal injury and /or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all documentation provided with the product. Please read and understand these safety instructions, and all user documentation for the equipment, prior to working with the equipment at any time. You must contact your local Indramat representative if you cannot locate the user documentation for your equipment. A listing of Indramat offices is supplied in the back of this manual. Request that your representative send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the product is resold, rented and/or otherwise transferred or passed on to others, these safety instructions must accompany it.

WARNING

Improper use of this equipment, failure to follow the attached safety instructions, or tampering with the product, including disabling of safety device, may result in personal injury, severe electrical shock, death, or property damage!

INDRAMAT GmbH is not liable for damages resulting from failure to observe the warnings given in these instructions.

- Operating, maintenance and safety instruction in the appropriate language must be ordered and received before initial start-up, if the instructions in the language provided are not understood perfectly.
- Proper and correct transport,storage, assembly, and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment:

  Only trained and qualified personnel may work on this equipment or in its vicinity. Personnel are qualified if they have sufficient knowledge of the assembly, installation, and operation of the product as well as of all warnings and precautionary measures noted in these instructions.

  Furthermore, they should be trained, instructed, and qualified to switch electrical circuits and equipment on and off, to ground them, and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.
- Use only spare parts approved by the manufacturer.
- All safety regulations and requirements for the specific application must be followed as practiced in the country of use
- The equipment is designed for installation on commercial machinery.
- Start-up is only permitted once it is sure that the machine in which the products are installed complies with the requirements of national safety regulations and safety specifications of the application.

  European countries: see Directive 89/392/EEC (Machine Guideline);
- Operation is only permitted if the national EMC regulations for the application are met.

The instructions for installation in accordance with EMC requirements can be found in the INDRAMAT document „EMC in Drive and Control Systems“.

The machine builder is responsible for the adherence of the limiting values as prescribed in the national regulations and specific regulations for the application concerning EMC.

European countries: see Directive 89/336/EEC (EMC Guideline);

U.S.A.: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

- Technical data, connections, and operational conditions are specified in the product documentation and must be followed.

2.2 Protection against contact with electrical parts

Note: This section pertains to equipment and drive components with voltages over 50 Volts.

Touching live parts with potentials of 50 Volts and higher applied to them can be dangerous and cause severe electrical shock. In order for electrical equipment to be operated, certain parts must have dangerous voltages applied to them.

DANGER

High Voltage!

Danger to life, severe electrical shock and risk of injury!

⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain and/or repair this equipment.

⇒ Follow general construction and safety regulations when working on electrical installations.

⇒ Before switching on power, the ground wire must be permanently connected to all electrical units according to the connection diagram.

⇒ At no time may electrical equipment be operated if the ground wire is not permanently connected, even for brief measurements or tests.

⇒ Before beginning any work, disconnect mains or the voltage source from the equipment. Lock the equipment against being switched on while work is being performed.

⇒ Wait 5 minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage on the capacitors before beginning work to make sure that the equipment is safe to touch.

⇒ Never touch the electrical connection points of a component while power is turned on.

⇒ Before switching the equipment on covers and guards provided with the equipment must be installed to prevent contact with live parts. Before operating cover and guard live parts properly so they cannot be touched.

⇒ A leakage current protective device must not be used for an AC drive! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.

European countries: according to EN 50178/ 1994;

⇒ Electrical components with exposed live parts must be installed in a control cabinet to prevent direct contact.

European countries: according to EN 50178/ 1994;

⇒ U.S.A: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

DANGER

High discharge current!

Danger to life, risk of severe electrical shock and risk of injury!

⇒ All units and the motors must be connected to a grounding point with the ground wire or must be grounded themselves before switching on power.

⇒ The discharge current is greater than 3.5 mA. A permanent connection to the supply system is therefore required for all units.

European countries: according to EN 50178/1994, section 5.3.2.3;

⇒ U.S.: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

⇒ The ground wire must always be connected before start-up, even during the performance of tests. Otherwise, high voltages may be present at the unit housing, which can result in severe electrical shock and personal injury.

2.3 Protection by protective low voltage (PELV) against electrical shock

All connections and terminals with voltages ranging between 5 and 50 volts on INDRAMAT products are protective low voltages designed in accordance with the following standards on contact safety:

- International: IEC 364-4-411.1.5
- European countries within the EU: see EN 50178/1994, section 5.2.8.1.

WARNING

High electrical voltages due to incorrect connections!

Danger to life and limb, severe electrical shock and/or serious bodily injury!

⇒ Only that equipment or those electrical components and cables may be connected to all terminals and clamps with 0 to 50 volts if these are of the protective low voltage type (PELV = Protective Extra Low Voltage).

⇒ Only connect those voltages and electrical circuits that are safely isolated. Safe isolation is achieved, for example, with an isolating transformer, an optoelectronic coupler or when battery-operated.

2.4 Protection against dangerous movements

Dangerous movements can be caused when units have bad interfaces or motors are connected incorrectly.

There are various causes of dangerous movements:

- Improper or incorrect wiring or cable connections
- equipment is operated incorrectly
- probe parameters or encoder parameters are set incorrectly
- broken components
- errors in software or firmware

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

Although the monitoring circuits in the drive components make improper operation almost impossible, personnel safety requires that proper safety precautions be taken to minimize the risk of electrical shock, personal injury and/or property damage. This means that unexpected motion must be anticipated since safety monitoring built into the equipment might be defeated by incorrect wiring or other faults.

DANGER

Dangerous movements!

Danger to life, electrical shock and risk of injury or equipment damage!

⇒ In the drive component monitoring units, every effort is made to avoid the possibility of faulty operation in connected drives. Unintended machine motion or other malfunction is possible if monitoring units are disabled, by-passed or not activated.

⇒ Safe requirements of each individual drive application must be considered on a case-by-case basis by users and machine builders.

Avoiding accidents, electrical shock, personal injury and/or property damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:

- use protective fences
- use protective railings
- install protective coverings
- install light curtains

⇒ Fences should be strong enough to withstand maximum possible momentum.

⇒ Mount the Emergency Stop (E-Stop) switch in the immediate reach of the operator. Verify that the Emergency Stop works before start-up. Do not use if not working.

⇒ Isolate the drive power connection by means of an Emergency Stop circuit or use a safe lock-out system to prevent unintentional start-up.

⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.

⇒ Disconnect electrical power to the equipment using a master lock-out and secure against reconnection for:

- maintenance and repair work
- cleaning of equipment
- long periods of discontinued equipment use

⇒ Avoid operating high-frequency, remote control, and radio equipment near equipment electronics and supply leads. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special Electromagnetic Compatibility (EMC) test on the plant.

2.5 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields in the vicinity of current-carrying conductors and permanent motor magnets represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.

WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

⇒ Persons with pacemakers and metal implants are not permitted to have access to the following areas:
  - Areas in which electrical equipment and parts are mounted, operating or are being commissioned.
  - Areas in which parts of motors with permanent magnets are being stored, repaired or mounted.

⇒ If it is necessary for a person wearing a heart pacemaker to enter into such an area then a physician must be consulted prior to doing so.

⇒ Persons with metal implants or hearing aids must take care prior to entering into areas described above. It is assumed that metal implants or hearing aids will be affected by such areas and a physician must be consulted prior to doing so.

2.6 Protection during handling and installation

All INDRAMAT products should be handled and assembled according to the instructions in the documentation.

CAUTION

Risk of injury due to incorrect handling!

Bodily injury caused by crushing, shearing, cutting, and thrusting movements!

⇒ Observe installation instructions and safety regulations before handling and working on the product.

⇒ Use suitable installation in using lifting or moving equipment. Refer to the user manual for the product.

⇒ Take precautions to avoid pinching and crushing.

⇒ Only use suitable tools specified in the user manuals and use them according the instructions.

⇒ Use lifting devices and tools correctly and safely.

⇒ Wear appropriate protective clothing, e.g., protective goggles, safety shoes, protective gloves.

⇒ Never stand under suspended loads.

⇒ Clean up liquids form the floor to prevent personnel from slipping.

2.7 Battery safety

Batteries contain reactive chemicals. Incorrect handling can result in injury or equipment damage.

CAUTION

Risk of injury due to incorrect handling!

⇒ Do not attempt to reactivate dead batteries by heating or other methods (danger of explosion and corrosion).

⇒ Never charge batteries (danger from leakage and explosion).

⇒ Never throw batteries into a fire.

⇒ Do not take batteries apart.

⇒ Handle carefully. Incorrect extraction or installation of a battery can damage equipment.

Note: Environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air, and sea transport in the sense of the legal requirements (Danger of explosion). Dispose of batteries separately from other refuse. Observe the legal requirements in the country of installation.

3 General Instructions for Installation

3.1 Explanation of Terms

It is helpful to explain the terms used in this document so that they will be better understood.

Parameter

Communication with the drive occurs (with a few exceptions) with the help of parameters. They can be used for

- Setting the configuration
- Parameterizing the control/drive settings
- Accessing control/drive functions and commands
- Configuring the cyclic telegrams

A parameter is identified with its ID numbers

All of the drive's operating data are identified by ID numbers.

All the parameter ID numbers available in the drive are listed in parameter **S-0-0017, IDN list of all operation data**.

The Data Status

Each parameter is provided with a data status, which can also be read. It serves the following purposes:

- Identifying the validity/invalidity of the parameter
- Contains the command acknowledgment if the parameter acts as a command (see Commands on page 3-5)

Data Block Structure

Each parameter has 7 different data block elements that can be read or written by a SERCOS control system.

Data Block Structure: Element No.:	Designation:	Remarks:
1	ID Number	Parameter identification
2	Name	can be changed in language selection
3	Attribute	contains data length, type and decimal places
4	Unit	can be changed in language selection
5	Minimum Input Value	contains the minimum input value of the operating data
6	Maximum Input Value	contains the maximum input value of the operating data
7	Operating Data	actual parameter value

Fig. 3-1: Data Block Structure

Changing the operating data depends on the communication phase

Only the operating data can be changed; all other elements can only be read. The operating data can be write-protected either continuously or temporarily.

Possible Error Messages When Reading and Writing the Operating Data

Error:	Reason:
0x7004, Data not changeable	The operating data is write-protected
0x7005, Data currently write-protected	The operating data cannot be written to in this communication phase (see Supplement A: Writing to Parameters)
0x7006, Data smaller than minimum value	The operating data is smaller than its minimal input value
0x7007, Data larger than maximum value	The operating data is larger than its maximum input value
0x7008, Data is not correct	The value could not be accepted as written because internal tests lead to a negative result

Fig. 3-2: Error messages while reading/writing operating data

Non-Volatile Parameter Storage Registers

All configuration and control settings are stored

Various non-volatile parameter storage registers that buffer operating data are contained in the drive. The operating data apply to:

- setting the configuration, or
- parameterizing the control drive settings

Each time operating data is written to it is stored.

Memory is available in the following structural component groups

- Control drive
- Motor feedback (optional)
- Programming module

Parameters Stored in the Digital Drive

All operating data that apply only to the drive controller and that cannot be changed by the user are stored in the digital drive. This consists of the following parameters:

- **S-0-0110, Peak Amplifier Current**
- **S-0-0112, Rated Amplifier Current**
- **S-0-0140, Controller Type**
- **P-0-0518, Rated Amplifier Current-2**
- **P-0-0519, Peak Amplifier Current-2**
- **P-0-4002, Amperage Amplifier Equalization Phase U**
- **P-0-4003, Amperage Amplifier Equalization Phase V**
- **P-0-4015, DC Bus Voltage**
- **P-0-4035, Equalization Current**

Parameter Storage in Motor Feedback

All motor-dependent parameters are stored in the motor feedback with MDD and MKD motors.

Additionally, parameters for the "load default" function and the motor feedback are stored here.

Parameters Stored in DSM Programming Module

By switching the programming module when devices are exchanged, the characteristics of the device that has been exchanged can be easily transferred to the new device.

Depending on the setting of SERCOS parameter **S-0-0269, Parameter buffer mode**, all the application parameters are either stored in programming module DSM 2.3 (EEPROM) or temporarily kept (RAM). These parameters are listed in the **S-0-0192, IDN List of Backup Operation Data**. In addition, parameters stored in the motor feedback of MDD or MKD motors are included in this list.
If programming modules are exchanged, these parameters must be read from the old module so that after the exchange they can be written to the new module.

Parameter Buffer Mode

The drive controller is capable of storing data that is transmitted via the service channel either temporarily (in RAM) or permanently (in the EEPROM).

The parameter **S-0-0269, Parameter Buffer Mode** determines what will be done with the parameters.

Operating Modes

Operating modes define which command values will be processed in which format, leading to the desired drive motion. They do not define how these command values will be transmitted from a control system to the drive.

One of the four selectable operating modes is active when the control and power supply is ready for operation and the controller enable signal is positive.

The drive displays **"AF"** in the H1 display.

Error Classes

The error class is evident from the diagnostic message.

Errors are separated into four different error classes. They determine the drive's error response.

Error Class:	**Diagnostic Message:**	**Drive Response:**
Fatal	F8xx	Torque free switching
Travel range	F6xx	Velocity command value switched to zero
SERCOS Interface	F4xx	In accordance with best possible deceleration
Non-fatal	F2xx	In accordance with best possible deceleration

Fig. 3-3: Error class divisions

Drive's Error Response

If an error state is detected in the drive, the drive's error response will automatically be executed as long as the drive is in control. The H1 display flashes Fx / xx. The drive's reaction to SERCOS interface and non-fatal errors can be parameterized with **P-0-0119, Deceleration as Best as Possible**. The drive switches to torque-free operation at the end of each error reaction.

Clearing Errors

Errors must be externally cleared.

Errors are not automatically cleared; they are cleared externally by:

Initiating the command **S-0-0099, Reset Class 1 Diagnostics**
or Pressing the **"S1"** key.

If the error state is still present, then the error will be immediately detected again. A positive edge bit on the controller enable signal is necessary in order to turn the drive on.

Clearing Errors When Controller Enable Is Set

If an error is discovered while operating with set controller enable, the drive will execute an error response. The drive automatically deactivates itself at the end of each error response; in other words, the power stage is switched off and the drive switches from an energized to a de-energized state.

To reactivate the drive:

- clear the error
- enter a 0-1 edge bit into the controller enable

Note: To reactivate the drive after an error has been detected, not only must the error be cleared, but a 0-1 edge bit of the controller enable signal must also follow.
This function differs from the DIAX-02 series drives.

Warnings

Warnings do not cause automatic shutdowns

Many areas are monitored in connection with operating modes and parameter settings. A warning will be generated if a state is detected that allows proper operation for the time being, but will eventually generate an error and thereby lead to a shutdown of the drive if this state continues.

Warning Classes

The warning class is evident from the diagnostic message

Warnings can be separated into 2 classes. They are differentiated by whether the drive executes an automatic reaction when the warning appears.

Warning Class:	Diagnostic Message:	Drive Response:
With drive response	E8xx	Drive stop
Without drive response	E2xx	--

Fig. 3-4: Division of the Warning Classes

Warnings cannot be cleared externally.

Commands

Each command that is started must also be cleared.

Commands are used to control complex functions in the drive. For example, the functions "Drive-Controlled Homing Procedure" or "Preparation For Transistion Check of Phase 3 After 4" are defined as commands.

A primary control can start, interrupt or erase a command.

Each command has a parameter with which the command can be controlled.

While a command is being executed, the diagnostic message "Cx" or "dx" appears in the H1 display, where x is the number of the command.

Command Types

There are 3 command types.

- **Drive-Controlled Command**
  - Eventually leads to an automatic drive operation or motion
  - Can be started only when controller enable is set
  - Deactivates the active operating mode during its operation
- **Monitor Command**
  - Activates or deactivates monitors or features in the control drive
- **Management Command**
  - executes management tasks; is not interruptable

Command Input and Acknowledgment

Control and monitoring of command execution occurs via the command input and command acknowlegment. The command input tells the drive if the command should be started, interrupted or ended. The commanded value is the operating data of the applicable parameter. The command input value can be

- not set and enabled (0)
- interrupted (1)
- set and enabled (3)

The drive gives the current condition of the command execution in the acknowledgment. It is contained in the data status of the command parameter.

The condition can be

- not set and enabled (0)
- in process (7)
- error, command execution not possible (0xF)
- command execution interrupted (5)
- command properly executed (3)

The **Change Bit Command** in the **Drive Status Word** helps the control recognize a change in the command acknowledgment by the drive. The bit is set by the drive if the command acknowledgment changes from the condition in process (7) to the condition error, command execution not possible (0xF) or command properly executed (3). The bit is cleared if the master clears the input (0).

The control system will recognize if the drive sets the change bit. It can read the corresponding data status of the command or the command itself, which was set sometime but has not been cleared. The control system will recognize from this if the command ended with or without an error in the drive. Afterwards this command should be cleared by the control.

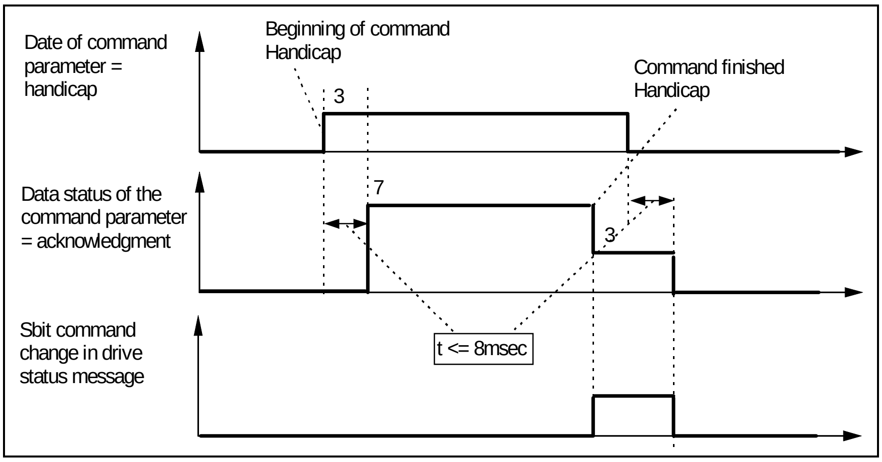


Fig. 3-5: Input, acknowledgment and KÄ bit during proper execution

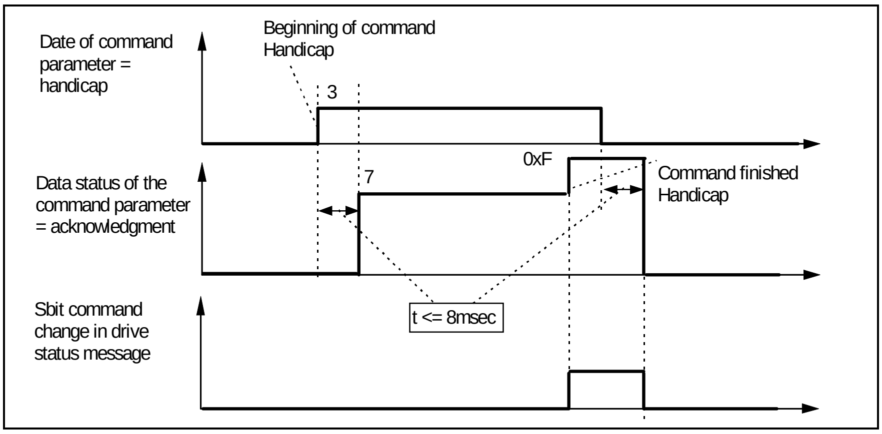


Fig. 3-6: Input, acknowledgment and KÄ bit during erroneous execution

A delay time of up to 8msec can occur in the drive between receiving the command input and setting the command acknowledgment.

3.2 Diagnostic Configurations

Overview of Diagnostic Configurations

The diagnostics are configured into 2 groups

- Current operating status and diagnostics
- Class diagnostics

Parameters exist for all important operating data

Drive-Internal Diagnostics

The current operating condition of the drive is evident by which errors, warnings, commands, drive stop signals and drive interlock signals are available and which operating mode is active. Whether the drive is in preparation for operation or in parameter mode also is displayed.

The current operating condition can be determined from

- the 2-part seven-segment display (H1 display)
- the diagnostic parameter **S-0-0095, Diagnostic Message**
- the parameter **S-0-0390, Diagnostic Message Number**
- the parameter **P-0-0009, Error Number**

The current diagnostic message with the highest priority is always shown in the H1 display, in the diagnostic parameter **S-0-0095, Diagnostic Message** and in the parameter **S-0-0390, Diagnostic Message Number**. The parameter **P-0-0009, Error Number** will contain a value unequal to 0 if an error is present. An overview of all diagnostic messages can be found in the diagnostic description in Supplement B.

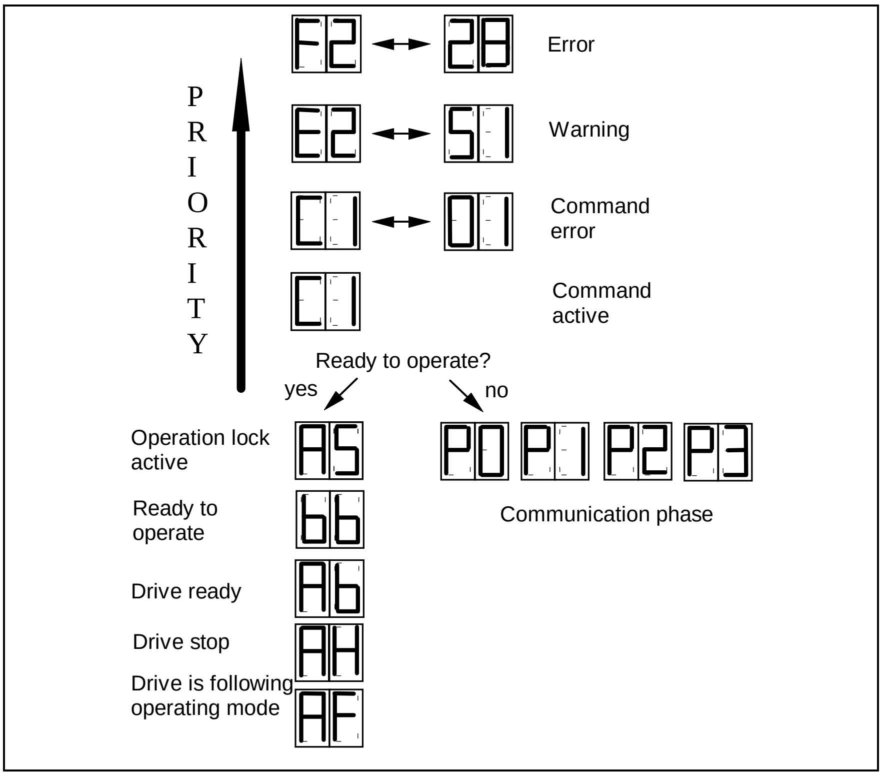


Fig. 3-7: Priority-dependent diagnostic formation in the H1 display

Diagnostic Message Composition

Each operating condition is designated with a diagnostic message, which consists of a

- diagnostic message number and a
- diagnostic text

For example, the diagnostic message for the non-fatal error "Excessive Control Deviation" is displayed as follows.

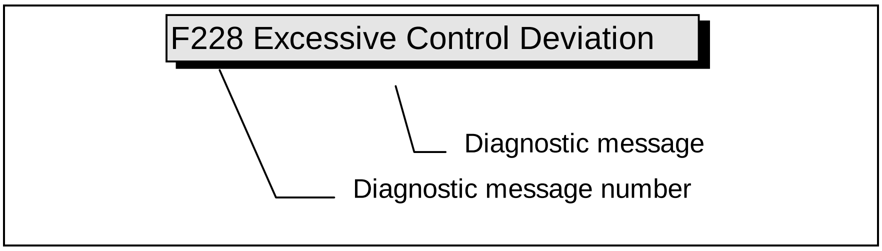


Fig. 3-8: Diagnostic message composition with a diagnostic message number and text

The H1 display alternates "F2" and "28". The diagnostic message number appears in hexadecimal format in the parameter **S-0-0390, Diagnostic Message Number**. In this example, this would be (0x)F228. The diagnostic message number and the diagnostic text are contained as a string "F228, Excessive Control Deviation" in the parameter **S-0-0095, Diagnostic Message**.

H1-Display

The diagnostic number appears on the two-part seven-segment display. The form of the display emerges from the graphic "Priority-Dependent Display of the Diagnostic Message".

With the help of this display, it is possible to quickly determine the current operating status without using a communication interface.

The operating mode cannot be seen on the H1-Display. If the drive follows the operating mode and no command was activated, then the symbol "AF" appears on the display.

Diagnostic Message

The diagnostic message contains the diagnostic number followed by the diagnostic text, as shown in the example, "Excessive Control Deviation." It can be read with the parameter **S-0-0095, Diagnostic Message** and directly displays the operation status on an operator interface.

The diagnostic message language can be changed.

Diagnostic Message Number

The diagnostic message number contains only the diagnostic number without the text. It can be read with the parameter **S-0-0390, Diagnostic Message Number** .

Error Number

The error number contains only the error number without the diagnostic text. It can be read with the parameter **P-0-0009, Error Number** and can indicate an error condition without a language barrier. This parameter contains a value unequal to "0" if an error is present in the drive.

An error is formed from the bottom 3 digits of the diagnostic number. For example, the error "F228, Excessive Control Deviation" with the diagnostic message number "(0x)F228" would produce the error number "228."

Collection of Status

The class diagnostics parameters provide a collection of status and diagnostic information for displaying operating conditions. These parameters are

- **S-0-0011, Class 1 Diagnostics**
- **S-0-0012, Class 2 Diagnostics**
- **S-0-0013, Class 3 Diagnostics**
- **S-0-0182, Manufacturer Class 3 Diagnostics**

S-0-0011, Class 1 Diagnostics

Bits for the various errors are contained in parameter **S-0-0011, Class 1 Diagnostics**. A bit is set in this parameter in the case of a drive error. The bit "Drive Interlock, Error in Class 1 Diagnostics" is set simultaneously in the **drive status word**.

All bits in Class 1 Diagnostics can be cleared by executing the command **S-0-0099, Reset Class 1 Diagnostics**.

(see Clearing Errors on page 3-4)

The following bits are supported in Class 1 Diagnostics.

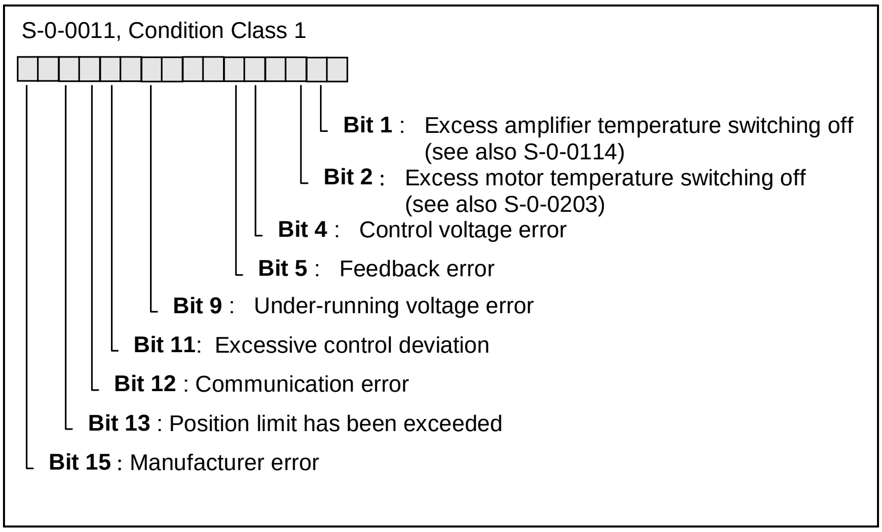


Fig. 3-9: S-0-0011, Class 1 Diagnostics

S-0-0012, Class 2 Diagnostics

Toggling a bit is signaled by a change bit in the drive status word.

Bits for various warnings are contained in this parameter. A bit is set in this parameter when a warning occurs. The bit "Change Bit Class 2 Diagnostics" is set simultaneously in the **drive status word**. This change bit is cleared by reading **S-0-0012, Class 2 Diagnostics** . Warnings may be masked in regards to their effect on the change bit with the parameter **S-0-0097, Mask Class 2 Diagnostics** .

The following bits are supported in class 2 diagnostics.

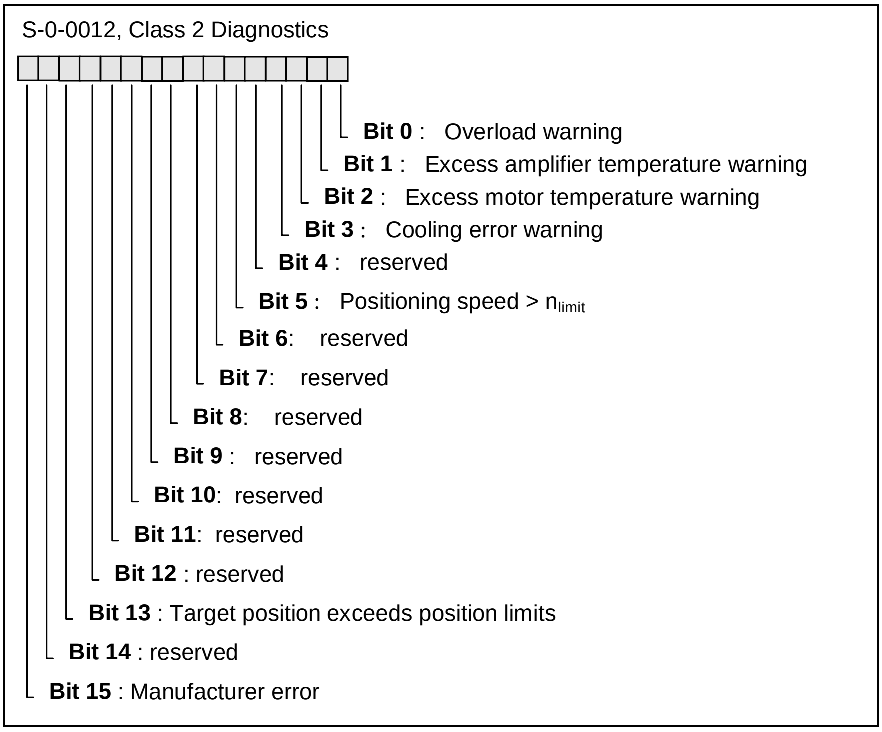


Fig. 3-10: Composition of the parameter S-0-0012, Class 2 Diagnostics

S-0-0013, Class 3 Diagnostics

Various operating status messages are stored here. If the status of a message changes, a bit will also be set here in the **Drive Status Word ("**Change Bit Class 3 Diagnostics"). This change bit is cleared by reading **S-0-0013, Class 3 Diagnostics** . Warnings may be masked in regards to their effect on the change bit with the parameter **S-0-0098, Mask Class 3 Diagnostic**.

The following bits are supported in Class 3 Diagnostics.

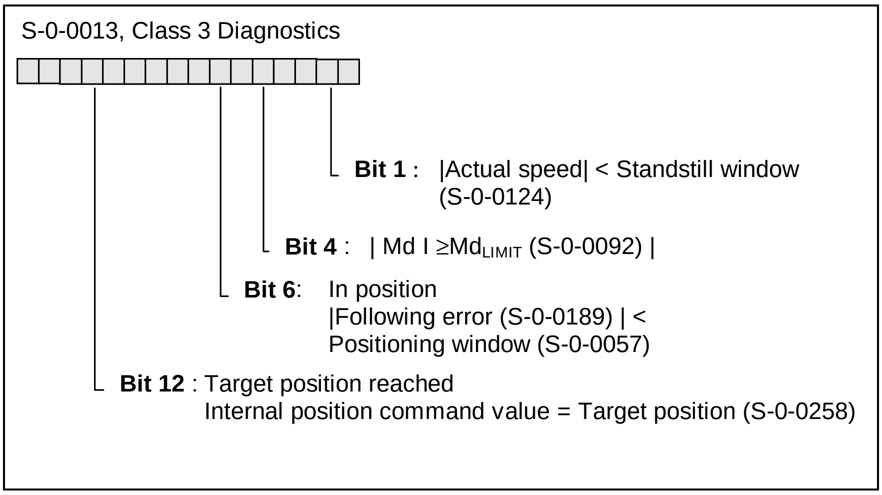


Fig. 3-11: Composition of S-0-0013, Class 3 Diagnostics

Class 2 and 3 Diagnostic Change Bits in the Drive Status Word

If the condition of a bit in **S-0-0012, Class 2 Diagnostics** or **S-0-0013, Class 3 Diagnostics** changes, the change bit class 2 or 3 diagnostics is set in the drive status word. This change bit is cleared by reading both parameters. Setting the change bit with bit-toggling in S-0-0012 or

S-0-0013 can be masked with the help of the parameter **S-0-0097, Mask Class 2 Diagnostics** or **S-0-0098, Mask Class 3 Diagnostics** .

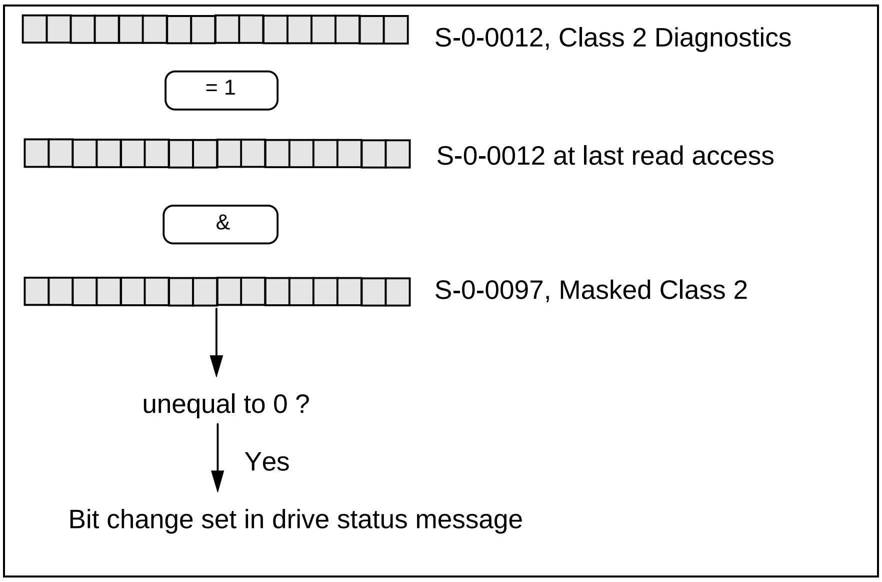


Fig. 3-12: Composition of the class 2 diagnostics change bit

S-0-0182, Manufacturer Class 3 Diagnostics

The parameter **S-0-0182, Manufacturer Class 3 Diagnostics** contains the current operating status. If the status changes, this is not signaled with a change bit.

The following bits are supported in the Manufacturer Class 3 Diagnostics.

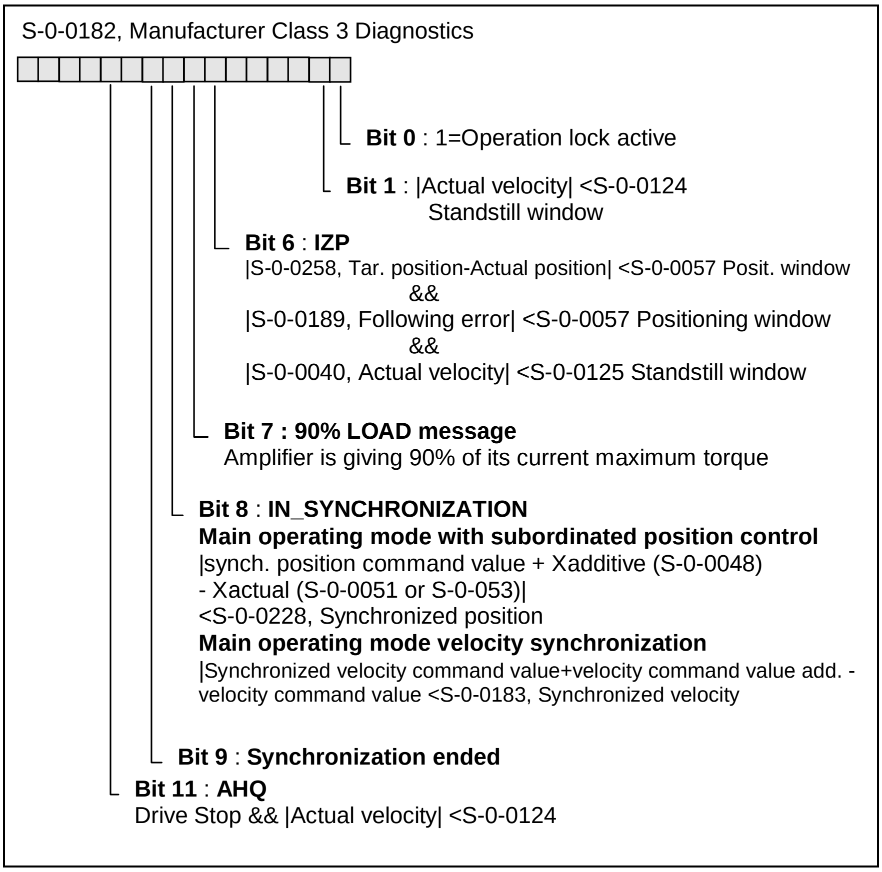


Fig. 3-13: Composition of S-0-0182, Manufacturer Class 3 Diagnostics

Refer to the Phase Synchronization Chapter for more information about bit 8, IN_SYNCHRONIZATION and bit 9, Synchronization Completed.

3.3 Parameter Mode - Operation Mode

The SERCOS control sets the communication phases including parameter mode.

After the drive is turned on, it does not automatically switch to the operating mode. The drive is put through a series of checks before the SERCOS control can switch the drive into operation mode.

Switching the drive to the operating mode is dependent on making the SERCOS INTERFACE system ready to operate.

This must occur in steps and is controlled by the master control by entering the communication phase 0 through 4 and starting/ending the commands **S-0-0127, C1 Communication Phase 3 Transition Check** and **S-0-0128, C2 Communication Phase 4 Transition Check**.

If the drive reaches phase 4 without errors, "**bb**" will appear on the H1 display. The diagnostic message is: **A013 Ready for Power ON**

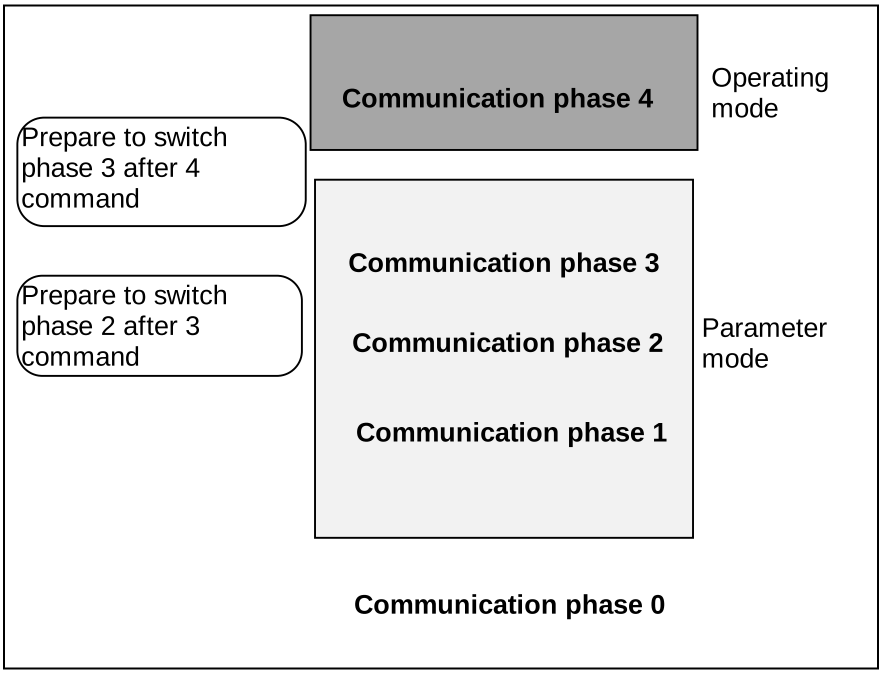


Fig. 3-14: Communication Phases

Communication between the SERCOS control and the drive is not possible during phase 0. Parameterization mode is given during communication phases 1..3.

Monitoring in the Transition Check Command

Transition check commands must be activated in the drive in order to switch from communication phase 2 to 3 and from 3 to 4. This commences a series of checks and parameter calculations.

The descriptions and solutions for transition check errors can be found in Supplement B, Diagnostic Message Descriptions.

S-0-0127, C1 Communication Phase 3 Transition Check

The following checks are run when this command is activated.

The telegram configuration is checked. The SERCOS cyclic telegram is checked for valid parameters configured in the MDT or AT data blocks and to ensure that the maximum length is not exceeded.

The command errors:
C104 Config. IDN for MDT not configurable
C105 Configurated Length > Max. Length for MDT
C106 Config. IDN for AT not configurable
C107 Configurated Length > Max. Length for AT

may occur.

Parameters are checked for proper values before the drive can switch into phase 3. If a parameter has an improper value, the following command error will occur:
C101 Communications Parameter Incomplete (S-0-0021)
The SERCOS ID numbers of invalid parameters are listed in **S-0-0021, IDN List of Invalid Op. Data for Comm. Ph. 2** and must be corrected before allowing a transition to phase 3.

The timing parameter for SERCOS communication in phase 3 and 4 are checked for proper values.

The command errors:
C108 Time Slot Parameter > SERCOS Cycle Time
C109 Position of Data Record in MDT even (S-0-0009)
C110 Length of MDT odd (S-0-0010)
C111 S-0-0009 + Record Length - 1 > S-0-0010
C112 TNcyc (S-0-0001) or TScyc (S-0-0002) Error
C113 Relation TNcyc (S-0-0001) to TScyc (S-0-0002) Error
C114 T4 > TScyc (S-0-0002) - T4min (S-0-0005)
C115 T2 too small
may occur.

S-0-0128, C2 Communication Phase 4 Transition Check

The following checks are run when this command is activated.

- Parameter **P-0-4014, Motor Type** is checked for a proper value. The command error **C204 Motor Type (P-0-4014) Incorrect** occurs if 1 (MDD) or 5 (MKD) is entered in this parameter but the corresponding motor type is not found in the motor feedback data memory.
- The parameters are checked for proper values required for switching in phase 4. The command error **C201 Invalid Parameter (-> S-0-0022)** occurs if one or more of the required parameters are invalid. The SERCOS ID numbers of the invalid parameters are listed in **S-0-0022, IDN List of Invalid Op. Data for Comm. Ph. 3** and must be corrected.
- Parameters **P-0-0513, Feedback Type** and **S-0-0116, Resolution of Rotational Feedback 1 (Motor Encoder)** are checked for proper values in the feedback data memory. If the data is invalid or cannot be read, one of the following command errors **C217 Motor Feedback Data Reading Error**
  C218 External Feedback Data Reading Error
  will be generated.
- A check is done to see if an external encoder is needed according to the operating mode parameters *S-0-0032..35* or homing parameter *S-0-0147*, but is not available because a 0 is entered in the parameter **P-0-0075, Interface Feedback**. The invalid parameters are listed in **S-0-0022, IDN List of Invalid Op. Data for Comm. Ph.3**. The command error **C210 External Feedback Required (-> S-0-0022)** is issued.

- The parameters stored in memory are read from motors with feedback data storage. If an error is found, the command error **C211 Invalid Feedback Data** appears.
- The drive controller reads operating data from the EEPROM. If an error is found, the command error **C212 Invalid Amplifier Data** appears.
- The scaling format is checked for position, acceleration, velocity and torque for proper configuration. If an error is found, one of the following errors
  C213 Position Data Scaling Error
  C214 Velocity Data Scaling Error
  C215 Acceleration Data Scaling Error
  C216 Torque/Force Data Scaling Error
  is issued.
- Values are checked for each parameter. The minimum and maximum values of each of the parameters are checked, and parameters with bit format are checked for proper configuration. If an error is found, the command error
  C202 Parameter Limit Error (-> S-0-0022)
  is issued. The SERCOS ID numbers of the invalid parameters are listed in
  S-0-0022, IDN List of Invalid Op. Data for Comm. Ph.3 and should be corrected.
- The parameter S-0-0103 Modulo Value is checked for its ability to be processed when modulo scaling is activated. If the parameter cannot be processed, the command error **C227 Modulo Range Error** is generated.
- Determines if the coprocessor is ready for initialization. If it is not, the error message **C225 Coprocessor Not Ready for Initialization** will appear.
- Special checks executed for specific parameters. For example, the encoder interface parameters P-0-0074/75/76 are checked to see if the selected encoder interface is actually available. If discrepancies are found, the command error **C203 Parameter Calculation Error (->S-0-0022)** is issued. The ID numbers of the invalid parameters are listed in **S-0-0022, IDN List of Invalid Op. Data for Comm. Ph.3** and should be corrected.
- Encoder initializations are executed. Depending on the type of encoder, specific errors may occur during initialization (for example, invalid position with DSF feedback). One of the following command errors
  C220 Mot.Feedback Initializing Error
  C221 Ext. Feedback (Encoder) Initializing Error
  will be issued.
- Absolute encoder monitoring. If the actual position is outside the actual position range +/- **P-0-0097, Absolute Encoder Control Window** before the machine was last switched off, the error **F276 Absolute Encoder Error** will be generated. The transition command will not be acknowledged as an error, but the error may be cleared by executing the command **S-0-0099, C5 Reset Class 1 Diagnostics**. (See also "Clearing Errors" on page 3-4).
- A determination is made whether the coprocessor has processed and accepted its initialization values. If this is not the case, the command error
  C226 Coprocessor Acknowledge Failed will appear.
- Various internal settings are made depending on the controller type. If the parameter S-0-0140, Controller Type cannot be read, the command error **C228 Controller Type (S0-0140) Incorrect** is issued.

4 Communication Through the SERCOS-INTERFACE

4.1 Overview of SERCOS Communication

Communication of devices with DIAX-03 software can be done only through the SERCOS Interface at this time. The basic features of this interface are:

- **Data exchange cycle of set and actual values with exact time equidistance**
- **Synchronization of measurement point and command value input**
- **Overall synchronization of all drives connected to the control**
- **Minimum cycle time 0,5 msec / maximum cycle time 65msec**
- **Baud rate selectable, either 2 or 4 MBaud**
- **Service channel for settings and diagnostics**
- **Data transfer through fiber optic ring**
- **Configuration of the telegram contents**

The features of the interface are mentioned here briefly. More detailed information is included in the SERCOS interface specification.

4.2 Data Transfer Cycle Through SERCOS

To synchronize the drives in a ring, the **Master Synchronization Telegram** (MST) is sent at the beginning of every SERCOS cycle. The MST contains only the preset communication phase information from the master.

You can configure the master data and drive telegram.

Once during every Sercos cycle, a **Master Data Telegram** (MDT) is sent from the control to every drive. The master control word, the service channel and a configurable data block are included here. In this data block, the command and limit values are contained, which are sent by the control according to the operation mode of the drive. The contents of this data block can be configured through the telegram settings.

The master data telegram is received by all drives in the ring at the same time.

In addition, a **Drive Telegram** (AT) is sent during each Sercos cycle time from every drive to the control. The drive status word, the service channel and a configurable data block are contained here. This data block contains mainly actual and status values, which are needed to operate the corresponding drives by the control.

Master Control Word

The master control word is part of the Master Data Telegram. The most important control information for the drives is contained here, such as

- **Drive ON and Drive enable**
- **Drive Stop**
- **Interpolator cycle**
- **Set operation mode**
- **Real-time control bit 1 and 2**
- **Control information for the service channel**

The master control word is structured as follows:

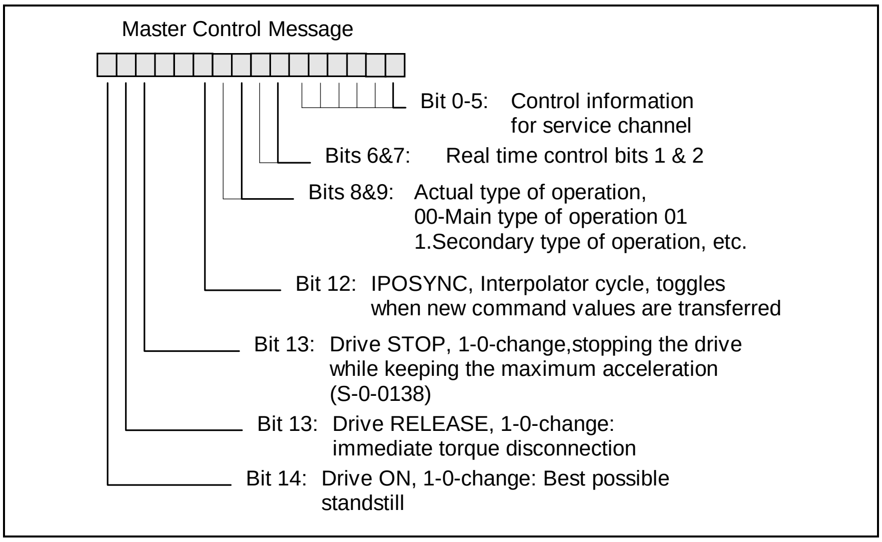


Fig. 4-1: Structure of the master control word

The master control word is transferred through the service channel to the control by using the parameter **S-0-0134, Master Control Word**.

Controller enable

The activation of the drive is done through a 0-1 edge of the controller enable signal. For drive controllers with a SERCOS Interface, the controller enable signal corresponds to bit 15 in the master control word of the master data telegram.

To have the controller enable signal accepted (meaning that the drive is ready to accept commands from the control), the following requirements must be fulfilled:

- SERCOS Interface in operating mode (Communication phase 4)
- No drive error
- Power section enabled

In this condition, the drive displays "**Ab**" on the seven-segment display, and the drive diagnostic from the parameter **S-0-0095, Diagnostic** is **A012, Control and Power Sections Ready for Operation**.

If the controller enable is set, the seven-segment display changes to "**AF**"**.** After that it displays the drive diagnostic for the activated operation mode (i.e., **A101 Position control, Encoder 1**).

If the controller enable is activated without a DC bus voltage ("**Ab**" doesn't appear on the H1 display), the error message **F226 Undervoltage Error** will be displayed.

Drive Status Word

The drive status word is part of the drive telegram. All important status information for the drive is contained here.

- **Readiness for use of the control and power sections**
- **Drive error**
- **Change bits for diagnostics class 2 and 3**
- **Current operation mode**
- **Real-time status bits 1 and 2**
- **Status information for the service channel**

The drive status word is structured as follows:

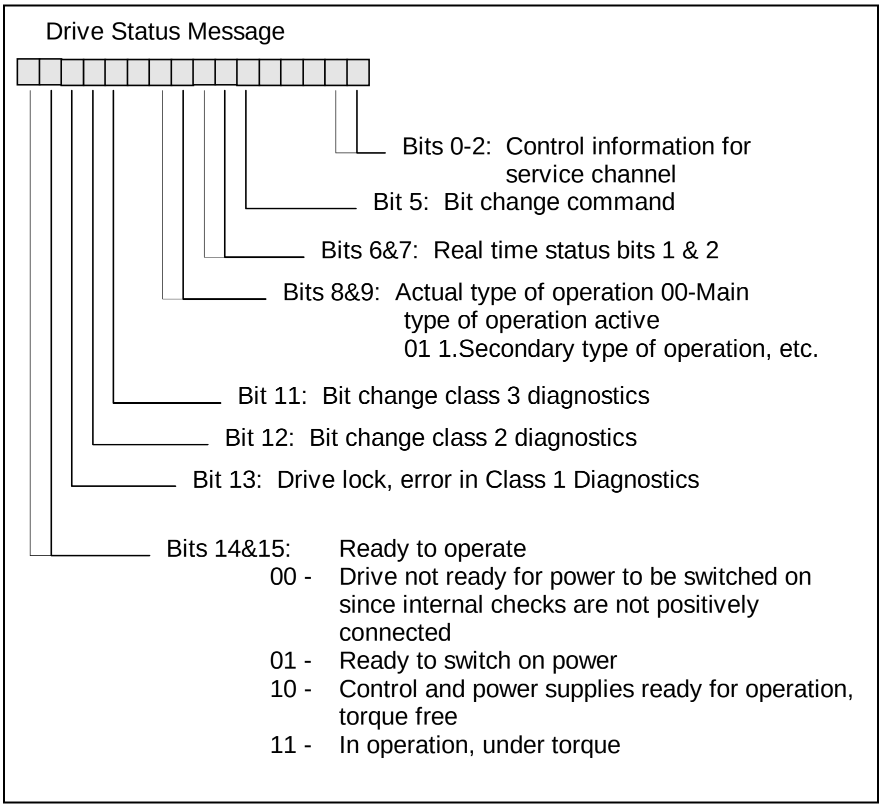


Fig. 4-2: Structure of the drive status word

The drive status word is transferred through the service channel to the control with the parameter **S-0-0135, Drive Status Word**.

Confirmation of the Controller Enable

The drive confirms the controller enable setting in the drive status word of the drive telegram. Bits 14 and 15 of "10" (control and power section enabled, temporarily) changes to "11" (in operation, temporarily enabled) after the controller enable is activated and was accepted.

The confirmation of the controller enable setting in the status word is acknowledged after the drive has sufficient time to prepare for its operation mode. For example, the asynchronous motor uses this time to magnetize itself.

If the controller enable is disabled, the drive performs its reaction through parameter **P-0-0119, Best possible deceleration**. Here, time passes between resetting and confirming the reset. This time depends on

- the setting of the parameter P-0-0119, Best possible deceleration
- the existence of a motor brake and its parameterization.
- the velocity of the axis before the reset of the controller enable

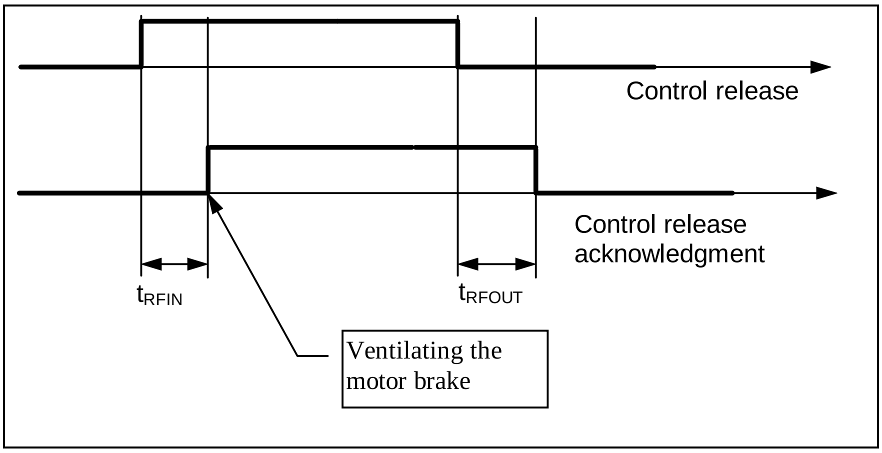


Fig. 4-3: Confirmation of the controller enable

Typical values for t_{RFEIN} are about 8msec for synchronous motors or 300msec for asynchronous motors.

Note: During the time t_{RFEIN}, the control should set its command values to reach a set velocity of 0. The activation of the optional motor brake takes place after the controller enable confirmation time. (0-1 edge from confirmation of controller enable)!

4.3 Real-Time Control and Status Bits

In the master control and drive status words, there are 2 configurable real-time bits. The configuration of these binary signals is achieved through parameters

- **S-0-0301, Allocation of Real-Time Control Bit 1**
- **S-0-0303, Allocation of Real-Time Control Bit 2**
- **S-0-0305, Allocation of Real-Time Status Bit 1**
- **S-0-0307, Allocation of Real-Time Status Bit 2**

The parameter number that will be assigned to the corresponding real-time status bit is set here. Bit 0 of this parameter will be sent cyclically to the master or the drive via the real-time status or control bit.

4.4 Transmission of Required Data Through SERCOS

Required data are not transmitted cyclically; they are transmitted through the service channel.

The transmission through the service channel is done in several steps for the MDT and AT, and the transmission of an element could last over several Sercos cycles.

The service channel is used for:

- **Parameterization**

and

- **Diagnostic**

4.5 Start Up for the SERCOS Interface

To start the interface you have to:

- **connect the fiber optic cable**
- **set the drive address**
- **set the transmission rate**
- **set the transmission power**

All settings can be done with switches on the front plate or directly on the plug-in card of the interface module DSS 2.1.

The settings should be complete before connecting communication to the fiber optic ring.

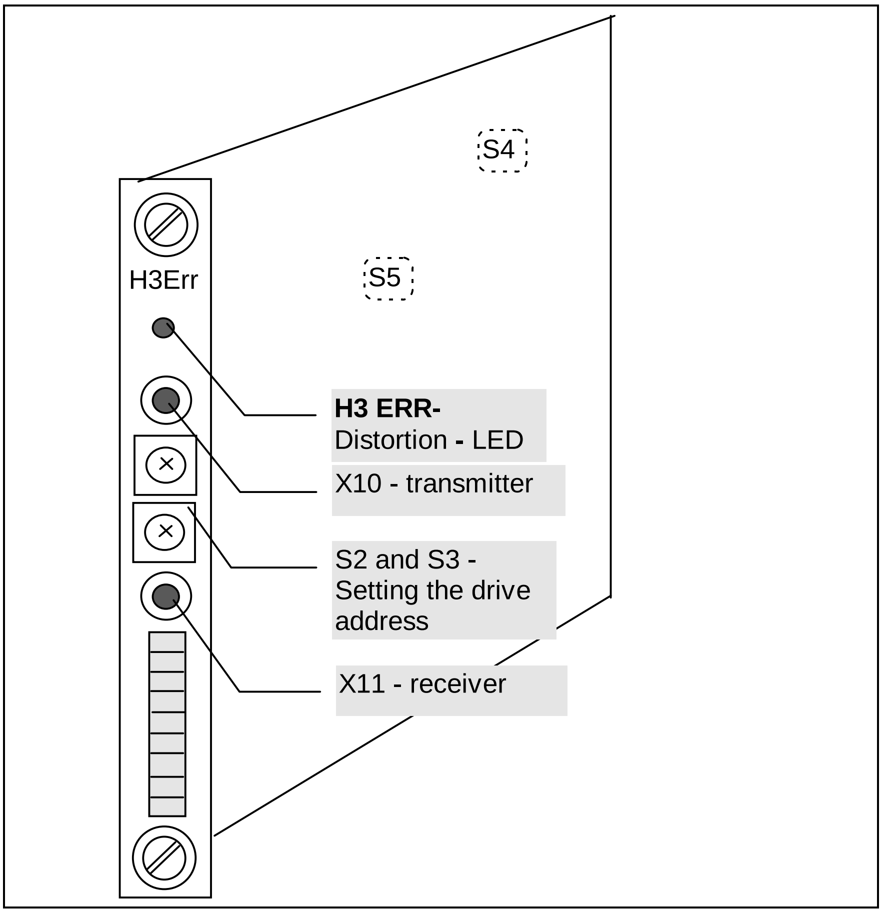


Fig. 4-4: Control communication module DSS2

See also Supplement B, Diagnostic Explanations: **E410 Slave not scanned or address 0**.

Setting the Drive Address of the SERCOS Interface

The drive address is set on the front plate of the DSS 2.1 through switches S2 and S3. You can set addresses in the range of 0 to 99.

The drive address is not dependent on the sequence of drive connections through the fiber optic ring.

Connection of the Fiber Optics for the SERCOS Interface

The fiber optic communication structure requires that the transmitter of the previous device has to be connected with the next device.

The fiber optic cable with the receive signal has to be connected to X11. If a signal is being sent through the cable, you can see a red light here.

The received light signal is amplified in the interface module and appears transmit output (X10), if the control voltage is turned on at the drive power supply. You have to connect the fiber optic cable that leads to the receiver of the next device to X 10.

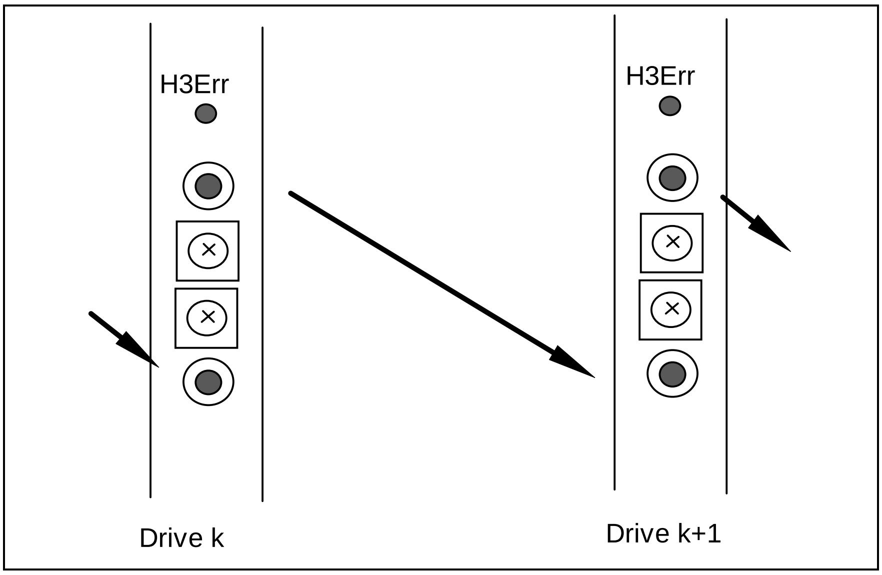


Fig. 4-5: General connection to a fiber optic ring

Transmission Rate of the SERCOS Interface

The transmission rate is set by the manufacturer to 2MBaud. The rate can be set with switch S4 on the interface module DSS 2.1. To do this, you have to remove the card from the slot.

Baud Rate:	Switch S4:	Remarks:
2 MBaud	OFF	Shipping condition
4 MBaud	ON	

Fig. 4-6: Setting the transmission rate

Transmission Power of the SERCOS Interface

The transmission power is set by the manufacturer to -9dBm. The transmission power can be set with switch S5 on the interface module DSS 2.1. To do this, you have to remove the card from the slot.

Transmission Power:	S5-B:	S5-A:
-11 dBm	OFF	OFF
-9 dBm	OFF	ON
-8 dBm	ON	OFF
-7 dBm	ON	ON

Fig. 4-7: Setting the transmission power

Distortion LED (H3Err) of the SERCOS Interface

The distortion LED indicates if the power of the received signal is too high or too low or if no input is recognized on the receive signal. By adjusting the transmission power of the previous ring participant, you can change to the permissible signal range. The LED turns off when the signal is no longer distorted.

4.6 SERCOS Telegram Configuration

To operate the drive properly, the settings of the telegram send and receive times, their lengths, and content have to be transmitted from the SERCOS master to the drive.

Configuration of the Telegram Send and Receive Times

The requirements to calculate the time slot parameter (telegram send and receive times) are stored in the following parameters:

- **S-0-0003, Minimum AT Transmit Starting Time (T1min)**
- **S-0-0004, Transmit/Receive Transition Time (TATMT)**
- **S-0-0005, Minimum Feedback Acquisition Time (T4min)**
- **S-0-0088, Receive to Receive Recovery Time (TMTSG)**
- **S-0-0090, Command Value Transmit Time (TMTSG)**

within the drive. The SERCOS Master calculates from the information received from all drives the time slot parameters for the operation of the communication phase 3. Those values are transferred to the drive in communication phase 2 through the parameters:

- **S-0-0002, SERCOS Cycle Time (Tscyc)**
- **S-0-0006, AT Transmission Starting Time (T1)**
- **S-0-0007, Feedback Acquisition Starting Time (T4)**
- **S-0-0008, Command Valid Time (T3)**
- **S-0-0009, Beginning Address in Master Data Telegram**
- **S-0-0010, Length of Master Data Telegram**
- **S-0-0089, MDT Transmit Starting Time (T2)**

The drive checks these settings while processing the command **S-0-0127, C1 Transfer preparation to comm.-phase 3**. The following error messages may appear:

- **C101 Invalid Communications Parameter (S-0-0021)**
- **C108 Time Slot Parameter > SERCOS Cycle Time**
- **C109 Position of Data Record in MDT Even(S-0-0009)**
- **C110 Length of MDT Odd (S-0-0010)**
- **C111 ID9 + Record Length - 1 > Length MDT (S-0-0010)**
- **C112 TNcyc (S-0-0001) or TScyc (S-0-0002) Error**
- **C113 Relation TNcyc (S-0-0001) to TScyc (S-0-0002) Error**
- **C114 T4 > TScyc (S-0-0002) - T4min (S-0-0005)**
- **C115 T2 Too Small**

Configuration of Telegram Contents

The telegram contents are set through parameters:

- **S-0-0015, Telegram Type Parameter**
- **S-0-0016, Custom Amplifier Telegram Configuration List**
- **S-0-0024, Config.-List of the Master Data Telegram**

However, the drive-directed conditions for the type and number of configured data must be in the set range. Those are provided by the drive in:

- **S-0-0185, Length of the Configurable data record in the AT**
- **S-0-0186, Length of the Config. Data Record in the MDT**
- **S-0-0187, List of Configurable Data in the AT**
- **S-0-0188, List of Configurable Data in the MDT**

The drive checks these settings while processing the command **S-0-0127, C1 Transfer preparation to comm.-phase 3**. The following error messages may appear:

- **C104 Config. IDN for MDT Not Configurable**
- **C105 Configurated Length > Max. Length for MDT**
- **C106 Config. IDN for AT Not Configurable**
- **C107 Configurated Length > Max. Length for AT**

4.7 SERCOS Interface Error

If conditions are detected in the drive that prevent the correct operation of the interface, or if error values are recognized during the initialization phase, the drive responds by resetting to communication phase 0. This means that no drive telegrams will be sent. The drive proceeds with the programmed error reaction.
(see **P-0-0119, Deceleration as best as possible**) and waits for the reinitialization of the SERCOS ring through the master.

Possible errors could be:

- **F401 Double MST Error Shutdown**
- **F402 Double MDT Error Shutdown**
- **F403 Invalid Communication Phase Shutdown**
- **F404 Error During Phase Progression**
- **F405 Error During Phase Regression**
- **F406 Phase Switching Without Ready Signal**

Diagnostic of the Interface Status

The parameter **S-0-0014, Interface Status** is used to analyze the existing initialization error and the current communication phase.

Error Count for Telegram Interrupts

The drive checks every received master synchronization and master data telegram for

- **the correct receive time set point,**
- **the assigned telegram length and**
- **the correct CRC check sum**

A telegram interrupt is registered with an incrementation in the error counter. For this purpose, these two parameters are used: **S-0-0028, MST Error Count** and **S-0-0029, MDT Error Count**.

These parameters are canceled by switching the communication phase from 2 to 3 (S-0-0028) or from 3 to 4 (S-0-0029).

5 Motor Configuration

5.1 Characteristics of the Different Motor Types

You can use the following motor types made by Indramat with the DIAX-03 software.

- MDD
- MKD
- 2AD/1MB/ADF
- LAF/LAR
- LSF

The individual motor types differ in the following points:

- Availability of data memory in the motor feedback
- Synchronous motor - Asynchronous motor
- Linear motor - Rotational motor
- Temperature check can be changed or not
- Basic load (load default) possible or not
- Motor encoder interface setting can be changed or one setting only

The individual motor types have the following characteristics

Motor type	Motorfeed-back data memory	Syn/Asyn	Temp.check	Motor-encoder interface	Load default
MDD/MKD	yes	synchronous	fixed	fixed (1)	mode possible
2AD/ADF	no	asynchronous	param.	param.	no
1MB	no	asynchronous	param.	param.	no
LAF/LAR	no	asynchronous	param.	param.	no
LSF	no	synchronous	param.	fixed (8)	no

Fig. 5-1: Characteristics of the Motor Types

Motor Feedback-Data Memory

The motor feedback data memory contains all motor-related parameters

For MDD and MKD motors, a motor feedback-data memory is provided, in which all motor-dependent parameters are stored. The drive controller recognizes this automatically and reads those parameters after turning on the device from the data memory with the command **S-0-0128, C2 Communication phase transition check**.

The following parameters are stored in this data memory:

- **S-0-0109, Motor Peak Current**
- **S-0-0111, Motor Current at Standstill**
- **S-0-0113, Maximum Motor Velocity (nmax)**
- **S-0-0141, Motor Type**
- **P-0-0018, Number of Pair of Poles/Pole Distance**
- **P-0-0051, Torque/Force Constant**
- **P-0-0510, Moment of Inertia of the Rotor**
- **P-0-0511, Brake Current**

and don't have to be entered for start up or after exchanging the motor.

Linear-Rotational

Depending on the setting of either rotational or linear motor, the units of measurement and the decimal places are changed by the parameters.

Depending on whether a linear or rotational motor is being used, changes in the units and the number of decimal places will be made by the parameters. The following table displays the differences in scaling of these parameters:

ID number:	Rotational:	Linear:
S-0-0100	0,1 Amin/m	0,1Amin/m
S-0-0113	0,0001 RPM	0,0001 mm/min
S-0-0116	Cycles/Rev.	0.00001 mm
P-0-0018	Pair poles	0,1mm
P-0-0040	RPM/10V	0,1 m/min/10V
P-0-0041	RPM/10V	0,1 m/min/10V
P-0-0042	degree/10V	0,001 mm/10V
P-0-0043	degree/10V	0,001 mm/10V
S-0-0348	mAsec²/rad	mAsec²/mm

Fig. 5-2: Scaling in Linear or Rotational Motors

The selected motor type also affects the scaling of the position data.

For example, it is impossible to set rotational motor settings for linear motors and linear motor settings for rotational motors. This would generate the command error **C213 Position Data Scaling Error** during a delayed phase switch.

Synchronous-Asynchronous

Specific parameters are used only for synchronous motors, others only for asynchronous motors.

There are differences in the use and review of the parameters in the command **S-0-0128, Communication phase 4 transition check**. They are:

Synchronous:

- **P-0-4004, Magnetizing Current** is set to 0
- **P-0-0508, Commutator Offset** is checked for validity

Asynchronous:

- **P-0-4004, Magnetizing Current** is initialized
- **P-0-0508, Commutator Offset** is not checked

Temperature Monitoring

The switch-off limit for the motor temperature check is fixed at one point for MDD and MKD motors.

The following parameters are used to monitor the motor temperature:

S-0-0201, Motor Warning Temperature

S-0-0204, Motor Switch-Off Temperature

For MDD and MKD motors, the parameter default values are:

S-0-0201, Motor Warning Temperature= 140,0°C

S-0-0204, Motor Switch-Off Temperature= 150,0°C

Those default values can be used to help set the parameters for all other motor types. However, you must ensure that the switch-off limit is not set higher than the maximum permissible temperature of the motor.

The maximum input value for **S-0-0201, Motor warning temperature** is **S-0-0204, Motor switch off temperature**.

If the temperature of the motor exceeds the value in **S-0-0201, Motor warning temperature**, the warning message **E251 Motor overtemperature warning** is generated.

If the temperature rises to the motor switch-off temperature, the error message **F219 Motor Overtemperature Shutdown** is displayed.

The minimum input value for **S-0-0204, Motor switch off temperature** is **S-0-0201, Motor warning temperature**.

To display the motor temperature, the parameter **S-0-0383, Motor temperature is used.**

The drive controller checks for proper functioning of the motor temperature monitoring system. If discrepancies occur (temperature drops below -10 degrees), the warning **E221 Warning motor temperature control** will be displayed for 10 seconds. After that, the error message **F221 Error motor temperature control** is generated.

Load Default Feature

MDD and MKD motors have a data memory in their feedbacks. The data memory contains a set of default control parameters in addition to all motor-dependent parameters.

These parameters are activated with the load default feature.

(see also "Load Default"feature)

5.2 Setting the Motor Type

The setting of the motor type is done either:

- automatically by reading the motor feedback memory, or
- through the input of the parameter **P-0-4014, Motor type.**

This depends on the motor type used.

The motor type should be set before start up because the motor type affects the following drive functions:

- Motor temperature monitor
- Load default feature
- Setting of the motor parameters
- Commutation

Automatic Setting of the Motor Type for Motors with Feedback Memory

MDD and MKD motors have a motor feedback data memory, in which the motor type is stored (along with other information). The drive controller recognizes these motor types automatically and

- the value of the parameter **P-0-4014, Motor type** is set to its proper value and will be write-protected.
- the value of the parameter **P-0-0074, Motor encoder interface** is set to the defined value for the corresponding motor type and will be write-protected.

- all bits except bit 6 are set for absolute/not-absolute to "0" in the parameter **S-0-0277, Position feedback type 1 parameter**.
- all motor-dependent parameters will be read from the motor feedback data memory. (see Motor Feedback-Data Memory on page 5-1)
- the value of **S-0-0201, Motor warning temperature** will be set to 140,0°C, and the **S-0-0204, Motor switch off temperature** will be set to 150,0°C.

This procedure is followed right after switching on as in the command **S-0-0128, C200 Communication phase 4 transition check**. The command error message, **C204 Motor type(P-0-4014) incorrect**, will be generated in case an MDD or MKD motor is selected in **P-0-4014, Motor type** but the corresponding character sequence cannot be found in the motor feedback data memory.

Setting of the Motor Type Through P-0-4014, Motor Type

For motors without motor feedback data memory, you have to set the motor type through **P-0-4014, Motor type**. The following values are planned for the different motor types:

Motor type:	**Data:**	**Remarks:**
MDD	1	auto detect
2AD/1MB/ADF	2	must be set
Linear synchronous motor	3	must be set
Linear asynchronous motor	4	must be set
MKD	5	auto detect

Fig. 5-3: Setting the Motor Type

5.3 Asynchronous Motors

With DIAX03-Firmware ELS04VRS, you can use asynchronous motors in the entire rpm range, including constant power range.

In addition to the general motor parameters, you have to set the following asynchronous motor parameters for specific motors according to the Indramat default:

- **P-0-4004, Magnetization Current**
- **P-0-4012, Slip Factor**
- **P-0-0530, Slip Increasing**
- **P-0-0531, Sweep Current Limit**
- **P-0-0533, Flux Loop Proportional Gain**
- **P-0-0534, Flux Loop Integral Action Time**
- **P-0-0535, Motor Voltage No Load**
- **P-0-0536, Motor Voltage Maximum**
- **P-0-0537, S1-Kink-Speed**

The user has two additional parameters to adjust the drive to his requirements.

- **P-0-0532, Scaling Factor Pre-Magnetizing**
- **P-0-0538, Motor Function Parameter 1**

Basics for the Asynchronous Motor

Asynchronous motors are divided in three working ranges.

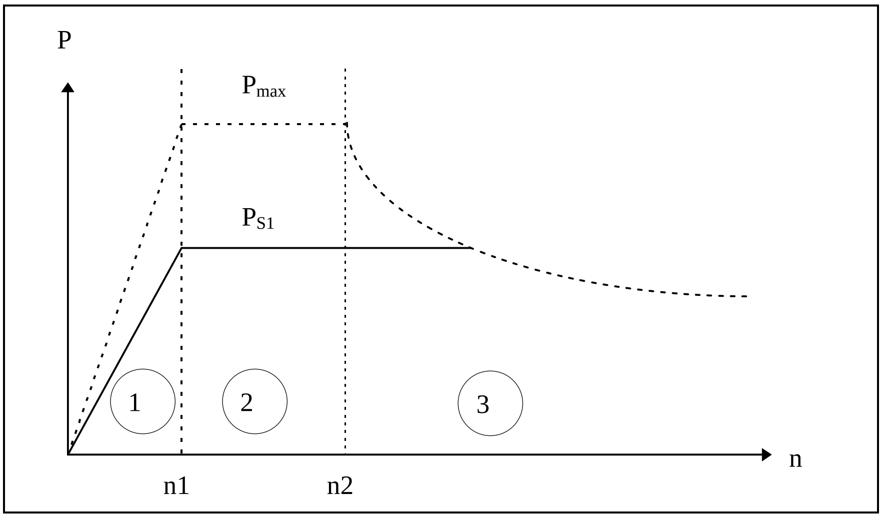


Fig. 5-4: Subsections of Work Ranges

Section 1:

Basic RPM Range is defined by a constant torque and locked rotation constant (parameter P-0-0051). In idle, the programmed magnetization current flows. The motor voltage is less than the maximum control output voltage. The corner RPM n1 is directly proportional to the DC bus voltage.

Section 2:

Range of Constant Power. The motor voltage is constant; the idle voltage and the corresponding magnetization and torque constants fall with increasing velocity. The slip is increased correspondingly.

The adjustment of magnetization current and slip is executed automatically by the field control. The voltage is decreased during idle to the motor idle voltage (P-0-0535), and when fully in use it is increased to the maximum motor voltage (P-0-0536).

Section 3:

Range of Decreasing Peak Power. The motor works at the sweep limit; an actual sweep is eliminated with the vector control. According to the parameter "sweep current limit," the peak current will be decreased enough so that the maximum power cannot be exceeded. An increase in current would lead only to wasted power and reduced shaft power. The peak power in range 3 is proportional to the square of the DC bus voltage. It is ensured that the maximum power always is reached for each DC bus voltage without parameter adjustment.

The power in range 3 cannot be extended through the use of more powerful controllers.

Torque Evaluation

In contrast to the RAC, 100% torque is not the peak value, but the motor set value according to the ID plate. Since the peak torque of asynchronous motors is limited to 2.5 times of the set value, you can reach torques up to 250%.

The significance of the torque values changes in the field-weakening range since the torque in the controller is set equal to the torque-producing current Iq. The torque, however, is the product of Iq and air gap induction, which decreases in the field-weakening range.

The assignment of the torque values in the different velocity ranges is displayed in the following picture:

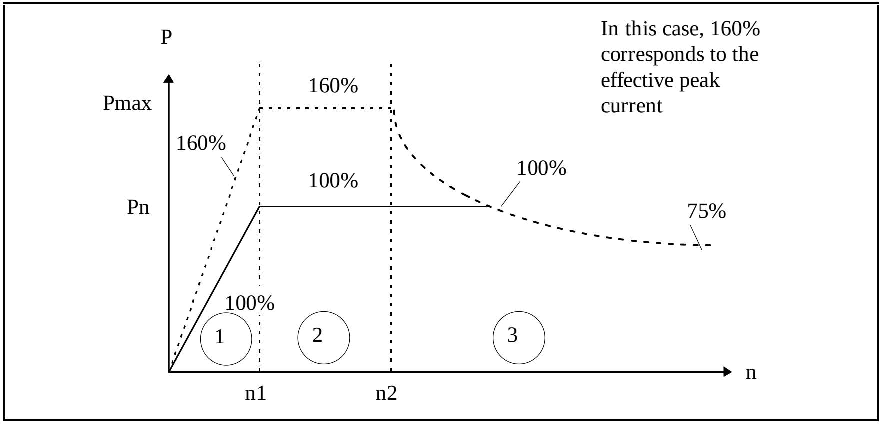


Fig. 5-5: Torque assignment

In range 1, the torque value is the actual torque. 100% = rated torque

In range 2, the torque value is equal to the power. 100% = rated power according to selection list (The rated power of the motor rating plate is not relevant here since it could relate to another DC bus voltage.)

Range 3 is similar to the evaluation of range 2, except that the preset torque decreases in correspondence to the increasing velocity of the peak power. For high velocity, the maximum torque value can drop below 100%.

In braking mode, you can reach 50% higher torque values in this range than in motor operation mode.

User-Defined Settings for the Asynchronous Motor

To operate an asynchronous motor, you have to set the specific DIAX03 motor parameters in the controller. The parameters are stored on the DSM module and are therefore transferable to another controller.

Note: Motor-specific parameters are used by all DIAX03 controls (DKR, DDS2.2) in the same manner. The resulting power characteristics curve depends on the current and especially on the DC bus voltage. Several additional parameters are available so the user can optimize the drive to his requirements.

Scaling Factor Pre-Magnetizing

With the pre-magnetizing scaling factor (P-0-0532), you can set the active magnetization current.

The following applies:

Effective magnetization current = magnetization voltage x scaling factor pre-magnetizing

Fig. 5-1: Calculation of the Effective Magnetization Current

If the pre-magnetizing scaling factor is at 100%, the motor is completely magnetized. There is a linear connection between set current and torque according to the torque constant P-0-0051. The torque builds up without delay. The drive has perfect servo properties.

The disadvantages are the high iron loss and the higher noise level in idle and in work mode, especially at 4kHz switching frequency, when the full magnetization current is flowing. For main spindle applications, it has proven successful to reduce the pre-magnetizing scaling factor to 50%. Through this procedure, the motor stays cooler and is not as noisy, while peak power is maintained. The extended start control time (only for jumps that exceed half the peak torque) and the missing linearity of torque and voltage do not distort the main spindle drives.

The qualitative connection between the pre-magnetizing scaling factor and drive behavior is displayed in the following graphic:

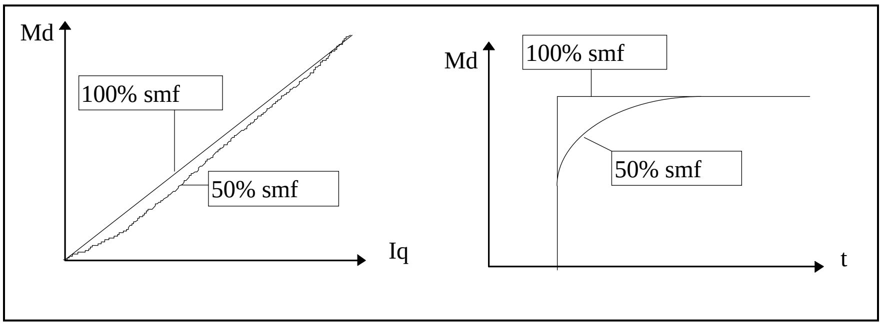


Fig. 5-6: Connection of pre-magnetizing scaling factor and drive behavior

The torque buildup is delayed by about 200ms during pre-magnetizing because the air gap range can only increase slowly in relation to the rotor time constant.

By reducing the pre-magnetizing scaling factor, you can achieve a better synchronous operation (in the one-thousandth degree range). This will reduce distorted torques, which result from saturation effects in the motor and from unavoidable deviations from an ideal sine form. To keep the torque linear in this case, the slip factor must be increased in the same measure at which the pre-magnetizing scaling factor was decreased. Warning: Torque constant, continual torque and peak torque are reduced!

Example: The synchronous operation should be improved in a servo drive. The pre-magnetizing scaling factor is set to 40%, and the slip factor is set to 2.5 times of the original value. The continual and peak torque decrease to approximately 40%. The reference speed increases to 2.5 times the velocity.

"S1-Operation" Function

By setting Bit 0 in the parameter "Motor function parameter," the function "S1-Operation" is activated.

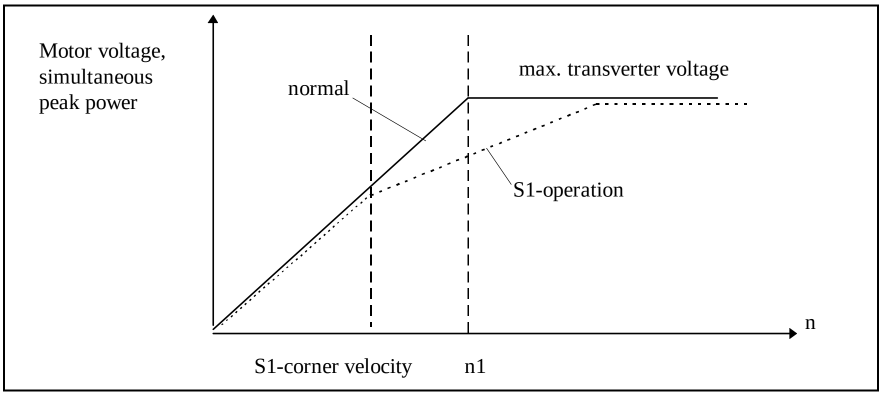


Fig. 5-7: Operating characteristics of the reference speed

Already from the S1 reference speed (corner velocity) (P-0-0537), a controlled field weakening prevents a continued increase in iron losses. If the motor-typical S1 kink speed drops drastically below the DC bus voltage and the motor-type dependent kink speed n1, then the iron loss in range S1 kink speed is kept constant until the output voltage is reached. The peak torque does decrease, but the motor losses are lower for resistances ≤ set rated loads. So activation of "S1-Operation" is advantageous for drives that are used with constant velocity in the medium RPM range, as would be the case for printing machines.

The S1 kink speed can be drastically below the electrical kink speed n1 especially with non-ventilated motors.

The S1 operation also can be used in connection with the reduced pre-magnetizing scaling factor.

Motor Function Parameter 1

Bit No.	Meaning
#0	= 0: no magnetizing current drop = 1: S1-magnetizing current drop active since the S1 kink speed
#1	= 0: Transmission reverse = 1: Voltage reverse

Fig. 5-8: Meaning P-0-0538, motor function parameter

5.4 Motor Holding Brake

The drive controllers of the DIAX-03 series allow for control of a motor holding brake. This is used to prevent undesired axis movements when the controller enable is turned off.

Note: The holding brake is not designed as a service brake. The brake will be worn out after 20.000 rotations while brake is locked.

To set the motor holding brake, use the parameters:

- **P-0-0525, Type of Brake**
- **P-0-0526, Brake Control Delay**
- **P-0-0511, Brake Current**

For motors with motor feedback data memory, the parameters for the motor holding brake are set automatically.

The parameters will be set automatically for the MDD or MKD motors. For all other motor types, you have to retrieve the values from the data sheet for the motor or the motor brake

Connection of the Motor Holding Brake

You connect the motor brake through connector X6 on the drive controller.

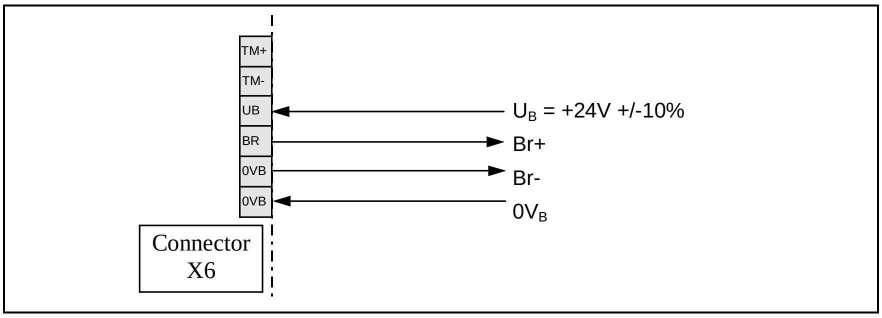


Fig. 5-9: Connection of the motor brake

To provide the required brake control voltage, you have to connect +24V external voltage. The brake is controlled with the contacts Br+ and Br-.

Note: To ensure error-free monitoring, a connection between the 0V of the brake supply and the 0V of the drive controller is recommended.

Setting the Motor Brake Type

In **P-0-0525, Motor brake type** , you set either a self-locking (MDD and MKD motors) or a self-releasing brake.

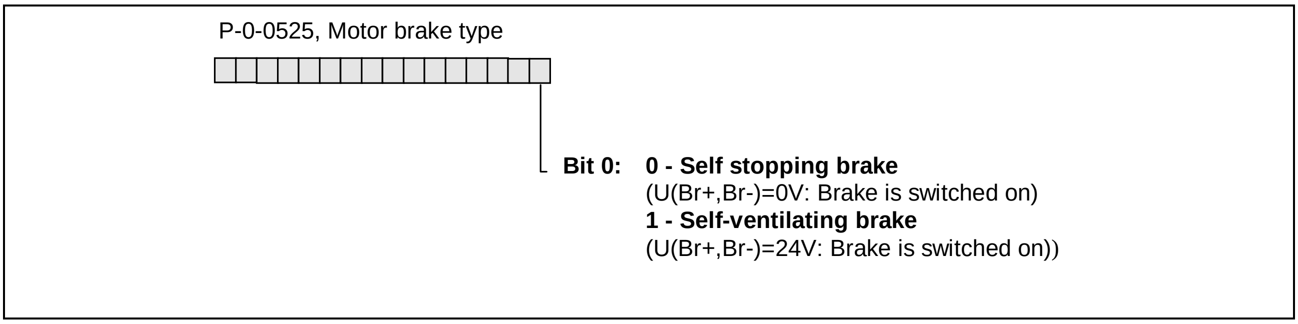


Fig. 5-10: Setting the motor brake type

Setting the Brake Control Delay

In **P-0-0526, Brake control delay**, you set the time it can take for the brake to become effective.

The standard value for the direct connection of holding brakes for Indramat motors should be set at 100msec.

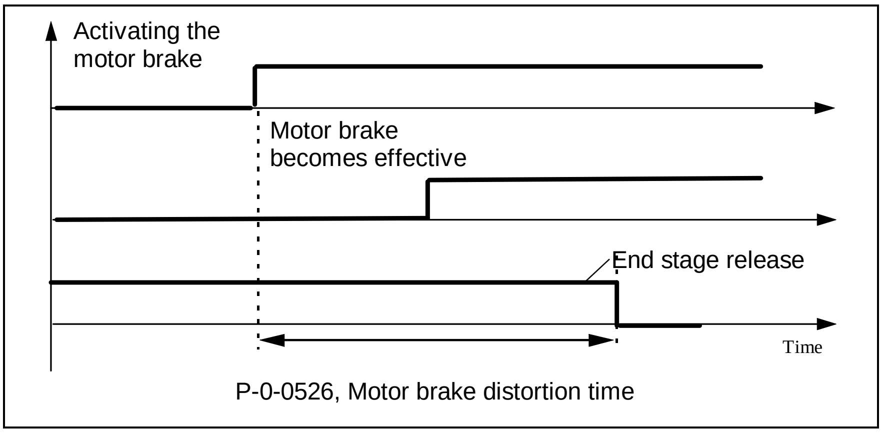


Fig. 5-11: Setting the brake control delay

Setting the Motor Brake Current

The motor holding brake is controlled by the drive controller with connector X6. The supply voltage of +24V for the brake control has to be entered externally. If the brake is actuated (release for self-locking brakes, enable for self-ventilating brakes), the current flowing through the connection contacts of the brake will be monitored.

Note: The maximum output voltage for the control of the motor brake is 2,0 A

In **P-0-0511, Motor brake current**, the rating of the brake current is defined. If the actual brake current after actuation is outside 0,4..1,6 * P-0-0511, then the error message **F268 Brake Error** will be generated.

The monitoring of the brake current is deactivated when **P-0-0511, Motor brake current** equals 0 is entered.

6 Operating Modes

6.1 Operating Modes - Definition

Operating modes define how command values should be processed. With the help of the parameters

- **S-0-0032, Primary Mode of Operation**
- **S-0-0033, Secondary Operating Mode 1**
- **S-0-0034, Secondary Operating Mode 2**
- **S-0-0035, Secondary Operating Mode 3**

4 different operating modes can be preselected simultaneously.

The following gives a more detailed explanation of the operating modes supported by the DIAX03-ELS software.

6.2 Basic Operating Modes

Torque/Force Control

A torque/force value is commanded to the drive in the **Torque/Force Control** operating mode. When the operating mode is activated, the diagnostic message reads **A100 Drive in Torque Mode**.

The command value is specified in the parameter **S-0-0080, Torque/Force Command Value**.

Monitors specific to this operating mode are:

- Monitoring of the actual speed at 1.125 times the value of the parameter **S-0-0091, Bipolar Velocity Limit Value**. (See also"Limiting to Bipolar Velocity Limit Value ")

If this value is exceeded, the error **F879 Crossing Max. Velocity Feedback Value** is generated.

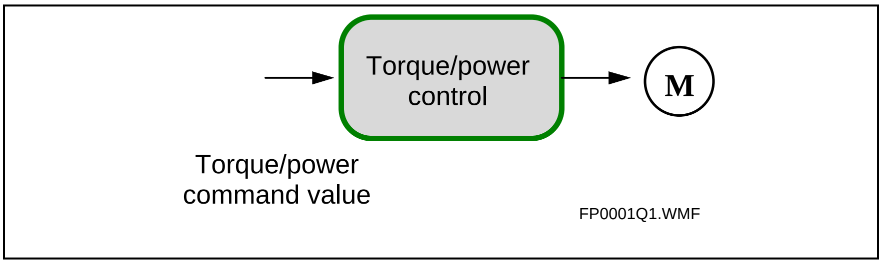


Fig. 6-1: Torque/Force Control Block Diagram

Torque/Force Controller

The command value in **S-0-0080, Torque/Force Command Value** is limited with the effective peak current **P-0-4046, Effective Peak Current**. The effective peak current is derived from the current and torque/force limit.

(See also"Current Limit and "Torque/Force Limit")

The torque/force generating command current "Iqcom" is derived according to these limits. This is the command value for the (effective) current regulator.

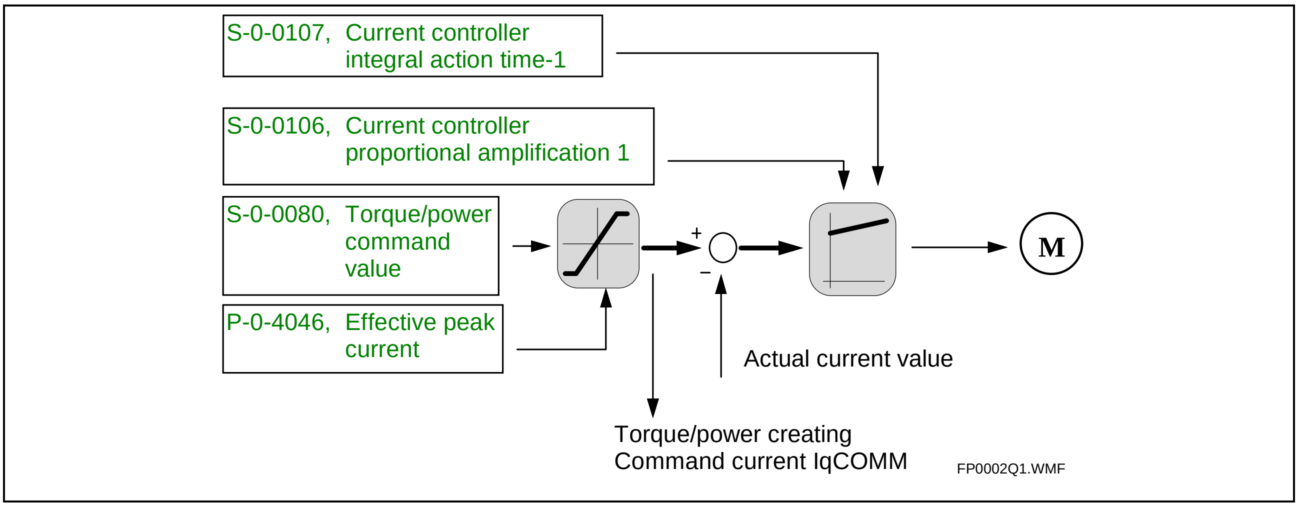


Fig. 6-3: Torque/Force Controller

Velocity Control

A velocity value is commanded to the drive in the **Velocity Control** operating mode. The diagnostic message reads **A101 Drive in Velocity Mode** when the operating mode is active.

The command values are specified in the parameters **S-0-0036, Velocity Command Value** and **S-0-0037 Additive Velocity Command Value**.

Monitors specific to this operating mode are:

- The parameter **S-0-0036, Velocity Command Value** is limited to the value of the parameter **S-0-0091, Bipolar Velocity Limit Value**. This generates the warning **E263 S-0-0036 Velocity Command Value Greater Than Bipolar Limit** .

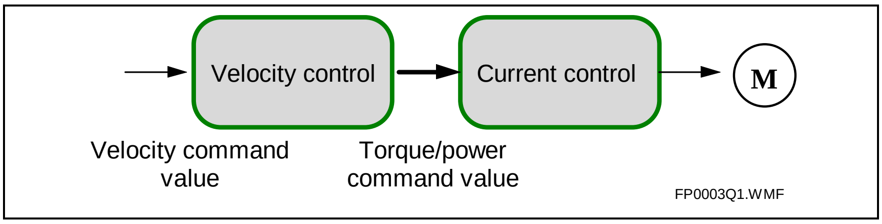


Fig. 6-5: Velocity control block diagram

Velocity Controller

The effective velocity command value is derived from the addition of the value **S-0-0036, Velocity Command Value** filtered via **P-0-1201, Ramp 1 Pitch (Velocity Ramp 1)** and **P-0-1222, Command Value Smoothing Time Constant** and the direct value of **S-0-0037 Additive Velocity Command Value**.

If the parameter **S-0-0036, Velocity Command Value** is entered greater than **S-0-0091, Bipolar Velocity Limit Value**, the message **E263 S-0-0036 Velocity Command Value Greater Than Bipolar Limit** is generated.

The command value from S-0-0036 is limited to S-0-0091.

The effective velocity command value is further limited to **S-0-0091, Bipolar Velocity Limit Value**.

(see also "Limiting to Bipolar Velocity Limit Value)

If the resulting command value is at the limit, the warning **E259 Command Velocity Limitation Active** is displayed.

The velocity control difference is produced by including the actual velocity in the control loop. The raw feedback velocities of the motor and, if available, the external encoder can be combined into an effective actual velocity value (see also" Setting the Velocity Mix Factor").

This can be band limited by using a low-pass filter (set with **S-0-0392, Velocity Feedback Value Filter Time Base**) on the actual velocity before it enters the velocity controller.

The output from the velocity controller is added with a feed forward component when a lagless position control mode is activated and **S-0-0348, Proportional Gain Acceleration Feed Forward** is set to a non-zero value.

This value is commanded according to the current and torque/force limit.

(See also" Current Limit" and "Torque/Force Limit").

The command value for the current controller can be band limited with **P-0-0004, Smoothing Time Constant**.

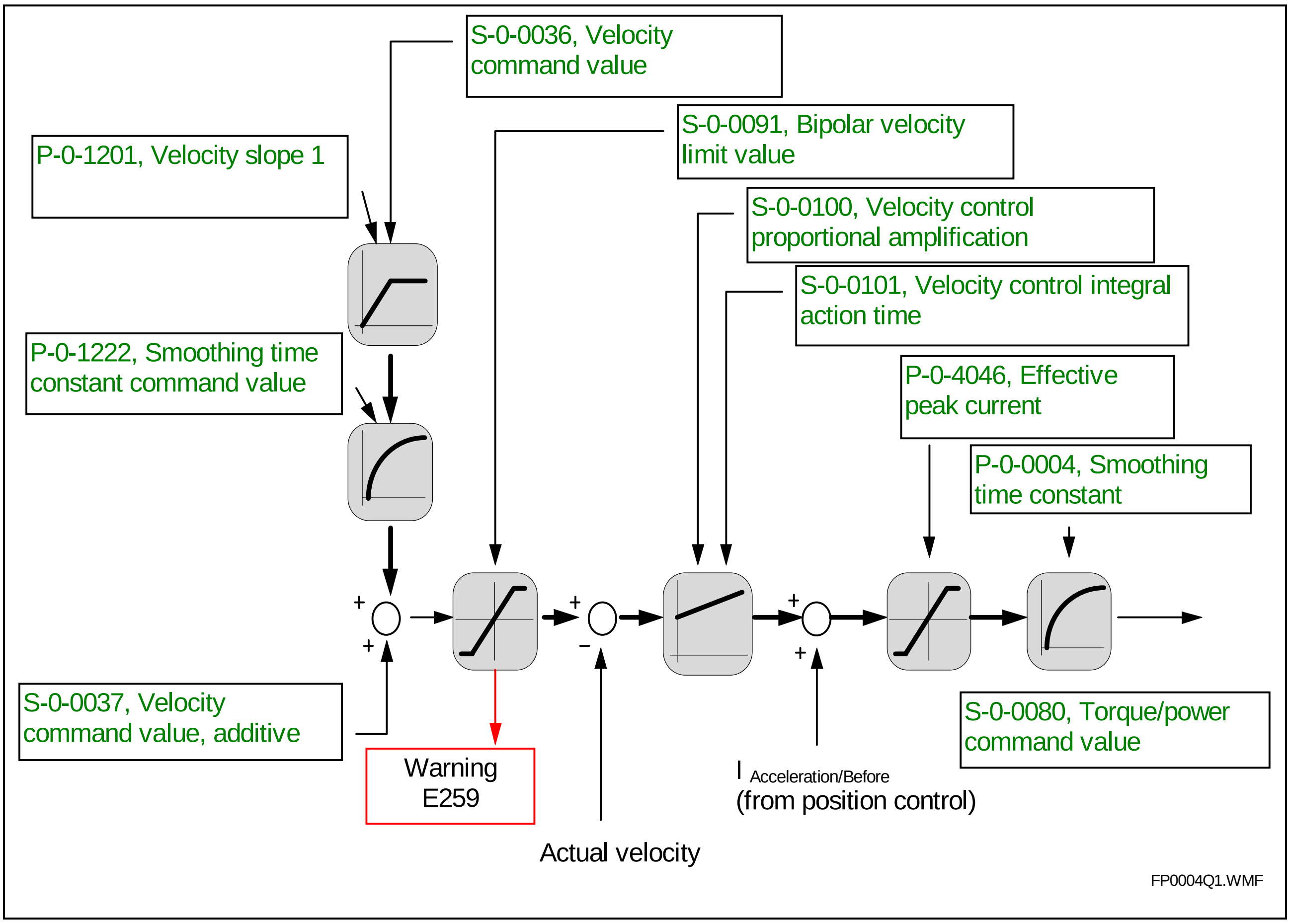


Fig. 6-7: Velocity Controller

(See also "Setting the Velocity Controller")

See also "Current Controller"

Current Controller

The current controller is parameterized with **S-0-0106, Current Regulator Proportional Gain 1** and **S-0-0107, Current Regulator 1 Integral Action Time** .

(see also "Setting the Current Controller")

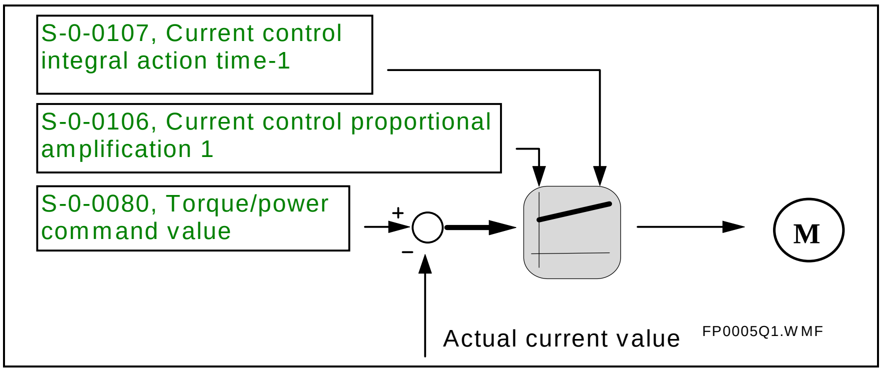


Fig. 6-9: Current Controller

Position Control

A position value is commanded to the drive every NC-cycle time in the **Position Control** operating mode. When this mode is activated, the diagnostic message is one of the following:

- **A102 Position Control Encoder 1**
- **A103 Position Control Encoder 2**
- **A104 Position Control Encoder 1 Lagless Positioning**
- **A105 Position Control/ Encoder 2 / Lagless Positioning**

The command value is specified in the parameter **S-0-0047, Position Command Value** .

Monitors specific to this operating mode are:

- Monitoring the command velocity at the value of the parameter **S-0-0091, Bipolar Velocity Limit Value**.

If this value is exceeded, the error **F237 Excessive Position Command Difference** is generated.

The command value specified in **S-0-0047, Position Command Value** is interpolated within the NC cycle time and is then given to the position controller.

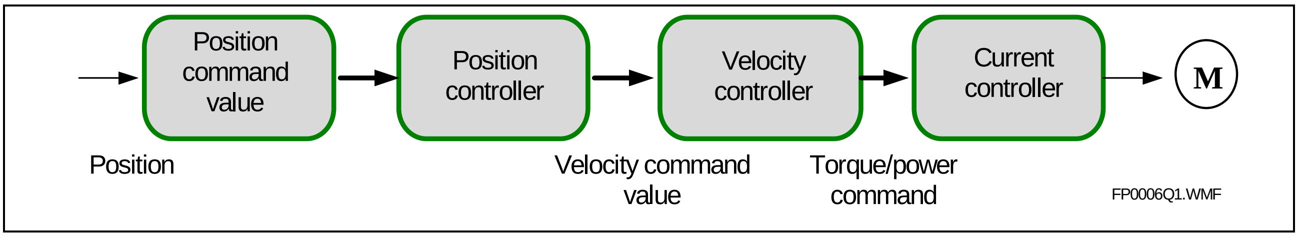


Fig. 6-11: Position control block diagram

Generator Feature: Position Command Value Interpolator

An actual velocity is formed from two successive position command values. The **S-0-0001, NC Cycle Time** acts as the time base.

The instructions for calculating the command velocity are as follows:

$$Vcommand = \frac{Position\,command\,value(k) - Position\,command\,value(k-1)}{S-0-0001}$$

Vcommand: Command velocity

Fig. 6-1: Calculating the command velocity

This velocity is monitored to see if it exceeds **S-0-0091, Bipolar Velocity Limit**. If **S-0-0091** is exceeded, the error **F237 Excessive Position Command Value Difference** is generated.

The commanded position profile can be filtered with the parameter **P-0-0099, Position Command Smoothing Filter Time Constant**.

The position loop is closed every 250usec. The position command value is also fine interpolated within the NC cycle time.

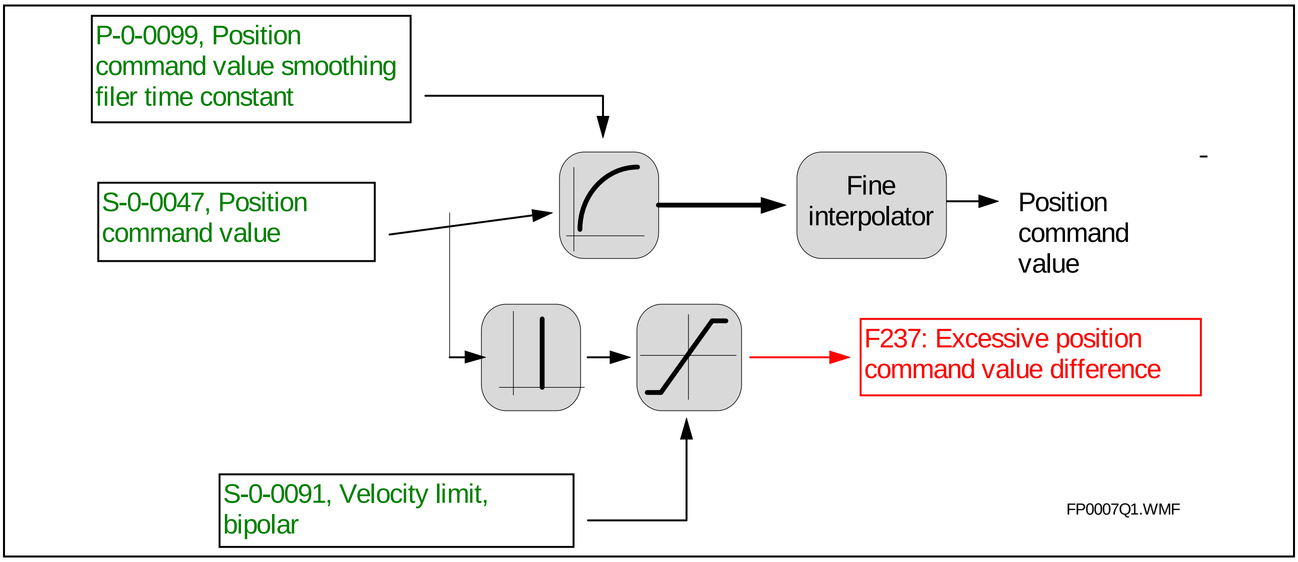


Fig. 6-13: : Generator function position command value interpolator

See also Position on page 6-5

See also Velocity Controller on page 6-2

See also

Current Controller on page 6-3

Position Controller

The position controller error is computed from the effective position command value from the generator function of the active operating mode and the actual position value (motor encoder or external encoder) used for the controller.

This is given to the position controller, whose control gain is set with **S-0-0104, Position Loop KV-Factor** .

(See also"Setting the Position Controller")

Bit 3 in the operating mode parameters (S-0-0032..35) indicates if positioning should be subject to the following errors.

With lagless position control, an acceleration feed forward component can be included with parameter **S-0-0348, Proportional GainAcceleration Feed Foraward**.

(see also"Setting the Acceleration Feed Forward")

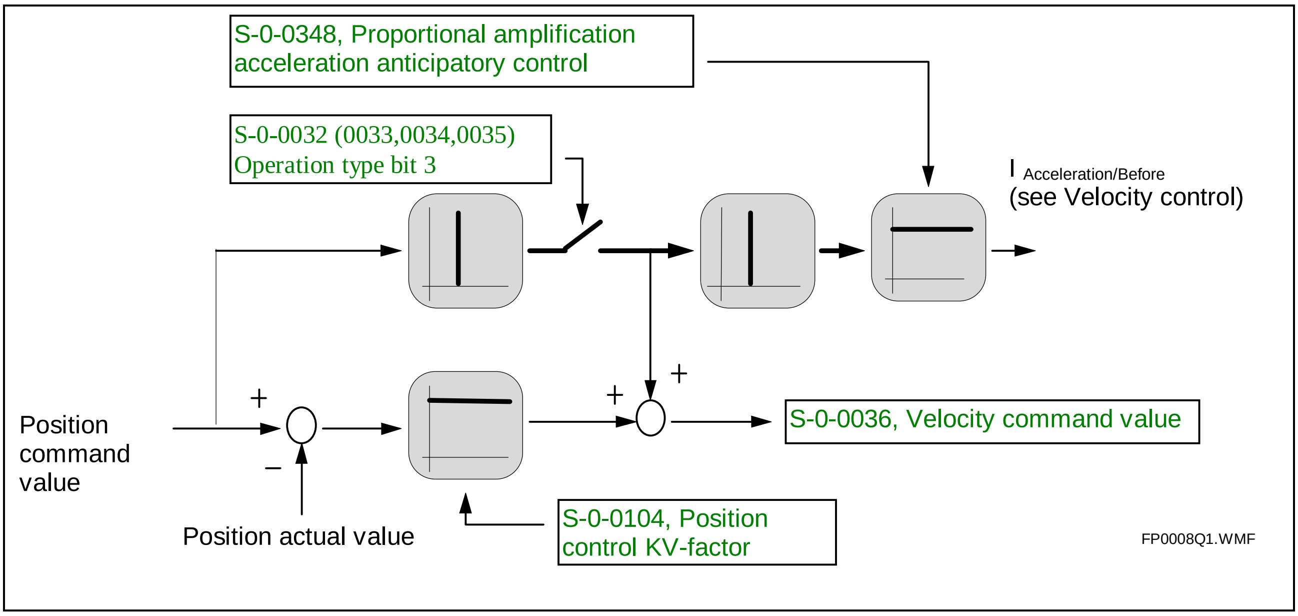


Fig. 6-14: Position controller block diagram

See also Velocity Controller on page 6-2

See also

Current Controller on page 6-3

Position Command Value Monitoring

If the drive is operated in the position control mode with cyclical position commands, new position values are transmitted to the drive every SERCOS cycle. The difference between the current and the last position command value is checked for validity.

Reasons monitoring is activated:

- Erroneous control system command values
- Command value transmission error

If the **Position Control** operating mode is active, the velocity produced by the difference in successive values of parameter **S-0-0047, Position Command Value** is compared to

- **S-0-0091, Bipolar Velocity Limit Value**

S-0-0001, NC Cycle Time acts as the time base for converting the position command value differences into a velocity. It is assumed that position command values are given cyclically in the NC cycle time. This is normally the case in the position control operating mode.

If the command velocity resulting from the position command value exceeds **S-0-0091, Bipolar Velocity Limit**, the error

- **F237, Excessive Position Command Difference**

is generated. For diagnostic purposes, both of the parameters

- **P-0-0010, Excessive Position Command Value**
- **P-0-0011, Last Valid Position Command Value**

will be saved. The velocity produced by the difference of the two values generated the error.

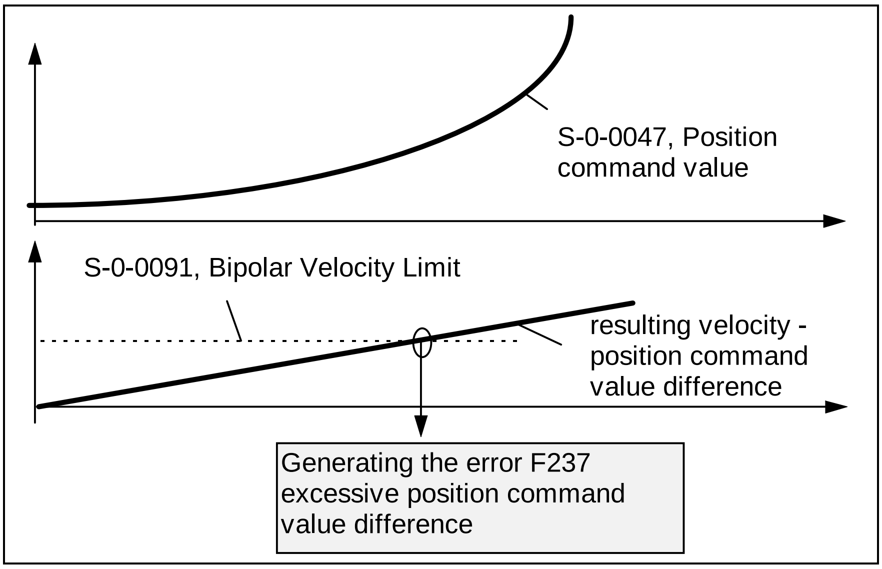


Fig. 6-15: Monitoring the position command value differences and generating the error F237, Excessive Position Command Value Difference

Setting Position Command Value Monitoring

The position command value monitor works with the parameter **S-0-0091 Bipolar Velocity Limit Value**. S-0-0091 should be set approx. 5..10% above the planned maximum velocity of the shaft.

Drive Internal Interpolation

The drive is given a target position in the **Drive Internal Interpolation** operating mode. When the operating mode is activated, the diagnostic message is one of the following:

- **A106 Drive Controlled (Internal) Interpolation / Encoder 1**
- **A107 Drive Controlled Interpolation / Encoder 2**
- **A108 Drive Controlled Interpolation / Encoder 1 / Lagless**
- **A109 Drive Controlled Interpolation / Encoder 2 / Lagless**

The following checks are executed:

- If axis limit value monitoring is activated (Bit 4 of **S-0-0-0055, Position Polarity Parameter** is set) and the measurement system used for the operating mode has been homed, the parameter S-0-0258, Target Position is monitored for staying within the axis limit values.
  If these are exceeded, the warning **E253 Target Position Out of Range** is generated.

  The prescribed target position will not be accepted.
- If the prescribed positioning velocity **S-0-0259, Positioning Velocity** exceeds the maximum allowable (**S-0-0091, Bipolar Velocity Limit**), the warning **E249, Positioning Velocity (S-0-0259) Greater Than S-0-0091** will be generated.

  The drive will move at the velocity **S-0-0091, Bipolar Velocity Limit** to the new target position.

The binary signal "Target Position Reached" is included in **S-0-0013, Class 3 Diagnostics** specifically for this operating mode. (See also"S-0-0013, Class 3 Diagnostics.") The IZP signal is included in **S-0-0182, Manufacturer Class 3 Diagnostics**. (See also"S-0-0182, Manufacturer Class 3 Diagnostics ")

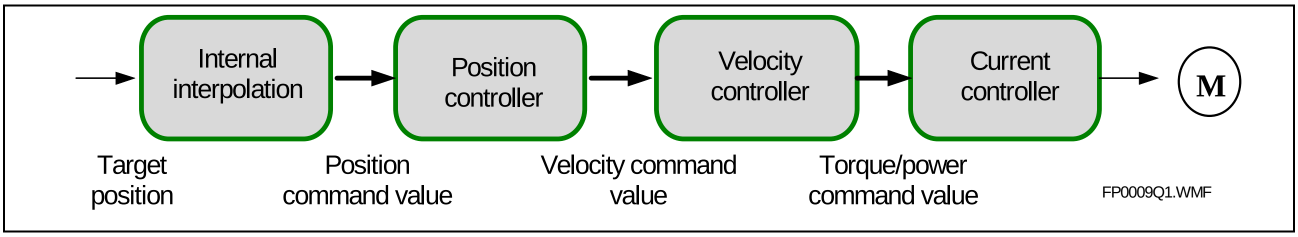


Fig. 6-17: Drive-internal interpolation diagram

Generator Function: Drive Internal Interpolation

The target value is entered in the parameter **S-0-0258, Target Position** . The drive generates the posi tion command profile necessary to move to the target position using the following parameters as limits:

- **S-0-0259, Positioning Velocity**
- **S-0-0260, Positioning Acceleration**
- **S-0-0193, Positioning Jerk**
- **S-0-0108, Feedrate Override**

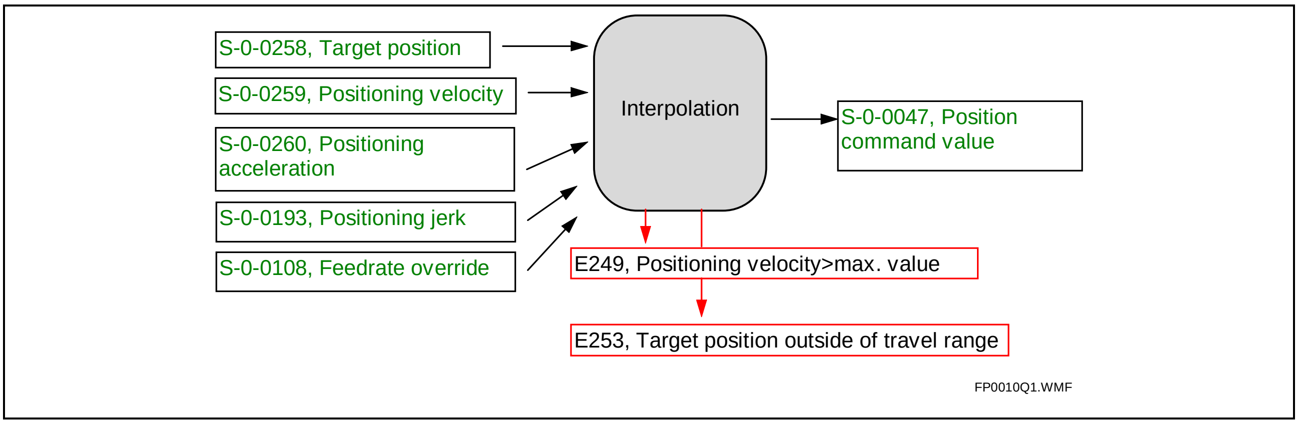


Fig. 6-19: Generator function drive internal generator function

If the drive-internal interpolation operating mode is active and a zero is entered in parameter S-0-0108, Feed Rate Override, the warning **E255 Feed Rate Override (S0-0108) = 0** is given.

See also Position on page 6-5

See also Velocity Controller on page 6-2

See also

Current Controller on page 6-3

6.3 Setting the Operating Mode Parameters

With the help of the parameters:

- **S-0-0032, Primary Mode of Operation**
- **S-0-0033, Secondary Operating Mode 1**
- **S-0-0034, Secondary Operating Mode 2**
- **S-0-0035, Secondary Operating Mode 3**

4 different operating modes can be preselected simultaneously.

Bits 8 and 9 of the master control word define which of the four modes will be operative. The operation can be switched between the 4 operating modes.

The operating modes can be preselected in parameters S-0-0032..35. The operating modes can be selected by entering a bit code.

Certain positions are fixed in this bit list.

In bit 3, you can choose between working with position control with or without lag.

The following applies:

Bit 3 = 0 position control with lag

Bit 3 = 1 position control without lag

Bit code:	Meaning:
0000,0000,0000,0001	Torque control
0000,0000,0000,0010	Velocity control
0000,0000,0000,x011	Position control with encoder 1
0000,0000,0000,x100	Position control with encoder 2
0000,0000,0001,x011	Drive-internal interpolation, encoder 1
0000,0000,0001,x100	Drive-internal interpolation, encoder 2

Fig. 6-20: Setting the Operating Mode Parameters

6.4 Determining the Active Operating Mode

Bits 8 and 9 in the master control word determine which of the 4 preselected operating modes will be active.

Bit 8 and 9 in the master control word:	Active operating mode:
0 0	Primary mode of operation
0 1	Secondary mode of operation 1
1 0	Secondary mode of operation 2
1 1	Secondary mode of operation 3

Fig. 6-21: Determining the Active Operating Mode

If "0" is entered in the operating mode parameters and the operating mode is activated, then the error **F207 Switched to a Non-Initialized Operating Mode** will be generated.

7 Basic Drive Functions

7.1 Physical Values Display Format

Data exchange between the controller and the primary control system or user interface occurs by reading and writing controller parameters. Information about the unit and the number of decimal places (see also parameter) is necessary for interpreting the operating data of a parameter. The LSB valence of the operating data is produced from these data. The following illustration shows this with an example.

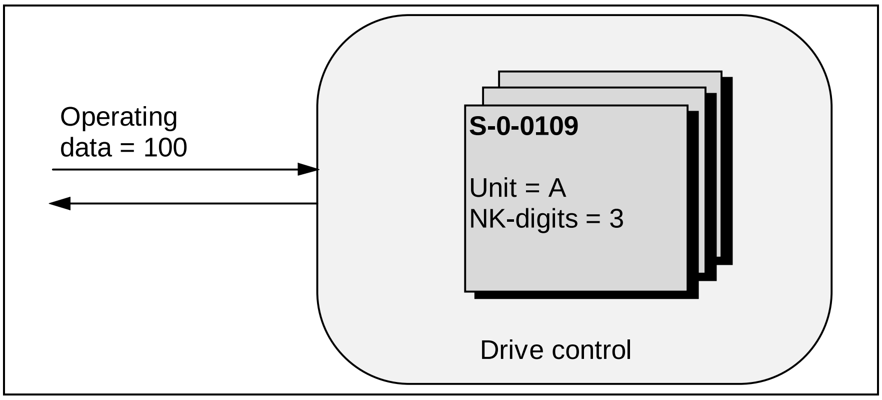


Fig. 7-1: Example for interpreting operating data in the drive

The combination of unit and number of decimal places is expressed with the term scaling.

The operating data of the parameter S-0-0109 is given the value 100 in the picture shown above. When combined, the unit A(mps) that belongs to this parameter and the number of decimal places produce the physical value 0.100 A.

Each parameter can therefore be called up with a unit and the number of decimal places. The combination of these two criteria is united under the term scaling. When interpreting operating data, these must always be included in the analysis. Units and number of decimal places are listed along with all other parameter attributes in Supplement A, Parameter Description, for each parameter.

Adjustable Scaling for Position, Velocity, and Acceleration Data

The LSB valence of position, velocity, and acceleration data can be set by adjustable scaling.

The parameter scaling for

- position,
- velocity and
- acceleration data

can be adjusted. It can be set by the user with scaling parameters. It enables

1. the valence of this data to be made compatible for exchange between control system and control drive, or, in other words, the data can be exchanged in the control system's internal format. The control system will not need to convert this data.

2. this data to conform to machine kinematics. Linear movements can be described with linear units, for example, and rotary movements can be described with rotary units.

It is possible to select between linear and rotary scaling, and preferred and parameter scaling, as well as between motor and load reference.

Linear - Rotary Scaling

Adjustable scaling allows either linear or rotary scaling to be selected. Linear motors normally use a linear scale. Rotary motors use either a rotary or linear scale if their rotary movement is converted into a linear movement (with a ball roll spindle, for example).

Preferred Scaling - Parameter Scaling

Adjustable scaling allows either preferred scaling or parameter scaling to be selected. If preferred scaling is selected, the appropriate scaling factor parameters and scaling exponent parameters in **S-0-0128, C200 Communication Phase 4 Transition Check** are overwritten with preferred values. This sets a pre-defined scaling. The scaling factor parameter and the scaling exponent parameter do not need to be entered. The concrete preferred scaling adjusts itself to the selection of linear or rotary scaling.

The following preferred scalings are available:

Physical Value:	Rotary Preferred Scaling:	Linear Preferred Scaling (mm):	Linear Preferred Scaling (Inch):
Position data	0.0001 Degrees	0.0001 mm	0.001 Inches
Velocity Data	0.0001 RPM, or 10^-6 R/sec	10^ 6 m/min	10^-5 in/min
Acceleration Data	0.001 rad/sec²	10^-6 m/sec²	--

Fig. 7-2: Preferred scaling - parameter scaling

Motor Reference - Load Reference

Either motor reference or load reference can be selected when adjusting the scaling.

With rotary load reference, the scaled data from the motor format is converted to the transmission output format with the transmission ratio **S-0-0122, Output Revolutions of Load Gear** / **S-0-0121, Input Revolutions of Load Gear**.

With linear load reference, the scaled data from the motor format is converted to feed constant spindle format with the transmission ratio **S-0-0122, Transmission Output Revolutions** / **S-0-0121, Transmission Input Revolutions** and the feed constant **S-0-0123, Feed Constant**.

The following restrictions apply in relationship to the motor type being used :

- Rotary motor reference cannot be set with linear motors.
- Linear motor reference cannot be set with rotary motors.

Display Format of Position Data

The scaling of drive controller position data is adjustable. This is done with the parameters:

- **S-0-0076, Position Data Scaling Type**
- **S-0-0077, Linear Position Data Scaling Factor**
- **S-0-0078, Linear Position Data Scaling Exponent**
- **S-0-0079, Rotary Position Resolution**

This differentiates between linear and rotary scaling. **S-0-0079, Rotary Position Resolution** sets the rotary position scaling. **S-0-0077, Position Data Scaling Factor** and **S-0-0078, Position Data Scaling Exponent** set the linear position scaling.

The scaling type is set in **S-0-0076, Position Data Scaling Type**.

The parameter is defined as follows:

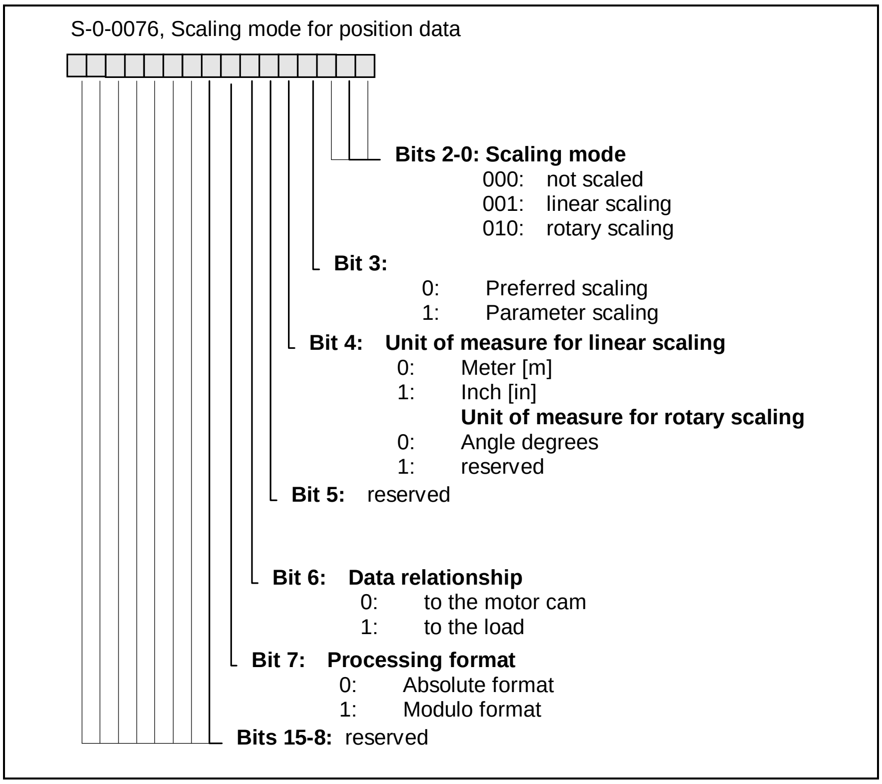


Fig. 7-3: Parameter S-0-0076

The actual scaling type is set in bit 0..2.

In Bit 3, either preferred scaling (parameters **S-0-0077, Position Data Scaling Factor**, **S-0-0078, Position Data Scaling Exponent** or **S-0-0079, Rotary Position Resolution** are pre-defined and cannot be changed) or parameter scaling (scaling is determined by entering this parameter) can be selected. (see Preferred Scaling - Parameter Scaling on page 7-2)

Bit 4 indicates the measurement unit. With linear scaling, either mm or inch can be selected here.

Bit 6 defines motor or load reference.

Bit 7 determines the processing format (see Modulo Feature on page 7-8).

The scaling type setting is checked for plausibility in **S-0-0128, C200 Communication Phase 4 Transition Check,** and the command error message **C213 Position Data Scaling Error** is generated, if necessary.

Velocity Data Display Format

The scaling of the drive controller's velocity data is adjustable.

This is done with the parameters:

- **S-0-0044, Velocity Data Scaling Type**
- **S-0-0045, Velocity Data Scaling Factor**
- **S-0-0046, Velocity Data Scaling Exponent**

The scaling type is set in **S-0-0044, Velocity Data Scaling Type**. The parameter is defined as follows:

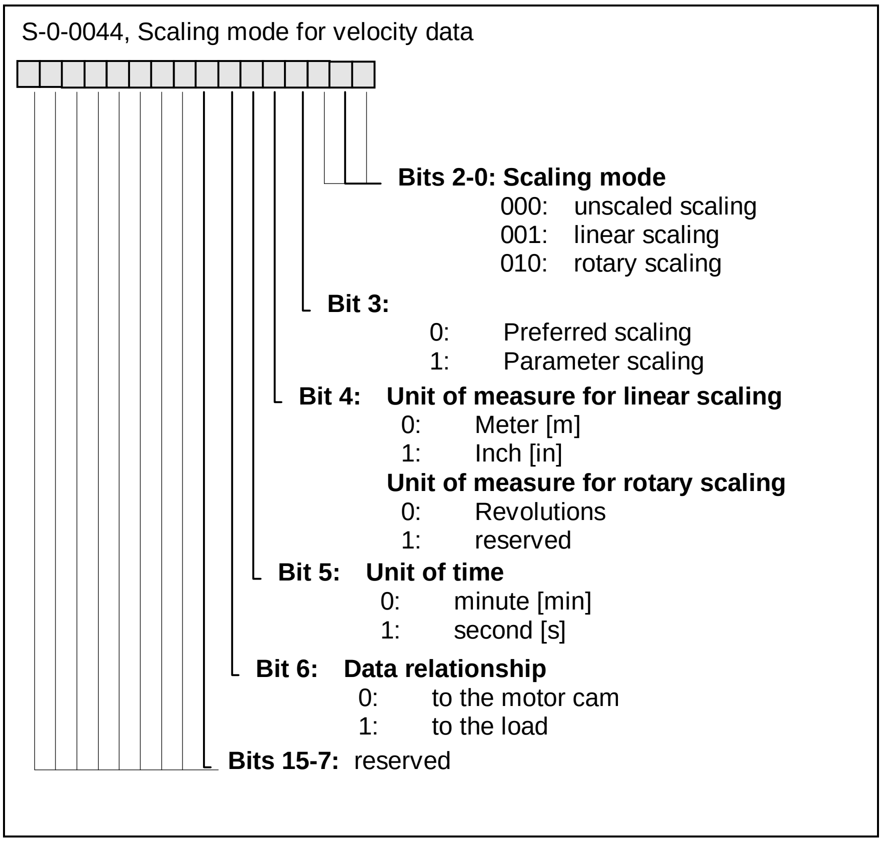


Fig. 7-4: Parameter S-0-0044

The actual scaling type is set in bit 0..2.

In bit 3, either preferred scaling (parameters **S-0-0045, Velocity Data Scaling Factor** and **S-0-0046, Velocity Data Scaling Exponent** are pre-defined and cannot be changed) or parameter scaling (scaling is determined by entering this parameter) can be selected. (see Preferred Scaling - Parameter Scaling on page 7-2)

Bit 4 indicates the measurement unit. With linear scaling, either m or inch can be selected here.

Bit 5 specifies the unit of time, either minutes or seconds.

Bit 6 defines motor or load reference.

The scaling type setting is checked for plausibility in **S-0-0128, C200 Communication Phase 4 Transition Check,** and the command error message **C214 Velocity Data Scaling Error** is generated, if necessary.

Acceleration Data Display Format

The scaling of the drive controller's acceleration data is adjustable.

This is done with the parameters:

- **S-0-0160, Acceleration Data Scaling Type**
- **S-0-0161, Acceleration Data Scaling Factor**
- **S-0-0162, Acceleration Data Scaling Exponent**

The scaling type is set in **S-0-0160, Acceleration Data Scaling Type**. The parameter is defined as follows:

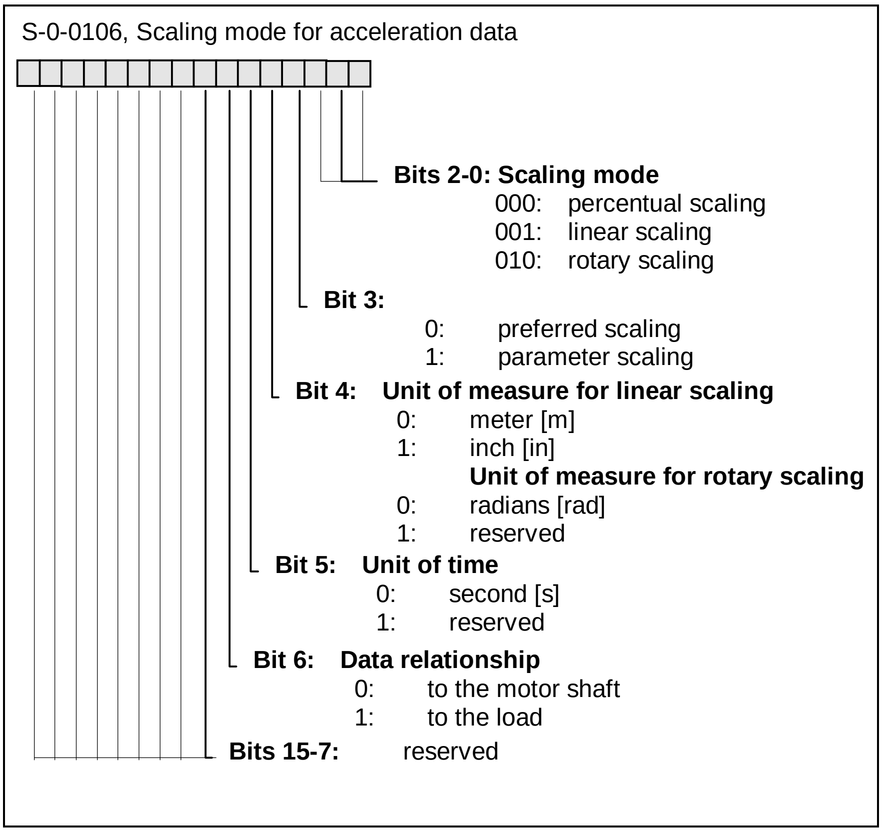


Fig. 7-5: Parameter S-0-0160

The actual scaling type is set in bit 0..2.

Either preferred scaling (parameters **S-0-0161, Acceleration Data Scaling Factor** and **S-0-0162, Acceleration Data Scaling Exponent** are pre-defined and cannot be changed) or parameter scaling (scaling is determined by entering this parameter) can be selected in bit 3. (see Preferred Scaling - Parameter Scaling on page 7-2)

Bit 6 defines motor or load reference.

The scaling type setting is checked for plausibility in **S-0-0128, C200 Communication Phase 4 Transition Check,** and the command error message **C215 Acceleration Data Scaling Error** is generated, if necessary.

Command Polarities and Actual Value Polarities

The drive-internal polarities of position, velocity, torque/force and actual value are fixed. The following applies:

Motor type:	Drive internal positive direction definition:
Rotary motors	Clockwise rotation facing the motor shaft
Linear motors	Move in the direction of the frontal area of the power cable on the primary component

Fig. 7-6: Drive internal positive direction definition

The positive direction is specified by the manufacturer for MDD and MKD motors. Asynchronous motors and linear synchronous motors should be set in this direction during installation. (see "Other Motor Encoder Characteristics" on page7-12). The command polarity and actual value polarity of the drive is thereby fixed.

If the drive's definition of the positive direction does not conform to the requirements of the machine, the parameters

- **S-0-0055, Position Polarity Parameter**
- **S-0-0043, Velocity Polarity Parameter**
- **S-0-0085, Torque/Force Polarity Parameter**

can invert the command and actual value polarities.

Note: If the polarity needs to be changed, all 3 parameters should always be inverted at the same time so that the polarities of the position, velocity, and torque/force have the same sign.

The following illustration shows the operating characteristics of the polarity parameters.

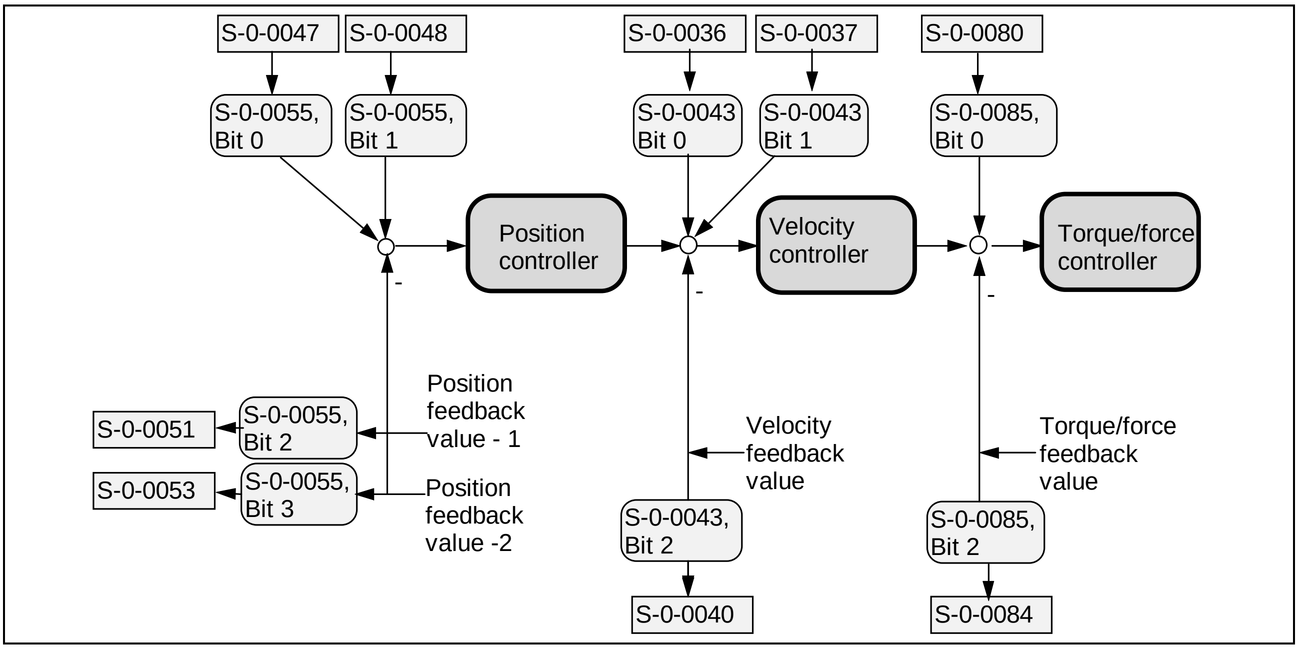


Fig. 7-7: Polarity parameter operating characteristics

The polarity parameters affect only the display values, not the control feedback values.

The drive software only allows all bits within a polarity parameter to be inverted. If bit 0 is inverted, all other bits of the parameter are also inverted. This prevents setting positive feedback in the regulator loops because of faulty command and feedback value polarities.

Mechanical Transmission Elements

Mechanical transmission elements are transmission and feed mechanisms between the motor shaft and the load. Entering this data is necessary for the load to convert the position, velocity, and acceleration physical values, if these are scaled for the load. (see also "Adjustable Scaling for Position, Velocity, and Acceleration Data" on page 7-1). To see if this parameter has been entered correctly, move the shaft and compare the path followed with the position feedback value and the path actually taken.

Transmission Ratio

The transmission ratio can be determined with the parameters

- **S-0-0121, Input Revolutions of Load Gear**
- **S-0-0122, Output Revolutions of Load Gear**

The ratio between transmission input and transmission output is parameterized here.

Example:

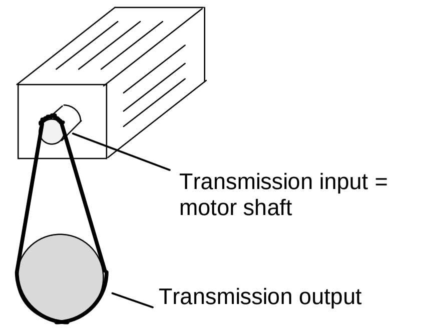


Fig. 7-8: Transmission ratio parameterization

In the illustration above, 5 transmission input revolutions (= motor revolutions) were equivalent to 2 transmission output revolutions. The proper parameterization for this would be :

S-0-0121, Input Revolutions of Load Gear = 5

S-0-0122, Output Revolutions of Load Gear = 2

Feed Constant

The feed constant defines which linear path the load should follow per transmission output revolution. It is specified in the parameter **S-0-0123, Feed Constant** .

The value programmed here is used along with the transmission ratio for converting the position, velocity, and acceleration data from motor reference to load reference.

Example:

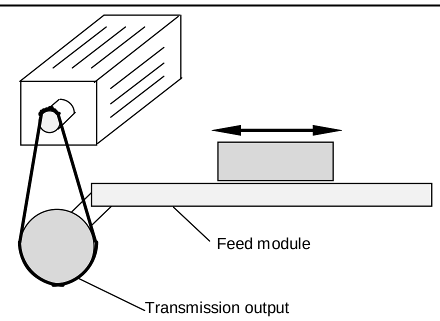


Fig. 7-9: Feed constant parameterization

In the illustration above, the feed module would cover 10 mm per transmission output revolution. The proper parameterization for this would be : S-0-0123, Feed Constant = 10 mm/Rev

Modulo Feature

When the modulo function is activated, all position data within the modulo range are displayed.

If the modulo function is activated, all position data in the range 0..(modulo value-1) are displayed. This makes it possible to have shafts continuously moving in one direction without an overflow in the position data.

The modulo value is set with the parameter **S-0-0103, Modulo Value**.

The modulo function is activated by the parameter **S-0-0076, Position Data Scaling Type**.

(See also "Display Format of Position Data" on page 7-3)

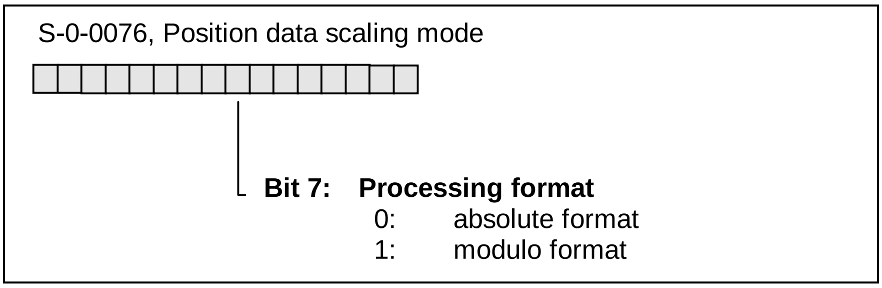


Fig. 7-10: Setting absolute format - modulo format

Note: Processing position data according to modulo is only allowed with rotary motor types. This is checked in **S-0-0128, C2 Communication Phase 4 Transition Check** and acknowledged by the command error **C213 Position Data Scaling Error** if necessary.

The following illustration elucidates the difference in displaying the position data in absolute format and modulo format:

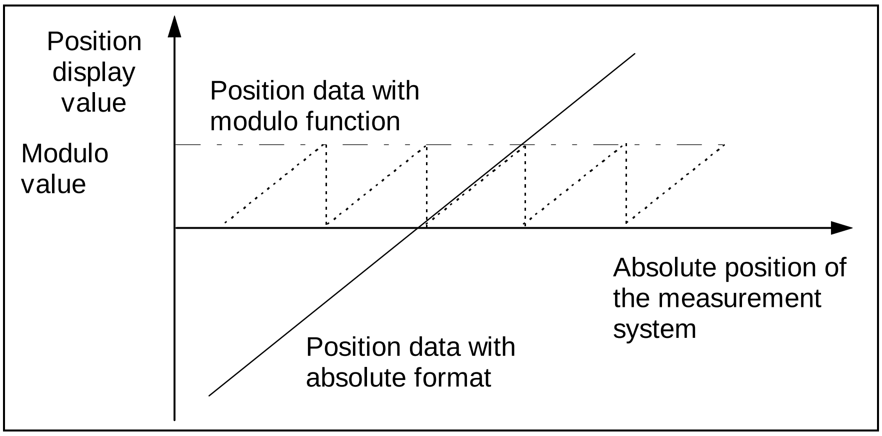


Fig. 7-11: Display value of positions in absolute format and modulo format

Modulo Processing-Limiting Conditions

If modulo processing of position data is selected, in connection with

- the active operating mode and
- the selected position scaling

the following limiting conditions for error-free processing of the position data must be observed. Compliance with the limiting conditions is checked in **S-0-0128, C2 Communication Phase 4 Transition Check** and the command is ended with the error **C227 Modulo Range Error** if necessary.

The limiting conditions for error-free modulo value processing are as follows:

- The modulo range **S-0-0103, Modulo Value** may not be larger than half the maximum travel range. The maximum travel range depends on the motor feedback being used (see also "Maximum Representable Travel Range" on page 7-13)
- If rotary or linear position scaling with load reference and without angle synchronization is used as the operating mode, the product of **S-0-0103, Modulo Value**, **S-0-0116, Resolution of Rotational Feedback 1 (Motor Encoder)** and **S-0-0121, Input Revolutions of Load Gear** must be smaller than 2^63.
- If rotary position scaling with load reference and angle synchronization is used as the operating mode, the product of **S-0-0237, Following Drive Revolutions-1**, **S-0-0116, Resolution of Rotational Feedback 1 (Motor Encoder)** and **S-0-0121, Input Revolutions of Load Gear** must be smaller than 2^63.
- If the angle synchronization operating mode is used, linear position scaling may not be selected.

If, in addition to this, an external measurement system is used, the additional requirements are:

- If rotary position scaling with motor reference and no angle synchronization operating mode is used, the product of **S-0-0103, Modulo Value**, **S-0-0117**, **Resolution of Rotational Feedback 2 (External Encoder)** and **S-0-0122, Output Revolutions of Load Gear** must be smaller than 2^63.
- If rotary position scaling with motor reference and angle synchronization operating mode is used, the product of **S-0-0237, Following Drive Revolutions-1**, **S-0-0117**, **Rotary Feedback 2 Resolution (External Encoder)** and **S-0-0122, Output Revolutions of Load Gear** must be smaller than 2^63.

Processing Command Values in Modulo Format, Shortest Path - Direction Selection

The interpretation of position command values such as **S-0-0047, Position Command Value** and**S-0-0258 Target Position** when the modulo function has been activated is dependent on the mode that has been selected.

The following possibilities exist:

- Shortest Path
- Positive Direction
- Negative Direction

The parameter **S-0-0393, Command Value Mode for Modulo Format** can be used to set the mode. This parameter is effective only if modulo format has been activated in **S-0-0076, Position Data Scaling Type**.

The following settings can be entered:

S-0-0393:	Meaning:
0	Shortest Path
1	Positive Direction
2	Negative Direction

Fig. 7-12: Selecting modulo mode

Modulo Mode "Shortest Path"

The next command value is reached with the shortest path. If the difference between two successive command values is larger than half of the modulo value, the drive moves toward the command value in the opposite direction.

Modulo Mode "Positive Direction"

The command value is always approached in a positive direction, regardless of whether or not the difference between two successive command values is larger than half of the modulo value.

Modulo Mode "Negative Direction"

The command value is always approached in a negative direction, regardless of whether or not the difference between two successive command values is larger than half of the modulo value.

7.2 Setting the Measurement System

The following feedback systems can be analyzeed with the DIAX 03 series of controllers:

- digital servo feedback
- resolver
- incremental encoder with sine signals
- incremental encoder with square-wave signals
- gear-type encoder
- measurement system with SSI interface
- measurement system with EnDat interface

Where the analysis of the measurement system as

Analysis as:	Comments:
Motor encoder	required
External encoder	optional

Fig. 7-13: Measurement system analysis

can occur.

The drive is connected to an encoder interface (standard), either a digital servo feedback or a resolver. Additional plug-in cards are available for evaluating different types of encoders. Specifically, the following measurement systems can be implemented with the corresponding module shown below.

Feedback System:	Module:	Number:
digital servo feedback or resolver	Standard	1
Incremental feedback with sine signal from the Heidenhain company, with either uA or 1V signals	DLF	2
gear-type encoder	DZF	3
digital servo feedback	DFF	4
incremental encoder with square-wave signals from the Heidenhain company	DEF 1	5
incremental encoder with square-wave signals from the Heidenhain company	DEF 2	6
Encoder with SSI interface (only 4096 incr./rev.)	DAG 1.2	7
Encoder with EnDat interface	DAG 1.2	8

Fig. 7-14: Feedback systems > necessary plug-in modules

Each module is assigned a number that determines the feedback interface. The module number is entered into the following parameters:

- **P-0-0074, Motor Encoder Interface**
- **P-0-0075, External Encoder Interface**

When writing to the encoder interface parameters, a check is made to determine if the module is actually connected. If it is not, the drive reacts with the error message "0x7008, Incorrect Date."

(see also Possible error messages when reading and writing the operating data).

This check is also made in the command **S-0-0128, Communication Phase 4 Transition Check**. The command error **C203 Parameter Conversion Error (->S-0-0022)** is generated there.

Displaying the position feedback values of the individual measurement systems is done with the parameters:

- **S-0-0051 Actual Feedback Value 1**
- **S-0-0053 Actual Feedback Value 2**

Setting the absolute relationship of the actual feedback values-1/2 to the machine zero point is done with the command:

- **S-0-0148, C6, Drive-Controlled Homing, and**
- **P-0-0012, C3, Setting Absolute Position (Dimension)**

Limiting Conditions for Encoder Evaluation

The following limitations exist:

- The DLF, DZF, DEF 1 modules may not be simultaneously operated within a controller.

  ⇒ **Danger of Damage!**

  The combination of DLF and DZF is not possible. The DEF 2 module can be used to operate an incremental feedback with square-wave signals while a DLF or DZF is also being used.

- The DAG 1.2 contains a switch that allows the interface to be changed to an SSI interface (7) or an EnDat interface (8). Make sure that the switch is set correctly.
- If attempting to evaluate an external encoder with an SSI interface, only measurement systems with a resolution of 4096 Incr./Rev. and absolute resolution can be used. If the position loop is closed via this measurement system, only a limited dynamic can be achieved because of the serial transmission from the feedback to the controller.
- Only the standard module, DLF, DZF, or DAG 1.2 can be used to analyze a motor encoder.
- It is not possible to use a resolver as an external measurement system.

Motor Encoder

The following parameters

- **P-0-0074, Motor Encoder Interface**
- **S-0-0116, Resolution of Rotational Feedback 1 (Motor Encoder)**
- **S-0-0277, Position Feedback Type Parameter 1**

are used to parameterize the motor feedback. These specify the interface number to which the measurement system is connected, the motor feedback resolution, as well as the direction of movement, etc. The parameter **S-0-0051, Actual Feedback Value-1** displays the position of the motor feedback.

Determining the Feedback Interface of the Motor Feedback

Determining the encoder interface of the motor encoder occurs with the parameter **P-0-0074, Motor Encoder Interface**. Enter the number of the module to which the motor feedback is connected in the parameter. The motor encoder interface in P-0-0074 is automatically set with certain types of motors. The parameter is then write-protected.

(see also "Characteristics of the Different Types of Motors").

The following measurement systems and modules may be used with motors with motor encoder interfaces that can be parameterized.

Feedback System:	**Module:**	**Number:**
digital servo feed back or resolver	Standard	1
incremental encoder with sine signals from the Heidenhain company, with either uA or 1V signals	DLF	2
gear-type encoder	DZF	3
Encoder with EnDat interface	DAG 1.2	8

Fig. 7-15: Determining the encoder interface for the motor encoder

Motor Encoder Resolution

The motor encoder resolution is parameterized in the parameter **S-0-0116, Resolution of Rotational Feedback 1 (Motor Encoder)**. Enter the graduation scale of the motor feedback. If using a measurement system with its own feedback data storage, the resolution will be taken from this and does not need to be entered. Measurement systems with feedback storage are available if

- Standard (1), or
- DAG 1.2 (8)

is used as the motor encoder interface

Depending on if a rotary or linear motor is being used, the units and the number of decimal places are changed via **S-0-0116, Resolution of Rotational Feedback 1 (Motor Encoder)**.

(see also linear rotary)

Other Motor Encoder Characteristics

To parameterize the other motor encoder characteristics, such as

- Direction of movement not-inverted/inverted
- Distance-coded home mark yes/no
- Rotary / linear measurement system
- Absolute / not-absolute

use **S-0-0227, Position Feedback Type Parameter 1**. The structure of this parameter is as follows:

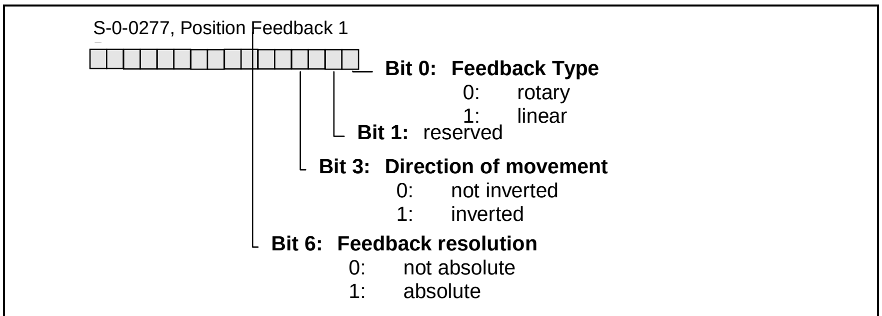


Fig. 7-16: Parameter S-0-0277

This parameter is automatically set with MDD and MKD motors and does not need to be entered.

Bit 6 is automatically set with absolute measurement systems.

(See also Other Settings for Absolute Measurement Systems on page 7-17)

Maximum Representable Travel Range

The maximum representable actual feedback value range is produced in connection with the motor measurement system. The position values of the motor encoder can be displayed in absolute or modulo format. (See also "Display Format of Position Data" on page 7-3). If absolute format is set, the maximum representable actual feedback value range is the same as the maximum possible travel range of the drive.

Motor measurement system	**Max. travel range rotary motor**	**Max. travel range linear motor**
digital servo feedback	+/- 2^11 motor revolutions	--
resolver	+/- (2^16 Encoder cycles / S-0-0116 Resolution of motor encoder) motor revolutions	--
Incremental feedback with sine signals	+/- (2^21 Feedback cycles / S-0-0116 Resolution of motor encoder) motor revolutions	+/- (2^31 * S-0-0116 Resolution of motor encoder) mm
gear-type encoder	+/- (2^20 Feedback cycles / S-0-0116 Resolution of motor encoder) motor revolutions	--
Encoder with EnDat interface	+/- (2^19 encoder cycles / S-0-0116 Resolution of motor encoder) motor revolutions [1)]	+/- (2^19 * S-0-0116 Resolution of motor encoder) mm [1)]

Fig. 7-17: Maximum travel range

[1)] A measurement system-dependent absolute representable range exists with absolute encoders with an EnDat-interface. The maximum drive internal travel range is created out of this absolute range.

(see Other Settings for Absolute Measurement Systems on page 7-17)

External encoder

The external encoder is parameterized with the

- **P-0-0075, External Encoder Interface**
- **S-0-0117, Resolution of Rotational Feedback 2 (External Encoder)**
- **S-0-0115, Position Feedback 2 Type Parameter**

parameters. These specify the interface number to which the measurement system is connected, the resolution of the external encoder, as well as the direction of movement, etc. The parameter **S-0-0053, Actual Feedback Value-2** displays the position of the external encoder.

The external encoder (feedback) should always be parameterized such that **S-0-0053, Actual Feedback Value-2** and **S-0-0051, Actual Feedback Value-1** run parallel if they are moved with the measurement system connected to the machine's mechanical system.

Determining the Encoder Interface of the External Encoder

The encoder interface of the external encoder is determined with the parameter **P-0-0075, External Encoder Interface**. Enter the number of the module to which the external encoder is connected here. The following measurement systems and modules for analyzing an external encoder are allowed.

Feedback System:	Module:	Number:
digital servo feedback	Standard	1
Incremental encoder with sine signals from the Heidenhain Company, with either uA or 1V signals	DLF	2
gear-type encoder	DZF	3
digital servo feedback from the Heidenhain or Stegmann companies	DFF	4
Incremental encoder with square-wave signals from the Heidenhain company	DEF 1	5
Incremental encoder with square-wave signals from the Heidenhain company	DEF 2	6
Encoder with SSI interface	DAG 1.2	7
Encoder with EnDat interface	DAG 1.2	8

Fig. 7-18: Encoder interface of the external encoder

If a "0" is entered for the module number, the encoder analysis of the external encoder is switched off.

Warning

Do not use an encoder with an SSI-interface in the velocity control and position control operating modes.

⇒ Long dead times occur when analyzing the SSI-interface.

External Encoder Resolution

To parameterize the resolution of the external encoder use the parameter **S-0-0117, Resolution of Rotational Feedback 2 (External Encoder)** . Enter the graduation scale of the external encoder here. If using a measurement system with its own feedback data storage, the resolution will be taken from this and does not need to be entered. Measurement systems with feedback storage are available if

- **Standard (1),**
- **DFF (4) or**
- **DAG 1.2 (8)**

is used as the external encoder interface

Depending on if a rotary or linear measurement system was parameterized in bit 0 of **S-0-0115, Position Encoder Type Parameter 2**, the unit and number of digits after the decimal is switched by **S-0-0117, Resolution of Rotational Feedback (External Encoder)**.

Rotational: Cycles/Rev.

Linear: 0.00001 mm

Actual Feedback Value Monitoring

In applications in which an external measurement system is being used, the actual feedback value monitor can offer an additional margin of safety. The actual feedback value monitor can diagnose the following shaft errors:

- Slippage in the drive mechanical system
- Measurement system error (as far as this is not recognized by the measurement system monitors)

To set the monitor function use the parameter

- **S-0-0391, External Encoder Monitoring Window**

If an error occurs, the error message **F236 Excessive Actual Feedback Value Difference** is generated.

Principal Operating Characteristics of the Actual Feedback Value Monitor

The actual feedback value monitor compares the actual feedback value of the motor encoder with the external encoder. If the deviation of both of the actual values is larger than **S-0-0391, External Encoder Monitoring Window**, the error **F236 Excessive Actual Feedback Value Difference** is generated. As a result, the motor and external encoder position statistics are erased.

The actual feedback value is only active if an external encoder is available and is not being analyzed and if **S-0-0391, External (Feedback) Encoder Monitoring Window** is not parameterized with a "0".

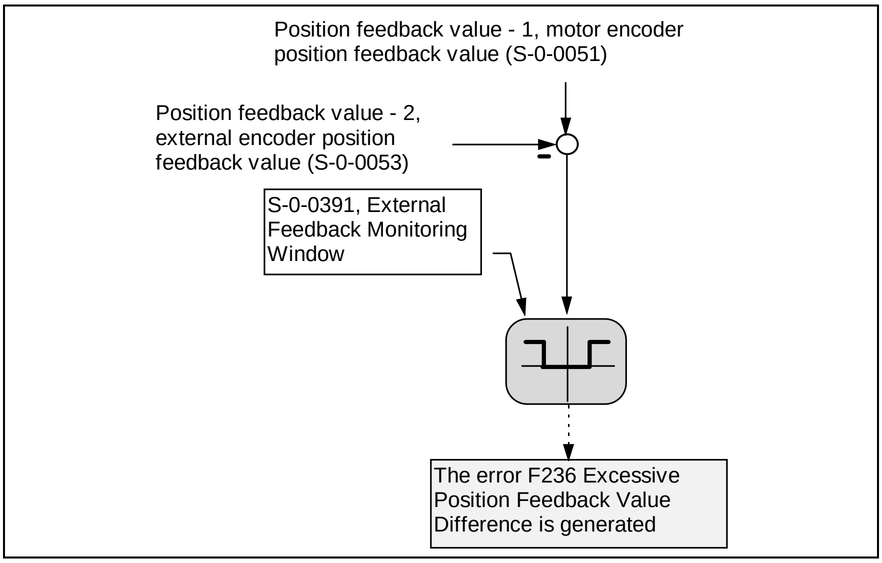


Fig. 7-19: Actual feedback value monitoring schematic

Setting the Actual Feedback Value Monitoring Window

The requirements for setting the actual feedback value monitor are

- All drive regulator loops must be set correctly.
- The axis mechanical system must be in its final form.
- The axis must be homed.

The monitoring window must be determined according to the application. The following basic procedure is recommended for doing this:

- Run through a typical operating cycle. While doing this, set the planned acceleration and velocity data of the axis.
- Enter progressively smaller values in the parameter **S-0-0391, External Encoder Monitoring Window** until the drive gives the error message **F236 Excessive Actual Feedback Value Difference**. Depending on the mechanical system, start with 1-2 mm and decrease the window in 0.3 ... 0.5 mm steps.
- The value at which the monitor is triggered should be multiplied with a tolerance factor of 2 ... 3 and entered in parameter **S-0-0391, External Encoder Monitoring Window**.

When determining the monitoring window, make sure that the actual feedback value monitor works dynamically. This means that even dynamic deviations of both actual feedback values in acceleration and braking phases are registered. This is why it is not enough to use statistical axis errors as the basis for the setting.

Deactivating the Actual Feedback Value Monitor

It is possible to turn off the actual feedback value monitor in applications where the externally connected measurement system does not control the axis position but is used for other measurements. To do this, enter 0 in the parameter **S-0-0391, External Encoder Monitoring Window**.

Other External Encoder Characteristics

To parameterize the important characteristics of the external encoder, such as

- Direction of movement not-inverted/inverted
- Distance-coded home mark yes/no
- Rotary / linear measurement system
- Absolute / not-absolute

use **S-0-0115, Position Feedback 2 Type Parameter**

The structure of this parameter is as follows:

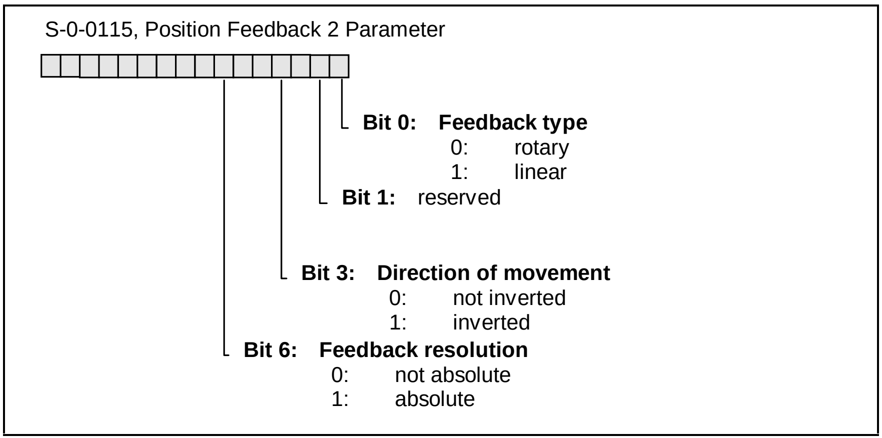


Fig. 7-20: Parameter S-0-0115

Bit 6 is automatically set with absolute measurement systems.

(see Other Settings for Absolute Measurement Systems on page 7-17)

Actual Feedback Values of Non-Absolute Measurement Systems After Initialization

If an absolute measurement system is not available, the actual feedback values in the command **S-0-0128, C2 Communication Phase 4 Transition Check** are initialized as shown below, depending on if the parameter **P-0-0019, Position Beginning Value** was written in the previous communication phase 2 or 3 or not.

P-0-0019 written:	Actual feedback value-1	Actual feedback value-2
no	init. motor encoder raw value	init. motor encoder raw value
yes	position beginning value	position beginning value

Fig. 7-21: Non-absolute measurement system actual feedback values after initialization

Warning

No valid actual feedback values exist before the measurement system is initialized.
The initialization is executed in the transition command from phase 3 to 4.

Some measurement systems have limitations concerning the maximum velocity being used while the measurement system is being initialized

Measurement system	Max. initialization velocity
DSF	300 Rpm
EnDat	Initialization should occur at standstill
Multiturn resolver	300 Rpm

Fig. 7-22: Velocity allowed during initialization

7.3 Other Settings for Absolute Measurement Systems

Absolute measurement systems can be used as motor measurement systems or external measurement systems.

The following table shows which absolute measurement systems can be used as a motor encoder or as an external encoder and which plug-in module is necessary for this.

Feedback System:	Module (No.):	As motor encoder	As external encoder
Single/Multiturn DSF	Standard(1)	yes	yes
Single/Multiturn DSF	DFF(4)	no	yes
Multiturn resolver	Standard(1)	yes	no
SSI-encoder with 4096 Inc/Rev	DAG 1.2(7)	no	yes
Heidenhain linear scale with EnDat interface	DAG 1.2(8)	no	yes
Heidenhain single/ multiturn rotary encoder with EnDat interface	DAG 1.2(8)	no	yes

Fig. 7-23: Modules needed for absolute measurement systems

Except for the SSI-encoder, the measurement systems can be accessed by way of a data storage device, from which information on whether it is an absolute measurement system is taken.

Bit 6 in the corresponding position encoder type parameter (absolute/non-absolute) is set during the command **S-0-0128, Communication Phase 4 Transition Check** .

Note: The handling of single-turn encoders as absolute measurement systems depends on whether the position data are scaled in modulo format (Bit 7 of **S-0-0076, Scaling Type of the Position Data** equals "1") **and** whether the modulo value used (in **S-0-0103, Modulo Value**) is smaller than the single turn range, i.e. one encoder revolution of the single turn encoder. A single-turn encoder will be handled as an absolute measurement system only if both of these conditions are met. Bit 6 of the position encoder type parameter (S-0-0277 for motor encoders or S-0-0115 for external encoders) shows whether the measurement system is handled as an absolute or not-absolute measurement system.

Set Absolute Measuring

When an absolute measuring system is installed, its actual feedback value displays a value that is arbitrary and has no relationship to the machine's zero point. In this case, the value of the **S-0-0403, Actual Feedback Value Status** parameter is "0".

The actual feedback value of this measurement system can be set to the desired value with the command "Set Absolute Measuring." After absolute measuring (dimension) is set, the actual feedback value of the encoder has a defined relationship to the machine's zero point.

All information will be available after reset because all necessary data from the absolute dimension system is stored in encoder data memory or in parameter data memory. The position feedback value retains its reference to the machine's zero point.

The following parameter is available for executing the function:

- **P-0-0012, C3 Command Set Absolute Measurement**

In addition, the following parameters are needed or are affected by the function:

- **S-0-0147, Homing Parameter**
- **S-0-0052, Reference Distance 1**
- **S-0-0054, Reference Distance 2**
- **S-0-0403, Actual Feedback Value Status**

"Set Absolute Measuring" Functional Principle

The feedback connected to the mechanical system is brought to an exactly measured position. The value desired for the actual feedback value of the measurement system is entered in the parameter **S-0-0052, Reference Distance 1** (for motor encoder) or **S-0-0054, Reference Distance 2** (for external encoder). Then the command **P-0-0012, C3 Command 'Set Absolute Measurement' (Absolute Dimension)** is started. The actual feedback value is set to the value in the respective homing measure and the position status becomes "1".

If only one absolute measurement system is available, the command automatically refers to this measurement system. If 2 absolute measurement systems are connected, the selection is conducted according to bit 3 of **S-0-0147, Homing Parameter**.

When the command is executed, 3 different cases can be distinguished :

1.) Set absolute measuring without controller enable

2.) Set absolute measuring with controller enable, function executed by subsequently starting the command "Drive Controlled Homing Procedure"

3.) Set absolute measuring with controller enable, function executed by subsequently removing the controller enable.

Set absolute measuring without controller enable

When absolute dimension is set without controller enable, the axis is moved to the exactly measured position and, while the controller enable is turned off, the command **P-0-0012, C3 Command 'Set Absolute Dimension' (Measuring)** is started, after the homing measure has been written with the desired actual feedback value at this position.

The command immediately sets the actual feedback value of the measurement system to the homing measure and the position status becomes "1". The command is finished in the drive and can be erased.

Normally, this simple method of executing the command is all that is needed. However, if the application is dealing with a "hanging axis" or if the approached position without controller enable is not stopped for another reason, the command can also be executed under controller enable with specific conditions.

(see 2. or 3. from Set absolute dimension (measuring) during controller enable, then turn off the controller enable on page 7-20

Setting Absolute Dimension Under Controller Enable and Subsequent "Drive-Controlled Homing"

Homing: Setting absolute dimension command, the actual feedback value of a controlled axis can be changed. This may be necessary with "hanging axes," for example.

The procedure is as follows :

- Move the axis to the measured position
- Enter the desired actual feedback value in the appropriate homing measurement (scale) actual feedback value parameter.
- Start the command **P-0-0012, C3 Command 'Set Absolute Dimension'** The position data will not be switched yet.
- Start the command S-0-0148, C6 Drive-Controlled Homing this feature recognizes that it is dealing with an absolute measurement system and executes "Set Absolute Dimension" or, in other words, the actual feedback value is set to the homing scale. The position command value (**S-0-0147, Position Command Value**) is simultaneously set to the same value. As with each execution of "drive-controlled homing," the position command value is read via the service channel and the control system's position command value is set to this value before the homing command is cleared.

  Warning:
  Make sure that the encoder to be set is selected in bit 3 of **S-0-0147, Homing Parameter**
- Clear the command **P-0-0012, C3 Command 'Set Absolute Dimension'**

Set absolute dimension (measuring) during controller enable, then turn off the controller enable

Setting absolute dimension: with CE and subsequent CE switch off, the actual feedback value of a controlled axis can be changed. Switching the actual feedback value occurs after the controller enable is turned off.

The procedure is as follows :

- Move the axis to the measured position
- Enter the desired actual feedback value in the appropriate homing measurement (scale) actual feedback value parameter.
- Start the command **P-0-0012, C3 Command 'Set Absolute Dimension'** (Measuring). The position data will not be switched yet.
- Turn off the controller enable, the actual feedback value is set to the homing scale, the command is ended in the drive.
- Clear the command P-0-0012, C3 Command 'Set Absolute Dimension' (Measuring)

Set the actual feedback values according to the absolute dimension

Actual Feedback Value: Set according to absolute dimension of the motor encoder and, if available, of the external encoder after executing the set absolute dimension command, depends on bit 3 in **S-0-0147, Homing Parameter** and the availability of an absolute encoder as the motor encoder or external encoder.

Motor encoder:	**External encoder:**	**S-0-0147 bit 3:**	**Actual feedback value 1:**	**Actual feedback value 2:**
Absolute	Non-absolute or not available	Any value	Reference distance 1	Reference distance 1
Non-absolute	Absolute	Any value	Reference distance 2	Reference distance 2
Absolute	Absolute	0	Reference distance 1	Unchanged
Absolute	Absolute	1	Unchanged	Reference distance 2

Fig. 7-24: Set actual feedback values according to absolute dimension

Actual feedback values from absolute encoder after switching on

(see Actual Feedback Values of Non-Absolute Measurement Systems After Initialization on page 7-17)

possible error messages when setting the absolute dimension

While the command is being executed, the following command errors can occur

- The command **P-0-0012, C3 Set Absolute Dimension Command** was started without an absolute measurement system being available.

Absolute Encoder Monitoring

If a measurement system with absolute position feedback is used, activating the absolute encoder monitor can create an additional margin of safety. The monitor feature works as follows:

When turning off the drive's power supply, the current actual position of the axis is loaded into resident memory. When the axis is turned back on, the difference between the stored position and the new position as read by the measurement system is formed. If this difference is larger than the parameterized position window in parameter **P-0-0097, Absolute Encoder Monitoring Window**, the error message **F276 Absolute Encoder Error, Deviation > P-0-0097** is given.

The absolute encoder monitor is appropriate for the following applications:

- The motor is equipped with a holding brake.
- The drive mechanical system is self-locking and cannot be moved manually.

Setting the Absolute Encoder Monitor

The absolute encoder monitoring window must be set by the user. Set the window according to how much the axis may move when it is turned off. Assuming that the axis has a brake or is self-locking, 0.1 motor revolutions (36° in reference to the motor shaft) can be entered for the parameter **P-0-0097, Absolute Encoder Monitoring Window**.

Deactivating the Absolute Encoder Monitor

The absolute encoder monitor cannot be effectively used with axes that can or must be moved manually after being turned off. The absolute encoder monitor should be turned off in situations such as this in order to prevent unnecessary error conditions.

The absolute encoder monitor can be turned off by writing 0 to P-0-0097.

Modulo Analysis of Absolute Measurement Systems

Modulo Feature: Modulo Feature of Absolute Measurement Systems of the position data has been activated :If both the motor encoder and the external encoder are absolute measurement systems, only the one selected in bit 3 of parameter **S-0-0147, Homing Parameter** will be analyzed as an absolute encoder. (See also "Modulo Feature" on page 7-8).

Actual Feedback Values of Absolute Measurement Systems After Initialization

The condition of the position feedback values of the motor feedback and, if available, of the external feedback after initializing the position feedback values in the command **S-0-0128, C2 Communication Phase 4 Transition Check** is dependent on:

- Bit 3 in S-0-0147, Homing Parameter
- Availability of an absolute feedback as the motor or external feedback.

Motor-feedback:	External feedback:	Bit 3 , S-0-0147:	S-0-0051, Position feedback value-1:	S-0-0053, Position feedback value-2:	S-0-0403, Position status:
absolute	not absolute	0	absolute value of motor feedback	absolute value of motor feedback	1
absolute	not absolute	1	absolute value of motor feedback	absolute value of motor feedback	0
not absolute	absolute	0	absolute value of external feedback	absolute value of external feedback	0
not absolute	absolute	1	absolute value of external feedback	absolute value of external feedback	1
absolute	absolute	arbitrary	absolute value of motor feedback	absolute value of external feedback	1

Fig. 7-25: Actual feedback values of absolute measurement systems after initialization

7.4 Drive Limitations

Current Limit

The current limit limits the command current to the parameters

- **P-0-4046, Active Peak Current, or**
- **P-0-4045, Active Continuous Current (Duration Current)**

The active continuous current designates the current that can be continually taken from the drive, whereas the active peak current is only available for short periods of time.

If the peak current is demanded from the drive for longer periods of time, the drive controller's internal thermal load monitor will make sure that the allowable output current is reduced from the active peak current to the active continuous current.Both parameters are produced from the applicable drive controller data, such as the peak amplifier current (**S-0-0110, Amplifier Peak Current**) etc., as well as the contents of the following parameters:

- **P-0-4004, Magnetizing Current**
- **S-0-0109, Motor Peak Current**
- **S-0-0111, Motor Current at Standstill**
- **S-0-0092, Bipolar Torque/Force Limit Value**
- **P-0-0109, Torque/Force Peak Limit**
- **P-0-4011, Switching Frequency**

Setting the Active Peak Current

The parameter **P-0-4046, Active Peak Current** may not be set separately, but is instead a factor of the following parameters:

- **S-0-0110, Amplifier Peak Current**
- **S-0-0109, Motor Peak Current**
- **P-0-4004, Magnetizing Current**
- **S-0-0092, Bipolar Torque/Force Limit Value**

- In addition:The allowable peak amplifier current is limited to the **S-0-0109, Motor Peak Current**, if this is smaller.
- As the process continues, the value determined under 1. is reduced in connection with **P-0-4004, Magnetizing Current**. The magnetizing current is 0 if it is dealing with a synchronous motor.
- Dynamic reduction during operation by monitoring the thermal load of the drive controller. (See also “Monitoring the Thermal Load“ on page 7-24)
- Limit to **P-0-0109, Torque/Force Peak Limit** and **S-0-0092, Bipolar Torque/Force Limit Value**
(See also “Limiting to Bipolar Velocity Limit Value“ on page **Fehler! Textmarke nicht definiert.**)

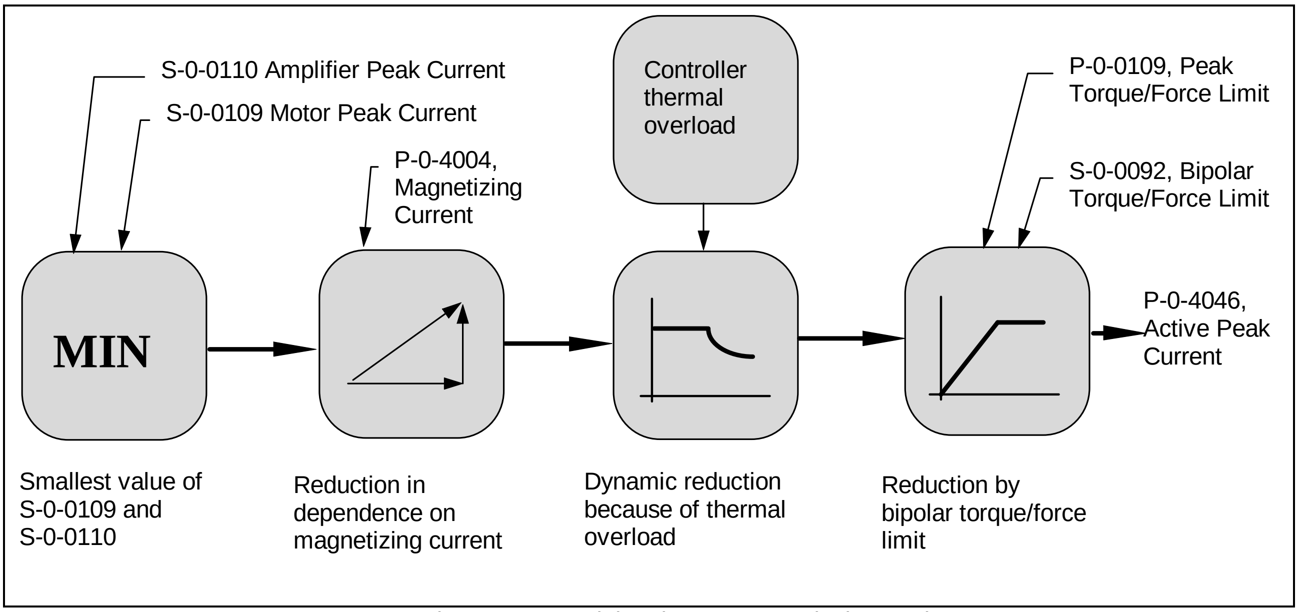


Fig. 7-1: Determining the torque-producing peak current

Setting the Active Continuous Current

The content of the parameter **P-0-4045, Active (Duration) Continuous Current** is a factor of the following parameters:

- **P-0-4011, Switching Frequency**
- **P-0-4004, Magnetizing Current**
- **P-0-4046, Active Peak Current**

In addition:

- The corresponding continuous current is determined from the selected switch frequency via the applicable drive controller data.
- As the process continues, the value determined under 1. is reduced in connection with **P-0-4004, Magnetizing Current**.
- The magnetizing current is 0 if it is dealing with a synchronous motor.Limit to the value determined from **P-0-4046 Active Peak Current**

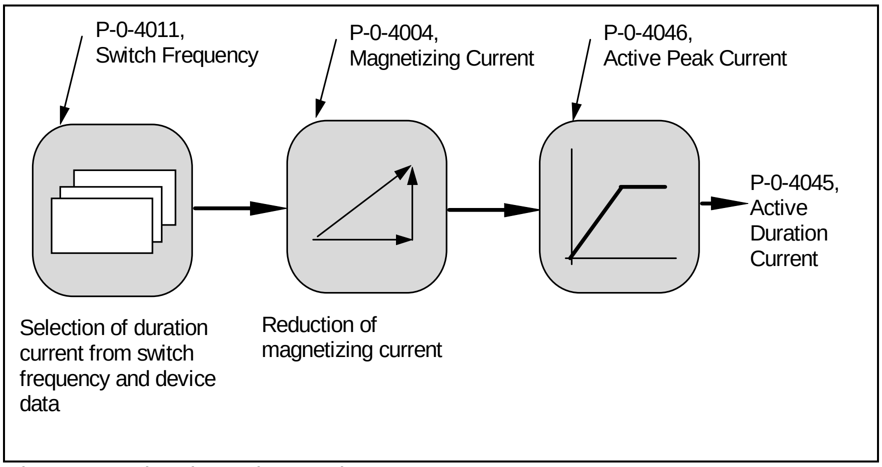


Fig. 7-2: Setting the active continuous current

Monitoring the Thermal Load

The thermal drive controller load indicates how heavily the drive controller's end stage unit is loaded by the command current being delivered. Additionally, information from the

- drive controller specific data,
- the command current profile and
- the selected switch frequency

is used to continually calculate the power transistor chip over-temperature. This may not become larger than the allowed chip over-temperature. If this condition is reached, the control drive will react by dynamically reducing the command current.

(See also Setting the Active Peak Current on page 7-22)

The drive controller will generate the warning **E257 Duration Current Limiting Active**.

For diagnostic purposes, a warning threshold can be set with **P-0-0127, Overload Warning**. For practical purposes, a value of 80% thermal load is parameterized here. This value should not be exceeded during normal drive operation. If the thermal load exceeds the value parameterized **in P-0-0127, Overload Warning**, the drive controller will generate the warning **E261 Continuous (Duration) Current Limit Warning**.

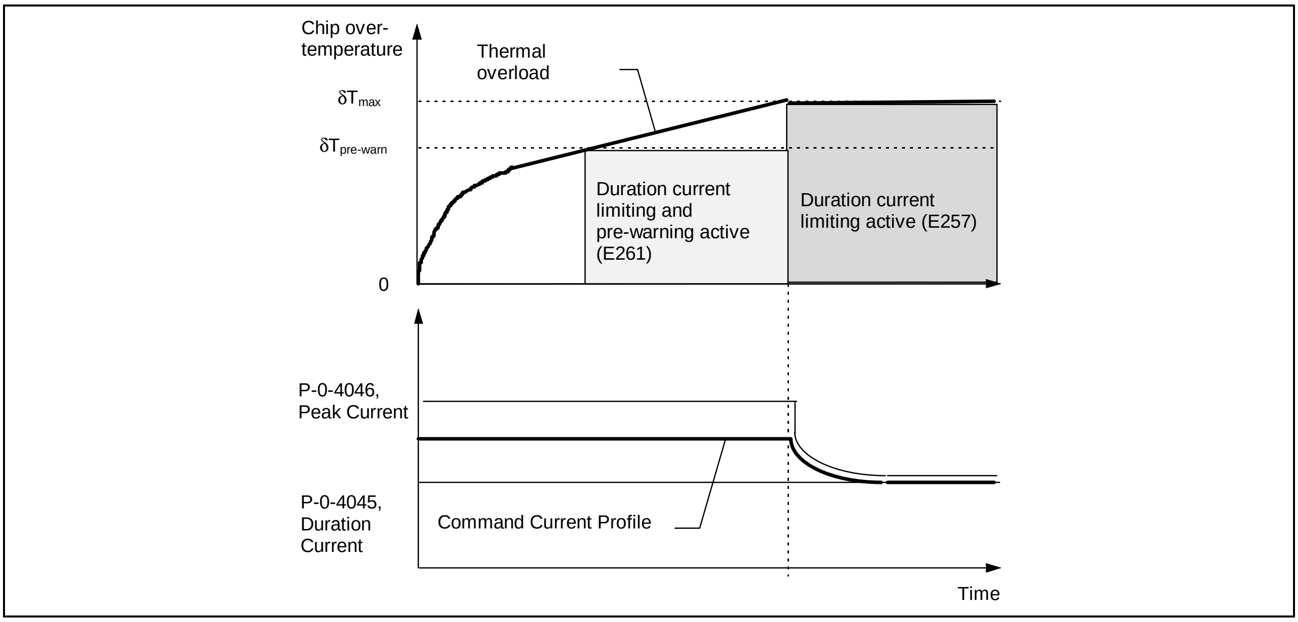


Fig. 7-3: Monitoring the thermal load and continous current limit

Checking the Thermal Load

The parameter **P-0-0141, Thermal Drive Load** is for diagnostic purposes. In this parameter, 0% corresponds to a chip over-temperature of 0 Kelvin, 100% corresponds to the maximum chip over-temperature. The thermal load should not exceed a value of 80% for the applied operating cycles if the drive is set up correctly.It typically takes about 10 minutes to warm up a drive controller end stage to its final temperature. To check the thermal load of a drive during installation without having to run operating cycles during this period of time, the drive controller load can be preset with 80%. This can happen by writing an arbitrary value to the parameter **P-0-0141, Thermal Drive Load**. A typical operating cycle must be simultaneously run for a short while. The thermal load should be observed while this is being done and falling tendencies should be shown. Otherwise the drive is incorrectly set up for the application. To check the thermal load for further increase above 80%, the

- Overload warning by means of **P-0-0127, Overload Warning**
- and/or the output of the thermal load at the analog output

may be used. The following illustration shows the typical process of the thermal load, as it can be observed by means of the analog output. During the execution of an operating cycle, the load is preset with 80% by writing to P-0-0141.

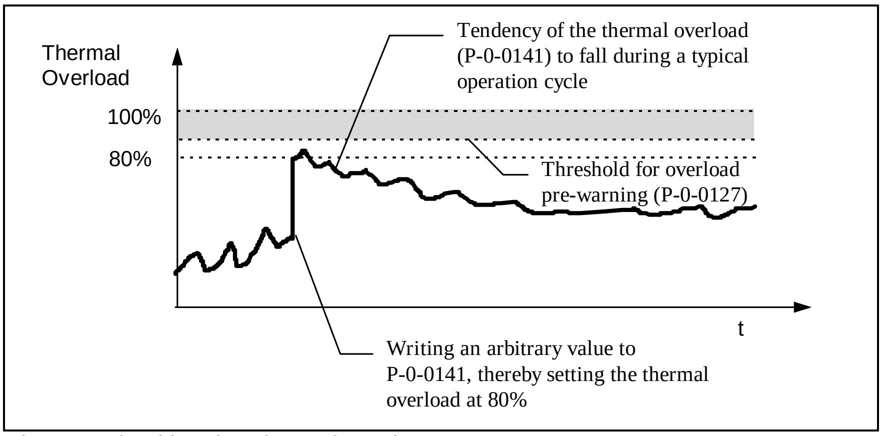


Fig. 7-4: Checking the Thermal Load

Torque/Force Limiting

The maximum allowable torque can be limited by the user with the parameters

- **S-0-0092, Bipolar Torque/Force Limit Value**
- **P-0-0109, Torque/Force Peak Limit**

These parameters determine what percentage of **S-0-0111, Motor Current at Standstill** is made available to the user.

The parameter **S-0-0092, Bipolar Torque/Force Limit Value**is designed to allow variable limits of the maximum drive torque to values smaller than the maximum allowable drive torque while it is in operation. This is useful when temporarily moving toward a positive stop, for example.Each drive produces a specific peak torque based on the maximum allowable current of the applicable motor/drive controller combination, which is desirable for acceleration procedures in many applications. Nevertheless, there are times when the maximum peak torque must be limited to lesser values for technical reasons specific to an application. The maximum peak torque of a drive can be limited as appropriate for an application with the parameter **P-0-0109, Torque/Force Peak Limitation**. The parameter overrides everything else to ensure that the maximum peak torque allowed for the application cannot be exceeded even if **S-0-0092, Bipolar Torque/Force Limit Value** is set arbitrarily high.

The maximum output current is thus determined together with the current limit, which is displayed in **P-0-4046, Active Peak Current.**

(See also **Fehler! Verweisquelle konnte nicht gefunden werden.**on page **Fehler! Textmarke nicht definiert.**)

The following illustration shows the connection between the current limit and the torque/force limit of the maximum allowed torque in determining the maximum output current.

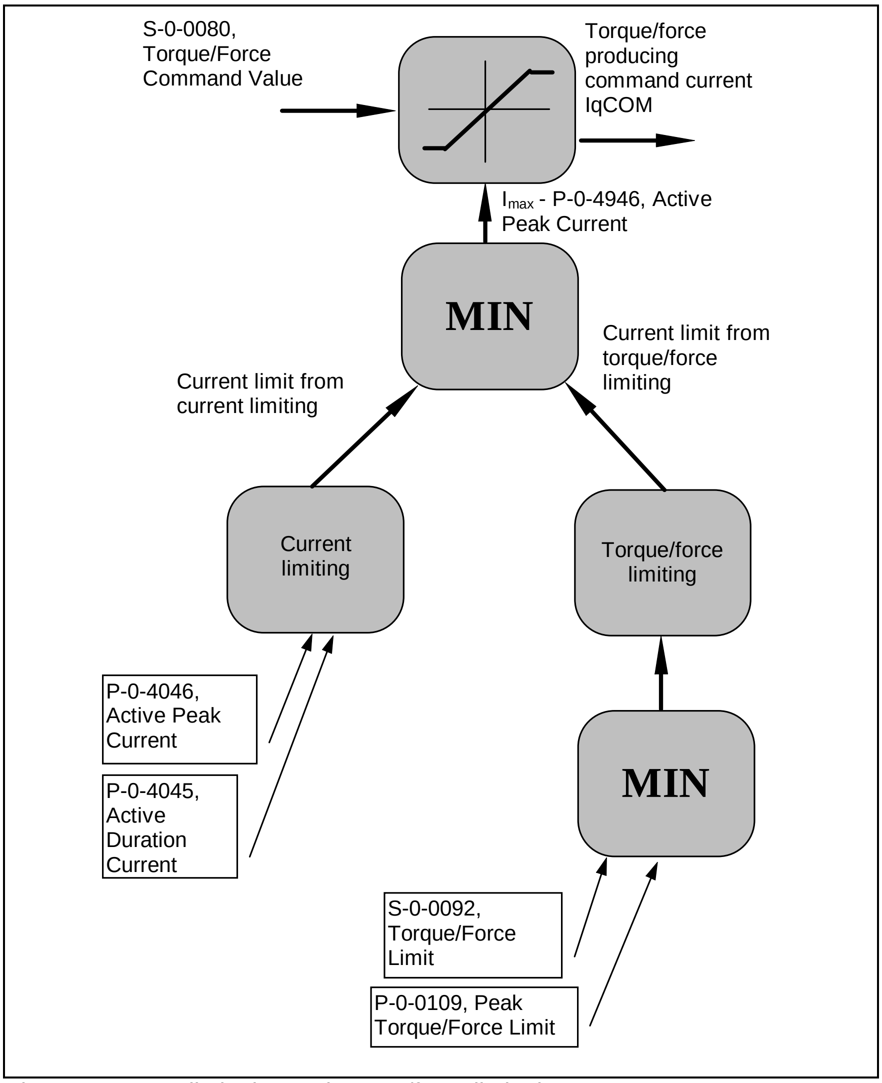


Fig. 7-5: Current limitation and torque/force limitation

The current limit and the torque/force limit both affect the torque-producing command current limit.

The active value is always the smaller value of

- Current limit value from current limitation
- Current limit value from torque/force limitation

This is displayed in parameter **P-0-4046, Active Peak Current**

Limiting Velocity

The following parameters limit the velocity of the drive

- **S-0-0113, Maximum Motor Velocity**
- **S-0-0091, Bipolar Velocity Limit Value**

The parameter **S-0-0091, Bipolar Velocity Limit Value** is designed to allow variable limits of the maximum velocity to values smaller than the maximum allowable velocity while it is in operation.

The parameter **S-0-0113, Maximum Motor Velocity**designates the maximum possible motor velocity. It is contained in the motor encoder data storage of MDD and MKD motors and does not need to be entered, but with other types of motors this value must be taken from the motor parameter specifications.

Limiting to Maximum Motor Velocity

The maximum motor velocity defines the maximum velocity of the drive. It becomes active as

- the maximum value entered in the parameter **S-0-0091, Bipolar Velocity Limit Value**

Limiting to Bipolar Velocity Limit Value

The bipolar velocity limit value defines the maximum velocity of the drive for the user. It becomes active as

- the monitor of the encoder velocity in the **Torque Control** operating mode
- the limit for the resulting command value in the velocity controller
- the monitor of the position command value difference in the **Position Control operating mode** (see also position command value monitoring)
- the limit of S-0-0036, Velocity Command Value in the velocity control operating mode

Monitoring the Feedback Velocity in the Torque Control Operating Mode

Monitoring the Feedback Velocity in **Torque Control** in the Torque Control operating mode occurs at 1.125 times the value of **S-0-0091, Bipolar Velocity Limit Value**.

If this value is exceeded, the fatal error

- **F879 S-0-0092, Crossing Maximum Velocity Feedback Value**

is generated. The drive switches to torque-free operation afterwards.

Limiting the Resulting Command Value in the Velocity Controller

In all operating modes in which the velocity controller is active (all operating modes except for **Torque Control**), the velocity command valueBipolar Velocity Limit Value: Limiting the Command Value that is entered is limited to the value of **S-0-0091, Bipolar Velocity Limit Value**. If this condition is reached, the warning

- **E259 Command Velocity Limitation Active**

is generated.

Limiting S-0-0036, Velocity Command Value in the Velocity Control Operating Mode

In the velocity control operating mode, the input of S-0-0036, Velocity Command Value is limited to S-0-0091, Bipolar Velocity Limit Value. If the value entered in S-0-0036 exceeds this limit, the warning

- **E263 S-0-0036 Velocity Command Value Greater Than S-0-0091**

is generated.

Travel Range Limits

Two procedures exist to monitor the allowable travel range of an axis.

These are the monitors for

- Travel zone end switches, and
- Axis Limit Values

The travel range is exceeded when either a travel zone end switch is activated or one of the two axis limit values is exceeded by the homed actual feedback value that is, the value referring to the machine zero point.

The drive's response to the travel range being exceeded is adjustable. The following possibilities exist:

- An error with a "Set Velocity Command Value to Zero" reaction and automatic controller enable shutoff
- A warning with a "Set Velocity Command Value to Zero" reaction and automatic reset when the error conditions are no longer present.

This is set in bit 2 of **P-0-0090, Travel Zone End Switch Parameter**:

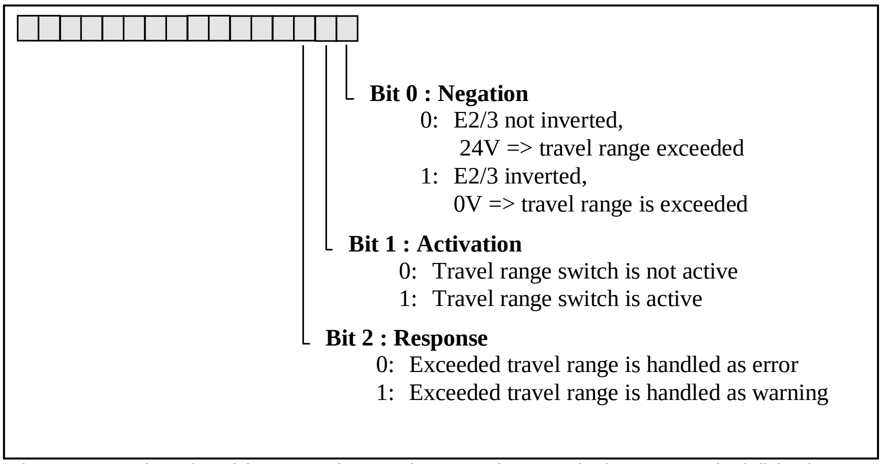


Fig. 7-6: Setting the drive reaction to the travel range being exceeded (bit 2)

Note: It is not possible to bring the axis to a standstill when using a command ramp (slope) over **P-0-1201, Ramp 1 pitch** (velocity ramp 1) (Best possible standstill =2)! The standstill always occurs with the maximum allowable torque/force. (**See P-0-4046, Active Peak Current**)

Exceeding the Travel Range as an Error

If a "0" is entered in bit 2 of P-0-0090, then exceeding the travel range as an error is handled with the reaction of the velocity command value being set to zero. (See also Velocity Command Value Set to Zero)

After the velocity command value has been set to zero, the drive turns off the internal controller enable and becomes torque-free. The ready-to-operate contact opens.

For re-installation

- clear the error with the command **S-0-0099, Reset Class 1 Diagnostics** or press the S1 button,
- reactivate the drive with the 0-1 edge of the controller enable signal.

If the error condition is still present, that is, if the limit switch is still activated or if the axis limits are still exceeded, only command values that lead back into the allowable range will be accepted. Monitoring the command values is dependent on the active operating mode.

The following applies:

Operating Mode:	Command Value Check:
Torque control	polarity of S-0-0080, Torque/Force Command Value
All operating modes with drive-internal velocity control	polarity of the internal velocity command value
all operating modes with drive-internal position control	polarity of the velocity created by the given position command values

Fig. 7-7: Monitoring the command values in error conditions

If command values are entered that would lead out of the allowable travel range, the travel range error will be generated again.

Exceeding the Travel Range as a Warning

If a "1" is entered in bit 2 of **P-0-0090, Travel Limit Switch Parameter,** then exceeding the travel range as a warning is handled with setting the velocity command value to zero.

The drive does not turn off its internal controller enable. If the error condition is still present, that is, if the limit switch is still activated or if the axis limits are still exceeded, only command values that lead back into the allowable range will be accepted. Monitoring the command values is dependent on the active operating mode. (See previous chapter.)

Travel Zone End Switch Monitoring

The monitor for exceeding the travel zone end switch is only activated if

- the monitor is switched on in bit 1 of **P-0-0090, Travel Zone End Switch Parameter**

Exceeding the travel zone end switch is recognized when these are activated. The diagnostic message depends on the type of reaction:

How handled:	SS display:	Diagnostic message:
As an error	F643	F643 Positive travel range limit switch activated/detected
	F644	F644 Negative travel range limit switch activated/detected
As a warning	E843	E843 Positive travel range limit switch activated/detected
	E844	E844 Negative travel range limit switch activated/detected

Fig. 7-8: Diagnostic message when travel zone end switch is exceeded

Travel Zone End Limit Switch - Connection

The drives in the DIAX-03 family have 2 binary inputs available for connecting travel zone end switches. These can be found in the DSS 2.1 plug-in module. The inputs are divided by potential and must be supplied with +24V by the same connector (X 12).

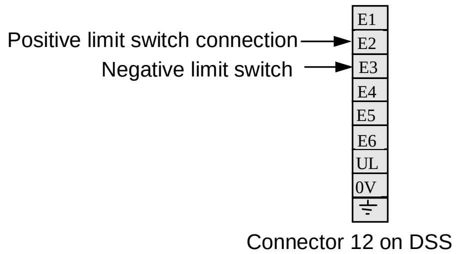


Fig. 7-9: Connecting the limit switches to X12

The travel zone limit switches are connected to the E2 and E3 inputs of the X12 connector.

Travel Zone End Switches - Activation and Polarity

The travel zone end switches are activated with the parameter **P-0-0090, Travel Zone End Switch Parameter**. Additionally, the inputs can be inverted in this parameter (0V on E2/3 -> Travel range exceeded).

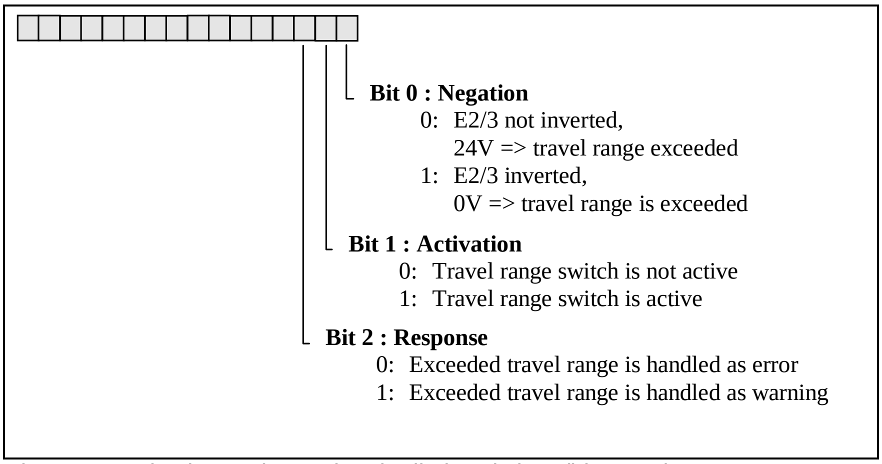


Fig. 7-10: Activating and negating the limit switches (bit 0 or 1)

If the monitor in bit 1 of P-0-0090 is turned on, the +24V DSS 2.1 +UL input monitor is simultaneously activated, if it was not already activated by using other X12 connector ports. I.e.: if the +UL voltage falls below +18V, the error F233, External Voltage Supply Error.

Axis Limit Values

The monitor for exceeding the axis limit parameters:

- **S-0-0049, Positive Axis Limit Value (Position Limit)**
- **S-0-0050, Negative Position Limit**

is executed only if:

- the encoder system of the active operating mode has been homed, i.e. the position encoder values are in relation to the machine zero point. The **S-0-0403, Position Feedpack Value Status** is therefore "1"

AND

- the monitor for the axis limit values in **S-0-0055, Position Polarities Parameter**, bit 4 was activated.

It is recognized that the axis limit values have been exceeded if the actual feedback value of the active operating mode exceeds the travel range set by the axis limit values.

Bit 3 of the parameter **S-0-0147, Homing Parameter** determines if the actual feedback value of the motor encoder or of the external encoder is brought up.If drive-internal interpolation is used as the active operating mode, the drive checks to see if the target position is outside of the axis limit values. If it is, the drive will not move and the warning **E2-53, Target Position Outside of Travel Range** is generated and bit 13 in parameter **S-0-0012, Class 2 Diagnostics** is also set.

The diagnostic message for when the axis limit values have been exceeded depends on the type of reaction:

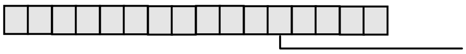
Howhandled:	SS display:	Diagnostic message:
As an error	F629	F629 Positive position limit value exceeded
	F630	F630 Negative position limit value exceeded
As a warning	E829	E829 Positive position limit value exceeded
	E830	E830 Negative position limit value exceeded

Fig. 7-11: Diagnostic message when axis limits have been exceeded

Axis Limit Values - Activation

The axis limit value monitor is activated in bit 4 **of S-0-0055, Position Polarities Parameter**.

S-0-0055, Position polarity parameter



Bit 4 : Position limit values
0 : not active
1 : active

Fig. 7-12: Activating the axis limits

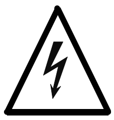
7.5 Drive Interlock Open

Manufacturing systems, transfer roll trains and tool machines often consist of physically separated work areas such as processing units, transport, distribution, and storage systems.

Persons in one of these areas must often undertake work in danger ranges, while other parts of the machine continue to operate. If persons will be in the working area of a motor, it should be brought to a standstill and secured against inadvertent operation.

The drive interlock provides a security margin for inadvertent operation of a connected motor when an error occurs. It ensures that separate work areas in a machine or system are turned off.

The DDS and DKR series of control drives are equipped with a drive interlock. Activating the drive interlock separates the power output control electronics from the power output with a relay contact.



DANGER

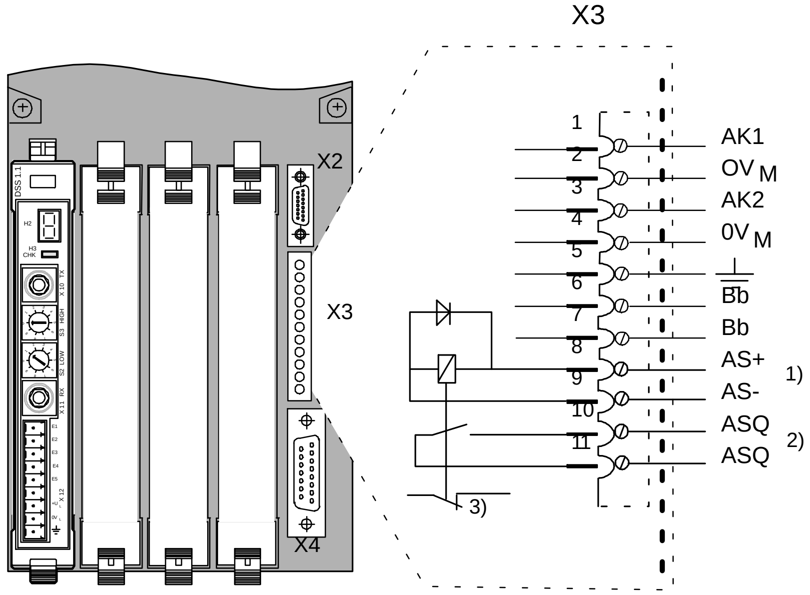
Danger of accidents through uncontrolled axis movements !

The drive interlock is not for stopping an axis that is in motion.
If the drive interlock is activated, the drives cannot be moved with the control system. The motor becomes torque-free instantly, and the axis can no longer be brought to a controlled stop.
With vertical axes, secure the axes with a mechanical brake before activating the drive interlock.

On motors with brakes, this occurs by removal of the controller enable. Only activate the drive interlock after this has been done.

Activating the Drive Interlock

The drive interlock is activated by putting a voltage of +24V on the AS+ and AS- connecting terminals of the X3 connector. The starting lockout relay found in the drive controller is switched by closing the potential-free acknowledgment contact (output ASQ -ASQ) starting at the control system.



1) AS+, AS-, -Control input for delay spools
Voltage 20-30V DC
Power 1.5 W
2) ASQ, ASQ -potential-free acknowledgement contact
24V, 1A
3) Contact for controlling the power electronics

ap5007d2.drw

Fig. 7-13: Drive interlock control output and message output on the drive controller

When the drive interlock is activated, the control drive's H1 condition display shows the message "AS".

The diagnostic message reads: **A011 Drive Interlock Open**

7.6 Drive Error Reaction

The error response depends on the current error class.

If an error is recognized in the drive controller, a preset error response occurs.

This drive error response depends on

- the error class of the current error

, and the setting of the parameters

- P-0-0117, Activation of NC Response During an Error
- P-0-0118, Power Switch Off in Error Situation
- P-0-0119, Best Possible Deceleration

Note: The error class determines if the parameter-selected responses are activated.

There are 4 error classes, which have different priorities.

(see "Error Classes")

Error Class	Diagnostic Messages	Drive Response
Fatal	F8xx	The error response parameter settings in **P-0-0117, Activation of NC Response During an Error** and **P-0-0119, Best Possible Deceleration** will be ignored, since a driver response is impossible.Torque/force is instantly disabled.
Travel range	F6xx	Independent of the settings in parameters **P-0-0117, Activation of NC Response During an Error** and **P-0-0119, Best Possible Deceleration**, the velocity command value is immediately set to zero. This response corresponds to the setting P-0-0117 = 0 (no NC Response) P-0-0119 = 0 (Velocity Command Value Reset). This setting provides the fastest stop of the axis if the drive range is exceeded.
Interface	F4xx	A control response is impossible, since the communication to the control became inoperative. The drive proceeds instantly with **P-0-0119, Best Possible Deceleration**.
Non-fatal	F2xx	The drive proceeds with **P-0-0117, Activation of the NC Response During Error** and **P-0-0119, Best Possible Deceleration**. If during an error the NC response is active, then the drive continues for 30 sec as if no error had been reported. This time can be used by the control to decelerate the axis. Afterwards the response P-0-0119 is activated by the drive.

Fig. 7-14: Error Response of the Drive

Best Possible Deceleration

The drive's response to interface and non-fatal errors can be parameterized by **P-0-0119, Best Possible Deceleration** .

At the end of each error response, the drive's torque is disabled.

The following settings are possible:

Value of P-0-0119:	Response
0	Velocity Command Value Reset
1	Disable Torque
2	Velocity Command Decelerated to Zero

Fig. 7-15: Setting Options for Best Possible Deceleration

The drive response, which is defined as "Best Possible Deceleration," controls the response of the drive if

- the controller enable signal changes from 1 to 0 (disable controller enable)
- the operating mode is switched to parameter mode while the drive is enabled. (Reset of the communication phase)

Velocity Command Value Reset

If "0" is set for "Best Possible Deceleration," the drive will stop the velocity control during an error with the command value = 0. The drive stops with its maximum permissible torque/force.

(see also Current Limit)

The time elapsed from the start of the motor brake (if available) and the final release during velocity command value deceleration to zero is displayed in the following graphic.

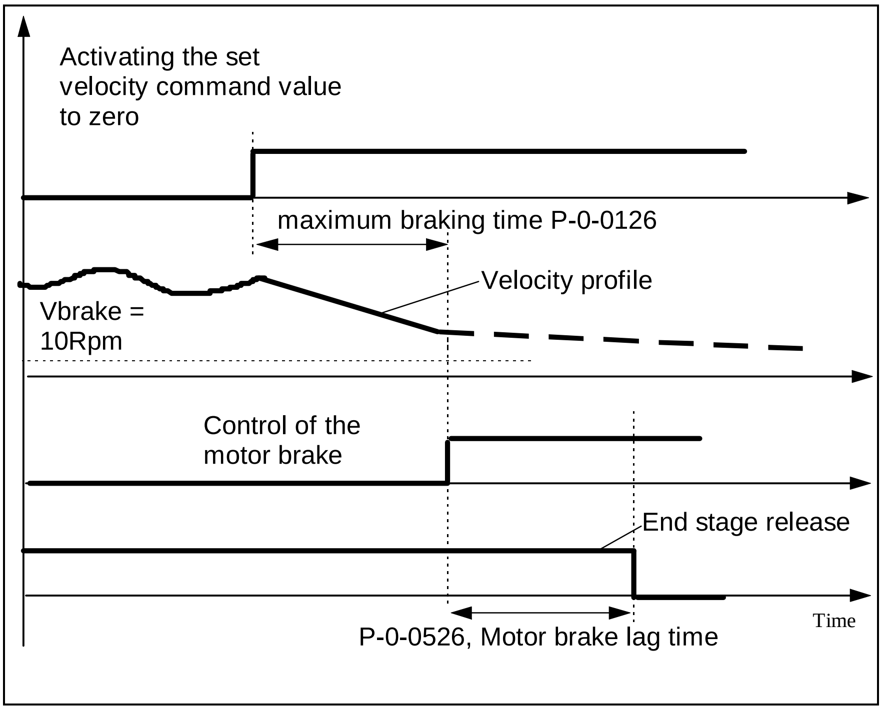


Fig. 7-16: Time sequence of the velocity command value reset

WARNING

P-0-0126, Maximum brake time is set to low

Danger of damaging the motor brake

⇒ The value for P-0-0126, Maximum Brake Time always has to be set larger than the time necessary, taking into consideration the max. possible velocity, to decelerate the axis through the velocity command value reset.

If the setting is too low at P-0-0126, the error reaction may finish before the axis has stopped. The holding brake will then be activated if velocity is not 0, which, in the long run, leads to damage of the brake.

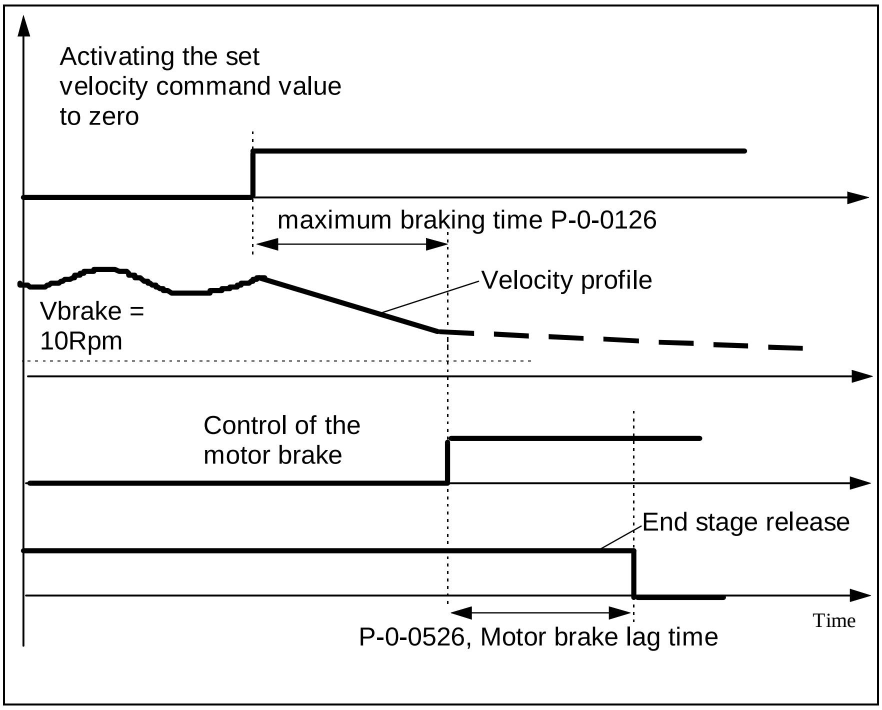


Fig. 7-17: Time sequence of the velocity command value reset, in case of setting maximum brake time too low

Disable Torque

The response "disable torque" is not recommended when a motor has a brake

If "Best Possible Deceleration" is set to "1," then the drive is set to torque disable during an error. The brake will be activated instantly.

WARNING

Disable torque as error response when motor brake is connected

Danger of damaging the motor brake

⇒ Avoid setting this error reaction

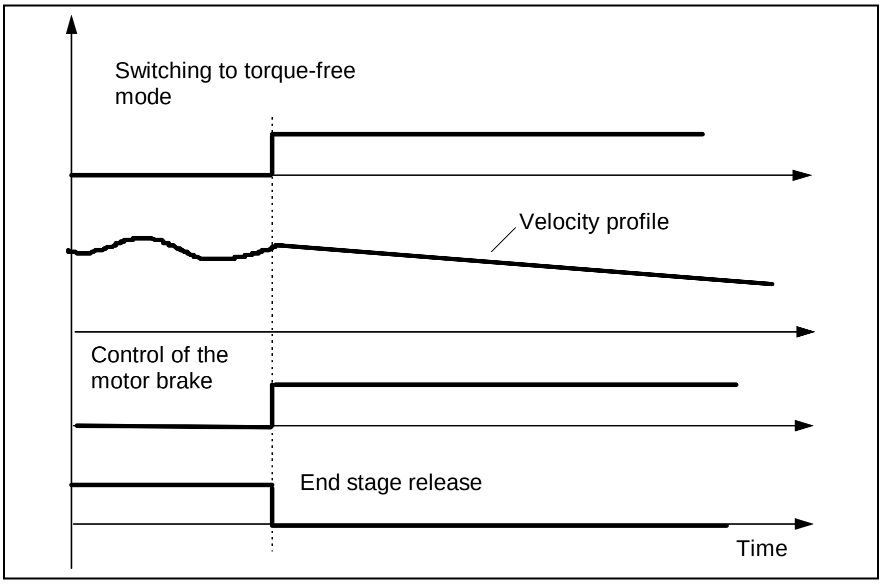


Fig. 7-18: Time sequence of torque disable

Velocity command value reset with filter and slope

If the setting for the "Best Possible Deceleration" is "2", the drive will be decelerated to a target of zero during an error. The acceleration or deceleration of the command value will be set with the parameter **P-0-1201, Rising Slope 1**. The velocity command value is passed through jerk-limiting filter, whose time constant is defined with **P-0-1222, Command Value Smoothing Time Constant**.

The velocity profile is equal to the profile of the velocity control with comparison and filter with a preset value of 0.

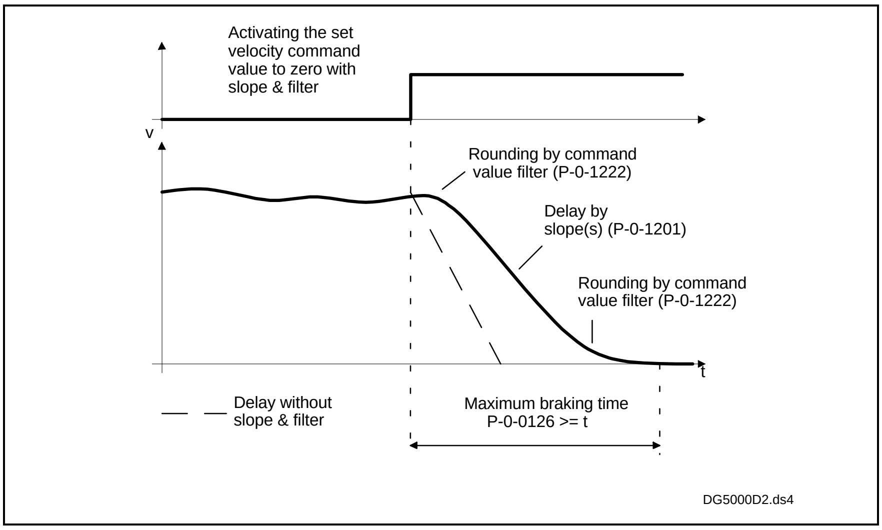


Fig. 7-19: Time sequence of velocity with activated filter

You must ensure that the **P-0-0126, Max. Brake Time** is larger than the time used by the drive to decelerate from its max. velocity to v = 0.

Example: vmax = 1000 R/min

Comparison = 100rad/s²

t of 1000RPM to 0 RPM = (1000/60 R/Sec * 2 * Pi rad/R) = 1, 05 Sec

The max. brake time selected in the previous example was 1,5 Sec.

The time sequence of the control for the motor brake (if available) and the final release equals the velocity command value reset.

(See also

Velocity Command Value Reset on page 7-34)

Power Supply Shutdown in Error Situation

For compact drive controllers, the shutdown of the power supply in an error situation is not recommended.

Modular devices can transmit an error signal to the power supply through a cable on the control voltage bus. If such a message is transmitted to the supply module, the DC bus voltage will be shut down. All other drive controllers connected to the supply module can detect this condition and proceed to **P-0-0119, Best Possible Deceleration** .

Signalling of a drive error to the supply module can be enabled in parameter **P-0-0118, Power Switch Off in Error Situation**.

The following applies:

Data in P-0-0118:	Function:
0	no signal to the supply module during an error situation
1	signal to the supply module during an error situation

Fig. 7-20: Signal of a drive error

Signals from devices connected to the power supply are received through connector X1, Pin 2.

M

NC Response in Error Situation

NC response during an error situation is only possible during non-fatal errors. Otherwise the drive reacts immediately with an error response.

A message is sent to the control, if the drive control device recognizes an Error. The control can then decelerate the servo axes of the machine without possible damage.

If this is desired, you have to delay the drive error reaction to allow the axes to continue movement to the values set by the control. This is achived by setting the time delay between the recognition of the error and the drive's error reaction. This can be set in parameter **P-0-0117, NC Response in Error Situation** .

The following applies:

Value of P-0-0117	Function
0	Drive proceeds immediately after error occurrence to reaction
1	Drive continues for 30 sec in the selected operating mode, then follows the "best possible deceleration".

Fig. 7-21: NC Response in Error Situation

Note: Activating the "NC Response in Error Situation" is only recommended for controls that have a corresponding error reaction procedure.

Emergency stop feature

The emergency stop feature is used to shutdown the drive through a hardware input on the drive controller.

After activation of the E-Stop Input, the drive is prompted to proceed to the selected shutdown of the drive. The Error diagnostic **F234, Emergency Stop Activated** is displayed, and parameter **S-0-0011, Class 1 Diagnostics** is set to bit 15. You can reset this error with the command **S-0-0099, Reset Class 1 Diagnostics,** if the E-Stop-Input is deactivated.

The E-Stop generally is handled the same as any other drive-issued error. You can select an error response via bit 1 **P-0-0008, Activation E-Stop-Function**.

If bit 1 = 0, the drive shuts down according to **P-0-0119, Best Possible Deceleration.** This corresponds to a non-fatal error.

If bit 1 = 1, then the drive stops with maximum torque to velocity = 0 after activation of the emergency stop, regardless of the reaction set in P-0-0119. The error response is the same as if P-0-0119 was set to 0.

Activation and Polarity of the E-Stop Input

For the activation of the E-Stop input and the selection of a response for shutdown of the drive, use parameter **P-0-0008, Activation of the E-Stop-Function**.

The following applies:

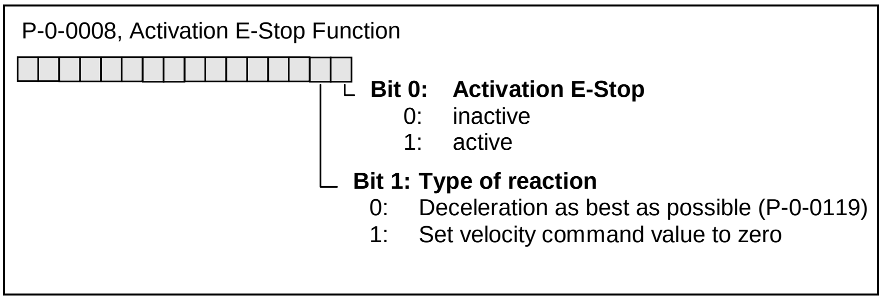


Fig. 7-22: Structure of P-0-0008, Activation of E-Stop-Function

The input polarity cannot be selected. It is always 0 active; i.e., 0V on E6 of the connector means the E-Stop is active.

If the evaluation of the E-Stop signal is activated, the monitoring of +UL (external +24V) is also activated, if it has not yet been active.

Connection of the Emergency-Stop Input

The drive controllers are provided with a binary input connector that includes the emergency-stop signal. You can find it on the plug-in module DSS 2.1. The input is separated potentially and has to be supplied through the same connector (X 12) with +24V.

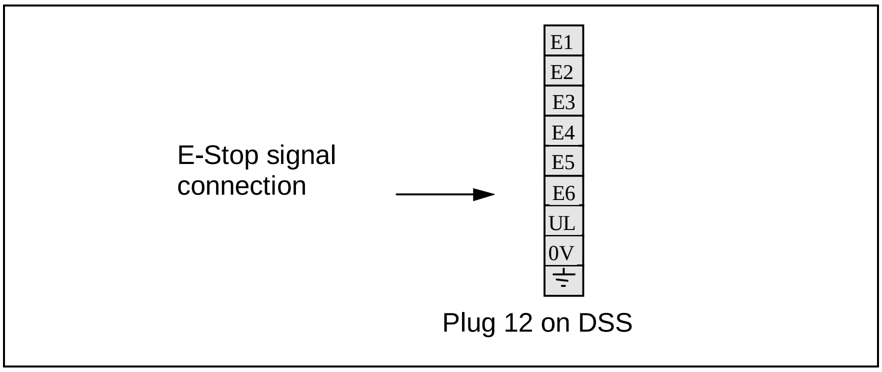


Fig. 7-23: Connection of E-Stop-Signal to X12

If the emergency stop input was activated but the 24 V supply failed, then the error **F233 External Power Supply Error** is generated.

7.7 Control Loop Settings

General Information for Control Loop Settings

The control loop settings in a digital drive controller are important for the characteristics of the servo axis. Determining the control loop settings requires expert knowledge.

"Optimizing" the regulator settings is generally not necessary!

For this reason, all digital INDRAMAT Drives have application-specific control parameters. These parameters can be retrieved from the drive data resource DRIVEDAT, or are accessible at start up through the programs SERCTOP or DRIVETOP. (see also Load Default on page 7-39)

In some exceptions, however, it may be necessary to adjust the control loop settings for a specific application. The following section gives a few simple, but important, basic rules for setting the control loop parameters in cases such as these.

In each situation, the prescribed methods should only be viewed as guidelines that lead to a strong control setting. Specific aspects of some applications may require settings that deviate from these guidelines.

Load Default

With the feature **Load Default**, for motor types with motor feedback data memory such as

- MDD
- MKD

you can activate the default controller parameters. With these parameters, you set the corresponding control parameters for the appropriate motor type used. The parameters are pre-defined by the manufacturer for moment of inertia relation of $J_{own} = J_{foreign}$.

Most applications can work with those values.

Default values can be set for the following parameters:

- **S-0-0106, Current Control-Proportional Gain**
- **S-0-0107, Current Loop-Integral Action Time**
- **S-0-0100, Velocity Loop-Proportional Gain**
- **S-0-0101, Velocity Loop Integral Action Time**
- **P-0-0004, Smoothing Time Constant**
- **S-0-0104, Position Loop Kv Factor**
- **S-0-0392, Velocity Feedback Value Filter Time Constant**

The feature **Load Default Settings** can be activated in two different ways:

- Automatic activation during the command procedure **S-0-0128, C200 Preparation of Switch to Comm.-Phase 4** for the first-time operation of the motor type with this drive.
- With the command procedure **S-0-0262, C700 Load Default**

Automatic Execution of the Load Default Feature

The drive recognizes the motor type the first time the drive is used with this motor type. The drive compares the parameter **S-0-0141, Motor type** during processing of the command **S-0-0128, C200 Communication Phase 4 Transition Check**. If these parameters are different, the error message **F208 Motor type has changed**, will be generated. On the seven-segment display, the message "UL" appears.

The user has the option to save the current drive parameters before he resets the error to start the load default.

The error **F2-08, Motor type has changed** can be reset in two different ways:

1.) Run the command **S-0-0099, Reset Class 1 Diagnostics**

2.) Press the key S1

In both cases, you activate the default settings.

If you cannot activate the default settings, the corresponding command error message of the command **S-0-0262, C700 Load Default** appears.

(See also "Error Conditions of the Load Default Settings Procedure" on page 7-40)

Run the Load Default Settings feature as a command

With the parameter **S-0-0262, C700 Load Default**, you can run the feature as a command. This might be useful if you want to reset manually changed control parameters back to the default values.

If controller enable is active, you cannot run this command.

Error Conditions of the Load Default Settings Procedure

If the feature started by running the command **S-0-0262, C700 Bootload (see also basic load or load default)** is not successfully processed, the reason for the error is displayed on either the 7-Segment-Display or through the diagnostic parameter **S-0-0095**.

The following reasons could cause an error during load default (basic load):

SS Display	Diagnostic Message:	Cause:
C701	Bootload (also basic load or load default) impossible with active controller enable	At the start of the command, the controller enable is set, which is not permissible
C702	No preset default parameter	Bootload (basic load or load default) is impossible for the motor type selected, only for MDD and MKD
C703	Default parameter invalid	Connection of drive to motor encoder-data memory is interrupted or feedback is defective
C704	Default parameter defective	The existing default value cannot be processed since, for example, the extreme value limit was exceeded through the default value

Fig. 7-24: Possible Errors during Bootload (Basic Load or Load Default) Command

If an error occurs during this procedure, you can set the default values for the indicated invalid parameters. This serves for safety purposes and helps in diagnosing additional errors.

Setting the Current Controller

The parameters for the current loop are set by INDRAMAT and cannot be adjusted for specific applications. The manufacturer-defined parameter values can be retrieved from the drive data memory DRIVEDAT or can be accessed at operation startup in DRIVETOP and SERTOP.
The parameters for the current controller are set via the parameters

- **S-0-0106, Proportional Gain 1 Current Controller**
- **S-0-0107, Current Controller 1 Integral Action Time**

Warning

Changing the values defined by INDRAMAT
can result in damages to the motor and the drive controller.
⇒ Changes to the current controller parameters are not permitted.

Setting the Velocity Controller

The velocity controller is set via the parameters

- **S-0-0100, Velocity Loop Proportional Gain**
- **S-0-0101, Velocity Loop Integral Action Time**
- **P-0-0004, Smoothing Time Constant**

These can be set either by running the Load Default feature or by following the described procedure.

Preparations for Setting the Velocity Controller

A number of preparations must be made in order to be able to set the velocity loop (controller):

- The mechanical system must be set up in its final form in order to have original conditions while setting the parameters.
- The drive controller must be properly connected as described in the user manual.
- The safety limit switches must be checked for correct operation (if available)
- The velocity control operating mode must be selected in the drive.

The controller setting must be selected for the start of parameterization as follows:

S-0-0100, Velocity Loop Proportional Gain = default value of the connected motor.

S-0-0101, Velocity Loop Integral Action Time = 6500 ms

P-0-0004, Smoothing Time Constant = Minimum value (250µs)

S-0-0392, Velocity Feedback Value Filter Time Constant = 500µs

For the determination of the velocity control parameters, no compensation function should be activated.

Definition of the Critical Proportional Gain and P-0-0004, Smoothing Time Constant

- After turning on the controller enable, let the drive move at a low velocity. Rotational motors: 10...20RPM Linear-Motors: 1...2 m/min)
- **Raise the S-0-0100, Velocity loop-proportional gain** until unstable operating behavior (continuous oscillation) begins.
- Frequency of the oscillation has to be determined by oscilloscoping the actual velocity (see also "Analog Output"). If the frequency of the oscillation is substantially higher than 500Hz, raise the **P-0-0004, Smoothing Time Constant** until the oscillation ends. After this, increase the **S-0-0100, Velocity Control Proportional Gain** until it becomes unstable again.
- **Reduce the S-0-0100, Velocity loop proportional gain** until the oscillation ends on its own.

The value found using this process is called the "*critical velocity loop proportional gain"*

Determining the Critical Integral Action Time

- **Set S-0-0100, Velocity Loop Proportional Gain** = 0.5 x critical proportional gain
- **Lower S-0-0101, Velocity controller integral action time** until unstable operating behavior results.
- **Raise S-0-0101, Velocity controller integral action time** until continuous oscillation stops.

The value found using this process is called the "*Critical Integral Action Time*."

Determining the Velocity Controller Setting

The critical value that is determined can be used to derive a control setting with the following features:

- Independent from changes to the axis since there is a large enough safety margin to the stability boundaries.
- Safe reproduction of the characteristics in production machines.

The following table shows many of the most frequently used application types and the corresponding control loop settings.

Application Type:	Velocity controller-Proportional gain	Velocity loop-Integral Action Time:	Comments:
Feed shaft on standard tool machine	Kp = 0.5 x Kpcrit	Tn = 2 x Tncrit	Good force allocation and good responsiveness
Feed shaft on forming press or chip-cutter machines	Kp = 0.8 x Kpcrit	Tn = 0	High proportional gain; no I-part, to achieve shorter transient periods.
Feed drive on following separation device	Kp = 0.5 x Kpcrit	Tn = 0	relatively undynamic control setting without I part, to avoid structural tension between the part and the machine.

Fig. 7-25: Identification of Velocity Controller Settings

See also Supplement B, Diagnostic Explanations: **F878 Velocity Controller Error**.

Setting the position controller

The position controller can be set with the parameter

- **S-0-0104, Position Controller Kv Factor**

This can be set by either executing the load default settings procedure once or by following the process below.

Preparations for Setting the Position Control Loop

A number of preparations must be made in order to be able to set the position controller:

- The mechanical system must be set up in its final form in order to have original conditions while setting the parameters.
- The drive controller must be properly connected as described in the user manual.
- The safety limit switches must be checked for correct operation (if available)
- The position control operating mode must be selected in the drive.
- The velocity controller must be properly tuned. The beginning value selected for the K_v-factor should be relatively small. ($K_v = 1$)
- For the determination of the position controller parameter, no compensation function should be activated.

Determing the Critical Position Controller Gain

- Operate the drive in mode that closes the position loop in the drive.
- Move axis at a slow velocity, i.e., with a jog function at a connected NC Control (Rotational Motors: 10...20RPM Linear-Motors: 1...2 m/min).
- Raise the K_v-factor until it begins to be unstable.
- Reduce the Kv-factor until the continuous oscillation ends by itself.

The Kv factor determined through this process is the "Critical position control loop gain".

Determining the Position Controller Setting

In most applications, an appropriate position controller setting will lie between 50% and 80% of the critical position controller loop gain.

This means: **S-0-0104, Position Loop KV-Factor** = 0.5 ... 0.8 x K_{vcrit}

Position Control Loop Monitoring

The position control loop monitor helps to diagnose errors in the position control loop.

Reasons for errors in the position control loop:

- Exceeding the torque or acceleration capability of the drive.
- Blocking of the axis mechanical system
- Disruptions in the position encoder

The monitoring of the position circuit is only active if an operation mode is activated that has the position loop connected to the drive. To set and check the monitoring function, two parameters are used:

- **S-0-0159, Monitoring Window**
- **P-0-0098, Max. Model Deviation**

If the drive detects an error in the position control loop, the error message

- **F228 Excessive Deviation**

is issued.

General Operating Characteristics of Position Control Loop Monitoring

To monitor the position control loop, a model actual position value is computed, which depends only on the commanded position value profile and the set position loop parameters. This model position is compared continually to the actual position. If the deviation exceeds **S-0-0159, Monitoring Window** for more than 50msec, an error **F228 Excessive Control Deviation** will be generated.

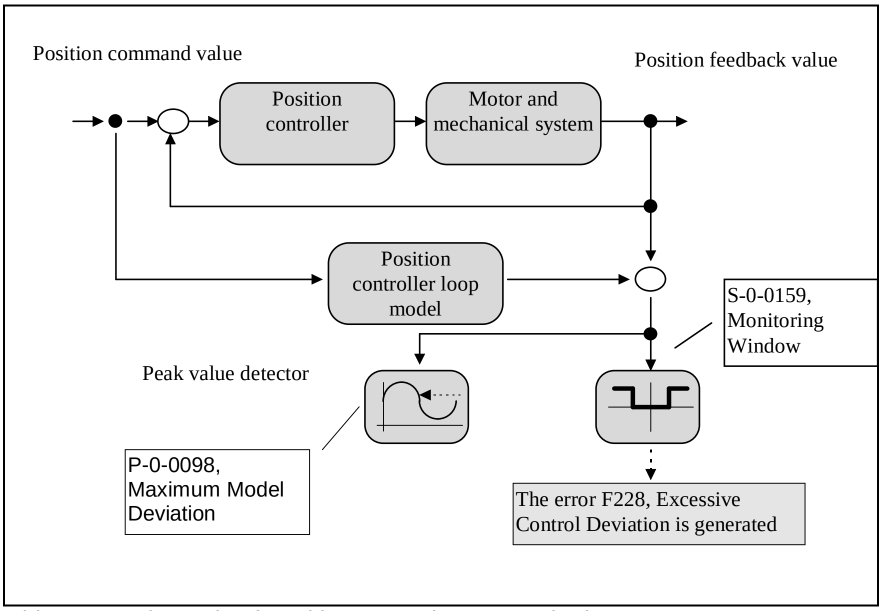


Abb. 7-26: Schematic of Position Control Loop Monitoring

For accurate monitoring, the actual feedback value from the position control is used. This means that for position control with the motor encoder, actual feedback value-1 is used; and for position control with the external encoder, the position feedback value-2 is used.

Setting the Position Control Loop Monitor

Requirements for the setup of the position loop monitoring are

- Check the velocity and position control loops for their appropriate settings.
- The axis in question should be checked mechanically and should be in its final state.

The position control loop monitor settings are performed:

- through the connected control, you should proceed in a typical operation mode. In this mode, you need to move at the maximum commanded velocity.
- In parameter **P-0-0098, Max. Model Deviation** , the maximum deviation between the actual feedback value and the expected feedback value is always displayed. (Note: The contents of this parameter are not saved. After enabling the drive, this parameter equals zero.)
- This value can be used to help set the monitoring window. Parameter **S-0-0159, Monitoring Window** should be set to **P-0-0098, Max. Model Deviation** multiplied by a safety factor. A safety factor between 1.5 and 2.0 is recommended.

Example:

Content of P-0-0098, Maximum Model Deviation:

0.1 mm

-> Determination for the parameter S-0-159, Monitoring Window:

0.2 mm (= 2 x 0.1 mm)

Deactivation of the Position Control Loop Monitoring

It is strongly recommended to activate the position loop monitoring. However, there are exceptions for which the position loop monitoring has to be deactivated. You can do that with the parameter **S-0-0159, Monitoring Window** , if it is set to very large values.

Setting the Acceleration Feed Forward

For Servo applications, where you have to depend on exactness at high speeds, you have the option to extend the exactness of an axis during acceleration and brake phases through activation of the acceleration feed forward.

Typical applications for the use of the acceleration feed forward:

- Free style surface editing
- Smoothing editing

To set the acceleration feed forward, use the parameter

- **S-0-0348, Proportional Gain Acceleration Feed Forward**

This value can be determined as follows:

Requirements for a Correct Setting of the Acceleration Feed Forward

- Velocity and position loop have to be set appropriately.
- For the position controller, a lagless operation mode must be selected.
- If frictional torque compensation should be activated, you must set this before setting the acceleration feed forward. A reversed procedure results in a limited operation of the acceleration feed forward after activation.

Setting the Acceleration Feed Forward

The setting of the correct acceleration feed forward can only be done by the user since it depends on the inertia momentum.

The setting is done in two steps:

- Calculation of the set value for the acceleration feed forward. For this purpose you need the size of the complete inertia momentum reduced for the motor shaft ($J_{Motor}+J_{actuated}$) of the axis. This value is known approximately from the axis scaling. Additionally, you need the torque constant of the used motor. This data can be retrieved from the motor data sheet or the parameter **P-0-0051, Torque-/Force Constant**. The set value is calculated as:

$$Acceleration\ Feed\ Forward = \frac{J_{Motor} + J_{Actuated}}{Kt} * 1000$$

Acceleration Feed Forward [mA\rad\s²]
J_{Motor}: Inertia momentum of the motor [kgm²]
$J_{Actuated}$: 'Inertia momentum of the actuation [kgm²]
Kt: Torque constant of the motor [NM/A]

Fig.7-27: Set Value for the Acceleration Feed Forward

The determined set value is entered in parameter **S-0-0348, Acceleration Feed Forward**.

- Checking the reliability of the acceleration feed forward and the exactness makeup of the parameter **S-0-0348, Proportional Corresp. Acceleration Feed Forward .**The difference of the actual feedback value to the position command value is displayed through the analog diagnostic output of the drive controller. To check the reliability of the acceleration feed forward, you must oscilloscope the signal during movement of the axis along the desired operation cycle. In acceleration and brake phases, you have to reduce the dynamically controlled deviation of the acceleration feed forward.

Setting the Velocity Mix Factor

With the help of the velocity mix factor, you can create the velocity feedback value, used for velocity control, from the motor and the external measurement system. This might be an advantage for play or torsion restricted clutches between motor and load. To set the mix condition, use the parameter

- **P-0-0121, Velocity-Mixfactor, Feedback1 & Feedback2**

The use of this function is appropriate only for external measurement systems. If this is not available, you have to set **P-0-0121** automatically to 0%:

The mixture of the velocity feedback value can be continually varied between:

- 100% Velocity feedback value of the motor encoder
/
0% actual value of the external encoder (P-0-0121 = 0)
and
- 0% Velocity feedback value of the motor encoder
/
100% actual value of the external encoder (P-0-0121 = 100)

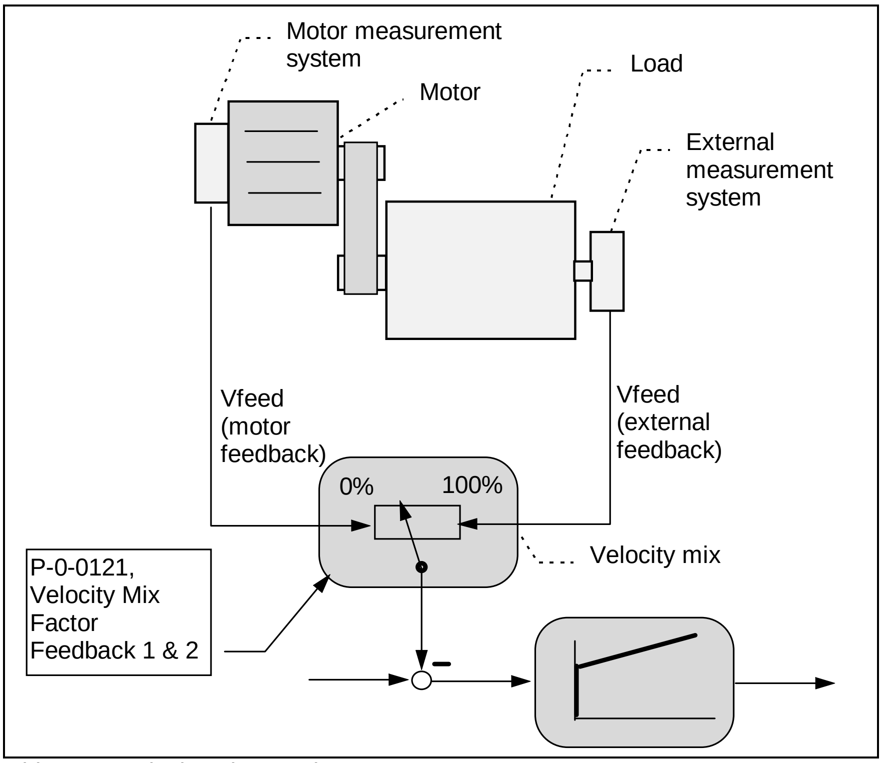


Abb. 7-28: Velocity Mixture Diagram

Setting the Frictional Torque Compensation

The drive-internal frictional torque compensation allows for directional-dependent switching of the torque command value (**S-0-0155, Friction Compensation**). The reason for this is to equalize the frictional torques of the connected mechanical system so that the deviations can be reduced during a directional reverse and so that the exactness of an axis can be increased.

Frictional torque compensation can be used in precision machines.

Meaningful Use of Frictional Torque Compensation

- The frictional torque of the axis must be a relevant size. If the frictional torque portion is less than 10% of the rated torque of the active drive, then the frictional torque compensation has negligible results.
- The frictional torque to be compensated must remain constant completely independent from the current processing.

Preparation for Setting the Frictional Torque Compensation

- Velocity and position loops must be set according to specification.
- The NC control system must be connected and must allow for the jog feature.
- Travel range limits of the axis must be set and activated.
- If the axis has a temperature-dependent friction characteristic, then the axis must be brought to operating temperature before determining the compensation value.

Determining the Compensation Torque

1. Move the axis in jog mode at the maximum determined operating velocity. During this process, the torque command value should be recorded (read) in the phase-constant velocity.

2. This procedure should be done in both movement directions of the axis.

3. The value to be set for the frictional torque compensation should be taken from the value determined in this process. The following applies:

$$\text{Reibmomentkompensation} = \frac{|\text{Reibwert}_{\text{positiv}}| + |\text{Reibwert}_{\text{negativ}}|}{2}$$

Fig.7-29: Frictional Torque Compensation

7.8 Drive Stop

The drive halt feature serves to stop the axis with defined acceleration and defined jerk.

The feature is activated either through deletion of the drive halt bit (bit 13) in the master control word or through interruption of the drive control commands (i.e., drive-controlled homing).

The following parameters are used:

- **S-0-0138, Bipolar Acceleration Value**
- **S-0-0349, Jerk limit bipolar**

For diagnostics, the following parameters

- **S-0-0124, Standstill Window**
- **S-0-0182, Manufacturer Class 3 Diagnostics**

can be used.

Drive Halt Feature Description

If in the master control word bit 13 is changed from "1" to "0", then this feature will be activated. The drive no longer follows the command values of the active operating mode, but changes to position control and decelerates the axis with the parameters **S-0-0138, Bipolar Acceleration Value** and **S-0-0349, Jerk limit bipolar**. The LED displays **AH**, and the diagnostic message in S-0-0095 is **A010 Halt Drive**.

If the actual velocity falls below the value of the parameter **S-0-0124, Standstill Window**, the bit "Drive Halt Confirmation" will be set in **S-0-0182, Manufacturer Class 3 Diagnostics**.

If bit 13 in the master control word is reset to "1", the selected operation mode will be reactivated.

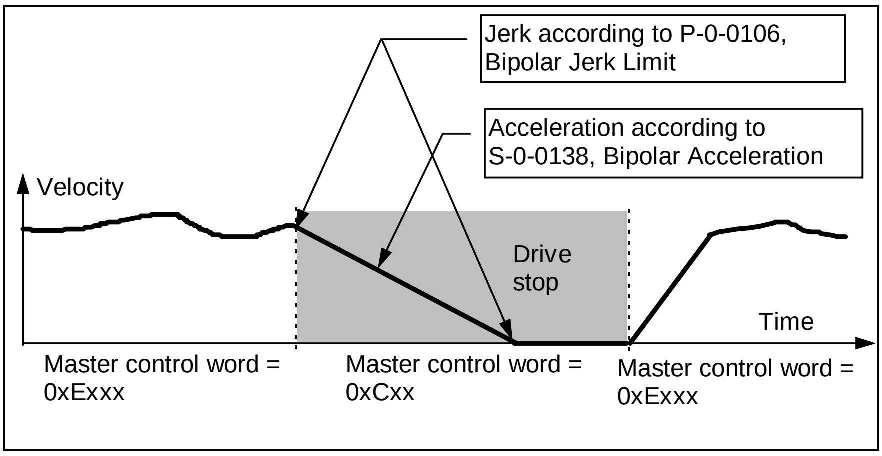


Fig. 7-30: Drive Halt Diagram

The position-controlled deceleration is done with lagless positioning, if the previous operating mode was lagless. If this was not the case, this feature proceeds without lagless control.

7.9 Drive-Controlled Homing

Through homing of a servo axis, you relate the actual feedback value to the machine start points.

Drive-controlled homing means that the drive independently creates necessary motion, which corresponds to the homing velocity settings and homing acceleration settings.

This feature can be used for either the motor encoder or the external encoder.

To run this feature, use the following parameters:

- **S-0-0148 C6 Drive-Controlled Homing Command**
- **S-0-0147, Homing Parameter**
- **S-0-0298, Reference Cam Shifting**
- **S-0-0299, Home Switch Offset**
- **S-0-0052, Reference Distance 1**
- **S-0-0054, Reference Distance 2**
- **S-0-0150, Reference Offset 1**
- **S-0-0151, Reference Offset 2**
- **S-0-0041, Homing Velocity**
- **S-0-0042, Homing Acceleration**
- **P-0-0153, Optimal Distance Home Switch Reference Mark**

The following parameters

- **S-0-0108, Feedrate Override**
- **S-0-0057, Positioning Window**
- **P-0-0099, Position Command Smoothing Filter Time Constant**
- **S-0-0403, Actual Feedback Value Status**

also can be used.

Type and Configuration of Homing Marks in the Measurement System

For better understanding, you can divide the measurement systems into 4 groups according to the type and configuration of their homing marks.

- **Type 1** : Measurement systems with absolute single turn range, such as the Single-Turn-DSF or Resolver. These measurement systems have an absolute range in the size configuration of one encoder rotation or parts of an encoder rotation (resolver). Typical applications are encoders for the MDD or MKD motors and the GDS measurement system.
- **Type 2**: Incremental rotational measurement systems with a homing mark for each encoder rotation, such as the ROD or RON types from the Heidenhain Company.
- **Type 3**: Incremental translation measurement systems with one or several homing marks, such as the LS linear scaling of the Heidenhain Company.
- **Type 4**: Incremental measurement systems with differential coded homing marks, such as the LSxxxC linear scaling of the Heidenhain Company.

The drive-internal detection for the configuration of the homing marks is done with the settings of the corresponding position encoder type parameter **S-0-0277, Position feedback 1 type parameter** (for motor encoder) or **S-0-0115, Position Encoder Type 2** (for external encoder).

In these parameters, you set the bit to 0, if it is a rotational or a linear measurement system, and the bit to 1 if the measurement system has a distance-coded homing mark.

For measurement systems with their own data memory, this setting is executed automatically.

See also Setting the Measurement Systems

Setting the Homing Parameter

The basic path depends on the setting of the parameter **S-0-0147, Homing Parameter**.

In that paramter, you can set the following:

- Homing direction positive/negative
- Homing with motor/external encoder
- Evaluation of the homing switch yes/no
- Evaluation of the reference mark yes/no

The structure of the parameter is as follows:

S-0-0147, Homing Parameter

Bit 0: Beginning direction
0: positive -clockwise with view of motor shaft
1: negative -counter-clockwise with view of motor shaft

Bit 3: Feedback selection
0: homing with motor feedback
1: homing with external feedback

Bit 5: Home switch analysis
0: home switch is analyzed
1: home switch is not analyzed

Bit 6: Reference mark analysis
0: Reference mark is analyzed
1: Reference mark is not analyzed

Fig. 7-31: Parameter structure S-0-0147, homing parameter

The procedure also depends on the type and configuration of the homing marks for the homing encoder. For distance-coded homing marks (Type 4), no homing switch evaluation will be performed, even if it is configured in S-0-0147.

Feature Procedure "Drive-Controlled Homing"

The command profile depends on the parameters S-0-0041 Homing path velocity, S-0-0108 Feed rate override, and S-0-0042 Homing acceleration.

To limit the acceleration changes, you can additionally activate a jerk limit. You can do this by entering the parameter **P-0-0099, Position command smoothing filter time constant**.

The following diagram explains:

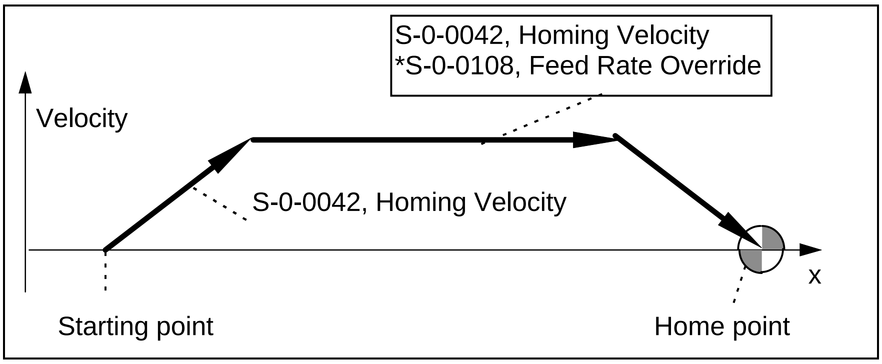


Abb. 7-32: Command value profile of homing velocity and acceleration

The maximum velocity is influenced, like all driven functions, by the feedrate. The effective maximum velocity is the result of the product of **S-0-0041, Homing velocity** and **S-0-0108, Feedrate-Override**.

If the parameter S-0-0108, Feedrate-Override is set to zero, the warning **E255 Feedrate-Override(S0-0108) = 0** will be displayed.

The transfer of the coordination system to the machine zero setup is done after entering the positioning window of the homing point.

For drive-controlled homing, the drive always positions to the homing point. This point is defined for types 1-3 by the position of the selected homing marks and an optional offset setting. For Type 4 (distance-coded), an offset will not be used.

When the drive enters the positioning window at the homing point, the position command value is switched to the feedback value. The position command value (**S-0-0047, Position command value**) is set to

- **Reference distance 1** (for motor encoder), or
- **Reference distance 2** (for external encoder)

at this point.The actual feedback values are calculated from the internally measured position of the homing mark and the desired feedback value for this mark. The drive-internal coordination system is therefore shifted and the command is acknowledged.

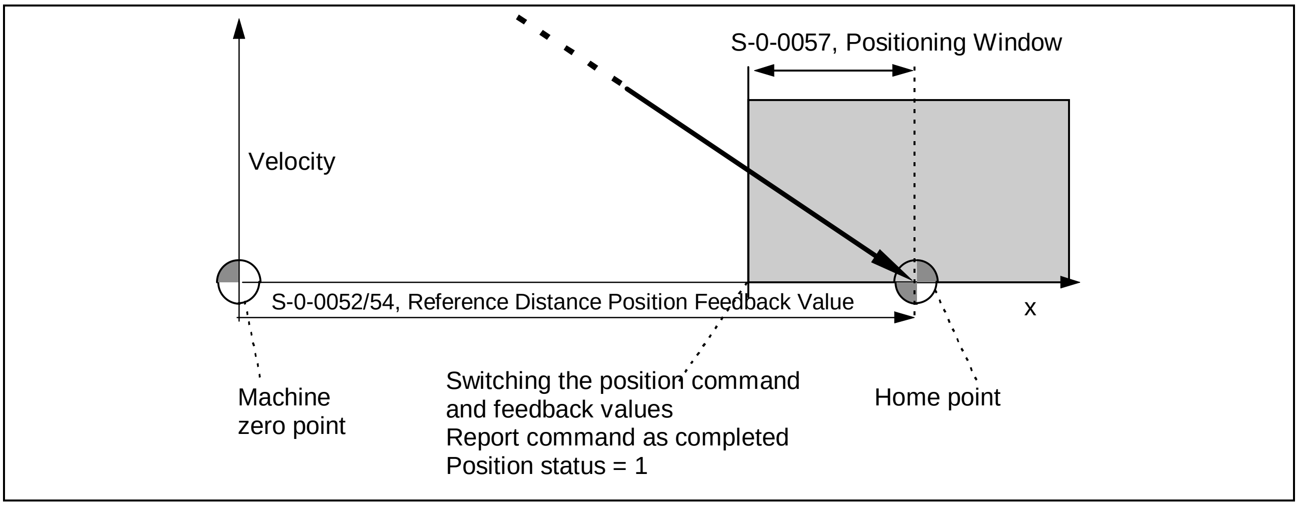


Fig. 7-33: Switching from command to actual feedback values

After the position command values are switched to the actual values, the **S-0-0403, Status of the Actual Feedback Values** is set to "1". This means that the actual feedback value now refers to the machine setup point. The parameter S-0-0403 displays the positioning status of the measurement system, which was selected in bit 3 of the **S-0-0147, Homing Parameter**.

Note: If the drive is switched back into phase 2 after running the homing command, then the parameter **S-0-0403, Status of the Actual Feedback Values** is set to "0", since the actual values are reset when switching to phase 4.

Actual Feedback Values After the "Drive-Controlled Homing" Command

The status of the actual feedback values from the motor encoder and, if available, from the external encoder after the drive-controlled homing command is processed depends on bit 3 in **S-0-0147, Homing Parameter** and on the availability of an absolute encoder as a motor or external encoder.

Motor encoder:	Ext. encoder:	S-0-0147 Bit 3:	Actual feedback value 1:	Actual feedback value 2:
absolute	not-absolute or not available	1	unchanged	homing scale 2
not absolute	absolute	0	homing scale 1	unchanged
not absolute	not absolute	0	homing scale 1	homing scale 1
not absolute	not absolute	1	homing scale 2	homing scale 2

Fig. 7-34: Actual feedback values after the "drive-controlled homing" command

Consideration of the Reference Offset

If the evaluation of the homing mark is activated in the homing parameter, then the homing point is always set based on the position of the selected homing point. If a measurement system type 1..3 is available (not distance-coded), you can shift the position of the homing point away from or toward the homing mark. Therefore you can select any position after homing.

The offset is set with the parameters:

- **Reference Offset 1** (for motor encoder)
- **Reference Offset 2** (for external encoder)

If the reference scale offset is positive, it will be interpreted that the homing mark is positioned closer to the start point than the homing point. Therefore, the homing mark will always be crossed before the drive stops at the homing point.The drive does not reverse the movement direction after the homing mark has been crossed.

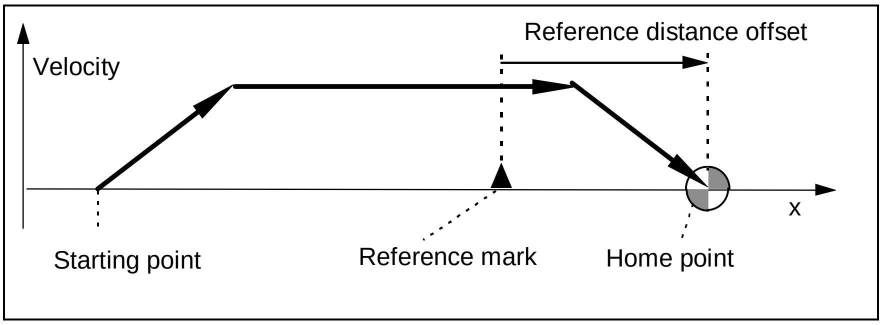


Fig. 7-35: Command value profile for positive reference scale offset

For negative reference scale offset, you can reverse the movement direction during the homing procedure.

If the reference scale offset is set negative, the offset will be interpreted such that the homing mark will be farther away from the start point than the homing point. If a measurement system type "1" is used, the drive moves immediately to the homing point after the command starts, without going to the homing mark. If the measurement system type "2" or "3" is used, the homing mark will be crossed. After going to the homing mark, the drive reverses the direction and goes to the homing point.

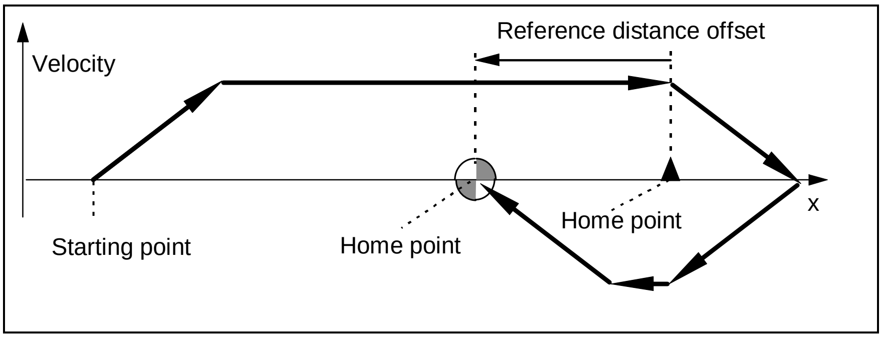


Fig. 7-36: Command value profile for negative reference scale offset with type 2 or 3

Through setting a negative home reference scale offset, you can position the homing between the start point and the homing mark. If you then restart the command, the drive will again find the homing mark to be evaluated.

Evaluation of the Zero Switch

With the zero switch you can label a specific mark, if the configuration of the homing marks for the homing measurement system is unclear. If the zero switch is evaluated (bit 5 in S-0-0147 = 0), then the homing mark will be evaluated, which follows the positive edge of the zero switch (if the drive is moving toward the homing point).

With the parameter **S-0-0400, Homing Switch** , you can assign an IDN for the switch.

Example: Homing of a motor encoder with 1 homing mark per rotation

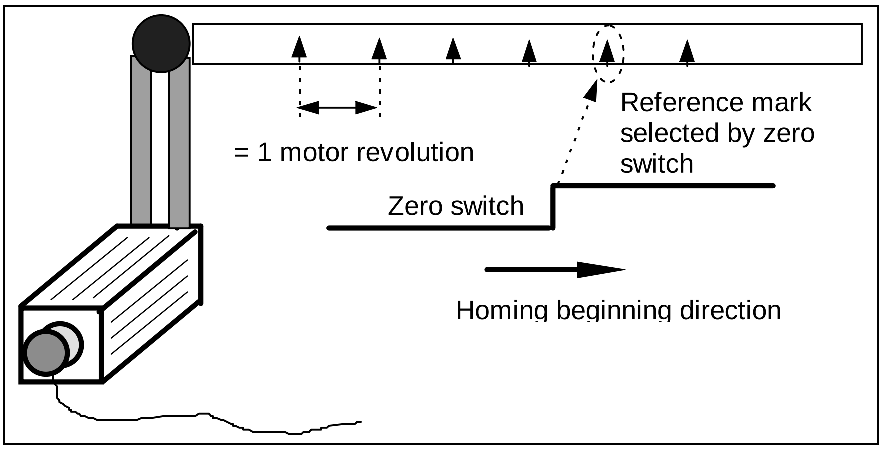


Fig. 7-37: Selection of a home mark depending on the movement direction

If the zero switch evaluation is activated, the drive searches at first for the positive edge of the zero switch. If the zero switch is not actuated at the beginning of the command, the drive moves in the preset homing path direction.

The homing motion direction has to be set to be able to find the positive edge.

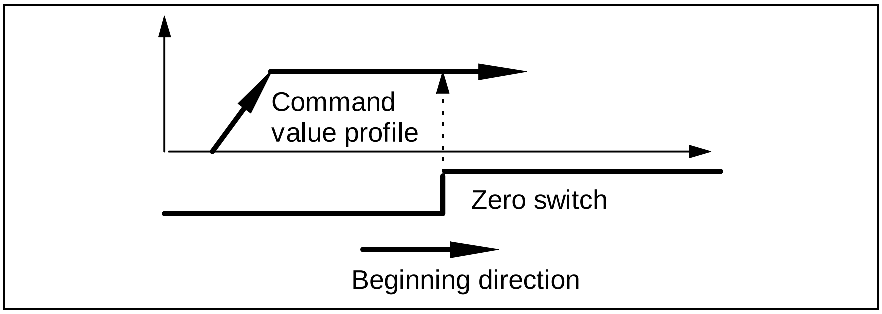


Fig. 7-38: Correct setting of the movement direction

If the movement direction is set incorrectly, damage to the system could result.

If the homing direction setting is incorrect, the drive command value then generates away from the positive zero switch edge. Here the danger exists that the drive may reach the travel range limits. This may result in damages to the system!

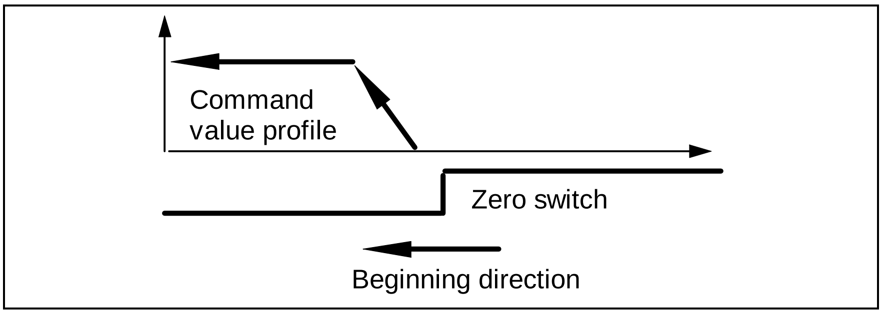


Fig. 7-39: Incorrectly set movement direction

Command value profile with actuated zero switch at the start of the command

If the zero switch is actuated at the command start, the drive generates set values in the opposite movement direction to remove from the zero switch. If the zero switch detects a 1-0 edge, the drive reverses its directional motion and continues the procedure without acknowledging the start point in the non-active zero switch range.

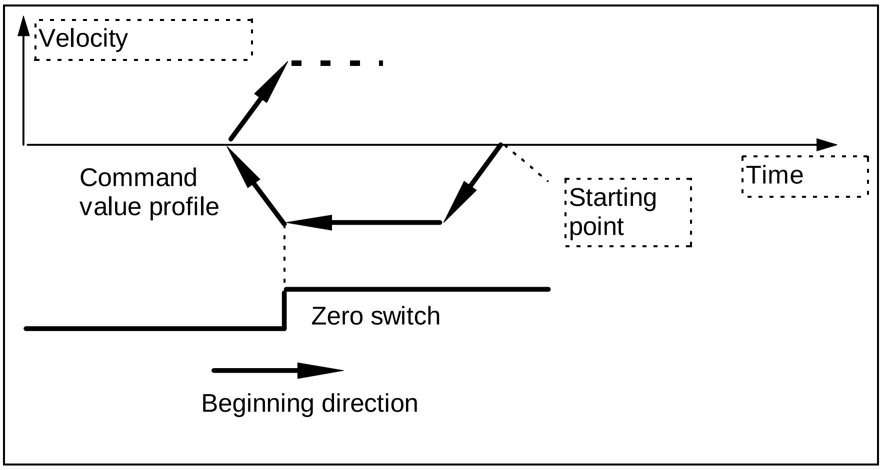


Fig. 7-40: Command value at the start position of the zero switch

Monitoring the Distance Between Zero Switch and Homing Mark

If the distance becomes too small between the zero switch edge and the homing mark, then it is possible that the zero switch edge will be detected after the homing mark has already approached. This leads to an evaluation of the following homing mark first. The selection of homing marks becomes unclear.

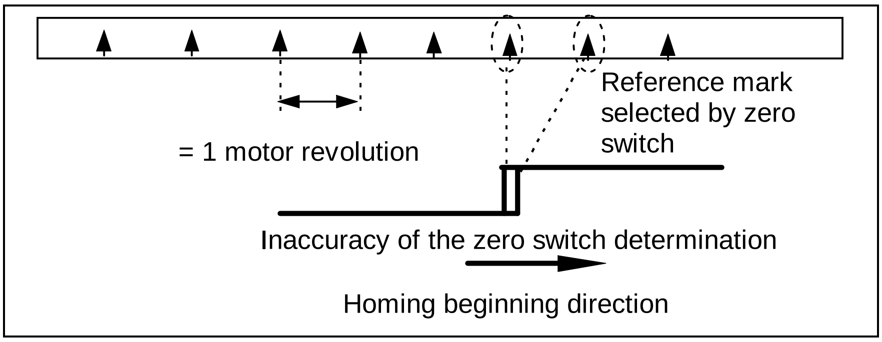


Fig. 7-41: Inexact selection of homing marks at small distances between zero switch edge and homing mark

For this purpose, the distance between the zero switch edge and the homing mark is monitored.

If the distance between the zero switch edge and the homing mark becomes smaller then a set value, the command error **C602 Distance Between Zero Switch and Homing Mark Erroneous** will be generated.

The Critical Range for the distance is:

0,25 * Distance between homing marks

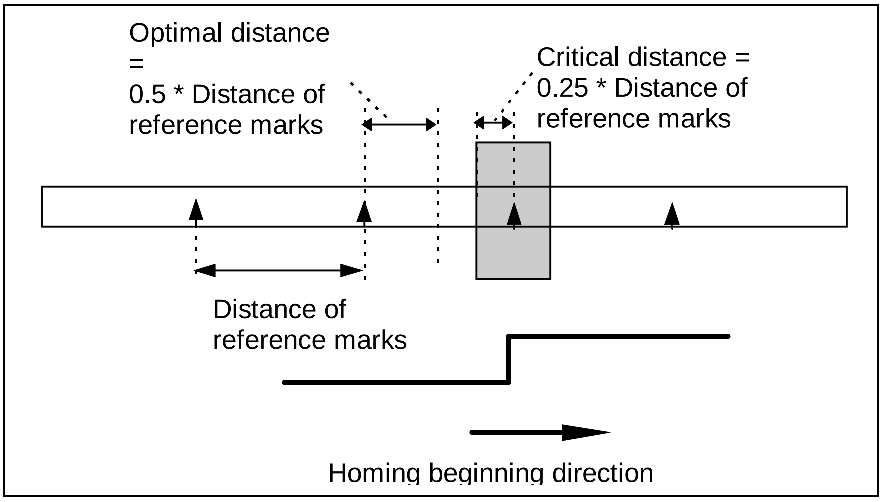


Fig. 7-42: Critical and optimal distance between zero switch and homing mark

The optimal distance between the zero switch edge and the homing mark is:

0,5 * Distance between homing marks

To monitor the distance between the zero switch and the homing mark, the optimal distance is entered in **P-0-0153, Optimal Distance Home Switch Reference Mark**.

The following requirements apply:

Encoder type	P-0-0153, Optimal Distance Home Switch-Reference Mark	Function
Rotational	0	The interval of the zero switch-home mark will be monitored. The optimal spacing will be calculated internally and amounts to a 1/2 encoder rotation for DSF or incremetnally rotational encoders, or 1/2 encoder rotation / **S-0-0116, Resolution of Rotational Feedback 1 (Motor Encoder)** for resolvers.
Rotational	x	The interval of the zero switch-home mark will be monitored. Half the home mark spacing must be entered in **P-0-0153, Optimal Distance Home Switch-Reference Mark**.
Linear	0	The interval of the zero switch-home mark will not be monitored. The linear encoder does not affect home marks with constant intervals. The real distance between the zero switch and the home mark must be large enough to achieve a sure recognition of the zero switch edge when considering the maximum homing velocity and the cycle time for the zero switch input request.
Linear	x	The interval of the zero switch-home mark will be monitored. Half the home mark spacing must be entered in **P-0-0153, Optimal Distance Home Switch-Reference Mark**.

Fig. 7-43: Interval Monitoring Zero Switch-Home Mark

For every homing with zero switch evaluation, the difference between actual distance and optimal distance is monitored. The difference is saved in parameter **S-0-0298, Reference Cam Shifting**. The zero switch edge can be shifted mechanically for this value.

To avoid a mechanical shifting of the zero switch edge, you can set this procedure in the software with the parameter **S-0-0299, Home Switch Offset**. The value in parameter **S-0-0298, Reference Cam Shifting** is transferred to parameter **S-0-0299, Home Switch Offset**.

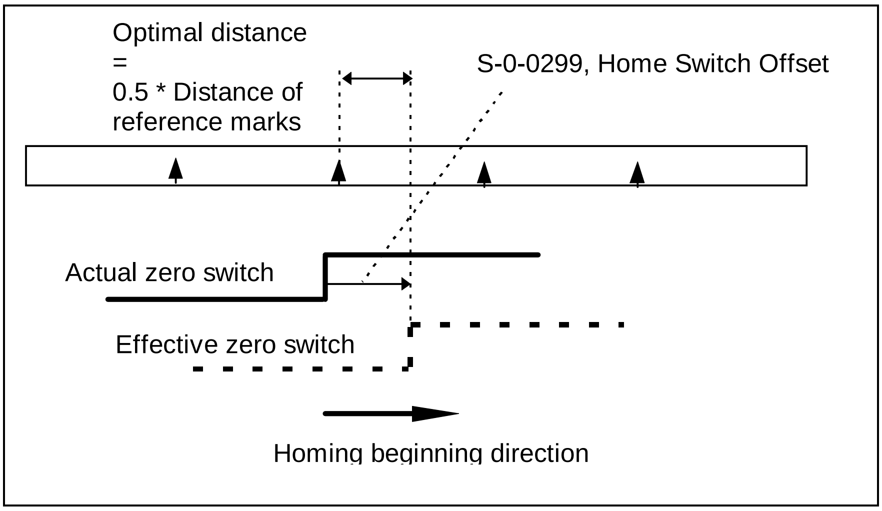


Fig. 7-44: Operating characteristics of parameter S-0-0299, Home Switch Offset

The parameter **S-0-0299, Home Switch Offset** can be set as follows:

- Running the homing command with **S-0-0299, Home Switch Offset** = 0.
- If the distance is not in the range between 0,5..1,5 * **P-0-0153, Optimal Distance Home Switch-Reference Mark,** the error message **C602 Distance Error Between Zero Switch and Homing Mark** will be generated. In this case, you have to enter the value **S-0-0298, Reference Cam Shifting** into **S-0-0299, Home Switch Offset**.
- Check: You should see a 0 displayed in **S-0-0298, Reference Cam Shifting** when homing is restarted.

Connection and Configuration of the Zero Switch

The zero switch is connected on pin E1 of the X12 connector on the DSS module. If evaluation of the zero switch is activated in the homing parameter, then the external power supply is monitored on the X12 connector.

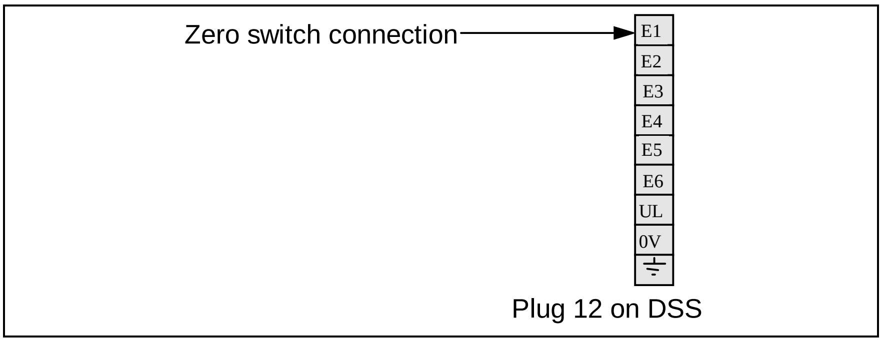


Fig. 7-45: Connection of the zero switch to the DSS

The zero switch should be set up far enough that the "actuated" range covers more than the permissible motion range. Otherwise, the travel range may be overrun at command start if the start position is in an unfavorable position. Damage is possible to the system!

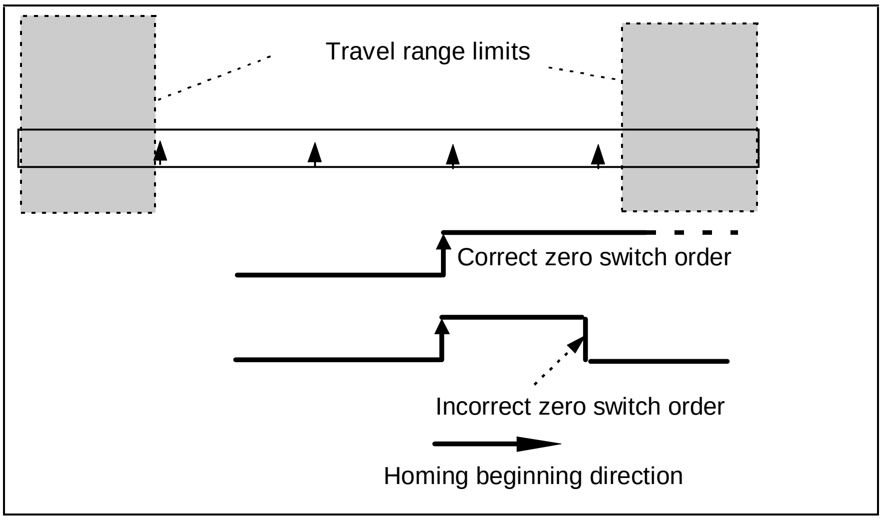


Fig. 7-46: Configuration of the zero switch in reference to the travel range

If the drive-controlled homing and zero-switch evaluation feature is activated, and if the 24V supply is missing, the error **F233 External Power Supply Error** will be generated.

Functions of the Control During "Drive-Controlled Homing"

The control's interpolator must be set to the position command value read from the drive.

During "drive-controlled homing", the drive independently generates position command values. Preset command values of the control will be ignored. If the command is confirmed by the drive as completed, the position command value corresponding to the machine zero point will be made available in the parameter **S-0-0047, Position command value**. This value must be read through the service channel by the control before ending the command, and the control interpolator must be set to this value. If this command is completed by the control and if the command values of the control for the drive become active again, these values should be added to the value read out of the drive.

Starting, interrupting and completing the command "Drive-Controlled Homing"

This feature is implemented as a command.

To start the feature, you must set and execute the command by writing to the parameter **S-0-0148, C6 Drive-controlled homing** (Input = 3). The drive confirmation has to be received from the data status out of the same parameter. The command is finished when the command-changing bit in the drive status word is set and the confirmation changes from *in process* (7) to *command executed* (3) or to *command error* (0xF).

If the command is interrupted (Input = 1) during processing (Confirmation = 7), the drive responds by activating the drive halt feature. The program continues if the interruption is canceled.

(See also Drive Stop on page 7-48)

Possible Error Messages During "Drive-Controlled Homing"

While the command is being executed, the following command errors can occur

- **C601 Homing not possible if drive is not enabled** While starting the command, the controller enable was not set.
- **C602 Distance Between Zero Switch-Home Mark Erroneous** The distance between the zero switch and home mark is too small, (see Monitoring the Distance Between Zero Switch and Homing Mark on page 7-56)
- **C604 Homing of absolute encoder not possible** The homing encoder is an absolute encoder. The command "Drive-Controlled Homing" was started without first starting the command "Absolute Scale Setting".

7.10 Language Selection

With the parameter **S-0-0265, Language Selection** you can switch between

- Parameter names and units
- Diagnostic texts

At this time, the following languages are implemented:

Value of S-0-0265:	Language:
0	German
1	English

Fig. 7-47: Language Selection

8 Optional Drive Features

8.1 Analog Output

With the "analog output" feature, drive-internal signals and output variables can be transmitted as an analog voltage signal. These can be examined by connecting an oscilloscope to the analog outputs.The digital values in the drive are converted with two 8-bit digital-analog converters. The maximum output voltage is +/- 10V; the cycle time of the output is 250usec.

The following parameters are available for this feature:

- **P-0-0038, Signal Select Analog Output Channel 1**
- **P-0-0039, Signal Select Analog Output Channel 2**
- **P-0-0040, Scaling Factor for Velocity Data Channel 1**
- **P-0-0041, Scaling Factor for Velocity Data Channel 2**
- **P-0-0042, Scaling Factor for Position Data Channel 1**
- **P-0-0043, Scaling Factor for Position Data Channel 2**
- **P-0-0044, Scaling Factor for Power for Data Channel Output**

Analog Output of Preset Signals

Pre-defined channel-selection numbers are available to select specific signals. The selection can be made by entering the channel-selection number (hex format) in parameters P-0-0038 and P-0-0039.

The following predefined signals are available:

Number:	Signal selection:	Scaling:
0x	--	--
1x	Torque-producing current	10V = S-0-0110 peak current amplifier
2x	Velocity feedback value after mixing and filtering	variable
0x3	S-0-0036, Velocity command value	variable
0x4	Position command value difference	variable
0x5	S-0-0051, Actual feedback value 1	variable
0x6	S-0-0053, Actual feedback value 2	variable
0x7	S-0-0189, Lag distance	variable
0x8	Sine wave motor encoder	1 : 1
0x9	Cosine wave motor encoder	1 : 1
0xd	Velocity command value input velocity controller	variable
0xe	DC bus power	variable
0xf	Amount of DC bus power	variable
0x10	Sine signal external encoder	1 : 1
0x11	Cosine signal external encoder	1 : 1
0x12	Torque-producing feedback current	10V = S-0-0110 peak current amplifier
0x13	Magnetization feedback current	10V = S-0-0110 peak current amplifier
0x14	Velocity feedback value of the motor encoder	variable
0x15	thermal load	10V = 100%

Fig. 8-1: Signal selection for analog output

Variable Scaling of Position, Velocity and Power Data

If position, velocity or power data are selected with the signal selection, then scaling can be set with the following parameters:

- **P-0-0040, Velocity Scaling Analog Channel 1**
- **P-0-0041, Velocity Scaling Analog Channel 2**
- **P-0-0042, Position Data Scaling Analog Channel 1**
- **P-0-0043, Position Data Scaling Analog Channel 2**
- **P-0-0044, Power Scaling for Analog Output**

.

The unit rpm/10V is always applied to motor rotations. This unit will not change for any other available gear ratios. The same applies to the unit degree/10V.

If a linear motor is connected (i.e., "3" is set for synchronous linear motors in the parameter **P-0-4014, Motor Type** or "4" is set for asynchronous linear motors), then the unit of the scaling parameter changes from

Rpm/10V to m/min/10V
and
Degree/10V to mm/10V

Bit and Byte Outputs of the Data Memory

This feature can be used only with the information about the structure of the drive processor's data memory. The structure changes from version to version. The feature can be loaded only by the developers.

The selection can be made with the signal selection parameter; instead of a preset number, the address and bit number or shift number of the bits/bytes to be exported should be entered.

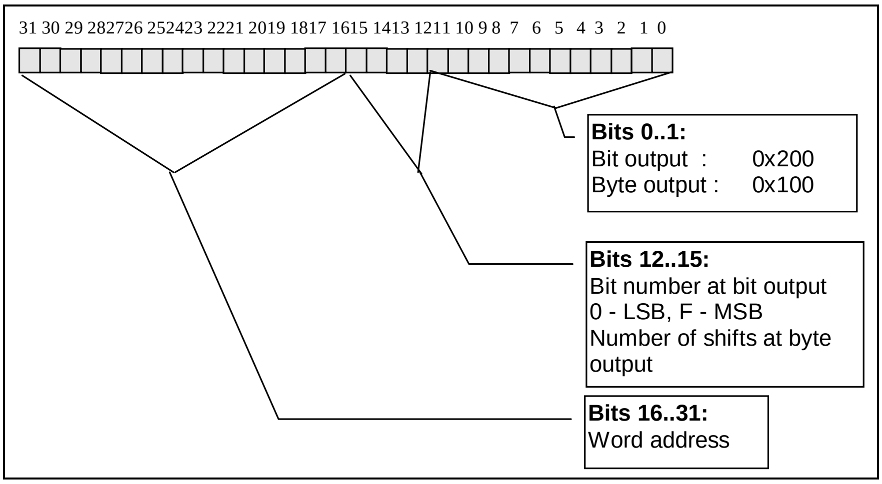


Abb. 8-2: Parameterizing bit or byte output

Connector Assignment for Analog Output

The analog signal is output over connector X3 of the basic device.

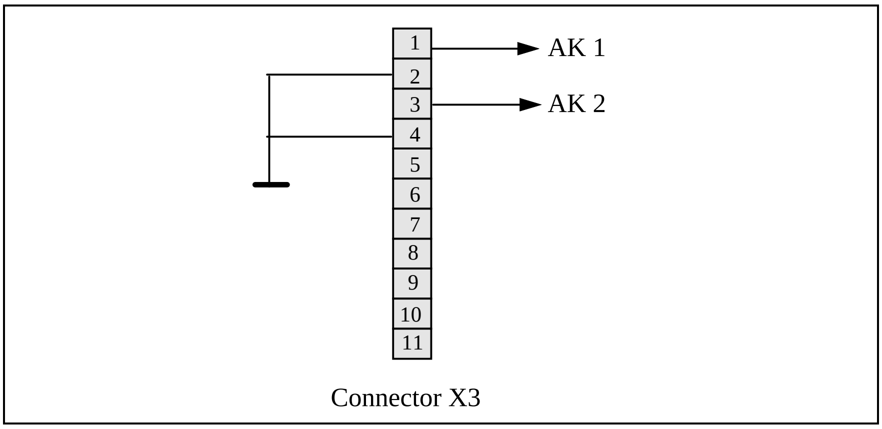


Fig. 8-3: Connector assignment for analog output

8.2 Analog Inputs

Module DRF 1 can never be used in conjunction with DLF 1 or DZF 1.

Interface module **DRF 1 can be used to measure analog voltages.** Two input channels are available. The two channels lead to a 12-bit analog-digital converter, whose maximum input range is +/- 10V. The input gain can be set to 1, 2, 4 and 10.

The digitized voltages are stored in the following parameters:

- **P-0-0115, Analog Input 1**
- **P-0-0116, Analog Input 2**

Note: Module **DRF 1** should never be used simultaneously with **DLF 1** or **DZF 1** modules.

The two analog signals are coupled through differential amplifiers, then G0 and G1 amplified and fed into a 12-bit ADU (ADC). This digitizes the analog voltages into 16-bit two's complement numbers; the top 4 bits are sign-extended.

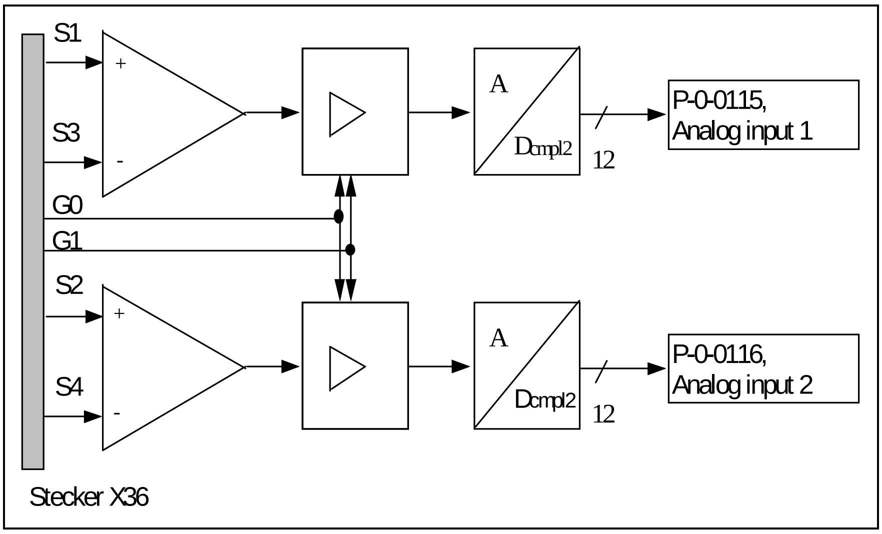


Fig. 8-4: Analog input schematic circuit diagram

The input gain is determined by wiring connector X36 to the **DRF 1** module.

The following applies:

X36,Pin 7 (A1):	X36,Pin 14 (A0):	Gain:
n.c.	n.c.	2 (1LSB = 2,44mV)
n.c.	Ground	1 (1LSB = 4,88mV)
Ground	n.c.	4 (1LSB = 1,22mV)
Ground	Ground	10 (1LSB = 0,49mV)

Fig. 8-5: Setting the input gain for the analog inputs

Connector Assignment DRF-1

The assignment of connector X36 of the DRF-1 module corresponds to the input analog processing as follows:

Pin No. onConnector X 36:	Function:
2	S3
3	S4
6	Ground
7	A1
9	S1
10	S2
11	Ground
13	Ground
14	A0

Fig. 8-6: Connector Assignment DRF-1

8.3 Digital Input/Output

The "digital input/output" feature allows for binary inputs and outputs through the DEA slide-in module. 15 binary inputs and 16 binary outputs are available per slide-in module.

The following DEA modules are supported:

- DEA 4.1
- DEA 5.1
- DEA 6.1

Each drive controller can contain one DEA 4.1, one DEA 5.1 and one DEA 6.1 module. A total of 45 inputs (3*15) and 48 outputs (3*16) are available per drive controller.

The following parameters are available for this feature:

- **P-0-0081, Parallel I/O Output 1**
- **P-0-0082, Parallel I/O Input 1**
- **P-0-0110, Parallel I/O Output 2**
- **P-0-0111, Parallel I/O Input 2**
- **P-0-0112, Parallel I/O Output 3**
- **P-0-0113, Parallel I/O Input 3**
- **P-0-0124, Assignment IDN -> DEA-Output**
- **P-0-0125, Assignment DEA-Input -> IDN**

It is also possible to assign a DEA output or DEA input to the current value of a parameter.

Digital I/O Functional Principle

The parameters "parallel input" and "parallel output" can be configured cyclically.

The 15 binary inputs and 16 binary outputs are mapped on two parameters: "parallel input" and "parallel output". Two parameters are available for each DEA. The following assignment applies:

DEA Module:	Parameter for Input:	Parameter for Output:
DEA 4.1	P-0-0082	P-0-0081
DEA 5.1	P-0-0111	P-0-0110
DEA 6.1	P-0-0113	P-0-0112

Fig. 8-7: Digital Input/Output: Assigned Parameters

By reading the parameter "parallel input", you can obtain an image of all 15 binary inputs of a DEA. By writing the parameter "parallel output", all 16 binary outputs are updated.

The assignment of individual binary inputs and outputs to the bit numbers of the corresponding parameters is divided as follows:

Pin No. Input:	Bit No. in the Parameter:	Pin No. Output:
1	0 (LSB)	16
2	1	17
3	2	18
4	3	19
5	4	20
6	5	21
7	6	22
8	7	23
9	8	24
10	9	25
11	10	26
12	11	27
13	12	28
14	13	29
15	14	30
--	15 (MSB)	31

Fig. 8-8: Digital Input/Output: Bit Output Assignment - DEA Module

The parameter "parallel output" is copied to the DEA port every 250 usec. Likewise, the "DEA port" is copied to the "parallel input" every 250 usec.

Note: An external power supply must be connected to operate a DEA card.

Pin 37:	24 V_{ext}
Pin 35	0 V_{ext}

If the power supply is missing, the **F233 External Power Supply Error** will be generated.

Allocating ID Number - Parallel I/O

The current value of any desired parameter can be exported to the binary output of a DEA. Likewise, the binary inputs of a DEA can be mapped onto the current value of any desired parameter.

This feature is set with the parameters:

- **P-0-0124, IDN -> DEA-Output Assignment**
- **P-0-0125, DEA-Input -> IDN Assignment**

The parameters are structured as follows:

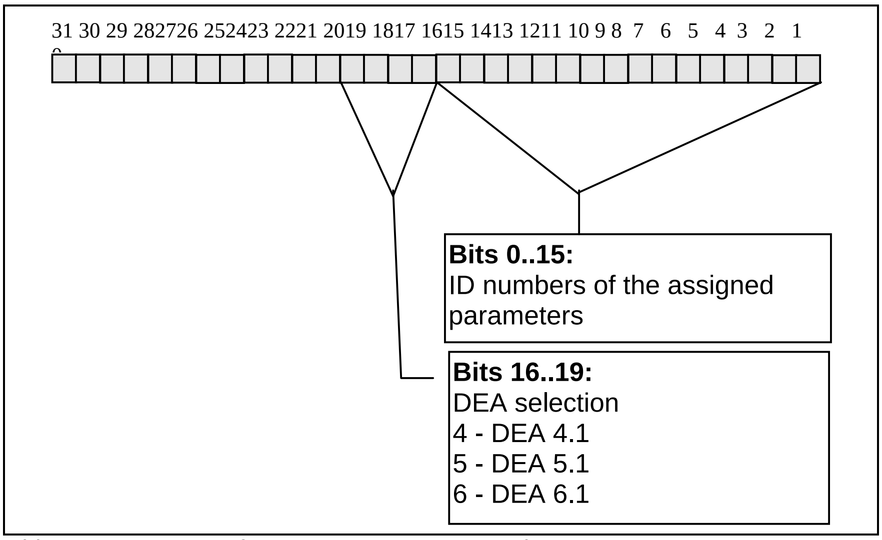


Abb. 8-9: Structure of Parameters P-0-0124 and P-0-0125

IDN -> DEA-Output Assignment

With the IDN -> DEA-Output Assignment, the current value of the assigned parameter is copied to the DEA output parameter; this is exported to the DEA outputs.

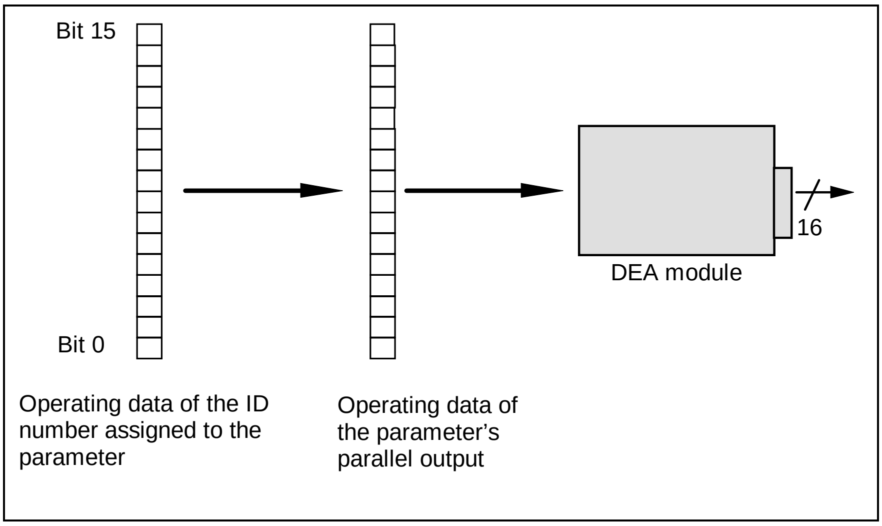


Fig. 8-10: Diagram for IDN-DEA Output Assignment

If the data length of the current value for the assigned ID number is larger than 16 bits, then the upper bits of the current value will be truncated.

If the parameter **P-0-0124, Assignment IDN -> DEA-Output** is written, then the following checks will be undertaken:

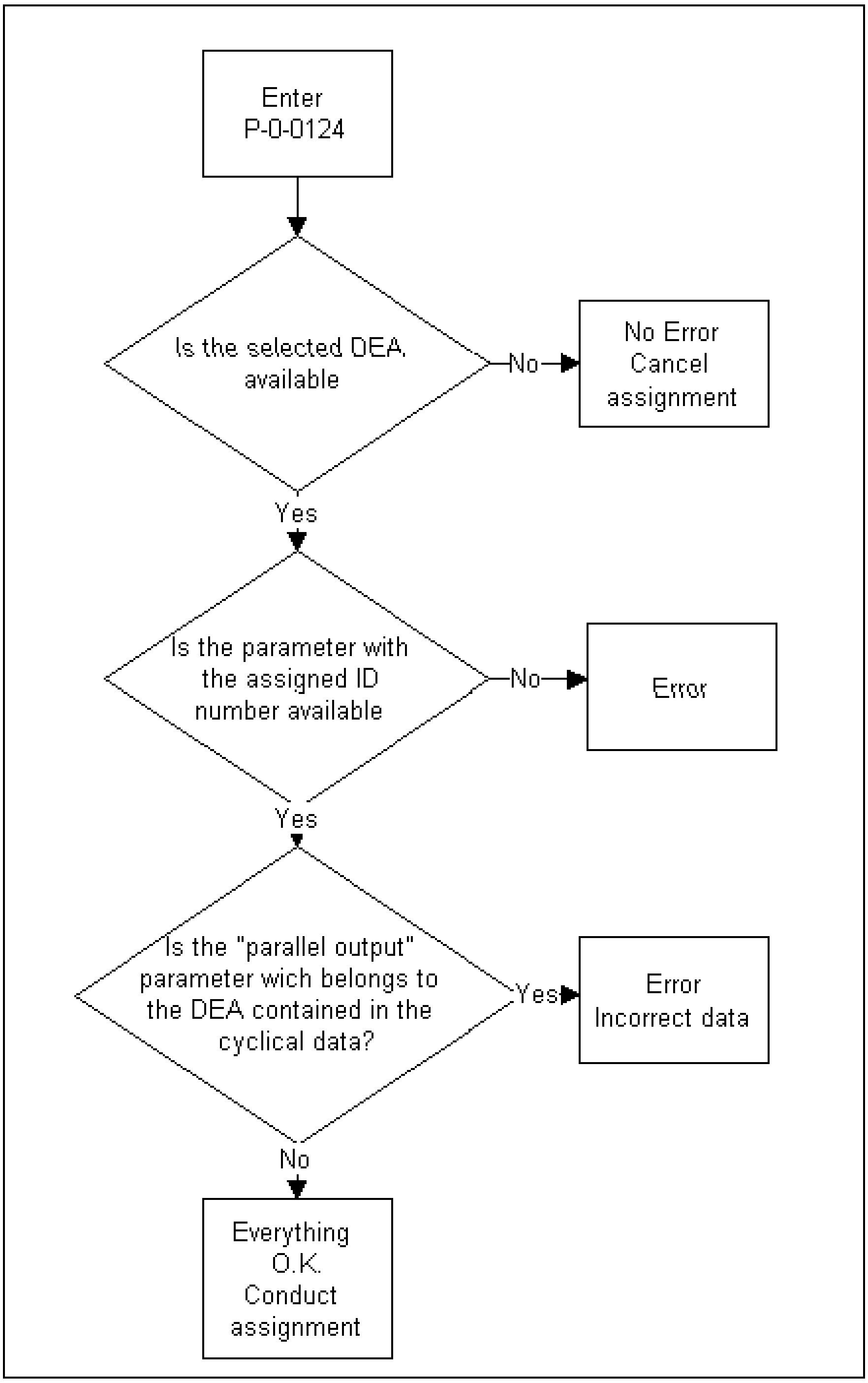


Abb. 8-11:Review During Input of the Parameter P-0-0124, Assignment IDN -> DEA-Output

DEA-Input -> IDN Assignment

During the "DEA Input -> ID Number" assignment, all binary inputs of the DEA are mapped onto the "DEA Input" parameter; the parameter is then copied to the current value of the assigned parameter.

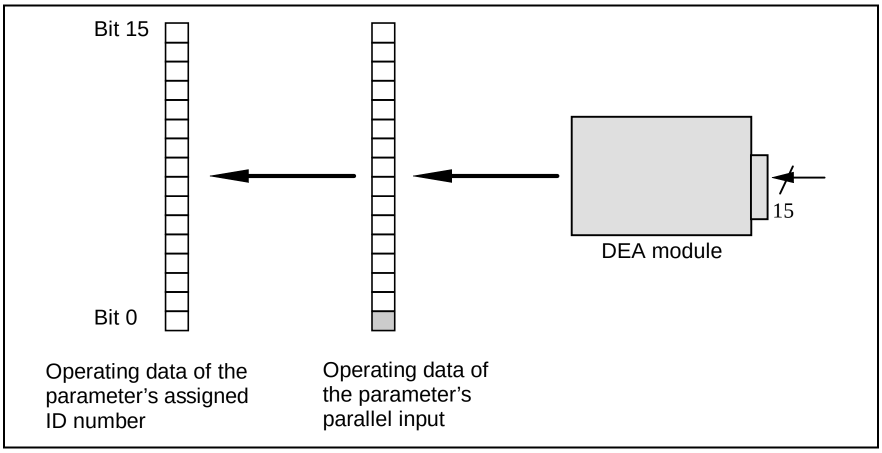


Fig. 8-12: Diagram for DEA-Input -> IDN Assignment

If the data length of the current value for the assigned ID number is larger than 16 bits, then the upper bits of the current value will be truncated.

If the parameter **P-0-0125, Assignment DEA-Input -> IDN** is written, then the following checks will be undertaken:

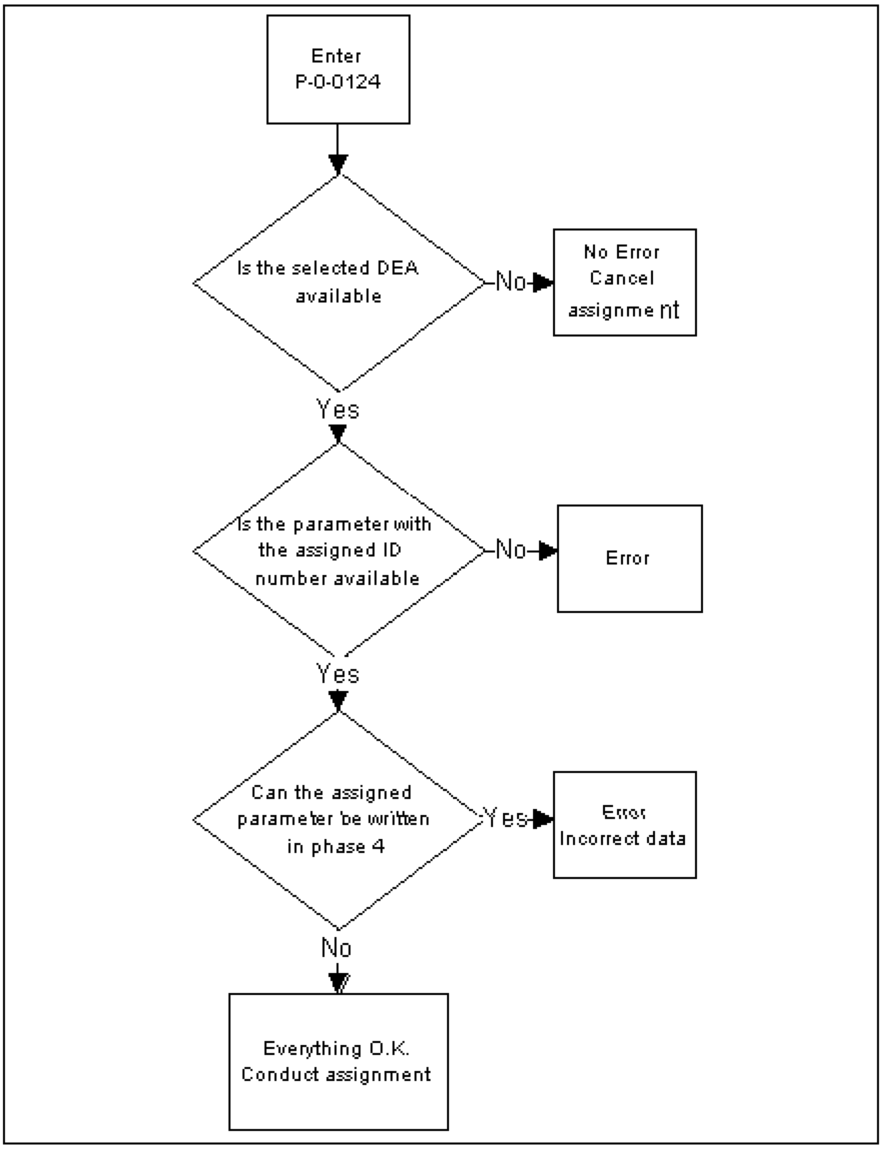


Fig. 8-13: Review During Input of the Parameter P-0-0125, Assignment DEA-Input -> IDN

8.4 Oscilloscope Feature

The oscilloscope feature is used to diagram internal and external signals and output variables. Its function is comparable to a simple 2-channel oscilloscope. The following parameters are available to set the oscilloscope feature:

- **P-0-0021, List of Scope Data 1 (always 4-byte data)**
- **P-0-0022, List of Scope Data 2 (always 4-byte data)**
- **P-0-0023, Signal Select Channel 1**
- **P-0-0024, Signal Select Channel 2**
- **P-0-0025, Trigger Source**
- **P-0-0026, Trigger Signal Selection**
- **P-0-0027, Trigger Level for Position Data**
- **P-0-0028, Trigger Level for Velocity Data**
- **P-0-0029, Trigger Level for Torque/Force Data**
- **P-0-0030, Trigger Edge (Flank)**
- **P-0-0031, Timebase**
- **P-0-0032, Size of Memory**
- **P-0-0033, Number of Samples After Trigger**
- **P-0-0035, Delay From Trigger to Start (cannot be written)**
- **P-0-0036, Trigger Control Word**
- **P-0-0037, Trigger Status Word**
- **P-0-0145, Expanded Trigger Edge**
- **P-0-0146, Expanded Trigger Address**
- **P-0-0147, Expanded Signal K1 Address**
- **P-0-0148, Expanded Signal K2 Address**
- **P-0-0149, Signal Selection for Oscilloscope Feature**
- **P-0-0150, Number of Valid Samples for Oscilloscope Feature**

Main Functions of the Oscilloscope Feature

The oscilloscope feature can be activated with parameter **P-0-0036, Trigger Control Word** by setting bit 2. From this point on, all data will be recorded that were selected through the parameters **P-0-0023, Signal Selection Channel 1** and **P-0-0024 Signal Selection Channel 2**. The selection will be defined with numbers that are assigned various signals.

The triggering is activated by setting bit 1 in the "Trigger Control Word" parameter. The trigger conditions can be set with the parameters **P-0-0025, Trigger Source, P-0-0026, Trigger Signal Selection** and **P-0-0030 Trigger Edge**. The signal amplitude that releases the trigger can be set with the parameters **P-0-0027 - P-0-0029 Trigger Level**.

If a trigger event is recognized, the values in the parameter **P-0-0033 Number of Samples After Trigger** will be recorded, and the function will end. Parameters **P-0-0031 Timease** and **P-0-0032 Memory Size** can define the recording duration and the time intervals for the probe values.

The probe values are stored in the **P-0-0021 and P-0-0022 Probe Value List Parameters** and can be read by the control.

Parameterizing the Oscilloscope Feature

Oscilloscope feature with defined recording signals

Preset signals and output variables can be selected through the **P-0-0023 and P-0-0024 Signal Selection Parameters**. The selection can be made by entering the signal number (hex format) in the corresponding signal selection parameter. The selected signal number defines the unit of data stored in the probe list. The following signals are predefined with numbers.

Number:	Signal selection:	Unit of the probe value list:
0x00	Channel not activated	--
0x01	Actual feedback value dependent on operating mode S-0-0051 or S-0-0053	dependent on position scaling
0x02	Velocity feedback value Parameter (S-0-0040)	velocity scaling dependent
0x03	Velocity control deviation (P-0-0347)	velocity scaling dependent
0x04	Lag distance Parameter (S-0-0189)	dependent on position scaling
0x05	Torque/Force command value Parameter S-0-0080	Percent
0x06	not yet occupied	

Abb. 8-14: Selection of predefined signals

The parameter **P-0-0149, Signal Selection List for Oscilloscope Feature** was introduced so the control can recognize if the number of preset numbers changes. The parameter is structured as a list parameter and transmits the ID numbers of possible signals.

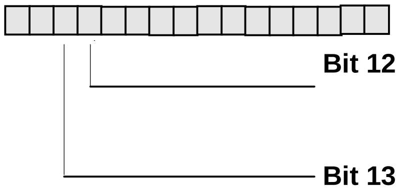
List entries:	ID number from:
1	S-0-0051 or S-0-0053
2	S-0-0040
3	S-0-0347
4	S-0-0189
5	S-0-0080
6	S-0-0051
7	S-0-0053
8	P-0-0147
9	P-0-0148

Fig. 8-15: Parameter P-0-0149 Occupancy

Expanded Oscilloscope Recording Function

In addition to the oscilloscope feature with preset signals, DIAX03 also allows for recording of any desired internal signals. Use of this feature is meaningful only with information about the structure of the internal data memory; therefore, this feature can be used effectively only by the corresponding developer. The feature can be activated with the **Signal Selection P-0-0023 & P-0-0024** parameters by setting bit 12 = "1". The format for the data to be protected can be defined with bit 13.

P-0-0023 & P-0-0024, Oscilloscope Function Signal Selection



Bit 12: Expanded oscilloscope function "ON"

Bit 13: Data width of the measurement values
0 = 16 Bit
1 = 32 Bit

Fig. 8-16: Structure of Parameters P-0-0023 and P-0-0024

If the expanded signal selection is parameterized, then the desired signal address can be defined in the parameters P-0-0147 Signal Address Expanded Signal Selection K1 and P-0-00148 Signal Address Expanded Signal Selection K2. During recording, the contents of the selected addresses are saved in the probe value lists.

Note: If a 16-bit data capacity is selected, then the signal data will be stored as sign-extended 32-bit values.

Oscilloscope Feature Trigger Source

With the **P-0-0025 Trigger Source** parameter, you can choose between two trigger types.

External trigger (P-0-0025 = 0x01)

The trigger is activated by the control through bit 0 in the **Trigger Control Word**. This makes it possible to transmit a trigger event to several drives. This parameterization supports parameter P-0-0035, which is necessary to visualize the recording data.

Internal trigger: (P-0-0025 = 0x02)

Triggering occurs through the monitoring of the parameterized trigger signal. If the selected edge is recognized, then the trigger will be released. The "Delay from Trigger to Start" parameter will be set to zero.

Selection of Trigger Edges

Various trigger edges can be selected with the parameter **P-0-0030 Trigger Edge**. The following options are available:

Number:	Trigger Edge (Flank):
0x01	Triggering on the positive edge of the trigger signal
0x02	Triggering on the negative edge of the trigger signal
0x03	Triggering on both the positive and negative edge of the trigger signal
0x04	Triggering when the trigger signal equals the trigger level

Fig. 8-17: Trigger edge selection

Selection of Fixed Trigger Signals

The parameter **P-0-0026 Trigger Signal Selection** determines the signal that is monitored for the parameterized edge reversal. Just as in the signal selection, there are drive-internal fixed trigger signals in the trigger signal selection. These are activated by entering the corresponding number.

The following signal numbers are valid:

Trigger signal number:	Trigger signal:	Associated trigger edge:
0x01	Actual feedback value according to active operating mode	Position data (P-0-0027)
0x02	Velocity feedback value Parameter S-0-0040	Velocity data (P-0-0028)
0x03	Velocity deviation Parameter --	Velocity data (P-0-0028)
0x04	Lag distance Parameter S-0-0189	Position data (P-0-0027)
0x05	Torque command value Parameter S-0-0080	Torque data (P-0-0029)
0x06	Torque feedback value Parameter S-0-0084	Torque data (P-0-0029)
0x07	Position command value Parameter S-0-0047	Position data (P-0-0027)

Fig. 8-18: Selection of fixed trigger signals

Selection of Expanded Trigger Signals

In addition to a trigger signal selection with preset signals, DIAX03 also allows for triggering to any desired internal signal. Use of this feature is meaningful only with information about the structure of the internal data memory; therefore, this feature can be used effectively only by the corresponding developer. This feature can be activated with the **P-0-0026 Trigger Signal Selection** parameter by setting bit 12 = "1".

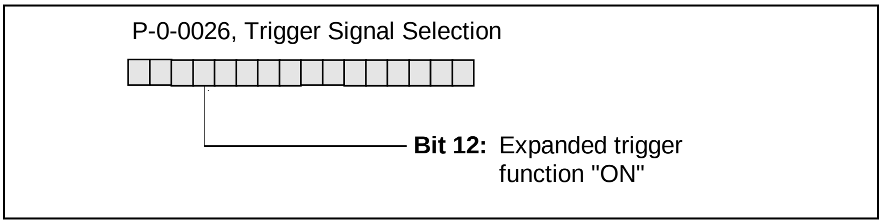


Fig. 8-19: Structure of Parameter P-0-0026

If the expanded trigger feature is activated, then the trigger signal address must be defined over the parameter **P-0-00146 Trigger Signal Address for Expanded Signal Selection**. The associated trigger level will be entered in parameter **P-0-0145 Trigger Level for Expanded Trigger Signals**. This parameter is defined as follows:

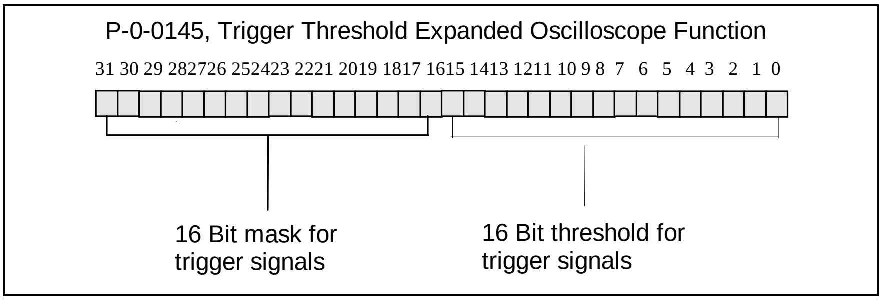


Fig. 8-20: Structure of Parameter P-0-0145

The 16-bit value of the trigger edge is monitored, and the trigger signal will be UND-linked over the trigger signal screen mask.

Setting the Time Resolution and the Memory Depth

The recording ranges for the oscilloscope feature can be defined with the parameters **P-0-0031 Timebase** and **P-0-0032 Memory Depth**. The maximum memory depth is defined as 512 probe values. If fewer probe values are needed, then the value can be changed in the memory depth (size) parameter.

The time resolution can be set from 250usec to 100msec in a 250usec division. This determines the time intervals in which the probe values are recorded. The minimum recording duration is 128msec; the maximum recording duration is 51.2sec.

Universally valid:

Recording duration = Time resolution * Memory depth [usec]

Setting the Trigger Delays

By setting the parameter **P-0-0033 Number of Probe Values After a Trigger Event**, it is possible to record probe values before the trigger event (trigger delay function of an oscilloscope). The setting occurs in units of the parameterized time resolution. The input value determines the number of probe values still recorded after a trigger event. By entering 0[Zeitauflösung] (time resolution), only data available before a trigger event will be recorded. If the value of the P-0-0032 Memory depth (size) parameter is entered, then only the probe values occurring after the trigger event will be recorded.

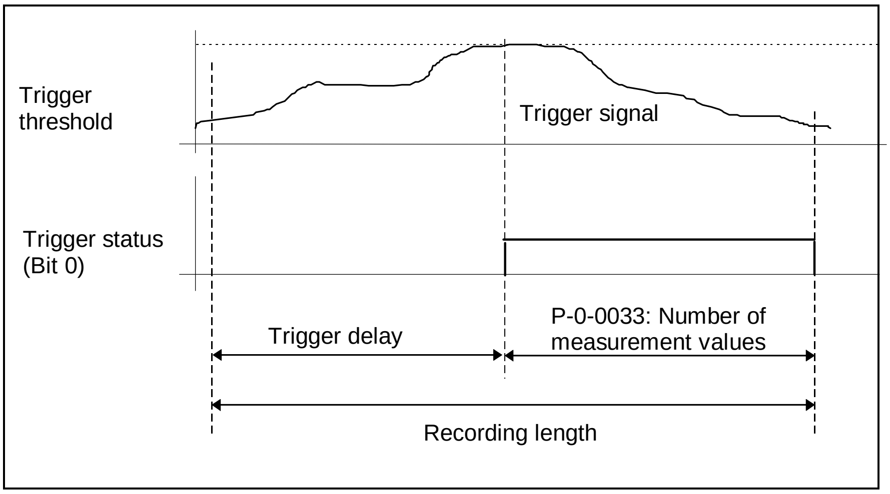


Abb. 8-21: Trigger delay - number of probe values after a trigger event

Activating the Oscilloscope Feature

The oscilloscope feature can be activated with the parameter **P-0-0036 Trigger Control Word**. The parameter is defined as follows:

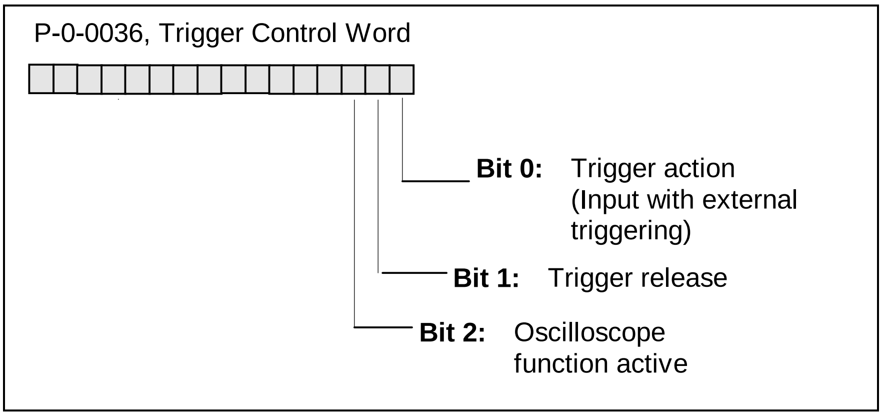


Fig. 8-22: Structure of Parameter P-0-0036

The oscilloscope feature is activated by writing bit 2 with "1"; i.e. the internal probe value memory is continually written with the selected measurement signals. If bit 1 is set, then the trigger monitor is activated, and the oscilloscope feature waits for the selected edge to occur. If a valid edge is recognized, then the probe value memory will be completed as set in parameter P-0-0033, and the oscilloscope feature will be deactivated by resetting bits 1 & 2 in the trigger control word.

Oscilloscope Feature With External Trigger and Internal Trigger Condition

If triggering is selected in parameter **P-0-0025 Trigger Source** with the control bit of the trigger control word, then the trigger will be initiated with 0 ->1 edge of bit 0 in the trigger control word.

With this drive, it is also possible to monitor a trigger signal for the trigger condition. If the trigger condition is recognized, then bit 0 will be set in the trigger status, but the trigger will not be released. In this way, it is possible with real-time status to signal the trigger event for several drives (and the control bits for the control) and to release the trigger simultaneously.

Since there is a delay between the recognition of the trigger event and the release of the trigger, the delay is measured by the control drive and stored in the parameter **P-0-0035, Trigger Delay (Delay From Trigger to Start)**. A time-correct display of the signal can be guaranteed by using this parameter for the visualization of the probe values.

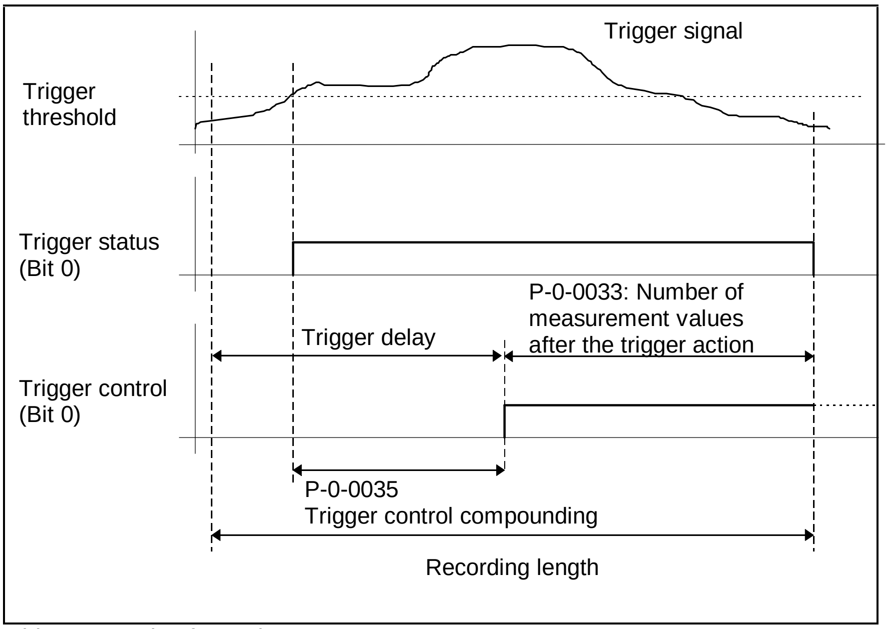


Abb. 8-23: Delay from trigger to start

Status Messages for the Oscilloscope Feature

Information about the status of the oscilloscope feature is shared with the control through the parameter **P-0-0037, Trigger Status Word**.

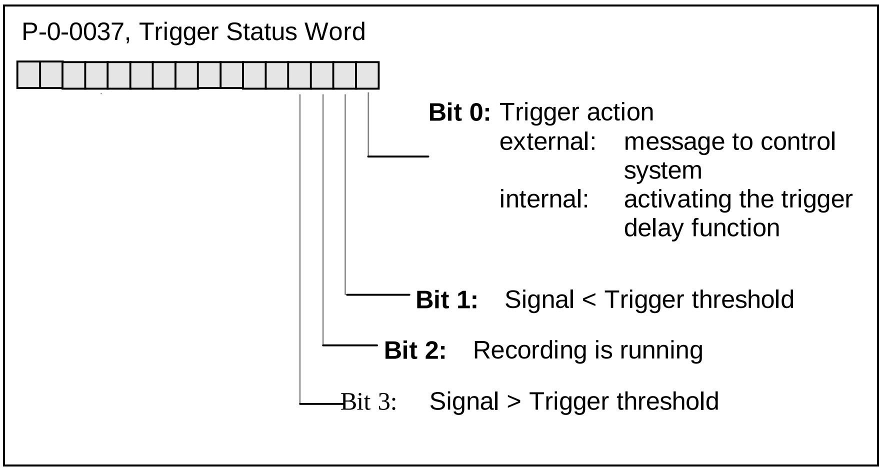


Fig. 8-24: Structure of Parameter P-0-0037

Number of Valid Probe Values

As soon as bit 2 is set by the **P-0-0036, Trigger Control Word**, the drive starts to record probe values.

If the trigger event is recognized after the bit is set, the oscilloscope feature records the number of probe values after the trigger event and then stops recording.

The total probe value memory for the current measurement will not always be written, dependent on the memory-depth setting, the time resolution, the number of probe values after the trigger event and the time when the trigger event occurs.

That means there are still probe values in the memory that are not valid for the measurement.

The parameter **P-0-0150, Number of Valid Oscilloscope Samples** indicates the number of valid probe values for the current recording.

8.5 Probe Input Feature

For position and time measurement through two binary input signals, there are two probe inputs on the communication control module DSS 2.1 that can be used to measure:

- the position feedback value 1/2 or
- the relative internal time in [usec]

Measurements are made, for one, through the edges of the defined time points for both inputs.

Note: The sampling of the probe inputs occurs every 1 usec. The measurement signal actual feedback value 1/2 is created only every 250 usec. Linear interpolation occurs between each sampling step with an exactness of 1 usec.

Parameters can be used to read the absolute value of the signal at the time a positive or negative edge occurs as well as their difference.

The following parameters are available for this feature:

- **S-0-0170, Probing Cycle Procedure Command**
- **S-0-0401, Probe 1**
- **S-0-0402, Probe 2**
- **S-0-0169, Probe Control Parameter**
- **P-0-0200, Signal Select Probe 1**
- **P-0-0201, Signal Select Probe 2**
- **S-0-0405, Probe 1 Enable**
- **S-0-0406, Probe 2 Enable**
- **S-0-0130, Probe Value 1 Positive Edge**
- **S-0-0131, Probe Value 2 Negative Edge**
- **P-0-0202, Difference Probe Values 1**
- **S-0-0132, Probe Value 2 Positive Edge**
- **S-0-0133, Probe Value 2 Negative Edge**
- **P-0-0203, Difference Probe Values 1**
- **S-0-0409, Probe 1 Positive Latched**
- **S-0-0410, Probe 1 Negative Latched**
- **S-0-0411, Probe 2 Positive Latched**
- **S-0-0412, Probe 2 Negative Latched**

Main Function of the Probe Analysis

S-0-0170, Probing Cycle Procedure Command activates the feature. The feature is activated as a command, but does not send a command acknowledgment. The KÄ bit is not used.

To activate the feature, S-0-0170 must be written with "3".

From this point on, the status of the probe signals will be displayed in the parameters **S-0-401, Probe 1** and **S-0-402, Probe 2**.

A probe input is enabled with parameter **S-0-0405, Probe 1 Enable** or **S-0-0406, Probe 2 Enable**. With a 0-1 switch of the signal, the trigger mechanism is activated to evaluate the positive and/or negative edge of the probe signal.

From this point on, if a probe signal edge is recognized, then the selected signal will be stored in the positive or negative probe value parameter. At the same time, the difference between the positive probe value and the negative probe value will be computed and saved in the probe value difference parameter. The following status messages will be set to "1": **S-0-0409, Probe 1 Positive Latched** and **S-0-0410, Probe 1 Negative Latched** or **S-0-0411, Probe 2 Positive Latched** and **S-0-0412, Probe 2 Negative Latched**.

When the probe enable is canceled, the following status messages will be erased: S-0-0409, Probe 1 Positive Latched and S-0-0410, Probe 1 Negative Latched or S-0-0411, Probe 2 Positive Latched and S-0-0412, Probe 2 Negative Latched.

Note: Only the first positive and the first negative signal edge of the input will be evaluated after the 0-1 edge of the probe enable. For each new measurement, the probe enable must be reset to 0 and then to 1. When the probe enable is canceled, the corresponding probe-value latched parameters are also canceled.

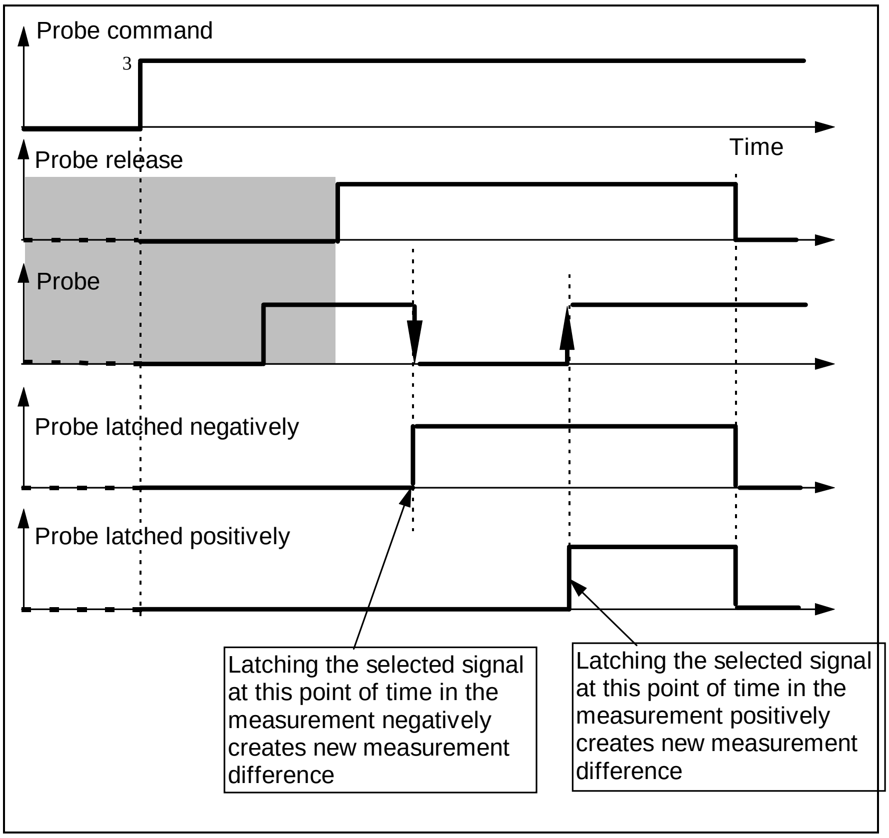


Abb. 8-25: Evaluation of probe signal edges, when positive and negative signal edge analysis is set in the probe control parameter

Results of Writing "3" to the S-0-0170, Probing Cycle Procedure Command

The probe feature begins when the parameter **S-0-0170, Command Probing Cycle Procedure** is written with "3". The following will occur:

- The data status will be set to "7" by the S-0-0170, Probing Cycle Procedure Command.
- All probe values and probe value differences will be set to "0".
- All probe-value latched parameters will be canceled.
- The external voltage monitor will be activated (if it has not yet been activated).

Signal Edge Selection for the Probe Inputs

A positive probe value and a negative probe value are available for one probe input. The positive probe value is assigned the 0-1 edge of the probe signal, and the negative probe value is assigned the 1-0 edge. The **S-0-0169, Probe Control Parameter** determines whether both occurring edges will be evaluated and will lead to the positive/negative probe values being saved.

The parameter should be set before activating this feature. The parameter is structured as follows:

S-0-0169, Probe Control Parameter

Bit 0: Activating Positive Flank Probe 1
0: positive flank is not analyzed
1: positive flank is analyzed

Bit 1: Activating Negative Flank Probe 1
0: negative flank is not analyzed
1: negative flank is analyzed

Bit 2: Activating Positive Flank Probe 2
0: positive flank is not analyzed
1: positive flank is analyzed

Bit 3: Activating Negative Flank Probe 2
0: negative flank is not analyzed
1: negative flank is analyzed

Bit 4: Position Feedback Value Selection
0: S-0-0053 is always used as the measurement, if an external feedback is connected and position feedback values are chosen in the signal selection.
1: S-0-0051 is always used as the measurement, if position feedback values are chosen in the signal selection.

Fig. 8-26: Structure of Parameter S-0-0169, Probe Control

Signal Selection for the Probe Inputs

The following signals are available for measurement:

- Actual feedback value 1 (motor encoder)
- Actual feedback value 2 (external encoder, only if available)
- Internal time

The selection can be made with parameters **P-0-0200, Signal Select Probe 1** and **P-0-0201, Signal Select Probe 2**, and with bit 4 of the **S-0-0169, Probe Control Parameter**.

In P-0-0200 and P-0201, you can indicate individually for the probe inputs whether a position feedback value or an internal time will be measured.

Value of P-0-0200/201:	Signal:
0	Actual feedback value 1/2
1	Time

Fig. 8-27: Signal determination for the probe feature

The units and decimal places of the positive, negative and difference probe value parameters will be switched depending on the selection made.

If position feedback value is selected in the signal selection parameter, then bit 4 in the **S-0-0169, Probe Control Parameter** will determine whether **S-0-0051, Actual Feedback 1** or **S-0-0053, Actual Feedback 2** will be used as the signal.

Connecting the Probe Inputs

The probe can be connected to E4 or E5 of connector X12 on the DSS 2.1 slide-in module.

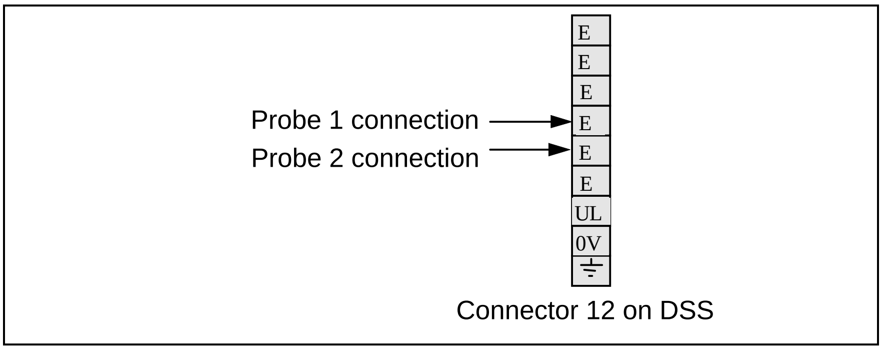


Fig. 8-28: Connecting the probe to the DSS

The following levels are valid for the probe inputs:

Low: 0..+6V

High: +14V..U $\backslash_{ext}$(max)

The inputs need an external power supply because they are electrically isolated.

The following applies:

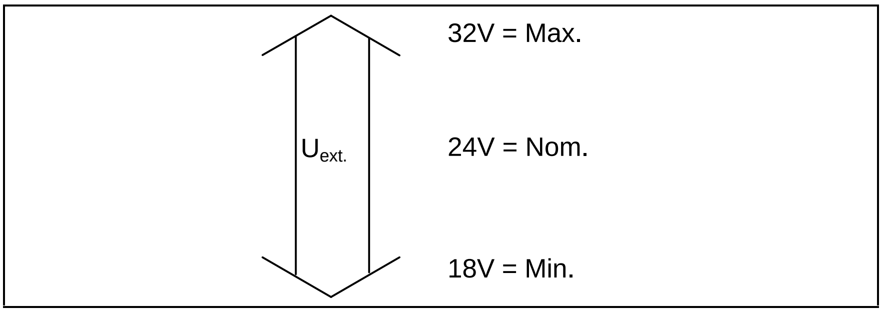


Fig. 8-29:Permissible input voltage range of the external power supply

If the external voltage is not in this range, then the error message:

F233 External Power Supply Error will be generated.

8.6 Axis Error Correction

The axis error correction serves to correct systematic failure in the mechanical system and in the measurement system of a Servo axis. These systematic failures are classified as follows:

- Error resulting from thermal expansion of the machine elements
- Error resulting from inexactness in the measurement system
- Error resulting from mechanical inexactness in the gearbox, coupling and spindle

The following correction features are available in the DIAX03 firmware to compensate for the errors:

- Reversal error correction
- Precision axis error correction
- Position-dependent temperature correction
- Position-dependent temperature correction
- Control axis error correction

These correction features are independent of one another, but they can be combined in any combination needed. The resulting correction value indicates the sum of the individual correction values.

Note: All position-dependent correction features work only if the drive contains a reference point.
Reference dimension can be created with the help of the drive-internal referencing procedure.

Active Correction Value

Since it is possible to activate several correction features simultaneously, there can be several correction values.

In parameter **P-0-0401, Pos. corr. Correction Value Aktive** , all internally created correction values will be added to the correction value and displayed in this parameter.

The created correction value refers to the encoder selected in **Homing Parameter** (Bit 3).

Reversal error correction

A slack in the axis mechanism can be corrected easily with the reversal error correction.

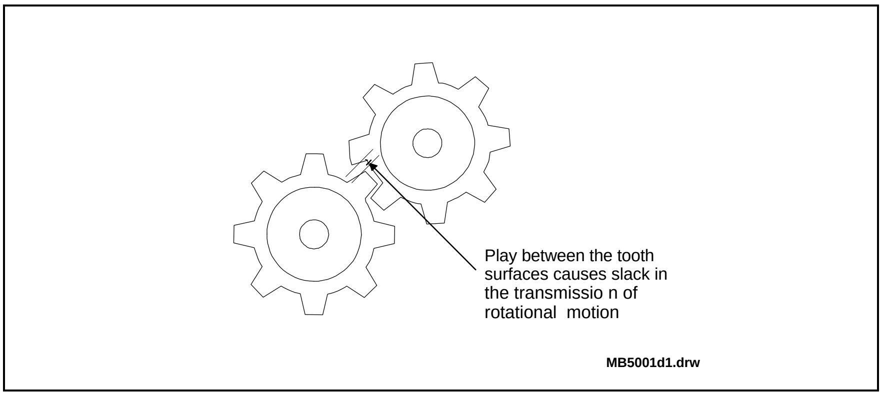


Fig. 8-30: Diagram of slack in gear

The feature can be activated by inputing the slack in the parameter **S-0-0058, Reversal play.** The actual feedback value 1 (**S-0-0051, Actual**

Feedback Value 1) is corrected with the parameterized correction value while taking into account the current command velocity (**S-0-0036, Velocity Command Value**).

The following applies:

For v(command) > standstill window (S-x-0124): x1(actual feedback) = x1(actual feedback) For v(command) < -standstill window (S-x-0124): x1(actual feedback) = x1(actual feedback) - correction value x1(actual feedback): actual feedback value 1

Fig. 8-31:Influence of the actual feedback value during reversal error correction

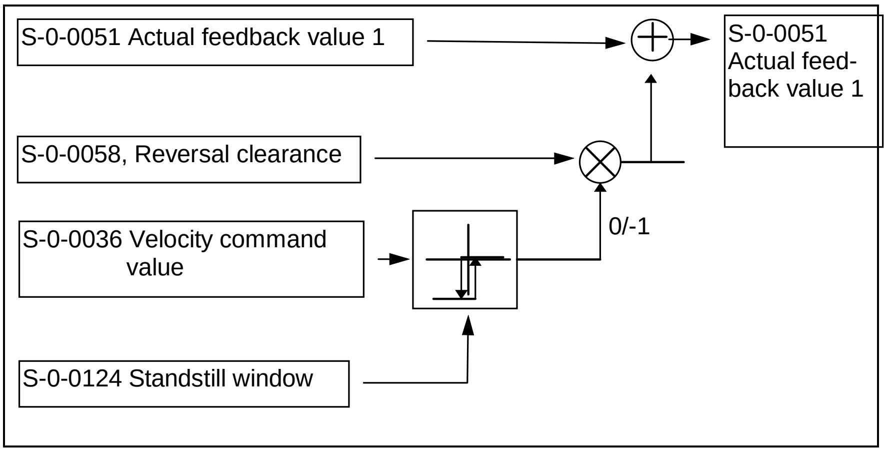


Abb. 8-32: Reversal error correction

Note: The actual feedback value of the motor encoder is corrected during reversal error correction.

Ascertaining the Reversal Play

The following procedure will determine the correct value for the parameter S-0-0058 Reversal Play:

- Move axis in a positive direction in jog mode
- Move the measurement clock to an appropriate point on the mechanical system of the axis and set to zero.
- Jog the axis in a negative direction until a change can be seen in the pointer position of the measurement clock.

The following calculation determines the reversal play:

$$\text{Umkehrspiel} = \Delta X_{\text{Steuerung}} - \Delta X_{\text{Meßuhr}}$$

$\Delta X_{\text{Steuerung}}$:Path traveled according to control display

$\Delta X_{\text{Steuerung}}$:Path traveled according to measurement clock

Fig. 8-33:Calculating the reversal play

Precision Axis Error Correction

The precision axis error correction can be used to correct non-linear encoder errors and non-linear errors in the mechanical system.

The following parameters are available to set the correction:

- **P-0-0408, Pos. corr. Precision corr. start pos.**
- **P-0-0409, Pos. corr. Correction table for precision corr.**
- **P-0-0410, Pos. corr. Support point distance for precision corr.**

Main Function of the Precision Axis Error Correction

With the table **P-0-0409, Pos. corr. Correction table for precision corr.**, the position- and velocity-dependent correction values, the so-called correction support points, can be defined within the correction range (correction range = reference position + 499*support point distance).

The positions from which the correction support points are taken can be defined with the parameters **P-0-0410, Pos. corr. Support point distance for precision corr.** and **P-0-0408, Pos. corr. Precision corr. start pos. Precision Correction**. The correction values are interpolated linearly between the correction support points.

If the axis is homed and if the parameters of the precision axis error correction are within permissible limits, then the actual feedback value of the homed encoder (dependent on **S-0-0147, Homing Parameter, Bit 3**) will be corrected with the interpolated correction value (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

The feature can be deactivated by setting the **P-0-0410, Pos. corr. Support point distance for precision corr.** to zero.

The following applies:

$$\text{Korrekturwert intern} = xk(n) + \text{Interpolationsfaktor} * ((Xist - X0) - n * ds)$$

with

$$\text{Tabellenindex } n = \frac{(Xist - X0)}{ds}$$

xk(n) : Correction value at the support point
Xactual : Actual feedback value
X0 : Start position
ds : Support point distance

Fig. 8-34: Influence of the actual feedback value during reversal error correction

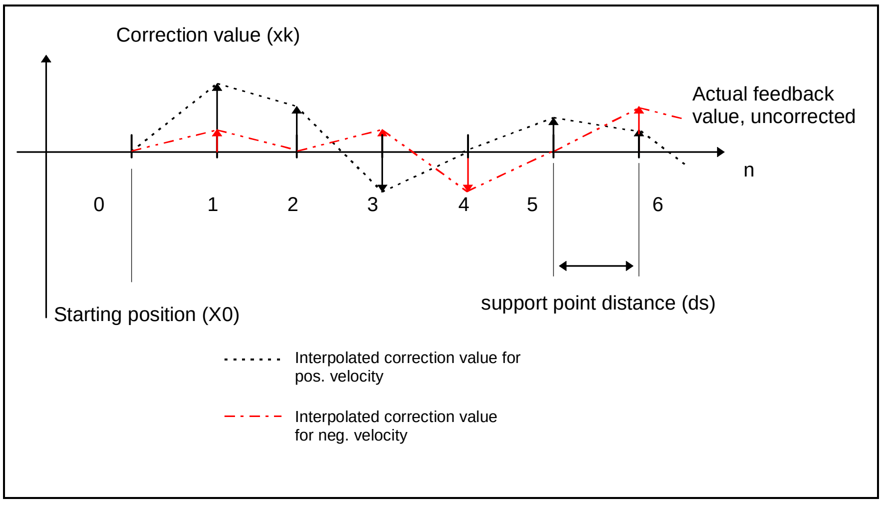


Abb. 8-35: Error correction with precision axis error correction

The following graphic displays the correction schematic for precision axis error correction.

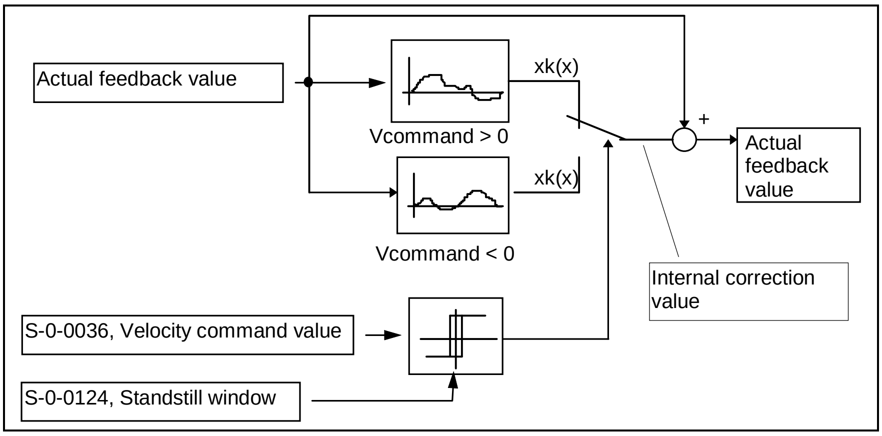


Abb. 8-36: Correction schematic for precision correction

Note: With precision axis error correction, the actual feedback value of the motor encoder or external encoder (dependent on **S-0-0147, Homing Parameter**) is corrected.

Determing the Correction Value

The correction table for the precision axis error correction consists of 2x500 correction values.

The first 500 correction value are for the positive travel direction; the second 500 correction values are for the negative travel direction.

The correction value can be determined with a reference measurement system (i.e. Laser Interferometers). Within the desired correction range, the support points for the various directions are sequentially approached and the corresponding position errors are measured.

The following applies:

$$Fehler = xk = x(mess) - x(Anzeige)$$

with:

xk	: position error
x(measured)	: measured position value
x(display)	: S-0-0051 or S-0-0053

Fig. 8-37: Correction value determination for precision axis error correction

This error is entered into the correction table as the correction value for the corresponding support point. If not all correction support points are needed, then the non-measured support points must be written with the correction value 0.

Note: To avoid actual feedback jumps, the first (xk1,xk501) and the last (xk500,xk1000) correction values must always be written with the correction value 0. The reference position (xs) must especially be selected.

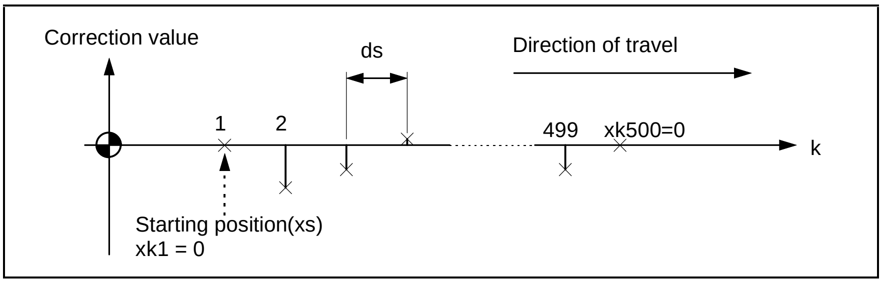


Abb. 8-38: Correction table for positive travel direction

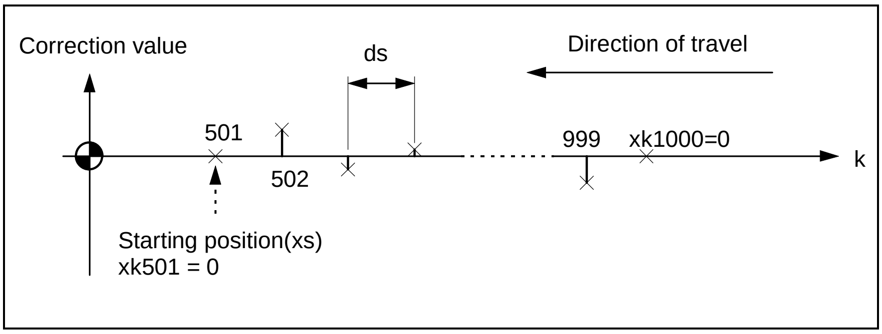


Abb. 8-39: Correction table for negative travel direction

Parameterizing the Support Point Distance

The parameter **P-0-0410, Support Point Distance Precision Correction** can be used to define the correction range. Since a maximum of 500 support points per direction are possible, the correction range is determined by:

$$\text{Korrekturbereich} = ds \times 499$$

with:
ds : Support point distance

Fig. 8-40: Determining the support point distance

If the parameter is set with 0, then the precision axis error correction feature is deactivated.

Parameterizing the Start Position

The start position for the precision axis error compensation (xs) defines the position of the first correction support point.

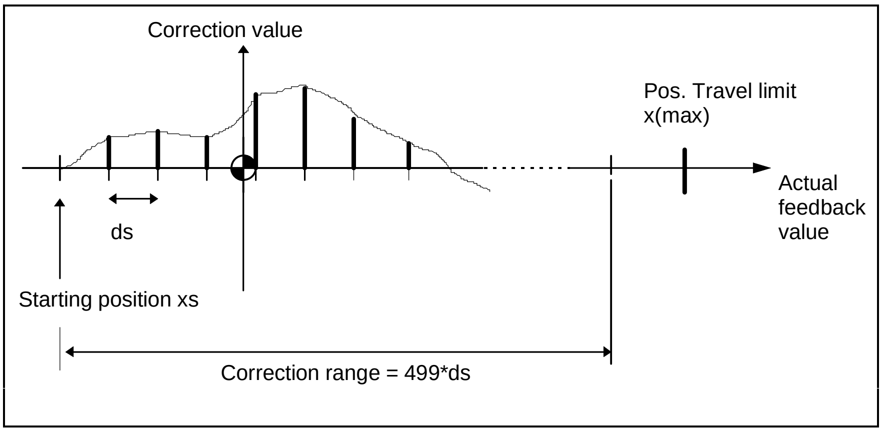


Abb. 8-41: Start position for precision correction

Temperature Correction

The temperature correction feature can be used to correct errors resulting from temperature-dependent longitudinal expansions on the servo axis.

There are two different correction types:

- Position-independent temperature correction
- Position-dependent temperature correction

Position-independent temperature correction

The position-independent temperature correction is used to compensate for temperature-dependent longitudinal expansions of tools, work pieces and carriages (see **Fehler! Verweisquelle konnte nicht gefunden werden.**). The expansion of these parts of a Servo axis always are equally sized, independent of their position.

To set the position-independent temperature correction, the following parameters are available:

- **P-0-0402, Pos. corr. Reference temperature**
- **P-0-0403, Pos. corr. Reference position for temperature correction**
- **P-0-0405, Pos. corr. , Actual temperature, position independent**
- **P-0-0407, Pos. corr. , Actual temperature, position independent (0.1/K)**

Position-dependent temperature correction

The position-dependent temperature correction is used to compensate for temperature-dependent longitudinal expansions of the mechanical system of a Servo axis or a measurement system. The expansion of the mechanical system or the measurement system depends on the relative position of the work component to the thermal zero point, and it is not constant.

To set the position-dependent temperature correction, the following parameters are available:

- **P-0-0402, Pos. corr. Reference temperature**
- **P-0-0403, Pos. corr. Reference position for temperature correction**
- **P-0-0404, Pos. corr. , Actual temperature, position dependent**
- **P-0-0406, Pos. corr. , Temperature, position dependent**

Position-Independent Temperature Correction

The correction value is determined with the parameter **P-0-0407, Pos. corr. , Actual temperature, position independent (0.1/K)** and the **P-0-0402, Pos. corr. Reference temperature**. By writing 0 to the parameter **P-0-0407, Pos. corr. , Actual temperature, position independent (0.1/K)** , the compensation is deactivated**.**

The following applies:

Internal correction value = correction factor * temperature deviation
with Temperature deviation = reference temperature - actual temperature Correction factor = P-0-0407, Temperature factor position independent

Fig. 8-42: Influence of the actual feedback value with position-independent temperature correction

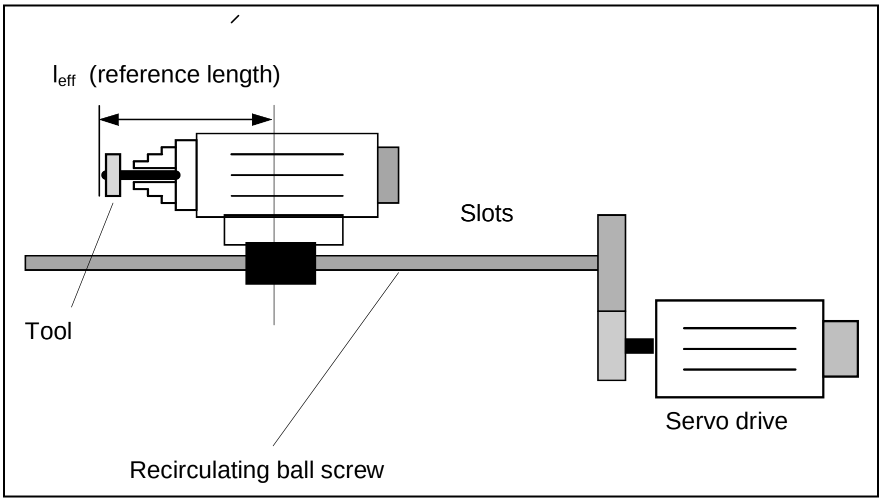


Abb. 8-43: Example of use for position-independent temperature correction

The following graphic shows the correction schematic for the position-independent temperature correction.

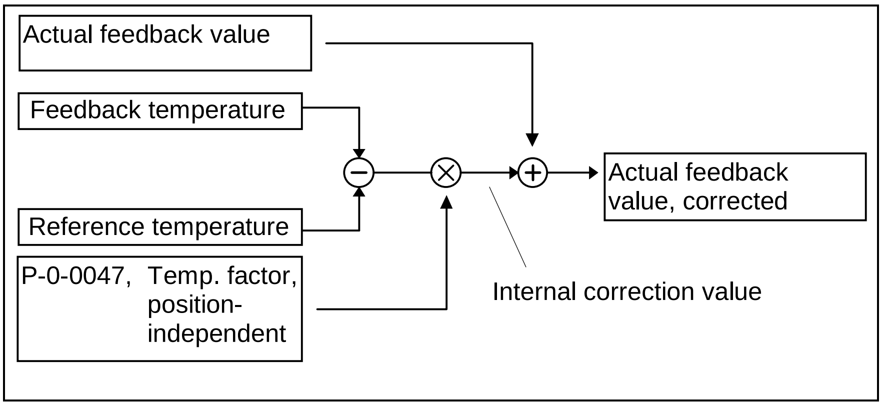


Abb. 8-44: Correction schematic for position-independent temperature correction

Homing the drive is not required to make the correction.

Note: With the position-independent temperature correction, the actual feedback value of the motor encoder or the external encoder (dependent on **S-0-0147, Homing Parameter**) is corrected.

Position-Dependent Temperature Correction

If the drive is homed, the corresponding correction value (xk) is determined and added to the actual feedback value with the parameter **P-0-0406, Pos. corr. , Temperature, position dependent**(α), with the **P-0-0403 Pos. corr. Reference position for temperature correction** (x0) and with the **P-0-0402 Pos. corr. Reference temperature** (T0).

The following applies:

$$xk = (xist - x0) * (Tist - T0) * \alpha$$

with
xk : Correction value
xactual : Actual feedback value
X0 : P-0-0403, Reference Position Temperature Correction
T0 : P-0-0402, Reference Temperature
α : P-0-0406, Tempeprature Factor Position Dependent
Tactual : Actual temperature

Fig. 8-45: Influence of the actual feedback value for position-dependent temperature correction

This feature works only on the actual feedback value 1 and is deactivated by setting the parameter **P-0-0406, Pos. corr. , Temperature, position dependent** to 0.

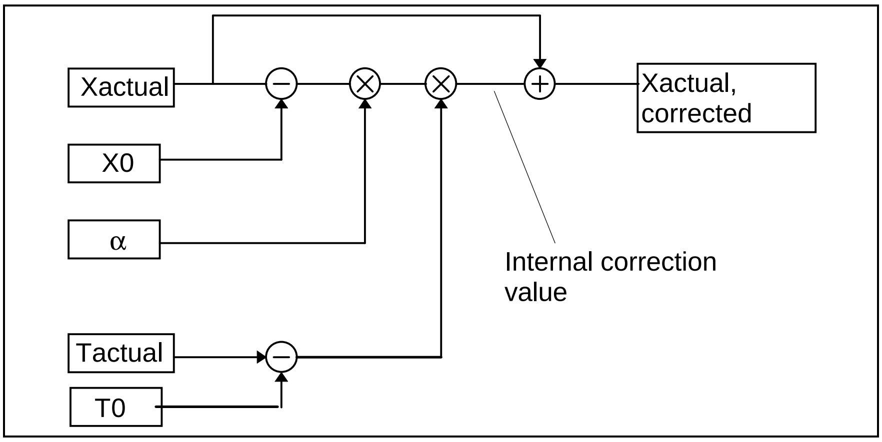


Abb. 8-46: Correction schematic: position-dependent temperature correction

Note: The actual feedback value of the motor encoder is corrected with the position-dependent temperature correction.

Parameterizing the Reference Temperature

To determine the correction values for temperature-dependent correction features, a reference temperature is needed to which the actual feedback temperatures **P-0-0404, Pos. corr. , Actual temperature, position dependent**and **P-0-0405, Pos. corr. , Actual temperature, position independent**can refer.

The parameter **P-0-0402, Pos. corr. Reference temperature**determines the temperature at which the temperature-dependent axis error equals 0 independent of the position.

Requirement:

When setting the reference temperature, all machine parts included in the correction must be at the same temperature.

Determining the Reference Position for Temperature Correction

The parameter **P-0-0403 Pos. corr. Reference position for temperature correction** defines for position-dependent correction types the position at which the axis error is always 0.

It is compensated from the reference position in both directions.

If the reference position is not clearly defined by the mechanical system, then the determination will be made through measurement. In this procedure, the position-dependent errors will be measured over three measurement points in the entire travel range at one temperature that is not the reference temperature.

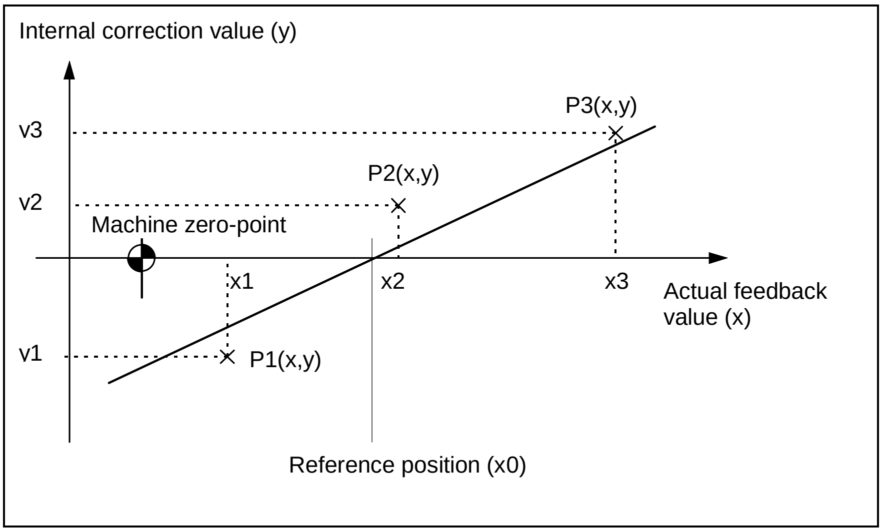


Abb. 8-47: Display of the reference position

With the measurement points (P1, P2, P3) the reference point can be determined with a mean straight line.

Mean Straight Line

The following applies:

$$\text{Bezugsposition}\, x0 = \frac{-b}{a}$$

Fig. 8-48: Equation to determine the reference position with:

$$a = \frac{n \times \sum (x \times y) - \sum x \times \sum y}{n \times \sum x^2 - (\sum x)^2}$$

with
n : Number of measured values
x : x position of a measured value
y : y position of a measured value

Fig. 8-49: Equation 1 to determine reference point

$$b = \frac{\sum y \times \sum x^2 - \sum x \times \sum (x + y)}{n \times \sum x^2 - (\sum x)^2}$$

Fig. 8-50: Equation 2 to determine reference point

Example

measured values with: Tx= 45°C > T0 = 23°C

n	x(actual feedback value 1) [mm]	xk(error) [mm]
1	+10.0000	-0.0300
2	+70.0000	+0.0100
3	+105.0000	+0.0250

Fig. 8-1: Established measurement array for temperature correction

Resulting measurement points: P = [x=Xist ; y=xk]
P1 = [+10.0mm; -0.03mm]
P2 = [+70.0mm;+0,01mm]
P3 = [+105.0mm;+0,025mm]
n = 3

Sum for help equations:

$$\sum y = -0.03 + 0.01 + 0.025 = +0.005$$

$$\sum x = 10.0 + 70.0 + 105.0 = 185.0$$

$$\sum x^2 = 10^2 + 70^2 + 105^2 = 16025$$

$$\sum x \times y = -0.3 + 0.7 + 2.625 = 3.025$$

Help equation 1:

$$\mathrm{a} = \frac{3 * 3.025 - 185.0 * 0.005}{3 * 16025 - (185.0)^2} = \frac{8.15}{13850} = 0.0005884$$

Help equation 2:

$$\mathrm{b} = \frac{0.005 * 16025 - 185.0 * 3.025}{3 * 16025 - (185.0)^2} = \frac{-479.5}{13850} = -0.034620$$

Reference position

$$\mathrm{x0} = \frac{-(-0.034620)}{0.0005884} = 58.83\,\mathrm{mm}$$

To ensure an exact reference position, several measurement arrays with differing temperatures should be collected during position-dependent temperature correction.

The resulting reference position will be determined arithmetically from the various reference positions.

Setting the Position-Dependent Temperature Correction Factors

The parameter **P-0-0406, Pos. corr. , Temperature, position dependent** indicates the longitudinal expansion of the spindle. The correction factor can be taken directly from table books for corresponding mechanical systems or, if necessary, it must be determined with measurements of the longitudinal expansion at various temperatures.

To determine the factor, the measurement array for determining the reference position can be used.

The sizes a and b thus arrived at determine the longitudinal expansion factor according to the following equation and are used by the drive to determine the linearized position error xk'.

$$\beta^* = \frac{a \times x + b}{(x - x0) \times (\vartheta 1 - \vartheta 0)}$$

with:

a	: Result from help equation 1
b	: Result from help equation 2
x	: Position value
x0	: Reference position
β^*	: Longitudinal expansion factor = P-0-0406
$\vartheta 1$	: Actual temperature
$\vartheta 0$	: Reference temperature

Fig. 8-51: Equation to determine the longitudinal expansion factor

To ensure a factor as exact as possible, use various temperatures for your determination.

For each new temperature measurement array, the values of a and b must be newly determined.

The resulting longitudinal expansion factor is determined mathematically from the various longitudinal expansion factors.

Determining the Position-Independent Temperature Correction Factor

The position-independent temperature correction factor **P-0-0407, Pos. corr., Actual temperature, position independent (0.1/K)** can be determined in 2 different ways.

If all data can be allocated clearly through the structure of the mechanical system for the following formula, then the correction factor can be derived mathematically.

Mathematical Determination

The following applies:

$$\alpha^* = \alpha \times lx(T0)$$

with:

α^*: P-0-0407, Temperature Factor Position Independent

α : Longitudinal expansion coefficient of the material

$lx(T0)$: Material length to be compensated by the reference temperature

Fig. 8-52: Equation to determine the position-independent temperature correction factor mathematically

Technical Measurement Determination

If a mathematical determination of the factor cannot be made, then the factor will be determined from a measurement array. The error of the correction object will be measured at various temperatures. The measurement array thus determined offers a correction mean that can be optimized for the determination of a correction factor through a mean straight line.

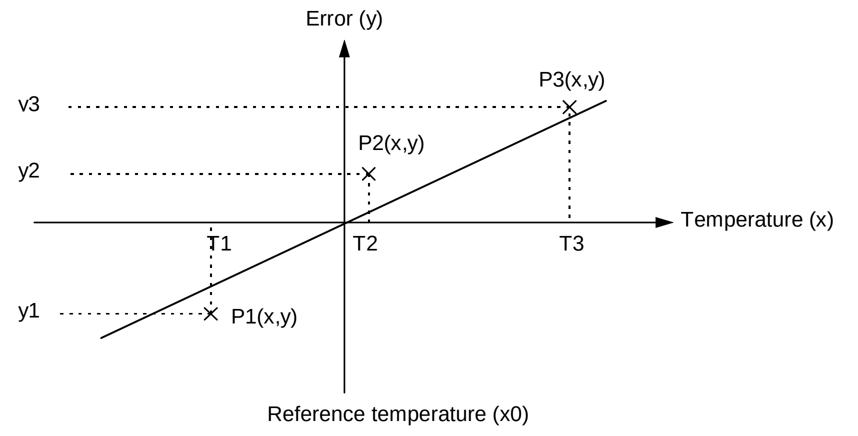


Abb. 8-53: Graphic of the mean straight line determined with technical measurement for the determination of the position-independent temperature factor

The following applies for the calculation of the correction factor α^*:

$$\alpha^* = \frac{n \times \sum (x \times y) - \sum x \times \sum y}{n \times \sum x^2 - (\sum x)^2}$$

with

α^*: P-0-0407, Temperature Factor Position Independent

n : Number of measured values
x : x position of a measured value
y : y position of a measured value

Fig. 8-54: Equation to determine the position-independent correction factor from the values of a mean straight line

Control Axis Error Correction

Since it is not possible to examine the axis in isolation for some applications, the control is given the option to cyclically add a correction value to the actual feedback value with the control axis error correction. The **P-0-0400 Pos. corr. Correction value external** will be added to the actual feedback value with the **S-0-0147 Homing parameter** (Bit 3).

Reference dimension does not need to be established in the drive-internal homing procedure in order to use this correction feature.

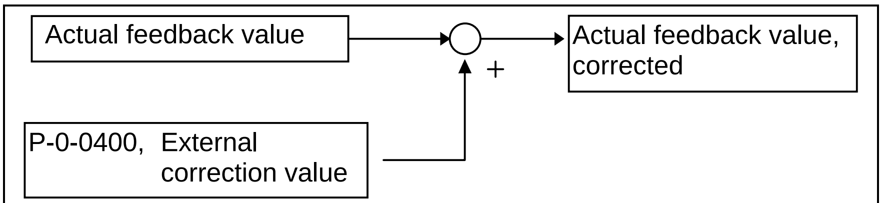


Abb. 8-55: Correction schematic: Control axis error correction

Note: With the control axis error correction, the actual feedback value of the motor encoder or the external encoder (dependent on **S-0-0147, Homing parameter**) is corrected.

8.7 Positive stop drive procedure

The command **S-0-0149, d400 Positive stop drive procedure** turns off all controller monitors that would lead to an error message in Class 1 Diagnostics during the blocking of a drive during a fixed limit stop.

If the command is started, the drive generates the diagnostic message **D400 Command Positive stop drive procedure**.

The switching off of the controller monitors occurs in all drive operating modes.

If there is a Class 1 Diagnostics error message at the start of the command, the error **D401, ZKL1 Error at Command Start** will be generated.

The drive will acknowledge the command as properly executed when:

- the controller monitors are switched off
- $|Md|$ (S-0-0084) >= $|Md_{Limit}|$ (S-0-0092) and
- $n_{is} = 0$

Note: The message $n_{is} = 0$ is influenced by the parameter **S-0-0124, Standstill Window**.

If the command is canceled by the control after execution, then all regular controller monitors are reactivated.

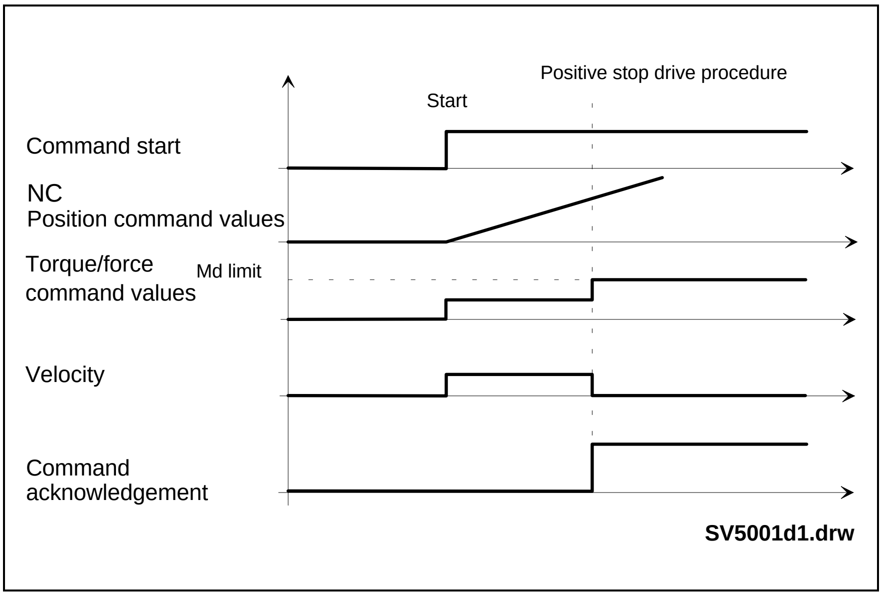


Fig. 8-56: Time sequence when activating the command: Positive stop drive procedure

9 Glossary

Command

Complex functions in the drive can be controlled with the help of commands. Each command is allocated a parameter. The drive signals the current extent to which the command has already been conducted via command acknowledgment, a part of the data status.

Data status

Every parameter has at its disposal a data status. It can be read by the control via the required data channel. The information on the validity of the parameter or the command acknowledgment of the command are contained therein.

Diagnostics

Drive diagnostics informs about the current state of the drive.It is made up of a diagnostic number and a diagnostic text. It is made available in the form of a 7-segment display (H1-Display) and in parameters **S-0-0390, Diagnosis number** and **S-0-0095, Diagnosis**.

Error

During operations, a number of monitoring functions are run in the drive. If a state is thus detected that no longer guarantees an orderly operation, then the drive generates an error. By executing an error reaction, the drive can bring itself to a standstill.

Error reaction or response

If an error is detected in the drive, then the drive reacts independently by executing an error reaction. At the end of each error reaction there is a deactivation of the drive. The error reaction type is dependent on the error class of the error that occurred as well as the setting in parameters P-0-0117..119.

External encoder

An external measuring system is optional. It is generally mounted directly to the load. The actual feedback value of the encoder can be seen in S-0-0053, Actual feedback value 2. By activating the position control operating mode with encoder 2, the position control loop is closed with the help of the actual feedback value of the external encoder.

Load default or basic load

The control parameters are stored in the motor feedback data memory in both MDD and MKD motors. This makes it possible for the drive controller to work trouble-free with this motor. The control parameters have not been optimized for the application.

Modulo format

Both actual feedback and command values can be processed in modulo or absolute format. If modulo processing has been set, then the position data move within the range of 0..S-0-0103, modulo value. With this function, it is possible to realize an endlessly turning axis.

Motor encoder

The motor encoder is the measuring system that is used during commutation. A measuring system is absolutely necessary. The actual feedback value of the encoder can be seen in S-0-0051, Actual position value 1. By activating the position control operating mode with encoder 1, the position control loop is closed with the help of the actual position of the motor encoder.

Operating data

The operating data is data block element 7 of a parameter. The value of the parameter is stored there.

Operating mode

All drive-internal initialization procedures have been completed in operating mode. The phase progression commands, switching from communication phase 3 to 4, have been completed. The interface is in communication phase 4. Some parameters can now no longer be write accessed. The drive can be activated by powering up and applying the drive enable signal.

Operating mode

Operating mode is set in parameters S-0-0032..35. It determines in what way a command value is processed in the drive and eventually initiates an axis movement. The operating mode does not define how the command value reaches the drive.

Parameterization mode

The drive is in parameterization mode if communication phases 1..3 have been set. The drive cannot be activated (drive enable signal applied). Operating mode must first be switched into. Some parameters can only be written into during parameterization mode.

Parameters

Communication with the drive controller takes place via the reading and writing of data block elements of the drive parameters. Parameters are addressed via their identification numbers (data block element 1).

Programming module

The programming module contains the software and parameter memory. It is mounted in slot U5. When exchanging the controller, a simple insertion of the programming module out of the old into the new unit means that the features of the replaced unit have been transferred to the new one.

Scaling

The combination of unit and number of decimal places of a parameter are defined as scaling. It can be set for position, velocity and acceleration data.

SERCOS-INTERFACE

Digital interface for communication between control and drives in numerically controlled machines. One or multiple ring structures are implemented. The physical connection of the participants generally implements a fiber optic cable.

Warning

Warnings support the diagnosis of states that cannot or cannot yet bring about an independent shutdown of the drive. The causes for these warnings must be cleared as they otherwise generate errors at some later point in time and then bring about an independent shutdown of the drive.

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DIAX03
Drive With
Servo Functions

Supplement A
Parameter Description
SSE-01VRS

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Contents

1 General Information

Using This Manual

All standard and product specific parameters are listed in this chapter in a numerically ascending order.

This chapter supplements the feature description and represents a complete description of all parameters used in the DIAX03 software.

The description of the individual parameters is divided into two subsections.

1) General description
This section contains the feature or meaning of the parameter and tips for setting parameters.

2) Description of attributes
The characteristic values or features listed here help to classify the parameter. They are necessary for a complete description of the parameter. However, they are not required to get a general idea of the meaning of the parameter.

Definitions

The following abbreviations are used:

Data length:

2-byte - the data length for the operating data is 2 bytes.

4-byte - the data length for the operating data is 4 bytes.

1-byte variable - this is a piece of operating data of variable length (list). The length of a data unit is 1 byte.

2-byte variable - this is a piece of operating data of variable length (list). The length of a data unit is 2 bytes.

4-byte variable - this is a piece of operating data of variable length (list). The length of a data unit is 4 bytes.

Format:

BIN - the display format for the operating data should be binary.

HEX - the display format for the operating data should be hexadecimal.

DEC_OV - The display format for the operating data should be decimal without a sign.

DEC_MV - The display format for the operating data should be decimal with a sign.

ASCII - the operating data is an ASCII string.

IDN - the operating data is an ID number (IDN).

Editability:

No - the operating data cannot be edited.

P2 - The operating data can only be edited in communications phase 2.

P23 - The operating data can only be edited in communications phases 2 and 3.

P234 - The operating data can be edited in any communications phase.

P3 - The operating data can only be edited in communications phase 3.

P4 - The operating data can only be edited in communications phase 4.

Memory:

fixed - the operating data is programmed in the drive (fixed value).

no - The operating data is not buffered in the drive; the value is undefined after the drive controller is switched on.

Param.E²prom - The operating data is buffered in E²prom of the programming module (DSM).

Verst.E²prom - The operating data is buffered in E²prom of the drive controller.

Feedb.E²prom - The operating data is buffered in the E²prom of the motor feedback data memory (only in MDD- and MKD motors).

Validity check:

no - the operating data is not checked for validity.

Phase2 - the operating data is checked in the "Communications phase 3 transition check" command.

Phase3 - the operating data is checked in the "Communications phase 4 transition check" command.

Extreme value check:

no - the operating data is not checked for its extreme values when it is written to.

yes - the operating data is checked for its extreme values when it is written to.

Combination check:

no - the operating data is not checked (bitwise) for a valid combination with other parameter values when it is written to.

yes - The operating data is checked (bitwise) for a valid combination with other parameter values when it is written to.

Cyc. transmittable:

no - The operating data cannot be configured as cyclical data in the master data telegram or in the drive telegram.

AT - The operating data can be configured as cyclical data in the drive telegram.

MDT - The operating data can be configured as cyclical data in the master data telegram.

2 Standard Parameters

S-0-0001, NC Cycle Time (TNcyc)

Description:

The NC cycle time indicates the time intervals between new command values being made available by the NC. The NC cycle time must be transmitted in communications phase 2 from the master to the slave; from communications phase 3 on it must be considered in the slave. The NC cycle time must be an integral multiple of **S-0-0002, SERCOS cycle time T_{Scyc}**.

$$T_{Ncyc} = T_{Scyc} * j, \text{ where } j = 1,2,3......$$

See also the functional description: "Position command value monitoring."

S-0-0001 Attributes

ID number:	S-0-0001	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	500 / 65000		

S-0-0002, SERCOS Cycle Time (Tscyc)

Description:

The interface cycle time indicates the time intervals for cyclical data transfer. The interface cycle times are set to 500 us, 1ms, 2ms, ... to 65 ms in increments of 1 ms. The SERCOS cycle time must be transmitted from master to slave in communications phase 2; and from communications phase 3 on it must be activated in both.

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0002 Attributes

ID number:	S-0-0002	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	500 / 65000		

S-0-0003, Minimum AT Transmit Starting Time (T1min)

Description:

The slave uses this parameter value to indicates the minimum time requirement between the reception of the master synchronization telegram and transmission of the drive telegram.

The time $T1_{min}$ is read in communications phase 2 by the master to calculate the time to send the drive telegram T1 **S-0-0006, AT Transmission Starting Time (T1)**.

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0003 Attributes

ID number:	S-0-0003	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0004, Transmit/Receive Transition Time (TATMT)

Description:

This parameter indicates the time required for the slave to switch to reception of the master data telegram after sending the drive telegram.

The transmission/reception transition time is read in communications phase 2 by the master to calculate the time to send the master data telegram T2 **S-0-0089, MDT Transmit starting time (T2)**.

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0004 Attributes

ID number:	S-0-0004	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0005, Minimum Feedback Acquisition Time (T4min)

Description:

This is the minimum time requirement between feedback-value acquisition and the end of the master synchronization telegram. This value is indicated by the drive in such a manner that the current feedback values can be transmitted to the NC in the next drive telegram.

The master reads this value in communications phase 2 to set the acquisition starting time of the feedback values T4 **S-0-0007, Feedback acquisition starting time (T4)** for all drives.

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0005 Attributes

ID number:	S-0-0005	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0006, AT Transmission Starting Time (T1)

Description:

The transmission telegram determines when the slave must send its drive telegram to communications phases 3 and 4. Transmission occurs after the end of the master synchronization telegram.

This parameter is transmitted from the master to the slave in communications phase 2 and is active from communications phase 3 on.

The transmission drive telegram must be set equal to or greater than the transmission reaction time **S-0-0003, Minimum AT transmit starting time (T1min)**.

The following must apply:

$$T1min \leq T1$$

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0006 Attributes

ID number:	S-0-0006	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	12 / 65535		

S-0-0007, Feedback Acquisition Starting Time (T4)

Description:

This is the feedback acquisition starting time set by the master after the end of the master synchronization telegram. The master can set the same feedback acquisition starting time for all drives that work together. This guarantees synchronized feedback-value acquisition among the affected drives. Also, the cyclically transferred command values are processed at time T4.

The master must set the feedback acquisition starting time equal to or less than the difference between the **S-0-0002, SERCOS cycle time** and the polled **S-0-0005, Minimum feedback acquisition time**.

The following must apply:

$$T4 \leq T_{Scyc} - T4min$$

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0007 Attributes

ID number:	S-0-0007	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0 / 65535		

S-0-0008, Command Valid Time (T3)

Description:

The "command valid time" indicates the time after which the drive may access new command values.

The master can set the same "command valid time" for all drives that work together. The drive activates the "command valid time" beginning with communications phase 3.

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0008 Attributes

ID number:	S-0-0008	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0 / 65535		

S-0-0009, Beginning Address in Master Data Telegram

Description:

This parameter displays the start address of a drive's data record in the MDT, expressed as a byte position. It begins with 1 for the first data byte after the address field in the MDT.

The start address of the drive's data record in the MDT is transmitted to each drive by the master in communications phase 2. The address is activated beginning with communications phase 3.

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0009 Attributes

ID number:	S-0-0009	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1 / 65531		

S-0-0010, Length of Master Data Telegram

Description:

The length in bytes of the MDT contains the data records of all the drives. The MDT length is transmitted by the master to all drives in communications phase 2. It is activated by the master and slave beginning with communications phase 3.

See also the functional description: "Configuration of the telegram send and receive times."

S-0-0010 Attributes

ID number:	S-0-0010	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	4 / 65534		

S-0-0011, Class 1 Diagnostics

Description:

Function: Drive lock

A Class 1 diagnostic error situation discovered by drive leads to:

1. The drive's error response, as described in the functional description under "Error. "
2. Setting the static error bits to 1 for Class 1 diagnostic in the drive status. The error bit will not be set back to "0" by the drive until no Class 1 diagnostic error remains and command **S-0-0099, Reset class 1 diagnostic** has been received by the drive via the service channel.

Parameter structure:

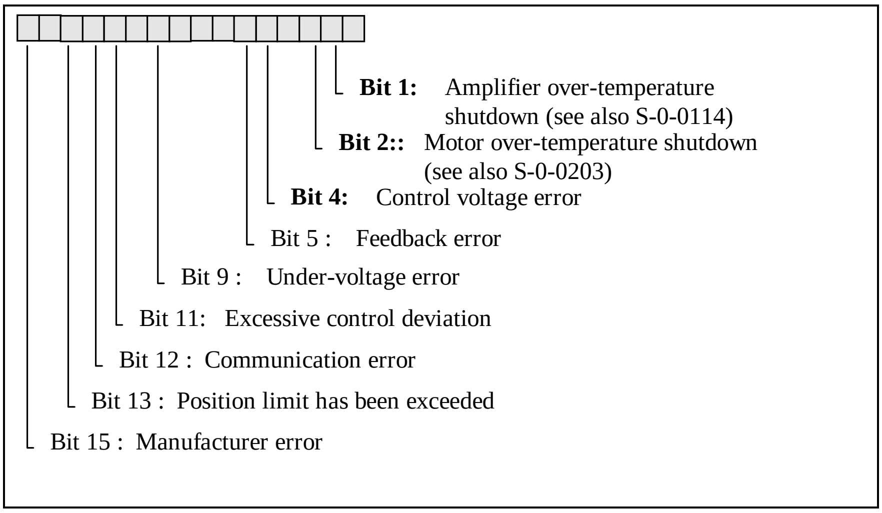

Fig. 2-1: S-0-0011, Diagnostics

Note: Only the bits indicated here are supported by the software.

See also the functional description: "S-0-0011, Class 1 diagnostics."

S-0-0011 Attributes

ID number:	S-0-0011	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0012, Class 2 Diagnostics

Description:

Function: Shutdown warning

When a warning appears or disappears in Class 2 diagnostics, the change bit in the drive status word will be set to 1. When Class 2 diagnostics are read over the service channel, the change bit is reset to "0".

Parameter structure:

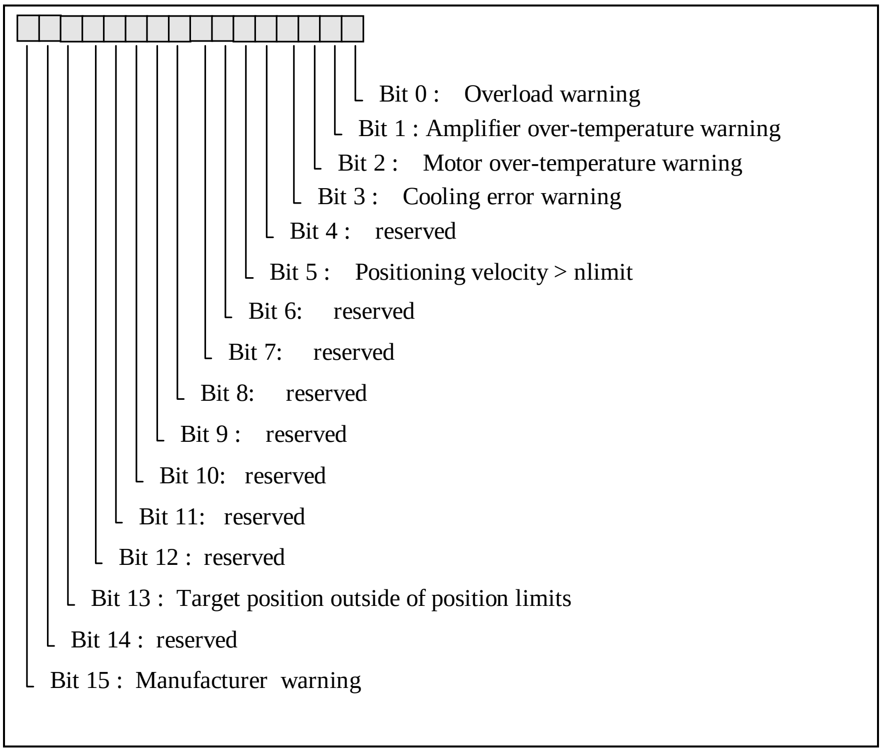

Fig. 2-2: S-0-0012, Class 2 Diagnostics

Note: Only the bits indicated here are supported by the software.

See also the functional description: "S-0-0012, Class 2 diagnostics."

S-0-0012 Attributes

ID number:	S-0-0012	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:		**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0013, Class 3 Diagnostics

Description:

Function: Operating status messages

When a message appears or disappears in Class 3 diagnostics, the change bit for Class 3 diagnostic in the drive status word will be set to 1. When Class 3 diagnostics are read via the service channel, the change bit is reset to "0".

Parameter structure:

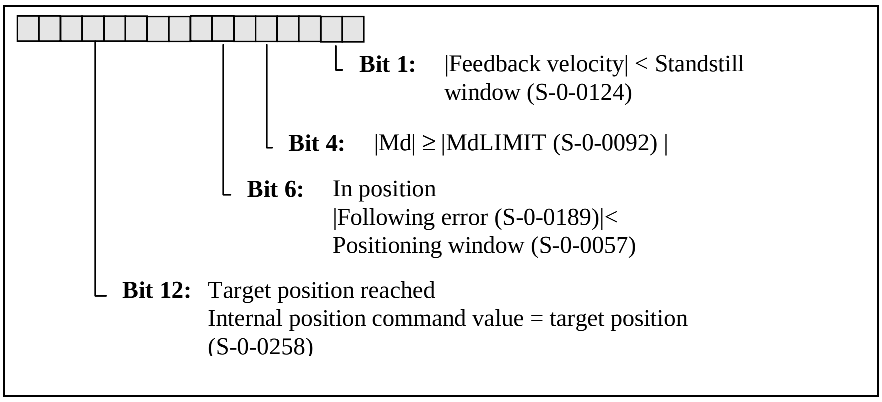

Fig. 2-3: S-0-0013, Class 3 Diagnostics

Note: Only the bits indicated here are supported by the software.

See also the functional description: "S-0-0013, Class 3 diagnostics."

S-0-0013 Attributes

ID number:	S-0-0013	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0014, Interface status

Description:

This parameter indicates in bits 3-15 whether a communication error occurred.

Note that: All bits 3 . . 15 = 0 => no error

One bit in 3 . . 15 = 1 => error pending

If a communications error occurs, then bit 12 will be set in the Class 1 diagnostic parameter (**S-0-0011**). The drive will not reset the communication error to "0" until no interface error remains and command **S-0-0099, Reset class 1 diagnostic** has been received via the service channel.

The current communications phase can be examined through the first three bits (0, 1, 2).

Parameter structure:

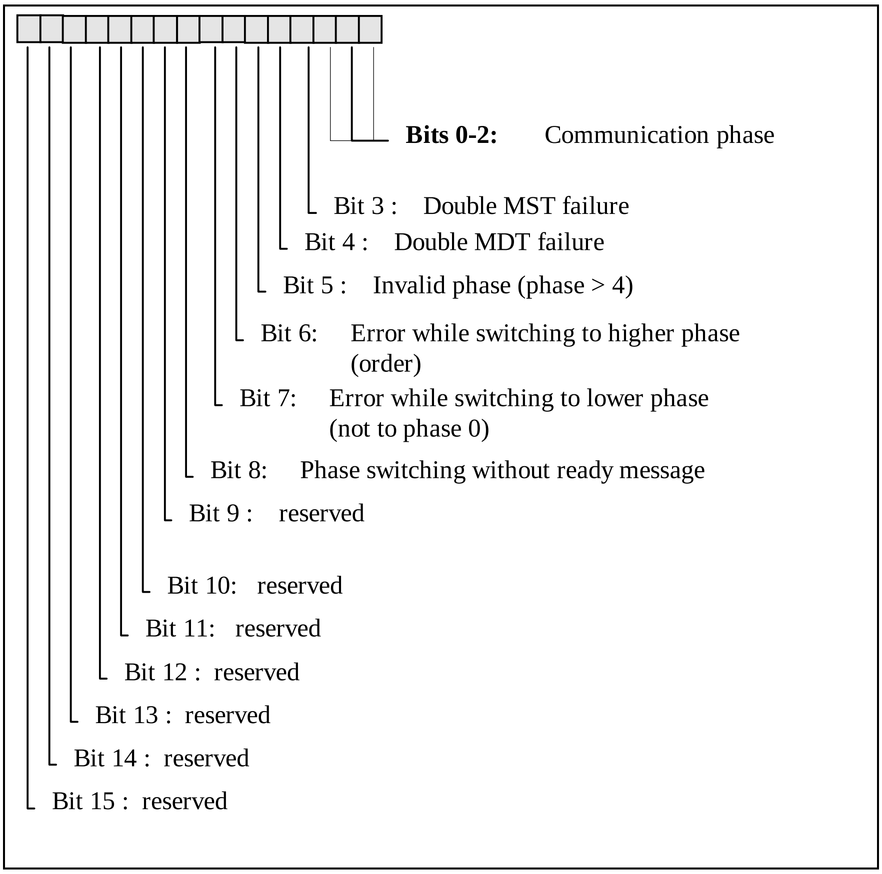

Fig. 2-4: S-0-0013, Interface status

See also the functional description: "Diagnostic message for the interface status."

S-0-0014 Attributes

ID number:	S-0-0014	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0015, Telegram Type Parameter

Description:

In this parameter, you can choose between a priority telegrams and configured telegrams.

The telegram type that is selected will be activated in the master and slave from communications phase 3 on.

Parameter structure:

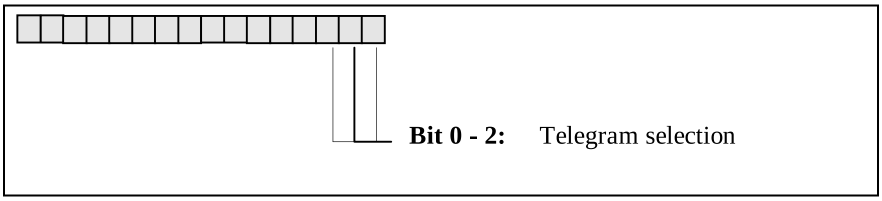

Fig. 2-5: S-0-0015, Telegram parameter

Note: Only the bits indicated here are supported by the software.

Telegrams:

Bit 0-2:		**MDT:**	**AT:**
0	PT 0	No cyclical data	No cyclical data
1	PT 1	**DF1**: S-0-0080 Torque command	No cyclical data
2	PT 2	**DF1**: S-0-0036, Velocity command value	**DF1**: S-0-0040 Velocity feedback value
3	PT 3	**DF1**: S-0-0036, Velocity command value	**DF1**: S-0-0051/S-0-0053 Position feedback value 1
4	PT 4	**DF1**: S-0-0047, Position command value	**DF1**: S-0-0051/S-0-0053 Position feedback value 1
5	PT 5	**DF1**: S-0-0047, Position command value **DF2**: S-0-0036, Velocity command value	**DF1**: S-0-0051/S-0-0053 Position feedback value 1 **DF2**: S-0-0040 Velocity feedback value
6	PT 6	**DF1**: S-0-0036, Velocity command value	No cyclical data
7	Configurable telegram		

Fig. 2-6: Supported bits

where PT : Priority telegram
DF1/2: Data field 1/2

See also the functional description: "Configuration of telegram contents."

S-0-0015 Attributes

ID number:	S-0-0015	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0016, Custom Amplifier Telegram Configuration List

Description:

If a configured telegram is set in **S-0-0015, Telegram type parameter**, then this list will be used for application-specific configuration of the data record in the AT.

The list can contain only operating data that are listed in parameter **S-0-0187 List of configurable data in the AT**.

See also the functional description: "Configuration of telegram contents."

S-0-0016 Attributes

ID number:	S-0-0016	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2-byte variable	**Validity check:**	Phase 2
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0017, IDN List of All Operation Data

Description:

The ID numbers for all operating data available in the drive are accessible in this IDN list.

See also the functional description: "Parameters."

S-0-0017 Attributes

ID number:	S-0-0017	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2-byte variable	**Validity check:**	no
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0021, IDN List of Invalid Op. Data for Comm. Ph. 2

Description:

The drive checks whether all communications parameters are complete and correct before executing a delayed phase switch from 2 to **S-0-0127, Communications phase 3** with the control system-driven transition check command.

If the drive identifies one or more IDNs as invalid, it will write the operating data that is still needed or is invalid to this ID No. list. This will be displayed to the drive by command error diagnostic message **C101, Communications parameter incomplete**.

See also the functional description: "S-0-0127, C1 communications phase 3 transition check."

S-0-0021 Attributes

ID number:	S-0-0021	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2-byte variable	**Validity check:**	no
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0022, IDN List of Invalid Op. Data for Comm. Ph. 3

Description:

Before the drive executes a delayed phase switch from 3 to **S-0-0128, Communications phase 4** with the control system-driven transition check command, the drive will check parameters for the following conditions:

- Validity of the parameter
- The parameter value is found within the valid input range.
- Compatibility with other parameters.

If the result of a parameter check is negative, this operating data will be entered in the ID No. (IDN) list.

The drive then responds to the transition command with the communications error diagnostic messages:

- **C201 Parameter record incomplete or**
- **C202 Parameter limit value error or**
- **C203 Parameter calculation error**

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

S-0-0022 Attributes

ID number:	S-0-0022	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2-byte variable	**Validity check:**	no
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0024, Configuration List of the Master Data Telegram

Description:

If the configured telegram is set in **S-0-0015, Telegram type parameter**, then the configurable data record in the MDT will be configured application-specifically using this list.

The list can contain only operating data that are listed in parameter **S-0-0188, List of configurable data in the MDT**.

See also the functional description: "Configuration of telegram contents."

S-0-0024 Attributes

ID number:	S-0-0024	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2-byte variable	**Validity check:**	Phase 2
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0028, MST Error Count

Description:

The "MST error count" counts all invalid MSTs in communications phases 3 and 4.

If two MSTs fail in direct succession, then error **F401, Shutdown for two MST failures** will be generated and the operation will return to phase 0.

The "MST error count" has a limit stop at (2^16) - 1. This means that during a highly distorted transfer the "MST Error count" will show the value 65535 after a long time.

See also the functional description: "Error count for telegram interrupts".

S-0-0028 Attributes

ID number:	S-0-0028	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0029, MDT Error Count

Description:

This parameter counts all invalid MDTs in communications phases 3 and 4.

If two MDTs fail in direct succession, then error **F401, Shutdown for two MDT failures** will be generated and the operation will return to phase 0.

The "MDT error counter" has a limit stop at (2^16) - 1. This means that during a highly distorted transfer the "MDT error count" will show a value of 65535 after a long time.

See also the functional description: "Error count for telegram interrupts".

S-0-0029 Attributes

ID number:	S-0-0029	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0030, Manufacturer Version

Description:

The version of the drive software can be read from this parameter.

Example:

DSM2.3-SSE-01V02

S-0-0030 Attributes

ID number:	S-0-0030	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	1-byte variable	**Validity check:**	no
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0032, Primary Mode of Operation

Description:

The mode of operation defined in this parameter will be activated in the drive if:

- The primary mode of operation is selected in the master control word (bits 8 and 9 = "00").
- The control and power sections are ready for operation.
- The controller enable RF is set.

The operating mode can be selected by entering a bit list. Specific positions are defined in the bit list.

In bit 3, you can choose between working with position control without following (lag) error or with following error.

The following applies:
Bit 3 = 0 position control with following error
Bit 3 = 1 position control without following error

Bit list:	Meaning:
0000,0000,0000,0001	Torque control
0000,0000,0000,0010	Velocity control
0000,0000,0000,x011	Position control with encoder 1
0000,0000,0000,x100	Position control with encoder 2
0000,0000,0001,x011	Drive-controlled interpolation, encoder 1
0000,0000,0001,x100	Drive-controlled interpolation, encoder 2

Fig. 2-7: Bit list S-0-0032

See also the functional description: "Setting operating parameters."

S-0-0032 Attributes

ID number:	S-0-0032	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0033, Secondary Operating Mode 1

Description:

The mode of operation defined in this parameter will be activated in the drive if:

- The primary mode of operation is selected in the master control word (bits 8 and 9 = "01")
- The control and power sections are ready for operation.
- The controller enable RF is set.

The operating mode can be selected by entering a bit list. Specific positions are defined in the bit list.

In bit 3, you can choose between working with position control without following (lag) error or with following error.

The following applies:

Bit 3 = 0 position control with following error
Bit 3 = 1 position control without following error

Bit list:	Meaning:
0000,0000,0000,0001	Torque control
0000,0000,0000,0010	Velocity control
0000,0000,0000,x011	Position control with encoder 1
0000,0000,0000,x100	Position control with encoder 2
0000,0000,0001,x011	Drive-controlled interpolation, encoder 1
0000,0000,0001,x100	Drive-controlled interpolation, encoder 2

Fig. 2-8: Bit list S-0-0033

See also the functional description: "Setting operating parameters."

S-0-0033 Attributes

ID number:	S-0-0033	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0034, Secondary Operation Mode 2

Description:

The mode of operation defined in this parameter will be activated in the drive if:

- The main operating mode is selected in the master control word (bits 8 and 9 = "10")
- The control and power sections are ready for operation.
- The controller enable RF is set.

The operating mode can be selected by entering a bit list. Specific positions are defined in the bit list.

In bit 3, you can choose between working with position control without following (lag) error or with following error.

The following applies:

Bit 3 = 0 position control with following error
Bit 3 = 1 position control without following error

Bit list:	Meaning:
0000,0000,0000,0001	Torque control
0000,0000,0000,0010	Velocity control
0000,0000,0000,x011	Position control with encoder 1
0000,0000,0000,x100	Position control with encoder 2
0000,0000,0001,x011	Drive-controlled interpolation, encoder 1
0000,0000,0001,x100	Drive-controlled interpolation, encoder 2

Fig. 2-9: Bit list S-0-0034

See also the functional description: "Setting operating parameters."

S-0-0034 Attributes

ID number:	S-0-0034	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0035, Secondary Operation Mode 3

Description:

The mode of operation defined in this parameter will be activated in the drive if:

- The primary mode of operation is selected in the master control word (bits 8 and 9 = "11")
- The control and power sections are ready for operation.
- The controller enable RF is set.

The operating mode can be selected by entering a bit list. Specific positions are defined in the bit list.

In bit 3, you can choose between working with position control without following (lag) error or with following error.

The following applies:

Bit 3 = 0	position control with following error
Bit 3 = 1	position control without following error

Bit list:	Meaning:
0000,0000,0000,0001	Torque control
0000,0000,0000,0010	Velocity control
0000,0000,0000,x011	Position control with encoder 1
0000,0000,0000,x100	Position control with encoder 2
0000,0000,0001,x011	Drive-controlled interpolation, encoder 1
0000,0000,0001,x100	Drive-controlled interpolation, encoder 2

Fig. 2-10: Bit list S-0-0035

See also the functional description: "Setting operating parameters."

S-0-0035 Attributes

ID number:	S-0-0035	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0036, Velocity Command Value

Description:

This parameter indicates the velocity command value. This is combined with **S-0037, Additive velocity command value**, to produce the effective velocity command value for the drive.

In the position control operating modes, this parameter displays the output error signal of the position controller.

See also the functional description: "Velocity control."

S-0-0036 Attributes

ID number:	S-0-0036	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	MDT
Input min/max:	S-0-0044		

S-0-0037, Additive Velocity Command Value

Description:

The additional velocity command value is added to **S-0-0036, Velocity command value** in the drive.

See also the functional description: "Velocity control."

S-0-0037 Attributes

ID number:	S-0-0037	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	MDT
Input min/max:	S-0-0044		

S-0-0040, Velocity Feedback Value

Description:

The velocity feedback value can be transferred from the drive control device to the control system either cyclically or via the service channel.

See also the functional description: "Preparation for setting the velocity controller."

S-0-0040 Attributes

ID number:	S-0-0040	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	AT
Input min/max:	S-0-0044		

S-0-0041, Homing Velocity

Description:

The product of **S-0-0041, Homing velocity** and the **Feedrate override** forms the velocity at which the drive executes command **S-0-0148, Drive-controlled** homing procedure.

See also the functional description: "Drive-controlled homing."

S-0-4041 Attributes

ID number:	S-0-0041	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	S-0-0044		

S-0-0042, Homing Acceleration

Description:

This parameter indicates the acceleration value at which the drive executes command **S-0-0148, Drive-controlled homing procedure**.

See also the functional description: "Drive-controlled homing."

S-0-0042 Attributes

ID number:	S-0-0042	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0160	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	S-0-0160		

S-0-0043, Velocity Polarity Parameter

Description:

This parameter is used to switch the polarity of the velocity data in relation to the application.

Polarities are switched externally, at the input and output of a control system rather than inside the system.

The following applies to rotary motors:
Clockwise rotation when facing the motor shaft is the rule for a positive velocity command value and a positive polarity.

The following applies to linear motors:
If the primary section of the linear motor drives in the direction facing the connecting lines, then a positive direction will be used.

Parameter structure:

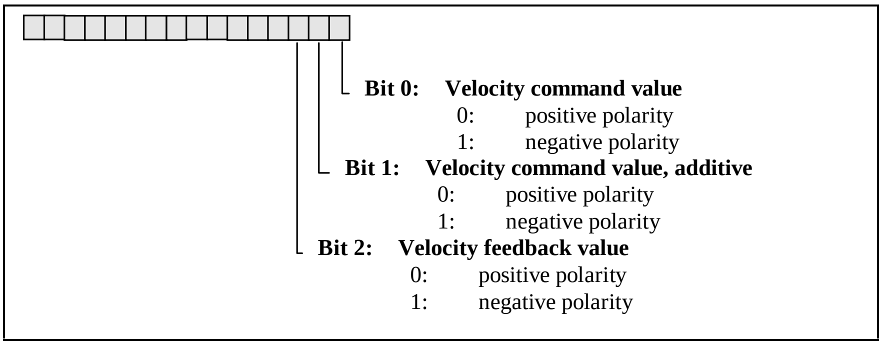

Fig. 2-11: S-0-0043, Velocity polarity parameter

See also the functional description: "Command polarities and actual value polarities."

S-0-0043 Attributes

ID number:	S-0-0043	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0044, Velocity Data Scaling Type

Description:

Various scaling types can be defined for the velocity data in the drive.

Parameter structure:

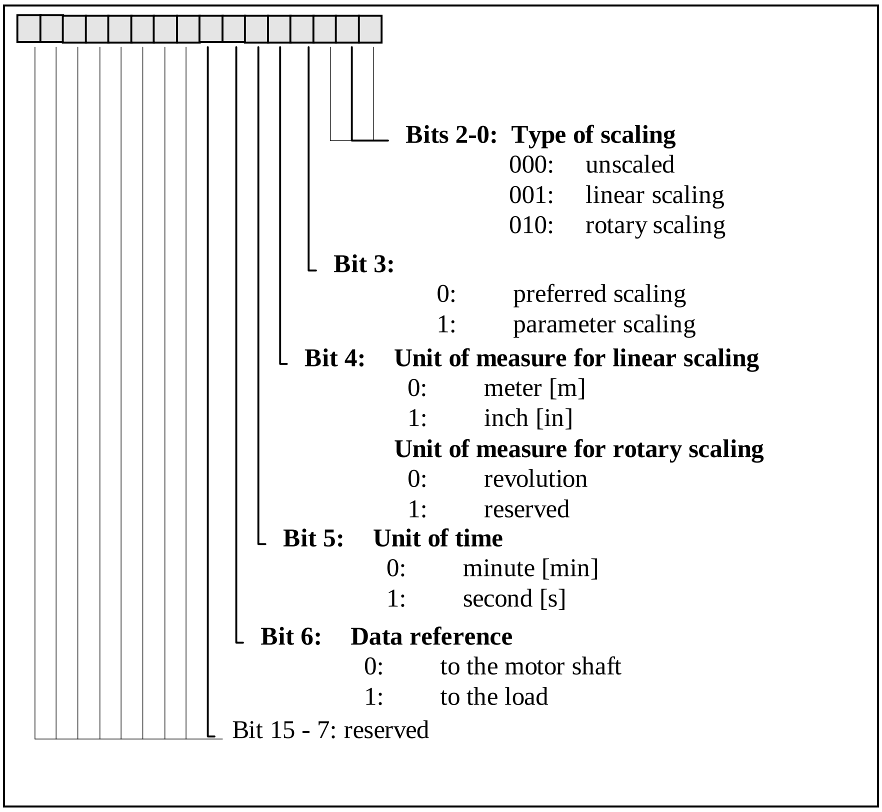

Fig. 2-12: S-0-0044, Velocity data scaling type

See also the functional description: "Velocity data display format."

S-0-0044 Attributes

ID number:	S-0-0044	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Check_P3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0045, Velocity Data Scaling Factor

Description:

This parameter defines the scaling factor for all velocity data in the drive.

If preferred scaling is set with **S-0-0044, Velocity data scaling type**, this parameter will be set to 1.

See also the functional description: "Velocity data display format."

S-0-0045 Attributes

ID number:	S-0-0045	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1 / 65535		

S-0-0046, Velocity Data Scaling Exponent

Description:

This parameter defines the scaling exponent for all velocity data in the drive.

See also the functional description: "Velocity data display format."

S-0-0046 Attributes

ID number:	S-0-0046	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0047, Position Command Value

Description:

In position control operating mode, this parameter is transferred from the control system to the drive on a time grid of the NC cycle time.

See also the functional description: "Position control."

S-0-0047 Attributes

ID number:	S-0-0047	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	MDT
Input min/max:	S-0-0076		

S-0-0049, Positive Position Limit Value

Description:

The "positive position limit value" describes the maximum extent of travel in the positive direction.

The position limit value is active only when all position data refers to the homing point (bit 0 is set to 1 in parameter **S-0-0403, Position feedback value status**). The position limit values can be switched off using bit 4 in **S-0-0055, Position polarity parameter**.

If a **Target position, S-0-0258** beyond the positive position limit value is set for the drive, then the drive sets warning bit 13 in **S-0-0012, Class 2 diagnostic** and also generates warning **E253, Target position outside the travel range**.

If the positive position limit value is exceeded, the drive sets error bit 13 in **S-0-0011, Class 1 diagnostic**.

See also the functional description: "Axis limit values ."

S-0-0049 Attributes

ID number:	S-0-0049	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076		

S-0-0050, Negative Position Limit Value

Description:

The "negative position limit value" describes the maximum extent of travel in the negative direction.

The position limit value is active only when all position data refer to the homing point (bit 0 is set to 1 in parameter **S-0-0403, Position feedback value status**). The position limit values can be switched off using bit 5 in **S-0-0055, Position polarity parameter**.

If a target position beyond the negative position limit value is set for the drive, then the drive sets warning bit 13 in **S-0-0012, Class 2 diagnostic** and also generates warning **E253, Target position outside the travel range**.

If the negative position limit value is exceeded, the drive will set error bit 13 in **S-0-0011, Class 1 diagnostic**.

See also the functional description: "Axis limit values ."

S-0-0050 Attributes

ID number:	S-0-0050	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076		

S-0-0051, Position Feedback Value 1 (Motor Feedback)

Description:

"Position feedback value 1" represents the current position of the motor encoder.

It can be transferred from the drive to the control system.

See also the functional description: "Setting the measurement systems"

S-0-0051 Attributes

ID number:	S-0-0051	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	-- / --		

S-0-0052, Reference Distance 1

Description:

This parameter displays the distance between the machine zero-point and the homing point for the motor measurement system (Position feedback value 1).

After executing command **S-0-0148, C6 Drive-controlled homing procedure**, the drive sets **S-0-0047, Position command value** to this value if the motor encoder has been homed.

See also the functional description: "Drive-controlled homing"

S-0-0052 Attributes

ID number:	S-0-0052	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076		

S-0-0053, Position Feedback Value 2 (ext. feedback)

Description:

The position feedback value 2 is always related to an external encoder.

See also the functional description: "Setting the measurement systems"

S-0-0053 Attributes

ID number:	S-0-0053	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	-- / --		

S-0-0054, Reference Distance 2

Description:

This parameter represents the distance between the machine zero-point and the homing point for the external measuring system (Position feedback value 2). After executing command **S-0-0148, C6 Drive-controlled homing command**, the drive sets the **Position command value,** S-0-0047, to this value if the motor encoder has been homed.

See also the functional description: "Drive-controlled homing"

S-0-0054 Attributes

ID number:	S-0-0054	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076		

S-0-0055, Position Polarity Parameter

Description:

This parameter can be used to invert the polarities of the given position data. These polarities are switched outside of the control system (i.e., at the input and output of the control system).

Note the following in reference to rotary motors:
"Motor-clockwise rotation" means the motor shaft turns in a clockwise direction (facing the motor shaft) if the position command value difference and the polarity are both positive.

The following applies to linear motors:
If the primary section of the linear motor drives in the direction facing the connecting lines, then a positive direction will be used.

Bit 4 is used to activate or deactivate software position limits.

Parameter structure:

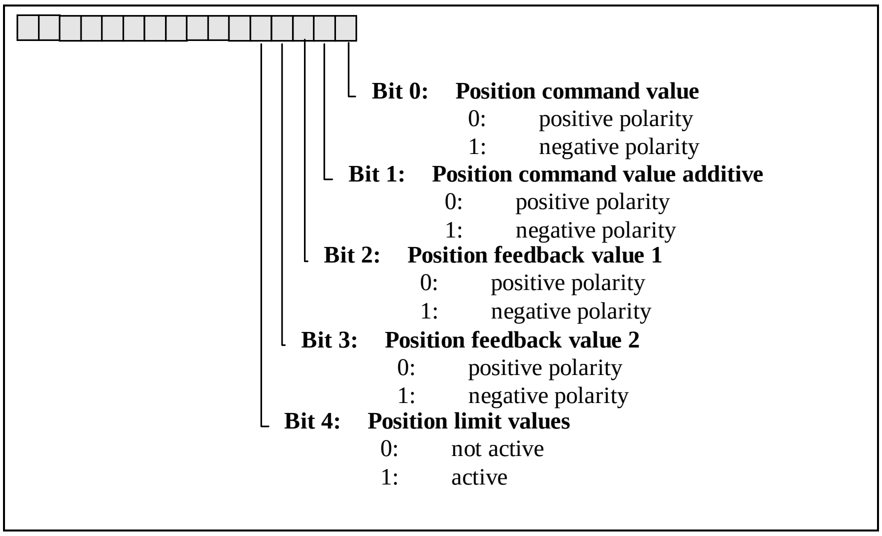

Fig. 2-13: S-0-0055, Position polarity parameter

Note: - Only the bits indicated here are supported by the software.
- If bit 0 is changed by the control system, bits 1 - 3 will also be set to the value of bit 0 by the drive.

See also the functional description: "Command polarities and actual value polarities."

S-0-0055 Attributes

ID number:	S-0-0055	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0 / 31		

S-0-0057, Position Window

Description:

The drive will set the bit "in position" in **S-0-0013, Class 3 diagnostic** when the difference between the position feedback value and the position end value is less than the value in the position window.

During command **S-0-0148, C6 Drive-controlled homing procedure**, this parameter reports the end of the command if the position feedback value enters into the homing point range ± **S-0-0057 Position window**).

See also the functional description: "S-0-0182, Manufacturer class 3 diagnostic."

S-0-0057 Attributes

ID number:	S-0-0057	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	0 / S-0-0076		

S-0-0058, Reversal Clearance

Description:

Reversal clearance describes the amount of slack between the drive and the load when direction is changed, in respect to the position data. In general, with a negative command velocity, the slack set by parameter is subtracted from the current actual feedback value 1.

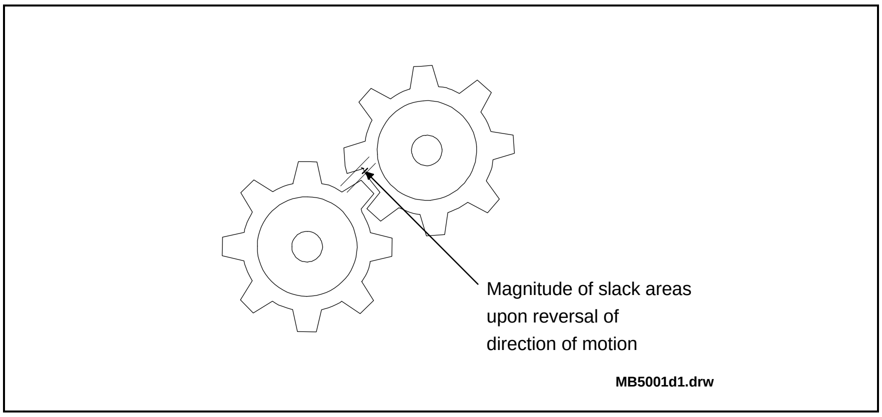

Fig. 2-14: Graphic representation of the motion play, or slack when direction is changed

See also the functional description: "Axis error correction."

S-0-0058 Attributes

ID number:	S-0-0058	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:		**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	S-0-0076		

S-0-0076, Position Data Scaling Type

Description:

Various scaling types for the position data in the drive can be set as described below.

Parameter structure:

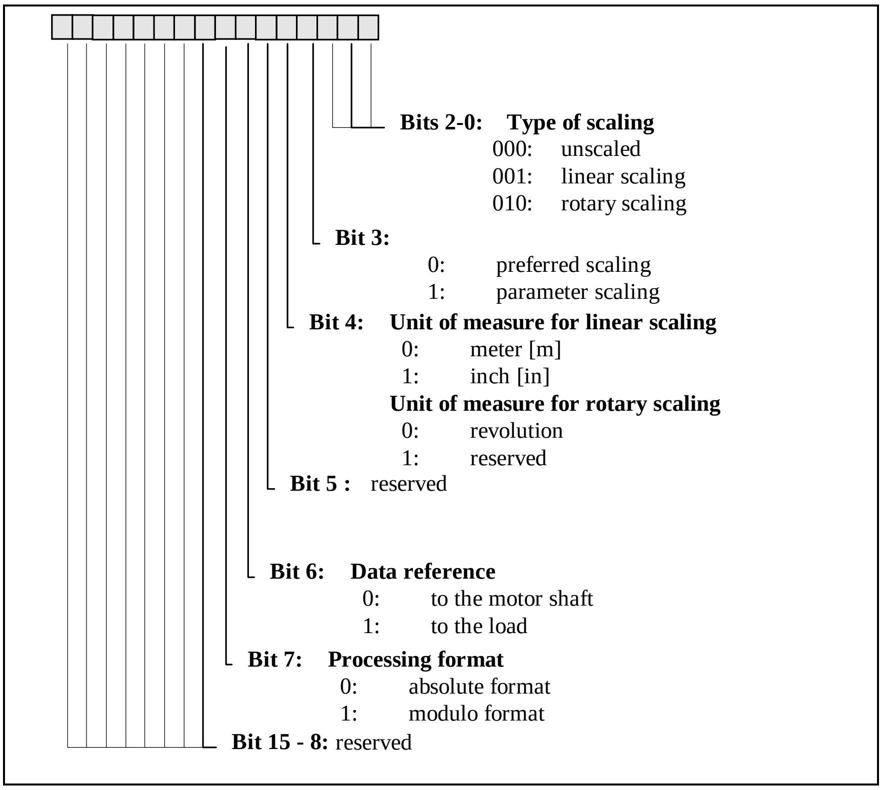

Fig. 2-15: S-0-0076, Position data scaling type

Note: Only the bits indicated here are supported by the software.

See also the functional description: "Display format for position data."

S-0-0076 Attributes

ID number:	S-0-0076	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0077, Linear Position Data Scaling Factor

Description:

This ID number contains the scaling factor to be used to scale all position data in the drive.

The parameter is set to 1 if linear preferred scaling has been set in **S-0-0076, Position data scaling type**.

See also the functional description: "Display format for position data."

S-0-0077 Attributes

ID number:	S-0-0077	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0078, Linear Position Data Scaling Exponent

Description:

This ID number contains the scaling exponent to be used to scale all position data in the drive if linear scaling has been selected.

If linear preferred scaling is selected, this parameter will be set by the drive.

See also the functional description: "Display format for position data."

S-0-0078 Attributes

ID number:	S-0-0078	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0079, Rotational Position Resolution

Description:

If rotary position scaling is selected, the LSB valence for all position data will be set in this parameter.

The LSB bit can be specified in the following manner:

Example:

If you would like a resolution of 0.01 degrees for the LSB, set the parameter to a value of 36000. The input value will then be 8CA0H.

If preferred scaling was set in parameter **S-0-0076, Position data scaling type**, the rotational position resolution will be set at 3,600,000. That means that the resolution for the LSB will be 0.0001 degrees.

See also the functional description: "Display format for position data."

S-0-0079 Attributes

ID number:	S-0-0079	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1 / 0xFFFFFFFF		

S-0-0080, Torque/Force Command

Description:

In the torque control operating mode, the torque command values are transferred by the control system to the drive.

If the velocity controller is active, the torque required for the corresponding velocity can be derived from this parameter.

At present, only percentage-based scaling is supported.

The date value corresponds to the current command value in respect to the motor current at standstill (S-0-0111).

The value can be converted to a torque or force value by multiplying the command current by the torque/force constant (P-0-0051).

See also the functional description: "Torque/force controller."

S-0-0080 Attributes

ID number:	S-0-0080	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0086	**Combination check:**	no
Decimal places:	S-0-0086	**Cyc. transmittable:**	MDT
Input min/max:	P-0-4046		

S-0-0084, Torque/Force Feedback Value

Description:

The current torque/force feedback value can be derived from this parameter.

At present, only percentage-based scaling is supported.

The data value corresponds to the measured feedback current to the motor current at standstill (S-0-0111).

The value can be converted to a torque or force value by multiplying the command current by the torque/force constant (P-0-0051).

S-0-0084 Attributes

ID number:	S-0-0084	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0086	**Combination check:**	no
Decimal places:	S-0-0086	**Cyc. transmittable:**	AT
Input min/max:	S-0-0086		

S-0-0085, Torque/Force Polarity Parameter

Description:

The polarities for the given torque data as related to the application can be switched in this parameter.

Polarities are switched externally, at the input and output of a control system rather than inside the system.

Note the following in reference to rotary motors:
The motor will turn in a clockwise direction (facing the motor shaft) with a positive torque command value and positive polarity.

The following applies to linear motors:
If the primary section of the linear motor drives in the direction facing the connecting lines, then a positive direction will be used.

Structure of the parameter:

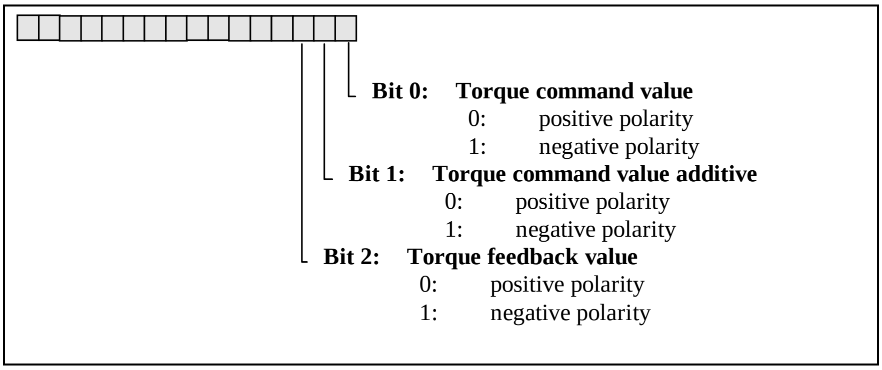

Fig. 2-16: S-0-0085, Torque/force polarity parameter

Note: If bit 0 of the control system is changed, then bits 1 - 2 of the drive will also be set to the value in bit 0.

See also the functional description: "Command polarities and actual value polarities."

S-0-0085 Attributes

ID number:	S-0-0085	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	--	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0086, Torque/Force Data Scaling Type

Description:

Currently, only percentage scaling for torque force data is supported.

The following applies:

100 % = S-0-0111, Motor current at standstill

See also the functional description: "Adjustable scaling for position, velocity, and acceleration data."

S-0-0086 Attributes

ID number:	S-0-0086	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0088, Receive to Receive Recovery Time (TMTSG)

Description:

This parameter defines the time needed for the slave to switch to readiness for the next master synchronization telegram after receiving a master data telegram.

This parameter is read by the control system in phase 2 to calculate the time slot parameter.

See also the functional description: "Configuration of telegram sending and receiving times."

S-0-0088 Attributes

ID number:	S-0-0088	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0089, MDT Transmit Starting Time (T2)

Description:

This is the transmit starting time for the master data telegram after the end of a master synchronization telegram. The value is transferred from the master to the slave in communications phase 2 and is activated in phase 3.

See also the functional description: "Configuration of telegram sending and receiving times."

S-0-0089 Attributes

ID number:	S-0-0089	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 2
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0 / 65535		

S-0-0090, Command Value Transmit Time (TMTSG)

Description:

This is the time required by the slave to prepare the command values for the drive after reception of the master data telegram.

See also the functional description: "Configuration of telegram sending and receiving times."

S-0-0090 Attributes

ID number:	S-0-0090	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0091, Bipolar Velocity Limit Value

Description:

The "bipolar velocity limit value" describes the maximum permissible velocity that is symmetrical in both directions. The maximum input value is determined by the **Maximum velocity, S-0-0113 of the motor**.

See also the functional description: "Limiting the velocity."

S-0-0091 Attributes

ID number:	S-0-0091	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	MDT
Input min/max:	0 / S-0-0113		

S-0-0092, Bipolar Torque/Force Limit Value

Description:

This parameter describes the maximum allowable torque that is symmetrical in both directions (acceleration, deceleration).

See also the functional description: "Torque/force limitation."

S-0-0092 Attributes

ID number:	S-0-0092	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0086	**Combination check:**	no
Decimal places:	S-0-0086	**Cyc. transmittable:**	MDT
Input min/max:	0 / P-0-4046		

S-0-0093, Torque/Force Data Scaling Factor

Description:

The scaling factor for all torque/force data in the drive is set in this parameter.

See also the functional description: "Adjustable scaling for position, velocity, and acceleration data."

S-0-0093 Attributes

ID number:	S-0-0093	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0094, Torque/Force Data Scaling Exponent

Description:

This parameter determines the scaling exponent for all torque/force data in the drive.

See also the functional description: "Adjustable scaling for position, velocity, and acceleration data."

S-0-0094 Attributes

ID number:	S-0-0094	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0095, Diagnostic Message

Description:

This parameter contains the currently relevant operating status of the drive.

The respective diagnostic message number from **S-0-0390, Diagnostic message number** will appear in front of the operating status.

Example:

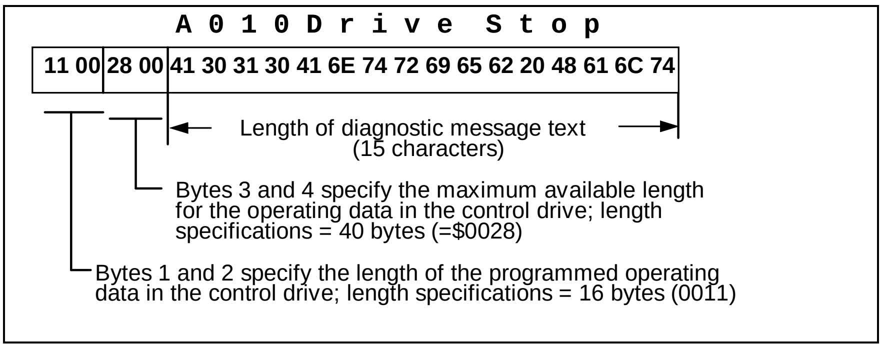

Fig. 2-17: S-0-0095, Diagnostic message

See also the functional description: "Plaintext diagnostic message."

S-0-0095 Attributes

ID number:	S-0-0095	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	1-byte variable	**Validity check:**	no
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0096, Slave Arrangement (SLKN)

Description:

During initialization, the master must know which drives are available under which slave numbers in order to execute an optimal, automatic time slot calculation.

The master receives this information from the drives in communications phase 2.

Valid address range: 01 .. 99

Example:

03	**03**

See also the functional description: "Setting the drive address of the SERCOS interface."

S-0-0096 Attributes

ID number:	S-0-0096	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0097, Mask Class 2 Diagnostic

Description:

This parameter can be used to mask pre-warnings in **S-0-0012, Class 2 diagnostic** in the drive status according to their effect on the change bit. When changes are made to the masked early warnings, the Class 2 diagnostic change bit will be set in the drive status.

The mask has no effect on the operating data of the Class 2 diagnostic.

See also the functional description: "Change bits in class 2 and class 3 diagnostics in the drive status word."

S-0-0097 Attributes

ID number:	S-0-0097	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0098, Mask Class 3 Diagnostic

Description:

This parameter can be used to mask pre-warnings in **S-0-0013, Class 3 diagnostic** in the drive status according to their effect on the change bit. When changes are made to the masked early warnings, the Class 3 diagnostic change bit will be set in the drive status.

The mask has no effect on the operating data of the Class 3 diagnostic.

See also the functional description: "Change bits in class 2 and class 3 diagnostics in the drive status word."

S-0-0098 Attributes

ID number:	S-0-0098	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	-- / --		

S-0-0099, Reset Class 1 Diagnostic

Description:

If the drive receives this command via the service channel, then the Class 1 diagnostic, the interface status, and the drive lock will be deleted in the drive status if no more errors are pending.

See also the functional description: "Clearing errors."

S-0-0099 Attributes

ID number:	S-0-0099	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0 / 3		

S-0-0100, Velocity Loop Proportional Gain

Description:

This parameter contains the value for the velocity loop proportional gain.

The proportional gain unit depends on the contacted motor type.

Motor type:	**Unit:**
Rotary motor:	A*sec/rad
Linear motor:	A*min/m

Fig. 2-18: Units for motor types

As the drive is being started, it is possible to load a default value for the parameter using the command "Basic load", as long as a motor is available with feedback memory (**P-0-4014, Motor type:** 1 or 5).

See also the functional description: "Setting the velocity controller."

S-0-0100 Attributes

ID number:	S-0-0100	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	As/rad	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	0 / 65535		

S-0-0101, Velocity Loop Integral Action Time

Description:

The velocity controller forms a current command value derived from the difference between the velocity command value and the velocity feedback value (= velocity control deviation).

This current command value consists of a proportional component and an integral component. The velocity loop integral action time is the time constant with which the integral component of the current command value increases by a constant speed control deviation.

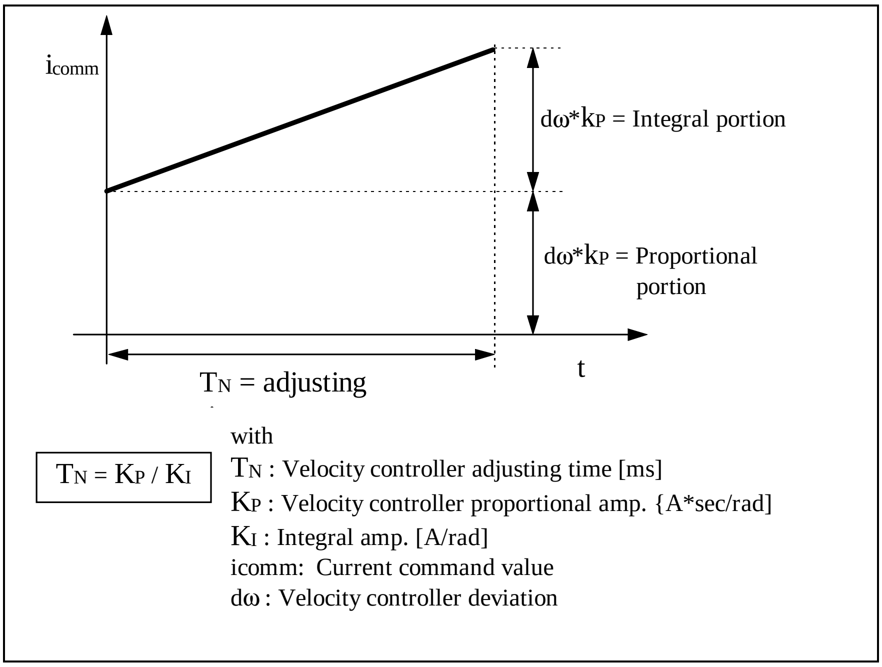

Fig. 2-19: Definition of the integral action time

The value of the time axis for which the integral component is equal to the proportional component is described as integral action time.

Entering an input value of 0 msec will turn off the integral component.

See also the functional description: "Setting the velocity controller."

S-0-0101 Attributes

ID number:	S-0-0101	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	ms	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	0 / 65535		

S-0-0103, Modulo Value

Description:

When a modulo format is set (parameter **S-0-0076, Position data scaling type**), the modulo value determines with which numeric value the modulo calculation should be executed in the drive and in the control system.

See also parameter **S-0-0393, Command value mode for modulo format**.

See also the functional description: "Modulo feature."

S-0-0103 Attributes

ID number:	S-0-0103	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	0 / S-0-0076		

S-0-0104, Position Loop KV Factor (Closed-Loop Control)

Description:

This parameter contains the value for the proportional gain of the position controller.

When the drive is being started, it is possible to load a default value for the parameter using the command "Basic load", as long as a motor is available with feedback memory(**P-0-4014, Motor type**: 1 or 5).

See also the functional description: "Setting the position loop."

S-0-0104 Attributes

ID number:	S-0-0104	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	1000/min	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	0/65535		

S-0-0106, Proportional Gain 1 Current Regulator

Description:

This parameter represents the proportional gain of the current controller.

The current controller proportional gain is fixed for each of the motor-drive combinations. It is dependent on the type of the motor and should not be changed. It can be determined using the "Basic load" command or from the motor data sheets.

See also the functional description: "Setting the current controller."

S-0-0106 Attributes

ID number:	S-0-0106	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	V/A	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	0/65535		

S-0-0107, Current Controller 1 Integral Action Time

Description:

The value of this parameter depends on the motor and can be found on the motor data sheet.

See also the functional description: "Setting the current controller."

S-0-0107 Attributes

ID number:	S-0-0107	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	ms	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	0/65535		

S-0-0108, Feedrate Override

Description:

The feedrate override is only available when "drive-controlled travel commands" such as:

- "Drive-controlled homing procedure" command
- "Drive-controlled interpolation" operating mode

are functioning. In such instances, the drive calculates the velocity command value itself.

The feedrate override has a multiplicative effect on these velocity command values.

S-0-0108 Attributes

ID number:	S-0-0108	**Editability:**	P4
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	%	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	0/65535		

S-0-0109, Motor Peak Current

Description:

If the peak current of the motor is less than the peak current of the amplifier, then the value will be automatically limited to the peak current of the motor.

For MDD and MKD motors, this value is stored in the motor feedback and is loaded from there into the controller RAM when the drive is started for the first time. This value must be taken from the data sheet with other types of motors.

See also the functional description: "Setting the active peak current."

S-0-0109 Attributes

ID number:	S-0-0109	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	1/500000		

S-0-0110, Amplifier Peak Current

Description:

The peak current available from the drive controller. The value is set by the drive itself.

See also the functional description: "Current limitation."

S-0-0110 Attributes

ID number:	S-0-0110	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	1/500000		

S-0-0111, Motor Current at Standstill

Description:

The "motor current at standstill" is the current from which the motor continuously generates the standstill torque according to the motor data sheet.

For MDD and MKD motors, this value is stored in the motor feedback and is loaded from there into the controller RAM when the drive is started for the first time. This value must be taken from the data sheet with other types of motors.

S-0-0111 Attributes

ID number:	S-0-0111	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E^{2}prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	1/500000		

S-0-0112, Amplifier Nominal Current

Description:

The permissible continuous current for the drive control device. The value is set by the drive itself.

S-0-0112 Attributes

ID number:	S-0-0112	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	1/500000		

S-0-0113, Maximum Motor Speed (nmax)

Description:

The maximum velocity of the motor cannot be exceeded.
It is also limited by parameter **S-0-0091, "Bipolar velocity limit value."**

For MDD and MKD motors, this value is stored in the motor feedback and is loaded from there into the controller RAM when the drive is started for the first time. This value must be taken from the data sheet for other types of motors.

See also the functional description: "Limiting the velocity."

S-0-0113 Attributes

ID number:	S-0-0113	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	no
Input min/max:	0/S-0-0044		

S-0-0115, Position Feedback 2 Type Parameter

Description:

Essential characteristics of the external encoder (position encoder 2) are established is this parameter.

Parameter structure:

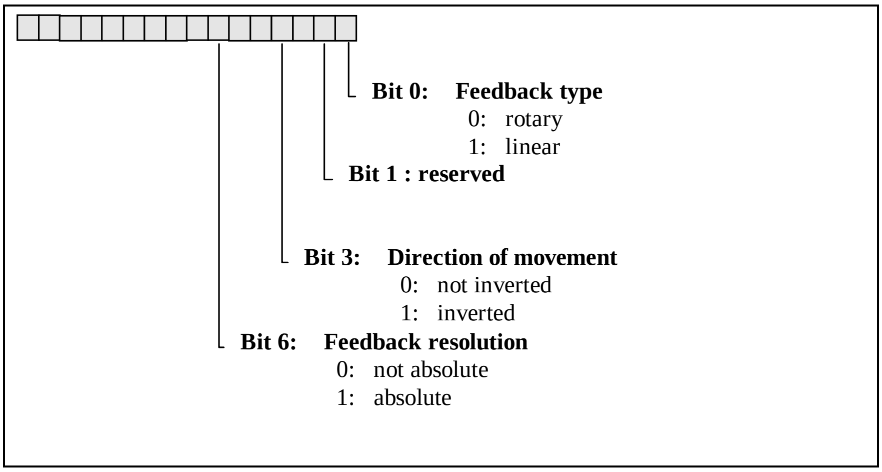

Fig. 2-20: S-0-0115, Position feedback 2 type parameter

Remark:

For absolute measurement systems with data memory, bit 6 is set automatically.

When MDD and MKD motors are used, bits 0, 1, and 3 are set and write-protected by the drive.

Note: Only the bits indicated here are supported by the software.

See also the functional description: "Other external feedback characteristics."

S-0-0115 Attributes

ID number:	S-0-0115	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0116, Resolution of Rotational Feedback 1

Description:

Depending on parameter **P-0-4014, Motor type** (rotary or linear motors), the resolution of the motor encoder is indicated by **S-0-0116, Resolution of Rotational Feedback 1**.

This value contains the number of cycles per motor revolution for rotational motors, or the segment spacing per mm for linear motors.

See also the functional description: "Motor encoder resolution."

S-0-0116 Attributes

ID number:	S-0-0116	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	Cycl/Rev or inch (depends on P-0-4014)		
Combination check:	no	**Decimal places:**	--
Cyc. transmittable:	no	**Input min/max:**	--/--

S-0-0117, Resolution of Rotational Feedback 2

Description:

The resolution of the external encoder contains the cycles per external encoder revolution for rotational encoders. The segment spacing is given in mm for linear external encoders.

See also the functional description: "Resolution of the external encoder."

S-0-0117 Attributes

ID number:	S-0-0117	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	Cycl/Rev or inch (depends on S-0-0115, bit 5)		
Combination check:	no	**Decimal places:**	--
Cyc. transmittable:	no	**Input min/max:**	--/--

S-0-0121, Input Revolutions of Load Gear

Description:

A mechanical gear is often used between the motor and the load.

The gear ratio is defined by:

$$\frac{\textbf{Transmission input (S-0-0121)}}{\textbf{Transmission output (S-0-0122)}}$$

Fig. 2-21: Gear ratio

Example:

5 motor revolutions result in 2 gear output revolutions.

=> S-0-0121: 5
S-0-0122: 2

See also the functional description: "Transmission ratio."

S-0-0121 Attributes

ID number:	S-0-0121	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/0xFFFFFFFF		

S-0-0122, Output Revolutions of Load Gear

Description:

A mechanical gear is often used between the motor and the load.

The gear ratio is defined by:

$$\frac{\textbf{Transmission input (S-0-0121)}}{\textbf{Transmission output (S-0-0122)}}$$

Fig. 2-22: Gear ratio

Example:

5 motor revolutions result in 2 gear output revolutions.

=> S-0-0121: 5
S-0-0122: 2

See also the functional description: "Transmission ratio."

S-0-0122 Attributes

ID number:	S-0-0122	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/0xFFFFFFFF		

S-0-0123, Feed Constant

Description:

This parameter describes the conversion from rotary to linear motion. It is defined as the linear displacement of the load measured during one revolution of the gear drive shaft.

Characteristic value:

Ball screw spindle:	Rack and pinion:
Feed constant=pitch of screw (typical value 10.00 mm)	Feed constant= effective pitch diameter of the pinion * pi

Fig. 2-23: Characteristic value for the feed constant

Note: The unit is dependent on bit 4 in **S-0-0076, Position data scaling type**.

Note that: Bit 4, S-0-0076 = 0 -> mm/rev
Bit 4, S-0-0076 = 1 -> inch/rev

See also the functional description: "Feed constant."

S-0-0123 Attributes

ID number:	S-0-0123	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	5	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0124, Standstill Window

Description:

The motor's standstill is defined in such a manner that the **Velocity feedback value, S-0-0040** falls below a threshold set by parameter ("standstill window").

Bit 1 of the **S-0-0013, Class 3 diagnostic** is set in the standstill.

See also the functional description: "S-0-0182, Manufacturer class 3 diagnostic."

S-0-0124 Attributes

ID number:	S-0-0124	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	no
Input min/max:	0/S-0-0044		

S-0-0127, C1 Communications Phase 3 Transition Check

Description:

The master (control system) uses this command to tell the slave (drive) that it has transmitted all of the necessary communications parameters for communications phase 3. After receiving this command, the slave checks to see whether error-free operation is possible in communication phase 3 from the slave's point of view.

The command is completed error-free if the slave is ready to follow the prompt in communication phase 3 MST and to maintain the structure of the telegram. If this is not the case, then the command ends with an error.

The control system erases the command after acknowledgement of a positive command. Not until then does the control system move into communications phase 3 in the MST.

See also the functional description: "S-0-0127, C1 communications phase 3 transition check."

S-0-0127 Attributes

ID number:	S-0-0127	**Editability:**	P2
Function:	Command	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/3		

S-0-0128, C2 Communications Phase 4 Transition Check

Description:

The master (control system) uses this command to tell the slave (drive) that it has transmitted all of the necessary communications parameters for communications phase 4. After receiving this command, the slave checks to see whether error-free operation is possible in communication phase 4 from the slave's point of view.

The command will be completed error-free if the slave is ready for the cyclical operation in communications phase 4.

The control system erases the command after acknowledgement of a positive command. Afterwards the control system moves into communications phase 4 in the MST.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

S-0-0128 Attributes

ID number:	S-0-0128	**Editability:**	P3
Function:	Command	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/3		

S-0-0130, Probe Value 1 Positive Edge

Description:

The drive uses the positive edge of the input signal from **S-0-0013, Probe 1**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-200, Signal select probe 1** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe feature".

S-0-0130 Attributes

ID number:	S-0-0130	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	--/--		

S-0-0131, Probe Value 1 Negative Edge

Description:

The drive uses the negative edge of the input signal from **S-0-0401, Probe 1**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-200, Signal select probe 1** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe feature".

S-0-0131 Attributes

ID number:	S-0-0131	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	--/--		

S-0-0132, Probe Value 2 Positive Edge

Description:

The drive uses the positive edge of the input signal from **S-0-0402, Probe 2**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-201, Signal select probe 2** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe feature".

S-0-0132 Attributes

ID number:	S-0-0132	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0133, Probe Value 2 Negative Edge

Description:

The drive uses the negative edge of the input signal from **S-0-0402, Probe 2**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-201, Signal select probe 2** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe feature".

S-0-0133 Attributes

ID number:	S-0-0133	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	--/--		

S-0-0134, Master Control Word

Description:

This makes it possible to display the master control word using the service channel on the display screen of the NC.

In addition, the master control word offers a help setting with the startup procedure and error search.

See also the functional description: "Master control word."

S-0-0134 Attributes

ID number:	S-0-0134	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0135, Drive Status Word

Description:

This makes it possible to display the drive status word using the service channel on the display screen of the NC. A help setting is available during the startup procedure and error search.

See also the functional description: "Drive status word."

S-0-0135 Attributes

ID number:	S-0-0135	**Editability:**	no
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0138, Bipolar Acceleration Limit Value

Description:

"Bipolar acceleration limit value" describes the maximum permissible acceleration that is symmetrical in both directions (acceleration and deceleration).

The drive brakes at this deceleration on velocity v = 0 when the function "Drive stop" is executed.

S-0-0138 Attributes

ID number:	S-0-0138	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0160	**Combination check:**	no
Decimal places:	S-0-0160	**Cyc. transmittable:**	MDT
Input min/max:	0/S-0-0160		

S-0-0140, Controller Type

Description:

The manufacturer's controller type can be found in the operating data of the controller type.

Example:

DDS2.2-W015-B

S-0-0140 Attributes

ID number:	S-0-0140	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	1-byte variable	**Validity check:**	Phase 3
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0141, Motor Type

Description:

The name and the motor type of the manufacturer are found in the operating data of the motor type.

For MDD and MKD motors, this value is stored in the motor feedback and is loaded from there into the controller RAM when the drive is started for the first time.

Example:

MDD 065A-N040-N2L-095GB0

S-0-0141 Attributes

ID number:	S-0-0141	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	1-byte variable	**Validity check:**	Phase 3
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0142, Application Type

Description:

A descriptive name for the drive can be stored in this parameter (for example: main spindle, swivel axle, etc.). It has no functional significance.

S-0-0142 Attributes

ID number:	S-0-0142	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	1-byte variable	**Validity check:**	Phase 3
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0143, SERCOS Interface Version

Description:

The version of the SERCOS interface specifications are found in the operating data.

Current valid settings:

V	V 01.01:	V 01.02:
SERCOS specification German 01.00:	SERCOS-English specification	SERCOS update German/English
Version 5/90	Version 4/91	Version 9/91

Fig. 2-24: S-0-0143, Version of the SERCOS interface specification

See also the functional description: "Overview of SERCOS communication."

S-0-0143 Attributes

ID number:	S-0-0143	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	1-byte variable	**Validity check:**	no
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0147, Homing Parameter

Description:

This parameter contains operating sequences for **S-0-0148, C6 Drive-controlled homing procedure command** in reference to the equipment, NC and drive installation.

Parameter structure:

Bit 0: Start direction
0: positive: clockwise with view towards motor shaft
1: negative: counter-clockwise with view towards motor shaft

Bit 3: Feedback selection
0: Homing with motor feedback
1: Homing with external feedback

Bit 5: Home switch analysis
0: home switch is analyzed
1: home switch is not analyzed

Bit 6: Reference mark analysis
0: reference mark is analyzed
1: reference mark is not analyzed

Fig. 2-25: S-0-0147, Homing parameter

Note: - Only the bits indicated here are supported by the software.
- In addition, bit 5 activates the monitoring of the external 24V current.

See also the functional description: "Drive-controlled homing."

S-0-0147 Attributes

ID number:	S-0-0147	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0148, C6 Drive-Controlled Homing Procedure Command

Description:

When this command is set and enabled, the drive switches automatically into internal position control and accelerates using the **S-0-0042, Homing acceleration** to the **Homing velocity, S-0-0042** as long as it is in operating status "AF". Bit 0 in **S-0-0403, Position feedback value status** will be deleted. As long as the command is inactive, changes in the cyclic position command values will be ignored.

The process for the homing procedure can be specified with **S-0-0147, Homing parameter**. After the command has been properly executed (drive is at standstill and position feedback value is related to the homing position), the drive sets bit 0=1 in parameter **S-0-0403, Position feedback value status**.

End command: The control system reads **S-0-0047, Position command value** via the service channel and sets its position command to this value. The control system finally erases the command and the drive follows the cyclical position command value again.

See also the functional description: "Drive-controlled homing."

S-0-0148 Attributes

ID number:	S-0-0148	**Editability:**	P4
Function:	Command	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/3		

S-0-0149, d400 Positive Stop Drive Procedure Command

Description:

When this command is set and enabled, all controller monitoring which would otherwise result in an class 1 diagnostic error message when the drive is blocked by a positive stop will be turned off.

Parameter structure:

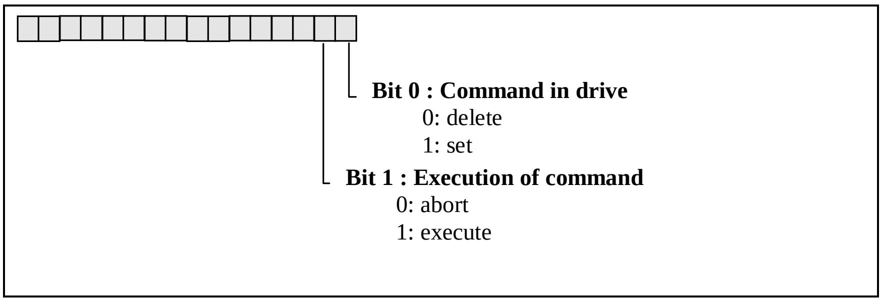

Fig. 2-26: S-00-0149, Positive stop drive procedure command

See also the functional description: "Positive stop drive procedure."

S-0-0149 Attributes

ID number:	S-0-0149	**Editability:**	P4
Function:	Command	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/3		

S-0-0150, Reference Offset 1

Description:

This parameter describes the distance between the position encoder home reference 1 and **S-0-0052, Reference distance 1**.

See also the functional description: "Drive-controlled homing."

S-0-0150 Attributes

ID number:	S-0-0150	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	/S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

S-0-0151, Reference Offset 2

Description:

This parameter describes the distance between the position encoder home reference 2 and **S-0-0054, Reference distance 2**.

See also the functional description: "Drive-controlled homing."

S-0-0151 Attributes

ID number:	S-0-0151	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

S-0-0155, Friction Compensation

Description:

Friction compensation is factored into the torque/force command value additively. The sign (+/-) of the compensation value is determined by the sign of the velocity command value. The only way to change the sign is outside of what has been set in **S-0-0124 Standstill window.**

By programming the friction compensation, it is possible to compensate for static friction resulting from acceleration from a standstill and change of direction.

See also the functional description: "Setting the friction torque compensation."

S-0-0155 Attributes

ID number:	S-0-0155	**Editability:**	P234
Function:	Parameter	**Memory:**	Prog. module
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	%	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	0/P-0-4046		

S-0-0159, Monitoring Window

Description:

The maximum tolerated deviation between the measured and calculated actual feedback value is set with the help of the monitoring window. If the position deviation exceeds the monitoring window, then the drive responds with error **F228, Excessive control deviation** in the class 1 diagnostic.

The greatest deviation that occurs will always be stored in parameter **P-0-0098, Maximum model deviation**.

Procedure for setting the parameter:

See the feature description: "Position loop monitoring."

S-0-0159 Attributes

ID number:	S-0-0159	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	0/S-0-0076		

S-0-0160, Acceleration Data Scaling Type

Description:

Various scaling types can be set as described below for the acceleration data in the drive as defined by the bit values of this parameter.

Parameter structure:

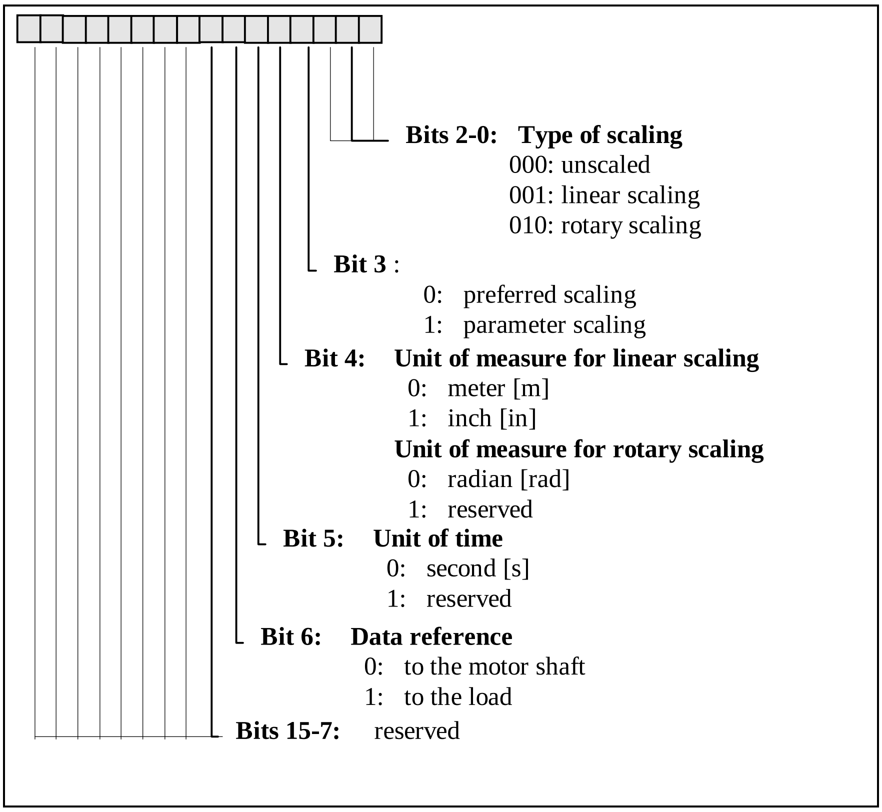

Fig. 2-27: S-0-0160, Acceleration data scaling type

Note: Only the bits indicated here are supported by the software.

See also the functional description: "Display format of the acceleration data.."

S-0-0160 Attributes

ID number:	S-0-0160	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0161, Acceleration Data Scaling Factor

Description:

When parameter scaling is set in **S-0-0160, Acceleration data scaling type**, the scaling factor for all of the acceleration data in the drive is determined by this parameter.

Parameter structure:

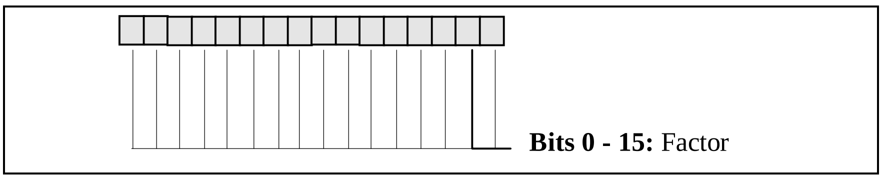

Fig. 2-28: S-0-0161, Acceleration data scaling factor

See also the functional description: "Display format of the acceleration data.."

S-0-0161 Attributes

ID number:	S-0-0161	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0162, Acceleration Data Scaling Exponent

Description:

When parameter scaling is set in **S-0-0160, Acceleration data scaling type**, the scaling exponent for all of the acceleration data in the drive is determined by this parameter.

Parameter structure:

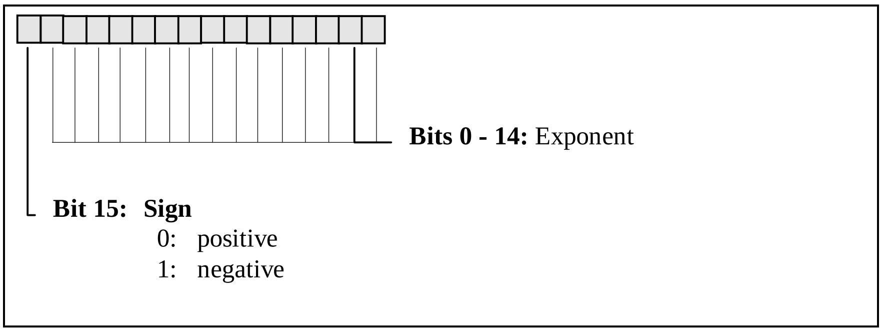

Fig. 2-29: S-0-0162 Scaling exponent for acceleration data

See also the functional description: "Display format of the acceleration data.."

S-0-0162 Attributes

ID number:	S-0-0162	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0169, Probe Control Parameter

Description:

This parameter is used to specify whether one or both of the probe inputs "probe 1" (DDS: X12-E4) and "probe 2" (DDS: X12-E5) have been activated, and which edge (positive/negative) should trigger the probe data memory.

Parameter structure:

Bit 0: Activation of positive flank probe 1
0: positive flank is not analyzed
1: positive flank is analyzed

Bit 1: Activation of negative flank probe 1
0: negative flank is not analyzed
1: negative flank is analyzed

Bit 2: Activation of positive flank probe 2
0: positive flank is not analyzed
1: positive flank is analyzed

Bit 3: Activation of negative flank probe 2
0: negative flank is not analyzed
1: negative flank is analyzed

Bit 4: Position feedback value selection
0: S-0-0053 is always used as the measurement, if external feedback is connected and position feedback values are selected in signal selection
1: S-0-0051 is always used as the measurement, if position feedback values are selected in signal selection

Fig. 2-30: S-0-0169, Probe control parameter

Note: Only the bits indicated here are supported by the software.

See also the functional description: "Probe feature."

S-0-0169 Attributes

ID number:	S-0-0169	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0170, Probing Cycle Procedure Command

Description:

By setting and enabling the command "probing cycle procedure," the drive reacts to the following:

- **S-0-0405, Probe 1 enable / S-0-0406, Probe 2 enable and**
- **S-0-0401, Probe 1, / S-0-0402, Probe 2.**

as is programmed in **S-0-0169, Probe control parameter**.

The NC can perform multiple measurements while this command is active.

If the NC no longer wants new measurements then it erases the command prompt.

Parameter structure:

Bit 0: Command in drive
0: clear
1: set

Bit 1: Command execution
0: interrupt
1: execute

Fig. 2-31: S-0-0170, Probing cycle procedure command

Note: - Only the bits indicated here are supported by the software.
- Bit 0 also activates monitoring of the external 24V current.

See also the functional description: "Probe feature."

S-0-0170 Attributes

ID number:	S-0-0170	**Editability:**	P4
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/3		

S-0-0177, Absolute Distance 1

Description:

The distance from the machine's zero-point to the zero-point of motor encoder can be indicated here as an absolute measurement.

S-0-0177 Attributes

ID number:	S-0-0177	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

S-0-0178, Absolute Distance 2

Description:

The distance from the machine's zero-point to the zero-point of the external measuring system can be indicated here as an absolute measurement.

S-0-0178 Attributes

ID number:	S-0-0178	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

S-0-0182, Manufacturer Class 3 Diagnostics

Description:

Various messages regarding operating status are stored here every 8ms. If the status of a message changes, this will not be signaled by a change bit.

Parameter structure:

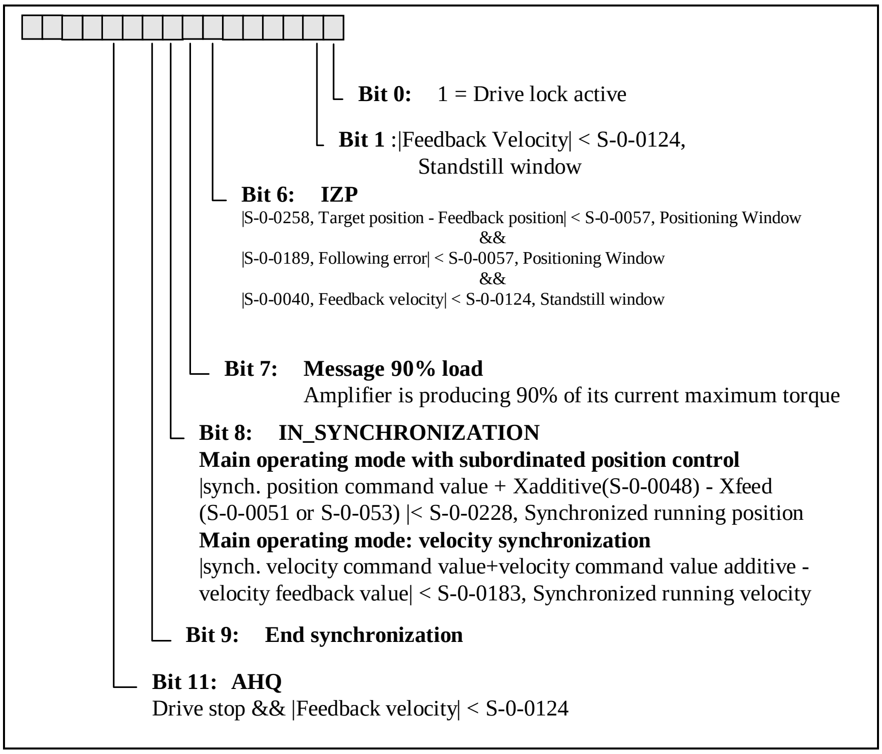

Fig. 2-32: S-0-0182, Manufacturer class 3 diagnostics

Note: Only the bits indicated here are supported by the software.

See also the functional description:
"S-0-0182, Manufacturer class 3 diagnostics."

S-0-0182 Attributes

ID number:	S-0-0182	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	AT
Input min/max:	--/--		

S-0-0185, Length of Configurable Data Record in the AT

Description:

In the operating data of this ID number, the drive indicates the maximum length in bytes which it can process in the configurable data record of the AT.

See also the functional description: "Configuration of telegram contents."

S-0-0185 Attributes

ID number:	S-0-0185	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0186, Length of the Configurable Data Record in the MDT

Description:

In the operating data of this ID number, the drive indicates the maximum length in bytes which it can process in the configurable data record of the MDT.

See also the functional description: "Configuration of telegram contents."

S-0-0186 Attributes

ID number:	S-0-0186	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0187, List of Configurable Data in the AT

Description:

This list contains the ID numbers of the operating data which can be configured in the drive telegram.

See also the functional description: "Configuration of telegram contents."

S-0-0187 Attributes

ID number:	S-0-0187	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2-byte variable	**Validity check:**	Phase 2
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0188, List of Configurable Data in the MDT

Description:

This list contains the ID numbers of the operating data which can be configured in the master data telegram.

See also the functional description: "Configuration of telegram contents."

S-0-0188 Attributes

ID number:	S-0-0188	**Editability:**	P2
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2-byte variable	**Validity check:**	Phase 2
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0189, Following Error

Description:

The drive stores the current difference between the position command value and the feedback position value relevant for the control system (**S-0-0051, Position feedback value 1** or **S-0-0053, Position feedback value 2**) in this operating data.

See also the functional description: "Determining the position controller setting."

S-0-0189 Attributes

ID number:	S-0-0189	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	--/--		

S-0-0192, IDN List of Backup Operation Data

Description:

The ID numbers for all operating data that must be loaded in the drive for proper operation are kept in the IDN list. Generally these are the parameters which are buffered in the programming module.

The control system uses this IDN list to create a backup copy of the drive parameters.

See also the functional description: "Parameter storage in programming module."

S-0-0192 Attributes

ID number:	S-0-0192	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2-byte variable	**Validity check:**	no
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0193, Positioning Jerk

Description:

The positioning jerk limits the acceleration change in the operating mode "Drive-controlled interpolation."

See also the functional description: "Generator function: Drive-controlled interpolation."

S-0-0193 Attributes

ID number:	S-0-0193	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0160	**Combination check:**	no
Decimal places:	S-0-0160	**Cyc. transmittable:**	no
Input min/max:	S-0-0160/S-0-0160		

S-0-0201, Motor Warning Temperature

Description:

If the motor temperature exceeds the motor warning temperature, then the motor warning high temperature bit will be set by the drive in **S-0-0012, Class 2 diagnostics**.

This parameter will be set by the drive at 140° for MDD and MKD motors.

See also the functional description: "Temperature monitoring."

S-0-0201 Attributes

ID number:	S-0-0201	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	C	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	45/155		

S-0-0204, Motor Shutdown Temperature

Description:

If the motor temperature exceeds the motor shutdown temperature, then the motor overtemperature switch bit in **S-0-0011, Class 1 diagnostic** will be set by the drive and error **F219, Motor overtemperature switch** will be generated.

See also the functional description: "Temperature monitoring."

S-0-0204 Attributes

ID number:	S-0-0204	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	C	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	45/155		

S-0-0258, Target Position

Description:

The target position is assigned to the drive as a command value by the controller in the "Drive-controlled interpolation" operating mode. The drive moves to the "target position" taking into account **S-0-0259, Positioning velocity**, **S-0-0260, Positioning acceleration** and **S-0-0193, Positioning jerk**.

S-0-0258 Attributes

ID number:	S-0-0258	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	MDT
Input min/max:	S-0-0076/S-0-0076		

S-0-0259, Positioning Velocity

Description:

Positioning velocity is used in the operating mode "Drive-controlled interpolation" to reach **S-0-0258, Target position**.

See also the functional description: "Generator function: Drive-controlled interpolation."

S-0-0259 Attributes

ID number:	S-0-0259	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	MDT
Input min/max:	S-0-0044/S-0-0044		

S-0-0260, Positioning Acceleration

Description:

"Positioning acceleration" is used in the "drive-controlled interpolation" operating mode to accelerate to **S-0-0259, Positioning velocity**.

See also the functional description: "Generator function: Drive-controlled interpolation."

S-0-0260 Attributes

ID number:	S-0-0260	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0160	**Combination check:**	no
Decimal places:	S-0-0160	**Cyc. transmittable:**	MDT
Input min/max:	S-0-0160/S-0-0160		

S-0-0262, Command Basic Load

Description:

By setting and enabling this command, the default parameters in the motor for current, velocity and position controller will be loaded and activated. The default parameters are not optimized for each of application. Their purpose is rather to ensure problem-free interplay between the amplifier and the motor.

Warning:

By performing this command, the previously optimized parameters will in some cases be overwritten.

See also the functional description: "Basic load."

S-0-0262 Attributes

ID number:	S-0-0262	**Editability:**	P234
Function:	Command	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/3		

S-0-0265, Language Selection

Description:

All parameter names, units and diagnostic warning messages within the drive controller are stored in several languages. This parameter determines the output language for the text.

- 0: German
- 1: English

More languages are in preparation

See also the functional description: "Language selection."

S-0-0265 Attributes

ID number:	S-0-0265	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

S-0-0267, Password

Description:

The parameter is used to unlock access to customer service features.

Warning:

Your drive can be destroyed if it is handled by someone who is not professionally trained!

S-0-0267 Attributes

ID number:	S-0-0267	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	1-byte variable	**Validity check:**	no
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0269, Parameter Buffer Mode

Description:

"Parameter buffer mode" is used to specify whether the data which is transferred via the service channel will be saved temporarily (in RAM) or in permanent, resident memory (in EEPROM).

Note these settings:

0: Data will be stored permanently.

1: Data will be stored temporarily.

After the control voltage supply has been switched on, the drive will initialize bit 0 to "0". To activate temporary storage mode, bit 0 must be forced to "1".

See also the functional description: "Parameter storage in programming module."

S-0-0269 Attributes

ID number:	S-0-0269	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_0V	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

S-0-0277, Position Feedback 1 Type Parameter

Description:

This parameter is used to determine the significant properties of the motor encoder (Position encoder 1).

Parameter structure:

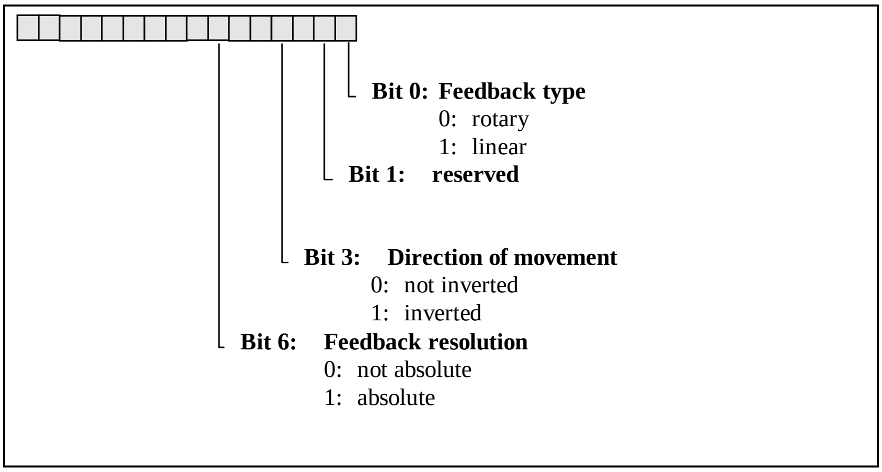

Fig. 2-33: S-0-0277, Position feedback 1 type parameter

Remark:

For absolute measurement systems with data memory, bit 6 is set automatically.

When MDD and MKD motors are used, bits 0, 1, and 3 are set and write-protected by the drive.

Note: Only the bits indicated here are supported by the software.

See also the functional description: "Other characteristics of the motor encoder."

S-0-0277 Attributes

ID number:	S-0-0277	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	yes
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0298, Reference Cam Shifting

Description:

A reference switch can be evaluated by the drive for drive-controlled homing travel. There is an optimal setting for the relative position of the homing switch signal to the motor encoder zero mark. To help the installer who is positioning the mechanical cam, the distance from the home switch to optimal switch position is given in this parameter.

The display is dependent on the set position data scaling type (**S-0-0076, Position data scaling type**) and is given in [mm], [grad] or [inch].

See also the functional description: "Drive-controlled homing."

S-0-0298 Attributes

ID number:	S-0-0298	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

S-0-0299, Home Switch Offset

Description:

If multiple reference marks of the homed measurement system are detectable during the travel range of the axis, then one of these marks must be selected as the relevant mark with the help of a zero-switch.

You should be careful not to select too small a distance between the zero-switch edge and reference mark, because the edge may not be recognized at the correct time, and the next mark will be selected as a result.

For measurement systems with multiple reference marks with known and constant distances between each other, a monitoring of the distances from edge to mark will be performed.

The minimum allowed distance is ¼ * d where d equals the distance between the reference marks. The optimum distance is ½ * d.

If the distance is smaller than ¼ * d, then **S-0-0148, C6 Drive-controlled homing procedure command** will be erroneously interrupted with the negative acknowledgement of **C602, Distance homing switch - reference mark erroneous**. The distance can then be changed mechanically or by using this parameter.
See also the functional description: "Drive-controlled homing."

S-0-0299 Attributes

ID number:	S-0-0299	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

S-0-0301, Allocation of Real-Time Control Bit 1

Description:

In order for a signal to assign the real-time control bit 1, the ID number of the signal is written to the operating data of the assignment for the real-time control bit 1.

If an assignment of this type is made, then the assigned signal (bit 0) will be controlled by the real-time control bit - 1 (= component of the master control word).

If the IDN which was set by parameter is not available, then the drive responds with the service channel error message "IDN is not available."

If the programmed IDN is available but is not editable in phase 4, then the drive responds with the error message "Data is not correct."

See also the functional description: "Real-time control and status bits."

S-0-0301 Attributes

ID number:	S-0-0301	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0303, Allocation of Real-Time Control Bit 2

Description:

In order for a signal to assign the real-time control bit 2, the ID number of the signal is written in the operating data of the assignment for the real-time control bit 2.

If an assignment of this type is made, then the assigned signal (bit 0) will be controlled by the real-time bit - 2 (= component of the master control word).

See also the functional description: "Real-time control and status bits."

S-0-0303 Attributes

ID number:	S-0-0303	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0305, Allocation of Real-Time Status Bit 1

Description:

In order to assign a signal to the real-time status bit 1, the ID number of the signal is written to the operating data of the assignment for the real-time status bit 1.

If an assignment of this type is made, then the assigned signal (bit 0) thereafter appears in the real-time status bit 1 (component of the drive status word).

If the programmed IDN is not available, then the drive responds with the service channel error message "IDN is not available."

See also the functional description: "Real-time control and status bits."

S-0-0305 Attributes

ID number:	S-0-0305	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0307, Allocation of Real-Time Status Bit 2

Description:

In order to assign a signal to the real-time status bit 2, the ID number of the signal is written to the operating data of the assignment for the real-time status bit 2.

If an assignment of this type is made, then the assigned signal (bit 0) thereafter appears in the real-time status bit 2 (component of the drive status word).

See also the functional description: "Real-time control and status bits."

S-0-0307 Attributes

ID number:	S-0-0307	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0347, Velocity Loop Deviation

Description:

Parameter S-0-0347 indicates the difference between the velocity command value and the velocity feedback value in the velocity controller!

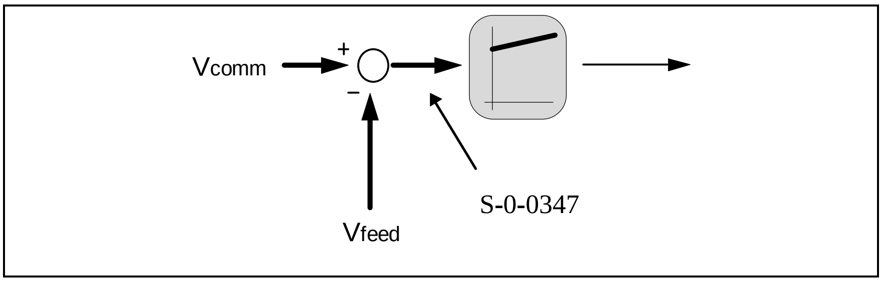

Fig. 2-34: S-0-0347, Velocity loop difference

See also the functional description: "Velocity controller."

S-0-0347 Attributes

ID number:	S-0-0347	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	no
Input min/max:	S-0-0044/S-0-0044		

S-0-0348, Proportional Gain Acceleration Feed Forward

Description:

The acceleration feed forward helps to reduce the following error during the acceleration phase in an operating mode without following error. The current acceleration command value is multiplied by the "Proportional gain acceleration feed forward" and added to the current command value of the velocity controller.

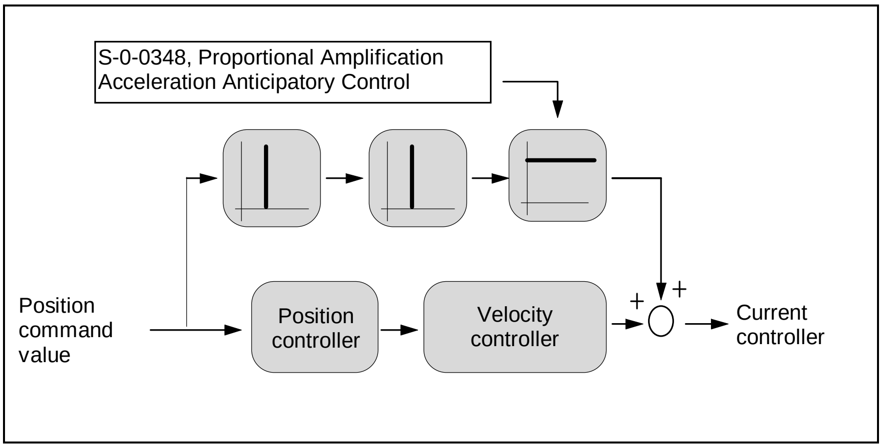

Fig. 2-35: Acceleration feedforward

Activation:

Writing a value greater than 0 to the parameter activates the acceleration feed forward!

Note: The acceleration feed forward is only possible in the operating mode without following error.

Correct input value:

$$K_R = (J_m + J_L) / K_m * 100$$

where: K_R = proportional gain acceleration feed forward

J_m = moment of inertia of the rotor

J_L= reduced load mass moment of inertia

K_m = torque constant

See also the functional description: "Setting the acceleration feed forward."

S-0-0348 Attributes

ID number:	S-0-0348	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	mAsec²/rad		
Combination check:	no	**Decimal places:**	1
Cyc. transmittable:	no	**Input min/max:**	0/P234

S-0-0349, Jerk Limit Bipolar

Description:

The jerk limit bipolar limits the acceleration change during "Drive halt."

See also the functional description: "The functional principle of drive halt."

S-0-0349 Attributes

ID number:	S-0-0349	**Editability:**	no
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	0/0		

S-0-0382 DC-Bus Power

Description:

Display of the DC-bus power.

S-0-0382 Attributes

ID number:	S-0-0382	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	KW	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	0/0		

S-0-0383, Motor Temperature

Description:

This parameter contains the measured motor temperature which is obtained from the motor temperature sensor attached to plug X6.

Remark:

A PTC resistor is used as the temperature sensor for all motors except asynchronous motors.

Since its temperature characteristic in the higher temperature range exhibits a strong progression, the value of parameter S-0-0383 in this range becomes much less exact.

See also the functional description: "Temperature monitoring."

S-0-0383 Attributes

ID number:	S-0-0383	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	not
Format:	DEC_MV	**Extreme value check:**	no
Unit:	C	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0390, Diagnostic Message Number

Description:

The diagnostic message number is stored in parameter "Diagnostic message number". It can also be viewed in the seven-segment display. This makes it possible for the control system to generate its own diagnostics using the diagnostic message number (for example in diagnostics in additional languages which are not stored in the drive).

Example:

Diagnostic Message:	"F8-22 Motor encoder error: "Signals are too small" in parameter S-0-0095
Seven-segment display:	Alternates between "F8" <=> "22"
Diagnostic message number:	"F822(hex)" in parameter S-0-0390

See also the functional description: "Diagnostic message number."

S-0-0390 Attributes

ID number:	S-0-0390	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0391, External Encoder Monitoring Window

Description:

This parameter defines the maximum allowable deviation of **S-0-0051, Actual feedback value 1** and **S-0-0053, Actual feedback value 2**.

If this value is exceeded by longer than 20ms, then error **F236, Excessive position feedback difference** will be generated.

Monitoring can be turned off by entering a 0 for the value of this parameter.

See also the functional description: "Actual feedback value monitoring."

S-0-0391 Attributes

ID number:	S-0-0391	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

S-0-0392, Velocity Feedback Value Filter Time Base

Description:

A VZ1 filter is used as the velocity feedback value filter. Its filter time constant can be adjusted within this parameter.

The filter becomes non-functional if you enter a value of 250 us.

See also the functional description: "Preparation for setting the velocity controller."

S-0-0392 Attributes

ID number:	S-0-0392	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	250/65500		

S-0-0393, Command Value Mode for Modulo Format

Description:

The interpretation of position command values such as **S-0-0047, Position command value** and **S-0-0258 Target position** when the modulo function has been activated is dependent on the mode which has been selected.

The purpose of parameter **S-0-0393, Command value mode for modulo format**, is to set the mode.

This parameter works only in the case where **S-0-0076, Position data scaling type** had been activated in modulo format.

S-0-0393:	Meaning:
0	Shortest path
1	Positive direction
2	Negative direction

Fig. 2-36: Values which can be set by parameter

See also the functional description: "Processing command values in modulo format, shortest path direction selection."

S-0-0393 Attributes

ID number:	S-0-0393	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	MDT
Input min/max:	0/2		

S-0-0400, Home Switch

Description:

This parameter is used to assign an IDN to the home switch (external signal).

Possible Application:

The IDN (and thus the feedback status of the home switch) can be assigned to a real-time status bit.

Construction of the parameter

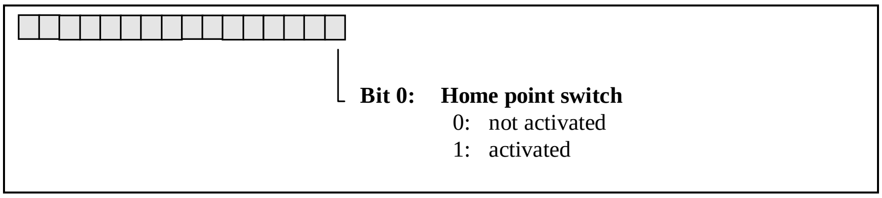

Fig. 2-37: S-0-0400, Home switch

See also the functional description: "Evaluation of the zero-switch."

S-0-0400 Attributes

ID number:	S-0-0400	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0401, Probe 1

Description:

This parameter is used to assign an ID number to Probe 1 (external signal). This makes it possible to assign Probe 1 to a real-time status bit, for example.

The signal Probe 1 is only polled by the drive and considered valid if command **S-0-0170, Probing cycle procedure** is active and **S-0-0405, Probe 1 enable** is present.

Parameter structure:

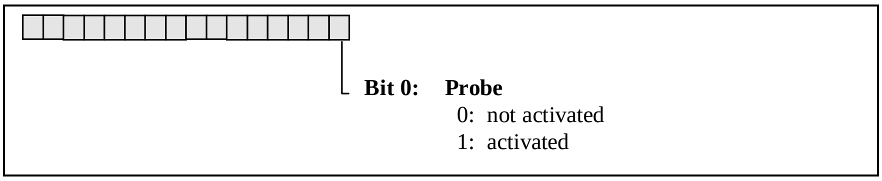

Fig. 2-38: S-0-0401, Probe

See also the functional description: "Probe feature."

S-0-0401 Attributes

ID number:	S-0-0401	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0402, Probe 2

Description:

This parameter is used to assign an ID number to Probe 2 (external signal). This makes it possible to assign Probe 2 to a real-time status bit, for example.

The signal Probe 2 is only polled by the drive and considered valid if command **S-0-0170, Probing cycle procedure** is active and **S-0-0406, Probe 2 enable** is present.

Parameter structure:

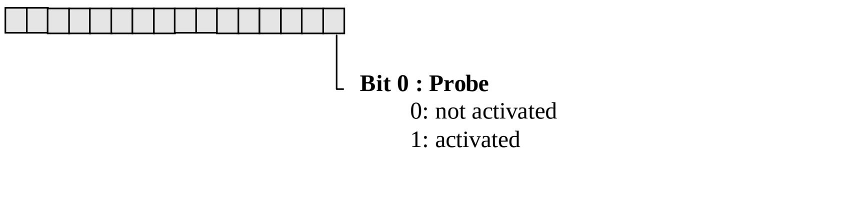

Fig. 2-39: S-0-0402, Probe

See also the functional description: "Probe feature."

S-0-0402 Attributes

ID number:	S-0-0402	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0403, Position Feedback Value Status

Description:

Bit 0 of this parameter will be set by the drive if the feedback position value which was selected with bit 3 by **S-0-0147, Homing parameter** is fixed in reference to the machine's zero-point.

If command **S-0-0148, C6 Drive-controlled homing procedure command** or **P-0-0012, Command 'Set absolute measurement'** were executed in the drive, then the bit will be reset at the start of those commands and then reset after successful termination of the same commands.

The position feedback value status can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

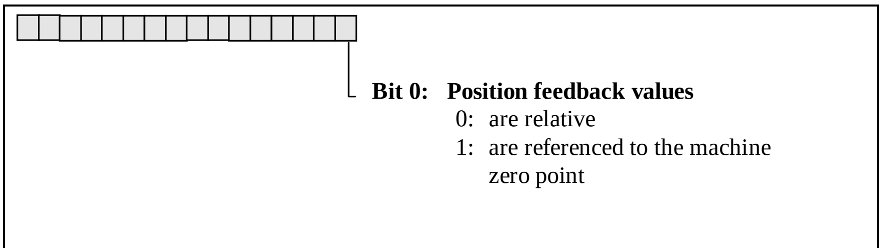

Fig. 2-40: S-0-0403, Position feedback value status

See also the functional description: "Drive-controlled homing."

S-0-0403 Attributes

ID number:	S-0-0403	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0405, Probe 1 Enable

Description:

This parameter is used to enable a probe input.

Changing this signal from 0 > 1 activates the trigger mechanism for evaluating the positive and/or negative slope of the probe signal.

The probe 1 enable can be assigned to a real-time control bit and thus be communicated to the master control word in the drive.

Parameter structure:

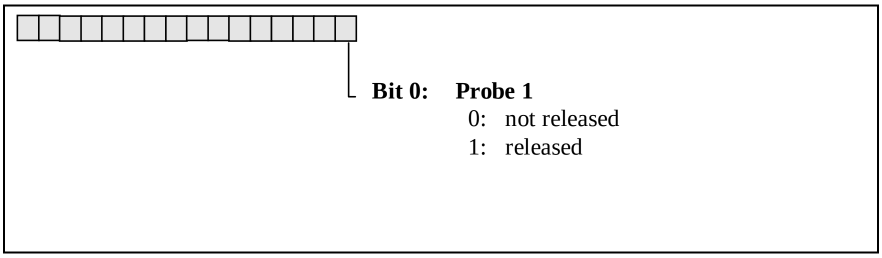

Fig. 2-41: S-0-0405, Probe 1 enable

See also the functional description: "Probe feature."

S-0-0405 Attributes

ID number:	S-0-0405	**Editability:**	P4
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0406, Probe 2 Enable

Description:

This parameter is used to enable a probe input.

Changing this signal from 0 > 1 activates the trigger mechanism for evaluating the positive and/or negative slope of the probe signal.

The probe 2 enable can be assigned to a real-time control bit and thus be communicated to the drive in the master control word.

Parameter structure:

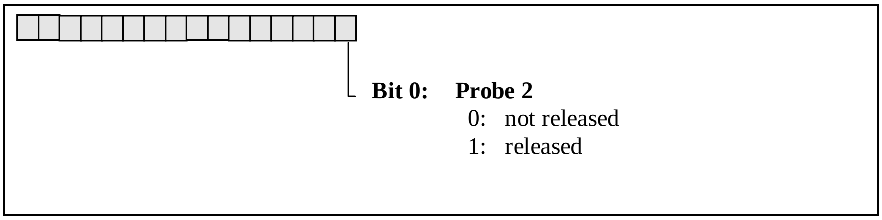

Fig. 2-42: S-0-0406, Probe 2 enable

See also the functional description: "Probe feature."

S-0-0406 Attributes

ID number:	S-0-0406	**Editability:**	P4
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0409, Probe 1 Positive Latched

Description:

Bit 0 in this parameter will be set by the drive if:

- Command **S-0-0170, Probe cycle** is active,
- Bit 0 in **S-0-0169, Probe control parameter** is set,
- **S-0-0405, Probe 1 enable** is present and
- The positive edge of **S-0-0401, Probe 1** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0130, Probe value 1 positive edge**.

The drive erases the bit if the NC erases command **S-0-0170, Probe cycle** or if **S-0-0405, Probe 1 enable** has been set from "1" to "0".

The parameter "Probe 1 positive latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

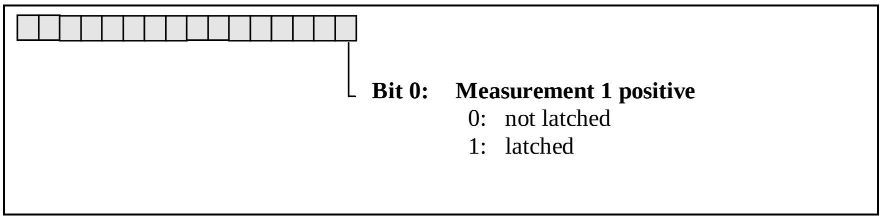

Fig. 2-43: S-0-0409, Probe 1 positive latched

See also the functional description: "Probe feature."

S-0-0409 Attributes

ID number:	S-0-0409	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0410, Probe 1 Negative Latched

Description:

Bit 0 in this parameter will be set by the drive if:

- Command **S-0-0170, Probe cycle** is active,
- Bit 1 in **S-0-0169, Probe control parameter** is set,
- **S-0-0405, Probe 1 enable** is present and
- The negative edge of **S-0-0401, Probe 1** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0131, Probe value 1 negative edge**.

The drive erases the bit if the NC erases command **S-0-0170, Probe cycle** or if **S-0-0405, Probe 1 enable** has been set from "1" to "0".

The parameter "probe 1 negative latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

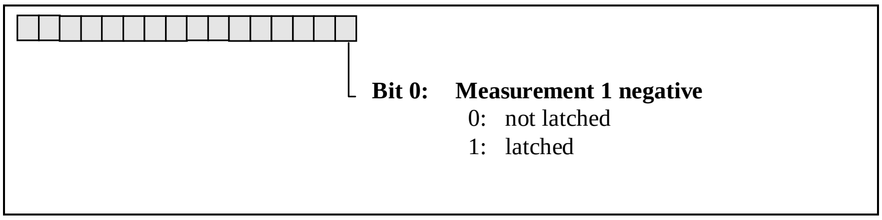

Fig. 2-44: S-0-0410, Probe 1 negative latched

See also the functional description: "Probe feature."

S-0-0410 Attributes

ID number:	S-0-0410	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	not
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0411, Probe 2 Positive Latched

Description:

Bit 0 in this parameter will be set by the drive if:

- Command **S-0-0170, Probe cycle** is active,
- Bit 3 in **S-0-0169, Probe control parameter** is set,
- **S-0-0406, Probe 2 enable** is present, and
- The positive edge of **S-0-0402, Probe 2** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0132, Probe value 2 positive edge**.

The drive erases the bit if the NC erases command **S-0-0170, Probing cycle** or if **S-0-0406, Probe 2 enable** has been set from "1" to "0".

The parameter "Probe 2 positive latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

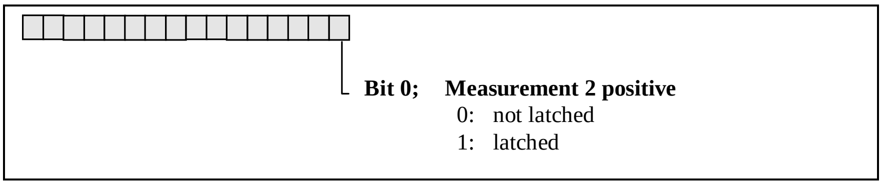

Fig. 2-45: S-0-0411, Probe 2 positive latched

See also the functional description: "Probe feature."

S-0-0411 Attributes

ID number:	S-0-0411	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

S-0-0412, Probe 2 Negative Latched

Description:

Bit 0 in this parameter will be set by the drive if:

- Command **S-0-0170, Probe cycle** is active,
- Bit 3 in **S-0-0169, Probe control parameter** is set,
- **S-0-0406, Probe 2 enable** is present, and
- The negative edge of **S-0-0402, Probe 2** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0133, Probe value 2 negative edge**.

The drive erases the bit if the NC erases command **S-0-0170, Probing cycle procedure command** or if **S-0-0406, Probe 2 enable** is set from "1" to "0".

The parameter "probe 2 negative latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

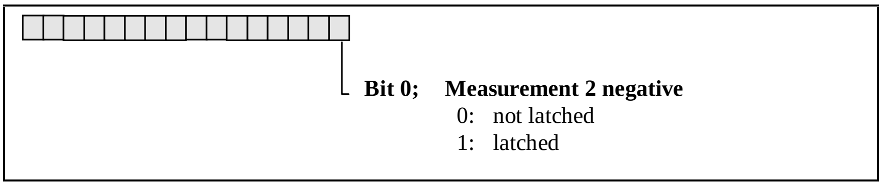

Fig. 2-46: S-0-0412, Probe 2 negative latched

See also the functional description: "Probe feature."

S-0-0412 Attributes

ID number:	S-0-0412	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	**--**	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

3 Product-specific parameters

P-0-0004, Smoothing Time Constant

Description:

The time constant that can be activated in this parameter affects the output of the velocity loop controller. It can be used to suppress quantization effects and limit the bandwidth of the velocity loop controller.

See also the functional description: "Setting the velocity controller."

P-0-0004 Attributes

ID number:	P-0-0004	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	us	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	250/65500		

P-0-0008, Activation of E-Stop Function

Description:

Parameter P-0-0008 can be used to activate E-Stop input and to select a response for bringing the drive to standstill.

Parameter structure:

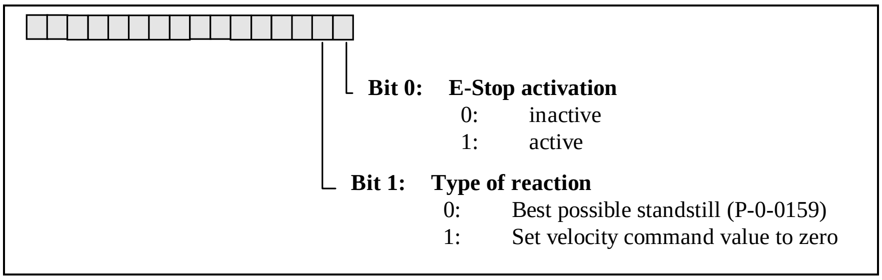

Fig. 3-1: P-0-008, Activation of E-Stop function

The input polarity cannot be selected. It is always 0-active i.e., 0V on E6 of the X12 connector means the E-Stop is active.

Note: Bit 0 also activates monitoring of the external 24V current.

See also the functional description: "Activation and polarity of the E-Stop input."

P-0-0008 Attributes

ID number:	P-0-0008	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0009, Error Message Number

Description:

If an error occurs during cyclical operation, it will be diagnosed by the drive and shown in the seven-segment display.

At the same time, a bit will be set in **S-0-0011, Class 1 diagnostic**, and the change bit for that Class 1 diagnostic will be set in the operation status word. The machine can now determine the queued error condition passed to the drive's diagnostic display by reading this parameter, which contains only the last three significant decimals of the diagnostic message number (in range 201..899), and determine a specific error response or custom diagnostic text message.

If no error is pending, then the value of this parameter is "0".

Example:

Pending error:	F822, "Motor feedback error: signal amplitude error"
P-0-0009:	822

See also the functional description: "Error number."

P-0-0009 Attributes

ID number:	P-0-0009	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0010, Excessive Position Command

Description:

Position command value monitoring triggered error **F237, Excessive position command value difference**, and decelerated the drive according to the error handling defined in parameter **P-0-0119, Deceleration as best as possible**.

The excessive position command value that triggered the error is stored in parameter P-0-0010, and the last valid position command value is stored in parameter **P-0-0011, Last valid position command value**.

Only command values preset by the NC are monitored.

See also the functional description: "Position command value monitoring."

P-0-0010 Attributes

ID number:	P-0-0010	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0011, Last Valid Position Command Value

Description:

If error **F237, Excessive position command value difference** occurs, then the last valid position command value will be stored in this parameter.

See also the functional description: "Position command value monitoring."

P-0-0011 Attributes

ID number:	P-0-0011	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0012, Command 'Set Absolute Measurement'

Description:

When an absolute measuring system is started for the first time, the drive will indicate a random feedback value that is not referenced to the machine zero-point.
In this case, the value of parameter **S-0-0403, Position feedback value status** is 0.

The position feedback of this measuring system can be set to the desired value with the command "Set absolute measurement". After the "Set absolute measurement" command is executed, the position feedback value of the measurement-supplied encoder will contain a defined reference to the machine zero-point.

All information will be available after reset because all necessary data from the absolute measurement system is buffered in feedback data memory or in parameter data memory. The position feedback value permanently retains its reference to the machine zero-point.

Parameter P-0-012 can be used to execute this function.

See also the functional description: "Set absolute measurement."

P-0-0012 Attributes

ID number:	P-0-0012	**Editability:**	P4
Function:	Command	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/3		

P-0-0015, Memory Address

Description:

This parameter can be used to select a memory address in the drive for operation-internal test purposes. The contents will be displayed in parameter **P-0-0016, Memory address contents**.

P-0-0015 Attributes

ID number:	P-0-0015	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0016, Contents of Memory Address

Description:

This parameter displays the contents of the memory address set in parameter **P-0-0015, Memory address** (for operation-internal test purposes only!).

P-0-0016 Attributes

ID number:	P-0-0016	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0018, Number of Pair of Pols/Pole Pair Distance

Description:

This indicates the number of pole pairs per motor revolution for rotating motors.

This value does not need to be indicated here for motors with motor feedback data memory.

For linear motors, the length of a pole pair must be indicated here.

P-0-0018 Attributes

ID number:	P-0-0018	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC-OV	**Extreme value check:**	no
Unit:	Pole pairs or mm (depends on P-0-4014, Type of motor)		
Combination check:	no	**Decimal places:**	0
Cyc. transmittable:	no	**Input min/max:**	--/--

P-0-0019, Position Start Value

Description:

The position start value sets a parameter for a defined initialization value for position feedback values 1 and 2 in non-absolute measurement systems.

During initialization of the position feedback value with command **S-0-0128, C1 transition check for communications phase 4**, the drive

checks whether the position start value was written in communications phase 2 or 3. Only then will position feedback values 1 and 2 be set to that value. The position start value is used only for non-absolute encoders.

See also the functional description: "Non-absolute measurement systems after initialization."

P-0-0019 Attributes

ID number:	P-0-0019	**Editability:**	P23
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0021, List of Scope Data 1

Description:

Captured values from the recording signal are stored in parameter **P-0-0021 List of scope data 1**.

See also the functional description: "Oscilloscope function".

P-0-0021 Attributes

ID number:	P-0-0021	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	P-0-0023	**Extreme value check:**	no
Unit:	P-0-0023	**Combination check:**	no
Decimal places:	P-0-0076	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0022, List of Scope Data

Description:

Captured values from the recording signal are stored in parameter **P-0-0022 List of scope data 2**.

See also the functional description: "Oscilloscope function".

P-0-0022 Attributes

ID number:	P-0-0022	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	P-0-0023	**Extreme value check:**	no
Unit:	P-0-0023	**Combination check:**	no
Decimal places:	P-0-0076	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0023 Signal Select Channel 1

Description:

Parameter P-0-0023 determines the signal that will be recorded. The following fixed, defined signals are available:

Number	Signal selection	Unit of the scope data list
0 x 00	Channel not activated	---
0 x 01	Actual feedback value dependent on operating mode S-0-0051 or S-0-0053	Dependent on position scaling
0 x 02	Velocity value parameter (S-0-0040)	Dependent on velocity scaling
0 x 03	Velocity control deviation (-S-0-0347)	Dependent on velocity scaling
0 x 04	Following error parameter (S-0-0189)	Dependent on position scaling
0 x 05	Torque/force command value parameter S-0-0080	Percent
0 x 06	Not in use	---

Fig. 3-2: P-0-0023, Signal numbers

Expanded oscilloscope recording feature:

In addition to fixed, defined signal selection, it is also possible to record any memory addresses of the drive. To do this, bit 12 = 1 must be set. Bit 13 defines the data length of the memory signal in question.

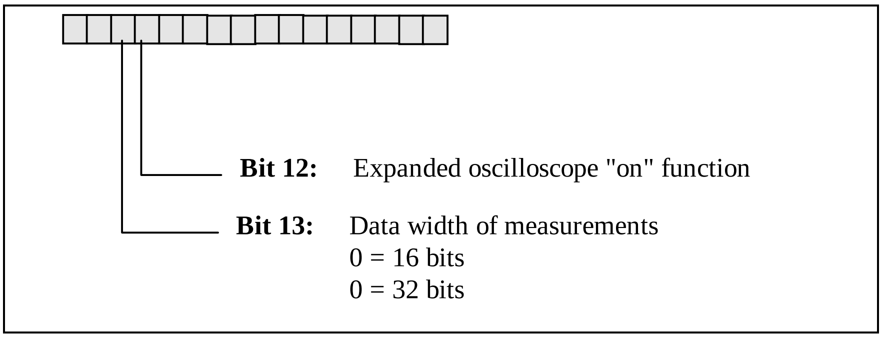

Fig. 3-3: P-0-0023, & P-0-0024, Oscilloscope function signal selection

See also the functional description: "Oscilloscope function".

P-0-0023 Attributes

ID number:	P-0-0023	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/0x3FFFFFFF		

P-0-0024, Signal Select Channel 2

Description:

Parameter P-0-0024 determines the signal that will be recorded. The following fixed, defined signals are available:

Number	Signal selection	Unit of the scope data (probe value) list
0 x 00	Channel not activated	---
0 x 01	Actual feedback value dependent on operating mode S-0-0051 or S-0-0053	Dependent on position scaling
0 x 02	Velocity value parameter (S-0-0040)	Dependent on velocity scaling
0 x 03	Velocity control deviation (-S-0-0347)	Dependent on velocity scaling
0 x 04	Following error parameter (S-0-0189)	Dependent on position scaling
0 x 05	Torque/force command value parameter S-0-0080	Percent
0 x 06	Not in use	---

Fig. 3-4: P-0-0024, Signal numbers

Expanded oscilloscope recording feature:

In addition to fixed, defined signal selection, it is also possible to record any memory addresses of the drive. To do this, bit 12 = 1 must be set. Bit 13 defines the data length of the memory signal in question.

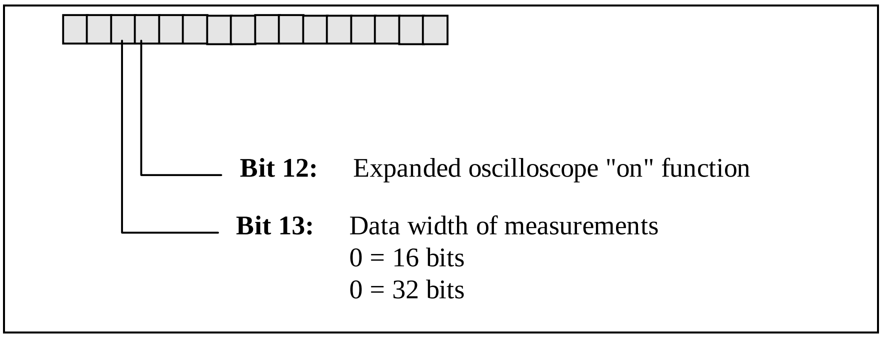

Fig. 3-5: P-0-0023, and P-0-0024, Oscilloscope function signal selection

See also the functional description: "Oscilloscope function".

P-0-0024 Attributes

ID number:	P-0-0024	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/0x3FFFFFFF		

P-0-0025, Trigger Source

Description:

Parameter P-0-0025 defines the source that initiates the trigger signal. There is a choice between:

- External trigger
- Internal trigger

External trigger (P-0-0025 = 0x01)

If an external trigger is chosen, then the trigger will be initiated by bit 0 of the trigger command word.

Internal trigger (P-0-0025 = 0x02)

If an internal trigger is selected, then the trigger signal set by parameter will be monitored for the trigger condition, and the trigger will be initiated as soon as the condition is met.

See also the functional description: "Oscilloscope function".

P-0-0025 Attributes

ID number:	P-0-0025	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	DEC-0V	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/2		

P-0-0026, Trigger Signal Select

Description:

For internal trigger sources, parameter P-0-0026 defines the signal that is monitored for the trigger condition that was set by parameter. The following fixed, defined signals are available:

Trigger signal numbers:	Trigger signal:	Corresponding trigger threshold
0 x 00	Not defined	Not defined
0 x 01	Actual feedback value based on mode of operation	Position data (P-0-0027)
0 x 02	Velocity feedback value Parameter S-0-0040	Velocity data (P-0-0028)
0 x 03	Velocity deviation parameter --	Velocity data (P-0-0028)
0 x 04	Following error parameter S-0-0189	Position data (P-0-0027)
0 x 05	Torque command value parameter S-0-0080	Torque data (P-0-0029)

Fig. 3-6: P-0-0026, Signal numbers

Additional trigger signals can also be defined by setting bit 12.

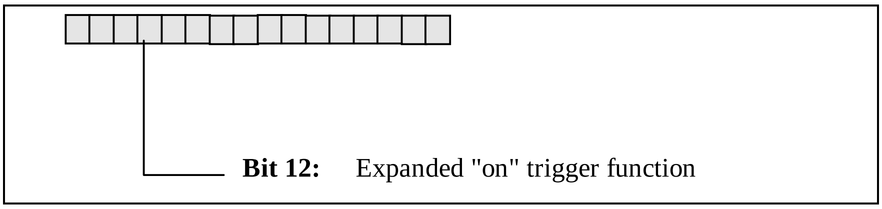

Fig. 3-7: P-0-0026, Trigger signal select

See also the functional description: "Oscilloscope function".

P-0-0026 Attributes

ID number:	P-0-0026	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0x0000/0x3FFF		

P-0-0027, Trigger Level for Position Data

Description:

Parameter P-0-0027 determines the value at which the trigger will be released as long as the correct edge has been recognized.

See also the functional description: "Oscilloscope function."

P-0-0027 Attributes

ID number:	P-0-0027	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	DEC-MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0028, Trigger Level for Velocity Data

Parameter P-0-0028 determines the value at which the trigger will be released as long as the correct edge has been recognized.

See also the functional description: "Oscilloscope function."

P-0-0028 Attributes

ID number:	P-0-0028	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	DEC-MV	**Extreme value check:**	yes
Unit:	S-0-0044	**Combination check:**	no
Decimal places:	S-0-0044	**Cyc. transmittable:**	no
Input min/max:	S-0-0044/S-0-0044		

P-0-0029, Trigger Level for Torque/Torce Data

Description:

Parameter P-0-0029 determines the value at which the trigger will be released as long as the correct edge has been recognized.

See also the functional description: "Oscilloscope function."

P-0-0029 Attributes

ID number:	P-0-0029	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	DEC-MV	**Extreme value check:**	yes
Unit:	%	**Combination check:**	no
Decimal places:	S-0-0086	**Cyc. transmittable:**	no
Input min/max:	P-0-4046/P-0-4046		

P-0-0030, Trigger Edge

Description:

Parameter P-0-0030 defines the signal change at which a trigger event can be initiated.

Number:	Trigger edge:
1	Triggering on the positive edge of the trigger signal
2	Triggering on the negative edge of the trigger signal
3	Triggering on both the positive edge and negative edge of the trigger signal
4	Triggering if the trigger signal equals the trigger level

Fig. 3-8: Selection of trigger edges

See also the functional description: "Oscilloscope function."

P-0-0030 Attributes

ID number:	P-0-0030	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	DEC-0V	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/4		

P-0-0031, Timebase

Description:

Timebase defines the time intervals within which the probe values of the selected signals are defined. Possible time intervals range from 250 us to 100 ms.

Note that in general:

Recording duration = Time resolution * Size of memory [us]

See also the functional description: "Oscilloscope function."

P-0-0031 Attributes

ID number:	P-0-0031	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	DEC-0V	**Extreme value check:**	yes
Unit:	uS	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	250/100000		

P-0-0032, Size of Memory

Description:

The size of memory determines the number of recorded probe values per measurement. A maximum of 512 probe values can be recorded per channel.

The memory size and time resolution together determine the recording duration. The minimum recording duration is 128 ms, and the maximum duration is 51.2 s.

Note that in general:

Recording duration = Time resolution * Size of memory [us]

See also the functional description: "Oscilloscope function."

P-0-0032 Attributes

ID number:	P-0-0032	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	DEC-OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	2/512		

P-0-0033, Number of Samples After Trigger

Description:

Parameter P-0-0033 defines the number of probe values, or samples, that will be entered in the probe value list after the trigger event. In this way it is possible to set a parameter to define a trigger delay. Parameter P-0-0033 is used for this.

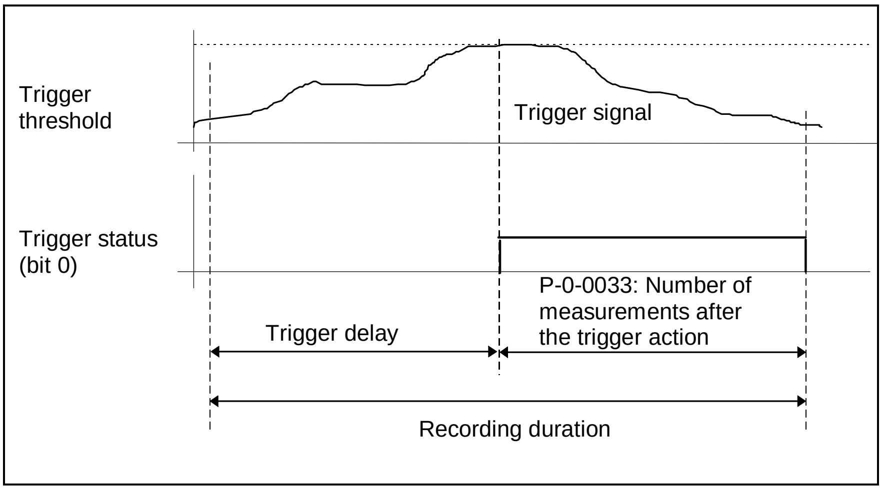

Fig. 3-9: Triggering

See also the functional description: "Oscilloscope function."

P-0-0033 Attributes

ID number:	P-0-0033	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	no
Format:	DEC-0V	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/512		

P-0-0035, Delay from Trigger to Start

Description:

Parameter P-0-0035 indicates the number of cycles between the trigger event (internal) and the release of the trigger (bit 0 trigger control word) in external triggering.

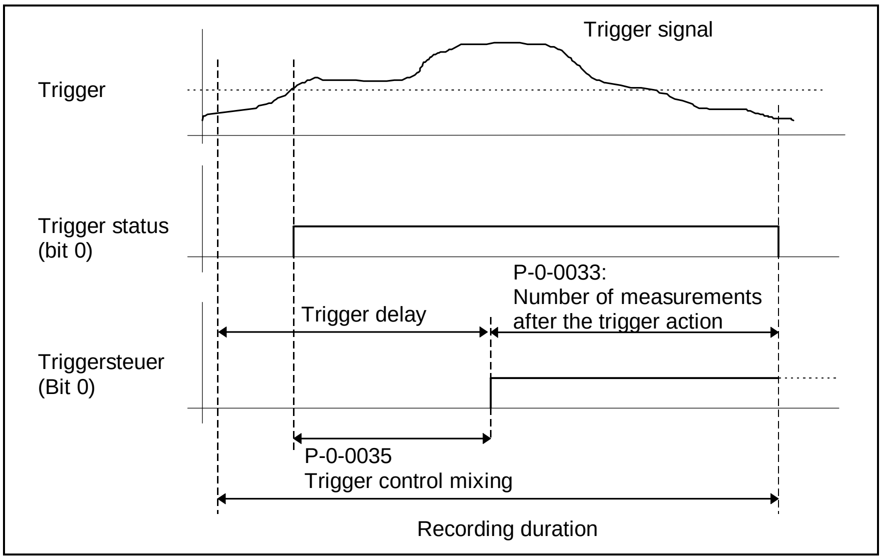

Fig. 3-10: Triggering

Since there is a delay between transmission of the trigger event by the control system and release of the trigger, the delay is measured by the drive controller and stored in parameter **P-0-0035, Trigger delay** parameter. A time-correct display of signals is ensured by using this parameter for visualizing the probe values.

See also the functional description: "Oscilloscope function."

P-0-0035 Attributes

ID number:	P-0-0035	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_0V	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0036, Trigger Control Word

Description:

Parameter P-0-0036 controls the oscilloscope function.

- Bit 2 activates the function, i.e., the lists of scope data are filled with the selected data.
- Bit 1 activates trigger monitoring.
- Bit 0 can initiate a trigger event. If a valid edge is recognized, the probe-value memory will be completed as specified by parameter **P-0-0033, Number of samples after the trigger**, and the oscilloscope function will be deactivated by resetting bits 1 and 2 in the trigger control word.

Parameter structure

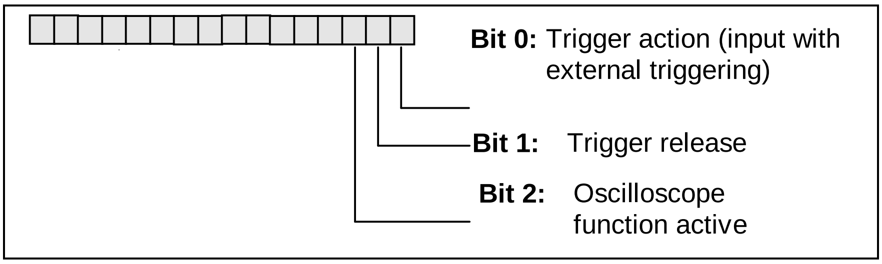

Fig. 3-11: P-0-0036, Activating the oscilloscope function

See also the functional description: "Oscilloscope function."

P-0-0036 Attributes

ID number:	P-0-0036	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0037, Trigger Status Word

Status messages for the oscilloscope function

Description:

Parameter P-0-0037 offers various pieces of information about the current status of the oscilloscope function.

Parameter structure

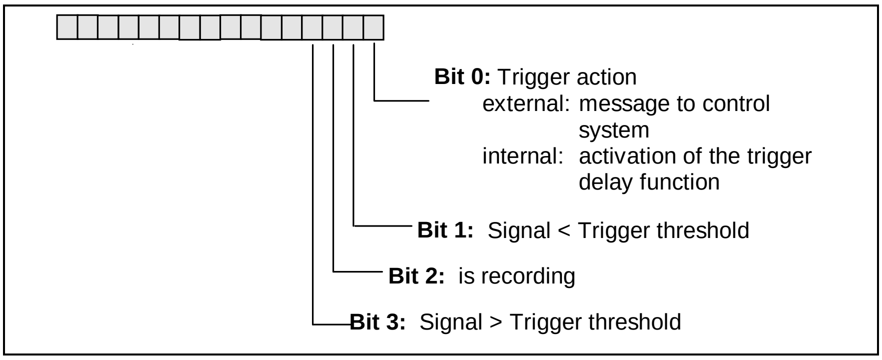

Fig. 3-12: P-0-0037, Status of the oscilloscope function

See also the functional description: "Oscilloscope function."

P-0-0037 Attributes

ID number:	P-0-0037	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0038, Signal Select Analog Output Channel 1

Description:

DIAX-03 offers you an "Analog output" function. Two outputs make it possible to export drive-controlled signals and status variables as analog voltage signals.

These can be examined by connecting an oscilloscope to the analog outputs. The maximum output voltage is +/- 10V with a resolution of 8 bits.

Predefined channel-selection numbers are available to select specific signals.

For analog channel 1, the selection can be made by entering the channel-selection number (hex format) in parameter P-0-038.

The following predefined signals are available:

Number:	Signal selection:	Scaling:
0x0	--	--
0x1	Torque-producing command current	10V = S-0-0110 Peak current amplifier
0x2	Velocity feedback value after mixing and filtering	P-0-0040
0x3	S-0-0036, Velocity command value	P-0-0040
0x4	Position command value difference	P-0-0040
0x5	S-0-0051, Position feedback value 1	P-0-0042
0x6	S-0-0053, Position feedback value 2	P-0-0042
0x7	S-0-0189, Following error	P-0-0042
0x8	Sine signal of motor encoder	1: 1
0x9	Cosine signal of motor encoder	1: 1
0xd	Velocity command value input velocity controller	P-0-0040
0xe	DC bus power	P-0-0044
0xf	Amount of DC bus power	P-0-0044
0x10	Sine signal external encoder	1: 1
0x11	Cosine signal external encoder	1: 1
0x12	Torque-producing current actual value	10V = S-0-0110 Peak current amplifier
0x13	Magnetization current actual value	10V = S-0-0110 Peak current amplifier
0x14	Velocity feedback value of the motor encoder	P-0-0040
0x15	Thermal load	10V = 100%
0x20	Synchronous position command value	P-0-0042
0x21	Synchronous velocity	P-0-0040

Fig. 3-13: Signal selection for analog output

The following parameters should be considered for scaling:

- **P-0-0040, Scaling factor for velocity data channel 1**
- **P-0-0042, Scaling factor for position data channel 1**
- **P-0-0044, Scaling power for analog output**

See also the functional description: "Analog output."

P-0-0038 Attributes

ID number:	P-0-0038	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0039, Signal Select Analog Output Channel 2

Description:

DIAX-03 offers you an "Analog output" function. Two outputs make it possible to export drive-controlled signals and status variables as analog voltage signals.

These can be examined by connecting an oscilloscope to the analog outputs. The maximum output voltage is +/- 10V with a resolution of 8 bits.

Predefined channel-selection numbers are available to select specific signals.

For analog channel 2, the selection can be made by entering the channel-selection number (hex format) in parameter P-0-039.

The following predefined signals are available:

Number:	Signal selection:	Scaling:
0x0	--	--
0x1	Torque-producing command current	10V = S-0-0110 Peak current amplifier
0x2	Velocity feedback value after mixing and filtering	P-0-0041
0x3	S-0-0036, Velocity command value	P-0-0041
0x4	Position command value difference	P-0-0041
0x5	S-0-0051, Position feedback value 1	P-0-0043
0x6	S-0-0053, Position feedback value 2	P-0-0043
0x7	S-0-0189, Following error	P-0-0043
0x8	Sine signal of motor encoder	1: 1
0x9	Cosine signal of motor encoder	1: 1
0xd	Velocity command value input velocity controller	P-0-0041
0xe	DC bus power	P-0-0044
0xf	Amount of DC bus power	P-0-0044
0x10	Sine signal external encoder	1: 1
0x11	Cosine signal external encoder	1: 1
0x12	Torque-producing current actual value	10V = S-0-0110 Peak current amplifier
0x13	Magnetization current actual value	10V = S-0-0110 Peak current amplifier

0x14	Velocity feedback value of the motor encoder	P-0-0041
0x15	Thermal load	10V = 100%
0x20	Synchronous position command value	P-0-0043
0x21	Synchronous velocity	P-0-0041

Fig. 3-14: Signal selection for analog output

The following parameters should be considered for scaling:

- **P-0-0041, Scaling factor for velocity data channel 2**
- **P-0-0043, Scaling factor for position data channel 2**
- **P-0-0044, Scaling power for analog output**

See also the functional description: "Analog output."

P-0-0039 Attributes

ID number:	P-0-0039	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0040, Scaling Factor for Velocity Data Channel 1

Description:

If velocity data have been selected with parameter **P-0-038, Signal selection analog channel 1**, then scaling will be set in parameter **P-0-0040, Scaling factor for velocity data channel 1**.

The unit Rpm/10V (or m/min/10V with a linear motor) always refers to the motor in this case. If a gear ratio is present, it will not be considered.

See also the functional description: "Analog output."

P-0-0040 Attributes

ID number:	P-0-0040	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC-OV	**Extreme value check:**	no
Unit:	Upm/10V bzw. mm/min/10V (abhängig von P-0-4014, Motorart) /Rpm/10V or mm/min/10V (depends on P-0-4014, Motor type)		
Combination check:	no	**Decimal places:**	0
Cyc. transmittable:	no	**Input min/max:**	0/65535

P-0-0041, Scaling Factor for Velocity Data Channel 2

Description:

If velocity data have been selected with parameter **P-0-039, Signal selection for analog channel 2**, then the scaling will be set in parameter **P-0-0040, Scaling factor for velocity data channel 1**.

The unit Rpm/10V (or m/min/10V with a linear motor) always refers to the motor in this case. If a gear ratio is present, it will not be considered.

See also the functional description: "Analog output."

P-0-0041 Attributes

ID number:	P-0-0041	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	Rpm/10V or mm/min/10V (depends on P-0-4014, Motor type)		
Combination check:	no	**Decimal places:**	1
Cyc. transmittable:	no	**Input min/max:**	0/65535

P-0-0042, Scaling Factor for Position Data Channel 1

Description:

If position data have been selected with parameter **P-0-038, Signal selection for analog channel 1**, then scaling will be set with parameter **P-0-0042, Scaling factor for position data channel 1**.

The unit "degrees" always refers to the motor.

See also the functional description: "Analog output."

P-0-0042 Attributes

ID number:	P-0-0042	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	Deg/10V or mm/min/10V (depends on P-0-4014, Motor type)		
Combination check:	no	**Decimal places:**	2
Cyc. transmittable:	no	**Input min/max:**	0/0x7FFFFFFF

P-0-0043, Scaling Factor for Position Data Channel 2

Description:

If position data were selected with parameter **P-0-039, Signal selection for analog channel 2**, then scaling will be set with parameter **P-0-0043, Scaling factor for position data channel 2**.

The unit "degree" always refers to the motor.

See also the functional description: "Analog output."

P-0-0043 Attributes

ID number:	P-0-0043	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	Deg/10V or mm/min/10V (depends on P-0-4014, Motor type)		
Combination check:	no	**Decimal places:**	2
Cyc. transmittable:	no	**Input min/max:**	0/0x7FFFFFFF

P-0-0044, Scaling Factor for Power for Analog Channel

Description:

DC bus power can be sent to the analog channels **P-0-0038, Signal select analog output channel 1** or **P-0-0039, Signal select analog output channel 2**. The power can be resolved according to various requirements by using parameter, P-0-0044, "Scaling power for analog channel".

See also the functional description: "Analog output."

P-0-0044 Attributes

ID number:	P-0-0044	**Editability:**	P234
Function:	Parameter	**Memory:**	Program
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	W/10V	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/0x7FFFFFFF		

P-0-0051, Torque Constant

Description:

The torque/force constant determines what drive torque or force the motor will deliver at a specific effective current.

For synchronous motors, this value depends entirely on the design of the motor.

In asynchronous motors, this value is valid only when the motor is not operated in the field-weakening range.

For MKD and MDD motors, this parameter is stored in feedback data memory.

Note the equation:

$$M_A[\text{Nm, N}] = \text{P-0-0051} * \text{S-0-0080}$$

where:

where:	M_A	Drive torque
	P-0-0051	Torque constant [N/A]
	S-0-0080	Torque-force command value [A]

P-0-0075 Attributes

ID number:	P-0-0051	**Editability:**	P3
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	Nm/A	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	1/65535		

P-0-0074, Interface Feedback 1

Description:

This parameter determines the encoder interface to which the motor encoder is connected. The number of the corresponding interface module should be entered in this parameter.

Module:	P-0-0074:	Measurement system:
Standard	1	dig. Servo feedback Heidenhain or Stegmann or Resolver
DLF	2	Incremental encoder with sine signal from Heidenhain inc., with either uA or 1V signals
DZF	3	Gear tooth encoder
DAG 2	8	Encoder with ENDAT interface

Fig. 3-15: P-0-0074, Interface module

Restriction:

Modules DLF, DZF, DRF and DEF 1 must not be operated simultaneously in a controller. => **Danger of Damage!**

It is not possible to combine DLF and DZF.
Module DEF 2 can be used to operate an incremental encoder along with DLF or DZF.

See also the functional description: "Determining the encoder feedback interface of the motor encoder."

P-0-0074 Attributes

ID number:	P-0-0074	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/3		

P-0-0075, Interface Feedback 2

Description:

This parameter determines the encoder interface to which the external encoder is connected. The number of the corresponding interface module should be entered in this parameter.

Module:	P-0-0075:	Measurement system:
	0	No external encoder interface available
Standard	1	dig. servo-feedback or resolver
DLF	2	Incremental encoder with sine signal from Heidenhain inc., with either uA or 1V signals
DZF	3	Gear tooth encoder
DFF	4	dig. Servo-feedback
DEF 1	5	Incremental feedback with square-wave signals from Heidenhain inc.
DEF 2	6	Incremental feedback with square-wave signals from Heidenhain inc.
DAG 1	7	Encoder with SSI interface
DAG 2	8	Encoder with ENDAT interface

Fig. 3-16: P-0-0075, Interface module

Restriction:

Modules DLF, DZF, DRF and DEF 1 must not be operated simultaneously in a controller. => **Danger of Damage!**

It is not possible to combine DLF and DZF.
Module DEF 2 can be used to operate an incremental encoder along with DLF or DZF.

See also the functional description: "Determining the encoder feedback interface of the motor encoder."

P-0-0075 Attributes

ID number:	P-0-0075	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/8		

P-0-0081, Parallel I/O Output 1

Description:

The control system can use this parameter to address the outputs of the DEA 4.1 I/O card.

See also the functional description: "Digital input/output".

P-0-0081 Attributes

ID number:	P-0-0081	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	MDT
Input min/max:	--/--		

P-0-0082, Parallel I/O Input 1

Description:

The control system can use this parameter to address the inputs of the DEA 4.1 I/O card.

See also the functional description: "Digital input/output."

P-0-0082 Attributes

ID number:	P-0-0082	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	AT
Input min/max:	--/--		

P-0-0090, Travel Limit Parameter

Description:

Parameter P-0-0090 activates the travel limit switch. In addition, the inputs can be inverted (0V on E2/3 => Travel limit exceeded).

Parameter structure:

Bit 0 : Negation
- 0: E2/3 not inverted,
  24 V => travel range exceeded
- 1: E2/3 inverted,
  0 V => travel range is exceeded

Bit 1 : Activation
- 0: Travel range switch is not active
- 1: Travel range switch is active

Bit 2 : Response
- 0: Exceeded travel range is handled as error
- 1: Exceeded travel range is handled as warning

Fig. 3-17: P-0-0090, Travel limit parameter

Note: In addition, bit 1 activates monitoring of the external 24V current.

See also the functional description: "Transverse (travel) range limits."

P-0-0090 Attributes

ID number:	P-0-0090	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0097, Absolute Encoder Control Window

Description:

When absolute encoder monitoring is used, the switch command 3 > 4 compares the saved feedback value with the current feedback value of the axis.

If the difference is greater than what is set in parameter P-0-0097, error message **C224, Absolute feedback error** will be generated.

As a standard value, 0.1 motor rotations (= 36 degrees in reference to the motor shaft) can be given if the axis has a brake or is self-braking.

See also the functional description: "Absolute encoder monitoring."

P-0-0097 Attributes

ID number:	P-0-0097	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	0/S-0-0076		

P-0-0098, Maximum Model Deviation

Description:

The maximum model deviation is the maximum deviation between the real position feedback value and the model position feedback value calculated by the drive.

This parameter can be read out by the user to help set parameters for **S-0-0159, Monitoring window**.

Two cases must be distinguished for determining the model position feedback value.

1) Position control with following (lag) error

In this operating mode, the controlled system is simulated by a model.

The maximum deviation between the calculated position feedback module value and the real position feedback value is stored in parameter P-0-0098.

The control system model represents a delayed component of the first order, which is dependent only on the Kv factor of the position controller.

2) Position control without following (lag) error

In this operating mode, the position command value is compared to the position feedback value. The maximum deviation encountered is stored in P-0-0098.

A model for the controlled system is not necessary in this case.

See also the functional description: "Position loop monitoring."

P-0-0098 Attributes

ID number:	P-0-0098	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	0/S-0-0076		

P-0-0099, Position Command Smoothing Time Constant

Description:

The position command smoothing time constant determines the maximum jerk possible with a cyclical position command setting.

The maximum jerk is determined by:

$$\text{max. jerk} = \frac{\text{2nd derivative of the position command values}}{\textbf{P-0-0099 Position command value smoothing filter time constant}}$$

Fig. 3-18: Max. jerk

If no filter is activated, then P-0-0099 <= S-0-0001, NC cycle time must be set.

P-0-0099 Attributes

ID number:	P-0-0099	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	ms	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	0/65535		

P-0-0109 Torque/Force Peak Limitation

See the feature description: "Torque/force limitation."

P-0-0109 Attributes

ID number:	P-0-0109	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0086	**Combination check:**	no
Decimal places:	S-0-0086	**Cyc. transmittable:**	no
Input min/max:	0/0X8000		

P-0-0110, Parallel I/O Output 2

Description:

The control system can use this parameter to address the outputs of the DEA 4.1 I/O card.

See also the functional description: "Digital input/output."

P-0-0110 Attributes

ID number:	P-0-0110	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	MDT
Input min/max:	--/--		

P-0-0111, Parallel I/O Input 2

Description:

The input signals of DEA 5.1 are produced in this parameter.

See also the functional description: "Digital input/output."

P-0-0111 Attributes

ID number:	P-0-0111	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	AT
Input min/max:	--/--		

P-0-0112, Parallel I/O Output 3

Description:

The control system can use this parameter to address the outputs of the DEA 6.1 I/O card.

See also the functional description: "Digital input/output."

P-0-0112 Attributes

ID number:	P-0-0112	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	MDT
Input min/max:	--/--		

P-0-0113, Parallel I/O Input 3

Description:

The input signals of DEA 6.1 are produced in this parameter.

See also the functional description: "Digital input/output."

P-0-0113 - Attribute

ID number:	P-0-0113	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	BIN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	AT
Input min/max:	--/--		

P-0-0115, Analog Input 1

Description:

Two differential inputs are available to acquire measurement values in drive controller devices equipped with the additional plug-in module "Analog signal interface," DRF type.

The voltage for the differential input is converted with a 12-bit resolution and prepared in parameters **P-0-0115, Analog input 1** and **P-0-0116, Analog input 2**.
Note the following assignment:

Input voltage:	**Value:**
>= 10 V	2047
0 V	0
<= -10V	-2048

Fig. 3-19: Assignment table

These values are valid for the input amplification 1.
For higher input amplifications (2, 4, or 10), the voltage values are reduced correspondingly.

See also the functional description: "Analog inputs."

P-0-0115 Attributes

ID number:	P-0-0115	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	AT
Input min/max:	--/--		

P-0-0116, Analog Input 2

Description:

Two differential inputs are available to acquire measurement values in drive controller devices equipped with the additional plug-in module "Analog signal interface," DRF type.

The voltage for the differential input is converted with a 12-bit resolution and prepared in parameters **P-0-0115, Analog input 1** and **P-0-0116, Analog input 2**.

Note the following assignment:

Input voltage:	Value:
>= 10 V	2047
0 V	0
<= -10V	-2048

Fig. 3-20: Assignment table

These values are valid for the input amplification 1. For higher input amplifications (2, 4, or 10), the voltage values are reduced correspondingly.

See also the functional description: "Analog inputs."

P-0-0116 Attributes

ID number:	P-0-0116	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	AT
Input min/max:	--/--		

P-0-0117, NC Reaction in Error Situation

Description:

This parameter allows the NC 30 seconds to bring the drive controller to a coordinated deceleration in an error situation. The drive reacts with the preset **P-0-0119, Deceleration as best as possible**.

This feature works for non-fatal errors and interface errors.

Parameter structure:

Bit 0: Activation
- 0: instant control drive reaction to non-fatal errors with "best possible standstill"
- 1: reaction to non-fatal errors delayed 30 sec

Fig. 3-21: P-0-0117, NC reaction in error situation

See also the functional description: "NC response in error situation."

P-0-0117 Attributes

ID number:	P-0-0117	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

P-0-0118, Power Switch Off in Error Situation

Description:

If a Class 1 Diagnostic error is recognized, the drive reacts either with the preset **P-0-0119 Deceleration as best as possible** or, in the case of a fatal error, with an immediate switch to torque-free state. If this parameter is set to "1", then the X1.2 signal for the supply module will be removed. As a result, the signal and the DC bus voltage will be switched off on all other drives connected to the same supply module. These drives react with their **P-0-0119** preset **Deceleration as best as possible**.

Parameter structure:

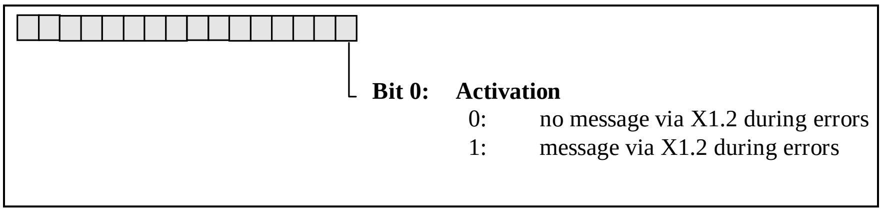

Fig. 3-22: P-0-0118, Power switch off in error situation

See also the functional description: "Power switch off in error situation."

P-0-0118 Attributes

ID number:	P-0-0118	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

P-0-0119, Deceleration as best as possible

Description:

This parameter specifies the type of braking to a standstill for the drive in the event of:

- a non-fatal error
- an interface error
- a phase relapse
- switching off the controller enable signal

P-0-0119:	Reaction mode:
0	Velocity command value set to zero, i.e., the motor brakes in regard to the torque limit value. The **Braking time** is set in parameter **P-0-0126**. 100 milliseconds before the brake time elapses, the blocking brake is activated. If the velocity has previously fallen below 10 rpm (rotational motors) or below 10 mm/min (linear motors), then the blocking brake will be engaged immediately. 100 milliseconds after the mechanical brake is set, the motor is torque free.
1	Switch to torque-free state
2	Velocity command value set to zero with command value slope and filter

Fig. 3-23: Deceleration mode for the drive

See also the feature description: "Deceleration as best as possible."

P-0-0119 Attributes

ID number:	P-0-0119	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

P-0-0121, Velocity-Mixfactor Feedback1 & Feedback2

Description:

The "Velocity-mixfactor" parameter determines the relation of the velocity feedback values between the motor encoder and the external encoder.

The input is percentage-based. Note the following:

0.0 %: The velocity controller works solely with the velocity of the motor encoder (= encoder 1)

100.0 %: The velocity controller works solely with the velocity of the external encoder (= encoder 2)

If no external encoder is available, then the parameter will be set to 0%.

See also the functional description: "Setting the velocity mix factor."

P-0-0121 Attributes

ID number:	P-0-0121	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	%	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	0/100,0		

P-0-0123, Absolute Encoder Buffer

Description:

All the data that the absolute encoder needs for position initialization is stored in this parameter.

P-0-0123 Attributes

ID number:	P-0-0123	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2-byte variable	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0124, Assignment IDN -> DEA Output

Description:

This parameter is used to assign a parameter value to a DEA output.
If the data capacity of the assigned parameter is greater than that of the DEA port, then the higher-valued bits will be truncated.

Parameter structure:

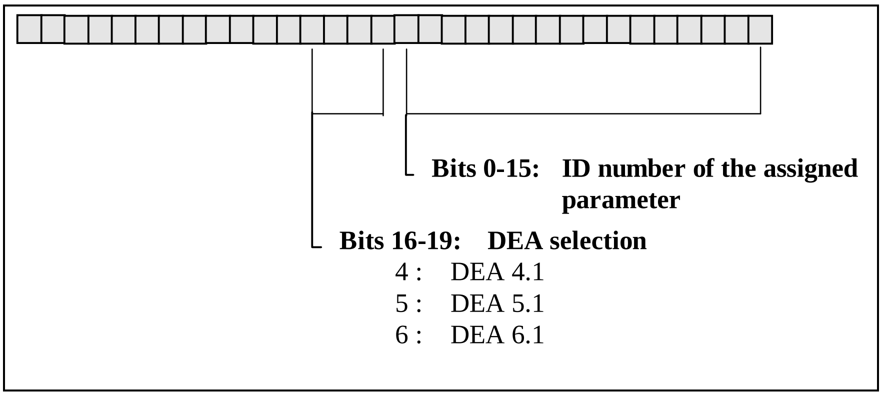

Fig. 3-24: P-0-0124, Assignment ID number > DEA output

The contents of the parameter are written to the DEA output.

Note: If an ID number is assigned to DEA 4.1, then parameter **P-0-0081, Parallel output 1** can no longer be used.

The same restriction applies to:

- Assignment DEA 5.1 <> **P-0-0110, Parallel output 2**
- Assignment DEA 6.1 <> **P-0-0112, Parallel output 3**

See also the functional description: "Digital input/output."

P-0-0124 Attributes

ID number:	P-0-0124	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0125, Assignment DEA Input -> IDN

Description:

This parameter can be used to assign a DEA input to the value of a parameter.

The input status of the DEA is written in the corresponding parameter.

Parameter structure:

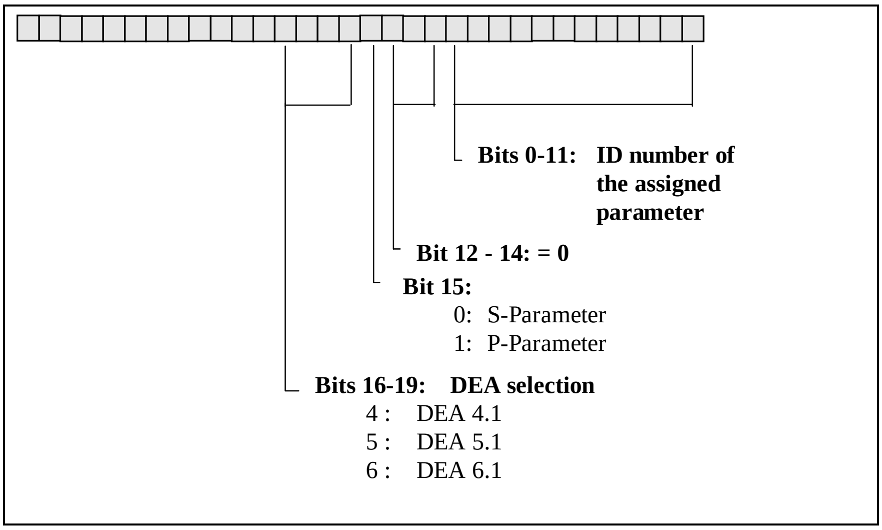

Fig. 3-25: P-0-0125, Assignment DEA input > ID number

Note: If a DEA is assigned an ID number using parameter P-0-0125, then the operating data of the assigned ID number will be cyclically overwritten by the DEA input.

See also the functional description: "Digital input/output."

P-0-0125 Attributes

ID number:	P-0-0125	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0126, Maximum Braking Time

Description:

The maximum braking time for the drive is set in this parameter.

The value should always be set higher then the time needed, considering the maximum possible velocity, to decelerate the shaft using velocity command value zero-switching.

The velocity command value is switched to zero if **P-0-0119 Deceleration as best as possible** is set to "0" and either:

- The controller enable (RF) is removed,
- The drive is switched to Set parameter mode with RF switched on,
- A drive error is recognized that still allows a reaction from the drive (all non-fatal errors),
- In the case of separately supplied devices (DDS), a drive connected to the same supply module reports an error to that module, so that the intermediate voltage is switched off.

See also the functional description: "Velocity command value zero-switch."

P-0-0126 Attributes

ID number:	P-0-0126	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	ms	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	500/100000		

P-0-0127, Overload Warning

Description:

To protect the final stage, the temperature is calculated with a temperature model for the transistor final stage. If the temperature exceeds 125°C, then the torque-producing command current will be limited.

To avoid an unexpected disruption of the torque from the drive, a warning threshold can be set in this parameter.

If the thermal load rises above the set value, warning **E2-58, Continuous current limitation early warning** will be generated.

If 100% is entered, this warning will be deactivated since then the message **E2-57, Continuous current limitation active** will be generated.

See also the functional description: "Monitoring the thermal load."

P-0-0127 Attributes

ID number:	P-0-0127	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	%	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/100		

P-0-0141, Thermal Drive Load

See the feature description: "Checking the thermal load."

P-0-0141 Attributes

ID number:	P-0-0141	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	Percent	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/100.0		

P-0-0145, Expand Trigger Edge

(For service purposes only)

Description:

If bit 12, Expanded trigger level is selected using parameter **P-0-0026, Trigger signal select**, then an address can be selected with parameter P-0-0145 that is monitored for the threshold parameter value.

Parameter structure:

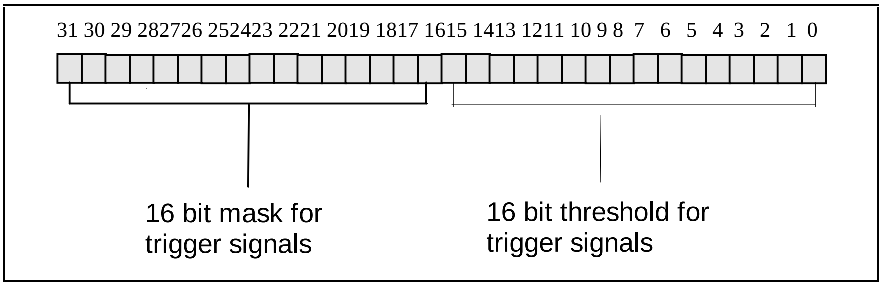

Fig. 3-26: P-0-0145, Expanded trigger edge (oscilloscope function)

See also the functional description: "Oscilloscope function."

P-0-0145 Attributes

ID number:	P-0-0145	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0146, Expand Trigger Address

(For service purposes only)

Description:

If bit 12 Expanded trigger level is selected in using parameter **P-0-0026, Trigger signal select**, then an address can be selected with parameter P-0-0146 that is monitored for the threshold parameter value.

Parameter structure:

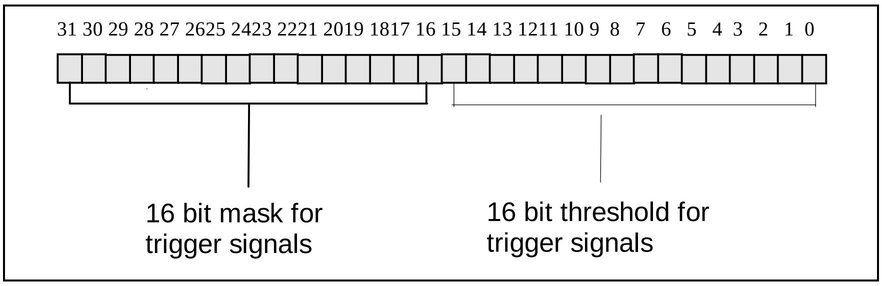

Fig. 3-27: P-0-0146, Expand trigger address

The 16-bit value of the trigger edge is monitored, and the trigger signal will have been previous ANDed via the mask for trigger signals.

See also the functional description: "Oscilloscope function."

P-0-0146 Attributes

ID number:	P-0-0146	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0147, Expanded Signal K1 Address

Description:

If an expanded signal selection is made with parameters **P-0-0023, Signal select channel 1** and **P-0-0024, Signal select channel 2**, then an address to be recorded can be chosen in the drive with parameter P-0-0147.

See also the functional description: "Oscilloscope function."

P-0-0147 Attributes

ID number:	P-0-0147	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0148, Expanded Signal K2 Address

Description:

If an expanded signal selection is chosen with parameters **P-0-0023, Signal select channel 1** and **P-0-0024, Signal select channel 2**, then an address to be recorded can be chosen in the drive with parameter P-0-0148.

See also the functional description: "Oscilloscope function."

P-0-0148 Attributes

ID number:	P-0-0148	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0149, List of Valid Samples for Oscilloscope Function

Description:

The control system can read drive-supported, defined signals with parameter P-0-0149.

List entries:	ID number of:
1	S-0-0051 or S-0-0053
2	S-0-0040
3	S-0-0347
4	S-0-0189
5	S-0-0080
6	P-0-0147
7	P-0-0148

Fig. 3-28: P-0-0149, List of valid samples for oscilloscope function

See also the functional description: "Oscilloscope function."

P-0-0149 Attributes

ID number:	P-0-0149	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes variable	**Validity check:**	no
Format:	IDN	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0150, Number of Valid Samples for Oscilloscope Function

Description:

Parameter P-0-0150 indicates the number of measured values in the samples list.

See also the functional description: "Oscilloscope function."

P-0-0150 Attributes

ID number:	P-0-0150	**Editability:**	no
Function:	Parameter	**Memory:**	fixed
Data length:	2 bytes variable	**Validity check:**	no
Format:	DEC_0V	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/512		

P-0-0153, Optimal Distance Home Switch - Reference Mark

Description:

During command "**Drive-controlled homing**" when the zero-switch and homing mark evaluation are activated, the distance between the zero-switch edge and the homing mark is monitored. For reference marks (home reference) with equal intervals, the optimal distance is half the home-reference interval. The optimal distance can be entered in parameter P-0-0153, Optimal distance home switch - reference mark as per the following table:

Encoder type	P-0-0153, Optimal distance homing switch - home mark	Function
Rotational	0	The zero-switch - reference mark interval is monitored. The optimal distance will be calculated internally, and is equal to 1/2 of an encoder revolution for DSF or incr. rotary encoders, or 1/2 of an encoder revolution / **S-0-0116, Rotary encoder resolution - 1** for resolvers.
Rotational	x	The zero-switch - reference mark interval is monitored. Half the reference mark distance must be entered in **P-0-0153, Optimal distance zero-switch - reference mark**.
Linear	0	The zero-switch - reference mark interval is not monitored. The linear encoder does not affect reference marks with constant intervals. The real distance between the zero-switch and the reference mark must be large enough to ensure recognition of the zero-switch edge, taking into account the maximum homing velocity and the cycle time for the zero-switch input request.
Linear	x	The zero-switch - reference mark interval is monitored. Half the reference mark distance must be entered in **P-0-0153, Optimal distance zero-switch - reference mark**.

Fig. 3-29: Interval monitoring, home switch - reference mark

See also the functional description: "Drive-controlled homing."

P-0-0153 Attributes

ID number:	P-0-0153	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_0V	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0200, Signal Select Probe 1

Description:

This parameter is used to select what measured quantity will be used for probe input 2.

The following signals can be selected:

P-0-0200:	Selected signal:
0	Position feedback value 1 or 2, dependent on: **S-0-0169, Probe control parameter** bit 4
1	Time measurement in us

Fig. 3-30: P-0-0200, Measurement value for probe input 2

See also the functional description: "Probe feature."

P-0-0200 Attributes

ID number:	P-0-0200	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

P-0-0201, Signal select probe 2

Description:

This parameter is used to select what measured quantity will be used for probe input 2.

The following signals can be selected:

P-0-0201:	Selected signal:
0	Position feedback value 1 or 2, dependent on: **S-0-0169, Probe control parameter** bit 4
1	Time measurement in us

Fig. 3-31: P-0-0201, Measurement quantity for the probe input 2

See also the functional description: "Probe feature."

P-0-0201 Attributes

ID number:	P-0-0201	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

P-0-0202, Difference Probe Values 1

Description:

The difference between the positive probe value and the negative probe value of probe 1 is stored in this parameter. The value is always recalculated when a new positive or negative probe value is latched.

See also the functional description: "Probe feature."

P-0-0202 Attributes

ID number:	P-0-0202	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	--/--		

P-0-0203, Difference Probe Values 2

Description:

The difference between the positive probe value and the negative probe value of probe 2 is stored in this parameter. The value is always recalculated when a new positive or negative probe value is latched.

See also the functional description: "Probe feature."

P-0-0203 Attributes

ID number:	P-0-0203	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	AT
Input min/max:	--/--		

P-0-0400 Pos. corr., Correction Value External

Description:

The control system can use parameter **P-0-0400, Pos. corr., correction value external** to assign correction values directly for the encoder specified by **S-0-0147 Homing parameter**. The correction value set in the parameter will be added to the appropriate actual feedback value.

See also the functional description: "Axis error correction."

P-0-0400 Attributes

ID number:	P-0-0400	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	MDT
Input min/max:	S-0-0076/S-0-0076		

P-0-0401 Pos. corr., Correction Value Active

Description:

Parameter **P-0-0401, Pos. corr., correction value active** indicates the correction value used to correct the encoder defined with **S-0-0147 Homing parameter**. It contains the sum of the correction values from the various correction functions.

See also the functional description: "Axis error correction."

P-0-0401 Attributes

ID number:	P-0-0401	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0402, Pos. corr., Reference Temperature

Description:

Parameter **P-0-0402, Pos. corr., reference temperature** is required for temperature-dependent correction functions. It defines the temperature reference point for determining the portion of the correction value that is temperature-dependent.

See also the functional description: "Axis error correction."

P-0-0402 Attributes

ID number:	P-0-0402	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	°C	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	-20,00/+200,00		

P-0-0403, Pos. corr., Reference Position for Temperature Correction

Description:

Parameter **P-0-0403, Pos. corr., reference position for temperature correction** defines the position at which the correction value for position-dependent temperature correction is zero. It can be determined by measurement of the axis.

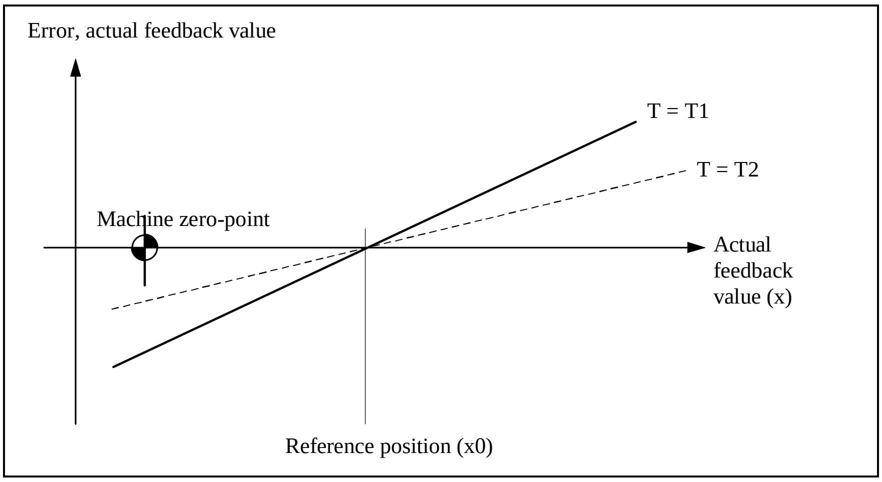

Fig. 3-32: Definition of the reference position

See also the functional description: "Axis error correction."

P-0-0403 Attributes

ID number:	P-0-0403	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0404, Pos. corr., Actual Temperature Position Dependent

Description:

If position-dependent correction has been selected, parameter **P-0-0404, Pos. corr., actual temperature position dependent** defines the current temperature of the hardware to be corrected. It must be transmitted to the drive by the control system.

See also the functional description: "Axis error correction."

P-0-0404 Attributes

ID number:	P-0-0404	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	°C	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0405, Pos. corr., Aktual Temperature Position Independent

Description:

If position-independent correction has been selected, parameter **P-0-0405, Pos. corr., temperature position independence** defines the current temperature of the hardware to be corrected. It must be transmitted to the drive by the control system.

See also the functional description: "Axis error correction."

P-0-0405 Attributes

ID number:	P-0-0405	**Editability:**	P234
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	yes
Unit:	°C	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	-20.0/+200.0		

P-0-0406, Pos. corr., Temperature Position Dependent

Description:

Parameter **P-0-0406, Pos. corr., temperature position dependent** defines the coefficient of linear expansion of the hardware to be corrected with a position-dependent correction function. It can be derived from standard reference tables or direct measurement.

See also the functional description: "Axis error correction."

P-0-0406 Attributes

ID number:	P-0-0406	**Editability:**	P234no
Function:	Parameter	**Memory:**	Prog. module
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	1/K	**Combination check:**	no
Decimal places:	5	**Cyc. transmittable:**	no
Input min/max:	0.00000/0.65535		

P-0-0407, Pos. corr., Temperature Position Independent (0.1/K)

Description:

Parameter **P-0-0407, Pos. corr., temperature position independent (0.1/K)** defines the coefficient of linear expansion for the hardware to be corrected with position-independent correction function. In specifying the coefficient, the length of the hardware to be corrected must be taken into account.

Formula:

$$\alpha^* = \alpha \times l(T0)$$

$\alpha^* =$ Length-dependent coefficient of temperature

$\alpha =$ Coefficient of linear expansion

$l =$ Length of the hardware to be corrected

$T0 =$ Reference temperature

Fig. 3-33: Calculating the temperature coefficient

See also the functional description: "Axis error correction."

P-0-0407 Attributes

ID number:	P-0-0407	**Editability:**	P234
Function:	Parameter	**Memory:**	Prog. module
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	-1.0/+1.0		

P-0-0408, Pos. corr., Precision corr. start pos.

Description:

The precision correction function is for use in extremely accurate applications. It consists of a table of correction values which are assigned to specific positions of the encoder. Parameter **P-0-0408, Pos. corr., precision corr. start pos.**, defines the start position of the correction table. It is the smallest position in the correction range.

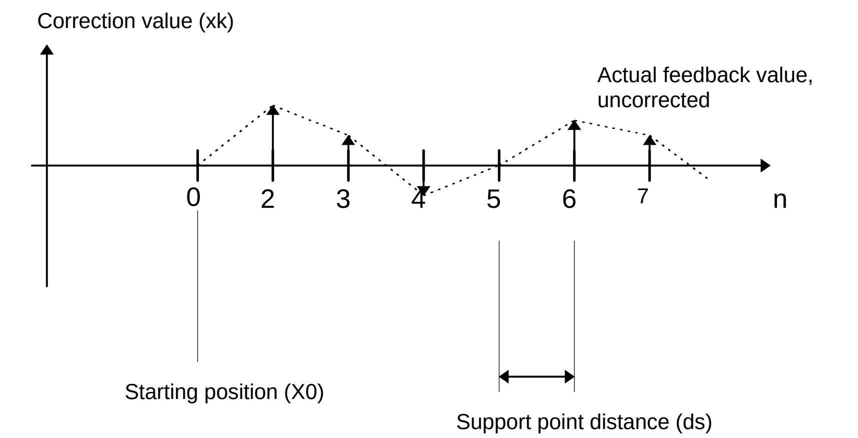

Fig. 3-34: Graphic representation of start position and distance between support point.

See also the functional description: "Axis error correction."

P-0-0408 Attributes

ID number:	P-0-0408	**Editability:**	P234
Function:	Parameter	**Memory:**	Prog. module
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0409, Pos. corr., Correction Table for Precision corr.

Description:

For highly accurate applications, correction values for the encoder are determined by measuring the axis. These correction values are stored in parameter **P-0-0409, Pos. corr., correction table for precision corr.**. 500 correction values can be stored for motion in each direction. The first 500 correction values are reserved for motion in the positive direction, and the second 500 are reserved for motion in the negative direction.

A correction value is defined as a 2-byte unit of data, which limits input values to ±2^15 in the selected direction of motion.

The difference between two adjacent correction values must not be greater than the value of parameter **P-0-0410, Pos. corr., support point distance for precision corr.**.

To avoid excessive leaps in feedback values, the first and last correction value in each direction must be defined as 0. All 1000 correction values must always be written. Support points which are not needed can be set to 0.

The table is composed as follows:

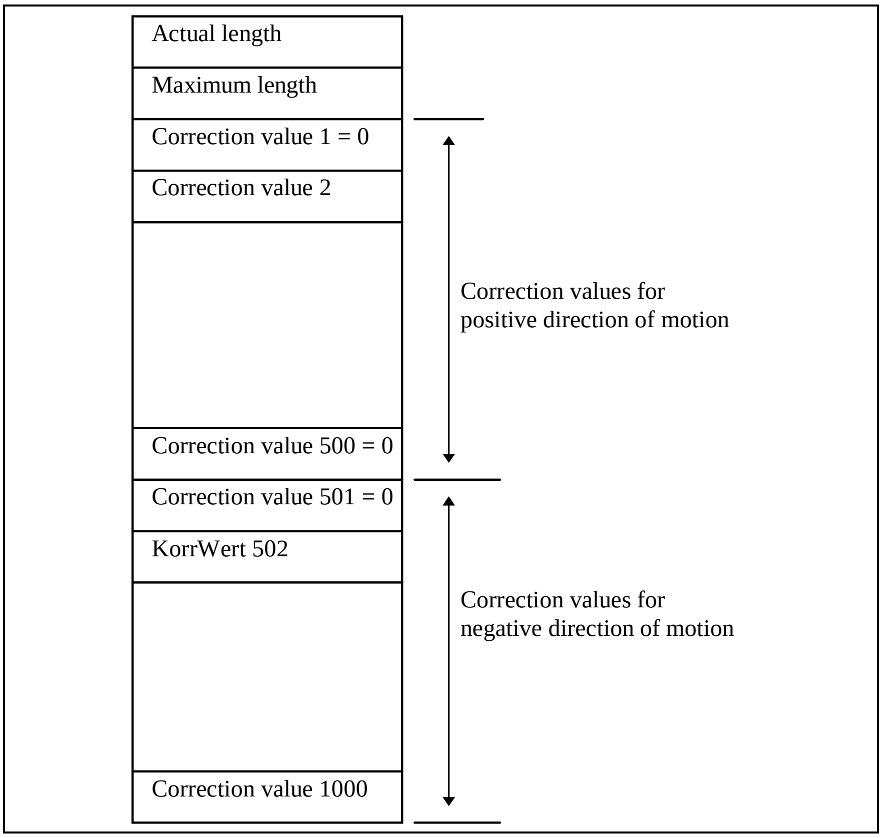

Fig. 3-35: Structure of the correction table

See also the functional description: "Axis error correction."

P-0-0409 Attributes

ID number:	P-0-0409	**Editability:**	P234
Function:	Parameter	**Memory:**	Prog. module
Data length:	2-byte variable	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	-3.2767/+3.2767		

P-0-0410, Pos. corr., Support Point Distance for Precision corr.

Description:

Parameter **P-0-0410, Pos. corr., support point distance for precision corr.**, defines the distance between two adjacent correction values.

It is constant for the entire correction range (=start position + 499*support point distance), depending on **P-0-0408, Pos. corr., precision corr. start pos.**, and defines the positions for which correction values in the table must be determined.

See also the functional description: "Axis error correction."

P-0-0410 Attributes

ID number:	P-0-0410	**Editability:**	P234
Function:	Parameter	**Memory:**	Prog. module
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	S-0-0076	**Combination check:**	no
Decimal places:	S-0-0076	**Cyc. transmittable:**	no
Input min/max:	S-0-0076/S-0-0076		

P-0-0508, Commutator Offset

Description:

For synchronous motors, this parameter indicates the offset between the raw value of the motor encoder and the resulting absolute electrical angle between the stator current vector and the rotor flux vector.

For motors with motor feedback data memory, the commutator offset is stored in memory and therefore does not need to be entered.

For linear synchronous motors, this value must always be redetermined if:

- The motor probe system encounters a change in its mechanical structure.
- A mechanical restructuring of primary and secondary portions is takes place.

See also the functional description: "Synchronous/asynchronous."

P-0-0508 Attributes

ID number:	P-0-0508	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/65535		

P-0-0509, Slot Angle

Description:

This parameter is not currently available for use.

P-0-0509 Attributes

ID number:	P-0-0509	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_MV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0510, Moments of Inertia of the Rotor

Description:

This parameter indicates the moment of inertia for the rotor, and is saved in the feedback for motors with feedback memory.

P-0-0510 Attributes

ID number:	P-0-0510	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	kgm²	**Combination check:**	no
Decimal places:	5	**Cyc. transmittable:**	no
Input min/max:	1/10000000		

P-0-0511, Break Current

Description:

The brake current is monitored by the drive controller if the motor is equipped with a blocking brake and a value other than 0 is entered in this parameter. If the brake current lies outside the range 0.7 . . . 1.3 * P-0-0511, then error message **F268, Brake error** will be generated.

See also the functional description: "Motor brake."

P-0-0511 Attributes

ID number:	P-0-0511	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	0/500.000		

P-0-0513, Feedbacktyp

Description:

This value is available for all measuring systems with feedback data memory. It describes important properties of the measuring system, in addition to encoder resolution. The coding of the parameter is set by the manufacturer of the drive or encoder.

The parameter cannot be written to (read only), and serves merely to provide information about the contacted feedback.

Measurement systems with feedback data memory are contacted via the following encoder interfaces:

- 1 Standard
- 4 DFF 1
- 8 DAG 2

P-0-0513 Attributes

ID number:	P-0-0513	**Editability:**	no
Function:	Parameter	**Memory:**	Feedb.-
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0514, Absolute Encoder Offset

Description:

This parameter is used for position initialization of absolute encoders that contain feedback data memory and are not defined as modulo axes.

P-0-0514 cannot be written to (read only).

P-0-0514 Attributes

ID number:	P-0-0514	**Editability:**	no
Function:	Parameter	**Memory:**	Feedb.-
Data length:	4 bytes	**Validity check:**	no
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-0518, Amplifier Nominal Current 2

Description:

This parameter specifies the maximum nominal current of the amplifier at reduced peak current.

It specifies the length of the peak current characteristics line for the peak current limit of the amplifier. Specifications are made with parameters **S-0-0110, Amplifier peak current, S-0-0112, Amplifier nominal current** and **P-0-0519, Amplifier peak current 2**.

No value can be entered since it is permanently programmed within the amplifier.

P-0-0518 Attributes

ID number:	P-0-0518	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	0/500000		

P-0-0519, Amplifier Peak Current 2

Description:

The drive allows you to define a changed continuous peak current characteristic line with reduced amplifier peak current, and therefore an increased amplifier continuous current.

Parameter P-0-0519 specifies an amplifier peak current for this case.

It determines the working points on the peak current characteristic line.

No value for this parameter can be entered, since it is permanently programmed in the amplifier.

P-0-0519 Attributes

ID number:	P-0-0519	**Editability:**	no
Function:	Parameter	**Memory:**	Ampl.
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	0/500000		

P-0-0525, Type of Motor Brake

Description:

This parameter specifies whether a self-stopping or self-ventilating brake is being used. If an **MDD** or **MDK** motor is used, then the brake will be self-stopping, if there is a brake. The parameter will be set automatically to 0. If other motor types are used, this parameter must be entered during the startup procedure.

See also the functional description: "Motor brake."

P-0-0525 Attributes

ID number:	P-0-0525	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1		

P-0-0526, Brake Control Delay

Description:

If a holding brake is being used, the time delay between the start of the brake and when it becomes effective must be set in this parameter. This value is entered automatically when **MDD** or **MKD** motors are used. If Indramat brakes are used in conjunction with asynchronous motors, then the standard value to be entered is 100 ms.

See also the functional description: "Motor brake."

P-0-0526 Attributes

ID number:	P-0-0526	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	ms	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/65000		

P-0-0530, Slip Increase

Description:

In asynchronous motors, the rotor resistance and the rotor time constant change with the temperature. The slip increase compensates for this change.

The slip increase per 100K is motor-specific and is specified by Indramat for each individual motor.

See also the functional description: "Asynchronous motors."

P-0-0530 Attributes

ID number:	P-0-0530	**Editability:**	P23
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	1/100K	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	1/3		

P-0-0531, Kipp Current Border

Description:

The kipp current border is used to limit the peak current of the motor to reasonable values when operating at high velocities. Higher currents lead only to higher losses, not to more wave power.

The kipp current border is set by Indramat. If zero is entered, the limit is inactive.

See also the functional description: "Asynchronous motors."

P-0-0531 Attributes

ID number:	P-0-0531	**Editability:**	P234
Function:	Parameter	**Memory:**	Program
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A/Vmin	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/MaxULong		

P-0-0532, Scaling Factor, Pre-Magnetizing

Description:

The pre-magnetizing factor is used for application-dependent decreases in the Servo magnetization current. Together with parameter **P-0-4004, Magnetization current**, it specifies the motor's magnetization current.

Effective magnetization current = magnetization current * pre-magnetization scaling factor

With a pre-magnetizing factor of 100%, the Servo magnetization current in the motor will flow so that a torque proportional to the momentum-producing current will result in the basic rotation range.

See also the functional description: "Scaling factor, pre-magnetizing."

P-0-0532 Attributes

ID number:	P-0-0532	**Editability:**	P234
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	%	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	25/100		

P-0-0533, Flux Loop Proportional Gain

Description:

The flux loop controls the magnetization current in the field-weakening range.

The parameter value is set by Indramat.

See also the functional description: "Asynchronous motors."

P-0-0533 Attributes

ID number:	P-0-0533	**Editability:**	P234
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A/V	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	0/MaxUInt		

P-0-0534, Flux Loop Integral Action Time

Description:

The flux loop controls the magnetization current in the field-weakening range.

The parameter value is set by Indramat.

See also the functional description: "Asynchronous motors."

P-0-0534 Attributes

ID number:	P-0-0534	**Editability:**	P234
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	ms	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	0/MaxUInt		

P-0-0535, Motor Voltage No Load

Description:

The motor voltage in the field-weakening range is set so that it reaches a value lower than the DC bus voltage.

Under load, the motor voltage will be raised to the maximum motor voltage.

See also the functional description: "Asynchronous motors."

P-0-0535 Attributes

ID number:	P-0-0535	**Editability:**	P234
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	%Uzwk	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	50/100		

P-0-0536, Motor Voltage Maximum

Description:

The motor voltage in the field-weakening range is set so that it reaches a value lower than the DC bus voltage.

During full load, the motor voltage will rise to the maximum motor voltage. The output voltage will be sinusoidal up to a value of 90%.

See also the functional description: "Asynchronous motors."

P-0-0536 Attributes

ID number:	P-0-0536	**Editability:**	P234
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	%Uzwk	**Combination check:**	no
Decimal places:	1	**Cyc. transmittable:**	no
Input min/max:	50/100		

P-0-0537, S1 Kink Speed

Description:

Starting with the S1 kink speed, core losses result in.. This motor-specific velocity determined by Indramat is only useful for the "S1 operating mode." From this velocity on, the field quickly weakens so as to keep the motor temperature low.

See also the functional description: "Asynchronous motors."

P-0-0537 Attributes

ID number:	P-0-0537	**Editability:**	P2
Function:	Parameter	**Memory:**	Program
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	1/min	**Combination check:**	no
Decimal places:	4	**Cyc. transmittable:**	no
Input min/max:	0/MaxULong		

P-0-0538, Motor Function Parameter 1

Description:

Bit 0: 1 = Function "S1 Operation active

See also the functional description: "Motor function parameter 1."

P-0-0538 Attributes

ID number:	P-0-0538	**Editability:**	P2
Function:	Parameter	**Memory:**	Program
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	BIN	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-1201, Ramp 1 Pitch

Description:

Parameter **P-0-1201, Ramp 1 pitch**, takes effect in "Velocity control" operating mode and during execution of error response "Velocity command value, zero-switch with pitch and filter".

The acceleration and delay entered here are used to create a pitch starting from the last effective command value to the new command value.

In "Velocity control" operating mode, the resulting velocity command value is derived from the sum of the value resulting from the pitch function in **S-0-0036, Velocity command value** and the direct value in **S-0-0037, Additive velocity command value**.

When error response "Velocity command value, zero-switch with pitch and filter" is executed, velocity proceeds from the current feedback velocity to 0, using the effective velocity command value with the delay specified by the parameter in **P-0-1201, Ramp pitch**.

See also the functional description: "Velocity command value zero-switch with filter and pitch."

P-0-1201 Attributes

ID number:	P-0-1201	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	S-0-0160	**Combination check:**	no
Decimal places:	S-0-0160	**Cyc. transmittable:**	no
Input min/max:	0/S-0-0160		

P-0-1222, Command Value Smoothing Time Constant

Description:

Parameter **P-0-1222, Command value smoothing time constant** works in "Velocity control" operating mode and in response to the error "Velocity command value zero-switch with slope and filter."

The time constant entered here is used in velocity control operating mode to pass the value in **S-0-0036, Velocity command value** which has been pitched by **P-0-1201, Ramp 1 pitch**, through a deep-pass filter.

This serves to diminish surges in acceleration over the course of command values.

The resulting velocity command value results from the sum of the sloped and filtered value in **S-0-0036, Velocity command value** and the direct value in **S-0-0037, Additive velocity command value**.

When error response "Velocity command value, zero-switch with pitch and filter" is executed, velocity proceeds from the current feedback velocity to 0, using the effective velocity command value with the delay specified by the parameter in **P-0-1201, Ramp pitch**. It is also passes through the deep pass filter specified by **P-0-1222, Command value smoothing time constant**.

See also the functional description: "Velocity command value zero-switch with filter and pitch."

P-0-1222 Attributes

ID number:	P-0-1222	**Editability:**	no
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	msec	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/MaxTSmoothing		

P-0-4000, Current Zero-Trim Phase U

Description:

This parameter serves to display the determined result of the zero-trim procedure for the current feedback sensor of phase U.

P-0-4000 Attributes

ID number:	P-0-4000	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	%	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	0/10000		

P-0-4001, Current Zero-Trim Phase V

Description:

This parameter serves to display the determined result of the zero-trim procedure for the current feedback sensor of phase V.

P-0-4001 Attributes

ID number:	P-0-4001	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	2 bytes	**Validity check:**	no
Format:	DEC_MV	**Extreme value check:**	no
Unit:	%	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	0/10000		

P-0-4002, Current Amplify Trim Phase U

Description:

This parameter is set in the test field of DDS X.2 devices to adjust the current sensor in relation to its amplifier error.

For DKR devices, the default value 1.3333 is entered here. The adjustment is made with a potentiometer on the RSK circuit board.

P-0-4002 Attributes

ID number:	P-0-4002	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	4	**Cyc. transmittable:**	no
Input min/max:	0/65535		

P-0-4003, Current Amplify Trim Phase V

Description:

This parameter is set in the test field of DDS X.2 devices to adjust the current sensor in relation to its amplifier error.

For DKR devices, the default value 1.3333 is entered here. The adjustment is made with a potentiometer on the RSK circuit board.

P-0-4003 Attributes

ID number:	P-0-4003	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	4	**Cyc. transmittable:**	no
Input min/max:	0/65535		

P-0-4004, Magnetizing Current

Description:

This parameter indicates the nominal or servo-magnetization current set by Indramat for asynchronous motors. The magnetizing current actually flowing is also dependent on the premagnetization scaling factor.

For synchronous motors, this parameter is automatically set to 0.

See also the functional description: "Asynchronous motors."

P-0-4004 Attributes

ID number:	P-0-4004	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A	**Combination check:**	no
Decimal places:	4	**Cyc. transmittable:**	no
Input min/max:	0/400000		

P-0-4011, Switchfrequenz

Description:

This parameter is used to set the switch frequency of the pulse switching controller to 4, 8 or 16 kHz.

For DDS X.2, only 4 kHz is possible at this time.

For DKR, 4 and 8 kHz can be set.

See also the functional description: "Setting the effective continuous current."

P-0-4011 Attributes

ID number:	P-0-4011	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	kHz	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	**no**
Input min/max:	4/8		

P-0-4012, Slip Faktor

Description:

The slip factor is the most important parameter for asynchronous motors. It indicates the rotor frequency in relation to the torque-producing current. The lower the rotor time constant is, the higher the slip factor.

This parameter is set motor-specifically by Indramat.

See also the functional description: "Asynchronous motors."

P-0-4012 Attributes

ID number:	P-0-4012	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	Hz/100A	**Combination check:**	no
Decimal places:	2	**Cyc. transmittable:**	no
Input min/max:	1/5000		

P-0-4014, Motor Type

Description:

The motor type can be selected with this parameter.

- 1: MDD
- 2: 2AD / 1MB
- 3: LSF
- 4: LAR / LAF
- 5: MKD

See also the functional description: "Setting the motor type with P-0-4014, Motor type."

P-0-4014 Attributes

ID number:	P-0-4014	**Editability:**	P23
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	1/5		

P-0-4015, Circle Voltage

Description:

The DC bus voltage is stored in the amplifier as a parameter.

The parameter cannot be edited and can be used only for display and internal calculations.

P-0-4015 Attributes

ID number:	P-0-4015	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	2 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	V	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	0/1000		

P-0-4028, Impulse Wire Feedback - Offset

Description:

The offset of the impulse wires to the resolver feedback is set in this parameter.

It is set before the product is delivered to you and stored in feedback memory.

P-0-4028 Attributes

ID number:	P-0-4028	**Editability:**	no
Function:	Parameter	**Memory:**	Feedb.-
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-4029, Impulse Wire Feedback - PIC Counter Value

Description:

This parameter contains the information for the absolute position of the encoder.

The value is updated at each position initialization. The value is read-only (cannot be edited).

P-0-4029 Attributes

ID number:	P-0-4029	**Editability:**	no
Function:	Parameter	**Memory:**	Feedb.-
Data length:	4 bytes	**Validity check:**	no
Format:	HEX	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-4035, Trim Current

Description:

This parameter is used to adjust the current measurement amplification and cannot be changed.

P-0-4035 Attributes

ID number:	P-0-4035	**Editability:**	no
Function:	Parameter	**Memory:**	Amplf.
Data length:	4 bytes	**Validity check:**	Phase 3
Format:	DEC_OV	**Extreme value check:**	yes
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	0/500000		

P-0-4036, Contacted Motor Type

Description:

The value of parameter **S-0-0141, Motor type** is stored in this parameter every time the "Basic load" function is executed.

Every time the controller is turned on, the value of parameter **S-0-0141** from the motor feedback data memory is compared to P-0-4036. If the data differ, then a different motor has been contacted. The message "UL" will then appear on the SS display. By pressing "S1", the default control parameters of the new motor will be activated.

This feature is relevant only for motors with motor feedback data memory, such as MDD or MKD motors.

See also the functional description: "Automatic execution of the basic load function."

P-0-4036 Attributes

ID number:	P-0-4036	**Editability:**	P234
Function:	Parameter	**Memory:**	Param.E²prom
Data length:	1-byte variable	**Validity check:**	Phase 3
Format:	ASCII	**Extreme value check:**	no
Unit:	--	**Combination check:**	no
Decimal places:	0	**Cyc. transmittable:**	no
Input min/max:	--/--		

P-0-4045, Aktiv duration Current

Description:

This value is used to display the continuous current that has been set. The device is not overloaded with this current. It is also the current to which the current limit reduces.

See also the functional description: "Setting the effective continuous current."

P-0-4045 Attributes

ID number:	P-0-4045	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	not
Format:	DEC_OV	**Extreme value check:**	no
Unit:	A/A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	0/500000		

P-0-4046, Aktiv Peak Current

Description:

The effective peak current parameter P-0-4046 indicates the maximum current that the amplifier can currently deliver. This value is limited by the current limiter. Additional factors are:

- **S-0-0092, Bipolar torque limit value**
- **S-0-0109, Peak motor current**

See also the functional description: "Setting the effective peak current."

P-0-4046 Attributes

ID number:	P-0-4046	**Editability:**	no
Function:	Parameter	**Memory:**	no
Data length:	4 bytes	**Validity check:**	not
Format:	DEC_OV	**Extreme value check:**	no
Unit:	A	**Combination check:**	no
Decimal places:	3	**Cyc. transmittable:**	no
Input min/max:	0/500000		

4 Index

V

DIAX03
Drive With
Servo Function

Supplement B
Diagnostic Message Description
SSE-01VRS

DOK-DIAX03-SSE-01VRS**-FKB1-EN-P • 09.96

Contents

1 Description of Diagnostic Messages

1.1 Error Diagnostic Messages

F207 Switching to uninitialized operating mode

Cause:

At least one of the 4 operating mode parameters **S-0-0032..35** is set to "0". When the drive controller is activated, this operating mode can be selected via bits 8 and 9 in the master control word.

Remedy:

Enter the desired operating mode in the activated operating mode parameter.

Permissible operating modes:

Meaning:	Bit list of the operating mode parameters:
Torque control	0000 0000 0000 0001
Velocity control	0000 0000 0000 0010
Position control with actual feedback value 1	0000 0000 0000 x011
Position control with actual position value 2	0000 0000 0000 x100
Drive-controlled interpolation with actual feedback value 1	0000 0000 0001 x011
Drive-controlled interpolation with actual feedback value 2	0000 0000 0001 x100

Tab. 1-1: Operating modes

Parameters:	Main operating mode	S-0-0032
	Secondary operation mode 1	S-0-0033
	Secondary operation mode 2	S-0-0034
	Secondary operation mode 3	S-0-0035

Check these parameters for input of permissible interpolation type.

See also the functional description: "Setting operating mode parameters."

F207 Attributes

SS Display:	F2/07
Error number:	207
Diagnostic message number:	F207
Error class:	Non-fatal

F208 Motor Type Has Changed

See also the functional description: "Automatic execution of the load default feature."

F208 Attributes

SS Display:	UL
Error number:	208
Diagnostic message number:	F208
Error class:	Non-fatal

F219 Motor Overtemperature Shutdown

If the motor temperature exceeds the value in **S-0-0204, Motor shutdown temperature**, the drive will generate this error message. The value in **S-0-0204** is fixed at 150°C for MDD and MKD motors. The appropriate value must be entered from the motor's technical specifications for all other types of motors.

For motors of series: 2AD, 1MB, LAF, LAR, and MBW, the current motor temperature can be called up with parameter **S-0-0383, Motor temperature**.

Cause:

1. The motor became overloaded. The effective torque demand on the motor was above its permissible continuous torque level for too long.
2. Short circuit or ground in the connection to motor temperature monitoring.
3. Instability in the velocity control loop.

Remedy:

For 1. Check the layout of the motor. For motors which have been in operation for longer periods of time, check to see if the operating conditions have changed (in regards to cleanliness, friction, moved components, etc.).

For 2. Check the wiring to the motor temperature monitor X6/1 and X6/2 for grounds and short circuits.

For 3. Check the velocity control loop parameters (see the functional description).

See also the functional description: "Temperature monitoring."

F219 Attributes

SS Display:	F2/19
Error number:	219
Diagnostic message number:	F219
Error class:	Non-fatal

F221 Error Motor Temperature Control

Cause:

Short-circuit in the wiring to the motor temperature monitoring.

Remedy:

Check the wiring to the motor temperature monitoring X6/1 and X6/2 for short-circuits.

See also the functional description: "Temperature monitoring."

F221 Attributes

SS Display:	F2/21
Error number:	221
Diagnostic message number:	F221
Error class:	Non-fatal

F222 Error Drive Overtemperature Watch Defekt

Temperature monitoring checks to see if the measured drive controller temperature is within reasonable bounds.

If it determines that it is lower than -10°C, then it is assumed the measuring unit is defective.

The error message is generated after the accompanying E219 warning has been given for 30 seconds.

Cause:

1. Sensor not connected to the DRP3 circuit board.
2. Broken cable in the drive controller, or defective sensor.

Remedy:

Exchange or repair the drive controller.

F222 Attributes

SS Display:	F2/22
Error number:	222
Diagnostic message number:	F222
Error class:	Non-fatal

F226 Undervoltage Error

The DC bus voltage is monitored in the power supply module. The drive controller is told via the control voltage bus whether the DC bus voltage is above the minimum permissible value of +200 V for DDS and +250 V for DKR. Going below this threshold stops the drive according to the error response which has been selected.

Requirement: The NCB bridge is not installed on the supply module.

Cause:

1. The power source has been interrupted without switching off the drive with the controller enable signal (RF).
2. Activation of the drive via the control enable (RF) without prior activation of the power supply.
3. Supply module malfunction.

Remedy:

1. Check the logic for activating the drive controller within the contacted control system.
2. If there is a supply module malfunction, eliminate it. See the explanation in the supply module user manual.

See also the functional description: "Controller enable."

F226 Attributes

SS Display:	F2/26
Error number:	226
Diagnostic message number:	F226
Error class:	Non-fatal

F228 Excessive Deviation

If the position loop is closed, the drive will monitor whether the command value that was set can be followed. In doing this, the drive will calculate a model feedback value and compare it to the actual feedback value. This error is generated if the difference between the theoretical and actual feedback values exceeds the value in parameter **S-0-0159, Monitoring window** on a continuous basis.

Cause:

1. The acceleration capacity of the drive was exceeded.
2. The axis was blocked.
3. Parameter error in the drive parameters.
4. ****Parameters set incorrectly for** S-0-0159, Monitoring window
5. The power supply was turned off with control enable present. Possible cause: an error in an AC servo drive at the common supply module.

Remedy:

For 1. Check parameter **S-0-0092, Bipolar torque limit** and set it equal to the maximum permissible value for the operation.
Reduce the acceleration setting of the control system (see control system handbook).

For 2. Check the mechanical system and eliminate any jamming of the motor axis.

For 3. Check the drive controller parameters.

For 4. ****Set parameters for S-0-0159, Monitoring window**.

For 5. Check the AC servo drive for an error message other than "28".

See also the functional description: "Position control loop monitoring."

F228 Attributes

SS Display:	F2/28
Error number:	228
Diagnostic message number:	F228
Error class:	Non-fatal

F229 Motor Encoder Failure: Quadrant Error

A hardware error was discovered in the motor encoder interface being used.

Cause:

1. Defective encoder cable.
2. Disruptive electro-magnetic interference on the encoder cable.
3. Defective motor encoder interface.
4. Defective drive controller.

Remedy:

For 1. Exchange the encoder cable.

For 2. Keep the encoder cable well away from the power cables.

For 3. Exchange the motor encoder interface.

For 4. Exchange the drive controller.

F229 Attributes

SS Display:	F2/29
Error number:	229
Diagnostic message number:	F229
Error class:	Non-fatal

F233 External Power Supply Error

Cause:

Various optional connector modules have metallically separated input and output. To use these inputs and outputs properly, you must install an external power supply. If this supply lies outside the permissible range, the error message explained here will be generated.

The following functions require an external power supply:

1. Homing switch for module DSS2, activated by parameter **S-0-0147, Homing parameter**, bit 5.
2. Travel range limit switch for module DSS, activated by parameter **P-0-0090, Travel range limit switch parameter**, bit 1.
3. Sensor inputs activated by **S-0-0170, Command sensor cycle**
4. Emergency stop input for module DSS2, activated by parameter **P-0-0008, Activation E-Stop function**, bit 0.
5. Use of a DEA module.
6. Evaluating a measurement system with a DAG module.

Remedy:

Check external power supply.

Description:	Unit:	min.:	typ.:	max.:
External operating voltage $+U_L$	V	18	24	32
External current consumption I_L	mA			100

Tab. 1-2: External power supply voltage

F233 Attributes

SS Display: F2/33
Error number: 233
Diagnostic message number: F233
Error class: Non-fatal

F234 Emergency Stop

Cause:

The emergency stop function (E-Stop) was activated by turning off the +24V current at the X12/6 input. The drive was brought to a standstill by the error response which had previously been set.

Remedy:

1. Eliminate the condition which caused the +24V current at the X12/6 input to be turned off.
2. Activate the "Reset class 1 diagnostic" command with the control system (see control system handbook).

See also the functional description: "Emergency stop feature."

F234 Attributes

SS Display: F2/34
Error number: 234
Diagnostic message number: F234
Error class: Non-fatal

F236 Excessive Position Feedback Difference

Cause:

Actual feedback value 1 and actual feedback value 2 are both set to the same value in the command for the transition check for communications phase 4, and cyclical evaluation of both encoders is started. In cyclical operation (phase 4), the actual feedback value difference of both encoders is then compared with **S-0-0391, External encoder monitoring window**. If the difference is greater than the monitoring window, error F236 "Excessive position feedback difference" is generated, and the error response previously set by parameter is executed.

1. Incorrect parameter for the external encoder. (**S-0-0115, Position feedback 2 type parameter, S-0-0117, Resolution of rotational feedback 2**).
2. Incorrect parameters have been set for the mechanical system between the motor axis and the external encoder. (**S-0-0121, Input revolutions of load gear S-0-0122, Output revolutions of load gear. S-0-0123, Feed constant**).
3. The mechanical system between the motor shaft and the external encoder is not rigid (for example there is play in the transmission).
4. Defective encoder cable.
5. The module (DLF or DEF) for evaluating the external measuring system is defective.
6. The maximum input frequency of the encoder interface has been exceeded.
7. External encoder not attached to the axis which is being controlled.

Remedy:

For 1. **Check S-0-0115, Position feedback 2 type parameter** and **S-0-0117, Resolution of rotational feedback 2**.

For 2. **Check S-0-0121, S-0-0122, Load gear input and output revolutions** and **S-0-0123, Feed constant** .

For 3. **Enlarge S-0-0391, External encoder monitoring window**.

For 4. Exchange the encoder cable.

For 5. Exchange the module for evaluating the external measurement system.

For 6. Reduce velocity.

For 7. ****Set S-0-0391, External encoder monitoring window** to 0 (turn off monitoring).

See also the functional description: "Actual feedback value monitoring."

F236 Attributes

SS Display:	F2/36
Error number:	236
Diagnostic message number:	F236
Error class:	Non-fatal

F237 Excessive Position Command Value Difference

Cause:

When the drive is operating in position control, position command values which come via the SERCOS interface are monitored. If the velocity required of the drive by two successive position command values is greater than or equal to the value in **S-0-0091, Bipolar velocity limit**, position command value monitoring is initiated. The **Excessive position command value** is stored in parameter **P-0-0010**. The **last valid position command value** is stored in parameter **P-0-0011**.

Remedy:

Compare S-0-0091, Bipolar velocity limit value with the velocity in the program and adjust to match it, if necessary.

See also the functional description: "Position command value monitoring."

F237 Attributes

SS Display:	F2/37
Error number:	237
Diagnostic message number:	F237
Error class:	Non-fatal

F242 External Encoder Failure: Signals Too Small

Cause:

The analog signals of an external measurement system are used for high resolution analysis of that measurement system. These are monitored according to two criteria:

1. The pointer length, which is calculated from the sine and cosine signals, must be at least 1 V.
2. The maximum pointer length resulting from the sine and cosine signals must not exceed 11.8 V.

Remedy:

1. Check the measurement system cable.
2. Check the measurement system.

F242 Attributes

SS Display:	F2/42
Error number:	242
Diagnostic message number:	F242
Error class:	Non-fatal

F245 External Encoder Failure: Quadrant Error

A hardware error was discovered in the high resolution position interface for "DLF" sine signals of the external measurement system.

Cause:

1. Defective encoder cable.
2. Disruptive electro-magnetic interference on the encoder cable.
3. Defective DLF module.

Remedy:

For 1. Exchange the encoder cable.

For 2. Keep the encoder cable well away from the power cables.

For 3. Exchange the DLF module.

F245 Attributes

SS Display:	F2/45
Error number:	245
Diagnostic message number:	F245
Error class:	Non-fatal

F248 Low Battery Voltage

Cause:

For motors of series MKD, the absolute position information is stored by a battery-powered buffer in the motor feedback. The battery is designed for a 10-year life span. If the battery voltage falls below 2.8 V, this message appears. The absolute encoder function will still be preserved for about 2 weeks.

CAUTION

Source of danger:	Malfunction in the control of motors and moving elements
Possible damages:	Mechanical injuries
Precautionary measures:	Replace the battery as soon as possible

Instructions for Exchanging Batteries

Have the following tools and accessories ready:

- Torx screwdriver size 10
- Needle-nose pliers, torque wrench
- New packaged battery (Part No.: 257101)

CAUTION

Source of danger:	A malfunction in the control of motors and moving elements
Possible damages:	Mechanical injuries
Precautionary measures:	Turn off the power supply. Make sure it will not be turned back on. Exchange the battery while the control voltage is turned on.

If the control voltage is turned off while the battery is taken out, the absolute reference point will be lost.

The reference point must then be reestablished.

Removing the Battery

- Unscrew torx screw with a size 10 screwdriver.
- Pull out the resolver feedback (RSF) lid by hand.
- Pull off the battery connection.
- Loosen battery clamp and remove the battery.
- Place the factory-made battery (Part No.: 257101) in the housing and screw on the clamp. **WARNING!** Do not kink the battery cable.
- Attach connection to the battery.

Close the resolver feedback lid, screw in 4 torx screws and tighten to 1.8 Nm with the torque wrench.

F248 Attributes

SS Display:	F2/48
Error number:	248
Diagnostic message number:	F248
Error class:	Non-fatal

F267 Incorrect Internal Hardware Synchronization

Cause:

The drive control of all drives in a SERCOS ring is synchronized by a phase control loop. Proper functioning of the synchronization is monitored. This error is generated if the average deviation is greater than 5 usec.

Remedy:

- Exchange DSS module.
- Exchange the drive controller.

F267 Attributes

SS Display:	F2/67
Error number:	267
Diagnostic message number:	F267
Error class:	Non-fatal

F268 Brake Error

The drive controller takes control of the brake for motors with an integrated holding brake. The braking current is monitored.
If the braking current is outside of the permissible range between:

0.4 -1.6 * **P-0-0511, Break current**

this error message will be generated.

Cause:

1. The power supply for the brake is not connected properly or is outside of the (24 V +/- 10%) tolerance.
2. The motor cable is incorrectly connected (wiring error).
3. Defective brake.
4. Defective drive controller.

Note: A metallic connection between the 0V brake supply and the 0V of the drive controller is required.

Remedy:

For 1. Check the power supply.

For 2. Check the motor cable.

For 3. Exchange the motor.

For 4. Exchange the drive controller.

See also the functional description: "Setting the motor brake current."

F268 Attributes

SS Display:	F2/68
Error number:	268
Diagnostic message number:	F268
Error class:	Non-fatal

F276 Absolute Encoder Error, Deviation > P-0-0097

When a drive controller with an absolute encoder motor (multiturn) is switched off, the actual feedback position is saved. When it is turned back on, the position determined by the absolute encoder evaluation is compared with this stored position. This error is given if the deviation is greater than the value set by parameter in **P-0-0097, Absolute encoder control window**.

Cause:

1. Turning on for the first time (invalid stored position).
2. The axis was moved further in switched-off state than allowed by parameter **P-0-0097, Absolute encoder control window**.
3. Incorrect position initialization.

Remedy:

For 1. Clear the error and set the reference point.

For 2. The axis was moved while turned off and is located outside of its permissible position.
Check to see if a new travel command would cause damage.
Then clear errors.

For 3. **Danger of Accident through Unwanted Axis Motion**
Check reference point. If the reference point is incorrect, there is a problem with the feedback. The feedback should be exchanged (with MDD or MKD absolute motor encoders, exchange the whole motor).

See also the functional description: "Absolute encoder monitoring."

F276 Attributes

SS Display:	F2/76
Diagnostic message number:	F276
Error class:	Non-fatal

F280 Earth connection

Cause:

Ground short in the DC bus or in the motor.

This error is reported only in compact devices.

Remedy:

- Isolation test of the motor and motor power supply cable.

- Disconnect the power supply cable from the motor to the drive and turn on the drive and the power. If the error recurs, the drive should be exchanged.

F280 Attributes

SS Display:	F2/80
Diagnostic message number:	F280
Error class:	Non-fatal if bleeder is present, otherwise fatal

F281 Mains Fault

Cause:
The power supply voltage was not present during operation for at least 3 power periods. As a result, the drive controller was brought to a standstill according to the set error response.

Remedy:

Check the power supply connection according to the project planning specifications.

F281 Attributes

SS Display:	F2/81
Error number:	281
Diagnostic message number:	F281
Error class:	Non-fatal if bleeder is present, otherwise fatal

F282 Phase Fault

The power supply voltage is checked each time the control voltage is switched on and each time the controller enable is switched off. A phase error was found during this check.

Cause:

A power supply phase has failed or is outside of the permissible tolerance.

Remedy:

Check the power supply connection according to the project planning specifications of the drive controller being used.

F282 Attributes

SS Display:	F2/82
Error number:	282
Diagnostic message number:	F282
Error class:	Non-fatal if bleeder is present, otherwise fatal

F283 Net Overvoltage

Cause:

The power supply voltage is above the permissible value > 460V+15%

Remedy:

Make sure the power supply is connected properly according to the project planning specifications of the drive controller being used.

F283 Attributes

SS Display:	F2/83
Error number:	283
Diagnostic message number:	F283
Error class:	Non-fatal if bleeder is present, otherwise fatal

F284 Main Contactor nc - Low Voltage

Cause:

When the main contactor was turned off, the DC bus voltage went below 400 V while controller enable was set.

Remedy:

Switch off the controller enable before switching off the main contactor.

F284 Attributes

SS Display:	F2/84
Error number:	284
Diagnostic message number:	F284
Error class:	Non-fatal if bleeder is present, otherwise fatal

F401 Double MST Error Shutdown

The master sync telegram was not received in the drive controller in two successive SERCOS cycles.

Cause:

1. Disruption in the LWL transmission line.
2. Too much attenuation in the light signal.
3. Malfunction in the SERCOS interface (general).

Remedy:

For 1. Check all LWL connections in the SERCOS ring.

For 2. Measure the attenuation in the LWL cable.

The maximum attenuation between TX and RX must not fall below 12.5 dB.

For 3. Exchange the SERCOS interface module in the drive controller.

See also the functional description: "SERCOS interface error."

F401 Attributes

SS Display:	F4/01
Error number:	401
Diagnostic message number:	F401
Error class:	Interface

F402 Double MDT Error Shutdown

The master data telegram (MDT) was not received in the drive controller in two successive SERCOS cycles.

Cause:

1. Disruption in the LWL transmission line.
2. Too much attenuation in the light signal.
3. Malfunction in the SERCOS interface (general).

Remedy:

For 1. Check all LWL connections in the SERCOS ring.

For 2. Measure the attenuation in the LWL cable.

The maximum attenuation between TX and RX must not fall below 12.5 dB.

For 3. Exchange the SERCOS interface module in the drive controller.

See also the functional description: "SERCOS interface error."

F402 Attributes

SS Display:	F4/02
Error number:	402
Diagnostic message number:	F402
Error class:	Interface

F403 Invalid Communications Phase Shutdown

An invalid communications phase was given by the SERCOS master module (phase > 4).

Cause:

Error in the SERCOS master module of the control system.

Remedy:

Consult the control system manufacturer.

See also the functional description: "SERCOS interface error."

F403 Attributes

SS Display:	F4/03
Error number:	403
Diagnostic message number:	F403
Error class:	Interface

F404 Error During Phase Progression

The prescribed order was not maintained during phase progression.

Cause:

Error in the SERCOS master module of the control system.

Remedy:

Consult the control system manufacturer.

See also the functional description: "SERCOS interface error."

F404 Attributes

SS Display:	F4/04
Error number:	404
Diagnostic message number:	F404
Error class:	Interface

F405 Error During Phase Regression

Phase 0 was not switched to while switching back from a communications phase.

Cause :

Error in the SERCOS master module of the control system.

Remedy:

Consult the control system manufacturer.

See also the functional description: "SERCOS interface error."

F405 Attributes

SS Display:	F4/05
Error number:	405
Diagnostic message number:	F405
Error class:	Interface

F406 Phase Switching Without Ready Signal

The SERCOS master attempted a phase switch without waiting for the drive controller's ready signal.

Cause:

Error in the SERCOS master module of the control system.

Remedy:

Consult the control system manufacturer.

See also the functional description: "SERCOS interface error."

F406 Attributes

SS Display:	F4/06
Error number:	406
Diagnostic message number:	F406
Error class:	Interface

F629 Positive Travel Limit Value Is Exceeded

The drive received a command value which resulted in an axis position outside the positive travel range. The axis was brought to a standstill with the "Set velocity command value to zero" error response. Bit 2 of paramater **P-0-0090, Travel range limit switch** is set for "Exceeding travel range as an error," or exceeding the position limit began a drive control command (such as the drive-controlled homing procedure).

Cause:

S-0-0049, Positive position limit value exceeded.

Remedy:

1. ****Check S-0-0049, Positive position limit value.**
2. Check the software limits of the control system.
3. Activate the axis after the error response.

Procedure:

- Clear the error.
- If the power supply was turned off, turn it back on.
- Move the axis into the permissible working range.

Note: Only command values which lead to the permissible working area will be accepted. All other command values will result in bringing the drive controller to a standstill again.

See also the functional description: "Axis Limit Values ."

F629 Attributes

SS Display:	F6/29
Error number:	629
Diagnostic message number:	F629
Error class:	Transverse range

F630 Negative Travel Limit Value Is Exceeded

The drive received a command value which resulted in an axis position outside the negative travel range. The axis was brought to a standstill with the "Set velocity command value to zero" error response. Bit 2 of paramater **P-0-0090, Travel range limit switch** is set for "Exceeding travel range as an error," or exceeding the position limit began a drive control command (such as the drive-controlled homing procedure).

Cause:

S-0-0050, Negative travel limit value exceeded.

Remedy:

1. ****Check S-0-0050, Negative travel limit value.**
2. Check the software limits of the control system.
3. Activate the axis after the error response.

Procedure:

- Clear the error.
- If the power supply was turned off, turn it back on.
- Move the axis into the permissible working range.

Note: Only command values which lead to the permissible working area will be accepted. All other command values will result in bringing the drive controller to a standstill again.

See also the functional description: "Axis Limit Values ."

F630 Attributes

SS Display:	F6/30
Error number:	630
Diagnostic message number:	F630
Error class:	Transverse range

F643 Positive Travel Limit Switch Detected

The positive travel limit switch was encountered. The axis was brought to a standstill with the "Set velocity command value to zero" error response. Bit 2 of parameter **P-0-0090, Travel range limit switch** is set for "Exceeding travel range as error," or exceeding the position limit began a drive control command (such as the drive-controlled homing procedure).

Cause:

The positive range limit switch is detected.

Remedy:

1. Reset the error.
2. Turn the power supply on again.
3. Move the axis into the permissible travel region.

Note: The drive will not accept command values which lead out of the permissible travel range. Entering these command values in the drive controller will result in this error.

See also the functional description: "Travel Zone End Switch Monitoring."

F643 Attributes

SS Display:	F6/43
Error number:	643
Diagnostic message number:	F643
Error class:	Transverse range

644 Negative Travel Limit Switch Detected

The negative travel limit switch was encountered. The axis was brought to a standstill with the "Set velocity command value to zero" error response. Bit 2 of parameter **P-0-0090, Travel range limit switch** is set for "Exceeding travel range as error," or exceeding the position limit began a drive control command (such as the drive-controlled homing procedure).

Cause:

The negative travel limit switch was detected.

Remedy:

1. Reset the error.
2. Turn the power supply on again.
3. Move the axis into the permissible travel region.

Note: The drive will not accept command values which lead out of the permissible travel range. Entering these command values in the drive controller will result in this error.

See also the functional description: "Travel Zone End Switch Monitoring."

F644 Attributes

SS Display:	F6/44
Error number:	644
Diagnostic message number:	F644
Error class:	Transverse range

F818 Drive Overtemperature Shutdown

A temperature level which was too high was reached in the power stage of the drive controller. In response, the drive controller has issued the warning: "E250 Drive overtemperature warning" for 30 seconds. The drive controller is then brought to a standstill according to the error response which has been selected and gives this error message.

Cause:

1. Failure of the drive's internal blower
2. Failure of the control cabinet's climate control
3. Incorrect control cabinet dimensioning in regards to heat dissipation.

Remedy:

For 1. If the blower has failed, exchange the drive controller.

For 2. Install climatization feature in the cabinet.

For 3. Check the dimensions of the control cabinet.

Note: Temperature monitoring must not lead to a fatal error class.

F818 Attributes

SS Display:	F8/18
Error number:	818
Diagnostic message number:	F818
Error class:	Fatal

F819 Drive Overtemperature Watch Defekt

Cause:

An NTC resistor is used to measure the drive temperature. If the resistor is defective or is not connected, the previously mentioned error message is generated.

Remedy:

Exchange or connect the NTC resistor.

F819 Attributes

SS Display:	F8/19
Error number:	819
Diagnostic message number:	F819
Error class:	Fatal

F820 Bleeder Overload

Cause:

The energy of a braking motor cannot be converted quickly enough by the bleeder resistors.

The energy converted by the internal bleeder is analyzed. When the maximum energy capacity of the bleeder is exceeded, it is shut off. The bleeder overload error is generated.

Remedy:

The braking slope should have a flatter parameter, or the bleeder capacity can be increased by adding an additional bleeder.
The drive can be used again after the bleeder has cooled down.

F820 Attributes

SS Display:	F8/20
Error number:	820
Diagnostic message number:	F820
Error class:	Fatal

F822 Motor Encoder Failure: Signals Too Small

The analog signals of an external measurement system are used for high resolution analysis of that measurement system. These are monitored according to two criteria:

1. The pointer length, which is calculated from the sine and cosine ignals, must be at least 1 V.
2. The maximum pointer length resulting from the sine and cosine ignals must not exceed 11.8 V.

Note: The error cannot be cleared in communications phase 4. Before clearing the error, switch to communications phase 2.

Remedy:

- Check the measurement system cable.
- Lay the feedback cable well away from the motor power cable. The cover must be placed over the drive controller (see drive controller project specifications.)
- Check the measurement system and exchange, if necessary.

F822 Attributes

SS Display:	F8/22
Error number:	822
Diagnostic message number:	F822
Error class:	Fatal

F827 Drive Interlock While Drive Activated

Cause:

The drive interlock was activated while controller enable was set. The drive controller switches to torque-free state immediately.

Remedy:

The drive interlock should not be activated when controller enable is set. Check the control system of the drive interlock input.

F827 Attributes

SS Display:	F8/27
Error number:	827
Diagnostic message number:	F827
Error class:	Fatal

F860 Overcurrent: Short in Powerstage

The current in the power transistor bridge has exceeded the value of the peak current of the drive by a factor of two. As a result, the drive will be switched immeediately to torque-free operation. An optional holding brake is activated immediately.

Cause:

1. Short-circuit in the motor cable.
2. Defective power section in the drive controller.

Remedy:

For 1. Check the motor cable for a short-circuit.

For 2. Exchange the drive controller.

F860 Attributes

SS Display:	F8/60
Error number:	860
Diagnostic message number:	F860
Error class:	Fatal

F861 Overcurrent: Short to Ground

The sum of the phase currents is monitored. During normal operation, the sum = 0. If the sum of the current is greater than 0.5 x I_N, the short-circuit to ground fuse is activated.

Cause:

1. Defective motor cable.
2. Short-circuit to ground in the motor.

Remedy:

Check the motor cable and motor for a short-circuit to ground and exchange if necessary.

F861 Attributes

SS Display:	F8/61
Error number:	861
Diagnostic message number:	F861
Error class:	Fatal

F869 +/- 15 Volt Error

The drive controller found a malfunction in the ± 15 V power supply.

Cause:

1. Defective control voltage bus cable.
2. Defective supply module.

Remedy:

For 1. Check the control voltage bus cable or plug connection and exchange if necessary.

For 2. Check supply module (see supply moduleinstructions for use).

F869 Attributes

SS Display:	F8/69
Error number:	869
Diagnostic message number:	F869
Error class:	Fatal

F870 + 24 Volt Error

The drive controller found a malfunction in the + 24 V power supply.

Cause:

1. Defective control voltage bus cable.
2. The 24 V power supply is overloaded.
3. Defective supply module.
4. Short-circuit in the emergency circuit.

Remedy:

For 1. Check the control bus cable or plug connection and exchange if necessary.

For 2. Check the wiring and/or replace the power supply module.

For 3. Check supply module (see supply module instructions for use).

For 4. Check the emergency circuit for shorts.

F870 Attributes

SS Display:	F8/70
Error number:	870
Diagnostic message number:	F870
Error class:	Fatal

F871 + 10 Volt Error

The power supply voltage for the current sensors has been disrupted.

Cause:

A defect in the drive controller.

Remedy:

Exchange the drive controller.

F871 Attributes

SS Display:	F8/71
Error number:	871
Diagnostic message number:	F871
Error class:	Fatal

F878 Velocity Control Loop Error

If the difference between velocity command value and feedback value is greater than 10% of the maximum motor velocity while the velocity control loop is active, then the feedback velocity value must move in the direction of the command value. This error is generated if the feedback value does not come closer to the command value within 20 ms and the effective torque/force command value is at the limit (=**P-0-4046, Aktiv peak current**).

Cause:

1. Motor cable is connected incorrectly.
2. Defective power section of the drive.
3. Defective feedback.
4. Parameters set incorrectly for velocity controller.
5. Parameters for acceleration or brake slope are too steep.
6. Effective peak current is too low.

Remedy:

For 1. Check motor cable connection.

For 2. Exchange the drive controller.

For 3. Exchange the motor.

For 4. Check the velocity controller according to the user instructions (see the velocity controller chapter).

For 5. Decrease the maximum acceleration in the control system or **decrease P-0-1201, Acceleration slope 1**.

See also the functional description: "Determining the velocity controller setting."

F878 Attributes

SS Display:	F8/79
Error number:	878
Diagnostic message number:	F878
Error class:	Fatal

F879 Crossing Velocity Limit (S-0-0092) Value

The feedback velocity is monitored in torque control mode. This error is generated if the programmed velocity in parameter **S-0-0091, Bipolar velocity limit value** is exceeded by 1.125 times or min. 100 rpms (rotary motors) or 100 mm/min (linear motors).

Cause:

The load torque was less than the torque command value. This leads to an increase in the feedback velocity up to the maximum possible motor velocity.

Remedy:

Assign the proper torque command value for the desired task. Reduce parameter **S-0-0092, Bipolar torque limit**.

See also the functional description: "Limiting to bipolar velocity limit value."

F879 Attributes

SS Display:	F8/79
Error number:	879
Diagnostic message number:	F879
Error class:	Fatal

F889 Regenerating Overcurrent

Cause:

The feedback current of the drive is greater than 1.2 times the type current (with DKR only).

Remedy:

Replace the drive.

F889 Attributes

SS Display:	F8/89
Error number:	889
Diagnostic message number:	F889
Error class:	Fatal

F890 Regenerating Electronic Watchdog

Cause:

The RSK processor on the plug-in storage card is not working.

Remedy:

Exchange drive controller or the plug-in storage card.

F890 Attributes

SS Display:	F8/90
Error number:	890
Diagnostic message number:	F890
Error class:	Fatal

F891 Power Supply Fault

The DC bus voltage is not established after the main contactor has been switched on.

Cause:

If there is a short-circuit in the DC bus, voltage cannot build up after the drive has been switched on. This error is generated if the voltage remains under 100 V for approx. 200ms.

Remedy:

Exchange the drive controller.

F891 Attributes

SS Display:	F8/91
Error number:	891
Diagnostic message number:	F891
Error class:	Fatal

F892 Wrong Code of the Current Measuring Unit

A faulty current measuring unit was discovered after the control voltage was turned on.

Cause:

The current measuring unit has an incorrect code. The coding does not work with the RSK circuit board.

Remedy:

Exchange the current measuring unit.

F892 Attributes

SS Display:	F8/92
Error number:	892
Diagnostic message number:	F892
Error class:	Fatal

F893 No Regenerating Current to Net

This error message is generated if the feedback current command value is at its maximum and no current is flowing for approx. 50ms.

Cause:

1. Power supply not properly connected.
2. Defective feedback.

Remedy:

For 1. Check the power supply connection according to the project planning specifications.

For 2. Exchange the drive controller.

F893 Attributes

SS Display:	F8/93
Error number:	893
Diagnostic message number:	F893
Error class:	Fatal

F894 Checksum Error

Cause:

The checksum is stored in the EPROM during the initial programming. Each time the drive is turned on, the processor checks to see if the checksum which was created from the processor corresponds to the one which has been stored. This error is generated if this is not the case.

Remedy:

Exchange the RSK circuit board EPROM.

F894 Attributes

SS Display:	F8/94
Error number:	894
Diagnostic message number:	F894
Error class:	Fatal

1.2 Warning Diagnostic Messages

E201 No Mains

Cause:

After the control voltage has been switched on, the drive checks to see if the mains connection of the power supply has also been switched on. This warning is given if this has not happened correctly (with DKR only).

Remedy:

Check power connections (external relay, fuse, etc.).

E201 Attributes

SS Display:	E2/01
Diagnostic message number:	E201
Warning class:	Non-fatal

E202 Not Ready for Power On

Cause:

As usually happens, the main contactor K1 was turned off when the controller enable was not set. Because of the drive controller capacities, the DC bus voltage must not decrease suddenly after the main contactor is turned off. This message is generated as long as the DC bus voltage > 250V and prevents the main contactor from being turned on. This serves to protect discharging resistors.

Remedy:

The warning is automatically recalled by the drive controller when the DC bus voltage falls below 250V.

E202 Attributes

SS Display:	E2/02
Diagnostic message number:	E202
Warning class:	Non-fatal

E219 Warning Drive Temperature Watch Defekt

Temperature monitoring checks to see if the measured drive controller temperature is within reasonable bounds. If it determines that it is lower than -10°C, then it is assumed the measuring unit is defective. Warning E219 "Warning Drive temperature watch defekt" will appear for 30 seconds. Afterwards the drive will be brought to a standstill according to the selected error response and message F220 "Error: drive temperature control error" will be generated.

Cause:

1. Sensor not connected to the DRP3 circuit board.
2. Broken cable in the drive controller, or defective sensor.

Remedy:

Exchange or repair the drive controller.

E219 Attributes

SS Display:	E2/19
Diagnostic message number:	E219
Warning class:	Non-fatal

E221 Warning Motor Temperature Control

Temperature monitoring checks to see if the measured motor temperature is within reasonable bounds. If it determines that it is lower than -10°C, then it is assumed the measuring unit is defective. Warning E221 "Warning motor temperature control" will appear for 30 seconds. Afterwards the drive controller will be brought to a standstill according to the selected error response and message F221 "Motor temperature control error" will be generated.

Cause:

1. Motor temperature sensor not connected.
2. Broken cable.
3. Defective sensor.
4. Broken cable in drive controller.

Remedy:

For 1. Connect the sensor to the drive controller and to the motor (see project planning specifications for the motor).

For 2. Exchange the wiring between the drive controller and the motor.

For 3. Exchange the motor.

For 4. Exchange the drive controller.

See also the functional description: "Temperature monitoring."

E221 Attributes

SS Display:	E2/21
Diagnostic message number:	221
Warning class:	Non-fatal

E249 Positioning Velocity (S-0259) Greater S-0-0091

Cause:

In "Drive-controlled interpolation" operating mode, a velocity is given in parameter **S-0-0259, Positioning velocity** at which the given target position is to be approached.

Message E249 is generated if this is greater than the permissible maximum value **S-0-0091, Bipolar velocity limit value**. Message bit 4 is set in **S-0-0013, Class 3 diagnostic** simultaneously.

Remedy:

Reduce S-0-0259, Positioning velocity.

See also the functional description: "Drive Internal Interpolation."

E249 Attributes

SS Display:	E2/49
Diagnostic message number:	E249
Warning class:	Non-fatal

E250 Drive Overtemperature Warning

The temperature of the heatsink in the drive controller has reached the maximum permissible temperature. The drive controller follows the command value input for a period of 30 seconds. This makes it possible to bring the axis to a standstill with the control system while keeping true to the process (for example, close the operation, leave the collision area, etc.).

After 30 seconds, the response set in parameter **P-0-0119, Deceleration as best as possible** will be performed by the drive controller.

Cause:

1. Failure of the drive's internal blower.
2. Failure of the control cabinet's climate control.
3. Incorrect control cabinet dimensioning in regards to heat dissipation.

Remedy:

For 1. If the blower fails, exchange the drive controller.

For 2. Install climatization feature in the cabinet.

For 3. Check the dimensions of the control cabinet.

E250 Attributes

SS Display:	E2/50
Diagnostic message number:	E250
Warning class:	Non-fatal

E251 Motor Overtemperature Warning

The motor is too hot. The motor temperature, which is displayed in parameter **S-0-0383, Motor temperature**, has exceeded the value in **S-0-0201, Motor warning temperature**. Warning E251 is generated. If the temperature increases above the value in **S-0-0204, Motor shutdown temperature**, error **F219, Motor overtemperature shutdown** will be generated.

The values for parameters **S-0-0201, Motor warning temperature** and **S-0-0204, Motor shutdown temperature** are set at 140°C and 150°C for MKD and MDD motors respectively.

Cause:

The motor became overloaded. The effective torque required of the motor was above the permissible continuous standstill torque for too long.

Remedy:

Check the layout of the motor. For systems which have been in use for a long time, check to see if the drive controller conditions have changed (in regards to pollution, friction, components which have been moved, etc.).

See also the functional description: "Temperature monitoring."

E251 Attributes

SS Display:	E2/51
Diagnostic message number:	E251
Warning class:	Non-fatal

E253 Target Position Out of Range

Cause:

In "Drive-controlled interpolation" operating mode, a check is performed to see whether the specified **S-0-0258, Target position**, is within the possible travel region of the drive.

This is defined by parameters **S-0-0049, Positive position limit value** and **S-0-0055, Negative position limit value**.

Message E253 is generated if the target position lies outside of the travel range. Additionally, warning bit 13 is set in **S-0-0012, Class 2 diagnostic**.

Remedy:

Check the specified **S-0-0258, Target position** and correct it, if necessary.

See also the functional description: "Drive Internal Interpolation."

E253 Attributes

SS Display:	E2/53
Diagnostic message number:	E253
Warning class:	Non-fatal

E255 Feedrate Override (S-0-0108) = 0

The travel velocity used in drive-controlled travel commands can be changed with parameter **S-0-00108, Feedrate override**.
This warning is given if the value of this parameter is 0, since the drive cannot then follow command values.

Cause:

1. The control system's feed potentiometer is set to zero or is being evaluated incorrectly.
2. The parameter was set to an incorrect value.

Remedy:

For 1. Check the feed potentiometer.

For 2. Set the parameter to the correct value for the application.

E255 Attributes

SS Display:	E2/55
Diagnostic message number:	E255
Warning class:	Non-fatal

E257 Continuous Current Limiting Active

The thermal controller load is monitored. If a rated current profile is demanded of the drive controller which would require too high a power transistor load over time (too much warming of the power output stage), the drive controller will react by dynamically reducing the effective peak current. This warning will be given at the same time. Parameter **P-0-4046, Aktiv peak current** is reduced. Before the peak current is actually limited, the advance warning message **E261 Continuous current limitation prewarning** should have been generated.

Cause:

The drive controller was overloaded.

Remedy:

1. Check the drive layout.
2. Reduce acceleration.

   With systems which have been used for longer periods of time, check to see if drive controller conditions have changed in regards to:

   - Friction

   - Components which have been moved.

See also the functional description: "Monitoring the thermal load."

E257 Attributes

SS Display:	E2/57
Diagnostic message number:	E257
Warning class:	Non-fatal

E259 Command Velocity Limitation Active

In the position control and velocity control operating modes, the effective velocity command value is limited to the value in parameter **S-0-0091, Bipolar velocity limit value**. The warning is given if the resulting velocity command value reaches this limit.

Cause:

Parameter **S-0-0091, Bipolar velocity limit value** was set too low.

Remedy:

In normal operating conditions, set parameter **S-0-0091, Bipolar velocity limit value** to a value 10% greater than the NC effective velocity.

See also the functional description: "Limiting to bipolar velocity limit value."

E259 Attributes

SS Display:	E2/59
Diagnostic message number:	E259
Warning class:	Non-fatal

E261 Continuous Current Limiting Prewarning

Digital drives are monitored by a continually operating temperature model. If the thermal load reaches 100%, the continuous current limit will be activated shortly thereafter.
Before the torque is reduced, a continuous current limit early warning is given via a switching threshold, which is determined by parameter **P-0-0127, Overload warning**.
To deactivate the warning, enter **P-0-0127** = 100% into the parameter.

Cause:

The drive controller was overloaded.

Remedy:

1. Check the drive layout.
2. Reduce acceleration.
3. Increase the switching threshold in parameter **P-0-0127, Overload warning**
4. With systems which have been used for longer periods of time, check to see if drive controller conditions have changed in regards to:

   - Friction
   - Components which have been moved
   - Feed during processing.

See also the functional description: "Monitoring the thermal load."

E261 Attributes

SS Display:	E2/61
Diagnostic message number:	E261
Warning class:	Non-fatal

E263 Velocity Command Value S-0-0036 Greater Than Bipolar Limit

Cause:

The value given to the drive for **S-0-0036, Velocity command value** was greater than permissible.

Remedy:

It is limited to **S-0-001, Bipolar velocity limit value**.

See also the functional description: "Velocity control."

E263 Attributes

SS Display:	E2/63
Diagnostic message number:	E263
Warning class:	Non-fatal

E410 Slave Not Scanned or Address 0

While the SERCOS ring is being initialized in communications phase 1, each slave which is to participate in the additional phase uptake must be addressed by the SERCOS master. Slaves which are not addressed or which have been set to drive address "0" indicate this by generating warning E410. Communication with these slaves in higher communications phases is not possible. They work only in the repeater mode.

Cause:

The slave was not scanned in phase 1, or "0" address is set.

Remedy:

- Set the correct slave address.
- Check the SERCOS master configuration.

See also the functional description: "Start Up for the SERCOS Interface."

E410 Attributes

SS Display:	E4/10
Diagnostic message number:	E410
Warning class:	Non-fatal

E825 Overvoltage Error

The DC bus voltage has reached impermissibly high values. (Ud > 475 V). The drive controller was switched to torque-free operation so as not to endanger the drive's power amplifier.

Cause:

The energy regenerated by a braking drive controller (a main-spindle drive, for example) cannot be converted by the bleeder resistors quickly enough.

Remedy:

The braking slope should have a flatter parameter, or the bleeder capacity can be increased by adding an additional bleeder.

E825 Attributes

SS Display:	E8/25
Diagnostic message number:	E825
Warning class:	Non-fatal

E829 Positive Position Limit Value Exceeded

The drive received a command value which resulted in an axis position outside the positive travel range. The axis was brought to a standstill by setting the velocity command value to zero. A class 1 diagnostic error is not generated. The drive will automatically follow command values which lead into the allowable range after they are entered. "Handle travel range exceeded as warning" is set in bit 2 of parameter **S-0-0090, Travel limit parameter**.

Cause:

S-0-0049, Positive position limit value exceeded.

Remedy:

Enter command values which lead back into the allowable range.

See also the functional description: "Axis Limit Values ."

E829 Attributes

SS Display:	E8/29
Diagnostic message number:	E829
Warning class:	Fatal

E830 Negative Position Limit Value Exceeded

The drive received a command value which resulted in an axis position outside the negative travel range. The axis was brought to a standstill by setting the velocity command value to zero. A class 1 diagnostic error is not generated. The drive will automatically follow command values which lead into the allowable range after they are entered. "Handle travel range exceeded as warning" is set in bit 2 of parameter **S-0-0090, Travel limit parameter**.

Cause:

S-0-0050, Negative travel limit value exceeded.

Remedy:

Enter command values which lead back into the allowable range.

See also the functional description: "Axis Limit Values ."

E830 Attributes

SS Display:	E8/30
Diagnostic message number:	E830
Warning class:	Fatal

E843 Positive Travel Zone Limit Switch Activated

The drive received a command value which resulted in an axis position outside the positive travel range. The axis was brought to a standstill by setting the velocity command value to zero. A class 1 diagnostic error is not generated. The drive will automatically follow command values which lead to the allowable range after they are entered. **"Handle travel range limit exceeded as warning"** is set in bit 2 of parameter **S-0-0090, Travel limit parameter**.

Cause:

Positive travel range limit switch detected.

Remedy:

Enter command values which lead back into the allowable range.

See also the functional description: "Travel Zone End Switch Monitoring."

E843 Attributes

SS Display:	E8/43
Diagnostic message number:	E843
Warning class:	Fatal

E844 Negative Travel Zone Limit Switch Activated

The drive received a command value which resulted in an axis position outside the negative travel range. The axis was brought to a standstill by setting the velocity command value to zero. A class 1 diagnostic error is not generated. The drive will automatically follow command values which lead to the allowable range after they are entered. **"Handle travel range limit exceeded as warning"** is set in bit 2 of parameter **S-0-0090, Travel limit parameter**.

Cause:

Negative travel range limit switch detected.

Remedy:

Enter command values which lead back into the allowable range.

See also the functional description: "Travel Zone End Switch Monitoring."

E844 Attributes

SS Display:	E8/44
Diagnostic message number:	E844
Warning class:	Fatal

1.3 Command Diagnostic Messages

C100 Communications Phase 3 Transition Check

Cause:

Command **S-0-0127, C1 Communications phase 3 transition check**, is activated.

See also the functional description: "S-0-0127, C1 transition procedure to communications phase 3."

C100 Attributes

SS Display:	C1/00
Diagnostic message number:	C100

C101 Invalid Communications Parameter (S-0-0021)

Cause:

Communications parameters which are needed to operate the drive in communication phase 3 are invalid.

Remedy:

A list of the invalid parameters can be seen in parameter **S-0-0021, List of invalid op. data for comm. ph. 2**.
The invalid parameters must be rewritten so they are correct.

See also the functional description: "S-0-0127, C1 communications phase 3 transition check."

C101 Attributes

SS Display:	C1/01
Diagnostic message number:	C101

C102 Limit Error Communication Parameter (S-0-0021)

Cause:

Parameters which are used for the operation of the communications phase 3 have to be outside of their minimum or maximum input values or the entered value can not be processed.

Remedy:

The erroneous parameters are listed in **S-0-0021, IDN List of Invalid Operation Data Phase 2**.

The parameters are edited with valid values in **S-0-0021**.

C102 Attributes

H1 Display :	C1/02
Diagnostic message number :	C102

C104 Config. IDN for MDT not configurable

Cause:

Telegram type 7 was set in parameter **S-0-0015, Telegram type parameter**. Parameters which are missing in **S-0-0188, List of configurable data in MDT** are kept in **S-0-0024**, **Configuration list for the master data telegram**.

Remedy:

You must either set a priority telegram (Telegram type = 0..6) or else provide **S-0-0024, Configuration list for MDT** with parameters. These parameters are also contained in **S-0-0188, List of configurable data**.

See also the functional description: "Configuration of telegram contents."

C104 Attributes

SS Display:	C1/04
Diagnostic message number:	C104

C105 Configured Length > Max. Length for MDT

Cause:

Telegram type 7 was set in parameter **S-0-0015, Telegram type parameter**. The length of the configured record in MDT, which is determined by **S-0-0024, Configurations list of the master data telegram**, exceeds the maximum permissible length **S-0-0186, Length of the configurable record in MDT.**

Remedy:

You must either set a priority telegram in **S-0-0015, Telegram type parameter** (telegram type = 0..6) or else reduce the number of configurable parameters in MDT.

See also the functional description: "Configuration of telegram contents."

C105 Attributes

SS Display:	C1/05
Diagnostic message number:	C105

C106 Config. IDN for AT Not Configurable

Cause:

Telegram type 7 was set in parameter **S-0-0015, Telegram type parameter**. Parameters which are not contained in **S-0-0187, List of configurable data in AT** can be seen in **S-0-0016, List of configurable data for the AT** .

Remedy:

You must either set a priority telegram in parameter **S-0-0015, Telegram type parameter** (telegram type = 0..6) or you must provide **S-0-0016, List of configurable data for the AT** with parameters that are contained in **S-0-0187, List of configurable parameters**

See also the functional description: "Configuration of telegram contents."

C106 Attributes

SS Display:	C1/06
Diagnostic message number:	C106

C107 Configured Length > Max. Length for AT

Cause:

Telegram type 7 was set in **S-0-0015, Telegram type parameter**. The length of the configurable record in AT, which is determined by **S-0-0016, Configuration drive telegram** exceeds the maximum permissible length **S-0-0187, Length of the configurable record in AT**.

Remedy:

Either set a priority telegram with **S-0-0015, Telegram type parameter** (telegram type = 0..6), or reduce the number of configurable parameters in the AT (**S-0-0016**).

See also the functional description: "Configuration of telegram contents."

C107 Attributes

SS Display:	C1/07
Diagnostic message number:	C107

C108 Time Slot Parameter > Sercos Cycle Time

Cause:

One of the time slot parameters:

- **S-0-0006, AT transmission starting time (T1)**
- **S-0-0089, MDT transmission starting time (T2)**
- **S-0-0007, Feedback acquisition starting time (T4)**
- **S-0-0008, Command valid time (T3)**

exceeds **S-0-0002, SERCOS cycle time.**

Remedy:

Correct the appropriate parameter(s). These times are determined by the manufacturer of the control system and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram sending and receiving times."

C108 Attributes

SS Display:	C1/08
Diagnostic message number:	C108

C109 Position of Data Record in MDT (S-0-0009) Even

Cause:

Parameter **S-0-0009, Starting address in MDT** contains an even value. This is not permitted.

Remedy:

Parameter **S-0-0009, Starting address in MDT** must be set to an odd value. These parameters are determined by the manufacturer of the control system, and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram send and receive times."

C109 Attributes

SS Display:	C1/09
Diagnostic message number:	C109

C110 Length of MDT (S-0-0010) Odd

Cause:

Parameter **S-0-0010, Length of master data telegram** contains an odd value. This is not permitted.

Remedy:

Parameter **S-0-0010, Length of master data telegram** must be set to an even value. These parameters are determined by the manufacturer of the control system, and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram sending and receiving times."

C110 Attributes

SS Display:	C1/10
Diagnostic message number:	C110

C111 ID9 + Record Length - 1 > Length of MDT (S-0-0010)

Cause:

Parameter(s) are set incorrectly for **S-0-0009, Beginning address in master data telegram** and **S-0-0010, Length of master data telegram**. The length of the record in MDT for the drive plus the starting address in MDT is greater than the total length of the MDT.

Remedy:

The parameters for **S-0-0009, Beginning address in master data telegram** and **S-0-0010, Length of master data telegram** must be corrected. Those parameters are determined by the manufacturer of the control system and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram send and receive times."

C111 Attributes

SS Display:	C1/11
Diagnostic message number:	C111

C112 TNcyc (S-0-0001) or TScyc (S-0-0002) Error

Cause:

Only 500 us or even multiples of 1ms are permitted as valid values for **S-0-0001, NC cycle time** and **S-0-0002, SERCOS cycle time**. Here, this is not the case.

Remedy:

S-0-0001, NC cycle time and **S-0-0002, SERCOS cycle time** must be corrected. These parameters are determined by the manufacturer of the control system, and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram send and receive times."

C112 Attributes

SS Display:	C1/12
Diagnostic message number:	C112

C113 Relation of TNcyc (S-0-0001) to TScyc (S-0-0002) incorrect

Cause:

The value of **S-0-0001, NC cycle time** can only be equal to or be a multiple of **S-0-0002, SERCOS cycle time**. Here this is not the case.

Remedy:

S-0-0001, NC cycle time and **S-0-0002, SERCOS cycle time** must be corrected. These parameters are determined by the manufacturer of the control system and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram send and receive times."

C113 Attributes

SS Display:	C1/13
Diagnostic message number:	C113

C114 T4 > TScyc (S-0-0002) - T4min (S-0-0005)

Cause:

The maximum permissible value for **S-0-0007, Measurement time feedback value T4** is:

> **S-0-0002, SERCOS cycle time - S-0-0005, minimum time feedback value determination T4min**.

The value for **S-0-0007, Feedback values acquisition starting time T4** is incorrect.

Remedy:

****Correct S-0-0007, Feedback acquisition starting time T4**. These parameters are determined by the manufacturer of the control system, and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram send and receive times."

C114 Attributes

SS Display:	C1/14
Diagnostic message number:	C114

C115 T2 Too Small

Cause:

The value set for **S-0-0089, MDT transmit starting time T2** is incorrect. The drive cannot work with this value.

Remedy:

****Correct S-0-0089, MDT transmit starting time T2**.

These parameters are determined by the manufacturer of the control system, and are specified by the SERCOS interface.

See also the functional description: "Configuration of telegram send and receive times."

C115 Attributes

SS Display:	C1/15
Diagnostic message number:	C115

C200 Communications Phase 4 Transition Check

Meaning:

Command **S-0-0128, C2 Communications phase 4 transition check** is activated.

See also the functional description: "S-0-0128, C2 transition procedure to communications phase 4."

C200 Attributes

SS Display:	C2/00

Diagnostic message number: C200

C201 Invalid Parameter (-> S-0-0022)

Cause:

Parameters which will be necessary to operate the drive in communications phase 4 are invalid. The invalid parameters can be seen in **S-0-0022, IDN list of invalid op. data for comm. ph. 3**.

Remedy:

The parameters of **S-0-0022, IDN list of invalid op. data for comm. ph. 3** must be rewritten so they are correct.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C201 Attributes

SS Display: C2/01

Diagnostic message number: C201

C202 Limit Error Parameter (-> S-0-0022)

Cause:

Parameters which are necessary to operate the drive in communications phase 4 are either outside of their minimum or maximum input values or the entered value can't be processed (for BIT bars). The incorrect parameters are listed in **S-0-0022, IDN list of invalid op. data for comm. ph. 3**.

Remedy:

The parameters of **S-0-0022, IDN list of invalid op. data for comm. ph. 3** must be rewritten so they are correct.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C202 Attributes

SS Display: C2/02

Diagnostic message number: C202

C203 Parameter Calculation Error (-> S-0-0022)

Cause:

Parameters which are necessary to operate in phase 4 cannot be processed. The incorrect parameters are listed in **S-0-0022, IDN list of invalid op. data for comm. ph. 3**. For example, in parameter **P-0-0075, External feedback interface**, the value for the DLF module has been entered, but it is actually not available.

Remedy:

Correct values must be written to the parameters in **S-0-0022, IDN list of invalid op. data for comm. ph 3**.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C203 Attributes

SS Display: C2/03

Diagnostic message number: C203

C204 Motor Type (P-0-4014) Incorrect

An MDD or MKD motor (value 1 or 5) is entered into parameter **P-0-4014, Motor type**. The appropriate abbreviation "MDD" or "MKD", however, was not found in parameter **S-0-0141, Motor type** in the motor feedback data memory.

Cause:

1. Incorrect parameter set for type of motor.
2. The motor feedback memory cannot be read.

Remedy:

For 1. Enter the type of motor used in parameter **P-0-4014, Type of motor**

For 2. Check feedback connection.
If feedback is defective, exchange motor.

See also the functional description: Setting motor type automatically for motors with feedback memory."

C204 Attributes

SS Display:	C2/04
Diagnostic message number:	C204

C210 External Feedback Required (-> S-0-0022)

Cause:

Values are entered in parameters **S-0-0147, Homing parameter** or **S-0-0032..35 Operating type parameters** which require the use of an external encoder. However, only "0" (i.e., no setting) is entered in parameter **P-0-0075, External encoder interface**.

Remedy:

S-0-0147, Homing parameter or **Operating mode parameters S-0-0032..35** need to be changed for use with the motor encoder instead of external encoder.

Activate an external measurement system by entering a non-zero value for **P-0-0075, External feedback interface**.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C210 Attributes

SS Display:	C2/10
Diagnostic message number:	C210

C211 Invalid feedback data (-> S-0-0022)

If you are using an MDD or MKD motor, a data storage area is available in the motor feedback. An attempt has been made to read parameters stored there. An error occurred during this process.

Causes:

1. Defective motor feedback cable.
2. Defective motor feedback.
3. Defective drive controller.

Remedy:

For 1. Check the motor feedback cable.

For 2. Exchange the motor.

For 3. Exchange the amplifier.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C211 Attributes

SS Display:	C2/11
Diagnostic message number:	C211

C212 Invalid Amplifier Data (-> S-0-0022)

During drive initialization, the operating software retrieves data from an EEPROM in the drive controller. If this access was unsuccessful, an error message will be generated.

Cause:

Defective hardware in the drive controller.

Remedy:

Exchange the drive controller.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C212 Attributes

SS Display:	C2/12
Diagnostic message number:	C212

C213 Position Data Scaling Error

Cause:

The display format of the position data can be set with the position data scaling parameter. The internal drive controller format of the position data is dependent on the motor encoder being used and the resolution of the controller. The factor for converting the position data from the internal drive format into display format or vice-versa is outside of the workable area because either:

- The motor is linear and positional scaling of the motor is rotary or
- the motor is rotary and positional scaling (in reference to motor) is linear or
- Linear motor and module scaling is set or
- The calculated factor for converting the position data from display format to internal format (or vice-versa) cannot be represented.

Remedy:

Check and set the relevant parameters correctly as follows:

- **S-0-0076, Position data scaling type**
- **S-0-0077, Position data scaling factor**
- **S-0-0078, Position data scaling exponent**
- **S-0-0079, Rotary position resolution**
- **S-0-0116, Resolution of motor encoder**
- **S-0-0121, Input revolutions of load gear**

- S-0-0122, Output revolutions of load gear
- **S-0-0123, Feed constant**
- **P-0-0074, Motor encoder interface**
- **S-0-0277, Position feedback 1 type parameter**

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C213 Attributes

SS Display:	C2/13
Diagnostic message number:	C213

C214 Velocity Data Scaling Error

Cause:

The display format of the velocity data can be set using scaling parameters. The drive-controlled format of the velocity data depends on what motor encoder and encoder resolution are used. The factor for converting the velocity data from drive-controlled format to display format (or vice-versa) is outside the workable range.

Remedy:

Check and set the relevant parameters correctly as follows:

- **S-0-0044, Velocity data scaling type**
- **S-0-0045, Velocity data scaling factor**
- **S-0-0046, Velocity data scaling exponent**
- **S-0-0116, Rotational encoder resolution 1**

- **S-0-0121, Input revolutions of load gear**
- **S-0-0122, Output revolutions of load gear**
- **S-0-0123, Feed constant**
- **P-0-0074, Motor encoder interface**
- **S-0-0277, Position feedback 1 type parameter**

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C214 Attributes

SS Display:	C2/14
Diagnostic message number:	C214

C215 Acceleration Data Scaling Error

Cause:

The display format of the acceleration data can be set for the acceleration data using scaling parameters. The drive-controlled format of the acceleration data is dependent on what motor encoder and encoder resolution are used. The factor for converting acceleration data from internal drive format to display format (or vice-versa) is outside the workable range.

Remedy:

Check and set the relevant parameters correctly as follows:

- **S-0-0160, Acceleration data scaling type**
- **S-0-0161, Acceleration data scaling factor**
- **S-0-0162, Acceleration data scaling exponent**
- **S-0-0116, Rotational encoder resolution 1**
- **S-0-0121, Input revolutions of load gear**
- **S-0-0122, Output revolutions of load gear**
- **S-0-0123, Feed constant**
- **P-0-0074, Motor encoder interface**
- **S-0-0277, Position feedback 1 type parameter**

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C215 Attributes

SS Display:	C2/15
Diagnostic message number:	C215

C216 Torque/Force Data Scaling Error

Cause:

The display format of the torque/force data can be set for the torque/force data using scaling parameters. The factor for converting torque data from drive-controlled format to display format (or vice-versa) is outside the workable area.

Remedy:

Check and set the relevant parameters correctly as follows:

- **S-0-0086, Torque/force data scaling type**
- **S-0-0093, Torque/force data scaling factor**
- **S-0-0094, Torque/force data scaling exponent**
- **S-0-0110, Amplifier peak current**
- **S-0-0111, Motor current at standstill**

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C216 Attributes

SS Display:	C2/16
Diagnostic message number:	C216

C217 Motor Feedback Data Reading Error

If you have entered these values into **P-0-0074, Motor feedback interface**:

- "1" for standard interface,
- "4" for DFF module, or
- "8" for DAG module (Endat)

then the attached encoder must have a feedback data memory. The values for the encoder resolution and the feedback type are taken from there. An error was discovered while reading these values.

Cause:

1. Defective motor feedback cable.
2. Defective motor feedback.

Remedy:

For 1. Check the motor feedback cable.

For 2. Exchange the motor.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C217 Attributes

SS Display:	C2/17
Diagnostic message number:	C217

C218 External Feedback Data Reading Error

If **P-0-0075, External encoder interface** is set at

- "1" for standard interface,
- "4" for DFF module, or
- "8" for DAG module (Endat)

then the attached encoder must have a feedback data memory. The values for the encoder resolution and the feedback type are taken from there. An error was discovered while reading these values.

Cause:

1. Defective measurement system cable.
2. Defective measurement system.

Remedy:

For 1. Check the measurement system cable.

For 2. Exchange the measurement system.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C218 Attributes

SS Display:	C2/18
Diagnostic message number:	C218

C220 Mot. Feedback Initialization Error

A number of tests are performed when the motor encoder is initialized. An error was detected during this process. This error may be:

- Error while reading the angle rectification data
- Error while copying the angle rectification data
- Interruption of communication with the encoder
- Assembly error with the position of an initialization track
- Error while reading the analog signal of an initialization track
- Error in the pointer length of the analog signal of an initialization track
- Invalid offset between the high and low resolution track
- Error in the measuring system micro-controller

Cause:

1. Defective motor feedback cable.
2. Defective motor feedback.
3. Defective measurement system interface.

Remedy:

For 1. Check the motor feedback cable.

For 2. Exchange the motor.

For 3. Exchange the measuring system interface (module).

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C220 Attributes

SS Display: C2/20

Diagnostic message number: C220

C221 Ext. Feedback Initialization Error

Several checks are performed during the initialization of an external encoder. An error was detected during this process. This error may be:

- Error while reading the angle rectification data
- Error while copying the angle rectification data

Interruption of communication with the encoder

- Assembly error with the position of an initialization track
- Error while reading the analog signal of an initialization track
- Error in the pointer length of the analog signal of an initialization track
- Invalid offset between the high and low resolution track
- Error in the measuring system micro-controller
- External 24V set for SSI interface with DAG 1.2

Cause:

1. External encoder cable defect.
2. Defective feedback.
3. Defective measurement system interface.

Remedy:

For 1. Check the external feedback cable.

For 2. Exchange feedback.

For 3. Exchange the measuring system interface (module).

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C221 Attributes

SS Display: C2/21

Diagnostic message number: C221

C225 Coprocessor Not Ready For Initialization

The drive controller has a coprocessor. This coprocessor is initialized during the transfer command. The coprocessor signals that it is ready for initialization. If it is not ready, this error is generated.

Cause:

Coprocessor failed.

Remedy:

Exchange the drive controller.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C225 Attributes

SS Display: C2/25

Diagnostic message number: C225

C226 Coprocessor Acknowledge Failed

The drive controller has a coprocessor. This coprocessor is initialized during the transfer command. If the coprocessor does not confirm the initialization by the master processor, this error will be generated.

Cause:

The coprocessor failed.

Remedy:

Exchange the drive controller.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C226 Attributes

SS Display: C2/26

Diagnostic message number: C226

C227 Module Range Error

See the feature description: "Modulo processing limiting conditions."

C227 Attributes

SS Display: C2/27

Diagnostic message number: C227

C228 Controller Type (S-0-0140) Incorrect

Several internal software settings are made based on parameter **S-0-0140, Control device type** . If the content of this parameter cannot be used, then this error will be generated.

Cause:

1. The controller type cannot be processed by this software.
2. Amplifier EEProm defective.

Remedy:

For 1. Contact Indramat.

For 2. Exchange/repair the control device.

See also the functional description: "S-0-0128, C2 communications phase 4 transition check."

C228 Attributes

SS Display: C2/28

Diagnostic message number: C228

C300 Set Absolute Measuring

Command **"P-0-0012, 'set absolute measurement'** was activated by the control system in use.

See also the functional description: "Set absolute measuring."

C300 Attributes

SS Display: C3/00

Diagnostic message number: C300

C302 Absolute Measuring System Not Installed

Command **P-0-0012, 'Set absolute measurement'** was started without an absolute measuring system being present.

The command cannot be processed because no absolute measuring system is available.

Cause:

1. The command should not have been activated.
2. The contacted motor or the external measurement system was not executed as an absolute encoder.

Remedy:

For 1. Stop execution of the command.

For 2. Equip the motor or external measurement system with an absolute encoder function.

See also the functional description: "Possible error messages when setting absolute dimension."

C302 Attributes

SS Display: C3/02

Diagnostic message number: C302

C500 Reset Class 1 Diagnostic (Error Reset)

The command for clearing errors, **"S-0-0099, Reset class 1 diagnostic"** was activated by the control system in use.

See also the functional description: "Clearing errors."

C500 Attributes

SS Display: C5/00

Diagnostic message number: C500

C501 Error Delet Only in Parameter Mode

Cause:

An attempt was made to delete error F8/22, Motor encoder error, signals too small, in communications phase 4. This is only possible in communications phases < 4.

Remedy:

1. Set communications phase back.
2. Retry command.

C501 Attributes

SS Display: C5/01

Diagnostic message number: C50

C600 Drive-Controlled Homing Procedure Command

Command **S-0-0148, Drive-controlled homing procedure** was activated by the control system in use.

See also the functional description: "Drive-controlled homing."

C600 Attributes

SS Display: C6/00

Diagnostic message number: C600

C601 Homing Not Possible if Drive is Not Enabled

Cause:

The command was started without control enable being turned on. This is not permissible.

Remedy:

1. Turn the controller enable on.
2. Start the command again.

See also the functional description: "Possible error messages during drive-controlled homing."

C601 Attributes

SS Display: C6/01

Diagnostic message number: C601

C602 Distance Homing Switch - Reference Mark Erroneous

Cause:

Evaluation of the zero-switch is turned on. The distance between the positive off switch transition and the reference mark to be evaluated is outside the permissible range.

Remedy:

Transfer the value in parameter **S-0-0298, Shift reference cam by...** to parameter **S-0-0299, Home switch offset**.

See also the functional description: "Connection and configuration of the zero-switch."

C602 Attributes

SS Display: C6/02

Diagnostic message number: C602

C604 Homing of Absolute Encoder Not Possible

Command **S-0-0148, Drive-controlled homing** was activated. An absolute measuring system was selected using the encoder selection in **S-0-0147, Homing parameter**. This command can only run if command **P-0-0012, 'Set absolute measurement'** has been previously activated.

Remedy:

First activate command **P-0-0012, 'Set absolute measurement'**, and then start command **S-0-0148, Drive-controlled homing procedure**. This procedure will define the absolute reference point.

See also the functional description: "Possible error messages during drive-controlled homing."

C604 Attributes

SS Display: C6/04

Diagnostic message number: C604

C700 Basic load

For motors of series MDD and MKD, the machine mechanics are adjusted to the digital drive by activating the velocity controller parameters stored in the motor feedback. The drive controller signals with message C700 that command C700, Basic load, was activated by command **S-0-0262, Command basic load**.

Cause:

Command C700, Basic load, was activated.

See also the functional description: "Load default."

C700 Attributes

SS Display: C7/00

Diagnostic message number: C700

C701 Basic Load Not Possible If Drive Is Enabled

Cause:

Command **S-0-0262, Command basic load** cannot be run if the controller enable is set.

Remedy:

1. Disable controller enable.
2. Start the command again.

See also the functional description: "Run the load default settings feature as a command."

C701 Attributes

SS Display: C7/01

Diagnostic message number: C701

C702 Default Parameters Not Available

For motors of series MDD and MKD, the machine mechanics are adjusted to the digital drive by activating the velocity controller parameters stored in the motor feedback. The drive controller signals

with message C702 that command **S-0-0262, Command basic load**, was activated, but no data memory is available in the contacted motor.

Remedy:

Order the parameter information sheet from Indramat customer service and enter the parameters.

See also the functional description: "Run the load default settings feature as a command."

C702 Attributes

SS Display: C7/02

Diagnostic message number: C702

C703 Default Parameters Invalid

Cause:

The default parameters are read from the motor feedback data memory. At least one of these parameters is invalid.

Remedy:

Check the connection to the motor feedback. Exchange motor if necessary.

See also the functional description: "Run the load default settings feature as a command."

C703 Attributes

SS Display: C7/03

Diagnostic message number: C703

C704 Parameters Not Copyable

Cause:

The default parameters in use are not compatible with this software version.

Remedy:

Contact Indramat.

See also the functional description: "Run the load default settings feature as a command."

C704 Attributes

SS Display: C7/04

Diagnostic message number: C704

D400 Positive Stop drive procedure command

When the positive stop drive procedure command is activated, all controller monitoring which would result in an error message for class 1 diagnostic while blocking the drive with a positive stop is turned off.

Cause:

Command **D400 Positive stop drive procedure command** was activated.

See also the functional description: "Positive stop drive procedure."

D400 Attributes

SS Display: D4/00

Diagnostic message number: D400

D401 ZKL1 Error at Command Start

Cause:

A class 1 diagnostic error was discovered while starting the command "Positive stop drive procedure." As a result, the command could not be executed.

Remedy:

Eliminate the cause of the error, clear the error, and start the command again.

See also the functional description: "Positive stop drive procedure."

D401 Attributes

SS Display: D4/01

Diagnostic message number: D401

1.4 Status Diagnostic Messages

A000 Communication Phase 0

The communication process is divided into four communications phases: Phases 0 and 1 are used to recognize the participants. Phase 2 is used to provide the time and data protocols for communications phases 3 and 4.

Initialization is performed in ascending order of the sequence. The defaults of the communications phase are set by the control system. When the switch to communications phase 4 takes place, initialization is completed and input power is enabled.
If the delayed phase switch is interrupted, the status display in the communications phase which has already been reached freezes.
If diagnostic message **A000 Communication phase 0** is active, the drive is in phase 0 and is waiting for a phase transfer to 1 by the control system.

See also the functional description: "Parameter mode - operation mode."

A000 Attributes

SS Display:	P0
Diagnostic message number:	A000

A001 Communications Phase 1

The communication process is divided into four communications phases: Phases 0 and 1 are used to recognize the participants. Phase 2 is used to provide the time and data protocols for communications phases 3 and 4.

Initialization is performed in ascending order of the sequence. The defaults of the communications phase are set by the control system. When the switch to communications phase 4 takes place, initialization is completed and input power is enabled.
If the delayed phase switch is interrupted, the status display in the communications phase which has already been reached freezes.
If diagnostic message **A001 Communication phase 1** is active, the drive is in phase 1, and transfer from phase 1 to 2 has not yet been initiated by the control system.

See also the functional description: "Parameter mode - operation mode."

A001 Attributes

SS Display:	P1
Diagnostic message number:	A001

A002 Communication Phase 2

The communication process is divided into four communications phases: Phases 0 and 1 are used to recognize the participants. Phase 2 is used to provide the time and data protocols for communications phases 3 and 4.

Initialization is performed in ascending order of the sequence. The defaults of the communications phase are set by the control system. When the switch to communications phase 4 takes place, initialization is completed and input power is enabled.

If the delayed phase switch is interrupted, the status display in the communications phase which has already been reached freezes. If diagnostic message **A002 Communication phase 2** is active, the drive is in phase 2.

Before the control system transfers to communications phase 3, command **S-0-0127, C1 Communications phase 3 transition check** must be started. If the command is acknowledged negatively, transfer to communications phase 3 is not possible. The problems that were diagnosed by the drive must be solved first.

Note: The parameters are not checked to see if they are correct.

See also the functional description: "Parameter mode - operation mode."

A002 Attributes

SS Display: P2

Diagnostic message number: A002

A003 Communications Phase 3

The communication connection is divided into four communication phases: Phases 0 and 1 are used to recognize the participants. Phase 2 is used to provide the time and data protocols for communications phases 3 and 4.
Initialization is performed in ascending order of the sequence. The defaults of the communications phase are set by the control system. When the switch to communications phase 4 takes place, initialization is completed and input power is enabled.
If the delayed phase switch is interrupted, the status display in the communications phase which has already been reached freezes. If diagnostic message **A002 Communication phase 3** is active, the drive is in phase 3.
Before the control system transfers to communications phase 4 (operating mode), command **S-0-0128, C2 communication phase 4 transition check** must be started. If the command is acknowledged negatively, transfer to communications phase 4 is not possible. The problems that were diagnosed by the drive must be solved first.

Note: The parameters are not checked to see if they are correct.

See also the functional description: "Parameter mode - operation mode."

A003 Attributes

SS Display: P3

Diagnostic message number: A003

A010 Halt Drive

The feature "Halt drive" was activated. The halt drive feature serves to stop the motor at a defined deceleration and a defined jerk.
This feature can either be activated by deleting the drive halt bits (BIT 13) in the master control word or by interrupting a drive control command (i.e., in drive-controlled homing).

See also the functional description: "Drive halt feature description."

A010 Attributes

SS Display: AH

Diagnostic message number: A010

A011 Drive Interlock Open

Digital drive controllers are equipped with a drive interlock. It prevents undesired starting of a servo axis. When drive interlock is activated, the control electronics of the power output stage are disconnected from the power output stage by a relay contact.
To terminals AS+; AS- of connector plug X3: +24V of power has been applied.

See also the functional description: "Drive interlock open."

A011 Attributes

SS Display: AS

Diagnostic message number: A011

A012 Control and Power Sections Ready for Operation

The drive is supplied with control voltage and the power is switched on. The drive is ready for power delivery.

See also the functional description: "Controller enable."

A012 Attributes

SS Display: Ab

Diagnostic message number: A012

A013 Ready for Power ON

The drive is supplied with a control voltage; there are no errors in the drive controller. The drive is ready to be turned on.

See also the functional description: "Parameter mode - operation mode."

A013 Attributes

SS Display: bb

Diagnostic message number: A013

A100 Drive in Torque Mode

The drive is in the torque control operating mode. It follows the torque command value sequence which was set by the control system.

See also the functional description: "Torque/force control."

A100 Attributes

SS Display: AF

Diagnostic message number: A100

A101 Drive in Velocity Mode

The drive is in the velocity control operating mode. It follows the velocity command value sequence set by the control system. The RPM control loop is closed in the drive.

See also the functional description: "Velocity control."

A101 Attributes

SS Display: AF

Diagnostic message number: A101

A102 Position Mode Encoder 1

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value with following (lag) error.

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of the axis position).

See also the functional description: "Position control."

A102 Attributes

SS Display:	AF
Diagnostic message number:	A102

A103 Position Mode Encoder 2

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value with following (lag) error.

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Position control."

A103 Attributes

SS Display:	AF
Diagnostic message number:	A103

A104 Position Mode Encoder 1/Lagless Positioning

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value **without following (lag) error**.

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of axis position).

See also the functional description: "Position control."

A104 Attributes

SS Display:	AF
Diagnostic message number:	A104

A105 Position Mode Encoder 2/Lagless Positioning

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value **without following (lag) error**.

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Position control."

A105 Attributes

SS Display:	AF
Diagnostic message number:	A105

A106 Drive-Controlled Interpolation, Encoder 1

The drive receives a position command value from the control system which is identical to the target position of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence, which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.
The drive moves with following (lag) error to the target position of the travel path.

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of the axis position).

See also the functional description: "Drive internal interpolation."

A106 Attributes

SS Display:	AF
Diagnostic message number:	A106

A107 Drive-Controlled Interpolation, Encoder 2

The drive receives a position command value from the control system which is identical to the target position of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence, which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.
The drive moves with following (lag) error to the target position of the travel path.

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Drive internal interpolation."

A107 Attributes

SS Display:	AF
Diagnostic message number:	A107

A108 Drive-Controlled Interpolation/Encoder 1 Lagless Positioning

The drive receives a position command value from the control system which is identical to the target position of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence, which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.

The drive moves **without following error** to the target position of the travel path.

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of the axis position).

See also the functional description: "Drive internal interpolation."

A108 Attributes

SS Display:	AF
Diagnostic message number:	A108

A109 Drive-Controlled Interpolation/Encoder 2 Lagless Positioning

The drive receives a position command value from the control system which is identical to the target position of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence, which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.
The drive moves **without following error** to the target position of the travel path.

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Drive internal interpolation."

A109 Attributes

SS Display:	AF
Diagnostic message number:	A109

1.5 Diagnostic Messages for Basic Initialization and After Fatal System Errors

Diagnostic Message Display: -0

Cause:

The data storage for the controller is tested for its functional capability.

If an error is detected, this display will remain.

Remedy:

The drive controller is defective (DRP3) and must be exchanged.

Diagnostic Message Display: -1

Cause:

The data storage for the DSS 2.1 Module is tested for its functional capability.

If an error is detected, this display will remain.

Remedy:

The DSS Module or the connection to the main device is defective.

- If DSS module is defective > exchange
- If drive controller is defective > exchange

Diagnostic Message Display: -2

Cause:

Makeup of the parameter structure.

If the EPROMS are exchanged for another version of the firmware, the parameter memory on the programming module is erased (duration appx. 5 sec.).

Diagnostic Message Display: -3

Cause:

The motor type and the type of the motor feedback are determined by reading their parameter storage areas.

Diagnostic Message Display: -5

During basic initialization, an error was reported by the coprocessor.

Cause:

1. Control voltage error (+24 V or +/-15 V).
2. +/-10 V - error.

Remedy:

For 1. Check the control voltage supply.

For 2. Replace the drive.

Diagnostic Message Display: -6

Cause:

A fatal processor or program error was encountered.

Remedy:

The error in question is a system error. Please contact the appropriate software development company.

Diagnostic Message Display: Watchdog ••

Cause:

A fatal processor or program error (Watchdog) was encountered.

Remedy:

Replace the drive.

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