



ECODRIVE03/DURADRIVE Drives for Machine Tool Applications with SERCOS and Parallel Interface

Firmware Version Notes: SMT 20VRS

SYSTEM200

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 Drives for Machine Tool Applications
 with SERCOS and Parallel Interface

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Purpose of Documentation This documentation offers an overview of the functionality of the firmware FWA-DRIVE*-SMT-20VRS and describes the differences between this firmware and its previous version FWA-ECODR3-SMT-02VRS.
 In the "Summary" chapter, the texts of the functions and parameters that have been changed or added since the previous version FWA-ECODR3-SMT-02VRS are marked with gray background color.

Record of Revisions

Description	Release Date	Notes
DOK-DRIVE*-SMT-20VRS**-FV01-EN-P	07.2001	First edition
DOK-DRIVE*-SMT-20VRS**-FV02-EN-P	01.2002	Release

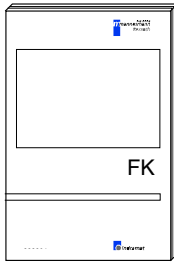
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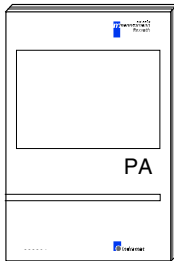
Summary of Documentation - Overview



Functional Description:

Description of all implemented functions based on SERCOS parameters

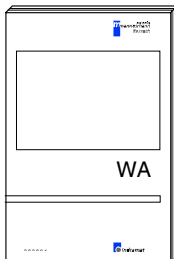
Order designation:
DOK-DRIVE*-SMT-20VRS**-FK01-EN-P



Parameter Description:

A description of all parameters used in the firmware

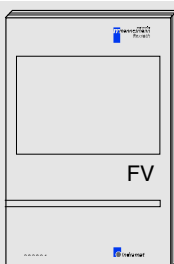
Order designation:
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Troubleshooting Guide:

-Explanation of the diagnostic states
-How to proceed when eliminating faults

Order designation:
DOK-DRIVE*-SMT-20VRS**-WA01-EN-P



Firmware Version Notes:

Summary of the functionalities of the new firmware and of the changes since the previous version
FWA-ECODR3-SMT-02VRS-MS

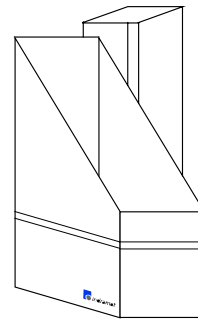
Order designation:
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CD: DRIVEHELP

Collection of Windows help systems which contain documents on firmware derivatives

Order designation:
DOK-GENERL-DRIVEHELP**-GEXX-MS-D0600



Order designation
DOK-DRIVE*-SMT-20VRS**-7101-EN-P

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1 General Information

1.1 Firmware Types

For the ECODRIVE03/DURADRIVE drive families there are three firmware types for different applications:

- **SMT:** Drives for Machine Tool Applications with SERCOS and Parallel Interface
- **SGP:** Drives for General Automation with SERCOS and Parallel Interface
- **FGP:** Drives for General Automation with Field Bus Interfaces

These Version Notes relate to the firmware version:

ECODRIVE03/DURADRIVE
 Drives for Machine Tool Applications
 with SERCOS and Parallel Interface
FWA-DRIVE*-SMT-20VRS-MS

Using this documentation it is possible to quickly obtain an overview of the functionalities of this firmware.

In addition, this documentation describes the differences between the firmware version FWA-DRIVE*-SMT-20VRS and the previous version FWA-ECODR3-SMT-02VRS. These differences are marked with gray background color in the "Summary" chapter.

The following drive controllers can be operated with the firmware released:

DKC21.3-040-7-FW	DKC21.3-100-7-FW	DKC21.3-200-7-FW
DKC22.3-040-7-FW	DKC22.3-100-7-FW	DKC22.3-200-7-FW
HDC01.1-A040N-SE02	HDC01.1-A100N-SE02	HDC01.1-A200N-SE02

1.2 Release Notes

The general distribution of the firmware version 20 starts as of the **FWA-DRIVE*-SMT-20V06** firmware release.

This firmware was released on: **16/01/2002**

Note: The commissioning of the drive firmware version **FWA-DRIVE*-SMT-20VRS-MS** requires the DriveTop version **SWA-DTOP***-INB-14VRS-MS-C1,44-COPY** (or higher).

1.3 Drive Controllers

With the SMT, SGP and FGP (all 20VRS) firmware types it is possible to operate all drive controllers of the ECODRIVE03/DURADRIVE ranges. The differences between the devices are due to different current ratings and different device concepts (interfaces, supported motor types and measuring systems).

Interfaces Apart from a serial interface, there are the following master communication interfaces available:

Master communication interface	FWA	ECODRIVE03	DURADRIVE
SERCOS	SMT, SGP (all 20VRS)	DKC22.3-xxx-7-FW	HDC01.1-AxxxN-SE02
Analog	SMT, SGP (all 20VRS)	DKC21.3-xxx-7-FW	no
Parallel	SMT, SGP (all 20VRS)	DKC21.3-xxx-7-FW	no
INTERBUS	FGP20VRS	DKC04.3-xxx-7-FW	HDC01.1-AxxxN-IB01
PROFIBUS	FGP20VRS	DKC03.3-xxx-7-FW	HDC01.1-AxxxN-PB01
CANopen	FGP20VRS	DKC05.3-xxx-7-FW	HDC01.1-AxxxN-CN01
DeviceNet	FGP20VRS	DKC06.3-xxx-7-FW	HDC01.1-AxxxN-DN01

Fig. 1-1: Master communication interfaces

1.4 Overview of Operating Modes

Operating mode	FWA	ECODRIVE03	DURADRIVE
torque/force control	SMT, SGP, FGP (all 20VRS)	yes	only possible via MCM (e.g. SERCOS)
velocity control	SMT, SGP, FGP (all 20VRS)	yes	only possible via MCM (e.g. SERCOS)
position control	SMT, SGP, FGP (all 20VRS)	yes	yes
drive-internal interpolation	SMT, SGP, FGP (all 20VRS)	yes	yes
drive-controlled positioning	SMT, SGP, FGP (all 20VRS)	yes	yes
jogging	SMT, SGP, FGP (all 20VRS)	yes	only possible via MCM (e.g. SERCOS)
positioning block mode	SMT, SGP, FGP (all 20VRS)	yes	only possible via MCM (e.g. SERCOS)
synchronous operating modes with virtual master axis	SGP, FGP (all 20VRS)	yes	yes
synchronous operating modes with real master axis	SGP, FGP (all 20VRS)	yes	yes

Fig. 1-2: Operating modes (MCM: master communication module)

2 Replacing the Firmware

2.1 Notes on How to Replace the Firmware

When replacing the firmware, please observe the following:

1. The drive controller must be on.
2. The current parameters must be saved.
3. The drive controller must be in phase 2.
4. The baud rate must be set to 9600
(the value '0' must be set in the parameter **P-0-4021, Baud rate RS-232/485**).

Note: Do not switch off the 24V control voltage while replacing the firmware!

2.2 Firmware Replacement Procedure

The following description applies to the firmware replacement with Dolfi V1.05 or newer (SWA-DOL*PC-INB-01V05-MS-C1.44-COPY, part number 279804).

1. Call Dolfi.
2. Input the following under **Options**:
 - Tab page **Interface**
 - Under **COM Port** select interface to PC.
 - Set '9600' under **Baud rate Connect**.
 - Set baud rate for download under **Baudrate download** (recommended setting: '115200').
 - Tab page **Address**
 - Enter the address set at switches S2 and S3 on the drive controller.
 - Tab page **Language**
 - Select language.
3. Press **Connect** button.
4. Press **Transmit** button.
 - The Windows standard dialog for opening a file opens.
5. Select *.ibf file for update and open file.
 - The headers of the programmed modules are read. (You can view the headers that have been read by selecting the tab page **Header**.)
6. Press **Send** button.
 - If "Module – alle" has been selected, the complete *.ibf file is programmed successively without query (an ECODRIVE03/DURADRIVE firmware normally contains three firmware modules). If "Module – Single" has been selected, press **Send** each time a firmware module has been programmed.
7. With successful update press **Disconnect** button.
 - The drive firmware is started.
8. Exit Dolfi.
 - Should the number of parameters to be buffered have changed, "PL" appears on the display (in case errors are pending, then clear these first). If you now press the S1 key, all buffered parameters are reset to their default values. During this time, "C8 Load default parameters" appears on the display.
 - If the "C8 Load default parameters" command has been started or the motor type replaced, "UL" appears on the display during the transition check from phase 3 to phase 4. Now press the S1 key or start the "Clear error" command. The controller default values are then loaded to the drive controller from the motor feedback data memory.
9. Load desired parameter file.

3 Summary FWA-DRIVE*-SMT-20VRS-MS

3.1 Master Communication Interfaces

SERCOS Interface

Note: With the FWA-DRIVE*-SMT-20VRS-MS firmware, the "SERCOS interface" master communication is only available with the DKC22.3/HDC01.1-A***N-SE02 devices.

General features:

- Cyclical data exchange of command values and actual values in equal time intervals
- Data transfer by means of optic fiber
- Service channel for parameterization and diagnosis
- Configuration of the telegram contents is possible
- Synchronization between the point in time the command values become effective and the actual value measuring point in time of all the drives in a ring

Firmware-specific features:

- Cycle time: min. 2000 μ s, max. 65 ms, granularity 1 (i.e. multiples of 1000 μ s can be set)
- SERCOS compatibility class C
- Baud rate: optionally 2 MBaud or 4 MBaud
- Transmission power can be set
- Max. number of configurable data in the MDT: 16 byte
- Max. number of configurable data in the AT: 16 byte
- Multiplex channel with one data container for MDT data and one for AT data; indexed addressing of elements of list parameters is possible
- Freely configurable signal control word and signal status word
- Automatic baud rate detection

Parallel Interface (with ECODRIVE03 Only)

Note: With the FWA-DRIVE*-SMT-20VRS-MS firmware, the "parallel interface" master communication is only available with DKC21.3. This functionality cannot be used with DURADRIVE.

General features:

- 16 digital inputs freely configurable via signal control word
- 12 digital outputs freely configurable via signal status word
- Operating modes can be switched via digital inputs of the parallel interface

Analog Interface (with ECODRIVE03 Only)

Note: With the FWA-DRIVE*-SMT-20VRS-MS firmware, the "analog interface" master communication is only available with DKC21.3. This functionality cannot be used with DURADRIVE.

For inputting analog command values, the general drive function "Analog inputs" (connector X3) is used (see "General functions").

General features:

- Drive halt input
- Input for drive enable
- Ready-for-operation output

3.2 Basic Operating Modes

Torque/Force Control

Note: With DURADRIIVE it is impossible to preset analog command values.

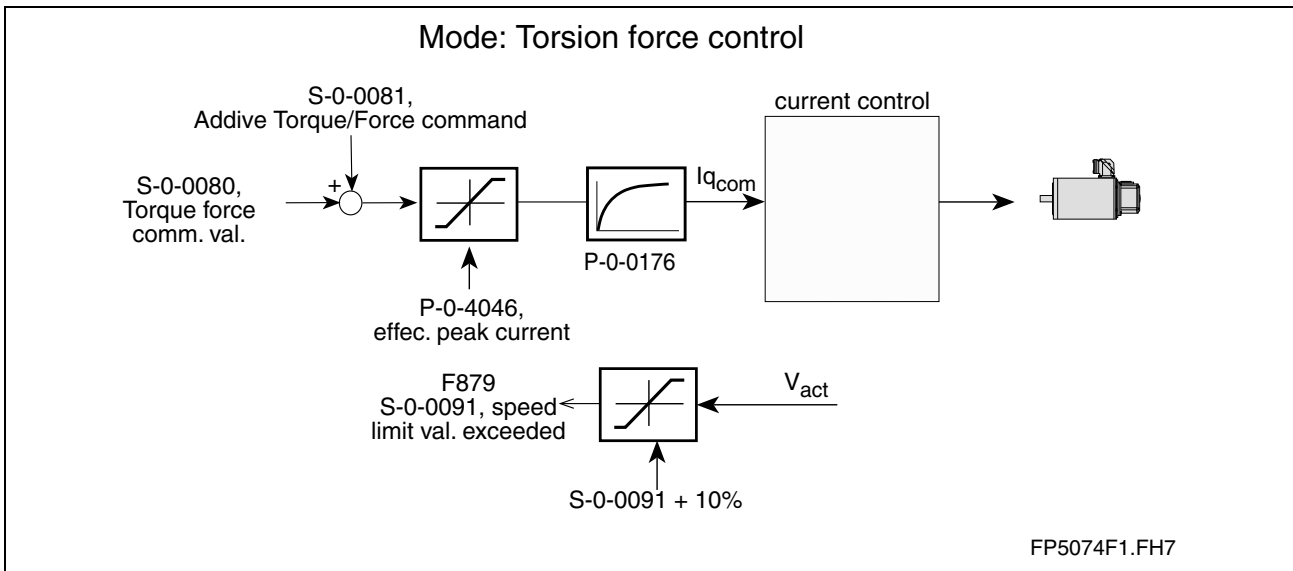


Fig. 3-1: Block diagram: torque/force control

- Torque/force control with regard to the command value preset in parameter **S-0-0080, Torque/Force command** and an additive torque command value in parameter **S-0-0081, Additive Torque/Force command**
- Limiting the preset command value to the limit value that can be parameterized
- Filtering the command value by means of parameter **P-0-0176, Torque/Force command smoothing time constant**
- Monitoring the actual velocity for exceeding parameter **S-0-0091, Bipolar velocity limit value**

Velocity Control

Note: With DURADRIVE it is impossible to preset analog command values.

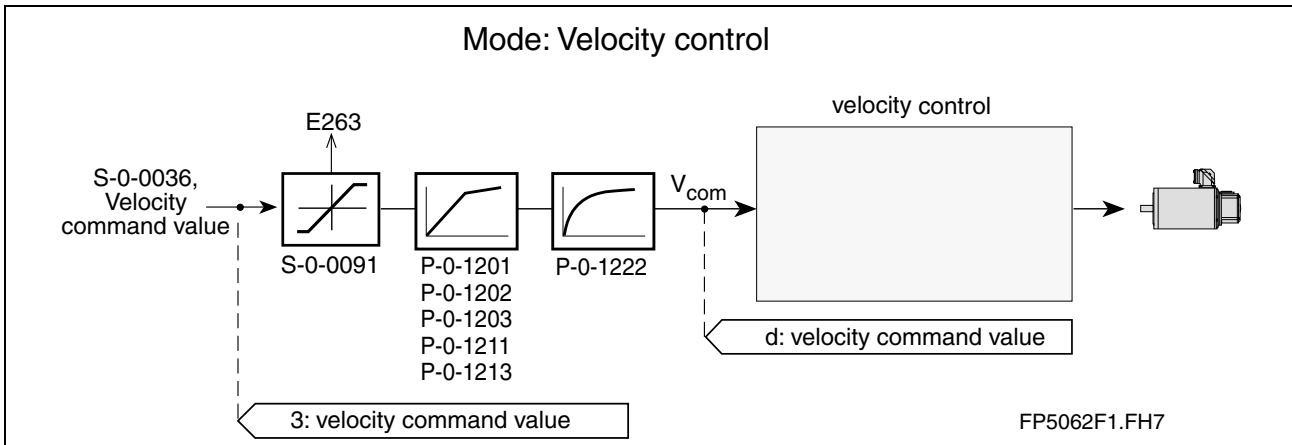


Fig. 3-2: Block diagram: velocity control

- Separately adjustable two-stage acceleration and deceleration limit of the preset velocity command value (parameter **P-0-1211, Deceleration ramp 1** and **P-0-1213, Deceleration ramp 2**); switching from ramp 1 to ramp 2 is done at selectable velocity
- Smoothing the preset command value using a low-pass filter that can be set
- Smoothing the variable using a low-pass filter that can be set
- Filtering a resonance frequency of the variable using a rejection filter with rejection frequency and bandwidth that can be set
- Limiting the variable to a limit value that can be set

Position Control

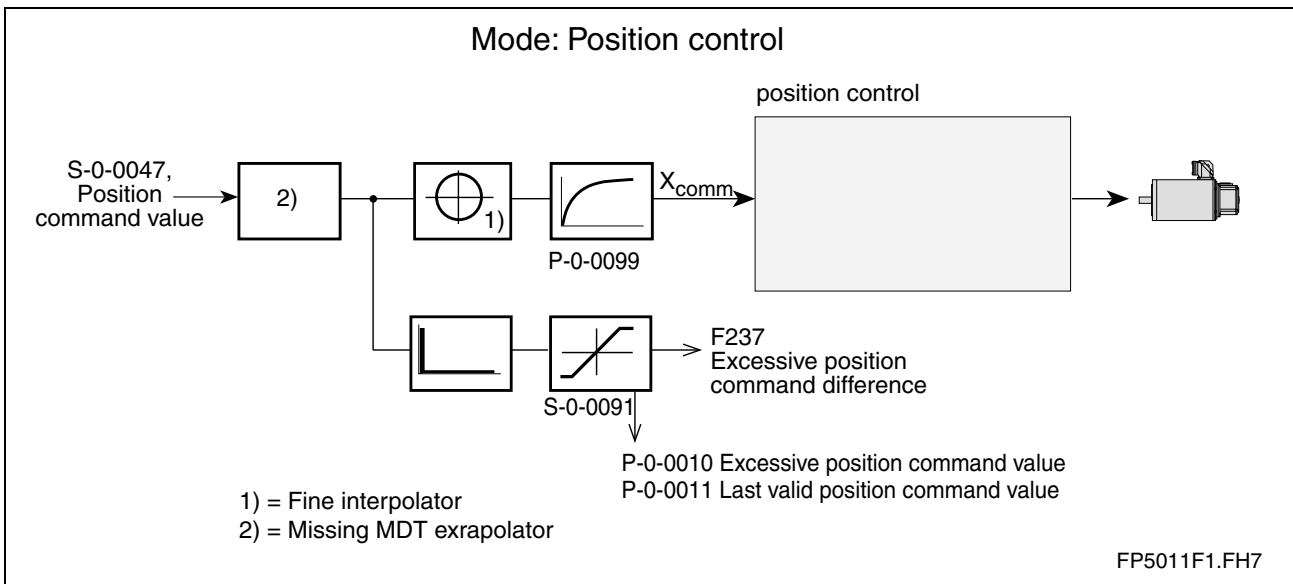


Fig. 3-3: Block diagram: position control

- Position control with regard to **S-0-0047, Position command value**
- Monitoring the position command value difference for exceeding parameter **S-0-0091, Bipolar velocity limit value**
- Fine interpolation of the command value specified in the NC cycle pulse to 1 ms
- Interpolator can be switched from linear to cubic by means of parameter **P-0-0187, Position command processing mode**, bit 0 (default is linear fine interpolator)
- Smoothing the fine interpolated position command values using a low-pass filter that can be set, parameter **P-0-0099, Position command smoothing time constant**
- Position control with regard to actual position value encoder 1 (motor encoder) or actual position value encoder 2 [external (load-side) encoder]
- Dynamic synchronization when changing the operating mode

Drive-Internal Interpolation

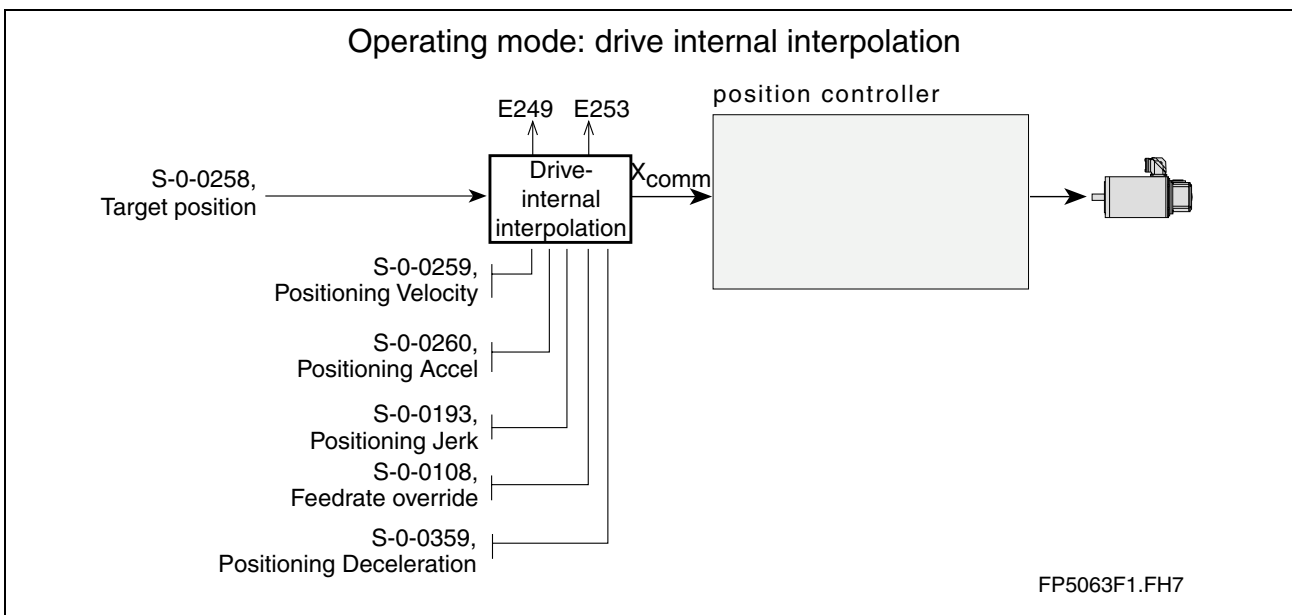


Fig. 3-4: Block diagram: drive-internal interpolation

- Drive-internal generation of a position command value profile to travel to a preset target position (S-0-0258) while maintaining the positioning velocity (S-0-0259) and positioning acceleration (S-0-0260) or positioning deceleration (S-0-0359) that can be set; can be set separately
- Jerk limitation of the generated position command value
- Evaluation of the positioning velocity with feedrate override
- Monitoring the positioning velocity for exceeding parameter **S-0-0091, Bipolar velocity limit value**
- Monitoring the target position for maintaining position limit values
- Command value mode in the modulo format can be set
- Acceleration feedforward (S-0-0348) can be set
- Position control with regard to actual position value encoder 1 (motor encoder) or actual position value encoder 2 [external (load-side) encoder]

Drive-Controlled Positioning

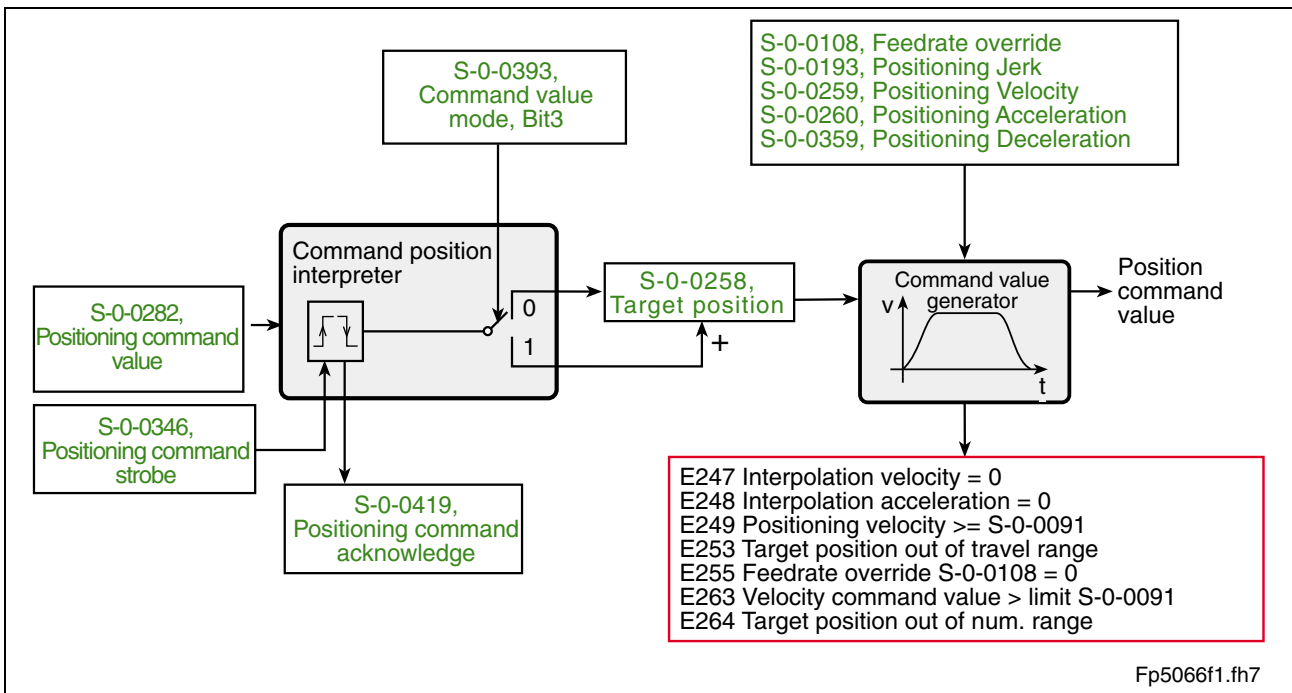


Fig. 3-5: Block diagram: drive-controlled positioning

- Drive-internal generation of a position command value profile to travel to a target position (S-0-0258) preset by means of a positioning command value (S-0-0282) while maintaining the positioning velocity (S-0-0259) and positioning acceleration (S-0-0260) or positioning deceleration (S-0-0359) that can be set; can be set separately
- Control of acceptance of the positioning command value via toggle bit (S-0-0346, bit 0)
- Jerk limitation of the generated position command value
- Evaluation of the positioning velocity with feedrate override
- Monitoring the positioning velocity for exceeding parameter **S-0-0091, Bipolar velocity limit value**
- Monitoring the target position for maintaining position limit values
- Command value mode in the modulo format can be set
- Acceleration feedforward (S-0-0348) can be set
- Position control with regard to actual position value encoder 1 (motor encoder) or actual position value encoder 2 [external (load-side) encoder]
- Generation of the target position from preset positioning command value (absolute or relative positioning)
- Acceleration and deceleration ramps can be set separately

Note: If the positioning command value is accepted, the drive data are written to parameter **S-0-0258, Target position**. The axis is positioned in its target position. If the control unit data are written directly to parameter **S-0-0258, Target position**, this operating mode is compatible with the operating mode "Drive-internal interpolation".

Positioning Block Mode

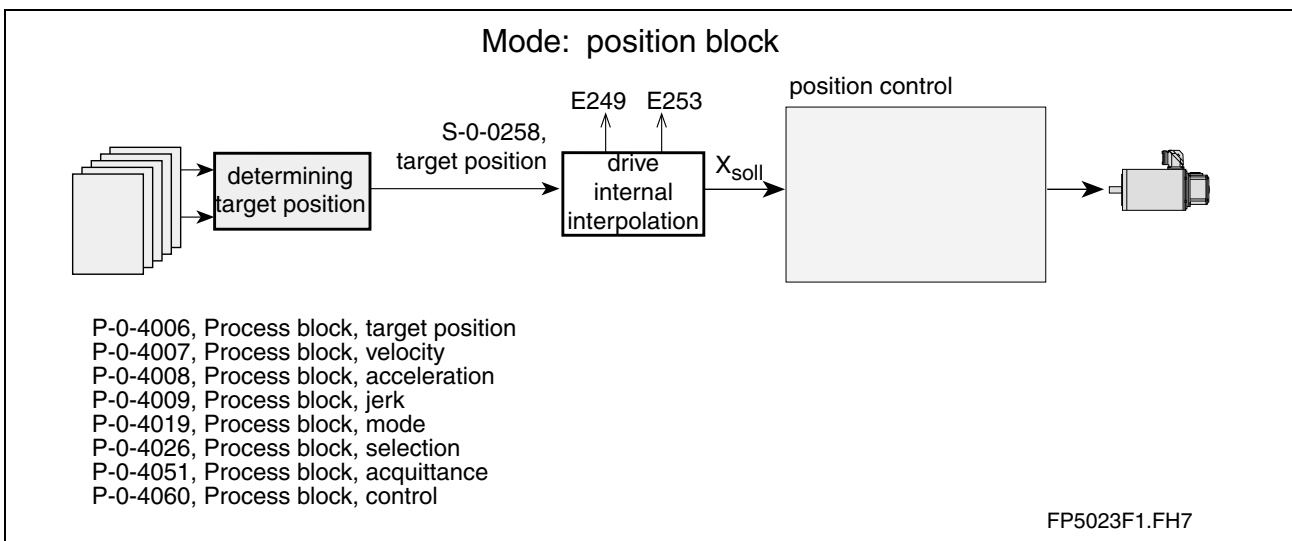


Fig. 3-6: Block diagram: positioning block mode

- Positioning block preselection via parameter **P-0-4026, Process block selection** or via digital inputs (with DKC21.3 only; impossible with DURADRIVE)
- Different modes can be set separately for each positioning block:
 - absolute
 - relative without residual path storage
 - relative with residual path storage
 - infinite travel in positive/negative direction
- Following block mode with position switching or switching signal-dependent switching
- Following block mode with position switching in modes "block transition with old positioning speed", "block transition with new positioning speed" and "block transition with intermediate stop"
- Monitoring the positioning velocity for exceeding the velocity limit value (S-0-0091)
- Monitoring the target position for maintaining position limit values
- Acceleration feedforward can be set
- Position control with regard to actual position value encoder 1 (motor encoder) or actual position value encoder 2 [external (load-side) encoder]
- Acceleration and deceleration can be parameterized separately for each process block. The maximum delay is fixed in parameter **P-0-4063, Process block deceleration**.
- For processing the next process block with block advance by a switch signal the active cam edge can be selected. The effective edge is fixed in parameter **P-0-4019, Process block mode**
Textmarkenname vergeben..
 - **bit 9** = 0: positive edge
 - = 1: negative edge

Jogging

- The "Jogging" mode (positive and negative) is configured:
 - via digital inputs with DKC21.3 (impossible with DURADRIVE)
 - via parameter **P-0-4056, Jog inputs** with DKC22.3/HDC01.1-A***N-SE02
- The drive generates the position command value profile while maintaining
P-0-4030, Jog velocity,
S-0-0260, Positioning Acceleration,
S-0-0359, Positioning Deceleration and
S-0-0193, Positioning Jerk for travelling in one direction.
- With active position limit values and a measuring system that has been homed, the drive runs to position limit value minus the positioning window and warning **E831 position limit value while jogging** is generated.

3.3 Controller Structure

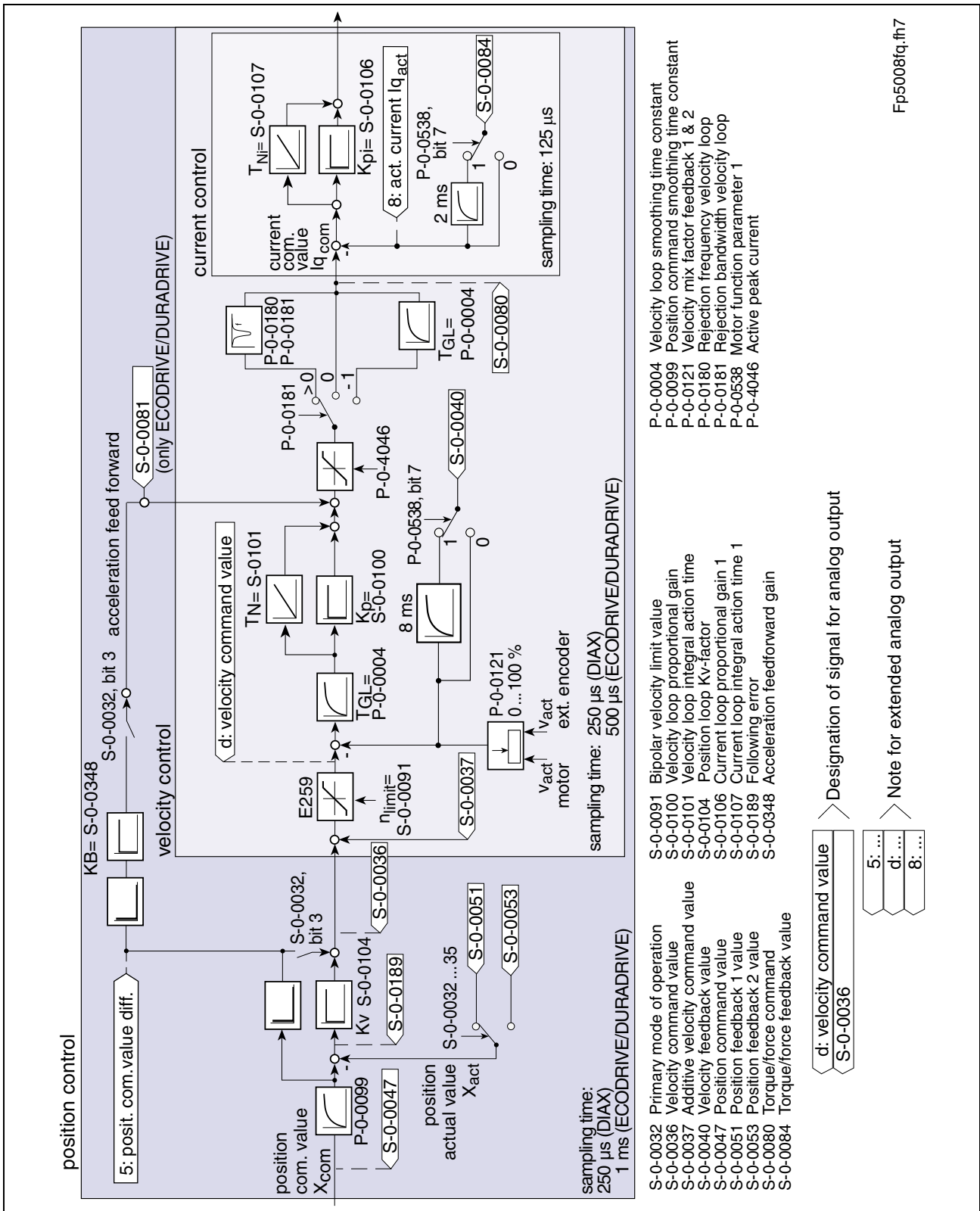


Fig. 3-7: Controller structure FWA-DRIVE*-SMT-20VRS

Note: The controller parameters can be set either manually or by an automated motion cycle (parameter **P-0-0162**, **D900 Command Automatic control loop adjust**).

3.4 Motor Types

The following motor types can be operated with the firmware:

- MKD
- 2AD
- 1MB
- LAF
- MKE
- MBS (rotary synchronous kit motor)
- MHD
- ADF
- MBW
- LAR
- LSF (linear synchronous kit motor)
- Motor encoder on load side with rotary asynchronous motors
- Field weakening also with synchronous motors
- Automatic commutation setting with synchronous motors with incremental motor measuring systems after initial switching on of drive enable after switching into operating mode; correction of the commutation offset when overrunning the reference mark (only incremental measuring systems) with parameter **P-0-0507, Optimized commutation offset**
- Standstill or nominal current standardized to cooling type; new parameter **P-0-0640, Cooling type**
- Support of third-party motors with temperature sensor KTY84

Motor Holding Brake

Features:

- Self-holding and self-releasing brake
- Brake delay time can be set
- Servo and main spindle brake can be selected
- Brake can be released by the user via parameter **P-0-0542, B100 Command Release motor holding brake**
- Holding brake monitor: "brake check" command via command start or automatically after drive enable applied
- Parameter **P-0-0539, Brake status** allows digital brake activation

3.5 Measuring Systems

Motor Encoder

Note: As standard, the motor encoders are already mounted at delivery of the motors. The motor encoder type can only be selected with kit motors.

The following motor encoders are supported:

P-0-0074	Interface connector	Measuring system
1	X4	digital servo feedback or resolver
2	X8	incremental encoder with 1V sine signals (from Heidenhain)
5	X8	incremental encoder with square-wave signals (from Heidenhain)
8	X8	encoder with EnDat interface
9	X8	gearwheel encoder with 1V _{pp} signals
10	X4	resolver encoder without feedback data memory
11	X4+X8	resolver without feedback data memory + incremental encoder with sine signals
12	X4+X8	Hall encoder + square-wave encoder
14	X4+X8	Hall encoder + sine encoder

Fig. 3-8: Measuring systems: connectors

Optional Measuring System

Evaluation as second load-side control encoder or load-side motor encoder is possible (depends on P-0-0185):

P-0-0075	Interface connector	Measuring system
1	X4	digital servo feedback
2	X8	incremental encoder with 1V sine signals (from Heidenhain)
5	X8	incremental encoder with square-wave signals (from Heidenhain)
8	X8	encoder with EnDat interface
9	X8	gearwheel encoder with 1V _{pp} signals

Fig. 3-9: Measuring systems: connectors

- Can be evaluated as an absolute measuring system
- Monitoring of the actual position value of the external encoder for plausibility in terms of the actual position value of the motor encoder

Absolute Measuring Systems

Absolute measuring systems are those encoders with an absolute range of at least one encoder revolution. This includes the measuring systems:

- Single-/multi-turn HSF
- Single-/multi-turn resolver
- Single-/multi-turn encoder with EnDat interface
- Absolute linear scales with EnDat interface

These measuring systems are only treated as absolute encoders, if their **absolute range exceeds or equals half the travel range or the entire travel range**.

The absolute encoder function can be switched off.

If position data are displayed in modulo format, it is possible to evaluate both motor and optional encoder as absolute encoders. Absolute encoder monitoring is also possible in both cases.

Establishing the Position Reference for Actual Values

It is possible to evaluate single-turn encoders and multi-turn encoders as absolute or non-absolute measuring systems. To be selected in the relevant "position encoder type" parameter.

Depending on the selection, the position reference is established by means of parameter **P-0-0012, C300 Command Set absolute measurement** or by means of parameter **S-0-0148, C600 Drive controlled homing procedure command**.

- **C300 Command Set absolute measurement:**

- Initializing the actual position value of an absolute measuring system with regard to a preset value related to the machine zero point, with the help of an **initiator** (switch cam)
- Initializing the actual position value of an absolute measuring system with regard to a preset value related to the machine zero point, with the help of a **command**
- Executing the command either for the actual position value of the motor encoder or the external encoder
- Setting absolute measurement without drive enable
- Setting absolute measurement with drive enable followed by "Drive-controlled homing"
- Setting absolute measurement with drive enable followed by deactivation of drive enable
- Absolute measurement can be set via the home switch input (for systems with slip)

- **C600 Drive controlled homing procedure command:**

- While maintaining a reference velocity and acceleration to be parameterized, the drive generates position command values in order to automatically execute a drive motion which is intended to establish a reference for the actual position value with regard to the machine zero point.
- Executing the command either for the actual position value of the motor encoder or the external encoder
- Executing command with evaluation of a reference mark and/or a home switch or switching the actual position value without axis motion
- Executing the command with selectable travel direction to reference point
- Evaluation of encoders with distance-coded reference marks is possible

3.6 Physical Values Display Formats

- Freely definable LSB valence for the following data transmitted between drive and control unit:
 - position data: degrees, mm, inch
 - velocity data: r.p.m., m/min, inch/min, r/s, m/s, inch/s
 - acceleration data: rad/s², m/s², inch/s²
- Choice of data reference to motor shaft or load
- Choice between translatory and rotary scaling
- Choice between preferred scaling and parameter scaling
- Parameterizable divisor for the modulo value that can be used with "Spindle positioning"

3.7 Error Reactions

- **Variable error reaction** as dependent on error class and selected best possible deceleration
- Selectable settings for **best possible deceleration**:
 - velocity command value reset
 - torque command value reset
 - velocity command value to zero with command value ramp and filter
 - additional error reactions can be realized by means of DISC drive macros; this allows, for example, absolute or relative return motion
- **Power off on error** can be set:
If the setting "no power off on error" has been selected, the BB1 contact is closed immediately after control voltage is switched on.
- Deceleration of the drive via an **emergency stop input (E-Stop)** with drive reaction to be selected:
 - emergency stop as drive error with error class "non-fatal"
 - emergency stop as drive error with error class "travel range"
 - emergency stop as fatal warning

3.8 General Functions

Comprehensive Diagnostic System

- Diagnosis parameter in plain text, as diagnosis number and as error number
- List of diagnosis numbers
- Hard wired collective messages
- Freely configurable signal status word
- Error memory with operating hours counter to store the drive errors that occurred

Parameterization

- Basic parameter set can be activated for defined setting of the drive parameters to default values
- Customer password protection; selection of password-protected parameters can be set

Language Selection

By means of parameter **S-0-0265, Language selection**, you can select the language of parameter names and units, as well as diagnostic texts.

The following languages have been implemented:

- German
- English
- French
- Spanish
- Italian

Drive Halt

The drive stops automatically, considering acceleration and jerk limit values.

The following limit values are used:

Previous operating state	Parameters used
no position control operating mode	P-0-1211, Deceleration ramp 1 P-0-1213, Deceleration ramp 2 P-0-1202, Final speed of ramp 1
position control with drive-internal interpolation (positioning block mode, drive-internal interpolation, drive-controlled positioning)	previous positioning deceleration and jerk limits remain active
position control without drive-internal interpolation	S-0-0138, Bipolar acceleration limit value S-0-0349, Jerk limit bipolar

Fig. 3-10: Acceleration and jerk with "Drive halt"

Analog Inputs

- 2 channels with maximum input voltage range of ± 10 V
- 12-bit A/D converter
- Input of drive parameter data via scaling that can be set

Analog Output

- 2 channels with maximum output voltage range of ± 10 V
- 8-bit D/A converter
- Output of drive parameter data via scaling that can be set
- Pre-set drive-internal signals and any bits and bytes of data memory can be output

Oscilloscope Function

- 2 channels with 512 values each
- Preset signals can be used
- Time resolution: 500 μ s to 100 ms (time pattern: 500 μ s)
- Trigger threshold that can be set for position, velocity and torque/force data
- Drive-internal signals can be triggered and recorded
- Extension of measuring signals to be selected (e.g. S-0-0036, P-0-0053, ...)

Probe Function

- 2 probe inputs with a resolution of 1 μ s
- Possible measuring signals:
 - actual position value encoder 1 or actual position value encoder 2 (if external encoder available)
 - relative internal time (internal counter) with a resolution of 1 μ s and a recording width of 32 bit
- Determining measured value differences
- Measured value signals can be triggered with regard to positive or negative edges
- Expectation window for probe inputs: It is possible to define a range within which probe edges are generally accepted.
- Continuous measurement: After a measurement, the edge evaluation of the probes is automatically activated again.
- To detect any overflow during the progressing measurement, a probe counter is included in bit 8 to 15 of the corresponding "Probe latched" parameter. This counter is incremented whenever a probe is detected. If the maximum value of 2^8-1 (255) is reached, the counter flows over and is reset to 0!
- Failure monitor for probe events: If there is no probe event within the expectation window specified, the counter is incremented in the parameter **P-0-0224, Probe, number of marker failures**. The counter is cleared as soon as a probe event occurs within the expectation window.
- The measuring signal is selected by entering the ID number of the signal in parameter **P-0-0200, Signal select probe 1** or parameter **P-0-0201, Signal select probe 2**. The parameter **P-0-0225, Probe, IDN list signal selection** lists specifies the ID numbers of the possible probe signals.
- Extended control parameter to activate expectation windows, failure monitoring function and time measurement:
 - The probe event can be limited to a predefined position window. The "Probe with expectation window" function is activated in parameter **P-0-0226, Probe, extended control word**.
 - In conjunction with the expectation window it is also possible to monitor the failure of a probe event. This "Mark failure monitoring function" can also be activated in parameter **P-0-0226, Probe, extended control word**.
 - The time measurement for probe 1 is switched on via parameter **P-0-0226, Probe, extended control word**, too. For probe 2 there isn't any time measurement function.
- The following parameters were reprogrammed and now are 16-bit counters:
 - **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**
- During continuous measurement the counter value is increased with every valid probe event.

Detecting the Marker Position

Parameter **P-0-0014, D500 Command determine marker position** allows

- checking the faultless detection of the reference mark of an incremental measuring system or
- determining the position of the reference mark in case the homing procedure is carried out by the control unit. In this case this information is used to switch the coordinate system in the control unit.

The home switch is not evaluated in this parameter.

Parking Axis

The parameter **S-0-0139, D700 Command Parking axis** allows uncoupling an axis. This may, for example, be necessary if an axis is temporarily brought to a standstill. The start of this command causes all monitoring functions of the measuring system and of the control loops to be switched off.

The command may only be started without drive enable. If the command is activated with drive enable applied, then the drive generates a command error.

After starting the command

- the measuring system monitors,
- the control loop monitors and
- the temperature monitors

are deactivated.

The measuring system initializations are conducted at the end of the command. This means all initializations as with command **S-0-0128, C200 Communication phase 4 transition check** are conducted. The 7-segment display reads "PA".

This drive no longer accepts the drive enable.

Backup Working Memory Procedure

By means of parameter **S-0-0264, B300 Backup working memory procedure command**, all cyclically configured data can be stored in the NOVRAM if required (all data that are not cyclically configured are already stored in the NOVRAM during the writing process).

Programmable Limit Switch

- 16 dynamic position switch points with one switch-on and switch-off position each
- Parameterizable lead time for each position switch point
- Effective direction of the threshold position switch that can be parameterized, i.e. the threshold position switch only takes effect with the corresponding velocity of the selected reference value.
- Reference position:
 - **S-0-0051, Position feedback 1 value**
 - **S-0-0053, Position feedback 2 value**
 - **P-0-0434, Internal Position command value**
- Correlation in the "DriveTop" commissioning software with positioning block target positions

Incremental Encoder Emulation (TTL format)

- **S-0-0051, Position feedback 1 value,**
- **S-0-0053, Position feedback 2 value** and
- **P-0-0434, Internal Position command value** can be emulated.

The number of lines in the case of emulation can be set as follows:

S-0-0076, Position data scaling type	Unit of parameter P-0-0502, Encoder emulation, resolution
rotary position scaling	lines/encoder revolution
linear position scaling	lines/mm or lines/inch

Fig. 3-11: Setting of the number of lines with incremental encoder emulation

- Zero pulse output also with linear motors and relative encoders (if homed)
- Number of lines with emulation of master axis position can be set in lines/master axis revolution
- Zero pulse can be offset by writing data to parameter **P-0-0503, Marker pulse offset**
- Dead time compensation

Absolute Encoder Emulation (SSI format)

- **S-0-0051, Position feedback 1 value,**
- **S-0-0053, Position feedback 2 value** and
- **P-0-0434, Internal Position command value** can be emulated.

The number of lines in the case of emulation can be set as follows:

Motor	Unit of parameter P-0-0502, Encoder emulation, resolution
rotary motor	bits/motor revolution
linear motor	bits/mm or bits/inch

Fig. 3-12: Setting of the number of lines with absolute encoder emulation

- With the emulation of the values displayed in the parameters S-0-0051, S-0-0053 and S-0-0047, also the emulated actual position values are offset by parameter **P-0-0012, C300 Command Set absolute measurement.**
- Possible display range: 0 to 4096 revolutions

Automatic Controller Setting

By means of parameter **P-0-0162, D900 Command Automatic control loop adjust**, the velocity and position control loop can be set automatically.

By inputting a travel distance, the command can also be used for modulo axes.

Automatic Commutation Setting

When the controller enable signal is switched on, **P-0-0508, Commutation offset** is determined by means of the automatic commutation setting. With this parameter it is possible to move the drive. When the command **S-0-0148, C600 Drive controlled homing procedure command** is started, the drive moves to the reference point of the machine. When passing the reference mark of the encoder, the drive switches to the value defined in parameter **P-0-0507, Optimized commutation offset**.

The value of parameter **P-0-0507, Optimized commutation offset** has to be determined with the initial commissioning procedure.

Spindle Positioning

Parameter **S-0-0152, C900 Position spindle command**:

- For tool change with milling and drilling machines or for workpiece change with turning machines
- Drive moves to spindle angle position with acceleration and jerk limiting
- Motor feedback or spindle feedback
- Integrated drive-controlled homing procedure, in case the measuring system has not been homed

Friction Torque Compensation

- Parameter **S-0-0155, Friction compensation** for switching in a torque command value depending on the direction of movement, in order to compensate for constant and predictable friction torques of the connected mechanical system
- The preceding sign of the friction compensation is determined by the preceding sign of the velocity command value. Signs are only changed outside the parameter **S-0-0124, Standstill window**.

Brake Status

Parameter **P-0-0539, Brake status** includes the possibility to realize redundant brake control via the digital output (cf. P-0-0124).

- **bit 0** = 1: Brake activated
= 0: Brake not activated
- **bit 1** = 1: Brake monitoring carried out successfully
= 0: Brake monitoring not successful

Digital Inputs/Outputs

In conjunction with the EMD modules it is possible to evaluate freely configurable digital inputs and outputs. The assignment of the inputs to parameters is realized with parameter **P-0-0125, Assignment digital input -> IDN**. Parameters are assigned to outputs by parameter **P-0-0124, Assignment IDN -> Digital output**.

Axis Error Correction

By means of the axis error correction it is possible to correct systematic errors of the mechanical system and the measuring systems of a servo axis. The following correction functions are supported:

- **Backlash on reversal correction**
Backlash in the mechanical axis system can be corrected by means of the backlash on reversal.
- **Precision axis error correction**
Within a defined travel range is possible to define up to 500 equidistant correction values (support points) per direction of movement. They are added to the respective position feedback value, the result is the corrected position feedback value. The correction values between the support points are generated by the drive by means of linear interpolation.
- **Control-side axis error correction**
The control unit can add any correction value to the position feedback value and consequently influence the position feedback value.

The correction functions are independent and can be combined in any desired way. The resulting correction value is the sum of the individual correction values. Only one position feedback value can be corrected at a time.

3.9 EcoX – Expansion Interface for Digital Drives

Overview

EcoX is the name of an expansion interface for digital drives. It is a serial, cyclic bus that allows the following functions:

- synchronization of drives and I/O modules
- connection of up to 2 modules with 16 digital inputs and outputs each per drive controller
- transmission of a command value to other drive controllers

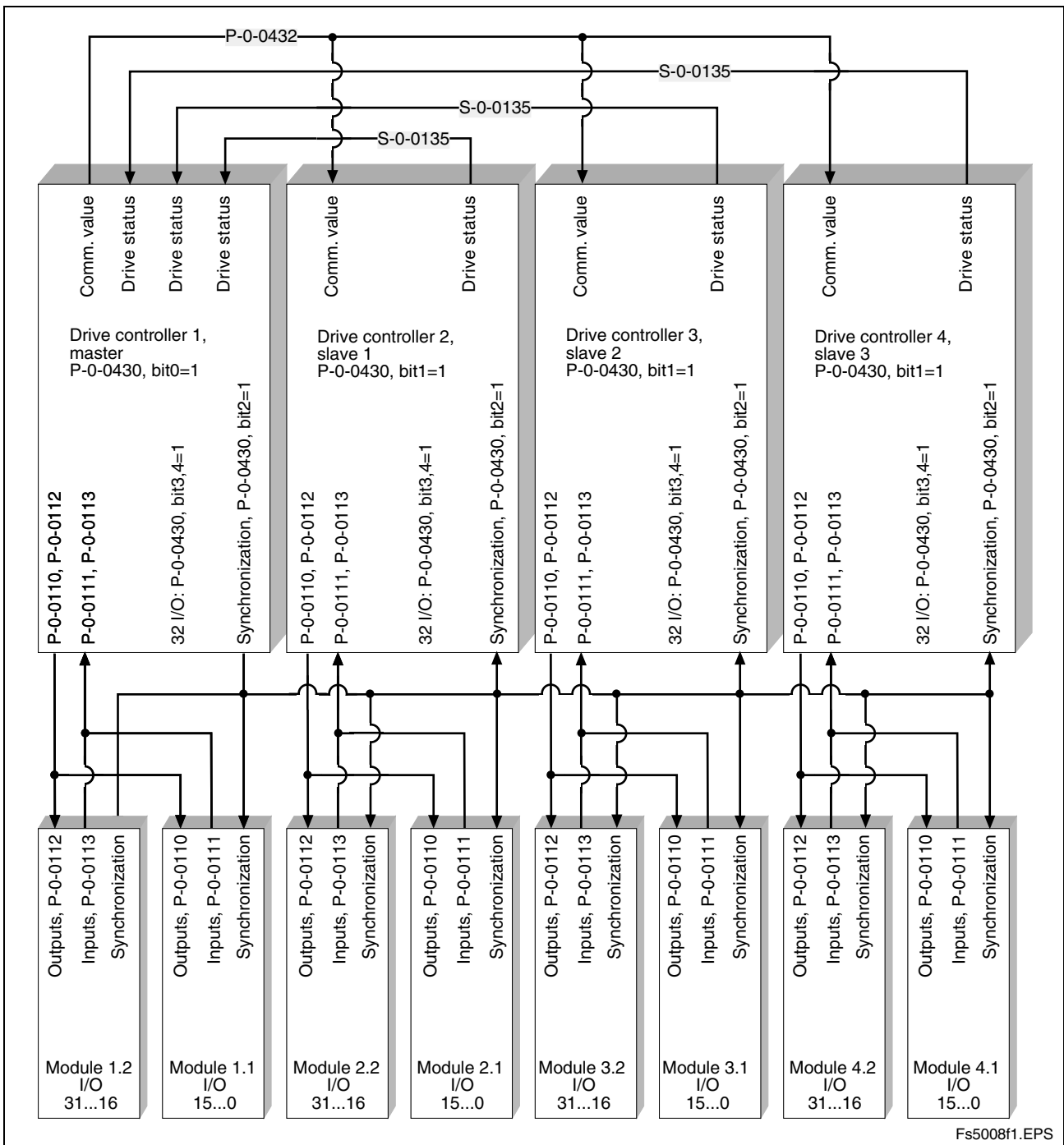


Fig. 3-13: Possible structure of an EcoX bus

Command Value Linkage

Command value linkage of up to 20 drives. The parameter to be transmitted is specified in parameter **P-0-0432, EcoX command value, configuration**.

The following parameters can be transmitted:

- **S-0-0036, Velocity command value**
- **S-0-0040, Velocity feedback value**
- **S-0-0080, Torque/Force command**
- **S-0-0084, Torque/force feedback value**
- **P-0-0434, Internal Position command value**
- Position command value linkage to operate Gantry axes: The master drive can be used in the positioning mode. The generated position command value is transmitted to the slave drive. The slave drive is operated in cyclic position control.
- Torque linkage: Master-slave operation of several drives. The torque command value (S-0-0080) is transmitted. The slave drive is operated in torque control.
- Speed command value linkage: The speed command value of the motor axis is transmitted to the slave. The slave drive is operated in velocity control.

I/O Extension

It is possible to activate one (16 inputs, 16 outputs) or two (32 inputs, 32 outputs) Indramat I/O modules per drive. Use parameter **P-0-0430, EcoX configuration** for selection.

The input data are written to parameters

- **P-0-0111, Parallel input 2 and**
- **P-0-0113, Parallel input 3.**

The outputs are written by the parameters

- **P-0-0110, Parallel output 2 and**
- **P-0-0112, Parallel output 3.**

The input parameter can be assigned to any parameter which can be configured in the MDT. Any parameter which can be configured in the AT can be written to the output parameter. The cycle time of the I/O modules depends on the number of controllers at the bus, but is independent of whether 16 or 32 I/Os have been connected.

As a matter of principle, the following applies:

- cycle time = 1 ms * (master + number of slaves)
- input/output delay = 1 ms

3.10 DISC Drive Macros

By means of program libraries available in the commissioning tool (e. g. DriveTop) or in the higher-level control unit, function macros can be loaded to the drive. Special functions that are not "hard wired" in the drive firmware are integrated in the standard firmware by means of DISC drive macros.

The following functional extensions have already been realized with DISC drive macros:

- More variable error reactions (relative and absolute return motion)
- Quick stop when signal at probe input
- Extension of existing operating modes (positioning block mode with delay time, ...)
- Automatic drive reactions when an event occurs
- Higher-level process controllers (register controllers, ...)
- Quick stop when signal at digital input
- relative limit switch

Notes

4 New Fields of Application

EcoX

Gantry Axis

A Gantry axis can be realized by linking a min. of 2 axes via the EcoX digital expansion interface. This allows using the Gantry axis function for "non-SERCOS drives", too.

Linkage of Several Axes (Master Axis Interconnection)

From the position selected via parameter **P-0-0763, Master axis generator, signal selection**, the master axis generates a master axis position for slave axes. The following slaves synchronize to this position.

Master-Slave Solution

Advantageous solution can be realized, because, owing to the synchronization via EcoX, there won't be any quantization effects and beat effects.

DISC Drive Macros

More Variable Error Reactions

DISC drive macros allow defining any error reaction, e.g. relative return motion.

Additional Axis-Specific Monitoring Functions

In addition, the DISC functionality allows you defining your own monitoring functions, e.g. current or torque monitors.

Technology Functions

The manufacturer offers a certain number of predefined technology functions that significantly enhance the functional range of the drive. At present, the following technology functions are made available:

- "flying shears"
- register controller
- In-Feed

Automatic (Event-Controlled) Drive Reactions

It is also possible to interrupt the active operating mode (e.g. cam mode or phase synchronization), in order to carry out, after a selectable event, a drive reaction that has been programmed in the DISC macro.

Extension of Existing Operating Modes

It is also possible to extend existing operating modes or make them more flexible. There are, for example, the following options:

- positioning block mode with delay time
- relative limit switch
- "Teach_In" function for positioning block mode
- force control

Notes

5 Functional Changes with Regard to the Previous Version

5.1 Incompatible Functional Changes

SSI Emulation

The output format (resp. the display range) was changed from ± 2048 revolutions to 0...4096 revolutions, because it is this kind of display that is generally used in the world of control systems.

5.2 Functions No Longer Available

As Regards "Master Communication Parallel Interface"

The stepper motor interface is no longer available.

As Regards "Relative Drive-Internal Interpolation"

This operating mode does no longer exist. This functionality can be performed completely and compatibly by the operating mode "Drive-controlled positioning".

As Regards "Error Reactions"

The error reaction "Return motion" can no longer be configured in parameter **P-0-0119, Best possible deceleration**. The corresponding function is provided by a DISC drive macro.

As Regards "Probe Function"

Signal selection in parameter **S-0-0169, Probe control parameter** is no longer available.

The quick stop function via probe 1 is no longer available. This functionality can be realized by means of a DISC drive macro.

5.3 Deleted Parameters

S-0-0269, Parameter buffer mode

P-0-0096, Distance to move in error situation

P-0-4033, Stepper motor resolution

P-0-4034, Stepper motor interface mode

5.4 New Parameters

S-0-0000, Dummy parameter
S-0-0058, Reversal clearance
S-0-0081, Additive Torque/Force command
S-0-0264, B300 Backup working memory procedure command
S-0-0359, Positioning Deceleration
S-0-0398, IDN list of configurable data in the signal status word
S-0-0419, Positioning command acknowledge

P-0-0110, Parallel output 2
P-0-0111, Parallel input 2
P-0-0112, Parallel output 3
P-0-0113, Parallel input 3
P-0-0125, Assignment digital input -> IDN
P-0-0204, Start position for active probe
P-0-0205, End position for active probe
P-0-0224, Probe, number of marker failures
P-0-0225, Probe, IDN list signal selection
P-0-0226, Probe, extended control word
P-0-0507, Optimized commutation offset
P-0-0539, Brake status
P-0-0350, DISC - Control word
P-0-0351, DISC - Status word
P-0-0352, DISC - Program Logic task
P-0-0353, DISC - Program Drive task
P-0-0354, DISC - Program Event task
P-0-0355, DISC - Register Logic task
P-0-0356, DISC - Register Drive task
P-0-0354, DISC - Program Event task
P-0-0358, DISC – Event condition
P-0-0359, DISC – Debug control word
P-0-0360, DISC – Breakpoint command line
P-0-0361, DISC – Current command line
P-0-0362, DISC – Compiler message
P-0-0363, DISC – Configuration parameter
P-0-0364, DISC – Special mode of operation
P-0-0370, DISC - Global Register G0
P-0-0371, DISC - Global Register G1
P-0-0372, DISC – Global Register G2
P-0-0373, DISC – Global Register G3
P-0-0374, DISC – Global Register G4
P-0-0375, DISC – Global Register G5
P-0-0376, DISC – Global Register G6
P-0-0377, DISC – Global Register G7

P-0-0378, DISC – Global Register G8
P-0-0379, DISC – Global Register G9
P-0-0380, DISC – Global Register G10
P-0-0381, DISC – Global Register G11
P-0-0382, DISC – Global Register G12
P-0-0383, DISC – Global Register G13
P-0-0384, DISC – Global Register G14
P-0-0385, DISC - Global Register G15
P-0-0400, Pos. corr., external correction value
P-0-0401, Pos. corr., active correction value
P-0-0408, Pos. corr., prec. corr. start position
P-0-0409, Pos. corr., correction table for prec. corr.
P-0-0410, Pos. corr., support point distance for prec. corr.
P-0-0430, EcoX Configuration
P-0-0431, EcoX command, IDN list of configurable parameters in master
P-0-0432, EcoX command value, configuration
P-0-0433, EcoX command, IDN list of configurable parameters in slave
P-0-0434, Internal Position command value
P-0-0435, List of configurable data dig. Input
P-0-0436, List of configurable data dig. Output
P-0-0437, List of EcoX slave drives
P-0-0507, Optimized commutation offset
P-0-0603, Position switch, control word
P-0-1211, Deceleration ramp 1
P-0-1213, Deceleration ramp 2
P-0-4063, Process block deceleration

5.5 Modified Parameters

S-0-0169, Probe control parameter

- Bit 4 is no longer available, selection by means of parameter **P-0-0200, Signal select probe 1** or parameter **P-0-0201, Signal select probe 2**
- Bit 7 quick stop is no longer available

S-0-0282, Positioning command value

- Also acts as an absolute positioning command value for drive-controlled positioning, depending on parameter **S-0-0393, Command value mode**

S-0-0393, Command value mode

- Bit 3: positioning command value is processed in relative or absolute form
- Bit 4: acceptance of the new positioning command value after having reached the current target position

P-0-0117, NC reaction on error

- Bit 2: immediate reaction of the event task (DISC drive macro)

P-0-0119, Best possible deceleration

- Return motion impossible

P-0-0200, Signal select probe 1

- Input of an IDN required; time measurement via bit in parameter **P-0-0226, Probe, extended control word**

P-0-0201, Signal select probe 2

- Input of an IDN required; time measurement only possible with channel 1

P-0-0538, Motor function parameter 1

- Bits 4 and 5: automatic commutation setting
- Bit 13: When the torque limit value is reached, the best possible deceleration is immediately initiated.

The following parameters are incremented as soon as a valid probe event occurs:

- **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**

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7 Service & Support

7.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

- telefonisch: **+49 (0) 9352 40 50 60**
über Service Call Entry Center Mo-Fr 07:00-18:00
- per Fax: **+49 (0) 9352 40 49 41**
- per e-Mail: **service@indramat.de**

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- by phone: **+49 (0) 9352 40 50 60**
via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- by fax: **+49 (0) 9352 40 49 41**
- by e-mail: **service@indramat.de**

7.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

oder **+49 (0) 171 333 88 26**
+49 (0) 172 660 04 06

After helpdesk hours, contact our service department directly at

or **+49 (0) 171 333 88 26**
+49 (0) 172 660 04 06

7.3 Internet

Unter www.indramat.de finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

- Verkaufsniederlassungen
- Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) <http://www.indramat.de/de/kontakt/adressen>
Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At www.indramat.de you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.

- sales agencies
- offices providing service

Please contact our sales / service office in your area first.

*) <http://www.indramat.de/en/kontakt/adressen>
Data in the present documentation may have become obsolete since printing.

7.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

7.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

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USA Hauptniederlassung - Headquarters Bosch Rexroth Corporation Rexroth Indramat Division 5150 Prairie Stone Parkway Hoffman Estates, IL 60192-3707 Tel.: +1 847 6 45 36 00 Fax: +1 847 6 45 62 01 service@indramat.com	USA Central Region - Mitte Bosch Rexroth Corporation Rexroth Indramat Division Central Region Technical Center 1701 Harmon Road Auburn Hills, MI 48326 Tel.: +1 248 3 93 33 30 Fax: +1 248 3 93 29 06	USA Southeast Region - Südwest Bosch Rexroth Corporation Rexroth Indramat Division Southeastern Technical Center 3625 Swiftwater Park Drive Suwanee, Georgia 30124 Tel.: +1 770 9 32 32 00 Fax: +1 770 9 32 19 03	USA SERVICE-HOTLINE - 7 days x 24hrs - +1-800-860-1055
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Argentina - Argentinien Bosch Rexroth S.A.I.C. "The Drive & Control Company" Acassusso 48 41/47 1605 Munro Prov. Buenos Aires Tel.: +54 (0)11 4756 01 40 Fax: +54 (0)11 4756 01 36 victor.jabif@boschrexroth.com.ar	Argentina - Argentinien NAKASE Servicio Tecnico CNC Calle 49, No. 5764/66 1653 Villa Balester Prov. - Buenos Aires Tel.: +54 (0) 11 4768 36 43 Fax: +54 (0) 11 4768 24 13 nakase@usa.net nakase@nakase.com	Brazil - Brasilien Bosch Rexroth Ltda. Av. Tégula, 888 Ponte Alta, Atibaia SP CEP 12942-440 Tel.: +55 (0)11 4414 56 92 +55 (0)11 4414 56 84 Fax sales: +55 (0)11 4414 57 07 Fax serv.: +55 (0)11 4414 56 86 alexandre.wittwer@rexroth.com.br	Brazil - Brasilien Bosch Rexroth Ltda. R. Dr.Humberto Pinheiro Vieira, 100 Distrito Industrial [Caixa Postal 1273] 89220-390 Joinville - SC Tel./Fax: +55 (0)47 473 58 33 Mobil: +55 (0)47 9974 6645 prochnow@zaz.com.br
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