This documentation contains an overview of the functionality of the FWA-ECODR3-MGP-01VRS firmware.

<table>
<thead>
<tr>
<th>Description</th>
<th>Release Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOK-ECODR3-MGP-01VRS**-FV01-EN-P</td>
<td>06.2003</td>
<td>1st Release</td>
</tr>
</tbody>
</table>

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Note

This document has been printed on chlorine-free bleached paper.
Summary of Documentation - Overview

- **Functional Description:**
  Description of all implemented functions based on SERCOS-Parameters
  
  Order designation:
  DOK-ECODR3-MGP-01VRS**-FK01-EN-P

- **Parameter Description:**
  A description of all parameters used in the firmware
  
  Order designation:
  DOK-ECODR3-MGP-01VRS**-PA01-EN-P

- **Troubleshooting Guide:**
  - Explanation of the diagnostic states
  - How to proceed when eliminating faults
  
  Order designation:
  DOK-ECODR3-MGP-01VRS**-WA01-EN-P

- **Firmware Version Notes:**
  Description of new and changed functions in terms of the derivatives:
  FWA-ECODR3-MGP-01VRS-MS
  
  Order designation:
  DOK-ECODR3-***-**VRS**-FV01-EN-P

**CD: DRIVEHELP**
Collection of Windows help systems which contains documentation on firmware types

Order designation:
DOK-GENERL-DRIVEHELP**-GExx-MS-D0600
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**1 FWA-ECODR3-MGP-01VRS-MS**

### 1.1 General Information

#### System Overview

ECODRIVE Cs is a new generation of system-compatible AC servo drives in the lower power range of 100 W to 750 W. It is an extension of the ECODRIVE03 product range. The drive controllers and motors have a specially compact design.

#### Overview of Functions

**Note:** The functions of the FWA-ECODR3-MGP-01VRS-MS firmware are compatible with FWA-ECODR3-FGP-03VRS and FWA-ECODR3-SGP-01VRS. Due to the hardware, however, there are some restrictions that are described below.

The following figure contains an overview of the scope of functions of MGP01VRS (ECODRIVE Cs).

![Overview of functions](DF0001v1.th)

**Fig. 1-1: Overview of functions**
Overview of Devices

The drive controllers are equipped with the master communication modules SERCOS interface, PROFIBUS-DP, CANopen, DeviceNet or analog/parallel interface; they are perfectly suited for use in systems with multiple-axis devices and can also be used as intelligent single axes on a standard field bus.

![Diagram of device types and master communication](image-url)

Fig. 1-2: Overview of device types
Overview of Motors

The FWA-ECODR3-MGP-01VRS-MS firmware can be used for operating the following MSM motors:

- MSM020B (100 W)
- MSM030B (200 W)
- MSM030C (400 W)
- MSM040B (750 W)

These motors are adjusted to the drive controllers and their size is very compact.

The following optional features are available for the motors:

- an integrated holding brake
- drive shaft with key
- absolute encoder (for detecting the current position of the load without travelling to reference point)

Motor-Controller Combinations

The FWA-ECODR3-MGP-01VRS-MS can be used for operating the following motor and controller combinations of the ECODRIVE Cs series.

<table>
<thead>
<tr>
<th>Drive controller</th>
<th>Motor</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>DKC01.3-004</td>
<td>MSM020B-0300-NN-C0-CG0</td>
<td>100 W</td>
</tr>
<tr>
<td>DKC01.3-004</td>
<td>MSM020B-0300-NN-C0-CG1</td>
<td></td>
</tr>
<tr>
<td>DKC01.3-004</td>
<td>MSM020B-0300-NN-C0-CC0</td>
<td></td>
</tr>
<tr>
<td>DKC01.3-004</td>
<td>MSM020B-0300-NN-C0-CC1</td>
<td></td>
</tr>
<tr>
<td>DKC02.3-004</td>
<td>MSM030B-0300-NN-C0-CG0</td>
<td></td>
</tr>
<tr>
<td>DKC02.3-004</td>
<td>MSM030B-0300-NN-C0-CG1</td>
<td></td>
</tr>
<tr>
<td>DKC02.3-004</td>
<td>MSM030B-0300-NN-C0-CC0</td>
<td></td>
</tr>
<tr>
<td>DKC02.3-004</td>
<td>MSM030B-0300-NN-C0-CC1</td>
<td></td>
</tr>
<tr>
<td>DKC03.3-008</td>
<td>MSM030C-0300-NN-C0-CG0</td>
<td>200 W</td>
</tr>
<tr>
<td>DKC03.3-008</td>
<td>MSM030C-0300-NN-C0-CG1</td>
<td></td>
</tr>
<tr>
<td>DKC03.3-008</td>
<td>MSM030C-0300-NN-C0-CC0</td>
<td></td>
</tr>
<tr>
<td>DKC03.3-008</td>
<td>MSM030C-0300-NN-C0-CC1</td>
<td></td>
</tr>
<tr>
<td>DKC05.3-008</td>
<td>MSM030C-0300-NN-C0-CG0</td>
<td></td>
</tr>
<tr>
<td>DKC05.3-008</td>
<td>MSM030C-0300-NN-C0-CG1</td>
<td></td>
</tr>
<tr>
<td>DKC05.3-008</td>
<td>MSM030C-0300-NN-C0-CC0</td>
<td></td>
</tr>
<tr>
<td>DKC05.3-008</td>
<td>MSM030C-0300-NN-C0-CC1</td>
<td></td>
</tr>
<tr>
<td>DKC06.3-008</td>
<td>MSM030C-0300-NN-C0-CG0</td>
<td></td>
</tr>
<tr>
<td>DKC06.3-008</td>
<td>MSM030C-0300-NN-C0-CG1</td>
<td></td>
</tr>
<tr>
<td>DKC06.3-008</td>
<td>MSM030C-0300-NN-C0-CC0</td>
<td></td>
</tr>
<tr>
<td>DKC06.3-008</td>
<td>MSM030C-0300-NN-C0-CC1</td>
<td></td>
</tr>
<tr>
<td>DKC16.3-008</td>
<td>MSM030C-0300-NN-C0-CG0</td>
<td></td>
</tr>
<tr>
<td>DKC16.3-008</td>
<td>MSM030C-0300-NN-C0-CG1</td>
<td></td>
</tr>
<tr>
<td>DKC16.3-008</td>
<td>MSM030C-0300-NN-C0-CC0</td>
<td></td>
</tr>
<tr>
<td>DKC16.3-008</td>
<td>MSM030C-0300-NN-C0-CC1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1-3: Drive controller – motor combinations

Note: The individual drive controllers may only be operated with the respective motors.
Firmware Types and Release Dates

For the ECODRIVE03 range there are four firmware types for different applications:

- **SMT**: Drive for Machine Tool Applications with SERCOS, Analog and Parallel Interface
- **SGP**: Drive for General Automation with SERCOS, Analog and Parallel Interface
- **FGP**: Drive for General Automation with Field Bus Interfaces
- **MGP**: Drive for General Automation with SERCOS interface, Field Bus Interfaces (PROFIBUS, CanOpen, DeviceNet) and Analog/Parallel Interface

**Note:** The functionalities of a firmware type can quickly be ascertained using this documentation. As this type of document is produced for each setup and each type of the firmware, it can also be used to compare different types of firmware.

**Scheduled Release Date**

The release dates for the **FWA-ECODR3-MGP-01VRS-MS** firmware are:

- week 43/2002 prototype version
- week 24/2003 general sales
1.2 Master Communication

The FWA-ECODR3-MGP-01VRS-MS firmware supports the following master communications:

- SERCOS Interface
- PROFIBUS-DP
- DeviceNet
- CanOpen
- analog interface with encoder emulation (SSI and incremental encoder)
- parallel interface

SERCOS interface

General features:

- cyclical data exchange of command and actual values in equal time intervals
- data transfer by means of fiber optic cable
- 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

Features specific to firmware:

- cycle time: min. 2000 µs, max. 65 ms, granularity 1 (i.e. multiples of 1000 µs can be set)
- SERCOS compatibility class C
- baud rate: optionally 2, 4, 8 and 16 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
PROFIBUS-DP

General features:
- protocol: PROFIBUS-DP according to DIN EN 50170/2
- baud rates: 9.6 kbps to 12 Mbps
- max. length of the cyclic channel 28 byte (with 12 byte parameter channel)
- electrical isolation of the interface

Features specific to firmware:
- acyclic transmission of parameters in the cyclic channel
- mapping of all drive parameters to field bus objects
- commissioning via Profibus without PC by supporting the "SetParam" service for bus initialization
- support of Freeze and SYNC

DeviceNet

General features:
- protocol: DeviceNet Specification, release 2.0
- baud rates: 125, 250 and 500 kbps
- length of cyclic channel: max. 16 byte
- parameter transmission via "Explicit Messages"
- utilization of the Predefined Master/Slave Connection Set
- electrical isolation of the interface
- Pluggable 5-Pin Open Style Connector

Features specific to firmware:
- mapping of all drive parameters to field bus objects (classes and instances)

CANopen

General features:
- protocol: CANopen according to CiA DS301
- baud rates: 10 kbps to 1 Mbps
- length of the cyclic channel max. 16 byte
- utilization of the Predefined Connection Set
- parameter transmission via SDO
- electrical isolation of the interface

Features specific to firmware:
- mapping of all drive parameters to field bus objects
Parallel Interface

Note: The complete master communication parallel interface is only available for the DKC01.3. For DKC10.3 its use is restricted due to the reduced number of I/Os.

Note: ECODRIVE Cs does not support the stepper motor function!

General features:
- digital inputs for selecting up to 64 positioning blocks
- digital outputs for acknowledging up to 64 positioning blocks
- one digital switch signal for positioning block acceptance
- one digital input for “going to zero”
- 2 digital inputs for jogging positive and jogging negative
- status messages IN_POSITION, IN_MOTION, IN_REFERENCE and 1 cam switch point

Note: The digital inputs and outputs can be freely configured. It is possible, for example, to apply cam switch signals to the outputs. Inputs can be used, for example, for starting the "position spindle" command.

Analog Interface

General features:
- Drive Halt input
- input for drive enable
- ready-for-operation output

Note: For setting the analog command values the general drive function "analog inputs" is used. (See "General functions")
1.3 Supported Profile Types

Overview

The following profile types are only supported in the case of the devices with Profibus or DeviceNet. In the case of devices with SERCOS interface (DKC02.3) there aren’t any predefined profiles although the parameters are contained in the firmware.

Overview of Supported Profile Types

<table>
<thead>
<tr>
<th>P-0-4084, Profile type</th>
<th>DKC</th>
<th>Field bus or drive operating mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF80h</td>
<td>3.3</td>
<td>I/O mode with block acknowledgment (positioning block mode)</td>
<td>Guarantees functional compatibility with DKC3.1; control word and status word have the same structure and significance.</td>
</tr>
<tr>
<td>FF81h</td>
<td>3.3</td>
<td>I/O mode with cam status (positioning block mode)</td>
<td>As with 0xFF80 but instead of the travel block acknowledgment, the cam status bits are applied to the status word.</td>
</tr>
<tr>
<td>FF82h</td>
<td>3.3</td>
<td>I/O mode freely expandable (positioning block mode) + expandable real-time channel</td>
<td>As with 0xFF81, but in addition to the control and status words, other real-time data can be configured. The bits in the field bus status word can be defined via the configurable signal status word function.</td>
</tr>
<tr>
<td>FF91h</td>
<td>3.3</td>
<td>drive-internal interpolation (with absolute and relative interpolation)</td>
<td>All real-time data are preconfigured by the lists P-0-4080 and P-0-4081. Control word and status word have the same structure as in the freely configurable operating mode. It is possible to switch between absolute and relative interpolation via bit 3 in the field bus control word.</td>
</tr>
<tr>
<td>FF93h</td>
<td>3.3</td>
<td>velocity control with filter and ramp (without profile interpreter)</td>
<td>The real-time data required for velocity control are preconfigured. Control word and status word have the same structure as in the freely configurable operating mode.</td>
</tr>
<tr>
<td>FFF5h</td>
<td>3.3</td>
<td>freely configurable operating mode (without profile interpreter)</td>
<td>The user is entirely responsible for the configuration of the real-time data. Control word and status word have a Rexroth-specific structure. This selection is suitable for using the complete drive functionality!</td>
</tr>
</tbody>
</table>

Fig. 1-4: Supported profile types of FWA-ECODR3-MGP-01VRS
Assignment to the Drive-Internal Operating Modes

The setting of P-0-4084, Profile type is not only a profile-dependent interpretation of the control and status words but also a preliminary selection of the primary mode of operation set in the drive!

There are the following relationships between the parameters P-0-4084, Profile type and S-0-0032, Primary mode of operation:

- I/O mode with 16-bit status and control word meaning:
  The operating mode "positioning block mode without lag error" is set in the drive.

- drive-internal interpolation meaning:
  Depending on bit 3 of parameter P-0-4077, the operating mode "drive-internal interpolation" or "relative drive-internal interpolation" is activated in the drive.

- velocity control meaning:
  The operating mode "velocity control with filter and ramp" is set in the drive.

- freely configurable mode
- no profile-dependent settings and checks
- no status machine
- free configuration of real-time channel by configuration lists P-0-4080 and P-0-4081
- allows analog operation for initial commissioning

Note: For all settings, except the freely configurable mode, the secondary operating mode 1 is set to "jogging"!

I/O Mode (P-0-4084 = 0xFF8x)

Basic Function of I/O Mode

- The primary mode of operation "positioning block mode" is set.
- In this operating mode the permanently-programmed positioning blocks are selected and started via the 16 bit wide control word.
- "Jogging" is set as the secondary operating mode 1!
- In the case of Profibus-DP, the parameter channel can be expanded to 6 words with parameter P-0-4083.
  (default: P-0-4083 = 0 → without parameter channel)
- One field bus control word and one status word (16 bit) are transmitted via the field bus.
**I/O Mode Default Setting**  
(Compatible with DKC3.1-> P-0-4084 = 0xFF80)

- In the I/O mode, the real-time channel consists of one word, the control or status word.
- Fixed real-time channel length of 2 bytes. Thus the length of the cyclic data channel is: \( P-0-4082 = P-0-4087 = 2 + P-0-4083 \)

**I/O Mode with Cams**  
(P-0-4084 = 0xFF81)

- Fixed real-time channel length of 2 bytes. Thus the length of the cyclic data channel is: \( P-0-4082 = P-0-4087 = 2 + P-0-4083 \)
- Instead of the travel block acknowledgment, 8 cam bits (P-0-0135, bit 0..7) are transmitted in bit 8 to bit 15 of the field bus status word.
- In addition to bit 8 to bit 15, bit 0 and bit 1 of the P-0-4078, Field bus status word parameter have also changed their significance in comparison to the profile (P-0-4084 = 0xFF80)!

**I/O Mode Freely Expandable**  
(P-0-4084 = 0xFF82)

- In addition to the field bus control and status words, other real-time data can be configured via the list parameters P-0-4080, Real-time input object structure and P-0-4081, Real-time output object structure. The length of cyclic data channel P-0-4082, Length of real-time data channel In or P-0-4087, Length of real-time data channel Out can be freely expanded by the user up to a maximum of \( (8+6=14) \) words (6 word parameter channel).
- The P-0-4077, Field bus control word parameter is structured as with I/O mode with cams (P-0-4084 = 0xFF81).
- The structure of P-0-4078, Field bus status word corresponds to the content of S-0-0144, Signal status word and can therefore be freely configured by the user.

**Drive-Internal Interpolation** (P-0-4084= 0xFF91)

- Functionally compatible with command target position setting but no DRIVECOM status machine is active!
- Position target (target position or travel distance) and positioning velocity are cyclically transmitted via the field bus.
- Via bit 3 in P-0-4077, Field bus control word, the selection can be made as to whether the position target transmitted via the field bus is to be processed in absolute (S-0-0258) or relative (S-0-0282) form. The acceptance and activation of the positioning command value is controlled with bit 0 and bit 4 in P-0-4077, Field bus control word.
- The profile selection defines the following operating modes:
  - primary mode of operation: drive-internal interpolation
  - secondary operating mode 1: jogging
- length of cyclic data channel defined with: P-0-4082 = P-0-4087 = 12 byte + P-0-4083
- The entire content of the real-time data channel and the structure of parameters **P-0-4077, Field bus control word** and **P-0-4078, Field bus status word** are defined by the programmed **P-0-4084, Profile type** (see "freely-configurable mode").

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>command value acceptance</td>
<td>Each time the bit is toggled, the travel distance or target position is accepted (S-0-0346, bit 0).</td>
</tr>
<tr>
<td>0</td>
<td>absolute/relative</td>
<td>0: absolute target position set (S-0-0258, Target position)</td>
</tr>
<tr>
<td>0</td>
<td>immediate block change</td>
<td>0: position target only accepted after previously active target position has been reached</td>
</tr>
<tr>
<td>5, 6, 7, 8, 9</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
<tr>
<td>10, 11</td>
<td>reserved</td>
<td>--</td>
</tr>
<tr>
<td>12</td>
<td>not relevant</td>
<td>--</td>
</tr>
<tr>
<td>13, 14, 15</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1-5: Structure of parameter P-0-4077, Field bus control word

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,1,2,3</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>command value reached</td>
<td>1:</td>
</tr>
<tr>
<td>4</td>
<td>command value reached</td>
<td>0:</td>
</tr>
<tr>
<td>5,6,7,8,9</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>reserved</td>
<td>--</td>
</tr>
<tr>
<td>11,12,13,14,15</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1-6: Structure of parameter P-0-4078, Field bus status word

\( ^* \) mode-dependent bits, i.e. the bits operate differently depending on the active operating mode
Velocity Control \((P-0-4084 = 0xFF93)\)

**Features**
- Velocity command values are cyclically transmitted via the field bus.
- No profile interpreter is active!
- The profile selection defines the following operating modes:
  - primary mode of operation: **vel. control with filter and ramp**
  - secondary operating mode 1: **jogging**
- Length of cyclic data channel defined with: \(P-0-4082 = P-0-4087 = 12\) byte + \(P-0-4083\)
- The entire content of the real-time data channel and the structure of parameters \(P-0-4077\), **Field bus control word** and \(P-0-4078\), **Field bus status word** are defined by the programmed \(P-0-4084\), **Profile type** (see "freely-configurable mode").

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0++</td>
<td>not relevant</td>
<td>--</td>
</tr>
<tr>
<td>1, 2</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
<tr>
<td>3*</td>
<td>not relevant</td>
<td>--</td>
</tr>
<tr>
<td>4*</td>
<td>not relevant</td>
<td>--</td>
</tr>
<tr>
<td>5, 6, 7, 8, 9</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
<tr>
<td>10, 11</td>
<td>reserved</td>
<td>--</td>
</tr>
<tr>
<td>12*</td>
<td>not relevant</td>
<td>--</td>
</tr>
<tr>
<td>13, 14, 15</td>
<td>see &quot;freely configurable mode&quot;</td>
<td></td>
</tr>
</tbody>
</table>

*mode-dependent bits, i.e. the bits operate differently depending on the active operating mode*
Freely Configurable Mode (P-0-4084 = 0xFFFE)

Features

- No profile interpreter is active!
- The content of the real-time data channel must be defined by means of the list parameters **P-0-4080, Real-time input object structure** and **P-0-4081, Real-time output object structure**.
- Primary and secondary operating modes must be manually configured!
- allows operation with analog command values by respective configuration of interface
- allows using the multiplex channel (see Functional Description) via the field bus by respective configuration of list parameters **S-0-0370, Configuration list for MDT data container** and **S-0-0371, Configuration list for AT data container**
- complete use of parameters **S-0-0144, Signal status word** and **S-0-0145, Signal control word** via the field bus

Note: The contents of parameters **P-0-4077, Field bus control word** and **P-0-4078, Field bus status word** are always transmitted!
**Structure of P-0-4077, Field bus control word**

(P-0-4084 = 0xFFFE)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>command value acceptance</td>
<td>Each time the bit is toggled, the travel distance or target position is accepted (S-0-0346, bit 0).</td>
</tr>
<tr>
<td>1</td>
<td>operating mode setting</td>
<td>1: operating mode&lt;br&gt;0: parameter mode</td>
</tr>
<tr>
<td>2</td>
<td>going to zero</td>
<td>1: start homing command &quot;C6&quot;&lt;br&gt;(S-0-0148 = 11b)&lt;br&gt;0: complete homing command &quot;C6&quot;&lt;br&gt;(S-0-0148 = 0b)</td>
</tr>
<tr>
<td>3</td>
<td>absolute/relative</td>
<td>0: absolute target position set&lt;br&gt;(S-0-0258, Target position)&lt;br&gt;1: relative target position set&lt;br&gt;(S-0-0258, Positioning command value)</td>
</tr>
<tr>
<td>4</td>
<td>immediate block change</td>
<td>0: position target only accepted after previously active target position has been reached&lt;br&gt;1: position target accepted immediately when command value acceptance is toggled</td>
</tr>
<tr>
<td>5</td>
<td>clearing errors</td>
<td>1: start error clearing command &quot;C5&quot;&lt;br&gt;0: complete command &quot;C5&quot;</td>
</tr>
<tr>
<td>6</td>
<td>jogging forward</td>
<td>1: jogging forward (P-0-4056, bit 0 = 1)</td>
</tr>
<tr>
<td>7</td>
<td>jogging backward</td>
<td>1: jogging backward (P-0-4056, bit 1 = 1)</td>
</tr>
<tr>
<td>8, 9</td>
<td>command operating mode</td>
<td>00: primary mode of operation&lt;br&gt;01: secondary operating mode 1 (e.g. jogging)&lt;br&gt;10: secondary operating mode 2&lt;br&gt;11: secondary operating mode 3</td>
</tr>
<tr>
<td>10, 11</td>
<td>reserved</td>
<td>--</td>
</tr>
<tr>
<td>12</td>
<td>IPOSYNC</td>
<td>interpolator clock: toggles when new command values transmitted</td>
</tr>
<tr>
<td>13</td>
<td>Drive Halt</td>
<td>1-&gt;0 change causes drive to be shut down</td>
</tr>
<tr>
<td>14</td>
<td>reserved</td>
<td>--</td>
</tr>
<tr>
<td>15</td>
<td>Drive ON</td>
<td>1-&gt;0 change leads to &quot;best possible deceleration&quot; (see P-0-0119)</td>
</tr>
</tbody>
</table>

Fig. 1-9: Structure of P-0-4077, Field bus control word

*) mode-dependent bits, i.e. the bits operate differently depending on the active operating mode
Structure of P-0-4078, Field bus status word  
(P-0-4084 = 0xFFFE)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| 0,1 | operating mode acknowledgment | 10: phase 4 (operating mode)  
          01: phase 3  
          00: phase 2 (parameter mode) |
| 2   | In reference                | 1: drive has been homed (S-0-0403, bit 0)  
          0: drive has not homed (S-0-0403, bit 0) |
| 3   | In standstill               | 1: drive has stopped (S-0-0013, bit 1)      |
| 4 *)| In position                 | 1: target position reached (S-0-0182, bit 10) |
| 5   | command change bit          | 1: if command status has changed             |
| 6   | operating mode error        | 1: error in transition command  
          0: no error in transition command         |
| 7   | Drive Halt                  | 1: Drive Halt active  
          0: Drive Halt not active                   |
| 8, 9| actual operating mode       | 00: primary mode of operation  
          01: secondary operating mode 1 (e.g.  
                                        jogging)  
          10: secondary operating mode 2  
          11: secondary operating mode 3 |
| 10 *)| command value acknowledgment | drive confirms acceptance of travel distance  
                          or target position by toggling the bit |
| 11  | class 3 diagnostics message | The bit is set if a class 3 diagnostics  
                          message is present.                         |
| 12  | class 2 diagnostics warning | The bit is set if a class 2 diagnostics warning  
                          is present.                                    |
| 13  | class 1 diagnostics error   | The bit is set if a class 1 diagnostics error is  
                          present (drive interlock).                     |
| 14, 15 | ready for operation   | 00: not ready for power on  
          01: ready for power on  
          10: control and power sections ready for  
                          operation and torque-free  
          11: operating, with torque               |

Fig. 1-10: Structure of P-0-4078, Field bus status word

*) mode-dependent bits, i.e. the bits operate differently depending on the active operating mode

Note: This basic structure of the control and status words is also used with the profile types *"Velocity control" and "Drive-internal interpolation"*. Only bit 4 and bit 10 in P-0-4078, Field bus status word can differ depending on the profile type selected.
1.4 Basic Operating Modes

In the MGP01VRS firmware type a **rapid switching of operating modes** is possible via the field bus control word (cf. bits 8, 9) \((dt = 1\text{ms})\).

**Torque/Force Control**

- torque/force control with regard to the command value preset in the S-0-0080 parameter
- limitation of the preset command value to 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 the velocity limit value S-0-0091, **Bipolar velocity limit value** \((F879 \text{ Velocity limit S-0-0091 exceeded})\)

Fig. 1-11: Block diagram: torque/force control
Velocity Control

Fig. 1-12: Block diagram: velocity control

- separately programmable two-stage acceleration and deceleration limits of preset velocity command value 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 band filter with rejection frequency and bandwidth that can be set
- limiting the variable to a limit value that can be set
Position Control

Note: This operating mode can only be used in conjunction with the SERCOS interface in the DKC2.3!

Operating mode: position control

- position control with regard to the position command value (S-0-0047)
- monitoring the position command value difference for exceeding the velocity limit value (S-0-0091)
- fine interpolation of the command value specified in the NC cycle clock to 1 ms
- interpolator can be switched between linear and 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
- position control with regard to actual position value encoder 1 (motor encoder)

Fig. 1-13: Block diagram: position control
Drive-Internal Interpolation

**Note:** This mode operates internally with profile type "drive-internal interpolation" and if bit 3 = 0 (→ absolute position target) has been set in **P-0-4077, Field bus control word**

---

**Fig. 1-14: Block diagram: Drive-internal interpolation**

- drive-internal generation of a position command value profile for approaching a preset target position while maintaining the programmable positioning velocity and positioning acceleration or positioning deceleration (separately adjustable)
- jerk limitation of the generated position command value
- evaluation of the positioning velocity with feedrate override
- monitoring the positioning velocity for exceeding the velocity limit value (S-0-0091)
- monitoring the target position for maintaining position limit values
- command value mode in the modulo format can be set
- acceleration feedforward can be set
- position control with regard to actual position value encoder 1 (motor encoder)
- expansion of the operating mode by introducing a new parameter "positioning command value" with respective data handshake (command value acceptance and command value acknowledgment) plus switching between absolute and relative positioning by means of a control bit
Relative Drive-Internal Interpolation

Operating mode: relative drive-internal interpolation

- drive-internal generation of a position command value profile for approaching a target position preset via a travel distance while maintaining the programmable positioning velocity and positioning acceleration or positioning deceleration (separately adjustable)
- control of acceptance of the travel distance 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 the velocity limit value (S-0-0091)
- monitoring the target position for maintaining position limit values
- command value mode in the modulo format can be set
- acceleration feedforward can be set
- position control with regard to actual position value encoder 1 (motor encoder)
- generating the target position to be approached from the preset travel distance (relative positioning)

Jogging

- jogging positive and negative via parameter P-0-4056, Jog inputs
- Drive generates position command value profile while maintaining P-0-4030, Jog velocity, S-0-0260, Positioning Acceleration 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 the position limit value minus positioning window and warning E831 Position limit reached during jog is generated.
Positioning Block Mode

**Note:** This operating mode is used with the "I/O mode" profile type!

Operating mode: positioning block mode

- Positioning block preselection can be made via bits in the field bus control word or by setting bits in P-0-4026, Process block selection.
- 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
- sequential block mode with position switching or switching signal-dependent advance
- sequential block mode with position switching in modes "block transition with old positioning velocity", "block transition with new positioning velocity" 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)
- acceleration and deceleration ramps can be set separately

---

Fig. 1-16: Block diagram: positioning block mode
Velocity Synchronization with Virtual Master Axis

Operating mode: velocity synchronization with virtual master axis

- Velocity control with regard to velocity command values calculated by drive from master axis positions, master axis gear and electronic gear ratio. It is possible to dynamically change the electronic gear ratio (fine adjustment) and the master axis gear (P-0-0156/P-0-0157).
- Drive-controlled acceleration with synchronization acceleration to the velocity command value when this operating mode has been activated.
- Status message "In_Synchronization" with active and non-active operating mode.
- Extrapolation of master axis position with single MDT failures.
- Rotary or linear output of electronic gear as dependent on the position scaling selected.
Phase Synchronization with Virtual Master Axis

- Position control with regard to position command values calculated by drive from master axis position, master axis gear and electronic gear ratio
- Master axis gear can be dynamically changed (P-0-0156/P-0-0157)
- Fine interpolation of the master axis positions specified in the NC cycle clock
- Drive-controlled synchronization to the sum of position command value and additive position command value while maintaining synchronization acceleration, velocity and direction
- Status message "Synchronization completed"
- Changes of the additive position command value are either smoothed using a filter or positioned by means of the synchronization acceleration and synchronization velocity.
- Generation of the position command additional actual value as the difference between actual position value and calculated position command value
- Status message "In_Synchronization" with active and non-active operating mode
- Extrapolation of master axis position with single MDT failures
- Rotary or linear output of electronic gear as dependent on the position scaling selected
Electronic Cam Shaft with Virtual Master Axis

Operating mode: electronic cam shaft with virtual master axis

- Position control with regard to position command values calculated by the drive from master axis position, master axis gear, a cam shaft profile and the cam shaft distance. The master axis position as per master axis gear (P-0-0156/P-0-0157) serves as the profile access angle for the cam shaft profiles.
- Change velocity can be set for P-0-0061, Angle offset begin of profile
- Extrapolation of master axis position with single MDT failures
- Fine interpolation of the master axis positions specified in the NC cycle clock
- Fine interpolation of the cam shaft profile values
- Two cam shaft profiles with possibility of switching at specified angle
- Changes in cam shaft distance only become effective at parameterized angle
- Offset for profile access angle can be set
- Lag-error dependent advance of the profile access angle for lag error compensation can be set
- Drive-controlled synchronization to the sum of position command value and additive position command value while maintaining synchronization acceleration, velocity and direction.

Fig. 1-19: Block diagram: electronic cam shaft with virtual master axis
status message "Synchronization completed"

- Changes of the additive position command value are either smoothed using a filter or positioned by means of the synchronization acceleration and synchronization velocity.

- Generation of the position command additional actual value as the difference between actual position value and calculated position command value

- Status message "In_Synchronization" with active and non-active operating mode

- Acceleration feedforward can be set
1.5 Control Loop Structure

Fig. 1-20: Control loop structure: FWA-ECODR3-MGP-01VRS

Note: The controller parameters can be set either manually or by an automated motion cycle (D900 Command automatic loop setting).
1.6 Motor Types (Incl. Brake)

Supported Motor Types

With this firmware it is possible to operate the following motors:

- MSM020B (100 W)
- MSM030B (200 W)
- MSM030C (400 W)
- MSM040B (750 W)

Note: The motor type is selected by the entry P-0-4014 = 12, for the above MSM motors. This entry is automatic (default value!) because there aren’t any other motors that can be operated with the ECODRIVE Cs controllers and the firmware described in this document.

Motor Holding Brake (Optional)

- self-holding or self-releasing brake
- brake delay time can be set
- servo or main spindle brake can be selected
- user can release the brake via a command
- holding brake monitor: command "brake torque monitoring" via command start or automatically after drive enable applied

1.7 Measuring Systems

Motor Encoder

Note: At the delivery of the motors the motor encoders are already mounted as a standard so that you cannot select the encoder in use.
To operate the serial encoder interface, "15" (default value!) must be entered in parameter P-0-0074, Feedback 1 type.

Absolute Measuring Systems

Absolute measuring systems are those encoders with an absolute range of at least one encoder revolution.
These measuring systems are only handled as absolute encoders, if their absolute range is greater than or equal to half the travel range or the entire travel range.

Note: The absolute encoder function can be switched off in parameter S-0-0277, Position feedback 1 type.
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. The selection must be made in the respective position encoder type parameter. Depending on this selection, the position data reference is established by the two commands described below:

- **P-0-0012, C300 Command Set absolute measuring**
  - Initializing the actual position value of an absolute measuring system with regard to a preset value related to the machine zero point, by means 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, by means of a command
  - Executing the command either for the actual position value of the motor encoder or of the external encoder
  - Setting absolute measuring without drive enable
  - Setting absolute measuring with drive enable followed by "Drive-controlled homing"
  - Setting absolute measuring with drive enable followed by deactivation of drive enable
  - Setting absolute measuring is possible via home switch input (for systems with slip)

- **S-0-0148, C600 Drive controlled homing procedure command**
  - While maintaining a homing velocity and acceleration that can be parameterized, the drive generates position command values to execute a drive movement automatically thus establishing a reference for the actual position value to the machine zero point.
  - Executing the command either for the actual position value of the motor encoder or of the external encoder
  - Executing the 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

1.8 Physical Values Display Format

- Freely definable LSB valence for the following data transmitted between drive and control unit:
  - Position data: degrees, mm, inch
  - Velocity data: rpm, 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 linear and rotary scaling
  - Choice between preferred scaling and parameter scaling
1.9 Basic Functions

Parameterization and Diagnosis

Numerous Diagnostic Possibilities
- diagnosis parameter in plain text, as diagnosis number and as error number
- list of diagnostic message 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 drive parameters to default values
- customer password protection; selection of password-protected parameters can be set

Language Selection for Parameter Names and Units, As Well As Diagnoses (S-0-0095)
- German
- English
- French
- Spanish
- Italian

Error Reactions

- variable error reaction as dependent on error class and selected best possible deceleration
- selectable settings for best possible deceleration:
  - velocity command value set to zero
  - torque command value set to zero
  - velocity command to zero with command ramp and filter
  - "return motion" error reaction
- 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
Internal Limitations and Monitoring Functions

The intelligent drive makes the following limitations available:

- current limits
- torque/force limit
- velocity limit
- travel range limits

Among other things, the intelligent drive makes the following monitoring functions available:

- velocity control loop monitoring
- position control loop monitoring (lag error monitoring)
- position limit value monitoring
- temperature monitoring (motor and controller)

Drive Halt

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

The following limit values are used:

<table>
<thead>
<tr>
<th>Previous operating status</th>
<th>Parameters used</th>
</tr>
</thead>
</table>
| no position control operating mode | P-0-1201, Ramp 1 pitch  
P-0-1203, Ramp 2 pitch  
P-0-1202, Final speed of ramp 1 |
| position control with drive-internal interpolation (positioning block mode, drive-internal interpolation, relative drive-internal interpolation) | previous positioning deceleration and jerk limit remain active |
| position control without drive-internal interpolation | S-0-0138, Bipolar acceleration limit value  
S-0-0349, Jerk limit bipolar |

Fig. 1-21: Acceleration and jerk with “Drive Halt”

1.10 Optional Functions

Oscilloscope Feature

- 2 channels with 512 values each
- preset signals can be used
- time resolution: 500 µs to 100 µs (in steps of 500 µs)
- trigger threshold can be set for position, velocity and torque/force data
- drive-internal signals can be triggered and recorded
- extension of the recording possibilities to the signals that can be output via the analog output of the other devices of the product range
Probe Function

- 2 probe inputs with a resolution of 1 µs
- possible measuring signals:
  - position feedback 1 value
  - relative internal time (internal counter) with a resolution of 1 µs 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 accepted.
- continuous measurement:
  After a measurement, the edge evaluation of the probes is automatically activated again.
- automatic quick stop when positive edge at probe 1 can be activated

"Determine Marker Position" Command

Parameter P-0-0014, D500 Command determine marker position allows:
- checking the correct 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.

"Positive Stop Drive Procedure" Command

The parameter S-0-0149, D400 Positive stop drive procedure command causes all controller monitoring functions to be switched off which in case the drive is blocked by positive stop would otherwise cause a class 1 diagnostics error message. If the control unit clears the command after it has been executed, all original controller monitors are again active.

Programmable Position Switch

- 16 dynamic position switch points with one switch-on and switch-off position each
- parameterizable lead time for each position switch point
- correlation in the "DriveTop" commissioning software with positioning block target positions
Analog Inputs

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

Encoder Emulation

Incremental Encoder Emulation
- Actual position value 1 can be emulated
- Zero pulse can be offset by parameter
- Zero pulse output also with relative encoders (if homed)
- The number of lines in the case of actual position value 1 emulation can be set as follows:

<table>
<thead>
<tr>
<th>Motor</th>
<th>Unit of P-0-0502, Encoder emulation, resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>rotary motor</td>
<td>lines/motor revolution</td>
</tr>
</tbody>
</table>

Fig. 1-22: Setting the number of lines for incremental emulation of actual position value 1

Absolute Encoder Emulation (SSI Format)
- Actual position value 1 can be emulated
- The number of lines in the case of actual position value 1 emulation can be set as follows:

<table>
<thead>
<tr>
<th>Motor</th>
<th>Unit of P-0-0502, Encoder emulation, resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>rotary motor</td>
<td>bits/motor revolution</td>
</tr>
</tbody>
</table>

Fig. 1-23: Setting the number of lines for absolute emulation of actual position value 1

- Emulation of the value displayed in S-0-0051; i.e. the emulated actual position value, too, is offset by P-0-0012, C300 Command Set absolute measuring.

"Automatic Control Loop Setting" Command

Automatic setting of control loop parameters by D900 Command automatic loop setting.

Note: Can also be used for modulo axes by entering the travel distance for automatic control loop setting.
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3 Service & Support

3.1 Helpdesk
Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns telefonisch - by phone: 49 (0) 9352 40 50 60 über Service Call Entry Center, Mo-Fr 07:00-18:00 - via Service Call Entry Center, Mo-Fr 7:00 am - 6:00 pm per Fax - by fax: +49 (0) 9352 40 49 41 per e-Mail - by e-mail: service@boschrexroth.de

3.2 Service-Hotline
Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter +49 (0) 171 333 88 26 oder - or +49 (0) 172 660 04 06

3.3 Internet

At www.boschrexroth.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.

3.4 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.

*) Data in the present documentation may have become obsolete since printing.
### 3.5 Kundenbetreuungsstellen - Sales & Service Facilities

#### Deutschland – Germany

<table>
<thead>
<tr>
<th>Vertriebsgebiet Mitte</th>
<th>Germany Centre</th>
<th><strong>SERVICE</strong></th>
<th>CALL ENTRY CENTER</th>
<th>MO – FR von 07:00 - 18:00 Uhr</th>
<th>Tel.: +49 (0) 9352 40 50 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rexroth Indramat GmbH</td>
<td></td>
<td></td>
<td></td>
<td>from 7 am – 6 pm</td>
<td><a href="mailto:service@boschrexroth.de">service@boschrexroth.de</a></td>
</tr>
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<td>97803 Lohr</td>
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<tr>
<td>Tel.: +49 (0) 9352 40-0</td>
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<tr>
<td>Fax: +49 (0) 9352 40-4885</td>
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<th>HOTLINE</th>
<th>MO – FR von 17:00 - 07:00 Uhr</th>
<th>Tel.: +49 (0) 172 660 04 06 / oder / or Tel.: +49 (0) 171 333 88 26</th>
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<td>Rexroth Indramat GmbH</td>
<td>Landshuter Allee 8-10</td>
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<tr>
<td>80637 München</td>
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<tr>
<td>Tel.: +49 (0) 89 127 14-0</td>
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<th>♦ nur an Werktagen</th>
<th>♦ von 07:00 - 18:00 Uhr</th>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Tel.: +49 (0) 341 25 61-0</td>
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<td>30853 Langenhagen</td>
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<td></td>
<td>Fax: +49 (0) 341 25 61-111</td>
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<tr>
<td>Tel.: +49 (0) 511 72 66 57-9</td>
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| Vertriebsgebiet Ost | Germany East | **SERVICE** |                      |                         |                    |                        | Tel.: +49 (0) 371 35 55-0 |
|---------------------|-------------|-------------|                      |                         |                    |                        | Fax: +49 (0) 371 35 55-333 |
| Bosch Rexroth AG    | Beckerstraße 31 |           |                      |                         |                    |                        | Tel.: +49 (0) 341 25 61-0 |
| 09120 Chemnitz      |              |            |                      |                         |                    |                        | Fax: +49 (0) 341 25 61-111 |

#### Deutschland – Germany vom Ausland: (0) nach Landeskennziffer weglassen! don’t dial (0) after country code!
**Europa (West) - Europe (West)**

<table>
<thead>
<tr>
<th>Country - Region</th>
<th>Address Details</th>
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</table>
| Austria - Österreich | Bosch Rexroth GmbH  
Bereich Indramat  
Stachelgasse 13  
1120 Wien  
Tel.: +43 (0)1 985 25 40  
Fax: +43 (0)1 985 25 40-93 |
| Bosch Rexroth Österreich  
Gesch.bes. Rexroth Indramat  
Industriepark 18  
4061 Pasching  
Tel.: +43 (0)221 605-0  
Fax: +43 (0)221 605-21 |
| Belgium - Belgien | Bosch Rexroth AG  
Electric Drives & Controls  
Industrielaan 8  
1740 Ternat  
Tel.: +32 (0) 5830719  
Fax: +32 (0) 5830731  
indramat@boschrexroth.be |
| Denmark - Dänemark | BEC A/S  
Zinkvej 6  
8900 Randers  
Tel.: +45 (0)87 11 90 60  
Fax: +45 (0)87 11 90 61 |
| Great Britain – Großbritannien | Bosch Rexroth Ltd.  
Rexroth Indramat Division  
Broadway Lane, South Cerney  
Cirencester, Glos GL7 5UH  
Tel.: +44 (0)1285 863000  
Fax: +44 (0)1285 863030  
nov@boschrexroth.co.uk  
service@boschrexroth.co.uk |
| Bosch Rexroth Oy  
Rexroth Indramat division  
Ansatea 6  
0174 Vantaa  
Tel.: +358 (0)9 84 91-11  
Fax: +358 (0)9 84 91-13 60 |
| Finland - Finnland | Bosch Rexroth SAS  
Division Rexroth Indramat  
Villa Paolo Veronesi, 250  
10148 Torino  
Tel.: +39 011 254 88 11  
Fax: +39 011 254 88 37 |
| France - Frankreich | Bosch Rexroth SAS  
Division Rexroth Indramat  
Z1 de Thibaud, 20 bd. Thibaud  
(BP. 1751)  
31084 Toulouse  
Tel.: +33 (0)5 61 43 61 87  
Fax: +33 (0)5 61 43 94 12 |
| France - Frankreich | Bosch Rexroth SAS  
Division Rexroth Indramat  
Avenue de la Trentaline  
(757)  
77503 Chelles Cedex  
Tel.: +33 (0)164 72-70 00  
Fax: +33 (0)164 72-63 00  
Hotline: +33 (0)608 33 43 28 |
| France - Frankreich | Bosch Rexroth SAS  
Division Rexroth Indramat  
Via del Progresso, 16 (Zona Ind.)  
35020 Padova  
Tel.: +39 049 8 70 13 70  
Fax: +39 049 8 70 13 77 |
| France - Frankreich | Bosch Rexroth SAS  
Division Rexroth Indramat  
Via Paolo Veronesi, 250  
10148 Torino  
Tel.: +39 011 254 88 11  
Fax: +39 011 254 88 37 |
| Italy - Italien | Bosch Rexroth S.p.A.  
Viale G. Di Vittoria, 1  
20063 Cernusco S/N  
Tel.: +39 01 29 92 365 1  
Fax: +39 01 29 92 365 500  
+39 01 29 92 365 516378 |
| Italy - Italien | Bosch Rexroth S.p.A.  
Viale G. Di Vittoria, 1  
20063 Cernusco S/N  
Tel.: +39 01 29 92 365 1  
Fax: +39 01 29 92 365 500  
+39 01 29 92 365 516378 |
| Italy - Italien | Bosch Rexroth B.V.  
Kruisbroeksestraat 1  
5281 RV Boxtel  
Tel.: +31 (0)411 65 19 51  
Fax: +31 (0)411 65 19 83  
www.boschrexroth.nl |
| Netherlands – Niederlande/Holland | Bosch Rexroth Services B.V.  
Technical Services  
Kruisbroeksestraat 1  
5281 RV Boxtel  
Tel.: +31 (0)411 65 19 51  
Fax: +31 (0)411 67 78 14  
services@boschrexroth.nl |
| Norway - Norwegen | Bosch Rexroth AS  
Rexroth Indramat Division  
Berghagan 1  
1402 Ski  
Tel.: +47 (0)64 86 41 00  
Fax: +47 (0)64 86 90 62  
info@rexa.nor |
# Europa (Ost) - Europe (East)

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<th>Czech Republic - Tschechien</th>
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<th>Hungary - Ungarn</th>
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<td>Bosch - Rexroth, spol.s.r.o.</td>
<td>DEL a.s. Strojirenska 38</td>
<td>Bosch Rexroth Kft.</td>
<td>Bosch Rexroth Sp.zo.o.</td>
</tr>
<tr>
<td>Hviezdoslavova 5 627 00 Brno</td>
<td>591 01 Zdar nad Sazavou</td>
<td>Angol utca 34</td>
<td>ul. Staszica 1</td>
</tr>
<tr>
<td>Tel.: +420 (0) 48 126 358</td>
<td>Tel.: +420 566 64 3144</td>
<td>Tel.: +36 (1) 422 3200</td>
<td>Tel.: +48 22 738 18 00</td>
</tr>
<tr>
<td>Fax: +420 (0) 48 126 112</td>
<td>Fax: +420 566 62 1657</td>
<td>Fax: +36 (1) 422 3201</td>
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<td>Bosch Rexroth Sp.z.o.o.</td>
<td>East Electric S.R.L.</td>
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<td>Bosch Rexroth OOO</td>
</tr>
<tr>
<td>ul. Dabrowskiego 81/85 60-529 Poznan</td>
<td>B-dul Basarabie, nr.250, sector 3 73429 Bucuresti</td>
<td>Str. Drobety nr. 4-10, app. 14 70258 Bucuresti, Sector 2</td>
<td>Wiatraka ul. 27/15 127015 Moskau</td>
</tr>
<tr>
<td>Tel.: +48 061 847 64 62 /-63</td>
<td>Tel./Fax: +40 (0)21 255 35 07</td>
<td>Tel.: +40 (0)1 210 48 25</td>
<td>Tel.: +7 095-785 74 78</td>
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<td>Fax: +48 061 847 64 02</td>
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<td>Fax: +40 (0)1 210 29 50</td>
<td>+7 095 785 74 79</td>
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<tr>
<td>Bosch Rexroth Otomasyon San &amp; Tic. A.S. Fevzi Cakmak Cad No. 3</td>
<td>ELMIS 10, Internationalnaya 246640 Gomel, Belarus</td>
<td>DOMEL Otoki 21 64 228 Zalezniki</td>
</tr>
<tr>
<td>Tel.: +90 212 541 60 70</td>
<td>Tel.: +375/ 232 53 42 70 +375/ 232 53 21 69</td>
<td>Tel.: +386 5 5117 152</td>
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<tr>
<td>Fax: +90 212 599 34 07</td>
<td>Fax: +375/ 232 53 37 69</td>
<td>Fax: +386 5 5117 225</td>
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<tr>
<td><a href="mailto:elmis.lt@ymail.com">elmis.lt@ymail.com</a></td>
<td><a href="mailto:elmis_ltd@yahoo.com">elmis_ltd@yahoo.com</a></td>
<td><a href="mailto:brane.ozebek@domel.si">brane.ozebek@domel.si</a></td>
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**Africa, Asia, Australia – incl. Pacific Rim**

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<tbody>
<tr>
<td>AIMS - Australian Industrial Machinery Services Pty. Ltd. 28 Westside Drive Laverton North Vic 3026 Melbourne Tel.: +61 3 93 243 321 Fax: +61 3 93 243 329 Hotline: +61 4 19 369 195 <a href="mailto:terryoibrain@aimservices.com.au">terryoibrain@aimservices.com.au</a></td>
<td>Bosch Rexroth Pty. Ltd. No. 7, Endeavour Way Braeside Victoria, 31 95 Melbourne Tel.: +61 3 95 80 39 33 Fax: +61 3 95 80 17 33 <a href="mailto:mel@rexroth.com.au">mel@rexroth.com.au</a></td>
<td>Shanghai Bosch Rexroth Hydraulics &amp; Automation Ltd. Waigaoqiao, Free Trade Zone No.122, Fu Te Dong Yi Road Shanghai 200131 - P.R.China Tel.: +86 21 58 66 30 30 Fax: +86 21 58 66 55 23 <a href="mailto:richard.yang.sh@boschrexroth.com.cn">richard.yang.sh@boschrexroth.com.cn</a> <a href="mailto:gf.zhu.sh@boschrexroth.com.cn">gf.zhu.sh@boschrexroth.com.cn</a></td>
<td>Shanghai Bosch Rexroth Hydraulics &amp; Automation Ltd. 4/F, Marine Tower No.1, Pudong Avenue Shanghai 200120 - P.R.China Tel.: +86 21 68 86 15 88 Fax: +86 21 58 40 65 77</td>
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<td>Bosch Rexroth China Ltd. 15/F China World Trade Center 1, Jiangguonewai Avenue Beijing 100004, P.R.China Tel.: +86 10 65 05 03 80 Fax: +86 10 65 05 03 79</td>
<td>Bosch Rexroth China Ltd. Guangzhou Repres. Office Room 1014-1016, Metro Plaza, Tian He District, 183 Tian He Bei Rd Guangzhou 510075, P.R.China Tel.: +86 20 8755-0030 Fax: +86 20 8755-0011 +86 20 8755-2387</td>
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| Hong Kong | India - Indien | India - Indien | India - Indien |
| Bosch Rexroth (China) Ltd. 6th Floor, Yeung Yiu Chung No.6 Ind Bldg. 19 Cheung Shun Street Cheung Sha Wan, Kowloon, Hong Kong Tel.: +852 22 62 51 00 Fax: +852 27 41 33 44 alexis.siu@boschrexroth.com.hk | Bosch Rexroth (India) Ltd. Rehradmat Division Plot. A-58, TTC Industrial Area Thane Turbhe Midc Road Mahape Village Navi Mumbai - 400 701 Tel.: +91 22 7 61 46 22 Fax: +91 22 7 61 15 31 | Bosch Rexroth (India) Ltd. Rehradmat Division Plot. 96, Phase III Peenya Industrial Area Bangalore - 560058 Tel.: +91 80 41 70 211 Fax: +91 80 83 94 34 5 | Bosch Rexroth (India) Ltd. 1st Floor, S-10 Green Park ext. Market New Delhi – 110016 Tel.: +91 1 16 56 68 88 Fax: +91 1 16 56 68 87 |

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<tr>
<td>PT. Rexroth Wijayakusuma Building #202, Cilandak Commercial Estate Jl. Cilandak KKO, Jakarta 12560 Tel.: +62 21 7891169 (5 lines) Fax: +62 21 7891170 - 71</td>
<td>Bosch Rexroth Automation Corp. Service Center Japan Yutakagaoka 1810, Melto-ku, NAGOYA 465-0035, Japan Tel.: +81 52 777 88 41 +81 52 777 88 53 +81 52 777 88 79 Fax: +81 52 777 89 01</td>
<td>Bosch Rexroth-Korea Ltd. Electric Drives and Controls Bongwoo Bldg. 7FL, 31-7, 1Ga Jiangchoong-dong, Jung-gu Seoul, 100-911 Tel.: +82 234 061 813 Fax: +82 222 641 295</td>
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<td>Bosch Rexroth-Korea Ltd. 1515-14 Dadadong, Saha-Ku Rehradmat Division Pusan Metropolitan City, 604-050 Tel.: +82 51 26 00 74 Fax: +82 51 26 00 747 <a href="mailto:gwhan@rexrothkorea.co.kr">gwhan@rexrothkorea.co.kr</a></td>
<td>Bosch Rexroth Sdn.Bhd. 11, Jalan U8/2, Seksyen U8 40150 Shah Alam Selangor, Malaysia Tel.: +60 3 78 44 80 00 Fax: +60 3 78 45 48 00 <a href="mailto:hockhwa@hotmail.com">hockhwa@hotmail.com</a> <a href="mailto:rexorh1@bm.net.my">rexorh1@bm.net.my</a></td>
<td>Bosch Rexroth Pte Ltd 150 Tuas Road Singapore 63820 Tel.: +65 68 61 87 33 Fax: +65 68 61 18 25 <a href="mailto:sanjay.nemade@boschrexroth.com.sg">sanjay.nemade@boschrexroth.com.sg</a></td>
<td>TECTRA Automation (Pty) Ltd. 71 Watt Street, Meadowdale Edenvale 1609 Tel.: +27 11 971 94 00 Fax: +27 21 971 94 40 Hotline: +27 82 903 29 23 <a href="mailto:georgy@tectra.co.za">georgy@tectra.co.za</a></td>
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<td>Rexroth Uchida Co., Ltd. No.17, Alley 24, Lane 737 Chengbei 1 Rd., Yungang Tainan Hsien Tel.: +886 6 25 36 565 Fax: +886 6 25 34 754 <a href="mailto:indra.charlie@msa.hinet.net">indra.charlie@msa.hinet.net</a></td>
<td>NC Advance Technology Co. Ltd. 5876 Moo 9 Ramintra road 34 Thrang, Bangkhien, Bangkok 10230 Tel.: +66 2 943 70 62 Fax: +66 2 943 71 21 +66 2 509 23 62 <a href="mailto:sonkawin@hotmail.com">sonkawin@hotmail.com</a></td>
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### Nordamerika – North America

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<th>USA Southeast Region - Südwest</th>
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<td>Bosch Rexroth Corporation</td>
<td>- 7 days x 24hrs -</td>
</tr>
<tr>
<td>Rexroth Indramat Division</td>
<td>Rexroth Indramat Division</td>
<td>Rexroth Indramat Division</td>
<td>+1-800-860-1055</td>
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<tr>
<td>Hoffman Estates, IL 60192-3707</td>
<td>Central Region Technical</td>
<td>Southeastern Technical</td>
<td></td>
</tr>
<tr>
<td>Tel.: +1 847 6 45 36 00</td>
<td>Center 1701 Harmon Road</td>
<td>Center 3625 Swiftwater Park</td>
<td></td>
</tr>
<tr>
<td>Fax: +1 847 6 45 62 01</td>
<td>Auburn Hills, MI 48326</td>
<td>Drive 3917A, Suite 220</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:servicebrc@boschrexroth-us.com">servicebrc@boschrexroth-us.com</a></td>
<td>Tel.: +1 248 3 93 33 30</td>
<td>Pleasant Hill, California</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:repairbrc@boschrexroth-us.com">repairbrc@boschrexroth-us.com</a></td>
<td>Fax: +1 248 3 93 29 06</td>
<td>94588</td>
<td></td>
</tr>
</tbody>
</table>

### USA East Region – Ost

| Bosch Rexroth Corporation           | Bosch Rexroth Corporation   | Bosch Rexroth Corporation     |                       |
| Charlotte Regional  Sales Office    | Charlotte Regional  Technical| Northeastern Technical        |                       |
| Tel.: +1 704 5 83 97 62              | Center 99 Rainbow Road      | Center 99 Rainbow Road       |                       |
| +1 704 5 83 14 86                   | East Granby, Connecticut 06026| East Granby, Connecticut 06026|                       |
| Tel.: +1 860 8 44 83 77              | Tel.: +1 925 227 10 84      | Tel.: +1 925 227 10 84       |                       |
| Fax: +1 860 8 44 85 95               | Fax: +1 925 227 10 84       | Fax: +1 925 227 10 84       |                       |

### Canada East - Kanada Ost

| Bosch Rexroth Canada Corporation    | Bosch Rexroth Canada Corporation | Bosch Rexroth Mexico S.A. de C.V. |                       |
| Burlington Division                 | Burnaby, British Columbia       | Calle Neptuno 72                  |                       |
| Tel.: +1 905 335 55 11              | Canada V73 1R1                  | Unidad Ind. Vallejo 07700 Mexico, D.F. |                       |
| Fax: +1 905 335-41 84               | Tel.: +52 5 754 17 11           | Tel.: +52 8 333 88 34...36      |                       |
| michael.moro@boschrexroth.ca        | Fax: +52 5 754 36 34           | +52 8 349 90 11...93            |                       |

### Sudamerika – South America

### Argentina - Argentinien

| Bosch Rexroth S.A.I.C.              | NAKASE                                | Bosch Rexroth Ltda.              |                       |
| “The Drive & Control Company”       | Servicio Tecnico CNC                  | Av. Tégula, 888                  |                       |
| Acassuso 48 41/47                   | Calle 49, No. 5764/66                 | Ponte Alta, Altaba SP            |                       |
| 1605 Munro Provincia de Buenos Aires | B1653AOX Villa Balester              | CEP 12942-440                    |                       |
| Tel.: +54 11 4756 01 40             | Telefonio de Buenos Aires             | Tel.: +55 11 4414 56 92         |                       |
| Fax: +54 11 4756 01 36              | NAKASE                                | Fax: +55 11 4414 56 84          |                       |
| victor.jaib@boschrexroth.com.ar     | Service                              | Fax sales: +55 11 4414 56 07    |                       |

### Argentina - Argentinien (Service)

| refutec@neutel.com.co | refutec@007mundo.com |

### Colombia - Kolumbien

<table>
<thead>
<tr>
<th>Reflutec de Colombia Ltda.</th>
<th>Cola 37 No. 22-31</th>
<th>Santafé de Bogotá, D.C.</th>
<th>colombia</th>
</tr>
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<tbody>
<tr>
<td>Tel.: +57 1 368 82 67</td>
<td>+57 1 368 02 59</td>
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<td><a href="mailto:refutec@neutel.com.co">refutec@neutel.com.co</a></td>
</tr>
<tr>
<td>Fax: +57 1 368 82 67</td>
<td><a href="mailto:refutec@007mundo.com">refutec@007mundo.com</a></td>
<td></td>
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### Brazil - Brasilien

| Av. Tégula, 888               | P.O. Box 1093, 888                | P.O. Box 1093, 888           |                       |
| Ponte Alta, Altaba SP        | 12942-440                        | 12942-440                    |                       |
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