



ECODRIVE03

Drive for General Automation

With SERCOS-, Analog- and Parallelinterface

Firmware-Version Notes: SGP 01VRS

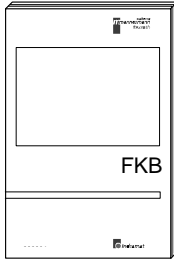
DOK-ECODR3-SGP-01VRS**-FVN1-EN-P

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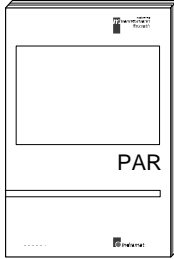
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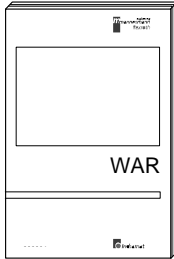
Summary of Documentation - Overview



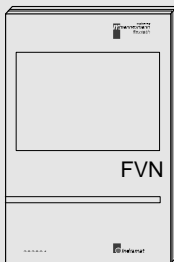
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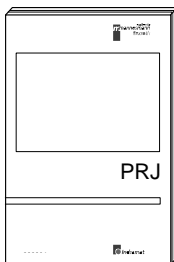
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Troubleshooting Guide:
 -Explanation of the diagnostic states
 -How to proceed when eliminating faults
 Order designation:
 DOK-ECODR3-SGP-01VRS**-WAR1-EN-P



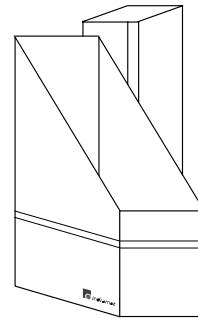
Firmware Version Notes:
 Description of new and changed functions in terms of the derivatives:
 -FWA-ECODR3-SMT01VRS-MS
 -FWA-ECODRV-ASE04VRS-MS
 -FWA-DIAX04-ELS05VRS-MS
 Order designation:
 DOK-ECODR3-SGP-01VRS**-FVN1-EN-P



Project Planning Manual:
 -Planning control cabinet construction
 -Planning the electric layout in the control cabinet
 Order designation:
 DOK-ECODR3-DKC**_3****-PRJ1-EN-P



CD: DRIVEHELP
 Collection of Windows help systems which contain documents on firmware derivatives
 Order designation:
 DOK-GENERL-DRIVEHELP**-GEN1-MS-D0600



Order designation
 DOK-ECODR3-SGP-01VRS**-7201-EN-P

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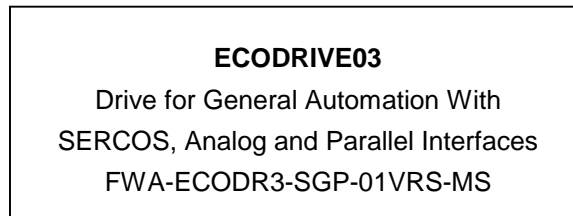
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Notes

1 General Information

1.1 Product Family

The product release description refers to the product family:



The following drive controls can be operated with this software:

DKC11.3-040-7-FW	DKC11.3-100-7-FW
DKC01.3-040-7-FW	DKC01.3-100-7-FW
DKC02.3-040-7-FW	DKC02.3-100-7-FW

This document describes the differences between ECODRIVE03 version FWA-ECODR3-SGP-01VRS and the previous ECODRIVE version FWA-ECODRV-ASE-04VRS or FWA-ECODR3-SMT-04VRS and FWA-DIAX-ELS-05VRS.

1.2 Documentation

The document for **FWA-ECODR3-SGP-01VRS** is available as follows:

- in paper form
- or as a Windows help system.

The following table contains a summary of available items.

POS	Type	Document style	Part number	Symbol number
1	DOK-ECODR3-SGP-01VRS**-7201-EN-P	Box 72-01V-EN	279094	209-0088-4321-01
2	DOK-ECODR3-SGP-01VRS**-FKB1-EN-P	Functional Description Paper	279095	209-0088-4322-01
3	DOK-ECODR3-SGP-01VRS**-PAR1-EN-P	Parameter Description	283218	209-0088-4323-01
4	DOK-ECODR3-DKC**.3-PRJ1-EN-P	Project Planning	280107	209-0088-4301-01
5	DOK-ECODR3-SGP-01VRS**-WAR1-EN-P	Troubleshooting GuidePaper	279096	209-0088-4324-00
6	DOK-ECODR3-SGP-01VRS**-FVN1-EN-P	Firmware Versionsnote	280282	209-0088-4325-01
7	DOK-GENERL-DRIVEHELP**-GEN1-MS-D0600	Windows-Help-System	282411	209-0069-4114-01

Fig. 1-1: Documentation available for FWA-ECODR3-SGP-01VRS

1.3 Notes on Replacing the Firmware

Note the following before replacing the firmwre:

1. The drive controller is on.
2. Secure the current parameters.
3. Switch the controller into phase 2.
4. Replace firmware with Dolfi,
SWA-DOL*PC-INB-01VRS-MS-C1.44-COPY, part number 279804.

Note: 24V control voltage may not be switched off during the firmware exchange procedure.

- a) Switch drive into phase 2.
 - b) Start Dolfi.
 - c) Input the following with the settings specified:
 - **Interface:**
 - select interface (COM 1 - 4)
 - set baudrate for connect to 9.6 kB (always)
 - set baudrate for download (9.6 to 115 kB)
 - **Addresses**
 - Set **sender** to value < 128
 - do not select the address set on the programming module via switches S2 and S3
 - Sender and receiver addresses must be different.
 - Set **receiver** to a value < 128
 - do not select the address set on the programming module via switches S2 and S3
 - Sender and receiver addresses must be different.
 - Enter the address set via switches S2 and S3 in field **unit address**.
 - **Language**
 - Select language (German/English)
 - d) Press connect button
→ Header of the programmed module is read out.
 - Look at header by selecting the header button.
 - then change into window messages by selecting the message button.
 - e) Press transmit button
→ *.ibf-file for update must be selected
 - f) Start firmware update with ok (must be pressed after every programmed firmware module, generally, one FWA contains three firmware modules).
 - g) Press separate button after successful update
→ drive firmware is started
 - h) end Dolfi
5. If the number of parameters to be backed up has changed, then "PL" appears in the display. (If errors are pending, then these must be cleared first). If the S1 key is now pressed, then all backed up parameters are set to their default values. During this time "C8 load default parameters" appears on the display.
 6. If command "C8 load default parameters" was started or the motor type changed, then "UL" appears prior to transition check from phase 3 to 4. The S1 key must now be pressed, or the command clear error started. The control default settings are then loaded out of the motor feedback into the drive controller.
 7. Load the desired parameter file.

1.4 Release notes

Firmware version **FWA-ECODR3-SGP-01V09** represents the first official edition of version 01. It was released on

29.01.1999

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

- DKC11.3-040-7-FW, DKC11.3-100-7-FW
- DKC01.3-040-7-FW, DKC01.3-100-7-FW
- DKC02.3-040-7-FW, DKC02.3-100-7-FW

Note: To commission drive firmware version **FWA-ECODRV03-SGP-01VRS-MS** then DriveTop version **SWA-DTOP***-INB-05VRS-MS-C1,44-COPY** or higher than **SWA-S*TOP*-INB-04T14-MS-C1,44-COPY** is needed.

2 Differences to FWA-ECODR3-SMT-01VRS

2.1 New Functions

Operating Modes

The following operating modes have been implemented:

Velocity synchronization with virtual master axis

The drive is in velocity control and is following the master axis position in a velocity synchronous manner. The master axis position is set via parameter P-0-0053.

Pertinent parameters

- **S-0-0236, Master drive 1 revs.**
- **S-0-0237, Slave drive 1 revs.**
- **P-0-0083, Gear ratio fine adjust**
- **P-0-0053, Master drive position**
- **P-0-0108, Master drive polarity**
- **P-0-0156, Master drive gear input revolutions**
- **P-0-0157, Master drive gear output revolutions**

Velocity synchronization with real master axis

The drive is in velocity control and is following the master axis position in a velocity synchronous manner. The master axis position is set by actual position value 3 (P-0-0052).

The gear is set using the parameters listed in section: "Velocity synchronization with virtual master axis".

The master axis encoder is evaluated by encoder 2.

Angle synchronization with virtual master axis

The drive is in position control and is following the master axis position in a position synchronous manner. The master axis position is set in parameter P-0-0053.

Pertinent parameters

- **S-0-0048, Position command value additional**
- **S-0-0236, Master drive 1 revs.**
- **S-0-0237, Slave drive 1 revs.**
- **P-0-0053, Master drive position**
- **P-0-0108, Master drive polarity**
- **P-0-0156, Master drive gear input revolutions**
- **P-0-0157, Master drive gear output revolutions**
- **P-0-0159, Slave drive feed travel**

Angle synchronisation with real master axis

The drive is in position control and is following the master axis position in a position synchronous manner. The master axis position is set by actual. The gear is set using the parameters listed in section: "Angle synchronization with virtual master axis".

The master axis encoder is evaluated by encoder 2.

Electronic cam with virtual master axis

The drive is in position control. The profile access angle of the cam profile is generated out of the master axis position. The profile value is evaluated using the hub. The results are read to the position controller and the drive follows the cam profile. The master axis position is specified by the actual position value 3 (P-0-0052).

Pertinent parameters

- **S-0-0048, Position command value additional**
- **P-0-0053, Master drive position**
- **P-0-0061, Angle offset begin of profile**
- **P-0-0072, Cam shaft profile 1**
- **P-0-0085, Dynamical phase offset**
- **P-0-0088, Cam shaft control**
- **P-0-0089, Cam shaft status**
- **P-0-0092, Cam shaft profile 2**
- **P-0-0093, Cam shaft distance**
- **P-0-0094, Cam shaft switch angle**
- **P-0-0108, Master drive polarity**
- **P-0-0144, Cam shaft distance switch angle**
- **P-0-0156, Master drive gear input revolutions**
- **P-0-0157, Master drive gear output revolutions**
- **P-0-0158, Phase offset velocity**

Electronic cam with real master axis

The drive is in position control. The profile access angle of the cam profile is generated out of the master axis position. The profile value is evaluated using the hub. The results are read to the position controller and the drive follows the cam profile. The master axis position is specified by the actual position value 3 (P-0-0052).

The gear is set with the parameters listed in section: "Electronic cam with virtual master axis".

The master axis encoder is evaluated by encoder 2.

Master Axis Encoder

Encoder 2 can be parametrized to function like a master axis encoder. Only encoders with binary lines may be used. Incremental encoders are also possible in addition to single or multiturn encoders. This includes automatic detection of the zero pulse followed by transition from P-0-0052 to offset P-0-0087. Actual position value 3 is smoothed via the PT1 filter; the time constant is set with parameter **P-0-0186, Actual Position value 3, smoothing time**.

Measuring Wheel Mode Command

A roll feed drive conveys or moves material that is processed later on down the line (e.g., tin cutting). In this case, a motor encoder is not suitable for measuring lengths of pieces of material if there is some slip between the material and the drive. Instead, it makes sense to use an optional encoder, the measuring wheel encoder. Ideally, there is no slip in the connection to the material with such an encoder and this sections of the material can be precisely measured.

2.2 Changed Functions

PL displayed when switching on the control voltage

If PL is displayed after the control voltage is switched on, then firmware version has been replaced and the drive wants to overwrite all parameters with the basic parameters. The base parameters can only be loaded by pressing the S1 key. It is not possible to communicate with the drive for this entire length of time.

Password

Those parameters protected by the user's password are entered in parameter **S-0-0279, IDN-list of password-protected operation data**.

Permanently Configured Status Messages

The permanently configured status message **S-0-0013, Class 3 diagnostics bit3: "Torque >= torque threshold"** is not longer supported.

The configurable signal status word (**S-0-0182, Manufacturer class 3 diagnostics**) contains:

- bit2- ready
- bit3 -warning.

The status messages for the synchronous operating modes

- bit 8 - in synchronisation
- bit 9 - synchronization completed

have been added.

Configurable Signal Status Word

In SERCOS units, bits 0 and 1 of the signal status words (S-0-0144) are illustrates at the digital outputs „Ready“ and „Warning“. With „Load base parameters“ the signal status word bits „Ready“ and „Warning“ are configured out of parameter S-0-0182.

Measuring Systems

P-0-0185, Function of encoder 2 identifies the use. Possible settings are 0, 1, 2 and 3 (measuring wheel encoder).

Analog Outputs

The selection of the signals has been expanded.

Probe Input Feature

The following signals can be recorded:

- Master axis position with and without window
- Actual position value 3 with and without window
- Actual position values 1 and 2 with window

Programmable Limit Switch

There are 16 cam switch points available to the cam switch group. For every one millisecond, one cam switch point is computed.

Cycle Time

The cycle time of the internal command value generating process of the position controller is 1ms.

2.3 Functions Not Implemented

- Main spindle applications: spindle positioning.
- Servo-application: running to end limit.

3 Differences to FWA-ECODRV-ASE-04VRS

3.1 New Functions

Error Memory and Operating Hour Counter

Operating hour counters and error memory were used in the past to store class 1 diagnostics errors and the number of operating hours of the machine in the form of parameters:

- **P-0-0190, Operating hours control section**
- **P-0-0191, Operating hours power section**
- **P-0-0192, Error recorder, diagnosis number**
- **P-0-0193, Error recorder, operating hours control section**

These are stored in the amplifier EEPROM. The user cannot write access them.

New Component to Communicate with the Parameter Interface

Additional ID number lists

For communication between drive firmware and parameter interface, new ID number lists have been introduced:

- **S-0-0018, IDN-list of operation data for CP2**
- **S-0-0019, IDN-list of operation data for CP3**
- **S-0-0025, IDN-list of all procedure commands**
- **S-0-0292, List of all operating modes**

Identifying the Writability of a Parameter in Attribute

The communications phase in which it is possible to write access a parameter is information which is stored in bits 28 to 30.

Bit no. in attribute	Definition
28	0 - writable in communications phase2 1 - not writable in communications phase2
29	0 - writable in communications phase3 1 - not writable in communications phase3
30	0 - writable in communications phase4 1 - not writable in communications phase4

Fig. 3-1: Write accessing in communication phases

List of diagnosis numbers

S-0-0375, List of diagnostic numbers is used to display the previously generated diagnoses for errors, warning, command errors, commands and operating states of the drive.

Permanently Configured Status Messages

The following general and operating-mode specific status messages have been newly implemented in parameters **S-0-0013, Class 3 diagnostics** and **S-0-0182, Manufacturer class 3 diagnostics**.

In **S-0-0013, Class 3 diagnostics** :

- actual velocity = command velocity
- $| \text{actual velocity} | < \text{velocity threshold}$
- $| M_d | > M_{dx}$
- $| M_d | > M_{d\text{grenz}}$
- $| P | > P_x$
- target position reached

In **S-0-0182, Manufacturer class 3 diagnostics** :

- IZP (target position reached & IN_POSITION & IN_STANDSTILL)
- IN_TARGETPOSITION
- drive halt acknowledged
- end position reached
- ready
- warning

Message „IN-MOTION“ has been replaced with $|n_{ist}| <$ **S-0-0124, Standstill window** and thus inverted.

Language switch to French, Spanish or Italian

The following languages for parameter names and units as well as diagnoses in parameter **S-0-0095, Diagnostic message** are in the drive.

S-0-0265, Language selectionl	Language selected
0	German
1	English
2	French
3	Spanish
4	Italian

Fig. 3-2: Language selection in *S-0-0265, Language selectionl*

Multiplex Channel

The limit cyclical data channel can be upgraded with the multiplex channel. It is also possible to cyclically access list elements by using index switching.

It is possible, with the multiplex channel to:

- cyclically exchange more parameter contents despite a limited maximum number of transmittable bytes in the master data telegram and drive telegram;
- access individual list elements with the use of both indices S-0-0362 and S-0-0366;
- transmit the multiplexed data with a cycle time of $T_{scyc} * \text{number of multiplexed data}$ by incrementing index S-0-0368 in each cycle;
- generate index switching in operating mode terms and thus only transmit the parameters needed for the activated operating mode.

Motor Types

The following synchronous and asynchronous motors can also be operated in addition to the MKD synchronous motors.

MHD	LAF/LAR
MKE	LSF
2AD/1MB/ADF	MBS
synchronous kit motor	

MHD, MKD and MKE motors are automatically detected and those motor parameters which are needed are set. All other motor types must be set by inputting the relevant parameters.

Motor holding brake control

Parameters

- **P-0-0525, Type of motor brake**
- **P-0-0526, Brake control delay** are used to control the holding brake.

These parameters are automatically set in MHD, MKD and MKE motors. The brake current is not monitored.

Load-side motor encoder in rotary asynchronous motors

If motor type "2" or "6" is set (rotary asynchronous motor), then the motor encoder can be mounted load side and operated there as well. The load side motor encoder is parametrized using parameters from encoder 2 (the optional encoder):

- **S-0-0115, Position feedback 2 type**
- **S-0-0117, Feedback 2 Resolution**
- **P-0-0075, Feedback type 2**

P-0-0074, Feedback type 1 must be parametrized with "0". Parameter **P-0-0121, Velocity mix factor Feedback 1 & 2** must be set to 100%.

Operating Modes

Four operating modes (one main and three auxiliary modes) can be simultaneously selected. Which of the four is active depends on the master control word which is selected. The higher ranking control performs both the setting and the selection.

The following modes can be set in the drive:

- torque control
- velocity control
- position control with cyclical position command
- (absolute) drive-internal interpolation
- relative drive-internal interpolation
- positioning block mode
- jogging
- position control with step motor interface
- velocity synchronization with virtual master axis
- velocity synchronization with real master axis
- phase synchronization with virtual master axis
- phase synchronization with real master axis
- electronic cam shaft with virtual master axis
- electronic cam shaft with real master axis

Measuring Systems

Up to two measuring systems can be simultaneously evaluated and used. One measuring system is used as motor encoder. The other is evaluated as an optional encoder. The operating mode selected determines the measuring system used to close the position control loop. In parameter **P-0-0121, Velocity mix factor Feedback 1 & 2** the actual velocity value can be mixed in velocity control.

The following table describes which measuring system is evaluated at which interface.

Measuring system	Interface	Value P-0-0074/75
Digital servo feedback or resolver	1	1
Incremental encoder with sine signals with 1V signals from Heidenhain	2	2
Incremental encoder with square-wave signals from Heidenhain	2	5
Encoder with EnDat interface	2	8
Gearwheel encoder with 1Vss signals	2	9
Resolver without feedback memory	1	10
Resolver without feedback memory + Incremental encoder with sine signals	1 + 2	11
Hall encoder + square-wave encoder	1 + 2	12
ECl encoderr	1	13
Hall encoder+ Incremental encoder with sine signals	1 + 2	14

Fig. 3-3: Measuring systems > connections

Absolute Encoder

Both motor encoder and optional encoders can be absolute encoders. Whether the measuring system is evaluated as an absolute encoder or not, depends on

- the travel range set in **S-0-0278, Maximum travel range** (with absolute format of position data) or
- the modulo value set in **S-0-0103, Modulo value** (with modulo format of position data).

This means it is now possible:

- to handle singleturn encoders as absolute encoders and
- to switch off an absolute encoder evaluation for multiturn encoders.

Programmable drive-internal position resolution

The resolution of the drive-internal position data is no longer dependent on the motor encoder type, but can be set via parameter **S-0-0278, Maximum travel range**. The maximum resolution is 2^{15} per encoder period, minimum 2^2 . The computed resolution for encoders 1 and 2 is displayed in parameters **S-0-0256, Multiplication 1** und **S-0-0257, Multiplication 2**.

Note: The drive-internal position resolution mentioned here does not identify the format and unit in which the position data are displayed. This is still set in parameter **S-0-0076, Position data scaling type**.

The drive-side resolution, in form of the number of increments per motor revolution of a rotary motor encoder, for example, is computed in terms of **S-0-0116, Feedback 1 Resolution** * **S-0-0256, Multiplication 1**.

The function supports

- the increase of drive-internal resolution of position data with small travel paths and high resolution requirements as well as
- to decrease the resolution in favor of the possible travel range.

Note: The per "Load default value" activated resolution generally meets demands in terms of possible travel range with sufficiently large position resolution.

Current Limits

The dynamic current limit no longer implements the overload factor **P-0-0006, Overload factor**, but rather the temperature model of the amplifier powerstage and the motor. The maximum available current, including limits, is displayed in parameter **P-0-4046, Active peak current** in terms of the dynamic current limit. The available continuous current is displayed in **P-0-4045, Active permanent current**. This value depends on the switching frequency which has been set.

Monitoring Amplifier Overload

Monitoring thermal controller load with a temperature model of the endstage

The thermal load of the controller endstage is performed with a temperature model. The thermal load is displayed in parameter **P-0-0141, Thermal drive load**. A setting in a parameter is no longer necessary. If the drive limits the effective peak current because of the amplifier overload, then warning **E257 Continuous current limit active** is generated and bit 0 (overload warning) is set in **S-0-0012, Class 2 diagnostics**.

Monitoring Motor Overload

Monitoring thermal motor load with temperature model of motor

The fourfold motor standstill current is allowed for 400msec. The 2.2 fold one is continuously allowed. If the motor overload limit is active, then warning **E225 Motor overload** is generated and bit 0 (overload warning) is set in **S-0-0012, Class 2 diagnostics**.

Drive-Side Error Reaction

The reaction of the drive to detected errors has been expanded as follows:

- Using parameter **P-0-0119, Best possible deceleration** it is possible to set the reaction of the drive to non-fatal and interface errors. In addition to the reactions, "Velocity command to zero", "Torque to zero", "Velocity to zero with ramp and filter" and "Jerk limit" are also used.
- "NC reaction with error". If a non-fatal error occurs, then the drive error reaction can be delayed for 30 seconds. Setting in parameter **P-0-0117, NC reaction on error**.
- In parameter **P-0-0118, Power off on error** settings can be made for a) the time that power should be switched on, b) shutdown of power with fault, c) execution of a package reaction and d) reaction of the drive to DC bus undervoltage.

Automatic Control Loop Settings

The velocity and position control loops are completely automatically parametrized with the automatic control loop settings.

This uses the new command "**D900 Command automatic loop tuning**" in the drive.

In conjunction with DriveTop the command "D9 Automatic control loop settings" can be started in the DriveTop dialog "Parameter / Automatic control loop settings".

The user can influence the resulting control loop dynamics by means of the so-called attenuating factor. This means that no technical knowledge is needed to make further control loop settings.

Additionally, at the end of the control loop setting, the determined load moment of inertia and the maximum parametrizable accel are displayed and stored in a parameter.

Note: To optimize the control loop, it is necessary to move an axis!

Velocity Mix Factor

With the help of the velocity mix factor, the actual velocity value used for velocity control can be put together based on motor and external measuring systems. This can be advantageous if the coupling units between motor and load are subject to backlash or torsion.

Use parameter **P-0-0121, Velocity mix factor Feedback 1 & 2** to set the mixing relationship.

Freely-Configurable Signal Status Word

A freely configurable signal status word has been used. It can be defined via parameters:

- **S-0-0026, Configuration list signal status word**
- **S-0-0328, Assign list signal status word**

This defines which bit of which parameter is configured in the parameter.

- **S-0-0144, Signal status word**

Up to 16 bits can be configured. Generating the collective message S-0-0144 only takes place once in each interface cycle.

The digital outputs of DKC01.3 correspond to bits 0..9 of the signal status word.

Freely-Configurable Signal Control Word

A freely configurable signal status word has been implemented. It can be defined via parameters:

- **S-0-0027, Configuration list signal control word** and
- **S-0-0329, Assign list signal control word**

This defines which bit of which parameter is configured in the parameter.

- **S-0-0145, Signal control word**

Up to 16 bits can be configured. The collective message is evaluated once in every interface cycle.

The digital outputs of DKC01.3 correspond to bits 0 to 9 of the signal control word.

Analog Inputs

Using the function *Analog inputs* it is possible to:

- enter some parameters of the drive with variable scaling via analog/digital converters. (Parameter **P-0-0212, Analog inputs, IDN list of assignable parameters, P-0-0213, Analog input 1, assignment, P-0-0214, Analog input 1, scaling per 10V full scale, P-0-0215, Analog input 2, assignment** and **P-0-0216, Analog input 2, scaling per 10V full scale, new**)
- or assign an offset to analog input signals (parameter **P-0-0217, Analog input 1, offset** and **P-0-0218, Analog input 2, offset new**).

Analog input 1 is processed every 500 usec, input 2 only every 8 msec.

Oscilloscope Function

With the oscilloscope function, specific signals of the drive such as

- **S-0-0051, Position feedback 1 value or S-0-0053, Position feedback 2 value,**
- **S-0-0040, Velocity feedback value**
- **S-0-0080, Torque/Force command**
- **S-0-0347, Speed deviation**
- **S-0-0189, Following error**

can be stored in 2*512-deep measurand lists. A triggering event is the result either of thresholds or they are due to something external that can be parametrized in the drive for position, velocity or torque data. An oscilloscope function can be implemented by using the triggering stipulations, reading the measurand list and graphically illustrating the measurands stored therein by using a parametrization interface. It is possible to illustrate contour accuracy by superimposing the measuring results of axes that are interpolating with each other.

Probe Function

There are two probe inputs on the drive. This function stores signals from:

- actual position values 1 or 2 with or without window
- relative drive-internal time
- actual position values 3 1 or 2 with or without window
- master axis position 1 or 2 with or without window

at the time the switching edge of this probe occurs. They are stored in the relevant parameters. By preselecting, it is fixed whether the positive or negative edge of the probe is evaluated. Each time the edge occurs, the difference between the measurand for the positive and that of the negative edge is stored in the parameter set for the measurand difference.

Detect Marker Position Command

Correct detection and the position of the reference marker of an incremental measuring system can be detected by using the command **P-0-0014, D500 Command determine marker position**. The position of the marker is displayed in parameter **S-0-0173, Marker position A**. The command is also used to operate gantry axes with external measuring systems as well as to examine the error-free detection of reference markers.

Park Axis Command

Command **S-0-0139, D700 Command Parking axis** was used. It is only possible to write access this command in communications phase 2. If this command is activated, then all the monitoring activities of command **S-0-0128, C200 Communication phase 4 transition check** are not conducted. Message "PA" appears on the 7-segment display. A phase regression deactivates this command (as is the case with all other commands).

Programmable Limit Switch

Up to 16 position-dependent cams can be realized with the function dynamic programmable limit switch. The actual position value 1 can be used as a reference signal (motor encoder) or 2 (optional encoder). There is one on and one off threshold for each cam. If an off threshold is smaller than the on threshold, then the cam is inverted. There is also a separately programmable prehold time for each cam with which the reference signal can be corrected in terms of the velocity.

Encoder Emulation

With function encoder emulation it is possible to emulate

- actual position value 1
- and actual position value 2
- the command position value
- master axis value
- actual position value 3

in the form of

- SSI signals or
- TTL signals (incremental encoder).

3.2 Changed Functions

Password

The password function has been modified so that

- by inputting a customer password, not all parameters of the drive become write protected but instead only those parameters that are in parameter **S-0-02792, IDN-list of password-protected operation data**. These are precisely those parameters stored in the programming module.

Command communication via SERCOS Interface

Communication via SERCOS interface has been modified as follows:

- if SERCOS communication is not active and if there are no edges at the LWL inputs, then the drive goes into phase 4. The drive behaves like an analog unit (drive enable and drive halt via hardware inputs are possible).
- SERCOS compliance class C
- Multiplex channel for reading and writing data are not needed in every cycle and are not dependent on the active mode. Individual elements of the list parameters can also be read/write. (Als check the new function: "Multiplex channel".)

Operating Modes

Position Block Mode

The following modifications have been made here:

- Mode "Run slow" is activated in bit 1 of parameter **P-0-4060, Process block control word** and no longer in **P-0-4027, Function parameter**.

Jogging

The parameters effecting accel and jerk limit values are parameters

- **S-0-0260, Positioning Acceleration** and
- **S-0-0193, Positioning Jerk**

Note: Activating "Run slow" no longer works in jogging mode. Only the velocity set in **P-0-4030, Jog velocity** is effective.

Operating mode cyclical position control

The command value is quadratically interpolated for the position control loop in the case of position control to cyclical position command values. The position controller cycle time equals 1ms.

Travel range limit

Whether the travel range limit switch input is active or not can be checked in parameter **P-0-0222, Status Inputs travel range limits**.

E-Stop Function

The E-stop function was changed so that

- in bits 1 and 2 of **P-0-0008, Activation E-Stop function** the reaction of the drive upon actuation of the E-stop input can be selected and
- the status of the E-stop input (active / not active) is displayed in parameter **P-0-0223, Status Input E-Stop function**.

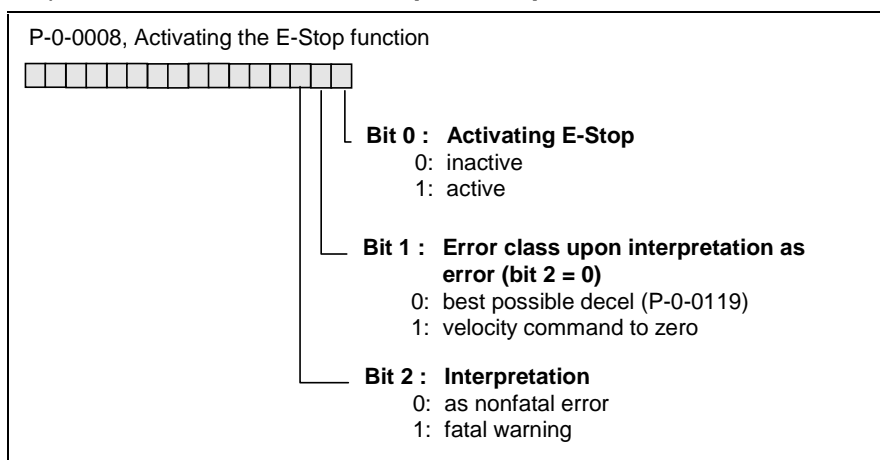


Fig. 3-4: P-0-0008, Activation of the E-stop function

Controller Structure

The velocity controller has been modified so that

- the deep pass filter of the actual velocity value is dropped in parameter **S-0-0392, Velocity feedback filter**,
- the variables (torque command) generated by the velocity controller can be filtered over a bandstop filter with programmable frequencies and bandwidth (Parameter **P-0-0180, Rejection frequency velocity loop** and **P-0-0181, Rejection bandwidth velocity loop** new) and
- the deep pass can be set via **P-0-0004, Velocity loop smoothing time constant** to not effect the variables but rather the control deviations of the velocity controller.

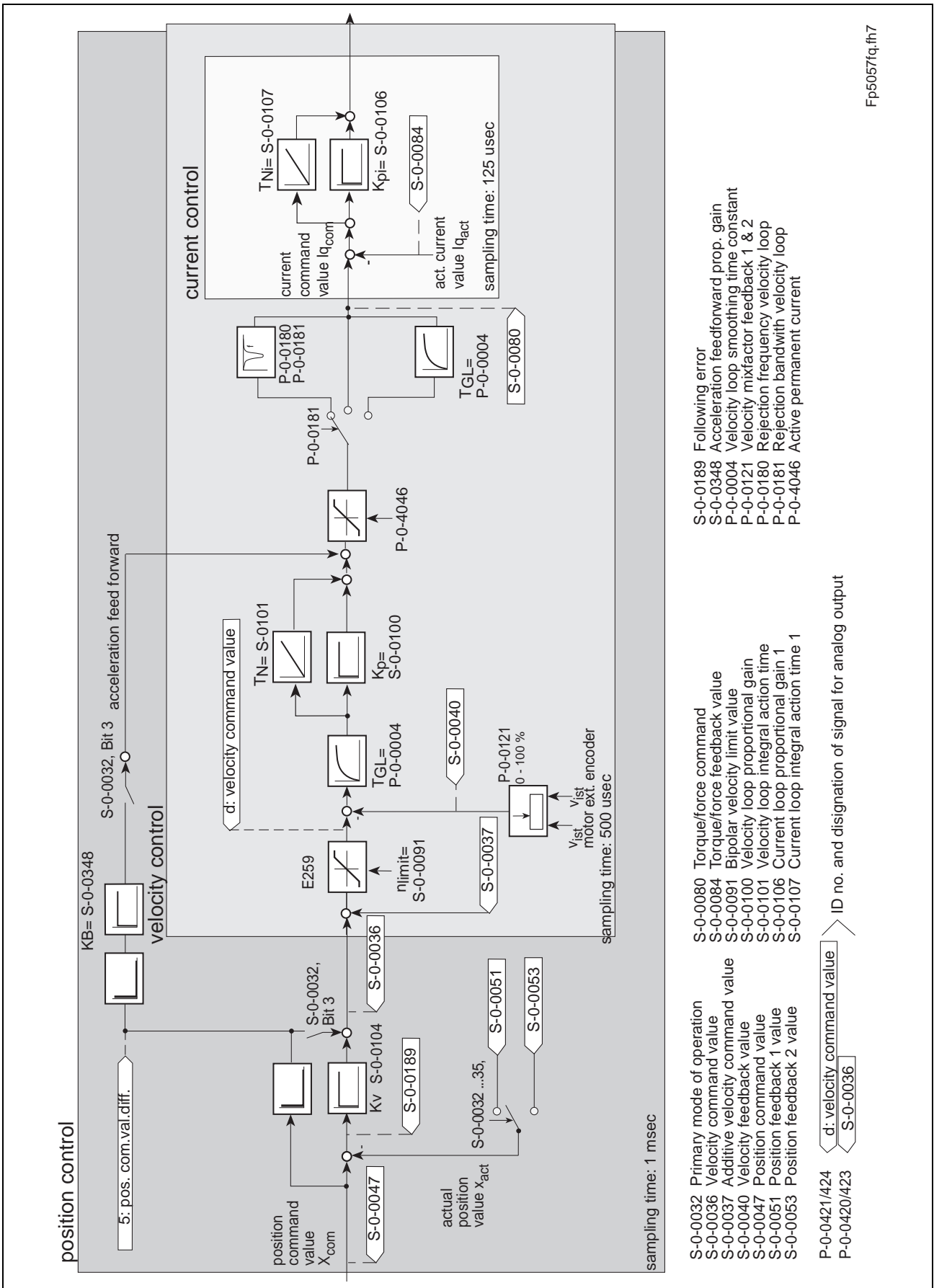


Fig. 3-5: Control structure FWA-ECODR3-SGP-01VRS

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Velocity Control Loop Monitoring

The velocity control loop monitor can be switched off with bit 8 of parameter **P-0-0538, Motor function parameter 1**.

Drive Halt

The drive brings itself to a stop taking accel and jerk limit values into account:

Previous operating state	Parameters usedr
no position control mode	P-0-1201, ramp-1, P-0-1203, ramp-2, P-0-1202, transition velocity
position control with drive-internal interpolation (positioning block mode, drive-internal interpolation, relative drive-internal interpolation)	previous accel and jerk limit remains active
position control without drive-internal interpolation	S-0-0138, bipolar accel S-0-0349, bipolar jerk limit

Fig. 3-6: Accel and jerk with drive halt

Drive-Controlled Homing

The function *Drive-Controlled Homing* has been expanded:

- Encoder 1 (motor encoder) and 2 (optional encoder) can be referenced.
- encoder with distance-coded reference marker is possible
- via bit 7 in parameter **S-0-0147, Homing parameter** it can be selected whether the drive will go to the reference point or stands still after switching into the actual value coordinate system.

Analog Output

The function *Analog output* was modified. It is now possible

- to output some drive parameters with variable scaling via the digital/analog converter. (Parameter **P-0-0426, Analog outputs, IDN list of assignable parameters, P-0-0420, Analog output 1 signal selection, P-0-0422, Analog output 1, scaling per 10V full scale, P-0-0423, Analog output 2, signal selection** and **P-0-0425, Analog output 2, scaling per 10V full scale, new**).
- Any bits and bytes can be output via the expanded signal select. (Parameter **P-0-0421, Analog output 1, expanded signal selection** and **P-0-0424, Analog output 2, expanded signal selection new**).
- Signals can be output via a list of permanently set signals.

Signal no. P-0-0421/424	Output signal	Reference unit: eval. factor 1.0
0x00000001	sine signal motor encoder	0.5V/10V
0x00000002	cosine signal motor encoder	0.5V/10V
0x00000003	sine signal optional encoder	0.5V/10V
0x00000004	cosine signal optional encoder	0.5V/10V
0x00000005	command position difference on position controller	rot. =>1000rpm/10V lin. =>100m/min/10V
0x00000006	DC bus power	1kW/10V
0x00000007	DC bus power absolute amount	1kW/10V
0x00000008	rms current (Iq)	S-0-0110/10V
0x00000009	Blind current (Id)	S-0-0110/10V
0x0000000a	Thermal load	--
0x0000000b	Motor temperature	150°C/10V
0x0000000c	Magnetization current	S-0-0110/10V
0x0000000d	velocity command value on speed controller	rot. =>1000rpm/10V lin. => 100m/min/10V
0x0000000e	Bleeder load	100 % / 10V
FREI		
FREI		
...		
0x00000014	synchronous position command value	rot. => 360°/10V lin. => 1mm/10V
0x00000015	synchronous velocity	rot. => 1000Upm/10V lin. => 100m/min/10V
0x00000016	master axis position interpolation	2 ²⁰ /10V
0x00000017	master axis speed in NC cycle	rot. => 1000Upm/10V

Fig. 3-7: Signal select list with predefined signal selection

- These outputs are scaling-independent and always relate to the motor shaft. The scaling of the signals is possible in terms of the evaluation parameters P-0-0422&P-0-0425. They are, with the expanded signal selection with predefined signals, fixed as a factor with four decimal places and have a permanent reference unit to the selected signal (see table).

Serial Communication

The serial communications with drive via the serial interface can implement either (connector X2):

- an ASCII protocol (see Ecodrive 1) or
- via SIS protocol (**S**erial **I**ndramat **I**nterface)

The protocol is automatically identified.

4 Differences to FWA-DIAX-ELS-05VRS

4.1 New Functions

Multiplex Channel

Using this channel it is possible to expand the limited cyclical data channel. It enables a cyclical accessing of list elements by index switching.

The following parameters are used here:

- **S-0-0360, MDT Data container A**
- **S-0-0362, List index, MDT data container A**
- **S-0-0364, AT Data container A**
- **S-0-0366, List index, AT data container A**
- **S-0-0368, Addressing for data container A**
- **S-0-0370, Configuration list for MDT data container**
- **S-0-0371, Configuration list for the AT data container**

Analog Command Communications

Velocity and torque command values are set using the analog inputs. Digital inputs are available to activate the controller. If SERCOS communications is not active at the point in time when the control voltage is switched on then the drive can be operated with the analog command communication option.

Parallel Command Communication

The parallel interfaces makes ten (10) freely configurable inputs and ten (10) outputs available.

Firmware Loader

A firmware loader can be used to load the firmware onto the programming module. The module does not have to be replaced to conduct an update.

Operating Modes

The following modes are used:

Positioning block mode

In this mode up to 64 programmed blocks can be run off. The drive runs in **position control** to the target position while maintaining the velocity, acceleration and jerk limits defined by the block.

Pertinent parameters

- **P-0-4006, Process block target position**
- **P-0-4007, Process block velocity**
- **P-0-4008, Process block acceleration**
- **P-0-4009, Process block jerk**
- **P-0-4019, Process block mode**
- **P-0-4026, Process block selection**
- **P-0-4051, Process block acquittance**
- **P-0-4052, Positioning block, last accepted**

- **P-0-4057, Positioning block, input linked blocks**
- **P-0-4060, Process block control word**
- **S-0-0346, Setup flag for relative command values**
- **S-0-0182, Manufacturer class 3 diagnostics**
- **S-0-0259, Positioning Velocity**

Operating Mode Step-Motor Operation

In "Step motor mode" the drive behaves like a conventional step motor drive. Conventional step motor controls can be used to control the drive in this case.

This mode is only available in conjunction with a parallel interface which is the reason why it is only used with the DKC01.3.

Pertinent parameters

- **P-0-4033, Stepper motor resolution**
- **P-0-4034, Stepper motor interface mode**
- **P-0-0099, Position command smoothing time constant**

Jogging Mode

This mode is used to "manually" run an axis.

Jog input switches to move the axes can be mounted to units equipped with positioning interface or step motor interface.

Pertinent parameters

- **P-0-4030, Jog velocity**
- **P-0-4056, Jog inputs**
- **S-0-0260, Positioning Acceleration**
- **S-0-0193, Positioning Jerk**

Velocity synchronization mode with real master axis

The drive synchronizes to a master axis position (real) gained from a master axis encoder.

Encoder 2 evaluates the master axis encoder.

(See section: "Master axis encoder").

Electronic cam with real master axis mode

See "Electronic cam with real master axis" in section: "Differences to FWA-ECODR3-SMT-01VRS".

Automatic Control Loop Settings

To make it easier to parametrize the drive, the firmware offers an automatic control loop setting. The results can be influenced via parameter **P-0-0163, Damping factor for autom. control loop adjust** and **P-0-0164, Application for autom. control loop adjust, (Control loop dynamics)**.

Configurable Signal Control Word

The signal control word offers the option to overwrite **individual control words** scattered over various parameters into one configurable **collective parameter**.

With the configurable signal control word, up to **16** copies can be made of bits in other drive parameters.

- Application** This mechanism can be used, e.g., with
- position block mode via parallel interface or
 - main spindle mode via parallel interface.

The following parameters are used for the function:

- **S-0-0027, Configuration list signal control word**
- **S-0-0329, Assign list signal control word**
- **S-0-0145, Signal control word**
- **S-0-0399, IDN list of configurable data in the signal control word**

4.2 Changed Functions

PL displayed when switching on the control voltage

If PL is displayed after the control voltage is switched on, then firmware version has been replaced and the drive wants to overwrite all parameters with the basic parameters. The base parameters can only be loaded by pressing the S1 key. It is not possible to communicate with the drive for this entire length of time.

Password

Those parameters protected by the user's password are entered in parameter **S-0-0279, IDN-list of password-protected operation data**.

List of Diagnostic Numbers

The 50 previously displayed diagnostic numbers are stored in parameter **S-0-0375, List of diagnostic numbers** in chronological order. Each time the contents of **S-0-0390, Diagnostic message number** are changed, the contents of **S-0-0375, List of diagnostic numbers** are assumed. If **S-0-0375, List of diagnostic numbers** is read, then the previous diagnostic number appears in the first element; the first element appears in the second and so on.

Permanently Configured Status Messages

- End position reached,
- ready and
- warning

have been added to parameter **S-0-0182, Manufacturer class 3 diagnostics**.

Compatibility Class C

SERCOS compatibility class C has been added.

Motor Holding Brake

The motor holding brake current is not monitored.

The holding brake can be set as a servo or main spindle brake (**P-0-0525, Type of motor brake Bit 1**). The brake of a servo brake is switched on after the maximum brake time (**P-0-0126, Maximum braking time**) is exceeded. A main spindle brake is not activated until the actual velocity is < 10rpm or 10mm/min.

Magnetization Current for Asynchronous Motors

It is not possible to lower the magnetization currents as of the transition speed in asynchronous motors for the S1 mode.

Commutation Settings

The commutation setting is only possible in kit motors (MBS) or linear motors (LSF). The setting is performed by oscillating the motor.

Operating Modes

The following modes have been changed:

Operating Mode Torque Control

Torque control mode has a command value filter. The value is filtered with a PT1 filter. The parameter to set the time constant is **P-0-0176, Torque command value smoothing time constant**.

Velocity control mode

Two command value ramps and one PT1 filter effect the velocity command value.

- **P-0-1201, Ramp 1 pitch**
- **P-0-1203, Ramp 2 pitch**
- **P-0-1202, Final speed of ramp 1**

Relative drive-internal interpolation mode

When activating this mode, the travel path can, depending on parameter **S-0-0393, Command value mode**, relate to the actual position or the value set in parameter **S-0-0258, Target position**.

Measuring Systems

See section: "Measuring Systems" in section "Differences to FWA-ECODRV-ASE-04VRS"

Evaluating an Absolute Measuring System

Parameter **S-0-0378, Encoder 1, absolute range** defines the area in which the position data of encoder 1 can be absolutely generated. Parameter **S-0-0379, Encoder 2, absolute range** defines the area in which the position data of encoder 2 can be absolutely generated.

Travel Range Monitoring

The state of the travel range limit switch is displayed in parameter **P-0-0222, State of Travel range limit inputs**.

Master axis encoder

In addition to single or multiturn encoders, incremental encoders are also possible. This includes automatic detection of zero pulse followed by transition from P-0-0052 to the offset P-0-0087. Actual position value 3 is smoothed via PT1 filter, the time constant is set in parameter **P-0-0186, Actual Position value 3, smoothing time**.

E-stop Function

The state of the E-stop input is shown in parameter **P-0-0223, Status Input E-Stop function**.

Load Base Values

The command can be conducted with drive enable applied.

A comparison between parameter motor type in feedback memory (S-7-0141) and parameter motor type in parameter memory (S-0-0141) generates the diagnosis "UL motor type has changed".

Velocity Control Loop Monitor with Off Capabilities

The monitor can be switched off with parameter **P-0-0538, Motor function parameter 1 Bit 8**.

Drive Halt

Depending on the current mode, drive halt is conducted variously.

Operating modes with internal interpolation set still in position control using the last active accel and jerk.

The values set in the following parameters are used to set still:

S-0-0138, Bipolar acceleration limit value

S-0-0349, Jerk limit bipolar

The following parameters are used to set still when in velocity and torque control:

P-0-1201, Ramp 1 pitch

P-0-1202, Final speed of ramp 1

P-0-1203, Ramp 2 pitch

P-0-1222, Velocity command filter

Drive-Controlled Homing

The drive runs to the reference point with the absolute encoder already referenced if bit 7 = 1 has been set in parameter **S-0-0148, C600 Drive controlled homing procedure command**.

Probe Input Feature

Measuring signal actual positions values 1 and 2, internal time, master axis position and actual position value 3 generate measuring value differences.

Windows for actual position values, master axis position and actual position value 3 have been implemented.

Programmable Limit Switch

The dynamic cam switch group has 16 cams at its disposal with one cam computed per millisecond.

Encoder Emulation

Encoder emulation and signal select for the emulation are set in parameter **P-0-4020, Encoder emulation type**.

Command Measuring Wheel Mode

The command can also be started without the drive being in position control. The measuring wheel encoder position will be correctly detected. Encoder 1 checks the controls. As soon as position control has been activated, the measuring wheel position is run to.

Serial Communication

Serial communications SIS protocol possible. Communications using the serial interface is possible with the ASCII or SIS protocols. The drive automatically detects which is set.

4.3 Functions Not Implemented

- Electrical pattern control
- Universal digital I/Os
Only the outputs read and warning can be freely allocated with the signal status word.

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