

DIAX03

Drive With Servo Function

Version Notes: SSE 02VRS

DOK-DIAX03-SSE-02VRS**-FVN1-EN-P

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Document identification of previous and present editions	Release Date	Note
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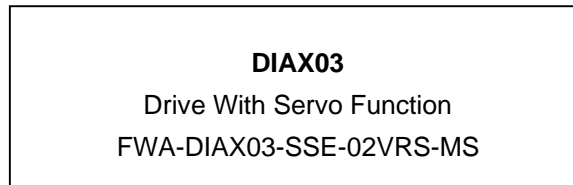
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1 General Information

1.1 Product Family

The product release description refers to the product family:



The following drive controls can be operated with this software:

- DDS 2.2
- DDS 3.2
- DKR 2.1
- DKR 3.1
- DKR 4.1

1.2 Documentation

The documentation for product **FWA-DIAX03-SSE-02VRS** is available as follows:

Paper form
Windows help system

The following table contains a summary of available items.

POS	Type	Document style	Register in Mapped 51-02V	Part number	Symbol number
1	DOK-DIAX03-SSE-02VRS**-50M1-EN-P	Mappe 51-02V-EN Paper	--	276244	209-0072-4331-01
2	DOK-DIAX03-SSE-02VRS**-FKB1-EN-P	Functional Description Paper	3	276248	209-0072-4332-01
3	DOK-DIAX03-SSE-02VRS**-INF1-EN-P	Drive Configuration	6	276246	209-0072-4333-01
4	DOK-DIAX03-SSE-02VRS**-WAR1-EN-P	Trouble Shooting GuidePaper	8	276247	209-0072-4334-01
6	DOK-DIAX03-SSE-02VRS**-FVN1-EN-P	Firmware Versionsnote	10	276245	209-0072-4335-01
7	DOK-DIAX03-SSE-02VRS**-51M1-EN-H1,44	Help System for Windows3.1 Disk	12	276243	209-0072-4331-01

Fig.: 1-1: Documentation for FWA-DIAX03-SSE-02VRS

1.3 Notes on Replacing the Firmware

To successfully replace the firmware, the following steps in the prescribed order must be complied with and the listed tasks conducted as outlined.

- **Release - read the entire documentation**
- **Secure the current set of parameters**

Note: The parameters that are to be secured are stored in parameter S-0-0192.

- **Switch machine off, exchange the drive controller firmware (Eproms) and switch machine back on.**
- **Switch into operating mode**
The machine is now operable with the new firmware.
- **Check the functions**
Check the functions of the re-equipped machine carefully after firmware exchange.

2 Firmware-Version DIAX03-SSE-02VRS

2.1 Release notes

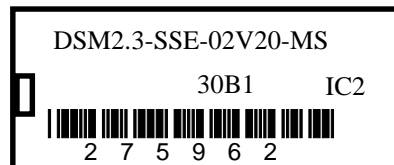
Firmware version **FWA-DIAX03-SSE-02V20** represents the first official edition of version 01. It was released on **01.08.97**.

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

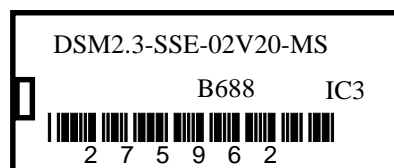
- DKR03.1-W100, DKR03.1-W150, DKR03.1-W200
- DKR03.1-F100, DKR03.1-F150, DKR03.1-F200
- DKR02.1-W200, DKR02.1-W300
- DKR02.1-F200, DKR02.1-F300
- DKR04.1-W300, DKR04.1-W400
- DKR04.1-F300, DKR04.1-F400
- DDS02.2-W015, DDS02.2-W025, DDS02.2-W050, DDS02.2-W100, DDS02.2-W150, DDS02.2-W200
- DDS02.2-A015, DDS02.2-A050, DDS02.2-A100, DDS02.2-A200
- DDS02.2-F015, DDS02.2-F050, DDS02.2-F100, DDS02.2-F200
- DDS03.2-W030, DDS03.2-W015, DDS03.2-W050

2.2 EPROM Labelling

EPROM IC2:



EPROM IC3:



2.3 New basic functions

SERCOS compatibility class B

The firmware is equipped with all functions needed to achieve SERCOS compatibility class B.

- **S-0-0018, IDN list of communications phase 2 operating data**
- **S-0-0019, IDN list of communications phase 3 operating data**
- **S-0-0025, IDN list of all commands**
- **S-0-0125, nx velocity threshold**
- **S-0-0157, speed window**
- **S-0-0013, C3D, bit 0 (nact = ncomm) and bit2 (|nact| < nx)**
- **S-0-0191, D600 command delete reference**

Command load base parameters

The command **P-0-4094, C800 command load base parameters** was implemented. While executing the command, all the parameters in **S-0-0192, IDN list of operating data to be secured**, are set to the default values specified in the drive.

If the firmware on a programming module is exchanged and the incompatibility of the parameter memory in terms of the previous firmware is detected, then the error message **F209 load base values of parameters** is generated. "PL" appears in the 7-segment display. By pressing the S1 key, "load base parameters" is executed.

Error memory and elapsed hour meter

Elapsed hour meters and error memory were implemented to store the C1D errors and the number of elapsed hours. These were stored in the form of parameters:

- **P-0-0190, elapsed hour in the control**
- **P-0-0191, elapsed hours in the power section**
- **P-0-0192, error memory of diagnosis numbers**
- **P-0-0193, error memory of elapsed hours in the control**

The parameters are stored in the E²prom. Write accessing is not possible.

Freely configurable signal status word

A freely configurable signal status word was used. Via parameters

- **S-0-0026, configuration list of signal status word and**
- **S-0-0328, configuration list of signal status word, bit number**

it is possible to define which bit of which parameter has been configured in parameter

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

Up to 16 bits can be configured. The group signal S-0-0144 is generated at time T4 every Sercos cycle.

Switching to French, Spanish and Italian

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

S-0-0265, language select	Selected language
0	German
1	english
2	French
3	Spanish
4	Italian

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

Bit "IN_TARGET POSITION" in S-0-0182, manufacturer's C3D

The message IN_TARGET POSITION has been introduced into the manufacturer's C3D as bit 10. The bit is "1". It applies:

$$\left| \text{S-0-0258, target position} - \text{S-0-0051/53 actual position value-1/2} \right| < \text{S-0-0057, positioning window}$$

Supporting plug-in modules DEA 8/9/10.1-M

Plug-in modules DEA 8.1, 9.1 and 10.1 are supported by the firmware. The following parameters have been introduced for this purpose:

- **P-0-0170, Parallel output 4**
- **P-0-0171, Parallel input 4**
- **P-0-0172, Parallel output 5**
- **P-0-0173, Parallel input 5**
- **P-0-0174, Parallel output 6**
- **P-0-0175, Parallel input 6**

The option to allocate a parallel input or output to a specific parameter is given using parameter P-0-0124/125. This means that for each drive there is a maximum of 72 digital outputs and 96 digital inputs.

Evaluating distance-coded measuring systems

It is now possible to evaluate distance-coded measuring systems. Via bit 1 in **S-0-0277, Position feedback type parameter 1** or **S-0-0115, Position feedback type parameter 2** it can be indicated as to whether the measuring system has distance-coded reference markers. Via parameters

- **S-0-0165, distance coded reference dimension 1** and
- **S-0-0166, distance coded reference dimension 2**

the bigger and smaller distance is entered. During command **S-0-0148, C600 drive-guided homing** the drive crosses two adjacent reference markers. It uses this to calculate the new actual position value, in terms of the machine's zero point, based on the distance of the reference marker and the value in **S-0-0177 absolute dimension offset 1** or **S-0-0178 absolute dimension offset 2**.

Determine command marker position

With the help of **P-0-0014, d500 determine command marker position**, it is possible to detect the correct determination and position of the reference marker of an incremental linear scale. The position of the reference marker is then displayed in parameter **S-0-0173, marker position A**. This command is used to operate gantry axes with external measuring systems or to check whether the reference marker determination is error-free.

Return movement with error

If a "3" is parametrized in parameter **P-0-0119, best possible deceleration** a return movement with error is conducted if a non-fatal error or interface error occurs, or if the drive enable signal is removed, with phase regression of a communications phase while the drive is in "AF". The drive runs a relative distance specified by parameters

- **P-0-0096, distance to move in error situation**
- **S-0-0091, bipolar velocity limit value**
- **S-0-0138, bipolar acceleration and**
- **S-0-0349, bipolar jerk limit value.**

E-Stop as fatal warning

The response of the drive to an activated E-stop input can take three forms:

- A response as "travel distance error". This generates **F6/34 E-Stop activated**. The drive responds by going to zero velocity regardless of the setting in **P-0-0119, best possible deceleration**. The error must be cleared with "error reset".
- A response as "interface error". This generates **F4/34 E-Stop activated**. The drive responds in terms of what was set in **P-0-0119, best possible deceleration**. The error must be cleared with "error reset".

- A response as "fatal warning". This generates **E8/34 E-Stop activated**. The drive responds in terms of what was set in **P-0-0119, best possible deceleration**. No error is generated. (Similar to removal of drive enable signal.)

This is set in parameter **P-0-0008, Activation E-stop function**:

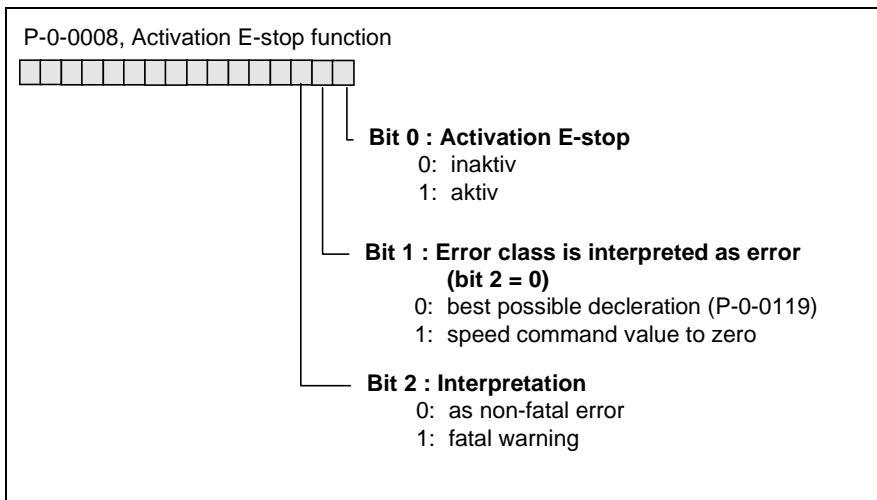


Fig. 2-3: E-Stop function in P-0-0008

Settable drive-internal position resolution

The resolution of the drive-internal position data is no longer dependent on the motor encoder type used but can instead be set in parameter **S-0-0278, Maximum travel range**. The maximum resolution equals 2^{15} per encoder spacing. Minimum resolution equals 2^2 . Calculated resolution for encoders 1 and 2 is displayed in parameters **S-0-0256, multiplicand-1** and **S-0-0257, multiplicand-2**.

The drive-internal resolution in the form of a the number of increments per motor resolution of a rotary motor encoder is thus calculated in terms of **S-0-0116, motor encoder resolution * S-0-0256, multiplicand-1**.

This function supports

- increasing the drive-internal resolution of the position data in small travel distances and high resolution requirements and
- to reduce the resolution in terms of a larger travel range.

New encoder types "Gear-wheel encoders with Leonhart&Bauer sensors", "Resolver encoder without feedback memory" and "Resolver encoder + sine encoder"

Three new encoder types have been introduced:

encoder type	Interface no. In P-0-0074/75	Module required
gear-wheel encoder with Leonhart&Bauer sensor	9	DZF 3.1
resolver encoder without feedback data storage	10	--
resolver encoder+ sine encoder	11	DLF-1

Fig. 2-4: New encoder types

Encoder type "gear-wheel encoder with Leonhart&Bauer sensor" can be used either as a motor encoder or an external encoder. "Resolver encoder+ sine encoder" and "resolver encoder feedback data storage" can only be used as a motor encoder.

New motor type "Rotary synchronous kit motor"

The new motor type *Rotary synchronous kit motor* has been introduced. In parameter **P-0-4014, motor type "7"** has been parametrized. This sets this type of motor. This motor type does not have a motor feedback data storage in which the motor parameters have been stored. The commutation offset in the form of parameter **P-0-0508, commutation offset** is buffered in the programming module.

The following motor encoders are permissible with this motor type:

P-0-0074, Motor encoder interface	Encoder type
1	all DSFs (Stegmann/Heidenhain)
8	Endat
10	Resolver without feedback data storage
11	Resolver without feedback data storage with sine encoder

Fig. 2-5: Possible motor encoders for rotary synchronous kit motors

"Relative drive-internal interpolation" mode

Four new operating mode for relative drive-internal interpolation have been introduced.

S-0-0032/33/34/35	operating mode
0000.0010.0001.0011	A146 Relative drive-internal Interpolation, encoder 1
0000.0010.0001.0100	A147 Relative drive-internal Interpolation, encoder 2
0000.0010.0001.1011	A148 Relative drive-internal Interpol. encoder 1, lagless
0000.0010.0001.1011	A149 Relative drive-internal Interpol. encoder 2, lagless

Fig. 2-6: Operating modes "Relative drive-internal Interpolation"

In these operating modes, the distance to be covered is set in parameter **S-0-0282, travel distance**. This is assumed by toggling parameter **S-0-0346, assume relative command value** into the absolute target position in **S-0-0258, target position**. It is set in the drive-internal interpolator and then covered. If modulo scaling has been set for the position data, then travel distances equalling more than one modulo value can also be set.

Load-side motor encoder with rotary asynchronous motor

If motor type "2" or "6" is set (rotary asynchronous motor), then the motor encoder can be mounted load side and operated there. This means that there is no motor encoder but rather an external encoder. The load side motor encoder is parametrized via external encoder parameters such as:

- **S-0-0115, position encoder type 2**
- **S-0-0117, resolution of external encoder**
- **P-0-0075, external encoder interface**

There is thus no motor encoder, i.e., **P-0-0074, motor encoder interface** must be parametrized with "0". Parameter **P-0-0121, velocity mix factor encoder 1 & encoder2** must be set to 100%.

Customer password

With parameter **S-0-0267, password** a customer password can be activated. If it is activated, then all parameters backed up in the programming module cannot be write accessed (All parameters in **S-0-0192, list of operating data to be secured**.) If the attempt is made to write access a parameter with password, then the service channel error message *0x7009, data write protected with password* is generated. At delivery, the unit does not have an activated customer password. Reading **S-0-0267, password** generates the value "007" (default customer password). By entering [old password] [new password] the (new) customer password is activated. Reading **S-0-0267, password** generates the value "****" (customer password active).

Park Axes Command

Command **S-0-0139, D700 park axes command** was used. This command can only be write accessed in communications phase 2. If this command is active, then all monitors of commands **S-0-0128, C200 communications phase 4 transition check** are run. The message "PA" appears in the 7-segment display. Phase regression deactivates this command (as is the case with all other commands).

Motor overload monitor

The new dynamic current limit of DIAX03/04 drive controllers with firmware SSE-01VRS/ELS-04VRS, which is based on the temperature model of the amplifier, does not take the motor into consideration. The motor is protected only by its temperature sensor. If the motor is overloaded, then the temperature sensor does not respond quickly enough meaning that the winding could burn up. It does not suffice to limit motor peak current.

A motor overload limit was thus instituted. For 400msec a fourfold motor current at standstill is permitted. A 2.2 fold motor current at standstill is generally permitted. If motor overload limit is active, then the warning **E225 motor overload** is generated, bit 0 (overload warning) is set in **S-0-0012, C2D**. The limited peak current is displayed in **P-0-4046, active peak current**.

Expansion of parameters P-0-0118, power off with error

Parameter **P-0-0118, power off with error**, which controls power off, has been expanded. The following settings are now possible:

Bit no. in P-0-0118	Definition
0	Power supply module message with error 0- no message via X1.2 with error 1- Meldung über X1.2 with error
1	First signal to power supply module 0 - first signal if no error and communications phase 4 <i>(X1.2 goes to "1", when first reaching comm. phase 4 and there is no C2D error)</i> 1 - first signal if no error ("passive axes") <i>(X1.2 goes to "1", if no C1D error)</i>
2	Time point for power off with error (only if bit 0 = "1", message via X1.2 with error) 0 - X1.2 with error goes to 0 immediately, <i>(total reaction of all same power supply units in controller, preset for modular units (DDS))</i> 1 - X1.2 with error goes to 0 if drive goes torque free. <i>(preset for compact units (DKR))</i>
3	Reaction to DC bus undervoltage 0 - undervoltage treated like non-fatal error 1 - undervoltage treated like fata warning which stops operation of motor

Fig. 2-7: Expansion of parameter P-0-0118

Displaying the writability of a parameter in terms of the communications phase in the attribute

Every parameter is made up of a data block with 7 elements. One of these elements is the attribute made up of a bit strip with 32 bits. Information such as display format, number of decimal places and so on are displayed there. The bits 28, 29 and 30, not presently used, are now being used to display whether a parameter can be write accessed in terms of the communications phase. This means that the parametrizable surface of this information is available.

The following definitions use the new bits:

Bit no. in attribute	Definition
28	0 - Operating data can be write accessed in comm. phase 2 1 - Oper.data cannot be write accessed in comm. phase 2
29	0 - Operating data can be write accessed in comm. phase 3 1 - Oper.data cannot be write accessed in comm. phase 3
30	0 - Operating data can be write accessed in comm. phase 4 1 - Oper.data cannot be write accessed in comm. phase 4

Fig. 2-8: Expanding the SERCOS attribute

(See Update 97.1 on SERCOS interface.)

Warning for interpolation speed and acceleration equal to 0

In operating mode "drive-internal or relative drive-internal interpolation, rive halt or "drive guided referencing" command, the drive autonomously generates a position command value profile in the so-called drive-internal interpolator. The interpolator is given the maximum speed or maximum acceleration (referencing speed and acceleration or position speed and acceleration) it may use. If the effective speed is equal to 0, then the warning **E247 interpolation speed = 0** is generated. If the effective limit acceleration is 0, then the warning **E248 interpolation acceleration = 0** is generated. The relevant parameters should be correctly set.

List of supported operating modes

Parameter **S-0-0292, list of supported operating modes** has been used. It lists the codes of the operating modes supported in this firmware.

Changing decimal places with rotary parametr position scaling

If rotary parameter scaling is set for position data (**S-0-0076, position data scaling** = 0000.0000.xx00.1010), then the decimal places for the scaling dependent position data are set in terms of the selected rotary position resolution in **S-0-0079, rotary position resolution**.

$S-0-0079, \text{rotary position resolution} = 360 * 10^x, \text{for } x = 0..6.$

If some other value is parametrized in **S-0-0079, rotary position resolution**, then the number of decimal places is 0 and the unit is increments.

Detailed error messages for missing external voltage supply

To quickly eliminate errors the error message **F2-33 external voltage supply error** has been broken down into the more detailed error messages as follows:

- **F2-70 zero switch voltage supply error**
- **F2-71 travel range limit switch voltage supply error**
- **F2-72 probe voltage supply error**
- **F2-73 emergency stop voltage supply error**

An error as defined by **F2-33 external voltage supply error** now exclusively defines the 24 volt supply for the DEA plug-in card.

Referencing with or without homing

Bit 7 of parameter **S-0-0147 homing parameter** as defined by the SERCOS specification is now supported. This means that that the drive, once it has recognized the reference marker and with bit 7 not set, will stop with the reference acceleration and velocity which has been set. **It does not go to home.**

If bit 7 is set in parameter **S-0-0147 homing parameter**, then the drive will assume the homing position.

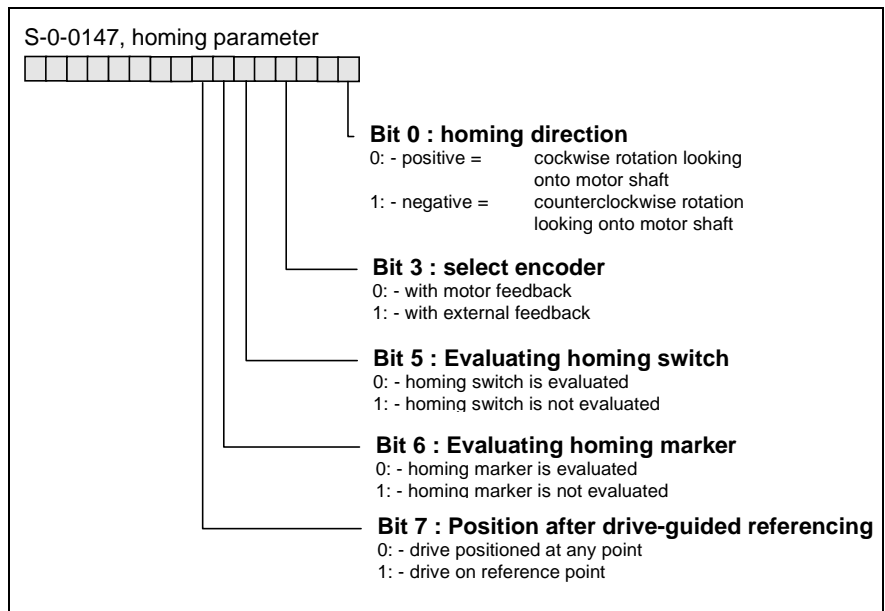


Fig. 2-9: Homing parameter S-0-0147

2.4 Expanded/ changed functions

Evaluating absolute measuring systems

Function *Evaluating absolute measuring systems* has been expanded.

It is now also possible:

- to treat single turn encoders as if there were absolute encoders and
- to switch absolute encoder evaluation for multiturn encoders off.

Additional, a plausibility check is run with the (new) parameters **S-0-0278, maximum travel range** or **S-0-0103, modulo values**. The following table outlines the relationships:

Encoder type (Absolute range)	Position scaling	Modulo value	Maximum travel range	Position feedback type parameter, Bit 6
incremental (< 1 encoder rev.)	absolute format	not relevant	not relevant	0
	modulo format	not relevant	>= modulo value	0
Singleturn (= 1 encoder rev.)	absolute format	not relevant	<= 1/2 absolute range	1
		not relevant	> 1/2 absolute range	0
	modulo format	<= absolute range	>= modulo value	1
		> absolute range	>= modulo value	0
Multiturn (> 1 encoder rev.)	absolute format	not relevant	<= 1/2 absolute range	1
		not relevant	> 1/2 absolute range	0
	modulo format	<= absolute range	>= modulo value	1
		> absolute range	>= modulo value	0
Absolute Linear scale	not relevant	not relevant	not relevant	1

Fig. 2-10: Absolute encoder evaluation as dependent on position format, modulo value and maximum travel range

To be able to switch the absolute encoder evaluation off, it was necessary to redefine bit 7 in the position encoder type parameters, as well as to modify the definition of bit 6.

Bit 7, Bit 6 in S-0-0277/S-0-0115	Definition
x , 0	absolute evaluation no possible, bit 7 is not relevant
0 , 1	absolute evaluation possible and permissible -> encoder treated as absolute encoder !
1 , 1	absolute evaluation possible but not permitted

Fig. 2-11: Absolute encoder evaluation as per position encoder type parameter

Analog output

Function analog output has been revised. It is now possible

- for the control to write access the parameters directly set by the digital/analog converter (parameter **P-0-0139, analog output-1** and **P-0-0140 analog output-2** new).
- to generate certain parameters of the drive with variable scaling via digital/analog converter (parameter **P-0-0426, Analog output, IDN list of all allocatable parameters, P-0-0420, analog output-1, signal select, P-0-0422, analog output-1, eval. , P-0-0423, analog output-1, signal select** and **P-0-0425, analog output-2, eval.,** new).
- to generate permanently set signals, as well as all bits and bytes via the expanded signal select (parameter **P-0-0421 analog output-1, expanded signal select** and **P-0-0424 analog output-2, expanded signal select** new).
- List of permanently set signals:

Signal number P-0-0421/424	Output signal	Reference unit: Weighting factor 1.0
0x00000001	sien signal motor encoder	0.5V/10V
0x00000002	cosine signal motor encoder	0.5V/10V
0x00000003	sine signal ext. encoder	0.5V/10V
0x00000004	cosine signal ext. encoder	0.5V/10V
0x00000005	position command difference on position control	rot. =>1000rpm/10V lin. =>100m/min/10V
0x00000006	DC bus output	1kW/10V
0x00000007	DC bus output absolute sum	1kW/10V
0x00000008	in-phase current (Iq)	S-0-0110/10V
0x00000009	idle current (Id)	S-0-0110/10V
0x0000000a	thermal load	--
0x0000000b	motor temperature	150°C/10V
0x0000000c	magnetization current	S-0-0110/10V
0x0000000d	speed command value at speed control	rot. =>1000Upm/10V lin. => 100m/min/10V

Fig. 2-12: Signal list with pre-defined selection of signals

- These outputs do not depend on the weightings and always related to the motor shaft. Signal scaling is possible via the evaluation parameters P-0-0422 & P-0-0425. With the expanded choice of signals with pre-defined signals, they are defined as factors with four decimal places with a permanent reference unit to the selected signal (see table).

Analog input

The function *Analog input* was expanded. It is now also possible

- to enter certain parameters of the drive with variable scaling via the analog/digital converter (parameter **P-0-0212, analog inputs, IDN list of all allocatable parameters, P-0-0213, analog input-1, allocation, P-0-0214, analog input-1, evaluation , P-0-0215, analog input-2, allocation and P-0-0216, analog input-2, evaluation , new**).
- the analog input signals can be given an offset (parameter **P-0-217, analog input-1, Offset** and **P-0-218, analog input-2, Offset** new)

Analog input-1 is processed every 250 usec, analog input-2 only every 8 msec.

Parameter **P-0-0115, analog input 1** and **P-0-0116, analog input-2**, used via plug-in module DRF-1, have been dropped. The new analog inputs use parameter **P-0-0210, Analog input 1** and **P-0-0211, Analog output 2** and use module DAE-2-1. This means it is now possible to use analog inputs in configurations using modules DLF-1 or DZF-1.

Speed control

Speed control has been modified in terms of

- the low-pass filter of the actual speed value via parameter **S-0-0392, actual speed limit filter time constant** has been dropped
- the manipulated variable generated by speed control (force - torque command value) can be filtered via a band stop filter with settable filter frequency and band width (parameter **P-0-0180, blocking frequency of speed control** and **P-0-0181 band width locking filter speed control** new) and
- the low-pass filter via **P-0-0004, smoothing time constant** does not effect the variable but rather speed control offset.

See Fig.2-13: control structure of FWA-DIAX03-SSE-02VRS

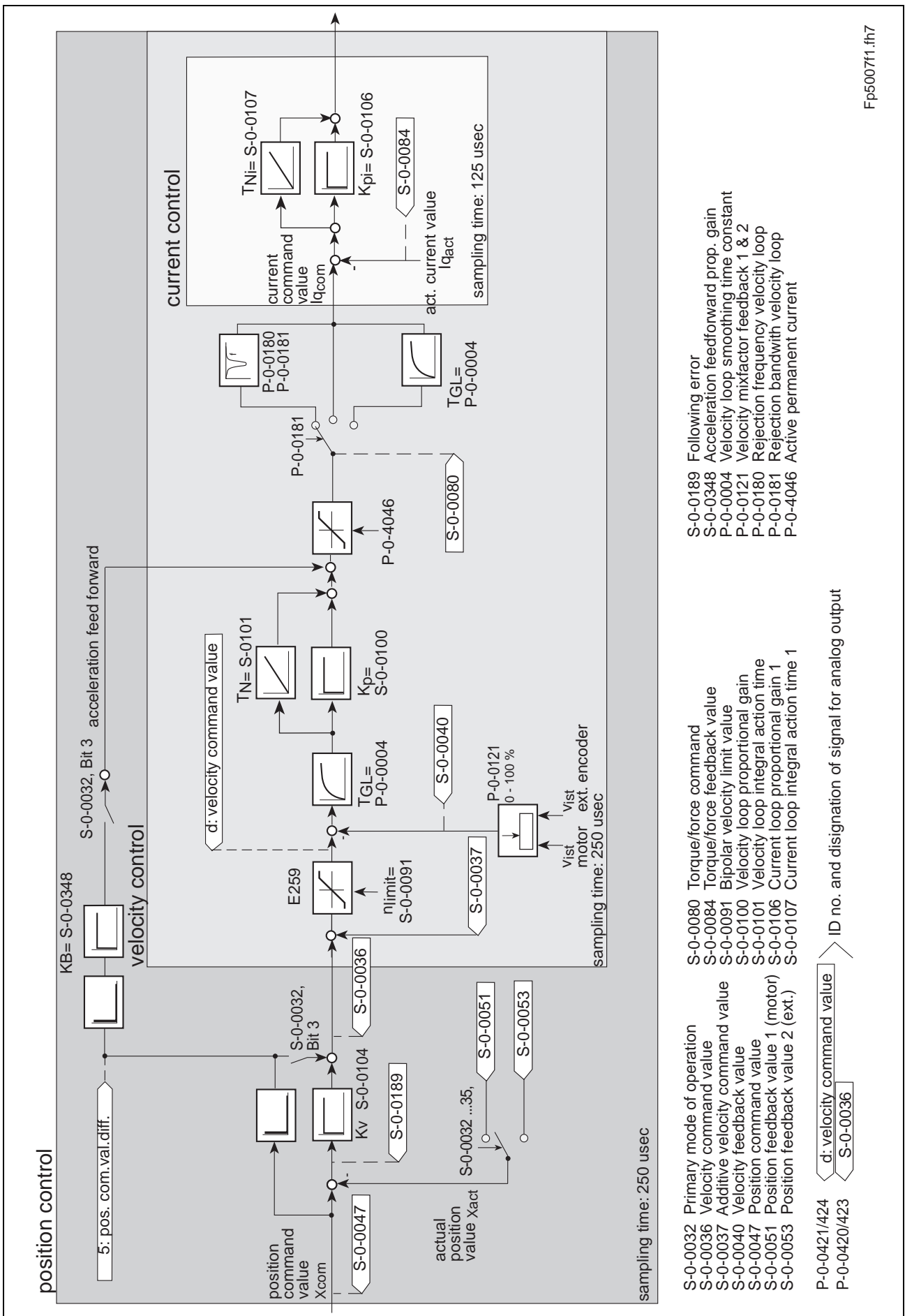


Fig. 2-13: Control structure of FWA-DIAX03-SSE-02VRS

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Evaluating an external encoder

Evaluating an external encoder has been changed so that the evaluation mode is set via parameter **P-0-0185, external encoder function**.

Value in P-0-0185, function of the external encoder	Definition
0	external encoder as additional control encoder (as earlier standard function "external encoder")
1	external encoder as master axis encoder
2	external encoder as load side motor encoder
3	external encoder as measuring wheel encoder

Fig. 2-14: External encoder functions

Notes

Customer Service Locations

Germany

Sales Area Central INDRAMAT GmbH D-97816 Lohr am Main Bgm.-Dr.-Nebel-Str. 2 Telefon: 09352/40-0 Telefax: 09352/40-4885	Sales Area East INDRAMAT GmbH D-09120 Chemnitz Beckerstraße 31 Telefon: 0371/3555-0 Telefax: 0371/3555-230	Sales Area West INDRAMAT GmbH D-40849 Ratingen Harkortstraße 25 Telefon: 02102/4318-0 Telefax: 02102/41315	Sales Area North INDRAMAT GmbH D-22525 Hamburg Kieler Str. 212 Telefon: 040/853157-0 Telefax: 040/853157-15
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Europe

Austria G.L.Rexroth Ges.m.b.H. Geschäftsbereich INDRAMAT Hägelingasse 3 A-1140 Wien Telefon: +43 1/985 25 40-400 Telefax: +43 1/985 25 40-93	Austria G.L.Rexroth Ges.m.b.H. Geschäftsbereich INDRAMAT Rاندlstraße 14 A-4061 Pasching Telefon: +43 7229/644 01-36 Telefax: +43 7229/644 01-80	Belgium Mannesmann Rexroth N.V.-S.A. Geschäftsbereich INDRAMAT Industrielaan 8 B-1740 Ternat Telefon: +32 2/582 31 80 Telefax: +32 2/582 43 10	Denmark BEC AS Zinkvej 6 DK-8900 Randers Telefon: +45 87/11 90 60 Telefax: +45 87/11 90 61
England Mannesmann Rexroth Ltd. INDRAMAT Division Broadway Lane, South Cerney Cirencester, Glos GL7 5UH Telefon: +44 1285/86 30 00 Telefax: +44 1285/86 30 03	Finnland Rexroth Mecman OY Riihimiehentie 3 SF-01720 Vantaa Telefon: +358 9/84 91 11 Telefax: +358 9/84 63 87	France Rexroth - Sigma S.A. Division INDRAMAT Parc des Barbanniers 4, Place du Village F-92632 Gennevilliers Cedex Telefon: +33 1/41 47 54 30 Telefax: +33 1/47 94 69 41	France Rexroth - Sigma S.A. Division INDRAMAT 17, Loree du Golf F-69380 Dommartin Telefon: +33 4/78 43 56 58 Telefax: +33 4/78 43 59 05
France Rexroth - Sigma S.A. Division INDRAMAT 270, Avenue de l'ardenne F-31100 Toulouse Telefon: +33 5/61 49 95 19 Telefax: +33 5/61 31 00 41	Italy Rexroth S.p.A. Divisione INDRAMAT Via G. Di Vittoria, 1 I-20063 Cernusco S/N.MI Telefon: +39 2/923 65-270 Telex: 331695 Telefax: +39 2/92 36 55 12	Italy Rexroth S.p.A. Divisione INDRAMAT Via Borgomanero, 11 I-10145 Torino Telefon: +39 11/771 22 30 Telefax: +39 11/771 01 90	Netherlands Hydraudyne Hydrauliek B.V. Kruisbroeksestraat 1a P.O. Box 32 NL-5280 AA Boxtel Telefon: +31 41 16/519 51 Telefax: +31 41 16/514 83
Spain Rexroth S.A. Centro Industrial Santiago Obradors s/n E-08130 Santa Perpetua de Mogoda (Barcelona) Telefon: +34 3/7 47 94 00 Telefax: +34 3/7 47 94 01	Spain Goimendi S.A. División Indramat Jolastokieta (Herrera) Apartado 11 37 San Sebastian, 20017 Telefon: +34 43/40 01 63 Telex: 361 72 Telefax: +34 43/39 93 95	Sweden AB Rexroth Mecman INDRAMAT Division Varuvägen 7 S-125 81 Stockholm Telefon: +46 8/727 92 00 Telefax: +46 8/64 73 277	Switzerland Rexroth SA Département INDRAMAT Chemin de l'Ecole 6 CH-1036 Sullens Telefon: +41 21/731 43 77 Telefax: +41 21/731 46 78
Switzerland Rexroth AG Geschäftsbereich INDRAMAT Gewerbestraße 3 CH-8500 Frauenfeld Telefon: +41 52/720 21 00 Telefax: +41 52/720 21 11	Russia Tschudnenko E.B. Arsenia 22 153000 Ivanovo Rußland Telefon: +7 93/22 39 633		

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Outside of Europe

<p>Argentina</p> <p>Mannesmann Rexroth S.A.I.C. Division INDRAMAT Acassusso 48 41/7 1605 Munro (Buenos Aires) Argentina</p> <p>Telefon: +54 1/756 01 40 +54 1/756 02 40 Telex: 262 66 rexro ar Telefax: +54 1/756 01 36</p>	<p>Argentina</p> <p>Nakase Asesoramiento Tecnico Diaz Velez 2929 1636 Olivos (Provincia de Buenos Aires) Argentina Argentina</p> <p>Telefon +54 1/790 52 30</p>	<p>Australia</p> <p>Australian Industrial Machinery Services Pty. Ltd. Unit 3/5 Home ST Campbellfield VIC 2061 Australia</p> <p>Telefon: +61 3/93 59 0228 Telefax: +61 3/93 59 02886</p>	<p>Brazil</p> <p>Mannesmann Rexroth Automação Ltda. Divisão INDRAMAT Rua Georg Rexroth, 609 Vila Padre Anchieta BR-09.951-250 Diadema-SP Caixa Postal 377 BR-09.901-970 Diadema-SP</p> <p>Telefon: +55 11/745 90 65 +55 11/745 90 70 Telefax: +55 11/745 90 50</p>
<p>Canada</p> <p>Basic Technologies Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8</p> <p>Telefon: +1 905/335-55 11 Telefax: +1 905/335-41 84</p>	<p>China</p> <p>Rexroth (China) Ltd. Shanghai Office Room 206 Shanghai Intern. Trade Centre 2200 Yanan Xi Lu Shanghai 200335 P.R. China</p> <p>Telefon: +86 21/627 55 333 Telefax: +86 21/627 55 666</p>	<p>China</p> <p>Rexroth (China) Ltd. Shanghai Parts & Service Centre 199 Wu Cao Road, Hua Cao Minhang District Shanghai 201 103 P.R. China</p> <p>Telefon: +86 21/622 00 058 Telefax: +86 21/622 00 068</p>	<p>China</p> <p>Rexroth (China) Ltd. 1430 China World Trade Centre 1, Jianguomenwai Avenue Beijing 100004 P.R. China</p> <p>Telefon: +86 10/50 50 380 Telefax: +86 10/50 50 379</p>
<p>China</p> <p>Rexroth (China) Ltd. A-5F., 123 Lian Shan Street Sha He Kou District Dalian 116 023 P.R. China</p> <p>Telefon: +86 411/46 78 930 Telefax: +86 411/46 78 932</p>	<p>Hongkong</p> <p>Rexroth (China) Ltd. 19 Cheung Shun Street 1st Floor, Cheung Sha Wan, Kowloon, Honkong</p> <p>Telefon: +852 2741 13 51/-54 and +852 741 14 30 Telex: 3346 17 GL REX HX Telefax: +852 786 40 19 +852 786 07 33</p>	<p>India</p> <p>Mannesmann Rexroth (India) Ltd. INDRAMAT Division Plot. 96, Phase III Peenya Industrial Area Bangalore - 560058</p> <p>Telefon: +91 80/839 21 01 +91 80/839 73 74 Telex: 845 5028 RexB Telefax: +91 80/839 43 45</p>	<p>Japan</p> <p>Rexroth Co., Ltd. INDRAMAT Division I.R. Building Nakamachidai 4-26-44 Tsuzuki-ku, Yokohama 226 Japan</p> <p>Telefon: +81 45/942-72 10 Telefax: +81 45/942-03 41</p>
<p>Korea</p> <p>Rexroth-Seki Co Ltd. 1500-12 Da-Dae-Dong Saha-Gu, Pusan, 604-050</p> <p>Telefon: +82 51/264 90 01 Telefax: +82 51/264 90 10</p>	<p>Korea</p> <p>Seo Chang Corporation Ltd. Room 903, Jeail Building 44-35 Yoido-Dong Youngdeungpo-Ku Seoul, Korea</p> <p>Telefon: +82 2/780-82 07 ~9 Telefax: +82 2/784-54 08</p>	<p>Mexico</p> <p>Motorización y Diseño de Controles, S.A. de C.V. Av. Dr. Gustavo Baz No. 288 Col. Parque Industrial la loma Apartado Postal No. 318 54060 Tlalnepanla Estado de Mexico</p> <p>Telefon: +52 /397 86 44 Telefax: +52 /398 98 88</p>	
<p>USA</p> <p>Rexroth Corporation INDRAMAT Division 5150 Prairie Stone Parkway Hoffman Estates, Illinois 60192</p> <p>Telefon: +1 847/645-36 00 Telefax: +1 847/645-62 01</p>	<p>USA</p> <p>Rexroth Corporation INDRAMAT Division 2110 Austin Avenue Rochester Hills, Michigan 48309</p> <p>Telefon: +1 810/853-82 90 Telefax: +1 810/853-82 90</p>	<p>USA</p> <p>Rexroth Corporation INDRAMAT Division Northeastern Sales Office 7 Columbia Blvd. Peabody, MA 019660</p> <p>Telefon: +1 508/531-25 74 Telefax: +1 508/531-2574</p>	<p>USA</p> <p>Rexroth Corporation INDRAMAT Division Southeastern Sales Office 3625 Swiftwater Park Drive Suwanee, GA 30174</p> <p>Telefon: +1 770/932 3200 Telefax: +1 770/932-1903</p>

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