## Your definitive source for quality pre-owned equipment.

## Artisan Technology Group

(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment along with credit for buybacks and trade-ins.

## Custom engineering

so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | $100 \%$ satisfaction

# SERVO INVERTER POSIDYN ${ }^{\circledR}$ <br> SDS 4000 

Installation and Commissioning Instructions

It is essential to read and comply with these instructions prior to installation and commissioning.

MANAGEMENTSYSTEM

certified by DQS according to DIN EN ISO 9001, DIN EN ISO 14001

Reg-No. 000780 UM/QM


## Table of contents

1. Notes on Safety
2. Technical Specifications
3. Physical Installation
3.1 Installation Site
4. Electrical Installation
4.1 EMC-Compatible Installation
4.2 FI Circuit Breaker
4.3 DC Link Coupling
4.3.1 Direct coupling of devices
4.3.2 Coupling of devices with DC fuse
4.4 Electrical Installation
4.5 Motor Connection, Halting Brake, X13
4.6 Brake Resistor, X12
5. Connection Assignment
5.1 Terminal Overview
5.2 Terminal Assignments
5.2.1 Terminal X1 (I/O)
5.2.2 Terminal X2 (24 V)
5.2.3 Terminals: X3 (Service), X20 (Encoder), X40 (Resolver), X41 (Sin/Cos)
5.2.4 Terminals X 11 and X 12 ( $\left.\mathrm{R}_{\text {Ballast }}\right)$
5.2.5 Terminal X13 (Motor)8
5.3 Control Portion, Terminal Strip X1 9
5.4 X3 Service Plug Connector (RS232, CAN) 10
5.5 X40 Resolver 10
5.6 X20 Encoder In/Out (TTL)
5.7 Encoder Input (External Encoder) 11
5.8 X41 Sin/Cos, Absolute Value Encoder 12
6. Multi-Motor Operation
7. Operator Control
7.1 Status Indication ..... 14
7.2 Controlbox ..... 14
7.2.1 Local Mode 14
7.2.2 Operation Indication 14
7.2.3 Parameter Memory 15
7.2.4 Parameterization 15
7.2.5 Password
8. Commissioning
8.1 Default Setting
8.2 Motor, Braking Resistor 16
8.3 Speed Specification 16
8.3.1 Speed Specification via Controlbox 16
8.3.2 External Speed Specification 16
8.3.3 Speed Spec. via Potentiometer 16
8.3.4 Characteristic Curve of Ref. Value 17
8.3.5 Speed Spec. via Fixed Ref. Value 17
8.3.6 Speed Spec. via Clk Pulse Generator 17
8.3.7 Motor Potentiometer

17
8.3.8 Frequency Reference Value 17
8.4 Speed Controller 17
8.5 Halt / Quick Stop 17
8.6 Brake Control 17
8.7 Binary Inputs BE1 to BE4 (Opt. BE5 to BE15) 18
8.8 Parameter Record Selection 18
8.9 Acknowledgment of Faults 18
8.10 Motor Startup
9. Torque Limits / Operating Range 18
9.1 Torque Limits
9.2 Operating Range
10. Positioning Control ..... 19
10.1 Function Overview ..... 19
10.2 Connections ..... 19
10.3 Dest. Positions and Proc. Blocks ..... 20
10.4 Absolute / Relative Positioning ..... 20
10.5 Commissioning ..... 21
10.5.1 Limited Position Range ..... 21
10.5.2 Continuous Traversing Range (Rotary Axis) ..... 21
10.6 Reference Point Traversing ..... 22
10.7 Position Controller ..... 23
10.8 Process Block Chaining ..... 23
10.9 Simple Examples ..... 24
10.10 Emergency Off ..... 25
10.11 Ext. Rot./Lin. Path Measurement ..... 25
10.11.1 Position Encoder ..... 25
10.11.2 Parameterization - Motor/Ext. Meas. Sys. ..... 25
10.11.3 Special reactions with SSI encoders ..... 25
10.12 Posi Switching Points ..... 26
11. Synchronous Running, Elec. Gearbox ..... 26
11.1 Function Overview ..... 26
11.2 Connection of Pulse Source ..... 27
11.3 Master - Slave ..... 27
11.4 Commissioning ..... 28
11.5 Angle Difference ..... 28
11.6 Angle and Speed Sync. Running ..... 28
11.7 Emergency Off ..... 28
11.8 Reference Point Traversing - Slave ..... 28
12. Technology ..... 29
12.1 PID Controller ..... 29
12.2 Winders ..... 29
12.2.1 Diameter Sensor on AE1/AE2 ..... 29
11.2.2 Indirect Tension Control at M-Max Limit ..... 30
11.2.3 Winding with Compensating Roller ..... 30
11.2.4 Winding with Tension Sensor ..... 30
11.2.5 Compensation of Fault Variables ..... 30
13. Parameter Description ..... 31
14. Option Boards ..... 59
14.1 Option Board SEA 4000 ..... 59
14.2 Option Board SDP 4000 ..... 60
14.3 Opt. Board SEA+SDP 4000 (Combi Board) ..... ) 60
15. Result Table ..... 61
16. Operating States ..... 62
17. Faults / Events ..... 63
STÖBER ANTRIEBSTECHNIK Deutschland ..... 65
STÖBER ANTRIEBSTECHNIK International ..... 67
18. Block Circuit Diagram - Sync. Running ..... 69
19. Block Circuit Diagrams ..... 69
19.1 Fast Speed Ref. Value Active (D99=1) ..... 69
19.2 Reference Value Processing ..... 70
20. Parameter Table ..... 71
21. Accessories ..... 74
21.1 Accessories Overview ..... 74
21.2 Braking resistor ..... 76
21.2.1 Allocation of braking resistor to SDS ..... 76
21.2.2 Braking Resistor FZT/FZZT (Dimensions) ..... 76
21.2.3 Braking Resistor VHPR (Dimensions) ..... 77
21.3 Input Filter (Dimensions) ..... 77
21.4 Output Derating (Dimensions) ..... 77

## 1. Notes on Safety

Notes:
The servo inverter must be installed in a switching cabinet which does not exceed the maximum ambient temperature (see technical data).
Only copper wiring may be used. For wire cross sections, see table $310-16$ of standard NEC at $60^{\circ} \mathrm{C}$ or $75^{\circ} \mathrm{C}$.

STÖBER ANTRIEBSTECHNIK accepts no liability for damages caused by non-adherence to the instructions or applicable regulations.

The motor must have an integral temperature monitoring device or external motor overload protection must be used.

Either the motor itself must be equipped with temperature monitoring, or external protection against motor overload must be used.

Only suitable for use on power networks which cannot supply more than a symmetric, nominal short-circuit current of 5000 A at 480 Volt.

Subject to technical changes for improvement of the devices without prior notice. This documentation is solely a product description. It is not a promise of features in the sense of warranty rights.

POSIDYN ${ }^{\circledR}$ SDS 4000
STÖBER
ANTRIEBSTECHNIK

## 2. Technical Specifications

| Model | Model 1 |  |  |  | Model 2a | Model 2b |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Type of device | SDS 4011 | SDS 4021 | SDS 4041 | SDS 4071 | SDS 4101 | SDS 4141 |
| Nominal connected load | 1 kVA | 2 kVA | 4 kVA | 7 kVA | 10 kVA | 14 kVA |
| Nominal current (effective value, $\pm 3 \%$ ) | 1.5 A | 3 A | 6 A | 10 A | 14 A | 20 A |
| Max. output current (max. of approx. $5 \mathrm{sec}, \pm 3 \%$ ) | 3 A | 6 A | 12 A | 20 A | 28 A | 40 A |
| Connected voltage | (L1-L3) $3 \times 230 \mathrm{~V}-10 \%$ to $480 \mathrm{~V}+10 \%, 50$ to 60 Hz |  |  |  |  |  |
| Power fuses ${ }^{1}$ | $3 \times 6$ AT |  | $3 \times 10$ AT |  | $3 \times 20$ AT |  |
| Conductor cross section, power connection | $1.5 \mathrm{~mm}^{2}$ | $1.5 \mathrm{~mm}^{2}$ | $1.5 \mathrm{~mm}^{2}$ | $1.5 \mathrm{~mm}^{2}$ | $2.5 \mathrm{~mm}^{2}$ | $4 \mathrm{~mm}^{2}$ |
| Conductor cross section, motor connection | $1.5 \mathrm{~mm}^{2}$ | $1.5 \mathrm{~mm}^{2}$ | $1.5 \mathrm{~mm}^{2}$ | $1.5 \mathrm{~mm}^{2}$ | 2.5 | $\mathrm{mm}^{2}$ |
| Conductor cross section, halting brake | Min. of $0.75 \mathrm{~mm}^{2}$ (consider voltage loss) |  |  |  |  |  |
| Conductor cross section, ext. 24 V/GND | Max. of $2.5 \mathrm{~mm}^{2}$ (consider voltage loss) |  |  |  |  |  |
| Overvoltage source |  |  |  |  |  |  |
| Clock pulse frequency | 8 kHz |  |  |  |  |  |
| Braking resistance, internal | $66 \Omega / 80 \mathrm{~W}$ <br> Max. of 10.5 kW for 1 sec |  | $33 \Omega / 200 \mathrm{~W}$ <br> Max. of 21 kW for 1 sec |  |  |  |
| Braking resistance, external ${ }^{2}$ (limit data for brake chopper) | $\mu 30 \Omega / m a x .500 \mathrm{~W}$ const. Max. of 21 kW for 1 sec |  | $\begin{gathered} \mu 30 \Omega / \max .1500 \mathrm{~W} \text { const. } \\ \text { Max. of } 21 \mathrm{~kW} \text { for } 1 \mathrm{sec} \end{gathered}$ |  |  |  |
| Switch-on threshold, brake chopper | 840 to 870 V |  |  |  |  |  |
| Switch-off threshold, brake chopper | 800 to 830 V |  |  |  |  |  |
| RFI suppression | Integrated network filter in accordance with EN 55011, class A |  |  |  |  |  |
| Permissible length of motor cable | 25 m , shielded; 25 to 100 m , shielded with output derating |  |  |  |  |  |
| Auxiliary voltage, 24 V without brake connection | 18 to $36 \mathrm{~V}, 1 \mathrm{~A}$ |  |  |  |  |  |
| Auxiliary voltage, 24 V with brake connection | $24 \mathrm{~V}-0 \%$ to $24 \mathrm{~V}+10 \%, 3 \mathrm{~A}+0.5 \mathrm{~A}$ at $\mathrm{Sin} / \mathrm{Cos}$ |  |  |  |  |  |
| Fuses, 24 V | Internal: 3.15 AT, external: max. of 16 AF due to conductor cross section $2.5 \mathrm{~mm}^{2}$ |  |  |  |  |  |
| Max. output current, brake | 2 A |  |  |  |  |  |
| Protection rating/mounting position | IP20/always vertical |  |  |  |  |  |
| Ambient temperature | $0^{\circ}$ to $45^{\circ} \mathrm{C}$ for nominal data <br> Up to $55^{\circ} \mathrm{C}$ with power reduction of $2.5 \% /{ }^{\circ} \mathrm{C}$ |  |  |  |  |  |
| Storage temperature | $-20^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}$, max. change, $20 \mathrm{~K} / \mathrm{h}$ |  |  |  |  |  |
| Humidity during operation | Relative humidity of $85 \%$, no condensation |  |  |  |  |  |
| Installation altitude | Up to 1000 m without restriction; 1000 to 2500 m with derating of $1.5 \% / 100 \mathrm{~m}$ |  |  |  |  |  |
| Degree of soil | Soiling degree of 2 in acc. w. EN 60204/EN 50178 |  |  |  |  |  |
| Dimensions $W \times H \times D$, without plug (in mm) | $70 \times 318 \times 255$ |  |  |  | $100 \times 318 \times 255$ | $115 \times 318 \times 255$ |
| Power loss | 30 W | 40 W | 60 W | 90 W | 160 W | 200 W |
| Storage capacity | 1 year |  |  |  |  |  |
| Weight (in kg) <br> - without packing <br> - with packing | $\begin{aligned} & 4,4 \\ & 5,8 \end{aligned}$ |  |  |  | $\begin{aligned} & 5,6 \\ & 6,9 \end{aligned}$ | $\begin{aligned} & 7,4 \\ & 8,7 \end{aligned}$ |

[^0]3. Physical Installation
4. Electrical Installation

3 PHYSICAL INSTALLATION





### 3.1 Installation site

- Operate only in closed switching cabinet.
- Install inverter only in vertical position.
- Avoid installation over heat-producing devices.
- Ensure sufficient air circulation in switching cabinet. (Minimum free space of 100 mm over and under the device!)
- Keep installation site free of dust, corrosive fumes and all liquids (in accordance with soil degree 2 in acc. with EN 60204/EN 50178).
- Avoid atmospheric humidity.
- Avoid condensation (e.g., by anti-condensation heaters).
- Use unpainted mounting plates with conductive surface (e.g., unpainted) to conform with EMC regulations.


## 4 ELECTRICAL INSTALLATION



## 4. Electrical Installation

### 4.1 EMC-compatible installation

## Basic rules

- Install control and power cables separately (> 20 cm ).
- Install power, encoder and motor cables in separate spaces.
- Central grounding point in immediate vicinity of the inverter. All shields and protective conductors of motor and power cables are applied here over a large area.
- Reference value cables must be shielded and, if necessary, twisted in pairs.
- Connect shield of control lines on one side to the reference ground of the reference value source (PLC, controller, etc.).

Motor cable (see accessories, chap. 21)

- Use shielded cables. Apply shield on both sides.
- Use output derating when cables are longer than 25 m .


### 4.2 FI circuit breaker

Network phases and directly grounded conductor are connected to the protective conductor with Y capacitors. When voltage is present, a leakage current flows over these capacitors to the protective conductor. The greatest leakage current is created when a malfunction occurs (asymmetric feeding over only one phase) and power-on (sudden change in voltage). The maximum leakage current caused by asymmetric powering is 66 mA (power voltage of 400 V ) for SDS inverters. If FI circuit breakers must be used, the problem of power-on and power-off can be minimized by using selective FI circuit breakers (delayed switch-off) or FI circuit breakers with greater triggering currents (e.g., 300 or 500 mA ). Use of several devices on one FI circuit breaker is not recommended.

### 4.3 DC link coupling

### 4.3.1 Direct coupling of devices

All coupled devices must be connected to one common power fuse. The fuse may not exceed 20 AT. This limits maximum possible drive power to approx. 10 kW .


### 4.3.2 Coupling of devices with DC fuse

Each device has its own power fuse based on its technical specifications (chap. 2). In addition, each device must be protected on the DC link ( $\mathrm{U}+$ and $\mathrm{U}-$ ) with the same current strength. The fuse must be suitable for a voltage of 500 V DC. Lines with lengths of 20 cm and longer must be shielded.


Brake resistance for DC link coupling:
Internal brake resistors may remain active since the braking power is distributed evenly. Important: Set type of resistor A20 correctly. Set A38=1 for a pure DC-link-coupling feed-in without power network connection.

### 4.4 Electrical installation

- Only connect inverter to three-phase, grounded, industrial power network.
- User must provide fuses for power network and 24 V supply (see technical specifications, chap. 2).
- Install power and control cables separately (> 20 cm ).

Important: When installing the 24 V brake lines in the motor cable, shield the brake lines separately if the inverter addresses the brake directly.


Important: With direct brake control, a voltage of approx. 1.3 $\checkmark$ occurs on the inverter (protection against pole reversal and EMC derating). However, since the halting brake requires at least $24 \mathrm{~V}-10 \%=21.6 \mathrm{~V}$, use an external contact (relay) for long brake lines. The same also applies to power packs which supply less than 24 V .

## 4. Electrical Installation



.Caution: Important information on motor connector

With devices delivered up to March 1999, motor connector X 13 has a different orientation than the front power connectors


The motor connector must be rewired when these older devices are replaced with newer ones. The old allocation is a mirror image of the new one and, if left as is, will damage inverter and motor!

## Shielding for STÖBER power cables

Use the included clamp to connect the shielding with the HF reference potential (mounting plate and inverter's housing). If this is not possible, the shielding (red flexible lead) can be connected to the PE terminal of the device.

### 4.5 Motor connection, halting brake, X13

Together with any halting brake, the motor is connected to plug connector X13 (on the bottom of the device). The inverter can directly address the halting brake. The external 24 V supply must be designed for this.

- Only use shielded cable to connect motor.
- Apply shield on both sides.
- On the inverter side, apply shield with a clamp over a large surface to the bare mounting plate.
- If the motor cable also contains lines to the +24 V halting brake and this brake is addressed by the inverter, these lines must be shielded separately! Connect the shields on both sides.

Terminal block


Power connector

|  | Power <br> Connector | STÖBER <br> Cable |
| :---: | :---: | :---: |
| U | 1 | 1 (U1) |
| V | 2 | $2(\mathrm{~V} 2)$ |
| W | 6 | 3 (W3) |
| $\stackrel{\perp}{\bar{\prime}}$ | $\stackrel{\perp}{\bar{\prime}}$ | $\stackrel{\perp}{\overline{ }}$ |
| +24 V | 4 | 5 (BR1) |
| 0 V | 5 | 6 (BR2) |

### 4.6 Brake resistor, X12

SDS servo inverters are always equipped with a brake resistor. A jumper between R1 and R2 must be wired to activate the internal brake resistor. For technical details, see page 2. Greater brake performance requires connection of an external brake resistor. Connector X12 is used for the connection (on the bottom of the device).
internal
Bottom of device


Jumper between
R1 and R2 only for
int. brake resistor!!
external
Bottom of device $\quad$ X12


|  | Jumper Between | Connection Between |
| :--- | :---: | :---: |
| Int. brake resistor | R1 and R2 | --- |
| Ext. brake resistor | not applicable | R1 and U+ |

Lines to the external brake resistor which are longer than 30 cm must be shielded. The brake chopper triggers at a DC link voltage of 840 to 870 V . The internal brake resistors will remain active for all axes when a DC link coupling of several devices is used with the terminals $\mathrm{U}+$ and U -. The brake chopper distributes the braking load evenly over all inverters (which may even have different current strengths).

The current of the internal brake resistor is monitored and protected against overload with a thermal i2t model.
With the external brake resistor, we recommend using types with integrated overcurrent relays to prevent thermal damage caused by overload.
5. Connection Assignment

### 5.1 Terminal overview



Bottom of device

5. Connection Assignment

### 5.2 Terminal assignments

### 5.2.1 Terminal X1 (I/O)

Analog ...


Digital ...


### 5.2.2 Terminal X2 (24 V)



Pole reversal will damage the device.

POSIDYN ${ }^{\circledR}$ SDS 4000
(W) STÖBER

ANTRIEBSTECHNIK

## 5. Connection Assignment

### 5.2.3 Terminals: X3 (Service), X20 (Encoder), X40 (Resolver), X41 (Sin/Cos)



### 5.2.4 Terminals X11 and X12 (RBallast)



### 5.2.5 Terminal X13 (Motor)

Motor connection SDS 4000

connector ES motor

connectionschluss motor terminal box


## 5. Connection Assignment

### 5.3 Control portion, terminal strip X1

|  | Terminal | Function | Circuiting |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1 | AGND: Reference ground for analog signals | Reference potential for | terminals X1.4 to | 1.9 |
|  | 2 3 | Relay $1 /$ ready for operation Max. of 24 V DC, $42 \mathrm{~V} \mathrm{AC}, 0.5 \mathrm{~A}$ | Shows readiness of the servo inverter (i.e., relay closed) <br> Function can be programmed under F10. |  |  |
|  | 4 5 | Analog input AE1 <br> 0 to $\pm 10 \mathrm{~V}, \mathrm{Ri}=20 \mathrm{k} \Omega$, 14-bit resolution <br> $\mathrm{Ta}=1 \mathrm{msec}$ | Function can be programmed under F25. Default setting: F25=10:ref.value; $10 \mathrm{~V}=3000 \mathrm{rpm}$ ( D02) |  |  |
|  | 6 7 | Analog input AE2 <br> 0 to $\pm 10 \mathrm{~V}, \mathrm{Ri}=20 \mathrm{k} \Omega$, 12-bit resolution $\mathrm{Ta}=4 \mathrm{msec}$ | Function can be programmed under F20. Default setting: F20=0:inactive |  |  |
|  | 8 | Analog output $1, \mathrm{Ta}=4 \mathrm{msec}$ $\pm 10 \mathrm{~V}, \mathrm{Ri}=2.2 \mathrm{k} \Omega, 10$-bit resolution Calibrated at the plant for a load $=20 \mathrm{k} \Omega$ | Function can be programmed under F40. Default setting: $\mathbf{F 4 0}=4: n$-motor, $10 \mathrm{~V}=3000 \mathrm{rpm}($ C01 $\mathrm{n}-\mathrm{Max})$ |  |  |
|  | 9 | Analog output 2, $\mathrm{Ta}=4 \mathrm{msec}$ $\pm 10 \mathrm{~V}, \mathrm{Ri}=2.2 \mathrm{k} \Omega, 10$-bit resolution Calibrated at the plant for load $=20 \mathrm{k} \Omega$ | Function can be programmed under F45. Default setting: F45=1:I-motor,$10 \mathrm{~V}=2 \times \mathrm{I}_{\mathrm{Nom}(\mathrm{SDS})}$ |  |  |
|  | 10 | AGND: Reference ground for analog signals | Reference potential for terminals X1.4 to X1.9, internally connected with X1.1 |  |  |
|  | 11 | Binary input BE1 <br> * 8:halt | Inputs which can be programmed as desired. Function is specified with parameters F31 to F34. <br> Scanning time $\mathrm{Ta}=4 \mathrm{msec}$. When an HTL incremental encoder is connected to $B E 1$ and $B E 2$, the max. input frequency is 80 kHz . With the functions posi.next, posi.start and syncFreeRun, BE1 reacts without delays. <br> * Default setting of the inverter |  | L level: <br> 0 to $7 \mathrm{~V} / 0 \mathrm{~mA}$ <br> H level: <br> +12 to $30 \mathrm{~V} /$ <br> 7 mA <br> Interference <br> immunity: <br> EN 61000-4 $\mathrm{Ri}=3.3 \mathrm{k} \Omega$ |
|  | 12 | Binary input BE2 <br> * 6:dirOfRotat |  |  |  |
|  | 13 | Binary input BE3 <br> * 9:quick stop (with ramp) |  |  |  |
|  | 14 | Binary input BE4 <br> * 0 :inactive |  |  |  |
|  | 15 | Enable, $\mathrm{Ta}=4 \mathrm{msec}$ | Enable power section. F38. |  |  |
|  | 16 | ```Binary output BA1 }\mp@subsup{}{}{1 Open collector, 36 V (max.), 10 mA (max.), Ta = 4 msec Pullup resistance \mu3.3 k\Omega``` | Outputs which can be programmed as desired. Function is specified with parameters F80 (BA1) and F00 (BA2). |  |  |
|  | 17 | ```Binary output BA2 }\mp@subsup{}{}{1 Open collector, 36 V (max.), 10 mA (max.), Ta = 4 msec Pullup resistance \mu 3.3 k\Omega``` |  |  |  |
|  | 18 | DGND: Digital ground | Reference potential for terminals X1.11 to X1.17 |  |  |

[^1]
## 5. Connection Assignment

### 5.4 X3 Service plug connector (RS232, CAN)

Service plug connector X3 can be used to connect a PC or the external operator unit (i.e., Controlbox). When a PC is connected, the same G3 FDS cable (Id.-No. 41488) can be used as for the POSIDRIVE ${ }^{\circledR}$ FDS 4000 frequency inverter.


1) PGND ground (I/O ground) is galvanically isolated from digital DGND on plug connector X 1 .


## FDS cable G3, cat. no. 41488

Connection cable between the serial interface of the PC (Notebook) and serial interface X3 of the FDS. Only applies to FDSs with a sealed keyboard. Do NOT replace with a conventional serial connection cable. Such cables can only be used with a special adapter (cat. no. 41489).
The +10 V on pin 1 is exclusively to power a Kommubox and/or a Controlbox.
Caution: A brief short circuit against ground can cause a brief reset of the processor.
The RS 232 interface can be used to create a low-cost network of several inverters with an "RS 232 ring."


Networking with an RS 232 ring is supported by FDS Tool.
The RS232 ring can be used to control the inverters by communication via USS protocol.

For more information on the USS protocol, see the USS documentation (no. 441564).

### 5.5 X40 Resolver

The default setting specifies a 2 -pin resolver as the motor encoder. For connection, adhere to the following points.

- Use fabricated STÖBER cables for optimum interference immunity.
- Use only resolver cables with cores which are twisted in pairs and shielded.
- Cross section: $0.14 \mathrm{~mm}^{2}$ [LIY (C) Y3 $(2 \times 0.14)+(2 \times 0.25)$ ]
- Use 2 cores with $0.25 \mathrm{~mm}^{2}$ for positor line evaluation.
- Apply outer shield on both sides. Apply inner shield only on the inverter side.
- Use exclusively sub D plug connectors with shielded housing (e.g., Siemens V42254-A6000-G109).
- Apply shield over a large surface on the housing of the plug connector.

Top of device


| Signal | S3 <br> Cos+ + | S1 <br> Cos- | S4 <br> Sin+ |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :--- | :---: | :---: | :---: | :---: |
| S2 <br> Sin- | PTC <br> Thermistor | PTC | R2 <br> Erreg+ | R1 <br> Erreg- | - |  |  |  |  |
| Pin <br> X40 | $\mathbf{8}$ | $\mathbf{4}$ | $\mathbf{7}$ | $\mathbf{3}$ | $\mathbf{6}$ | $\mathbf{2}$ | $\mathbf{9}$ | $\mathbf{5}$ |  |
| Motor $^{1}$ | 1 | 2 | 3 | 4 | 6 | 5 | 7 | 8 |  |
| Kabel $^{2}$ | ge | gn | ws | br | bl | rt | gr | rs |  |

1) Pin number of the 12-pin resolver connector for the STÖBER ES motor 2) Color when the STÖBER resolver cable is used

### 5.6 X20 Encoder IN/OUT (RS422)

Simulation of an incremental encoder on plug connector X20 is activated with $\mathbf{H 2 0}=1$ :encoder sim. The number of pulses can be changed with the parameter H21. Adhere to the following points when using encoder simulation.

- Use only suitable cables with cores which are twisted in pairs and shielded.
- On the receiver side, the lines require low-ohmic termination and differential evaluation. Recommended termination impedance: $150 \Omega$.
- Connect ground on pin 1 with the ground of the higher-level controller.
- Apply shield on both sides over a large surface to the housing of the plug connector.



## 5. Connection Assignment

Other possible configurations:
$\mathbf{H 2 0}=2$ :encoder in; input for ext. incremental encoder (TTL)
$\mathbf{H 2 O}=3$ :stepMot in; frequency + sign

> (chap. 11.2)
$\mathrm{H} 20=4$ :SSI sim; output of position in SSI format
H20=5:SSI master, connection of external SSI encoder

| Pin | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ | $\mathbf{5}$ | $\mathbf{6}$ | $\mathbf{7}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{H 2 0}=0$ | PGND | - | - | - | - | - | - |
| $\mathbf{H 2 0}=1$ | PGND | Zero + | Zero- | A- | A+ | B+ | B- |
| $\mathbf{H 2 0}=2$ | PGND | - | - | A- | A+ | B+ | B- |
| $\mathbf{H 2 0}=3$ | PGND | - | - | Freq- | Freq + | Sign + | Sign- |
| $\mathbf{H 2 0}=4$ | PGND | - | - | CLK + | CLK- | Data+ | Data- |
| $\mathbf{H 2 0}=5$ | PGND | - | - | CLK- | CLK + | Data + | Data- |

1) PGND ground (I/O ground) is galvanically isolated from digital DGND on plug connector X1.

### 5.7 Encoder input (external encoder)

Four versions are available to connect encoder or frequency / sign signals (stepper motor simulation).

- HTL signals on BE1 and BE2, fmax $=80 \mathrm{kHz}$
- TTL signals (differential, RS 422) on X20, fmax $=160 \mathrm{kHz}$
- $1 \mathrm{~V}_{\mathrm{SS}}$ and TTL signals on X 41 , $\mathrm{fmax}=160 \mathrm{kHz}$.
- SSI signals from an external SSI encoder on X20

When an encoder is connected to BE1/BE2, F31=14 and F32=15 must be programmed.
Connector X20 is programmed with $\mathbf{H 2 0}=2$ :encoder in to evaluate incremental encoders. External SSI encoders can also be connected to X20 ( $\mathrm{H} 20=5$ :SSI master).
Although, in contrast to X20, X41 does not offer galvanic isolation, it does provide a regulated voltage supply ( 10 V with sense lines, regulated to 5 V ) for the external encoder. For connection assignment, see the beginning of chap. 5. Connector X41 is programmed with $\mathbf{H 4 0}=2$ :encoder in to evaluate incremental encoders.
Voltage supply of 5 V encoders


## Adhere to the following points.

- Only track A and track B are evaluated but not the zero track.
- BE1/BE2, X20 and X41 may not be parameterized simultaneously as the encoder input (i.e., only one pulse counter exists!).
- When plug connector X20 is used as the encoder input and lines exceed 1 m , a terminating impedance of 150 Ohm must be provided externally between signals $\mathrm{A}+$ and A - and $B+$ and $B-$. See figure.
- Since X41 does not offer galvanic isolation, only measuring systems which are closed and powered by X41 may be connected there.
- Use double-shielded cable with cores twisted in pairs.

X20 - Encoder input (incremental encoder)


H2O=2

* Terminating resistor for cables longer than 1 m

BE1/BE2 encoder input


The external encoder is usually used as the signal source for synchronous operation ( $\mathbf{G 2 7}$ reference value) or for position control (102 posi.encoder, chap. 10.11). When stepper motor simulation is used, angle synchronous operation ( $\mathbf{G 2 0}=2$, chap. 11) must be activated in operating mode $\mathbf{C 6 0 = 1}$.
$\mathbf{H 2 0}=4: S S I$ sim. simulates the signals of an SSI encoder on X20. This is particularly useful when the motor is controlled with an absolute encoder with sin/cos track. The absolute angle and the multi-turn information can then be obtained from there. H60 can be used to switch the code between "0:gray" and "1:binary." The information is output in the following format: 12 bits multi-turn, 12 bits within one motor revolution, the 25 th bit is always 0 .

## 5. Connection Assignment

### 5.8 X41 SIN/COS, absolute encoder

Connector X 41 is primarily used to connect multi-turn and single-turn absolute encoders with EnDat ${ }^{\circledR}$ or HIPERFACE ${ }^{\circledR}$ interface (sin/cos encoder). An extra sin/cos track gives an excellent speed resolution for maximum running smoothness and dynamics.


| Pin | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Signal | $\begin{gathered} \mathrm{B}- \\ +\mathrm{Sin} \end{gathered}$ | OV | $\begin{gathered} \mathrm{A}- \\ +\mathrm{Cos} \end{gathered}$ | Up | Data+ | - | PTC | Clock+ |
| Motor ${ }^{11}$ | 13 | 10 | 16 | 7 | 14 | - | 6 | 8 |
| Cable ${ }^{2}$ | $\begin{gathered} \text { or- } \\ \text { ange } \end{gathered}$ | br/bl | yel | br/rd | gray | - | br/yel | wt/bk |
| Pin | 9 | 10 | 11 | 12 | 13 | 14 | 15 |  |
| Signal | $\begin{gathered} \mathrm{B}+ \\ \text { RefSin } \end{gathered}$ | $\begin{array}{\|c\|} \hline 0 \mathrm{~V} \\ \text { Sense } \end{array}$ | $\begin{gathered} \mathrm{A}+ \\ \text { RefCos } \end{gathered}$ | $\begin{array}{\|c\|} \hline \text { Up } \\ \text { Sense } \end{array}$ | Data- | PTC | Clock- |  |
| Motor ${ }^{1 /}$ | 12 | 4 | 15 | 1 | 17 | 5 | 9 |  |
| Cable ${ }^{2}$ | red | grn/bk | grn | grn/rd | bl | br/gra | wt/yel |  |

Italics: HIPERFACE ${ }^{\circledR}$ encoder

- Due to the missing galvanic isolation of X41, only closed measuring systems can be operated with the power supply via X41.
- The $\sin /$ cos encoder must be built onto the motor since it is also used for commutation.
- Use only original STÖBER cables for ES motors!
- Enable connector X41 with $\mathbf{H 4 0}=1: \mathrm{SinCos}$ in.
- Activate motor control with $\mathbf{B 2 6}=3: X 41$.
- The fault "37:n-feedback" may occur during parameterization. This fault can only be acknowledged by turning the power and 24 V off (save parameters before with $A 00=1!$ ).
- Resolvers and $\sin / c o s$ encoders cannot be used at the same time.
- Simultaneous use of sin/cos encoders with external incremental encoders is not possible.
- Simultaneous use of $\sin / c o s$ encoders with frequency specified externally (synchronous operation, stepper motor simulation) is not possible.
- Sin/cos and SSI encoders or SSI simulation on X20 can be used at the same time.
- Use of SSI encoder as master for synchronous operation with $\mathrm{sin} / \mathrm{cos}$ encoder on the motor is under preparation.
- SSI simulation on X20 is available with sin/cos encoders.

A continuous zero-point setting is possible with all available reference traversing modes (e.g., mode $\mathbf{I} 30=3$ :def.home). The inverter is equipped with an electronic gearbox (safe against power failure) which permits absolute position acquisition over $4096 \times 64=262,144$ encoder revolutions for linear axes, or an unlimited traversing area for continuous axes with any gearbox. When this feature is used, the zero position only has to be re-referenced when the inverter is changed.
6. Multi-Motor Operation

6 MULTI-MOTOR OPERATION


## 7. Operator Control

## 7 OPERATOR CONTROL

There are three ways to control and program the SDS servo inverter.

- External Controlbox operator unit
- FDS PC software
- Simubox Fieldbus communication



### 7.1 Status indication

The SDS servo inverter is equipped with a three-position status display, showing the
 operational status (e.g., "rdy" for ready) or the flashing number of a fault which has occurred (e.g., "E31" for fault 31:short/ground).

Controlbox offers a plain-text display with additional diagnostic capabilities (see chap. $16+17$ ).

| Operational states |  |
| :--- | :--- |
| dir | Illegal direction of rotation. Specified direction of <br> rotation contradicts the permissible direction of <br> rotation in C02. |
| EnA | Turned on. Only for control via fieldbus (DRIVECOM <br> profile) |
| HLt | Halt signal active (e.g., during manual traversing) |
| inH. | Switch-on disable <br> - <br> Inverter is powered with +24 V but the network <br> power is missing. |
| inH | Switch-on disable <br> - <br> Enable was active during power-on and Autostart <br> was deactivated by A34=0. Inverter expects a <br> change from H to L level on enable input X1.15. |
| i2t | i2t message. Current limitation due to overload. |
| PoS | Positioning mode. Drive is stationary. |
| rEF | Reference point traversing |
| rdy | Ready for operation (not enabled) |
| run | Drive is enabled. |
| tSt | Self test and calibration after +24 V becomes available <br> on X2. Standard devices show the software version <br> after the 24 V power is turned on. Customized devices <br> with modifications indicate tSt. For complete version <br> designation, see parameter E50. |
| OFF | FDS Tool has removed the enable so <br> parameterization can be performed. Enable again with <br> FDS Tool or turn 24 V OFF-ON to resume operation. |
| StP | Limit switch is active. |

### 7.2 Controlbox

The Controlbox as portable housing or in DIN built-in housing ( $96 \times 96 \mathrm{~mm}$ ) is connected with the X 3 interface ( $2-\mathrm{m}$ cable is included). It offers:

- Local mode (manual traversing) - see chap. 7.2.1
- Text indicator - see chap. 7.2.2
- Memory for seven parameterizations - see chap. 7.2.3
- Parametrization without PC - see chap. 7.2.4
- Locking with password - see chap. 7.2.5

If you do not have a Controlbox, you can use the
"Simubox.exe" program (also installed during installation of FDS Tool) to simulate a Controlbox.

### 7.2.1 Local mode

When manual tipping is used for the drive, Controlbox can be used to turn the motor shaft without having to address the binary inputs.


Switches to local mode and back. The drive stops (internal enable = off). An $\square$ appears on the bottom right of the display. A55 (manual key function) must be active.
Enable = turn on with local mode. The drive is in the state 5:halt and can be controlled with the arrow keys and $\Delta$. Enable = off with local mode
If not already active, local mode is activated (i.e., the drive stops).

### 7.2.2 Operation indication

In speed ( $\mathbf{C 6 0}=\mathbf{0}$ ) mode, the layout of the operational display is shown below.


All possible operational states are listed in chap. 16. When $\boldsymbol{Z}$ is on, the inverter is using parameter record no. 2. No special indication is provided when parameter record no. 1 is active (default setting). The symbol ${ }^{\mathrm{B}} \mathrm{C}$ appears when the brake chopper is running.

C51 is used to scale the speed (when a gearbox is installed on the motor, $\mathbf{C 5 1}$ can be used to indicate the output speed). The measured actual speed / C51 s indicated.
The first line of the display can also be customized. A variable selected via C50 (e.g., power) is divided by C51 and provided with the unit in C53 (e.g., "items/min"). The unit can only be specified via FDS Tool. The number of positions after the decimal point is provided by C52.
In position mode ( $\mathbf{C 6 0}=2$ ), the first line shows the act. position. The second line shows the status.


Regardless of the operating mode, events and alarms are indicated in the second line (e.g., " $53:$ Stop"). All events and alarms are listed in chap. 17.

## 7. Operator Control

### 7.2.3 Parameter memory

Controlbox offers memory space for the parameters of up to 7 SDS servo inverters.

Store parameterization of the SDS on Controlbox

- Press \# key. Display shows "A.. inverter."
- Press \# key. Display shows "A00 save param."
- Press $\triangle$ key until "A03 write PBox" appears.
- Press \# key until the second line of the display flashes.
- Press the $\Delta$ and $\nabla$ keys to select the memory address number (1 to 7 ). If the memory address is already occupied, this is indicated with the name of the data record on the display.
- Press \# key to save the parameterization.

Read data from Controlbox

- Press \# key. Display shows" A.. inverter."
- Press \# key. Display shows "A00 save param."
- Press $\boldsymbol{\Delta}$ key. "A01 readBox\&save" appears.
- Press \# key. The second line of the display flashes.
- Press the $\boldsymbol{\Delta}$ and $\boldsymbol{\nabla}$ keys to select the memory address number (1 to 7). The data record names of the already stored parameterizations are indicated.
- Press \# key to read in the parameterization and store automatically, safe from power failures.
The data are not automatically stored with $\mathbf{A 4 0}$ (read Parabox).
The Controlbox Tool program makes it possible to directly transmit the parameters between Controlbox and a PC.


### 7.2.4 Parameterization

The following six keys are used for the parameterization with Controlbox.

- Return to prev. menu level
- Select various menu levels
- Reject changes
- Accept changes
- Acknowledgement of malfunctions (A31=1)

- Group selection
- Parameter selection
- Edit parameters

To program, press the \# key (Enter). You are now in group selection. The menu is divided into groups which are identified as A, B, C, $\ldots$. Select the groups with the arrow keys (i.e., $\Delta$ and $\Delta$ ). Press the $\#$ key again to access the parameters of the selected group.
The parameters are designated with the group letters and a number (e.g., A10 or D02).

Only when parameter in parameter set no. 2


Parameters are selected with the $\Delta$ and $\nabla$ keys. To change a parameter, press the \# key again. The flashing value can now be changed with $\Delta$ and $\boldsymbol{\nabla}$. The changes take effect
immediately. The change value is accepted by pressing the \# key. The Esc key undoes the change. To return from parameter selection to the group letters, press Esc. To return to the status display, press Esc again.


Parameter changes must be saved with $\mathbf{A O O = 1}$ (save parameters) before the device is turned off.


In the default setting (status on delivery), the inverter only displays the most important parameters required for commissioning. For complex drive tasks, the expanded menu is activated with $\mathbf{A 1 0}=1$.
With $\mathbf{A 1 0}=2$ :service; Access to rarely used service parameters Both the normal menu and the expanded menu do not show parameters which are not related to the current task.

Example: When a predefined STÖBER motor (e.g., ES 44) is selected in parameter B00 (motor type), parameters B10 to B17 (poles to M0) are not shown.
Approximately 50 sec after the last key was pressed, the device returns automatically to the status display. This return can be switched off with A15=0 (auto return inactive).
Fieldbus: Most of the parameters pertaining to the fieldbus can only be set on the PC with FDS Tool.

### 7.2.5 Password

The parameters can be protected against unauthorized change. To do this, enter a password (a number between 1 and 9999) in parameter A14, and save it with $\mathbf{A 0 0}=1$. Password protection is inactive if A14=0. The Parameter A14 can only be accessed in the extended menu with $\mathbf{A 1 0}=1$.
On a protected device, the parameters can only be changed after the correct password has been entered in A13.

## 8. Commissioning

## 8 COMMISSIONING <br> 8.1 Default setting

To obtain the default setting, set parameter A04=1
The default settings are listed below.

- Run mode: Speed
- Speed reference value via AE1 (fast reference value D99=1)
- $10 \mathrm{~V}=3000 \mathrm{rpm}$
- Encoder output X20: 1024 imp./U.
- Ramps:
- Binary input 1 (F31): 1:Halt (ramp inactive)
- Binary input 2 (F32): 2:Direction of rotation
- Binary input 3 (F33): 9:Quick stop
- Analog output 1 (F40): 4:E08 n-motor
- Analog output 2 (F45): 1:E00 I-motor
- Holding brake is not addressed.
$\Rightarrow$ The expanded menu is activated with $\mathbf{A 1 0}=1$.


### 8.2 Motor, braking resistor

Before the drive is commissioned, the STÖBER ES servo motor must be identified on the SDS. Selection with B00 is performed from a motor database.

- In B00, select the motor type (e.g., 64:ES44).
- In B02, enter the "EMK" constant (standard = 110 V ).
- In B26, enter the motor encoder (standard = resolver).
- When a holding brake is to be addressed, set F08=1, and enter the application and release time in F06 and F07.
- If an external fan exists, set $\mathbf{B 0 3}=1$.
- With external braking resistor, set the type in A20.
- Torque limits $\mathbf{C 0 3}$ and C04 must be adjusted to the loadability of the mechanical parts (i.e., gear box). C03 and C04 are percentages relative to standstill torque M0 of the motor. Limit C04 is used for quick stop, for example. Usually

$$
\mathbf{C 0 3}=\mathbf{C 0 4} \leq \mathrm{M}_{2 \text { B_gearbox }} / \mathrm{M}_{0 \_ \text {motor }} / \mathrm{i} \quad\left(^{*}\right)
$$

must be set $\left(\mathrm{M}_{2 \mathrm{~B}}=\right.$ max. acceleration torque of the gear box, $i=$ transmission). Starting with the 1999 edition, the SMS catalog lists in column $\mathrm{S}_{\mathrm{C} 03}$ the value ( ${ }^{*}$ ) to be entered as a suggestion. For more information on torque limits, see chapter 9.2.

This can be monitored with a phase test using B40=1 (procedure: enable off; $\mathbf{B 4 0}=1$; enable on; enable off again when finished). Caution: The drive must be decoupled from the load since movement takes place. For details, see B40 in the parameter list.
With external motors, the selection "60:user defined" must be made in B00 with input of the other motor parameters B02 to B17. This information can usually be found on the motor nameplate.
This procedure must be concluded with $\mathbf{B 4 0 = 1}$ (phase test).
Caution: Make sure that the load is decoupled from the drive!

### 8.3 Speed specification

There are many ways to specify the speed. However, remember that parameter D99 fast reference value restricts the possibilities.
D99=1:active Fast sampling (1 msec) of analog input AE1.
Caution: Reference value options and fixed reference values are not shown.
D99 0 0:inactive Release the fixed reference values and access to all reference value parameters. Sample analog input AE1 $=4 \mathrm{msec}$

### 8.3.1 Speed specification via Controlbox

Controlbox offers a commissioning function without circuiting the control terminals. The tipping speed is determined by the following selection. It can be changed with the appropriate parameters.

| Speed control | $\mathbf{C 6 0 = 1 :}$ | Tip speed / Tip ref. value (A51) |
| :--- | :--- | :--- |
| Position control | $\mathbf{C 6 0 = 2 :}$ | Tip speed (I12) |

Position control $\mathbf{C 6 0}=\mathbf{2}$ : Tip speed (I12)
Activation/deactivation of local operation is signaled
by LED.

### 8.3.2 External speed specification

- Connect speed reference value to analog input AE1.
- Enter speed at 10 V in parameter D02.
- When higher-level position control is being used, D02 must exceed the maximum speed actually required by at least 10\% (i.e., control reserve).
- Any offset for the analog input can be compensated for with D06.
- If required, program ramps with D00 and D01.



### 8.3.3 Speed specification via potentiometer

When a potentiometer is used to specify the reference values, the analog outputs must be parameterized to +10 V or -10 V reference voltage. (Caution: $\mathrm{Ri}=2.2 \mathrm{~K} \Omega$ ).

- F40=7:+100\% for +10 V on analog output 1
- F45=8:-100\% for -10 V on analog output 2
- Set F47 (analog output 2 factor) $=100 \%$



## 8. Commissioning

### 8.3.4 Characteristic curve of ref. value

With fast reference value (D99=1) active, the reference value must be available on $A E 1$. With $\mathbf{D 9 9}=0$, the (main) reference value can be available on either AE1 or AE2, but the AE function (i.e., either F25 or F20) must be 10:reference value (default setting for AE1). The speed is calibrated with the parameters D06 (RV offset) and D02 (speed at maximum reference value). Parameter D03 (maximum reference value) is helpful, for example, when the higher-level controller can output a maximum of 5 V (i.e., D03 $=50 \%$ would then have to be entered).


### 8.3.5 Speed specification via fixed ref. value

With D99=0 (fast reference value inactive), 8 fixed ref. values (FSW) are available with the corresponding ramps in group $\mathbf{D}$. Binary coding via signals RV-select 0 to RV-select 2 (param. F31 to F34) is used for the selection. The combination "000" corresponds to the conventional analog reference value.

### 8.3.6 Speed specification via clock pulse generator

A clock pulse generator is available to optimize the speed controller.

- Enter desired speed in A51 (e.g., 50 rpm).
- Activate clock pulse generator with $\mathbf{D} 93=1$.
- Enter clock pulse cycle in D94 (e.g., 0.5 sec ).
- Activate enable.

The drive switches the speed between +A51 and -A51 with cycle D94.

### 8.3.7 Motor potentiometer

The "motorpoti function" can be used to steplessly increase or decrease the motor speed via two binary inputs.

- Two binary inputs are programmed to "4:motorpoti up" or "5:motorpoti dwn" via F31 to F34.
- The "motorpoti function" is activated with $\mathbf{D 9 0}=1$.
- When the key is pressed, the speed is changed in accordance with ramps in D00 and D01. When the "motorpoti function" is active ( $\mathrm{D} 90=1$ ), most of the parameters of group D (reference values) are not indicated.
- D90=2 causes the motor potentiometer to be added to the normal reference value.
- The reference value generated by the motor potentiometer is set to 0 if both binary inputs are high.
- With D91=1, the ref. value is saved in non-volatile memory.
- With $\mathbf{D 9 1}=0$, a low level on the enable deletes the motor potentiometer reference value.
$\Rightarrow$ The motor potentiometer function is not available when D99=1 (fast reference value).


### 8.3.8 Frequency reference value

There are two ways to accept the frequency reference value.

- Incremental encoder, tracks A and B
- Stepper motor signal, frequency + sign

For connection, see chapters 4 and 5 . The software must be programmed to "el. gear," as described in chapter 11.

### 8.4 Speed controller

The speed controller is an ideal PI controller with reference value smoothing. With STÖBER ES motors, the optimum function of the speed controller is ensured by the default setting. The necessity of controller adjustment (parameters C31, C32 and C33) is usually restricted to:

- Great external moments of inertia (C31 $\uparrow, \mathbf{C} 32 \downarrow, \mathbf{C} 33 \uparrow$ )
- Mechanical parts with oscillation capability (C31 $\downarrow$, C33 $\uparrow$ )



### 8.5 Halt / quick stop

In the default setting, binary input BE1 is programmed to F31=8:halt. In the default setting, the halt is performed without ramp since D01 $=0 \mathrm{sec}$ is preset. A separate deceleration ramp can be implemented with the function "9:quick stop" (D81 Decel-S). In the default setting, BE3 is programmed to F33=9:quick stop.
With operational mode "position," the ramp function is always active. The process block Decel ramp takes effect with halt. Max. acceleration $\mathbf{I 1 1}$ takes effect with quick stop.

### 8.6 Brake control

The addressing of a +24 V motor halting brake is activated with F08=1. The connections are available on X13 (B+ and B-).
The brake is released by the end stage enable and closed with falling enable. The set release time F06 and the application time F07 of the brake is considered.
The brake is applied again under the following conditions:

- Removal of the enable. Watch F38=1.
- Halt. One BE must be programmed to HALT (e.g., F31=8).
- Quick stop. One BE must be programmed to quick halt (e.g., F31=9).
- Fault. Watch F38=2.
- For process block for positioning, see group L..

The motor halting brake can be manually released. For this, parameter F08=0 must be set and one component must be assigned with the function "32: breakRelease" and addressed. Caution: Before this, ensure safe state for brake release. Even when $\mathbf{F 0 8 = 0}$, the brake output is addressed. The release and application times are not considered, however. This function is intended to prevent excess wear when the brake functionality is not configured (starting with SV 4.5B).

## 9. Torque Limits / Operating Range

### 8.7 Binary inputs BE1 to BE4 (Opt. BE5 to BE15)

With the default setting, the binary inputs which can be programmed as desired have the following meaning.

- BE1 = 8:Halt
- BE2 $=6$ :Direction of rotation (left/right)
- BE3 = 9:Quick stop
- BE4 = 0:Inactive

Option board SEA-4000 offers 10 additional binary inputs. The function of the binary inputs is specified via the parameters
F31 to F34, and F60 to F69 in the extended menu ( $\mathbf{A} 10=1$ ).


When several inputs are connected to one function, the signals are either AND or OR-linked (F30 BE-logic). Functions without a connection to a BE signal are provided internally with an L-level signal.

### 8.8 Parameter record selection

The SDS inverter supports two separate parameter records. Specification of the active parameter record is performed in one of the following ways.

- Externally via a binary input (A41=0)
- Internally via a keyboard (A41=1 or 2)

The active parameter record is indicated in E84. To specify via a binary input, one of the parameters F31 to F35 must be set to "11:paraSet-select" in both parameter records. Selection never takes place unless the power section is deactivated.

The parameters of both parameter records can be indicated and programmed regardless of which parameter record is currently active. $\mathbf{A 1 1}$ (paraSet Edit) is used to specify the parameter record (1 or 2) to be edited. When parameters of the 2nd record are involved ( $\mathbf{A} 11=2$ ), a E is indicated to the right of the parameter number.
Certain parameters (e.g., operation input, A30) are only available once, and a is then not indicated next to the parameter number. This applies to all parameters of group A, the display parameters of group E (e.g., torque, utilization and similar), and positioning (groups I, J, L and N).
Example of time behavior with quick stop for enable-off ( $\mathbf{F} 38=1$, for enable see also $\mathbf{F} 31=11$ ):

Signals for fieldbus control


When autostart is active ( $\mathbf{A} 34=1$ ), the switchover takes place immediately when the edge of the signal "11:Paraset" occurs. Enabling is automatically deactivated internally.

Parameter records can be copied via A42 and A43 (copy paraSet). A42: copy paraSet $1>2$ to "1:active" overwrites parameter record 2 with the values of parameter record 1.
$\Rightarrow$ Usually, the first parameter record should be set up first.
The parameters are then copied to parameter record 2 with $\mathbf{A 4 2 = 1}$ (active). A11=2 is then used to switch to parameter record 2 and edit the necessary values there.
After completion, all parameters are saved with $\mathbf{A 0 0}=1$.
Remember: When the mode ( $\mathbf{C 6 0}$ ) is switched from position to speed, the actual position during $\mathbf{C 6 0}=1$ is only partially included. This means the reference position is lost when you switch back ( $\mathbf{1 8 6} \rightarrow 0$ ).
With electronic gear boxes, the internal variables like the current angle of deviation are retained when a parameter record is switched (prerequisite: C60 remains the same). However, the parameters of group G.. are switched.

### 8.9 Acknowledgment of faults

The table of possible faults is located on page 48. Faults are acknowledged in the following ways.

- Enable: Change from L to H level on the enable input, and then back to L. Always available.
- Binary input (F31 to F34=13)
- Esc key (only when A31=1) and only in the display)
- Auto reset (only when A32=1)


Caution! Drive starts up immediately.

Parameters E40 and E41 can be used to scan the last 10 faults. Value 1 represents the last fault. FDS Tool can be used to define the inverter reaction (e.g., fault, warning, message or nothing) to certain events (e.g., overload, excessive
temperature, and operating range) as desired.
The fault "37:n-feedback" can only be acknowledged by turning the 24 V supply off and on.

### 8.10 Motor startup



A34=0 (auto-start inactive) in the default setting prevents the motor from starting up by itself after the power is turned on. Cf. operation status "12:inhibited" on page 45 . Before activating auto start (A34=1), check to determine whether safety requirements permit an automation restart.

## 9 TORQUE LIMITS / OPERATING RANGE

### 9.1 Torque limits

There are several methods of limiting motor torque.

- In the default setting, C03 (M-Max 1) is the current torque limit in \% of motor standstill torque M0.
- A binary input (assign BE funct. "10:torque select" via one of the param. F31 to F34) can be used to switch between the two torque limits C03 (M-Max 1) and C04 (M-Max 2).
- Analog input AE2 can also be used to limit torque. Set parameter $\mathbf{F} 20=2.10 \mathrm{~V}$ corresponds to $100 \%$ motor standstill torque M0. Other scaling is available via F22 (AE2 gain).
- With quick stop, C04 always takes effect.


## 10. Positioning Control

The actually effective torque limit is calculated from the minimum of the various limit values. It can be scanned in parameter E62. Maximum available torque is always limited by the maximum inverter current.

### 9.2 Operating range

Freely programmable comparators can be used to simultaneously monitor 3 measured values (i.e., "operating range"). The first 2 values (speed and torque) are fixed. The third value can be selected as desired with C47. The limit values are specified with the following parameters.

- C41, C42: n-Min, n-Max
- C43, C44: M-Min, M-Max
- C45, C46: Measured value "X" (specified in C47)

C48=1 monitors the absolute value of measured value " X " (C47). C48=0 also includes the sign. Parameter C49 specifies whether monitoring is also to be continued during acceleration phases and enable-off. When at least one of the limits is exceeded, this can be signaled on a binary output with the "6:operation range" function (e.g., $\mathrm{FOO}=6$ ). Another use is the control of process-block chaining (cf. J17=4).
If only one or two of these range monitoring options are used, the limits of the unused ranges must be set to their limit values (e.g., C43=0\% and C44=400\% when torque monitoring is not required).

## 10 POSITIONING CONTROL

The basic model of the SDS 4000 servo inverter offers integrated positioning control.

Since the capabilities of standard devices are limited by the number of inputs available, use of option board SEA-4000 or digital communication (e.g., RS 232, CAN bus and PROFIBUS-DP) is recommended for solving typical positioning tasks.

### 10.1 Function overview

- 32 positions can be programmed as 32 process blocks.
- Continuous position control with following error monitoring
- Parameterization in units (e.g., degrees, mm)
- Resumption of interrupted process blocks possible
- Change in destination possible during traversing
- Reference point travel with several modes
- Sequence programming possible via process block chaining (e.g., "Go to pos. 1, wait 2 sec , go on to pos. 2, wait for signal and return")
- Tip mode (inching)
- Teach-in function
- Speed override via analog input possible
- Any gear ratios are calculated with fractions without rounding errors. No drifting with continuous axes.
- Continuous referencing for continuous axes
- "Electrical cam" function switches digital output within programmed position range.
- Hardware and software limit switch
- Rotary attachment function
- Path specification via analog input possible
- Brake control for lifting systems
- Positioning with absolute value encoders (also continuous mode)


### 10.2 Connections

The standard device without option board is used for simple applications.
Applications with greater demands on binary inputs require the use of the SEA 4001 option board.
The SEA 4000 expansion board offers 10 binary inputs and 5 binary outputs.
An analog input can be used to adjust positioning speed steplessly. Called "speed override," this function is not only useful during commissioning but also for tipping mode, changes in the number of pulses of a machine, and so on.
Below is a typical configuration with option.


The following functions for binary inputs (parameters F31 to F34 and F60 to F69) are important:

- RV-select0 to 4: Binary coded position selection. Process block 1 is selected with "00000," and process block 32 is selected with "11111."
- 8:halt: Rising edge interrupts running motion with the current process block ramp. Since tip mode (i.e., inching) via binary inputs is not possible unless halt is active, halt switches between tip and automatic operation.
- 9:quick stop: Rising edge interrupts positioning with maximum acceleration I11.
- 16:posi.step: When a chain of process blocks is being used, posi.step starts the consecutive process blocks. A movement which is in progress is not interrupted.
- 19:posi.start: Starts the just selected process block. A movement which is in progress is always interrupted.
- 20:posi.next: Only for chained process blocks. If programmed appropriately (cf. J17=3), immediately concludes the running process block, and starts the next one. A remaining path which is to be traveled after posi.next occurs can be defined. See chapter 10.8.
- 17:tip+, 18:tip-: Tip mode (i.e., inching)
- 21:stop+, 22:stop-: Limit switch
- 23:reference input: Reference switch connection
- 24:start reference: Starts reference point traversing
- 25:teach-in: Actual position is assumed in the just selected process block.
$\Rightarrow$ The binary inputs can be inverted via F51 to F54 and F70 to F73. Removal of the enable always causes a quick stop with maximum acceleration 111.


## Analog inputs AE2 and AE1 (par. F20 and F25)

- 1:additional RV: Relative traversing paths are multiplied by (100\% + level). Example: $0 \mathrm{~V} \rightarrow$ no additional reference value (i.e., $100 \%$ of the traversing path).


## 10. Positioning Control

- 4:RV-factor: Relative traversing paths are multiplied by the level. Example: $0 \mathrm{~V} \rightarrow$ no movement (i.e., $0 \%$ of the traversing path).
- 5:override: The programmed positioning speed can be changed online via potentiometer ("speed override" function for CNC controllers), for example.
- 6:posi. offset: An offset can be added to the current position online via AE2. Cf. parameter 170.

Binary outputs (par. F00, F80, F81, ... )

- 3:Ref Val reached: Location in position window I22. Signal appears when drive "in position."
- 8:electrical cam: Signal appears when the actual position is located between parameters I60 and I61. Signal is used as message to other modules, for example.
- 9:Following error: Signal appears when the maximum following error in $\mathbf{I 2 1}$ is exceeded.
- 10:Position active: Drive is in position control. No process block and no process block chain being processed.
- 13:referenced: Drive is referenced.
- 19:s-memory1 to 21:s-memory3: Output the memory locations set by the posi switching points during processblock movements (see chap. 10.12).
- 23:RV-ackn. 0 to 25:RV-ackn.4: Binary coded response message from the active $\mathbf{I 8 2}$ process block. Cf. diagram in chap. 10.3.


### 10.3 Destination positions and process blocks

Each position to be approached to is described by several parameters. Together these parameters make up a process block. Since 32 process blocks are available, 32 separate positions or paths can be traversed. Currently, only the first 8 process blocks can be accessed via Controlbox. Process block no. 1 is described by parameters J10 to J18, while the second process block is described by parameters $\mathbf{J} 20$ to $\mathbf{J 2 8}$, and so on.


Process blocks 9 to 32 can only be programmed via FDS Tool or via fieldbus.

A process block can be selected as shown below.

- Binary coded via binary inputs $R V$-select0 to $R V$-select4. The binary combination "00000" selects process block no. 1, while "11111" selects process block no. 32. Selection via binary inputs is not possible unless $\mathbf{J 0 2}=0$.
- Parameter J02 if not equal zero here.

The response message of the current process block appears:

- In parameter 182 ("active process block")
- In the $2 n d$ line of the operational indication
- It is binary-coded from binary outputs "23:RV-ackn.0" to "27:RV-ackn.4."
The selected process block is shown inverted until the movement starts.
When a process block starts, the active block is not shown inverted (binary-coded like $R V$-select signals) as long as posi.start, posi.step or posi.next is queued.

When a process block cannot be started (e.g., see
"51:refused"), the selected block continues to be shown inverted. This happens even when a movement is terminated.

$\Rightarrow$ When the position is specified directly via fieldbus, process block 1 (J10) receives special treatment.
The inverter does not acknowledge the write routine until all internal conversions have been completed and the inverter is ready to start. The parameter E124 ("start.pos $1^{\prime \prime}$ ) is also available from the fieldbus. J10 is written here and, after conversion, is immediately started automatically. The output signal "32:param.active" signals the completion of a parameter conversion.

### 10.4 Absolute/relative positioning

One of 4 possible traversing methods (parameters J11, J21, J31 and so on) can be assigned to each process block.

- Relative
- Absolute
- Continuous, positive
- Continuous, negative

A relative path always refers to the current location (chain dimensions).
An absolute position refers to a fixed reference point (i.e., machine zero point) which is determined with reference traversing. See chapter 10.6. For this reason, an absolute position always requires reference traversing. Any start commands given without reference traversing are answered by the inverter with " 51 :refused".
When a process block is defined as continuous and a start command is given, the axis moves in the specified direction until a signal arrives from the outside (e.g., posi.next or posi.start). The speed can be adjusted via analog input AE2. (Set the AE2 function $\mathbf{F 2 0}=5$ :Override for this.)

Successful conclusion of a movement is signaled via the output signal "reference value-reached" ( $\mathbf{F 0 0}=3$ and $\mathbf{F 8 0}=3$ ). This signal appears when the actual position lands in the position window (destination $\pm \mathbf{I 2 2}$ ) for the first time. The signal is not withdrawn until the next traversing command is given.

## 10. Positioning Control

### 10.5 Commissioning

Before positioning control is activated, speed control must be commissioned and, if necessary, optimized with the FDS Scope function.
Positioning control is activated with

> C60=2:position

The status indicator ${ }^{1}$ changes and displays the actual position in the first line.


Important: If you want to change the location of the decimal point in the position display via $\mathbf{1 0 6}$ (106=decimal point shift), do this at the beginning of commissioning since the significance of all positions is changed.

### 10.5.1 Limited position range



Limited traversing range means that the permissible area of movement is restricted by end stops or similar. Safety requires that limit switches be provided. If the inverter is not equipped with a sufficient number of free inputs (i.e., operation without an option board), the limit switches must be evaluated by a higher level controller. The primary parameters are listed below:

- 100=0 Limited traversing range
- 105: Unit of measurement (e.g., mm, degrees ( ${ }^{\circ}$, inch)
- 106: Number of decimal places
- 107: Distance per motor revolution (e.g., mm/U)
- I10: Maximum speed (e.g., mm/sec)
- I11: Maximum acceleration (e.g., $\mathrm{mm} / \mathrm{sec}^{2}$ )
- I12: Tip mode speed

Important: Since some parameters in groups I and J (e.g., paths or accelerations) may assume very large values, the keys can be used to directly select (via Controlbox) the tens exponent to be changed. Only the individual digit flashes and not the entire number. The $\boldsymbol{\Delta}$ keys can be used to increment/decrement the value by the selected tens exponent:

$\Rightarrow$ Before starting initial tests, check the limit switches, and decouple the drive from the machine if necessary.

The enable can now be activated as the first test. The display ${ }^{1}$ shows

## 17:posi.active

The position control loop functions, and the current position is maintained. During the next step, the drive is moved via tip mode (i.e., inching mode). Set parameter J03=1 for this. The $\triangle \Delta$ keys can be used to traverse the drive.
$\Rightarrow$ The speed can also be changed during traversing via analog input AE2 ( $\mathbf{F} \mathbf{2 0}=5$ ).

The next step is the commissioning of reference traversing. See chapter 10.6. Software limit switches $\mathbf{I 5 0}$ and $\mathbf{I 5 1}$ can be programmed with a referenced axis ( $186=1$ ). The software limit switches prevent movement to positions outside $\mathbf{I 5 0}$ and 151.

A short relative movement $(\mathbf{J 1 1}=0)$ can be specified in $\mathbf{J 1 0}$ (destination position process block 1) for testing purposes. The speed is entered in J12, while the ramps are entered in $\mathbf{J} \mathbf{1 3}$ and $\mathbf{J} 14$. J00=1 can be used to start and monitor the movement. Do not forget the enable.

### 10.5.2 Continuous traversing range (rotary axis)



The most important feature of a continuous traversing area is the cyclic repetition of certain positions during movement in one direction (e.g., hand on a clock).
Gear ratio: Parameters 107 and 108 permit precise specification of the gear ratio (i.e., based on the number of teeth). This prevents a path drift with relative positioning. Cf. examples in chapter 10.9.

Rotary axis function: Selection of $\mathbf{1 0 0 = 1}$ :unlimited means that the actual position is only counted up to circular length 101 (e.g., $360^{\circ}$ ). After this value, counting begins again at zero. If both directions are permitted, the movement progresses from point A to point B (i.e., absolute destination specification) over the shortest path (i.e., path optimization).

Direction of rotation: If both directions are permitted (104=0), the movement from $A$ to $B$ is performed over the shortest path when absolute destination specification is used $(103=1$, path optimization active). However, with block changes on the fly, the original direction of rotation is retained. Limitation of the permissible direction of rotation 104 affects all process blocks and manual traversing. An alternate method is to use $\mathbf{I 0 3}=0$ to deactivate path optimization. Remember, however, that, when you want to approach an absolute destination in the negative direction of rotation, you must enter the destination with a negative sign (in connection with the modulo calculation). Example: After you enter $-270^{\circ}$, the drive moves to position $90^{\circ}$ rotating counterclockwise.
A short relative movement (J11=0) can be specified for testing purposes in J10 (destination position, process block 1). J00=1 can be used to start and monitor the movement.

[^2]
## 10. Positioning Control

### 10.6 Reference point traversing

When the 24 V supply voltage is turned on, the actual position is unknown. A defined preliminary position is achieved with reference traversing. Absolute movements can only be performed in referenced status. The referenced state is signaled with $\mathbf{1 8 6}=1$ and can be output on the binary output.
Reference point traversing is parameterized with I30 to I38.
The primary parameters are listed below.

- I30: Type of reference point traversing
- I31: Direction of reference point traversing
- I32: High-speed reference point traversing
- I33: Low-speed reference point traversing
- I35: Zero-pulse of the motor encoder
- I37: Automatic reference point traversing at power-on

There are three ways to start reference point traversing.

- Automatically ( $\mathbf{I 3 7}=1$ or 2 )
- Signal on binary input (F31 to F34=24)
- Inching with J05=1

If only one direction ( $\mathbf{1 0 4 > 0}$ ) is permitted, reference point traversing is performed from the beginning with speed I33. Reference traversing type $\mathbf{I} 30$ specifies the required initiators or the functions for binary inputs. $\mathbf{I} 31$ is used to determine the (search) direction when reference point traversing is started. If the reference switch (or limit switch) is active, the direction is reversed. Cf. example 2 further down. The correct value for 131 can be tested by inching the axis (parameter J03), for example. The status of the binary inputs can be scanned in E19.

Specification of two speeds (i.e., I32 and I33) is primarily an advantage for long linear axes.
The acceleration during reference point traversing is $1 / 2$ of the maximum acceleration in I11. When the reference point is detected, the actual position is set to I34 (i.e., reference position), and the drive brakes until it is at a standstill. The distance required for reversal or braking is generally

$$
\text { Distance }=\frac{1 \mathrm{v}^{2}}{2 \mathrm{a}}
$$

With v: Speed
a: Acceleration (I11/2 here).
After reference point traversing has been concluded, the drive remains where it is after the required braking distance ( $\mathbf{I} 3^{2} / / 111$ ) and does not return to the reference position. Cf. above. The AE2 "override" function ( $\mathbf{F 2 0}=5$ ) changes the speed and also the braking distance.



The direction defined in I31 is reversed if the reference switch is active at the beginning.


The reference switch (i.e., cam) only reacts briefly. A limit switch is used for the reversal.


A limit switch can be used for referencing instead of a reference switch.
When the power or the external 24 V voltage supply fails, the information on the reference position is lost. After power returns, $\mathbf{I 3 7}=1$ is used to automatically trigger reference point traversing with the first start command (i.e., posi.start or posi.step).
After a reference point traversing procedure has been concluded, you can automatically move to any initial position by programming parameter I38 (ref. block) to the number of the parameter record to be approached.

## 10. Positioning Control

### 10.7 Position controller

To minimize following error deviation (i.e., difference between reference value and actual position), the SDS uses speed precontrol (speed feed forward). The maximum permissible following error deviation specified in $\mathbf{1 2 1}$ is continuously monitored. The position controller is running continuously during the entire movement.


- H23 (X20 gear ratio): Example of position control using X20

The gain of position control $\mathbf{I 2 0}$ (i.e., the "stiffness" of control) is called the "Kv factor."
The parameter 116 (S-ramp) can be used to parameterize "joltless" traversing profiles and prevent high-frequency excitation due to a low pass. The time constant I16 corresponds to a low-pass limit frequency of $\mathrm{fg}=2 \pi / / 16$.

### 10.8 Process block chaining

The "next block" parameters J16, J26, J36 and so on can be used to chain process blocks into sequences. For example, at the end of one process block, this can be used to automatically move to an additional position (i.e., next block). The following parameters apply to the 1st process block.

- J16 next block. If J16=0, then no chaining.
- J17 next start. Specifies how next block J16 is to be started.
- J18 delay. Applies when J17=1:with delay

For details on J17, see the parameter table.
Example 1: With a rotary attachment, $60^{\circ}$ steps are performed in a continuous cycle with 1 -sec pauses in between.
Solution:

| $\mathrm{J} 10=60^{\circ}$ | (Path) |
| :--- | :--- |
| $\mathrm{J} 11=0$ :relative | (Position mode) |
| $\mathrm{J} 16=1$ | (Next block no. 1) |
| $\mathbf{J 1 7}=1$ : with delay | (Next start with delay) |
| $\mathbf{J 1 8 = 1 . 0 0 0}$ sec | (delay of 1 sec ) |

$\Rightarrow$ Process block no. 1 starts itself.
Example 2: Three fixed positions are always traversed in the same order.
Solution: J10, J20, J30=Destination specification J11=J21=J31=1: absolute
J16=2, J26=3, J36=1 (chaining)
J17=J27=J37=0:posi.step
$\Rightarrow$ The movements are triggered by the rising edge of the posi.step signal.

Example 3: A conveyor belt is to stop after exactly 100 mm following a sensor signal.
Solution: J11=2:endless positive
J16=2 (Next block no. 2)
J17=3:posi.next (Next start)
J20 $=100 \mathrm{~mm}$
J21=0:relative

$\Rightarrow$ The posi.start signal starts process block no. 1. The drive continues to run until the rising edge of the posi.next signal after which a branch is made to process block no. 2. When posi.next is connected to BE1, the reaction occurs without a delay time. If the $\mathbf{J 1 7}=3$ :posi.next setting is not made, posi.next is ignored! Cf. example 4.
Example 4: Positioning of a shelf handling device. The exact destination position is specified by a light barrier which is triggered briefly at each shelf. Until just before the destination, the signals of the light barrier must be ignored. We will assume that the destination is located between 5.1 m and 5.4 m .
Solution:
The approximate position is traveled to with block no. 1.

$$
\mathrm{J} 10=5.1 \mathrm{~m}
$$

(Approximate position)
J11=1:absolute J16=2
J17=2:no stop
(Next block no. 2) (Next start)
Posi.next is activated in block 2 (J27).
J20 $=5.4 \mathrm{~m}$
(Maximum position)
J21=1: absolute
J26=3
(Next block no. 3)
J27=3:posi.next
(Next start)
The braking distance is defined in block 3.
J30 $=0.05 \mathrm{~m} \quad$ (Braking distance)
J31=0:relative

$\Rightarrow$ Process block no. 1 is started with posi.start. Just before the probable destination and without an intermediate stop, a switch is made to process block no. 2 where the posi.next signal is armed. Process block no. 3 is triggered with posi.next, and the braking distance specified in J30 is executed. If the posi.next signal fails to appear (e.g., light barrier is defective), the drive stops at position J20.
Tips:

- An operational status of 17:posi.active indicated on the display means that no process block and no chain of process blocks (i.e., sequential program) is being executed at the moment. The drive is under position control. The posi.start and posi.step signals have the same effect here.
- I82 indicates the number of the process block currently being processed. $\mathbf{1 8 2 = 0}$ means that no process block is being processed.


## 10. Positioning Control

- The inverter assumes the basic state "17:posi.active" when the enable is turned off and on.
- The "17:posi.active" state can also be output on BA1 or BA2.


### 10.9 Simple examples

Without the option board, 4 digital inputs are available.
Example 1: Belt drive (i.e., endless movement). Four different feed lengths are traversed relatively.
Solution: BE1: RV-select0 (F31=1)
BE2: RV-select1 (F32=2)
BE3: posi.start (F33=19)

| BE1 | BE2 | Block | Process Block Parameter |
| :---: | :---: | :---: | :---: |
| 0 | 0 | 1 | $\mathbf{J 1 0 , J 1 2 , J 1 3 , J 1 4 ~}$ |
| 1 | 0 | 2 | $\mathbf{J 2 0 , J 2 2 , J 2 3 , J 2 4}$ |
| 0 | 1 | 3 | $\mathbf{J 3 0 , J 3 2 , J 3 3 , J 3 4}$ |
| 1 | 1 | 4 | $\mathbf{J 4 0 , J 4 2 , J 4 3 , J 4 4}$ |

$\Rightarrow$ The traversing method (e.g., J11, J21, J31 and so on) remains set to "0:relative" for all blocks. The selected process block is indicated in 183.
Example 2: Linear axis with end stops. Two fixed positions are traversed absolutely.
Solution: BE1: RV-select0 (F31=1)
BE2: posi.start (F32=19)
BE3: ref.input (F33=23)

| BE1 | Position | Process Block Parameter |
| :---: | :---: | :---: |
| 0 | 1 | $\mathbf{J 1 0 , J 1 2 , J 1 3 , J 1 4}$ |
| 1 | 2 | $\mathbf{J 1 0 , \mathbf { J 1 2 } , \mathbf { J 1 3 } , \mathbf { J 1 4 }}$ |

$\Rightarrow$ The traversing method (J11 and J21) for both process blocks is "1:absolute." After power-on, reference point traversing is automatically executed by $137=1$ with the first posi.start command. The reference switch must have the characteristics shown in example 1 of chapter 10.6.

Example 3: Belt drive (endless movement) with stop at pulse (i.e., defined braking distance)
Solution: BE1: posi.start $(\mathbf{F} 31=19)$
BE3: posi.next (F33=20)
J11=2:endless positive
J17=3:posi.next
$\mathbf{J 2 0}=$...(braking distance)
$\Rightarrow$ We recommend applying the posi.next signal to BE1 ( $\mathrm{F} 31=20$ ) so that the delay time of 4 msec is omitted. Evaluation of posi.next is activated with $\mathbf{J 1 7}=3$.

For additional details on posi.next, see chapter 10.8 (chaining of process blocks).

Example 4: A rotary attachment is to be positioned continuously and without drift in $60^{\circ}$ increments. A STÖBER K302 0170 with $i=16.939393$... is to be used as the gearbox. The exact ratio is $\mathrm{i}=3354 / 198$.


Solution: The rotary attachment rotates precisely $360^{\circ} \mathrm{x}$ 198 / 3354 per motor revolution. Thus, $\mathbf{I O 7}=71280$, and $\mathbf{I O 8}=3354$. The path is programmed in degrees $\left(\mathbf{J} 10=60^{\circ}\right)$. The circular length 101 is $360^{\circ}$.

Example 5: A toothed belt drive is to move continuously and without drift in fixed increments ( 41 catches per circular length). The toothed disk has 23 teeth, while the belt has 917 teeth. For gearbox, see above.


Solution: To obtain a precise solution, 1/41 of the circular length is taken as the unit of distance $(\mathbf{I O 5}=0)$. One unit of distance is exactly one catch. The belt drive rotates precisely $198 / 3354 \times 23 \times 41$ / 917 units of distance per motor revolution. Thus, $\mathbf{1 0 7}=186714$, and $\mathbf{1 0 8}=3075618$. The path is programmed in units of distance $=1 / 41$ of the circular length. The circular length $\mathbf{I 0 1}$ is 41 units.
Example 6: A conveyor belt drive with slip is to move in fixed increments continuously and without drift. Exactly 41 catches are distributed over acircular length of 4 m .


Solution: The distance per motor revolution is $2 \pi R / i$. Thus $\mathbf{1 0 7}=37.09 \mathrm{~mm} / \mathrm{R}$. Drift is prevented by continuous referencing $(\mathbf{I} 36=1)$ or the posi.next signal. Important: The distance to be traveled (e.g., J10) multiplied by the number of catches (41) must precisely equal the circular length $\mathbf{1 0 1}$. If not, the drive will drift away even with continuous referencing. If necessary, $\mathbf{1 0 1}$ and $\mathbf{I 0 7}$ must be adjusted accordingly. The reference switch should be located between two catches. Important: When continuous referencing I36=1 is used, 107 must always be rounded off to the next higher number.
Example 7: Screw/press controller
Starting at a certain position, the torque is to be monitored. When a limit is exceeded, a return to the start position is made.
Solution: The first part of the movement is handled by process block no. 1. Without stopping, the system switches to process block no. 2 before the end position ( $\mathbf{J} 16=2$ ) and $\mathbf{J 1 7}=2$ ). The speed remains the same (J12=J22). When the torque limit (working area) specified by C44 is exceeded, the system switches to process block no. 3 (J26=3 and $\mathbf{J 2 7}=4$ ). In our example, the working area is limited by the maximum torque C44.


## 10. Positioning Control

### 10.10 Emergency off

If the power is cut off from the inverter with the emergency off switch, all information on the position is lost. When the inverter goes on again, the power must be referenced again.
When 24 V is provided via an option board, a movement which is interrupted by an emergency off can be continued and completed under the following conditions.

- The HALT signal becomes active at least 4 msec before the enable is removed.
- The HALT signal remains present until power returns and the enable is minimum 4 msec active.

Another method of interrupting and continuing a process block is to use the following sequence of signals.


Interrupted movement is completed with posi.step.

Parameter I19=1 can be used to specify that an enable-off will lead to "23:interrupted." The interrupted process block can then be completed with posi.step. With the default setting (119=0), removal of the enable causes sequence control to be reset (status "17:posi.active").
Process blocks with chaining "without a stop" (J17=2) can only be terminated (status "17:posi.active").

### 10.11 Ext. rotary / linear path measurement

When an "external" measuring system is mounted directly on the machine for positioning, this measuring system controls the position. The motor is controlled with its own encoder (standard procedure).
Example for linear path measurement:


Important: The external measuring system must be able to supply at least 30 measuring increments per revolution - as converted to the motor shaft.

### 10.11.1 Position encoder

The encoder for position control is selected with $\mathbf{1 0 2}$ and the motor encoder for motor control is selected with B26. The following table lists the possible interfaces with the inverter's supply voltages $U_{B}$ and the parameters for the number of increments (inc/R) and the gear ratios between motor and encoder (gear-i).

|  | Remarks | $\mathbf{U}_{\mathbf{B}}$ | $\mathbf{I n c} / \mathbf{R}$ | Gear-i |
| :--- | :--- | :--- | :--- | :--- |
| X20 | TTL incremental encoder, <br> SSI encoder | - | $\mathbf{H 2 2}$ | $\mathbf{H 2 3}$ |
| BE | HTL incremental encoder | - | F36 | F49 |
| X41 | TTL incremental encoder <br> (no galv. isolation) | 5 V | $\mathbf{H 4 1}$ | $\mathbf{H 4 2}$ |

### 10.11.2 Parameterization - motor/ext. meas. system

The movement of the external measuring system (rotary or straight) must be defined with 107 and 108 . First, the increments of the encoder must be specified (for SSI encoder, the resolution is converted from bits to increments; 24 bits equal 1024 pulses). See table above. Then the physical implementation is defined with 107 and 108.

Examples:

1) A revolving table with a rotation angle of $360^{\circ}$ is directly coupled with a pulse encoder (1024 pulses per revolution).
H20 = 2:encoder In
$\mathbf{H 2 2}=1024 \mathrm{I} / \mathrm{R}$
$105=2:^{\circ}$
$107=360$
$108=1 \mathrm{R}$
2) A conveyor belt with a $100-\mathrm{mm}$ drive roller is combined with a pulse encoder (1024 pulses per rotation) which is mounted on the drive roller.
$\mathbf{H 2 O}=2:$ Encoder In
$\mathrm{H} 22=1024 \mathrm{I} / \mathrm{R}$
$105=3:$ millimeter
$107=314 \quad(100 \mathrm{~mm} * \pi)$ feed per roller revolution
$108=1 \mathrm{R}$
3) A linear axis with position encoder ( 100 pulses per 1 mm )

H20 = 2:encoder In
$\mathbf{H 2 2}=100 \mathrm{I} / \mathrm{R}$
$105=3$ :millimeter
$107=1$
$108=1 R$
H23: The ratio of the motor speed to the encoder speed must be entered in $\mathbf{H} 23$ for speed precontrol. $\mathbf{H} 23$ has no effect on the positioning but speed precontrol is very important for system dynamics.

Block circuit diagram:


### 10.11.3 Special reactions with SSI encoders

The connection of the encoder is made on interface X20 ( $\mathrm{H} 2 \mathrm{O}=5$ ).
At a resolution of 24 or 25 bits (see H61), one revolution has 12 bits (i.e., one revolution is divided into 4096 positions). This corresponds to a resolution of a pulse encoder with 1024 lines (quadruple evaluation).
H20 must thus be set to 1024 .
Be sure that the coding (gray or binary) is set correctly in H62.

## 11. Synchronous Running, El. Gearbox

### 10.12 Posi switching points

Posi switching points can be used to generate signals on the binary outputs during the movement. In contrast to the "electric cam" which is always active between positions I60 and I61, posi switching points are only evaluated during the running process blocks (movement) in which they were activated (L11, L12).
There are 4 posi switching points - S1 to S4. Each of these switching points can be used in several process blocks. Up to two switching points can be selected in one process block. Two switching points are selected for process block no. 1 with the parameters L11 and L12, as shown below.

| Parameter |  | Possible Selection Values |
| :--- | :--- | :--- |
| L11 | Switch A | "0:inactive", "1:switch S1", |
| L12 | Switch B | .. "4:switch S4" |

The characteristics of the switching points are specified in group N.. . For instance, the first switching point (S1) is described with N10 ... N14.

| Parameter |  | Possible Selection Values |
| :--- | :--- | :--- |
| N10 | s1-position | Example: 113.00 mm |
| $\mathbf{N} 11$ | s1-method | "0:absolute", "1:rel,to start" or <br> "2:rel.to end" |
| N12 | s1-memory1 | Selection for each: "0:inactive", <br> N13 |
| s1-memory2 | "1:set", "2:clear", "3:toggle"* |  |

* Toggle = change state each time level changes
(i.e., "L" -> "H" -> "L" -> "H" and so on)

Definition of the switching-point position can be absolute (e.g., 1250.0 mm ) or relative to the beginning or end of the running process block ( $\mathbf{N} 10, \mathbf{N} 11$ ). The position of the switching point must be outside the target window $\mathbf{I 2 2}$.
The switching points have no direct effect on the outputs. Instead, up to 3 switch memories can be set, cleared or toggled in each switching point. Each binary output can be programmed to one of these three switch memories.
F80 $=20: s$-memory2 outputs switch memory 2 to output BA1.


Example 1: Binary output 2 (relay 2) should be set in process block $2,150 \mathrm{~mm}$ before the target position and then reset just before the Posi window is reached.
Solution: Two switch points (S1 and S2) are required. Switch point S1 activates switch memory 1 (s-memory1). Switch point S2 deactivates the same memory.

| Switch Point S |
| :--- | :--- |
| N10 $=150 \mathrm{~mm}$ |
| N11 $=2:$ rel.to endpos |
| N12=1:set s-memory1 |


| Switch Point S2 |
| :--- | :--- |
| $\mathbf{N 2 0}=5 \mathrm{~mm}$ |
| $\mathbf{N 2 1}=1: r e l . t o ~ e n d p o s$ |
| $\mathbf{N 2 2}=2: c l e a r$ s-memory1 |

Switching points S1 and S2 are assigned to process block 2 in group L... .
$\mathbf{L 2 1}=$ switch S1, $\quad \mathbf{L 2 2}=$ switch S2
Output BA2 is assigned to s-memory1 with $\mathbf{F 0 0}=19$.
Example 2: A paint pistol is moving back and forth between two points and is to be turned on and off by the inverter with binary output BA1. Since the pistol's reactions are slow, it must be turned on (after the start of the process block) in advance at distance $\boldsymbol{a}$ and turned off at distance $\boldsymbol{b}$ before the end of the process block.
Solution: Two process blocks
 (position up, position down) and two switch points are required. The first switch point activates switch memory 1 ("smemory1"). The second switch point deactivates the same memory.

| Switch Point S1 | Switch Point S2 |
| :--- | :--- |
| N10=a (distance a) | N20=b (distance $\boldsymbol{b}$ ) |
| N11=1:rel.to start | N21=2:rel.to endpos |
| N12=1:set s-memory1 | N22=2:clear (s-memory1) |

The same switching points are parameterized in both process blocks.

| Process Block 1 | Process Block 2 |
| :--- | :--- |
| L11 $=$ Switch point S1 | L21 $=$ Switch point S1 |
| L12 $=$ Switch point S2 | L22 $=$ Switch point S2 |

Output BA1 is assigned to s-memory-1 with $\mathbf{F 8 0}=19$.

## 11 SYNCHRONOUS RUNNING, EL. GEARBOX

Using the synchronous running functionality, you can precisely synchronize two shafts. Different gear ratios are calculated without rounding errors. An incremental encoder of a master drive is used as the master, for example, but frequency/sign signals (i.e., stepper motor simulation) can also be processed.

### 11.1 Function overview

- Precise speed and angle ratio
- Gear ratio can be set as fraction.
- Following error monitoring
- Free wheeling via binary input
- Precontrol (speed feed forward) for high dynamics
- No stationary angle error
- Angle offset via binary inputs
- Fine adjustment of the gear ratio possible via AE2
- Master signals as incremental encoder (tracks A and B) or stepper motor (frequency and sign)
- SSI as master encoder

The block circuit diagram for synchronous running is shown in chapter 18.

## 11. Synchronous Running, El. Gearbox

### 11.2 Connection of pulse source

The reference value can be received in the form of impulses in one of the following ways.

- Track A + B of an incremental encoder
- Direction + frequency (stepper motor simulation) or
- Serial data interface SSI

Pulse processing is performed by the "electronic gear" function $(\mathbf{G 2 0} \boldsymbol{>} 0)$ in mode $\mathbf{C 6 0}=1$ :speed. The fast reference value must be off ( $\mathrm{D} 99=0$ ).
Both HTL (24 V) and TTL (5 V differential in accordance with RS 422) signals are processed.

## HTL signals:

- Use BE1 and BE2 (X1.11 and X1.12).
- Set F31=14, F32=15 for incremental encoder.
- Set F31=15, F32=14 for stepper motor simulation.
- Enter resolution (pulses/revolution) in F36.
- Set master encoder G27=0:BE encoder.
(Activate synchronous run with G20 before.)



## TTL signals:

- Use plug connector X20. Remember terminal resistance for cables longer than 1 m .
- Set $\mathbf{H 2 0}=2$ :encoder in for incremental encoder.
- Set $\mathbf{H 2 0}=3$ :stepMot in for stepper motor simulation.
- Enter resolution (pulses/revolution) in H22.
- Set master encoder G27=1:X20.
(Activate synchronous run with $\mathbf{G 2 0}$ before.)
- X41 can also be used instead of X20. See chap. 5.5.


A finished, cascadeable master slave connection (ID no. 42940) can be used to pass the pulses from one SDS to the next. The cable length has been optimized for inverters up to 20 A (SDS 4141).


SSI interface:

- Use plug connector X20.
- Set H20 to SSI master (H2O=5).
- Set H61 (SSI code) in accordance with encoder used.
- Set H62 (data bits) in accordance with the resolution of the encoder.

The parameter H60 (SSI-inverse) can be used to influence the direction of rotation.

### 11.3 Master - slave

When two SDS 4000 inverters are coupled as master-slave, signals of the encoder simulation on plug connector X20 are connected to the same plug connector of the next inverter.

## Master:

- Set encoder simulation on X20 with $\mathbf{H 2 0}=1$.
- If necessary, change number of increments in H21.


## Slave:

- Deactivate fast reference value with $\mathbf{D 9 9}=0$.
- Set $\mathbf{H 2 0}=2$ :encoder in.
- Set the number of pulses/revolution in H22 for the master (i.e., $\mathbf{H} 22$ on slave $=\mathbf{H} 21$ on master).
- Activate angle synchronous run with $\mathbf{G 2 0}=2$.
- Set master encoder to G27=1:X20.
- Set slave/master speed ratio in G22/G21.
- If necessary, change direction of revolution in D92.
- The primary functions are listed below.

Binary inputs (parameters F31 to F34)

- 12:ext fault;
- 17:tip +; The slave is shifted in the positive direction in relation to the master. The speed is the result of the current speed reference value (AE1 or fixed reference value).
- 18:tip -; Same as "17:tip +" but in the negative direction.
- 27:syncFreeRun; Switch off synchronous running to run the drive with the analog reference value, for example.
- 28:syncReset; Current synchronous difference G29 is reset.

Binary outputs (parameters F00 and F80, F81)

- 12:sync.diff.; The synchronous difference exceeds limit value G24.

Analog inputs AE2 (parameter F20, F25)

- 5:override.; The gear ratio is affected during operation (i.e., change every 250 msec ).
- 13:Sync.offset; Slave position is changed via analog voltage ( $100 \%=\mathbf{G 3 8}$ ).
- 14:Sync. $n-R V$; External speed feed forward with analog reference value


### 11.4 Commissioning

- Commission master and slave separately (speed control). Parameters F26, F36 and H22 are important.
- Configure the encoder input/master on the slave (F31=14 and $\mathbf{F} 32=15$ or $\mathbf{H} 20=2$ ).
- On the slave, speed synchronous running is activated with G20=1, and the angle synchronous running is activated with G20=2.
- On the slave, enter the number of encoder increments of the master (F36 or H22).
- On the slave, specify the speed ratio (G22/G21).
- Direction of rotation can be changed with D92.

The master often requires no further parameterization.

### 11.5 Angle difference

The current difference between master and slave is indicated in G29. The angle of difference is reset when:

- When voltage is turned on (power and 24 V ) if $\mathbf{G 2 0}<3$
- Always for BE function "28:SyncReset"
- For enable, halt and quick stop. See G25.
- For BE function "27:SyncFreeRun." See G25.

The angle controller multiplies angle difference $\mathbf{G 2 9}$ by $\mathbf{G 2 3}$ (Kp.). The resulting speed offset is limited to $\pm \mathbf{G 2 6}$ ( n -correc-tion-Max).

A continuous angle shift between master and slave can be implemented with the BE functions Tip + and Tip -. The speed difference is the current speed reference value (i.e., analog input AE1 or the fixed reference value). Another way to shift the angle is the AE function "13:synchron-offset."

The dynamic angle difference during acceleration is reduced with speed feed foward.

- Usually, the master increments are differentiated and added as speed feed forward to the speed reference value.
Advantage: No extra wiring required
Disadvantage: The master must move first before the slave can react. The speed obtained by differentiation is smoothed with a low pass. ( $T=\mathbf{G} 22 / \mathbf{G 2 1}$ * $\mathbf{F 3 6} / \mathbf{H 2 2 *} 4 \mathrm{msec}$ if $\mathbf{G 2 7}=0: B E$-encoder. Otherwise $T=\mathbf{G 2 2} / \mathbf{G 2 1}$ * H22/F36 *4 msec . In addition: $\mathrm{T} \geq 16 \mathrm{msec}$ ).
- The "14:Synchron reference value" function can be used to directly switch the speed reference value (post ramp) from the master to the analog input of the slave ( $\mathbf{F 2 0}=14$ ). The function of the analog output $\mathbf{F 4 0 = 1 1 : E 0 7 ~ n - p o s t R m p ~ c a n ~}$ be used for this with the master. No ramp can be parameterized on the slave for the external precontrol (speed feed forward). If the analog reference value is circuited in parallel on master and slave, no ramps may be active on the master.


### 11.6 Angle and speed synchronous running

With angle synchronous running ( $\mathbf{G 2 0}=2$ ), all angle deviations are acquired and adjusted. However, this is not always desired. In speed synchronous running mode ( $\mathbf{G 2 0}=1$ ), the angle controller can be partially or completely deactivated.
The following setting is used to limit angle difference $\mathbf{G 2 9}$ to the value $\mathbf{G 2 4}$.

> G20 $=1$ : speed synchron run
> G23>0 (Kp synchronous running)

Although the speed ratio is precisely adhered to, the slave never attempts to catch up with an angle difference over G24. This is similar to a mechanical safety notching coupling.

Make the following selection for pure speed synchronous running.

## G24=0

The speed ratio is not mathematically precise.

### 11.7 Emergency off

The following measures are helpful in minimizing divergence of master and slave when the power goes off.

- Select master low voltage limit A35 higher than that of the slave.
- Set master quick stop to $\mathbf{F} 38=2$.
- Couple DC links between master and slave.
- Adapt master quick stop ramp (D81) and torque limits (C04) on the master and slave to the mass ratios.
Turning off the power while the enable is active causes the fault "46:Iow voltage." After power returns, a device initialization is performed which may take several seconds.
$\Rightarrow$ We recommend removing the enable at the same time the power is removed so that the inverter does not go into "fault mode".


### 11.8 Reference point traversing - slave

Reference point traversing permits you to automatically put the slave into a defined initial position.

Reference point traversing is specified with parameters G31 to G35. Reference point traversing is started with a binary input (function F31=24:Start ref.).


The drive moves at speed G32 in direction G31 until the reference switch (reference input) on a BE becomes active (function F31=23:Ref.input). The angle deviation is reset, and the drive halts.
If only one direction of revolution is permitted (CO2), the drive moves in direction C02 at speed G33 until the rising edge of the reference switch. The reference direction (G31) is ignored in this case.

## 12. Technology

## 12 TECHNOLOGY <br> 12.1 PID controller

The PID controller on analog input AE2 can be used as a technology controller for compensating rollers, pressure, throughput and similar. It is activated with $\mathbf{G 0 0}=1$.


There are four ways to compare reference and actual values.

- Use of differential input AE2. The two signals are connected to "+" and "-" in relation to analog ground.
- A fixed reference value can be defined in F21 (AE2 offset).
- AE1 can be programmed to F25=11:PID-reference.
- PID-reference via fieldbus (E121)

The low pass filter (smoothing, time constant F23) suppresses undesired high-frequency oscillations. The output of the PID controller is usually used as an additional reference value (F20=1). The binary input function "26:disable PID" (F31 to F35) deactivates the controller. The controller output (i.e., adjustment variable) can be limited by G04 and G05. Active limitation can be signaled on relay 2 ( $\mathbf{F 0 0}=11$ ), for example. This can be used to indicate a malfunction in the process (e.g., tearing of wound material).

Important: Enable-off sets the output of the PID controller and the I portion to zero.

### 12.2 Winders

The standard inverter software contains functions for solving simple winding tasks (i.e., reel drives). The following tasks are supported.

|  | Task |  |
| :---: | :---: | :---: |
| 1 | Winding with diameter sensor at constant speed $v=$ const |  |
| 2 | Winding with indirect tension control at the M-max. limit |  |


|  | Task |  |
| :---: | :---: | :---: |
| 3 | Winding with compensating rollers via speed offset and PID controller on AE2 | add. $R V$ V- master $\rightarrow A$ |
| 4 | Winding with direct tension control with tension sensor on AE2 |  |

When a material is wound and unwound, the speed progresses in reverse proportion to the diameter ( $n \sim 1 / D$ ). If there is no diameter sensor (tasks 2 to 4 ), the diameter is calculated by the inverter as $D \sim v$-master / $n$-motor ( $\mathbf{G 1 1}=1$ ) or obtained by integration of the roller deviation $(\mathbf{G 1 1}=2)$. The maximum change in speed of the diameter is provided by G16. The current diameter is indicated in parameter $\mathbf{G 1 9}$ (actual winding diameter). This can be output on the monitor output with
F40=5. Depending on the task, the winding drive uses the following modes.

- Speed-controlled, G10=1:n mode (tasks $1+3$ )
- At the M-max. limit, G10=2:M-Max mode (tasks $2+4$ )


### 12.2.1 Diameter sensor on AE1/AE2

Winders or unwinders with constant circumferential speed. The diameter sensor is connected to the analog input. The primary parameters are listed below.

- F20=7:wind.diameter (for AE1: F25)
- G10=1:n mode
- G11=0:AE2-measured
- G12 winder D-Min., G13 winder D-Max.

Parameters F21 and F22 are used to assign the values D-Min. and $D$-Max. to the related sensor voltages U-Min. and U-Max.

- F21 = - U-Min. $\div 10 \mathrm{~V} \times 100 \%$
(AE2 offset)
- F22 = 10 V $\div$ (U-Max. - U-Min.) $\times 100 \%$
(AE2 gain)

Since the reference value decreases with increasing diameter in accordance with the reciprocal value 1/D, the master reference value is the highest possible speed with an empty roll.


## 12. Technology

### 12.2.2 Indirect tension control at M-max limit

Winders or unwinders with constant tension without extra sensors. The winding speed is specified by a master drive. The master reference value must be such that it precisely corresponds to the motor speed required there for D-Min. (i.e., empty roll). The master reference value must always be positive. See E10 (AE1 level). If necessary, the direction of motor revolution must be adjusted with D92.
The winding drive calculates the diameter in accordance with $D \sim v$-master $\div n$-motor and affects the torque limit in proportion to $D$. The torque limit on AE2 or C03 is the greatest possible torque with a full roll. The primary parameters are listed below:

- G10=2:M-Max mode
- G11=1:n-line/n-motor
- G12 Winding D-Min., G13 winding D-Max
- G14 Winding D-ini
- F20=2:torque-limit or $\mathbf{C 0 3}$
- D92 Reference value negation
- G15 Override reference value

The speed reference value of a winder must always be greater than the master reference value so that the drive runs at the torque limit. This is ensured with the override reference value G15 which is added to the master reference value. In contrast, an unwinder should never be allowed to start running automatically in the direction of unwinding. For this reason, the master reference value of AE1 is never provided unless it is positive. Override reference value $\mathbf{G 1 5}$ ensures that the material is tensed when the master reference value $=0$ (i.e., the unwinder attempts to rotate slowly against the direction of winding). The direction of motor revolution can be adjusted with D92 or via a binary input. Cf. $\mathbf{F 3 1}=6$. The following figure illustrates how this process functions.


Before the winding process starts, the initial diameter must be set to $\mathbf{G 1 4}$ via a binary input (e.g., F31=29 for BE1). When the power is turned off, the current diameter ( $D$-act) is saved in non-volatile memory.
Incorrect calibration of the master reference value will cause $D$-act to drift away. If the master reference value is too high (e.g., due to D02 being too high), $D$-act will also be too high! G17 can be used to parameterize tension reduction with increasing diameter.

### 12.2.3 Winding with compensating roller

Winders or unwinders with constant tension provided by a compensating roller. The position of the compensating roller is measured and controlled via a PID controller on AE2. The winding speed is specified by a master drive. The winding drive
calculates the diameter in accordance with $D \sim v$-master / $n$ motor and multiplies both the master reference value and the offset reference value by $1 / \mathrm{D}$. The primary parameters are listed below.

- G10=1:n mode
- G11=1:n-line/n-motor
- G12 Winding D-Min., G13 winding D-Max
- G14 Winding D-ini
- G00=1 (PID controller active)
- G01 PID controller Kp, G02 PID controller Ki
- F20=1:additional reference value

Block circuit diagram:


Instead of using G11=1:n-line/n-motor to calculate the diameter, G11=2:roller can also be used for a compensating roller. The deviation of the roller is measured with an analog input ( $\mathbf{F 2 0}=12$ :wind.roller). A speed feedback is not required. Integration of the diameter is controlled by the positive or negative deviation of the roller.

### 12.2.4 Winding with tension sensor

Tasks similar to winding with compensating roller but with the following differences.

- G10=2:M-Max mode
- F20=2: torque-limit
- G15 Override reference value

When winding with tension sensors, it is often a good idea to use an external PID controller with integration and precontrol (speed feed forward) of the tension reference value.


### 12.2.5 Compensation of fault variables

The effects of friction and inertia on the traction can be compensated for. The torque limit is offset by the friction used with G40 and G41.
Compensation of inertia: The inertia torque of the full roll at $D$ Max must be converted to the motor shaft and entered in C30 as a ratio of the inertia torque of the motor. The acceleration is obtained by differentiation of the encoder signal. The result can be smoothed with G42.
The variable diameter may also affect the gain of the speed controller. The gain between C31*C35 at D-Min and C31 at DMax changes in proportion to the square of the diameter.
The I portion is affected in the same way.

## 13. Parameter Description

| A.. In | erter | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| A00 ${ }^{\text {1) }}$ | Save parameter: <br> 0: inactive; <br> 1: The parameters of both parameter records are saved in non-volatile memory. Saving is triggered when the value changes from 0 to 1 . "A02 check parameter" is then performed automatically. |  |
| A01• | Read parabox \& save: Read parameters from Controlbox and save in non-volatile memory. The inverter recognizes automatically what is connected to X3. <br> With Controlbox: First select desired data record (1 to 7), and then press \#. <br> "A02 check parameter" is started automatically. When read errors occur (e.g., Parabox disconnected while being read accessed), all parameters are rejected, and the settings last saved with A00 are restored. <br> 0 : inactive; <br> 1: active; <br> 1 to 7 for Controlbox (number of the data record) |  |
| A02 ${ }^{\text {1) }}$ | Check parameter: Parameterization is checked for correctness. For possible results, see chap. 15. 0 : inactive; <br> 1: active; Parameters of the parameter record to be edited (see A11) are checked for the following. <br> - Adherence to the value range <br> - Correct programming of the binary inputs (F31 to F35) |  |
| A03 ${ }^{\text {1) }}$ | Write to Parabox: Write data of the inverter to external data medium (Parabox, Controlbox) <br> 0 : inactive; <br> 1 to 7; The parameters of both parameter records are copied from the inverter to Parabox (Controlbox). For handling, see A01. |  |
| A04* ${ }^{\text {1 }}$ | Default settings: All parameters are reset to their default settings. <br> 0 : inactive; <br> 1: active; The procedure is triggered when the value changes from 0 to 1 . |  |
| A10 | Menu level: Specifies the parameters which can be accessed by the user <br> 0: standard; Parameters which can be accessed are highlighted in gray in the parameter table (see chap. 21). <br> All parameters remain in effect including those in the "1:extended" menu level. <br> 1: extended; Access to all parameters which can be set <br> 2: service; Access to rarely used service parameters. Small print (e.g., A37). |  |
| A11 | Parameter set edit: Specifies the parameter record to be edited. The parameter record to be edited (A11) and the active parameter record (status indication) do not have to be identical. For example, parameter record 1 can be edited while the inverter continues operation with parameter record 2 . See also chapter 9.4. <br> 1: parameter set 1; Parameter record 1 is edited. <br> 2: parameter set 2; Parameter record 2 is edited. |  |
| A12 | Language: When the language is changed, FDS-Tool-specific texts U22, U32, U42 and U52 are reset to the default setting. This also applies to C53 and $\mathbf{I 0 9 .}$ <br> O: deutsch; <br> 1: english; <br> 2: french; |  |
| A13 | Set password: Password is requested. If a password is defined in A14, this must be entered here before parameters can be changed. See chapter 7.3. |  |
| A14 | Edit password: Definition and modification of the password. 0 means that no password has been set. All other values are valid passwords. See chapter 7.3. A defined password can only be read out via FDS Tool. |  |
| A15 | Auto-return: Permits automatic return from the menu to the status indication. In edit mode (i.e., the edited parameter is flashing), there is no automatic return to the status indication. <br> 0 : inactive; <br> 1: active; If 50 seconds pass without a key being pressed, the display jumps back to the status indication. |  |
| A20 | Braking resistor type: Specification of the braking resistor type <br> 19:inactive; Brake transitor deactivated. Too much braking force causes fault "36:overcurrent." <br> 20: Internal; Integrated braking resistor. See page 2 of technical data. <br> 21: User defined; Any external braking resistor. See A21, A22 and A23. <br> 22: 80Ohm0.3kW <br> 23: 800hm0.6kW <br> A thermal model monitors the max. permissible power which can be led off via the <br> 24: 30Ohm0.6kW braking resistor. This protects the braking resistor against thermal overload. A thermal <br> 25: 300hm1.0kW overload causes the fault "42:tempBrakeRes." <br> 26: 30Ohm1.2kW <br> 27:300hm2.5kW |  |
| A21 | Brake resistor resist.: Only with $\mathbf{A 2 0}=1$ (user defined), resistance value of the braking resistor used. Value range in $\Omega$ :: Depends on type, up to 600 |  |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set
1)
$\begin{array}{lll}\text { See result table in chap } 15 . & \text { 2) Only available when } \mathbf{D} 90 \neq 1 & \text { 3) Only available when } \mathbf{D} 99=0\end{array}$
$\begin{array}{lll}\text { See result table in chap } 15 . & \text { 2) Only available when } \mathbf{D} 90 \neq 1 & \text { 3) Only available when } \mathbf{D} 99=0\end{array}$
1
Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2$ :service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| A.. Inverter |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| A22 | Braking resistor rating: Only with $\mathbf{A 2 0}=1$ (user defined), capacity of the braking resistor used. Value range in $k W$ : 0 to ..., depends on type |  |
| A23 | Braking resistor therm.: Only with A20=1 (user defined), thermal time constant of the braking resistor. Value range in sec: 0.1 to 40 to 100 |  |
| A30• | Operation input: Specifies the origin of the control signals (i.e., enable, direction of rotation and ref. value) $\underline{0}$ : control interface (X1); Control signals (e.g., enable and so on) are generated via the X 1 terminals. All binary inputs must be programmed accordingly. Fieldbus operation without Drivecom profile. <br> 1: serial (X3); Control signals (e.g., enable and so on) are generated from the PC (FDS Tool software). The inverter is connected to the PC via sub D plug connector X3 (RS 232-C interface). See chapter 9.9. Remote control via the PC requires that the enable input (X1.15) be high. <br> 2: inactive; <br> 3: SDP 4000; Control of the device via PROFIBUS-DP. This requires the PROFIBUS-DP option board. <br> 4: CAN-bus; Control of the device via CANopen with the integrated CAN bus interface which is standard. The following applies to both settings (i.e., "3: Profibus-DP" and "4: CAN-bus"). The servo inverter is put into a drive-compatible mode for device control. This control is performed exclusively either via the selected fieldbus (requires that all parameters for the function of the binary and analog inputs F20, F31, F32, F33 and so on be set to inactive) or in mixed operation with these inputs. The high level must always be present on the enable input (X1.15). |  |
| A31 | Esc-reset: Use the Esc key to acknowledge faults while they are being indicated. <br> 0 : inactive; <br> 1: active; Faults can be acknowledged with Esc . |  |
| A32 | Auto-reset: Faults which occur are acknowledged automatically. <br> O: inactive; <br> 1: active; The inverter acknowledges some faults automatically. See chapter 17. Faults can be automatically acknowledged successfuly three times within a time period of 15 minutes (default setting). A fourth fault is not acknowledged automatically. Instead, relay 1 opens, and the fault must be acknowledged in some other way (i.e., enable, binary input F31 to $\mathbf{F 3 5}=13$, or Esc key A31). The automatic acknowledgment counter is reset. After three unsuccessful attempts at acknowledgment, the inverter ignores automatic acknowledgment and malfunctions. The time period for automatic acknowledgment can be parameterized from 1 to 255 min in A33. |  |
| A33 | Time auto-reset: Time period for automatic acknowledgment. See A32. Value range in min: 1 to 15 to 255 |  |
| A34 | Auto-start: Before you activate auto-start A34=1, check to determine whether safety requirements permit an automatic restart. Use only permitted when the standards or regulations pertaining to the system or machine are adhered to. <br> $\underline{0}$ : inactive; After power-on, the enable must change from $L$ level to $H$ level to enable the drive $(\rightarrow$ message "12:inhibited"). This prevents the motor from starting up unintentionally (i.e., machine safety). <br> 1: active; When auto-start is active, the drive can start running immediately (if enabled) after the power is turned on. |  |
| A35 | Low voltage limit: If the inverter is enabled and the DC-link voltage is less than the value set here, the inverter assumes fault "46:Iow voltage. " A35 should usually be approx. $85 \%$ of the power voltage present to offset possible failure of a power phase. <br> Value range in V: 150 to 350 to 570 |  |
| A36 | Mains voltage: Maximum voltage provided to the motor by the inverter. Usually the power voltage. Starting at this voltage, the motor runs in the field weakening range. <br> Value range in V: 140 to 400 to 480 |  |
| A37 | Reset memorized values: The six different following error counters E33 to E38 (e.g., maximum current, maximum temperature and so on) are reset. |  |
| A38 | DC power-input: <br> O: inactive; <br> 1: active: |  |
| A40. ${ }^{\text {1) }}$ | Read parabox: Read parameters from a Controlbox without automatic storage. 0 : inactive; <br> 1 to 13: active; For function, cf. A01. |  |
| A41 | Select parameter set: Two parameter records are available. These can be selected via the binary inputs or directly via A41. The selected parameter record does not become active until the enable has been removed and after a maximum of 300 msec have passed. Some parameters retain their validity in both parameter record 1 and parameter record 2 (e.g., the posi. parameters in I, J and L). Parameters which can be programmed separately in parameter record 2 are indicated by a between the coordinate and parameter name. See chap. 7.1. |  |

$\begin{array}{lll}\text { See result table in chap } 15 . & \text { 2) Only available when } \mathbf{D} 90 \neq 1 & \text { 3) Only available when } \mathbf{D} 99=0\end{array}$ Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1$ :extended or $\mathbf{A 1 0}=2$ :service. Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| A.. In | rter | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
|  | 0 : external; The active parameter record is selected via binary inputs BE1 to BE5. At least one of the parameters F30 to F35 must be set to 11 (parameter set-select) in both parameter records. Parameter record 1 is active when a LOW signal is present on BE. Parameter rec. 2 is active when a HIGH signal is present on BE. <br> 1: parameter set 1; The inverter uses parameter record 1. External selection is not possible. <br> 2: parameter set 2; The inverter uses parameter record 2. External selection is not possible. <br> Caution: Parameter A41 is only provided for testing purposes. It is not saved with $\mathbf{A 0 0}=1$. Use a BE or the E101 parameter (bus access) if you want to switch parameter records during operation. |  |
| A42. ${ }^{1)}$ | Copy parameter set 1>2: Copies parameter record 1 to parameter record 2. The old values of parameter record 2 are overwritten. The procedure is started when the value changes from 0 to 1 . <br> The result is always " 0 :error free." The new parameter assignment must be stored in non-volatile memory with A00. <br> 0: error free; |  |
| A43. ${ }^{\text {1) }}$ | Copy parameter set 2>1: Same as A42 except parameter record 2 is copied to parameter record 1 0: error free: |  |
| A50 | Tip: Only if $\mathbf{C 6 0}=2$ (run mode $\neq$ position). Permits commissioning with minimum circuiting of the control terminal as long as A51 is entered. <br> 0 : inactive; Normal operation <br> 1: active; The controller only requires a high signal on the "enable" input. All other binary control signals have no function when $\mathbf{C 6 0}<2$. The $\triangle$ and $\square$ keys can be used to accelerate the drive counterclockwise or clockwise to the speed set in A51. Since an enable is generated which has a higher priority than the additional enable, operation remains possible even when additional-enable = low via fieldbus. |  |
| A51 | Tip reference value: Only if $\mathbf{C 6 0} \neq 2$ (run mode $\neq$ position). Reference value for speed for commissioning without external circuiting of the control inputs. The "enable" input must be high! The current actual speed is shown on the right of the display. When $\mathbf{A} 50=1$ and $\mathbf{A 5 1}$ is in input mode (value flashing), A51 becomes active as continuous reference value. For behavior of enable and BEs, see A50. Value range in rpm: -6000 to 300 to 6000 | $\checkmark$ |
| A55 | Key hand function: Can be used to disable the MANUAL $\boxed{\boxed{\circ} \text { key on Controlbox for turning local operation }}$ on/off. For additional information, see Controlbox documentation (publ. no.: 441445). <br> 0 : inactive; 国 key has no function. <br> 1: local; key activates local operation. Device enabling is then handled exclusively by the keys "green I" $I^{\text {p }}$ and "red 0 " 0 . The 4 and keys can be used to move backward and forward in the status display. Active local operation and active enable are indicated by LEDs on Controlbox. The reference speed value results from A51 for speed mode and from I12 for POSI. <br> CAUTION: When local operation is disabled with the 00 key (LED goes off), the drive immediately switches back to the queued control signals (i.e., danger of unintentional startup!). |  |
| A80 | Serial address: Only if $\mathbf{A 1 0}=\mathbf{2}$. Address for communication via X3 with FDS Tool and with master via USS protocol (cf. documentation „USS link for POSIDRIVE ${ }^{\oplus}$ and POSIDYN ${ }^{\text {®u، }}$, pupl. no.:441564). <br> Value range: $\underline{0}$ to 31 |  |
| A82 | CAN-baudrate: Sets the baud rate for the CAN bus. Cf. CAN bus documentation publ. no.: 441562. <br> 0: $10 \mathrm{kBit} / \mathrm{s}$ <br> 1: $20 \mathrm{kBit} / \mathrm{s}$ <br> 2: $50 \mathrm{kBit} / \mathrm{s}$ <br> 4: $125 \mathrm{kBit} / \mathrm{s}$ <br> 6: $500 \mathrm{kBit} / \mathrm{s}$ <br> 8: $1000 \mathrm{kBit} / \mathrm{s}$ <br> 3: $100 \mathrm{kBit} / \mathrm{s}$ <br> 5: $250 \mathrm{kBit} / \mathrm{s}$ <br> 7: $800 \mathrm{kBit} / \mathrm{s}$ |  |
| A83 | Busaddress: Specifies the device address for use with the fieldbus (i.e., Kommubox). For permissible value range, see documentation of the applicable Kommubox. A83 has no effect on device programming via PC with FDS Tool or the RS 232 interface with the USS protocol. <br> Value range: $\underline{0}$ to 125 |  |
| A84 | Profibus baudrate: When the SDS is used with the PROFIBUS-DP option board, the baud rate found on the bus is indicated (!) here. Cf. PROFIBUS documentation publ. no.: 441535. |  |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set.

1) See result table in chap 15.12 2) Only available when $\mathbf{D} 90 \neq 1$
2) Only available when D99=0

Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| B.ı N | tor | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| B00• | Motor-type: Motor selection from the motor data base. The STÖBER system motor used is specified with $\mathbf{B 0 0}=61$ to $69 . \mathbf{B O O}=60$ (user defined) is used for special windings or motors of other manufacturers. <br> The EMC voltage constant must be entered in B02. <br> An "夫" on the display means that at least one of the parameters (B53, B64 and B65) differs from the default setting of the STÖBER motor data base. | $\checkmark$ |
| B02 | EMC-constant: Specifies the peak value of inducted voltage between two phases at 1000 rpm . Value range in V: 5 to 110 to 3000 | $\checkmark$ |
| B03 | Motor fan: Only if B00 > 60 (STÖBER motors). The thermally permissible motor torque is increased $\mathrm{i}^{2}$ t model of the motor). B03=1 thus also increases the torque limits since M-Max limits C03 and C04 are specified relative to motor standstill torque MO. To prevent overloading a gearbox after installing a motor fan retroactively, C03/C04 must be adjusted to the new M0. See catalog or name plate. <br> Q: inactive; <br> 1: active; | $\checkmark$ |
| B10 | Poles: Calculated from the nominal speed of the motor $\mathrm{p}=2 \times\left(\mathrm{f} \times 60 / \mathrm{n}_{\text {Nom }}\right.$ ). Internally, the controller works with frequencies. Correct speed indication requires entry of the number of poles. <br> Value range: 2 to $\underline{6}$ to 16 | $\checkmark$ |
| B11• | P-nominal: Nominal power as per nameplate Value range in $\mathrm{kW}: 0.12$ to (depends on type) | $\checkmark$ |
| B12 | I-nominal: Nominal current as per nameplate. Value range in A:0 to (depends on type) | $\checkmark$ |
| B13 | n-nominal: Nominal speed as per nameplate Value range in rpm: 0 to depends on type to 6000 | $\checkmark$ |
| B17 | M0 (standstill): Standstill torque M0 as shown on name plate. Reference value for M-max limits C03 and C04. Value range in Nm: 0 to (depends on type) to 327.67 | $\checkmark$ |
| B26• | Motor-encoder: B26 specifies which encoder input will be used for motor control. The encoder increments are specified with F36 or H22. Regardless of B26, the master encoder is set for synchronous operation (G20=1) with $\mathbf{G 2 7}$ and the POSI encoder ( $\mathbf{C 6 0}=2$ ) is set with $\mathbf{I 0 2}$. <br> 2: resolver (X40); Standard for STÖBER ES motors <br> 3: X41 (SinCos); Single and multi-turn, absolute-value encoders with sin/cos track | $\checkmark$ |
| B40 ${ }^{1)}$ | Phase test: <br> 0 : inactive; <br> 1: active; Tests motor symmetry in increments of $60^{\circ}$. The following points are checked. <br> - Connection of phases U, V and W <br> - Motor and resolver pole number <br> - Phase position of resolver or sin/cos encoder <br> - Symmetry of the winding resistors of the phases $\mathrm{U}, \mathrm{V}$ and W . If a winding resistor deviates by $\pm 10 \%$, the inverter reports "19:symmetry." <br> The function is started when the level on the input enable (X1.9) changes from low to high. Exiting the parameter requires another low signal on the enable. |  |
| B41. ${ }^{\text {1 }}$ | Autotuning: <br> 0: inactive; <br> 1: active; Winding resistors of the motor are measured. The function is started when the level on the input enable (X1.9) changes from low to high. Exiting the parameter requires another low signal on the enable. <br> $\mathbf{A} 00=1$ saves the measuring results in non-volatile memory. <br> $\mathbf{B O O}=60$, autotuning of the motor is essential! Important for optimum coordination between inverter and motor. <br> $\mathbf{B 0 0}=61$ to 69 , autotuning of the motor is not required. |  |
| B52 | L-motor: Inductivity Lu-v of the motor winding. Only enter for motors of other manufacturers. Value range in $\mathrm{mH}: 0.01$ to depend on type to 327.67 | $\checkmark$ |
| B53 | R1-motor: Stator resistance (Ru-v) of the motor winding. Only entered for non STÖBER motors. Value range in $\Omega:: 0.01$ to depends on type to 327.67 | $\checkmark$ |
| B64 | $\mathrm{Ki}-\mathrm{IQ}$ (torque): Integral gain of the torque controller. Value range in \%: 0 to depends on type to 400 | $\checkmark$ |
| B65 | Kp-IQ (torque): Proportional gain of the torque controller. Value range in \%: 0 to depends on type to 400 | $\checkmark$ |

The power pack must be turned off before these parameters can be changed.
Italics These parameters are sometimes not shown depending on which parameters are set.
See result table in chap $15 . \quad$ 2) Only available when $\mathbf{D 9 0} \neq 1$
3) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| C.. Machine |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| C00 | n-Min: Only if $\mathbf{C 6 0} \neq 2$ (run mode $\neq$ position). Minimum permissible speed. The speed refers to the motor shaft speed. Reference values less than $\mathrm{n}-\mathrm{Min}$ are ignored and raised to $\mathrm{n}-\mathrm{Min}$. <br> Value range in rpm: $\underline{0}$ to $\mathbf{C 0 1}$ | $\checkmark$ |
| C01 | n-Max: Maximum permissible speed. The speed refers to the motor shaft speed. Reference values over n -Max are ignored and limited to n-Max. <br> Value range in rpm: $\mathbf{C 0 0}$ to 3000 to 6000 | $\checkmark$ |
| C02• | Permitted. direction of rotat: Only if $\mathbf{C 6 0} \neq 2$ (run mode $\neq$ position). Determines the permissible direction of rotation. The direction of rotation can be specified via the binary inputs. <br> O: clockwise \& counter-clockwise; <br> 1: clockwise; <br> 2: counter-clockwise; | $\checkmark$ |
| C03 | M-Max 1: Maximum torque in \% of motor zero current. The active torque limit can be further reduced with an analog input (see $\mathbf{F} 25=2$ ). If the maximum torque is exceeded, the controller responds with the message "47:drive overload." See also remarks for C04. <br> Value range in \%: 0 to 150 to 400 (and any M-Max signal present on analog input-AE function "2:Torque limit") | $\checkmark$ |
| C04 | M-Max 2: Additional torque limit. You can switch between $\mathbf{C 0 3}$ and $\mathbf{C 0 4}$ with a binary input ( $\mathbf{F 3} . .=10$ :torque select). See chap. 9.2. <br> Remarks: Since $\mathbf{C 0 4}$ is always active for a quick stop, $\mathbf{C 0 4} \geq \mathbf{C 0 3}$ should usually apply! Value range in \%: 0 to 150 to 400 | $\checkmark$ |
| C30 | J-mach/J-motor: Ratio of the inertia of load to motor. This factor is effective for all control modes and is important for optimization between inverter and motor (i.e., dynamics). Entry is not mandatory. <br> Remarks: In winding mode, the effective inertia torque is calculated for C30 $\geq 1.5$ to the fourth power with the winding diameter for compensation of the acceleration torque. <br> The following applies: $J(\mathrm{D}-\mathrm{Min})=1.5^{*} \mathrm{~J}$-motor, $\mathrm{J}(\mathrm{D}-\mathrm{Max})=\mathrm{C30}{ }^{*} \mathrm{~J}$-motor. The torque supplied by the drive is increased so that tension remains constant and extra torque is available for acceleration. <br> Value range: 0 to 1000 | $\checkmark$ |
| C31 | n-controller Kp: Proportional gain of the speed controller. Remarks: In winding mode ( $\mathbf{G 1 0 > 0}$ ), the Kp gain with the winding diameter is quadratically reduced from C31 for D-Max down to C31*C35 for D-Min. <br> Value range in \%: 0 to $\underline{60}$ to 400 | $\checkmark$ |
| C32 | n-controller Ki: Integral gain of the speed controller. Reduce C32 when overswinging occurs in the target position. <br> Remarks: In winding mode ( $\mathbf{G 1 0}>0$ ), the Ki gain with the winding diameter is quadratically reduced from C32*C31 for D-Max down to C32*C31*C35 for D-Min. <br> Value range in \%: 0 to 30 to 400 | $\checkmark$ |
| C33 | n-RefVal low pass: Reference value smoothing. C33 should be increased for reference value noise, physical oscillation or large foreign masses. <br> Value range in msec: 0 to 2 to 3276.7 | $\checkmark$ |
| C34 | n-motor low pass: Smoothing of the motor speed. Value range in msec: 0.3 to (depends on type) to 3276.7 | $\checkmark$ |
| C35 | n-control. Kp standstill: <br> Without winders: C31 and C32 are multiplied by C35 as soon as the motor speed drops below C40. With winders: The formulas described under C31 and C32 apply. <br> Value range in \%: 5 to 100 | $\checkmark$ |
| C40 | n-window: If $\mathbf{F 0 0}=3$ (BA 2 as signal relay for " 3 :reference value-reached") or $\mathbf{F O 0}=2$ (BA 2 as signal contact for speed " 2 :standstill"), the reference value is considered achieved in a window of reference value $\pm \mathbf{C 4 0}$. Also applies to the other binary inputs. A halting brake is not activated as long as $[\mathrm{n}]>\mathrm{C40}$. Value range in rpm: 0 to 3 to 300 | $\checkmark$ |
| C41 | Operating range n-Min: Parameters C41 to C46 can be used to specify an operating area. An output (F00=6) can be used to signal that these values have been exceeded. All area monitoring procedures are performed at the same time. If area monitoring is not required, the minimum parameters must be set to the lower-limit values, and the maximum parameters must be set to the upper-limit values. Cf. chapter 9.3. When C49=0, operatingrange monitoring is suppressed when the motor is not powered and during acceleration/braking procedures. When C48=1, amount generation is activated. <br> Value range in rpm: 0 to $\mathbf{C 4 2}$ | $\checkmark$ |
| C42 | Operating range n-Max: See C41. Value range in rpm: C41 to 6000 | $\checkmark$ |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set.
1)
See result table in chap 15 . 2) Only available when $\mathbf{D} 90 \neq 1$
3) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A} 10=0$ ). For other parameters, select $\mathbf{A 1 0}=1$ :extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| C.. Machine |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| C43 | Operating range M-Min: See C41. Value range in \%: $\underline{0}$ to C44 | $\checkmark$ |
| C44 | Operating range $\mathbf{M}$-Max: See C41. Value range in \%: C43 to 400 | $\checkmark$ |
| C45 | Operating range X-Min.: See C41. Monitors range defined in C47. Value range in \%: -400 to 0 to C46 | $\checkmark$ |
| C46 | Operating range X-Max.: See C41. Monitors range defined in C47. Value range in \%: C45 to 400 | $\checkmark$ |
| C47 | Operating range C45/C46: Defines the range to be monitored.   <br> O: E01 P-motor; 5: E22 i2t-device; 10: E71 AE1-scaled; <br> 1: E02 M-motor; 6: E23 i2t-motor; 11: E72 AE2-scaled; <br> 2: E10 AE1-level; 7: E24 i2t-braking resistor; 12: E73 AE2-scaled 2; <br> 3: E11 AE2-level; 8: E62 actual M-Max; 13: inactive <br> 4: E16 analog-output1-level; 9: E65 PID-error; 14: E08 n-motor; (\% ref. to C01) | $\checkmark$ |
| C48 | Operating range of amount C47: <br> O: absolute; First, the amount is generated from the signal selected in C47. <br> Example: $\mathbf{C 4 7}=\mathrm{AE} 2 ; \mathbf{C 4 5}=30 \%$; $\mathbf{C 4 6}=80 \%$. The operating range is $-80 \%$ to $-30 \%$ and $+30 \%$ to $+80 \%$. <br> 1: range; The signal selected in C47 must be located in range C45 to C46. <br> Example: $\mathbf{C 4 7}=\mathrm{AE} 2, \mathbf{C 4 5}=-30 \%, \mathbf{C 4 6}=+10 \%$. The operating range is $-30 \%$ to $+10 \%$. | $\checkmark$ |
| C49 | Operating range accel\&ena: <br> Q: inactive; During acceleration or deactivated enable, the "operating range" signal for the binary outputs is set to "0"=ok. The three ranges are only monitored during stationary operation (compatible with device software V 4.4). <br> 1: active; The operating range is always monitored. | $\checkmark$ |
| C50 | Display function: Only if $\mathbf{C 6 0} \neq 2$ (operating mode $\neq$ position). Parameters $\mathbf{C 5 0}$ to $\mathbf{C 5 3}$ can be used to design the first line of the display as desired. See chapter 6.1. Eight characters are available for a number, and 8 characters are available for any unit. Display value = raw value/display factor. <br> Q: n2 \& I-motor; <br> 1: EOO I-motor; The inverter supplies the actual motor current in amperes as the raw value. <br> 2: E01 P-motor; The inverter supplies as the raw value the actual active power as a percentage of the nominal motor power. <br> 3: E02 M-motor; As the raw value, the inverter supplies the actual motor torque as a percentage of the nominal motor torque. <br> 4: E08 n-motor; The inverter supplies the actual speed in rpm as the raw value. | $\checkmark$ |
| C51 | Display factor: Only if $\mathbf{C 6 0}=2$. Raw value (C50) is divided by the value entered here. Value range: - 1000 to 1 to 1000 | $\checkmark$ |
| C52 | Display decimals: Only if $\mathbf{C 6 0}=\mathbf{2}$. Number of positions after the decimal point for the value in the display. Value range: 0 to 5 | $\checkmark$ |
| C53 | Display text: Only if $\mathbf{C 6 0} \neq 2$ (operating mode $\neq$ position) and $\mathbf{C} 50>0$. Text for customer-specific unit of measure in the operating display (e.g., "units/hour"). Maximum of 8 positions. Can only be entered with FDS Tool. | $\checkmark$ |
| C60• | Run mode <br> Q: torque; Specification of a bipolar torque reference value. Reference value processing on AE1 at 1 msec . <br> 1: speed; Speed reference value, conventional operating mode <br> 2: position; Position control activated. When enable signal on X1.9, the position controller is turned on, and the current position is maintained. If $\mathbf{C 6 0}=2$, group "D.. reference value") is not shown at all. <br> When the mode is switched from speed to position, the reference position is lost. <br> 3: postion extern; | $\checkmark$ |
| D.. Reference Value Group $\mathbf{D}$ is not shown in run mode $\mathbf{C 6 0 = 2}$ :position. |  | E |
| Para. No. | Description |  |
| D00 | Reference value accel: Acceleration ramp for analog reference value inputs. Is only used for specification of reference value via terminal strip X1 and motor potentiometer. <br> - Voltage, current via analog input 1 (X1.2 to 4) <br> - Frequency via binary input BE5 (X1.8 to 14) <br> - Motor potentiometer via the binary inputs (D90=1) <br> Value range in msec/3000 rpm: $\underline{0}$ to 30000 | $\checkmark$ |

$\begin{array}{lll}\text { See result table in chap } 15 . & \text { 2) Only available when } \mathbf{D} 90 \neq 1 & \text { 3) Only available when } \mathbf{D} 99=0\end{array}$ Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1$ :extended or $\mathbf{A 1 0}=2$ :service.

## 13. Parameter Description

## D.. Reference Value

Para. No. Description

| D01 |
| :--- |
|  |
| D02 ${ }^{2)}$ |

Reference value decel: Deceleration ramp for analog reference value inputs. Is only used for specification of reference value via terminal strip X1 and motor potentiometer.

- Voltage, current via analog input 1 (X1.2 to 4)
- Frequency via binary input BE5 (X1.8 to 14)
- Motor potentiometer via the binary inputs (D90=1)

Value range in msec/3000 rpm: $\underline{0}$ to 30000
D02 ${ }^{2)}$ Speed (max. ref. value): Parameters D02 to D05 can be used to specify as desired the relationship between analog reference value and speed with a reference value characteristic curve.
D02: Speed achieved with the maximum reference value (D03)
Value range in rpm: 0 to 3000 to 6000

|  | Value range in rpm: 0 to 3000 to 6000 |  |
| :---: | :---: | :---: |
| $D 03{ }^{2 ; 3)}$ | Reference value-Max.: Reference value to which the speed (max. RV - D02) is assigned. Percentage of the analog reference value ( $10 \mathrm{~V}=100 \%$ ) at which the maximum speed (D02) is achieved. Value range in \%: D05 to 100 | $\checkmark$ |
| D04 ${ }^{2 ; 3)}$ | n speed (min. ref. value): Speed achieved with minimum reference value (D05). Value range in rpm: 0 to 6000 | $\checkmark$ |
| D05 ${ }^{2 ; 3)}$ | Reference value-Min.: Reference value to which the speed (min. RV - D04) is assigned. Percentage of the analog reference value ( $10 \mathrm{~V}=100 \%$ ) at which the minimum speed ( D 04 ) is achieved. Value range in \%: $\underline{0}$ to D03 | $\checkmark$ |
| $D 06^{2 ; 3)}$ | Reference value offset: Corrects an offset on analog input 1 (X1.2 to 4 ). When the ref. value is 0 , the motor may not be permitted to rotate. If a revolution occurs anyway, this value must be entered with reversed sign as the offset (e.g., if param. E10 shows 1.3\%, D06 must be parameterized to $-1.3 \%$ ). The value range is $\pm 100 \%$. While the ref. value offset is being entered, the current value of the analog input is shown at the same time. Value range in \%: - 100 to 0 to 100 | $\checkmark$ |
| D07•2;3) | Reference value enable: When the minimum reference value (D05) is set to a value greater than $1 \%$, an enable can be derived from the reference value output. <br> Q: inactive; <br> $\overline{1}$ : active; An additional enable is derived from the reference value on analog input 1. If the reference value enable is high, the output is greater than or equal to the minimum reference value (D05). If the reference value enable is low, the output is less than the minimum reference value (D05). | $\checkmark$ |

$D 08^{2 ; 3)}$ Monitor reference value. Monitors reference value output. Monitors for wire break. Ref. value monitoring will only function if the minimum reference value specified in D05 is greater than or equal to $5 \%$ (D05 $\geq 5 \%$ ). O: inactive;
1: active; If the reference value output is $5 \%$ less than the minimum permissible reference value (D05), the inverter shows "43:RV wire brk."

| $D 09^{2 ; 3)}$ | $\begin{array}{l}\text { Fix reference value no.: Selection of a fixed reference value } \\ \underline{O}: \text { external selection via binary inputs and BE functions } R V \text {-select } 0 \text { to } 2\end{array}$ |
| :--- | :--- |

$\frac{0}{1}$ : external selection via binary inputs and BE functions $R V$-select 0 to
1 to 7 : fixed selection of fixed reference value. BE inputs are ignored.
D10 ${ }^{2 ; 3}$ Accel 1: Up to 7 fixed reference values/ramp records can be defined per parameter record. Selection is made via the binary inputs. At least one binary input must be programmed to reference value selector
(e.g., F31=1:RV-select0). The reference value selector is used to assign the fixed reference values or ramp records to the signals of the binary inputs. The result of the binary coding is shown in E60 (0 to 7). The ramp records (accel 1 to 7 / decel 1 to 7 ) are only active in connection with the assigned fixed reference values 1 to 7 . Accel 1: Acceleration time for ramp record 1 as related to 150 Hz .
Value range in msec/3000 rpm: 0 to $\underline{60}$ to 30000
D112;3) Decel 1: Deceleration time for ramp record 1 as related to 150 Hz .
Value range in msec/3000 rpm: 0 to 60 to 30000
$D 12^{2 ; 3)} \quad \begin{aligned} & \text { Fix reference value 1: Selection is made parallel } \\ & \text { inputs. Value range in rpm: }-6000 \text { to } 750 \text { to } 6000\end{aligned}$
$D 20^{2 ; 3)}$ Accel 2: Acceleration time for ramp rec. 2
as related to 150 Hz .
Value range in msec/3000 rpm: 0 to $\underline{90}$ to 30000

| No. | Accel | Decel | Reference Value |
| :---: | :---: | :---: | :---: |
| 0 | D00 | D01 | Analog, freq,.. |
| 1 | D10 | D11 | Fixed RV 1 |
| 2 | D20 | D21 | Fixed RV 2 |
| $\vdots$ | $\vdots$ | $\vdots$ | $\vdots$ |
| 7 | D70 | D71 | Fixed RV 7 |


|  |
| :--- |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |

## 13. Parameter Description

| D.ı Reference Value |  | Group $\mathbf{D}$ is not shown in run mode $\mathbf{C 6 0}=2$ :position. |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Para. No. | Description |  |  |  |  |
| D21 ${ }^{\text {2;3) }}$ | Decel 2: Deceleration time for ramp rec. 2 as related to 150 Hz . <br> Value range in msec/3000 rpm: 0 to 90 to 30000 <br> Fix reference value 2: Selection is made parallel to ramp rec. 2 (accel $2 /$ decel 2 ) via the binary inputs. <br> Value range in rpm: -6000 to 1500 to 6000 |  |  |  | $\checkmark$ |
| D22 ${ }^{2 ; 3)}$ |  |  |  |  | $\checkmark$ |
| D30 ${ }^{2 ; 3)}$ | Accel 3: Acceleration time for ramp rec. 3 as related to 150 Hz . Value range in $\mathrm{msec} / 3000 \mathrm{rpm}: 0$ to 120 to 30000 |  |  |  | $V$ |
| D31 ${ }^{2 ; 3)}$ | Decel 3: Deceleration time for ramp rec. 3 as related to 150 Hz . Value range in msec/3000 rpm: 0 to 120 to 30000 |  |  |  | $\checkmark$ |
| D32 ${ }^{2 ; 3)}$ | Fix reference value 3: See D12. <br> Value range in rpm: -6000 to 3000 to 6000 |  |  |  | $\checkmark$ |
| D40 ${ }^{2 ; 3)}$ | Accel 4: Acceleration time for ramp record 4 as related to 150 Hz . Value range in msec/3000 rpm: 0 to $\underline{5}$ to 30000 |  |  |  | $\checkmark$ |
| D41 ${ }^{2 ; 3)}$ | Decel 4: Deceleration time for ramp record 4 as related to 150 Hz . Value range in msec/3000 rpm: 0 to 5 to 30000 |  |  |  | $\checkmark$ |
| D42 ${ }^{2 ; 3)}$ | Fix reference value 4: See D12. <br> Value range in rpm: -6000 to 500 to 6000 |  |  |  | $\checkmark$ |
| $D 50{ }^{2 ; 3)}$ | Accel 5: Acceleration time for ramp record 5 as related to 150 Hz . Value range in msec/3000 rpm: 0 to 10 to 30000 |  |  |  | $\checkmark$ |
| D51 ${ }^{2 ; 3)}$ | Decel 5: Deceleration time for ramp record 5 as related to 150 Hz . Value range in msec/3000 rpm: 0 to 10 to 30000 |  |  |  | $\checkmark$ |
| D52 ${ }^{2 ; 3)}$ | Fix reference value 5: See D12. <br> Value range in rpm: -6000 to 1000 to 6000 |  |  |  | $\checkmark$ |
| D60 ${ }^{2 ; 3)}$ | Accel 6: Acceleration time for ramp record 6 as related to 150 Hz . Value range in msec/3000 rpm: 0 to $\underline{20}$ to 30000 |  |  |  | $\checkmark$ |
| D61 ${ }^{2 ; 3)}$ | Decel 6: Deceleration time for ramp record 6 as related to 150 Hz . Value range in msec/3000 rpm: 0 to $\underline{20}$ to 30000 |  |  |  | $\checkmark$ |
| D62 ${ }^{2 ; 3)}$ | Fix reference value 5: See D12. <br> Value range in rpm: -6000 to 2000 to 6000 |  |  |  | $\checkmark$ |
| D70 ${ }^{2 ; 3)}$ | Accel 7: Acceleration time for ramp record 7 as related to 150 Hz . Value range in msec/3000 rpm: 0 to $\underline{25}$ to 30000 |  |  |  | $\checkmark$ |
| D71 ${ }^{2 ; 3)}$ | Decel 7: Deceleration time for ramp record 7 as related to 150 Hz . Value range in msec/3000 rpm: 0 to $\underline{25}$ to 30000 |  |  |  | $\checkmark$ |
| D72 ${ }^{\text {;3) }}$ | Fix reference value 7: See D12. <br> Value range in rpm: -6000 to 2500 to 6000 |  |  |  | $\checkmark$ |
| D81 | Decel-quick: Quick stop ramp. Effective if a binary input is programmed to quick stop (F3..=9) or parameter F38>0. When a quick stop is triggered by the binary inputs, the drive is decelerated with the deceleration ramp set here. In position mode ( $\mathbf{C 6 0}=2$ ), quick stop is performed on ramp I11. <br> Value range in $\mathrm{msec} / 3000 \mathrm{rpm}: 0$ to $\underline{2}$ to 30000 |  |  |  | $\checkmark$ |
| D90. ${ }^{\text {3) }}$ | Reference value source: See block circuit diagram in chap. 19. <br> O: standard reference value; <br> 1: motor potentiometer; Two binary inputs can be used to simulate a "motor potentiometer." This requires that one binary input be programmed to "4:motorpoti up" and another binary input to "5:motorpoti dwn" <br> (e.g., F33=4 and F34=5). Only ramps D00 and D01 can change the speed. <br> 2: motor potentiometer+reference value; The ref. value for speed of the motor potentiometer function is added to the "standard" ref. value (i.e., analog input, fix D90=1, only the motor potentiometer ref. value is used. The ramps selected with and the motor potentiometer ref. value changes with RV-accel/RV-decel (i.e., D0 | BE3 <br> L <br> $H$ <br> L <br> $H$ <br> d refe <br> he bin <br> and D | BE4 <br> L <br> L <br> $H$ <br> H <br> nce valu <br> y input. | Motor Poti <br> RV <br> Constant <br> Larger <br> Smaller <br> 0 <br> wes). When <br> are used, | $\checkmark$ |
| D91 ${ }^{\text {3) }}$ | $\underline{0}$ : non-volatile; The reference value which was approached is retained both when the enable is removed and when the power is turned off/on. <br> 1: volatile; The reference value is set to 0 when the enable becomes low or the power for the drive is turned off. |  |  |  | $\checkmark$ |
| D92 | Negate reference value: See block circuit diagram in chap. 19. <br> Q: inactive; <br> 1: active; The reference value channel is negated. Corresponds to a reverse in direction of rotation. Not related to the selected reference value. |  |  |  | $\checkmark$ |

## 13. Parameter Description

## D.. Reference Value

| Para. No. | Description |
| :---: | :---: |
| D93 | RV-generator: For com O: inactive; Normal refer 1: active; $\pm$ A51 is specif |
| D94 | Ref. val. generator tim Value range in msec: 0 |
| D99 | Fast reference value: position controller). 0:inactive; Reference values, additional refe performed with 4 msec 1:active; The analog re controller uses 0.5 ms technology function) |
| E.. Display Values |  |


| Para. No. | Description |
| :---: | :---: |
| E00 | I-motor: Indicates the active motor current in amperes. |
| E01 | P-motor: Indicates the current power of the motor in kW and as a relative percentage in relation to nominal motor power. |
| E02 | M-motor: Indicates the current motor torque in Nm and as a relative percentage in relation to the motor zero torque MO. |
| E03 | DC-link-voltage: Indicates the current DC-link voltage. <br> Value range for single-phase inverters: 0 to 500 V Value range for three-phase inverters: 0 to 800 V |
| E06 | n-reference value: Only if $\mathbf{C 6 0}=1$ (speed). Indicates the current reference value for speed in relation to the motor shaft. |
| E07 | n-post-ramp: Indicates the current speed in relation to the motor shaft after the ramp generator. In position mode ( $\mathbf{C 6 0}=2$ ), the sum of "output controller position" + " $n$-speed feed forward" = "speed controller reference value" is indicated. Cf. chap. 10.7. |
| E08 | n-motor: Indicates the current motor speed. |
| E09 | Rotor position: Position of the motor shaft. With absolute-value encoders, the encoder position read from the encoder is entered when the device starts up. This position is available in all modes. The display shows whole motor revolutions with 3 positions after the decimal point. The full resolution of 20 bit/R is supplied via fieldbus. |
| E10 | AE1-level: Level of the signal present on analog input 1 ( X 1.2 to 4 ). $\pm 10 \mathrm{~V}$ is $100 \%$. |
| E11 | AE2-level: Level of the signal present on analog input 2 ( X 1.6 to X 1.7 ). $\pm 10 \mathrm{~V}$ is $100 \%$. |
| E16 | Analog-output1-level: Indicates the level on the analog output ( X 1.5 to 6 ). $\pm 10 \mathrm{~V}$ corresponds to $\pm 100 \%$. |
| E17 | Relay 1: Status of relay 1 (ready for operation). 0 : open; For meaning, see parameter F10. 1: closed; Ready for operation. |
| E18 | Relay 2: Status of BA 2. The function of BA 2 is specified with parameter F00. 0 : inactive; <br> 1: active; |
| E19 | BE15... BE1 \& enable: The status of the binary inputs including the option board is shown as a binary word. |
| E20 | Device utilization: Indicates the current load of the inverter in \%. 100\% corresponds to the nominal capacity of the inverter. |
| E21 | Motor utilization: Indicates the current load of the motor in \%. Reference value is the nominal motor current specified under B12. |
| E22 | i2t-device: Level of the thermal device model (i.e., $i^{2} t$ model). If utilization is $100 \%$, the fault message "39:tempDev.i2t" appears. |
| E23 | i2t-motor: Level of the thermal motor model (i.e., $i^{2} t$ model). 100\% corresponds to full utilization. The thermal model is based on the design data specified under group B (motor) (e.g., continuous operation (S1 operation)). |
| E24 | i2t-braking resistor: Level of the thermal braking resistor model (i.e., i ${ }^{2}$ t model). $100 \%$ corresponds to full utilization. The data of the braking resistor are specified with A20 to A23. |
| E25 | Device temperature: Current device temperature in ${ }^{\circ} \mathrm{C}$. |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set
1)
See result table in chap 15.
2) Only available when $\mathbf{D} 90 \neq 1$
3) Only available when D99=0

E
Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| E.. Display Values |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| E26 | Binary output 1: Only present when an option board exists (E54=1 or 2). |  |
| E27 | BA15..1\&Rel1: Status of all binary outputs as binary word. BA15 to BA1 are indicated from left to right. Relay 1 is indicated to the far right. |  |
| E28 | Analog-output-level: See E16. |  |
| E29 | n-ref. value raw: Speed reference value before the offset reference values and the reference value limitation. This is the master reference value for the winder and the free-wheeling reference value for synchronous running. |  |
| E30 | Run time: Indicates the current run time. Run time means that the inverter is connected to the power supply. |  |
| E31 | Enable time: Indicates the active time. Active time means that the motor is powered. |  |
| E32 | Energy counter: Indicates the total power consumption in kWh . |  |
| E33 | Vi-max-memorized value: The DC-link voltage is monitored continuously. The largest value measured is saved here in nonvolatile memory. This value can be reset with $\mathbf{A 3 7} \rightarrow 1$. |  |
| E34 | I-max-memorized value: The motor current is continuously monitored. The largest value measured is stored here in nonvolatile memory. This value can be reset with $\mathbf{A 3 7} \rightarrow 1$. |  |
| E35 | Tmin-memorized value: The temperature of the inverter is continuously monitored. The smallest value measured is stored here in non-volatile memory. This value can be reset with $\mathbf{A 3 7} \rightarrow 1$. |  |
| E36 | Tmax-memorized value: The temperature of the inverter is continuously monitored. The greatest value measured is stored here in non-volatile memory. This value can be reset with $\mathbf{A 3 7} \rightarrow 1$. |  |
| E37 | Pmin-memorized value: The active power of the drive is continuously monitored. The smallest value measured is stored here in non-volatile memory. This value can be reset with $\mathbf{A} 37 \rightarrow 1$. |  |
| E38 | Pmax-memorized value: The active power of the drive is continuously monitored. The largest value measured is stored here in non-volatile memory. This value can be reset with $\mathrm{A} 37 \rightarrow 1$. |  |
| E40 | Fault type: This parameter allows you to make a selection from archived faults. The inverter stores the last 10 faults in the order in which they occurred. The number of the fault is indicated at the top right. 1 indicates the latest fault, and 10 indicates the oldest fault. The type of fault is shown in plain text in the bottom line. Proceed as follows to select which of the 10 faults will be indicated. Press the \# key. The number ( 1 to 10) of the indicated fault flashes in the top line. The type of fault is indicated in plain text in the bottom line (e.g., "31:short/ground"). The arrow keys can then be used to select the desired fault number. |  |
| E41 | Fault time: The run time at the time of the selected fault is indicated. Selection is the same as for E40. |  |
| E42 | Fault count: Number of faults of the type of fault selected. Proceed as follows to select the type of fault. Press the \#key. A fault code and the fault appear in plain text (e.g., "31:short/ground") in the bottom line. The arrow keys can then be used to select the desired type of fault. The number of faults of this event is shown in the top line ( 0 to 65,535 ). |  |
| E45 | Control word: Control of Drivecom device state machine during fieldbus operation with Kommubox. |  |
| E46 | Status word: Status of the device during fieldbus operation with Kommubox. See fieldbus documentation. |  |
| E47 | n-field-bus: Reference value speed during fieldbus operation with Kommubox. |  |
| E50 | Device: Indication of the exact device type (e.g., SDS 4041). |  |
| E51 | Software-version: Software version of the inverter (e.g., V4.5). |  |
| E52 | Device-number: Number of the device from a manufactured series. Same as the number on the nameplate. |  |
| E53 | Variant-number |  |
| E54 | Option-board: Indication of the option board detected during initialization. <br> 10: none; <br> 11: SDP 4000 <br> 12: SEA 4000 <br> 13: $S E A+D P 4000$ |  |
| E55 | Identity-number: Number assigned by the user as desired from 0 to 65535 . Can only be write-accessed with FDS Tool or fieldbus. |  |
| E56 | Parameter set ident. 1: Indicates whether parameters in parameter record 1 were changed. Can be used to detect unauthorized manipulation of parameters. The parameter record ID does not change when the actions "B40 phase test" and "J04 Tech-in" are executed. <br> 0 : All values are default settings (A04=1). <br> 1: Specified value during initialization by FDS Tool. <br> 2 to 253: Customer specification/configuration with FDS Tool. Status without change. <br> 253: When parameters are changed via fieldbus or via the USS protocol, E56 and E57 $=254$ are set. <br> 254: At least one parameter value was changed with the keyboard (Controlbox or device)! |  |
| E57 | Parameter set ident. 2: Same as E56 but for parameter set 2. |  |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set.
$\begin{array}{lll}\text { 1) See result table in chap } 15 \text {. 2) Only available when } D 90 \neq 1 & \text { 3) Only available when } \mathbf{D} 99=0\end{array}$
1 Parameters which are included in the normal menu scope ( $\mathbf{A} 10=0$ ). For other parameters, select $\mathbf{A} 10=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| E.. Display Values |  |  |  |  |  |  |  | E |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Para. No. | Description |  |  |  |  |  |  |  |
| E60 | Reference value selector: Indicates the result of the binary coding of the fixed reference values with specification via binary inputs. At least one binary input must be parameterized for the reference value selector (F3..=1 to 3). The result of the binary coding is indicated with the digits 0 to 7 . A fixed reference value/ramp record is assigned to this result. A fixed reference value can also be specified directly with D09. However, E60 is not affected by D09. In position mode (C60=2), E60 indicates the result of process block specification with binary inputs ( $\mathbf{E 6 0}=0 \rightarrow$ proc. block1). | $\begin{array}{\|cc} \hline \text { RV select } \\ 2 & 1 \end{array}$ |  |  | E60 | Reference | Proc. Block |  |
|  |  | 2 | 0 | 0 | 0 | Analog, freq, | 1 |  |
|  |  | 0 | 0 | 1 | 1 | Fix. ref. val. 1 | 2 |  |
|  |  | 0 | 1 | 0 | 2 | Fix. ref. val. 2 | 3 |  |
|  |  | 0 | 1 | 1 | 3 | Fix. ref. val. 3 | 4 |  |
|  |  | 1 | 0 | 0 |  | Fix. ref. val. 4 | 5 |  |
|  |  | 1 | 0 | 1 | 5 | Fix. ref. val. 5 | 6 |  |
|  |  | 1 | 1 | 0 | 6 | Fix. ref. val.t 6 | 7 |  |
|  |  | 1 | 1 | 1 | 7 | Fix. ref. val. 7 | 8 |  |
| E61 | Additional ref. value: Current additional reference value to be added to the reference value being used. Can come from AE2 ( $\mathbf{F 2 0}=1$ ) or the fieldbus. See block circuit diagram in chap. 19. |  |  |  |  |  |  |  |
| E62 | Actual M-max: Currently effective M-Max as a minimum from M-Max 1 (C03), M-Max 2 (C04), and the torque resulting from the level on AE2, if the AE2 function is parameterized for torque limit ( $\mathbf{F 2 0}=2$ ) or power limit ( $\mathbf{F 2 0}=3$ ) or is from the fieldbus. |  |  |  |  |  |  |  |
| E63 | PID-controller limit: Only if $\mathbf{G 0 0}=1$ (i.e., PID controller is active). <br> 0 : inactive; <br> 1: active; The PID controller output is limited to G04 or G05. |  |  |  |  |  |  |  |
| E64 | Brake: 24 V voltage to brake control is output on plug connector X13. See also F08 (brake). <br> 0: closed; <br> 1: open; |  |  |  |  |  |  |  |
| E65 | PID control deviation: Difference of analog input 2 signal after smoothing, offset and factor and E121 PID reference. |  |  |  |  |  |  |  |
| E71 | AE1 scaled: AE1 signal after offset and factor. E71= (E10 + F26) * F27. Cf. block circuit diagram in chap. 19. |  |  |  |  |  |  |  |
| E72 | AE2 scaled: AE2 signal after smoothing, offset and factor. E72= (E11 + F21) * F22. |  |  |  |  |  |  |  |
| E73 | AE2 scaled 2: AE2 signal after smoothing, offset and factor as well as PID controller and offset 2. E72= (PID ( (E11 + F21) * F22) ) + F24. Cf. block circuit diagram in chap. 19. |  |  |  |  |  |  |  |
| E80 | Operating condition: Indicates the current operating state as shown by the operational display. Cf. chapter 16 (Operating States). Useful for fieldbus polling or serial remote control. |  |  |  |  |  |  |  |
| E81 | Event level: Indicates whether a current event is present. The type of event is indicated in E82. Useful for fieldbus polling or serial remote control. <br> 0 : inactive; No event is present. <br> 1: message; <br> 2. warning; <br> 3: fault; |  |  |  |  |  |  |  |
| E82 | Event name: Indicates the current event/fault. Cf. table in chapter 17. Useful for fieldbus polling or serial remote control. |  |  |  |  |  |  |  |
| E83 | Warning time: The time remaining until the fault is triggered is indicated for the active warnings. This time can be changed via FDS Tool. Useful for fieldbus polling or serial remote control. |  |  |  |  |  |  |  |
| E84 | Active parameter set: Indicates the current parameter record. Cf. chapter 9.4. Useful for fieldbus polling or serial remote control. <br> 1: parameter set 1; <br> 2: parameter set 2; |  |  |  |  |  |  |  |
| E100... | Parameters E100 and above are used to control and parameterize the inverters by fieldbus. For details, see the documentation of your fieldbus system. |  |  |  |  |  |  |  |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set

1) See result table in chap $15 . \quad 2$ ) Only available when $\mathbf{D} 90 \neq 1$
2) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1$ :extended or $\mathbf{A 1 0}=2$ :service.
E
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

| F.. Control Interface |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| F00 | BA2-function: Functions of binary output 2 (X1.17). <br> 1: inactive; <br> $\frac{1}{2}$ : standstill; Output active when speed $0 \mathrm{rpm} \pm \mathbf{C 4 0}$ is reached. <br> 3: reference value-reached; When $\mathbf{C 6 0}=1$ (speed mode): output is active when speed reference value is within $\pm \mathbf{C 4 0}$. When $\mathbf{C 6 0}=2$ (position mode), refVal-reached means "in position." The signal appears when reference value specification is concluded (i.e., end of ramp) and the actual position is located within target window $\pm \mathbf{2 2}$. The signal is not withdrawn until the next start command. When enable-off occurs, "RefValreached" is reset when window $\mathbf{I 2 2}$ is exited or $\mathbf{I 2 1}$ (following error) is exceeded. "RefVal-reached" then remains low. <br> This function cannot be used with process block changes via chaining "no stop" (J17=2). <br> 4: torque-limit; Output active when the active torque limit is reached. See E62. <br> 5: warning; Output active when a warning occurs. <br> 6: operation range; Output active when the defined operational range (C41 to C46) is exited. <br> 7: active parameter set; Only works when $\mathrm{F} 00=7$ is parameterized in both parameter records. BA2 inactive $=$ parameter record 1, BA2 active = parameter record 2. The signal arrives before the new parameter record takes effect and can be used, for example, for contacter control with a two-motor drive. Cf. chap. 9.4. <br> 8: electronic cam 1; Only applicable when $\mathbf{C 6 0}=2$ (position mode). Signal appears when the actual position is located between the limits $\mathbf{I 6 0}$ and $\mathbf{I 6 1}$. Useful for starting actions on other drives or modules. <br> 9: following error; Only applicable when $\mathbf{C 6 0}=2$. Maximum following error $\mathbf{I 2 1}$ was exceeded. The reaction to a following error (e.g., fault, warning, and so on) can be parameterized via FDS Tool. <br> 10: posiactive; Only applicable when $\mathbf{C 6 0}=2$. Signal only appears when positioning control is in the basic status "17:posi.active" (i.e., no process block and no chaining being processed). This can be used to signal the end of a chaining sequence, for example. <br> 11: PID-controller limit; Signals restriction of the output of the PID controller to the value G04. <br> 12: synchron difference; Signals that the maximum synchronous angle difference $\mathbf{G 2 4}$ has been exceeded. <br> 13: referenced; Only if $\mathbf{C} 60=2$ (position control). Output is high while the drive is being referenced <br> (i.e., reference point traversing has been successfully concluded). <br> 14: clockwise; Speed $n>0$. For zero crossing, hysteresis with C40. <br> 15: fault; A fault has occurred. <br> 16: inhibited; See "12:inhibited" mode in chap. 16. <br> 17: BE1; Route binary input to binary output. In addition to galvanic isolation, also used to read binary inputs via ASi bus. <br> 18: BE2; Cf. selection "17:BE1." <br> 19: Switch-memory 1; Output switch memory S1. Each of the "posi switching points" defined in Group N.. can be used to control 3 switch memories (S1, S2 and S3) simultaneously. <br> 20: Switch-memory 2; Output switch memory S2. <br> 21: Switch-memory 3; Output switch memory S3. <br> 22: ready for reference value; The drive is powered. Magnetization is established. Reference value can be specified. <br> 23: reference value-ackn.0; In position rmode: When no posi.start, posi.step or posi.next signal is queued, the $R V$-select signals are output inverted (monitoring with wire break detection). Otherwise active process block $\mathbf{1 8 2}$ is output. See time diagram in chap. 10.3. <br> 24: reference value-ackn.1; See "23:reference value-ackn.0." <br> 25: reference value-ackn.2; See "23:reference value-ackn.0." <br> 26: reference value-ackn.3; See "23:reference value-ackn.0." <br> 28: BE3; Cf. selection "17:BE1." <br> 29: BE4; <br> 30: BE5; <br> 31: BE6; <br> 32: parameters active; Low signal means internal parameter conversions not completed. Useful for the handshake with a higher level controller when converting parameter records, and similar. | $\checkmark$ |
| F03 | BA2 t-on: Causes a delay in switch-on of BA2. Can be combined with all functions of BA2. The related function must be present for at least $t$-on so that the BA 2 becomes active. Value range in sec: $\underline{0}$ to 5.024 | $\checkmark$ |
| F04 | BA2 $\mathbf{t}$-off: Causes a delay in switch-off of BA2. Can be combined with all functions of BA2. Value range in sec: $\underline{0}$ to 5.024 | $\checkmark$ |

## 13. Parameter Description

| F.. Control Interface |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| F05 | BA2 invert: Only if $\mathbf{F 0 0}>0$. Permits the BA2 output to be inverted. Inversion occurs after the function switch-on/switch-off delay (F04/F03). Can be combined with all functions of BA2. Value range: $\underline{0}$ to 1 | $\checkmark$ |
| F06 | t-brake release: Only if $\mathbf{F 0 8 = 1}$ (brake). Defines the amount of time the brake is released. $\mathbf{F 0 6}$ must be selected approximately 30 msec greater than the time $\mathrm{t}_{1}$ in section M of the STÖBER SMS catalog. When the enable is granted or the halt/quick stop signal is removed, startup is delayed by the time F06. Value range in sec:: 0 to 0.1 to 5.024 | $\checkmark$ |
| F07 | t-brake set: Only if $\mathrm{F08}=1$ (brake). Defines the time the brake is applied. $\mathbf{F 0 7}$ must be selected approximately 30 msec greater than the time $\mathrm{t}_{2}$ (SMS catalog). When the enable and halt/quick stop are removed, the drive still remains under control for the time F07. <br> Time $t_{1} \Rightarrow$ scanning time $t_{21} \triangle t_{21}$ varies with switching on AC or DC side! $\triangle$ Value range in sec: 0 to 0.052 to 5.024 | $\checkmark$ |
| F08 | Brake: Activates the controller of the 24 V brake by the inverter ( $\mathrm{B}+$ and B - terminals on the motor plug connector). $\underline{0}$ : inactive; The brake is always open ( 24 V on X 13 ) and is not controlled by the inverter. <br> 1: active; The brake is controlled by the inverter. After brake application time F07 expires, the motor is automatically depowered. For example, the brake is applied after the halt or quick-stop signal and when the enable is removed. | $\checkmark$ |
| F10 | Relay 1-function: Relay 1 is closed when the inverter is ready for operation (i.e., no malfunction and power-on). The opening of the relay can be controlled by scanning the status of relay 1 via parameter E17. <br> $\mathbf{0}$ : fault; Relay is open when a fault is queued. <br> 1: fault and warning; Relay open when a fault or warning is queued. <br> 2: fault and warning and message; Relay open when a fault, warning or message is queued. If auto-reset (A32=1) is active, the switching of the relay is suppressed until all auto-acknowledgment attempts have been exhausted. | $\checkmark$ |
| F19 | Quick stop end: Only if $\mathbf{C 6 0}=1$. F 19 is available starting with SV 4.5E. It specifies when the quick stop ramp can be concluded. <br> $\underline{\mathbf{0}}$ : standstil; With the rising edge of the quick stop signal (or removal of the enable for $\mathbf{F 3 8}>0$ ), the drive brakes down to standstill ("zero reached" message) even when the quick stop signal (or enable off) was only briefly queued. <br> 1: no stop; When the quick stop signal disappears or the enable returns, the drive immediately accelerates again to the current reference value. | $\checkmark$ |
| F20• | AE2-function: Function of analog input 2 (X1.6-X1.7). Caution: F20 $=$ F25 must be true. <br> 0 : inactive; <br> 1: additional reference value; Additional reference value input. Takes effect regardless of which operation input is selected. Is added to the running reference value (A30). 100\% control of AE2 is 100 Hz ( 3000 rpm for 4 -pole motor). Can be scaled with F21 and F22. <br> 2: torque-limit; Additional torque limit. $10 \mathrm{~V}=$ nominal motor torque. Active torque limit is the minimum from M-Max 1 (C03), M-Max 2 (C04) and the level on analog input 2. <br> 3: inactive; <br> 4: reference value-factor; The main reference value on AE1 is multiplied by the RV-factor ( $10 \mathrm{~V}=100 \%$ ). Also applicable to relative movements in $\mathbf{C 6 0}=2$ :Position mode. <br> 5: override; In positioning mode ( $\mathbf{C 6 0}=2$ ), the current positioning speed is changed via AE2 during traversing. $0 \mathrm{~V}=$ standstill! $10 \mathrm{~V}=$ programmed speed if $\mathbf{F 2 2}=100 \%$. During synchronous running $(\mathbf{G 2 0}>0)$, the speed ratio is changed via override. <br> 6: posi.offset; Only effective in positioning mode ( $\mathbf{C 6 0}=2$ ). An offset based on the voltage on AE2 is overlaid on the current reference value position. The ratio of path/voltage is specified with $\mathbf{I 7 0}$. <br> 7: winding diameter; Only effective if $\mathbf{G 1 0}=1$ (winding operation active). <br> 8: inactive; <br> 9: $\boldsymbol{n}$-Max; Limitation of the maximum speed via external voltage. <br> 10: reference value; Ref. value for speed or torque (AE1 is typically parameterized to "10:reference value"). <br> 11: PID-reference; Second input of the PID controller. This can be used to generate the standard deviation from two analog inputs. Cf. block circuit diagram in chap. 12.1. <br> 12: winder roller; Only effective for winder software ( $\mathbf{G 1 0 > 0}$ ) when the diameter is calculated by integration of the roller deviation ( $\mathbf{G 1 1}=2$ ). <br> 13: synchron offset; Only effective for synchronous running ( $\mathbf{G 2 0}>0$ ). The current slave position is overlaid with an angle offset corresponding to the voltage on the analog input. The angle/voltage ratio is specified in G38. Cf. block circuit diagram in chap. 18. <br> 14: synchron reference value; Speed precontrol during angle synchronous running ( $\mathbf{G 2 0}>0$ ) via external analog voltage. The slave can be supplied with the same speed reference value as the master. This minimizes dynamic angle deviation. Cf. block circuit diagram in chap. 18. | $\checkmark$ |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set.
Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| F.. Control Interface |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| F21 | AE2-offset: An offset on analog input 2 (X1.6-X1.7) can be corrected. To do this, jumper terminals X1.6 and X1.7. Then observe the AE2 level in parameter E11, and enter it with the reverse sign in parameter F21. For example, if parameter E11 indicates 1.3\%, F21 must be parameterized to $-1.3 \%$. Value range in \%: - 100 to $\underline{0}$ to 100 | $\checkmark$ |
| F22 | AE2-gain: The signal present on analog input 2 is added to the AE2 offset (F21) and then multiplied by this factor. Depending on F20, F22 is scaled as shown below. <br> F20 $=1 \Rightarrow 10 \mathrm{~V}=\mathbf{F} 22 \times \mathbf{C 0 1} \mathrm{n}-\mathrm{Max}$ <br> F20 $=2 \Rightarrow 10 \mathrm{~V}=\mathbf{F 2 2} \times$ nominal motor torque <br> F20 $=3 \Rightarrow 10 \mathrm{~V}=\mathbf{F 2 2} \times$ nominal motor power <br> F20 $=4 \Rightarrow 10 \mathrm{~V}=\mathbf{F} 22 \times$ multiplication with 1.0 <br> $\mathbf{F 2 0}=5 \Rightarrow 10 \mathrm{~V}=\mathbf{F 2 2} \times$ programmed positioning speed <br> $\mathbf{F 2 0}=6 \Rightarrow 10 \mathrm{~V}=\mathbf{F 2 2} \times$ path in $\mathbf{I 7 0}$ <br> F20 $=7 \Rightarrow 10 \mathrm{~V}=\mathbf{F 2 2} \times$ (D-Max $-\mathrm{D}-\mathrm{Min})$. See chapter 12.2.1. <br> F20 $=8 \Rightarrow 10 \mathrm{~V}=\mathbf{F} 22 \times$ nominal motor voltage <br> F20 $=9 \Rightarrow 10 \mathrm{~V}=\mathbf{F} 22 \times 100 \mathrm{~Hz}(3000 \mathrm{rpm})^{*}$ <br> $\mathbf{F 2 0}=10 \Rightarrow 10 \mathrm{~V}=\mathbf{F 2 2} \times 100 \%$ input of ref. val. curve <br> F20 $=11 \Rightarrow 10 \mathrm{~V}=\mathbf{F} 22 \times 100 \%$ <br> $\mathbf{F} 20=12 \Rightarrow 10 \mathrm{~V}=\mathbf{F 2 2} \times 100 \%$ for $\mathbf{G 1 1}=2$ <br> F20 $=13 \Rightarrow 10 \mathrm{~V}=\mathbf{F} 22 \times \mathbf{G 3 8}$ <br> F20=14 $\Rightarrow 10$ V = F22 $\times \mathbf{C 0 1}$ n-Max <br> Example: If $\mathbf{F 2 0}=1$ and $\mathbf{F 2 2}=50 \%$, the offset is 1500 rpm with 10 V and AE 2 . <br> Note: Even higher gains can be obtained by connecting the PID controller (G00=1). <br> Value range in \%: - 400 to 100 to 400 | $\checkmark$ |
| F23 | AE2-lowpass: Smoothing time constant. Useful for setting up control loops via AE2 (with or without a PID controller) to avoid high-frequency oscillation. <br> Caution: High time constants will make the control loop unstable. <br> Value range in msec: $\underline{0}$ to 10000 | $\checkmark$ |
| F24 | AE2-offset2: An additional offset after multiplication by F22. Used when the reference value is to be multiplied between $95 \%$ and $105 \%$ via AE2, for example. <br> Value range in \%: -400 to 0 to 400 | $\checkmark$ |
| F25 | AE1-function: See F20 AE2 function. Caution: Parameters F25 and F20 may not be equal! $\mathbf{F 2 5}=\mathbf{F 2 0}$. Value range: 0 to $\underline{10}$ to 14 | $\checkmark$ |
| F26 | AE1-offset: Cf. F21. <br> Value range in \%: -400 to 0 to 400 | $\checkmark$ |
| F27 | AE1-gain: Cf. F22. <br> Value range in \%: -400 to 100 to 400 | $\checkmark$ |
| F30 | BE-logic: Logical link when several BEs are programmed for the same function. Q: OR; <br> 1: AND; | $\checkmark$ |
| F31• | BE1-function: All binary inputs can be programmed as desired. Selection points 0 to 13 and those greater than 16 are identical for all binary inputs. If the same function is used by several BEs, F30 can be used to program a logical link. Inversion can be performed with F51 to F55 and F70 to F74. <br> 0 : inactive; <br> 1: reference value-select $\mathbf{0}$; Binary coded selection of fixed reference values or process blocks. The result of the reference value selection is indicated in E60. <br> 2: reference value-select 1; See above. <br> 3: reference value-select 2; See above. <br> 4: motorpoti up; If $\mathbf{D 9 0}=1$, two binary inputs can be used to simulate a motor potentiometer. One BE must be programmed as "4:Motorpoti up," and another BE must be programmed as "5:Motorpoti dwn." See also D90. <br> 5: motorpoti down; Same as "4:Motorpoti up." <br> 6: direction of rotation; Negation of the current reference value. <br> 7: additional enable; BE provides the function of an additional enable (i.e., a fault can also be acknowledged via this additional enable). The drive is not enabled unless a high signal is present on the "enable" input (X1.15) and the binary input. <br> 8: halt; With high signal, drive is slowed with the selected deceleration ramp. If $\mathrm{F08=1}$, the brake is then applied. Ramps: Analog RV specification/motor potentiometer: D01; fixed reference values: D12 to D72; Positioning: process block ramp. | $\checkmark$ |

## 13. Parameter Description

## F.. Control Interface

Para. No. Description
quick stop; When a rising edge occurs, the drive is slowed with the selected decel-quick ramp (D81). The brake is then applied if $\mathbf{F 0 8}=1$. A brief high pulse ( $\geq 4 \mathrm{msec}$ ) on the binary input is sufficient to trigger the quick stop. The quick stop cannot be terminated until speed C40 is passed below. Cf. also F38. Caution: Torque limit C04 is always active for quick stop.
10: torque select; Switches between the torque limits M-Max 1 (C03) and M-Max 2 (C04). Low signal $=$ M-Max 1 . High signal $=$ M-Max 2.
11: parameter set-select; A parameter record can only be selected via $B E$ if $\mathbf{A 4 1}=0$. This means that this binary input must be set to 11 in both parameter records. A low signal means that parameter record 1 is selected. A high signal means that parameter record 2 is selected. If $\mathbf{A 3 4}=0$ (autostart = inactive), the selected parameter record is not switched until the enable is removed. Cf. chap. 9.4.
12: extern fault; Permits fault messages of the periphery to be evaluated. The inverter evaluates a rising edge on the binary input and assumes "44:ext.fault." If several binary inputs are programmed for external fault, the rising edge can only be evaluated when a low signal is present on the other binary inputs programmed for "12:ext.fault."
13: fault reset; A fault which is no longer queued can be acknowledged with a rising edge. If several binary inputs are programmed for acknowledgment, the rising edge can only be evaluated when a low signal is present on the other binary inputs programmed with "13:faultReset."
14: Encoder signal B; Signal B of the incremental encoder (HTL) connected to BE1. This incremental encoder can be used as the master for the "electronic gear" function, for example.
15: stepMot.sign; Sign (direction) for a stepper motor simulation. The direction and frequency are specified on BE1 and BE2. The "electr. gear" function ensures that pulse processing is synchronous with speed or angle.
16: posi.step; 1 pulse ( $\mathrm{t} \geq 4 \mathrm{msec}$ ) starts a movement without interrupting the positioning procedure in progress. (-> I40) Primarily used for manual next-block procedures with process-block chaining. Cf. J17=0 and J01.
17: tip +; Manual traversing in the positive direction (tipping). HALT (selection 8) must be active. For manual speed with posi, see I12. When synchronous running is active ( $\mathbf{G 2 0}>0$ ), TIP+ or TIP- is used to add the current speed RV to the movement of the slave (angle offset). In speed operating mode (C60=1), the operational state "22:tip" appears on Controlbox and the motor stops as called for in "8:halt" ( $\mathrm{n}=0$ ).
18: tip -; Manual traversing in the negative direction.
19: posi.start; 1 pulse ( $\mathrm{t} \geq 4 \mathrm{msec}$ ) starts a movement. Terminates any positioning procedure in progress, and proceeds to the new destination (i.e., changing destination on the fly). Process block selection via BEs (RVselect) or J02.
20: posi.next; (With chained process blocks) 1 pulse ( $\mathrm{t} \geq 4 \mathrm{msec}$ ) interrupts the running process block and starts the next one. Important: A braking path may be defined there, for example. Evaluation of posi.next must be programmed specifically to the process blocks. Cf. $\mathbf{J 1 7}=3$ :posi.next. Otherwise the drive will not react to posi.next! If posi.next is parameterized to BE1, the signal is recorded without a time delay (i.e., high repetition accuracy).
21: stop +; Limit switch at the positive end of the traversing area. In position mode, the limit switch causes a fault.
22: stop -; Limit switch at the negative end of the traversing area. In speed mode, the direction of rotation is disabled.
23: reference input; Input for reference switch ( $130=0$ ).
24: start reference; Change in edge from low to high starts reference point traversing. See also $\mathbf{I} 37=0$.
25: teach-in; With a rising edge, the target position of the currently selected process block is overwritten with the present actual position and stored in non-volatile memory. See also J04.
26: disable PID-controller; PID controller on AE2 is disabled and the integrator is reset. Cf. chap. 12.1.
27: synchron free-run; The reference value for synchronous running is disconnected. The drive can be moved as desired via analog input AE1, for example. Speed adjustment is performed on the current reference value ramp (e.g., D00).
28: synchron reset; The angle deviation of synchronous-run control is reset. Cf. chap. 18.

## 29: set initial winding diameter;

30: RV-select 3; Binary-coded process block selection (5 bits = 1 to 32 ). Only for Posi.
See also 1:RV-select0 to $3: R V$-select2.
31: RV-select 4; Same as 30 but for Posi.

14: StepMot.sign; Frequency (impulses) for a stepper motor simulation. See also F31=15.
15: Encoder signal A: Signal A of the incremental encoder (HTL) connected to BE2.
Value range: 0 to $\underline{6}$ to 32

[^3]
## 13. Parameter Description

| F.. Control Interface |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| F33. | BE3-function: 0 to 13 and greater than 16. See F31. 15:inactive <br> 14:ccw V3.2; By programming F33=14 and F34=14, the direction of rotation of inverters can be simulated with software 3.2. | $\checkmark$ |
| F34• | BE4-function: 0 to 13 and greater than 16. See F31, 14:cw V3.2 (see F33), 15:inactive. Value range: 0 to 32 | $\checkmark$ |
| F35• | BE5-function: Additional input only available with option board SEA-4000. Selection via F31: BE1 function (exception: selection values 14 and 15 are not available here). Value range: $\underline{0}$ to 32 | $\checkmark$ |
| F36• | BE-increments: When an incremental encoder is used on BE1 and BE2, the number of increments per revolution must be entered here. If the incremental encoder is not mounted on the motor shaft, the step-down ratios may have to be considered. When external encoders (i.e., not on the motor) are used, remember F49. Value range in I/R: 30 to 1024 to 4096 | $\checkmark$ |
| F38 | Quick stop: Only if $\mathbf{C 6 0} \neq 2$ (mode $=$ position). $\mathbf{F 3 8}$ controls the automatic triggering of quick stop under certain operating conditions (brake on quick stop ramp D81). <br> O: inactive; Quick stop can only be triggered by the BE function "9:Quick stop." <br> 1: enable and clockwise/counter-clockwise; Important for use of two direction-of-rotation inputs (i.e., <br> clockwise and counterclockwise) on BE1 and BE2. Quick stop is triggered when BE1 is low and BE2 is low or when the enable is removed (also reference value enable D07 or additional enable via BE). <br> 2: fault and enable; In addition to the BE function "9:Quick stop," removal of the enable and "non-dangerous" faults (e.g., "46:Low voltage") causes the quick stop. <br> During positioning ( $\mathbf{C} 60=2$ ), quick stop is always triggered with $\mathbf{F 3 8}=2$. <br> When a quick stop is triggered by removing the enable, this ends after $\mathrm{t}=500 \mathrm{msec}+2.2$ * $\mathbf{C 0 1}$ * D81 (e.g., $\mathbf{C 0 1}=3000 \mathrm{rpm}$; D81 $=1000 \mathrm{msec} / 3000 \mathrm{rpm}$ is $\mathrm{t}=2.7 \mathrm{sec}$ ). | $\checkmark$ |
| F40 | Analog-output1-function: Functions of analog output X 1.8 . A voltage of $\pm 10 \mathrm{~V}$ is available on the terminals. <br> The resolution is 19.5 mV , and the scanning time is 4 msec . <br> Q: inactive; <br> 1: E00 I-motor; Indication of motor vector current, $10 \mathrm{~V}=$ nominal inverter current, bipolar (-10 V to +10 V ). <br> 2: E01 P-motor; Indication of motor active power, $10 \mathrm{~V}=$ nominal motor power (B11), bipolar. <br> 3: E02 M-motor; Indication of motor torque, $10 \mathrm{~V}=$ nominal motor torque, bipolar. <br> 4: E08 n-motor; Indication of motor speed, $10 \mathrm{~V}=\mathrm{n}$-max (C01), bipolar. <br> 5: G19 D-actual.; Indication of the diameter (winder), $10 \mathrm{~V}=\operatorname{Dmax}(\mathbf{G 1 3})$. <br> 6: winder actual tension; Output of current winder tension. F-tension =( M-act./M0 x (D-max/D-act.) 100\%. <br> 7: +10V; Fixed value (e.g., for powering a potentiometer). <br> 8: -10V; Fixed value (e.g., for powering a potentiometer). <br> 9: winder tension setpoint; Tension reference value for winding at torque limit ( $\mathbf{G 1 0}=2$ ). <br> 10: motor potent. value; $10 \mathrm{~V}=\mathrm{n}-\mathrm{Max}$ (C01), unipolar. <br> 11: E07 n-post-ramp; $10 \mathrm{~V}=\mathrm{n}$-Max (C01), bipolar. | $\checkmark$ |
| F41 | Analog-output1-offset: Offset of analog output X1.8. Value range in \%: -400 to $\underline{0}$ to 400 | $\checkmark$ |
| F42 | Analog-output1-gain: The raw value specified via F40 is offset with F41 and multiplied by factor F42. Example: If $\mathbf{F 4 0}=1$ and $\mathbf{F 4 2}=50 \%$, then 5 V on the analog output $=$ nominal inverter current. <br> Value range in \%: -400 to 100 to 400 | $\checkmark$ |
| F43 | Analog-output1-absolute: An absolute value (amount) is generated for the output signal. Q: inactive; <br> 1: active; | $\checkmark$ |
| F45 | Analog-output2-function: Function of analog output X1.9. For selection, see F40. Value range: 0 to 1 to 11 | $\checkmark$ |
| F46 | Analog-output2-offset: Offset for output X1.9. Cf. F41. Value range in \%: -400 to $\underline{0}$ to 400 | $\checkmark$ |
| F47 | Analog-output2-gain: Gain for output X1.9. Cf. F42. Value range in \%: - 400 to 50 to 400 | $\checkmark$ |

See result table in chap $15 . \quad 2$ 2) Only available when $\mathbf{D} 90 \neq 1$
3) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| F.. Control Interface |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| F49 | BE-gear ratio: Only if $\mathbf{C 6 0}=2$. Conversion of an external posi encoder to the motor shaft. <br> Caution: Parameter has no effect on the speed calculation for motor control (vector control). It is only used to convert the position of an external encoder. <br> The following must apply: F49 = number of motor revolutions/number of encoder revolutions. If this formula results in values over 32.767, the number of encoder increments in F36 must be divided by a suitable factor (e.g., 2). The result of the above formula is then also divided and entered in F49. See also chapter 10.11.2. Value range: -32.768 to 1 to 32.767 | $\checkmark$ |
| $\begin{aligned} & \text { F51 ... } \\ & \text { F55. } \end{aligned}$ | BE1-invert to BE5-invert <br> Q: inactive; No inversion. <br> 1: active; Input is inverted. Useful for the HALT signal or limit switch, for example. | $\checkmark$ |
| F60• | BE6-function: Additional inputs only available with option board SEA-4000. Selection via F31: BE1 function (exception: selection values 14 and 15 are not available here). <br> Value range: $\underline{0}$ to 32 | $\checkmark$ |
| F61• | BE7-function: See F60. Value range: $\underline{0}$ to 32 | $\checkmark$ |
| F62• | BE8-function: See F60. Value range: 0 to 32 | $\checkmark$ |
| F63• | BE9-function: See F60. Value range: $\underline{\underline{0}}$ to 32 | $\checkmark$ |
| F64• | BE10-function. See F60. Value range: 0 to 32 | $\checkmark$ |
| F65• | BE11-function: See F60. Value range: $\underline{0}$ to 32 | $\checkmark$ |
| F66• | BE12-function: See F60. Value range: 0 to 32 | $\checkmark$ |
| F67• | BE13-function: See F60. Value range: $\underline{0}$ to 32 | $\checkmark$ |
| F68• | BE14-function: See F60. Value range: $\underline{\underline{0}}$ to 32 | $\checkmark$ |
| $\begin{aligned} & F 70 \ldots \\ & F 78 . \end{aligned}$ | BE6-invert to BE14-invert: Cf. F51 to F55 (only available with option boards). <br> $\underline{0}$ : inactive; no inversion. <br> 1: active; Input is inverted. | $\checkmark$ |
| F80 | BA1-function: Function of binary output 1. <br> 1: inactive; <br> $\overline{2}$ to 32: Selection values in acc. w. parameter F00 (BA2-function). | $\checkmark$ |
| F81 | BA2-function: Selection values in acc. w. parameter F00. Value range: 0 to to 1 to 32 | $\checkmark$ |
| F82 | BA3-function: Selection values in acc. w. parameter F00. Only available with option boards. Value range: 1 to 32 | $\checkmark$ |
| F83 | BA4-function: Selection values in acc. w. parameter F00. Value range: 1 to 32 | $\checkmark$ |
| F84 | BA5-function: Selection values in acc. w. parameter F00. Value range: 1 to 32 | $\checkmark$ |
| F85 | BA6-function: Selection values in acc. w. parameter F00. Value range: 1 to 32 | $\checkmark$ |
| F86 | BA7-function: Selection values in acc. w. parameter F00. Value range: 1 to 32 | $\checkmark$ |
| G.. Technology |  | E |
| Para. No. | Description |  |
| G00• | PID-controller: Activates the PID controller on input AE2. Cf. chapter 12.1. Q: inactive; <br> 1: active: | $\checkmark$ |
| G01 | PID-controller Kp: Only if G00=1 (i.e., PID controller active). Loop gain. The total gain of the control loop is also affected by F22 (AE2 gain) in addition to G01. Cf. block circuit diagram in chap. 12.1. Value range: 0 to 0.3 to 100 | $\checkmark$ |
| G02 | PID-controller Ki: Only if G00=1 (i.e., PID controller active). Gain of I share in $1 / \mathrm{sec}$. Example: If G02=0.2 x $1 / \mathrm{sec}$, then a $20 \%$ higher constant input signal is integrated within one second. Value range in $1 / \mathrm{sec}$ : 0 to 10 | $\checkmark$ |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set.

1) $\begin{array}{lll}\text { See result table in chap } 15 . & \text { 2) Only available when } \mathbf{D} 90 \neq 1 & \text { 3) Only available when } \mathbf{D} 99=0\end{array}$ Parameters which are included in the normal menu scope ( $\mathbf{A} 10=0$ ). For other parameters, select $\mathbf{A 1 0}=1$ :extended or $\mathbf{A 1 0}=2:$ service.

## 13. Parameter Description

| G.. 1 | hnology | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| G03 | PID-controller Kd: Only if $\mathbf{G 0 0}=1$ (i.e., PID controller active). Gain of D share in msec. Value range in msec: 0 to 1000 | $\checkmark$ |
| G04 | PID-controller limit: Only if G00=1 (i.e., PID controller active). Adjuster-variable limit. For scaling, see F22. Asymmetric limits can be specified with G04 and G05 (e.g., from -10\% to +30\%). Upper and lower limit values are automatically (internally) sorted correctly. <br> Value range in \%: -400 to 400 | $\checkmark$ |
| G05 | PID-controller limit2: See G04. Value range in \%: - 400 to 400 | $\checkmark$ |
| G06 | PID-controller Kp2: Pure proportional gain of the PID controller. Effective parallel to I and D portion. Value range: 0 to 1 to 10 | $\checkmark$ |
| G10• | Winding operation: Activates the winding functions (speed reduction based on diameter). O: inactive; <br> $\overline{1}$ : $n$ mode; Speed adjustment in accordance with $n \sim 1 / D$. No effect on torque limit M-Max. <br> 2: M-Max mode; Maximum torque is reduced based on D-Act/D-Max. | $\checkmark$ |
| G11 | Diameter: Only if $\mathbf{G 1 0}=0$ (winding operation active). Specifies the type of diameter definition. <br> O: AE-measurement; Diameter sensor 0 to 10 V is connected to AE 2 . <br> 1: n-line/n-motor; For traction or compensating roller controllers. The diameter is calculated from the ratio of control speed to motor speed. The control speed (i.e., speed reference value) always refers to an empty reel (i.e., the smallest diameter). <br> 2: roller; The diameter is calculated with an overtravel ramp based on E122 (from fieldbus or via analog input function "12:winder roller"). If $\mathbf{E 1 2 2}>5 \%, \mathbf{G} 19$ is increased by ramp G16. If $\mathbf{E} 122<-5 \%, \mathbf{G 1 9}$ is decreased by ramp G16. Otherwise G19 remains constant. | $\checkmark$ |
| G12 | Min. winding diameter: Only if $\mathbf{G 1 0} \neq 0$ (winding operation active). Diameter of an empty reel. Value range in mm: 10 to 3000 | $\checkmark$ |
| G13 | Max. winding diameter: Only if $\mathbf{G 1 0}=0$ (winding operation active). Diameter of a full reel. Value range in mm: 10 to 100 to 3000 | $\checkmark$ |
| G14 | Begin. winding diameter: Only if $\mathbf{G 1 0}=0$ (winding operation active). Initial diameter. Must be set via a binary input with the function "29:wind.setD-ini" (F31 to F35). <br> Value range in $\mathrm{mm}: 10$ to 3000 | $\checkmark$ |
| G15 | Overdrive ref. value: Only if $\mathbf{G 1 0} \neq 0$ (winding operation active). $\mathbf{G 1 5}$ is added to the control reference value while winding at the torque limit $(\mathbf{G 1 0}=2)$ so that M -limit is triggered and the winding material remains taunt. Value range in rpm: -6000 to $\underline{0}$ to 6000 | $\checkmark$ |
| G16 | Diam.calculator ramp: Only when $\mathbf{G 1 0}>0$. Integration speed of the diameter calculation. G11=0: no function <br> G11=1: limitation of the integration speed for G19 <br> G11=2: ramp with which the diameter is changed when $-5 \%<\mathrm{E} 122<+5 \%$. <br> Value range in $\mathrm{mm} / \mathrm{sec}: 0$ to 10 to 100 | $\checkmark$ |
| G17 | Tension reduction: Only when G10>0. Reduction of tension as diameter increases. If min. diameter D-Min: winding with 100\% tension. Up to D-Max: tension reduced linearly up to ( $100 \%$ - G17). <br> Value range in \%: $\underline{0}$ to 100 | $\checkmark$ |
| G19 | Actual. winding diameter: Only if G10 $\neq 0$ (winding operation active). Indication of the current diameter. |  |
| G20• | Electronic gear: Only when $\mathbf{C 6 0}=1$ :speed. Activates the "electronic gear/synchronous running" function (chap. 11). See block circuit diagram in chap. 18. <br> O: inactive; <br> 1: speed synchron run; $\mathbf{G 2 4}$ limits the effect of the angle controllers. Cf. chap. 11.6. <br> 2: angle synchron run <br> 3: angle + save; Same as $\mathbf{G 2 0}=2$. However, each time enable-off occurs, the angle deviation is stored nonvolatilely and thus remains available after power off and on. See also G25. | $\checkmark$ |
| G21 | Speed master: Only if G20>0 (electronic gear active). The slave speed is calculated from nSlave=G22/G21 x nMaster. The increments of the incremental encoders are specified with F36 and H22. If $\mathbf{G 2 1}=1$ and $\mathbf{G 2 2}=2$, the slave is twice as fast as the master. We recommend selecting the number of increments for the master encoder (in acc. w. G27) as a power of 2 (e.g., 1024). <br> Value range: 1 to 2147483647 | $\checkmark$ |
| G22 | Speed slave: Only if G20>0 (electronic gear active). See G21. At a speed ratio of 1:1, G21=G22=1 must be parameterized. The direction of rotation of the slave can be changed with D92. <br> Value range: 1 to 2147483647 | $\checkmark$ |

See result table in chap 15.12 2) Only available when $\mathbf{D} 90 \neq 1$
3) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| G.. Technology |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| G23 | Kp synchron: Only if $\mathbf{G 2 0}>0$ (electronic gear active). Gain of the angle controller in $1 / \mathrm{sec}$. Typical values are 10 to 60 . G23 $=0$ activates speed synchronous running. The slave then no longer attempts to catch up with the master (e.g., after a blockage). Instead, the mathematically precise speed ratio is only ensured within the window $\pm \mathbf{G 2 4}$. When $\mathbf{G 2 3}=0$ and $\mathbf{G 2 4}=0$, the master encoder is only used as a speed reference value, and the ratio set in G22/G21 is not precisely maintained mathematically. Cf. chapter 11.6. <br> Value range in $1 / \mathrm{sec}$ : 0 to 30 to 100 | $\checkmark$ |
| G24 | Max. synchron. difference: Only if G20>0 (electronic gear active). Maximum angle of deviation between master and slave (following error). When this value is exceeded, a signal is generated on the output (cf. F00 or F80=12:synch.diff.), but no fault is triggered. This can be performed with external wiring and the input function "12:ext.fault" (F31 to F35). In G20=1:speed sync. mode, G24 limits the effect of the angle controller. This smooths the transition between pure speed synchronous and angle synchronous running. Value range in ${ }^{\circ}: 0$ to 3600 to 30000 | $\checkmark$ |
| G25 | Synchron reset: Only if $\mathbf{G 2 0}>0$. Defines conditions for resetting the current synchronous deviation. 0 : with $B E$; Reset only possible with BE function "28:SyncReset" (always possible). <br> 1: enable \& $B E$; Reset also with removal of the enable as well as with halt and quick stop. <br> 2: free run \& BE; Reset only with BE functions "27:syncFreeRun" and "28:SyncReset." <br> 3: enable \& free run \& BE; All methods above will cause a reset. <br> The synchronous deviation is always set to zero when the device is turned on. (Exception: G20=3. Reset is only performed when the stored deviation exceeds $5^{\circ}$ ). | $\checkmark$ |
| G26 | n -correction-Max: Only if $\mathbf{G 2 0}>0$ (electronic gear active). $\mathbf{G} 26$ limits the output of the angle controller. Important when large angle deviations must be reduced (e.g., when the free-run function is used). Value range in rpm: 0 to 3000 to 6000 | $\checkmark$ |
| G27 | Synchronous encoder: Only when $\mathbf{G 2 0}>0$. Signals of the master arrive over this interface. O: BE-encoder; Master signals are connected to binary inputs. <br> 1: X20; Master signals arrive over plug connector X20. <br> 2: X41; | $\checkmark$ |
| G28 | n-Master: Only when $\mathbf{G 2 0}>0$. For monitoring during commissioning. Speed of reference value encoder as per G27. <br> Value range in rpm: $\pm 6000$ |  |
| G29 | Synchron difference: Only if $\mathbf{G 2 0}>0$ (electronic gear active). Indication of the current synchronous deviation in degrees as related to the slave motor. $n$-controller $K i>0$ is required for a synchronous deviation near 0 . Value range in ${ }^{\circ}$ : -2147483648 to 0 to 2147483647 |  |
| G30 | Speed feed forward: Speed precontrol for synchronous running. When $\mathbf{G 3 0}=100 \%$, no following error is used when speed is constant (synchronous deviation is zero). With dynamic movements, G30 must be reduced (50 to $80 \%$ ). Otherwise the slave will overswing. <br> Value range in \%: 0 to 80 to 100 | $\checkmark$ |
| G31 | Reference direction: Only if $\mathbf{G 2 0}>0$. Starting direction to look for the reference point. Referencing searches for a reference cam. Cf. $130=0$ :Ref.input in positioning mode and the examples in chap. 10.6. Synchronous deviation is reset at the reference position. Other ways of resetting the synchronous deviation include the BE signal "28:Synchron Reset" or automatically with parameter G25. <br> Q: positive; <br> 1: negative: | $\checkmark$ |
| G32 | Reference speed fast: Only if G20>0. Speed for first phase of referencing (rough traversing). Value range in rpm: 0 to 1000 to 6000 | $\checkmark$ |
| G33 | Reference speed slow: Only if $\mathbf{G 2 0}>0$. Speed for final phase of referencing. Value range in rpm: 0 to 300 to 6000 | $\checkmark$ |
| G35 | Ref.encoder signal 0: Only if $\mathbf{G 2 0}>0$. Referencing to zero pulse of the motor encoder. Do not use for continuous mode with an odd-number gear ratio. <br> O: inactive; <br> 1: Motor-encoder; | $\checkmark$ |
| G38 | Synchronous offset: Only if $\mathbf{G 2 0} \mathbf{> 0}$. An offset distance based on the voltage on an analog input can be added to the current slave position. 10 V corresponds to the angle entered in G38. <br> Value range in ${ }^{\circ}:-214748364.8$ to 0 to 214748364.7 | $\checkmark$ |
| G40 | Static friction torque: Only if $\mathbf{G 1 0}>0$. Offset of the static friction (i.e., the friction (coulomb) independent of the speed). Value is converted to the motor shaft. <br> Value range in Nm: 0 to 327.67 | $\checkmark$ |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set

1) See result table in chap 15.12 2) Only available when $\mathbf{D} 90 \neq 1$
2) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1$ :extended or $\mathbf{A 1 0}=2:$ service.
E
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| G.. Technology |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| G41 | Dynamic friction torque: Only if $\mathbf{G 1 0}>0$. Offset of the speed-proportional friction. Value converted to the motor shaft at 1000 rpm . <br> Value range in Nm/1000 rpm: $\underline{0}$ to 327.67 | $\checkmark$ |
| G42 | T-dyn lowpass: Only if G10>0. Torque for acceleration/deceleration can be offset dynamically. The load/motor inertia ratio with a full reel (D-Max) must be entered for this in parameter C30. The acceleration portion to be offset is obtained by differentiation of the speed. G42 specifies the related smoothing time constant. Value range in msec: 0 to 50 to 10000 | $\checkmark$ |
| H., Encoder |  | E |
| Para. No. | Description |  |
| H20- | X20-function: See also description in chap. 5.4. <br> 0 : inactive; <br> 1: encoder simulation; Encoder simulation (TTL) output for a host controller. H21 specifies the number of pulses. <br> 2: encoder In; Connection of an incremental encoder with ROD signals. Wire-break monitoring active. <br> 3: stepmotor In ; Stepper motor input function. Track $A$ is the sign (low = positive, high = negative). Track B is the counting frequency (chapters 11.2 and 14.1). <br> 4: SSI simulation; Simulation of a multi-turn SSI encoder. Useful for an absolute-value encoder on X41 for motor control. The host controller can scan the absolute position in SSI format on X20. <br> 5: SSI master; Connection of an SSI encoder (absolute value encoder). Note: SSI encoders can be used as external encoders for POSI. The absolute position for POSI can only be read from the encoder when the device starts up. If $\mathbf{H 2 O}$ is reparameterized and $\mathbf{H 2 O}$ was or is now $\mathbf{H 2 O}=5$, this triggers fault " 37 :n-feedback" which cannot be acknowledged. Save values with A00, and turn basic device off/on. | $\checkmark$ |
| H21 |  | $\checkmark$ |
| H22 | X20-increments: Number of increments for incremental encoders. With SSI encoders, the range of H23 (X20 gear ratio) can be expanded with H22. See chap. 10.11. H22=1024 is the neutral setting. Value range in I/R: 30 to 1024 to 4096 | $\checkmark$ |
| H23 | X20-gear ratio: Only if $\mathbf{C 6 0}=2$. Conversion of an external posi encoder to the motor shaft. Caution: Parameter has no effect on the speed calculation for motor control (vector control). It is only used to convert the position of an external encoder. <br> The following must apply: $\mathbf{H 2 3}=$ number of motor revolutions/number of encoder revolutions. If this formula results in values over 32.767, the number of encoder increments in $\mathbf{H 2 2}$ must be divided by a suitable factor (e.g., 2). The result of the above formula is then also divided and entered in H23. See also chapter 10.11.2. With SSI encoders, the gear ratio is expanded by setting $\mathbf{H} 22$ to a value other than 1024. Value range: - 32.768 to 1 to 32.767 | $\checkmark$ |
| H24 | X20-zero-Pos.: Zero pulse shift during encoder simulation. Value range in ${ }^{\circ}: \underline{0}$ to 360 | $\checkmark$ |
| H31 | Resolver poles: Number of poles of the connected resolver. Typical values are 2 (standard for STÖBER) and 6. Value range: 2 to 16 | $\checkmark$ |
| H32 | Commutation-offset: Shifts the resolver zero position in comparison to the motor. Since STÖBER motors are set to $\mathbf{H} 32=0$ at the plant and tested, it is usually never necessary to change H32. If the B40 phase test results in an $\mathbf{H} 32$ value $>0$, this probably indicates a problem with the plug connectors or wiring. <br> Value range in ${ }^{\circ}: \underline{0}$ to 360 | $\checkmark$ |
| H40 | X41-function: See description in chapters 5.5 and 5.6. <br> Q: inactive; <br> 1: SinCos in; <br> 2: encoder in; <br> 3: stepMot in; | $\checkmark$ |
| H41 | X41-increments: The value is automatically determined with sin/cos encoders with EnDat ${ }^{\circledR}$ or Hiperface ${ }^{\circledR}$ interface. <br> Value range in I/R: 30 to 1024 to 4096 | $\checkmark$ |
| H42 | X41-gear ratio: See H23. Value range: -32.768 to 1 to 32.767 | $\checkmark$ |
| H60 | SSI-invert: Reverse sign for external SSI encoders. Wrong sign $\rightarrow$ unstable control loops. O: inactive; Clockwise revolution of motor shaft while facing the shaft (A side) counts as positive. 1: active; Clockwise revolution of motor shaft counts as negative. | $\checkmark$ |

[^4]
## 13. Parameter Description

| H.. Encoder |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| H61 | SSI-coding: Entry as per encoder data sheet. <br> O: gray; <br> 1: binary; | $\checkmark$ |
| H62 | SSI-data bits: Entry as per encoder data sheet. Value range: 24 to 25 | $\checkmark$ |
| I.. Posi. Machine |  | E |
| Para. No. | Description |  |
| Parameter record switchover cannot be used for the parameters of groups I, J,L and $\mathbf{N}$. To save memory space, they are only present once. |  |  |
| 100 | Position range: <br> 0 : limited; The area of movement is limited by end stops or similar mechanisms. Software limit switches $\mathbf{I 5 0}$ and 151 are active. <br> 1: unlimited; Unlimited movement (e.g., roller feed, rotary attachment or belt drive). No physical end positions. The position values repeat themselves cyclically with the circular length $\mathbf{I 0 1}$ (e.g., with a rotary attachment, you start at $0^{\circ}$ again after reaching $360^{\circ}$ ). When absolute positioning is used, the shortest path is selected unless only one direction of rotation is permitted. If a new destination is selected with posi.start while a movement is in progress, the old direction of rotation is retained. This function is known as the "rotary axis function." |  |
| 101 | Circular length: Only if $\mathbf{I O O = 1}$ (continuous axis). Maximum value for the actual position starting at which the position is counted from zero again (e.g., 360 degrees, modulo function). Value range in $105: 0$ to $\underline{360}$ to 31 bits ( $=2^{31}$ encoder increments after quadruple evaluation) |  |
| 102 | Posi.encoder: Position control is usually performed by the encoder mounted on the motor (I02=2). A second encoder (e.g., also linear measuring system) can be used to prevent slip or inaccuracies caused by the mechanics. Calibration of an external measuring system is described in chap. 10.11. <br> 0 : BE-encoder; HTL encoder on binary inputs. <br> 1: X20; Incremental or SSI encoder on input X20. <br> 2:motorEncoder, The encoder selected with B26 (motor feedback). <br> 3: X41; Encoder on connector X41 (sin/cos encoder for motor control or external TTL incremental encoder with regulated 5 V (voltage supply). |  |
| 103 | Direction optimization: Only if $\mathbf{I O O}=1$. Activate/deactivate automatic direction optimization for absolute process blocks ("rotary axis" function). In contrast to the permissible direction of revolution IO4>0, manual traversing is always permitted in both directions. Cf. chap. 10.5.2. <br> 0 : inactive; The direction of rotation depends on the sign of the destination position (e.g., J10). When the circular length is $\mathbf{1 0 1}=360^{\circ}$, the same position is approached with $\mathbf{J 1 0}=90^{\circ}$ and $\mathbf{J 2 0}=-270^{\circ}$ as with $90^{\circ}$. In the latter case, however, the direction of rotation is negative. <br> 1: active; Absolute process blocks are approached over the shortest path. |  |
| 104 | Move direction: Only if $\mathbf{I O O =}=1$. For continuous axes with only one physically permissible direction of movement. Movements in the wrong direction are answered with the message " 51 :Refused." Reference point traversing is performed completely with the speed I33. A reverse in direction does not occur. <br> O: positive \& negative; Both directions are permitted. <br> 1: positive; Only the positive direction is permitted. (Also applies to manual traversing.) <br> 2: negative; |  |
| 105 | Measure unit selection: The unit of measure does not yet mean a conversion. The numerical relationship between the physical mechanics and the indicated position is provided by $\mathbf{I 0 7}$ and $\mathbf{I 0 8}$. <br> 0: user (I09); The unit (4 characters) can be programmed as desired with FDS Tool. See also I09. <br> 1: increments; Encoder increment based on quadruple evaluation (i.e., quadrature pulses). <br> 2: degrees; <br> 3: millimeter; <br> 4: Inch; |  |
| 106 | Decimal digits: Number of decimal positions for the display and the entry of position reference values, speeds, accelerations and 107. <br> Important: Since a change in 106 will cause a shift in the decimal point and thus a change in the affected values, 106 should be programmed at the very beginning of commissioning. <br> Example: If 106 is reduced from 2 to 1 , values such as 12.27 mm are changed to 122.7 mm . The reason for this lies in the error-free rounding used by the positioning software. <br> Value range: 0 to $\underline{2}$ to 3 |  |

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set.

1) $\begin{array}{lll}\text { See result table in chap } 15 . & \text { 2) Only available when } \mathbf{D} 90 \neq 1 & \text { 3) Only available when } \mathbf{D} 99=0\end{array}$ Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2$ :service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| 1 | achine | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| 107 | Way/revolution numerator: For consideration of the gear ratio between machine and encoder I02. For external position measurement, cf. chap. 10.11. The number of decimal positions corresponds to $\mathbf{1 0 6}$. The posi. direction of rotation can be changed with negative values in 107. <br> Example: With a gear ratio of $\mathrm{i}=12.43$ and an angle specification on the drive shaft, then $\mathbf{I O 7}=360 \% 12.43$ $\mathrm{R}=28.96^{\circ} / \mathrm{R}$. For higher requirements, precision can be increased to almost any amount with 108. Example: $12.34567 \mathrm{~mm} / \mathrm{R}$ corresponds to $\mathbf{I O 7}=12345.67$ and $\mathbf{I O 8 = 1 0 0 0}$. Cf. also chap. 10.9. Value range in 105: -31 bits to 360 to 31 bits |  |
| 108 | Way/revolution denomin.: Counter 107 is divided by denominator I08. A mathematically precise gear ratio can thus also be calculated as a fraction (e.g., toothed gear box and toothed belt gear box). Important for external encoders that are not mounted on the motor shaft: One "encoder revolution" must be related to one motor revolution. <br> Value range in R: 1 to 31 bits |  |
| 109 | Measurement unit: Only if $\mathbf{I O 5 = 0}$ (user unit). Indication of the unit of measure defined by the user with FDS Tool. Up to 4 characters can be used. |  |
| 110 | Max. speed: Unit/sec. <br> Works simultaneously with the maximum motor speed in C01. The actual speed limit corresponds to the lower of the two parameters. When a higher feed speed is specified, the value is limited to $\mathbf{I 1 0}$ or $\mathbf{C 0 1}$ without causing the following error. <br> Value range in $105 / \mathrm{sec}$ : 0 to 10 to 31 bits |  |
| 111 | Max. acceleration: Units/sec ${ }^{2}$. With quick stop, the drive decelerates with I11. The acceleration for manual (I12) and reference point traversing ( $\mathbf{I} 33$, chap. 10.6) is also derived from I11 (i.e., each is $1 / 2$ of $\mathbf{I 1 1}$ ). Value range in $105 / \mathrm{sec}^{2}$ : 0 to 10 to 31 bits |  |
| 112 | Tip speed: Units/sec. Speed during manual operation (J03). As with all speeds, it can be changed via analog input ( $\mathbf{F} 20=5$ : Override). Acceleration during manual operation is $1 / 2$ of $\mathbf{I 1 1}$. Value range in $105 / \mathrm{sec}$ : 0 to 180 to 31 bits |  |
| 115 | Accel-override: Permits modification of the set ramps via AE2 (F20=5:Override). <br> Q: inactive; Ramps are not changed by override. Standard setting. <br> 1: active; Ramps are changed by override. Only recommended in exceptional cases (e.g., process block chaining without stop to generate simple $n(x)$ speed profiles. <br> Caution: The override value affects acceleration to the power of two. Danger of overload when override $>100 \%$. During ramps, changes in accel-override are only adjusted slowly in a background task. When Accel-Override ( $115=1$ ) is activated, the override value should not be decreased to $0 \%$. This would make the ramp infinitely long and the drive would never stop! |  |
| 116 | S-ramp: Reverse limitation through square sinus ramp. The generated acceleration profile is smoothed with the specified time constant. Positioning takes a little longer. <br> Value range in msec: 0 to 32767 |  |
| 119 | ENA-interrupting: In the default setting, removal of the enable causes the position controller to be reset (status "17:posi.active"). Particularly during continuous positioning, it is important that interrupted process blocks can be concluded after emergency off or similar. I19=1 offers particularly simple process block interruption. See also chap. 10.10. <br> O: inactive; Enable-off resets the positioning controller. <br> 1: active; Enable-off while process block is running causes status "23:interrupted." The interrupted process block is completed with Posi.step. Not possible for process blocks which are chained without Stop (J17=2). |  |
| 120 | Kv-factor: Gain of position controller (only P characteristic) with unit of $1 / \mathrm{sec}$. The Kv factor is also known as the speed gain. In actual practice, the Kv factor is sometimes specified with the unit $\mathrm{m} / \mathrm{min} / \mathrm{mm}$ which is exactly $0.06 \times 120$. See also block circuit diagram in chap. 10.7. <br> Value range in $1 / \mathrm{sec}$ : 0 to 30 to 100 |  |
| 121 | Max. following error: The output function ( $\mathbf{F 0 0}=9$ :follow.error) is activated when the following error defined in $\mathbf{1 2 1}$ is exceeded. FDS Tool can then be used to specify the desired reaction to the exceeded following error as a fault (default setting), warning or message. Value range in 105: 0 to 90 to 31 bits |  |
| 122 | Target window: Window for the output signal "reference value reached" (F00=3:RefVal-reached). $\mathbf{1 2 2}$ must be greater than I23!. <br> Value range in 105: 0 to 5 to 31 bits |  |
| 123 | Dead band pos. control. "Dead zone" of the position controller. Useful to prevent idle-state oscillation particularly when an external position encoder is used and there is reversal play in the mechanics. Cf. chap. 10.7. Caution: $\mathbf{1 2 3}$ Dead band must be smaller than target window I22! Value range in 105: $\underline{0}$ to 31 bits |  |

See result table in chap 15.
2) Only available when $\mathbf{D 9 0} \neq 1$
3) Only available when D99=0

Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2$ :service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| I.. Posi. Machine |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| 125 | Speed feed forward: Switches the calculated speed profile to the output of the position controller (chap. 10.7). If there is overswinging in the destination position, $\mathbf{I 2 5}$ and C32 must be reduced. <br> Value range in \%: 0 to 80 to 100 |  |
| 130 | Reference mode: For details on reference point traversing, see chapter 10.6. <br> $\underline{\mathbf{O}}$ : reference input; When searching for the reference point, the reference input is the determining factor (i.e., the BE function "23:Reference input" must be parameterized). <br> 1: stop input; The function of the reference input is fully covered by the stop switch (i.e., BE function "21:Stop +" or "22:Stop -" must be parameterized). When the starting direction is positive (I31=0), positive "Stop + " is required. Triggering the wrong stop switch causes a fault. <br> 2: encoder signal 0; Only of interest for drives without a gearbox. Used to align the motor shaft to a defined position. <br> 3: define home; BE function "24:Start ref." or J05 $\rightarrow 1$ immediately sets the actual position to $\mathbf{I} 34$ without performing an additional movement. For example, this can be used to set the actual position to zero at all times (enable must be active). <br> 4: posi.start; Each posi.start signal causes reference position I34 to be set. This can be used, for example, to indicate the actual distance as the current position with relative positioning and offset of the traversing path via analog signal ("1:additional reference value" and "4:reference value-factor"). |  |
| 131 | Reference direction: Initial direction to take when searching for the reference point. Cf. chapter 10.6. If only one direction is permitted ( $\mathbf{I O 4}>0$ ), the reference traversing direction depends on $\mathbf{I O 4}$ and not $\mathbf{I 3 1}$. O: positive; <br> 1: negative; |  |
| 132 | Reference speed fast: Speed for the first phase of reference point traversing (i.e., determining the rough area). Omitted when only one direction of rotation (104) is permitted. Only the slow speed (I33) is then used for this type of reference point traversing. <br> Value range in $105 / \mathrm{sec}$ : 0 to 90 to 31 bits |  |
| 133 | Reference speed slow: Speed for the final phase of reference point traversing. Switching between I32 and I33 is automatic. Cf. figures in chapter 10.6. The acceleration during reference point traversing is $\mathbf{I 1 1 / 2}$. Value range in $105 / \mathrm{sec}$ : 0 to 4.5 to 31 bits |  |
| 134 | Reference position: Value which is loaded to the reference point (e.g., provided by the reference switch or the stop switch) as the actual position. The drive stops after reference point traversing. The position is determined by brake ramp I11/2. Cf. chapter 10.6 . <br> Value range in 105: -31 bits to $\underline{0}$ to 31 bits |  |
| 135 | Ref.encoder signal $\mathbf{0}$ : Only if $\mathbf{I} 36=0$ and $\mathbf{I} \mathbf{3 0} \neq 2$. Referencing to zero pulse of an incremental encoder. <br> $\underline{O}$ : inactive; Zero pulse is not evaluated. Referencing to the edge of the stop or reference switch. Important for continuous axes with transmissions, for example. Also useful when there are not enough binary inputs and demands on accuracy are not high. <br> 1: motor encoder; <br> 2: posi encoder; In acc. w. parameter 102 (under preparation). |  |
| 136 | Continuous reference: Only for continuous axes ( $130=0$ ). Used for fully automatic compensation of slip or inexact gear ratio. After the reference points are traversed for the first time, actual position 180 is always overwritten with reference position I34 each time the reference switch is passed over in direction I31 (but only in this direction!). Since the path which is still to be traversed is corrected, the axis is able to perform any number of relative movements in one direction without drifting, even when drives have slip. If the reference switch is connected to BE3, the signal is processed immediately. <br> Remember: When $\mathbf{I} 36=1$, the other edge of the reference switch is evaluated than the one for $\mathbf{I} 36=0$ during reference point traversing. Circular length $\mathbf{I 0 1}$ must be as close as possible to the path between two reference signals (e.g., after one belt rotation, the same position must be indicated). Check actual position 180 during a rotation with $\mathbf{I} \mathbf{3 6}=0$, and adjust $\mathbf{I O 7}$ if necessary. The distance per rotation $\mathbf{I O 7}$ must always be rounded to the next higher number to prevent undesired counterclockwise offsets. The reference switch should not be triggered during a deceleration ramp since a negative offset would cause a counterclockwise movement. <br> Important: Target window $\mathbf{I 2 2}$ must be greater than the maximum physical inaccuracy! <br> Q: inactive; <br> 1: active |  |
| 137 | Power-on reference: Automatic reference point traversing after power-on. <br> Q: inactive; <br> 1: posi.start; After power-on, the inverter assumes operating mode "24:ref.wait." The first posi.start or posi.step signal starts the reference point traversing procedure. <br> 2: automatic; Reference point traversing is started automatically as soon as the enable appears. |  |

## 13. Parameter Description

| I.. Posi. Machine |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| 138 | Reference block: Number of the process block (i.e., 1 to 32 ) which is to be automatically started at the end of reference point traversing. This can be used to put the drive into a defined position after the reference points have been traversed. <br> $\underline{0}$ : standstill. No automatic start. <br> 1 to 32: Number of the process block to be executed. |  |
| 140 | Posi.-step memory: Helpful during relative positioning of continuous axes. <br> O: inactive; Posi.step signals during a movement are ignored. <br> 1: no stop; Posi.step signals which arrive during a movement cause the current destination position to be changed immediately. The process block specified by the reference block or, if no reference block is defined, the currently selected process block takes over. Example: Two additional posi.step signals arrive during a relative movement of 100 mm . The drive then moves precisely 300 mm without stopping. |  |
| 150 | Software-stop -: Only if $\mathbf{1 0 0}=0$ (limited position range). Effective only when axis is referenced. Positioning control rejects traversing jobs outside the software limit switches (message "51:Refused"). Manual-traversing and continuous process blocks are stopped at the software stops. <br> Caution: Software stops do nothing to compensate when the permissible position range is exceeded due to a change on the fly to a process block with slower ramps! Value range in 105: - -31 bits to 10000000 to 31 bits |  |
| 151 | Software-stop +: Only if $\mathbf{I O O}=0$ (limited position range). Effective only when axis is referenced. Value range in 105: -31 bits to 10000000 to 31 bits |  |
| 160 | Electronic cam 1 begin: In the positioning area between $\mathbf{I 6 0}$ and I61, the el.cam signal ( $\mathbf{F 0 0}=8$ ) becomes high. "Electronic cam" only functions in the referenced state. Cf. also the related function "operating range" in chapter 9.3. <br> Value range in 105: -31 bits to 0 to 31 bits |  |
| 161 | Electronic cam 1 end: See $\mathbf{1 6 0}$. <br> Value range in 105: -31 bits to 100 to 31 bits |  |
| 170 | Position-offset: A correction path corresponding to the voltage on AE2 can be added to the current reference value position ( $\mathbf{F 2 0}=6$ ). 10 V corresponds to the path specified in $\mathbf{I 7 0}$. Useful, for example, for creating complicated $\mathrm{x}(\mathrm{t})$ profiles which are generated by a PC as voltage. After activation of the inverter (i.e., enable), the current offset value is approached at the manual speed I12. The reference value from AE2 is then supplied without restrictions, and the AE2 low pass can be used for smoothing. <br> Value range in 105: $\underline{0}$ to 31 bits |  |
| 180 | Actual position: Read only. Indication of the actual position. Value range in 105: $\pm 31$ bits |  |
| 181 | Target position: Read only. Indication of the current reference value position. Value range in 105: $\pm 31$ bits |  |
| 182 | Active process block: Read only. Indication of the currently active block during block processing (traverse, wait) and during standstill at a process block position. The approached process block is indicated in $\mathbf{8 2}$ as long as the "RV reached" signal (i.e., in position) is present. When the drive in not in a process block position (e.g., after power on, manual traversing or termination of a movement), I82=0 applies. <br> When $182>0$, the signals "23: reference value-ackn. 0 " to "27: reference value-ackn. 4 " can indicate the active process block in binary coded format ("000" for process block 1 - i.e., $\mathbf{1 8 2 = 1}$ ). Cf. chap. 10.3. |  |
| 183 | Selected process block: Read only. Indication of the block selected via binary inputs or J02. This process block would be executed with the posi.start signal. Cf. also chap. 10.3 and $\mathbf{F 0 0}=23$. |  |
| 184 | Following error: Read only. Indication of the current position deviation. Cf. I21 and F00=9. Value range in I05: $\pm 31$ bits |  |
| 185 | In position: Read only. Indication of output signal F00=3:refVal-reached. 0 : inactive; Drive moving or destination position not reached. <br> 1: active: See output signal $\mathbf{F 0 0}=3$ :refVal-reached and $\mathbf{I} 22$ target window. |  |
| 186 | Referenced: Read only. Indication of output signal "13:referenced." For reference point traversing, see chap. 10.6. <br> 0 : inactive; Drive not referenced. No absolute positioning possible. <br> 1: active; Drive referenced. |  |
| 187 | Electronic cam 1: Read only. Indication of output signal "8:electronic cam 1." 0: inactive; Current position is outside $\mathbf{1 6 0}$ and $\mathbf{I 6 1}$. <br> 1: active: Current position is within 160 and 161. |  |
| 188 | Speed: Read only. Indication of the current reference value of the positioning speed with unit. Cf. chap. 10.7. Value range in $105 / \mathrm{sec}: \pm 31$ bits |  |

See result table in chap 15.
2) Only available when $\mathbf{D 9 0} \neq 1$
3) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A} 10=0$ ). For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

## J.. Posi. Command (Process Blocks)

| No. | Description |
| :---: | :---: |
| J00 | Posi.start: $0 \rightarrow 1$. Starts the currently selected process block. The block is selected via binary inputs ( $R V$-select 0 to 2) or J02. Since posi.start interrupts positioning procedures in progress, it has the highest priority. The J00 parameter corresponds to the BE function "19:posi.start." |
| J01 | Posi.step: $0 \rightarrow 1$. With process block chaining, posi.step is used to start the next programmed block if this is not started automatically (e.g., via $\mathbf{J 1 7}=1$ :with delay). This is done without regard to the RV-select inputs, for example. In operating state "17:posi.active," (standstill, no process block being processed), posi.step starts the currently selected process block the same as posi.start (see above). Posi.step never interrupts a running movement (exception: $\mathbf{1 4 0 = 1}$ ). Delays between process blocks ( $\mathbf{J 1 8}$ ) are prematurely concluded by posi.step. If a movement is interrupted (operating state "23:interrupt."), posi.step completes the interrupted process block. |
| J02 | Process block number: Selection of the process block which can be started at all times with posi.start. $\underline{0}$ : external selection via binary inputs and the BE functions $\mathbf{F 3 1 = R V}$-select 0 to 4 . See also $\mathbf{I 8 3}$. 1 to 32: fixed selection of the process block. RV-select signals are ignored. |
| J03 | Tip-mode: Manual operation via the device keyboard. See also F31=17 and F31=18. 0 : inactive; <br> 1: active; The drive can be positioned with the $\triangle$ and $\square$ keys. |
| J04 | Teach-in: $0 \rightarrow 1$ starts the action (i.e., triggered manually). The current actual position is used as the destination of the currently selected process block and stored non-volatilely. Example: Normally, the desired position is approached manually and then accepted with teach-in. See also $\mathbf{F 3 1}=25$. |
| J05 | Start reference: $0 \rightarrow 1$ starts the action (i.e., triggered manually). Reference point traversing can also be started via a binary input or automatically after power-on. See $\mathbf{I 3 7}$ and chapter 10.6 and $\mathbf{F 3 1 = 2 4}$. |
| J10 | Position: Position specification. The value can also be changed during traversing, but the change does not take effect until the next posi.start command (if internal conversion has been concluded). Cf. $\mathbf{F 0 0}=32$. <br> Value range in 105: -31 bits to 0 to 31 bits |
| J11 | Position mode: There are 4 modes. Cf. chapter 10.4. <br> Q: relative; <br> 1: absolute; <br> 2: endless positive; With "continuous" position modes, destination position J10 can be disregarded. <br> 3: endless negative; |
| J12 | Speed: Unit/sec. Caution: If you enter a value greater than the maximum speed I10 in J12, the actual traveling speed is limited to I10. <br> Value range in $105 / \mathrm{sec}$ : 0 to 1000 to 31 bits |
| J13 | Accel: Acceleration, unit/sec ${ }^{2}$. Caution: If the values $\mathbf{J 1 3}$ and $\mathbf{J 1 4}$ exceed the maximum acceleration I11, acceleration during movement is limited to I11. Up to software version 4.5: If the direction of rotation must be changed during a change in process blocks on the fly, the entire reversal procedure is performed with the Accel ramp (J13). <br> Value range in $105 / \mathrm{sec}^{2}: 0$ to 1000 to 31 bits |
| J14 | Decel: Deceleration, unit/sec ${ }^{2}$. Value range in $105 / \mathrm{sec}^{2}: 0$ to 1000 to 31 bits |
| J15 | Repeat number: Only available if $\mathrm{J} 11=0:$ relative. <br> If necessary, a relative movement can be repeated several times based on the value $\mathbf{J 1 5}$. With $\mathbf{J 1 7}=0$, posi.step is waited for after each partial movement. With $\mathbf{J 1 7}=1$, the partial movements are run through automatically. Delay J18 is inserted between the movements. J15=0 means no repetition (i.e., one single movement). Value range: $\underline{0}$ to 254 |

J16 Next block: Chaining of process blocks. Specification of a process block to which a jump is to be made at the end of the movement or after a posi.next signal. 0 : stop; No process block chaining. 1 to 32: Number of the next process block. Cf. chapter 10.8.
$\mathbf{J} 17 \quad$ Next start: Only if $\mathbf{J} 15 \neq 0$ or $\mathbf{J 1 6} \neq 0$. $\mathbf{J 1 7}$ defines when and how the branch is made to next block $\mathbf{J 1 6}$.
O: posi.step; Continued movement via posi.step function (rising edge). Cf. J01.
1: with delay; Automatic continued movement after delay J18 expires. In contrast to J17=2, an intermediate stop is also always performed with $\mathbf{J 1 8}=0$ sec. Delays between process blocks ( $\mathbf{J 1 8}$ ) are prematurely concluded by posi.step.
2: no stop; When the reference position reaches the target position J10, the speed is adjusted without halting (on-the-fly process block change without intermediate stop!). Drive travels to J 10 without braking and then changes to process block J16. Also useful for generating $\mathrm{n}(\mathrm{x})$ speed profiles with support points in up to 8 positions. Cf. I15, chapter 10.8, example 4. When process blocks are terminated with HALT of enable off, resumption of the terminated movement is not possible with Posi.Step.

- The power pack must be turned off before these parameters can be changed.

Italics These parameters are sometimes not shown depending on which parameters are set.

1) See result table in chap $15 . \quad$ 2) Only available when D90 $=1$
2) Only available when D99=0

Parameters which are included in the normal menu scope ( $\mathbf{A} 10=0$ ). For other parameters, select $\mathbf{A 1 0}=1$ :extended or $\mathbf{A 1 0}=2:$ service.
Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

| J.. Posi. Command (Process Blocks) |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
|  | 3: Posi.next; The block change is performed on the fly with the posi.next function. If $\mathbf{J 1 7} \neq 3$, posi.next has no effect. See also example 3 in chap. 10.8. <br> If the next block is reative, it refers to the actual position at the time the process block changed. <br> 4: Operation range; The block change is performed on the fly when the operating range ( $\mathbf{C 4 1}$ to $\mathbf{C 4 6}$ ) is exited. Compare example 7 (press/screw) in chapter 10.9. <br> If the next block is reative, it refers to the actual position at the time the process block changed. <br> When a block change is performed on the fly without intermediate stop ( $\mathbf{J} 17=2,3,4$ ), no refVal-reached signal (in position) is generated. |  |
| J18 | Delay: Parameter only effective if $\mathbf{J} \mathbf{1 5} \neq 0$ or $\mathbf{J} \mathbf{1 6} \neq 0$ and $\mathbf{J 1 7}=1$. Otherwise not shown. <br> Delay before the repetition of relative movements $(\mathbf{J} 15 \neq 0)$ or before automatic change to the next record ( $\mathrm{J} 17=1$ :with delay). After expiration of the delay time, movement is automatically resumed. A delay can be terminated (i.e., shortened) with the posi.step signal (rising edge). <br> Value range in sec: $\underline{0}$ to 65.535 |  |

$\Rightarrow$ The layout of process block nos. 2 to 8 is identical. Process block no. 2 is located in $\mathbf{J} \mathbf{2 0} \mathbf{-} \mathbf{J 2 8}$, process block no. 3 in J30-J38, etc.

| L.. Posi. Command 2 (Extended Process Block Parameters) |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| L10 | Brake: Definition for process block no. 1. Only if $\mathbf{F 0 8 = 1}$. Process block-related brake control (e.g., for lifting systems). After reaching destination position J10, you can apply the brake. <br> $\underline{0}$ : inactive; Destination position is held by the motor (i.e., position control). Brake is only applied when enable, halt, quick stop or fault is missing. <br> 1: active; After the destination position is reached, the brake is automatically applied. The next start command is delayed by the time F06 (brake release). |  |
| L11 | Switch A: Selection of the first switching point for process block no. 1. Up to two switching points ("switch A" and "switch B") can be used in each process block. Each of the four switching points defined in group N.. can be used in various process blocks. Cf. chap. 10.12. <br> O: inactive; <br> 1: switch S1; <br> 2: switch S2; <br> 3: switch S3; <br> 4: switch S4; |  |
| L12 | Switch B: Selection of the second switching point for process block no. 1. Cf. L11. Value range: 0 to 4 |  |

$\Rightarrow$ The layout of extended process block parameters is identical for all process blocks. Process block no. 1 is located in L10 to L12, process block no. 2 in L20 to L22, and so on.

| M.. Menu skip (Menu jump destinations) | E |  |
| :--- | :--- | :--- |
| Para. No. | Description |  |
| M50 | F1-jump to: Parameter provided by the F1 function key for editing. Depending on the device function, some <br> parameters may not be shown and cannot be selected. <br> Value range: A00 to E50 to N44 |  |
| M51 | F1-lower limit: <br> Value range: depends on the parameter selected in M50. |  |
| M52 | F1-upper limit: <br> Value range: depends on the parameter selected in M50. |  |

$\Rightarrow$ The jump destinations F2 to F4 are designed identically. Jump destination F2 is in M60 to M62, and so on.
If several jump destinations (M50; M60; M70 or M80) are parameterized to the same coordinates (e.g., J10), the lower, upper limit of the lowest jump destination takes effect.
See result table in chap 15 2) Only available when $\mathbf{D} 90 \neq 1$
3) Only available when D99=0
Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2$ :service.

Parameters marked with a $" \sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

## 13. Parameter Description

Para. No. Description

| N10 | S1-position: Position of switching point S1. With relative specifications (N11>0), the absolute value is gener- <br> ated internally. <br> Value range in I05: - -31 bits to $\underline{0}$ to 31 bits |  |
| :--- | :--- | :--- |
| N11 | S1-method: Reference of position $\mathbf{N 1 0}$ <br> O: absolute; Swithing point is triggered when position N10 is traveled over. <br> 1: rel.to start; Switching point is trigered after a distance of N10 (absolute value) after the starting point. <br> 2: rel.to endpos; Switching point is triggered at a distance of N10 before the destination position. |  |


| N12 |  |
| :---: | :---: |
|  | Q: inactive; <br> 1: set; Switch memory 1 is set to hig |

1: set; Switch memory 1 is set to high.
3: toggle; Switch memory 1 is inverted (low $\rightarrow$ high $\rightarrow$ low $\rightarrow \ldots$...).

| N13 | S1-memory: Behavior of switch memory 2. Cf. N12. <br> Value range: $\mathbf{0}$ to 3 |
| :--- | :--- |
| N14 | S1-memory: Behavior of switch memory 3. Cf. N12. <br> Value range: |

$\Rightarrow$ Posi switching points S 2 to S 4 are set up identically. Switching point S 2 is located in $\mathbf{N} 20$ to $\mathbf{N} 24$, and so on.

| U.. Protective Functions |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| U00 | Level low voltage: Is activated when the value U00 set in A35 is passed below. <br> 2: warning; After expiration of the tolerance time in U01, the device assumes fault mode (for E46, see chap. 17). 3: fault; The device assumes malfunction mode (for E46, see chap. 17) immediately after the value in A35 is passed below. |  |
| U01 | Time low voltage: Can only be set with $\mathbf{U O O}=2$ :warning. Defines the time during which triggering of undervoltage monitoring is tolerated. After expiration of this time, the device assumes fault mode. Value range in sec: 1 to 2 to 10 |  |
| U02 | Level temp. limit dev. i2t: Parallel to monitoring the heat dissipater temperature, an additional protective function is offered via $i^{2}$ t. The percentage of utilization of the device can be indicated via the E22 parameter. If the value in E22 is greater than 100\%, U02 is triggered. <br> 0 : off; Device does not react when U02 is triggered. <br> 1: message; Triggering of $\mathbf{U 0 2}$ is only indicated. The device continues to be ready for operation. <br> 2: warning; After expiration of the tolerance time in U03, the device assumes fault mode (for E39, see chap. 17). <br> 3: fault; The device immediately assumes fault mode (for E39, see chap. 17) after U02 is triggered. |  |
| U03 | Time temp. limit dev. i2t: Can only be set with U02=2:warning. Defines the time during which the triggering of $i^{2} \mathrm{t}$ monitoring is tolerated. After expiration of this time, the device assumes fault mode. <br> Value range in sec: 1 to 10 to 120 |  |
| U10 | Level temp. limit mot. i2t: Parallel to the monitoring of the positor line in the motor, the SDS simulates the motor temperature via an $i^{2 t}$ model. The percentage of load of the motor is indicated in parameter E23. If the value in E23 is greater than 100\%, U10 is triggered. <br> 0 : off; Device does not react when U10 is triggered. <br> 1: message; Triggering of $\mathbf{U 1 0}$ is only indicated. The device continues to be ready for operation. <br> 2. warning; After expiration of the tolerance time in U11, the device assumes fault mode (for E45, see chap. 17). |  |
| U11 | Time temp. limit mo. i2t: Can only be set with U10=2:warning. Defines the time during which the triggering of $i^{2} t$ monitoring is tolerated. After expiration of the set time, the device assumes fault mode. Value range in sec: 1 to 30 to 120 |  |
| U20 | Level drive overload: If the calculated torque in static operation exceeds the current M-Max in E62, U20 is triggered. <br> 0 : off; Device does not react when U20 is triggered. <br> 1: message; Triggering of U20 is only indicated. The device continues to be ready for operation. <br> 2: warning; After expiration of the tolerance time in U21, the device assumes fault mode (for E47, see chap. 17). <br> 3: fault; The device immediately assumes fault mode (for E47, see chap. 17) after U20 is triggered. |  |
| U21 | Time drive overload: Can only be set with U20=2:warning. Defines the time during which an overload of the drive is tolerated. After expiration of the set time, the device assumes fault mode. <br> Value range in sec: 1 to 10 to 120 |  |
| U22 | Text drive overload: The entry "drive overload" can be varied to suit user-specific requirements. Value range: 0 to "drive overload" to 11 |  |

[^5]
## 13. Parameter Description

| U.. Protective Functions |  | E |
| :---: | :---: | :---: |
| Para. No. | Description |  |
| U30 | Level acceleration overload: If the calculated torque exceeds the current M-Max in E62 during the acceleration ramp, U30 is triggered. <br> 0 : off; Device does not react when U30 is triggered. <br> 1: message; Triggering of U30 is only indicated. The device continues to be ready for operation. <br> 2. warning; After expiration of the tolerance time in U31, the device assumes fault mode (for E48, see chap. 17). <br> 3: fault; The device immediately assumes fault mode (for E48, see chap. 17) after U30 is triggered. |  |
| U31 | Time acceleration overload: Can only be set with U30=2:warning. Defines the time during which drive overload during acceleration is tolerated. After expiration of the set time, the device assumes fault mode. Value range in sec: 1 to 5 to 10 |  |
| U32 | Text acceleration overload: The entry "acceleration overload" can be varied to suit user-specific requirements. Value range: 0 to "acceleration overload " to 11 |  |
| U40 | Level break overload: <br> 0 : off; Device does not react when U40 is triggered. <br> 1: message; Triggering of U40 is only indicated. The device continues to be ready for operation. <br> 2. warning; After expiration of the tolerance time in U41, the device assumes fault mode (for E49, see chap. 17). <br> 3: fault; The device immediately assumes fault mode (for E49, see chap. 17) after U40 is triggered. |  |
| U41 | Time break overload: Can only be set with $\mathbf{U 4 0}=2$ :warning. Defines the time during which an overload of the drive during deceleration is tolerated. After expiration of the set time, the device assumes fault mode. Value range in sec: 1 to $\underline{5}$ to 10 |  |
| U42 | Text break overload: The entry "break overload" can be varied to suit user-specific requirements. Value range: 0 to "break overload" to 11 |  |
| U50 | Level operating range: If one or more of the parameters C41 to C46 are violated, U50 is triggered. <br> 0 : off; Device does not react when U50 is triggered. <br> 1: message; Triggering of $\mathbf{U} 50$ is only indicated. The device continues to be ready for operation. <br> 2. warning; After expiration of the tolerance time in U51, the device assumes fault mode (for E50, see chap. 17). <br> 3: fault; The device immediately assumes fault mode (for E50, see chap. 17) after U50 is triggered. |  |
| U51 | Time operating range: Can only be set with U50=2:warning. Defines the time tolerated outside the work area. After expiration of the set time, the device assumes fault mode. <br> Value range in sec: 1 to 10 to 120 |  |
| U52 | Text operating range: The entry "operating area" can be varied to suit user-specific requirements. Value range: 0 to "operating range" to 11 |  |
| U60 | Level following error: If the value in 184 exceeds the value of I21, U60 is triggered. 0: off; Device does not react when U10 is triggered. <br> 1: message; Triggering of $\mathbf{U} \mathbf{6 0}$ is only indicated. The device continues to be ready for operation. <br> 2: warning; After expiration of the tolerance time in U61, the device assumes fault mode (for E54, see chap. 17). <br> 3: fault; The device immediately assumes fault mode (for E54, see chap. 17) after U60 is triggered. |  |
| U61 | Time following error: Can only be set with $\mathbf{U 6 0 = 2}$ :warning. Defines the time during which the value in $\mathbf{I 2 1}$ is exceeded. After expiration of the set time, the devices assumes fault mode. Value range in msec: 0 to 500 to 32767 |  |
| U70 | Level posi. refused: If the target position is located outside software stops $\mathbf{I 5 0}$ and $\mathbf{5 1}$ or an absolute process block is started in an unreferenced state ( $\mathbf{I 8 6 = 0}$ ), $\mathbf{U 7 0}$ is triggered. <br> 0 : off; Device does not react when U70 is triggered. <br> 1: message; Triggering of $\mathbf{U 7 0}$ is only indicated. The device continues to be ready for operation. <br> 2: warning; after expiration of the tolerance time of 1 sec , the device assumes fault mode (for E51, see chap. 17). <br> 3: fault; The device immediately assumes fault mode (for E51, see chap. 17) after U70 is triggered. |  |

14. Option board
14.1 Option board SEA 4000
14.1 Option board SEA 4000


|  | Terminal | Function | Parameter | Circuiting |
| :---: | :---: | :---: | :---: | :---: |
|  | 1 | Input BE5 | F35 | $\begin{aligned} & \mathrm{L} \text { - level: } 0 \text { to } 7 \mathrm{~V} / 0 \mathrm{~mA} \\ & \mathrm{H} \text { - level: }+12 \text { to } 30 \mathrm{~V} / 7 \mathrm{~mA}, \mathrm{Ri}=3,3 \mathrm{k} \Omega \end{aligned}$ |
|  | 2 | Input BE6 | F60 |  |
|  | 3 | Input BE7 | F61 |  |
|  | 4 | Input BE8 | F62 |  |
|  | 5 | Input BE9 | F63 |  |
|  | 6 | Input BE10 | F64 |  |
|  | 7 | Input BE11 | F65 |  |
|  | 8 | Input BE12 | F66 |  |
|  | 9 | Input BE13 | F67 |  |
|  | 10 | Input BE14 | F68 |  |
|  | 11 | Output BA3 | F82 | - External power must be available on terminal X21.17 and be between 15 and 29 V . <br> - Maximum output current 50 mA with load against ground <br> - Maximum output current 200 mA with load against 24 V |
|  | 12 | Output BA4 | F83 |  |
|  | 13 | Output BA5 | F84 |  |
|  | 14 | Output BA6 | F85 |  |
|  | 15 | Output BA7 | F86 | SDS $\int^{16} \quad$ SDS $1^{16}$ |
|  | 16 | GND |  | Reference ground galvanically isolated from inverter |
|  | 17 | +24 V |  | Voltage for the output drivers (BA3 to BA7) |

14.2 Option board SDP 4000
14.3 Option board SEA 4000 and SDP 4000 (combi board)
14.2 Option board SDP 4000


|  | Terminal | Function | Comment |
| :---: | :---: | :---: | :---: |
|  | 1 | Not used | For correct function, use only suitable plug connectors for connection of the bus cable. <br> The incoming and outgoing bus cable can be inserted in this plug connector and screwed down. <br> The sliding switch on the plug connector must be set to "on" for the last station so that the bus terminal resistors are connected. |
|  | 2 | Not used |  |
|  | 3 | TxD/RxD (P) = B |  |
|  | 4 | RTS |  |
|  | 5 | DGND |  |
|  | 6 | VP |  |
|  | 7 | Not used |  |
|  | 8 | TxD/RxD (N) = A |  |
|  | 9 | Not used |  |

14.3 Option board SEA 4000 and SDP 4000 (combi board)


For terminal allocation X21 and X32, see option boards SEA 4000 and SDP 4000.

## 15. Result Table

| Result Table |  |
| :---: | :---: |
| 0: Error free | The data were transferred correctly. |
| 1: Error! | General error |
| 2: Wrong box | Controlbox's data memory has incompatible data structure (e.g., formatting for another memory size). |
| 3: Invalid data | Controlbox's data memory contains invalid data. Write Controlbox again, and repeat the procedure. |
| 5: OK (adjusted) | Software version of Controlbox data (or similar) and inverter differ in several parameters. Confirm with the \# key. Message does not affect functionality of the controller. |
| 6: OK (adjusted) | Software version of Controlbox data (or similar) and inverter differ in several parameters. Confirm with the \# key. Message does not affect functionality of the controller. |
| 9: BE encoder signal | - If synchronous reference value $\mathbf{G 2 7}=0: B E$ encoder or posi encoder I02=0:BE encoder, the following must apply: F31=14(15), F32=15(14). <br> - If $\mathbf{G 2 7}=1$ (synchronous reference value $=\mathrm{X} 20$ ) or $\mathbf{I 0 2 = 1}$ (posi encoder $=\mathrm{X} 20$ ), the following must apply: $\mathbf{F} 31 \neq 14(15), \mathbf{F} 32 \neq 15(14)$. <br> Values in parentheses: Encoder (signal A, B) and stepper motor connection (frequency + sign) access the same counter. |
| 10: Limit value | Value outside the value range |
| 12: BE/X20/X41 | Conflict while accessing the encoder pulse counter (there is only one) or error in parameterization of the sin/cos encoder <br> - X20 may not be simultaneously programmed as the pulse input with BE1/BE2 or X40 (F31, F31 $=14$, 15 and $\mathbf{H} \mathbf{4 0} \neq 2$ :encoder In when $\mathbf{H 2 0}=2,3$ and vice versa). <br> - When motor encoder $\mathbf{B 2 6}=3$ : SinCos, $\mathbf{H} 40=1$ :Sincos must be programmed. <br> - When motor encoder B26=3:SinCos, neither X20 nor BE1/BE2 may be programmed as the pulse input (encoder or stepper motor). |
| 13: BE cw/ccw | Programming F31=14 and F32=14 can be used to simulate the direction of rotation of inverters with software SDS 3.2. The functions "direction of rotation," "halt," and "quick stop" may not be assigned to other BEs. |
| 14: Canceled | - The B40/B41 actions could not be executed correctly. <br> - Action canceled (e.g., due to removal of enable). <br> - The current exceeded the permissible maximum value (e.g., short circuit or ground fault) during "autotuning" or "phase test" (B40, B41). |
| 15: R1 too high | A stator resistance measured during "autotuning" (B41) was too high. Motor is circuited incorrectly. Motor cable is defective. |
| 16: Phase fault U | Error in phase $U$ |
| 17: Phase fault V | Error in phase V |
| 18: Phase fault W | Error in phase W |
| 19: Symmetry | Error in symmetry of phases $\mathrm{U}, \mathrm{V}$ and W . Deviation of a winding resistor by $\pm 10 \%$. |
| 20: Motor connection | Resolver or motor pole number is not correct. |
| 21: Enable? | The enable must be present for actions J00/J01/J05. |
| 22: F20=F25 ?? | Both analog inputs (AE1 and AE2) are programmed for the same function. $\mathbf{F 2 0} \neq \mathbf{F} \mathbf{2 5}$ must apply. |
| 25: Phase order | Error in motor wiring (order of the phases, U, V, W incorrect). Is reported as the result of the B40 phase test. <br> - Check motor wiring and, if necessary, resolver cable too. |
| 26: Encoder offset | The zero offset of the motor encoder (resolver) is not correct. Is reported as the result of the B40 phase test. With STÖBER ES motors, the error is usually to be found in the wiring or in the plug connector. <br> - Check motor and resolver wiring. Then start phase test (B40) again. <br> - If no wiring error can be found, the measured offset is stored (non-volatile) via $\mathbf{A 0 0}=1$ in $\mathbf{H} 32$ with all other parameters. |

## 16. Operating States

Operating States
The operating state is indicated in the display of Controlbox with number and name and can be queried under E80 during fieldbus access. An abbreviation appears in the LED status display of the device.

| 0 : Ready | -8S | Inverter is ready. Voltage is available. |
| :---: | :---: | :---: |
| 1: Clockwise | run | Fixed positive speed |
| 2. Counter-clockwise | run | Fixed negative speed |
| 3: Acceleration | run | Acceleration procedure in progress (Accel) |
| 4: Deceleration | Fun | Deceleration procedure in progress (Decel) |
| 5: Halt | HEL | Halt command present |
| 7: $\mathrm{n}>\mathrm{n}-\mathrm{Max}$ | run | Reference value is greater than minimum of C01 and E126 (via analog input or fieldbus). |
| 8: Illegal direction | dir | Specified direction of rotation is not the permissible direction of rotation (C02). |
| 11: Quick stop | HLF | Quick stop is being performed. |
| 12: Inhibited | inh | This state prevents an undesired startup of the drive. Effective for: <br> - Drive is turned on (power on) with enable = high (only if A34=0). <br> - A fault is acknowledged with a low-high change in enable. <br> - Opened load relay (no power or no phase). <br> - If $\mathbf{A 3 0}=3: S D P 4000$ or $\mathbf{A 3 0}=4: C A N$-bus and the fieldbus sends a "disable voltage" control command, or the enable terminal becomes low, or a quick stop is completed. |
| 13: Serial (X3) | run Not always | Parameter $\mathbf{A 3 0}=1$ parameterized. Inverter is controlled by the PC via serial interface. |
| 14: Enabled | $E \cap B$ | Only available with Drivecom profile. Bus connection. |
| 15: Self test | -58 | Self-test is being performed on inverter. |
| 16: Fault | Exy | Inverter's power pack is disabled. "xy" is the fault code (see chap. 17). |
| 17: Positioning-active | 905 | Position control is active. Waiting for a start command. Basic state of positioning control. |
| 18: Moving | run | Processing a traversing job. Drive is moving. Indicated instead of the states of the speed mode (i.e. accelerate, brake, left and right). |
| 19: Delay | 005 | For process block chaining with defined delay or for repetition of relative movements. During a stop between two sequential jobs, the signal "in position" is generated, but the display shows "delay." |
| 20: Wait | 905 | For process block chaining with defined manual start (i.e., wait for posi.step signal) |
| 21: Referencing | -EF | During reference point traversing with posi or synchronous running |
| 22: Tip | run | During manual traversing |
| 23: Interrupted | 005 | After an interrupted process block (i.e., halt or quick stop) with the option of continuing with the posi.step signal. Posi.step is then used to move to the original destination position regardless of whether the drive has been moved in the meantime. The "23:Interrupted" state is retained when the enable is turned off and on while the halt signal is active. A change in enable without the halt signal and manual traversing cause the basic state "17:Posi.active." |
| 24: Reference wait | -EF | Wait for posi.start or posi.step signal to trigger reference point traversing after power on ( $137=1$ ). |
| 25: Stop input | 518 | Drive is positioned on stop input and can only be moved out of this position with manual or reference point traversing. |
| 26: Parameter inhibit | ด\%\% | Enable was deactivated from the PC with software while data was being transferred from the PC to the inverter. |

## 17. Fault / Events

## Faults / Events

When faults occur, the inverter is no longer able to control the drive and is disabled. An entry is made in the fault memory (E40/E41), and relay 1 (ready for operation) releases. If installed when the fault occurs, the Parabox is written automatically. Certain events (cf. last column of the table below) can be declared via FDS Tool as faults, messages, warnings or not effective.

|  |  | Auto Reset | $\begin{aligned} & \text { FDS } \\ & \text { Tool* } \end{aligned}$ |
| :---: | :---: | :---: | :---: |
| 31: Short/ground | The hardware overcurrent switch-off is active. <br> - Motor requires too much current from the inverter (e.g., interwinding fault or overload). | $\checkmark$ |  |
| 34: Hardw. fault | The non-volatile data memory is defective or software version is time-limited. |  |  |
| 35: Watchdog | Monitors the load and functions of the microprocessor This malfunction may also be caused by EMC problems (e.g., shield of the motor cable or PE conductor not connected at all or connected incorrectly). | $\checkmark$ |  |
| 36: High voltage | DC-link voltage too high <br> - Power too high <br> - Reverse powering of the drive while braking (no brake resistor connected, brake chopper defective, brake chopper deactivated with A20). See chap. 4.6. <br> - Braking resistor with too low resistance value (overcurrent protection). <br> - Automatic ramp extension at $\mathrm{U}_{\text {max }}$ is possible with $\mathbf{A 2 0}=1$ and $\mathbf{A 2 2 = 0}$. | $\checkmark$ |  |
| 37: n-feedback | Resolver: Wire break or signal level too low <br> Fault can only be acknowledged by turning 24 V off and on! <br> $\mathrm{Sin} / \mathrm{cos}$ absolute-value encoder: <br> - During device startup <br> - Communication to the device is faulty. <br> - Absolute-value encoder unknown <br> - Communication protocol unknown (neither EnDat ${ }^{\circledR}$ nor HiperFace) <br> - During operation <br> - Wire break or signal level too low <br> - Change in B26 |  |  |
| 38: tempDev.sens | The heat dissipater temperature is over the limit value. Cf. E25. <br> - Temperature of environment/switching cabinet is too high. |  |  |
| 39: TempDev.i2t | The inverter limits the output current to $99 \%$ of the nominal current. <br> The $i^{2}$ t model calculated for the inverter has reached $100 \%$ of the thermal load. <br> - Inverter is overloaded. (inverter too small). <br> - Temperature of the environment/switching cabinet is too high. <br> - Closed brake <br> - Motor connected incorrectly <br> - Resolver connected incorrectly |  |  |
| 40: Invalid data | The data in non-volatile memory are incomplete. Reset non-volatile memory with "A00 save values." This loads the default values. |  |  |
| 41: Temp.motorTMP | Excessive temperature indicated by the motor temperature sensor. <br> - Motor is overloaded. Use external ventilation. <br> - Temperature sensor not connected (X40.2 to X40.6) |  |  |
| 42: Temp.brakeRes | The $i^{2} t$ model for the braking resistor reaches $100 \%$ thermal load. <br> - A20 programmed incorrectly <br> - Permissible power loss of brake resistance is too high. <br> - With internal brake resistance: No jumper on $\mathrm{X} 12 . \rightarrow$ chap. 5.2. <br> - With external brake resistance: Brake resistor not connected. |  |  |
| 44: Ext.fault | Fault triggered by BE |  |  |
| 45: OTempMot. ${ }^{2} \mathrm{t}$ | - Motor overloaded <br> - Cooling insufficient |  | $\checkmark$ |
| 46: Low voltage | DC-link voltage is below the limit value set in A35. <br> - Drops in the power supply <br> - Acceleration times are too short (ramps, D..). | $\checkmark$ | $\checkmark$ |

* Events can be programmed with FDS Tool as messages, warnings or faults, or can be completely deactivated.


## 17. Fault / Events

## Faults / Events

When faults occur, the inverter is no longer able to control the drive and is disabled. An entry is made in the fault memory (E40/E41), and relay 1 (ready for operation) releases. Certain events (cf. last column of the table below) can be declared via FDS Tool as faults, messages, warnings or not effective.

|  |  | Auto Reset | $\begin{aligned} & \hline \text { FDS } \\ & \text { Tool* } \end{aligned}$ |
| :---: | :---: | :---: | :---: |
| 47: Device overl. | The maximum torque has been exceeded. <br> The permissible torque is limited by parameters C03 and C04 and the possible torque limitation via analog input. See chap. 9.2. | $\checkmark$ | $\checkmark$ |
| 48: Accel.overl. | Same as "47:Device overload" except for an acceleration procedure. M-Max 2 (C04) is permitted for the acceleration procedure with "cycle characteristic" startup (C20=2). | $\checkmark$ | $\checkmark$ |
| 49: Decel.overl. | Same as "47:Device overload" except for a deceleration procedure | $\checkmark$ | $\checkmark$ |
| 50: Operat.area | The operating area defined under $\mathbf{C 4 1}$ to $\mathbf{C 4 6}$ has been exited. See also chap. 9.3. | $\checkmark$ | $\checkmark$ |
| 51: Refused | Only for positioning (C60=2). Posi.start or posi.step was not accepted. <br> - Destination position is located outside software limit switches $\mathbf{I 5 0}$ and $\mathbf{I 5 1}$. <br> - In non-referenced status ( $\mathbf{I 8 6 = 0}$ ), no absolute positions (e.g., $\mathbf{J 1 1 = 1}$ ) are traveled to. <br> - The direction of rotation in the current process block is not the same as the permissible direction 104. | $\checkmark$ | $\checkmark$ |
| 52: Communication | - Fault during communication between inverter and FDS Tool during remote control via PC <br> - Communication fault during fieldbus operation | $\checkmark$ |  |
| 53: Stop input | A limit switch connected via a BE input or monitored via fieldbus has been triggered. During referencing at the limit switch ( $\mathbf{I} \mathbf{3 0}=1$ ), a reversal of the limit switches will cause a fault. | $\checkmark$ |  |
| 54: Follow. error | The maximum following error (i.e., deviation between actual position and reference value position) permitted by $\mathbf{1 2 1}$ has been exceeded. <br> - Motor overload, too much acceleration or blockage <br> - Kv-factor $\mathbf{I 2 0}$ too small, speed feed forward $\mathbf{I 2 5}$ too small | $\checkmark$ | $\checkmark$ |
| 55: OptionBoard | - When option board SEA-4000 is used, the external 24 V voltage is not present or the card is defective. No fault if enable is deactivated. <br> - No option card found |  |  |
| 56: Overspeed | Actual speed exceeds n-Max by more than 15\%. |  |  |

* The events checked in the "FDS Tool" column can be parameterized with FDS Tool as messages, warnings or faults in the group U.. protective functions.


## Acknowledgment of faults:

- Enable: Change from low to high level on the enable input.

Always available:

- Esc -key (only if A31=1).

Auto-reset (only if A32=1).
Binary input (F31 to F34=13).

## Caution!

Drive starts up
immediately!

Parameters E40 and E41 can be used to scan the last 10 faults (i.e., value 1 is the last fault). FDS Tool can then be used to assign the inverter's reaction (fault, warning, message or nothing) to certain events.

|  |  |
| :--- | :--- |
| Hauptverwaltung: | STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG <br> Postfach 910103 <br> 75091 Pforzheim |


| Fon | $07231582-0$ |
| :--- | :--- |
| Fax | $07231582-1000$ |
| eMail | sales@stoeber.de |

eselbronner Straße 12
75177 Pforzheim
24-Stunden-Service-Nr.
01805786323
Vanity-No:
01805 STOEBER

## Vertriebsgebiet Nordwest:

Zentrale

## STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG <br> Friedrich-Ebert-Str. 85 58454 Witten

## Zugehörige Technische Büros

Norddeutschland
$20000-23919$
$24000-29999$

Münster
$33000-33599$
$33600-33899$
$33900-33999$
$48000-49999$
$59200-59329$
$59470-59699$

Dortmund West
40000-41999
46000-47999
50000-50999
52000-53999
Dortmund Ost
42000-45999
51000-51999
57000-59199
59330-59469
59700-59999

## Hannover

30000-32999
34330-34549
37000-37199
37400-38799

## STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG

Stefan Hildebrandt
Bei den roten Höfen 4 21698 Harsefeld

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Markus Merker
Grottenkamp 28
48565 Steinfurt
33900-33999
$59200-59329$
59200-59329
9470-59699

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Jürgen Volkmuth
Friedrich-Ebert-Str. 85
58454 Witten

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Detlef Mock
Friedrich-Ebert-Str. 85
58454 Witten

## Vertriebsgebiet Mitte:

Zentrale
STÖbER ANTRIEBSTECHNIK GmbH \& Co. KG
Postfach 910103, 75091 Pforzheim
Kieselbronner Straße 12, 75177 Pforzheim

| Fon | 07231 582-0 |
| :--- | :--- |
| Fax | $07231582-1000$ |
| eMail | sales@stoeber.de |

## Zugehörige Technische Büros:

Saar-Pfalz
54000-56999
65000-66919
67200-67319
67500-67999
Wiesbaden
34000-34329
34550-36399
37200-37299
60000-64999

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Roland Dillmann
Black \& Decker-Str. 1
65510 Idstein

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Jens Thomas
Black \& Decker-Str. 1
65510 Idstein

Vertriebsgebiet Süd:

| Fon | 07231 582-0 |
| :--- | :--- |
| Fax | $07231582-1000$ |
| eMail | sales@stoeber.de |

Zugehörige Techn
Pforzheim Süd
$71000-71299$
$75100-75399$

Pforzheim Nord
$70000-70999$
$71300-71499$
$71600-71999$
$74000-74172$
$74300-74399$
$75400-75999$

## Nordbaden

66920-67199
67320-67499
68000-69999
74173-74299
74600-75099
76600-76999
97860-97999

## Südbaden

72190-72299
76000-76599
77000 - 77999
78090-78149
79000-79999
Reutlingen
72000-72189
72300-72999
78000-78089
78150-78999
88000-89299
89570-89999

Württemberg Nord-Ost
71500-71599
73000-73999
74400-74599
89500-89569
München
80000-84999
85200-87999
89300-89499
94000-94999
Nürnberg
85000-85199
90000-93999
95000-96499
97000-97859
Vertriebsgebiet Ost: Zentrale

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Günter Großmann
Postfach 910103, 75091 Pforzheim
Kieselbronner Straße 12, 75177 Pforzheim
STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Philipp Gerstner
Postfach 910103, 75091 Pforzheim
Kieselbronner Straße 12, 75177 Pforzheim

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Stefan Rotterdam
Postfach 910103, 75091 Pforzheim
Kieselbronner Straße 12, 75177 Pforzheim

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Daniel Lohse
Postfach 910103, 75091 Pforzheim
Kieselbronner Straße 12, 75177 Pforzheim

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Wilhelm Haydt
Gerh.-Hauptmann-Str. 53
72793 Pfullingen

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Klaus Buschko
Meisenweg 25
72589 Westerheim

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Udo Cyrol
Industriestraße 20 a
91353 Hausen

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Wolfgang Lukas
Industriestraße 20 a
91353 Hausen

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Postfach 910103, 75091 Pforzheim
Kieselbronner Straße 12, 75177 Pforzheim

## Zugehörige Technische Büros:

Berlin / Brandenburg
06000-06599
06730-07299
10000-19999
23920-23999
38800-39999

## Lichtenstein

00000-05999
06600-06729
07300-09999
36400-36999
37300-37399
96500-96999
98000-99999

STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG
Bernd Weise
Werneuchener Weg 9
15345 Altlandsberg

## STÖBER ANTRIEBSTECHNIK GmbH \& Co. KG

Jürgen Stolper
Günsbacher Straße 4
09350 Lichtenstein

| Fon | $07231582-1229$ |
| :--- | :--- |
| Fax | $07231582-1349$ |
| eMail | TB_PFSued@stoeber.de |
|  |  |
| Fon | $07231582-1217$ |
| Fax | $07231582-1349$ |
| eMail | TB PFNord@stoeber.de |


| Fon | $07231582-1149$ |
| :--- | :--- |
| Fax | $07231582-1349$ |
| eMail | TB_NB@stoeber.de |


| Fon | $07231582-1114$ |
| :--- | :--- |
| Fax | $07231582-1349$ |
| eMail | TB_SB@stoeber.de |


| Fon | 07121994035 |
| :--- | :--- |
| Fax | 07121994036 |
| eMail | TB_RT@stoeber.de |


| Fon | 07333950773 |
| :--- | :--- |
| Fax | 07333950774 |
| eMail | TB_WNO@stoeber.de |


| Fon | 09191616890 |
| :--- | :--- |
| Fax | 09191734538 |
| eMail | TB_M@stoeber.de |

Fon 09191734537

Fax 09191734538 eMail TB_N@stoeber.de

| Fon | $07231582-0$ |
| :--- | :--- |
| Fax | $07231582-1000$ |
| eMail | sales@stoeber.de |

Fon 0334385731
Fax 0334385732
eMail TB_BR@stoeber.de

| Fon | 0372042985 |
| :--- | :--- |
| Fax | 0372042986 |
| eMail | TB_L@@stoeber.de |


| Austria | STÖBER ANTRIEBSTECHNIK GmbH <br> Fabriksplatz 1 <br> 4662 Steyrermühl | Phone Fax eMail | $\begin{aligned} & +43761376000 \\ & \text { +43 } 761376009 \\ & \text { office@stoeber.at } \end{aligned}$ |
| :---: | :---: | :---: | :---: |
| France | STÖBER S.a.r.I. <br> 47, rue Maurice Flandin 69003 Lyon | Phone Fax eMail | $\begin{aligned} & \text { +33 } 472132438 \\ & \text { +33 } 472132457 \\ & \text { mail@stober.fr } \end{aligned}$ |
| Great Britain | STOBER DRIVES LTD. <br> Unit 9, Abbeymead Industrial Park Brooker Road, Waltham Abbey Essex EN9 1HU | Phone Fax eMail | $\begin{aligned} & +441992709710 \\ & +441992714111 \\ & \text { mail@stober.co.uk } \end{aligned}$ |
| Italy | STÖBER TRASMISSIONI S. r. I. <br> Via Risorgimento, 8 <br> 20017 Mazzo di Rho (Milano) | Phone Fax eMail | $\begin{aligned} & \text { +39 } 02 \text { 93909-570 } \\ & \text { +39 } 02 \text { 93909-325 } \\ & \text { info@stoeber.it } \end{aligned}$ |
| Korea | DAE KWANG STOEBER CO. LTD. <br> 441-10 Sangdewon-dong, Joongwon-ku, Sungnam-city, Kyuunggi-do, <br> Postcode 462-120 | Phone Fax eMail | $\begin{aligned} & \text { +82 } 317350293 \\ & \text { +82 } 317360281 \\ & \text { dkstoeber@stoeber.co.kr } \end{aligned}$ |
| Poland | STOEBER POLSKA <br> ul.H.Kamienskiego 201-219 51-126 Wroclaw | Phone Fax eMail | $\begin{aligned} & \text { +48 } 713207417 \\ & \text { +48 } 713207417 \\ & \text { biuro@stoeber.pl } \end{aligned}$ |
| USA | STOBER DRIVES INC. 1781 Downing Drive Maysville, KY 41056 | Phone Fax eMail | $\begin{aligned} & \text { +1 } 6067595090 \\ & \text { +1 } 6067595045 \\ & \text { sales@stober.com } \end{aligned}$ |
| Belgium | VAN DOREN - PILLE N. V. <br> Industrieterrein De Prijkels <br> Venecoweg 25 <br> 9810 Nazareth | Phone Fax eMail | $\begin{aligned} & \text { +32 } 92521309 \\ & \text { +32 } 92522374 \\ & \text { info@vandorenpille.be } \end{aligned}$ |
| Brasil | FRAPHE COMERCIAL Ltda. Rua Bairro Da Ponte Alta S/N 37640-000 Extrema - MG | Phone Fax eMail | $\begin{aligned} & +553534355965 \\ & \text { +55 } 3534353887 \\ & \text { fraphe@fraphe.com.br } \end{aligned}$ |
| Bulgaria | Z \& M PRIVATE COMPANY <br> 5, Angel Kantchev Str. 1000 Sofia | Phone Fax eMail | $\begin{aligned} & \text { +359 } 29865855 \\ & \text { +35929865916 } \\ & \text { zandm@techno-link.com } \end{aligned}$ |
| China | WK-INTERSALES BEIJING <br> German Centre Unit 0525-0530, Landmark Tower 2 8 North Dongsanhuan Road Chaoyang District Beijing 100004 | Phone Fax eMail | $\begin{aligned} & \text { +86 } 1065906425 \text { + } 26 \\ & +861065906785 \end{aligned}$ <br> stoeber@wk-intersales.com |
| Colombia | SOCOMEX LTDA. <br> Apdo. Aereo 11606 <br> Santafe de Bogota D. C. | Phone <br> Fax | $\begin{aligned} & \text { +57 } 2856105 /+572856496 \\ & +572856336 \\ & \text { +57 } 13350487 \end{aligned}$ |
| Denmark | EEGHOLM A/S <br> Grundtvigs Allé 165-169 <br> P. O. Box 190 <br> 6400 Sønderborg | Phone Fax eMail | $\begin{aligned} & +4573121212 \\ & \text { +45 } 73121213 \\ & \text { eegholm@eegholm.dk } \end{aligned}$ |


| STÖBER ANTRIEBSTECHNIK - International |  |  |  |
| :---: | :---: | :---: | :---: |
| (Toes) STÖBER ANTRIEBSTECHNIK |  |  |  |
| Finland | EIE MASKIN OY <br> PL 80 <br> 10600 Tammisaari | Phone Fax eMail | $\begin{aligned} & +358192461642 \\ & \text { +358 } 192461643 \\ & \text { eie@eie.fi } \end{aligned}$ |
| Hungary | BDI Hungary Ltd. <br> Fóti Street 141, Bldg 37. 1046 Budapest | Phone Fax eMail | $\begin{aligned} & +3612311010 \\ & +3612311030 \end{aligned}$ <br> bdi-hun@elender.hu |
| the Netherlands | MIJNSBERGEN B. V. <br> Postbus 166 3640 AD Mijdrecht | Phone Fax eMail | $\begin{aligned} & \text { +31 } 297285821 \\ & \text { +31 } 297272326 \end{aligned}$ <br> info@mijnsbergen.nl |
| Norway | ELMEKO AS <br> Postbox 80 1306 Baerum Postterminal | Phone Fax eMail | $\begin{aligned} & +4767572270 \\ & \text { +4767572280 } \\ & \text { elmeko@elmeko.no } \end{aligned}$ |
| Peru | POWERMATIC S. A. <br> Av. Los Ingenieros 333 Ate-Vitarte, Lima 3 | Phone Fax eMail | $\begin{aligned} & \text { +51 } 134990184 \text { / } 3494011 \\ & \text { +51 } 14370073 \\ & \text { powermatic@terra.com.pe } \end{aligned}$ |
| Philippines | LEELENG COMMERCIAL, INC. <br> 387-393 Dasmariñas St. <br> P. O. Box 480 <br> Manila | Phone Fax eMail | $\begin{aligned} & \text { +63 } 22418901 \text { to } 05 \\ & \text { +63 } 22414060 \\ & \text { leeleng@manila.vasia.com } \end{aligned}$ |
| South Africa | BEARING MAN LTD. <br> P. O. Box 33431 Jeppestown 2043 | Phone Fax eMail | $\begin{aligned} & \text { +27116201500 } \\ & \text { +27116201775 } \\ & \text { sales@bearing_man.co.za } \end{aligned}$ |
| Spain | TAHFER COMERCIAL, S. A. <br> Jesus, 27 28917 - LA FORTUNA | Phone Fax eMail | $\begin{aligned} & \text { +34 } 916193424 \\ & \text { +34 } 916197792 \end{aligned}$ <br> tahfercom@tahfer.com |
|  | S.p.i.t. KOOM s. I. <br> Camino Caserio Parada, 25 20015 San Sebastián | Phone Fax eMail | $\begin{aligned} & \text { +34 } 943297809 \\ & \text { +34 } 943297810 \\ & \text { koom@spitkoom.com } \end{aligned}$ |
| Sweden | EIE MASKIN AB <br> Postfach 7 <br> 12421 Bandhagen | Phone Fax eMail | $\begin{aligned} & \text { +46 } 87278800 \\ & \text { +46 } 87278899 \\ & \text { eie@eie.se } \end{aligned}$ |
| Switzerland | INDUR ANTRIEBSTECHNIK AG <br> Margarethenstraße 87 4008 Basel | Phone Fax eMail | $\begin{aligned} & \text { +41612792900 } \\ & \text { +41612792910 } \\ & \text { info@indur.ch } \end{aligned}$ |
| Thailand | GERMAN ENGINEERING \& MACHINERY CO., LTD. <br> 399 Moo 17 Bangna Trad Rd. Km 23 Bangsaothong Sub District 10540 Samutprakarn | Phone Fax eMail | $\begin{aligned} & \text { +66 } 23153331 \text { / } 3153332 \\ & \text { +66 } 23153663 \\ & \text { sale-ge@mweb.co.th } \end{aligned}$ |
| Turkey | YÜRE MAKINA SAN. ve TIC. LTD. STI. <br> Fevzi Çakmak Mah. 5. Cad. <br> 19. Sok. No: 13 <br> 34200 ESENLER-ISTANBUL | Phone Fax | $\begin{aligned} & \text { +90 } 2122228750 \\ & \text { +90 } 2122228751 \end{aligned}$ |

18. Block Circuit Diagram Synchronous Running 19.1 Fast Reference Value active (D99=1)

19.1 Block circuit diagram: Fast reference value active (D99=1)

19.2 Block Circuit Diagram Reference Value Processing


## 20. Parameter Table

| Parameter |  | DS | Inpt. |
| :---: | :---: | :---: | :---: |
| A.. Inverter |  |  |  |
| A00 | Save parameter [\%] |  |  |
| A01 | Read parabox \& save [\%] |  |  |
| A02 | Check parameter [\%] |  |  |
| A03 | Write to parabox [\%] |  |  |
| A04 | Default settings [\%] |  |  |
| A10 | Menu level | 0 |  |
| A11 | Parameter set edit |  |  |
| A12 | Language | 0 |  |
| A13 | Set password |  |  |
| A14 | Edit password |  |  |
| A15 | Auto-return | 1 |  |
| A20 | Braking resistor type | 20 |  |
| A21 | Brak. resistor resist. [ $\Omega$ ] | * |  |
| A22 | Brak. resistor rating [kW] | * |  |
| A23 | Brak. resistor therm [sec] | 40 |  |
| A30 | Operation input | 0 |  |
| A31 | Esc-reset | 1 |  |
| A32 | Auto-reset | 0 |  |
| A33 | Time auto-reset [min] | 15 |  |
| A34 | Auto-start | 0 |  |
| A35 | Low voltage limit [V] | 350 |  |
| A36 | Mains voltage [V] | 400 |  |
| A37 | Reset memorized values |  |  |
| A38 | DC power-input | 0 |  |
| A40 | Read parabox [\%] |  |  |
| A41 | Select parameter set |  |  |
| A42 | Copy para set 1>2 [\%] |  |  |
| A43 | Copy para set 2>1 [\%] |  |  |
| A50 | Tip |  |  |
| A51 | Tip ref. value [rpm] | 300 |  |
| A55 | Key hand function | 1 |  |
| A80 | Serial address | 0 |  |
| A82 | CAN-baudrate | 1 |  |
| A83 | Busaddress | 0 |  |
| A84 | Profibus baudrate |  |  |
| B.. Motor |  |  |  |
| B00 | Motor-type | * |  |
| B02 | EMC-constant [V] | 110 |  |
| B03 | Motor fan | 0 |  |
| B10 | Poles | 6 |  |
| B11 | P-nominal [kW] | * |  |
| B12 | I-nominal [A] | * |  |
| B13 | n-nominal [rpm] | * |  |
| B17 | M0 (standstill) [ Nm ] | * |  |
| B26 | Motor-encoder | 2 |  |
| B40 | Phase test [\%] |  |  |
| B52 | L-motor [mH] | * |  |
| B53 | R1-motor [ $\Omega$ ] | * |  |
| B64 | Ki-IQ (Moment) [\%] | * |  |
| B65 | Kp-IQ (moment) [\%] | * |  |
| C.. Machine |  |  |  |
| C00 | n-Min [rpm] | 0 |  |
| C01 | n-Max [rpm] | 3000 |  |
| C02 | Perm. dir. of rotation | 0 |  |
| C03 | M-Max 1 [\%] | 150 |  |
| C04 | M-Max 2 [\%] | 150 |  |
| C30 | J-mach/J-motor | 0 |  |
| C31 | n-controller Kp [\%] | 60 |  |


| Parameter |  | DS | Inpt. |
| :---: | :---: | :---: | :---: |
| C32 | n-controller Ki [\%] | 30 |  |
| C33 | n-RefVal low pass [msec] | 2 |  |
| C34 | n-motor low pass [msec] | * |  |
| C35 | n-control. Kp standstill [\%] | 100 |  |
| C40 | n-window [rpm] | 3 |  |
| C41 | Oper. range n-Min [rpm] | 0 |  |
| C42 | Oper. range n-Max [rpm] | 6000 |  |
| C43 | Operat. range M-Min [\%] | 0 |  |
| C44 | Operat. range M-Max [\%] | 400 |  |
| C45 | Operat. range x-Min [\%] | 0 |  |
| C46 | Operat. range x-Max [\%] | 400 |  |
| C47 | Operat. range C45/C46 | 0 |  |
| C48 | Operat. range C47 abs | 0 |  |
| C49 | Operat. range accel\&ena | 0 |  |
| C50 | Display function | 0 |  |
| C51 | Display factor | 1 |  |
| C52 | Display decimals | 0 |  |
| C53 | Display text |  |  |
| C60 | Run mode | 1 |  |
| D.. Reference value |  |  |  |
| D00 | RV accel [msec/3000rpm] | 0 |  |
| D01 | RV decel [msec/3000rpm] | 0 |  |
| D02 | Speed (max. ref. value)[rpm] | 3000 |  |
| D03 | Reference value -Max [\%] | 100 |  |
| D04 | Speed (min. ref. value) [rpm] | 0 |  |
| D05 | Ref. value-Min [\%] | 1 |  |
| D06 | Ref. value offset [\%] | 0 |  |
| D07 | Ref. value enable | 0 |  |
| D08 | Monitor ref. value | 0 |  |
| D09 | Fix reference value no. | 0 |  |
| D10 | Accel 1 [msec/3000rpm] | 60 |  |
| D11 | Decel 1 [msec/3000rpm] | 60 |  |
| D12 | Fix ref. value $1 \quad[\mathrm{rpm}]$ | 750 |  |
| D20 | Accel $2 \quad[\mathrm{msec} / 3000 \mathrm{rpm}]$ | 90 |  |
| D21 | Decel 2 [msec/3000rpm] | 90 |  |
| D22 | Fix ref. value $2 \quad[\mathrm{rpm}]$ | 1500 |  |
| D30 | Accel $3 \quad[\mathrm{msec} / 3000 \mathrm{rpm}]$ | 120 |  |
| D31 | Decel 3 [msec/3000rpm] | 120 |  |
| D32 | Fix ref. value $3 \quad[\mathrm{rpm}]$ | 3000 |  |
| D40 | Accel $4 \quad[\mathrm{msec} / 3000 \mathrm{rpm}]$ | 5 |  |
| D41 | Decel $4 \quad[\mathrm{msec} / 3000 \mathrm{rpm}]$ | 5 |  |
| D42 | Fix ref. value $4 \quad[\mathrm{rpm}]$ | 500 |  |
| D50 | Accel 5 [msec/3000rpm] | 10 |  |
| D51 | Decel 5 [msec/3000rpm] | 10 |  |
| D52 | Fix ref. value $5 \quad[\mathrm{rpm}]$ | 1000 |  |
| D60 | Accel $6 \quad[\mathrm{msec} / 3000 \mathrm{rpm}]$ | 20 |  |
| D61 | Decel 6 [msec/3000rpm] | 20 |  |
| D62 | Fix ref. value 6 [rpm] | 2000 |  |
| D70 | Accel $7 \quad[\mathrm{msec} / 3000 \mathrm{rpm}]$ | 25 |  |
| D71 | Decel $7 \quad[\mathrm{msec} / 3000 \mathrm{rpm}]$ | 25 |  |
| D72 | Fix ref. value $7 \quad[\mathrm{rpm}]$ | 2500 |  |
| D81 | Decel-quick [msec/3000rpm] | 2 |  |
| D90 | Reference value source | 0 |  |
| D91 | Motorpoti function | 0 |  |
| D92 | Negate reference value | 0 |  |
| D93 | RV-generator |  |  |
| D94 | Ref. val. generator time [msec] | 500 |  |
| D99 | Fast reference value | 1 |  |


| Parameter |  | DS | Inpt. |
| :---: | :---: | :---: | :---: |
| E.. Display values |  |  |  |
| E00 | I-motor [A] |  |  |
| E01 | P-motor [kW] |  |  |
| E02 | M-motor [ Nm ] |  |  |
| E03 | DC-link-voltage [V] |  |  |
| E06 | n-reference value [rpm] |  |  |
| E07 | n-post-ramp [rpm] |  |  |
| E08 | n-motor [rpm] |  |  |
| E09 | Rotor position [r] |  |  |
| E10 | AE1-level [\%] |  |  |
| E11 | AE2-level [\%] |  |  |
| E16 | Analog-output1-level [\%] |  |  |
| E17 | Relay 1 |  |  |
| E18 | BA 2 |  |  |
| E19 | BE15...BE1 \& enable |  |  |
| E20 | Device utilization [\%] |  |  |
| E21 | Motor utilization [\%] |  |  |
| E22 | i2t-device [\%] |  |  |
| E23 | i2t-motor [\%] |  |  |
| E24 | i2t-braking resistor [\%] |  |  |
| E25 | Device temperature [ $\left.{ }^{\circ} \mathrm{C}\right]$ |  |  |
| E26 | Binary output 1 |  |  |
| E27 | BA15..1\&Rel1 |  |  |
| E28 | Analog-output2-level [\%] |  |  |
| E29 | n-ref. value raw [rpm] |  |  |
| E30 | Run time [h,m,sec] |  |  |
| E31 | Enable time [h,m,sec] |  |  |
| E32 | Energy counter [kWh] |  |  |
| E33 | Vi-max-memo value [V] |  |  |
| E34 | I-max-memo value [A] |  |  |
| E35 | Tmin-memo value [ $\left.{ }^{\circ} \mathrm{C}\right]$ |  |  |
| E36 | Tmax-memo value [ $\left.{ }^{\circ} \mathrm{C}\right]$ |  |  |
| E37 | Pmin-memo value [kW] |  |  |
| E38 | Pmax-memo value [kW] |  |  |
| E40 | Fault type |  |  |
| E41 | Fault time |  |  |
| E42 | Fault count |  |  |
| E45 | Control word |  |  |
| E46 | Status word |  |  |
| E47 | n-field-bus [rpm] |  |  |
| E50 | Device |  |  |
| E51 | Software-version |  |  |
| E52 | Device-number |  |  |
| E53 | Variant-number |  |  |
| E54 | Option-board |  |  |
| E55 | Identity-number |  |  |
| E56 | Parameter set ident. 1 |  |  |
| E57 | Parameter set ident. 2 |  |  |
| E58 | Kommubox |  |  |
| E60 | Reference value selector |  |  |
| E61 | Additional ref. value [rpm] |  |  |
| E62 | Actual M-max [\%] |  |  |
| E63 | PID-controller limit |  |  |
| E64 | Brake |  |  |
| E65 | PID-error [\%] |  |  |
| E71 | AE1 scaled [\%] |  |  |
| E72 | AE2 scaled [\%] |  |  |
| E73 | AE2 scaled 2 [\%] |  |  |
| E80 | Operating condition |  |  |

## 20. Parameter Table

| Parameter |  | DS | Inpt. |
| :---: | :---: | :---: | :---: |
| E81 | Event level |  |  |
| E82 | Event name |  |  |
| E83 | Warning time |  |  |
| E84 | Active parameter set |  |  |
| F.. Control interface |  |  |  |
| F00 | BA2-function | 1 |  |
| F03 | Relay2 t-on [sec] | 0 |  |
| F04 | Relay2 t-off [sec] | 0 |  |
| F05 | Relay2 invert | 0 |  |
| F06 | t-brake release [sec] | 0.1 |  |
| F07 | t-brake set [sec] | 0.052 |  |
| F08 | Brake | 0 |  |
| F10 | Relay1-function | 0 |  |
| F19 | Quick stop end | 0 |  |
| F20 | AE2-function | 0 |  |
| F21 | AE2-offset [\%] | 0 |  |
| F22 | AE2-gain [\%] | 100 |  |
| F23 | AE2-lowpass [msec] | 0 |  |
| F24 | AE2-offset2 [\%] | 0 |  |
| F25 | AE1-function | 10 |  |
| F26 | AE1-offset [\%] | 0 |  |
| F27 | AE1-gain [\%] | 100 |  |
| F30 | BE-logic | 0 |  |
| F31 | BE1-function | 8 |  |
| F32 | BE2-function | 6 |  |
| F33 | BE3-function | 9 |  |
| F34 | BE4-function | 0 |  |
| F35 | BE5-function | 0 |  |
| F36 | BE increment [I/R] | 1024 |  |
| F38 | Quick stop | 0 |  |
| F40 | Analog-output1-function | 4 |  |
| F41 | Analog-output1-offset [\%] | 0 |  |
| F42 | Analog-output1-gain [\%] | 100 |  |
| F43 | Analog-output1-absolut | 0 |  |
| F45 | Analog-output2-function | 1 |  |
| F46 | Analog-output2-offset [\%] | 0 |  |
| F47 | Analog-output2-gain [\%] | 50 |  |
| F49 | BE-gear ratio | 1 |  |
| F51 | BE1-invert | 0 |  |
| F52 | BE2-invert | 0 |  |
| F53 | BE3-invert | 0 |  |
| F54 | BE4-invert | 0 |  |
| F55 | BE5-invert | 0 |  |
| F60 | BE6-function | 0 |  |
| F61 | BE7-function | 0 |  |
| F62 | BE8-function | 0 |  |
| F63 | BE9-function | 0 |  |
| F64 | BE10-function | 0 |  |
| F65 | BE11-function | 0 |  |
| F66 | BE12-function | 0 |  |
| F67 | BE13-function | 0 |  |
| F68 | BE14-function | 0 |  |
| F70 | BE6-invert | 0 |  |
| F71 | BE7-invert | 0 |  |
| F72 | BE8-invert | 0 |  |
| F73 | BE9-invert | 0 |  |
| F74 | BE10-invert | 0 |  |
| F75 | BE11-invert | 0 |  |
| F76 | BE12-invert | 0 |  |


| Parameter |  | DS | Inpt. |
| :---: | :---: | :---: | :---: |
| F77 | BE13-invert | 0 |  |
| F78 | BE14-invert | 0 |  |
| F80 | BA1-function | 1 |  |
| F81 | BA2-function | 1 |  |
| F82 | BA3-function | 1 |  |
| F83 | BA4-function | 1 |  |
| F84 | BA5-function | 1 |  |
| F85 | BA6-function | 1 |  |
| F86 | BA7-function | 1 |  |
| G.. Technology |  |  |  |
| G00 | PID-controller | 0 |  |
| G01 | PID-controller Kp | 0.3 |  |
| G02 | PID-controller $\mathrm{Ki} \quad[1 / \mathrm{sec}]$ | 0 |  |
| G03 | PID-controller Kd [msec] | 0 |  |
| G04 | PID-controller limit [\%] | 400 |  |
| G05 | PID-controller limit2 [\%] | -400 |  |
| G06 | PID-controller Kp2 | 1 |  |
| G10 | Winding operation | 0 |  |
| G11 | Diameter | 0 |  |
| G12 | Min. winding diam. [mm] | 10 |  |
| G13 | Max. winding diam. $\quad[\mathrm{mm}]$ | 100 |  |
| G14 | Beg. winding diam. [mm] | 10 |  |
| G15 | Overdrive ref. value [rpm] | 0 |  |
| G16 | Diam. calculator ramp [mm/sec] | 10 |  |
| G17 | Tension reduction [\%] | 0 |  |
| G19 | Winding act. diam. [mm] |  |  |
| G20 | Electronic gear | 0 |  |
| G21 | Speed master | 1 |  |
| G22 | Drehzahl Slave | 1 |  |
| G23 | Kp synchron [1/sec] | 30 |  |
| G24 | Max. sync. difference [ $\left.{ }^{\circ}\right]$ | 3600 |  |
| G25 | Synchron reset | 3 |  |
| G26 | n-correction-Max. [rpm] | 3000 |  |
| G27 | Synchronous encoder | 0 |  |
| G28 | n-Master [rpm] |  |  |
| G29 | Synchron difference [ $\left.{ }^{\circ}\right]$ | 0 |  |
| G30 | Speed feed forward [\%] | 80 |  |
| G31 | Reference direction | 0 |  |
| G32 | Reference speed fast [rpm] | 1000 |  |
| G33 | Reference speed slow [rpm] | 300 |  |
| G35 | Ref.encoder signal 0 | 0 |  |
| G38 | Synchronous offset [ $\left.{ }^{\circ}\right]$ | 0 |  |
| G40 | Static friction torque [ Nm$]$ | 0 |  |
| G41 | Dyn. friction torque [ $\mathrm{Nm} / 100 \mathrm{rpm}$ ] | 0 |  |
| G42 | T-dyn lowpass [msec] | 50 |  |
| H.. Encoder |  |  |  |
| H20 | X20-function | 1 |  |
| H21 | Encodersim. increments | 2 |  |
| H22 | X20-increments [1/R] | 1024 |  |
| H23 | X20-gear ratio | 1 |  |
| H24 | X20-zeroPos. [ ${ }^{\circ}$ ] | 0 |  |
| H31 | Resolver poles | 2 |  |
| H32 | Commutation-offset [ $\left.{ }^{\circ}\right]$ | 0 |  |
| H40 | X41-function | 0 |  |
| H41 | X41-increments [I/R] | 1024 |  |
| H42 | X41-gear-ratio | 1 |  |
| H60 | SSI-invert | 0 |  |
| H61 | SSI-Code | 0 |  |
| H62 | SSI-databits | 25 |  |


| Parameter |  | DS | Inpt. |
| :---: | :---: | :---: | :---: |
| I.. Posi.Machine |  |  |  |
| 100 | Position range | 1 |  |
| 101 | Circular length [105] | 360 |  |
| 102 | Posi-encoder | 2 |  |
| 103 | Direction optimization | 1 |  |
| 104 | Move direction | 0 |  |
| 105 | Measure unit selection | 2 |  |
| 106 | Decimal digits | 2 |  |
| 107 | Way/rev. numerator [105] | 360 |  |
| 108 | Way/rev. denominator [R] | 1 |  |
| 109 | Measurement unit |  |  |
| 110 | Max. speed [105/sec] | 10 |  |
| 111 | Max. accel. [105/8ec $\left.{ }^{2}\right]$ | 10 |  |
| 112 | Tip speed [105/sec] | 180 |  |
| 115 | Accel-override | 0 |  |
| 116 | S-ramp [msec] | 0 |  |
| 119 | ENA-interrupting | 0 |  |
| 120 | Kv-factor [1/sec] | 30 |  |
| 121 | Max. following error [105] | 90 |  |
| 122 | Target window [105] | 5 |  |
| 123 | Dead band pos. control [105] | 0 |  |
| 125 | Speed feed forward [\%] | 80 |  |
| 130 | Reference mode | 0 |  |
| 131 | Reference direction | 0 |  |
| 132 | Ref. speed fast [105/sec] | 90 |  |
| 133 | Ref. speed slow [105/sec] | 4,5 |  |
| 134 | Reference position [105] | 0 |  |
| 135 | Ref. encoder signal 0 | 0 |  |
| 136 | Continuous reference | 0 |  |
| 137 | Power-on reference | 0 |  |
| 138 | Reference block | 0 |  |
| 140 | Posi.-step memory | 0 |  |
| 150 | Software-stop - [105] | -10000000 |  |
| 151 | Software-stop + [105] | 10000000 |  |
| 160 | Electr. cam1 begin [105] | 0 |  |
| 161 | Electronic cam1 end [105] | 100 |  |
| 170 | Position-offset [105] | 0 |  |
| 180 | Actual position [105] |  |  |
| 181 | Target position [105] |  |  |
| 182 | Active process block |  |  |
| 183 | Selected process block |  |  |
| 184 | Following error [105] |  |  |
| 185 | In position |  |  |
| 186 | Referenced |  |  |
| 187 | Electronic cam 1 |  |  |
| 188 | Speed [105/sec] |  |  |
| J.. Posi.Command |  |  |  |
| J00 | Posi.start |  |  |
| J01 | Posi.step |  |  |
| J02 | Process block number | 0 |  |
| J03 | Tip-mode |  |  |
| J04 | Teach-in |  |  |
| J05 | Start reference |  |  |

= Standard menu level. Cf. par. A10 Extended menu level: A10=1
$W E=$ Default setting

* = Depends on type

POSIDYN ${ }^{\circledR}$ SDS 4000

## 20. Parametertabelle

| Parameter |  |  | DS | Entry of Process Blocks 1 to 8 (Process blocks 9 to 32 can only be programmed with FDS-Tool) |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Block 1 | Block 2 | Block 3 | Block 4 | Block 5 | Block 6 | Block 7 | Block 8 |
|  |  |  |  | J10 to J18 | J20 to J28 | J30 to J38 | J40 to J48 | J50 to J58 | J60 to J68 | J70 to J78 | J80 to J88 |
| J.. 0 | Positio | [105] | 0 |  |  |  |  |  |  |  |  |
| J.. 1 | Positio |  | 0 |  |  |  |  |  |  |  |  |
| J. 2 | Speed | [105/sec] | 1000 |  |  |  |  |  |  |  |  |
| J. 3 | Accel | [105/sec ${ }^{2}$ ] | 1000 |  |  |  |  |  |  |  |  |
| J.. 4 | Decel | [105/sec ${ }^{2}$ ] | 1000 |  |  |  |  |  |  |  |  |
| J. 5 | Repea |  | 0 |  |  |  |  |  |  |  |  |
| J.. 6 | Next b |  | 0 |  |  |  |  |  |  |  |  |
| J.. 7 | Next s |  | 0 |  |  |  |  |  |  |  |  |
| J.. 8 | Delay | [sec] | 0 |  |  |  |  |  |  |  |  |


\section*{| Parameter | DS | Entry |
| :--- | :--- | :--- |}


| L.. Posi.Command 2 (Extended Process Block Parameters) |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | L10 to L12 | L20 to L22 | L30 to L32 | L40 to L42 | L50 to L52 | L60 to L62 | L70 to L72 | L80 to L82 |
| L. 0 | Brake | 0 |  |  |  |  |  |  |  |  |
| L. 1 | Switch A | 0 |  |  |  |  |  |  |  |  |
| L. 2 | Switch B | 0 |  |  |  |  |  |  |  |  |


| Parameter |  | DS | Entry |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| M.. Menu skip (Menüsprungziele) |  |  |  |  |  |  |
|  |  |  | Jump to F1 M50 to M52 | Jump to F2 M60 to M62 | Jump to F3 M70 to M72 | Jump to F4 M80 to M82 |
| M50 | F1-jump to |  |  |  |  |  |
| M51 | F1-lower limit |  |  |  |  |  |
| M52 | F1-upper limit |  |  |  |  |  |


| Parameter |  |  | DS | Entry |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N.. Posi.Switches |  |  |  |  |  |  |  |
|  |  |  |  | Switch S1 <br> N10 to N14 | Switch S2 $\mathrm{N} 20 \text { to } \mathrm{N} 24$ | Switch S3 N30 to N34 | Switch S4 N40 to N44 |
| N.. 0 | S..-position | [105] | 0 |  |  |  |  |
| N.. 1 | S..-method |  | 0 |  |  |  |  |
| N.. 2 | S..-memory1 |  | 0 |  |  |  |  |
| N. 3 | S..-memory 2 |  | 0 |  |  |  |  |
| N.. 4 | S..-memory 3 |  | 0 |  |  |  |  |


| Parameter |  |  | DS |
| :--- | :--- | :---: | :--- |
| Entry |  |  |  |
| U..Protective Functions |  |  |  |
| U00 | Level low voltage | 3 |  |
| U01 | Time low voltage | 2 |  |
| U02 | Level temp. limit device i2t | 1 |  |
| U03 | Time temp. limit device i2t | 10 |  |
| U10 | Level temp. limit motor i2t | 1 |  |
| U11 | Time temp. limit motor i2t | 30 |  |
| U20 | Level drive overload | 1 |  |
| U21 | Time drive overload | 10 |  |
| U22 | Text drive overload | drive <br> overload |  |
| U30 | Level acceleration overload | 1 |  |
| U31 | Time acceleration overload | 5 |  |
| U32 | Text acceleration overload | acceleration <br> overload |  |
| U40 | Level break overload | 1 |  |
| U41 | Time break overload | 5 |  |
| U42 | Text break overload | break <br> overload |  |
| U50 | Level operating range | 1 |  |
| U51 | Time operating range | 10 |  |
| U52 | Text operating range | operating <br> range |  |
| U60 | Level following error | 3 |  |
| U61 | Time following error | 500 |  |
| U70 | Level posi. refused | 1 |  |

## 21. Accessories

### 21.1 Accessories overview

|  | Id. No. | Designation | Remark |
| :---: | :---: | :---: | :---: |
|  | 42604 | Option board SEA4000 <br> In addition: 10 binary inputs and 5 binary outputs. | Chap. 14.1 |
|  | 42605 | Option board SDP4000 <br> Profibus-DP link | Chap. 14.1 |
|  | 42559 | Option board SDP4000 and SEA4000 (combi board) <br> In addition: 10 binary inputs and 5 binary outputs plus Profibus-DP link. | Profibus-DP documentations: <br> Publ. no. 441525 (german) <br> Publ. no. 441535 (english) |
|  | --- | CAN-Bus link integrated | CAN bus documentation: <br> Publ. no. 441532 (german) <br> Publ. no. 441562 (english) |
|  | 42940 | Master-slave connection (prefabricated) <br> Connection of the incremental encoder interface on the configuration output of the master drive to the incremental encoder interface on the configuration input of the slave. | Chap. 11.2 |
|  | 44087 | CD WELT DER ELEKTRONIK <br> This CD-ROM contains: <br> - Sample applications, <br> - Documentation, <br> - FDS-Tool (PC programm for programming, operation and observation of the inverters) <br> - Fieldbus datas | Download from: http://www.stoeber.de <br> FDS-Tool documentation: <br> Publ. no. 441349 (german) <br> Publ. no. 441409 (english) |
|  | 41488 | Connection cable G3 <br> PC <-> FDS connection cable with 9-pin sub D plug connector, plug connector/socket | Chap. 9.9 |

## 21. Accessories

|  | Id. No. | Designation | Remark |
| :--- | :--- | :--- | :--- |

## 21. Accessories

### 21.2 Braking resistor

21.2.1 Allocation of braking resistor to SDS

| Type | Id. No. | FZT |  |  | FZZT |  | FZDT | VHPR ${ }_{c} \mathrm{TM}_{\text {us }}$ | VHPR |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{gathered} 300 \times 45 \\ 300 \mathrm{~W} \\ 80 \Omega \\ \hline \end{gathered}$ | 400x65 600 W $>30 \Omega$ | $\begin{gathered} 400 \times 65 \\ 600 \mathrm{~W} \\ 20 \Omega \\ \hline \end{gathered}$ | $\begin{gathered} 400 \times 65 \\ 1200 \mathrm{~W} \\ 30 \Omega \\ \hline \end{gathered}$ | $\begin{array}{\|c} \hline 400 \times 65 \\ 1200 \mathrm{~W} \\ 20 \Omega \\ \hline \end{array}$ | $\begin{gathered} 500 \times 65 \\ 2500 \mathrm{~W} \\ 20 \Omega \\ \hline \end{gathered}$ | $\begin{gathered} \text { VHPR150V } \\ 150 \mathrm{~W} \\ 100 \Omega \\ \hline \end{gathered}$ | $\begin{gathered} \text { VHPR600V } \\ 600 \mathrm{~W} \\ 100 \Omega \\ \hline \end{gathered}$ |
|  |  | 41730 | 41641 | 41648 | 41643 | 41651 | 41653 | 45973 | 44316 |
| SDS 4011 | 42227 | X | - | - | - | - | - | X | - |
| SDS 4021 | 42228 | X | - | - | - | - | - | X | - |
| SDS 4041 | 42229 | X | X | - | X | - | - | - | X |
| SDS 4071 | 42230 | X | X | - | X | - | - | - | X |
| SDS 4101 | 42961 | X | X | - | X | - | - | - | X |
| SDS 4141 | 42231 | X | X | - | X | - | - | - | X |
| SDS 4281 | 43481 | - | - | X | - | X | X | - | - |
| SDS 4481 | 43482 | - | - | X | - | X | X | - | - |

21.2.2 Braking resistor FZT / FZZT (dimensions)


POSIDYN ${ }^{\circledR}$ SDS 4000

## 21. Accessories

### 21.2.3 Braking resistor VHPR (dimensions)

| Type | VHPR150V <br> $\mathbf{1 5 0} \mathbf{W , 1 0 0} \boldsymbol{\Omega}$ | VHPR600V <br> $\mathbf{6 0 0} \mathbf{W , 1 0 0} \boldsymbol{\Omega}$ |
| :--- | :---: | :---: |
| L | 212 | 420 |
| C | 193 | 400 |
| B | 40 | 60 |
| A | 21 | 31 |
| D | 4,3 | 5,3 |
| E | 8 | 11,5 |
| F | 13 | 19.5 |
| Weight $[g]$ | approx. 310 | approx. 1300 |


[dimensions in mm ]

### 21.3 Input filter (dimensions)

| Type | Id. No. | Input filter for radio-interference level „B" |
| :--- | :--- | :--- |
| SDS 4011 | 42227 |  |
| SDS 4021 | 42228 |  |
| SDS 4041 | 42229 |  |
| SDS 4071 | 42230 |  |
| SDS 4101 | 42961 | FS 4835-25-29, 25 A $_{\text {eff }}[28204]$ |
| SDS 4141 | 42231 |  |



### 21.4 Output derating (dimensions)



| Output derating AD $\mathbf{3 2 0}$ (complete) |  |
| :--- | :--- |
| Id. No. | 99860 |
| Rated current | $\max .3 \times 20 \mathrm{~A}$ |
| Frequency | 8.3 kHz |
| Inductance | 1.2 mH |

## Additional information under: http://www.stoeber.de

[^6]
## STÖBER . . . The Drive for Your Automation


Presented by:

## Artisan Technology Group is an independent supplier of quality pre-owned equipment

## Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

## We buy equipment

Planning to upgrade your current
equipment? Have surplus equipment taking up shelf space? Well give it a new home.

## Learn more!

Visit us at artisantg.com for more info on price quotes, drivers, technical specifications, manuals, and documentation.


[^0]:    ${ }^{1}$ Line circuit breaker - tripping characteristic D in accordance with EN 60898
    ${ }^{2}$ External braking resistors with thermal monitoring are recommended. Mandatory for UL use!

[^1]:    ${ }^{1}$ Evaluation of the outputs via inverting interface terminals (e.g., Phönix DEK-REL-24///1)

[^2]:    ${ }^{1}$ Only in connection with a Controlbox

[^3]:    - The power pack must be turned off before these parameters can be changed.

    Italics These parameters are sometimes not shown depending on which parameters are set.
    1)
    See result table in chap 15.
    2) Only available when $\mathbf{D} 90 \neq 1$
    3) Only available when D99=0

    Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
    Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

[^4]:    - The power pack must be turned off before these parameters can be changed.

    Italics These parameters are sometimes not shown depending on which parameters are set.
    $\begin{array}{lll}\text { See result table in chap } 15 . & \text { 2) Only available when } \mathbf{D} 90 \neq 1 & \text { 3) Only available when } \mathbf{D 9 9}=0\end{array}$
    Parameters which are included in the normal menu scope ( $\mathbf{A 1 0}=0$ ). For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
    Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

[^5]:    - The power pack must be turned off before these parameters can be changed.

    Italics These parameters are sometimes not shown depending on which parameters are set.

    1) See result table in chap $15 . \quad$ 2) Only available when $\mathbf{D} 90 \neq 1$
    2) Only available when D99=0

    Parameters which are included in the normal menu scope $(\mathbf{A 1 0}=0)$. For other parameters, select $\mathbf{A 1 0}=1:$ extended or $\mathbf{A 1 0}=2:$ service.
    E Parameters marked with a " $\sqrt{ }$ " can be parameterized separately from each other in parameter record 1 and 2.

[^6]:    2004 STÖBER ANTRIEBSTECHNIK GmbH + Co. KG Publication no. 441449.02.01 - 02.2004

    - Subject to change without prior notice -

