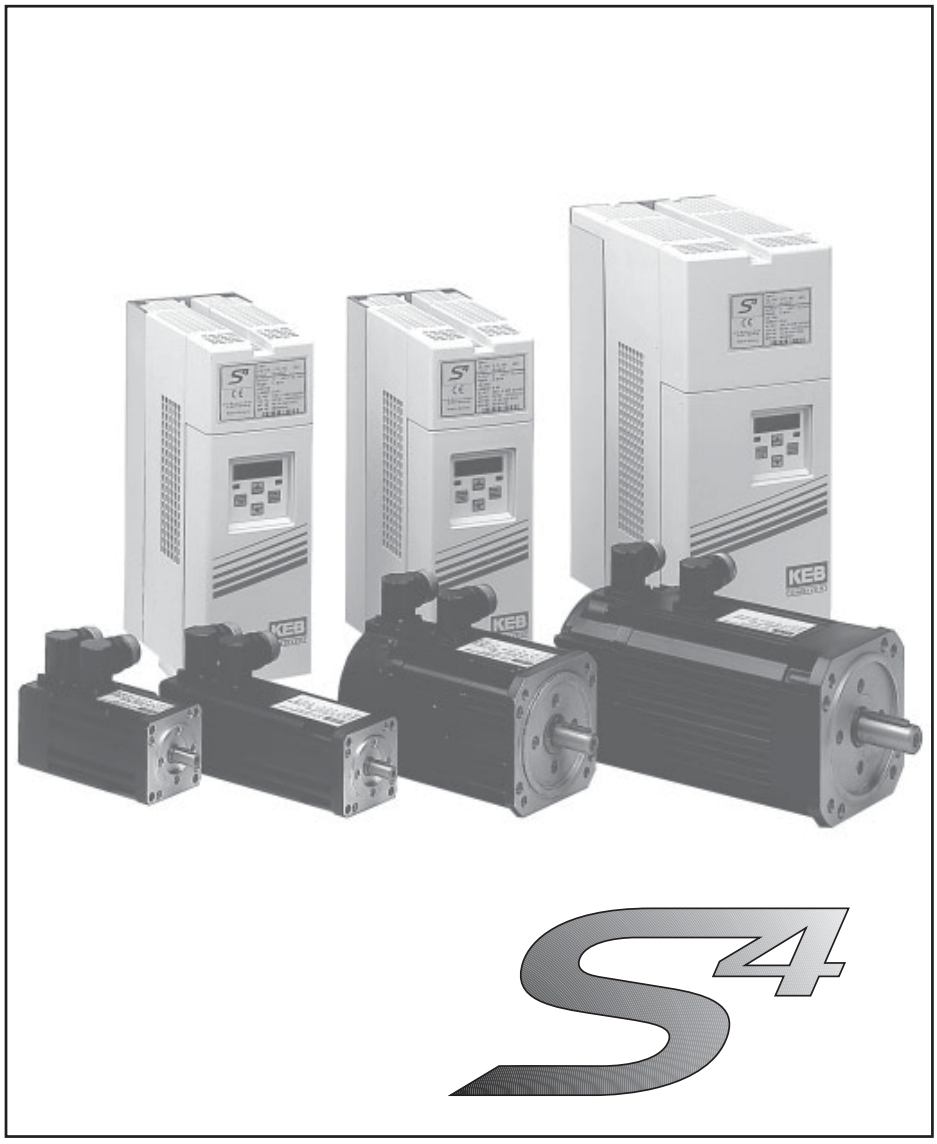
APPLICATION MANUAL



KEB COMBIVERT S4 **Version 3.0**
Size D / E / G / H / R / U

00.S4.0EA-K300

Discretionary charge 40,- Euro

KEB

1/2004

Contents

1 . General

This manual is valid for the **KEB COMBIVERT S4.**

Prior to carrying out any work the user must familiarize himself with the unit. This includes in particular the knowledge and oberservance of the safety and warning instructions. Absolutely read the "Technical Dokumentation Part 1".

The pictograms used in this manual mean:

Danger Warning Caution		Used when the life or health of the user is exposed to danger or considerable damage to property can occur.
Attention		Must be observed! Special instructions for a safe and trouble-free operation.
Information		Help, Tip

1.1 Interference Suppression of Servo-Control

The control and power inputs of the servo-control are protected against interferences.

Increased operational reliability and additional protection against malfunctions is achieved through following measures:

- Use of mains filter when the mains voltage is affected by the connection of large consumers (reactive-power compensation equipment, HF-furnaces etc.)
- Protective wiring of inductive consumers (solenoid valves, relays, electromagnets) with RC elements or similar devices to absorb the energy released when the unit is switched off.
- Separate laying of power lines as described in the connection directions to avoid inductive and capacitive coupling of interference pulses.
  Paired-twisted cables protect against inductive parasitic voltages, shielding provides protection against capacitive parasitic voltages. Optimal protection is achieved with twisted and shielded cables when signal and power lines are layed separately.

1.2 Interference Suppression of Electrical Units

The servo-control **KEB COMBIVERT S4** transmits waves of high frequency. The following measures can reduce the arising interference pulses that may effect electrical units in the vicinity of the servo-control:

- Installation of the KEB COMBIVERT S4 in a metal housing.
- Shielded motor cables.
  The shield must be connected to PE of the servo-control and to the housing of the motor (connect extensive shield). The shielding shall not be used as protective earthing. Only an uninterrupted shield beginning as close as possible at the servo-control or servo motor ensures a safe function of the shielding.
- Good earthing (grounding strip or 10 mm^2 earth lead).
- Use of radio interference suppression filters.

1.3 Operating Instructions

To avoid premature ageing and/or destruction of the servo-control KEB COMBIVERT S4, observe the following instructions!

- Install an isolating switch between voltage supply and servo-control, so that **KEB COMBIVERT S4** can be shut off independently
- Frequent switching between mains and servo-control is not permitted!
- Switching between motor and servo-control during operation is prohibited!
- The **KEB COMBIVERT S4** is to be operated under suitable conditions (see Ambient Conditions).

2. Installation and Connection

2.1 Ambient Conditions

Altitude of site max. 2000m. A power reduction of 1% per 100 m must be taken into account for site altitudes of 1000 m and more above sea level, e.g. at 1500m = 95% P rated is allowed.

Max. Permissible Limit Values:	KEB COMBIVERT S4
Coolant inlet temperature / ambient temperature during operation	-10 °C…+45 °C
Storage temperature	-25 °C…+70°C
Transport temperature	-25 °C…+70°C
Relative humidity	max. 95% no condensation climatic category 3K3

2.2 Type of Protection

KEB COMBIVERT S4: **IP 20**

The type of protection is only warranted with the correct installation and connection of the components.

2.3 Installation Instructions

- Stationary installation and earthing of the servo-control KEB COMBIVERT S4.
- When installing the servo-control observe minimum distance to adjacent elements (see Installation Instructions).
- No moisture or water may penetrate into the COMBIVERT S4.
- Avoid penetration of dust into the KEB COMBIVERT S4. For installation in a dustproof housing sufficient heat dissipation must be provided.
- Do **not** operate the servo system KEB COMBIVERT S4 in explosion-protected rooms.
- Protect KEB COMBIVERT S4 against aggressive gases and liquids.

If other consumers which produce electric or magnetic fields or which effect the power supply are located in the vicinity of the servo-control, they must be positioned as far away as possible from the servo-control and steps must be taken to suppress interferences.

2.4 Calculations

Calculation of control cabinet surface: $A = \frac{P_V}{\Delta T \cdot K}$ [m²]

Rate of air flow with fan cooling: $V = \frac{3{,}1 \cdot P_V}{\Delta T}$ [m³/h]

A = Control cabinet surface [m²]

ΔT = Temperature difference [K] (Standard value = 20 K)

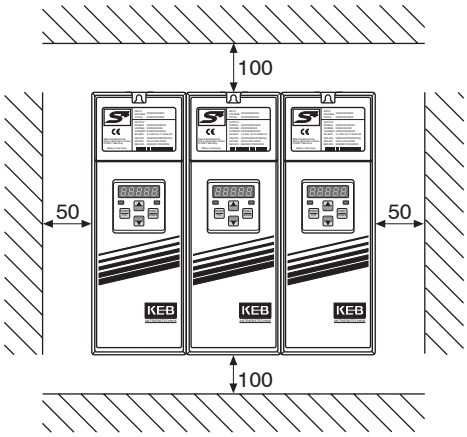
K = Heat transfer coefficient $\left[\frac{W}{m^2 \cdot K}\right]$ (Standard value = 5 $\frac{W}{m^2 \cdot K}$)

P_V = Heat dissipation [W]

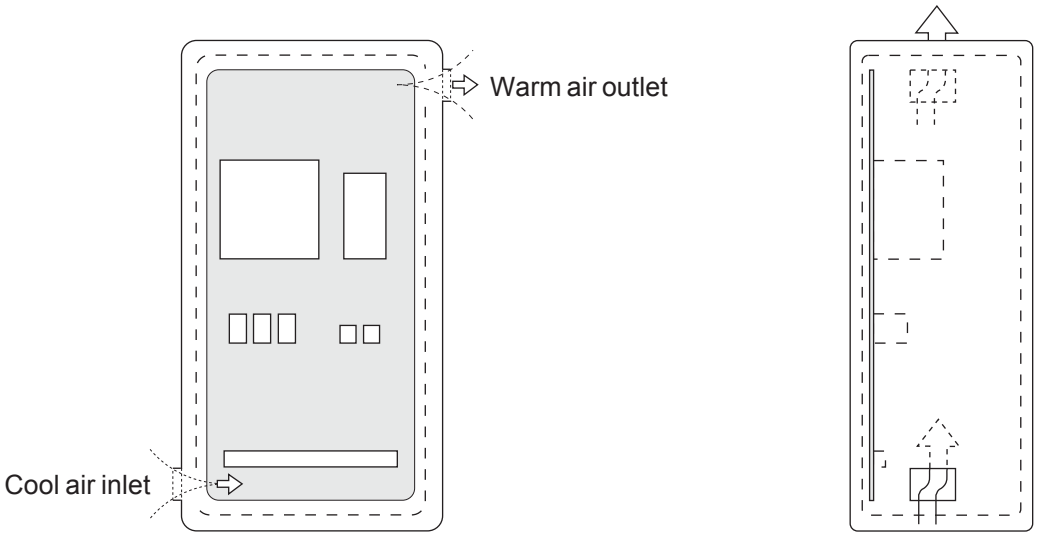
V = Air flow rate of fan [m³/h]

For detailed information please refer to the catalogs from the control cabinet manufacturer.

2.5 Installation Conditions



Minimum distance



2.6 Technical Data

Operating temperature	-10° ... +45°C; Storage: -25° ... +70°C
Type of Protection	IP20

The Type of protection is warranted only with correct installation and connection of the components.

230 V Class

Size		03		05		14
Housing		**D**		**D**		**G**
Mains voltage [1]	[V]	180 . . . 260 ± 0%				
Line frequency	[Hz]	50 / 60 Hz ± 2 Hz				
Line phases		**1**	**3**	**1**	**3**	**3**
Input current	[A]	4,8	2,6	12,8	7	36
max. perm. Mains fuse [3]	[A]	16	10	16	10	50
Rated output current	[A]	2,4		6,4		33
Stall current I_{do}	[A]	6,4		6,4		33
Peak current I_{max} [4]	[A]	8,5 for 1200 ms		14,8 for 600 ms		49,5 for 1000 ms
Line cross section [2]	[mm²]	1,5		1,5		280
Heat dissipation P_V [5]	[W]	65		75		100
Max. motor line length [6]	[m]	50		50		50

[1] In relation to 230V nominal input voltage

400 V Class

Size		07	10
Housing		**D**	**D**
Mains voltage [1]	[V]	305 . . . 500 ± 0%	
Line frequency	[Hz]	50 / 60 Hz ± 2 Hz	
Line phases		3	3
Input current	[A]	3	7
max. perm. Mains fuse [3]	[A]	10	10
Rated output current	[A]	2,7	6,4
Stall current I_{do}	[A]	2,7	6,4
Peak current I_{max} [4]	[A]	8,5 for 200 ms	22 for 200 ms
Line cross section [2]	[mm²]	1,5	1,5
Heat dissipation P_V [5]	[W]	95	110
Max. motor line length [6]	[m]	50	50

[1] In relation to 400 V nominal input voltage.
[2] Recommended min. cross section of mains supply at rated power.
[3] Mains fuse and line cross section can also be dimensioned on the basis of the rated current of the servo motor.
[4] The peak current I_{max} is a theoretical value, that causes the response of the current limiting. The maximum torque limit should be adjusted 10...15% below I_{max}.
[5] Heat dissipation related to the static continuous current (heat dissipation control circuit ca. 20 W).
[6] Other cable lengths on request.

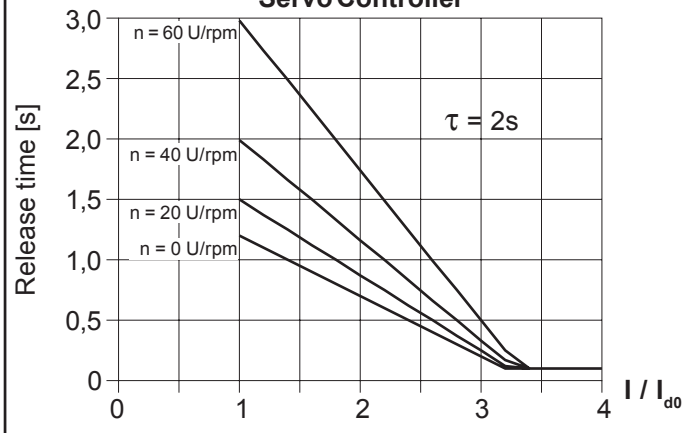
Size		12	16
Housing		E	G
Mains voltage [1]	[V]	305 . . . 500 ± 0%	
Line frequency	[Hz]	50 / 60 Hz ± 2 Hz	
Line phases		3	3
Input current	[A]	18,2	36
max. perm. Mains fuse [3]	[A]	20	50
Rated output current	[A]	16,5	33
Stall current I_{do}	[A]	16,5	21,5
Peak current I_{max} [4]	[A]	38 for 600 ms	49,5 for 600 ms
Line cross section [2] [3]	[mm²]	2,5	10
Heat dissipation P_V [5]	[W]	240	310
Max. motor line length [6]	[m]	100	100

Size		18	22	24
Housing		H	R	U
Mains voltage [1]	[V]	305 . . . 500 ± 0%		
Line frequency	[Hz]	50 / 60 Hz ± 2 Hz		
Line phases		3		
Input current	[A]	55	127	198
max. perm. Mains fuse [3]	[A]	80	160	315
Rated output current	[A]	50	115	180
Stall current I_{do}	[A]	45	115	180
Peak current I_{max} [4]	[A]	75 for 800 ms	172,5 for 1000 ms	270 for 1000 ms
Line cross section [2] [3]	[mm²]	25	50	95
Heat dissipation P_V [5]	[W]	610	1500	2400
Max. motor line length [6]	[m]	100	100	100

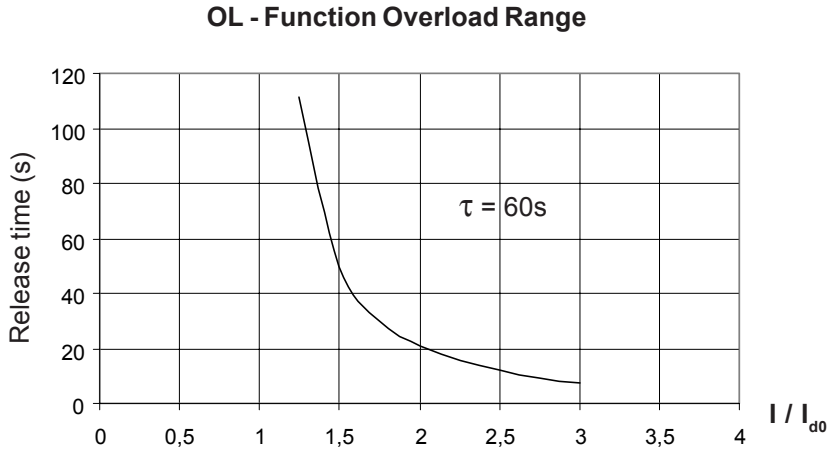
[1] In relation to 400 V nominal input voltage.
[2] Recommended min. cross section of mains supply at rated power.
[3] Mains fuse and line cross section can also be dimensioned on the basis of the rated current of the servo motor.
[4] The peak current I_{max} is a theoretical value, that causes the response of the current limiting. The maximum torque llimit should be adjusted 10...15% below I_{max}.
[5] Heat dissipation related to the static continuous current (heat dissipation control circuit ca. 20 W).
[6] Other cable lengths on request.

PTC- connection (200 V / 400 V -Class)	1…3 PTC–detectors (series connection)
max. cold resistance of PTC-detector chain [Ω]	400
Error tripping range [Ω]	≥1650
Error reset range [Ω]	≤ 500

OL-Function
KEB COMBIVERT S4:
Size 03, 05, 07, 10, 12, 16
Protection of output stage at < 60 rpm

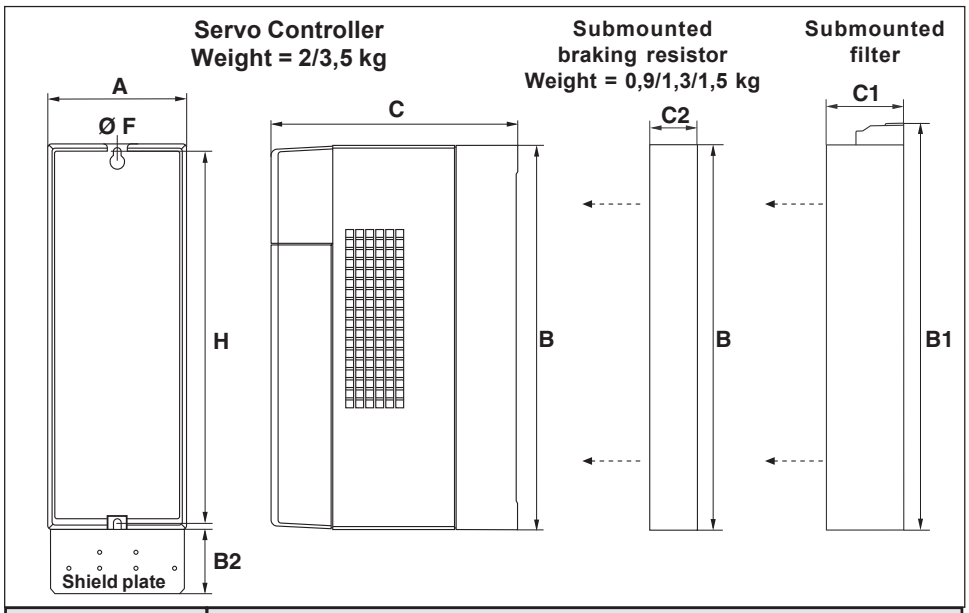


Unit	$\frac{I}{I_{d0}}$ max.
03	1,3
05	2,3
07	3,1
10	3,4
12	2,3
14	1,5
16	2,3
18	1,7
22	1,5
24	1,5



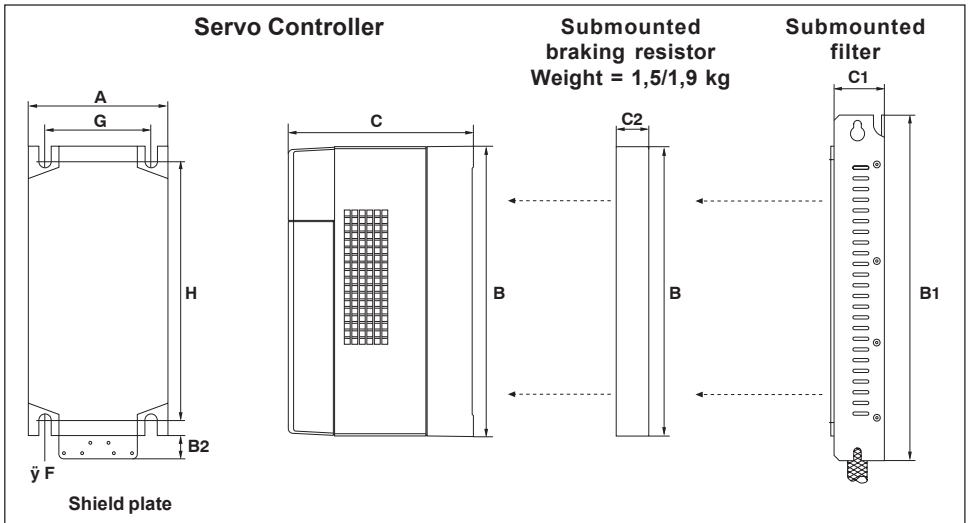
τ = Reset time of the overload counter, relating to 100 % of the release time

2.7 Dimensions KEB COMBIVERT S4



Size	A	B	B1	B2	C	C1	C2	F	H
D	90	250	264	37,5	160	50	30	5	240
E	130	290	352	37,5	200	50	30	7	275

B1/C1 with submounted filter
B2 with shield plate
B3 with submounted filter and shield plate
C2 with submounted braking resistor
C3 with submounted braking resistor and filter



Size	A	B	B1	B2	C	C1	C2	F	G	H	Weight
G	170	340	415	32	255	56	30	7	150	330	10
H	297	340	445	51	255	66	-	7	250	330	14
R*	340	520	-	68	355	-	-	10	300	495	25-29
U	340	800	-	-	355	-	-	11	300	775	75
Built-on filter	181	415	---	---	56	---	---	7	150	400	---

B2 with shield plate
C2 with submounted braking resistor

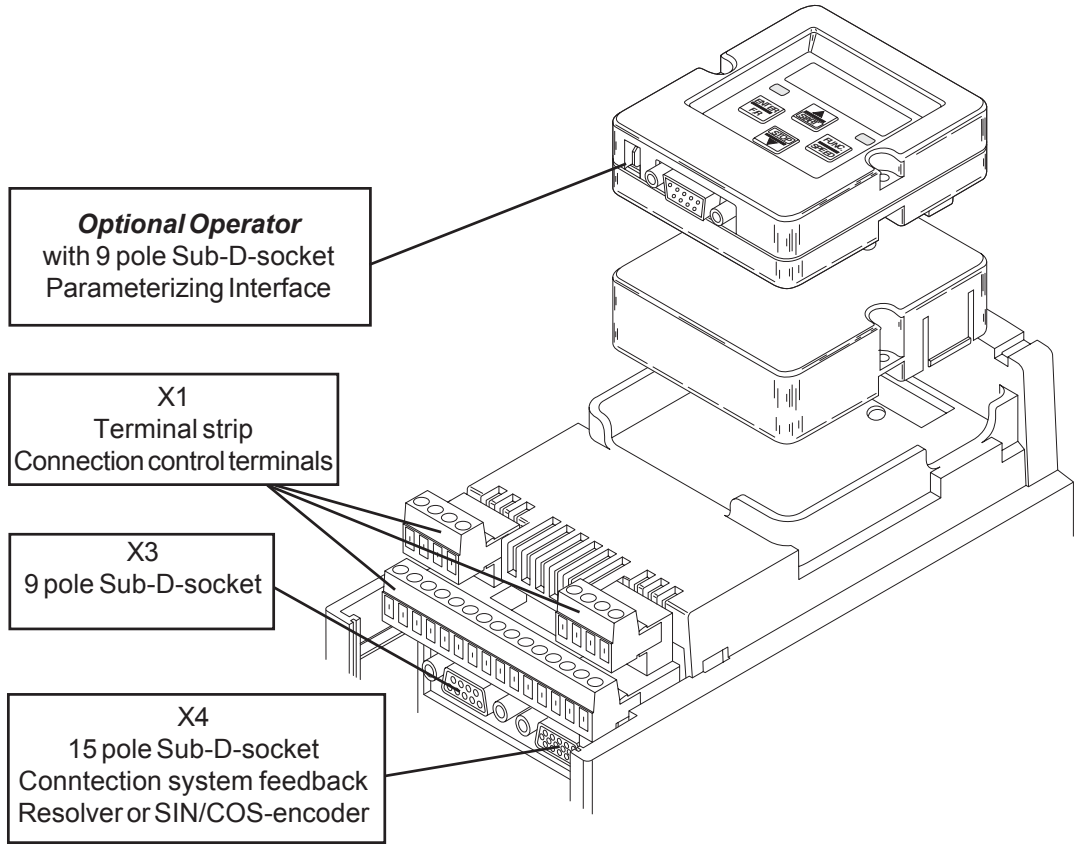
Dimensions and wights of the HF-filter: see Instruction Manual 00.F4.00B-K000 (KEB-COMBIVERT F4).

*) The R-Housing installation filter have no influence to the dimensions of the housing. (Weight = 7 kg)

2.8 Connection

2.8.1 Summary

Size D - E



Size G / H / R / U

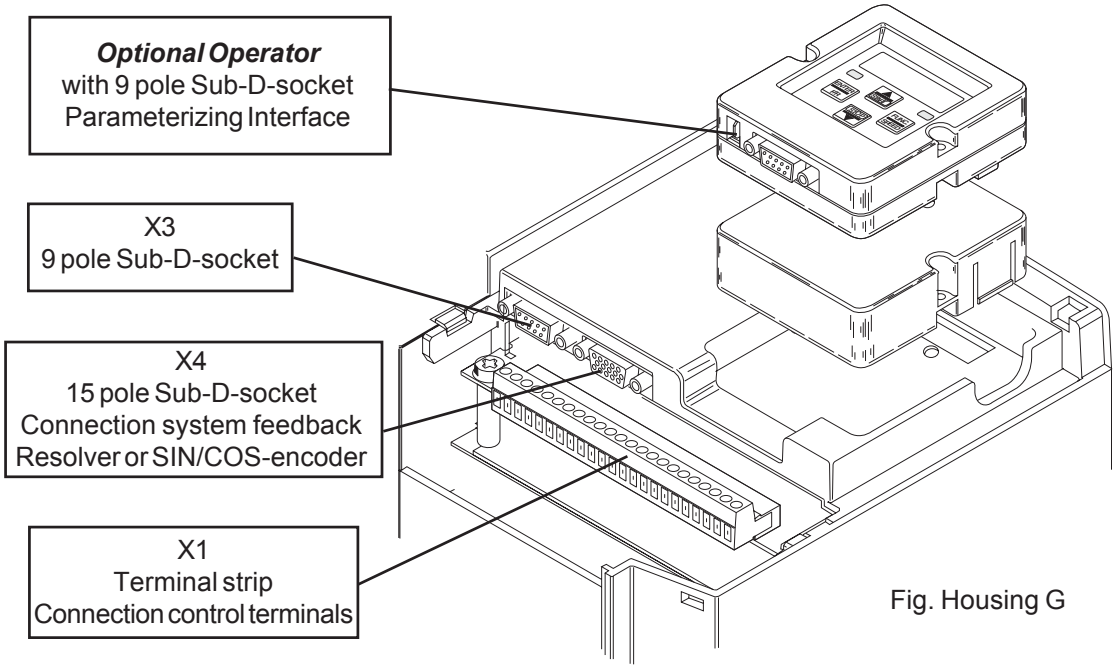
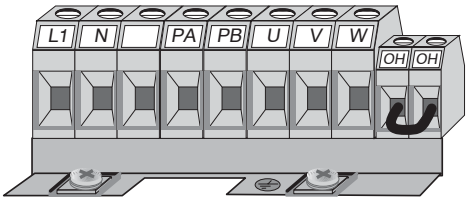


Fig. Housing G

Size D

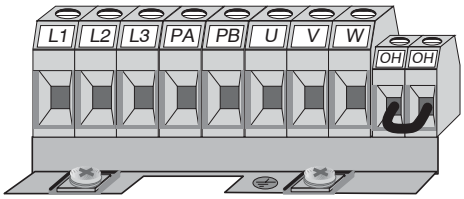
Note input voltage, since 230V and 400V class (3 phase) is possible.

1-phase



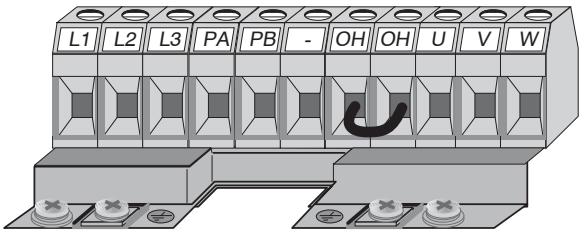
L1, N	1 phase mains connection
L1, L2, L3	3 phase mains connection
PA, PB	Connection braking resistor

3-phase



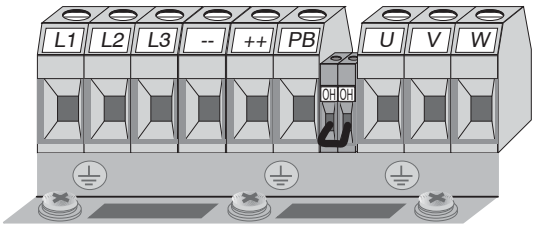
U, V, W	Motor connection
OH, OH	Connection for temperature sensor
⏚	Connection for screening/earthing

Size E



L1, L2, L3	3 phase mains connection
PA, PB	Connection braking resistor
PA, -	Connection for braking module and feedback unit
OH, OH	Connection for temperature sensor
U, V, W	Motor connection
⏚	Connection for screening/earthing

Size G

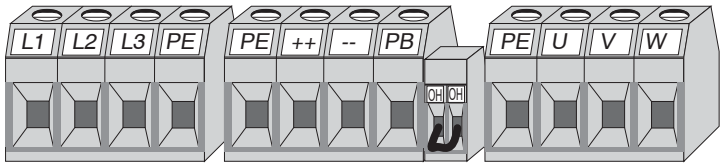


L1, L2, L3	3 phase mains connection
++, PB	Connection braking resistor
++, --	Connection for braking module, feedback and supply unit DC input 420...720VDC
OH, OH	Connection for temperature sensor
U, V, W	Motor connection
⏚	Connection for screening/earthing

Unit without DC input

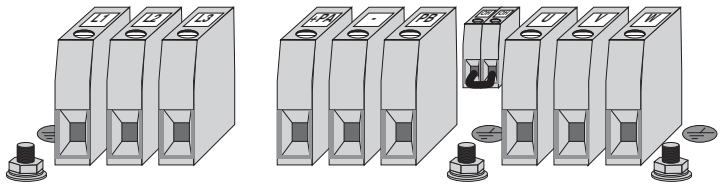
+PA, PB	Connection braking resistor
+PA, -	Connection for braking module and feedback unit

Size H



L1, L2, L3	3 phase mains connection
++, PB	Connection braking resistor
++, --	Connection for braking module, feedback and supply unit DC input 420...720VDC
OH, OH	Connection for temperature sensor
U, V, W	Motor connection
PE	Connection for screening/earthing

Size R and U



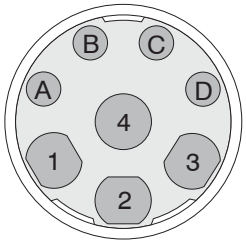
L1, L2, L3	3 phase mains connection
+PA, PB	Connection for braking resistor
+PA, -	Connection for braking module and feedback unit
OH, OH	Connection for temperature sensor
U, V, W	Motor connection
⏚	Connection for screening/earthing

Remove or plug in the power connector only at switched off unit and disconnected power supply!

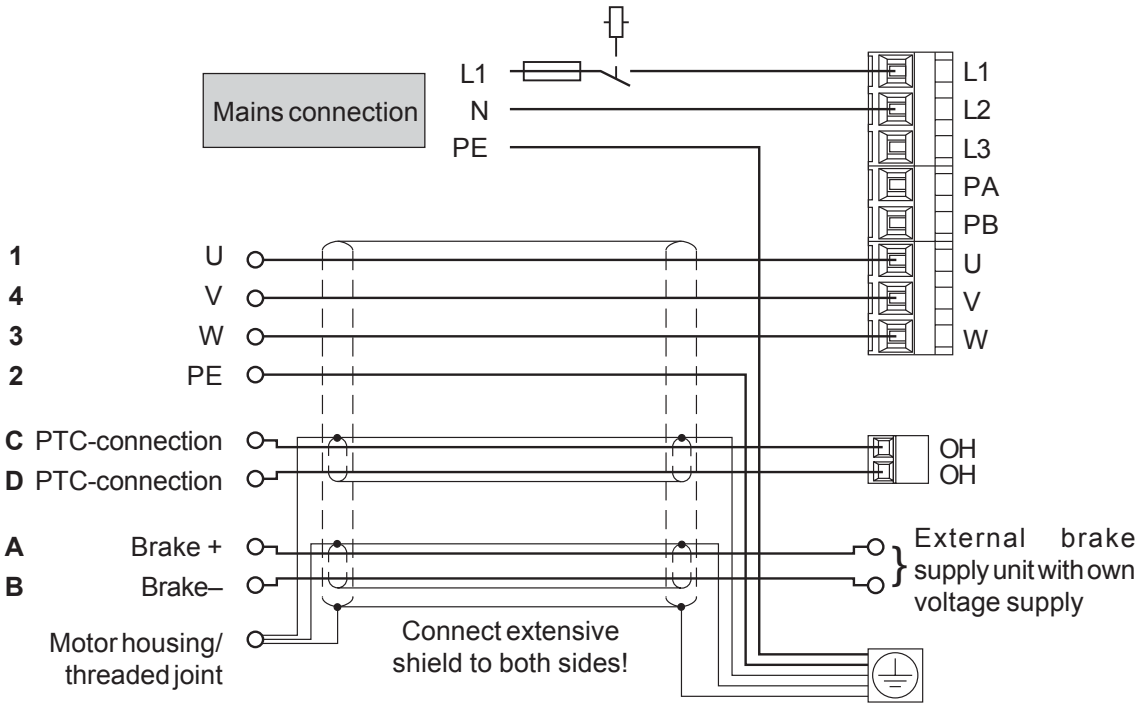
Observe the correct phase sequence for the connection of the servo motor!

2.8.2 1-phase Connection
230 V Class

PE Protective earth conductor
U, V, W Motor
PA, PB Connection braking resistor
L1, L2 Mains connection 1-phase



Servo motor
power connector



Connector Contact No.	Designation	Cable Core No.
1	U	1
4	V	2
3	W	3
2	PE	Green-Yellow
A	Brake +	5
B	Brake –	6
C	PTC-Contact	7
D	PTC-Contact	8
Recommended motor cable		
4 x 1,5 + 2 x (2 x 0,75)		

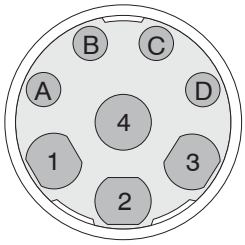
2.8.3 3-phase Connection
230V / 400V Class

> Absolutely ensure the observance of the supply voltage of the servo controller (3 x 230 V / 3 x 400 V!

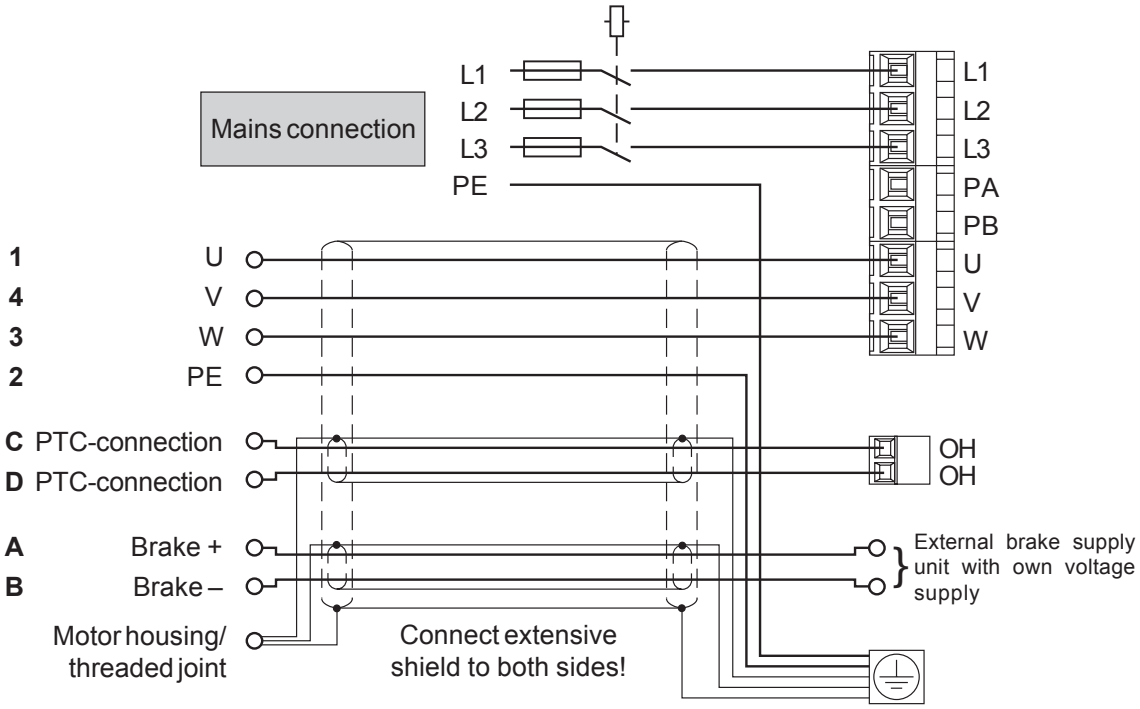
> Remove or plug in the power connector only at switched off unit and disconnected power supply!

> Observe the correct phase sequence for the connection of the servo motor!

PE	Protective earth conductor
U, V, W	Motor
L1, L2, L3	Mains connection 3-phase
PA, PB	Connection braking resistor



Servo motor
power connector



Connector Contact No.	Designation	Cable Core No.
1	U	1
4	V	2
3	W	3
2	PE	Green-Yellow
A	Brake +	5
B	Brake –	6
C	PTC-Contact	7
D	PTC-Contact	8

Size of the Unit	Recommended motor cable
07 / 10	4 x 1,5 + 2 x (2x0,75)
12	4 x 2,5 + 2 x (2x0,75)
16	4 x 4 + 2 x (2x0,75)

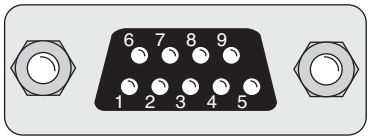
2.8.4 Connection Incremental Encoder Input / Emulation (X3)

With parameter **EC.10** the encoder interface X3 is reversible from an incremental encoder emulation to an incremental encoder input. The increments of the emulation are fixed to 1024 for units with resolver interface. For units with SIN/COS interface, the increments of the SIN/COS - encoder are used.

Remove or plug in the power connector when the unit is switched off and the power supply is disconneced!

Max. input frequency:	< 300 kHz
Signals:	RS 422 / 2 track signal and zero signal
Max. transmission link:	50 m
Released encoder types:	Kübler 5800 / 5820
	Heidenhain RON 425 / ROD 426 or compatible

Sub-D-Socket X3



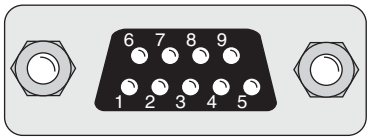
PIN No.	Signal	Meaning
1	Ua1	Signal channel A
2	Ua2	Signal channel B
3	Ua0	Signal zero
4	+5V	max. 150 mA (1)
5	+18V	max. 100 mA (1)
6	Ua1	Signal channel A inverted
7	Ua2	Signal channel B inverted
8	Ua0	Signal zero inverted
9	GND	

2.8.5 SSI-Interface for absolute value encoder (Optional to X3)

Remove or plug in the power connector when the unit is switched off and the power supply is disconnected!

Clock frequency:	326,5 kHz or 156,2 kHz
Signals:	RS 422 / Clock and data
Max. transmission link:	50 m
Released encoder types:	Heidenhain ROC 424,
	Stegmann AG 626 or compatible.

Sub-D-Socket X3



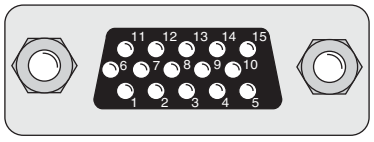
PIN No.	Signal	Meaning
1	Clock +	
2	Data +	
3	n.c.	
4	+ 5 V	max. 150 mA (1)
5	+18 V	max. 100 mA (1)
6	Clock -	
7	Data -	
8	n.c.	
9	GND	

(1) Voltage supply at X3 and X4 can be loaded at the +18V with max. 100mA. Alternatively the +5V can be loaded with 300mA.

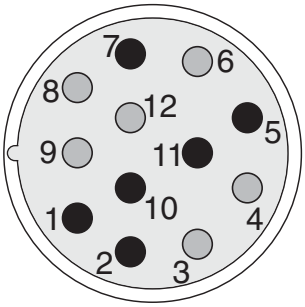
2.8.6 Connection Resolver (X4)

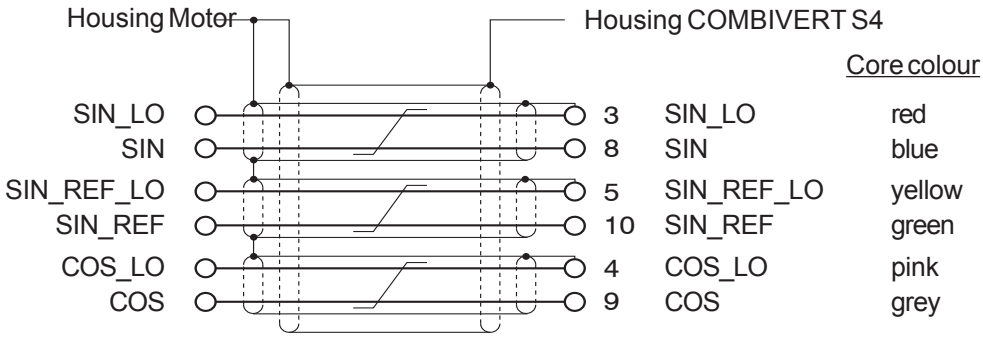
Remove or plug in the power connector when the unit is switched off and the power supply is disconnected!

SUB-D-Socket X4



Servo Motor
Resolver connector

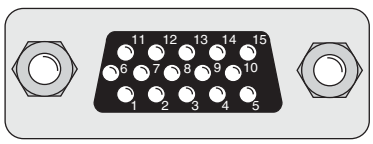




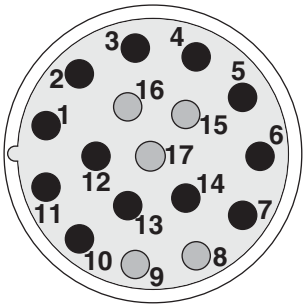
2.8.7 Connection SIN/COS encoder (Optional to X4)

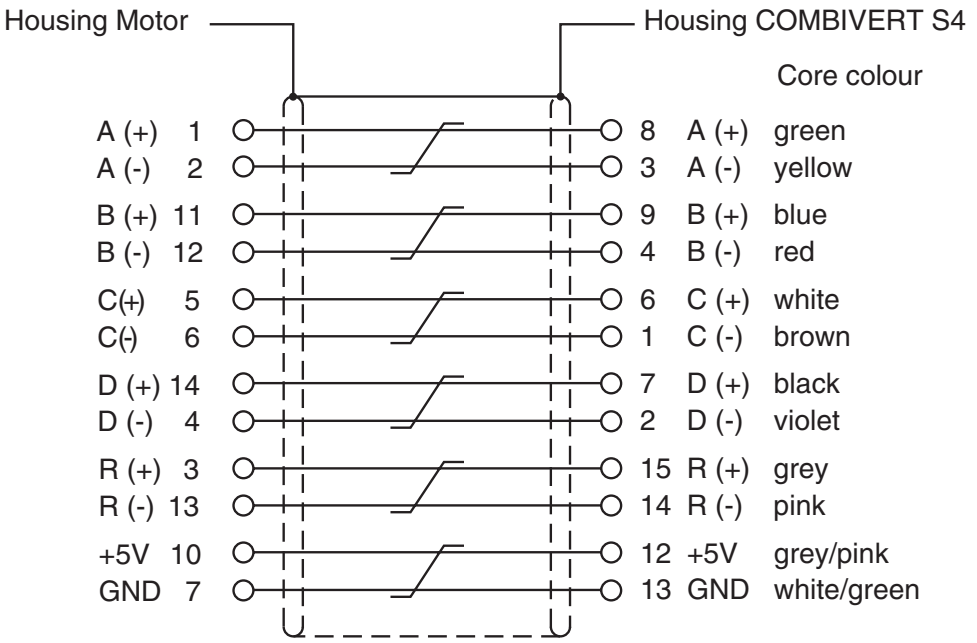
Remove or plug in the power connector when the unit is switched off and the power supply is disconnected!

SUB-D-Socket X4



Servo Motor
Encoder connector

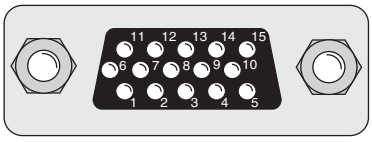




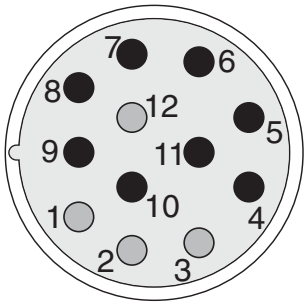
2.8.8 Connection Hiperface

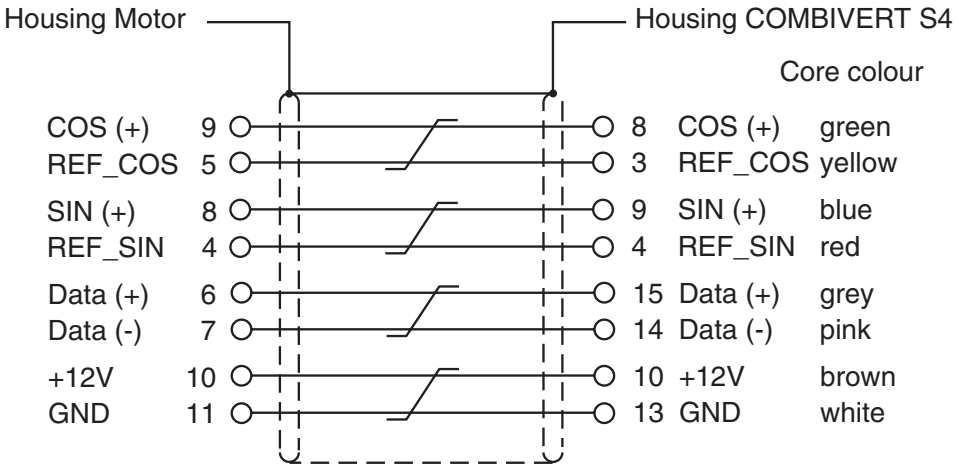
Remove or plug in the power connector when the unit is switched off and the power supply is disconnected!

SUB-D-Socket X4



Servo Motor
Encoder connector



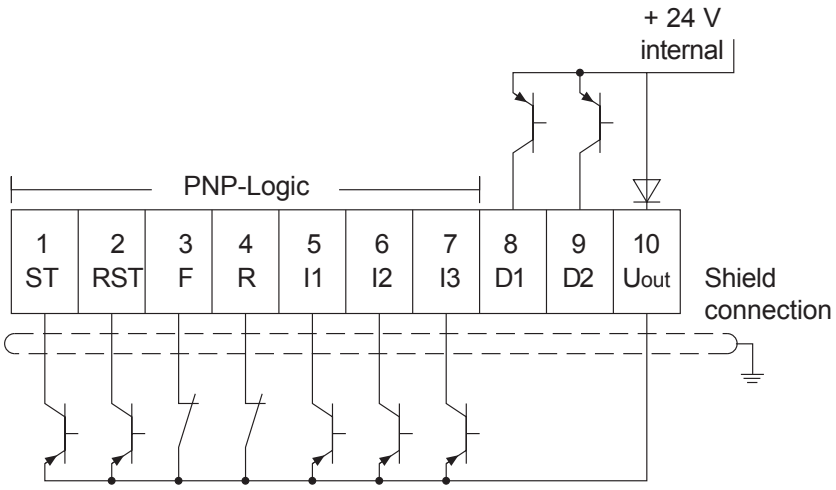


2.8.9 Terminal Strip X1

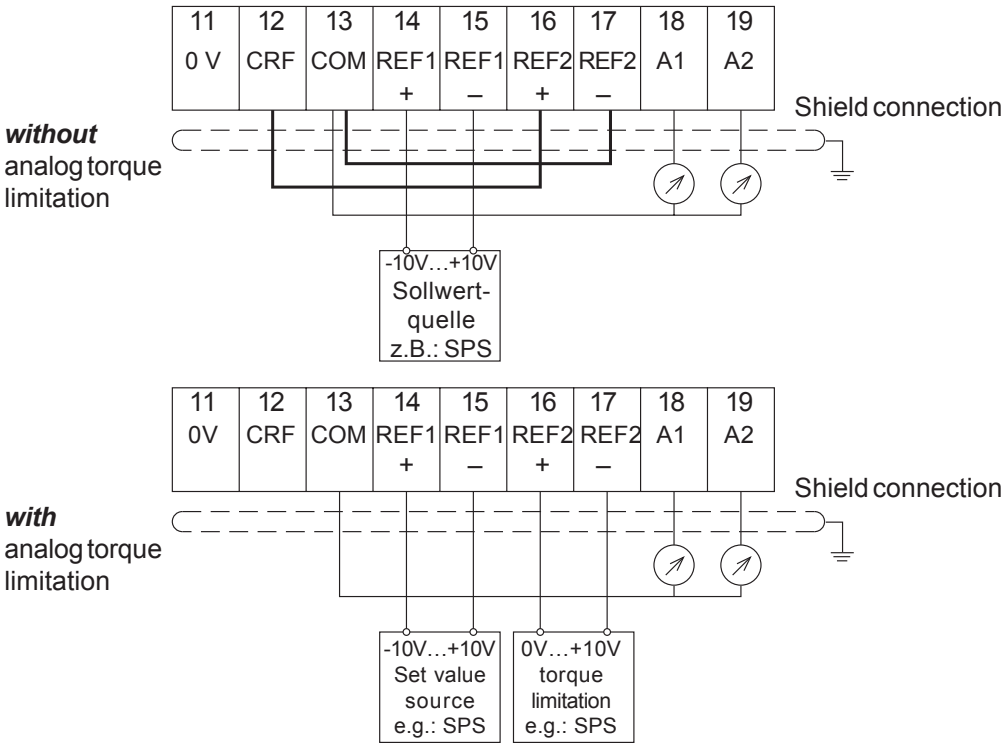
Terminal	Designation	Function	
1	ST	Control release	digital inputs logic 1 : +/- 12…33 V / Ri = 2,7 kΩ Logic : PNP/NPN programmable with **di.1** (1) When the unit is defective there is no guarantee that the software protective functions will work. (2) Factory setting. Other functions can also be assigned to the inputs (**di-parameter**) Scan time 2 ms, I1 ... I3 will be scanned at special functions (**Pc.18, Pc19**) with 128 µs.
2	I4 (2) (RST)	Reset	
3	I5 (F) (2)	Release of rotation direction (limit switch (1)) forward	
4	16 (R) (2)	Release of rotation direction (limit switch (1)) reverse	
5	I1	Programmable input 1 (Jog-speed reverse (2))	
6	I2	Programmable input 2 (Jog-speed reverse (2))	
7	I3	Programmable input 3 (External error setting (2))	
8	D1	Digital output signall 1	programmable PNP-transistor outputs 16 V - 30 V max. 20 mA with ext. supply approx. Uext - 3V Scan time 2 ms (**do-parameter**)
9	D2	Digital output signal 2	
10	U_{out}	+ 24 V Voltage output	16V - 30V max 60 mA with ext. supply approx. Uext
11	0 V	Ground for +24 V and digital in/outputs	
12	CRF	+10 V reference voltage	+10V (+/-3%) ; max. 4 mA
13	COM	Ground for analog in/outputs	
14	REF 1 +	Analog setpoint value setting (**An.2 - An.5**)	Voltage difference input, -10V…+10V/Resolution: 12 Bit, Ri = 40 kΩ. When a difference input is connected with COM, Ri reduces to 24kΩ. Load impedance 500 Ω. Scan time 2 ms, with fast analog setpoint setting or torque control the scan time reduces to 128 µs (**An.13, SP-parameter**).
15	REF 1 –		
16	REF 2 +	Analog torque limitation (**An.8 - An.11, CS.6, CS.7**)	
17	REF 2 –		
18	A1	Analog output 1 (**An.14 - An.16**)	-10V…+10V / Resolution: 10 Bit Ri = 100 Ω Scan time 2 ms
19	A2	Analog output 2 (**An.18 - An.20**)	
20	RLA	Output relay: (**do-parameter**) RLA / RLC : 1 : active RLB / RLC : 0 : dropped out	30 V DC/1 A
21	RLB		
22	RLC		
23	Ext. Voltage	external supply of the control	24V ... 30V / 1A external voltage input, Reference potential 0V : X1.11. Only for housing size D and E.

Potential isolation between terminals for digital signals (X1.1, X1.11, X1.23) and terminals for analog signals (X1.12 - X1.19). Release of rotation (X1.3, X1.4) and analog torque limitation (X1.16, X1.17) do not have a function in the Drive-Mode.

2.8.10 Digital In/Outputs

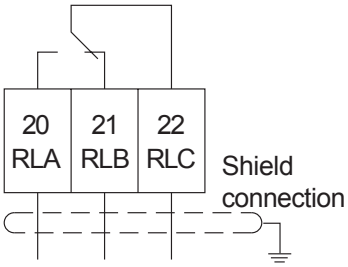


2.8.11 Analog In/Outputs

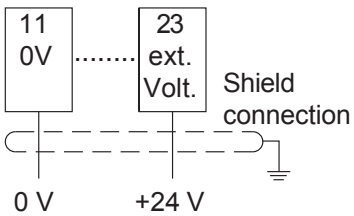


2.8.12 Output Relay

External voltage supply only possible at housing size D and E.



2.8.12 External Voltage Supply of the Control

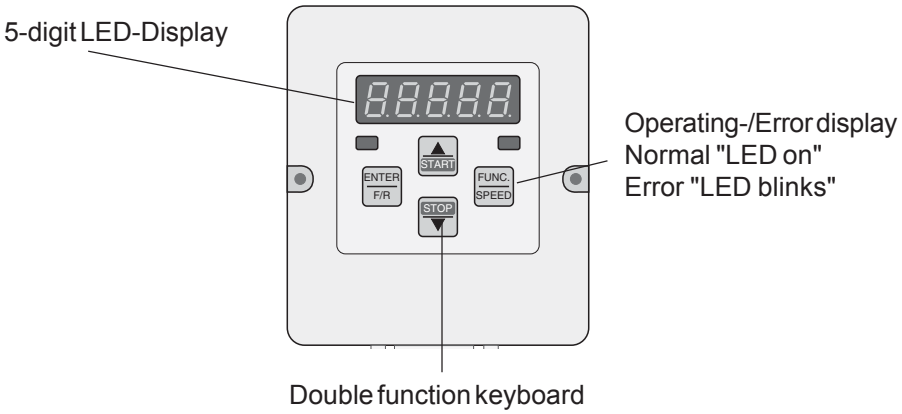


The connections of the terminal strip and encoder inputs have a safety isolation according to VDE 0100. The manufacturer of systems or machines has to ensure that by an existing or a new wired circuit with precise separation the VDE-requirements remains fulfilled.

2.9 Operator

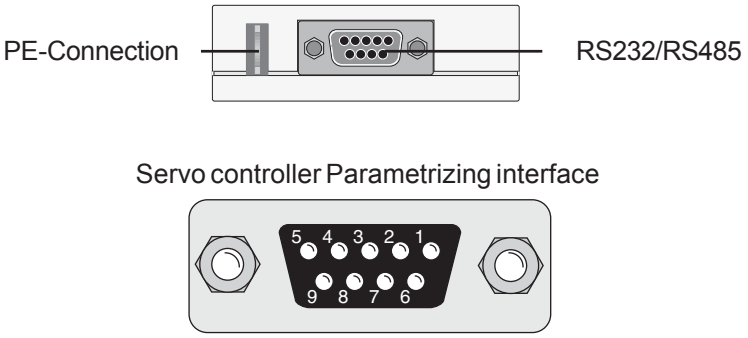
An operator is a necessary accessory for local operation of the inverter KEB COMBIVERT. To prevent malfunctions, the inverter must be brought into ***nOP*** status (control release terminal X1.1). When starting the Servo controller without an operator, it is started with the last stored values or factory setting.
The operator is available in several versions:

Digital-Operator
Part No. 00.F4.010-2009



Interface-Operator
Part No. 00.F4.010-1009

In the Interface operator there is an additionally isolated RS232/RS485-Interface integrated. The RS232/485-parameterizing interface expands the KEB COMBIVERT S4 for communication with data communications equipment. Suitable wiring permits the physically isolated data transmission.



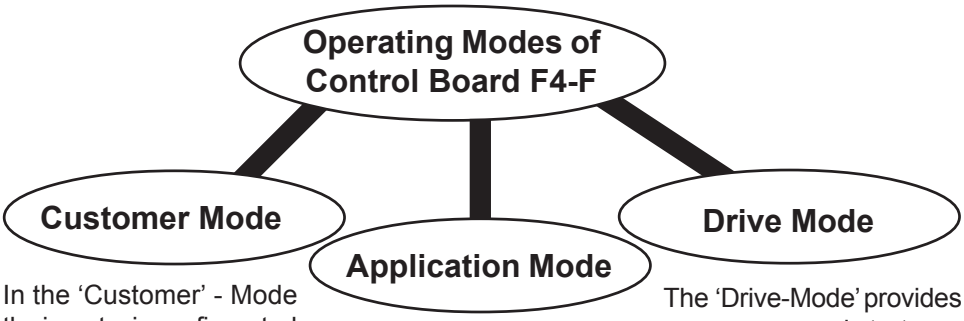
PIN No.	RS485 / Norm	Signal	Meaning
1	–	–	reserved
2	–	TxD	Transmit signal / RS232
3	–	RxD	Receive signal / RS232
4	A'	RxD-A	Receive signal A / RS485
5	B'	RxD-B	Receive signal B / RS485
6	–	VP	Supply voltage +5 V, I_{max} = 10 mA
7	C/C'	COM	Data reference potential
8	A	TxD-A	Transmit signal A / RS485
9	B	TxD-B	Transmit signal B / RS485

Information about further operators at KEB!

3. Operation

3.1 Fundamentals

In order to meet the various requirements for flexible parameterizing and simple operation there are 3 different operator control levels.



In the 'Customer' - Mode the inverter is configurated so that only the minimum number of parameters needed for controlled-speed operation are visible. These are the CP-parameters. The user can define the CP parameter group himself **(ud-parameter).** Thus a maximum clarity is achieved.

In the 'Application' - Mode extensive functions are available which offer an individual optimized solution for all users.

The 'Drive-Mode' provides an easy manual startup.
ATTENTION:
Function of the limit switches is deactivated!

3.1.1 Parameters, Parameter Groups, Parameter Sets

What are parameters, parameter groups and parameter sets?

Parameters are values changeable by the operator in a program, which have an influence on the program flow. A parameter consists of

Parameter designation and **Parameter value**

Each parameter is clearly specified!

The **parameter value** shows the actual setting.

The **parameter number** specifies the parameters within a group.

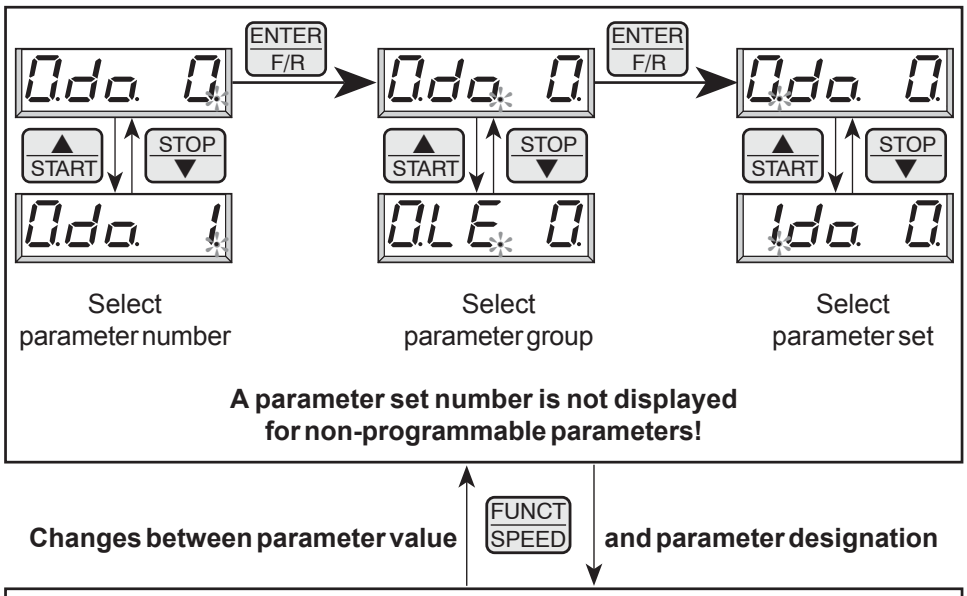
To maintain a cleary-to-survey operation inspite of the great number of parameters, we have combined function-related parameters into **parameter groups** (e.g. all motor-related parameters are combined in the Drive(dr)-group).

8 **parameter sets** (0...7) exist to adjust several values for one parameter. If the active values shall be displayed for a running unit the digit is set to „A". The digit is not-applicable for non-programmable parameters.

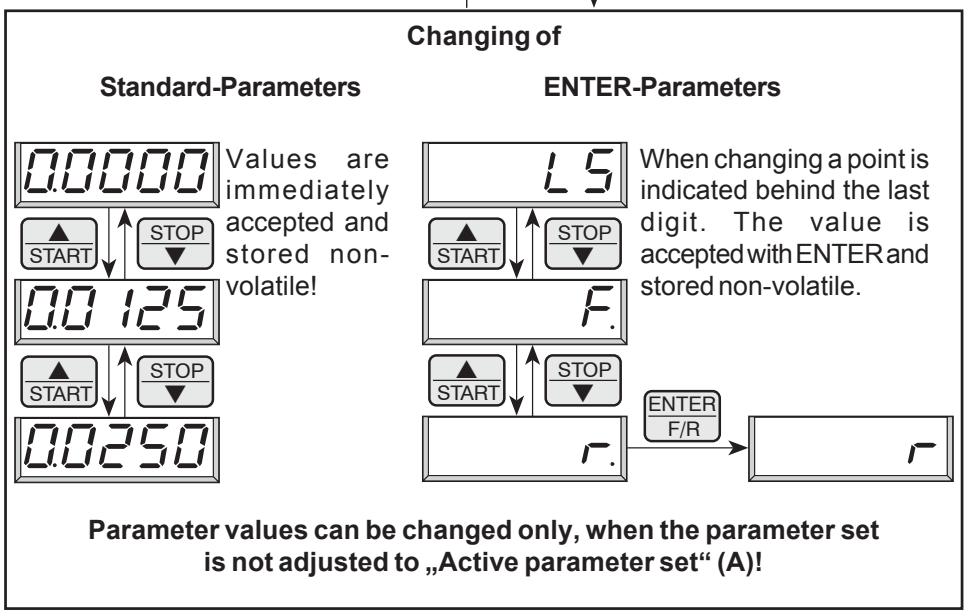
Example: A conveyor belt shall be used with 3 different speeds. For each "speed"... a parameter set is programmed in which acceleration, deceleration etc. can be adjusted individually.

3.1.2 Selection of a Parameter

The blinking point indicates the changeable area. By pressing the ENTER-key the blinking point is shifted.



3.1.3 Adjustment of Parameter Values



3.1.4 ENTER-Parameter

For some parameters it is not sensible that the selected values become active immediately. For that reason they are called ENTER-parameters, they do not become active until the ENTER-key is pressed.

Example: At digital setting of rotation direction the rotation reverse (r) shall be selected from standstill (LS). As shown above, the actuation must be done via rotation forward (F). However, the drive must not start yet, first the rotation direction reverse has to be selected and confirmed with ENTER.

3.1.5 Non-programmable Parameters

Certain parameters are not programmable as their value must be the same in all sets (e.g. bus address or baud rate). For an easy identification of these parameters the parameter set number is missing in the parameter identification. **For all non-programmable parameters the same value is valid independent of the selected parameter set!**

3.1.6 Resetting of Error Messages

If a malfunction occurs during operation, the actual display is overwritten by a blinking error message. The error message can be cancelled by pressing the ENTER-key, so that the original value is again shown in the display.
ATTENTION! The resetting of the error message with ENTER is no error reset, i.e. the error status in the inverter is not reset. Thus it is possible to correct adjustments before the error reset. An error reset is only possible through the reset terminal or control release (see chapter 6.3.1 „Short Description Digital Inputs“).

3.1.7 Resetting of Peak Values

To permit conclusions on the operational performance of the drive, parameters are provided that indicate the peak values. Peak value means that the highest measured value is stored for the ON-time of the inverter (slave pointer principle). The peak value is cancelled by ▲ or ▼ and the actual measured value is shown in the display.

3.1.8 Acknowledgement of Status Signals

To monitor the correct execution of an action some parameters send a status signal. For example, after copying a set the display shows „PASS“ to indicate that the action was carried out without error. These status signals must be acknowledged with ENTER.

3.2 Password Structure

The KEB COMBIVERT is provided with extensive password protection. The different passwords are used to

- **change the operating mode**
- **set a write protection**
- **activate the Service-Mode**
- **switch to the Drive-Mode**

Depending on the actual operating mode the password can be entered in following parameters

when the CP-Mode is active

when the applicatioan mode is active

3.2.1 Password Levels

The parameter value of the above parameters shows the actual password level. Following indications are possible:

CP - read only

Only the Customer-parameter group is visible, exept for CP.0 all parameters are in the read-only status.

CP - on

Only the Customer-parameter group is visible. All parameters can be changed.

CP - Service

Like CP-on, but the parameter identification is indicated according to the original parameter.

Application

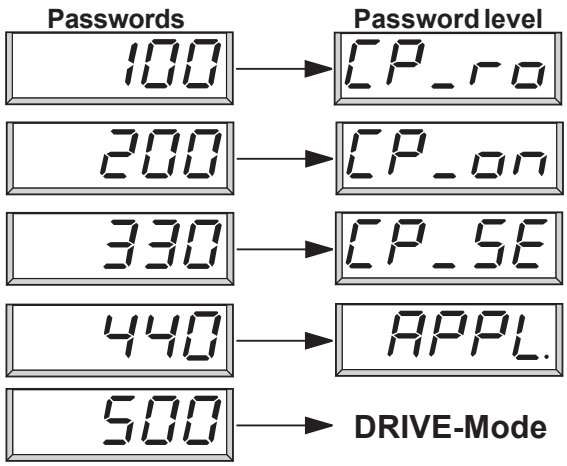
All application parameters are visible and can be changed. The CP-parameters are not visible.

Drive-Mode

The Drive-Mode is a special operating mode, here the unit can be put into operation via the operator.

3.2.2 Passwords

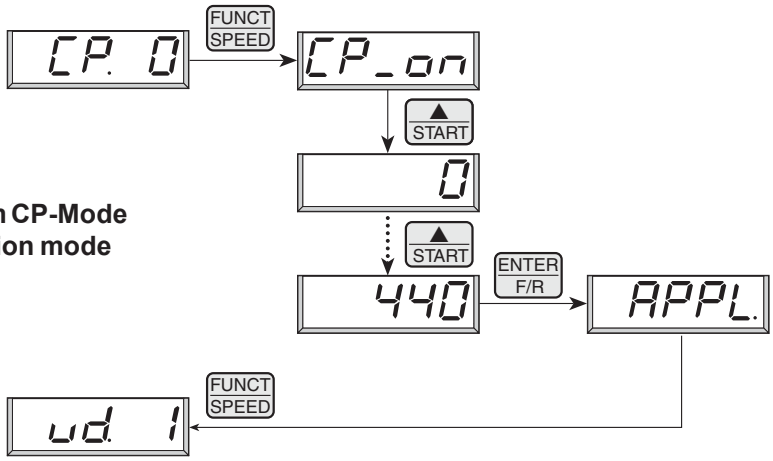
By selecting one of the following passwords you can switch to the respective password level:



To finish the Drive-Mode press ENTER + FUNCT key for approx. 3 sec.

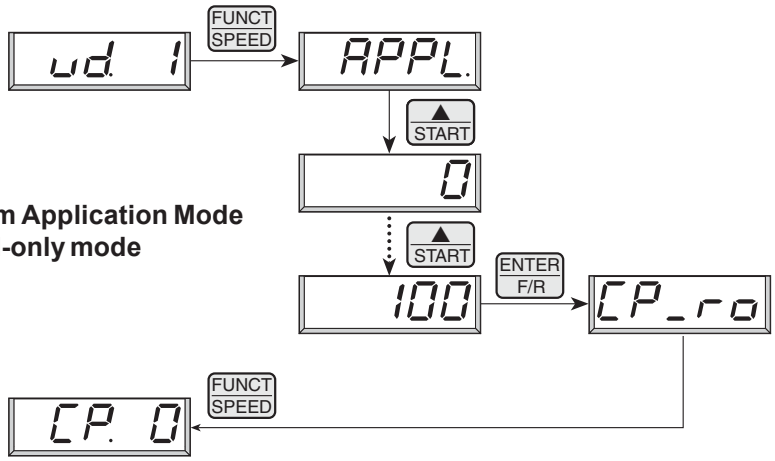
3.2.3 Changing of Password Level

Example 1 **Switching from CP-Mode to the application mode**



> Except for the service password the entered password levels are generally stored in a non-volatile manner!

Example 2 **Switching from Application Mode to the CP-read-only mode**



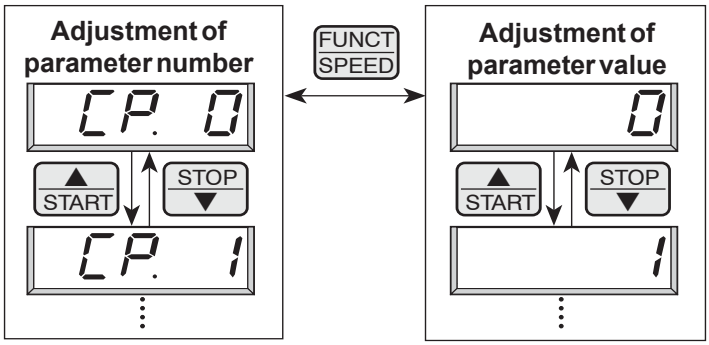
3.3 CP-Parameter

The Customer-Parameters (CP) are a special group of parameter. With the exception of CP.0 (Password input), they can be defined by the user. The following Parameters are preset at delivery.

Advantages from it:
- operator-friendly for the customer
- critical parameters are protected against maloperation
- low documentation cost for the machine builder

3.3.1 Operation in CP-Mode

Compared to the Application-Mode the operation in the CP-Mode is easier because parameter set selection and parameter group selection are unnecessary.



3.3.2 Definition of the CP-Parameter

Generally the CP-parameters are defined as follows:

Display	Parameter	Parameter Description in the Application-Mode	Factory setting
CP. 0	Password input		customer on
CP. 1	Actual speed display	ru.1	---
CP. 2	Inverter status	ru.0	---
CP. 3	Apparent current	ru.9	---
CP. 4	Peak apparent current	ru.25	---
CP. 5	Actual torque	ru.2	---
CP. 6	Speed reference display	ru.20	---
CP. 7	Acceleration time	SP.11	0,05 s
CP. 8	Deceleration time	SP.12	0,05 s
CP. 9	Torque limit	CS.6	3 M_N
CP.10	Maximal speed reference	SP.5	n_N
CP.11	Jogging speed	SP.22	100 rpm
CP.12	P-speed	CS.0	depending
CP.13	I-speed	CS.1	on motor
CP.14	Encoder 1 (Ink./U)	EC.11	1024 / 2048
CP.15	Ext. fault stopping mode	Pn.20	0
CP.16	Offset REF 1	An.5	0 %
CP.17	Zero clamp REF 1	An.2	0 %
CP.18	Function OUT A1	An.14	2
CP.19	GAIN OUT A1	An.15	3 M_N = 10V
CP.20	Gain OUT A2	An.19	+/- n_N = +/-10V
CP.21	Output condition OUT D1	do.1	20
CP.22	Output condition OUT D2	do.2	18
CP.23	Torque level OUT D1	LE.20	0,5 M_N
CP.24	Speed level OUT D2	LE.5	0,5 n_N

3.3.3 Reactivate the default setting

The factory setting can be reactivated everytime. Therefore the following values must be adjusted via the keyboard of the operator. The terminal control release X1 must be open.

CP. 0 440
Fr. 0 -2
ud. 0 200

3.4 Drive-Mode

The Drive Mode is a special operating mode of the KEB COMBIVERT. It allows an easy manual startup. To activate the Drive Mode enter the corresponding password 500 in **CP.0 .or ud.0. Following settings are possible:**

3.4.1 Adjustment Possibilities

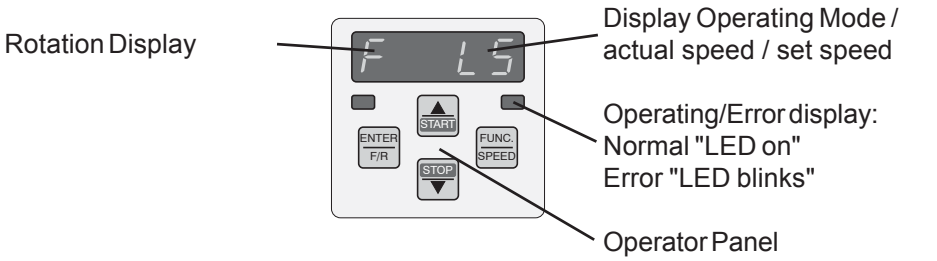
– Stop / Start / Run
– Set value
– Direction of rotation

All other settings like setpoint limitation, acceleration time, deceleration time etc. correspond to the preselection in the parameter sets.

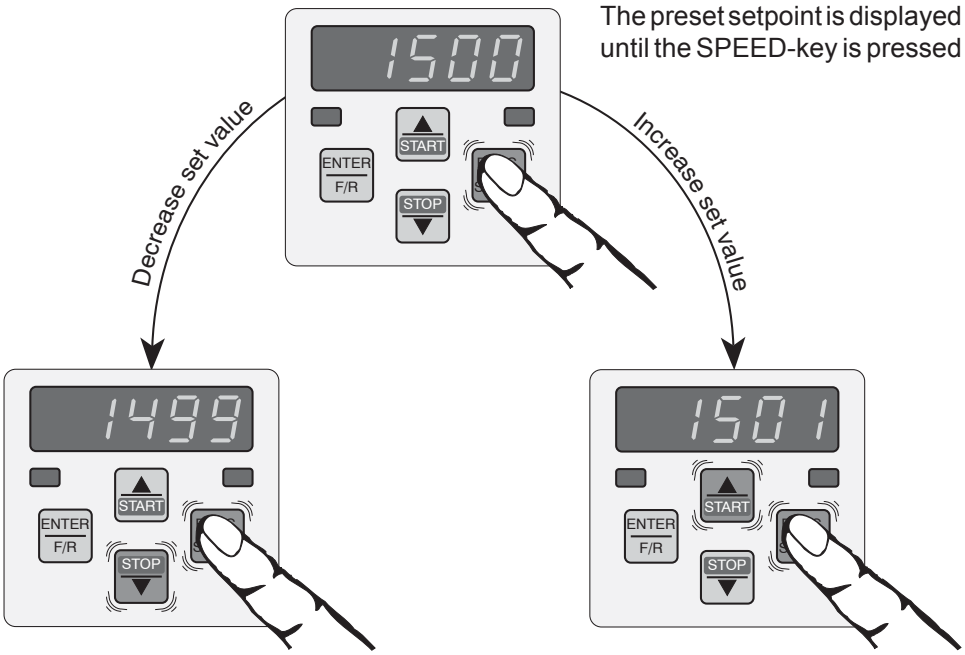
Hardware condition: The control release must be bridged!

Release of rotation (terminal X1.3 / X1.4), analog torque limitation (terminal X1.16 / X1.17) and brake control do not have a function in the Drive Mode.

3.4.2 Display and Keyboard



3.4.3 Setpoint Display / Setpoint Input



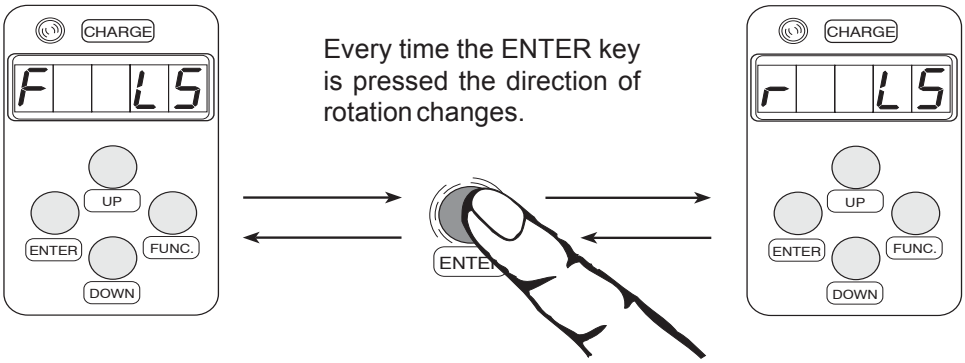
Hold the SPEED-key pressed down and decrease the indicated setpoint value with the STOP key

Hold the SPEED-key pressed down and increase the indicated setpoint value with the START-key

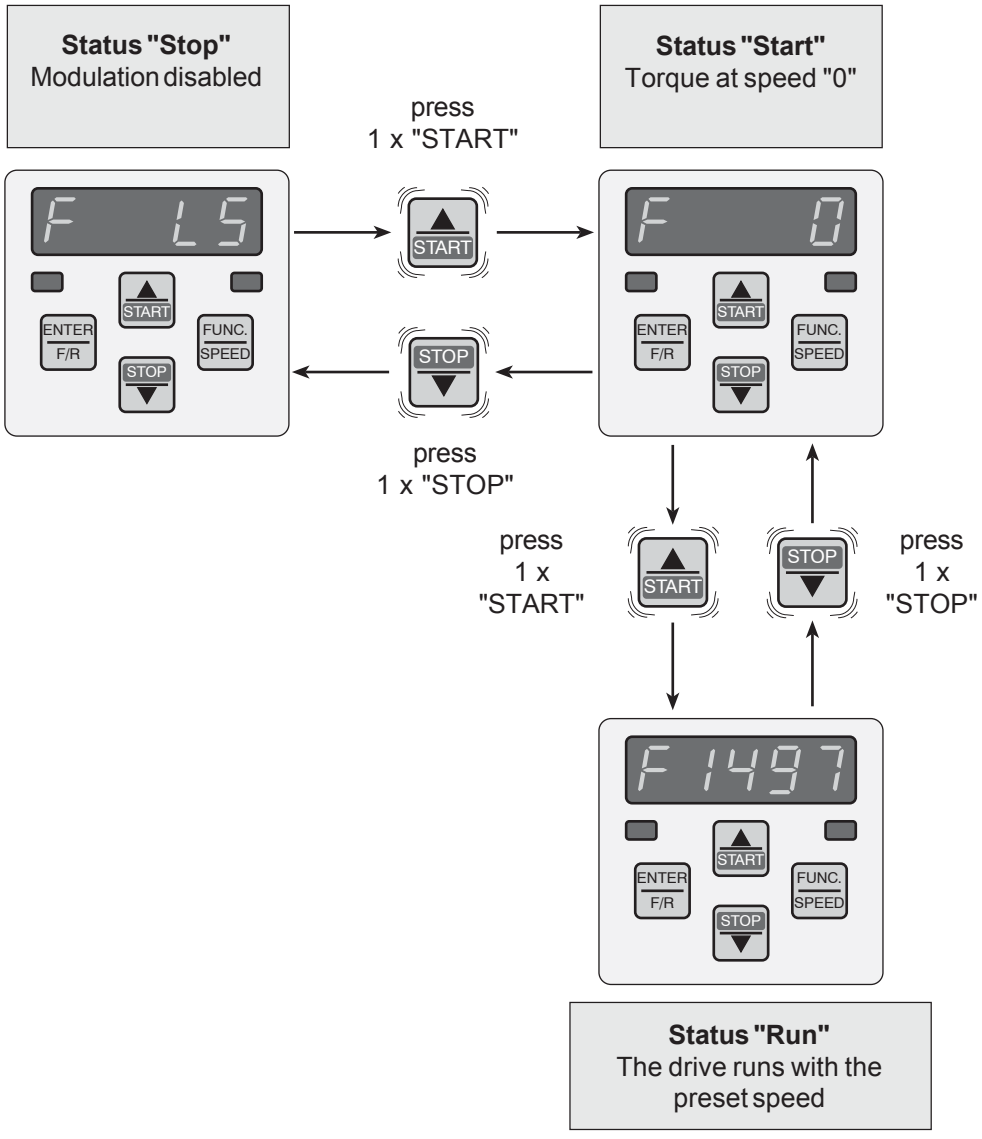
3.4.4 Rotation Presetting

Presetting possibilities:

F = forward (clockwise)
r = reverse (anti-clockwise)

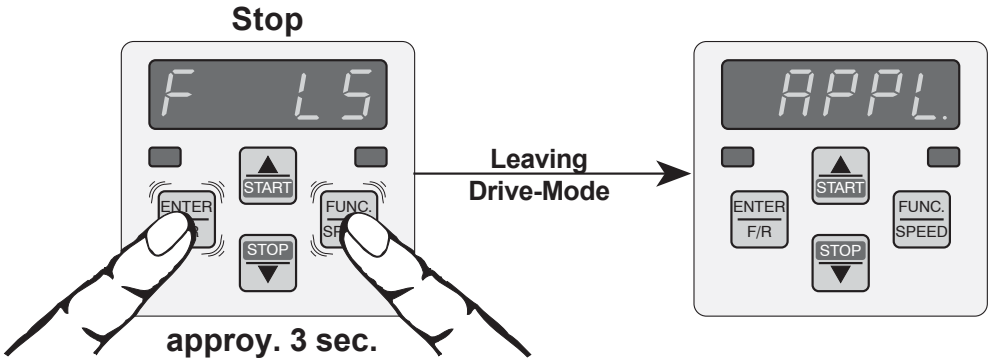


3.4.5 Start / Stop / Run



3.4.6 Leaving the Drive-Mode

To leave the Drive-Mode, the keys "FUNC" and "ENTER" must be pressed simultaneously for approx. 3 seconds while being in **status "STOP"**! The unit jumps back into the mode from where the Drive-Mode was started.



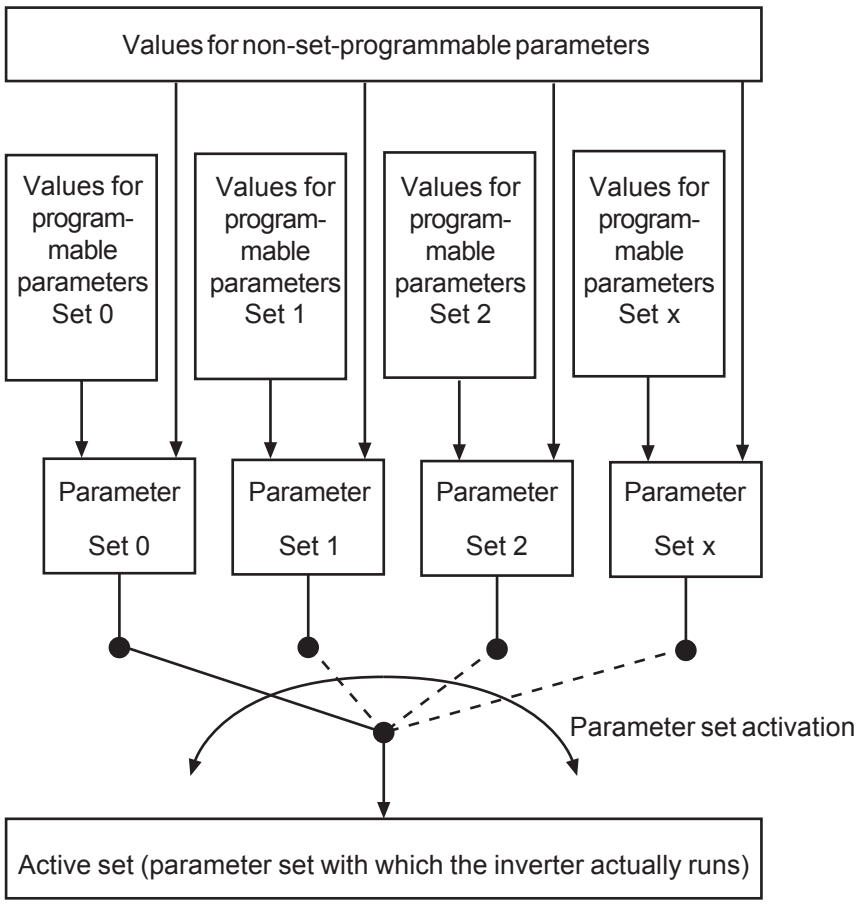
4. Parameter Structure

The parameters are combined in groups according to their functions. The following parameter groups are available in S4:

ru	***run-Parameter***	Contains all operating displays (process data visualization)
SP	***Speed definition-Parameter***	All parameters for setpoint input limits, ramps
Pn	***Protection-Parameter***	All protective functions (quick stop etc.)
dr	***drive-Parameter***	All motors specific parameters
CS	***Control Speed-Parameter***	Parameterization of the speed and flux controller
dS	***drive specifical control-Parameter***	Parameterization of the current controllers
ud	***user definition-Parameter***	Parameter for individual adjustment of the operator and the serial interface
Fr	***Free programmable-Parameter***	Determines, adjusts and selects the parameter sets
An	***Analog I/O-Parameter***	Programming of the analog I/Os
di	***digital input-Parameter***	Programming of the digital inputs
do	***digital output-Parameter***	Programming of the digital outputs
LE	***Level-Parameter***	Adjustment of triggering level for the digital outputs
Sn	***Synchron-Parameter***	Adjustment of parameters for synchronous control
In	***Information-Parameter***	Information about inverter type, serial number etc.
EC	***Encoder Control-Parameter***	Parameter for adjustments and information of the encoder interface
Pc	***Position Control-Parameter***	Basic setting for the posi mode
Pd	***Position definition-Parameter***	Position input in the posi mode
AA	***Adjustment Assistance-Parameter***	Parameter for visualization program 'Inverter-Scope' (are directly managed by the program)

4.1 Set Programming

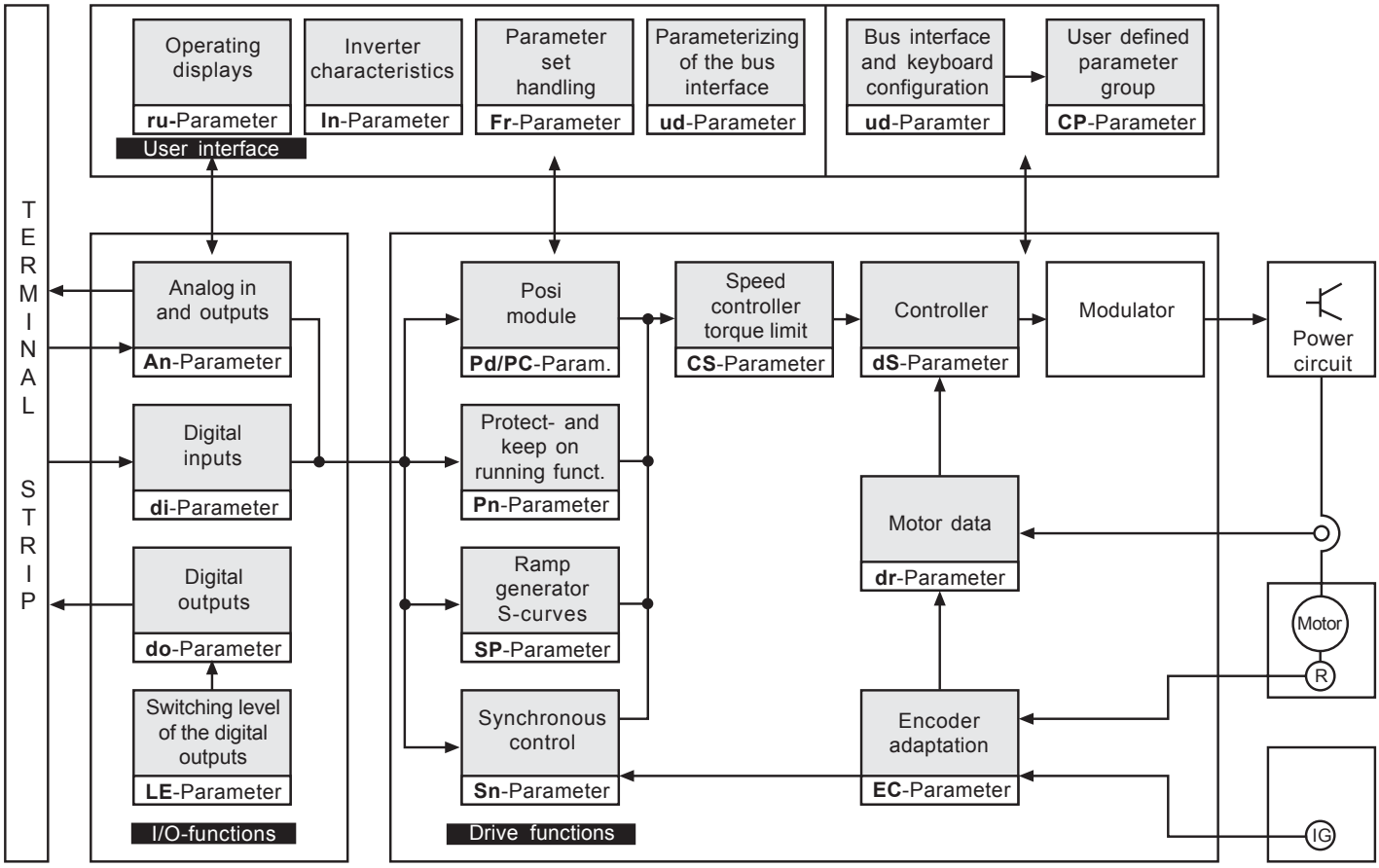
Some of the parameters are programmable in 8 parameter sets, i.e. a parameter can have different values in different sets. Individual drive profiles and functions can be realized without external intelligence.



With the factory setting the KEB COMBIVERT S4 runs in set 0, initially all other sets are deactivated.

4.2 Block Diagram of Software Functions and Closed-Loop Control Structure

On the following pages you can see the block diagram and the closed-loop control structure of COMBIVERT S4. All parameter groups are typed in **boldface**. See **dS parameters** for a detailed description of the current controller.



5. Functional Description

5.1 Run (ru)-Parameter

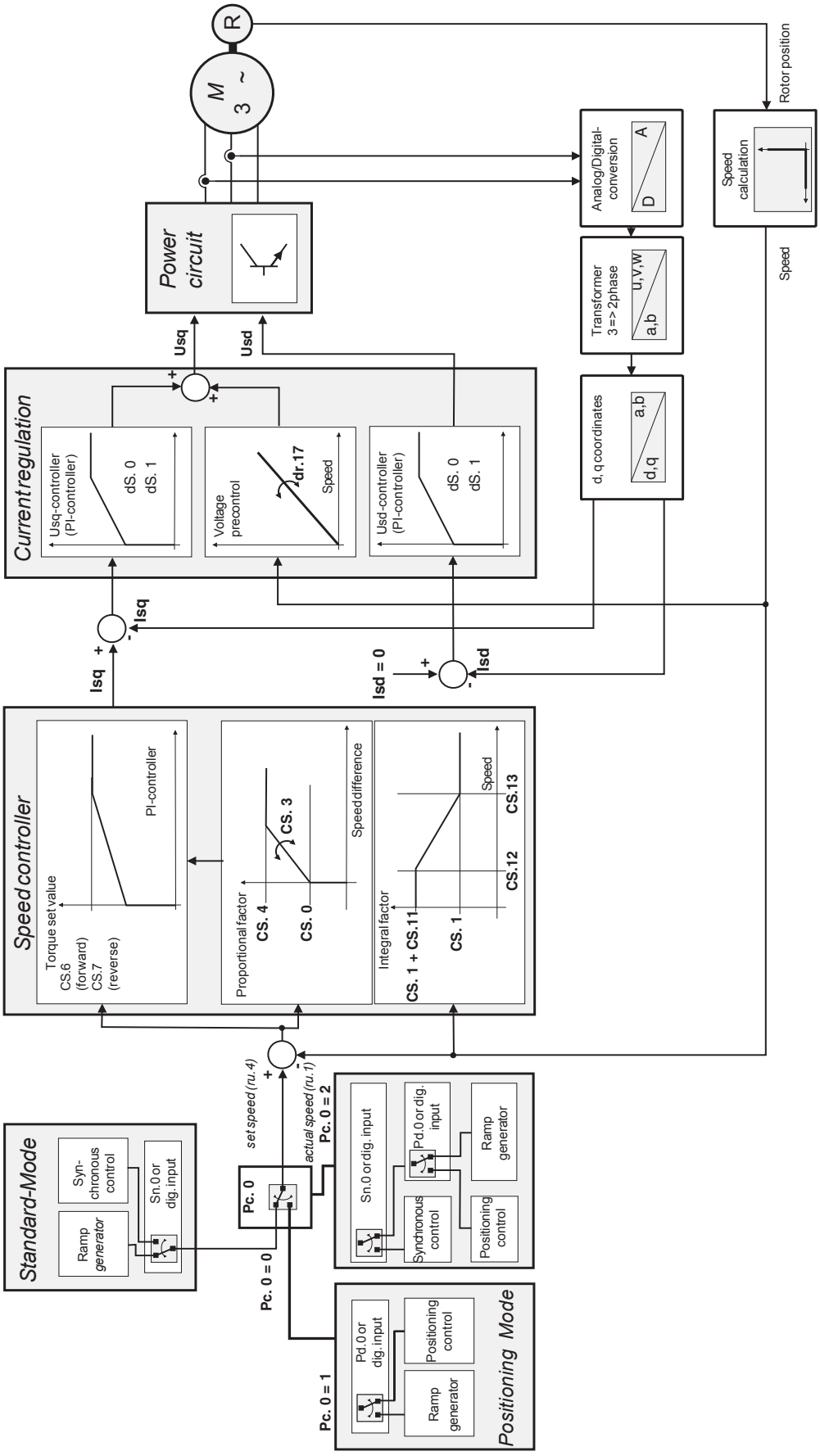
Read-only parameters!

Press "Enter"-key to store the parameter value!

Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
ru	0	Inverter state	2000			R	table	---	---	---	---
ru	1	Actual speed display	2001			R	0,5	---	---	---	rpm
ru	2	Actual torque display	2002			R	0,1	---	---	---	Nm
ru	4	Set speed display	2004			R	0,5	---	---	---	rpm
ru	5	Set torque display	2005			R	0,1	---	---	---	Nm
ru	9	Apparent current	2009			R	0,1	---	---	---	A
ru	10	Active current	200A			R	0,1	---	---	---	A
ru	11	Actual DC voltage	200B			R	1	---	---	---	V
ru	12	Peak DC voltage	200C				1	---	---	---	V
ru	14	Input terminal state	200E			R	table	---	---	---	---
ru	15	Output terminal state	200F			R	table	---	---	---	---
ru	16	Internal input state	2010			R	table	---	---	---	---
ru	17	Internal output state	2011			R	table	---	---	---	---
ru	18	Actual parameter set	2012			R	table	---	---	---	---
ru	20	Speed reference display	2014			R	0,5	---	---	---	rpm
ru	22	Ref 1 display	2016			R	0,1	-100	100	---	%
ru	23	Ref 2 display	2017			R	0,1	-100	100	---	%
ru	25	Peak apparent current	2019				0,1	---	---	---	A
ru	26	Actual speed master	201A			R	0,5	---	0	---	rpm
ru	27	Angular deviation / contouring error	201B			R	0,1	---	---	---	°
ru	28	Speed deviation	201C			R	0,5	---	---	---	rpm
ru	29	Heat sink temperature	201D			R	1	---	---	---	°C
ru	31	Power on counter 1	201F				1	0	65535	---	h
ru	32	Modulation on counter 2	2020				1	0	65535	---	h
ru	35	Actual position sign	2023			R	1	---	---	---	---
ru	36	Actual position high	2024			R	1	---	---	---	inc
ru	37	Actual position low	2025			R	1	---	---	---	inc
ru	38	Set position sign	2026			R	1	---	---	---	---
ru	39	Set position high	2027			R	1	---	---	---	inc
ru	40	Set position low	2028			R	1	---	---	---	inc
ru	58	Latch position sign	203A			R	1	---	---	---	---
ru	59	Latch position high	203A			R	1	---	---	---	inc
ru	60	Latch position low	203A			R	1	---	---	---	inc
ru	64	Motor temperature	203A			R	1	0	200	---	°C

Block Diagram Control structure
KEB COMBIVERT S4



General In the ru-parameter group all parameters are combined where the actual operating condition of the inverter can be read. The parameters in this group are read-only. Exception: peak value memory ru.12 and ru.25 can be deleted with the serial interface by entering any value. You can also use the keyboard and do the reset with the UP/ DOWN keys.

Inverter State (ru.0) Displays the operating state of the inverter.

There are generally 4 different groups of operating states:

- ***ready*** Inverter ready for operation, i.e. initialization is completed, no fault signal.
- ***run*** Inverter in operation, modulation enabled.
- ***abnormal condition*** Malfunction which can lead to different reactions. The Pn-parameters specify whether the modulation is disabled, the malfunction ignored or the drive stopped.
- ***fatal error*** Malfunction which causes an immediate disabling of the modulation. Restart only possible after reset.

The various operating states are listed below:

Operating State **ready:**			
noP	0	No Operation	Control release not briged, modulation switched off, output voltage=0, drive uncontrolled
LS	70	Low Speed	Control release bridged, no rotational direction command, modulation switched off, output voltage=0 drive uncontrolled

Operating State **run:**			
Facc	64	Forward Acceleration	Drive accelerates forward
Fcon	66	Forward Constant	Drive runs with constant speed forward
FdEc	65	Forward Deceleration	Drive decelerates forward
rAcc	67	Reverse Acceleration	Drive accelerates in reverse
rCon	69	Reverse Constant	Drive runs with constant speed in reverse
rdEc	68	Reverse Deceleration	Drive decelerates in reverse
rFP	79	ready for positioning	Drive waits for the positioning to start
P A	80	positioning active	Drive executes a positioning command
SrA	82	search for reference active	Drive in reference point search

Operating State **Abnormal Condition:**			
A.OH2	97	abnormal stopping OH	Quick stop after OH-prewarning
A.dOH	96	abnormal stopping drive OH	Quick stop after motor overheating
A.EF	90	abnormal stopping EF	Quick stop after external error
A.PrF/	94	abnormal stopping prohibited	Quick stop because at presetting direction of rotation by bipolar
A.Prr	95	rotation forward / reverse	setpoint value terminal F or R is not triggered
A.bus	93	abnormal stopping bus	Quick stop after response of the communication time monitoring (Watchdog)

Operating State **Fatal sError:**			
E.OC	4	error overcurrent	Overcurrent
E.OP	1	error overpotential	Overvoltage
E.UP	2	error underpotential	Undervoltage
E.OH	8	error overheat	Overheat in the inverter
E.dOH	9	error drive overheat	Motor overheated
E.OH2	30	error motor protection	Motor overloaded
E.OL	16	error overload inverter	Overload KEB COMBIVERT S4
E.EF	31	error extern fault	External Fault
E.PrF/	46	error prohibited rotation	Quick stop because ar presetting directionof rotation by bipolar
E.Prr	47	forward/reverse	setpoint value terminal F or R is not triggered
E.OS	105	error overspeed	error overspeed
E.LSF	15	current limit resistor error	Loading shunt error
E.SEt	39	error at set selection	Set selection error set x
E.bus	18	error bus	Time monitoring for serial communication
E.EnC	32	error encoder	Error in the resolver interfacing
E.PuC	49	error power unit	Error in the power part detection
E.dSP	51	error DSP	Internal processor error
E.hyb	52	error hybrid	Internal hardware error in the hybrid detection

You find a detailed error description with fault diagnosis in the instruction manual (chapter 5.26).

Actual speed display (ru.1)

In ru.1 the actual motor speed is displayed with a resolution of 0,5 rpm. A reverse rotating field at the output is indicated by the display of negative speeds

Actual torque display (ru.2)

In ru.2 the actual motor torque is displayed (calculated from the active current).

Set speed display (ru.4)

In ru. 4 the set speed is displayed at the output of the ramp generator. If the modulation is switched off or an 'abnormal' operating state is active, then the actual setpoint 0 rpm is shown. This parameter is important for the visualization of the inverter scope.

Set torque display (ru.5)

In ru. 5 the setpoint for the motor torque is displayed. Calculation and scaling like ru.2. This value corresponds to the output signal of the speed controller.

Apparent current (ru.9)

Display of the actual apparent current.

Active current (ru.10)

Display of the actual active current.

Actual DC voltage (ru.11)

Display of the actual DC-bus voltage.

Peak DC voltage (ru.12)

Display of the maximum DC-bus voltage measured. In addition the highest value which occurs in ru.11 is stored in ru.12. The peak memory can be deleted by pressing the UP/DOWN key. The memory is also deleted when the inverter is switched off.

Input Terminal State (ru.14)

In ru.14 the physical status of the input terminals X1.1...X1.7 is displayed. Internal logical interconnections, strobe or edge evaluation are not taken into consideration. The input status is displayed binary coded, meaning every input corresponds to a value of 1 (ST) to 64 (I3). If several inputs are triggered, then the sum of their values is shown.

Decimal Value	Input	Terminal
1	ST (control release)	X1.1
2	I4 (RST) (Reset)	X1.2
4	I5 (F) (forward rotation)	X1.3
8	I6 (R) (reverse rotation)	X1.4
16	I1 (prog. input 1)	X1.5
32	I2 (prog. input 2)	X1.6
64	I3 (prog. input 3)	X1.7

Example

ST, F and R are triggered:
ST → 1
F → 4 1 + 4 + 8 = 13
R → 8
→ The value 13 is shown in the display.
→ ST + F + R are shown as parameter value information in COMBIVIS.

Output terminal state (ru.15)

ru.15 makes it possible to control the digital outputs. The controller supports a total of 7 digital outputs: transistor outputs D1 and D2, output relay RLA,RLB,RLC, 4 software internal outputs OUTA, OUTB, OUTC, OUTD, they can be used for internal connections.The software internal outputs have a direct internal connection to the software internal inputs IA, IB, IC and ID.

For every active output the corresponding decimal value from 1 (open collector output D1) to 128 (software output OUT D) is displayed. If several outputs are active, then the sum of their values is shown.

Decimal Value	Input	Terminal
1	D1 (transistor output)	X1.8
2	D2 (transistor output)	X1.9
4	Output relay	X1.20, X1.21, X1.22
8	no function	
16	OUT A (internal output A)	none
32	OUT B (internal output B)	none
64	OUT C (internal output C)	none
128	OUT D (internal output D)	none

Internal input state (ru.16)

Binary coded status of - the terminal input signals after the strobe, triggering, negation and logical interconnection unit.
- the 4 software input signals.

The internal inputs IA, IB, IC, ID are internally connected to the software outputs OUT A, OUT B, OUT C and OUT D.

Decimal Value	Input	Terminal
1	ST (control release)	X1.1
2	I4 (RST) (reset)	X1.2
4	I5 (F) (forward rotation)	X1.3
8	I6 (R) (reverse rotation)	X1.4
16	I1 (prog. input 1)	X1.5
32	I2 (prog. input 2)	X1.6
64	I3 (prog. input 3)	X1.7
128	no function	- - -
256	IA (internal input A)	none
512	IB (internal input B)	none
1024	IC (internal input C)	none
2048	ID (internal input D)	none

Internal output state (ru.17)

ru.17 shows the results of the output function tables (do.1 - do.4). If an output condition is met, then the corresponding decimal value is displayed. If several output conditions are met, then the sum of the decimal values is displayed.

Decimal Value	Switching Condition
1	Switching condition 1 (do.1) is met
2	Switching condition 2 (do.2) is met
4	Switching condition 3 (do.3) is met
8	Switching condition 4 (do.4) is met
16	Switching condition 5 (do.5) is met
32	Switching condition 6 (do.6) is met
64	Switching condition 7 (do.7) is met
128	Switching condition 8 (do.8) is met

Actual parameter set (ru.18)

Display of the parameter set currently active.

Speed reference display (ru.20)

ru.20 displays the set speed at the input of the ramp generator. As long as no function with a higher priority is activated the inverter works at this speed. Functions with higher priority are e.g.: 'abnormal stopping', 'jogging' and 'nOP'. This parameter checks the preset setpoint before startup.
The speed reference display is shown with a resolution of 0,5 rpm.
If no direction of rotation is selected, then the setpoint for forward rotation is shown.

Ref 1 display, Ref 2 display (ru.22, ru.23)

Display of the applied analog voltage in % (10 V = 100%) at REF 1 (setpoint input) or REF 2 (auxiliary input).

Peak apparent current (ru.25)

Maximum motor current that occurs during operating time. Display in [A]. The peak memory can be deleted by pressing the UP or DOWN key. The memory is also deleted by switching off the inverter.

Actual speed master (ru.26)

Actual speed ot the master drive; resolution 0.5 rpm.

Angular deviation / contouring error (ru.27)

Display of angular deviation between the position setpoint and the actual position of the slave (only when the synchronous module is activated Sn.0 = on). Resolution 0.1 degrees. If the Posi-module is active the contouring error is displayed.

Speed deviation (ru.28)

The speed deviation between the actual speed of the master and the slave is displayed (independent of direction of rotation); Resolution 0.5 rpm.
+ Master turns faster than the slave
- Slave turns faster than the master

Heat sink temperature (ru.29)

ru.29 displays the actual heat sink temperature in °C. Resolution 1 °C.

Power on counter 1 (ru.31)

ru.31 displays the total time the KEB COMBIVERT S4 was supplied with power. Resolution: 1 hour

Modulation on counter 2 (ru.32)

ru.32 displays the total time the KEB COMBIVERT S4 was active. Resolution: 1 hour (modulation active, run-state).

Actual position sign (ru.35 ... ru.37)

Display of the actual position at activated Posi-module. Please take into consideration the signs at parameter Pc.1

Set position (ru.38 ... ru.40)

Display of the set position and/or drive profile at activated Posi-module. Please take into consideration the signs at parameter Pc.1.

Latch position (ru.58 ... ru.60)

With the input function di.03...12 = 23 Posi-Latch the indicated actual position ru.35...37 is displayed in the parameters ru.58...60 at actuated input.

Motor temperature (ru.64)

This parameter displays the motor temperature, if it is measured by means of a KTY-sensor over a KTY-submounted card (part no. 00.F4.771-/009) (only units $\geq$ G).

5.2 Speed definition (SP)-Parameter

Read-only parameters!
Press "Enter" key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
SP	0	Speed setting source	3000		E		1	0	17	2	---
SP	1	Speed setting absolute	3001	P			0,5	-14000	14000	1500,0	rpm
SP	2	Speed setting %	3002	P			0,1	-100	100	0	%
SP	3	Rotation setting	3003	P	E		1	0	2	0	---
SP	5	Max. speed reference	3005	P			0,5	0,0	14000	dep. on unit	rpm
SP	8	Absolute maximum speed	3008				0,5	0,0	14000	dep. on unit	rpm
SP	10	Delta speed ACC/DEC time	300A	P			0,5	0,0	14000	dr.01	rpm
SP	11	Acceleration time	300B	P			0,01	0,00	320,0	0,05	s
SP	12	Deceleration time	300C	P			0,01	0,00	320,0	0,05	s
SP	15	S-curve acceleration	300F	P			0,01	0,00	320,0	0,00	s
SP	16	S-curve deceleration	3010	P			0,01	0,00	5,00	0,00	s
SP	22	Jogging speed	3016				0,5	0,0	14000	100,0	rpm
SP	26	Motor-poti function	301A				1	0	15	0	---
SP	27	Motor-poti time	301B				0,01	0,00	300,00	128,00	s

SP. 0 defines how setpoint speed and direction of rotation are preset (analog, digital, terminal).

Value	Setpoint	Direction of Rotation
0	analog	digital (SP. 3)
1	analog	terminal strip (X1.3 / X1.4)
2	analog	**sign of the setpoint**
3	digital abs. (SP. 1)	digital (SP. 3)
4	digital abs. (SP. 1)	terminal strip (X1.3 / X1.4)
5	digital abs. (SP. 1)	sign of the setpoint
6	digital % (SP. 2)	digital (SP. 3)
7	digital % (SP. 2)	terminal strip (X1.3 / X1.4)
8	digital % (SP. 2)	sign of the setpoint
9 ... 14	reserved	- - -
15	Motorpoti	digital (SP.3)
16	Motorpoti	terminal strip
17	Motorpoti	sign of the setpoint

The analog setpoint speed is calculated in accordance with the following formula:
n_{soll} = analog value / 10 V * max. Speed (SP.5)

If the direction of rotation is preset by the terminal or parameter SP.3, then all negative speed setpoints lead to $n_{set} = 0$.

At values 2, 5 and 8 (set value and direction of rotation from bipolar setting) and activated response to limit switch, the input F for clockwise rotation and R for anti-clockwise rotation must be active additionally, otherwise the drive goes into the 'abnormal stopping mode' (A.Pr.F and/or A.Prr).

Speed setting absolute (SP.1)

Adjustment of the set speed. (positive value = direction of rotation forward / negative value = direction of rotation reverse).

Speed setting % (SP.2)

Adjustment of the digital set speed in % of the maximum speed (SP.5).

Rotation setting (SP.3)

Adjustment of digital direction of rotation.

Max. speed reference (SP.5)

The maximum set speed can be entered in SP.5. At U_{ref} = 10 V the analog setpoint speed is generally = SP. 5. The resolution of the analog input is also preset with SP.5. In the case of superior positioning controls for example the processing of a workpiece can be done with a higher resolution than the feed rate movement. In this way better surfaces are achieved in the processing.

Abs. max. speed (SP.8)

This parameter limits the set speed. Contrary to SP.5 it has no influence on the calculation of the analog or percentage setpoint.
When exceeding this speed limit, the error E.OS is displayed.

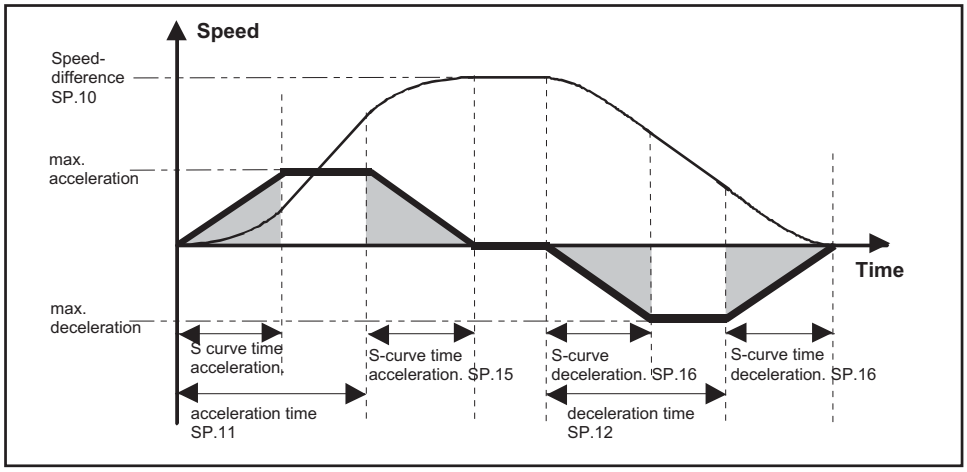
Delta speed
ACC/DEC time (SP.10)
Acceleration time (SP.11)
Deceleration time (SP.12)

These parameters define the acceleration and deceleration.
Acceleration = SP.10 / SP.12
Deceleration = SP.10 / SP.11

S-curve time
Acceleration (SP.15)
Deceleration (SP.16)

These parameters can limit the maximum jerk during acceleration or deceleration of the drive. SP. 15 / SP. 16 is the time in which the acceleration/deceleration increases from 0 to set acceleration/deceleration.

Ramp times (SP.10 - SP.16)



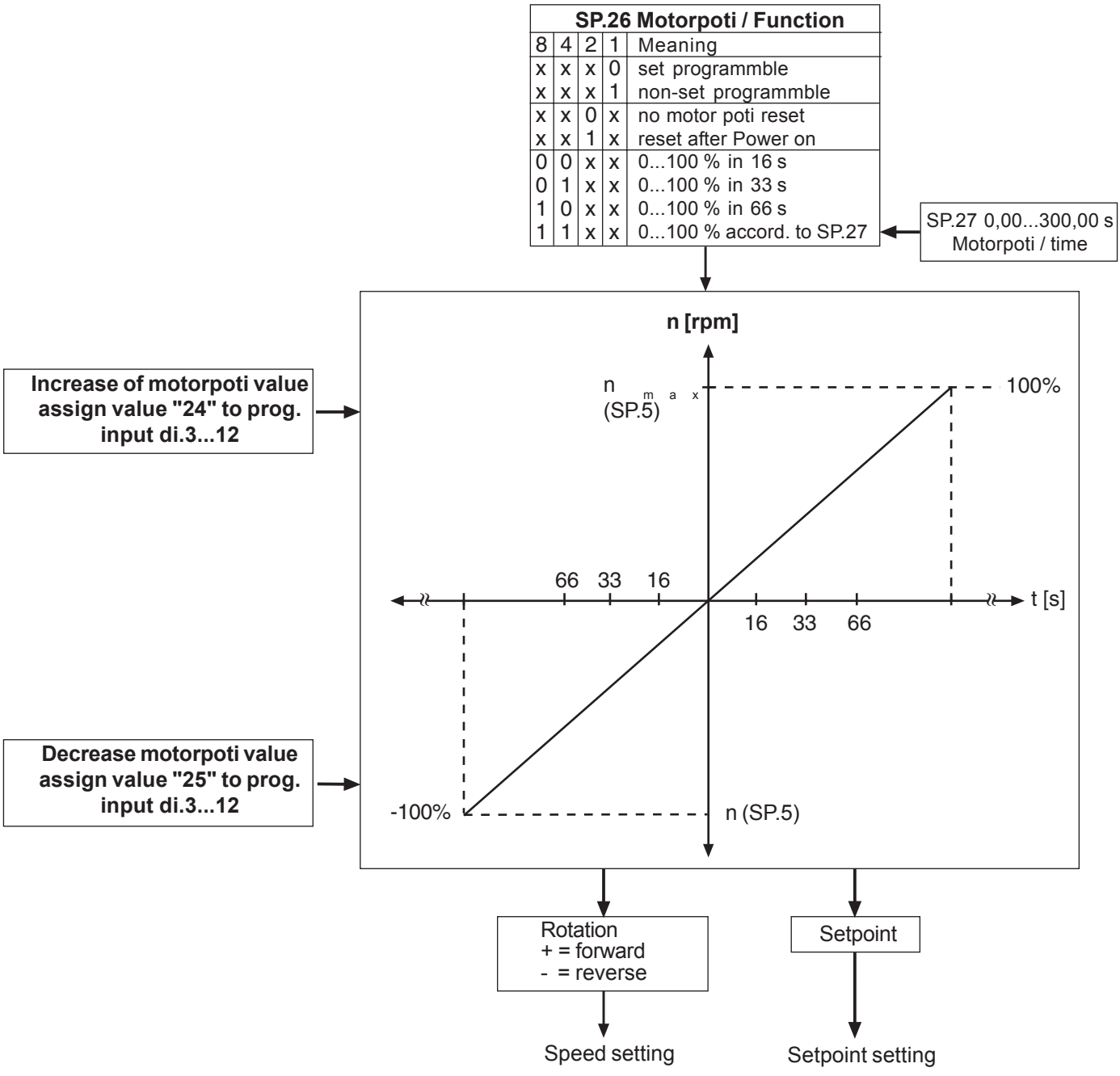
In order to have defined ramp times, the acceleration time must be adjusted larger than the s-curve time. The times always refer to the speed difference adjusted in Sp.10.
SP.11 + SP.15 defines the total acceleration time
SP.12 + SP.16 defines the total deceleration time

Jogg speed (SP.22)

Programs the ´jog speed´. The set value in the jogging mode is directly executed without ramp times. The activation of the jogging mode ´forward´or ´reverse´ is done with a digital input.
In the jogging mode the standard setpoint and direction of rotation are disabled. F and R continue to serve as software limit switches during the jogging mode. If forward and reverse are simultaneously selected, forward has priority.

Motor potiometer function (SP.26)

This function simulates a mechanic motor potentiometer. By way of two programmable inputs the value of the motor potentiometer can be increased or decreased.



Input definition

The first step is the definition of two inputs with which the motor potentiometer can be increased and decreased. Depending on the selected inputs two of the parameters di.3...di.12 are assigned with the value 24 and 25.

Increase mototpoti value ⇓ Value 24	Decrease mototpoti value ⇓ Value 25	Motorpoti = 0 ⇓ Value 26

The potentiometer value is decreased, if the inputs potentiometer value are triggered at the same time.
With SP.26 some basic operational modes of the motor potentiometer are defined. The parameter is bit-oriented.

Value				Meaning
8	4	2	1	
x	x	x	0	Motor potentiometer can be programmed differently in all parameter sets.
x	x	x	1	Motor potentiometer is not set-programmable.
x	x	0	x	After a power-on reset the last potentiometer value is adjusted.
x	x	1	x	After a power-on reset the potentiometer value is set to 0 %.
0	0	x	x	Rise time of 0...100% of motor potentiometer 16 s
0	1	x	x	Rise time of 0...100% of motor potentiometer 33 s
1	0	x	x	Rise time of 0...100% of motor potentiometer 66 s
1	1	x	x	Rise time of 0...100% depending on parameter SP.27
0	0	0	0	= 0 (Default value)

Motor potentiometer/Rise time (SP.27)

With this parameter a time is defined which the motor potentiometer needs to drive from 0...10 %. The adjusted time takes effect when a value of ≥ 12 is adjusted in parameter SP.26. The time is adjustable in a range of 0,00...300,00 s (Factory setting 128 s).

Correcting range (±SP.5)

The absolute setpoint limits of the motor potentiometer (-100%...0...+100%) are limited by the maximum frequencies (SP.5).

Setpoint and rotation direction (SP.0)

To set the setpoint value by way of the motor potentiometer parameter SP.0 (setpoint source) must be adjusted accordingly.

Rotation	SP.0	Setpoint
Keyboard/Bus	15	Motorpoti
Terminal strip	16	Motorpoti
±Motorpoti	17	Motorpoti

5.2.1 Set Value Setting for Positioning Control

Fast analog setpoint value for superior positioning control

The scan time of the standard software is 2ms. During this time all functions, which relate to the inputs and/or outputs, run once. When the controller is operated together with a control, then these times are usually not sufficient. The analog set value can directly be switched over onto the processing in the control-processor, resulting in scan times of 128 µs for the set value. The direct set value processing is activated by: SP. 0 = 2, SP.11 = 0.0 s, SP.12 = 0.0 s. When this mode is activated all An-parameters which relate to REF1 are without function (An.2, An.3, An.4, An.5, An.13=1).

5.3 Protection (Pn)-Parameter

Read-only parameters!
Press "Enter" key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
Pn	16	Switch-off delay E.dOH	2210				1	0	120	10	s
Pn	17	Power off / starting voltage	2211		E		1	198	800	198:off	V
Pn	20	Extern fault stopping mode	2214		E		1	0	6	0	---
Pn	23	E. Bus stopping condition	2217		E		1	0	6	6	---
Pn	24	Prohibited rotation stopping condition	2218		E		1	0	6	5	---
Pn	25	Warning dOH stopping condition	2219		E		1	0	6	5	---
Pn	27	Warning OH2 stopping condition	221B		E		1	0	6	6	---
Pn	30	OH2 - Warning level	221E		E		1%	0	100	100	%
Pn	31	dOH - error level	221F		E		1	0	201:off	201:off	°C
Pn	33	Power off / mode	2221		E		1	1	2	2	---
Pn	60	Braking torque for emergency stop	223C		E		0,1	0	dr.10	3*dr.09	Nm
Pn	63	Emergency-Stop-ramp	223F				0,01	0	10	0	s

These parameters determine the behaviour if a malfunction occurs. There are 3 different error groups:

Error group 1:
- E.OP error overpotential
- E.OC error overcurrent
- E.UP error underpotential
- E.SEt error at set selection

Modulation is immediately disabled. No other characteristics can be preset here.

Error group 2:
- EF external fault
- buS error Bus
- PrF limit switch forward
- Prr limit switch reverse

Modulation is not necessarily switched off. The reaction is specified with Pn.20, Pn.23 and Pn.24.

Error group 3:
- E.dOH error drive overheat (PTC)
- E.OL error overload inverter (KEB COMBIVERT S4)

The fault signal dOH is generated by the internal temperature sensor of the motor. The fault signal OH occurs if the inverter temperature is > 70°. Both signals lead to the disabling of the modulation, however a prewarning can be generated. The remaining time for the setting of the prewarning until the modulation is switched off, can be used to stop the drive.

All protective functions are controlled by the software. This means they may not work when the controlling unit is defective!

Table for Parameter Pn.20 and Pn.23 to Pn.25 and Pn.27:

Value	Reaction	COMBIVIS Display
0	Error message: **E.xx** modulation immediately disabled. To restart remove error and active Reset!	0: error / power on after reset
1	Status message: **A.xx** quick stop / modulation disabled after speed 0 is reached! To restart remove error and activate Reset!	1: quick stop / modulation; Power on after reset
2	Status message: **A.xx** quick stop / holding torque at speed 0. To restart remove error and activate Reset!	2: quick stop / holding torque; Power on after reset
3	Status message: **A.xx** modulation immediately disabled! Automatic restart, when error is no longer present!	3: modulation disabled/ automatic power on reset
4	Status message: **A.xx** quick stop / modulation disabled after speed 0 is reached! Automatic restart, when error is no longer present!	4: quick stop / modulation disabled / automatic power on reset
5	Status message: **A.xx** quick stop / holding torque at speed 0! Automatic restart, when error is no longer present!	5: quick stop / holding torque / automatic power on reset
6	Status message: no effect on the drive signal is ignored!	6: protective function off (no reaction)

Value 0:
The 'abnormal stopping condition' becomes an error. The drive remains in 'fatal error' status until a reset signal is recognized.

Value 1 ... 2:
The drive remains in the condition 'abnormal stop', until a reset signal is recognized.

Value 3 ... 5:
The drive automatically goes back into standard operation as soon as the malfunction is no longer present.

Value 6:
The malfunction is ignored by the drive.

Switch off time E.dOH (Pn.16)

With this parameter the triggering of the error E.dOH (motor overheating) after apply of the PTC-signal can be delayed.

Power off / Starting voltage (Pn.17)

Pn.17 adjusts the tripping voltage.

198 (Off): With this adjustment the power off function is generally disabled.
199 ... 800 V: If the DC-link voltage undershoots the adjusted value during a mains failure, the power off function will be started.

For a safe operation the tripping threshold must be 50 V higher than the UP-threshold.

	UP-Threshold 400 V Class	UP-Threshold 200 V Class
Unit D/E:	360 V DC	180 V DC
Unit ≥ G:	250 V DC	205 V DC

OH2 - Warning level (Pn.30)

Adjusts the OH2 - warning level in the range from 0...100%. Warning level =100 % means, that the triggering threshold for the prewarning signal is identical with the error triggering threshold. This error disables the modulation, thus the setting 'stopping mode' does not have an effect. (Pn.27)

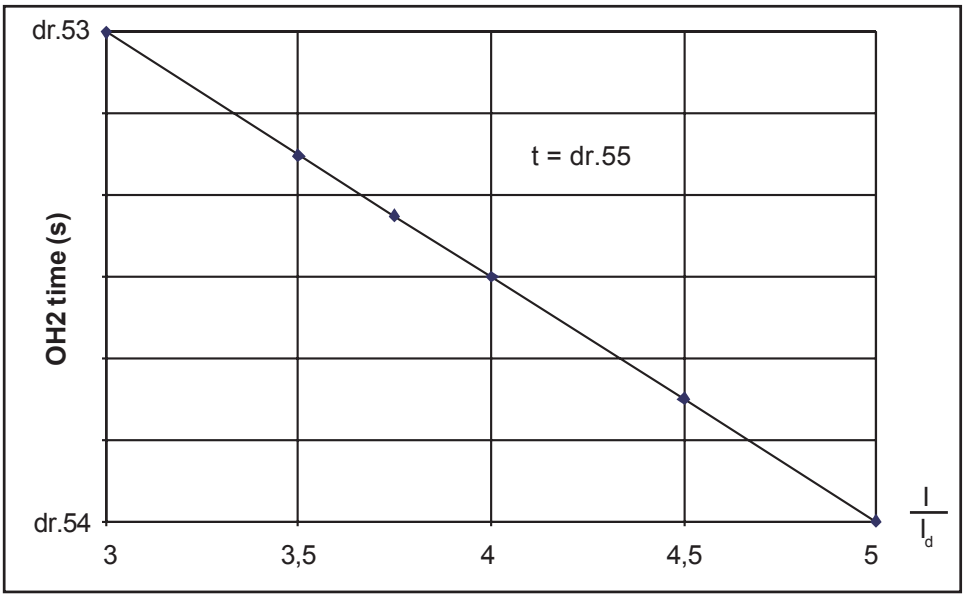
OH2 - Function

The OH2-function monitors the allowed heating of the drive. Parameterization occurs with dr.2 rated motor current I_N and dr.7 standstill current I_{d0}.

The following diagram refers to the speed dependent motor current.

$I_d = I_{d0} + (I_N - I_{d0}) * n / n_N$ für $n < n_N$

$I_d = I_N$ für $n \geq n_N$



t = Reset time of the overload counter, relates to 100 % of the release time

The times in the diagram for the response of the OH2 function relate to the triggering of OH2-error or 100 % OH2 level.

dOH-Error level (Pn.31)

If the motor temperature is measured with a KTY130 (see ru.64), a temperature can be entered over this parameter, at which the inverter switches off the motor with E.dOH after elapsed time Pn.16.

Power off / Mode (Pn.33)

Value	Reaction	COMBIVIS Display
1	Status message: **POFF** quick stop / modulation disabled after speed 0 is reached! To restart remove error and activate Reset!	1: quick stop / modulation off; Power on after reset
2	Status message: **POFF** quick stop / holding torque at speed 0. To restart remove error and activate Reset!	2: quick stop / holding torque / Power on after reset

Braking torque for emergency stop (Pn.60)

The torque limit is preset with parameter PN.60 for all emergency stop functions (Pn.20 - Pn.27). The maximum torque for the operation or malfunction can be preset separately.

Not-Stop-Rampe (Pn.63)

For all abnormal stop conditions that shall execute quick stop, the ramp can be preset here. The motor is no longer decelerated with the torque limit adjusted in Pn.60, but carries out the quick stop with the adjusted ramp time. The ramp time refers to 1000 rpm.

5.4 Control Speed (CS)-Parameter

The speed controller is parameterized in the CS-parameter group.

Read-only parameters!
Press "Enter" key to store the parameter value!
Set programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
CS	0	KP speed	2D00	P			1	0	32767	dep. on unit	---
CS	1	KI speed	2D01	P			1	0	65535	dep. on unit	---
CS	3	KP speed amplification	2D03				1	0	65535	dep. on unit	---
CS	4	KP speed limit	2D04				1	0	32767	dep. on unit	---
CS	6	Torque limit forward	2D06				0,1	0,1	dr.10	3 * dr.9	Nm
CS	7	Torque limit reverse	2D07				0,1	-0,1 : off	dr.10	-0,1 : off	Nm
CS	11	Maximal Ki increase	2D0B				1	0	65535	0	---
CS	12	Max. speed for max. Ki	2D0C				0,5	0	9999,5	0	rpm
CS	13	Min. speed for standard Ki	2D0D				0,5	0	9999,5	0	rpm
CS	14	Standstill pos. control	2D0E				1	0	65535	0	---
CS	16	max. voltage	2D10				0,1	0,1	100,0	100,0	%
CS	19	KP Flux controller	2D13				1	0 : off	65535	0 : off	---
CS	20	KI Flux controller	2D14				1	1	65535	1	---
CS	21	Flux controller limitation	2D15				0,1	0,0	dr.2	0,0	A

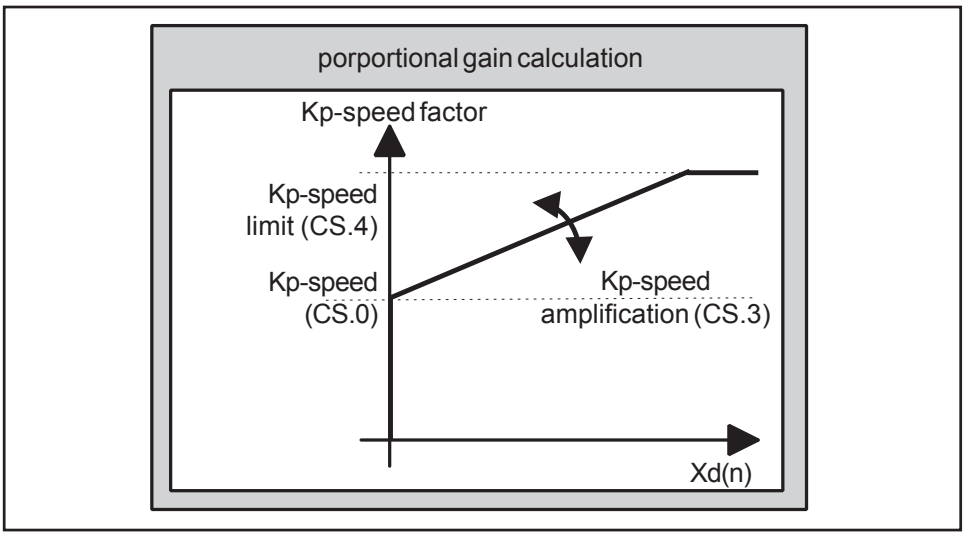
Speed Controller

The CS-parameter group contains all parameters that are needed to adjust speed and flux control. The speed controller is a PI-controller, which contains an additional proportional gain that is dependent on the system deviation (picture A) and a speed dependent integral factor (picture B). The torque limits can be separately adjusted for both directions of rotation.

KP-Speed (CS.0)
KP-Speed Amplification (CS.3)
KP-Speed Limit (CS.4)

These parameters adjust the proportional factor of the speed controller. In CS.3 the system-deviation dependent proportional factor can be parameterized. CS.4 limits the proportional gain. If Kp speed (CS.0) > Kp speed limit (CS.4), then the proportional gain is set at CS.0.

Picture A



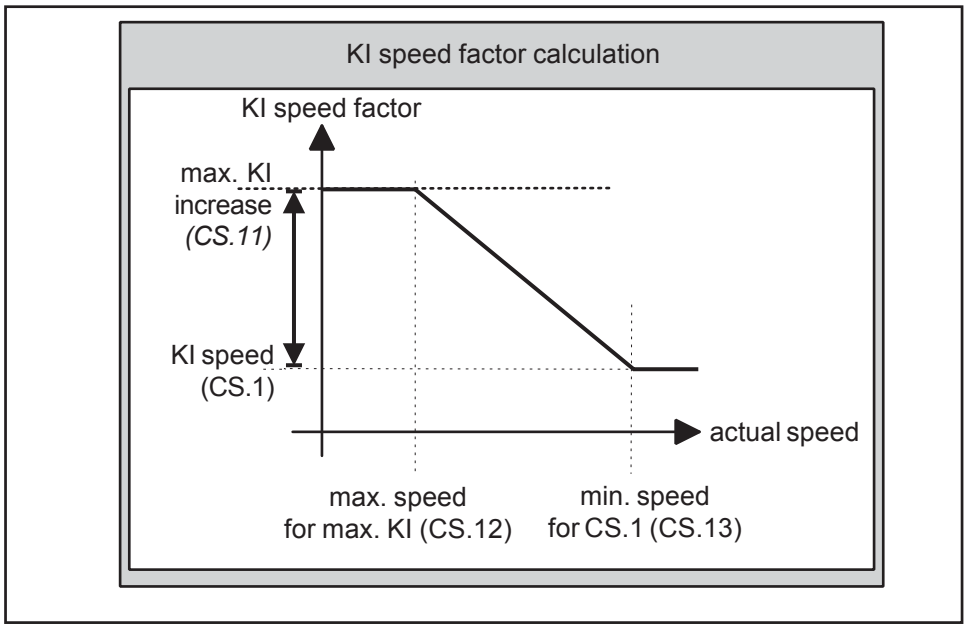
CS.3 determines to what extent the control deviation influences the proportional factor. CS.4 limits the proportional factor.

Exception: When the standard Kp-value (CS.0) is larger than the limit value (CS.4), then the proportional factor CS.3 = 0.

KI Speed (CS.1)
KI-Maximal (CS.11)
Max. Speed for max. KI (CS.12)
Min. Speed for CS.1 (CS.13)

These parameters adjust the integral factor of the speed controller.

Picture B



For better motor performance at lower speeds and standstill the KI speed can be varied depending on the actual motor speed (CS.12, CS.13).

CS.1 forms the basic value.

The maximum KI-value is: CS.1 + CS.11

Both corner frequencies CS.12 and CS.13 specify in which speed range the KI-value can be changed.

Torque Limit Forward (CS.6)

These parameters determine the torque limits in both directions of rotation.

Torque Limit Reverse (CS.7)

If only one torque limit is needed (standard condirion in speed-controller operation), it is possible to set CS.7 to 'off '. The torque limit in CS.6 is then valid for both directions of rotation.

Standstill Position Control (CS.14)

The standstill position controller improves the standstill rigidity of the drive. The position controller becomes active when the set speed and the actual speed = 0 rpm. The reference position for the controller is that position where the condition actual speed and set speed = 0 rpm was reached first. The position controller becomes inactive as soon as the set speed is unequal to zero.

The displacement of the drive may not exceed 1/2 a revolution. If the motor is displaced by load with more than 1/2 a revolution, then the set position changes by a complete motor revolution.

The position controller has only one function in the speed-controlled mode, except at fast analog setpoint presetting (SP-parameter).

The proportional factor of the standstill controller can be programmed in CS.14. A proportional factor of 0 deactivates the standstill controller.

Maximal Voltage (CS.16)

With CS.16 voltage is specified in % of the inverter voltage, at which the motor runs in field-weakening operation.

Flux Controller (CS.19 ... CS.21)

With this parameter the flux controller is operated, that forces a current into the motor which weakens the field.
CS.19 KP-value of flux controller 0: flux controller off.
CS.20 KI-value of fluc controller.
CS.21 maximum current that can be preset for the weakening of the field.

5.5 Adjustment of the Speed Controller

Speed Controller Adjustment

The speed controller must be adjusted when the KEB COMBIVERT S4 is taken into operation. By using KEB-COMBIVIS a setvalue jump can be recorded. With the examples on the following page the speed controller can be adjusted.

- Install COMBIVIS on the PC and startup. Select the programm INVERTER SCOPE.

- parameterize INVERTER SCOPE:

Operating mode	Offline
Time reference	2ms
Trigger position	5%
Trigger condition	4 : I5
Channel A	ru.4 Set speed
Channel B	ru.1 Actual speed

- Calibrate channels and adjust time reference (e.g. 50ms/DIV).

- Switch on control release X1.1, but do not activate direction of rotation X1.3 and X1.4.

- Preset speed setpoint value.
  (e.g.: 50% nominal, 5V at the analog input X1.14, X1.15)

- Start the recording of INVERTER SCOPE.

- If X1.3 is activated now, the KEB COMBIVERT S4 executes a setpoint step change. The function is recorded simultaneously by the INVERTER SCOPE. The recording stops automatically.

- Compare recorded step change with the examples on the following page and adjust speed controller.

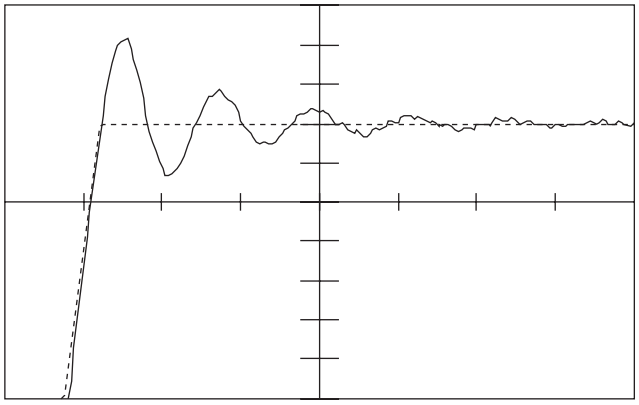
- Repeat step change and record again until a satisfying initial response and an optimal controller adjustment is found.

Rough adjustment of the speed controller without using the INVERTER SCOPE:

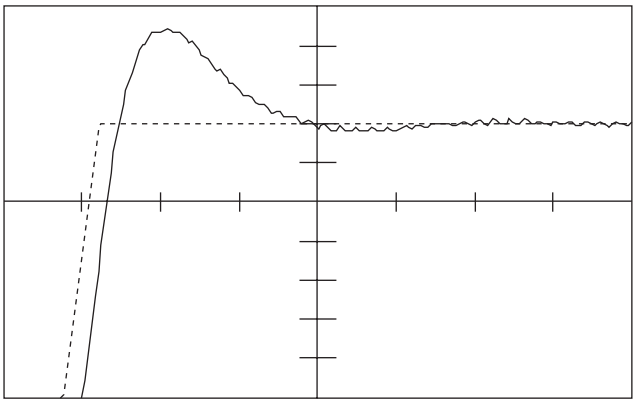
- Increase P-part to the stability limit (system starts to oscillate) and then decrease by 30%.

- Repeat the same procedure with the I-part.

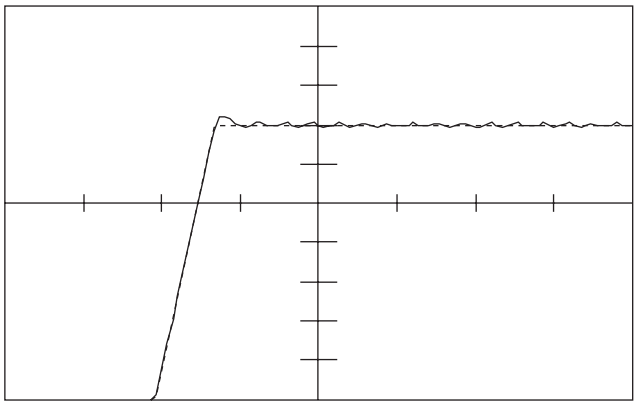
Adjustment Assistance Speed Controller



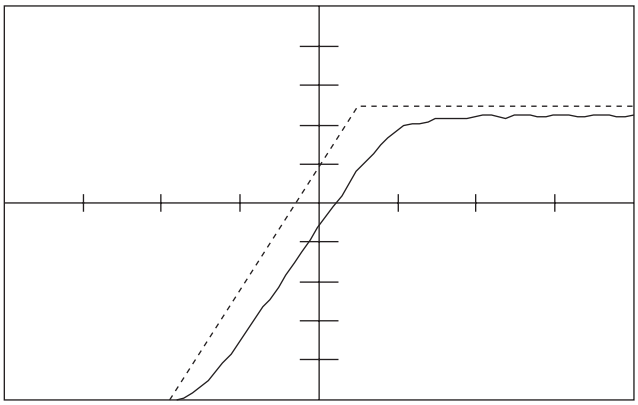
Problem: Very long transient reaction, but stabilization during constant run
Corrective measure: Increase P-fraction (CS.0; possibly reduce I-fraction (CS.1)



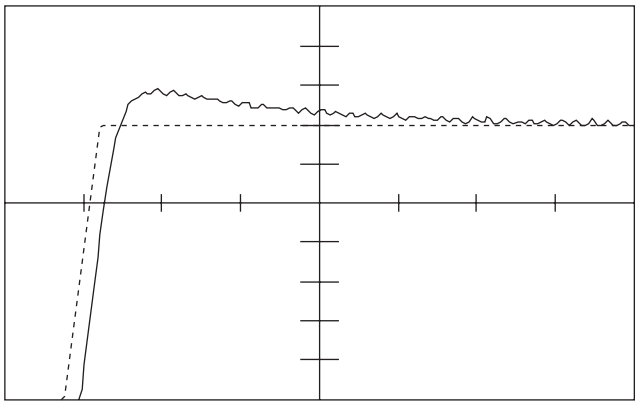
Problem: Speed overshoot too high
Corrective measure: Increase P-fraction (CS.0); possibly reduce I-fraction (CS.1)



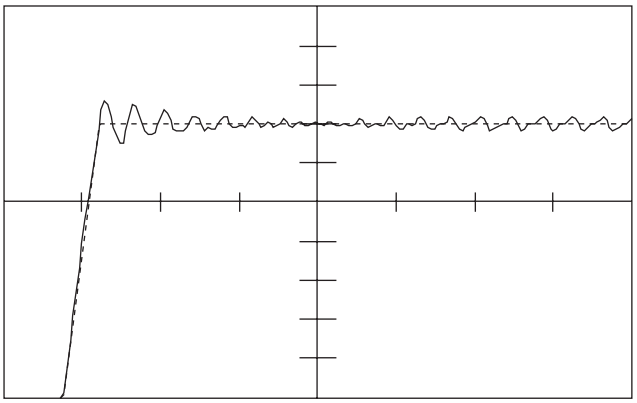
Problem: Sustained oscillation during constant run
Corrective measure: Decrease P-fraction (CS.o)



Problem: Transient reaction too slow / permanent controller deviation
Corrective measure: Increase I-fraction (CS.1)



Problem: Overshoot too long
Corrective measure: Increase I-fraction (CS.1)



Problem: Sustained oscillation with high amplitude
Corrective measure: Reduce I-fraction (CS.1)

5.6 Drive-specific control (dS)-Parameter

The dS-parameters parameterize the current controllers. The current controllers are standard PI-controllers.

Read-only parameters!
Press "Enter" key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
dS	0	KP I active	2F00				1	0	65535	dep. on unit	---
dS	1	KI I active	2F01				1	10	65535	dep. on unit	---
dS	12	Modulation Rate	2F0C			R	1				%
dS	13	Operating Frequency	2F0D				1	0 : 8 kHz	1:16 kHz	0 : 8 kHz	---

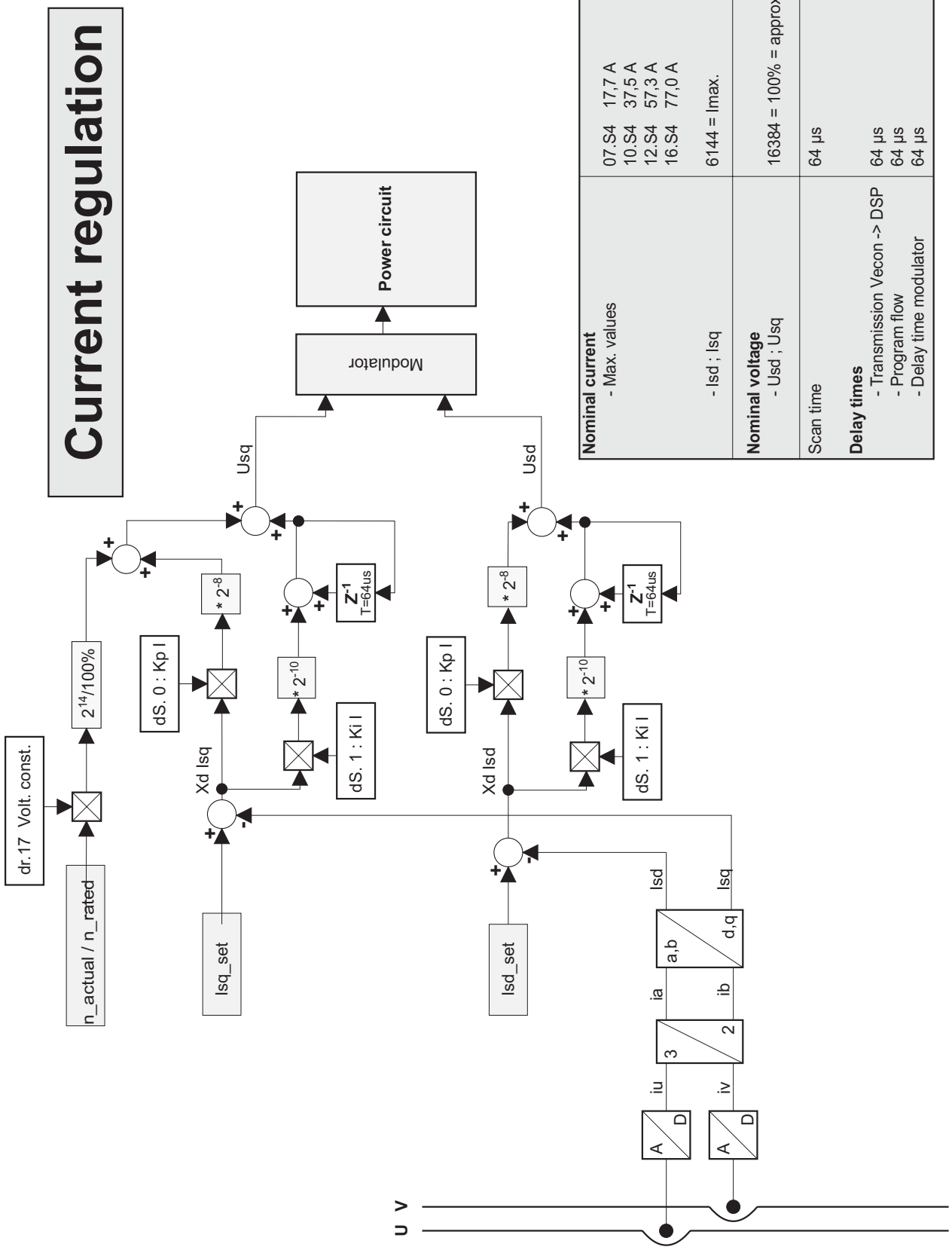
KP active (dS.0) These parameters adjust the amplification factor for the current controller.

KI active (dS.1) These parameters adjust the integral factor of the current controller.

These parameters are factory set to the standard KEB-motor. Adjustment changes should only be done if an oszilloscope with current probe is available.

Modulation Rate (dS.12) The indication corresponds to the output voltage in % of the DC-link voltage.

Operating Frequency (dS.13) Units, that can be operated with a switching frequency of 16 kHz, can be switched over to a switching frequency of 16 kHz by means of this parameter.



Nominal current		
- Max. values	07.S4 17,7 A 10.S4 37,5 A 12.S4 57,3 A 16.S4 77,0 A	= Imax.
- Isd ; Isq	6144 = Imax.	
Nominal voltage		
- Usd ; Usq	16384 = 100% = approx. Uzk / 1,414	
Scan time	64 µs	
Delay times		
- Transmission Vecon -> DSP	64 µs	
- Program flow	64 µs	
- Delay time modulator	64 µs	

5.7 Drive (dr)-Parameter

The drive parameters indicate the technical data of the motor. These parameters are already adjusted ex-works to the standard KEB-servo motor drive package.

Read-only parameters!
Press "Enter" key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
dr	0	Rated motor power	2400				0,01	0	327,67	Type plate	kW
dr	1	Rated motor speed	2401				1	100	9000	Type plate	rpm
dr	2	Rated motor current	2402				0,1	0,1	500,0	Type plate	A
dr	3	Rated motor frequency	2403				1	20	1000	Type plate	Hz
dr	7	Motor current for zero speed	2407				0,1	0,1	500,0	Type plate	A
dr	9	Rated torque	2409				0,1	0,1	500,0	Type plate	Nm
dr	10	Max. torque	240A				0,1	0,1	Inv.max.	---	---
dr	17	E.M.K. Voltage constant	2411				1	0	500,0	Type plate	V*min/1000
dr	41	Winding resistance Ruv	2429				0,1	0,1	100,0	Type plate	Ohm
dr	42	Winding inductance Luv	242A				0,1	0,1	100,0	Type plate	mH
dr	53	OH2-time 300 % ID	2435				1	50	10000	300	ms
dr	54	OH2-time I_max	2436				1	50	10000	200	ms
dr	55	OH2-recovery time	2437				1	50	10000	5000	ms
dr	56	Moment of inertia	2438				0,1	0	3000	0	kgcm^2

Max. Torque (dr.10)

The maximum torque of the motor can be specified with this parameter. But only one maximum value can be preset, which the inverter can also preset (upper limit see HSR). The parameter is used as upper limit for Pn.60, CS.6, CS.7.

OH2-protective function (dr.53...dr.55)

See parameter Pn.30.

Moment of inertia (dr.56)

The total moment of inertia can be preset here. Then the inverter controls the acceleration torque directly.

5.8 User Definition (ud)-Parameter

Read-only parameters!
Press "Enter" keb to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
ud	0	Key password input	2600		E		1	0	9999	200	---
ud	1	Bus password input	2601				1	-32767	32767	200	---
ud	2	Start parameter group	2602				Table	1 : ru	17 : pd	1 : ru	---
ud	3	Start parameter number	2603				Table	0	255	1	---
ud	6	Inverter address	2606		E		1	0	239	1	---
ud	7	Baud rate	2607		E		Table	1200	57600	9600	Baud
ud	8	Watchdog time	2608		E		0,01	0 : off	10	0 : off	s
ud	13	CP.0 Address	260D			R	1	---	---	---	---
ud	14	CP.0 Set	260E			R	1	---	---	---	---
ud	15	Display mode positioning	260F				1	-1 : off	7FFF	2001 (ru.1)	---
ud	16	CP.1 Set	2610				1	0	8 (A)	0	---
ud	17	CP.2 Address	2611				1	-1 : off	7FFF	2000 (ru.0)	---
ud	18	CP.2 Set	2612				1	0	8 (A)	0	---
ud	19	CP.3 Address	2613				1	0	7FFF	2009 (ru.9)	---
ud	20	CP.3 Set	2614				1	0	8 (A)	0	---
ud	21	CP.4 Address	2615				1	0	7FFF	2019 (ru.25)	---
ud	22	CP.4 Set	2616				1	0	8 (A)	0	---
ud	23	CP.5 Address	2617				1	0	7FFF	2002 (ru.2)	---
ud	24	CP.5 Set	2618				1	0	8 (A)	0	---
ud	25	CP.6 Address	2619				1	0	7FFF	2014 (ru.20)	---
ud	26	CP.6 Set	261A				1	0	8 (A)	0	---
ud	27	CP.7 Address	261B				1	0	7FFF	300B (SP.11)	---
ud	28	CP.7 Set	261C				1	0	8 (A)	0	---
ud	29	CP.8 Address	261D				1	0	7FFF	300C (SP.12)	---
ud	30	CP.8 Set	261E				1	0	8 (A)	0	---
ud	31	CP.9 Address	261F				1	0	7FFF	2D06 (CS.6)	---
ud	32	CP.9 Set	2620				1	0	8 (A)	0	---
ud	33	CP.10 Address	2621				1	0	7FFF	3005 (SP.5)	---
ud	34	CP.10 Set	2622				1	0	8 (A)	0	---
ud	35	CP.11 Address	2623				1	0	7FFF	3016 (SP.22)	---
ud	36	CP.11 Set	2624				1	0	8 (A)	0	---
ud	37	CP.12 Address	2625				1	0	7FFF	2D00 (CS.0)	---
ud	38	CP.12 Set	2626				1	0	8 (A)	0	---
ud	39	CP.13 Address	2627				1	0	7FFF	2D01 (CS.1)	---
ud	40	CP.13 Set	2628				1	0	8 (A)	0	---
ud	41	CP.14 Address	2629				1	0	7FFF	380b (EC.11)	---
ud	42	CP.14 Set	262A				1	0	8 (A)	0	---
ud	43	CP.15 Address	262B				1	0	7FFF	2214 (Pn.20)	---
ud	44	CP.15 Set	262C				1	0	8 (A)	0	---
ud	45	CP.16 Address	262D				1	0	7FFF	2805 (An.5)	---
ud	46	CP.16 Set	262E				1	0	8 (A)	0	---
ud	47	CP.17 Address	262F				1	0	7FFF	2802 (An.2)	---
ud	48	CP.17 Set	2630				1	0	8 (A)	0	---
ud	49	CP.18 Address	2631				1	0	7FFF	280E (An.14)	---
ud	50	CP.18 Set	2632				1	0	8 (A)	0	---
ud	51	CP.19 Address	2633				1	0	7FFF	280F (An.15)	---
ud	52	CP.19 Set	2634				1	0	8 (A)	0	---
ud	53	CP.20 Address	2635				1	0	7FFF	2813 (An.19)	---
ud	54	CP.20 Set	2636				1	0	8 (A)	0	---
ud	55	CP.21 Address	2637				1	0	7FFF	2A01 (do.1)	---
ud	56	CP.21 Set	2638				1	0	8 (A)	0	---
ud	57	CP.22 Address	2639				1	0	7FFF	2A02 (do.2)	---
ud	58	CP.22 Set	263A				1	0	8 (A)	0	---
ud	59	CP.23 Address	263B				1	0	7FFF	2B14 (LE.20)	---
ud	60	CP.23 Set	263C				1	0	8 (A)	0	---
ud	61	CP.24 Address	263D				1	0	7FFF	2B05 (LE.5)	---
ud	62	CP.24 Set	263E				1	0	8 (A)	0	---
ud	92	Display mode positioning	265C				1	0	1	0	---

Key password input (ud.0)

As explained in chapter 'Operating the S4 COMBIVERT' three different operational levels exist. These operational levels are subdivided into 5 password levels.

Bus password input (ud.1)

With parameter ud.0 the password level for operation via keyboard is selected. The password level for operation via bus is adjusted in ud.1. Only the customer-mode and application-mode are available for bus operation.

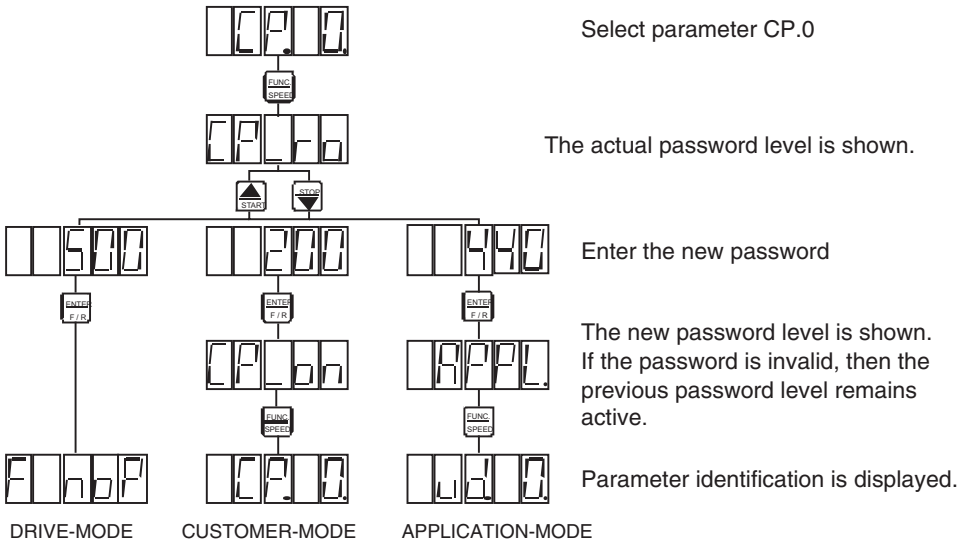
By entering the respective password the customer can change to different password/ operational levels:

Password	Password level	Function
100	customer read only	Customer parameter only visible. Parameter value cannot be changed.
200	customer on	Customer parameter visible and changeable.
330	customer service	Customer parameter visible and changeable, but they are displayed under their full parameter identification.
440	application password	All parameters are visible and changeable.
500	drive mode	Device control via keyboard.

Example

The user wants to switch from the ´customer read only Mode´ to another password level.

The password input is done as follows:



Select parameter CP.0

The actual password level is shown.

Enter the new password

The new password level is shown. If the password is invalid, then the previous password level remains active.

Parameter identification is displayed.

Start parameter group (ud.2)
Start parameter number (ud.3)

With ud.2 and ud.3 you can select which parameter should be displayed after power-on. In ud.2 the parameter group is adjusted and in ud.3 the parameter number. The parameter set is always set 0.
If the combination of parameter number and group leads to an invalid parameter (parameter does not exist), the ru.0 (in the application mode) or CP.0 (in the standard mode) is displayed after power on.

Inverter address (ud.6)

The inverter address for operation via serial bus (e.g. COMBIVIS) is set by ud.6. Possible inverter addresses are 0...239. If more than one inverter is connected to the bus it is absolutely necessary to assign them different addresses. Otherwise communication disturbances can result. For further information see the description of DIN 66019 protocol (Art. Nr. 0S.58.011-K710).

Baud Rate (ud.7)

Communication via bus is only possible as long as master and inverter are adjusted to the same baud rate.

Value	Baud Rate	
0	1200 Baud	
1	2400 Baud	
2	4800 Baud	
3	**9600 Baud**	**(Factory setting)**
4	19200 Baud	
5	38400 Baud	
6	57600 Baud	

Watchdog time (ud.8)

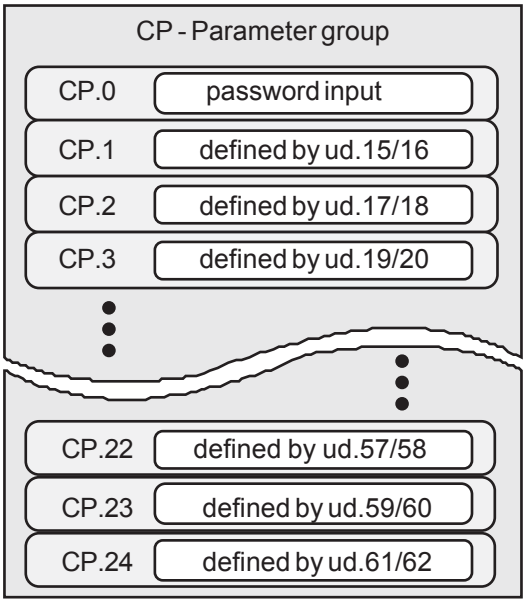
To control the connection between the inverter and the serial bus it is possible to activate a ´Watchdog´ function. If no bus signal is received within the adjusted ´Watchdog time´ the inverter trips to failure (programmable with Pn.23: reaction to Watchdog). ud.8 is deactivated by setting the value 0 (=off).

Definition of customer parameters (ud.13 ... ud.62 CPx Address, CPx Set)

Configuration of the CP operating surface is done by parameters ud.13...ud.62. Up to 24 parameters can be defined which form the CP-parameter group. CP.0 always contains the password input and is non-programmable.

Each customer parameter is defined by 2 specifications:
- the parameter address: defines parameter group and number
- the set number

Therefore two ud parameters are necessary to define one CP-parameter. ´CPX address´and ´CpX set´.



Example:
CP.1 = ru.1 (not prog.)
CP.2 = ru.0 (not prog.)
CP.3 = ru.4 (not prog.)
CP.4 = SP.11 (Set 0)

Parameter	bus address	ud-parameter
CP.1 / ru.1	2001H	ud.15 = 2001H / ud.16 = 0
CP.2 / ru.0	2000H	ud.17 = 2000H / ud.18 = 0
CP.3 / ru.4	2004H	ud.19 = 2004H / ud.20 = 0
CP.4 / SP.11	300BH	ud.21 = 300BH / ud.22 = 0

Aside from the set numbers 0..7 the adjustment A (=active set) is possible. In this case, the parameter value is changed in the set that is currently active.

To show the user which set is currently parameterized the set number is shown on SEG 5 of the 7 segment display.

Changing the active set during parameterization in the CP-Mode may result in undesirable parameter settings.

If a non-existing parameter address is chosen in ´CP.x address´ the equivalent CP-parameter is ignored.

Invalid bus addresses:
- all parameter addresses not documented in this application manual
- the CP-definition parameters themselves (ud.15...ud.62)
- parameters with copy-functions (Fr.0, Fr.1, Fr.2)

Display mode positioning (ud.92)

This parameter affects all ru-parameters with position representation (ru.35 ... ru.57). If the value "1" is adjusted, the Low-part and the sign are updated with the reading of the High-part. This setting is necessary whenever 32-bit position values are to be evaluated by a bus connection.

5.9 Information (In)-Parameter

Read-only parameters!
Press "Enter" key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
In	4	Software version	2C04			R	1	---	---	---	---
In	5	Software date	2C05			R	0,1	---	---	---	---
In	6	Configfile number	2C06			R	1	0	255	38	---
In	7	Serial No. (date)	2C07				1	0	65535	0	---
In	8	Serial No. (counter)	2C08				1	0	65535	0	---
In	9	Serial No. (AB-Nr. high)	2C09				1	0	65535	0	---
In	10	Serial No. (AB-Nr. low)	2C0A				1	0	65535	0	---
In	11	Customer No. (high)	2C0B				1	0	65535	0	---
In	12	Customer No. (low)	2C0C				1	0	65535	0	---
In	40	Last error	2C28				1	0	63	0	---
In	41	Error counter E.OC	2C29				1	0	255	0	---
In	42	Error counter E.dOH	2C2A				1	0	255	0	---
In	43	Error counter E.OP	2C2B				1	0	255	0	---
In	44	Error counter E.OH2	2C2C				1	0	255	0	---
In	45	Error counter WD	2C2D				1	0	255	0	---
In	54	Software version DSP	2C36			R	0,1	---	---	---	---
In	55	Software date DSP	2C37			R	0,1	---	---	---	---
In	60	Last error (t-1)	2C3C			R	1	---	---	---	---
In	61	Last error (t-2)	2C3D			R	1	---	---	---	---
In	62	Last error (t-3)	2C3E			R	1	---	---	---	---
In	63	Last error (t-4)	2C3F			R	1	---	---	---	---

Software Version (In.4) The version number of the Host-Software is encoded in this parameter.

Software Date (In.5) Display of the date of the Host-Software. The value contains the day, month and year, but only the last 2 digits of the year are shown.
Example: Display= 1507.4 ==> Date = 15.07.04

Configfile Number (In.6) Contains a software identifier used by KEB COMBIVIS to select the correct configfile. The configuration starts automatically when COMBIVIS is activated and the inverter is connected.

Serial Numbers, Customer Number (In.7 ... In.12) Serial number and customer number identify the inverter.

Error Counter (In.40 ... In.45) Error counters (for E.OC, E.dOH, E.OP, E.OH2 E.buS) specifiy the total number of errors that occurred of each type during operation.

Software Version DSP (In.54) The version number of the DSP-Software is encoded in this software.

Software Date DSP (In.55) Display of the date of the DSP-Software (see Parameter In.5)

Last Error (t-x) (In.60 ... In.63) For a better error diagnosis the last four errors, that were triggered, are displayed.

5.10 Encoder Control (EC)-Parameter

All information and parameters for the encoder interface are found in the EC-parameters. EC.0 to EC.9 and EC.20 to EC.23 stand for encoder interface X4, EC.10 - EC.18 for the encoder interface X3.

Read-only parameters!
Press "Enter" key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
EC	0	Encoder 1 interface	3800			R	1	---	---	dep. on unit	---
EC	1	Encoder 1 (inc/r)	3801		E		1	256	10000	2048	inc
EC	2	Track change encoder 1	3802				1	0 : off	1 : on	o : off	---
EC	5	Encoder 1 clock frequency	3805				0,01	5,00	10,00	10,00	kHz
EC	7	System position	3807		E		1	0	65535	---	mA
EC	8	Time for speed calculation	3808				1	0	5	0	---
EC	9	Current input resolver	3809				0,1	-1:auto	72,0	7,7	---
EC	10	Encoder 2 interface	380A			R	1	---	---	dep. on unit	---
EC	11	Encoder 2 (inc/r)	380B				1	100	10000	---	inc
EC	12	Track change encoder 2	380C				1	0	1	0	---
EC	13	Encoder 2 mode	380D				1	0	1	0	---
EC	14	Multiturn resolution encoder 2	380E				1	0	13	0	---
EC	15	Encoder 2 clock frequency	380F				1	0	1	0	---
EC	16	Encoder 2 data code	3810				1	0	1	0	---
EC	18	Time for speed calculation 2	3812				1	0	5	0	---
EC	20	Hiper-Type	3814			R	1	---	---	---	---
EC	21	Hiper-Status	3815			R	1	---	---	---	---
EC	22	Read Hiper-Data	3816				1	0	1	0	---
EC	23	Write Hiper-Data	3817				1	0	1	0	---

Encoder interface (EC.0, EC.10)

The parameters EC.0 and EC.10 give information of the encoder interfaces. EC. 0 stands for a 15 pole interface X4, EC.10 for the 9 pole interface X3.

Value	Encoder Interface
0	SIN / COS - encoder interface
1	Incremental encoder emulation 5V
2	Incremental encoder input
3	**Resolver interface 12 bit**
4	Incremental encoder emulation 24V
5	SSI - Interface for absolute value encoder
6	**Incremental encoder Input / Output reversible**
7	- - -
8	Hiperface
9	Incremental encoder Input/emulation reversible

Encoder 1 incr/rev (INC/R)

When using a SIN/COS encoder as system feedback the encoder increments can be adjusted in this parameter.

Track change encoder 1 (EC.2)

With EC.2 the direction of rotation of the servo system can be inverted. If EC.2 is switched on, positive speed values and/or rising positions mean anti-clockwise rotation at the motor with view onto the shaft. This parameter has no function at Hiperface-encoders.

Clock frequency encoder 1 (EC.5)

With EC.5 the exciter frequency for a resolver can be preset.

System position (EC.7)

The system position of the attached resolver system is adjusted at EC.07. With this parameter it is possible to adjust the controller to a not aligned motor. If the system position of the motor is unknown an automatic trimming can be done.

- The speed display at ru.1 must be positive when the motor runs manually in clockwise direction. The signals SIN and SIN_LO have to be changed for units with resolver systems if the sign is wrong. Please ensure that the signals are not short-circuited with the internal shield (see connection resolver) The signals A(+) and A(-) must be changed for units with SIN/COS encoder.
- Deactivation of the posi-module Pc.0 = 0 : off
- preset EC.07 to 89Eh (ENTER)
- For units with SIN/COS encoder the direction of rotation of the absolute position must be checked additionally. If the motor runs manually in clockwise direction, the value which is displayed at EC.07 must get smaller. The signals C (+) and C (-) at the encoder must be changed if this doesn't happen.
- Close control release. Now the motor is excited with its rated current and aligned to its zero position. The adjustment is finished when the displayed system position at EC.07 does not change for approx. 5 s. In this case open control release and switch off the unit.
- If the error message E.EnC is displayed during trimming the terminals U and V of the motor connection must be changed. In this case the position trimming must be repeated.

In case that motors with aligned encoder system are used, the value which has been established by the automatic trimming, can be entered under EC.07 as well. The parameter has a 16 bit resolution 0 ... FFFFh.

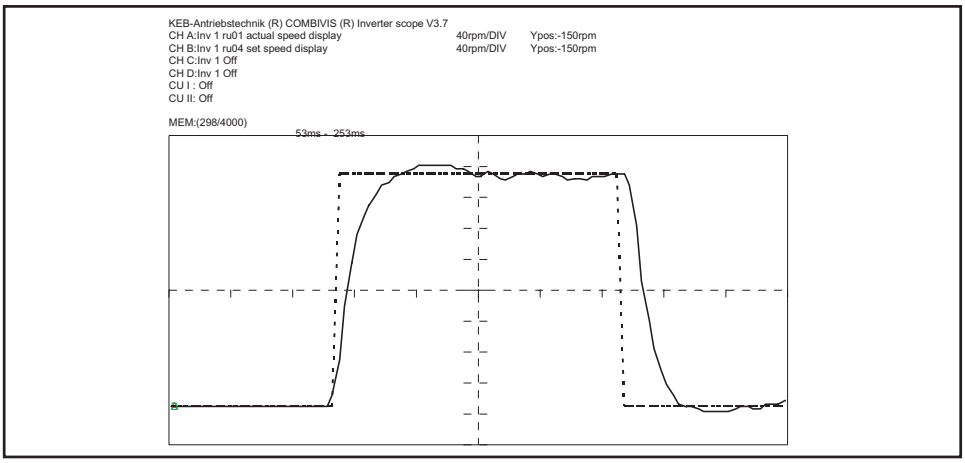
Speed scan time (bandwidth) (EC.8, EC.18)

The speed scan time respectively the bandwidth of the controller is already preset ex factory:

EC.8	Bandwidth speed controller	Max. speed of the speed measurement	Resolution ERN1387	Resolution Resolver
0 : 0,5 ms	2 kHz	16383 rpm	1,8 rpm	29,3 rpm
1 : 1 ms	1 kHz	16383 rpm	0,9 rpm	14,6 rpm
2 : 2 ms	500 Hz	16383 rpm	0,5 rpm	7,3 rpm
3 : 4 ms	250 Hz	14648rpm	0,2 rpm	3,7 rpm
4 : 8 ms	125 Hz	7324 rpm	0,1 rpm	1,8 rpm
5 : 16 ms	63 Hz	3662 rpm	0,06 rpm	0,9 rpm

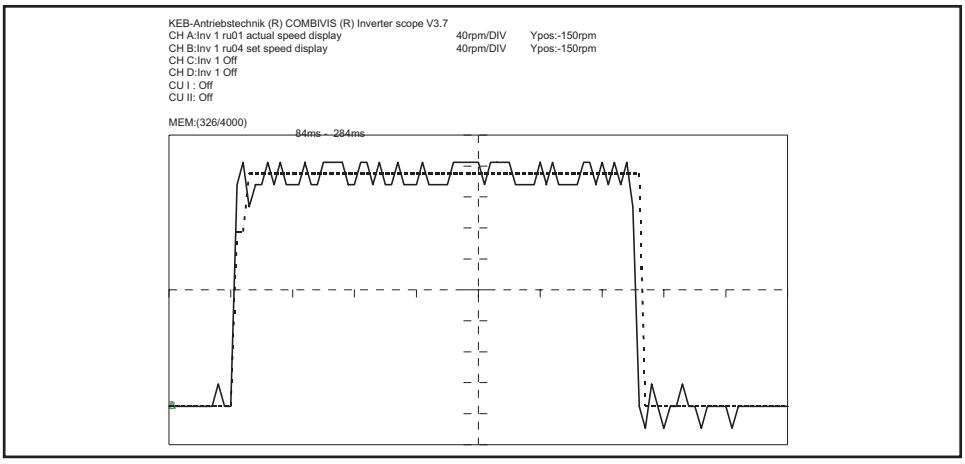
Example for a step response with short bandwidth: (EC.8 = 5)

The gain of the speed controller must be adjusted very small.
The vibrations in the drive are very small.
The speed fluctuations are very small .
The response is not sufficient.



Adjust the same servo system with high bandwidth: (EC.8 = 0)

The gain of the speed controller can be adjusted very high.
The vibrations in the drive are very strong.
The speed fluctuations are very high.
The response is very good.



The optimum adjustment of the bandwidth, depending on the respective application, lies between these two examples.

Current input resolver (EC.9)

This parameter is used only for adjusting the threshold of the current input of the resolver for E.ENC. When writing the value -1 : Auto the current input is measured and the parameter optimally adjusted.

Encoder 2 (EC.11)

This parameter has two functions for units with a standard interface (EC.10 = 6). If EC.13 is 0, the increments of the emulation can be read. The parameter cannot be changed then. When EC.13 is changed to 1 the increments of the incremental encoder can be entered in EC.11.

Change encoder 2 rotation (EC.12)

With a connected encoder to X3 the direction of rotation can be inverted here. (Incremental encoder of SSI-encoder).

Encoder 2 mode (EC.13)

For units with a standard interface (EC.10 = 6) the encoder 2 interface can be changed from incremental encoder emulation to encoder input by means of this parameter.
0 : Incremental encoder emulation 1 : Incremental encoder input

Multiturn resolution encoder 2 (EC.14)

When a SSI - multiturn- absolute value encoder is connected, the bits for the multiturn - resolution can be adjusted. (12 bit)

Encoder 2 clock frequency (EC.15)

The clock frequency of the SSI- encoder is adjusted with parameter EC.15. Two clock frequencies are available 0 : 321,5 kHz or 1 : 156,25 kHz. The smaller clock frequency should only be adjusted with long cable lenghts and/or in case of greater malfunctions.

Encoder 2 code (EC.16)

For SSI - encoder two codes are supported by the unit:
0 : Binary coded 1 : Gray code

Hiper-Type (EC.20)

The parameter shows the type identifier of the Hiperface-encoder (Stegmann) at X4-encoder 1.
02h ..... SCS 60/70
07h ..... SCM 60/70
22h ..... SRS 50/60 SCS-KIT 101
27h ..... SRS 50/60 SCM-KIT 101

Hiper-Status (EC.21) The current encoder status is displayed here.

Error Type	Status Code	Description	SINCOS SCS/-SCM/KIT	SINCOS SRS/-SRM	E.ENC	
Initialization	00h	OK	✔	✔		
	01h	Analog signal outside the specification		✔		
	02h	Internal angular offset faulty		✔		
	03h	Table about data arrangement destroyed	✔	✔		
	04h	Analog limit values not available		✔		
	05h	Internal I^2C-Bus not functioning	✔	✔		
	06h	Internal check-sum error	✔	✔		
Protocol	07h	Encoder reset occurred through program monitoring		✔		
	09h	Parity error	✔	✔		
	0Ah	Check-sum of transmitted data wrong	✔	✔		
	0Bh	Unknown command code	✔	✔		
	0Ch	Number of transmitted data wrong	✔	✔		
	0Dh	Transmitted command argument inadmissible	✔	✔		
Data	0Eh	Selected data field may not be written on	✔	✔		
	0Fh	Wrong access code	✔	✔		
	10h	Specified data field not changeable in its size		✔		
	11h	Specified word address outside the data field	✔	✔		
	12h	Access do non-existing data field	✔	✔		
Position	01h	Analog signal outside the specification		✔		
	1Fh	Speed too high, no positioning possible		✔		
	20h	Position Single-turn inadmissible		✔		
	21h	Position error Multi-turn		✔		
	22h	Position error Multi-turn		✔		
	23h	Position error Multi-turn		✔		
Others	1Ch	Amount monitoring of analog signals (process data)				
	1Dh	Transmitting current critical		✔		
	1Eh	Encoder temperature critical		✔		
	08h	Overflow of the counter		✔		
KEB internal	41h	Type identifier+serial identifier undefined	✔	✔	✔	
	42h	KEB identifier bytes undefined	✔	✔	✔	
	43h	Hiperface busy (after time-out timeE.EnC)	✔	✔	✔	
	4Ah	Read data	✔	✔		
	4Bh	Store data	✔	✔		
	60h	Unknown service	✔	✔	✔	
	FFh	Collective error, no communication	✔	✔	✔	
	80h	Position error (deviation of absolute position from the counted increments)	✔	✔	✔	
	FDh	Check-sum error	✔	✔	✔	
	FEh	Parity error	✔	✔	✔	

Hiper-Daten read (EC.22) By writing a "1" the data, which the KEB COMBIVERT previously stored in the encoder,can be read with this parameter.

Motor data		
dr	0	Motor rated power
dr	1	Motor rated speed
dr	2	Motor rated current
dr	3	Motor rated frequency
dr	7	Standstill continuous current
dr	9	Motor rated torque
dr	10	Maximal torque
dr	17	EMK voltage constant
dr	41	Winding resistance Ruv
dr	42	Winding inductivity Luv

Encoder data		
EC	1	Increment encoder 1
EC	7	System position
EC	8	Speed scan time encoder 1

Controller data		
CS	6	Torque limit clockwise rotation
CS	7	Torque limit anti-clockwise rotation = -1 : off

Hiper-Daten write (EC.23) The data, that can be read with EC.22 from the Hiperface-encoder, can be stored with parameter EC.23 in the encoder by writing a "1".

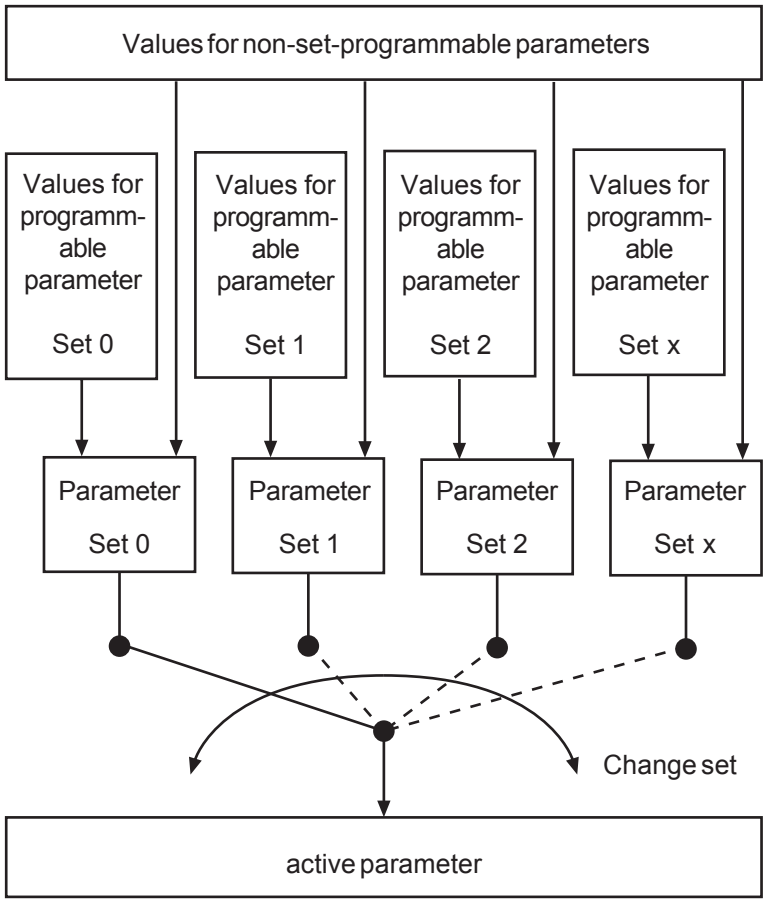
5.11 Free programmable (Fr)-Parameter

Read-only parameters!
Press "Enter"-key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
Fr	0	Copy Para Set (Key)	2700	P	E		1	-2 : init	7	0	---
Fr	1	Copy Para Set (Bus)	2701				1	-2 : init	7	0	---
Fr	2	Parameter Set Source	2702		E		1	0	3	0	---
Fr	3	Parameter Set Lock	2703		E		1	0	255	0	---
Fr	4	Parameter Set Setting	2704		E		1	0	7	0	---
Fr	5	Parameter Set Activation Delay	2705	P			0,001	0	10,000	0	s
Fr	6	Parameter Set Deactivation Delay	2706	P			0,001	0	10,000	0	s
Fr	9	Bus Parameter Set	2709				1	-1	7	0	---

Copy sets (Fr.1, Fr.0)

Some of the inverter parameters are set-programmable, i.e. several values can be assigned to one parameter (8 parameter sets).



However, in most applications the basic setting of the various parameter sets remains the same and only a few parameters are adjusted differently in different sets. Therefore, it is possible to copy one set into another in order to maintain the same values in all sets. At the same time all parameter values of the destination set (Fr.9 or left segment of the display) are overwritten with the respective values of the source set. (Fr.1 or Fr.0)

The following copy functions are possible:

Parameter value	Function
-2 : init	Copy factory setting into all sets
-1 : def	Copy factory setting into destination set
0	Copy set 0 into destination set
1 ... 7	Copy set 10...7 into destination set

The following limitations must be taken into account when copying sets:

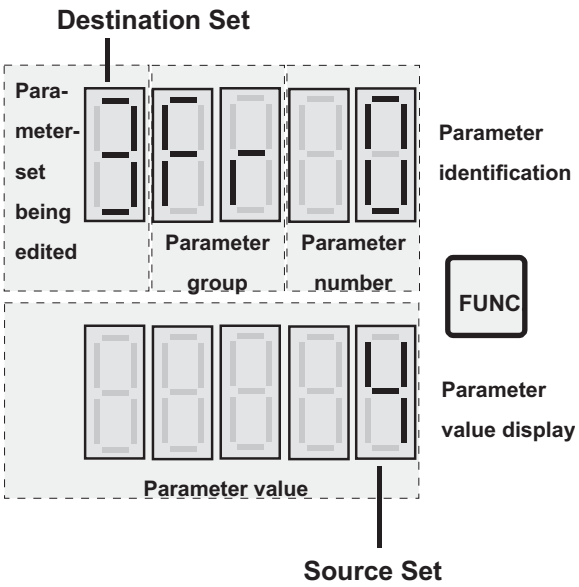
- Source set and destination set may not be the same.
- It is impossible to copy sets as long as the active set **A** is displayed.
- If the destination set is not equal to zero, then only the programmable parameters are copied.
- The default set cannot be copied into the active set, as long as the drive is not in the state noP (control release opened).
- The function „init“ can only be executed with noP.

Copy keyboard parameter set (Fr.0)

When the inverter is operated via keyboard the copy process is triggered by Fr.0. Fr.0 is not visible by bus.

Example

parameter set 4 should be copied into parameter set 3.



The parameter value specifies the source set. The destination set is the parameter set that is currently edited (by keyboard). The copying process is triggered by confirming the parameter value with **ENTER**:

Return information over seven-segment display:
- **PASS** => copying process successfully completed
- **nco** => copying process could not be completed

Copy parameter set (Fr.1)

When operating the inverter via bus the copying process is triggered by Fr.1. This parameter is not visible.

Destination set => parameter value Fr. 9 (set presently being edited by bus)
Source set => parameter value Fr. 1

Parameter set source (Fr.2)

Fr. 2 defines how the parameter set selection is done.

Value	Parameter Set Source
0	Set selection deactivated
1	Set selection by Fr.4 (set selection digital)
2	Set selection terminal strip (binary coded)
3	Set selection with terminal strip (input coded)

Value 0 :
When the parameter set selection is deactivated the inverter is always operated with the values adjusted in set 0.

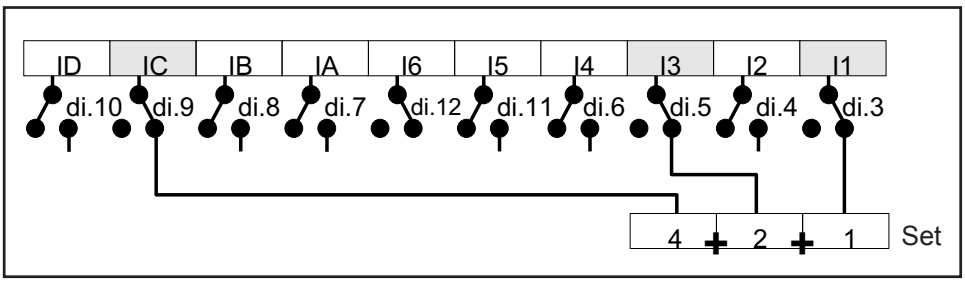
Value 1 :
When a set is selected with Fr.4 the inverter is always operated with the set that is programmed in Fr.4. Fr.4 can be adjusted by bus or keyboard.

If the active set shall be selected via terminal strip, (value 2 or 3) the respective input terminals X1.2...X1.7 or the software inputs IA...ID must be programmed onto the set selection (di.3...di.10).

Value 2:
Binary coded means that the inputs (the inputs whose input function = set selection) are interpreted as a binary number in ascending sequence. (Sequence: I1, I2, I3, I4...ID). The sum of all controlled inputs determines the set.

Example

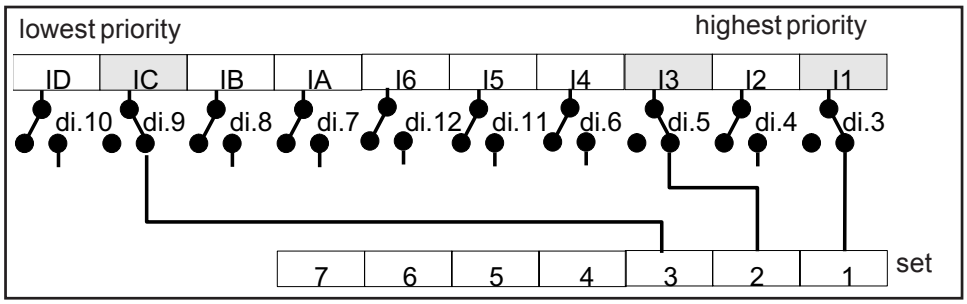
I1, I3 and IC have the function
set selection => di.3, di.5, di.9 = 1 / di.4, di.7, di.8, di.10 <> 1
8 sets can be addressed.



Signal to input terminal			active set
IC	I3	I1	
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

Value 3:
Input coded means, the activated input with the highest priority, which has the input function set selection, determines the active set.

Example I1, I3 and IC have the function
set selection=> di.3, di.5, di.9 = 1 / di.4, di.7, di.8, di.10 <> 1
4 sets can be addressed.



Signal on the input terminals			active set
I1	I3	IC	
0	0	0	0
0	0	1	3
0	1	0	2
0	1	1	2
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Parameter set lock (Fr.3) Fr.3 can lock the selection of individual sets. Trying to select a locked set triggers the set selection error (E.SET).

Valency	Locked set
0	set not locked
1	0
2	1
4	2
8	3
16	4
32	5
64	6
128	7

If several sets are locked, their valencs must be added up.

Example Set 2 and 4 should be locked
Set 2 = 4
Set 4 = 16
Fr.3 = 4 + 16 = 20
Combivis display: Set 2 + Set 4

Parameter set setting (Fr.4)

With Fr.4 the active parameter set can be selected via bus or keyboard.
Condition: parameter set source = digital (Fr.2 = 1).

Parameter set activation delay (Fr.5)
Parameter set deactivation delay (Fr.6)

These parameters can delay the changeover between two parameter sets. Fr.5 defines the time with which the activation of the new set is delayed. Fr.6 specifies the delay of the deactivation of the old set. Both times are added up at the set changeover. If the posi-module is active, the delay times start when the position is reached.

Example

ON delay Fr.5 (set 0) = 1 s
OFF delay Fr.6 (set 0) = 2.5 s
ON delay Fr.5 (set 1) = 2 s
OFF delay Fr.6 (set 1) = 0.5 s

Delay of the changeover from set 0 to set 1: 2.5s + 2s = 4.5 s.
Delay of the changeover from set 1 to set 0: 0.5s + 1s = 1.5 s.

Bus parameter set (Fr.9)

Specifies the parameter set that is parameterized by bus. It does not necessarily correspond to the active set in which the inverter is currently running. The following settings are possible:

Value	Function
-1 (A)	The parameter set with which the inverter actually operates is displayed. The parameter values cannot be changed.
0 ... 7	Parameter set 0...7 is displayed. Parameter values can be changed.

5.12 Analog I/O (An)-Parameter

Read-only parameters!
Press "Enter"-key to store the parameter values!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
An	0	Measured value hysteresis	2800				0,01	0,00	10,00	0,00	%
An	1	Noise filter analog inputs	2801				Table	0	10	4 (2ms)	---
An	2	Zero clamp REF 1	2802				0,1	0,0	10,0	0,2	%
An	3	REF 1 gain	2803				0,01	-20,00	20,00	1,00	---
An	4	REF 1 Offset X	2804				0,1	-100,0	100,0	0,0	%
An	5	REF 1 Offset Y	2805				0,1	-100,0	100,0	0,0	%
An	8	Zero clamp REF 2	2808				0,1	0,0	10,0	0,2	%
An	9	REF 2 gain	2809				0,01	-20,00	20,00	1,00	---
An	10	REF 2 Offset X	280A				0,1	-100,0	100,0	0,0	%
An	11	REF 2 Offset Y	280B				0,1	-100,0	100,0	0,0	%
An	12	REF 1 <-> REF 2	280C	P			1	0	1	0	---
An	13	REF 2-input function	280D		E		1	0	9	5	---
An	14	Analog Out 1 function	280E		E		1	0	6	2	---
An	15	Analog Out 1 gain	280F				0,01	-25,00	25,00	25 Nm / MN	---
An	16	Analog Out 1 Offset X	2810				0,1	-100,0	100,0	0,0	%
An	18	Analog Out 2 function	2812		E		1	0	6	0	---
An	19	Analog Out 2 gain	2813				0,01	-25,00	25,00	6000 rpm/nN	---
An	20	Analog Out 2 Offset X	2814				0,1	-100,0	100,0	0,0	%

The analog set value or limit value presetting is done with two voltage differential inputs. If the analog signal should be a current signal, then external resistors must be connected. (par example 500 ohm at 0 ... 20 mA)

Measured value hysteresis (An.0)

Input of y hysteresis in % onto the analog end value, under which the analog value does not change.

Noise filter (An.1)

The digital filter for both analog inputs can be adjusted with An.1.

Zero clamp REF1, REF2 (An.2, An.8)

In order to prevent the drive from drifting due to ripple voltages or offset voltages it is possible to program a zero point hysteresis in this parameter. Below the zero-clamp level the analog signals are internally suppressed (set to 0).
The level may be adjusted between 0...10%.
This function has a switching hysteresis of 50%. The signal value is passed through, if the analog value becomes larger than the zero clamp level. The analog signal is blocked when the analog value is smaller than half of the zero clamp level.

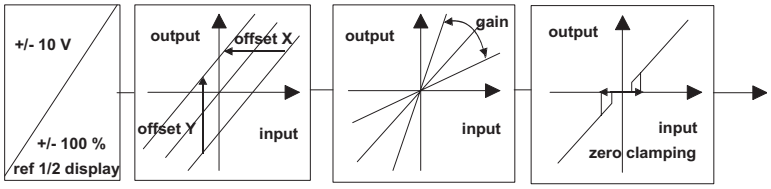
REF Gain (An.3, An.9)

These parameters adapt the analog input of the KEB COMBIVERT S4 onto the output voltage of the superimposed control. If the control has a maximum output voltage of e.g. +/- 5 V, then the entire speed range between 0 and SP.5 (maximal speed reference) may be used by programming a gain of 2.00. Since the amplification adjustment is done by the software, the resolution of the analog value is reduced if the amplifications are larger than 1.

REF Offset Y (An.5, An.11) These parameters can compensate an offset on the output signal of the control.

Functional summary An.2, An.3, An.4, An.5, An.8, An.9, An.10, An.11

Analog value



REF1 <-> REF2 (An.12) The two analog parameters can be exchanged by means of this parameter.

REF 2-input function (An.13) Specifies the function of Ref 2 - analog input.

Value	Function
0	no function
1	input added to the set value input (set value can be analog and digital)
2	serves as a multiplier for the parameter CS.0 (KP speed)
3	serves as a multiplier for the parameter CS.0 (KP speed)
4	serves as a multiplier for the parameter CS.0 and CS.1 (=> meaning for the total gain of the speed controller)
5	serves as a multiplier for CS.6 and CS.7 (meaning for the torque limit)
6	torque control
7	gear factor pos. (0% . . . 100 % an REF 2 ==> 0,05 . . . 20,00)
8	gear factor neg. (0% . . . 100 % an REF 2 ==> 0,05 . . . 20,00)
9	max. positioning speed (0%...100 % an REF 2 ==> 0...Pd.7)

- **At value 6 the function of both analog inputs changes.** With REF 2 the max. speed is preselected. 10 V agrees with the specified speed at SP.5. Negative values to REF 2 are interpreted as 0. The torque setpoint value is preselected with a sign via REF 1. The torque presetting is defined in such a way that 10V at the reference input correspond to the torque limit CS.6. The torque setpoint is scanned with 128 µs in this operating mode. The function is only available in the speed-controlled mode.

- The gear factor for the synchronous moduel is calculated from the **analog value** + the value adjusted in **Sn.2**. The internal value range is limited to -20,00...0...20,00. The activated register function has also in this mode an affect on the gear factor.

- Acceptance of the speed at PC.0 = 1 only at the beginning of the positioning. PC.0 = 2 the speed is also accepted during the positioning.

Analog output function (An.14, An.18)

These parameters decide which process variables should be visualized. The resolution of the analog values is 10 Bit. The smoothing constant for the analog signals is 2 ms.

Value	Process Variable	Value at 100%
0	actual speed	6000 rpm
1	apparent current	25 A
2	actual torque	25 Nm
3	DC-bus voltage	1000 V
4	speed reference input (i.e.: output of the ramp generator)	6000 rpm
5	system deviation of the speed controller (speed reference-actual speed)	6000 rpm
6	speed controller manipulated variable = torque set value	25 Nm
7	amount of the current speed	6000 rpm
8	amount of the current torque	8 • M_N

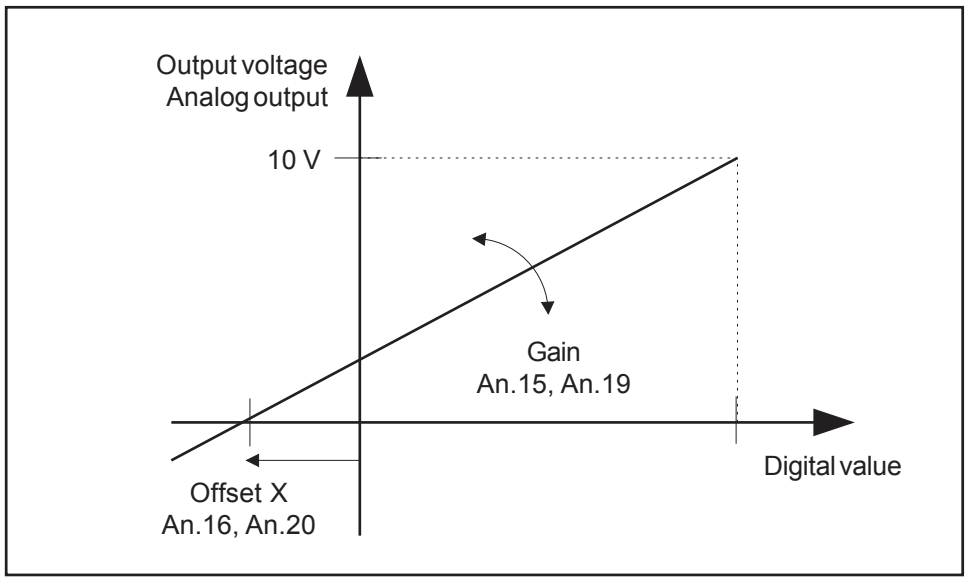
Analog Out gain (An.15, An.19)

The analog output signal can be adapted to the input range of the connected device. Maximum output voltage is +/- 10 V.

Analog OUT Offset X (An.16, An.20)

These parameters are needed when signal fluctuations around a basic value should be visualized (e.g. actual value of the DC-voltage in comparison to the nominal value of the DC-voltage).

Characteristic curve formation for the analog outputs



Example 1 **Calculation example for the actual speed visualization:**

- analog output function = actual speed
- the speed range from 2700 rpm to 3000 rpm should be displayed
- this speed range should be displayed with a voltage range of +/-10V

Offset calculation:
100 % digital value = 6000 rpm
Signal offset = 2850 rpm
Offset X = 2850 / 6000 = 47,5 %
Analog output offset X (An.16 / An.20) = 47,5

Gain calculation:
A speed difference of +/- 500 rpm = +/- 8,3 % digital value should produce a change in the analog output of +/- 10 V = +/- 100 %
Gain = 100 / 8,3 = 12,05
Analog output gain (An.15 / An.19) =12,05

Example 2 **Calculation example for the apparent current visualization :**

- analog output function = apparent current
- the range from 0 A to 5 A should be displayed
- this current range should be displayed with a voltage of +/- 10 V

Offset calculation:
Analog output offset X (An.16 / An.20) = 0,0

Gain calculation:
A current difference of 5 A = +/- 20% digital value should cause a change in the analog output of +/- 10 V = +/- 100 %
Gain = 100 / 20 = 5
analog output gain (An.15 / An.19) = 5,00

5.13 Digital Input (di)-Parameter

Read-only parameters!
Press "Enter"-key to store the parameter values!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
di	0	Digital noise filter	2900				0,1	0,0	20,0	0,5	ms
di	1	NPN / PNP selection	2901		E		1	0 : pnp	1 : npn	0 : pnp	----
di	2	Input logic	2902		E		1	0	127	0	----
di	3	Input function I1	2903		E		1	0	26	4	----
di	4	Input function I2	2904		E		1	0	26	5	----
di	5	Input function I3	2905		E		1	0	26	3	----
di	6	Input function I4	2906		E		1	0	26	13	----
di	7	Input function IA	2907		E		1	0	26	0	----
di	8	Input function IB	2908		E		1	0	26	0	----
di	9	Input function IC	2909		E		1	0	26	0	----
di	10	Input function ID	290A		E		1	0	26	0	----
di	11	Input function I5	290B		E		1	0	26	14	----
di	12	Input function I6	290C		E		1	0	26	15	----
di	15	Select signal source	290F		E		1	0	127	0	----
di	16	Digital input setting	2910		E		1	0	127	0	----
di	17	Input strobe dependance	2911		E		1	0	4095	0	----
di	18	Select strobe source	2912		E		1	0	4095	0	----
di	19	Select strobe mode	2913		E		1	0	1	0	----

Input processing

The inverter provides 7 digital control terminal inputs X1.1 to X1.7. In addition 4 software inputs are available.

All digital inputs are programmable. Exception: terminal X1.1(ST) Control release:

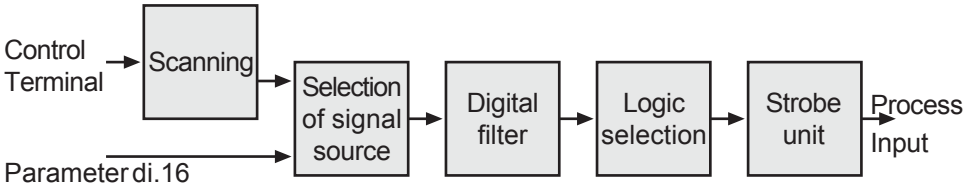
The function of the 6 terminals X1.2...X1.7 (I1 ... I6) and the 4 software inputs (IA, IB, IC, ID) is programmable.

The software inputs are directly driven by the software outputs (OA...OD). This allows the realization of internal linkage and control units without any external cabling.

The control terminal inputs pass through a programmable filter and strobe unit.

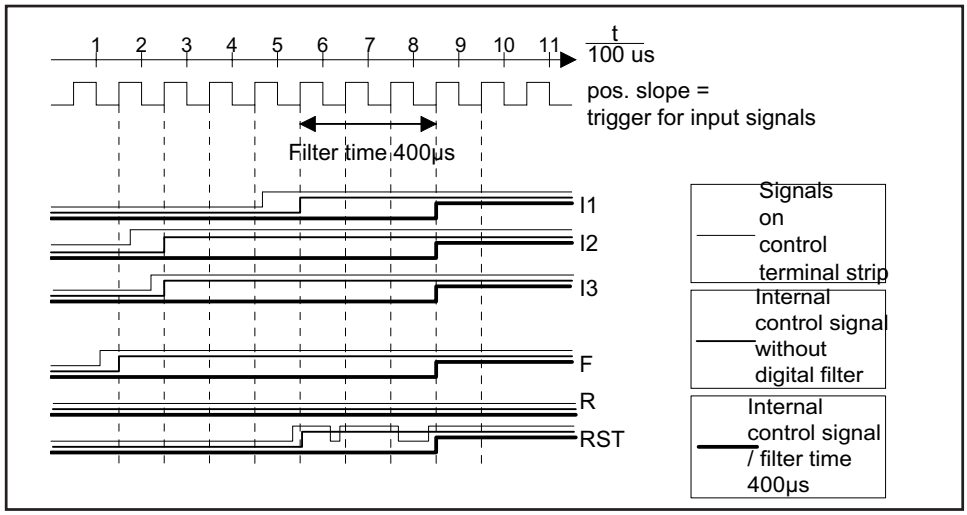
The input ST (control release, X1.1) has a special feature:
The modulation is switched off by hardware and therefore ST cannot be inverted, filtered or made strobe-dependent.

The diagram below shows the function blocks which the digital inputs pass through.



Noise filter (di.0)

This parameter defines the filter time constant for the digital inputs X1.2 .. X1.7 (I1, I2, I3, I4, I5, I6). The digital filter for input X1.1 (ST) is not programmable.



Time constant of the digital filter: max. 20 ms. Resolution of filter time: 0,1 ms.

NPN \ PNP selection (di.1)

Selection of PNP or NPN logic for the input terminals (standard : PNP).

Input logic (di.2)

In this parameter you can choose whether the software of a controlled drive should internally trigger a 1 or 0 signal. The parameter is bit-coded.

Valency	Function
1	no function
2	I4 inverted (X1.2)
4	I5 inverted (X1.3)
8	I6 inverted (X1.4)
16	I1 inverted (X1.5)
32	I2 inverted (X1.6)
64	I3 inverted (X1.7)

Example

If more than one input should be inverted, then the sum of the values must be used.
I4 and I5 should be inverted.
di.2 = 2 + 4 = 6
KEB COMBIVIS display: I4 + I5

Input function I1, I2, I3, I4, I5, I6, IA, IB, IC, ID (di.3 ... di.12)

These parameters specify the functions of the 6 programmable input terminals X1.2 .. X1.7 (I1 .. I6) and the function of the internal software inputs (IA ... ID). The inputs IA to ID are internally llinked to the software outputs Out A to Out D.

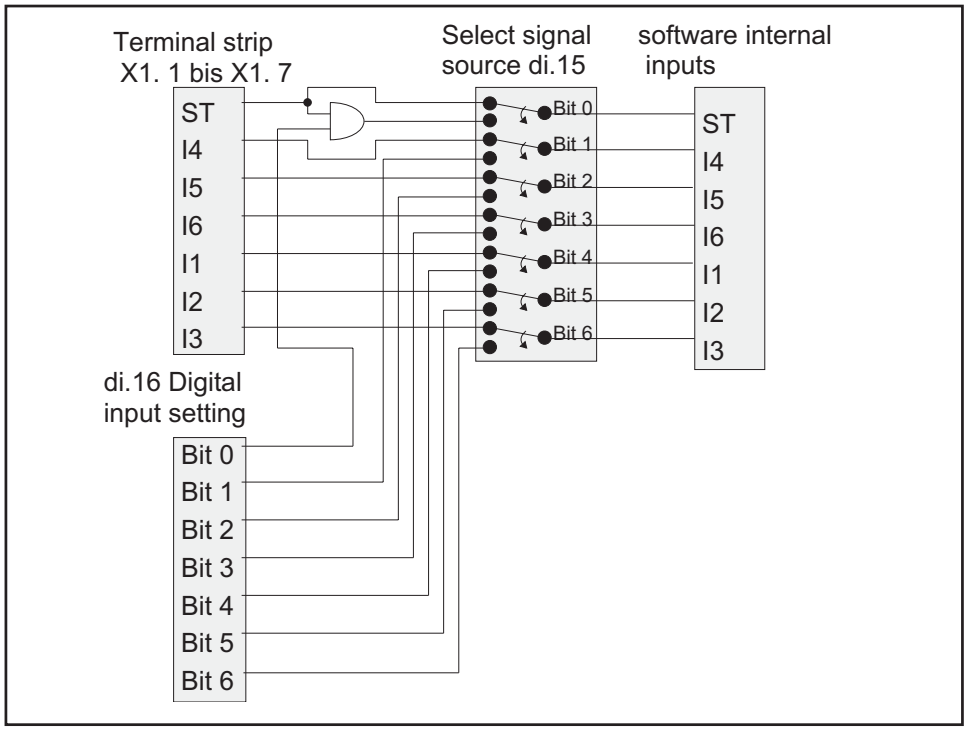
The input functions 9 'Synchronous off ' and 22 'Posi-abort' are scanned with 128 µs, provided it is programmed on the inputs I1, I2 or I3 programmiert.

Value	Function	Restrictions
0	inputs have no function	
1	set selection(Fr-Para)	
2	return to set 0 (Fr-Para)	
3	external fault	
4	Jogging forward (SP.22)	active synchronous or positioning control has priority over jogging
5	Jogging reverse (SP.22)	
6	Reset angular deviation (Sn-Para)	These functions exist only in the synchronous module (Sn.0=1/Pc.0=0)
7	Angular shifting of the slave positive (Sn.6, Sn.7)	
8	Angular shifting of the slave negative (Sn.6, Sn.7)	
9	Synchron control off (Sn-Para)	
10	Reference mode forward / Posi (Sn-, Pc-Para)	
11	Reference mode reverse (Sn-, Pc-Para)	
12	Reference switch (Sn, Pc-Para)	
13	Fault reset	
14	F, Rotation enabled (limit switch) forward	priority over R
15	R ,Rotation enabled (limit switch) reverse	
16	F + R, limit switch for both direction of rotation	If both limit switches ar controlled with one input a reference point drive is not possible.
17	Start positioning (Pc-, Pd-Para)	
18	F + Reference point switch (Sn, Pc-Para)	becomes priority over R
19	R + Reference point switch (Sn, Pc-Para)	
20	Positioning deactivated (Pc-, Pd-Para)	
21	Posi-Teach-in	The teach-in of positions is possible by PD.1=3 of a digiral input
22	Posi-abort	see Pc.18, Pc.19, Pc.33, Pc.34
23	Posi-Latch	see ru.58 ... ru.60
24	Inc. Motor-poti	see SP.26
25	Dec. Motor-poti	
26	Reset Motor-poti	

Select signal source (di.15)
Digital input setting (di.16)

For test reasons or during operation via bus it may be helpful to set the inputs with a parameter instead of using the terminal strip.
Parameter di.15 selects for each input, whether the state of the terminal strip or the state of parameter di.16 is evaluated.

Select signal source (di.15)



Digital input setting (di.16)

The parameter di.15 and di.16 are binary coded:

Dec. value	Function with di.16	Function with di.15
1	ST	ST must be set by parameter di.16 **and** input terminal X1.1.
2	I4 (RST)	RST is activated by di.16. Terminal X1.2 **has no function.**
4	I5 (F)	F is activated by di.16. Terminal X1.3 **has no function.**
8	I6 (R)	R is activated by di.16. Terminal X1.4 **has no function.**
16	I1	I1 is activated by di.16. Terminal X1.5 **has no function.**
32	I2	I2 is activated by di.16. Terminal X1.6 **has no function.**
64	I3	I3 is activated by di.16. Terminal X1.7 **has no function.**

If the digital presetting of the control release is selected, then the control release signal can be preset over the termina stripl **and** parameter di.16.

Input strobe dep. (di.17)
Select strobe signal (di.18)

di.17 specifies which inputs are dependent on the strobe signal.

di.18 specifies which inputs make up the strobe signal. All signals selected by this parameter are OR-connected. The use as a strobe signal has no influence on the programmable input function. (di.3...8).

Bit No.	Decimal value	Input strobe-dependent (di.17)	Select strobe signal (di.18)
0	1	no function ST is never strobe dep.	X1.1 is the strobe signal
1	2	X1.2 strobe dependent	X1.2 is the strobe signal
2	4	X1.3 strobe dependent	X1.3 is the strobe signal
3	8	X1.4 strobe dependent	X1.4 is the strobe signal
4	16	X1.5 strobe dependent	X1.5 is the strobe signal
5	32	X1.6 strobe dependent	X1.6 is the strobe signal
6	64	X1.7 strobe dependent	X1.7 is the strobe signal
8	256	IA strobe dependent	IA is the strobe signal
9	512	IB strobe dependent	IB is the strobe signal
10	1024	IC strobe dependent	IC is the strobe signal
11	2048	ID strobe dependent	ID is the strobe signal

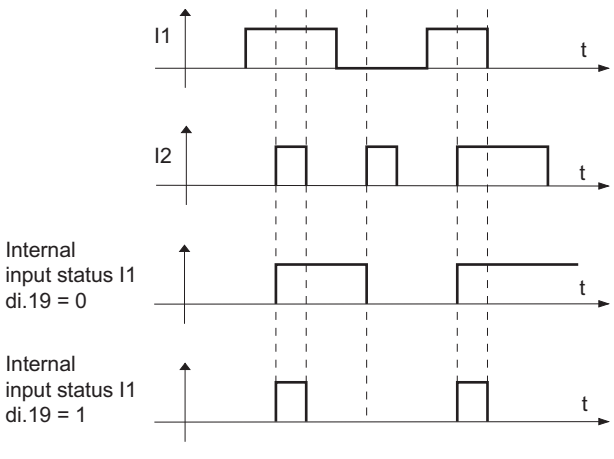
Select strobe mode (di.19)

di.19 determines the strobe mode.

Par. value	Strobe Mode
0	The actual input state is stored with the positive slope of the strobe signal.
1	As long as the strobe signal is inactive, all input signals are inactive. When the strobe signal is active, then the input signals are valid.

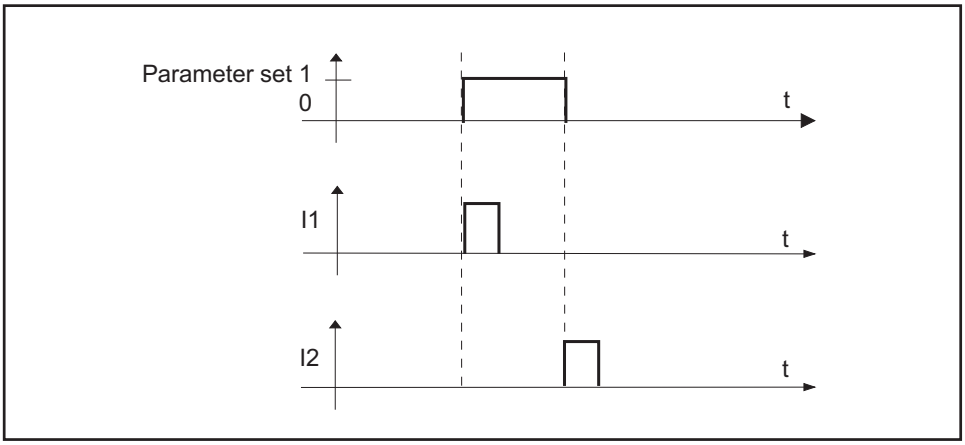
Example for the strobe function

I1 is strobe-dependent di.17 = 16 : I1, I2 is the strobe signal di.18 = 32 : I2 (see ru.14, ru.16)



5.13.1 Example Edge Triggering Set Selection

Two initiator signals should change between two parameter sets via the digital inputs. The set transfer should be done with the respective positive edge of the initiator signals. Digital input I2 shall select parameter set 0, I1 parameter set 1.



For this example the following parameterization is necessary.

Parameter	Value
Fr.2 Parameter set source	3: Set selection via terminal strip input coded
di.3 Input functionI1	1: I1 for set selection
di.4 Input functionI2	2: I2 for reset to set 0
di.17 Input strobe dep.	48: I1 + I2 are strobe-dependent
di.18 Select strobe source	48: I1 + I2 are strobe signal
di.19 Select strobe mode	0: positive edge

5.14 Digital Output (do)-Parameter

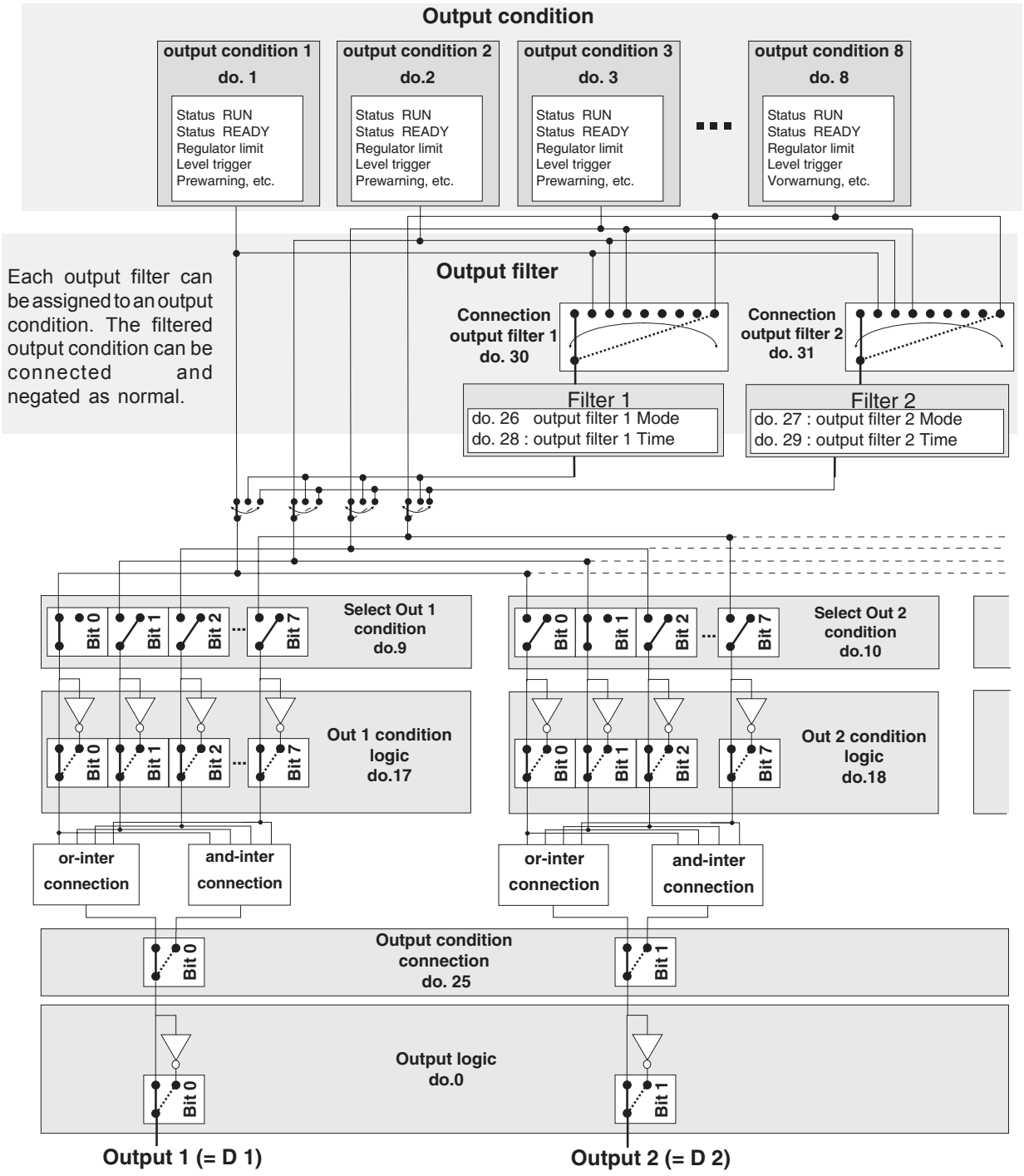
Read-only parameters!
Press "Enter"-key to store the parameter value!
Set-programmable parameters!

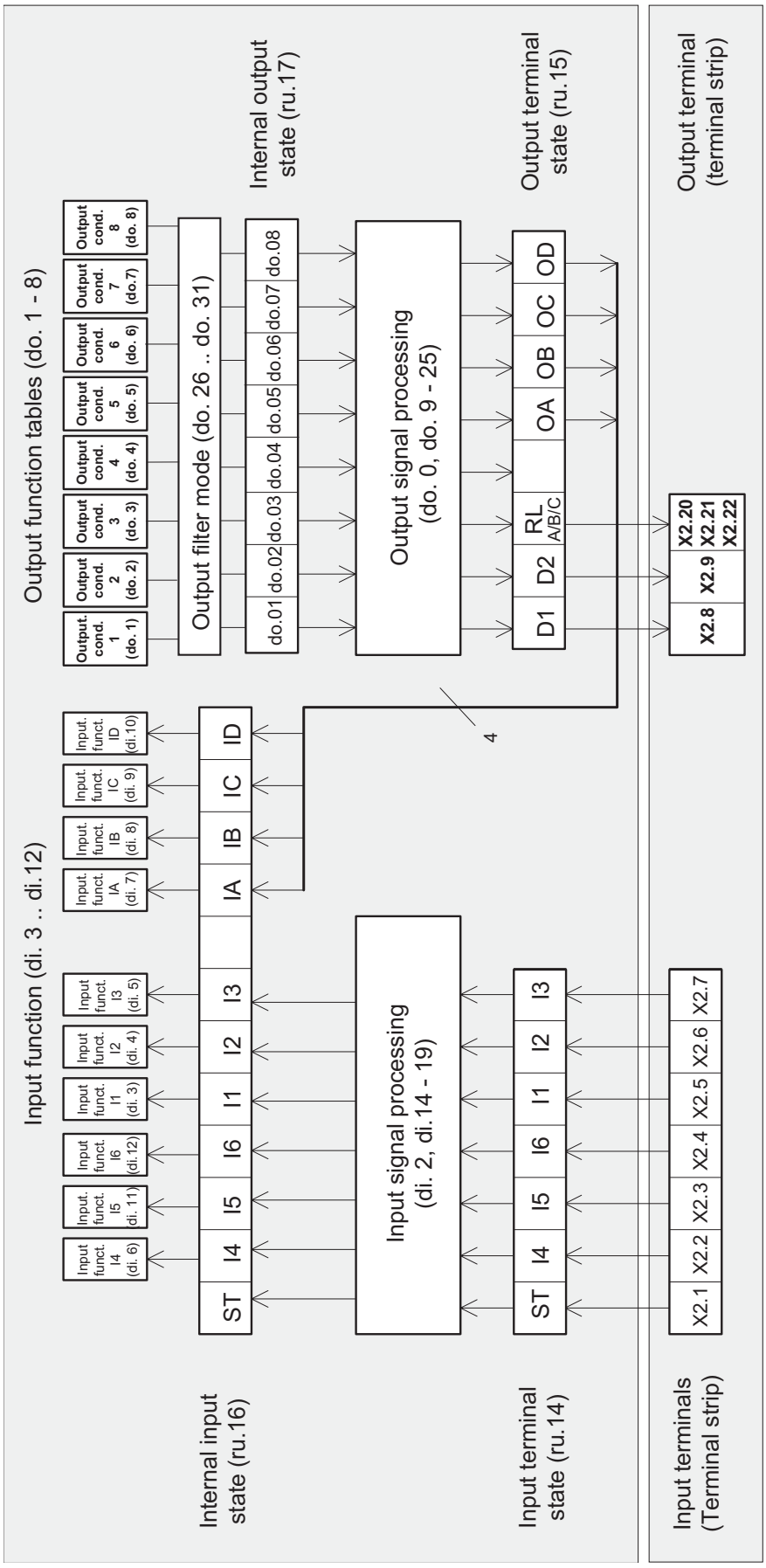
Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
do	0	Output logic	2A00	P	E		1	0	255	0	---
do	1	Output condition 1	2A01	P	E		1	0	31	20	---
do	2	Output condition 2	2A02	P	E		1	0	31	18	---
do	3	Output condition 3	2A03	P	E		1	0	31	5	---
do	4	Output condition 4	2A04	P	E		1	0	31	0	---
do	5	Output condition 5	2A05	P	E		1	0	31	---	---
do	6	Output condition 6	2A06	P	E		1	0	31	---	---
do	7	Output condition 7	2A07	P	E		1	0	31	---	---
do	8	Output condition 8	2A08	P	E		1	0	31	---	---
do	9	Select Out 1 condition	2A09	P	E		1	0	255	1	---
do	10	Select Out 2 condition	2A0A	P	E		1	0	255	2	---
do	11	Select Out 3 condition	2A0B	P	E		1	0	255	4	---
do	13	Select Out A condition	2A0D	P	E		1	0	255	0	---
do	14	Select Out B condition	2A0E	P	E		1	0	255	0	---
do	15	Select Out C condition	2A0F	P	E		1	0	255	0	---
do	16	Select Out D condition	2A10	P	E		1	0	255	0	---
do	17	Out 1 condition logic	2A11	P	E		1	0	255	0	---
do	18	Out 2 condition logic	2A12	P	E		1	0	255	0	---
do	19	Out 3 condition logic	2A13	P	E		1	0	255	4	---
do	21	Out A condition logic	2A15	P	E		1	0	255	0	---
do	22	Out B condition logic	2A16	P	E		1	0	255	0	---
do	23	Out C condition logic	2A17	P	E		1	0	255	0	---
do	24	Out D condition logic	2A18	P	E		1	0	255	0	---
do	25	Output condition connection	2A19	P	E		1	0	2047	0	---
do	26	Output filter 1 mode	2A1A	P	E		1	0	1	0	---
do	27	Output filter 2 mode	2A1B	P	E		1	0	1	0	---
do	28	Output filter 1 time	2A1C	P	E		2,048	0	999	0	ms
do	29	Output filter 2 time	2A1D	P	E		2,048	0	999	0	ms
do	30	Output filter 1 connection	2A1E	P	E		1	0	8	0	---
do	31	Output filter 2 connection	2A1F	P	E		1	0	8	0	---

Summary of functions of digital output parameter

Parameter summary

- Parameters ‘output condition 1’ ... ‘output condition 8’ (do.1 ... do.8) specify the output conditions for the hardware and software outputs.
- 2 output conditions can be filtered with the output filters 1 / 2 (do.26 ... do.31)
- Parameters ‘Select OUT 1 condition’... ‘OUT D condition’ specify which condition is valid for an output.
- with do.17...do.24 ‘OUT 1 condition logic’ ... ‘OUT D condition logic’ you can select whether a condition must be 'true' or 'false' in order to activate the output.
- the parameter 'output condition connection' (do.25) specifies whether all conditions which belong to one output should be interconnected 'AND' or 'OR'.




Input function (di. 3 .. di.12)
Input funct. I4 (di. 6)
Input. funct. I5 (di. 11)
Input funct. I6 (di.12)
Input funct. I1 (di. 3)
Input funct. I2 (di. 4)
Input funct. I3 (di. 5)
Input. funct. IA (di. 7)
Input. funct. IB (di. 8)
Input. funct. IC (di. 9)
Input. funct. ID (di.10)
ST I4 I5 I6 I1 I2 I3 IA IB IC ID
Internal input state (ru.16)
Input signal processing (di. 2, di.14 - 19)
ST I4 I5 I6 I1 I2 I3
Input terminal state (ru.14)
4
Output function tables (do. 1 - 8)
Output. cond. 1 (do. 1)
Output cond. 2 (do. 2)
Output cond. 3 (do. 3)
Output cond. 4 (do. 4)
Output cond. 5 (do. 5)
Output cond. 6 (do. 6)
Output cond. 7 (do.7)
Output cond. 8 (do. 8)
Output filter mode (do. 26 .. do. 31)
do.01 do.02 do.03 do.04 do.05 do.06 do.07 do.08
Internal output state (ru.17)
Output signal processing (do. 0, do. 9 - 25)
D1 D2 RL A/B/C OA OB OC OD
Output terminal state (ru.15)
X2.8 X2.9 X2.20 X2.21 X2.22
Output terminal (terminal strip)
X2.1 X2.2 X2.3 X2.4 X2.5 X2.6 X2.7
Input terminals (Terminal strip)

Output logic (do.0)

With do.0 the status of the digital outputs can be inverted. The parameter is binary coded.

Dezimal Value	Output	Terminal
1	D1 (Transistor Output)	X1.8
2	D2 (Transistor Output)	X1.9
4	RLA, RLB, RLC (Relay output)	X1.20 X1.21 X1.22
8	no function (reserved)	
16	OUT A (internal software output)	none
32	OUT B (internal software output)	none
64	OUT C (internal software output)	none
128	OUT D (internal software output)	none

If several outputs are inverted, the sum of the decimal values has to be used.

Switching condition 1 ... 8 (do.1 ... do.8)

These parameters specify the table of output conditions for the three hardware and four software outputs.

Value	Output Conditions	Restrictions
0	always inactive	
1	always active	
2	Ready (ready for operation : initialization completed, no malfunction detected)	
3	Run (ready for operation and modulation enabled)	
4	Abnormal operating condition (remains at speed 0 after quick stop)	
5	Disturbance (modulation disabled after error or quick stop)	
6	OH2 - motor protective relay level exceeded **(Pn.30)**	
7	dOH - Motor-PTC- contact is active	
8	dOH - or OH2 output level exceeded	
9	Current regulator limit (max. output voltage reached)	
10	Speed regulator limit (torque limit reached **CS.6, CS.7**)	
11	Regulator limit	
12	Drive accelerates	not available in the posi mode and in the synchronous operation
13	Drive decelerates	
14	Drive runs with constant speed	
15	Drive runs with constant speed > zero	
16	Forward (not at noP,LS, oper. abn.stop, error)	
17	Reverse (not at noP, LS, abn.stop, error)	
18	Actual speed > speed level **(LE.4 ... LE.7)**	
19	Apparent current >apparent current level **(LE.12 ... LE.15)**	
20	Torque > torque level **(LE.20 ... LE.23)**	
21	Angle deviation > angle level **(LE.28...LE.31)**	
22	Reference mode completed	
23	Target position reached **(Pd.12)**	only available in the posi mode
24	Actual position>position level **(LE.48...LE.61)**	
25	Brake control **(LE.37, LE.66...LE.68)**	function only in the posi mode or rotation presetting via terminal strip (SP.0=1,4,7)
26	Inverter temperature control	see LE.70 ... LE.73
27	Cooling medium inverter	see LE.74
28	Motor temperature control .	see LE.75-78
29	Cooling medium motor	see LE.79
30	dOH-warning	see LE.80
31	Target not reached	see Pd.15
32	Way to target < position level	see posi mode
33	Posi stop active	see posi mode
34	Way after start > position level	see posi mode

The corresponding level for current, speed etc., can be adjusted in the LE-parameters. The value from level 1 always is a part of output condition 1 and 5, level 2 of output condition 2 and 6, etc. If for parameter ‘output condition 4’ the function 'apparent current > apparent current level' is selected (do.4 = 19), then the actual apparent current is compared to apparent current level 4 (LE.15).

Select out condition Out1, Out2, Out3 (do.9 ... do.11)
Select out condition OutA, OutB, OutC, OutD (do.13 ... do.16)

These parameters determine which output conditions have an effect on the output. Generally in parameter 'output condition 1' (do.1) the switching criterion for output 1 is specified, in 'output condition 2' (do.2) the switching criterion for output 2 etc.(that means: do.9 = 1 / do.10 = 2 / do.11 = 4).
If more than one output condition should be effective for one output, the sum of the decimal values must be used.

Bit No.	Decimal value	Output x switches and is dependent on:
0	1	Output condition 1 (do.1)
1	2	Output condition 2 (do.2)
2	4	Output condition 3 (do.3)
3	8	Output condition 4 (do.4)
4	16	Output condition 5 (do.5)
5	32	Output condition 6 (do.6)
6	64	Output condition 7 (do.7)
7	128	Output condition 8 (do.8)

Condition logic OUT 1, 2, 3, A, B, C, D (do.17 ... do.19, do.21 ... do.24)

These parameters specify whether the selected output condition(s) are true or inverted, to activate the output.

Decimal value	The following output conditions are inverted for output x
1	Output condition 1 (do.1)
2	Output condition 2 (do.2)
4	Output condition 3 (do.3)
8	Output condition 4 (do.4)
16	Output condition 5 (do.5)
32	Output condition 6 (do.6)
64	Output condition 7 (do.7)
128	Output condition 8 (do.8)

Output condition connection (do.25)

do.25 specifies whether the various output conditions should be interconnected by an 'AND-function' or by an 'OR-function'.

Decimal value	Output conditions of the following output are 'AND'-connected:
1	OUT 1 (D1) terminal X1.8
2	OUT 2 (D2) terminal X1.9
4	OUT 3 (relay) terminal X1.20/21/22
8	no function
16	OUT A
32	OUT B
64	OUT C
128	OUT D

If the output conditions of several outputs should be ‘AND’ - connected, the decimal values must be added!

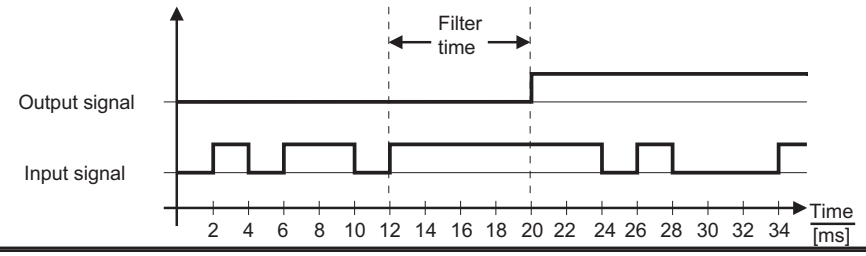
Output filter (do.26 ... do.31)

There are 2 digital filters which work independently from each other for the output conditions 1... 8. An output condition (do.30/do.31), a filter time (do.28/do.29) and a filter mode (do.26/do.27) can be assigned to each filter.

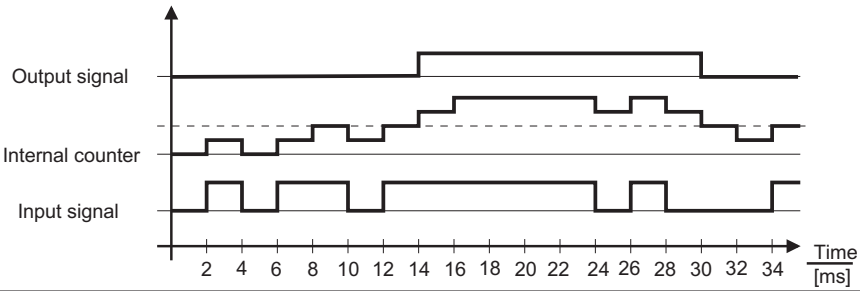
Output filter 1 mode (do.26)
Output filter 2 mode (do.27)

Value	Filter mode
0	the filter output only changes when during the filter time a constant signal was present on the filter input
1	averaging of the input signal
2	the filter output is set, when during the filter time the corresponding output condition was met. The filter output is immediately reset, when the output condition is not met.

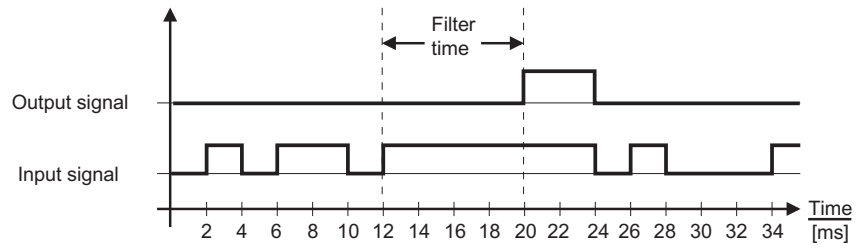
Example filter mode = 0:



Example filter mode = 1:



Example filter mode = 2:



Output filter 1 time (do.28)
Output filter 2 time (do.29)

Value	Filter time
0 ... 488	= Value * 2,048 ms = 0 .. 999 ms If entered via COMBIVIS the value is displayed in ms. Due to the program cycle time of 2,048 ms not all filter times can be realized. COMBIVIS automatically rounds up the value to the next possible filter time.

Connection
Output filter 1 (do.30)
Output filter 2 (do.31)

Value	Output filter 1/2 is valid for the following output conditions:
0	none
1	Output condition 1 (do.1)
2	Output condition 2 (do.2)
.	.
.	.
.	.
7	Output condition 7 (do.7)
8	Output condition 8 (do.8)

Example

- Output D1 (Terminal X1.8) shall be active at actual speed between 100 and 1500 rpm.
- Output D2 (Terminal X1.9) shall be active when the torque is > ± 8 Nm.
- The relay RLA, RLB, RLC (Terminals X1.20...X1.22) shall work as a fault detector.

A) Programming of D1 (= OUT 1)

Output condition 1:	actual speed > speed level (1)	do.1=18
Speed level 1:	lower limit shall be 100 rpm	LE.4=100
Output condition 4:	actual speed > speed level (4)	do.4=18
Speed level 4:	upper limit shall be 1500 rpm	LE.7=1500
rpm OUT 1 condition logic:	output condition 4 must be inverted	do.17=8
Select OUT 1 condition:	output D1 dependent on switching condition 1 and 4	do.9=9

B) Programming of D2 (= OUT 2)

Output condition 2:	torque > torque level (2)	do.2=20
Torque level 2:	limit is 8 Nm	LE.21=8,0Nm
OUT2 condition logic:	not inverted	do.18=0
Select OUT2 condition:	D2 dependent on switching condition 2	do.10=2

C) Programming of the relay (= OUT 3)

Output condition 2:	fault	do.3=5
OUT3 condition logic:	not inverted	do.19=0
Select OUT3 condition:	relay dependent on switch. condition 3	do.11=4

D) Parameter which refer to all outputs

Output logic:	no output inverted	do.0=0
Interconnection of the Output condition:	output conditions for output 1 are ´AND´- connected	do.25=1

E) Summary of all necessary parameter:

do.0 = 0	do.9 = 9	do.19 = 0
do.1 = 18	do.10 = 2	do.25 = 1
do.2 = 20	do.11 = 4	LE.4 = 100 rpm
do.3 = 5	do.17 = 8	LE.7 = 1500 rpm
do.4 = 18	do.18 = 0	LE.21 = 8,0 Nm

5.15 Level (LE)-Parameter

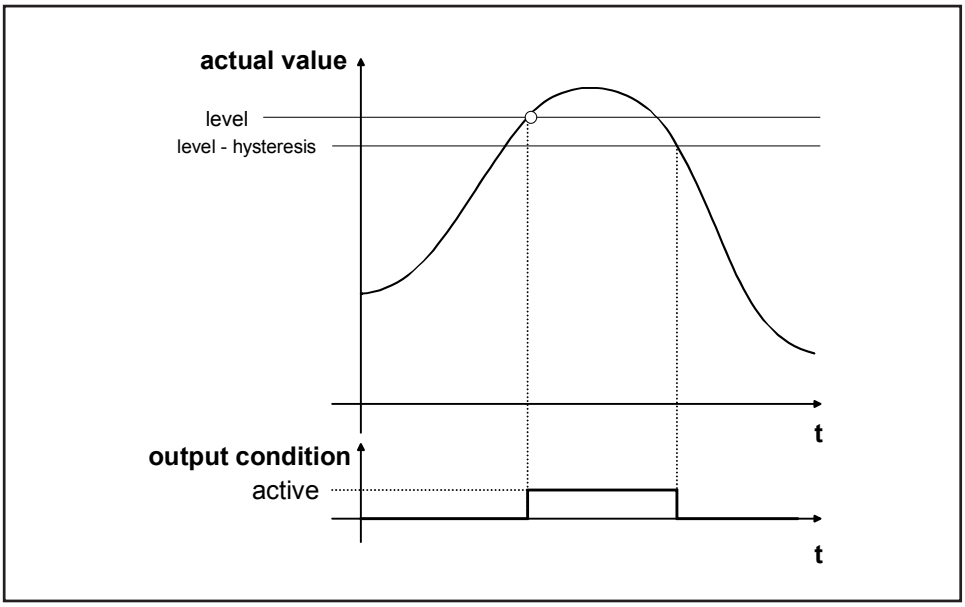
Read-only parameters!

Press "Enter"-key to store the parameter value!

Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default value	Unit
LE	4	Speed level 1	2B04	P			0,5	0,0	14000	0,1* dr.1	rpm
LE	5	Speed level 2	2B05	P			0,5	0,0	14000	0,5 * dr.1	rpm
LE	6	Speed level 3	2B06	P			0,5	0,0	14000	dr.1	rpm
LE	7	Speed level 4	2B07	P			0,5	0,0	14000	SP.8	rpm
LE	12	Apparent current level 1	2B0C	P			0,1	0,0	50,0	dr.2	A
LE	13	Apparent current level 2	2B0D	P			0,1	0,0	50,0	0.5 * dr.2	A
LE	14	Apparent current level 3	2B0E	P			0,1	0,0	50,0	2 * dr.2	A
LE	15	Apparent current level 4	2B0F	P			0,1	0,0	50,0	3 * dr.2	A
LE	20	Torque level 1	2B14	P			0,1	0,0	50,0	0,5 * dr.9	Nm
LE	21	Torque level 2	2B15	P			0,1	0,0	50,0	dr.9	Nm
LE	22	Torque level 3	2B16	P			0,1	0,0	50,0	2 * dr.9	Nm
LE	23	Torque level 4	2B17	P			0,1	0,0	50,0	3 * dr.9	Nm
LE	28	Angular level 1	2B1C	P			0,1	0	2800	0	°
LE	29	Angular level 2	2B1D	P			0,1	0	2800	0	°
LE	30	Angular level 3	2B1E	P			0,1	0	2800	0	°
LE	31	Angular level 4	2B1F	P			0,1	0	2800	0	°
LE	37	Speed hysteresis	2B25				0,5	0	14000	10	rpm
LE	48	Position hysteresis	2B30	P			1	0	28000	0	inc
LE	50	Position level 1 sign	2B32	P			1	0	2	0	---
LE	51	Position level 1 high	2B33	P			1	0	65535	0	inc
LE	52	Position level 1 low	2B34	P			1	0	65535	0	inc
LE	53	Position level 2 sign	2B35	P			1	0	2	0	---
LE	54	Position level 2 high	2B36	P			1	0	65535	0	inc
LE	55	Position level 2 low	2B37	P			1	0	65535	0	inc
LE	56	Position level 3 sign	2B38	P			1	0	2	0	---
LE	57	Position level 3 high	2B39	P			1	0	65535	0	inc
LE	58	Position level 3 low	2B3A	P			1	0	65535	0	inc
LE	59	Position level 4 sign	2B3B	P			1	0	2	0	inc
LE	60	Position level 4 high	2B3C	P			1	0	65535	0	inc
LE	61	Position level 4 low	2B3D	P			1	0	65535	0	inc
LE	66	Brake delay time	2B42				1	0	5000	1000	ms
LE	67	Brake release time	2B43				1	0	5000	100	ms
LE	68	Brake engaging time	2B44				1	0	5000	100	ms
LE	70	Temp.-switching time	2B46				0,1	1,0	100,0	10,0	s
LE	71	Setpoint temperature	2B47				1	20	OH-Inv	40	°C
LE	72	max. temperature	2B48				1	20	OH-Inv	50	°C
LE	73	min. temperature	2B49				1	20	OH-Inv	30	°C
LE	74	Coolant warning	2B4A				1	1	50	5	---
LE	75	Mot. temp.-switching time	2B4B				0,1	1,0	100,0	10,0	s
LE	76	Mot. setpoint temperature	2B4C				1	20	200	80	° C
LE	77	max. motor temperature	2B4D				1	20	200	120	° C
LE	78	min. motor temperature	2B4e				1	20	200	40	° C
LE	79	Coolant warning motor	2B4F				1	1	50	5	---
LE	80	dOH-warning level	2B50				1	20	200	130	° C

(LE.4 ... LE.31) The LE-parameters contain the switching levels for the output conditions (do.1...do.8). LE.4 / LE.8 / LE.12 / etc. (...-level 1) are interconnected to switching condition 1 and 5, LE.5 / LE.9 etc. (...level 2) with output conditions 2 and 6 etc.



The switching levels have in each case a fixed hysteresis.

speed hysteresis:	5 %
current hysteresis:	10 %
angular hysteresis:	10 %
torque hysteresis:	10 %

The hysteresis for the position level are adjustable with LE.48.

5.15.1 Controlling of a Holding Brake

Brake control

A complete brake controlling is included in the software. For that one digital output must be programmed with the function 25 brake controlling.
(do-Parameter)

Brake release time (LE.67)

After a speed set value is given and torque is available at the drive, the brake is triggered immediately. If no malfunction occurs during the release time the value will be active.

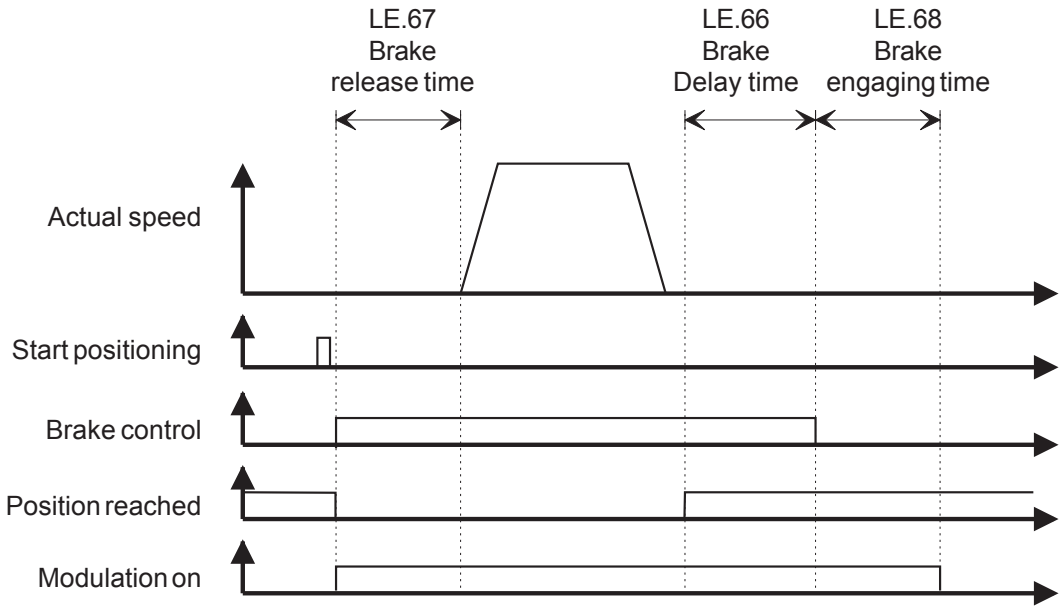
Speed hysteresis (LE.37)
Brake delay time (LE.66)

After speed actual value < speed hysteresis LE.37, the delay time of the brake starts after that the brake is engaged. If a new setpoint value is set during the delay time, the drive is enabled again. The delay time starts to run again. In the posi mode Parameter LE.37 does not have a function. The delay time starts here, if the condition 'position reached' is met.

The brake control does not have a function:
- in the Drive mode
- at ± setpoint input
- in the synchronous mode

Brake engaging time (LE.68)

After the brake is engaged and the brake engaging time has elapsed the modulation is stopped.



In the Posi-Mode the brake handling has changed insofar that the positioning is already active during the brake release time.

5.15.2 Temperature control

This function serves for the temperature control of water-cooled inverters. The cooling can be connected by means of a magnetic valve. The switching electronics must be made available by the customer in accordance with the used valve. The control takes place over the transistor output of the KEB COMBIVERT S4.

Do not use relay output !

Temperature switching time (LE.70)

The temperature switching time defines the cycle time, in which the output is switched. It is adjustable within the range of 1.0 ... 100.0 s (Standard 10 s).

Setpoint temperature (LE.71)

With the setpoint temperature the heat sink temperature is preset onto which it is to be regulated. It is adjustable within the range of 20 °C ... OH-temperature (see power circuit data) (Standard 40 °C).

Maximum temperature (LE.72)

If the heat sink temperature exceeds the maximum temperature adjusted in LE.72, the output is generally set. LE.72 is adjustable within the range of 20 °C ... OH-temperature (see power circuit data) (Standard 50 °C).

Minimum temperature (LE.73)

If the heat sink temperature drops below the minimum temperature adjusted in LE.73 the output is generally switched off. LE.73 is adjustable within the range of 20 °C ... OH-temperature (see power circuit data) (Standard 30 °C).

If the heat sink temperature lies within the adjusted temperature range of LE.72 ...LE.73 the pickup duration T_{an} of the output is calculated according to following formula:

$$T_{an} = \frac{\text{(Max.temp.-Set temp.) + (heat sink temp.-Set temp.)}}{\text{Max. temperature-Min. temperature}} \bullet \text{Temp. switching time}$$

Coolant warning (LE.74)

In case of coolant warning a digital output can be set (do.1...do.8="27"), if the heat sink temperature exceeds the maximum temperature (LE.72) by the adjusted prewarning time. The prewarning time is calculated as follows:

Prewarning time = temp. switching time (LE.70) • cooling medium warning (LE.74)

Coolant warning (LE.74) is adjustable in the range of 1 . . . 50 (Standard 5).

Motor temperature control (LE.75...LE.79)

Same function as LE.70 ... LE.74 only referring to the motor temperature. The function can only be used at measured motor temperature (see ru.64).

dOH-prewarning (LE.80)

Output of a prewarning signal before the inverter switches off the motor with E.dOH (see Pn.31). The function can only be used at measured motor temperature (see ru.64).

5.16 Synchron (Sn)-Parameter

Read-only parameters!
Press "Enter"-key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Reso-lution	Lower Limit	Upper Limit	Default value	Unit
Sn	0	Synchron control	3400	P			1	0 : off	5	0 : off	---
Sn	1	KP Synchron control	3401	P			1	0	65535	2	---
Sn	2	Gear ratio Master / Slave	3402	P			0,001	-20	20	1	---
Sn	3	Gear ratio Master / Slave denominator	3403	P			0,001	0,001	20	1	---
Sn	5	Angular shifting Slave activation	3405		E		1	0	2	0	---
Sn	6	Angular shifting value LO	3406				0,1	0	360	0	°
Sn	7	Angular shifting value HI	3407				1	0	65535	0	rotations
Sn	8	Register function period	3408				0,001	0	0,100	0,001	---
Sn	22	Perioden level für angular correction sign	3417				1	0	2	2	---
Sn	23	Perioden level für angular correction high	3417				1	0	65535	0	inc
Sn	24	Perioden level für angular correction low	3417				1	0	65535	8192	inc
Sn	52	Register function max. angular correction sign	3434				1	0	2	2	---
Sn	53	Register function max. angular correction high	3435				1	0	65535	0	inc
Sn	54	Register function max. angular correction low	3436				1	0	65535	16834	inc
Sn	20	Slave ratio	3414	P			1	1	15	1	---
Sn	21	Register function filter mode	3415				1	0 : off	2	0	---
Sn	25	Register function correction mode	3419				1	0	2	0	---
Sn	26	max. angle for correction sign	341A				1	0	2	2	---
Sn	27	max. angle for correction high	341B				1	0	65535	0	inc
Sn	28	max. angle for correction low	341C				1	0	65535	0	inc
Sn	29	Minimum speed for angular offset 1	341D				0,5	0	15000	0	rpm
Sn	30	Angular offset 1 sign	341E				1	0	2	2	---
Sn	31	Angular offset 1 high	341F				1	0	65535	0	inc
Sn	32	Angular offset 1 low	3420				1	0	65535	0	inc
Sn	33	Maximum speed for angular offset 2	3421				0,5	0	15000	0	rpm
Sn	34	Angular offset 2 sign	3422				1	0	2	2	---
Sn	35	Angular offset 2 high	3423				1	0	65535	0	inc
Sn	36	Angular offset 2 low	3424				1	0	65535	0	inc
Sn	40	Slave register display sign	3428			R	1	0	2	2	inc
Sn	41	Slave register display high	3429			R	1	0	65535	0	---
Sn	42	Slave register display low	342A			R	1	0	65535	0	---
Sn	43	Master register display sign	342B			R	1	0	2	2	inc
Sn	44	Master register display high	342C			R	1	0	65535	0	---
Sn	45	Master register display low	342D			R	1	0	65535	0	---
Sn	46	Period deviation sign	342E			R	1	0	2	2	inc
Sn	47	Period deviation high	342F			R	1	0	65535	0	---
Sn	48	Period deviation high	3430			R	1	0	65535	0	---
Sn	49	Angular shifting sign	3431			R	1	0	2	2	inc
Sn	50	Angular shifting high	3432			R	1	0	65535	0	---
Sn	51	Angular shifting low	3433			R	1	0	65535	0	---
Sn	55	Start Offset sign	3431				1	0	2	2	inc
Sn	56	Start Offset low	3433				1	0	65535	0	---
Sn	57	Start Offset high	3432				1	0	65535	0	---

The synchronous parameters are only functioning if X3 is parameterized as incremental encoder input (EC.10 ... EC.13).

Synchronous control (Sn.0)

When this parameter is written, the positional deviation is set to 0. You can deactivate the synchronous function and reset the positional deviation with a programmable input. **(di.3 ... di.10)**

Sn.0 activates the synchronous functions:
0 — OFF
1 — Synchronous ON
2 — Synchronous and register function ON (angular correction with ramps)
3 — Synchronous and register function with teach-function (no ramps for angualr correction, only usable for teach-function)
4 — Synchronous with ramps synchronization
5 — Synchronous with ramps synchronization with reference to reference position

KP Synchronous control(Sn.1)

Sn.1 determines whether the drive operates with speed synchronous. **(Sn.1 = 0)** or angular synchronous **(Sn.1 > 0).** During angular operation the P-fraction of the synchronous control is also preset.

Gear ratio (Sn.2, Sn.3)

The gear ratio between master and slave speed is adjusted in Sn.2/Sn.3. If the sign of Sn.2 is negative it results in opposite direction of rotation for master and slave. Sn.2/Sn.3 = Slave speed / master speed.

$$\frac{Sn.2}{Sn.3} = \frac{\text{slave speed}}{\text{master speed}}$$

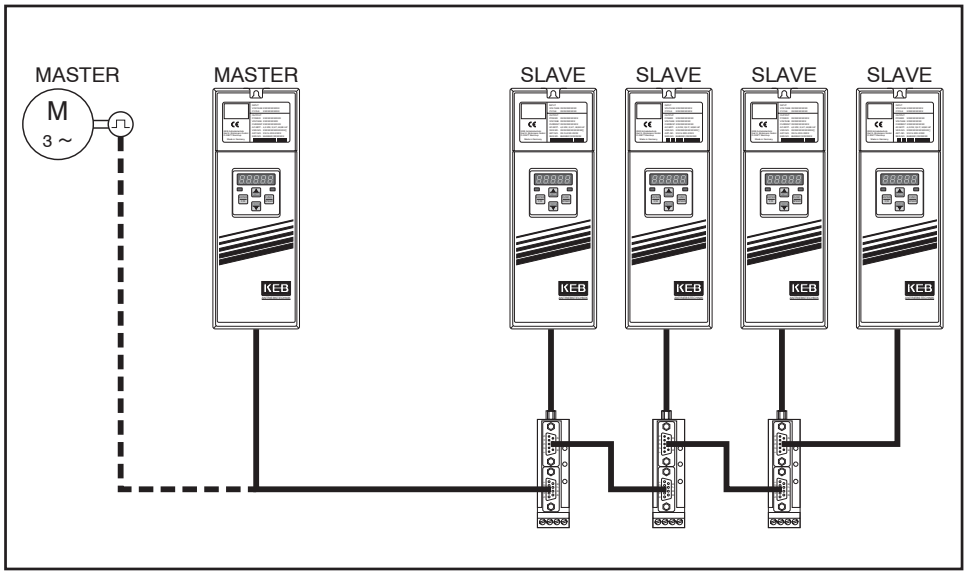
Angular shifting
slave activation (Sn.5)
value low (Sn.6)
value high (Sn.7)

Sn.5, Sn.6, Sn.7 adjust the angular deviation between master and slave. The angle correction is entered in Sn.6 and in Sn.7 complete revolutions. The actual correction can be started with a programmed input in the desired direction. You can also start the correction with Sn.5.

Sn.5 = 1 - correction in positive direction
Sn.5 = 2 - correction in negative direction

5.16.1 Connection Accessories for Master-Slave Operation

For a master-slave operation with several slaves the MS-Repeater 00.F4.072-2009 and cables ready for connection are available as accessories . For more information please order the application manual of the MS-Repeater **(00.F4.Z10-K101)**.



5.16.2 Parameterization Example for Master- Slave Operation

After switching on the KEB COMBIVERT S4 a reference point search shall be done with the slave. After conclusion the axis shall follow the master signal. At that a contouring error of max 45° is allowed.
Parameter example:

Sn.0	Synchronous control	**1**	Synchronous control ON
Sn.1	Kp synchronous control	**20**	P - part for position control
Sn.2	Gear ratio	**1,000**	Gear ratio = 1,0
Pc.10	Reference speed	**100**	Reference speed 100 rpm
EC.13	Operating mode encoder 2	**1**	X3 = Incremental encoder input
EC.11	Encoder (inc/r) 2	**2500**	**- - -**
di.3	Input function I1	**10**	Reference point search forward
di.4	Input function I2	**12**	Reference point switch
do.1	Output condition 1	**22**	Reference point search closed
do.2	Output condition 2	**21**	Angular shifting > Angular level
LE.29	Angular difference level 2	**45**	Angular level= 45°

After the reference point search is activated the axis runs in the direction of the reference end switch. If the corresponding limit switch is triggered during this time, the direction of the reference point search changes. After the reference end switch is triggered, the drive stops and turns around onto its internal reference position. After the reference position is reached output 1 is set.
If I1 is deactivated now, the drive runs synchronously to the master signal. Output 2 is set, when the contouring error exceeds 45°.

You can find a detailed description of the reference point search (with examples) in the posi-module. (Pc.10 ... Pc.14)

5.16.3 Register function

During synchronous operation it is possible to synchronize the Master and Slave additionally onto 2 reference signals. These reference signals could be proximity sensors on the Master and Slave axis. The register function activates the gear factor and the angular correction until both reference signals are synchronized. At that the ramps adusted in the SP-parameters (only SP.11/12) are active. Changes of the ramp values while the register function is active are not accepted. Ramp values are only accepted at the Start-Register function.

The register function is activated by:
Sn.0 = 2 Register function ON
di.03 = off Input 1 always has the function of the Master signal
di.04 = off Input 2 always has the function of the Slave signal
di.05 = 9 Synchronous off

After the activation of the register function both initiator signals must be recorded twice before the register function triggers an action. If in one parameter set it is switched with Sn.3 = 0, the first calculated angular offset between master and slave is stored in Sn.30 ... Sn.32 (Teach).

Register function period (Sn.8)

This is the max.the gear factor that can change during the period. An integration period means that a positive edge is recognized at both reference signals. The changed gear factor remains permanently stored in Sn.2. When the gear factor cannot be changed during a process, then the value 0 should be preset in Sn.8. In this case only the angle is corrected.

Display parameters Register function (Sn.40 ... Sn.51)

The function of the register function can be monitored with these parameters.

Slave Register Display (Sn.40 ... Sn.42)

These parameters display the distance covered by the slave between two signals of input 2. One revolution corresponds to a value of 65535. The register is updated with every signal on I2.

Master Register Display (Sn.43 ... Sn.45)

These parameters display the distance covered by the master between two signals of input 1. One revolution of the master encoder with the increments adjusted in EC.11 corresponds to a value of 65535. This value is multiplied with the gear factor Sn.2 and displayd in the master register. The register is updated with every signal at I1.

Period duration Display (Sn.46 ... Sn.48)

After master and slave register were written, the difference of these two values is displayed in the period duration. The calculation is activated when master and slave signals were recognized. After the initialization each master and slave signal must be recognized twice. If the gear factor is adjusted to the proper value by the register function, the period duration display is approximately zero.

Angular deviation Display (Sn.49 ... Sn.51)

This register is calculated simultaneously with the period duration display. The path of the slave between master and slave signal is represented.

Period level for angular correction (Sn.22 ... Sn.24)

The angular correction can be suppressed with this parameter for as long as the deviation of the period is too large. As long as the value displayed in Sn.46 ... Sn.48 is larger than Sn.22 ... Sn.24, no angular correction is executed.

Slave ratio (Sn.20)

With active register function the ratio between master signal to slave signal can be adjusted here.

Register function filter mode (Sn.21)

This mode is used for the suppression of interference signals on the two initiator signals.

0 : off
1 : Master strobe After a master signal the next slope of the slave signal is used. Further slave signals are ignored.
2 : Slaves trobe After a slave signal only the next slope of the master signal is used. Further master signals are ignored.

Register function correction mode (Sn.25)

The direction of the angular offset is selected with this parameter. In order to achieve a stable operation with only one correction direction, the gear factor should be adjusted slightly, so that the angular correction is only possible with one direction.

Maximum value for angular correction (Sn.26 ... Sn.28)

The angular correction is not carried out, if the value displayed in Sn.49 ... Sn.51 is larger than this parameter.

Angular offset (Sn.29 ... Sn.36)

The setpoint value of the angular offset between master and slave signal is pre-set in these parameters. The angular offset can be adjusted constant (Sn.33 =N =) or linearly interpolated within a speed range. If the angular offset is determined with the Teach-function, the value is always written to Sn.29 ... Sn.31.

Register function (Sn.52 ... Sn.54)

Maximum angle, that is corrected in a measuring period.

Synchronization with ramps

Sn.00 = 4 : Synchronous with ramp synchronization. To synchronize the slave jerk-free onto a running master, the slave is advanced over the ramps adjusted in the SP-parameters (only SP.11/12) to the master and compensates the position lost during acceleration. Changes of the ramp values, while synchronous is active, are not accepted. Acceptance of the ramp values only at Start-synchronous

Start-Offset-Synchronous (Sn.55 ... Sn.57)

With the parameter Sn.55 ... Sn.57 an offset can be pre-set that corresponds to the leading start position of the slave to the master.

Snychronization with reference to reference position

Sn.00 = 5 : Synchronous with ramp synchronization and reference to reference position. Here the offset value (Sn.55 ... Sn.57) does not refer to the start position, instead it can be synchronized with the master over ramps onto a running slave, at that the offset value indicates the positional difference to the reference point.
To use this function a reference point approach is necessary, otherwise it is operated synchronously without offset.

5.17 Positioning Control (Pc)-Parameter

Read-only parameters!

Press "Enter"-key to store the parameter value!

Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
Pc	0	Control mode	3600		E		1	0	2	0	---
Pc	1	Position input mode	3601		E		1	0	3	3	---
Pc	4	Limit switch left sign	3604				1	0	2	2	---
Pc	5	Limit switch left high	3605				1	0	65535	8000h	inc
Pc	6	Limit switch left low	3606				1	0	65535	0	inc
Pc	7	Limit switch right sign	3607				1	0	2	2	---
Pc	8	Limit switch right high	3608				1	0	65535	7fffh	inc
Pc	9	Limit switch right low	3609				1	0	65535	ffffh	inc
Pc	10	Mode of position reference	360A		E		1	0	5	0	---
Pc	11	Reference point sign	360B				1	0	2	0	---
Pc	12	Reference point high	360C				1	0	65535	0	---
Pc	13	Reference point low	360D				1	0	65535	0	---
Pc	14	Reference speed	360E				0,5	-3000	3000	100	rpm
Pc	16	Encoder mode for positioning	3610				1	0	1	1	---
Pc	17	Gear factor for positioning	3611				0,01	1,00	150,00	1,00	---
Pc	18	Distance after stop high	3612	P			1	0	32767	0	inc
Pc	19	Distance after stop low	3613	P			1	0	65535	0	inc
Pc	33	Distance before abort high	3621	P			1	0	32767	0	inc
Pc	34	Distance before abort low	3622	P			1	0	65535	0	inc
Pc	35	Posi init mode	3623				1	0	2	0	---
Pc	36	Posi stop mode	3624				1	0	3	0	---

With the KEB COMBIVERT S4 storage and position controlled activation of up to 8 positions is possible.
The position input is based on the parameter set programming. In each parameter set one position can be stored.

The position input and -display can be made decimal or hexadecimal. Reading of the actual position as position setpoint value (Teach-Function) is possible, too.

Generally one revolution will be splitted into 65536 (2^{16}) increments. The total value range for positions is about 4.294.967.295 (2^{32}) increments.

Using this high resolution is only possible with systems having SIN/COS - encoder. Only 12 Bit per revolution are analyzed for motors with resolver feedback. That means the best precision is at $2^4 = \pm 16$ increments.

The positioning can be made relative to the actual position or to a fixed absolute position. The drive profile (max. speed, accel curves, position controller) is individually adjustable for each positioning set.

Posi Module (Pc.0)

Changing the parameter is only possible without control release. This parameter specifies the control mode.

Pc.0 = 0 synchronous-/speed-controlled
Pc.0 = 1 position-/speed-controlled
Pc.0 = 2 synchronous-/position-/speed-controlled.

The listing sequence behind the parameter values also represents the priority, if all functions are selected. Only in Pc.0 = 2 it can be switched over directly between posi and synchronous.

The torque-controlled operation is also possible, but it is not possible to jump directly from this mode into the posi module or the synchronous module. That can be done only from the speed-controlled mode. Several other functions are also integrated in Pc.0 = 2.

Particularities for PC.0 = 2:

Ramps

The ramps of the posi module are now used from the SP-parametes (SP.10, SP.11, SP.12, SP.15, SP.16) and no longer from the Pd-parameters (Pd.5, Pd.6). Thus a different acceleration and deceleration ramp is to be adjusted.

Maximum positioning speed

A change of the maximum positioning speed can be effected during the positioning.

Positioning with starting speed

It is possible to start a positioning with a constant starting speed. If posi is activated, the controller always drives to the speed adjusted in the SP-parameters, in status ready for positioning. As long as the command Start-Posi module is not given, the drive continues with the SP-speed. The controller does this from every status in Posi on (also from nop).
If the Start-command is given, the controller executes the positioning (positioning active) and on reaching the destination goes to "ready for positioning". The Start-Positioning command can already be given, if Posi is on and the controller approaches the setpoint speed. If the controller has carried out the first positioning after Posi on, each further positioning is executed as in the standard posi-moduel Pc.0 = 1.

Position setting during the positioning

With Pc.0 = 2 new **absolute** positions can be pre-set, while the controller carries out a positioning. It approaches the new position immediately without having to give an additional Start-Posi command. A new relative positioning must be restarted after the completion of the positioning. If the new position is within reach, it is accepted and approached immediately. If the new position is not within reach, it is pre-set with Pd.15, how the controller shall proceed with the new position.

Position input (Pc.1)

The representation of the position values is selected with this parameter. A position value consists internally of 32 bits. The standardization is selected so that 65536 increments always correspond to a complete motor revolution.

With the decimal display the sign is displayed in one parameter, in the 'high'-part of the parameter the increments *10.000 are found and in the 'low'-part the increments *1.

In the hexadecimal representation the sign is implemented in the 32 bit number. The sign parameter does not have a function in this mode.

Position set values that were set once do not change when the display mode is reset.

Position input decimal
example 1

The following calculation must be done if for example in the decimal input mode 11.7 motor revolutions in negative direction are requested.

11,7 * 65536 = 766771 Increments

Starting on the right side and cut the last 4 positions.

76 I 6771

Sign= 1 for negative input
High-part = 76
Low-part = 6771

Position input hexadecimal
example 2
(see parameter Pd.8 ... Pd.10)

With the hexadecimal input the sign in the upper Bit of the High-part will be coded. Example for the input of 128.5 revolutions in negative direction

128,5 * 65536 = 8421376 Increments

For a negative input this number must be inverted:

-8421376 Increments

The best way to change this number in a hexadecimal number is by using a calculator. Such a calculator is, e.g., available on each PC with WINDOWS 3.1 or WINDOWS 95. (C:\WINDOWS\CALC.EXE)

-8421376 dez = FF7F8000 hex

Starting on the right side this value will be splitted in two values with four digits.

I FF7F I 8000 I

High-part = FF7Fh
Low-part = 8000h

Position input hexadecimal
example 3

If using hexadecimal numbers appears to be complicated, the hexadecimal input mode can be interpreted in another way as well.

Example for an input of 2,5 revolutions in positive direction:
0,5 revolutions = 32768 Increments

High-part= 2
Low-part = 32768

Example for an input of 1,25 revolutions in negative direction
0,75 revolutions = 49152 Increments

High-part = -2
Low-part = 49152

(-2 + 0,75 revolutions, because no negative increments can be entered in the Low-part.)

Limit switch left, Limit switch right (Pc.4...Pc.9)

With these parameters you can define a range which cannot be left by the Posi-mode. If the target position lies outside this range when the positioning is started, then the command is not accepted. The left limit switch contains the smaller (negative) values, the right limit switch the larger (positive) values. The entries are dependent on Pc.1. The software limit switches are not active in the factory setting. If they shall be switched off supplementary the following values must be adjusted.

Pc.1 = 3	Pc.5 = 8000h	Pc.6 = 0	Pc.8 = 7FFFh	Pc.9 = FFFFh

After deactivation Pc.1 can be set to the required value.

Mode of position ref
Reference point
Reference speed
(Pc.10 ... Pc.14)

The reference point search can be started with a digital input or also with parameter Pd.1. When the value 1 is set in Pc.10 the reference point search is activated after Power-on with the first 'start-posi' signal. After the reference point search is activated the servo starts with the reference speed adjusted in Pc.14. If the reference point search is started with input function 11 (reference point search left) the preferred direction determined in Pc.14 is inverted.
If the drive runs in this state onto the limit switch, the inverter reverses. If the reference point switch is activated in the preferred direction, the speed changes now to 25% and the switch is driven free. If Pc.10 is set at 0 or 1, the drive turns further on to the 0 position.
The current position is overwritten with the reference point position Pc.11...Pc.13.
The reference drive is completed.
The function of the reference point drive is identical in the synchronous mode.

Mode of position reference (Pc.10)

Value in Pc.10	Function
0	no autostart
1	start automatically
2	no autostart + stop at reference switch
3	start automatically + stop at reference switch
4	no autostart, E.EnC if zero-track is missing
5	start automaticall, E.EnC if zero-track is missing

Input			Note
1	2	3	
F	R	REF	Reference point is between the two limit switches
F+REF	R	––	Reference point is on the right limit switch
F	R+REF	––	Reference point is on the left limit switch

Encoder mode for positioning (Pc.16)

The position feedback for the posi module can be done via the system position encoder to X4 or via an external encoder to X3:

0 : position feedback via system position encoder
1 : position feedback with X3

If an **external encoder** is used as encoder mode **all position inputs** relate to this encoder. In this case 65536 increments = one revolution of this external encoder. The parameters of the precontrol profile **Pd.5 to Pd.7** always relate to the system encoder mode via X4.

Gear factor for positioning (Pc.17)

If the external position encoder is connected with the motor via a gear the gear ratio must be adjusted here.

Range of values: 1,00 ... 150,00
Resolution: 0,01

With this parameter the profile of the speed precontrol is calculated. The limited resolution of this parameter has no consequences on the positioning precision of the drive. **The positioning precision of an external encoder is only dependent on that resolution.**

Distance after stop high/low (Pc.18, Pc.19)

All parameters for the positioning abort are set-programmable. The function residual distance after abort is activated as soon as in one parameter set in Pc.18 or Pc.19 a value uneven 0 is adjusted and the input condition di.3 ... di.5 = 22 Posi-abort is selected.

The residual distance which must still be covered is adjusted in **Pc.18 and Pc.19.** The residual distance must be higher or alike the distance specified for the accelerating phase. **Independent** from the adjustment in **Pc.1** the residual distance will be preset in hexadecimal mode. The resolution corresponds to the postion inputs. 65536 is equivalent to one motor revolution.

Distance before abort (Pc.33, Pc.34)

At the positioning with abort (Pc.18 or Pc.19 uneven 0) a distance can be preset, in which the initiator signal for the abort shall not be **evaluated**.

Posi init mode (Pc.35)

This parameter has an effect only at the switch-on of the unit.

0 : zero: When switching on the unit the actual position is reset. Usually a referencing is necessary.

1 : absolute: The actual position is stored in the unit. Provided that the axis does not rotate in de-energized condition, no referencing is necessary.

2 : absolute / relative positioning with correction: Like 1, additionally after switching on with the first Start Posi an aborted relative positioning is first of all completed.

Posi stop mode (Pc.36)

0: condition-active / residual distance after stop
1: slope-active / residual distance after stop
2: condition-active / stop before target position
3: slope-active / stop before target position

With this parameter the function of di.3 ... di.5 = 22 (abort with residual distance) is affected. If slope-active was selected, it can additionally be chosen between positive and negative slope with the input logic di.2.

With bit 1 the residual distance is selected. Stor before target position means, that the drive runs to the adjusted target position. With the setting residual distance after abort, the residual distance in Pc.18, Pc.19 is still covered after the stop signal.

5.18 Positioning Definition (Pd)-Parameter

Read-only parameters!

Press "Enter"-key to store the parameter value!

Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
Pd	0	Posi mode	3700	P			1	0	2	0	---
Pd	1	Manual start	3701		E		1	0	4	0	---
Pd	2	KP position	3702	P			1	0	65535	20	---
Pd	3	Limit for kp position	3703	P			0,5	0	500	250	rpm
Pd	5	S curve time	3705	P			0,01	0.01	8,00	0,1	s
Pd	6	Acceleration time	3706	P			0,01	0,01	8,00	1	s
Pd	7	Max. speed	3707	P			1	1	10000	1000	rpm
Pd	8	Set position sign	3708	P			1	0	2	0	---
Pd	9	Set position high	3709	P			1	0	65535	0	inc
Pd	10	Set position low	370a	P			1	0	65535	0	inc
Pd	11	Mode of positioning	370b	P			1	0	1	0	---
Pd	12	Position deviation	370c	P			1	0	65535	1000	inc
Pd	15	Target mode	370F				1	0	3	0	---

Positioning (Pd.0)

The positioning mode can be activated with the input function or with parameter Pd.0 (see restrictions at Pc.0). All Pd-parameters are set-programmable with the exception of Pd.1.

0 Positioning mode OFF
1 Positioning mode ON
2 Positioning mode ON, automatic start of the positioning at set change

Manual start (Pd.1)

By writing on this parameter the posi-mode and the reference point search can be started manually at any time.

1 Start posi-mode
2 Start reference point search
3 Teach function
4 Setting of reference point

With the Teach function the current position in the active parameter set is stored in parameters Pd.8 ... Pd.10.

Setting of actual position without reference point approach

The reference point adjusted in Pc.11 ... Pc.13 is taken over onto the actual position by writing the value 4 to Pd.1.

KP position (Pd.2)

The position controller of the positioning mode can be optimally adjusted to every position in Pd.2. It is a P-controller and its gain is adjusted in Pd.2.

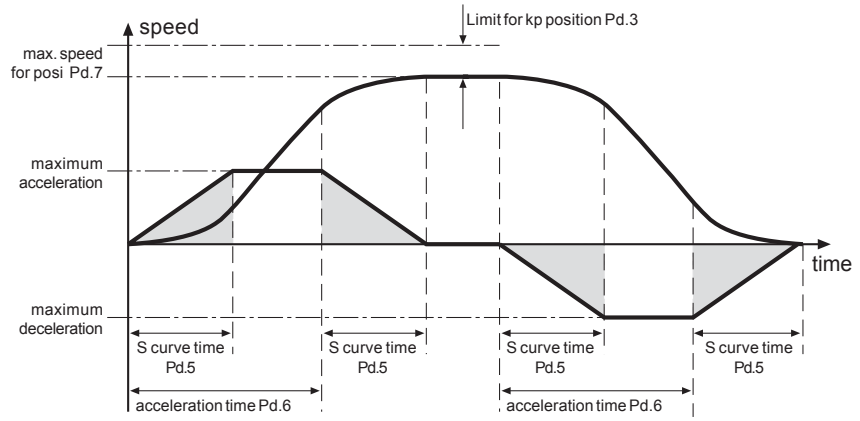
If the gain factor is too high there are constant oscillations; if the gain factor is too small the positioning precision gets worse. Position controller (Pd.2) and speed controller (CS-Parameter) influence each other. For an optimal positioning precision it is recommended to reduce the I-part of the speed controller with a high gain factor Pd.2 at the position controller.

Limit for KP position (Pd.3)

The maximum speed, which the position controller can add to the profile of the speed precontrol, is preset in Pd.3.

S curve time acceleration time max. speed for posi (Pd.5 ... Pd.7)

The profile of the speed precontrol is preset with parameters Pd.5...Pd.7. At Pc.0 = 2 see SP-Parameter.



The drive can only keep the precontrol profile, if the maximum speed is not limited by other parameters **(Sp.5, Sp.8)** and the drive is not overloaded. The torque adjusted in CS.6 must not be reached at any time during the positioning process (see example operation with high mass moment of inertia).

Set position (Pd.8 ... Pd.10)

The set position is preset in Pd.8 ... Pd.10. The input is possible by writing on these parameters or by activating the Teach-function (Pd.1 = 3). During the execution of a positioning step it is not possible to preset a new target position in the active parameter set.

Mode of positioning (Pd.11)

In this parameter you can select whether the positioning set value is preset absolutely, or whether it should position relatively to the actual position. In case of relative mode of positioning the new position will be calculated starting from the present position setpoint value, i.e. positioning errors will not be added.

0 absolute mode of positioning
1 relative mode of positioning

Position deviation (Pd.12)

After a positioning command is completed, a 'position reached' signal can be set via digital output **(do-Parameter).** This message is read out when the precontrol profile is completed and the drive is in the target window. The position deviation can be adjusted in **Pd.12.** The parameter is exactly standarized as the 'low-part' of the set position. 360° of the motor revolution = 65536 increments. The position deviation extends to both sides of the target position with the increments adjusted in Pd.12.

Target mode (Pd.15)

The parameter specifies what the controller is supposed to do with a position not reached (Pc.0 = 2; new position during the positioning or position abort with residual distance).

0 : stop
1 : immediately
2 : ignore
3 : old target + restart

Pd.15	Pc.0 = 2; new - positioning while Posi is active	Position abort with residual distance
0	The controller stops and outputs a message (do.0X = 31), that it could not reach the new position.	The controller stops and outputs a message (do.0X = 31), that it could not reach the residual distance position.
1	The controller stops and then drives automatically to the new position.	The controller stops and outputs a message (do.0X = 31), that it could not reach the residual distance position.
2	The controller ignores the new position and drives to the old position.	The controller ignores the position abort and drives to the position.
3	The controller drives to the old position and then starts automatically a positioning onto the new position.	The controller stops and outputs a message (do.0X = 31), that it could not reach the residual distance position.

5.19 Checklist for the Positioning Module

1	Posi Module on	Pc.0 = 1
2	Select kind of position input (decimal / hexadecimal)	Pc.1
3	Parameter set selection on	Fr.2 = 1...3
4	Inputs for selection of positions (parameter sets) defined	di.3...di.12 = 1
5	Reference point search defined or switched off	Pc.10..Pc.14, di.3...di.12
6	Positioning in each individual set switched on-/ off	Pd.0
7	Set positions and mode of positioning are defined in the sets	Pd.8...Pd.11
8	define the drive profile for the positions	Pd.5...Pd.7
9	define position deviation	Pd.12
10	Software-limit switches on/off	Pc.4...Pc.9
11	Hardware-limit switch on	di.3...di.6, di.11...di.12, Pn.24
12	define start command for positioning	di.3...di.6, di.11...di.12
13	adjust speed controller and position controller	CS.0, CS.1, Pd.2, Pd.3
14	If necessary programming of digital outputs (e.g.: target window reached)	do-parameter

5.20 Programming Example for Positioning Control with 4 Positions

- 4 different positions should be reached by the control
- the addressing of the positions is done via terminal
- the positioning starts with a 'start positioning' - signal
- output D1 should be set, when the target is reached
- after Power-on you should start with 'start positioning' the reference point search
- the positions are preset absolutely, in relation to the reference point (Input in increments , ε_{set} = 80500, 1286000, 24000, 163800)
- the absolute positions 0 and +1500000 are the limits for the position set point
- the positions are shown and entered in decimal
- when a digital input is set, the drive must be able to be moved manually with the analog set value (emergency operation).

Sequence:

- the control selects a positioning set
- afterwards the 'start positioning' - signal is given by the control (positioning set must be preset on the terminal)
- the controller takes on the position, speed, control adjustment etc. from the positioning set selected
- after the target position is reached the signal 'position reached' is set
- now the new set addresses are accepted with a new 'start positioning' command
- the signal 'position reached' is reset with the new 'start positioning' command
- when I4 is activated the controller runs with the analog set value

positioning - control (Pc) - Parameter			
Pc.0	Control mode	1	on
Pc.1	Position input mode	0	position display / - input decimal
Pc.4	Limit software left sign	0	positive pos. value for end pos. left position = 0
Pc.5	Limit software left high	0	
Pc.6	Limit software left low	0	
Pc.7	Limit software right sign	0	positive pos. value for end pos. right Pos. = (Pos.high * 10000 + Pos.low) * sign = + (150 * 10.000 + 0)
Pc.8	Limit software right high	150	
Pc.9	Limit software right low	0	
Pc.10	Mode of position reference	1	auto ref on
Pc.11	Reference point sign	0	reference point position = zero point
Pc.12	Reference point high	0	
Pc.13	Reference point low	0	
Pc.14	Reference speed	-100	the reference point is searched with a speed of 100 rpm in reverse rotation / automatic reversal when the limit switch is reached.

positioning definition (Pd) - Parameter						
		Set 0	Set 1	Set 2	Set 3	
Pd.0	Posi mode	1	1	1	1	on
Pd.1	Manual start	0	0	0	0	no manual start
Pd.2	Kp (position)	20	20	20	20	dependent on load
Pd.3	Limit for kp position	500	500	500	500	
Pd.5	S-curve time	0,5	0,5	0,5	0,5	
Pd.6	Acceleration time	0,6	0,6	0,6	0,6	
Pd.7	Max. speed for posi	3000	3000	3000	3000	
Pd.8	Set position sign	0	0	0	0	
Pd.9	Set position high	8	128	2	16	input see reference point
Pd.10	Set position low	500	6000	4000	3800	
Pd.11	Mode of positioning	0	0	0	0	absolute
Pd.12	Position deviation	16383	16383	16383	16383	position deviation 90°

digital input (di) - Parameter		
di.3	Input function I1	1 : set selection
di.4	Input function I2	1 : set selection
di.5	Input function I3	17 : start positioning
di.6	Input function I4	20 : positioning mode OFF
di.11	Input function I5	14 : limit switch right
di.12	Input function I6	19 : limit switch left + reference switch

digital output (do) - Parameter		
do.1	Output condition 1	23 : position reached
do.28	Output filter 1 time	20 ms
do.30	Output filter 1 connection	1 : do.1

free prog. para. sets (Fr) - Parameter		
Fr. 2	Parameter set source	2 : terminal binary coded

5.20.1 COMBIVIS Parameter List for Programming Example

*	ud1	Bus password	=	440
	Fr1	Copy parameter set	=	-2: copy default sets in all sets
	di3	Input function I1	=	1: Set selection
	di4	Input function I2	=	1: Set selection
	di5	Input function I3	=	17: Start Posi
	di6	Input function I4	=	20: Posi mode off
	di11	Input function I5	=	14: F
	di12	Input function I6	=	19: R + reference switch
	Fr2	Parameter set source	=	2: Terminal (binary coded)
	Pc0	Posi mode	=	1:on
	Pc1	Input mode	=	0: pos.disp. DEZ / pos.input DEZ
	Pc4	Limit software left sign	=	0 : +
	Pc5	Limit software left high	=	0
	Pc6	Limit software left low	=	0
	Pc7	Limit software right sign	=	0 : +
	Pc8	Limit software right high	=	150
	Pc9	Limit software right low	=	0
	Pc10	Mode of position ref	=	1: auto ref on
	Pc14	Reference speed	=	-100.0 UpM
	Pd0	Positioning	=	1:on
	Pd2	Kp position	=	20
	Pd3	Limit f. position controller	=	250 UpM
	Pd5	S curve time	=	0.50 s
	Pd6	Acceleration time	=	0.60 s
	Pd7	Max. speed	=	3000 UpM
	Pd8	Set position sign	=	0 : +
	Pd9	Set position high	=	8
	Pd10	Set position low	=	500
	Pd11	Mode of positioning	=	0: absolute
	Pd12	Position deviation	=	16383
	do1	Output condition 1	=	23: position reached
	do28	Output filter 1 time	=	20 ms
	do30	Output filter 1 connection	=	do01
*	Fr9	Bus parameter set	=	1: set 1
	Fr1	Copy parameter set	=	copy 0: set 0 (stand.) to Fr.09
	Pd8	Set position sign	=	0 : +
	Pd9	Set position high	=	128
	Pd10	Set position low	=	6000
*	Fr9	Bus parameter set	=	2: set 2
	Fr1	Copy parameter set	=	copy 0: set 0 (stand.) to Fr.09
	Pd8	Set position sign	=	0 : +
	Pd9	Set position high	=	2
	Pd10	Set position low	=	4000
*	Fr9	Bus parameter set	=	3: set 3
	Fr1	Copy parameter set	=	copy 0: set 0 (stand.) to Fr.09
	Pd8	Set position sign	=	0 : +
	Pd9	Set position high	=	16
	Pd10	Set position low	=	3800
*	Fr9	Bus parameter set	=	0: set 0

5.21 Programming of an Automatic Sequence Control System

- 7 different positions should be automatically approached one after the other
- to start a new positioning you must enter 'start posi'
- the reference point has the absolute value + 100.000 , the limit switches are in position 0 and + 200.000
- the reference point search is started with a digital input
- from the reference point a $\Delta\varepsilon$ should:
  + 75000 / - 50.000 / - 50.000 / - 50.000 / -15.000 / + 100.000 / - 10.000 be driven
- the relay should work as a 'position reached' - signal

Sequence:

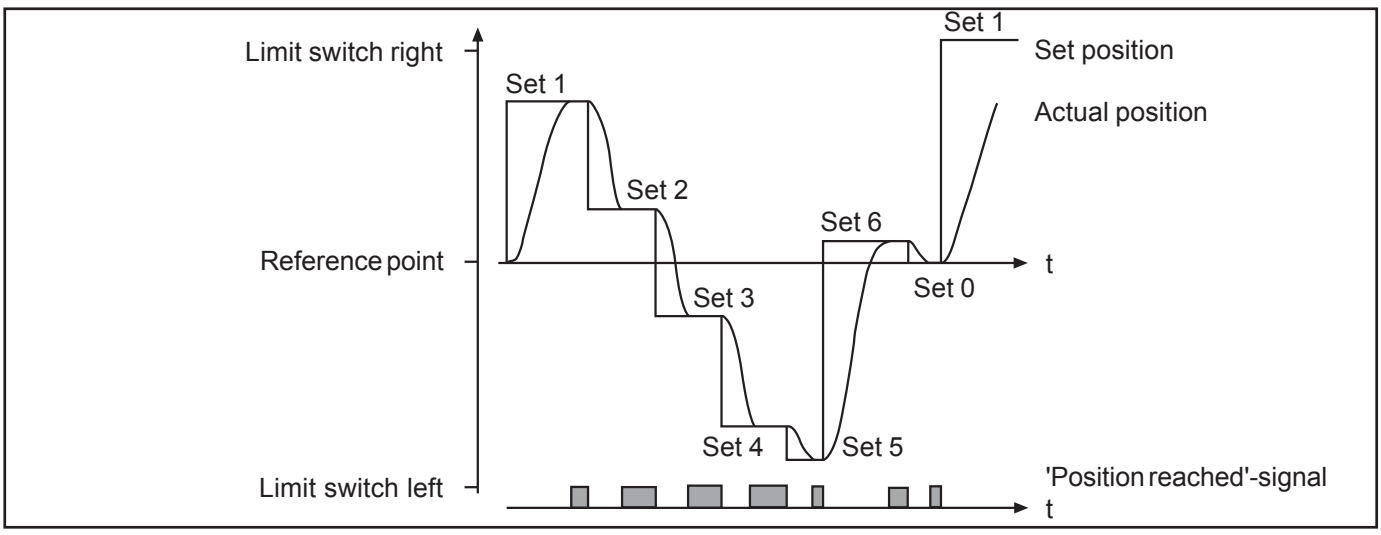
- After power on you can start the reference point search with I2. When the reference switch I3 is active, the actual position is overwritten with the reference position and the mode is ended.
- With I1 the positioning in set 1 is started
- With every further positive slope of I1 the next position is selected
- In set 0 the drive goes back to its reference position

positioning - control (Pc) - Parameter			
Pc.0	Control mode	1	on
Pc.1	Position input mode	0	Pos. display decimal/pos. input decimal
Pc.4	Limit software left sign	0	0 : +
Pc.5	Limit software left high	0	
Pc.6	Limit software left low	0	
Pc.7	Limit software right sign	0	0 : +
Pc.8	Limit software right high	20	
Pc.9	Limit software right low	0	
Pc.10	Mode of position reference	0	auto ref on
Pc.11	Reference point sign	0	0 : +
Pc.12	Reference point high	10	
Pc.13	Reference point low	0	
Pc.14	Reference speed	-100	The reference point is searched with a speed of 100 rpm in reverse direction / automatic reversal when the limit switch is reached

positioning definition (Pd)-Parameter									
		Set 0	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**	**Set 6**	
Pd.0	Posi mode	1	1	1	1	1	1	1	1 : on
Pd.1	Manual start	0	0	0	0	0	0	---	no manual start
Pd.2	Kp (position)	20	20	20	20	20	20	20	
Pd.3	Limit for kp position	500	500	500	500	500	500	500	
Pd.5	S curve time	0,1	0,5	0,5	0,5	2	0,5	0,5	
Pd.6	Acceleration time	0,2	0,8	0,8	0,8	2	0,8	0,8	
Pd.7	Max. speed for Posi	1000	2000	3000	3000	3000	3000	3000	
Pd.8	Set position sign	0 : +	0 : +	1 : -	1 : -	1 : -	1 : -	0 : +	
Pd.9	Set position high	10	7	5	5	5	1	10	Input see Pc.1
Pd.10	Set position low	0	5000	0	0	0	5000	0	
Pd.11	Mode of positioning	0	1	1	1	1	1	1	0:absolute/1:relative
Pd.12	Position deviation	16383	16383	16383	16383	16383	16383	16383	target window 90°

digital input (di) - Parameter		
di.3	Input function I1	17 : start positioning
di.4	Input function I2	10 : start reference point search
di.5	Input function I3	12 : reference limit switch
di.6	Input function I4	13 : RST
di.7	Input function IA	1 : SET
di.8	Input function IB	2 : SET
di.9	Input function IC	3 : SET
di.11	Input function I5	14 : limit switch right
di.12	Input function I6	15 : limit switch left
di.17	Input strobe dependent	1792 : IA + IB + IC
di.18	Select strobe source	16 : I1

digital output (do) - Parameter								
do.3	Output condition 3	23 : position reached						
do.4	Output condition 4	1 : enabled						
do.28	Output filter 1 time	4 ms						
do.30	Output filter 1 connection	4 : do.4						
		Set 0	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**	**Set 6**
do.13	Select OUT A condition	do.4	0	do.4	0	do.4	0	0
do.14	Select OUT B condition	0	do.4	do.4	0	0	do.4	0
do.15	Select OUT C condition	0	0	0	do.4	do.4	do.4	0



5.22 Reference Point Search
Example 1

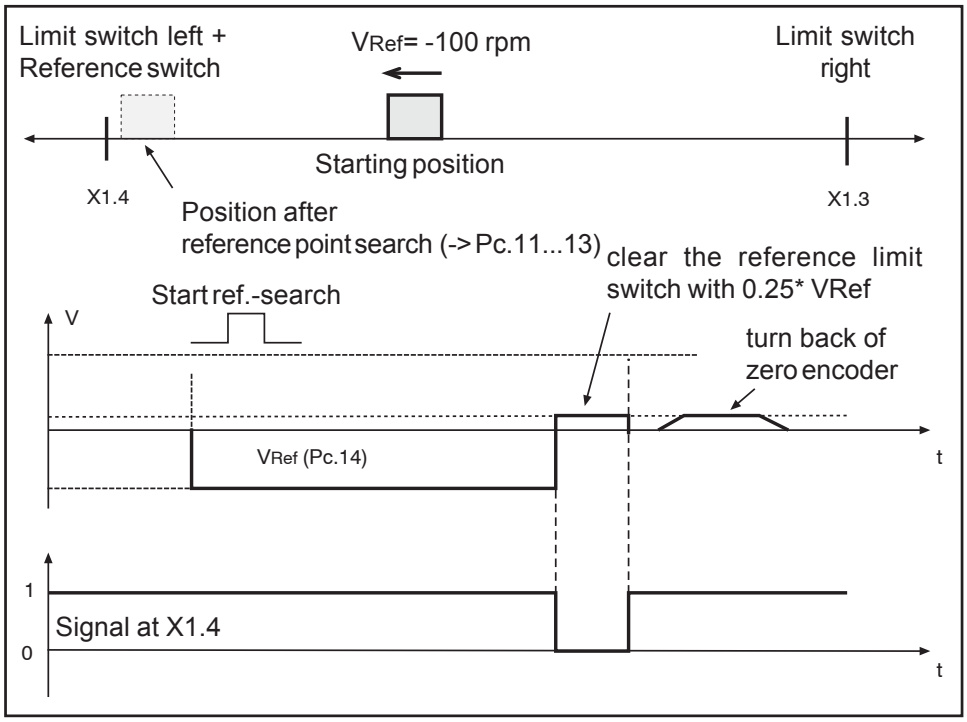
Simultaneously the limit switch also serves as reference limit switch.

Terminal X1.3 = limit switch right
Terminal X1.4 = limit switch left + reference limit switch

Adjustments: di.11 = 14; di.12 = 19; Pc.14 = -100 rpm

Start of the reference point search by setting of a digital input (e.g. X1.7 => parameter di.5 = 10) **or** by Bus / PC with parameter Pd.1 = 2 **or** automatically after switching on the voltage supply with the first 'start positioning' signal (parameter Pc.10 = 1).

The 'start positioning' signal can also be set with a digital input (e.g. X1.2 => par. di.6 = 17) **or** via Bus / PC with parameter Pd.1 = 1.



5.23 Reference Point Search Example 2

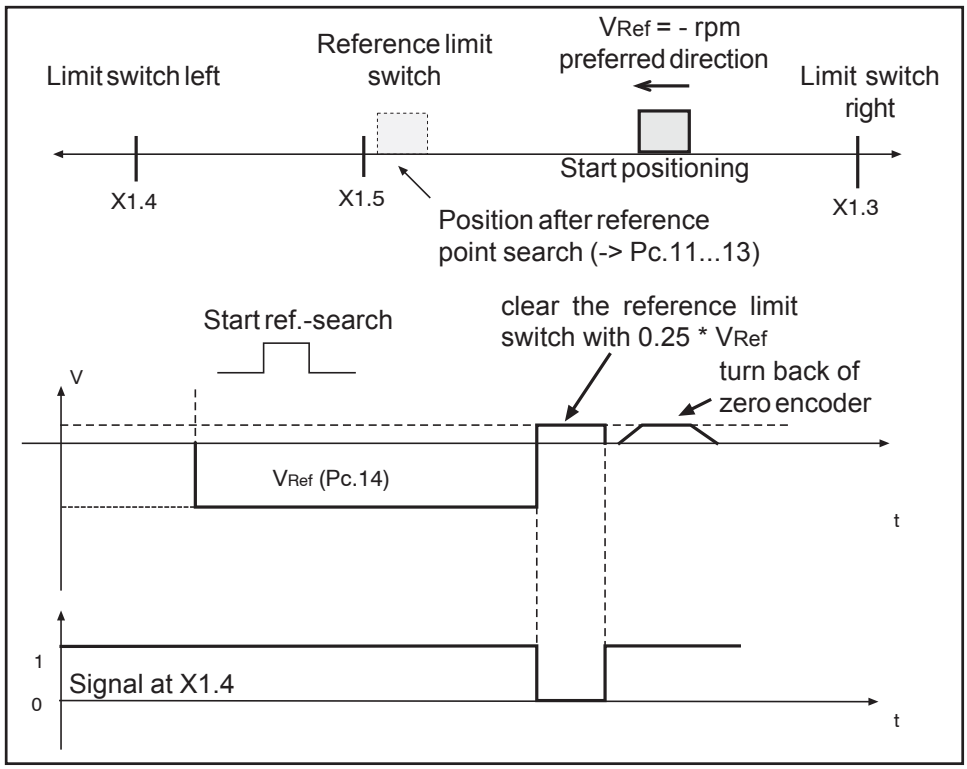
The reference switch is independent to the limit switches.

Terminal X1.3 = limit switch right
Terminal X1.4 = limit switch left
Terminal X1.5 = reference switch

Adjustments: di.11 = 14; di.12 = 15; di.3 = 12; Pc.14 = -100 rpm

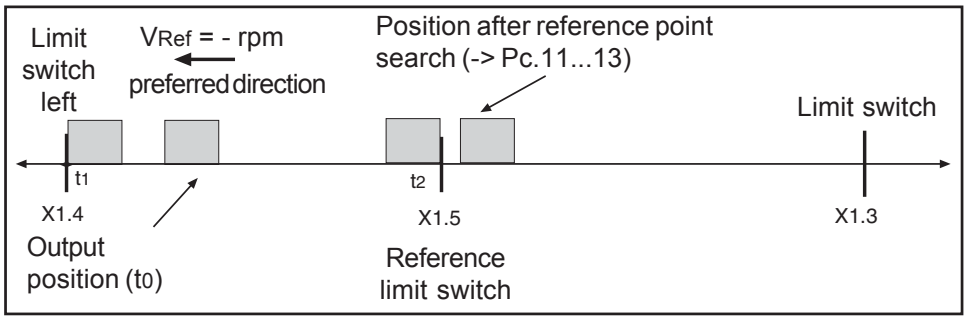
Start of the reference point search by setting of a digital input (e.g. X1.7 => parameter di.5 = 10) **or** by Bus / PC with parameter Pd.1 = 2 **or** automatically after switching on the voltage supply with the first 'start positioning' signal (parameter Pc.10 = 1).

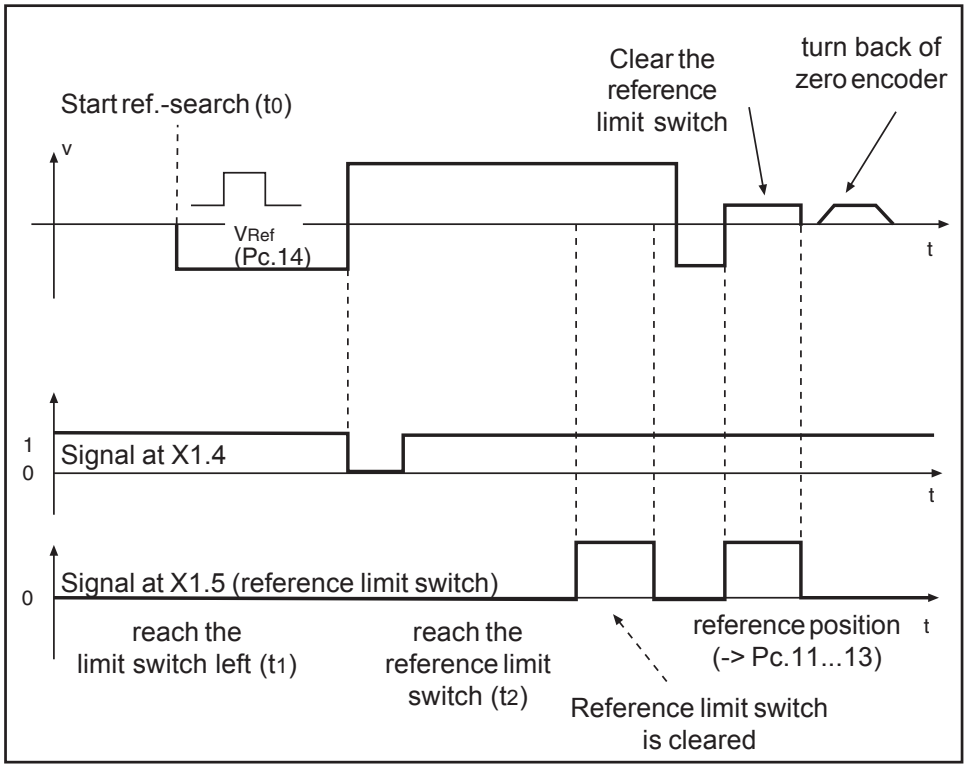
The 'start positioning' signal can also be set with a digital input (e.g. X1.2 => par. di.6 = 17) **or** via Bus / PC with parameter Pd.1 = 1.



5.24 Reference Point Search
Example 3

Starting of the drive to the reference limit switch against the preferred direction (special case to example 2).



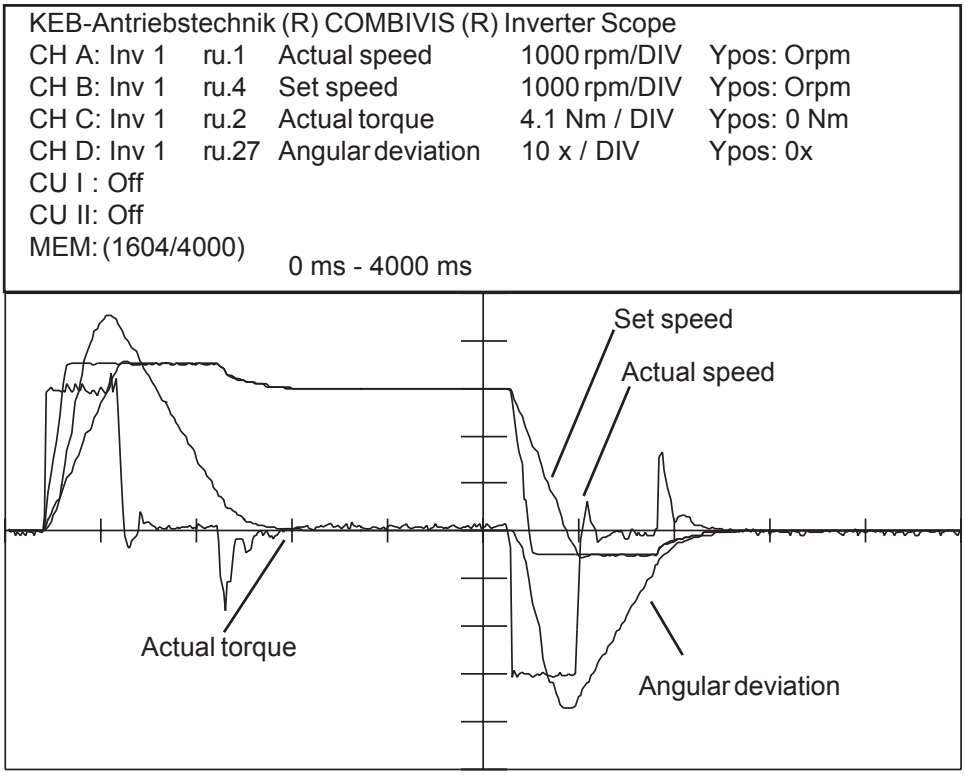


5.25 Operation with High Mass Moment of Inertia

In this case undesirable effects can occur during the positioning; see the following short description of the parameterization

- realize speed controller adjustment as usual **(CS-Par.)**
- activate posi module and record positioning function with inverter-scope

The following example was recorded with a motor 12.SM.000-4400 and a rotating mass with 88 · 10^{-4} kgm^2.

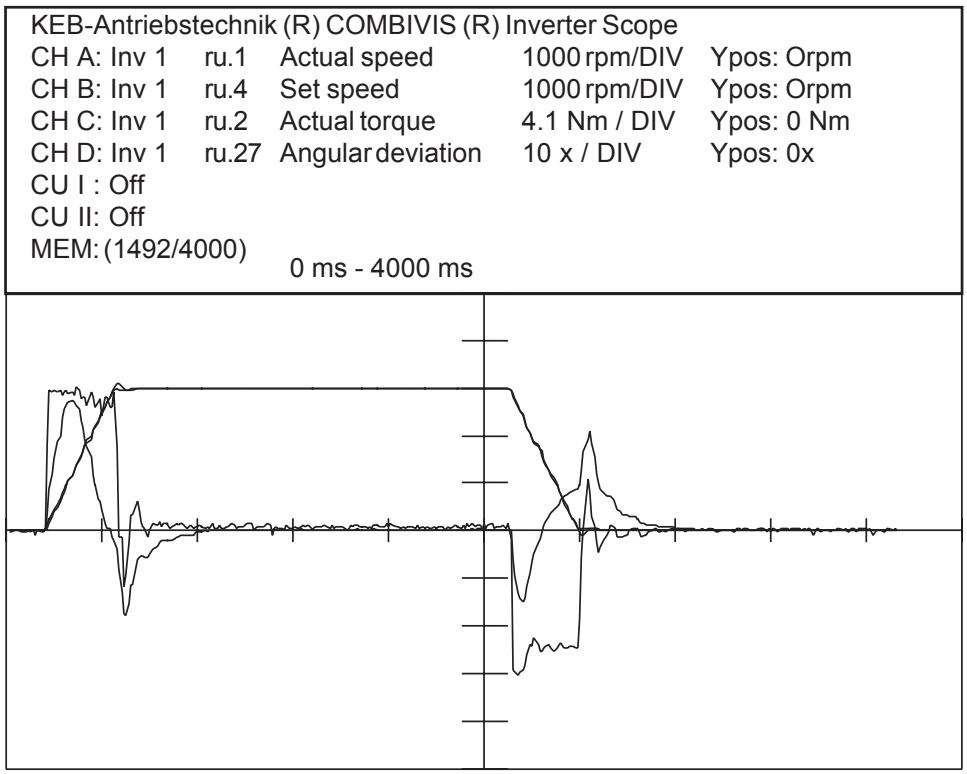


In this recording the drive cannot follow the set value. During acceleration at the torque limit the angular deviation increases. By repetition up to zero the drive compensates the angular deviation. It is important that the max. speed (SP.5, SP.8) > Pd.3 + Pd.7.

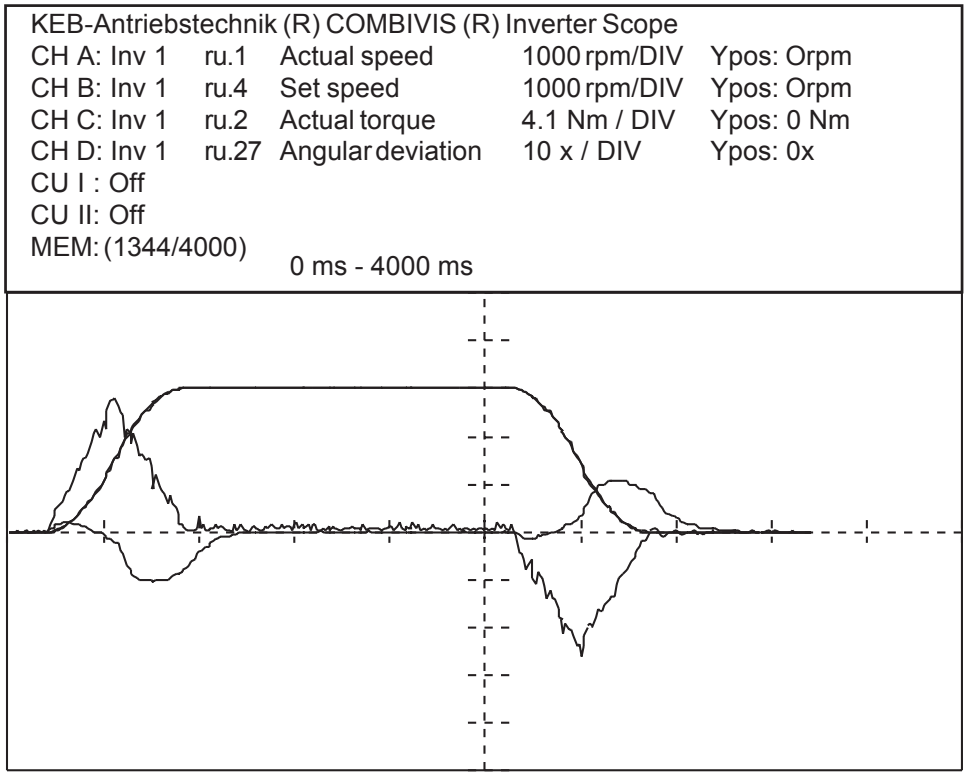
During deceleration the drive also cannot follow the the precontrol profile. An overshoot occurs. With the adjusted speed in Pd.3 the drive reverses to his set position. In this example the overshoot (angular deviation) is 3,5 motor revolutions.

In this example the drive needs 300 ms to accelerate max speed. For the second test the value is adjusted for the acceleration time in Pd.6.

With this adjustment Pd.6= 0,3 s the drive can follow the precontrol profile. Only in the corner of the precontrol profile there are torque shocks which can have a negative effect to the mechanic of the machine.



It is recommended to use S-curves in case of high mass moment of inertia. See the following test: Pd.5 = 0,3s and Pd.6 = 0.01s.



- The drive follows the precontrol profile optimally.
- Setpoint speed and actual speed are identical.
- The torque has a 'triangular' form.
- The drive has no overswing in the target position.
- The angular deviation is max. approx 10°.

5.26 Fault Locating in the Positioning-Module

Mistakes	Reason	Control / Help
Positioning step or reference point search is not executed	Control release inactive	Terminal X1.1, Par. ru.14
	Limit switch signal interrupted or not connected	Terminal strip, Par. ru.14, ru.16
	Torque limit active	set An.13 = 0; increase CS.6 / CS.7
	Limit software active	change or switch off software-limit switch (see Par. Pc.4...9)
	Position reached	compare position input Pd.8...10 and actual position ru.35... 37
	last positioning step is not completed Reference search active	status display ru.0 (P A = positioning active) status display ru.0 (SrA = ref.point search active)
Positioning is to inexact (Position deviation not reached)	Position controller to soft or switched off (Pd.2)	increase value of Pd.12
	Target window to small	increase value of Pd.12
	Torque limit active	set An.13 = 0; increase CS.6 / CS.7
Drive overshoots the position and then returns	Ramps for posi-drive profile are adjusted to short	extend ramp times Pd.5 / Pd.6
	Torque limit active	set An.13 = 0; increase CS.6 / CS.7
	Speed limit active, i.e.. Sp.5 or Sp.8 < Pd.7	adjust Sp.5 / Sp.8 > Pd.7 or reduce Pd.7 to correspond value
	Position controller to soft or switched off (Pd.2)	increase value of Pd.2
Drive goes to the wrong position	Wrong parameter set activated	check actual par.set (ru.18)
	Position input or mode of positioning is adjusted wrong	check Pd.8...11
	Reference search active	status display ru.0 (SrA = ref.point search active)
Drive oscillates	Speed controller adj.badly Position controller adj. badly	see CS-Par. adjust Pd.2
Strong mech. load at positioning (Torque shocks)	Ramps for posi drive profile are adjusted to short	extend ramp times Pd.5 / Pd.6
	activate s-curves	increase Pd.5
Drive goes over proximity switch	Exchange limit switch right / left	check terminal strip, Par. ru.14
	Deact. of reaction to limit switch	check Par. Pn.24
Reference point search has not finished Drive runs from one limit switch to the other	Sign of the reference speed Pc.14 is wrong	If the limit switch left is also a reference switch, Pc.14 must be negative; If the limit switch right is also a reference switch, Pc.14 must be positive
	No digital input defined as ref. point switch or ref. limit is not connected	set ref. signal to a digital input and program this as a ref. switch (-> di.-Par.)

5.27 Adjustment Assistance (AA)-Parameter

Read-only parameters!
Press "Enter"-key to store the parameter value!
Set-programmable parameters!

Gr.	No.	Name	Address	P	E	R	Resolution	Lower Limit	Upper Limit	Default Value	Unit
AA	0	Channel 1 parameter selection	3200				1	0	65535	0	---
AA	1	Channel 2 parameter selection	3201				1	0	65535	0	---
AA	2	Channel 3 parameter selection	3202				1	0	65535	0	---
AA	3	Channel 4 parameter selection	3203				1	0	65535	0	---
AA	4	Time base	3204				0,001	0,001	32,000	0,001	---
AA	5	Trigger source	3205				1	0	255	255	---
AA	6	Trigger position	3206				1	0	variabel	10	---
AA	7	Start/stop recording	3207				1	0	255	0	---
AA	8	Scope function	3208			R	1	0	2	0	---
AA	9	Select graph address	3209				1	0	variabel	0	---
AA	10	Read channel1	320A			R	1	0	---	---	---
AA	11	Read channel 2	320B			R	1	0	---	---	---
AA	12	Read channel 3	320C			R	1	0	---	---	---
AA	13	Read channel 4	320D			R	1	0	---	---	---

Inverter Scope (AA.0 ... AA.13)

These parameters are managed by the communication program 'Inverter Scope'.

AA.0 - AA.3 contain the addresses of the parameters which should be recorded by the 'Inverter Scope'.

AA.4 contains a time base for the recording of the parameter values.

AA.5 / AA.6 contain the trigger condition and position.

AA.7 / AA.8 serve to synchronize the PC-program with the inverter.

AA.9 ... AA.13 serve to read out the recorded values in the unit.

The program ‘Inverter Scope’ is menu-assisted and manages these parameters independently. Therefore direct access onto the AA-parameters is not necessary. Operating of the inverter scope program is described in the COMBIVIS instruction manual.

6. Annex

6.1 Changed Functions starting at Version 3.0

6.1.1 Changes in the Posi-Module

An aborted positioning is first of all completed with the nest Start Positioning.

6.1.2 Changes in the OL and OH2 Function

The OH2-function only takes over the protection of the motor winding. That means, that the function only responds above the triple motor rated current. For motor protection against overtemperature a PTC-contact must be connected now. Additonally tripping times can be adjusted in the dr-parameters.

The OL-function has changed for the units in G and H housing. For the overload range the rated current was specified as follows: 16.S4.G... 33 A and f18.S4.H... 50 A. The standstill continuous current, which is significant for the power module protection below 3 Hz, was not changed.

6.1.3 Software Limit Switch

If a position outside the software limit switch is selected and started, E.SLF or E.SLr is triggered. This error is also triggered at Pc.2 = 2 new position settings during positioning.

Display	Value	Meaning
E.SLF	110	Error software final position forward (selected position above Pc.7 ... Pc.9)
E.SLr	111	Error software final posiiton reverse (selected position below Pc.4 ... Pc.6)

6.1.4 New Functions 3.0

- Motor temperature measurement (KTY-submounted card)
- Extension of the speed range 14000 rpm
- Motor-poti function
- Brake torque and ramp for emergency-stop
- Field weakening range
- Exchange of the analog inputs
- Regulation of the controller-motor temperature
- Operation of a motor with hiperface encoder
- Direct change-over possibility between synchronous-, posi- and speed-controlled operation
- Presetting of other acceleration ramp like deceleration ramp in posi-operation
- Change of the maximum positioning speed during positioning
- Presetting of new positions during positioning
- Positioning with starting speed
- Register function
- Synchronization with ramps