COMBIVERT

Programming Manual

COMBIVERT R6-N

Version 1.3

Translation of the original manual		
Document	Part	Version
20129189	ENG	01

1.2 Product overview

1.2.1 Preface

First we would like to welcome you as a customer of KEB Automation KG and congratulation to the purchase of this product. You have decided for a product on highest technical niveau.
The enclosed documents as well as the specified hard- and software are developments ofKEB Automation KG. Errors excepted. The KEB Automation KG has created these documents, this hard- and software with the best knowledge. We doesn´t accept the guarantee that the user gets the profit with this specifications. KEB Automation KG reserves the right to change specifications without prior notice or to inform third persons. This list is not exhaustive.

The used pictograms have following significance:

Danger
Warning
Caution

Attention
observe at all costs

Information
Help
Tip

1.2.2 View of power supply and regenerative units

In power transmission different operating conditions occur with the electrical machines. Beside the motor operation, there is the regenerative operation, where energy is regenerate into the system. An inverter with uncontrolled rectifier enables only one energy flow direction, so usually the regenerative energy is dissipated with a brake transistor and braking resistor. The overvoltage is limited by this way and thus an error disconnection or destruction of the inverter is avoided.

The target of the regenerative unit is not to dissipate the regenerative energy into heat, but to regenerate the usable energy into the net. Condition for this: inverters with at least one DC voltage output, where the DC link voltage is coupled to the regenerative unit. In this case decoupling diodes are used for determination of the energy flow direction. The regenerative unit is connected via commutation throttle or harmonic filter and EMC-filter with the 3-phase line. Thus a regenerative unit is place-, energy-saving, environmentally friendly and cost reducing.

If several inverters are used in a machine, these can be coupled via DC interconnection with the regenerative unit, whereby the DC link voltage becomes more stable within the interconnection. This can improve the processing of the individual drives. To make the wiring as simple as possible, it is reasonable to supply the inverters via DC interconnection.

Here the regenerative unit serves simultaneously as supply unit. The inverters must be designed for DC voltage supply in this case. The COMBIVERT R6-N power supply and regenerative units can be parallel connected for high power supply and/or regenerative supply with a base load of 10% each.

1.2.3 Function principle

After switching on the DC interconnection is supplied with voltage after correct initialisation phase. If the voltage in the DC interconnection exceeds an adjustable threshold due to generative operation, the COMBIVERT R6-N

starts to regenerate the energy into the net by square-wave modulation. With the internal input voltage detection, the COMBIVERT can synchronize to the mains frequency, so that the regeneration takes place synchronously with the mains frequency.A sine-wave current is formed of it at the harmonic filter. The compliance with the requirements in accordance with EN 61000-3-12 is secured only by the harmonic filter.

If the regenerative power decreases an adjustable value, the COMBIVERT R6-N switches off the regeneration after expiration of a turn-off delay and it will be turn into motoric operation.

1.2.4 Unit identification

1 9 R 6 N 3 E - 9 0 0 A

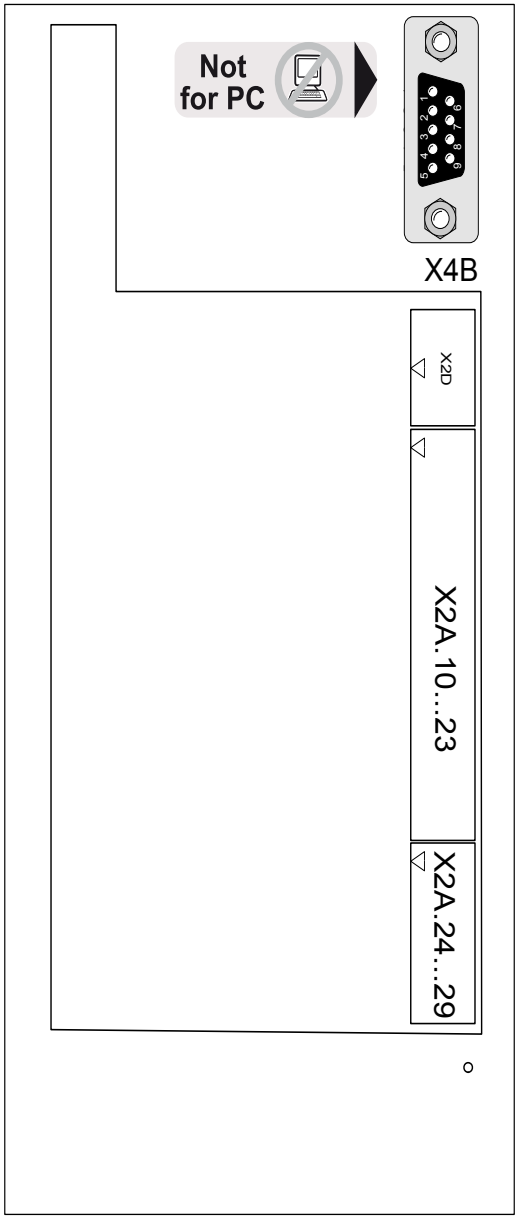
A-Z: As digits, varnished	A: varnished (standard)	
	B: varnished (flat rear)	
	C: varnished (water cooling)	
	D: varnished (external fan)	
	E: varnished (special fan)	
Design	0: default	
Design	0: KEB default design	
	1: modified default	
Voltage, connection type, interference suppression	KEB standard units:	
	9: 3-ph.; 400 V; AC	
Housing size	Previously defined: E, R, P	
Options	1: Precharging	
	3: Precharging, DC-fuses	
Control board	S: Control board 1B.R6 / 2B.R6	
	N: Control board 1N.R6 / 2N.R6	
Unit type	always R6	
1th. and 2nd. digit	Unit size	

1.3 Hardware

1.3.1 Control boards

1.3.1.1 Control board 1N.R6

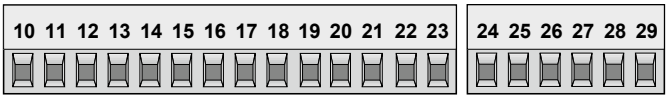
Connection terminals of the control board



X2A	Control terminal strip		Install control and mains cable separately!
X2D	Master/slave synchronization socket		
X4B	Operator interface		No direct PC connection

1.3.1.2 Control terminal strip X2A

X2A



Core cross-section 0.14…1.5 mm², tightening torque 0.5 Nm

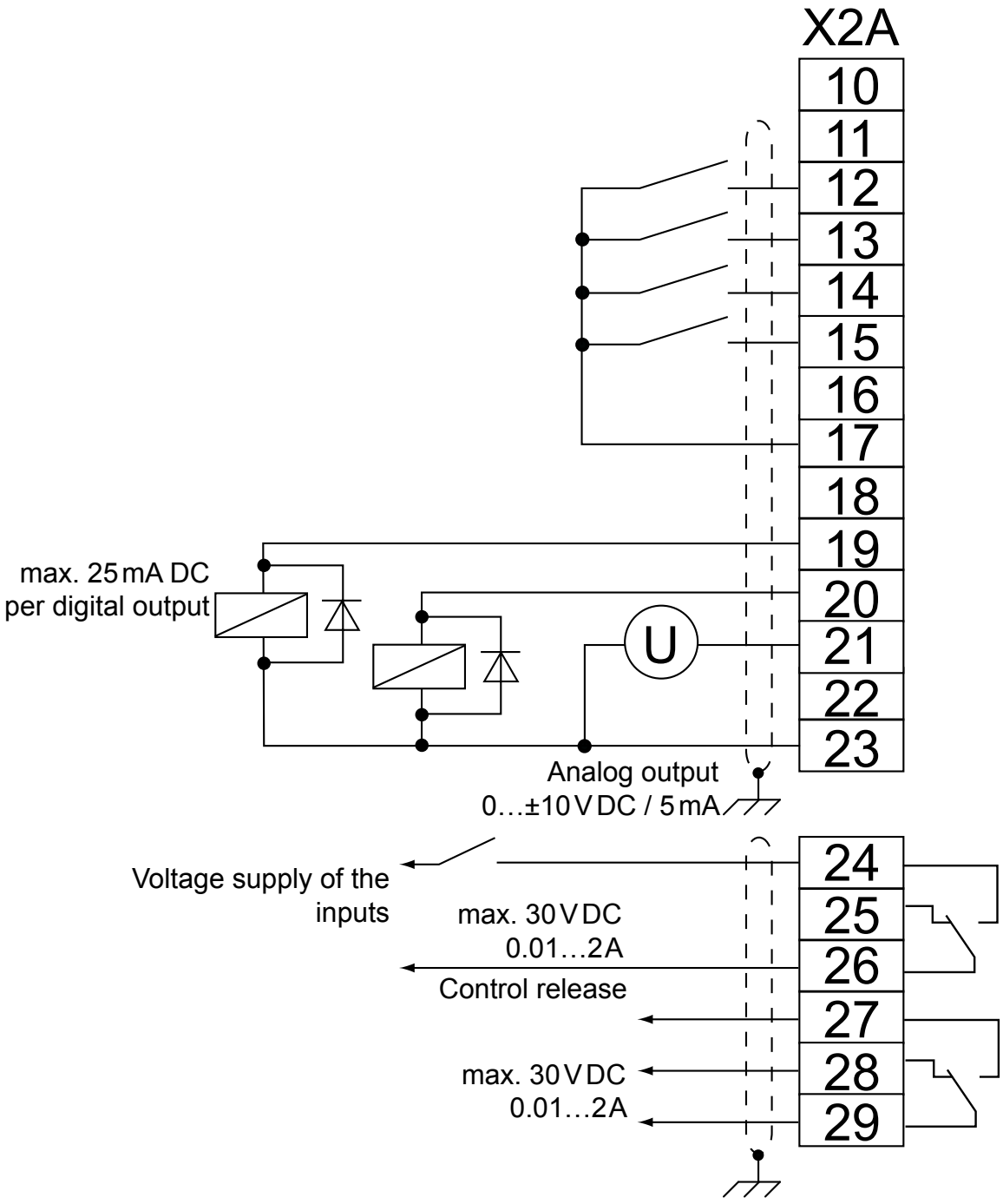
PIN	Function	Name	Description	Specifications
10	24 V DC input	Uin	External supply of the control board	21,6…26,4 V DC / 1A
11	Mass	COM	Reference potential	
12	Digital input 1	ST	Control release / reset	Ri: 4.4 kΩ
13	Digital input 2	I1	programmable	
14	Digital input 3	I2	programmable	
15	Digital input 4	I3	programmable	
16	Mass	COM	Reference potential	
17	24V-output	Uout	Voltage supply for in- and outputs	approx. 24 V / max. 100 mA
18	Mass	COM	Reference potential	
19	Digital output 1	O1	Transistor output (DC > CP.19)	I_{max}: 25 mA
20	Digital output 2	O2	Transistor output (error message)	I_{max}: 25 mA
21	Analog output 1 / gain	ANOUT	Difference between actual supply frequency and set supply frequency	1 V per 0,1 Hz difference
22	24Voutput	Uout	see terminal 17	
23	Mass	COM	Reference potential	
24	Relay 1 / NO contact	RLA	Relay output Ready signal (no error)	max. 30 V DC *) 0.01…2 A DC
25	Relay 1 / NC contact	RLB		
26	Relay 1 / switching contact	RLC		
27	Relay 2 / NO contact	FLA	Relay output (DC > CP.19 and tightened load-shunt)	max. 30 V DC *) 0.01…2 A DC
28	Relay 2 / NC contact	FLB		
29	Relay 2 / switching contact	FLC		

*) The relay outputs must be operated with max. 48 V DC protective separation voltage to guarantee the CE standard. After consultation KEB a current of max. 1 A DC is permissible for 120 V AC.

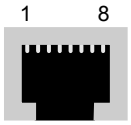
In order to prevent a malfunction caused by interference voltage supply on the control inputs, the following directions should be observed:

EMC

- Use shielded/drilled cables
- Lay shield on one side of the inverter onto earth potential
- Lay control and power cable separately (about 10...20 cm apart); Lay crossings in a right angle



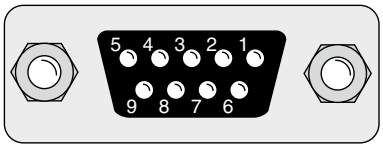
1.3.1.4Synchronisation line X2D

X2D Master/Slave Synchronization in parallel connection of two regenerative units.	No.	Function
	1	IGBT off, high
	2	IGBT off, low
	3	SLAVE active, high
	4	IGBT on, high
	5	IGBT on, low
	6	SLAVE active, low
	7	–
	8	–

If two regenerative units are switched parallelly they have to be connected via patch cable (Part No. 00F50C3-1010 1m).

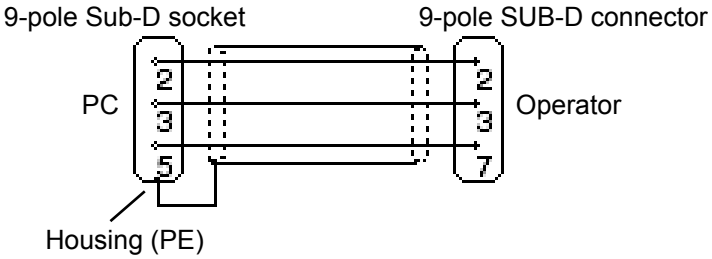
1.3.1.5HSP5 operator interface X4B

X4B

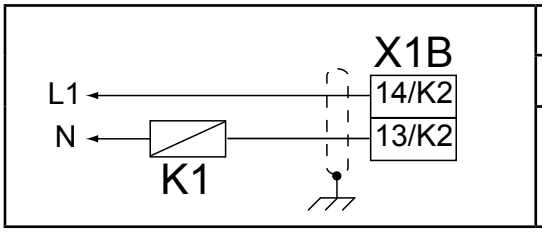


PIN	RS485	Signal	Meaning
1	-	-	reserved
2	-	TxD	Transmission signal RS232
3	-	RxD	Receive signal RS232
4	A‘	RxD-A	Receive signal A RS485
5	B‘	RxD-B	Receive signal B RS485
6	-	VP	Voltage supply +5 V (Imax=50 mA)
7	C/C‘	DGND	Data reference potential
8	A	TxD-A	Transmission signal A RS485
9	B	TxD-B	Transmission signal B RS485

RS 232 cable
Part number
00.58.025-001D
Length 3 m

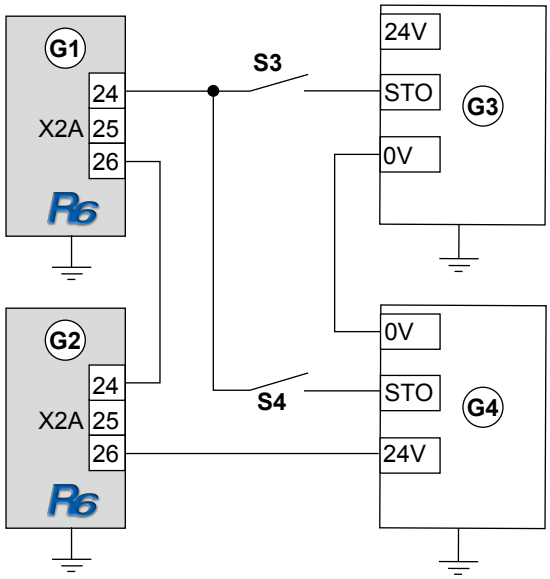


1.3.1.6Connection mains contactor X1B at R and P housing



K1	Mains contactor
X1B	Connection for mains contactor K1

1.3.1.7 Connection of the control release of the connected inverter



	A load draw in the DC circuit may be done only when the message „ready“ is set. This can be guaranteed by a series connection of the relay R1 of the R6 units with the control release of the connected converters.			
G1, G2	Regenerative unit COMBIVERT R6			
	X2A	Control terminal strip		
		24	Relay 1 / NO contact	Ready for operation relay
		25	Relay 1 / NC contact	
		26	Relay 1 / switching contact	
G3, G4	Frequency inverter			
	X2A	Control terminal strip		
		STO	Control release	General terminal assignment for frequency inverters
		24V	24V-output	
		0V	Mass	
S3, S4	Control release			

2. Operation

The fundamentals of the software configuration, as well as the operation of the unit are described in the present chapter.

2.1 Fundamentals

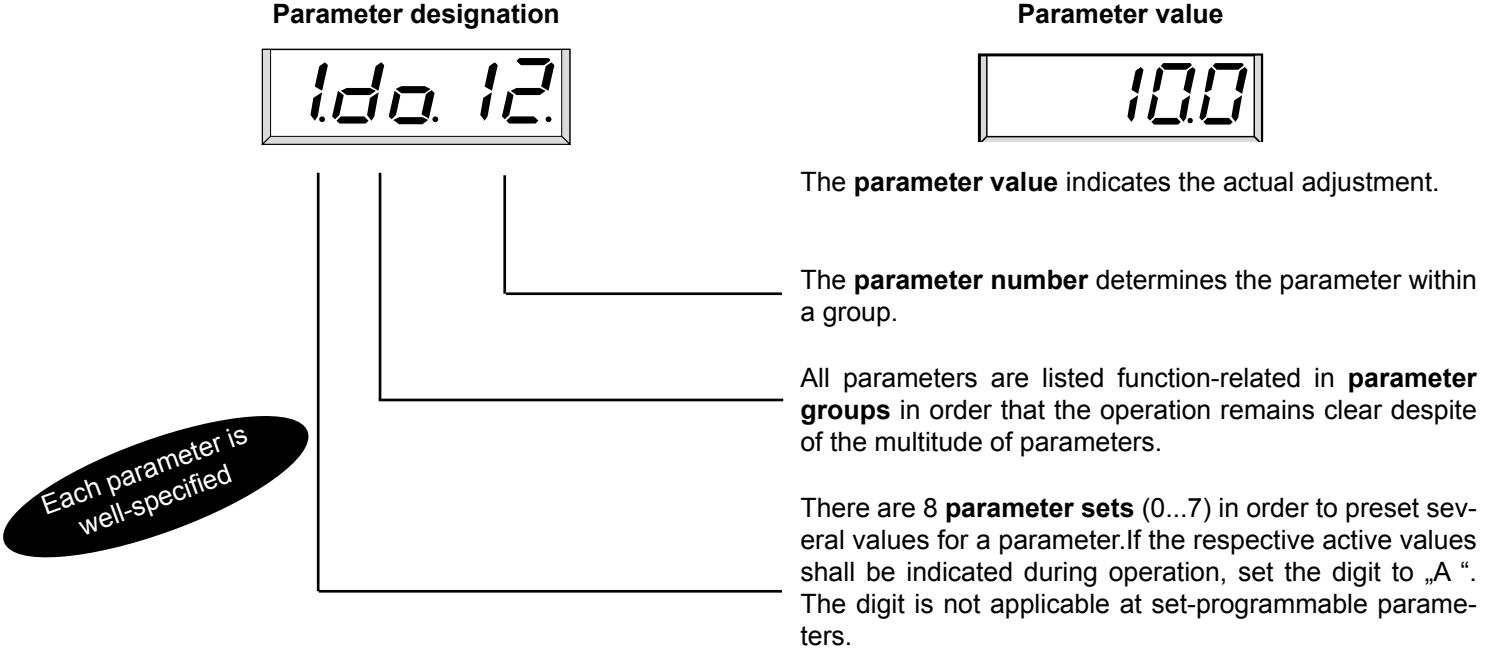
The control boards R6 contain the following operation modes:

Operation modes of the Control board	
Customer mode	**Application mode**
- is a freely definable list of parameters (CP-Parameters), which are necessary or important for the end user - delivered condition with a parameter list defined by KEB	- all parameters, parameter groups (exception: CP-Parameters) and parameter sets can be selected and changed if necessary - is generally activated only for application adaption

2.1.1 Parameter, parameter groups, parameter sets

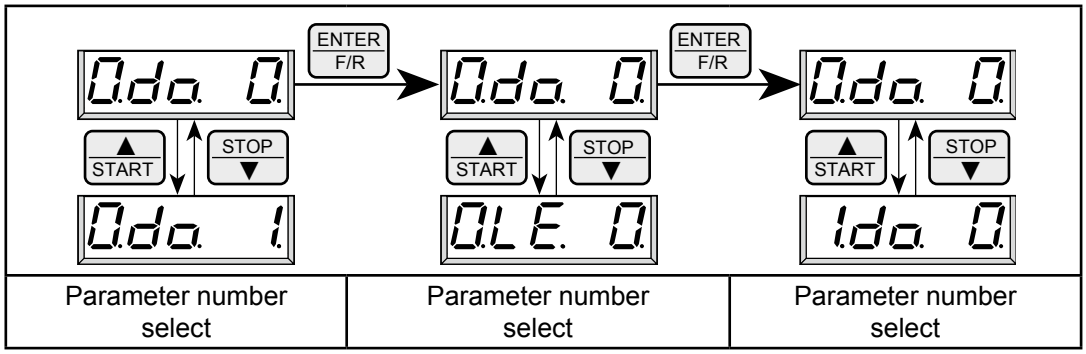
What are parameters, parameter groups and parameter sets?

Parameters are values changeable by the user in a program, which affect the program flow. A parameter consists of



2.1.2 Selection of a parameter

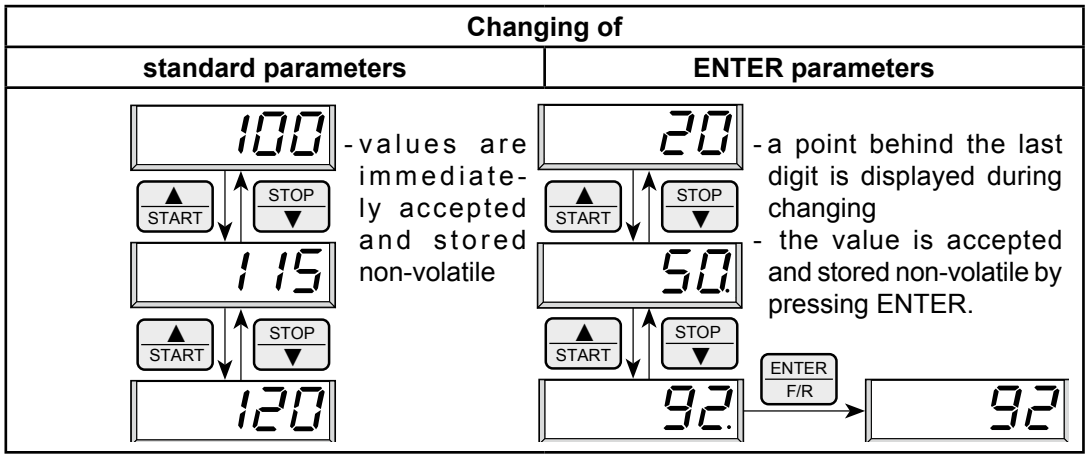
The flashing point displays the changeable digit. The flashing point is shifted by pressing the ENTER key.



For non-programmable parameters (see 4.1.5)
a parameter set number is not displayed

Changes between parameter value	FUNC SPEED	**and parameter designation.**

2.1.3 Adjustment of parameter value



The parameter values can only be changed, if the parameter set is not adjusted to „active parameter set“ (A)! (see 4.1.6)

2.1.4 ENTER-Parameter

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

2.1.5 Not set-programmable parameters

Certain parameters are not set-programmable, since their value must be the same in all sets (e.g. bus address or baud rate). The parameter set number is missing in the parameter identification in order that these parameters are immediately visible.
Always the same value is valid for all non set-programmable parameters independent of the selected parameter set!

2.1.6 Reset of error messages

If a malfunction occurs during operation, the actual display is overwritten by a blinking error message. The error message can be deleted by pressing the ENTER key, so the initial value is displayed again.
Attention! Resetting the error message with ENTER is not an error reset, i.e. the error status in the inverter is not reset. Thus it is possible to change adjustments before the error reset. An error reset is only possible by reset terminal or control release.

2.1.7 Resetting of peak values

There are parameters which display the peak values to draw conclusions from the operational performance of a drive. Peak value means 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.

2.1.8 Acknowledge of feedbacks

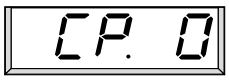
Some parameters send a feedback in order to monitor the proper operation. Par example, the display "PASS" indicates after copying a set, that the operation was completed error free. These feedbacks must be accepted with ENTER.

2.2 Password structure

The KEB COMBIVERT is equipped with an extensive password protection. With the individual passwords it is possible:

- to change the operating mode
- to set a write protection
- to activate the service mode

Dependent on the actual operation mode the password can be entered in the following parameters:

	if the CP mode is activated
	if the application mode is activated

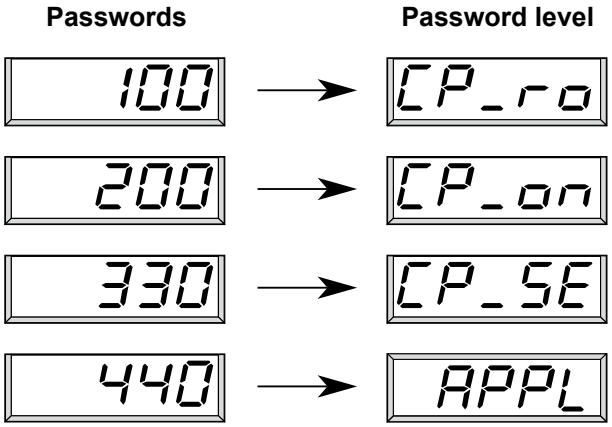
2.2.1 Password levels

The parameter value of the parameters above displays the actual password level. The following displays are possible:

	**CP - read only**	Only the Customer-parameter group is visible, exept for CP. 0 all parameters are in the read-only status (see chapter 4.3).
	**CP - on**	Only the customer parameter group is visible. All parameters can be changed.
	**CP service**	Like CP-on, however the parameter identification is displayed in accordance with its origin parameter (see chapter 4.3)
	**Application**	All application parameters are visible and can be changed. The CP-Parameters are not visible.

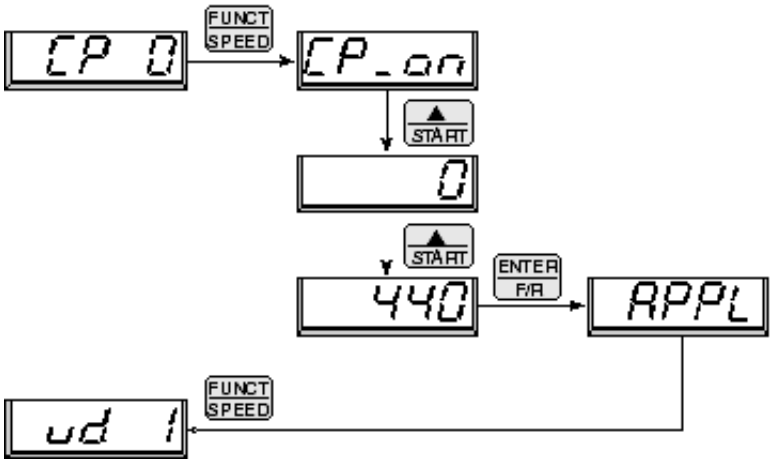
2.2.2 Passwords

It can be changed into the respective password level by selection of one of the following passwords:



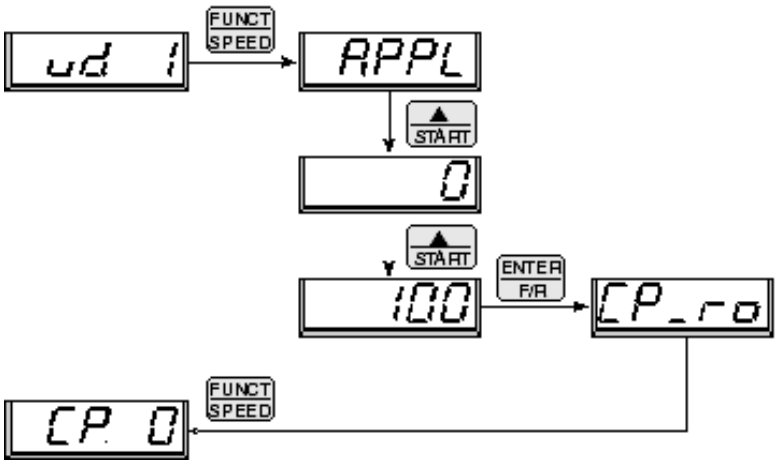
2.2.3 Changing of the password level

Example 1:
Change from CP mode into application mode



The entered password levels are generally stored non-volatile, except service password!

Example 2:
Change from application mode into CP read only mode



2.3 Network components

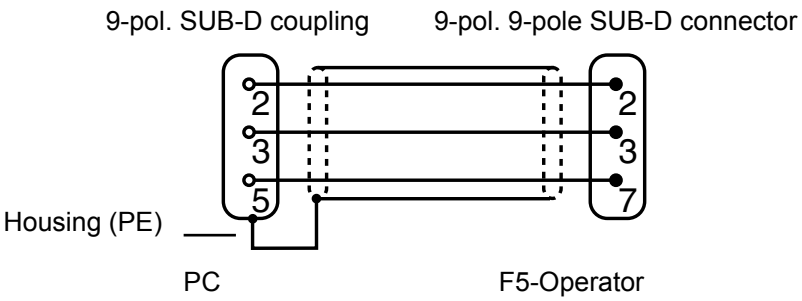
2.3.1 Available hardware

The KEB COMBIVERT can be easily integrated into different networks. For that purpose the inverter is fitted with an operator that is appropriate for the respective bus system. Following hardware components are available:

- **RS232-Cable PC/operator** **Part No.: 0058025-001D**
  for operation with interface operator
- **HSP5-Adaptor PC/control board** **Part No.: 00F50C0-0001**
  for operation without operator; RS232 => TTL
- **F5 Interface operator** **Part No.: 00F5060-2000**
  serial networks in RS232 or RS485 standard
- **F5 Profibus-DP operator** **Part No.: 00F5060-3000**
- **F5 InterBus operator** **Part No.: 00F5060-4000**
- **InterBus-Remote bus interface connection** **Part No.: 00B00BK-K001**
  (in connection with interface operator)
- **F5 CanOpen operator** **Part No.: 00F5060-5000**
- **F5 sercos operator** **Part No.: 00F5060-6000**

2.3.2 RS232-cable PC / operator 0058025-001D

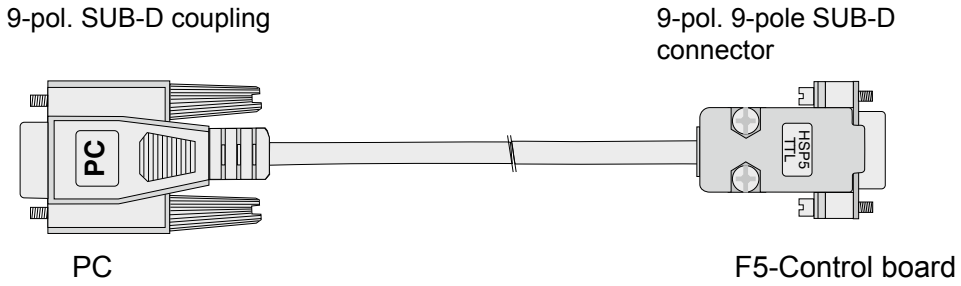
The cable of 3m length is used for the direct RS232-connection between PC (9-pole SUB-D-connector) and operator.



⚠	The RS232 cable is suitable exclusively for the communication between PC and operator. If the cable is plugged in directly onto the control board, it can lead to the destruction of the interface of the PC.

2.3.3 HSP5 cable PC / control board 00F50C0-0010

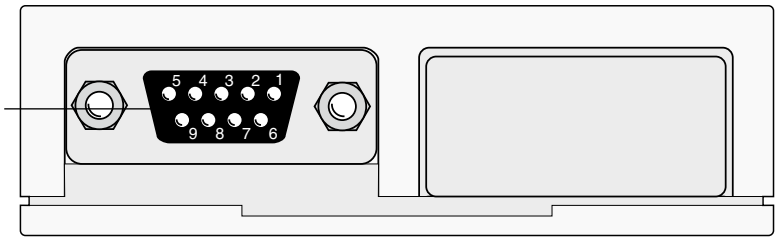
The HSP5-cable is used for the direct connection between PC and control board. The necessary conversion to TTL level occurs in the cable.



2.3.4 Interface operator F5 00F5060-2000

A potential-isolated RS232/RS484 interface is integrated in the interface operator (00.F5.060-2000). The telegram structure is compatible to protocol DIN 66019 and ANSI X3.28 as well as to protocol extension DIN 66019 II.

RS232/RS485



PIN	Signal	Meaning
1	–	reserved
2	TxD	Transmission signal/RS232
3	RxD	Receive signal/RS232
4	RxD-A (+)	Receive signal A/RS485
5	RxD-B (-)	Receive signal B/RS485
6	VP	Supply voltage -Plus +5V (Imax=10mA)
7	GND	Data reference potential; Mass for VP
8	TxD-A (+)	Transmission signal A/RS485
9	TxD-B (-)	Transmission signal B/RS485

2.3.5 Patch cable for parallel connection of regenerative units

The parallel connection of regenerative units is made with the patch cable (Part No.: 0090829-9902) between the X2D sockets.

3. Functions

3.1 Parameter summary

3.1.1 Parameter list R6-N

Legend

Parameter: Parameter group, number and name (sorted acc. to parameter group and number)
Addr.: Parameter address in hex
R: Password level rw => write and read, ro => only readable
P: p => set-programmable; np => not set-programmable
E: E => Enter parameter
Lower limit: Minimum value (standardized); the non-standardized value results by division by the resolution
Upper limit: Maximum value (standardized); the non-standardized value results by division by the resolution
Step: Step size, resolution
Default: Default value (standardized); the non-standardized value results by division by the resolution
LTK => the default value is dependent on the power circuit identification
Unit: Unit
Reference: further information to this parameter on specified page (not chapter)

Parameter		Addr.	R	P	E	Lower limit	Upper limit	Default	Step	Unit	See on page
An.31	ANOUT1 function	0A1Fh	rw	p	E	0	26	2	1	---	3.3-3, 3.3-4
An.32	ANOUT1 value	0A20h	rw	p	---	-100,0	100,0	0,0	0,1	%	3.3-3, 3.3-4, 3.3-6
An.33	ANOUT1 gain	0A21h	rw	p	---	-20,00	20,00	1,00	0,01	---	3.3-3, 3.3-5, 3.3-6
An.34	ANOUT1 offset X	0A22h	rw	p	---	-100,0	100,0	0,0	0,1	%	3.3-5, 3.3-6
An.35	ANOUT1 offset Y	0A23h	rw	p	---	-100,0	100,0	0,0	0,1	%	3.3-5
An.41	ANOUT3 function	0A29h	rw	np	E	0	26	12	1	---	3.3-3, 3.3-4, 3.7-3
An.42	ANOUT3 value	0A2Ah	rw	np	---	-100,0	100,0	0,0	0,1	%	3.3-6
An.43	ANOUT3 gain	0A2Bh	rw	np	---	-20,00	20,00	1,00	0,01	---	3.3-5
An.46	ANOUT3 period	0A2Eh	rw	np	E	1	240	1	1	s	3.3-3, 3.3-4, 3.4-13
An.47	ANOUT4 function	0A2Fh	rw	np	E	0	26	12	1	---	3.3-4
An.48	ANOUT4 value	0A30h	rw	np	---	-100,0	100,0	0,0	0,1	%	3.3-6
An.49	ANOUT4 gain	0A31h	rw	np	---	-20,00	20,00	1,00	0,01	---	3.3-5
An.52	ANOUT4 period	0A34h	rw	np	E	1	240	1	1	s	3.3-4, 3.4-13
cS.02	Regeneration level	0F02h	rw	np	---	100	120	103	1	%	3.2-6, 3.5-4, 4.2-4
cS.03	Mains frequency max. tolerance	0F03h	rw	np	---	0	5	5	1	%	3.6-7, 4.2-4, 5.1-3
cs.04	Switch off delay OSF	0F04h	rw	np	---	-10	+10	0	1	°	3.5-5
cS.06	puls off level	0F06h	rw	np	---	-10000	0	-8	1	kW	3.5-4, 4.2-4, 4.2-5
cS.07	Mains filter quality	0F07h	rw	np	E	1	8	1	1	---	3.5-5
cS.08	Kp commutation reactor	0F08h	rw	np	E	7	13	10	1	---	3.5-5
cS.09	Ki commutation reactor	0F09h	rw	np	E	5	11	8	1	---	3.5-5
cS.11	Kp harmonic filter	0F0Bh	rw	np	E	7	13	10	1	---	3.5-5
cS.12	Ki harmonic filter	0F0Ch	rw	np	E	5	11	8	1	---	3.5-5
cS.15	DT1 threshold	0F0Fh	rw	np	E	0	255	255	1	---	3.5-5
cS.17	Actual deviation E.net	0F11h	rw	np	E	10	100	50	1	---	3.5-5
di.00	PNP / NPN selection	0B00h	rw	np	E	0	1	0	1	---	3.4-2, 3.4-4, 7.1-3
di.01	Select signal source	0B01h	rw	np	E	0	4095	0	1	---	3.2-17, 3.2-18, 3.4-2, 3.4-3, 3.4-4, 3.4-5
di.02	digital input setting	0B02h	rw	np	E	0	4095	0	1	---	3.2-17, 3.2-18, 3.4-2, 3.4-4, 3.4-5
di. 03	digital noise filter	0B03h	rw	np	E	0	127	0	1	ms	3.4-2, 3.4-6
di.04	Invert. Digital inputs	0B04h	rw	np	E	0	4095	0	1	---	3.4-2, 3.4-6
di.05	Edge triggered flip-flop	0B05h	rw	np	E	0	4095	0	1	---	3.4-2, 3.4-6
di.06	select strobe source	0B06h	rw	np	E	0	4095	0	1	---	3.4-2, 3.4-6, 3.4-7
di.07	Strobe mode	0B07h	rw	np	E	0	2	0	1	---	3.4-2, 3.4-6, 3.4-7, 3.4-8
di.08	input strobe dependence	0B08h	rw	np	E	0	4095	0	1	---	3.4-2, 3.4-6, 3.4-7
di. 09	reset input selection	0B09h	rw	np	E	0	4095	3	1	---	3.4-2, 3.4-8, 3.4-9
di.10	reset input slope sel.	0B0Ah	rw	np	E	0	4095	3	1	---	3.4-2, 3.4-8
di.11	I1 functions	0B0Bh	rw	np	E	-2^31	2^31-1	1	1	hex	3.4-3,3.4-8,3.4-9,3.4-10
di.22	ST functions	0B16h	rw	np	E	-2^31	2^31-1	128	1	hex	3.4-8, 3.4-9, 3.4-10
di.24	I1 + function	0B18h	rw	np	E	0	6	0	1	---	3.4-8, 3.4-9
di.35	ST + function	0B23h	rw	np	E	0	6	0	1	---	3.4-8, 3.4-9
di.36	Software ST input sel.	0B24h	rw	np	E	0	4095	0	1	---	3.4-9, 3.4-10
di.37	Locking ST input selection	0B25h	rw	np	E	0	4095	0	1	---	3.4-9, 3.4-10
di.38	set deactivation delay ST	0B26h	rw	np	---	0,0	10,0	0,0	0,1	s	3.4-9, 3.4-10
do.00	Condition 0	0C00h	rw	p	E	0	92	20	1	---	3.2-8, 3.4-2, 3.4-12, 3.4-13, 3.4-14
do.01	Condition 1	0C01h	rw	p	E	0	92	3	1	---	3.4-15

continued on the next page

Parameter		Addr.	R	P	E	Lower limit	Upper limit	Default	Step	Unit	See on page
do.02	Condition 2	0C02h	rw	p	E	0	92	3	1	---	
do.03	Condition 3	0C03h	rw	p	E	0	92	0	1	---	
do.04	Condition 4	0C04h	rw	p	E	0	92	0	1	---	
do.05	Condition 5	0C05h	rw	p	E	0	92	0	1	---	
do.06	Condition 6	0C06h	rw	p	E	0	92	0	1	---	
do.07	Condition 7	0C07h	rw	p	E	0	92	0	1	---	3.2-8, 3.4-2, 3.4-12, 3.4-13, 3.4-14
do.08	invert. Cond. select. for flag 0	0C08h	rw	p	E	0	255	0	1	---	3.4-2, 3.4-12, 3.4-15
do.09	invert. Cond. select. for flag 1	0C09h	rw	p	E	0	255	0	1	---	3.4-15
do.11	invert. Cond. select. for flag 3	0C0Bh	rw	p	E	0	255	0	1	---	
do.15	invert. Cond. select. for flag 7	0C0Fh	rw	p	E	0	255	0	1	---	3.4-2, 3.4-12, 3.4-15
do.16	Cond. select. for flag 0	0C10h	rw	p	E	0	255	1	1	---	3.4-2, 3.4-12, 3.4-15
do.19	Cond. select. for flag 3	0C13h	rw	p	E	0	255	1	1	---	
do.23	Cond. select. for flag 7	0C17h	rw	p	E	0	255	128	1	---	3.4-2, 3.4-12, 3.4-15
do.24	AND/OR conn. for flags	0C18h	rw	p	E	0	255	0	1	---	3.4-2, 3.4-12, 3.4-15, 3.4-16
do.25	inv. flags for O1	0C19h	rw	p	E	0	255	0	1	---	3.4-2, 3.4-12, 3.4-16
do.28	inv. flags for R2	0C1Ch	rw	p	E	0	255	0	1	---	3.4-3
do.32	inv. flags for OD	0C20h	rw	p	E	0	255	0	1	---	3.4-2, 3.4-16
do.33	flag select. for O1	0C21h	rw	p	E	0	255	1	1	---	3.4-2, 3.4-12, 3.4-17
do.36	flag select. for R2	0C24h	rw	p	E	0	255	8	1	---	3.4-3
do.40	flag select. for OD	0C28h	rw	p	E	0	255	128	1	---	3.4-2, 3.4-16, 3.4-17
do.41	AND conn. for outputs	0C29h	rw	p	E	0	255	0	1	---	3.4-2, 3.4-12, 3.4-17
do.42	inverted outputs	0C2Ah	rw	p	E	0	255	0	1	---	3.4-12, 3.4-17
do.43	SB0 filter time	0C2Bh	rw	p	---	0	1000	0	1	ms	3.4-2, 3.4-12
do.44	SB1 filter time	0C2Ch	rw	p	---	0	1000	0	1	ms	3.4-2, 3.4-12,
do.51	hardw. output allocation	0C33h	rw	p	E	0	255	228	1	---	3.2-11, 3.2-17, 3.4-2, 3.4-12, 3.4-18
Fr.01	Parameter set copy funct.	0901h	rw	p	E	-9	7	0	1	---	3.7-2, 3.7-3, 3.7-4, 3.7-5
Fr.02	Parameter set source	0902h	rw	np	E	0	5	0	1	---	3.2-19, 3.7-3, 3.7-6, 3.7-8, 3.7-9
Fr.03	Parameter set lock	0903h	rw	np	E	0	255	0	1	---	3.6-6, 3.7-6, 3.7-9
Fr.04	Parameter set setting	0904h	rw	np	E	0	7	0	1	---	3.7-6, 3.7-7
Fr.05	set activation delay	0905h	rw	p	---	0,00	32,00	0,00	0,01	s	3.7-2, 3.7-10
Fr.06	set deactivation delay	0906h	rw	p	---	0,00	32,00	0,00	0,01	s	3.7-2, 3.7-10
Fr.07	Paraset input sel.	0907h	rw	np	E	0	4095	0	1	---	3.4-9, 3.7-7, 3.7-8
Fr.09	Bus parameter set	0909h	rw	np	---	-1: act set	7	0	1	---	3.7-2, 3.7-3, 3.7-5, 3.9-4
Fr.11	Reset>set 0 input sel.	090Bh	rw	np	E	0	4095	0	1	---	3.4-9, 3.7-9
In.00	Inverter type	0E00h	ro	np	---	0	65535	0	1	hex	3.2-12
In.01	DC rated current	0E01h	ro	np	---	0,0	6553,5	0,0	0,1	A	3.2-12
In.06	Software version	0E06h	ro	np	---	SW	SW	SW	0,01	---	3.2-12
In.07	Software date	0E07h	ro	np	---	SW	SW	SW	0,1	---	3.2-12
In.10	Serial no. (date)	0E0Ah	ro	np	---	0	65535	0	1	---	3.2-13, 3.7-3
In. 11	Serial no. (count)	0E0Bh	ro	np	---	0	65535	0	1	---	3.2-13
In.12	serial no.(AB-no.high)	0E0Ch	ro	np	---	0	65535	0	1	---	3.2-13
In.13	serial no.(AB-no.low)	0E0Dh	ro	np	---	0	65535	0	1	---	3.2-13
In.14	customer no. high	0E0Eh	ro	np	---	0	65535	0	1	---	3.2-13
In.15	customer no. low	0E0Fh	ro	np	---	0	65535	0	1	---	3.2-13
In.16	QS no.	0E10h	ro	np	---	0	65535	0	1	---	3.2-13
In.22	User parameter 1	0E16h	rw	np	---	0	65535	0	1	---	3.2-13
In.23	User parameter 2	0E17h	rw	np	---	0	65535	0	1	---	3.2-13
In. 24	Last error	0E18h	ro	p	E	0	255	0	1	---	3.2-13, 3.7-3
In. 25	Error Diagnosis	0E19h	ro	p	---	0	65535	0	1	hex	3.2-14
In.26	E.OC error counter	0E1Ah	ro	np	---	0	65535	0	1	---	3.2-15
In.27	E.OL error counter	0E1Bh	ro	np	---	0	65535	0	1	---	3.2-15
In.28	E.OP error counter	0E1Ch	ro	np	---	0	65535	0	1	---	3.2-15
In. 29	E.OH error counter	0E1Dh	ro	np	---	0	65535	0	1	---	3.2-15
In.30	E.OHI error counter	0E1Eh	ro	np	---	0	65535	0	1	---	3.2-15
LE.00	comparison level 0	0D00h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	3.4-14, 3.8-3, 3.8-6, 3.9-6
LE.01	comparison level 1	0D01h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	
LE.02	comparison level 2	0D02h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	
LE.03	comparison level 3	0D03h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	
LE.04	comparison level 4	0D04h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	
LE.05	comparison level 5	0D05h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	
LE.06	comparison level 6	0D06h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	
LE.07	comparison level 7	0D07h	rw	p	---	-10737418,24	10737418,23	0,00	0.01	---	3.4-14, 3.8-6
LE.08	hysteresis 0	0D08h	rw	p	---	0,00	300,00	0,00	0.01	---	3.4-15
LE.09	hysteresis 1	0D09h	rw	p	---	0,00	300,00	0,00	0.01	---	3.4-15

continued on the next page

Parameter		Addr.	R	P	E	Lower limit	Upper limit	Default	Step	Unit	See on page
LE.15	hysteresis 7	0D0Fh	rw	p	---	0,00	300,00	0,00	0.01	---	3.4-14, 3.4-15
LE.17	timer 1 start inp. sel.	0D11h	rw	np	E	0	4095	0	1	---	3.2-10, 3.4-9, 3.7-3, 3.8-3, 3.8-4, 3.8-5
LE.18	timer 1 start condition	0D12h	rw	np	E	0	15	0	1	---	3.8-3, 3.8-4
LE.19	timer 1 start inp. sel.	0D13h	rw	np	E	0	4095	0	1	---	3.4-9, 3.8-3, 3.8-5
LE.20	timer 1 reset condition	0D14h	rw	np	E	0	31	16	1	---	3.8-3, 3.8-6
LE.21	timer 1 mode	0D15h	rw	np	---	0	63	0	1	---	3.2-10, 3.8-3, 3.8-4, 3.8-5
LE.22	timer 2 start inp. sel.	0D16h	rw	np	E	0	4095	0	1	---	3.2-10, 3.4-9, 3.8-3, 3.8-4, 3.8-5
LE.23	timer 2 start condition	0D17h	rw	np	E	0	15	0	1	---	3.8-3, 3.8-4
LE.24	timer 2 start inp. sel.	0D18h	rw	np	E	0	4095	0	1	---	3.4-9, 3.8-3, 3.8-5
LE.25	timer 2 reset condition	0D19h	rw	np	E	0	31	16	1	---	3.8-3, 3.8-6
LE.26	timer 2 mode	0D1Ah	rw	np	---	0	63	0	1	---	3.2-10, 3.8-3, 3.8-4
Pn.00	Auto retry E.OC E. UP	0400h	rw	np	---	0: off	1: on	1: on	1	---	3.6-9, 3.7-3
Pn.02	Auto retry E.OC E. OC	0402h	rw	np	---	0: off	1: on	0: off	1	---	3.6-10
Pn.03	E.EF stopping mode	0403h	rw	np	---	0	6	0	1	---	3.6-6, 3.6-7, 3.6-8, 3.6-10
Pn.04	ext. fault input select	0404h	rw	np	E	0	4095	64	1	---	3.4-9, 3.6-6
Pn.05	Watchdog reaction	0405h	rw	np	---	0	6	6	1	---	3.6-3, 3.6-6, 3.6-7, 3.6-8, 3.6-10
Pn.06	Watchdog time	0406h	rw	np	E	0,00: off	60,00	0,00: off	0,01	s	3.6-6
Pn.08	Warning OL stop. mode	0408h	rw	np	---	0	6	6	1	---	3.4-13, 3.6-5, 3.6-8, 3.6-10
Pn.09	OL warning level	0409h	rw	np	---	0	100	80	1	%	3.4-13, 3.6-5, 3.6-10
Pn.10	warning OH stop. mode	040Ah	rw	np	---	0	6	6	1	---	3.4-13, 3.6-3, 3.6-5, 3.6-8, 3.6-10
Pn.11	OH warning level	040Bh	rw	np	---	0	variable	70	1	Degree	3.4-13, 3.6-3, 3.6-5, 3.6-10
pn.14	disconnecting time E.nEt	040Eh	rw	np	---	0,00	10,00	0,00	0,01	s	3.6-8, 3.6-10, 5.1-3
Pn.15	General fault reset	040Fh	rw	np	---	0	10	3	1	---	3.6-2, 3.6-9
pn.16	Int. warning OH stop. mode	0410h	rw	np	---	0	6	0	1	---	3.6-5, 3.6-8, 3.6-9, 3.6-10
Pn.17	Int. warning OH switch off time	0411h	rw	np	---	0	300	0	1	s	3.6-5
pn.18	E.Set stopping mode	0412h	rw	np	---	0	6	0	1	---	3.6-6, 3.6-7, 3.6-8, 3.7-9
Pn.19	Operating mode	0413h	rw	np	E	0	5	0	1	---	3.4-3, 3.5-3, 3.6-10, 4.2-3, 4.2-4, 4.2-5
Pn.30	Fadeout of status- / error messages	0420h	rw	np	E	0	3	0	1	---	3.6.5-10
Pn.31	Input selection Master/Slave	041F	rw	np	---	0	112	0	1	---	
ru.00	Inverter state	0200h	ro	np	---	0	255	0	1	---	3.2-5, 3.6-3
ru.01	Type	0201h	ro	np	---	0	6	0	1	---	3.2-1, 3.2-4
ru.03	Actual mains frequency	0203h	ro	np	---	-320,00	320,00	0,00	0,01	Hz	3.2-5, 3.3-3, 3.3-4, 3.9-6, 4.2-4
ru.08	AC-Phase current L1	0208h	ro	np	---	0,0	6553,5	0,0	0,1	A	3.2-5
ru.09	AC-Phase current L2	0209h	ro	np	---	0,0	6553,5	0,0	0,1	A	3.2-5
ru.10	AC-Phase current L3	020Ah	ro	np	---	0,0	6553,5	0,0	0,1	A	3.2-5
ru.11	Input voltage	020Bh	ro	np	---	0	1000	0	1	V	3.2-5
ru.13	Act. DC utilization	020Dh	ro	np	---	0	255	0	1	%	3.2-6
ru.14	Actual DC utilisation / peak value	020Eh	rw	np	---	0	255	0	1	%	3.2-6
ru.15	DC current	020Fh	ro	np	---	0,0	6553,5	0	0,1	A	3.2-6, 3.3-3, 3.3-4
ru.16	DC output current / peak value	0210h	rw	np	---	0,0	6553,5	0	0,1	A	3.2-6
ru.17	AC current	0211h	ro	np	---	-3276,7	3276,7	0	0,1	A	3.2-6, 3.3-3, 3.3-4
ru.18	DC voltage / reference value	0212h	ro	np	---	0	1000	0	1	V	3.2-6, 3.3-3, 3.3-4, 3.5-4, 4.2-4
ru.19	DC output voltage	0213h	ro	np	---	0	1000	0	1	V	3.2-6, 3.2-7
ru.20	peak DC voltage	0214h	rw	np	---	0	778	0	1	V	3.2-7
ru.21	Input terminal state	0215h	ro	np	---	0	4095	0	1	---	3.2-7, 3.4-2, 3.4-3, 3.4-5
ru.22	Internal input state	0216h	ro	np	---	0	4095	0	1	---	3.2-7, 3.2-18, 3.4-2, 3.4-3, 3.4-5, 3.4-14
ru.23	Output condition state	0217h	ro	np	---	0	255	0	1	---	3.2-8, 3.4-11, 3.4-12
ru.24	State of output flags	0218h	ro	np	---	0	255	0	1	---	3.2-8, 3.4-11, 3.4-12
ru.25	Output terminal state	0219h	ro	np	---	0	255	0	1	---	3.2-9, 3.2-18, 3.4-2, 3.4-11, 3.4-12, 3.4-18, 7.1-4
ru.26	Active parameter set	021Ah	ro	np	---	0	7	0	1	---	3.2-9
ru.33	ANOUT1 pre ampl. disp.	0221h	ro	np	---	-400,0	400,0	0	0,1	%	3.2-9, 3.3-2, 3.3-4
ru.34	ANOUT1 post ampl. disp.	0222h	ro	np	---	-100,0	100,0	0	0,1	%	3.2-9, 3.3-4, 3.4-14
ru.38	Power module temperature	0226h	ro	np	---	0	100	0	1	Degree	3.2-9, 3.3-3, 3.3-4, 3.4-13
ru.39	OL counter display	0227h	ro	np	---	0	100	0	1	%	3.2-10, 3.4-13, 3.6-5
ru.40	Power on counter	0228h	rw	np	---	0	65535	0	1	h	3.2-10, 3.7-3
ru.41	modulation on counter	0229h	rw	np	---	0	65535	0	1	h	3.2-10
ru.43	Timer 1 display	022Bh	rw	np	---	0	655,35	0	0,01	---	3.2-10, 3.4-13, 3.8-3, 3.8-5
ru.44	Timer 2 display	022Ch	rw	np	---	0	655,35	0	0,01	---	3.2-10, 3.4-13, 3.8-3, 3.8-5
ru.68	rated DC voltage	0244h	ro	np	---	0	1000	0	1	V	3.2-10

continued on the next page

Parameter		Addr.	R	P	E	Lower limit	Upper limit	Default	Step	Unit	See on page
ru.80	Digital output state	0250h	ro	np	---	0	255	0	1	---	3.2-11, 3.2-17, 3.4-2, 3.4-11, 3.4-12, 3.4-18
ru.81	Actual power	0251h	ro	np	---	-3200,00	3200,00	0,00	0,01	kW	3.2-11, 3.3-3, 3.3-4, 3.4-14, 4.2-4, 4.2-5
ru.82	Total regen	0252h	rw	np	---	0	2147483647	0	1	KWh	3.2-11
ru.83	Total motor	0253h	rw	np	---	0	2147483647	0	1	KWh	3.2-11
ru.84	Total net	0254h	rw	np	---	0	2147483647	0	1	KWh	3.2-11
ru.85	actual net	0255h	ro	np	---	0,00	655,35	0	0,01	kVA	3.2-11
SY.02	Inverter identifier	0002h	cp-ro	np	---	identifier	identifier	identifier	1	hex	3.2-16, 3.7-3
SY.03	Power unit code	0003h	cp-ro	np	E	0	32767	0	1	---	3.2-16, 3.6-7, 5.1-5
SY.06	Inverter address	0006h	rw	np	E	0	239	1	1	---	3.2-16, 7.1-4
SY.07	baud Rate ext. bus / PC	0007h	rw	np	E	0	6	3	1	---	3.2-16
Sy.09	HSP5 watchdog time	0009h	cp-ro	np	E	0,00: off	10,00	0,00: off	0,01	s	3.2-16, 3.6-6
SY.11	Baud rate int. bus	000Bh	cp-ro	np	E	0	10	5	1	---	3.2-17
SY.32	Scope timer	0020h	ro	np	---	0	65535	0	1	---	3.2-17
SY.41	control word (high)	0029h	rw	np	E	0	65535	0	1	hex	3.2-17, 3.2-18
SY.42	status word (high)	002Ah	ro	np	---	0	65535	0	1	hex	3.2-17, 3.2-18, 3.2-19
SY.43	control word (long)	002Bh	rw	np	E	-2^31	2^31 - 1	0	1	hex	3.2-17, 3.2-18, 3.7-6
SY.44	status word (long)	002Ch	ro	np	---	-2^31	2^31 - 1	0	1	hex	3.2-17, 3.2-18, 3.2-19
SY.50	control word (low)	0032h	rw	np	E	0	65535	0	1	hex	3.2-17, 3.2-18, 3.2-19, 3.7-6,
Sy. 51	status word (low)	0033h	ro	np	---	0	65535	0	1	hex	3.2-17, 3.2-18, 3.2-19
Sy.56	Start display address	0038h	rw	np	E	0	7FFFH	0200H	1	hex	3.2-20
ud.01	Password input	0801h	cp-ro	np	o.P.	0	9999	APPLICA-TION	1	---	3.7-3, 4.2-34
ud.15	CP selector	080Fh	rw	np	E	1	36	1	1	---	3.9-3, 3.9-4, 3.9-6
ud.16	cp address	0810h	rw	np	E	-1: off	7FFFH	CP-def.	1	hex	3.9-3, 3.9-4, 3.9-6
ud.17	cp set norm	0811h	rw	np	E	1	8191	1	1	---	3.9-3, 3.9-4, 3.9-6
ud.18	divisor display norm	0812h	rw	p	E	-32767	32767	1	1	---	3.9-5, 3.9-7, 3.9-9
ud.19	multiplier display norm	0813h	rw	p	E	-32767	32767	1	1	---	3.9-7, 3.9-9
ud.20	offset display norm	0814h	rw	p	E	-32767	32767	0	1	---	3.9-7, 3.9-9
ud.21	ctrl. display norm	0815h	rw	p	E	0	1791	0	1	---	3.9-7, 3.9-8

3.2 Operating and appliance data

The parameter groups „ru“, „In“ and „SY“ are described in this chapter. They serve for operational monitoring, error analysis and evaluation as well as for unit identification.

3.2.1 Overview of the ru-Parameters

The ru parameter group displays the multimeter of the inverter. Here voltages, currents etc. are displayed, with those a statement about the actual operating condition of the inverter can be made. Especially during the start-up or error search at the unit this can be a great help. Following parameters are available:

ru.	00	Inverter state
ru.	01	Actual operation mode
ru.	03	Actual line frequency
ru.	08	AC-Phase current L1
ru.	09	AC-Phase current L2
ru.	10	AC-Phase current L3
ru.	11	Input voltage
ru.	13	Act. DC utilization
ru.	14	Peak DC utilization
ru.	15	DC current
ru.	16	DC output current / peak value
ru.	17	AC current
ru.	18	DC voltage / reference value
ru.	19	DC output voltage
ru.	20	DC output voltage / peak value
ru.	21	Input terminal state
ru.	22	Internal input state
ru.	23	Output condition state
ru.	24	State of output flags
ru.	25	Output terminal state
ru.	26	Active parameter set
ru.	33	Analog output 1 display before amplification
ru.	34	Analog output 1 display after amplification
ru.	38	Power module temperature
ru.	39	OL counter display
ru.	40	Power on counter
ru.	41	Modulation on counter
ru.	43	Timer 1 display
ru.	44	Timer 2 display
ru.	68	Rated DC voltage
ru.	80	Digital output state
ru.	81	Actual power
ru.	82	Total regen
ru.	83	Total motor
ru.	84	Total net
ru.	85	Actual net

3.2.2 Overview of the In-Parameters

In parameter groups contain data and information for the identification of the hardware and software as well as for the type and number of occurred errors. Following parameters are available:

In.	00	Inverter type
In.	01	DC rated current
In.	06	Software version
In.	07	Software date
In.	10	Serial no. (date)
In.	11	Serial no. (count)
In.	12	serial no.(AB-no.high)
In.	13	serial no.(AB-no.low)
In.	14	Customer no. high
In.	15	Customer no. low
In.	16	QS no.
In.	22	User parameter 1
In.	23	User parameter 2
In.	24	Last error
In.	25	Error Diagnosis
In.	26	E.OC error counter
In.	27	E.OL error counter
In.	28	E.OP error counter
In.	29	E.OH error counter
In.	30	E.OHI error counter

3.2.3 Overview of the Sy-Parameters

The Sy parameter group contains system-specific parameters. Following parameters are available:

SY.	02	Înverter identifier
SY.	03	Power unit code
SY.	06	Inverter address
SY.	07	Baud rate ext. bus / PC
SY.	09	HSP5 watchdog time
SY.	11	Baud rate int. bus
SY.	32	Scope timer
SY.	41	Control word high
SY.	42	Status word high
SY.	43	Control word long
SY.	44	Status word long
SY.	50	Control word low
SY.	51	Status word low
SY.	56	Start display address

3.2.4 Description of the ru-Parameters

Legend:

Addr.	=	Address			
PG	=	programmable	→	+	= programmable
				-	= non-programmable
E	=	Enter	→	+	= yes
				-	= no
R	=	Rights	→	ro	= read-only
				rw	= reading and writing
				KB	= Keyboard
Min. value	=	Min. value			
Max. value	=	Max. value			
Res.	=	Resolution			
Default	=	Default value			
[?]	=	Unit			

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.00	Inverter state	0200h	ro	-	-	0	255	1	-	0
The inverter state displays the actual operating condition of the regenerative unit. The actual error message is displayed in error case, even if the display is already reset by ENTER (error LED in the operator is still flashing). Status messages and information about the cause and removal are described in chapter 5 „Error diagnosis“.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.01	Actual operation mode	0201h	ro	-	-	0	6	1	-	0
This parameter indicates the set operating mode of Pn.19 and Pn.31.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.03	Actual line frequency	0203h	ro	-	-	-320,00	320,00	0,01	Hz	-
After switching on the actual line frequency is determined during the initialization phase. Slowly changes of the line frequency during the operation are recognized and displayed in ru.03. If the COMBIVERT R6-S is in „netof“, ru.03 displays the actual regenerative frequency. Positive values mean a clockwise rotating field and negative values an anti-clockwise rotating field.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.08	AC-Phase current L1	0208h	ro	-	-	0,0	6553,5	0,1	A	0,0
ru.09	AC-Phase current L2	0209h								
ru.10	AC-Phase current L3	020Ah								
Display of the actual input current of the respective phase.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.11	Input voltage	020Bh	ro	-	-	0	1000	1	V	-
Display of the actual mains voltage										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.13	Act. DC utilization	020Dh	ro	-	-	0	255	1	%	-
Display of the actual utilization referring to the rated current of the regenerative unit, depending on the operating mode (power supply or regenerative operation). Only positive values are displayed, whereby a differentiation between supply and regeneration is not possible.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.14	Actual DC utilisation / peak value	020Eh	rw	-	-	0	255	1	%	-
ru.14 permits the detection of short-time peak loads within an operating cycle. For that the highest value of ru.13 is stored in ru.14. The peak value memory can be cleared by pressing the UP, DOWN or ENTER key or via bus by writing any value you like to the address of ru.14. Switching off COMBIVERT also clears the memory.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.15	DC current	020Fh	ro	-	-	0,0	6553,5	0,1	A	-
Display of the actual DC output current in ampere.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.16	DC output current / peak value	0210h	rw	-	-	0,0	6553,5	0,1	A	-
ru.16 permits the detection of short-time peak loads within an operating cycle. For that the highest value of ru.15 is stored in ru.16. The peak value memory can be cleared by pressing the UP, DOWN or ENTER key or via bus by writing any value you like to the address of ru.16. Switching off COMBIVERT also clears the memory.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.17	AC current	0211h	ro	-	-	-3276,7	3276,7	0,1	A	-
Display of the actual input current.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.18	ref. DC voltage	212h	ro	-	-	0	1000	1	V	-
The DC voltage is measured at switching on and stored as reference value. The regenerative level (cS.02) refers proportionally to this reference value and follows to the mains voltage.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.19	DC output voltage	0213h	ro	-	-	0	1000	1	V	-
Display of the actual DC output voltage. The value is measured at the DC output terminals of the COMBIVERT R6.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.20	DC output voltage / peak value	0214h	rw	-	-	0	778	1	V	-

Parameter ru.20 enables to recognize voltage peaks within an operating cycle. For that the highest value of ru.19 is stored in ru.20. The peak value memory can be cleared by pressing the UP, or DOWN key or via bus by writing any value you like to the address of ru.20. Switching off COMBIVERT R6 also clears the memory.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.21	Input terminal state	0215h	ro	-	-	0	4095	1	-	-

Display of the digital inputs controlled currently. The logic levels are indicated at the input terminals or at the internal inputs regardless of the following logic operations (see chapter 7.3 „Digital inputs“). According to following table a specific decimal value is given out for each digital input. If several inputs are controlled, the sum of the decimal values is indicated.

Bit	Decimal value	Input	Terminal
0	1	ST (prog. input „control release/reset“)	X2A.12
1	2	RST (prog. input „reset“)	no
2	4	F (prog. input)	no
3	8	R (prog. input)	no
4	16	I1 (prog. input 1)	X2A.13
5	32	I2 prog. input 2)	X2A.14
6	64	I3 (prog. input 3)	X2A.15
7	128	I4 (prog. input 4)	X2A.16
8	256	IA (internal input A)	no
9	512	IB (internal input B)	no
10	1024	IC (internal input C)	no
11	2048	ID (internal input D)	no

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.22	Internal input state	0216h	ro	-	-	0	4095	1	-	-

Display of the digital external and internal inputs set currently. The input is only regarded as set if it is available as effective signal to the further processing (i.e. accepted through strobe, edge-triggering or logic operation). According to table like ru.21 a specific decimal value is output for each digital input. If several inputs are controlled, the sum of the decimal values (see ru.21) is indicated (also see chapt. 3.4 „Digital inputs“).

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.23	Output condition state	0217h	ro	-	-	0	255	1	-	-

With parameters do 00...do.07 switching conditions can be selected, that serve as base for setting the outputs. This parameter indicates which of the selected switching conditions are met before they are linked or inverted by programmable logic (also see Chapt. 7.3. „Digital outputs“). According to following table a specific decimal value is given out for the switching conditions. If several of the selected switching conditions are met, the sum of the decimal values is indicated.

Bit	Decimal value	Output
0	1	switching condition 0 (do.0)
1	2	Switching condition 1 (do.1)
2	4	Switching condition 2 (do.2)
3	8	Switching condition 3 (do.3)
4	16	Switching condition 4 (do.4)
5	32	Switching condition 5 (do.5)
6	64	Switching condition 6 (do.6)
7	128	Switching condition 7 (do.7)

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.24	State of output flags	0218h	ro	-	-	0	255	1	-	-

Display of the output flags after logic step 1. The selected switching conditions are linked in logic step 1 (do.8...24) and indicated here (see chapt. 7.3 „Digital outputs“). According to following table a specific decimal value is given out for any output flags. If several output flags are set, the sum of the decimal values is indicated.

Bit	Decimal value	Output
0	1	Flag 0
1	2	Flag 1
2	4	Flag 2
3	8	Flag 3
4	16	Flag 4
5	32	Flag 5
6	64	Flag 6
7	128	Flag 7

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.25	Output terminal state	0219h	ro	-	-	0	255	1	-	-

Display of the currently set external and internal digital outputs. According to following table a specific decimal value is output for each digital output. If several outputs are set, the sum of the decimal values is displayed.

Bit	Decimal value	Output	Terminal
0	1	O1 (transistor output 1)	X2A.19
1	2	O2 (transistor output 2)	X2A.20
2	4	R1 (relay RLA,RLB,RLC)	X2A.24...26
3	8	R2 (relay FLA,FLB,FLC)	X2A.27...29
4	16	OA (internal output A)	no
5	32	OB (internal output B)	no
6	64	OC (internal output C)	no
7	128	OD (internal output D)	no

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.26	Active parameter set	021Ah	ro	-	-	0	7	1	-	-

The KEB COMBIVERT can have access to 8 parameter sets (0-7). Through programming the inverter can change parameter sets autonomously and can thus start different modes of operation. This parameter displays the actual parameter set. Independent of it another parameter set can be edited by bus (also see chapter 3.7).

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.33	ANOUT1 / pre ampl. disp.	0221h	ro	-	-	-400	400	0,1	%	-

This parameter displays the value of the analog signal ANOUT1 in percent before passing the characteristic amplifier (also see 3.3 „Analog outputs“).

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.34	ANOUT1 / post ampl. disp.	0222h	ro	-	-	-100	100	0,1	%	-

This parameter displays the value of the signal given out at analog output ANOUT1 (terminal X2A.21) in percent. A value of 0...±115 % corresponds to an output signal of 0...±11,5 V (also see chapt. 3.3 „Analog outputs“).

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.38	Power module temperature	0226h	ro	-	-	0	100	1	°C	-

ru.38 displays the actual power module temperature. On exceeding the maximum power module temperature the modulation is switched off and error E.OH is displayed. Message E.nOH is displayed after the cooling period. The error can be reset now.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.39	OL counter display	0227h	ro	-	-	0	100	1	%	-
In order to prevent „E.OL“ - errors by overload (load reduction in due time), the internal count of the OL counter can be made visible with this display. At 100% the COMBIVERT switches off with error „E.OL“. The error can be reset only after a cooling time (blinking display „E.nOL“).										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.40	Power on counter	0228h	rw	-	-	0	65535	1	h	-
The power on counter displays the time the inverter was switched on. The displayed value comprises all operating phases. On reaching the maximum value (approx. 7.5 years) the indication remains on the maximum value.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.41	Modulation on counter	0229h	rw	-	-	0	65535	1	h	-
The modulation on counter displays the time the COMBIVERT was active (power modules controlled). On reaching the maximum value (approx. 7.5 years) the indication remains on the maximum value.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.43	Timer 1 display	022Bh	rw	-	-	0	655,35	0,01	-	-
The count of the free-programmable timer 1 is displayed. The display is done either in seconds, in hours or in slopes/100 (see LE.21). The counter can be adjusted to any chosen value by keyboard or bus. The programming of the counter is done with parameters LE.17...LE.21.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.44	Timer 2 display	022Ch	rw	-	-	0	655,35	0,01	-	-
The count of the free-programmable timer 2 is displayed. The display is done either in seconds, in hours or in slopes/100 (see LE.26). The counter can be adjusted to any chosen value by keyboard or bus. The programming of the counter is done with parameters LE.22...LE.26.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.68	Rated DC voltage	0244h	ro	-	-	0	1000	1	V	-
This parameter displays the rated DC voltage automatically determined by the inverter. The value is measured at switch-on.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.80	Digital output state	0250h	ro	-	-	0	255	1	-	-

With do.51 the digital output signals can be assigned to the hardware outputs (see chapter 7.3.). This parameter displays the digital output state of the output signals in accordance with the following table. If several outputs are set, the sum of the decimal values is displayed.

Bit	Decimal value	Output	Terminal
0	1	O1 (transistor output 1)	X2A.19
1	2	O2 (transistor output 2)	X2A.20
2	4	R1 (relay RLA,RLB,RLC)	X2A.24...26
3	8	R2 (relay FLA,FLB,FLC)	X2A.27...29
4	16	OA (internal output A)	no
5	32	OB (internal output B)	no
6	64	OC (internal output C)	no
7	128	OD (internal output D)	no

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.81	Actual power	0251h	ro	-	-	-3200,0	3200,0	0,1	kW	0,0

ru.81 displays the actual power of the COMBIVERT R6. Motor power is displayed with positive values, generatoric power is displayed with negative values.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.82	Total net	0252h	rw	-	-	0	2147483647	1	KWh	0

Counter for the regeneratoric electric work to the mains.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.83	Total motor	0253h	rw	-	-	0	2147483647	1	KWh	0

Counter for the supplied electrical work from the mains.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.84	Total netMains input	0254h	rw	-	-	0	2147483647	1	KWh	0

Display of the difference between supplied and regeneratoric work. The result is displayed right sign and is depending on the faulty wiring.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
ru.85	Actual net / Mains input	0255h	ro	-	-	0,00	655,35	0,01	kVA	0

Display of the current apparent power at the mains input.

3.2.5 Description of the In-parameters

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.00	Inverter type	0E00h	ro	-	-	0	65535	1	-	0

Bit	Description	Meaning			
0	Unit size				
1			binary coded, e.g.:	01111 for size 15, 00000 for size 32	
2					
3					
4					
5	Voltage class	0	230 V	1	400 V
6	Phases	1	3-phase		
7	free	0			
8	Housing				
9					
		4	E housing		
10		15	P housing		
11		17	R housing		
12					
13	Control	3	S control		
14					
15					

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.01	DC rated current	0E01h	ro	-	-	0,0	6553,5	0,1	A	-
Display of the DC rated current in ampere. The value is determined from the power circuit identification (P-ID) and cannot be changed.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.06	Software version	0E06h	ro	-	-	1,30	1.30	0,01	-	-
Display of the software version number. 1. and 2. digit: software version (e.g. 1.3X) 3. digit: special version (X,X0 = standard)										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.07	Software date	0E07h	ro	-	-	707,8	707,8	0,1	-	-
Display of the software date. The value contains day, month and year, from the year only the last digit is indicated. Example: Display = 2102.0 Date = 21.02.2000										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.10	Serial no.	0E0Ah	rw	-	-	0	65535	1	-	0
In. 11	Serial no.	0E0Bh								
In.12	Serial no.	0E0Ch								
In.14	Customer number	0E0Eh								
In.15	Customer number	0E0Fh								
In.16	QS no.	0E10h								
The serial number and the customer number identify the COMBIVERT. The QS-number contains production internal information.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.22	User parameter 1	0E16h	rw	-	-	0	65535	1	-	0
This parameter is not assigned to any function and is available to the user for input.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.23	User parameter 2	0E17h	rw	-	-	0	65535	1	-	0
This parameter is not assigned to any function and is available to the user for input.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In. 24	Last error	0E18h	rw	+	+	0	255	1	-	-
In.24 stores the 8 errors that occurred last. The display is set-programmable. E. UP is not stored. The error messages are described in chapter 5.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In. 25	Error Diagnosis	0E19h	ro	+	-	0	65535	1	-	0

Shows the last errors that occurred (in the sets 0...7). The oldest error is in set 7. A new error is stored in set 0. All other errors are shifted to the next parameter. The oldest error is not applicable. The display of the error occurs in the highest word (Bit 12…15).
A difference time is determined between errors of the same type (e.g. double OC). This time is stored in the three low-order words. The display occurs in hexadecimal code.

Error	Difference time			Value
Bit 15…12	Bit 11…8	Bit 7…4	Bit 3…0	
X	0	0	0	0 min.
X	0	0	1	1 min.
X	:	:	:	:
X	F	F	E	4094 min.
X	F	F	F	> 4095min.
0	X	X	X	No error
1	X	X	X	E. OC
2	X	X	X	E. OL
3	X	X	X	E. OP
4	X	X	X	E. OH
5	X	X	X	E.OHI

Example: The following values are displayed:

Set 0: 3000
Set 1: 2000
Set 2: 4023
Set 3: 4000
Set 4-7: 0000

Explanation: The error that occurs last is stored in set 0. The table shows for the most significant hex-value "3" the error E.OP (overvoltage).
Before it error E.OL (set 1=2xxx) occurs. Because it concerns two different errors, no time difference was stored.
Error E.OH is stored in set 2 and 3. Since the errors are of the same type, a diffenrence time (here „023 “) is stored in the three low-order words of set 2. The value of 23 hexadecimal corresponds decimal to a difference time of 35 minutes.
No errors are stored in set 4…7.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
In.26	E.OC error counter	0E1Ah	rw	-	-	0	65535	1	-	0
In.27	E.OL error counter	0E1Bh								
In.28	E.OP error counter	0E1Ch								
In. 29	E.OH error counter	0E1Dh								
In.30	E.OHI error counter	0E1Eh								
The error counters (for E.OC, E.OL, E.OP, E.OH, E.OHI) specify the total number of errors of each error type.										

3.2.6 Description of the SY-Parameters

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.02	Înverter identifier	0002h	rw	-	-	4000	4002	1	-	-
An unique number is assigned to each inverter type which identifies the COMBIVERT. This value is used for example by COMBIVIS to load the correct configuration files.Sy.02 can be written with the indicated value (e.g. for identification of download lists).										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.03	Power unit code	0003h	rw	-	+	0	32767	1	-	-
On the basis of the power circuit identification the control recognizes the used power circuit, respectively a change of the power circuit and adjusts certain parameters accordingly. To accept a new P-Id enter positive values (see chap. 8 „E.Puch“).										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.06	Inverter address	0006h	rw	-	+	0	239	1	-	1
In SY.06 can be adjusted, if the COMBIVERT shall be responded via „COMBIVIS“ or another control. Values between 0 and 239 are possible, the default value is 1. If several COMBIVERT are operated on the bus simultaneously, it is absolutely necessary to assign different addresses to them, since otherwise it leads to communication failures because several COMBIVERT may answer at the same time. The description of the DIN 66019II protocol (C0.F5.01I-K001) contains further information to this.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.07	Baud rate ext. bus / PC	0007h	rw	-	+	0	6	1	-	3

Following values for the baud rate of the serial interface are possible:

Parameter value	Baud rate
0	1,2 KBaud
1	2,4 kBaud
2	4,8 KBaud
3 (default)	9,6 kBaud
4	19,2 kBaud
5	38,4 kBaud
6	55,5 kBaud

If the value for the baud rate is changed via the serial interface, it can be changed again only by the keyboard or after adapting the baud rate of the master, as no communication is possible with different baud rates of master and slave.
Should problems occur at the data transmission choose a transmission rate of maximal 38,4 Baud.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
Sy.09	HSP5 watchdog time	0009h	rw	-	+	0 (off)	10,00	0,01	s	0 (off)
The HSP5 watchdog function monitors the communication of the HSP5 interface (control board - operator; or control board - PC). After expiration of an adjustable time (0,01...10 s) without incoming telegrams, the response adjusted in Pn.5 is triggered. The value „off“ deactivates the function.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.11	Baud rate int. bus	000Bh	rw	-	+	3	10	1	-	5

The transmission speed between operator/inverter or PC/inverter is determined with the internal baud rate. Following values are possible:

Value	Baud rate
3	9.6 kBaud
4	19.2 kBaud
5	38.4 kBaud

Value	Baud rate
6	55.5 kBaud
7	57.6 kBaud
8	100 kBaud

Value	Baud rate
9	115.2 kBaud
10	125 kBaud

After Power-On it is always started with 38.4 kBaud and dependent on the operator higher set.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.32	Scope timer	0020h	ro	-	-	0	65535	1	-	0

The scope timer generates a time period of 1 ms. This can be used by external programs, e.g. scope, to represent time patterns. The timer counts from 0...65535 and starts again with 0 after an overflow.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.41	Control word high	0029h	rw	-	+	0	65535	1	-	0

The control word is used for status control of the inverter via bus. The control word long (SY.43) consists of the two 16 bit parameters control word high (SY.41) and control word low (SY.50). The status word is bit-coded.

Bit	Function	Value	Description
16	I1	1: I1	corresponding input is set via the control word instead via hardware input. These bits are only effective if the bit for the appropriate input is set in di.01 „select signal source“. Then the OR operation of this bit with the corresponding bits of parameter di.02 " digital input setting" is valid.
17	I2	2: I2	
18	I3	4: I3	
19	I4	8: I4	
20	IA	16: IA	
21	IB	32: IB	
22	IC	64: IC	
23	ID	128: ID	
24	O1	256: O1	Appropriate output is set via the control word or via the switching conditions. Die Ausgangssignale O1, O2, R1 und R2 (sichtbar in Parameter ru.80) werden mit den entsprechenden Bits des Steuerworts ODER verknüpft. The connection occurs according do.42 „inverted outputs “(inverting level for the output signals) and before they are switched to the hardware outputs with do.51 „ hardware output allocation“.
25	O2	512: O2	
26	R1	1024: R1	
27	R2	2048: R2	
28...31	reserved		

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.42	Status word high	002Ah	ro	-	-	0	65535	1	-	0

The current condition of the COMBIVERT can be readout with the status word. The status word long (SY.44) consists of the two 16 bit parameters status word high (SY.42) and status word low (SY.51). The status word is bit-coded.

Bit	Value	Description
0..7	1: I1	Display of the internal input terminal status (input terminals and software inputs after the input processing block). Corresponds to the display in ru.22 „internal input state“
	2: I2	
	4: I3	
	8: I4	
	16: IA	
	32: IB	
	64: IC	
	128: ID	
8..15	256: O1	Display of the state of the output terminals and the software outputs (digital outputs after the output proccessing block). Corresponds to the display in ru.25 „output terminal state“
	512: O2	
	1024: R1	
	2048: R2	
	4096: OA	
	8192: OB	
	16384: OC	
	32768: OD	

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.43	Control word long	002Bh	KB	-	+	-2147483648	2147483647	1	-	0
The control word is used for status control of the inverter via bus. The control word long (SY.43) consists of the two 16 bit parameters control word high (SY.41) and control word low (SY.50). The status word is bit-coded.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.44	Status word long	002Ch	ro	-	-	-2147483648	2147483647	1	-	0
The current condition of the COMBIVERT can be readout with the status word. The status word long (SY.44) consists of the two 16 bit parameters status word high (SY.42) and status word low (SY.51). The status word is bit-coded.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
SY.50	Control word low	0032h	rw	-	+	0	65535	1	-	0
The control word is used for status control of the inverter via bus. The control word long (SY.43) consists of the two 16 bit parameters control word high (SY.41) and control word low (SY.50). The status word is bit-coded.										

Bit	Function	Value	Description
0	Control release	1: ST	This bit is only effective if di.01 „select signal source“ bit 0 is set. Then the AND operation of this bit with di.02„digital input setting“ bit 0 is valid.
1	Reset	2: RST	An error reset is executed when changing from not activated (0) to activated (2).
2	Start / stop	0: Stop	Direction of rotation release or the „start “(„run “) command can be given via the control word, if oP.01 „rotation source“ contains the values 6, 8, 9 or 10.
		4: Start	

continued on the next page

SY.50: Control word low			
Bit	Function	Value	Description
3	reserved	0: reserved	
		8: reserved	
4...6	Parameter set	0: Set 0	Selection of the active parameter set, if in Fr.02 „parameter set source“ the value „5: control word (SY.50)“ is programmed.
		16: Set 1	
		32: Set 2	
		48: Set 3	
		64: Set 4	
		80: Set 5	
		96: Set 6	
		112: Set 7	
7	reserved		
8	reserved		
9	reserved		
10	reserved		
11	reserved		

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
Sy. 51	Status word low	0033h	ro	-	-	0	65535	1	-	0
The current condition of the COMBIVERT can be readout with the status word. The status word long (SY.44) consists of the two 16 bit parameters status word high (SY.42) and status word low (SY.51). The status word is bit-coded.										

Bit	Value	Description
0	1: ST	1=set control release (AND operation with di.1 bit 0)
1	2: Error	Inverter is in error state
2	0: Stop	The modulation is switched off at „stop“ and switched on at „start“. Exception: if a positioning is stopped with bit 11 "stop" in the control word, "stop" is displayed in the status word, if the drive reaches speed 0 (even if modulation is still active). This exception can be reversed with bit 9 in parameter Pn.65 „special functions“.
	4: Start	
3	8: reserved	
4...6	0: Set 0	Display of the actual parameter set
	16: Set 1	
	32: Set 2	
	48: Set 3	
	64: Set 4	
	80: Set 5	
	96: Set 6	
	112: Set 7	
7	reserved	
8	reserved	
9	reserved	

continued on the next page

10	reserved	
11	reserved	

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
Sy.56	Start display address	0038h	rw	-	+	0	32767	1	-	512

Sy.56 adjusts the parameter address which shall be represented on switching on the operator. Operator parameters can also be adjusted as starting display. Only valid addresses are accepted. If there is adjusted an invalid address (neither in the inverter nor assigned in the operator) the operator searches for the next existing address of the parameter group.
If this parameters is available in the CP mode, the setting becomes effective there. Otherwise CP.00 is indicated as start parameter.

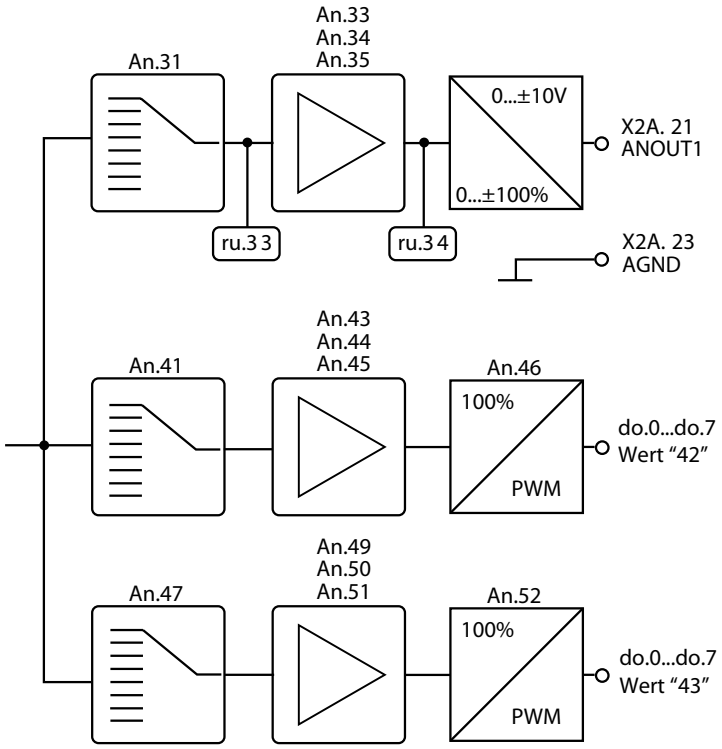
3.3 Analog output

3.3.1 Short description analog output

The KEB COMBIVERT has one programmable analog output (ANOUT1). The variable which shall be output at the outputs X2A.21 can be selected with An.31. ANOUT 3 and ANOUT 4 (An.41 / 47) can be output as switching condition 42 or 43 with the digital outputs as PWM signal. The analog signal can be adapted to the requirements with the characteristic amplifiers (An.33...35 / 43...45 / 49...51). The ru parameters display the actual size before and after amplification. The period for the PWM signal can be adjusted with An.46/ 52.

Picture 7.2.1 Principle of the analog outputs

An.31/41/47		
Actual line frequency Δ	2	ru.03
Ref. DC voltage	5	ru.18
DC current	6	ru.15
AC current	7	ru.17
Digital with An.32 / 42 / 48	8	An.xx
Power module temperature	12	ru.38
Actual power	26	ru.81

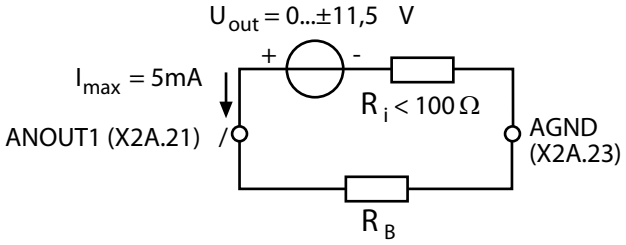


3.3.2 Output signals

ANOUT 1

A voltage of 0...±11.5 VDC displays the selected size in the range of 0...±115 % with a resolution of 10 bit at the output. In order to compensate load-dependent voltage drops, the limitation at the output of the characteristic amplifier is ±115 %.

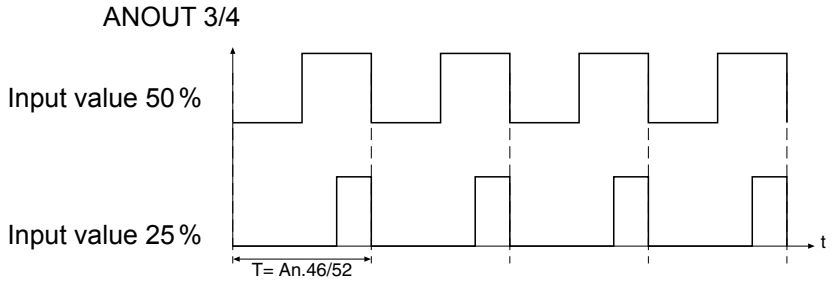
Picture 7.2.2 Analog output



ANOUT 3 / 4, PWM outputs

Process variables that change only slowly e.g. the power module temperature, can be output via two virtual analog outputs (ANOUT3 and 4). This is realized by generating a PWM signal (pulse width modulation) on a digital output. The period T is adjustable with parameter An.46 or An.52 "ANOUT period" of 1 ...240 s.

Fig. 7.2.2.a PWM output signal



3.3.3 Analog output / display (ru.33...34)

The following parameters are used to display the analog outputs, before and after the characteristic amplifier:

ru.33 ANOUT1 / pre amplification display 0...±400 %
ru.34 ANOUT1 / post ampl. disp. 0...±115 %

3.3.4 ANOUT 1 function (An.31 / An.36 / An.41, An.47)

These parameters define the process variable, which controls the respectiveoutput . Following adjustments are possible:

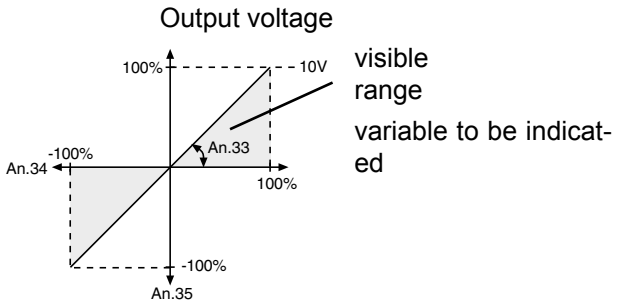
An.31 / An.41 / An.47			
Value	**Function**	**Standard An.31**	**10 V ≙ 100 %**
2	Actual line frequency (ru.03)	X	100% ≙ 100 Hz
5	Reference DC voltage (ru.18)		100% ≙ 1000 V
6	DC current (ru.15)		100% ≙ 2x DC rated current (In.02)
7	AC current (ru.17)		100% ≙ 200 A supply rated current
8	Digital with An.32 / 42 / 48		0...100 %
12	Power module temperature (ru.38)		100% ≙ 100 °C
26	Actual power (ru.81)		100% ≙ 2x Regeneration rated actual power
Not listed values are not assigned.			

3.3.5 Amplifier of the output characteristic (An.33...35 / An.43...45 / An.49...51)

As shown in picture 7.2.1, the characteristic amplifiers follow after the selection of the output signal. With these parameters the output signal can be adapted in x and Y direction and in the slope to the requirements. No zero offset is adjusted at factory setting, the amplification is 1, i.e., 100% of the output size correspond to 10V at the analog output (see picture 7.2.2).

Function	ANOUT1	Value range	Resolution	Default
Gain	An.33	±20,00	0,01	1,00
X offset	An.34	±100,0%	0,1%	0,0%
Y offset	An.35	±100,0%	0,1%	0,0%

Picture 7.2.5.a factory setting: no offset, gain 1

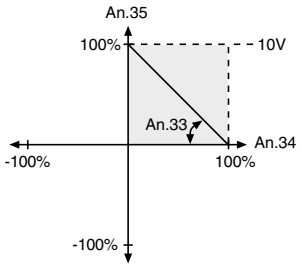


Inverting the analog output

An example for the use of the characteristic amplifier is shown in picture 7.2.5.b

1. set X-Offset (An.34) to 100 (%)
2. set the gain (An.33) to -1.00

Picture 7.2.5.b Invert the analog output



This adjustments cause an inversion of the analog signal.

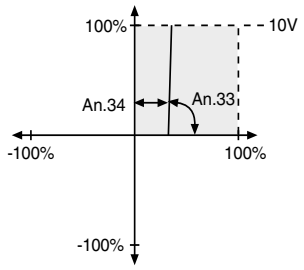
0%	corresponds	10V	at the output
100%	corresponds	0 V	at the output

Analog output as switch

An example for the use of the analog output as 0/10V switch is shown in picture 7.2.5.c

1. set the gain (An.33) to 20.00
2. set X-offset (An.34) to the desired switching level

Picture 7.2.5.c Analog output as switch



Due to the high gain the analog output switches in a relative small switching window.

Computation of the amplification

Since the analog output works always to the specified values in 7.2.4 the characteristic can be adjusted with the gain so that the total range of 0… ±10V is used.

$$\frac{\text{specified value}}{\text{desired value}} = \text{gain (An.33 / 43 / 49)}$$

3.3.6 ANOUT 1 digital setting (An.32 / 42 / 48)

Analog values for the respective input can be preset in percentage with parameters An.32/ An.42/ An.48 . For that purpose the value 8: „digital setting“ must be adjusted. The setting is in the range of ±100 %.

3

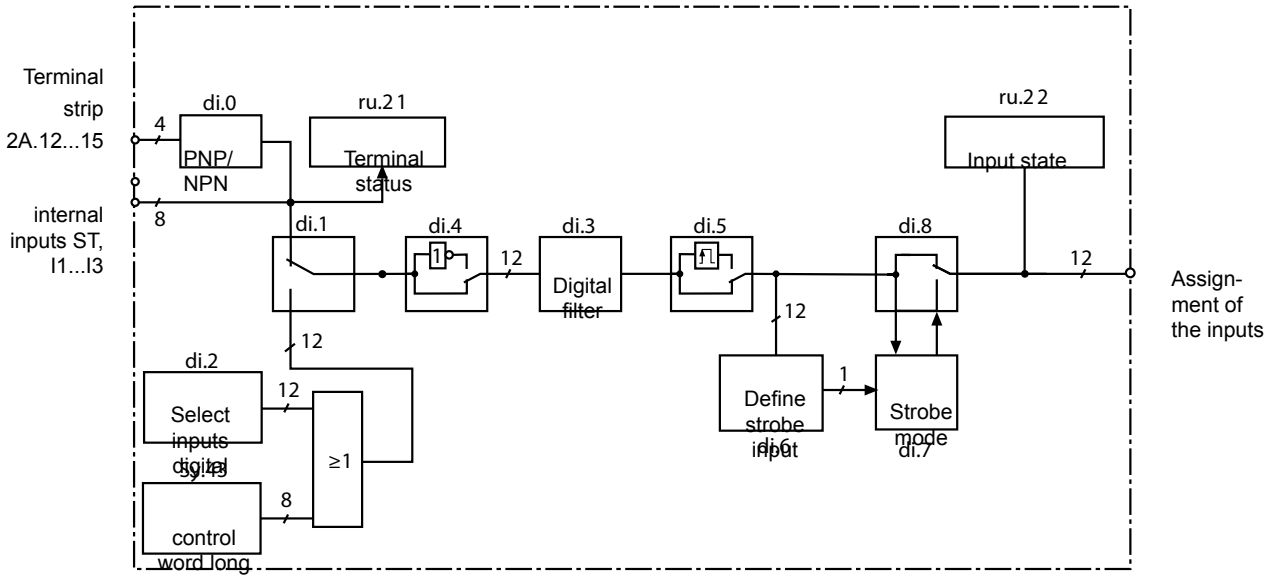
3.4 Digital in- and outputs

3.4.1 Summary description digital inputs

The KEB COMBIVERT R6 has 4 external digital inputs (ST, I1…I3) and 8 internal inputs (F, R, RST, I4, IA…ID). All inputs can be assigned to one or several functions.
Beside the terminal strip parameter di.00 determines whether the external inputs are controlled in PNP or NPN circuit. Parameter ru.21 shows the currently controlled input. Each input can optionally (di.01) be set via terminal strip or by means of software with di.02. A digital filter (di.03) decreases the noise sensitivity of the inputs. The inputs can be inverted with di.04 and switched to di.05 slope-triggering with di.05. A strobe mode can be activated with parameters di.06...di.08. The input status (ru.22) shows the inputs that are actually set for processing. The function(s) carried out by a programmed input is defined by means of the input selection of the corresponding function or di.11...di.22.

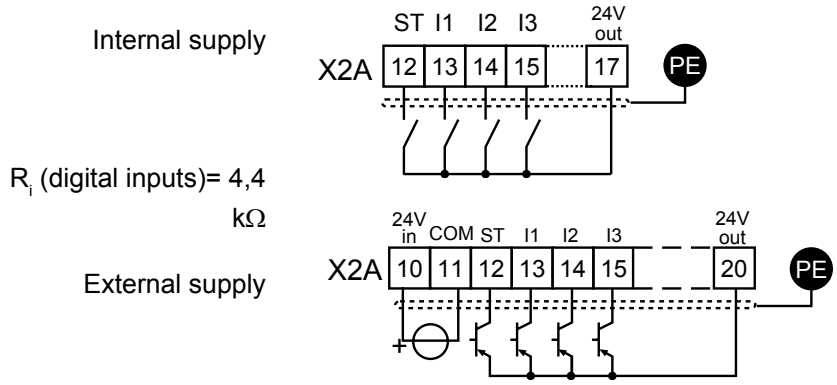
The control release must generally be switched by means of hardware. Edge-triggering, inversion and strobe signal can be adjusted, but they have no influence.

Fig. 7.3.1 Principle of the digital inputs



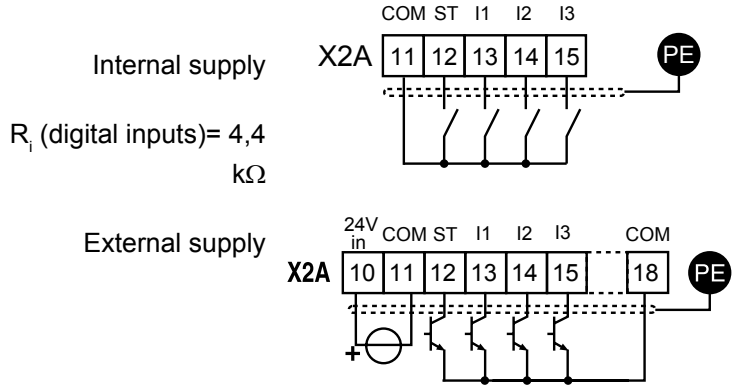
3.4.2 Input signals PNP / NPN selection (di.00)

Figure 3.1.3.a Digital inputs in PNP control (di.00 = 0)



Switching voltage for digital inputs = 13...30V DC ±0% smoothed

Figure 7.3.2.b Digital inputs in NPN control (di.00 = 1)

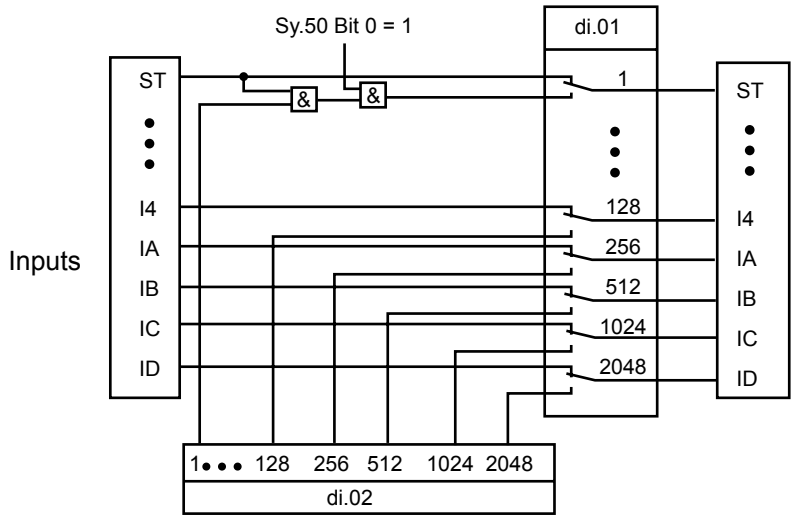


3.4.3 Setting of digital inputs by software (di.01, di.02)

Digital inputs can be set without external circuit with parameter di.01 "select signal source" and di.02 "digital input setting".

The control release must be switched generally by hardware, even if it is switched by software (see picture 7.3.3 AND connection with di.02 and SY.50)!

Figure 7.3.3 Digital inputs controlled by software (di.01/di.02)



As shown in picture 7.3.3 it can be selected with di.01 whether the inputs are switched by terminal strip (default) or via parameter di.02 . The two parameters are bit-coded, i.e. in accordance with the following table the associated value of the input must be entered. With several inputs the sum is to be formed.
(Exception: Control release must always be bridged at the terminal strip).

Table terminal state

Bit	Decimal value	Input	Terminal
0	1	ST (external / internal input, see di.22)	X2A.12
1	2	RST (internal input, see di.21)	no
2	4	F (internal input, see di.19)	no
3	8	R (internal input, see di.20)	no
4	16	I1 (external / internal input, di.11)	X2A.13
5	32	I2 (external / internal input, di.12)	X2A.14
6	64	I3 (external / internal input, di.13)	X2A.15
7	128	I4 (internal input, di.14)	no
8	256	IA (internal input, di.15)	no
9	512	IB (internal input, di.16)	no
10	1024	IC (internal input, di17)	no
11	2048	ID (internal input, di.18)	no

Example: ST, F and IB are controlled, indicated value = 1+4+512 = 517

3.4.4 Input terminal status (ru.21), internal input status (ru.22)

The input terminal state (ru.21) displays the logical levels at the input terminals. It is irrelevant whether the inputs are internally active or not. If a terminal is controlled, then the appropriate decimal value according to the table below is output. With several active terminals the sum of the decimal values is output.
The internal input state (ru.22) displays the logical state of the digital inputs set internally for processing. If an input is set, the appropriate decimal value according to the table 7.3.1 is output. If several inputs are set, the sum of the decimal values is output.

3.4.5 Digital noise filter (di.03)

The digital filter reduces the susceptibility to interferences on the digital inputs. Only hardware inputs can be filtered. Each input has a separate filter counter, which counts upward at active input and downward at inactive input. The output of the filter is set when the filter time is reached and is reset at zero.

Parameter	Setting range	Resolution
di. 03	0...127 ms	1 ms

Priority of the filter times: The higher time is used.

3.4.6 Inverting the inputs (di.04)

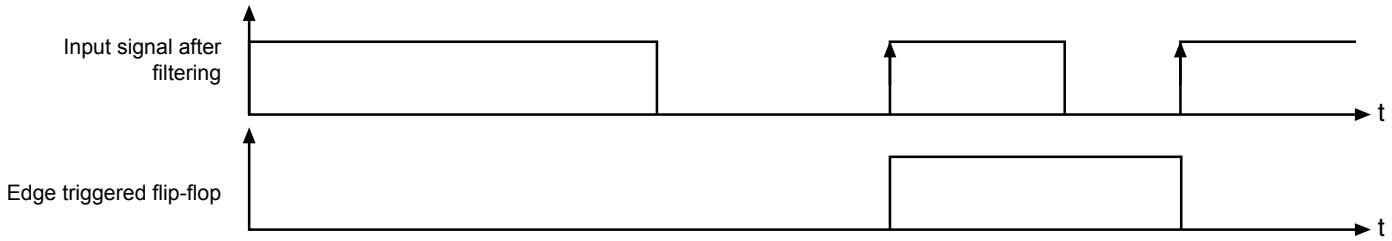
If a signal is 1- or 0-active (inverted) can be adjusted with parameter di.04. The parameter is bit-coded, i.e. the appropriate value of the input must be entered. If several inputs shall be inverted, the sum is to be formed. (Exception: inverting of the control release remains without function.)

3.4.7 Input trigger (di.05)

As standard the COMBIVERT is controlled with static signals i.e., an input is set as long as a signal is active. But in practice it may happen that a signal is only available temporary, but the input shall remain set. For this case this or several inputs can be set to input trigger. A rising slope with a pulse duration, which is longer than the response time of the digital filter is sufficient for switching on. Switching off is done with the next rising slope.

Control release (ST) can be set to edge-triggering, but remains without effect on the function, since it is a pure static signal.

Picture 3.4.7 Example of a signal flow diagram for input I1 (di.05 = 16)



3.4.8 Input strobe dependence (di.06, di.07, di.08)

A Strobe signal is used mainly for triggering the input signals. For example, two inputs are used for parameter set selection. But the signals for the control do not arrive exactly even, so for a short time it would be switched into an unintended set. For active strobe (scanning signal) the actual input signals of the strobe-dependent inputs are stored and have been retained to the next scanning.
Which inputs are switched by strobe?

Any input can be selected as strobe-dependent input with parameter di.08. With the control release di.08 has no function since this is a static input.

Where is the strobe signal come from?

The strobe input is set with parameter di.06. If several inputs are adjusted as strobe, these are OR-connected.

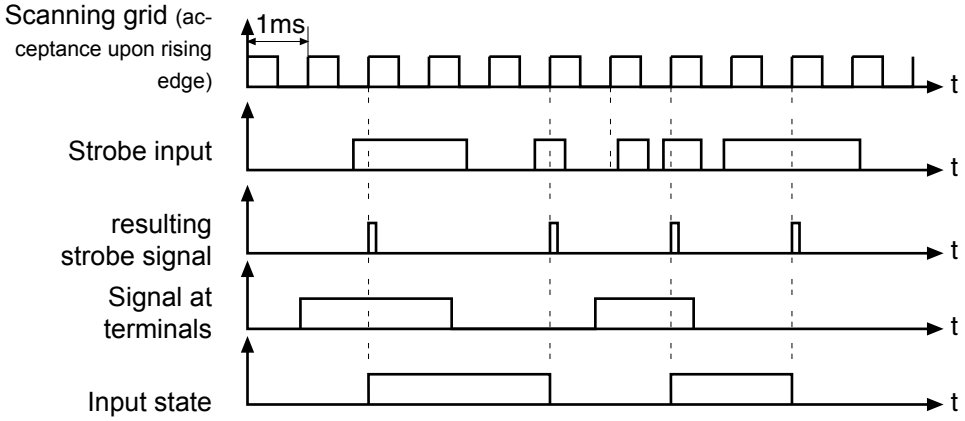
Edge-active or static strobe?

As standard the strobe is slope active, i.e. the input conditions with the rising slope at strobe input are stored and retained to the next rising slope. In some applications, it is useful to use the strobe in a kind of gate function. In this case the strobe is static, i.e. the input signals are stored as long as the strobe signal is set (or the gate is open).

di.07 strobe-mode

di.07: strobe mode		
Value	**Function**	**Description**
0	edge-active strobe (default)	Input states are stored with the rising edge at strobe input and retained to the next rising edge.
1	static strobe - frooze if strobe is not active	Input states are updated, as long as the strobe signal is set. When the signal becomes inactive, the state is retained.
2	static strobe - only active at active strobe	Input states are updated, as long as the strobe signal is set. When the signal becomes inactive, the state is reset.

Figure 3.4.8.a Edge active strobe (di.07 = 0)



Picture 3.4.8.b Static strobe mode 1 (di.07 = 1)

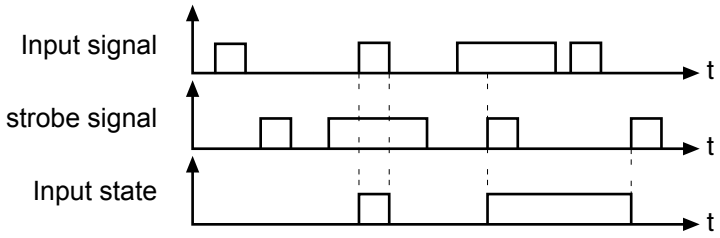
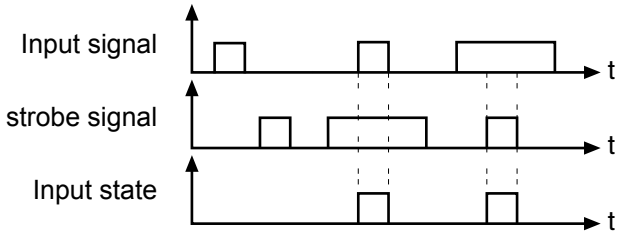


Bild 3.4.8.c Statischer strobe mode 2 (di.07 = 2)



3.4.9 Reset input selection (di.09) and neg slope f. reset inputs (di.10)

The reset input is defined according table 7.3.1 with parameter di.09. If the reset input shall react to a negative slope, one or several of the reset inputs defined with di.09 can be switched to negative edge evaluation with di.10.

3.4.10 Assignment of the inputs

There are two fundamentally different procedures for the assignment of inputs.

a.) One or several inputs can be assigned to each function. That means, with the individual functions one input can be selected which activates this function.

b.) One or several functions can be assigned to each digital input. This means, in parameters di.11...di.22 „Function“ and parameters di.24...di.35 „+ Function“ one or several functions can be assigned to each single digital input. Several functions can be assigned to the respective inputs with parameters di.11... di.22 , only one function can be selected with parameters di.24...di.35.

Both variants have influence on each other; if an input is assigned to a function, also parameters di.11...di.22 and di.24...di.35 are accordingly adjusted.

Due to the two variants the operation combines two advantages:

- by the function-related programming of the inputs it can also be specified which inputs shall activate the function,
- the input-related representation gives an overview of the complete input function and finally it can be checked whether unwanted function overlappings have been occured.

The following table indicates a parameter list whereby digital inputs can be assigned to the individual functions:

di.09 reset input selection

di.36 software ST input sel.
di.37 ST lock input sel.
di.38 turn off ST delay time
Fr.07 select inputs f. paraset
Fr.11 select inputs f. rst set
LE.17 timer 1 start input sel.
LE.19 timer 1 reset input sel.
LE.22 timer 2 start input sel.
LE.24 timer 2 reset input sel.
Pn.04 ext. fault input selection

The following table gives an overview of all functions, which can be assigned to a digital input with parameters di.11...di.22 (several functions are possible).

di.11...di.22: Input function			
Bit	Value	Description	Fct. Para [1)]
0	1: Modus master/slave (only di.11..di.13)	Specify input for master/slave via external input (see pn.19)	Pn.31
7	128: reset error	Release reset	di. 09
11	2048: Set	Parameter set selection	Fr.07
12	4096: reset set		Fr.11
13	8192: external fault	Triggers error state at the inverter	Pn.04
17	131072: run timer 1	start / stop timer	LE.17
18	262144: reset timer 1		LE.19
19	524288: run timer 2		LE.22
20	1048576: reset timer 2		LE.24
31	2147483648: I+ function	one additional function („+“ function) is selected	---
Not listed bits are not assigned.			

[1)] displays the function-related parameter, which corresponds to the value in di.11… di.22.

The next table indicates an overview of the additional functions, which can be assigned to a digital input with parameters di.24...di.35 (only one additional function per input is possible / bit 31 „I+ function must be activated for the appropriate input):

di.24...di.35: input „+“ function		
Value	Description	Fct. Para[1)]
5: software ST (di.35 no funct.)	any digital input gets the function "control release" (soft-ware-emulation / function can not be placed on the input ST)	di.36
6: ST lock (di.35 no funct.)	Setting the input leads to locking of the software control release	di.37
Not listed values are not assigned.		

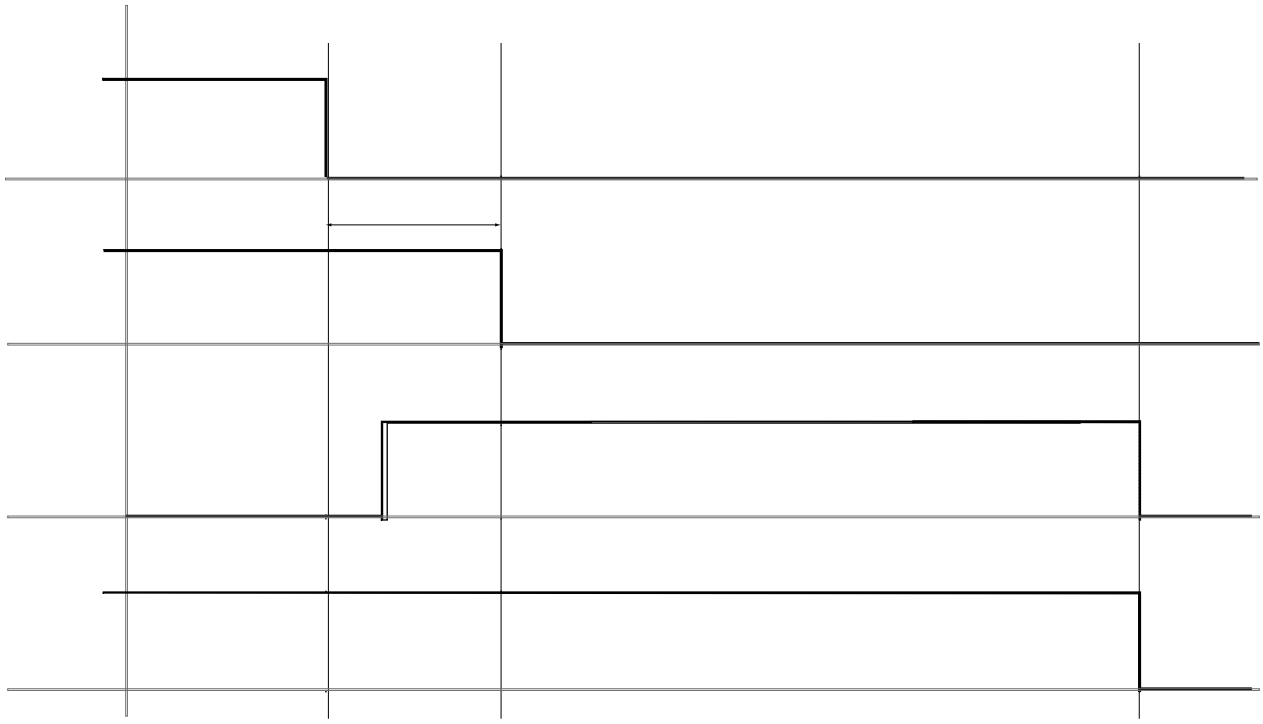
[1)] the column „Fct. para“ displays the function-related parameter, which corresponds to the value in di.11...di.22

3.4.11 Software ST and locking of the control release

di.36 software ST, di.37 ST lock, di.38 turn off ST delay time

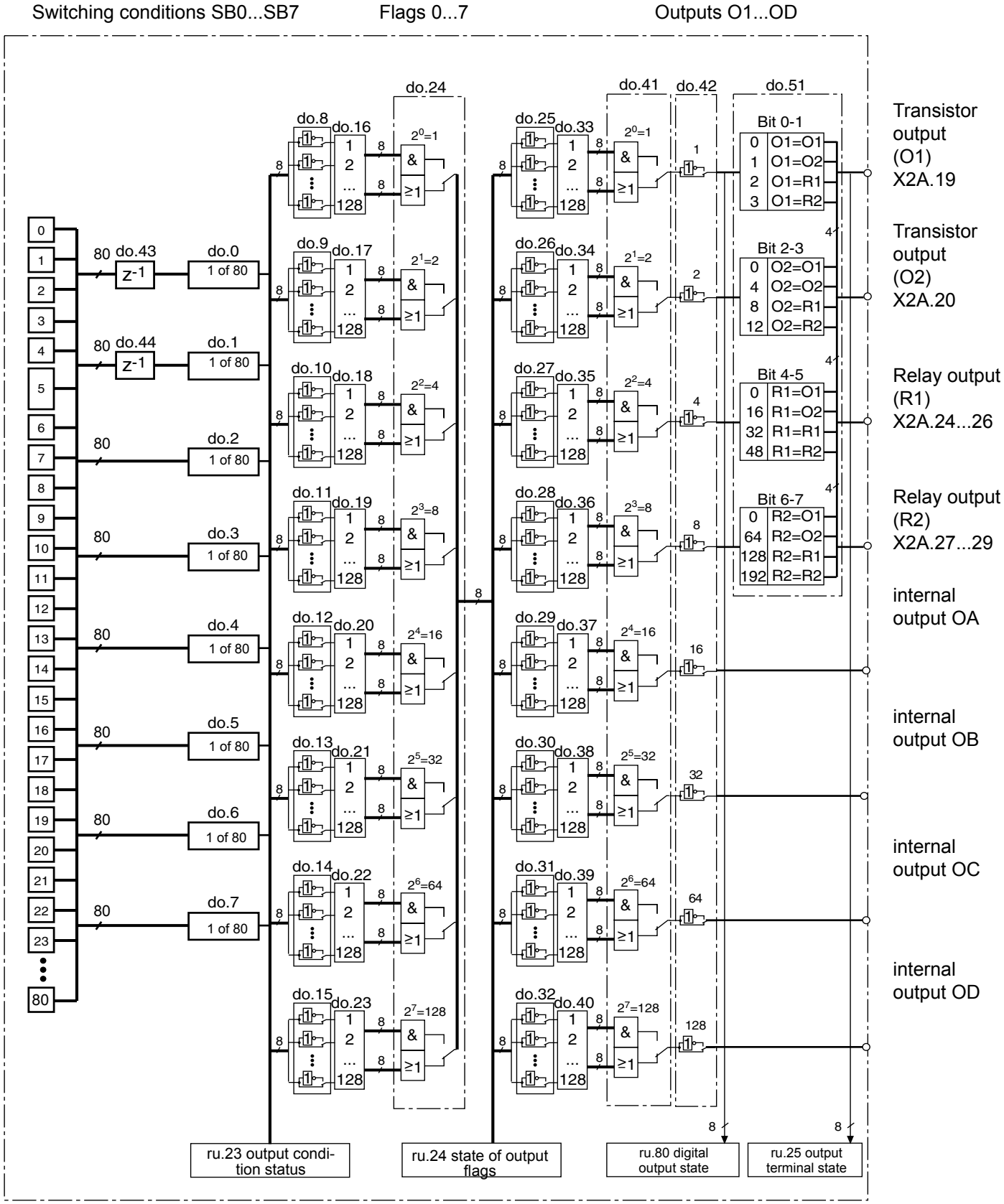
The function is switched off, if no input is selected in di.36. ST can not be selected as software ST or input for locking.
With the locking function the control release can be controlled in case of voltage failure (even if the controlled PLC is failure).
A condition is that the terminal ST is bridged!
The switching off of an input (selection in di.36) is delayed by the time adjusted in di.38. Within this time the locking input (selection into di.37) must be active in order to secure the function.

Fig. 3.4.11 Software-ST and locking of the control release



3.4.12 Summary description digital outputs

Fig. 3.4.12 Principle of the digital outputs



Description

To switch the digital outputs up to 8 conditions can be selected from different conditions. These are entered in do.00...do.07. Switching condition 0 and 1 can be filtered by do.43 and do.44. Parameter ru.23 shows, if one or several of these conditions are met. For each flag it can now be selected which of the 8 conditions shall apply to it (do.16...do.23). Each condition can still be inverted before selection (do.08...do.15). As a standard all conditions (if several are selected) are OR-operated. With do.24 this can be changed to AND-operation, i.e. all conditions selected for this flag must be fulfilled before it is set. Parameter ru.24 displays the flags set in this level. do.33 ... 40 form a second logic level, whereby a selection of flags from logic level 1 can be made. Every individual condition can be inverted with do..25...32. do.41 adjusts the manner of the linkage (AND/OR). Parameter do.42 is used for inverting one or several outputs. With do.51 the output signals are assigned to the terminals. ru.80 serves for the display of the status prior to allocation, thereafter ru.25. The internal outputs OA...OD are directly connected with the internal inputs IA...ID.

3.4.13 Output signals / hardware

Fig. 7.3.13a Transistor outputs

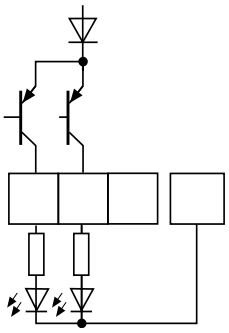
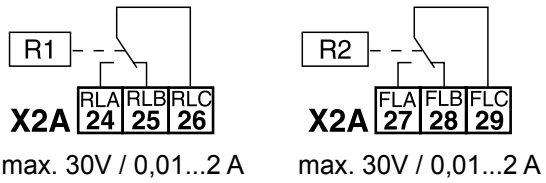


Fig. 7.3.13b Relay outputs



The current of X2A.17, 19 is limited to 25mA. A protective wiring shall be provided at inductive load at the relay outputs or transistor output (free-wheeling diode)!

3.4.14 Output filter (do.43, do.44)

A filter can be set for switching condition 0 with do.43. With do.44 for switching condition 1. The change of a switching condition must be applied for the filter time, then it becomes active at the output of the filter. If the change is cancelled during the filter time, the filter time is reset and restarted with the next change. The filter time can be adjusted in a range of 0 (off)...1000 ms.

3.4.15 Switching conditions (do.00...do.07)

From the following switching conditions one can select up to 8 for further processing. The values are then entered in parameters do.00...do.07.

do.00...do.07: Switching Conditions		
Value	Function	Description
0	always switched-off	Switching condition not met
1	always active	Switching condition always met
2	run	Unit modulates and there is no malfunction (also set if modulation is generally released, but temporary blocked for example by "blocking time modulation").
3	ready (no error)	Drive is ready for operation (status unequal error and control release active).
4	error message	There is an error message (status equal to error).
5	error message/ no ar.	Is not set for errors where automatic restart is programmed.
6	err.mess./abn.stopping	
7	OL warning	ru.39 is an overload counter, counting in steps of 1%. The COMBIVERT switches off at 100%. When exceeding level Pn.09 (default 80%) overload pre-warning is given. The performance in case of a warning can be adjusted with Pn.08 (response to OL-warning).
8	OH warning	Overtemperature pre-warning (OH)! Depending on the power unit the COMBIVERT switches off between 60… 95°C heat sink temperature. The pre-warning is output, if the OH-warning level (Pn.11) is reached (default 70°C). The behaviour in case of a warning can be adjusted with Pn.10 (response to OH-warning).
24	act. utilization > level	
25	abs. val. AC curr. > level	
26	ref. DC voltage > level	
27	DC voltage > level	
37	timer 1 > level	ru.43 „timer 1 display“ or ru.44 „timer 2 display“ > switching level
38	timer 2 > level	
41	modulation on	set if the modulation is active
42	ANOUT3 PWM	Output of the analog signal ANOUT 3 respectively ANOUT 4 as PWM signal. The cycle duration is set with An.46 and An.52, respectively.
43	ANOUT4 PWM	
44	inv.status(ru.0) = level	Number of the state (e.g. 18 at error! watchdog) = switching level
45	pow. mod. temp. (ru.38) > level	Power module temperature (ru.38) > switching level
46	external temp. > level	
48	DC current > level	

continued on the next page

<table>
<tr><th colspan="3">do.00...do.07: Switching Conditions</th></tr>
<tr><td>Value</td><td>Function</td><td>Description</td></tr>
<tr><td>59</td><td>dig. in (ru.22) AND level</td><td rowspan="4">
<table>
<tr><th>Function</th><th>Switching condition fulfilled if:</th></tr>
<tr><td>AND</td><td>all selected inputs are active</td></tr>
<tr><td>OR</td><td>min. one selected input active</td></tr>
<tr><td>NAND</td><td>min. one selected input inactive</td></tr>
<tr><td>NOR</td><td>all selected inputs are inactive</td></tr>
</table>

The selection of inputs to be linked occurs via the comparison level parameters LE.00...LE.07.

<table>
<tr><td>Input</td><td>ST</td><td>RST</td><td>F</td><td>R</td><td>I1</td><td>I2</td><td>I3</td><td>I4</td><td>IA</td><td>IB</td><td>IC</td><td>ID</td></tr>
<tr><td>Value</td><td>1</td><td>2</td><td>4</td><td>8</td><td>16</td><td>32</td><td>64</td><td>128</td><td>256</td><td>512</td><td>1024</td><td>2048</td></tr>
</table>

The sum of the inputs to be queried is entered in the switching levels.
Example: If R and I1 shall be linked to condition 0 F, value 4 + 8 + 16 = 28.00 must be entered in LE.00.</td></tr>
<tr><td>60</td><td>dig. in (ru.22) OR level</td></tr>
<tr><td>61</td><td>dig. in (ru.22) NAND level</td></tr>
<tr><td>62</td><td>dig. in (ru.22) NOR level</td></tr>
<tr><td>63</td><td>abs.val. ANOUT2 > level</td><td>Value of ANOUT1 (amount of ru.34 „ANOUT1 post ampl. display) higher than the switching level</td></tr>
<tr><td>65</td><td>ANOUT2 > level</td><td>ANOUT1 (ru.34 „ANOUT1 post ampl. display) higher than the switching level</td></tr>
<tr><td>73</td><td>abs. val. act.power > level</td><td>Amount ru.81 „active power“ > switching level</td></tr>
<tr><td>74</td><td>active power > level</td><td>ru.81 „actual power“ > switching level</td></tr>
<tr><td>80</td><td>AC input current > level</td><td></td></tr>
<tr><td colspan="3">Not listed values are not assigned.</td></tr>
</table>

Comparison level 0...7, LE.00...LE.07

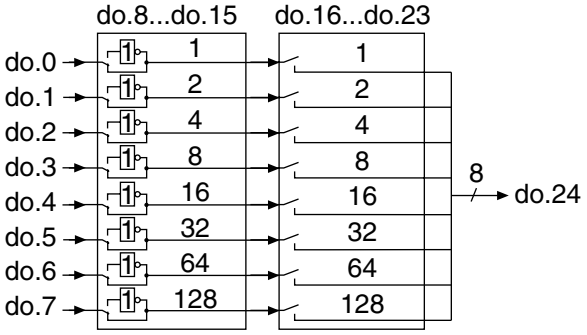
These parameters define the levels of the switching conditions.
Level 0 (LE.0) applies for switching condition 0; LE.1 for switching condition 1 ... and so forth.

Hysteresis 0...7, LE. 08...LE.15

The hysteresis in reference to the adjusted values, define parameters LE. 08...LE.15.
Hysteresis 0 (LE.08) is valid for switching level 0; LE.09 for switching level 1... etc.

3.4.16 Invert conditions for flags 0...7 (do.08...do.15)

Fig. 3.4.16 Inverting and selection of switching conditions



Each of the 8 switching conditions (do.00 ... do.07) can be inverted separately for each flag with parameters do.08...do.15 . Through this function it is possible to set any chosen switching condition as non-condition. The parameter is bit-coded. The value for the switching condition to be inverted must be entered in do.08...do.15 according to picture 3.4.15. If several conditions shall be inverted, the sum is to be formed.

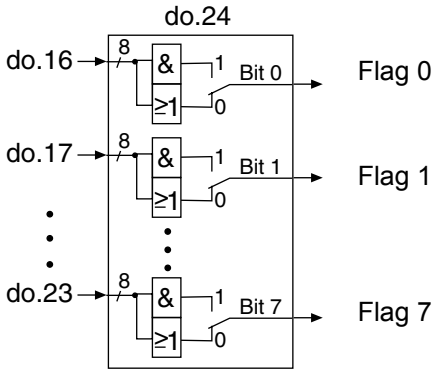
3.4.17 Selection of switching conditions for flags 0...7 (do.16...do.23)

The parameters do.16... do.23 serve for the selection of the 8 defined switching conditions. The selection is done for each flag separately, where one can choose between no one and up to all 8 switching conditions. The weighting of the selected switching conditions must be entered into do.16...do.23 according to Fig. 3.4.15. If several conditions shall be selected, the sum must be formed.

3.4.18 Linking the switching conditions for flags (do.24)

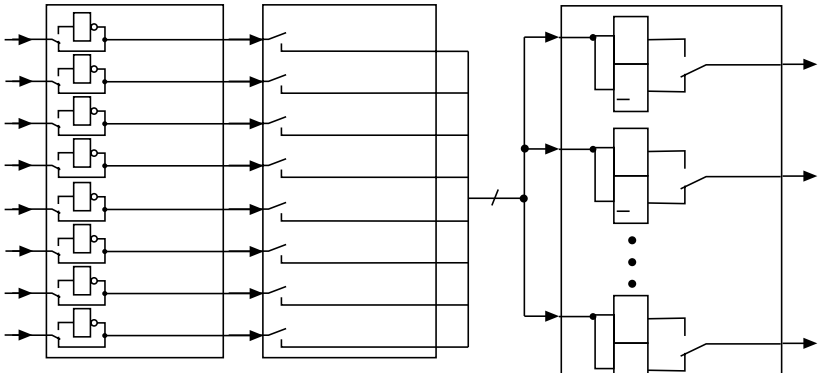
After the switching conditons are selected for each output, it can now be determined, how these are linked. As a default all conditions are OR-operated, i.e. if one of the selected conditions is met, the flag is set. An AND connection is available as further possibility which can be adjusted with do.24. AND connection means that all selected conditions must be fulfilled before the flag is set.
Parameter do.24 is bit-coded. The table under 3.4.19 shows the assignment.

Fig. 3.4.18 Linking the switching conditions in logic step 1



3.4.19 Inverting of flags (do.25...do.32)

Fig. 3.4.19 Inverting and selection of flags



With the parameters do.25...do.32 each of the 8 flags (bit 0...7) from logic step 1 can be inverted separately.

Through this function it is possible to set any chosen flag as non-flag. The parameter is bit-coded. The value of the flag to be inverted must be entered in do.25...do.32 according fig. 3.4.19. If several flags shall be inverted, the sum is to be formed.

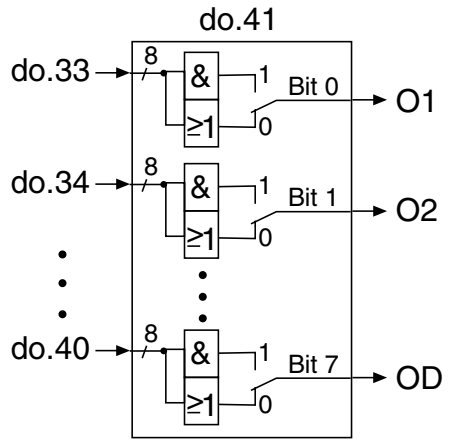
3.4.20 Selection of flags (do.33...do.40)

In the second logic step a selection of the flags of the first logic step can be made. The selection is done for each output separately, where one can choose between no one and up to all 8 flags. The value of the selected flags must be entered in do.33...do.40 according fig. 3.4.19. If several flags shall be selected, the sum must be formed.

3.4.21 Linking the flags (do.41)

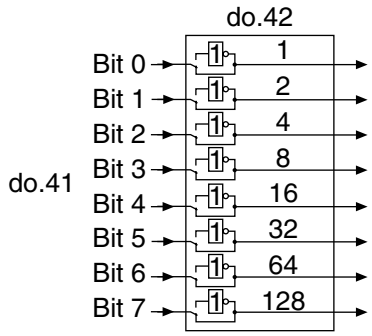
After the switching conditions are selected for each output, it can now be determined, how these are linked. As a default all flags are OR-operated, i.e. if one of the selected flags is met, the output switches. An AND connection is available as further possibility which can be adjusted with do.41. AND connection means, all selected flags must be set before the output switches.

Picture 3.4.21a. Connecting the outputs



As shown in picture 3.4.22b. the outputs can be inverted again with parameter do.42 after connection. The parameter is bit-coded, i.e. according to following table the value belonging to this output must be entered. If several outputs shall be inverted, the sum is to be formed.

Picture 3.4.21b. Inverting the outputs



3.4.22 Status digital outputs (ru.25) and digital output state (ru.80)

Parameter ru.25 displays the logic state of the digital outputs after allocation with do.51. Parameter ru.80 indicates the logic condition before the allocation. If an output is set the appropriate decimal value according to the table below, is output. If several outputs are set, then the sum of the decimal values is output.

Name	Function	Decimal values
O1	Transistor output	1
O2	Transistor output	2
R1	Relay output	4

R2	Relay output	8
OA	Internal output	16
OB	Internal output	32
OC	Internal output	64
OD	Internal output	128

3.4.23 Hardware output allocation (do.51)

The output signals are assigned to output terminals O1, O2, R1 and R2 with parameter do.51. The assignment is done according to following table:

do.51: hardw. output allocation				
Bit	Value	Signal	Output	Default
0 + 1	0	O1	O1 (terminal X2A.19)	x
	1	O2		
	2	R1		
	3	R2		
2+3	0	O1	O2 (terminal X2A.20)	
	4	O2		x
	8	R1		
	12	R2		
4+5	0	O1	R1 (terminal X2A.24...26)	
	16	O2		
	32	R1		x
	48	R2		
6+7	0	O1	R2 (terminal X2A.27...29)	
	64	O2		
	128	R1		
	192	R2		x

3.5 Regenerative adjustments

3.5.1 Operating mode

Operating mode Pn.19 determines :

- if the unit is a master or a slave
- Unit is operated with commutation choke or harmonic filter

Commutation reactor

Advantages	Disadvantages
· cheap purchase	· only for area of industry

harmonic filter

Advantages	Disadvantages
· sine-wave regeneration	· high purchase cost

Pn.19: Operating mode		
Value	Default	Note
0: Master with commutation choke	X	For high power regenerative units can be parallel connected. Here, a device must be specified as master. All further are adjusted as slave. Single units are always master.
1: Master with harmonic filter		
2: Slave with commutation choke		
3: Slave with harmonic filter		
4: Selection of master/slave with commutation choke via input I1, I2 or I3		Input selection for 4 and 5 in parameters I1:di11/I2:-di12/I3:di13 each Bit 1 or pn.31. Only one input shall be selected.
5: Selection of master/slave with harmonic filter via input I1, I2 or I3		

The input query at 4 or 5 will once held by power on reset.

The parameterization for the KEB standard commutation choke or the KEB standard harmonic filter is preset by changing the setting of Pn.19. When using KEB products no further parameter setting is necessary.

3.5.2 Activate regeneration

The activation of the regeneration is dependent on the reference value of the DC voltage (ru.18) and the regeneration level cS.02.
The regeneration unit starts to modulate if the DC voltage exceeds the specified value in cS.02, which is percental related to the reference voltage.

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.02	regeneration level	0F02h	rw	-	-	100	120	1	%	103

3.5.3 Deactivate regeneration

If the active power exceeds the level specified in cS.06 the modulation is switched off after puls off delay (cS.05).

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.05	puls off delay	0F05h	rw	-	-	0	32000	1	ms	200

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.06	puls off level	0F06h	rw	-	-	-10000	0	1	kW	-0.8

3.5.4 Optimization for regeneration

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.04	switch off delay OSF		rw	np	E	-10	+10	1	–	0
Offset of the modulation window at the start of the modulation with harmonic filter										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.07	mains sync. filter quality	0F07h	rw	np	E	1	8	1	–	1
The smaller the value, the faster the internal mains synchronisation follows the main voltage frequency fluctuations.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.08	Kp - comm.choke	0F08h	rw	np	E	7	13	1	–	10
Gain of the controlled variable at commutation choke.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.09	Ki - comm.choke	0F09h	rw	np	E	5	11	1	–	8
Controller speed at commutation choke.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.11	Kp - harm.filter	0F0Bh	rw	np	E	7	13	1	–	10
Gain of the controlled variable at harmonic filter.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.12	Ki - harm.filter	0F0Ch	rw	np	E	5	11	1	–	8
Controller speed at harmonic filter.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.15	DT1 threshold	0F0Fh	rw	np	E	0	255	1	–	255
In addition to the regeneration level (cs.02) the regeneration can be activated with this parameter. The activation of the regeneration is dependent on the rate of change of the DC link voltage. The function is switched off at value 255 (default). The smaller the value, the faster the unit changes into the regeneration mode. For systems with large load changes it may be advantageous to react faster. For optimal adjustment, the phase currents must be recorded with an oscilloscope and the optimal value must be determined by means of the envelope curve. If the value is too low, the regeneration can be activated unintentionally when there are fluctuations at the DC link voltage.										

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.17	current deviation E.net		rw	np	E	10	100	1	–	50
A supply failure is generated if the phase currents differ by the adjusted value.										

3.6 Protection functions

The protective functions protect the regenerative unit against switching off caused by overcurrent, overvoltage as well as thermal overheating. Furthermore, you can restart the drive after an error automatically (Keep-On-Running).

3.6.1 Error and warning messages

For diagnostic purposes, the regenerative unit displays different malfunction- and error messages. Errors are all those events that trigger an immediate switching off of the modulation, malfunctions allow a defined response. For some events (ext. error, bus monitor response), one can decide in the programming whether this is an error or a malfunction.
A pre-warining can be generated for some errors, such as for example the overload error. This pre-warning is treated like a malfunction, i.e., the appropriate response to the pre-warning is programmable.

Example 1 (error):

The regenerative unit detects overcurrent and raises the error. Display in parameter ru.00: "Error! Overcurrent" (E. OC). Since this error cannot be predicted, there is no possibililty of a pre-warning. The modulation is switched off immediately.

Example 2 (operating condition programmed as error):

The reaction of the bus monitor ("watchdog") shall trigger an error. Programming Pn.05: „Watchdog response“ = 0 (error / no auto restart). Display in parameter ru.00: "ERROR bus" (E. buS). If a digital output is programmed on a fault signalling relay, the relay switches.

Example 3 (operating condition programmed as malfunction):

The reaction of the bus monitor ("watchdog") shall trigger a malfunction. Programming Pn.05: „Watchdog response“ = 0 (error / no auto restart). Display in parameter ru.00: "ERROR bus" (E. buS). If a digital output is programmed on a fault signalling relay, the relay does not switch by fault.
(If the digital output shall also respond to malfunctions, switching condition 6 "abnormal stopping / error" must be used. Alternatively, Pn.65 can be adjusted so that a malfunction is treated like an error with respect to the status displays and the digital outputs. see chapter 5. Error Diagnosis

Example 4 (pre-warning):

If the heat sink temperature exceeds a limit (dependent on the unit type), the modulation is switched off, the unit raises an error. With Pn.11 "heat sink overtemperature warning level" a temperature can be set at which a pre-warning is generated.
Desired response: when exceeding the temperature of Pn.11 the unit switches off the modulation. When the heat sink temperature decreases again, an automatic restart shall occur.
Programming Pn.10 „warning OH stop. mode“ = 3 (modulation off/ auto restart).
Display in parameter ru.00: "Warning! Heat sink temperature" (A. OH)
After decreasing the temperature the unit carry out an automatic restart. If, however, the heat sink temperature continues to rise and exceeds the error limit, the COMBIVERT raises an "Error! Heat sink temperature" (E. OH).

									Unit of the pre-warning
								Pre-warning period or level adjustable	
							Pre-warning possible via digital output		
						Function can be switched off			
					Automatic restart adjustable				
				Error without adjustable response					
Message Operator	**values**	**Message COMBIVIS**							
E.buS/ A.buS	18/93	Error!/warning! Watchdog	-	•	•	-	•	s
E.EEP	21	ERROR! EEPROM defective	•	-	-	-	-	-
E.EF/ A.EF	31/90	Error!/warning! ERROR external fault	-	•	•	-	-	-
Error!	15	ERROR! Load shunt fault	•	-	-	-	-	-
E.nEt	3	ERROR! Mains	•	-	-	-	-	-
E. OC	4	ERROR! Overcurrent	-	•	-	-	-	-
E.OH/ A.OH	8/89	Error!/warning! Power module temperature	-	•	-	•	•	°C
E.OHI/ A.OHI	6/87	Error!/warning! Interior temperature	-	•	•	•	•	s
E.OL/ A.OL	16/99	Error!/warning! overload (Ixt)	-	•	-	•	•	%
E. OP	1	ERROR! Overvoltage	-	•	-	-	-	-
E. Pu	12	ERROR! defective in power unit	•	-	-	-	-	-
E.Puch	50	ERROR! Power unit code changed	•	-	-	-	-	-
E.Puci	49	ERROR! Power circuit unknown	•	-	-	-	-	-
Error: Power circuit identification was changed;	14	ERROR! power unit coding	•	-	-	-	-	-
E.SEt/ A.SEt	39/102	Error!/warning! Set	-	•	•	-	-	-
E.SYn	59	ERROR! Synchronization	•	-	-	-	-	-
E. UP	2	ERROR! Undervoltage	-	•	-	-	-	-
F.nEt	40	ERROR! mains frequency	•	-	-	-	-	-

3.6.1.1 Undervoltage

"Error! Undervoltage "(E.UP) is triggered if the DC link voltage drop due to voltage dip or generally at low network. The automatic restart can be activated for this error.

3.6.1.2 Overvoltage

"Error! Overvoltage" is triggered if the DC link voltage increases beyond the overvoltage level.

3.6.1.3 Overcurrent

The "Error! Overcurrent“ (E.OC) is triggered, if the „OC tripping current“ (see technical data in the instruction manual) is exceeded.
If this error occurs permanently, either the parameter setting is not correct or the COMBIVERT is defective.

3.6.1.4Overload

The overload protection is a function that triggers an error for which, however, a pre-warning can be generated. With Pn.09 "Overload warning level" a value between 0...100 % can be adjusted, when the "Warning! Overload" or the "Warning! Overload during standstill" is set. The response to the overload warning is set with Pn.08 "overload warning response".

Overload (OL)

The implementation of the general overload protection is described in chapter 6.1.7 "Overload characteristics". If the 100% load factor of the COMBIVERT is exceeded by 5 %, the internal overload counter starts to count forward. If the load factor falls below 100 %, the counter counts backward. The current counter content can be read in parameter ru.39. Upon reaching 100 % the inverter switches off with error message "E.OL" and the counter counts backward. If it reaches 0 %, the status changes to E.nOL and the error can be reset.

3.6.1.5Inverter over temperature

Heat sink overtemperature

The heat sink temperature acquisition protects the power module from thermal overload. The temperature when the COMBIVERT switches off with error message "8: ERROR! Overtemperature" (E.OH) depends on the power unit.
The status changes after a cooling period from "Error! Overtemperature" to "36: Heat sink temperature normal "(E.nOH) and is then resettable.
With Pn.11 "Heat sink overtemperature warning level" a level of between 0° C and 90 °C can be set, at which the pre-warning is triggered. The response to the warning message is set with Pn.10 „Heat sink overtemperature response“.

internal overtemperature

The COMBIVERT is protected against malfunctions due to high interior temperatures.

Upon exceeding a unit-specific (warning) temperature the interior fan is activated. If the interior temperature is still too high after 10 minutes, the response adjusted with Pn.16 is triggered. The reaction when decreasing the limit value is depending on the adjusted response in Pn.16.

On exceeding the unit-specific (error) temperature the delay time adjusted in Pn.17 is activated. If the interior temperature is still too high after this period, E.OHI is triggered. If the interior temperature decreases again below the limit value, it is switched to E.nOHI. Now the reset is possible.

3.6.1.6External fault

With Pn.04 „Input selection external fault", one or more digital inputs can be programmed which can trigger the error „31: ERROR! External input" (E.EF).
With Pn.03 "Response to external error" , the response of the inverter to the digital input is defined. With Bit 1 „2: Pn.04 = E.UP“, the function of Pn.04 can be changed and the triggering of an error via a digital input can be deactivated.

3.6.1.7Bus error

The COMBIVERT contains two watchdogs that monitor the communication between an external bus, the oper-

ator, and the inverter control.
With parameter Pn.05 "Response to E.bus", the response to a watchdog error is defined. Dependent on the chosen adjustment, either "Error! Watchdog" (E.buS) or "Warning! Watchdog error" (A.buS), is issued or a warning message via a digital output is generated.

Watchdog time (Pn.06)

This watchdog monitors the communication at the operator interface. With an activated watchdog, the response set under Pn.05 is triggered after expiration of an adjustable time (0.01...40 s) without received telegrams.
By input of the value "0: off“ the function is deactivated.

HSP5 Watchdog time (SY.09)

The HSP5 Watchdog function monitors the communication of the HSP5 interface (control card - operator; or control card - PC). The adjusted response in Pn.05 is released if no telegrams after expiration of an adjustable time (0,01...10 s) are received. Value „0: off“ deactivates the function.

3.6.1.8 Set selection error

With Fr.03 "Parameter set lock", sets can be disabled. If a disabled set is selected, the inverter remains in the old set, i.e., no set change occurs.
The response to the selection of a disabled set is set via Pn.18 "Set selection error response". In the factory setting, the error "39: ERROR! Parameter set selection" (E.Set) is triggered. For Pn.18 = 1...5 a malfunction "102: Warning! Set selection error" (A.Set) is generated. For Pn.18 = "6: Function disabled", the drive continues running in the old set without message.

3.6.1.9 Hardware error

Monitoring for the internal hardware (e.g., switch-mode power supply or loading shunt relay) is integrated on some inverter types. If one of these monitoring circuits reports an error, "12: general power circuit error" (E. PU) is triggered.

	Error Messages		
E.EEP	ERROR! EEPROM defective	21	After reset the operation is again possible (without storage in the EEPROM).
Error!	Error! Load shunt fault	15	Error: Load-shunt relay has not picked up, occurs for a short time during the switch-on phase, but must automatically be reset immediately. If the error message remains the following causes may be applicable:
			load-shunt defective
			input voltage wrong or too low
			high losses in the supply cable
E.Puci	Error! Power circuit unknown	49	During the initialization the power circuit could not be recognized or was identified as invalid.
E.Puch	Error! Power unit changed	50	Power circuit identification was changed; with a valid power circuit this error can be reset by writing to SY.3. If the value displayed in SY.03 is written, only the power-circuit dependent parameters are reinitialized. If any other value is written, then the default set is loaded. On some systems after writing Sy.03 a Power-On-Reset is necessary.
E.PUIN	Error! Power circuit coding	14	Error: Software version for power circuit and control card are different. Error cannot be reset.

3.6.1.10 Regeneration error

	Error Messages
E.nEt	"Error! Mains", one or more phases are missing
E.SYn	"Error! Synchronization", phase allocation at commutation choke not correct

Parameter		Addr.	R	PG	E	Min. value	Max. value	Res.	[?]	Default
cS.03	Mains frequency max. tolerance	0F03h	rw	-	-	0	5	1	%	5
Adjustment of the max. frequency tolerance.										

3.6.2 Response to malfunction messages

3.6.2.1 Selection of the response

Abnormal stopping (i.e., automatic shutdown of the drive) is possible for all errors that do not enforce immediate shutdown of the modulation or for which pre-warnings can be generated.
If abnormal stopping is reasonable in the application, the possibility to set a digital output is available for many malfunctions.

The response is programmable for the following malfunctions:

- Ext. error — Pn.03 Reaction to external fault
- Watchdog — Pn.05 Watchdog reaction
- Set selection error — Pn.18 E.Set stopping mode

Other errors switch off the modulation, but a pre-warnings can be generated prior to their triggering. In the time between the pre-warning signal and the triggering of the error, the drive can be stopped. The response is programmable:

- Overload — Pn.08 warning OL stop. mode
- Heat sink overtemperature — Pn.10 Heat sink overtemperature response
- internal overtemperature — Pn.16 Internal overtemperature response

The descriptions of the errors and the corresponding pre-warning signals are contained in chapter 5.1 "Error assistance".

The following responses can be used for all malfunctions and errors, respectively:

Pn.03, Pn.05, Pn.18: **Response**	
Value	Description
0: error / no auto restart	the malfunction turns into the error (Status: E.xx), immediate shut-down of the modulation, restart only after RESET
3: Modulation off / auto restart	Immediate shutdown of the modulation, automatic restart as soon as the malfunction is resolved
6: No error	malfunction deactivated

Pn.08, Pn.10, Pn.16	
Value	Description
0: error / no auto restart	the malfunction turns into the error (Status: E.xx), immediate shut-down of the modulation, restart only after RESET
3: Modulation off / auto restart	Immediate shutdown of the modulation, automatic restart as soon as the malfunction is resolved
6: Warning via digital output	No response of the drive, the malfunction (and pre-warning, respectively) can be issued via a digital output

3.6.2.2General fault reset (Pn.15)

Functional description „Pn.15 > 0“

a) The first error is reset after a waiting period of approx. 4 seconds.

b) Any further errors that occur within the next hour, will also be reset at the end of the waiting period.
If the error criterion is reached the error number 41 is displayed in ru.00.(Operator: E.FrLr).

If there are more errors than adjusted in Pn.15 within this hour, the unit can only be reset manually via terminal strip or via "BUS".
Manual resetting of a fault resets also the "time grid". That means, the next error will automatically reset again after the waiting period.

3.6.3 Automatic Restart

With the automatic restart, the COMBIVERT resets the error automatically or clears it automatically by a malfunction.

The automatic restart only makes sense if the error can be expected based on the application. Normally, the cause of the error must first be investigated and eliminated before the drive can be put back in operation by executing the reset.
Therefore, it must be selected after which errors an automatic restart should be executed

Because of the independent starting of the machine safety measures must be provided for operating personnel and machine!

3.6.3.1 Undervoltage error (E.UP)

In Pn.00 "automatic restart E.UP", the automatic restart for the undervoltage error is activated in the factory setting.

A typical application for the automatic restart E.UP (Pn.00) is operation on a bad power grid where sporadic voltage dips are to be expected. With this function, the application continues running as soon as the mains voltage is sufficiently high again.

3.6.3.2 Overvoltage error (E.OP)

The error overvoltage usually occurs at deceleration in connection with an overcurrent error.
At automatic restart the blocking time modulation is at least 1 second.

3.6.3.3 Overcurrent error (E.OC)

The automatic restart after occurence of an overcurrent error is activated with Pn.02 "automatic restart E.OC".
It can be used at burst-like overloads.
The blocking time modulation will proceed as in overvoltage errors.
After 10 restart attempts, the inverter state must be unequal to the blocking time modulation or the overcurrent error for at least one second, otherwise the restart is aborted.

3.6.3.4 Malfunction messages and pre-warnings

A malfunction response with automatic restart is selected in parameters Pn.03, Pn.05, Pn.08, Pn.09, Pn.10, Pn.11, Pn.16, Pn.18 with the value 3 .

3.6.4 Special functions

In these parameters, many different functions for adapting the inverter behaviour to special applications are pooled.

Pn.19: Operating mode	
Value	Description
0: Master with commutation choke	For high power regenerative units can be parallel connected. One device must be set to "master", the other set to "slave" (pn.19). Single units are always master. **The coupling of the regenerative units is made by terminals X2A.16/18, since this is a fast digital input.**
1: Master with harmonic filter	
2: Slave with commutation choke	
3: Slave with harmonic filter	
4: Selection of Master/Slave with commutation choke via input I1, I2 or I3	**Input selection for 4 and 5 in the parameters I1:di11/I2:di12/I3:-di13 each Bit 1 or pn.31**
5: Selection of Master/Slave with harmonic filter via input I1, I2 or I3	

The input query at 4 or 5 will once held by Power-on reset.

3.7 Parameter sets

KEB COMBIVERT includes 8 parameter sets (0. .. 7), i.e., all programmable parameters are 8 times available in the inverter and can be assigned independently with different values. Since many parameters in the parameter sets have the same values, it would be complicated to adjust each parameter individually in each set. This section describes how to copy, lock and select entire parameter sets and to reinitialize the inverter.

3.7.1 Not set-programmable parameters

Certain parameters are not set-programmable, since their value must be the same in all sets (e.g. bus address or baud rate). The parameter set number is missing in the parameter identification in order that these parameters are immediately visible.

Always the same value is valid for all non set-programmable parameters independent of the selected parameter set!

The following parameters are not set-programmable:

SY-Parameters	ud.01...17
ru-Parameter	Fr.02...04/ 07/ 09/ 11
di-Parameter	An.41…52
In-Parameter (exception: In.24 and 25)	LE.17-26
Pn.00...19, 31	

3.7.2 Security-Parameters

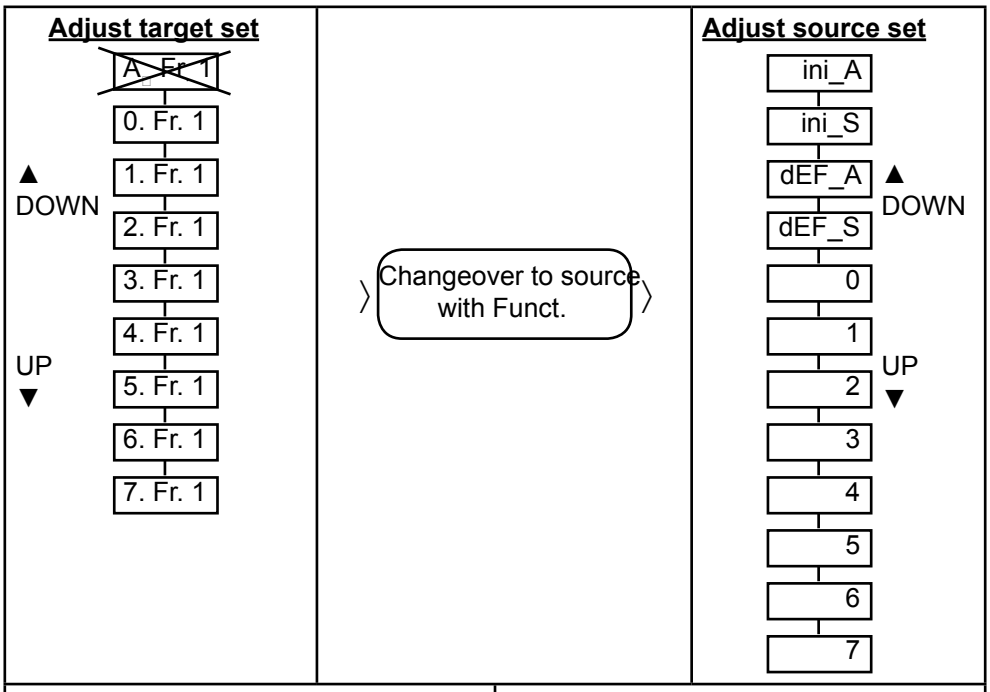
The security parameters include the baud rate, inverter address, hour counter, control type, serial number/customer number, trimming values, and fault diagnosis. It make sense that they are not overwritten when loading the default set.

SY.02/ 03/ 06/ 07/ 11
ru.40/ 41
ud.01
Fr.01
In.10...16/ 24...30

3.7.3 Indirect and direct set-addressing

The parameter values are displayed and edited at indirect set-addressing, which of the set pointer (Fr.09) is adjusted. Direct set-addressing allows the display or writing of a parameter value directly into one or more parameter sets independent of the set pointer. Direct set programming is only possible via bus operation.

3.7.4 Copying of parameter sets via keyboard (Fr.01)



With the keys UP/Down and at flashing point the target set 0...7 is adjusted in addition to the parameter set number. The active (A) parameter set must not be adjusted as target set while copying. If the target set is > 0, only the programmable parameters are overwritten!	The source set is adjusted with the keys UP/Down. The copy process is started with „Enter“. Copy process is only possible with open control release or error, otherwise "I_op" (invalid operation) is displayed. After copying „PASS“ appears in the display and could be erase by „ENTER“.

3.7.5 Copying of parameter sets via bus (Fr.01, Fr.09)

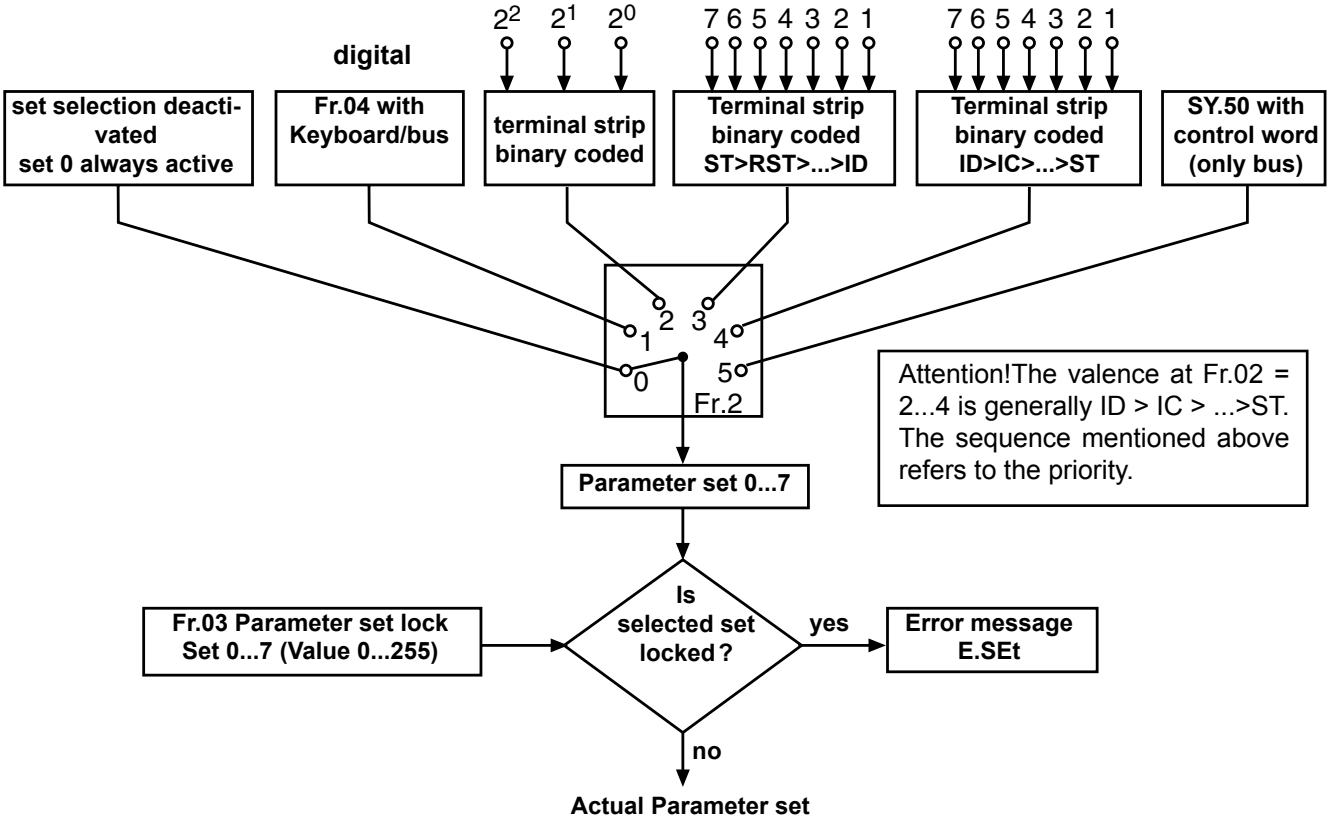
At indirect set addressing two parameters are responsible for copying parameter sets at bus operation. Fr.09 determines the target set. Fr.01 determines the source parameter set and starts the copy process. With direct set-programming the source set (Fr.01) is copied in the selected parameter sets. The following copy functions can be executed:

Target set Fr.09	Source set Fr.01	Action
0...7	0...7	All set-programmable parameters (also system parameters) of the source set are copied in the target set.
0	-1: dEF_S	Default values are copied in all parameters of set 0 (exception system and security parameters).
1...7	-1: dEF_S	Default values are copied in all set-programmable parameters of the target set (exception system and security parameters).
All	-2: dEF_A	Default values are copied in all parameters of all sets (exception system and security parameters).
0	-3: ini_S	Default values are copied in all parameters of set 0 (exception security parameters).
1...7	-3: ini_S	Default values are copied in all set-programmable parameters of the target set (exception security parameters).
All	-4: ini_A	Default values are copied in all parameters of all sets (exception security parameters).

All definitions defined by the machine builder are reset by loading the factory setting! This can include the terminal assignment, set changeover or operating conditions. Ensure before loading the default set that there are no unwanted operating conditions.

3.7.6 Parameter set selection

Picture 3.7.6 Principle of the parameter set selection



Fr.02 Parameter set source

As seen in picture 3.7.6 Fr.02 determines, whether the parameter set selection is done or switched off via keyboard/bus (Fr.04) terminal strip or via control word (SY.43/ 50). The selection is activated by pressing "Enter".

Fr.02: Parameter set source	
Value	Function
0	Set selection deactivated; set 0 always active
1	Set selection via keyboard/bus with Fr.4
2	Set selection binary-coded via terminal strip
3	Set selection input-coded via terminal strip Priority: ST >RST>R>F>I1>I2>I3>I4>IA>IB>IC>ID
4	Set selection input-coded via terminal strip Priority: ID >IC>IB>IA>I4>I3>I2>I1>R>F>RST>ST
5	Set source via control word SY.43 / 50

Fr.04 Parameter set setting

Parameter Fr.04 can be written via keyboard and via bus. The desired parameter set (0… 7) is directly preset as value and activated by pressing Enter.

Fr.07 Parameter set Input selection

The setting for the terminal strip can be done binary-coded or input-coded. The inputs are determined with parameter Fr.07. Maximally 3 inputs should be programmed to set source at binary-coded set source, in order to avoid set source errors.

Fr.10: **Parameter set input selection**			
Bit	Value	Input	Terminal
0	1 [1)]	ST (prog. input „control release/reset“)	X2A.12
1	2	RST (prog. input „reset“)	no
2	4	F (prog. input „forward“)	no
3	8	R (prog. input „reverse“)	no
4	16	I1 (prog. input 1)	X2A.13
5	32	I2 prog. input 2)	X2A.14
6	64	I3 (prog. input 3)	X2A.15
7	128 [2)]	I4 (prog. input 4)	X2A.16
8	256	IA (internal input A)	no
9	512	IB (internal input B)	no
10	1024	IC (internal input C)	no
11	2048	ID (internal input D)	no

1) Input ST is assigned by hardware with the function „control release“. Further functions can only be adjusted additionally.

2) The input I4 is connected by hardware with the master- / slave control. Further functions can only be adjusted additionally.

Example

Binary-coded set selection

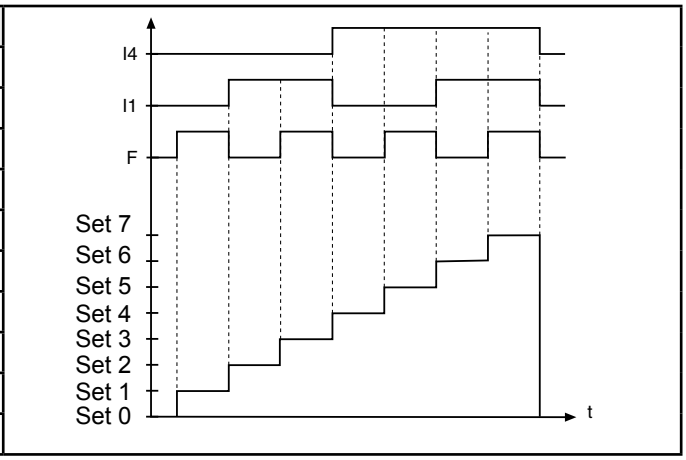
At binary coded set selection:

- - maximally 3 of the internal or external inputs may be programmed to set selection (2^3=8 sets) to avoid set selection errors.
- if the value of the inputs programmed for set selection is ascending (ID>IC>IB>IA>I4>I3>I2>I1>R>F>RST>ST)

Example 1: set 0...7 shall be selected with 3 inputs (I1, I2, and I3)

1.) Adjust parameter Fr. 07 to value „148“
2.) Set Fr.02 to value „2“ (set source binary-coded via terminal strip)

I3	I2	I1	Input
2^2	2^1	2^0	Set
0	0	0	0
0	0	1	1
0	2	0	2
0	2	1	3
4	0	0	4
4	0	1	5
4	2	0	6
4	2	1	7



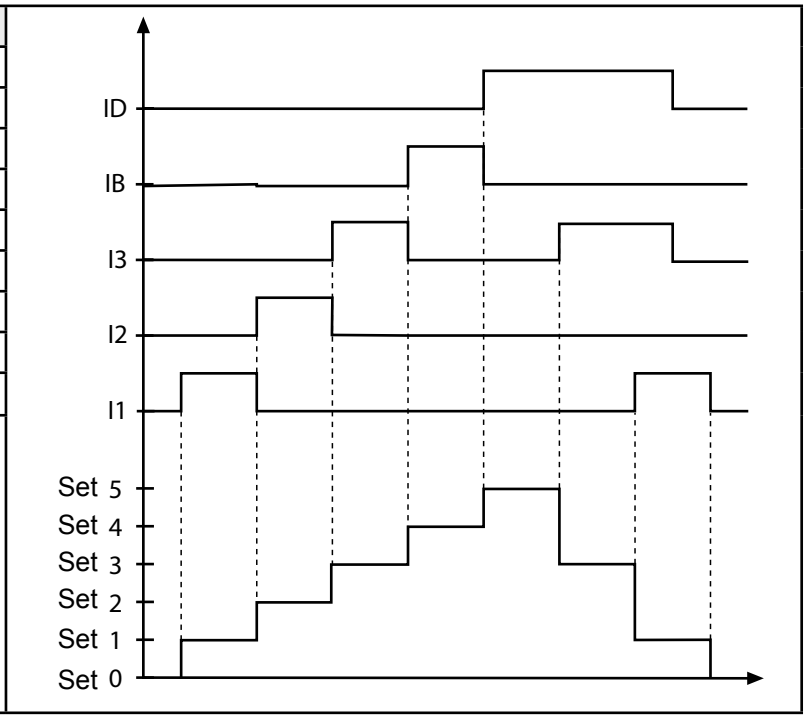
Input-coded set selection
With input-coded set selection

- maximally 7of the internal or external inputs may be programmed to set source (0...7 sets) to avoid set selection errors.
- the lowest of the selected inputs has priority at Fr.02 = „3" (ST>RST>R>F>I1>I2>I3>I4>IA>IB>IC>ID)
- the highest of the selected inputs has priority at Fr.02 = „4“ (ID>IC>IB>IA>I4>I3>I2>I1>R>F>RST>ST)

Example 1: set 0...5 shall be selected with 5 inputs (I1, I2, I3, IB and ID)

1.) Adjust parameter Fr. 07 to value „2672“
2.) Set Fr.02 to value „3“ (set source input-coded via terminal strip)

ID	IB	I3	I2	I1	Set	Set
				Fr.02 =	3	4
0	0	0	0	0	0	0
0	0	0	0	1	1	1
0	0	0	2	0	2	2
0	0	3	0	0	3	3
0	4	0	0	0	4	4
5	0	0	0	0	5	5
5	0	3	0	0	3	5
5	0	3	0	1	1	5



Reset set input selection (fr.11)

Parameter Fr.11 defines an input, independent of the actual parameter set it can be switched in parameter set 0. This function is only active at Fr.02 = 2...4

- with static input assignment the inverter remains in set 0 as long as the input is set.
- with edge-triggered inputs set 0 is activated with the 1st edge. With the 2 nd edge the set activated by the other inputs is selected again.

3.7.7 Locking of parameter sets

Fr.03 Parameter set lock

Parameter sets, which shall not be selected, can be locked with Fr.03. If one of the locked sets is selected, the adjusted response in Pn.18 is executed (default: set source error E.SEt) .

Value	Locked set
1	0
2	1
4	2
8	3
16	4
32	5
64	6
128	7

Example (set 2 and 5 locked)

-
-
4
-
-
32
-
-

Sum: 36

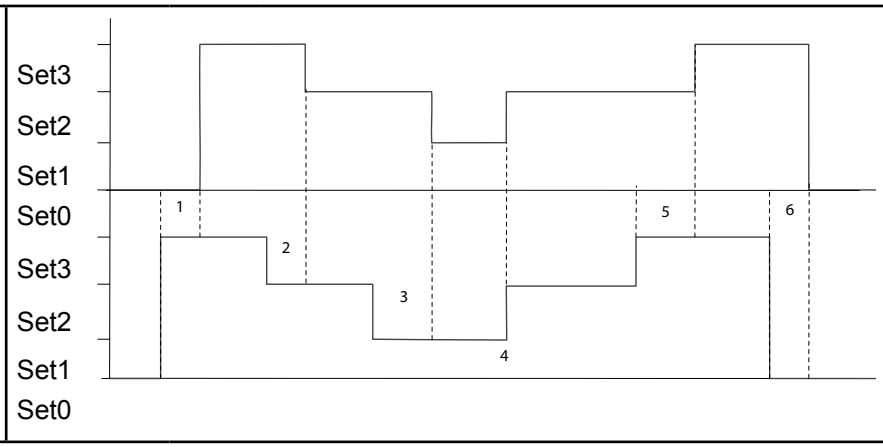
3.7.8 Parameter set ON/OFF delay (Fr.05, Fr.06)

With these parameters the time is adjusted,

- with which the activation of a new set is delayed (Fr.05)
- with which the deactivation of an old set is delayed (Fr.06)

At set changeover, the switch-off time of the old set and the switch-on time of the new set are added.

Figure 3.7.8 ON and OFF delay



Example					
	on	off		1:	ON delay for set 3 of 2s
Set	Fr.05	Fr.06		2:	OFF delay for set 3 of 2s
0	0s	0s		3:	OFF delay for set 2 of 1s +
1	2s	0s			ON delay for set 1 of 2 s
2	0s	1s		4:	immediate changeover as no delay is adjusted
3	2s	2s		5:	OFF delay for set 2 of 1s +
					ON delay for set 3 of 2s
				6:	OFF delay for set 3 of 2s

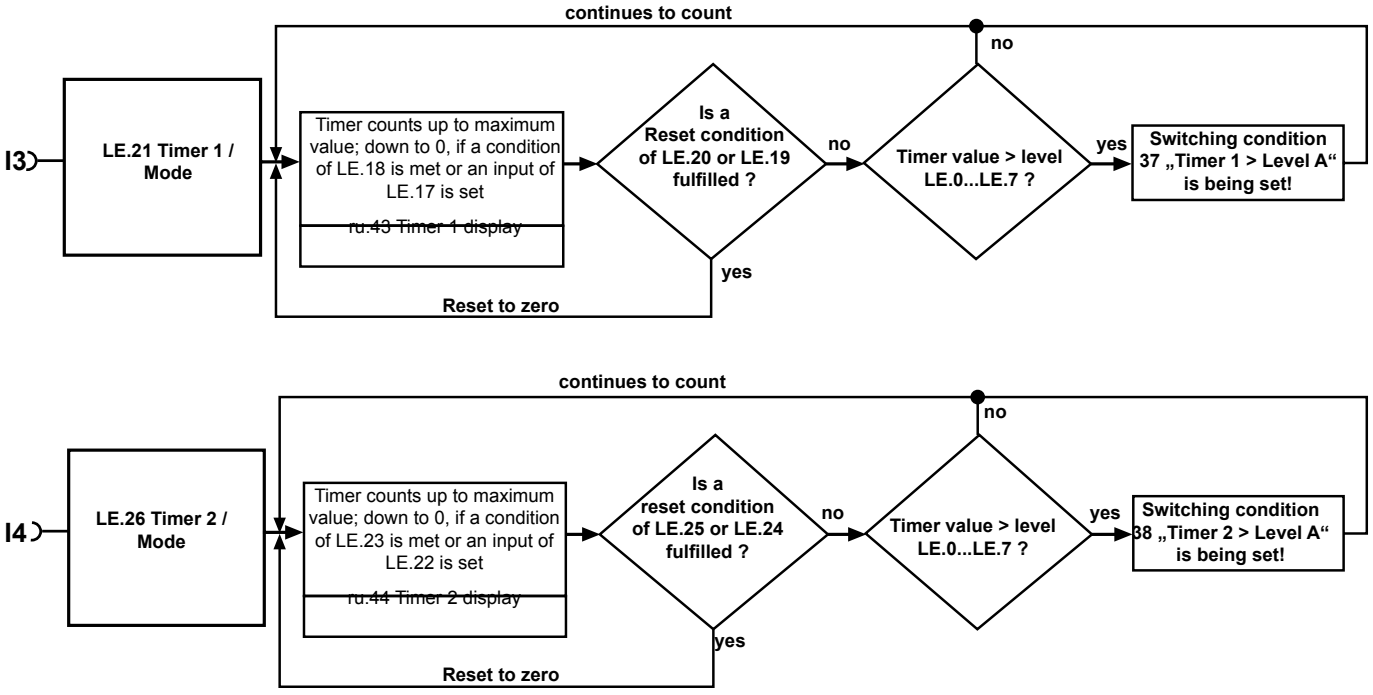
3.8 Special Functions

The following section should facilitate the adjustment and programming of special functions.

3.8.1 Timer and Counter

Two timers are incorporated in the COMBIVERT. As long as one of the adjustable starting conditions (LE.18/23) or a programmable input (LE.17/22) is set, the timer counts until reaching the final range value. If one of the reset conditions (LE.20/25) is met or one programmable input (LE.19/24) is set, the timer jumps back to zero. The clock source and the counting direction is adjusted with LE.21/26. It can be counted in seconds, hours or by a special programmed input for that. The current timer content is displayed in ru.43/44. Switching condition 37/38 is set with reaching an adjustable switching level (LE.00...07). It can be used to set an output.

Fig. 7.15.4 Timer programming



Timer / mode (LE.21 / LE.26)

LE.21 and LE.26 determine the clock source and the counting direction of timer 1 and 2. Clock pulse source can be the time counter in 0.01s or 0.01h grid, pulses from a digital input. The timer runs generally as long as a starting condition is active. After a reset the timer starts again at zero. Following clock sources can be selected:

LE.21 / LE.26 Timer 1 / 2 Mode			
Bit	Meaning	Value	Description
0...2	Selection clock pulse source	0: 0,01s (internally clock)	The timer value increases / decreases every 10 ms by 0.01.
		1: 0,01h (internally clock)	The timer value increases / decreases every 36s by 0.01.
		2: every slope T1-I3 / T2-I4	Each slope on I3 (for timer 1) or I4 (for timer 2) increases / decreases the timer value by 0.01.
		3: positive slope T1-I3 / T2-I4	A rising slope on I3 (for timer 1) or I4 (for timer 2) increases / decreases the timer value by 0,01.
		4...7: reserved	
3, 4	Counting direction	0: Upward	The counting direction of the timer is always upwards
		24:downwards	

Timer / start condition (LE.18 / LE.23)

From the following table the conditions can be selected at which the timer is started. The individual conditions are OR-operated with the timer start input selection (LE.17/ LE.22).

LE.18 / LE.23: Timer / Starting condition		
Bit	Value	Timer / Starting condition
0	1	Modulation on
1	2	Modulation off

In case of several starting conditions the values are to be added up.

Timer start input selection (LE.17 / LE.22)

Additionally the timer can be activated by one or several inputs. The sum of the valences is to be entered, if the timer shall be started by different inputs The individual inputs are OR-operated. The start input selection is OR-operated with the timer / starting condition (LE.18 / LE.22).

LE.17/ LE.22: Timer start input selection			
Bit	Value	Input	Terminal
0	1	ST (prog. input „control release/reset“)	X2A.16
1	2	RST (prog. input „reset“)	X2A.17
2	4	F (prog. input)	X2A.14
3	8	R (prog. input)	X2A.15
4	16	I1 (prog. input 1)	X2A.10
5	32	I2 prog. input 2)	X2A.11
6	64	I3 (prog. input 3)	X2A.12
7	128	I4 (prog. input 4)	X2A.13
8	256	IA (internal input A)	no
9	512	IB (internal input B)	no
10	1024	IC (internal input C)	no
11	2048	ID (internal input D)	no

Timer display (ru.43 / ru.44)

ru.43 / ru.44 displays the actual counter reading dependent on the adjusted clock source (LE.21 / 26). By writing on ru.43 / 44 the counter can be set to a value. If the clock source is changed during the running time the counter content is maintained but is interpreted according to the new clock source.

Timer reset input selection (LE.19 / LE.24)

The inputs which reset the timer can be defined with the following table. The individual inputs are OR-operated, i.e. if one of the specified inputs is triggered, the timer jumps back to zero. If a starting and reset condition are active simultaneously, reset has priority.

LE.19/ LE.24: Timer reset input selection			
Bit	Value	Input	Terminal
0	1	ST (prog. input „control release/reset“)	X2A.16
1	2	RST (prog. input „reset“)	X2A.17
2	4	F (prog. input)	X2A.14
3	8	R (prog. input)	X2A.15
4	16	I1 (prog. input 1)	X2A.10
5	32	I2 prog. input 2)	X2A.11
6	64	I3 (prog. input 3)	X2A.12
7	128	I4 (prog. input 4)	X2A.13
8	256	IA (internal input A)	no
9	512	IB (internal input B)	no
10	1024	IC (internal input C)	no
11	2048	ID (internal input D)	no

Timer reset condition (LE.20 / LE.25)

The conditions when the timer is reset additionally to the inputs can be defined in accordance with the following table. The individual conditions are OR-operated.

Bit No.	Decimal value	Condition
0	1	Modulation on
1	2	Modulation off
2	4	reserved
3	8	Change of parameter set
4	16	Power-On-Reset

Comparison level 0...7 (LE.00...LE.07)

LE.00...LE.07 define the level for the switching conditions 37 / 38 („timer > level“). If the timer exceeds the adjusted value the switching condition is set. A level in the range of -10.737.418,24 to 10.737.418,23 can be adjusted. But only values of 0...655,35 are sensible for the counter.

3.8.2 Mask out inverter state (Pn.30)

The following two functions are combined in this parameter:

pn.30		
Bit	Value	Description
0	0	The state base-block is displayed in ru.00
	1	The state base-block is not displayed in ru.00
1	0	Errors E.FnEt and E.nEt are always entered in the error history (In.24).
	2	Errors E.FnEt and E.nEt are only entered in the error history (In.24) at control release.

3.8.3 Master / Slave input selection

With parameter Pn.31 the digital input can be selected with which the master / slave mode is activated.By default, no value is selected.

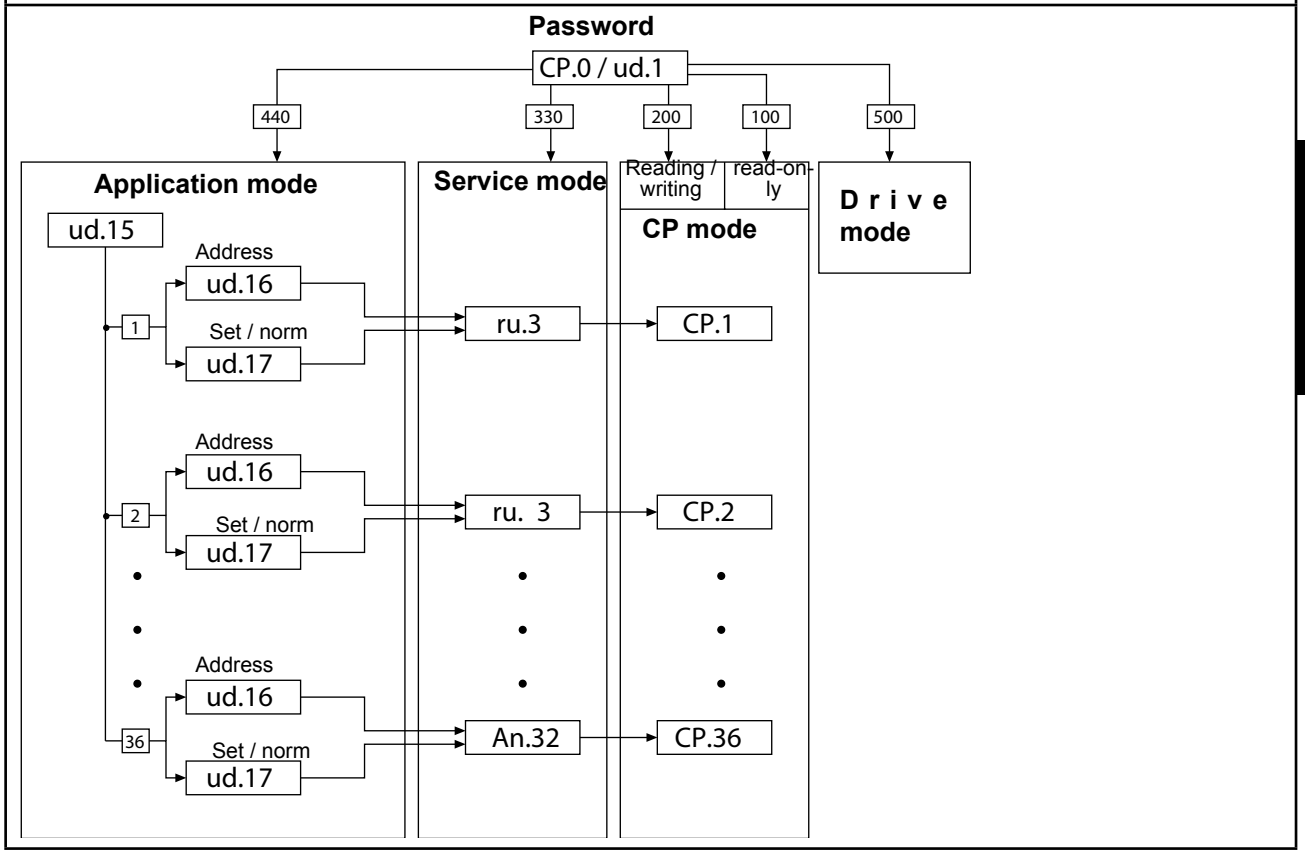
Pn.31: Input selection Master/Slave		
Bit	Value	Description
4	16: I1	Digital input 1
5	32: I2	Digital input 2
6	64: I3	Digital input 3

3.9 Define CP-Parameters

If the development stage of a machine is completed, usually only a few parameters are required to adjust or control the COMBIVERT. In order to simplify the handling and end-user documentation, as well as the security against unauthorized access, there is the possibility to create an own user interface, the CP-Parameters. 37 parameters (CP.00 ... CP.36) are available for this, 36 parameters (CP.01 ... CP.36) can be assigned free.

3.9.1 Survey

Picture 3.91 Definition structure



ud.15 determines the CP-Parameter to be processed. With ud.16 and ud.17 the CP-Parameter is defined by its address, the respective set and the display norm. Dependent on the adjusted password (CP.0 or ud.1)

- the adjusted parameter is directly displayed in the service mode
- the adjusted parameter is displayed as CP-Parameter in the CP mode

Parameter CP.0 is not configurable, it always includes the password input. ud.1 is used for password input if the inverter is in application or service mode.
Parameters which are not permissible as CP-Parameters (e.g. ud.15 ... 17 and Fr.1) are confirmed with "data invalid". Input of an invalid parameter address switches the parameter to "oFF" (-1). The corresponding CP-Parameter is not displayed in this setting.

3.9.2 Assignment of CP-Parameters

CP selector (ud.15)

The CP-Parameter to be programmed in a range of 1...36 is adjusted with ud.15. CP.00 is not adjustable.

CP address (ud.16)

ud.16 determines the parameter address of the parameter to be displayed:

ud.16	CP address
-1:	Parameter not used
0...32767:	Parameter address

Not available or not allowed parameter addresses are rejected with "data invalid".

CP set norm (ud.17)

The set, the addressing and the norm of the parameter to be displayed are specified with ud.17. The parameter is bit-coded. The individual bits are decoded as follows:

Define set selection for direct set addressing

Bit 0 .. 7 determine the set selection for direct set programming i.e., all selected sets gets the same value, determined by the CP-Parameter. If direct set programming (bit 8, 9) is selected, at least one set must be selected, otherwise error message "set invalid" is displayed in the CP menue.

Bit									
7	6	5	4	3	2	1	0	Value	Set
0	0	0	0	0	0	0	0	0	no
0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	1	0	2	1
0	0	0	0	0	1	0	0	3	0+1
...								...	...
1	1	1	1	1	1	1	1	255	All

-> Data invalid, if bit 8 + 9 = 0

Define set addressing mode

Bit 8 and 9 determine the set addressing mode:

Bit			
8	9	Value	Function
0	0	0	direct set addressing; the defined sets of bit 7 .. 0 are valid
0	1	256	actual set; the actual set is displayed / edited
1	0	512	indirect set addressing, the parameter set determined by the set pointer Fr.09 is displayed / edited
1	1	768	reserved

Display standardization

Bit 10 .. 12 determines how to display the parameter value. With parameters ud.18 ... 21 it is possible to define up to seven different user standardizations (below in this chapter).

Bit				
12	11	10	Value	Function
0	0	0	0	Use standardization of the parameter
0	0	1	1024	Display standardization of parameters ud.18...21 of set 1
0	1	0	2048	Display standardization of parameters ud.18...21 of set 2
	...		...	
1	1	1	7168	Display standardization of parameters ud.18...21 of set 7

3.9.3 Example

An user menu with the following features shall be programmed as example:

1. Display of the actual line frequency (ru.03) in the respective set

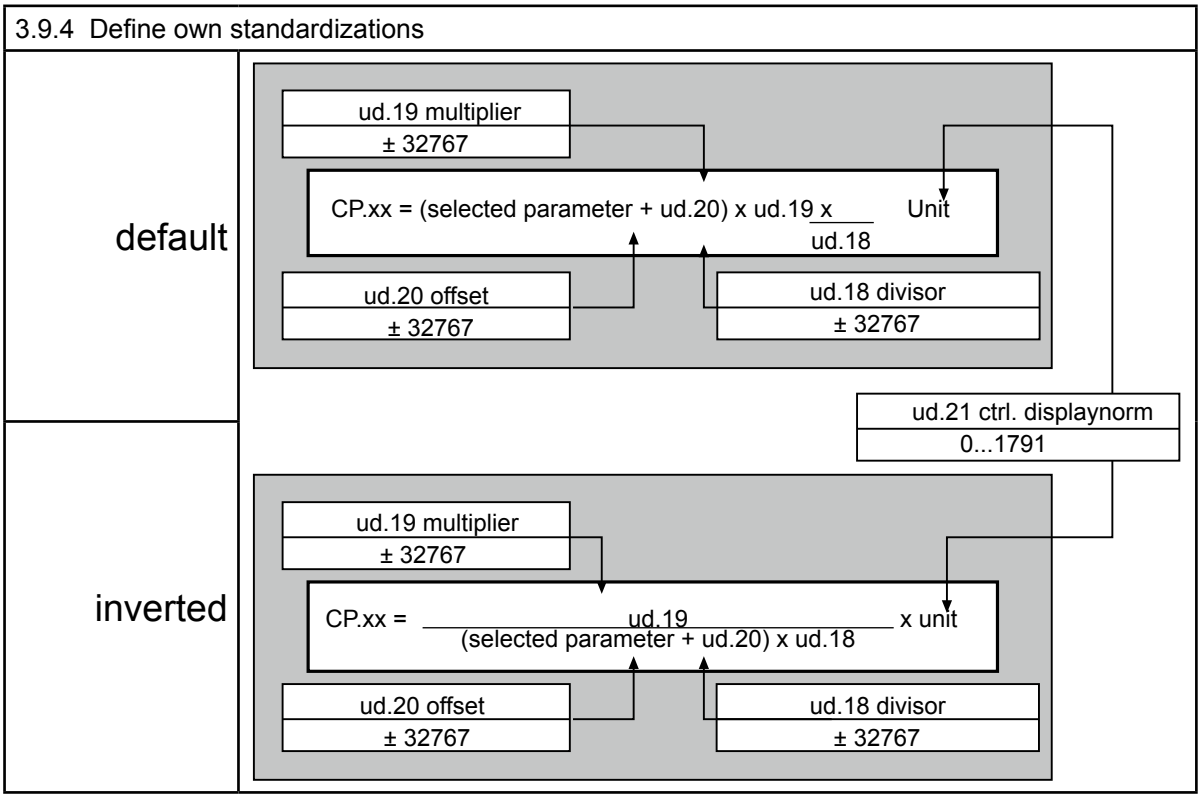
2. Setting of a comparison level (LE.00) in set 2
3. Setting of a comparison level (LE.00) in set 3

```
1.)   ud.15 = 1          ; CP.1
      ud.16 = 0203h      ; Parameter address for ru.03
      ud.17 = 256        ; Display in the active set

2.)   ud.15 = 2          ; CP.2
      ud.16 = 0D00h      ; Parameter address for LE.00
      ud.17 = 4          ; Setting in set 2

3.)   ud.15 = 3          ; CP.3
      ud.16 = 0D00h      ; Parameter address for LE.00
      ud.17 = 8          ; setting in set 3

4.)   ud.15 = 4          ; CP.4
      ud.16 = -1: off    ; CP.4 not displayed
      ud.17 = xxx        ; ud.17 no function
```

Set all other parameters like CP.4 to "off", that there is no display.
The acceptance of values occurs only after power-on reset of the operator.

3.9.4 Display standardization

KEB COMBIVERT offers the user the possibility to define the own standardizations in the CP mode. Parameters ud.18...20 serve as conversion, ud.21 serves as specification of the calculation method, decimal places, as well as the displayed unity in KEB COMBIVIS.



For the "selected parameter" either "non-standardized value" or "standardized value/resolution" is used!

ud.18 Divisor display standardization

Adjusts the divisor in the range of ±32767 (default 1). The parameter is set-programmable.

ud.19 Multiplier display standardization

Adjusts the multiplier in the range of ±32767 (default 1). The parameter is set-programmable.

ud.20 Offset display standardization

Adjusts the offset in the range of ±32767 (default 0). The parameter is set-programmable.

ud.21 Display standardization Mode

ud.21 adjusts the calculation mode, decimal places as well as the displayed unity in KEB COMBIVIS. The parameter is bit-coded and set-programmable. The parameter can be adjusted in the range of 0...1791.

Bit 12...15	Bit 11...8	Bit 7...6	Bit 5...0	ud.21

-	-	-	see table 1	Unit
-	-	see table 2	-	Mode of calculation
-	see table 3	-	-	Display
free	-	-	-	-

Table 1 unity (bit 0...5)

Value	Unit	Value	Unit	Value	Unit	Value	Unit
0	no	16	km/h	32	K	48	lbin
1	mm	17	rpm	33	mW	49	in/s
2	cm	18	Hz	34	W	50	ft/s
3	M	19	kHz	35	kW	51	ft/min
4	km	20	mV	36	inc	52	ft/s²
5	g	21	V	37	%	53	ft/s³
6	kg	22	kV	38	KWh	54	MPH
7	us	23	mW	39	mH	55	kp
8	ms	24	W	40	-	56	psi
9	s	25	kW	41	-	57	°F
10	h	26	VA	42	in	58	-
11	Nm	27	kVA	43	ft	59	-
12	kNm	28	mA	44	yd	60	-
13	m/s	29	A	45	oz	61	-
14	m/s^2	30	kA	46	lb	62	-
15	m/s^3	31	°C	47	lbft	63	-

Table 2 calculation mode (bit 6...7)

Value	Function

0	(selected parameter + ud.20) x	$\frac{\text{ud.19}}{\text{ud.18}}$	= CP.xx
64	$\frac{\text{ud.19}}{\text{(selected parameter + ud.20) x ud.18}}$		= CP.xx
-	free		

The "non-standardized value" is used for the „selected parameter“!
Non-standardized value = standardized value / resolution

Table 3 display (bit 8...11)

Value	Display
0	0 decimal places
256	1 decimal place
512	2 decimal places
768	3 decimal places
1024	4 decimal places
1280	variable decimal places
1536	Hexadecimal
-	free

4. Start-up

The following chapter is intended for everybody who has no experience with the KEB power supply and regenerative units. It shall allow a correct entering into this field. But because of the complex application possibilities we must restrict ourselves to explaining the start-up of standard applications.

4.1 Preparatory measures

4.1.1 After unpacking the goods

After unpacking the goods and checking them for complete delivery following measures are to be carried out:

☑ Visual control for transport damage

Should any external damages to the KEB COMBIVERT be visible get in tough with your forwarding agent and return the unit with a corresponding report to KEB.

4.1.2 Installation and Connection

Installation and connection instructions as well as EMC conform installation are found in the instruction manual.

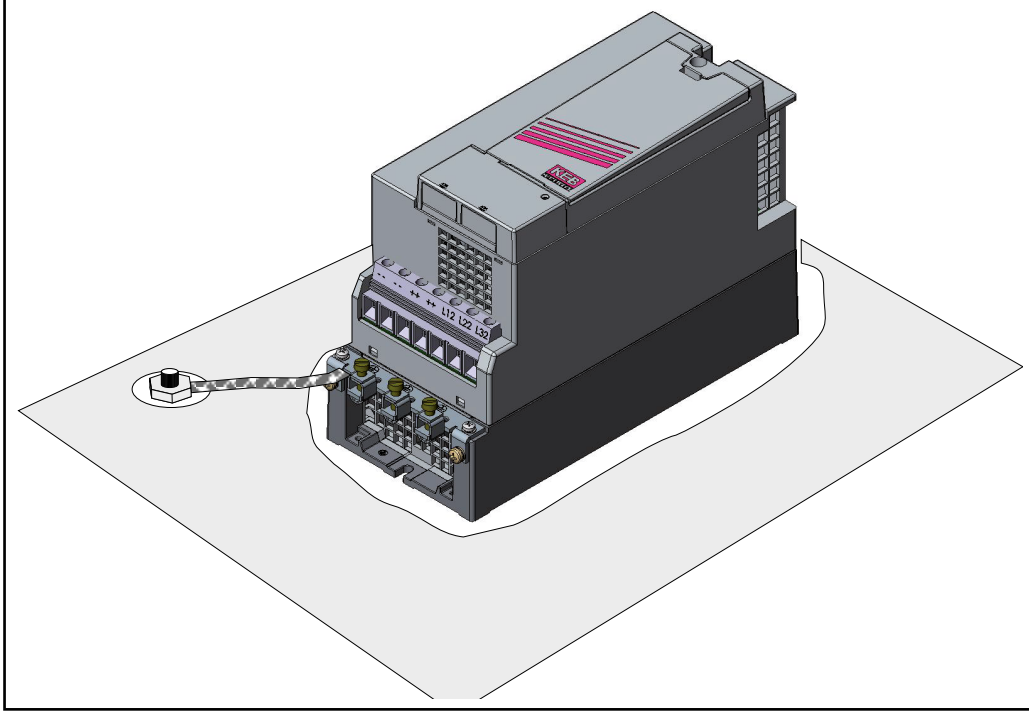
a.) Galvanized surface

b.) The mounting surface of the inverter must be bright.

☑ If necessary, use contact lacquer as protection against corrosion

☑ Connect the earthing strip to central point in the control cabinet

Installation and connection using the example of E-Housing



4.1.3 Checklist prior to start-up

Before switching on the inverter go through the following checklist.

- ☑ Is the COMBIVERT firmly bolted in the control cabinet?
- ☑ Is there enough space to ensure sufficient air circulation?
- ☑ Are mains and DC cables as well as the control cables installed separately from each other?
- ☑ Are all mass and earthing cables attached and well contacted?
- ☑ Check, whether all power and control cables are firmly in place!
- ☑ Remove any tools from the control cabinet!
- ☑ Attach all covers and protective caps to ensure that all live parts are secured against direct contact.
- ☑ When using measuring instruments or computers an isolating transformer should be used, if not, make sure that the equipotential bonding between the supply lines is guaranteed!
- ☑ Open the control release of the COMBIVERT to avoid the unintended starting of the machine.

Instructions to the wiring can be taken from the installation manual!

4.1.4 Safety Instructions

General instructions

 **Electric Shock**	COMBIVERT R6 power supply und regenerative units contain dangerous voltages which can cause death or serious injury. COMBIVERT R6 can be adjusted by way that energy is regenerated into the supply system in case of power failure at regenerative operation. Therefore a dangerous high tension can be in the unit after switching off the supply system. **Before working with the unit check the isolation from supply by measurements in the unit.** Care should be taken to ensure correct and safe operation to minimise risk to personnel and equipment.

 **Only Qualified Electro-Personnel**	All work from the transport, to installation and start-up as well as maintenance may only be done by qualified personnel (IEC 364 and/or CENELEC HD 384 and IEC-Report 664 and note national safety regulations). According to this manual qualified staff means those who are able to recognise and judge the possible dangers based on their technical training and experience and those with knowledge of the relevant standards and who are familiar with the field of power transmission.

 **Observe standards**	The COMBIVERT R6 must not be started until it is determined that the installation complies with 2006/42/EC (machine directive) (note EN60204). The COMBIVERT R6 must not be started until it is determined that the installation complies with 2006/42/EC (machine directive) (note EN60204). The COMBIVERT R6 meets the requirements of the Low-Voltage Directive 2006/95/EC. The harmonized standard of the series EN 61800-5-1 (VDE 0160) is used. This is a product of limited availability in accordance with IEC 61800-3. This product may cause radio interference in residential areas. In this case the operator may need to take corresponding measures.

Transport, storage and installation

The storage of the COMBIVERT must be done in the original packing. It is to be protected against humidity and excessive cooling and thermal effect. A long-distance transport must be carried out in the original packing. It is to be secured against impact influence. Observe the marking on the final packing! After removing the final packing the COMBIVERT must be set down on a stable base.

 **Protect Against Accidental Contact**	The COMBIVERT R6 must be protected against invalid loading. Components and covers must not be bent or moved as this may affect insulation distances. The units contain electrostatic sensitive devices which can be destroyed by inappropriate handling. For that reason the contact of electronic devices and contacts is to be avoided. The equipment must not be switched on if it is damaged as it may no longer comply with mandatory standards. Make sure that during installation there is enough minimum clearance and enough cooling. Climatic conditions must be observed in accordance with the instruction manual.

 **Hot surface**	Heat sinks can reach temperatures, which can cause burns when touching. If in case of structural measures a direct contact cannot be avoided, a warning notice "hot surface" must be mounted at the machine.

Electrical connection

 **Note Capacitor all costs**	Before any installation and connection work, the system must be switched off and secured. After clearing the DC link capacitors are still charged with high voltage for a short period of time. The unit can be worked on again, after it has been switched off for 5 minutes.

 **Secure Isolation**	The terminals of the control terminal strip are securely isolated in accordance with EN 61800-5-1. With existing or newly wired circuits the person installing the units or machines must ensure that the EN requirements are met. With frequency inverters that are not isolated from the supply circuit all control lines must be included in other protective measures (e.g. double insulation or shielded, earthed and insulated).

Voltage With Respect To Ground	The connection of COMBIVERT R6 is allowed to: a) Symmetrical mains with a voltage phase (L1, L2, L3) with respect to neutral conductor/ ground (N/PE) of maximum 305 V. b) Phase conductor grounded mains: • the control system is no longer regarded as “safe isolated circuit”, further protection measures are required therefore (see "Safe isolation"). • with this type of power system, the max. voltage phase / earth must not exceed 528 V absolute • appropriate, external DC fuses at the DC connections are necessary for the 400 V class. Use the COMBIVERT R6 without internal DC fuses. • Contact KEB regarding EMC filter. An isolating transformer must be used for supply networks which exceed this value! The units may be damaged if this is not observed.

Stationary Connection	The COMBIVERT R6 is designed for fixed connection, since discharge currents of > 3.5 mA occur especially when using together with EMI filters. Therefore, the requirements or instructions from EN 60204-1 (VDE 0113) and EN 61800-5-1 (IEC 0160-5-1) must be observed.

Insulation Measurement	When doing an insulation or voltage measurement in accordance with in EN 60204-1 / VDE 0113-1, the power semiconductor of the unit and existing radio interference filters must be disconnected because of the danger of destruction. When doing an insulation or voltage measurement in accordance with in EN 60204-1 / VDE 0113-1, the power semiconductor of the unit and existing radio interference filters must be disconnected because of the danger of destruction. This is permissible in compliance with the standard, since all inverters are given a high voltage test in the end control at KEB. In the case of special requirements please contact KEB.

Different Earth Potentials	When using components without isolated inputs/outputs, it is necessary that equipotential bonding exists between the components to be connected (e.g. through the equalizer). Disregard can cause destruction of the components by the equalizing currents.

Prevent disturbances	A trouble-free and safe operation of the COMBIVERT R6 is only guaranteed when the connection instructions below are strictly followed. Incorrect operation or damage may result from incorrect installation. • Pay attention to mains voltage. • Install power cables and control cables separately (>15 cm separation). • Use shielded / twisted control lines. Lay shield at one side to COMBIVERT R6 to PE! • Only use suitable circuit elements to control the logic and analog inputs, whose contacts are rated for extra-low voltages. • Housing of the COMBIVERT R6 must be well earthed. Screens of larger power cable must be directly and securely attached to both the inverter PE terminal and the motor ground terminal (remove paint). • Ground the cabinet or the system earth star point with the shortest connection to mains earth (avoid earth loops) • **Use exclusively the line commutation throttle specified by KEB.** • The average value of the supplied DC current may not exceed the maximum DC current. • If several frequency inverters are connected to the COMVIBERT R6-S the max. permissible network component currents and DC link capacities of all connected frequency inverters must be considered during supply operation (see technical data).

Automatic Restart	The COMBIVERT R6 can be adjusted by such way that the inverter restarts automatically after an error case (e.g. broken phase line). System design must take this into account, if appropriate, and additional monitoring or protective features added where necessary.

Not Short-Circuit Proof (Supply)	The COMBIVERT R6 is not short-circuit proof at the power supply input! If the I2t-protection is adapted with a gR fuse, a conditional protection at supply input is possible. The short-circuit protection at DC output is if applicable ensured by internal or external aR respectively gR fuses.

Conditionally Short-Circuit Proof (Feedback)	The COMBIVERT R6 is conditionally short-circuit proof (EN 61800-5-1 / VDE 0160). After resetting the internal protection devices, the function as directed is guaranteed. Exception: if an earth-leakage fault or short-circuit often occurs at the output, this can lead to a defect in the unit.

Cyclic Activation And Deactivation	With applications requiring the COMBIVERT R6 to be switched on and off cyclically, maintain an off-time of at least 5 min. Switching off during the initialization phase can cause undefined conditions. If you require shorter cycle times please contact KEB.

RCD (Residual Current Operated Circuit-Breaker)	When using systems with RCD, the instructions or the requirements of VDE 0100-T 530 (IEC 60364-5) must be observed. The recommended tripping current of the RCD type „B“ is 300 mA.

4.2 Start-up

After all preparatory measures have been carried out and checked the
KEB COMBIVERT can be switched on.
All control releases ST (X2A.12) must be deactivated when switching on the first time, since the COMBIVERT R6-S is not custom-specific parameterized.

The following descriptions suppose that the COMBIVERT is on the password level "application mode" (ud.01 = application mode). The selection of the password level is described in the manual chapter 2.2. The start-up should be executed with COMBIVIS in order to have a short start-up time.
Operating lists are available on the KEB homepage (www.keb.de). This lists contain the necessary parameters for start-up.

Attention: The start-up instruction manual can only give a short overview of the parameter adjustments which are mandatory necessary to start-up the COMBIVERT.
Thus it represents a check list and not a complete parameter description.
The appropriate chapters of the application manual must be read carefully for exact information about the parameters, additionally points to consider and application-specific adjustments!

The units are not short-circuit proof without corresponding dimensioned fuses!
Exceeding of the max. rechargeable DC link capacity can lead to a defect!
A load removal in the DC link circle may be done only after the message „ready“.

The wiring must be checked before start-up, particularly the wiring of the control release of the connected inverters (see page 1.3-8). No parameterizations are needed for power supply operation. A vew parameter settings are necessary only for regenerative operation.

4.2.1 R6 operation power supply and regenerative unit

No parameter settings are necessary in the operating mode as power supply and regenerative unit when using a R6-N unit and KEB commutation choke or harmonic filter based on default settings and Pn.19 (CP.33).

Pn.19 Operating mode

The parameter defines whether the respective R6 unit is operated as master or slave, with commutation choke or harmonic filter.

Activate regeneration

cS.02 Regeneration level (CP.34)

The activation of the regeneration is dependent on the reference value of the DC voltage (ru.18) and the regeneration level cS.02 (CP.34).
The regenerative units starts to modulate if the actual DC voltage exceeds the adjusted percentage in cS.02 (CP.34) related to ru.18.
Normally the default value of cS.02 (CP.34) can remain unchanged. A reduction of the level may be necessary only for very high and very fast increasing regenerative loads.

cS.03 mains frequency max. tolerance

If the current mains frequency deviates to the adjusted percentage value of the recognized line frequency (ru.03), error message „E.FnEt“ is displayed. A change of the default value is not necessary.

The parameter is preset with Pn.19.

Deactivate regeneration

cS.05 Puls off delay, cS.06 puls off level (CP.32)

If the actual power (ru.81 / CP.13) exceeds the defined value in cS.06 (CP.32), the modulation is switched off after expiration of the adjusted time in cS.05.

The parameter settings can usually be left at the default settings!

4.2.2 R6 operation only as regenerative unit

Generally also for operating mode regeneration all relevant parameters of the regenerative unit are preset when using a R6 unit and KEB commutation choke or harmonic filter based on default values, power unit code and the operating mode Pn.19 (CP.33).

Deactivate regeneration

cS.05 Puls off delay, cS.06 puls off level (CP.32)

If the actual power (ru.81 / CP.13) exceeds the defined value in cS.06 (CP.32), the modulation is switched off after expiration of the adjusted time in cS.05.

5. Error Diagnosis

The following chapter shall help you to avoid errors as well as help you to determine and remove the cause of errors on your own.

5.1 Troubleshooting

5.1.1 General

If error messages or malfunctions occur repeatedly during operation, the first thing to do is to pinpoint the exact error. To do that go through the following checklist:

- Is the error reproducable?
For that reset the error and try to repeat it under the same conditions. If the error can be reproduced, the next step is to find out during which operating phase the error occurs.

- Does the error occur during a certain operating phase (e.g. always during regeneration)?
If so, consult the error messages and remove the causes listed there.

- Does the error occur or disappear after a certain time?
That may be an indication for thermal causes. Check, whether the COMBIVERT is used in accordance to the ambient conditions and that no moisture condensation takes place.

5.1.2 Error messages and their causes

At KEB COMBIVERT error messages are always represented with an "E." and the appropriate error in the display. Error messages cause the immediate deactivation of the modulation. Restart possible only after reset or autoreset.
Malfunction are represented with an " A." and the appropriate message. Reactions to malfunctions can vary.
Status messages have no addition. The status message shows the current operating status of the inverter (e.g. forward constant run, standstill etc.).
In the following the display and their cause are described.

Display	COMBIVIS	Val-ue	Meaning
	Status Messages		
nEtoF	Power-off	64	Mains power failure; regenerative operation is further possible, if the disconnecting time E.nEt (Pn.14) > 0 s
nO_PU	Power unit not ready	13	Power circuit not ready or not identified by the control.The error output O2 is set.
noP	No operation	0	Control release (terminal ST) is not switched.
rEGEn	Regeneration active	66	Regeneration active (regenerative operation)
Stb	Standby	69	R6 regenerative unit in stand-by operation (motoric operation)
bbL	Base-Block	76	Count down of the base-block time, R6-N released
rinit	Re-init device	42	Re-initialisation
	Error Messages		

continued on the next page

Display	COMBIVIS	Value	Meaning
E.buS	Error! Watchdog	18	Adjusted monitoring time (Watchdog) of communication between operator and PC / operator and inverter has been exceeded.
E.EEP	Error! EEPROM defective	21	After reset the operation is again possible (without storage in the EEPROM)
E. EF	Error! External fault	31	Is triggered, if a digital input is being programmed as external error input and trips.
E.LSF	Error! Load shunt fault	15	The load-shunt relay has not picked up. This occurs for a short time during the switch-on phase, but must automatically be reset immediately. If the error message remains the following causes may be applicable:
			load-shunt defective
			input voltage wrong or too low
			high losses in the supply cable
E.Frlr	Error fault reset level reached	41	Error "Fault reset level reached" is triggered when the adjusted value in parameter Pn.15 is reached within one hour. The error can be reset.
E.nEt	ERROR! Mains	3	One or more phases are missing.
E.FnEt	Error ! Mains frequency	40	Mains frequency outside the adjusted tolerance range (cS.03)
E.nOH	No error over heat power module	36	No longer overheating in the interior E.OHI, interior temperature has fallen by at least 5°C, error can be reset
E.nOHI	No error internal overheat	7	
E.nOL	No error overload	17	no overload, OL counter reaches 0 %; a cooling down phase must be awaited after error E.OL. This message appears upon completion of the cooling phase. The error can be reset. The inverter must remain switched on during the cooling phase.
E. OC	Error! Overcurrent	4	Occurs, if the specified peak current is exceeded. Causes:
			acceleration ramps too short
			short-circuit at the output
			ground fault
			overload too high (e.g., deceleration ramp too high at the inverter)
			wrong parameterization
E.OH	Error! Power module temperature	8	Overtemperature of power module. Error can only be reset at E.nOH, if the temperature has dropped by at least 5 °C. Causes:
			insufficient air flow at the heat sink (soiled)
			ambient temperature too high
			ventilator clogged
E.OHI	Error! Interior temperature	6	Overheating in the interior.error can only be reset at E.nOHI, if the interior temperature has dropped by at least 5 °C.
E. OL	Error! Overload (Ixt)	16	Overload, error can only be reset at E.nOL, if OL-counter reaches 0% again. Occurs, if an excessive load is applied longer than for the permissible time (see technical data). Causes:
			Overload in the application

continued on the next page

Display	COMBIVIS	Value	Meaning
E. OP	Error! Overvoltage	1	Voltage in the DC-link circuit too high. Occurs if the DC-link voltage exceeds the permissible value. Causes:
			input voltage too high
			interference voltages at the input
E. Pu	Error! Power unit	12	General power circuit error (e.g. switch-mode power supply or loading shunt relay)
E.Puci	Error! Power circuit unknown	49	During the initialization the power circuit could not be recognized or was identified as invalid.
E.Puch	Error! Power unit code changed	50	Power circuit identification was changed; with a valid power circuit this error can be reset by writing to SY.03. If the value displayed in SY.03 is written, only the power-circuit dependent parameters are reinitialized. If any other value is written, then the default set is loaded. On some systems after writing Sy.03 a Power-On-Reset is necessary.
E.SEt	Error! Set	39	It has been attempted to select a locked parameter set. Programmed response “Error, restart after reset”.
E.SYn	Error ! Synchronization	59	Incorrect phase assignment (clockwise rotating field).
E. UP	Error! Undervoltage	2	Undervoltage (DC-link circuit). Occurs, if DC-link voltage falls below the permissible value. Causes:
			input voltage too low or unstable
			Transformer capacity too small
			voltage losses through wrong cabling
	Warning messages		
A.buS	Warning! Watchdog	93	Watchdog for communication between operator / PC or operator / inverter has responded. The response to this warning can be programmed.
A. EF	Warning! External fault	90	This warning is triggered via an external input. The response to this warning can be programmed.
A.nOH	All-clear! Power module temperature	88	The heat sink temperature is again below the adjusted warning level.
A.nOHI	All-clear! Interior temperature	92	The temperature in the interior of the inverter is again below the warning threshold.
A.nOL	All-clear! Overload	98	Warning: no more overload, OL counter has reached 0 %, warning „overload" can be reset.
A. OH	Warning! Power module temperature	89	A level can be defined, when it is exceeded this warning is output. Furthermore the response to this warning can be programmed.
A.OHI	Warning! Interior temperature	87	The temperature in the interior of the inverter lies above the permissible level. The switch off time was started. The programmed response to this warning message is executed.
A. OL	Warning! Overload	99	A level between 0 and 100% of the load counter can be adjusted, when it is exceeded this warning is output. The response to this warning can be programmed.
A.SEt	Warning! Set	102	It has been attempted to select a locked parameter set. The response to this warning can be programmed.

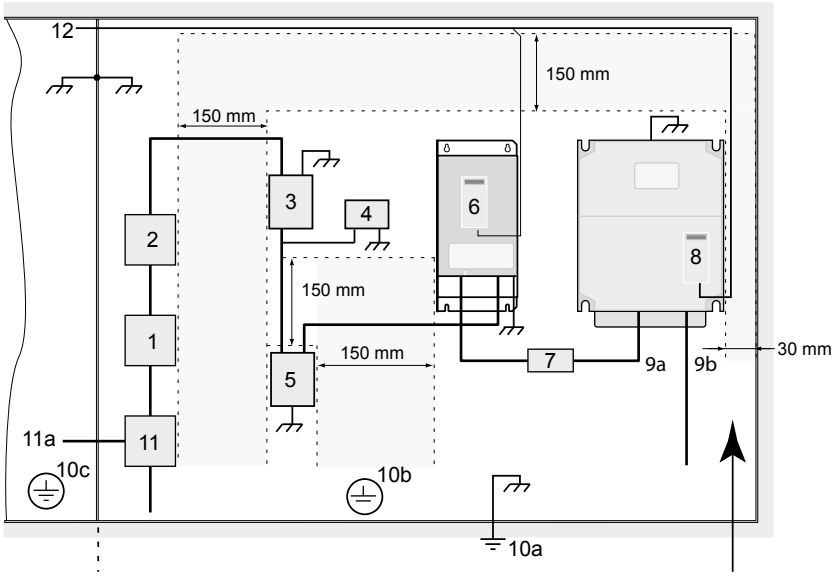
6. Project Design

The following chapter shall assist you in the planning stage of applications.

6.1 General designs

6.1.1 Control cabinet design

1	Main fuse
2	Main contactor
3	EMC side-mounted filter (≤ size 19) (>=size 25 R-S or R6-N) EMC-sub-mounted filter (<=size 19 R6-S)
4	Optionally, external power limit / synchronization R6-S
5	Commutation reactor / harmonic filter
6	COMBIVERT R6
7	if necessary external DC fuses
8	Frequency inverter
9a	DC cables with ferrite
9b	Motor cable with ferrite
10 A	Protective Earth (PE) on the mounting plate power circuit
10b	Protective Earth (PE) on the mounting plate control circuit
10c	Equipotential bonding with the housing earth
11	Mains connection power circuit
11 A	Mains connection control circuit
12	Control lines
⏚	Large area contact at the mounting plate



EMC-compatible control cabinet installation

6

Control cabinet surface

Calculation of control cabinet surface:

$$A = \frac{P_V}{\Delta T \bullet K} \quad [m^2]$$

Air flow rate with fan cooling:

$$V = \frac{3{,}1 \bullet P_V}{\Delta T} \quad [m^3/h]$$

A	=	Control cabinet surface	[m^2]
ΔT	=	temperature differential (standard value = 20K)	[K]
K	=	coefficient of heat transmission (standard value = 5)	
P_V	=	power loss (see technical data)	
V	=	air flow rate of fan	

For more details please refer to the catalogs of the control cabinet manufacturers.

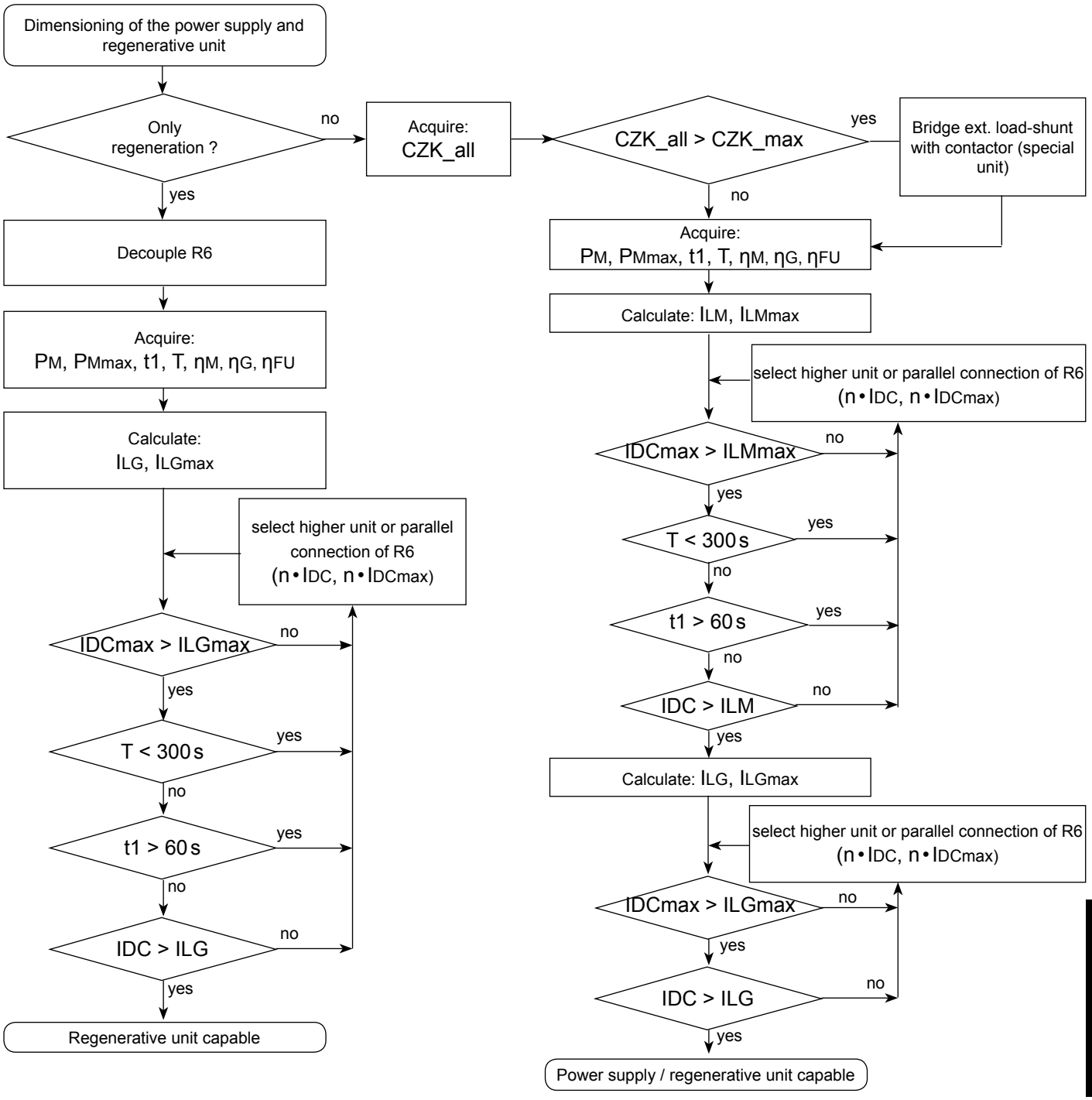
Installation instructions		
	•	Stationarily install and earth COMBIVERT.
	•	The device must not be permeated by mist or water.
	•	Allow for sufficient heat dissipation if installed in a dust-proof housing.
	•	Install the COMBIVERT in an appropriate housing in accordance with the local regulations when operating it in explosion-endangered spaces.
	•	Protect COMBIVERT against conductive and aggressive gases and liquids.
	•	The lines of the R6-N commutation reactor must be limiting to 1 m.
	•	The frequency inverters must be placed in the immediate environment of the R6-N.

6.1.2 Dimensioning power supply and regenerative units

The COMBIVERT R6 serves in the operating mode as power supply and regenerative unit for supply of a DC bus with the connected components (inverters). Furthermore the regenerative energy supplied into the DC bus is refeed into the net via COMBIVERT R6.
A ‚sinusoidal' supply and regenerative current establishes in connection with a harmonic filter.
In operational case ‚feed-in' approx. 8% THD.
In operational case ‚regeneration' approx.8% THD.
Several R6 units can be switched parallelly to increase the supply and regenerative power with a base load of 10% each.
The following basic requirements must be met for the operation as power supply and regenerative unit (standard operating mode):

- The sum of the DC link capacities of the connected inverters may not exceed the max. permissible DC link capacity of the R6 units.
- The maximum motor DC load current of the connected drive must be ≤ than the maximum DC supply current of the R6 unit.
- The motor DC load current in continuous operation must be ≤ than the DC supply rated current.
  Observe OL function at high load currents.
- The maximum regenerative DC load current of the connected drive must be ≤ than the max. DC regenerative current.
- The regenerative DC load current in continuous operation must be ≤ than the DC regenerative rated current.
  Observe OL function at high load currents.
- The maximum permissible DC link capacity can be taken from the power data of the respective regenerative units!
  $\sum C_{ZK\ capacitors} \leq$ max. permissible DC link capacity

6.1.3 Dimensioning power supply and regenerative units flow chart



PM	Mechanical power	ηM	Motor efficiency	IDC	DC current R6
PMmax	Max. mechanical power	ηG	Gearbox efficiency	IDCmax	max. DC output current R6
t1	Overload time	ηFU	Inverter efficiency	ILG	DC load regenerative current
T	Last cycle	ILM	DC load motoric current	ILGmax	Max. DC load regenerative current
n	Number of R6	ILMmax	max. DC load motoric current	CZK_all	DC link capacity of all frequency inverters
				CZK_max	max. connecting capacity R6

6.1.4 DC link capacitors of KEB frequency inverters F5

200 V units		400 V units	
Size	Capacity	Size	Capacity
05	780 µF	05	180 µF
07	880 µF (940 µF*)	07	180 µF (300 µF*)
09	1080 µF	09	300 µF
10	1080 µF	10	345 µF
12	2220 µF	12	470 µF
13	3280 µF	13	580 µF
14	4100 µF	14	650 µF
15	4100 µF	15	940 µF
16	5040 µF	16	1290 µF
17	9900 µF	17	1640 µF
18	13200 µF	18	1875 µF
19	15600 µF	19	2700 µF
20	16500 µF	20	3900 µF
21	19800 µF	21	4950 µF
*) special version		22	4950 µF
		23	6350 µF
		24	8400 µF
		25	9900 µF
		26	11700 µF
		27	14100 µF
		*) special version	

6.1.5 DC link capacitors of KEB frequency inverters G6

Device size	Capacity
7	135 µF
9	195 µF
10	235 µF
12	470 µF
13	560 µF
13	680 µF
14	
15	750 µF
16	1035µF
17	1400 µF
18	
19	1985 µF

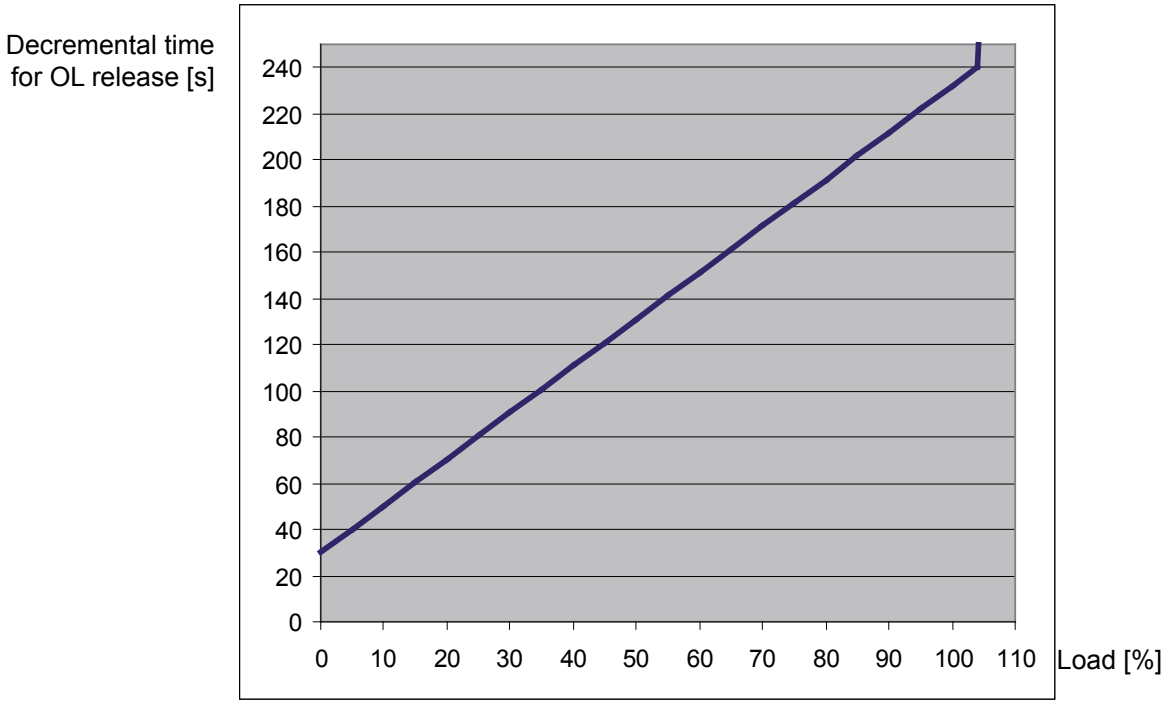
6.1.6 Dimensioning of decoupling diodes

R6	Material number	Type	Volume	Ta [°C]	Th [°C]	Rha [K/W]
15	0090147-3500	1600 V / 80 A	2	45	90	1,50
19	0090147-4101	1600 V / 120 A	2	45	90	0,84
25	0090147-6009	1600 V / 560 A	2	45	90	0,19
29	0090147-6009	1600 V / 560 A	2 x 2	45	90	0,09

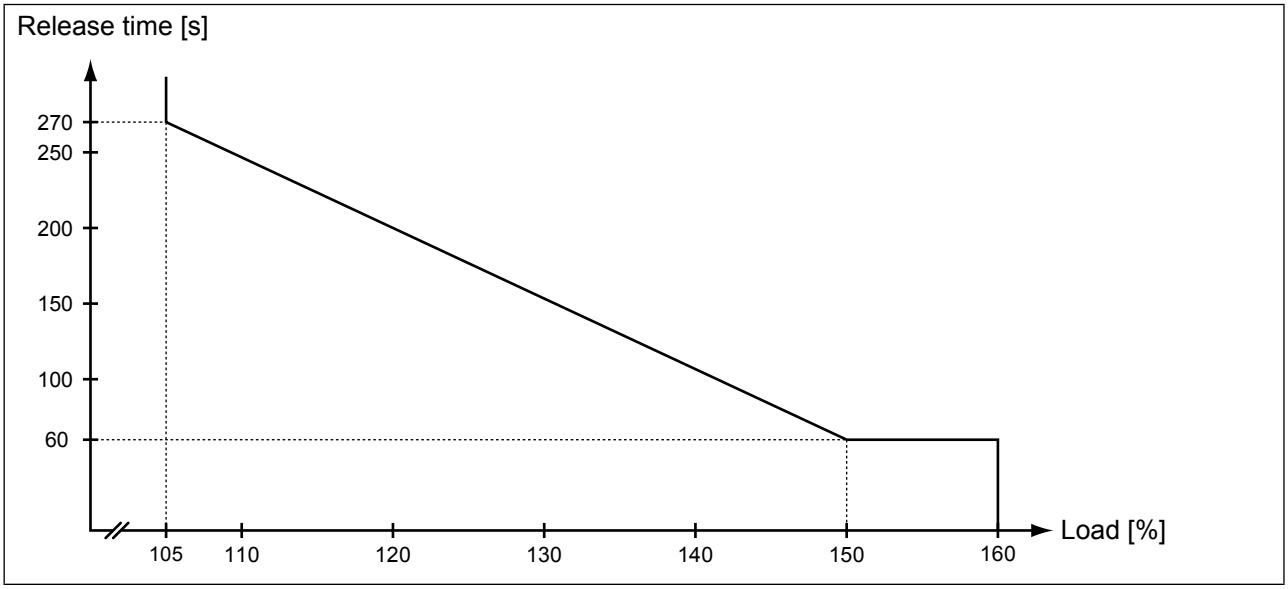
Legend
Ta: maximum ambient temperature
Th: maximum heat sink temperature
Rha: required thermal resistance of the heat sink at rated operation (thermal value of the thermal compound ≥ 0.5 W/(m*K))

6.1.7 Overload characteristics

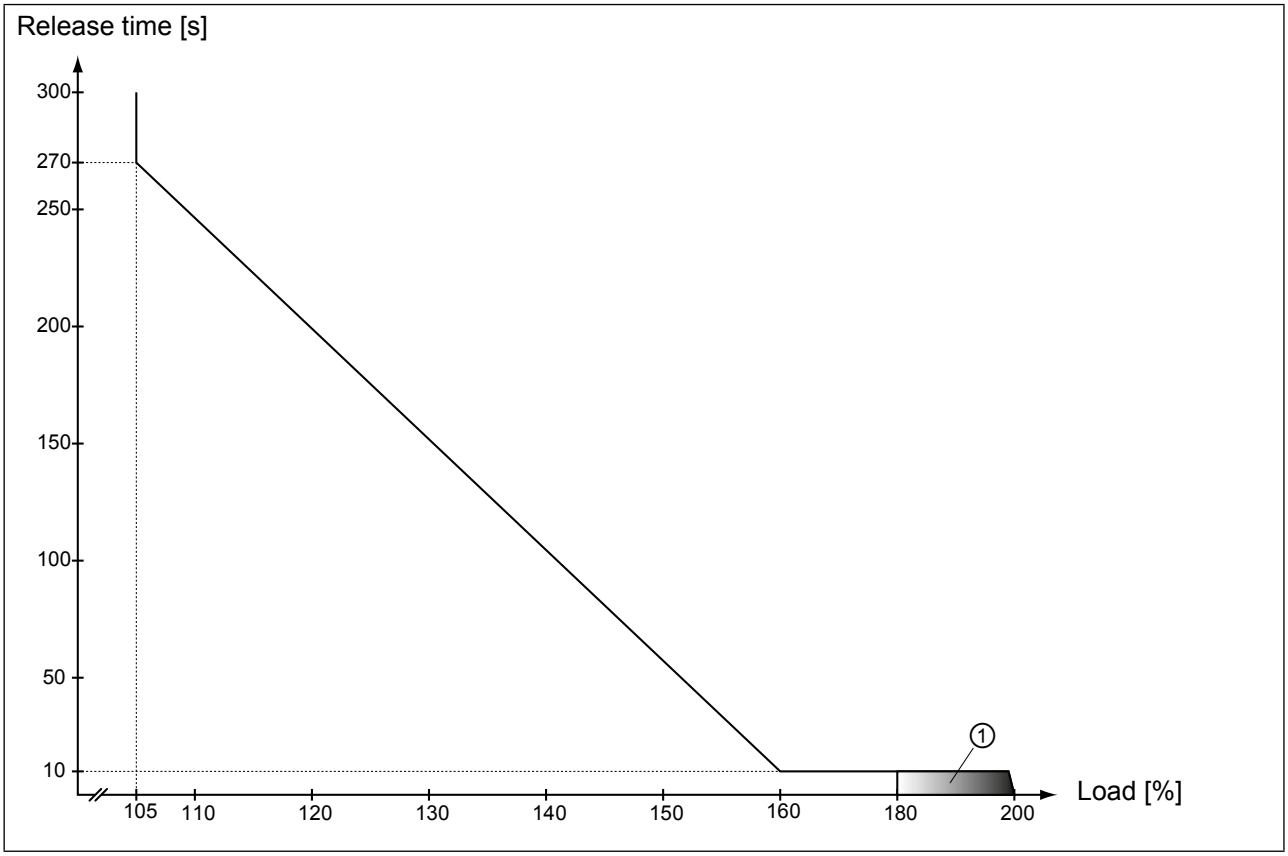
OL release time at load reduction



OL release time at load increase (standard)



OL release time at load increase (Peak Power)



7. Appendix

7.1 Search and Find

7.1.1 Search by keyword

Index

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

KEB Automation KG
Suedstrasse 38 • 32683 Barntrup
fon: +49 5263 401-0 • fax: +49 5263 401-116
net: www.keb.de • mail: info@keb.de

KEB worldwide…

KEB Automation GmbH
Ritzstraße 8 • 4614 Marchtrenk
fon: +43 7243 53586-0 • fax: +43 7243 53586-21
net: www.keb.at • mail: info@keb.at

KEB Automation KG
Herenveld 2 • 9500 Geraadsbergen
fon: +32 5443 7860 • fax: +32 5443 7898
mail: vb.belgien@keb.de

KEB Power Transmission Technology (Shanghai) Co.,Ltd.
No. 435 Qianpu Road, Chedun Town, Songjiang District,
Shanghai 201611, P.R. China
fon: +86 21 37746688 • fax: +86 21 37746600
net: www.keb.de • mail: info@keb.cn

KEB Automation GmbH
Organizační složka
Suchovrbenske nam. 2724/4 • 370 06 České Budějovice
fon: +420 387 699 111 • fax: +420 387 699 119
mail: info@keb.cz

KEB Antriebstechnik GmbH
Wildbacher Str. 5 • 08289 Schneeberg
fon: +49 3772 67-0 • fax: +49 3772 67-281
mail: info@keb-drive.de

KEB España
C/ Mitjer, Nave 8 - Pol. Ind. LA MASIA
08798 Sant Cugat Sesgarrigues (Barcelona)
fon: +34 93 897 0268 • fax: +34 93 899 2035
mail: vb.espana@keb.de

Société Française KEB
Z.I. de la Croix St. Nicolas • 14, rue Gustave Eiffel
94510 LA QUEUE EN BRIE
fon: +33 1 49620101 • fax: +33 1 45767495
net: www.keb.fr • mail: info@keb.fr

KEB (UK) Ltd.
Morris Close, Park Farm Industrial Estate
Wellingborough, NN8 6 XF
fon: +44 1933 402220 • fax: +44 1933 400724
net: www.keb.co.uk • mail: info@keb.co.uk

KEB Italia S.r.l.
Via Newton, 2 • 20019 Settimo Milanese (Milano)
fon: +39 02 3353531 • fax: +39 02 33500790
net: www.keb.de • mail: kebitalia@keb.it

KEB Japan Ltd.
15–16, 2–Chome, Takanawa Minato-ku
Tokyo 108-0074
fon: +81 33 445-8515 • fax: +81 33 445-8215
mail: info@keb.jp

KEB Korea Seoul
Room 1709, 415 Missy 2000
725 Su Seo Dong, Gang Nam Gu
135-757 Seoul/South Korea
fon: +82 2 6253 6771 • fax: +82 2 6253 6770
mail: vb.korea@keb.de

KEB RUS Ltd.
Lesnaya Str. House 30, Dzerzhinsky (MO)
140091 Moscow region
fon: +7 495 632 0217 • fax: +7 495 632 0217
net: www.keb.ru • mail: info@keb.ru

KEB America, Inc.
5100 Valley Industrial Blvd. South
Shakopee, MN 55379
fon: +1 952 224-1400 • fax: +1 952 224-1499
net: www.kebamerica.com • mail: info@kebamerica.com

More and latest addresses at http://www.keb.de

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