

4 Technical Specifications

The main standard for the switchgear interlocking units is

- VDE 0160 / 11.81, 04.89
"Equipment for electrical power installations with electronic equipment"

The following standards also apply:

- VDE 0110 / 11.72, 02.79, 05.88, 01.89
"Regulations for the rating of air gap and creepage distances of electrical equipment"
- VDE 0435, part 201 / 05.83, 05.90
"Electrical relays, ALL or NOTHING relays"
- VDE 0660, part 5 / 11.67, 04.91
"Regulations for turnkey switchgear combinations (FSK) with nominal voltages up to 1 kV AC and 3 kV DC"

4.1 Technical specifications of the units

4.1.1 Inputs

Telecontrol command inputs

CLOSE, OPEN, TEST, ACKNOW.
unlocking of the keyswitch
function S1, S2, S3, S4
up to 14 switchgear inputs

Telecontrol voltage / current consumption
typical

24 V	/	16 mA
48 V	/	29 mA
60 V	/	39 mA
110 V	/	9 mA
125 V	/	10 mA
220 V	/	10 mA
250 V	/	10 mA

Breaker position checkback

feeder and central unit 28 SPS

feeder and central unit 20 SPS

operating DC voltage and

current consumption at

$V = V_{\text{Batt}} \pm 20\%$

and connector resistance

14 x CLOSE	14 x OPEN
6 x CLOSE	6 x OPEN
48 V	/ 36.8 ... 75.3 mA / 390 Ω
60 V	/ 13.8 ... 26.9 mA / 820 Ω
110 V	/ 7.4 ... 12.8 mA / 4.7 k Ω
125 V	/ 7.9 ... 12.6 mA / 4.7 k Ω
220 V	/ 4.8 ... 9.5 mA / 15 k Ω
250 V	/ 4.9 ... 9.4 mA / 20 k Ω

V24 receiver

feeder unit 28 / 20 SPS

central unit 28 SPS

central unit 20 SPS

baudrate

message cycle time

hamming distance

1
32
16
9.6 k Bd
130 ms
d = 4

4.1.2 Outputs

Command output circuit	
feeder and central unit 28 SPS	up to 14
feeder and central unit 20 SPS	up to 6
max. make/break voltage	250 V
max. continuous current	10 A
max. break power, inductive	300 W
Telecontrol indications	
feeder and central unit	7 fault indications
	4 monitoring indications
breaker position indications	14 x CLOSE, 14 x OPEN
max. make/break voltage	250 V (+ 10 %, – 15 %)
max. continuous current	2 A
max. break power, inductive	10 W
Relay contacts master unit bus–tie 1, bus–tie 2	
	2 A, 10 W
V24 transmitter	
feeder unit 28 / 20 SPS	1
central unit 28 SPS	32
central unit 20 SPS	16
baudrate	9.6 kBd

4.1.3 Power consumption

Feeder unit	power supply module 30 W
Central unit	power supply module 75 W
Nominal voltage (connection voltage station battery)	48 V)
	60 V)
	110/125 V) + 15 %
	220 V) – 20 %
	250 V)
Residual ripple	≤ 6 %

The total power consumption of the switchgear interlocking unit is determined by the following factors:

- battery voltage
- number of switching devices (feeder or central unit)
- number of feeders (only for central unit)

The total power is made up of:

- power loss in the series resistances of the checkback circuits (Figs. 4.1 and 4.2)
- power consumption of the modules in the feeder unit (Figs. 4.3 and 4.4). The degree of efficiency of the power supply module has already been taken into account.
- power consumption of the central unit by addition of the power Figs. 4.3 and 4.4 (number of switching devices) and 4.5 (number of feeders).

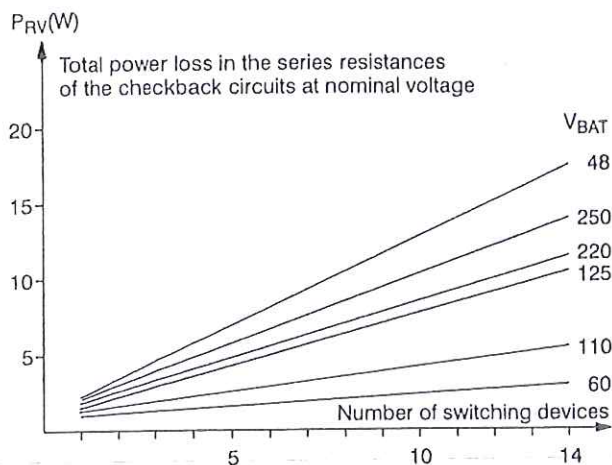


Fig. 4.1

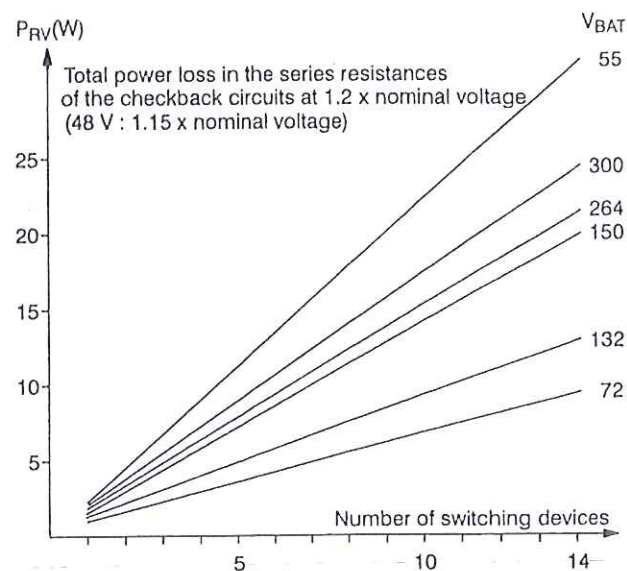


Fig. 4.2

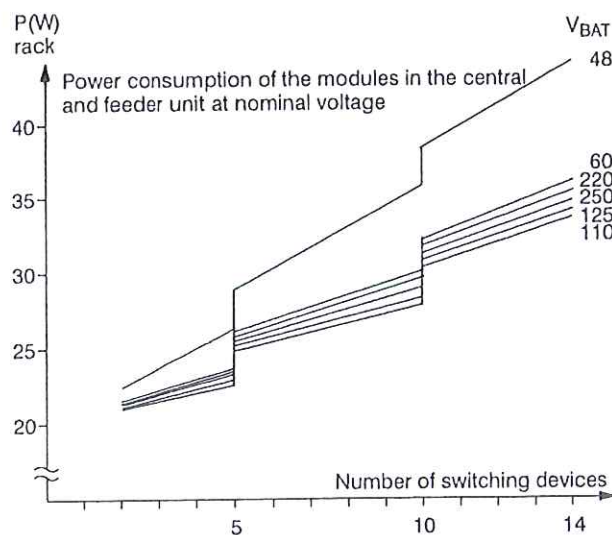


Fig. 4.3

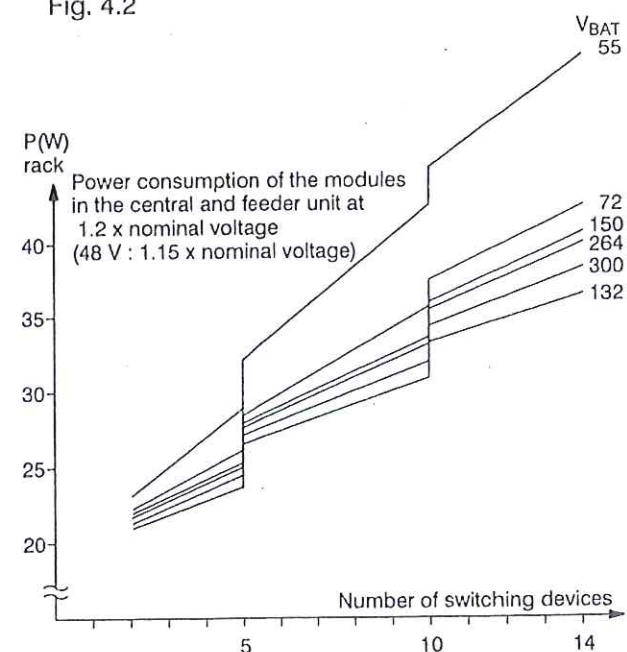


Fig. 4.4

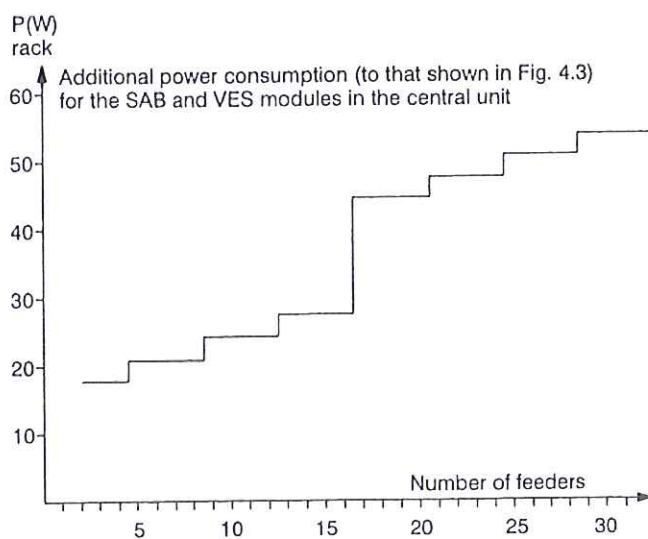


Fig. 4.5

Fig. 4.6 Power curves of the switchgear interlocking units

4.1.4 Test voltages, EMC tests

Insulation test:
(100% test)

$V_{rms} = 0.5$ or 2 kV, 50 Hz, sinusoidal, duration 1 min., to VDE 0435

Voltage surge test:
(Type test)

$V = 1$ or 5 kV, $1.2/50 \mu s/\mu s$; 3 positive and 3 negative surges at intervals of 5 s to IEC 255-4, VDE 0435 part 303

High frequency interference test: $V = 1$ or 2.5 kV, 1 MHz, 400 surges/s, duration 2 s to IEC 255-22-1

The voltage values are defined in accordance with the test voltage diagram (Fig. 4.7).

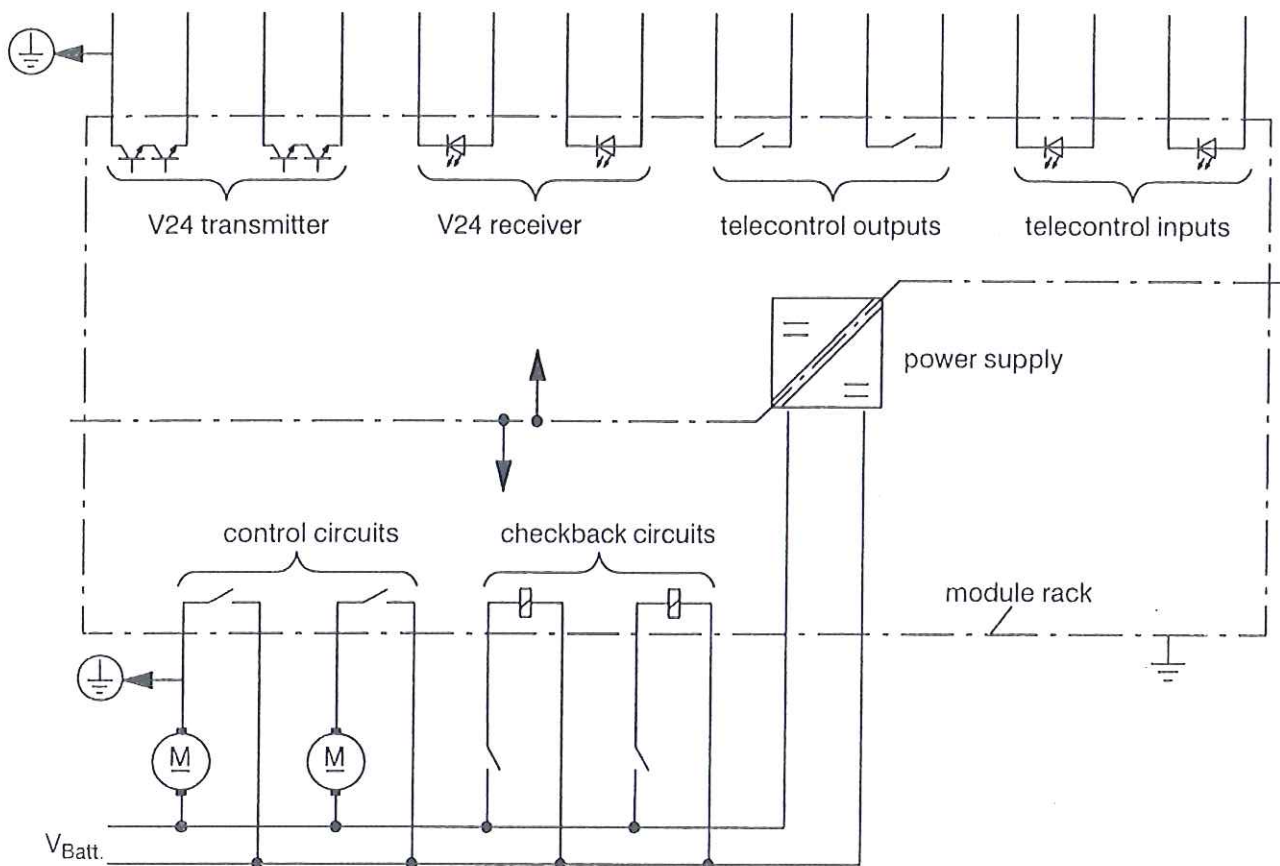


Fig. 4.7 Test voltage diagram

High frequency field to VDE / VDI 2190, sheet 3

Radio transmitter (type test)

68, 150, 460 MHz to IEC 255-22-3
distance of antenna from front of the device
under test = 30 cm

Discharge test (type test)

8 kV
 $C = 150$ pF
 $R_i = 150 \Omega$ according to IEC 255-22-2

External field (type test)

1 mT, 50 Hz

Current surge through housing (type test)

1 kA; $0.1/80 \mu s/\mu s$

4.1.5 Mechanical ambient conditions

Installation location (stationary deployment in rooms such as control and switchgear rooms)

test according to DIN 40046, part 8: class 12

Seismic stress

test according to DIN 40046, part 35: elevation factor 2

Transport

test according to DIN 40046, part 8: class 23

Shock stress

test according to DIN 40046, part 7: 30g in each axis

4.1.6 Climatic ambient conditions

Temperature range for

– Operation

–5° C to +55 °C

relative humidity 90 % on up to 30 days a year
condensation not permissible

– Transport, storage

–25 °C to +55 °C

relative humidity 75 %

4.1.7 Connection method

The interface and control modules and the manual control modules are connected via 30-way codeable cable connectors. The connector for the manual control module has coding number 8, the connectors for the interface and control modules have coding numbers 1 to 7 depending on the configuration (see Fig. 6.2, page 6/3). The associated cables of the ABB are flexible control cables of the type ÖPVC–JZ–CY 25 x 0.75 mm². 21 cores are required. These are crimped onto the blade contacts of the connector.

The connectors of the interface and control modules also contain two four-wire shielded cables of type JE–LiYCY 4 x 0.5 mm² for the telecontrol interface.

The control line for the FGB is of type ÖPVC–JZ–CY 30 x 0.5 mm².

The cable length is 2.5 m for the standard version. In the covers of the connectors for the interface and control modules there are two series resistors for adaptation of the checkback circuits to the nominal voltage of the station battery. The serial data transmission between the feeder and central units is performed via a four-core cable of type LiYCY–CY 2 x 2 x 0.25 mm². The cable is fitted with an additional PVC sheath and is suitable for laying underground. It is connected via four-way precision plug-in connectors.

The power supply cable and the signal cable for "disrupted power supply" are connected via screw-on terminals. Two cables of type LiYCY–2 x 0.75 mm² are used for this. The cable shields must be firmly attached using the cable holders provided.

Note:

The cable shields of the connecting cables must be connected to the PE rail on the terminal strip by the shortest path.

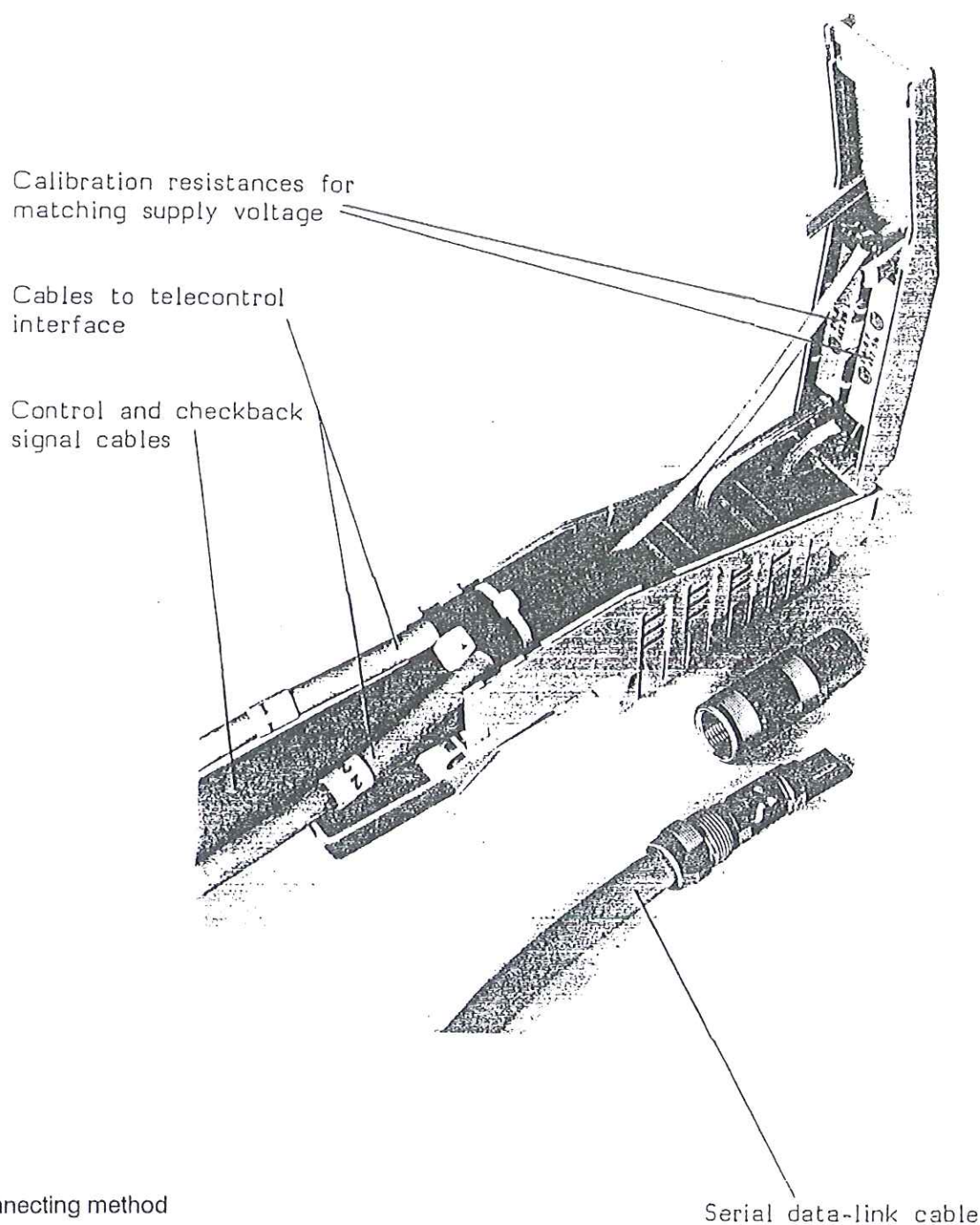


Fig. 4.8 Connecting method

4.1.8 Degree of protection

For the module rack with modules IP 20

4.1.9 Weight with maximum configuration

Feeder unit	28 SPS	approx. 15kg
	20 SPS	approx. 13kg
Central unit	28 SPS	approx. 25kg
	20 SPS	approx. 23kg

4.2 Technical specifications of the modules

4.2.1 Interface and control module (ABB)

Note:

The ABB modules must only be used with connecting cables with series resistors (cable type 8TK3810-....., connectors X801 to X807)

Inputs

breaker position checkback

	connector resistance
48 V / 36.8...75.3 mA	390 Ω
60 V / 13.8...26.9 mA	820 Ω
110 V / 7.4...12.8 mA	4.7 k Ω
125 V / 7.9...12.6 mA	4.7 k Ω
220 V / 4.8... 9.5 mA	15 k Ω
250 V / 4.9... 9.4 mA	20 k Ω

Telecontrol command inputs (switching device selection (ON/OFF) ¹⁾)

operating voltage / current consumption

24 V / 16 mA	125 V / 10 mA
48 V / 29 mA	220 V / 10 mA
60 V / 39 mA	250 V / 10 mA
110 V / 9 mA	

Input resistance / current

approx. 22 k Ω / approx. 2 mA

Outputs

Command outputs

maximum continuous current	10 A
maximum make / break voltage	250 V
maximum break power, inductive	300 W

Telecontrol breaker position signals

maximum continuous current	2 A
maximum make / break voltage	60 V
maximum break power, inductive	10 W

Test voltage	Insulation test 50 Hz, 1 min. to VDE 0435 part 303	Surge voltage test to IEC 255/4, VDE 0435 part 303 1.2/50 μ s/ μ s	High freq. interference voltage to IEC 255/4, 255-22-1 1 MHz
Command output against telecontrol outputs against telecontrol inputs against internal circuits	2 kV	5 kV	2.5 kV
Checkback circuit against telecontrol outputs against telecontrol inputs against internal circuits	2 kV	5 kV	2.5 kV
Internal circuits against telecontrol outputs against telecontrol inputs	1 kV	1 kV	1 kV

Dimensions double height Eurocard
mounting width 2 SPS = 30.48 mm

weight equipped for 1 switching device: approx. 480 g
equipped for 2 switching devices: approx. 740 g

¹⁾ The telecontrol switching device selection must only be connected in series with the FGB module (ON/OFF) (see ²⁾ on page 4/8, Fig. 5.2 on page 5/10) !

4.2.2 Manual control module (FGB)

Note:

The FGB can only be used with a connecting cable without series resistors (Cable type 8TK3820 –, connector X808).

Inputs

Optical coupler inputs, internal	15
input resistance	approx. 22 k Ω
operating current	approx. 2 mA

Optical coupler inputs, telecontrol inputs

TEST, ACKNOW., S1, S2, S3, S4	6
operating voltage	24 V ... 60 V (+ 10 %, – 15 %) until delivery date 09.93 24 V ... 250 V(+ 10%. – 15%) as of delivery date 10.93 4 mA ... 12 mA

ON/OFF ²⁾

Outputs

telecontrol outputs, number	10
max. make / break voltage	60 V to 250 V
max. make / break current	2 A
max. break power, inductive	10 W

Test voltage	Insulation test 50 Hz, 1 min. to VDE 0435 part 303	Surge voltage test to IEC 255/4, VDE 0435 part 303 1.2/50 μ s/ μ s	High frequency inter- ference voltage to IEC 255/4, 255–22–1 1 MHz
internal 5 V circuits against telecontrol outputs against telecontrol inputs against internal 48 V circuits	0.5 kV	1 kV	1 kV
internal 48 V circuits against telecontrol outputs against telecontrol inputs	0.5 kV	1 kV	1 kV

Supply voltage / power consumption

5 V \pm 5 % / up to 1.15 A
48 V \pm 10 % / up to 65 mA

Dimensions

double height Eurocard
mounting width 4 SPS = 60.96 mm

Weight

approx. 920 g

²⁾ The telecontrol inputs ON/OFF must only be connected in series with the ABB module (switchgear selection) (see ¹⁾ page 4/7) !

4.2.3 Input / output module (EAB)

Inputs

Optocoupler inputs, number

5 checkback circuits
5 command input circuits

Input resistance

approx. 22 k Ω (checkback circuit)
approx. 4.7 k Ω (command input circuit)

Operating current

approx. 2 mA

Outputs

Optocoupler outputs, number

5 (intermediate position lamp control)

max. current load

15 mA

voltage limitation between collector and emitter

2.4 V \pm 5 %

Latching relay outputs, number

5 control direction CLOSE
5 control direction OPEN

maximum make / break voltage

48 V

maximum make/ break current

2 A

Test voltage	Insulation test 50 Hz, 1 min. to VDE 0435 part 303	Surge voltage test to IEC 255/4, VDE 0435 part 303 1.2/50 μ s/ μ s	High freq. interference voltage to IEC 255/4, 255-22-1 1 MHz
5 V circuits against 48 V circuits	0.5 kV	1 kV	1 kV

Supply voltage / power consumption

5 V \pm 5 % / up to 0.6 A

Dimensions

double height Eurocard
mounting width 1 SPS = 15.24 mm

Weight

approx. 300 g

4.2.4 Microcomputer module (BSF)

Inputs

V24 receiver interface	1
input level	$\pm 5 \text{ V to } \pm 15 \text{ V}$
input resistance	approx. $3 \text{ k}\Omega$
Interrupt input	2
Optocoupler inputs / input resistance	1 latching relay monitoring, approx. $12 \text{ k}\Omega$ 1 relay testing, approx. $15 \text{ k}\Omega$
Operating current	approx. 2 mA

Outputs

V24 transmitter interface		
output level		$\pm 5 \text{ V to } \pm 15 \text{ V}$
max. current load		20 mA (response threshold of the current limitation)
Bus driver		
Data and address bus	I_{high}	15 mA
	I_{low}	24 mA
Control bus	I_{high}	2.6 mA
	I_{low}	24 mA
Enabling relay for L+48 V and M48 V		1 each
maximum make / break voltage		48 V
maximum make / break current		2 A
External memory		
working memory		$1 \text{ K} \times 8 \text{ bit}$
program memory		$64 \text{ K} \times 8 \text{ bit}$ (4 units of 16 K each)

Test voltage	Insulation test 50 Hz, 1 min. to VDE 0435 part 303	Surge voltage test to IEC 255/4, VDE 0435 part 303 1.2/50 $\mu\text{s}/\mu\text{s}$	High freq. interference voltage to IEC 255/4, 255-22-1 1 MHz
V24 receiver against each other against V24 transmitter against internal 5 V circuits against internal 48 V circuits	$0.5 \text{ kV}\sqrt{2} \text{ DC}$ 0.5 kV DC 0.5 kV $0.5 \text{ kV}\sqrt{2} \text{ DC}$	0.5 kV	0.5 kV
V24 transmitter against each other against internal 5 V circuits against internal 48 V circuits	$0.5 \text{ kV}\sqrt{2} \text{ DC}$ 0.5 kV $0.5 \text{ kV}\sqrt{2} \text{ DC}$	0.5 kV	0.5 kV

Supply voltage / power consumption	$5 \text{ V} \pm 5 \% / \text{ up to } 1.2 \text{ A}$
Dimensions	double height Eurocard mounting width 1 SPS = 15.24 mm
Weight	approx. 350 g

4.2.5 Transmitter / receiver controlling module (SAB)

Parallel inputs and outputs

Data bus:	8 Bit bidirectional
Address bus:	7 Bit unidirectional
Control bus:	3 Bit unidirectional
	1 Bit bidirectional

Serial inputs and outputs

Inputs:	16 multiplexed channels
Outputs:	2 x 4 channels
Supply voltage / current consumption	5 V \pm 5 % / up to 2.4 A
Dimensions	double height Eurocard mounting width 1 SPS = 15.24 mm
Weight	approx. 350 g

4.2.6 Four-channel serial interface module (VES)

Number of V24 receivers:	4
Number of V24 transmitters:	4

5 V side

Maximum power consumption 5 V:	0.8 W
Maximum transmitting frequency:	9.6 kHz; 19.2 kBaud

\pm 15 V side

Transmitter:	
Minimum output voltage:	\pm 15 V – 3.3 V
Maximum output current:	50 mA short circuit proof
Maximum power consumption \pm 15 V:	1.8 W
Maximum transmitting frequency:	9.6 kHz; 19.2 kBaud
Receiver:	
Input voltage range:	\pm 5 V to \pm 15 V
Input resistance:	3 k Ω
Maximum receive frequency:	9.6 kHz; 19.2 kBaud
Test voltage	Insulation test 50 Hz. 1 min. and VDE 0435
5 V side against 15 V side:	2 kV
5 V side against receiver:	2 kV
Receiver against transmitter:	2 kV x $\sqrt{2}$ DC
Receiver against receiver:	2 kV x $\sqrt{2}$ DC
Supply voltage / current consumption	5 V \pm 5 % / up to 0.16 A \pm 15 V \pm 5 % / up to 0.15 A
Dimensions	double height Eurocard mounting width 1 SPS = 15.24 mm
Weight	approx. 270 g

4.2.7 Power supply unit feeder unit 30 W (SV30)

Input

Nominal input voltage	version 2: 48 V) 3: 60 V) 4: 110 V) 5: 125 V) + 15 % each 6: 220 V) - 20 % each 7: 250 V)
Residual ripple	$V_{pp}/V \leq 6 \%$
Pole reversal protection	longitudinal diode in the input fuse,
Input fuse	medium slow
	version 2: 3.15 A; 250 V
	3/4 and 5: 2 A; 250 V
	6 and 7: 1 A; 250 V

Output

Output voltage	
Output 1	+ 15 V \pm 10 %
Output 2	- 15 V \pm 10 %
Output 3	+ 48 V \pm 15 %
Output 4	+ 5 V \pm 3 %
Output load	
Output 1	2.5 W (+ 15 V)
Output 2	2.5 W (- 15 V)
Output 3	10 W (+ 48 V)
Output 4	15 W (+ 5 V)
Minimum load of the 5 V output	$P_{min} \geq 3 \text{ W}$
Response threshold of the current limitation	approx. 1.1 P_{nom}
Short circuit proof	5 V outputs: continuous all other outputs: for 5 s
Overvoltage protection	V_{A1} (5 V): 6...6.6 V
Residual ripple	5 V: 200 mV _{pp} ; \pm 15 V: 300 mV _{pp} ; 48 V: 500 mV _{pp}
Alarm relay for voltage failure	contact load: 250 V/1 A, 20 W/VA
Radio interference suppression (measured in the module rack)	limit value class B to VDE 0871 (no individual approval required)
Working temperature range	- 5 °C to + 55 °C at 30 W continuous power
Dimensions	double height Eurocard mounting width 4 SPS = 60.96 mm
Weight	approx. 1 kg

Note: SV30 as of delivery date 10.91 without cover
(S1 voltage divider for reversing operation no longer used)

4.2.8 Power supply module central unit 75 W (SV75)

Input

Nominal input voltage	version 2: 48 V) 3: 60 V) 4: 110 V) 5: 125 V) + 15 % each 6: 220 V) - 20 % each 7: 250 V)
Residual ripple	$V_{pp}/V \leq 6 \%$
Pole reversal protection	longitudinal diode in the input fuse,
Input fuse	medium slow version 2 and 3: 6 A; 250 V 4 and 5: 4 A; 250 V 6 and 7: 2 A; 250 V

Output

Output voltage	
Output 1	+ 15 V \pm 10 %
Output 2	- 15 V \pm 10 %
Output 3	+ 48 V \pm 15 %
Output 4	+ 5 V \pm 3 %
Output load	
Output 1	6 W (+ 15 V)
Output 2	6 W (- 15 V)
Output 3	10 W (+ 48 V)
Output 4	50 W (+ 5 V)
Minimum load of the 5 V output	$P_{min} \geq 10 \text{ W}$
Response threshold of the current limitation	approx. 1.1 P_{nom}
Short circuit proof	5 V output: continuous all other outputs: for 10 s
Overvoltage protection	V_{A1} (5 V): 6...6.5 V
Residual ripple	5 V: 200 mV _{pp} ; \pm 15 V: 300 mV _{pp} ; 48 V: 500 mV _{pp}
Alarm relay for voltage failure	contact load: 250 V/1 A, 20 W/VA
Radio interference suppression (measured in the module rack)	limit value class B to VDE 0871 (no individual approval required)
Working temperature range	- 5 °C to + 55 °C at 75 W continuous power
Dimensions	double height Eurocard mounting width 4 SPS = 60.96 mm
Weight	approx. 1.3 kg

Note: SV75 as of delivery date 10.91 without S1 voltage divider for commutating operation

Test voltages EMC tests (common data for 30 and 75 W power supply module)

Voltage test to VDE 0435 (100% test)

Input against outputs	}	2.8 kV DC, 30 s each polarity
Input against rack and protective conductor		
Outputs against one another	}	500 V; 50 Hz sinusoidal, 1 min
Outputs against rack		

Surge voltage test to IEC 255–4 (type test)

Input against outputs	}	5 kV; 1.2/50 μ s/ μ s
Input against rack and protective conductor		
Input across		
Outputs against one another	}	500 V; 1.2/50 μ s/ μ s
Outputs against rack and protective conductor		
Outputs across		

High frequency interference test to IEC 255–22–1 (type test)

Input against outputs	}	2.5 kV; 1 MHz
Input against rack and protective conductor		
Input across		
Outputs against one another	}	1 kV; 1 MHz
Outputs against rack and protective conductor		
Outputs across		500 V; 1 MHz

High frequency field to IEC 255–22–3 radio transmitter (type test)

Device under test in the rack	68, 150, 460 MHz, 1 W, distance antenna from the front of the device under test = 30 cm
-------------------------------	---

Discharge test (in the rack) (type test) to IEC 255–22–2	8 kV C = 150 pF Ri = 150 Ω
---	---

External field influence (type test)	1 mT, 50 Hz
--------------------------------------	-------------

Current surge through housing (type test) Device under test in the rack	1 kA; 0.1/80 μ s/ μ s
--	-------------------------------

4.2.9 Contact multiplier module (KVB)

Note:

The KVB can only be used with connecting cables without series resistors
(cable type 8TK3850—..., connectors X801 to X807)

Inputs

breaker position signal

48 V 20.0 ... 50.0 mA
60 V 4.8 ... 14.5 mA
110 V 4.5 ... 11.7 mA
125 V 4.5 ... 10.3 mA
220 V 4.6 ... 8.5 mA
250 V 4.6 ... 8.0 mA

contact multiplying

48 V 17.0 ... 30.0 mA
60 V 7.9 ... 34.9 mA
110 V 8.1 ... 15.8 mA
125 V 4.2 ... 16.3 mA
220 V 4.4 ... 8.7 mA
250 V 4.4 ... 8.4 mA

Outputs

maximum continuous current
maximum make / break voltage
maximum break power, inductive

2 A
250 V
10 W

Test voltage	Insulation test 50 Hz, 1 min. to VDE 0435 part 303	Surge voltage test to IEC 255/4, VDE 0435 part 303 1.2/50 µs/µs	High frequency interference voltage to IEC 255/4, 255-22-1 1 MHz
checkback circuit/ inputs against checkback circuit / output CM / input circuits CM / output circuits	2 kV	5 kV	2.5 kV
checkback circuit/ outputs against CM / input circuits CM / output circuits	2 kV	5 kV	2.5 kV
CM / input against CM / output circuits	2 kV	5 kV	2.5 kV
CM / output circuits against one another	2 kV	5 kV	2.5 kV

Dimensions

double height Eurocard
mounting width 2 SPS = 30.48 mm

Weight

approx. 570 g

