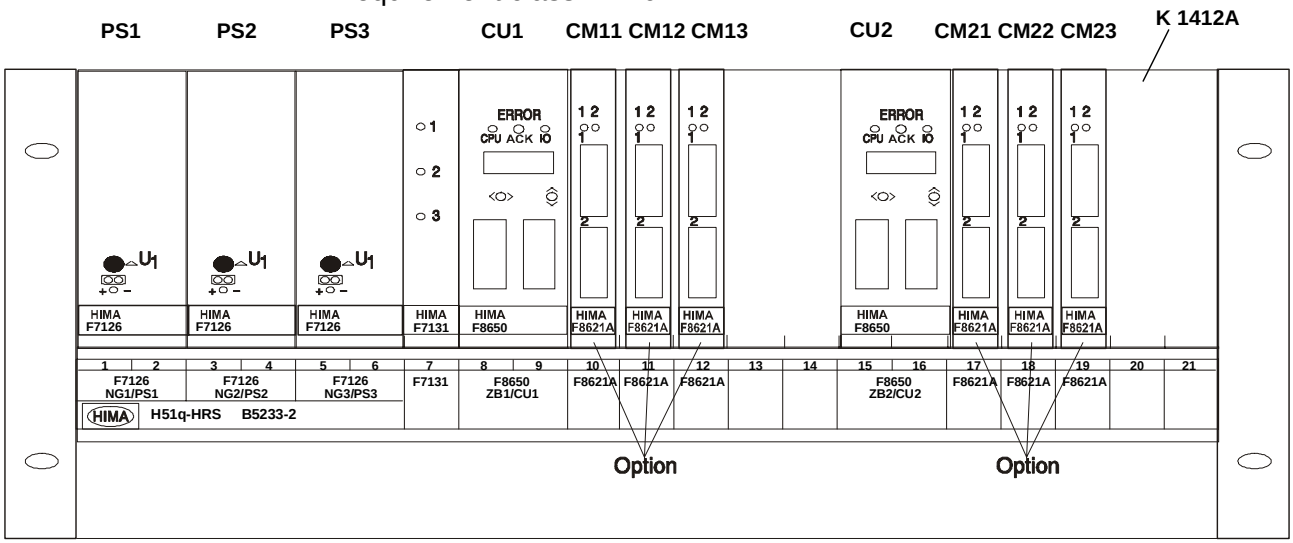
CATALOG

CATALOG FOR ESD TECHNICAL OFFER ATTACHMENT#1

B 5233-1/-2

Assembly kit B 5233-1/-2
System H51q-HS / B 5233-1,
System H51q-HRS / B 5233-2,
PES high available, TÜV-tested,
requirement class 1 ... 6



Parts of the assembly kit B 5233-1/-2:

- 1 x K 1412A central rack, 5 units high, 19 inch, with integrated cable tray, with a hinged receptable for the label.
- additional modules on the rear
  3 x Z 6011 decoupling and fusing to feed the power supply modules
  1 x Z 6012 fan module with fan run monitoring and fuse monitoring
  2 x Z 6013 decoupling and fusing of the supply voltage for the WD signal

includes the modules:

- 3 x F 7126 power supply module 24 V / 5 V, each 10 A (PS1 - PS3). The 5 V outputs of the power supply outputs are switched in parallel.
- 1 x F 7131 power supply monitoring
- 2 x F 8650 central module (CU1, CU2)
- 2 x F 7546 bus termination module (B 5233-1)
- 4 x F 7546 bus termination module (B 5233-2)
- 1 x BV 7032 data connecting cable (only B 5233-1)

modules for option (separate order)

- 6 x F 8621A Coprocessor module (CM11 - CM13, CM21 - CM23)
- 10 x F 8625 Ethernet-communication module
- 10 x F 8626 Profibus-DP-communication module

Assembly kits to be used for the I/O level:

- B 9302 I/O-rack 4 units high, 19 inch
- B 9361 additional power supply, 5 V DC, 5 units high, 19 inch

The max. current must be 18 A, if 3 x F 7126 are used to keep the system in operation even one power supply module F 7126 has failed. The total required current of the control is the summary of the consumption of the modules in the central rack and of the I/O modules. For the values of the current requirement (+5 V DC) refer to the data sheets.

The assembly kit is usable since operating system BS41q/51q V7.0-7.

Wiring of the assembly kit connections
Wirings to be done by the user (refer to "Wiring of the assembly kit, diagram"):

Supply 24 V DC

Connection	Wire and connection	Fusing	Use
XG.21/22/23:2 (L+)	rt 2,5 mm^2, Faston 6,3 x 0,8	max. 16 A gL	PS1 ... PS3
XG.21/22/23:1 (L-)	sw 2,5 mm^2, Faston 6,3 x 0,8		Reference pole

Output 5 V=

Connection	Wire and connection	Use
XG.2: +5 V	ge 2 x 2,5 mm^2, Faston 6,3 x 0,8	Supply I/O rack (B 9302)
XG.3: GND	gn 2 x 2,5 mm^2, Faston 6,3 x 0,8	Supply I/O rack (B 9302)

Output 24 V=

Connection	Wire and connection	Use
XG.24:2 (L+)	rt 1,5 mm^2, Faston 6,3x0,8	Supply fuse monitoring and IO-CON in the I/O rack
XG.25:2 (L+)	rt 1,5 mm^2, Faston 6,3x0,8	Supply fuse monitoring and IO-CON in I/O rack for the 2nd I/O bus (B 5233-2 only)

Output of the WD

Connection	Wire and connection	Use
XG.1:2 (4) und :6(8)	gr 0,5 mm^2, wire end ferrule	WD to I/O bus (B 5233-1)
XG.1:2(4) XG.1:6(8)	gr 0,5 mm^2, wire end ferrule gr 0,5 mm^2, wire end ferrule	WD to 1st I/O bus (B 5233-2)) WD to 2nd I/O bus (B 5233-2) (Refer to "Wiring WD, diagram")

Connection of the monitoring loop (for fuses and fan)

Connection	Wire and connection	Fusing	Use
XG.26:4/5/6	gr 0,5 mm^2, Faston 2,8 x 0,8	max. 4 A T	Floating NO/NC contact for signalling

I/O bus, B 5233-1

Connection	Procedure
XD.1 to XD.2	Connect together with BV 7032
XD.4	Remove F 7546 and plug it on XD.2 of the last I/O rack Connect BV 7032 and plug it on XD.1 1st I/O rack

I/O bus, B 5233-2

Connection	Procedure
XD.3 and XD.4	Remove F 7546 and plug it on XD.2 of the last I/O rack of both I/O buses
XD.4	Connect BV 7032 and plug it on XD.1 of the 1st I/O rack in the 1st I/O bus
XD.3	Connect BV 7032 and plug it on XD.1 of the 1st I/O rack in the 2nd I/O bus

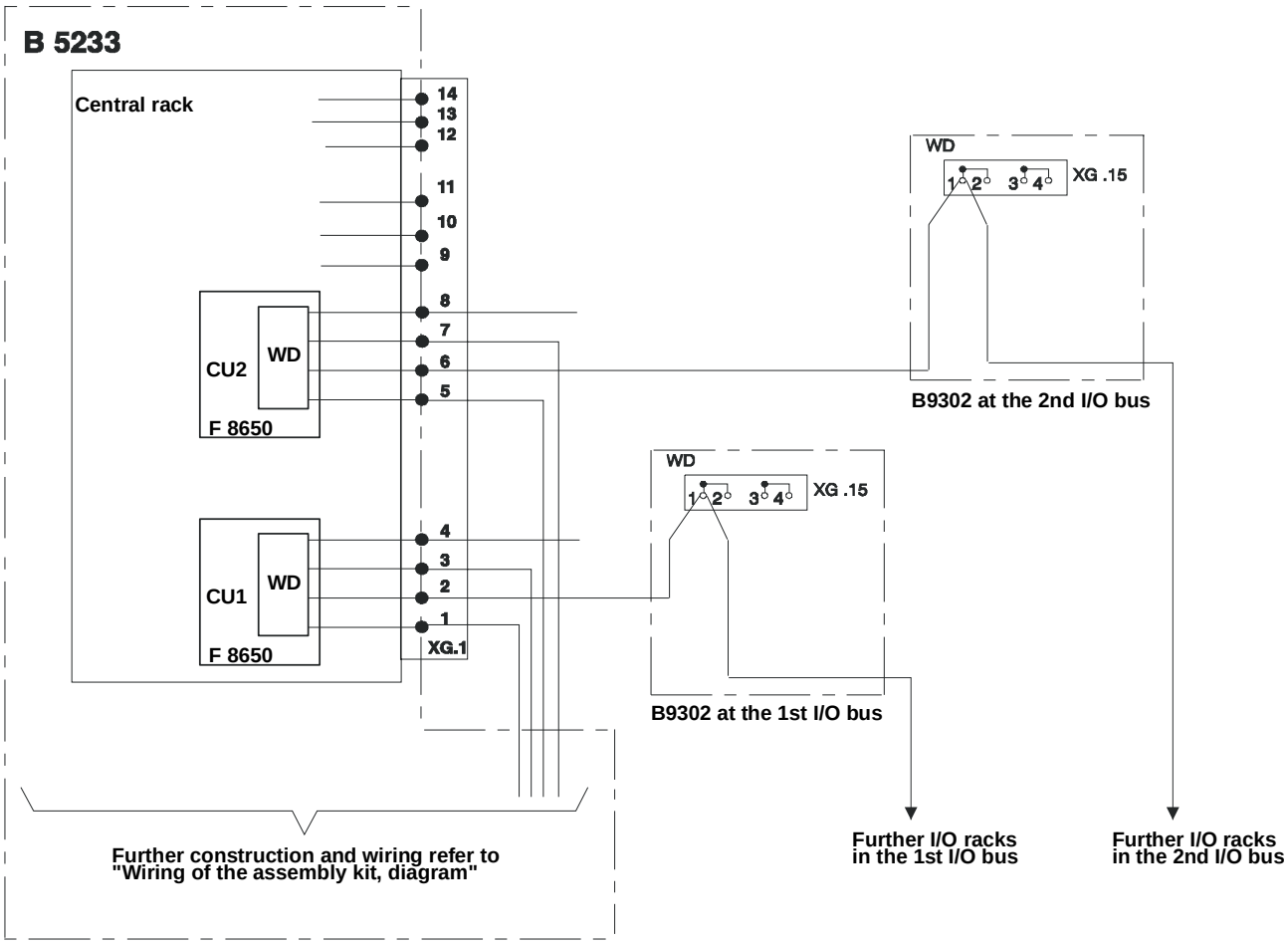
Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A T/slow	5 x 20 mm	57 0174169
Z 6013	1,6 A T/slow	5 x 20 mm	57 0174409

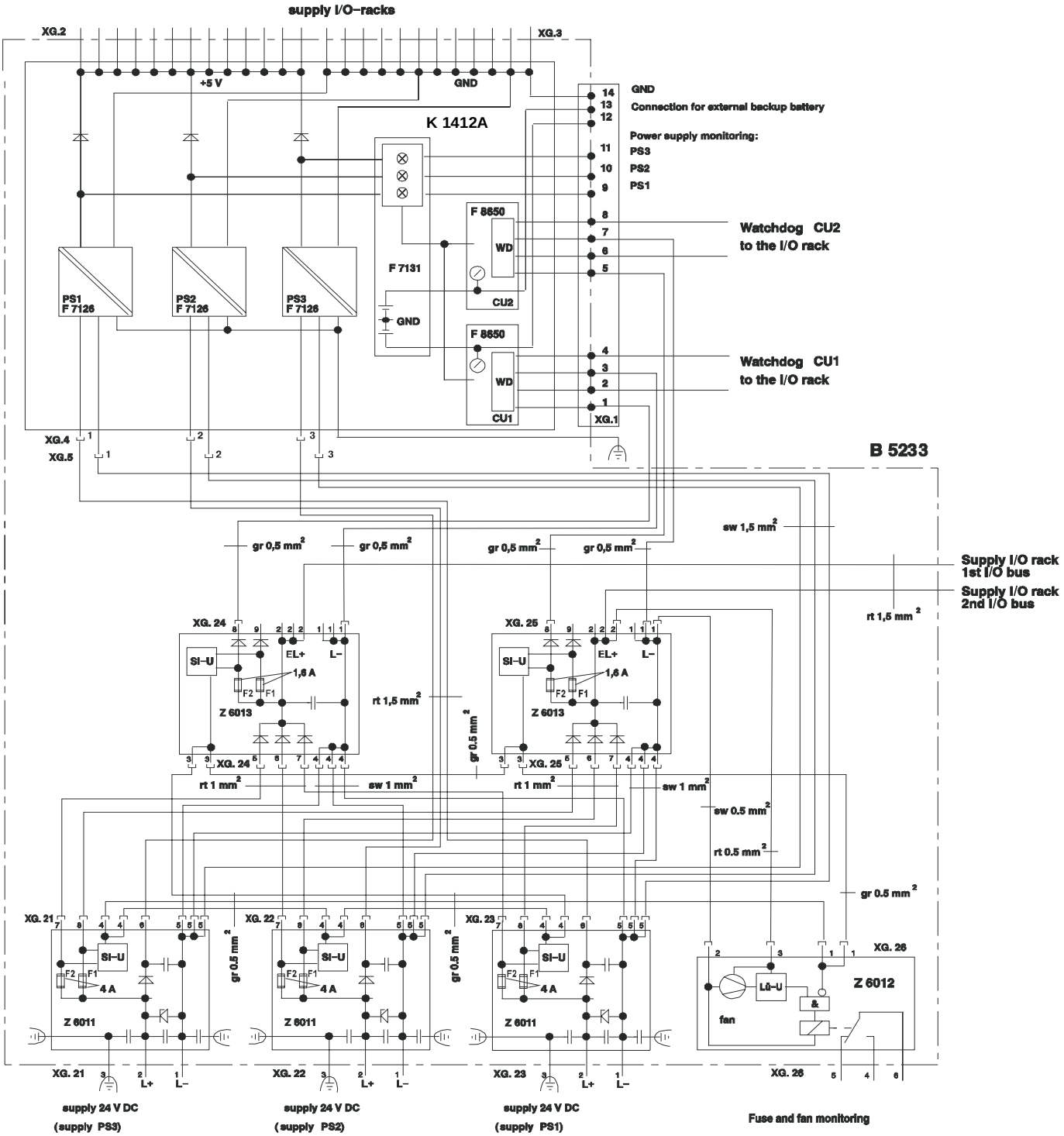
Note for earthing

With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements. Connection: Faston 6,3 x 0,8 mm

Attention: Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

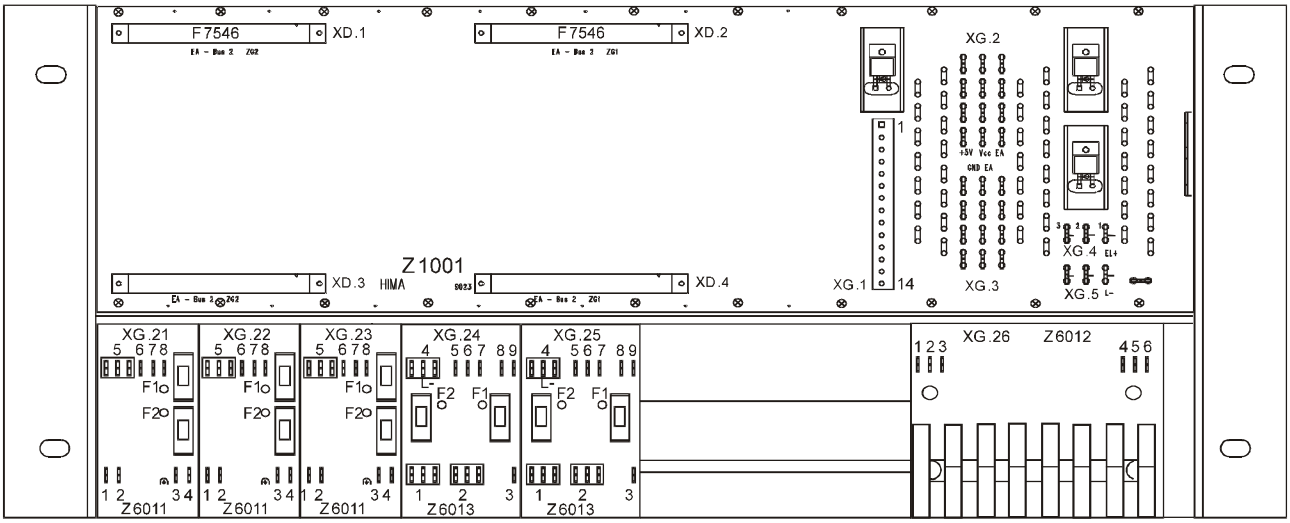


Wiring WD (only B 5233-2), diagram

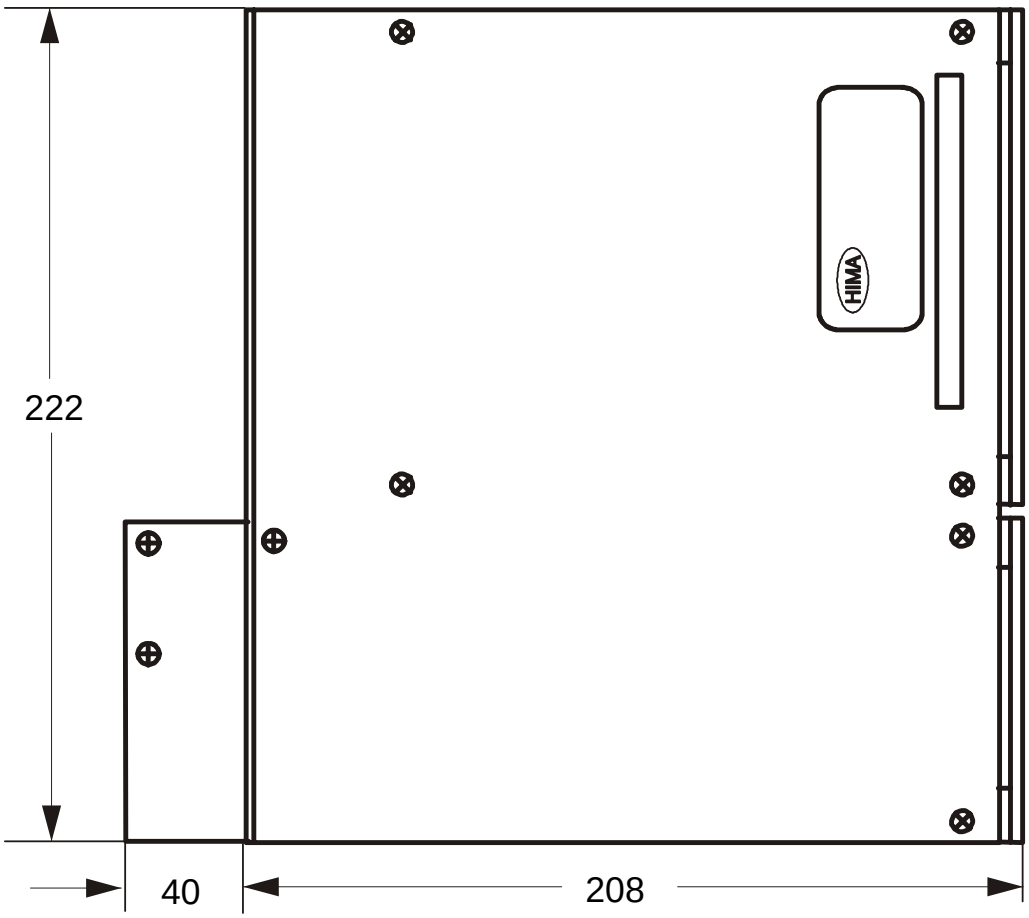


Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

Wiring of the assembly kit, diagram



Rear B 5233-2

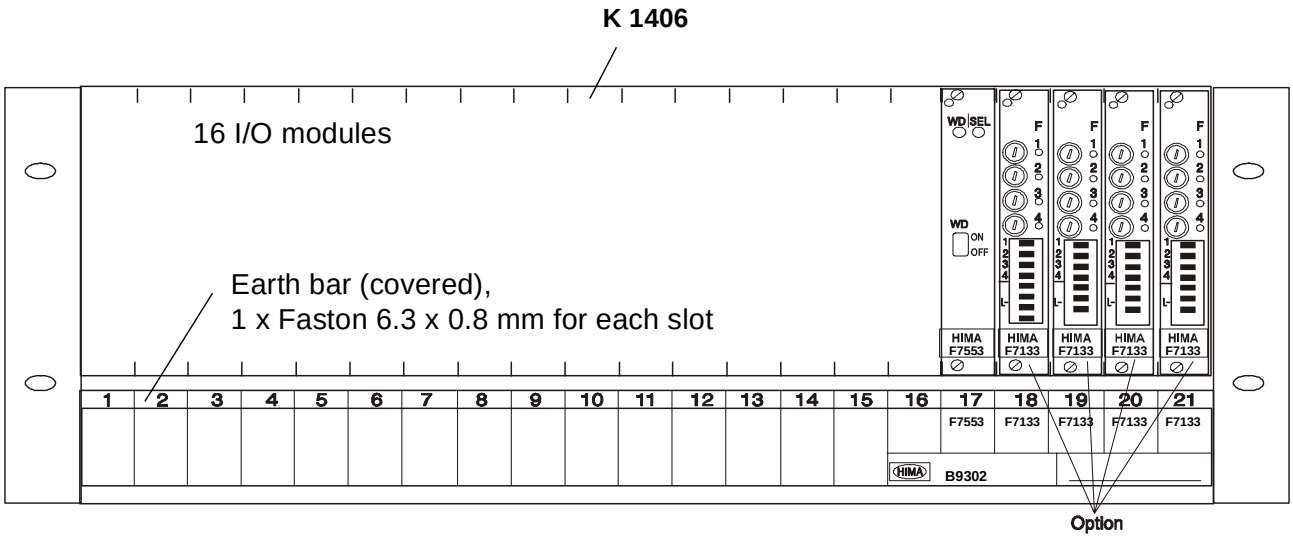


Side view

For your notes

B 9302

Assembly kit B 9302-0,5 (-1, -X)
I/O-rack 4 units high



Parts of the assembly kit B 9302:

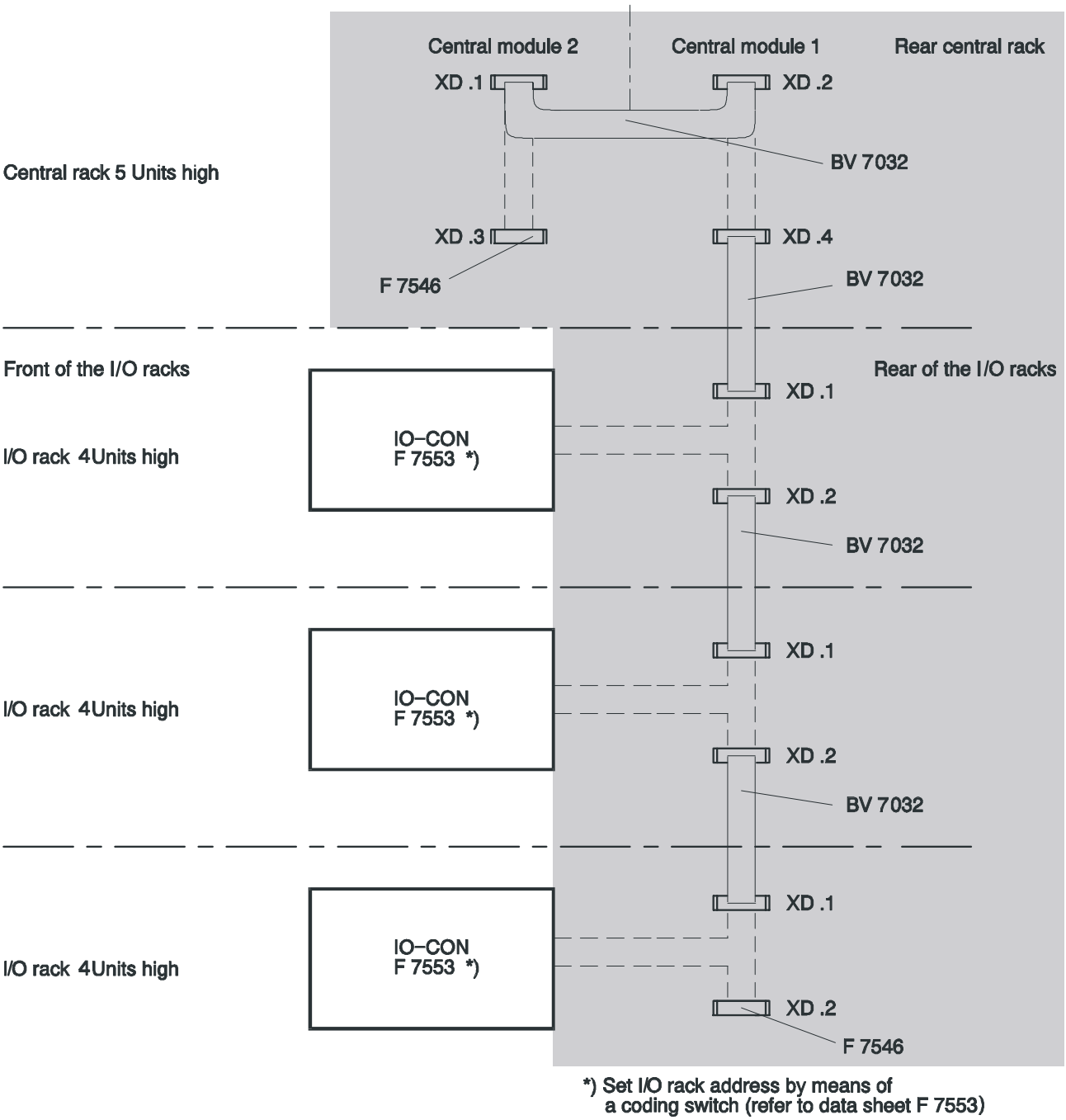
- 1 x F K 1406 I/O rack, 4 units high, 19 inch, with integrated cable tray, with a hinged receptable for the lable
- 1 x F 7553 Coupling module (in slot 17)
- 1 x BV 7032 flat cable, length is dependent on the order. Standards are B 9302-0,5 (with 0.5 m cable) and B 9302-1 (with 1 m cable). Assembly kit with choosable cable length B 9302-X. Total bus length is maximum of 30 m.

The slots 1 through 16 of the rack K 1406 are reserved for I/O modules.

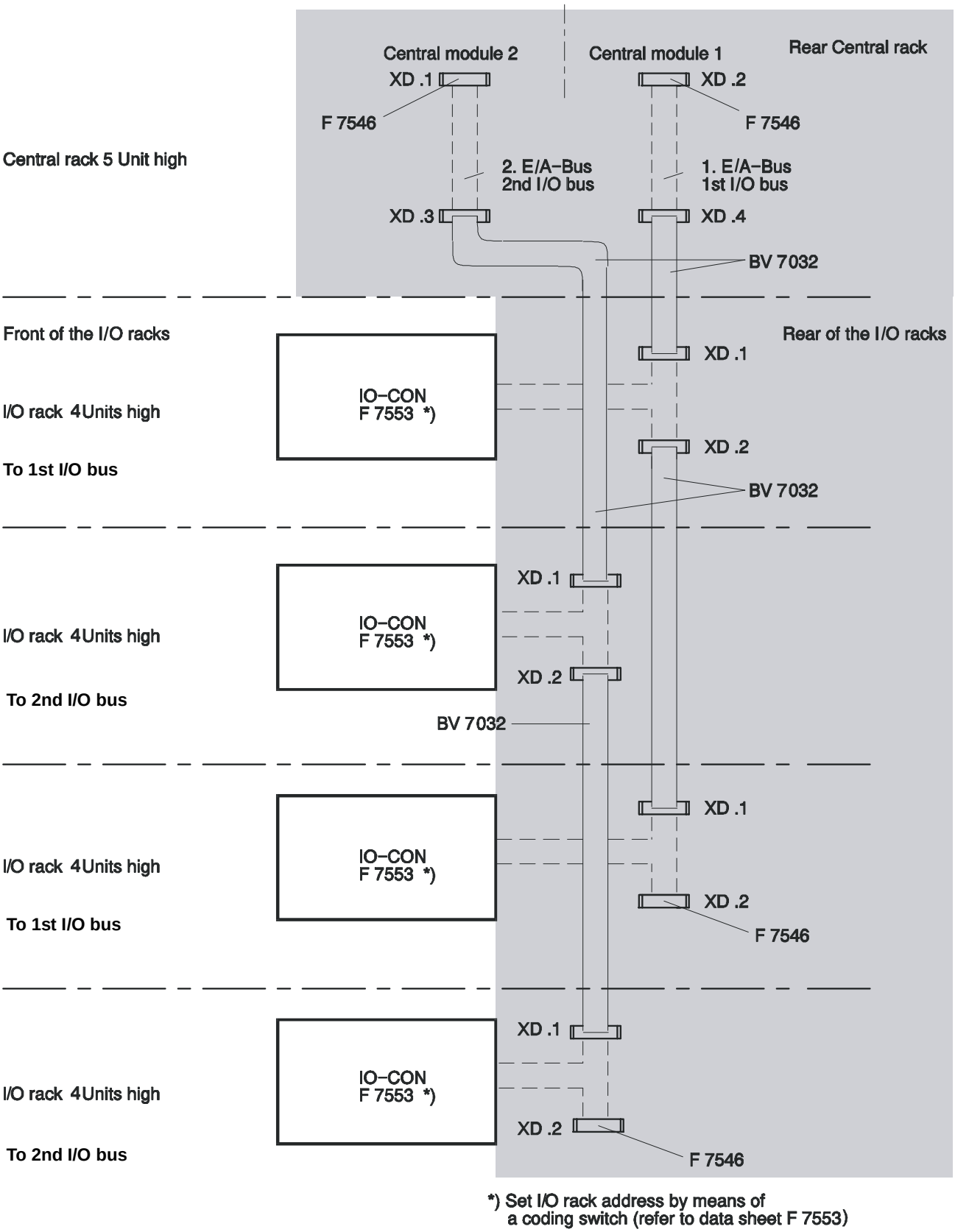
Modules for option (separate order):

- 1 ... 4 x F 7133 4-fold power distribution with fuses (slots 18 ... 21) to fuse and distribute L+ (EL+) and L-.

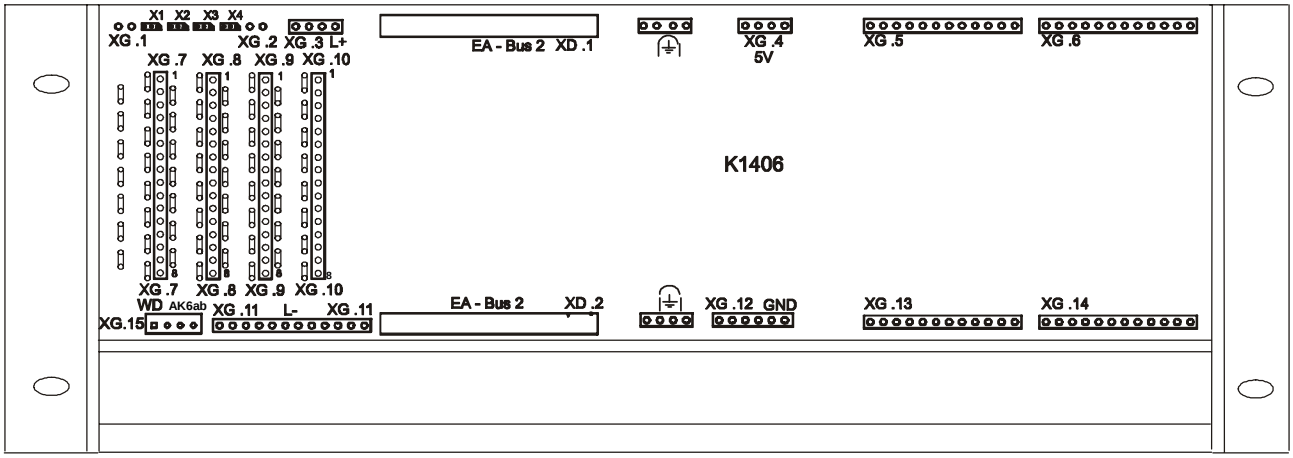
The fuse monitoring on the current distribution modules are internally switched in series. A corresponding fault signal is served via a neutral contact. The fault contact of a not installed current distribution module is bypassed by a jumper.



Wiring of the single channel I/O bus



Wiring of the redundant I/O bus



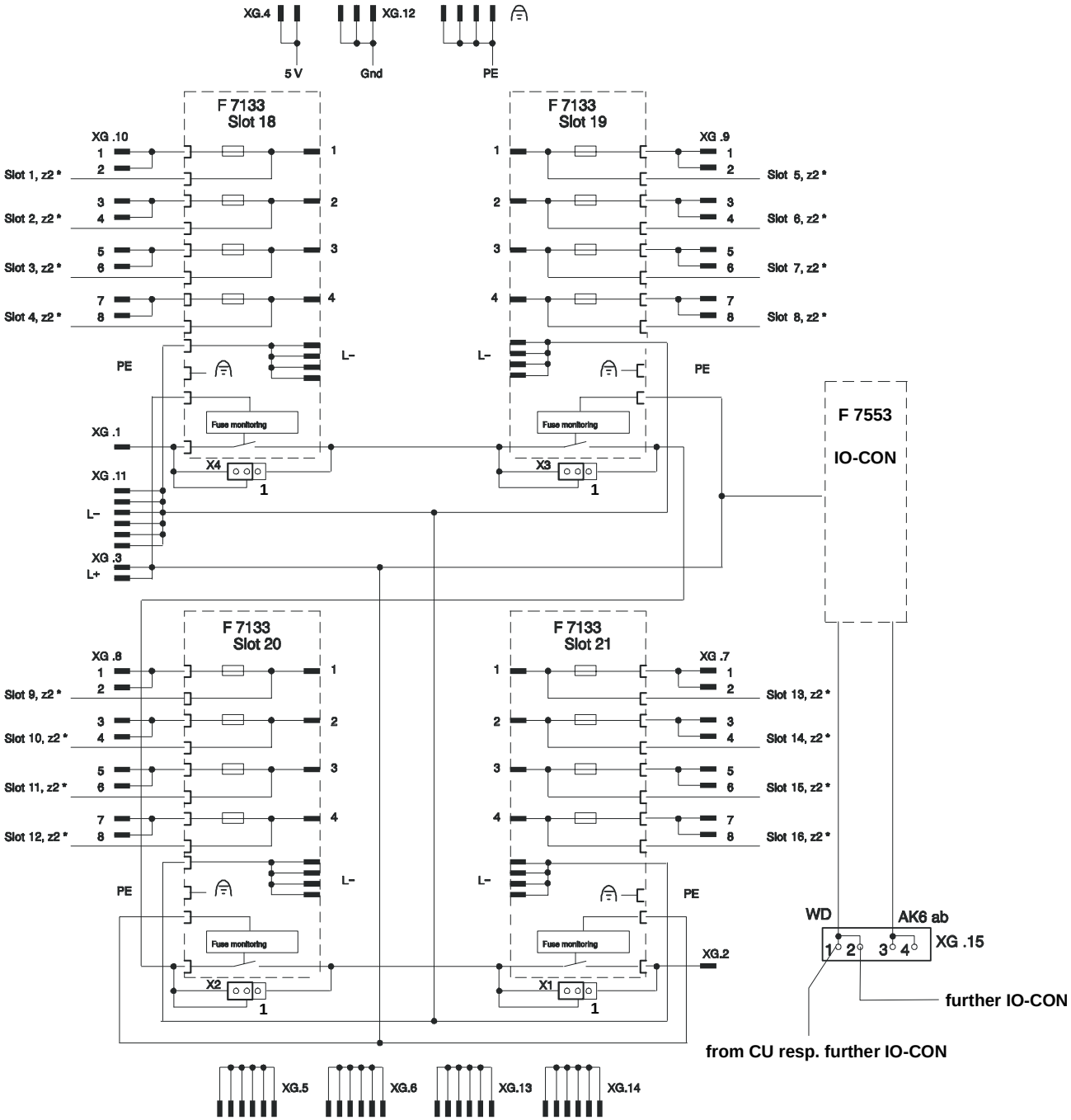
Rear

Connections on the rear of the I/O subrack K 1406 (refer also to: Supply, feeding and distribution of the 24 V system voltage, diagram):

XG .1, XG .2	Fuse monitoring (neutral contacts on current distribution module F 7133, not equipped F 7133 slot can be overrided by the jumpers X1 ... X4) ▬▭ = Slot equipped
XG .3	Supply EL+ for F 7133 and F 7553 To be wired with output XG. 24/25 of the central rack Reference pole: XG .11 (L-)
XG. 4	+ 5 V To be wired with XG. 2 of the central rack Reference pole: XG .12 (Gnd)
XG .5	Potential distributor, free disposal of
XG .6	Potential distributor, free disposal of
XG. 13	Potential distributor, free disposal of
XG .14	Potential distributor, free disposal of
XG .7	L+ to F 7133, slot 21
XG .8	L+ to F 7133, slot 20
XG .9	L+ to F 7133, slot 19
XG .10	L+ to F 7133, slot 18 Max. backup fuse 25 A gL each
XG .11	Potential distributor L- Note: To be wired to the central L- bus bar with at least 2 x 2,5 mm^2 sw. If output modules with 2pole connection to the actors are used depending on the load up to 4 x 2,5 mm^2 sw wiring is necessary
XG.12	Potential distributor GND To be wired with XG. 3 of the central rack
XG .15 (1+2)	WD (Watchdog signal) from the central module XG. 1, or from XG. 15 of another I/O subrack

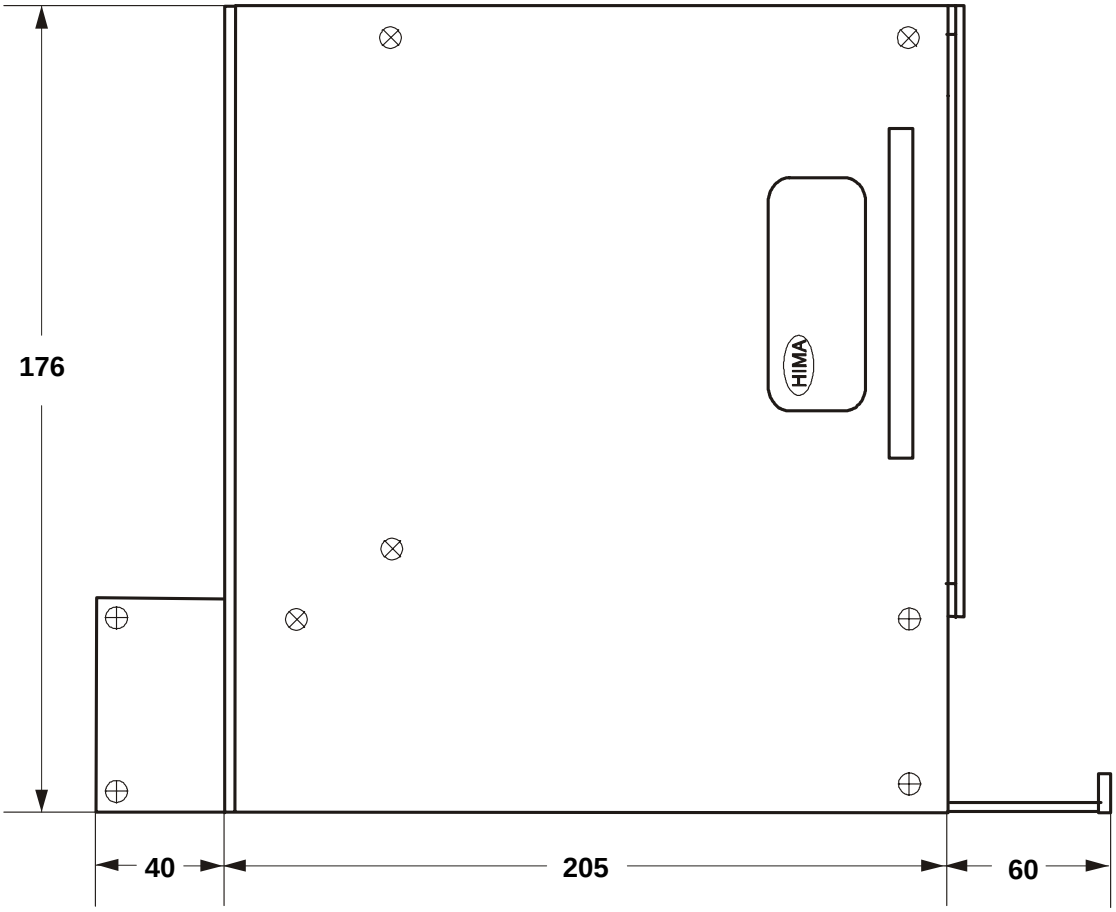
XD .1, XD .2 I/O bus from central rack/to further I/O subracks resp. bus termination module

PE (earth)



* Note: Fix related slots due to the connection via bus board

Supply, monitoring and distribution of the 24 V system voltage inclusive potential distribution, diagram

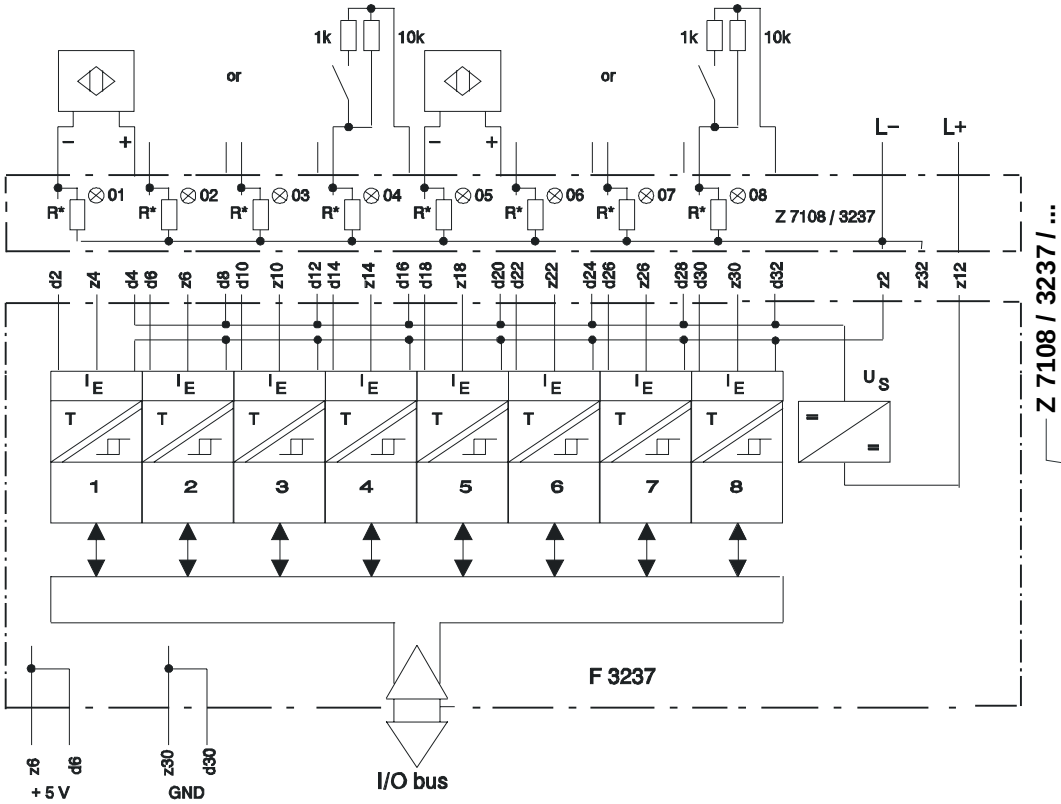


Side view

F 3237

F 3237: 8 fold input module, safety related

for the connection of safety related proximity switches, proximity switches acc. to DIN 19234 (NAMUR) and resistor-wired sensors
monitoring of the lines for short-circuit and line break
Safety related, requirement class AK 1 ... 6



Block diagram Front cable plug

The module is automatically tested completely during operation. The main test routines are:
- Switch on and switch off cability
- Crosstalk of the input circuits by walking 0 test
- Function of the input filters
- Correct function of the module
- Short circuit and wire break of the sensor line

Function of LEDs are not tested.
Appertaining softw. building block: HB-RTE-. (for current version refer to the description of the operating system).

Switching time	approx. 10 ms
Operating points I_E	
0 signal	$0.35 \leq I_E \leq 1.2$ mA
1 signal	$2.1 \leq I_E \leq 6.0$ mA
wire break	≤ 0.28 mA
short circuit	≥ 6.5 mA
Line impedance	≤ 50 Ohm (acc. to DIN 19234)
Line length	≤ 1000 m ($\varnothing = 0.5$ mm^2)
Supply voltage U_S	8.2 V
Shunt R*	681 Ohm; 1 %; 0.25 W
(R17 ... R24)	part no. 00 0751681
Space requirement	4 TE
Operating data	5 V =: 90 mA; 24 V =: 170 mA

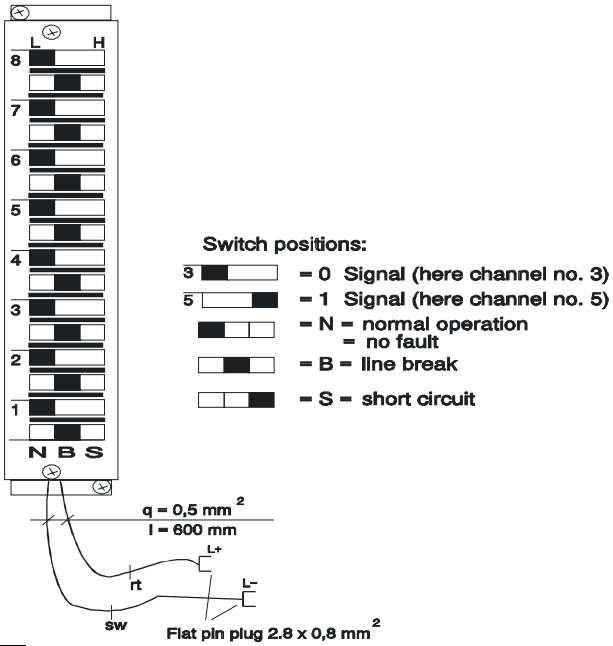
Channel	Connection	Colour
1	d2 d4 (x4)	ws br
2	d6 d8 (x8)	gn ge
3	d10 d12 (x12)	gr rs
4	d14 d16 (x12)	bl rt
5	d18 d20 (x20)	sw vio
6	d22 d24 (x24)	ws-br ws-gn
7	d26 d28 (x28)	ws-ge ws-gr
8	d30 d32 (x32)	ws-rs ws-bl
L– L– L+	 z2 z12	sw sw rt

Cable
LiYY 16 x 0.25 mm^2

LIY 0.5 mm^2
l = 2 m

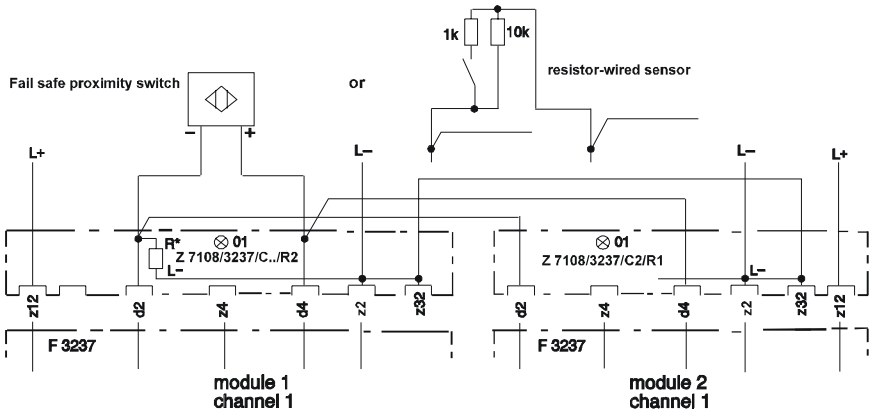
Flat pin plug
2.8 x 0.8 mm^2

q = 1 mm^2
l = 750 mm

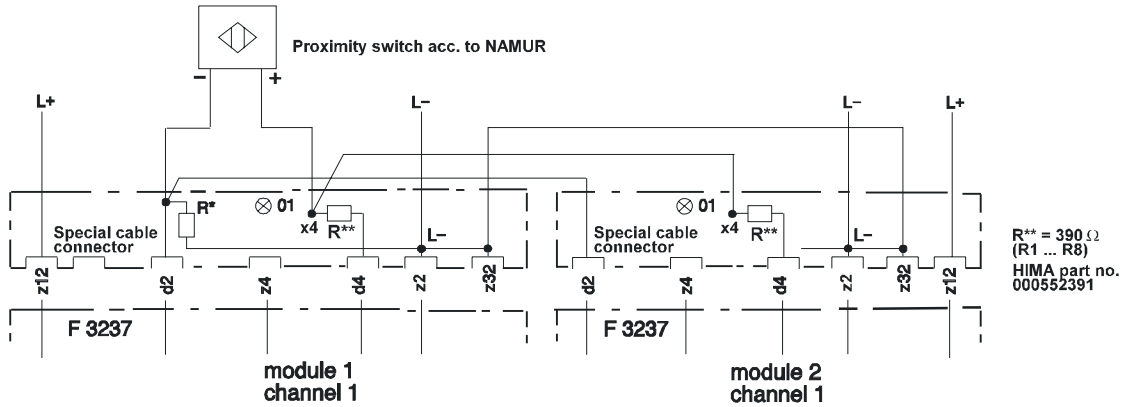


Construction test plug Z 7204

Lead marking cable plug
Z 7108 / 3237 / C..
(x.) with special cable connection



Redundant connection for one proximity switch circuit



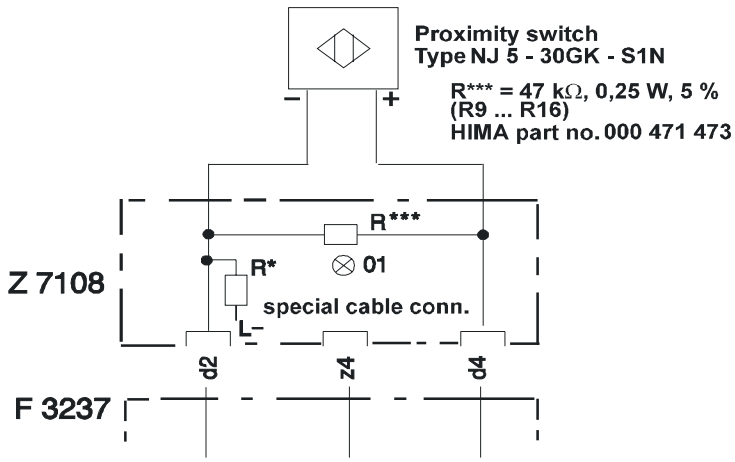
Redundant connection for one proximity switch according to DIN 19234 (NAMUR)

Proximity switches outside the DIN 19234 standard

Different proximity switches are not according to the DIN 19234 standard. E. g. the proximity switch type NJ 5 - 30GK - S1N of the P&F company delivers a very low current in the non-damped state. This effects the reaction of the line break supervision of the F 3237 module

Nevertheless to guarantee a correct function also in this case it is possible to increase the output current of the proximity switch to 170 µA in the non-damped state by switching in parallel a resistor of 47 kΩ.

There are no limitations concerning the using in fail safe circuits because a break of the resistor would be signalled like a line break. Also a real line break will be detected as before.

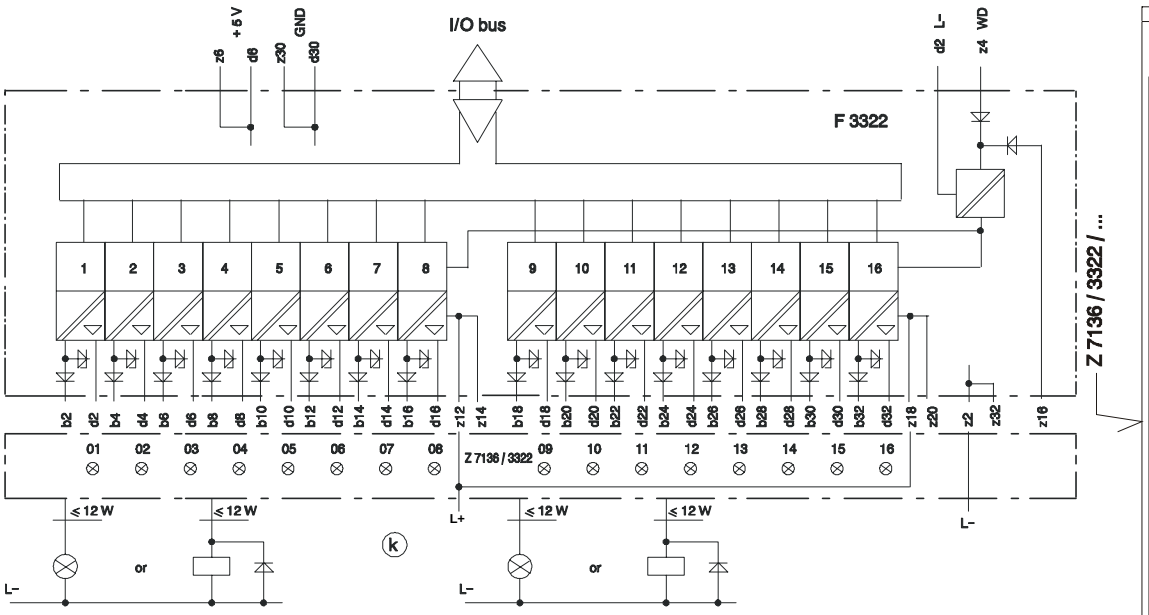


Connection of the parallel resistor to increase current

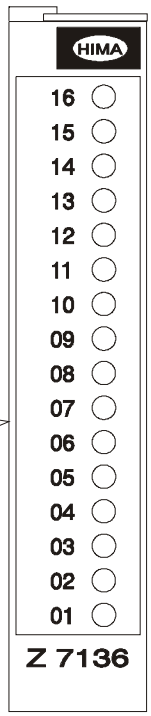
For your notes

F 3322

F 3322: 16 fold output module
resistive load or inductive load up to 500 mA (12 W),
lamp connection up to 12 W,
with safety isolation
no output signal with break of the L- supply



Block diagram

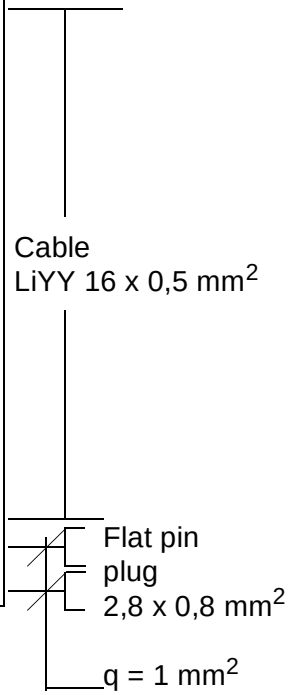


Front cable plug

Planning hint
Only max. 10 output modules with nominal load may be used in one IO-subrack and not more than half of the possible output load of 16 x 0.5 A = 8 A may be switched on at the same time. The standard fusing of the modules in the IO rack is 4 A slow.

Outputs	(k) short circuit proof
Response value for current limiter	> 550 mA
Space requirements	4 TE
Operating data	5 V DC: 110 mA 24 V DC: 150 mA in addition load

Channel	Connection	Colour
1	d2	ws
2	d4	br
3	d6	gn
4	d8	ge
5	d10	gr
6	d12	rs
7	d14	bl
8	d16	rt
9	d18	sw
10	d20	vio
11	d22	ws-br
12	d24	ws-gn
13	d26	ws-ge
14	d28	ws-gr
15	d30	ws-rs
16	d32	ws-bl
L–	z2	sw
L+	z12	rt



Lead marking of the cable plug
Z 7136 / 3322 / C..

Channel	Connection	Colour
1	b2	ws-rt
	x2	ws
2	b4	ws-sw
	x4	br
3	b6	br-gn
	x6	gn
4	b8	br-ge
	x8	ge
5	b10	br-gr
	x10	gr
6	b12	br-rs
	x12	rs
7	b14	br-bl
	x14	bl
8	b16	br-rt
	x16	rt
9	b18	br-sw
	x18	sw
10	b20	gn-gr
	x20	vio
11	b22	gn-rs
	x22	ws-br
12	b24	gn-bl
	x24	ws-gn
13	b26	gn-rt
	x26	ws-ge
14	b28	gn-sw
	x28	ws-gr
15	b30	ge-gr
	x30	ws-rs
16	b32	ge-rs
	x32	ws-bl
L–	z2	sw
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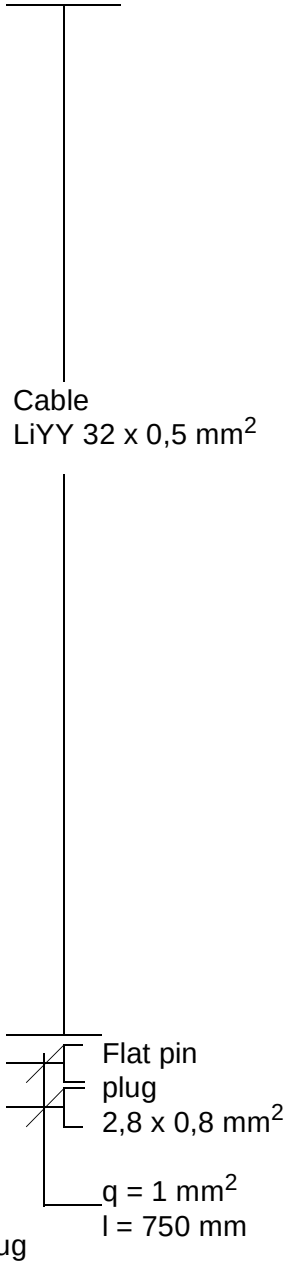
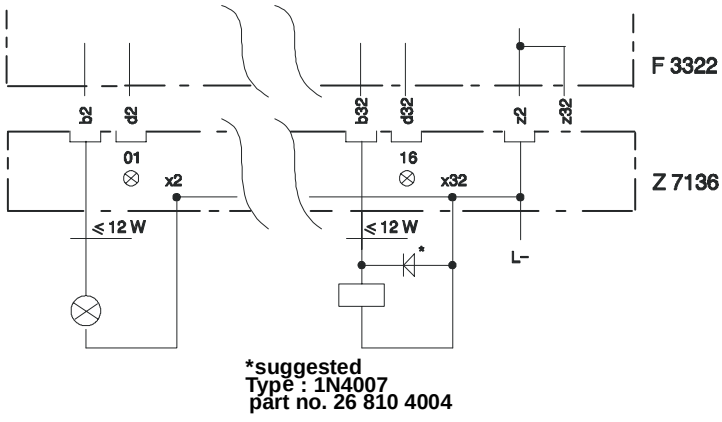


Lead marking of the cable plug
Z 7136 / 3322 / C.. / P2
2-pole connection

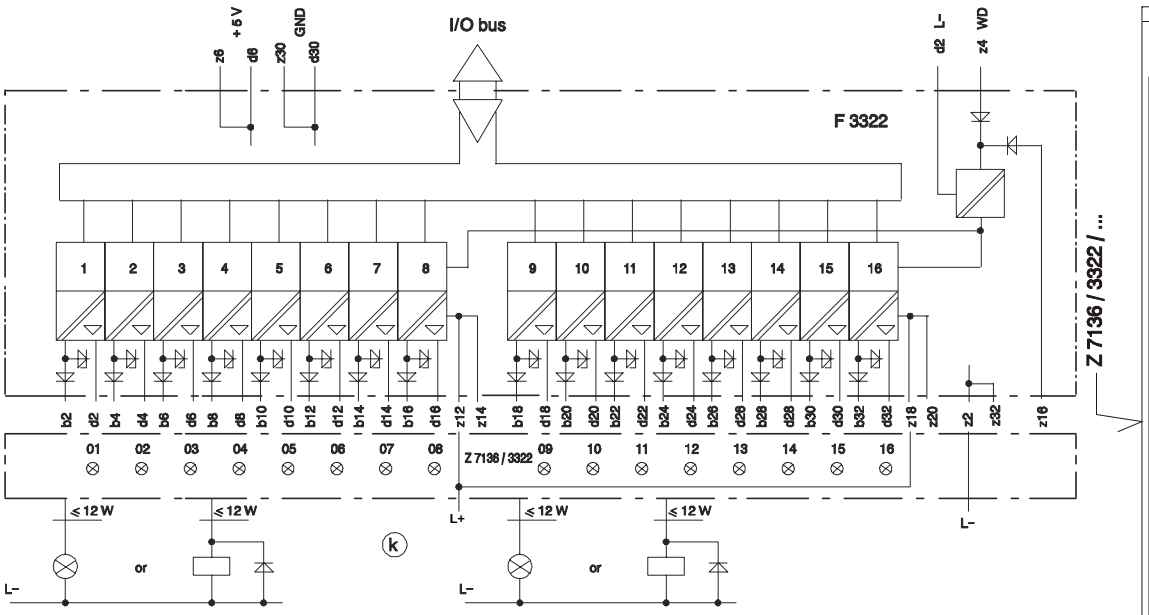


***suggested**
Type : 1N4007
part no. 26 810 4004

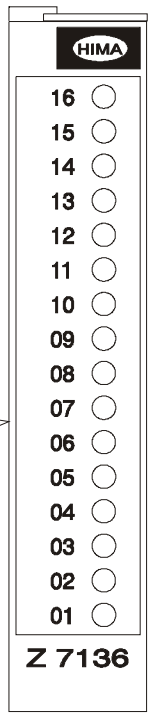
2-pole connection

F 3322

F 3322: 16 fold output module
resistive load or inductive load up to 500 mA (12 W),
lamp connection up to 12 W,
with safety isolation
no output signal with break of the L- supply



Block diagram



Front cable plug

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Response value for current limiter	> 550 mA
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12	d24	ws-gn
13	d26	ws-ge
14	d28	ws-gr
15	d30	ws-rs
16	d32	ws-bl
L–	z2	sw
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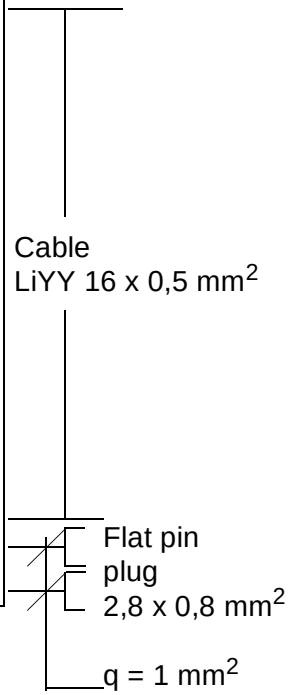
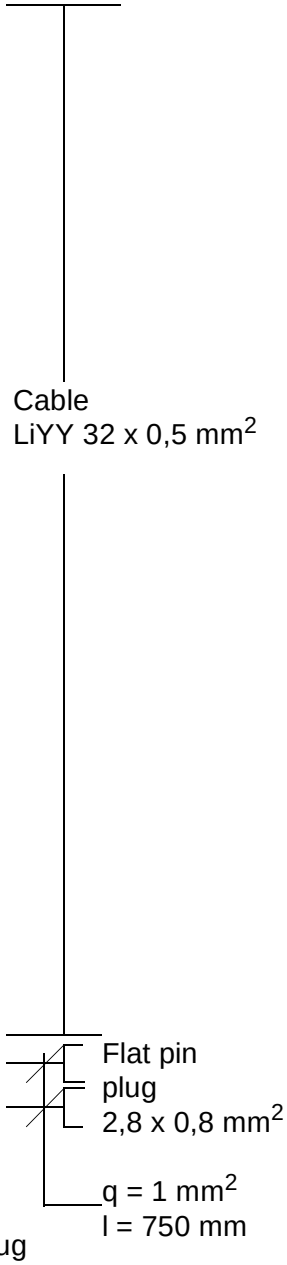
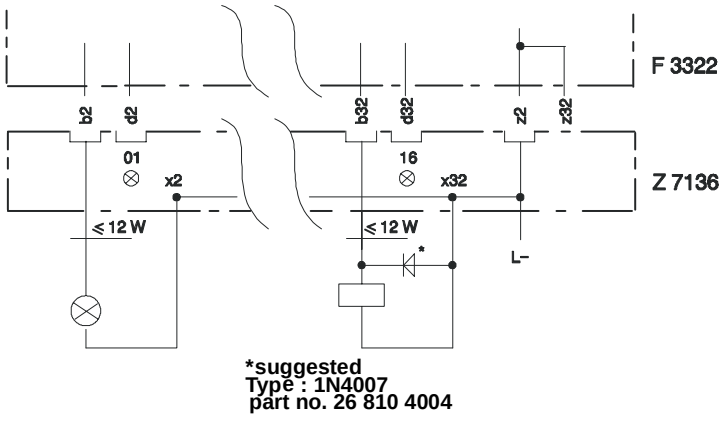


Lead marking of the cable plug
Z 7136 / 3322 / C..

Channel	Connection	Colour
1	b2	ws-rt
	x2	ws
2	b4	ws-sw
	x4	br
3	b6	br-gn
	x6	gn
4	b8	br-ge
	x8	ge
5	b10	br-gr
	x10	gr
6	b12	br-rs
	x12	rs
7	b14	br-bl
	x14	bl
8	b16	br-rt
	x16	rt
9	b18	br-sw
	x18	sw
10	b20	gn-gr
	x20	vio
11	b22	gn-rs
	x22	ws-br
12	b24	gn-bl
	x24	ws-gn
13	b26	gn-rt
	x26	ws-ge
14	b28	gn-sw
	x28	ws-gr
15	b30	ge-gr
	x30	ws-rs
16	b32	ge-rs
	x32	ws-bl
L–	z2	sw
L+	z12	rt



Lead marking of the cable plug
Z 7136 / 3322 / C.. / P2
2-pole connection



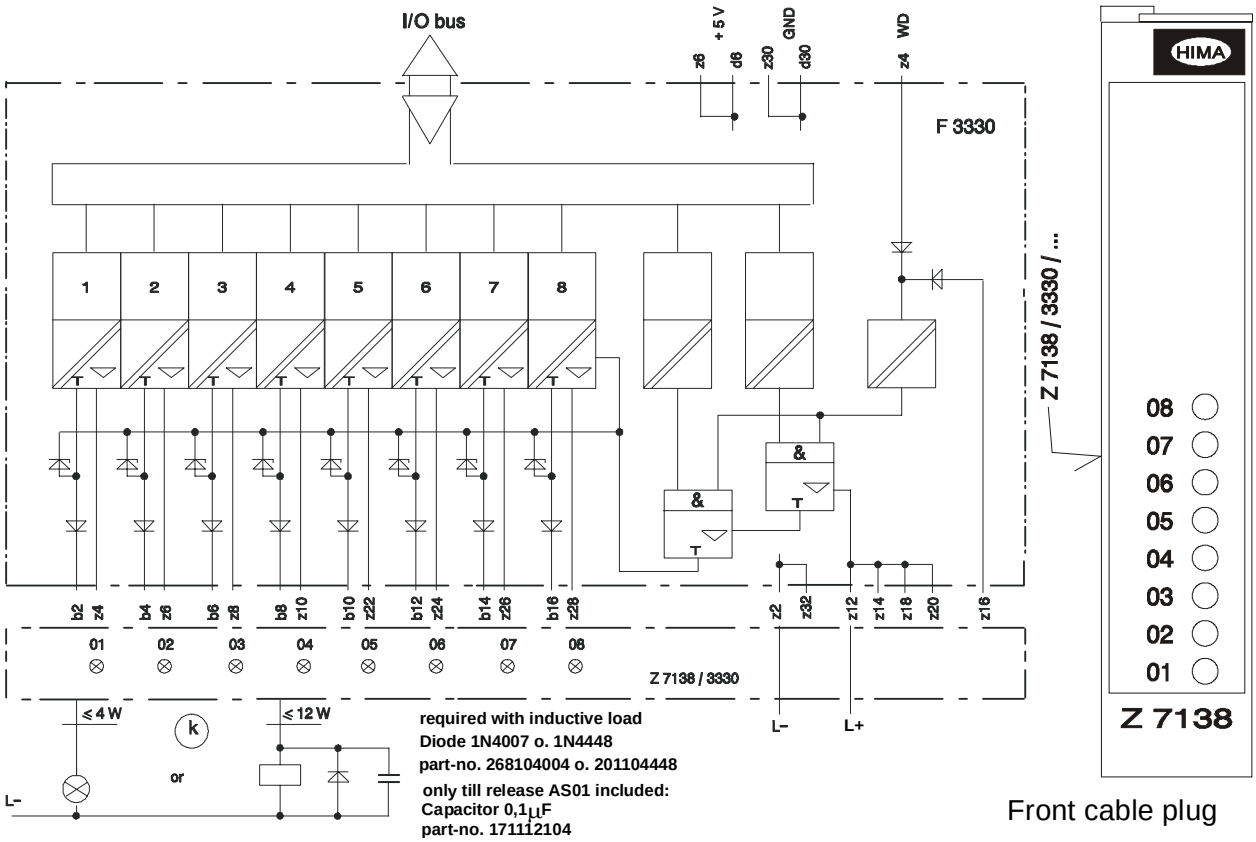
***suggested**
Type : 1N4007
part no. 26 810 4004

2-pole connection

F 3330

F 3330: 8 fold output module,
safety related

resistive load or inductive load up to 500 mA (12 W),
lamp connection up to 4 W,
with integrated safety shutdown, with safe isolation,
no output signal with break of the L- supply
requirement class AK 1 ... 6



Block diagram

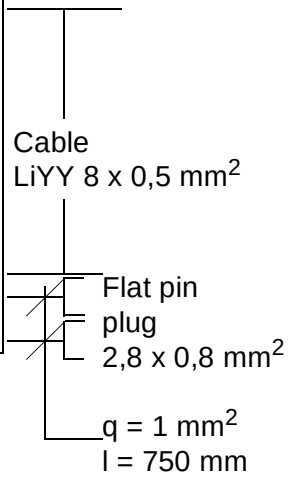
Front cable plug

The module is automatically tested during operation. The main test routines are:

– Reading back of the output signals. The operating point of the 0 signal read back is ≤ 6.5 V. Up to this value the level of the 0 signal may arise in case of a fault and this will not be detected
– Switching capability of test signal and cross-talking (walking-bit test).

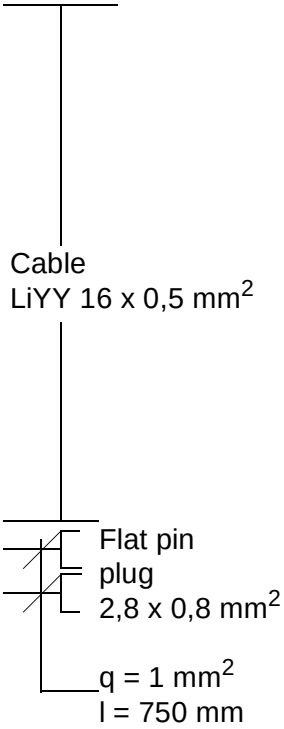
Outputs	500 mA, (k) short circuit proof
Internal voltage drop	max. 2 V at 500 mA load
Admissible line resistance (in + out)	max. 11 Ohm
Undervoltage tripping	at ≤ 16 V
Operating point for short circuit current	0.75 ... 1.5 A
Outp. leakage current	max. 350 µA
Output voltage if output is reset	max. 1,5 V
Duration of the test signal	max. 200 µs
Space requirement	4 TE
Operating data	5 V DC: 110 mA 24 V DC: 180 mA in add. load

Channel	Connection	Colour
1	b2	ws
2	b4	br
3	b6	gn
4	b8	ge
5	b10	gr
6	b12	rs
7	b14	bl
8	b16	rt
L–	z2	sw
L+	z12	rt

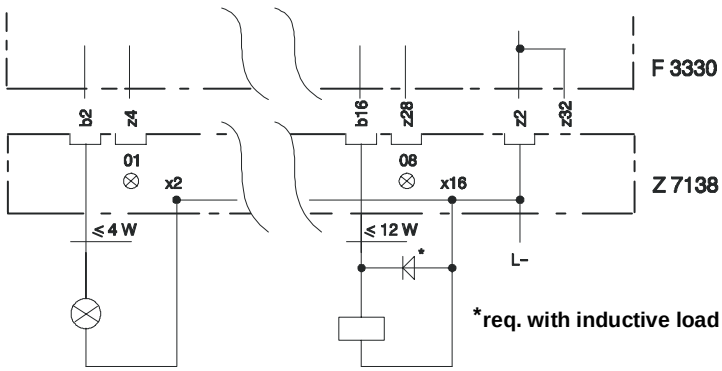


Lead marking of the cable plug
Z 7138 / 3330 / C..

Channel	Connection	Colour
1	b2	br
	x2	ws
2	b4	ge
	x4	gn
3	b6	rs
	x6	gr
4	b8	rt
	x8	bl
5	b10	vio
	x10	sw
6	b12	ws-gn
	x12	ws-br
7	b14	ws-gr
	x14	ws-ge
8	b16	ws-bl
	x16	ws-rs
L–	z2	sw
L+	z12	rt



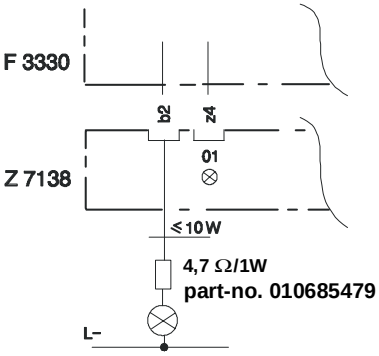
Lead marking of the cable plug
Z 7138 / 3330 / C.. / P2
2-pole connection



2-pole connection

Planning hints

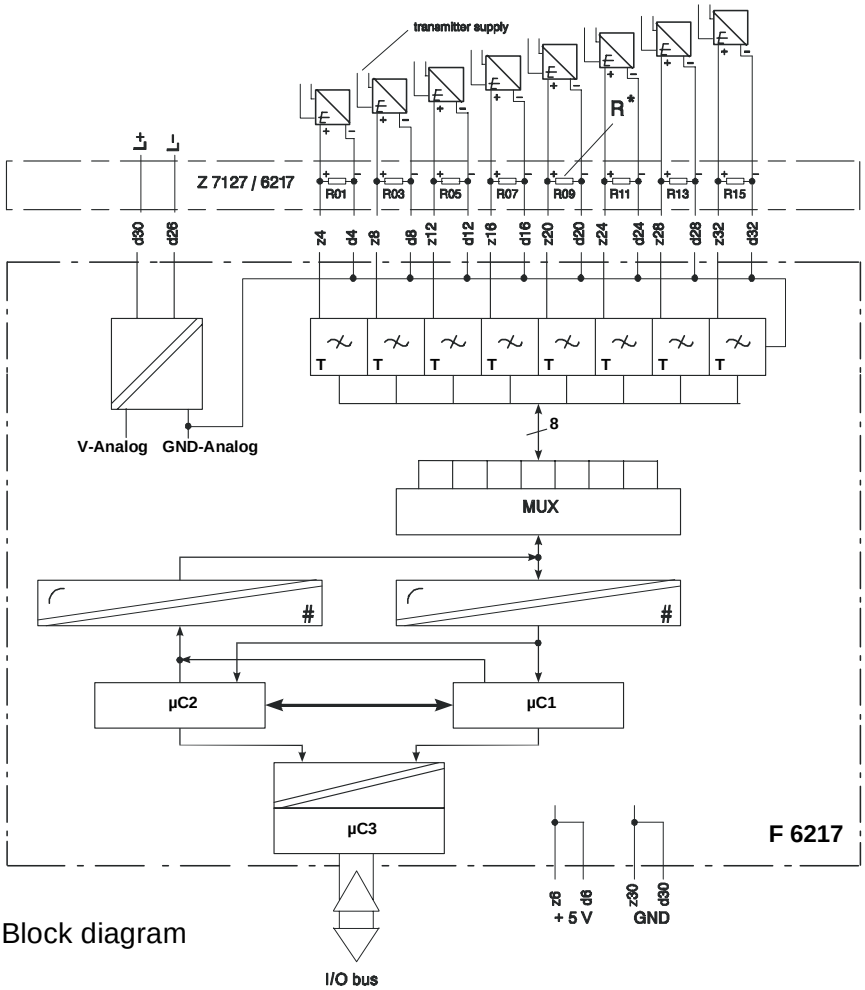
– max. 10 output modules with nominal load may be used in one I/O rack
– can be paralleled without external diodes
– for lamp load 4 W to 10 W refer to sketch:



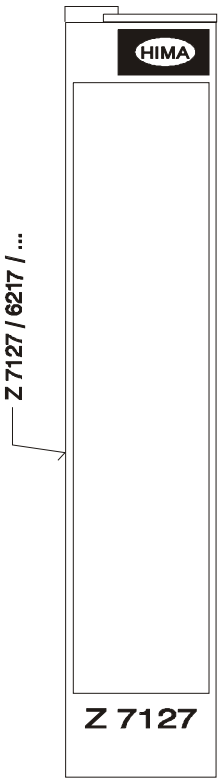
F 6217

F 6217: 8 fold analog input module, safety related

for current inputs 0/4...20 mA, voltage inputs 0...5/10 V,
with safety isolation
resolution 12 bits
tested according to AK6/SIL3



Block diagram



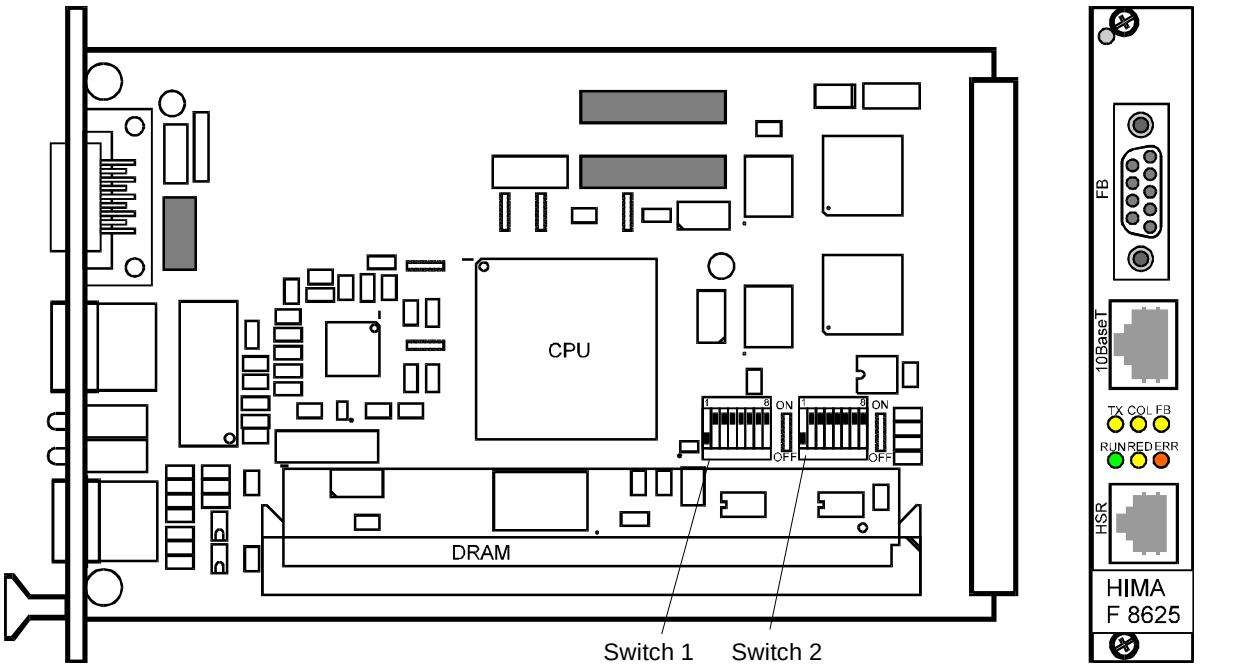
Front cable plug

Input voltage	0...5.5 V
max. input voltage	7.5 V
Input current	0...22 mA (via shunt)
max. input current	30 mA
R*: Shunt with current input	250 Ohm; 0.05 %; 0.25 W; T<10 ppm/K; part-no: 00 0710251
Resolution	12 bit, 0 mV = 0 5.5 V = 4095
Measurand up date	50 ms
Safety time	< 450 ms
Input resistance	100 kOhm
Time const. inp. filter	appr. 10 ms
Basic error	0.1 % at 25 °C
Operating error	0.3 % at 0...+60 °C
Error limit related on safety	1 %
Electric strength	200 V against GND
Space requirement	4 TE
Operating data	5 V DC: 80 mA, 24 V DC: 50 mA

F 8625

F 8625: Communication Module for Ethernet-Communication
Application in H51q PLCs (usable with BS41q/51q V7.0-7 (9835) and higher) with ELOP II-NT.

General Description



Top view of module

Front side of module

With this communication module F 8625, up to 64 HIMA H51q PLCs can communicate with each other in a safety-related manner (Ethernet communication according to IEEE 802.3).

Interfaces

- Serial interface FB not used
- Ethernet interface 10BaseT according to the IEEE 802.3 standard. Connection via an RJ-45 plug
- High-speed serial communication interface to the redundant HSR (High Speed Redundancy) communication module. Connection via an RJ-12 plug

Specifications

Processor	32 Bit Motorola CPU with integrated RISC communication controller
RAM	4...16 MB
Operating current	5 V = / 1 A
Space required	3 HE (units high), 4 TE (units width)

Table 1: Specifications

Display Readings During Operation (LED)

LED	LED	Operation Mode
RUN=ON	ERR=OFF	Communication active
RUN=flashg.	ERR=OFF	Communication inactive
RED=ON	ERR=OFF	Communication to redundant communication module active
RUN=flashg.	ERR=flashg.	Booting of communication module
RUN=OFF	ERR=ON	Error in communication module
RUN=OFF	ERR=flashg.	Error in communication module Uploading of errors ***Do not unplug communication module!***
RUN and ERR	alternate flashg.	Communication module waiting for IP address = error Please contact HIMA Paul Hildebrandt GmbH + Co KG
TX		Send Ethernet communication LED
COL		Collision on the Ethernet segment
FB=OFF		No Profibus-DP activity of slave on bus
FB=flashg.		Slave waiting for parameterization from Profibus-DP master
FB=ON		Data exchange of slave with Profibus-DP master

Table 2: Display readings during operation

Switches on the Communication Module

Switches for Ethernet

Switch 2/1 ON = Module number 1
OFF = Module number 2
Switch 2/2 ON = single wiring
OFF = redundant wiring

Switches for the Fieldbus

Switches 1/1 to 1/8 and switches 2/3 to 2/8
not used

Definitions

10BaseT
Standardization in the IEEE 802.3 standard. Ethernet with twisted pair wiring with a Hub and a transmission rate of 10 MBit/s. Supported cable types: STP (shielded twisted pair), UTP (unshielded twisted pair).

big-endian Format
Four-digit hexadecimal data format

MSB	LSB	
00	00 hex	0 dec
FF	FF hex	65535 dec

Bridge
A bridge connects the same type or different types of networks according to IEEE 802 (standardization of physical and back-up levels of networks). The bridge filters the corresponding data of the network components.

BUSCOM
Serial communication between HIMA PLCs and external systems (for configuration and programming see the ELOP II-NT manuals).

CSMA/CD (Carrier Sense Multiple Access with Collision Detection)

ELOP II-NT
Engineering tool for the planning and programming of HIMA PLCs according to IEC 61131-3.

HIPRO-S
Safety-related communication between HIMA PLCs and external systems (for configuration and programming see the ELOP II-NT manuals).

Hub
With the interconnection of more than two Ethernet components having a 10BaseT connection, a central distributor (hub) is required. Ethernet components can be arranged in a star-shaped connection to the hub. The differences between the various types lie in the number of connections and the construction of the hub.

IEEE 802.3 (Institute of Electrical and Electronic´s Engineers)
International standardization of the lower levels (physical and address level) of local networks. Part 3 specifies networks with bus topology, access procedures, CSMA/CD and transmission rates (10Base5, 10Base2, 10BaseT, 10BaseF, 100BaseX).

IP Address
Internet Protocol address: defines the address of a network component for the unambiguous transmission of data bursts across several networks.

OLE (Object Linking and Embedding)

OPC Gateway
The OPC (OLE for the process industry) gateway provides an intelligent standardized transformation of a protocol into another or to other systems, respectively.

PES Master (according to IEC 61131-3)
Master in a HIMA PLC managing the safety-related communication under HIPRO-S.

Ressource
A HIMA PLC under ELOP II-NT.

RJ-12
Internationally standardized plug or socket, respectively, for a maximum of 6 cores.

RJ-45
Internationally standardized 8 pin plug-in connector for the connection of STP/UTP lines according to 10BaseT. Pin allocation of RJ-45 under 10BaseT:

1 Transmit Data + (TD+)
2 Transmit Data - (TD-)
3 Receive Data + (RD+)
6 Receive Data - (RD-)

Pins 4, 5, 7 and 8 are not used.

Router
The router optimizes the choice of routes within complex networks (using the IP address).

Switch
Like the bridge, the switch connects the same type or different types of networks with each other. One important feature is the short delay time during data routing. Unlike the bridge, which first checks the packet and then routes it, the switch can route the data to the corresponding interface very fast after the beginning of the frame (receiver's address in the data pakket).

Ethernet Communication

Application Guidelines/Hints

- The IEEE 802.3 standards must be adhered to.
- The transmission of data packets on the Ethernet, seen from the HIMA communication module, must not be delayed by more than 500 µs.
- The entire transmission link must ensure a transmission rate of 10 MBit/s.
- If deterministic data exchange for safety-related communication is to be ensured, a load-free Ethernet segment must be made available to the HIMA communication modules.
  Is this not possible, no defined time behaviour on the Ethernet segment can be ensured. This can be result in a safety shutdown because of an overflow of the monitoring time.
- Redundant Ethernet segments must not be connected with one another.
- Interchanging a communication module with associated HSR cable at first withdraw the module, to ensure a defined cancelling of the Ethernet segment.
- Should the Ethernet segment not be available to the HIMA communication module alone, the IP address range from 192.168.0.3 to 192.168.0.131 must not be used otherwise.
- All single communication module connections must be connected to the same logical Ethernet segment.
- Communication modules belonging to one PLC and having the same module number must be connected to different Ethernet segments.

Ethernet Topologies

All connected Ethernet components must adhere to the application guidelines!

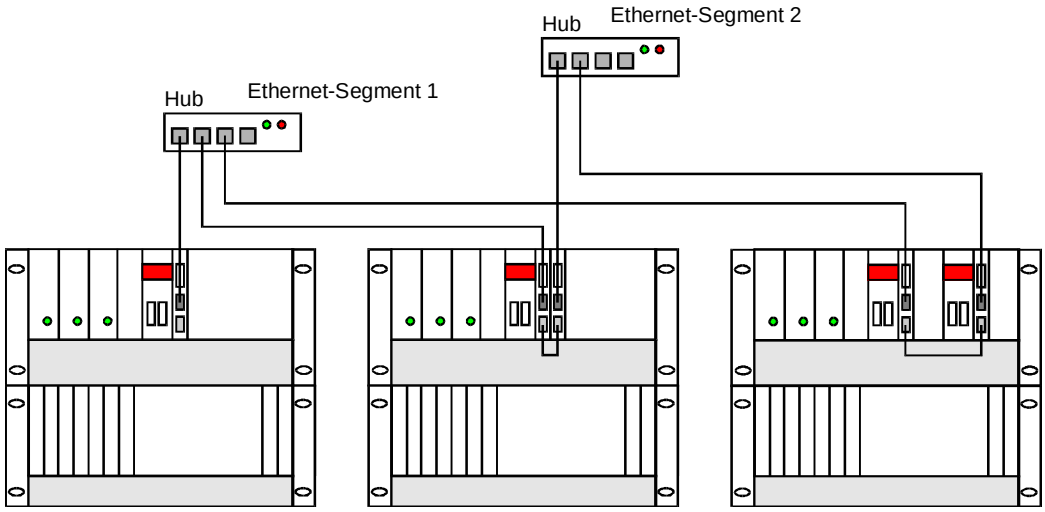


Figure 1: Ethernet topology: Possible PLC connections

The redundant structure of the Ethernet segments is possible at any time. A bridge has to be plugged in between the redundant communication modules using the HSR interface with HSR cable BV 7053.

Figure 1 shows all possibilities of interconnecting the PLCs.

- Single PLC on one Ethernet segment (each hub is an independent Ethernet segment)
- Single PLC with two communication modules on both Ethernet segments
- Redundant PLC with two communication modules on both Ethernet segments

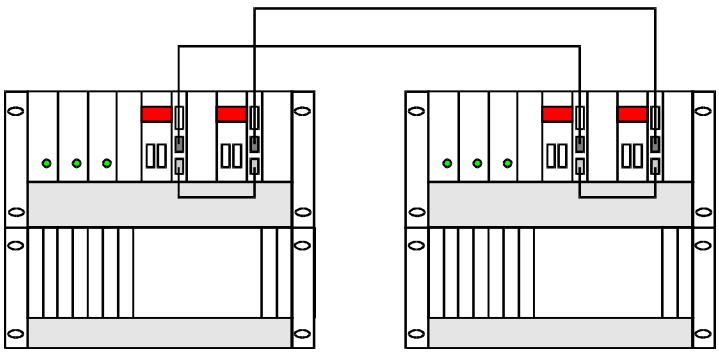


Figure 2: Ethernet Topology - Interconnection of two PLCs

When two PLCs are interconnected (Figure 2), the hub is not necessary. The two 10BaseT interfaces of the communication modules are connected directly by a special cable "cross over" (with twisted cores).

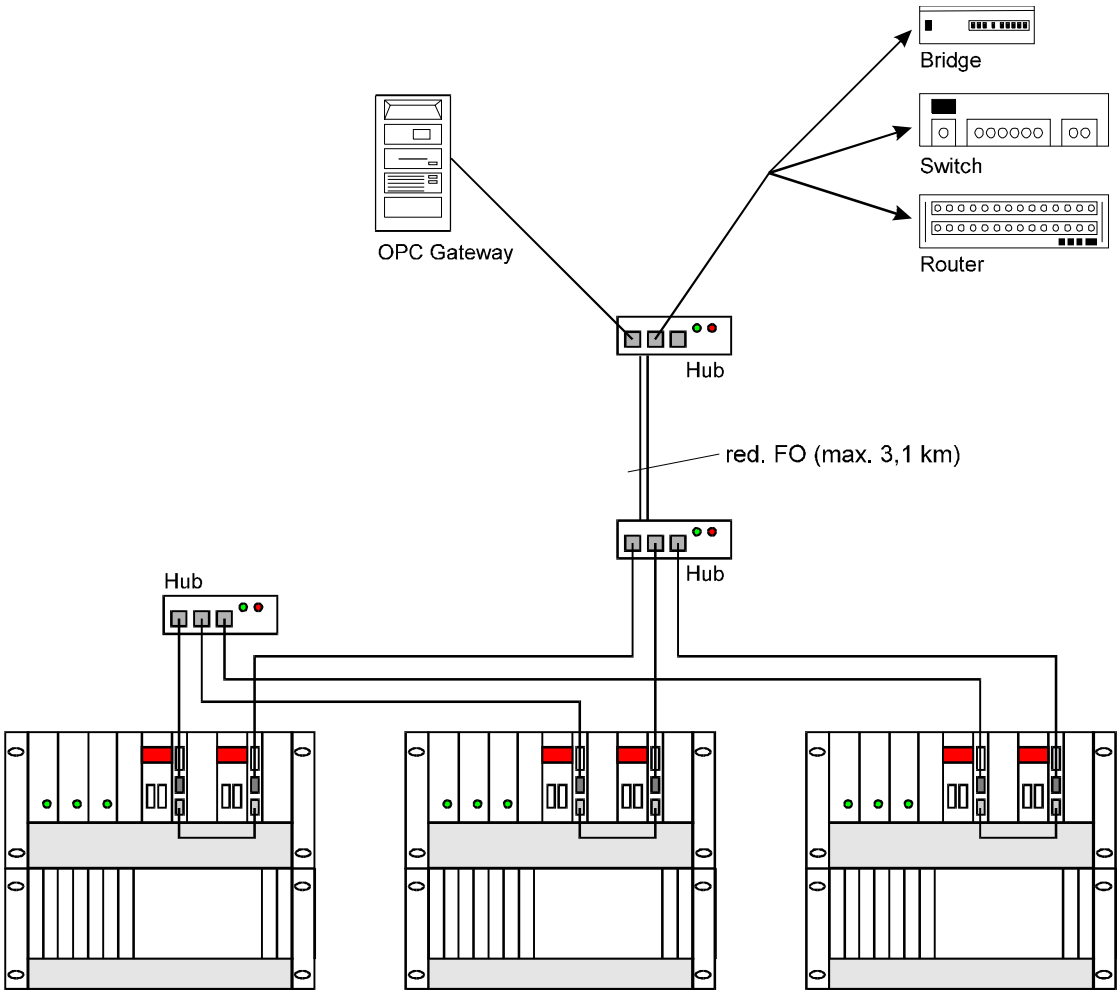


Figure 3: Ethernet topology: redundant interconnection with hubs

In Figure 3, three PLCs are completely redundantly interconnected via 2 hubs.
A third hub is connected to the redundantly interconnected PLCs via a redundant fiber optic (FO) connection (the fiber optic interface is integrated in the hub, maximum transmission distance 3100 m). An OPC gateway and further Ethernet components, for example, are connected to the third hub.

Hints on the creation of the user program

The Ethernet network is **configured** automatically in ELOP II-NT for HIPRO-S. However, the following hints are to be considered when creating the user program:

- The resource name under ELOP II-NT must consist of 8 characters, and the last two must be numbers. Numbers between 01 and 64 are permissible. The numbers must be unambiguous so that they can be used free of collision as IP address of the communication module.
- The safety-related communication with HIPRO-S must be extended so that **each PLC is configured with safety-related data exchange when communicating with each other PLC** (i.e. exchange of dummy data in case no user data are exchanged).
  The direction of the data exchange can be freely selected.
  The reason for this procedure is that Ethernet has to know the network of each Ethernet junction in each PLC which configures itself automatically so that communication in the network is possible.
- The communication modules must be configured by switches 2/1 and 2/2.
  Switch 2/1 describes the module number, which corresponds to the Ethernet segment connected.
  By switch 2/2, the single or redundant wiring of the communication module is set.
- The user program is provided with a diagnosis for safety-related transmission according to HIPRO-S.
- For the verification of the HIPRO-S configuration, the PES master program should be compiled. Should errors occur, they can be corrected.

Determining the IP address

The IP address is calculated as follows:
the last two numbers of resource *2 + 1 for module 1 (switch 2/1 = ON)
the last two numbers of resource *2 + 2 for module 2 (switch 2/1 = OFF)

Example:
Resource name MT200_33 and module 2 (switch 2/1 = OFF)
IP address: 33*2 + 2 = 68; IP = 192.168.0.**68**

Serial Communication

Name Definition Table

To give an overview of and explain the terms used in the various standards.

	ELOP II-NT (variables, data types)	Communication module	Data processing basis
Digital	Bool	Bool	1 Bit
Analog	Word (SINT USINT INT UINT)	Word	2 Byte

Table 3: Name definitions

In ELOP II-NT, Word variables stand for all types of data which can be configured as 16 bit variables in the BUSCOM serial communication.

Data Imaging in the Communication Module

To transmit data in the Fieldbus format, the data of the central module of the PLC are imaged into the communication module.

In ELOP II-NT, the data to be transmitted are configured as BUSCOM variables in the context menu "HW Allocation".
A distinction is made between export and import variables.

The internal memory of the communication module contains two data pools into which the BUSCOM variables are copied.
Data pool 1 of the communication module reflects the export variables and data pool 2 reflects the import variables.
Within one data pool the individual variable is described by its identity number.

Within one array of the central unit, the Boolean data and the Word data are stored separately, but they may be stored under the same BUSCOM address (Table 4).

Arrays	Bool (BUSCOM addresses)	Word (BUSCOM addresses)
Import array 0 (IA-0000)	0000 to 2047	0000 to 2047
Import array 1 (IA-4096)	4096 to 8191	4096 to 8191
Export array 0 (EA-0000)	0000 to 2047	0000 to 2047
Export array 1 (EA-4096)	4096 to 8191	4096 to 8191

Table 4: BUSCOM variable arrays in the central unit

The **Word** variables from BUSCOM address 0 on begin with the identity number 0 (Figure 4), then they proceed in ascending order up to the Word variable with the highest address in array 0. The Word variables from BUSCOM address 4096 (array 1) on begin with identity number of the highest Word variable following (array 0) and then proceed in ascending order up to the Word variable with the highest address.

The **Bool** variables having basis address 0 begin with the identity number following the identity number of the highest Word variable and then proceed in ascending order up to the Bool variable with the highest address in the array 0 of the central unit (Figure 4). The Bool variables from BUSCOM address 4096 (array 1) on begin with the identity number of the highest Bool variable in array 0 following and then proceed in ascending order up to the Bool variable with the highest address.
If only Bool variables exist, they begin with identity number 0 corresponding to the Word variables (Figure 5).

This scheme of conversion of BUSCOM variables to identity numbers is used for import and export variables in the same way.

The sequence of the BUSCOM variables is determined by ELOP II-NT and can be programmed by the user with setting the base address and relative address.

The BUSCOM addresses of the central unit is calculated as follows:

Base address + Relative address = BUSCOM address

The BUSCOM address must be in the same array as the belonging base address.

The blanks in the BUSCOM addresses of a data type of one array remain with the data type also in the data pool of the communication module.

Examples of Address Imaging (Export Array - Data Pool 1)

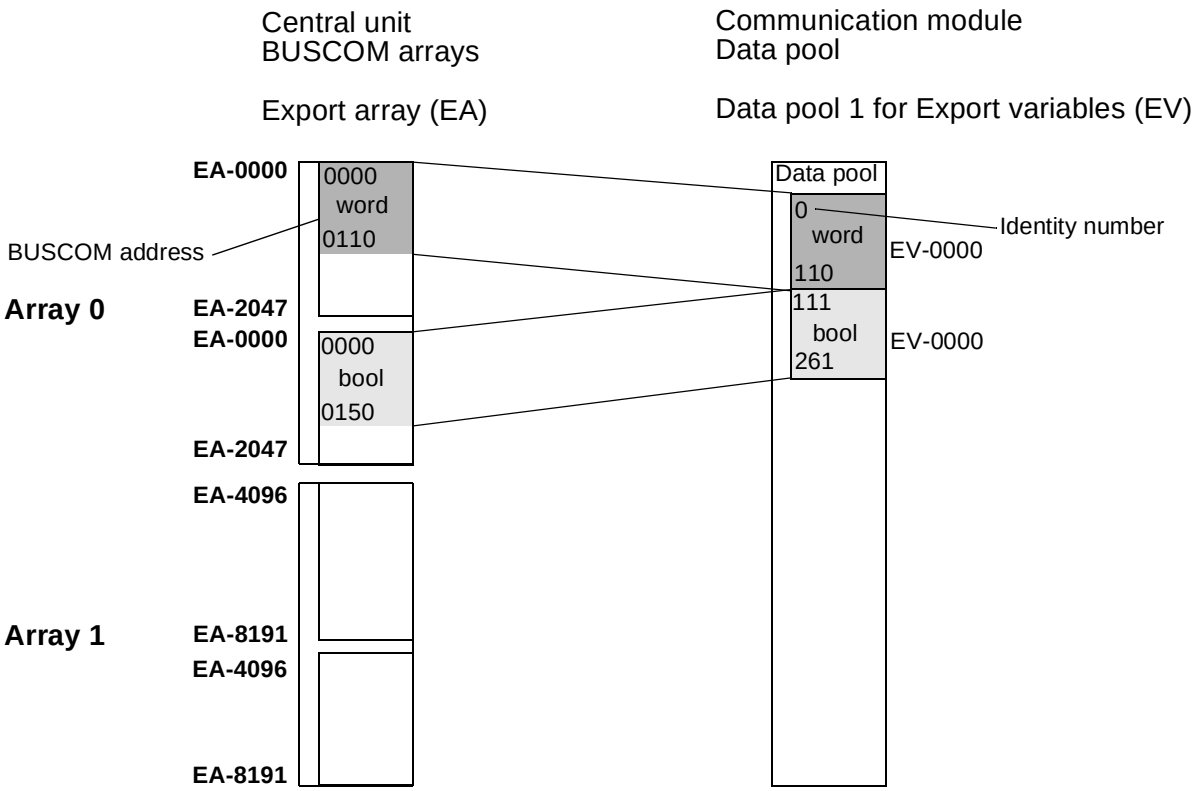


Figure 4: Example of address imaging for Word und Bool export variables from the array 0 (EA-0000)

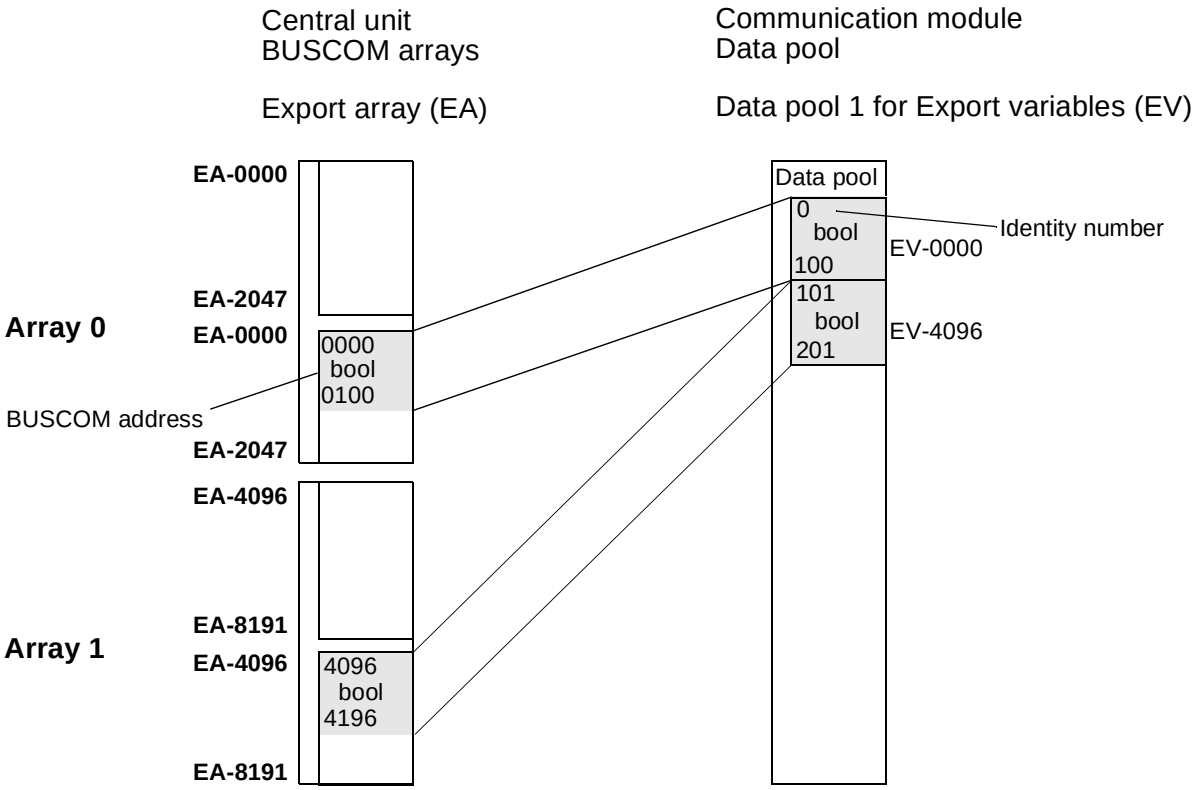


Figure 5: Example of address imaging for Bool export variables from both arrays (EA-0000 and EA-4096)

The Bool variables from BUSCOM address 0 on (array 0) begin at identity number 0 in the data pool. The Bool variables from BUSCOM address 4096 (array 1) on begin with the identity number of the highest Bool variable in array 0 following and then proceed in ascending order up to the Bool variable with the highest address.

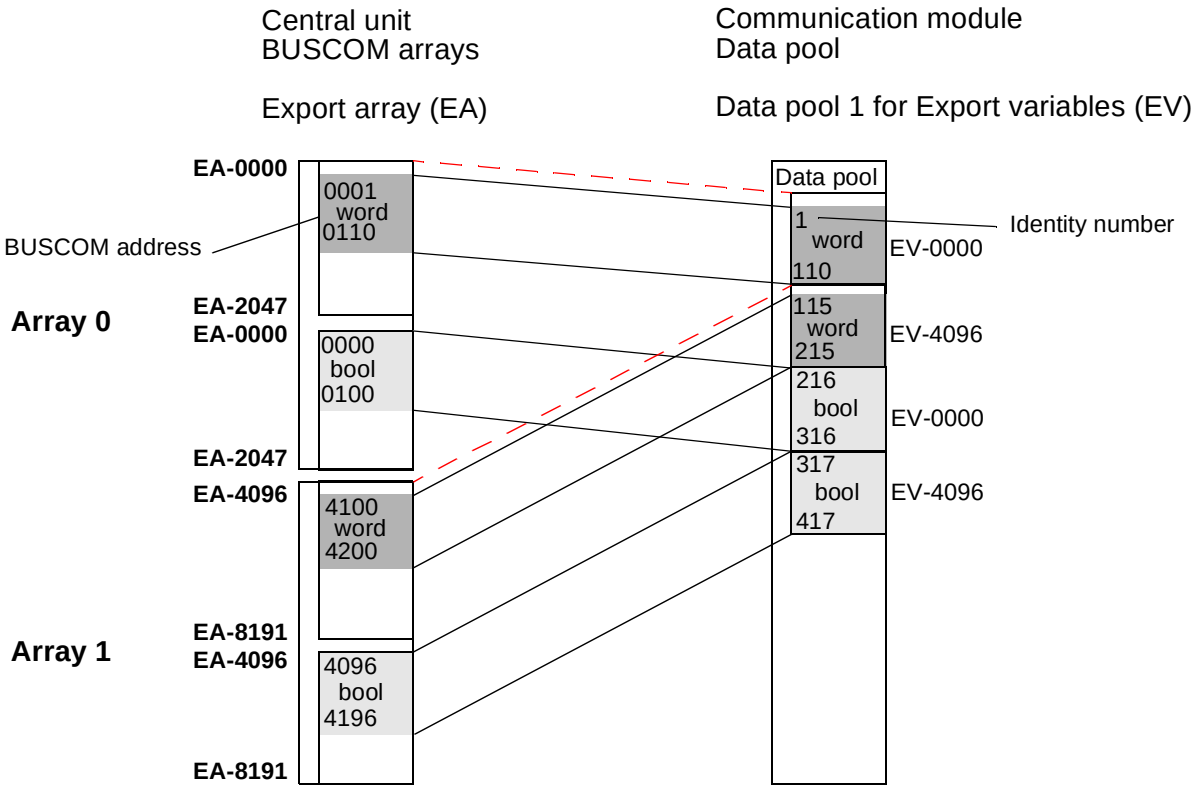
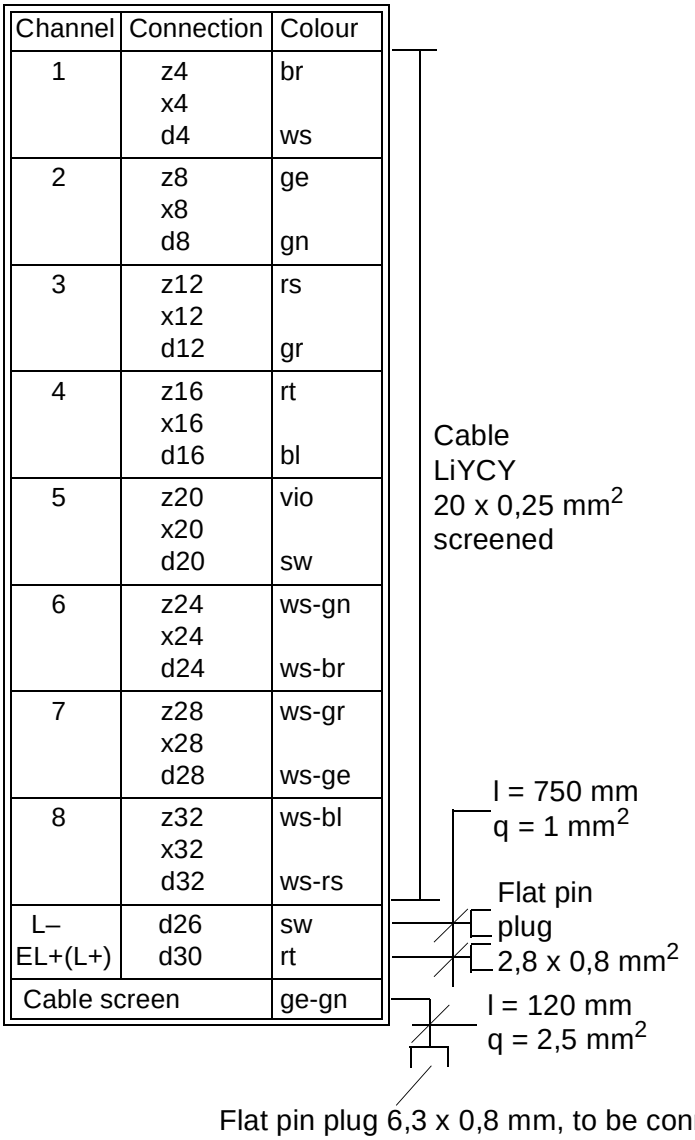


Figure 6: Example of address imaging for Word and Boolean export variables from both arrays

Beginning variables not at the top of an array will be complemented the part in the data pool of the communication module with dummies.

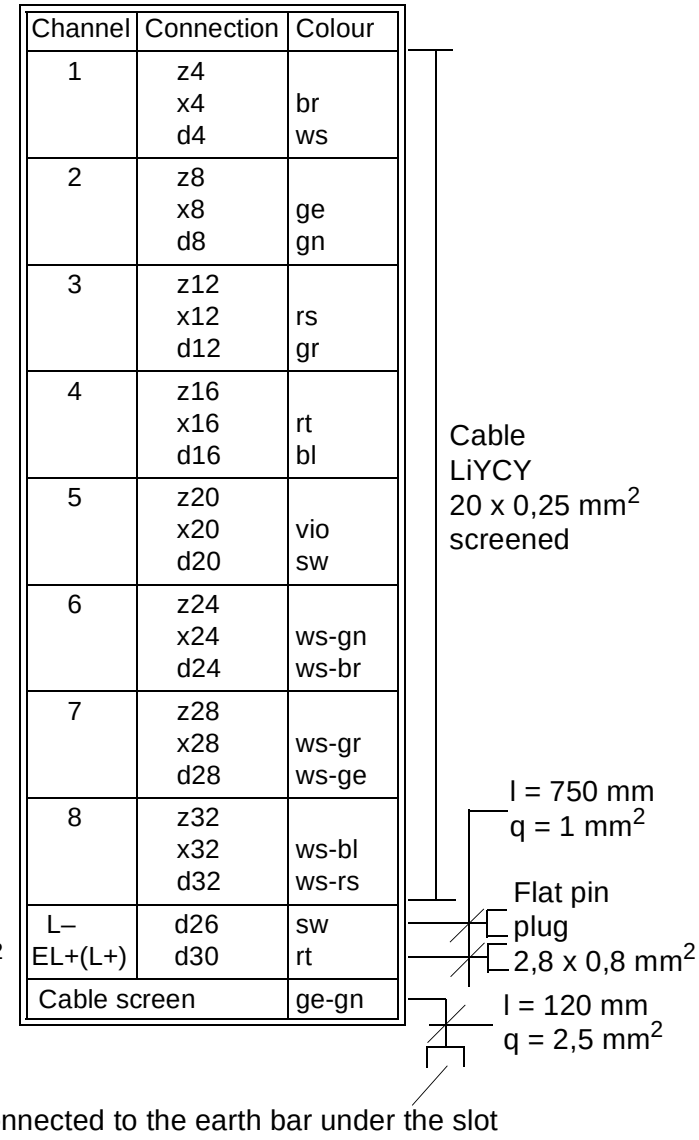
Address imaging of import variables in data pool 2 of the communication module has the same corresponding structure.

Channel	Connection	Colour
1	z4 x4 d4	br ws
2	z8 x8 d8	ge gn
3	z12 x12 d12	rs gr
4	z16 x16 d16	rt bl
5	z20 x20 d20	vio sw
6	z24 x24 d24	ws-gn ws-br
7	z28 x28 d28	ws-gr ws-ge
8	z32 x32 d32	ws-bl ws-rs
L– EL+(L+)	d26 d30	sw rt
Cable screen		ge-gn



Lead marking cable plugto connect current/ voltage Z 7127 / 6217 / C.. / I (U5V)

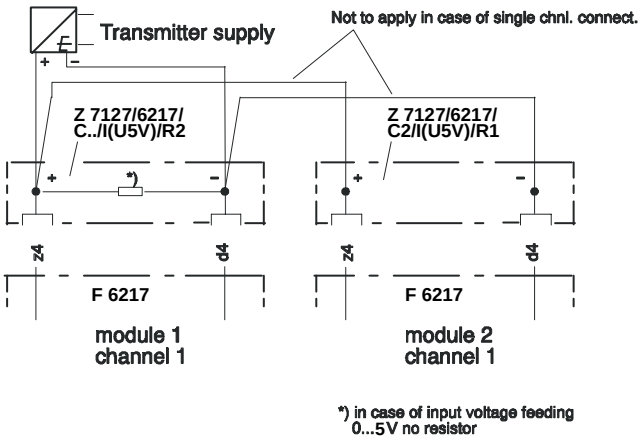
Channel	Connection	Colour
1	z4 x4 d4	 br ws
2	z8 x8 d8	 ge gn
3	z12 x12 d12	 rs gr
4	z16 x16 d16	 rt bl
5	z20 x20 d20	 vio sw
6	z24 x24 d24	 ws-gn ws-br
7	z28 x28 d28	 ws-gr ws-ge
8	z32 x32 d32	 ws-bl ws-rs
L– EL+(L+)	d26 d30	sw rt
Cable screen		ge-gn



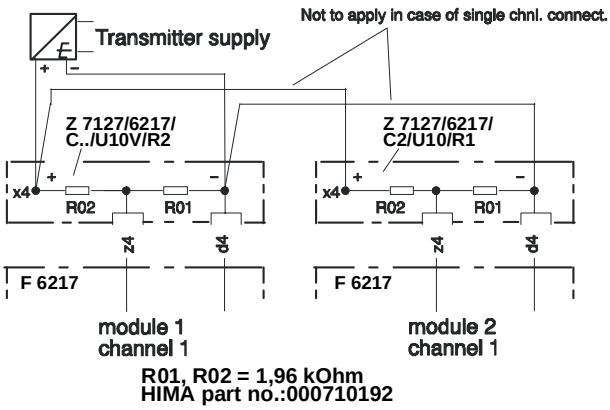
Lead marking cable plug to connect voltage via potentiometer and smart transmitters
Z 7127 / 6217 / C.. / U10V

The module contains a redundant, safety related processor system. Because of this, all the tests are executed directly on the module. The main test routines are:

- Linearity of the AD converters
- Cross talking between the 8 input channels
- Function of the input filters
- Function of the IO bus communication
- Selftests of the microcontrollers
- Tests of the memories

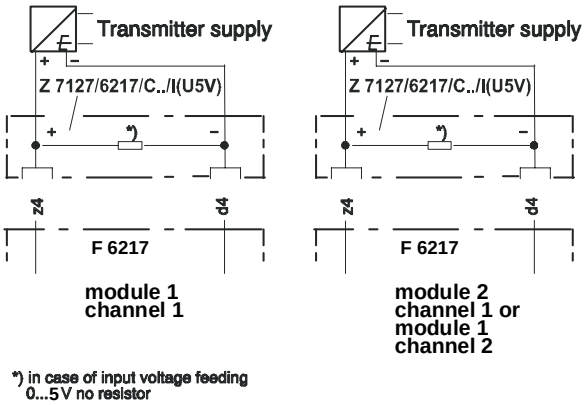


Redundant connection of current or voltage



Note : Regard to the internal resistance of the power source of the transmitter

Redundant connection via potentiometer



Current or voltage connection of redundant transmitters (evaluation in the user program)

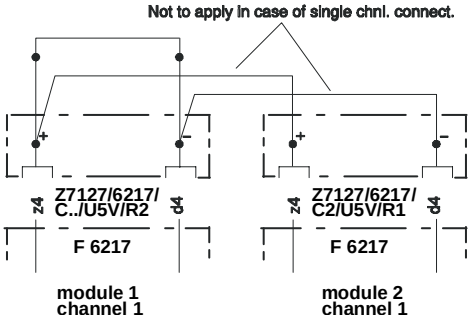
Occupation of not used inputs

Not used voltage inputs 0 ... 5 V have to be terminated with jumpers. Not used current inputs are terminated with the shunt, not used voltage inputs with the potentiometer in the cable connector.

Not used inputs, redundant connection

Example is for channel 1.

Installation of jumpers outside the cable connectors: On terminals.



Voltage input 0 ... 5 V

Notes to the safety related operation and use

Screened cables have to be used for the field input circuits, twisted leads are recommended.

If it is sure that the environment of the transmitter up to the module is free from interferences and the distance is relatively short (e. g. inside a cabinet) then the cabling can be performed without screened cables or twisted leads. However, the immunity from interference to the analog inputs can only be achieved by using screened cables.

Planning hints in ELOP II

For each input channel of the module an analog input value exists and a appertaining channel fault bit. With activated channel fault bit a safety-related reaction has to be programmed in ELOP II related to the corresponding analog input.

Recommendations for the use of the module according to IEC 61508, SIL 3

– Leads for power supply shall be locally separated from the input and output circuits.
– Application of a suitable earthing must be regarded.
– Measures against rising of the temperature are to be taken outside of the module, e. g. fans in the cabinet.
– Recording events in a logbook for operation and maintenance.

A maintenance of the module is not required. The failed module must be replaced.