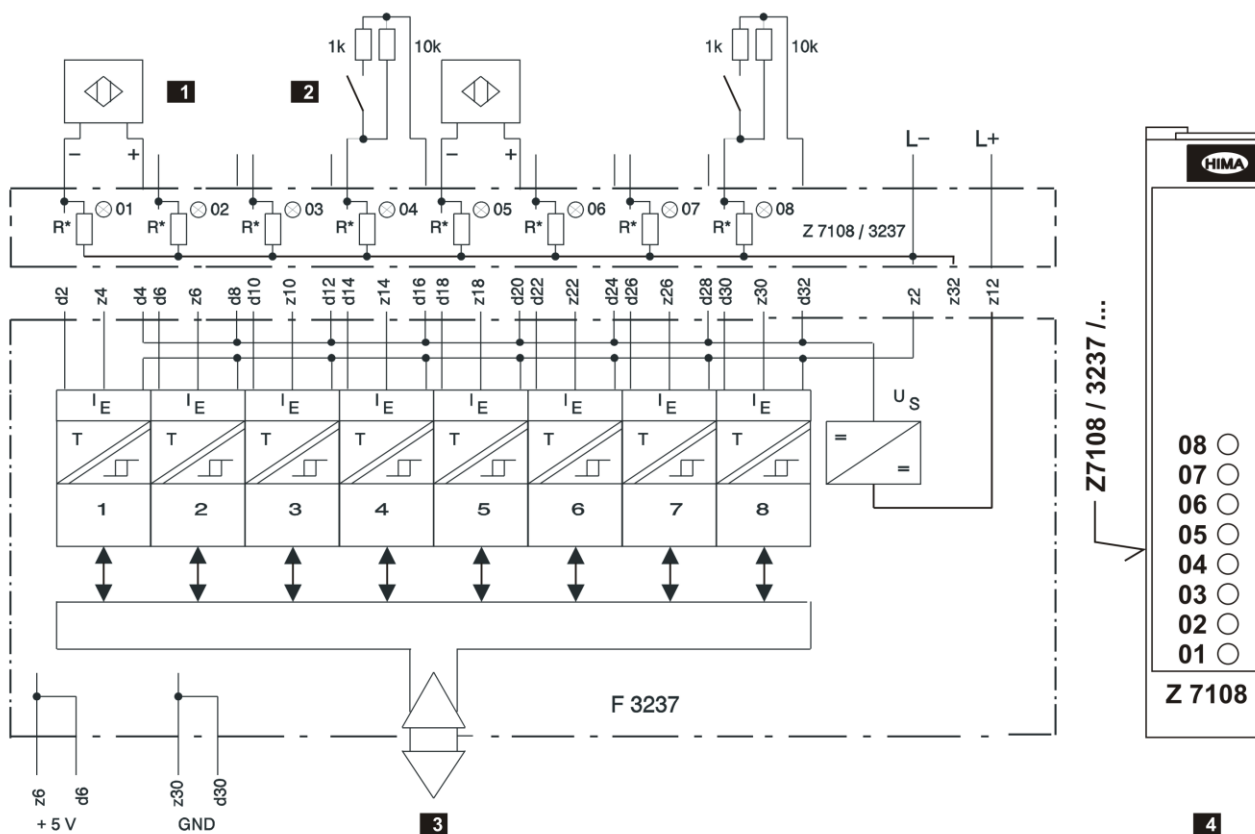




F 3237: Input Module

Safety-related, TÜV-tested in accordance with IEC 61508 for applications up to SIL 3

- 8 channels for connecting to safety proximity switches, proximity switches in accordance with EN 60947-5-6 (NAMUR) or wired mechanical contacts.
- Short-circuits and open-circuits monitoring.
- For HIQuad X (SILworX) and HIQuad (ELOP II, **HB-RTE-3** function block required).



- | | |
|-----------------------------------|---------------------------------|
| 1 Proximity switch | 3 I/O bus |
| 2 Wired mechanical contact | 4 Cable plug, front view |

Figure 1: Module Block Diagram and Cable Plug Front View

The module is completely and automatically tested for safety-related errors during operation.
The main tests are:

- Module functionality.
- Switch-on and switch-off ability of the inputs.
- Crosstalk of the inputs (walking zero: The channels are set to 0 successively and only 1 channel may have this value).
- Check of the filter capacitors' capacity.

The cable plug LEDs are not tested.

Specifications

Switching time	Approx. 10 ms
Switching thresholds I_E :	
0-signal	$0.35 \leq I_E \leq 1.2 \text{ mA}$
1-signal	$2.1 \leq I_E \leq 6.0 \text{ mA}$
Open-circuit	$\leq 0.28 \text{ mA}$
Short-circuit	$\geq 6.5 \text{ mA}$
Line resistance	$\leq 50 \Omega$ (in accordance with EN 60947-5-6)
Cable length	$\leq 1000 \text{ m}$ (cross-section = 0.5 mm^2)
Supply voltage U_s	Approx. 8.2 V, short-circuit-proof per channel (25Ω , PTC resistor)
Shunt R^* (R17...R24)	681Ω , 1 %, 1 W Part no.: 01 0553681
Shunt R^{**} (see Figure 3) (R1...R8)	390Ω , 1 %, 1 W Part no.: 01 0553391
Space requirement	4 HP
Current consumption	90 mA at 5 VDC (via backplane) 170 mA at 24 VDC (via cable plug)

Wiring

Refer to the following table for the wire color coding:

Channel	Pin	Color	Connection
1	d2	WH	Cable: LiYY 16 x 0.5 mm ² or 16 x LIY 0.5 mm ² , l = 2 m
	d4 (x4) ¹⁾	BN	
2	d6	GN	
	d8 (x8) ¹⁾	YE	
3	d10	GY	
	d12 (x12) ¹⁾	PK	
4	d14	BU	
	d16 (x16) ¹⁾	RD	
5	d18	BK	
	d20 (x20) ¹⁾	VT	
6	d22	WHBN	
	d24 (x24) ¹⁾	WHGN	
7	d26	WHYE	
	d28 (x28) ¹⁾	WHGY	
8	d30	WHPK	
	d32 (x32) ¹⁾	WHBU	
L–	z2	BK	Female connector 2.8 x 0.8 mm ² q = 1 mm ² , l = 750 mm
L+	z12	RD	

¹⁾ Connectors (x4) to (x32) are only used with special cable plugs.

Table 1: Wire Color Coding of the Cable Plug Z 7108/3237/...

Redundant Connection

Figure 2 shows the connection of a safety proximity switch or a wired mechanical contact.

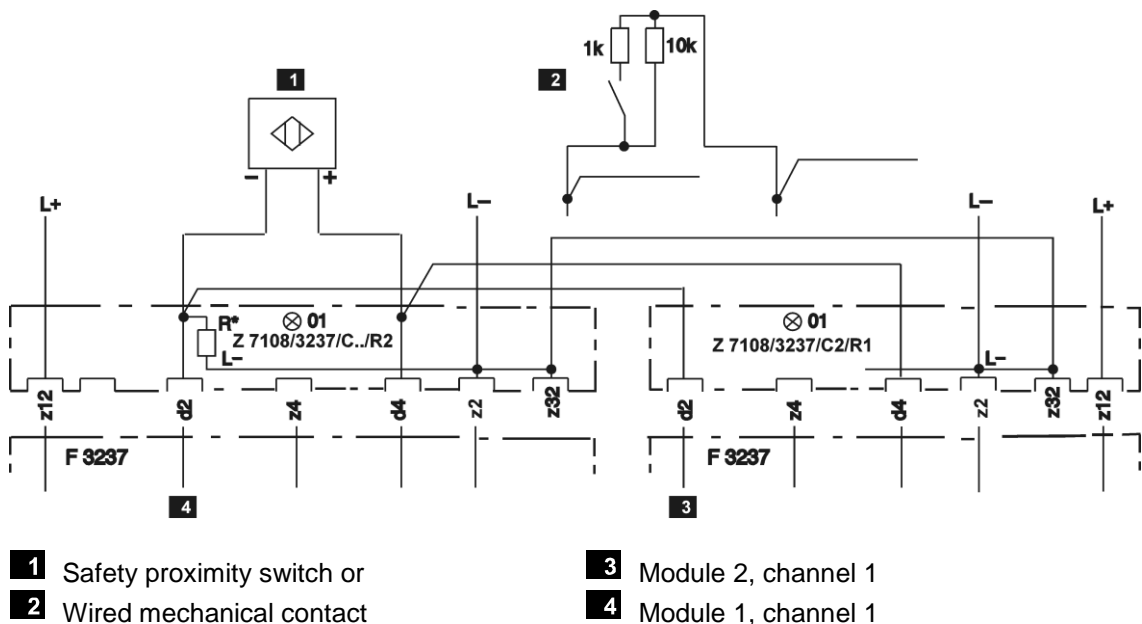
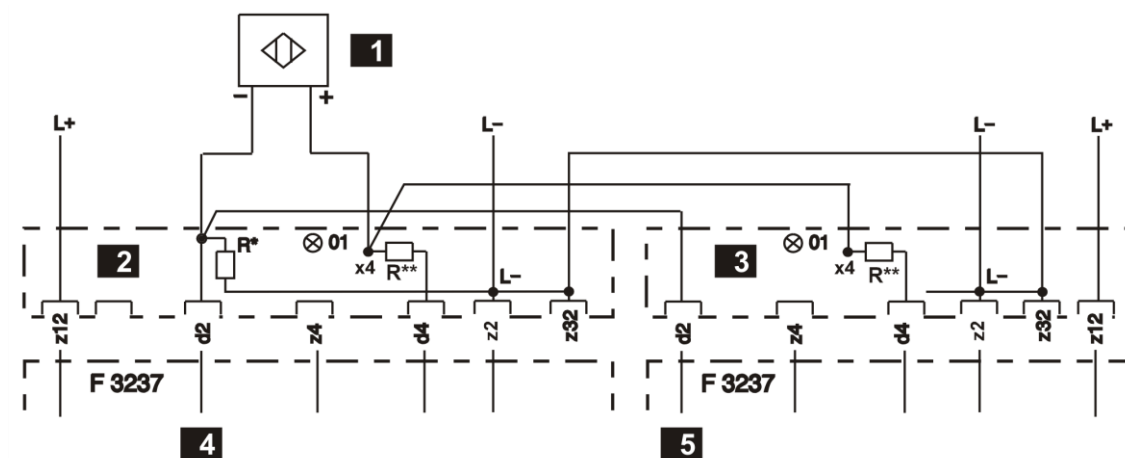


Figure 2: Redundant Connection for a Safety Proximity Switch or Wired Mechanical Contact

Redundant cable plug Z 7108 / 3237 / Cx / Rx is required for the redundant connection of safety proximity switches or wired contacts.

Mono and Redundant Connection of a Proximity Switch

Figure 3 shows the redundant connection of a proximity switch in accordance with NAMUR EN 60947-5-6.



- | | |
|--|------------------------------|
| 1 Proximity switch in accordance with NAMUR | 4 Module 1, channel 1 |
| 2 Special cable plug (R2) | 5 Module 2, channel 1 |
| 3 Special cable plug (R1) | |

Figure 3: Redundant Connection for a Proximity Switch in Accordance with NAMUR EN 60947-5-6

Mono connection: For the mono connection of proximity switches in accordance with NAMUR EN 60947-5-6, the special cable plug, Z 7108/3237/Cx/S102, must be used.

Redundant connection: For the redundant connection of proximity switches in accordance with NAMUR EN 60947-5-6, the redundant special cable plug, Z 7108/3237/Cx/Rx/S209, must be used.

The connections between plug R2 and plug R1 are wired with single cores, see Figure 3.

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If the special cable plug is used for proximity switches in accordance with NAMUR EN 60947-5-6, the reduced SIL specifications potentially applying to the proximity switch also apply to the safety loop (module and proximity switch).

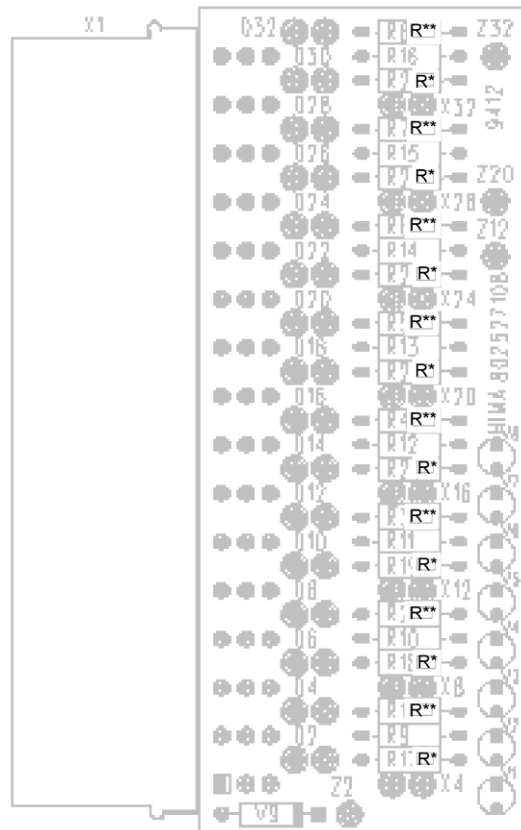


Figure 4: Cable Plug Z 7108/3237/Cx/S Special Design for NAMUR

Termination of Unused Inputs

Unused module inputs must be terminated with a 10 k Ω resistor. This avoids error messages related to short-circuits and open-circuits on unused inputs. The following figure shows an example for termination of channel 1 (1), terminals (d2, d4), and channel 5 (2), terminals (d18, d20).

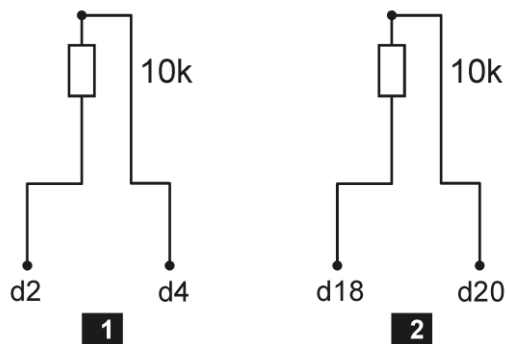


Figure 5: Terminating Resistors on Unused Inputs

1 Configuration in SILworX

The module is configured in the Hardware Editor of the SILworX programming tool.

Observe the following points when configuring the module:

- In addition to the measuring values, the system parameters can be evaluated in the user program to diagnose the module or channels. For more information on the statuses and parameters, refer to the tables starting with Chapter 1.1.
- If redundancy groups are created, their configuration is defined in the associated tabs. The redundancy group tabs differ from those of the individual modules, see the following tables.

To evaluate the system parameters in the user program, they must be assigned to global variables. The necessary steps are to be performed in the detail view of the Hardware Editor.

The following tables present the system parameters for the module in the same order as in the SILworX Hardware Editor.

1.1 The Module Tab

The **Module** tab contains the following system parameters:

System parameters	Data type	S ¹⁾	R/W	Description
Name	---	---	W	Module name.
Noise Blanking	BOOL	Y	W	Noise blanking performed by the system module allowed (activated/deactivated). After a transient fault, the system delays the fault response until the safety time. The user program retains its last valid process value. Default setting: Activated. Refer to the system manual (HI 803 211 E) for more details on noise blanking.
The following statuses and parameters can be assigned global variables and used in the user program.				
Explicitly Triggered Restart Required	BOOL	Y	R	TRUE The module must be explicitly required to restart.
				FALSE <ul style="list-style-type: none"> ▪ Restart is necessary and the module performs it automatically. ▪ Module in the STOP state. ▪ Connection loss.
Background Test Noise Blanking Active	BOOL	Y	R	TRUE Error detected by a background test.
				FALSE <ul style="list-style-type: none"> ▪ No errors detected by the background tests. ▪ Module in the STOP state. ▪ Connection loss.
Initialization Active	BOOL	Y	R	TRUE The module is performing initial tests.
				FALSE <ul style="list-style-type: none"> ▪ The initial tests are complete. ▪ Module in the STOP state. ▪ Connection loss.
Module OK	BOOL	Y	R	TRUE No internal fault detected by the system.
				FALSE <ul style="list-style-type: none"> ▪ Internal fault detected by the system. ▪ Module in the STOP state. ▪ Connection loss.

System parameters	Data type	S ¹⁾	R/W	Description	
Module Process Value OK	BOOL	Y	R	TRUE	No channel fault detected by the system.
				FALSE	<ul style="list-style-type: none">At least one channel fault detected by the system.Module in the STOP state.Connection loss.
Restart on Error Suppressed	BOOL	Y	W	Automatic restart after errors can be suppressed by the user. To cause the automatic restart to be performed after an error, the system parameter must have been set to FALSE for longer than the F-CPU safety time (does not apply to field faults).	
				TRUE	No automatic restart after a module or channel fault.
				FALSE	Automatic restart after a module or channel fault.
				Default setting: FALSE	

¹⁾ The operating system handles the system parameter in a safety-related manner, yes (Y) or no (N).

Table 2: The **Module** Tab in the Hardware Editor

1.2 The F 3237_1: Channels Tab

The **F 3237_1: Channels** tab contains the following system parameters for each channel:

System parameters	Data type	S ¹⁾	R/W	Description	
Channel no.	---	---	R	Channel number, preset and cannot be changed.	
Channel Value [BOOL] ->	BOOL	Y	R	Binary value in accordance with the switching level LOW (dig) and HIGH (dig).	
				TRUE	Channel energized.
				FALSE	Channel de-energized.
-> Process Value OK [BOOL]	BOOL	Y	R	TRUE	Fault-free channel. No internal fault nor fault on the field side detected. Module initialization successfully completed.
				FALSE	<ul style="list-style-type: none">Faulty channel. Internal fault or fault on the field side detected.The initial test has not been completely performed.Module in the STOP state.Connection loss.
-> Channel OK [BOOL]	BOOL	Y	R	TRUE	Fault-free channel. The channel value is valid.
				FALSE	<ul style="list-style-type: none">Faulty channel.Module in the STOP state.Connection loss.
SC/OC Active	BOOL	Y	W	Short-circuit and open-circuit monitoring activated or deactivated. Default setting: Activated.	
-> OC [BOOL]	BOOL	Y	R	TRUE	Open-circuit.
				FALSE	<ul style="list-style-type: none">No open-circuit.Module fault.Module in the STOP state.Connection loss.
-> SC [BOOL]	BOOL	Y	R	TRUE	Short-circuit.
				FALSE	<ul style="list-style-type: none">No short-circuit.Module fault.Module in the STOP state.Connection loss.
Redund.	BOOL	Y	R	Requirement: A redundant module must exist.	
				TRUE	The channel redundancy for this channel is active.
				FALSE	The channel redundancy for this channel is not active.
Default setting: TRUE					

¹⁾ The operating system handles the system parameter in a safety-related manner, yes (Y) or no (N).

Table 3: Tab **F 3237_1: Channels** in the Hardware Editor

Global variables can be assigned to the system parameters with -> and used in the user program. The values of the system parameters without -> must be directly defined.

1.3 Description of Diagnostic Entry

The module is completely and automatically tested for safety-related errors during operation. The diagnostic entry is not 0 if one or more errors were detected in the module.

Defective modules must be replaced with a faultless module of the same type or with an approved replacement model.

Bit	Coding ¹⁾	Description
0	0x00000001	Hardware module fault.
4	0x00000010	Module defective (the error code is for internal purposes only).
...	...	
31	0x80000000	
¹⁾ The status may consist of several codings, e.g.: Module status = 0x80000001 (0x00000001 + 0x80000000).		

Table 4: Diagnostic Entry Coding

1.3.1 Channel Status

The channel status byte in the diagnostic entry shows the following statuses:

Bit	Coding ¹⁾	Description
0	0x0001	Hardware channel fault. F-IOP indicator: Continuous light of the channel LED.
1	0x0002	Short-circuit (SC). F-IOP indicator: Blinking1 of the channel LED.
2	0x0004	Open-circuit (OC). F-IOP indicator: Blinking1 of the channel LED.
3	0x0008	Module defective (the error code is for internal purposes only). F-IOP indicator: Continuous light of the channel LED.
...	...	
7	0x0080	
¹⁾ The status may consist of several codings, e.g.: Channel status = 0x0081 (0x0001 + 0x0080).		

Table 5: Channel Status Byte for the F 3237

