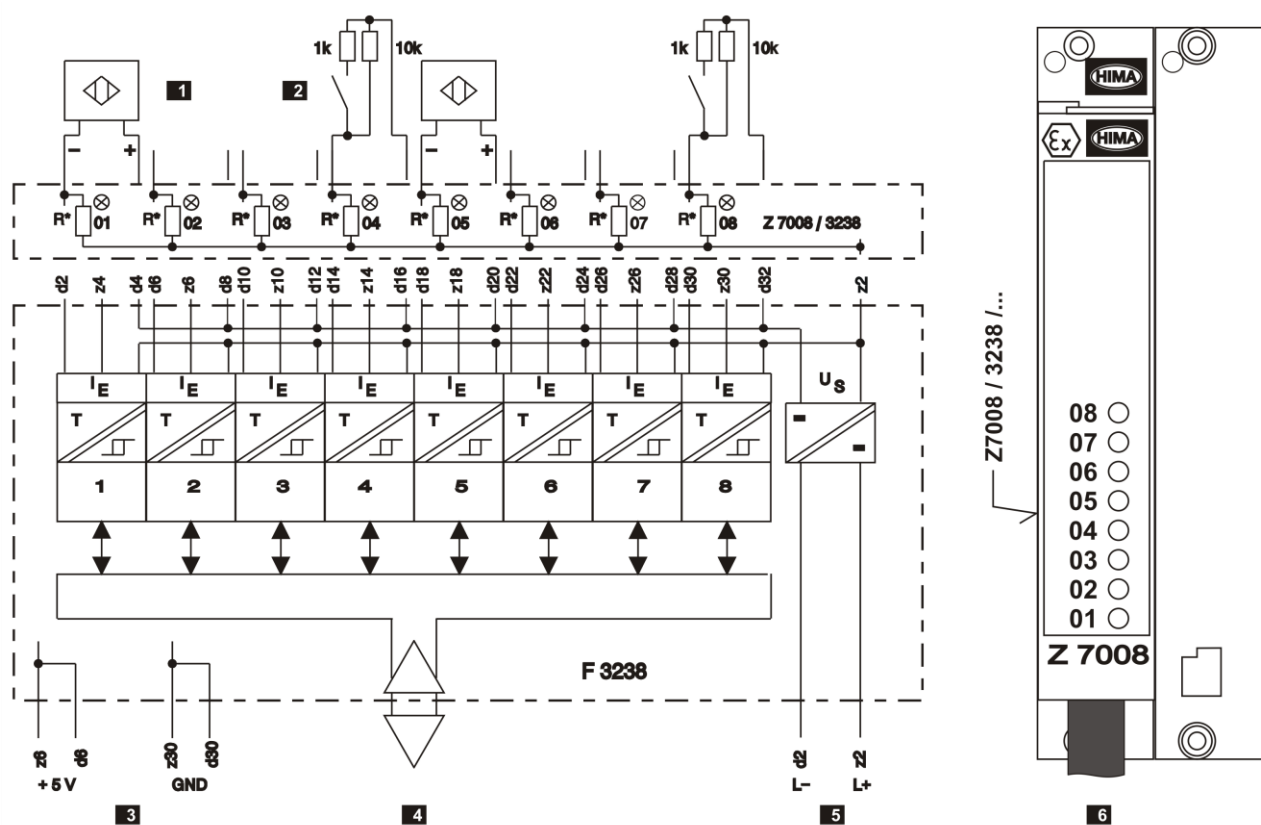




F 3238: Input Module (Ex)i

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

- 8 channels for intrinsically safe circuits (Ex)i, with electrically protective separation and power source for proximity switches
- For connecting to safety proximity switches (P + F), proximity switches in accordance with EN 60947-5-6 (NAMUR) or wired mechanical contacts.
- Short-circuits and open-circuits monitoring.
- EU Type Test Certificate: TÜV 18 ATEX 8169.
- For HIQuad X (SILworX) and HIQuad (ELOP II, **HB-RTE-3** function block required).
- Space requirement for two slots.



- | | |
|------------------------------------|------------------------------------|
| 1 Proximity switch | 4 I/O bus |
| 2 Wired mechanical contact | 5 Connectors for right slot |
| 3 Connections for left slot | 6 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

Ex category	II (1) GD [Ex ia Ga] IIC, [Ex ia Da] IIIC
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
Shunt R^*	681Ω
(R1...R8)	Part no.: 00 0751681
Shunt R^{**} (see Figure 4)	390Ω
(R9...R16)	Part no.: 00 0552391
Space requirement	8 HP
Current consumption	150 mA at 5 VDC (via backplane) 100 mA at 24 VDC (via backplane)

Wiring

Refer to Table 1 for the wire color coding of the cable plugs specified below:

- Cable plug Z 7008/3238/Cx with gray cable
- Cable plug Z 7008/3238/Ex/Cx with blue cable for intrinsically safe circuits (Ex)i

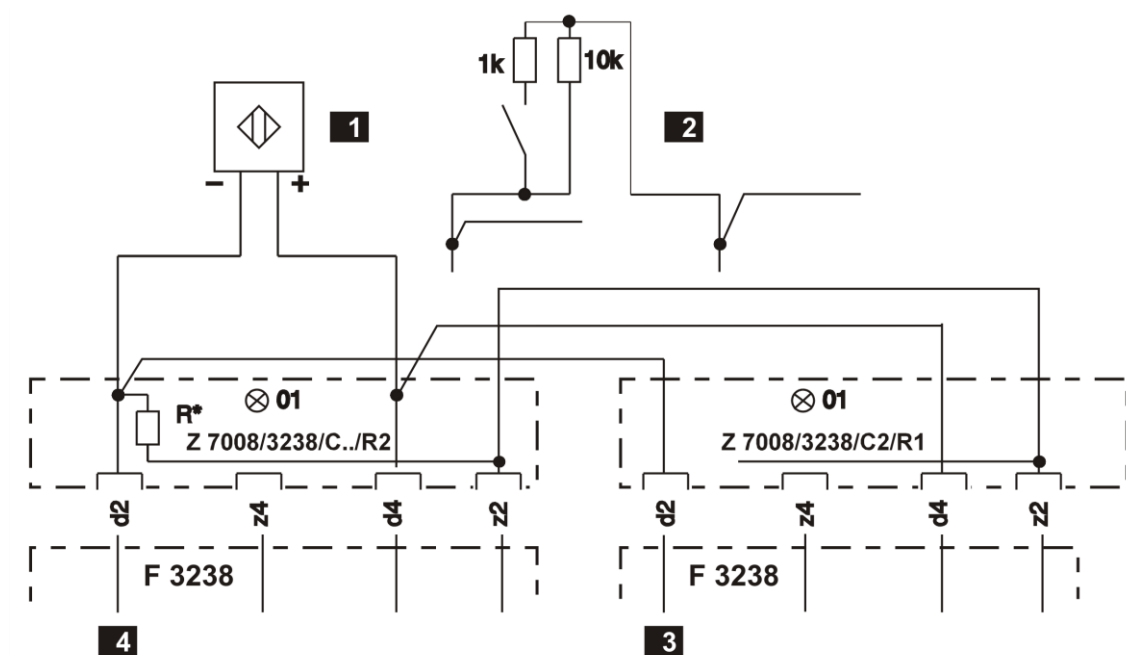
channel	Pin	Color	Connection
1	d2	WH	Cable: LiYY 16 x 0.5 mm ²
	d4 (x4) ¹⁾	BN	
2	d6	GN	
	d8 (x8) ¹⁾	YE	
3	d10	GY	
	d12 (x12) ¹⁾	PK	
4	d14	BU	
	d16 (x16) ¹⁾	RD	
5	d18	BK	
	d20 (x20) ¹⁾	VT	
6	d22	WHBN	
	d24 (x24) ¹⁾	WHGN	
7	d26	WHYE	
	d28 (x28) ¹⁾	WHGY	
8	d30	WHPK	
	d32 (x32) ¹⁾	WHBU	

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

Table 1: Wire Color Coding of the Cable Plug Z 7008/3238/...

Redundant Connection

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



- 1** Safety proximity switch or
- 2** Wired mechanical contact

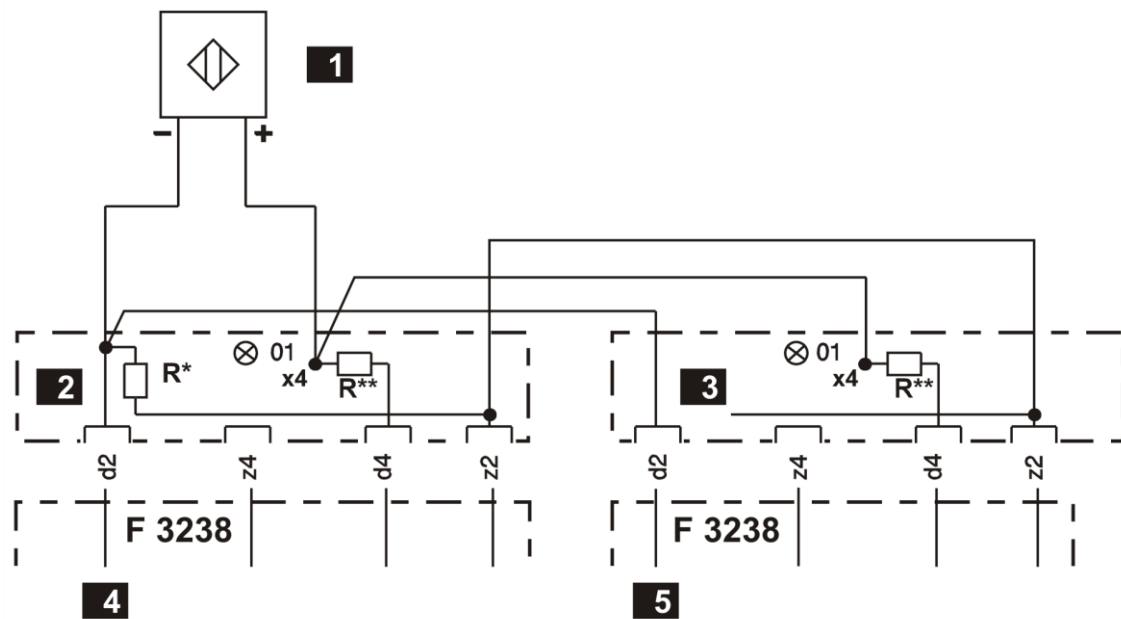
- 3** Module 2, channel 1
- 4** Module 1, channel 1

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

Redundant cable plug Z 7008/3238/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

2 Special cable plug (R2)

3 Special cable plug (R1)

4 Module 1, channel 1

5 Module 1, channel 2

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 7008/3238/Ex/Cx/S101, 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 7008/3238/Ex/Cx/Rx/S301, 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).

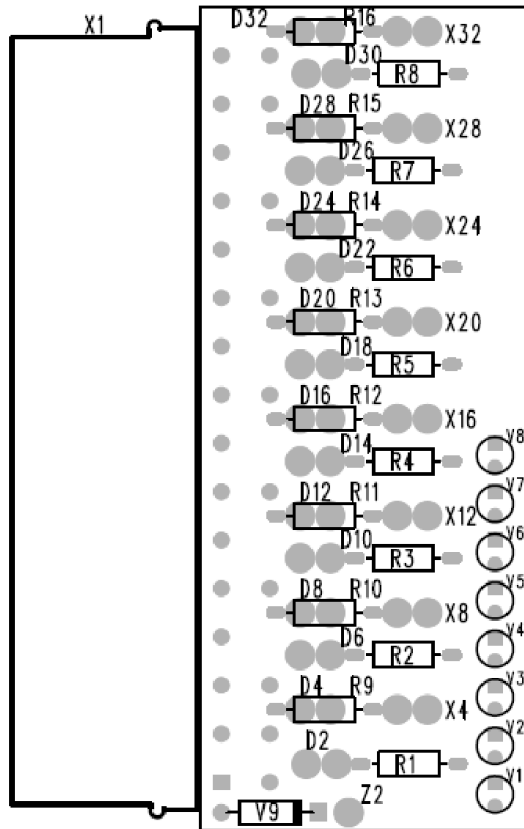


Figure 4: Cable Plug Z 7008/3238/Ex/Cx/S Special Design for NAMUR

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. Figure 5 shows an example for termination of channel 1 (**1**), terminals (d2, d4), and channel 5 (**2**), terminals (d18, d20).

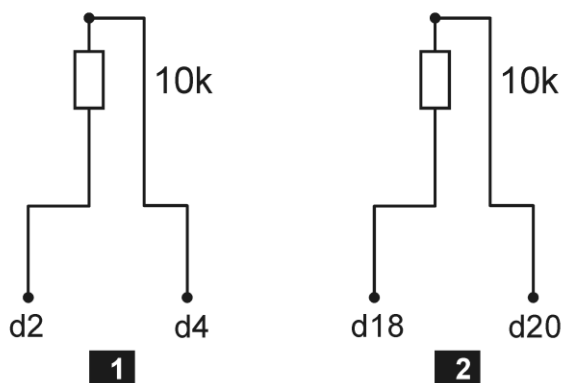


Figure 5: Terminating Resistors on Unused Inputs

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.
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).

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 3238_1: Channels Tab

The **F 3238_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 3238_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 status:

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 3238

2 Operating Instructions

This chapter describes important aspects when using the module in the HIQuad X and HIQuad system.

2.1 Use

The module evaluates proximity switches (in accordance with NAMUR) or wired mechanical contacts in intrinsically safe circuits (Ex)i.

The proximity switches or wired mechanical contacts may be installed in areas with explosive atmosphere in zone 0, 1 or 2.

The connection of a mechanical contact requires a parallel resistor (10 k Ω) directly at the mechanical contact to avoid an open-circuit signal when the contact is open.

WARNING



The inputs must not be supplied with external voltage.

The module may no longer be used in (Ex)i applications as associated equipment if it has been previously used in a general electrical plant.

All applications other than those described in this document are not allowed!

2.2 Electrical Data Concerning Intrinsic Safety

For these specifications, refer to the Annex to the EU type test certificate TÜV 18 ATEX 8169.

2.3 General Configuration Notes

Module in SMD technology (AS03) usable with BS41q/51q V7.0-7 or higher.

If used with intrinsically safe circuits (Ex)i, adjacent F 3238 slots may be equipped with any type of module.

2.4 Configuration Notes for ELOP II

For a description of the software function block HB-RTE-3, refer to the online help of the programming tool.

2.5 Mounting

The module is mounted in a 19-inch rack. A mounting distance is not mandatory. The rack must be designed to allow dissipation of the generated power.

The module is connected to the intrinsically safe field circuits through cable plug Z 7008.

For further installation instructions, refer to the HIQuad X system manual (HI 803 211 E) or the HIQuad catalog (HI 800 263 E).

2.6 Installation

- The electronic module as associated equipment, included its connected components, must be installed to ensure achievement of degree of protection IP20 or better in accordance with EN 60529/IEC 60529.
- If the intrinsically safe circuits of two F 3238 modules are connected in parallel, a special cables designed by HIMA must be used.
- A distance of ≥ 50 mm (arcing distance) must be ensured between external, intrinsically safe and non-intrinsically safe terminals.
- A distance of ≥ 6 mm (arcing distance) must be ensured between the external terminals of adjacent, intrinsically safe circuits.
- Intrinsically safe and non-intrinsically safe lines must be separated, or the intrinsically safe lines must be additionally insulated.
- Intrinsically safe lines must be marked, e.g., using a light blue color (RAL 5015) for the sheath.
- The wiring must be mechanically protected to guarantee that the minimum distance between intrinsically safe and non-intrinsically safe connection (EN 60079-11/IEC 60079-11) is not violated due to accidental disconnection.

The wires in use must comply with the following insulation test voltages:

Intrinsically safe wires	\geq	1000 VAC
--------------------------	--------	----------

Non-intrinsically safe wires	\geq	1500 VAC
------------------------------	--------	----------

If finely stranded wires are used, the wire ends must be provided with wire end ferrules. The terminals must be suitable for fastening the cross-sections of the cables in use.

Additionally, the applicable regulations and standards must be observed. In particular, these include:

- EN 60079-14:2014 / IEC 60079-14:2013
- EN 60079-0:2012 + A11:2013 / IEC 60079-0:2011, Revised + Cor.:2012 + Cor.: 2013
- EN 60079-11:2012 / IEC 60079-11:2011 + Cor.:2012
- EN 60947-5-6:2000 / IEC 60947-5-6:1999

2.7 Start-Up

Proper installation, in particular the connections of the supply voltage and intrinsically safe circuits, must be checked by an explosion protection expert prior to starting up the module for the first time.

2.8 Maintenance

If failures occur, the defective module must be replaced with a module of the same type or with an approved replacement model.

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Only the manufacturer may repair the modules.

(1) **EU-TYPE EXAMINATION CERTIFICATE**

- (2) Equipment and Protective Systems intended for use in
Potentially Explosive Atmosphere - **Directive 2014/34/EU**
- (3) EU-Type Examination Certificate Number

TÜV 18 ATEX 8169

Issue: 00

- (4) Equipment: **HIQuad Module F 3238**
- (5) Manufacturer: **HIMA Paul Hildebrandt GmbH**
- (6) Address: **Albert-Bassermann-Str. 28
68782 Brühl, Germany**
- (7) This product and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.
- (8) The TÜV Rheinland Zertifizierungsstelle für Explosionsschutz of TÜV Rheinland Industrie Service GmbH, Notified Body No. 0035 in accordance with Article 21 of the Council Directive 2014/34/EU of 26th February 2014, certifies this product which has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmosphere, given in Annex II to the Directive.
- The examination and test results are recorded in the confidential report 557/Ex8169.00/18
- (9) Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule of this certificate, has been assessed by reference to:
- EN 60079-0: 2012+A11:2013 EN 60079-11: 2012**
- (10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.
- (11) This EU-Type Examination Certificate relates only to the design and specification for construction of the equipment or protective system. It does not cover the process for actual manufacture or supply of the equipment or protective system, for which further requirements of the directive are applicable.
- (12) The marking of the equipment shall include the following:



**II (1) GD [Ex ia Ga] IIC
[Ex ia Da] IIIC**

TÜV Rheinland Zertifizierungsstelle für Explosionsschutz

Cologne, 2018-09-03

Dipl.-Ing. Andreas Maschke

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Tel. +49 (0) 221 806-0 Fax. + 49 (0) 221 806 114

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(13) Annex

(14) **EU Type Examination Certificate**
TÜV 18 ATEX 8169

Issue: 00

(15) Description of equipment

15.1 Equipment and type:

HIQuad Module F 3238

15.2 Description / Details of Change

General product information

The module F 3238 is a 8 channel input module and is used to evaluate proximity switches (according to NAMUR) or contacts with resistor network, in intrinsically safe circuits (Ex)i. The proximity switches or contacts can be installed in hazardous areas from Zone 0 on, if certified.

Technical DataAmbient temperature: $T_a = 0^{\circ}\text{C} \dots + 60^{\circ}\text{C}$

Supply circuit UB1:

 $U_n = 24\text{VDC} (-15\%, +20\%), \text{max.} \leq 30\text{V}$ $U_m = 40\text{V}$

(connector X4, pins z2, d2)

Supply circuit UB2:

 $U_n = 5\text{VDC} (\pm 10\%), \text{max.} \leq 6\text{V}$ $U_m = 7\text{V}$

(connector X2, pins z6/d6 and z30/d30)

Intrinsically safe values for the control circuits,

type of protection [Ex ia Ga] IIC/IIB

or [Ex ia Da] IIIC/IIIB

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single circuit:	parallel circuit:
U _o : 9.9 V	U _o : 9.9 V
I _o : 15 mA	I _o : 15 mA
P _o : 38 mW	P _o : 38 mW

Maximum allowed external capacitance **or** inductance:

Ex ia / Ex ib	single circuit		parallel circuit	
	IIC	IIB/IIIC/IIIB	IIC	IIB/IIIC/IIIB
L _o	155 mH	560 mH	155 mH	560 mH
C _o	3.2 µF	22 µF	3.2 µF	22 µF

Maximum allowed external capacitance **and** inductance (mixed consideration):

Ex ia / Ex ib	single circuit		parallel circuit	
	IIC	IIB/IIIC/IIIB	IIC	IIB/IIIC/IIIB
L _o	5 mH	5 mH	5 mH	5 mH
C _o	0.78 µF	4.1 µF	0.78 µF	4.1 µF

(16) Test-Report No. 557/Ex8169.00/18(17) Special Conditions for safe use

None

(18) Basic Safety and Health Requirements

Covered by afore mentioned standard

TÜV Rheinland Zertifizierungsstelle für Explosionsschutz

Cologne, 2018-09-03



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