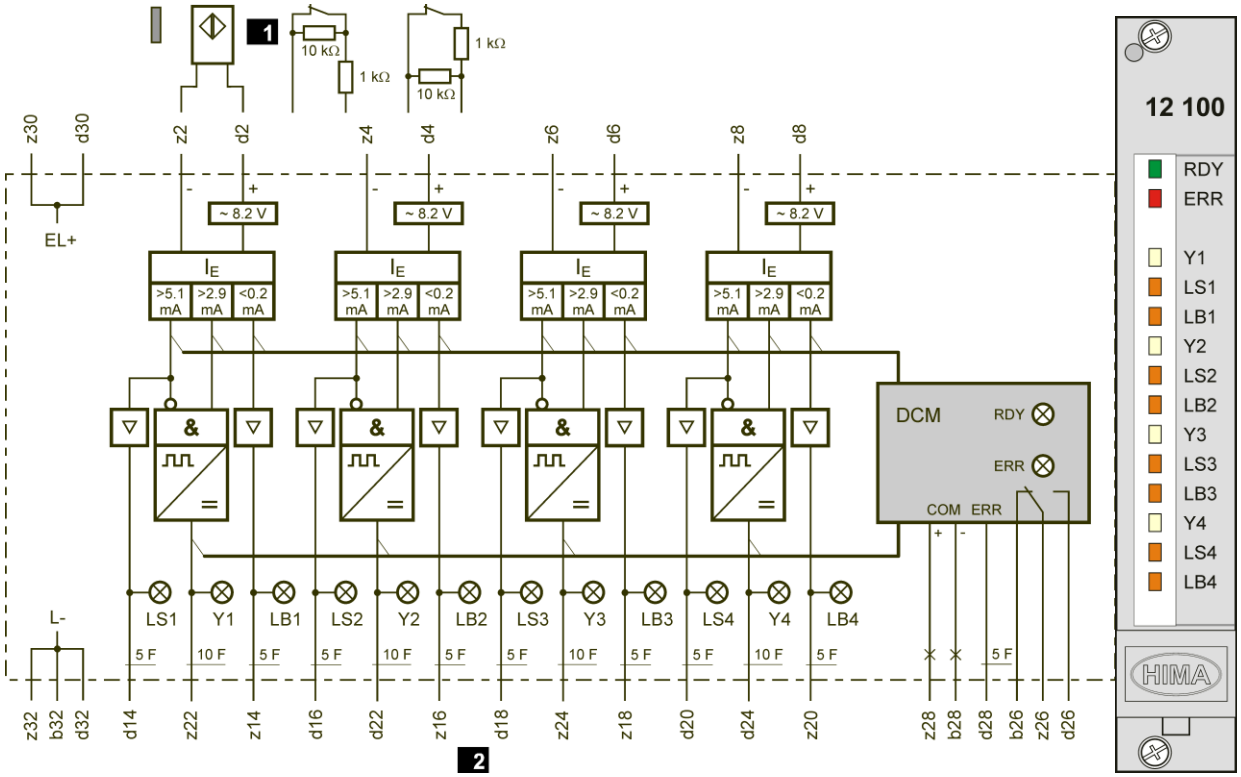
12 100: Input Module

- **Safety-related**
- 4 channels, with open-circuit and short-circuit monitoring

The module is TÜV-tested for SIL 4 in accordance with IEC 61508.



1 Proximity switch or contact makers with resistors (see inputs)

2 Outputs are short-circuit-proof

Figure 1: Block Diagram

The module evaluates the signal from a safety-tested proximity switch and reports open-circuits and short-circuits. If a mechanical contact is used instead of a proximity switch, the mechanical contact must be connected on site with the specified resistors.

The field lines of the input current circuits must be led with shielded cables; HIMA recommends using twisted pair wires. The shield must be placed on both sides.

The outputs Y1…Y4 are not safety-related. The outputs for short-circuits (SC1…SC4) and open-circuits (OC1…OC4) are not safety-related, but they can be grouped to a collective message on a signal bar.

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Inputs	Proximity switches in accordance with DIN EN 60947-5-6 (VDE 0660-212) Safety-tested, and designed for ▪ P+F proximity switches with safety function (i.e., SN), ▪ Proximity switches with no safety function (i.e., not SN), with external wiring ▪ Proximity switches with resistors 1 kΩ / 10 kΩ (0.25 W) ▪ BARTEC resistive coupling element 1 kΩ / 10 kΩ (type 17-9Z62-0002)
Switching time Y1…Y4	Approx. 3 ms
Reset time Y1…Y4	Approx. 3 ms
Operating data	24 VDC / 140 mA
Space requirement	3 RU, 4 HP

Function Table

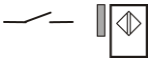
Inputs	**Outputs**		
	Y1…Y4	LS1…LS4	LB1…LB4
R_A = 23.0 kΩ…2.9 kΩ I_E = 0.35…2.1 mA 	⊗	⊗	⊗
R_A = 1.8 kΩ…0.9 kΩ I_E = 2.9…4.3 mA 	●	⊗	⊗
R_A < 600 Ω, I_E > 5.1 mA (LS)	⊗	●	⊗
R_A > 40 kΩ, I_E < 0.2 mA (LB)	⊗	⊗	●
The current values, I_E, refer to the rated 8.2 V open-circuit voltage. ⊗ LED off ● LED on			

Table 1: Function Table

All the module functions are monitored by a microcontroller.

If a malfunction occurs, the *ERR* LED is lit, output d28 is on 1-signal and relay contact z26-d26 opens.

Output z28-b28 is intended for connecting to the communication module, e.g., for transferring data to a distributed control system (DCS).

RDY (Ready) indicates the applied voltage (≥ 20 V).

Notices

Functionally and in terms of safety, the signal from a proximity switch may not be switched on two inputs.

Use of Proximity Switches with No Safety Function

The safety-related Planar4 input modules are designed for connecting to safety-tested P+F proximity switches (SN).

This results in values for switching point and detection of short-circuits that differ from those of the DIN EN 60947-5-6. If proximity switches with no safety function (i.e., not SN) are used, these differences may cause an unintended behavior.

The planner is responsible for properly matching proximity switches with no safety function. To this end, the instructions and specifications of the manufacturer and the DIN EN 60947-5-6 standard must be observed.

Unintended Behavior in Connection with Short-Circuit Detection

When a proximity switch with no safety function is switched on, the flowing current is sufficient to cause the safety-related Planar4 input modules to detect a short-circuit. As a workaround, an adjustable resistor must be connected in series (e.g., 390 Ω, 0.25 W).

The responsible planner must calculate and test this serial adjustable resistor specifically for the corresponding proximity switch family.

Unintended Behavior in Connection with Switching Point On

When a proximity switch with no safety function is switched on, it does not provide the current required to switch on the safety-related Planar4 input modules (2.9 mA). As a workaround, an adjustable resistor must be directly connected in parallel to the proximity switch with no safety function.

The responsible planner must calculate and test this parallel adjustable resistor specifically for the corresponding proximity switch family.

Example

Increasing the NAMUR output to safely switch on the Planar4 inputs.

When a NAMUR output of a proximity switch is switch on, it provides 2.6 mA, but the Planar4 input module need 2.9 mA. Direct connection of a coiled 8.2 kΩ (1 % / 0.25 W) metal film resistor in parallel to the NAMUR output increases the flowing current to 2.9 mA.

The connected adjustable resistor does not impair functional safety.

Unintended Behavior of the ERR, LS and LB LEDs

Components on the module have been replaced due to higher requirements resulting from the prescribed interference immunity: When the LEDs are off, they glow slightly due to the increased output bias current of the components in use. This does not impair the functional safety.

Communication via Modbus

Read Variables

Type BOOL: Function code 1

Type WORD: Function code 3

Events: Function codes 65, 66, 67

Relative address	Data type	Value	Description	Relative event no.
0	WORD	11 H	Module type 12 100	
1	BOOL	0	None	
2	BOOL	1	Module removed	
3	BOOL	1	Communication with module not ok	
4	BOOL	1	Module in slot, communication ok	
5	BOOL	1	Operating voltage too low, no RDY	
6	BOOL	1	Module fault, ERR	
7	BOOL	1	Current in input circuits not ok, LS, LB	
8…40	BOOL	0	None	
41	BOOL	1	1-signal at output z22 Y1	24
42	BOOL	1	1-signal at output d22 Y2	25
43	BOOL	1	1-signal at output z24 Y3	26
44	BOOL	1	1-signal at output d24 Y4	27
45…48	BOOL	0	None	

Table 2: Module Status via Modbus

Value: 0 always has the opposite meaning
H: Hexadecimal value

Absolute address: A = p * 256 + relative address

Absolute event no.: E = (p - 1) * 32 + relative event no.
p = Slot no. in the subrack

Reading of All Variables

Function code 3, 84 WORDS

Starting with address 2000 H, 3000 H or 4000 H

	WORD 0 (16-bit)		WORD 1 (16-bit)		WORD 2 (16-bit)		WORD 3 (16-bit)	
Relative address	0	8…1	24…17	16…9	40…33	32…25		48…41
Data	Module type	Module status	None	None	None	None	None	Outputs

For error-free data transfer, all 84 WORDS must be read. This ensures that the variables of all the modules within a subrack are transferred. 0 is transferred for unused module slots.

Communication via PROFIBUS DP

Read Variables

Relative addresses of WORD and BYTE type

WORD	Bit	BYTE	Bit	Value	Description
0	0…7	0	0…7	11 H	Module type 12 100
	8	1	0	0	None
	9		1	1	Module removed
	10		2	1	Communication with module not ok
	11		3	1	Module in slot, communication ok
	12		4	1	Operating voltage too low, no RDY
	13		5	1	Module fault, ERR
	14		6	1	Current in input circuits not ok, LS, LB
	15		7	0	None
1…2		2…5		0	None
3	0	6	0	1	1-signal at output z22 Y1
	1		1	1	1-signal at output d22 Y2
	2		2	1	1-signal at output z24 Y3
	3		3	1	1-signal at output d24 Y4
	4…7		4…7	0	None
	8…15	7	0…7	0	None

Table 3: Module Status via PROFIBUS DP

Value: 0 always has the opposite meaning
H: Hexadecimal value

Absolute address WORD: W = 4 * (p - 1) + relative address

Absolute address BYTE: B = 8 * (p - 1) + relative address
p = Slot no. in the subrack