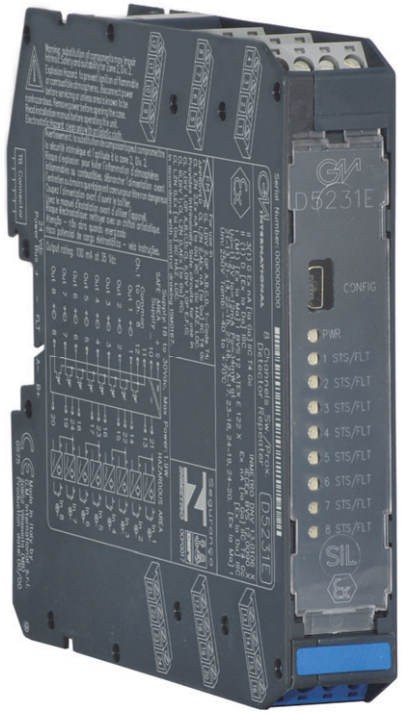


INSTRUCTION & SAFETY MANUAL

SIL 2 Switch / Proximity Detector Repeater, Open Collector Output DIN-Rail and Termination Board, Model D5231E

gmi technology for safety

Characteristics

General Description:

The Switch/Proximity Detector Repeater type D5231E is a unit with eight independent channels suitable for applications requiring SIL 2 level (according to IEC 61511) in safety related systems for high risk industries.
The unit can be configured for switch or proximity detector (EN60947-5-6 NAMUR), NO or NC input and for NO or NC floating solid-state relay (photo-MOS) isolated output compatible with logic circuits. Configuration is programmable from PC by the GM Pocket Portable Adapter PPC5092 via USB serial line and SWC5090 Configurator software. Each channel enables a Safe Area load to be controlled by a switch, or a proximity detector, located in Hazardous Area.
Fault detection circuit (configurable by PC) is available for all proximity sensors and switches equipped with end of line resistors. In case of fault, when enabled it de-energizes the corresponding solid-state relay (photo-MOS) and turns the fault red LED on; when disabled the corresponding solid-state relay (photo-MOS) repeats the input line open or closed status as configured.
D5231E has eight inputs and eight independent outputs. Modbus RTU RS-485 output is available on Bus connector.

Mounting on standard DIN-Rail, with or without Power Bus, or on customized Termination Boards, in Safe Area / Non Hazardous Location or in Zone 2 / Class I, Division 2 or Class I, Zone 2.

Technical Data

Supply:

24 Vdc nom (18 to 30 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp, 2 A time lag fuse internally protected.
Current consumption @ 24 V: 75 mA for 8 channels with short circuit input and solid-state relay (photo-MOS) closed, typical.
Power dissipation: 1.8 W with 24 V supply voltage, for 8 channels with short circuit input and solid-state relay (photo-MOS) closed, typical.

Isolation (Test Voltage):

I.S. In/Out 1.5 KV; I.S. In/Supply 1.5 KV; Out/Supply 500 V.

Input switching current levels:

ON ≥ 2.1 mA (1.9 to 6.2 mA range), OFF ≤ 1.2 mA (0.4 to 1.3 mA range),
switch current ≈ 1.65 mA ± 0.2 mA hysteresis.
Fault current levels: open fault ≤ 0.2 mA, short fault ≥ 6.8 mA.
Input equivalent source: 8 V 1 KΩ typical (8 V no load, 8 mA short circuit).

Output:

voltage free SPST optocoupled open-collector transistor (solid-state relay, photo-MOS).
Open-collector rating: 100 mA at 35 V (≤ 1.0 V voltage drop).
Leakage current: ≤ 10 µA at 35 V.
Response time: 500 µs.
Frequency response: 500 Hz maximum.
Modbus Output: Modbus RTU protocol up to 115.200 baud on Bus connector.

Compatibility:

CE mark compliant, conforms to Directive: 2014/34/EU ATEX, 2014/30/EU EMC, 2014/35/EU LVD, 2011/65/EU RoHS.

Environmental conditions:

Operating: temperature limits – 40 to + 70 °C, relative humidity 95 %, up to 55 °C.
Storage: temperature limits – 45 to + 80 °C.

Safety Description:

ATEX: II 3(1) G Ex nA [ia Ga] IIC T4 Gc, II (1) D [Ex ia Da] IIIC, I (M1) [Ex ia Ma] I
IECEx / INMETRO / NEPSI: Ex nA [ia Ga] IIC T4 Gc, [Ex ia Da] IIIC, [Ex ia Ma] I,
FM: NI-AIS / I / 2 / ABCD / T4, AIS / I,II,III / 1 / ABCDEFG, I / 2 / AEx nA [ia] / IIC / T4
FMC: NI-AIS / I / 2 / ABCD / T4, AIS / I,II,III / 1 / ABCDEFG, I / 2 / Ex nA [ia] / IIC / T4
EAC-EX: 2Ex nA [ia Ga] IIC T4 Gc X, [Ex ia Da] IIIC, [Ex ia Ma] I.
UKR TR n. 898: 2ExnAiaIICT4 X, Exial X
associated apparatus and non-sparking electrical equipment.
Uo/Voc = 11.2 V, Io/Isc = 12 mA, Po/Po = 34 mW at terminals 21-13, 21-14, 22-15,
22-16, 23-17, 23-18, 24-19, 24-20.
Um = 250 Vrms, -40 °C ≤ Ta ≤ 70 °C.
Approvals:
BVS 12 ATEX E 122 X conforms to EN60079-0, EN60079-11, EN60079-15,
EN60079-26, EN50303.
IECEx BVS 12.0090 X conforms to IEC60079-0, IEC60079-11, IEC60079-15.
INMETRO DNV 13.0106 X conforms to ABNT NBR IEC60079-0, ABNT NBR IEC60079-11, ABNT NBR IEC60079-15, ABNT NBR IEC60079-26.
FM 3046304 and FMC 3046304C conforms to Class 3600, 3610, 3810, 3611,
ANSI/ISA-60079-0, ANSI/ISA-60079-11, ANSI/ISA-60079-15, C22.2 No.142, C22.2 No.157, C22.2 No.213, C22.2 No. 60079-0, C22.2 No. 60079-11, C22.2 No. 60079-15.
C-IT.ME92.B.00206 conforms to GOST 30852.0, 30852.10, 30852.14.
СЦ 16.0036 X conforms to ДСТУ 7113, ГОСТ 22782.5-78, ДСТУ IEC 60079-15.
GYJ14.1406X conforms to GB3836.1, GB3836.4; GB3836.8, GB3836.20.
TÜV Certificate No. C-IS-236198-02, SIL 2 conforms to IEC61511.
DNV Type Approval Certificate No.A-13625 and KR No.MIL20769-EL002 Certificates for maritime applications.

Mounting:

T35 DIN-Rail according to EN50022, with or without Power Bus or on customized Termination Board.
Weight: about 175 g.
Connection: by polarized plug-in disconnect screw terminal blocks to accomodate terminations up to 2.5 mm^2.
Location: installation in Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4 or Class I, Division 2, Group A,B,C,D, T4 or Class I, Zone 2, Group IIC, T4.
Protection class: IP 20.
Dimensions: Width 22.5 mm, Depth 123 mm, Height 120 mm.

Programming

The module is fully programmable. Operating parameters can be changed from PC via PPC5092 adapter connected to USB serial line and SWC5090 software.
Measured values and diagnostic alarms can be read on both serial configuration or Modbus output line.
SWC5090 software also allows the Monitoring and Recording of values. For details please see SWC5090 manual ISM0154.

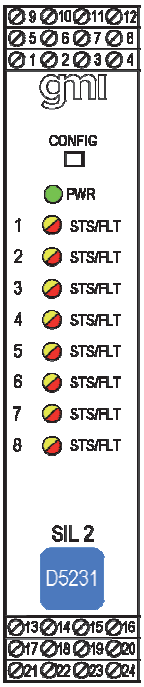
Ordering Information

Model:	D5231	
8 channels		E

Power Bus and DIN-Rail accessories:

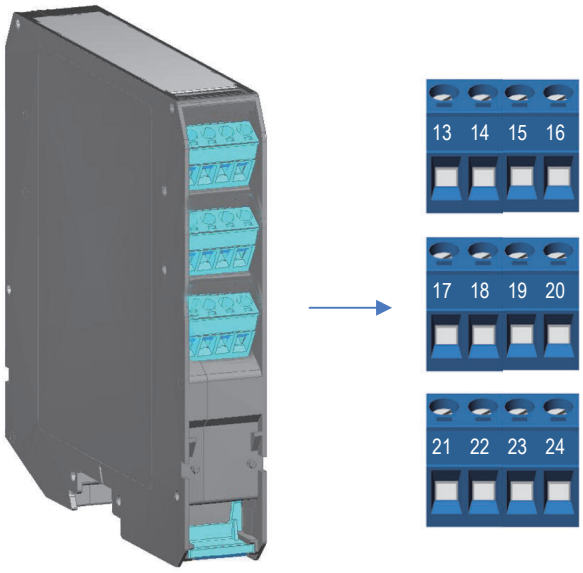
Connector JDFT049	Cover and fix MCHP196
Terminal block male MOR017	Terminal block female MOR022

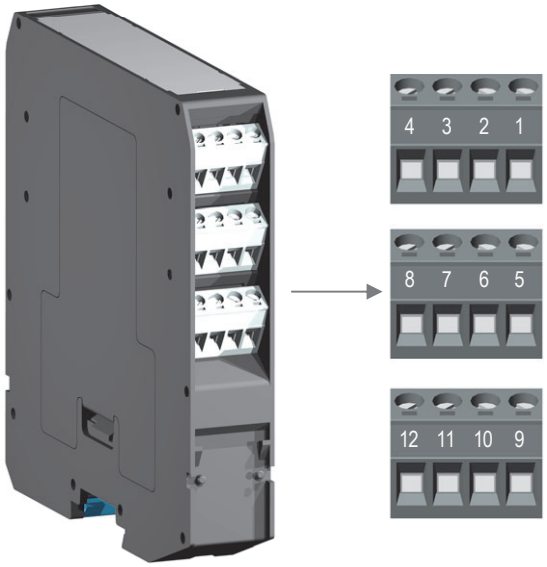
Front Panel and Features



- SIL 2 according to IEC 61511
  for Tproof = 3 / 10 yrs (≤10% / >10 % of total SIF), SFF 73.90%, PFDavg (1 year) 2.96 E-04.
- 8 fully independent channels
- Input from Zone 0 (Zone 20) / Division 1, Installation in Zone 2/Division 2.
- NO/NC switch/proximity Detector Input, NO/NC solid-state output relay .
- Field open and short circuit detection.
- High Accuracy, µP controlled A/D converter.
- Three port isolation, Input/Output/Supply.
- Modbus RTU RS-485 Output.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety system.
- Fully programmable operating parameters.
- Any input can be assigned to any number of outputs. Logical output functions available.
- ATEX, IECEx, FM, FMC, INMETRO, EAC-EX, UKR TR n. 898, NEPSI, TÜV Certifications.
- Type Approval Certificate DNV and KR for maritime applications.
- High Density, eight channels per unit.
- Simplified installation using standard DIN-Rail and plug-in terminal blocks, with or without power Bus, or customized Termination Boards.
- 250 Vrms (Um) max. voltage allowed to the instruments associated with the barrier.

Terminal block connections





HAZARDOUS AREA	
13	- Input Ch 1 for Proximity or Voltage free Contact
14	- Input Ch 2 for Proximity or Voltage free Contact
15	- Input Ch 3 for Proximity or Voltage free Contact
16	- Input Ch 4 for Proximity or Voltage free Contact
17	- Input Ch 5 for Proximity or Voltage free Contact
18	- Input Ch 6 for Proximity or Voltage free Contact
19	- Input Ch 7 for Proximity or Voltage free Contact
20	- Input Ch 8 for Proximity or Voltage free Contact
21	+ Common positive Input for Ch 1 to 8
22	+ Common positive Input for Ch 1 to 8
23	+ Common positive Input for Ch 1 to 8
24	+ Common positive Input for Ch 1 to 8

SAFE AREA	
1	Output 1
2	Output 2
3	Output 3
4	Output 4
5	Output 5
6	Output 6
7	Output 7
8	Output 8
9	+ Power Supply 24 Vdc
10	- Power Supply 24 Vdc
11	Common Output channel 1 to 8
12	Common Output channel 1 to 8

Parameters Table

In the system safety analysis, always check the Hazardous Area/Hazardous Locations devices to conform with the related system documentation, if the device is Intrinsically Safe check its suitability for the Hazardous Area/Hazardous Locations and group encountered and that its maximum allowable voltage, current, power (Ui/Vmax, Ii/Imax, Pi/Pi) are not exceeded by the safety parameters (Uo/Voc, Io/Isc, Po/Po) of the D5231 series Associated Apparatus connected to it. Also consider the maximum operating temperature of the field device, check that added connecting cable and field device capacitance and inductance do not exceed the limits (Co/Ca, Lo/La, Lo/Ro) given in the Associated Apparatus parameters for the effective group. See parameters indicated in the table below:

D5231 Terminals	D5231 Associated Apparatus Parameters		Must be	Hazardous Area/ Hazardous Locations Device Parameters
21-13, 21-14, 22-15, 22-16, 23-17, 23-18, 24-19, 24-20	Uo / Voc = 11.2 V		≤	Ui / Vmax
	Io / Isc = 12 mA		≤	Ii/ Imax
	Po / Po = 34 mW		≤	Pi / Pi

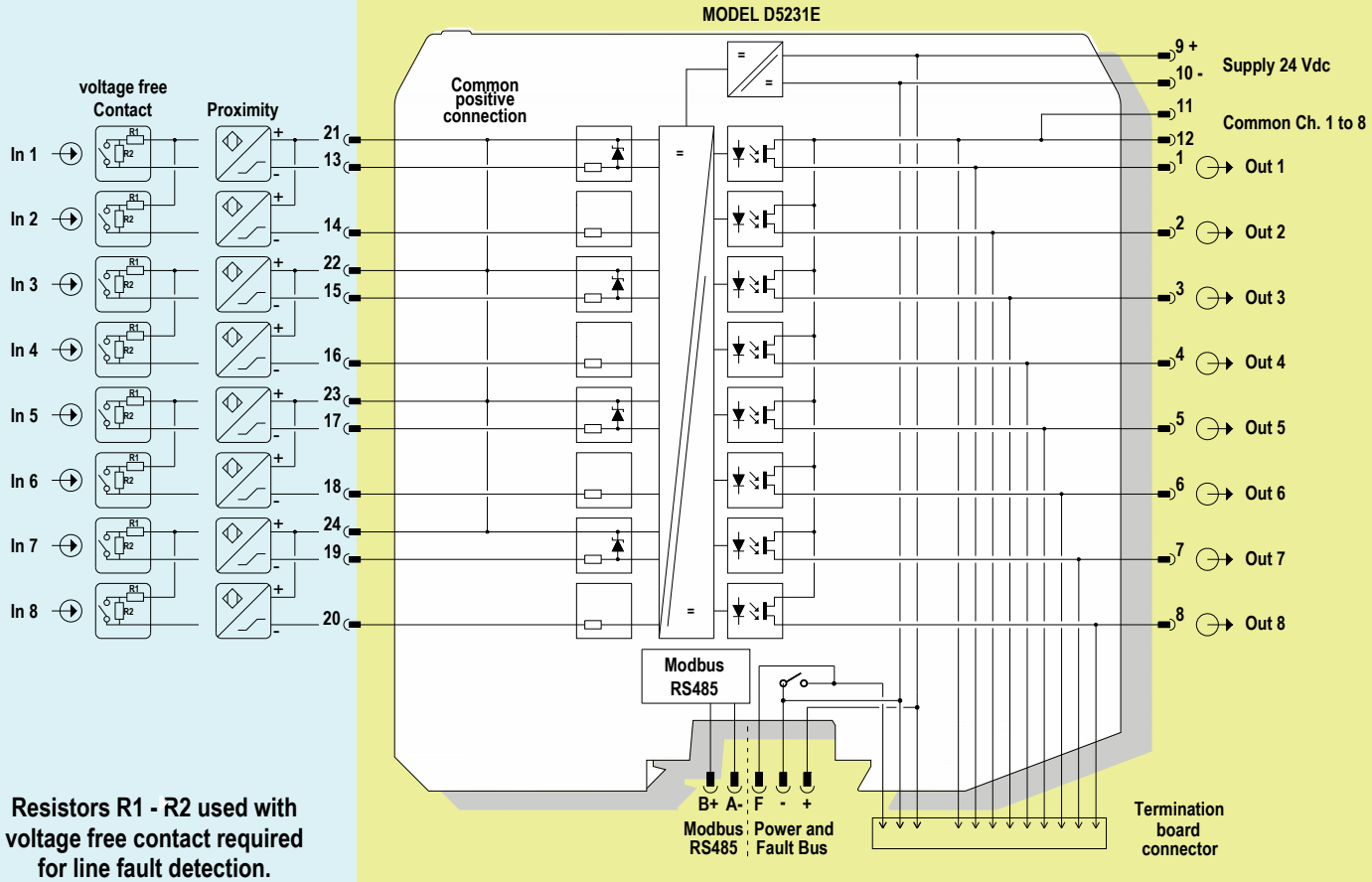
D5231 Terminals	D5231 Associated Apparatus Parameters Cenelec (US)		Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
21-13, 21-14, 22-15, 22-16, 23-17, 23-18, 24-19, 24-20	Co / Ca = 1.84 µF Co / Ca = 12.6 µF Co / Ca = 54 µF Co / Ca = 49 µF Co / Ca = 12.6 µF	IIC (A, B) IIB (C) IIA (D) I iaD (E, F, G)	≥	Ci / Ci device + C cable
	Lo / La = 246.9 mH Lo / La = 987.6 mH Lo / La = 1900 mH Lo / La = 3200 mH Lo / La = 987.6 mH	IIC (A, B) IIB (C) IIA (D) I iaD (E, F, G)	≥	Li / Li device + L cable
	Lo / Ro = 1070 µH/Ω Lo / Ro = 4280 µH/Ω Lo / Ro = 8550 µH/Ω Lo / Ro = 14030 µH/Ω Lo / Ro = 4280 µH/Ω	IIC (A, B) IIB (C) IIA (D) I iaD (E, F, G)	≥	Li / Ri device and L cable / R cable

For installations in which both the Ci and Li of the Intrinsically Safe apparatus exceed 1 % of the Co and Lo parameters of the Associated Apparatus (excluding the cable), then 50 % of Co and Lo parameters are applicable and shall not be exceeded (50 % of the Co and Lo become the limits which must include the cable such that Ci device + C cable ≤ 50 % of Co and Li device + L cable ≤ 50 % of Lo).
If the cable parameters are unknown, the following value may be used: Capacitance 180pF per meter (60pF per foot), Inductance 0.60µH per meter (0.20µH per foot).

Function Diagram

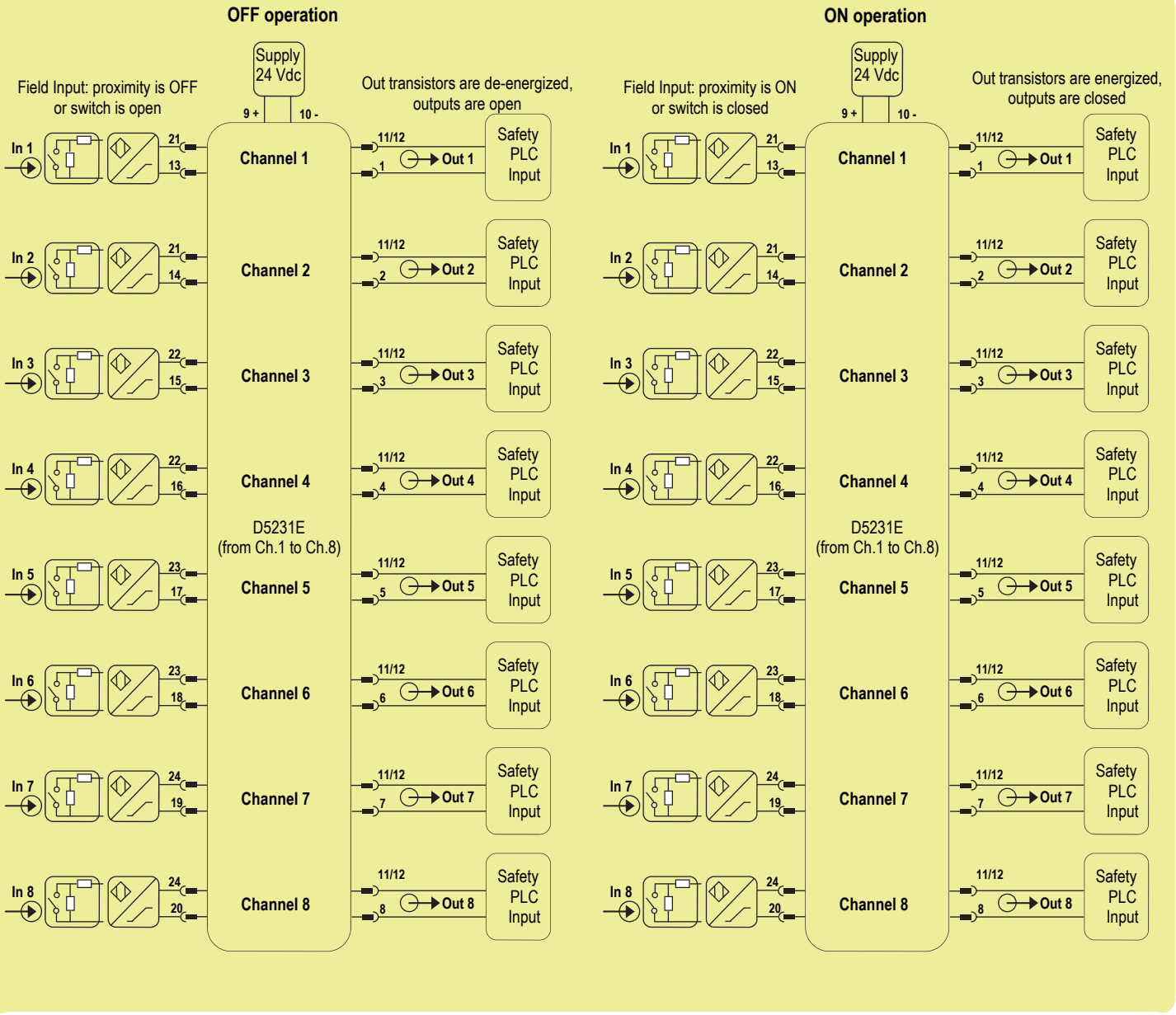
HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,
CLASS I, ZONE 0, GROUP IIC

SAFE AREA, ZONE 2 GROUP IIC T4,
NON HAZARDOUS LOCATIONS, CLASS I, DIVISION 2,
GROUPS A, B, C, D T-Code T4, CLASS I, ZONE 2, GROUP IIC T4



Resistors R1 - R2 used with voltage free contact required for line fault detection.

Application for D5231E



Description:

Configurate via software (see page 9 for more information), through SWC5090 configurator, the D5231E as follows:

- Contact position when input is open (1 to 8): select “open”;
- Contact position in case of fault (1 to 8): select “open”.

The module is powered by connecting 24 Vdc power supply to Pins 9 (+ positive) - 10 (- negative). The green LED is lit in presence of supply power.

Input signals from field are applied to Pins 21-13 (In 1 - Ch.1), Pins 21-14 (In 2 - Ch.2), Pins 22-15 (In 3 - Ch.3), Pins 22-16 (In 4 - Ch.4), Pins 23-17 (In 5 - Ch.5), Pins 23-18 (In 6 - Ch.6), Pins 24-19 (In 7 - Ch.7), Pins 24-20 (In 8 - Ch.8).

Transistor outputs Pins 1-11/12 (for Channel 1), Pins 2-11/12 (for Channel 2), Pins 3-11/12 (for Channel 3), Pins 4-11/12 (for Channel 4), Pins 5-11/12 (for Channel 5), Pins 6-11/12 (for Channel 6), Pins 7-11/12 (for Channel 7), Pins 8-11/12 (for Channel 8) are normally open (or transistor de-energized as safe state condition) for OFF operation, while they are closed (or transistor energized) for ON operation.

The following table describes for each channel the state (open or closed) of its output when its input signal is in OFF or ON state, and it gives information about turn-on or turn-off of the related channel status LED and channel fault LED:

Input signal state **Pins 21-13 (In 1 - Ch.1) or Pins 21-14 (In 2 - Ch.2) or Pins 22-15 (In 3 - Ch.3) or Pins 22-16 (In 4 - Ch.4) or Pins 23-17 (In 5 - Ch.5) or Pins 23-18 (In 6 - Ch.6) or Pins 24-19 (In 7 - Ch.7) or Pins 24-20 (In 8 - Ch.8)**	**Transistor output state** **Pins 1-11/12 (for Ch 1) or Pins 2-11/12 (for Ch 2) or Pins 3-11/12 (for Ch 3) or Pins 4-11/12 (for Ch 4) or Pins 5-11/12 (for Ch 5) or Pins 6-11/12 (for Ch 6) or Pins 7-11/12 (for Ch 7) or Pins 8-11/12 (for Ch 8)**	**Channel status / fault yellow / red LED state**
Proximity sensor is OFF or switch is open	Open (De-energize transistor)	OFF
Proximity sensor is ON or switch is closed	Closed (Energized transistor)	ON (yellow)
Independently from proximity sensor or switch state, the input line is break	Open (De-energized transistor as safe state condition)	ON (red)
Independently from proximity sensor or switch state, the input line is in short circuit	Open (De-energized transistor as safe state condition)	ON (red)

Safety Function and Failure behavior:

D5231E is considered to be operating in Low Demand mode, as a Type B module, having Hardware Fault Tolerance (HFT) = 0.

The failure behaviour is described from the following definitions :

- □ fail-Safe State: it is defined as the transistor output being de-energized or open;
- □ fail Safe: failure mode that causes the module / (sub)system to go to the defined Fail-Safe state without a demand from the process
- □ fail Dangerous: failure mode that does not respond to a demand from the process (i.e. being unable to go to the defined Fail-Safe state), so that the transistor output remains energized or closed;
- □ fail "No Effect": failure mode of a component that plays a part in implementing the Safety Function but that is neither a safe failure nor a dangerous failure. When calculating the SFF, this failure mode is not taken into account. ;
- □ fail "Not part": failure mode of a component which is not part of the Safety Function but is part of the circuit diagram and is listed for completeness. When calculating the SFF this failure mode is not taken into account.

As the module is supposed to be proven-in-use device, therefore according to the requirements of IEC 61511-1 section 11.4.4, a HFT = 0 is sufficient for SIL 2 (sub-) systems including Type B components and having a SFF equal or more than 60%.

Failure rate data: taken from Siemens Standard SN29500.

Failure rate table:

Failure category	Failure rates (FIT)
λ_{dd} = Total Dangerous Detected failures	0.00
λ_{du} = Total Dangerous Undetected failures	67.44
λ_{sd} = Total Safe Detected failures	0.00
λ_{su} = Total Safe Undetected failures	191.00
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**258.44**
MTBF (safety function, one channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**441 years**
$\lambda_{no\ effect}$ = "No Effect" failures	212.26
$\lambda_{not\ part}$ = "Not Part" failures	390.30
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**861.00**
MTBF (device, one channel) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**132 years**

Failure rates table according to IEC 61508:2010 Ed.2 :

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	SFF
0.00	191.00	0.00	67.44	73.90%

This type "B" system has SFF = 73.90 % ≥ 60 % and HFT = 0, which is sufficient to get SIL 2 in accordance with the requirements of IEC 61511-1 section 11.4.4 during a proven-in-use assessment.

PFDavg vs T[Proof] table (assuming Proof Test coverage of 99%), with determination of SIL supposing module contributes ≤10% of total SIF dangerous failures:

T[Proof] = 1 year	T[Proof] = 3 years	T[Proof] = 20 years
PFDavg = 2.96 E-04 Valid for **SIL 2**	PFDavg = 8.88 E-04 Valid for **SIL 2**	PFDavg = 5.92 E-03 Valid for **SIL 1**

PFDavg vs T[Proof] table (assuming Proof Test coverage of 99%), with determination of SIL supposing module contributes >10% of total SIF dangerous failures:

T[Proof] = 10 years
PFDavg = 2.96 E-03 Valid for **SIL 2**

Testing procedure at T-proof

The proof test shall be performed to reveal dangerous faults which are undetected by diagnostic. This means that it is necessary to specify how dangerous undetected fault, which have been noted during the FMEDA, can be revealed during proof test.

Note for switch input: to detect a broken wire, or a short circuit condition, in the input connections it is necessary to mount, close to the switches, the end of line resistors: R1=1 KΩ typical (470 Ω to 2 KΩ range) resistor in series and R2=10 kΩ typical (5 KΩ to 15 KΩ range) resistor in parallel to the contacts.

The Proof test consists of the following steps:

Steps	Action
1	Bypass the safety-related PLC or take other appropriate action to avoid a false trip.
2	Vary the state conditions of the input sensors/contacts coming from field and verify that transistor outputs change from de-energized to energized and vice versa, then check that the de-energized state condition corresponds to the required safety-related function.
3	If input line fault detection is enabled for each channel by means of the configuration software, disconnect the input wiring coming from the field sensor/contact and check that the corresponding transistor output is de-energized. Then, put in short circuit condition the input connections and verify that the same output remains de-energized.
4	Restore the loop to full operation.
5	Remove the bypass from the safety-related PLC or restore normal operation.

This test will reveal approximately 99 % of possible Dangerous Undetected failures in the repeater.

Warning

D5231 series are isolated Intrinsically Safe Associated Apparatus installed into standard EN50022 T35 DIN-Rail located in Safe Area or Zone 2, Group IIC, Temperature T4, Hazardous Area (according to EN/IEC60079-15) within the specified operating temperature limits Tamb –40 to +70 °C, and connected to equipment with a maximum limit for AC power supply Um of 250 Vrms. Not to be connected to control equipment that uses or generates more than 250 Vrms or Vdc with respect to earth ground.
D5231 series must be installed, operated and maintained only by qualified personnel, in accordance to the relevant national/international installation standards (e.g. IEC/EN60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), following the established installation rules, particular care shall be given to segregation and clear identification of I.S. conductors from non I.S. ones.
De-energize power source (turn off power supply voltage) before plug or unplug the terminal blocks when installed in Hazardous Area or unless area is known to be nonhazardous.
Warning: substitution of components may impair Intrinsic Safety and suitability for Zone 2.
Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential.
Explosion Hazard: to prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or unless area is known to be nonhazardous.
Failure to properly installation or use of the equipment may risk to damage the unit or severe personal injury.
The unit cannot be repaired by the end user and must be returned to the manufacturer or his authorized representative.
Any unauthorized modification must be avoided.

Operation

The Switch/Proximity Detector Repeater type D5231E is a unit with eight independent channels suitable for applications requiring SIL 2 level (according to IEC 61511) in safety related systems for high risk industries.
The unit can be configured for switch or proximity detector (EN60947-5-6 NAMUR), NO or NC input and for NO or NC floating solid-state relay (photo-MOS) isolated output compatible with logic circuits. Configuration is programmable from PC by the GM Pocket Portable Adapter PPC5092 via USB serial line and SWC5090 Configurator software. Each channel enables a Safe Area load to be controlled by a switch, or a proximity detector, located in Hazardous Area.
Fault detection circuit (configurable by PC) is available for all proximity sensors and switches equipped with end of line resistors. In case of fault, when enabled it de-energizes the corresponding solid-state relay (photo-MOS) and turns the fault red LED on; when disabled the corresponding solid-state relay (photo-MOS) repeats the input line open or closed status as configured.
Note: use of voltage free electrical contacts with fault detection enabled (control equipment) requires, near the switch at the end of the line a R1=1 KΩ typical (470 Ω to 2 KΩ range) resistor in series and a R2=10 kΩ typical (5 KΩ to 15 KΩ range) resistor in parallel to the contacts in order to allow the fault detection circuit to distinguish between a condition of contact close/open and a line open/short circuit fault.

Installation

D5231 series modules are housed in a plastic enclosure suitable for installation on T35 DIN-Rail according to EN50022, with or without Power Bus or on customized Termination Board. D5231 unit can be mounted with any orientation over the entire ambient temperature range.
Electrical connection of conductors up to 2.5 mm² are accommodated by polarized plug-in removable screw terminal blocks which can be plugged in/out into a powered unit without suffering or causing any damage **(for Zone 2 installations check the area to be nonhazardous before servicing)**.
The wiring cables have to be proportionate in base to the current and the length of the cable.
On the section “Function Diagram” and enclosure side a block diagram identifies all connections.
Identify the function and location of each connection terminal using the wiring diagram on the corresponding section.

Intrinsically Safe conductors must be identified and segregated from non I.S. and wired in accordance to the relevant national/international installation standards (e.g. EN/IEC60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), make sure that conductors are well isolated from each other and do not produce any unintentional connection.
The enclosure provides, according to EN60529, an IP20 minimum degree of mechanical protection (or similar to NEMA Standard 250 type 1) for indoor installation, outdoor installation requires an additional enclosure with higher degree of protection (i.e. IP54 to IP65 or NEMA type 12-13) consistent with the effective operating environment of the specific installation.
Units must be protected against dirt, dust, extreme mechanical (e.g. vibration, impact and shock) and thermal stress, and casual contacts.
If enclosure needs to be cleaned use only a cloth lightly moistened by a mixture of detergent in water.
Electrostatic Hazard: to avoid electrostatic hazard, the enclosure of D5231E must be cleaned only with a damp or antistatic cloth.
Any penetration of cleaning liquid must be avoided to prevent damage to the unit. Any unauthorized card modification must be avoided.
According to EN61010, D5231 series must be connected to SELV or SELV-E supplies.
Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential.

Start-up

Before powering the unit check that all wires are properly connected, particularly supply conductors and their polarity, input and output wires, also check that Intrinsically Safe conductors and cable trays are segregated (no direct contacts with other non I.S. conductors) and identified either by color coding, preferably blue, or by marking.
Check conductors for exposed wires that could touch each other causing dangerous unwanted shorts.
Turn on power, the “power on” green LED must be lit, output signal must be in accordance with the corresponding input signal value and input/output chosen transfer function, Status/fault LED should reflect the input variable condition with respect to configured settings. If possible change the sensor condition and check the corresponding Safe Area output.

Configurating and Monitoring via Software:

CONFIGURATION

Configuration parameters can be read and written from the module or from saved file.
It is also possible to reset the module configuration to factory default settings.
A report sheet containing complete configuration can be printed.

INPUTS 1 to 8:

Sensor Type:

☐ Proximity
☐ Voltage free contact

Note: To enable line diagnostic on Voltage free contacts, configure sensor as "Proximity" and follow instructions in Section "Operation".

TAGS 1 to 8:

16 alphanumerical characters.

OUTPUTS 1 to 8:

Source:

☐ Input 1 Output represents Input 1,
☐ Input 2 Output represents Input 2,
☐ Input 3 Output represents Input 3,
☐ Input 4 Output represents Input 4,
☐ Input 5 Output represents Input 5,
☐ Input 6 Output represents Input 6,
☐ Input 7 Output represents Input 7,
☐ Input 8 Output represents Input 8,
☐ Logical function Output represents AND/OR function of selected inputs.

Contact: normal condition of output contact when input is open

☐ Open (for SIL applications)
☐ Closed

In case of fault: Output behaviour when Input fault is detected.

☐ Ignore Ignore,
☐ Open (for SIL applications)
☐ Closed

Fault repeater: Output represents Input Fault status

Logical Function: visible only when selected in "Output source".

Select 2 or more (up to 8) Inputs to connect logically.

☐ AND Output represents AND logical function of selected Inputs,
- NO: On AND On = Close; On AND Off = Open; Off AND Off = Open
- NC: On AND On = Open; On AND Off = Close; Off AND Off = Close

☐ OR Output represents OR logical function of selected Inputs
- NO: On OR On = Close; On OR Off = Close; Off OR Off = Open
- NC: On OR On = Open; On OR Off = Open; Off OR Off = Close

MONITOR

Allows the real-time monitoring of every Input and Output status.
Note that configuration is disabled when Monitoring is active.

INPUT STATUS: The status of each input is shown

☐ Open circuit Open circuit fault (only for Proximity Inputs),
☐ Off Off,
☐ On On,
☐ Short circuit Short circuit fault (only for Proximity Inputs).

OUTPUT STATUS: The status of each output contact is shown

☐ Open
☐ Closed

DATA LOGGER

The status of all Inputs and all Outputs is acquired at constant chosen intervals and saved to user selected file in Comma Separated Value format (.csv).
Note that configuration is disabled when Data Logger is active.

PARAMETERS SETUP:

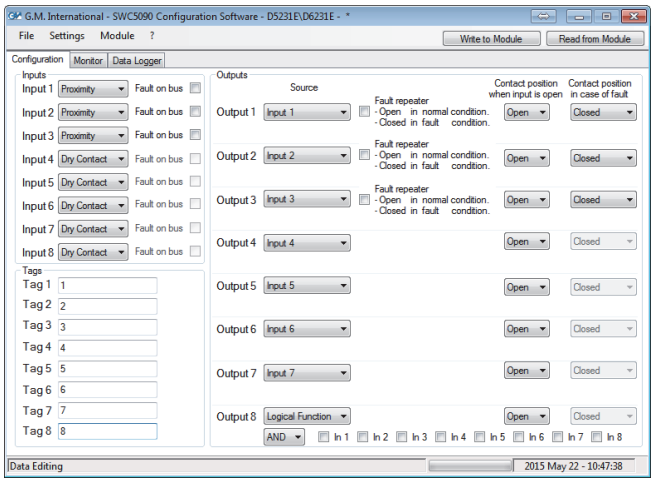
Days: Number of days to acquire.
Hours: Number of hours to acquire.
Minutes: Number of minutes to acquire.
Scan rate: Frequency interval for acquisitions.

General Notes:

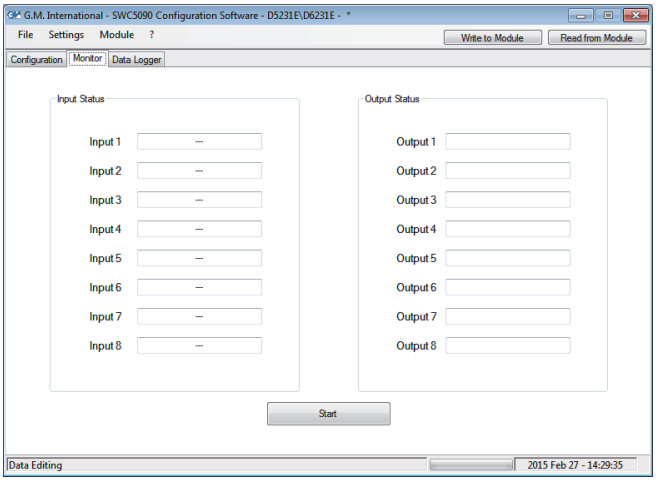
SWC5090 Software can be downloaded for free at www.gmintsrl.com
PPC5092 Adapter is needed to interface PC to D5231E module.
The PC supplies the module via USB, therefore operating power supply (24 Vdc) is not strictly needed when configuring the module.
Each channel has completely independent configurations.
See ISM0154 Manual for details on SWC5090 software.

Screenshots:

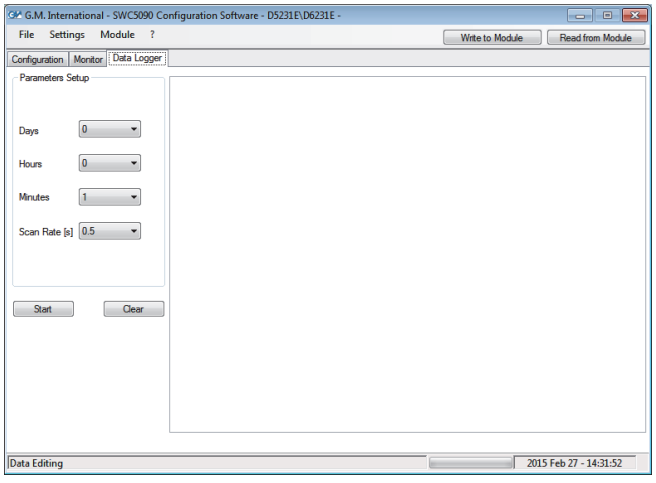
SWC5090 Software and PPC5092 USB Adapter



Input / Output configuration



Input / Output status real-time monitor



Real-time data logging to file

Supported Modbus parameters:

D5231E communicates via Modbus RTU RS-485 protocol. Below are all available registers.

Addr.	Description	Notes	Type[5]
0	G.M. Factory Code	Identification Data	R
1	Instrument Code		
2	Option Code		
3	Hardware Release		
4	Software Release		
16	Modbus Address	Communication Data	R/W
17	Modbus Baudrate [1]		
18	Modbus Format [1]		
81	Input status of all channels [1]	Input Data	R
96-111	Output 1 Source [2]	Output Configuration	R/W
112-127	Output 2 Source [2]		
128-143	Output 3 Source [2]		
144-159	Output 4 Source [2]		
160-175	Output 5 Source [2]		
176-191	Output 6 Source [2]		
192-207	Output 7 Source [2]		
208-223	Output 8 Source [2]		
224	Output 1 Fault configuration [1]	Fault Configuration	R/W
225	Output 2 Fault configuration [1]		
226	Output 3 Fault configuration [1]		
227	Output 4 Fault configuration [1]		
228	Output 5 Fault configuration [1]		
229	Output 6 Fault configuration [1]		
230	Output 7 Fault configuration [1]		
231	Output 8 Fault configuration [1]		
232	Fault on Bus [1]		
233	Inputs configuration [1]	Input Configuration	R/W
464	Commands execution [4]	Command	W
520	Outputs Status	Output Data	R
548-555	Ch 1 [3]	Tags	R/W
556-563	Ch 2 [3]		
564-571	Ch 3 [3]		
572-579	Ch 4 [3]		
580-587	Ch 5 [3]		
588-595	Ch 6 [3]		
596-603	Ch 7 [3]		
604-611	Ch 8 [3]		

Notes:

Each Modbus parameter is described by one 16-bit word.

(1) See command details on the right.
(2) Each Output can reflect the status of any Input.
In order to change Output Source fill Output Address range as shown below:
Input 1: All addresses contain value 43690.
Input 2: All addresses contain value 52428.
Input 3: All addresses contain value 61680.
Input 4: All addresses contain value 65280.
Input 5: Addresses contain:
0,65535,0,65535,0,65535,0,65535,0,65535,0,65535,0,65535,0,65535.
Input 6: Addresses contain:
0,0,65535,65535,0,0,65535,65535,0,0,65535,65535,0,0,65535,65535.
Input 7: Addresses contain:
0,0,0,0,65535,65535,65535,65535,0,0,0,0,65535,65535,65535,65535.
Input 8: Addresses contain:
0,0,0,0,0,0,0,0, 65535,65535,65535,65535,65535,65535,65535,65535.
(3) Tags are composed of 16 characters.
Each address contains 2 chars, starting from left.
(4) All configurations must be confirmed via Addr. 464, see details on the right.
(5) Parameter Type:
R = read only,
W = write only,
R/W = read and write.

Supported modbus functions:

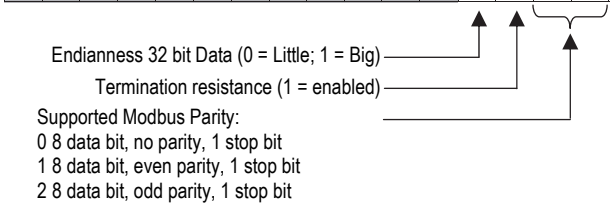
Code	Name	Notes
03	read holding registers	reads a stream of words from memory
04	read input registers	reads a stream of words from memory
08	diagnostics: subcode 0	returns query data
06	write single register	writes a word in memory
16	write multiple registers	writes a stream of words in memory

Parameters details:

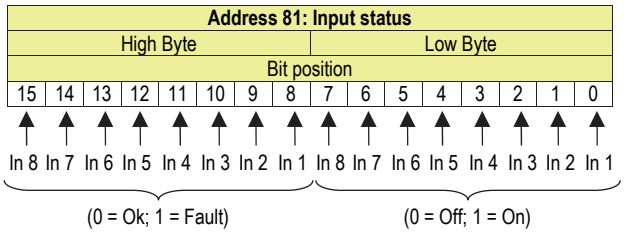
Address 17: Supported ModBus Baudrates

Index	Baudrate
0	4800
1	9600
2	19200
3	38400
4	57600
5	115200

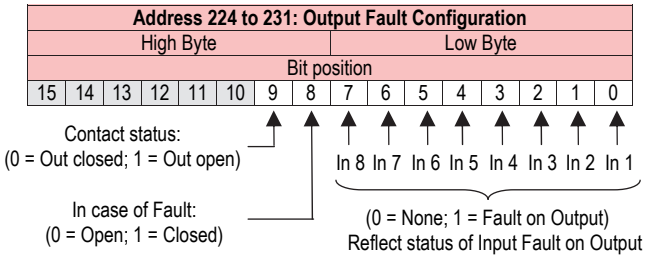
Address 18: Supported ModBus Formats



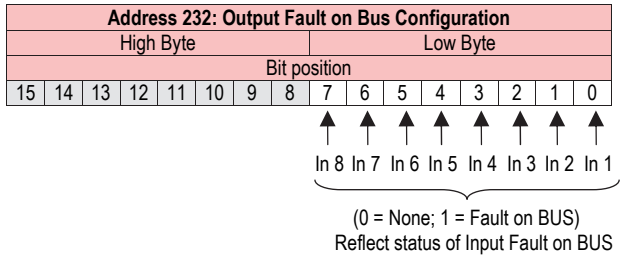
Address 81: Input status



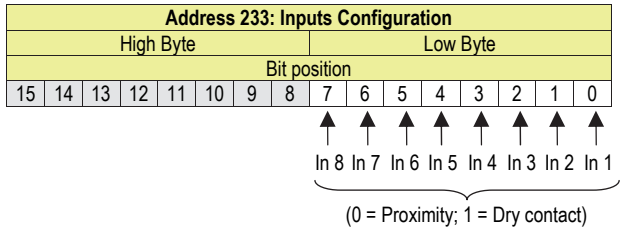
Address 224 to 231: Output Fault Configuration



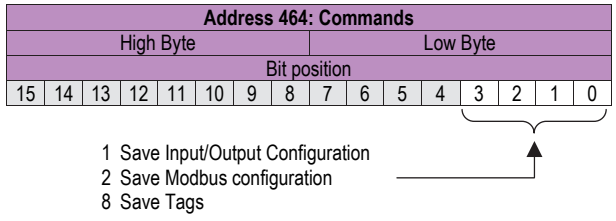
Address 232: Output Fault on Bus Configuration



Address 233: Inputs Configuration



Address 464: Commands



Address 520: Outputs Data