



INSTRUCTION MANUAL

Switch/Proximity Detector
Repeater Transistor Output
DIN-Rail Models D1031D, D1031Q

Characteristics

General Description: The Switch/Proximity Detector Repeater type D1031 is a DIN Rail unit with two or four independent channels. The unit can be configured for contact or proximity detector, NO or NC and for NO or NC optocoupled open collector transistor output. Each channel enables a Safe Area load to be controlled by a switch, or a proximity detector, located in Hazardous Area.

D1031Q quad channel type has four independent input channels and actuates the corresponding output transistor. Two actuation modes can be independently DIP switch configured on each input channel: NO input/NC transistor or NO input/NO transistor. Contact or proximity sensor and its connection line short or open circuit fault detection is also DIP switch configurable: fault detection can be enabled (in case of fault it de-energizes the corresponding output transistor and turns the fault LED on) or disabled (in case of fault the corresponding output transistor repeats the input line open or closed status as configured).

D1031D dual channel type has two input channels and four output transistors; the unit has two DIP switch configurable operating modes:

Mode A) input channel actuates in parallel the two output transistors. Transistor actuation mode can be independently configured for each output in two modes: NO input/NC transistor or NO input/NO transistor.

Mode B) input channel actuates output transistor A configurable in two modes as in mode A above. Output transistor B operates as a fault output (in case of input fault, transistor B actuates and the fault LED turns on while transistor A repeats the input line as configured). Actuation can be DIP switch configured in two modes:

No input fault/energized transistor (it de-energizes in case of fault) or No input fault/de-energized transistor (it energizes in case of fault).

Function: 2 or 4 channels I.S. switch repeater for contact or EN60947-5-6 proximity. Provides 3 port isolation (input/output/supply).

Signalling LEDs: Power supply indication (green), output status (yellow), line fault (red).

Field Configurability: NO/NC input for contact/proximity, NO/NC transistor operation and fault detection enable/disable.

EMC: Fully compliant with CE marking applicable requirements.

Technical Data

Supply: 12-24 Vdc nom (10 to 30 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp.

Current consumption @ 24 V: 50 mA for 4 channels D1031Q, 40 mA for 2 channels D1031D with input closed and transistors energized.

Current consumption @ 12 V: 100 mA for 4 channels D1031Q, 80 mA for 2 channels D1031D with input closed and transistors energized.

Power dissipation: 1.2 W for 4 channels D1031Q, 1.0 W for 2 channels D1031D with 24 V supply voltage, input closed and transistors energized.

Max. power consumption: at 30 V supply voltage, short circuit input and transistors energized, 1.4 W for 4 channels D1031Q, 1.0 W for 2 channels D1031D.

Isolation (Test Voltage): I.S. In/Out 1.5 KV; I.S. In/Supply 1.5 KV; Out/Supply 500 V; Out 1-3/Out 2-4 500 V.

Input switching current levels: ON ≥ 2.1 mA, OFF ≤ 1.2 mA, switch current ≈ 1.65 mA ± 0.2 mA hysteresis.

Fault current levels: open fault ≤ 0.2 mA, short fault ≥ 6.8 mA

(when enabled both faults de-energize channel transistor with quad channel unit D1031Q or actuate fault transistor with dual channel unit D1031D).

Input equivalent source: 8 V 1 K Ω typical (8 V no load, 8 mA short circuit).

Output: voltage free SPST optocoupled open-collector transistor.

Open-collector rating: 100 mA at 35 V (≤ 2.0 V voltage drop).

Leakage current: ≤ 50 μ A at 35 V.

Response time: 500 μ s.

Frequency response: 1 KHz maximum.

Compatibility:



CE mark compliant, conforms to 94/9/EC Atex Directive and to 2004/108/CE EMC Directive.

Environmental conditions: Operating: temperature limits -20 to +60 °C, relative humidity max 90 % non condensing, up to 35 °C.

Storage: temperature limits -45 to +80 °C.



Safety Description:

II (1) G [Ex ia Ga] IIC, II (1) D [Ex ia Da] IIIC, I (M1) [Ex ia Ma] I, II 3G Ex nA II T4, [Ex ia Ga] IIC, [Ex ia Da] IIIC, [Ex ia Ma] I associated electrical apparatus.

Uo/Voc = 10.7 V, Io/Isc = 15 mA, Po/Po = 39 mW at terminals 13-14, 15-16, 9-10, 11-12.

Um = 250 Vrms, -20 °C \leq Ta \leq 60 °C.

Approvals: DMT 01 ATEX E 042 X conforms to EN60079-0, EN60079-11, EN60079-26, EN61241-0, EN61241-11,

IECEx BVS 07.0027X conforms to IEC60079-0, IEC60079-11, IEC60079-26, IEC61241-0, IEC61241-11, IMQ 09 ATEX 013 X conforms to EN60079-0, EN60079-15,

UL & C-UL E222308 conforms to UL913 (Div.1), UL 60079-0 (General, All Zones), UL60079-11 (Intrinsic Safety "i" Zones 0 & 1), UL60079-15 ("n" Zone 2), UL 1604 (Div.2) for UL and

CSA-C22.2 No.157-92 (Div.1), CSA-E60079-0 (General, All Zones), CSA-E60079-11 (Intrinsic Safety "i" Zones 0 & 1), CSA-C22.2 No. 213-M1987 (Div. 2) and

CSA-E60079-15 ("n" Zone 2) for C-UL, refer to control drawing ISM0129 for complete UL and C-UL safety and installation instructions,

FM & FM-C No. 3024643, 3029921C, conforms to Class 3600, 3610, 3611, 3810 and C22.2 No.142, C22.2 No.157, C22.2 No.213, E60079-0, E60079-11, E60079-15,

Russia according to GOST 12.2.007.0-75, R 51330.0-99, R 51330.10-99 [Exia] IIC X, Ukraine according to GOST 12.2.007.0,22782.0,22782.5 Exia IIC X,

DNV and KR Type Approval Certificate for marine applications.

Mounting: T35 DIN Rail according to EN50022.

Weight: about 130 g D1031Q, 120 g D1031D.

Connection: by polarized plug-in disconnect screw terminal blocks to accommodate terminations up to 2.5 mm².

Location: Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4, Class I, Division 2, Groups A, B, C, D Temperature Code T4 and Class I, Zone 2, Group IIC, IIB, IIA T4 installation.

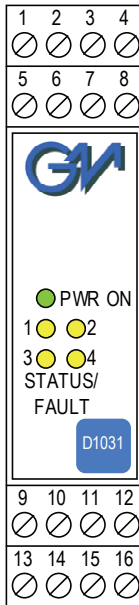
Protection class: IP 20.

Dimensions: Width 22.5 mm, Depth 99 mm, Height 114.5 mm.

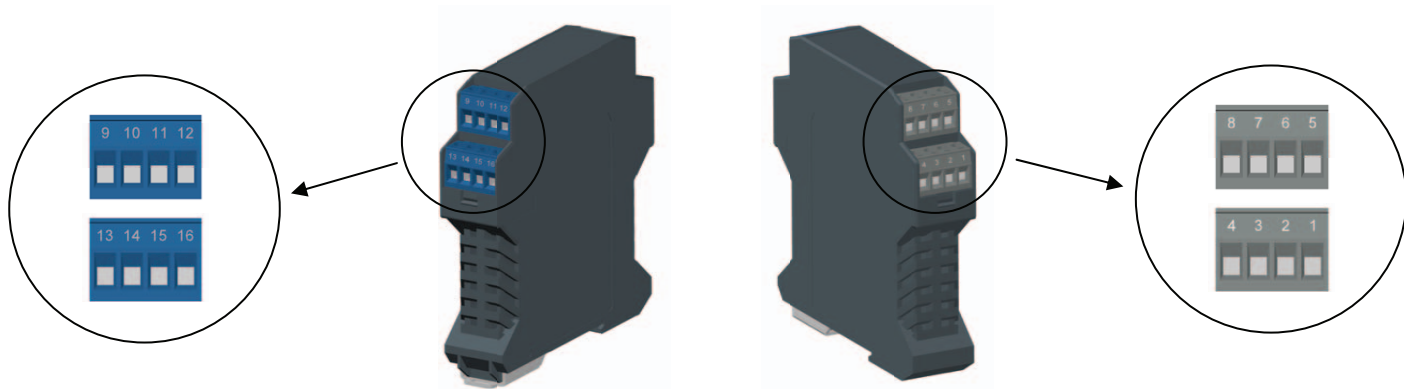
Ordering information

Model: D1031		
2 channels	D	
4 channels	Q	
Power Bus enclosure		/B

Front Panel and Features



- Input from Zone 0 (Zone 20), Division 1, installation in Zone 2, Division 2.
- NO/NC contact/proximity Detector Input.
- Four opto isolated voltage free Transistor Output Signals.
- Transistor Output for fault detection on dual channel version.
- Three port isolation, Input/Output/Supply.
- EMC Compatibility to EN61000-6-2, EN61000-6-4.
- In-field programmability by DIP Switch.
- ATEX, IECEX, UL & C-UL, FM & FM-C, Russian and Ukrainian Certifications.
- Type Approval Certificate DNV and KR for marine applications.
- High Reliability, SMD components.
- High Density, four channels per unit.
- Simplified installation using standard DIN Rail and plug-in terminal blocks.
- 250 Vrms (Um) max. voltage allowed to the instruments associated with the barrier.



D1031Q

HAZARDOUS AREA		SAFE AREA	
9	+ Input Ch 3 for Proximity or Input Ch 3 for Voltage free Contact	1	Output Ch 1
10	- Input Ch 3 for Proximity or Input Ch 3 for Voltage free Contact	2	Output Common Ch 1 and Ch 3
11	+ Input Ch 4 for Proximity or Input Ch 4 for Voltage free Contact	3	+ Power Supply 24 Vdc
12	- Input Ch 4 for Proximity or Input Ch 4 for Voltage free Contact	4	- Power Supply 24 Vdc
13	+ Input Ch 1 for Proximity or Input Ch 1 for Voltage free Contact	5	Output Ch 2
14	- Input Ch 1 for Proximity or Input Ch 1 for Voltage free Contact	6	Output Common Ch 2 and Ch 4
15	+ Input Ch 2 for Proximity Input Ch 2 for Voltage free Contact	7	Output Ch 3
16	- Input Ch 2 for Proximity Input Ch 2 for Voltage free Contact	8	Output Ch 4

D1031D

HAZARDOUS AREA		SAFE AREA	
13	+ Input Ch 1 for Proximity or Input Ch 1 for Voltage free Contact	1	Output Ch 1-A
14	- Input Ch 1 for Proximity or Input Ch 1 for Voltage free Contact	2	Output Common Ch 1-A and Ch 1-B
15	+ Input Ch 2 for Proximity or Input Ch 2 for Voltage free Contact	3	+ Power Supply 24 Vdc
16	- Input Ch 2 for Proximity or Input Ch 2 for Voltage free Contact	4	- Power Supply 24 Vdc
		5	Output Ch 2-A
		6	Output Common Ch 2-A and Ch 2-B
		7	Output Ch 1-B
		8	Output Ch 2-B

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 gas group encountered and that its maximum allowable voltage, current, power (U_i/V_{max} , I_i/I_{max} , P_i/P_i) are not exceeded by the safety parameters (U_o/V_o , I_o/I_{sc} , P_o/P_o) of the D1031 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 (C_o/C_a , L_o/L_a , L_o/R_o) given in the Associated Apparatus parameters for the effective gas group. See parameters on enclosure side and the ones indicated in the table below:

D1031 Terminals		D1031 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	13 -14	$U_o / V_o = 10.7 \text{ V}$	\leq	U_i / V_{max}
Ch2	15 -16			
Ch3	9 - 10			
Ch4	11 - 12			
Ch1	13 -14	$I_o / I_{sc} = 15 \text{ mA}$	\leq	I_i / I_{max}
Ch2	15 -16			
Ch3	9 - 10			
Ch4	11 - 12			
Ch1	13 -14	$P_o / P_o = 39 \text{ mW}$	\leq	P_i / P_i
Ch2	15 -16			
Ch3	9 - 10			
Ch4	11 - 12			

D1031 Terminals		D1031 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
Ch1	13 -14	$C_o / C_a = 2.23 \mu\text{F}$ (IIC-A, B)	\geq	$C_i / C_i \text{ device} + C \text{ cable}$
Ch2	15 -16	$C_o / C_a = 15.6 \mu\text{F}$ (IIB-C)		
Ch3	9 - 10	$C_o / C_a = 69 \mu\text{F}$ (IIA-D)		
Ch4	11 - 12			
Ch1	13 -14	$L_o / L_a = 172 \text{ mH}$ (IIC-A, B)	\geq	$L_i / L_i \text{ device} + L \text{ cable}$
Ch2	15 -16	$L_o / L_a = 689 \text{ mH}$ (IIB-C)		
Ch3	9 - 10	$L_o / L_a = 1379 \text{ mH}$ (IIA-D)		
Ch4	11 - 12			
Ch1	13 -14	$L_o / R_o = 930 \mu\text{H}/\Omega$ (IIC-A, B)	\geq	$L_i / R_i \text{ device and L cable} / R \text{ cable}$
Ch2	15 -16	$L_o / R_o = 3720 \mu\text{H}/\Omega$ (IIB-C)		
Ch3	9 - 10			
Ch4	11 - 12	$L_o / R_o = 7440 \mu\text{H}/\Omega$ (IIA-D)		

NOTE for USA and Canada:
 IIC equal to Gas Groups A, B, C, D, E, F and G,
 IIB equal to Gas Groups C, D, E, F and G,
 IIA equal to Gas Groups D, E, F and G

For installations in which both the C_i and L_i of the Intrinsically Safe apparatus exceed 1 % of the C_o and L_o parameters of the Associated Apparatus (excluding the cable), then 50 % of C_o and L_o parameters are applicable and shall not be exceeded (50 % of the C_o and L_o become the limits which must include the cable such that $C_i \text{ device} + C \text{ cable} \leq 50 \% \text{ of } C_o$ and $L_i \text{ device} + L \text{ cable} \leq 50 \% \text{ of } L_o$).

If the cable parameters are unknown, the following value may be used: Capacitance 60pF per foot (180pF per meter), Inductance 0.20μH per foot (0.60μH per meter).

The Intrinsic Safety Entity Concept allows the interconnection of Intrinsically Safe devices approved with entity parameters not specifically examined in combination as a system when the above conditions are respected.

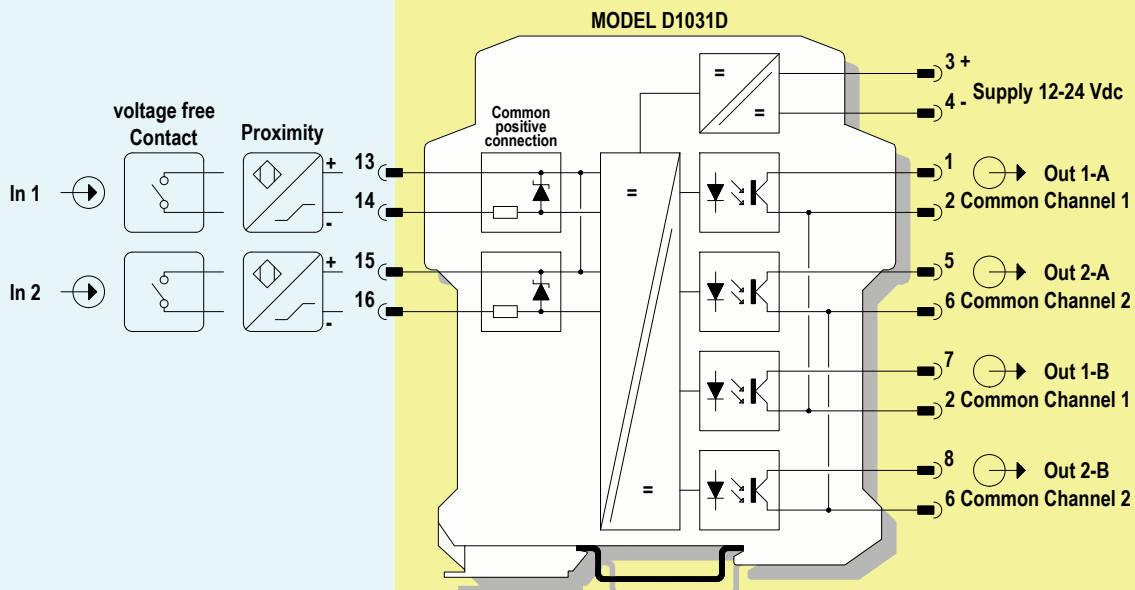
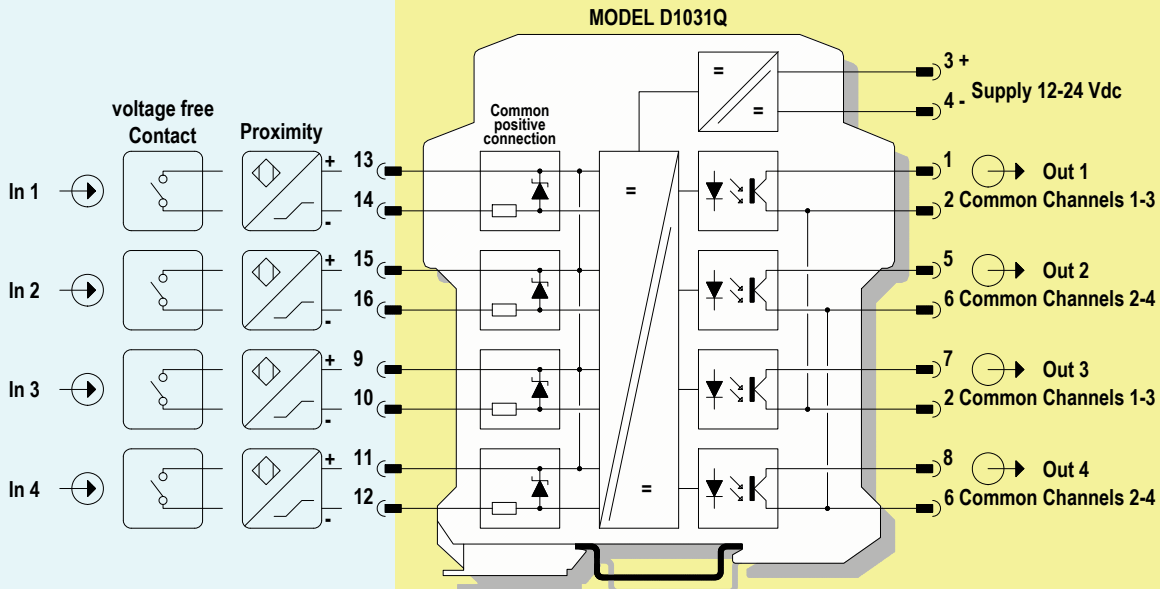
For Division 1 and Zone 0 installations, the configuration of Intrinsically Safe Equipment must be FM approved under Entity Concept (or third party approved);

for Division 2 installations, the configuration of Intrinsically Safe Equipment must be FM approved under non-incendive field wiring or Entity Concept (or third party approved).

Function Diagram

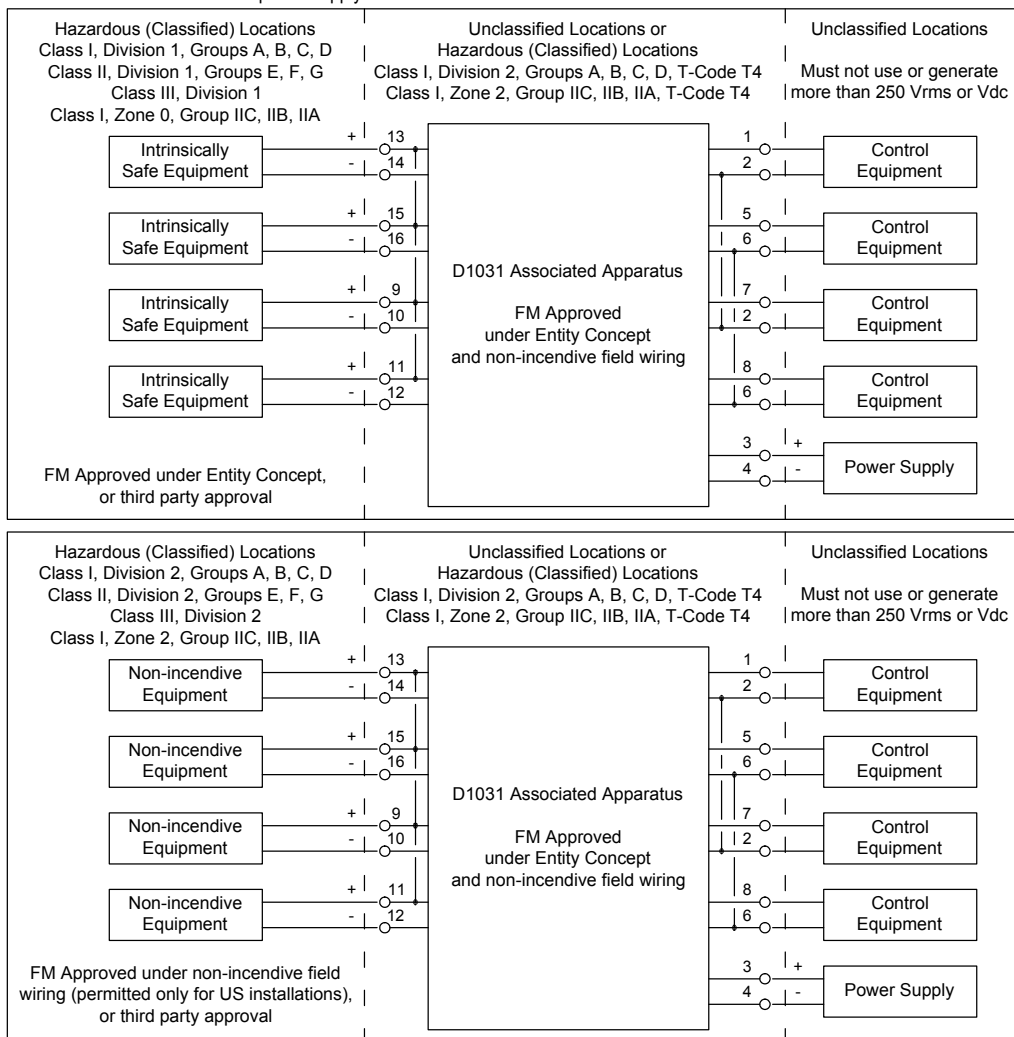
HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,
CLASS I, ZONE 0, GROUP IIC

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



Warning

D1031 series are isolated Intrinsically Safe Associated Apparatus installed into standard EN50022 T35 DIN Rail located in Safe Area/Non Hazardous Locations or Zone 2, Group IIC, Temperature Classification T4, Class I, Division 2, Groups A, B, C, D, Temperature Code T4 and Class I, Zone 2, Group IIC, IIB, IIA Temperature Code T4 Hazardous Area/Hazardous Locations (according to EN/IEC60079-15, FM Class No. 3611, CSA-C22.2 No. 213-M1987, CSA-E60079-15) within the specified operating temperature limits Tamb -20 to +60 °C, and connected to equipment with a maximum limit for AC power supply Um of 250 Vrms.



Non-incendive field wiring is not recognized by the Canadian Electrical Code, installation is permitted in the US only.

For installation of the unit in a Class I, Division 2 or Class I, Zone 2 location, the wiring between the control equipment and the D1031 associated apparatus shall be accomplished via conduit connections or another acceptable Division 2, Zone 2 wiring method according to the NEC and the CEC.

Not to be connected to control equipment that uses or generates more than 250 Vrms or Vdc with respect to earth ground.

D1031 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), BS 5345 Pt4, VDE 165, ANSI/ISA RP12.06.01 Installation of Intrinsically Safe System for Hazardous (Classified) Locations, National Electrical Code NEC ANSI/NFPA 70 Section 504 and 505, Canadian Electrical Code CEC) 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/Hazardous Locations or unless area is known to be nonhazardous.

Warning: substitution of components may impair Intrinsic Safety and suitability for Division 2, Zone 2.

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

D1031 accepts as an input from Hazardous Area/Hazardous Locations a proximity sensor or voltage free electrical contact and repeats their status to Safe Area/Non Hazardous Locations by optoisolated open collector transistor. Presence of supply power and status of output (energized or de-energized), as well as integrity or fault condition of sensor and connecting line are displayed by signaling LEDs (green for power, yellow for status and red for fault condition). D1031Q (quad channel type) has four independent input channels and actuates the corresponding output transistor; two actuation modes can be independently DIP switch configured for each input channel:

Normally open input / Normally close transistor or Normally close input / Normally close transistor.

Contact or proximity sensor and its connection line short or open circuit fault detection is also DIP switch configurable. Fault detection can be enabled (in case of fault de-energizes the corresponding output channel transistor (open) and turns ON the fault LED) or be disabled (in case of fault the corresponding output channel transistor repeats the input line open or close status as configured). D1031D (dual channel type) has two input channel and four output transistors; the unit has two DIP switch configurable operating modes:

A) Input channel actuates in parallel output transistors (providing a DPST type of output). Transistors actuation can be independently configured for each output in two modes:

Normally open input / Normally close transistor or Normally close input / Normally close transistor

B) Input channel actuates output transistor (A) configurable in two modes as above. Output transistor B operates as fault output (in case of input fault, transistor B actuates and the fault LED turns on while transistor A repeats the input line as configured). Actuation can be configured in two modes:

No input fault / Close transistor (it de-energizes in case of fault) or No input fault / Open transistor (it energizes in case of fault).

Note: use of voltage free electrical contacts with fault detection enabled requires, near the switch at the end of the line, a 1 KΩ series connected resistor and a 10 KΩ parallel connected resistor 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

D1031 series are switch/proximity detector repeaters housed in a plastic enclosure suitable for installation on T35 DIN Rail according to EN50022.

D1031 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 or Division 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 and configuration DIP switches.

Identify the number of channels of the specific card (e.g. D1031D is a dual channel model and D1031Q is a quad channel model), the function and location of each connection terminal using the wiring diagram on the corresponding section, as an example:

Connect 12-24 Vdc power supply positive at terminal "3" and negative at terminal "4".

For Model D1031Q connect common output of channel 1-3 at terminal "2" and transistor output at terminal "1" for channel 1 and "7" for channel 3.

For Model D1031Q connect common output of channel 2-4 at terminal "6" and transistor output at terminal "5" for channel 2 and "8" for channel 4.

For Model D1031D connect proximity sensor or voltage free contact at terminal "13" positive and "14" negative for channel 1, connect at terminal "15" and "16" respectively for channel 2.

For Model D1031Q in addition to channel 1-2 connections above, connect terminal "9" positive and "10" negative for channel 3 and "11" positive and "12" negative for channel 4.

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), BS 5345 Pt4, VDE 165,

ANSI/ISA RP12.06.01 Installation of Intrinsically Safe System for Hazardous (Classified) Locations, National Electrical Code NEC ANSI/NFPA 70 Section 504 and 505,

Canadian Electrical Code CEC), make sure that conductors are well isolated from each other and do not produce any unintentional connection.

Connect SPST output transistors checking the load rating to be within the maximum rating (100 mA, 35 V resistive load).

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 D1031 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.

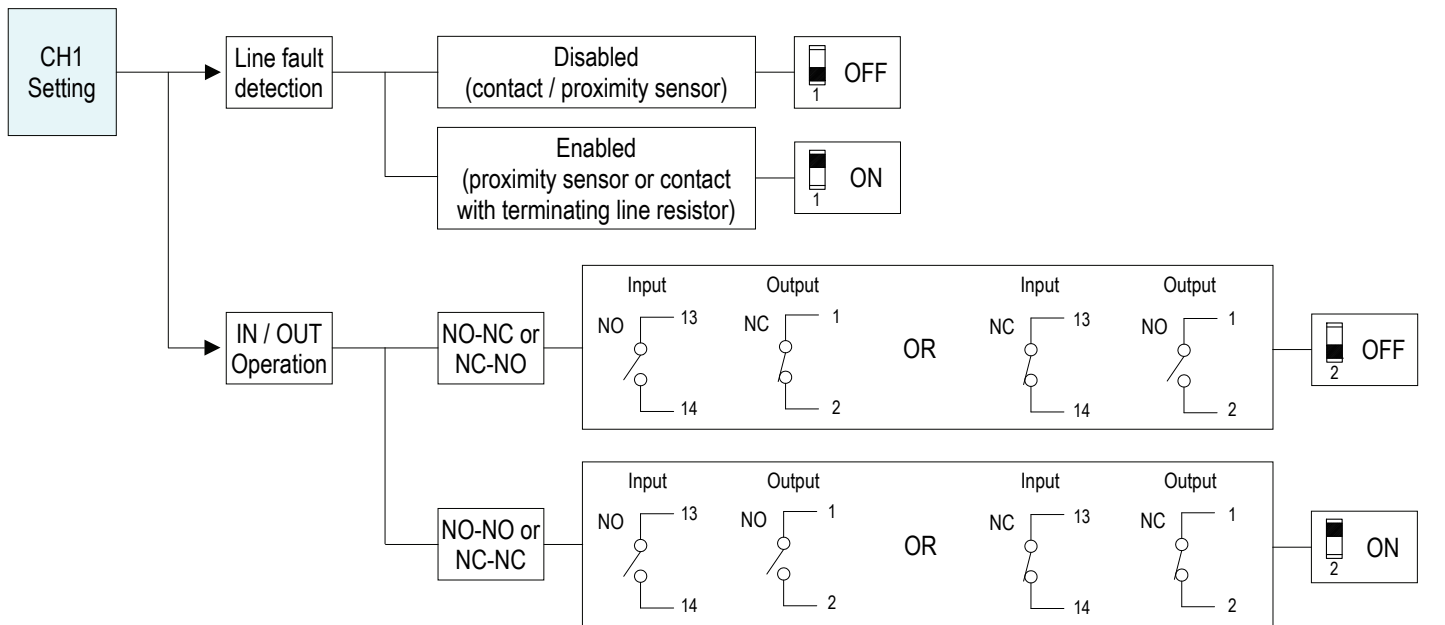
According to EN61010, D1031 series must be connected to SELV or SELV-E supplies.

Start-up

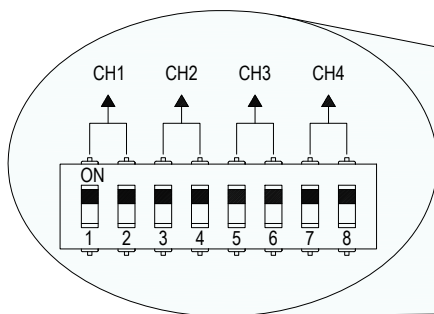
Before powering the unit check that all wires are properly connected, particularly supply conductors and their polarity, input and output wires, also check that Intrinsically Safe conductors and cable trays are segregated (no direct contacts with other non I.S. conductors) and identified either by color 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, status and fault led on each channel must be in accordance with condition of the corresponding input line. If possible close and open input lines one at a time checking the corresponding status and fault leds condition as well as output to be correct.

Configuration

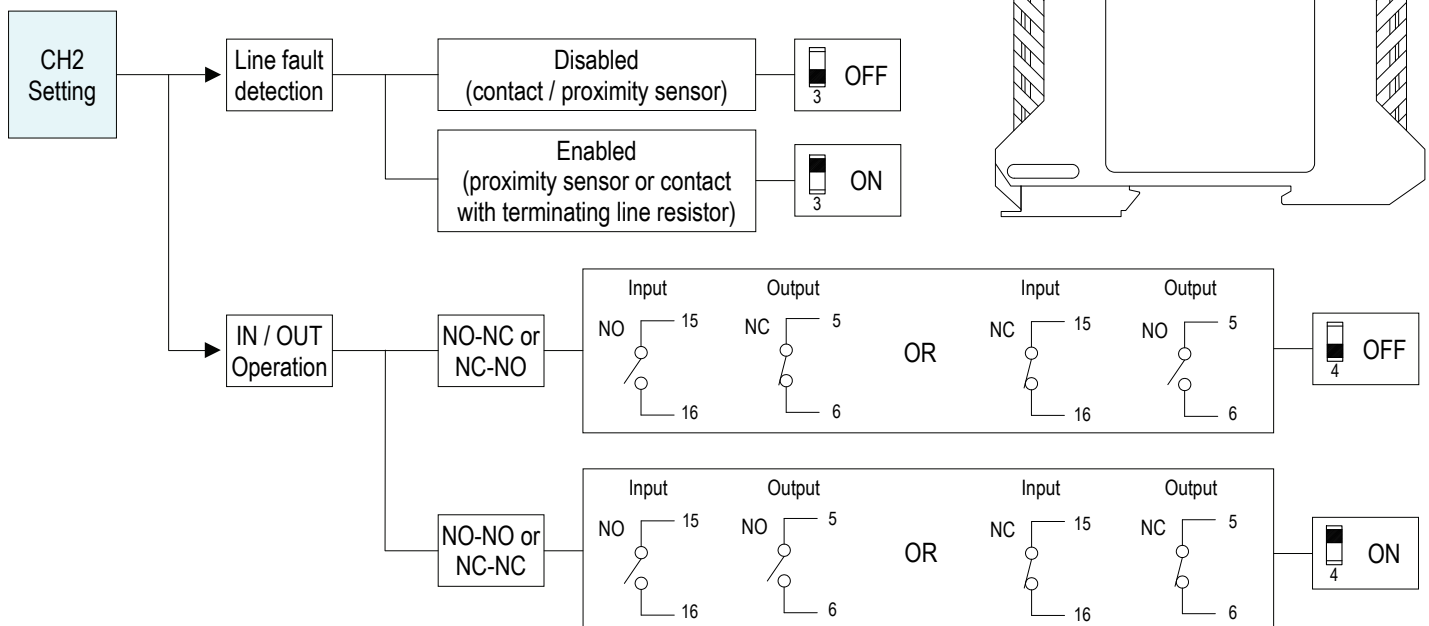
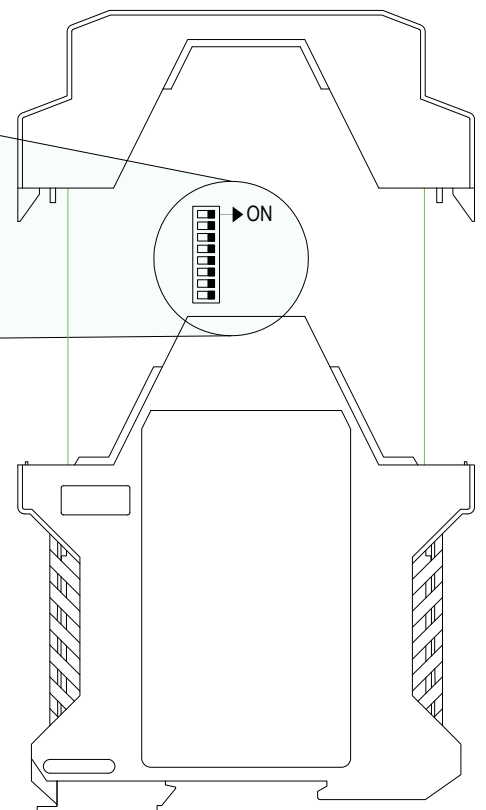
A configuration DIP switch is located on component side of pcb. This switch allows the configuration of input/output relationship, fault detection functions and operating mode.

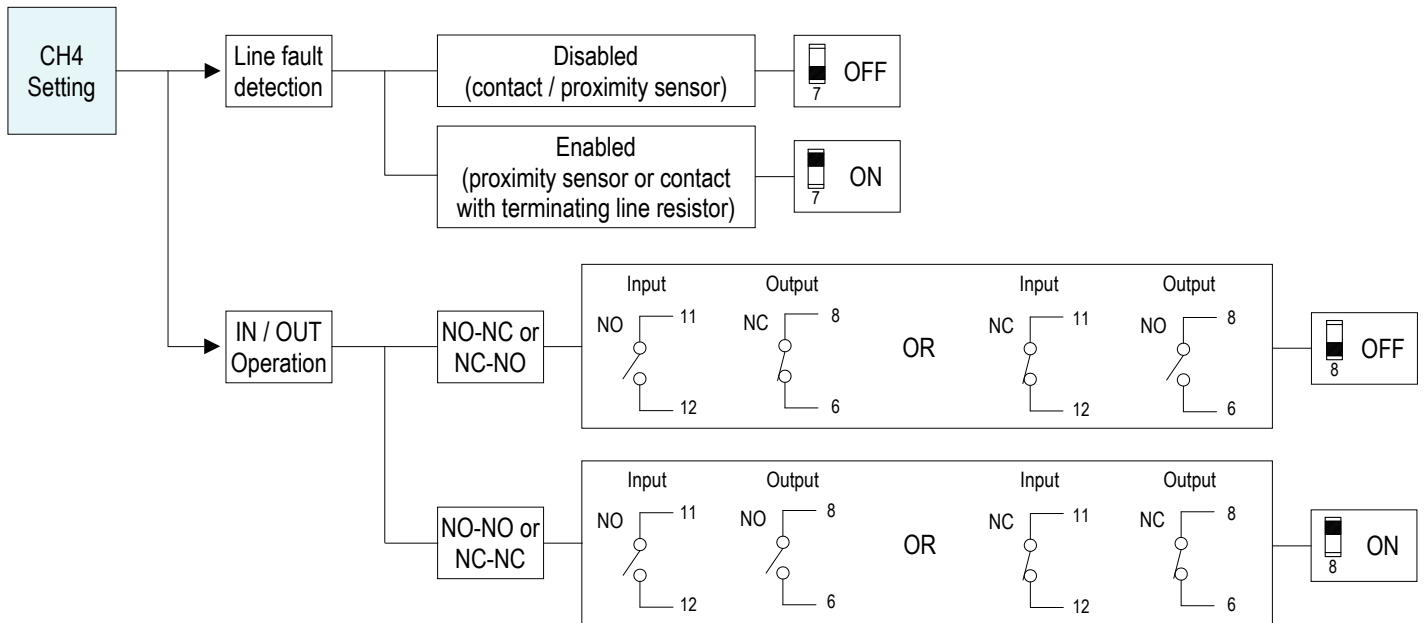
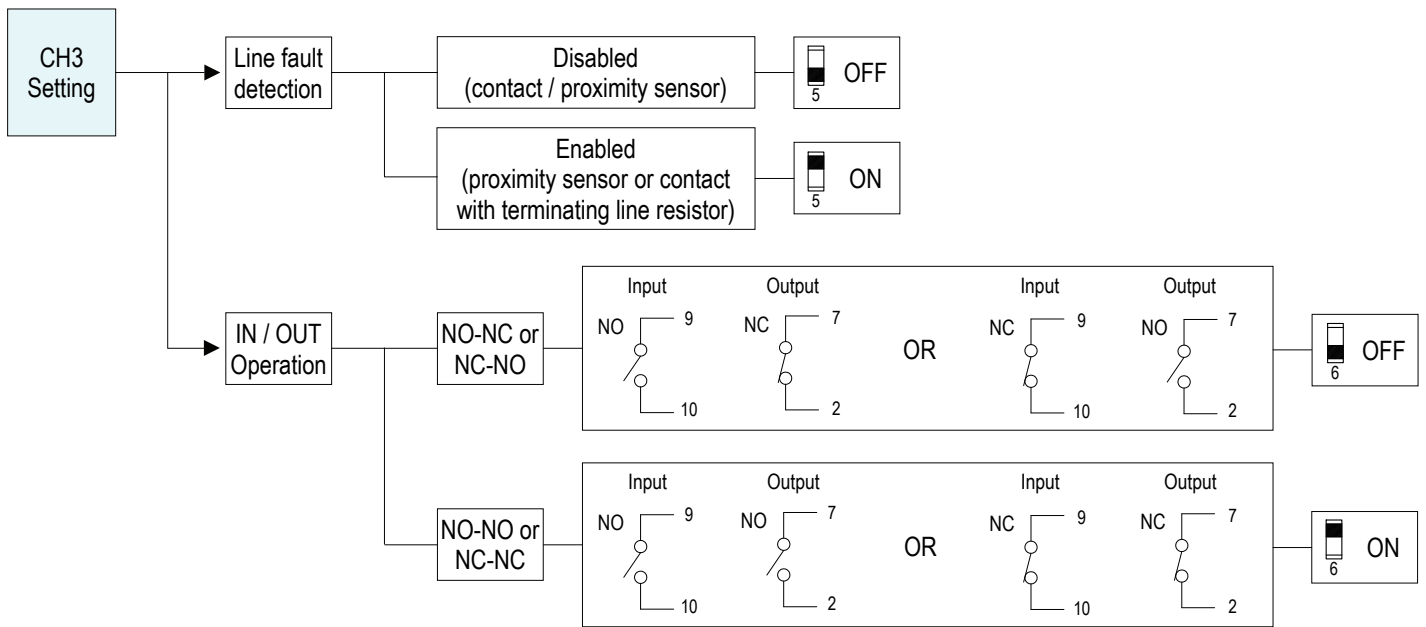


Side A Panel View



Dip switch configuration
D1031Q

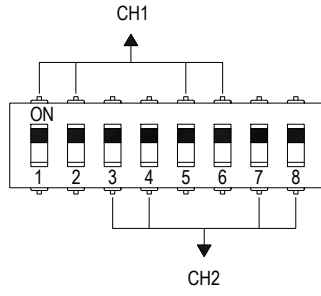




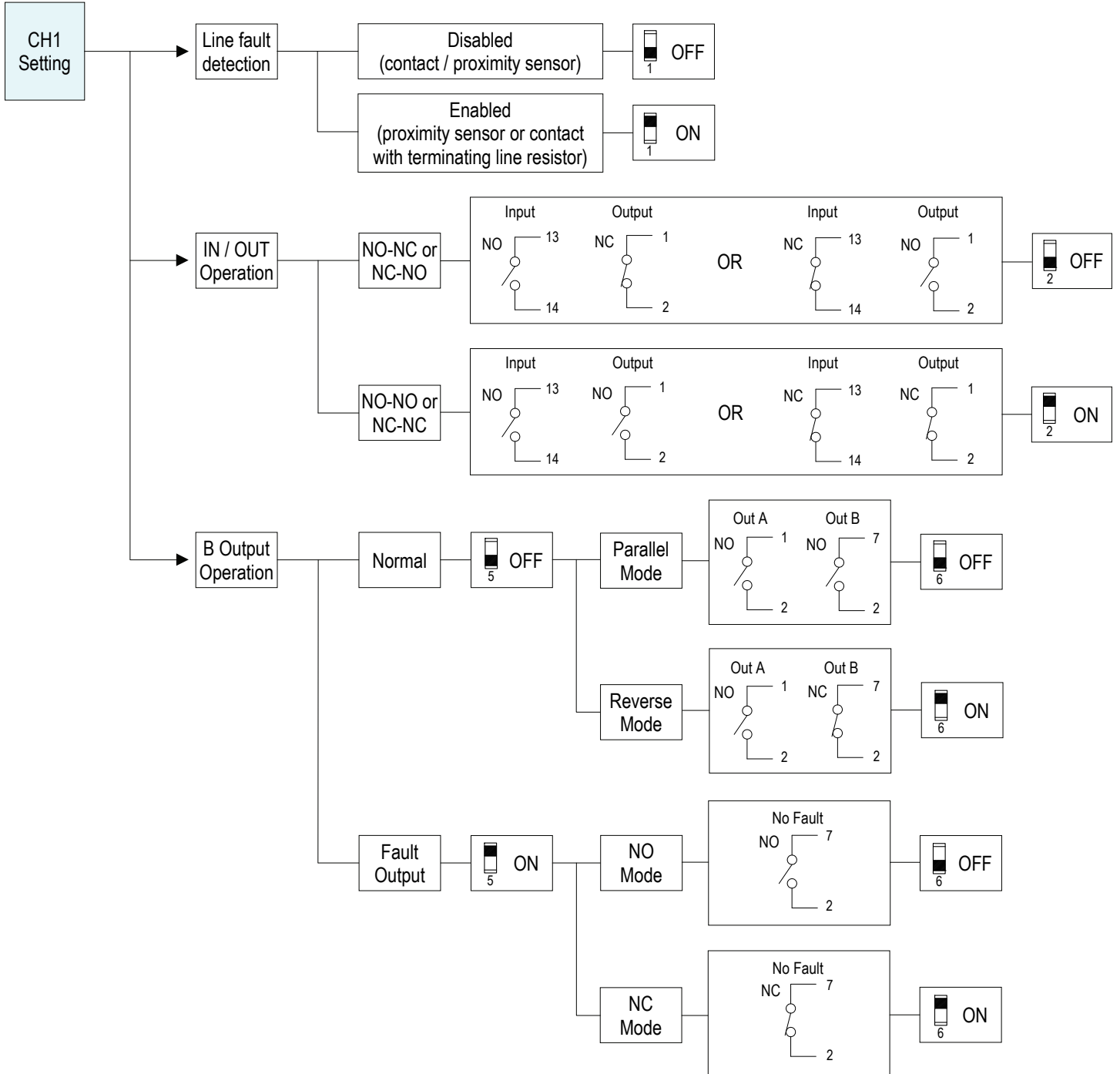
D1031Q Configuration Summary Table

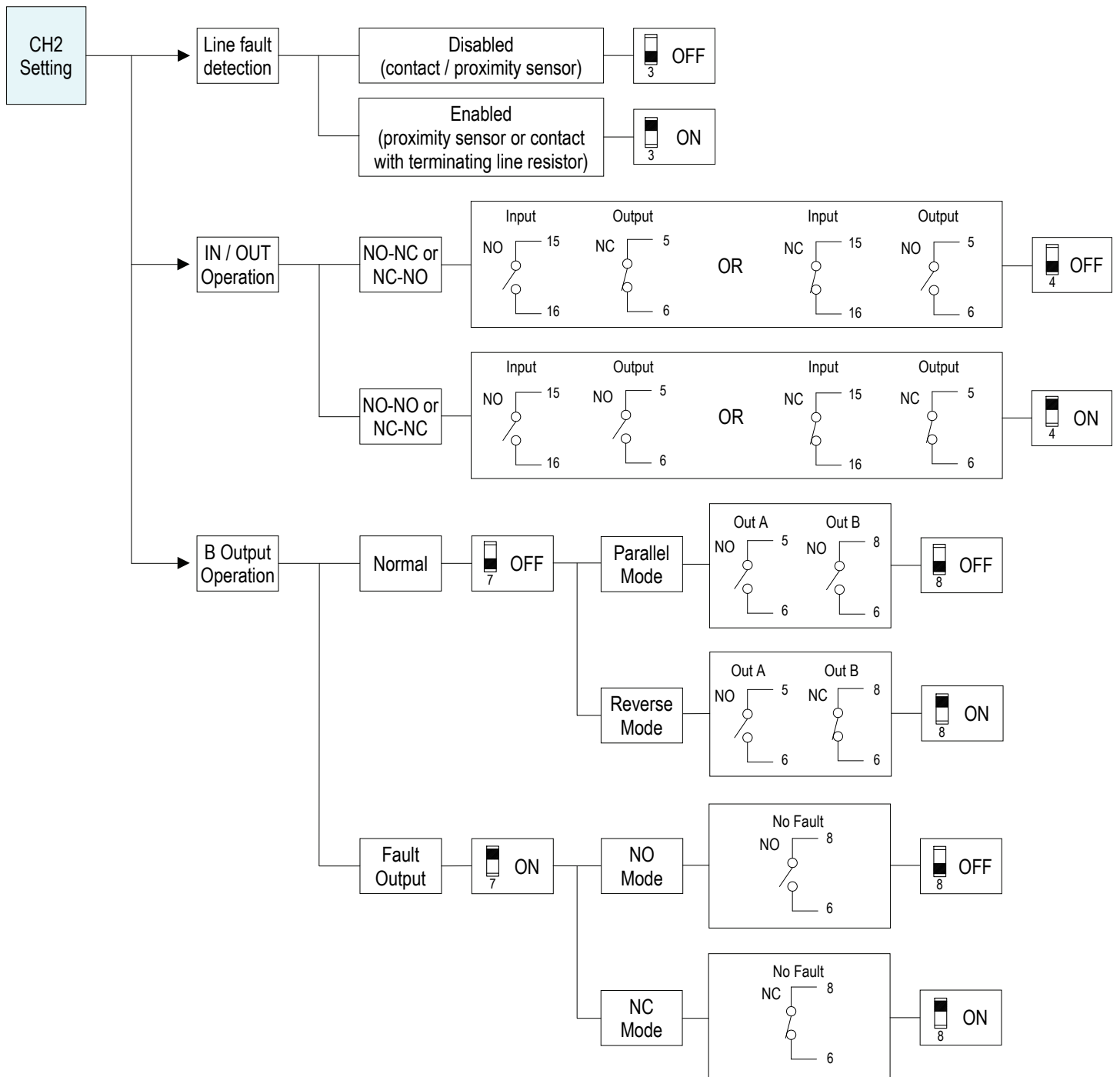
Channel	1	2	3	4	Channel	1	2	3	4
IN/OUT Operation	SW2	SW4	SW6	SW8	Line fault detection	SW1	SW3	SW5	SW7
NO-NC or NC-NO	OFF	OFF	OFF	OFF	Disabled (contact/proximity sensor)	OFF	OFF	OFF	OFF
NO-NO or NC-NC	ON	ON	ON	ON	Enabled (proximity sensor or contact with terminating line resistor)	ON	ON	ON	ON

Configuration



Dip switch configuration
D1031D





D1031D Configuration Summary Table

Channel	1	2	Channel	1	2	Channel	1	2	Mode	1	2
IN/OUT Operation	SW2	SW4	Line fault detection	SW1	SW3	B Output Operation	SW5	SW7		SW6	SW8
NO-NC or NC-NO	OFF	OFF	Disabled	OFF	OFF	Normal	OFF	OFF	Direct	OFF	OFF
NO-NO or NC-NC	ON	ON	Enabled	ON	ON				Reverse	ON	ON
						Fault Output	ON	ON	NO	OFF	OFF
									NC	ON	ON