



# INSTRUCTION MANUAL

Digital Output  
Loop/Bus Powered  
DIN-Rail Model D1045Y

## Characteristics

**General Description:** The D1045 is a dual channel, actuated in alternative, DIN Rail Digital Output module enabling a Safe Area contact, logic level or drive signal, to control a device in Hazardous Area, providing 3 port isolation (input/output/supply). Typical applications include driving 1 or 2 positions directional solenoid valves or other process control devices.

It can also be used as a controllable supply to power measuring or process control equipments in Hazardous Area.

Output channels have the capability of driving loads both in Gas Groups IIC and IIB/IIA with different safety parameters.

**Function:** 2 channels I.S. actuated in alternative to operate Hazardous Area loads from contacts, logic levels or drive logics in Safe Area providing 3 port isolation (input/output/supply), loop or bus powered, as indicated in the function diagram.

**Signalling LEDs:** Power supply indication (green), output status (yellow).

**Field Configurability:** Loop/Bus powered operating mode, output channel driving capability by external wiring.

**EMC:** Fully compliant with CE marking applicable requirements.

## Technical Data

**Supply:** 24 Vdc nom (21.5 to 30 Vdc) reverse polarity protected, ripple within voltage limits  $\leq 5$  Vpp.

**Current consumption @ 24 V:** 90 mA with output energized at nominal load, 110 mA with short circuit output.

**Power dissipation:** 1.4 W with 24 V supply voltage, output energized at nominal load.

**Max. power consumption:** at 30 V supply voltage and short circuit output, 2.9 W.

**Isolation (Test Voltage):** I.S. Out/In 1.5 KV; I.S. Out/Supply 1.5 KV; In/Supply 500 V; In/In 500 V.

**Input:** voltage free contact, logic level or loop powered.

**Trip voltage levels:** OFF status  $\leq 1.0$  V, ON status  $\geq 6.0$  V (maximum 30 V).

**Current consumption @ 24 V:** 3 mA ( $\approx 10$  K $\Omega$  input impedance).

**Output:** 70 mA at 11.3 V (17.0 V no load, 81.4  $\Omega$  series resistance) at terminals 13-14, 9-10 (Out A).

70 mA at 12.2 V (17.0 V no load, 68.6  $\Omega$  series resistance) at terminals 15-16, 11-12 (Out B).

**Short circuit current:**  $\geq 85$  mA (90 mA typical)

**Response time:** 20 ms (power up in 600 ms typical in loop powered mode).

**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 = 18.9 V, Io/Isc = 249 mA, Po/Po = 1173 mW at terminals 13-14, 9-10 (Out A).

Uo/Voc = 18.9 V, Io/Isc = 307 mA, Po/Po = 1286 mW at terminals 15-16, 11-12 (Out B).

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,

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.

**Mounting:** T35 DIN Rail according to EN50022.

**Weight:** about 130 g.

**Connection:** by polarized plug-in disconnect screw terminal blocks to accommodate terminations up to 2.5 mm<sup>2</sup>.

**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.

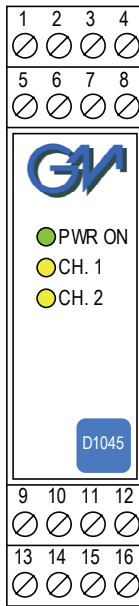
**Protection class:** IP 20.

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

## Ordering information

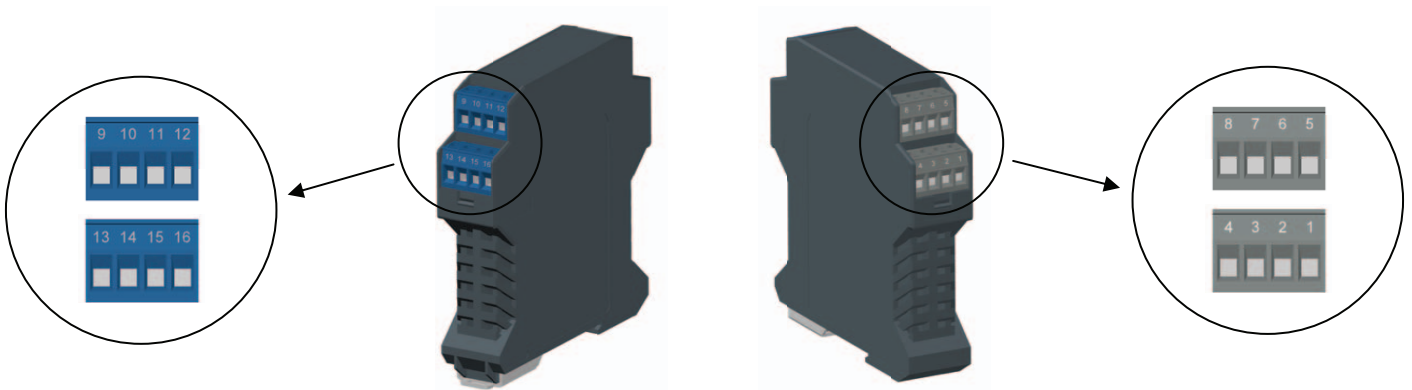
Model:	D1045Y	
Power Bus enclosure		/B

## Front Panel and Features



- Output to Zone 0 (Zone 20), Division 1, installation in Zone 2, Division 2.
- Voltage input with isolated commands, loop powered or bus powered.
- Suitable for driving 1 or 2 positions directional solenoid valves.
- Output short circuit proof and current limited.
- Three port isolation, Input/Output/Supply.
- EMC Compatibility to EN61000-6-2, EN61000-6-4.
- ATEX, IECEx, FM & FM-C Certifications.
- High Reliability, SMD components.
- Simplified installation using standard DIN Rail and plug-in terminal blocks.
- 250 Vrms (Um) max. voltage allowed to the instruments associated with the barrier.

## Terminal block connections



### HAZARDOUS AREA

<b>9</b>	+ Output Ch 2-A for Solenoid Valve
<b>10</b>	- Output Ch 2-A for Solenoid Valve
<b>11</b>	+ Output Ch 2-B for Solenoid Valve
<b>12</b>	- Output Ch 2-B for Solenoid Valve
<b>13</b>	+ Output Ch 1-A for Solenoid Valve
<b>14</b>	- Output Ch 1-A for Solenoid Valve
<b>15</b>	+ Output Ch 1-B for Solenoid Valve
<b>16</b>	- Output Ch 1-B for Solenoid Valve

### SAFE AREA

<b>1</b>	Loop powered (Open Terminals) or Loop powered (Close Terminals) by jumper
<b>2</b>	Loop powered (Open Terminals) or Loop powered (Close Terminals) by jumper
<b>3</b>	+ Power Supply 24 Vdc
<b>4</b>	- Power Supply 24 Vdc
<b>5</b>	Input Ch 1 for Control
<b>6</b>	Input Ch 1 for Control
<b>7</b>	Input Ch 2 for Control
<b>8</b>	Input Ch 2 for Control

## 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 ( $U_o/V_{oc}$ ,  $I_o/I_{sc}$ ,  $P_o/P_o$ ) of the D1045 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:

D1045 Terminals	D1045 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1 (Out A) 13 - 14	$U_o / V_{oc} = 18.9 V$	$\leq$	$U_i / V_{max}$
Ch2 (Out A) 9 - 10			
Ch1 (Out B) 15 - 16	$U_o / V_{oc} = 18.9 V$		
Ch2 (Out B) 11 - 12			
Ch1 (Out A) 13 - 14	$I_o / I_{sc} = 249 mA$	$\leq$	$I_i / I_{max}$
Ch2 (Out A) 9 - 10			
Ch1 (Out B) 15 - 16	$I_o / I_{sc} = 307 mA$		
Ch2 (Out B) 11 - 12			
Ch1 (Out A) 13 - 14	$P_o / P_o = 1173 mW$	$\leq$	$P_i / P_i$
Ch2 (Out A) 9 - 10			
Ch1 (Out B) 15 - 16	$P_o / P_o = 1286 mW$		
Ch2 (Out B) 11 - 12			

D1045 Terminals	D1045 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
Ch1 (Out A) 13 - 14	$C_o / C_a = 260 nF$ (IIC-A, B) $C_o / C_a = 1.6 \mu F$ (IIB-C)	$\geq$	$C_i / C_i \text{ device} + C \text{ cable}$
Ch2 (Out A) 9 - 10			
Ch1 (Out B) 15 - 16	$C_o / C_a = 260 nF$ (IIC-A, B) $C_o / C_a = 1.6 \mu F$ (IIB-C)		
Ch2 (Out B) 11 - 12			
Ch1 (Out A) 13 - 14	$L_o / L_a = 0.58 mH$ (IIC-A, B) $L_o / L_a = 2.31 mH$ (IIB-C)	$\geq$	$L_i / L_i \text{ device} + L \text{ cable}$
Ch2 (Out A) 9 - 10			
Ch1 (Out B) 15 - 16	$L_o / L_a = 0.38 mH$ (IIC-A, B) $L_o / L_a = 1.52 mH$ (IIB-C)		
Ch2 (Out B) 11 - 12			
Ch1 (Out A) 13 - 14	$L_o / R_o = 30.3 \mu H/\Omega$ (IIC-A, B) $L_o / R_o = 121.2 \mu H/\Omega$ (IIB-C)	$\geq$	$L_i / R_i \text{ device and } L \text{ cable} / R \text{ cable}$
Ch2 (Out A) 9 - 10			
Ch1 (Out B) 15 - 16	$L_o / R_o = 24.5 \mu H/\Omega$ (IIC-A, B) $L_o / R_o = 98.3 \mu H/\Omega$ (IIB-C)		
Ch2 (Out B) 11 - 12			

**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 0.20 $\mu H$  per foot (0.60 $\mu H$  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.

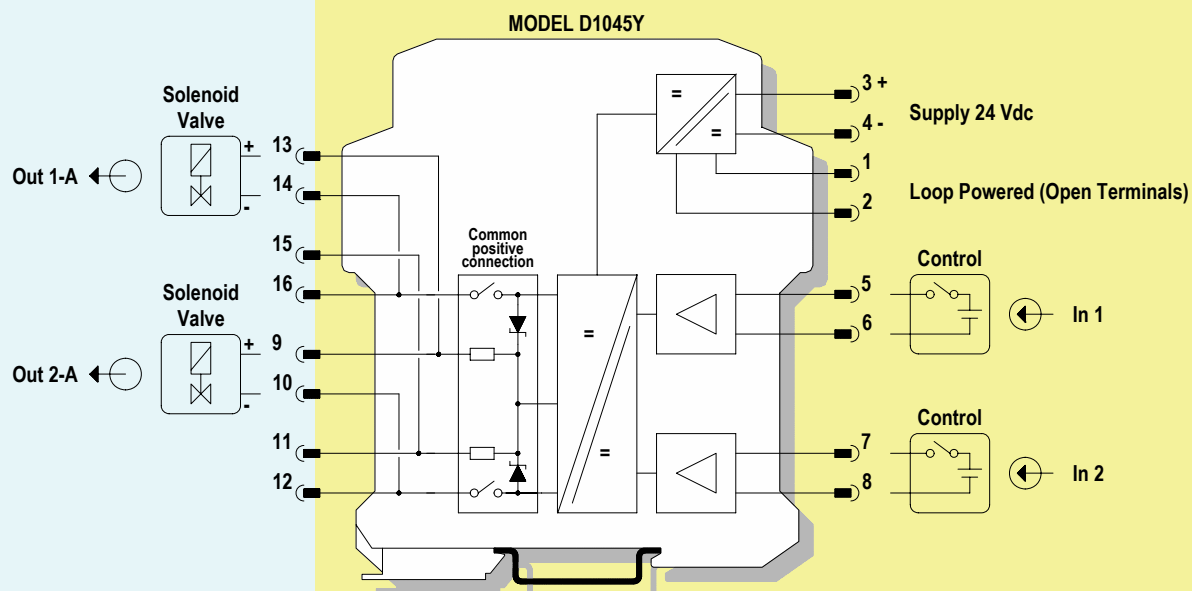
For Division 1 and Zone 0 installations, the configuration of Intrinsically Safe Equipment must be FM approved under Entity Concept (or third party approved);

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).

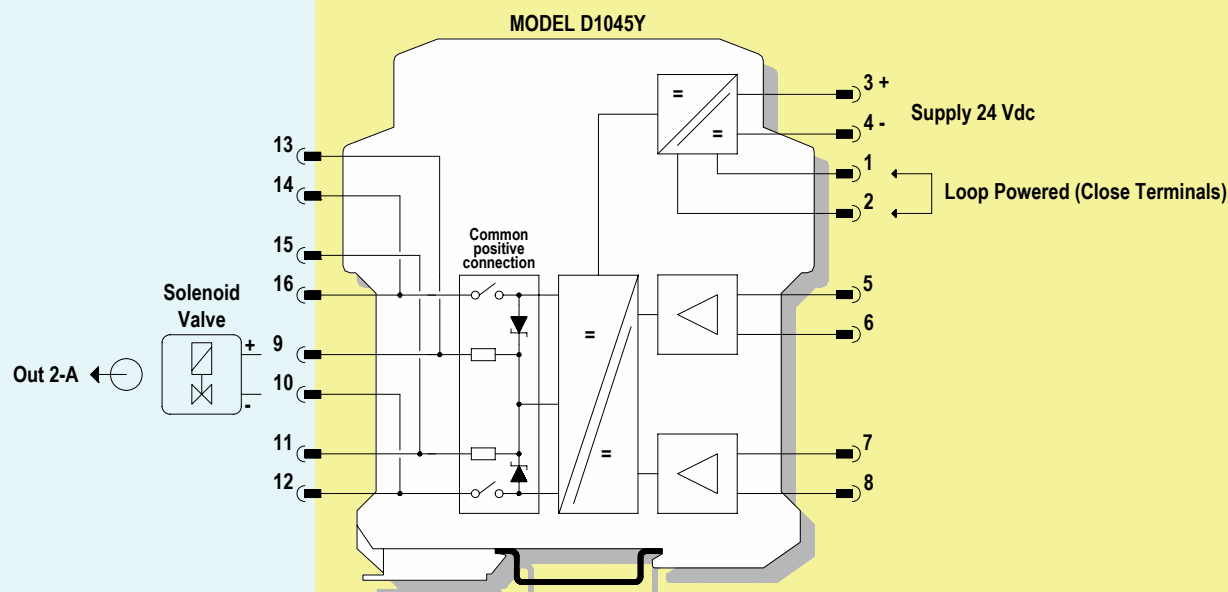
## Function Diagram

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



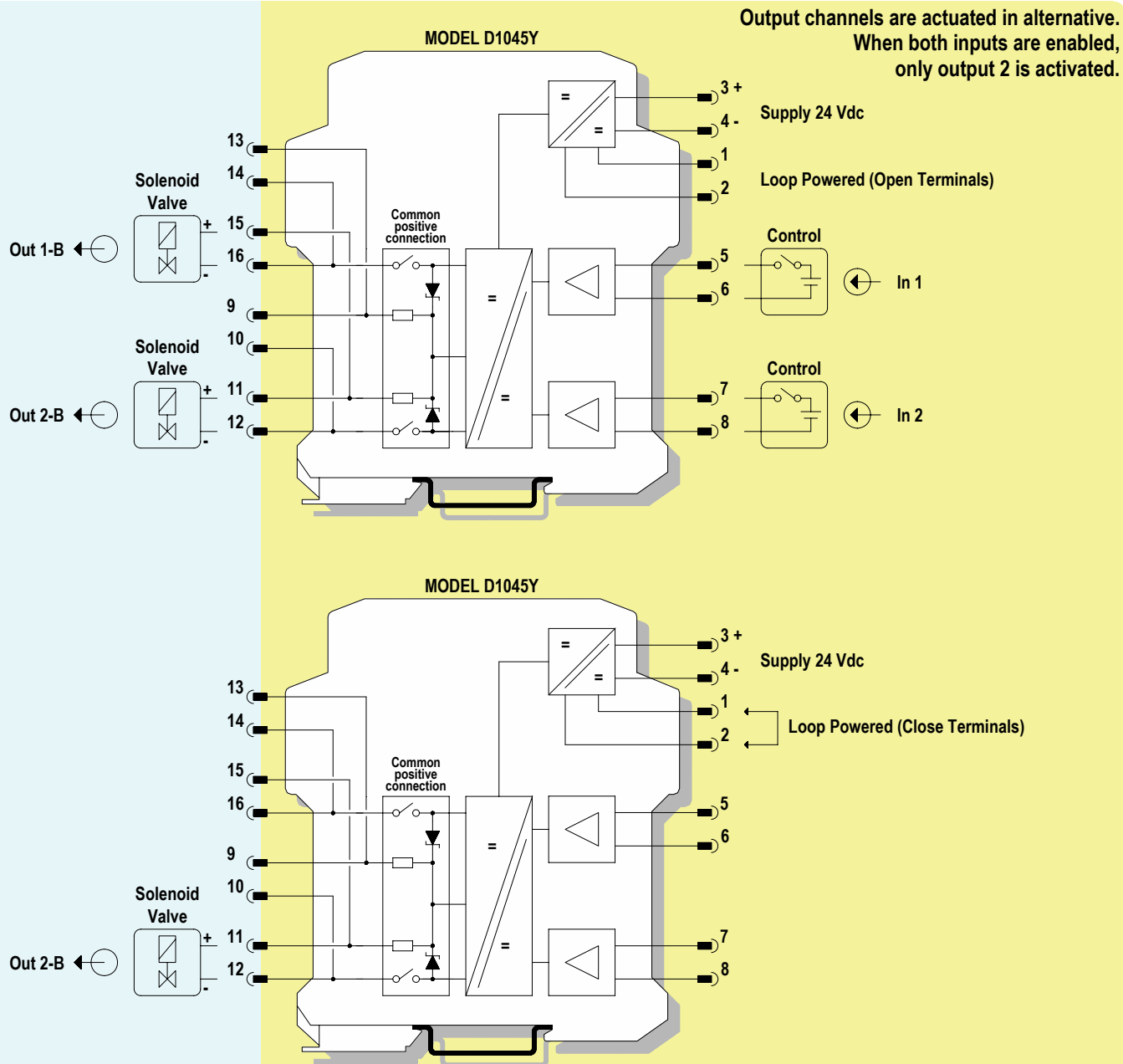
**Output channels are actuated in alternative.  
When both inputs are enabled,  
only output 2 is activated.**



## Function Diagram

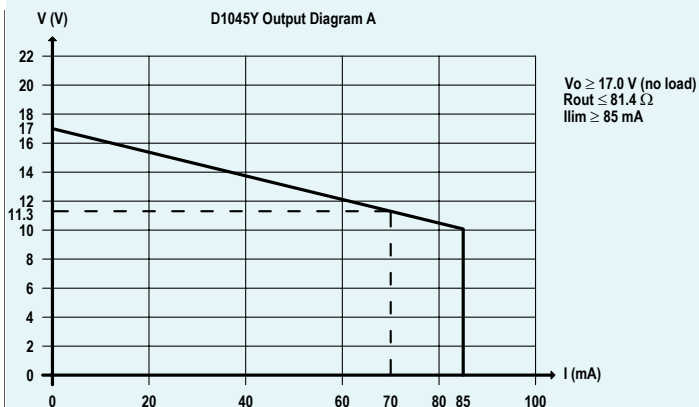
HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,  
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,  
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,  
CLASS I, ZONE 0, GROUP IIC

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

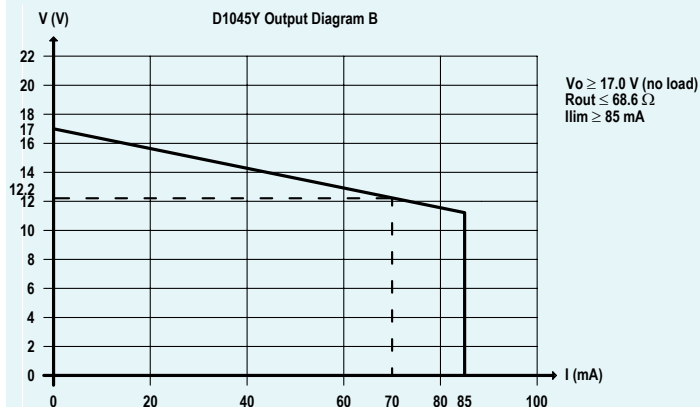


## Output Diagram

D1045Y OUTPUT DIAGRAM OUT A

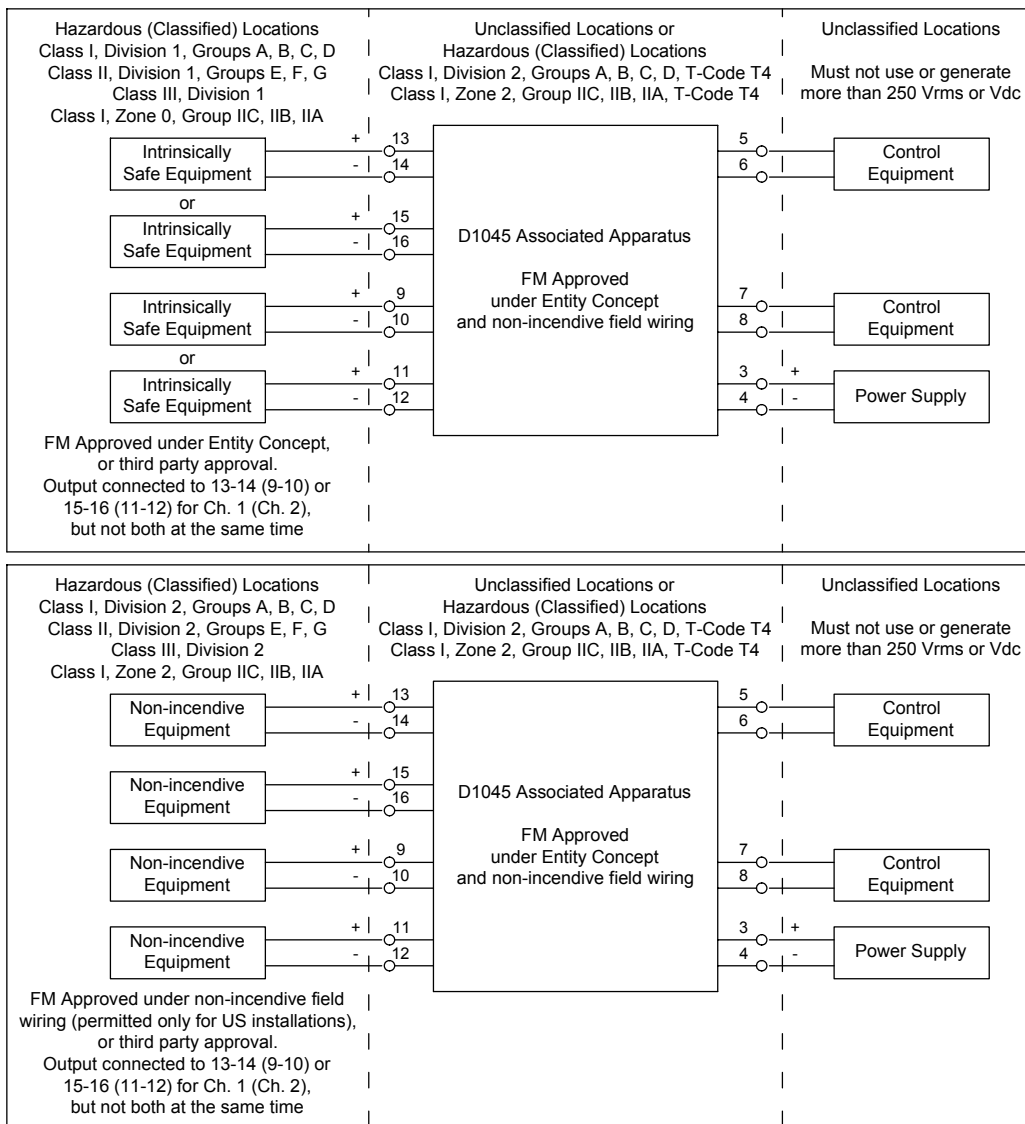


D1045Y OUTPUT DIAGRAM OUT B



## Warning

D1045 is an 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 D1045 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.

D1045 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

Each of the two independent and isolated channels of D1045Y accepts an input from Safe Area/Non Hazardous Locations (logic level or voltage free contact) and provides an output (see the output diagram on data sheet for details of voltage and current to the load) in Hazardous Area/Hazardous Locations to drive Intrinsically Safe loads (solenoid valves, audible alarms, signaling leds etc.). The two channels are actuated independently and in alternative, when both inputs are enabled only output of channel 2 is actuated.

The table below indicates the output conditions:

Input Ch. 1	Input Ch. 2	Output Ch. 1	Output Ch. 2
OFF	OFF	OFF	OFF
ON	OFF	ON	OFF
OFF	ON	OFF	ON
ON	ON	OFF	ON

Presence of supply power and status of output (energized or de-energized) are displayed by signaling LEDs (green for power, yellow for status).



## Installation

D1045 is a digital output isolator housed in a plastic enclosure suitable for installation on T35 DIN Rail according to EN50022.

D1045 unit can be mounted with any orientation over the entire ambient temperature range, see section "Installation in Cabinet" and "Installation of Electronic Equipments in Cabinet" Instruction Manual D1000 series for detailed instructions.

Electrical connection of conductors up to 2.5 mm<sup>2</sup> 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.

Identify the function and location of each connection terminal using the wiring diagram on the corresponding section, as an example:

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

Connect input signal of channel 1 at terminal "5" and "6" regardless the polarity.

Connect input signal of channel 2 at terminal "7" and "8" regardless the polarity.

Connect positive output of channel 1 at terminal "13" and negative output at "14" using Out-A diagram or positive output at terminal "15" and negative at terminal "16" using Out-B diagram.

Connect positive output of channel 2 at terminal "9" and negative output at "10" using Out-A diagram or positive output at terminal "11" and negative at terminal "12" using Out-B diagram.

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.

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 D1045 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, D1045 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 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 leds condition as well as output to be correct.

## Installation in Cabinet

### Power Dissipation of D1045 Isolators


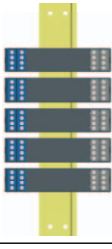
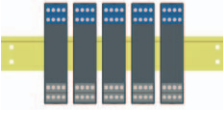
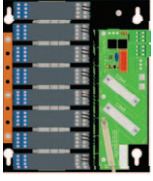
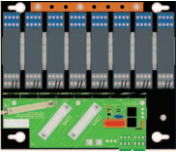
Section "Technical Data" of D1045 isolator specifies the current consumption (maximum current from the nominal power supply, typical 24 Vdc, in normal operation); this data serves to dimension the current rating of the power supply unit. Section "Technical Data" indicates also the maximum power consumption (maximum power required from the power supply in the worst (abnormal) operating conditions like for example supply voltage at 30 Vdc, short circuit on the outputs and on the inputs terminals).

The power dissipated **P<sub>d</sub>** inside the enclosure for analog signal isolators is: **P<sub>d</sub> = Current Consumption (A) \* Supply Voltage (V) - Power Dissipated into the input/output loads**

Digital signal isolators have lower dissipation than analog signal isolators. Isolators are not running at the maximum current all at the same time, the average power consumption of a multitude of isolators can be considered to be only 70 % of the value obtained from the section "Technical Data". Considering the 1/3 load power and the 70 % above discussed, the power effectively dissipated internally by the isolators can therefore become 1/2 of the actual power delivered by the power supply. Digital barriers dissipate all the supply power inside the enclosure consequently the total power dissipation into a cabinet, with mixed analog and digital barriers, is determined by the number of channels more than by the number of isolator enclosures. The following tables give advises for the DIN rail orientation (vertical or horizontal) of the barriers mounting, D1045Y (double channel) isolators, installed on DIN rail, bus or custom board assembly.

#### A) Cabinet with Natural Ventilation


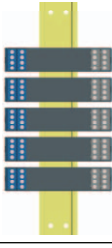
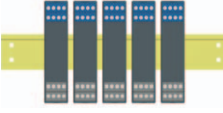
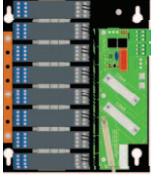
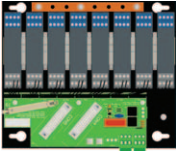
Maximum recommended ambient temperature in °C depending on barrier type and installation method:

Type of Isolator	Single unit Installation	Installation of Multiple units with DIN-rail Bus		Installation on Custom Boards	
		Vertical	Horizontal	Vertical	Horizontal
	Any orientation 	Vertical 	Horizontal 	Vertical 	Horizontal 
D1045Y	60°C	Not recommended <sup>(1)</sup>	30°C	30°C	35°C

<sup>(1)</sup> Installation is not recommended since it would significantly shorten the units life and increase the probability of failures.

#### B) Cabinet with Forced Ventilation

Maximum recommended ambient temperature in °C depending on barrier type and installation method:

Type of Isolator	Single unit Installation	Installation of Multiple units with DIN-rail Bus		Installation on Custom Boards	
		Vertical	Horizontal	Vertical	Horizontal
	Any orientation 	Vertical 	Horizontal 	Vertical 	Horizontal 
D1045Y	60°C	40°C	45°C	45°C	50°C