



INSTRUCTION MANUAL

SIL 3 Switch/Proximity
Detector Interface DIN-Rail
Models D1034S, D1034D

SIL Applications

For Safety Related System and SIL2, SIL3 Applications according IEC61508 & IEC61511 Standards refer to "Functional Safety Manual" document number ISM0071

Characteristics

General Description: The single and dual channel DIN Rail Switch/Proximity Detector Interface, D1034S and D1034D is a high integrity repeater designed to interface contacts or proximity detectors located in Hazardous Area, maintaining a high level of loop integrity (safety integrity level SIL 3 according to IEC61508). Field loop integrity and status (line plus contact or proximator) are continuously and directly monitored, in transparent mode, into the PLC, ESD, DCS using their existing input line, without requiring an additional channel for failure detection. This solution results in 100 % input channel saving with evident space, cost and failure risk benefits.

Function: 1 or 2 totally independent and isolated channels I.S. for voltage free contact or EN60947-5-6 proximity switches. Provides 3 port isolation(input/output/supply).

Signalling LED: Power supply indication (green).

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: 40 mA for 2 channels D1034D, 20 mA for 1 channel D1034S with short circuit input typical.

Current consumption @ 12 V: 80 mA for 2 channels D1034D, 40 mA for 1 channel D1034S with short circuit input typical.

Power dissipation: 1.4 W for 2 channels D1034D, 0.7 W for 1 channel D1034S with 24 V supply voltage, short circuit input and 24 V loop output voltage.

Max. power consumption: at 30 V supply voltage and short circuit input, 1.2 W for 2 channels D1034D, 0.6 W for 1 channel D1034S.

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

Input: Current levels: ≥ 0.1 mA, ≤ 7.0 mA

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

Output: 0.1 to 7.0 mA in sink mode, V min. 5 V at 0 Ω load V max. 30 V, current limited at ≈ 8 mA, repeats input current level.

Response time: 5 ms (10 to 90 % step change).

Compatibility:

CE 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 = 9.6 V, Io/Isc = 11 mA, Po/Po = 25 mW at terminals 14-15, 10-11. 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 ISM0132 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,

TUV Certificate No. C-IS-183645-01, SIL 2 / SIL 3 according to IEC 61508. Please refer to Functional Safety Manual for SIL applications.

DNV and KR Type Approval Certificate for marine applications.

Mounting: T35 DIN Rail according to EN50022.

Weight: about 160 g D1034D, 110 g D1034S.

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.

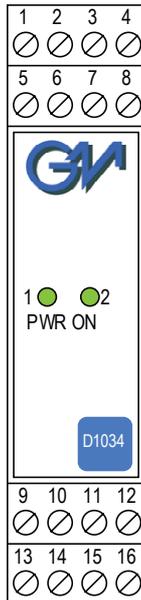
Protection class: IP 20.

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

Ordering information

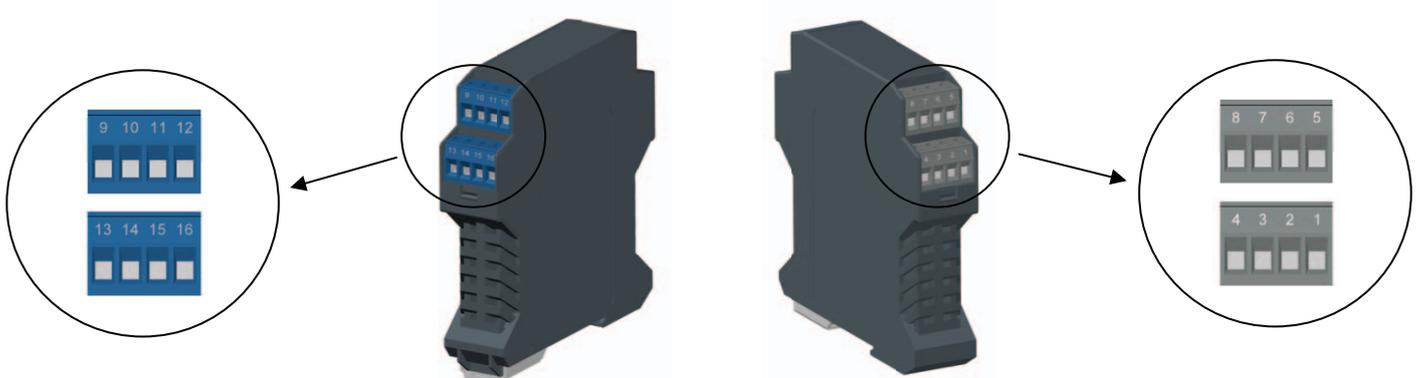
Model:	D1034			
1 channel		S		
2 channels		D		
Power Bus enclosure			/B	

Front Panel and Features



- SIL 3 according to IEC 61508 for Tproof = 1 / 2 years (10 / 20 % of total SIF).
- SIL 2 according to IEC 61508 for Tproof = 10 years (10 % of total SIF).
- PFDAvg (1 year) 8.41 E-05, SFF 93.24 %.
- 2 fully independent channels.
- Input from Zone 0 (Zone 20), Division 1, installation in Zone 2, Division 2.
- Contact/Proximity Detector Input.
- Short and open circuit fault detection.
- Three port isolation, Input/Output/Supply.
- EMC Compatibility to EN61000-6-2, EN61000-6-4.
- 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, two 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.

Terminal block connections



HAZARDOUS AREA

9	Not used
10	+ Input Ch 2 for Proximity or Input Ch 2 for voltage free Contact
11	- Input Ch 2 for Proximity or Input Ch 2 for voltage free Contact
12	Not used
13	Not used
14	+ Input Ch 1 for Proximity or Input Ch 1 for voltage free Contact
15	- Input Ch 1 for Proximity or Input Ch 1 for voltage free Contact
16	Not used

SAFE AREA

1	+ Output Ch 1 for Proximity Interface
2	- Output Ch 1 for Proximity Interface
3	+ Ch 1 Power Supply 12-24 Vdc
4	- Ch 1 Power Supply 12-24 Vdc
5	+ Output Ch 2 for Proximity Interface
6	- Output Ch 2 for Proximity Interface
7	+ Ch 2 Power Supply 12-24 Vdc
8	- Ch 2 Power Supply 12-24 Vdc

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_0/V_{oc} , I_0/I_{sc} , P_0/P_0) of the D1034 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_0/C_a , L_0/L_a , L_0/R_0) given in the Associated Apparatus parameters for the effective gas group. See parameters on enclosure side and the ones indicated in the table below:

D1034 Terminals		D1034 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	14 - 15	$U_0 / V_{oc} = 9.6 \text{ V}$	\leq	U_i / V_{max}
Ch2	10 - 11			
Ch1	14 - 15	$I_0 / I_{sc} = 11 \text{ mA}$	\leq	I_i / I_{max}
Ch2	10 - 11			
Ch1	14 - 15	$P_0 / P_0 = 25 \text{ mW}$	\leq	P_i / P_i
Ch2	10 - 11			

D1034 Terminals		D1034 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
Ch1	14 - 15	$C_0 / C_a = 3.6 \mu\text{F}$	\geq	$C_i / C_i \text{ device} + C \text{ cable}$
Ch2	10 - 11	$C_0 / C_a = 26 \mu\text{F}$		
		$C_0 / C_a = 210 \mu\text{F}$		
Ch1	14 - 15	$L_0 / L_a = 336 \text{ mH}$	\geq	$L_i / L_i \text{ device} + L \text{ cable}$
Ch2	10 - 11	$L_0 / L_a = 1345 \text{ mH}$		
		$L_0 / L_a = 2690 \text{ mH}$		
Ch1	14 - 15	$L_0 / R_0 = 1449 \mu\text{H}/\Omega$	\geq	$L_i / R_i \text{ device and}$ $L \text{ cable} / R \text{ cable}$
Ch2	10 - 11	$L_0 / R_0 = 5790 \mu\text{H}/\Omega$		
		$L_0 / R_0 = 11590 \mu\text{H}/\Omega$		

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_0 and L_0 parameters of the Associated Apparatus (excluding the cable), then 50 % of C_0 and L_0 parameters are applicable and shall not be exceeded (50 % of the C_0 and L_0 become the limits which must include the cable such that $C_i \text{ device} + C \text{ cable} \leq 50 \% \text{ of } C_0$ and $L_i \text{ device} + L \text{ cable} \leq 50 \% \text{ of } L_0$).

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.

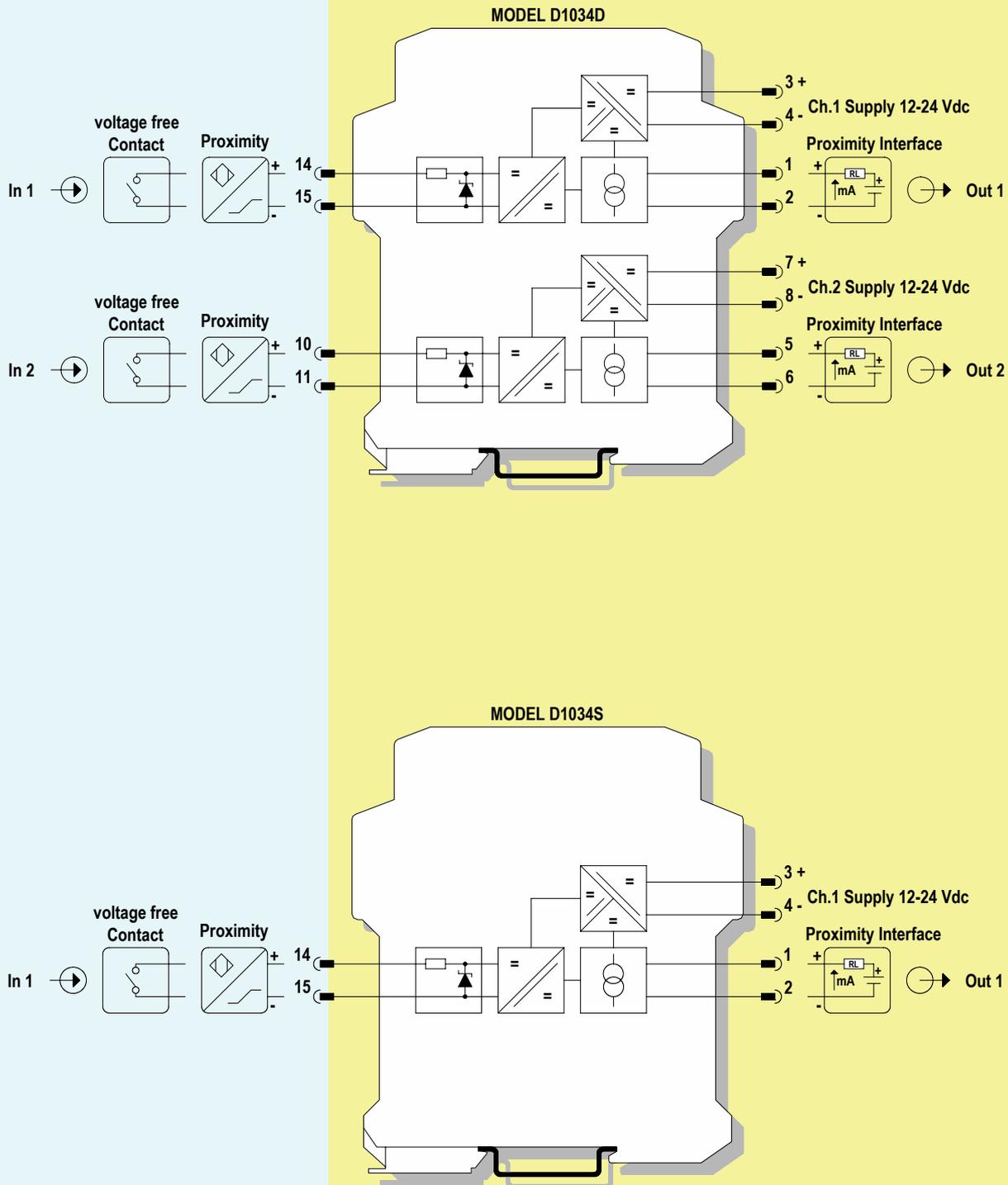
For Division 1 and Zone 0 installations, the configuration of Intrinsically Safe Equipment must be FM approved under Entity Concept (or third party approved);

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

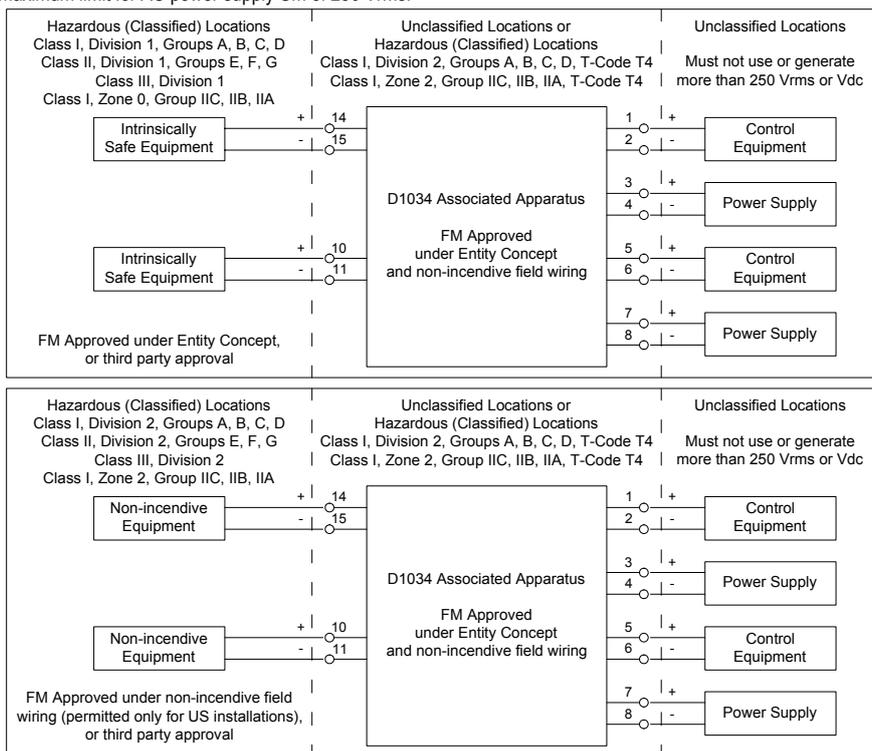
HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,
CLASS I, ZONE 0, GROUP IIC

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

D1034 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 D1034 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.

D1034 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

D1034 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 reflecting the current consumption (transparent mode connection of input sensor to control room equipment). A "POWER ON" green led lits when input power is present.

Note: use of voltage free electrical contacts with fault detection enabled (control equipment) 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

D1034 series are contact/proximity detector interfaces housed in a plastic enclosure suitable for installation on T35 DIN Rail according to EN50022.

D1034 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 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.

Identify the number of channels of the specific card (e.g. D1034S is a single channel model and D1034D is a dual 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 channel 1.

For Model D1034D connect 12-24 Vdc power supply positive at terminal "7" and negative at terminal "8" for channel 2.

For Model D1034S connect positive output of channel 1 at terminal "1" and negative output at "2".

For Model D1034D in addition to channel 1 connections above, connect positive output of channel 2 at terminal "5" and negative output at "6".

For Model D1034S connect the wires of input contact/proximity at terminal "14" for positive and "15" for negative.

For Model D1034D in addition to channel 1 connections above, connect terminal "10" for positive and "11" for negative on channel 2.

Note: terminal "3" and terminal "4" are internally connected to terminal "7" and terminal "8" for factory default.

To supply the unit with different supply voltage or different power supply, open the wiring between the terminals; consult factory for detailed information.

When using Power Bus enclosure the power supply is the same for all channel.

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 D1034 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, D1034 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, output condition must be in accordance with condition of the corresponding input line. If possible close and open input lines one at time checking the corresponding reflected current output to be correct.

Installation in Cabinet

Power Dissipation of D1034 Isolators

Section "Technical Data" of D1034 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).

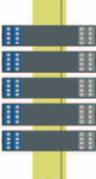
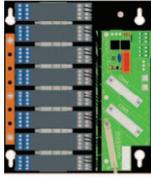
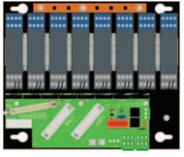
The power dissipated **P_d** inside the enclosure for analog signal isolators is: **P_d = Current Consumption (A) * Supply Voltage (V) - Power Dissipated into the input/output loads**

Digital signal isolators have lower dissipation than analog signal isolators, in addition 2 channels barriers (D1034D) have higher dissipation than single channel units (D1034S).

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, D1034D (double channel) and D1034S (single channel) isolators, installed on DIN rail, bus or custom board assembly.

A) Cabinet with Natural Ventilation

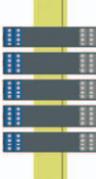
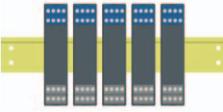
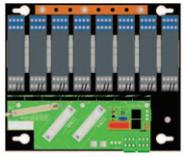
Maximum recommended ambient temperature in °C depending on barrier type and installation method:

Type of Isolator	Single unit Installation	Installation of Multiple units with DIN-rail Bus		Installation on Custom Boards	
	Any orientation	Vertical	Horizontal	Vertical	Horizontal
					
D1034S	60°C	30°C	35°C	35°C	40°C
D1034D	60°C	Not recommended ⁽¹⁾	30°C	30°C	35°C

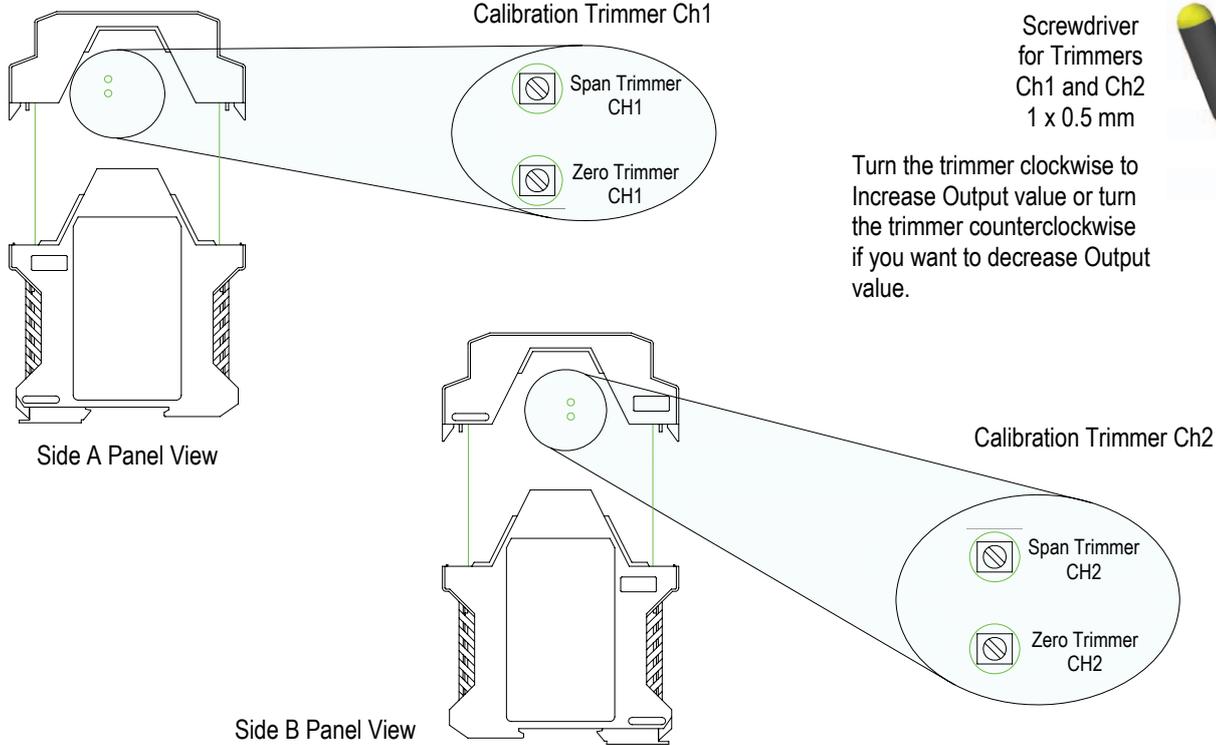
⁽¹⁾ Installation is not recommended since it would significantly shorten the units life and increase the probability of failures.

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	
	Any orientation	Vertical	Horizontal	Vertical	Horizontal
					
D1034S	60°C	40°C	45°C	45°C	50°C
D1034D	60°C	40°C	45°C	45°C	50°C

Configuration

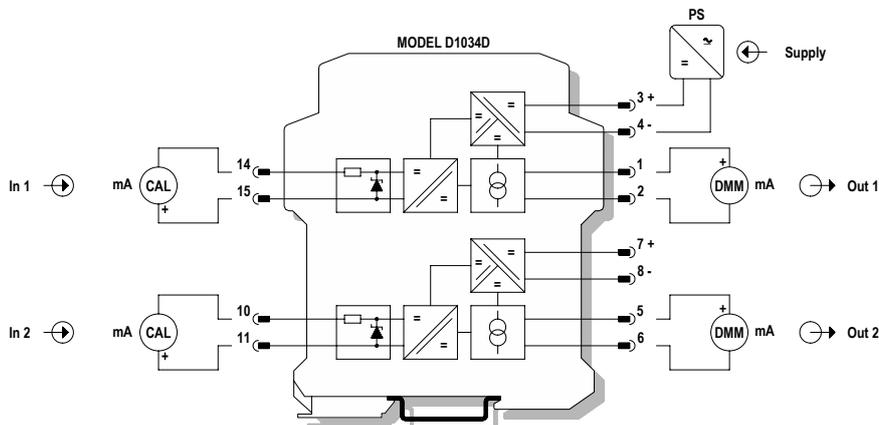


Calibration instruction and Troubleshooting

In case a calibration check or readjustment is necessary the following equipment is required:

Equipment Required	Instrument	Identification
Adjustable Power Supply Range 0-35 V Resolution 0.1 V, Accuracy 1% Output Capability 200 mA	Agilent E3611A	PS
Current Meter range 20 mA, Resolution 1 μ A Accuracy 0.01% or Voltage Meter Range 10 V, Resolution 1 mV Accuracy 0.01%	Agilent 34410A	DMM
Current Calibrator range 20 mA, Resolution 1 μ A Accuracy 0.01 %	Yokogawa 7651	CAL

- Connect the unit as shown below:



- Set power supply (PS) at 24.0 V at terminals 3 (+) and 4 (-), the calibrator (CAL) in the function "mA" 20 mA range at terminals 14 (-) and 15 (+), the multimeter (DMM) for the reading in DC supply 20 mA range at terminals 1 (+) and 2 (-).
- Execute the next test to verify D1034S unit channel or execute it twice to verified both D1034D unit channels.
- Verify that green led on the front panel is ON.

If the power ON Led is off, check supply voltage, polarity and wiring.

- Set calibrator (CAL) at 1.000 mA and verify that the output voltage, read by multimeter (DMM), is correspondent with a maximum deviation presented in the section "Technical Data".
- Set calibrator (CAL) at 7.500 mA and verify that the output current, read by multimeter (DMM), is correspondent with a maximum deviation presented in the section "Technical Data".

If the maximum deviation is exceeded, repeat the board calibration and proceed in the following way:

- Set the calibrator (CAL) at 7.500 mA and regulate the current, read by multimeter (DMM), by turning the span trimmer of the unit (see "Configuration" section) until reading 7.500 mA \pm 5 μ A value.
- Set the calibrator (CAL) at 1.000 mA and regulate the current, read by multimeter (DMM), by turning the zero trimmer of the unit (see "Configuration" section) until reading 1.000 mA \pm 5 μ A value.
- Repeat the last two steps to verify that the span trimmer' s movement has not significantly modified the value of zero (a dragging of 1/5 exists when moving span and zero values).
- To execute a linearity test: set the calibrator (CAL) at 1.000, 3.000, 5.000, 7.500 mA and verify current output is correspondent with a maximum deviation presented in the section "Technical Data".