D5096-106

SIL3 Relay Low-V Module for 5 A NE/ND Loads with LFD

Models D5096-106

INSTRUCTION MANUAL

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1. CHARACTERISTICS

General Description:
The D5096S-106 is a relay module suitable for the switching of safety related circuits, up to SIL 3 level according to IEC 61508:2010 Ed. 2 for high risk industries. It provides isolation between input and output contacts. A wide compatibility towards different DCS/PLC is guaranteed: driving line pulse testing, executed by DCS/PLC, is permitted by a dedicated internal circuit, to prevent relay and LED flickering. D5096S-106 has 2+2 SPST relay contacts connected in parallel and then in series to avoid spurious trip and to increase availability (see function diagram). High availability SIL 3 Safety Function for NE load or F&G / ND load is available. Load is isolated from supply on both polarities: +/AC, -/AC. 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.

Load and Line Diagnostic:
Line and load short/open circuit detection is provided, both when the load is off and when the load is on. Presence of load voltage is also monitored, both when the load is off and when the load is on. The fault in the field is directly mirrored to the PLC DO and it is also reported by opening the fault output.

Functional Safety Management Certification:
G.M. International is certified by TUV to conform to IEC61508:2010 part 1 clauses 5-6 for safety related systems up to and included SIL3.

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: 15 mA typical.
Power dissipation: 0.35 W typical.

Isolation (Test Voltage): Output/Input 1.5 KV; Output/Supply 1.5 KV; Output/Fault Output 1.5 KV; Input/Supply 500 V; Input/Fault Output 500 V; Supply/Fault Output 500 V.

Input: 24 Vdc nom (20 to 28.8 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp. Relay coils are internally protected with suppressor diodes.

Current consumption @ 24 V: 45 mA.
Power dissipation @ 24 V: 1.1 W.
Impedance in case of fault: > 1 MΩ.

Output: voltage free 2+2 SPST relay contact (2 paralleled contacts in series) at terminals 7-11 and 8-12, close when relay energized, open in de-energized condition.

Contact material: Ag Alloy (Cd free), gold plated.
Contact rating: 5 A 250 Vac 1250 VA, 5 A 250 Vdc 140 W (resistive load), 1 A 24 Vdc, 220 mA 125 Vdc, 110 mA 250 Vdc for UL. Min.switching current 1 mA.

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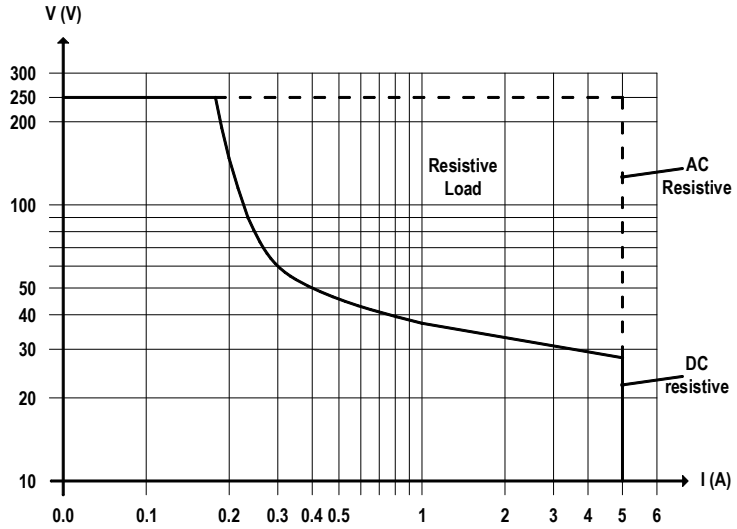
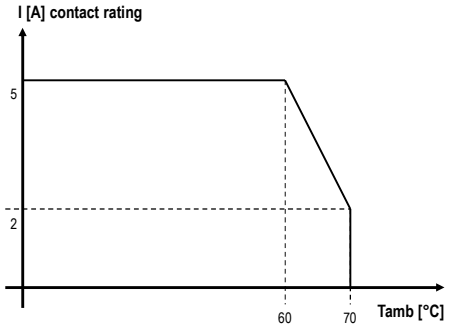
Contact inrush current: 6 A at 24 Vdc, 250 Vac.
Mechanical / Electrical life: 5 * 10^6 / 3 * 10^4 operation, typical.
Operate / Release time: 30 ms / 30 ms typical.
Frequency response: 10 Hz maximum.
DC and AC Load breaking capacity:





Fault detection:
De-energized diagnostic signal: 6.5 V open circuit, 1.3 mA short circuit, typical.
De-energized short output detection: load R ≤ 15 Ω.
De-energized no short output detection: load R ≥ 25 Ω.
De-energized open output detection: load R ≥ 21 KΩ.
De-energized no open output detection: load R ≤ 19 KΩ.
Energized short output detection: load I ≥ 6 A rms.
Energized no short output detection: load I ≤ 5 A rms.
Energized open output detection: load I ≤ 5 mA rms.
Energized no open output detection: load I ≥ 15 mA rms.
Load Supply fault detection: load voltage ≤ 5 V rms.
Load Supply no fault detection: load voltage ≥ 20 V rms.
Fault signalling: voltage-free NE SPST solid-state relay contact (output de-energized in fault condition).
Output rating: 100 mA 35 V (≤ 1 V voltage drop)
Response time: <500 ms typical.

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.
Max altitude: 2000 m a.s.l.
Storage: temperature limits - 45 to + 80 ° C.

Safety Description:
ATEX: II 3G Ex ec nC IIC T4 Gc
IECEx / INMETRO: Ex ec nC IIC T4 Gc
UL: NI / I / 2 / ABCD / T4; ***C-UL:*** NI / I / 2 / ABCD / T4
EAC-EX: 2Ex ec nC IIC T4 Gc X
CCC: Ex ec nC IIC T4 Gc
PESO: Ex ec nC IIC T4 Gc
non-sparking electrical equipment.
-40 °C ≤ Ta ≤ 70 °C.
Approvals:
BVS 10 ATEX E 114 X conforms to EN60079-0, EN60079-7, EN60079-15.
IECEx BVS 10.0072X conforms to IEC60079-0, IEC60079-7, IEC60079-15.
INMETRO DNV 13.0109 X conforms to ABNT NBR IEC60079-0, ABNT NBR IEC60079-7, ABNT NBR IEC60079-15.
UL & C-UL E222308 conforms to UL 61010-1, UL 121201 for UL and CAN/CSA C22.2 No. 61010-1-12, CSA C22.2

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No. 213-17 for C-UL.
EAЭC RU C-IT.AA87.B.01516/25 conforms to GOST 31610.0, GOST 31610.15.
CCC n. 2020322316000978 conforms to GB/T 3836.1, GB/T 3836.3, GB/T 3834.8
PESO P652307 conforms to IEC60079-0, IEC60079-7, IEC60079-15.
TUV Certificate No. TUV IT 25 SIL 0634 SIL 3 conforms to IEC61508:2010 Ed. 2.
SIL 3 Functional Safety TÜV Certificate conforms to IEC61508:2010 Ed.2, for Management of Functional Safety.
DNV Type Approval Certificate No. TAA00001U0 Certificate for maritime applications.

Mounting: EN/IEC60715 TH 35 DIN-Rail, with or without Power Bus or on customized Termination Board.

Weight: about 125 g.
Connection: by polarized plug-in disconnect screw terminal blocks to accommodate terminations up to 2.5 mm^2 (AWG13).
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.
Protection class: IP 20.
Dimensions: Width 12.5 mm, Depth 123 mm, Height 120 mm.

3. DIAGNOSTIC

F = available function

NA = not available

PF = available function with programmable thresholds (see smart relay modules for complete programmable diagnostics functions)

Load status	Load voltage	Load open circuit	Load short circuit	Load to earth leakage	Internal coil short
OFF	F	F	F	NA	NA
ON	F	F	F	NA	NA

4. ORDERING INFORMATION

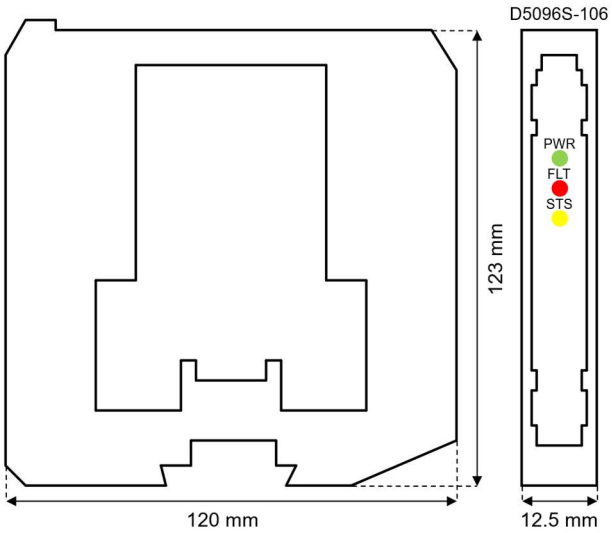
4.1 Ordering codes

D5096S-106: 1 channel

4.2 Accessories

Bus Connector JDFT049, Bus Mounting Kit OPT5096.

5. OVERALL DIMENSIONS



6. TERMINAL BLOCK CONNECTIONS

6.1 Field Side

7: + Load Power DC/AC

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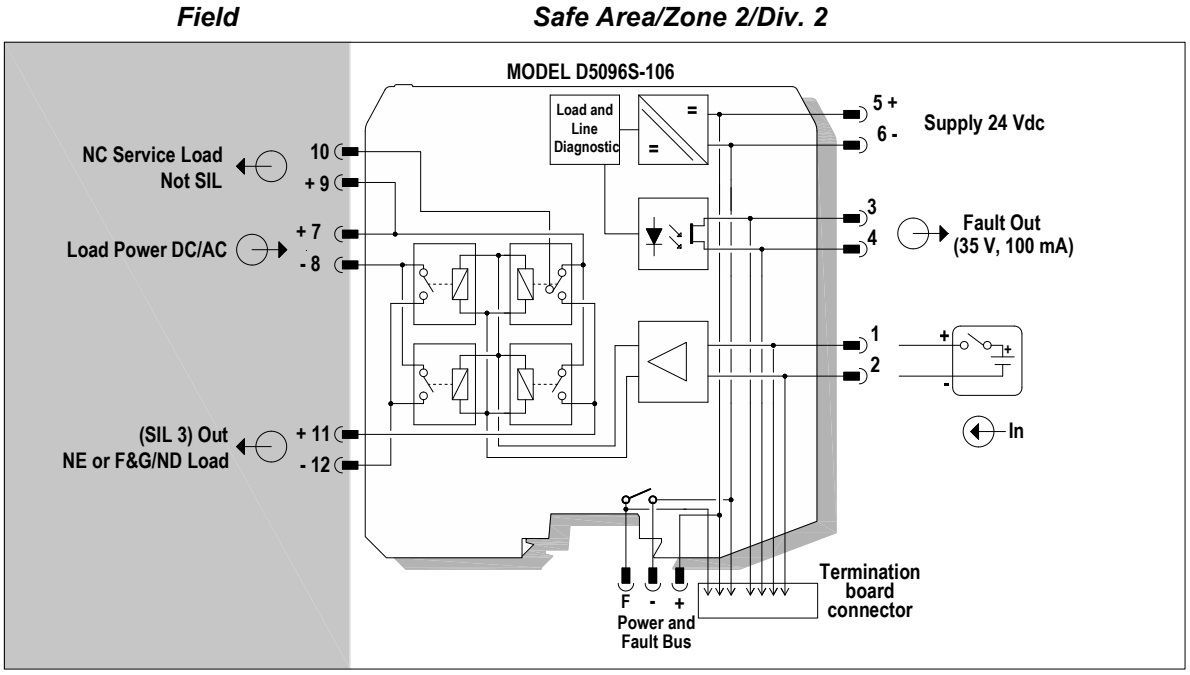
8: - Load Power DC/AC
9: 1st pole of NC contact for Service load
10: 2nd pole of NC contact for Service load
11: (SIL 3) + Output NE Load or F&G/ND Load
12: (SIL 3) - Output NE Load or F&G/ND Load

6.2 System Side

1: + Input
2: - Input
3: Fault Output (35 V, 500 mA)
4: Fault Output (35 V, 500 mA)
5: + Power Supply 24 Vdc
6: - Power Supply 24 Vdc

7. FUNCTION DIAGRAM



All relay contacts are shown in de-energized position. To prevent relay contacts from damaging, connect an external protection (fuse or similar), chosen according to the relay breaking capacity diagram.

8. WARNING

D5096-106 series are electrical apparatus installed on EN/IEC60715 TH 35 standard DIN-Rail located in Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4 or Class I, Division 2, Group A, B, C, D, T4 Hazardous Area within the specified operating temperature limits Tamb - 40 to +70 °C.

D5096-106 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. 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 suitability for Zone 2/Division 2. Avertissement: la substitution des composants peut nuire à l'aptitude à la Zone 2/Div. 2.
Explosion Hazard: to prevent ignition of flammable atmospheres, disconnect power before servicing or unless area is known to be nonhazardous. Danger d'Explosion: pour éviter l'inflammation d'atmosphères inflammables, débrancher l'alimentation avant l'entretien ou à moins que région est connue pour être non dangereuse.
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.

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Avertissement: débrancher l'alimentation (couper la tension d'alimentation) et les blocs de jonction enfichables avant d'ouvrir le boîtier pour éviter les chocs électriques lorsqu'ils sont connectés à un potentiel dangereux.

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.

9. OPERATION

The single channel 5 A Relay Output D5096S-106 is a relay module suitable for the switching of safety related circuits, up to SIL 3 level according to IEC 61508:2010 Ed.2 for high risk industries. It provides isolation between input and output contacts. D5096S-106 has 2+2 SPST relay contacts connected in parallel and then in series to avoid spurious trip and to increase availability (see function diagram). High availability SIL 3 Safety Function for NE load or F&G/ND load is available at Terminal Blocks 11-12. When the driving signal is low (0 Vdc), the relay is de-energized, contacts at terminals 7-11 and 8-12 are open and load is de-energized. When the driving signal is high (24 Vdc), the relay is energized, contacts at terminals 7-11 and 8-12 are closed and the load is energized. Presence of diagnostic circuit power supply, status of input / output channel (energized or de-energized), as well as any type of fault condition (line and load short/open circuit, etc.) are displayed by related signalling LEDs: green power supply, yellow for status channel and red for fault.

10. INSTALLATION

D5096-106 series are relay output module housed in a plastic enclosure suitable for installation on EN/IEC60715 TH 35 DIN-Rail, with or without Power Bus or on customized Termination Board. D5096-106 series unit can be mounted with any orientation over the entire ambient temperature range. Electrical connection 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)**. Connect only one individual conductor per each clamping point, use conductors up to 2.5 mm² (13 AWG) and a torque value of 0.5-0.6 Nm. For USA and Canada installations, use only cables that are suitable for a temperature of at least 85°C. The wiring cables have to be proportionate in base to the current and the length of the cable.

In case of installation in zone 2, the connecting cables of non-intrinsically safe circuits must be safely routed in a cable duct or similar. The distance between the pluggable connection terminal and the cable duct should not exceed 500 mm cable length.

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 "5" and negative at terminal "6".
- Connect positive input at terminal "1" and negative input at "2".
- Connect Fault output (35 V, 100mA) at terminals "3" and "4".
- Connect positive output NE or F&G/ND load at terminal "11" and negative at terminal "12".
- Connect positive Load Power DC/AC at terminal "7" and negative at terminal "8".

Installation and wiring must be 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.

Connect load relay contacts checking the load rating to be within the contact maximum rating (5 A 250 Vac 1250 VA, 5 A 250 Vdc 140 W resistive load).
To prevent relay contacts from damaging, connect an external protection (fuse or similar), chosen according to the relay breaking capacity diagram from installation instructions.

The enclosure provides, according to EN60529, an IP20 minimum degree of protection (or similar to NEMA Standard 250 type 1). The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1. When installed in EU Zone 2, the unit shall be installed in an enclosure that provides a minimum ingress protection of IP54 in accordance with IEC 60079-0. When installed in a Class I, Division 2 Hazardous Location, the unit shall be mounted in a supplemental enclosure that provides a degree of protection not less than IP54. The enclosure must have a door or cover accessible only by the use of a tool. The end user is responsible to ensure that the operating temperature of the module is not exceeded in the end use application.
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.

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Electrostatic Hazard: to avoid electrostatic hazard, the enclosure of D5096-106 series 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.
D5096-106 series must be connected to SELV or PELV supplies.
All circuits connected to D5096-106 series must comply with the overvoltage category II (or better) according to EN/IEC60664-1.

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.

11. START-UP

Before powering the unit check that all wires are properly connected, particularly supply conductors and their polarity, input and output wires. Check conductors for exposed wires that could touch each other causing dangerous unwanted shorts. Turn on power for diagnostic circuit, the “power on” green led must be lit. Enabling input, the channel status yellow led must be lit and load circuit must be energized because 2+2 SPST relay output contacts are closed. Instead, disabling input, the channel status yellow led must be turned off and load circuit must be de-energized because 2+2 SPST relay output contacts are open.

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