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# **Fail Safe Control Hardware Manual**

**Revision 02**

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**Total Plant**



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## Module Index

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## Functional Index

This is a general index of the entire FSC Hardware Manual. The index is based on the module functions. In many cases there will be more than one index entry to direct you to a particular module. For example, if you are looking for a 24 Vdc digital output module, you can look under '#' for 24 Vdc, 'D' for digital, or 'O' for output. The numbers in front of the page numbers refer to the sections. For example, '2-19' refers of page 19 of section 2 ("Power Supplies").

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**Honeywell**

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# **Fail Safe Control**

## **Hardware Manual**

### **Abbreviations**

**Total Plant**





## Abbreviations

A/D	.....	Analog/digital
AC	.....	Alternating current
AI	.....	Analog input
AK	.....	Anforderungsklasse (= requirement class)
AO	.....	Analog output
AWG	.....	American Wire Gage
BCD	.....	Binary coded decimal
c	.....	common
CE	.....	Conformité Européenne
Ch	.....	Channel
COM	.....	Communication
COSI	.....	Crimp-on snap-in
CP	.....	Central Part
CPU	.....	Central processor unit
D/A	.....	Digital/analog
DBM	.....	Diagnostic and battery module
DC	.....	Direct current
DCD	.....	Data carrier detect
DCS	.....	Distributed control system
DI	.....	Digital input
DIL	.....	Dual in-line
DIN	.....	Deutsche Industrienorm
DO	.....	Digital output
DOS	.....	Disk operating system
DSR	.....	Data set ready
DTR	.....	Data terminal ready
EEA	.....	European Economic Area
EEPROM	.....	Electrically erasable programmable read-only memory
ELD	.....	Earth leakage detector
EMC	.....	Electromagnetic compatibility
EN	.....	Europäische Norm (European standard)
EPROM	.....	Erasable programmable read-only memory
ESD	.....	Electrostatic discharge
ESD	.....	Emergency shutdown
EU	.....	European Union
ext.	.....	external
F	.....	Fuse(d)
FF	.....	Flip-flop
FS	.....	Fail-safe
FSC	.....	Fail Safe Control
FSC-DS	.....	FSC Development System
FSC-SM	.....	FSC Safety Manager
FSC-SMM	.....	FSC Safety Manager Module
FTA	.....	Field termination assembly
GND	.....	Ground
HBD	.....	Horizontal bus driver
HE	.....	Höheneinheit (= U)
HP	.....	Horizontal pitch (= TE)
HSMS	.....	Honeywell Safety Management Systems
HW	.....	Hardware
H x W x D	.....	Height x width x depth



## Abbreviations (continued)

I/O	Input/output
IC	Integrated circuit
IEC	International Electrotechnical Commission
int.	internal
J	Jumper
LED	Light-emitting diode
LSB	Least significant bit
MEM	Memory
MUX	Multiplexer
n/a	not applicable
NC	Normally closed
nc	not connected
NFS	Non fail-safe
NO	Normally open
NTC	Negative temperature coefficient
NVRAM	Non-volatile random-access memory
P/N	Part number
PCB	Printed circuit board
PSD	Power supply distribution
PSU	Power supply unit
R	Resistance / Resistor
RAM	Random-access memory
RTS	Request to send
SBD	Single bus driver
S-Bus	Single bus
SER	Sequence-of-event recording
SIC	System interconnection cable
SIL	Safety integrity level
SM	Safety Manager
SMM	Safety Manager Module
SOE	Sequence of events
STP	Shielded twisted pair
SW	Software
TE	Teileinheit (= HP)
TIB	Transformer isolated barrier
TPS	TotalPlant Solutions
TTL	Transistor-transistor logic
TTY	Teletype
TÜV	Technischer Überwachungsverein
U	Unit (= HE)
UCN	Universal Control Network
UL	Underwriters Laboratories
UV	Ultraviolet
Vac	Volt alternating current
VBD	Vertical bus driver
V-Bus	Vertical bus
Vdc	Volt direct current
WD	Watchdog
WDG	Watchdog
WDR	Watchdog repeater
ZIF	Zero insertion force

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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Position: \_\_\_\_\_

Company: \_\_\_\_\_

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**Honeywell**

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# **Fail Safe Control Hardware Manual**

## **Section 1: General Information**

**TotalPlant**



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## Legend of symbols

### Description

This Hardware Manual contains layout diagrams and wiring examples. The figure below explains some specific symbols used in these diagrams.

description	symbol	description	symbol	description	symbol	description	symbol
fuse terminal		crossing conductors without electric connection		make contact		level switch	
indication / alarm lamp		junction of conductors		break contact		rotary switch	
indicator LED		incoming or outgoing signals		push button maintained		proximity switch	
diode		card connector		pulse contact		push button momentary	
resistor		solenoid valve		sheet connector connects from sheet 22 line 1		keyswitch	
alarm horn		interposing relay or motor-operated valve		transistor		 PCB relays relay + diode + LED	
fan		circuit breaker		capacitor			
sheet connectors to FSC I/O module redundant central part		receptacle		varistor		temperature element	

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## FSC operating conditions

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### FSC cabinets

FSC systems are generally built into steel cabinet enclosures for mechanical protection of the delicate electronic equipment of the FSC system. Also, compliance with the CE directives requires the FSC systems to be properly enclosed.

---

### FSC main components

An FSC system typically consists of the following main components:

- cabinet enclosure,
  - field termination assemblies (FTAs) and/or terminals,
  - central part (CP) racks with all CPU, memory and communication modules,
  - input/output racks with all input and output modules, and
  - power supply system consisting of power supply units (PSUs), main switches and circuit breakers.
- 

### FSC operating conditions

The operating conditions for FSC systems are as follows:

- Storage temperature:  $-25^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$  ( $-13^{\circ}\text{F}$  to  $+176^{\circ}\text{F}$ )
- Operating temperature:  $0^{\circ}\text{C}$  to  $60^{\circ}\text{C}$  ( $32^{\circ}\text{F}$  to  $140^{\circ}\text{F}$ )\*
- Relative humidity: 95% (non-condensing)
- Vibration (sinusoidal): excitation: sine-shaped with sliding freq.  
frequency range: 10-150 Hz  
loads: 10 Hz - 57 Hz: 0.075 mm  
57 Hz - 150 Hz: 1 G  
no. of axes: 3 (x, y, z)  
traverse rate: 1 oct/min.
- Shock: 15 G in 3 axes (shock duration: 11 ms).

\* Measured at the Central Part rack(s) by the Diagnostic and Battery Module (DBM).

---



## **FSC environment**

The most common environment for an FSC system cabinet is an air-conditioned equipment/control room. If the FSC system cabinet is to be used in an outdoor environment, special attention should to paid to:

- minimum and maximum ambient temperatures,
  - humidity, and
  - protection grade (IP grading) against dust, water, etc.
- 

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## FSC standards compliance

### Description

This data sheet lists the standards that FSC complies with, and also provides some background information on CE marking (EMC directive and Low Voltage directive).

Table 1 FSC compliance to standards

Standard	Title	Remarks
DIN V 19250 (1/89, 5/94)	Measurement and control. Fundamental safety aspects to be considered for measurement and control equipment. <i>(German title: Leittechnik. Grundlegende Sicherheitsbetrachtungen für MRS-Schutzeinrichtungen)</i>	Safety applications up to safety class AK 8
DIN V 0801 (1/90) and Amendment A (10/94)	Principles for computers in safety-related systems. <i>(German title: Grundsätze für Rechner in Systemen mit Sicherheitsaufgaben)</i>	Microprocessor-based safety systems
VDE 116 (10/89)	Electrical equipment of furnaces. <i>(German title: Elektrische Ausrüstung von Feuerungsanlagen)</i>	
EN 54 part 2 (01/90)	Components of automatic fire detection systems, Introduction <i>(German title: Bestandteile automatischer Brandmeldeanlagen)</i>	
EN 50081-2-1993	Electromagnetic compatibility – Generic emission standard, Part 2: Industrial environment	
EN 50082-2-1993	Electromagnetic compatibility – Generic immunity standard, Part 2: Industrial environment	
EN 61131-2-1994	Programmable controllers. Part 2: Equipment requirements and tests	
UL 1998	Safety-related software, first edition	Underwriters Laboratories
UL 508	Industrial control equipment, sixteenth edition	Underwriters Laboratories



Table 1 FSC compliance to standards (continued)

Standard	Title	Remarks
UL 991	Test for safety-related controls employing solid-state devices, second edition	Underwriters Laboratories
CSA C22.2	Process control equipment. Industrial products.	Canadian Standards Association No. 142 (R1993)
DIN IEC 68	Basic environmental testing procedures	
DIN IEC 68 Part 2-1	Cold test	0°C (32°F); 16 hours; system in operation; reduced power supply voltage (-15%) U=20.4 Vdc or (-10%); U=198 Vac
DIN IEC 68 Part 2-1	Cold test	-5°C (23°F); 16 hours; system in operation
DIN IEC 68 Part 2-2	Dry heat test	up to 60°C (140°F); 16 hours; system in operation; increased power supply voltage (+15%): U=27.6 Vdc or (+10%): U=242 Vac
DIN IEC 68 Part 2-3	Test Ca: damp heat, steady state	21 days at +40°C (104°F), 95% relative humidity; function test after cooling
DIN IEC 68 Part 2-3	Test Ca: damp heat, steady state	96 hours at +40°C (104°F), 95% relative humidity; system in operation
DIN IEC 68 Part 2-6	Environmental testing – Part 2: Tests – Test Fc: vibration (sinusoidal)	Excitation: sine-shaped with sliding frequency; Frequency range: 10-150 Hz Loads: 10-57 Hz; 0.075 mm 57-150 Hz; 1 G Duration: 10 cycles (20 sweeps) per axis No. of axes: 3 (x, y, z) Traverse rate: 1 oct/min System in operation
DIN IEC 68 Part 2-27	Environmental testing – Part 2: Tests – Test Ea: shock	Half sinus shock 1 shock per direction (6 in total) Maximum acceleration: 15 G Shock duration: 11 ms System in operation



## CE marking

The CE mark (see Figure 1) is a compliance symbol which indicates that a product meets the requirements of the EU directives that apply to that product. CE (Conformité Européenne) marking is a prerequisite to marketing FSC systems in the European Union.

EU directives are documents issued on the authority of the Council of the European Union. They set out requirements and regulations for certain categories of products or problem areas. The directives apply not only to the member countries of the European Union but to the whole European Economic Area (EEA), which is made up of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom.

The directives have the following key objectives:

- free movement of goods within the EU/EEA geographical regions through harmonization of standards and elimination of trade barriers,
- safety of persons, their property and of animals, and
- protection of the environment.



Figure 1 CE mark

For control products like FSC, a number of EU directives apply. The FSC product has been certified for two of these: the Electromagnetic Compatibility (EMC) Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC). Each is discussed in more detail below.

---



## EMC directive (89/336/EEC)

One of the EU directives that FSC complies with is the EMC directive, or *Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility* as it is officially called. It "applies to apparatus liable to cause electromagnetic disturbance or the performance of which is liable to be affected by such disturbance" (Article 2).

The EMC directive defines protection requirements and inspection procedures relating to electromagnetic compatibility for a wide range of electric and electronic items.

Within the context of the EMC directive, 'apparatus' means all electrical and electronic appliances together with equipment and installations containing electrical and/or electronic components.

'Electromagnetic disturbance' means any electromagnetic phenomenon which may degrade the performance of a device, unit of equipment or system. An electromagnetic disturbance may be electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

'Electromagnetic compatibility' is the ability of a device, unit of equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

There are two sides to electromagnetic compatibility: emission and immunity. These two essential requirements are set forth in Article 4, which states that an apparatus must be constructed so that:

- (a) the electromagnetic disturbance it generates does not exceed a level allowing radio and telecommunications equipment and other apparatus to operate as intended;
- (b) the apparatus has an adequate level of intrinsic immunity of electromagnetic disturbance to enable it to operate as intended.

The EMC directive was originally published in the Official Journal of the European Communities on May 23, 1989. The directive became effective on January 1, 1992, with a four-year transitional period.

During the transitional period, a manufacturer can choose to meet existing national laws (of the country of installation) or comply with the EMC directive (demonstrated by the CE marking and Declaration of Conformity). The transitional period ended on December 31, 1995, which meant that as of January 1, 1996 compliance with the EMC directive became **mandatory** (a legal requirement). All electronic products may now only be marketed in the European Union if they meet the requirements laid down in the EMC directive. This also applies to FSC system cabinets.



## Low voltage directive (73/23/EEC)

The FSC product also complies with the low voltage directive, or *Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits* as it is officially called. It states that "electrical equipment may be placed on the market only if, having been constructed in accordance with good engineering practice in safety matters in force in the Community, it does not endanger the safety of persons, domestic animals or property when properly installed and maintained and used in applications for which it was made" (Article 2).

The low voltage directive defines a number of principal safety objectives that electrical equipment must meet in order to be considered "safe".

Within the context of the low voltage directive, 'electrical equipment' means any equipment designed for use with a voltage rating of between 50 and 1,000 V for alternating current and between 75 and 1,500 V for direct current.

The low voltage directive was originally published in the Official Journal of the European Communities on March 26, 1973. It was amended by Council Directive 93/68/EEC, which became effective on January 1, 1995, with a two-year transitional period. During the transitional period, a manufacturer can choose to meet existing national laws (of the country of installation) or comply with the low voltage directive (demonstrated by the CE marking and Declaration of Conformity). The transitional period ended on December 31, 1996, which meant that as of January 1, 1997 compliance with the low voltage directive became **mandatory** (a legal requirement). All electronic products may now only be marketed in the European Union if they meet the requirements laid down in the low voltage directive. This also applies to FSC system cabinets.

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## Key coding

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### Introduction

There are basically two types of modules in the racks of an FSC cabinet:

- Central Part modules (see section 4 of this manual), and
  - I/O modules (see section 5 and section 6 of this manual).
- 

### Central Part modules

The Central Part modules must be placed in the Central Part rack(s), at the locations calculated by the FSC user station software. Only then will the Diagnostic and Battery Module (DBM, 10006/1/1 or 10006/2/.) and the diagnostic program indicate faulty module positions correctly.

---

### I/O modules

The locations of the I/O modules in the I/O rack(s) are not predetermined by the FSC user station software. They are user-defined using the 'Configure FSC system' option of the FSC user station software. To ensure proper interfacing with the field devices (wiring, etc.) and to prevent damage to equipment, the I/O modules **must** be placed at the I/O rack positions as defined in the FSC user station software. To prevent insertion of an incorrect module type on a certain I/O position, the I/O rack connector and the module connector are key-coded with coding pins.

---

#### **Note:**

If the coding pins of the module are bent, they must be removed. If you try to bend the pins back to their correct position, they will break, and the connector will then need to be replaced.

---

### Coding system

There are two types of FSC modules:

- Plug-and-play modules (type number 10xxx/2/x), and
- Non plug-and-play modules (type number 10xxx/1/x) (i.e. modules with I/O wiring on the rack connectors).

FSC I/O modules are coded using coding system type 5159, make SOURIAU. The items used for key coding the modules depend on the I/O module type. Table 1 and Table 2 below list the items used for key coding plug-and-play modules and non plug-and-play modules.



Table 1 Items used for key coding plug-and-play I/O modules

<b>Plug-and-play modules (10xxx/2/x)</b>	<b>Souriau type no.</b>
Module part: 2 holes	
Rack part: large pins	5159.009.17.22 (use special insertion tool, type 5159.009.96)

The rack connector must be coded by inserting two large pins in the appropriate holes (see Table 3).

Table 2 Items used for key coding non plug-and-play I/O modules

<b>Non plug-and-play modules (10xxx/1/x)</b>	<b>Souriau type no.</b>
Module part: pins	5159.009.17.01 (use special insertion tool, type 5159.009.99)
Rack part: blind stops	5159.009.18.01 (use special insertion tool, type 5159.009.98)
Rack part: large pins	5159.009.17.22 (use special insertion tool, type 5159.009.96)

The indicated coding pins are inserted in the appropriate holes in the module connector. The rack connector must be coded by inserting blind stops and one large pin in the appropriate holes (see Table 4).





## Connectors

Every I/O module is fitted with a connector that is plugged into the appropriate rack connector.

### Plug-and-play I/O modules

Figure 1 and Figure 2 show the layout of the module connector and rack connector of plug-and-play I/O modules (10xxx/2/x).

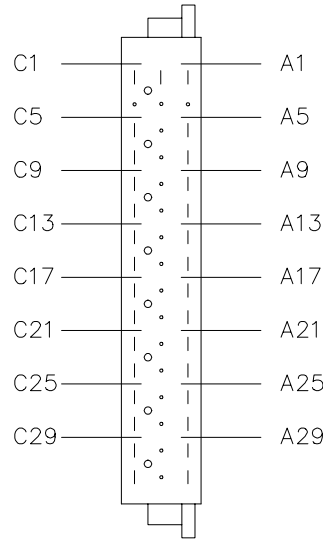


Figure 1 Module connector (back view)

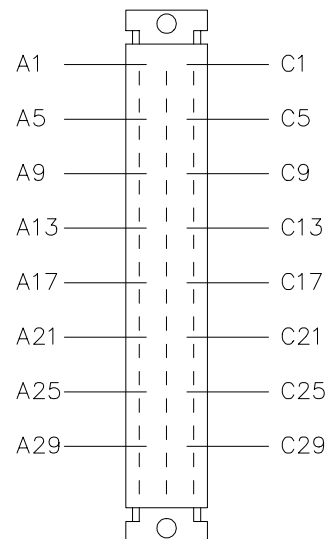


Figure 2 Rack connector (front view)

### Non plug-and-play I/O modules

Figure 3 and Figure 4 show the layout of the module connector and rack connector of non plug-and-play I/O modules (10xxx/1/x).

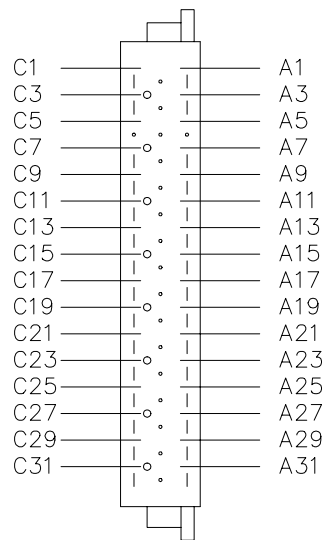


Figure 3 Module connector (back view)

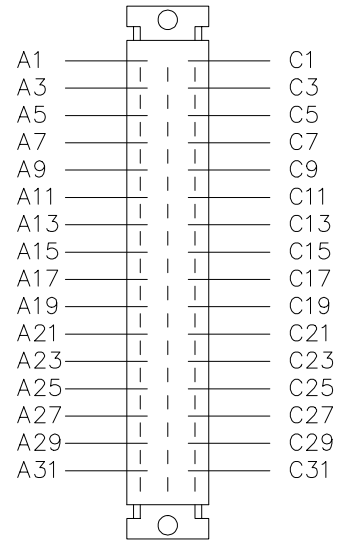


Figure 4 Rack connector (front view)



## Key coding

### Plug-and-play modules

Table 3 below shows the key coding of plug-and-play FSC modules (with type number 10xxx/2/x).

Table 3 Key coding of plug-and-play I/O modules

Module type	Module code		Module type	Rack code	
	Holes			Large pins	
10100/2/1	A5	A7	10100/2/1	A5	A7
10101/2/1	A5	C5	10101/2/1	A5	C5
10101/2/2	A5	C9	10101/2/2	A5	C9
10101/2/3	A5	C13	10101/2/3	A5	C13
10102/2/1	A5	C17	10102/2/1	A5	C17
10104/2/1	A5	C21	10104/2/1	A5	C21
10105/2/1	A5	C25	10105/2/1	A5	C25
10201/2/1	A9	C9	10201/2/1	A9	C9
10205/2/1	A9	C5	10205/2/1	A9	C5
10206/2/1	A9	C13	10206/2/1	A9	C13
10208/2/1	A9	C17	10208/2/1	A9	C17
10209/2/1	A9	C21	10209/2/1	A9	C21
10213/2/2	A9	C25	10213/2/2	A9	C25
10213/2/3	A9	C29	10213/2/3	A9	C29
10215/2/1	A13	C5	10215/2/1	A13	C5
10216/2/1	A13	C9	10216/2/1	A13	C9
10216/2/3	A13	C13	10216/2/3	A13	C13
10302/2/1	A5	A9	10302/2/1	A5	A9
10310/2/1	A5	A11	10310/2/1	A5	A11
10311/2/1	A5	A13	10311/2/1	A5	A13



**Non plug-and-play modules**

Table 4 belows show the key coding of non plug-and-play FSC modules (with type number 10xxx/1/x).

Table 4 Key coding of non plug-and-play I/O modules

Module type	Module code				Module type	Rack code			
	Hole	Pins				Blind stops			Large pin
10100/1/1	A27	C3	C11	C27	10100/1/1	C19	C23	C31	A27
10101/1/1	A27	C3	C11	C23	10101/1/1	C19	C27	C31	A27
10101/1/2	A15	C3	C11	C23	10101/1/2	C19	C27	C31	A15
10101/1/3	A3	C3	C11	C23	10101/1/3	C19	C27	C31	A3
10102/1/1	A27	C3	C19	C27	10102/1/1	C11	C23	C31	A27
10102/1/2	A27	C11	C19	C31	10102/1/2	C3	C23	C27	A27
10103/1/1	A27	C3	C19	C31	10103/1/1	C11	C23	C27	A27
10103/1/2	A27	C3	C19	C31	10103/1/2	C11	C23	C27	A27
10104/1/1	A27	C11	C19	C23	10104/1/1	C3	C27	C31	A27
10201/1/1	A27	C3	C11	C31	10201/1/1	C19	C23	C27	A27
10202/1/1	A27	C11	C27	C31	10202/1/1	C3	C19	C23	A27
10203/1/2	A27	C11	C27	C31	10203/1/2	C3	C19	C23	A27
10205/1/1	A27	C3	C23	C27	10205/1/1	C11	C19	C31	A27
10206/1/1	A27	C3	C19	C23	10206/1/1	C11	C27	C31	A27
10207/1/1	A27	C3	C11	C19	10207/1/1	C23	C27	C31	A27
10208/1/1	A27	C3	C23	C31	10208/1/1	C11	C19	C27	A27
10209/1/1	A27	C3	C27	C31	10209/1/1	C11	C19	C23	A27
10212/1/1	A27	C11	C23	C31	10212/1/1	C3	C19	C27	A27
10213/1/1	A11	C3	C11	C19	10213/1/1	C23	C27	C31	A11
10213/1/2	A15	C3	C11	C19	10213/1/2	C23	C27	C31	A15
10213/1/3	A3	C3	C11	C19	10213/1/3	C23	C27	C31	A3
10214/1/2	A23	C3	C11	C23	10214/1/2	C19	C27	C31	A23
10215/1/1	A27	C19	C23	C31	10215/1/1	C3	C11	C27	A27
10216/1/1	A19	C3	C11	C23	10216/1/1	C19	C27	C31	A19
10302/1/1	A27	C11	C23	C27	10302/1/1	C3	C19	C31	A27
10305/1/1	A27	C11	C19	C27	10305/1/1	C3	C23	C31	A27
10305/1/2	A23	C3	C19	C23	10305/1/2	C11	C27	C31	A23



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# **Fail Safe Control Hardware Manual**

## **Section 2: Power Supplies**

**TotalPlant**



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## 1200 S 24 P067 24 Vdc power supply (45 A)

### Description

The 1200 S 24 P067 power supply is a switched-mode DC power supply with a high efficiency (88%). It accepts a wide range of input voltages to provide 24 Vdc, 45 A output.

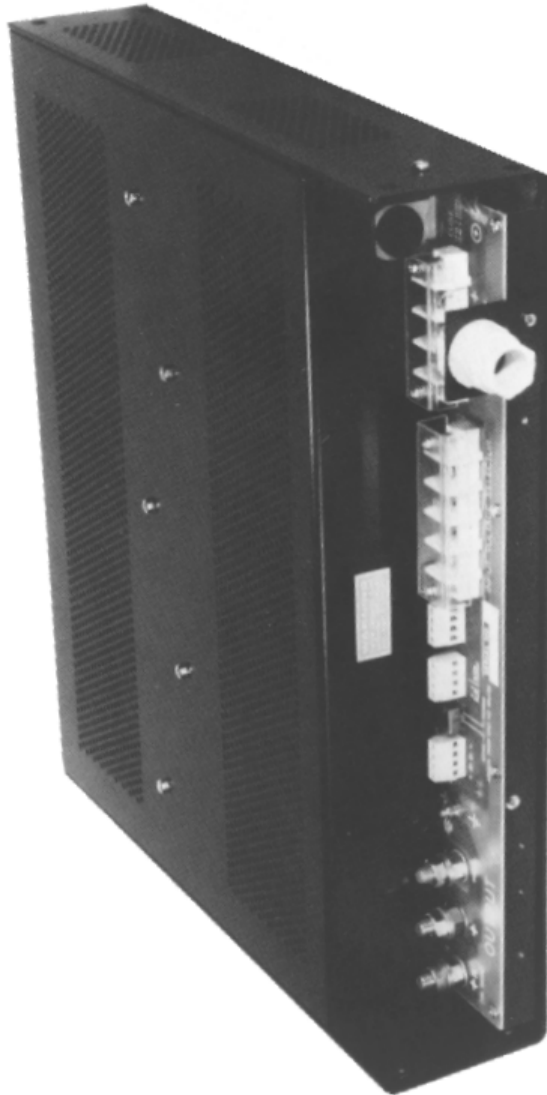


Figure 1 Full view

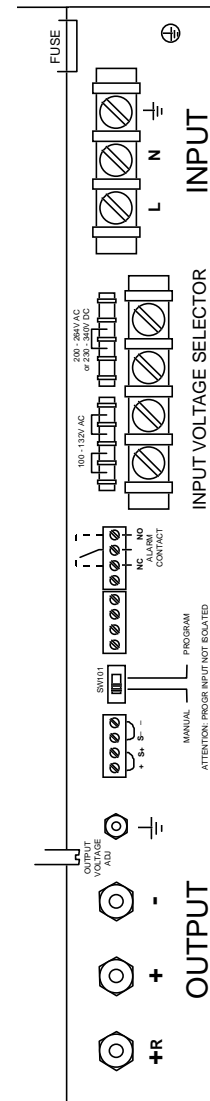


Figure 2 Connections



## Main features

The unit's main features include:

- dual built-in overvoltage protection to comply with the strict functional safety requirements of the DIN V 19250 and VDE V 0801 standards,
- undervoltage alarm,
- redundant parallel operation (+R),
- serial operation (e.g. to create 48 Vdc), and
- optimum protection against continuous overload and short-circuiting.

Green LEDs in the front and rear panels are lit if the output voltage is present.

## Installation

The 1200 S 24 P067 power supply can be mounted both vertically and horizontally, although vertical mounting is preferred for optimum cooling.

Convection cooling works best when the unit is mounted vertically, with the input connections facing upwards (see Figure 3). The unit is constructed in such a way that the heat generated in the semiconductors and transformer flows through a thick aluminum profile to both covers, which act as heat sinks. Thus, it is important that the air can flow freely along both vertical sides of the power supply unit. This design with natural convection cooling was chosen to avoid the use of forced ventilation, which has disadvantages like reliability, wear and tear, noise and dust filters. The unit is shipped with two H88 brackets for easy mounting.

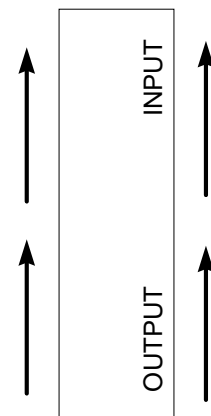


Figure 3 Vertical mounting

Although vertical mounting is preferred, the unit may also be mounted horizontally, providing that the maximum ambient temperature does not exceed 40°C (104°F) at full load (see Figure 4). When mounted in a 19" rack, the unit must have sufficient free space around it for optimum cooling (min. 1 HE, 1U).

### Note:

If multiple power supplies are to be mounted above each other horizontally, it is recommended to use forced air cooling.

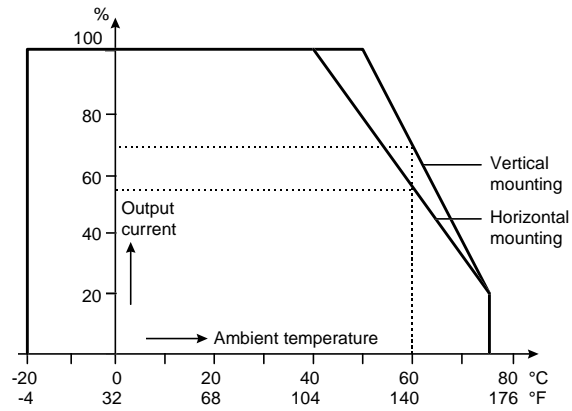


Figure 4 Derating curve  
(percentage of load versus ambient temperature)

## Recommended wire sizes

The table below shows the recommended wire sizes for the power supply's input and output wiring.

Table 1 Recommended wire sizes

INPUT		OUTPUT	
230 Vac	115 Vac	24 Vdc	Voltage drop
2.5 mm <sup>2</sup> (AWG 14)	4.0 mm <sup>2</sup> (AWG 12)	16 mm <sup>2</sup> (AWG 6)	50.4 mV/m at 45 A

## Current limit

The unit has a current limit feature, which is used to limit the maximum output to 1100 W. Figure 5 shows the power supply's current limit curve.

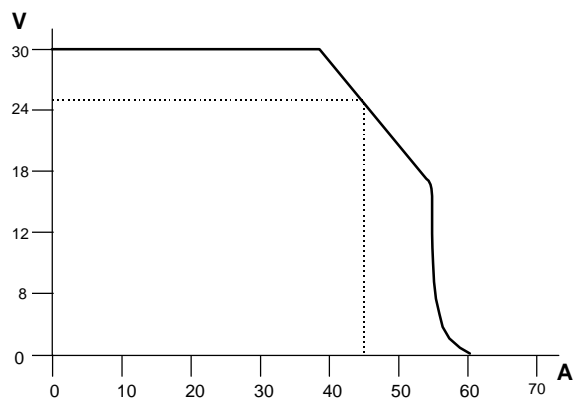


Figure 5 Current limit

## Hardware control features

The 1200 S 24 P067 power supply has a number of features which allow the unit to be tailored to specific applications (see Figure 2). They are:

- an output adjustment selector switch (SW101),
- an input voltage selector block,
- a sense block, and
- an alarm contact.

Each of these features is discussed in more detail below.

## Output adjustment selector switch (SW101)

For FSC applications, switch SW101 must be in the MANUAL position, which means that the output voltage can be adjusted using the potentiometer at the back (see Figure 2).

## Input voltage selector block

The power supply accepts a wide input voltage range. The input voltage selector block (see Figure 2) is used to set the input voltage range.

With the jumper in the 230 V position (see Figure 6), the unit can be used at any line voltage between 200 and 264 Vac, 50/60 Hz (or between 230 and 340 Vdc). Place a 12.5 A fuse in the fuse holder.

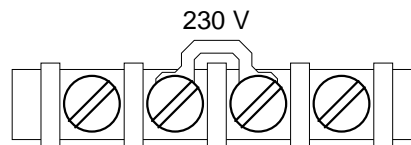


Figure 6 Selector block set at 230 V

With the two jumpers in the 115 V position (see Figure 7), the unit can be used at any line voltage between 100 and 132 Vac 50/60 Hz. Place a 25 A fuse in the fuse holder.

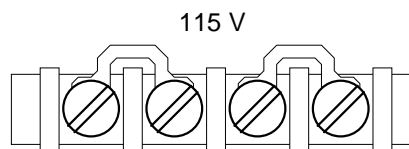


Figure 7 Selector block set at 115 V



## Sense block

For FSC applications (no remote sensing), S+ on the sense block (see Figure 8) must be connected to + and S- to -. This is the default factory setting.

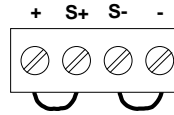


Figure 8 Sense block

## Alarm contact

The alarm contact (see Figure 9) is used for voltage monitoring. The alarm contact diagram shows the relay energized, which means that the output voltage is above 90% of the output voltage setting.

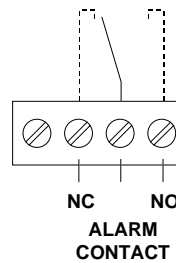


Figure 9 Relay contact alarm diagram



## Technical data

The 1200 S 24 P067 power supply unit has the following specifications:

<b>General</b>	Type number:	1200 S 24 P067
	Approvals:	CE, TÜV, UL
<b>Power</b>	Power requirements:	200-264 Vac, 50/60 Hz; 8.2 A rms, 12.5 AT fuse (see Figure 6) 100-132 Vac, 50/60 Hz; 16.4 A rms, 25 AT fuse (see Figure 7) 230-340 Vdc (see Figure 6); 4.7 A dc, 12.5 AT fuse
	Power consumption at no load:	< 40 W
	<b>Physical</b>	Dimensions:
	Weight:	11 kg (24.2 lb)
	Fuse dimensions:	32 x 6.3 mm (1.26 x 0.25 in)
<b>Environment</b>	Ambient temperatures:	
	– storage	–40°C to +85°C (–40°F to +185°F)
	– operating	–20°C to +75°C (–4°F to +167°F) (see Figure 4 for derating of output current as a function of ambient temperature)
<b>Input</b>	Inrush current:	< 40 A
<b>Output</b>	Output voltage:	24 Vdc with dual overvoltage protection
	Ripple and noise:	Max. 5 mV rms, 15 mV p-p





## Technical data (continued)

<b>Output (cont.)</b>	Output current:	45 A at $-20^{\circ}\text{C}$ to $+50^{\circ}\text{C}$ ( $-4^{\circ}\text{F}$ to $+122^{\circ}\text{F}$ ) when mounted vertically
		45 A at $-20^{\circ}\text{C}$ to $+40^{\circ}\text{C}$ ( $-4^{\circ}\text{F}$ to $+104^{\circ}\text{F}$ ) when mounted horizontally
	Derating of output current:	to 68% at $60^{\circ}\text{C}$ ( $140^{\circ}\text{F}$ ) when mounted vertically
		to 54% at $60^{\circ}\text{C}$ ( $140^{\circ}\text{F}$ ) when mounted horizontally (see Figure 4 for derating curve)
	Hold-up time:	15 ms at 220 Vac input and full load 30 ms at half load
	Output voltage setting:	25 Vdc (+R output)
	Efficiency of +R output:	88% at 230 Vac
	Undervoltage alarm contact:	Relay de-energizes when output voltage drops below 90% of the output voltage setting. Contact rating: 100 mA / 30 V
	Voltage limit:	For safety, two independent regulation circuits limit the output voltage to approx. 31 V in case of malfunction of the normal regulation.
	Serial operation:	up to 500 V total voltage
<b>Isolation</b>	Input to output:	3750 V rms (1 min.)
	Input to case:	2500 V rms (1 min.)
	Output to case:	500 Vdc

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## M24-20HE 24 Vdc power supply (20 A)

### Description

The power supply M24-20HE is a linear power supply with high efficiency (74%). It is available in a number of versions that accept different AC input voltages: 110, 117, 220, 230 or 240 Vac.

The power supply has an extra output (via a diode) for use in redundant operation. It also has a built-in overvoltage protection and a delayed foldback characteristic to prevent overheating in case of overload.

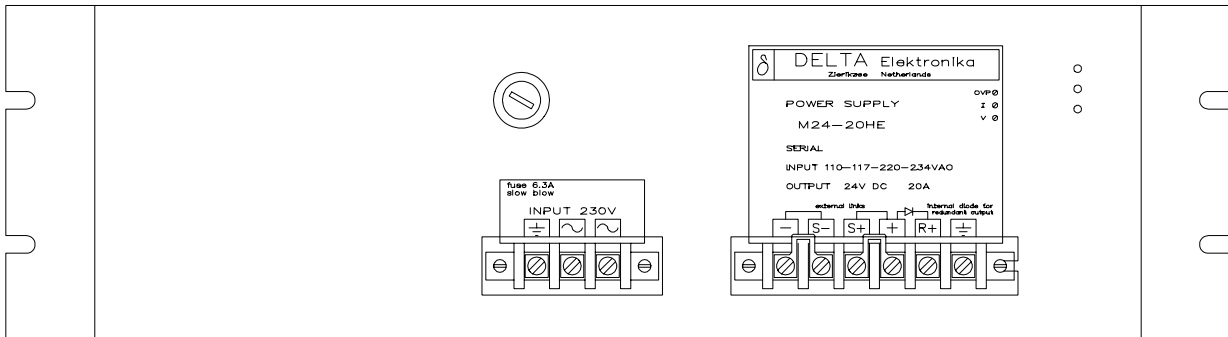


Figure 1 Front view

### Delayed foldback

Delayed foldback means that, when the power supply is overloaded, it first goes into constant current and after a few hundred milliseconds into foldback (see Figure 2).

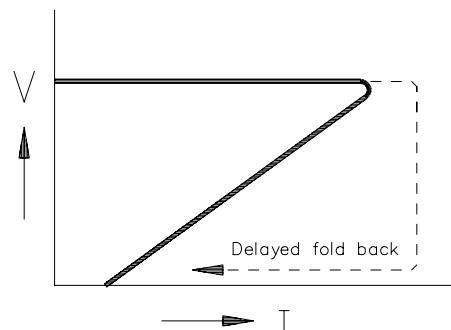


Figure 2 Delayed foldback

## Derating curve

The derating curve of the M24-20HE power supply is as follows:

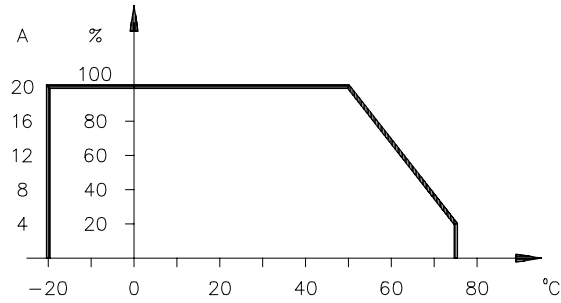


Figure 3 Derating curve (current & percentage of load vs. ambient temperature)

## Connections

The transformer connections of the M24-20HE power supply are as follows:

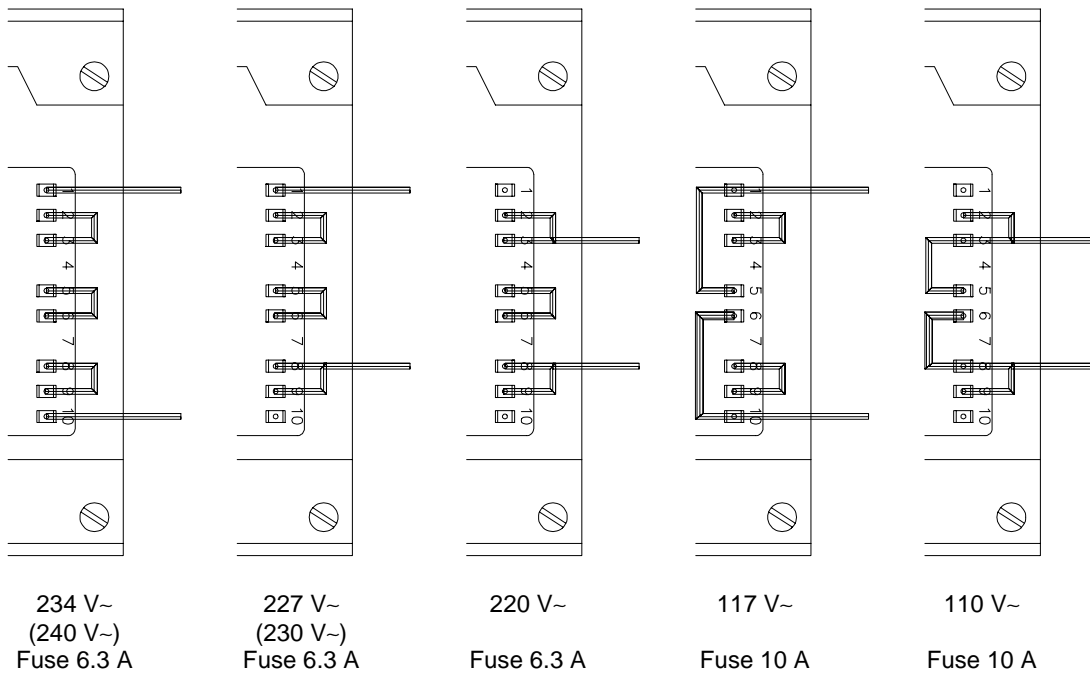


Figure 4 Transformer connections



## Wiring example

Figure 5 shows an example of 24 Vdc power distribution for redundant Central Parts with redundant I/O (with common 0 V of 24 Vdc).

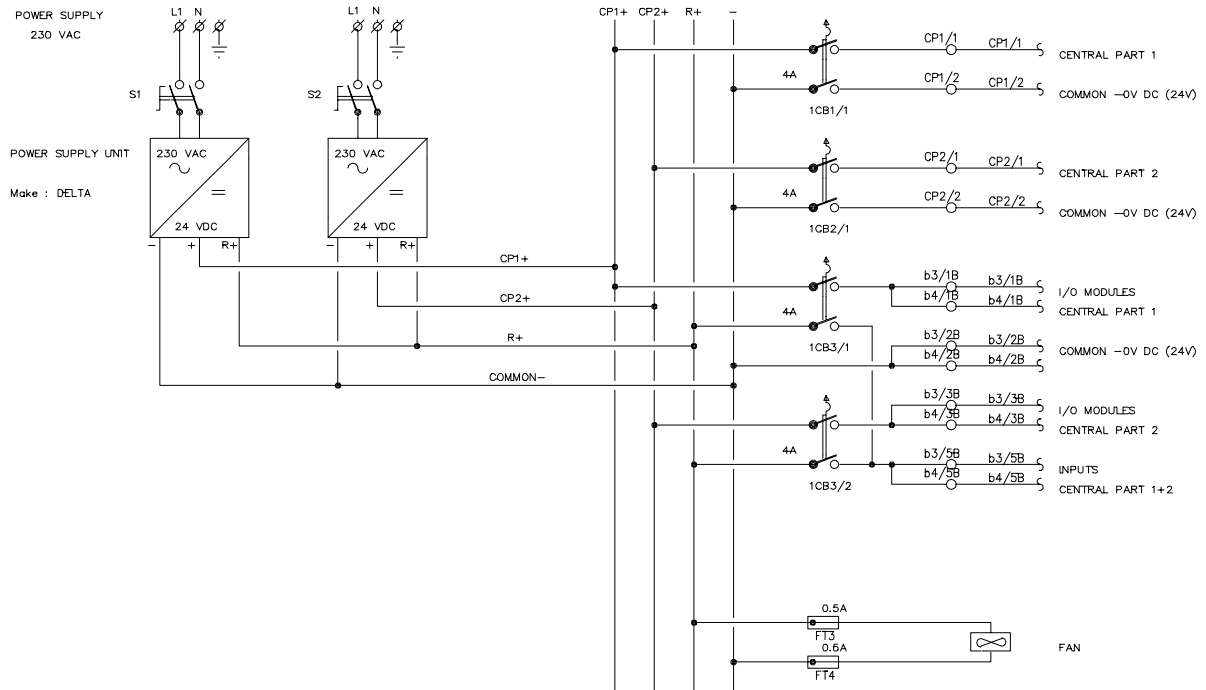


Figure 5 24 Vdc power distribution example

## Technical data

The M24-20HE power supply has the following specifications:

<b>General</b>	Type number:	M24-20HE
	Approvals:	CE, TÜV, UL
<b>Power</b>	Power requirements:	110 or 117 Vac (10 AT fuse), ± 10% 220, 230 or 240 Vac (6.3 AT fuse), ± 10%
	Frequency:	50 / 60 Hz (48...62 Hz)
<b>Physical</b>	Space requirements:	84 TE (full rack), 3 HE, 260 mm 84 HP (full rack), 3U, 10.24 in
	Weight:	15.6 kg (34.3 lb)
	Fuse dimensions:	5 x 20 mm (0.20 x 0.79 in)



## Technical data (continued)

<b>Environment</b>	Ambient temperature:	-20°C to +60°C (-4°F to +140°F)
<b>Input</b>	Input current:	3.7 A at 220 Vac
	Inrush current:	< 80 A at 220 Vac
	Crest factor:	1.9
<b>Output</b>	Output voltage:	24 Vdc with overvoltage protection
	Ripple content:	< 0.1 V p-p
	Output current:	20 A at -20°C to +50°C (-4°F to +122°F)
		13.5 A at 50°C to 60°C (122°F to 140°F)
	Hold-up time:	nominal AC input voltage, see Figure 4 20 ms at full load 50 ms at half load
	Output voltage setting:	25 Vdc (R+ output)
	Maximum current setting:	21 A
	Overvoltage protection:	26 Vdc
	Efficiency:	74%
<b>Isolation</b>	AC input to case:	2500 Vac
	DC output to case:	500 Vdc

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## M24-12HE 24 Vdc power supply (12 A)

### Description

The power supply M24-12HE is a linear power supply with high efficiency (74%). It is available in a number of versions that accept different AC input voltages: 110, 117, 220, 230 or 240 Vac.

The power supply has an extra output (via a diode) for use in redundant operation. It also has a built-in overvoltage protection and a delayed foldback characteristic to prevent overheating in case of overload.

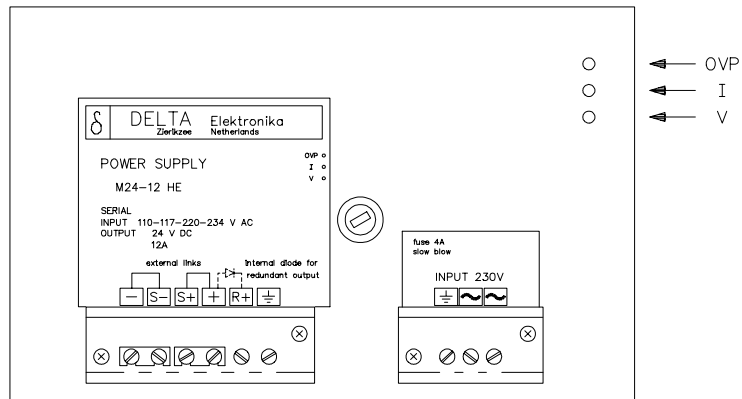


Figure 1 Back view

As the M24-12HE power supply uses only half a rack, the other half can be used for a second M24-12HE unit or an M60-5HE power supply. If the second half is not used, this space should be filled with an empty half rack, type M 1/2.

Mounting the two supply units (or one supply unit and an empty unit) in a cabinet requires two brackets, type number: H7-with grip.



## Delayed foldback

Delayed foldback means that, when the power supply is overloaded, it first goes into constant current and after a few hundred milliseconds into foldback (see Figure 2).

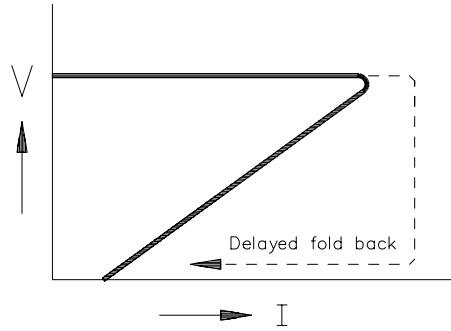


Figure 2 Delayed foldback

## Derating curve

The derating curve of the M24-12HE power supply is as follows:

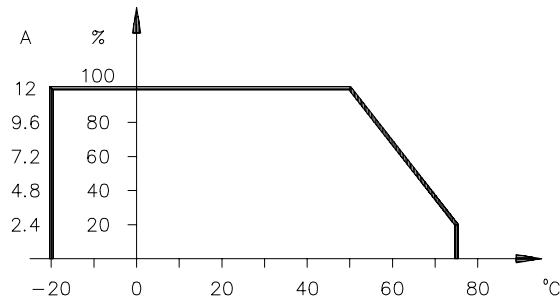


Figure 3 Derating curve (current & percentage of load vs. ambient temperature)





## Connections

The transformer connections of the M24-12HE power supply are as follows:

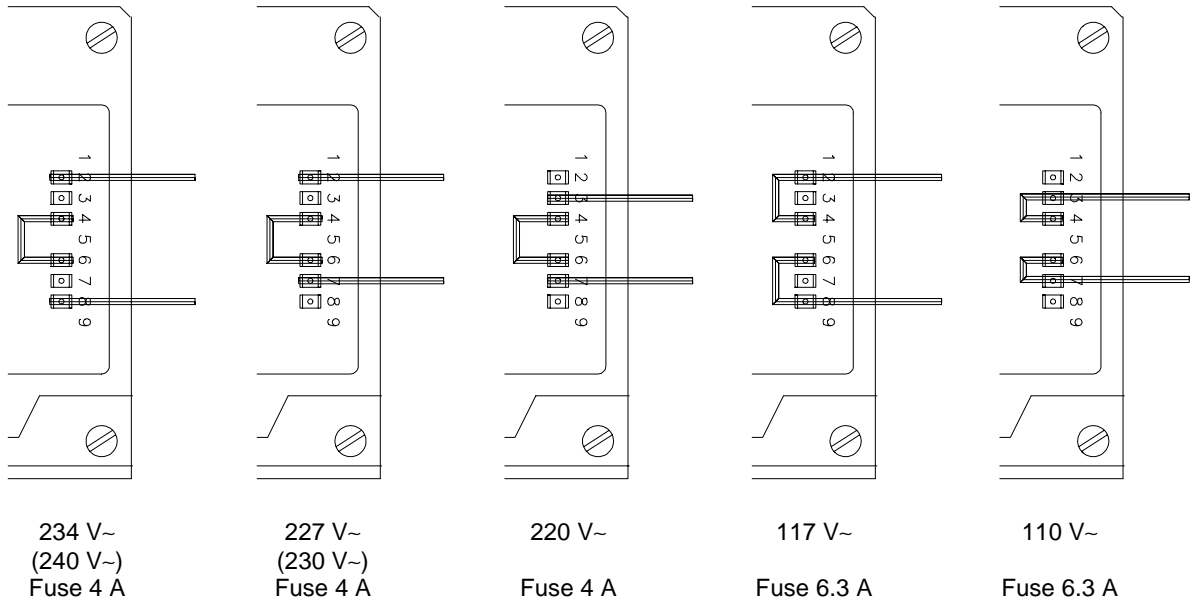


Figure 4 Transformer connections



## Wiring example

Figure 5 shows an example of 24 Vdc power distribution for redundant Central Parts with redundant I/O (with common 0 V of 24 Vdc).

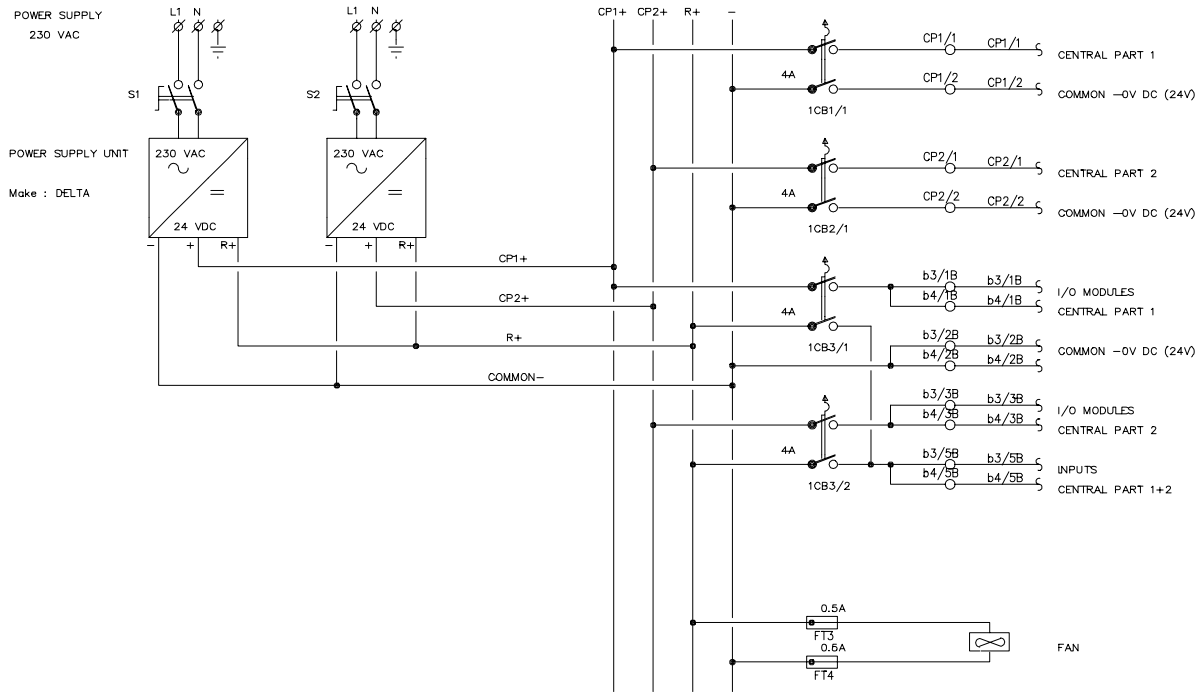


Figure 5 24 Vdc power distribution example

## Technical data

The M24-12HE power supply has the following specifications:

<b>General</b>	Type number:	M24-12HE
	Approvals:	CE, TÜV, UL
<b>Power</b>	Power requirements:	110 or 117 Vac (6.3 AT fuse), ± 10% 220, 230 or 240 Vac (4 AT fuse), ± 10%
	Frequency:	50 / 60 Hz (48...62 Hz)
<b>Physical</b>	Space requirements:	42 TE (half rack), 3 HE, 275 mm 42 HP (half rack), 3U, 10.83 in
	Weight:	8.8 kg (19.4 lb)
	Fuse dimensions:	5 x 20 mm (0.20 x 0.79 in)



## Technical data (continued)

<b>Environment</b>	Ambient temperature:	-20°C to +60°C (-4°F to +140°F)
<b>Input</b>	Input current:	2.2 A at 220 Vac
	Inrush current:	< 40 A at 220 Vac
	Crest factor:	1.8
<b>Output</b>	Output voltage:	24 Vdc with overvoltage protection
	Ripple content:	< 0.1 V p-p
	Output current:	12 A at -20°C to +50°C (-4°F to +122°F)
		8.5 A at 50°C to 60°C (122°F to 140°F)
	Hold-up time:	Nominal AC input voltage, see Figure 4 20 ms at full load 50 ms at half load
	Output voltage setting:	25 Vdc (R+ output)
	Maximum current setting:	12.5 A
	Overvoltage protection:	26 Vdc
Efficiency:	74%	
<b>Isolation</b>	AC input to case:	2500 Vac
	DC output to case:	500 Vdc

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## M48-10HE 48 Vdc power supply (10 A)

### Description

The power supply M48-10HE is a linear power supply with high efficiency (75%). It is available in a number of versions that accept different AC input voltages: 110, 117, 220, 230 or 240 Vac.

The power supply has an extra output (via a diode) for use in redundant operation. It also has a built-in overvoltage protection and a delayed foldback characteristic to prevent overheating in case of overload.

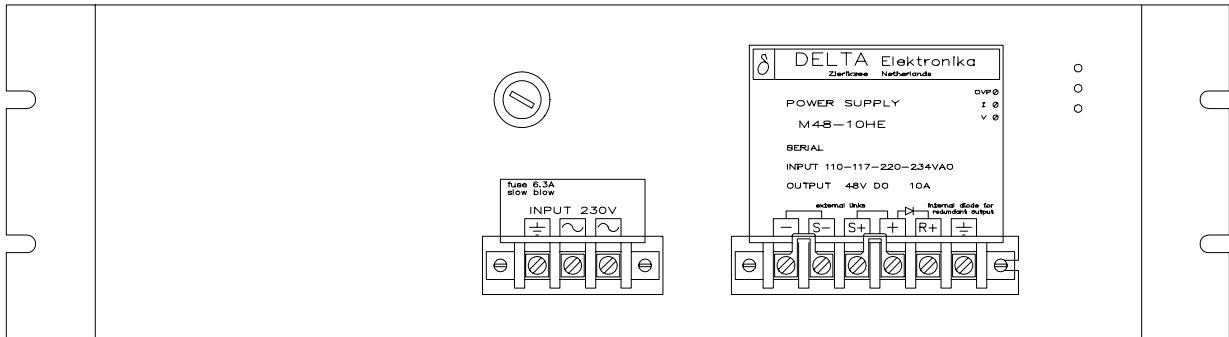


Figure 1 Front view

### Delayed foldback

Delayed foldback means that, when the power supply is overloaded, it first goes into constant current and after a few hundred milliseconds into foldback (see Figure 2).

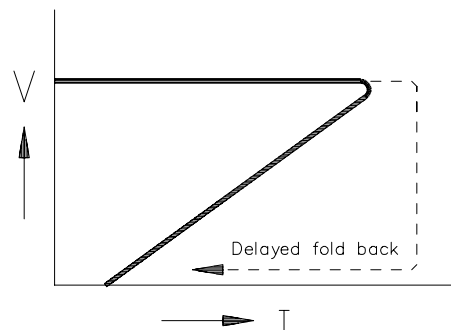


Figure 2 Delayed foldback

## Derating curve

The derating curve of the M48-10HE power supply is as follows:

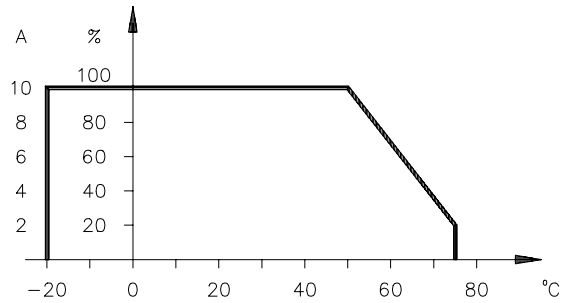


Figure 3 Derating curve (current & percentage of load vs. ambient temperature)

## Connections

The transformer connections of the M48-10HE power supply are as follows:

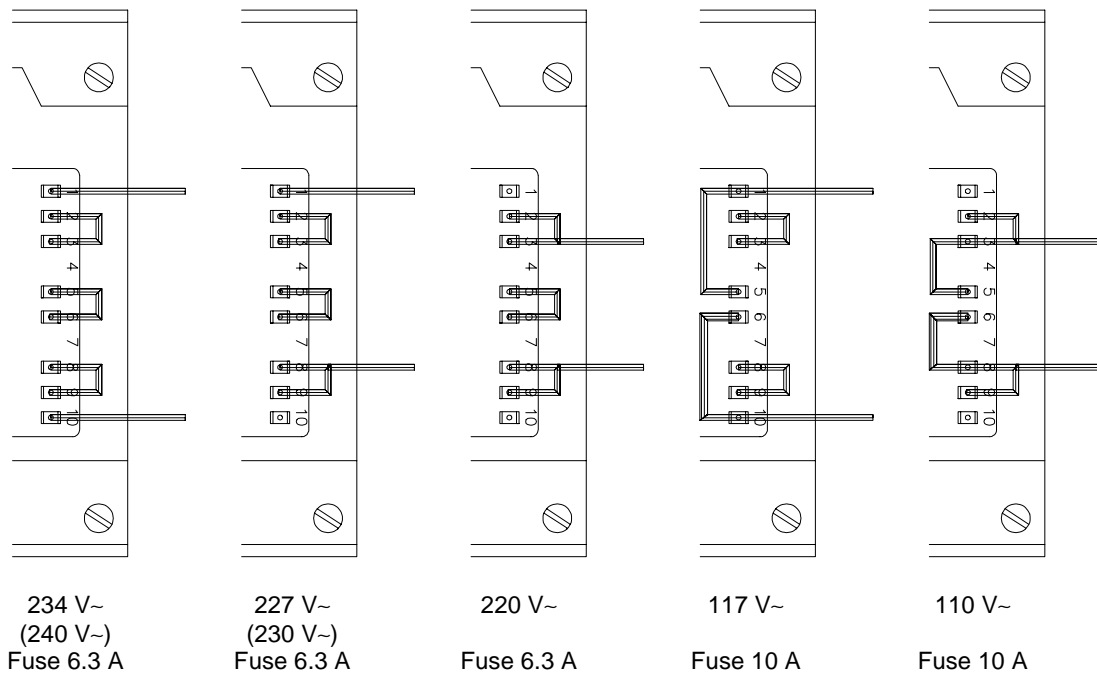


Figure 4 Transformer connections



## Technical data

The M48-10HE power supply has the following specifications:

<b>General</b>	Type number:	M48-10HE
	Approvals:	CE, TÜV, UL
<b>Power</b>	Power requirements:	110 or 117 Vac (10 AT fuse), $\pm 10\%$ 220, 230 or 240 Vac (6.3 AT fuse), $\pm 10\%$
	Frequency:	50 / 60 Hz (48...62 Hz)
<b>Physical</b>	Space requirements:	84 TE (full rack), 3 HE, 260 mm 84 HP (full rack), 3U, 10.24 in
	Weight:	15.6 kg (34.3 lb)
	Fuse dimensions:	5 x 20 mm (0.20 x 0.79 in)
<b>Environment</b>	Ambient temperature:	$-20^{\circ}\text{C}$ to $+60^{\circ}\text{C}$ ( $-4^{\circ}\text{F}$ to $+140^{\circ}\text{F}$ )
<b>Input</b>	Input current:	3.7 A at 220 Vac
	Inrush current:	$< 80$ A at 220 Vac
	Crest factor:	1.9
<b>Output</b>	Output voltage:	48 Vdc with overvoltage protection
	Ripple content:	$< 0.2$ V p-p
	Output current:	10 A at $-20^{\circ}\text{C}$ to $+50^{\circ}\text{C}$ ( $-4^{\circ}\text{F}$ to $+122^{\circ}\text{F}$ )
		7 A at $50^{\circ}\text{C}$ to $60^{\circ}\text{C}$ ( $122^{\circ}\text{F}$ to $140^{\circ}\text{F}$ )
	Hold-up time:	Nominal AC input voltage, see Figure 4 15 ms at full load 30 ms at half load
	Output voltage setting:	49 Vdc (R+ output)
	Maximum current setting:	10.5 A
	Overvoltage protection:	50 Vdc
	Efficiency:	75%
<b>Isolation</b>	AC input to case:	2500 Vac
	DC output to case:	500 Vdc



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## M60-5HE

## 48/60 Vdc power supply (5 A)

### Description

The power supply M60-5HE is a linear power supply with high efficiency (75%). It is available in a number of versions that accept different AC input voltages: 110, 117, 220, 230 or 240 Vac. The output voltage of this power supply unit can be either 48 Vdc or 60 Vdc.

### Note:

Changing the output voltage from 48 V to 60 V or vice versa requires changing a transformer tap (see Figure 5) and readjustment of the 'OVP' and 'V' potentiometers.

The power supply has an extra output (via a diode) for use in redundant operation. It also has a built-in overvoltage protection and a delayed foldback characteristic to prevent overheating in case of overload.

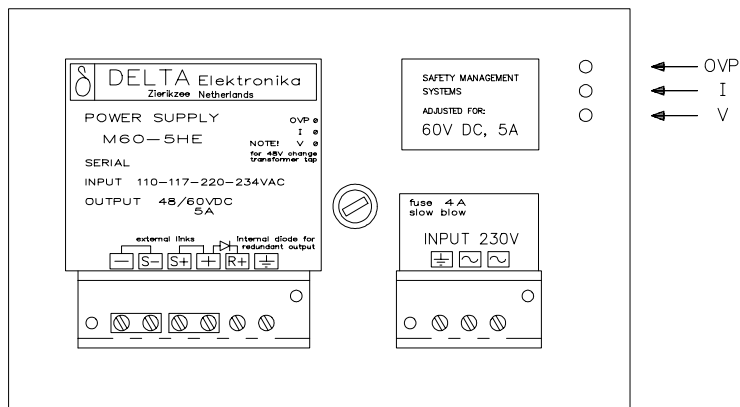


Figure 1 Back view

As the M60-5HE power supply uses only half a rack, the other half can be used for a second M60-5HE unit or an M24-12HE power supply. If the second half is not used, this space should be filled with an empty half rack, type M 1/2.

Mounting the two supply units (or one supply unit and an empty unit) in a cabinet requires two brackets, type number: H7-with grip.

## Delayed foldback

Delayed foldback means that, when the power supply is overloaded, it first goes into constant current and after a few hundred milliseconds into foldback (see Figure 2).

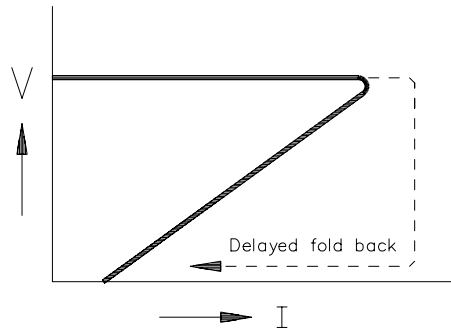


Figure 2 Delayed foldback

## Derating curve

The derating curve of the M60-5HE power supply is as follows:

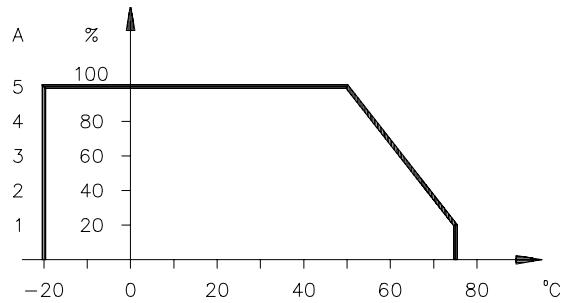


Figure 3 Derating curve (current & percentage of load vs. ambient temperature)



## Connections

The transformer connections of the M60-5HE power supply are as follows:

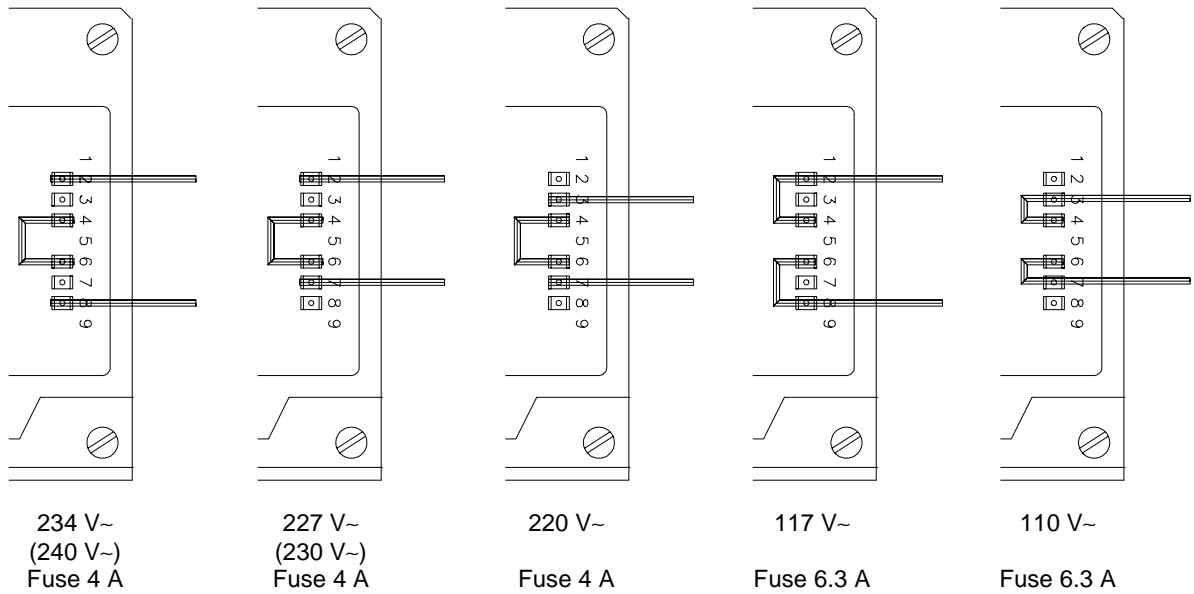


Figure 4 Transformer connections: primary side

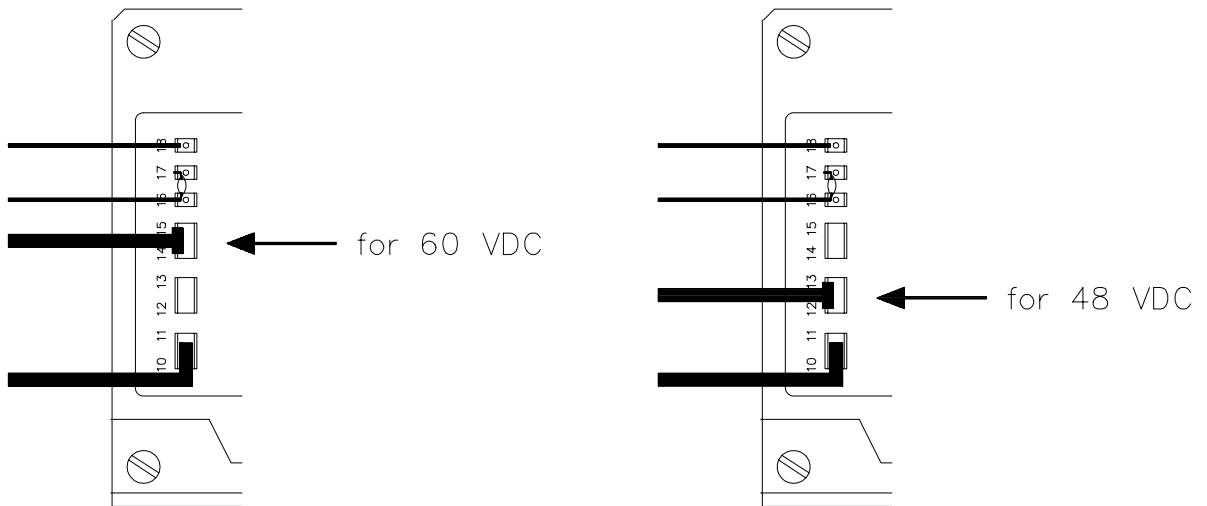


Figure 5 Transformer connections: secondary side



<b>Technical data</b>	The M60-5HE power supply has the following specifications:	
<b>General</b>	Type number:	M60-5HE
	Approvals:	CE, TÜV, UL
<b>Power</b>	Power requirements:	110 or 117 Vac (6.3 AT fuse), $\pm 10\%$ 220, 230 or 240 Vac (4 AT fuse), $\pm 10\%$
	Frequency:	50 / 60 Hz (48...62 Hz)
<b>Physical</b>	Space requirements:	42 TE (half rack), 3 HE, 275 mm 42 HP (half rack), 3U, 10.83 in
	Weight:	8.8 kg (19.4 lb)
	Fuse dimensions:	5 x 20 mm (0.20 x 0.79 in)
<b>Environment</b>	Ambient temperature:	$-20^{\circ}\text{C}$ to $+60^{\circ}\text{C}$ ( $-4^{\circ}\text{F}$ to $+140^{\circ}\text{F}$ )
<b>Input</b>	Input current:	2.2 A at 220 Vac
	Inrush current:	$< 40$ A at 220 Vac
	Crest factor:	1.8
<b>Output</b>	Output voltage:	48 Vdc or 60 Vdc with overvoltage protection
	Ripple content:	$< 0.2$ V p-p
	Output current:	5 A at $-20^{\circ}\text{C}$ to $+50^{\circ}\text{C}$ ( $-4^{\circ}\text{F}$ to $+122^{\circ}\text{F}$ ) 3.5 A at $50^{\circ}\text{C}$ to $60^{\circ}\text{C}$ ( $122^{\circ}\text{F}$ to $140^{\circ}\text{F}$ )
	Hold-up time:	Nominal AC input voltage, see Figure 4 15 ms at full load 30 ms at half load



## Technical data (continued)

<b>Output (cont.)</b>	Output voltage setting (48 V):	49 Vdc (R+ output)
	Output voltage setting (60 V):	61 Vdc (R+ output)
	Maximum current setting:	5.3 A
	Overvoltage protection (48 V):	50 Vdc
	Overvoltage protection (60 V):	62 Vdc
	Efficiency:	75%
	<b>Isolation</b>	AC input to case:
DC output to case:		500 Vdc

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## 10300/1/1

## 24 Vdc to 5 Vdc/12 A converter

### Description

The supply voltage of the FSC system is 24 Vdc, which can be powered from the plant's 24 Vdc supply system with battery back-up. The FSC system uses an internal 5 Vdc to power the FSC modules. The 10300/1/1 DC/DC converter provides the internal 5 Vdc with galvanic isolation between the two supply voltages.

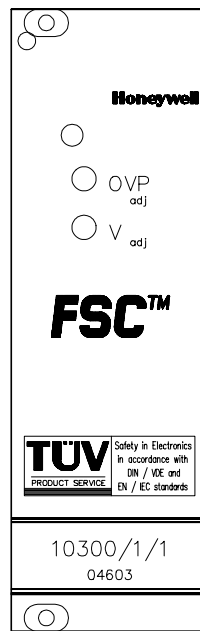


Figure 1 Front view

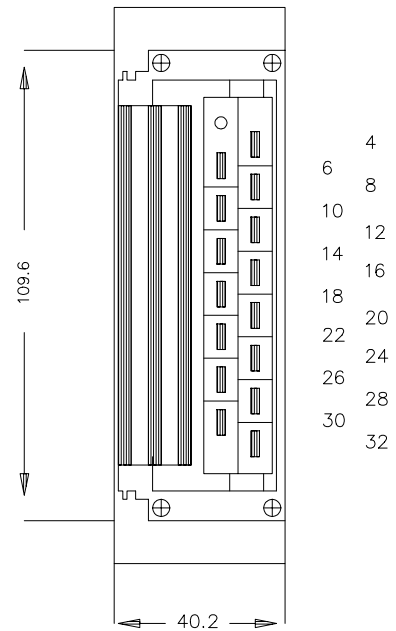


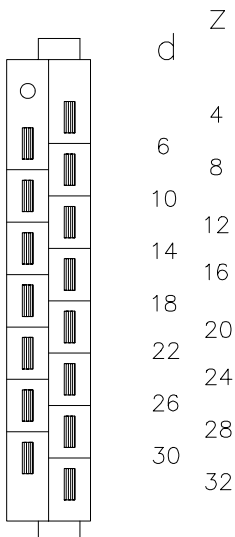
Figure 2 Back view

### Note:

Keep 10300/1/1 modules off-line for at least 30 seconds after being on-line. 10300/1/1 modules have an NTC resistor as an inrush current limiter. Replacing (or repowering) the module within 30 seconds after removal (or power-off) may cause a supply voltage dip which may trip the system (because the NTC resistor did not yet cool down sufficiently).

## Pin allocation

The back view and pin allocation of the 10300/1/1 power connector are as follows:



		z4	Supply 5 Vdc
d6	+ sense	z8	Supply 5 Vdc
d10	- sense	z12	GND 5 Vdc
d14	(see note below)	z16	GND 5 Vdc
d18		z20	
d22		z24	Supply 0 Vdc
d26	Supply 0 Vdc	z28	Supply 24 Vdc
d30	Supply 24 Vdc	z32	Earth

### Notes:

1. 10300/1/1 modules without a suffix code and with suffix code 04601 have an ON/OFF input on pin d14. This pin should not be connected.
2. The 10300/1/1 module is a pin-compatible upgraded version of the GK60 module.

## Derating curve

The derating curve of the 10300/1/1 module is as follows:

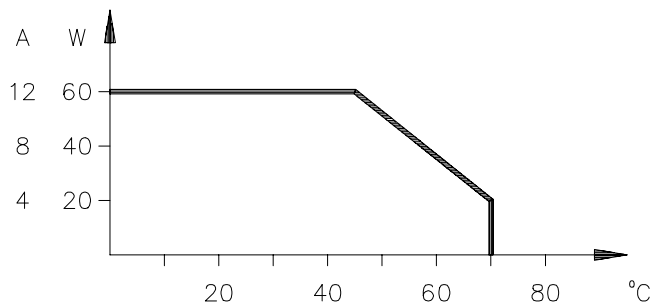


Figure 3 Derating curve (current and power vs. ambient temperature)





## Wiring diagram

The 10300/1/1 module is wired in accordance with the wiring diagram below:

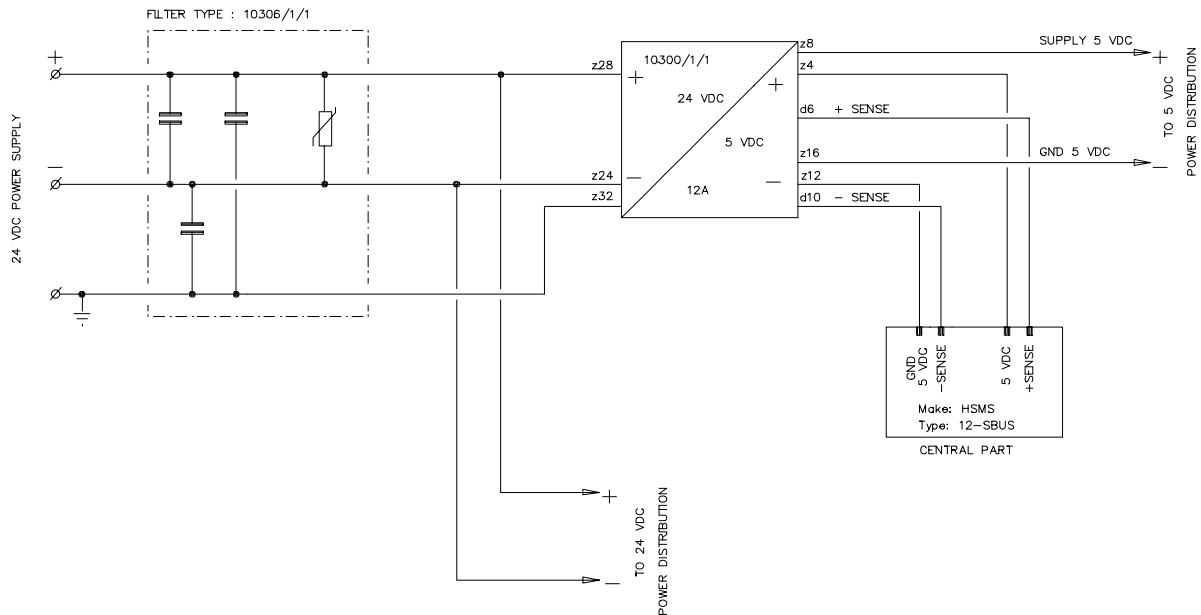


Figure 4 Wiring diagram

---

### Note:

If the 24 Vdc is supplied from an M24-20HE or M24-12HE power supply that is located in the same cabinet as the FSC system, the input filter is not mandatory.

---

As the limits on the 5 Vdc power supply are very tight ( $\pm 5\%$ ), this module must be placed closely to the system bus (e.g. 12-SBUS). Use the sense wires correctly and use short wires of proper wire diameter to minimize voltage drop over the wiring.

The minimum wire diameters for 'SUPPLY 5 VDC' and 'GND 5 VDC' to the system bus of the Central Part are as follows:

- up to 8 A: 2.5 mm<sup>2</sup> (AWG 14)
  - up to 12 A: 6 mm<sup>2</sup> (AWG 10)
-



## Technical data

The 10300/1/1 module has the following specifications:

<b>General</b>	Type number:	10300/1/1 04603*
	Approvals:	CE, TÜV, UL**
	Software versions:	all
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U)
<b>Power</b>	Power requirements:	current < 3.9 A at 24 Vdc voltage 24 Vdc (-15%...+30%)
	Inrush current:	< 18 A
<b>Environment</b>	Ambient temperature:	0°C to 60°C (32°F to 140°F) (see derating curve, Figure 3)
<b>Output</b>	Output voltage:	5 Vdc with overvoltage protection
	Ripple content:	< 40 mV p-p (at full load)
	Output current:	12 A at 0°C to 45°C (32°F to 113°F) 8 A at 0°C to 60°C (32°F to 140°F)
	Hold-up time:	≥ 0 ms
	Output voltage setting (V adj):	5.00 Vdc measured across system bus connections
	Overvoltage protection (OVP adj):	5.75 Vdc
	Efficiency:	≥ 70%

---

### Notes:

- \* For 10300/1/1 modules without a suffix code, the output LED may remain on in redundant configurations with single I/O, even if the 10300/1/1 is switched off (LED is energized by a redundant 10300/1/1 unit).
  - \*\* 10300/1/1 modules with suffix code 04602 or less are not CE-approved.
- 

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# **Fail Safe Control Hardware Manual**

## **Section 3: Buses and Backplanes**

**TotalPlant**



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## S-BUS

## Horizontal bus for I/O in Central Part rack

### Description

The S-BUS is used to connect up to 14 I/O modules with a single bus driver (SBD). It has sixteen 16-pin connectors, one 14-pin connector and bus terminators at the front, and eight pins at the back.

The S-bus print is contained in a metal housing for easy mounting in a cabinet for standard 19-inch racks.

One 16-pin connector at the front and the eight pins at the back interconnect the watchdog flatcable (at the front) with the wiring for watchdog output, watchdog reset input (24 Vdc), watchdog ESD input (5 Vdc) and the ESD input (24 Vdc) terminals.

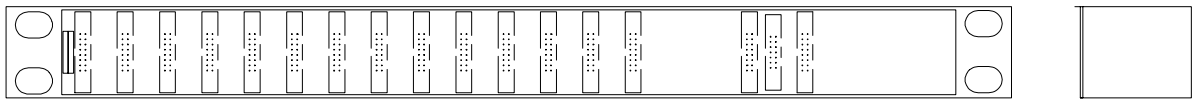


Figure 1 Front and side views

### Connections

The pin connections of the S-BUS are as follows:

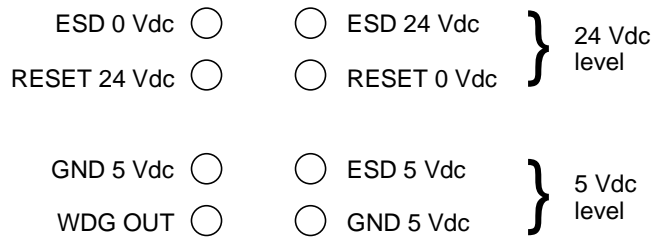


Figure 2 Back view of watchdog pins

The separation between the 5 Vdc and 24 Vdc wiring must be maintained in the same manner as for the I/O module terminations.



## Watchdog wiring

The watchdog output must be connected to all the modules that have WDG inputs (see Figure 3).

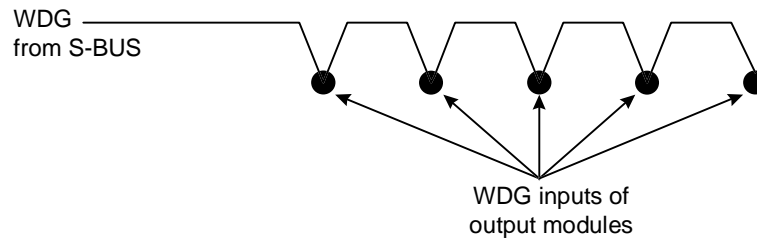


Figure 3 Watchdog wiring

## Technical data

The S-BUS has the following specifications:

<b>General</b>	Type number:	S-BUS
	Approvals:	CE, TÜV, UL
	Space requirements:	84 TE (full rack), 1 HE (= 84 HP, 1U)
<b>Power</b>	Power requirements:	Included in SBD (10007/1/1) specification

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## 1-BUS

## Horizontal bus in non-redundant I/O rack

### Description

The 1-BUS is used to connect up to 18 I/O modules with a horizontal bus driver (HBD, 10100/1/1 or 10100/2/1). It has nineteen 16-pin connectors and bus terminators at the front, and one 20-pin connector at the back.

The 1-BUS print is contained in a metal housing for easy mounting in a cabinet for standard 19-inch racks. The housing has a hinged front plate, which can hold a tag strip.

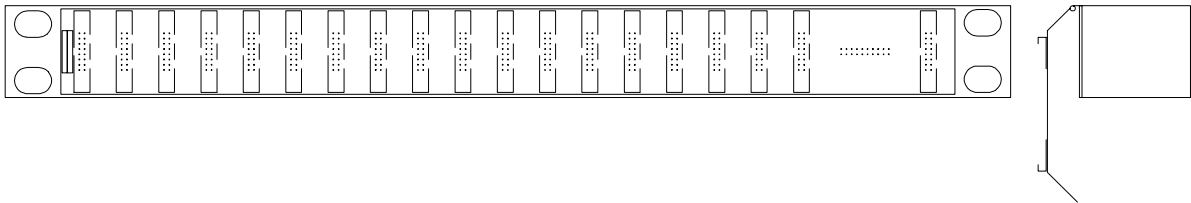


Figure 1 Front and side views

### Technical data

The 1-BUS has the following specifications:

<b>General</b>	Type number:	1-BUS
	Approvals:	CE, TÜV, UL
	Space requirements:	84 TE (full rack), 1 HE (= 84 HP, 1U)
<b>Power</b>	Power requirements:	Included in HBD (10100/1/1 or 10100/2/1) specification

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## 2-BUS

## Horizontal bus in redundant I/O rack

### Description

The 2-BUS is used to connect up to 18 I/O modules with the horizontal bus drivers (HBD, 10100/1/1 or 10100/2/1). It has twenty 16-pin connectors and bus terminators at the front, and two 26-pin connectors at the back.

The 2-BUS print is contained in a metal housing for easy mounting in a cabinet for standard 19-inch racks. The housing has a hinged front plate, which can hold a tag strip.

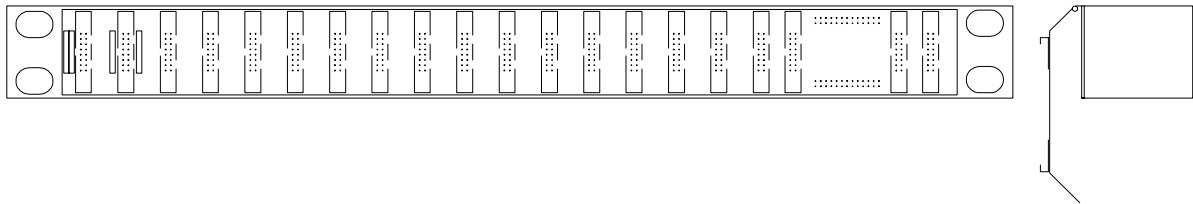


Figure 1 Front and side views

### Technical data

The 2-BUS has the following specifications:

<b>General</b>	Type number:	2-BUS
	Approvals:	CE, TÜV, UL
	Space requirements:	84 TE (full rack), 1 HE (= 84 HP, 1U)
<b>Power</b>	Power requirements:	Included in HBD (10100/1/1 or 10100/2/1) specification

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## 5-SBUS, 7-SBUS, 12-SBUS, 17-SBUS: Central Part system buses

### Description

Central Part system buses are used to interconnect the modules of the Central Part. The buses have a number of 96-pin connectors as well as bus terminators on both ends of the system bus.

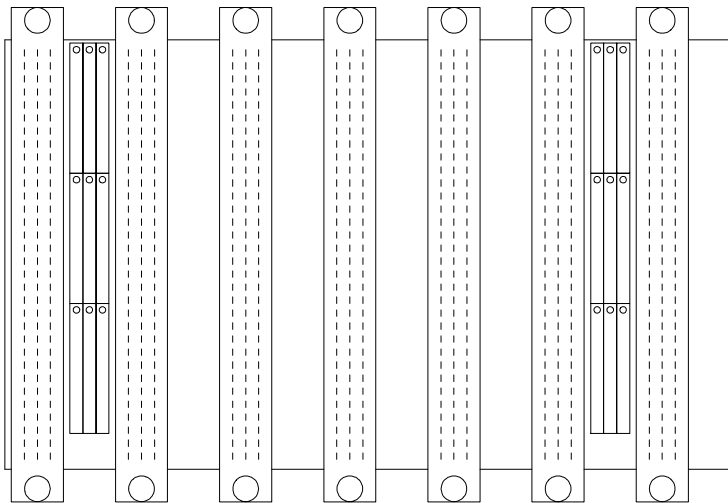


Figure 1 System bus (7-SBUS) front view

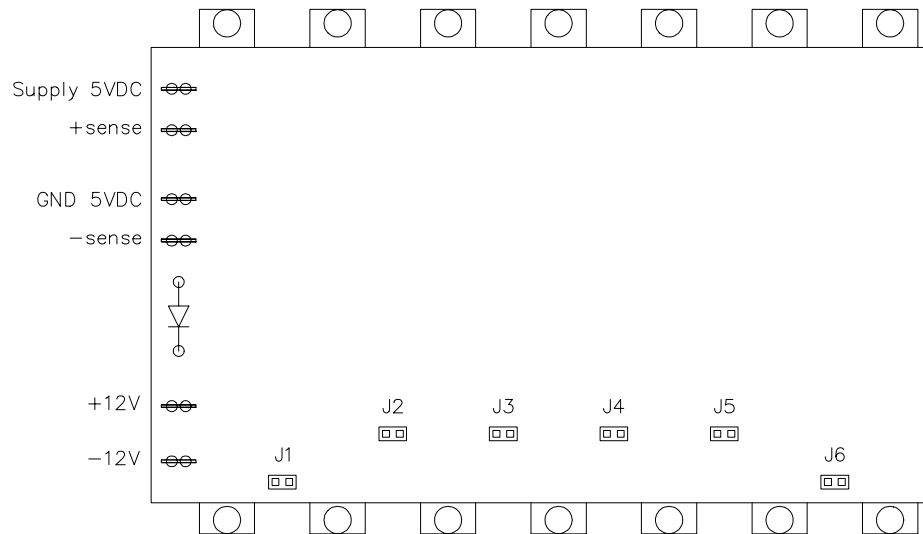


Figure 2 System bus (7-SBUS) back view with jumpers and faston terminations



The jumpers on the system bus are normally closed, except if one or more communication (COM) modules have been placed. Communication modules take up two rack positions. The jumper between the connectors that are used (covered) by the COM module must then be removed. (Seen from the back of the system bus, this jumper is located to the right of the COM module mainboard.)

---

## 5-SBUS

The 5-SBUS is used for Central Parts which also contain I/O. It has the following specifications:

Type number:	5-SBUS
Approvals:	CE, TÜV, UL
Number of positions:	5
Space requirements:	20 TE, 3 HE (= 20 HP, 3U)
Power requirements:	5 Vdc 1 A

---

## 7-SBUS

The 7-SBUS can be used for Central Parts which also contain I/O. It is also used when two Central Parts are placed in one Central Part rack. It has the following specifications:

Type number:	7-SBUS
Approvals:	CE, TÜV, UL
Number of positions:	7
Space requirements:	28 TE, 3 HE (= 28 HP, 3U)
Power requirements:	5 Vdc 1 A

---

## 12-SBUS

The 12-SBUS is normally used with one Central Part per Central Part rack. It has the following specifications:

Type number:	12-SBUS
Approvals:	CE, TÜV, UL
Number of positions:	12
Space requirements:	48 TE, 3 HE (= 48 HP, 3U)
Power requirements:	5 Vdc 1 A

---





## 17-SBUS

The 17-SBUS is only used if the number of Central Part modules exceeds the capacity of the 12-SBUS. It has the following specifications:

Type number:	17-SBUS
Approvals:	CE, TÜV, UL
Number of positions:	17
Space requirements:	68 TE, 3 HE (= 68 HP, 3U)
Power requirements:	5 Vdc 1 A

---

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## V-Buses

## Vertical bus from CP rack to I/O rack

---

### Description

The vertical buses (V-Buses) in the FSC system are the umbilical cord between the processor and the I/O modules. All scan, test and update actions between the processor and I/O modules in I/O racks are routed via one or more vertical buses.

The V-Bus is a 34-wire flatcable with connectors for the VBD(s), connectors for the HBD(s), and a connector for the vertical bus terminator (10307/1/1). Large systems (using more than one cabinet) need a V-Bus link from the cabinet with the CP part(s) to the cabinet that only contains I/O racks. This V-Bus link consists of a 34-wire round "flatcable" with connector(s) for the VBD(s) and a connector for the V-bus in the dedicated I/O cabinet.

The type of V-Bus that is required depends on three things:

- the configuration (redundant Central Parts and/or I/O),
  - the cabinet layout (e.g. racks with redundant I/O followed by racks with non-redundant I/O), and
  - the integration method (HBD type 10100/1/1 vs. 10100/2/1 with 10314, 10315, 10316 or 10317 backplanes).
- 

### Ordering V-Buses

Ordering a V-Bus flatcable requires all relevant cabinet layout data (including dimensions). As CE and TÜV approval is required in more and more systems, the use of standard cabinet layouts has become common practice. This enables simplified V-Bus ordering information.

The V-Bus code can only be used if the cabinet layout and the VBD positioning meet all of the following requirements:

- The VBD must have rack position 14, 15 or 16.
- The VBDs of a V-Bus for configurations with redundant Central Parts and non-redundant I/O must have the same rack position number in both CP racks (e.g. VBD1: rack 1, position 15, and VBD2: rack 2, position 15).
- Every rack with its S-Bus, 1-Bus or 2-Bus is 4 HE (4U) high.
- The CP rack(s) must be the first rack or the first two racks.
- There are only FSC racks between the first CP rack and the last I/O rack.



- The redundant I/O racks are placed in one consecutive row of racks (per cabinet).
- The non-redundant I/O racks are placed in one consecutive row of racks (per cabinet).

If there is a deviation from any of these rules, the V-Bus order must include a full description of the required V-Bus (see example 4).

## V-Bus ordering code

If the V-Bus meets the requirements listed above, it is possible to order that V-Bus by using its V-Bus code.  
The V-Bus code is built up as follows:

**VBUS** □/□/□□

The first digit is the sum of VBDs (1 or 2) and HBDs that are to be connected via the V-Bus (in practice this will be a number between 1 and 9).

**VBUS** □/□/□□

The second digit represents the integration method:

- 1 = Use of 10100/1/1 HBDs, with V-Bus guided through the racks.
- 2 = Use of 10100/2/1 HBDs with I/O backplanes 10314/1/1, 10315/1/1 or HBD backplanes 10316/1/1 or 10317/1/1 guided via a duct on the side of the racks.
- R = Round cable (see 'Round V-Bus ordering code' section below).

**VBUS** □/□/□□

The third digit represents the V-Bus configuration:

- 1 = Configuration with non-redundant CP and non-redundant I/O.
- 2 = Configuration with redundant CPs and non-redundant I/O.
- 3 = Central Part 1 of configuration with redundant CPs and redundant I/O.
- 4 = Central Part 2 of configuration with redundant CPs and redundant I/O.



## VBUS □/□/□□

The fourth digit refers to the distance between the (bottom) CP rack and the first involved I/O rack. The number represents the number of racks that are skipped:

- 0 = The first involved I/O rack is located directly below the (bottom) CP rack.
- 1 = One rack is placed between the (bottom) CP rack and the first involved I/O rack.
- 2 = Two racks are placed between the (bottom) CP rack and the first involved I/O rack.
- 3 = Three racks are placed between the (bottom) CP rack and the first involved I/O rack.
- 4 = Four racks are placed between the (bottom) CP rack and the first involved I/O rack.
- 5 = Five racks are placed between the (bottom) CP rack and the first involved I/O rack.
- 6 = Six racks are placed between the (bottom) CP rack and the first involved I/O rack.
- 7 = Seven racks are placed between the (bottom) CP rack and the first involved I/O rack.
- 9 = The V-Bus is placed in a dedicated I/O cabinet.

### Round V-Bus ordering code

Ordering round cables requires a slightly different approach. The V-Bus code for round cables is built up as follows:

## VBUS □/R/□□

The first digit is the number of VBDs (1 or 2) connected via the V-Bus:

- 1 = one VBD for fully redundant or fully non-redundant configurations.
- 2 = two VBDs for configurations with redundant CPs and non-redundant I/O.

## VBUS □/R/□□

The last two digits represent the required cable length between the (top) VBD connector and the connector on the I/O rack side in units of 10 cm (3.94 in) (see example 3).



The required length depends on a large number of factors, including:

- cabinet size (height and width),
- hinge position of CP cabinet (left or right),
- hinge position of I/O cabinet (left or right),
- relative position of I/O cabinet to CP cabinet (left or right),
- position of the first involved HBD (e.g. rack 11),
- position of the top VBD (usually rack 1, but in configurations with redundant CPs and redundant I/O, the V-Bus for CP2 starts in rack 2, and therefore the cable must be 20 cm / 7.9 in longer).

As the round cable only allows connector placement at specific distances, the ordered length must have a margin of at least 5 cm (2 in).

---

**Note:**

The maximum length of the round cable is 5 m (16.4 ft), since the maximum combined length of the round cable and the V-Bus is 8 m (26.2 ft).

---

---

**Note:**

**The vertical buses mentioned above are all part of the standard HSMS hardware program. Customized V-Bus cables are available on request. When ordering customized vertical buses, detailed specifications should be provided as to their design and layout.**

---



## Ordering examples

The following examples will clarify the coding method.

### Example 1:

An FSC cabinet with non-redundant Central Part and non-redundant I/O, with a rack layout as shown in Figure 1 (using 10100/1/1 HBDs).

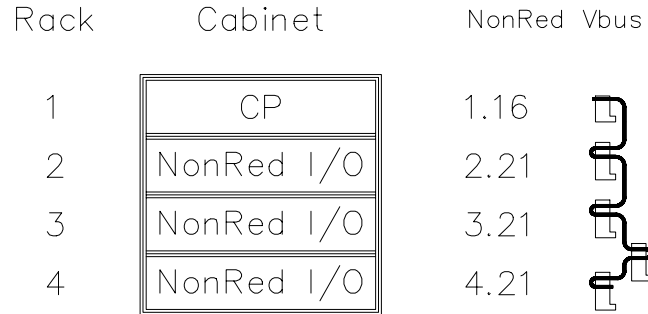


Figure 1 V-Buses example 1

The ordering code to be used is:

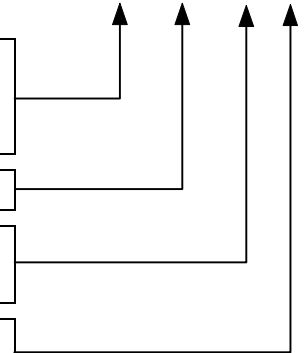
**VBUS** 4 / 1 / 1 0

The V-Bus must connect the VBD (position 1.16) to the three HBDs (positions 2.21, 3.21 and 4.21).

10100/1/1 HBDs

V-Bus for configuration with non-redundant CP and non-redundant I/O

No rack is skipped between the CP and the first I/O rack.





### Example 2:

An FSC cabinet with redundant Central Parts and both redundant and non-redundant ("hybrid") I/O, with a rack layout as shown in Figure 2 using I/O backplanes (with 10100/2/1 HBDs).

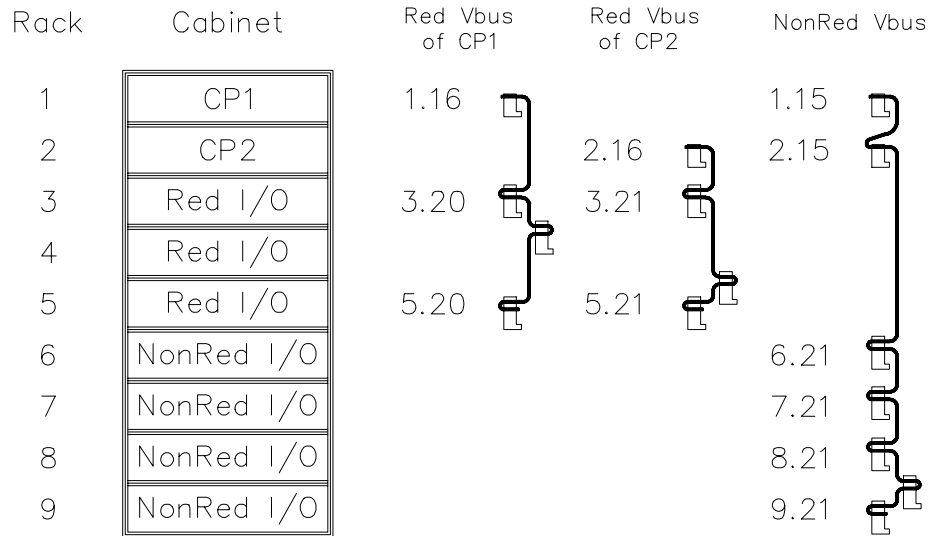
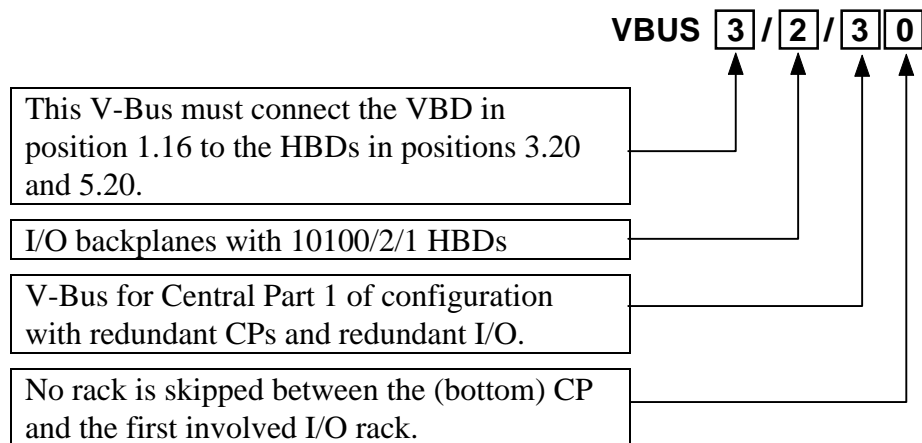


Figure 2 V-Buses example 2

This system has three V-Buses:

- V-Bus of redundant I/O part for CP1,
- V-Bus of redundant I/O part for CP2, and
- V-Bus of non-redundant I/O part.

The ordering code to be used for the V-Bus of the redundant I/O part for CP 1 is:







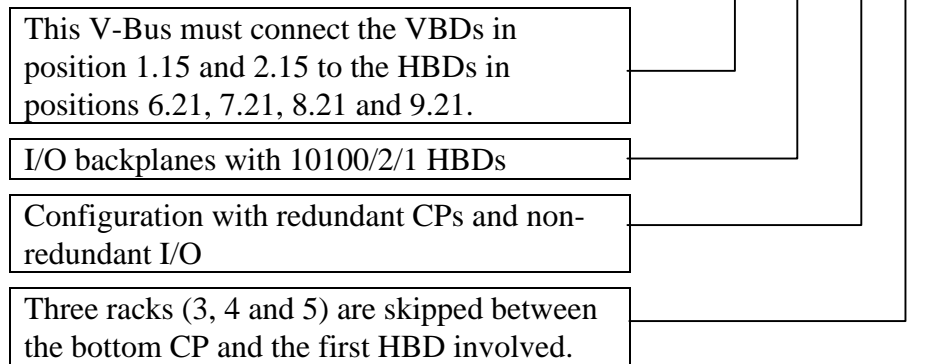
The ordering code to be used for the V-Bus of the redundant I/O part for CP 2 is:

**VBUS 3 / 2 / 4 0**

The only relevant difference between this cable and the first one is the Central Part number, so only the third digit changes to 4.

The ordering code to be used for the V-Bus of the non-redundant I/O part is:

**VBUS 6 / 2 / 2 3**



### Example 3:

An FSC cabinet with redundant Central Parts and both redundant and non-redundant ("hybrid") I/O, with a rack layout as shown in Figure 3 using I/O backplanes (with 10100/2/1 HBDs) and a 3 m (9.8 ft) round cable between CP1 and rack 11 (in cabinet 2).

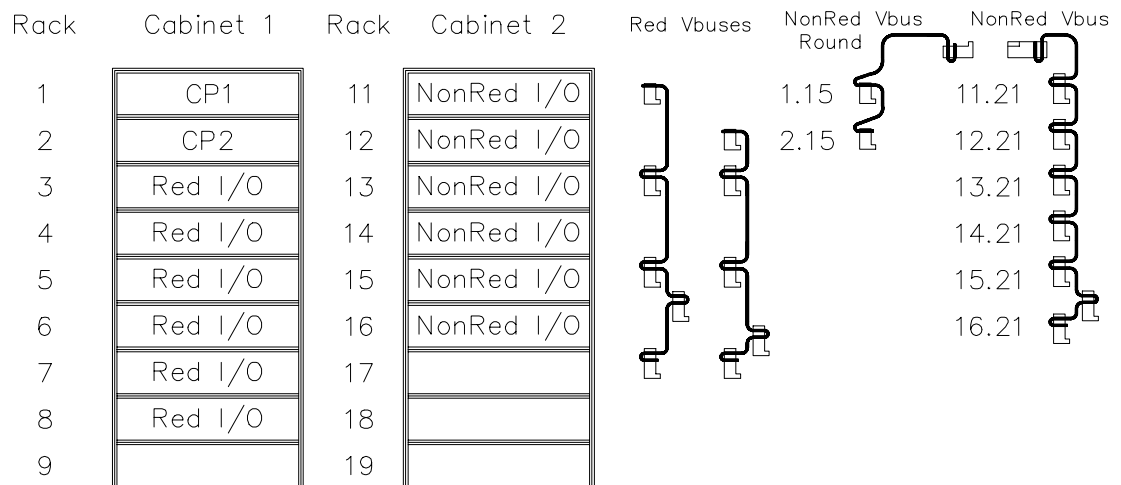


Figure 3 V-Buses example 3



This system has four V-Buses:

- V-Bus of redundant I/O part for CP1,
- V-Bus of redundant I/O part for CP2,
- V-Bus of non-redundant I/O part (round), and
- V-Bus of non-redundant I/O part.

The ordering code to be used for the V-Bus of the redundant I/O part for CP 1 is:

**VBUS** 4 / 2 / 30

(See example 2.)

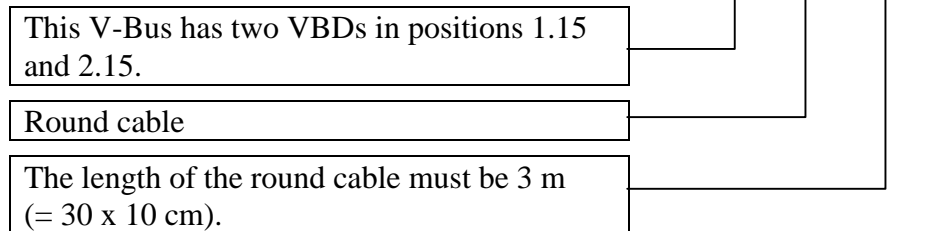
The ordering code to be used for the V-Bus of the redundant I/O part for CP 2 is:

**VBUS** 4 / 2 / 40

(See example 2.)

The ordering code to be used for the V-Bus round cable of the non-redundant I/O part is:

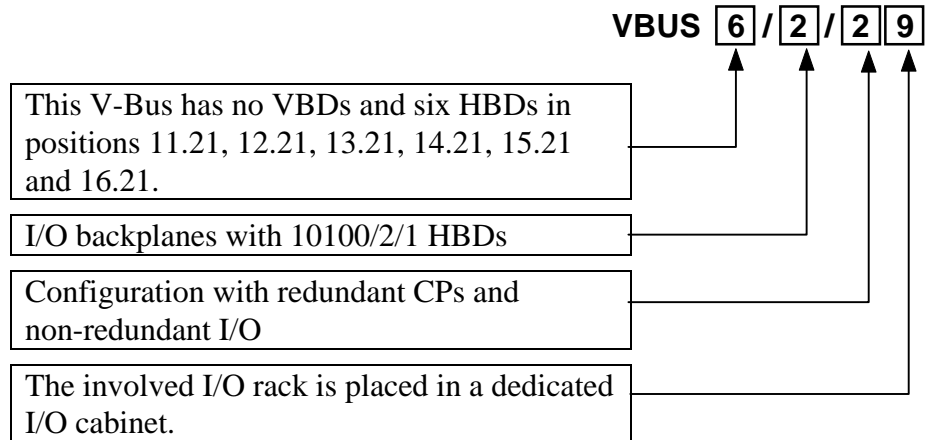
**VBUS** 2 / R / 30



As the distance between the CP1 connector and the CP2 connector is 20 cm (7.9 in), the round cable will have a total length of approx. 320 cm (10.5 ft).



The ordering code to be used for the V-Bus of the non-redundant I/O part is:



**Example 4:**

An FSC cabinet with redundant Central Parts and both redundant and non-redundant ("hybrid") I/O, with a 35 cm (13.8 in) high (CE-approved) annunciator display panel in rack 3, a mix of redundant/non-redundant I/O racks, and VBDs in positions 13 and 14. The cabinet layout does not meet the standard V-Bus coding requirements. As no V-Bus code is applicable, the V-Buses must be described.

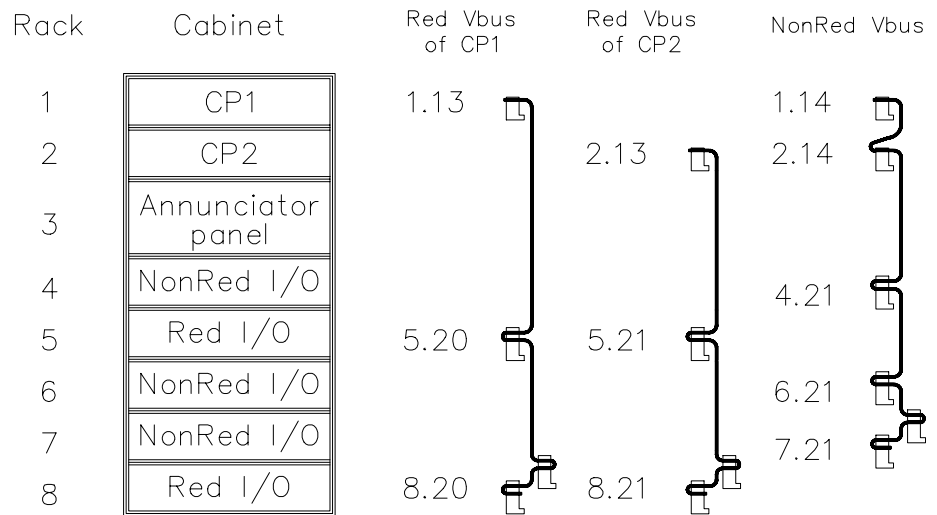


Figure 4 V-Buses example 4

The V-Bus of the redundant I/O part for CP 1 is sufficiently described as: "a V-Bus with a VBD in position 1.13, HBDs type 10100/2/1 in positions 5.20 and 8.20, and a 35 cm (13.8 in) high free-issue panel as rack 3".



The V-Bus of the redundant I/O part for CP 2 is sufficiently described as: "a V-Bus with a VBD in position 2.13, HBDs type 10100/2/1 in positions 5.21 and 8.21, and a 35 cm (13.8 in) high free-issue panel as rack 3".

The V-Bus of the non-redundant I/O part is sufficiently described as: "a V-Bus with VBDs in positions 1.14 and 2.14, HBDs type 10100/2/1 in positions 4.21, 6.21 and 7.21, and a 35 cm (13.8 in) high free-issue panel as rack 3".

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## 10314/1/1

## I/O backplane for non-redundant I/O

### Description

The I/O backplane 10314/1/1 is used in non-redundant I/O racks.

Up to 18 I/O modules can be placed in the I/O backplane 10314/1/1 (rack positions 1 to 18). A horizontal bus driver (HBD, 10100/2/1) must be placed in rack position 21.

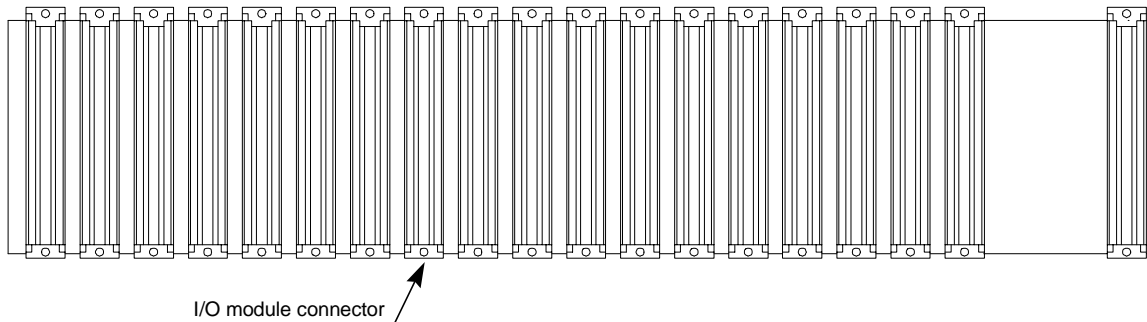


Figure 1 Front view

The back side (see Figure 2) has eighteen I/O connectors (CN1 to CN18) for system interconnection cables (SIC cables) and eighteen programming connectors (P1 to P18). These programming connectors are used for:

- current setting (e.g. range-setting module 10216/A/.), and
- signal conversion (e.g. analog input converter module 10102/A/.).

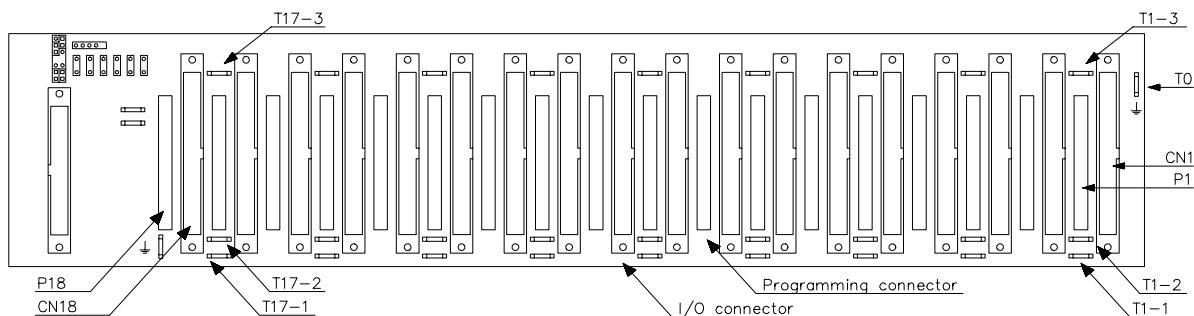


Figure 2 Back view



## Connections

The diagram below shows the back view of the programming connectors (P), the I/O module connectors and the I/O backplane connectors (CN):

*Programming (P)*

	41 / earth
40 / d10	37 / z10
36 / d12	33 / z12
32 / d14	29 / z14
28 / d16	25 / z16
24 / d18	21 / z18
20 / d20	17 / z20
16 / d22	13 / z22
12 / d24	9 / z24
8 / d26	5 / z26
4 / d28	1 / z28

*I/O module*

<b>d</b>	<b>b</b>	<b>z</b>
2	2	2
-		-
6		6
8		8
10		10
12		12
14		14
16		16
18		18
20		20
22		22
24		24
26		26
28		28
30		30
32		32

*I/O backplane (CN)*

-	-
-	41 / earth
40 / d10	-
-	37 / z10
36 / d12	-
-	33 / z12
32 / d14	-
-	29 / z14
28 / d16	-
-	25 / z16
24 / d18	-
-	21 / z18
20 / d20	-
-	17 / z20
16 / d22	-
-	13 / z22
12 / d24	-
-	9 / z24
8 / d26	-
-	5 / z26
4 / d28	-
-	1 / z28

Between every I/O connector pair, three faston connectors are available (in nine groups) to connect power to the I/O module pairs. The faston connectors are marked as follows:

- Tx-1 (connected to d32 and z32 of the I/O connector left and right)
- Tx-2 (connected to d30 and z30 of the I/O connectors rack positions 1 to 18)
- Tx-3 (connected to d6 and z6 of the I/O connector left and right).

The Tx-2 pins are used for the common 0 Vdc and are all interconnected on the I/O backplane. Each faston pin can handle 10 A.



If any module in the rack requires 24 Vdc internal power (on pins d8 and z8), the internal power of 24 Vdc must be connected via two fastons:

- T19-3: 24 Vdc
- T19-2: common 0 Vdc

---

**Note:**

The internal 24 Vdc connections for the 10314/1/1 and 10315/1/1 backplanes differ:

Connector	10314/1/1	10315/1/1
T19-1	cabinet earth	cabinet earth
T19-2	common 0 Vdc	24 Vdc for I/O of CP 1
T19-3	24 Vdc for I/O of CP 1 or 2	common 0 Vdc
T19-4	not placed	24 Vdc for I/O of CP 2

---

The V-Bus connector is plugged into CN21 (see Figure 3).

The rack address of the HBD is programmed using the jumpers RA0 to RA3 (see 10100/2/1 data sheet).

The I/O backplane transfers the V-Bus signals and the rack address to the HBD (10100/2/1).

The watchdog (WDG), 5 Vdc and ground (GND) are connected to the I/O backplane via connector CN22 (see Figure 3 and Figure 4).

---

**Note:**

For connection details of CN22 refer to the data sheet of the 5 Vdc and watchdog distribution module 10313/1/1.

---

Watchdog separation is possible by removing jumpers WD1 to WD6 (six groups of three I/O modules) and connecting a 5 Vdc or watchdog signal to the lower pin of the jumper.

WD1 is the watchdog for the modules in rack positions 1 to 3.

WD2 is the watchdog for the modules in rack positions 4 to 6.

WD3 is the watchdog for the modules in rack positions 7 to 9.

WD4 is the watchdog for the modules in rack positions 10 to 12.

WD5 is the watchdog for the modules in rack positions 13 to 15.

WD6 is the watchdog for the modules in rack positions 16 to 18.

The I/O backplane comes with two earth faston connections (T0 and T19-1). These earth connections should be terminated to the I/O rack frame using short wires (2.5 mm<sup>2</sup>, AWG 14), e.g. directly to the nearest bolt on the 19-inch I/O rack.

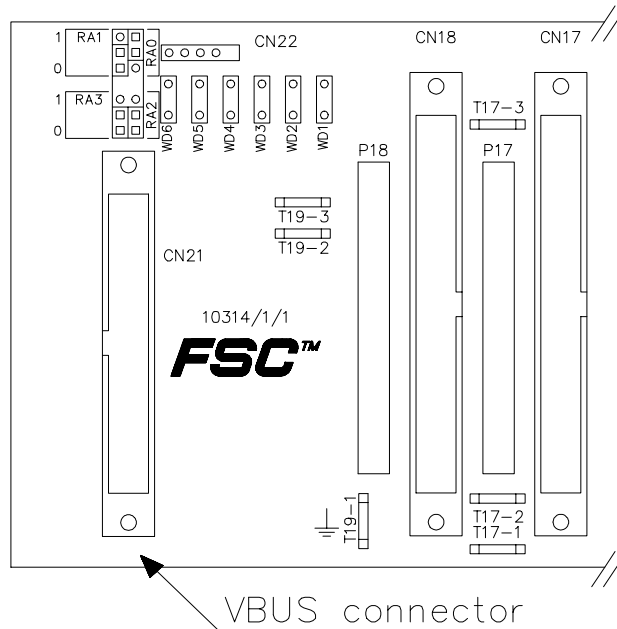


Figure 3 Back view detail

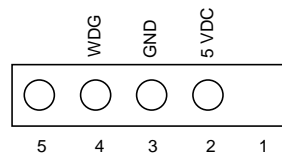


Figure 4 Connector CN22 (detail)

## Important considerations

1. The number of Tx-2 pins that need to be wired to the common 0 Vdc busbar depends on the maximum total load of the I/O modules in the rack. The total current capacity of the Tx-2 connections should be higher than the maximum total load of all I/O modules in the rack. As each Tx-2 connection can handle 10 A, a demand total of 25 A would require three Tx-2 connections for optimum current distribution across the I/O modules.
2. The maximum number of modules that may be installed in a single I/O rack depends on their heat dissipation. The maximum allowed heat dissipation of one I/O rack is 100 W. The combined heat





dissipation of all modules installed in a rack should therefore not exceed 100 W. The total dissipation of a single module is made up of three components:

- the module's 24 V power consumption,
- the module's 5 V power consumption, and
- dissipation due to voltage drop across the output circuit (depending on the output load).

The sum of these three components will determine the module's total heat dissipation.

**Example:** how many 10215/2/1 modules may be installed in a single I/O rack?

Following the calculation method described above and using the technical data from the 10215/2/1 data sheet, the heat dissipation of a single 10215/2/1 module can be determined as:

$$((24 V_{int} * 0.035 A) + (24 V_{ext} * 2 * 0.025 A)) + (5 V * 0.012 A) + (1.3 V * 6 A) = 9.9 W$$

Thus, the maximum number of 10215/2/1 modules in a single I/O rack is 10 (total heat dissipation: 99 W).

3. There should always be two 0 Vdc connections, one at each end of the backplane (connected to T1-2 and T17-2, respectively). If additional 0 Vdc connections are required, the extra connections should be connected as closely to the power user(s) as possible.

## Technical data

The I/O backplane 10314/1/1 has the following specifications:

<b>General</b>	Type number:	10314/1/1 20501*
	Approvals:	CE, TÜV, UL
	Space requirements:	84 TE (full rack), 3 HE (= 84 HP, 3U)
<b>Power</b>	Current consumption:	none
	Max. current on faston pin:	10 A
	Max. current on I/O connector pin:	2 A

**\* Note:**

10314/1/1 modules with suffix code 20500 have watchdog separation in three groups of six modules, and have only one earth faston connector.



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## 10315/1/1 I/O backplane for redundant I/O

### Description

The I/O backplane 10315/1/1 is used in redundant I/O racks.

Up to 18 I/O modules can be placed in the I/O backplane 10315/1/1 (rack positions 1 to 18). Two horizontal bus drivers (HBD, 10100/2/1) can be placed in rack positions 20 and 21.

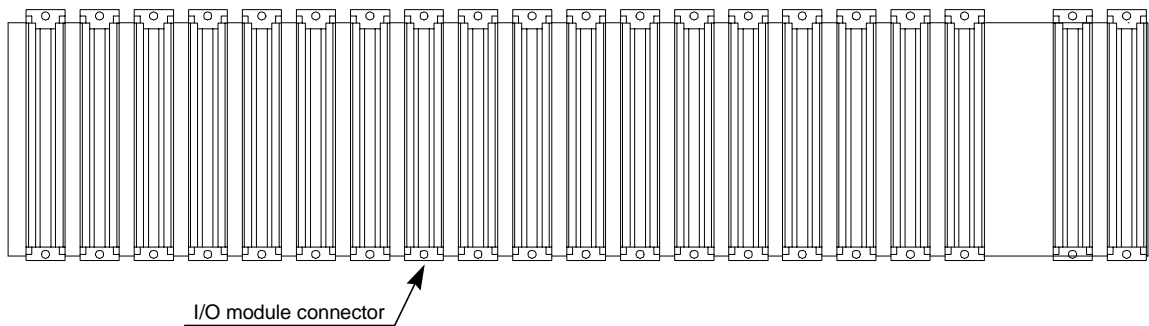


Figure 1 Front view

The back side (see Figure 2) has nine I/O connectors (CN1, CN3, etc., to CN17) for system interconnection cables (SIC cables) and nine programming connectors (P1, P3, etc., to P17). These programming connectors are used for:

- current setting (e.g. range-setting module 10216/A/.),
- signal conversion (e.g. analog input converter module 10102/A/.),
- communication I/O wiring (in configurations with exclusively redundant I/O),
- secondary switch-off wiring, and
- watchdog repeater (10302/2/1) wiring.

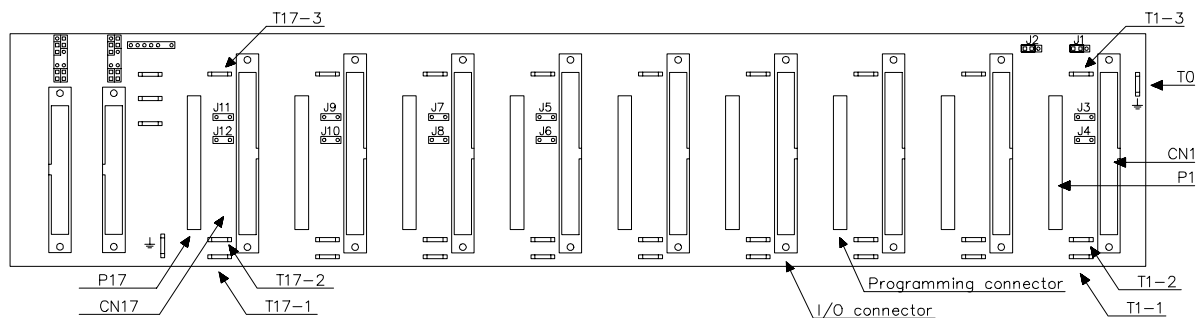


Figure 2 Back view



## Connections

The diagram below shows the back view of the programming connectors (P), the I/O module connectors and the I/O backplane connectors (CN):

*Programming (P)*

	41 / earth
40 / d10	37 / z10
36 / d12	33 / z12
32 / d14	29 / z14
28 / d16	25 / z16
24 / d18	21 / z18
20 / d20	17 / z20
16 / d22	13 / z22
12 / d24	9 / z24
8 / d26	5 / z26
4 / d28	1 / z28

*I/O module*

d	b	z
2	2	2
-		-
6		6
8		8
10		10
12		12
14		14
16		16
18		18
20		20
22		22
24		24
26		26
28		28
30		30
32		32

*I/O backplane (CN)*

-	-
-	41 / earth
40 / d10	-
-	37 / z10
36 / d12	-
-	33 / z12
32 / d14	-
-	29 / z14
28 / d16	-
-	25 / z16
24 / d18	-
-	21 / z18
20 / d20	-
-	17 / z20
16 / d22	-
-	13 / z22
12 / d24	-
-	9 / z24
8 / d26	-
-	5 / z26
4 / d28	-
-	1 / z28

The I/O backplane connects the redundant I/O modules of CP1 and CP2 in parallel. These parallel links of d12 and d16 can be opened for I/O module positions 1-2, 11-12, 13-14, 15-16 and 17-18. For FSC configurations with *exclusively* redundant I/O, this is necessary for COM I/O wiring, secondary switch-off wiring and watchdog repeater wiring.

The connections to the CP1 module must be placed on the I/O connector.

The connections to the CP2 module must be placed on the programming connector.



Two connections of five redundant groups can be opened by removing a jumper. The jumpers are numbered and marked as follows (see Figure 2):

- J3 and J4 (connected to d12 and d16 on modules 1 and 2)
- J5 and J6 (connected to d12 and d16 on modules 11 and 12)
- J7 and J8 (connected to d12 and d16 on modules 13 and 14)
- J9 and J10 (connected to d12 and d16 on modules 15 and 16)
- J11 and J12 (connected to d12 and d16 on modules 17 and 18)

The following table shows the relation between the jumpers and the I/O channels of the I/O modules that can be selected:

Type	Fail-safe module	J3, J5, J7, J9, J11	J4, J6, J8, J10, J12
I	10101/2/1	channel 1	channel 5
O	10201/2/1	channel 1	channel 3

**Example 1 (see Figure 3):** Configuration of 'Com I/O'.

- If: FS input modules, type 10101/2/1, are located on positions 15 and 16, and the input 'Com I/O' is allocated to positions 15 and 16, channel 1,
- and: FS output modules, type 10201/2/1, are located on positions 17 and 18, and the output 'Com I/O' is allocated on positions 17 and 18, channel 3,
- then: jumper J9 must be removed for the input 'Com I/O', jumper J12 must be removed for the output 'Com I/O', and two wires must be connected as shown in Figure 3.

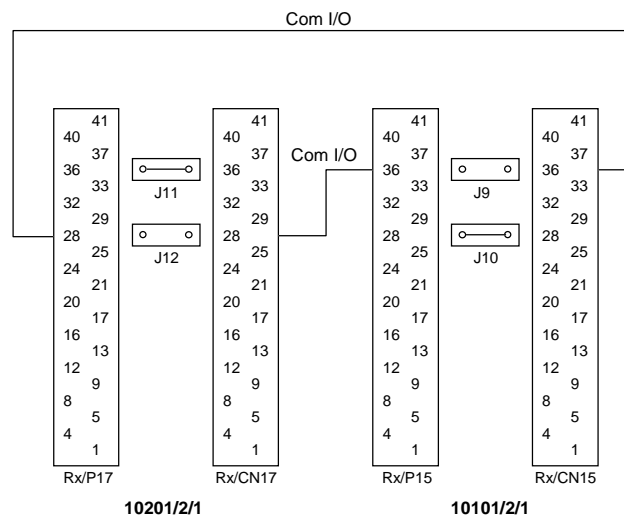


Figure 3 Example of 'Com I/O' configuration



---

**Example 2:** Configuration of 'Secondary switch-off'.

If: FS output modules, type 10201/2/1, are located on positions 1 and 2, and the output 'Secondary switch-off' is allocated to positions 1 and 2, channel 1,  
then: jumper J3 must be removed for the output 'Secondary switch-off'.

---

**Note:**

Secondary switch-off also requires jumpers J1 and J2 to be set (see below). For details on the configuration of secondary switch-off refer to the FSC Safety Manual.

---

Between the I/O connector and programming connector, faston connectors are available (in nine groups) to connect power to the I/O module pairs. The faston connectors are marked as follows:

- Tx-1 (connected to d32 and z32 of the I/O connector left and right)
- Tx-2 (connected to d30 and z30 of the I/O connectors rack positions 1 to 18)
- Tx-3 (connected to d6 and z6 of the I/O connector left and right).

The Tx-2 pins are used for the common 0 Vdc and are all interconnected on the I/O backplane. Each faston pin can handle 10 A.

---

**Important considerations**

1. The number of Tx-2 pins that need to be wired to the common 0 Vdc busbar depends on the maximum total load of the I/O modules in the rack. The total current capacity of the Tx-2 connections should be higher than the maximum total load of all I/O modules in the rack. As each Tx-2 connection can handle 10 A, a demand total of 25 A would require three Tx-2 connections for optimum current distribution across the I/O modules.
2. The maximum number of modules that may be installed in a single I/O rack depends on their heat dissipation. The maximum allowed heat dissipation of one I/O rack is 100 W. The combined heat dissipation of all modules installed in a rack should therefore not exceed 100 W. The total dissipation of a single module is made up of three components:
  - the module's 24 V power consumption,
  - the module's 5 V power consumption, and
  - dissipation due to voltage drop across the output circuit (depending on the output load).



The sum of these three components will determine the module's total heat dissipation.

**Example:** how many redundant 10215/2/1 module pairs may be installed in a 10315/1/1 I/O rack?

Following the calculation method described above and using the technical data from the 10215/2/1 data sheet, the heat dissipation of a redundant 10215/2/1 module pair can be determined as:

$$((2 * (24 V_{int} * 0.035 A)) + (2 * (24 V_{ext} * 2 * 0.025 A))) + (2 * (5 V * 0.012 A)) + (1.3 V * 6 A) = 12 W$$

Thus, the maximum number of redundant 10215/2/1 module pairs in a 10315/1/1 I/O rack is 8 pairs (total heat dissipation: 96 W).

- There should always be two 0 Vdc connections, one at each end of the backplane (connected to T1-2 and T17-2, respectively). If additional 0 Vdc connections are required, the extra connections should be connected as closely to the power user(s) as possible.

## Secondary switch-off

Two jumpers (J1 and J2) are available for secondary switch-off functionality (see Figure 4). The jumper settings are as follows:

- Secondary switch-off disabled (= standard position).  
The watchdog input of the modules on rack positions 1 and 2 are linked to WD 1 and WD 2, respectively.
- Secondary switch-off enabled.  
The watchdog input of the modules on rack positions 1 and 2 are linked to 5 Vdc 1 and 5 Vdc 2, respectively.

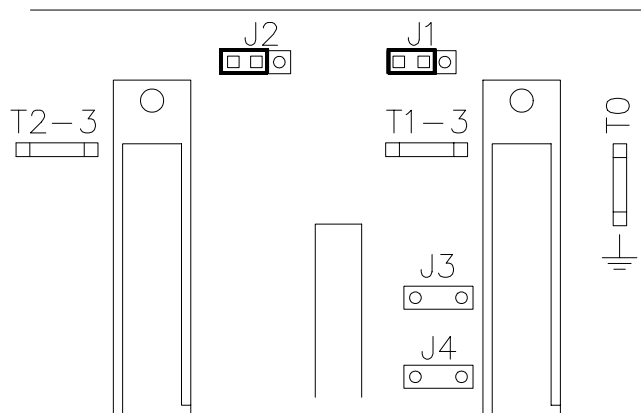
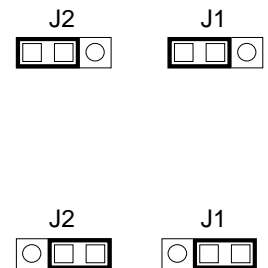


Figure 4 Location of jumpers J1 and J2 (set to their standard position)



The internal power of 24 Vdc can be connected via three fastons:

- T19-2: 24 Vdc for I/O of CP1
- T19-3: common 0 Vdc
- T19-4: 24 Vdc for I/O of CP2

---

**Note:**

The internal 24 Vdc connections for the 10315/1/1 and 10314/1/1 backplanes differ:

Connector	10315/1/1	10314/1/1
T19-1	cabinet earth	cabinet earth
T19-2	24 Vdc for I/O of CP 1	common 0 Vdc
T19-3	common 0 Vdc	24 Vdc for I/O of CP 1 or 2
T19-4	24 Vdc for I/O of CP 2	not placed

---

If the I/O backplane contains HBDs, the V-Bus connector of CP1 is plugged into CN20 and the V-Bus connector of CP2 into CN21.

The rack address of the HBDs is programmed using the jumpers RA0 to RA3 (see Figure 5 and 10100/2/1 data sheet). Jumpers RA0 to RA3 above connector CN20 are for Central Part 1. Jumpers RA0 to RA3 above connector CN21 are for Central Part 2.

The I/O backplane transfers the V-Bus signals and the rack address to the HBDs (10100/2/1).

Watchdog 1, watchdog 2, 5 Vdc 1, 5 Vdc 2 and ground (GND) are connected to the I/O backplane via connector CN22 (see Figure 5 and Figure 6).

---

**Note:**

For connection details of CN22 refer to the data sheet of the 5 Vdc and watchdog distribution module 10313/1/1.

---

The I/O backplane comes with two earth faston connections (T0 and T19-1). These earth connections should be terminated to the I/O rack frame using short wires (2.5 mm<sup>2</sup>, AWG 14), e.g. directly to the nearest bolt on the 19-inch I/O rack.



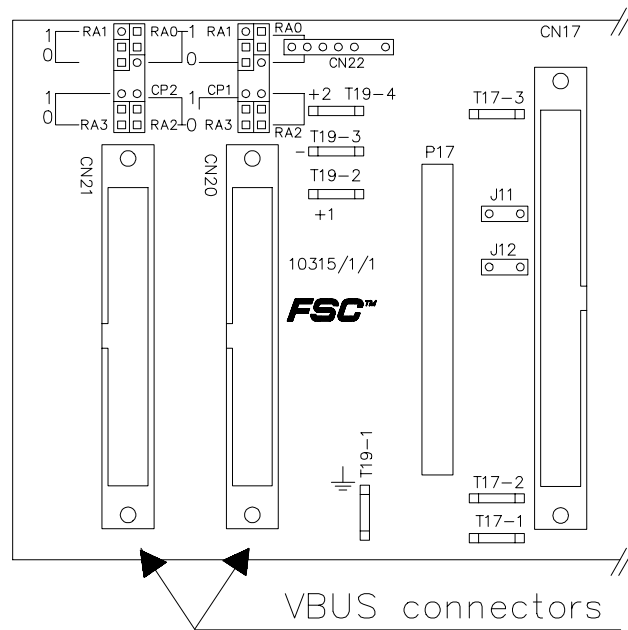


Figure 5 Back view detail

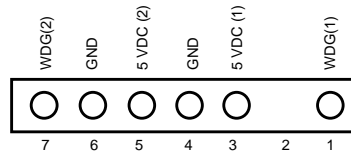


Figure 6 Connector CN22 (detail)



## Technical data

The I/O backplane 10315/1/1 has the following specifications:

<b>General</b>	Type number:	10315/1/1 20601*
	Approvals:	CE, TÜV, UL
	Space requirements:	84 TE (full rack), 3 HE (= 84 HP, 3U)
<b>Power</b>	Current consumption:	none
	Max. current on faston pin:	10 A
	Max. current on I/O connector pin:	2 A

---

**\* Note:**

10315/1/1 modules with suffix code 20600 has no jumpers for secondary switch-off functionality, only two pairs of jumpers for opening the link between I/O modules, and only one earth faston connector.

---

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## 10316/1/1

## HBD backplane for non-redundant I/O

### Description

The horizontal bus driver (HBD) backplane 10316/1/1 is used in non-redundant I/O racks that do not have an I/O backplane. Up to 18 I/O modules can be placed in the I/O rack (rack positions 1 to 18). The I/O modules must be wired using conventional wiring techniques, e.g. crimp-on snap-in (COSI). The HBD module 10100/2/1 must be placed in rack position 21.

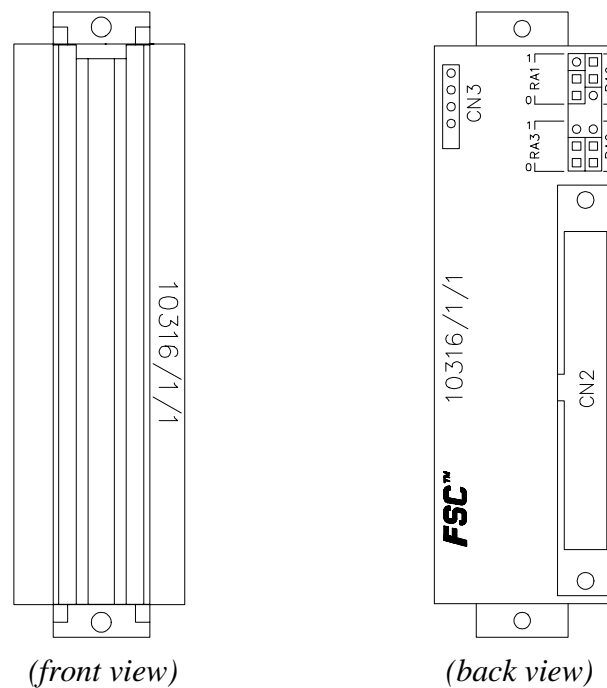


Figure 1 Front and back views

The 10316/1/1 module is fixed in the I/O rack using two M2.5x6 screws.

The HBD backplane 10316/1/1 transfers the V-Bus signals and the rack address to the horizontal bus driver 10100/2/1. The rack address of the HBD module is programmed using the jumpers RA0 to RA3.

### Note:

For programming details refer to the data sheet of the HBD module 10100/2/1.



## Connections

The V-Bus connector is plugged into connector CN2 (see Figure 1). 5 Vdc and ground (GND) are connected to the I/O backplane via connector CN3 (see Figure 1 and Figure 2).

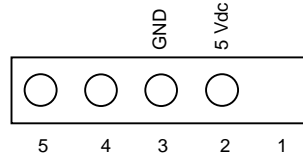


Figure 2 Connector CN3 (detail)

---

### Note:

For connection details of CN3 refer to the data sheet of the 5 Vdc and watchdog distribution module 10313/1/1.

---

## Technical data

The HBD backplane 10316/1/1 has the following specifications:

<b>General</b>	Type number:	10316/1/1 21100
	Approvals:	CE, TÜV; UL approval pending
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Current consumption:	none

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## 10317/1/1

## HBD backplane for redundant I/O

### Description

The horizontal bus driver (HBD) backplane 10317/1/1 is used in redundant I/O racks that do not have an I/O backplane. Up to 18 I/O modules can be placed in the I/O rack (rack positions 1 to 18). The I/O modules must be wired using conventional wiring techniques, e.g. crimp-on snap-in (COSI). Two HBD modules 10100/2/1 must be placed in rack positions 20 and 21.

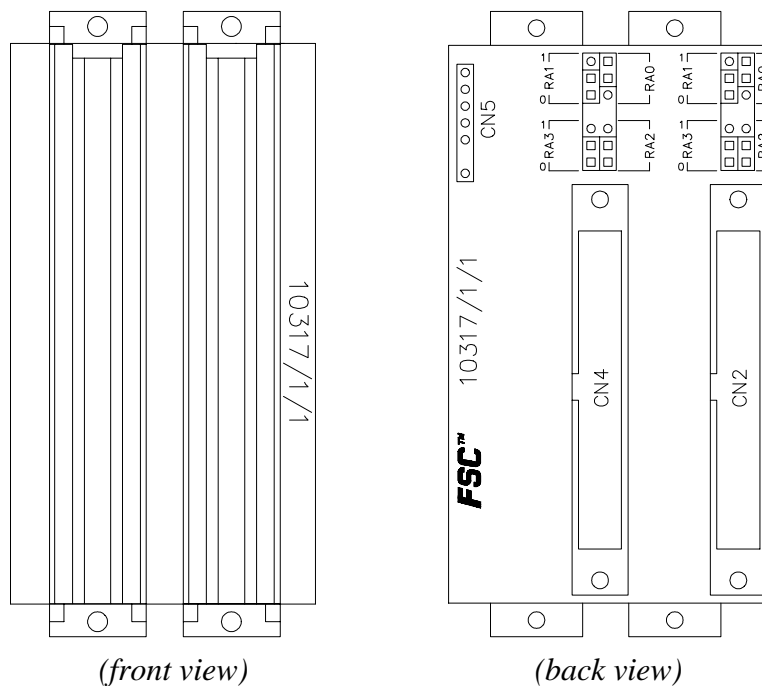


Figure 1 Front and back views

The 10317/1/1 module is fixed in the I/O rack using four M2.5x6 screws.

The HBD backplane 10317/1/1 transfers the V-Bus signals and the rack addresses to the horizontal bus driver 10100/2/1. The rack addresses of the HBD modules are programmed using the jumpers RA0 to RA3. Jumpers RA0 to RA3 above connector CN2 are for Central Part 1. Jumpers RA0 to RA3 above connector CN4 are for Central Part 2.

### Note:

For programming details refer to the data sheet of the HBD module 10100/2/1.



## Connections

The V-Bus connector of Central Part 1 (CP1) is plugged into connector CN2 and the V-Bus connector of Central Part 2 (CP2) into connector CN4 (see Figure 1).

5 Vdc (1), 5 Vdc (2) and ground (GND) are connected to the I/O backplane via connector CN5 (see Figure 1 and Figure 2).

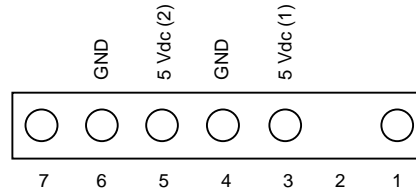


Figure 2 Connector CN5 (detail)

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### Note:

For connection details of CN5 refer to the data sheet of the 5 Vdc and watchdog distribution module 10313/1/1.

---

## Technical data

The HBD backplane 10317/1/1 has the following specifications:

<b>General</b>	Type number:	10317/1/1 21200
	Approvals:	CE, TÜV; UL approval pending
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U)
<b>Power</b>	Current consumption:	none

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## 10318/1/1

## I/O backplane for non-redundant I/O (10 slots)

### Description

The I/O backplane 10318/1/1 for non-redundant I/O is used in two configurations:

- Central Part (CP) with I/O, in combination with 7-SBUS (see Figure 5), or
- non-redundant I/O racks in combination with the HBD backplane 10316/1/1 (see Figure 6).

Up to 10 FSC I/O modules can be placed in the I/O backplane 10318/1/1 (rack positions 1 to 10).

If the 10318/1/1 backplane is used in a system with I/O in the Central Part rack, the CP modules can be placed in the 7-SBUS (rack positions 12 to 18), which is located next to the I/O backplane 10318/1/1. If the 10318/1/1 backplane is used in non-redundant I/O racks, rack positions 12 to 18 are available for other components, e.g. an additional DC/DC converter 10300/1/1.

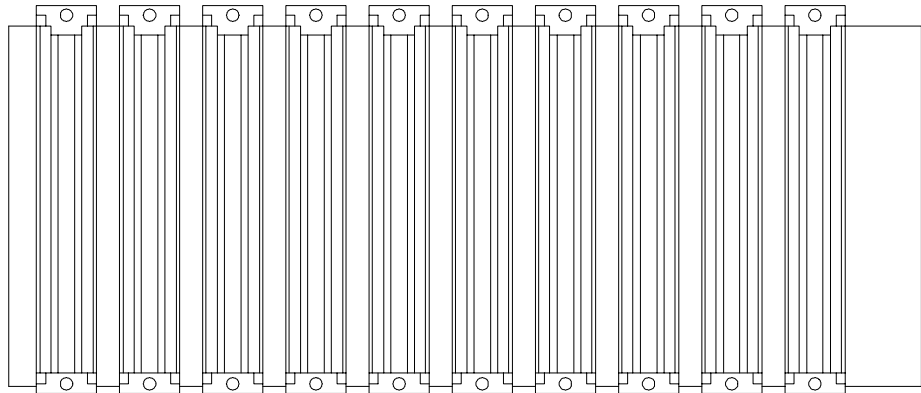


Figure 1 Front view

The back side (see Figure 2) has ten I/O connectors (CN1 to CN10) for system interconnection cables (SIC cables) and ten programming connectors (P1 to P10). These programming connectors are used for:

- current setting (e.g. range-setting module 10216/A/.), and
- signal conversion (e.g. analog input converter module 10102/A/.).

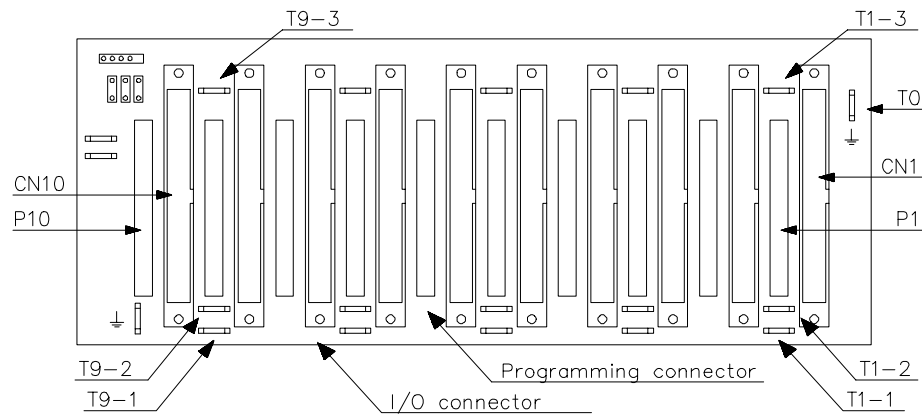


Figure 2 Back view

## Connections

The diagram below shows the back view of the programming connectors (P), the I/O module connectors and the I/O backplane connectors (CN):

### Programming (P)

	41 / earth
40 / d10	37 / z10
36 / d12	33 / z12
32 / d14	29 / z14
28 / d16	25 / z16
24 / d18	21 / z18
20 / d20	17 / z20
16 / d22	13 / z22
12 / d24	9 / z24
8 / d26	5 / z26
4 / d28	1 / z28

### I/O module

d	b	z
2	2	2
-		-
6		6
8		8
10		10
12		12
14		14
16		16
18		18
20		20
22		22
24		24
26		26
28		28
30		30
32		32

### I/O backplane (CN)

-	-
-	41 / earth
40 / d10	-
-	37 / z10
36 / d12	-
-	33 / z12
32 / d14	-
-	29 / z14
28 / d16	-
-	25 / z16
24 / d18	-
-	21 / z18
20 / d20	-
-	17 / z20
16 / d22	-
-	13 / z22
12 / d24	-
-	9 / z24
8 / d26	-
-	5 / z26
4 / d28	-
-	1 / z28





Between every I/O connector pair, three faston connectors are available (in five groups) to connect power to the I/O module pairs.

The faston connectors are marked as follows:

- Tx-1 (connected to d32 and z32 of the I/O connector left and right)
- Tx-2 (connected to d30 and z30 of the I/O connectors rack position 1 to 10)
- Tx-3 (connected to d6 and z6 of the I/O connector left and right).

The Tx-2 pins are used for the common 0 Vdc and are all interconnected on the I/O backplane. Each faston pin can handle 10 A.

If any module in the rack requires 24 Vdc internal power (on pin d8 and z8), the internal power of 24 Vdc must be connected via two fastons:

- T11-3: 24 Vdc, and
- T11-2: common 0 Vdc.

The watchdog (WDG), 5 Vdc and ground (GND) are connected to the I/O backplane via connector CN11 (see Figure 3 and Figure 4).

Watchdog separation is possible by removing jumpers WD1 to WD3 and connecting a 5 Vdc or watchdog signal to the lower pin of the jumper.

Jumper WD1 is the watchdog for the modules in rack positions 1 to 3 (group of three).

Jumper WD2 is the watchdog for the modules in rack positions 4 to 6 (group of three).

Jumper WD3 is the watchdog for the modules in rack positions 7 to 10 (group of four).

The I/O backplane comes with two earth faston connections (T0 and T11-1). These earth connections should be terminated to the I/O rack frame using short wires (2.5 mm<sup>2</sup>, AWG 14), e.g. directly to the nearest bolt on the 19-inch I/O rack.

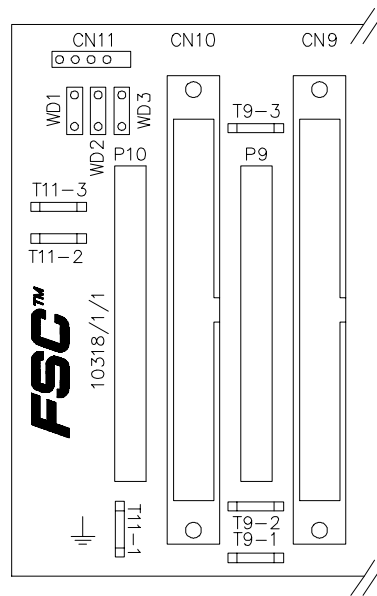
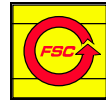


Figure 3 Back view detail

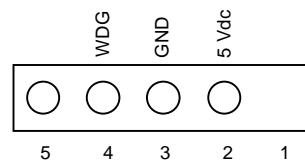


Figure 4 Connector CN11 (detail)

**Note:**

For connection details of CN11 refer to the data sheet of the 5 Vdc and watchdog distribution module 10313/1/1.

**Important considerations**

1. The number of Tx-2 pins that need to be wired to the common 0 Vdc busbar depends on the maximum total load of the I/O modules in the rack. The total current capacity of the Tx-2 connections should be higher than the maximum total load of all I/O modules in the 10318/1/1 backplane. As each Tx-2 connection can handle 10 A, a demand total of 25 A would require three Tx-2 connections for optimum current distribution across the I/O modules.
2. There should always be two 0 Vdc connections, one at each end of the backplane (connected to T1-2 and T9-2, respectively). If additional 0 Vdc connections are required, the extra connections should be connected as closely to the power user(s) as possible.



## Application examples

Figure 5 and Figure 6 below show typical applications of the I/O backplane 10318/1/1.

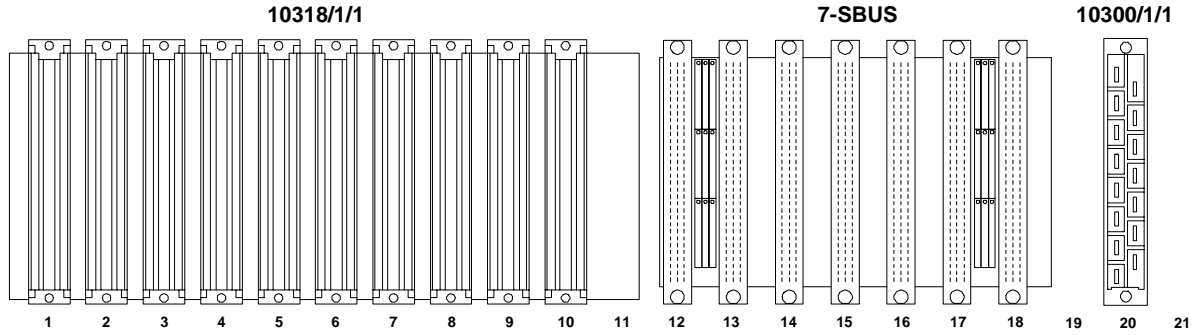


Figure 5 Front view of Central Part with I/O backplane and system bus

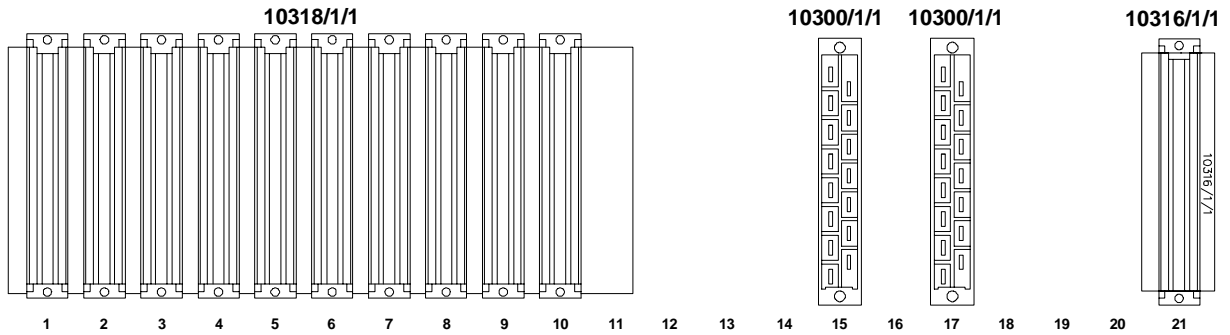


Figure 6 Front view of non-redundant I/O rack with HBD and I/O backplane

## Technical data

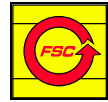
The I/O backplane 10318/1/1 has the following specifications:

### General

Type number: 10318/1/1 21300  
 Approvals: CE, TÜV;  
 UL approval pending  
 Space requirements: 44 TE, 3 HE (= 44 HP, 3U)

### Power

Current consumption: none  
 Max. current on faston pin: 10 A  
 Max. current on I/O connector pin: 2 A



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# **Fail Safe Control Hardware Manual**

## **Section 4: Central Part Modules**

**TotalPlant**



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## 10001/1/1 & 10001/R/1 Vertical bus driver (VBD)

### Description

The Central Part (CP) of the FSC system is connected to the I/O level via the vertical bus driver (VBD) modules, which are located in the Central Part rack. A maximum of 14 vertical bus drivers can be installed per Central Part. Each vertical bus driver can support up to 10 horizontal bus driver (HBD) modules.

The maximum distance between a vertical bus driver and any I/O rack on the vertical bus is 5 m (16.4 ft).

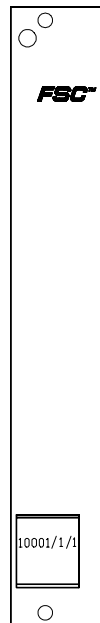


Figure 1

Front view (10001/1/1)

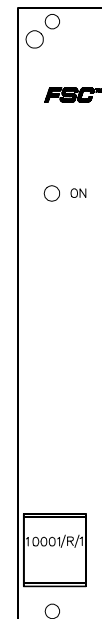


Figure 2

Front view (10001/R/1)

The 10001/1/1 and 10001/R/1 modules consist of two parts (see Figure 3):

- electronic part (mainboard), and
- wiring part (10001/A/1).

The bolts on the 96-pin connector are used to secure the 10001/A/1 part of the VBD to the 19-inch rack. This allows exchange of the electronic part of the VBD without disconnecting the vertical bus flatcable.

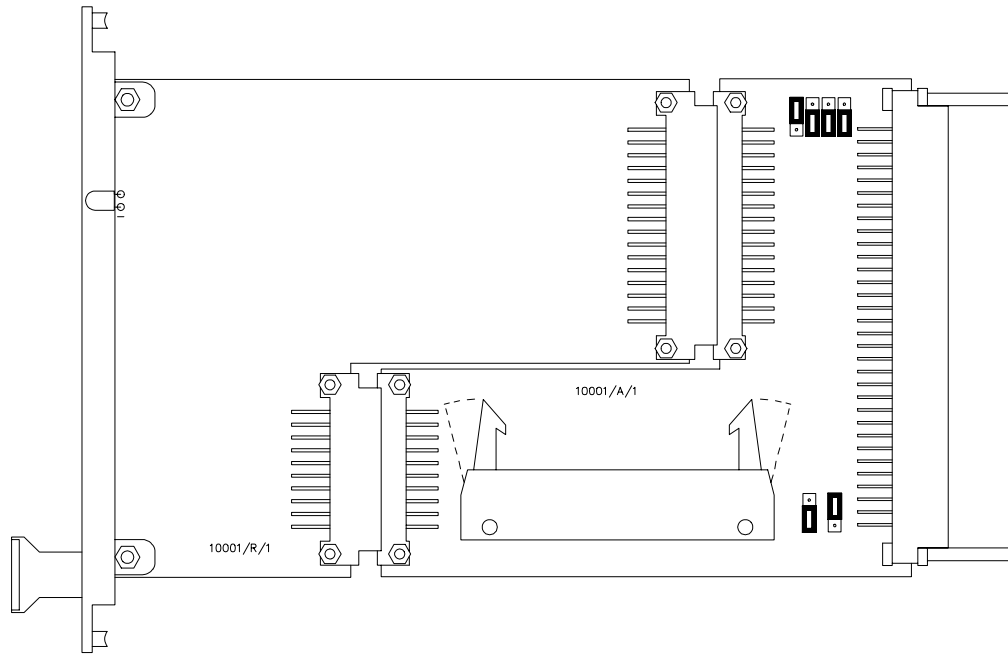


Figure 3 Layout of 10001/R/1 module

## Jumpers

Jumpers J1 to J4 on the wiring part (10001/A/1) are used to set the VBD number (see Figure 4).

Jumpers J5 and J6 on the wiring part (10001/A/1) are used to set the Central Part (CP) number (see Figure 4).

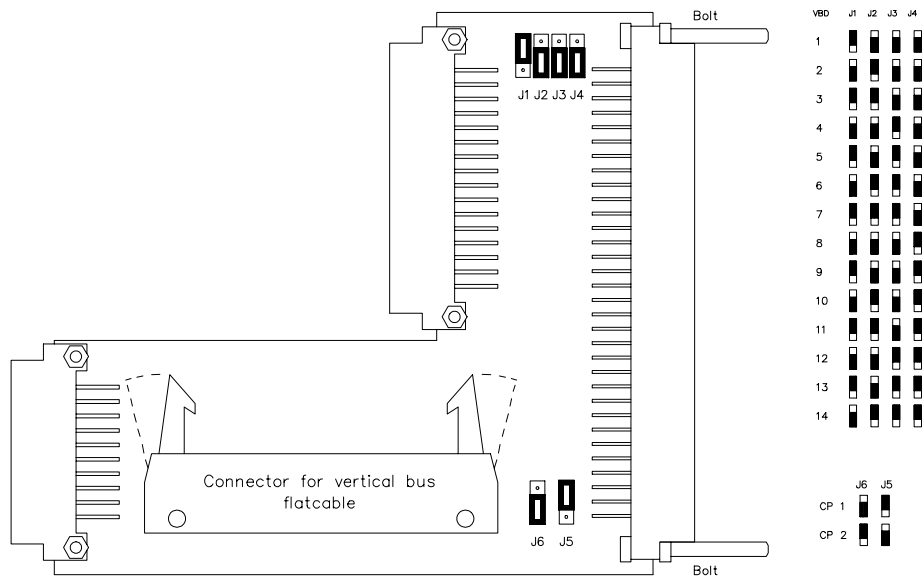


Figure 4 Jumper setting on 10001/A/1 module for CP 1, VBD 1



## Applications

Table 1 below shows which vertical bus drivers can be used in the various configurations.

Table 1 Application of 10001/1/1 & 10001/R/1 VBDs

	<b>Non-redundant CP</b>	<b>Redundant CP</b>
<b>Non-redundant I/O</b>	10001/1/1 or 10001/R/1	10001/R/1
<b>Redundant I/O</b>	10001/1/1 or 10001/R/1	10001/1/1 or 10001/R/1

Configurations with redundant Central Parts and non-redundant I/O require 10001/R/1 VBDs, because the relay on the 10001/R/1 disconnects the VBD from the vertical bus in case of a Central Part shutdown (via an on-board watchdog on the VBD or via software).

## Vertical bus

The vertical bus flatcable connects the vertical bus drivers (VBDs, 10001/1/1 or 10001/R/1) to the horizontal bus drivers (HBDs, 10100/1/1 or 10100/2/1). For details on vertical buses refer to the 'V-Buses' data sheet.



## Technical data

The 10001/1/1 & 10001/R/1 modules have the following specifications:

<b>General</b>	Type number:	10001/1/1
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 225 mA
	Ripple content:	< 50 mV p-p
<b>General</b>	Type number:	10001/R/1
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 275 mA
	Ripple content:	< 50 mV p-p

---

**Note:**

Do not remove or replace these modules while the power to their Central Part is on.

---

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10002/1/1

## Central processor unit (CPU)

---

### Description

The central processor unit (CPU) is the heart of each FSC system. It controls all system operations.

The module is placed in the Central Part of the FSC system, and has the following features:

- a Motorola 68000 microprocessor,
- four EPROM sockets for a maximum memory capacity of 512 Kbytes, and
- 64 Kbytes of random-access memory (RAM) for system variables and application variables (all I/O, markers, counters, timers and max. 7 Kbytes for registers).

To enable testing of the memory contents within the shortest possible time, memory duplication with hardware compare facilities have been implemented on the CPU module. This enables testing of the memory contents of the bytes read at each memory fetch cycle. Further test hardware enables full testing of the CPU module.

The module has a key switch in the front which provides a hardware reset of the processor. The key switch has two positions:

- Vertical: running
- Horizontal: stop (CPU reset)

The CPU module is provided with battery back-up circuits for the RAM memory, which enables back-up supply from the batteries on the diagnostic and battery module (DBM, 10006/1/1 or 10006/2/.) or single bus driver (SBD, 10007/1/1).

---

### EPROM types

The CPU module supports the following EPROM types:

- 27512 / 27C512: 64 k \* 8 (512 Kb)
- 27010 / 27C1001: 128 k \* 8 (1 Mb)
- 27C2001: 256 k \* 8 (2 Mb)

The maximum access time for all types is 150 ns.

**Note:**

For details on the supported manufacturers and EPROM types refer to the FSC Software Manual (section 11, "Program application in EPROMs").

**Jumpers**

Jumpers J2 and J3 are used to set the memory type of the on-board EPROMs. They are factory-set at the 'Local Appl. EPROM' setting.

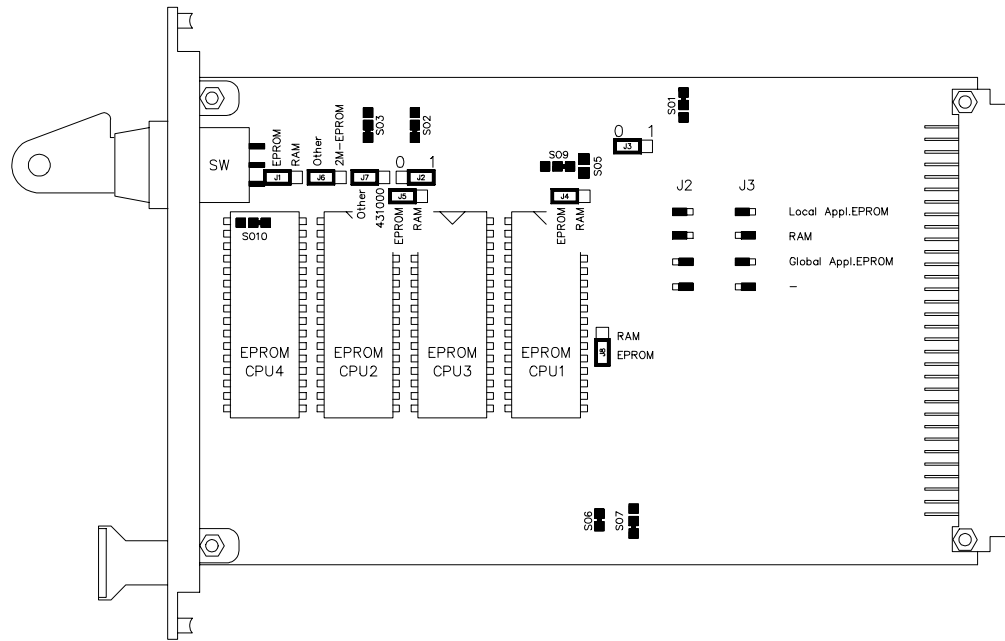


Figure 1 Jumper settings





## Technical data

The 10002/1/1 module has the following specifications:

<b>General</b>	Type number:	10002/1/1
	Approvals:	CE, TÜV
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
	Maximum EPROM capacity:	512 Kbytes
	Maximum RAM capacity:	64 Kbytes
<b>Power</b>	Power requirements:	5 Vdc 1 A
	Ripple content:	< 50 mV p-p

---

**Note:**

Do not remove or replace this module while the power to its Central Part is on.

---

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## 10002/1/2

## Central processor unit (CPU)

---

### Description

The central processor unit (CPU) is the heart of each FSC system. It controls all system operations.

The module has a key switch in the front which provides a hardware reset of the processor. The key switch has two positions:

- Vertical: running
- Horizontal: stop (CPU reset)

The CPU module is provided with battery back-up circuits for the RAM memory, which enables back-up supply from the batteries on the diagnostic and battery module (DBM, 10006/1/1 or 10006/2/.) or single bus driver (SBD, 10007/1/1).

---

### Memory

The CPU module has the following on-board memory:

- 128 Kbytes of RAM for the system and application variables (all I/O, markers, counters, timers and up to 7 Kbytes for registers), and
- 128 Kbytes of RAM that can be used as application RAM (depending on jumper positions).

The available 128 Kbytes of application RAM makes it possible to run small application programs in RAM, without additional memory circuits in the dual in-line (DIL) sockets.

A separate memory print (10002/A/1) is placed in the connector strips on the 10002/1/2 module. The 10002/A/1 module accommodates surface-mounted EPROMs that contain the system program, and has four sockets which offer space for the application program memory (EPROMs or RAM).

Reprogramming the surface-mounted EPROMs is possible using the 07170/1/1 FSC EPROM programmer with a 07170/A/1 adapter module. The EPROMs are erased by placing the 10002/A/1 module in an EPROM eraser (UV light source).

---

#### **Note:**

The four sockets of the 10002/A/1 module must be empty during reprogramming. Failure to remove the ICs from the sockets may cause fatal damage to the ICs and/or the EPROM programmer.

---

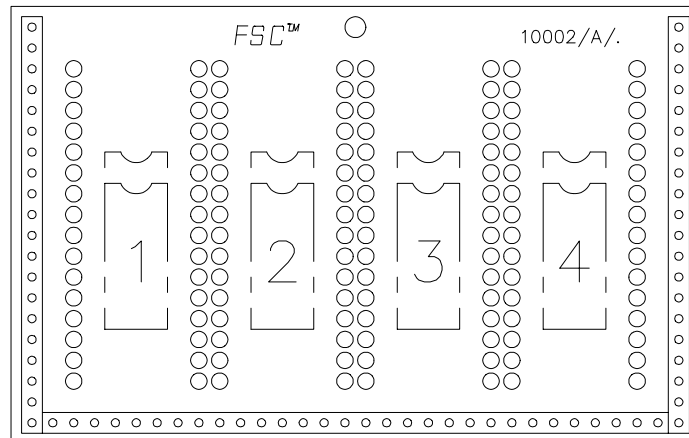


Figure 1 Memory sockets on 10002/A/1

To enable testing of the memory contents within the shortest possible time, memory duplication with hardware compare facilities have been implemented on the CPU module. This enables testing of the memory contents of the bytes read at each memory fetch cycle. Further test hardware enables full testing of the CPU module.

## EPROM types

The 10002/A/1 module supports the following EPROM types:

- 27C512: 64 k \* 8 (512 Kb) or equivalent
- 27C1001: 128 k \* 8 (1 Mb) or equivalent
- 27C2001: 256 k \* 8 (2 Mb) or equivalent
- 27C4001: 512 k \* 8 (4 Mb) or equivalent

The maximum access time for all EPROM types is 150 ns.

### Note:

For details on the supported manufacturers and EPROM types refer to Section 11 of the FSC Software Manual ("Program application in EPROMs").

## RAM types

The 10002/A/1 module supports the following RAM types:

- 628128/431000: 128 k \* 8 (1 Mb) or equivalent
- 684000: 512 k \* 8 (4 Mb) or equivalent

The maximum access time for all RAM types is 100 ns.



## Jumpers

The CPU module has nine jumpers. Figure 2 shows the location of these jumpers.

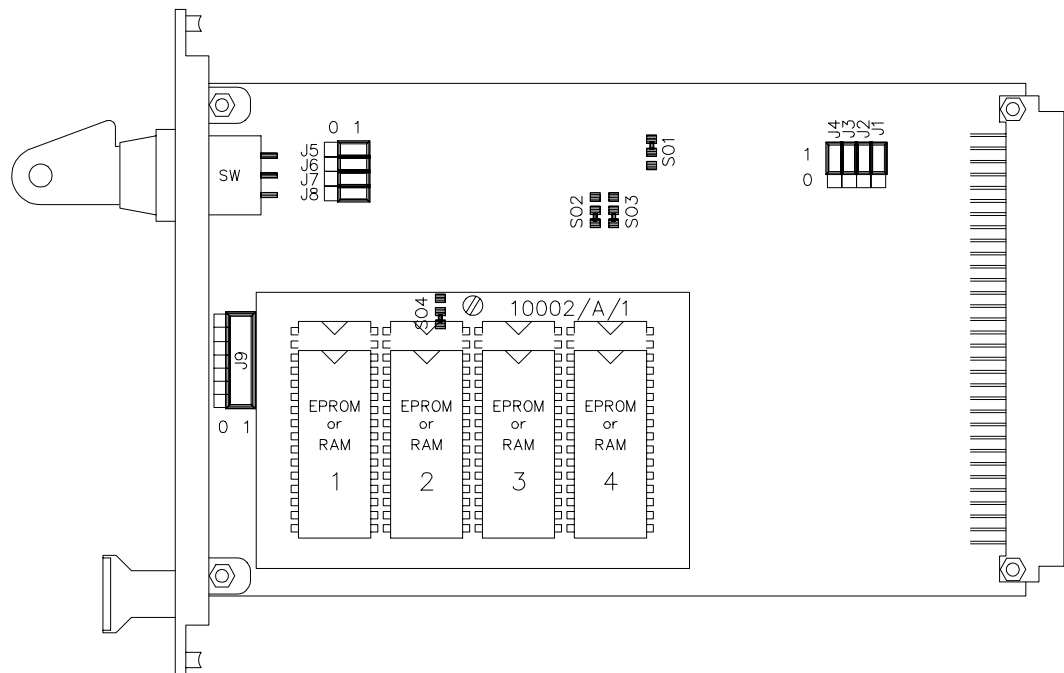


Figure 2 Location of jumpers

The jumpers have the following functions:

- Jumpers J1 to J3 are factory-set.
- Jumpers J4 to J6 define the application program as local or global.
- Jumpers J5 to J9 define the local memory type and size.

Figure 3 on the next page shows the required jumper settings.

The soldering links (SO1 to SO4) on the back of the 10002/1/2 module and the 10002/A/1 module are all factory-set.

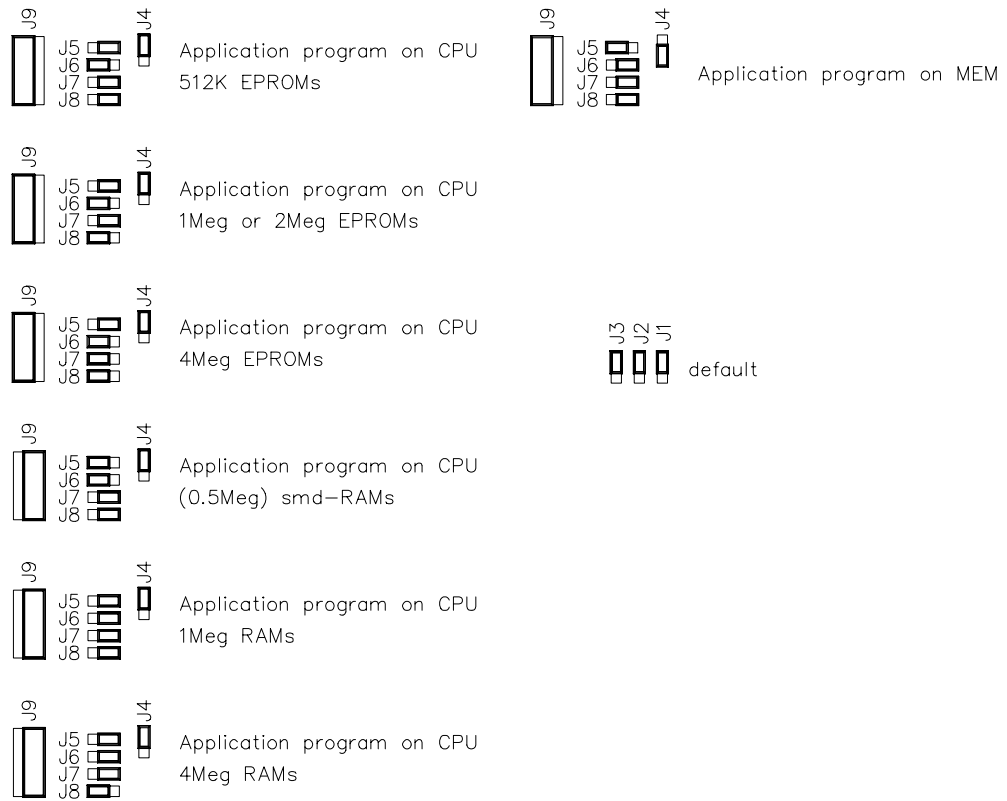


Figure 3 Jumper settings



## Technical data

The 10002/1/2 module has the following specifications:

<b>General</b>	Type number:	10002/1/2 06001* 10002/A/1 06100
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.80b
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U) (incl. 10002/A/1 module)
<b>Power</b>	Power requirements:	5 Vdc 1 A (incl. 10002/A/1 module)
	Ripple content:	< 50 mV p-p
<b>Physical</b>	Dimensions of 10002/A/1:	84 x 54 x 12 mm (3.31 x 12 x 0.05 in)
<b>Memory</b>	System RAM:	128 Kbytes (on 10002/1/2 module)
	Application RAM:	128 Kbytes (on 10002/1/2 module)**
	System EPROM:	256 Kbytes (on 10002/A/1 module)
	Max. capacity of application EPROM:	1 Mbyte (on 10002/A/1 module)**
	Max. capacity of application RAM:	1 Mbyte (on 10002/A/1 module)**

---

### Notes:

\* 10002/1/2 modules with suffix code 06001 have improved EMC behavior.

\*\* Only one application memory type and place can be used.

---

### Note:

Do not remove or replace this module while the power to its Central Part is on.

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## 10003/1/1

## Memory module (MEM)

### Description

The memory (MEM) module contains memory circuits (RAM or EPROM) for the application program (as defined by the functional logic diagrams).

The MEM module is provided with battery back-up circuits for the RAM memory, which enables back-up supply from the batteries on the diagnostic and battery module (DBM, 10006/1/1 or 10006/2/.) or single bus driver (SBD, 10007/1/1).

To enable testing of the memory contents within the shortest possible time, memory duplication with hardware compare facilities have been implemented on the memory module. This enables testing of the memory contents of the bytes read at each memory fetch cycle. Further test hardware enables full testing of the MEM module.

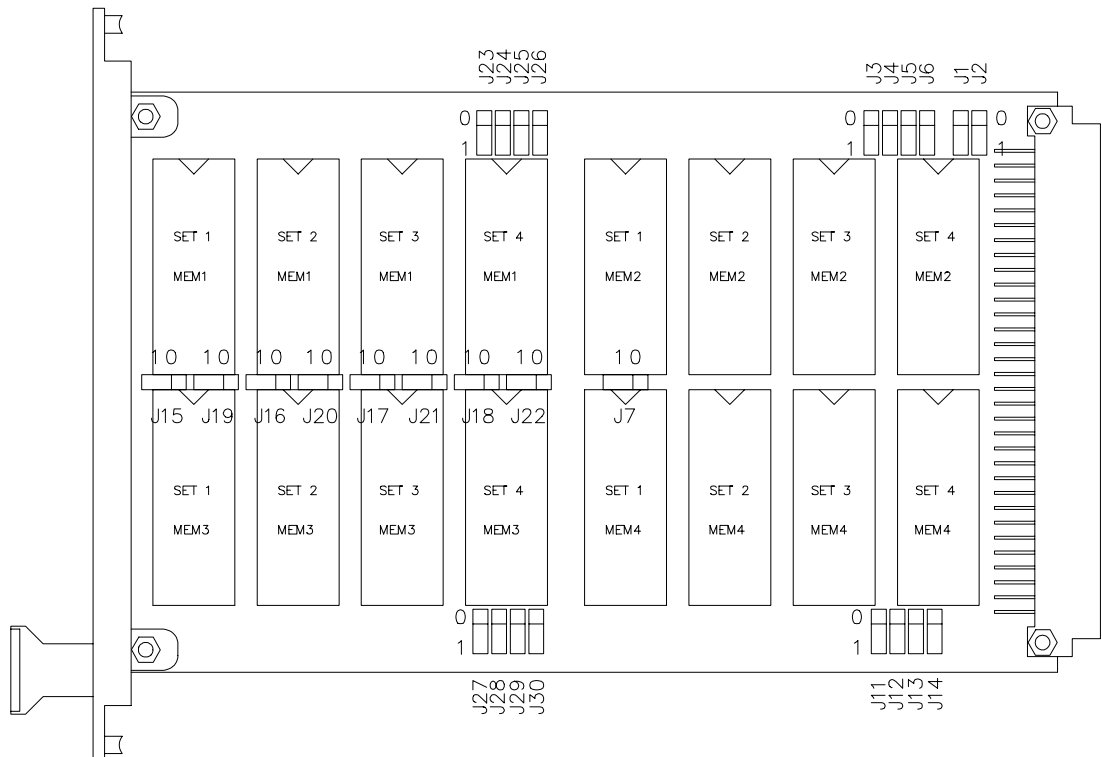


Figure 1 Memory module with jumper and memory locations



## Memory types

The memory module supports the following memory types:

- EPROM: 27512 or 27C512 (64 k \* 8 = 512 Kb)  
maximum access time: 200 ns.
- RAM: 43256 or equivalent (32 k \* 8 = 256 Kb)  
maximum access time: 100 ns.

## Jumpers

The memory module can be used in a number of modes. The required mode is selectable by means of jumpers on the board (see Figure 1 to Figure 13). Figure 1 shows the location of the jumpers and the memory sets of the module. Figure 2 to Figure 13 show the required positions for the various applications.

## J1 and J2

Jumpers J1 and J2 define the memory module number (see Figure 2).

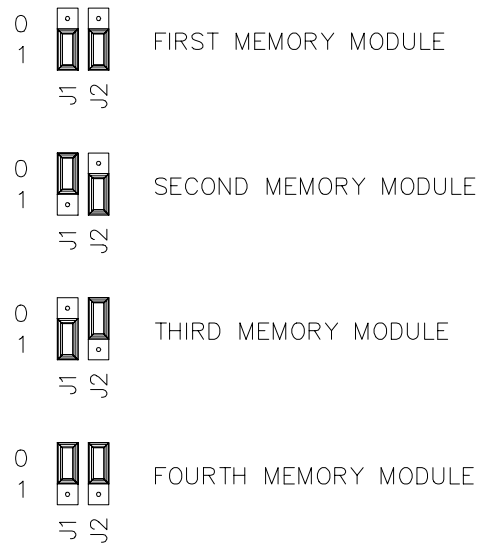


Figure 2 Jumper setting for memory module number setting

The memory module number counts from one to four, regardless of the function of the module (application in EPROM or application in RAM).



## J3 to J30 (EPROMs)

Jumpers J3 to J30 define the placement of EPROMs on the memory module (see Figure 3 to Figure 9).

No. of EPROM sets on 1st application program module	For jumper setting of...	
	J3 to J22	J23 to J30
1	see Figure 3	see Figure 3
2	see Figure 4	see Figure 4
3	see Figure 5	see Figure 5
4	see Figure 6	see Figure 6

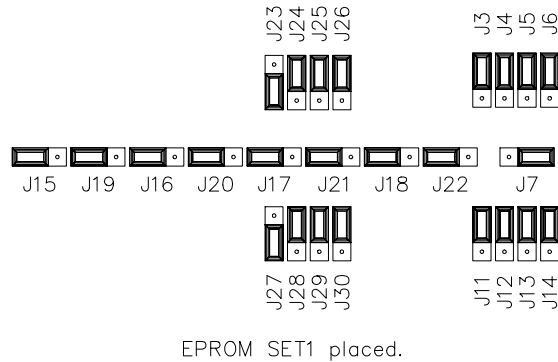


Figure 3 Jumper setting for one set of EPROMs on the first application program module

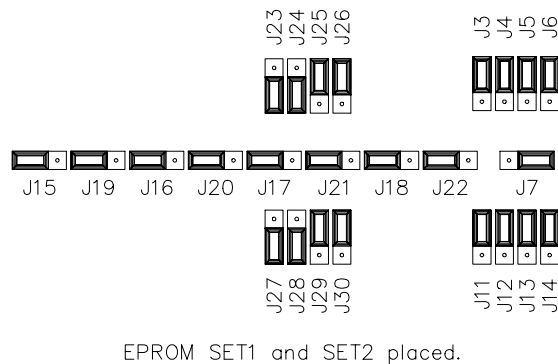
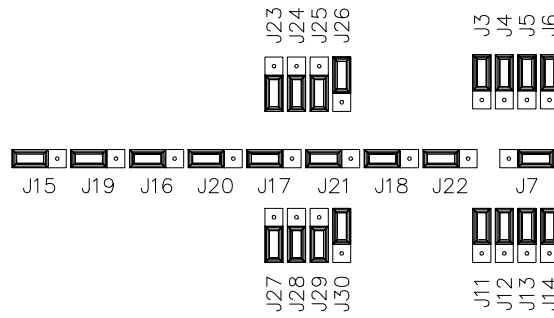
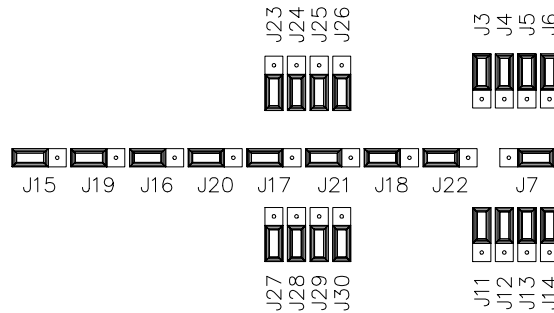


Figure 4 Jumper setting for two sets of EPROMs on the first application program module



EPROM SET1, SET2 and SET3 placed.

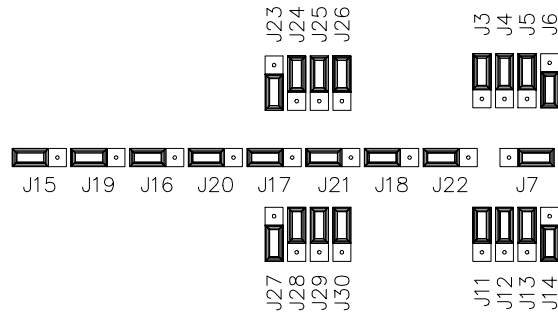
Figure 5 Jumper settings for three sets of EPROMs on the first application program module



EPROM SET1, SET2, SET3 and SET4 placed.

Figure 6 Jumper settings for four sets of EPROMs on the first application program module

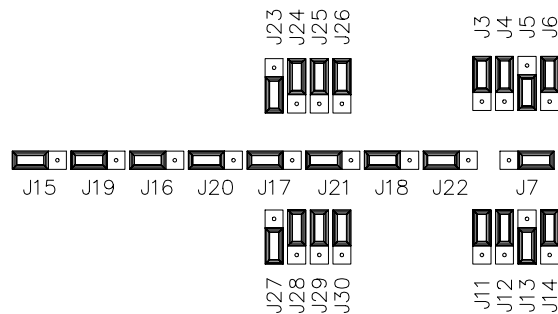
No. of EPROM sets on 2nd application program module	For jumper setting of...	
	J3 to J22	J23 to J30
1	see Figure 7	see Figure 7
2	see Figure 7	see Figure 4
3	see Figure 7	see Figure 5
4	see Figure 7	see Figure 6



EPROM SET1 placed.

Figure 7 Jumper setting for one set of EPROMs on the second application program module

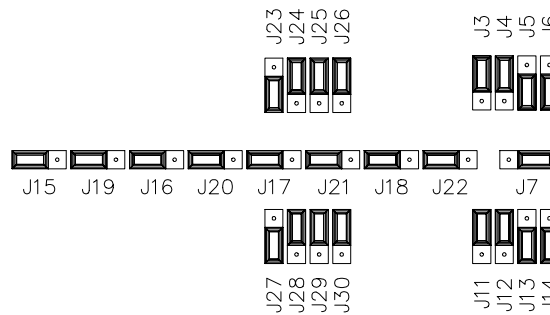
No. of EPROM sets on 3rd application program module	For jumper setting of...	
	J3 to J22	J23 to J30
1	see Figure 8	see Figure 8
2	see Figure 8	see Figure 4
3	see Figure 8	see Figure 5
4	see Figure 8	see Figure 6



EPROM SET1 placed.

Figure 8 Jumper setting for one set of EPROMs on the third application program module

No. of EPROM sets on 4th application program module	For jumper setting of...	
	J3 to J22	J23 to J30
1	see Figure 9	see Figure 9
2	see Figure 9	see Figure 4
3	see Figure 9	see Figure 5
4	see Figure 9	see Figure 6

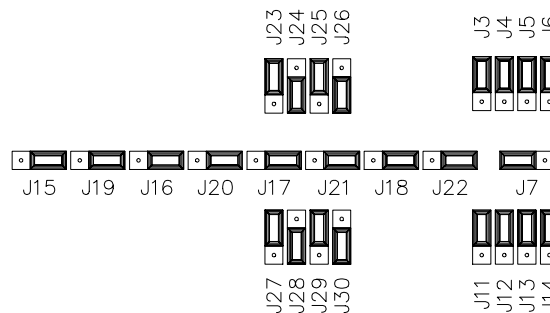


EPROM SET1 placed.

Figure 9 Jumper setting for one set of EPROMs on the fourth application program module

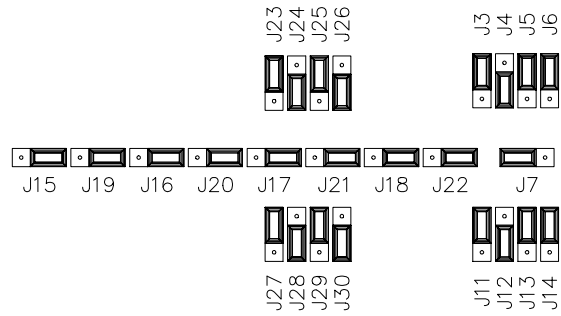
### J3 to J30 (RAM)

Jumpers J3 to J30 define the placement of RAMs on the memory module (see Figure 10 to Figure 13). Application RAM modules must always be fitted with all (16) RAMs.



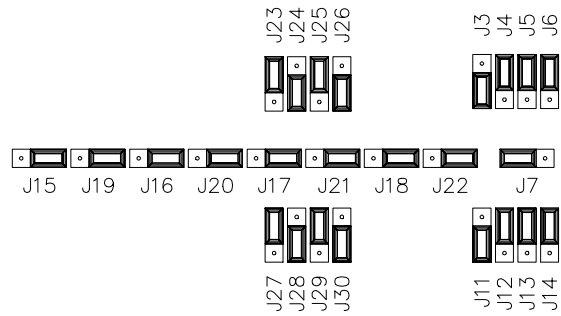
RAM SET1, SET2, SET3 and SET4 placed.

Figure 10 Jumper setting for the first application RAM module



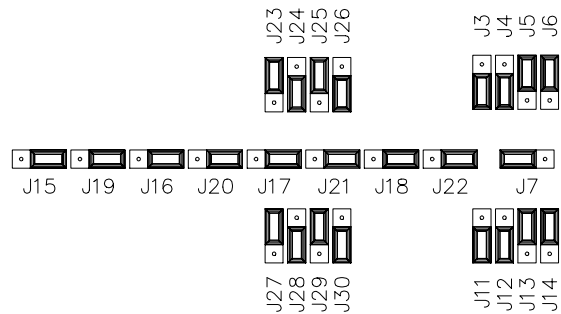
RAM SET1, SET2, SET3 and SET4 placed.

Figure 11 Jumper setting for the second application RAM module



RAM SET1, SET2, SET3 and SET4 placed.

Figure 12 Jumper setting for the third application RAM module



RAM SET1, SET2, SET3 and SET4 placed.

Figure 13 Jumper setting for the fourth application RAM module



## Technical data

The 10003/1/1 module has the following specifications:

<b>General</b>	Type number:	10003/1/1
	Approvals:	CE, TÜV
	Software versions:	all (> 1 MEM module $\geq$ 2.80b)
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc
	– with 4 EPROMs	650 mA
	– with 8 EPROMs	800 mA
	– with 12 EPROMs	950 mA
	– with 16 EPROMs	1100 mA
	– with 16 RAMs	750 mA
	Ripple content:	< 50 mV p-p
<b>Memory</b>	Max. EPROM capacity:	512 Kbytes (4 sets of 64 Kbytes)
	Max. RAM capacity:	256 Kbytes

---

### Note:

Do not remove or replace this module while the power to its Central Part is on.

---

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## 10004/1/1

## Communication module (COM)

### Description

Communication (COM) modules are used for:

- communication between redundant Central Parts in an FSC configuration,
- communication between a master FSC system and slave FSC systems,
- external communication with integrated control systems and/or printers, etc., and
- external communication with the FSC user station.

For these functions, the communication module supports serial communication links for either RS422, RS232C, RS485, current loop or glass fiber.

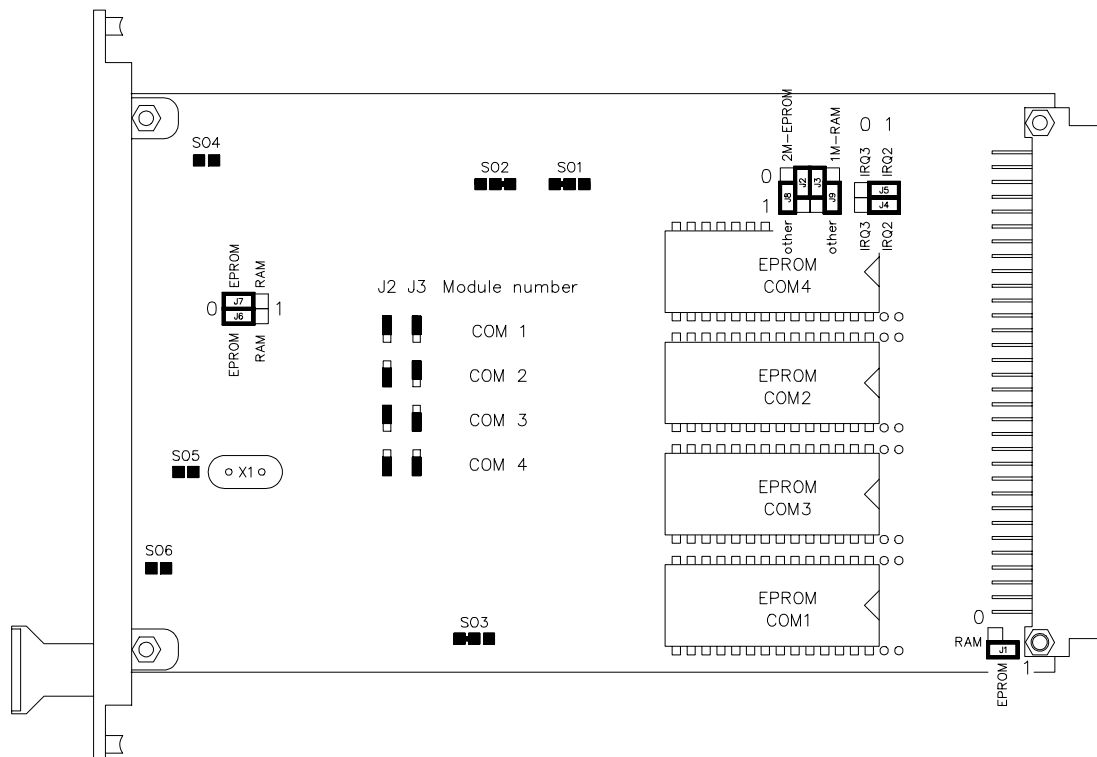


Figure 1 Jumpers and EPROM sockets on 10004/1/1 module

The COM module has its own processor and memory to relieve the central processor and to offer optimum support for the external equipment.



The extensive memory capacity of this module allows many special features to be included in the software, e.g.:

- communication protocols: – FSC-FSC  
– FSC-DS  
– ModBus RTU  
– ModBus H&B  
– RKE3964R
- sequence of event recording (SER),
- report generation, and
- support of printers and video display units.

The COM module is provided with battery back-up circuits for the RAM memory, which enables back-up supply from the batteries on the diagnostic and battery module (DBM, 10006/1/1 or 10006/2/.) or single bus driver (SBD, 10007/1/1).

38.4 Kbaud on COM channel A is only possible if oscillator X1 is placed and solder jumper SO6 closed (see Figure 1).

---

## EPROM types

The 10002/A/1 module supports the following EPROM types:

- 27C512: 64 k \* 8 (512 Kb) or equivalent
- 27C1001: 128 k \* 8 (1 Mb) or equivalent
- 27C2001: 256 k \* 8 (2 Mb) or equivalent

The maximum access time for all EPROM types is 200 ns.

---

## Type coding

If special interfaces are used, the type coding of the COM modules is as follows:

10004 / . / .  
└──┬── Letter of interface (B) bottom  
└──┬── Letter of interface (A) top

For example, 10004/H/F is a COM module with:

- Top interface: 10004/H/1
- Bottom interface: 10004/F/1

Empty interface positions are indicated with the number 1.

For details on the various interfaces refer to the 10004/. /1 data sheets.

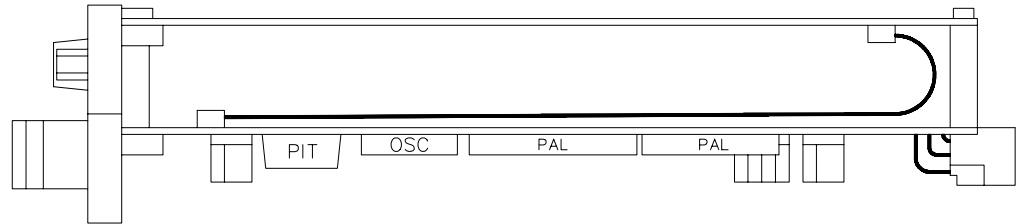


Figure 2 Top view of COM module with interface modules

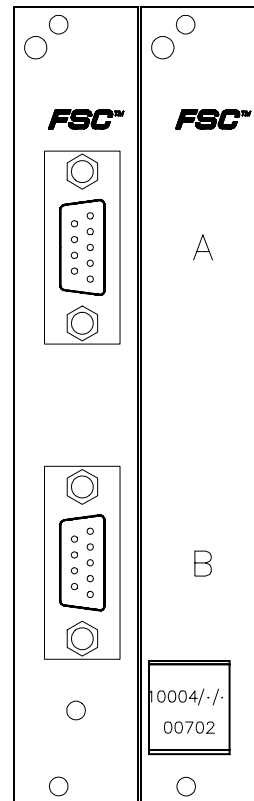


Figure 3 Front view of COM module with two interface modules



## Technical data

The 10004/1/1 module has the following specifications:

<b>General</b>	Type number:	10004/1/1 00702*
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U) (with interfaces)
<b>Power</b>	Power requirements:	5 Vdc 1150 mA (without interfaces)
	Ripple content:	< 50 mV p-p

---

### Notes:

10004/1/1 modules with suffix code 00701 or higher have an improved module timing.

10004/1/1 modules with suffix code 00702 have been modified to meet the changed Serial Communication Controller specification.

---

---

### Note:

Do not remove or replace this module while the power to its Central Part is on.

---

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## 10004/B/1 RS232C interface

### Description

The RS232C interface can be used to connect another device to the FSC system, e.g. the FSC user station or a printer.

The 10004/B/1 module provides galvanic isolation, which allows connecting 220 Vac powered devices according to VDE 0160/0110. RS232 is usable for cable lengths up to 15 m (49.2 ft) at baud rates up to 20 Kbaud. If proper cable types (e.g. Belden 8723) are used, the maximum cable length at 38.4 Kbaud is 10 m (32.8 ft).

### Pin allocation

Figure 1 shows the pin allocation of the female connector.

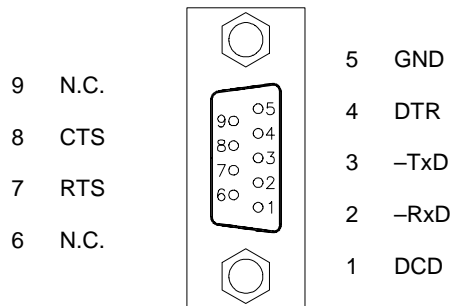


Figure 1 Front view of 10004/B/1 connector

### Connections

Figure 2 to Figure 6 show the connections of various cables.

FSC-system  
RS232C (10004/B/1)  
9-pin connector male

IBM (compatible) PC  
COM1:  
9-pin connector female

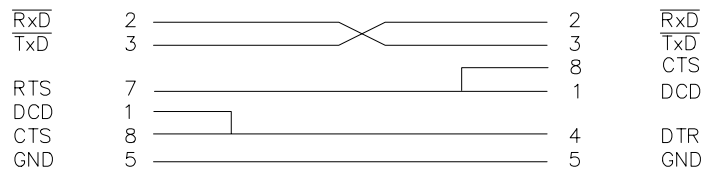
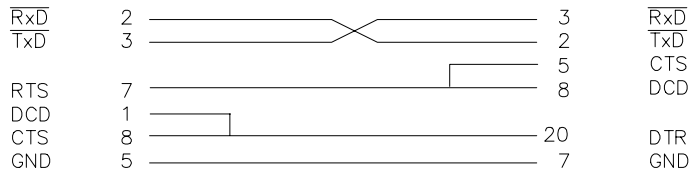


Figure 2 Cable between FSC system and IBM (compatible) PC 9-pin connector with hardware handshake



FSC-system  
RS232C (10004/B/1)  
9-pin connector male

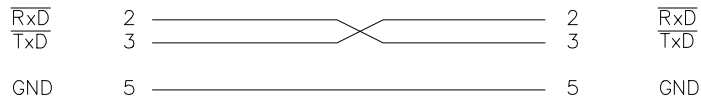
IBM (compatible) PC  
COM1:  
25-pin connector female



**Figure 3** Cable between FSC system and IBM (compatible) PC  
25-pin connector with hardware handshake

FSC-system  
RS232C (10004/B/1)  
9-pin connector male

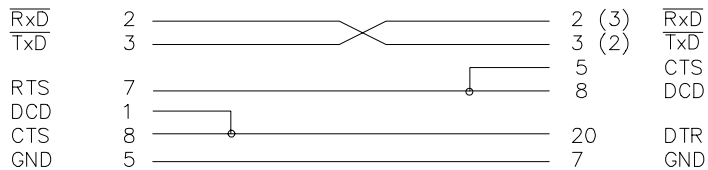
IBM (compatible) PC  
COM1:  
9-pin connector female



**Figure 4** Cable between FSC system and IBM (compatible) PC  
9-pin connector without hardware handshake

FSC-system  
RS232C (10004/B/1)  
9-pin connector male

Printer  
25-pin connector male



**Figure 5** Cable between FSC system and printer  
25-pin connector with hardware handshake

**Note:**

Pins 2 and 3 of some printer types are interchanged.



FSC-system  
 RS232C (10004/B/1)  
 9-pin connector male

Printer  
 25-pin connector male

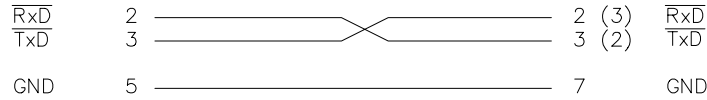


Figure 6 Cable between FSC system and printer  
 25-pin connector without hardware handshake

**Note:**

Pins 2 and 3 of some printer types are interchanged.

**Technical data**

The 10004/B/1 module has the following specifications:

**General**

Type number: 10004/B/1  
 Approvals: CE, TÜV  
 Software version: all  
 Space requirements: 4 TE (= 4 HP), half height  
 RS232: according to RS232C standard  
 Maximum baud rate: 38.4 Kbaud

**Power**

Power requirements: 5 Vdc 100mA  
 Ripple content: < 50 mV p-p

**Isolation**

Galvanic isolation: > 6 kV

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## 10004/E/1 Current loop interface

### Description

The current loop interface can be used to connect another device to the FSC system, e.g. a printer or a process control system. The 10004/E/1 module provides galvanic isolation, which allows connecting 220 Vac powered devices according to VDE 0160/0110.

### Pin allocation

Figure 1 shows the pin allocation of the female connector.

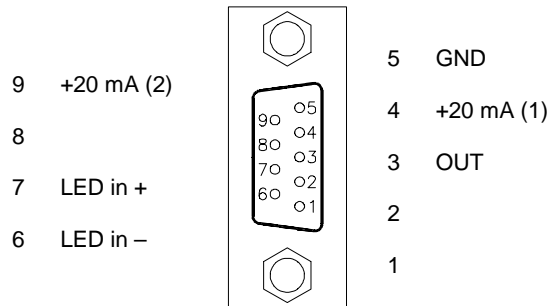


Figure 1 Front view of 10004/E/1 connector

### Jumpers

Solder jumpers SO1 and SO3 are factory-set (–RTS or power-down = 20 mA). If solder jumpers SO2 and SO4 are closed, the local watchdog is disabled.

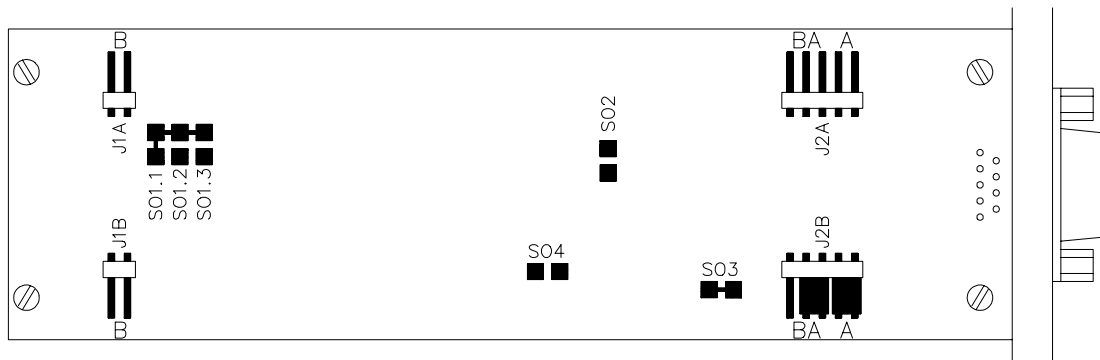


Figure 2 Jumper settings

## Baud rates

Table 1 shows the baud rates that are supported by the 10004/E/1 interface. It also provides the maximum cable length for each baud rate. The lengths indicated only apply if proper cable types are used, e.g. Belden 8723.

Table 1 Supported baud rates with max. cable lengths

Baud rate	Max. cable length	
	meters	yards
19200	5	5.5
9600	10	10.9
4800	25	27.3
2400	50	54.7
1200	100	109

## Wiring diagrams

The wiring diagrams of the 10004/E/1 module are as follows:

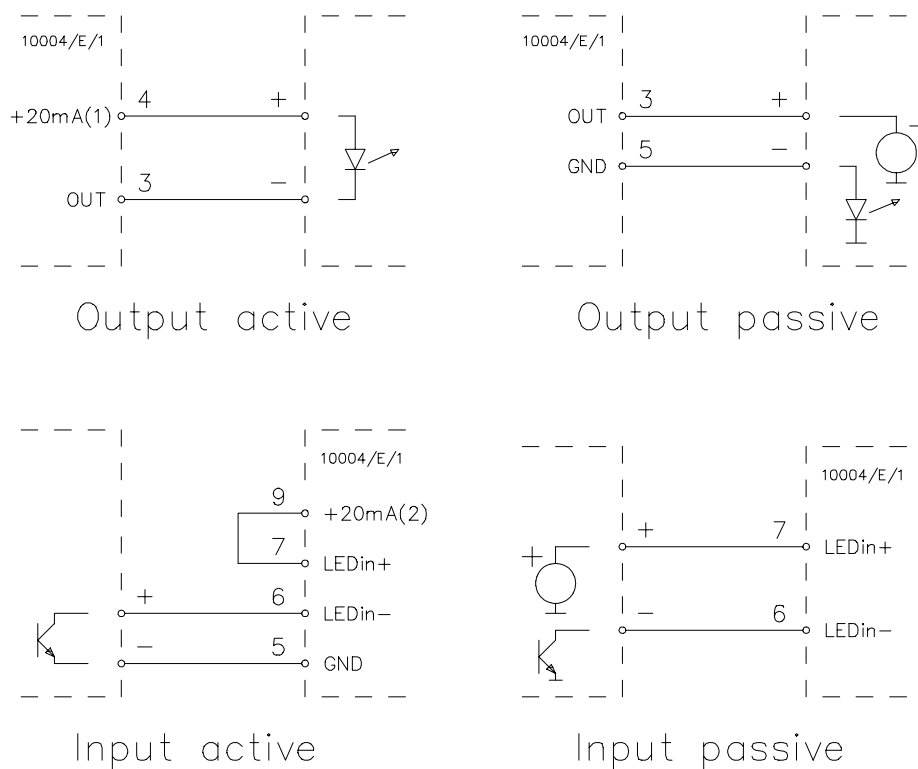


Figure 3 Wiring diagrams for the connection of the 10004/E/1



## Connections

The connections of the duplex current loop are as follows:

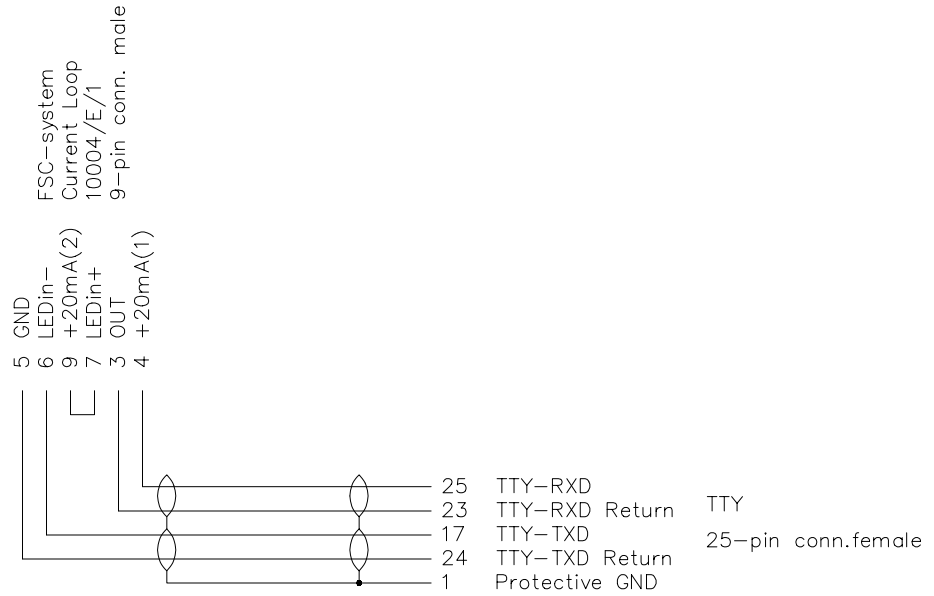


Figure 4 Duplex current loop connection (TTY passive, FSC active)

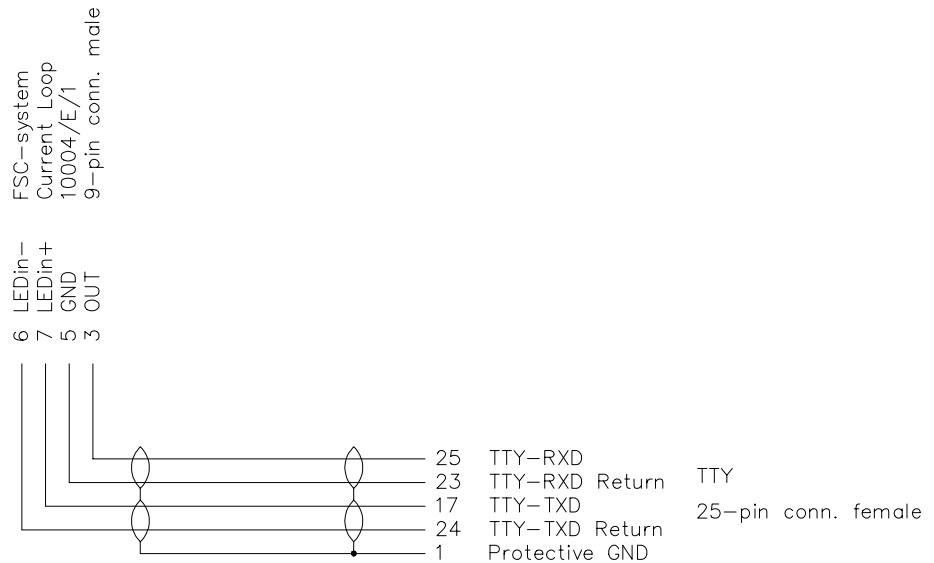


Figure 5 Duplex current loop connection (TTY active, FSC passive)



## Technical data

The 10004/E/1 module has the following specifications:

<b>General</b>	Type number:	10004/E/1
	Approvals:	CE, TÜV, UL
	Software versions:	$\geq 2.78e$
	Space requirements:	4 TE (= 4 HP), half height
	Maximum baud rate:	19.2 Kbaud
<b>Power</b>	Power requirements:	5 Vdc 350 mA
	Ripple content:	$< 50$ mV p-p
<b>Source</b>	Current source:	$20$ mA $\pm 10\%$
	Maximum load:	1 kOhm
	Open voltage:	max. 25 V
<b>Output transistor</b>	Maximum voltage:	50 V
	On current:	$> 20$ mA (internally limited)
	Voltage drop:	$< 3$ V at 20 mA
<b>LED</b>	LED input voltage:	$< 2$ V at 20 mA
	Maximum current:	100 mA
	Off current:	$< 3$ mA
<b>Isolation</b>	Galvanic isolation:	$> 6$ kV

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## 10004/F/1

## Tri-state RS232C interface

### Description

The Tri-state RS232C interface can be used to connect another device to the FSC system, e.g. the FSC user station or a process control system.

The 10004/F/1 module provides galvanic isolation, which allows connecting 220 Vac powered devices according to VDE 0160/0110.

The tri-state RS232C interface can be used to connect the FSC user station to all Central Parts in a redundant configuration. In that case the Central Parts decide between each other which Central Part will answer if a request is made to the FSC system. This will guarantee optimum availability if an interface goes faulty. An on-board watchdog circuit disconnects the communication line when the communication processor (on the 10004/1/1 COM module) goes into software hangup or hardware reset.

RS232 is usable for cable lengths up to 15 m (49.2 ft) at baud rates up to 20 Kbaud. If proper cable types (e.g. Belden 8723) are used, the maximum cable length at 38.4 Kbaud is 10 m (32.8 ft).

### Pin allocation

Figure 1 shows the pin allocation of the female connector.

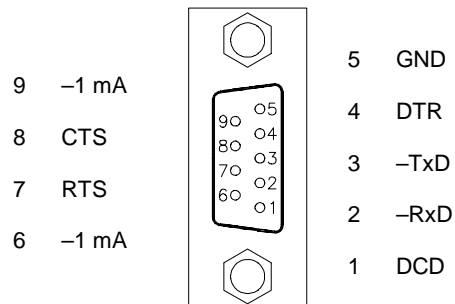


Figure 1 Front view of 10004/F/1 connector



## Connections

Figure 2 to Figure 8 show the connections of the various cables.

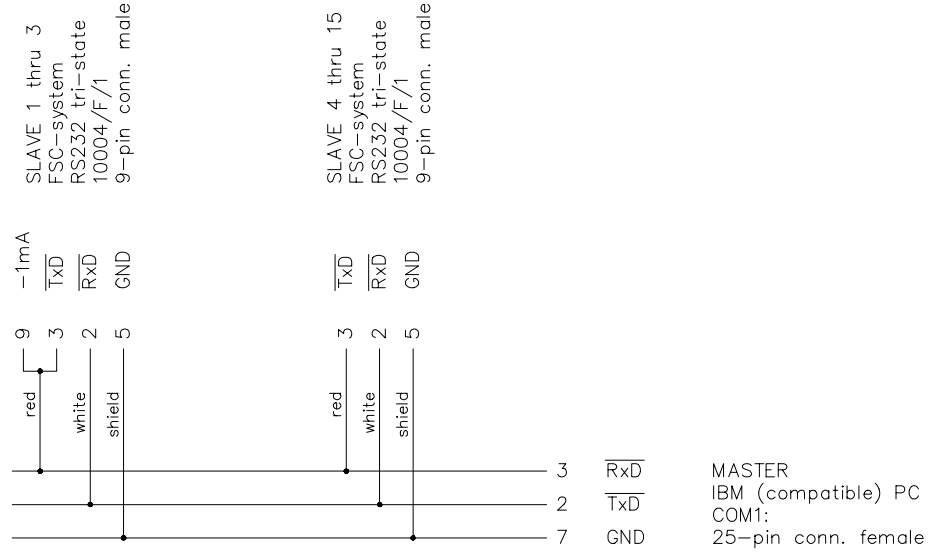


Figure 2 Cable between FSC systems and IBM (compatible) PC 25-pin connector without hardware handshake

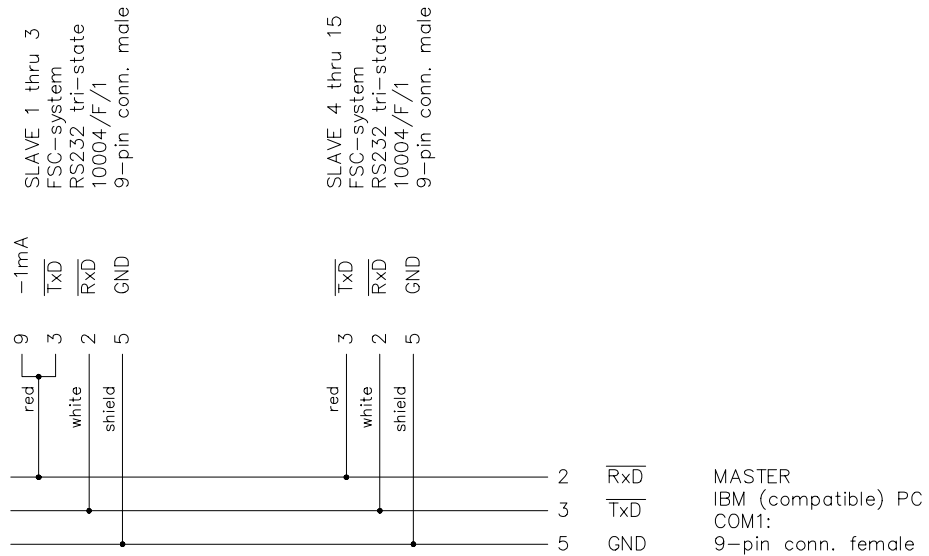


Figure 3 Cable between FSC systems and IBM (compatible) PC 9-pin connector without hardware handshake

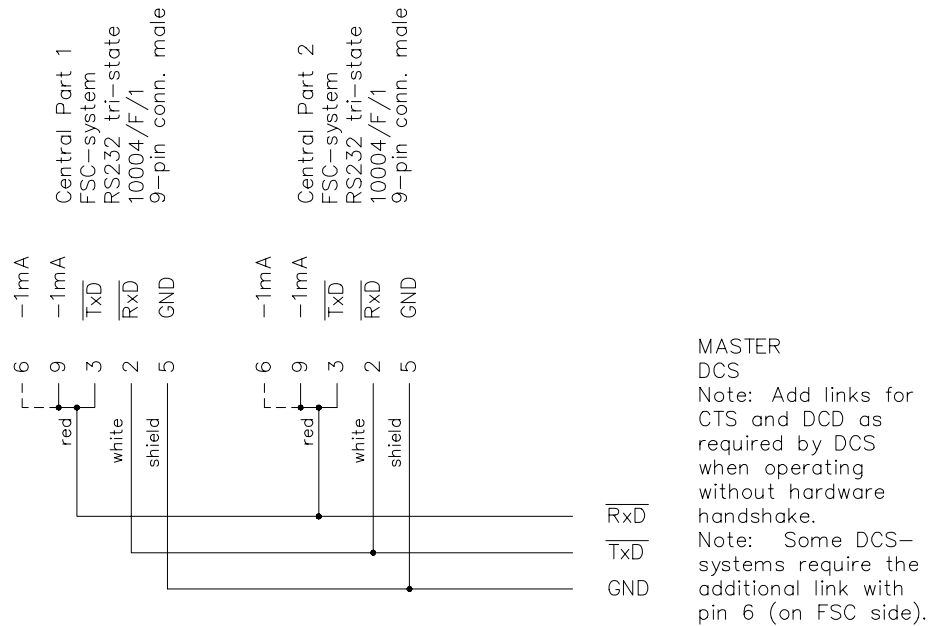


Figure 4 Cable between FSC systems and DCS system, without hardware shaking

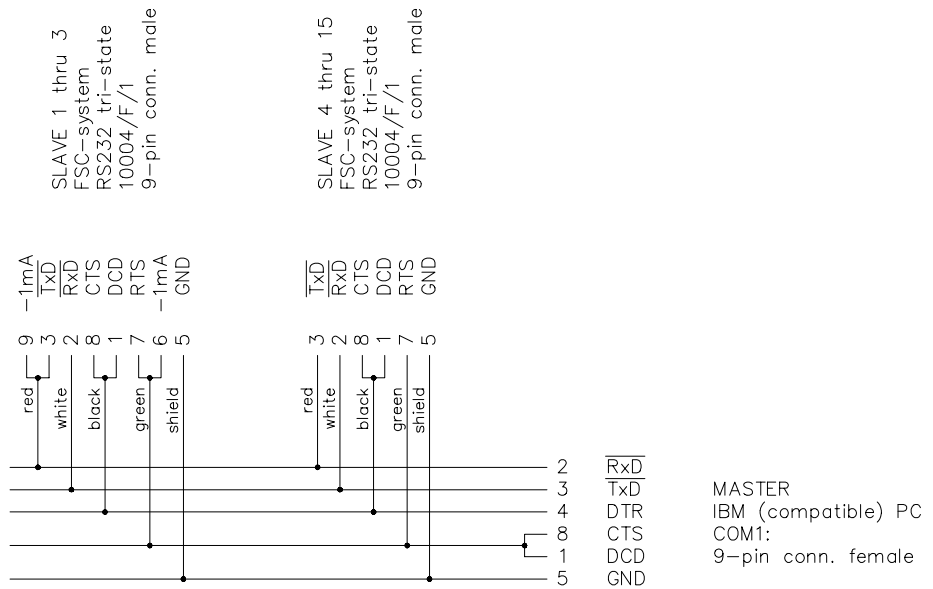


Figure 5 Cable between FSC systems and IBM (compatible) PC 9-pin connector with hardware shaking

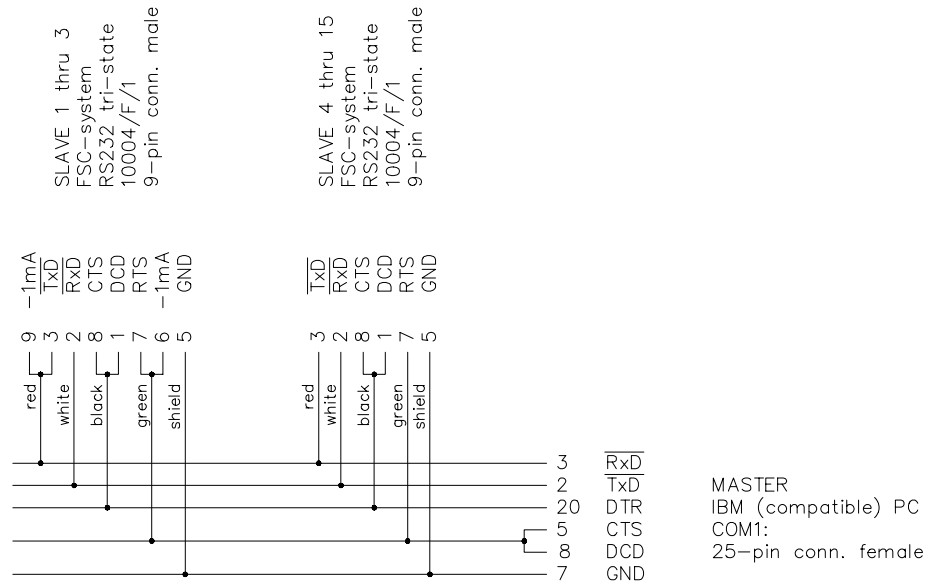


Figure 6 Cable between FSC systems and IBM (compatible) PC 25-pin connector with hardware handshake

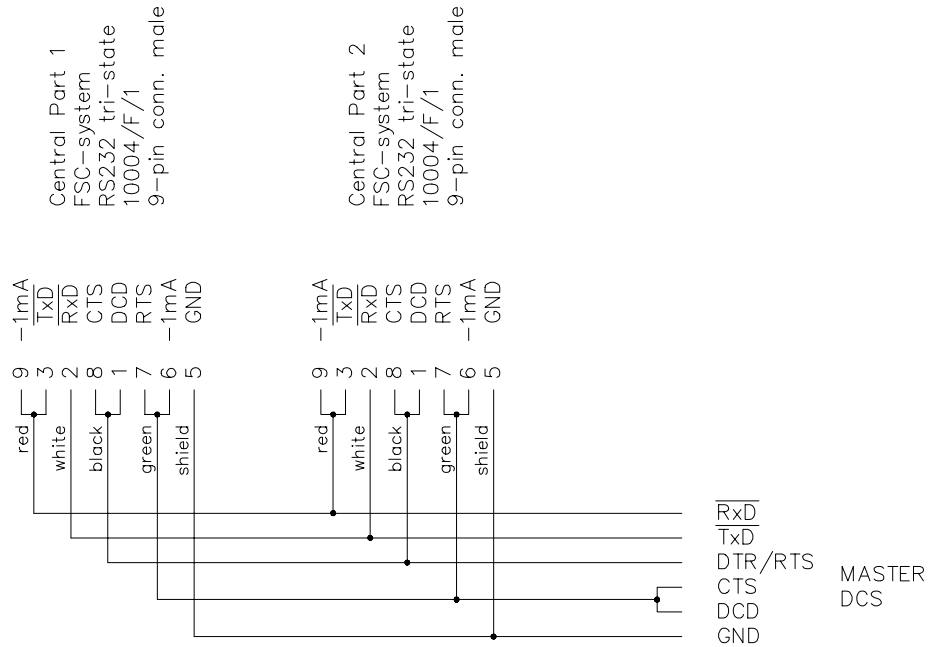


Figure 7 Cable between FSC systems and DCS system, with hardware handshake





FSC-system  
 central part 1 and/or 2  
 RS232 tri-state  
 10004/F/1  
 9-pin conn. male

Printer  
 25-pin conn. male

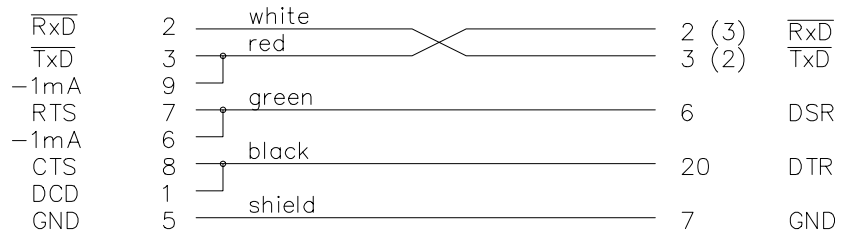


Figure 8 Cable between FSC system and printer  
 (25-pin connector) with hardware handshake

**Note:**

Pins 2 and 3 of some printer types are interchanged.

**Jumpers**

The solder jumpers S01 to S05 on the 10004/F/1 module are factory-set.

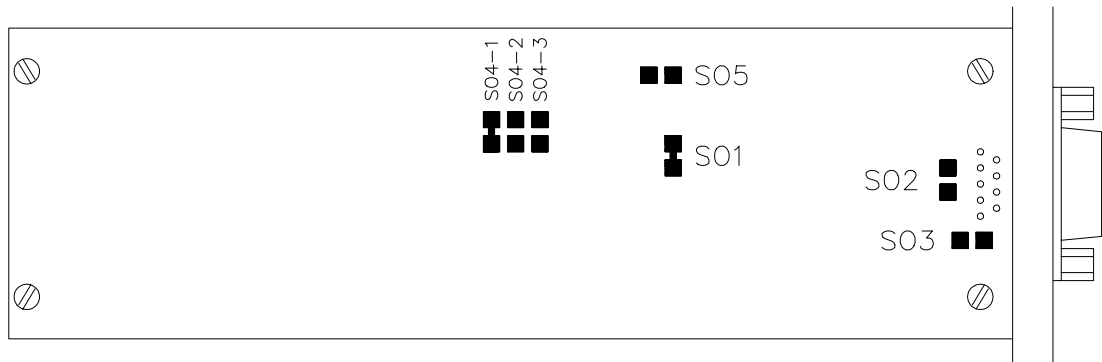


Figure 9 Solder jumpers on the 10004/F/1



## Technical data

The 10004/F/1 module has the following specifications:

<b>General</b>	Type number:	10004/F/1
	Approvals:	CE, TÜV, UL
	Software versions:	$\geq 2.77$
	Space requirements:	4 TE (= 4 HP), half height
	Maximum baud rate:	38.4 Kbaud
<b>Power</b>	Power requirements:	5 Vdc 150 mA
	Ripple content:	$< 50$ mV p-p
<b>Isolation</b>	Galvanic isolation:	$> 6$ kV

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## 10004/G/1

## Glass fiber interface

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### Description

The glass fiber interface can be used to interconnect two FSC systems with multimode fiber optic cable to avoid magnetic interference and earth loops.

The 10004/G/1 module supports encoded serial communication at 1 or 2 Mbaud. The module requires a symmetrical coding system (Manchester, FM0 and FM1 coding are supported).

The modules are equipped with Honeywell transmitters (top) and receivers (bottom). They allow a maximum permissible transmission loss of 23.5 dB and require a minimum loss of 8 dB. The modules are designed for 100/140 fibers.

---

### Cable lengths

The maximum distance that can be bridged depends on the type and number of connectors used, the fiber optic quality and the fiber type.

The transmission loss is the sum of the connector attenuations ( $n * A_c$ ), the fiber attenuation ( $L * A_f$ ) and the transmitter-fiber mismatch ( $A_m$ ). The total calculated transmission loss ( $\sum A$ ) may not exceed the maximum permissible loss.

$$\sum A = (n * A_c) + (L * A_f) + A_m \leq A_{max}$$

To give some calculation examples, we assume the following values:

- Connector attenuation ( $A_c$ ) = 2 dB.
- 100/140  $\mu\text{m}$  fiber attenuation ( $A_f$ ) = 5.5 dB/km (at 820 nm).
- 50/125  $\mu\text{m}$  fiber attenuation ( $A_f$ ) = 3 dB/km (at 820 nm).
- 100/140 transmitter to 50/125 fiber mismatch ( $A_m$ ) = 6 dB.

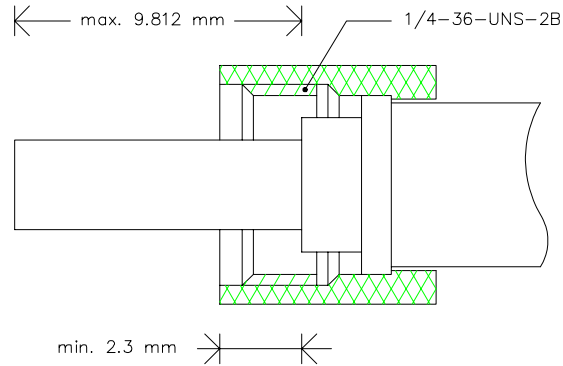
Using these values, we can calculate the maximum distance we can bridge using a 100/140 fiber with two connectors (at begin and end point).

$$\sum A = (2 * 2) + (L * 5.5) + 0 = 23.5 \rightarrow L = 3.5 \text{ km} (= 2.18 \text{ mi})$$

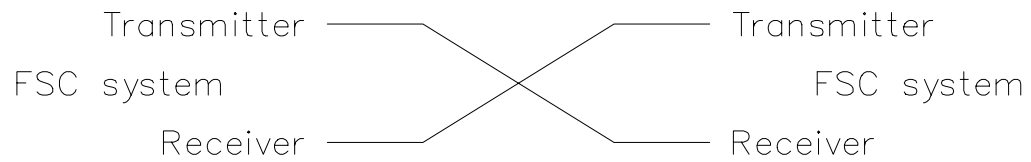
Using the modern 50/125 fiber and two connectors we can bridge:

$$\sum A = (2 * 2) + (L * 3) + 6 = 23.5 \rightarrow L = 4.5 \text{ km} (= 2.80 \text{ mi})$$

Using more connectors in the loop, other types of connectors and/or other fiber qualities will result in other maximum distance calculation results.



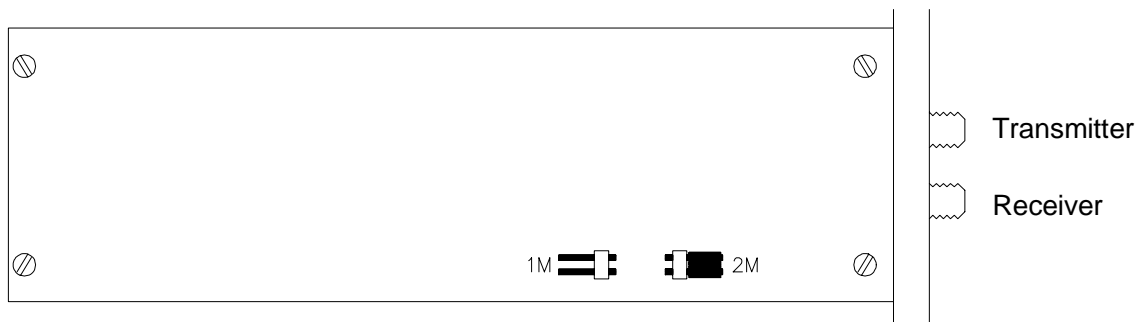
**Figure 1 Cable connector type FSMA**



**Figure 2 Optical link between two FSC systems**

## Jumpers

1 Mbaud or 2 Mbaud decoding is programmed by means of the jumper on the module.



**Figure 3 Jumper settings on the 10004/G/1**

This module can only be used on the 10004/1/1 COM channel B due to mechanical constraints on the fiber optic cable. 10004/G/G modules are possible with special guiding of the optic cables.



## Technical data

The 10004/G/1 module has the following specifications:

<b>General</b>	Type number:	10004/G/1 09800*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.77
	Space requirements:	4 TE (= 4 HP), half height
	Peak emission/responsivity wave length:	820 nm
	Maximum baud rate:	2 Mbaud
<b>Power</b>	Power requirements:	5 Vdc 250 mA
	Ripple content:	< 50 mV p-p

---

**Note:**

10004/G/1 modules without a suffix code cannot decode 1 Mbaud, and have a maximum transmitter-receiver transmission loss of 18.5 dB.

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## 10004/H/1

## RS422 interface with readback

### Description

The RS422 interface with readback is used only for internal communication in redundant Central Part configurations. In case of an internal communication failure, the correct functioning of the interface is tested. If an interface is faulty, the Central Part with the faulty interface will be switched off. The 10004/H/1 module has no galvanic isolation, and may therefore not be used for external communication links.

The 10004/H/1 module is suitable for cable lengths up to 1.5 m (4.9 ft) at 2 Mbaud using Belden 9728 or Belden 8314 cable.

### Pin allocation

Figure 1 shows the pin allocation of the male connector.

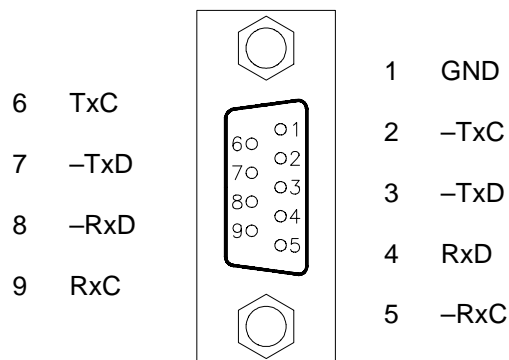


Figure 1 Front view of 10004/H/1 connector

FSC-system  
RS422\* (10004/H/1)  
9-pin conn.female

FSC-system  
RS422\* (10004/H/1)  
9-pin conn.female

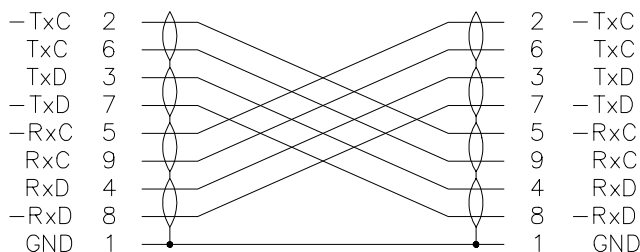


Figure 2 Cable between two Central Parts in redundant FSC configurations



## Technical data

The 10004/H/1 module has the following specifications:

<b>General</b>	Type number:	10004/H/1
	Approvals:	CE, TÜV, UL
	Software versions:	$\geq 2.77$
	Space requirements:	4 TE (= 4 HP), half height
	Maximum baud rate:	2 Mbaud
<b>Power</b>	Power requirements:	5 Vdc 25 mA
	Ripple content:	$< 50$ mV p-p

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## 10004/I/1

## Isolated RS485 / RS422 interface

### Description

The isolated RS485/RS422 interface can be used to connect the FSC system to, for example, the FSC user station and/or other FSC systems.

The RS422 option provides a duplex communication link between the FSC system and one other party.

The RS485 option provides a simplex or duplex communication link between several other parties.

The RS422 master with RS485 slave option provides a duplex communication link between the master and any slave. The slaves can only communicate with the master.

The RS485 interface can be used to connect the FSC user station to all Central Parts in a redundant configuration. In that case the Central Parts decide between each other which Central Part will answer if a request is made to the FSC system. This will guarantee optimum availability if an interface goes faulty. An on-board watchdog circuit disconnects the communication line when the communication processor (on the 10004/1/1 COM module) goes into software hangup or hardware reset.

The 10004/I/1 module provides galvanic isolation, which allows connecting 220 Vac powered devices according to VDE 0160/0110. RS422/RS485 is suitable for cable lengths up to 1.2 km (0.75 mi) at  $\leq 100$  Kbaud, 1 km (0.63 mi) at 125 Kbaud, 120 meter (131.2 yd) at 1 Mbaud and 60 meter (65.6 yd) at 2 Mbaud.

### Pin allocation

Figure 1 shows the pin allocation of the male connector.

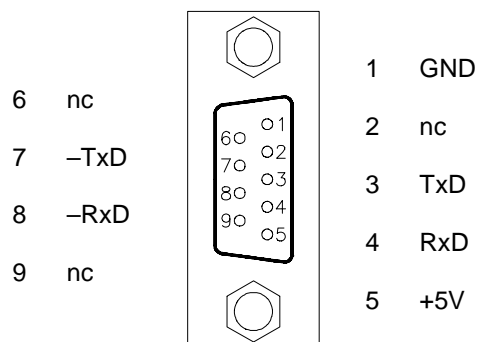


Figure 1 Front view of 10004/I/1 connector

## Connections

The connections of the 10004/I/1 module are as follows:

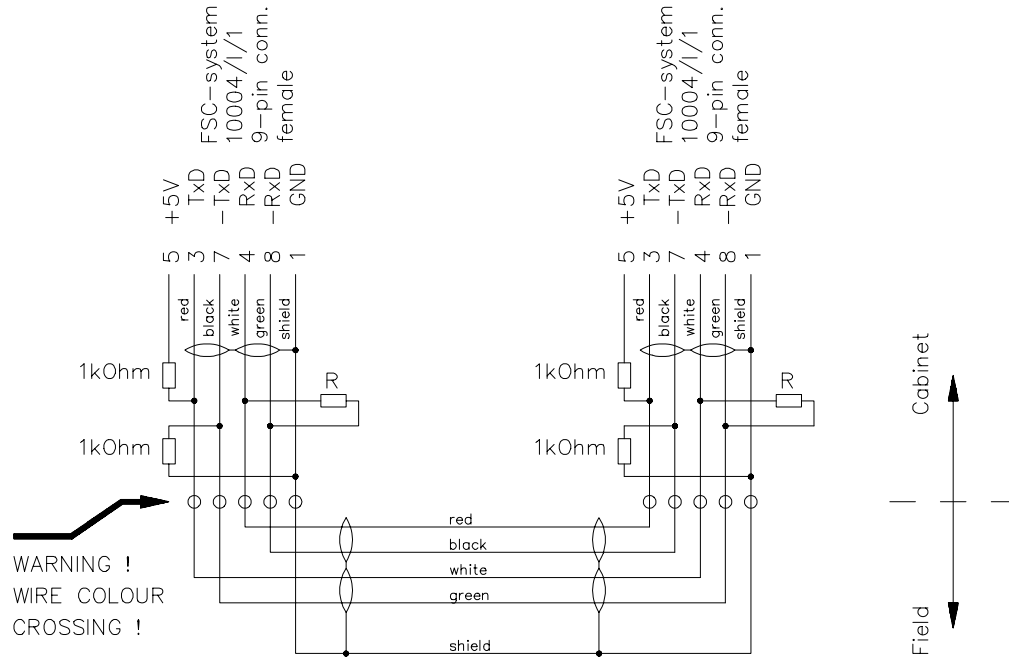


Figure 2 Point-to-point (duplex) communication cable between two FSC systems

Use one terminator resistor (R) and two 1 kOhm resistors per wire pair in RS422 applications.

Use two terminator resistors (R) and two 1 kOhm resistors per wire pair in RS485 applications.

The terminator resistors should be placed at the cable ends. The 1 kOhm resistors must be placed on the master side of the communication cable. Resistor types: 5%, 0.25 W.

The shield must be connected to instrument earth close to the master.

The wire colors in Figure 2 refer to Belden cable type 8723.

IBM P/N 4716748 (IBM N<sup>o</sup>1) cable may also be used (see Table 1 for wire assignment).

TKF cable type: 4 x 2 x 0.5 PVLVDVmb-2af (see Table 1 for wire assignment).

Use only one cable type per communication loop.



Table 1 Color reference and terminator resistor

Wire	Belden 8723	IBM N <sup>o</sup> 1	TKF
TxD	Red	Orange	White (1)
-TxD	Black	Black	Black (1)
RxD	White	Red	White (2)
-RxD	Green	Green	Black (2)
Term. res. R	56 Ohm	150 Ohm	100 Ohm

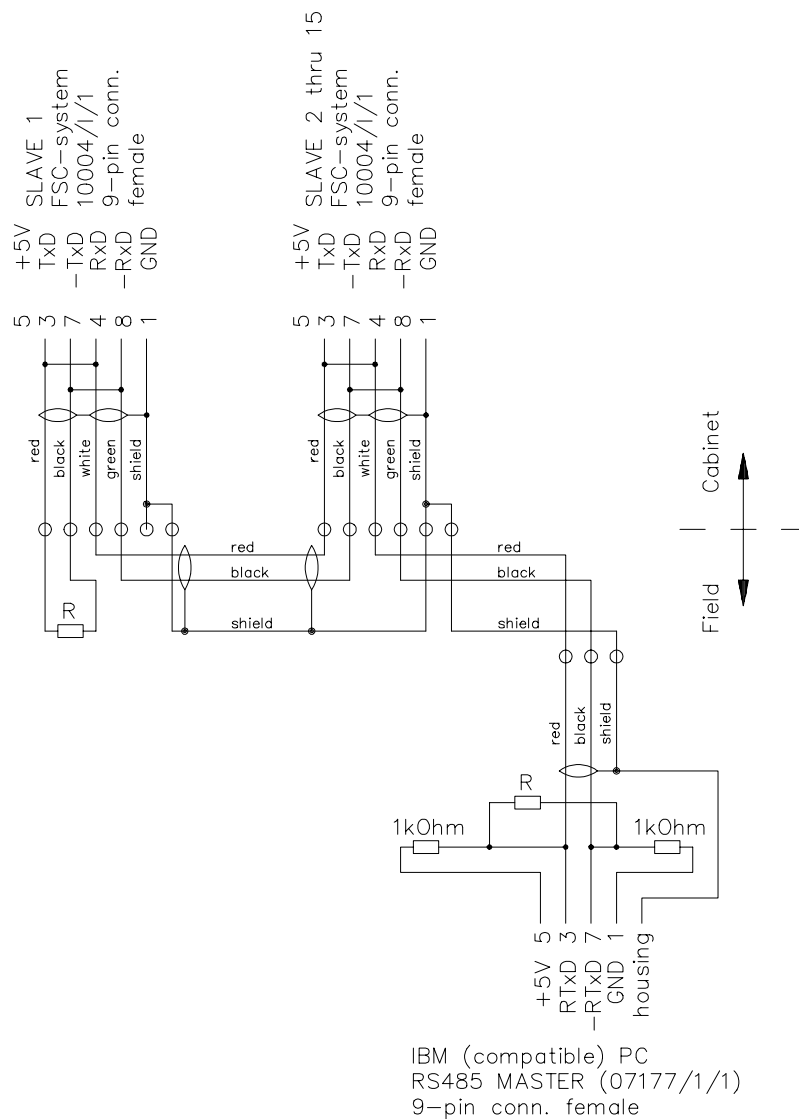


Figure 3 Communication cable (simplex) between FSC systems and an FSC user station

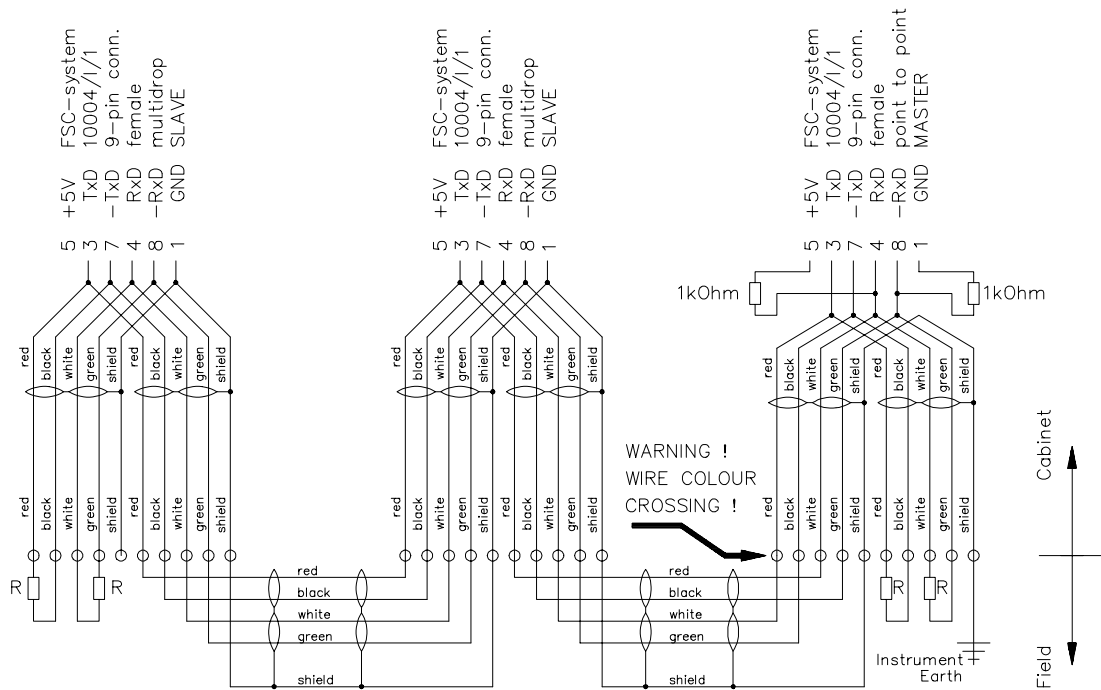


Figure 4 Multidrop (duplex) communication cable between one master and up to 15 slaves

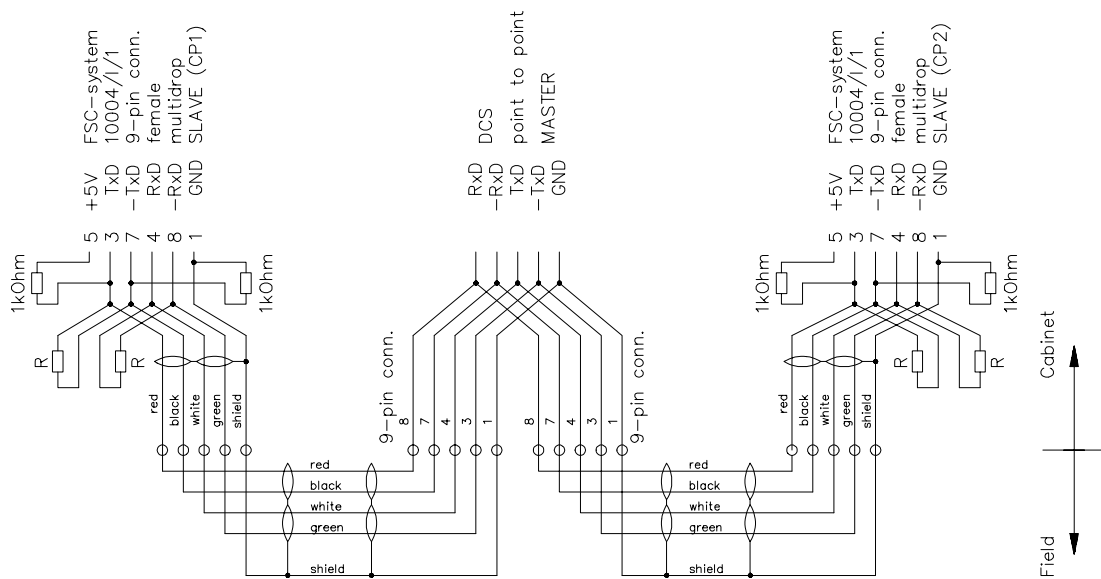


Figure 5 Communication cable between DCS and redundant FSC system using Belden 8723 cable



## Jumpers

The solder jumpers on the 10004/I/1 module are factory-set. Solder jumper SO5 is factory-set for 1 Mbaud (as shown in Figure 6). For 2 Mbaud, SO5 must be set to the opposite position.

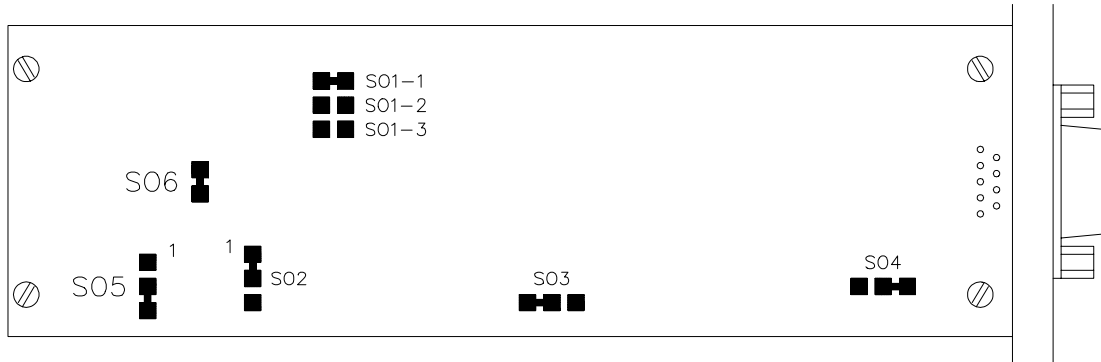


Figure 6 Solder jumpers on the 10004/I/1

If the 10004/I/1 module is used on 10004/1/1 COM channel B, the oscillator X1 of the 10004/1/1 will be removed, resulting in a maximum baud rate of 19k2 on 10004/1/1 COM channel A. A 10004/I/F configuration is therefore recommended for a combination of RS485 and RS232 on the same COM module.

## Technical data

The 10004/I/1 module has the following specifications:

<b>General</b>	Type number:	10004/I/1
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.78
	Space requirements:	4 TE (= 4 HP), half height
	Maximum number of systems:	16
	Maximum baud rate:	2 Mbaud
<b>Power</b>	Power requirements:	5 Vdc 300 mA
	Ripple content:	< 50 mV p-p
<b>Isolation</b>	Galvanic isolation:	> 6 kV



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10005/1/1

## Watchdog module (WD)

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### Description

The watchdog module monitors system parameters including:

- the application loop maximum execution time in order to detect if the process is executing its program correctly and is not looping (hang-up).
- the application loop minimum execution time in order to detect if the processor is executing its program correctly and is not skipping program parts.
- 5 Vdc voltage monitoring for overvoltage and undervoltage (5 Vdc  $\pm$  5 %).
- memory error logic from CPU, COM and MEM modules. In case of a memory error, the watchdog output is de-energized.
- ESD input to de-energize the watchdog output independently from the processor. This ESD input is 24 Vdc and galvanically isolated from the internal 5 Vdc.

In order to be able to test the WD module for all functions, the WD module itself is a 2-out-of-3-voting system. Each section monitors the parameters described above.

The maximum WDG OUT output current is 900 mA (fuse 1A) 5 Vdc. If the number of output modules on the same 5 Vdc supply require a higher current (total of WD input currents of the output modules), then a watchdog repeater (WDR, 10302/1/1) must be used, and the load must be divided over the WD and the WDR.

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## Connections

For safety-relevant applications, the plant ESD can be connected directly to the WD module. In case of an ESD, the outputs will be de-energized independently from the processor.

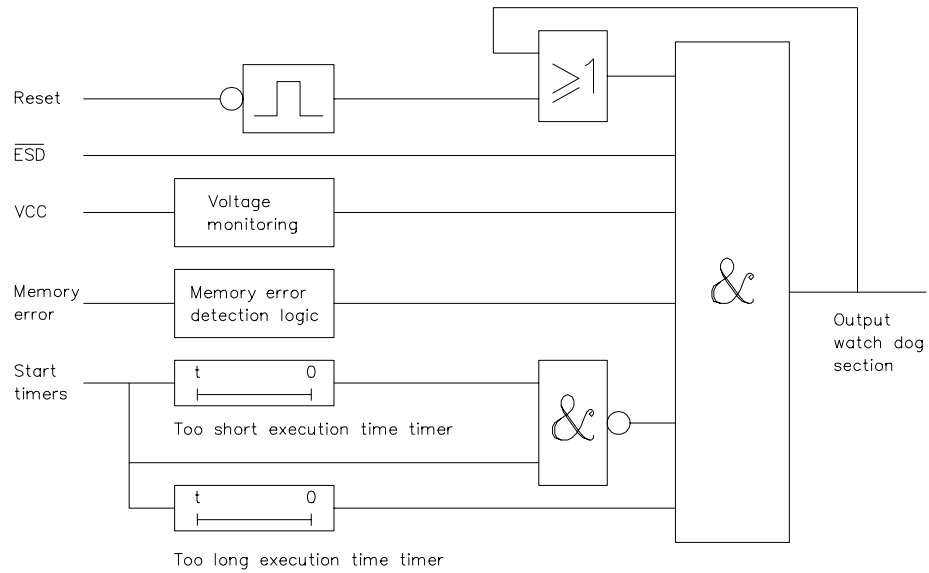


Figure 1 Watchdog section

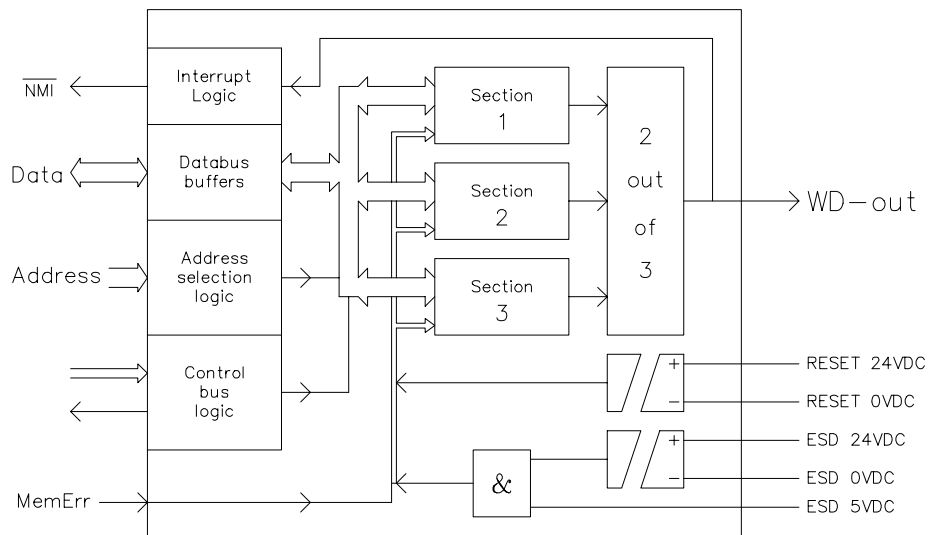


Figure 2 Watchdog module

The watchdog module terminates on the front to the 10005/O/1 module or the S-BUS located on top of the Central Part rack.





## Jumpers

The jumper settings of the 10005/1/1 module are as follows:

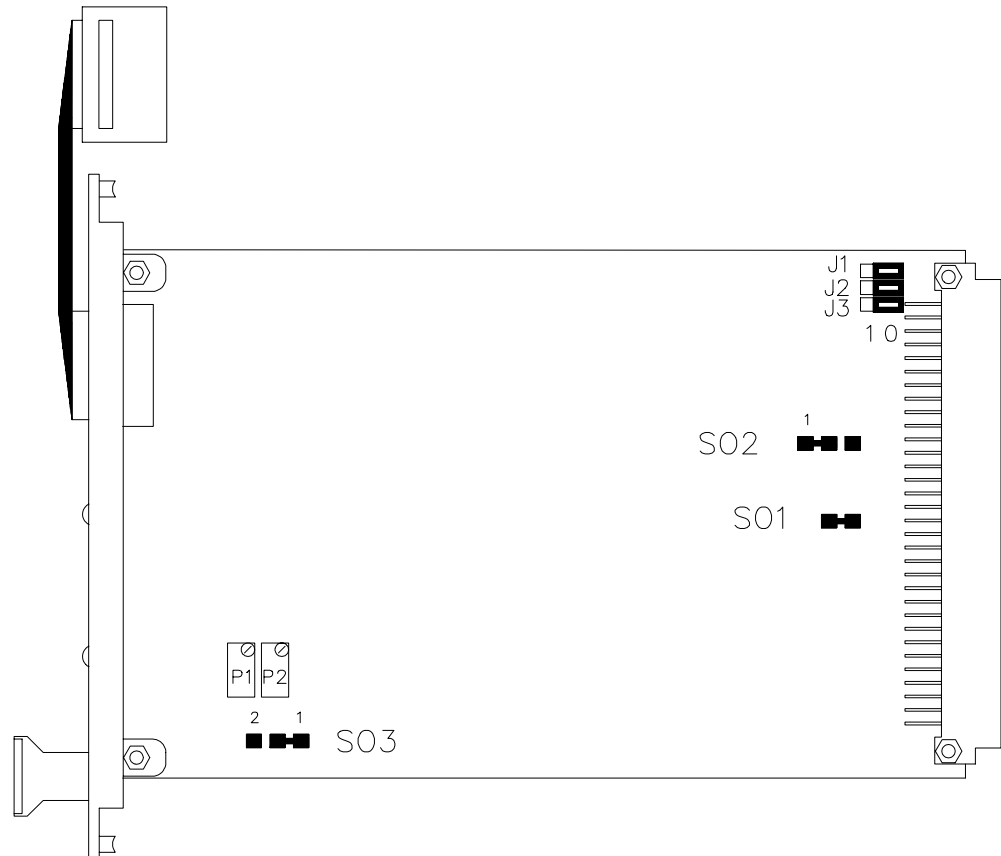
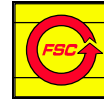


Figure 3 Jumper settings on 10005/1/1 module

The solder jumpers SO1 and SO2 are factory-set.

Position 1 (as shown in Figure 3) of the solder jumper SO3 is used for those applications that always require a manual start command. The solder jumper SO3 in position 2 is used for those applications that have to start automatically after power-up (warm start). In the latter case, a manual reset is still required after a system trip. An automatic start is not executed if the system was powered off with a fault present (VDE 0116). In that case it still requires a manual reset (resulting in cold start).

Jumpers J1 to J3 must be positioned as shown in Figure 3.



## Technical data

The 10005/1/1 module has the following specifications:

<b>General</b>	Type number:	10005/1/1 01301*
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 175 mA (without WDGOUT output current)
	Ripple content:	< 50 mV p-p
<b>Input</b>	ESD1 input:	24 Vdc 5 mA
	Reset input:	24 Vdc 10 mA
	ESD2 input:	5 Vdc 10 mA

---

**\* Note:**

10005/1/1 modules with suffix code 01301 are functionally identical to 10005/1/1 modules without a suffix code. The changes involve improved production yield and reliability.

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**Note:**

Do not remove or replace this module while the power on its Central Part is on.

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## 10005/O/1

## Watchdog horizontal bus

### Description

The watchdog horizontal bus interconnects the watchdog flatcable (at the front) with the watchdog output, watchdog reset input (24 Vdc), watchdog ESD input (5 Vdc) and the plant ESD input (24 Vdc) terminals.

The watchdog horizontal bus is mounted in an HC housing on top of the Central Part rack by means of two screws. A watchdog horizontal bus is required for each watchdog module except for the watchdog module in those configurations where a single bus driver (SBD, 10007/1/1) is placed. The termination details in the latter case are the same as for the 10005/O/1.

### Connections

The watchdog output must be connected to all output modules that have a WDG input.

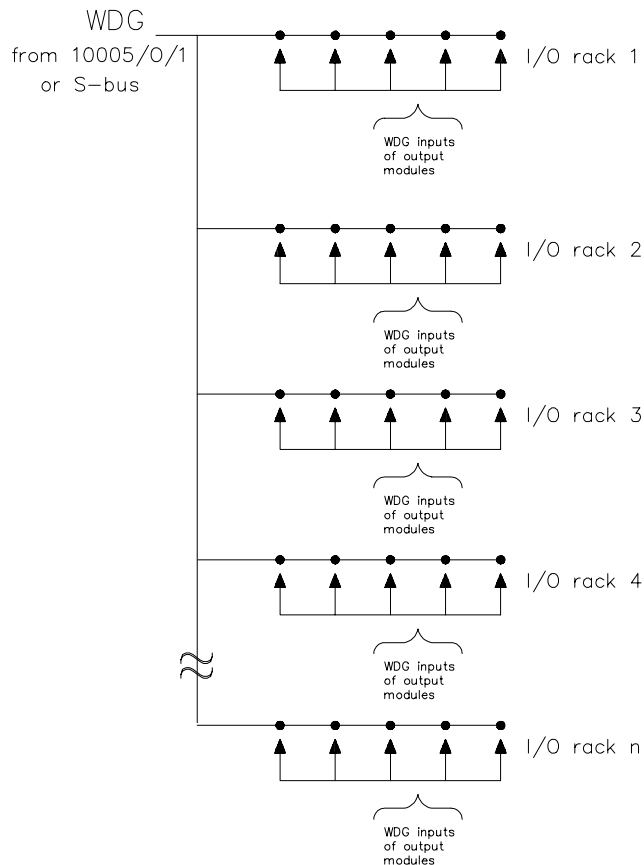


Figure 1 Schematic watchdog wiring to I/O racks and output modules

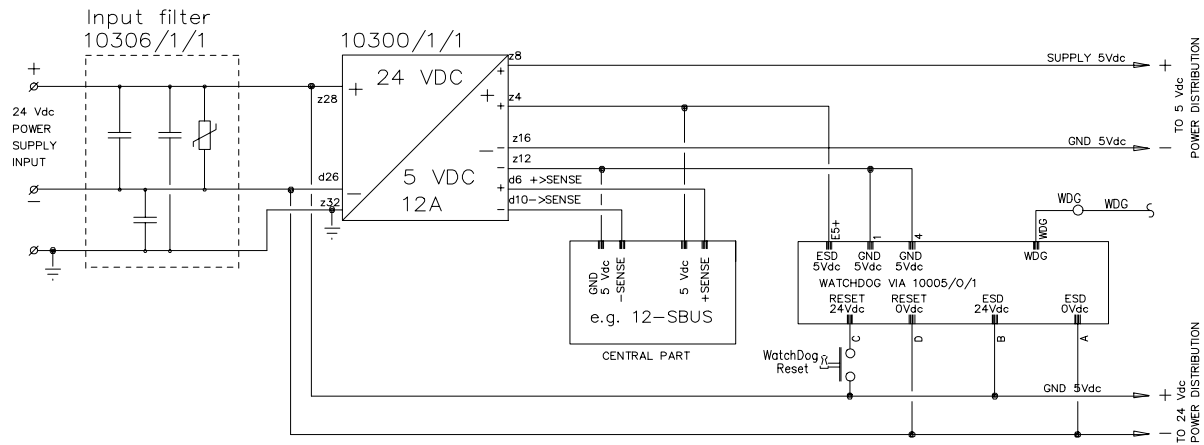


Figure 2 Connection details of 10005/O/1 for one Central Part

## Pin allocation

Figure 3 shows the pin allocation of the female connector.

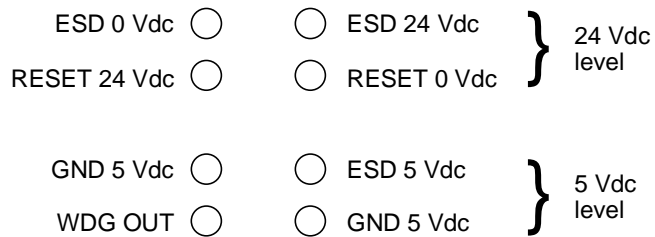


Figure 3 Back view of 10005/O/1 connector

The separation between the 5 Vdc level and the 24 Vdc level must be maintained in the same manner as for the I/O module terminations.



## Technical data

The 10005/O/1 module has the following specifications:

### General

Type number:	10005/O/1
Approvals:	CE, TÜV, UL
Software versions:	not applicable
Space requirements:	4 TE (= 4 HP) (in horizontal bus module for Central Part)

### Power

Power requirements:	none
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*Left blank intentionally.*



## 10006/1/1

## Diagnostic and battery module (DBM)

### Description

The diagnostic and battery module (DBM) 10006/1/1 provides a low-cost interface to the user for diagnosing the FSC system. The displays on the front of the module are used to display messages about the faults found by the diagnostic routines. The message gives type, rack and position number of the module found to be faulty.

In addition to the diagnostic messages, the DBM module is provided with a real-time clock function which gives the current date and time. Both date and time can be displayed on the front of the DBM module and can be read by the application program.

The DBM module is able to display the temperature values measured by two independent temperature sensors inside the Central Part of the FSC system, as well as the 5 Vdc level and the battery voltage. High and low alarm points and high and low trip points can be entered for the temperature measurement during DBM configuration in the 'Configure FSC system' program.

The switch at the front of the DBM module can be operated to retrieve system information (switch upwards) or diagnostic information (switch downwards).

To get all information, the switch must be operated several times.

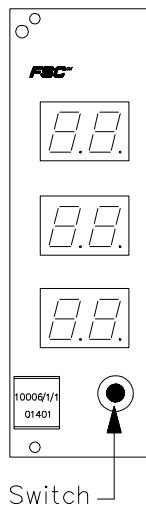


Figure 1  
Front view

The diagnostic information is displayed as follows:

Top display:	Signal type:
<i>AI</i>	Analog input fault
<i>dI</i>	Digital input fault
<i>AO</i>	Analog output fault
<i>dO</i>	Digital output fault
<i>CP</i>	Central part fault
<i>EL</i>	Temperature low
<i>EH</i>	Temperature high
<i>CE</i>	HBD correlation (address HBD not set correct)
<i>hb</i>	HBD fault

Middle display:	Rack number
Bottom display:	Position number

The display will normally show the time (hours, minutes, seconds) and will automatically return to this mode when the switch is not used for approx. 30 seconds.



A flashing display indicates that a system fault is present and diagnostic information may be available.

A blank display means that no diagnostic information is present or diagnostic information was read before.

The system information cycle has four stages which can be called up by (repeatedly) moving the switch upward (see Table 1).

Table 1 Switch operation for system information

Switch moved upward →	0x	1x	2x	3x	4x
Top display	Day			5 Vdc units	Battery units
Middle display	Date	Degree 1	Degree 2	5 Vdc decimals	Battery decimals
Bottom display	Month	Unit	Unit		

Diagnostic messages, if they are available, can be retrieved by (repeatedly) moving the switch downward:

Temperature alarm

T. Temperature  
Pr. Pre  
AL. Alarm

Second fault timer started

F.T. Fault timer  
AL. Alarm

External communication error

E. External  
Co. Communication  
AL. Alarm

Internal communication error

I. Internal  
Co. Communication  
AL. Alarm

Transmitter fault alarm

AI. Analog input  
Tr. Transmitter  
AL. Alarm

Redundant input fault alarm

rd. Redundant  
I. Input  
AL. Alarm

Device communication error

d. Device  
Co. Communication  
AL. Alarm

Module faulty (example)

do Digital output fault  
03 Rack 3  
15 Position 15





## Batteries

The DBM module holds the rechargeable batteries that supply the back-up power for the RAM memory on the CPU (10002/1/1 or 10002/1/2), COM modules (10004/./.) and MEM modules (10003/1/1).

It is recommended that the batteries are replaced every four years.

## Jumpers

Jumper J1 switches the batteries in stock (OFF) or in circuit (ON).

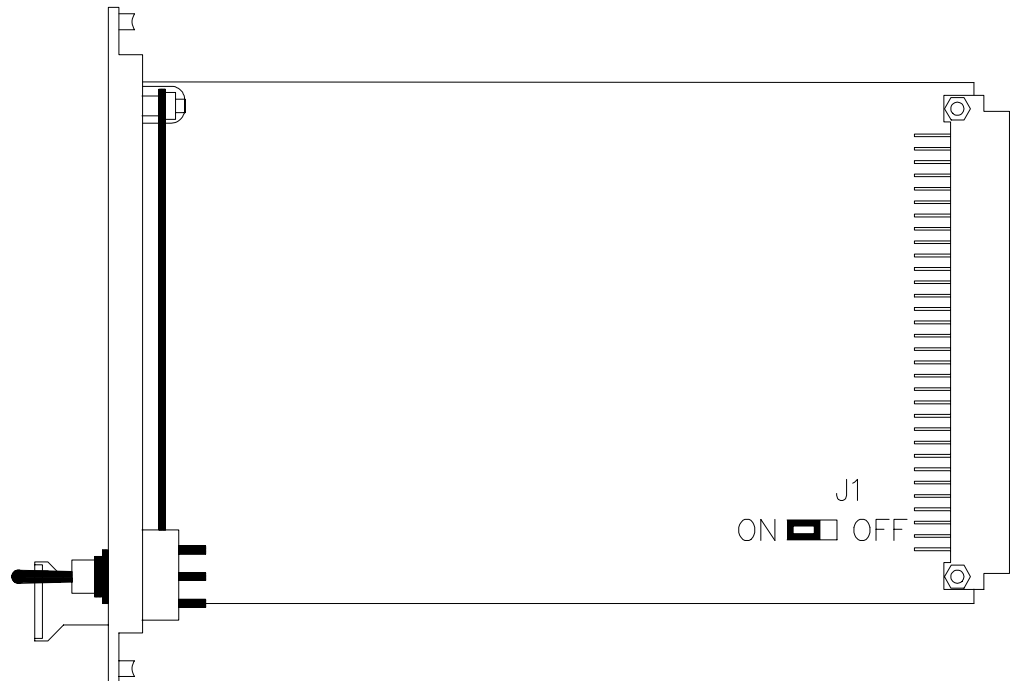


Figure 2 Jumper settings on 10006/1/1 module



## Technical data

The 10006/1/1 module has the following specifications:

<b>General</b>	Type number:	10006/1/1 01401
	Approvals:	CE, TÜV
	Software versions:	all
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U)
	Time drift:	< 1 sec/day
<b>Power</b>	Power requirements:	5 Vdc 400 mA
	Ripple content:	< 50 mV p-p
<b>Batteries</b>	Back-up capacity:	4 Ah

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### Note:

Do not remove or replace this module while the power to its Central Part is on.

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## 10006/2/1

## Diagnostic and battery module (DBM)

### Description

The diagnostic and battery module (DBM) 10006/2/1 provides a low-cost interface to the user for diagnosing the FSC system. The displays on the front of the module are used to display messages about the faults found by the diagnostic routines. The message gives type, rack and position number of the module found to be faulty.

In addition to the diagnostic messages, the DBM module is provided with a real-time clock function which gives the current date and time. Both date and time can be displayed on the front of the DBM module and can be read by the application program.

The DBM module is able to display the temperature values measured by two independent temperature sensors inside the Central Part of the FSC system, as well as the 5 Vdc level and the battery voltage. High and low alarm points and high and low trip points can be entered for the temperature measurement during DBM configuration in the 'Configure FSC system' program.

The switch at the front of the DBM module can be operated to retrieve system information (switch upwards) or diagnostic information (switch downwards).

To get all information, the switch must be operated several times.

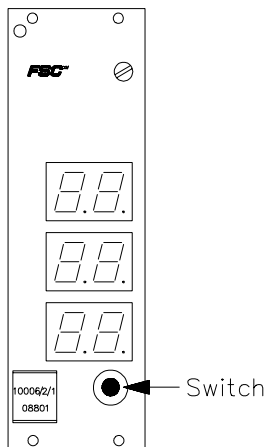


Figure 1  
Front view

The diagnostic information is displayed as follows:

Top display:	Signal type:
<i>A</i> <i>I</i>	Analog input fault
<i>d</i> <i>I</i>	Digital input fault
<i>A</i> <i>o</i>	Analog output fault
<i>d</i> <i>o</i>	Digital output fault
<i>C</i> <i>P</i>	Central part fault
<i>L</i> <i>L</i>	Temperature low
<i>H</i> <i>H</i>	Temperature high
<i>c</i> <i>E</i>	HBD correlation (address HBD not set correct)
<i>h</i> <i>b</i>	HBD fault

Middle display: Rack number  
Bottom display: Position number

The display will normally show the time (hours, minutes, seconds) and will automatically return to this mode when the switch is not used for approx. 30 seconds.



A flashing display indicates that a system fault is present and diagnostic information may be available.

A blank display means that no diagnostic information is present or diagnostic information was read before.

The system information cycle has four stages which can be called up by (repeatedly) moving the switch upward (see Table 1).

Table 1 Switch operation for system information

Switch moved upward →	0x	1x	2x	3x	4x
Top display	Day			5 Vdc units	Battery units
Middle display	Date	Degree 1	Degree 2	5 Vdc decimals	Battery decimals
Bottom display	Month	Unit	Unit		

Diagnostic messages, if they are available, can be retrieved by (repeatedly) moving the switch downward:

Temperature alarm

T. Temperature  
Pr. Pre  
AL. Alarm

Second fault timer started

F.T. Fault timer  
AL. Alarm  
 

External communication error

E. External  
Co. Communication  
AL. Alarm

Internal communication error

I. Internal  
Co. Communication  
AL. Alarm

Transmitter fault alarm

AI. Analog input  
Tr. Transmitter  
AL. Alarm

Redundant input fault alarm

rd. Redundant  
I. Input  
AL. Alarm

Device communication error

d. Device  
Co. Communication  
AL. Alarm

Module faulty (example)

do Digital output fault  
03 Rack 3  
15 Position 15



## Batteries

The DBM module holds the rechargeable batteries that supply the back-up power for the RAM memory on the CPU (10002/1/1 or 10002/1/2), COM modules (10004/./.) and MEM modules (10003/1/1).

It is recommended that the batteries are replaced every four years.

## Jumpers

Jumper J1 switches the batteries in stock (OFF) or in circuit (ON). Jumpers J2 and J3 are factory-set (closed).

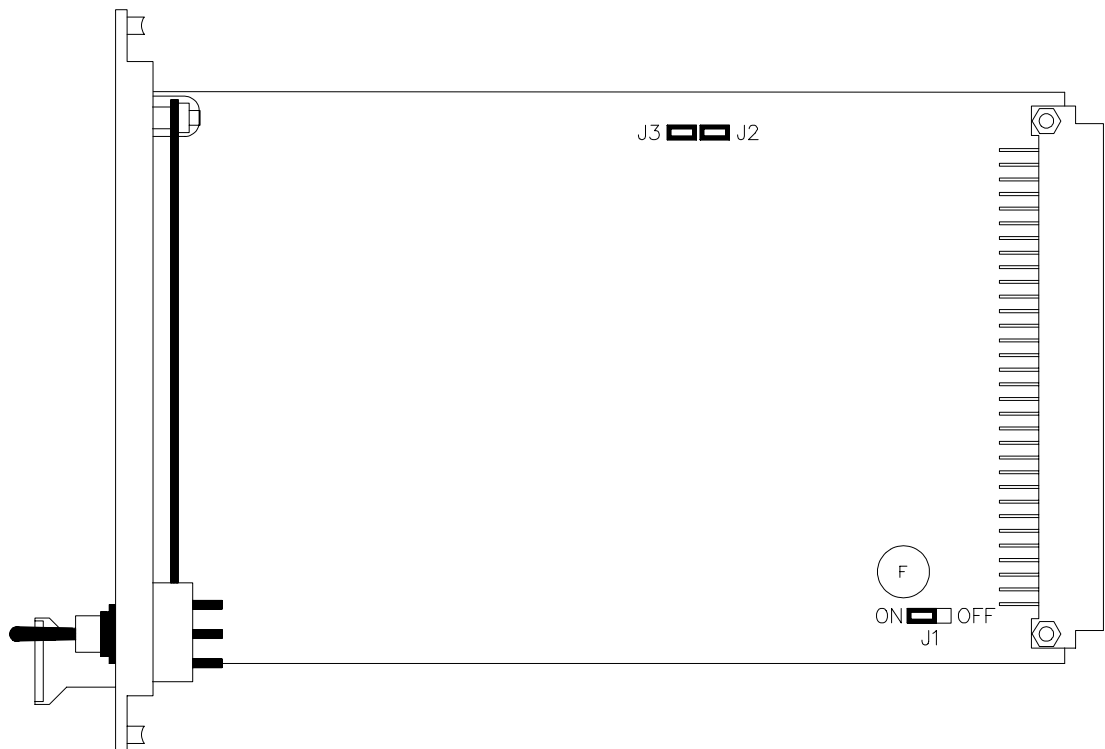


Figure 2 Jumper settings on 10006/2/1 module



## Technical data

The 10006/2/1 module has the following specifications:

<b>General</b>	Type number:	10006/2/1 08801*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.90
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U)
	Time drift:	< 1 sec/day
<b>Power</b>	Power requirements:	5 Vdc 300 mA
	Ripple content:	< 50 mV p-p
<b>Batteries</b>	Back-up capacity:	0.5 Ah

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**Note:**

\* 10006/2/1 modules with suffix code 08801 have an improved noise immunity.

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**Note:**

Do not remove or replace this module while the power to its Central Part is on.

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10006/2/2

## Diagnostic and battery module (DBM) with DCF-77 interface

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### Description

The diagnostic and battery module (DBM) 10006/2/2 provides a low-cost interface to the user for diagnosing the FSC system. The displays on the front of the module are used to display messages about the faults found by the diagnostic routines. The message gives type, rack and position number of the module found to be faulty.

In addition to the diagnostic messages, the DBM module is provided with a real-time clock function which is synchronized to the DCF-77 radio time beacon. This time beacon is transmitted at a frequency of 77.5 kHz (long wave) from a transmitter near Frankfurt (Germany), and has a time deviation of less than 1 second in 300,000 years. During bad radio receive conditions, the 10006/2/2 module will switch to the local (DCF-synchronized, quartz-controlled) real-time clock to continue providing the current time.

By synchronizing to the time beacon, it is easy to use a variety of process control systems without getting differences in their real-time clock value. Both date and time can be displayed on the front of the DBM module and can be read by the application program. The 10006/2/2 module requires a Hopf aerial or a DCF-77 equivalent signal to be connected to the coax connector on the module front.

A green LED on the module front indicates an absolute time accuracy within 10 ms (either DCF-synchronized or crystal-controlled). A time and date download is possible providing the real-time clock module has not (yet) found a validated DCF signal (green LED is off).

The DBM module is able to display the temperature values measured by two independent temperature sensors inside the Central Part of the FSC system, as well as the 5 Vdc level and the battery voltage. High and low alarm points and high and low trip points can be entered for the temperature measurement during DBM configuration in the 'Configure FSC system' program.



The switch on the front of the DBM module can be operated to get system information (switch upwards) or diagnostic information (switch downwards).

To get all information the switch must be operated several times.

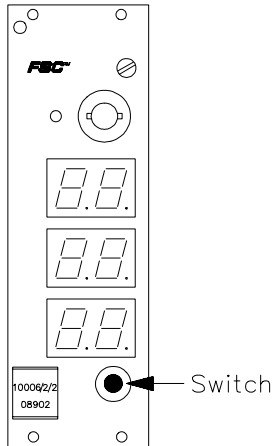


Figure 1  
Front view

The diagnostic information is displayed as follows:

Top display:	Signal type:
<i>AI</i>	Analog input fault
<i>dI</i>	Digital input fault
<i>AO</i>	Analog output fault
<i>dO</i>	Digital output fault
<i>CP</i>	Central part fault
<i>EL</i>	Temperature low
<i>EH</i>	Temperature high
<i>CE</i>	HBD correlation (address HBD not set correct)
<i>hb</i>	HBD fault

Middle display: Rack number  
Bottom display: Position number

The display will normally show the time (hours, minutes, seconds) and will return to this mode when the switch is not used for approx. 30 seconds.

A flashing display indicates that a system fault is present and diagnostic information may be available.

A blank display means that no diagnostic information is present or diagnostic information was read before.

The system information cycle has four stages which can be called up by (repeatedly) moving the switch upward (see Table 1).

Table 1 Switch operation for system information

Switch moved upward →	0x	1x	2x	3x	4x
Top display	Day			5 Vdc units	Battery units
Middle display	Date	Degree 1	Degree 2	5 Vdc decimals	Battery decimals
Bottom display	Month	Unit	Unit		





Diagnostic messages, if they are available, can be retrieved by (repeatedly) moving the switch downward:

### Temperature alarm

Temperature  
 Pre  
 Alarm

### Second fault timer started

Fault timer  
 Alarm

### External communication error

External  
 Communication  
 Alarm

### Internal communication error

Internal  
 Communication  
 Alarm

### Transmitter fault alarm

Analog input  
 Transmitter  
 Alarm

### Redundant input fault alarm

Redundant  
 Input  
 Alarm

### Device communication error

Device  
 Communication  
 Alarm

### Module faulty (example)

Digital output fault  
 Rack 3  
 Position 15

At power-on, the green LED will stay off for 16 seconds and then switch to the 'Aerial positioning' mode.

In this mode the green LED flashes (at 1 Hz) giving an indication of the received radio signal level (the ON time becomes longer if the radio signal level goes up).

After approximately four minutes, the green LED switches to 'DCF accurate' mode. The LED stays off until the DCF receiver knows it holds the current time. Then it goes on (and stays on).

## Batteries

The DBM module holds the rechargeable batteries that supply the back-up power for the RAM memory on the CPU (10002/1/1 or 10002/1/2), COM modules (10004/./.) and MEM modules (10003/1/1).

It is recommended that the batteries are replaced every four years.

## Jumpers

Jumper J1 switches the batteries in stock (OFF) or in circuit (ON).  
Jumpers J2 and J3 are factory-set (closed).

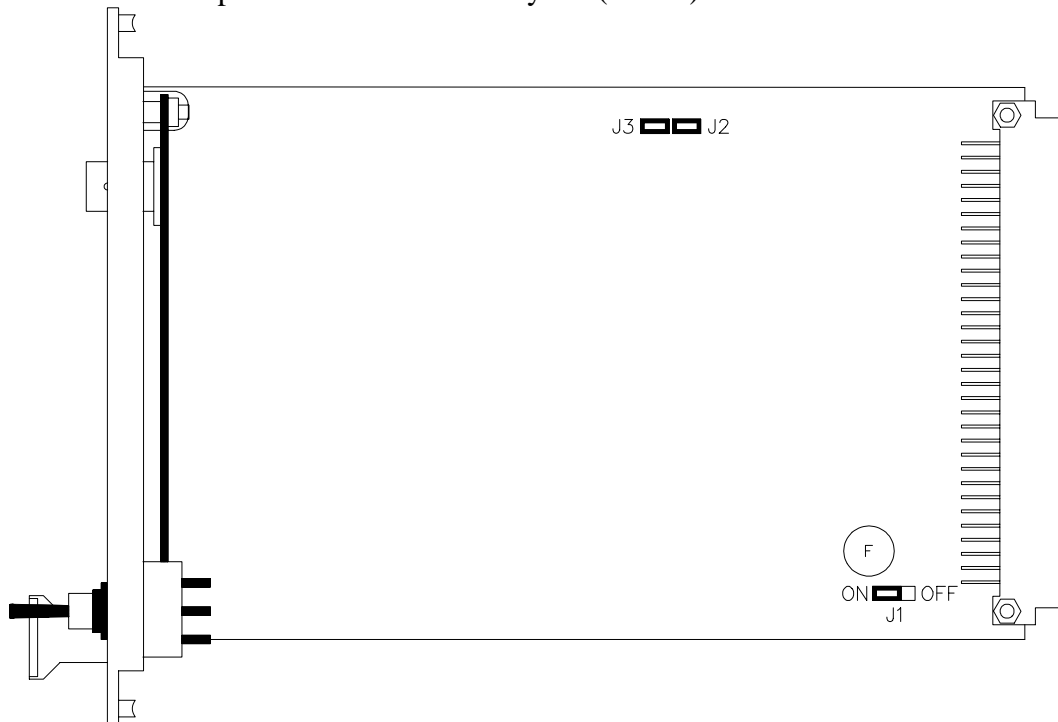


Figure 2 Jumper settings on 10006/2/2 module

## DCF signal

The (gray) inner circle on Figure 3 shows the region of Europe where reception of the DCF radio signal is usually good.  
The outer circle on Figure 3 shows the region where the reception of the DCF radio signal is usually possible.



Figure 3 Receive radius of DCF atomic clock radio near Frankfurt



Do not place the aerial in the neighborhood of TVs or PC monitors, elevator shafts, radio transmitters, fluorescent lamps, phase shift controlled equipment, switching cabinets for inductive loads, or ignition equipment for combustion engines. Use of an outdoor aerial is also recommended in reinforced concrete buildings.

## Technical data

The 10006/2/2 module has the following specifications:

<b>General</b>	Type number:	10006/2/2 08902*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.90
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 350 mA
	Ripple content:	< 50 mV p-p
<b>DCF</b>	Receiver sensitivity:	10 µV
	Time offset:	± 2.5 ms after DCF synchronization
	Quartz accuracy:	± 10 ppm at installation start ± 2 ppm after DCF synchronization
<b>Aerial**</b>	Aerial connector:	BNC female
	Aerial type:	active ferrite
	Max. cable length:	500 m (547 yd) (50 Ohm)
	Input isolation:	500 Vdc (to 0 V of 5 Vdc supply)
<b>Batteries</b>	Back-up capacity:	0.5 Ah

---

### Notes:

- \* 10006/2/2 modules with suffix code 08901 and higher have been modified to meet CE requirements. 10006/2/2 modules with suffix code 08902 have an improved noise immunity.
  - \*\* Weatherproof outdoor aerials and lightning protection units are supplied by Hopf Elektronik GmbH in Lüdenscheid, Germany.
- 

### Note:

Do not remove or replace this module while the power to its Central Part is on.

---



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## 10006/O/1

## DBM-to-aerial assembly

### Description

The DBM-to-aerial assembly (10006/O/1) transfers the aerial connection on the front of the diagnostic and battery module (DBM, 10006/2/2) to a BNC connector inside the cabinet.

The print is placed in an HC housing on top of the central part rack. The male right-angled BNC connector is placed on the DBM front connector.

The female chassis BNC connector is available for the 50 Ohm coax cabinet wiring.

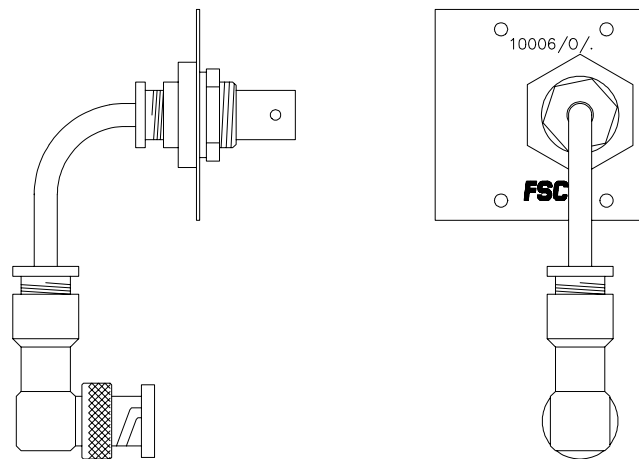


Figure 1 Side and front views

### Technical data

The 10006/O/1 module has the following specifications:

#### General

Type number: 10006/O/1 41000  
Approvals: CE, TÜV, UL  
Space requirements: 8 TE (= 8 HP)  
(in horizontal bus module for Central Part)  
Cabinet connector: BNC female 50 Ohm

#### Power

Power requirements: none



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## 10007/1/1

## Single bus driver (SBD)

### Description

The single bus driver is placed in the Central Part and combines the function of the vertical bus driver (VBD, 10001/1/1) and the horizontal bus driver (HBD, 10100/1/1) in one module without the need of a vertical bus.

The SBD is used in configurations with I/O modules in the Central Part rack(s). This may be useful for small applications or if placing a few I/O modules in the CP rack will save an I/O rack.

The SBD module can only drive the I/O modules which are placed on the left side in the Central Part rack (max. 14).

The SBD module provides rechargeable batteries that supply the back-up power for the RAM memory on the CPU (10002/1/1 or 10002/1/2), COM modules (10004/./.) and MEM modules (10003/1/1).

### Typical layout

Figure 1 shows a typical schematic layout for configurations with I/O modules in the Central Part rack(s).

A diagnostic and battery module (DBM, 10006/./.) is optional for both single and redundant configurations. A communication module (COM, 10004/./.) is optional for single configurations.

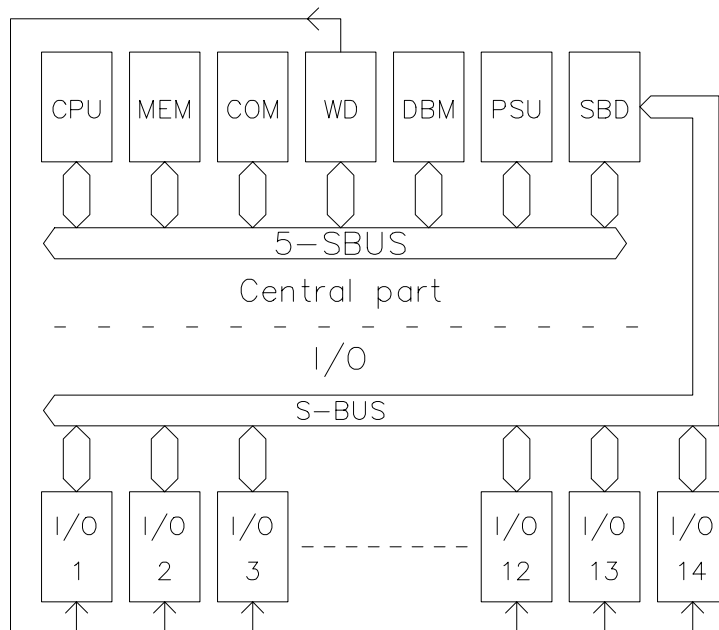


Figure 1 Typical layout

## Jumpers

The solder links are factory-set.

Jumper J1 switches the batteries in stock (OFF) or in circuit (ON).  
Jumpers J5 and J6 are used to set the Central Part number (factory-set at Central Part 1).

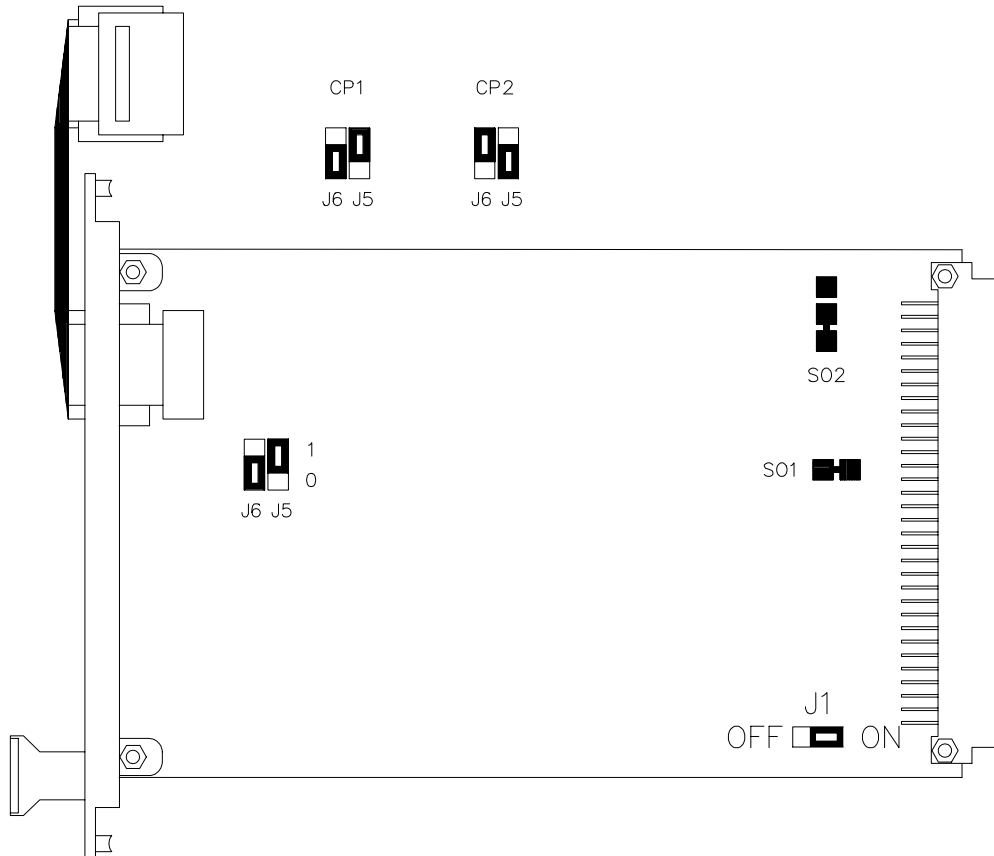


Figure 2 Jumper setting on 10007/1/1





## Technical data

The 10007/1/1 module has the following specifications:

<b>General</b>	Type number:	10007/1/1
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 35 mA
	Ripple content:	< 50 mV p-p
<b>Batteries</b>	Back-up capacity:	1 Ah

---

**Note:**

Do not remove or replace this module while the power to its Central Part is on.

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*Left blank intentionally.*



## 10008/2/U

## FSC-SMM communication module

### Description

The 10008/2/U communication module is used for communication with the Honeywell TotalPlant Solution (TPS) System, via the Universal Control Network (UCN).

The module is placed in the Central Part of the FSC system, and consists of:

- a Motorola 68360 Quad Integrated Communication Controller (running on 25 MHz),
- EPROM (4 Mbit) for the FSC firmware program (see Figure 2),
- local RAM (16 Mbit with parity) for the application-specific data,
- shared RAM (2 Mbit) for all data exchange between this module and the FSC control processor,
- EEPROM (1 kbit) for storing critical configuration data,
- a Motorola 68824 token bus controller (running on 10 MHz),
- a Motorola 68194 carrierband modem, and
- an isolated redundant communication link.

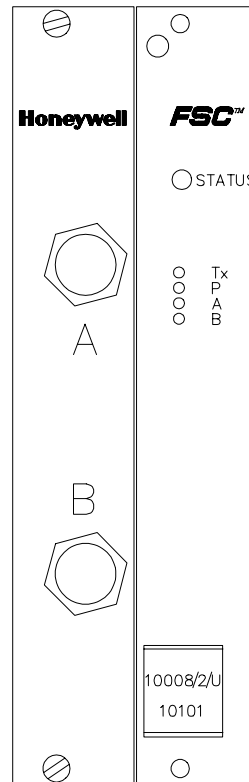


Figure 1 Front view



After power-up, the application program is automatically downloaded from the FSC control processor into local RAM.

The redundant link to the TPS system is made on the two connections (A and B) at the module front (see Figure 1). The top connector is linked to a tab of cable A. The bottom connector is linked to a tab of cable B.

---

## LED indicators

The module has a (red/green) 'STATUS' LED and four additional (red) LEDs.

The 'STATUS' LED is:

- off when the 5 Vdc power on the FSC Central Part system bus is down,
- red when the module is offnet or alive,
- green when the UCN program is running (idle or OK),
- red/green flashing when the UCN program has failed.

If the 'STATUS' LED is green, the four small LEDs provide additional information about the UCN communication:

- The 'Tx' LED is on when data is being transmitted.
- The 'P' LED is on when the node is primary (and off when the node is secondary).
- The 'A' LED is on when the A channel is the active channel.
- The 'B' LED is on when the B channel is the active channel.

---

### **Note:**

If the node is not redundant, the 'P' LED will always be off.

---



## Jumpers

The FSC-SMM communication module can operate as COM1, COM2, COM3 or COM4. The COM number is set using jumpers J1 and J2 on the board (see Figure 2).

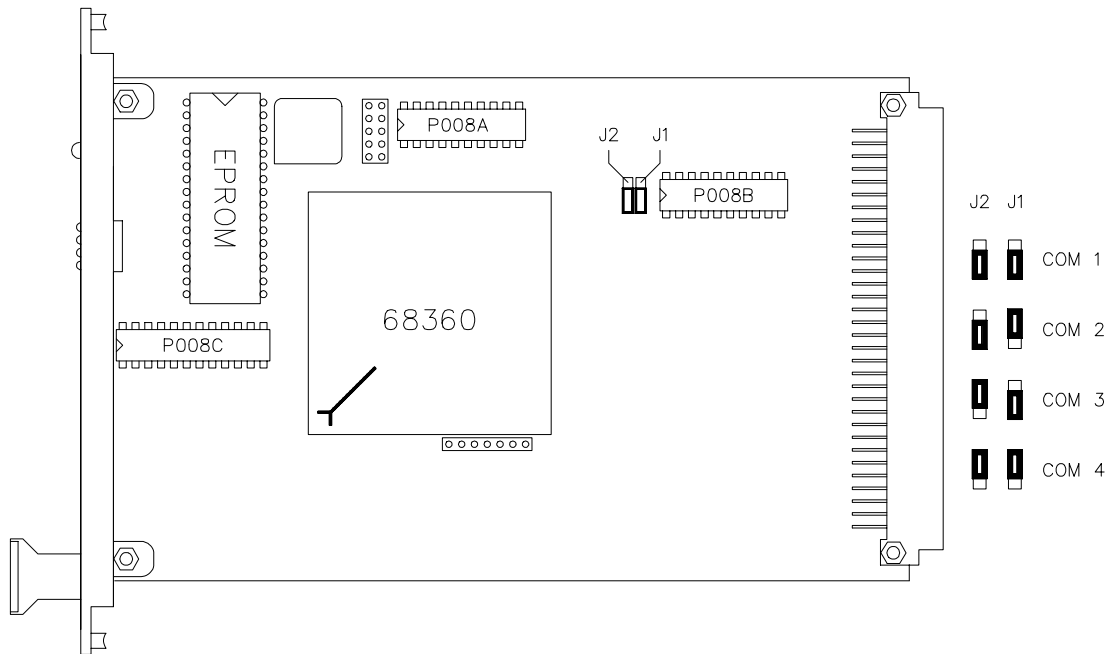


Figure 2 Jumper positions on 10008/2/U

The jumper on the Central Part system bus (5-SBUS, 7-SBUS, 12-SBUS or 17-SBUS) must be opened (see the 'Central Part system buses' data sheet).

---

### Note:

The two screws on the left module front section must be used to meet the CE requirements.

---



## Technical data

The 10008/2/U module has the following specifications:

<b>General</b>	Type number:	10008/2/U 10101
	Approvals:	CE, TÜV, UL
	FSC software version:	≥ 400
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 2 A
	Ripple content:	< 50 mV p-p

---

### Note:

Do not remove or replace this module while the power to its Central Part is on.

---

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## 10008/3/P

## FSC to P-bus communication module

### Description

The 10008/3/P communication module is used for communication between the FSC system and Hartmann & Braun process control systems using the peripheral communication bus (P-bus) with redundant communication lines and Contronic E data formats.

The 10008/3/P module is placed in the Central Part of the FSC system, and consists of three boards (see Figure 1):

- the FSC communication board (L),
- the isolation board (M), and
- the P-bus communication board (R).

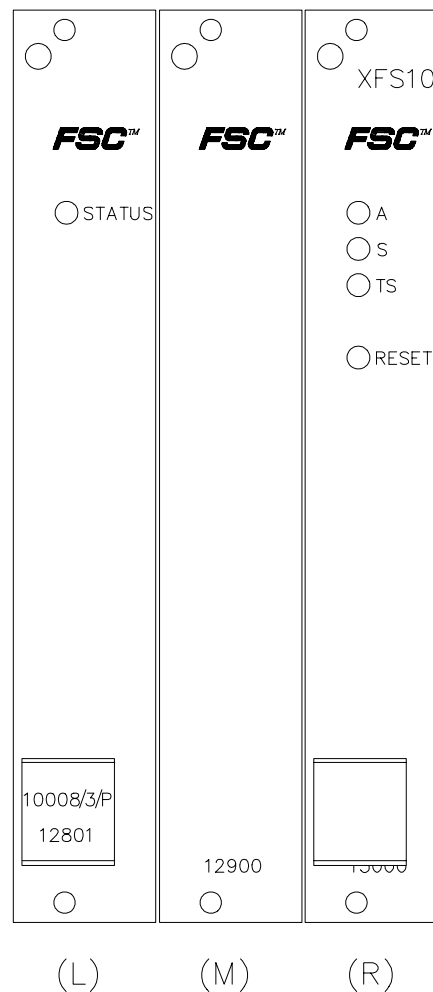


Figure 1 Front view

The 10008/3/P module requires a P-bus backplane board (10008/P4/1) in the 19-inch rack and the rightmost position of an FSC Central Part system bus. Seen from the back of the 19-inch rack, the leftmost jumper (J1) of the FSC Central Part system bus (5-SBUS, 7-SBUS or 12-SBUS) must be opened (see the 10008/P4/1 data sheet).

## FSC communication board

The FSC communication board (see Figure 2) consists of:

- a Motorola 68360 Quad Integrated Communication Controller (running on 25 MHz),
- EPROM (4 Mbit) for the FSC firmware program,
- local RAM (16 Mbit with parity) for the application-specific data,
- shared RAM (2 Mbit) for all data exchange between this module and the FSC control processor, and
- EEPROM (1 kbit) for storing critical configuration data.

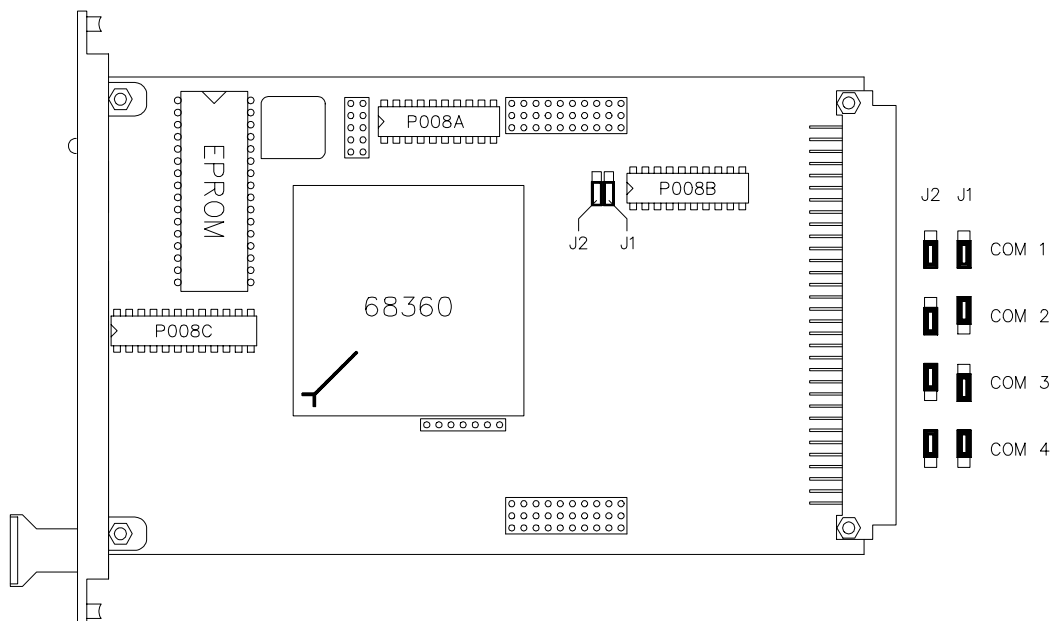


Figure 2 Jumper and EPROM positions on FSC communication board of 10008/3/P module

The 'STATUS' LED on the FSC communication board is:

- off when the 5 Vdc power on the FSC central part system bus is down,
- red when this FSC communication processor is down, and
- green when this FSC communication processor is running.





The FSC section of the communication module can operate as COM1, COM2, COM3 or COM4. This COM number is set using jumpers J1 and J2 on the FSC communication board (see Figure 2).

Changing the COM number (jumpers J1 and J2) requires "opening" the 10008/3/P module. This must be done very carefully and in an ESD-protected environment, using the following procedure:

1. Place the module on the antistatic surface in an upright position (with the module handles near the surface).
2. Apply pressure at the indicated positions (see Figure 3) using the thumb and index finger of both hands until the space between the boards has increased by approx. 2 mm (0.1 in).

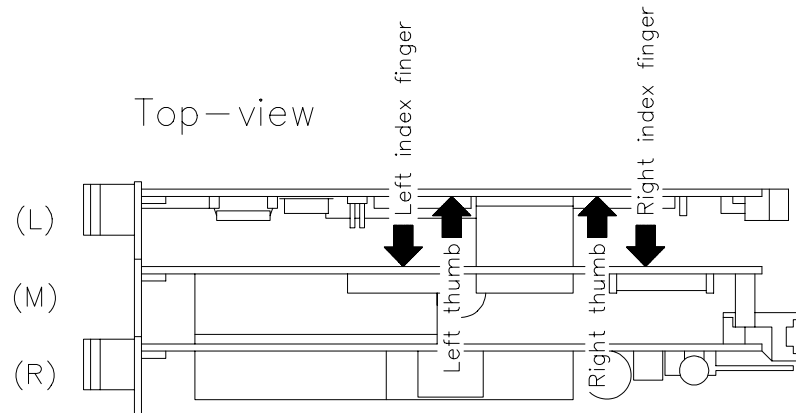


Figure 3 Pressure points at top side during disassembly of module

3. Turn the module upside-down.
4. Apply pressure at the indicated positions (see Figure 4) using the thumb and index finger of both hands until the space between the boards has increased by approx. 2 mm (0.1 in).

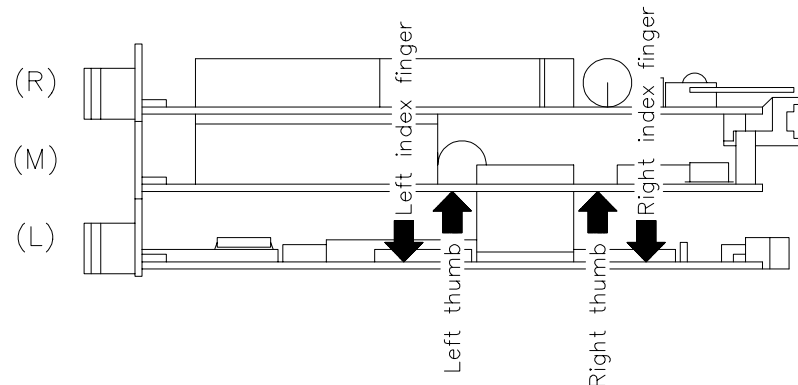


Figure 4 Pressure points at bottom side during disassembly of module

5. Turn the module upright again.
6. Repeat steps 2 to 5 until the module sections have fully separated.
7. Set the jumpers (J1 and J2) in the desired position (see Figure 2).
8. Reassemble the module by carefully positioning the two sections on top of each other and pressing them together at the indicated positions (see Figure 5) using the thumb and index finger of both hands. Make sure to apply equal pressure at both sides of the module (top and bottom). Keep pressing until the module sections are tightly connected. Do not use excessive force!

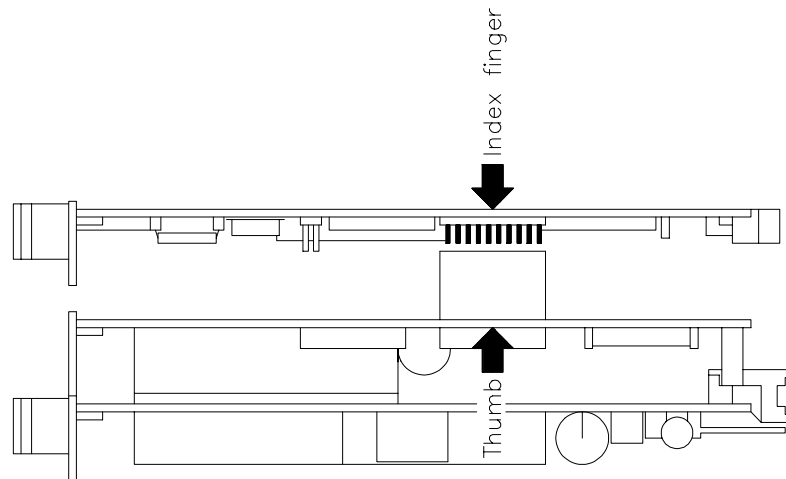


Figure 5 Pressure points during reassembly of module

---

## Isolation board

The middle board (M) provides galvanic isolation between the FSC system and the P-bus system.

---

## P-bus communication board

The P-bus communication board consists of:

- EPROM (512 kbit) for the P-bus communication program (see Figure 6),
- RAM (256 kbit) for the cyclic calculated program values,
- NVRAM (4 kbit) for the cyclic calculated data that must be saved in case of power loss, and
- EEPROM (248 kbit) for the configuration data.



The P-bus communication board has its own 24 Vdc supply. The power supply and all P-bus signals are connected to the P-bus backplane board at the rear of the 19-inch rack (see 10008/P4/1 data sheet).

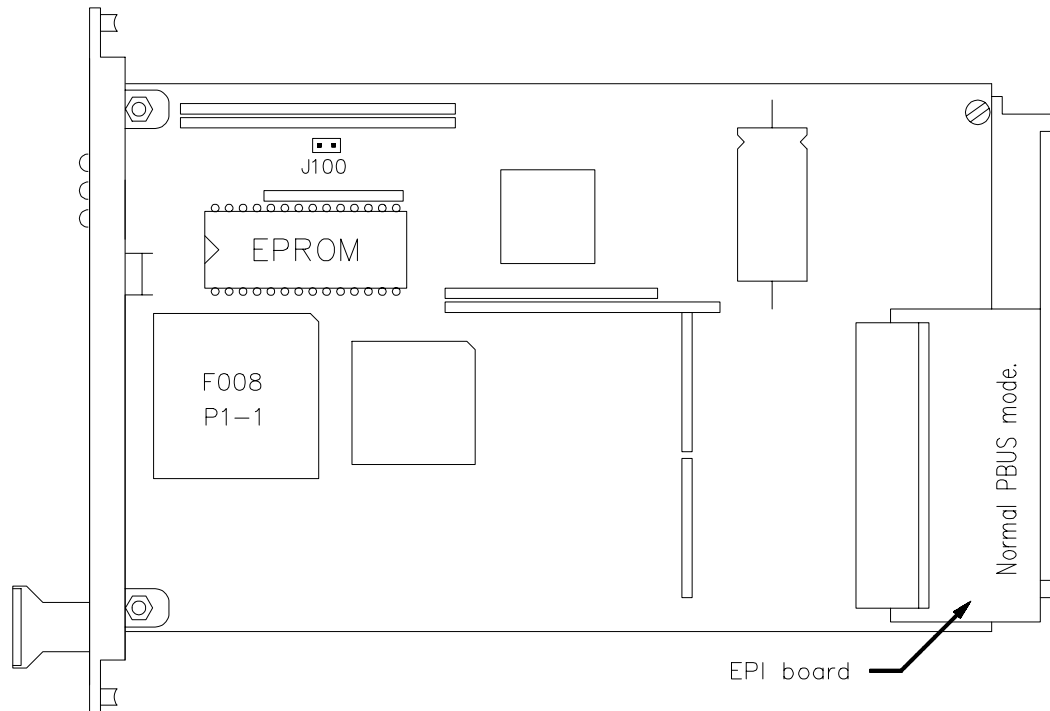


Figure 6 EPROM and EPI board position on P-bus communication board of 10008/3/P module

The 'A' LED on the P-Bus communication board is:

- on when the module is active,
- off when the module is passive or has not yet been configured.

The 'S' LED is flashing when a module fault is detected.

The 'TS' LED is on when a partial fault is detected, e.g.:

- there is a communication fault on the P-bus lines,
- there is loss of 'RUM' signals,
- there is/was loss of communication with the FSC system.

The RESET switch (located behind the module front RESET hole) provides a hardware reset for the P-bus processor. This switch can be pressed using a small, blunt, non-conducting tool.



The EPI board on the P-bus communication board can be inserted in two different ways.

Normally, the text "Normal PBUS mode." is visible. The position with the text "WARNING: EPI mode! !" visible is used to clear the NVRAM and the EEPROM, which brings the module back in its initial startup mode (with all configuration data cleared). The clearing routine starts as soon as the P-bus power supply (24 Vdc) is switched on. After approx. 5 seconds, the 'TS' LED goes on to indicate completion of the clearing routine.

Changing the position of the EPI board requires removal of the 10008/3/P module from the 19-inch rack.

---

## Technical data

The 10008/3/P module has the following specifications:

<b>General</b>	Type number:	10008/3/P 12801
	Approvals:	CE, TÜV
	FSC software version:	≥ 410
	Space requirements:	12 TE, 3 HE (= 12 HP, 3U)
<b>Power</b>	Power requirements (FSC side):	5 Vdc 1 A
	Ripple content:	< 50 mV p-p
	Power requirements (P-bus side):	24 Vdc (20-33 V)
	Current consumption (Uv + Us):	< 150 mA (at 24 Vdc)
	Inrush current:	< 3 A (at 24 Vdc)
	Current consumption (Us):	15 mA + LEDs (Us > Uv)

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### Note:

Do not remove or replace the 10008/3/P module while the power to its Central Part or the 24 Vdc to its P-bus side is on.

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## 10008/P4/1 P-Bus backplane module

### Description

The 10008/P4/1 P-bus backplane module is used to connect the 10008/3/P communication module to its 24 Vdc power supply and the P-bus.

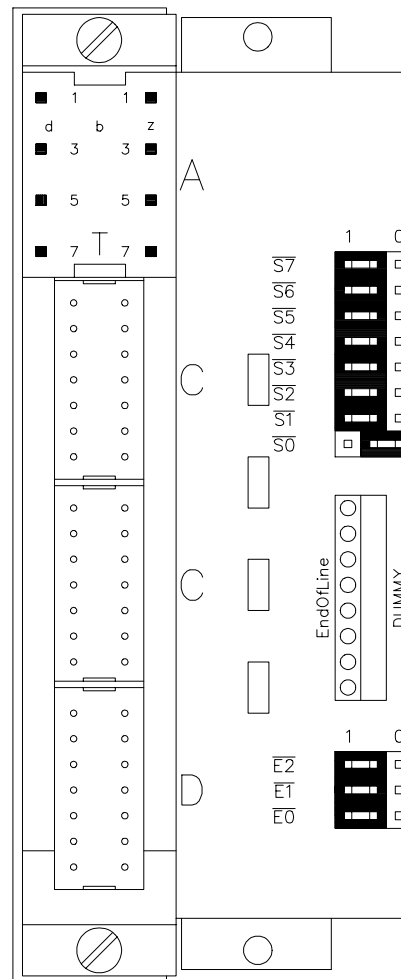


Figure 1 Front view



## Features

The 10008/P4/1 module has the following features (see Figure 1):

- a 32-pin connector for the 10008/3/P module (also used to secure the 10008/P4/1 module in the rack),
- three jumpers (/E0 to /E2) for the rack number coding,
- eight jumpers (/S0 to /S7) for the cabinet number coding,
- a wire-wrap adapter (position A in Figure 1) for the 24 Vdc P-bus supply voltage(s), the 'RUME' input, the 'RUMA' output and the protective earth connection,
- two identical redundant P-bus plug positions (positions C in Figure 1),
- a lamp-test signal input is available on pin c25 of plug position D (see Figure 1), and
- a line termination resistor array (located in the 'End Of Line' position or the 'DUMMY' position).

## Installation

The 10008/P4/1 module is placed in the back of a Central Part rack, next to the FSC Central Part system bus (5-SBUS, 7-SBUS or 12-SBUS). The module is secured in the rack using two M2.5x6 screws. Figure 2 shows the position of the 10008/P4/1 module in the 19-inch rack. The distance between the last x-SBUS connector and the 32-pin 10008/P4/1 connector holes must be 30.5 mm (1.20 in) (see Figure 2).

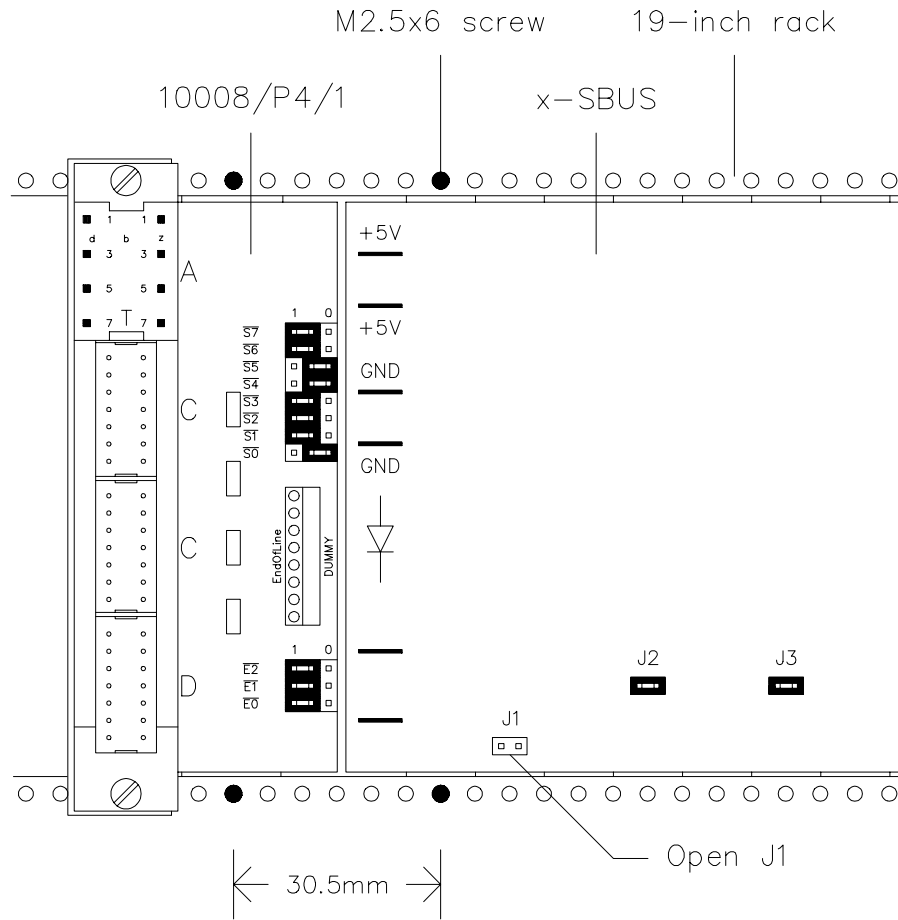


Figure 2 Back view of 19-inch rack with 10008/P4/1 module in place

## Jumper settings

The daisy-chain jumper J1 on the FSC Central Part system bus must be opened (see Figure 2).

The jumper settings for the rack number coding are listed in Table 1.

Table 1 Rack number coding

Jumper	Rack number							
	1 (A)	2 (B)	3 (C)	4 (D)	5 (E)	6 (F)	7 (G)	8 (H)
/E0	1	0	1	0	1	0	1	0
/E1	1	1	0	0	1	1	0	0
/E2	1	1	1	1	0	0	0	0



The jumper settings for the cabinet number coding (for cabinets 1 to 96) are listed in Table 2.

Table 2 Cabinet number coding

Cab. no.	Jumper							
	/S0	/S1	/S2	/S3	/S4	/S5	/S6	/S7
01	0	1	1	1	1	1	1	1
02	1	0	1	1	1	1	1	1
03	0	0	1	1	1	1	1	1
04	1	1	0	1	1	1	1	1
05	0	1	0	1	1	1	1	1
06	1	0	0	1	1	1	1	1
07	0	0	0	1	1	1	1	1
08	1	1	1	0	1	1	1	1
09	0	1	1	0	1	1	1	1
10	1	0	1	0	1	1	1	1
11	0	0	1	0	1	1	1	1
12	1	1	0	0	1	1	1	1
13	0	1	0	0	1	1	1	1
14	1	0	0	0	1	1	1	1
15	0	0	0	0	1	1	1	1
16	1	1	1	1	0	1	1	1
17	0	1	1	1	0	1	1	1
18	1	0	1	1	0	1	1	1
19	0	0	1	1	0	1	1	1
20	1	1	0	1	0	1	1	1
21	0	1	0	1	0	1	1	1
22	1	0	0	1	0	1	1	1
23	0	0	0	1	0	1	1	1
24	1	1	1	0	0	1	1	1
25	0	1	1	0	0	1	1	1
26	1	0	1	0	0	1	1	1
27	0	0	1	0	0	1	1	1
28	1	1	0	0	0	1	1	1
29	0	1	0	0	0	1	1	1
30	1	0	0	0	0	1	1	1
31	0	0	0	0	0	1	1	1
32	1	1	1	1	1	0	1	1
33	0	1	1	1	1	0	1	1
34	1	0	1	1	1	0	1	1
35	0	0	1	1	1	0	1	1
36	1	1	0	1	1	0	1	1
37	0	1	0	1	1	0	1	1
38	1	0	0	1	1	0	1	1
39	0	0	0	1	1	0	1	1
40	1	1	1	0	1	0	1	1
41	0	1	1	0	1	0	1	1
42	1	0	1	0	1	0	1	1
43	0	0	1	0	1	0	1	1
44	1	1	0	0	1	0	1	1
45	0	1	0	0	1	0	1	1
46	1	0	0	0	1	0	1	1
47	0	0	0	0	1	0	1	1
48	1	1	1	1	0	0	1	1

Cab. no.	Jumper							
	/S0	/S1	/S2	/S3	/S4	/S5	/S6	/S7
49	0	1	1	1	0	0	1	1
50	1	0	1	1	0	0	1	1
51	0	0	1	1	0	0	1	1
52	1	1	0	1	0	0	1	1
53	0	1	0	1	0	0	1	1
54	1	0	0	1	0	0	1	1
55	0	0	0	1	0	0	1	1
56	1	1	1	0	0	0	1	1
57	0	1	1	0	0	0	1	1
58	1	0	1	0	0	0	1	1
59	0	0	1	0	0	0	1	1
60	1	1	0	0	0	0	1	1
61	0	1	0	0	0	0	1	1
62	1	0	0	0	0	0	1	1
63	0	0	0	0	0	0	1	1
64	1	1	1	1	1	1	0	1
65	0	1	1	1	1	1	0	1
66	1	0	1	1	1	1	0	1
67	0	0	1	1	1	1	0	1
68	1	1	0	1	1	1	0	1
69	0	1	0	1	1	1	0	1
70	1	0	0	1	1	1	0	1
71	0	0	0	1	1	1	0	1
72	1	1	1	0	1	1	0	1
73	0	1	1	0	1	1	0	1
74	1	0	1	0	1	1	0	1
75	0	0	1	0	1	1	0	1
76	1	1	0	0	1	1	0	1
77	0	1	0	0	1	1	0	1
78	1	0	0	0	1	1	0	1
79	0	0	0	0	1	1	0	1
80	1	1	1	1	0	1	0	1
81	0	1	1	1	0	1	0	1
82	1	0	1	1	0	1	0	1
83	0	0	1	1	0	1	0	1
84	1	1	0	1	0	1	0	1
85	0	1	0	1	0	1	0	1
86	1	0	0	1	0	1	0	1
87	0	0	0	1	0	1	0	1
88	1	1	1	0	0	1	0	1
89	0	1	1	0	0	1	0	1
90	1	0	1	0	0	1	0	1
91	0	0	1	0	0	1	0	1
92	1	1	0	0	0	1	0	1
93	0	1	0	0	0	1	0	1
94	1	0	0	0	0	1	0	1
95	0	0	0	0	0	1	0	1
96	1	1	1	1	1	0	0	1





## Connections

The 1x1 mm (0.04 x 0.04 in) wire-wrap pins at position A of the module (see Figure 1) must be connected using 0.25 mm<sup>2</sup> (AWG 24) wires. Figure 3 shows the connection layout of the wire-wrap adapter.

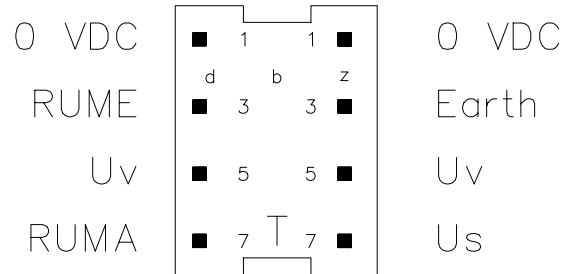


Figure 3 Wire-wrap adapter (detail)

The 24 Vdc power supply must be connected to the 0 Vdc and the Uv pins. 24 Vdc may also be connected to Us, which enables the LED driver to operate even if the module fuse has blown (or Uv is switched off).

The earth connection pin must be connected to the protective (cabinet) earth.

The 'RUMA' (output) and 'RUME' (input) pins are used for (optional) redundant connection of two 10008/3/P modules. In redundant applications, the 'RUMA' pin of module 1 must be connected to the 'RUME' pin of module 2, and the 'RUMA' pin of module 2 to the 'RUME' pin of module 1. In non-redundant applications, these pins do not need to be connected.

The two P-bus plug positions (C) are used to connect the 10008/P4/1 module in a redundant P-bus loop (using a 7x2-pin flatcable system). Figure 4A (left) on the next page shows the 10008/P4/1 module operating as a P-bus user somewhere in the P-bus link. The resistor array must be located in the 'DUMMY' position.

Figure 4B (right) shows the 10008/P4/1 module operating as the last P-bus user (one 7x2-pin flatcable). The resistor array must be located in the 'End Of Line' position on the board.

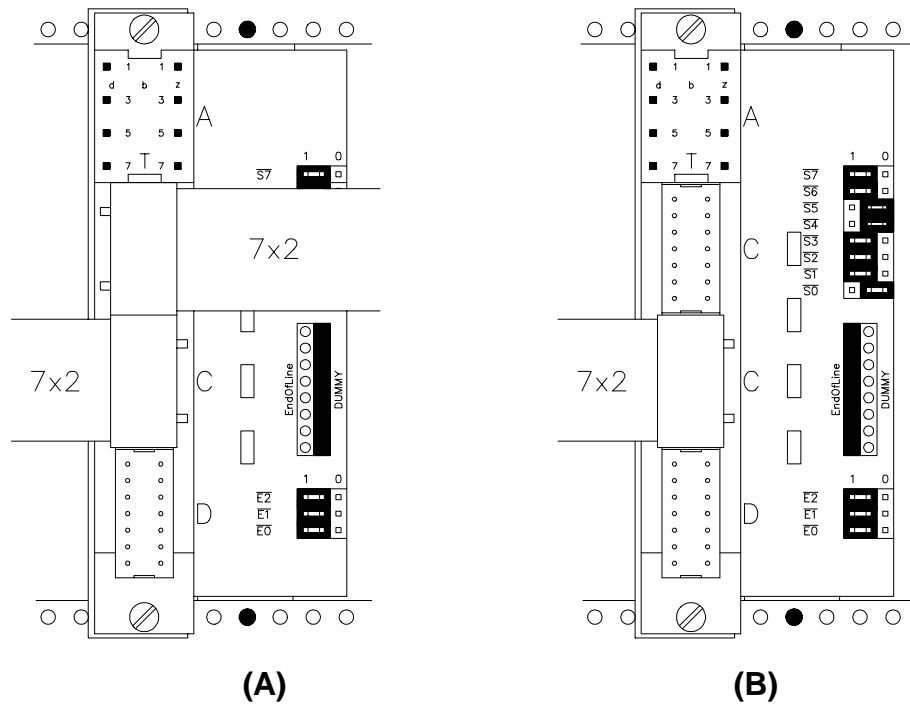


Figure 4 Location of P-bus flatcables on 10008/P4/1 module

The wire-wrap adapter (position A) and the P-bus flatcable connections (position C) feature a snap-on connecting system for easy and secure fastening. Removing any of the connectors requires a special extraction tool from Hartmann & Braun.

## Technical data

The 10008/P4/1 module has the following specifications:

<b>General</b>	Type number:	10008/P4/1 13200
	Approvals:	CE
	Space requirements:	8 TE, 3 HE (= 8 HP, 3U) (mounted in the back of the 19-inch rack behind the 10008/3/P module)
<b>Power</b>	Power requirements:	none (included in 10008/3/P specifications)

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## 10100/1/1

## Horizontal bus driver (HBD)

---

### Description

The horizontal bus driver (HBD) module is a basic module which is installed in the I/O racks.

The horizontal bus driver consists of two parts:

- electronic part (10100/1/1), and
- wiring part (10100/A/.).

The wiring part is secured to the I/O rack with two bolts. This allows exchange of the electronic part without disconnecting the vertical bus and address selection flatcable.

The wiring parts are used as follows:

- 10100/A/1 used for non-redundant I/O
- 10100/A/21 used for redundant I/O (1 rack per HBD)
- 10100/A/22 used for redundant I/O (2 racks per HBD)

The vertical bus flatcable from the Central Part is plugged into the vertical bus connector on the HBD wiring part (10100/A/.).

The flatcable which extends from the front of the module connects the HBD module to the horizontal bus above the I/O rack.

The address selection lines of the I/O modules terminate on the back of the horizontal bus via a flatcable from the HBD wiring part (10100/A/.).

The HBD may be replaced with the power switched on, but the Central Part will shut down if the HBD is safety-related.

---



## Pin allocation

The HBD is fitted with a male connector according to DIN 41612 type F, with the 'd' and 'z' rows used. The back view and pin allocation of the 10100/1/1 rack connector are as follows:

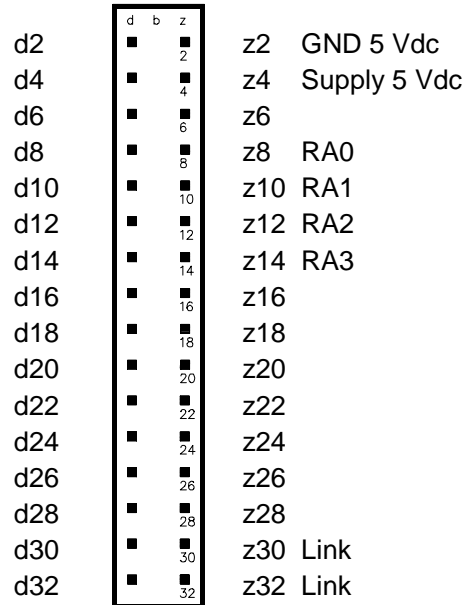


Figure 1 Back view and pin allocation

## Address setting

The rack address of the HBD is programmed by connecting wires from GND or 5 Vdc to pins RA0, RA1, RA2 and RA3 on the 10100/1/1 rack connector (see Table 1, Figure 1 and Figure 5)

Table 1 Address setting for HBD

	RA3	RA2	RA1	RA0
<b>HBD1</b>	0	0	0	1
<b>HBD2</b>	0	0	1	0
<b>HBD3</b>	0	0	1	1
<b>HBD4</b>	0	1	0	0
<b>HBD5</b>	0	1	0	1
<b>HBD6</b>	0	1	1	0
<b>HBD7</b>	1	0	0	0
<b>HBD8</b>	1	0	0	1
<b>HBD9</b>	1	0	1	0
<b>HBD10</b>	1	1	0	0

0 = GND 5 Vdc      1 = Supply 5 Vdc



## Flatcable routing

Figure 2 to Figure 4 below show the flatcable routing for the various configurations.

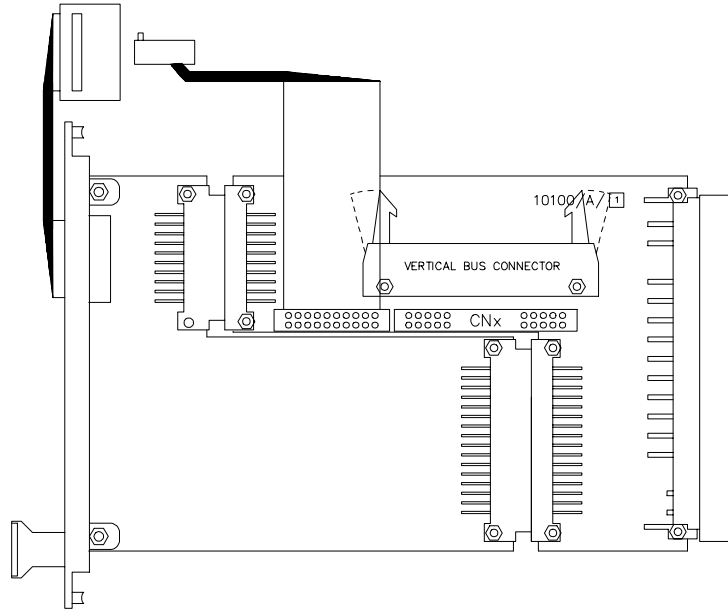


Figure 2 Schematic diagram for flatcable routing using the HBD with 10100/A/1 (non-redundant I/O)

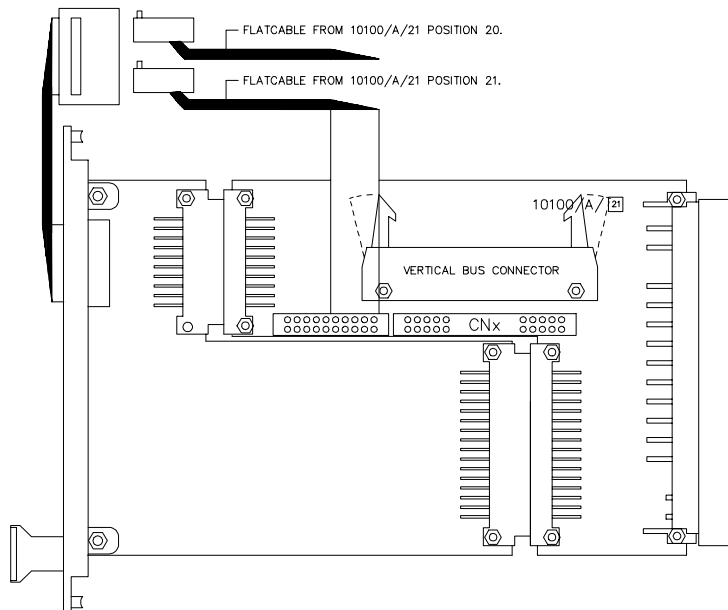


Figure 3 Schematic diagram for flatcable routing using the HBD with 10100/A/21 (redundant I/O with one rack per HBD)

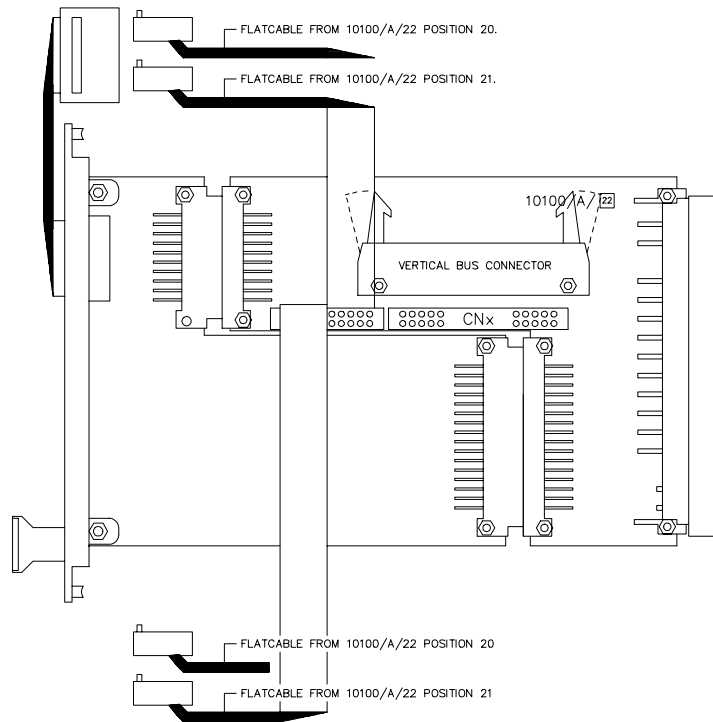


Figure 4 Schematic diagram for flatcable routing using the HBD with 10100/A/22 (redundant I/O with two racks per HBD)

## Wiring diagram

The 10100/1/1 module is wired in accordance with the wiring diagram below.

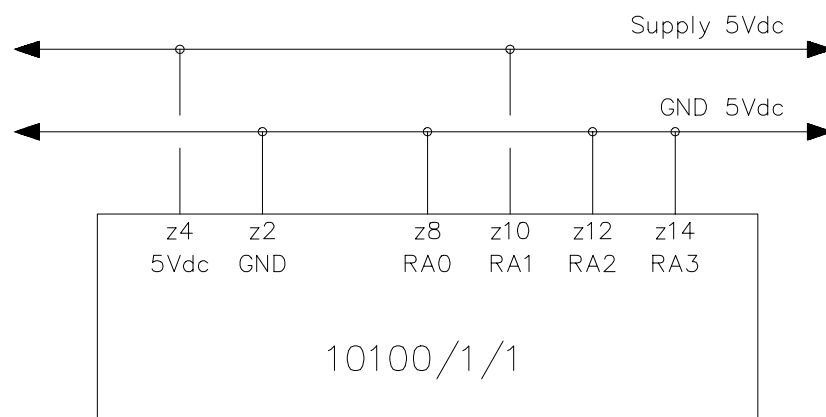


Figure 5 Wiring diagram of 10100/1/1 module with rack address 2 (see Table 1)



## Rack extension

A rack extension in an existing cabinet can be realized by using the CNx connector on the wiring part of the module (see Figure 2).

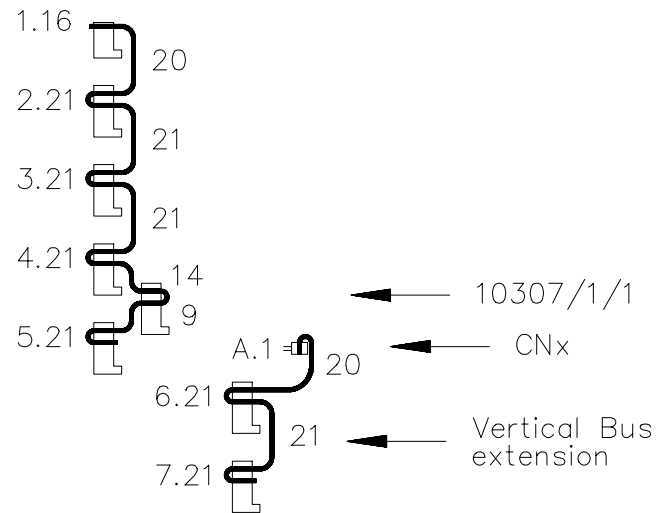


Figure 6 Vertical bus rack extension

Ordering a rack extension module requires extensive information about the number of connectors and the distance between the connectors on that vertical bus extension, and the involved wiring part type (10100/A/1, 10100/A/21 or 10100/A/22).



## Technical data

The 10100/1/1 module has the following specifications:

### General

Type number: 10100/1/1  
Approvals: CE, TÜV, UL  
Software versions: all  
Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

### Power

Power requirements: 10100/1/1 + 10100/A/1 5 Vdc 35 mA  
10100/1/1 + 10100/A/21 5 Vdc 35 mA  
10100/1/1 + 10100/A/22 5 Vdc 65 mA  
Ripple content: < 50 mV p-p

### Key coding

(see 'Key coding' data sheet)

Module code:

- hole A27
- pins C3, C11, C27

Rack code:

- blind stop C3, C11, C27
- large pin A27

---

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## 10100/2/1

## Horizontal bus driver (HBD)

---

### Description

The horizontal bus driver (HBD) module is a basic module which is installed in the I/O racks.

The horizontal bus driver consists of two parts:

- electronic part (10100/2/1), and
- a A1, A21 or A22 flatcable.

The vertical bus flatcable between the Central Part and the I/O rack is connected to the HBD module via the back connector CN1 (see Figure 2).

The flatcable which extends from the front of the module connects the HBD module to the horizontal bus above the I/O rack.

The address selection lines of the I/O modules terminate on the back of the horizontal bus(es) via a flatcable on connector CN3.

The HBDs are used as follows:

- 10100/2/1 with flatcable A1 used for non-redundant I/O
- 10100/2/1 with flatcable A21 used for redundant I/O (one rack per HBD)
- 10100/2/1 with flatcable A22 used for redundant I/O (two racks per HBD)

The HBD may be replaced with the power switched on, but the Central Part will shut down if the HBD is safety-related.

---

## Pin allocation

The HBD is fitted with a male connector according to DIN 41612 type F, with the 'd', 'b' and 'z' rows used. The back view of the 10100/2/1 rack connector is as follows:



Figure 1 Back view of 10100/2/1 connector

## Address setting

The rack address of the HBD is programmed by means of jumpers on the 10314/1/1, 10315/1/1, 10316/1/1 or 10317/1/1 modules (RA0 to RA3).

Table 1 Address setting for HBD

	RA3	RA2	RA1	RA0
<b>HBD1</b>	0	0	0	1
<b>HBD2</b>	0	0	1	0
<b>HBD3</b>	0	0	1	1
<b>HBD4</b>	0	1	0	0
<b>HBD5</b>	0	1	0	1
<b>HBD6</b>	0	1	1	0
<b>HBD7</b>	1	0	0	0
<b>HBD8</b>	1	0	0	1
<b>HBD9</b>	1	0	1	0
<b>HBD10</b>	1	1	0	0

0 = GND 5 Vdc

1 = Supply 5 Vdc



## Flatcable routing

Figure 2 to Figure 4 below show the flatcable routing for the various configurations.

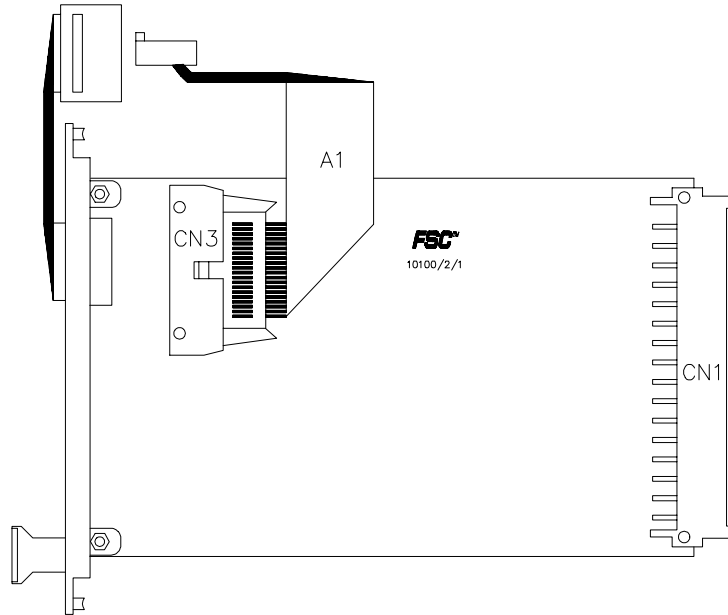


Figure 2 Schematic diagram for flatcable routing from the HBD (non-redundant I/O)

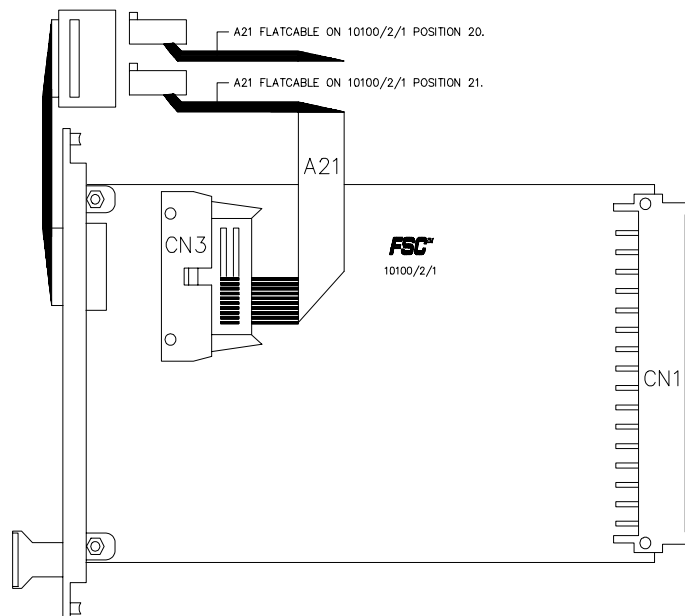


Figure 3 Schematic diagram for flatcable routing from the HBD (redundant I/O with one rack per HBD)

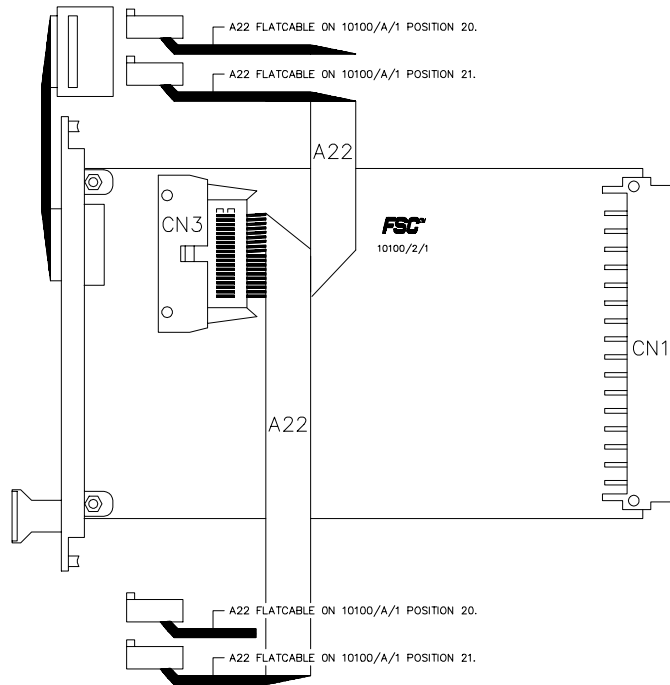


Figure 4 Schematic diagram for flatcable routing from the HBD (redundant I/O with two racks per HBD)



## Technical data

The 10100/2/1 module has the following specifications:

### General

Type number: 10100/2/1 10900  
Approvals: CE, TÜV, UL  
Software versions:  $\geq 3.00$   
Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

### Power

Power requirements: 10100/2/1 + A1 cable 5 Vdc 35 mA  
10100/2/1 + A21 cable 5 Vdc 35 mA  
10100/2/1 + A22 cable 5 Vdc 65 mA  
Ripple content:  $< 50$  mV p-p

### Key coding

(See 'Key coding' data sheet)

Module code:

– holes A5, A7

Rack code:

– large pins A5, A7

---

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# **Fail Safe Control Hardware Manual**

## **Section 5: FSC Input Modules**

**TotalPlant**



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## FSC input modules

### General information

All the input modules are European standard size (100 x 160 mm) instrument modules. The width of the module front is 4 TE (20.32 mm) (= 4 HP, 0.8 in), which is one position in a standard 19-inch I/O rack.

Each input module is connected to the horizontal bus via a flatcable, which protrudes from the module front. Digital input modules have status LEDs for each input channel. The LEDs are placed in the module front, below the flatcable.

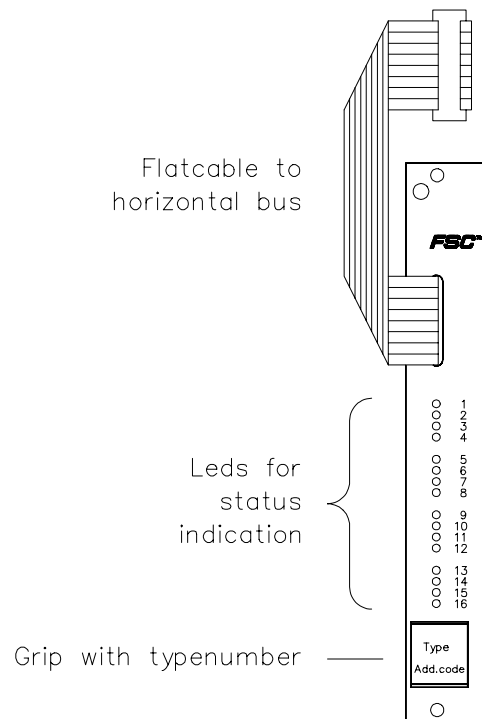


Figure 1 Front of a digital input module

There are digital input modules for 24 Vdc, 48 Vdc, 60 Vdc and EExi signals. The modules are powered with 5 Vdc for the circuits associated with the horizontal bus logic, and with 24 Vdc for the circuits associated with the input signals.

There are analog inputs for 0-20 mA, 0-5 V and 0-10 V signals. All input modules have galvanic isolation between the 5 Vdc circuitry and the field inputs.



The input modules are fitted with a male connector according to DIN 41612, type F, with the d, (b) and z rows used.

The following items are terminated on the rack connector:

- the internal power supply of 5 Vdc,
- the internal power supply of 24 Vdc,
- the external power supply of 24 Vdc, 48 Vdc or 60 Vdc (if needed), and
- the wiring for the input signals.

The 5 Vdc signals are physically separated from the I/O connections and supply.

---

## Addressing

The addressing of an input module is determined by the module's position in the I/O rack. This means that the input modules have no jumpers or switches for setting the address. Each input module can be replaced by any module of the same type.

---

## Replacing an input module

All input modules can be replaced with the power switched on. Depending on the input signal function and the system I/O configuration, process operation may be affected. When removing an input module, first disconnect the flatcable from the horizontal bus, then carefully pull the module from the rack. When placing an input module, carefully push the module into the rack until it is flush with the rack, then connect the flatcable to the horizontal bus.

---

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## 10101/1/1

# Fail-safe digital input module (24 Vdc, 16 channels)

### Description

The fail-safe digital input module 10101/1/1 has sixteen 24 Vdc digital input channels. The input stage of the module is of a 'fail-to-safe' nature. This means that a component failure results in a de-energized input signal to the processor, which is the safe condition in a normally energized system.

The remaining logic circuitry on the module is completely covered by the self-test functions of the system. Within the configured process safety time, the modules are tested for:

- ability to receive logic level '0' signals,
- ability to receive logic level '1' signals, and
- crosstalk between inputs.

The supply circuitry is split into two galvanically isolated groups of eight inputs each. This enables powering the two input groups from two independent power supply groups to support segregation in a process unit and/or subunit structure.

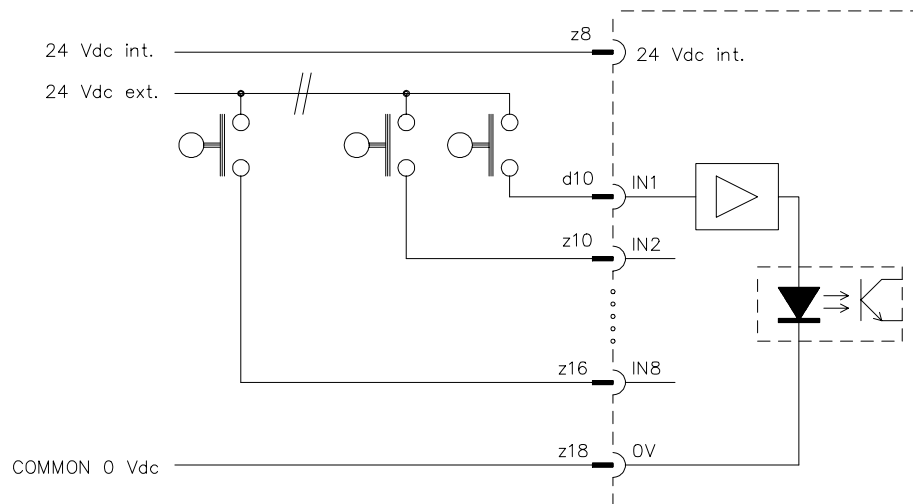
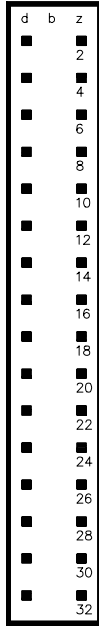


Figure 1 Schematic diagram for connection of inputs to one input group of the 10101/1/1 module



## Pin allocation

The back view and pin allocation of the 10101/1/1 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	(Supply 24 Vdc (1))	z8	Supply 24 Vdc (1)
d10	IN 1	z10	IN 2
d12	IN 3	z12	IN 4
d14	IN 5	z14	IN 6
d16	IN 7	z16	IN 8
d18	(Supply 0 Vdc (1))	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22	(Supply 24 Vdc (2))	z22	Supply 24 Vdc (2)
d24	IN 9	z24	IN 10
d26	IN 11	z26	IN 12
d28	IN 13	z28	IN 14
d30	IN 15	z30	IN 16
d32	(Supply 0 Vdc (2))	z32	Supply 0 Vdc (2)

## Connection examples

The figures below show a number of connection examples for the fail-safe digital input module 10101/1/1.

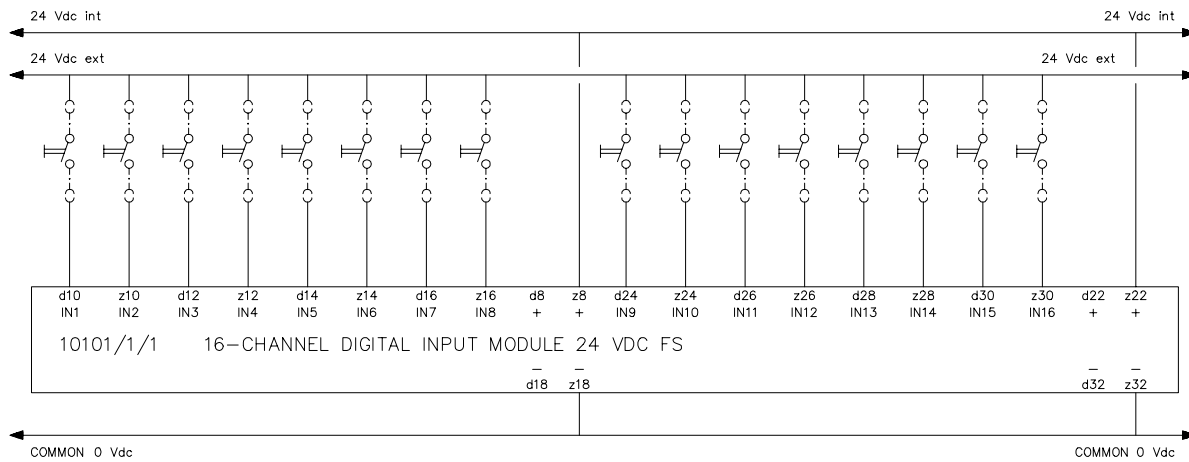


Figure 2 Connection example for non-redundant I/O configurations



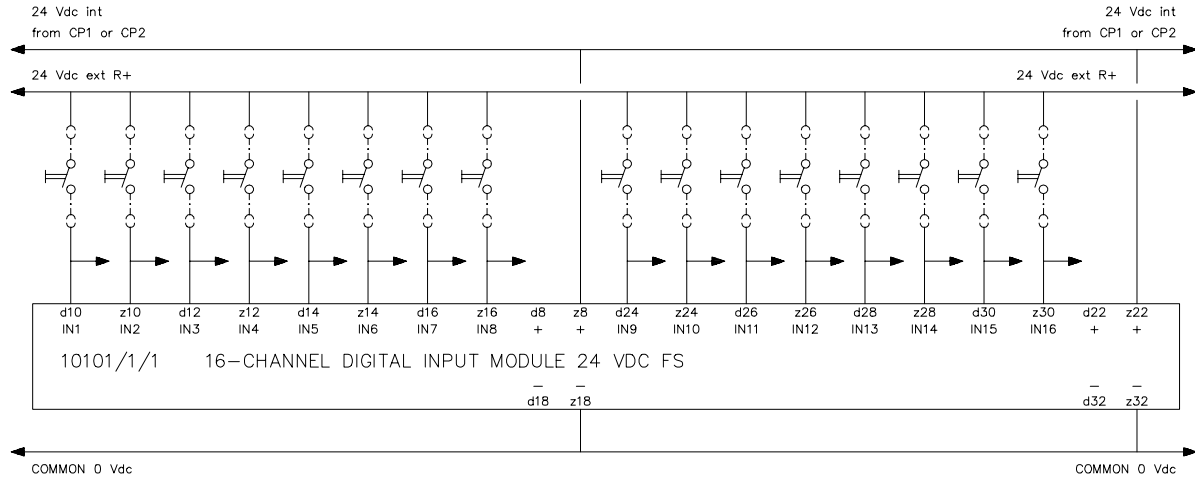


Figure 3 Connection example for redundant I/O configurations

**Note:**

Both input groups of the input module must be connected to a 24 Vdc (internal) power supply (on pins z8, z18 and z22, z32) to prevent fault detection during the self-test.

**Technical data**

The 10101/1/1 module has the following specifications:

<b>General</b>	Type number:	10101/1/1 01703*
	Approvals:	CE, TÜV, UL
	Software versions:	all*
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 8 mA 24 Vdc 2*100 mA (including input currents)
	Ripple content (on 5 Vdc):	< 0.5 Vp-p (0-360 Hz)
<b>Input</b>	Number of input channels:	16 (2 isolated groups of 8)
	Maximum input voltage:	36 Vdc
	Input current:	7 mA at 24 Vdc
	Input HIGH:	> 15 Vdc
	Input LOW:	< 9 Vdc (I < 2 mA)
	Input delay:	typically 10 ms



## Technical data (continued)

<b>Key coding</b>	(See 'Key coding' data sheet):
	Module connector code:
– hole	A27
– pins	C3, C11, C23
	Rack connector code:
– blind stops	C19, C27, C31
– large pin	A27

---

### \* Notes:

10101/1/1 modules without a suffix code have a different processor interface timing.

10101/1/1 modules with suffix code 01701 and higher have a soldering link on the copper side of the print to enable operation with software versions 2.78f5 or lower (open link for old timing).

10101/1/1 modules with suffix code 01702 and higher have a modified component layout but identical functionality.

10101/1/1 modules with suffix code 01703 have an improved supply circuit.

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## 10101/1/2

# Fail-safe digital input module (60 Vdc, 16 channels)

### Description

The fail-safe input module 10101/1/2 has sixteen 60 Vdc digital input channels, but an internal supply voltage of 24 Vdc. The input stage of the module is of a 'fail-to-safe' nature. This means that a component failure results in a de-energized input signal to the processor, which is the safe condition in a normally energized system.

The remaining logic circuitry on the module is completely covered by the self-test functions of the system. Within the configured process safety time, the modules are tested for:

- ability to receive logic level '0' signals,
- ability to receive logic level '1' signals, and
- crosstalk between inputs.

The supply circuitry is split into two galvanically isolated groups of eight inputs each. This enables powering the two input groups from two independent power supply groups to support segregation in a process unit and/or subunit structure.

### Note:

The 24 Vdc (internal) and the 60 Vdc (external) must have a common 0 Vdc connection.

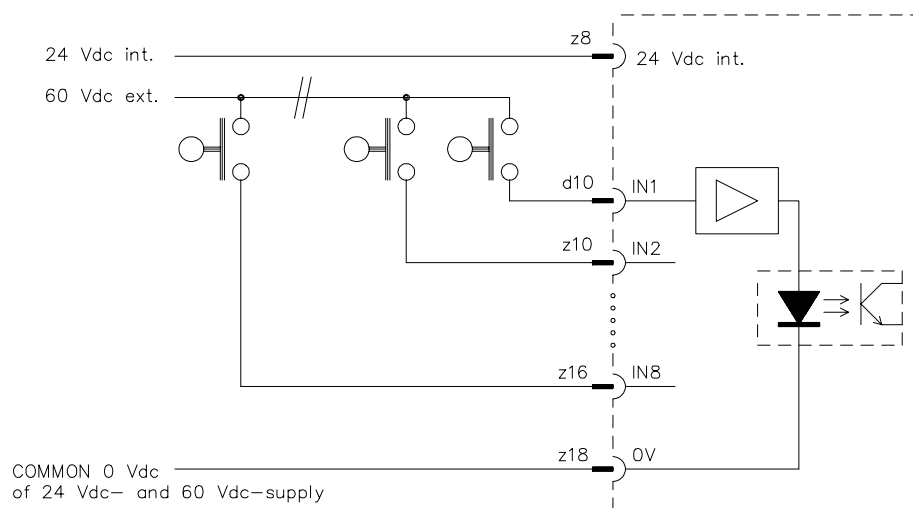
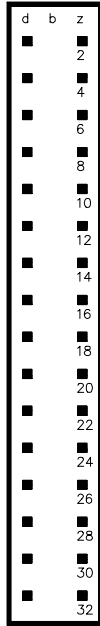


Figure 1 Schematic diagram for connection of inputs to one input group of the 10101/1/2 module



## Pin allocation

The back view and pin allocation of the 10101/1/2 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	(Supply 24 Vdc (1))	z8	Supply 24 Vdc (1)
d10	IN 1	z10	IN 2
d12	IN 3	z12	IN 4
d14	IN 5	z14	IN 6
d16	IN 7	z16	IN 8
d18	(Supply 0 Vdc (1))	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22	(Supply 24 Vdc (2))	z22	Supply 24 Vdc (2)
d24	IN 9	z24	IN 10
d26	IN 11	z26	IN 12
d28	IN 13	z28	IN 14
d30	IN 15	z30	IN 16
d32	(Supply 0 Vdc (2))	z32	Supply 0 Vdc (2)

## Connection examples

The figures below show a number of connection examples for the fail-safe digital input module 10101/1/2.

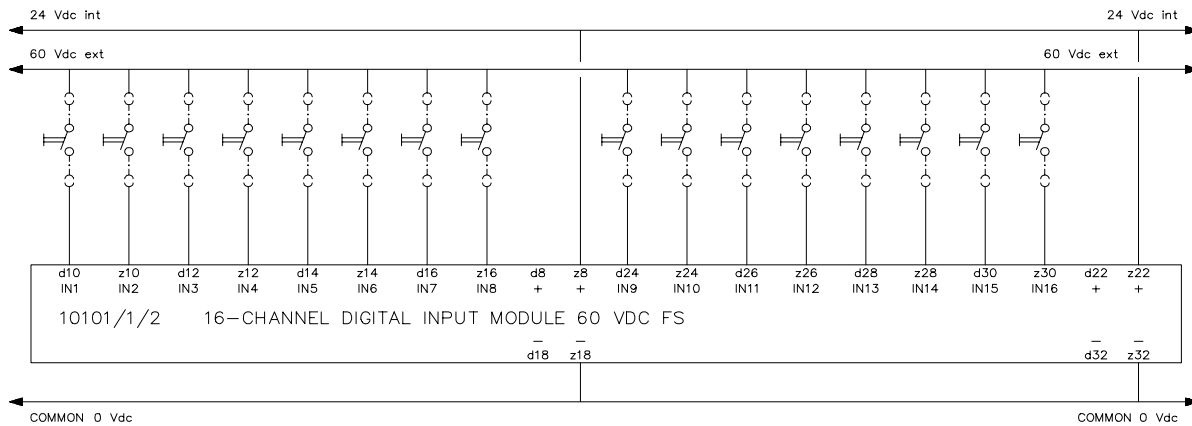


Figure 2 Connection example for non-redundant I/O configurations

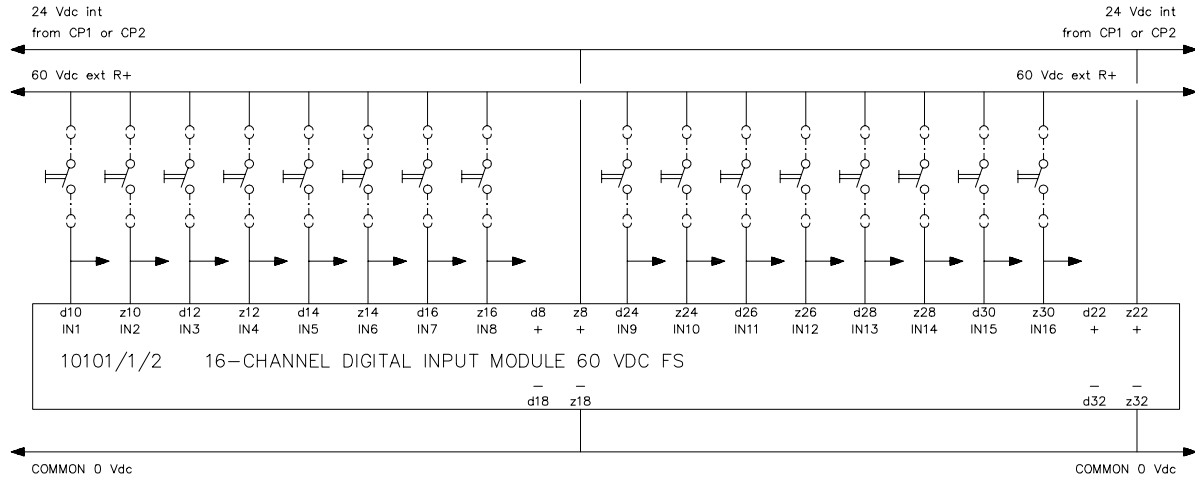


Figure 3 Connection example for redundant I/O configurations

**Note:**

Both input groups of the input module must be connected to a 24 Vdc (internal) power supply (on pins z8, z18 and z22, z32) to prevent fault detection during the self-test.

**Technical data**

The 10101/1/2 module has the following specifications:

<b>General</b>	Type number:	10101/1/2 07200
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.80b
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 8 mA 24 Vdc 2*40 mA (internal supply only) 60 Vdc 2*27 mA (input currents)
	Ripple content (on 5 Vdc):	< 0.5 Vp-p (0-360 Hz)
	Supply voltage:	24 Vdc, -15%...+30% (max. 36 V)
<b>Fuses</b>	Fuse values:	2x 100 mA
	Fuse type:	Round, TR5-F/19370K
	Fuse dimensions:	Ø 8.2 mm (0.32 in), height 7.7 mm (0.3 in)



---

## Technical data (continued)

<b>Input</b>	Number of input channels:	16 (2 isolated groups of 8)
	Input voltage:	typically 60 Vdc, max. 85 Vdc
	Input current:	3.3 mA at 60 Vdc
	Input HIGH:	> 40 Vdc
	Input LOW:	< 20 Vdc (I < 1 mA)
	Input delay:	typically 10 ms
	<b>Key coding</b>	(See 'Key coding' data sheet)
Module code:		
– hole		A15
– pins		C3, C11, C23
Rack code:		
– blind stops		C19, C27, C31
– large pins	A15	

---

**Note:**

The soldering link on the copper side must be closed.

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## 10101/1/3

# Fail-safe digital input module (48 Vdc, 16 channels)

### Description

The fail-safe digital input module 10101/1/3 has sixteen 48 Vdc digital input channels, but an internal supply voltage of 24 Vdc. The input stage of the module is of a 'fail-to-safe' nature. This means that a component failure results in a de-energized input signal to the processor, which is the safe condition in a normally energized system.

The remaining logic circuitry on the module is completely covered by the self-test functions of the system. Within the configured process safety time, the modules are tested for:

- ability to receive logic level '0' signals,
- ability to receive logic level '1' signals, and
- crosstalk between inputs.

The supply circuitry is split into two galvanically isolated groups of eight inputs each. This enables powering the two input groups from two independent power supply groups to support segregation in a process unit and/or subunit structure.

### Note:

The 24 Vdc (internal) and the 48 Vdc (external) must have a common 0 Vdc connection.

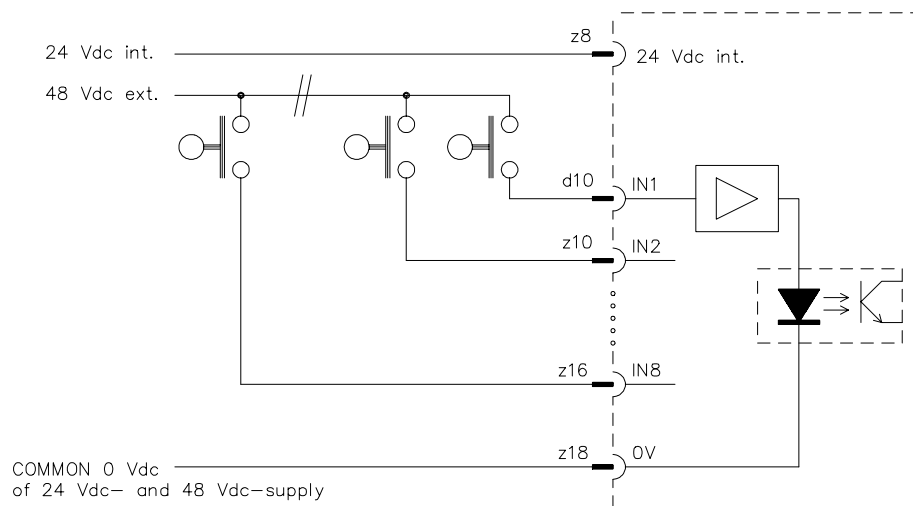
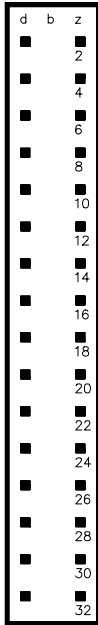


Figure 1 Schematic diagram for connection of inputs to one input group of the 10101/1/3 module



## Pin allocation

The back view and pin allocation of the 10101/1/3 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	(Supply 24 Vdc (1))	z8	Supply 24 Vdc (1)
d10	IN 1	z10	IN 2
d12	IN 3	z12	IN 4
d14	IN 5	z14	IN 6
d16	IN 7	z16	IN 8
d18	(Supply 0 Vdc (1))	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22	(Supply 24 Vdc (2))	z22	Supply 24 Vdc (2)
d24	IN 9	z24	IN 10
d26	IN 11	z26	IN 12
d28	IN 13	z28	IN 14
d30	IN 15	z30	IN 16
d32	(Supply 0 Vdc (2))	z32	Supply 0 Vdc (2)

## Connection examples

The figures below show a number of connection examples for the fail-safe digital input module 10101/1/3.

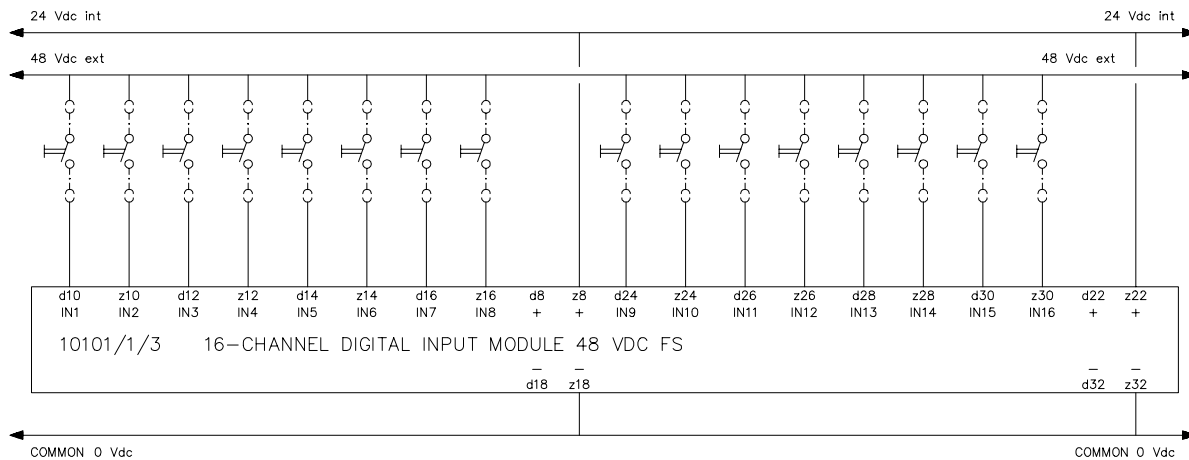


Figure 2 Connection example for non-redundant I/O configuration



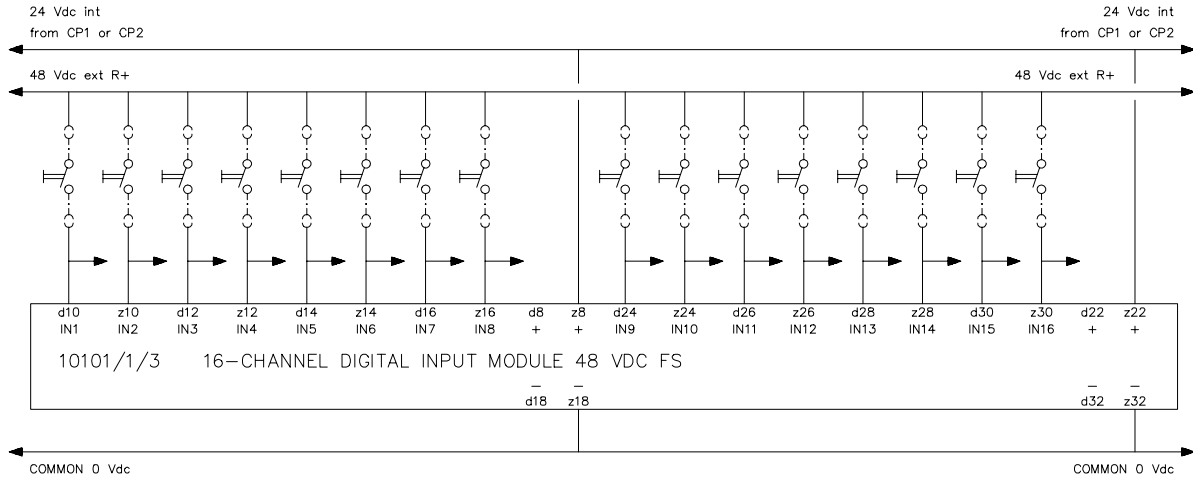


Figure 3 Connection example for redundant I/O configuration

**Note:**

Both input groups of the input module must be connected to a 24 Vdc (internal) power supply (on pins z8, z18 and z22, z32) to prevent fault detection during the self-test.

**Technical data**

The 10101/1/3 module has the following specifications:

**General**

Type number: 10101/1/3 07300  
 Approvals: CE, TÜV, UL  
 Software versions: ≥ 2.80b  
 Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

**Power**

Power requirements: 5 Vdc 8 mA  
 24 Vdc 2\*40 mA (internal supply only)  
 48 Vdc 2\*32 mA (input currents)  
 Ripple content (on 5 Vdc): < 0.5 Vp-p (0-360 Hz)  
 Supply voltage: 24 Vdc, -15%...+30% (max. 36 V)

**Input**

Number of input channels: 16 (2 isolated groups of 8)  
 Input voltage: typically 48 Vdc, max. 70 Vdc  
 Input current: 4 mA at 48 Vdc  
 Input HIGH: > 30 Vdc  
 Input LOW: < 16 Vdc (I < 1.1 mA)  
 Input delay: typically 10 ms



---

## Technical data (continued)

<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A3
	– pins	C3, C11, C23
	Rack code:	
	– blind stops	C19, C27, C31
	– large pin	A3

---

**Note:**

The soldering link on the copper side must be closed.

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## 10101/2/1

# Fail-safe digital input module (24 Vdc, 16 channels)

### Description

The fail-safe digital input module 10101/2/1 has sixteen 24 Vdc digital input channels. The input stage of the module is of a 'fail-to-safe' nature. This means that a component failure results in a de-energized input signal to the processor, which is the safe condition in a normally energized system.

The remaining logic circuitry on the module is completely covered by the self-test functions of the system. Within the configured process safety time, the modules are tested for:

- ability to receive logic level '0' signals,
- ability to receive logic level '1' signals, and
- crosstalk between inputs.

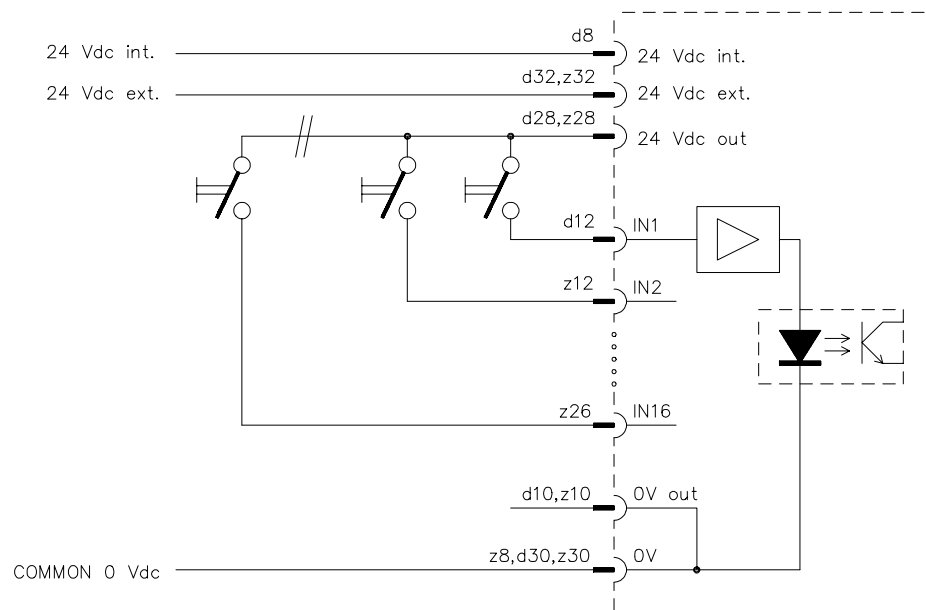
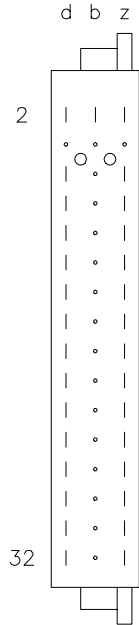


Figure 1 Schematic diagram for connection of inputs to the 10101/2/1 module



## Pin allocation

The back view and pin allocation of the 10101/2/1 module connector are as follows:



d2		b2	GND	z2	5 Vdc
d4	-			z4	-
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	0 Vdc out			z10	0 Vdc out
d12	IN 1			z12	IN 2
d14	IN 3			z14	IN 4
d16	IN 5			z16	IN 6
d18	IN 7			z18	IN 8
d20	IN 9			z20	IN 10
d22	IN 11			z22	IN 12
d24	IN 13			z24	IN 14
d26	IN 15			z26	IN 16
d28	24 Vdc ext. out			z28	24 Vdc ext. out
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 24 Vdc ext.			z32	Supply 24 Vdc ext.

## Connection examples

The figures below show a number of connection examples for the fail-safe digital input module 10101/2/1.

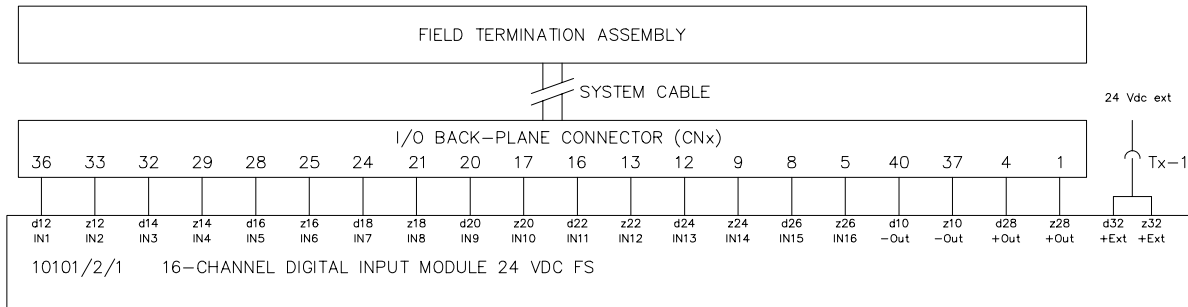


Figure 2 Connection example of 10101/2/1 module to FTA for both non-redundant and redundant I/O configurations

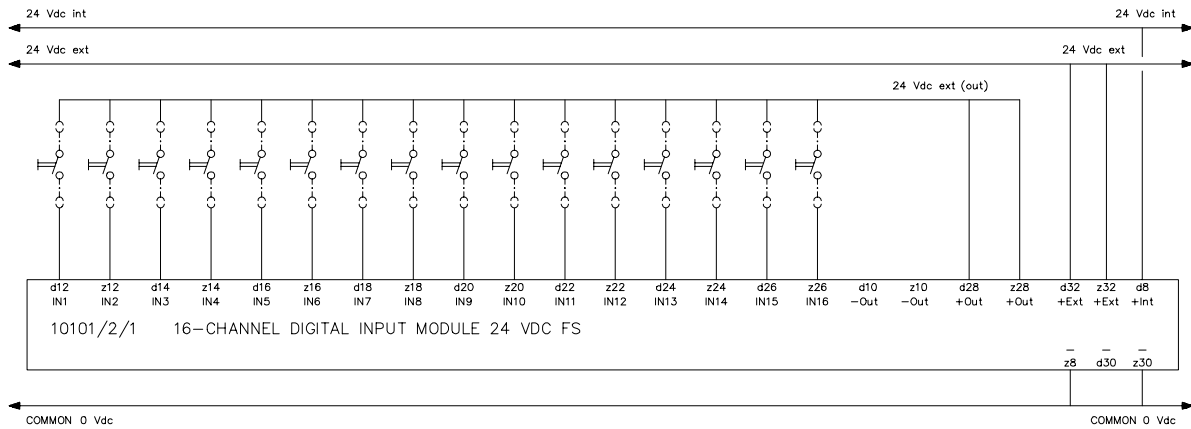


Figure 3 I/O connection example of 10101/2/1 module for non-redundant I/O configurations

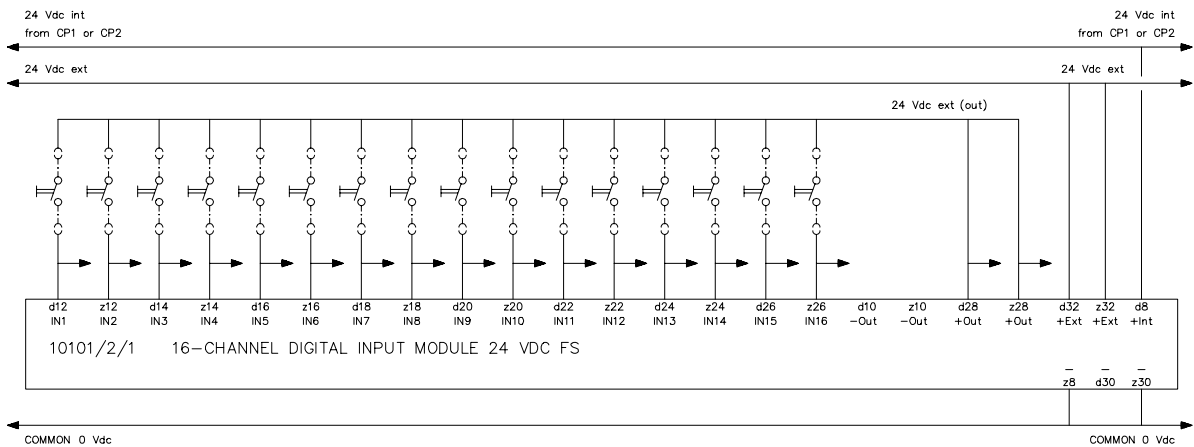


Figure 4 I/O connection example of 10101/2/1 module for redundant I/O configurations

**Note:**

The 24 Vdc (internal) supply must be connected to prevent fault detection during the self-test.



## Technical data

The 10101/2/1 module has the following specifications:

<b>General</b>	Type number:	10101/2/1 11000
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 8 mA 24 Vdc int. 110 mA 24 Vdc ext. 110 mA (input currents)
	Ripple content (on 5 Vdc):	< 0.5 Vp-p (0-360 Hz)
<b>Input</b>	Number of input channels:	16
	Maximum input voltage:	36 Vdc
	Input current:	7 mA at 24 Vdc
	Input HIGH:	> 15 Vdc
	Input LOW:	< 9 Vdc (I < 2 mA)
	Input delay:	typically 10 ms
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module connector code:	
	– holes	A5, C5
	Rack connector code:	
– large pins	A5, C5	

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## 10101/2/2

# Fail-safe digital input module (60 Vdc, 16 channels)

### Description

The fail-safe digital input module 10101/2/2 has sixteen 60 Vdc digital input channels, but an internal supply voltage of 24 Vdc. The input stage of the module is of a 'fail-to-safe' nature. This means that a component failure results in a de-energized input signal to the processor, which is the safe condition in a normally energized system.

The remaining logic circuitry on the module is completely covered by the self-test functions of the system. Within the configured process safety time, the modules are tested for:

- ability to receive logic level '0' signals,
- ability to receive logic level '1' signals, and
- crosstalk between inputs.

### Note:

The 24 Vdc (internal) and the 60 Vdc (external) must have a common 0 Vdc connection.

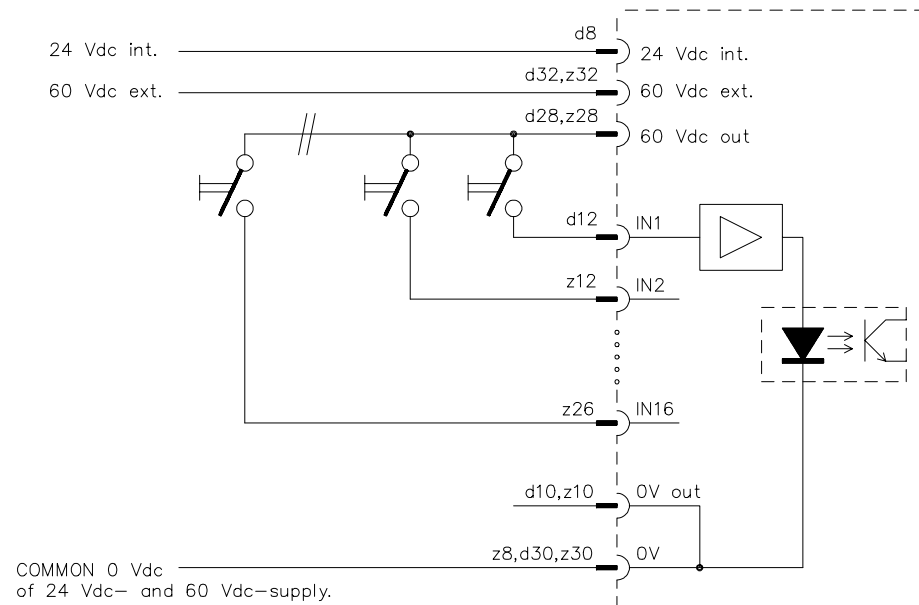
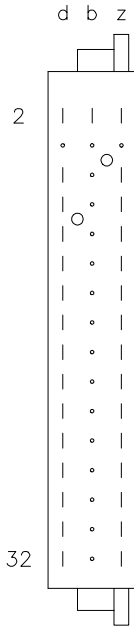


Figure 1 Schematic diagram for connection of inputs to the 10101/2/2 module



## Pin allocation

The back view and pin allocation of the 10101/2/2 module connector are as follows:



d2		b2	GND	z2	5 Vdc
d4	—			z4	—
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	0 Vdc out			z10	0 Vdc out
d12	IN 1			z12	IN 2
d14	IN 3			z14	IN 4
d16	IN 5			z16	IN 6
d18	IN 7			z18	IN 8
d20	IN 9			z20	IN 10
d22	IN 11			z22	IN 12
d24	IN 13			z24	IN 14
d26	IN 15			z26	IN 16
d28	60 Vdc ext. out			z28	60 Vdc ext. out
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 60 Vdc ext.			z32	Supply 60 Vdc ext.

## Connection examples

The figures below show a number of connection examples for the fail-safe digital input module 10101/2/2.

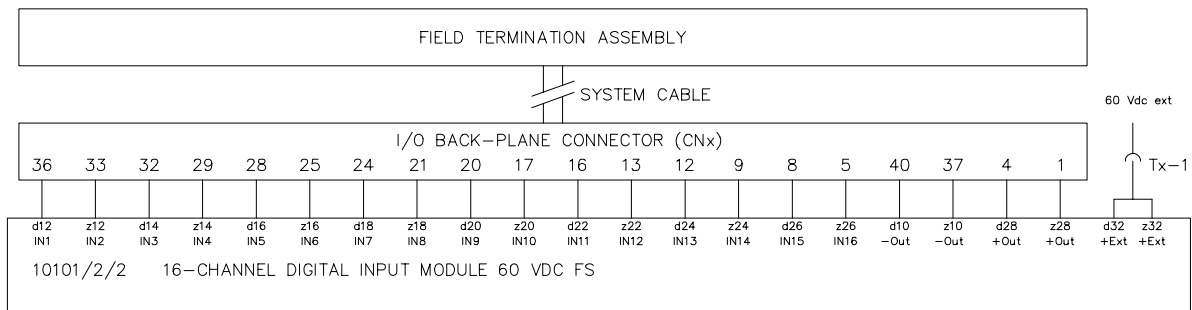


Figure 2 Connection example of 10101/2/2 module to FTA for both non-redundant and redundant I/O configurations



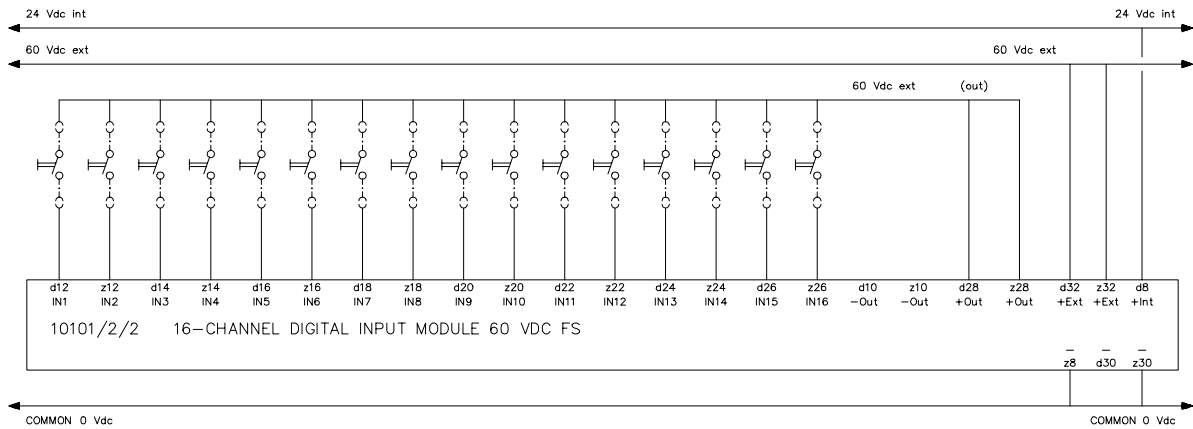


Figure 3 I/O connection example of 10101/2/2 module for non-redundant I/O configurations

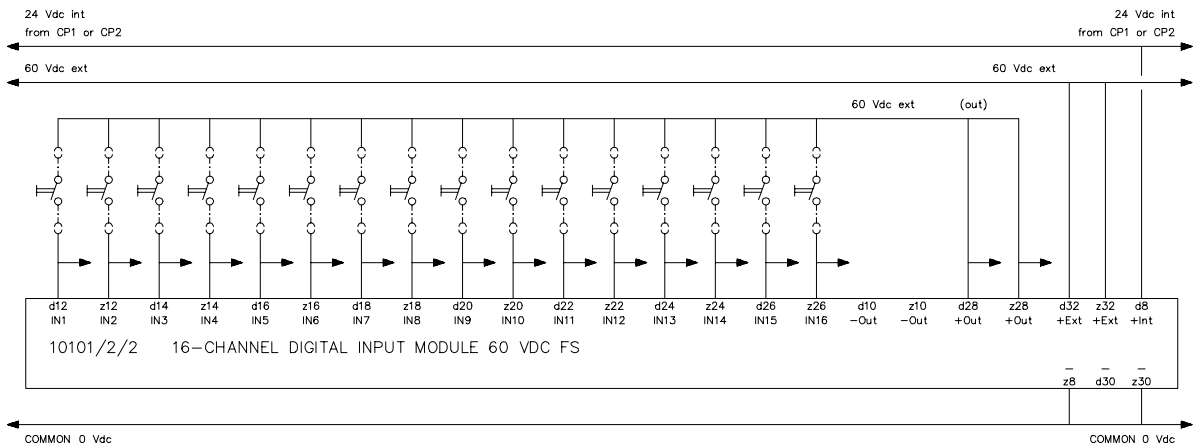


Figure 4 I/O connection example of 10101/2/2 module for redundant I/O configurations

**Note:**

The 24 Vdc (internal) supply must be connected to prevent fault detection during the self-test.



## Technical data

The 10101/2/2 module has the following specifications:

<b>General</b>	Type number:	10101/2/2 11100
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 8mA 24 Vdc int. 80 mA 60 Vdc ext. 55 mA (input currents)
	Ripple content (on 5 Vdc):	< 0.5 Vp-p (0-360 Hz)
<b>Fuse</b>	Fuse value:	1x 100 mA
	Fuse type:	Round, TR5-F/19370K
	Fuse dimensions:	Ø 8.2 mm (0.32 in), height 7.7 mm (0.3 in)
<b>Input</b>	Number of input channels:	16
	Maximum input voltage:	85 Vdc
	Input current:	3.3 mA at 60 Vdc
	Input HIGH:	> 40 Vdc
	Input LOW:	< 20 Vdc (I < 1 mA)
	Input delay:	typically 10 ms
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module connector code:	
	– holes	A5, C9
	Rack connector code:	
– large pins	A5, C9	

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## 10101/2/3

# Fail-safe digital input module (48 Vdc, 16 channels)

### Description

The fail-safe digital input module 10101/2/3 has sixteen 48 Vdc digital input channels, but an internal supply voltage of 24 Vdc. The input stage of the module is of a 'fail-to-safe' nature. This means that a component failure results in a de-energized input signal to the processor, which is the safe condition in a normally energized system.

The remaining logic circuitry on the module is completely covered by the self-test functions of the system. Within the configured process safety time, the modules are tested for:

- ability to receive logic level '0' signals,
- ability to receive logic level '1' signals, and
- crosstalk between inputs.

### Note:

The 24 Vdc (internal) and the 48 Vdc (external) must have a common 0 Vdc connection.

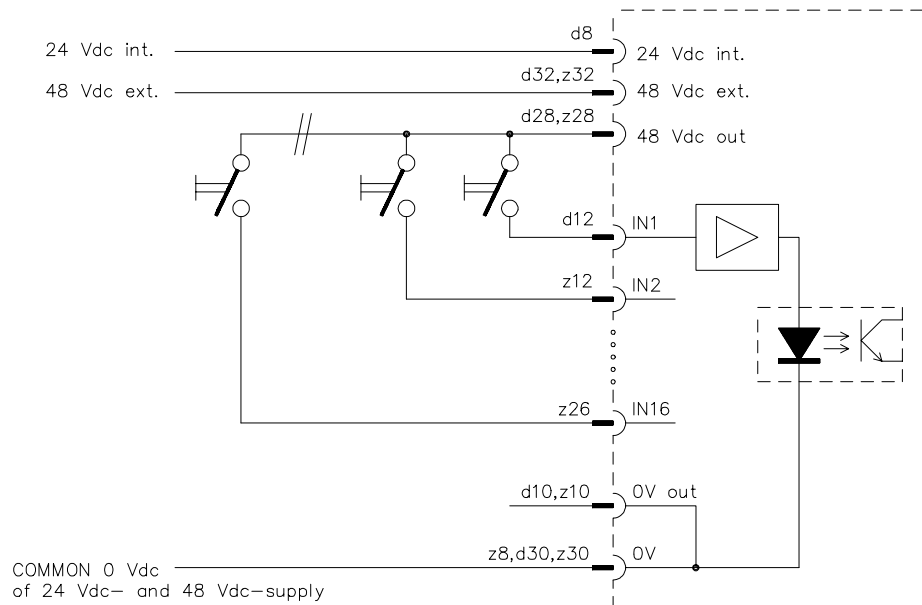
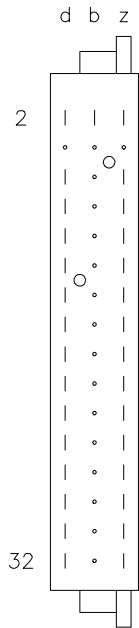


Figure 1 Schematic diagram for connection of inputs to the 10101/2/3 module



## Pin allocation

The back view and pin allocation of the 10101/2/3 module connector are as follows:



d2		b2	GND	z2	5 Vdc
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	0 Vdc out			z10	0 Vdc out
d12	IN 1			z12	IN 2
d14	IN 3			z14	IN 4
d16	IN 5			z16	IN 6
d18	IN 7			z18	IN 8
d20	IN 9			z20	IN 10
d22	IN 11			z22	IN 12
d24	IN 13			z24	IN 14
d26	IN 15			z26	IN 16
d28	48 Vdc ext. out			z28	48 Vdc ext. out
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 48 Vdc ext.			z32	Supply 48 Vdc ext.

## Connection examples

The figures below show a number of connection examples for the fail-safe digital input module 10101/2/3.

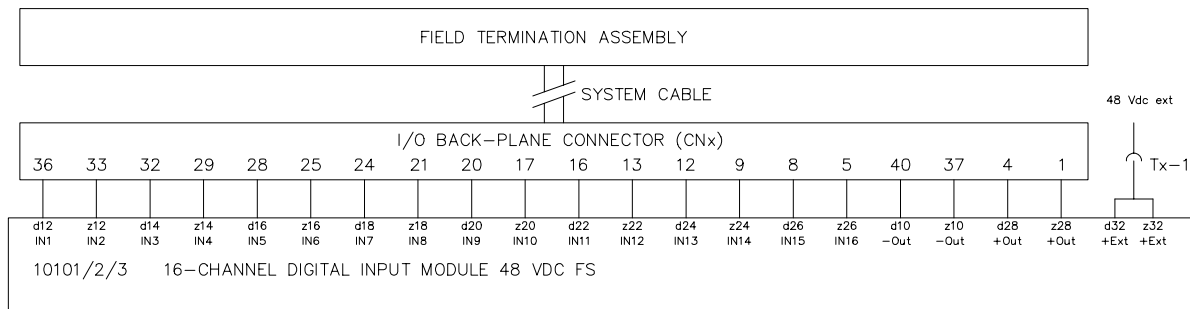


Figure 2 Connection example of 10101/2/3 module to FTA for both non-redundant and redundant I/O configurations

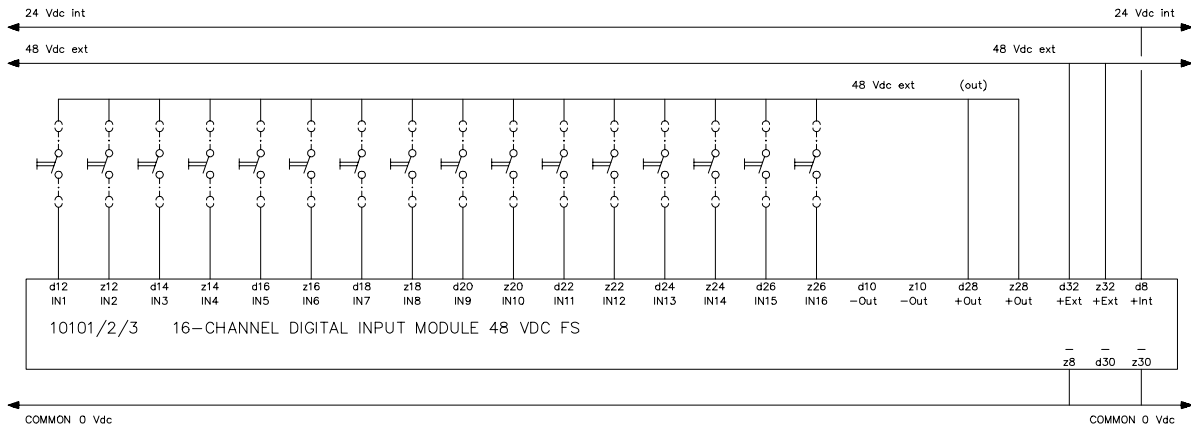


Figure 3 I/O connection example of 10101/2/3 module for non-redundant I/O configurations

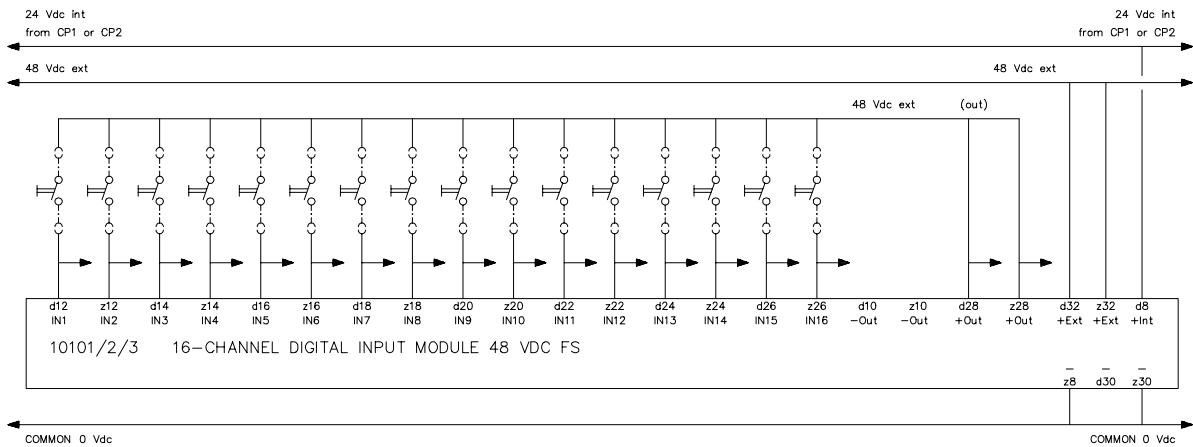


Figure 4 I/O connection example of 10101/2/3 module for redundant I/O configurations

**Note:**

The 24 Vdc (internal) supply must be connected to prevent fault detection during the self-test.



## Technical data

The 10101/2/3 module has the following specifications:

<b>General</b>	Type number:	10101/2/3 11200
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 8 mA 24 Vdc int. 80 mA 48 Vdc ext. 65 mA (input currents)
	Ripple content (on 5 Vdc):	< 0.5 Vp-p (0-360 Hz)
<b>Input</b>	Number of input channels:	16
	Maximum input voltage:	70 Vdc
	Input current:	4 mA at 48 Vdc
	Input HIGH:	> 30 Vdc
	Input LOW:	< 16 Vdc (I < 1.1 mA)
	Input delay:	typically 10 ms
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module connector code:	
	– holes	A5, C13
	Rack connector code:	
– large pins	A5, C13	

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## 10102/1/1

## Fail-safe analog input module (4 channels)

### Description

The fail-safe analog input module 10102/1/1 has four 0(2)-10 V / 0(4)-20 mA analog input channels. The analog inputs have a common 0 V connection, but are galvanically isolated from the 24 Vdc and the 5 Vdc.

The analog inputs can either be used actively (i.e. each input has a separate 26 Vdc, > 20 mA short-circuit protected output) or passively (i.e. the supply is directly connected to the transmitter).

The 10102/1/1 input stage has a low input impedance for current (100 Ohm). It is therefore not allowed to connect 10102/1/1 modules in parallel in the mA range, as this will considerably affect the measured value. If parallel operation in the mA range is required, the analog input module 10102/1/2 must be used.

*Several types of smart transmitters require a loop impedance of at least 250 Ohm in order to guarantee correct operation of communication with hand-held terminals. In non-redundant I/O configurations, this can be accomplished by using a 10102/1/2 module combined with a 10305/1/1 module.*

The analog input module scans the analog inputs, the 26 V output voltages, the internal supply voltages, and a reference voltage generated by a D/A converter. This D/A converter generates several reference voltages which are used to test the analog input module completely. The self-test includes a leakage test of the input filter as this could influence the accuracy of the analog input value.

Within the configured process safety time, the analog inputs are tested for:

- absolute accuracy,
- correct conversion over full range,
- crosstalk between inputs, and
- output voltage of the 26 Vdc outputs.

The 26 Vdc outputs are generated by the DC/DC converter and stabilized at 26 Vdc. They are therefore independent of the voltage of the incoming 24 Vdc.

**Note:**

The maximum output current is at least 21 mA. If the transmitters require a higher supply current, the input channel must be used in passive mode (= external supply).

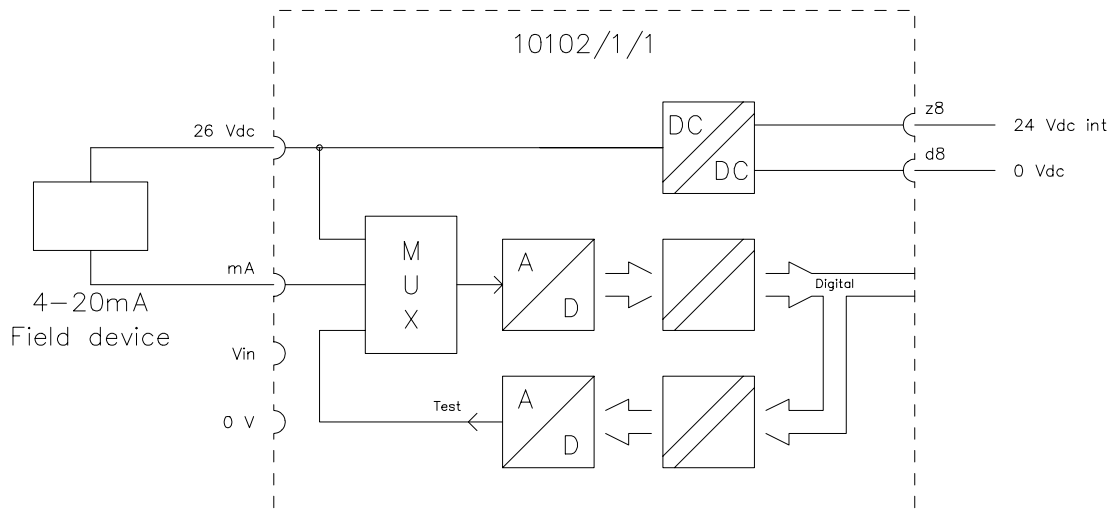


Figure 1 Schematic diagram for connection of inputs to the 10102/1/1 module

**Analog inputs for FSC**

Table 1 provides an overview of the analog inputs for the FSC system.

Table 1 Overview of analog inputs for FSC

Signal level	Non-redundant I/O	Redundant I/O
0(1)-5 V	10102/1/2	10102/1/2
0(2)-10 V	10102/1/1 or 10102/1/2	10102/1/2
0(4)-20 mA	10102/1/1 or 10102/1/2 + 10305/1/1	10102/1/2 + 10305/1/1

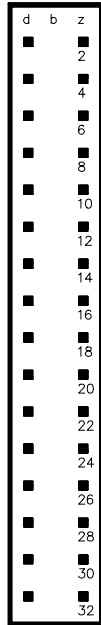
Other analog input signals such as thermocouple, PT-100, etc. can only be used after conversion to one of the analog input ranges that the FSC system can handle.





## Pin allocation

The back view and pin allocation of the 10102/1/1 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 0 Vdc	z8	Supply 24 Vdc
d10	Link	z10	Link
d12		z12	
d14		z14	
d16		z16	
d18	volts 1	z18	0 V1
d20	26 Vdc 1	z20	mA 1
d22	volts 2	z22	0 V2
d24	26 Vdc 2	z24	mA 2
d26	volts 3	z26	0 V3
d28	26 Vdc 3	z28	mA 3
d30	volts 4	z30	0 V4
d32	26 Vdc 4	z32	mA 4

## Connection example

The figure below shows a connection example for the fail-safe analog input module 10102/1/1.

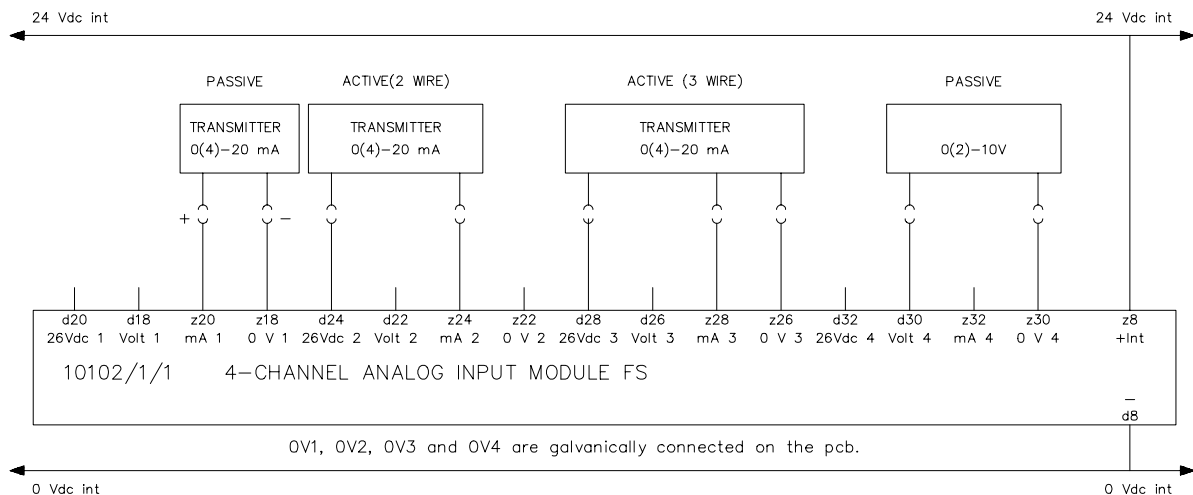


Figure 2 Connection example for non-redundant I/O configurations

## Calibration

The 10102/1/1 module has potentiometers for calibration purposes (P1, P2, P4, P5). The module can be calibrated using the calibration option of the 'View FSC system and process status' program, an external calibrator, an extender module and an extender flatcable.

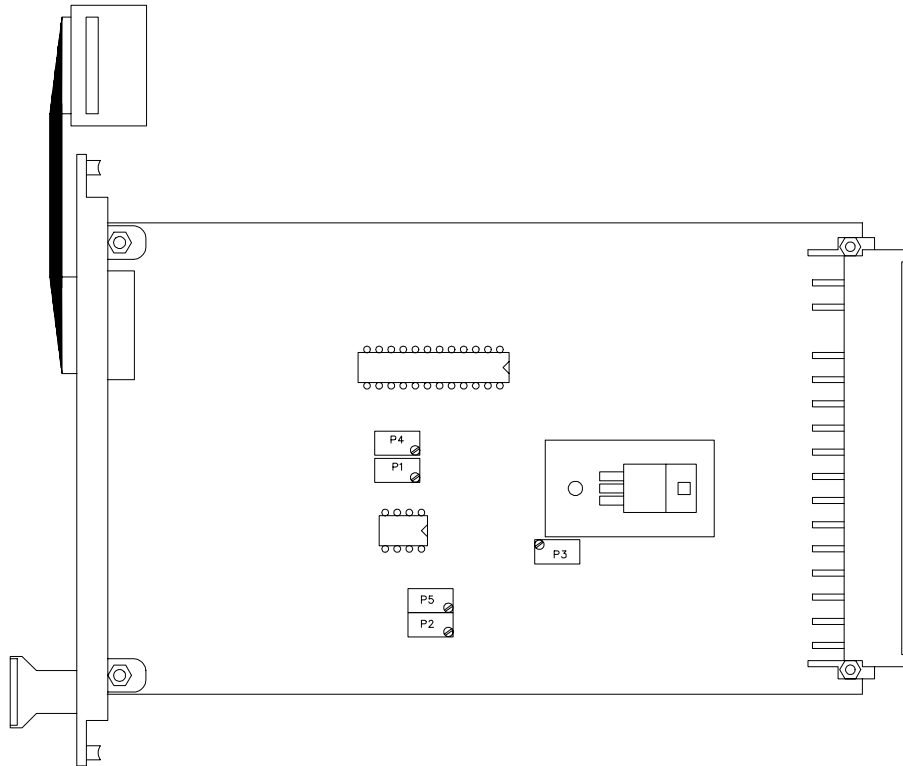


Figure 3 Location of potentiometers on 10102/1/1 module

## Technical data

The 10102/1/1 module has the following specifications:

<b>General</b>	Type number:	10102/1/1 01803*
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 30mA 24 Vdc 175 mA + 25 mA for each active input



## Technical data (continued)

<b>Input</b>	Number of input channels:	4
	Input specification (mA):	active or passive 0-20 / 4-20 mA
	– max. loop resistance	1 kOhm
	– input resistance	100 Ohm
	Input specification (V):	0-10 / 2-10 V
	– input resistance	12.5 kOhm
	Loop powering:	26 Vdc ( $\pm 1$ V for $0.2\text{mA} < I < 20\text{mA}$ )*, short-circuit protected
	Loop current limit:	> 20 mA solid state
	A/D converter:	12-bit
	Inaccuracy:	$\leq 0.75\%$
	Absolute max. input signal:	-150% or +200% of selected range*
	<b>Key coding</b>	(See 'Key coding' data sheet)
	Module code:	
	– hole	A27
	– pins	C3, C19, C27
	Rack code:	
	– blind stops	C11, C23, C31
	– large pin	A27

---

### \* Notes:

10102/1/1 modules without a suffix code have 23 Vdc solid state loop powering.

10102/1/1 modules with suffix code 01802 and higher have a maximum input signal of  $\pm 40$  Vdc on Volt inputs and a maximum input signal of  $\pm 70$  mA on mA inputs.

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## 10102/1/2

## Fail-safe analog input module (4 channels)

---

### Description

The fail-safe analog input module 10102/1/2 has four 0(1)-5 V / 0(2)-10 V analog input channels. The four analog inputs have a common 0 V connection, but are galvanically isolated from the 24 Vdc and the 5 Vdc.

The analog inputs can either be used actively (i.e. each input has a separate 26 Vdc, > 20 mA short-circuit protected output) or passively (i.e. the supply is directly connected to the transmitter).

The 10102/1/2 input stage has a high input impedance at 5 V (333 kOhm) and 10 V (250 kOhm). It is therefore allowed to connect 10102/1/2 modules in parallel.

The analog input module scans the analog inputs, the 26 V output voltages, the internal supply voltages, and a reference voltage generated by a D/A converter. This D/A converter generates several reference voltages which are used to test the analog input module completely. The self-test includes a leakage test of the input filter as this could influence the accuracy of the analog input value.

Within the configured process safety time, the analog inputs are tested for:

- absolute accuracy,
- correct conversion over full range,
- crosstalk between inputs, and
- output voltage of the 26 Vdc outputs.

The 26 Vdc outputs are generated by the DC/DC converter and stabilized at 26 Vdc. They are therefore independent of the voltage of the incoming 24 Vdc.

---

### Note:

The maximum output current is at least 21 mA. If the transmitters require a higher supply current, the input channel must be used in passive mode (= external supply).

---

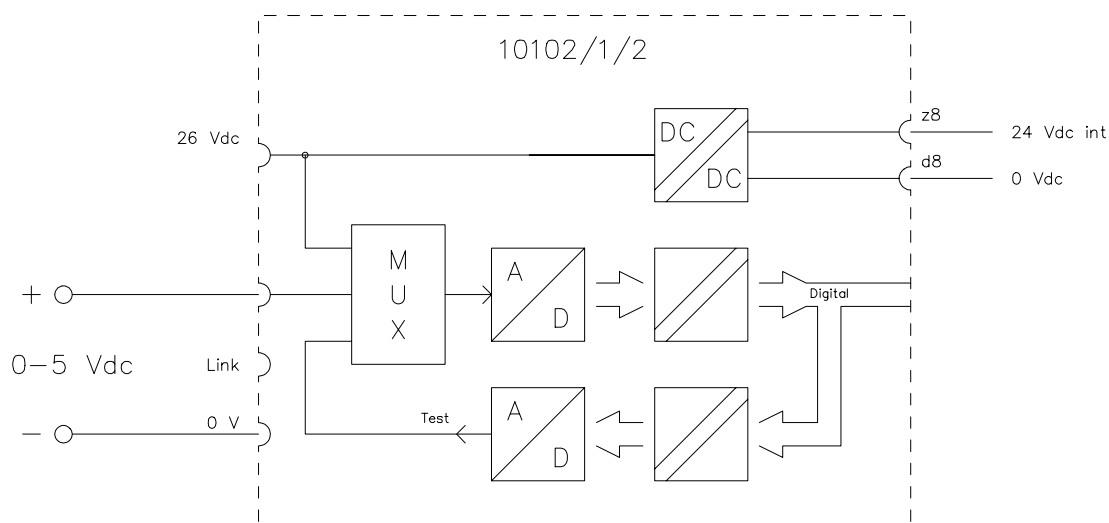


Figure 1 Schematic diagram for connection of a voltage input to the 10102/1/2 module

To use the 10102/1/2 module for 0(4)-20 mA analog inputs, the current must first be converted to voltage using the 10305/1/1 16-channel analog input converter module.

## Analog inputs for FSC

Table 1 provides an overview of the analog inputs for the FSC system.

Table 1 Overview of analog inputs for FSC

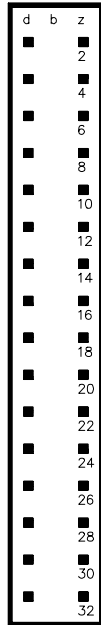
Signal level	Non-redundant I/O	Redundant I/O
0(1)-5 V	10102/1/2	10102/1/2
0(2)-10 V	10102/1/1 or 10102/1/2	10102/1/2
0(4)-20 mA	10102/1/1 or 10102/1/2 + 10305/1/1	10102/1/2 + 10305/1/1

Other analog input signals such as thermocouple, PT-100, etc. can only be used after conversion to one of the analog input ranges that the FSC system can handle.



## Pin allocation

The back view and pin allocation of the 10102/1/2 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 0 Vdc	z8	Supply 24 Vdc
d10	Link	z10	Link
d12		z12	
d14		z14	
d16		z16	
d18	IN 1	z18	0 V1
d20	26 Vdc 1	z20	Link 1 (0-10 Vdc)
d22	IN 2	z22	0 V2
d24	26 Vdc 2	z24	Link 2 (0-10 Vdc)
d26	IN 3	z26	0 V3
d28	26 Vdc 3	z28	Link 3 (0-10 Vdc)
d30	IN 4	z30	0 V4
d32	26 Vdc 4	z32	Link 4 (0-10 Vdc)

## Connection examples

The figures below show a number of connection examples for the fail-safe analog input module 10102/1/2.

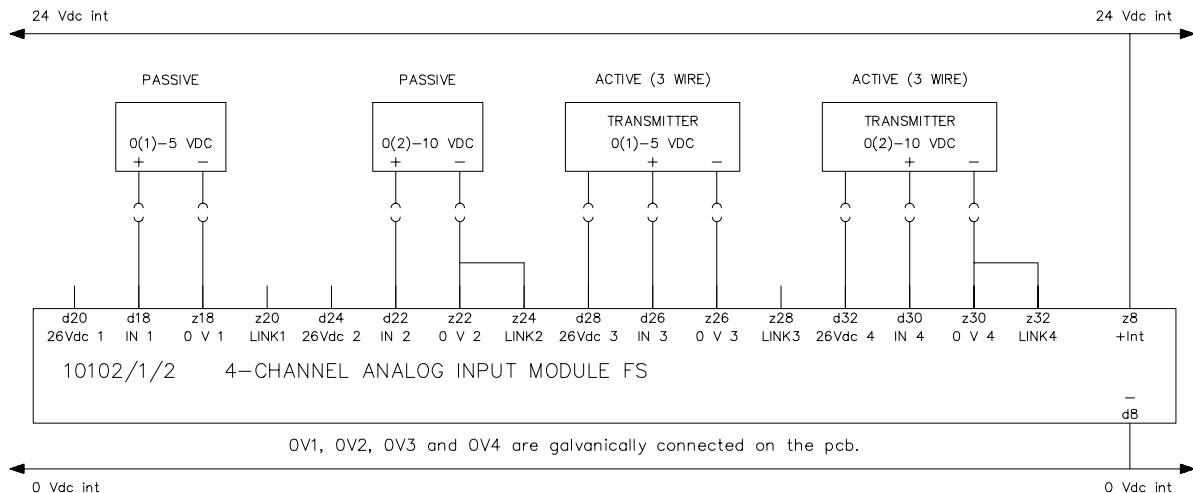


Figure 2 Connection example for non-redundant I/O configurations

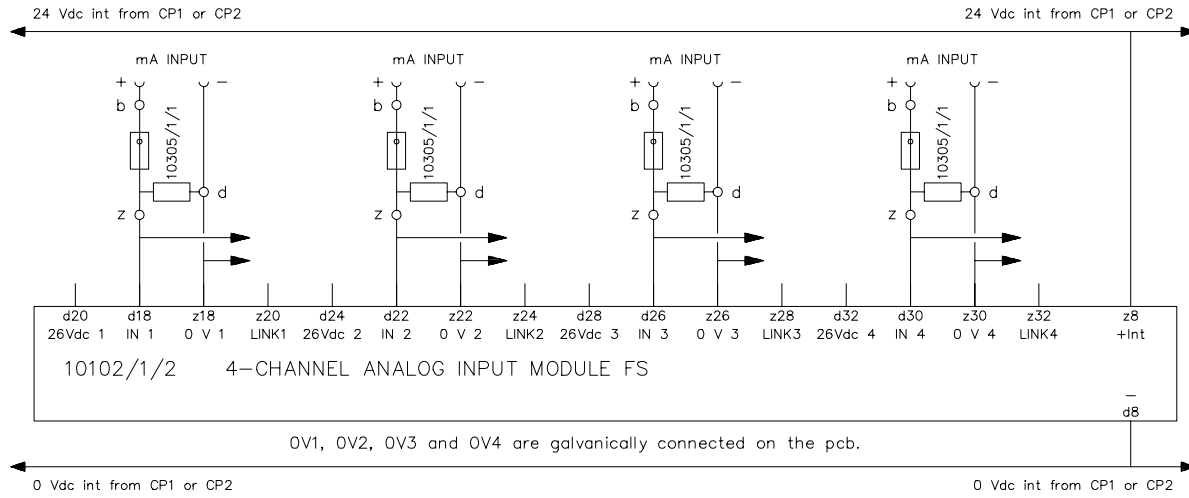


Figure 3 Connection example for redundant I/O configurations 0(4)-20 mA (passive)

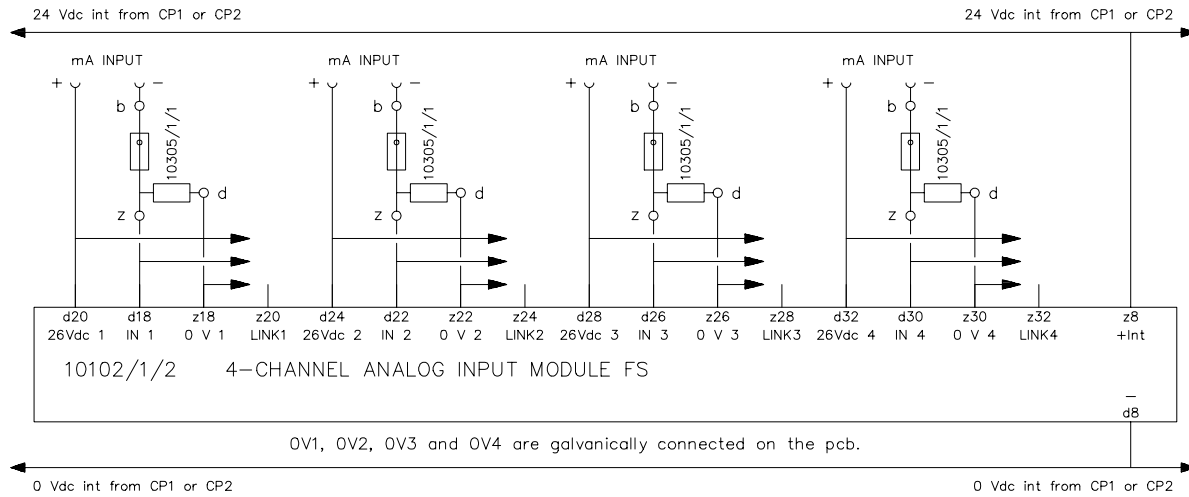


Figure 4 Connection example for redundant I/O configurations 0(4)-20 mA (active)



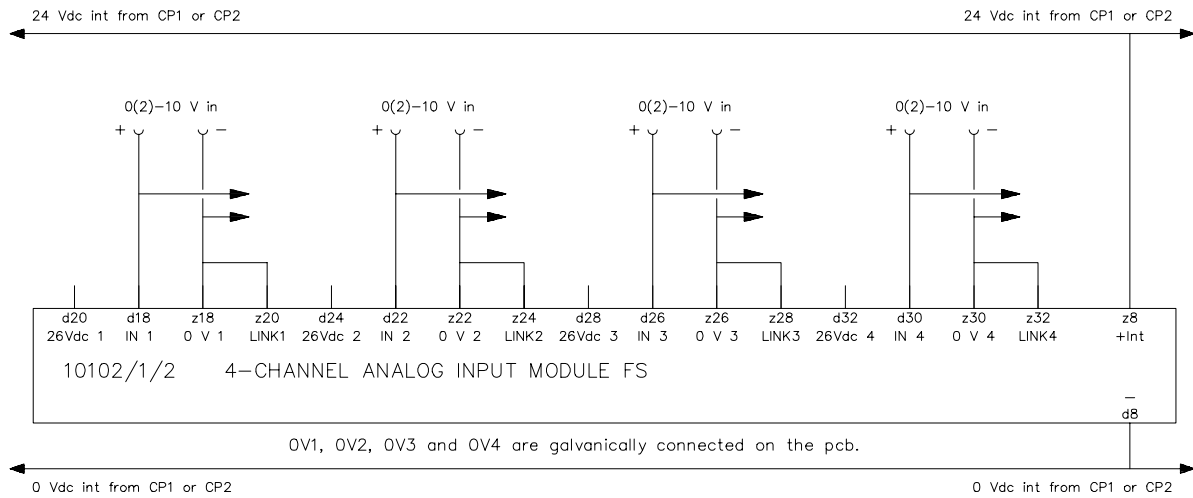


Figure 5 Connection example for redundant I/O configurations  
0(2)-10 V (passive)

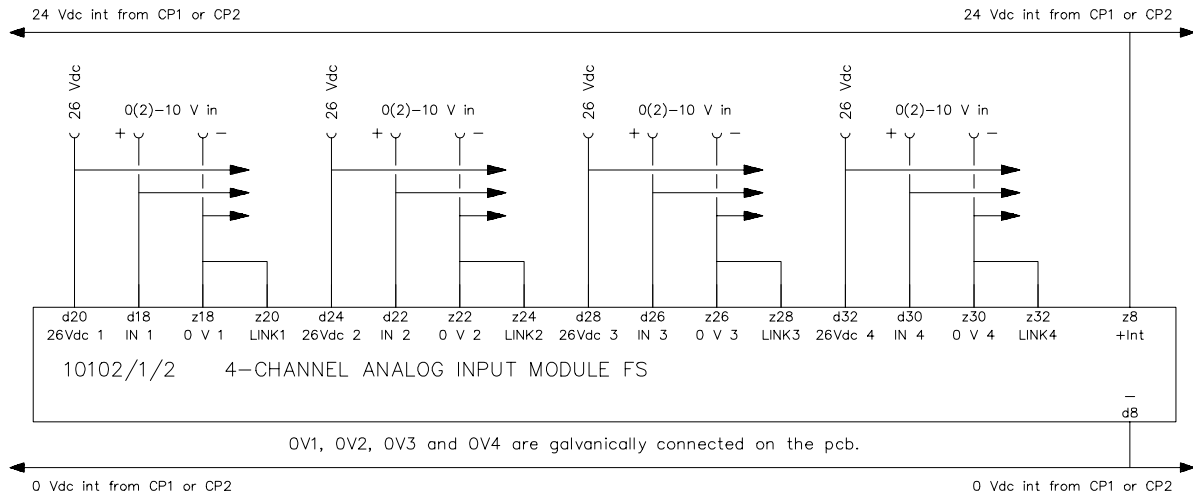


Figure 6 Connection example for redundant I/O configurations  
0(2)-10 V (active)

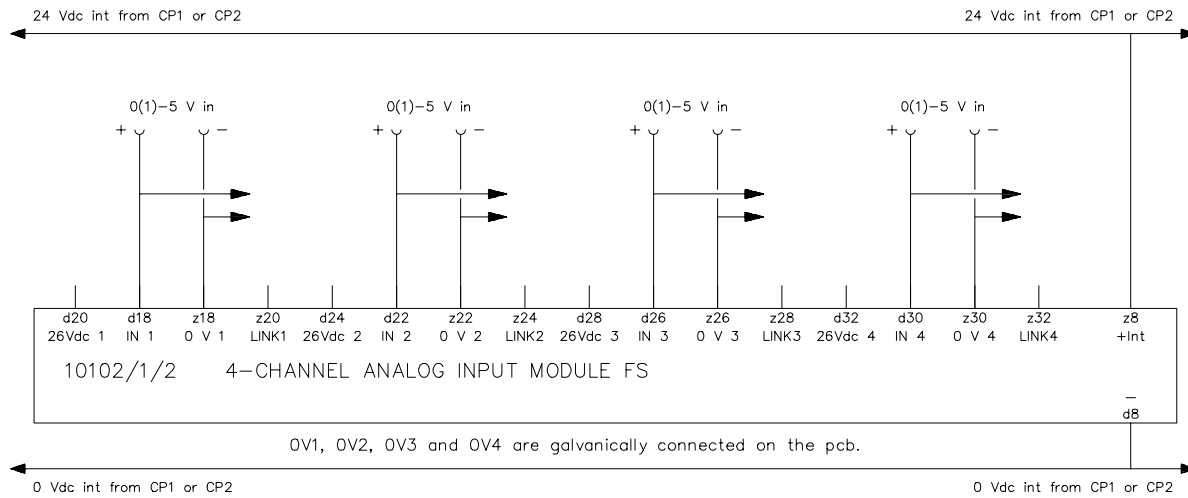


Figure 7 Connection example for redundant I/O configurations  
0(1)-5 V (passive)

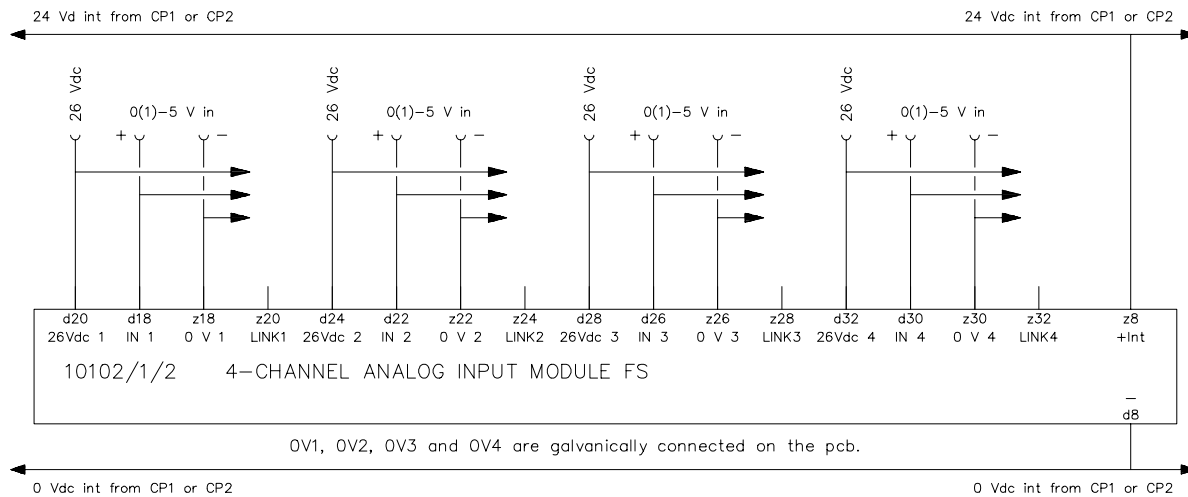


Figure 8 Connection example for redundant I/O configurations  
0(1)-5 V (active)



## Calibration

The 10102/1/2 module has potentiometers for calibration purposes (P1, P2, P4, P5). The module can be calibrated using the calibration option of the 'View FSC system and process status' program, an external calibrator, an extender module and an extender flatcable.

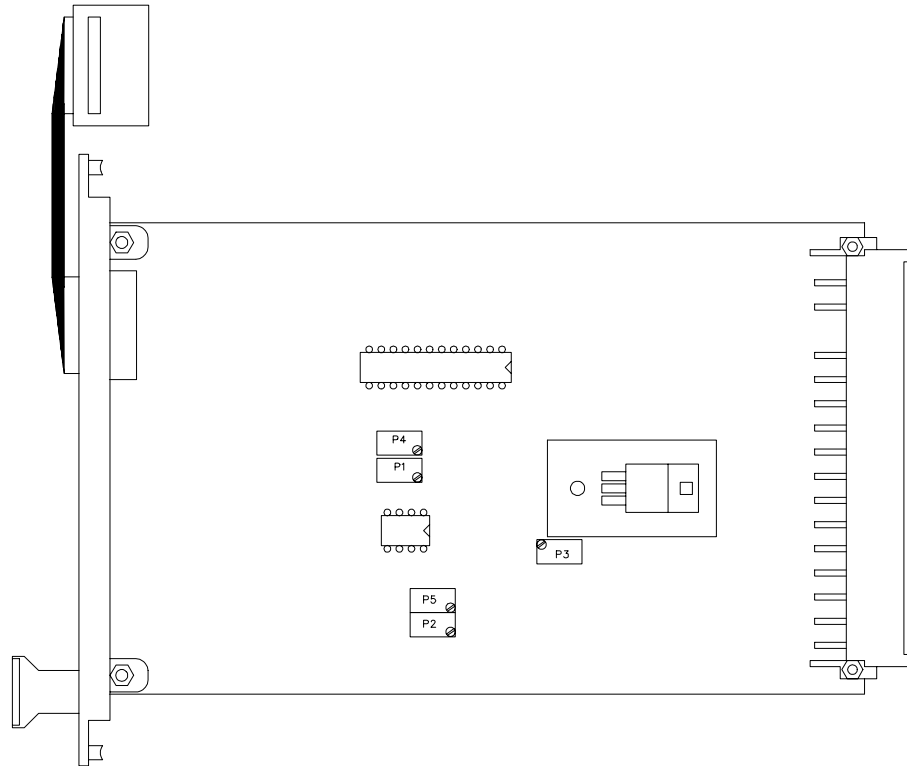


Figure 9 Location of potentiometers on 10102/1/2 module

## Technical data

The 10102/1/2 module has the following specifications:

<b>General</b>	Type number:	10102/1/2 01903*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.77
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 30 mA 24 Vdc 175 mA + 25 mA for each active input



## Technical data (continued)

<b>Input</b>	Number of input channels:	4
	Input specification (V):	0-10 / 2-10 V and 0-5 / 1-5 V
	Input resistance:	0(1)-5 V: 333 kOhm 0(2)-10 V: 250 kOhm
	Loop powering:	26 Vdc ( $\pm 1$ V for $0.2\text{mA} < I < 20\text{mA}$ )*, short-circuit protected
	Loop current limit:	> 20 mA solid state
	A/D converter:	12-bit
	Inaccuracy:	$\leq 0.75\%$
	Absolute max. input signal:	-150% or +200% of selected range*
	<b>Key coding</b>	(See 'Key coding' data sheet)
	Module code:	
	– hole	A27
	– pins	C11, C19, C31
	Rack code:	
	– blind stops	C3, C23, C27
	– large pin	A27

---

### \* Notes:

10102/1/2 modules without a suffix code have 23 Vdc solid state loop powering.

10102/1/2 modules with suffix code 01902 and higher have a maximum input signal of  $\pm 150$  Vdc.

---

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## 10102/2/1

# Fail-safe analog input module (4 channels)

### Description

The fail-safe analog input module 10102/2/1 has four 0-2 V analog input channels. The analog inputs have a common 0 V connection, but are galvanically isolated from the 24 Vdc and 5 Vdc.

The analog inputs can either be used actively (i.e. each input has a separate 26 Vdc, > 20 mA short-circuit protected output) or passively (i.e. the supply is directly connected to the transmitter).

The 10102/2/1 input stage has a high input impedance. It is therefore allowed to connect two 10102/2/1 modules in parallel. Each input requires an analog input converter module 10102/A/. (see the 10102/A/. data sheets).

### Note:

As the inputs require a 10102/A/. converter module, the 10102/2/1 module can only be used in combination with an I/O backplane in the rack.

The analog input module scans the analog inputs, the 26 V output voltages, the internal supply voltages, and a reference voltage generated by a D/A converter. This D/A converter generates several reference voltages which are used to test the analog input module completely. The self-test includes a leakage test of the input filter as this could influence the accuracy of the analog input value.

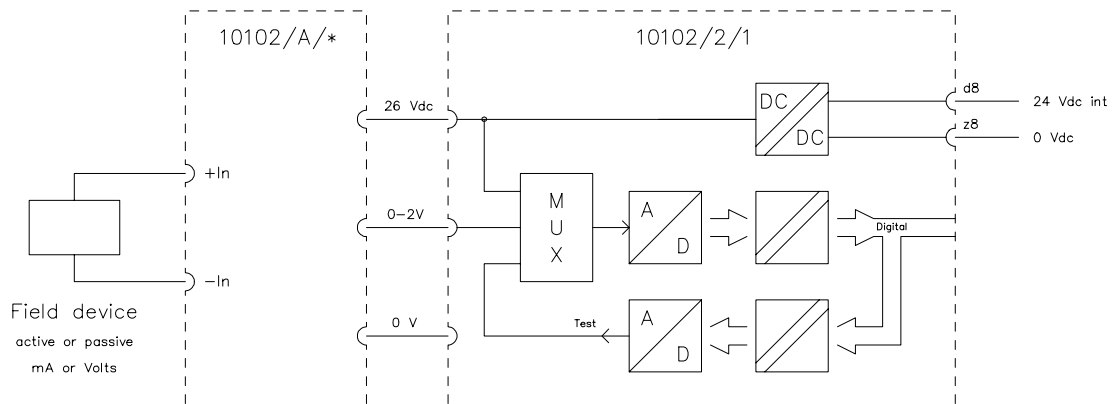


Figure 1 Schematic diagram for connection of inputs to the 10102/2/1 module



Within the configured process safety time, the analog inputs are tested for:

- absolute accuracy,
- correct conversion over full range,
- crosstalk between inputs, and
- output voltage of the 26 Vdc outputs.

The 26 Vdc outputs are generated by the DC/DC converter and stabilized at 26 Vdc. They are therefore independent of the voltage of the incoming 24 Vdc.

---

**Note:**

The maximum output current is at least 21 mA. If the transmitters require a higher supply current, the input channel must be used in passive mode (= external supply).

---

## Analog input ranges for FSC

Table 1 provides an overview of the analog input ranges for the FSC system, and how the 10102/2/1 module can be used for each of these ranges.

Table 1 Overview of analog inputs for FSC

0(4)-20 mA	Internal power	10102/2/1 + 10102/A/1
0(4)-20 mA	External power	10102/2/1 + 10102/A/2
0(1)-5 V	External power	10102/2/1 + 10102/A/3
0(2)-10 V	External power	10102/2/1 + 10102/A/4
Loop-monitored digital input		10102/2/1 + 10102/A/5

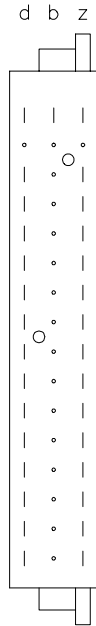
Other analog input signals such as thermocouple, PT-100, etc. can only be used after conversion to one of the analog input ranges that the FSC system can handle.

---



## Pin allocation

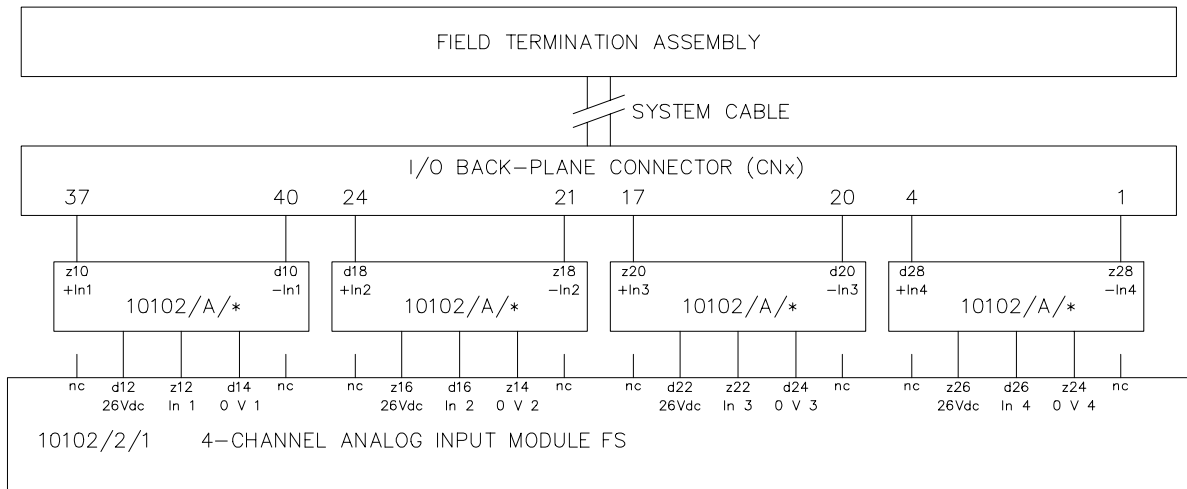
The back view and pin allocation of the 10102/2/1 module connector are as follows:



d2		b2	GND	z2	5 Vdc
d4	-			z4	-
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	(IN1-)			z10	(IN 1+)
d12	26 Vdc 1			z12	IN 1
d14	0 V 1			z14	0 V 2
d16	IN 2			z16	26 Vdc 2
d18	(IN 2+)			z18	(IN 2-)
d20	(IN 3-)			z20	(IN 3+)
d22	26 Vdc 3			z22	IN 3
d24	0 V 3			z24	0 V 4
d26	IN 4			z26	26 Vdc 4
d28	(IN 4+)			z28	(IN 4-)
d30				z30	
d32				z32	

## Connection example

Figure 2 shows a connection example for the fail-safe analog input module 10102/2/1.



OV1, OV2, OV3 and OV4 are galvanically connected on the pcb.

Figure 2 Connection example of 10102/2/1 module to FTA for both non-redundant and redundant I/O configurations

## Calibration

The 10102/2/1 module has potentiometers for calibration purposes (P1, P2, P4, P5). The module can be calibrated using the calibration option of the 'View FSC system and process status' program, an external calibrator, an extender module and an extender flatcable.

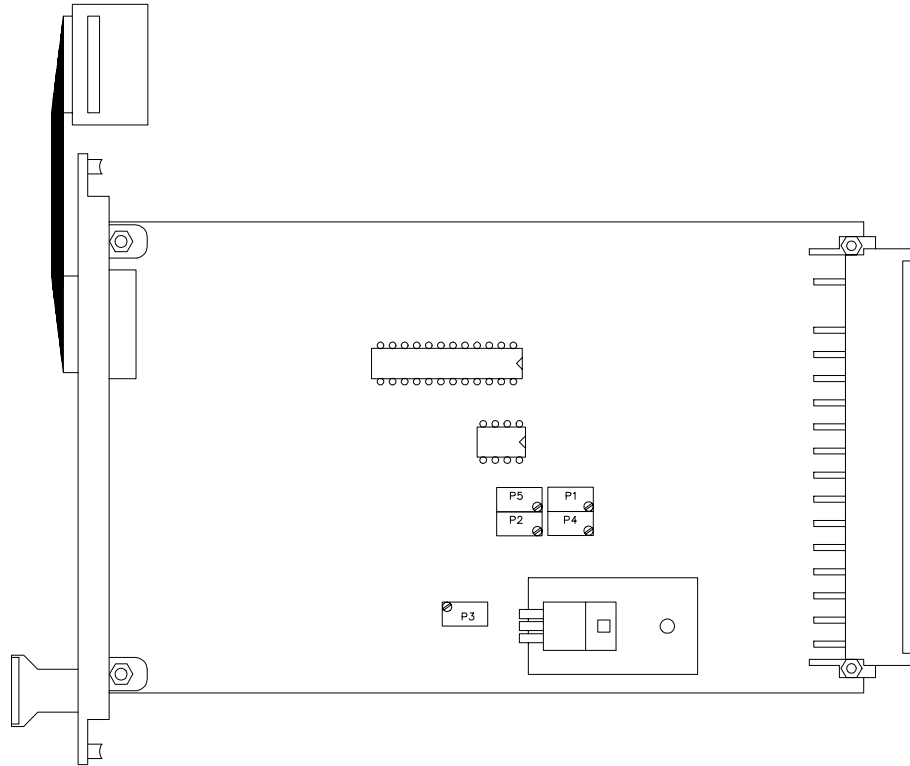


Figure 3 Location of potentiometers on 10102/2/1 module

## Technical data

The 10102/2/1 module has the following specifications:

<b>General</b>	Type number:	10102/2/1 11301*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 30 mA 24 Vdc 175 mA + 25 mA for each active input





## Technical data (continued)

<b>Input</b>	Number of input channels:	4
	Input specification (V):	0-2 Vdc
	Input resistance:	> 100 kOhm
	Loop powering:	26 Vdc ( $\pm 1$ V for $0.2 \text{ mA} < I < 20 \text{ mA}$ ), short-circuit protected
	Loop current limit:	> 21 mA solid state
	A/D converter:	12-bit
	Inaccuracy:	$\leq 0.75\%$
	Absolute max. input signal:	$\pm 5$ Vdc

## Key coding

(See 'Key coding' data sheet)

Module connector code:

– holes A5, C17

Rack connector code:

– large pins A5, C17

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### \* Notes:

10102/2/1 modules with suffix code 11301 have improved EMC behavior.

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## 10102/A/. Analog input converter modules

### Description

The analog inputs of a 10102/2/1 module require 10102/A/. analog input converter modules to convert the field signal to a 0-2 V signal for the 10102/2/1 module.

The 10102/A/. modules are placed on a programming connector (Px) on the back of the I/O backplane in the 19-inch rack. To assist proper placement of these 10102/A/. modules, a 10102 positioning print can be placed on the programming connector.

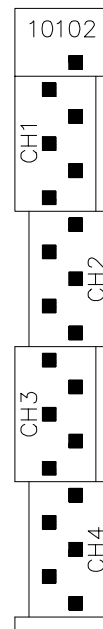


Figure 1 10102 positioning print

The printed circuit board of a 10102/A/. module should be oriented to slide into the cut-out zone of the appropriate channel.

Redundant channels require only one 10102/A/. module per channel.

## 10102/A/1

## 0(4)-20 mA internal power

### Description

The 10102/A/1 analog input converter converts a 0(4)-20 mA field signal to 0-2 V signal for one 10102/2/1 input channel.

The 10102/A/1 module supplies the 26 Vdc power to the field.

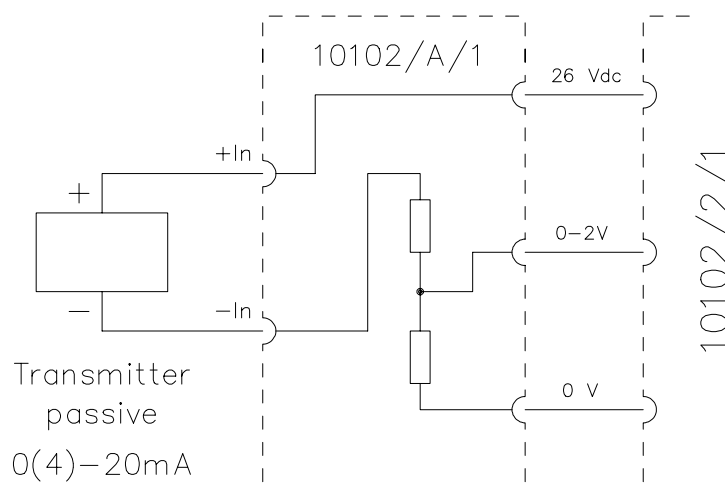


Figure 2 Schematic diagram of 10102/A/1 module

### Technical data

The 10102/A/1 module has the following specifications:

<b>General</b>	Type number:	10102/A/1
	Approvals:	CE, TÜV, UL
	Dimensions:	23 x 12.7 x 9 mm (0.91 x 0.5 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	26 Vdc (supplied by 10102/2/1 module)
<b>Input</b>	Number of input channels:	1
	Input current:	0-20 / 4-20 mA
	Maximum loop resistance:	800 Ohm
	Input resistance:	250 Ohm 0.1%
	Transmitter voltage:	21 Vdc ( $\pm 1$ V at 20 mA)
	Loop current limit:	> 20 mA solid state
	Absolute max. input signal:	$\pm 50$ mA



## 10102/A/2

## 0(4)-20 mA external power

### Description

The 10102/A/2 analog input converter module converts a 0(4)-20 mA field signal to a 0-2 V signal for one 10102/2/1 input channel. The 10102/A/2 module does not supply energy to the field.

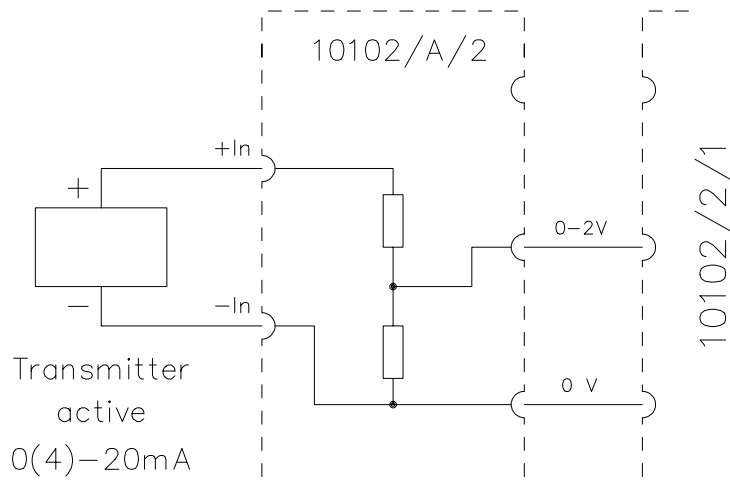


Figure 3 Schematic diagram of 10102/A/2 module

### Technical data

The 10102/A/2 module has the following specifications:

<b>General</b>	Type number:	10102/A/2
	Approvals:	CE, TÜV, UL
	Dimensions	23 x 12.7 x 9 mm (0.91 x 0.5 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none
<b>Input</b>	Number of input channels:	1
	Input current:	0-20 / 4-20 mA
	Input resistance:	250 Ohm 0.1%
	Absolute max. input signal:	± 50 mA

## 10102/A/3

## 0(1)-5 Vdc external power

### Description

The 10102/A/3 analog input converter module converts a 0(1)-5 Vdc field signal to a 0-2 V signal for one 10102/2/1 input channel. The 10102/A/3 module does not supply energy to the field.

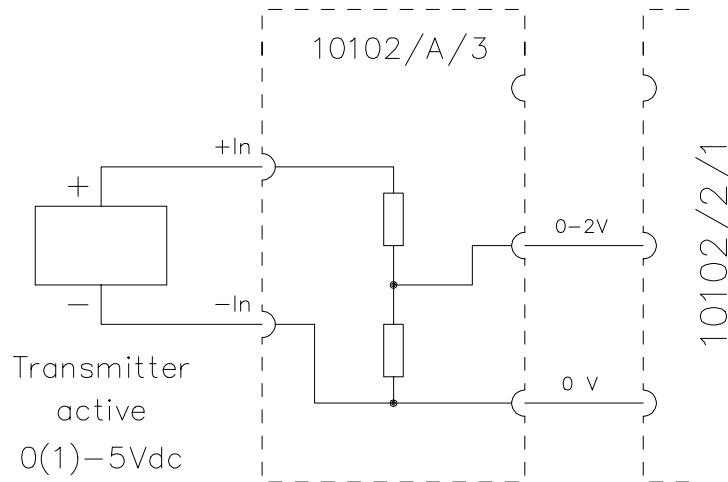


Figure 4 Schematic diagram of 10102/A/3 module

### Technical data

The 10102/A/3 module has the following specifications:

<b>General</b>	Type number:	10102/A/3
	Approvals:	CE, TÜV, UL
	Dimensions	23 x 12.7 x 9 mm (0.91 x 0.5 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none
<b>Input</b>	Number of input channels:	1
	Input voltage:	0-5 / 1-5 V
	Input resistance:	2.5 kOhm 1%
	Absolute max. input signal:	± 12.5 Vdc



## 10102/A/4

## 0(2)-10 Vdc external power

### Description

The 10102/A/4 analog input converter module converts a 0(2)-10 Vdc field signal to a 0-2 V signal for one 10102/2/1 input channel. The 10102/A/4 module does not supply energy to the field.

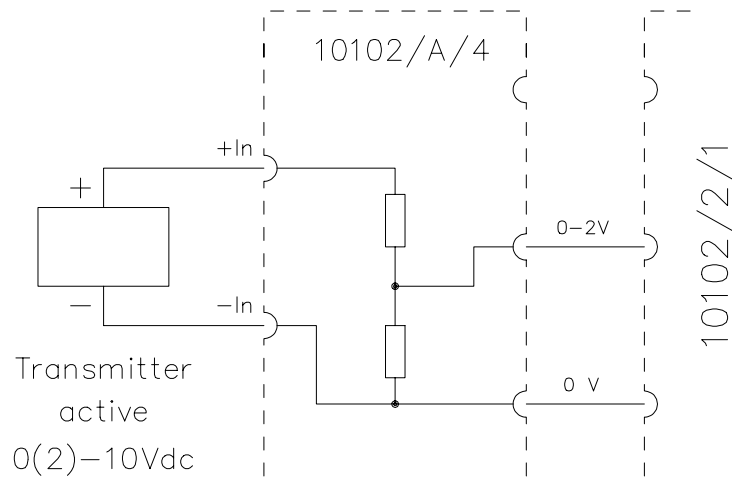


Figure 5 Schematic diagram of 10102/A/4 module

### Technical data

The 10102/A/4 module has the following specifications:

<b>General</b>	Type number:	10102/A/4
	Approvals:	CE, TÜV, UL
	Dimensions	23 x 12.7 x 9 mm (0.91 x 0.5 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none
<b>Input</b>	Number of input channels:	1
	Input voltage:	0-10 / 2-10 V
	Input resistance:	5 kOhm 1%
	Absolute max. input signal:	$\pm 25$ Vdc

## 10102/A/5

## Loop-monitored digital input

### Description

The 10102/A/5 digital input converter module converts a field contact with appropriate resistors to a 0-2 V signal for one 10102/2/1 input channel

The field resistors must be at least 0.25 W, 10%, and should be placed as close to the actual field contact as possible.

The 10102/A/5 module supplies the 26 Vdc power to the field.

The actual 'loop-monitored' digital input result is obtained by assigning a functional block to this input (in the application program).

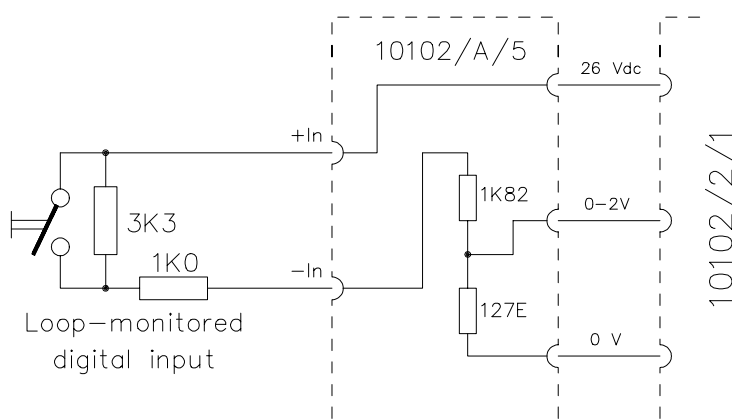


Figure 6 Schematic diagram of 10102/A/5 module

### Technical data

The 10102/A/5 module has the following specifications:

<b>General</b>	Type number:	10102/A/5
	Approvals:	CE, TÜV, UL
	Dimensions:	23 x 12.7 x 9 mm (0.91 x 0.5 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	26 Vdc (supplied by 10102/2/1 module)
<b>Input</b>	Number of input channels:	1
	Lead breakage voltage:	approx. 26 Vdc
	Input resistance:	approx. 2 kOhm
	Short-circuit current:	approx. 13 mA





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## 10103/1/1

## Intrinsically safe input module (4 channels)

### Description

The 10103/1/1 input module has four input channels which comply with DIN 19234 and NAMUR. They may be used in intrinsically safe area class [EEx ia] IIC. The inputs are not tested, which means that they may **not** be used for fail-safe applications.

The four inputs can be used to connect contact inputs (with line terminator resistors) or proximity sensors. They are fully galvanically separated from each other and from the 24 Vdc and 5 Vdc.

10103/1/1 modules can only be used in non-redundant I/O configurations as it is **not** allowed to interconnect intrinsically safe inputs from different 10103/1/1 modules. This would violate the [EEx ia] IIC approved rules. Inputs from the same 10103/1/1 module may be interconnected, as shown in the 10207/1/1 data sheet (intrinsically safe BCD multiplexer with 10207/1/1 module).

The module front has four channel LEDs and one (yellow) error LED. If a short-circuit or a lead breakage occurs, the channel LED and the common error LED go on. All channels have lead breakage detection circuits, which can be disabled separately by means of links on the connector (LB to -IN).

An enabled lead breakage circuit generates a 'short-circuit' signal during lead breakage. The software handles a 'short-circuit' signal as an open input.

Unused channels should be linked (LB to -IN) to keep the error LED function available to the used channels.

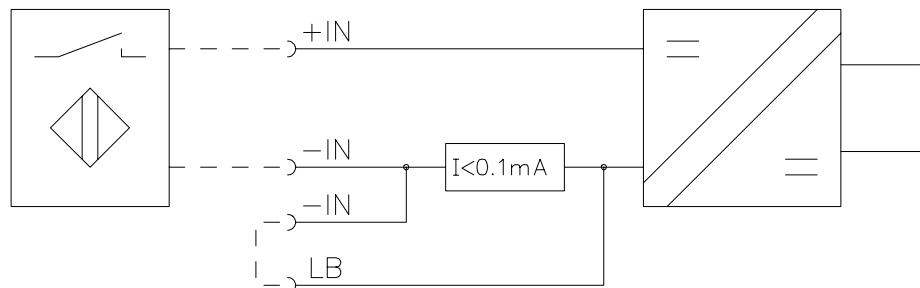


Figure 1 Schematic diagram for connection of one input to the 10103/1/1 module



The yellow error LED is on if one or more inputs of the module show lead breakage or short circuit. The inputs can be connected to a switch (with external resistors) or to a NAMUR sensor. The external resistors should be mounted as close to the switch as possible, because the lead breakage and/or the short-circuit detection does not monitor the wires between the resistors and the switch.

The recommended resistor values are 10 kOhm ( $\pm 10\%$ ) for the parallel resistor and 1 kOhm ( $\pm 10\%$ ) for the series resistor.

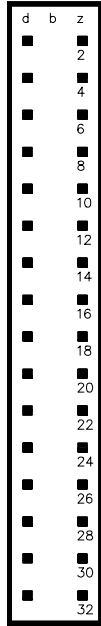
Table 1 Input connections and functions of 10103/1/1 module

	Channel LED	Lead breakage detection enabled	Channel during lead breakage
	OFF	YES	OFF
	ON		
	OFF	YES	OFF
	ON		
	OFF	NO	OFF
	ON		



## Pin allocation

The back view and pin allocation of the 10103/1/1 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8		z8	
d10	Link	z10	Link
d12	Supply 0 Vdc	z12	Supply 24 Vdc
d14		z14	
d16		z16	
d18	LB 1	z18	IN 1-
d20	IN 1-	z20	IN 1+
d22	LB 2	z22	IN 2-
d24	IN 2-	z24	IN 2+
d26	LB 3	z26	IN 3-
d28	IN 3-	z28	IN 3+
d30	LB 4	z30	IN 4-
d32	IN 4-	z32	IN 4+

## Connection example

The figure below shows a connection example for the intrinsically safe input module 10103/1/1.

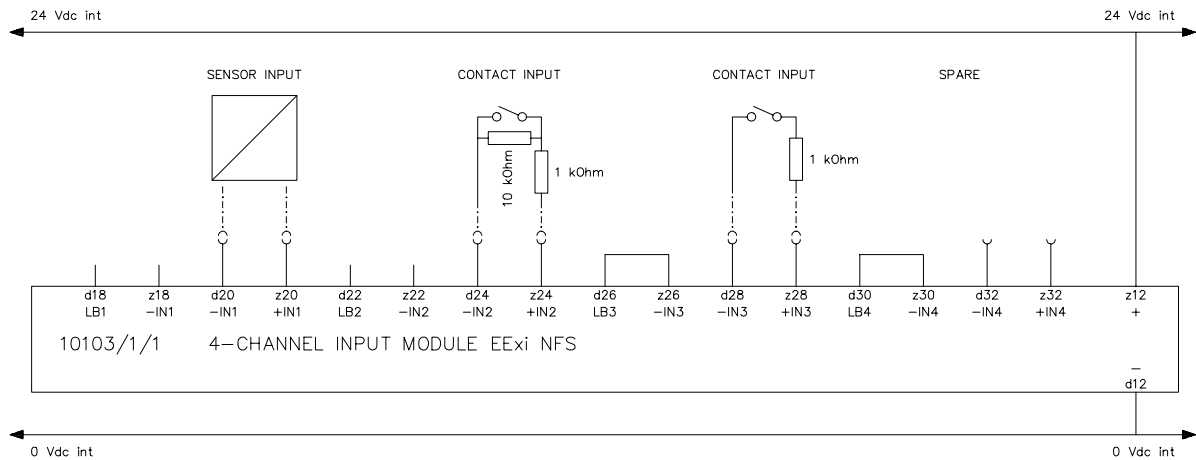


Figure 2 Connection example for non-redundant I/O configurations



## Technical data

The 10103/1/1 module has the following specifications:

<b>General</b>	Type number:	10103/1/1
	Approvals:	CE, TÜV, Baseefa
	Baseefa number:	Ex. 88B2354U
	class:	[EEx ia] IIC
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 1 mA 24 Vdc 60 mA
<b>Input</b>	In accordance with DIN 19234 and NAMUR	
	Number of input channels:	4
	Open voltage:	approx. 8 Vdc, max. 12.7 V
	Short-circuit current:	approx. 8 mA, max. 20 mA
	Switch point:	1.2 mA < I < 2.1 mA
	Hysteresis:	approx. 0.2 mA
	Input delay:	< 0.5 ms
	Lead breakage setpoint:	0.1 mA ± 50 µA

	in Eex ia applications		in EEx ib applications	
	IIB	IIC	IIB	IIC
Max. external capacitance $C_e$	≤ 1100 nF	≤ 415 nF	≤ 3900 nF	≤ 800 nF
Max. external inductance $L_e$	≤ 5 mH	≤ 2 mH	≤ 290 mH	≤ 76 mH

## Key coding

(See 'Key coding' data sheet)

Module code:

- hole A27
- pins C3, C19, C31

Rack code:

- blind stops C11, C23, C27
- large pin A27

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## 10103/1/2

# Intrinsically safe input module (4 channels)

### Description

The 10103/1/2 input module has four input channels which comply with DIN 19234 and NAMUR. They may be used in intrinsically safe area class [EEx ia] IIC. The inputs are not tested, which means that they may **not** be used for fail-safe applications.

The four inputs can be used to connect contact inputs or proximity sensors. They are fully galvanically separated from each other and from the 24 Vdc and 5 Vdc.

10103/1/2 modules can only be used in non-redundant I/O configurations as it is **not** allowed to interconnect intrinsically safe inputs from different 10103/1/2 modules. This would violate the [EEx ia] IIC approved rules. Inputs from the same 10103/1/2 module may be interconnected, as shown in the 10207/1/1 data sheet (intrinsically safe BCD multiplexer with 10207/1/1 module).

The module front has four channel LEDs and one (disabled) error LED. All channels have lead breakage detection circuits, which can be disabled separately by means of links on the connector (LB to -IN). An enabled lead breakage detection circuit generates a 'closed contact' signal during lead breakage.

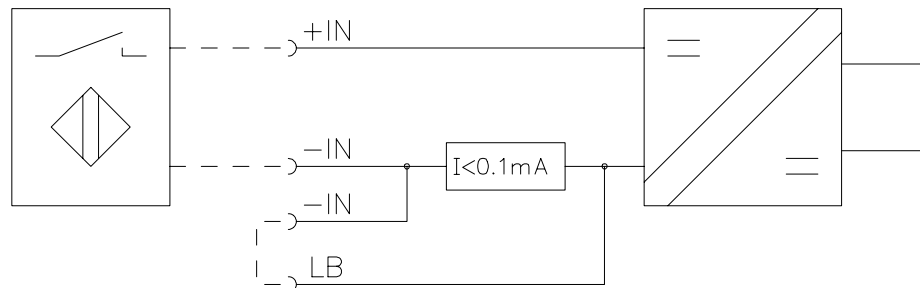


Figure 1 Schematic diagram for connection of one input to the 10103/1/2 module

The lead breakage or short-circuit information of the 10103/1/2 module is ignored by the software. The inputs can be connected to a switch (with or without external resistors) or to a NAMUR sensor. The recommended resistor values are 10 kOhm ( $\pm 10\%$ ) for the parallel resistor and 1 kOhm ( $\pm 10\%$ ) for the series resistor.



Table 1 Input connections and functions of 10103/1/2 module

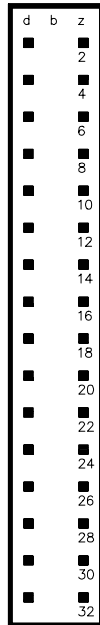
	Channel LED	Channel during lead breakage
	OFF	ON
	ON	
	OFF	ON
	ON	
	OFF	ON
	ON	
	OFF	OFF
	ON	
	OFF	OFF
	ON	





## Pin allocation

The back view and pin allocation of the 10103/1/2 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8		z8	
d10	Link	z10	Link
d12	Supply 0 Vdc	z12	Supply 24 Vdc
d14		z14	
d16		z16	
d18	LB 1	z18	IN 1-
d20	IN 1-	z20	IN 1+
d22	LB 2	z22	IN 2-
d24	IN 2-	z24	IN 2+
d26	LB 3	z26	IN 3-
d28	IN 3-	z28	IN 3+
d30	LB 4	z30	IN 4-
d32	IN 4-	z32	IN 4+

## Connection example

The figure below shows a connection example for the intrinsically safe input module 10103/1/2.

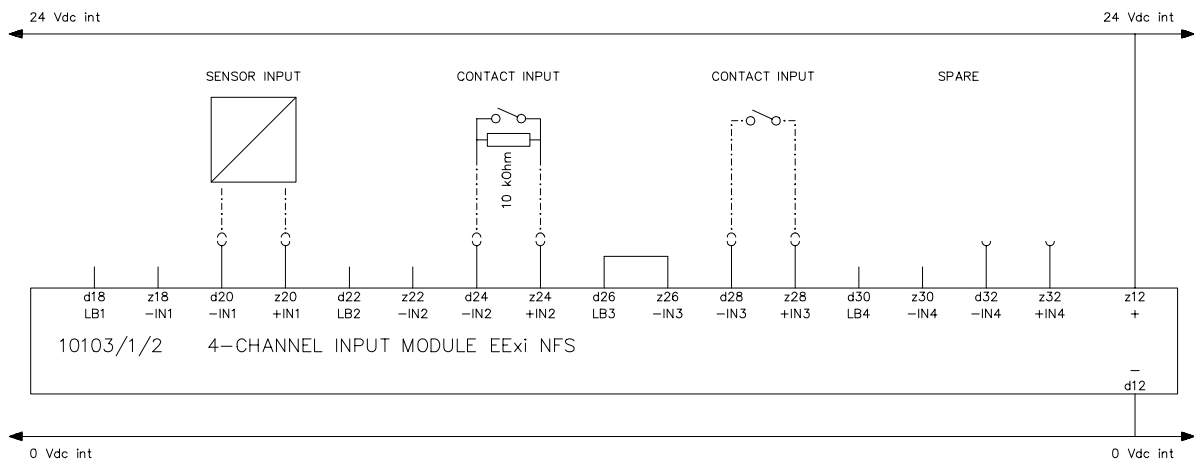


Figure 2 Connection example for non-redundant I/O configurations



**Technical data** The 10103/1/2 module has the following specifications:

**General**

Type number: 10103/1/2

Approvals: CE, TÜV, Baseefa

Baseefa number: Ex. 88B2354U

class: [EEx ia] IIC

Software versions: all

Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

**Power**

Power requirements: 5 Vdc 1 mA  
24 Vdc 60 mA

**Input**

In accordance with DIN 19234 and NAMUR

Number of input channels: 4

Open voltage: approx. 8 Vdc, max. 12.7 V

Short-circuit current: approx. 8 mA, max. 20 mA

Switch point: 1.2 mA < I < 2.1 mA

Hysteresis: approx. 0.2 mA

Input delay: < 0.5 ms

Lead breakage setpoint: 0.1 mA ± 50 µA

	in Eex ia applications		in EEx ib applications	
	IIB	IIC	IIB	IIC
Max. external capacitance Ce	≤ 1100 nF	≤ 415 nF	≤ 3900 nF	≤ 800 nF
Max. external inductance Le	≤ 5 mH	≤ 2 mH	≤ 290 mH	≤ 76 mH

**Key coding** (See 'Key coding' data sheet)

Module code:

- hole A27
- pins C3, C19, C31

Rack code:

- blind stops C11, C23, C27
- large pin A27

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## 10104/1/1 Digital input module (24 Vdc, 16 channels)

### Description

The digital input module 10104/1/1 has sixteen 24 Vdc digital input channels. The inputs are not tested, which means that they may *not* be used for fail-safe applications.

The 24 Vdc circuitry is split into two isolated groups of eight inputs each. This enables powering the two input groups from two independent power supply groups to support segregation in a process unit and/or subunit structure.

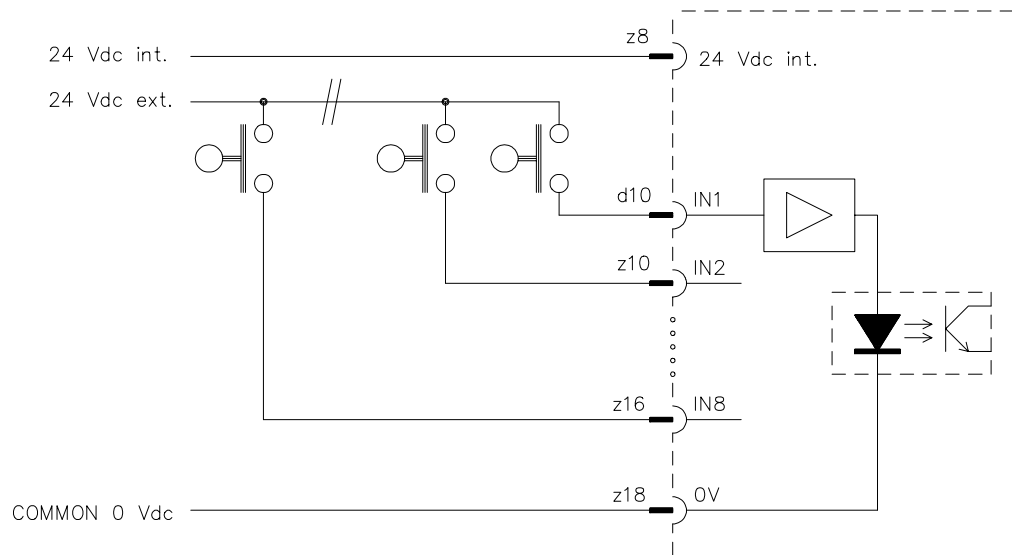
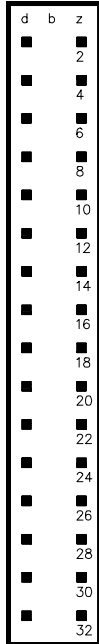


Figure 1 Schematic diagram for connection of inputs to one input group of the 10104/1/1 module



## Pin allocation

The back view and pin allocation of the 10104/1/1 rack connector are as follows:



d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	(Supply 24 Vdc (1))	z8	Supply 24 Vdc (1)
d10	IN 1	z10	IN 2
d12	IN 3	z12	IN 4
d14	IN 5	z14	IN 6
d16	IN 7	z16	IN 8
d18	(Supply 0 Vdc(1))	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22	(Supply 24 Vdc (2))	z22	Supply 24 Vdc (2)
d24	IN 9	z24	IN 10
d26	IN 11	z26	IN 12
d28	IN 13	z28	IN 14
d30	IN 15	z30	IN 16
d32	(Supply 0 Vdc (2))	z32	Supply 0 Vdc (2)

## Connection examples

The figures below show a number of connection examples for the digital input module 10104/1/1.

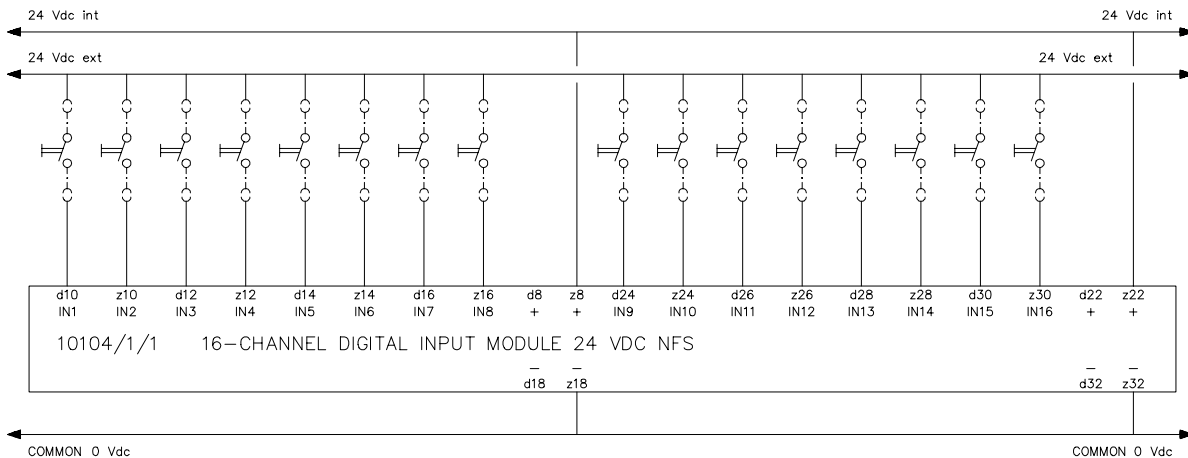


Figure 2 Connection example for non-redundant I/O configurations

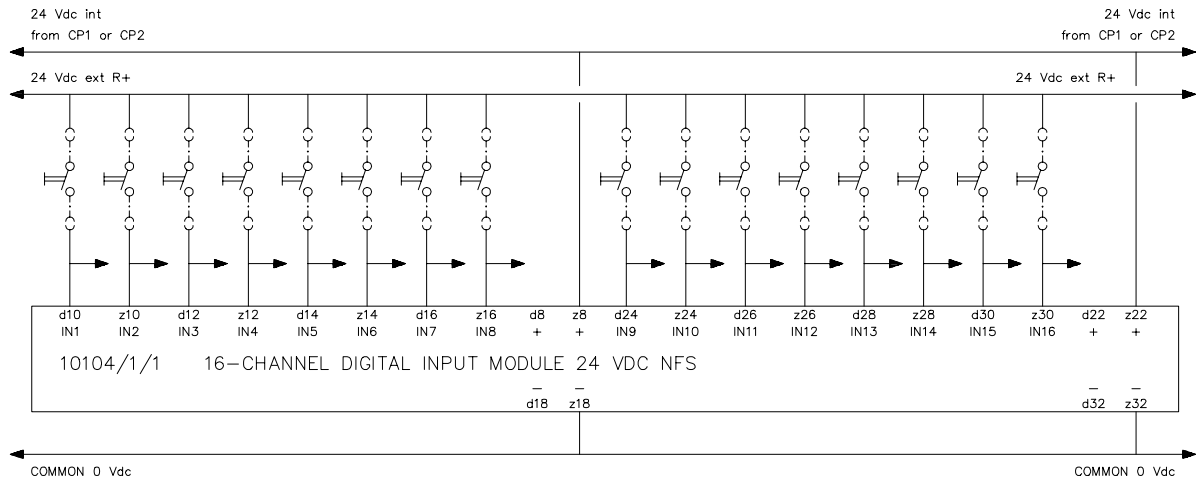


Figure 3 Connection example for redundant I/O configurations

## Technical data

The 10104/1/1 module has the following specifications:

### General

Type number: 10104/1/1  
 Approvals: CE, TÜV, UL  
 Software versions: all  
 Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

### Power

Power requirements: 5 Vdc 1 mA  
 24 Vdc 2\*70 mA (incl. input currents)

### Input

Number of input channels: 16 (2 isolated groups of 8)  
 Maximum input voltage: 36 Vdc  
 Input current: 7 mA at 24 Vdc  
 Input HIGH: > 15 Vdc  
 Input LOW: < 5 Vdc (I < 1 mA)  
 Input delay: typically 10 ms

### Key coding

(See 'Key coding' data sheet):

Module code:

- hole A27
- pins C11, C19, C23

Rack code:

- blind stops C3, C27, C31
- large pins A27



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## 10104/2/1

## Digital input module (24 Vdc, 16 channels)

### Description

The digital input module 10104/2/1 has sixteen 24 Vdc digital input channels. The inputs are not tested, which means that they may *not* be used for fail-safe applications.

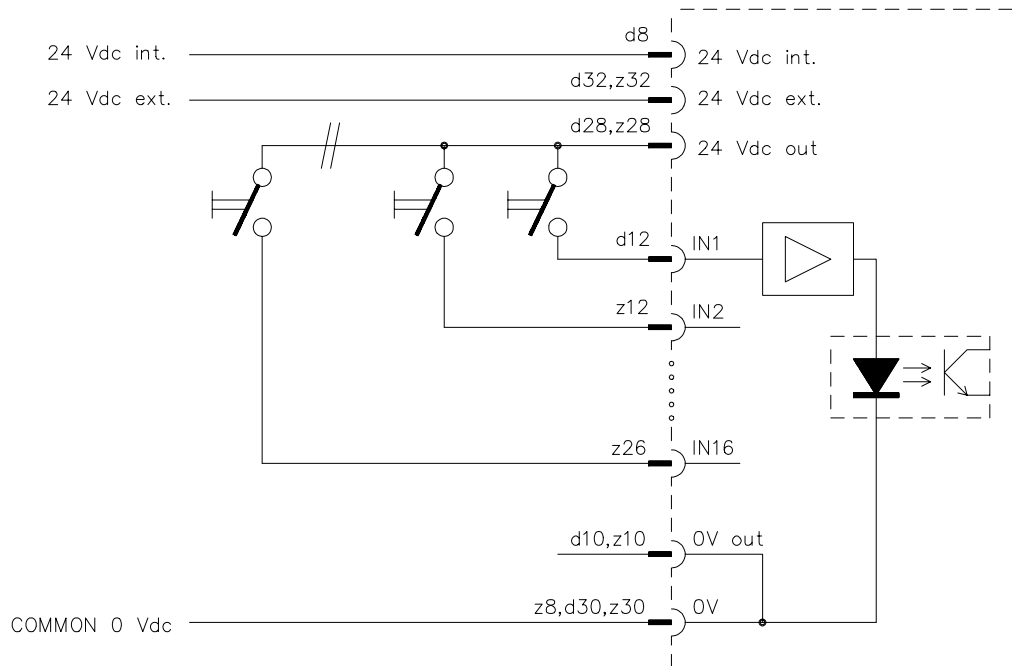
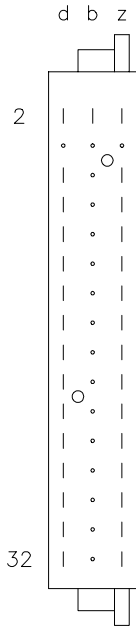


Figure 1 Schematic diagram for connection of inputs to the 10104/2/1 module



## Pin allocation

The back view and pin allocation of the 10104/2/1 module connector are as follows:



d2		b2	GND	z2	5 Vdc
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	0 Vdc out			z10	0 Vdc out
d12	IN 1			z12	IN 2
d14	IN 3			z14	IN 4
d16	IN 5			z16	IN 6
d18	IN 7			z18	IN 8
d20	IN 9			z20	IN 10
d22	IN 11			z22	IN 12
d24	IN 13			z24	IN 14
d26	IN 15			z26	IN 16
d28	24 Vdc ext. out			z28	24 Vdc ext. out
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 24 Vdc ext.			z32	Supply 24 Vdc ext.

## Connection examples

The figures below show a number of connection examples for the digital input module 10104/2/1.

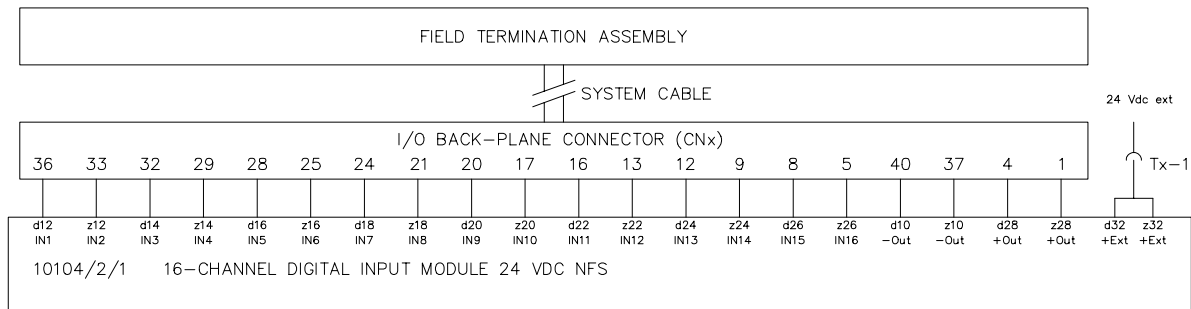


Figure 2 Connection example of 10104/2/1 module to FTA for both non-redundant and redundant I/O configurations



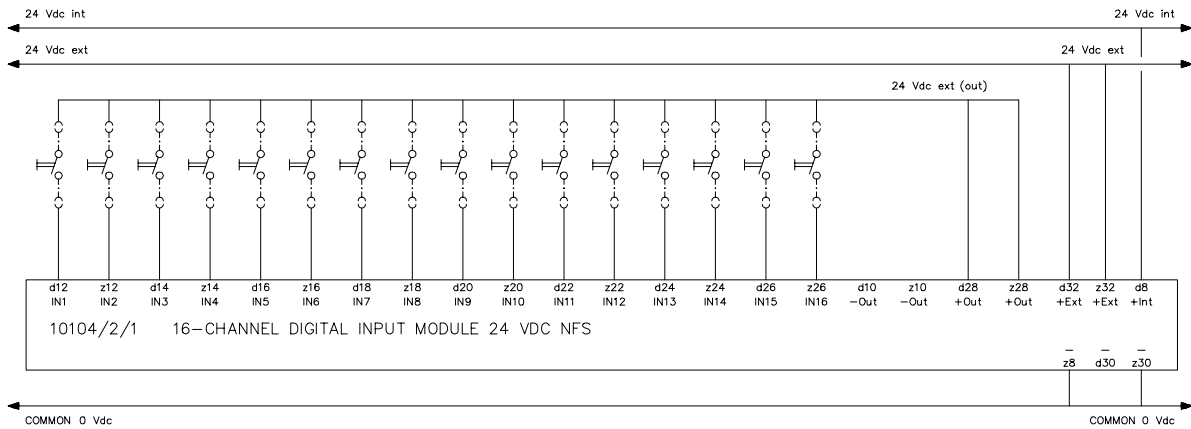


Figure 3 I/O connection example of 10104/2/1 module for non-redundant I/O configurations

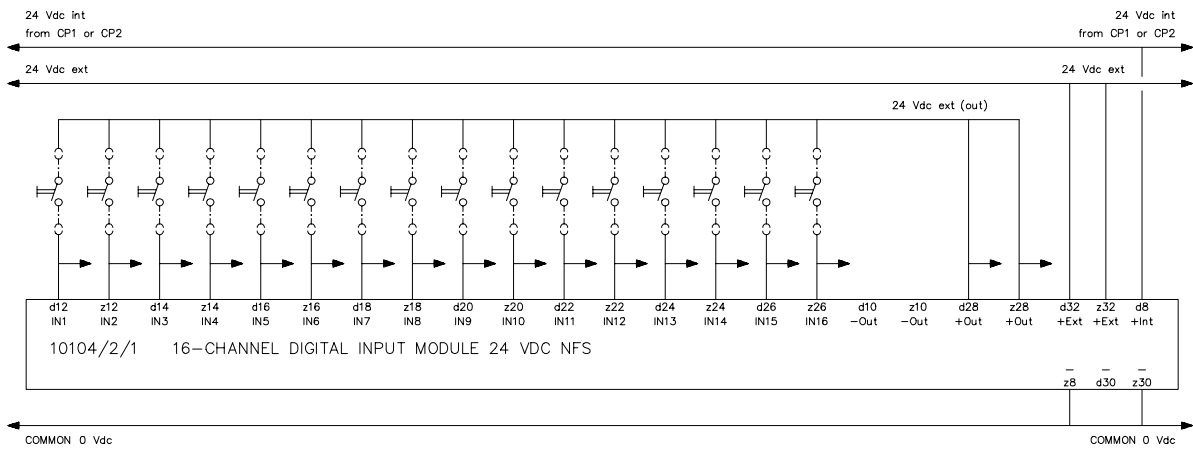


Figure 4 I/O connection example of 10104/2/1 module for redundant I/O configurations



## Technical data

The 10104/2/1 module has the following specifications:

<b>General</b>	Type number:	10104/2/1 12700
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 1 mA 24 Vdc int. 35 mA 24 Vdc ext. 100 mA (input currents)
	Ripple content (on 5 Vdc):	< 0.5 Vp-p (0-360 Hz)
<b>Input</b>	Number of input channels:	16
	Maximum input voltage:	36 Vdc
	Input current:	7 mA at 24 Vdc
	Input HIGH:	> 15 Vdc
	Input LOW:	< 9 Vdc (I < 2 mA)
	Input delay:	typically 10 ms
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module connector code:	
	– holes	A5, C21
	Rack connector code:	
– large pins	A5, C21	

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## 10105/2/1

# Fail-safe high-density analog input module (24 Vdc, 16 channels)

### Description

The analog input module 10105/2/1 has sixteen analog inputs (0-4 V) and an external voltage readback input (0-4 V). The sixteen channels are fail-safe (safety class AK5) and have an isolated analog 0 V common to all sixteen channels.

The analog inputs of the 10105/2/1 module require the field signals to be converted from 0-20 mA to a level that can be used by the 10105/2/1 module. This conversion can be established in two ways:

- on the field termination assembly module FTA-T-14, or
- using the analog input conversion module 10105/A/1, which is placed on a programming connector (P<sub>x</sub>) on the back of the I/O backplane in the 19-inch rack.

Analog input signals such as thermocouple, PT-100, etc. can only be used after conversion to 0(4)-20 mA using a dedicated converter (and an FTA-T-14 or 10105/A/1 module).

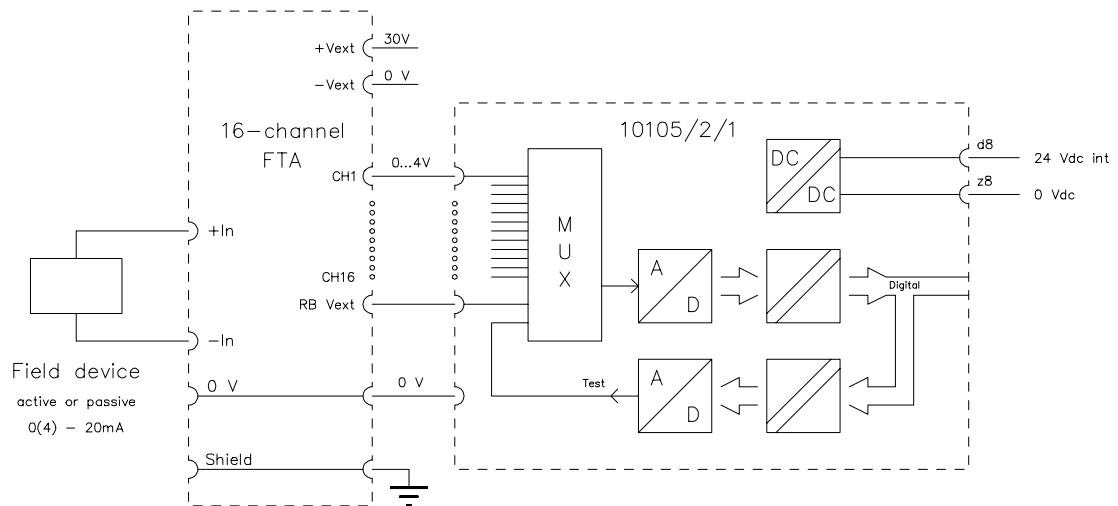


Figure 1 Schematic diagram for connection of inputs to 10105/2/1 module

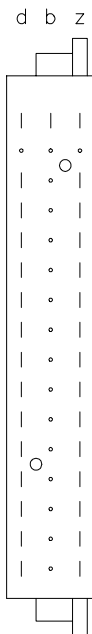


The self-test of the module, which is controlled by the FSC system's central processor unit (CPU), includes:

- absolute accuracy,
- correct conversion over the full range,
- crosstalk between inputs,
- channel input filters, and
- internal supply voltages.

## Pin allocation

The back view and pin allocation of the 10105/2/1 module connector are as follows:



d2		b2	GND	z2	5 Vdc
d4	–			z4	–
d6				z6	
d8	Int. 24 Vdc supply			z8	Int. 0 Vdc supply
d10	Analog ground			z10	Analog ground
d12	IN 1			z12	IN 2
d14	IN 3			z14	IN 4
d16	IN 5			z16	IN 6
d18	IN 7			z18	IN 8
d20	IN 9			z20	IN 10
d22	IN 11			z22	IN 12
d24	IN 13			z24	IN 14
d26	IN 15			z26	IN 16
d28	Analog ground			z28	Readback external power
d30				z30	
d32				z32	



## Connection examples

Figure 2 and Figure 3 below show typical connection examples for the 10105/2/1 module.

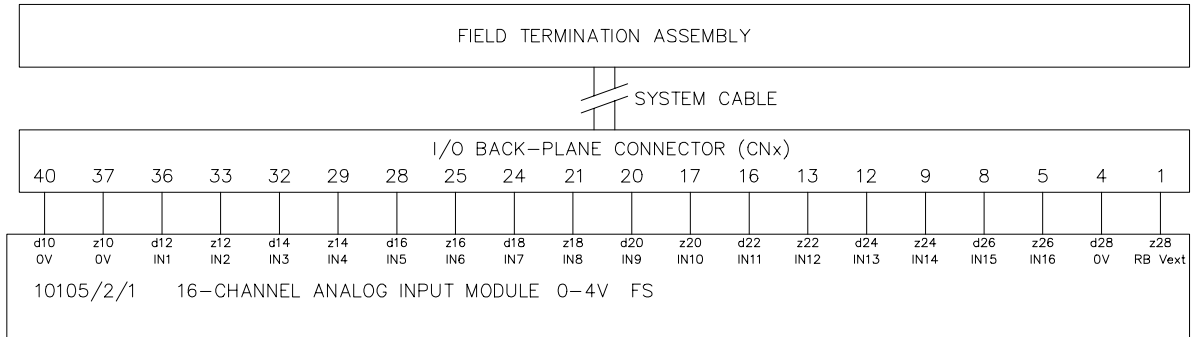


Figure 2 Connection example of 10105/2/1 module to FTA

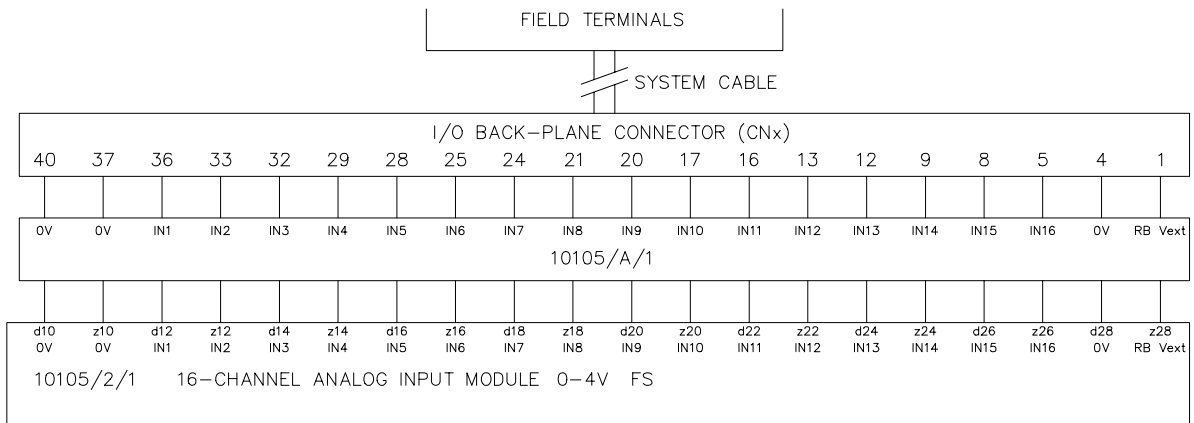


Figure 3 Connection example of 10105/2/1 module with signal converter 10105/A/1



## Technical data

The 10105/2/1 module has the following specifications:

<b>General</b>	Type number:	10105/2/1 16900
	Approvals:	CE; TÜV, UL approvals pending
	Safety class:	AK1-6 (AK6 in redundant mode)
	Software versions:	≥ 500
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 35 mA 24 Vdc 35 mA
	<b>Input</b>	Number of input channels: 16
	Input range:	0 to 4.1 V
	Input resistance:	> 1 MOhm
	A/D converter:	12-bit
	A/D converter inaccuracy:	± 1 LSB
	Module inaccuracy:	< 0.25%
	Absolute max. input signal:	± 36 Vdc
	Crosstalk between channels:	> 60 dB*
	External voltage readback:	
	– range	0 to 4.1 V
	– input resistance	typically 1 MOhm
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module connector code:	
	– holes	A5, C25
	Rack connector code:	
– large pins	A5, C25	

---

### \* Note:

Crosstalk is defined as follows:

A step response on one channel from 0 to 100% v.v. shall not influence any other analog input channel beyond its two least significant bits (LSBs), i.e.  $20 * \log(4 / 4096)$ .

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## 10105/A/1

## 0-25 mA to 0-4.1 V analog input converter module (16 channels)

### Description

The analog input converter module 10105/A/1 converts sixteen 0(4)-20 mA field signals to 0(0.66)-3.3 V signals for the fail-safe high-intensity analog input module 10105/2/1.

All inputs are passive and have a common 0 V connection. The converter module 10105/A/1 has been prepared for external power readback. This only requires one extra resistor of 9.09 kOhm (1%) to prescale the voltage range (0-41 V).

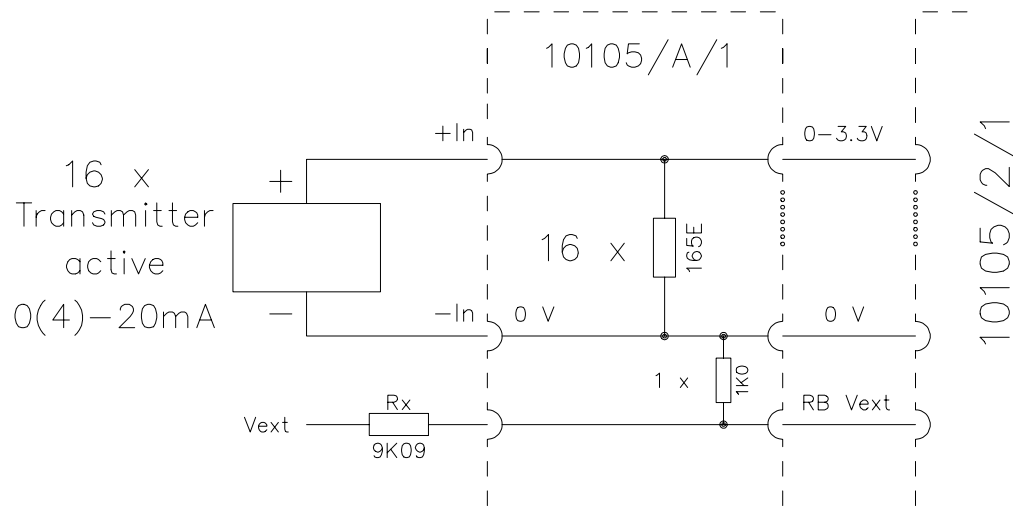


Figure 1 Schematic diagram



**Technical data**      The 10105/A/1 module has the following specifications:

**General**      Type number:                    10105/A/1  
                  Approvals:                        CE;  
   TÜV, UL approvals pending

**Power**      Power requirements:            none

**Analog input**      Number of input channels:    16  
                          Input current:                    0-20 / 4-20 mA (full scale = 25 mA)  
                          Input resistance:                165 Ohm 0.1%  
                          Absolute maximum input  
                          current:                            ± 50 mA

**Readback input**      R<sub>x</sub> resistor:                    9k09 1%, 0.6 W  
                          Input voltage (Vext):            0 to 41 V  
                          Input resistance (Vext):        10k1 1%  
                          Absolute maximum (Vext):    80 V

**Physical**      Dimensions:                    56 x 28 x 9 mm (L x W x H)  
   2.20 x 1.10 x 0.35 in (L x W x H)  
                          Rack space requirements:    none (placed on programming  
   connector on I/O backplane)

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# **Fail Safe Control Hardware Manual**

## **Section 6: FSC Output Modules**

**TotalPlant**



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## FSC output modules

### General information

All the output modules are European standard size (100 x 160 mm) instrument modules. The width of the module front is 4 TE (20.32 mm) (= 4 HP, 0.8 in), which is one position in a standard 19-inch I/O rack.

Each output module is connected to the horizontal bus via a flatcable, which protrudes from the module front. Digital output modules have status LEDs for each channel. The LEDs are placed in the module front, below the flatcable.

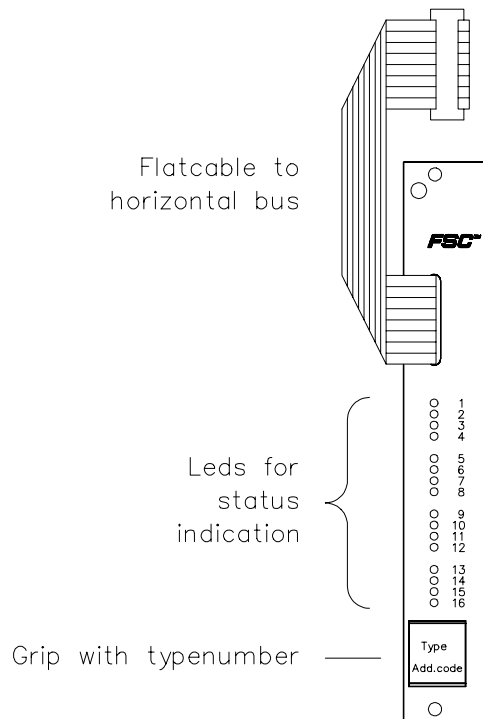


Figure 1 Front of a digital output module

The output modules are fitted with a male connector according to DIN 41612, type F, with the d, (b) and z rows used.



The following items are terminated on the rack connector:

- the internal power supply of 5 Vdc,
- the internal control input(s) for the secondary means of de-energization (WD inputs),
- the internal and external power supply of 24 Vdc or other supply voltages (e.g. 110 Vdc), and
- the wiring for the output signals.

All output modules have galvanic isolation between the 5 Vdc circuitry and the output circuitry for separation between the processor and field section.

If indicated, the output modules are 'fail-to-safe'. This means that in case of a component failure of the output module the outputs can still be switched off. The fail-safe property of output modules is mainly achieved through self-test routines and additional (test) circuits on the module.

The fail-to-safe output modules have a secondary means of de-energization via the watchdog (WD) inputs (5 Vdc level). This makes it possible to de-energize an output irrespective of the horizontal bus control signals. This results in a de-energized output signal to the process, which is the safe condition in a normally energized system. The safety-relevant circuitry of the module is completely covered by the self-test functions of the system.

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## Addressing

The addressing of an output module is determined by the module's position in the I/O rack. This means that the output modules have no jumpers or switches for setting the address. Each output module can be replaced by any module of the same type.

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## Replacing an output module

All output modules can be replaced with the power switched on. Depending on the output signal function and the system I/O configuration, process operation may be affected. When removing an output module, first disconnect the flatcable from the horizontal bus, then carefully pull the module from the rack. When placing an output module, carefully push the module into the rack until it is flush with the rack, then connect the flatcable to the horizontal bus.

---





## Output load, current limiting and supply voltage

The digital outputs with transistor outputs are provided with an electronic current-limiting circuit. If the output is overloaded or shorted, it goes in current limit for a brief period of time (several milliseconds), supplying *at least* the specified maximum output current. If the overload or short-circuit persists, the output switches off.

Safety-related outputs will then generate an FSC system fault, and remain de-energized until a fault reset is given.

Non-safety-related outputs switch on again after a delay of several hundreds of milliseconds (see Figure 2). A system fault is only generated if the output is of a fail-safe type.

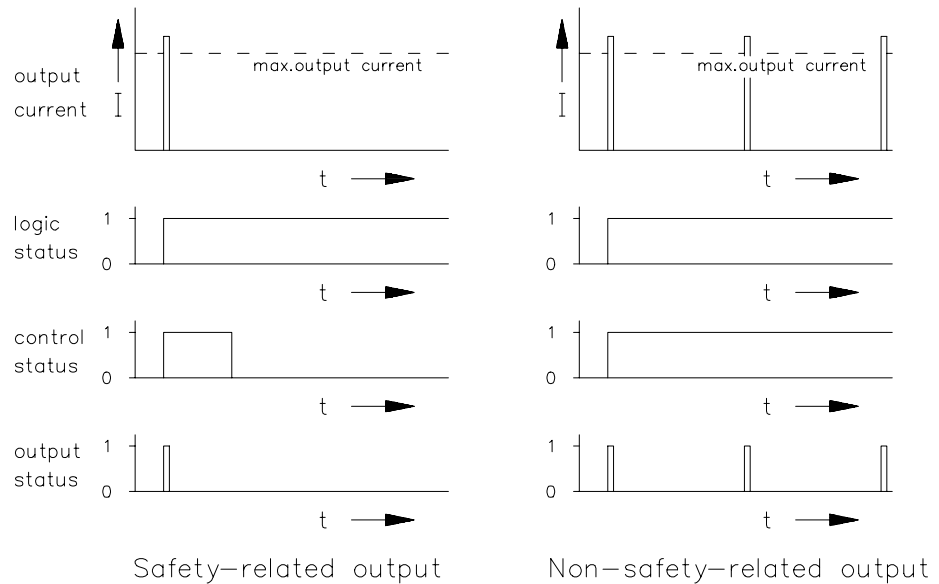


Figure 2 Output overload / short-circuit behavior

The specified maximum output current is independent of the supply voltage. The load current usually changes in a linear fashion with the supply voltage ( $I = V/R$ ). To calculate the maximum permissible load of a channel, we must take into account the maximum supply voltage we expect. To do this, we can use the following formula:

$$I_{nl} = I_m * \frac{V_n}{V_m}$$

where:

$V_n$  = nominal supply voltage (usually 24 Vdc)

$I_{nl}$  = nominal load current

$V_m$  = expected maximum supply voltage

$I_m$  = maximum output current (see module specification)

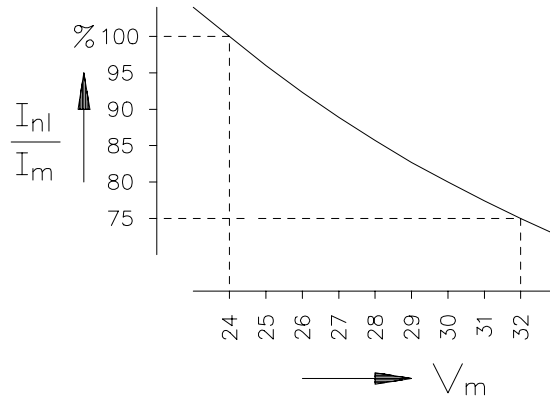


Figure 3 Maximum current derating vs. expected maximum supply voltage

**Example:**

We have a 10201/1/1 module and we expect a maximum supply voltage of 30 V. The maximum output current of each channel is 550 mA. The current derating factor is 80% (see Figure 3).

The maximum nominal load current will then be  $80\% * 550 \text{ mA} = 440 \text{ mA}$  ( $\cong 10.56 \text{ W}$ ).

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## 10201/1/1

# Fail-safe digital output module (24 Vdc, 0.55 A, 8 channels)

### Description

The fail-safe digital output module 10201/1/1 has eight 24 Vdc, 550 mA output channels to drive loads up to 13 W. These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize the group (via secondary means),
- crosstalk between outputs, and
- functioning of the suppression diodes.

The 24 Vdc circuitry is split into two galvanically isolated groups of four outputs each. This enables powering the two output groups from two independent power supplies to support segregation in a process unit and/or subunit structure.

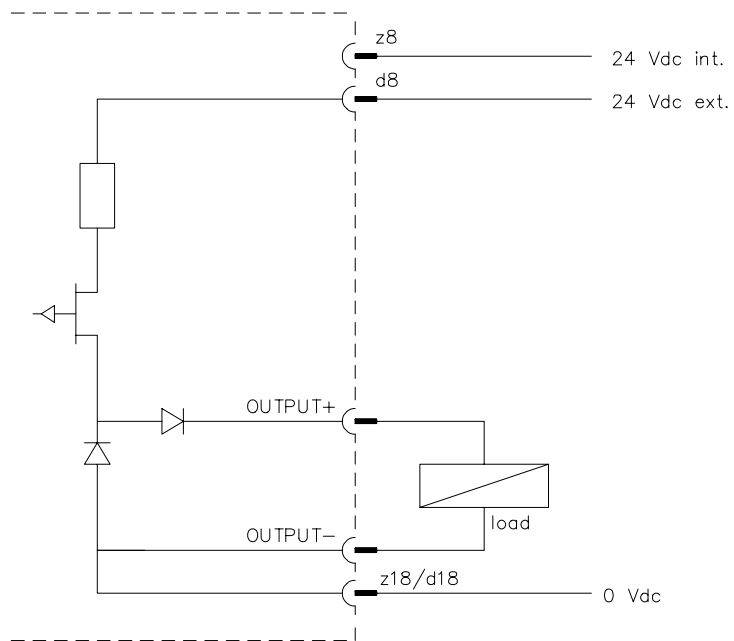


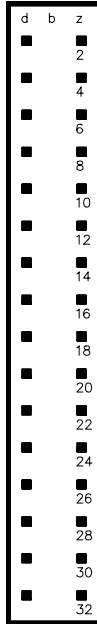
Figure 1 Schematic diagram for connection of one output (output 1-4) to the 10201/1/1 module



Each group (of four outputs) has its own secondary means of de-energization. This facility enables the watchdog and/or the processor to de-energize the outputs in case of an FSC internal fault, irrespective of the result of the application function.

## Pin allocation

The back view and pin allocation of the 10201/1/1 rack connector are as follows:



d2	WDG 1 (5 Vdc)	z2	GND 5 Vdc
d4	WDG 2 (5 Vdc)*	z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext. (1)	z8	Supply 24 Vdc int. (1)*
d10	OUT 1-	z10	OUT 1+
d12	OUT 2-	z12	OUT 2+
d14	OUT 3-	z14	OUT 3+
d16	OUT 4-	z16	OUT 4+
d18	Supply 0 Vdc (1)	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22	Supply 24 Vdc ext. (2)	z22	Supply 24 Vdc int. (2)*
d24	OUT 5-	z24	OUT 5+
d26	OUT 6-	z26	OUT 6+
d28	OUT 7-	z28	OUT 7+
d30	OUT 8-	z30	OUT 8+
d32	Supply 0 Vdc (2)	z32	Supply 0 Vdc (2)

### \* Note:

Early 10201/1/1 modules have only one WDG connection (on pin d2; d4 is not connected) and no internal voltage connection. Pins d8 and z8, resp. d22 and z22, are interconnected on the board (no dedicated +24Vdc int1, resp. +24Vdc int2, is available). The earlier modules can easily be distinguished visually from later ones because they have a P+F logo in the upper right corner of the board (on the component side).



## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10201/1/1.

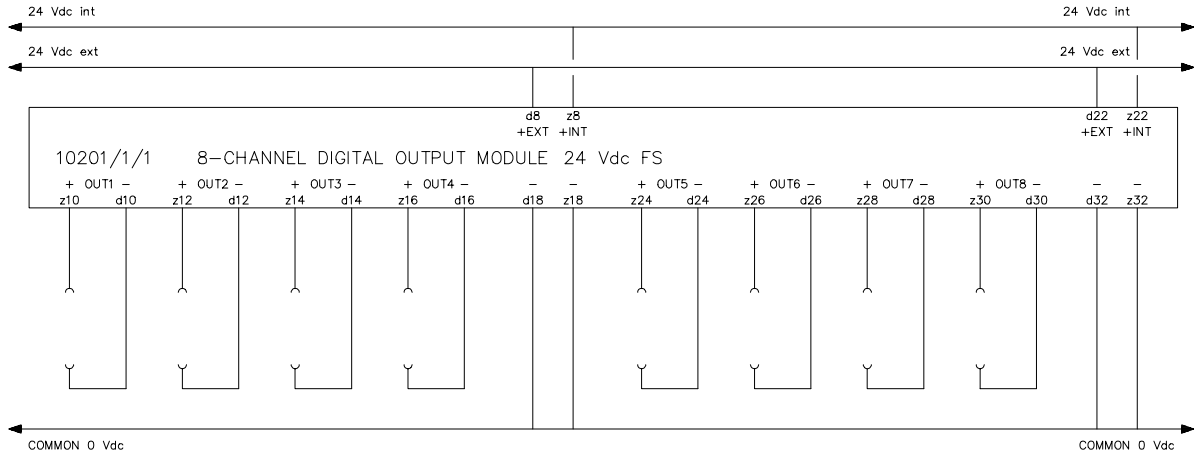


Figure 2 Connection example for non-redundant I/O configurations

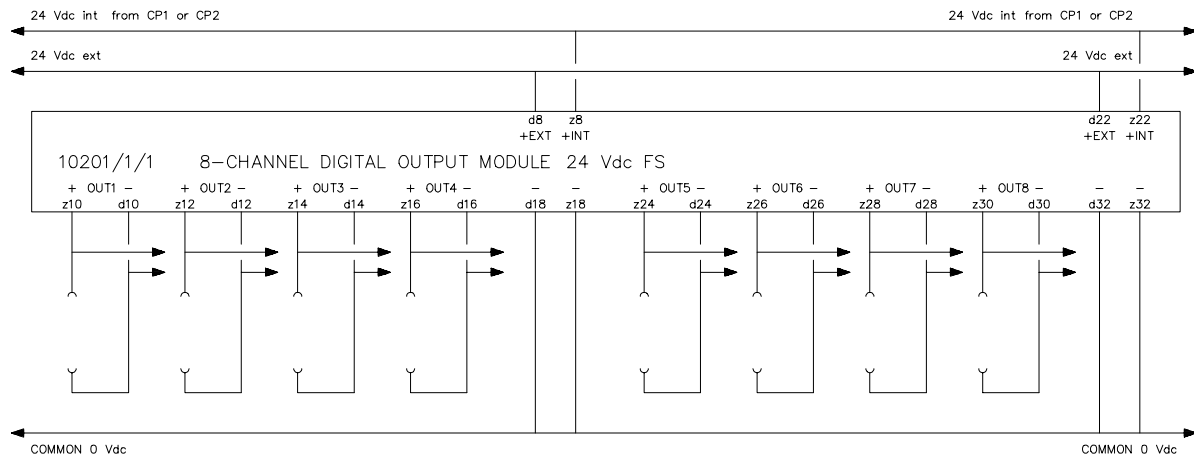


Figure 3 Connection example for redundant I/O configuration

### Note:

Both output groups of the output module must be connected to the 24 Vdc internal and external power supply (pins z8, d8, z18/d18, z22, d22 and z32/d32) to prevent fault detection during the self-test of the module.



## Technical data

The 10201/1/1 module has the following specifications:

<b>General</b>	Type number:	10201/1/1 02201*
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 25 mA 24 Vdc internal 2*15 mA 24 Vdc external 2*35 mA (without output load)
	Number of output channels:	8 (2 isolated groups of 4)
	Output specification:	24 Vdc solid-state source, short-circuit proof
<b>Output</b>	Maximum current:	550 mA* (see 'FSC output modules' data sheet)
	Maximum lamp load:	120 mA (2.9 W)*
	Maximum load capacitance:	1 µF
	Voltage drop:	< 2.0 Vdc at 500 mA*
	Off current:	< 0.1 mA
	WDG input current:	2*4 mA
	<b>Key coding</b>	(See 'Key coding' data sheet)
Module code:		
– hole		A27
– pins		C3, C11, C31
Rack code:		
– blind stops	C19, C23, C27	
– large pin	A27	

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### \* Note:

10201/1/1 modules without a suffix code have a maximum current of at least 450 mA, a maximum lamp load of 100 mA (2.4 W) and a voltage drop of < 2.0 Vdc at 400 mA.

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## 10201/2/1

# Fail-safe digital output module (24 Vdc, 0.55 A, 8 channels)

### Description

The fail-safe digital output module 10201/2/1 has eight 24 Vdc, 550 mA output channels to drive loads up to 13 W. These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize the group (via secondary means),
- crosstalk between outputs, and
- functioning of the suppression diodes.

The outputs are split into two groups of four outputs each. Each group has its own secondary means of de-energization. This increases the shutdown selectivity in case of a channel failure.

The secondary means of de-energization enables the watchdog and/or the processor to de-energize the outputs, irrespective of the result of the application function.

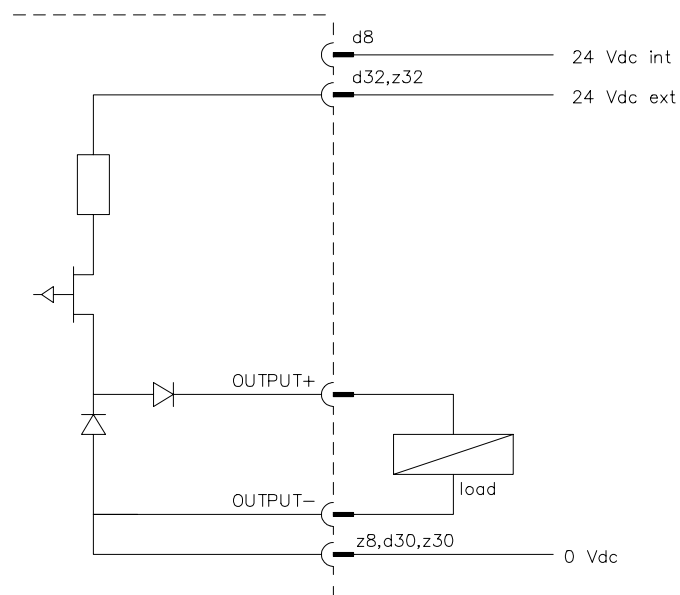
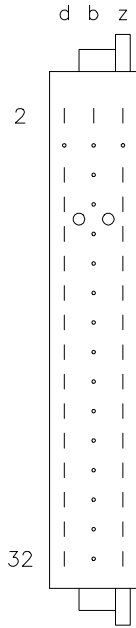


Figure 1 Schematic diagram for connection of one output to the 10201/2/1 module

## Pin allocation

The back view and pin allocation of the 10201/2/1 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	-			z4	-
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	(0 Vdc)			z10	(0 Vdc)
d12	OUT 1+			z12	OUT 1-
d14	OUT 2+			z14	OUT 2-
d16	OUT 3+			z16	OUT 3-
d18	OUT 4+			z18	OUT 4-
d20	OUT 5+			z20	OUT 5-
d22	OUT 6+			z22	OUT 6-
d24	OUT 7+			z24	OUT 7-
d26	OUT 8+			z26	OUT 8-
d28	(0 Vdc)			z28	(0 Vdc)
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 24 Vdc ext.			z32	Supply 24 Vdc ext.

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10201/2/1.

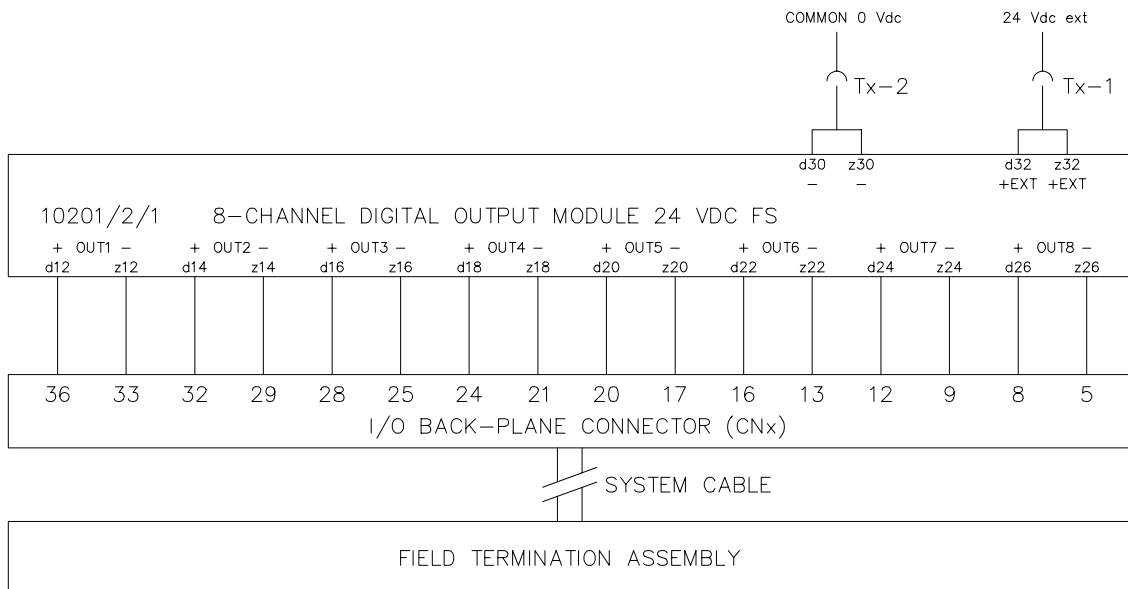


Figure 2 Connection example of 10201/2/1 module to FTA for both non-redundant and redundant I/O configurations



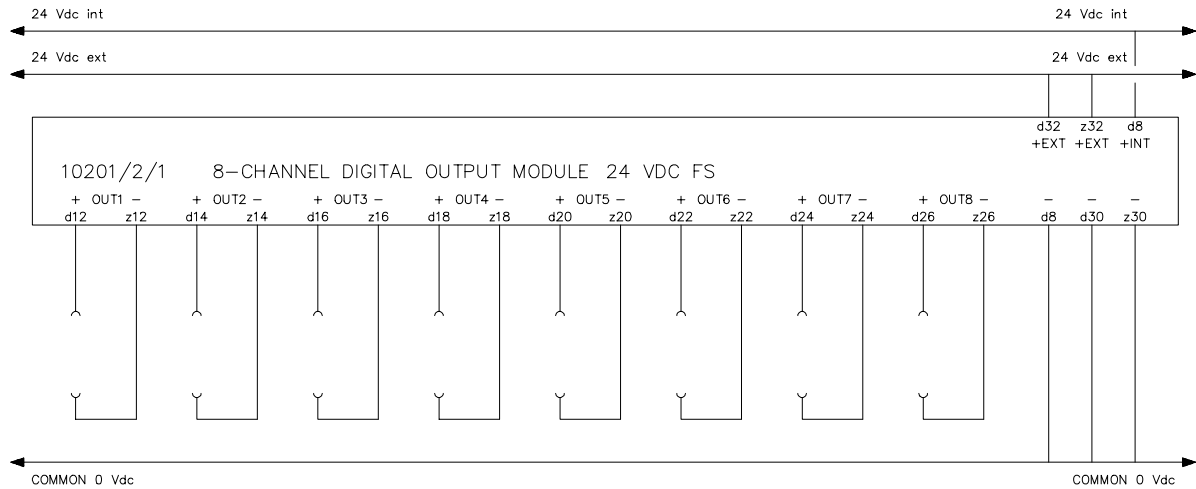


Figure 3 I/O connection example of 10201/2/1 module for non-redundant I/O configurations

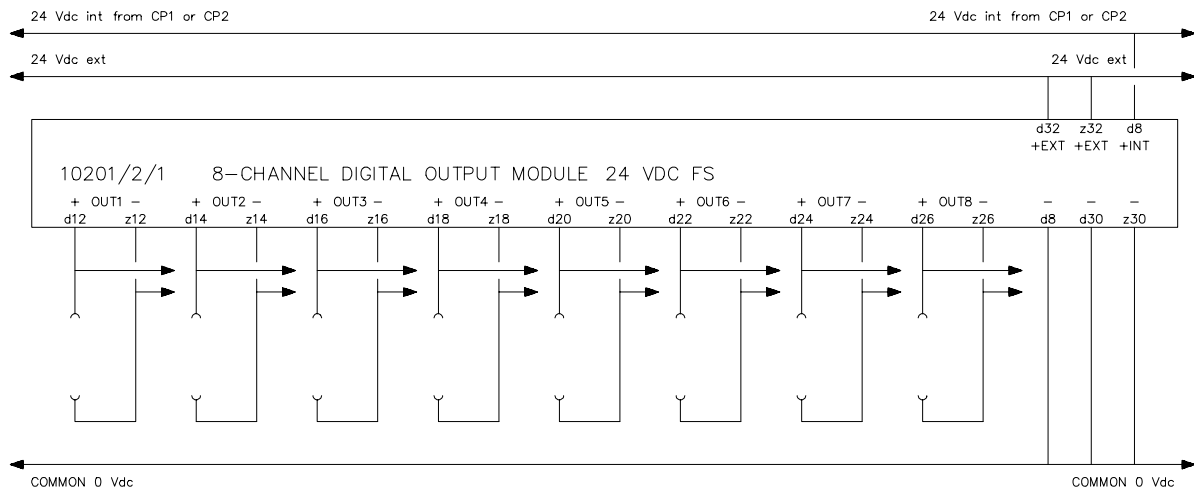


Figure 4 I/O connection example of 10201/2/1 module for redundant I/O configurations

**Note:**

The 24 Vdc internal and external power supplies must be connected to prevent fault detection during the self-test of the output module (pins d8, z8, d30/z30 and d32/z32).



## Technical data

The 10201/2/1 module has the following specifications:

<b>General</b>	Type number:	10201/2/1 11501*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 25 mA 24 Vdc internal 25 mA 24 Vdc external 70 mA (without output load)
	<b>Output</b>	Number of output channels: 8
	Output specification:	24 Vdc solid-state source, short-circuit proof
	Maximum current:	550 mA* (see 'FSC output modules' data sheet)
	Maximum lamp load:	120 mA (2.9 W)*
	Maximum load capacitance:	1 µF
	Voltage drop:	< 2.0 Vdc at 500 mA*
	Off current:	< 0.1 mA
	WDG input current:	8 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– holes	A9, C9
	Rack code:	
	– large pins	A9, C9

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**\* Note:**

10201/2/1 modules with suffix code 11500 have a maximum current of at least 450 mA, a maximum lamp load of 100 mA (2.4 W) and a voltage drop of < 2.0 Vdc at 400 mA..

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## 10203/1/2

# Fail-safe output module with double switch-off (24 Vdc, 0.9 A, 4 channels)

### Description

The fail-safe output module 10203/1/2 has four 24 Vdc, 900 mA output channels to drive loads up to 21.5 W.

These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

This output module is special in that, besides the secondary means of de-energization and a normal output transistor, it has a second output transistor, which is controlled by the processor and the watchdog. This means that if a short-circuit occurs in one output transistor, it is allowed to continue operation without switching off an output or an FSC system, thus increasing availability.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between the outputs, and
- functioning of the suppression diodes.

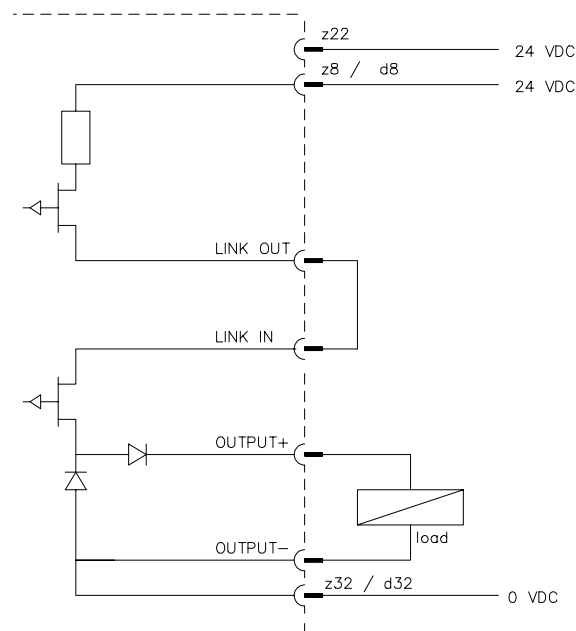


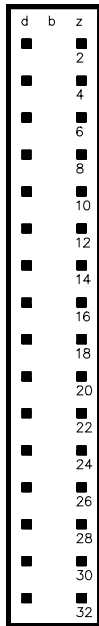
Figure 1 Schematic diagram for connection of one output to the 10203/1/2 module



The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs in case of an FSC internal fault, irrespective of the result of the application function.

## Pin allocation

The back view and pin allocation of the 10203/1/2 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext.	z8	Supply 24 Vdc ext.
d10	Link OUT 2	z10	Link OUT 1
d12	Link IN 2	z12	Link IN 1
d14	OUT 2+	z14	OUT 1+
d16	OUT 2-	z16	OUT 1-
d18	(Supply 0 Vdc)	z18	(Supply 0 Vdc)
d20	Link	z20	Link
d22		z22	Supply 24 Vdc int.
d24	Link OUT 4	z24	Link OUT 3
d26	Link IN 4	z26	Link IN 3
d28	OUT 4+	z28	OUT 3+
d30	OUT 4-	z30	OUT 3-
d32	Supply 0 Vdc	z32	Supply 0 Vdc

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10203/1/2.

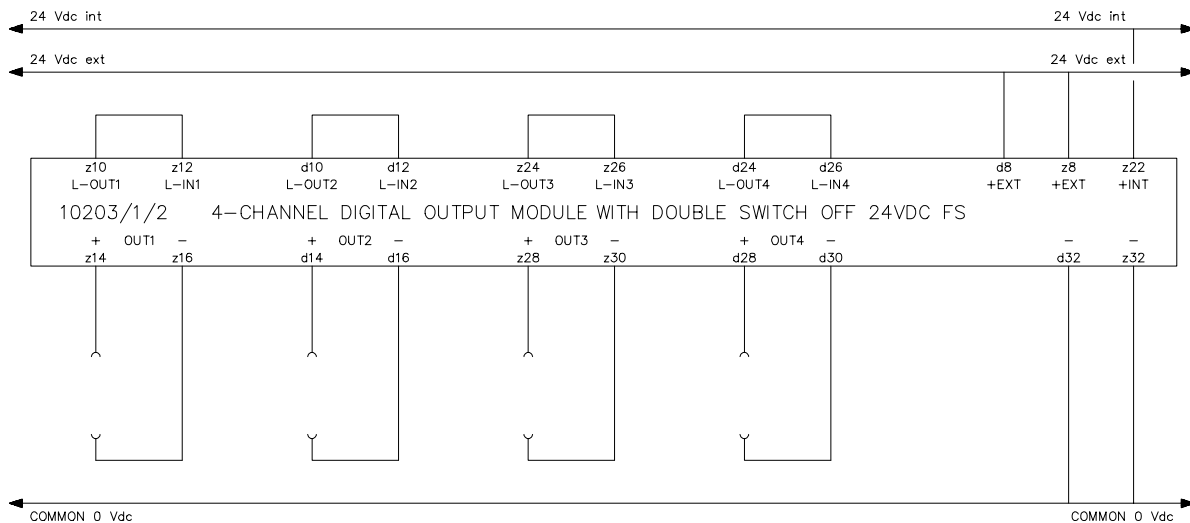


Figure 2 Connection example for non-redundant configurations

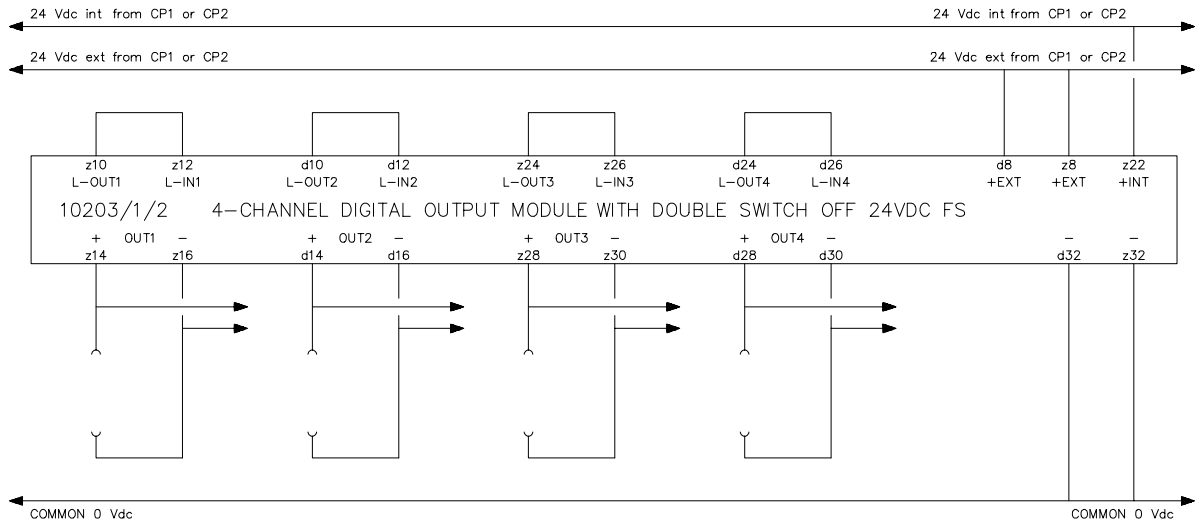


Figure 3 Connection example for redundant configurations

**Note:**

The 24 Vdc internal and external power supplies must be connected and all link OUT and link IN connections must be made to prevent fault detection during the self-test of the output module (pins z8/d8, z10/z12, d10/d12, z22, z24/z26, d24/d26 and z32/d32).



## Technical data

The 10203/1/2 module has the following specifications:

<b>General</b>	Type number:	10203/1/2	
	Approvals:	CE, TÜV	
	Software versions:	≥ 2.78	
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)	
<b>Power</b>	Power requirements:	5 Vdc 25 mA 24 Vdc internal 30 mA 24 Vdc external 50 mA (without output load)	
	Number of output channels:	4	
	Output specification:	24 Vdc solid-state source, short-circuit proof	
<b>Output</b>	Maximum current:	900 mA (see 'FSC output modules' data sheet)	
	Maximum lamp load:	200 mA (4.8 W)	
	Max. load capacitance:	1 µF	
	Voltage drop:	< 2.5 Vdc at 800 mA	
	Off current:	< 0.1 mA	
	WDG input current:	8 mA	
	<b>Key coding</b>	(See 'Key coding' data sheet)	
		Module code:	
– hole		A27	
– pins		C11, C27, C31	
Rack code:			
– blind stops	C3, C19, C23		
– large pin	A27		

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### Note:

The soldering link is factory-set.

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## 10205/1/1

# Fail-safe analog output module (0(4)-20 mA, 2 channels)

### Description

The fail-safe analog output module 10205/1/1 has two 0(4)-20 mA output channels for analog control applications.

The load may only be resistive or capacitive. Inductive loads will cause the analog output module to be reported faulty. The two analog outputs are galvanically isolated from the 24 Vdc and the 5 Vdc. The 0 V 1 and 0 V 2 pins are interconnected on the module.

Each analog output channel consists of a 12-bit D/A converter for the output value and an A/D converter which reads the output value. Using the A/D converter it is possible to check the correct functioning of the D/A converter.

Within the configured process safety time, the analog outputs are tested for:

- correct output value (current value  $\pm 5\%$ ),
- ability to de-energize, and
- crosstalk between analog outputs.

Each analog output has a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs, irrespective of the result of the application value.

The analog output module 10205/1/1 can only be used in non-redundant I/O configurations as it is not possible to put current outputs in parallel (which would be required for redundant I/O configurations).

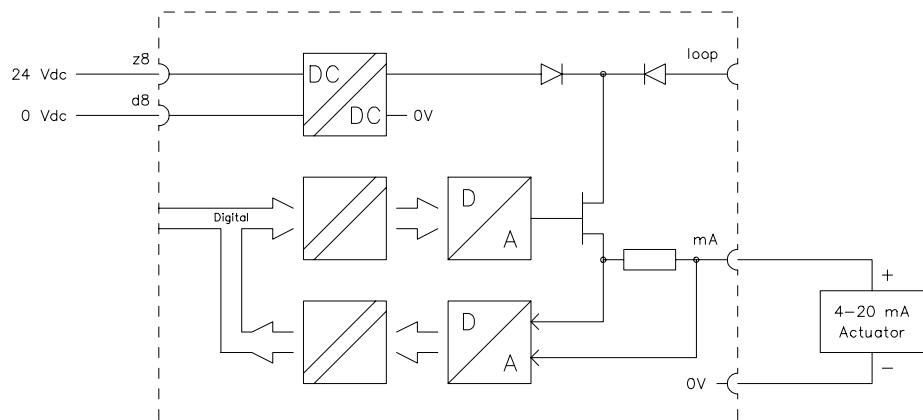


Figure 1 Schematic diagram for connection of the 10205/1/1 module as an active output

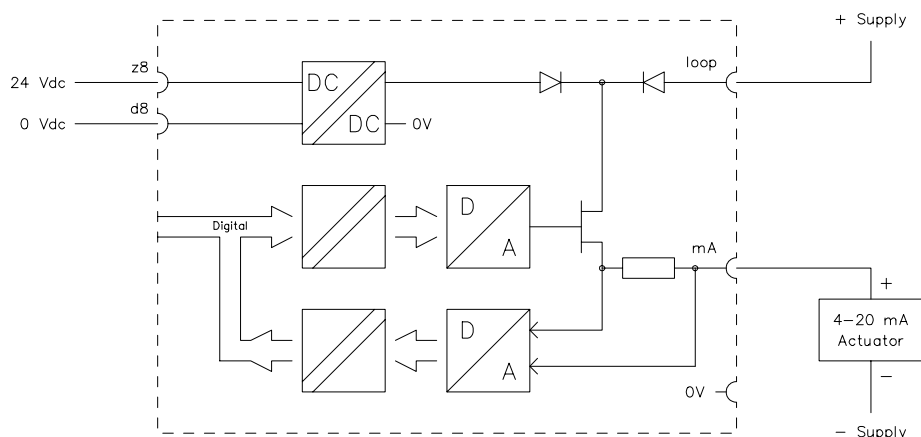
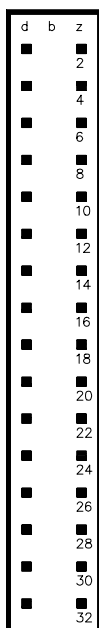


Figure 2 Schematic diagram for connection of the 10205/1/1 module as a passive output

## Pin allocation

The back view and pin allocation of the 10205/1/1 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 0 Vdc	z8	Supply 24 Vdc
d10		z10	
d12	Link	z12	Link
d14		z14	
d16		z16	
d18		z18	
d20		z20	
d22		z22	
d24		z24	
d26		z26	0 V 1
d28	Loop 1	z28	mA 1
d30		z30	0 V 2
d32	Loop 2	z32	mA 2





## Connection example

The figure below shows a connection example for the fail-safe analog output module 10205/1/1.

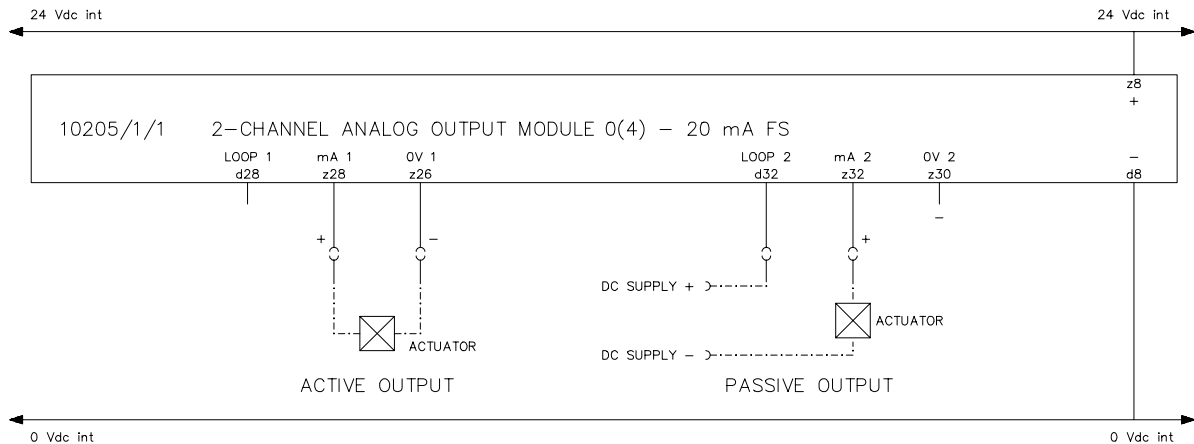


Figure 3 Connection example for non-redundant I/O configurations (one channel active, one channel passive)

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**Note:**

The 24 Vdc power supply must be connected (pins z8, d8) and unused outputs must be shorted (pins z26-z28, resp. z30-z32) to prevent fault detection during the self-test of the module.

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## Calibration

The 10205/1/1 module has potentiometers for calibration purposes (P2 and P3). The module can be calibrated using the calibration option of the 'View FSC system and process status' program, an extender module, an extender flatcable and a multimeter.

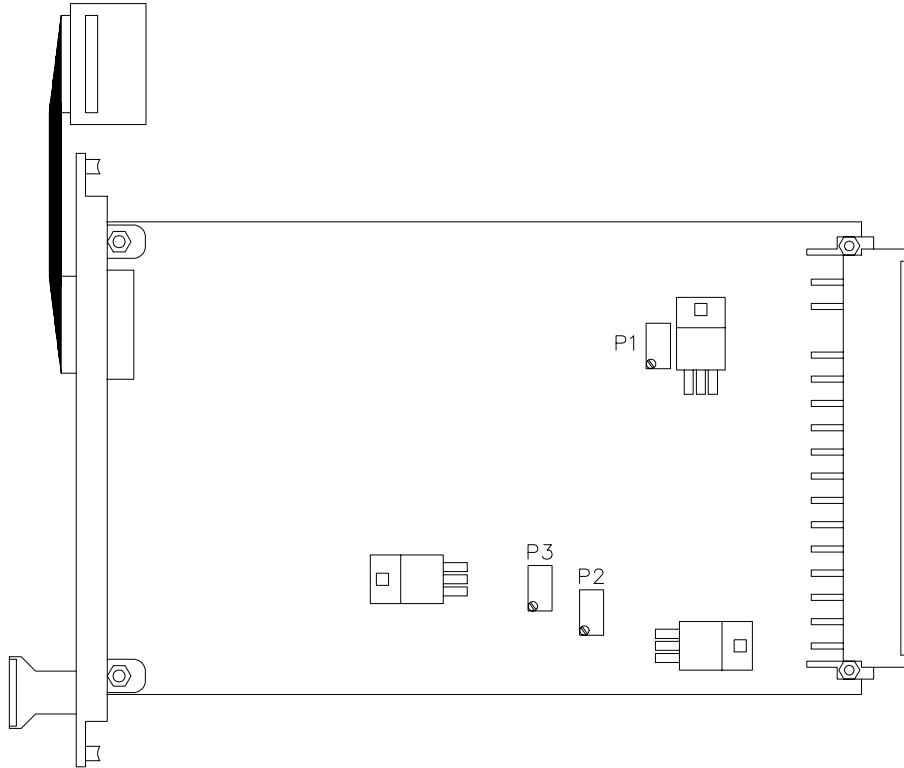


Figure 4 Location of potentiometers on 10205/1/1 module



## Technical data

The 10205/1/1 module has the following specifications:

<b>General</b>	Type number:	10205/1/1
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 30 mA 24 Vdc 65 mA + 30 mA for each active output
	<b>Output</b>	Number of output channels: 2 (galvanically isolated from supply voltage; 0V 1 and 0V 2 interconnected)
	Output specification (mA):	active or passive, 0-20 / 4-20 mA
	D/A converter:	12-bit
	Off current:	< 0.05 mA
	Loop powering (active):	maximum loop resistance: 1kOhm maximum output voltage: 30 Vdc
	External powering (passive):	maximum: 40 Vdc minimum voltage drop: ≤ 7.5 V
	WDG input current:	0.5 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A27
	– pins	C3, C23, C27
	Rack code:	
– blind stops	C11, C19, C31	
– large pin	A27	

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**10205/2/1**

## **Fail-safe analog output module (0(4)-20 mA, 2 channels)**

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### **Description**

The fail-safe analog output module 10205/2/1 has two 0(4)-20 mA output channels for analog control applications.

The load may only be resistive or capacitive. Inductive loads will cause the analog output module to be reported faulty. The two analog outputs are galvanically isolated from the 24 Vdc and the 5 Vdc. The 0 V 1 and 0 V 2 pins are interconnected on the module.

Each analog output channel consists of a 12-bit D/A converter for the output value and an A/D converter which reads the output value. Using the A/D converter it is possible to check the correct functioning of the D/A converter.

Within the configured process safety time, the analog outputs are tested for:

- correct output value (current value  $\pm 5\%$ ),
- ability to de-energize, and
- crosstalk between analog outputs.

If I/O backplanes are used, the analog output module 10205/2/1 requires a 10205/A/ module on each channel.

Each analog output has a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs, irrespective of the result of the application value.

The analog output module 10205/2/1 can only be used in non-redundant I/O configurations as it is not possible to put current outputs in parallel (which would be required for redundant I/O configurations).

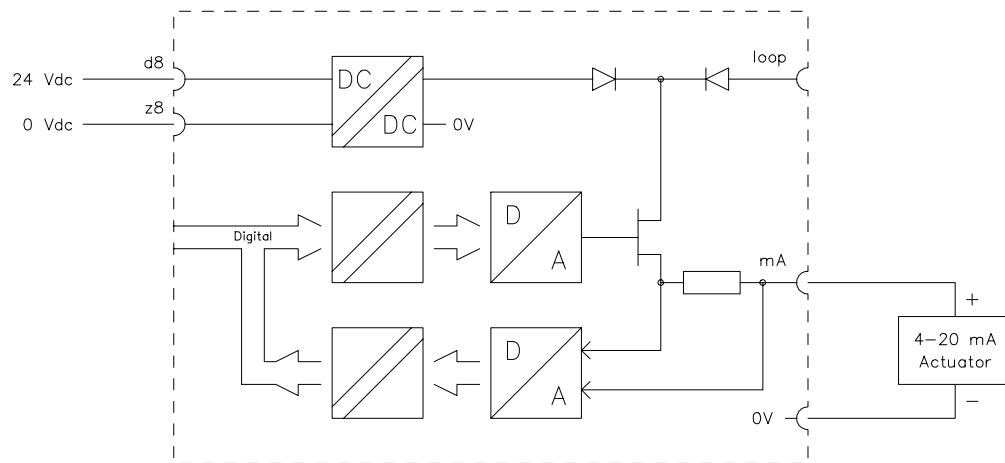


Figure 1 Schematic diagram for connection of the 10205/2/1 module as an active output

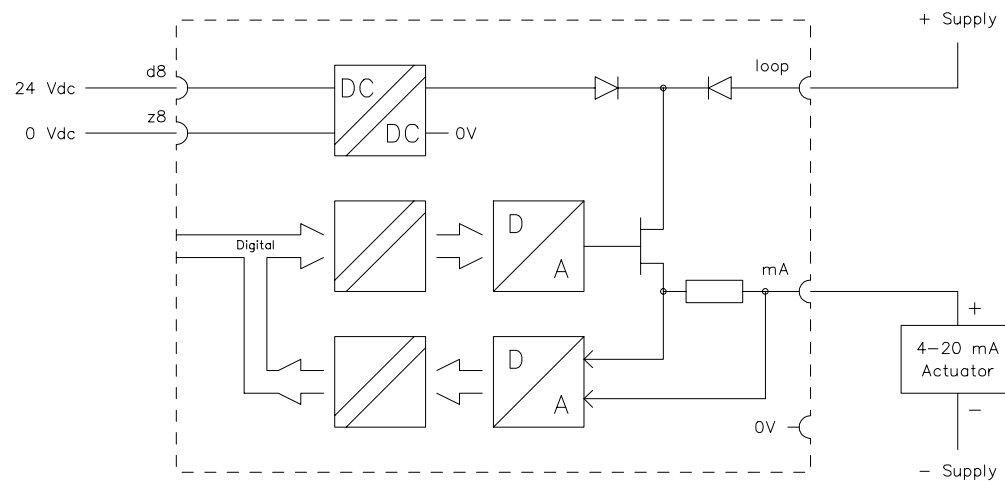
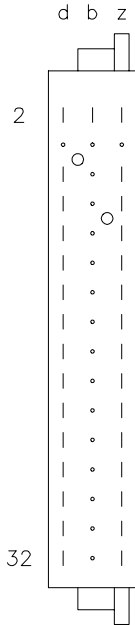


Figure 2 Schematic diagram for connection of the 10205/2/1 module as a passive output



## Pin allocation

The back view and pin allocation of the 10205/2/1 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	(F 1+)			z12	(F 1–)
d14	0 V 1			z14	
d16	mA 1			z16	Loop 1
d18	(F 2+)			z18	(F 2–)
d20	0 V 2			z20	
d22	mA 2			z22	Loop 2
d24				z24	
d26				z26	
d28				z28	
d30				z30	
d32				z32	

## Connection examples

The figures below show a number of connection examples for the fail-safe analog output module 10205/2/1.

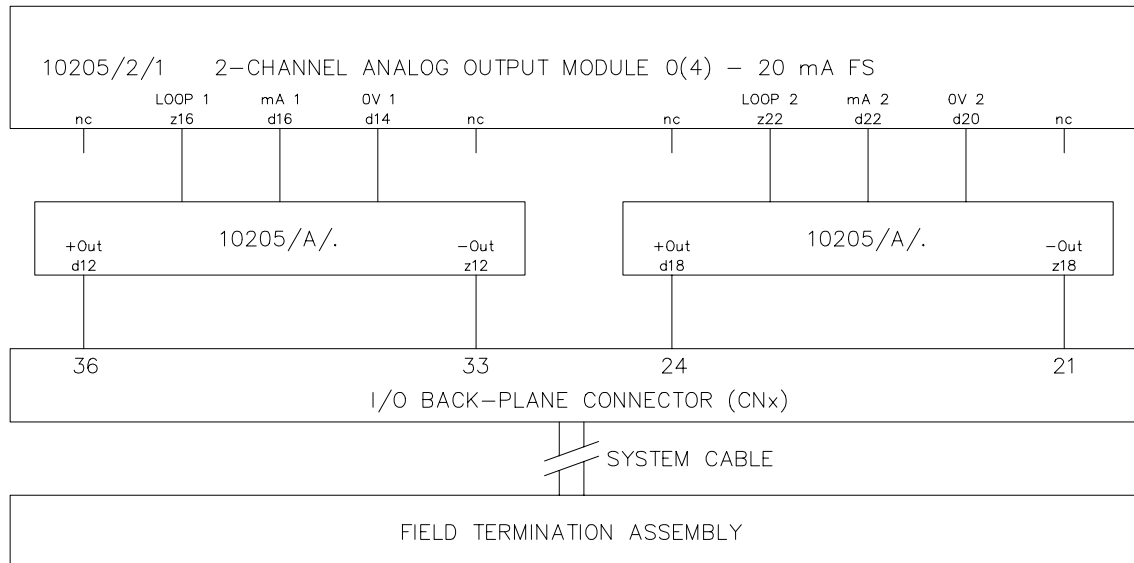


Figure 3 Connection example of 10205/2/1 module to FTA for non-redundant I/O configurations

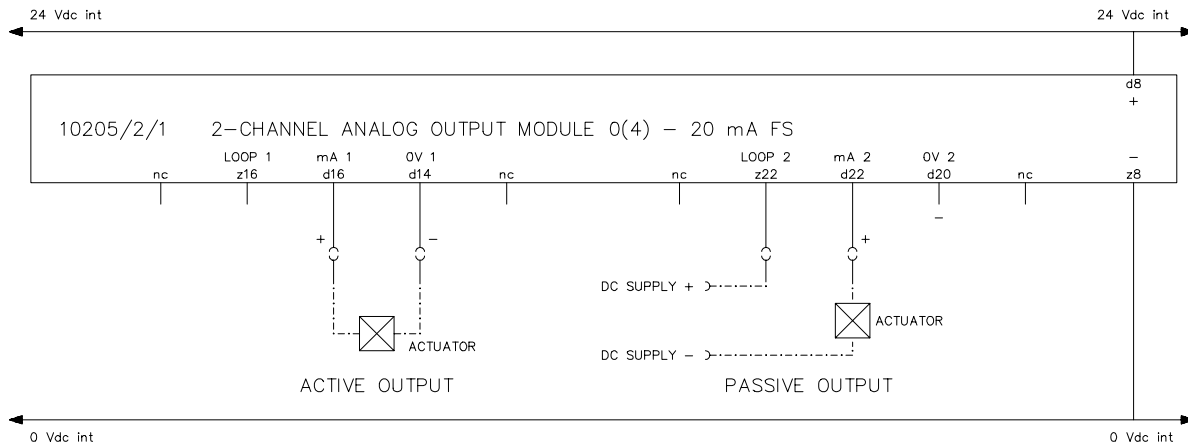


Figure 4 I/O connection example for 10205/2/1 module for non-redundant I/O configurations (one channel active, one channel passive)

**Note:**

The 24 Vdc power supply must be connected (pins z8, d8) and unused outputs must be shorted (10205/A/3 on channel 1, resp. 2, or interconnect pins d16-d14, resp. d22-d20) to prevent fault detection during the self-test of the module.





## Calibration

The 10205/2/1 module has potentiometers for calibration purposes (P2 and P3). The module can be calibrated using the calibration option of the 'View FSC system and process status' program, an extender module, an extender flatcable and a multimeter.

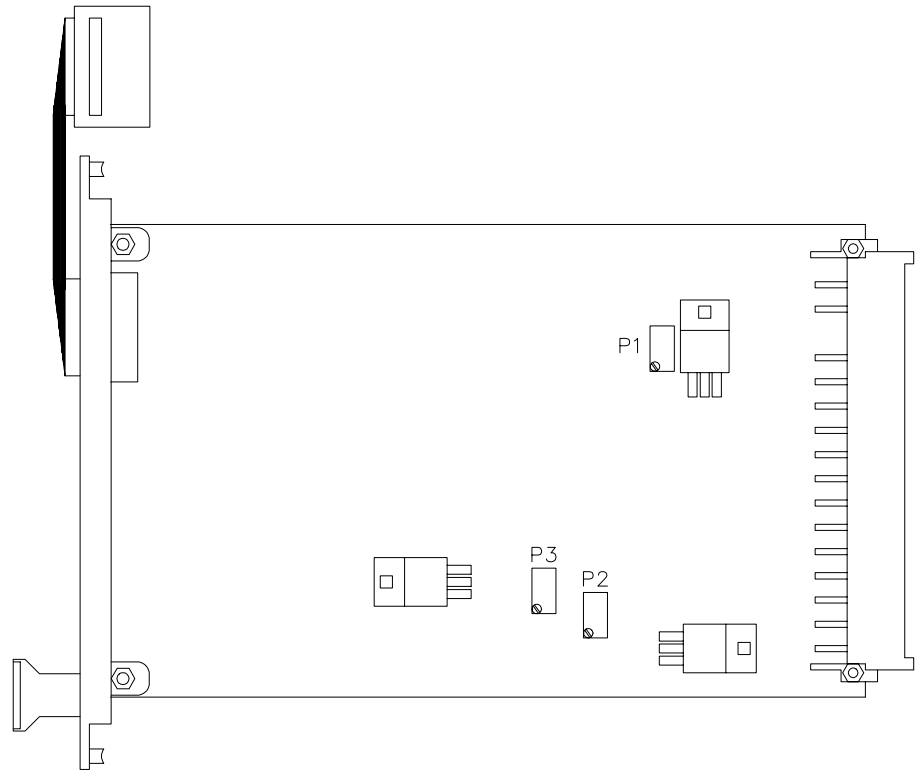


Figure 5 Location of potentiometers on 10205/2/1 module



## Technical data

The 10205/2/1 module has the following specifications:

<b>General</b>	Type number:	10205/2/1 11600
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 30 mA 24 Vdc 65 mA + 30 mA for each active output
	<b>Output</b>	Number of output channels: 2 (galvanically isolated from supply voltage; 0V 1 and 0V 2 interconnected)
	Output specification (mA):	active or passive, 0-20 / 4-20 mA
	D/A converter:	12-bit
	Off current:	< 0.05 mA
	Loop powering (active):	maximum loop resistance: 1kOhm maximum output voltage: 30 Vdc
	External powering (passive):	maximum: 40 Vdc minimum voltage drop: ≤ 7.5 V
	WDG input current:	0.5 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– holes	A9, C5
	Rack code:	
– large pins	A9, C5	



## 10205/A/. Analog output mode modules

### Description

If used with I/O backplanes, the analog outputs of a 10205/2/1 module require 10205/A/. analog output mode modules. The 10205/A/. modules are placed on a programming connector (Px) on the back of the I/O backplane in the 19-inch rack. To assist proper placement of these 10205/A/. modules, a 10205 positioning print can be placed on the programming connector.

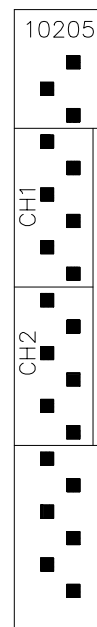


Figure 1 10205 positioning print

The printed circuit board of a 10205/A/. module should be oriented to slide into the cut-out zone of the appropriate channel.

## 10205/A/1

## 0(4)-20 mA internal power

### Description

The 10205/A/1 analog output mode module links the 0(4)-20 mA as current source to accommodate channels with passive loads (e.g. passive actuators).

The 10205/2/1 module supplies the loop energy.

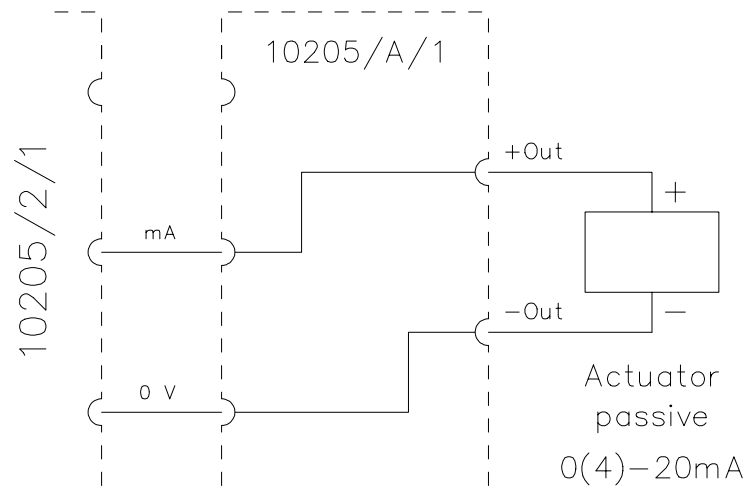


Figure 2 Schematic diagram of a 10205/A/1 module

### Technical data

The 10205/A/1 module has the following specifications:

<b>General</b>	Type number:	10205/A/1
	Approvals:	CE, TÜV, UL
	Number of channels:	1
	Dimensions:	23 x 15.3 x 9 mm (0.91 x 0.6 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none



## 10205/A/2

## 0(4)-20 mA external power

### Description

The 10205/A/2 analog output mode module links the 0(4)-20 mA as current regulator to accommodate channels with active loads (e.g. active actuators).

The field device module supplies the loop energy.

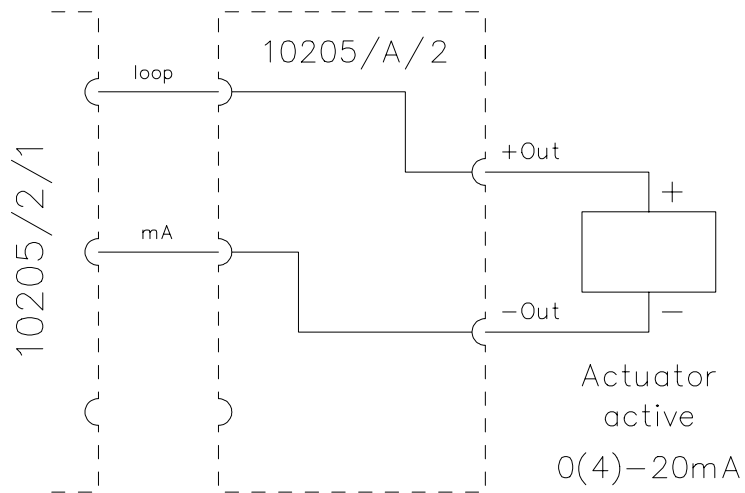


Figure 3 Schematic diagram of a 10205/A/2 module

### Technical data

The 10205/A/2 module has the following specifications:

#### General

Type number: 10205/A/2  
Approvals: CE, TÜV, UL  
Number of channels: 1  
Dimensions: 23 x 15.3 x 9 mm (0.91 x 0.6 x 0.35 in)  
Rack space requirements: none (placed on programming connector on I/O backplane)

#### Power

Power requirements: none

## 10205/A/3

## Dummy

### Description

The 10205/A/3 analog output mode module shorts the 0(4)-20 mA output. No field connection is made.

This module is required for unused analog output channels to prevent fault detection during self-testing of the 10205/2/1 module.

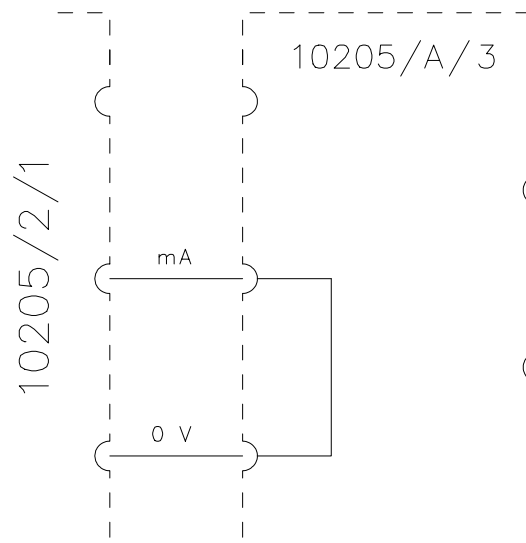


Figure 4 Schematic diagram of a 10205/A/3 module

### Technical data

The 10205/A/3 has the following specifications:

<b>General</b>	Type number:	10205/A/3
	Approvals:	CE, TÜV, UL
	Number of input channels:	1
	Dimensions:	23 x 15.3 x 9 mm (0.91 x 0.6 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none

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10206/1/1

## Digital output module (24 Vdc, 0.55 A, 12 channels)

### Description

The digital output module 10206/1/1 has twelve 24 Vdc, 550 mA output channels to drive loads up to 13 W. These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs are not tested and may therefore *not* be used for fail-safe applications.

The 24 Vdc circuitry is split into three galvanically isolated groups of four outputs each. This enables powering the three output groups from three independent power supply groups to support power supply segregation in a process unit and/or subunit structure.

The outputs are also controlled by the watchdog. This means that the outputs are de-energized if the system shuts down and the watchdog switches off.

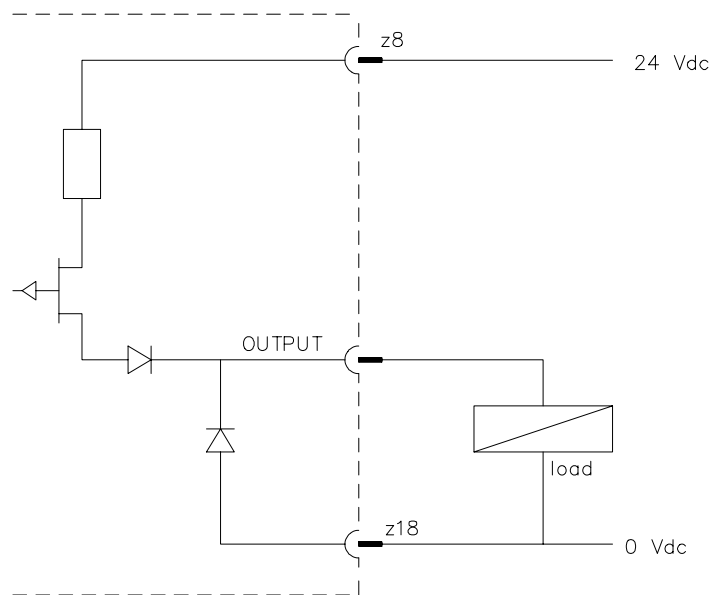
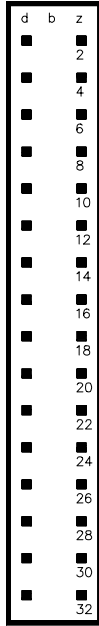


Figure 1 Schematic diagram for connection of one output to the 10206/1/1 module



## Pin allocation

The back view and pin allocation of the 10206/1/1 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc (3)	z8	Supply 24 Vdc (1)
d10	OUT 9	z10	OUT 1
d12	OUT 10	z12	OUT 2
d14	OUT 11	z14	OUT 3
d16	OUT 12	z16	OUT 4
d18	Supply 0 Vdc (3)	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22		z22	Supply 24 Vdc (2)
d24		z24	OUT 5
d26		z26	OUT 6
d28		z28	OUT 7
d30		z30	OUT 8
d32		z32	Supply 0 Vdc (2)

## Connection examples

The figures below show a number of connection examples for the digital output module 10206/1/1.

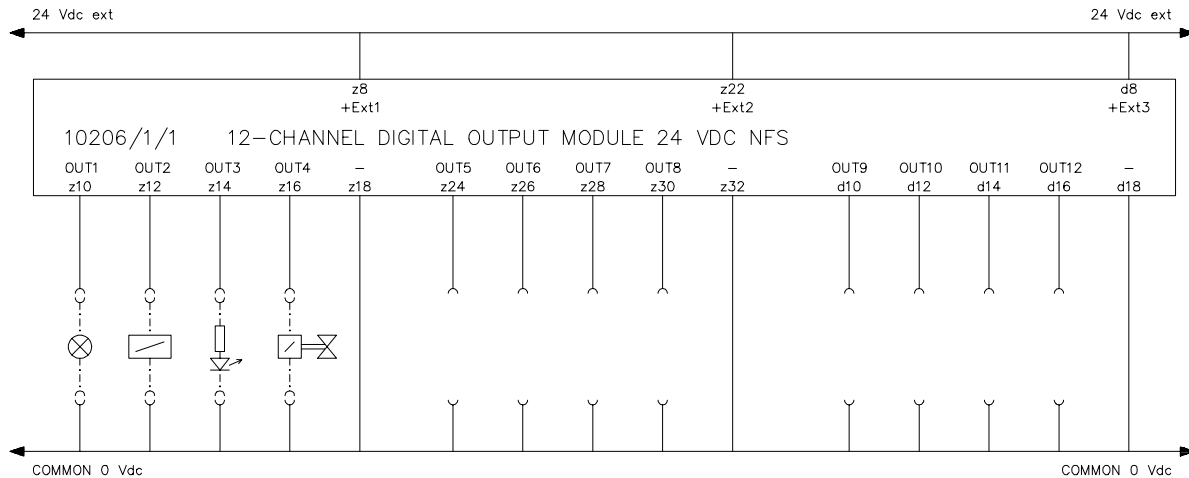


Figure 2 Connection example for non-redundant I/O configurations



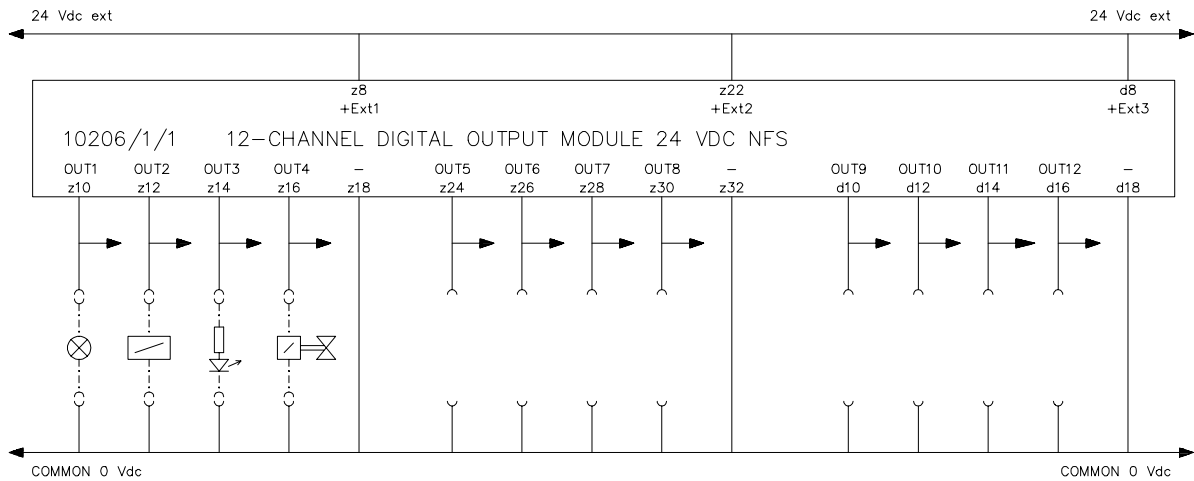


Figure 3 Connection example for redundant I/O configuration

## Technical data

The 10206/1/1 module has the following specifications:

<b>General</b>	Type number:	10206/1/1 02402*
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 25 mA 24 Vdc internal 3*20 mA (without output load)
<b>Output</b>	Number of output channels:	12 (3 isolated groups of 4)
	Output specification:	24 Vdc solid-state source, short-circuit proof
	Maximum current:	550 mA* (see 'FSC output modules' data sheet)
	Maximum lamp load:	275 mA (6.6 W)*
	Maximum load capacitance:	1 µF
	Voltage drop:	< 1.5 Vdc at 500 mA*
	Off current:	< 0.1 mA
	WDG input current:	0.06 mA



## Technical data (continued)

<b>Key coding</b>	(See 'Key coding' data sheet)
Module code:	
– hole	A27
– pins	C3, C19, C23
Rack code:	
– blind stops	C11, C27, C31
– large pin	A27

---

### \* Notes:

10206/1/1 modules without a suffix code have no watchdog input circuit and have an undefined output status at power-up.

10206/1/1 modules without a suffix code or with suffix code 02401 have a maximum current of at least 450 mA, a maximum lamp load of 225 mA (5.4 W) and a voltage drop of < 1.5 Vdc at 400 mA.

---

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## 10206/2/1

# Digital output module (24 Vdc, 0.55 A, 12 channels)

### Description

The digital output module 10206/2/1 has twelve 24 Vdc, 550 mA output channels to drive loads up to 13 W. These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs are not tested and may therefore *not* be used for fail-safe applications.

The 24 Vdc circuitry is split into two groups of six outputs each. This enables powering the two outputs groups from two independent power supply groups to support power supply segregation in a process unit and/or subunit structure or to limit circuit-breaker/fuse rating. The outputs are also controlled by the watchdog. This means that the outputs are de-energized if the system shuts down and the watchdog switches off.

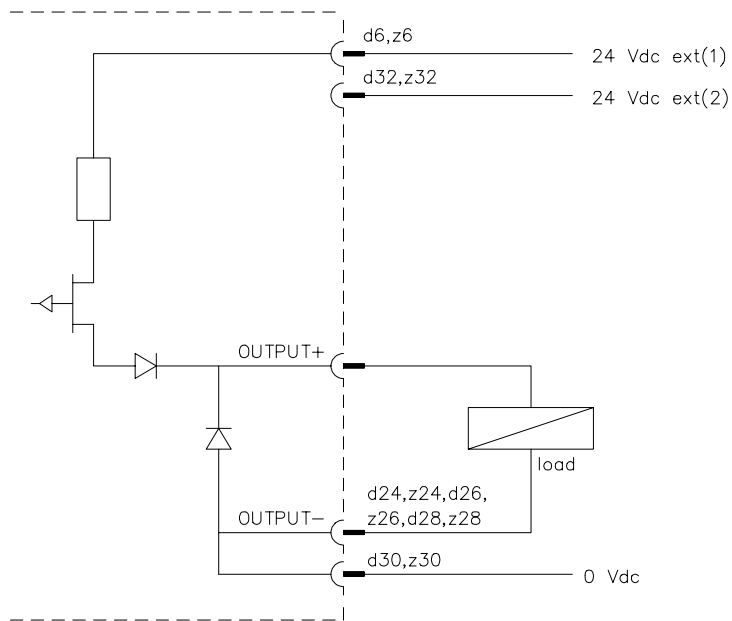
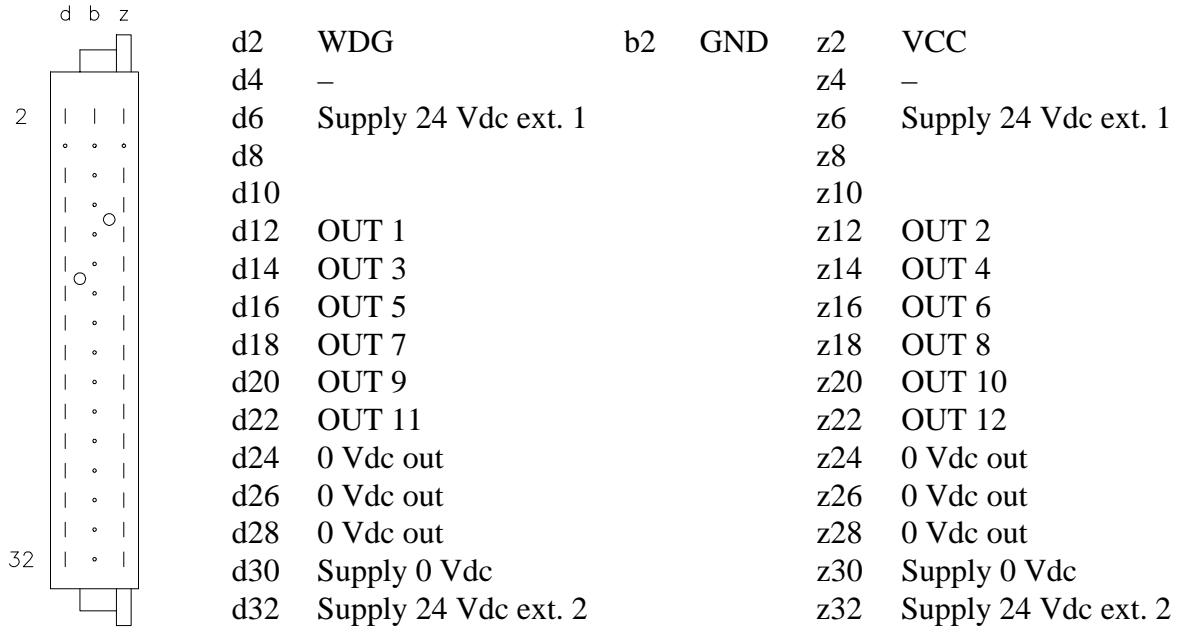


Figure 1 Schematic diagram for connection of one output to the 10206/2/1 module



## Pin allocation

The back view and pin allocation of the 10206/2/1 module connector are as follows:



## Connection examples

The figures below show a number of connection examples for the digital output module 10206/2/1.

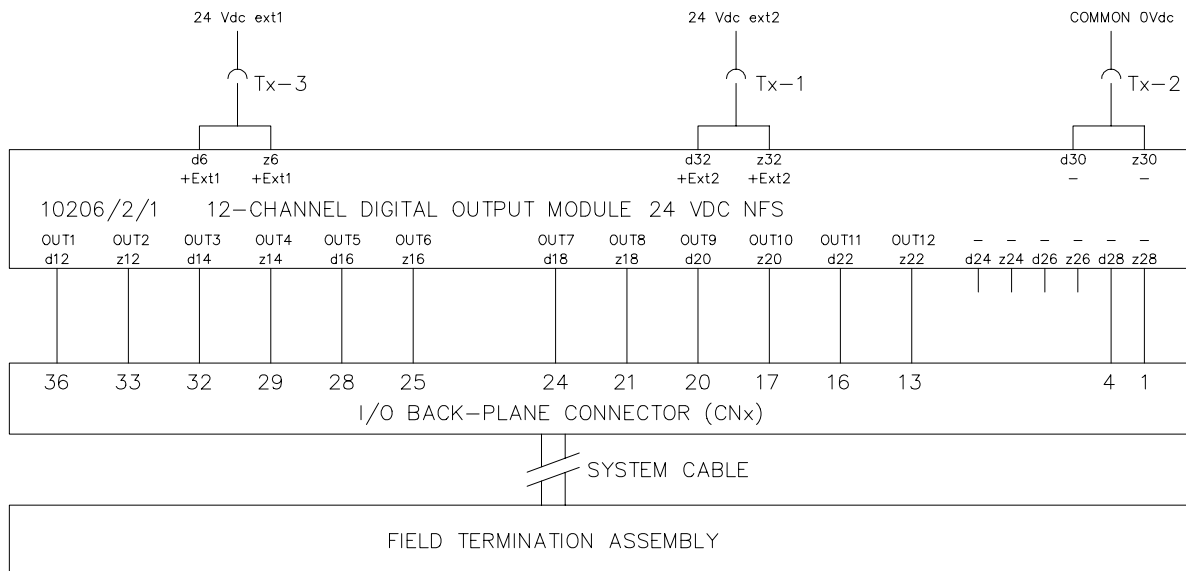


Figure 2 Connection example of 10206/2/1 module to FTA for both non-redundant and redundant I/O configurations

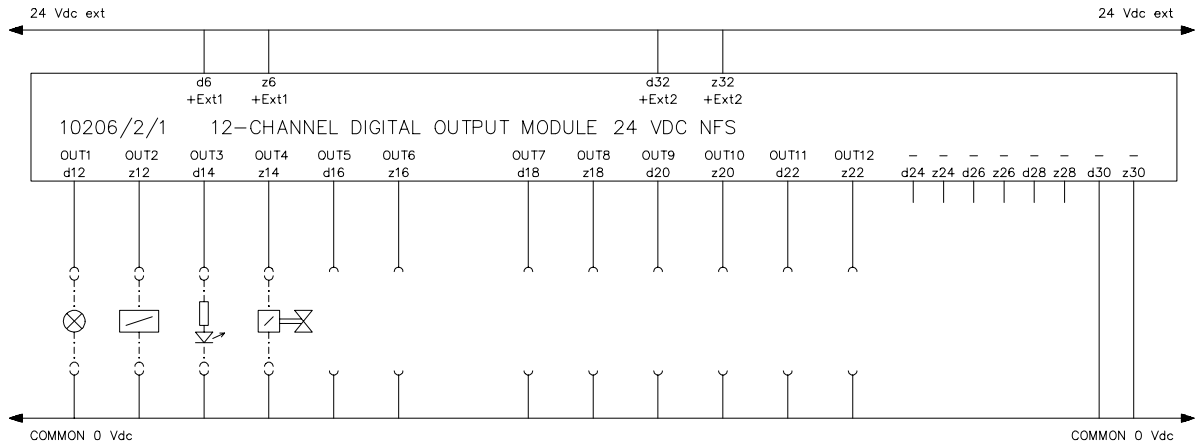


Figure 3 I/O connection example for 10206/2/1 module for non-redundant I/O configurations

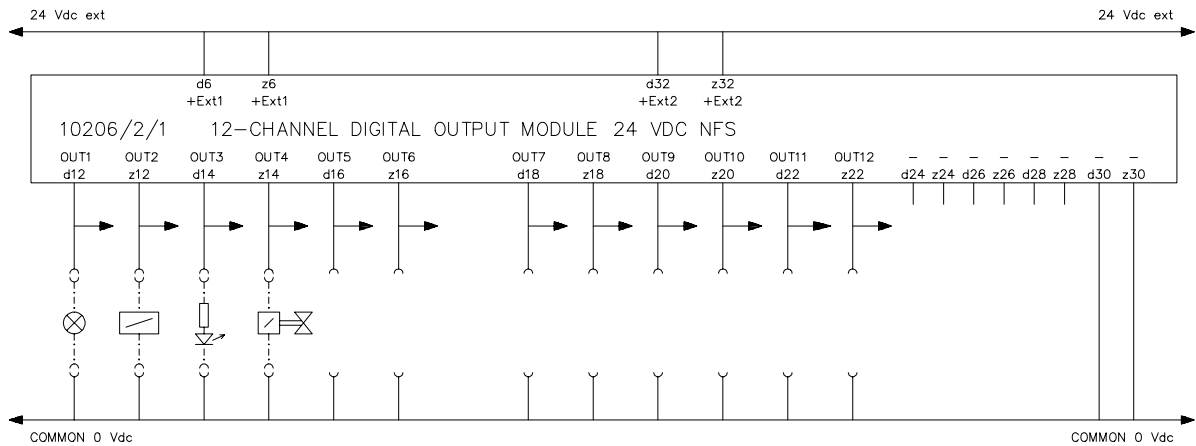


Figure 4 I/O connection example for 10206/2/1 module for redundant I/O configurations



## Technical data

The 10206/2/1 module has the following specifications:

<b>General</b>	Type number:	10206/2/1 11702*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 25 mA 24 Vdc 2*30 mA (without output load)
	<b>Output</b>	Number of output channels: 12 (2 groups of 6) Output specification: 24 Vdc solid-state source, short-circuit proof Maximum current: 550 mA* (see 'FSC output modules' data sheet) Maximum lamp load: 275 mA (6.6 W)* Maximum load capacitance: 1 µF Voltage drop: < 1.5 Vdc at 500 mA* Off current: < 0.1 mA WDG input current: 0.06 mA

## Key coding

(See 'Key coding' data sheet)

Module code:	
– holes	A9, C13
Rack code:	
– large pins	A9, C13

---

### \*Notes:

10206/2/1 modules with suffix code 11700 have a maximum current of at least 450 mA, a maximum lamp load of 225 mA (5.4 W) and a voltage drop of < 1.5 Vdc at 400 mA.

---

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## 10207/1/1

# Intrinsically safe optocoupler output module (8 channels)

### Description

The output module 10207/1/1 has eight optocouplers with an output buffer to switch currents up to 15 mA.

The signals that can be switched on and off may be located in intrinsically safe area class [EEx ia] IIC. The outputs are not tested and may therefore *not* be used for fail-safe applications.

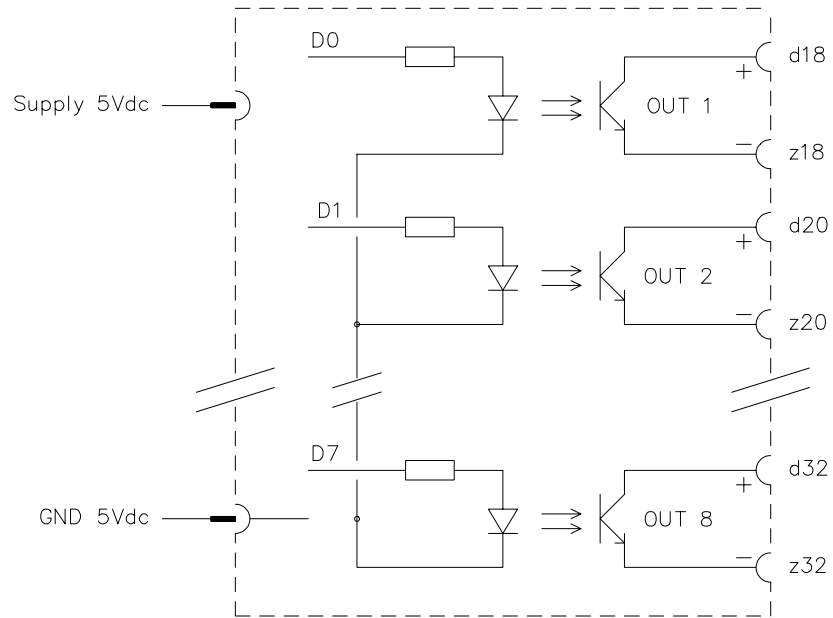


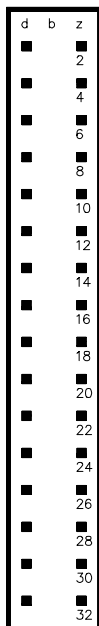
Figure 1 Schematic diagram for the 10207/1/1 module (D0-D7 are lines on the horizontal bus)

The outputs are also controlled by the watchdog. This means that the outputs are de-energized if the system shuts down and the watchdog switches off.



## Pin allocation

The back view and pin allocation of the 10207/1/1 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8		z8	
d10	Link	z10	Link
d12		z12	
d14		z14	
d16		z16	
d18	OUT 1+	z18	OUT 1-
d20	OUT 2+	z20	OUT 2-
d22	OUT 3+	z22	OUT 3-
d24	OUT 4+	z24	OUT 4-
d26	OUT 5+	z26	OUT 5-
d28	OUT 6+	z28	OUT 6-
d30	OUT 7+	z30	OUT 7-
d32	OUT 8+	z32	OUT 8-

## Connection example

The figure below shows a connection example for the intrinsically safe output module 10207/1/1.

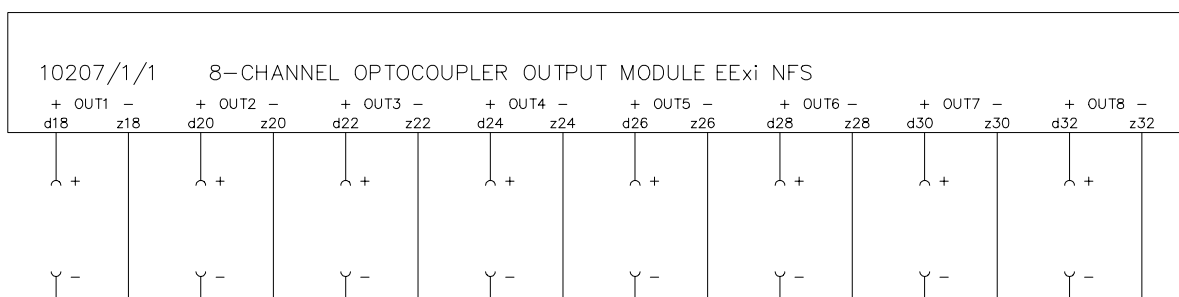


Figure 2 Connection example for non-redundant I/O configurations





## Application

A typical application for the 10207/1/1 module, in combination with the intrinsically safe input module 10103/1/1, is the read-out of decimal thumbwheel switches located in the class [EEx ia] IIC area configured as an input multiplexer. The digits are selected using the 10207/1/1 outputs and the value is read via the 10103/1/1 inputs.

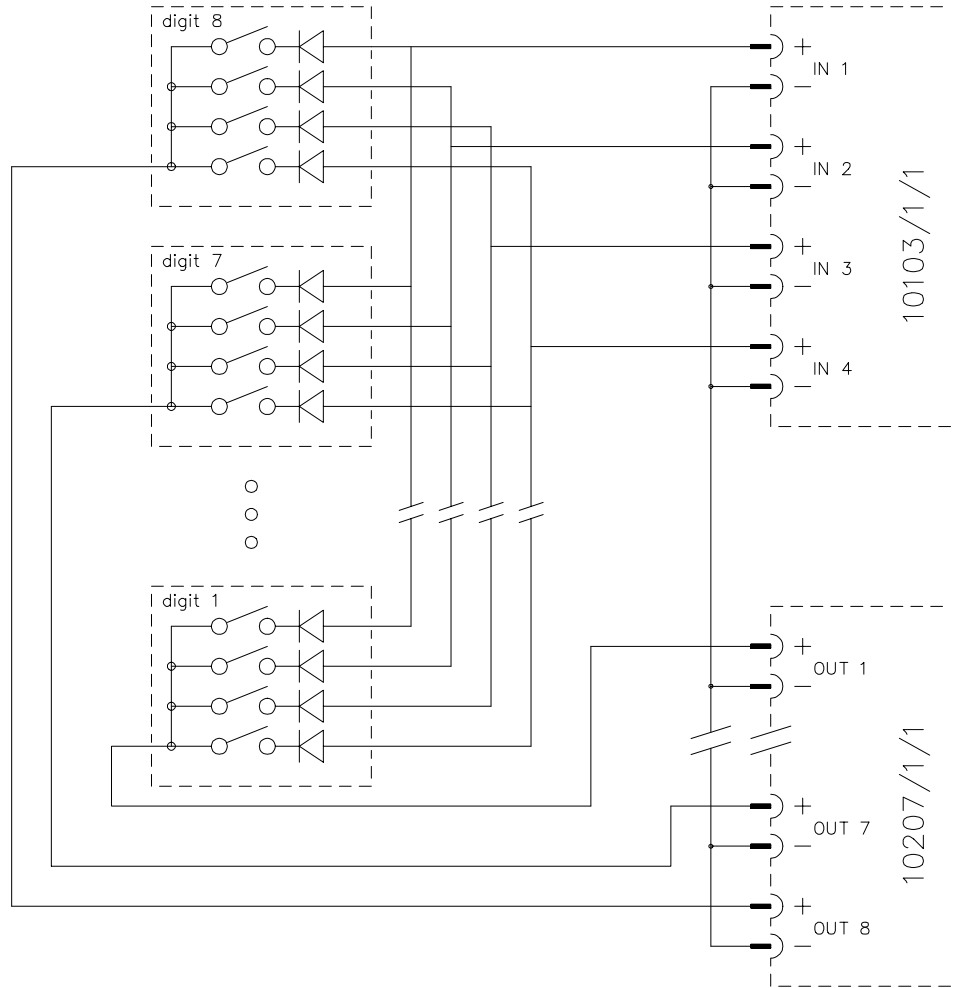


Figure 3 Input multiplexer for BCD thumbwheel switches using 10207/1/1 and 10103/1/1 modules



**Technical data**      The 10207/1/1 module has the following specifications:

<b>General</b>	Type number:	10207/1/1
	Approvals:	CE, TÜV, Baseefa
	Baseefa number:	Ex. 88B2355U
	class:	[EEx ia] IIC
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

<b>Power</b>	Power requirements:	5 Vdc 35mA
	Ripple content:	< 50 mV p-p

<b>Output</b>	Number of output channels:	8
	Maximum open voltage:	30 V
	Off current:	< 0.1 mA
	Maximum output current:	15 mA
	Voltage drop:	< 3 V at 10 mA
	Maximum dissipation:	0.7 W
	WDG input current:	4 mA

**Key coding**      (See 'Key coding' data sheet)

Module code:	
– hole	A27
– pins	C3, C11, C19
Rack code:	
– blind stops	C23, C27, C31
– large pin	A27

---

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## 10208/1/1

# Relay output module (contacts, 12 channels)

### Description

The relay output module 10208/1/1 has twelve potential-free relay contact output channels to drive loads up to 70 W. These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode **must be mounted externally**. The outputs are not tested and may therefore *not* be used for fail-safe applications. The maximum voltage on the relay contacts may be 36 Vdc to meet IEC 1010.

The outputs are also controlled by the watchdog. This means that the relays de-energize if the system shuts down and the watchdog switches off.

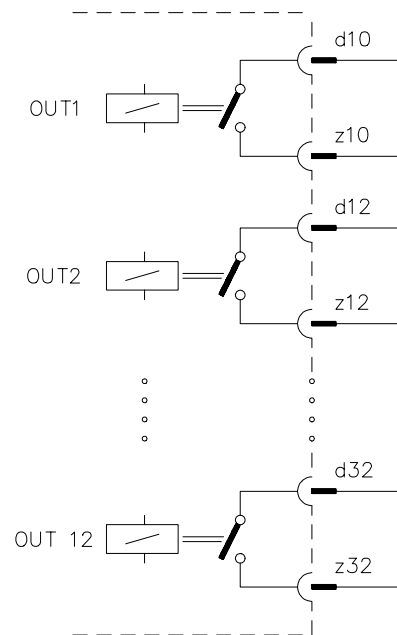
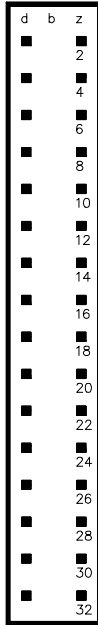


Figure 1 Schematic diagram for 10208/1/1 module



## Pin allocation

The back view and pin allocation of the 10208/1/1 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 0 Vdc	z8	Supply 24 Vdc
d10	Common 1	z10	Normally open 1
d12	Common 2	z12	Normally open 2
d14	Common 3	z14	Normally open 3
d16	Common 4	z16	Normally open 4
d18	Common 5	z18	Normally open 5
d20	Common 6	z20	Normally open 6
d22	Common 7	z22	Normally open 7
d24	Common 8	z24	Normally open 8
d26	Common 9	z26	Normally open 9
d28	Common 10	z28	Normally open 10
d30	Common 11	z30	Normally open 11
d32	Common 12	z32	Normally open 12

## Connection examples

The figures below show a number of connection examples for the relay output module 10208/1/1.

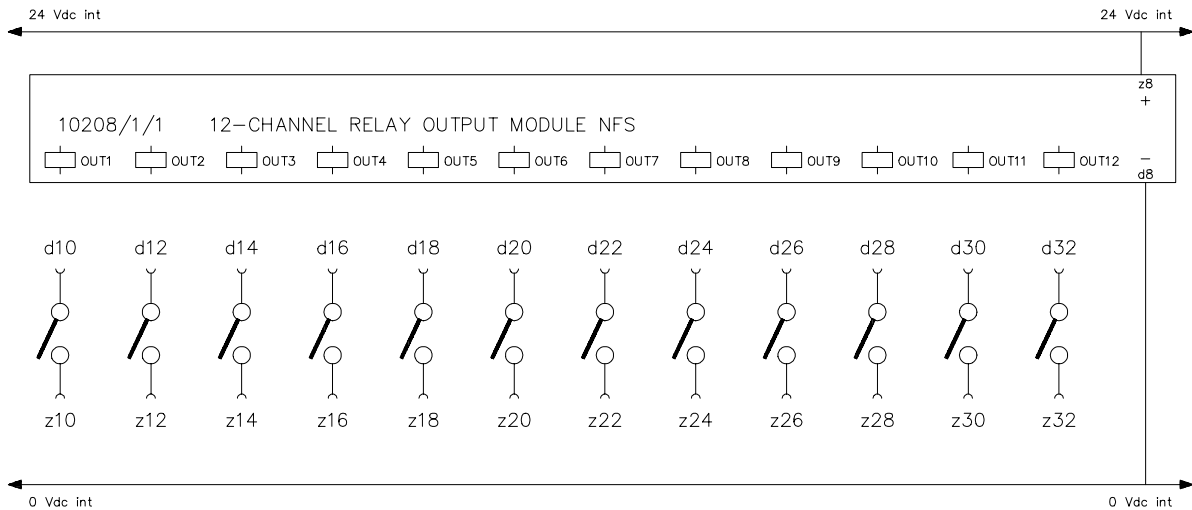


Figure 2 Connection example for non-redundant I/O configurations

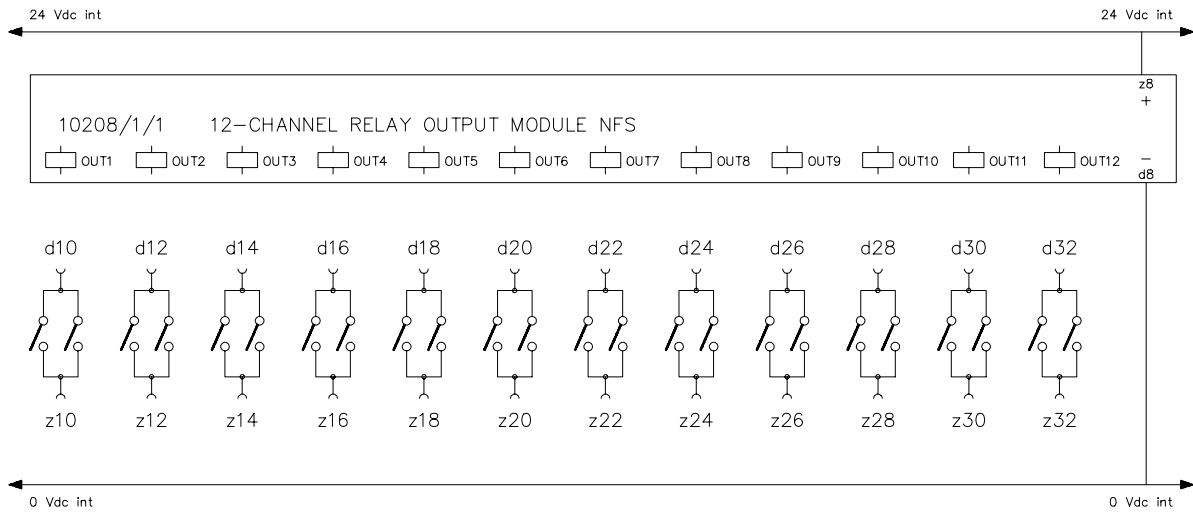


Figure 3 Connection example for redundant I/O configurations

## Technical data

The 10208/1/1 module has the following specifications:

<b>General</b>	Type number:	10208/1/1 02601*
	Approvals:	CE, TÜV, UL
	Software version:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 25 mA 24 Vdc 130 mA
	<b>Output</b>	Number of output channels: 12
	Output specification:	relay contact
	Maximum current:	2 A
	Maximum voltage:	30 Vac / 36 Vdc – IEC 1010 (1990), overvoltage category 3, Table D.12
	Maximum switched power:	100 W / 1000 VA
	Contact material:	gold flush silver-cadmium oxide
	WDG input current	4 mA



## Technical data (continued)

<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A27
	– pins	C3, C23, C31
	Rack code:	
	– blind stops	C11, C19, C27
	– large pin	A27

---

**\* Note:**

10208/1/1 modules with suffix code 02601 have a changed fuse rating of 160 mA.

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## 10208/2/1

## Relay output module (contacts, 10 channels)

### Description

The relay output module 10208/2/1 has ten potential-free relay contact output channels to drive loads up to 70 W. These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode **must be mounted externally**. The outputs are not tested and may therefore *not* be used for fail-safe applications. The maximum voltage on the relay contacts may be 36 Vdc to meet IEC 1010.

The outputs are also controlled by the watchdog. This means that the relays de-energize if the system shuts down and the watchdog switches off.

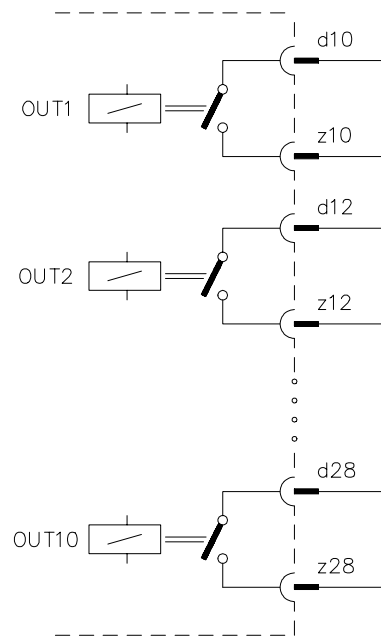
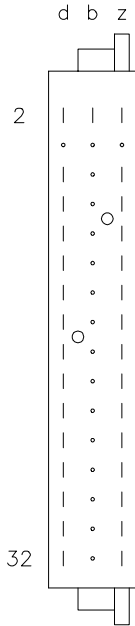


Figure 1 Schematic diagram for 10208/2/1 module



## Pin allocation

The back view and pin allocation of the 10208/2/1 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc			z8	Supply 0 Vdc
d10	Common 1			z10	Normally open 1
d12	Common 2			z12	Normally open 2
d14	Common 3			z14	Normally open 3
d16	Common 4			z16	Normally open 4
d18	Common 5			z18	Normally open 5
d20	Common 6			z20	Normally open 6
d22	Common 7			z22	Normally open 7
d24	Common 8			z24	Normally open 8
d26	Common 9			z26	Normally open 9
d28	Common 10			z28	Normally open 10
d30				z30	
d32				z32	

## Connection examples

The figures below show a number of connection examples for the relay output module 10208/2/1.

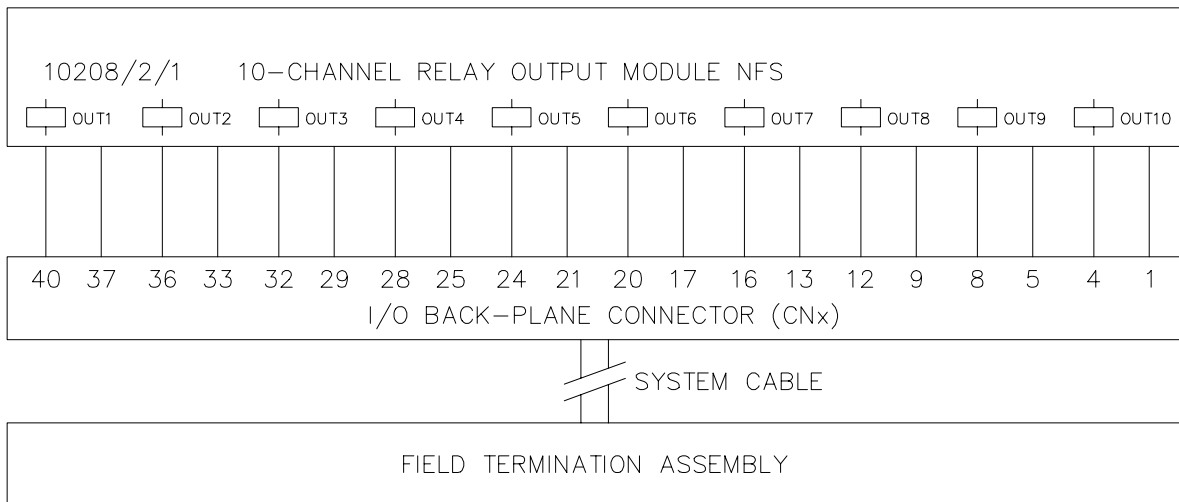


Figure 2 Connection example of 10208/2/1 module to FTA for both non-redundant and redundant I/O configurations



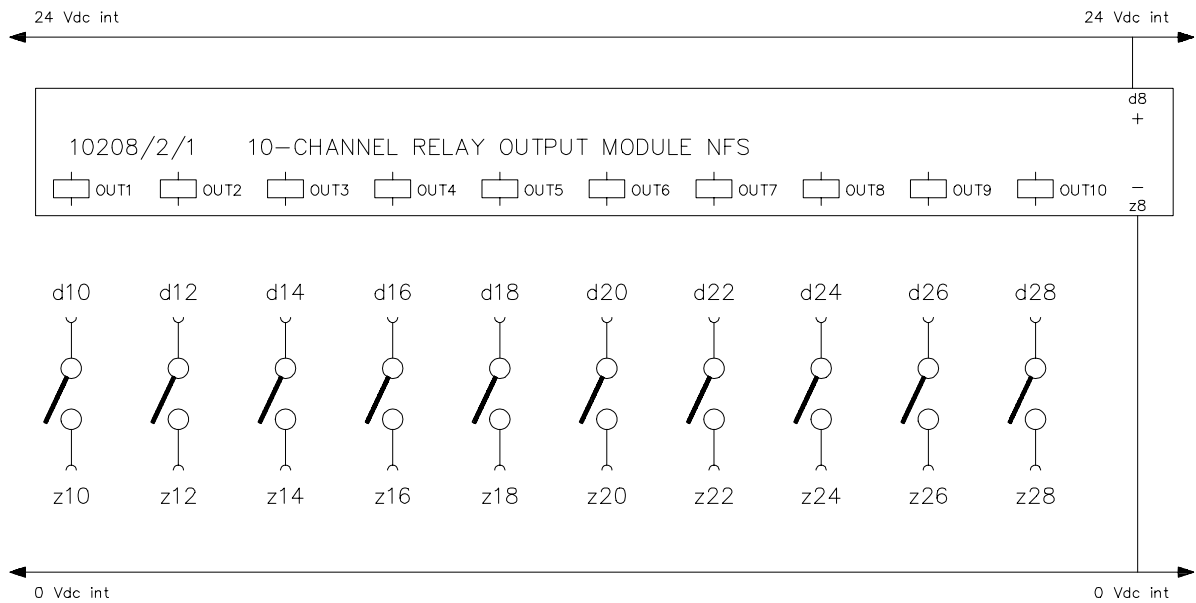


Figure 3 I/O connection example for 10208/2/1 module for non-redundant I/O configurations

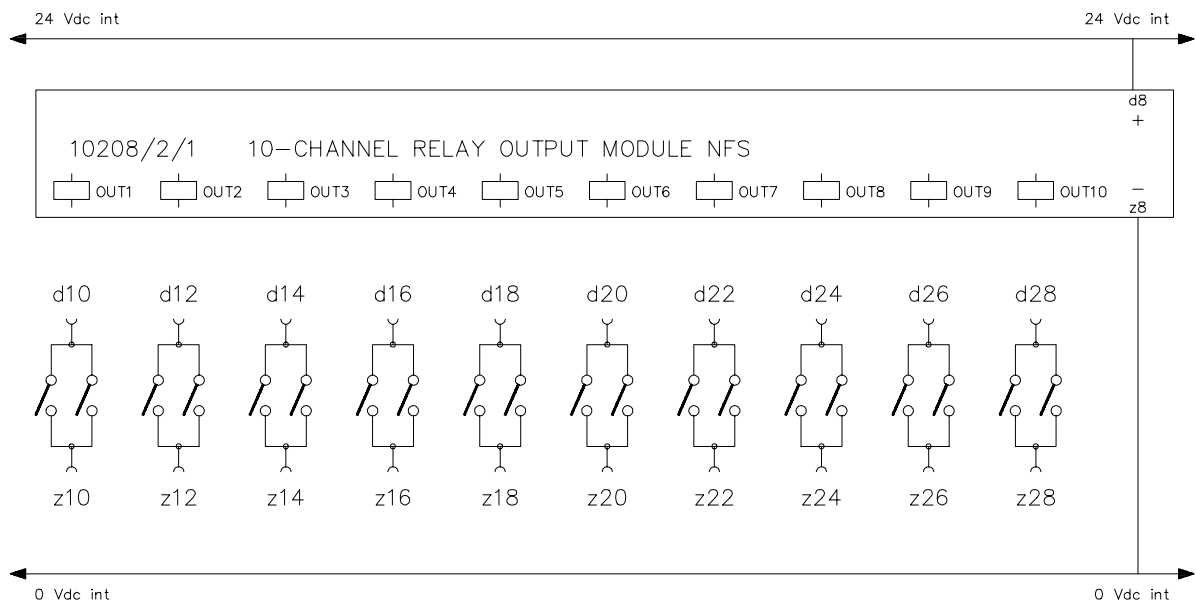


Figure 4 I/O connection example for 10208/2/1 module for redundant I/O configurations



## Technical data

The 10208/2/1 module has the following specifications:

### General

Type number: 10208/2/1 11800  
Approvals: CE, TÜV, UL  
Software versions:  $\geq 3.00$   
Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

### Power

Power requirements: 5 Vdc 25 mA  
24 Vdc 120 mA

### Output

Number of output channels: 10  
Output specification: relay contact  
Maximum current: 2 A  
Maximum voltage: 30 Vac / 36 Vdc – IEC 1010 (1990),  
overvoltage category 3, Table D.12  
Maximum switched power: 100 W / 1000 VA  
Contact material: gold flush silver-cadmium oxide  
WDG input current 4 mA

### Key coding

(See 'Key coding' data sheet)

Module code:  
– holes A9, C17  
Rack code:  
– large pins A9, C17

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## 10209/1/1

## Digital output module (24 Vdc, 0.1 A, 16 channels)

### Description

The digital output module 10209/1/1 has sixteen 24 Vdc, 100 mA output channels to drive loads up to 2.5 W. These loads may be resistive (e.g. LEDs) or inductive (e.g. relays). For inductive loads, a suppression diode is included on each output. The outputs are not tested and may therefore *not* be used for fail-safe applications.

The 24 Vdc circuitry is split into two galvanically isolated groups of eight outputs each. This enables powering the two output groups from two independent power supplies to support segregation in a process unit and/or subunit structure.

The outputs are also controlled by the watchdog. This means that the outputs are de-energized if the system shuts down and the watchdog switches off.

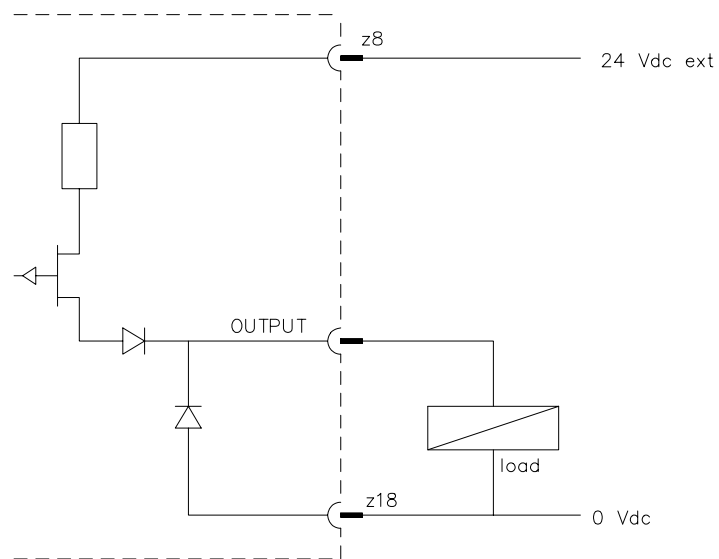
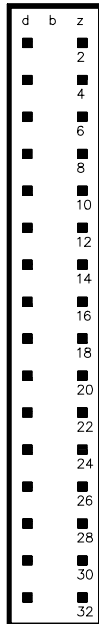


Figure 1 Schematic diagram for connection of one output (output 1-8) to the 10209/1/1 module



## Pin allocation

The back view and pin allocation of the 10209/1/1 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	(Supply 24 Vdc (1))	z8	Supply 24 Vdc (1)
d10	OUT 1	z10	OUT 2
d12	OUT 3	z12	OUT 4
d14	OUT 5	z14	OUT 6
d16	OUT 7	z16	OUT 8
d18	(Supply 0 Vdc (1))	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22	(Supply 24 Vdc (2))	z22	Supply 24 Vdc (2)
d24	OUT 9	z24	OUT 10
d26	OUT 11	z26	OUT 12
d28	OUT 13	z28	OUT 14
d30	OUT 15	z30	OUT 16
d32	(Supply 0 Vdc (2))	z32	Supply 0 Vdc (2)

## Connection examples

The figures below show a number of connection examples for the digital output module 10209/1/1.

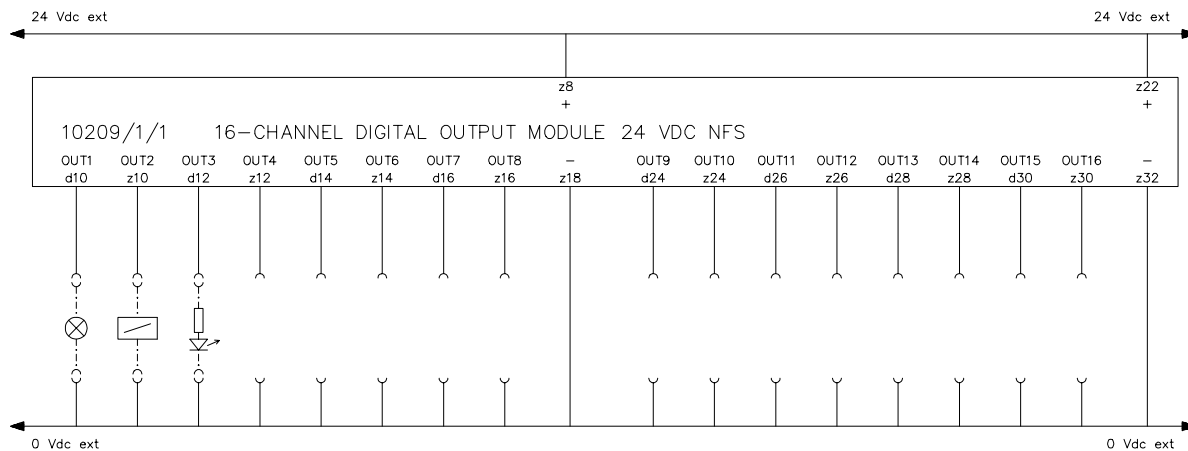


Figure 2 Connection example for non-redundant I/O configurations

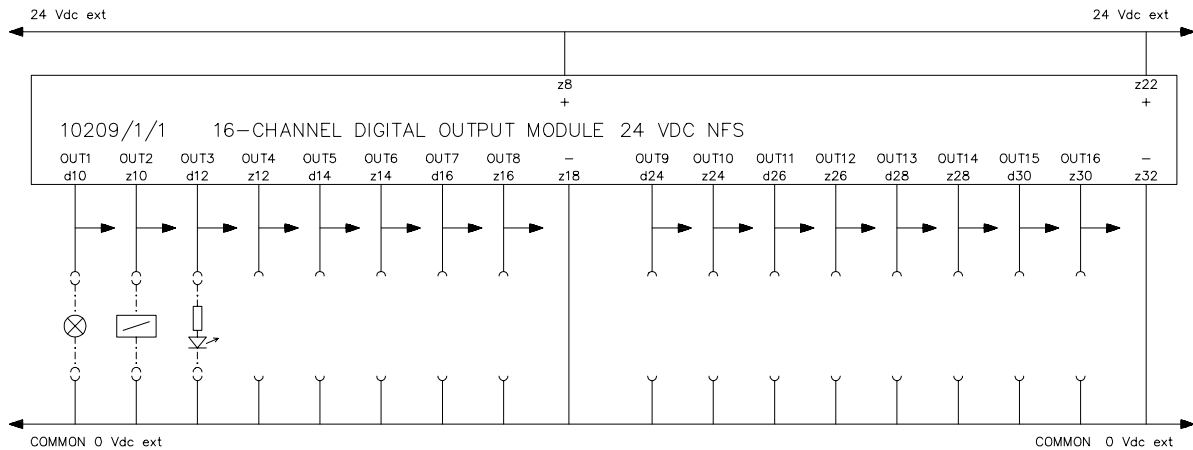


Figure 3 Connection example for redundant I/O configurations

## Technical data

The 10209/1/1 module has the following specifications:

<b>General</b>	Type number:	10209/1/1
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.77
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 35 mA 24 Vdc 2*45 mA (without output load)
<b>Output</b>	Number of output channels:	16 (2 isolated groups of 8)
	Output specification:	24 Vdc solid-state source, short-circuit proof
	Maximum current:	100 mA (see 'FSC output modules' data sheet)
	Maximum lamp load:	50 mA (1.2 W)
	Maximum load capacitance:	1 µF
	Voltage drop:	< 1.2 Vdc at 100 mA
	Off current:	< 0.1 mA
	WDG input current:	4 mA



## Technical data (continued)

<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A27
	– pins	C3, C27, C31
	Rack code:	
	– blind stop	C11, C19, C23
	– large pin	A27

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## 10209/2/1

## Digital output module (24 Vdc, 0.1 A, 16 channels)

### Description

The digital output module 10209/2/1 has sixteen 24 Vdc, 100 mA output channels to drive loads up to 2.5 W. These loads may be resistive (e.g. LEDs) or inductive (e.g. relays). For inductive loads, a suppression diode is included on each output. The outputs are not tested and may therefore *not* be used for fail-safe applications.

The outputs are also controlled by the watchdog. This means that the outputs are de-energized if the system shuts down and the watchdog switches off.

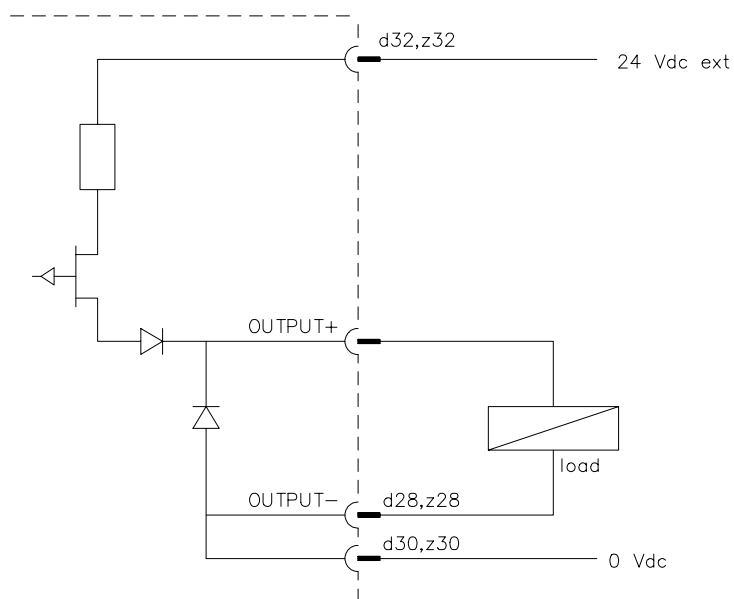
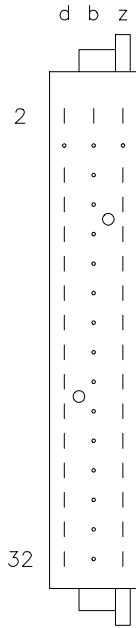


Figure 1 Schematic diagram for connection of one output to the 10209/2/1 module



## Pin allocation

The back view and pin allocation of the 10209/2/1 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6				z6	
d8				z8	
d10				z10	
d12	OUT 1			z12	OUT 2
d14	OUT 3			z14	OUT 4
d16	OUT 5			z16	OUT 6
d18	OUT 7			z18	OUT 8
d20	OUT 9			z20	OUT 10
d22	OUT 11			z22	OUT 12
d24	OUT 13			z24	OUT 14
d26	OUT 15			z26	OUT 16
d28	0 Vdc out			z28	0 Vdc out
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 24 Vdc			z32	Supply 24 Vdc

## Connections examples

The figures below show a number of connection examples for the digital output module 10209/2/1.

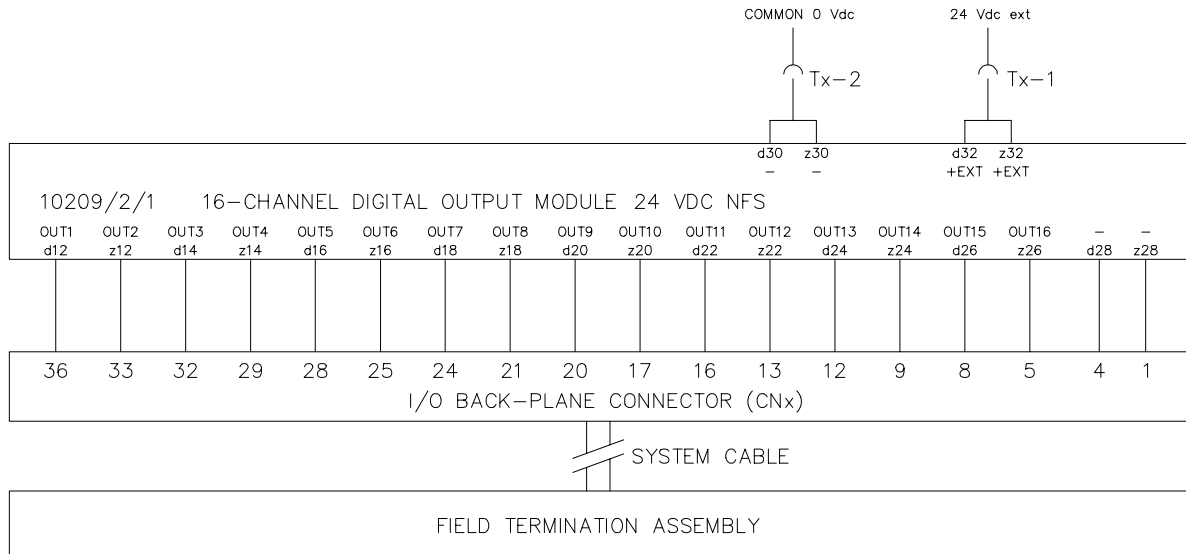


Figure 2 Connection example of 10209/2/1 module to FTA for both non-redundant and redundant I/O configurations



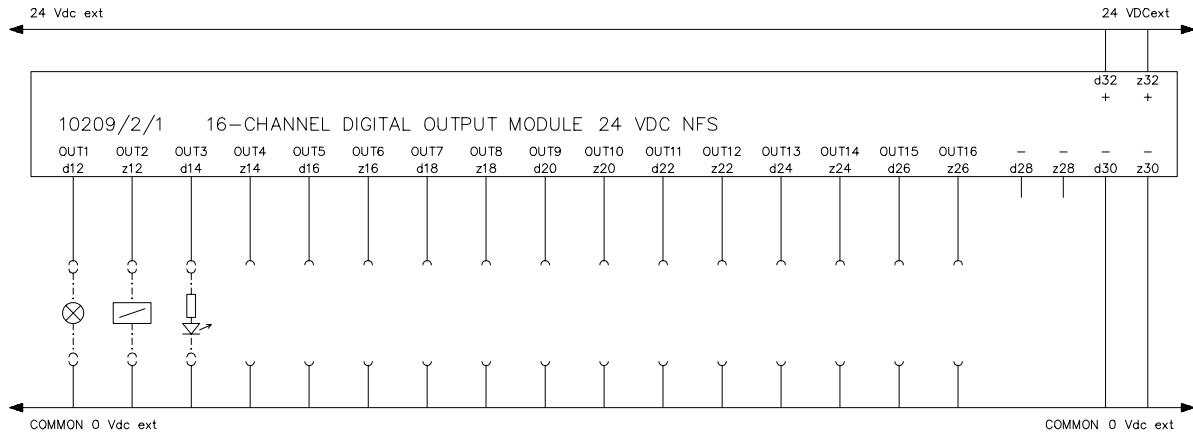


Figure 3 I/O connection example for 10209/2/1 module for non-redundant I/O configurations

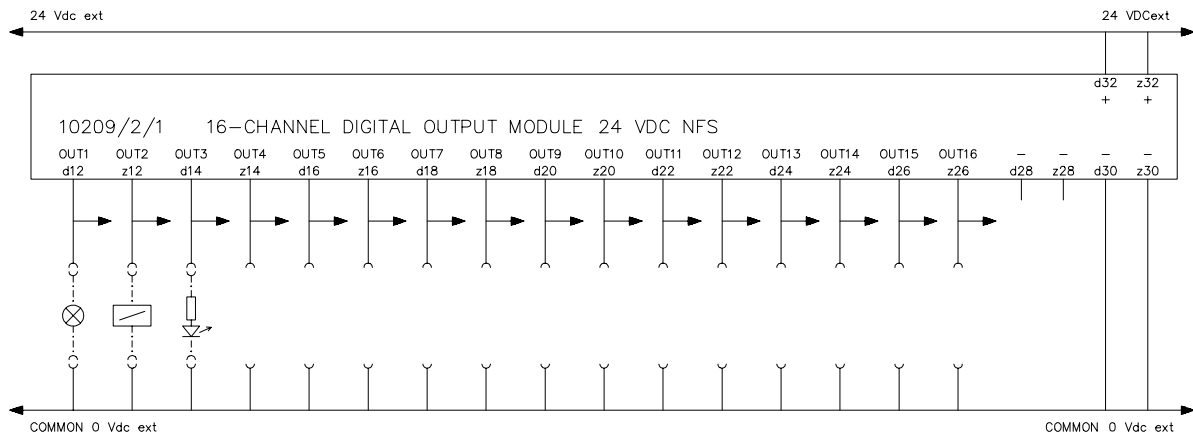


Figure 4 I/O connection example for 10209/2/1 module for redundant I/O configurations



## Technical data

The 10209/2/1 module has the following specifications:

<b>General</b>	Type number:	10209/2/1 11900
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 35 mA 24 Vdc 85 mA (without output load)
	<b>Output</b>	Number of output channels: 16
	Output specification:	24 Vdc solid-state source, short-circuit proof
	Maximum current:	100 mA (see 'FSC output modules' data sheet)
	Maximum lamp load:	50 mA (1.2 W)
	Maximum load capacitance:	1 µF
	Voltage drop:	< 1.2 Vdc at 100 mA
	Off current:	< 0.1 mA
	WDG input current:	4 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– holes	A9, C21
	Rack code:	
– large pins	A9, C21	

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10212/1/1

## Digital output module (24 Vdc, 0.9 A, 8 channels)

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### Description

The digital output module 10212/1/1 has four 24 Vdc, 900 mA fail-safe output channels and four 24 Vdc, 900 mA non-fail-safe output channels to drive loads up to 21.5 W.

These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The four fail-safe outputs (1 to 4), including their suppression diodes, are fully tested and may therefore be used for fail-safe applications. The four non-fail-safe outputs (5 to 8) are only tested for correct switching and do not contain a secondary means of de-energization, and may therefore *not* be used for fail-safe applications.

Within the configured process safety time, the four fail-safe outputs are tested for:

- ability to de-energize,
- ability to de-energize the group (via secondary means),
- crosstalk between outputs, and
- functioning of the suppression diodes.

The four fail-safe outputs have a secondary means of de-energization. The four non-fail-safe outputs are also controlled by the watchdog. These facilities enable the watchdog and/or the processor to de-energize the outputs, irrespective of the result of the application function.

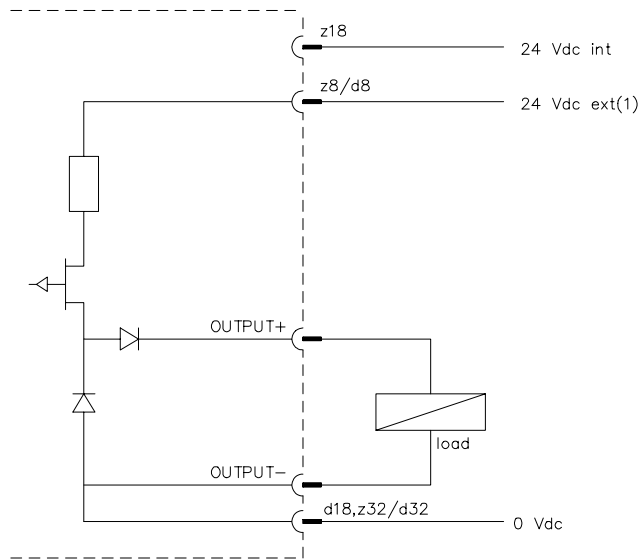


Figure 1 Schematic diagram for connection of one fail-safe output (1-4) to the 10212/1/1 module

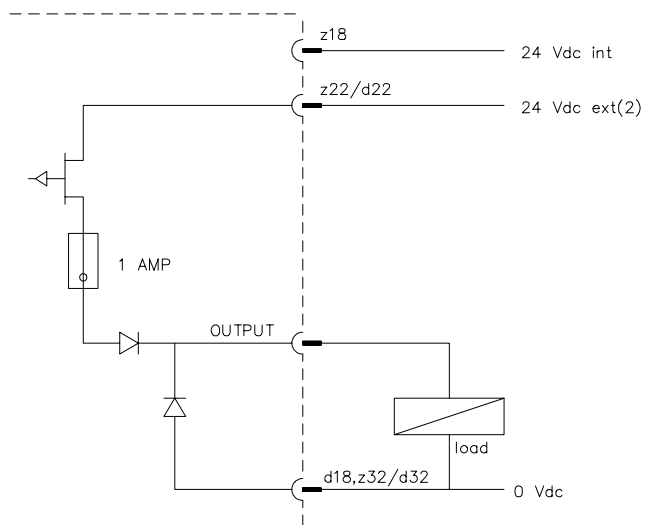
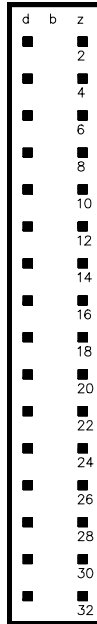


Figure 2 Schematic diagram for connection of one non-fail-safe output (5-8) to the 10212/1/1 module



## Pin allocation

The back view and pin allocation of the 10212/1/1 rack connector are as follows:



d2	WDG 1 (5 Vdc)	z2	GND 5 Vdc
d4	WDG 2 (5 Vdc)*	z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext. (1)	z8	Supply 24 Vdc ext. (1)
d10	OUT 1-	z10	OUT 1+
d12	OUT 2-	z12	OUT 2+
d14	OUT 3-	z14	OUT 3+
d16	OUT 4-	z16	OUT 4+
d18	Supply 0 Vdc	z18	Supply 24 Vdc int. *
d20	Link	z20	Link
d22	Supply 24 Vdc ext. (2)	z22	Supply 24 Vdc ext. (2)
d24	OUT 5-	z24	OUT 5+
d26	OUT 6-	z26	OUT 6+
d28	OUT 7-	z28	OUT 7+
d30	OUT 8-	z30	OUT 8+
d32	Supply 0 Vdc	z32	Supply 0 Vdc

---

### \* Notes:

10212/1/1 modules without suffix code have one combined watchdog input (d2) and no separate 24 Vdc int. pin. The internal supply comes from pin z8/d8.

10212/1/1 modules with suffix code 02801 have two watchdog inputs. WDG1 (d2) controls outputs 1 to 4, and WDG2 (d4) controls outputs 5 to 8.

---



## Connection examples

The figures below show a number of connection examples for the digital output module 10212/1/1.

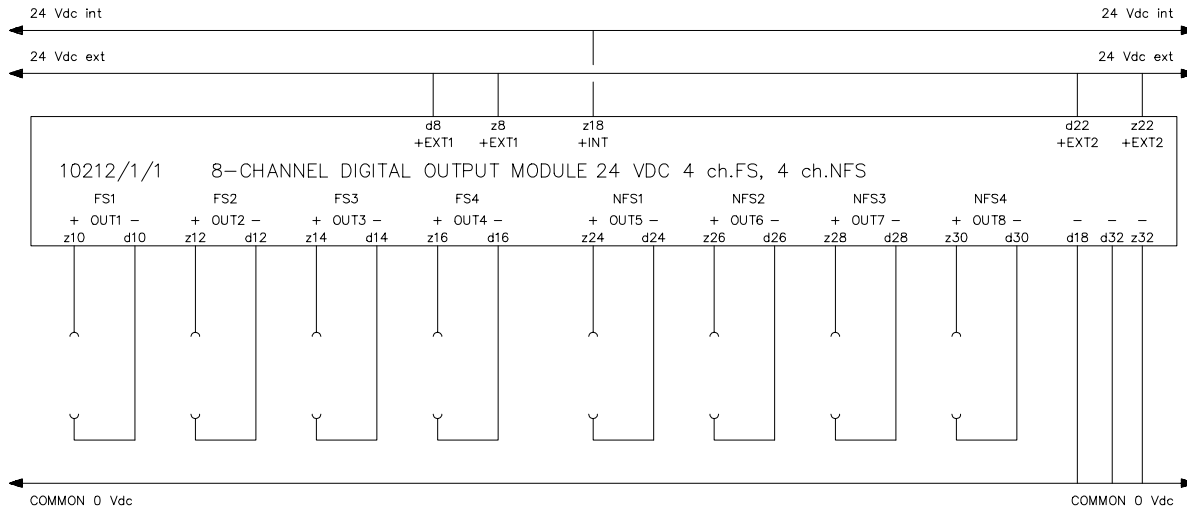


Figure 3 Connection example for non-redundant I/O configurations

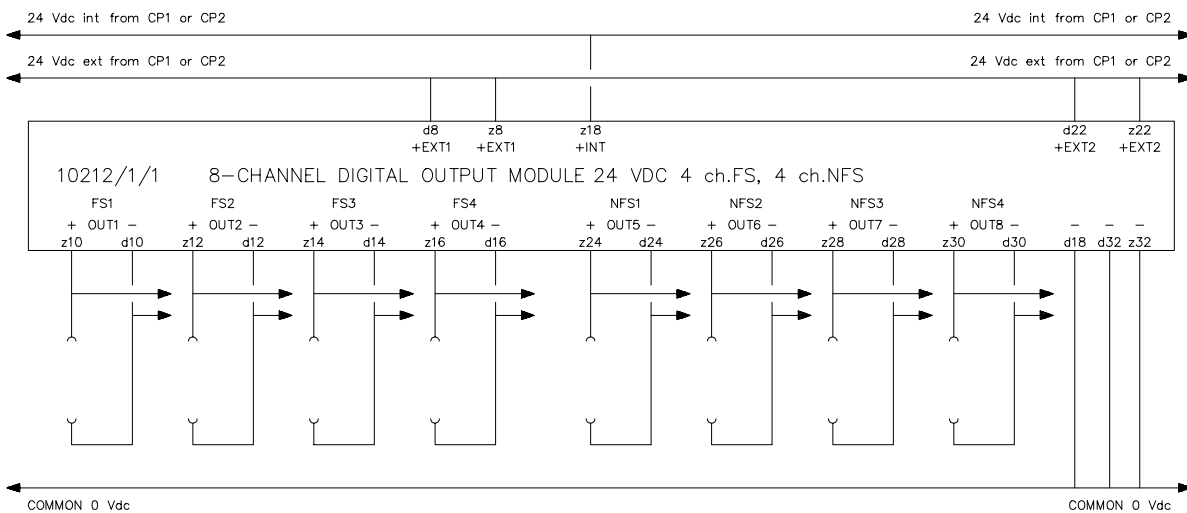


Figure 4 Connection example for redundant I/O configurations

### Note:

The 24 Vdc internal and external power supplies must be connected to prevent fault detection during the self-test of the output module (pins z8/d8, z18, d18, z22/d22 and z32/d32).



## Technical data

The 10212/1/1 module has the following specifications:

<b>General</b>	Type number:	10212/1/1 02801*
	Approvals:	CE, TÜV
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 25mA 24 Vdc 70 mA (without output load)
	<b>Output</b>	Number of output channels: 8 (2 groups of 4)
	Output specification (1-4):	24 Vdc solid-state source, short-circuit proof
	– maximum current	900 mA (see 'FSC output modules' data sheet)
	– maximum lamp load	200 mA (4.8 W)
	Output specification (5-8):	fuse-protected (1 A)
	– maximum current	900 mA
	– maximum lamp load	450 mA (10.8 W)
	Max. load capacitance:	1 µF
	Voltage drop:	
	– output 1-4 (FS)	< 2.0 Vdc at 800 mA
	– output 5-8 (NFS)	< 1.0 Vdc at 800 mA
	Off current:	< 0.1 mA
	WDG input current:	2*4 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A27
	– pins	C11, C23, C31
	Rack code:	
– blind stops	C3, C19, C27	
– large pins	A27	

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## 10213/1/1

# Fail-safe digital output module (110 Vdc, 0.32 A, 4 channels)

### Description

The fail-safe digital output module has four 110 Vdc, 325 mA output channels to drive loads up to 35 W.

These loads may be resistive or inductive (e.g. solenoids).

For inductive loads, a suppression diode is included on each output.

The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between outputs, and
- functioning of the suppression diodes.

The internal 110 Vdc supply is galvanically isolated from the external 110 Vdc circuit.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

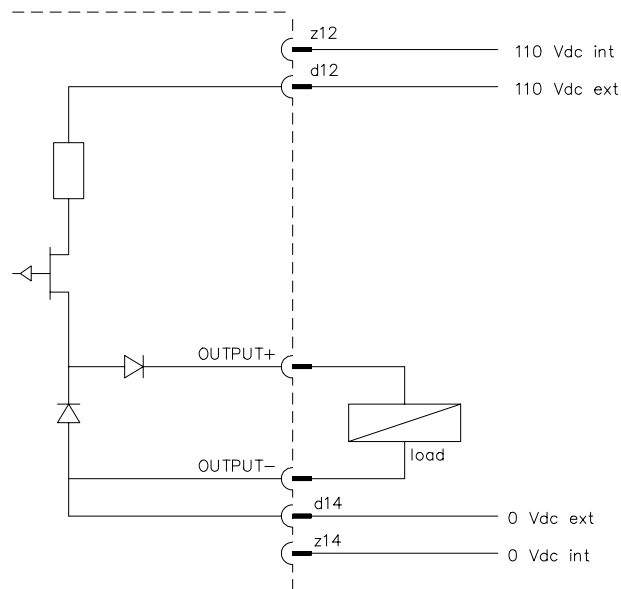
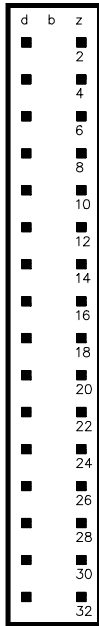


Figure 1 Schematic diagram for connection of one output to the 10213/1/1 module



## Pin allocation

The back view and pin allocation of the 10213/1/1 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Link	z8	Link
d10	(Supply 110 Vdc ext.)	z10	
d12	Supply 110 Vdc ext.	z12	Supply 110 Vdc int.
d14	Supply 0 Vdc ext.	z14	Supply 0 Vdc int.
d16	(Supply 0 Vdc ext.)	z16	
d18		z18	
d20	OUT 1-	z20	OUT 1+
d22		z22	
d24	OUT 2-	z24	OUT 2+
d26		z26	
d28	OUT 3-	z28	OUT 3+
d30		z30	
d32	OUT 4-	z32	OUT 4+

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10213/1/1.

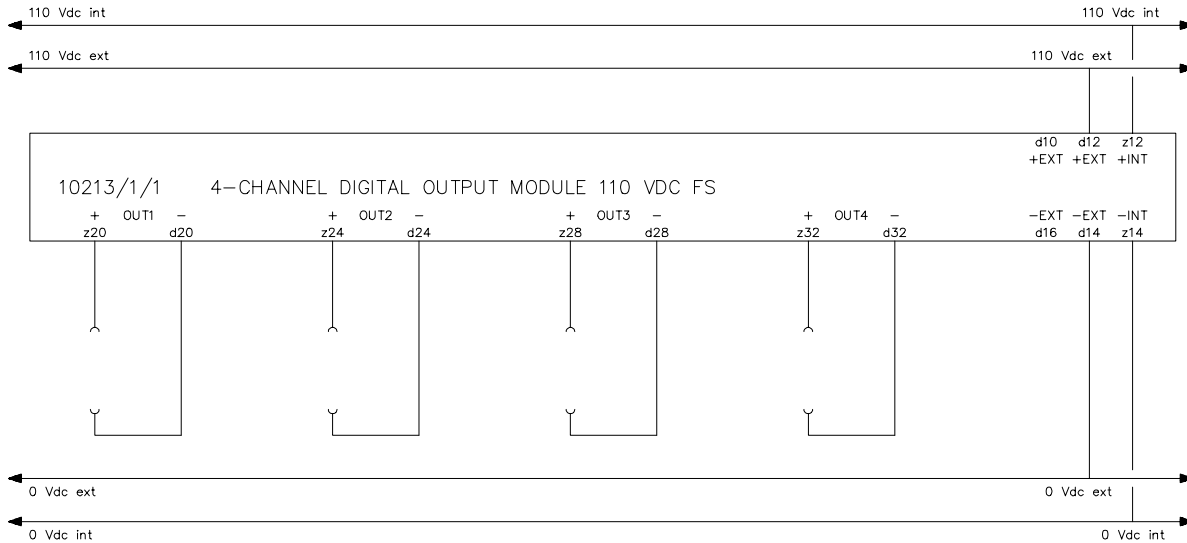


Figure 2 Connection example for non-redundant I/O configurations

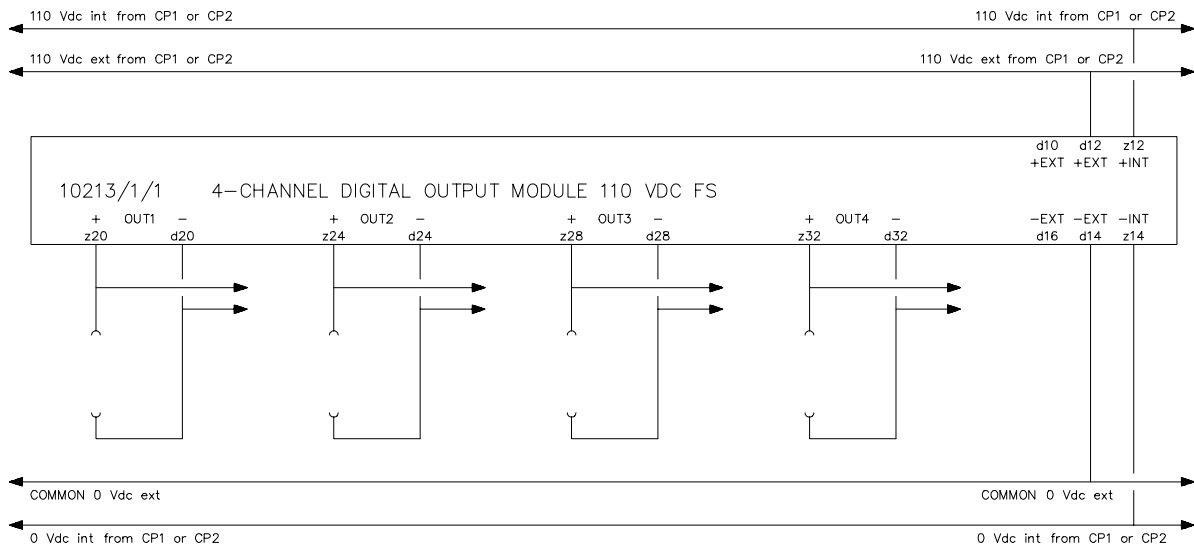


Figure 3 Connection example for redundant I/O configurations.

**Note:**

The 110 Vdc internal and external power supplies must be connected to prevent fault detection during the self-test of the output modules (pins d12, z12, d14 and z14).

**Technical data**

The 10213/1/1 module has the following specifications:

<b>General</b>	Type number:	10213/1/1 02902*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.78
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Supply voltage:	110 Vdc, -15%...+25%
	Power requirements:	5 Vdc 25 mA 110 Vdc internal 10 mA 110 Vdc external 20 mA (without output load)
<b>Fuses</b>	Fuse values:	1x 1.6 A 3x 40 mA
	Fuse type:	Round, TR5-F/19370K
	Fuse dimensions:	Ø 8.2 mm (0.32 in), height 7.7 mm (0.3 in)



## Technical data (continued)

<b>Output</b>	Number of output channels:	4
	Output specification:	110 Vdc solid-state source, short-circuit proof
	Maximum current:	325 mA (see 'FSC output modules' data sheet)
	Maximum lamp load:	55 mA (6 W)
	Max. load capacitance:	1 $\mu$ F
	Voltage drop:	< 2.5 Vdc at 300 mA
	Off current:	< 0.1 mA
	WDG input current:	5 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A11
	– pins	C3, C11, C19
	Rack code:	
– blind stops	C23, C27, C31	
– large pin	A11	

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### \* Notes:

10213/1/1 modules with suffix code 02901 or 02902 have an improved watchdog input circuit.

10213/1/1 modules with suffix code 02902 have improved voltage readback near the minimum supply voltage (110 Vdc –15%).

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## 10213/1/2

## Fail-safe digital output module (60 Vdc, 0.67 A, 4 channels)

### Description

The fail-safe digital output module 10213/1/2 has four 60 Vdc, 675 mA output channels to drive loads up to 40 W. These loads may be resistive or inductive (e.g. solenoids). For inductive loads a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between outputs, and
- functioning of the suppression diodes.

The internal 60 Vdc supply is galvanically isolated from the external 60 Vdc circuit.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

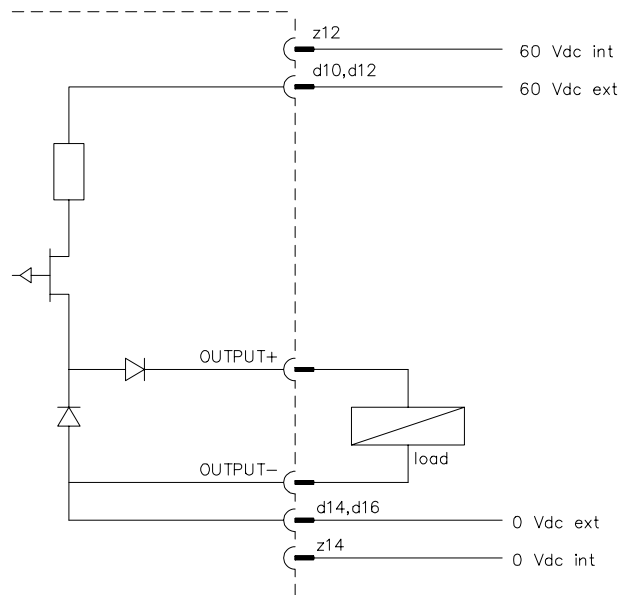
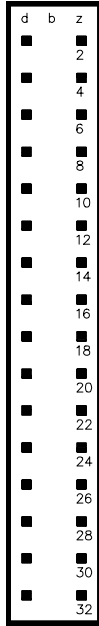


Figure 1 Schematic diagram for connection of one output to the 10213/1/2 module



## Pin allocation

The back view and pin allocation of the 10213/1/2 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Link	z8	Link
d10	Supply 60 Vdc ext.	z10	
d12	Supply 60 Vdc ext.	z12	Supply 60 Vdc int.
d14	Supply 0 Vdc ext.	z14	Supply 0 Vdc int.
d16	Supply 0 Vdc ext.	z16	
d18		z18	
d20	OUT 1-	z20	OUT 1+
d22		z22	
d24	OUT 2-	z24	OUT 2+
d26		z26	
d28	OUT 3-	z28	OUT 3+
d30		z30	
d32	OUT 4-	z32	OUT 4+

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10213/1/2.

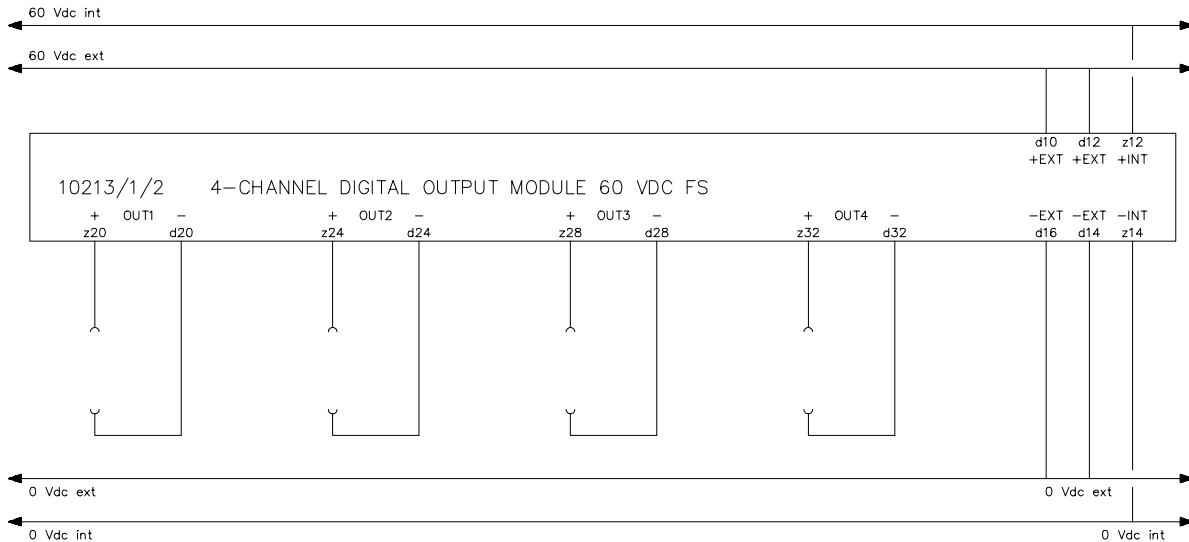


Figure 2 Connection example for non-redundant I/O configurations

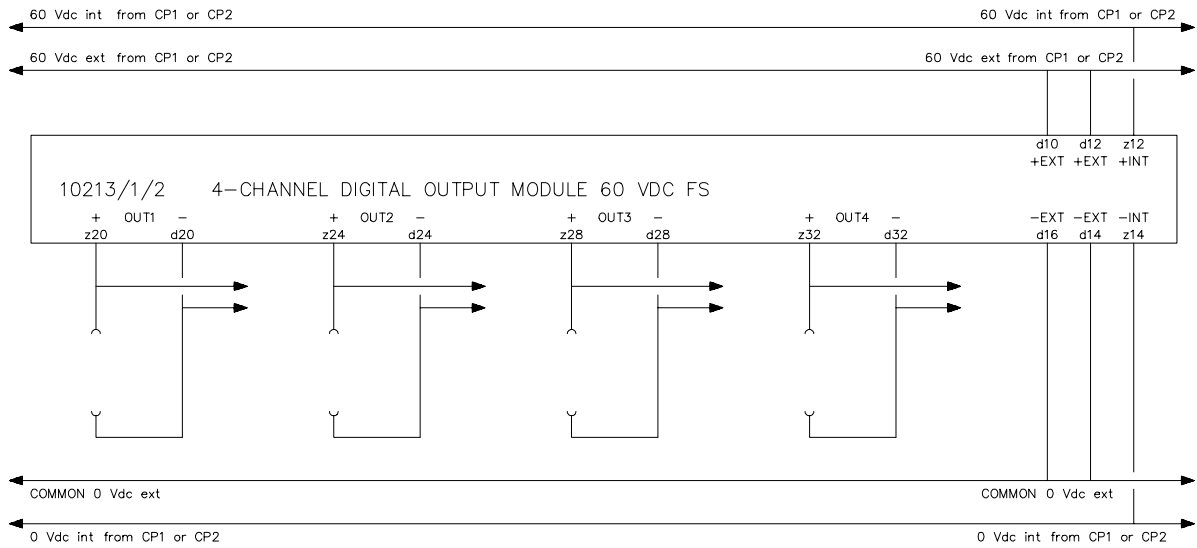


Figure 3 Connection example for redundant I/O configurations

**Note:**

The 60 Vdc internal and external power supplies must be connected to prevent fault detection during the self-test of the output modules (pins d10, d12, z12, d14, z14 and d16).

**Technical data**

The 10213/1/2 module has the following specifications:

<b>General</b>	Type number:	10213/1/2 07001*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.80b
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Supply voltage:	60 Vdc ± 15%
	Power requirements:	5 Vdc 25 mA 60 Vdc internal 20 mA 60 Vdc external 20 mA (without output load)
<b>Fuses</b>	Fuse values:	1x 3.15 A 3x 40 mA
	Fuse type:	Round, TR5-F/19370K
	Fuse dimensions:	Ø 8.2 mm (0.32 in), height 7.7 mm (0.3 in)



## Technical data (continued)

<b>Output</b>	Number of output channels:	4
	Output specification:	60 Vdc solid-state source, short-circuit proof
	Maximum current:	675 mA (see 'FSC output modules' data sheet)
	Maximum lamp load:	100 mA (6 W)
	Maximum load capacitance:	1 $\mu$ F
	Voltage drop:	< 2.1 Vdc at 675 mA
	Off current:	< 0.1 mA
	WDG input current:	5 mA
	<b>Key coding</b>	(See 'Key coding' data sheet)
Module code:		
– hole		A15
– pins		C3, C11, C19
Rack code:		
– blind stops		C23, C27, C31
– large pin	A15	

---

**\* Note:**

10213/1/2 modules with suffix code 07001 have improved voltage readback near the minimum supply voltage (60 Vdc –15%).

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## 10213/1/3

# Fail-safe digital output module (48 Vdc, 0.75 A, 4 channels)

### Description

The fail-safe digital output module 10213/1/3 has four 48 Vdc, 750 mA output channels to drive loads up to 36 W. These loads may be resistive or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between outputs, and
- functioning of the suppression diodes.

The internal 48 Vdc supply is galvanically isolated from the external 48 Vdc circuit.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

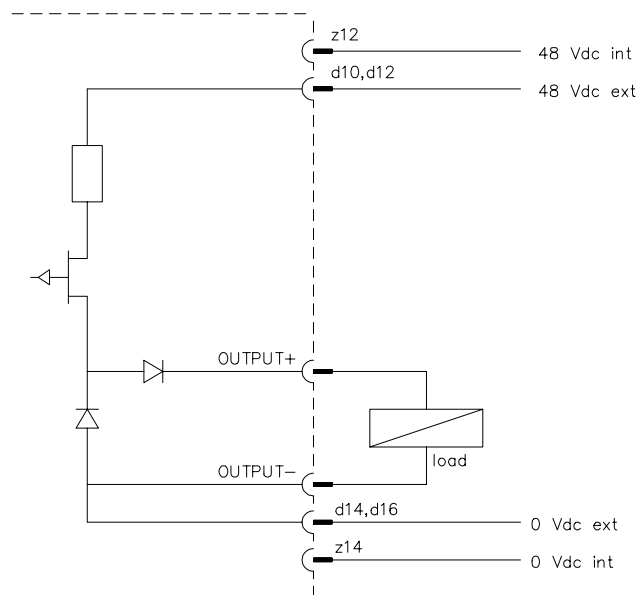
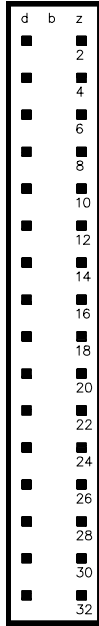


Figure 1 Schematic diagram for connection of one output to the 10213/1/3 module



## Pin allocation

The back view and pin allocation of the 10213/1/3 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Link	z8	Link
d10	Supply 48 Vdc ext.	z10	
d12	Supply 48 Vdc ext.	z12	Supply 48 Vdc int.
d14	Supply 0 Vdc ext.	z14	Supply 0 Vdc int.
d16	Supply 0 Vdc ext.	z16	
d18		z18	
d20	OUT 1-	z20	OUT 1+
d22		z22	
d24	OUT 2-	z24	OUT 2+
d26		z26	
d28	OUT 3-	z28	OUT 3+
d30		z30	
d32	OUT 4-	z32	OUT 4+

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10213/1/3.

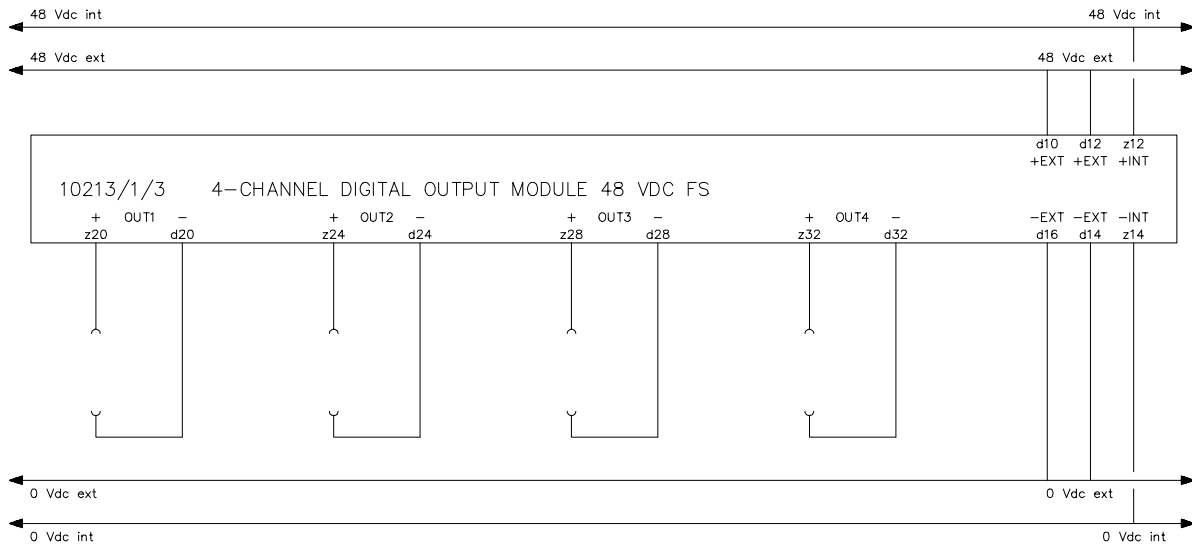


Figure 2 Connection example for non-redundant I/O configuration

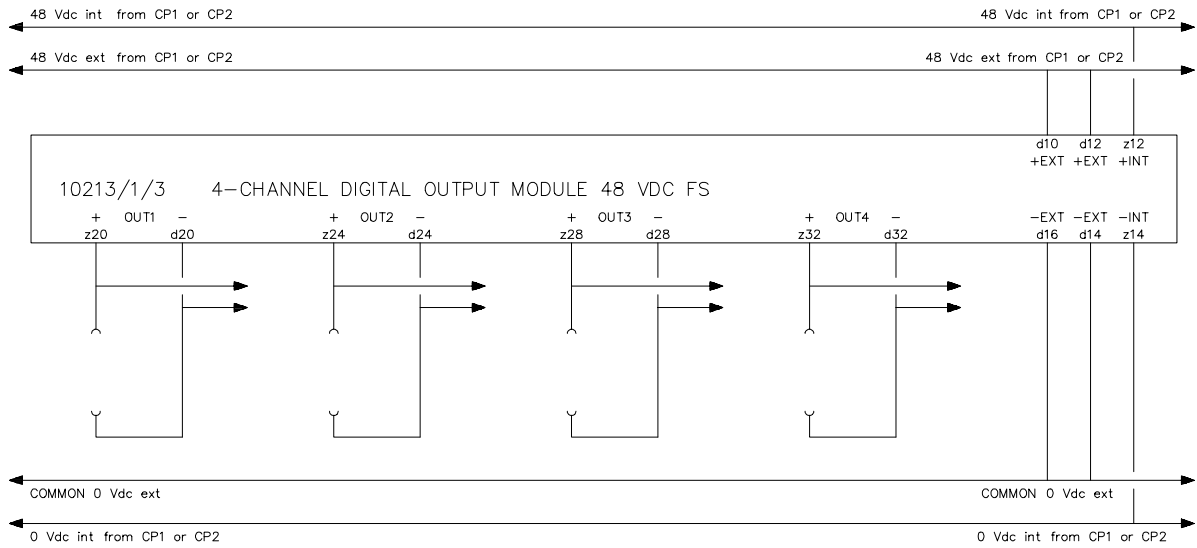


Figure 3 Connection example for redundant I/O configurations

**Note:**

The 48 Vdc internal and external power supplies must be connected to prevent fault detection during the self-test of the output module (pins d10, d12, z12, d14, z14 and d16).

**Technical data**

The 10213/1/3 module has the following specifications:

**General**

Type number: 10213/1/3 07101\*  
 Approvals: CE, TÜV, UL  
 Software versions: ≥ 2.80b  
 Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

**Power**

Supply voltage: 48 Vdc ± 15%  
 Power requirements: 5 Vdc 25 mA  
 48 Vdc internal 20 mA  
 48 Vdc external 20 mA (without output load)



## Technical data (continued)

<b>Output</b>	Number of output channels:	4
	Output specification:	48 Vdc solid-state source, short-circuit proof
	Maximum current:	750 mA (see 'FSC output modules' data sheet)
	Maximum lamp load:	125 mA (6 W)
	Maximum load capacitance:	1 $\mu$ F
	Voltage drop:	< 2.1 Vdc at 750 mA
	Off current:	< 0.1 mA
	WDG input current:	5 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A3
	– pins	C3, C11, C19
	Rack code:	
– blind stops	C23, C27, C31	
– large pin	A3	

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**\* Note:**

10213/1/3 modules with suffix code 07101 have improved voltage readback near the minimum supply voltage (48 Vdc –15%).

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## 10213/2/1

# Fail-safe digital output module (110 Vdc, 0.32 A, 4 channels)

### Description

The fail-safe digital output module 10213/2/1 has four 110 Vdc, 325 mA output channels to drive loads up to 35 W.

These loads may be resistive or inductive (e.g. solenoids).

For inductive loads, a suppression diode is included on each output.

The outputs, including the suppression diodes, are fully tested and may be therefore used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between outputs, and
- functioning of the suppression diodes.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

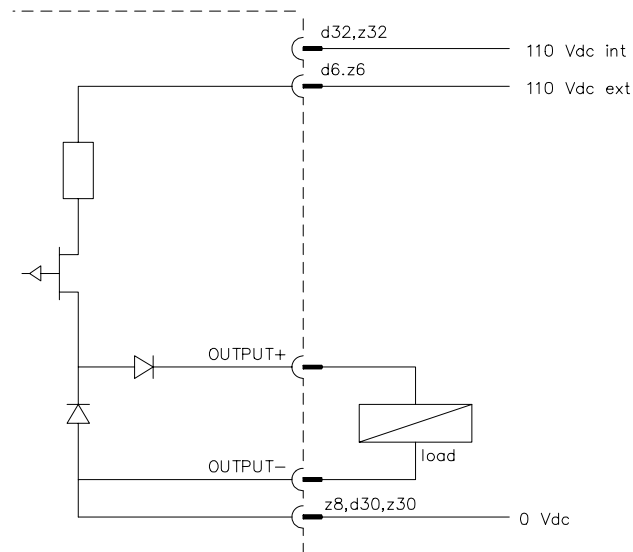
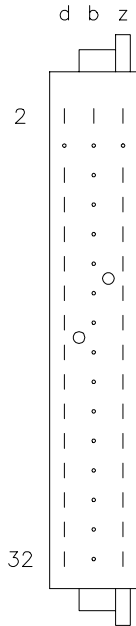


Figure 1 Schematic diagram for connection of one output to the 10213/2/1 module



## Pin allocation

The back view and pin allocation of the 10213/2/1 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 110 Vdc ext.			z6	Supply 110 Vdc ext.
d8				z8	Supply 0 Vdc
d10				z10	
d12	(0 Vdc)			z12	(0 Vdc)
d14	OUT 1+			z14	OUT 1–
d16	(0 Vdc)			z16	(0 Vdc)
d18	OUT 2+			z18	OUT 2–
d20	(0 Vdc)			z20	(0 Vdc)
d22	OUT 3+			z22	OUT 3–
d24	(0 Vdc)			z24	(0 Vdc)
d26	OUT 4+			z26	OUT 4–
d28	(0 Vdc)			z28	(0 Vdc)
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 110 Vdc int.			z32	Supply 110 Vdc int.

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10213/2/1.

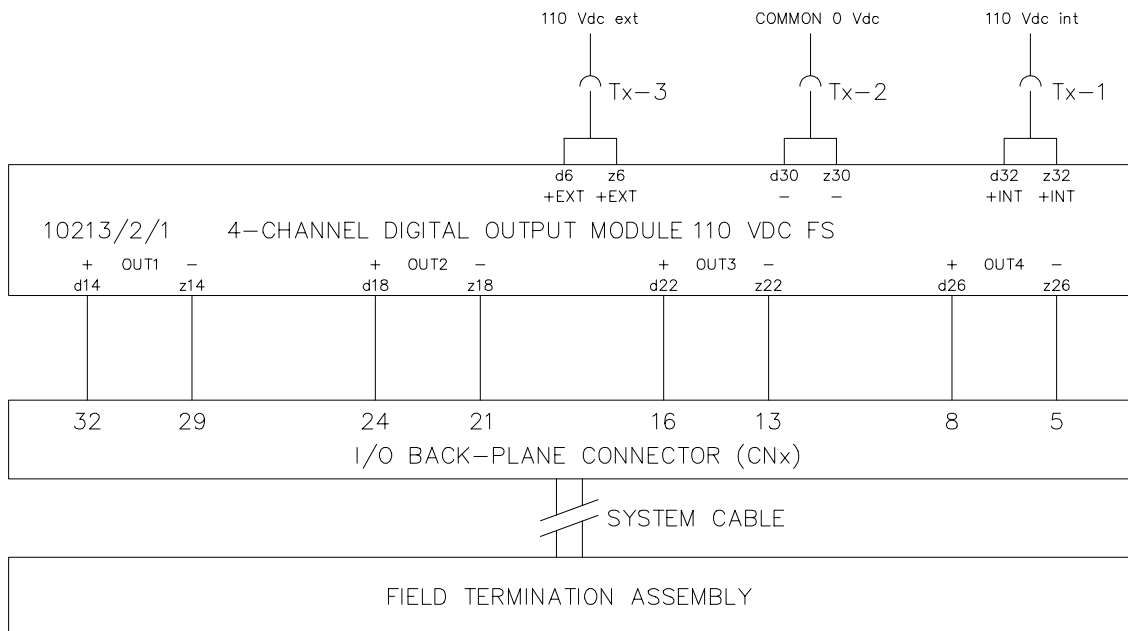


Figure 2 Connection example of 10213/2/1 module to FTA for both non-redundant and redundant I/O configurations

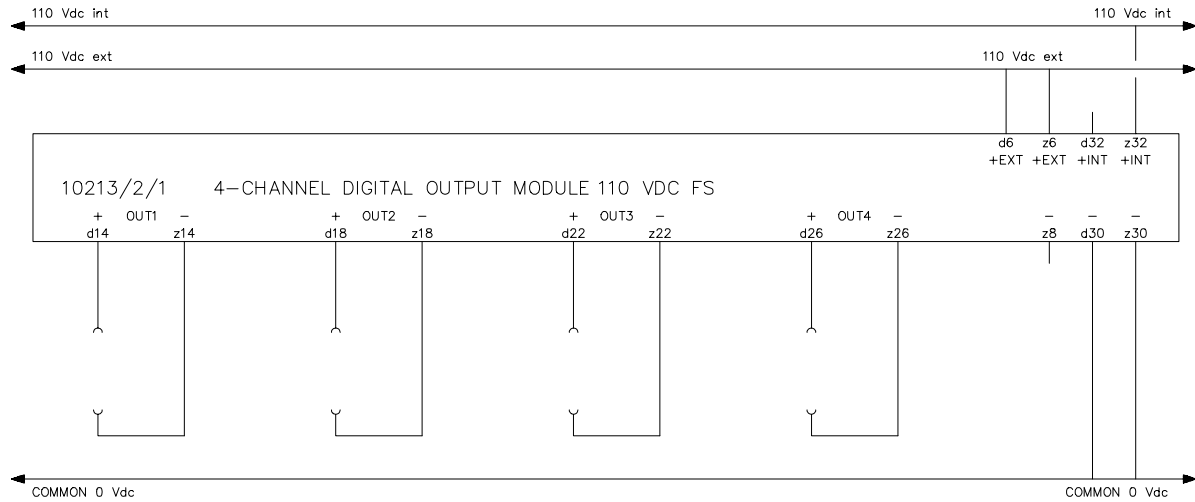


Figure 3 I/O connection example for 10213/2/1 module for non-redundant I/O configurations

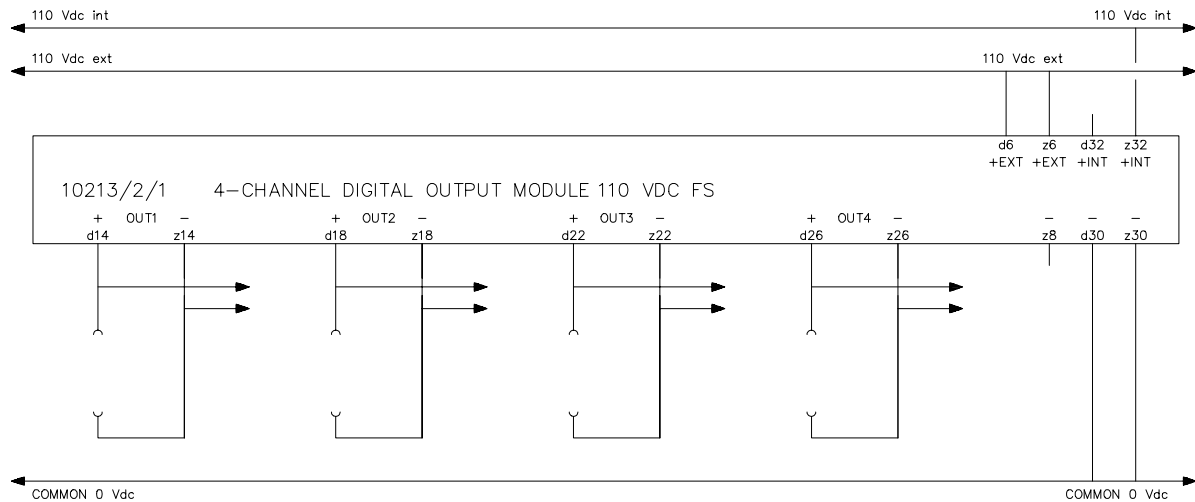


Figure 4 I/O connection example for 10213/2/1 module for redundant I/O configurations

**Note:**

The 110 Vdc internal and external power supplies must be connected to prevent fault detection during self-test of the output module (pins d6/z6, d30/z30 and z32).



## Technical data

The 10213/2/1 module has the following specifications:

<b>General</b>	Type number:	10213/2/1 12002*
	Approvals:	CE, TÜV; UL approval pending
	Software versions:	≥ 310
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Supply voltage:	110 Vdc, -15%...+25%
	Power requirements:	5 Vdc 25 mA 110 Vdc internal 10 mA 110 Vdc external 20 mA (without output load)
	<b>Fuses</b>	Fuse values: 1x 1.6 A 3x 40 mA Fuse type: Round, TR5-F/19370K Fuse dimensions: Ø 8.2 mm (0.32 in), height 7.7 mm (0.3 in)
<b>Output</b>	Number of output channels:	4
	Output specification:	110 Vdc solid-state source, short-circuit proof
	Maximum current:	325 mA (see 'FSC output modules' data sheet)
	Maximum lamp load:	55 mA (6 W)
	Maximum load capacitance:	1 µF
	Voltage drop:	< 2.5 Vdc at 300 mA
	Off current:	< 0.1 mA
	WDG input current:	5 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– holes	A13, C17
	Rack code:	
– large pins	A13, C17	

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**\* Note:**

10213/2/1 modules with suffix code 12001 or 12002 have improved voltage readback near the minimum supply voltage (110 Vdc -15%).

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## 10213/2/2

## Fail-safe digital output module (60 Vdc, 0.67 A, 4 channels)

### Description

The fail-safe digital output module 10213/2/2 has four 60 Vdc, 675 mA output channels to drive loads up to 40 W. These loads may be resistive or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between outputs, and
- functioning of the suppression diodes.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

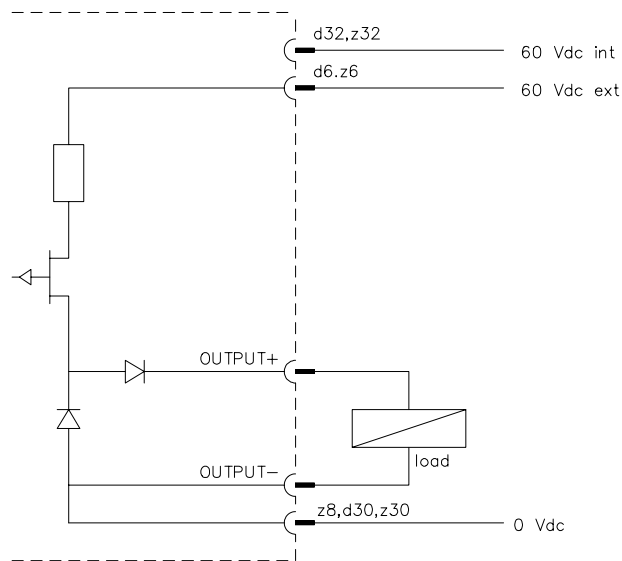
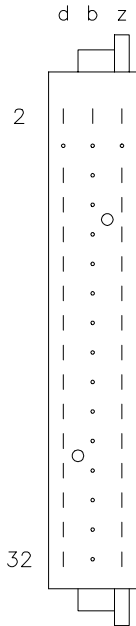


Figure 1 Schematic diagram for connection of one output to the 10213/2/2 module

## Pin allocation

The back view and pin allocation of the 10213/2/2 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 60 Vdc ext.			z6	Supply 60 Vdc ext.
d8				z8	Supply 0 Vdc
d10				z10	
d12	(0 Vdc)			z12	(0 Vdc)
d14	OUT 1+			z14	OUT 1–
d16	(0 Vdc)			z16	(0 Vdc)
d18	OUT 2+			z18	OUT 2–
d20	(0 Vdc)			z20	(0 Vdc)
d22	OUT 3+			z22	OUT 3–
d24	(0 Vdc)			z24	(0 Vdc)
d26	OUT 4+			z26	OUT 4–
d28	(0 Vdc)			z28	(0 Vdc)
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 60 Vdc int.			z32	Supply 60 Vdc int.

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10213/2/2.

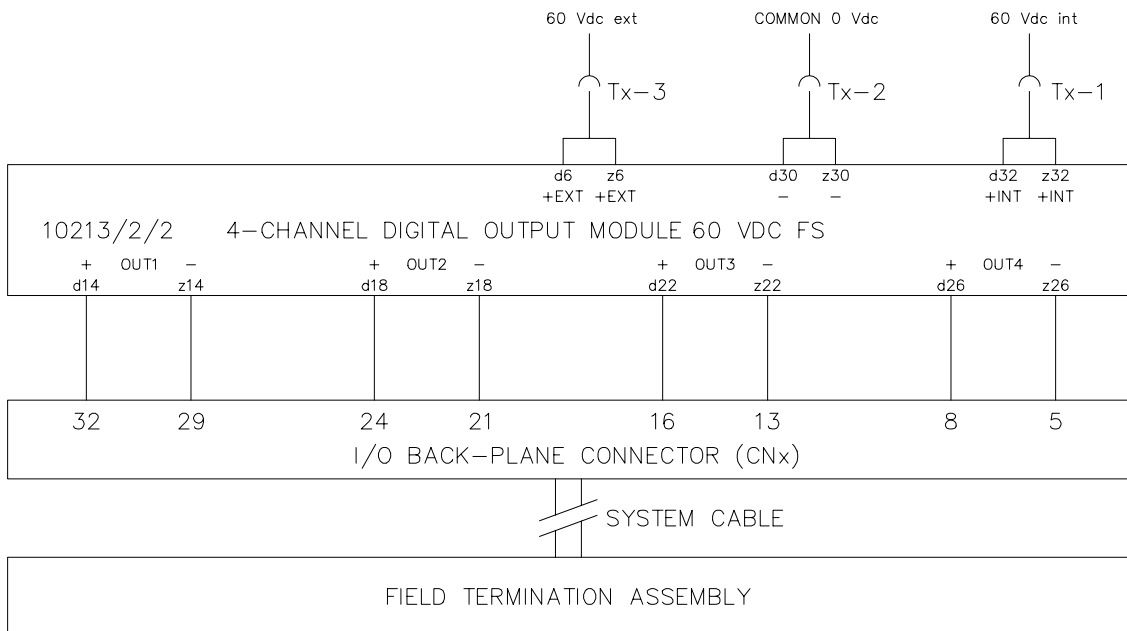


Figure 2 Connection example of 10213/2/2 module to FTA for both non-redundant and redundant I/O configurations

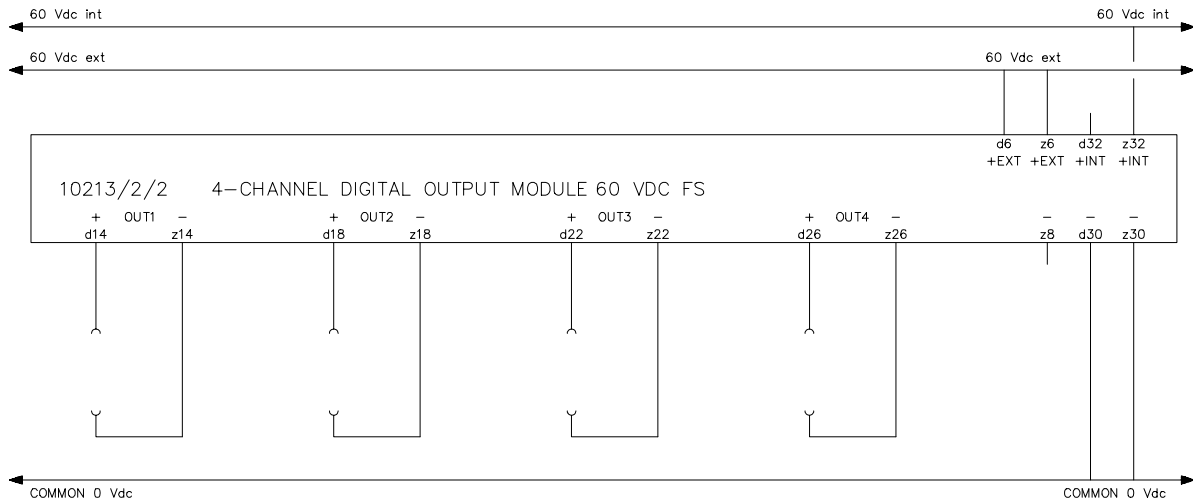


Figure 3 I/O connection example for 10213/2/2 module for non-redundant I/O configurations

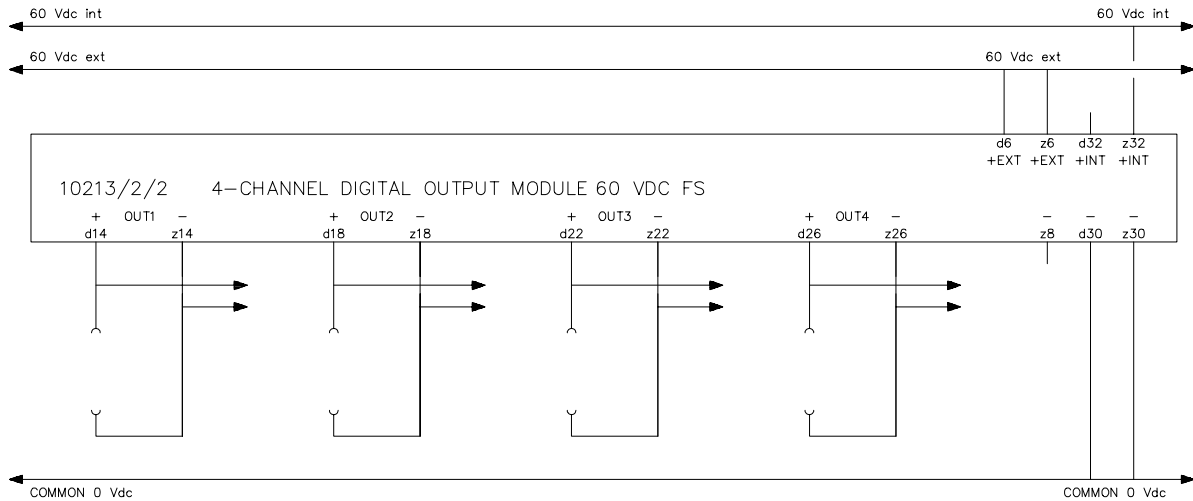


Figure 4 I/O connection example for 10213/2/2 module for redundant I/O configurations

**Note:**

The 60 Vdc internal and external power supplies must be connected to prevent fault detection during self-test of the output module (pins d6/z6, d30/z30 and z32).



## Technical data

The 10213/2/2 module has the following specifications:

<b>General</b>	Type number:	10213/2/2 12101*	
	Approvals:	CE, TÜV, UL	
	Software versions:	≥ 3.00	
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)	
<b>Power</b>	Supply voltage:	60 Vdc ± 15 %	
	Power requirements:	5 Vdc 25 mA 60 Vdc internal 20 mA 60 Vdc external 20 mA (without output load)	
	<b>Fuses</b>	Fuse values:	1x 3.15 A 3x 40 mA
		Fuse type:	Round, TR5-F/19370K
Fuse dimensions:		Ø 8.2 mm (0.32 in), height 7.7 mm (0.3 in)	
<b>Output</b>	Number of output channels:	4	
	Output specification:	60 Vdc solid-state source short-circuit proof	
	Maximum current:	675 mA (see 'FSC output modules' data sheet)	
	Maximum lamp load:	100 mA (6 W)	
	Maximum load capacitance:	1 µF	
	Voltage drop:	< 2.1 Vdc at 675 mA	
	Off current:	< 0.1 mA	
	WDG input current:	5 mA	
<b>Key coding</b>	(See 'Key coding' data sheet)		
	Module code:		
	– holes	A9, C25	
	Rack code:		
– large pins	A9, C25		

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### \* Note:

10213/2/2 modules with suffix code 12101 have improved voltage readback near the minimum supply voltage (60 Vdc –15%).

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## 10213/2/3

## Fail-safe digital output module (48 Vdc, 0.75 A, 4 channels)

### Description

The fail-safe digital output module 10213/2/3 has four 48 Vdc, 750 mA output channels to drive loads up to 36 W. These loads may be resistive or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between outputs, and
- functioning of the suppression diodes.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

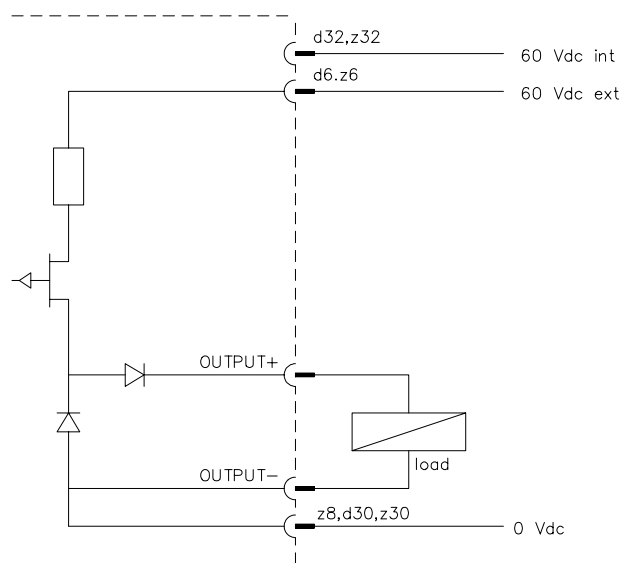
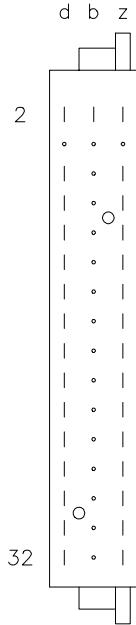


Figure 1 Schematic diagram for connection of one output to the 10213/2/3 module



## Pin allocation

The back view and pin allocation of the 10213/2/3 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 48 Vdc ext.			z6	Supply 48 Vdc ext.
d8				z8	Supply 0 Vdc
d10				z10	
d12	(0 Vdc)			z12	(0 Vdc)
d14	OUT 1+			z14	OUT 1–
d16	(0 Vdc)			z16	(0 Vdc)
d18	OUT 2+			z18	OUT 2–
d20	(0 Vdc)			z20	(0 Vdc)
d22	OUT 3+			z22	OUT 3–
d24	(0 Vdc)			z24	(0 Vdc)
d26	OUT 4+			z26	OUT 4–
d28	(0 Vdc)			z28	(0 Vdc)
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 48 Vdc int.			z32	Supply 48 Vdc int.

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10213/2/3.

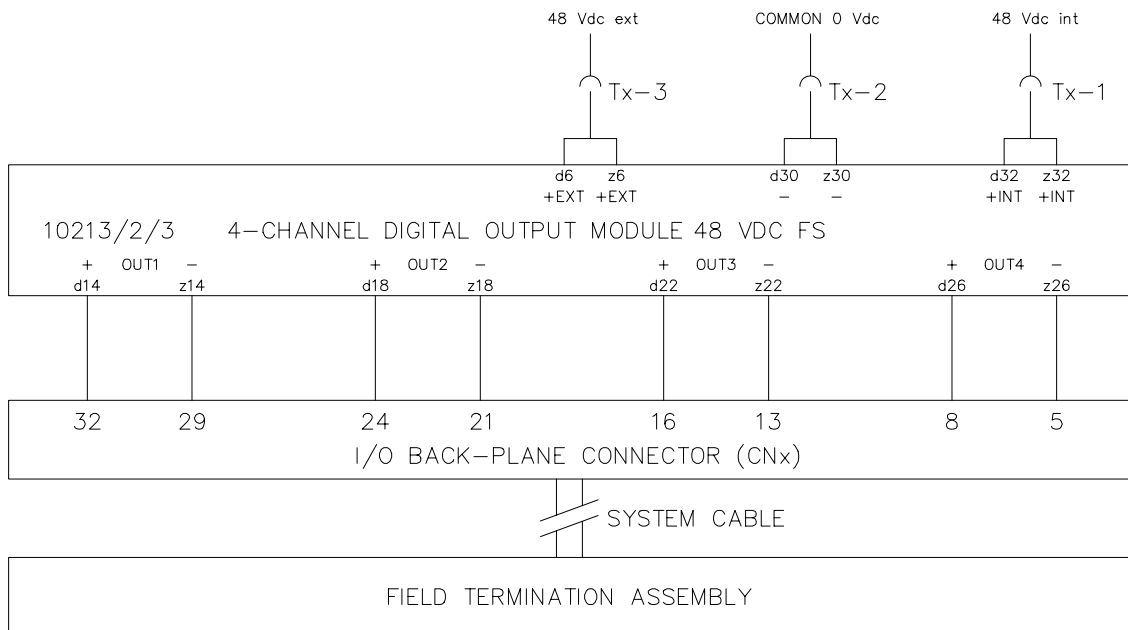


Figure 2 Connection example of 10213/2/3 module to FTA for both non-redundant and redundant I/O configurations

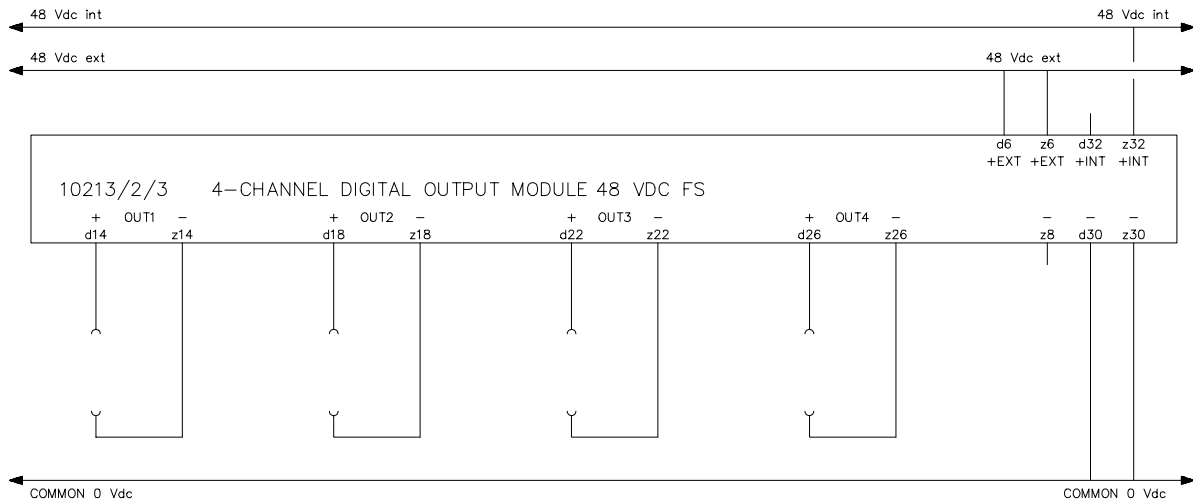


Figure 3 I/O connection example for 10213/2/3 module for non-redundant I/O configurations

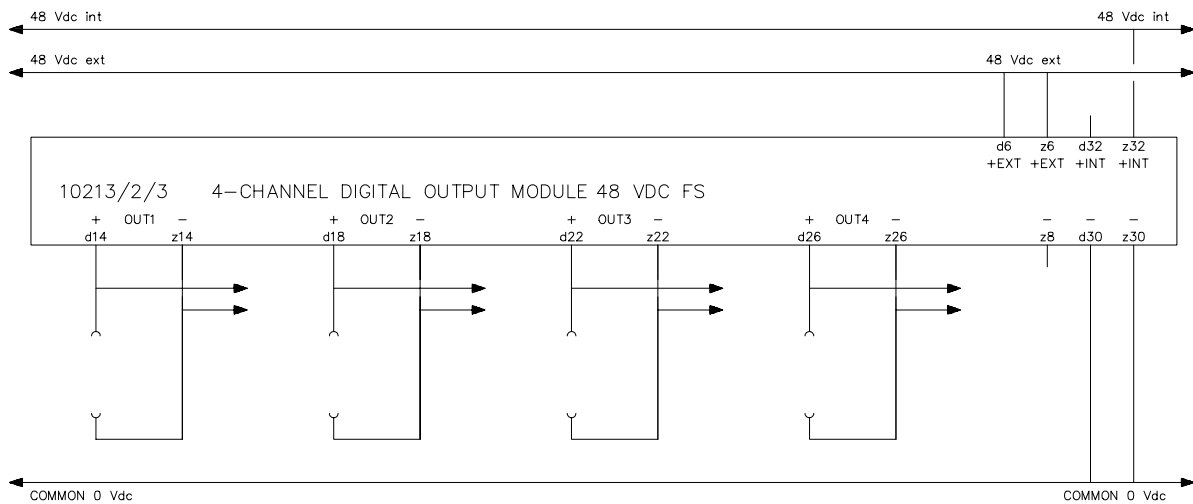


Figure 4 I/O connection example for 10213/2/3 module for redundant I/O configurations

**Note:**

The 48 Vdc internal and external power supplies must be connected to prevent fault detection during self-test of the output module (pins d6/z6, d30/z30 and z32).



**Technical data** The 10213/2/3 module has the following specifications:

<b>General</b>	Type number:	10213/2/3 12201*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Supply voltage:	48 Vdc ± 15 %
	Power requirements:	5 Vdc 25 mA
		48 Vdc internal 20 mA
		48 Vdc external 20 mA (without output load)
<b>Output</b>	Number of output channels:	4
	Output specification:	48 Vdc solid-state source, short-circuit proof
	Maximum current:	750 mA (see 'FSC output modules' data sheet)
	Maximum lamp load:	125 mA (6 W)
	Maximum load capacitance:	1 µF
	Voltage drop:	< 2.1 Vdc at 750 mA
	Off current:	< 0.1 mA
	WDG input current:	5 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– holes	A9, C29
	Rack code:	
– large pins	A9, C29	

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**\* Note:**

10213/2/3 modules with suffix code 12201 have improved voltage readback near the minimum supply voltage (48 Vdc –15%).

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## 10214/1/2

## Fail-safe digital output module (220 Vdc, 0.25 A, 3 channels)

### Description

The fail-safe digital output module 10214/1/2 has three 220 Vdc, 250 mA output channels to drive loads up to 55 W.

These loads may be resistive or inductive. For inductive loads, a suppression diode is included on each output.

All outputs are monitored for lead breakage and short circuit. To get a rough lead breakage current setting, the current sense level must be programmed (see Table 1 on next page). In redundant configurations, the programming link must be placed on both modules.

The outputs, including the suppression diodes and the lead breakage detection, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize via secondary means,
- crosstalk between outputs,
- functioning of the suppression diodes,
- lead breakage in the (external) output wiring, and
- short circuit of the output.

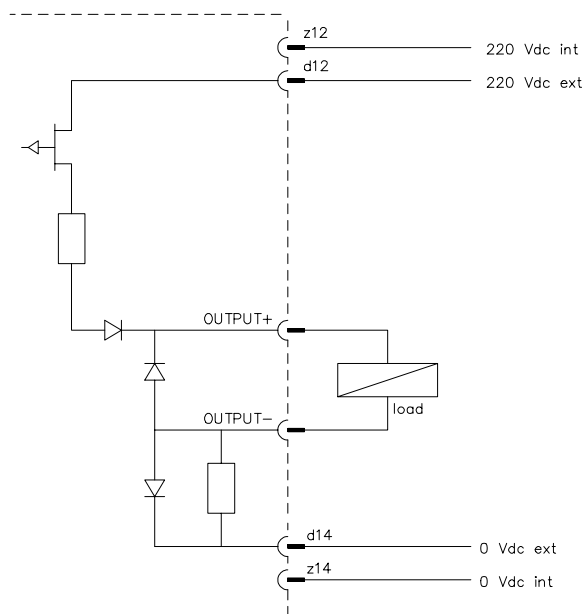


Figure 1 Schematic diagram for connection of one output to the 10214/1/2 module



The internal 220 Vdc supply is galvanically isolated from the external 220 Vdc circuit.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

Table 1 Link Table

LOAD				LINK		
Non-redundant I/O configurations		Redundant I/O configurations		Ch 1	Ch 2	Ch 3
0.5 - 1.4 W	2 - 6 mA	1 - 2.9 W	4 - 13 mA	–	–	–
1.5 - 3.1 W	7 - 14 mA	3 - 6.3 W	14 - 29 mA	d20-d16	d26-d22	d32-d28
3.2 - 8.9 W	15 - 40 mA	6.4 - 17.9 W	30 - 81 mA	d20-z16	d26-z22	d32-z28
9 - 18.9 W	41 - 85 mA	18 - 37.9 W	82 - 171 mA	d20-d18	d26-d24	d32-d30
≥ 19 W	≥ 86 mA	≥ 38 W	≥ 172 mA	d20-z18	d26-z24	d32-z32

To prevent lead breakage detection on spare or unused channels, a dummy load should be placed over these outputs:

- single channels: 100 kOhm ( $\pm 10\%$ , 0.5 W),
- redundant channels: 50 kOhm ( $\pm 10\%$ , 1 W).

No links with Px.1 to Px.4 may be placed on those channels.

If crimp-on snap-in (COSI) wiring is used, spare channels should be provided with a link from OUT– to a dummy position on the 'b' row (b20, b26 or b32, respectively). This makes it easier to add the spare channel to the system. Just remove the dummy load, connect the output load and replace the link from the dummy position to the required position (see Table 1). This operation sequence may also be used when the system is first installed to enable step-by-step addition of output loads.

---

**Note:**

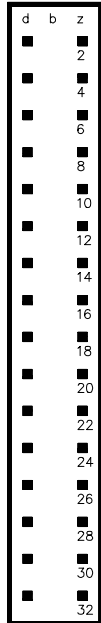
It is recommended that shielded wire pairs are used in order to reduce the interference caused by the self-test of the 10214/1/2 module.

---



## Pin allocation

The back view and pin allocation of the 10214/1/2 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Link	z8	Link
d10		z10	
d12	Supply 220 Vdc ext.	z12	Supply 220 Vdc int.
d14	Supply 0 Vdc ext.	z14	Supply 0 Vdc int.
d16	P1.1	z16	P1.2
d18	P1.3	z18	P1.4
d20	OUT 1-	z20	OUT 1+
d22	P2.1	z22	P2.2
d24	P2.3	z24	P2.4
d26	OUT 2-	z26	OUT 2+
d28	P3.1	z28	P3.2
d30	P3.3	z30	P3.4
d32	OUT 3-	z32	OUT 3+

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10214/1/2.

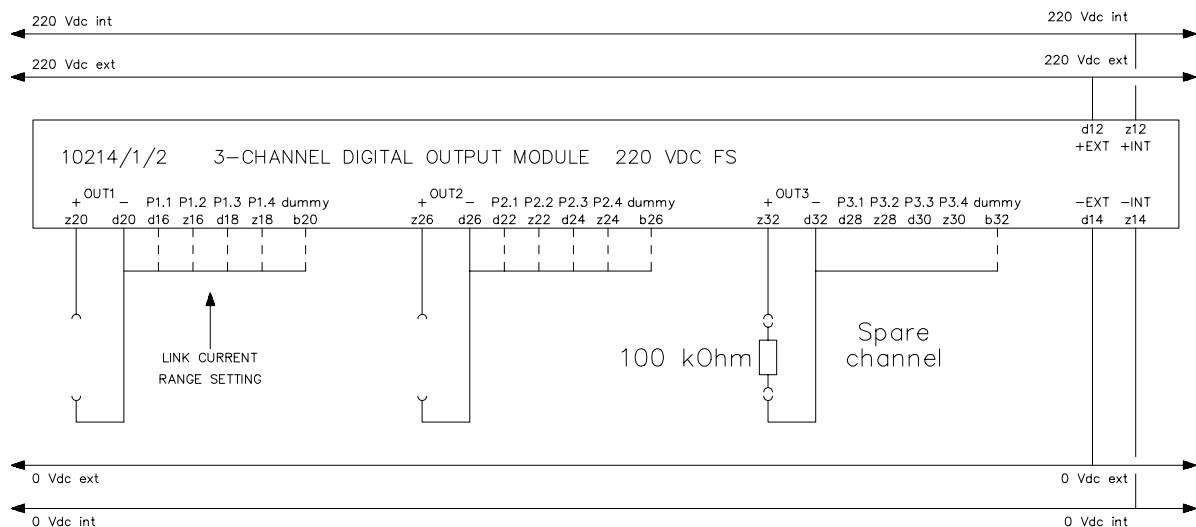


Figure 2 Connection example for non-redundant configurations

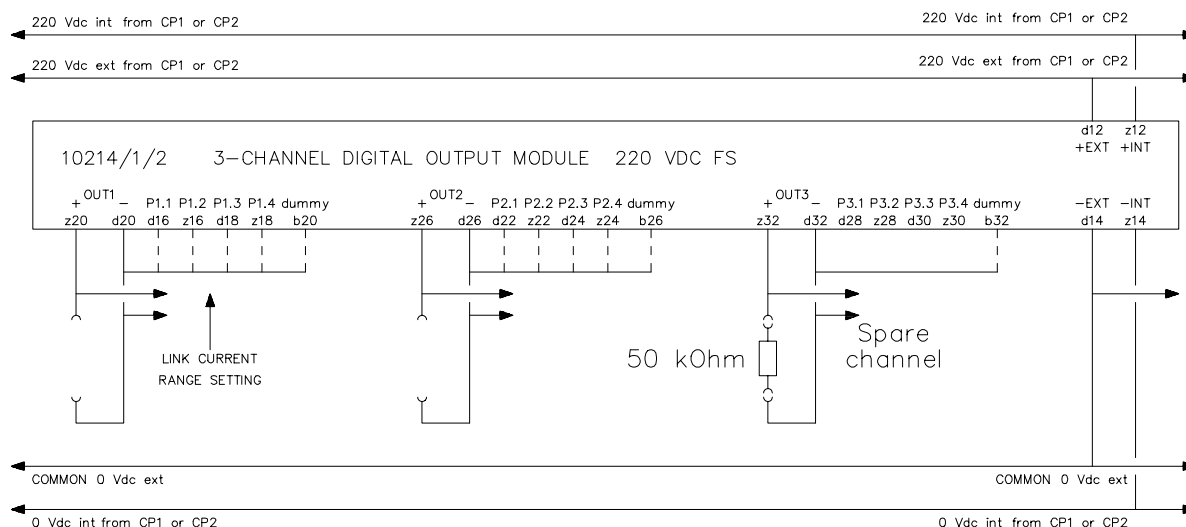


Figure 3 Connection example for redundant I/O configurations

**Note:**

The 220 Vdc internal and external power supplies must be connected to prevent fault detection during the self-test of the output module (pins d12, z12, d14 and z14). As soon as external power is applied, a (dummy) load must be present for all outputs to prevent lead breakage detection.

**Technical data**

The 10214/1/2 module has the following specifications:

<b>General</b>	Type number:	10214/1/2 03201*
	Approvals:	CE, TÜV
	Software versions:	≥ 2.78e
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Supply voltage:	220 Vdc, -15%...+10%
	Power requirements:	5 Vdc 30 mA
		220 Vdc internal 8 mA 220 Vdc external 12 mA (without output load)





## Technical data (continued)

<b>Fuses</b>	Fuse values:	1x 1.0 A 3x 40 mA
	Fuse type:	Round, TR5-F/19370K
	Fuse dimensions:	Ø 8.2 mm (0.32 in), height 7.7 mm (0.3 in)
	<b>Output</b>	Number of output channels: 3
	Output specification:	220 Vdc solid-state source, short-circuit proof
	Maximum current:	250 mA* (see 'FSC output modules' data sheet)
	Maximum lamp load:	27 mA (6 W)
	Max. load capacitance:	0.1 µF
	Voltage drop:	< 3.5 Vdc at 250 mA
	Off current:	< 0.1 mA
	Current sense voltage drop:	< 1 Vdc at 250 mA
	WDG input current:	2 mA

### Key coding (See 'Key coding' data sheet)

Module code:	
– hole	A23
– pins	C3, C11, C23
Rack code:	
– blind stops	C19, C27, C31
– large pin	A23

---

**\* Note:**

10214/1/2 modules without a suffix code have a maximum output current of 175 mA.

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## 10215/1/1

# Fail-safe digital output module (24 Vdc, 2 A, 4 channels)

### Description

The fail-safe digital output module 10215/1/1 has four 24 Vdc, 2 A output channels to drive loads up to 50 W. The maximum module load is 6 A.

These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize,
- ability to de-energize the group (via secondary means),
- crosstalk between outputs, and
- functioning of the suppression diodes.

The external 24 Vdc is split into two groups of two outputs each to support segregation in a subunit structure or to limit circuit-breaker / fuse rating. The external 0 Vdc is common to both groups.

The internal 24 Vdc supply is galvanically isolated from the external 24 Vdc circuit.

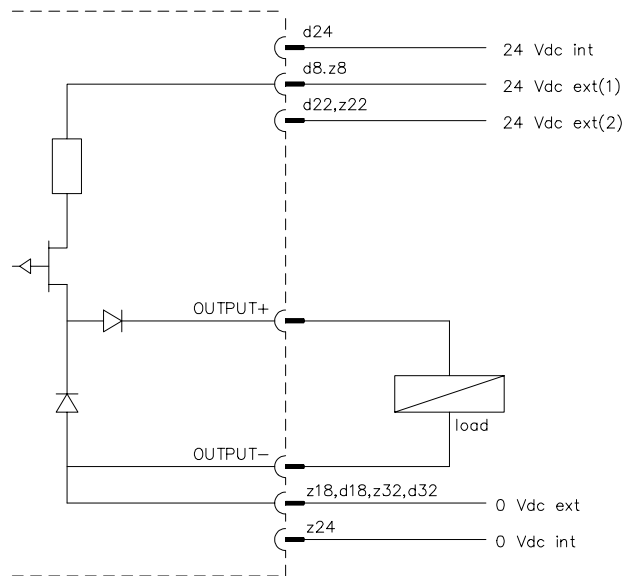


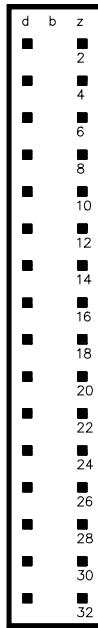
Figure 1 Schematic diagram for connection of one output (output 1-2) to the 10215/1/1 module



A secondary means of de-energization has been provided per two outputs. This facility enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

## Pin allocation

The back view and pin allocation of the 10215/1/1 rack connector are as follows:



d2	WDG 1 (5 Vdc)	z2	GND 5 Vdc
d4	WDG 2 (5 Vdc)	z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext. (1)	z8	Supply 24 Vdc ext. (1)
d10		z10	
d12	OUT 1-	z12	OUT 1+
d14	(0 Vdc)	z14	(0 Vdc)
d16	OUT 2-	z16	OUT 2+
d18	Supply 0 Vdc	z18	Supply 0 Vdc
d20	link	z20	link
d22	Supply 24 Vdc ext. (2)	z22	Supply 24 Vdc ext. (2)
d24	Supply 24 Vdc int.	z24	Supply 0 Vdc int.
d26	OUT 3-	z26	OUT 3+
d28	(0 Vdc)	z28	(0 Vdc)
d30	OUT 4-	z30	OUT 4+
d32	Supply 0 Vdc	z32	Supply 0 Vdc

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10215/1/1.

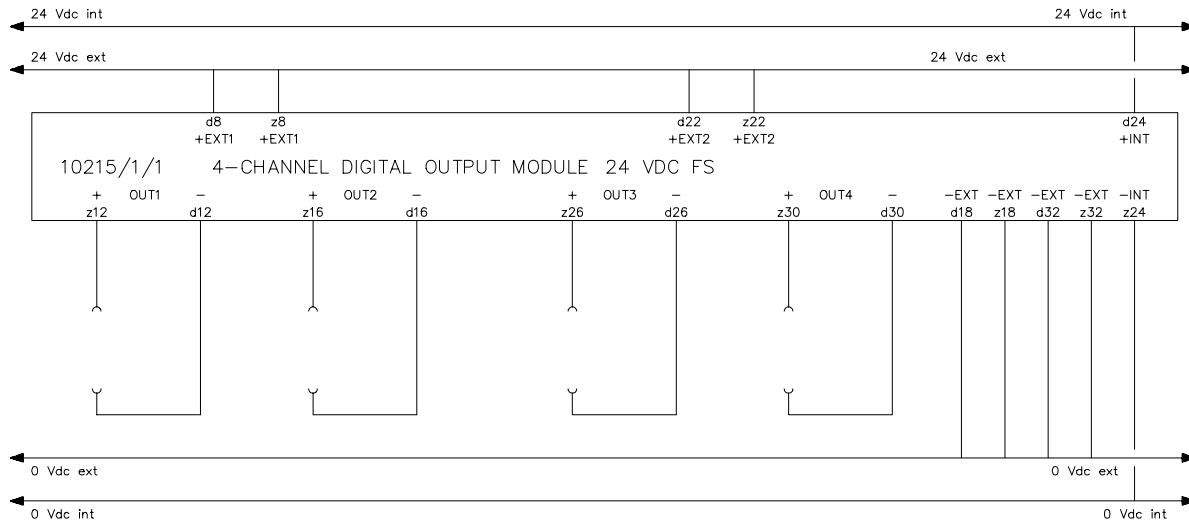


Figure 2 Connection example for non-redundant I/O configurations

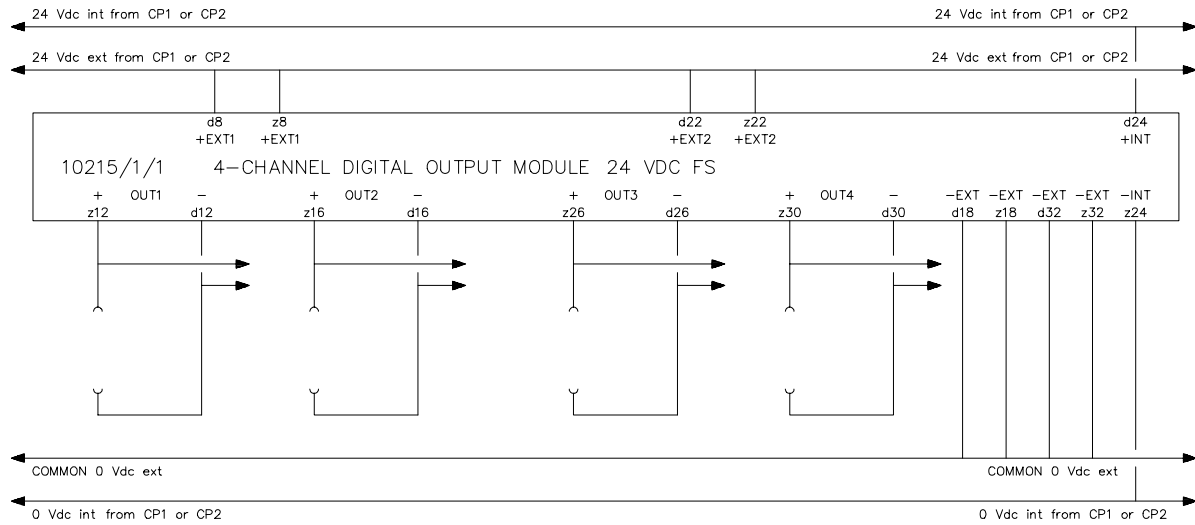


Figure 3 Connection example for redundant I/O configurations

**Note:**

The 24 Vdc internal and external power supplies must be connected to both output groups to prevent fault detection during the self-test of the output module (pins z8/d8, z18, d18, z22/d22, z24/d24 and z32/d32).

**Technical data**

The 10215/1/1 module has the following specifications:

<b>General</b>	Type number:	10215/1/1 05701*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.78f
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 12 mA 24 Vdc internal 35 mA 24 Vdc external 2*25 mA (without output load)



## Technical data (continued)

<b>Output</b>	Number of output channels:	4 (2 groups of 2)
	Output specification:	24 Vdc solid-state source, short-circuit proof
	Maximum channel current:	2 A (see 'FSC output modules' data sheet)
	Maximum total module load:	6 A (module dissipation limit)
	Maximum lamp load:	417 mA (10 W)
	Maximum load capacitance:	1 $\mu$ F
	Voltage drop:	< 1.3 Vdc at 2 A
	Off current:	< 0.1 mA
	WDG input current:	2*4 mA
	<b>Key coding</b>	(See 'Key coding' data sheet)
Module code:		
– hole		A27
– pins		C19, C23, C31
Rack code:		
– blind stops		C3, C11, C27
– large pin	A27	

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**\* Note:**

10215/1/1 modules with suffix code 05701 have an improved external power voltage range.

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## 10215/2/1

# Fail-safe digital output module (24 Vdc, 2 A, 4 channels)

### Description

The fail-safe digital output module 10215/2/1 has four 24 Vdc, 2 A output channels to drive loads up to 50 W. The maximum module load is 6 A.

These loads may be resistive (e.g. lamps) or inductive (e.g. solenoids). For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diodes, are fully tested and may therefore be used for fail-safe applications.

Within the configured process safety time, the outputs are tested for:

- ability to de-energize the output,
- ability to de-energize the group (via secondary means),
- crosstalk between outputs, and
- functioning of the suppression diodes.

The external 24 Vdc supply is split into two groups of two outputs each to support segregation in a subunit structure or to limit the circuit-breaker / fuse rating. The 0 Vdc is common to both groups.

A secondary means of de-energization has been provided per two outputs. This facility enables the watchdog or the processor to de-energize the outputs irrespective of the result of the application function.

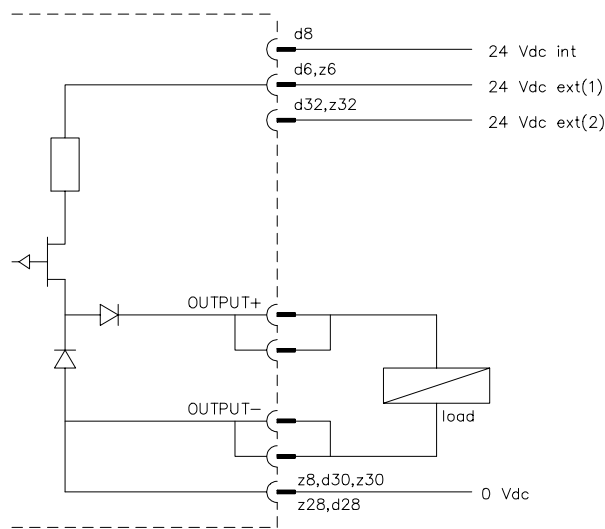
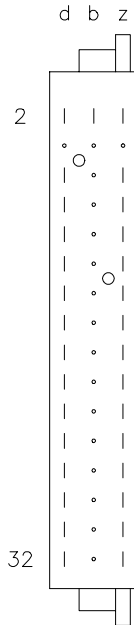


Figure 1 Schematic diagram for connection of one output (output 1-2) to the 10215/2/1 module



## Pin allocation

The back view and pin allocation of the 10215/2/1 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 24 Vdc ext. 1			z6	Supply 24 Vdc ext. 1
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	OUT 1+			z12	OUT 1–
d14	OUT 1+			z14	OUT 1–
d16	OUT 2+			z16	OUT 2–
d18	OUT 2+			z18	OUT 2–
d20	OUT 3+			z20	OUT 3–
d22	OUT 3+			z22	OUT 3–
d24	OUT 4+			z24	OUT 4–
d26	OUT 4+			z26	OUT 4–
d28	(0 Vdc)			z28	(0 Vdc)
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 24 Vdc ext. 2			z32	Supply 24 Vdc ext. 2

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10215/2/1.

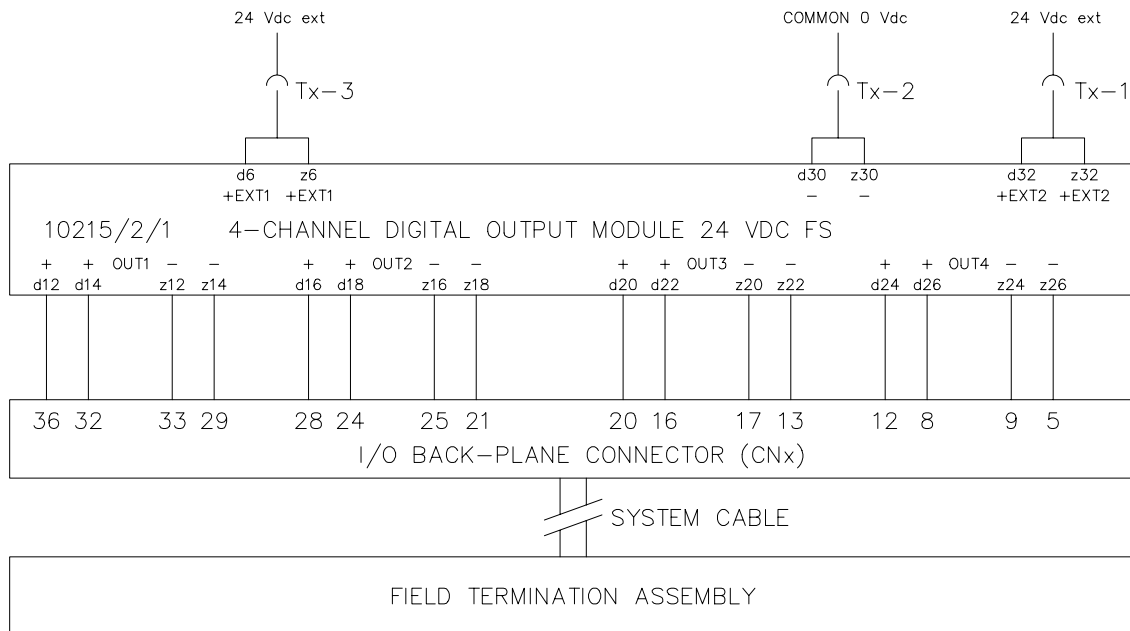


Figure 2 Connection example of 10215/2/1 module to FTA for both non-redundant and redundant I/O configurations



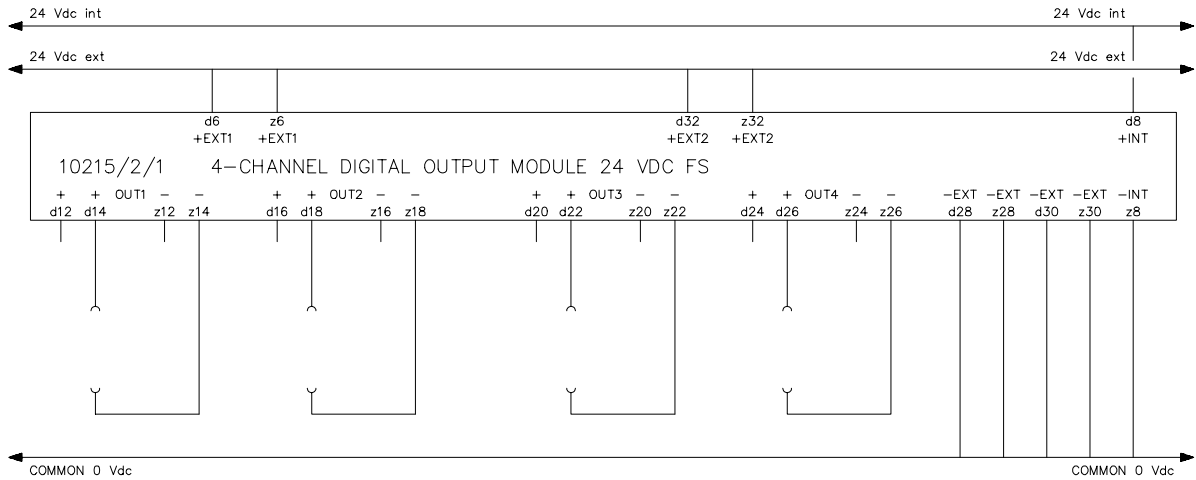


Figure 3 I/O connection example for 10215/2/1 module for non-redundant I/O configurations

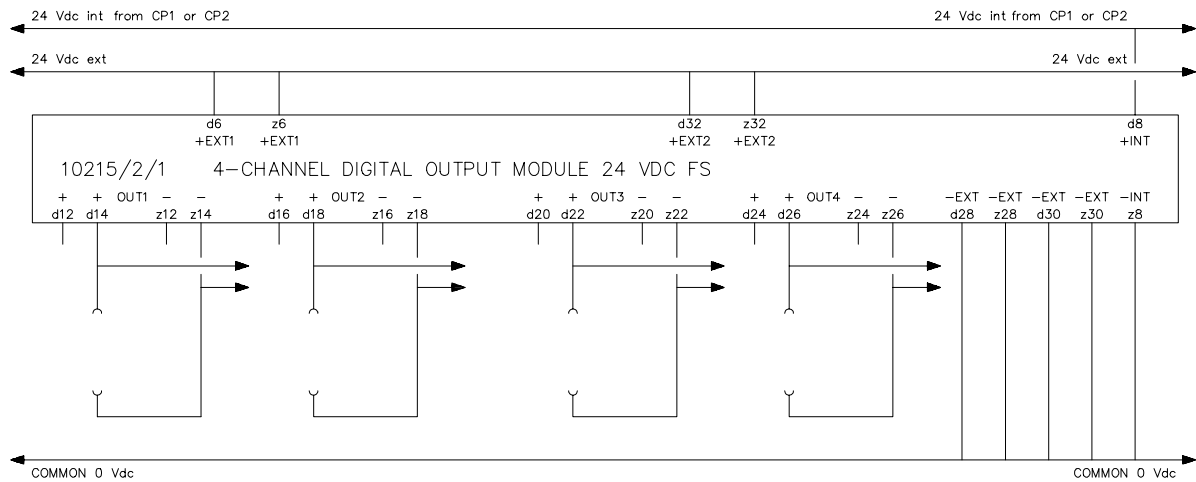


Figure 4 I/O connection example for 10215/2/1 module for redundant I/O configurations

**Note:**

The 24 Vdc internal and external power supplies must be connected to both output groups to prevent fault detection during the self-test of the output module (pins d6/z6, d8, d30/z30 and d32/z32)



## Technical data

The 10215/2/1 module has the following specifications:

<b>General</b>	Type number:	10215/2/1 12302
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 12 mA 24 Vdc internal 35 mA 24 Vdc external 2 * 25 mA (without output load)
	Number of output channels:	4 (2 groups of 2)
	Output specification:	24 Vdc solid-state source short-circuit proof
<b>Output</b>	Maximum channel current:	2 A (see 'FSC output modules' data sheet)
	Maximum total module load:	6 A (module dissipation limit)
	Maximum lamp load:	417 mA (10 W)
	Maximum load capacitance:	1 µF
	Voltage drop:	< 1.3 Vdc at 2 A
	Off current:	< 0.1 mA
	WDG input current:	8 mA
	<b>Key coding</b>	(See 'Key coding' data sheet)
Module code:		
– holes		A13, C5
Rack code:		
– large pins	A13, C5	

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## 10216/1/1

# Fail-safe loop-monitored digital output module (24 Vdc, 1 A, 4 channels)

### Description

The fail-safe digital output module 10216/1/1 has four 24 Vdc, 1 A loop-monitored output channels to drive loads up to 24 W. The maximum module load is 3.6 A.

These loads may be resistive or inductive. For inductive loads, a suppression diode is included on each output.

The outputs, including the suppression diode, the lead breakage detection and short-circuit detection, are fully tested and may therefore be used for fail-safe applications.

The outputs are tested for:

- ability to de-energize,
- ability to de-energize via the secondary means,
- crosstalk between outputs,
- function of the suppression diodes,
- lead breakage in the (external) output wiring, and
- short circuit of the outputs.

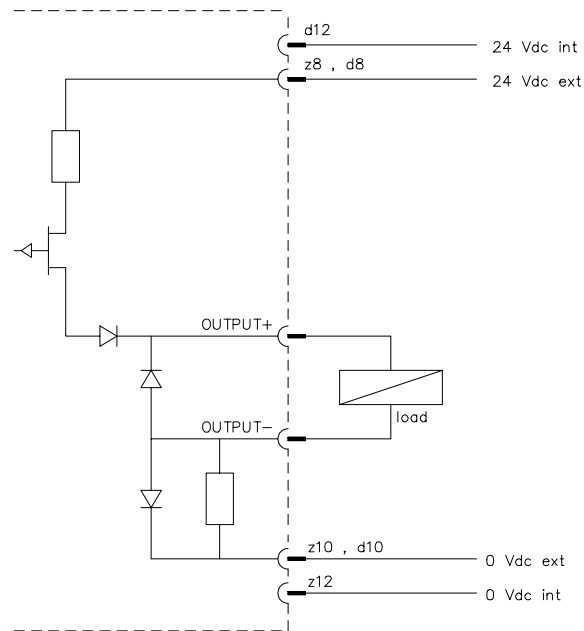


Figure 1 Schematic diagram for connection of one output to the 10216/1/1 module



The internal 24 Vdc supply is galvanically isolated from the external 24 Vdc circuit.

The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

## Loop-monitoring

All outputs are monitored for lead breakage and short circuit. To get a rough lead breakage current setting, the current sense level must be programmed (see Table 1 below). In redundant configurations, the programming links must be placed on both modules.

Table 1 Link table

LOAD				LINK			
Non-redundant I/O configurations		Redundant I/O configurations		Ch 1	Ch 2	Ch 3	Ch 4
0.05 - 0.39 W	2 - 16 mA	0.1 - 0.79 W	4 - 33 mA	–	–	–	–
0.4 - 1.1 W	17 - 47 mA	0.8 - 2.3 W	34 - 95 mA	d26-d14	d28-z14	d30-d16	d32-z16
1.2 - 4.7 W	48 - 199 mA	2.4 - 9.5 W	96 - 399 mA	d26-d18	d28-z18	d30-d20	d32-z20
≥ 4.8 W	≥ 200 mA	≥ 9.6 W	≥ 400 mA	d26-d22	d28-z22	d30-d24	d32-z24

To prevent lead breakage detection on spare or unused channels, a dummy load should be placed over these outputs:

- single channels: 10 kOhm ( $\pm 10\%$ , 0.25 W),
- redundant channels: 4.7 kOhm ( $\pm 10\%$ , 0.5 W).

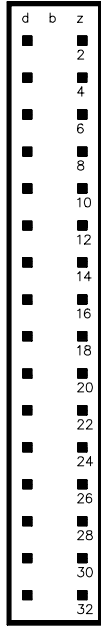
No links with Px.1 to Px.3 may be placed on those channels.

If crimp-on snap-in (COSI) wiring is used, spare channels should be provided with a link from OUT– to a dummy position on the 'b' row (b26, b28, b30 or b32, respectively). This makes it easier to add the spare channel to the system. Just remove the dummy load, connect the output load and replace the link from the dummy position to the required position (see Table 1). This operation sequence may also be used when the system is first installed to enable step-by-step addition of output loads.



## Pin allocation

The back view and pin allocation of the 10216/1/1 rack connector are as follows:



d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext.	z8	Supply 24 Vdc ext.
d10	Supply 0 Vdc ext.	z10	Supply 0 Vdc ext.
d12	Supply 24 Vdc int.	z12	Supply 0 Vdc int.
d14	P1.1	z14	P2.1
d16	P3.1	z16	P4.1
d18	P1.2	z18	P2.2
d20	P3.2	z20	P4.2
d22	P1.3	z22	P2.3
d24	P3.3	z24	P4.3
d26	OUT1-	z26	OUT1+
d28	OUT2-	z28	OUT2+
d30	OUT3-	z30	OUT3+
d32	OUT4-	z32	OUT4+

## Connection examples

The figures below show a number of connection examples for the fail-safe digital output module 10216/1/1.

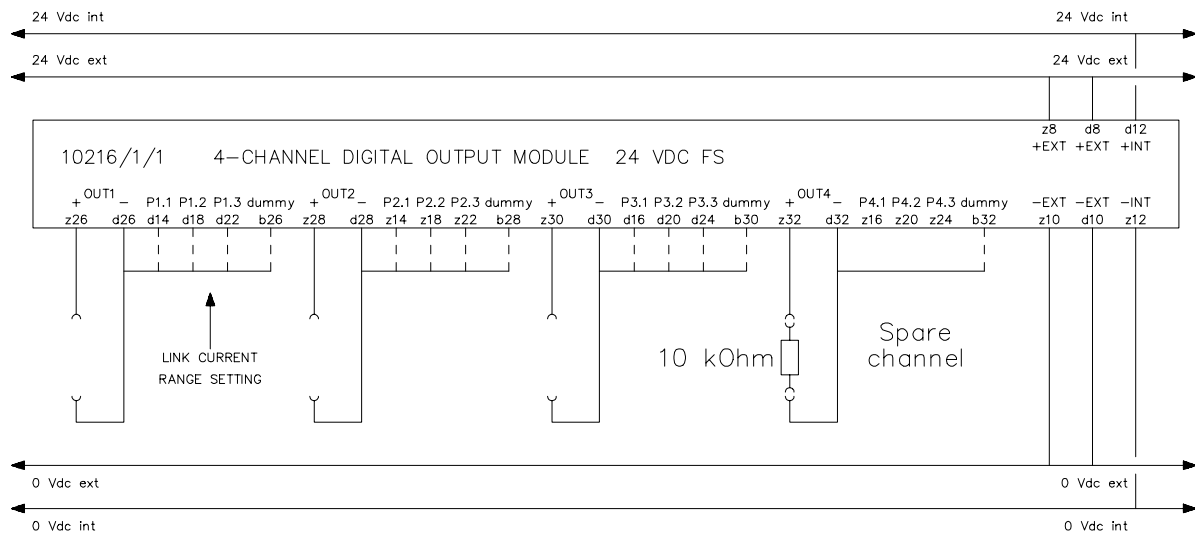


Figure 2 Connection example for non-redundant I/O configurations

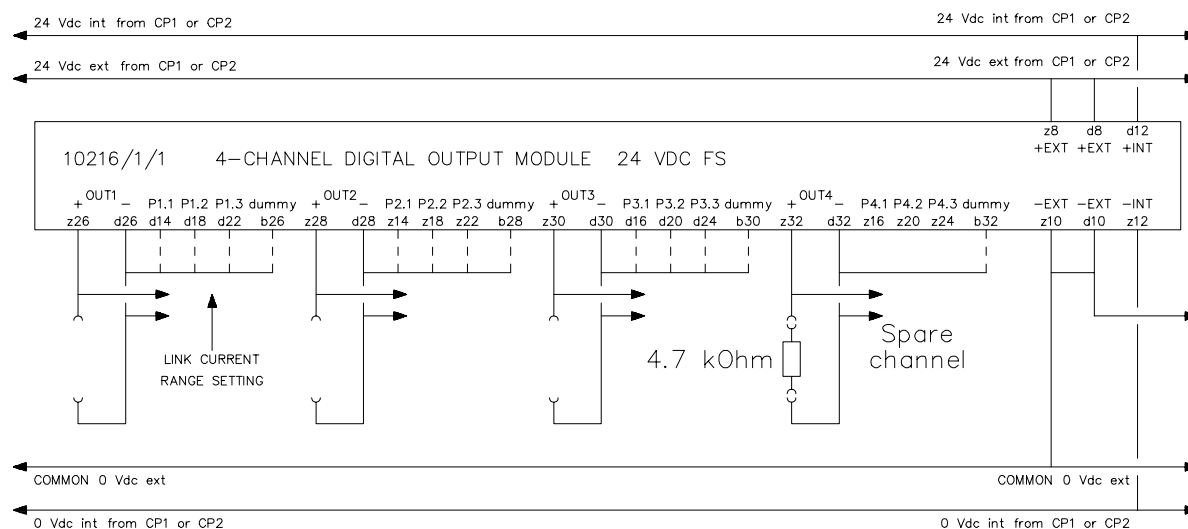


Figure 3 Connection example for redundant I/O configurations

**Note:**

The 24 Vdc internal power supply (z12 and d12) must be connected to prevent fault detection during the self-test of the output module. The external power supply (z8/d8 and z10/d10), as well as dummy loads on all spare channels, must be connected to prevent fault detection during the lead breakage test of the output module.

**Technical data**

The 10216/1/1 module has the following specifications:

**General**

Type number: 10216/1/1 06302\*  
 Approvals: CE, TÜV, UL  
 Software version: ≥ 2.81  
 Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

**Power**

Power requirements: 5 Vdc 15 mA  
 24 Vdc internal 50 mA  
 24 Vdc external 15 mA (without output load)



## Technical data (continued)

<b>Output</b>	Number of output channels:	4
	Output specification:	24 Vdc solid-state source, short-circuit proof
	Maximum channel current:	1 A (see 'FSC output modules' data sheet)
	Maximum total module load:	3.6 A (module dissipation limit)
	Maximum load inductance:	0.5 H
	Maximum load capacitance:	1 $\mu$ F
	Top of overload detection:	> 10 Ohm*
	Cold resistance lamp:	> 20 Ohm
	Voltage drop:	< 1.3 Vdc at 1 A
	Off current:	< 0.1 mA
	Current sense voltage drop:	< 1 Vdc at 1 A
	WDG input current:	4 mA
	<b>Key coding</b>	(See 'Key coding' data sheet)
Module code:		
– hole		A19
– pins		C3, C11, C23
Rack code		
– blind stops	C19, C27, C31	
– large pin	A19	

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**\* Notes:**

10216/1/1 modules with suffix code 06301 and higher have an improved current sense circuit.

10216/1/1 modules with suffix code 06302 have an improved (> 10 Ohm) overload detection during channel OFF.

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## 10216/2/1

# Fail-safe loop-monitored digital output module (24 Vdc, 1 A, 4 channels)

### Description

The fail-safe digital output module 10216/2/1 has four 24 Vdc, 1 A loop-monitored output channels to drive loads up to 24 W. The maximum module load is 3.6 A.

These loads may be resistive or inductive. For inductive loads, a suppression diode is included on each output.

The outputs, including the suppression diode, the lead breakage detection and short-circuit detection, are fully tested and may therefore be used for fail-safe applications.

The outputs are tested for:

- ability to de-energize,
- ability to de-energize via the secondary means,
- crosstalk between outputs,
- function of the suppression diodes,
- lead breakage in the (external) output wiring, and
- short circuit of the outputs.

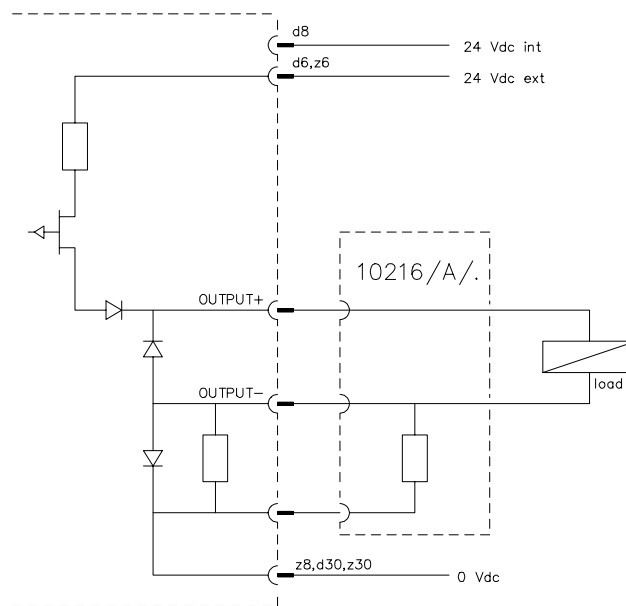


Figure 1 Schematic diagram for connection of one output to the 10216/2/1 module



The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

**Note:**

The 10216/2/1 module can only be used in combination with an I/O backplane in the rack, since the outputs require a 10216/A/. module.

## Loop-monitoring

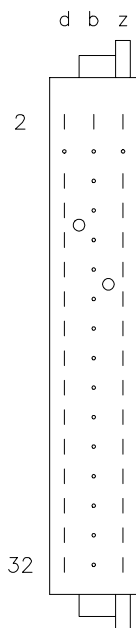
All outputs are monitored for lead breakage and short circuit. To get a rough lead breakage current setting, the current sense level must be programmed (see Table 1 below).

Table 1 Selection of range-setting module

LOAD		Range-setting module
Spare channel		10216/A/1
0.1 - 0.39 W	4 - 16 mA	none
0.4 - 1.1 W	17 - 47 mA	10216/A/2
1.2 - 4.7 W	48 - 199 mA	10216/A/3
≥ 4.8 W	≥ 200 mA	10216/A/4

## Pin allocation

The back view and pin allocation of the 10216/2/1 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 24 Vdc ext.			z6	Supply 24 Vdc ext.
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	(0 Vdc)			z12	(0 Vdc)
d14	OUT 1+			z14	OUT 1–
d16	0 Vdc			z16	0 Vdc
d18	OUT 2+			z18	OUT 2–
d20	0 Vdc			z20	0 Vdc
d22	OUT 3+			z22	OUT 3–
d24	0 Vdc			z24	0 Vdc
d26	OUT 4+			z26	OUT 4–
d28	0 Vdc			z28	0 Vdc
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32				z32	



## Connection example

The figure below shows a connection example for the fail-safe digital output module 10216/2/1.

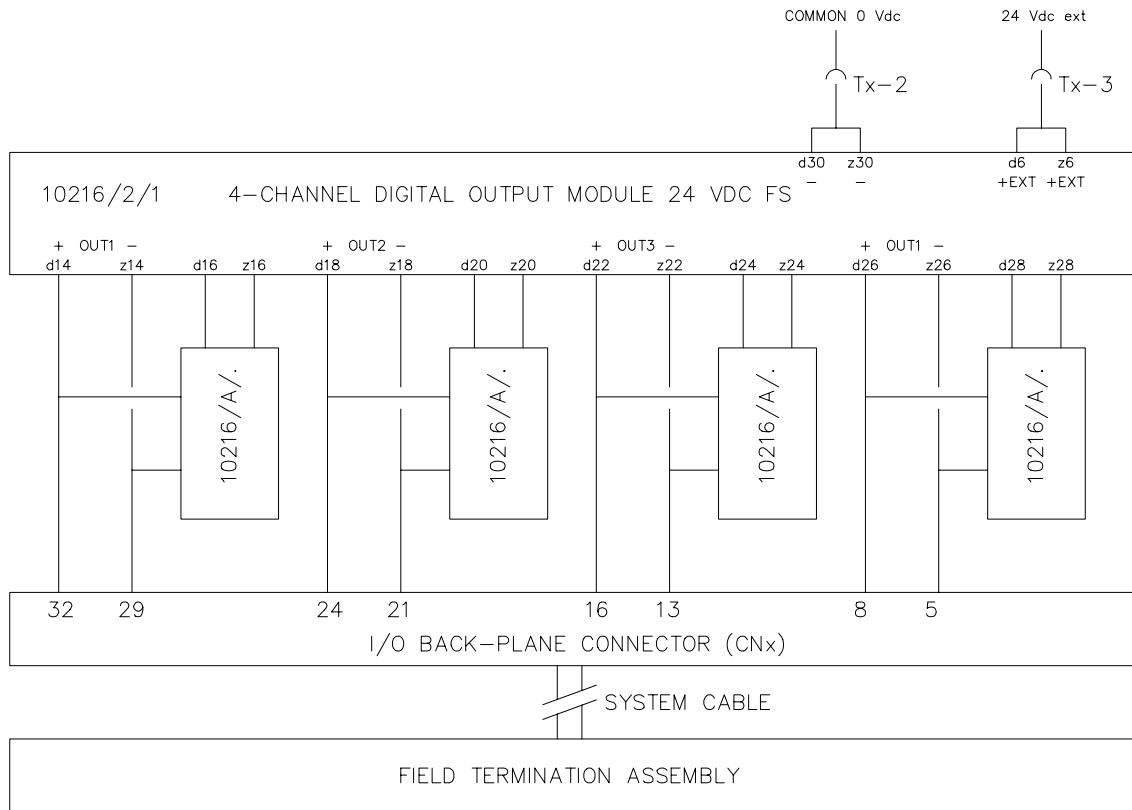


Figure 2 Connection example of 10216/2/1 module to FTA for both non-redundant and redundant I/O configurations

### Note:

The 24 Vdc internal power supply (d8 and z8) must be connected to prevent fault detection during the self-test of the output module. The external power supply (d6/z6 and d30/z30), as well as dummy loads on all spare channels, must be connected to prevent fault detection during the lead breakage test of the output module.



## Technical data

The 10216/2/1 module has the following specifications:

<b>General</b>	Type number:	10216/2/1 12400	
	Approvals:	CE, TÜV, UL	
	Software versions	≥ 3.00	
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)	
<b>Power</b>	Power requirements:	5 Vdc 15 mA 24 Vdc internal 50 mA 24 Vdc external 15 mA (without output load)	
	Number of output channels:	4	
	Output specification:	24 Vdc solid-state source, short circuit proof	
<b>Output</b>	Maximum channel current:	1 A (see 'FSC output modules' data sheet)	
	Maximum total module load:	3.6 A (module dissipation limit)	
	Maximum load inductance:	0.5 H	
	Maximum load capacity:	1 µF	
	Top of overload detection:	> 10 Ohm	
	Cold resistance lamp:	> 20 Ohm	
	Voltage drop:	< 1.3 V at 1 A	
	Off current:	< 0.1 mA	
	Current sense voltage drop:	< 1 V at 1 A	
	WDG input current:	4 mA	
	<b>Key coding</b>	(See 'Key coding' data sheet)	
		Module code:	
– holes		A13, C9	
Rack code:			
– large pins	A13, C9		

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## 10216/2/3

# Fail-safe loop-monitored digital output module (48 Vdc, 0.5 A, 4 channels)

### Description

The fail-safe digital output module 10216/2/3 has four 48 Vdc, 0.5 A loop-monitored output channels to drive loads up to 24 W. These loads may be resistive or inductive. For inductive loads, a suppression diode is included on each output. The outputs, including the suppression diode, the lead breakage detection and short-circuit detection, are fully tested and may therefore be used for fail-safe applications.

The outputs are tested for:

- ability to de-energize,
- ability to de-energize via the secondary means,
- crosstalk between outputs,
- function of the suppression diodes,
- lead breakage in the (external) output wiring, and
- short circuit of the outputs.

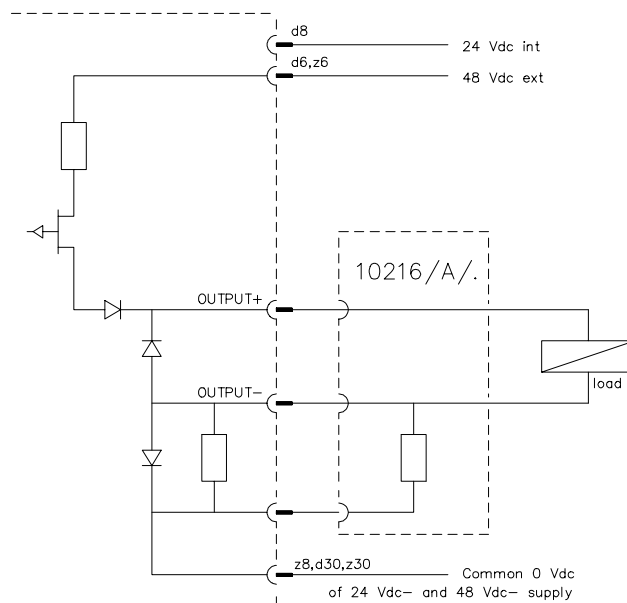


Figure 1 Schematic diagram for connection of one output to the 10216/2/3 module



The outputs have a secondary means of de-energization, which enables the watchdog and/or the processor to de-energize the outputs irrespective of the result of the application function.

**Notes:**

The 10216/2/3 module can only be used in combination with an I/O backplane in the rack, since the outputs require a 10216/A/ module.

The 24 Vdc (internal) and the 48 Vdc (external) must have a common 0 Vdc connection.

## Loop-monitoring

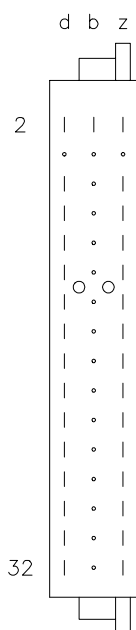
All outputs are monitored for lead breakage and short circuit. To get a rough lead breakage current setting, the current sense level must be programmed (see Table 1 below).

Table 1 Selection of range-setting module

LOAD		Range-setting module
Spare channel		10216/A/1
0.1 - 0.79 W	4 - 16 mA	none
0.8 - 2.3 W	17 - 47 mA	10216/A/2
2.4 - 9.5 W	48 - 199 mA	10216/A/3
≥ 9.6 W	≥ 200 mA	10216/A/4

## Pin allocation

The back view and pin allocation of the 10216/2/3 module connector are as follows:



d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 48 Vdc ext.			z6	Supply 48 Vdc ext.
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	(0 Vdc)			z12	(0 Vdc)
d14	OUT 1+			z14	OUT 1–
d16	0 Vdc			z16	0 Vdc
d18	OUT 2+			z18	OUT 2–
d20	0 Vdc			z20	0 Vdc
d22	OUT 3+			z22	OUT 3–
d24	0 Vdc			z24	0 Vdc
d26	OUT 4+			z26	OUT 4–
d28	0 Vdc			z28	0 Vdc
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32				z32	



## Connection example

The figure below shows a connection example for the fail-safe digital output module 10216/2/3.

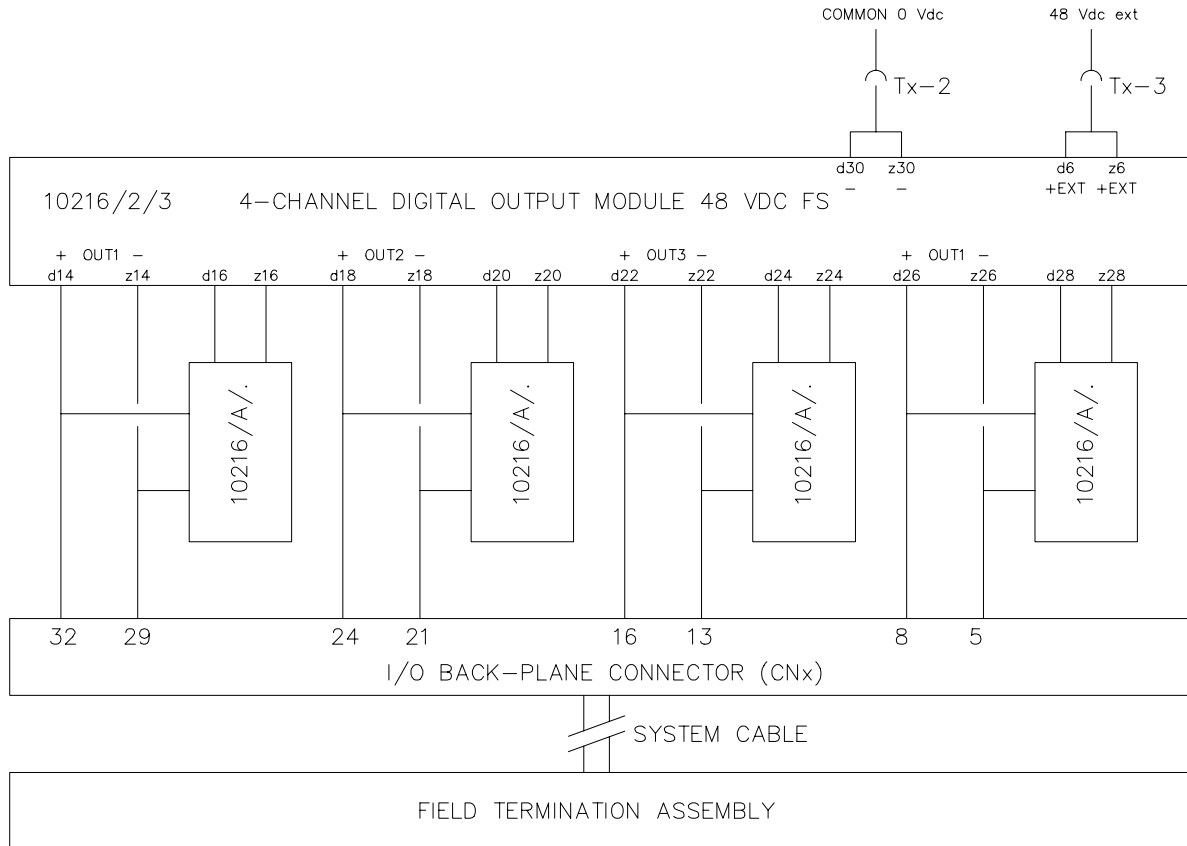


Figure 2 Connection example of 10216/2/3 module to FTA for both non-redundant and redundant I/O configurations

### Note:

The 24 Vdc internal power supply (d8 and z8) must be connected to prevent fault detection during the self-test of the output module. The 48 Vdc external power supply (d6/z6 and d30/z30), as well as dummy loads on all spare channels, must be connected to prevent fault detection during the lead breakage test of the output module.



## Technical data

The 10216/2/3 module has the following specifications:

<b>General</b>	Type number:	10216/2/3 13400
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 310
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	5 Vdc 15 mA 24 Vdc internal 50 mA 48 Vdc external 15 mA (without output load)
	<b>Output</b>	Number of output channels: 4
	Output specification:	48 Vdc solid-state source, short circuit proof
	Maximum channel current:	0.5 A (see 'FSC output modules' data sheet)
	Maximum load inductance:	1 H
	Maximum load capacity:	1 µF
	Top of overload detection:	> 40 Ohm
	Cold resistance lamp:	> 80 Ohm
	Voltage drop:	< 1.2 V at 0.5 A
	Off current:	< 0.1 mA
	Current sense voltage drop:	< 1 V at 0.5 A
	WDG input current:	4 mA
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– holes	A13, C13
	Rack code:	
	– large pins	A13, C13

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## 10216/A/. Range-setting modules

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### Description

The loop-monitored output channels of the 10216/2/. module usually need a range-setting module to put the current sense level in the proper range or to prevent lead breakage detection on spare channels. The 10216/A/. modules are placed on a programming connector (Px) on the back of the I/O backplane in the 19-inch rack. To assist proper placement of these 10216/A/. modules, a 10216 positioning print can be placed on the programming connector.

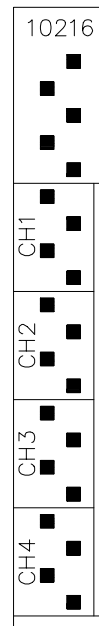


Figure 1 10216 positioning print

The printed circuit board of a 10216/A/. module should be oriented to slide into the cut-out zone of the appropriate channel. Redundant channels require only one 10216/A/. module.

---

## 10216/A/1

## Spare channel

### Description

The 10216/A/1 range-setting module is used for spare channels of 10216/2/. modules to prevent lead breakage detection on those channels.

The 10216/A/1 module has a 4.7 kOhm (dummy load) resistor.

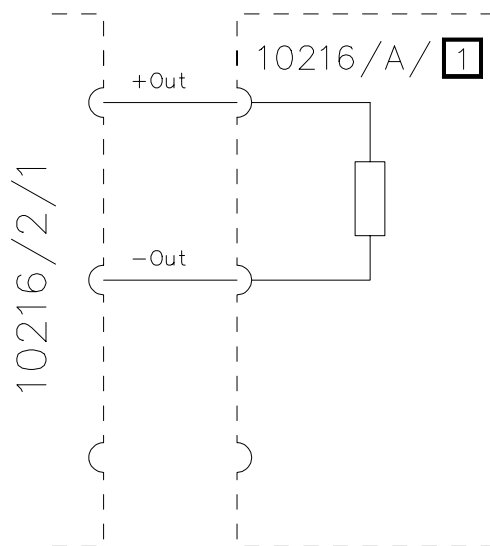


Figure 2 Schematic diagram of a 10216/A/1 module

### Technical data

The 10216/A/1 module has the following specifications:

#### General

Type number:	10216/A/1
Approvals:	CE, TÜV, UL
Number of channels:	1
Dimensions:	23 x 10.2 x 9 mm (0.91 x 0.4 x 0.35 in)
Rack space requirements:	none (placed on programming connector on I/O backplane)

#### Power

Power requirements:	5 mA from 24 Vext. of 10216/2/1 10 mA from 48 Vext. of 10216/2/3
---------------------	---



## 10216/A/2

## 17-47 mA range-setting module

### Description

The 10216/A/2 range setting module is used for 10216/2/. channels with loads between 17 and 47 mA.

The 10216/A/2 module has a 33 Ohm resistor to set the current sense level.

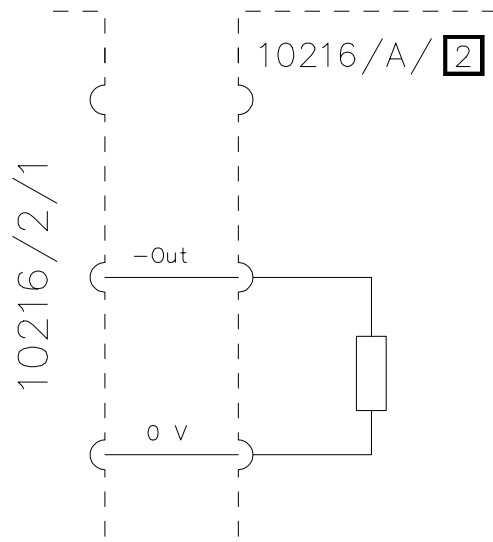


Figure 3 Schematic diagram of a 10216/A/2 module

### Technical data

The 10216/A/2 module has the following specifications:

<b>General</b>	Type number:	10216/A/2
	Approvals:	CE, TÜV, UL
	Number of channels:	1
	Dimensions:	23 x 10.2 x 9 mm (0.91 x 0.4 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none
	Load range:	17 to 47 mA
		0.4 to 1.1 W at 24 Vdc 0.8 to 2.3 W at 48 Vdc

## 10216/A/3

## 48-199 mA range-setting module

### Description

The 10216/A/3 range setting module is used for 10216/2/. channels with loads between 48 and 199 mA. The 10216/A/3 module has a 10 Ohm resistor to set the current sense level.

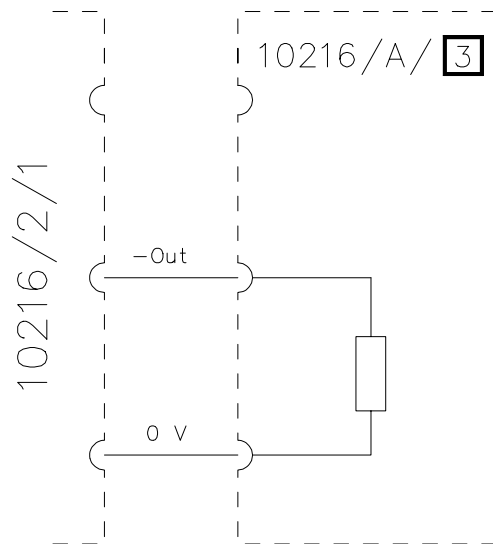


Figure 4 Schematic diagram of a 10216/A/3 module

### Technical data

The 10216/A/3 module has the following specifications:

<b>General</b>	Type number:	10216/A/3
	Approvals:	CE, TÜV, UL
	Number of channels:	1
	Dimensions:	23 x 10.2 x 9 mm (0.91 x 0.4 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none
	Load range:	48 to 199 mA
		1.2 to 4.7 W at 24 Vdc 2.4 to 9.5 W at 48 Vdc



## 10216/A/4

## ≥ 200 mA range-setting module

### Description

The 10216/A/4 range setting module is used for 10216/2/. channels with loads of 200 mA or higher.

The 10216/A/4 module has a 2.2 Ohm resistor to set the current sense level.

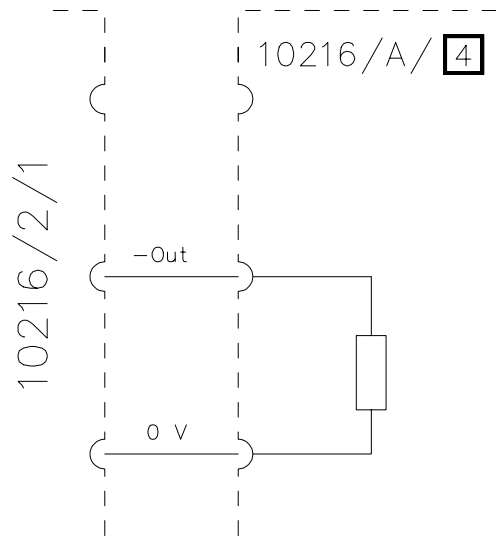


Figure 5 Schematic diagram of a 10216/A/4 module

### Technical data

The 10216/A/4 module has the following specifications:

<b>General</b>	Type number:	10216/A/4
	Approvals:	CE, TÜV, UL
	Number of channels:	1
	Dimensions:	23 x 10.2 x 9 mm (0.91 x 0.4 x 0.35 in)
	Rack space requirements:	none (placed on programming connector on I/O backplane)
<b>Power</b>	Power requirements:	none
	Load range:	≥ 200 mA
		≥ 4.8 W at 24 Vdc ≥ 9.6 W at 48 Vdc



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# **Fail Safe Control Hardware Manual**

## **Section 7: FSC Modules for Special Functions**

**TotalPlant**



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## 10302/1/1

## Watchdog repeater (WDR)

---

### Description

The watchdog repeater 10302/1/1 is a module that monitors the 5 Vdc and 24 Vdc supplied to the I/O modules. The watchdog output of the watchdog repeater is connected to the watchdog input of those output modules whose power supply (5 Vdc and/or 24 Vdc) is monitored.

A watchdog repeater is required in the following cases:

- in multiple-PSU configurations, for each subsequent 24 Vdc to 5 Vdc power supply unit, e.g. PSU 2, 3, 4.
- if the 24 Vdc is supplied via an M24-20 HE or M24-12 HE power supply.
- if the 24 Vdc is supplied via a power supply which can provide supply voltages that exceed 31.0 Vdc. (The maximum output voltage of the 24 Vdc supply must be less than 37 Vdc under any single or double fault condition of the 24 Vdc power supply unit.)
- if the required watchdog current exceeds 900 mA.
- in configurations which combine redundant and non-redundant I/O, in order to create the watchdog output for the output modules of the non-redundant I/O part.
- in configurations with redundant Central Parts and non-redundant I/O, in order to monitor the 5 Vdc power supply (if no 5 Vdc monitoring is done).

The watchdog repeater requires a horizontal bus connection. This means that space must be reserved in the I/O racks (positions 1 to 18). A watchdog repeater must always be placed in the I/O section whose output modules are monitored by that watchdog repeater. This means that watchdog repeaters in configurations with multiple (redundant) I/O sections may not be installed in such a way that they control the "other" I/O section.

The watchdog repeater may be exchanged with the power supply switched on, but the Central Part will shut down, or both Central Parts will shut down if used in a configuration with redundant Central Parts and non-redundant I/O.

The watchdog repeater is fitted with a male connector according to DIN 41612, type F, with the 'd' and 'z' rows used.

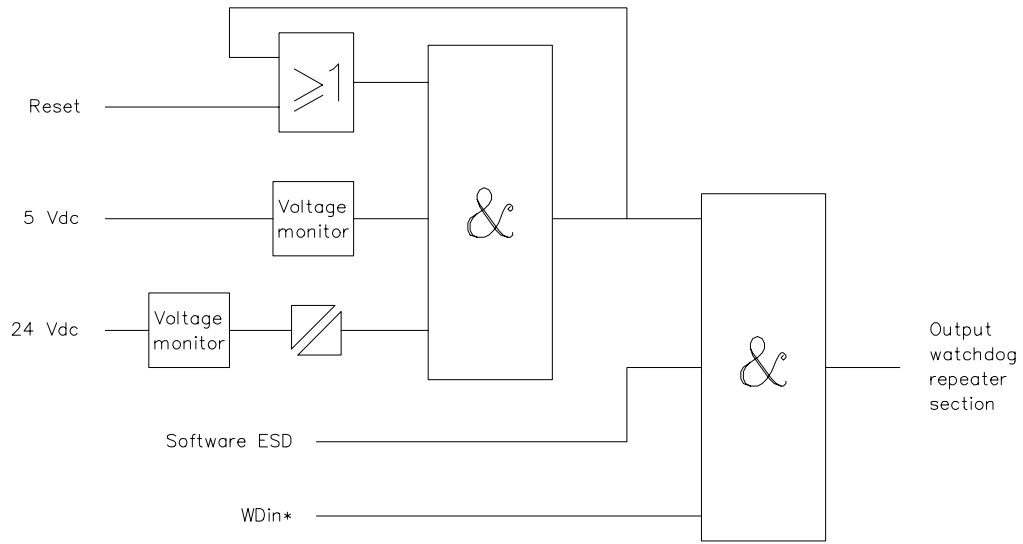


Figure 1 Logic diagram for a watchdog repeater section

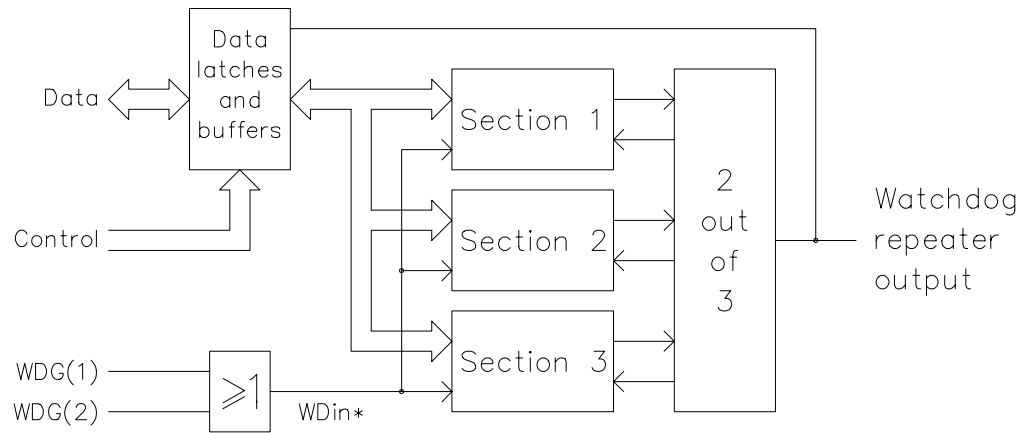
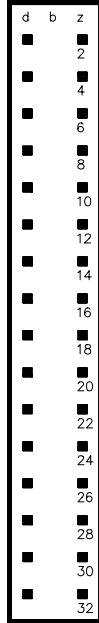


Figure 2 Block diagram for the watchdog repeater module



## Pin allocation

The back view and pin allocation of the 10302/1/1 rack connector are as follows:



d2	WDG1 (5 Vdc)	z2	GND 5 Vdc
d4	WDG2 (5 Vdc)	z4	Supply 5 Vdc
d6		z6	
d8	GND 5 Vdc	z8	GND 5 Vdc
d10	WDR OUT	z10	WDR OUT
d12	GND 5 Vdc	z12	GND 5 Vdc
d14		z14	
d16		z16	
d18		z18	
d20		z20	
d22		z22	
d24	Link	z24	Link
d26		z26	
d28		z28	
d30	Supply 24 Vdc	z30	
d32	Supply 0 Vdc	z32	

## Technical data

The 10302/1/1 module has the following specifications:

### General

Type number:	10302/1/1
Approvals:	CE, TÜV, UL
Software versions:	all
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

### Power

Power requirements:	5 Vdc 35 mA (without WDROUT output current) 24 Vdc 25 mA
WDG1 + WDG2 input current:	0.1 mA

### Key coding

(See 'Key coding' data sheet)

Module code:

- hole A27
- pins C11, C23, C27

Rack code:

- blind stops C3, C19, C31
- large pin A27



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## 10302/2/1

## Watchdog repeater (WDR)

---

### Description

The watchdog repeater 10302/2/1 is a module that monitors the 5 Vdc and 24 Vdc supplied to the I/O modules. The watchdog output of the watchdog repeater is connected to the watchdog input of those output modules whose power supply (5 Vdc and/or 24 Vdc) is monitored.

A watchdog repeater is required in the following cases:

- in multiple-PSU configurations, for each subsequent 24 Vdc to 5 Vdc power supply unit, e.g. PSU 2, 3, 4.
- if the 24 Vdc is supplied via an M24-20 HE or M24-12 HE power supply.
- if the 24 Vdc is supplied via a power supply which can provide supply voltages that exceed 31.0 Vdc. (The maximum output voltage of the 24 Vdc supply must be less than 37 Vdc under any single or double fault condition of the 24 Vdc power supply unit.)
- if the required watchdog current exceeds 900 mA.
- in configurations which combine redundant and non-redundant I/O, in order to create the watchdog output for the output modules of the non-redundant I/O part.
- in configurations with redundant Central Parts and non-redundant I/O, in order to monitor the 5 Vdc power supply (if no 5 Vdc monitoring is done).

The watchdog repeater requires a horizontal bus connection. This means that space must be reserved in the I/O racks (positions 1, 2, 11-18).

A watchdog repeater must always be placed in the I/O section whose output modules are monitored by that watchdog repeater. This means that watchdog repeaters in configurations with multiple (redundant) I/O sections may not be installed in such a way that they control the "other" I/O section.

The watchdog repeater may be exchanged with the power supply switched on, but the Central Part will shut down, or both Central Parts will shut down if used in a configuration with redundant Central Parts and non-redundant I/O.

The watchdog repeater is fitted with a male connector according to DIN 41612, type F, with the 'd', 'b' and 'z' rows used.

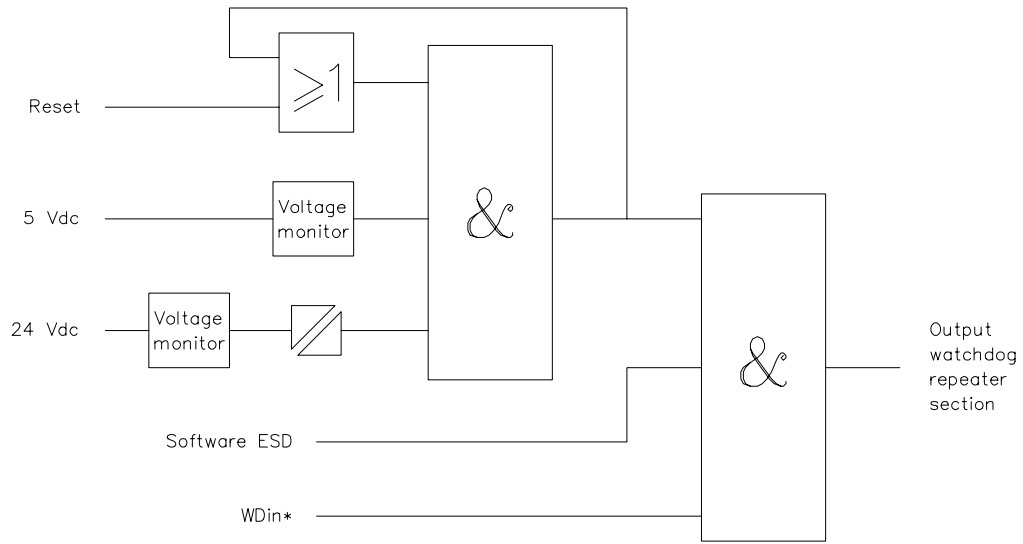


Figure 1 Logic diagram for a watchdog repeater section

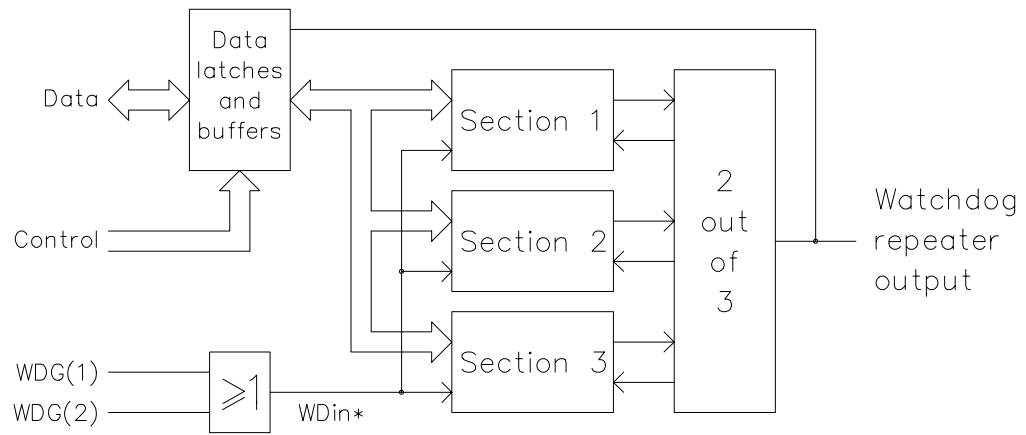
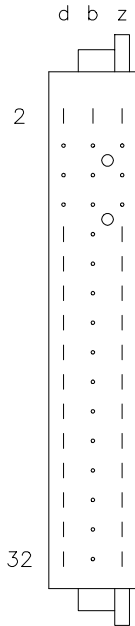


Figure 2 Block diagram for the watchdog repeater module



## Pin allocation

The back view and pin allocation of the 10302/2/1 module connector are as follows:



d2		b2	GND 5 Vdc	z2	Supply 5 Vdc
d4	–			z4	–
d6	–			z6	–
d8	–			z8	–
d10	(GND 5 Vdc)			z10	(GND 5 Vdc)
d12	WDG1 IN			z12	WDG2 IN
d14	GND 5 Vdc			z14	(GND 5 Vdc)
d16	WDG OUT			z16	(GND 5 Vdc)
d18	(GND 5 Vdc)			z18	(GND 5 Vdc)
d20				z20	
d22				z22	
d24				z24	
d26				z26	
d28				z28	
d30	Supply 0 Vdc			z30	Supply 0 Vdc
d32	Supply 24 Vdc			z32	Supply 24 Vdc

## Technical data

The 10302/2/1 module has the following specifications:

### General

Type number:	10302/2/1 12600
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

### Power

Power requirements:	5 Vdc 35 mA (without WDROUT output current) 24 Vdc 25 mA
WDG1 + WDG2 input current:	0.1 mA

### Key coding

(See 'Key coding' data sheet)

Module code:	
– holes	A5, A9
Rack code:	
– large pins	A5, A9



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## 10303/1/1

# Power supply distribution module (PSD)

### Description

The power supply distribution module (PSD) 10303/1/1 is only used in configurations with redundant Central Parts and non-redundant I/O. It is used to combine the output of the power supply units (PSUs) in the redundant Central Parts into one 5 Vdc supply for the non-redundant I/O part of the system. One power supply distribution module is required per PSU module.

The power supply to the Central Part must also be routed through this module to create an equal voltage drop to the Central Part and I/O section.

As the limits on the 5 Vdc power supply are very tight ( $\pm 5\%$ ), it is required to place the PSD modules next to the PSU modules to reduce the voltage drop in the wiring. The minimum wire diameter is 2.5 mm<sup>2</sup> (AWG 14).

The PSD module may only be exchanged with the power supply to its PSU switched off.

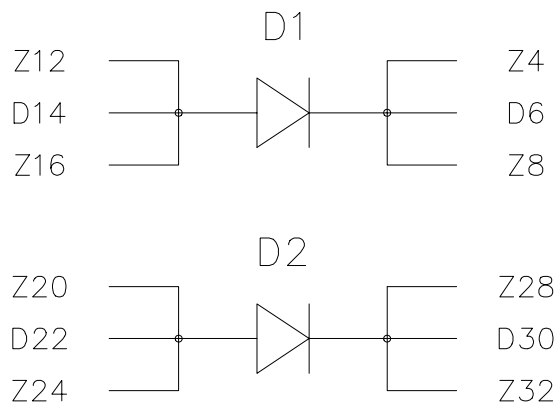


Figure 1 Schematic diagram of 10303/1/1 module



## Technical data

The 10303/1/1 module has the following specifications:

<b>General</b>	Type number:	10303/1/1 03501*
	Approvals:	CE, TÜV, UL
	Software versions:	all
	Space requirements:	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	none
	Max. current:	20 A (module dissipation limit)*
	Max. forward voltage drop:	0.55 V
	Max. reverse voltage:	30 V
<b>Connector</b>	Connector type:	DIN 41612-H 15 P (faston)
	Max. connector current:	10 A per pin

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**\* Note:**

10303/1/1 modules without a suffix code have a maximum current of 12 A.

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## 10305/1/1

## 0-20 mA to 0-5 V analog input converter (16 channels)

### Description

The 10305/1/1 module is a 16-channel 0-20 mA to 0-5 Vdc analog input converter module. It provides a low-impedance voltage source for a high-impedance analog input as those of the analog input module 10102/1/2.

To reduce the influence of voltage drop over the wiring, the 10305/1/1 module must be placed close to the corresponding analog input modules, e.g. position 19 in the same rack.

The fuse on the 10305/1/1 module is only used to protect the precision resistor. If the 'b' row is not available, the 'z' row can be used as both input and output. This allows a standard 32-pin connector to be used for all FSC I/O modules.

The 10305/1/1 modules may be exchanged with the power supply switched on, but all connected analog inputs will go to their low (zero) value (*also* in redundant configurations).

The 10305/1/1 module is fitted with a male connector according to DIN 41612, type F, with the 'd', 'b' and 'z' rows used.

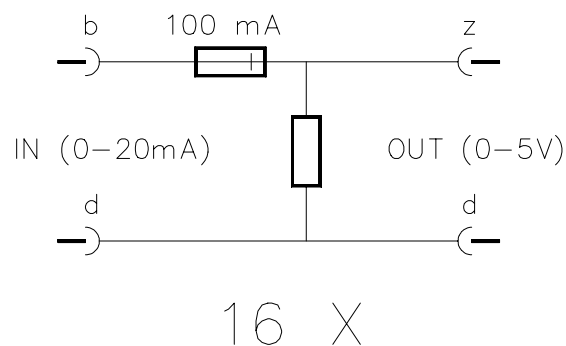
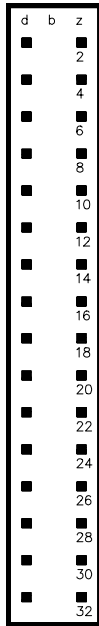


Figure 1 Schematic diagram of one 10305/1/1 channel



## Pin allocation

The back view and pin allocation of the 10305/1/1 rack connector are as follows:



d2	GND 16	b2	IN 16	z2	OUT 16
d4	GND 15	b4	IN 15	z4	OUT 15
d6	GND 14	b6	IN 14	z6	OUT 14
d8	GND 13	b8	IN 13	z8	OUT 13
d10	GND 12	b10	IN 12	z10	OUT 12
d12	GND 11	b12	IN 11	z12	OUT 11
d14	GND 10	b14	IN 10	z14	OUT 10
d16	GND 9	b16	IN 9	z16	OUT 9
d18	GND 8	b18	IN 8	z18	OUT 8
d20	GND 7	b20	IN 7	z20	OUT 7
d22	GND 6	b22	IN 6	z22	OUT 6
d24	GND 5	b24	IN 5	z24	OUT 5
d26	GND 4	b26	IN 4	z26	OUT 4
d28	GND 3	b28	IN 3	z28	OUT 3
d30	GND 2	b30	IN 2	z30	OUT 2
d32	GND 1	b32	IN 1	z32	OUT 1

## Application

For wiring diagrams of the 10305/1/1 module refer to the 10102/1/2 data sheet (analog input module).





## Technical data

The 10305/1/1 module has the following specifications:

<b>General</b>	Type number:	10305/1/1
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 2.77
	Space requirements	4 TE, 3 HE (= 4 HP, 3U)
<b>Power</b>	Power requirements:	none (passive)
<b>Input/output</b>	Number of channels:	16
	Input:	0-25 mA
	Output:	0-6.25 V
	Resistor value:	250 Ohm 0.1% 2.5 W
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A27
	– pins	C11, C19, C27
	Rack code:	
	– blind stops	C3, C23, C31
– large pin	A27	

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## 10305/1/2

## Loop-monitored input converter (16 channels)

### Description

The 10305/1/2 module provides the components to create a loop-monitored input function using a 0 to 5 Vdc analog input. The actual loop-monitoring function is implemented in the application program (e.g. in a function block).

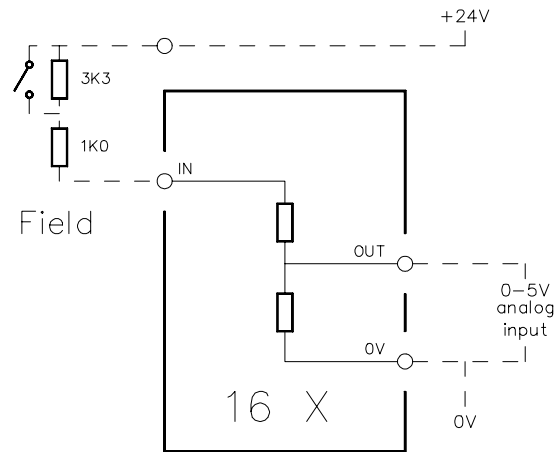
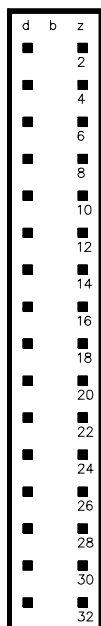


Figure 1 Schematic diagram for connection to the 10305/1/2 module

### Pin allocation

The back view and pin allocation of the 10305/1/2 rack connector are as follows:



d2	IN 16	b2	0 V 16	z2	OUT 16
d4	IN 15	b4	0 V 15	z4	OUT 15
d6	IN 14	b6	0 V 14	z6	OUT 14
d8	IN 13	b8	0 V 13	z8	OUT 13
d10	IN 12	b10	0 V 12	z10	OUT 12
d12	IN 11	b12	0 V 11	z12	OUT 11
d14	IN 10	b14	0 V 10	z14	OUT 10
d16	IN 9	b16	0 V 9	z16	OUT 9
d18	IN 8	b18	0 V 8	z18	OUT 8
d20	IN 7	b20	0 V 7	z20	OUT 7
d22	IN 6	b22	0 V 6	z22	OUT 6
d24	IN 5	b24	0 V 5	z24	OUT 5
d26	IN 4	b26	0 V 4	z26	OUT 4
d28	IN 3	b28	0 V 3	z28	OUT 3
d30	IN 2	b30	0 V 2	z30	OUT 2
d32	IN 1	b32	0 V 1	z32	OUT 1



## Technical data

The 10305/1/2 module has the following specifications:

<b>General</b>	Type number:	10305/1/2 08300
	Approvals:	CE, TÜV, UL
<b>Power</b>	Input voltage (+ to 0 V):	max. 36 V
	Input current:	max. 12 mA at 24 Vdc
<b>Connector</b>	Connector type:	DIN41612F (48 pins)
	Max. pin-to-pin voltage:	36 Vac / 50 Vdc – IEC 1010 (1990) overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– hole	A23
	– pins	C3, C19, C23
	Rack code:	
– blind stops	C11, C27, C31	
– large pin	A23	

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## 10306/1/. Supply input filters

### Description

The 10306/1/. modules are used as power supply input filters. The type of 10306/1/. module to be used depends on the voltage level:

- 24 Vdc: 10306/1/1
- 48 Vdc: 10306/1/4
- 60 Vdc: 10306/1/5
- 110 Vdc: 10306/1/2
- 220 Vdc: 10306/1/3

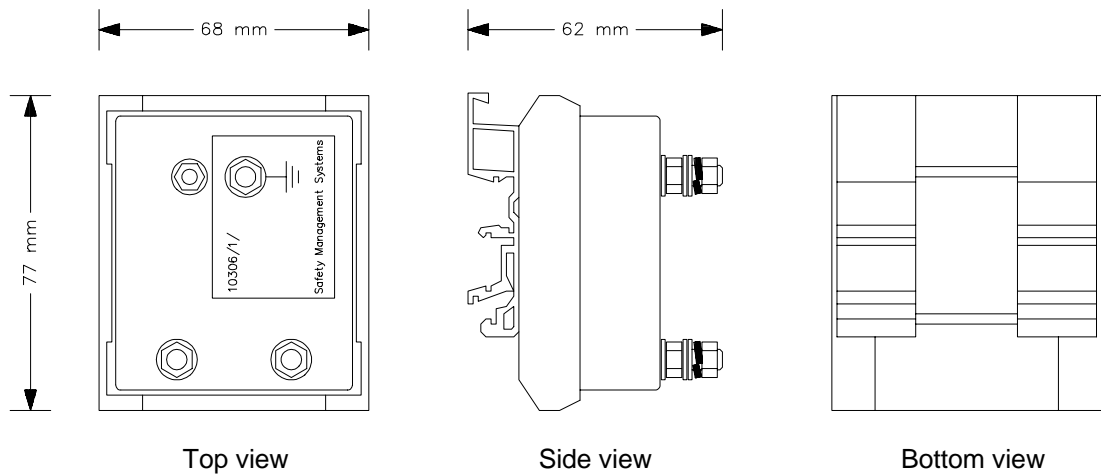


Figure 1 10306/1/. mechanical layout

The 10306/1/. modules have a universal snap-in facility for standard DIN EN rails.

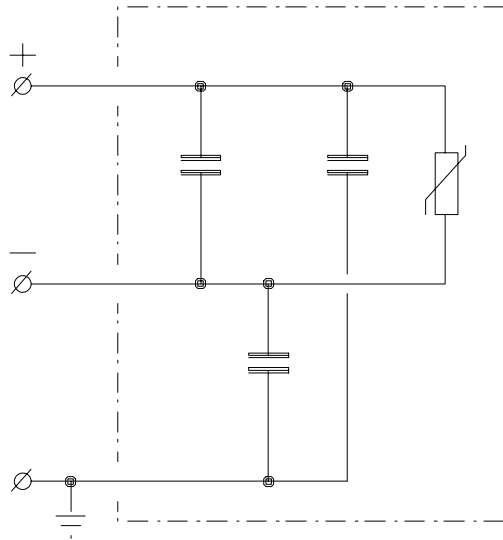


Figure 2 10306/1/. circuit

If the DC power is supplied externally, the input filter must be placed close to the input terminals of the power supply. The plus (+) and minus (-) connections are arbitrary. The ground connection is indicated.

The supply wires must be routed via the filter terminals, or they must be connected to the input filter using wires with a diameter of at least 6 mm<sup>2</sup> (AWG 10) and a maximum length of 10 cm (4 in).

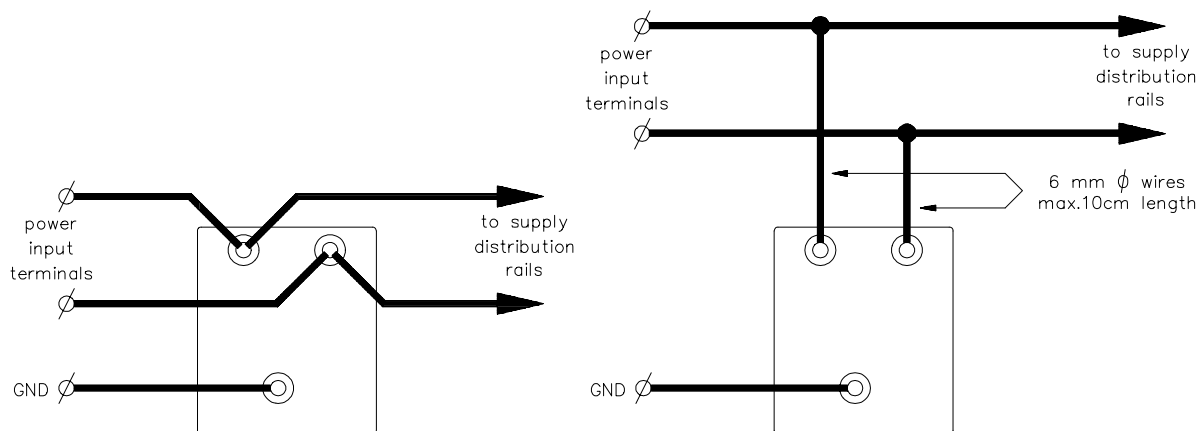


Figure 3 Wiring examples for 10306/1/. modules



## Technical data

The 10306/1/. modules have the following specifications:

<b>General</b>	Type number:	10306/1/1 to 10306/1/5
	Approvals:	CE, TÜV, UL
<b>Physical</b>	Dimensions:	77 x 68 x 62 mm (L x W x H) 3.03 x 2.68 x 2.44 in (L x W x H)
	Color:	green
	Weight:	approx. 190 gr (6.70 oz)
	<b>Power</b>	Power requirements:
	Maximum voltage:	10306/1/1: 36 Vdc 10306/1/2: 140 Vdc 10306/1/3: 255 Vdc 10306/1/4: 62 Vdc 10306/1/5: 74 Vdc
	Maximum voltage between any input and GND:	500 Vac or 700 Vdc
<b>Terminations</b>	Connection type:	M5

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## 10307/1/1

## Vertical bus terminator

### Description

The vertical bus terminator 10307/1/1 provides extra line terminators for the vertical bus. The module gets its own connector on the vertical bus (see 10001/1/1 & 10001/R/1 data sheet).

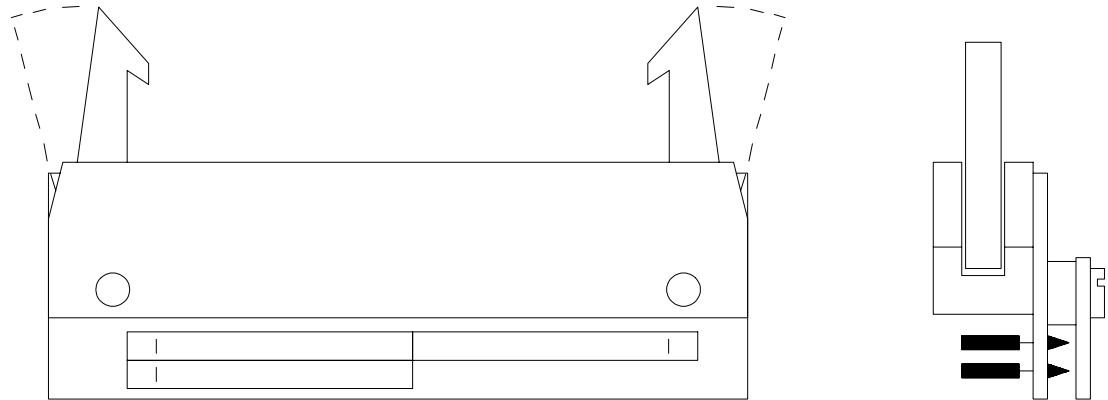


Figure 1 Mechanical layout

### Technical data

The 10307/1/1 module has the following specifications:

<b>General</b>	Type number:	10307/1/1
	Approvals:	CE, TÜV, UL
<b>Power</b>	Power requirements:	50 mA (from 5 Vdc of vertical bus driver, VBD)
<b>Physical</b>	Dimensions:	62.5 x 34.5 x 17.5 mm (2.46 x 1.41 x 0.71 in)
	Weight:	approx. 17 g (0.60 oz)

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## 10309/1/1

## Dual BNC connector interface module

### Description

The dual BNC connector interface module 10309/1/1 is a two-channel interface for signals routed via coax cables (see Figure 1).

In a typical application, the 10309/1/1 module interfaces between the FSC cabinet's internal signal cable(s) for the DCF real-time clock on the DBM module(s) (10006/2/2), and the field cable(s) to the DCF amplifier or aerial. The incoming and outgoing wiring to the dual BNC connector interface module must be terminated with a (right-angled) BNC plug.

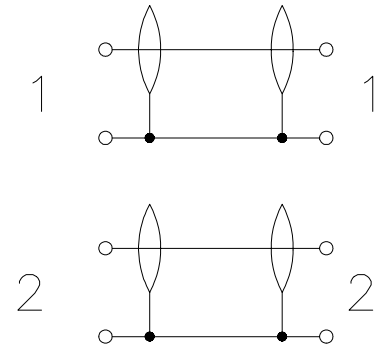


Figure 1

The 10309/1/1 module has a universal snap-in facility for standard DIN EN rails (see Figure 2).

The click mechanism of the housing enables opening of the module and inverse placement of the PC board (see Figure 3).

Incoming and outgoing wiring can be connected to either side of the 10309/1/1 module.

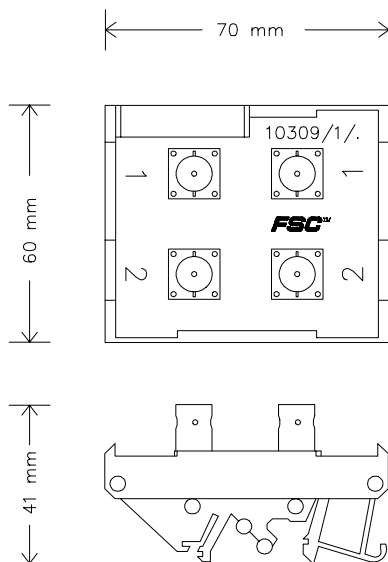


Figure 2

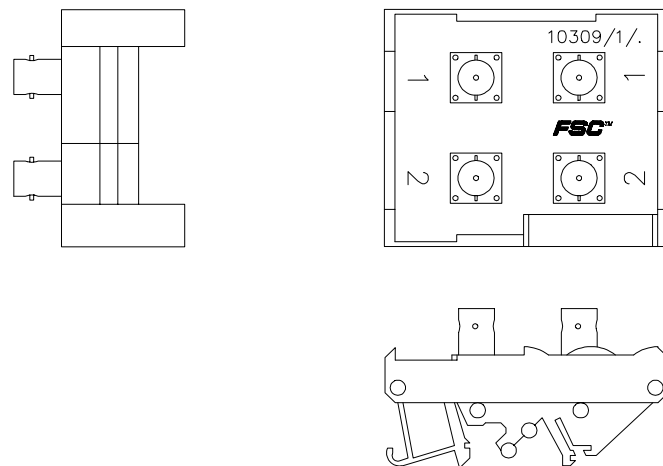


Figure 3



## Technical data

The 10309/1/1 module has the following specifications:

<b>General</b>	Type number:	10309/1/1 09600
	Approvals:	CE, TÜV, UL
<b>Physical</b>	Dimensions:	70 x 60 x 41 mm (L x W x H) 2.76 x 2.36 x 1.61 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	max. 61 mm (2.40 in)
<b>Connectors</b>	BNC connectors:	50/75 Ohm jack
	Frequency range:	DC ... 50 MHz

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## 10310/1/1

## Earth leakage detector (ELD)

### Description

The 10310/1/1 module is an earth leakage detector (ELD) for 24 Vdc systems. It has a manually operated self-test and earth connection monitor (switch 2 in 'TEST' position).

The system may include 48 Vdc and/or 60 Vdc supplies with a common 0 V rail (see Figure 3).

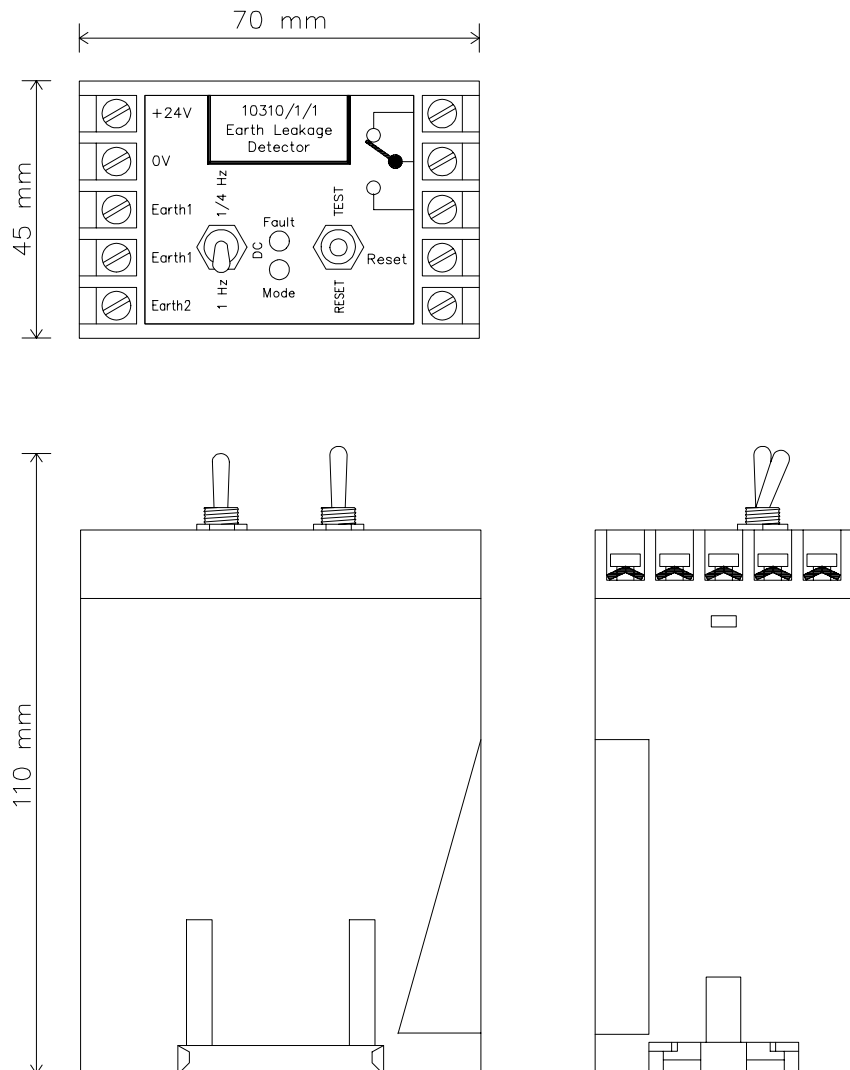


Figure 1 Module layout

The module has a universal snap-in facility for standard 35 mm DIN EN rails.

The ELD module connects earth level with  $-12\text{ Vdc}$  (referenced to the  $0\text{ V}$  connection of the  $24\text{ Vdc}$  supply). This connection is:

- continuous (switch 1 in 'DC' position), or
- interrupting at  $1\text{ Hz}$  (switch 1 in '1 Hz' position), or
- interrupting at  $0.25\text{ Hz}$  (switch 1 in '1/4 Hz' position).

With switch 1 in the '1 Hz' or '1/4 Hz' position, the green 'MODE' LED on the module front flashes at the selected connection frequency.

Switch 1 is normally used in the 'DC' position.

The '1 Hz' position should only be used to accommodate for solenoids or relays that could stay energized by the negative earth voltage.

The '1/4 Hz' position can be used for locating earth faults. Locating earth faults requires a current clamp (e.g. the C37 clamp from Chauvin Arnoux) and a voltmeter ( $200\text{ mV AC}$  range).

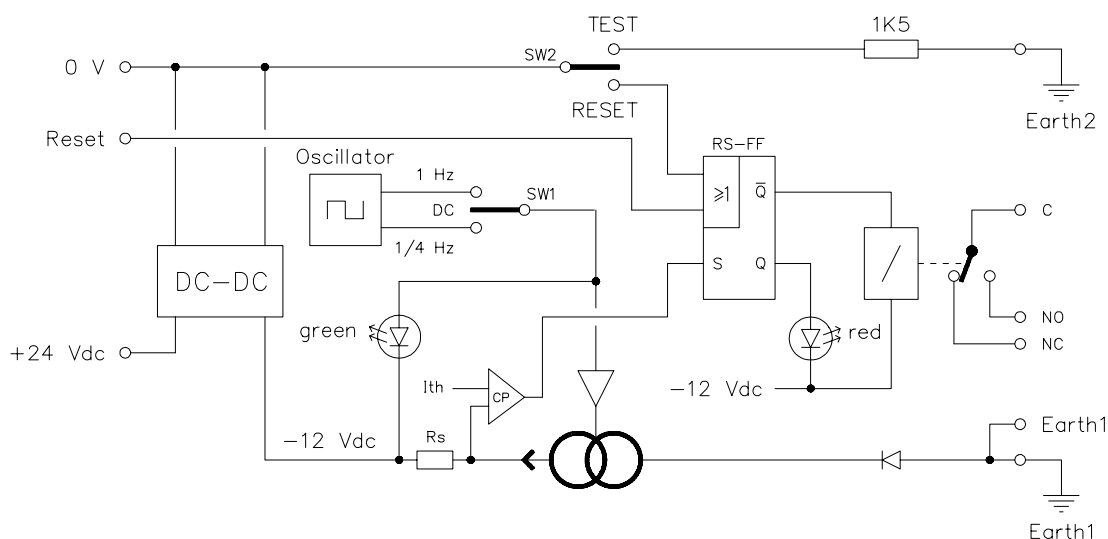


Figure 2 Block diagram of 10310/1/1 ELD

An earth fault sets the flip-flop (FF), and de-energizes the relay (see Figure 2). The flip-flop remains set until a reset is given. This can be done in two ways:

- manually (by setting switch 2 to 'RESET' position), or
- by a high level at the reset input.

The ELD module can be tested by connecting a  $1.5\text{ k}\Omega$  resistor between  $0\text{ V}$  and earth. This should set the flip-flop. A  $1.5\text{ k}\Omega$  resistor in the ELD with its own connection to earth (on the Earth2 pin) allows testing of the ELD and the earth connection (switch 2 in



'TEST' position). A disconnected Earth1-to-Earth2 link will block the flip-flop set action (because no earth current is flowing). By placing a link between Earth 1 and Earth 2, only one earth wire is required. However, a fault in this wire will not be detected during test (see Figure 4).

## Connection examples

The figures below show two connection examples of the 10310/1/1 ELD module.

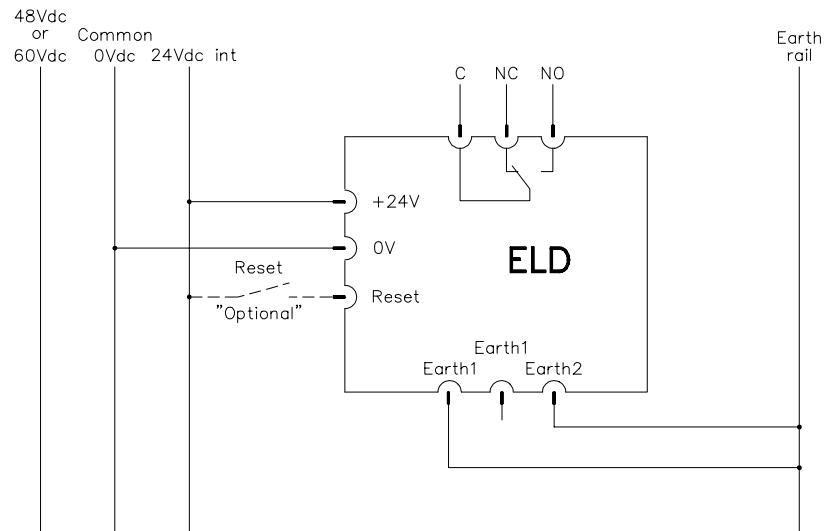


Figure 3 24 Vdc with 48 Vdc or 60 Vdc monitoring

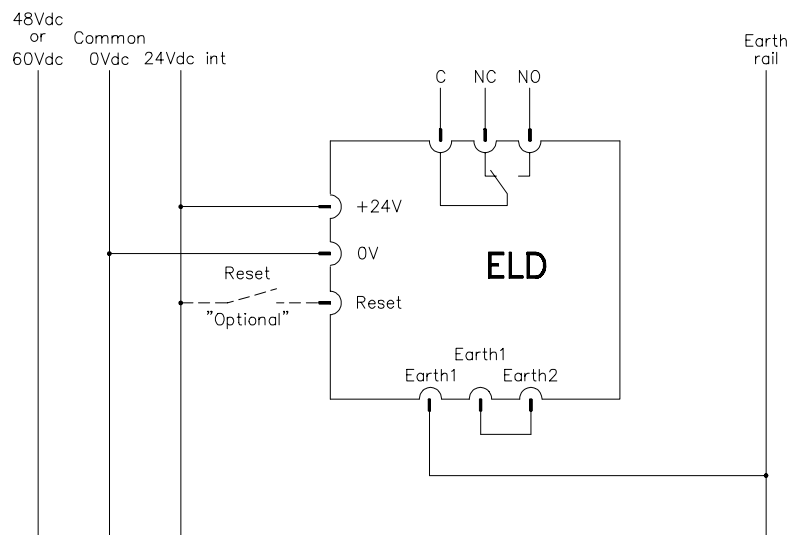


Figure 4 ELD with single earth wire



<b>Technical data</b>	The 10310/1/1 module has the following specifications:	
<b>General</b>	Type number:	10310/1/1 09700
	Approvals:	CE
<b>Power</b>	Supply voltage:	24 Vdc (max. 30 Vdc)
	Supply current:	max. 60 mA
	Reset input voltage:	18...70 Vdc
	Reset input current:	1.1 mA at 24 Vdc
<b>Earth</b>	Earth voltage:	-12 Vdc (no earth fault) -30...+70 Vdc (earth fault)
	Earth fault threshold:	5.5 mA ( $\pm$ 1 mA)
	Max. earth current:	25.0 mA ( $\pm$ 5 mA)
	Tightening torque of earth connections:	1 Nm (0.74 ft-lb)
<b>Physical</b>	Dimensions:	70 x 45 x 110 mm (L x W x H) 2.76 x 1.77 x 4.33 in (L x W x H)
	DIN EN rails:	TS35 x 7.5
	Used rail length:	max. 46 mm (1.81 in)
<b>Output contact</b>	Max. output voltage:	115 Vdc
	Max. output current:	2 A
<b>Relay contact</b>	Initial contact resistance:	30 mOhm
	Max. current:	5 A
	Max. switched voltage:	250 Vdc / 250 Vac
	Max. switched load:	100 W / 1000 VA
	Expected life:	
	– electrical	100,000 switch operations
	– mechanical	200,000,000 switch operations
	Ambient temperature:	-55°C to +65°C (-67°F to +149°F)

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## 10310/2/1

## Earth leakage detector (ELD)

### Description

The 10310/2/1 module is an earth leakage detector (ELD) for 24 Vdc systems. It has a manually operated self-test and earth connection monitor (switch 2 in 'TEST' position).

The ELD can be used to monitor:

- 24 Vdc, 48 Vdc and/or 60 Vdc systems (see Figure 3), or
- 110 Vdc systems (see Figure 4).

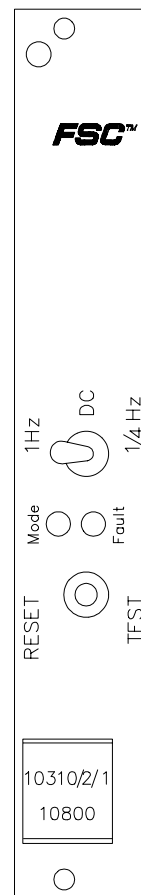


Figure 1 Front view

The ELD module connects earth level with  $-12\text{ Vdc}$  (referenced to the  $0\text{ V}$  connection of the 24, 48, 60 and/or  $110\text{ Vdc}$  supply). This connection is:

- continuous (switch 1 in 'DC' position), or
- interrupting at  $1\text{ Hz}$  (switch 1 in '1 Hz' position), or
- interrupting at  $0.25\text{ Hz}$  (switch 1 in '1/4 Hz' position).

With switch 1 in the '1 Hz' or '1/4 Hz' position, the green 'MODE' LED on the module front flashes at the selected connection frequency.

Switch 1 is normally used in the 'DC' position.

The '1 Hz' position should only be used to accommodate for solenoids or relays that could stay energized by the negative earth voltage.

The '1/4 Hz' position can be used for locating earth faults. Locating earth faults requires a current clamp (e.g. the C37 clamp from Chauvin Arnoux) and a voltmeter ( $200\text{ mV AC}$  range).

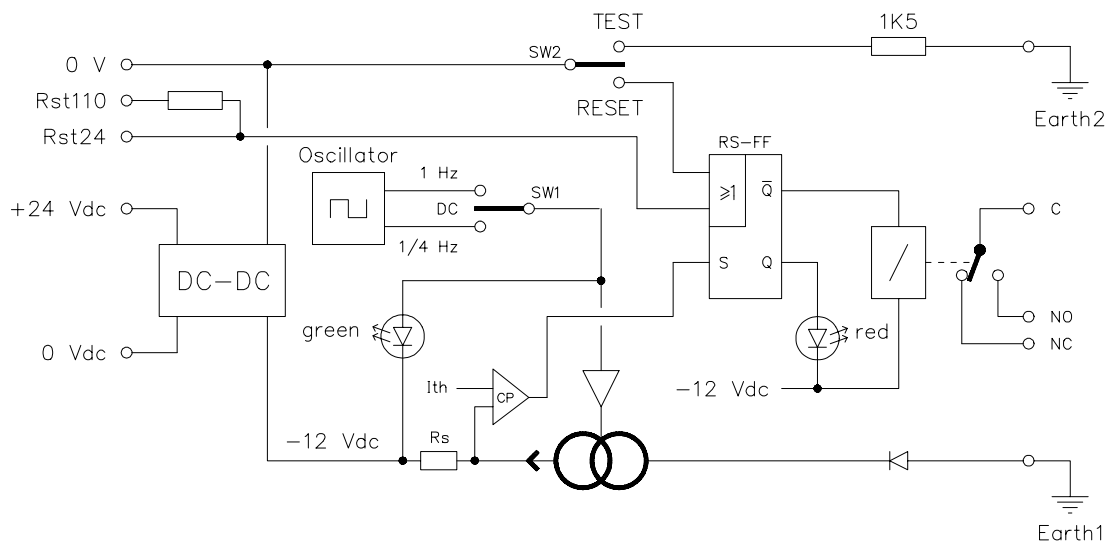


Figure 2 Block diagram of 10310/2/1 ELD

An earth fault sets the flip-flop (FF), and de-energizes the relay (see Figure 2). The flip-flop remains set until a reset is given. This can be done in three ways:

- manually (by setting switch 2 to 'RESET' position), or
- by a high level at the Rst24 input, or
- by a high level at the Rst110 input.



The ELD module can be tested by connecting a 1.5 kOhm resistor between 0 V and earth. This should set the flip-flop. A 1.5 kOhm resistor in the ELD with its own connection to earth (on the Earth2 pin) allows testing of the ELD and the earth connection (switch 2 in 'TEST' position). A disconnected Earth1-to-Earth2 link will block the flip-flop set action (because no earth current is flowing).

## Connection examples

The figures below show two connection examples of the 10310/2/1 ELD module.

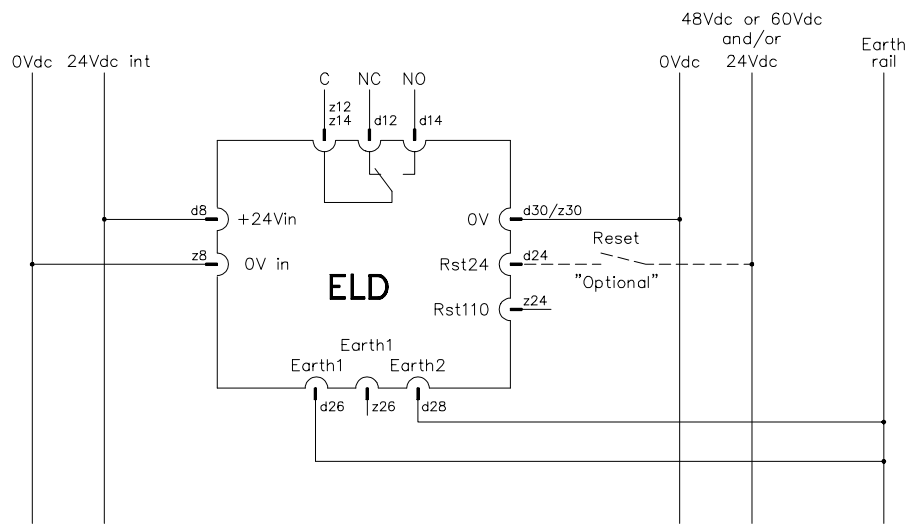


Figure 3 24 Vdc with 48 Vdc and/or 60 Vdc monitoring

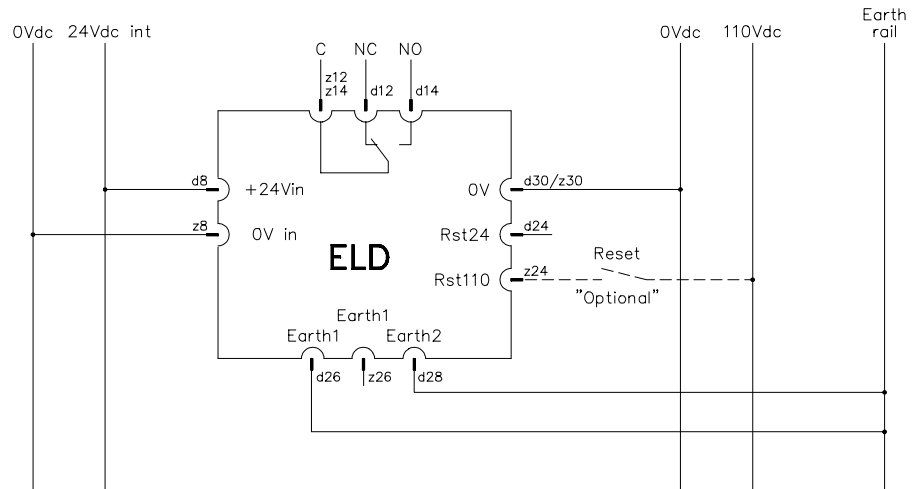
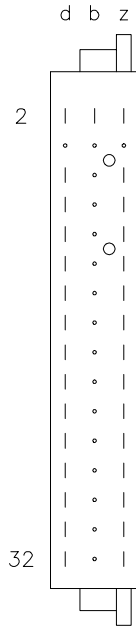


Figure 4 110 Vdc monitoring

## Pin allocation

The back view and pin allocation of the 10310/2/1 module connector are as follows:



Pin	Function	Pin	Function
d2		b2	
d4	-	z4	-
d6		z6	
d8	+24 Vin	z8	0 Vin
d10		z10	
d12	NC	z12	C
d14	NO	z14	C
d16		z16	
d18		z18	
d20		z20	
d22		z22	
d24	Rst24	z24	Rst110
d26	Earth 1	z26	Earth 1
d28	Earth 2	z28	
d30	0 V	z30	0 V
d32		z32	

## Technical data

The 10310/2/1 module has the following specifications:

<b>General</b>	Type number:	10310/2/1 10800
	Approvals:	CE, UL
<b>Power</b>	Supply voltage:	24 Vdc (max. 30 Vdc)
	Supply current:	max. 60 mA
	Rst24 input voltage:	18...70 Vdc
	Rst110 input voltage:	40...130 Vdc
	Rst24 input current:	1.1 mA at 24 Vdc
	Rst110 input current:	2.5 mA at 110 Vdc
<b>Earth</b>	Earth voltage:	-12 Vdc (no earth fault) -30...+125 Vdc (earth fault)
	Earth fault threshold:	5.5 mA ( $\pm$ 1 mA)
	Max. earth current:	25.0 mA ( $\pm$ 5 mA)



## Technical data (continued)

<b>Output contact</b>	Max. output voltage:	115 Vdc
	Max. output current:	2 A
<b>Relay contacts</b>	Initial contact resistance:	30 mOhm
	Max. current:	5 A
	Max. switched voltage:	250 Vdc / 250 Vac
	Max. switched load:	100 W / 1000 VA
	Expected life:	
	– electrical	100,000 switch operations
– mechanical	200,000,000 switch operations	
<b>Key coding</b>	(See 'Key coding' data sheet)	
	Module code:	
	– holes	A5, A11
	Rack code:	
– large pins	A5, A11	

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## 10313/1/1

## 5 Vdc & watchdog distribution module

### Description

The 10313/1/1 module is used for the distribution of 5 Vdc and watchdog (WD) signals in the FSC system.

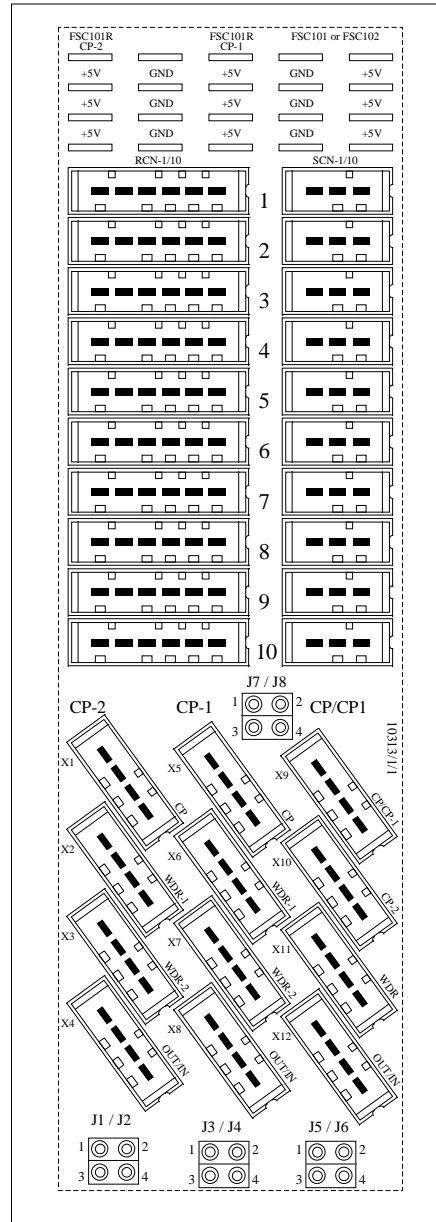


Figure 1 Top view

The module has a universal snap-in facility for standard DIN EN rails.



## Connections

The 10313/1/1 module has the following connection facilities (see Figure 1):

- ten connectors (RCN-1 to RCN-10) for connecting redundant I/O backplanes (10315/1/1) (see Figure 2),
- ten connectors (SCN-1 to SCN-10) for connecting non-redundant I/O backplanes (10314/1/1) (see Figure 3),
- 'FSC101 or FSC102' fastons for the incoming 5 Vdc power (for non-redundant I/O backplanes),
- 'FSC101R CP-1' and 'FSC101R CP-2' fastons for the incoming 5 Vdc power (for redundant I/O backplanes),
- connectors for directly connecting the watchdog repeaters (WDRs), and
- connectors for directly connecting the 10005/O/1 modules.
- connectors for linking an additional 10313/1/1 module in a separate cabinet (next 'section').

## Pin connections

### RCN-x

Figure 2 below shows the pin connections of the RCN-x connectors, which are used to connect redundant I/O backplanes.

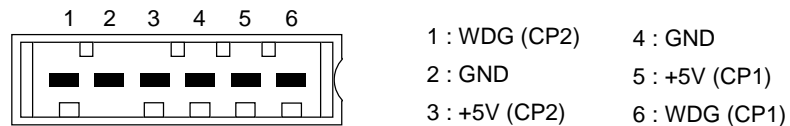


Figure 2 Pin connections of RCN-x

### SCN-x

Figure 3 below shows the pin connections of the SCN-x connectors, which are used to connect non-redundant I/O backplanes.

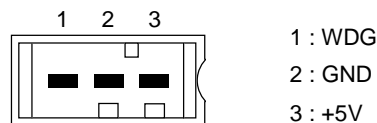


Figure 3 Pin connections of SCN-x





## 10005/O/1 module

Table 1 below shows the connectors that are used to connect 10005/O/1 modules, depending on the system configuration.

Table 1 Connectors used to connect 10005/O/1 module

System configuration		Connectors used on 10313/1/1 module
Central Part(s)	I/O	
Non-redundant	Non-redundant	'CP/CP-1' connector (X9)
Redundant	Non-redundant	'CP/CP-1' and 'CP-2' connectors (X9 and X10)
Redundant	Redundant	'CP' connectors of CP-1 and CP-2 (X1 and X5)
Redundant	Redundant & Non-redundant	'CP' connectors of CP-1 and CP-2 (X1 and X5)

Figure 4 below shows the pin connections of these connectors.

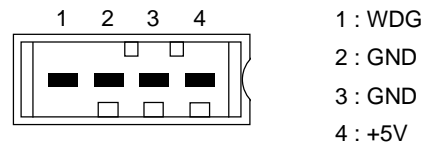


Figure 4 Pin connections of 'CP' and 'CP/CP-1' connector

## Watchdog repeaters

Table 2 below shows the connectors that are used to connect watchdog repeaters, depending on the system configuration.

Table 2 Connectors used to connect watchdog repeaters

System configuration		Connectors used on 10313/1/1 module
I/O	Watchdog	
Redundant	1st watchdog repeater	'WDR-1' connectors (X2 and X6)
	2nd watchdog repeater	'WDR-2' connectors (X3 and X7)
Non-redundant	one watchdog repeater	'WDR' connector (X11)

Figure 5 on the next page shows the pin connections of these connectors.

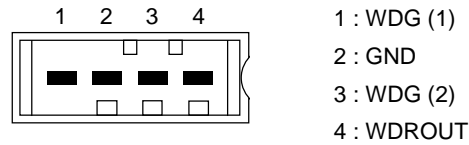


Figure 5 Pin connections of 'WDR', 'WDR-1' and 'WDR-2' connectors

### Additional 10313/1/1 modules

The 'OUT/IN' connectors (X4, X8 and X12) are used to link an additional 10313/1/1 module in a separate cabinet (next 'section'). Figure 6 shows the pin connections of these connectors.

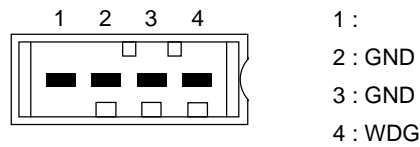


Figure 6 Pin connections of 'OUT/IN' connectors

### Connectors used for various configurations

Table 3 below provides an overview of the connectors that may be used for the various FSC configurations:

Table 3 Use of connectors on 10313/1/1 module

System configuration		Connectors on 10313/1/1 module		
Central Part(s)	I/O	'RCN'	'SCN'	'X'
Non-redundant	Non-redundant	–	1-10	X9, X11, X12
Redundant	Non-redundant	–	1-10	X9-X12
Redundant	Redundant	1-10	–	X1-X8
Redundant	Redundant & Non-redundant	1-10	1-10	X1-X8, X12



## Application

Figure 7 shows an example of how to use the 10313/1/1 module for the 5 Vdc and watchdog distribution by using the system power interconnection cables:

- WD-01 cable, which connects the 10313/1/1 module to the non-redundant backplane 10314/1/1.
- WD-02 cable, which connects the 10313/1/1 module to the redundant backplane 10315/1/1.
- WDG cable, which connects the 10313/1/1 module to the 10005/O/1 watchdog horizontal bus.
- WD-WD cable, which connects the 10313/1/1 module to the 10313/1/1 module in the next section.
- WDR cable, which connects the 10313/1/1 module to the watchdog repeater 10302/2/1.

The concept diagram below shows the connections of a redundant configuration.

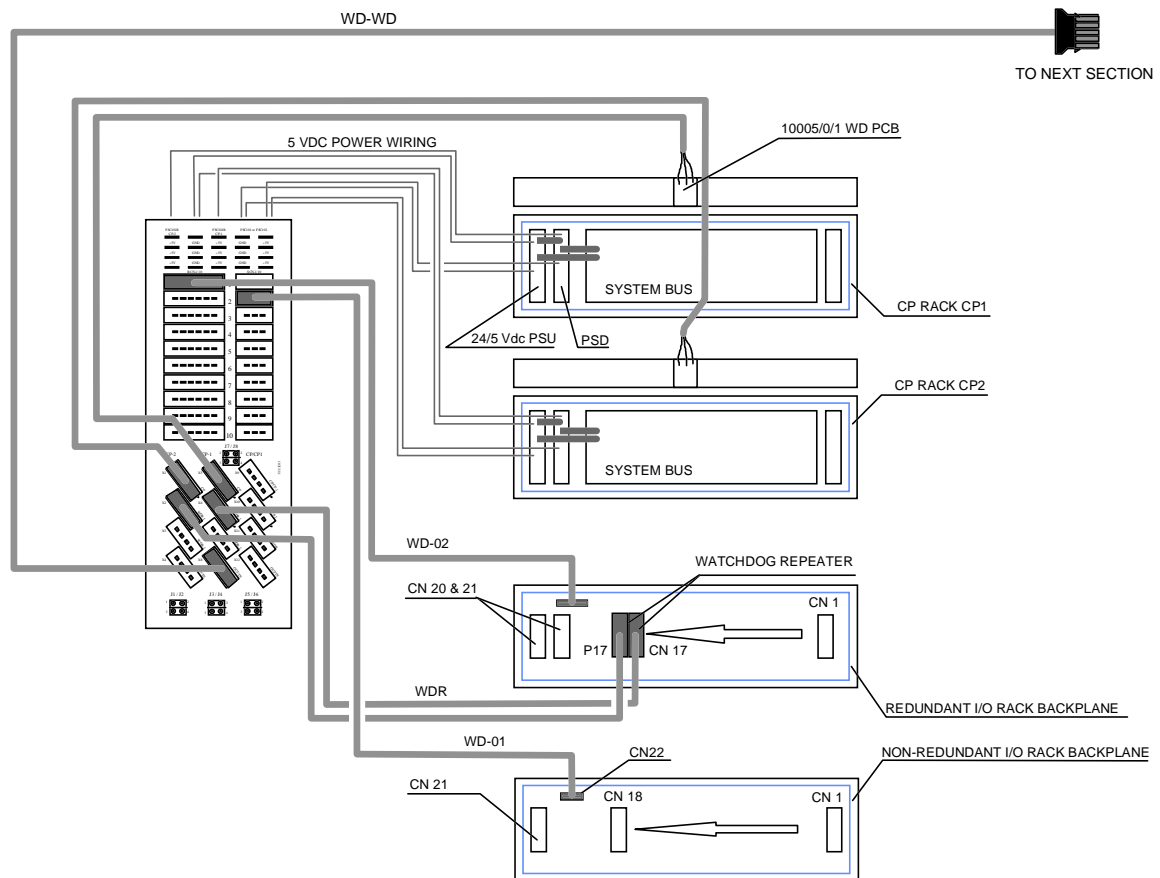


Figure 7 Concept diagram of 5 Vdc & watchdog distribution



## **Distribution examples**

The following pages contain a number of distribution examples for the various FSC configurations. Each example has been subdivided into configurations that consist of one, two or three cabinets ('sections'). Each of the examples assumes that the Central Part racks are located in section 1.

Examples of the following configurations are given:

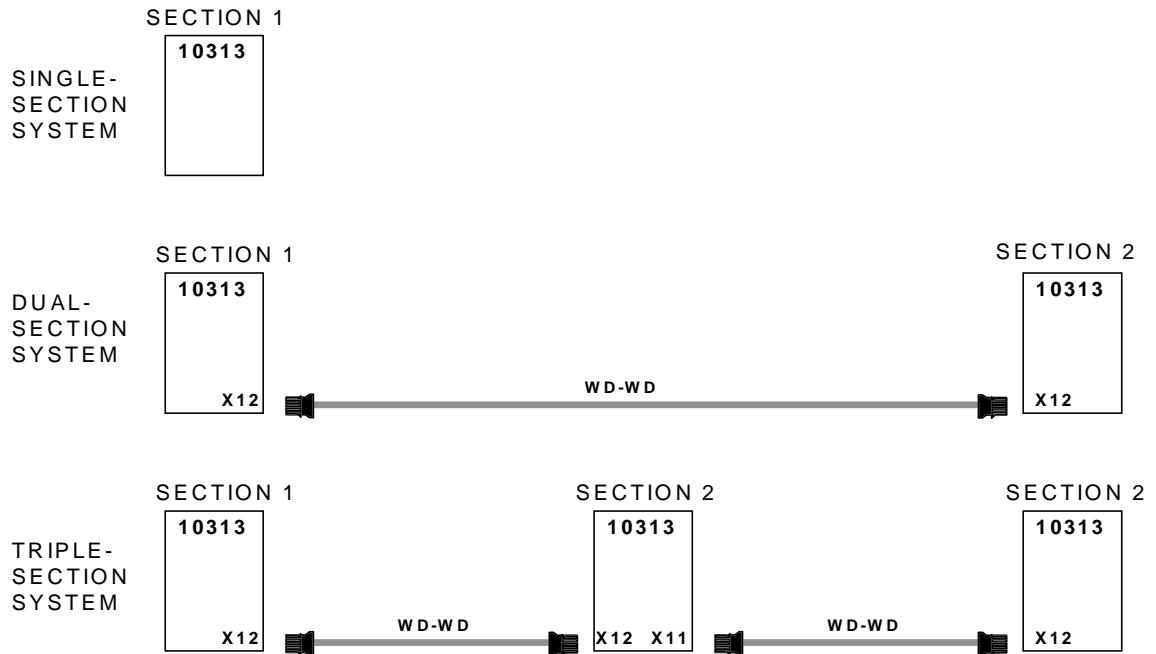
- Non-redundant Central Part and non-redundant I/O,
  - Redundant Central Parts and non-redundant I/O,
  - Redundant Central Parts and redundant I/O,
  - Redundant Central Parts, with redundant I/O in section 1 and non-redundant I/O in sections 2/3, and
  - Redundant Central Parts, with redundant I/O in sections 1/2 and non-redundant I/O in section 3.
-



## Example 1

### Non-redundant Central Part and non-redundant I/O

The Central Part racks are located in section 1. Depending on the number of watchdog repeaters (WDRs) and the number of sections per FSC system, the following jumper settings must be made:



Section 1

Section 1

Section 1

Section 2

Section 2

Section 3

Jumper:

	1x WDR	No WDR	with only +5V
J1/J2	not placed	not placed	not placed
J3/J4	not placed	not placed	not placed
J5/J6	not placed	1 - 3	3 - 4
J7/J8	not placed	not placed	not placed

No WDR
not placed
not placed
1 - 3
not placed

No WDR
not placed
not placed
not placed
not placed

#### Function of jumper settings:

- J5/J6 in section 1, setting 1-3:
- J5/J6 in section 1, setting 3-4:
- J5/J6 in section 2, setting 1-3:

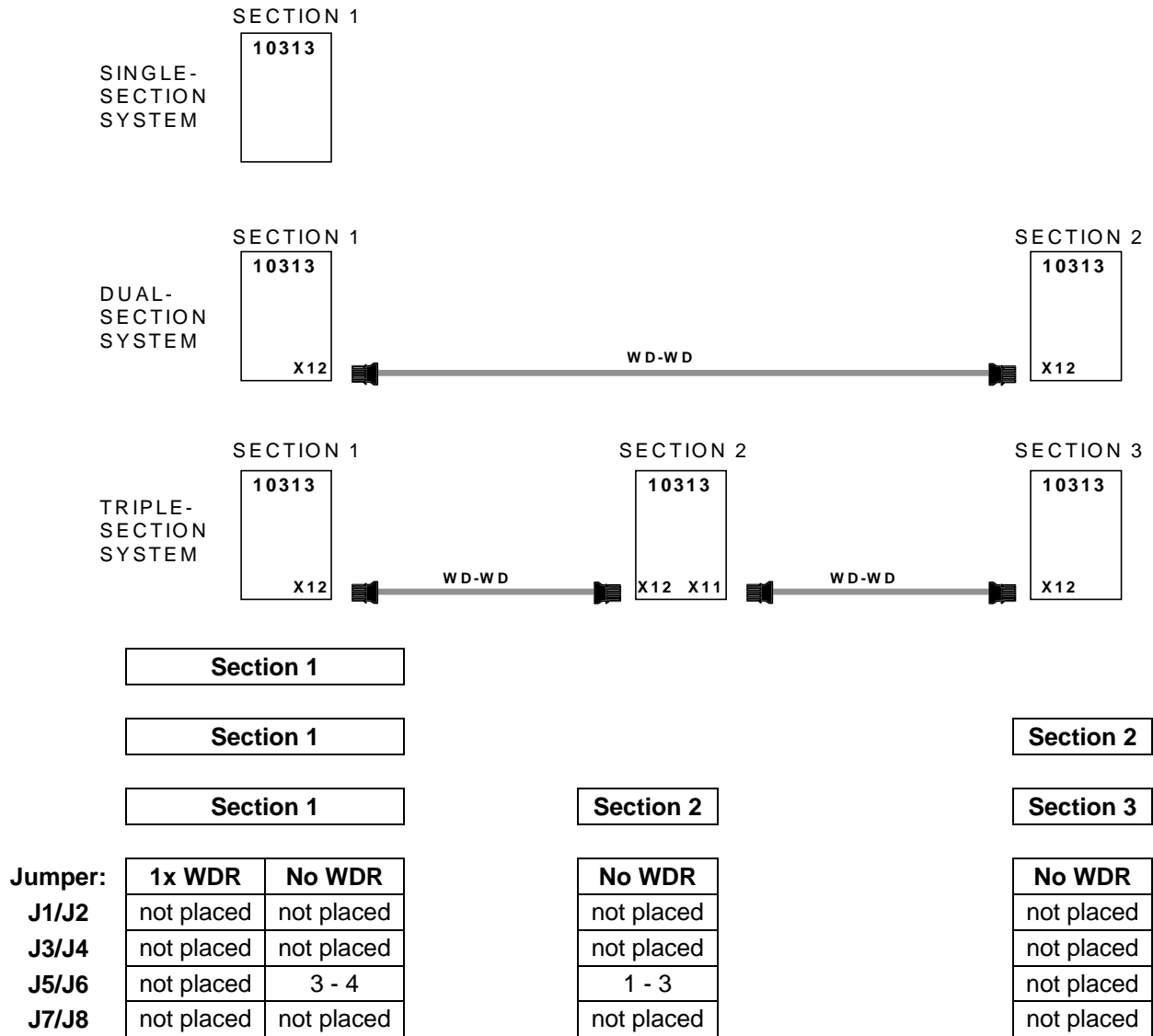
- to connect the WDG line to the I/O racks via the SCN connectors.
- to connect the 5 Vdc to the WDG lines of the I/O racks via the SCN connectors.
- to link the WDG line to section 3.



## Example 2

### Redundant Central Parts and non-redundant I/O

The Central Part racks are located in section 1. Depending on the number of watchdog repeaters (WDRs) and the number of sections per FSC system, the following jumper settings must be made:



#### Function of jumper settings:

J5/J6 in section 1, setting 3-4:  
J5/J6 in section 2, setting 1-3:

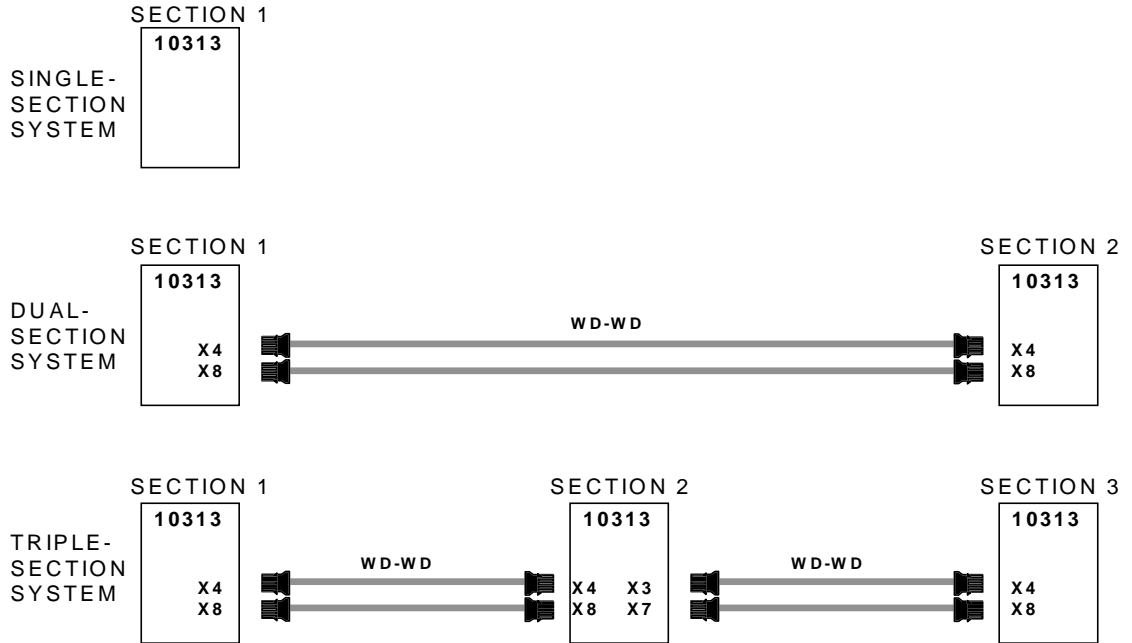
to connect the 5 Vdc to the WDG lines of the I/O racks via the SCN connectors.  
to link the WDG line to section 3.



### Example 3

### Redundant Central Parts and redundant I/O

The Central Part racks are located in section 1. Depending on the number of watchdog repeaters (WDRs) and the number of sections per FSC system, the following jumper settings must be made:



Section 1

Section 1

Section 2

Section 1

Section 2

Section 3

Jumper:	2x WDR	1x WDR	No WDR	No WDR	No WDR
J1/J2	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4	not placed
J3/J4	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4	not placed
J5/J6	not placed	not placed	not placed	not placed	not placed
J7/J8	not placed	not placed	not placed	not placed	not placed

Note: 2 x WDR = 2 x redundant WDR pairs in the redundant I/O part.

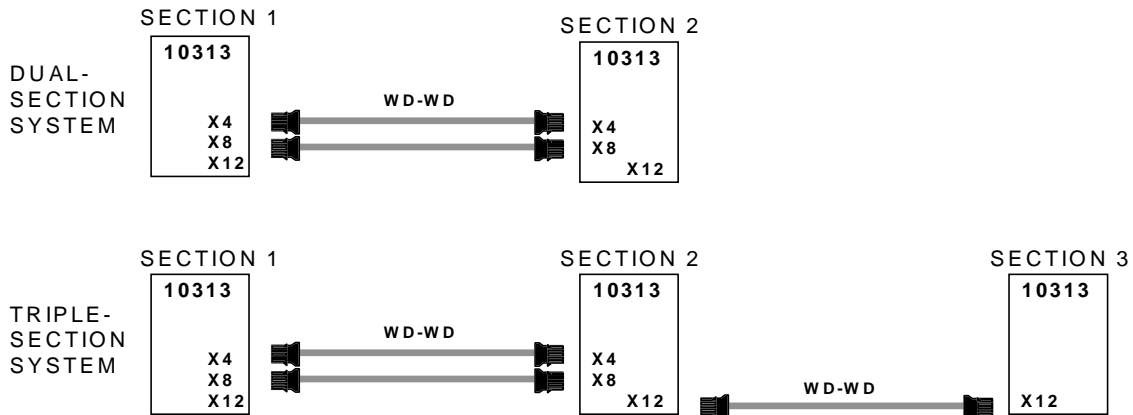
#### Function of jumper settings:

- J1/J2 and J3/J4 in section 1, setting 1-2: to connect the WDs from the central parts to the WDG inputs of the watchdog repeater module.
- J1/J2 and J3/J4 in section 1, setting 3-4: to connect the WDG outputs of the watchdog repeater module (if only one watchdog repeater module is used) to the WDG lines of the I/O racks via the RCN connectors.
- J1/J2 and J3/J4 in section 1, setting 1-3: to connect the WDG lines to the I/O racks via the RCN connectors.
- J1/J2 and J3/J4 in section 2, setting 3-4: to link the WDG lines to section 3.

## Example 4

### Redundant Central Parts and hybrid I/O, with redundant I/O in section 1, redundant/non-redundant I/O in section 2, and non-redundant I/O in section 3.

The Central Part racks are located in section 1. Depending on the number of watchdog repeaters (WDRs) and the number of sections per FSC system, the following jumper settings must be made:



	Section 1			Section 2		
	Section 1			Section 2		Section 3
Jumper:	(2 + 0) x WDR	(1 + 0) x WDR	(0 + 0) x WDR	(0 + 1) x WDR	(0 + 0) x WDR	(0 + 0) x WDR
J1/J2	1 - 2	1 - 2 3 - 4	1 - 3	1 - 3	not placed	not placed
J3/J4	1 - 2	1 - 2 3 - 4	1 - 3	1 - 3	not placed	not placed
J5/J6	not placed	not placed	not placed	not placed	3 - 4	not placed
J7/J8	not placed	not placed	not placed	1 - 2 3 - 4	not placed	not placed

Note: (2 + 0) x WDR = 2 redundant WDR pairs in redundant I/O part and no WDR in non-redundant part.

#### Function of jumper settings:

- J1/J2 and J3/J4 in section 1, setting 1-2: to connect the WDs from the central parts to the WDG inputs of the watchdog repeater module.
- J1/J2 and J3/J4 in section 1, setting 3-4: to connect the WDG outputs of the watchdog repeater module (if only one watchdog repeater module is used) to the WDG lines of the I/O racks via the RCN connectors.
- J1/J2 and J3/J4 in section 1, setting 1-3: to connect the WDG lines to the I/O racks via the RCN connectors.
- J1/J2 and J3/J4 in section 2, setting 1-3: to connect the WDs from the central parts to the WDG input of the watchdog repeater module in the non-redundant I/O part.
- J5/J6 in section 2, setting 3-4: to connect the WDG line to the 5 Vdc.
- J7/J8 in section 2, setting 1-2/3-4: to connect the WDs from the central parts to the WDG input of the watchdog repeater module in the non-redundant I/O part.

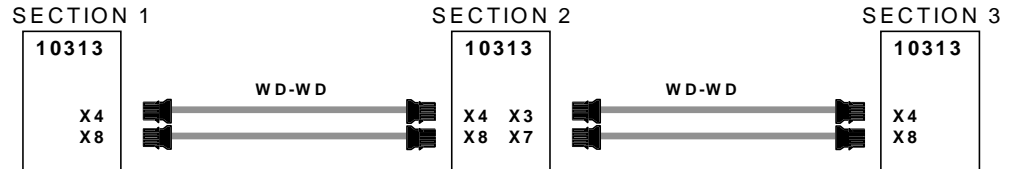




## Example 5

### Redundant Central Parts and hybrid I/O, with redundant I/O in sections 1/2 and redundant/non-redundant I/O in section 3.

The Central Part racks are located in section 1. Depending on the number of watchdog repeaters (WDRs) and the number of sections per FSC system, the following jumper settings must be made:



	Section 1			Section 2	Section 3	
Jumper:	(2 + 0) x WDR	(1 + 0) x WDR	(0 + 0) x WDR	(0 + 0) x WDR	(0 + 1) x WDR	(0 + 0) x WDR
J1/J2	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4	1 - 3	not placed
J3/J4	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4	1 - 3	not placed
J5/J6	not placed	not placed	not placed	not placed	not placed	3 - 4
J7/J8	not placed	not placed	not placed	not placed	1 - 2 3 - 4	not placed

Note: (2 + 0) x WDR = 2 redundant WDR pairs in redundant I/O part and no WDR in non-redundant I/O part.

#### Function of jumper settings:

- J1/J2 and J3/J4 in section 1, setting 1-2: to connect the WDs from the central parts to the WDG inputs of the watchdog repeater module.
- J1/J2 and J3/J4 in section 1, setting 3-4: to connect the WDG outputs of the watchdog repeater module (if only one watchdog repeater module is used) to the WDG lines of the I/O racks via the RCN connectors.
- J1/J2 and J3/J4 in section 1, setting 1-3: to connect the WDG lines to the I/O racks via the RCN connectors.
- J1/J2 and J3/J4 in section 2, setting 3-4: to link WDG lines to section 3.
- J1/J2 and J3/J4 in section 3, setting 1-3: to connect the WDs from the central parts to the WDG input of the watchdog repeater module in the non-redundant I/O part.
- J5/J6 in section 3, setting 3-4: to connect the WDG line to the 5 Vdc.
- J7/J8 in section 3, setting 1-2/3-4: to connect the WDs from the central parts to the WDG input of the watchdog repeater module in the non-redundant I/O part.



## Connectors

The connectors on the 10313/1/1 module are of make AMP.  
The table below lists the items that should be used when handling the connectors:

Item	AMP description	AMP part no.
Receptacle housing:	3 POS. RECEPTACLE HOUSING	1-178288-3
	4 POS. RECEPTACLE HOUSING	1-178288-4
	6 POS. RECEPTACLE HOUSING	1-178288-6
Crimp pin type:	RECEPTACLE CONTACTS (on reel)	0-175195-2
	RECEPTACLE CONTACTS (loose pieces)	0-175217-2
Crimp tool for these pins:	HANDTOOL	0-914595-2
Extraction tool:	EXTRACTION TOOL	0-914677-1

## Wire types

The following wire types can be used:

- 0.25 mm<sup>2</sup> (AWG 24), or
- 0.5 mm<sup>2</sup> (AWG 20).



## Technical data

The 10313/1/1 module has the following specifications:

<b>General</b>	Type number:	10313/1/1 20701*
	Approvals:	CE, TÜV; UL approval pending
<b>Power</b>	Current consumption:	none (included in I/O module data sheets)
	Max. current on faston pin:	4 A
	Max. current on I/O connector pin:	2 A
<b>Physical</b>	Dimensions:	240 x 87 x 60 mm (L x W x H) 9.45 x 3.43 x 2.36 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	241 mm (9.49 in)

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**\* Note:**

10313/1/1 modules with suffix code 20700 have a different connector layout.

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# **Fail Safe Control Hardware Manual**

## **Section 8: System Interconnection Cables**

**TotalPlant**



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## System interconnection cables (SICs)

### Description

FSC I/O backplanes in FSC system cabinets need cabinet wiring to interface boards or terminals (e.g. FTAs). These interface boards or terminals may be located in the FSC cabinet or in cross-wiring cabinets next to the FSC cabinet.

There are three I/O signal wiring methods that can be used:

- **SIC-C:** I/O signal wiring using system interconnection cables (SIC) to field termination assembly (FTA) boards.

*For details on SIC-C cables refer to the 'System interconnection cables terminating on FTAs' data sheet.*

- **SIC-P:** I/O signal wiring using system interconnection cables (SIC) to screw terminals.

*For details on SIC-P cables refer to the 'System interconnection cables terminating on crimp pins' data sheet.*

- **Single wires:** I/O signal wiring using individual wires for each channel.

*For details on this method refer to the 'Single-wire connection method' data sheet.*

### Cable lengths

Table 1 below lists the standard lengths of the SIC cables. Other cable lengths are available on request.

Table 1 Standard lengths of SIC cables

meters	feet		meters	feet
2.5	8.2		12	39.4
3.25	10.7		15	49.2
4	13.1		20	65.6
5	16.4		25	82.0
6	19.7		30	98.4
8	26.2		40	131.2
10	32.8			

## SIC-C

The wiring method that uses SIC cables terminating on FTAs (SIC-C) is shown in Figure 1. The SIC cables used in this method are fitted with connectors on both ends and are called SIC-C cables.

For details on SIC-C cables refer to the 'System interconnection cables terminating on FTAs' data sheet.

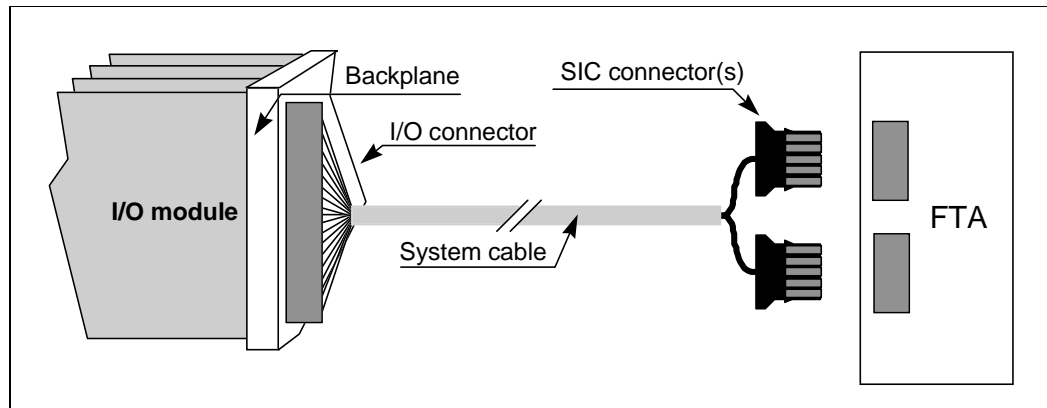


Figure 1 Principle of SIC-C connection method

## SIC-P

The wiring method that uses SIC cables terminating on crimp pins is shown in Figure 2. The SIC cables used in this method are fitted with connector(s) on the I/O backplane side and with crimp pins on the other side. These cables are called SIC-P cables.

For details on SIC-P cables refer to the 'System interconnection cables terminating on crimp pins' data sheet.

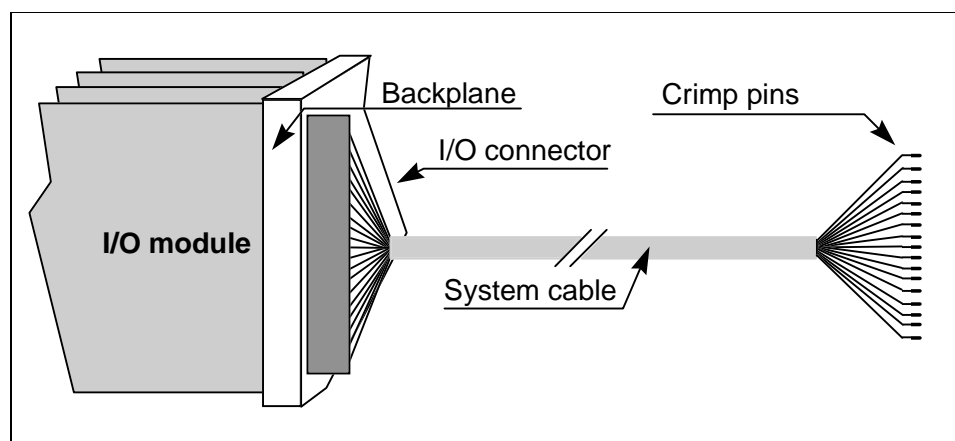


Figure 2 Principle of SIC-P connection method



## Single wires

The single-wire connection method is shown in Figure 3. This method involves separate production and assembly of each wire that is connected to the I/O connectors (CNx).

For details on the single-wire method refer to the 'Single-wire connection method' data sheet.

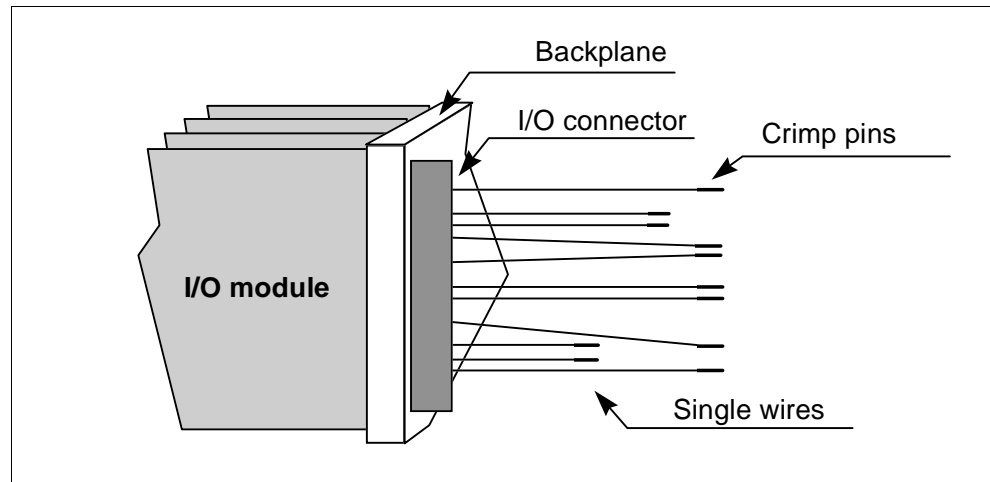


Figure 3 Principle of single-wire connection method

## Applications

For application details for SIC-C cables refer to the 'SIC to FTA applications' data sheet.

For application details for SIC-P cables refer to the 'SIC to pin applications' data sheet.

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## System interconnection cables terminating on FTAs

### Description

System interconnection cables (SICs) with termination to field termination assemblies (FTAs) are used to connect FSC I/O modules via an I/O backplane to FTAs (see Figures 2 to 6). These cables are called SIC-C cables and have one or more connectors at both ends.

This data sheet provides detailed information on the connections of the SIC-C cables.

### Note:

For details on FSC input modules refer to section 5 ("FSC Input Modules") of the FSC Hardware Manual.

For details on FSC output modules refer to section 6 ("FSC Output Modules") of the FSC Hardware Manual.

### Connection principle

The wiring method that uses SIC cables terminating on FTAs (SIC-C) is shown in Figure 1.

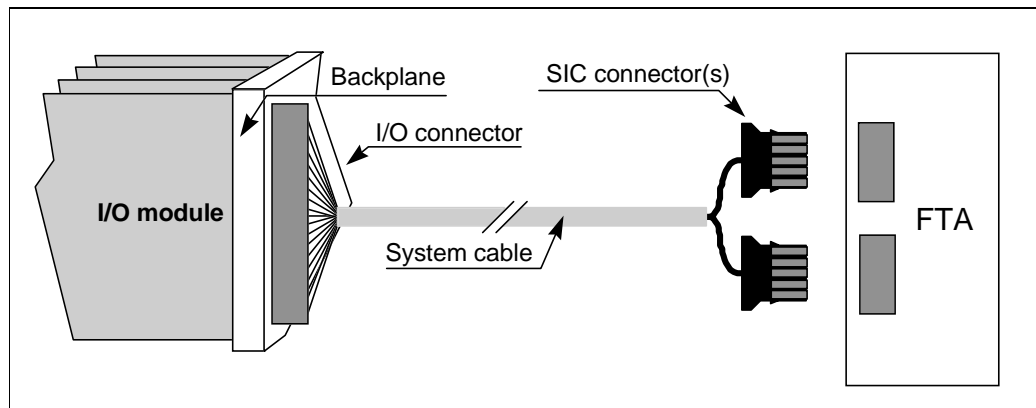


Figure 1 Principle of SIC-C connection method

### Applications

For application details for SIC-C cables refer to the 'SIC to FTA applications' data sheet.

## SIC-C cable types

SIC-C cables (i.e. SIC cables terminating in one or more connectors) are available in five layout types:

- 1) SIC-C cable with one I/O connector and one 10-pin FTA connector:

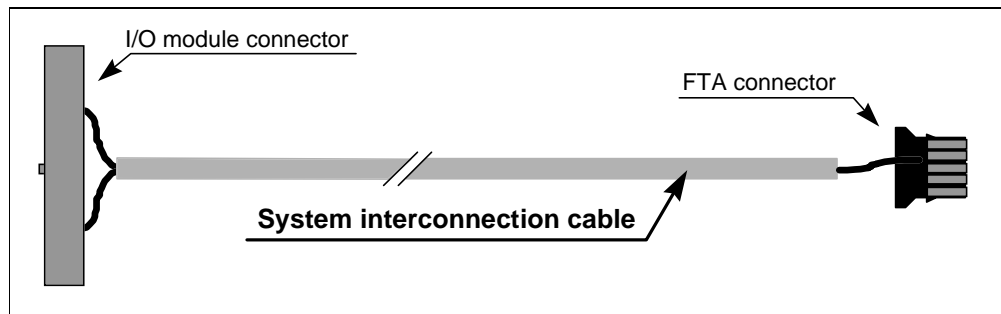


Figure 2 SIC-C cable, layout type 1

- 2) SIC-C cable with one I/O connector, one 10-pin FTA connector and two ferrites:

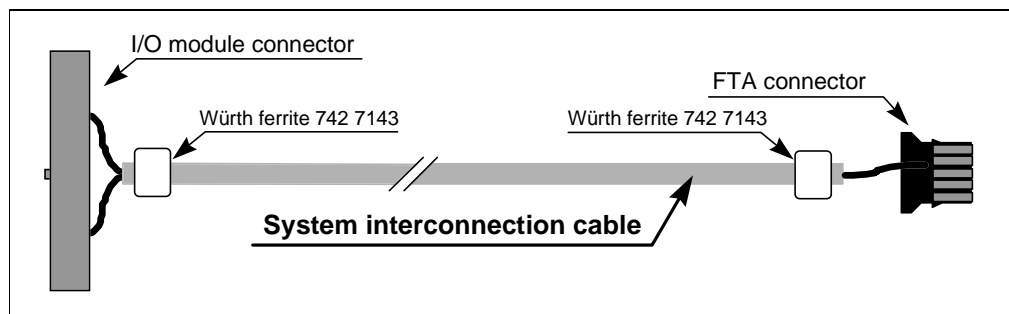


Figure 3 SIC-C cable, layout type 2

- 3) SIC-C cable with one I/O connector and one 20-pin FTA connector:

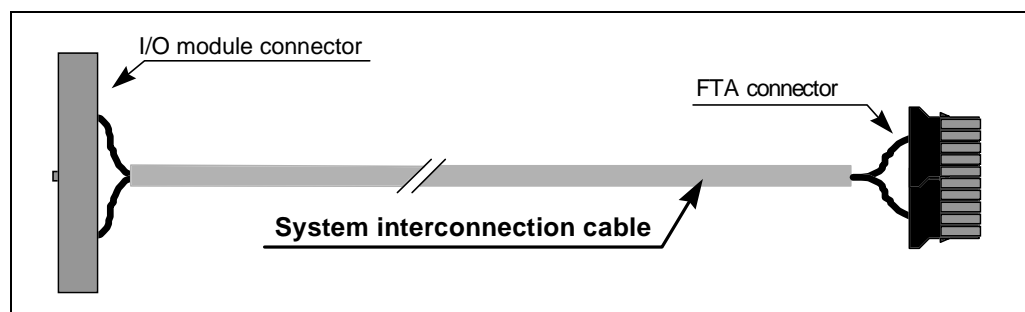


Figure 4 SIC-C cable, layout type 3





- 4) SIC-C cable with one I/O connector and two 10-pin FTA connectors (marked 'a' and 'b'):

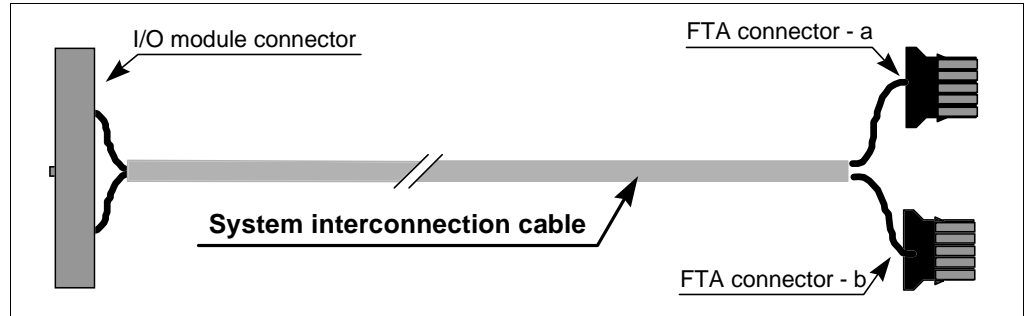


Figure 5 SIC-C cable, layout type 4

- 5) SIC-C cable with two I/O connectors (marked 'a' and 'b') and one 10-pin FTA connector:

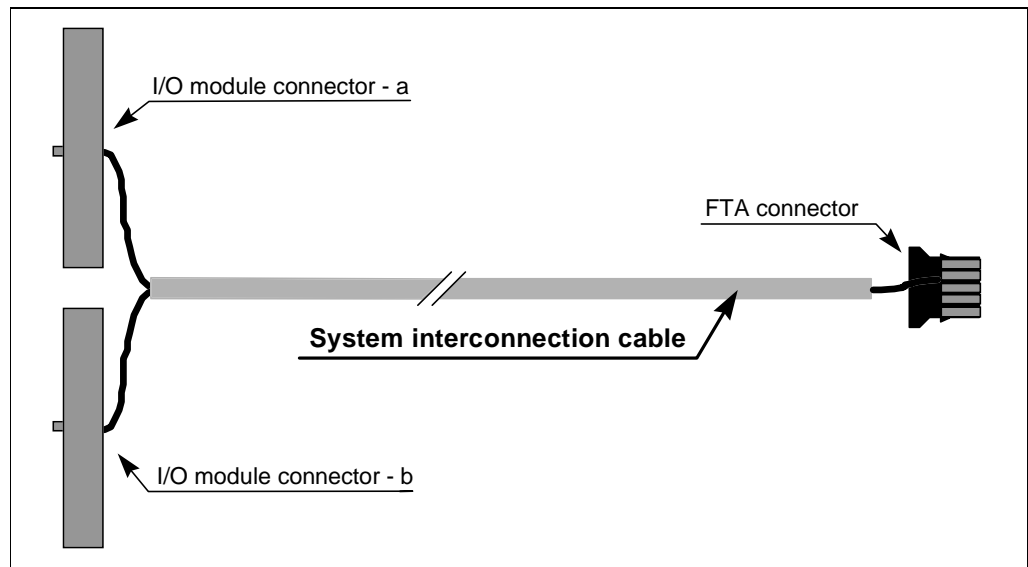


Figure 6 SIC-C cable, layout type 5



## SIC-C cable characteristics

Table 1 below shows the available SIC-C cables with their main characteristics:

Table 1 Standard SIC-C cables

Cable type	Cores	Shielding	Outer diameter (mm)	Cable layout (see fig. 2 to 6)
SIC-C-01/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	4
SIC-C-02/Lx	16 x 0.5 mm <sup>2</sup>	unshielded	8.00 (± 0.20)	4
SIC-C-03/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	5
SIC-C-04/Lx	20 x 0.5 mm <sup>2</sup>	unshielded	9.80 (± 0.20)	4
SIC-C-05/Lx	8 x 0.5 mm <sup>2</sup>	shielded	4.90 (± 0.15)	1
SIC-C-06/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-C-07/Lx	18 x 0.5 mm <sup>2</sup>	unshielded	9.40 (± 0.20)	4
SIC-C-08/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	4
<i>SIC-C-09/Lx</i>	<i>18 x 0.25 mm<sup>2</sup></i>	<i>unshielded</i>	<i>7.90 (± 0.20)</i>	<b>OBSOLETE</b>
SIC-C-10/Lx	10 x 0.25 mm <sup>2</sup>	unshielded	6.50 (± 0.20)	1
SIC-C-11/Lx	8 x 0.5 mm <sup>2</sup>	unshielded	6.80 (± 0.20)	1
SIC-C-12/Lx	20 x 0.25 mm <sup>2</sup>	screened and shielded	9.90 (± 0.20)	3

Usable wire types:  
 0.25 mm<sup>2</sup> = AWG 24  
 0.5 mm<sup>2</sup> = AWG 20

Explanation of cable type codes:  
 SIC-C-./Lx = Standard SIC-C cable with a standard length of x meters.  
 x = 2.5 m, 3.25 m, 4 m, 6 m, 8 m, 10 m, 12 m, 15 m, 20 m, 25 m, 30 m or 40 m.



## SIC-C cable connections

The tables below list the available SIC-C cables with their connections:

Table 2 Standard SIC-C-01 cable

SIC-C-01/Lx			
Cable type :		18 x 0.25 mm <sup>2</sup> (AWG 24), unshielded	
Outer diameter :		7.90 (± 0.20) mm, 0.311 (± 0.008) in	
Cable layout :		Figure 5 SIC-C cable, layout type 4	
10101/2/ 10104/2/1 signal	10209/2/1 signal	I/O module connector pin	FTA connectors a and b pin
CH1	CH1	36	a-A5
CH2	CH2	33	a-B5
CH3	CH3	32	a-A4
CH4	CH4	29	a-B4
CH5	CH5	28	a-A3
CH6	CH6	25	a-B3
CH7	CH7	24	a-A2
CH8	CH8	21	a-A1
CH9	CH9	20	b-A5
CH10	CH10	17	b-B5
CH11	CH11	16	b-A4
CH12	CH12	13	b-B4
CH13	CH13	12	b-A3
CH14	CH14	9	b-B3
CH15	CH15	8	b-A2
CH16	CH16	5	b-A1
+ Vext	- Vext	4	a-B1
+ Vext	- Vext	1	b-B1



Table 3 Standard SIC-C-02 cable

SIC-C-02/Lx		Cable type :	16 x 0.5 mm <sup>2</sup> (AWG 20), unshielded	
		Outer diameter:	8.90 (± 0.20) mm 0.350 (± 0.008) in	
		Cable layout :	Figure 5 SIC-C cable, layout type 4	
10201/2/1	10215/2/1	I/O module connector	FTA connectors a and b	
signal	signal	pin	pin	
CH1+	CH1+	36	a-A5	
CH1-	CH1-	33	a-B5	
CH2+	CH1+	32	a-A4	
CH2-	CH1-	29	a-B4	
CH3+	CH2+	28	a-A3	
CH3-	CH2-	25	a-B3	
CH4+	CH2+	24	a-A2	
CH4-	CH2-	21	a-B2	
CH5+	CH3+	20	b-A5	
CH5-	CH3-	17	b-B5	
CH6+	CH3+	16	b-A4	
CH6-	CH3-	13	b-B4	
CH7+	CH4+	12	b-A3	
CH7-	CH4-	9	b-B3	
CH8+	CH4+	8	b-A2	
CH8-	CH4-	5	b-B2	

Table 4 Standard SIC-C-03 cable

SIC-C-03/Lx		Cable type :	4 x 2 x 0.25 mm <sup>2</sup> (AWG 24), shielded, twisted pairs (STP)	
		Outer diameter:	6.60 (± 0.20) mm 0.260 (± 0.008) in	
		Cable layout :	Figure 6 SIC-C cable, layout type 5	
	10205/2/1 modules 1 and 2 signal	I/O module connectors a and b	FTA connector	
	signal	pin	pin	
	shield	41 a	B1	
	1 CH1+	36 a	A5	
	1 CH1-	33 a	B5	
	1 CH2+	24 a	A4	
	1 CH2-	21 a	B4	
	2 CH1+	36 b	A3	
	2 CH1-	33 b	B3	
	2 CH2+	24 b	A2	
	2 CH2-	21 b	B2	



Table 5 Standard SIC-C-04 cable

<b>SIC-C-04/Lx</b> <b>Cable type</b> : <b>20 x 0.5 mm<sup>2</sup> (AWG 20), unshielded</b> <b>Outer diameter:</b> <b>9.80 (± 0.20) mm, 0.386 (± 0.008) in</b> <b>Cable layout</b> : <b>Figure 5 SIC-C cable, layout type 4</b>			
	10208/2/1	I/O module connector	FTA connectors a and b
	signal	pin	pin
	CH1 c	40	a-A5
	CH1 no	37	a-B5
	CH2 c	36	a-A4
	CH2 no	33	a-B4
	CH3 c	32	a-A3
	CH3 no	29	a-B3
	CH4 c	28	a-A2
	CH4 no	25	a-B2
	CH5 c	24	a-A1
	CH5 no	21	a-B1
	CH6 c	20	b-A5
	CH6 no	17	b-B5
	CH7 c	16	b-A4
	CH7 no	13	b-B4
	CH8 c	12	b-A3
	CH8 no	9	b-B3
	CH9 c	8	b-A2
	CH9 no	5	b-B2
	CH10 c	4	b-A1
	CH10 no	1	b-B1

c = common      no = normally open

Table 6 Standard SIC-C-05 cable

<b>SIC-C-05/Lx</b> <b>Cable type</b> : <b>8 x 0.5 mm<sup>2</sup> (AWG 20), shielded</b> <b>Outer diameter:</b> <b>4.90 (± 0.20) mm, 0.193 (± 0.008) in</b> <b>Cable layout</b> : <b>Figure 2 SIC-C cable, layout type 1</b>			
10213/2/2	10216/2/1	I/O module connector	FTA connector
10213/2/3	10216/2/3	pin	pin
signal	signal		
shield	shield	41	B1
CH1+	CH1+	32	A5
CH1-	CH1-	29	B5
CH2+	CH2+	24	A4
CH2-	CH2-	21	B4
CH3+	CH3+	16	A3
CH3-	CH3-	13	B3
CH4+	CH4+	8	A2
CH4-	CH4-	5	B2



Table 7 Standard SIC-C-06 cable

<b>SIC-C-06/Lx</b>	<b>Cable type</b> :	<b>4 x 2 x 0.25 mm<sup>2</sup> (AWG 24), shielded, twisted pairs (STP)</b>		
	<b>Outer diameter</b> :	<b>6.60 (± 0.20) mm, 0.260 (± 0.008) in</b>		
	<b>Cable layout</b> :	<b>Figure 3 SIC-C cable, layout type 2</b>		
	10102/2/1 signal	I/O module connector pin	FTA connector pin	
	shield	41	B1	
	CH1-	40	B5	
	CH1+	37	A5	
	CH2+	24	A4	
	CH2-	21	B4	
	CH3-	20	B3	
	CH3+	17	A3	
	CH4+	4	A2	
	CH4-	1	B2	

Table 8 Standard SIC-C-07 cable

<b>SIC-C-07/Lx</b>	<b>Cable type</b> :	<b>18 x 0.5 mm<sup>2</sup> (AWG 20), unshielded</b>			
	<b>Outer diameter</b> :	<b>9.80 (± 0.20) mm, 0.386 (± 0.008) in</b>			
	<b>Cable layout</b> :	<b>Figure 5 SIC-C cable, layout type 4</b>			
10101/2/. signal	10209/2/1 signal	10206/2/1 signal	I/O module connector pin	FTA connectors a and b pin	
CH1	CH1	CH1	36	a-A5	
CH2	CH2	CH2	33	a-B5	
CH3	CH3	CH3	32	a-A4	
CH4	CH4	CH4	29	a-B4	
CH5	CH5	CH5	28	a-A3	
CH6	CH6	CH6	25	a-B3	
CH7	CH7	CH7	24	a-A2	
CH8	CH8	CH8	21	a-A1	
CH9	CH9	CH9	20	b-A5	
CH10	CH10	CH10	17	b-B5	
CH11	CH11	CH11	16	b-A4	
CH12	CH12	CH12	13	b-B4	
CH13	CH13	- Vext	12	b-A3	
CH14	CH14	- Vext	9	b-B3	
CH15	CH15	- Vext	8	b-A2	
CH16	CH16	- Vext	5	b-A1	
+ Vext	- Vext	- Vext	4	a-B1	
+ Vext	- Vext	- Vext	1	b-B1	



Table 9 Standard SIC-C-08 cable

SIC-C-08/Lx		Cable type : 18 x 0.25 mm <sup>2</sup> (AWG 24), unshielded	
		Outer diameter : 7.90 (± 0.20) mm, 0.311 (± 0.008) in	
		Cable layout : Figure 5 SIC-C cable, layout type 4	
10101/2/. signal	10104/2/1 signal	I/O module connector pin	FTA connectors a and b pin
- Vext	- Vext	40	a-B2
- Vext	- Vext	37	b-B2
CH1	CH1	36	a-A5
CH2	CH2	33	a-B5
CH3	CH3	32	a-A4
CH4	CH4	29	a-B4
CH5	CH5	28	a-A3
CH6	CH6	25	a-B3
CH7	CH7	24	a-A2
CH8	CH8	21	a-A1
CH9	CH9	20	b-A5
CH10	CH10	17	b-B5
CH11	CH11	16	b-A4
CH12	CH12	13	b-B4
CH13	CH13	12	b-A3
CH14	CH14	9	b-B3
CH15	CH15	8	b-A2
CH16	CH16	5	b-A1



Table 10 Standard SIC-C-09 cable (OBSOLETE)

SIC-C-09/Lx			
Cable type :		18 x 0.25 mm <sup>2</sup> (AWG 24), unshielded	
Outer diameter :		7.90 (± 0.20) mm, 0.311 (± 0.008) in	
Cable layout :		Figure 5 SIC-C cable, layout type 4	
10101/2/ signal	10104/2/1 signal	I/O module connector pin	FTA connectors a and b pin
- Vext	- Vext	40	a-B1
- Vext	- Vext	37	b-B1
CH1	CH1	36	a-A5
CH2	CH2	33	a-B5
CH3	CH3	32	a-A4
CH4	CH4	29	a-B4
CH5	CH5	28	a-A3
CH6	CH6	25	a-B3
CH7	CH7	24	a-A2
CH8	CH8	21	a-A1
CH9	CH9	20	b-A5
CH10	CH10	17	b-B5
CH11	CH11	16	b-A4
CH12	CH12	13	b-B4
CH13	CH13	12	b-A3
CH14	CH14	9	b-B3
CH15	CH15	8	b-A2
CH16	CH16	5	b-A1

Table 11 Standard SIC-C-10 cable

SIC-C-10/Lx			
Cable type :		10 x 0.25 mm <sup>2</sup> (AWG 24), unshielded	
Outer diameter :		6.50 (± 0.20) mm, 0.256 (± 0.008) in	
Cable layout :		Figure 2 SIC-C cable, layout type 1	
	10201/2/1 signal	I/O module connector pin	FTA connector pin
	CH1+	36	A5
	CH2+	32	B5
	CH3+	28	A4
	CH4+	24	B4
	CH5+	20	A3
	CH6+	16	B3
	CH7+	12	A2
	CH8+	8	A1
	- Vext	4	B2
	- Vext	1	B1





Table 12 Standard SIC-C-11 cable

SIC-C-11/Lx	Cable type : Outer diameter : Cable layout :	8 x 0.5 mm <sup>2</sup> (AWG 20), unshielded 6.80 (± 0.20) mm, 0.268 (± 0.008) in Figure 2 SIC-C cable, layout type 1		
	10213/2/1 signal	I/O module connector pin	FTA connector pin	
	CH1+	32	B5	
	CH1-	29	A5	
	CH2+	24	A4	
	CH2-	21	B4	
	CH3+	16	B3	
	CH3-	13	A3	
	CH4+	8	A2	
	CH4-	5	B2	

Table 13 Standard SIC-C-12 cable

SIC-C-12/Lx		Cable type : Outer diameter : Cable layout :	20 x 0.25 mm <sup>2</sup> (AWG 24), screened and shielded 9.90 (± 0.20) mm, 0.390 (± 0.008) in Figure 4 SIC-C cable, layout type 3		
10101/2/. signal	10104/2/1 signal	10105/2/1 signal	I/O module connector pin	FTA connector pin	
		Shield	41	-	
- Vext	- Vext	0 Vdc	40	A10	
- Vext	- Vext	0 Vdc	37	B10	
CH1	CH1	CH1	36	A9	
CH2	CH2	CH2	33	B9	
CH3	CH3	CH3	32	A8	
CH4	CH4	CH4	29	B8	
CH5	CH5	CH5	28	A7	
CH6	CH6	CH6	25	B7	
CH7	CH7	CH7	24	A6	
CH8	CH8	CH8	21	B6	
CH9	CH9	CH9	20	A5	
CH10	CH10	CH10	17	B5	
CH11	CH11	CH11	16	A4	
CH12	CH12	CH12	13	B4	
CH13	CH13	CH13	12	A3	
CH14	CH14	CH14	9	B3	
CH15	CH15	CH15	8	A2	
CH16	CH16	CH16	5	B2	
+ Vext	+ Vext	0 Vdc	4	A1	
+ Vext	+ Vext	+ Vext/8	1	B1	



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## System interconnection cables terminating on crimp pins

### Description

System interconnection cables (SICs) with termination to crimp pins are suitable for connection to screw terminals (see Figure 1). The SIC cables used in this method are fitted with one or more connectors on the I/O backplane side and crimp pins on the other side. These cables are called SIC-P cables.

This data sheet provides detailed information on the connections of the SIC-P cables.

### Note:

For details on FSC input modules refer to section 5 ("FSC Input Modules") of the FSC Hardware Manual.

For details on FSC output modules refer to section 6 ("FSC Output Modules") of the FSC Hardware Manual.

### Connection principle

The wiring method that uses SIC cables terminating on crimp pins (SIC-P) is shown in Figure 1.

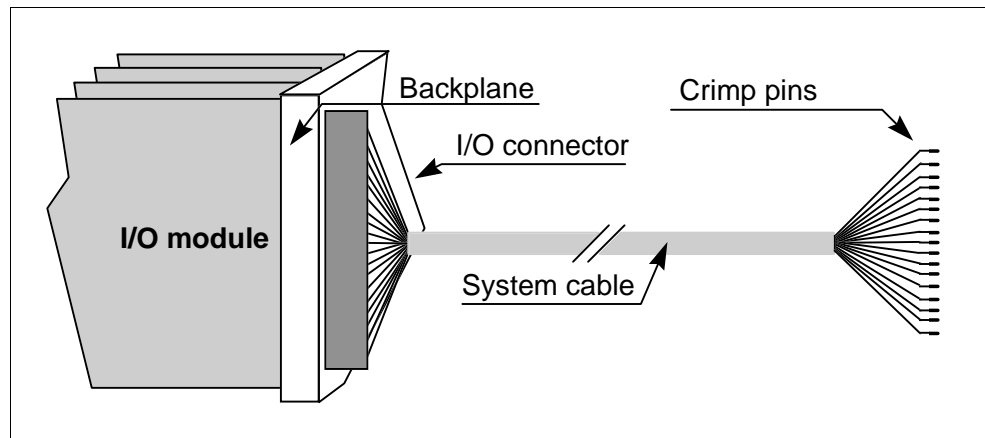


Figure 1 Principle of SIC-P connection method

### Applications

For application details for SIC-P cables refer to the 'SIC to pin applications' data sheet.

## SIC-P cable types

SIC-P cables (i.e. SIC cables terminating on individual crimp pins) are available in three layout types:

- 1) SIC-P cable with one I/O connector:

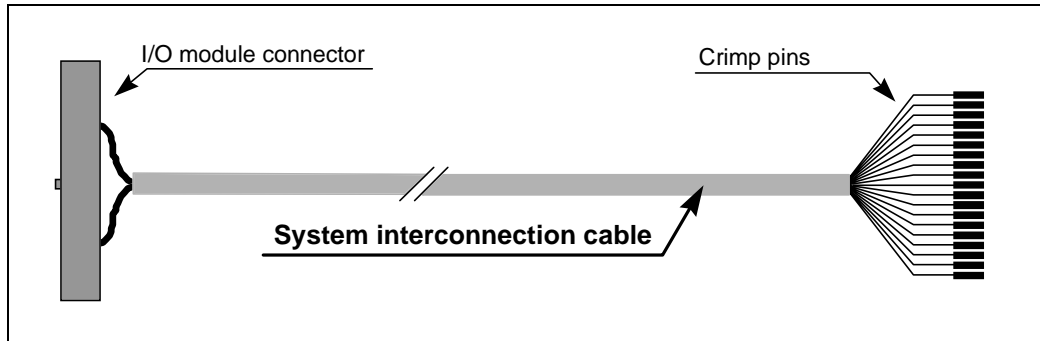


Figure 2 SIC-P cable, layout type 1

- 2) SIC-P cable with one I/O connector and two ferrites:

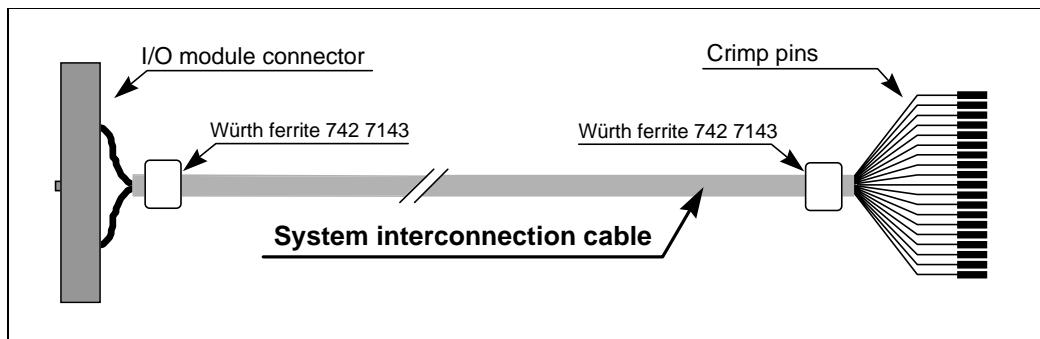


Figure 3 SIC-P cable, layout type 2



3) SIC-P cable with two I/O connectors (marked 'a' and 'b'):

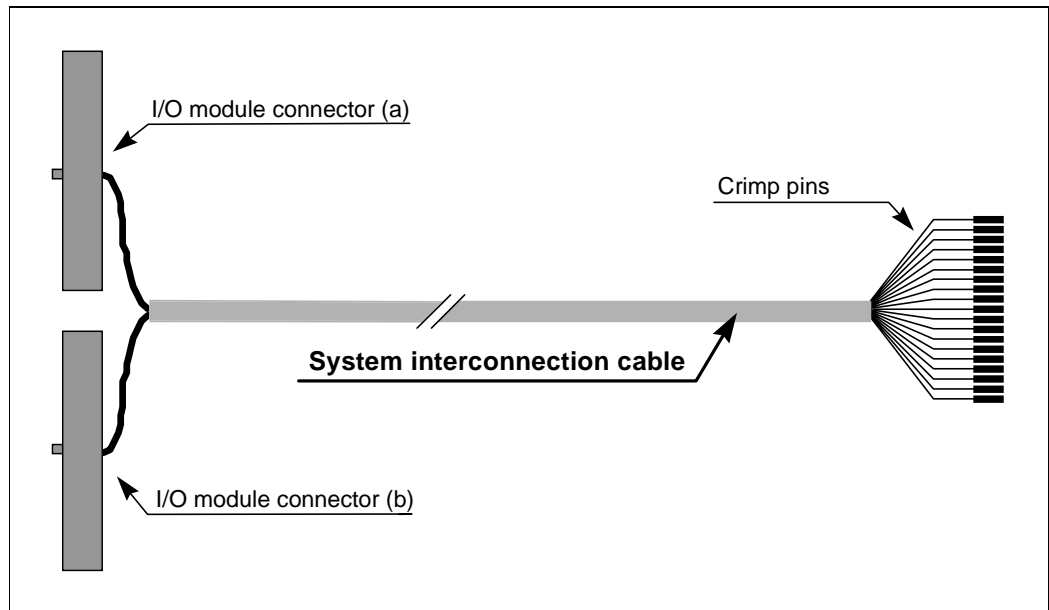


Figure 4 SIC-P cable, layout type 3



## SIC-P cable characteristics

Table 1 below shows the available SIC-P cables with their main characteristics:

Table 1 Standard SIC-P cables

Cable type	Cores	Shielding	Outer diameter (mm)	Cable layout (see fig. 2 to 4)
SIC-P-01/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	1
SIC-P-02/Lx	16 x 0.5 mm <sup>2</sup>	unshielded	8.00 (± 0.20)	1
SIC-P-03/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	3
SIC-P-04/Lx	20 x 0.5 mm <sup>2</sup>	unshielded	9.80 (± 0.20)	1
SIC-P-05/Lx	8 x 0.5 mm <sup>2</sup>	shielded	4.90 (± 0.15)	1
SIC-P-06/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-P-07/Lx	18 x 0.5 mm <sup>2</sup>	unshielded	9.40 (± 0.20)	1
SIC-P-08/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	1
<i>SIC-P-09/Lx</i>	<i>18 x 0.25 mm<sup>2</sup></i>	<i>unshielded</i>	<i>7.90 (± 0.20)</i>	<b><i>OBSOLETE</i></b>

Usable wire types:  
 0.25 mm<sup>2</sup> = AWG 24  
 0.5 mm<sup>2</sup> = AWG 20

Explanation of cable type codes:  
 SIC-P-../Lx = Standard SIC-C cable with a standard length of x meters.  
 x = 2.5 m, 3.25 m, 4 m, 6 m, 8 m, 10 m, 12 m, 15 m, 20 m, 25 m, 30 m or 40 m.



## SIC-P cable connections

The tables below list the available SIC-P cables with their connections:

Table 2 Standard SIC-P-01 cable

SIC-P-01/Lx			
Cable type :		18 x 0.25 mm <sup>2</sup> (AWG 24), unshielded	
Outer diameter :		7.90 (± 0.20) mm, 0.311 (± 0.008) in	
Cable layout :		Figure 2 SIC-P cable, layout type 1	
10101/2/ 10104/2/1 signal	10209/2/1 signal	I/O module connector pin	Color code crimp pin
CH1	CH1	36	White
CH2	CH2	33	Brown
CH3	CH3	32	Green
CH4	CH4	29	Yellow
CH5	CH5	28	Gray
CH6	CH6	25	Pink
CH7	CH7	24	Blue
CH8	CH8	21	Red
CH9	CH9	20	Black
CH10	CH10	17	Violet
CH11	CH11	16	Gray / Pink
CH12	CH12	13	Red / Blue
CH13	CH13	12	White / Green
CH14	CH14	9	Brown / Green
CH15	CH15	8	White / Yellow
CH16	CH16	5	Yellow / Brown
+ Vext	- Vext	4	White / Gray
+ Vext	- Vext	1	Gray / Brown



Table 3 Standard SIC-P-02 cable

<b>SIC-P-02/Lx</b> <b>Cable type</b> : <b>16 x 0.5 mm<sup>2</sup> (AWG 20), unshielded</b> <b>Outer diameter:</b> <b>8.90 (± 0.20) mm 0.350 (± 0.008) in</b> <b>Cable layout</b> : <b>Figure 2 SIC-P cable, layout type 1</b>			
10201/2/1	10215/2/1	I/O module connector	Color code crimp pin
signal	signal	pin	
CH1+	CH1+	36	White
CH1-	CH1-	33	Brown
CH2+	CH1+	32	Green
CH2-	CH1-	29	Yellow
CH3+	CH2+	28	Gray
CH3-	CH2-	25	Pink
CH4+	CH2+	24	Blue
CH4-	CH2-	21	Red
CH5+	CH3+	20	Black
CH5-	CH3-	17	Violet
CH6+	CH3+	16	Gray / Pink
CH6-	CH3-	13	Red / Blue
CH7+	CH4+	12	White / Green
CH7-	CH4-	9	Brown / Green
CH8+	CH4+	8	White / Yellow
CH8-	CH4-	5	Yellow / Brown

Table 4 Standard SIC-P-03 cable

<b>SIC-P-03/Lx</b> <b>Cable type</b> : <b>4 x 2 x 0.25 mm<sup>2</sup> (AWG 24), shielded twisted pairs (STP)</b> <b>Outer diameter:</b> <b>6.60 (± 0.20) mm 0.260 (± 0.008) in</b> <b>Cable layout</b> : <b>Figure 4 SIC-P cable, layout type 3</b>			
	10205/2/1 modules 1 and 2 signal	I/O module connectors a and b pin	Color code crimp pin
	shield	41 a	Yellow / Green
	1 CH1+	36 a	White
	1 CH1-	33 a	Brown
	1 CH2+	24 a	Green
	1 CH2-	21 a	Yellow
	2 CH1+	36 b	Gray
	2 CH1-	33 b	Pink
	2 CH2+	24 b	Blue
	2 CH2-	21 b	Red





Table 5 Standard SIC-P-04 cable

<b>SIC-P-04/Lx</b> <b>Cable type</b> : <b>20 x 0.5 mm<sup>2</sup> (AWG 20), unshielded</b> <b>Outer diameter:</b> <b>9.80 (± 0.20) mm, 0.386 (± 0.008) in</b> <b>Cable layout</b> : <b>Figure 2 SIC-P cable, layout type 1</b>			
	10208/2/1	I/O module connector	Color code
	signal	pin	crimp pin
	CH1 c	40	White
	CH1 no	37	Brown
	CH2 c	36	Green
	CH2 no	33	Yellow
	CH3 c	32	Gray
	CH3 no	29	Pink
	CH4 c	28	Blue
	CH4 no	25	Red
	CH5 c	24	Black
	CH5 no	21	Violet
	CH6 c	20	Gray / Pink
	CH6 no	17	Red / Blue
	CH7 c	16	White / Green
	CH7 no	13	Brown / Green
	CH8 c	12	White / Yellow
	CH8 no	9	Yellow / Brown
	CH9 c	8	White / Gray
	CH9 no	5	Gray / Brown
	CH10 c	4	White / Pink
	CH10 no	1	Pink / Brown

c = common      no = normally open

Table 6 Standard SIC-P-05 cable

<b>SIC-P-05/Lx</b> <b>Cable type</b> : <b>8 x 0.5 mm<sup>2</sup> (AWG 20), shielded</b> <b>Outer diameter:</b> <b>4.90 (± 0.20) mm, 0.193 (± 0.008) in</b> <b>Cable layout</b> : <b>Figure 2 SIC-P cable, layout type 1</b>			
10213/2/.	10216/2/1	I/O module connector	Color code
signal	10216/2/3	pin	crimp pin
signal	signal		
shield	shield	41	Yellow / Green
CH1+	CH1+	32	White
CH1-	CH1-	29	Brown
CH2+	CH2+	24	Green
CH2-	CH2-	21	Yellow
CH3+	CH3+	16	Gray
CH3-	CH3-	13	Pink
CH4+	CH4+	8	Blue
CH4-	CH4-	5	Red



Table 7 Standard SIC-P-06 cable

<b>SIC-P-06/Lx</b>			
<b>Cable type</b>		: 4 x 2 x 0.25 mm <sup>2</sup> (AWG 24), shielded twisted pairs (STP)	
<b>Outer diameter</b>		: 6.60 (± 0.20) mm, 0.260 (± 0.008) in	
<b>Cable layout</b>		: Figure 3 SIC-P cable, layout type 2	
	10102/2/1 signal	I/O module connector pin	Color code crimp pin
	shield	41	Yellow / Green
	CH1-	40	Brown
	CH1+	37	White
	CH2+	24	Green
	CH2-	21	Yellow
	CH3-	20	Pink
	CH3+	17	Gray
	CH4+	4	Blue
	CH4-	1	Red

Table 8 Standard SIC-P-07 cable

<b>SIC-P-07/Lx</b>				
<b>Cable type</b>		: 18 x 0.5 mm <sup>2</sup> (AWG 20), unshielded		
<b>Outer diameter</b>		: 9.80 (± 0.20) mm, 0.386 (± 0.008) in		
<b>Cable layout</b>		: Figure 2 SIC-P cable, layout type 1		
10101/2/. signal	10209/2/1 signal	10206/2/1 signal	I/O module connector pin	Color code crimp pin
CH1	CH1	CH1	36	White
CH2	CH2	CH2	33	Brown
CH3	CH3	CH3	32	Green
CH4	CH4	CH4	29	Yellow
CH5	CH5	CH5	28	Gray
CH6	CH6	CH6	25	Pink
CH7	CH7	CH7	24	Blue
CH8	CH8	CH8	21	Red
CH9	CH9	CH9	20	Black
CH10	CH10	CH10	17	Violet
CH11	CH11	CH11	16	Gray / Pink
CH12	CH12	CH12	13	Red / Blue
CH13	CH13	- Vext	12	White / Green
CH14	CH14	- Vext	9	Brown / Green
CH15	CH15	- Vext	8	White / Yellow
CH16	CH16	- Vext	5	Yellow / Brown
+ Vext	- Vext	- Vext	4	White / Gray
+ Vext	- Vext	- Vext	1	Gray / Brown



Table 9 Standard SIC-P-08 cable

<b>SIC-P-08/Lx</b> <b>Cable type</b> : <b>18 x 0.25 mm<sup>2</sup> (AWG 24), unshielded</b> <b>Outer diameter:</b> <b>7.90 (± 0.20) mm, 0.311 (± 0.008) in</b> <b>Cable layout</b> : <b>Figure 2 SIC-P cable, layout type 1</b>			
10101/2/.	10104/2/1	I/O module connector	Color code crimp pin
signal	signal	pin	
- Vext	- Vext	40	White / Gray
- Vext	- Vext	37	Gray / Brown
CH1	CH1	36	White
CH2	CH2	33	Brown
CH3	CH3	32	Green
CH4	CH4	29	Yellow
CH5	CH5	28	Gray
CH6	CH6	25	Pink
CH7	CH7	24	Blue
CH8	CH8	21	Red
CH9	CH9	20	Black
CH10	CH10	17	Violet
CH11	CH11	16	Gray / Pink
CH12	CH12	13	Red / Blue
CH13	CH13	12	White / Green
CH14	CH14	9	Brown / Green
CH15	CH15	8	White / Yellow
CH16	CH16	5	Yellow / Brown



Table 10 Standard SIC-P-09 cable (OBSOLETE)

SIC-P-09/Lx			
Cable type :		18 x 0.25 mm <sup>2</sup> (AWG 24), unshielded	
Outer diameter:		7.90 (± 0.20) mm, 0.311 (± 0.008) in	
Cable layout :		Figure 2 SIC-P cable, layout type 1	
10101/2/. signal	10104/2/1 signal	I/O module connector pin	Color code crimp pin
- Vext	- Vext	40	White / Gray
- Vext	- Vext	37	Gray / Brown
CH1	CH1	36	White
CH2	CH2	33	Brown
CH3	CH3	32	Green
CH4	CH4	29	Yellow
CH5	CH5	28	Gray
CH6	CH6	25	Pink
CH7	CH7	24	Blue
CH8	CH8	21	Red
CH9	CH9	20	Black
CH10	CH10	17	Violet
CH11	CH11	16	Gray / Pink
CH12	CH12	13	Red / Blue
CH13	CH13	12	White / Green
CH14	CH14	9	Brown / Green
CH15	CH15	8	White / Yellow
CH16	CH16	5	Yellow / Brown

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## Single-wire connection method

### Description

FSC I/O backplanes in FSC system cabinets need cabinet wiring to interface boards or terminals (e.g. FTAs). If these interface boards or terminals are located in the FSC cabinet, then the single-wire connection method can be used.

This data sheet provides detailed information on the single-wire method.

### Note:

For details on FSC input modules refer to section 5 ("FSC Input Modules") of the FSC Hardware Manual.

For details on FSC output modules refer to section 6 ("FSC Output Modules") of the FSC Hardware Manual.

### Connection principle

The single-wire connection method is shown in Figure 1. This method involves separate production and assembly of each wire that is connected to the I/O connectors (CNx).

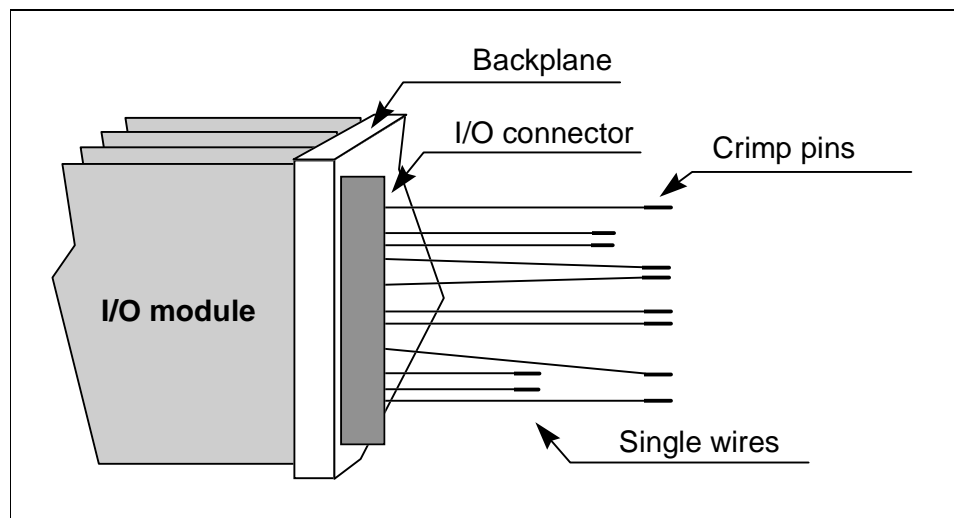


Figure 1 Principle of single-wire connection method



## Connections

The pin allocation of the I/O backplane connector is shown in Figure 2. The pin codes refer to the connected pins of the I/O module in the rack.

Programming		I/O module			I/O backplane	
		<b>d</b>	<b>b</b>	<b>z</b>		
		2	2	2		
		-		-		
		6		6		
	41 / earth	8		8	-	-
40 / d10		10		10	40 / d10	-
	37 / z10	12		12	-	37 / z10
36 / d12		14		14	36 / d12	-
	33 / z12	16		16	-	33 / z12
32 / d14		18		18	32 / d14	-
	29 / z14	20		20	-	29 / z14
28 / d16		22		22	28 / d16	-
	25 / z16	24		24	-	25 / z16
24 / d18		26		26	24 / d18	-
	21 / z18	28		28	-	21 / z18
20 / d20		30		30	20 / d20	-
	17 / z20	32		32	-	17 / z20
16 / d22					16 / d22	-
	13 / z22				-	13 / z22
12 / d24					12 / d24	-
	9 / z24				-	9 / z24
8 / d26					8 / d26	-
	5 / z26				-	5 / z26
4 / d28					4 / d28	-
	1 / z28				-	1 / z28

Figure 2 Back view of programming connector (P), I/O module connector and I/O backplane connector (CN)



Table 1 below shows the connections of the I/O modules to the I/O backplane connector.

Table 1 Connections to I/O backplane connector

10101/2/ signal	10102/2/1 + 10102/A/ signal	10104/2/1 signal	10105/2/1 signal	10201/2/1 signal	10205/2/1 + 10205/A/ signal	I/O backplane connector pin	I/O module connector pin
	shield		shield		shield	41	earth
- Vext	CH1-	- Vext	0 Vdc	(0 Vdc)	nc	40	d10
- Vext	CH1+	- Vext	0 Vdc	(0 Vdc)	nc	37	z10
CH1	(26V 1)	CH1	CH1	CH1+	CH1+	36	d12
CH2	(IN 1)	CH2	CH2	CH1-	CH1-	33	z12
CH3	(0V 1)	CH3	CH3	CH2+	(0V 1)	32	d14
CH4	(0V 2)	CH4	CH4	CH2-	nc	29	z14
CH5	(IN 2)	CH5	CH5	CH3+	(mA 1)	28	d16
CH6	(26V 2)	CH6	CH6	CH3-	(loop 1)	25	z16
CH7	CH2+	CH7	CH7	CH4+	CH2+	24	d18
CH8	CH2-	CH8	CH8	CH4-	CH2-	21	z18
CH9	CH3-	CH9	CH9	CH5+	(0V 2)	20	d20
CH10	CH3+	CH10	CH10	CH5-	nc	17	z20
CH11	(26V 3)	CH11	CH11	CH6+	(mA 2)	16	d22
CH12	(IN 3)	CH12	CH12	CH6-	(loop 2)	13	z22
CH13	(0V 3)	CH13	CH13	CH7	nc	12	d24
CH14	(0V 4)	CH14	CH14	CH7-	nc	9	z24
CH15	(IN 4)	CH15	CH15	CH8+	nc	8	d26
CH16	(26V 4)	CH16	CH16	CH8-	nc	5	z26
+ Vext	IN 4+	+ Vext	0 Vdc	(0 Vdc)	nc	4	d28
+ Vext	IN 4-	+ Vext	+ Vext/8	(0 Vdc)	nc	1	z28

nc = not connected



Table 1 Connections to I/O backplane connector (continued)

10206/2/1	10208/2/1	10209/2/1	10213/2/.	10215/2/1	10216/2/. + 10216/A/1 signal	I/O backplane connector pin	I/O module connector pin
signal	signal	signal	signal	signal	signal		
					shield	41	earth
nc	CH1 c	nc	nc	nc	nc	40	d10
nc	CH1 no	nc	nc	nc	nc	37	z10
CH1	CH2 c	CH1	(- Vext)	CH1+	(- Vext)	36	d12
CH2	CH2 no	CH2	(- Vext)	CH1-	(- Vext)	33	z12
CH3	CH3 c	CH3	CH1+	CH1+	CH1+	32	d14
CH4	CH3 no	CH4	CH1-	CH1-	CH1-	29	z14
CH5	CH4 c	CH5	(- Vext)	CH2+	(- Vext)	28	d16
CH6	CH4 no	CH6	(- Vext)	CH2-	(- Vext)	25	z16
CH7	CH5 c	CH7	CH2+	CH2+	CH2+	24	d18
CH8	CH5 no	CH8	CH2-	CH2-	CH2-	21	z18
CH9	CH6 c	CH9	(- Vext)	CH3+	(- Vext)	20	d20
CH10	CH6 no	CH10	(- Vext)	CH3-	(- Vext)	17	z20
CH11	CH7 c	CH11	CH3+	CH3+	CH3+	16	d22
CH12	CH7 no	CH12	CH3-	CH3-	CH3-	13	z22
- Vext	CH8 c	CH13	(- Vext)	CH4+	(- Vext)	12	d24
- Vext	CH8 no	CH14	(- Vext)	CH4-	(- Vext)	9	z24
- Vext	CH9 c	CH15	CH4+	CH4+	CH4+	8	d26
- Vext	CH9 no	CH16	CH4-	CH4-	CH4-	5	z26
- Vext	CH10 c	- Vext	(- Vext)	(- Vext)	(- Vext)	4	d28
- Vext	CH10 no	- Vext	(- Vext)	(- Vext)	(- Vext)	1	z28

nc = not connected      c = common      no = normally open





## Requirements

The single-wire connection method has the following requirements:

### Connector

I/O backplane connector:

- housing 44 pos. MODU MOD IV Housing.  
(AMP Part No. 1-102387-3)
- crimp pin on reel MODU MOD IV RECEPTACLE  
(AMP Part No. 0-167301-4)
- crimp pin loose pieces MODU MOD IV RECEPTACLE  
(AMP Part No. 0-141708-1)

Connector pin:

- max. current 2 A
- usable wire types 0.25 mm<sup>2</sup> (AWG 24)  
0.34 mm<sup>2</sup> (AWG 22)  
0.5 mm<sup>2</sup> (AWG 20)

### Tools

Crimp tool: AMP Part No. 0-169481-1  
Extraction tool: AMP Part No. 0-843473-1

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## SIC to FTA applications

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### Introduction

This data sheet provides detailed information on the selection of SIC-C cables and FTAs based on I/O signal specifications.

Table 1 gives an overview of the standard SIC-C cables.

Table 2 and Table 3 list the available FTA modules.

Table 4 to Table 6 are selection tables that will help you determine which combinations of FSC I/O modules, FTAs and SIC cables are possible.

---

#### **Note:**

For details on field termination assemblies (FTAs) refer to section 9 ("Field Termination Assembly Modules") of the FSC Hardware Manual.

For details on FSC input modules refer to section 5 ("FSC Input Modules") of the FSC Hardware Manual.

For details on FSC output modules refer to section 6 ("FSC Output Modules") of the FSC Hardware Manual.

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### SIC-C cable types

SIC-C cables (i.e. SIC cables terminating in one or more connectors) are available in five layout types:

1. SIC-C cable with one I/O connector and one 10-pin FTA connector,
2. SIC-C cable with one I/O connector, one 10-pin FTA connector and two ferrites,
3. SIC-C cable with one I/O connector and one 20-pin FTA connector,
4. SIC-C cable with one I/O connector and two 10-pin FTA connectors (marked 'a' and 'b'), and
5. SIC-C cable with two I/O connectors (marked 'a' and 'b') and one 10-pin FTA connector.

---

#### **Note:**

For details on SIC-C cables refer to the 'System interconnection cables terminating on FTAs' data sheet (SIC-C).

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## SIC-C cable characteristics

Table 1 below shows the available SIC-C cables with their main characteristics:

Table 1 Standard SIC-C cables

Cable type	Cores	Shielding	Outer diameter (mm)	Cable layout
SIC-C-01/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	4
SIC-C-02/Lx	16 x 0.5 mm <sup>2</sup>	unshielded	8.00 (± 0.20)	4
SIC-C-03/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	5
SIC-C-04/Lx	20 x 0.5 mm <sup>2</sup>	unshielded	9.80 (± 0.20)	4
SIC-C-05/Lx	8 x 0.5 mm <sup>2</sup>	shielded	4.90 (± 0.15)	1
SIC-C-06/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-C-07/Lx	18 x 0.5 mm <sup>2</sup>	unshielded	9.40 (± 0.20)	4
SIC-C-08/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	4
<i>SIC-C-09/Lx</i>	<i>18 x 0.25 mm<sup>2</sup></i>	<i>unshielded</i>	<i>7.90 (± 0.20)</i>	<b>OBSOLETE</b>
SIC-C-10/Lx	10 x 0.25 mm <sup>2</sup>	unshielded	6.50 (± 0.20)	1
SIC-C-11/Lx	8 x 0.5 mm <sup>2</sup>	unshielded	6.80 (± 0.20)	1
SIC-C-12/Lx	10 x 2 x 0.25 mm <sup>2</sup>	shielded	9.90 (± 0.20)	3

Usable wire types:  
 0.25 mm<sup>2</sup> = AWG 24  
 0.5 mm<sup>2</sup> = AWG 20

For SIC-C cable layouts refer to SIC-C data sheet.

Explanation of cable type codes:  
 SIC-C-../Lx = standard SIC-C cable with a standard length of x meters.  
 x = 2.5 m, 3.25 m, 4 m, 6 m, 8 m, 10 m, 12 m, 15 m, 20 m, 25 m, 30 m or 40 m.

### Note:

For details on the connections of SIC-C cables refer to the 'System interconnection cables terminating on FTAs' data sheet (SIC-C).



## FTA types

Field termination assemblies (FTAs) are the interface between the SIC cables and the external field wiring. They are available in two versions:

1. fitted with a standard Elco E-56 connector to connect E-56 system cables (FTA-E), and
2. fitted with screw terminals to connect field wires directly (FTA-T).

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**Note:**

For details on FTAs refer to section 9 ("Field Termination Assembly Modules") of the FSC Hardware Manual.

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## FTA-E characteristics

FTA-E modules are field termination assemblies (FTAs) that are fitted with a standard Elco E-56 connector. They are the interface between system interconnection cables (SICs) and the external field wiring. Table 2 below lists the available FTA-E modules with their main characteristics:

Table 2 Available FTA-E modules

FTA type	Description	FTA connector x channels	Termination type
FTA-E-01	24-channel FTA with E-56	3F x 8	E56
FTA-E-02	24-channel FTA with E-56	6 x 4	E56
FTA-E-03	24-channel FTA with E-56	3 x 8	E56
FTA-E-04	25-channel FTA with E-56	5 x 5	E56
FTA-E-05	25-channel FTA with E-56	5F x 5	E56/T

Total number of signals per FTA, specified by FTA connector. F=fused  
 Examples: 2 x 4 = 2 connectors, 4 signals each  
 3F x 8 = 3 connectors, 8 signals each and common fuse per 8 signals

Termination types:  
 E56 = ELCO connector E56/54  
 E56/T = E56 with 5 groups of 2 screw terminals for external power



## FTA-T characteristics

FTA-T modules are field termination assemblies (FTAs) fitted with screw terminals to connect field wires directly. They are the interface between system interconnection cables (SICs) and the external field wiring. Table 3 below lists the available FTA-E modules with their main characteristics:

Table 3 Available FTA-T modules

FTA type	Description	FTA connector x channels	Termination type
FTA-T-01	FTA with screw terminals (24 channels)	3F x 8	T48
FTA-T-02	FTA with screw terminals (24 channels)	6 x 4	T48
FTA-T-03	FTA with screw terminals (24 channels)	3 x 8	T48
FTA-T-04	FTA with screw terminals (25 channels)	5 x 5	T50
FTA-T-05	FTA with screw terminals (12 channels)	6 x 2	T24
FTA-T-06	Fail-safe active digital input FTA (115 Vac, 8 channels)	1 x 8	T18
FTA-T-07	Fail-safe passive digital input FTA (115 Vac, 8 channels)	1 x 8	T16
FTA-T-08	Fail-safe digital output (relay) FTA (4 channels)	1 x 4F	T10
FTA-T-09	Fail-safe passive digital input FTA (115 Vac/dc, 8 channels)	1 x 8	T16
FTA-T-10	Digital output (relay) FTA (8 channels)	1 x 8F	T16
FTA-T-11	FTA with screw terminals (8 channels)	2 x 4	T16
FTA-T-12	Passive isolated digital input FTA (8 channels)	1 x 8	T16
FTA-T-13	Current-limited digital input FTA (24 Vdc, 16 channels)	2F x 8	T32
FTA-T-14	Fail-safe 0(4)-20 mA analog input FTA (16 channels)	1FF x 16	T64/T
FTA-T-15	24 Vdc to 30 Vdc/1 A converter	–	–
FTA-T-16	Fail-safe active digital input FTA with line-monitoring (16 channels)	1 x 16	T32/T
FTA-T-17	Digital output (relay) FTA for AK 5/6 applications (4 channels)	1 x 4F	T8

Total number of signals per FTA, specified by FTA connector. F=fused  
 Examples: 2 x 4 = 2 connectors, 4 signals each  
 3F x 8 = 3 connectors, 8 signals each and common fuse per 8 signals  
 1 x 4F = 1 connector of 4 signals, with one fuse per signal  
 1 x 8F = 1 connector of 8 signals, with one fuse per signal  
 1FF x 16 = 1 connector of 16 signals, with one fuse per 8 signals

Termination types:  
 T8 = 4 groups of 2 screw terminals  
 T10 = 4 groups of 2 screw terminals plus 2 screw terminals for readback  
 T16 = 8 groups of 2 screw terminals  
 T18 = 8 groups of 2 screw terminals plus 2 screw terminals for external power  
 T24 = 12 groups of 2 screw terminals plus 1 earth screw terminal  
 T32 = 16 groups of 2 screw terminals  
 T48 = 24 groups of 2 screw terminals plus 2 earth screw terminals  
 T50 = 25 groups of 2 screw terminals  
 T64/T = 16 groups of 4 screw terminals with 2 groups of 2 screw terminals for external power plus 2 earth screw terminals  
 T32/T = 16 groups of 2 screw terminals with 2 groups of 2 screw terminals for external power

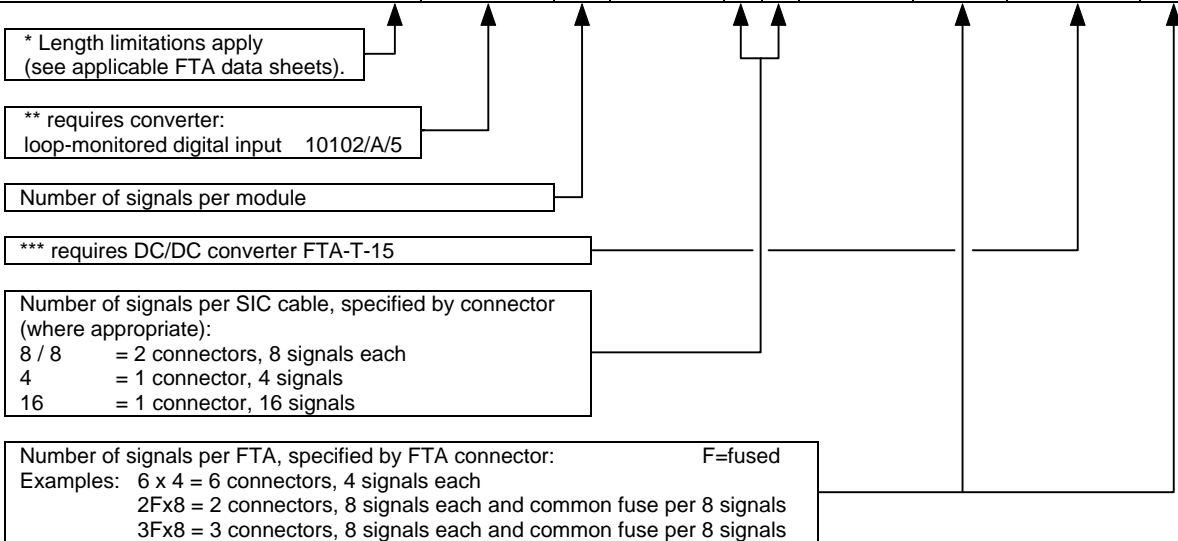


## Selection table for digital field inputs

Table 4 is an aid in determining which combinations of FSC input modules, FTAs and SIC cables can be used depending on the characteristics of the digital field input signal. Modules, SIC cables and FTAs support different numbers of channels, depending on the field signal characteristics.

Table 4 Selection table for digital field inputs

Digital input signal characteristic	Module		SIC cable		ELCO FTA (FTA-E)		Terminal FTA (FTA-T)		
			A	B					
Digital Input, 24 Vdc, int. power, FS	10101/2/1	16	SIC-C-01	8	8	FTA-E-01	3Fx8	FTA-T-01	3Fx8
Digital Input, 24 Vdc, int. power, NFS	10104/2/1	16	SIC-C-01	8	8	FTA-E-01	3Fx8	FTA-T-01	3Fx8
Digital Input, 24 Vdc, ext. power, NFS	10104/2/1	16	SIC-C-01	8	8	---	---	FTA-T-12	1x8
Digital Input, 24 Vdc, int. power, FS, current-limited	10101/2/1	16	SIC-C-01	8	8	---	---	FTA-T-13	2Fx8
Digital Input 24 Vdc, int. power, NFS, current-limited	10104/2/1	16	SIC-C-01	8	8	---	---	FTA-T-13	2Fx8
Digital Input with LM, 24 Vdc, int. power, FS	10105/2/1	16	SIC-C-12	16		---	---	FTA-T-16***	1x16
	10102/2/1**	4	SIC-C-06	4		FTA-E-02	6x4	FTA-T-02	6x4
Digital Input, 48 Vdc, int. power, FS	10101/2/3	16	SIC-C-01	8	8	FTA-E-01	3Fx8	FTA-T-01	3Fx8
Digital Input, 60 Vdc, int. power, FS	10101/2/2	16	SIC-C-01	8	8	FTA-E-01	3Fx8	FTA-T-01	3Fx8
Digital Input, 115 Vac, int. power, FS*	10101/2/1	16	SIC-C-08	8	8	---	---	FTA-T-07	1x8
Digital Input, 115 Vac, int. power, NFS*	10104/2/1	16	SIC-C-08	8	8	---	---	FTA-T-07	1x8
Digital Input, 115 Vac, ext. power, FS*	10101/2/1	16	SIC-C-08	8	8	---	---	FTA-T-06	1x8
Digital Input, 115 Vac, ext. power, NFS*	10104/2/1	16	SIC-C-08	8	8	---	---	FTA-T-06	1x8
Digital Input, 115 Vac/dc, int. power, FS*	10101/2/1	16	SIC-C-08	8	8	---	---	FTA-T-09	1x8
Digital Input, 115 Vac/dc, int. power, NFS*	10104/2/1	16	SIC-C-08	8	8	---	---	FTA-T-09	1x8





## Selection table for analog field inputs

Table 5 is an aid in determining which combinations of FSC input modules, FTAs and SIC cables can be used depending on the characteristics of the analog field input signal. Modules, SIC cables and FTAs support different numbers of channels, depending on the field signal characteristics.

Table 5 Selection table for analog field inputs

Analog input signal characteristic	Module		SIC cable		ELCO FTA (FTA-E)		Terminal FTA (FTA-T)	
			A	B				
Analog Input, 0(4)-20 mA, ext. power, FS	10102/2/1*	4	SIC-C-06	4	FTA-E-02	6x4	FTA-T-02	6x4
	10105/2/1	16	SIC-C-12	16	---	---	FTA-T-14	1FFx16
Analog Input, 0(4)-20 mA, int. power, FS	10102/2/1*	4	SIC-C-06	4	FTA-E-02	6x4	FTA-T-02	6x4
	10105/2/1	16	SIC-C-12	16	---	---	FTA-T-14**	1FFx16
Analog Input, 0(1)-5 V, FS	10102/2/1*	4	SIC-C-06	4	FTA-E-02	6x4	FTA-T-02	6x4
Analog Input, 0(2)-10V, FS	10102/2/1*	4	SIC-C-06	4	FTA-E-02	6x4	FTA-T-02	6x4

\* requires analog input converter:  
 0(4)-20 mA internal power 10102/A/1  
 0(4)-20 mA external power 10102/A/2  
 0(1)-5 Vdc external power 10102/A/3  
 0(2)-10 Vdc external power 10102/A/4

Number of signals per module

\*\* requires DC/DC converter FTA-T-15

Number of signals per SIC cable, specified by connector (where appropriate):  
 8 / 8 = 2 connectors, 8 signals each  
 4 = 1 connector, 4 signals

Number of signals per FTA, specified by FTA connector: F=fused  
 Examples: 6 x 4 = 6 connectors, 4 signals each  
 1FF x 16 = 1 connector of 16 signals, with one fuse per 8 signals



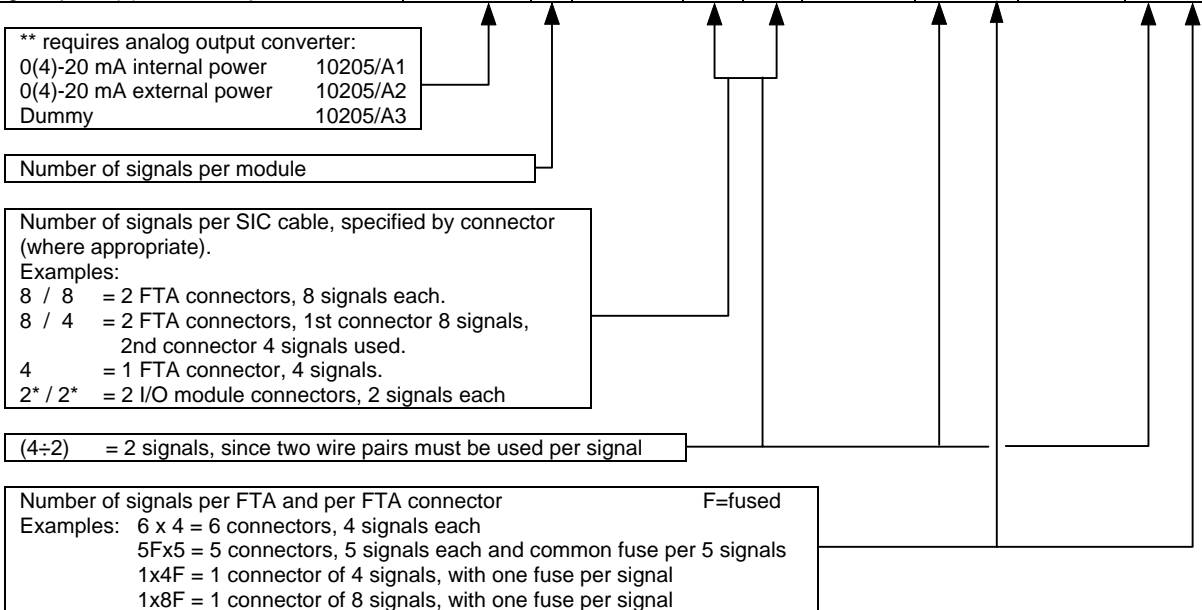


## Selection table for field outputs

Table 6 is an aid in determining which combinations of FSC I/O modules, FTAs and SIC cables can be used depending on the characteristics of the field output signal. Modules, SIC cables and FTAs support different numbers of channels, depending on the field signal characteristics.

Table 6 Selection table for field outputs

Output signal characteristics	Module	SIC cable		ELCO FTA (FTA-E)		Terminal FTA (FTA-T)			
		A	B						
Digital Output, 24 Vdc, FS	10201/2/1	8	SIC-C-02	4	4	FTA-E-02	6x4	FTA-T-02	6x4
Digital Output, 24 Vdc – 2 A, FS	10215/2/1	4	SIC-C-02	(4÷2)	(4÷2)	FTA-E-02	6x(4÷2)	FTA-T-05	6x(4÷2)
Digital Output, 24 Vdc, FS line-monitored	10216/2/1	4	SIC-C-05		4	FTA-E-02	6x4	FTA-T-02	6x4
Digital Output, 24 Vdc, 550 mA, NFS	10206/2/1	12	SIC-C-07	8	4	FTA-E-03	3x8	FTA-T-03	3x8
Digital Output, 24 Vdc, 100 mA, NFS	10209/2/1	16	SIC-C-07	8	8	FTA-E-03	3x8	FTA-T-03	3x8
Digital Output, 48 Vdc, FS	10213/2/3	4	SIC-C-05		4	FTA-E-02	6x4	FTA-T-02	6x4
Digital Output, 48 Vdc, FS line-monitored	10216/2/3	4	SIC-C-05		4	FTA-E-02	6x4	FTA-T-02	6x4
Digital Output, 60 Vdc, FS	10213/2/2	4	SIC-C-05		4	FTA-E-02	6x4	FTA-T-02	6x4
Digital Output, 110 Vdc, FS	10213/2/1	4	SIC-C-11		4	---	---	FTA-T-11	2x4
Digital Output, potential-free contacts	10208/2/1	10	SIC-C-04	5	5	FTA-E-04	5x5	FTA-T-04	5x5
Digital Output, powered contacts	10208/2/1	10	SIC-C-04	5	5	FTA-E-05	5Fx5	---	---
Digital Output, relay, FS, AK1-4, 250 Vac / 110 Vdc	10201/2/1	8	SIC-C-02	4	4	---	---	FTA-T-08	1x4F
Digital Output, relay, FS, AK1-6, 250 Vac / 250 Vdc	10201/2/1	8	SIC-C-02	4	4	---	---	FTA-T-17	1x4F
Digital Output, relay, FS lin-mon, AK1-6, 250 Vac / 250 Vdc	10216/2/1	4	SIC-C-05		4	---	---	FTA-T-17	1x4F
Digital Output, relay, NFS, 250 Vac / 110 Vdc	10209/2/1	16	SIC-C-01	8	8	---	---	FTA-T-10	1x8F
	10201/2/1	8	SIC-C-10		8	---	---	FTA-T-10	1x8F
Analog Output, 0(4)-20 mA ext. power, FS	10205/2/1**	2	SIC-C-03	2*	2*	FTA-E-02	6x4	FTA-T-02	6x4
Analog Output, 0(4)-20 mA int. power, FS	10205/2/1**	2	SIC-C-03	2*	2*	FTA-E-02	6x4	FTA-T-02	6x4



## Relationship between FTA-T-14 and FTA-T-15

Figure 1 below shows the relation between the field termination assembly module FTA-T-14 and the DC/DC converter FTA-T-15. The FTA-T-15 module can power a maximum of two FTA-T-14 modules.

Figure 1(a) shows how to connect a mix of active and/or passive sensors using two FTA-T-15 modules in redundant operation powering two FTA-T-14 modules.

Figure 1(b) shows how to connect an active sensor using the FTA-T-14 module. In that case the FTA-T-15 module is not required.

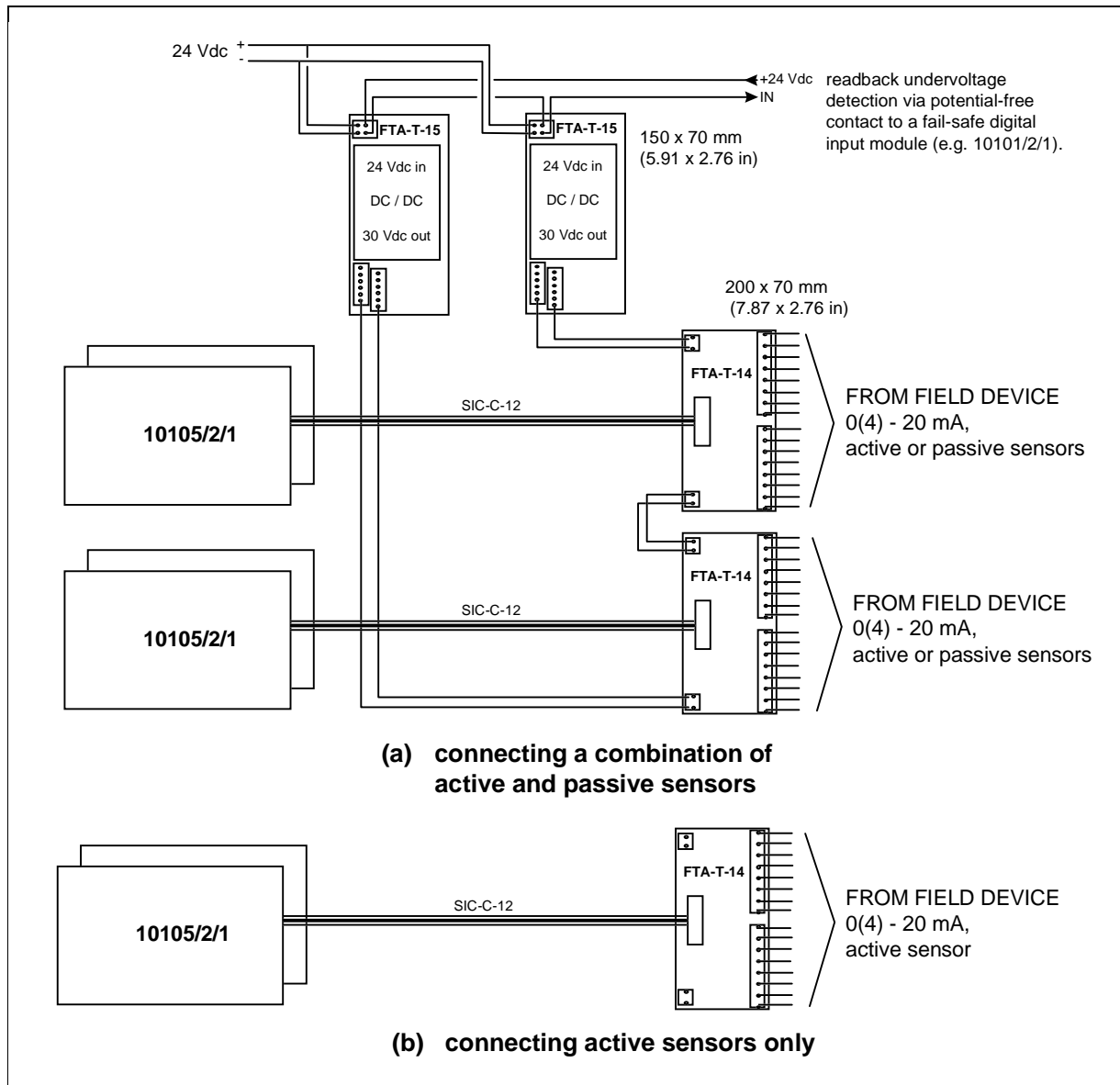


Figure 1 Relationship between FTA-T-14 and FTA-T-15



## Relationship between FTA-T-16 and FTA-T-15

Figure 2 below shows the relation between the field termination assembly module FTA-T-16 and the DC/DC converter FTA-T-15. The FTA-T-15 module can power a maximum of six FTA-T-16 modules. The example shows two FTA-T-15 modules in redundant operation powering three FTA-T-16 modules.

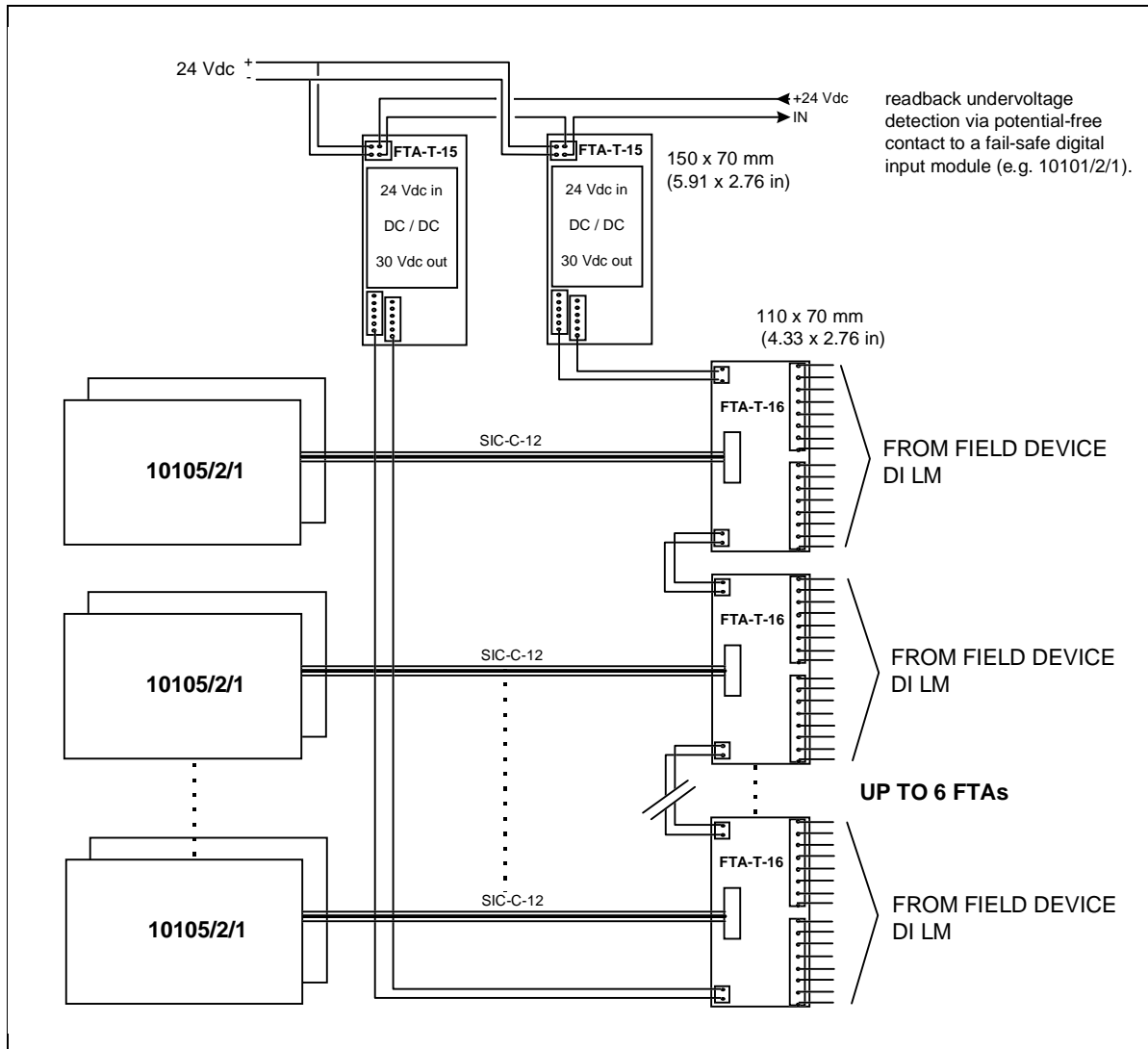


Figure 2 Relationship between FTA-T-16 and FTA-T-15

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## SIC to pin applications

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### Introduction

This data sheet provides detailed information on the selection of SIC-P cables based on I/O signal specifications.

Table 1 gives an overview of the standard SIC-P cables  
Table 2 to Table 4 are selection tables that will help you determine which combinations of FSC I/O modules and SIC cables are possible.

---

**Note:**

For details on FSC input modules refer to section 5 ("FSC Input Modules") of the FSC Hardware Manual.

For details on FSC output modules refer to section 6 ("FSC Output Modules") of the FSC Hardware Manual.

---

### SIC-P cable types

SIC-P cables (i.e. SIC cables terminating in individual crimp pins) are available in three layout types:

1. SIC-P cable with one I/O connector,
2. SIC-P cable with one I/O connector and two ferrites,
3. SIC-P cable with two I/O connectors (marked 'a' and 'b').

---

**Note:**

For details on SIC-P cables refer to the 'System interconnection cables terminating on crimp pins' data sheet (SIC-P).

---



## SIC-P cable characteristics

Table 1 below shows the available SIC-P cables with their main characteristics:

Table 1 Standard SIC-P cables

Cable type	Cores	Shielding	Outer diameter (mm)	Cable layout
SIC-P-01/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	1
SIC-P-02/Lx	16 x 0.5 mm <sup>2</sup>	unshielded	8.00 (± 0.20)	1
SIC-P-03/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	3
SIC-P-04/Lx	20 x 0.5 mm <sup>2</sup>	unshielded	9.80 (± 0.20)	1
SIC-P-05/Lx	8 x 0.5 mm <sup>2</sup>	shielded	4.90 (± 0.15)	1
SIC-P-06/Lx	4 x 2 x 0.25 mm <sup>2</sup>	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-P-07/Lx	18 x 0.5 mm <sup>2</sup>	unshielded	9.40 (± 0.20)	1
SIC-P-08/Lx	18 x 0.25 mm <sup>2</sup>	unshielded	7.90 (± 0.20)	1
SIC-P-09/Lx	18 x 0.25 mm <sup>2</sup>	<i>unshielded</i>	7.90 (± 0.20)	<b>OBSOLETE</b>

Usable wire types:  
 0.25 mm<sup>2</sup> = AWG 24  
 0.5 mm<sup>2</sup> = AWG 20

For SIC-P cable layouts see SIC-P data sheet

Explanation of cable type codes:  
 SIC-C-.../Lx = Standard SIC-C cable with a standard length of x meters.  
 x = 2.5 m, 3.25 m, 4 m, 6 m, 8 m, 10 m, 12 m, 15 m, 20 m, 25 m, 30 m or 40 m.

**Note:**

For details on the connections of SIC-P cables refer to the 'System interconnection cables terminating on crimp pins' data sheet (SIC-P).

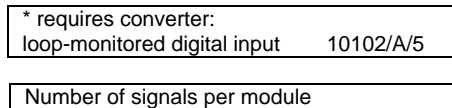


## Selection table for digital field inputs

Table 2 is an aid in determining which combinations of FSC input modules and SIC cables can be used depending on the characteristics of the digital field input signal. Modules and SIC cables support different numbers of channels, depending on the field signal characteristics.

Table 2 Selection table for digital field inputs

Digital input signal characteristic	Module		SIC cable	
Digital Input, 24 Vdc, int. power, FS	10101/2/1	16	SIC-P-01	16
Digital Input, 24 Vdc, int. power, NFS	10104/2/1	16	SIC-P-01	16
Digital Input, 24 Vdc, ext. power, FS	10101/2/1	16	SIC-P-08	16
Digital Input, 24 Vdc, ext. power, NFS	10104/2/1	16	SIC-P-08	16
Digital Input, 24 Vdc, int. power, FS, current-limited	10101/2/1	16	SIC-P-01	16
Digital Input 24 Vdc, int. power, NFS, current-limited	10104/2/1	16	SIC-P-01	16
Digital Input with LM, 24 Vdc, int. power, FS	10102/2/1*	4	SIC-P-06	4
Digital Input, 48 Vdc, int. power, FS	10101/2/3	16	SIC-P-01	16
Digital Input, 60 Vdc, int. power, FS	10101/2/2	16	SIC-P-01	16

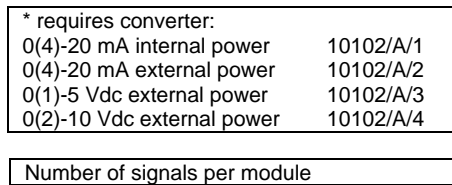


## Selection table for analog field inputs

Table 3 is an aid in determining which combinations of FSC input modules and SIC cables can be used depending on the characteristics of the analog field input signal. Modules and SIC cables support different numbers of channels, depending on the field signal characteristics.

Table 3 Selection table for analog field inputs

Analog input signal characteristic	Module		SIC cable	
Analog Input, 0(4)-20 mA, ext. power, FS	10102/2/1*	16	SIC-P-06	16
Analog Input, 0(4)-20 mA, int. power, FS	10102/2/1*	16	SIC-P-06	16
Analog Input, 0(1)-5 V, power, FS	10102/2/1*	16	SIC-P-06	16
Analog Input, 0(2)-10 V, FS	10102/2/1*	16	SIC-P-06	16





## Selection table for field outputs

Table 4 is an aid in determining which combinations of FSC I/O modules and SIC cables can be used depending on the characteristics of the field output signal. Modules and SIC cables support different numbers of channels, depending on the field signal characteristics.

Table 4 Selection table for field outputs

Digital input signal characteristic	Module		SIC cable	
	Module	Channels	SIC cable	Channels
Digital Output, 24 Vdc, FS	10201/2/1	8	SIC-P-02	8
Digital Output, 24 Vdc, 2 A, FS	10215/2/1	4	SIC-P-02	(8÷2)
Digital Output, 24 Vdc, FS, line-monitored	10216/2/1	16	SIC-P-05	16
Digital Output, 24 Vdc, 550 mA, NFS	10206/2/1	12	SIC-P-07	12
Digital Output, 24 Vdc, 100 mA, NFS	10209/2/1	16	SIC-P-07	16
Digital Output, 48 Vdc, FS	10213/2/3	4	SIC-P-05	4
Digital Output, 48 Vdc, FS, line-monitored	10216/2/3	4	SIC-P-05	4
Digital Output, 60 Vdc, FS	10213/2/2	4	SIC-P-05	4
Digital Output, 110 Vdc, FS	10213/2/1	4	SIC-P-05	4
Digital Output, potential-free contacts	10208/2/1	10	SIC-P-04	10
Analog Output, 0(4)-20 mA, ext. power, FS	10205/2/1**	2	SIC-P-03	2*   2*
Analog Output, 0(4)-20 mA, int. power, FS	10205/2/1**	2	SIC-P-03	2*   2*

\*\* requires analog output converter:  
 0(4)-20 mA internal power    10205/A/1  
 0(4)-20 mA external power    10205/A/2  
 Dummy                            10205/A/3

Number of signals per module

Number of signals per SIC cable, specified by connector (where appropriate).  
 Examples:  
 2\* / 2\*    = 2 I/O module connectors, 2 signals each.  
 (8÷2)    = 4 signals, since two wire pairs must be used per signal.

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# **Fail Safe Control Hardware Manual**

## **Section 9: Field Termination Assembly Modules**

**TotalPlant**



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## FTA-E-01 Fail-safe digital input FTA (24/48/60 Vdc, 24 channels)

### Description

The field termination assembly module FTA-E-01 is the interface between the system interconnection cables (SIC) and the external field wiring (on E-56 ELCO).

Twenty-four channels (separated into three groups of eight channels with a 250 mA fuse in the common +) can be connected to the FTA-E-01 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The three SIC connectors are marked '1A', '1B' and '2A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails.

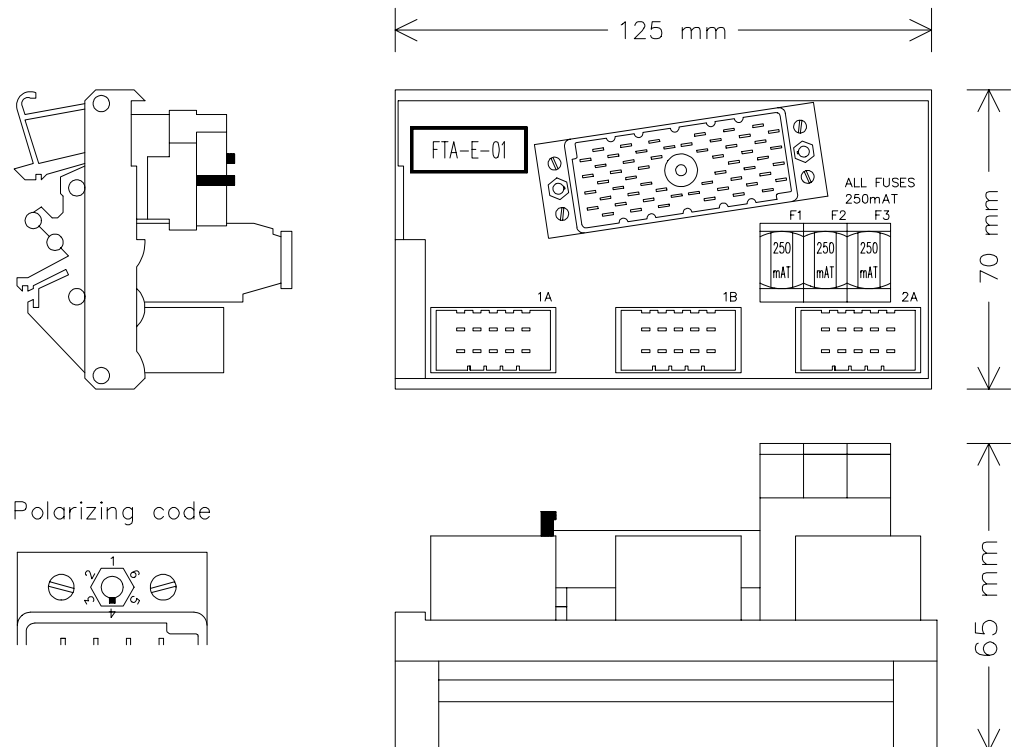


Figure 1 Mechanical layout



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The polarizing notches of the ELCO socket can be set to any of six positions per side (factory-set at position 4). Changing the polarization requires removal of the FTA from the DIN EN rail and the use of a polarizing tool, make ELCO (part no. 06 1989 02).

The ELCO socket has guide pins and socket gills to ensure correct alignment when mating.

---

## **Applications**

For details on applications and connection options for the FTA-E-01 module refer to the 'SIC to FTA applications' data sheet.

---





## Connections

The connections diagram of the FTA-E-01 module is as follows:

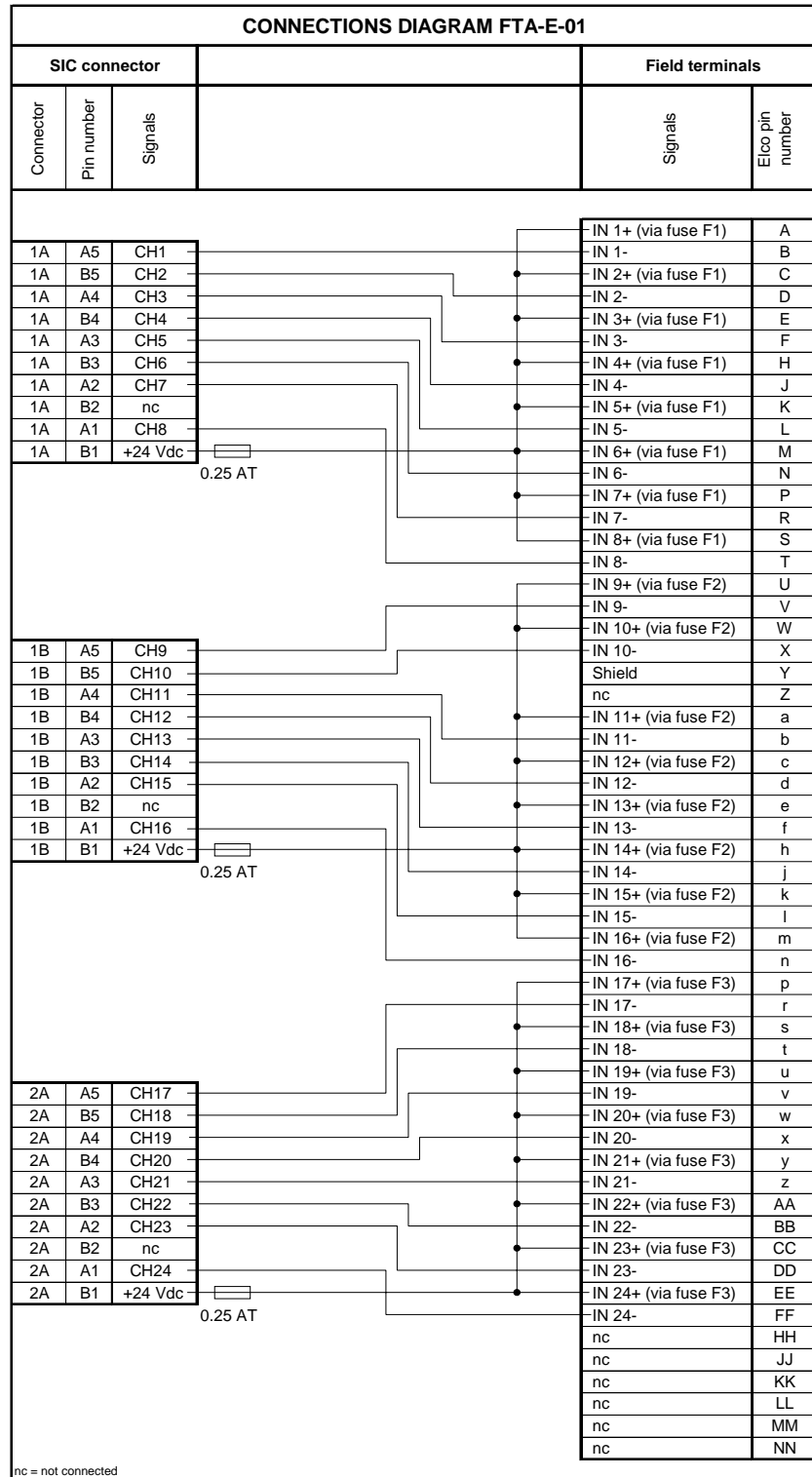


Figure 2 Connections diagram



**Technical data**      The FTA-E-01 module has the following specifications:

<b>General</b>	Type number:	FTA-E-01
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	24 (3 groups of 8)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
<b>Physical</b>	Module dimensions:	125 x 70 x 65 mm (L x W x H) 4.92 x 2.76 x 2.56 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	126 mm (4.96 in)
<b>Fuses</b>	Rating:	250 mA <sub>T</sub> (slow-acting)
	Dimensions:	5 x 20 mm (0.2 x 0.79 in) or 5 x 25 mm (0.2 x 0.98 in)
<b>Termination</b>	ELCO socket:	8016 series, 56 pins

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## FTA-E-02 Fail-safe digital output FTA (24/48/60 Vdc, 24 channels)

### Description

The field termination assembly module FTA-E-02 is the interface between the system interconnection cables (SIC) and the external field wiring (on E-56 ELCO).

Twenty-four channels (separated into six groups of four channels) can be connected to the FTA-E-02 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The six SIC connectors are marked '1A', '1B', '2A', '2B', '3A' and '3B' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails.

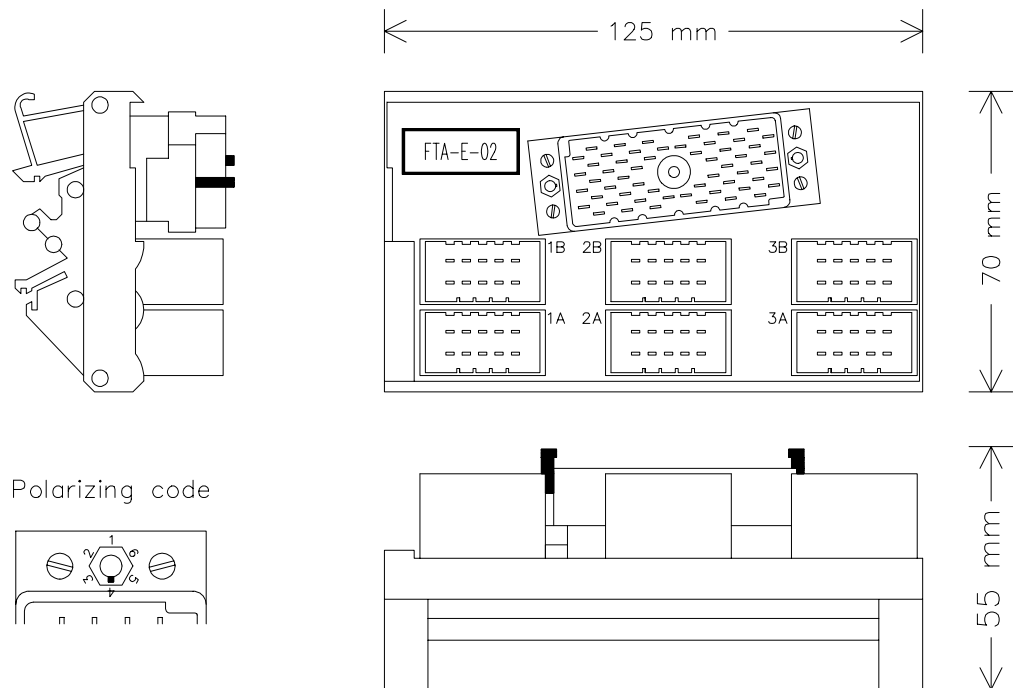


Figure 1 Mechanical layout



The polarizing notches of the ELCO socket can be set to any of six positions per side (factory-set at position 4). Changing the polarization requires removal of the FTA from the DIN EN rail and the use of a polarizing tool, make ELCO (part no. 06 1989 02).

The ELCO socket has guide pins and socket gills to ensure correct alignment when mating.

---

## Applications

For details on applications and connection options for the FTA-E-02 module refer to the 'SIC to FTA applications' data sheet.

---

## Connections diagrams

Figure 2 and Figure 3 on the next two pages show the connections diagrams of the FTA-E-02 module.

Figure 2 applies to configurations with one wire pair per channel (e.g. 10102/2/1, 10201/2/1, 10216/2/1 and 10205/2/1). Figure 3 applies to configurations with two wire pairs per channel (e.g. 10215/2/1).



## Connections diagram

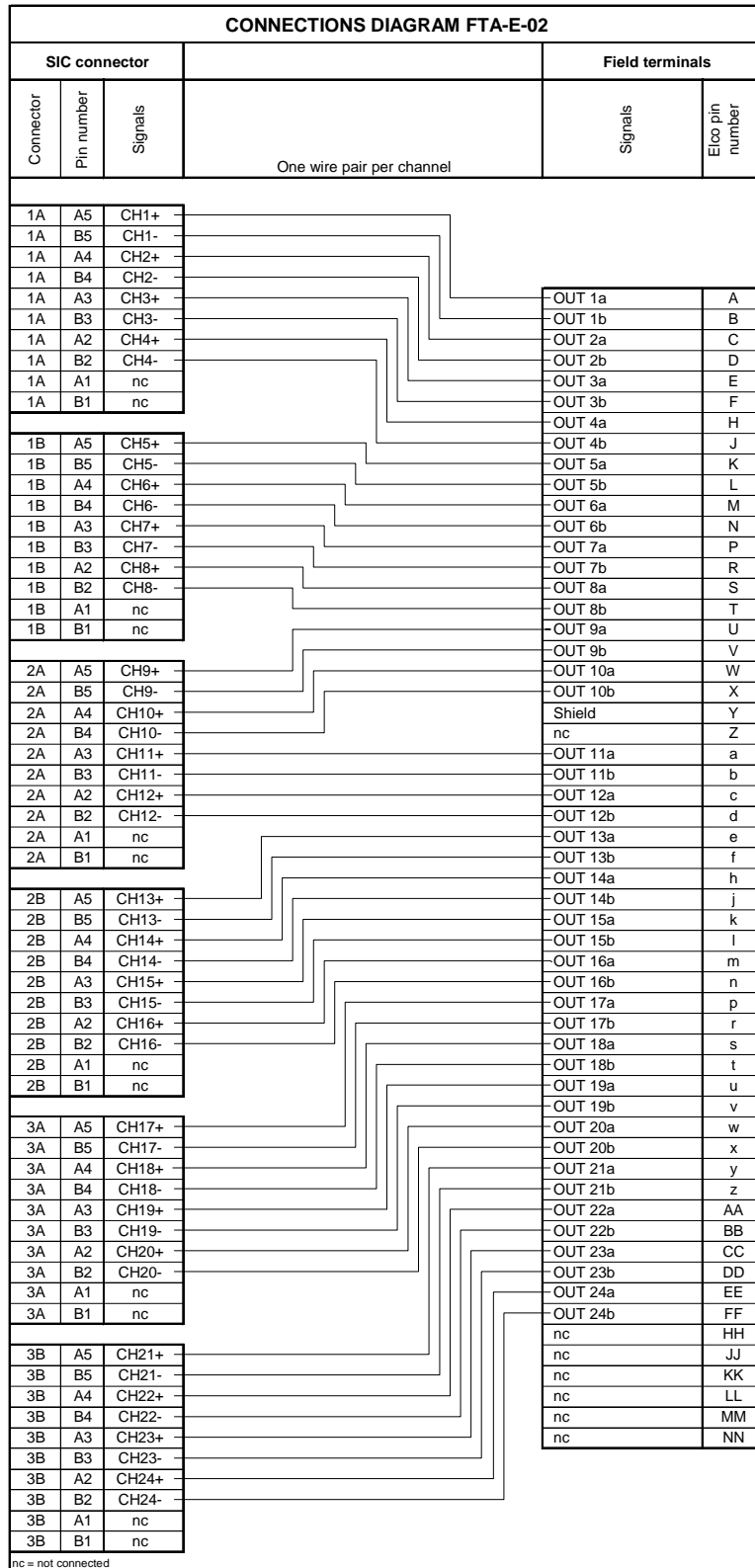


Figure 2 Connections diagram (one wire pair per channel)



## Connections diagram

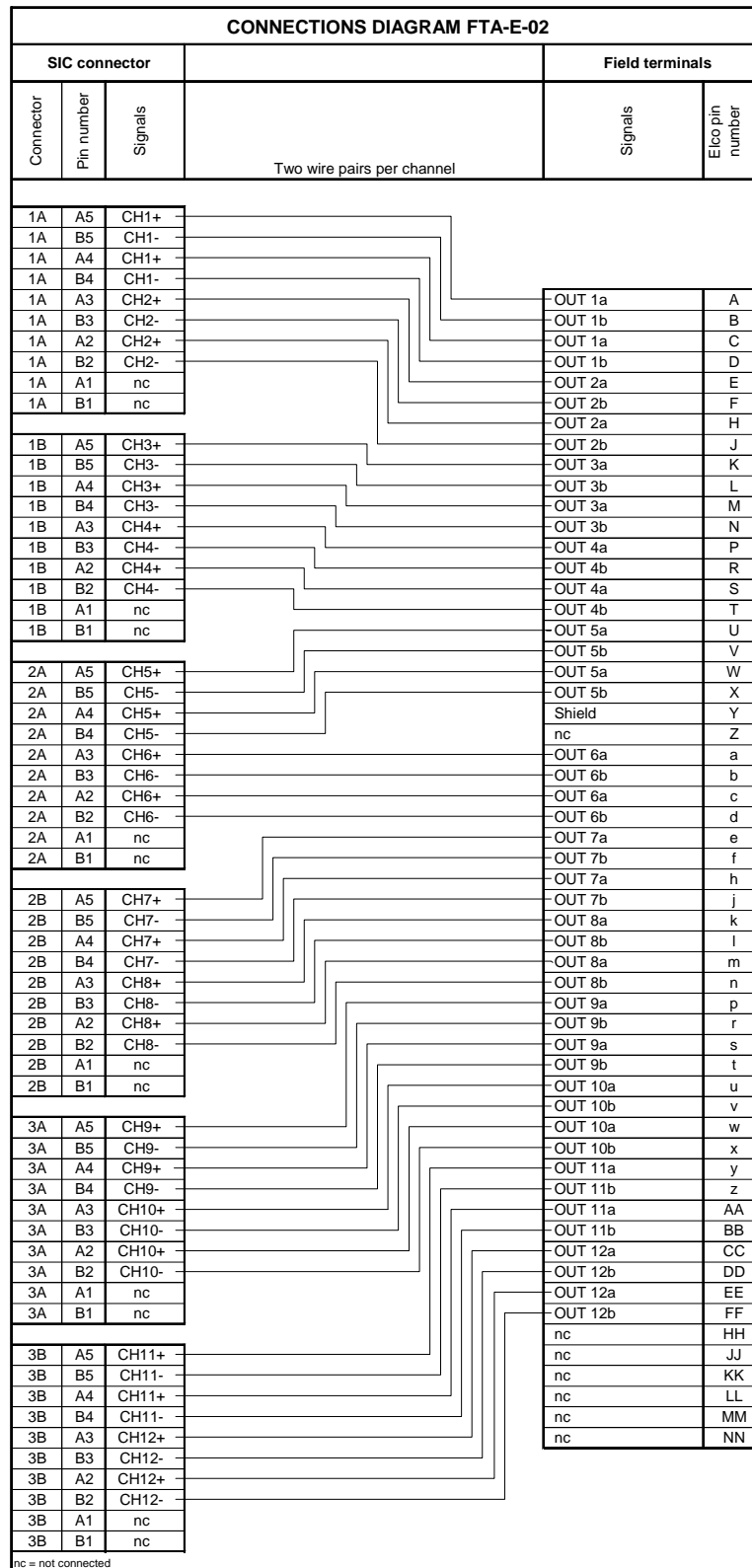


Figure 3 Connections diagram (two wire pairs per channel)



## Technical data

The FTA-E-02 module has the following specifications:

<b>General</b>	Type number:	FTA-E-02
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	24 (6 groups of 4)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	2 A
<b>Physical</b>	Module dimensions:	125 x 70 x 55 mm (L x W x H) 4.92 x 2.76 x 2.17 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	126 mm (4.96 in)
<b>Termination</b>	ELCO socket:	8016 series, 56 pins

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## FTA-E-03

## Digital output FTA (24 Vdc, 24 channels)

### Description

The field termination assembly module FTA-E-03 is the interface between the system interconnection cables (SIC) and the external field wiring (on E-56 ELCO).

Twenty-four channels (separated into three groups of eight channels with a common -) can be connected to the FTA-E-03 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The three SIC connectors are marked '1A', '1B' and '2A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails.

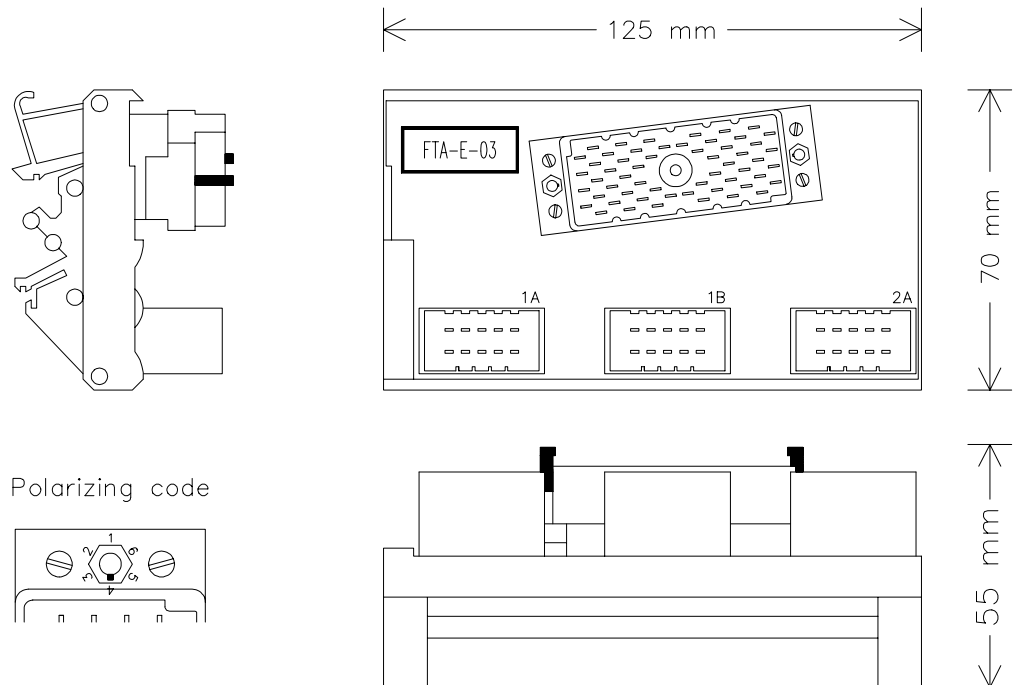


Figure 1 Mechanical layout



The polarizing notches of the ELCO socket can be set to any of six positions per side (factory-set at position 4). Changing the polarization requires removal of the FTA from the DIN EN rail and the use of a polarizing tool, make ELCO (part no. 06 1989 02).

The ELCO socket has guide pins and socket gills to ensure correct alignment when mating.

---

## **Applications**

For details on applications and connection options for the FTA-E-03 module refer to the 'SIC to FTA applications' data sheet.

---

## **Connections diagrams**

Figure 2 and Figure 3 on the next two pages show the connections diagrams of the FTA-E-03 module.

Figure 2 shows the connections diagram for 16-channel digital output modules. Figure 3 is a connection example for the 12-channel digital output module 10206/2/1.



## Connections diagram

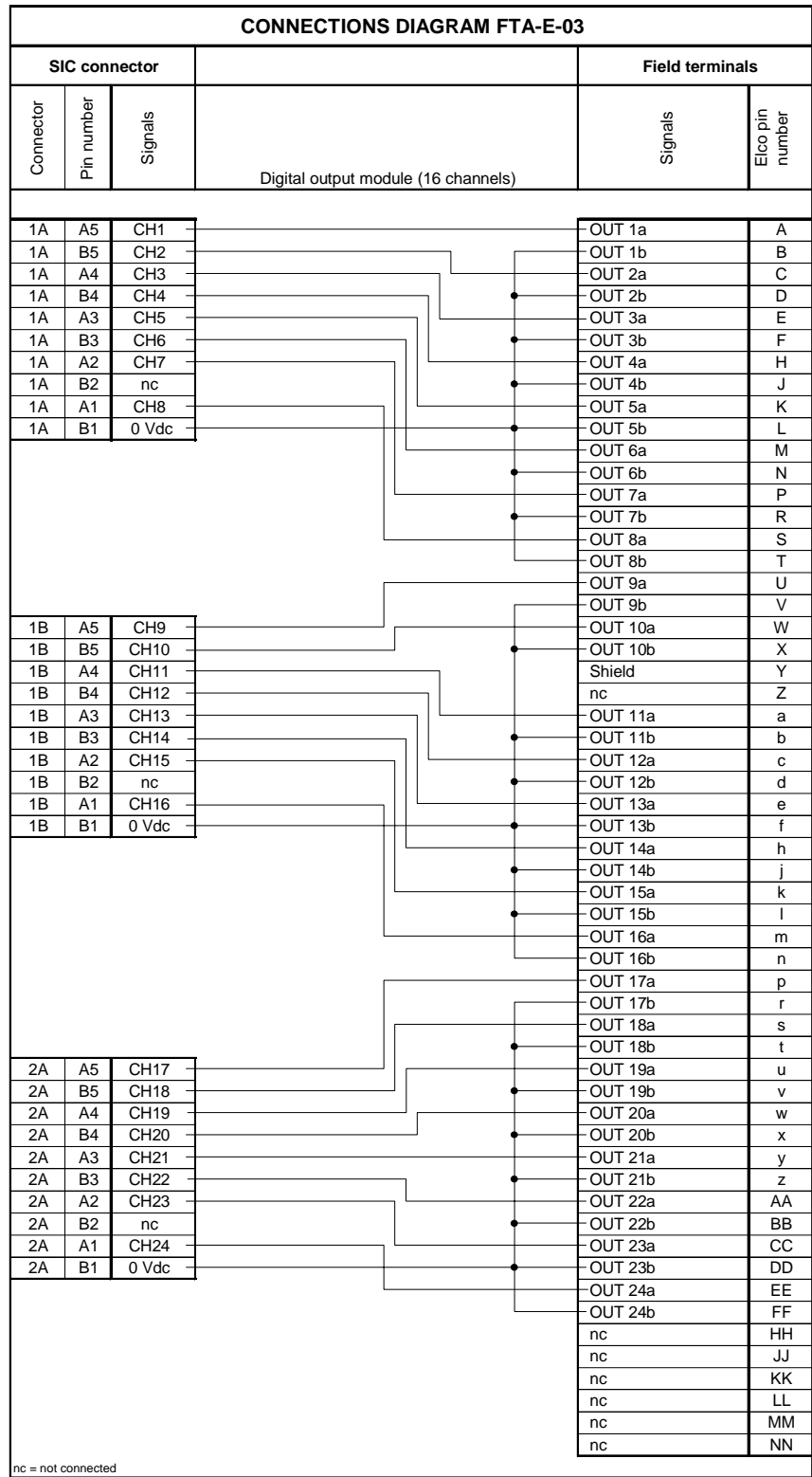


Figure 2 Connections diagram  
(for 16-channel digital output modules)



## Connections diagram

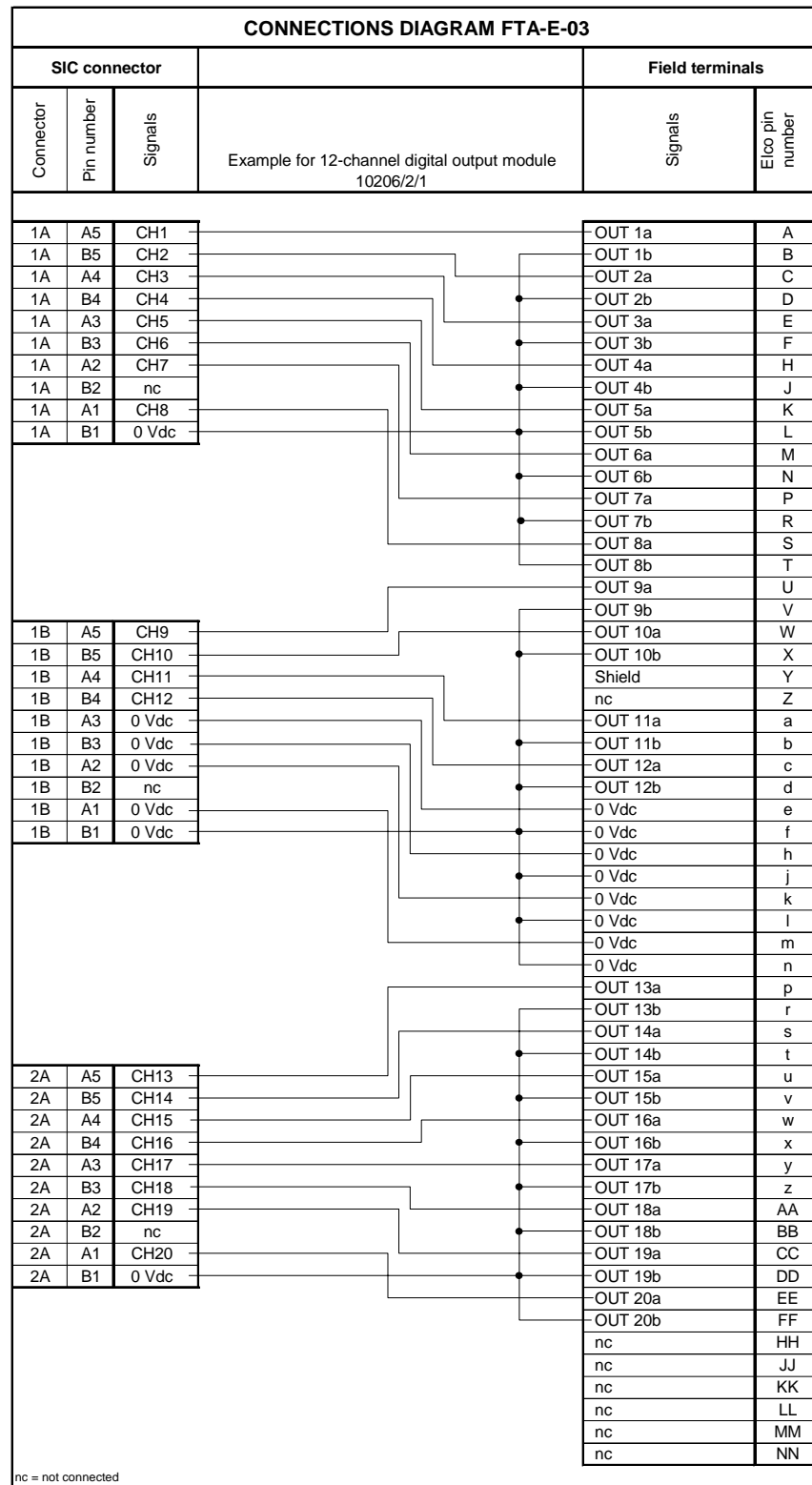


Figure 3 Connections diagram  
(example for 12-channel digital output module 10206/2/1)



## Technical data

The FTA-E-03 module has the following specifications:

<b>General</b>	Type number:	FTA-E-03
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	24 (3 groups of 8)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	2 A
<b>Physical</b>	Module dimensions:	125 x 70 x 55 mm (L x W x H) 4.92 x 2.76 x 2.17 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	126 mm (4.96 in)
<b>Termination</b>	ELCO socket:	8016 series, 56 pins

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## FTA-E-04 Digital output (relay contact) FTA (25 channels)

### Description

The field termination assembly module FTA-E-04 is the interface between the system interconnection cables (SIC) and the external field wiring (on E-56 ELCO).

Twenty-five channels (separated into five sets of five channels) can be connected to the FTA-E-04 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The five SIC connectors are marked '1A', '1B', '2A', '2B' and '3A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails.

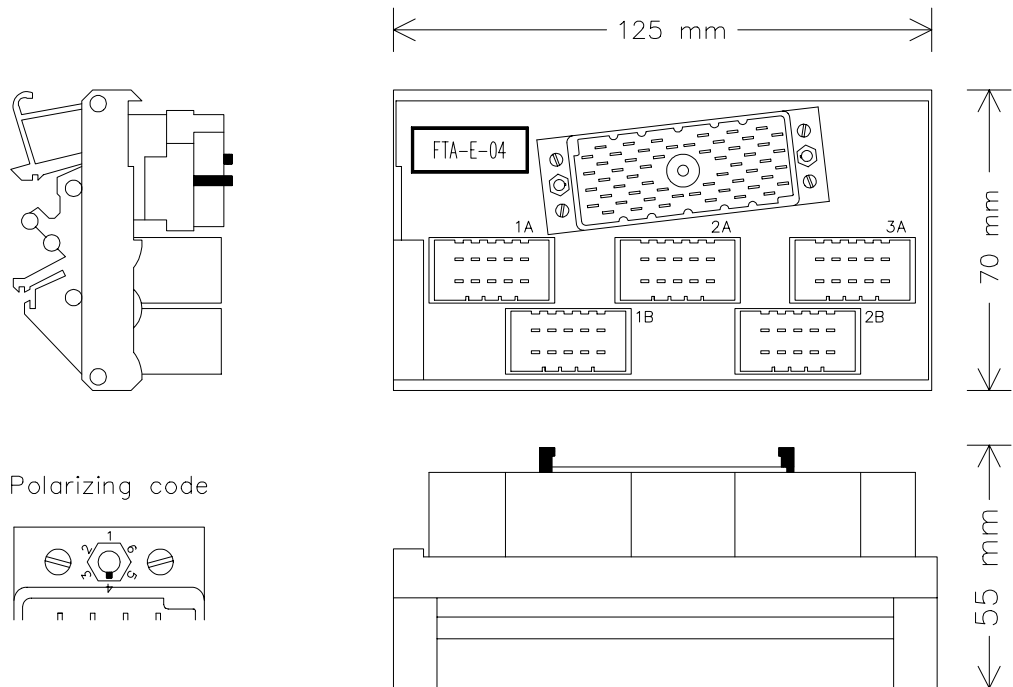


Figure 1 Mechanical layout



---

The polarizing notches of the ELCO socket can be set to any of six positions per side (factory-set at position 4). Changing the polarization requires removal of the FTA from the DIN EN rail and the use of a polarizing tool, make ELCO (part no. 06 1989 02).

The ELCO socket has guide pins and socket gills to ensure correct alignment when mating.

---

## **Applications**

For details on applications and connection options for the FTA-E-04 module refer to the 'SIC to FTA applications' data sheet.

---





## Connections diagram

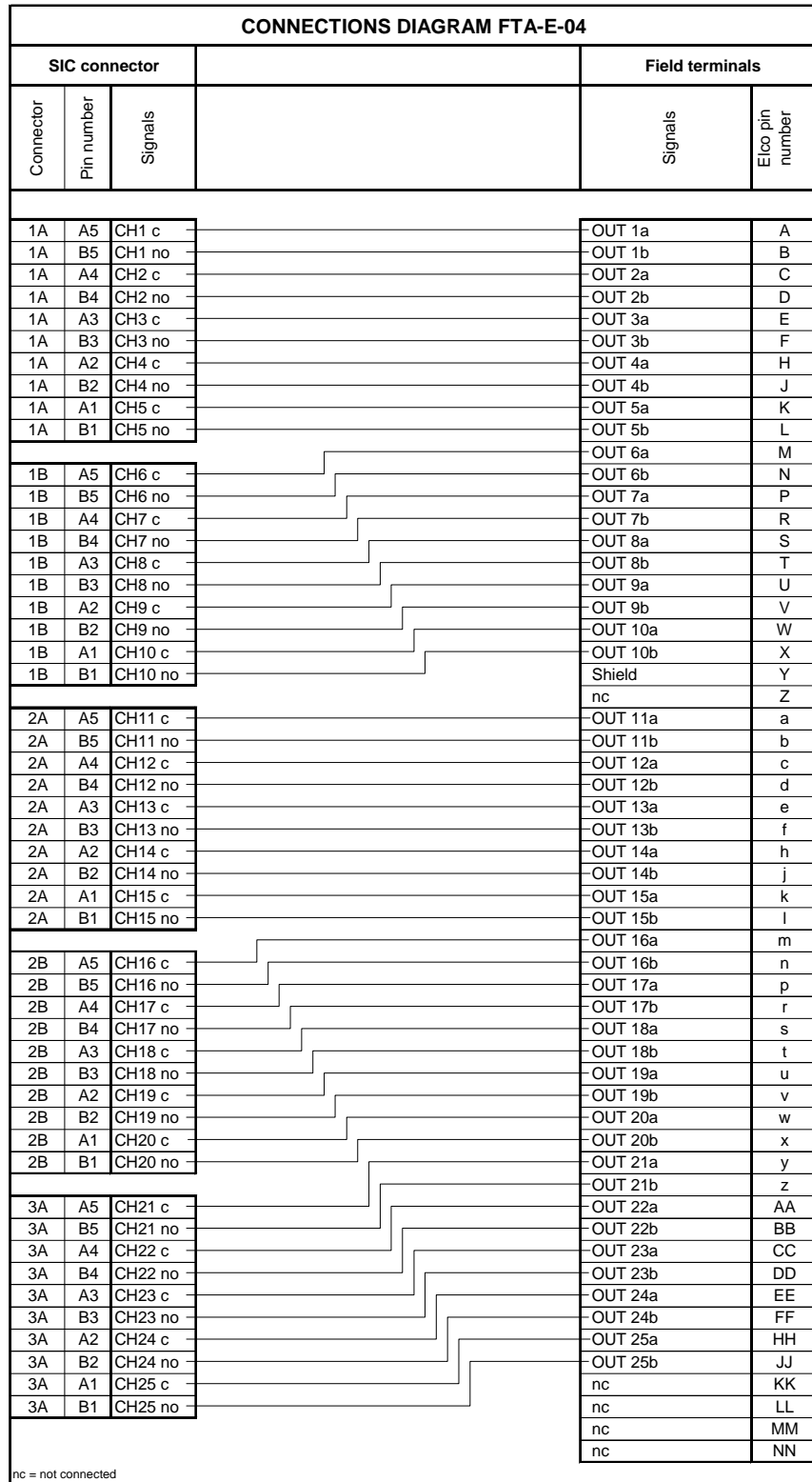


Figure 2 Connections diagram



## Technical data

The FTA-E-04 module has the following specifications:

<b>General</b>	Type number:	FTA-E-04
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	25 (5 groups of 5)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	2 A
<b>Physical</b>	Module dimensions:	125 x 70 x 55 mm (L x W x H) 4.92 x 2.76 x 2.17 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	126 mm (4.96 in)
<b>Termination</b>	ELCO socket:	8016 series, 56 pins

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## FTA-E-05 Active digital output (relay) FTA (25 channels)

### Description

The field termination assembly module FTA-E-05 is the interface between the system interconnection cables (SIC) and the external field wiring (on E-56 ELCO).

Twenty-five potential-free relay contact output channels (separated into five groups of five channels) can be connected to the FTA-E-05 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The five SIC connectors are marked '1A', '1B', '2A', '2B' and '3A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails.

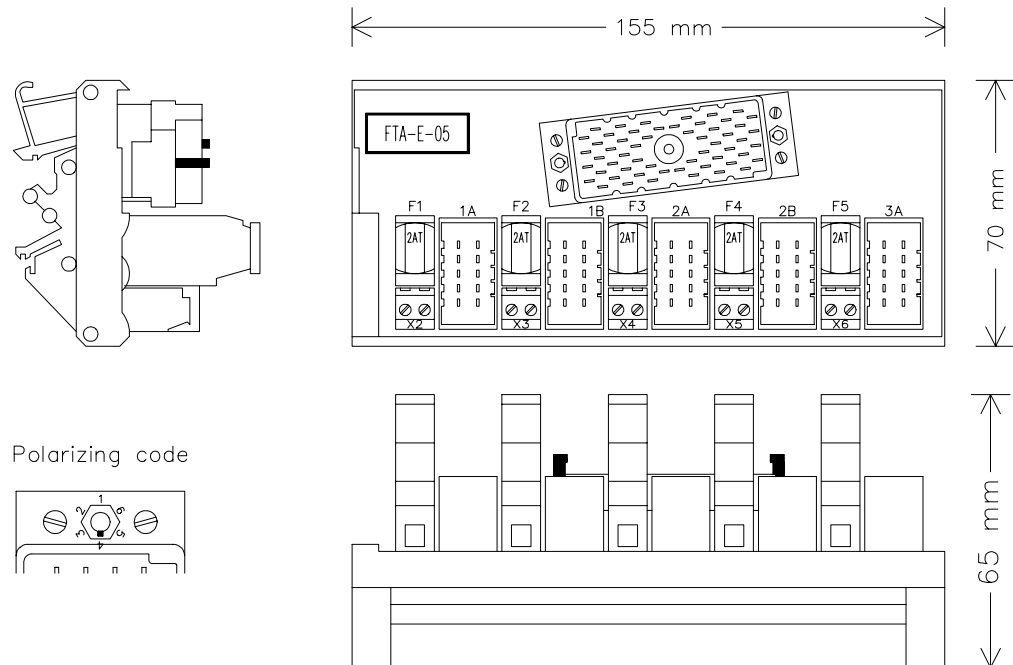


Figure 1 Mechanical layout



Each group has a fuse (2 A) and a screw terminal pair for external power. This way the potential-free relay contacts of 10208/2/1 modules can be used as powering outputs to the field.

The polarizing notches of the ELCO socket can be set to any of six positions per side (factory-set at position 4). Changing the polarization requires removal of the FTA from the DIN EN rail and the use of a polarizing tool, make ELCO (part no. 06 1989 02). The ELCO socket has guide pins and socket gills to ensure correct alignment when mating.

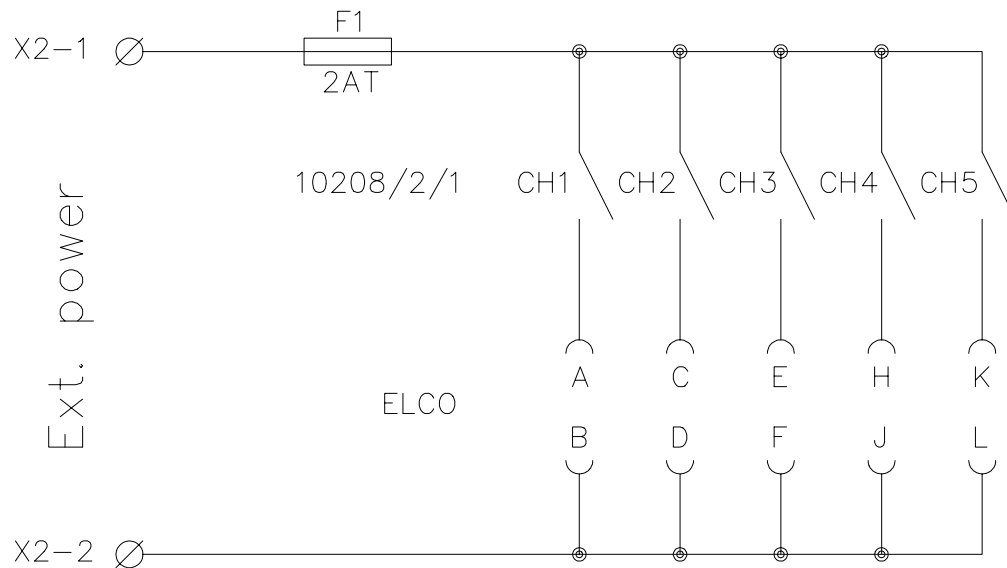


Figure 2 Schematic diagram of one group

## Applications

For details on applications and connection options for the FTA-E-05 module refer to the 'SIC to FTA applications' data sheet.



## Connections diagram

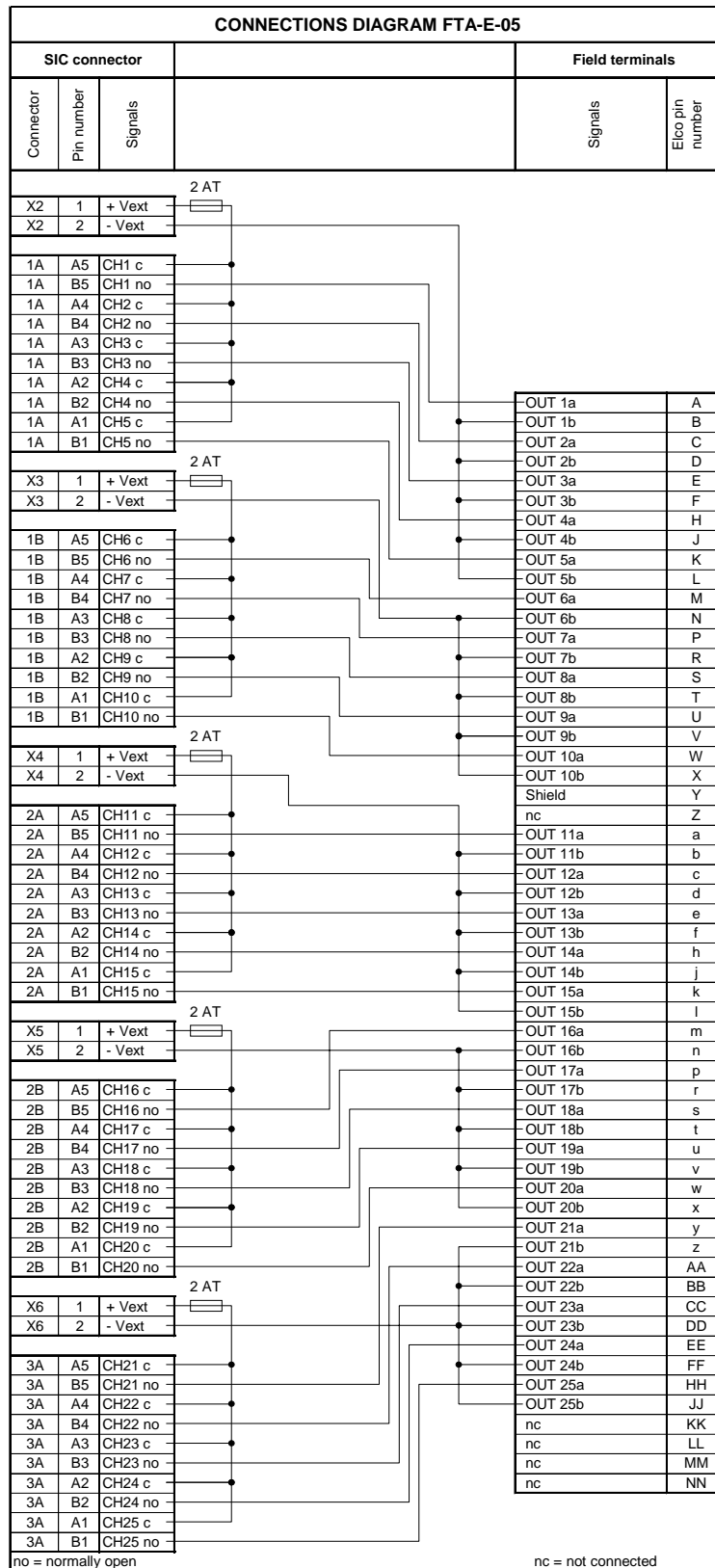


Figure 3 Connections diagram



## Technical data

The FTA-E-05 module has the following specifications:

<b>General</b>	Type number:	FTA-E-05
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	25 (5 groups of 5)
	Maximum voltage:	30 Vac / 36 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
<b>Fuses</b>	Rating:	2 AT (slow-acting)
	Dimensions:	5 x 20 mm (0.2 x 0.79 in) or 5 x 25 mm(0.2 x 0.98 in)
<b>Physical</b>	Module dimensions:	155 x 70 x 65 mm (L x W x H) 6.10 x 2.76 x 2.56 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	156 mm (6.14 in)
<b>Termination</b>	ELCO socket:	8016 series, 56 pins

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## FTA-T-01 Fail-safe digital input FTA (24/48/60 Vdc, 24 channels)

### Description

The field termination assembly module FTA-T-01 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals).

Twenty-four channels (separated into three groups of eight channels with a 250 mA fuse in the common +) can be connected to the FTA-T-01 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The three SIC connectors are marked '1A', '1B' and '2A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

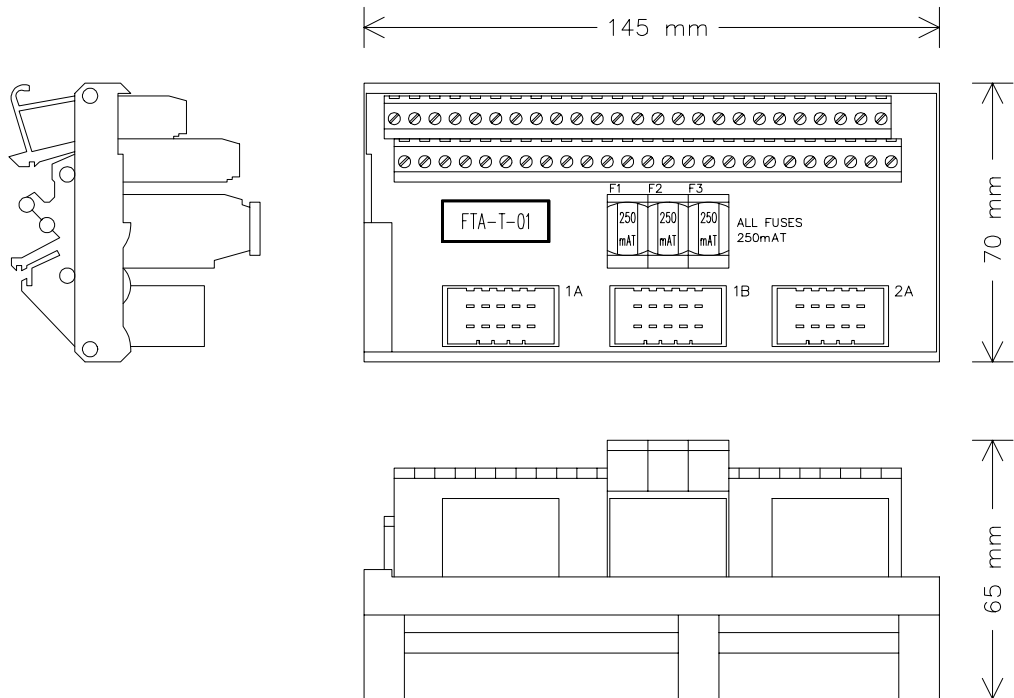


Figure 1 Mechanical layout

### Applications

For details on applications and connection options for the FTA-T-01 module refer to the 'SIC to FTA applications' data sheet.



## Connections

The connections diagram of the FTA-T-01 module is as follows:

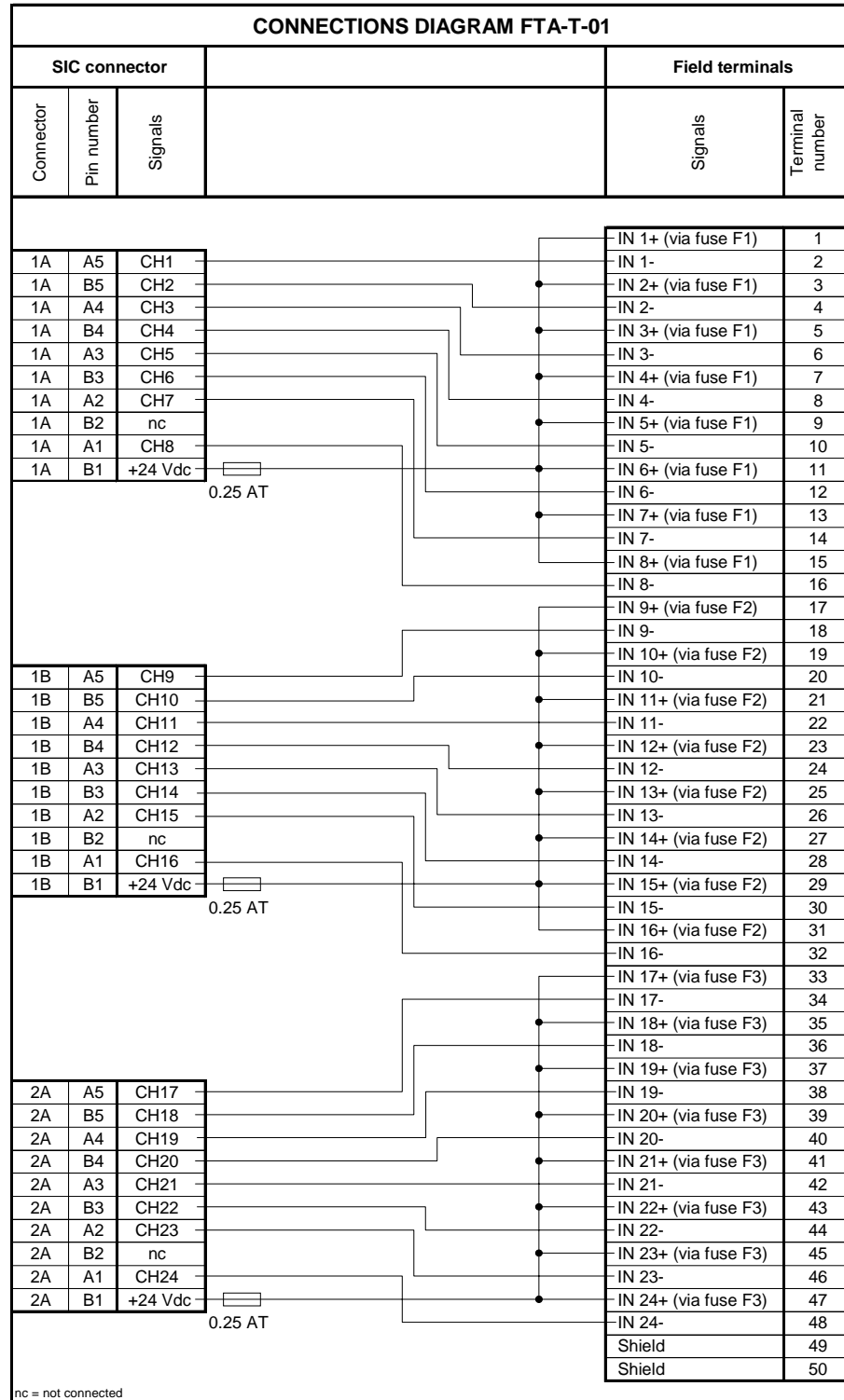


Figure 2 Connections diagram





## Technical data

The FTA-T-01 module has the following specifications:

<b>General</b>	Type number:	FTA-T-01
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	24 (3 groups of 8)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
<b>Physical</b>	Module dimensions:	145 x 70 x 65 mm (L x W x H) 5.71 x 2.76 x 2.56 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	146 mm (5.75 in)
<b>Fuse</b>	Rating:	250 mA <sub>T</sub> (slow-acting)
	Dimensions:	5 x 20 mm (0.2 x 0.79 in) or 5 x 25 mm (0.2 x 0.98 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-02

## Fail-safe digital output FTA (24/48/60 Vdc, 24 channels)

### Description

The field termination assembly module FTA-T-02 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals).

Twenty-four channels (separated into six groups of four channels) can be connected to the FTA-T-02 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The six SIC connectors are marked '1A', '1B', '2A', '2B', '3A' and '3B' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

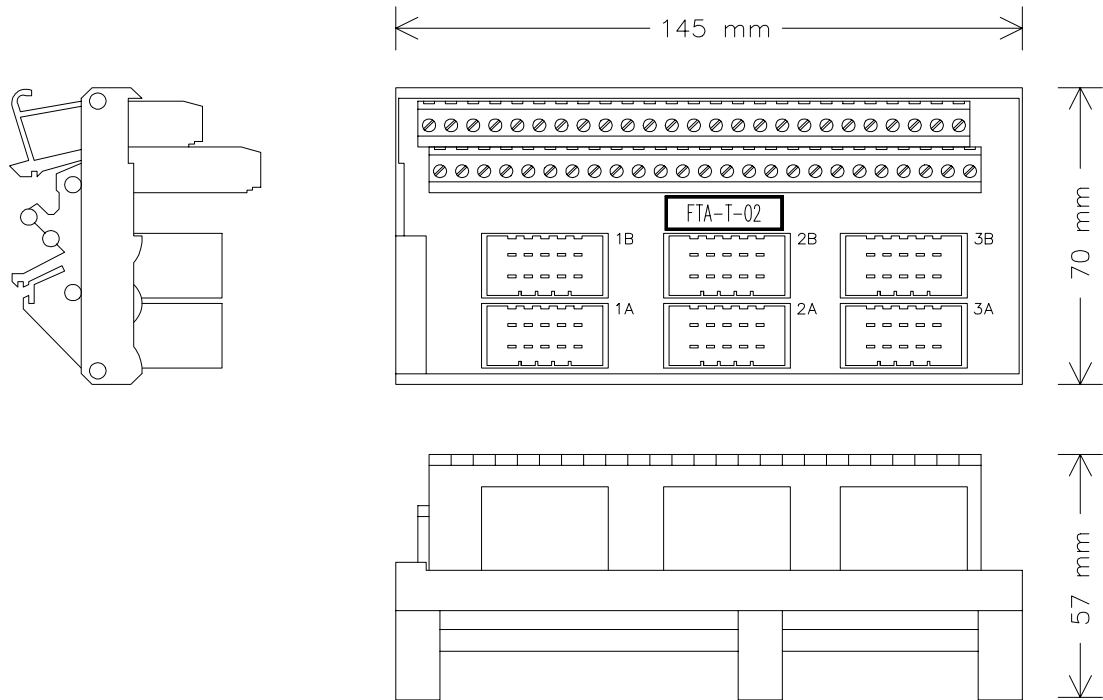


Figure 1 Mechanical layout

### Applications

For details on applications and connection options for the FTA-T-02 module refer to the 'SIC to FTA applications' data sheet.



## Connections

The connections diagram of the FTA-T-02 module is as follows:

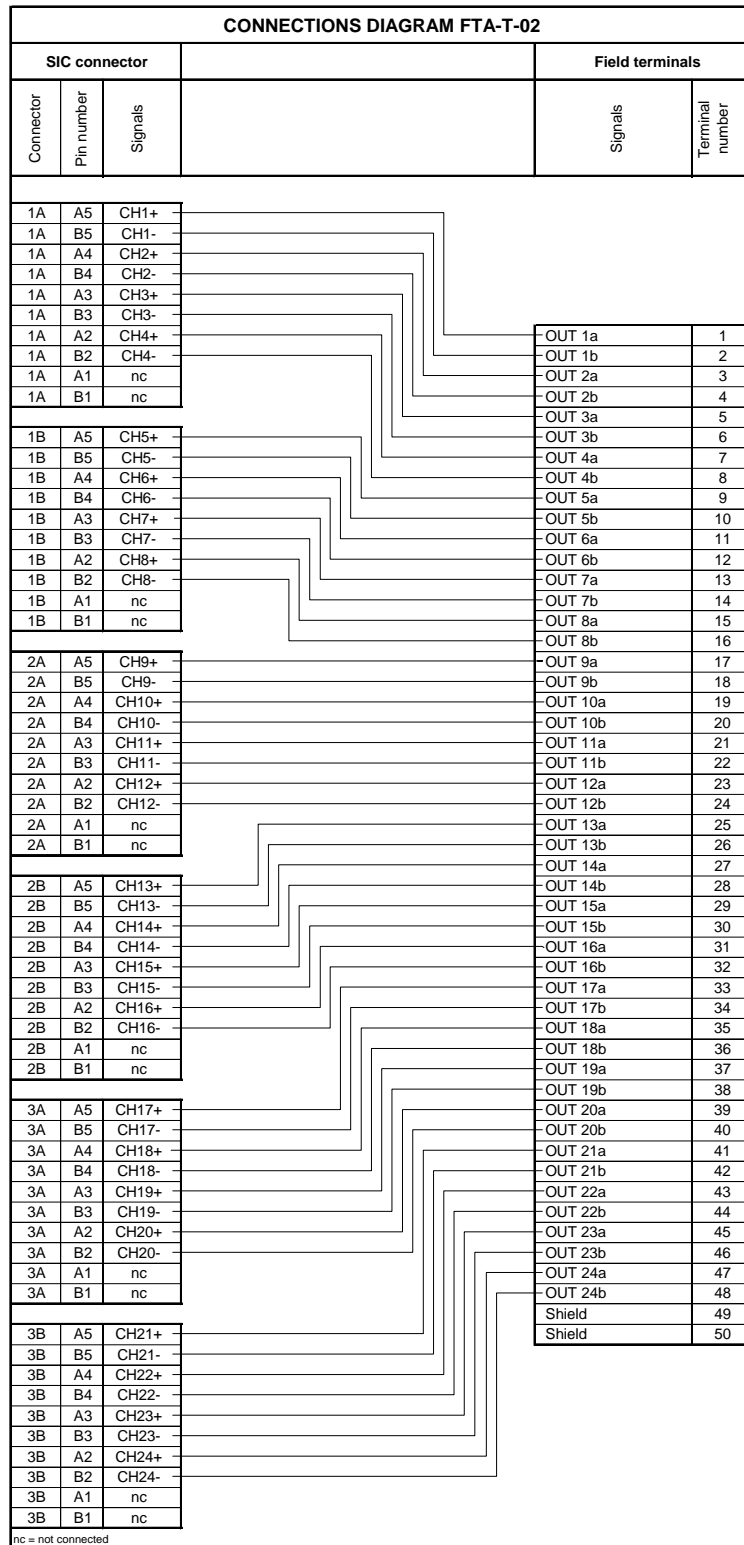


Figure 2 Connections diagram



## Technical data

The FTA-T-02 module has the following specifications:

<b>General</b>	Type number:	FTA-T-02
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	24 (6 groups of 4)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	2 A
<b>Physical</b>	Module dimensions:	145 x 70 x 57 mm (L x W x H) 5.71 x 2.76 x 2.24 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	146 mm (5.75 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-03

## Digital output FTA (24 Vdc, 24 channels)

### Description

The field termination assembly module FTA-T-03 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals).

Twenty-four channels (separated into three groups of eight channels with a common –) can be connected to the FTA-T-03 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The three SIC connectors are marked '1A', '1B' and '2A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

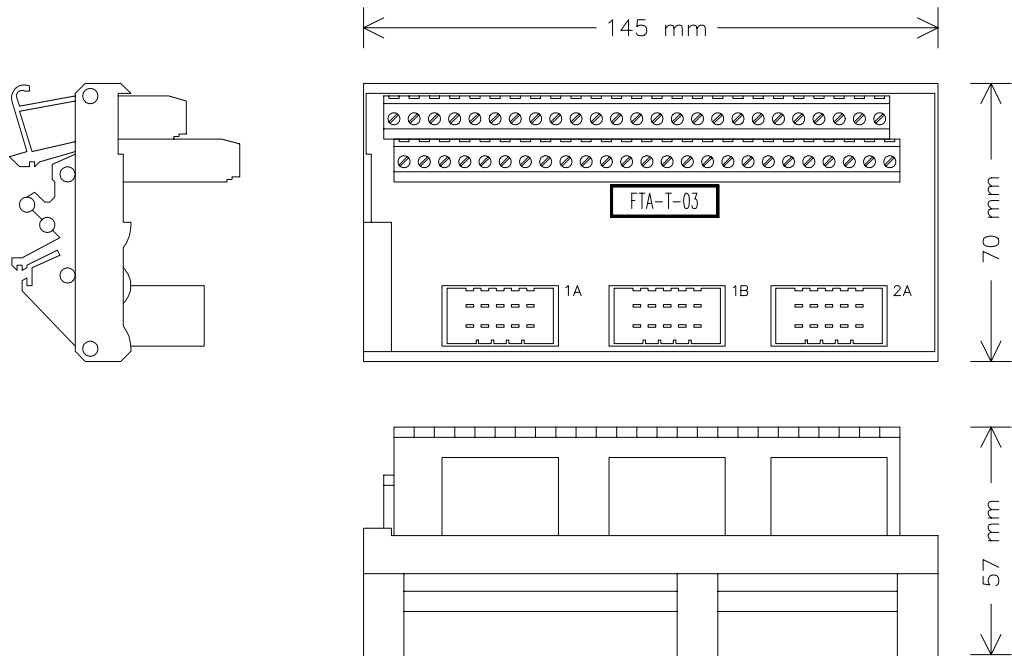


Figure 1 Mechanical layout



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## Applications

For details on applications and connection options for the FTA-T-03 module refer to the 'SIC to FTA applications' data sheet.

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## Connections diagrams

Figure 2 and Figure 3 on the next two pages show the connections diagrams of the FTA-T-03 module.

Figure 2 shows the connections diagram for 16-channel digital output modules. Figure 3 is a connection example for the 12-channel digital output module 10206/2/1.





## Connections diagram

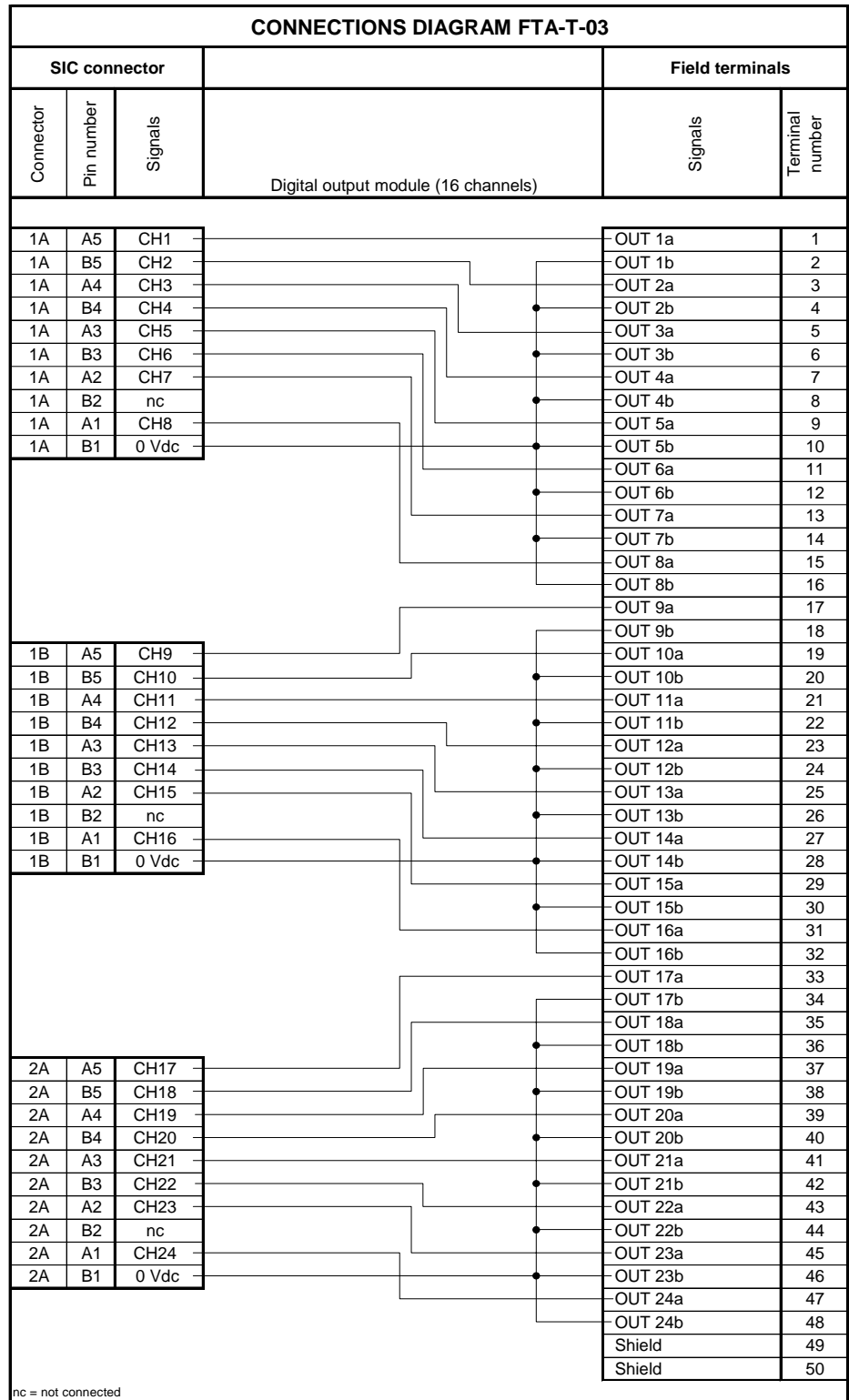


Figure 2 Connections diagram  
(for 16-channel digital output modules)



## Connections diagram

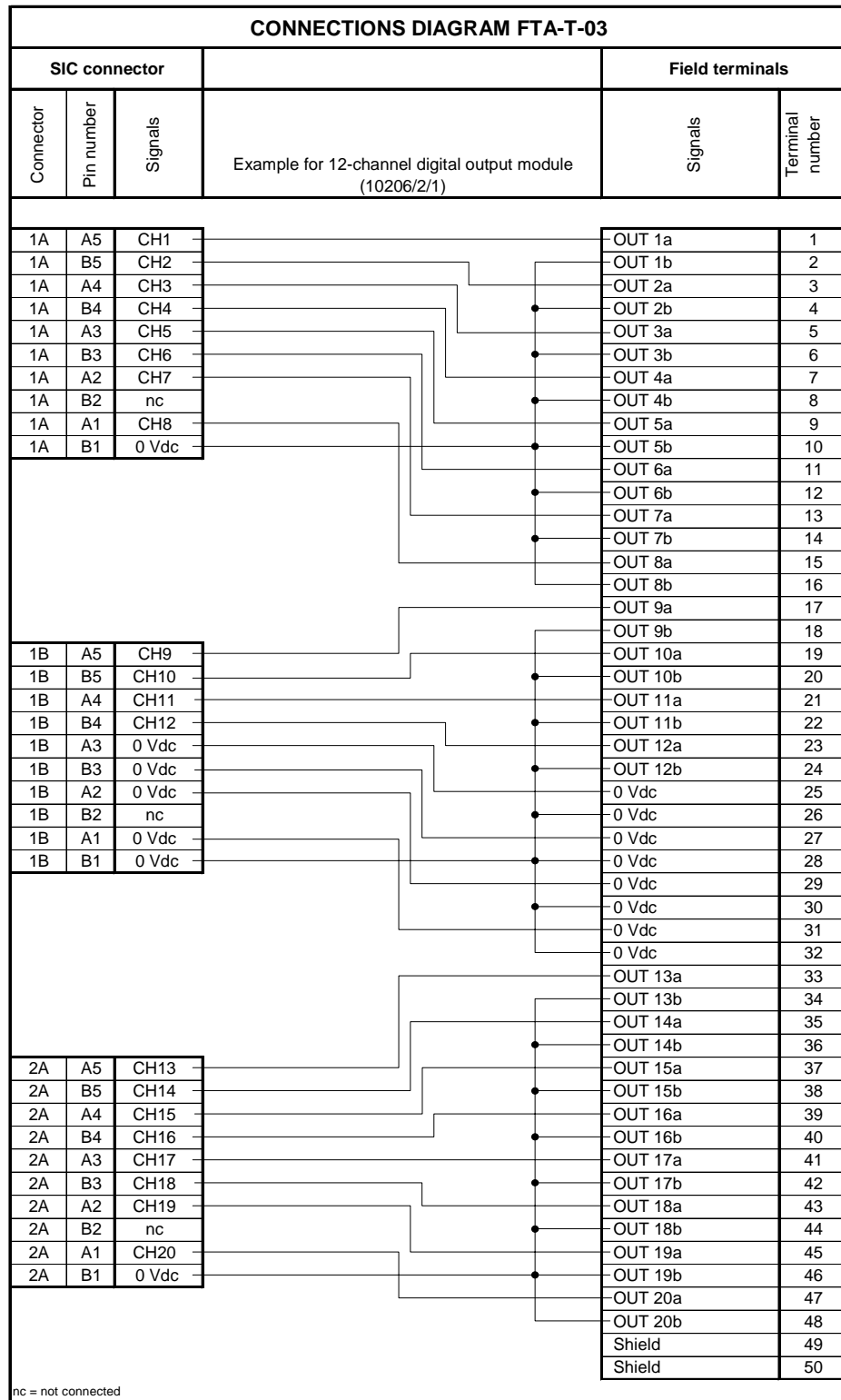


Figure 3 Connections diagram  
(example for 12-channel digital output module 10206/2/1)



## Technical data

The FTA-T-03 module has the following specifications:

<b>General</b>	Type number:	FTA-T-03
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	24 (3 groups of 8)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	2 A
<b>Physical</b>	Module dimensions:	145 x 70 x 57 mm (L x W x H) 5.71 x 2.76 x 2.24 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	146 mm (5.75 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-04 Digital output (relay contact) FTA (25 channels)

### Description

The field termination assembly module FTA-T-04 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals).

Twenty-five channels (separated into five groups of five channels) can be connected to the FTA-T-04 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The five SIC connectors are marked '1A', '1B', '2A', '2B' and '3A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

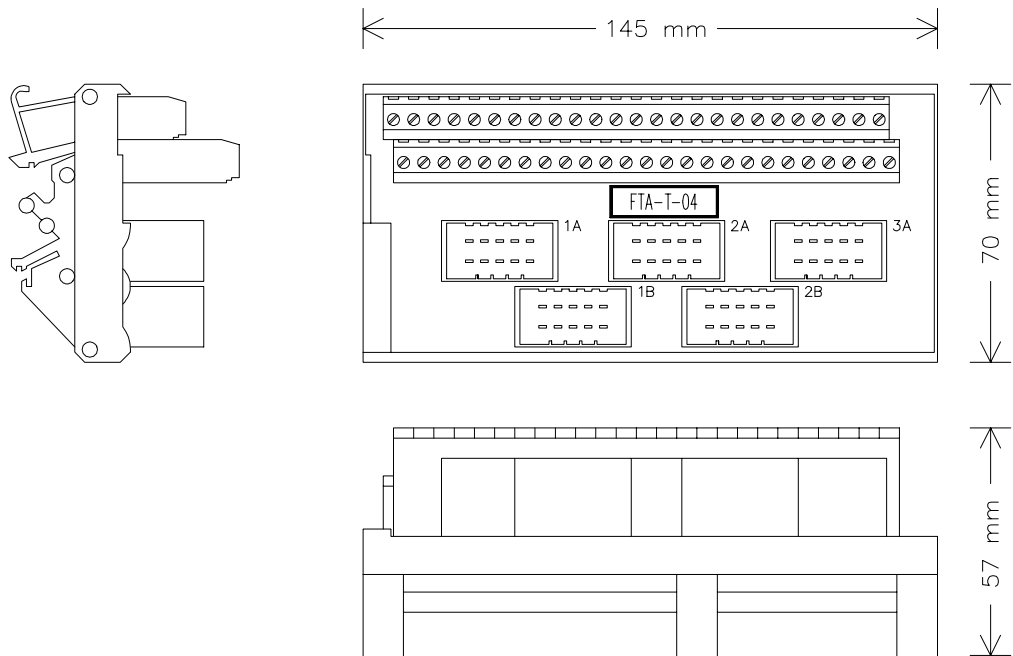


Figure 1 Mechanical layout

### Applications

For details on applications and connection options for the FTA-T-04 module refer to the 'SIC to FTA applications' data sheet.



## Connections

The connections diagram of the FTA-T-04 module is as follows:

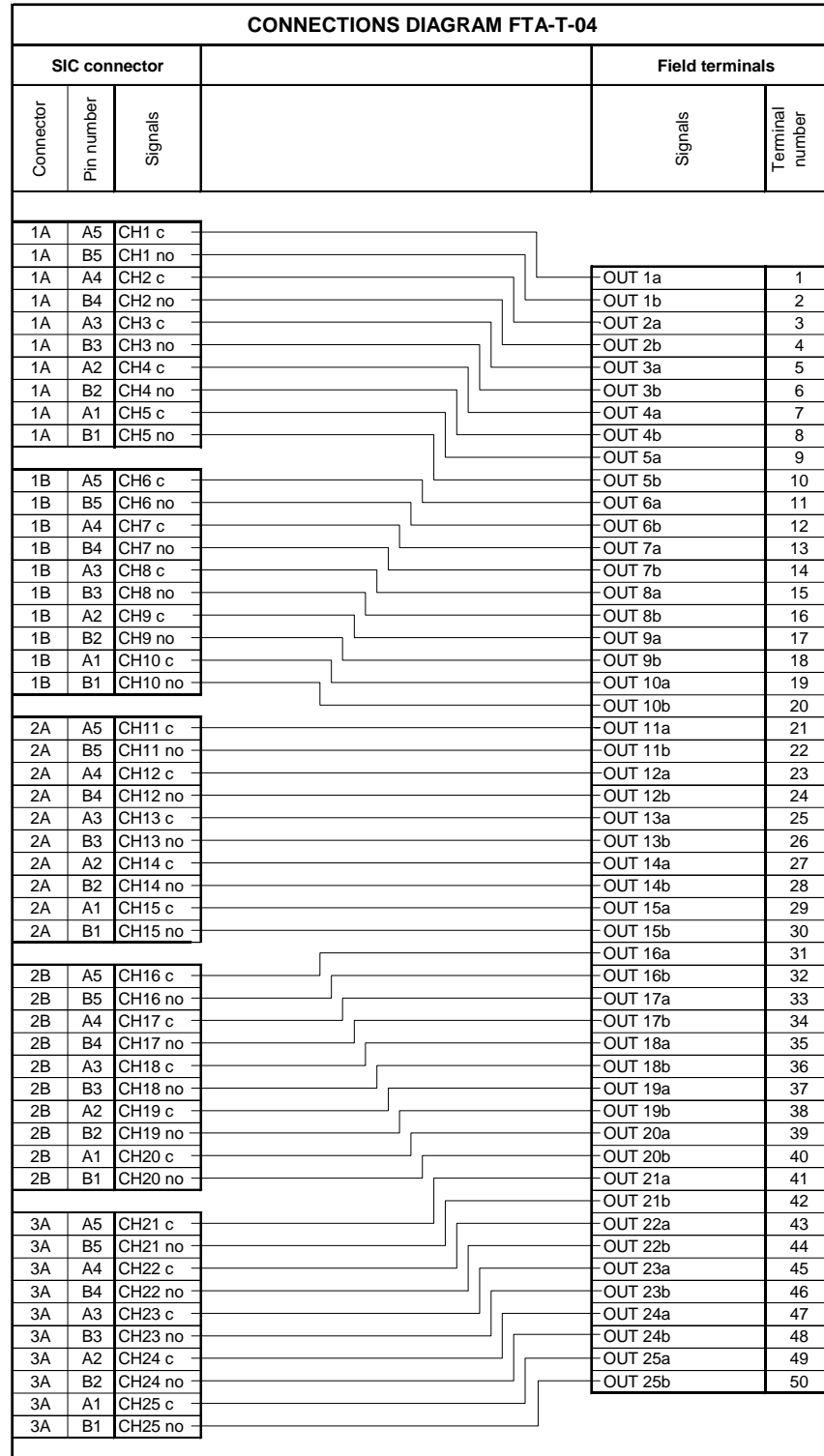


Figure 2 Connections diagram



## Technical data

The FTA-T-04 module has the following specifications:

<b>General</b>	Type number:	FTA-T-04
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	25 (5 groups of 5)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	2 A
<b>Physical</b>	Module dimensions:	145 x 70 x 57 mm (L x W x H) 5.71 x 2.76 x 2.24 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	146 mm (5.75 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-05

## Fail-safe digital output FTA (24 Vdc, 12 channels)

### Description

The field termination assembly module FTA-T-05 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals).

Twelve channels (separated into six groups of two channels) can be connected to the FTA-T-05 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The six SIC connectors are marked '1A', '1B', '2A', '2B', '3A' and '3B' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

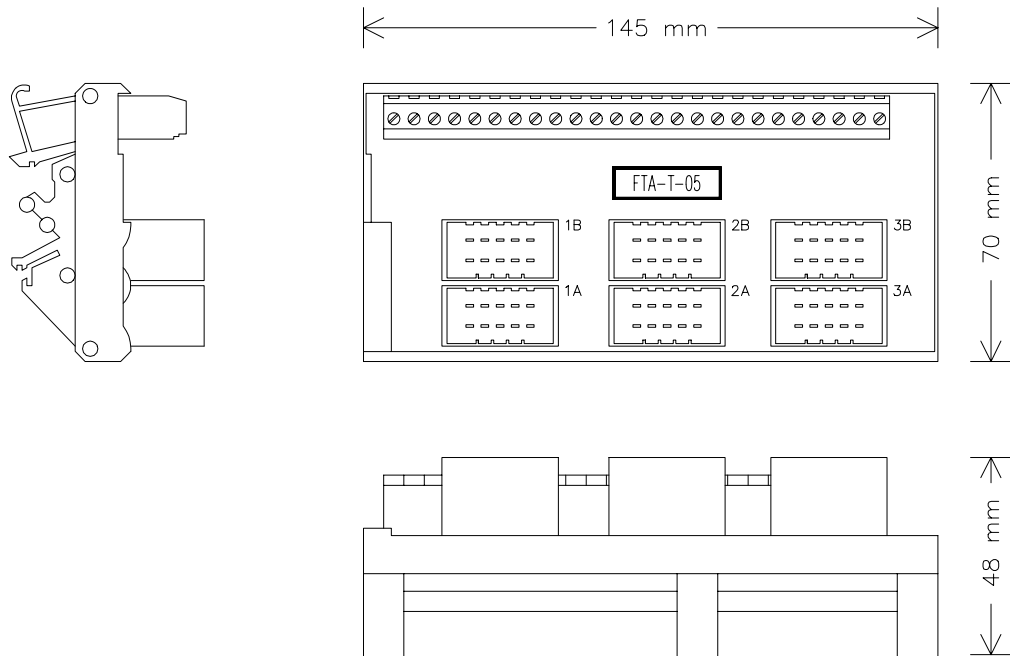


Figure 1 Mechanical layout

### Applications

For details on applications and connection options for the FTA-T-05 module refer to the 'SIC to FTA applications' data sheet.



## Connections

The connections diagram of the FTA-T-05 module is as follows:

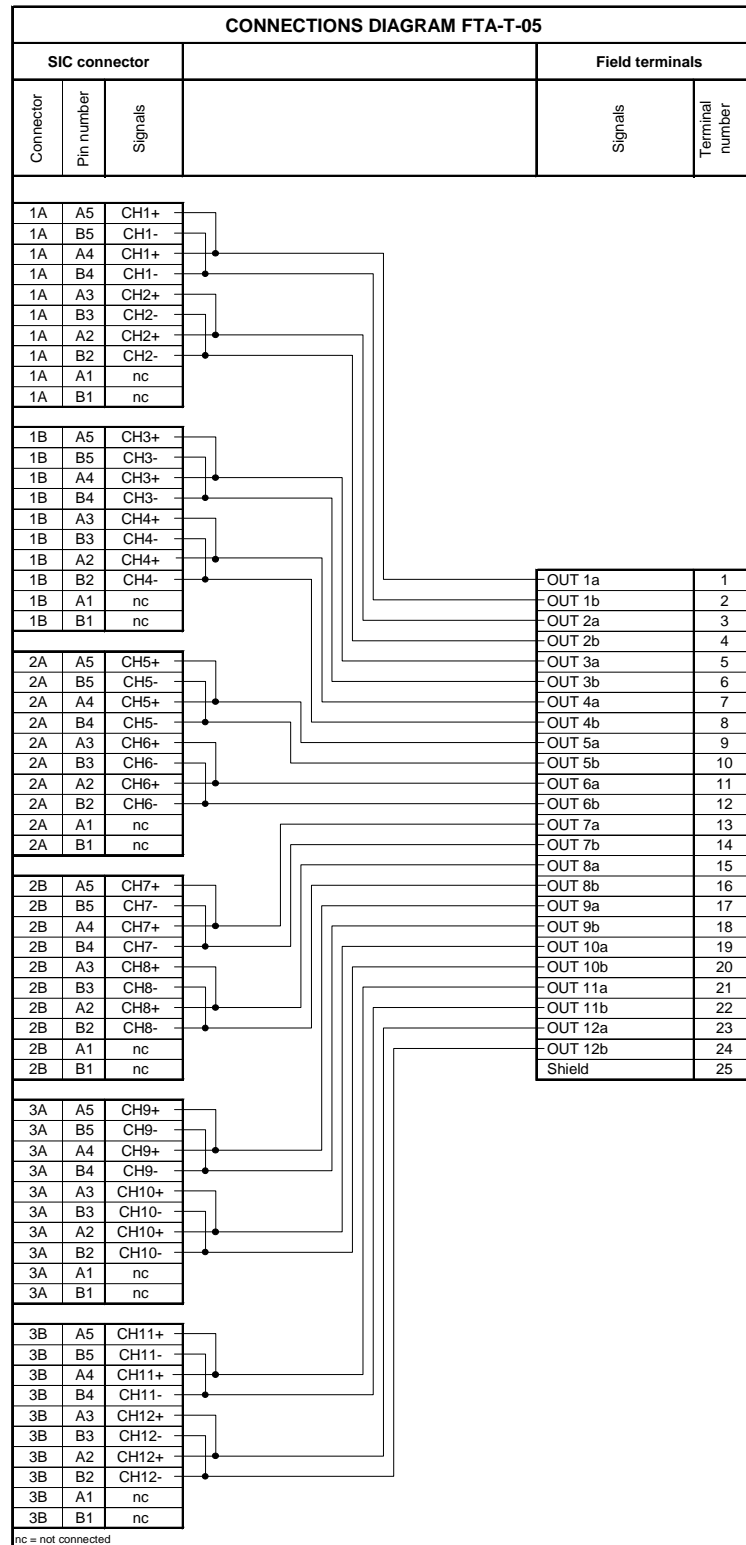


Figure 2 Connections diagram



## Technical data

The FTA-T-05 module has the following specifications:

<b>General</b>	Type number:	FTA-T-05
	Approvals:	CE, UL
<b>Power</b>	Number of channels:	12 (6 groups of 2)
	Maximum voltage:	36 Vac / 50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 125 Vac / 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	3 A
<b>Physical</b>	Module dimensions:	145 x 70 x 48 mm (L x W x H) 5.71 x 2.76 x 1.89 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	146 mm (5.75 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-06 Fail-safe active digital input FTA (115 Vac, 8 channels)

### Description

The field termination assembly module FTA-T-06 is an eight-channel fail-safe 115 Vac input converter module which supplies the AC voltage to the field contacts (potential-free). The module has one pair of terminals to connect the external excitation voltage for all eight channels.

Each channel converts a 115 Vac input signal to a 24 Vdc input signal which can be connected to the 24 Vdc fail-safe input module 10101/2/1, thus creating a fail-safe 115 Vac input for the FSC system.

Eight channels can be connected to the FTA-T-06 module via a system interconnection cable (SIC). This cable is plugged into the SIC connector on the FTA module. The SIC connector is marked '1A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

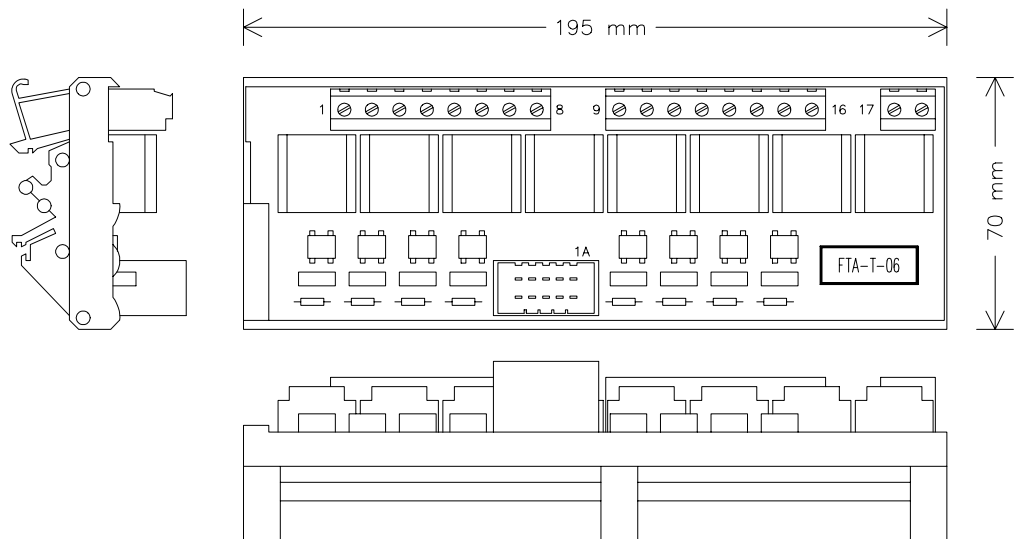


Figure 1 Mechanical layout

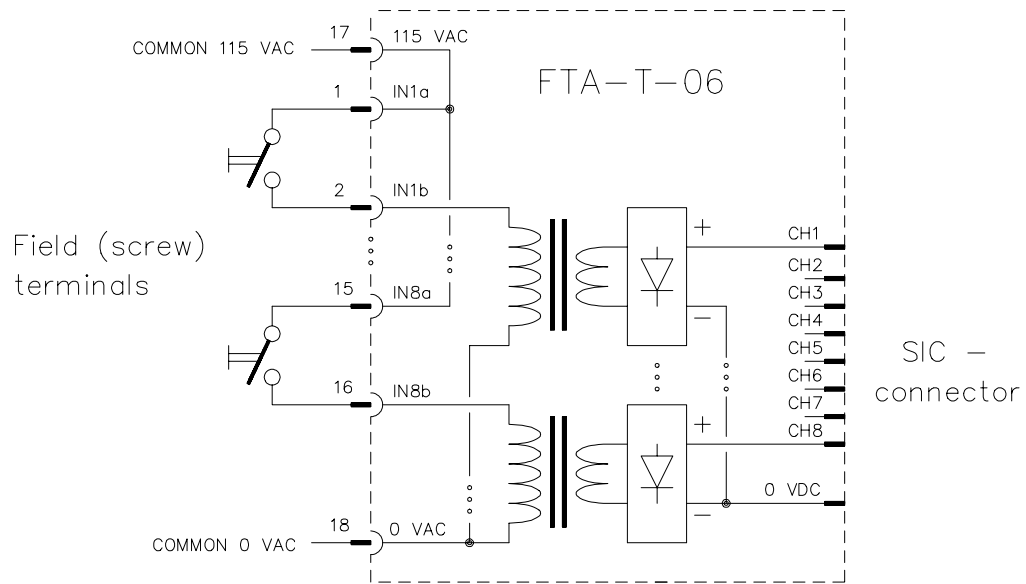


Figure 2 Schematic diagram

## Applications

For details on applications and connection options for the FTA-T-06 module refer to the 'SIC to FTA applications' data sheet.

## Field cable lengths

High-impedance AC inputs – like the inputs on this FTA – have a limited capability of handling the wire capacitance of standard multicore field cables. The wire capacitance of the field cable acts as a shunt impedance over the field contact (see Figure 3).

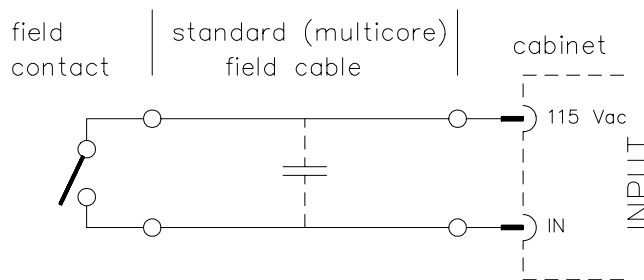


Figure 3 Standard (multicore) field cable



When the current through this shunt impedance exceeds the maximum 'LOW' current, the input may be activated by this shunt impedance, thus disabling the input function (by keeping the input activated continuously, i.e. ON). Every AC input will have a maximum 'LOW' current that it can handle.

The maximum allowable cable length depends on the maximum 'LOW' current (e.g. 1.0 mA), the typical cable capacitance (e.g. 120 pF/m), the maximum supply voltage (e.g. 130 Vac) and the supply frequency (e.g. 60 Hz).

The maximum length (in meters) can be calculated using the following formula:

$$L_{\max} = \frac{I_{\text{low}}}{V_{\max} * 2 * \pi * f * C_{\text{typ}}}$$

where:

$L_{\max}$  = maximum allowable cable length

$I_{\text{low}}$  = maximum 'LOW' current

$V_{\max}$  = maximum supply voltage

$f$  = supply frequency

$C_{\text{typ}}$  = typical cable capacitance

As an example, we will calculate the maximum field cable length (in meters) using the values mentioned above:

$$L_{\max} = \frac{(1.0 * 10^{-3})}{130 * 2 * \pi * 60 * (120 * 10^{-12})} = 170 \text{ m}$$

In this example, the maximum allowable field cable length is 170 meters (186 yards).

### Solutions:

The field cable length limit can be eliminated by using field cables with wires that are shielded separately (see Figure 4).

The only (relevant) capacitance of the input wire is to the shield (0 Vac or earth) and this will not activate a 'LOW' input.

In case of shielded wire pairs, the second wire of the pair must be:

1. left unconnected, or
2. connected to the same input signal, or
3. connected to 0 Vac.

The 115 Vac wire can be used for more than one input.

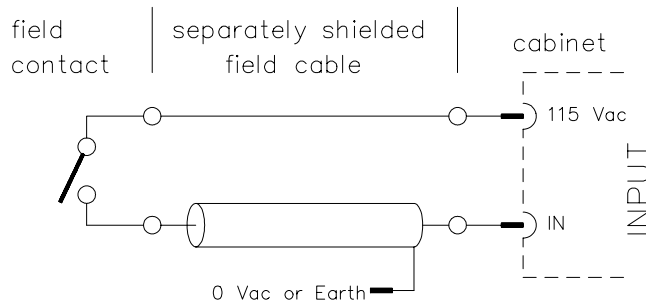


Figure 4 Field cable with separately shielded wires

In practice, a mix of wiring methods may be used. For example, use a cable with shielded wires between the control cabinet and a distribution box close to the process. This cable may be long, e.g. 3 km (1.8 mi). Then use a standard (multicore) cable for the connection between the distribution box and the field contact. This cable length is limited to the value calculated using the formula mentioned above.

## Connections

The connections diagram of the FTA-T-06 module is as follows:

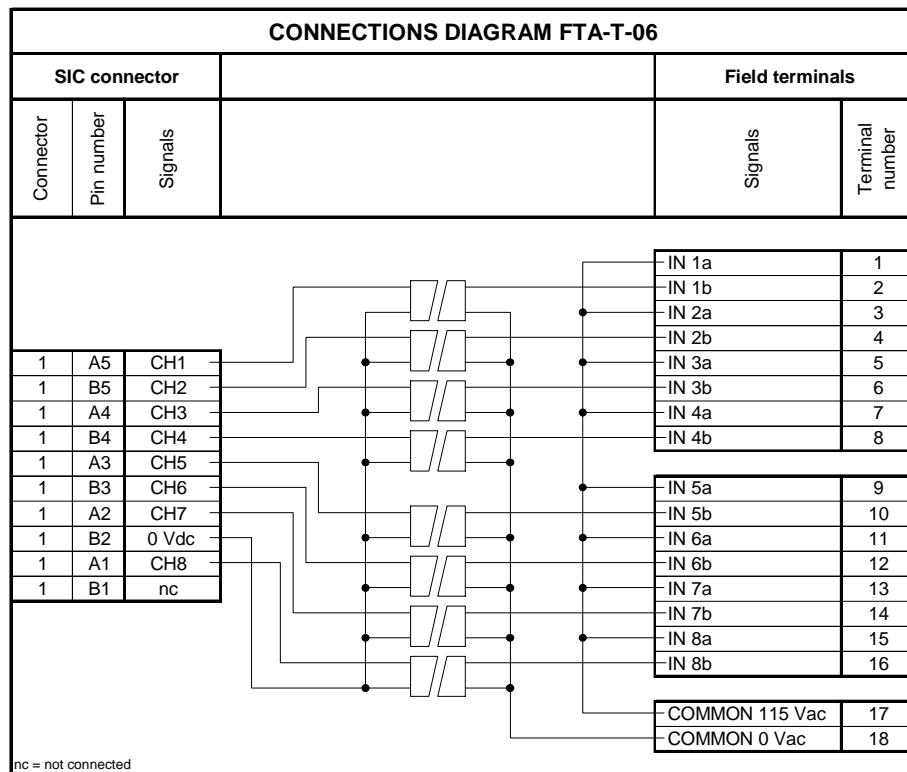


Figure 5 Connections diagram





## Technical data

The FTA-T-06 module has the following specifications:

<b>General</b>	Type number:	FTA-T-06
	Approvals:	CE, TÜV, UL
<b>Input</b>	Number of input channels:	8
	Input voltage:	115 Vac, $\pm 15\%$
	Input frequency:	50-60 Hz
	Input current:	$< 16$ mA at 115 Vac
	Input LOW:	$I \leq 1$ mA (see 'Field cable length' section in this data sheet)
<b>Physical</b>	Module dimensions:	195 x 70 x 48 mm (L x W x H) 7.68 x 2.76 x 1.89 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	196 mm (7.72 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-07 Fail-safe passive digital input FTA (115 Vac, 8 channels)

### Description

The field termination assembly module FTA-T-07 is an eight-channel fail-safe 115 Vac input converter module.

Each channel converts an externally supplied 115 Vac input signal to a 24 Vdc input signal which can be connected to the 24 Vdc fail-safe input module 10101/2/1, thus creating a fail-safe 115 Vac input for the FSC system.

Eight channels can be connected to the FTA-T-07 module via a system interconnection cable (SIC). This cable is plugged into the SIC connector on the FTA module. The SIC connector is marked '1A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

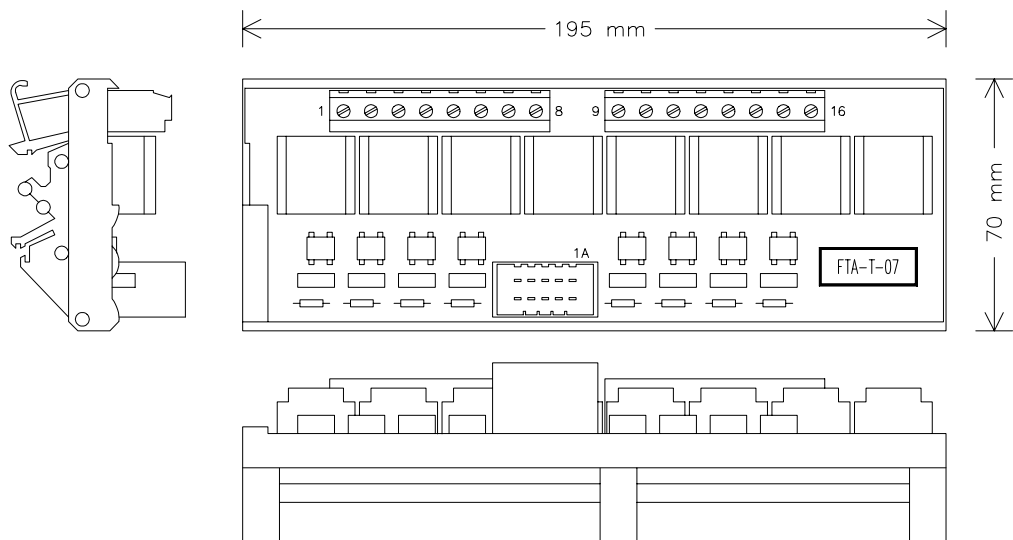


Figure 1 Mechanical layout

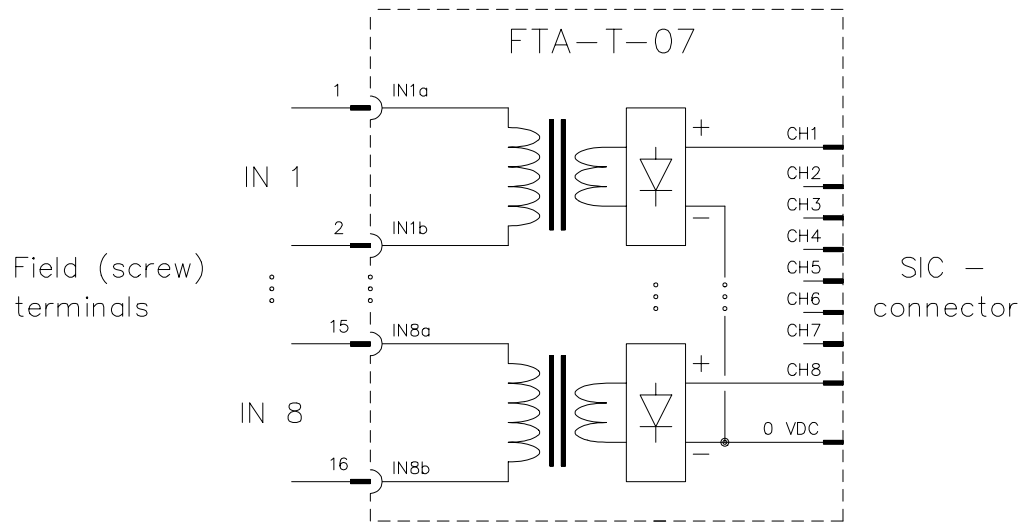


Figure 2 Schematic diagram

## Applications

For details on applications and connection options for the FTA-T-07 module refer to the 'SIC to FTA applications' data sheet.

## Field cable lengths

High-impedance AC inputs – like the inputs on this FTA – have a limited capability of handling the wire capacitance of standard multicore field cables. The wire capacitance of the field cable acts as a shunt impedance over the field contact (see Figure 3).

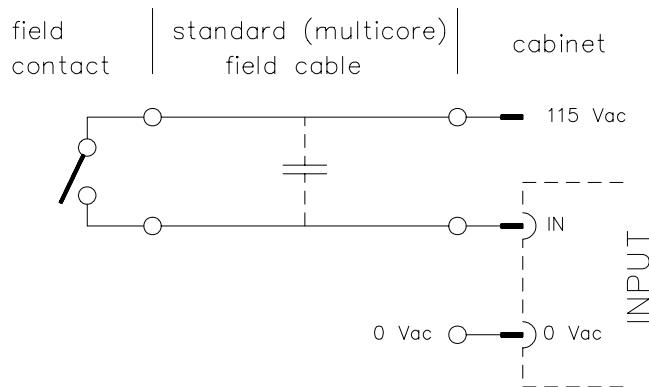


Figure 3 Standard (multicore) field cable



When the current through this shunt impedance exceeds the maximum 'LOW' current, the input may be activated by this shunt impedance, thus disabling the input function (by keeping the input activated continuously, i.e. ON). Every AC input will have a maximum 'LOW' current that it can handle.

The maximum allowable cable length depends on the maximum 'LOW' current (e.g. 1.0 mA), the typical cable capacitance (e.g. 120 pF/m), the maximum supply voltage (e.g. 130 Vac) and the supply frequency (e.g. 60 Hz).

The maximum length (in meters) can be calculated using the following formula:

$$L_{\max} = \frac{I_{\text{low}}}{V_{\max} * 2 * \pi * f * C_{\text{typ}}}$$

where:

$L_{\max}$  = maximum allowable cable length

$I_{\text{low}}$  = maximum 'LOW' current

$V_{\max}$  = maximum supply voltage

$f$  = supply frequency

$C_{\text{typ}}$  = typical cable capacitance

As an example, we will calculate the maximum field cable length (in meters) using the values mentioned above:

$$L_{\max} = \frac{(1.0 * 10^{-3})}{130 * 2 * \pi * 60 * (120 * 10^{-12})} = 170 \text{ m}$$

In this example, the maximum allowable field cable length is 170 meters (186 yards).

### Solutions:

The field cable length limit can be eliminated by using field cables with wires that are shielded separately (see Figure 4).

The only (relevant) capacitance of the input wire is to the shield (0 Vac or earth) and this will not activate a 'LOW' input.

However, this type of cable is rather unusual. Field cables with shielded wire pairs are more commonly used. This allows for two connections methods:

1. Use the method of Figure 4 and leave the second wire of each pair unconnected, or
2. Connect the second wire of each pair to 0 Vac (see Figure 5). The 115 Vac / 0 Vac supply pair can be used for more than one input.

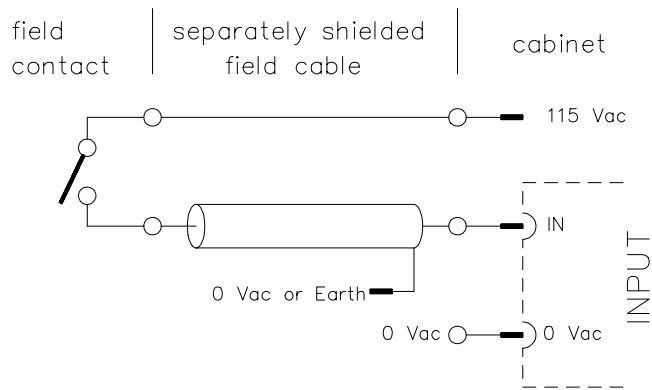


Figure 4 Field cable with separately shielded wires

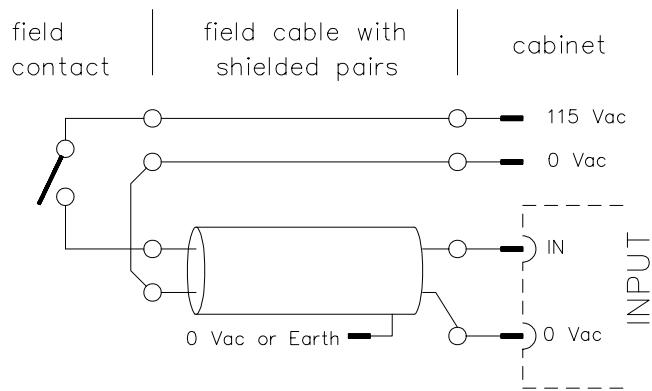


Figure 5 Field cable with shielded pairs

In practice, a mix of wiring methods may be used. For example, use a cable with shielded pairs between the control cabinet and a distribution box close to the process. This cable may be long, e.g. 3 km (1.8 mi). Then use a standard (multicore) cable for the connection between the distribution box and the field contact. This cable length is limited to the value calculated using the formula mentioned above.



## Connections

The connections diagram of the FTA-T-07 module is as follows:

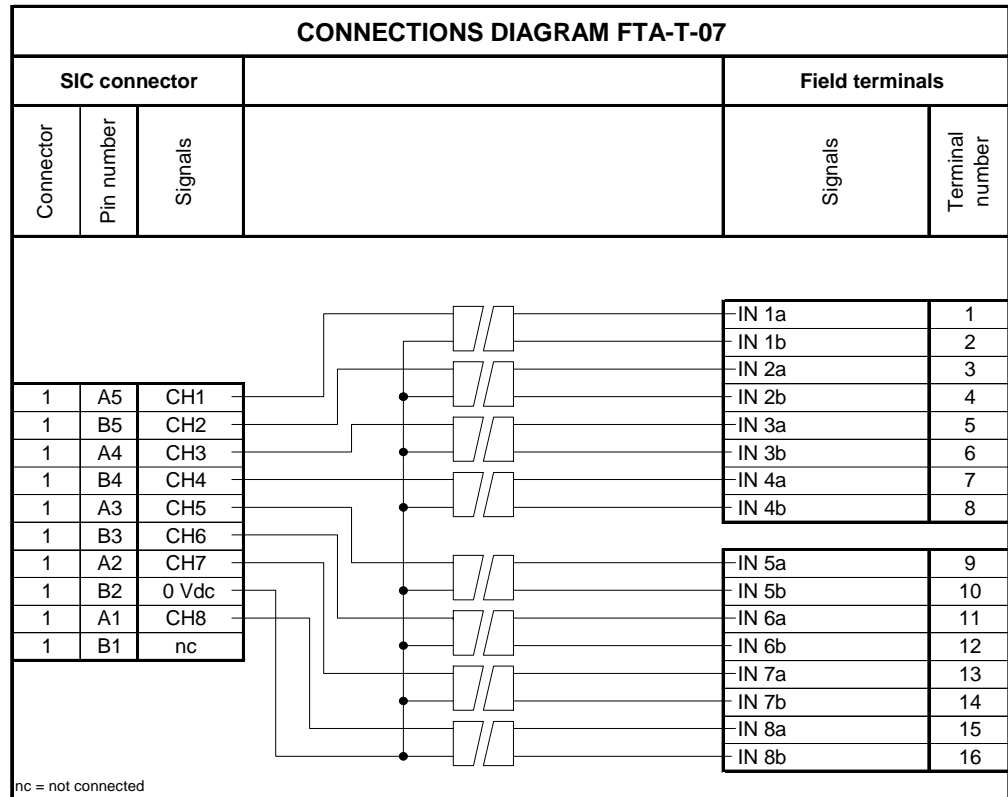


Figure 6 Connections diagram



## Technical data

The FTA-T-07 module has the following specifications:

<b>General</b>	Type number:	FTA-T-07
	Approvals:	CE, TÜV, UL
<b>Input</b>	Number of input channels:	8
	Input voltage:	115 Vac, $\pm 15\%$
	Input frequency:	50-60 Hz
	Input current:	$< 16$ mA at 115 Vac
	Input LOW:	$I \leq 1$ mA (see 'Field cable length' section in this data sheet)
<b>Physical</b>	Module dimensions:	195 x 70 x 48 mm (L x W x H) 7.68 x 2.76 x 1.89 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	196 mm (7.72 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-08 Fail-safe digital output (relay contact) FTA (4 channels)

### Description

The FTA-T-08 module has four fail-safe potential-free relay contact (NO) output channels, created by two different relays connected in series. These relays are capable of driving a wide variety of loads including 115/230 Vac, which gives the FSC system a fail-safe 115/230 Vac output capability.

The energized state of the relay is indicated by an LED on the module.

Four channels can be connected to the FTA-T-08 module via a system interconnection cable (SIC). This cable is plugged into the SIC connectors on the FTA module. The SIC connector is marked '1A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

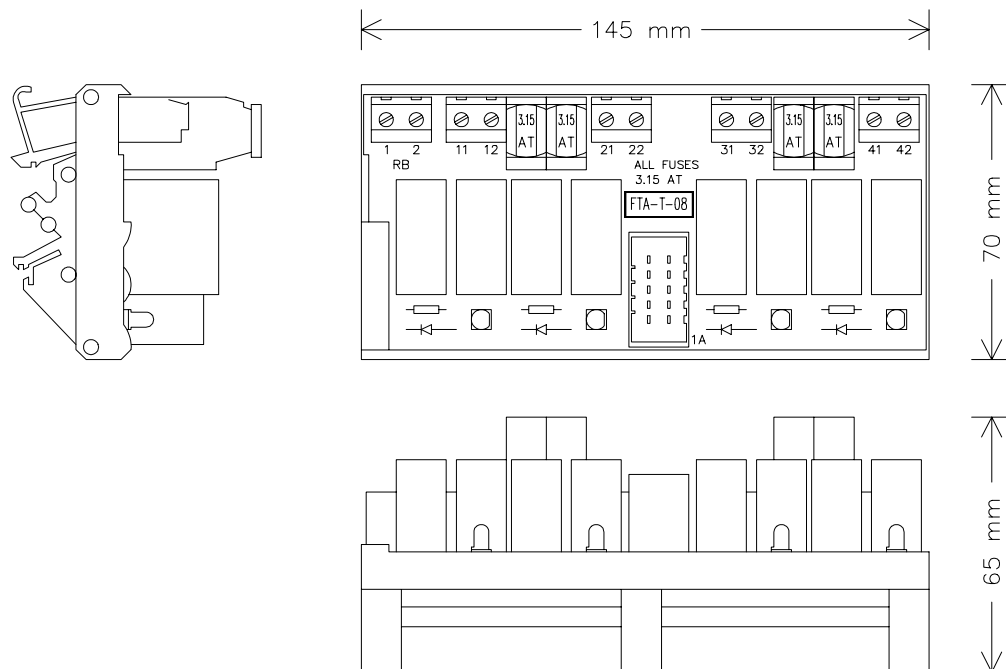


Figure 1 Mechanical layout

Each channel consists of:

- two relays of different manufacturers,
- a fused NO field contact (3.15 AT), and
- a status indicator LED.

The module has a common readback circuit for all four channels, which is closed if all relays are functioning correctly. If the readback circuit is opened, this indicates that one of the relays of the FTA is faulty.

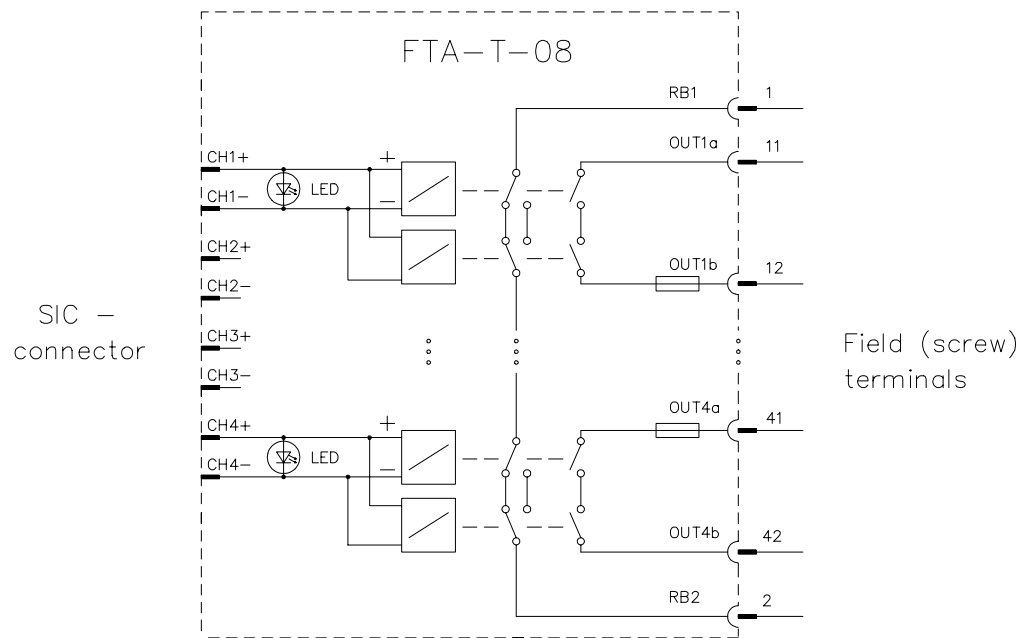


Figure 2 Schematic diagram

## Applications

For details on applications and connection options for the FTA-T-08 module refer to the 'SIC to FTA applications' data sheet.



## Connections

The connections diagram of the FTA-T-08 module is as follows:

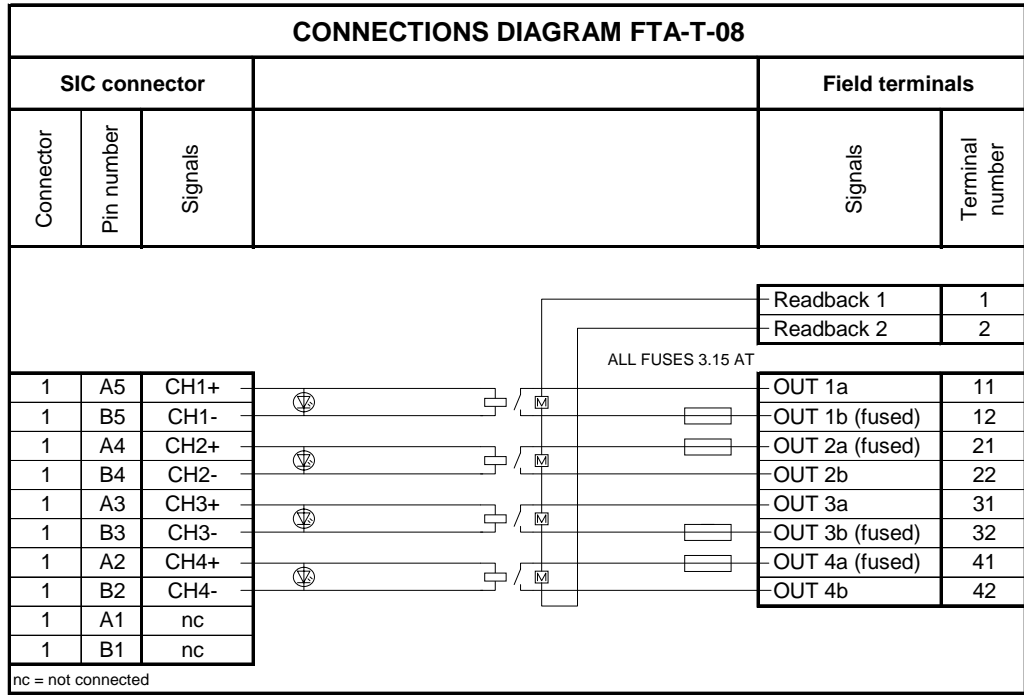


Figure 3 Connections diagram

## Technical data

The FTA-T-08 module has the following specifications:

<b>General</b>	Type number:	FTA-T-08
	Approvals:	CE, TÜV, UL
<b>Input</b>	Nominal input voltage:	24 V
	Max. input voltage:	31 V
	Relay cut-in voltage:	19 V
	Input current:	typically 50 mA at 24 V
<b>Output</b>	Number of output channels:	4
	Max. output current:	3.15 A
	Min. output current:	400 mA at 24 Vdc
	Max. output voltage:	250 Vac / 150 Vdc
	Max. output load:	800 VA / 150 W



## Technical data (continued)

<b>Fuses</b>	Rating:	3.15 AT (slow-acting)
	Dimensions:	5 x 20 mm (0.2 x 0.78 in) or 5 x 25 mm (0.2 x 0.98 in)
<b>Physical</b>	Module dimensions:	145 x 70 x 65 mm (L x W x H) 5.71 x 2.76 x 2.56 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	146 mm (5.75 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Relay contact</b>	Max. current:	5 A
	Max. switched voltage:	250 Vac / 150 Vdc
	Max. switched load:	1250 VA / 150 W
	Max. switched frequency:	20 Hz
	Expected life:	
	– electrical	80,000 switch operations
	– mechanical	5,000,000 switch operations
	Ambient temperature:	–40°C to +60°C (–40°F to +140°F)
Contact material:	silver alloy	

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## FTA-T-09 Fail-safe passive digital input FTA (115 Vac/dc, 8 channels)

### Description

The field termination assembly module FTA-T-09 is an eight-channel fail-safe input converter module, universal for both 115 Vac and/or 115 Vdc. All inputs are galvanically isolated.

Each channel converts an externally supplied 115 V input signal to a 24 Vdc input signal which can be connected to the 24 Vdc fail-safe input module 10101/2/1, thus creating a fail-safe 115 V input for the FSC system.

Eight channels can be connected to the FTA-T-09 module via a system interconnection cable (SIC). This cable is plugged into the SIC connector on the FTA module. The SIC connector is marked '1A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

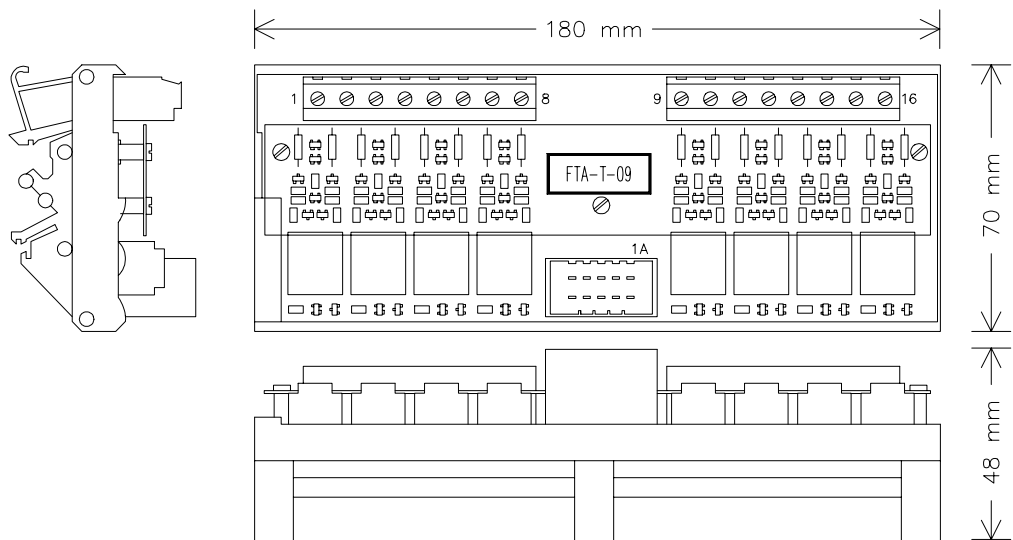


Figure 1 Mechanical layout

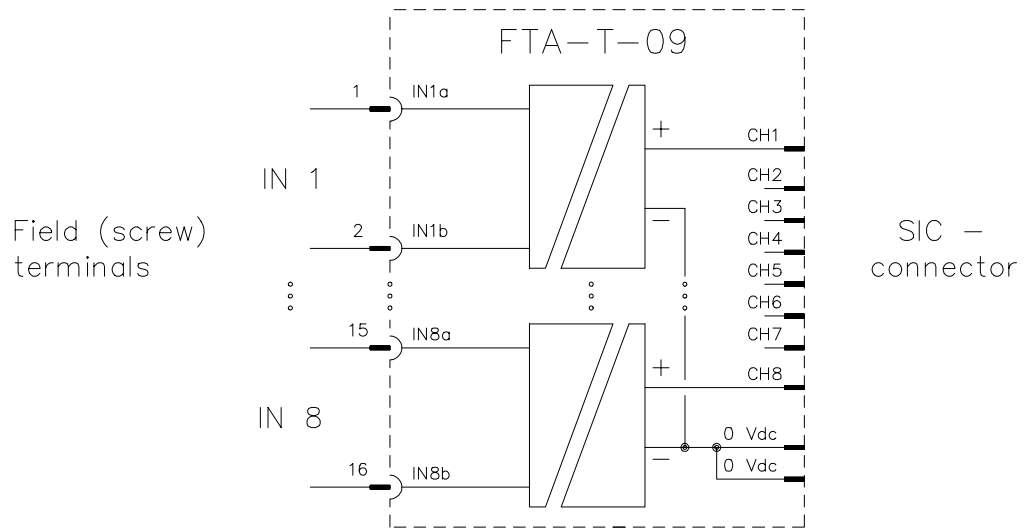


Figure 2 Schematic diagram

## Applications

For details on applications and connection options for the FTA-T-09 module refer to the 'SIC to FTA applications' data sheet.

## Field cable lengths

High-impedance AC inputs – like the inputs on this FTA – have a limited capability of handling the wire capacitance of standard multicore field cables. The wire capacitance of the field cable acts as a shunt impedance over the field contact (see Figure 3).

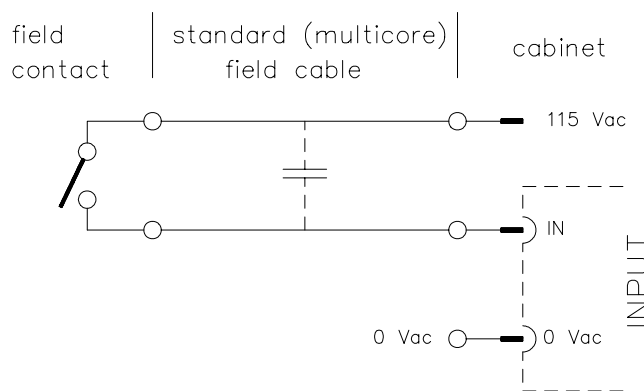


Figure 3 Standard (multicore) field cable



When the current through this shunt impedance exceeds the maximum 'LOW' current, the input may be activated by this shunt impedance, thus disabling the input function (by keeping the input activated continuously, i.e. ON). Every AC input will have a maximum 'LOW' current that it can handle.

The maximum allowable cable length depends on the maximum 'LOW' current (e.g. 1.2 mA), the typical cable capacitance (e.g. 120 pF/m), the maximum supply voltage (e.g. 130 Vac) and the supply frequency (e.g. 60 Hz).

The maximum length (in meters) can be calculated using the following formula:

$$L_{\max} = \frac{I_{\text{low}}}{V_{\max} * 2 * \pi * f * C_{\text{typ}}}$$

where:

$L_{\max}$  = maximum allowable cable length

$I_{\text{low}}$  = maximum 'LOW' current

$V_{\max}$  = maximum supply voltage

$f$  = supply frequency

$C_{\text{typ}}$  = typical cable capacitance

As an example, we will calculate the maximum field cable length (in meters) using the values mentioned above:

$$L_{\max} = \frac{(1.2 * 10^{-3})}{130 * 2 * \pi * 60 * (120 * 10^{-12})} = 204 \text{ m}$$

In this example, the maximum allowable field cable length is 204 meters (223 yards).

### Solutions:

The field cable length limit can be eliminated by using field cables with wires that are shielded separately (see Figure 4).

The only (relevant) capacitance of the input wire is to the shield (0 Vac or earth) and this will not activate a 'LOW' input.

However, this type of cable is rather unusual. Field cables with shielded wire pairs are more commonly used. This allows for two connections methods:

1. Use the method of Figure 4 and leave the second wire of each pair unconnected, or
2. Connect the second wire of each pair to 0 Vac (see Figure 5). The 115 Vac / 0 Vac supply pair can be used for more than one input.

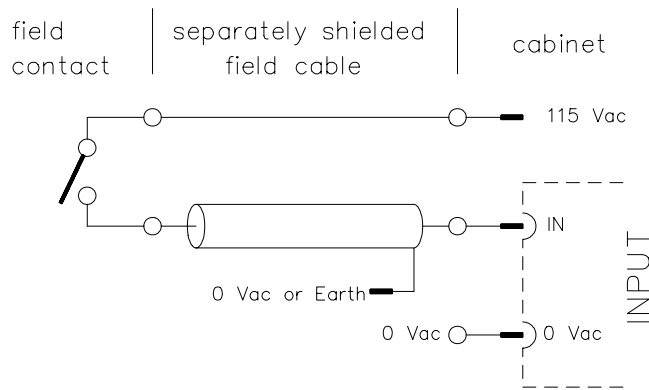


Figure 4 Field cable with separately shielded wires

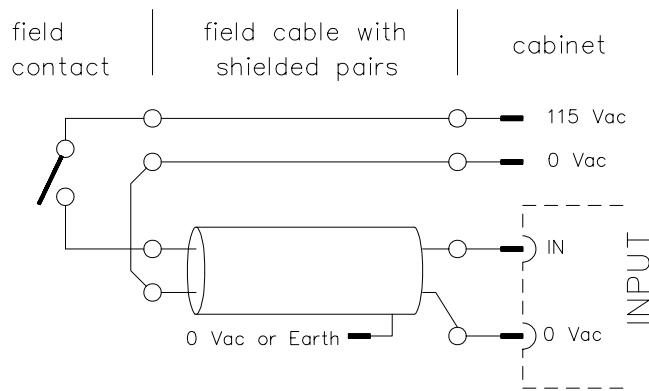


Figure 5 Field cable with shielded pairs

In practice, a mix of wiring methods may be used. For example, use a cable with shielded pairs between the control cabinet and a distribution box close to the process. This cable may be long, e.g. 3 km (1.8 mi). Then use a standard (multicore) cable for the connection between the distribution box and the field contact. This cable length is limited to the value calculated using the formula mentioned above.





## Connections

The connections diagram of the FTA-T-09 module is as follows:

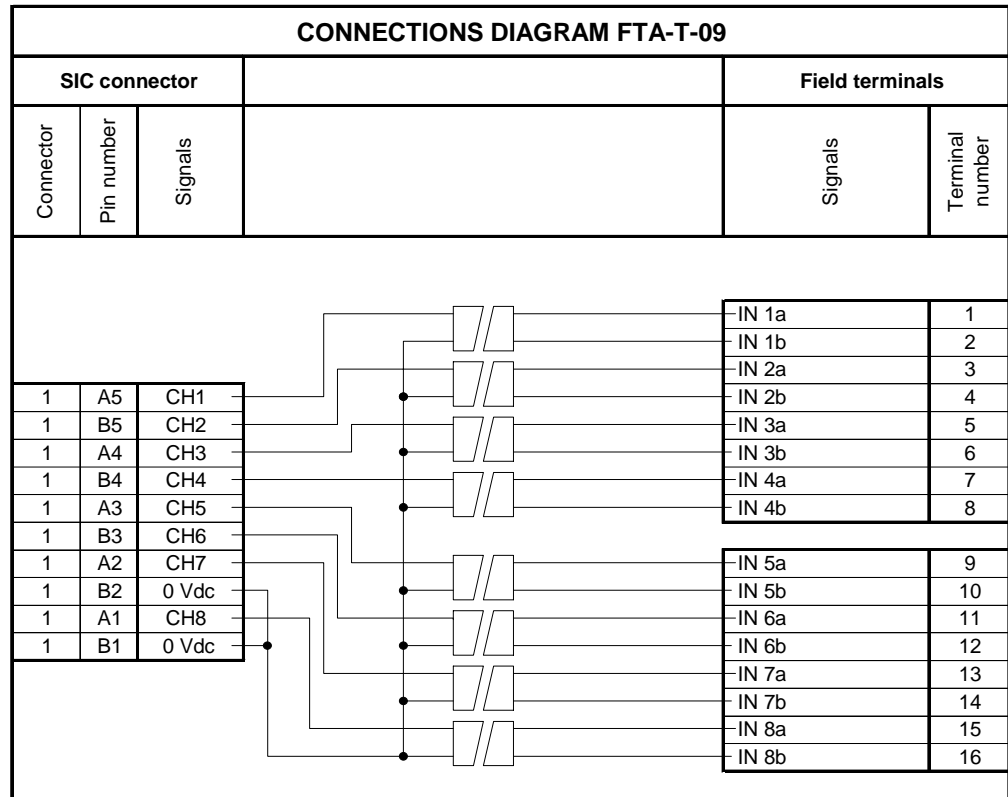


Figure 6 Connections diagram



## Technical data

The FTA-T-09 module has the following specifications:

<b>General</b>	Type number:	FTA-T-09
	Approval:	CE, TÜV
<b>Input</b>	Number of input channels:	8
	Input voltage:	115 V, -15% ... + 30%
	Input frequency:	DC or 40...300 Hz
	Input current:	7.5 mA ( $\pm$ 1 mA) at 115 V
	Input impedance:	non-inductive, > 9 kOhm
	Input LOW:	U $\leq$ 15 V or I $\leq$ 1.2 mA (see 'Field cable length' section in this data sheet)
<b>Physical</b>	Module dimensions:	180 x 70 x 48 mm (L x W x H) 7.09 x 2.76 x 1.89 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	181 mm (7.13 in)
<b>Isolation</b>	Isolation input to output:	2 kV
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-10

## Digital output (relay contact) FTA (8 channels)

### Description

The field termination assembly module FTA-T-10 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals). It has eight non-fail-safe potential-free relay contact (NO) outputs. The energized state of the relay is indicated by an LED on the module.

Eight channels can be connected to the FTA-T-10 module via a system interconnection cable (SIC). This cable is plugged into the SIC connector on the FTA module.

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

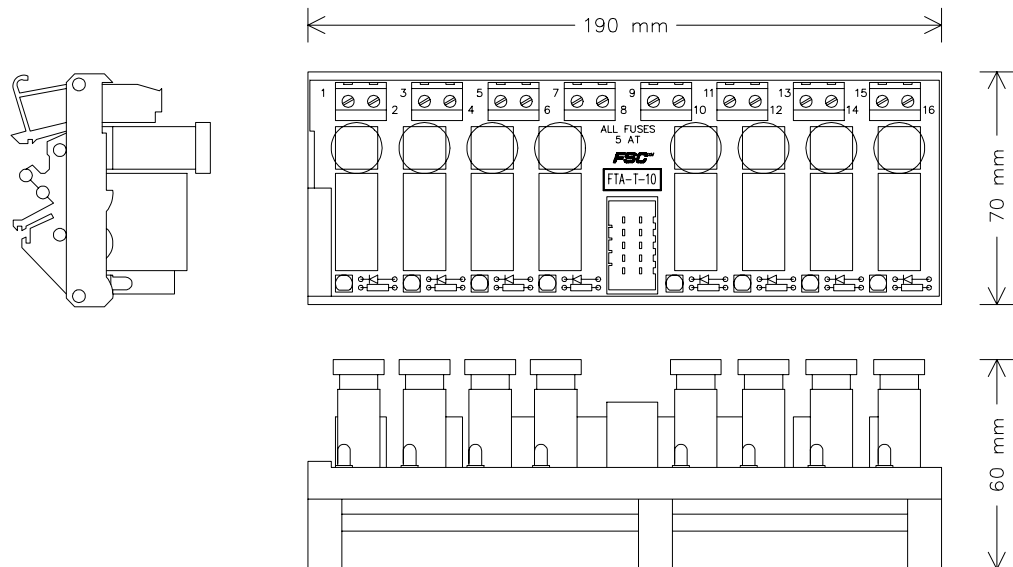


Figure 1 Mechanical layout

Each channel consists of:

- one relay,
- a fused NO field contact (5 AT), and
- a status indicator LED.

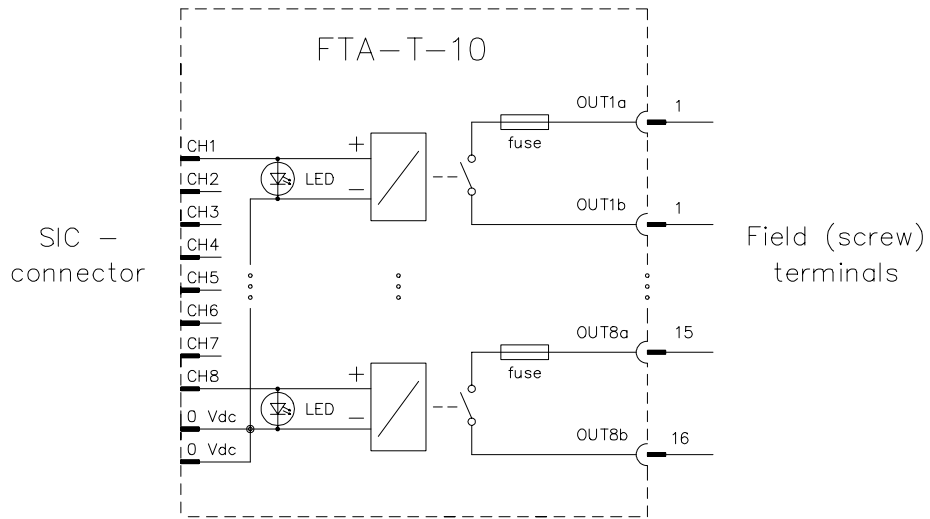


Figure 2 Schematic diagram

## Applications

For details on applications and connection options for the FTA-T-10 module refer to the 'SIC to FTA applications' data sheet.

## Connections

The connections diagram of the FTA-T-10 module is as follows:

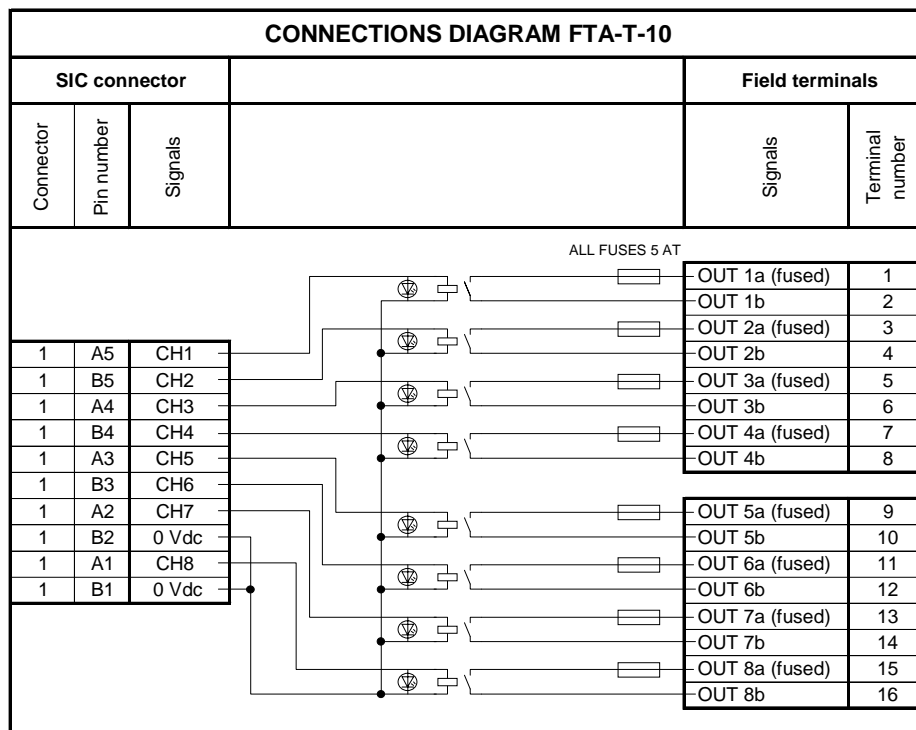


Figure 3 Connections diagram



## Technical data

The FTA-T-10 module has the following specifications:

<b>General</b>	Type number:	FTA-T-10
	Approvals:	CE, TÜV; UL approval pending
<b>Input</b>	Nominal input voltage:	24 Vdc
	Max. input voltage:	31 Vdc
	Relay cut-in voltage:	19 Vdc
	Input current:	typically 27 mA at 24 Vdc
<b>Output</b>	Number of output channels:	8
	Max. output current:	5 A
	Max. output voltage:	250 Vac / 300 Vdc
	Max. switched load:	2500 VA / 150 W at 30 Vdc (see Figure 4)
<b>Fuses</b>	Rating:	5 AT (slow-acting)
	Dimensions	5 x 20 mm (0.20 x 0.79 in)
<b>Physical</b>	Module dimensions:	190 x 70 x 60 mm (L x W x H) 7.48 x 2.76 x 2.36 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	191 mm (7.52 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Relay contacts</b>	Max. current:	8 A
	Max. switched voltage:	250 Vac / 300 Vdc
	Max. switched load:	4000 VA / 192 W at 24 Vdc (see Figure 4)
	Max. switching frequency:	20 Hz
	Expected life:	
	– electrical	100,000 switch operations
– mechanical	30,000,000 switch operations	



## Technical data (continued)

Relay contacts  
(cont.)

Isolation:

- coil to contact                    4000 Vac
- contact to contact                1000 Vac

Ambient temperature:            -40°C to +70°C (-40°F to +158°F)

Contact material:                    silver-cadmium oxide

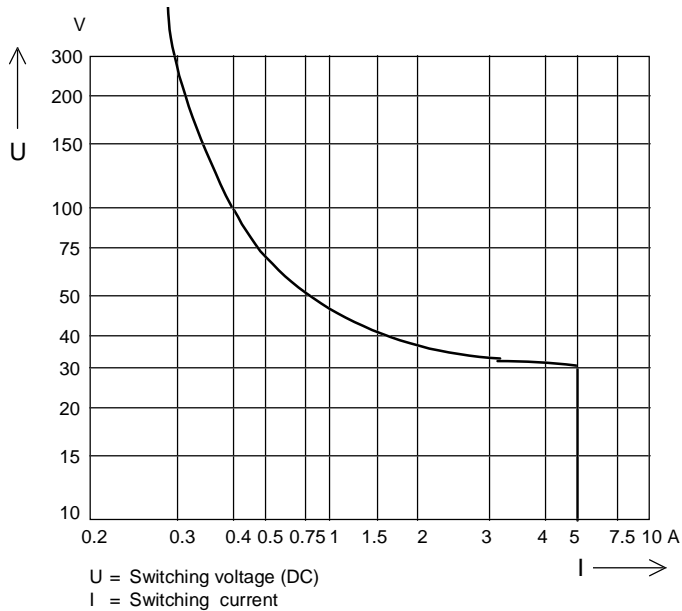


Figure 4 Maximum DC switched power curve for FTA-T-10 module

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## FTA-T-11 Fail-safe digital output FTA (110 Vdc, 8 channels)

### Description

The field termination assembly module FTA-T-11 is the interface between the system interconnection cables (SIC) and the external field wiring (screw terminals).

It was specially developed to meet isolation requirements for higher voltages in accordance with IEC 1010 (1990), overvoltage category 3 (Table D.12).

Eight channels (separated into two groups of four channels) can be connected to the FTA-T-11 module via system interconnection cables (SIC). These cables are plugged into the SIC connectors on the FTA module. The two SIC connectors are marked '1A' and '2A' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

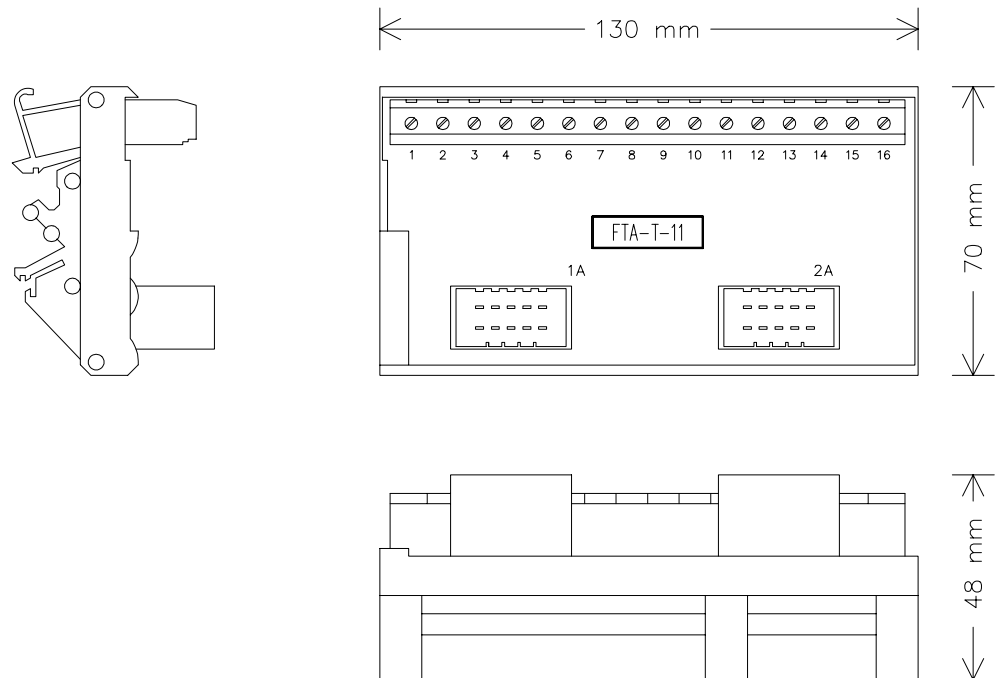


Figure 1 Mechanical layout



## Applications

For details on applications and connection options for the FTA-T-11 module refer to the 'SIC to FTA applications' data sheet.

## Connections

The connections diagram of the FTA-T-11 module is as follows:

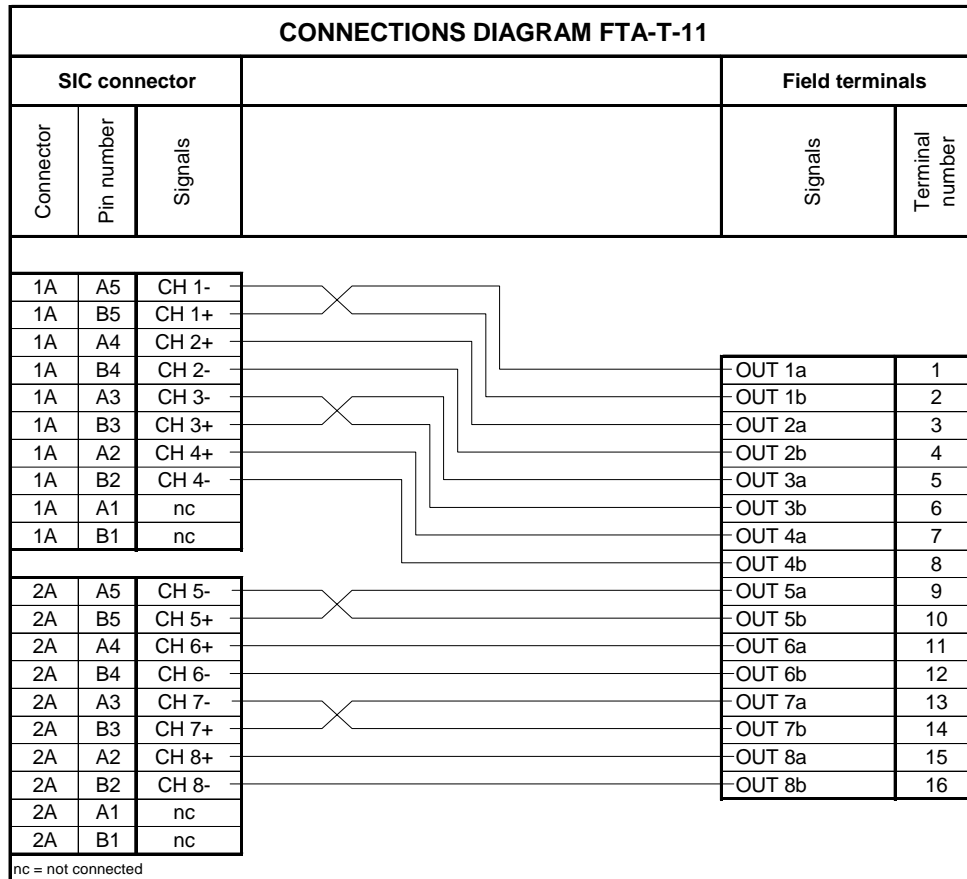


Figure 2 Connections diagram





## Technical data

The FTA-T-11 module has the following specifications:

<b>General</b>	Type number:	FTA-T-11
	Approvals:	CE, TÜV
<b>Power</b>	Number of channels:	8 (2 groups of 4)
	Maximum voltage:	100 Vac / 120 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Max. continuous current per channel:	2 A
<b>Physical</b>	Module dimensions:	130 x 70 x 48 mm (L x W x H) 5.12 x 2.76 x 1.89 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	131 mm (5.16 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)

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## FTA-T-12 Isolated passive digital input FTA (8 channels)

### Description

The field termination assembly module FTA-T-12 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals). It has eight non-fail-safe isolated 24 Vdc input channels.

Eight channels can be connected to the FTA-T-12 module via a system interconnection cable (SIC). This cable is plugged into the SIC connector on the FTA module.

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

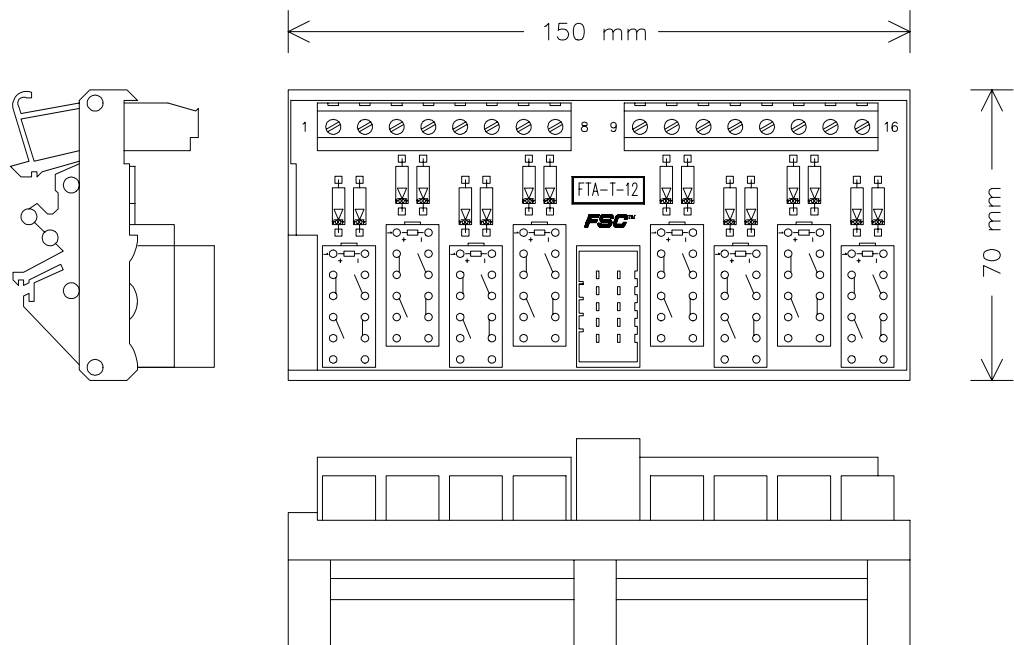


Figure 1 Mechanical layout

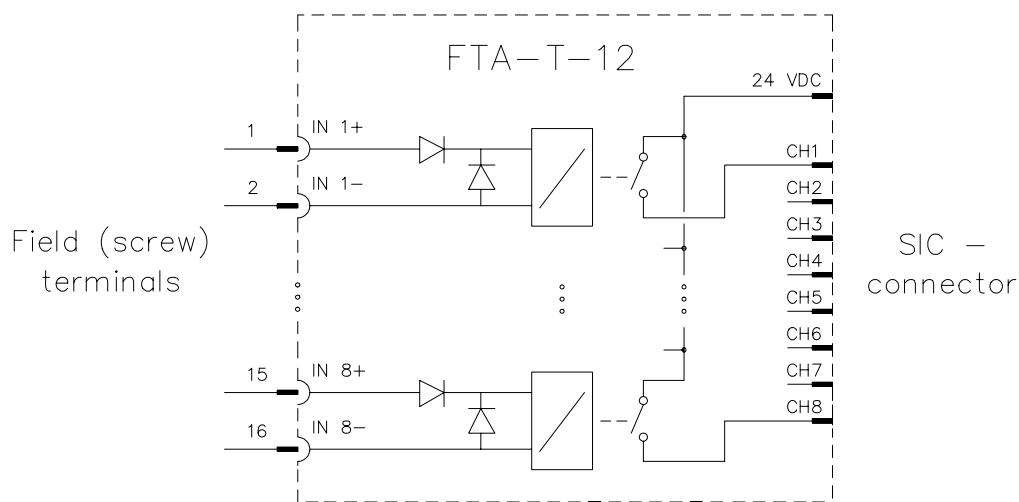


Figure 2 Schematic diagram

## Applications

For details on applications and connection options for the FTA-T-12 module refer to the 'SIC to FTA applications' data sheet.

## Connections

The connections diagram of the FTA-T-12 module is as follows:

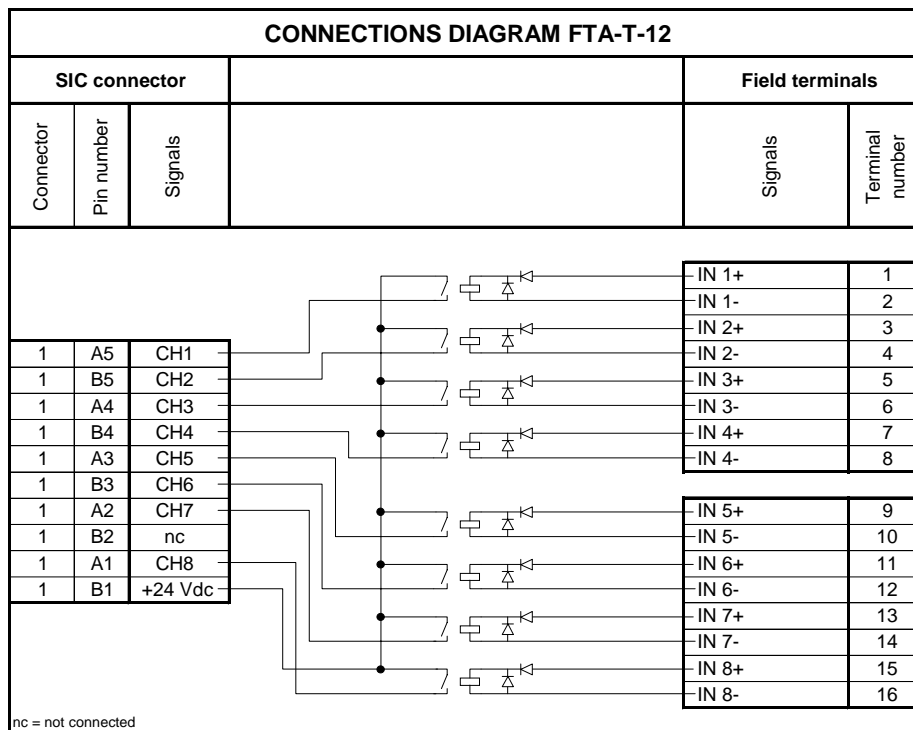


Figure 3 Connections diagram



## Technical data

The FTA-T-12 module has the following specifications:

<b>General</b>	Type number:	FTA-T-12
	Approvals:	CE, TÜV; UL approval pending
<b>Input</b>	Number of input channels:	8
	Nominal input voltage:	24 Vdc
	Drop-out voltage:	2.8 Vdc
	Pick-up voltage:	17.5 Vdc
	Max. input voltage:	47.5 Vdc
	Reverse polarity protection:	series diode
	Max. reverse voltage:	300 V
	Input current:	typically 9 mA at 24 Vdc
Max. switching frequency:	20 Hz	
<b>Output</b>	Output voltage:	0.1 to 36 V
	Output current:	10 $\mu$ A to 1 A
	Contact material:	gold-clad silver alloy
<b>Physical</b>	Module dimensions:	150 x 70 x 48 mm (L x W x H) 5.91 x 2.76 x 1.89 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	151 mm
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Isolation</b>	Galvanic isolation:	
	– input to output	1000 Vac
	– input to input	1000 Vac

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## FTA-T-13

## Current-limited digital input FTA (24 Vdc, 16 channels)

### Description

The field termination assembly module FTA-T-13 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals). It can be used for interfacing digital input signals from Class I, Division 2 Hazardous Locations.

Sixteen channels (separated into two groups of eight channels with a 250 mA fuse in the common +) can be connected to the FTA-T-13 module via SIC cables. These cables are plugged into the SIC connectors on the FTA module. The two SIC connectors are marked '1A' and '1B' (white print on the board).

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

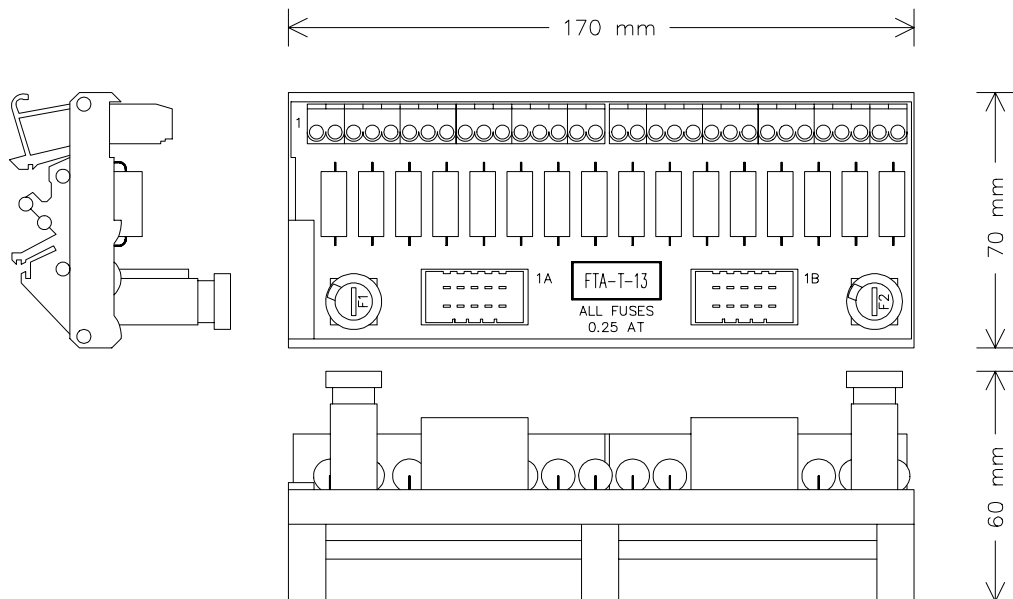


Figure 1 Mechanical layout

## Applications

For details on applications and connection options for the FTA-T-13 module refer to the 'SIC to FTA applications' data sheet.

## Connections

The connections diagram of the FTA-T-13 module is as follows:

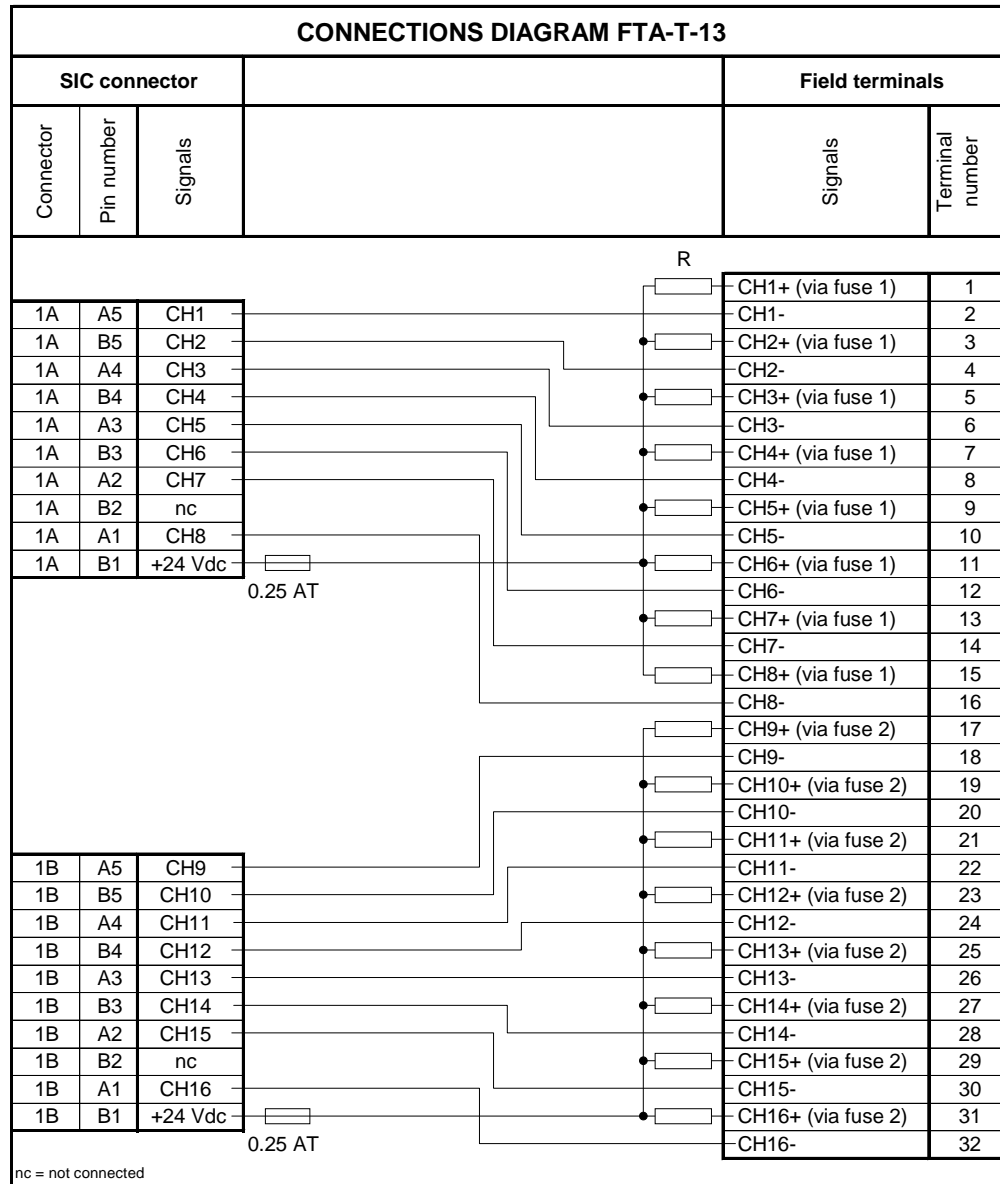


Figure 2 Connections diagram





## Technical data

The FTA-T-13 module has the following specifications:

<b>General</b>	Type number:	FTA-T-13
	Approvals:	CE, TÜV; UL, FM approvals pending
<b>Input</b>	Number of input channels:	16 (2 isolated groups of 8)
	Input voltage:	24 Vdc, -15% ... +30%
	Input current:	≤ 15 mA at 24 Vdc (with a redundant pair of fail-safe digital input modules 10101/2/1 as load)
	Igniting current per channel:	< 100 mA at 24 Vdc +30%
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Physical</b>	Module dimensions:	170 x 70 x 60 mm (L x W x H) 6.69 x 2.76 x 2.36 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	171 mm
<b>Field signal specifications</b>	Max. closed loop resistance:	250 Ohm
	Min. open loop resistance:	15 kOhm
	HYDROGEN (Group A & B):	
	– max. loop inductance	8 mH
	– max. loop capacitance	0.3 µF
	NON-HYDROGEN (Group C & D):	
	– max. loop inductance	22 mH
	– max. loop capacitance	7 µF

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## FTA-T-14 Fail-safe 0(4)-20 mA analog input FTA (16 channels)

### Description

The field termination assembly module FTA-T-14 is the interface between field components (sensors, etc.) and the fail-safe high-density analog input module 10105/2/1 in the FSC system. It can be used for interfacing signals from Class I, Division 2 Hazardous Locations.

The FTA-T-14 module has sixteen analog input channels which may be used for both safety-related and non-safety-related applications. These sixteen channels (separated into two groups of eight channels with common 0 V) are connected to the FTA-T-14 module via a system interconnection cable (SIC), which is plugged into the SIC connector on the FTA module.

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connection of power supply, ground and field wiring.

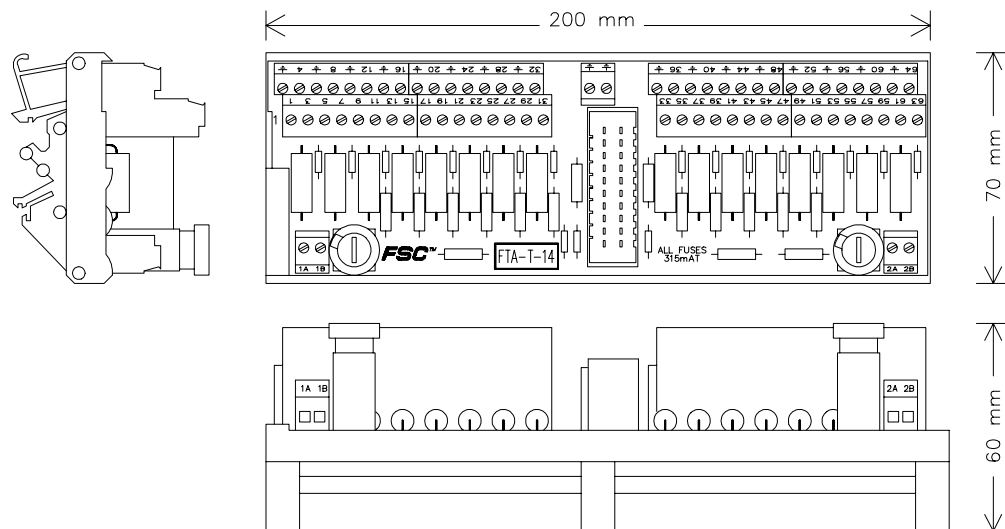


Figure 1 Mechanical layout

## Main functions

The FTA-T-14 module has three main functions:

- linear direct conversion of 0(4)-20 mA DC field signals to the signal levels of the fail-safe high-density analog input module 10105/2/1,
- power supply distribution to each transmitter with voltage-current limitation in compliance with Hazardous Area Class I Division 2, and
- enable monitoring of the external power connected to the FTA-T-14 module.

## Linear direct conversion

The input circuit of each channel consists of a high-precision resistor which converts the input current (0 to 20 mA) to the input voltage for the high-density analog input module 10105/2/1. The power to the analog transmitter is supplied via a series resistor. Each analog signal has its own terminal for the field cable shield.

Figure 2 below shows the schematic diagram for connecting a transmitter (active and passive).

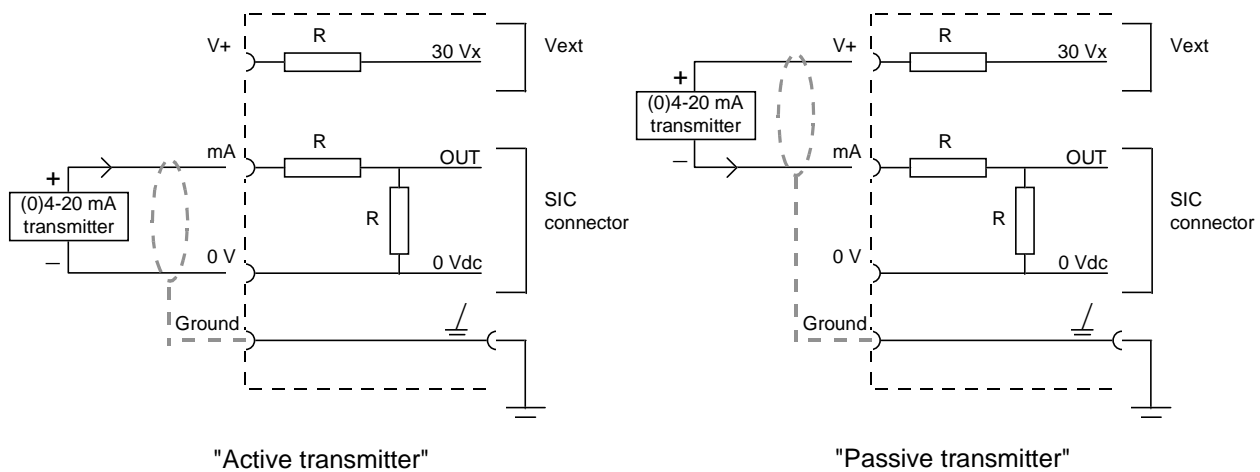


Figure 2 Schematic diagram for connecting a transmitter

## Class I Division 2

The FTA-T-14 module may be used in areas with Class I, Division 2 applications. The external output voltage (V+) is current-limited by means of a series resistor.



## Transmitter voltage

Figure 3 below shows the available transmitter voltage for passive transmitters.

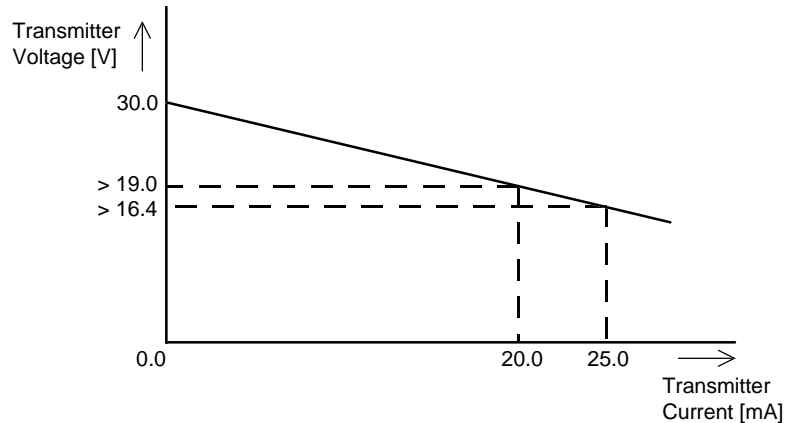


Figure 3 Transmitter voltage for passive transmitters

## External power

If all inputs are active, no external power is required.

For loops which contain passive transmitters, analog process data is only available if the supply voltage to the electronics is guaranteed. The high-density analog input concept (using FTA-T-14/15 modules) offers full monitoring of power that is provided externally. If DC/DC converter modules FTA-T-15 are used, even redundant power supplies are covered.

External power can be connected to the FTA-T-14 module via one or both of the two screw terminal pairs marked '1A', '1B', '2A' and '2B'. The screw terminal pairs are interconnected on the FTA module. The sixteen channels on the FTA module are divided into two groups of eight channels, with each group being protected by a 315 mA fuse. Single-channel errors (shorts from V+ to 0 V) cannot blow the group fuse.

---

### Note:

The 0 V connection of the external power is directly connected to the common 0 V of all sixteen analog inputs.

---

The FSC software can monitor the external power voltage via the fail-safe high-density analog input module 10105/2/1.

Figure 4 below shows the schematic diagram for power distribution with monitoring.

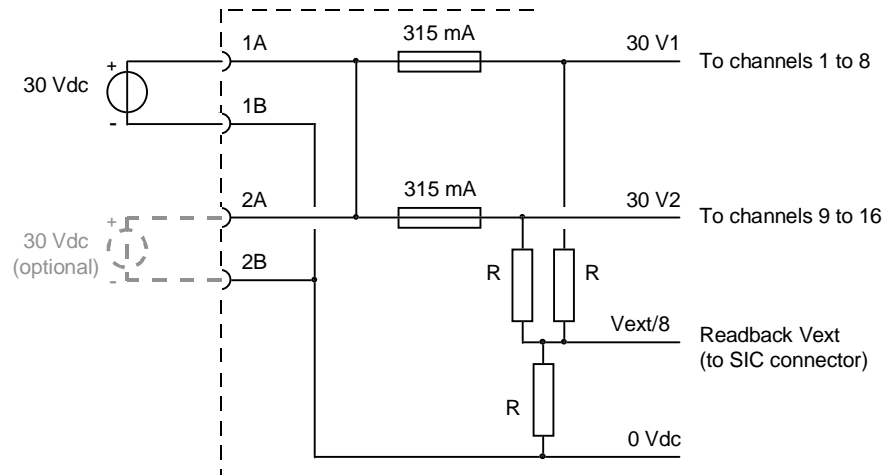


Figure 4 Schematic diagram for power distribution with monitoring

## Applications

For details on applications and connection options for the FTA-T-14 module refer to the 'SIC to FTA applications' data sheet.

## Connections

### External power and ground

The external supply voltage ( $V_{ext}$ ) and ground are connected to the following screw terminals (marked '1A', '1B', '2A', '2B' and '⎓' on the FTA):

Screw terminal	Function
1A	30 Vdc $V_{ext}$
1B	0 Vdc $V_{ext}$
2A	30 Vdc $V_{ext}$
2B	0 Vdc $V_{ext}$
⎓	Ground connection
⎓	Ground connection

### Connections diagram

The FTA-T-14 module has sixteen groups (= sixteen channels) of four screw terminals to provide optimum connection of field wiring, with a ground terminal per channel for screening of analog input cables. The screw terminals are numbered 1 to 64. The connections diagram of the FTA-T-14 module is as follows:



## Connections diagram

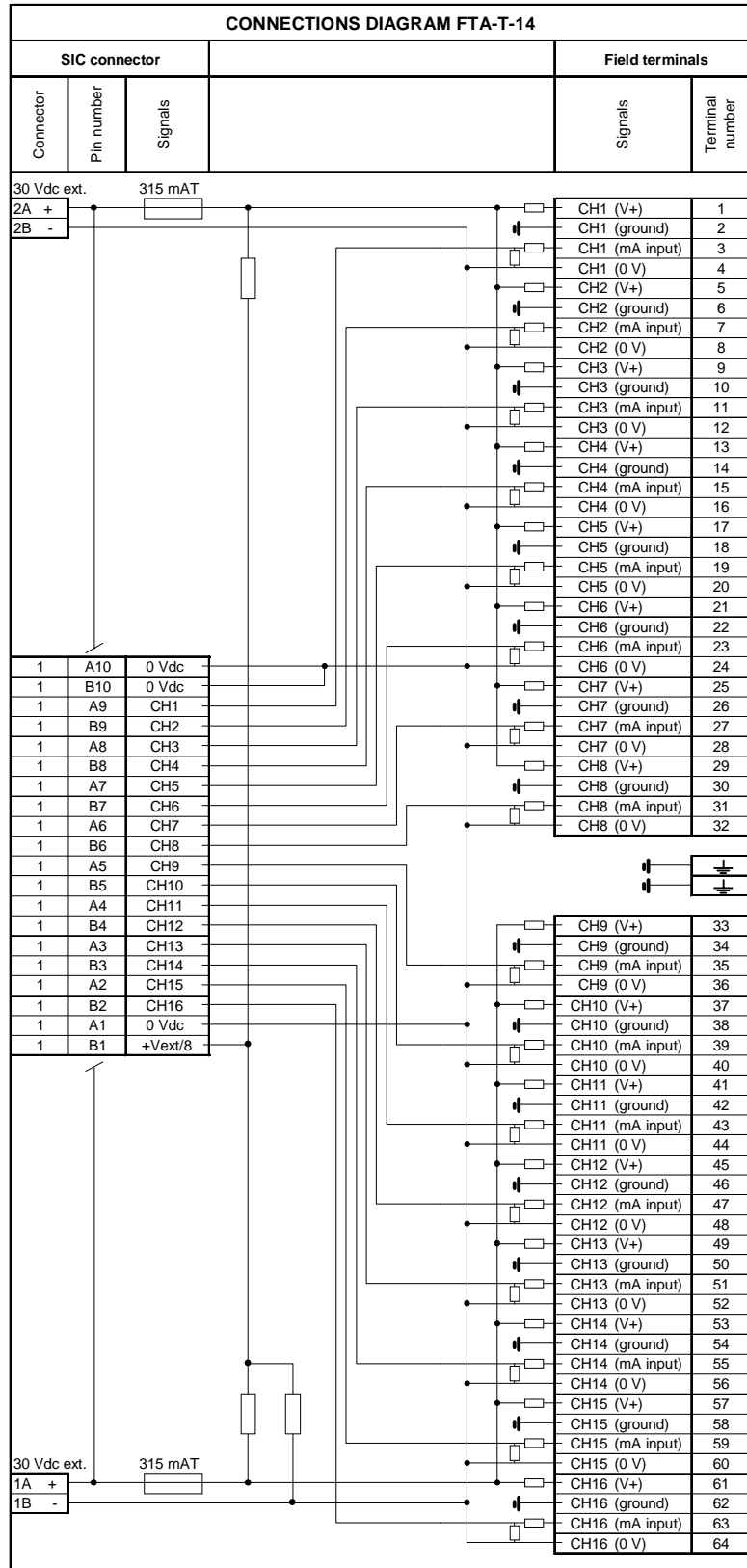


Figure 5 Connections diagram



## Technical data

The FTA-T-14 module has the following specifications:

<b>General</b>	Type number:	FTA-T-14
	Approvals:	CE; UL, FM, TÜV approvals pending
<b>Input</b>	Number of input channels:	16 (2 groups of 8 with common 0 V)
	Power requirements:	30 Vdc external 3 mA (without input loop loads)
	Input current:	0 to 25 mA
	Input resistance:	250 Ohm ( $\pm 1\%$ )
<b>Output</b>	To passive transmitters (Vext):	
	– output resistance:	270 Ohm ( $\pm 5\%$ )
	– igniting current per channel:	< 120 mA at 30 Vdc
	To 10105/2/1 module:	
	– output voltage	0 to 4 Vdc
<b>Fuses</b>	Rating:	315 mAT (slow-acting)
	Dimensions:	5 x 20 mm (0.20 x 0.79 in)
<b>Physical</b>	Module dimensions:	200 x 70 x 60 mm (L x W x H) 7.87 x 2.76 x 2.36 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	201 mm (7.91 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Field signal specifications</b>	HYDROGEN (Group A & B):	
	– max. loop inductance	6 mH
	– max. loop capacitance	0.25 $\mu$ F
	NON-HYDROGEN (Group C & D):	
	– max. loop inductance	20 mH
	– max. loop capacitance	5 $\mu$ F





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## FTA-T-15      24 Vdc to 30 Vdc/1 A converter

### Description

The FTA-T-15 module is a DC/DC converter, which is used to provide an isolated 30 Vdc / 1 A to other field termination assemblies (FTAs), e.g. the analog input FTA module FTA-T-14 or the active analog input FTA module FTA-T-16. It has voltage monitoring capabilities with local LED indication and also provides alarm functions (readback relay contact). The LED is on and the relay contact is closed if the local DC/DC output voltage is OK.

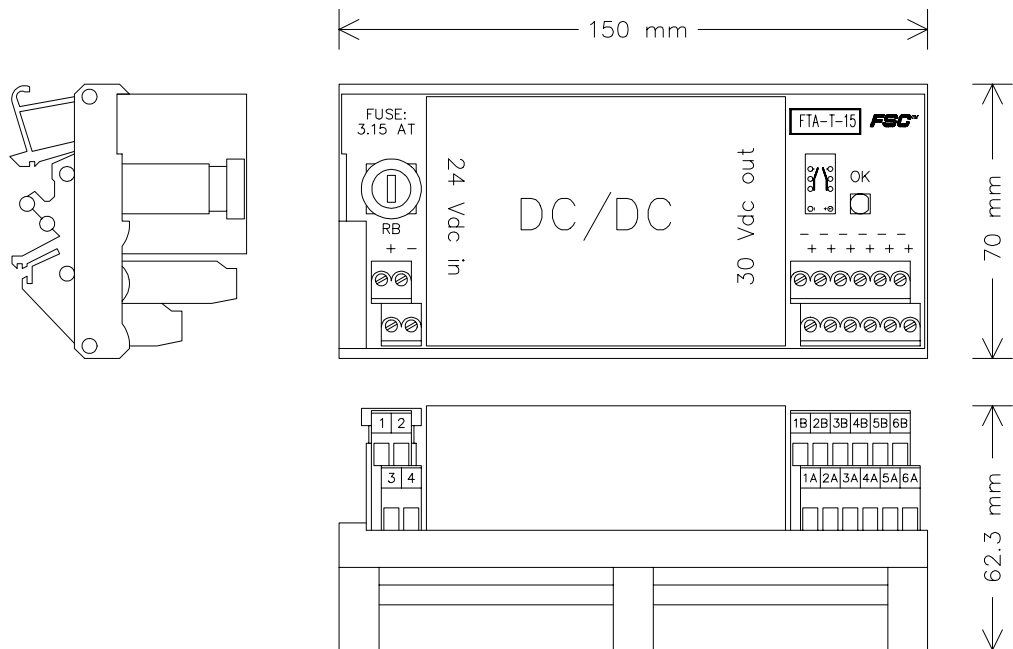


Figure 1 Mechanical layout



## Applications

For details on applications and connection options for the FTA-T-15 module refer to the 'SIC to FTA applications' data sheet.

---

## Connections

The FTA-T-15 module has four screw terminals for connection of incoming power wires and the readback wiring. The screw terminals are numbered 1 to 4. The function of each terminal is listed below:

Screw terminal	Function
1	Readback contact
2	Readback contact
3	24 Vdc IN +
4	24 Vdc IN –

---

### Note:

Removal or connection of the 24 Vdc IN+ and/or 24 Vdc IN– wire(s) is only allowed when the 24 Vdc power supply to the FTA-T-15 module has been switched off.

---

The FTA-T-15 module has twelve screw terminals for connection of outgoing power wires. The screw terminals are numbered '1A', '1B', '2A', etc. to '6B'. The function of each terminal is listed below:

Screw terminal	Function
1A	30 Vdc OUT
1B	0 Vdc OUT
2A	30 Vdc OUT
2B	0 Vdc OUT
3A	30 Vdc OUT
3B	0 Vdc OUT
4A	30 Vdc OUT
4B	0 Vdc OUT
5A	30 Vdc OUT
5B	0 Vdc OUT
6A	30 Vdc OUT
6B	0 Vdc OUT

---



## Technical data

The FTA-T-15 module has the following specifications:

<b>General</b>	Type number:	FTA-T-15
	Approvals:	CE, UL, TÜV approvals pending
	Safety class:	AK1-6
	MTBF:	approx. 400,000 hours
<b>Input</b>	Nominal input voltage:	24 Vdc
	Input voltage range:	18 to 36 Vdc
	Inrush current:	$\leq 4$ A ( <i>see note below</i> )
<b>Output</b>	Output voltage:	30 Vdc, $\pm 0.25$ V
	Output current:	1 A (short-circuit proof)
	Short-circuit current:	$< 3.3$ A
	Ripple (0-30 MHz):	$< 0.1$ Vrms
	Regulation:	$< 1\%$ (load + line)
	Transient response:	class C according to NFC42801C
	Power-on overshoot:	output $\leq 31$ V
	Long-term stability (after 30 min. operation):	$< 0.3\%$
	Efficiency:	$> 75\%$
Switching frequency:	$> 25$ kHz	
<b>Physical</b>	Module dimensions:	150 x 70 x 62.3 mm (L x W x H) 5.91 x 2.76 x 2.45 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	151 mm (5.94 in)
<b>Fuse</b>	Rating:	3.15 AT (slow-acting)
	Dimensions:	5 x 20 mm (0.2 x 0.79 in)

---

### Note:

The inrush current limiter is only active at power-on. To regain the inrush current limiting function, the FTA-T-15 module must be switched off for at least 30 seconds. Switching on the module within 30 seconds may blow a fuse or activate a circuit breaker.

---



## Technical data (continued)

<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Isolation</b>	Isolation voltage:	
	– input to output	2000 Vac (1 min.)
	– input to relay contact	2000 Vac (1 min.)
	– output to relay contact	2000 Vac (1 min.)
<b>Environment</b>	Operating temperature:	–5°C to +70°C (23°F to 158°F)
	Storage temperature:	–40°C to +85°C (–40°F to +185°F)
	Cooling:	natural convection
<b>Alarm functions</b>	Overvoltage protection:	dual, two-fault-tolerant
	Restart overvoltage protection:	only after removal of 24 Vdc power
	Undervoltage detector:	LED on if voltage OK, readback relay contact closed if voltage OK
	Undervoltage level:	typically 27.5 Vdc
<b>Readback</b>	Relay contact rating:	36 Vdc / 40 mA, 30 Vac / 40 mA

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## FTA-T-16 Fail-safe active digital input FTA with line-monitoring (16 channels)

### Description

The field termination assembly module FTA-T-16 is the interface between field components (sensors, etc.) and the fail-safe high-density analog input module 10105/2/1 in the FSC system. It can be used for interfacing signals from Class I, Division 2 Hazardous Locations.

The FTA-T-16 module has sixteen digital input channels which may be used for both safety-related and non-safety-related applications. These sixteen channels are connected to the FTA-T-16 module via a system interconnection cable (SIC), which is plugged into the SIC connector on the FTA module.

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connection of power supply and field wiring.

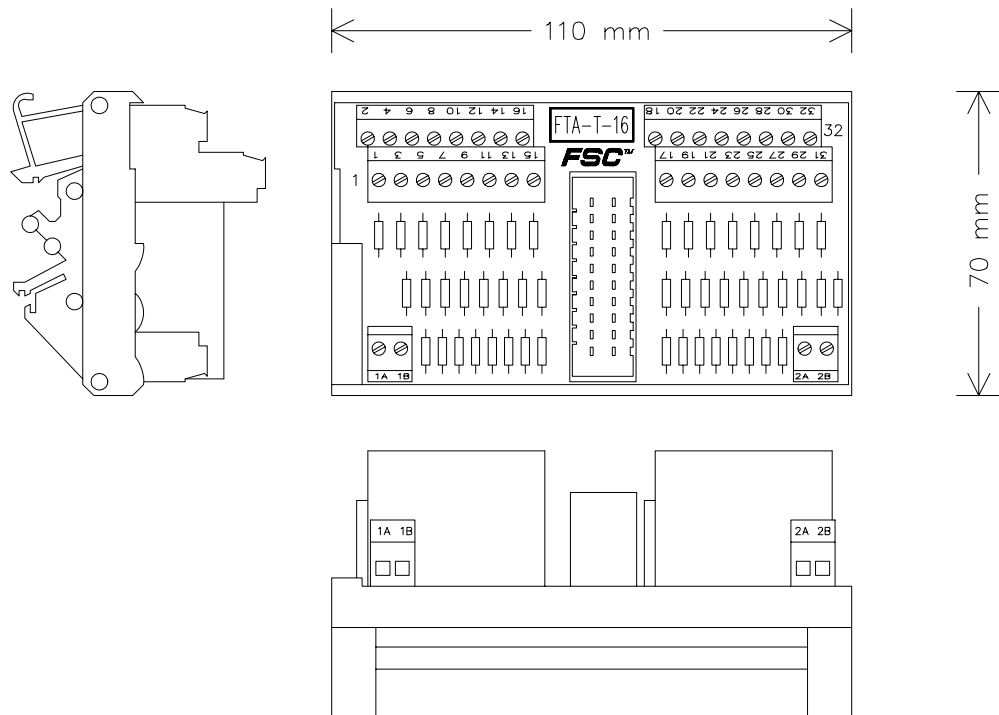


Figure 1 Mechanical layout

## Main functions

The FTA-T-16 module has three main functions:

- loop-monitored input function,
- power supply to each transmitter with voltage-current limitation in compliance with Hazardous Area Class I Division 2, and
- enable monitoring of the external power connected to the FTA-T-16 module.

## Loop-monitored input

The FTA-T-16 module supports a loop-monitored input function for serial and parallel field resistor or digital sensor contact configurations. Figure 2 below shows the schematic diagrams for connecting serial and parallel resistor configurations.

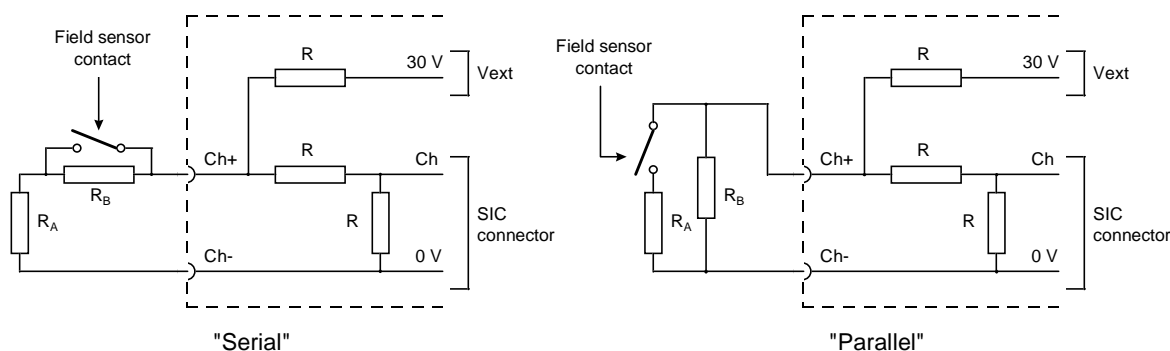


Figure 2 Schematic diagrams for connecting serial and parallel resistor configurations

In these configurations,  $R_A$  is 1.0 kOhm and  $R_B$  is 3.3 kOhm or 10 kOhm ( $\pm 10\%$ ). The maximum field wire resistance is 500 Ohm.

## Monitoring of external power

External power can be connected to the FTA-T-16 module via one or both of the two screw terminal pairs marked '1A', '1B', '2A' and '2B'. The screw terminal pairs are interconnected on the FTA module.

The FSC software can monitor the external power voltage via the analog input module.





Figure 3 below shows the schematic diagram for power distribution with monitoring.

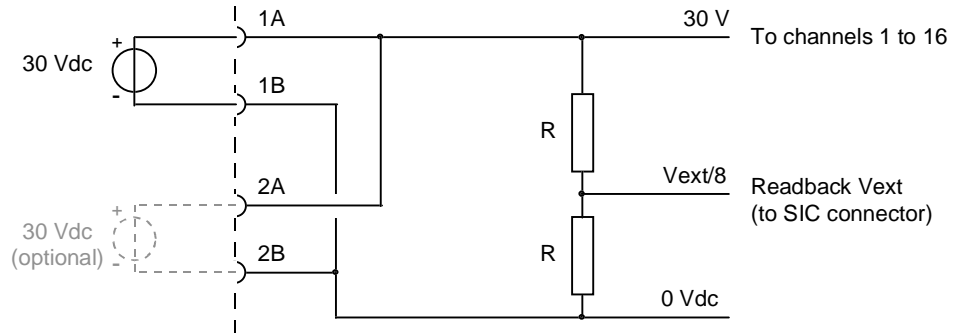


Figure 3 Schematic diagram for power distribution with monitoring

## Applications

For details on applications and connection options for the FTA-T-16 module refer to the 'SIC to FTA applications' data sheet.

## Connections

### External power

The external supply voltage ( $V_{ext}$ ) is connected to the following screw terminals (marked '1A', '1B', '2A' and '2B' on the FTA):

Screw terminal	Function
1A	30 Vdc $V_{ext}$
1B	0 Vdc $V_{ext}$
2A	30 Vdc $V_{ext}$
2B	0 Vdc $V_{ext}$

**Connections diagram** The FTA-T-16 module has 32 screw terminals for connection of field wiring. The screw terminals are numbered 1 to 32. The connections diagram of the FTA-T-16 module is as follows:

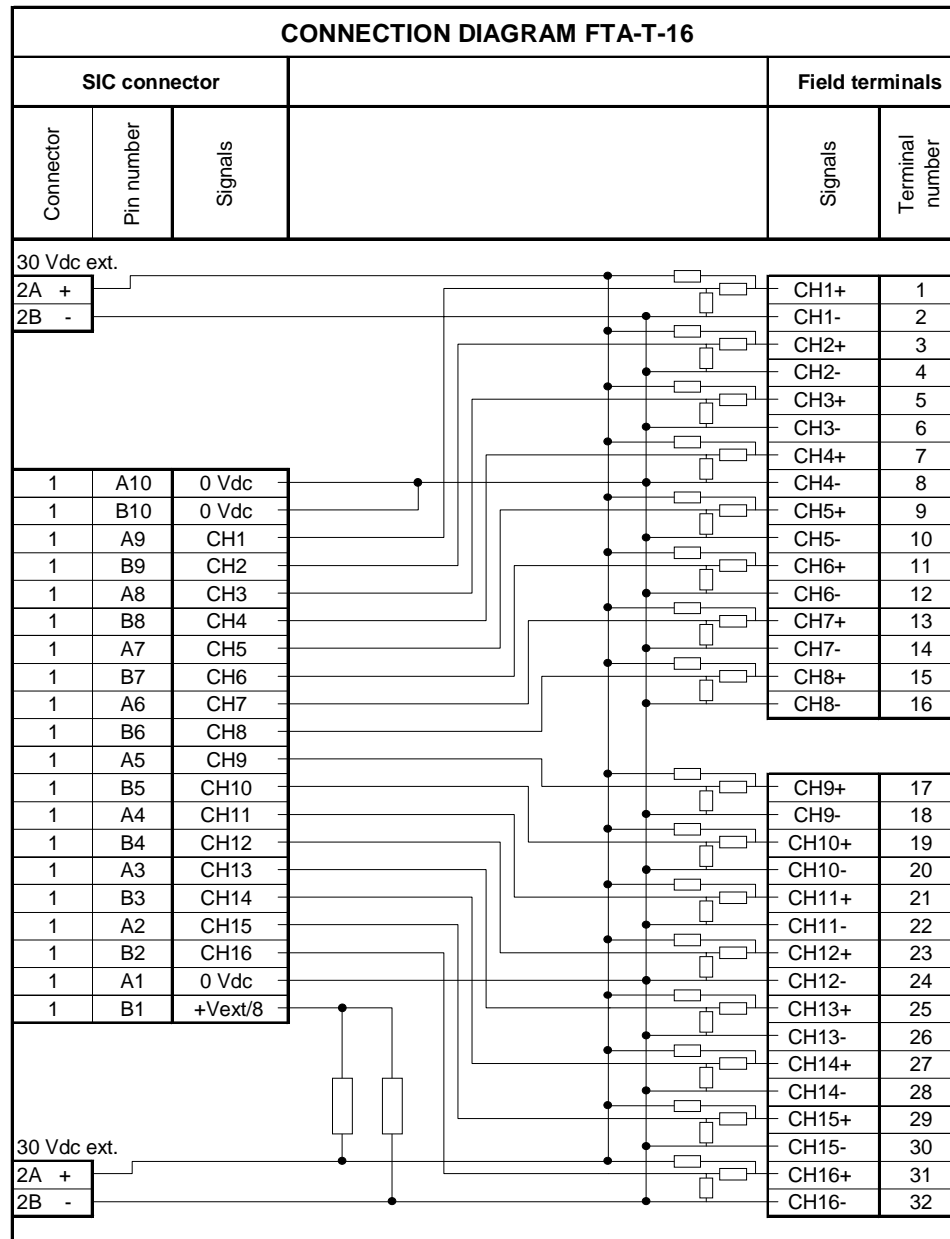


Figure 4 Connections diagram



## Technical data

The FTA-T-16 module has the following specifications:

<b>General</b>	Type number:	FTA-T-16
	Approvals:	CE; UL, FM, TÜV approvals pending
<b>Input</b>	Number of input channels:	16
	Power requirements:	30 Vdc external 150 mA (all inputs closed)
	Max. current per channel:	< 12 mA at 30 Vdc
<b>Output</b>	To passive transmitters (Vext):	
	– open voltage	typically 24 Vdc
	To 10105/2/1 module:	
	– output voltage	0 to 3.5 Vdc
<b>Physical</b>	Module dimensions:	110 x 70 x 60 mm (L x W x H) 4.33 x 2.76 x 2.36 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	111 mm (4.37 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter	2.5 mm <sup>2</sup> (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Field signal specifications</b>	Field wire resistance:	< 500 Ohm
	Field device resistance (see Figure 2):	
	– R <sub>A</sub>	1k0 (serial or parallel), ± 10%
	– R <sub>B</sub>	3k3 / 10k (serial or parallel), ± 10%
	HYDROGEN (Group A & B):	
	– max. loop inductance	500 mH
	– max. loop capacitance	0.3 µF
	NON-HYDROGEN (Group C & D):	
	– max. loop inductance	1 H
	– max. loop capacitance	7 µF



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## FTA-T-17

## Digital output (relay) FTA for AK5/6 applications (4 channels)

### Description

The field termination assembly module FTA-T-17 is the interface between the system interconnection cables (SICs) and the external field wiring (screw terminals). It has four relay-based potential-free output channels suitable for applications up to AK6 without making use of fault exclusions.

The FTA-T-17 module complies with safety requirements for general use in safety requirement classes AK5/6 as defined in DIN V 19250.

Each channel consists of:

- three relays,
- a fused NO field contact (5 AT, slow-acting), and
- a status indication LED.

The relays are capable of driving a wide variety of loads including 115/230 Vac, which gives the FSC system a 115/230 Vac output capability for AK5/6 applications. The energized state of the relay is indicated by an LED on the module.

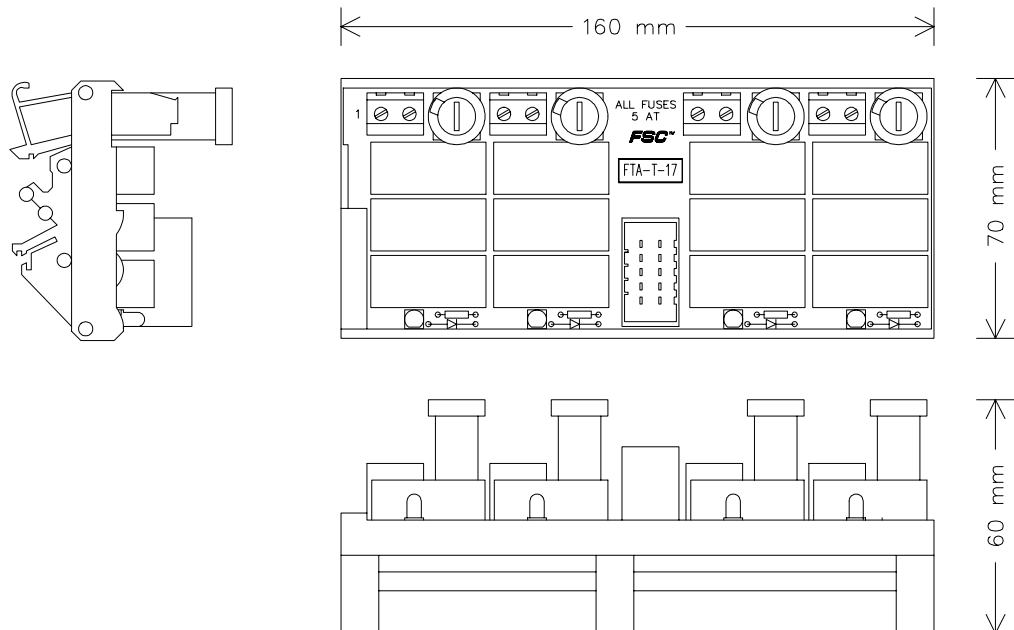


Figure 1 Mechanical layout

Four channels can be connected to the FTA-T-17 module via a system interconnection cable (SIC). This cable is plugged into the SIC connector on the FTA module.

The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

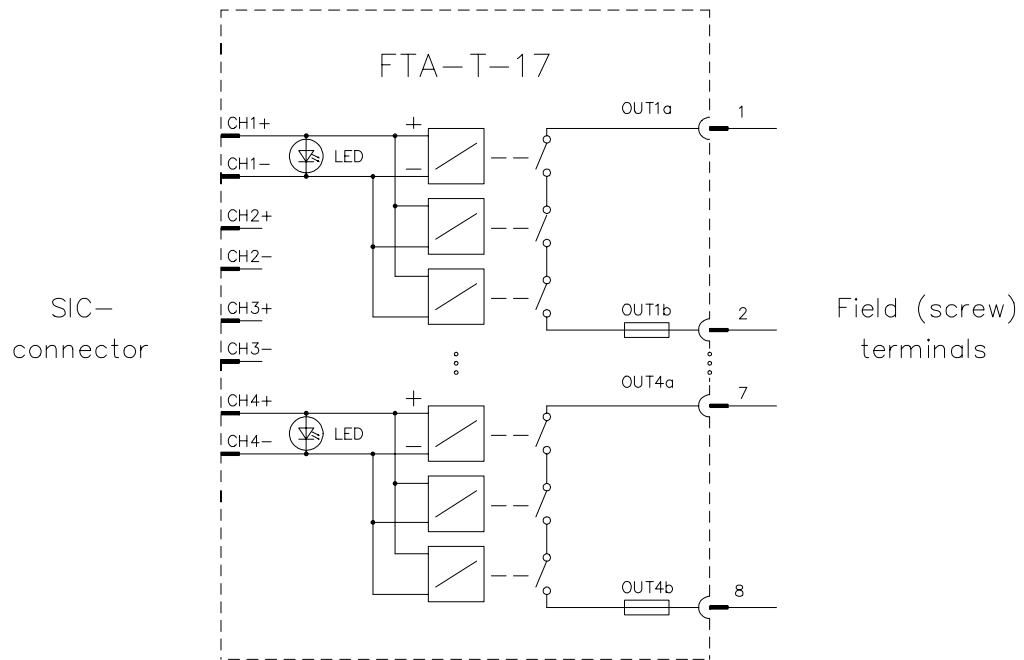


Figure 2 Schematic diagram

## Applications

For details on applications and connection options for the FTA-T-17 module refer to the 'SIC to FTA applications' data sheet.



## Connections

The connections diagram of the FTA-T-17 module is as follows:

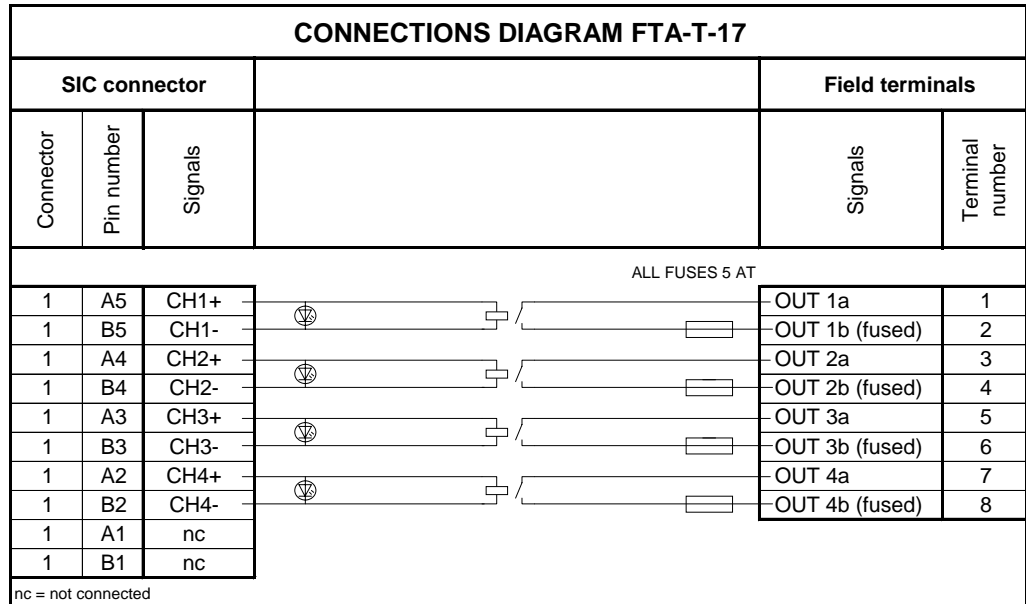


Figure 3 Connections diagram



## Technical data

The FTA-T-17 module has the following specifications:

<b>General</b>	Type number:	FTA-T-17
	Approvals:	CE; UL, FM, TÜV approvals pending
	Safety class:	AK1-6
<b>Input</b>	Nominal input voltage:	24 Vdc
	Max. input voltage:	36 Vdc
	Relay pick-up voltage:	19.2 Vdc
	Input current:	typically 35 mA at 24 Vdc
<b>Output</b>	Number of output channels:	4
	Max. output current:	5 A
	Min. output current:	1 mA at 5 V
	Max. output voltage:	250 Vac / 250 Vdc
	Max. switched load:	1250 VA / 150 W (see Figure 4)
<b>Fuses</b>	Rating:	5 AT (slow-acting)
	Dimensions:	5 x 20 mm (0.2 x 0.78 in)
<b>Physical</b>	Module dimensions:	160 x 70 x 60 mm (L x W x H) 6.30 x 2.76 x 2.36 in (L x W x H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	161 mm (6.34 in)
<b>Termination</b>	Screw terminals:	
	– max. wire diameter:	2.5 mm <sup>2</sup> (AWG 14)
	– strip length:	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
<b>Environment</b>	Ambient temperature:	–5°C to +60°C (23°F to 140°F)
<b>Isolation</b>	Isolation:	
	– coil to contact	3750 Vac
	– contact to contact	1200 Vac





## Technical data (continued)

<b>Relay contact</b>	Max. current:	8 A
	Max. switched voltage:	250 Vac / 250 Vdc
	Max. switched load:	2000 VA / 150 W
	Max. switch frequency:	20 Hz
	Expected life:	
	– electrical	100,000 switch operations
– mechanical	10,000,000 switch operations	
Contact material:	gold flash over silver alloy	

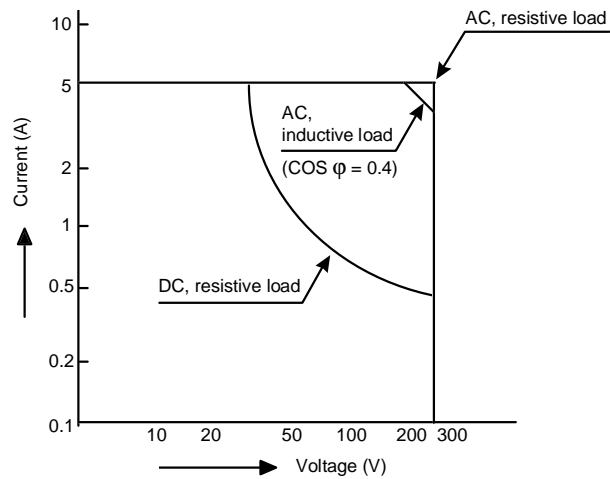


Figure 4 Maximum switched power

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# **Fail Safe Control Hardware Manual**

## **Section 10: User Station Modules**

**TotalPlant**



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## 07170/1/1

## FSC EPROM programmer

### Description

The FSC EPROM programmer enables the programming of a complete set of EPROMs for the FSC system's central processor unit (CPU), communication (COM) modules or memory (MEM) modules. One set consists of four EPROMs.

The user interface that is used to program the EPROMs is part of the FSC user station software ('Program application in EPROMs' option).

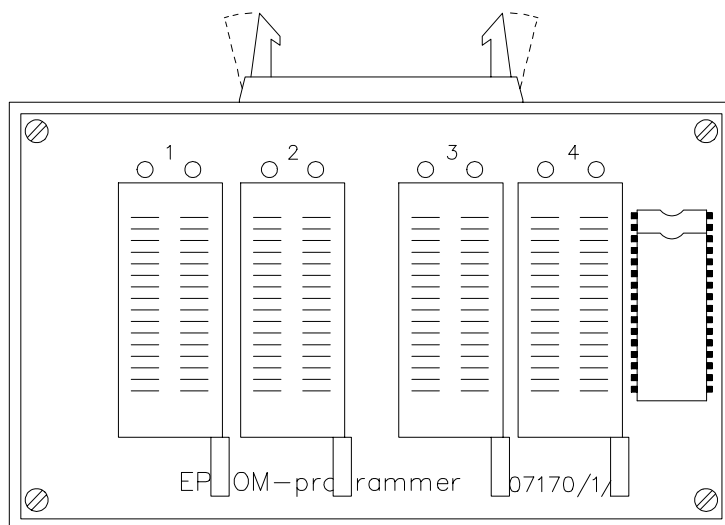


Figure 1 Top view

The 'Program application in EPROMs' section in the FSC Software Manual contains a list of the EPROMs that can be programmed with the FSC EPROM programmer.

The programmer can be connected to the PC interface modules 07177/1/1 or 07177/1/3 using the 34-pole flatcable which is supplied with the 07170/1/1 programmer.

### Notes:

1. Switch off the power to your PC before connecting or disconnecting the 07170/1/1 EPROM programmer.
2. Do not place the EPROMs until the FSC 'Program application in EPROMs' program has started up.



---

**Warning!**

Electrostatic discharge (ESD) and fast transients on the power supply at the PC may result in EPROM programming errors.

---

**Pin allocation**

The pin allocation of the 07170/1/1 connector is as follows:

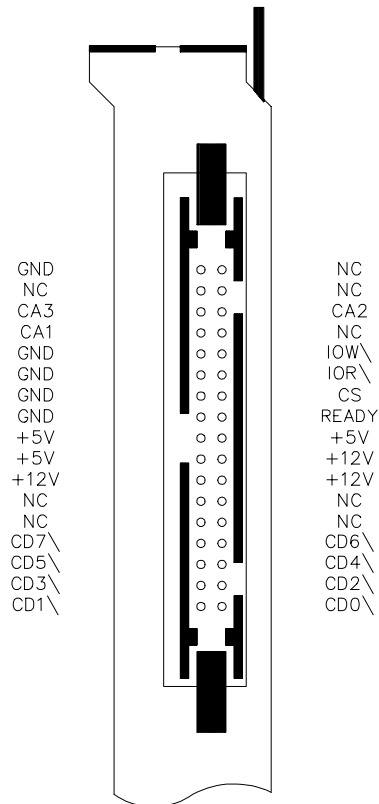


Figure 2 Pin allocation of 07170/1/1 connector

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## Calibration

The 07170/1/1 EPROM programmer has potentiometers for calibration purposes (P50 to P53). The programmer can be calibrated in combination with the 07177/1/1 (or 07177/1/3) module using the calibration option of the 'Program application in EPROMs' program.

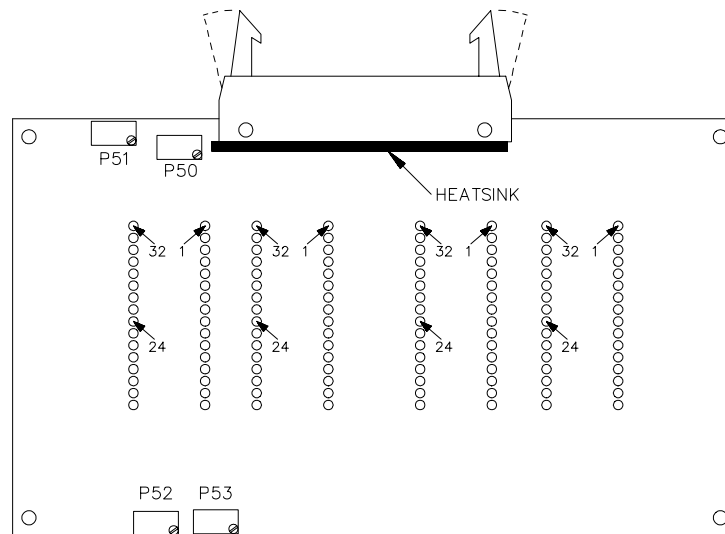


Figure 3 Location of potentiometers on EPROM programmer

## Technical data

The 07170/1/1 EPROM programmer has the following specifications:

<b>General</b>	Type number:	07170/1/1
	Approvals:	CE
	Software versions:	all; supported EPROM types vary*
	Connector:	34-pin male
<b>Power</b>	Power requirements:	5 Vdc 12 Vdc

**\* Note:**

The 4 Megabit EPROMs (e.g. 27C4001) are not supported by EPROM programmers produced before June 1, 1990.



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## 07170/A/1

## Adapter module for 10002/A/1 memory module

### Description

The 07170/A/1 module is an adapter module between the FSC EPROM programmer (07170/1/1) and the CPU memory module (10002/A/1).

The 07170/A/1 module is fixed onto the 07170/1/1 EPROM programmer by closing the ZIF sockets of the 07170/1/1 module. Remove all memory ICs from the sockets of the 10002/A/1 module (RAM or EPROM) before placing the 10002/A/1 module in the connector strip of the 07170/A/1 adapter module.

### Note:

Failure to remove the ICs from the 10002/A/1 sockets may cause fatal damage to the ICs and/or the EPROM programmer.

Using the 07170/A/1 adapter module, it is possible to load the surface-mounted EPROMs on the bottom side of the 10002/A/1 module with a new system program.

The surface-mounted EPROMs are erased by putting the 10002/A/1 module in an EPROM eraser (UV light source).

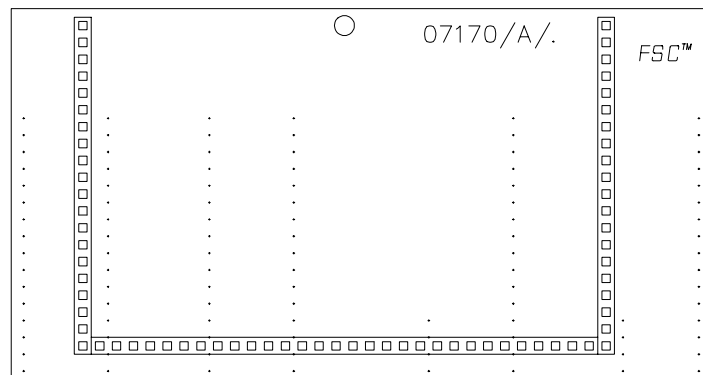


Figure 1 Top view



## Technical data

The 07170/A/1 adapter module has the following specifications:

### General

Type number:	07170/A/1
Approvals:	CE
Software versions:	not applicable
Dimensions:	107 x 56 x 19 mm (L x W x D) 4.21 x 2.20 x 0.75 in (L x W x D)

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## 07177/1/. PC serial interface + key module

### Description

The 07177/1/1 module combines three functions in one module:

- TTL interface between an IBM (AT-compatible) PC and the 07170/1/1 EPROM programmer,
- two isolated serial interfaces (one RS232C and one half-duplex RS485), and
- hardware key for the FSC user station (U100).

The 07177/1/3 module has the following function:

- TTL interface between an IBM (AT-compatible) PC and 07170/1/1 EPROM programmer.

### Jumpers

Figure 1 shows the location of the jumpers on the 07177/1/. module.

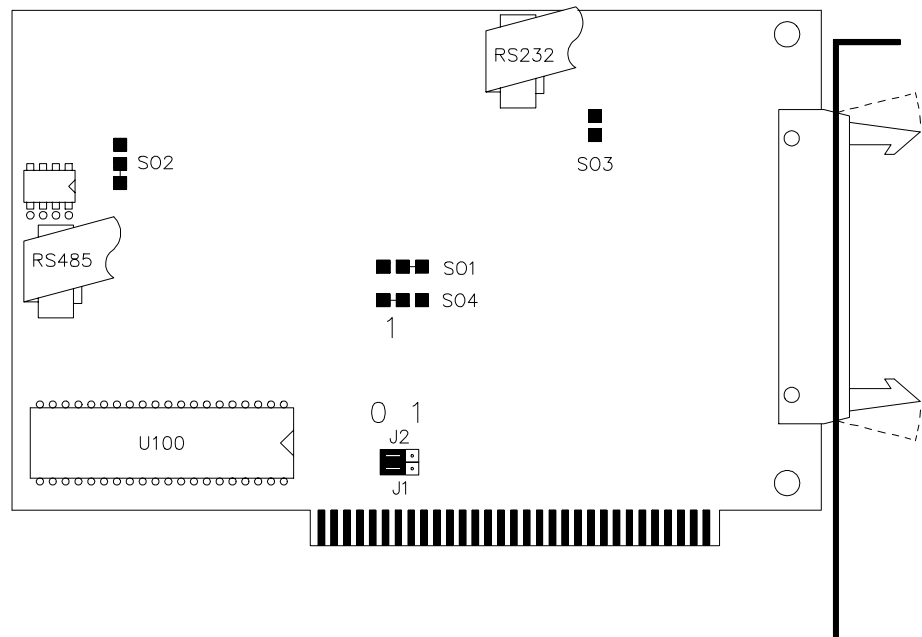


Figure 1 Location of connectors and jumpers on 07177/1/. module

Solder jumper SO1 and SO2 are factory-set.

If solder jumper SO3 is closed, the DTR is set high as soon as power is available.





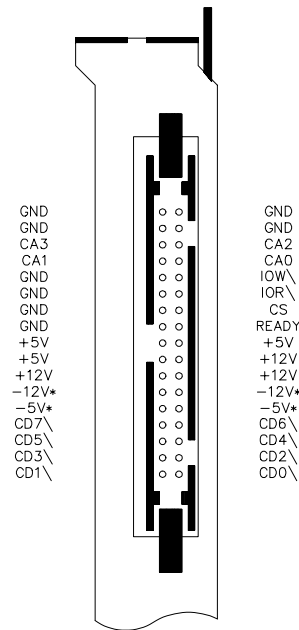


Figure 3 Front view of connector of 07177/1/3 module

## Serial interfaces

Two serial interfaces are available (07177/1/1 only):

- RS232C, and
- RS485.

## RS232C interface

An RS232C interface (on the 07177/1/1 module or one of the PC's COM ports) can be used to connect the FSC user station to the FSC system (see also 10004/B/1 and 10004/F/1 data sheets). In these data sheets, the colors in the figures with cable examples refer to Belden 8723 cable. Figure 4 below shows the pin connections of the male RS232C connector.

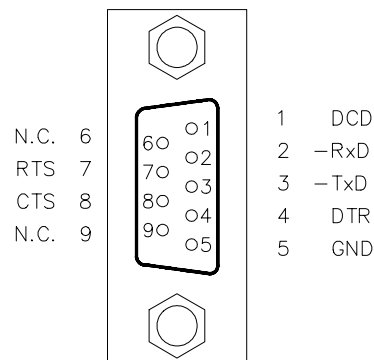


Figure 4 Front view of male RS232C connector



The cable connections are as follows:

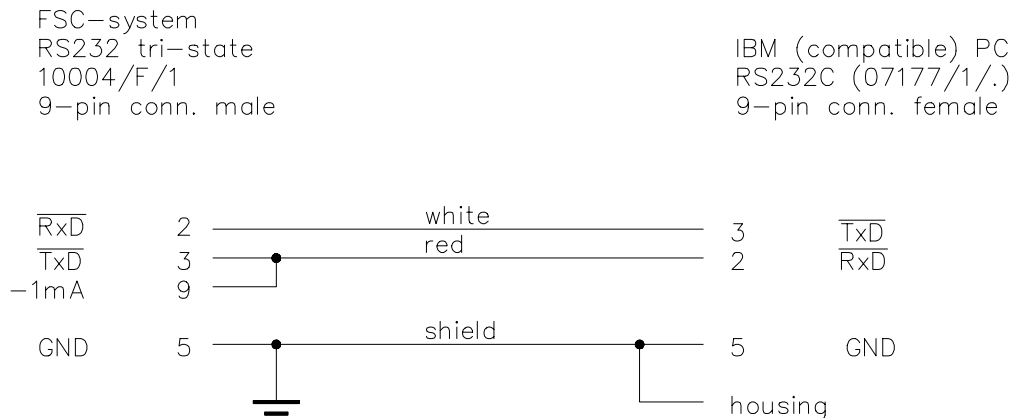


Figure 5 Cable between FSC system and IBM-compatible PC 9-pin connector, without hardware handshake

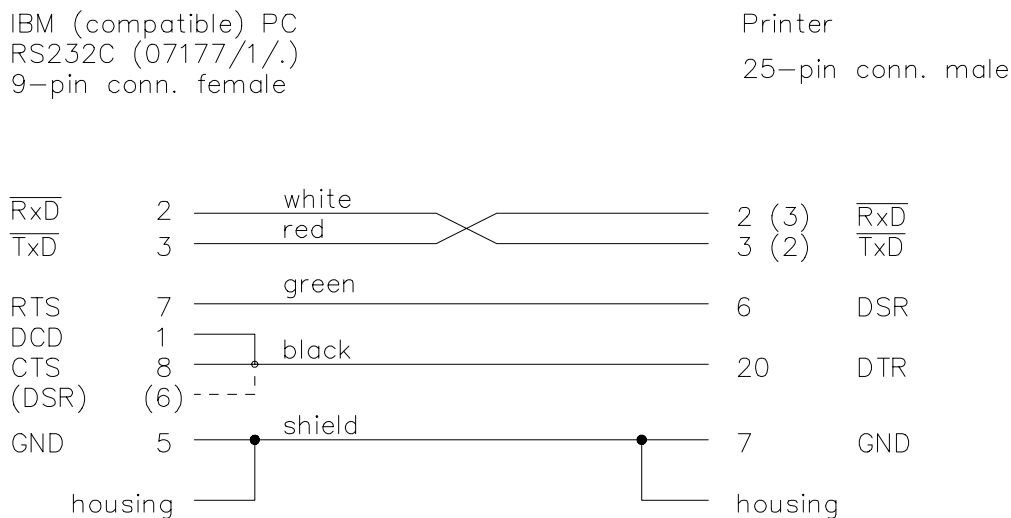


Figure 6 Cable between IBM-compatible PC and printer 25-pin connector, with hardware handshake.

**Notes:**

- Pins 2 and 3 of some printer types are interchanged.
- Printing on DOS level via standard COM1 or COM2 ports of the PC may require connecting pin 6 (DSR) to the black wire.



IBM (compatible) PC  
 RS232C (07177/1/.)  
 9-pin conn. female

Printer  
 25-pin conn. male

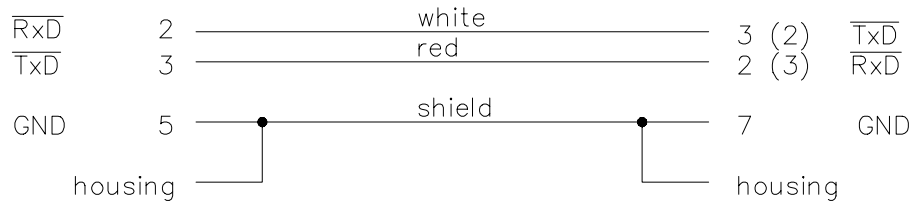


Figure 7 Cable between an IBM (compatible) PC and printer 25-pin connector, without hardware handshake.

**Note:**

Pins 2 and 3 of some printer types are interchanged.

**RS485 interface**

The half-duplex RS485 interface on the 07177/1/1 module can be used to connect the FSC user station to multiple FSC systems (max. 15) in a multidrop configuration.

For details on communication cables refer to the 10004/I/1 data sheet.

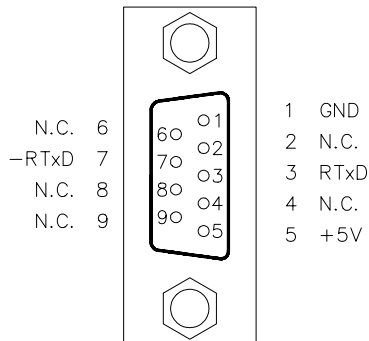


Figure 8 Front view of male RS485 connector

**Hardware key**

For releases < 2.92, the hardware key of the 07177/1/. module is required to be able to use all the options of the FSC Development System software. If the key is not placed, not all programs can be used.



## Technical data

The 07177/1/. module has the following specifications:

### General

Type number: 07177/1/.  
Approvals: CE\*  
Software versions:  $\geq 2.77$  (for 486 PCs > 2.80b)  
Space requirements: 07177/1/1: 2 PC slots  
07177/1/3: 1 PC slot

### Power

Power source: IBM (AT-compatible) PC  
Power requirements: 5 Vdc, 1 A, without external load on 34-pin connector;  
12 Vdc, 0 A, without external load on 34-pin connector;  
-5 Vdc, 0 A, without external load on 34-pin connector;  
-12 Vdc, 0 A, without external load on 34-pin connector

### Connectors

EPROM programmer interface: 34-pin male  
RS485 serial interface: 9-pin male  
RS232C serial interface: 9-pin male

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#### \* Note:

CE approval requires plastic covers to be placed on unused 9-pin communication connectors.

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