Fail Safe Control

Hardware Manual

Revision 02

PM.MAN.8048

10/97

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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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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Hardware Manual

Section 1:
General Information

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Revision 02 (10/97)

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Section 1: General Information

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
fuse terminal	
indication / alarm lamp	
indicator LED	
diode	
resistor	
alarm horn	
fan	
sheet connectors to FSC I/O module redundant central part	

description	symbol
crossing conductors without electric connection	
junction of conductors	
incoming or outgoing signals	
card connector	
solenoid valve	
interposing relay or motor-operated valve	
circuit breaker	
receptacle	

description	symbol
make contact	
break contact	
push button maintained	
pulse contact	
sheet connector connects from sheet 22 line 1	S22/1
transistor	
capacitor	
varistor	

description	symbol
level switch	
rotary switch	
proximity switch	
push button momentary	
keyswitch	
PCB relays relay + diode + LED	
temperature element	

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Left blank intentionally.

FSC operating conditions

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°C to +80°C (–13°F to +176°F)
- Operating temperature: 0°C to 60°C (32°F to 140°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. *(German title: Leittechnik. Grundlegende Sicherheits-betrachtungen für MRS-Schutzeinrichtungen)*	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. *(German title: Grundsätze für Rechner in Systemen mit Sicherheitsaufgaben)*	Microprocessor-based safety systems
VDE 116 (10/89)	Electrical equipment of furnaces. *(German title: Elektrische Ausrüstung von Feuerungsanlagen)*	
EN 54 part 2 (01/90)	Components of automatic fire detection systems, Introduction *(German title: Bestandteile automatischer Brandmeldeanlagen)*	
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 frequence; 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.

$$C\!\!\in$$

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.

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**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.

Left blank intentionally.

Key coding

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

Plug-and-play modules (10xxx/2/x)	Souriau type no.
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

Non plug-and-play modules (10xxx/1/x)	Souriau type no.
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).
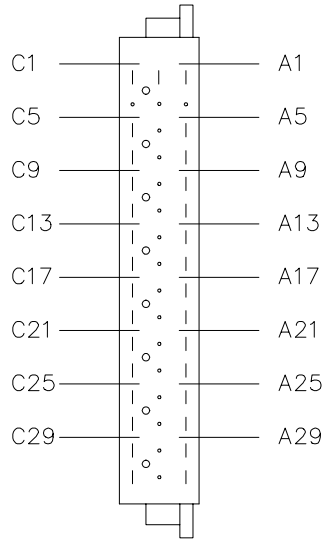
Figure 1   Module connector
(back view)
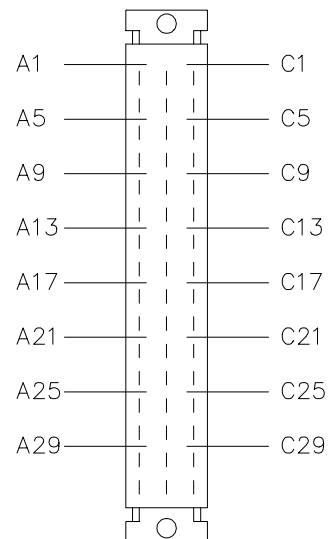
Figure 2   Rack connector
(front view)

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).
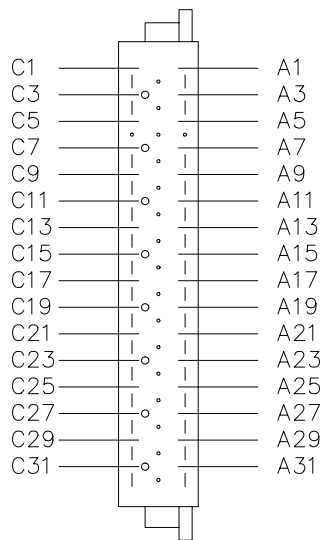
Figure 3   Module connector
(back view)
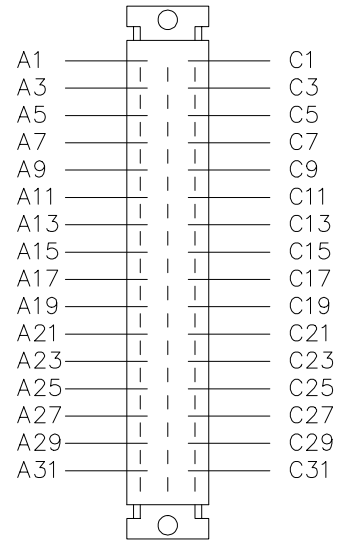
Figure 4   Rack connector
(front view)

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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 code				Rack code			
Module type	Hole	Pins			Module type	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

Honeywell

Total Plant

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Honeywell

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.
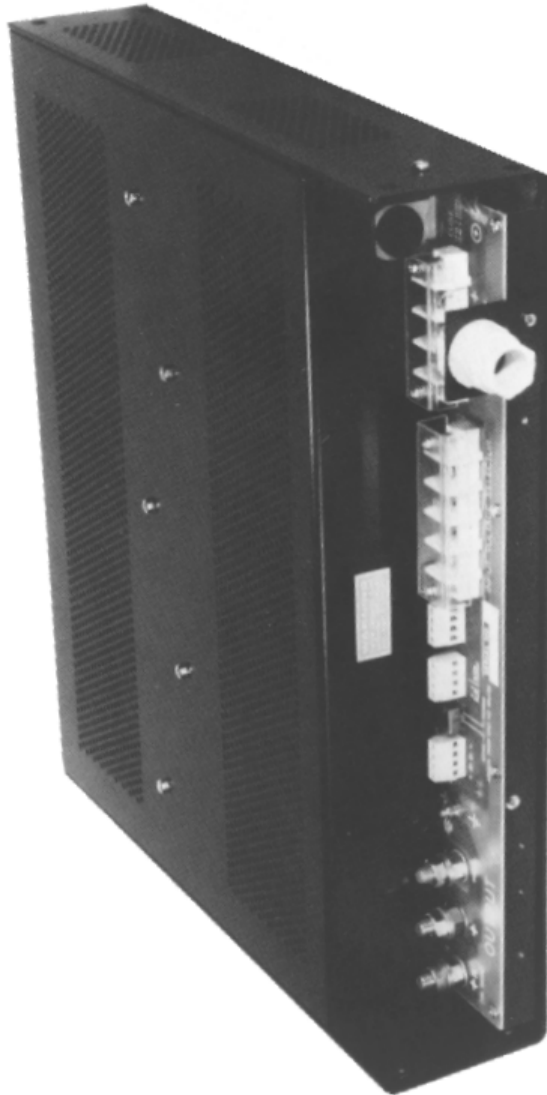
Figure 1   Full view
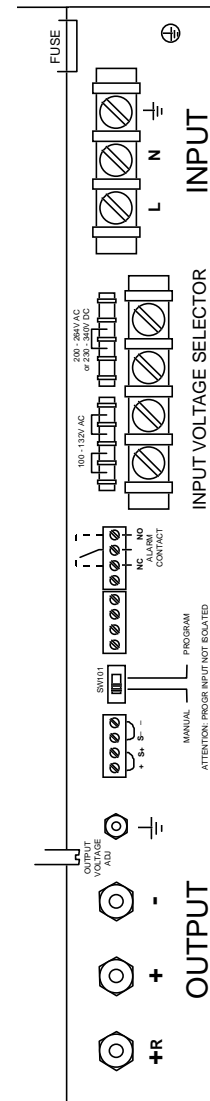
Figure 2   Connections

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.
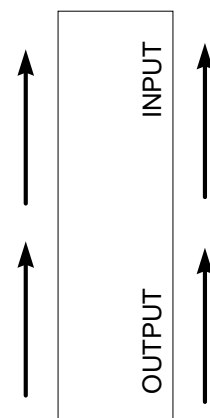
Figure 3   Vertical mounting

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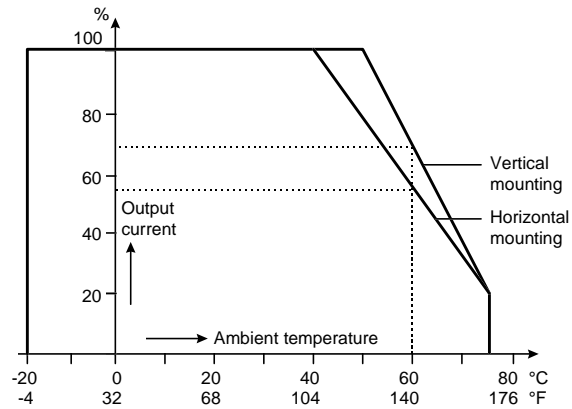
Figure 4   Derating curve
(percentage of load versus ambient temperature)

**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 mm² (AWG 14)	4.0 mm² (AWG 12)	16 mm² (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.
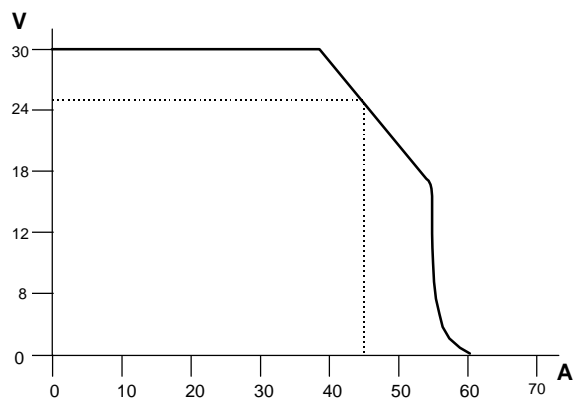
Figure 5   Current limit

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.
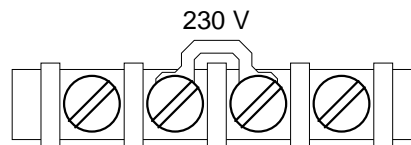
230 V

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.
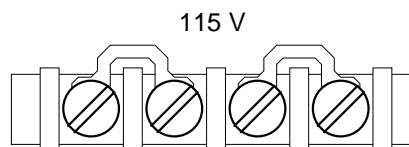
115 V

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.

+   S+   S-   -
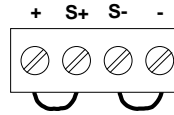
Figure 8   Sense block

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.

NC   NO
ALARM
CONTACT
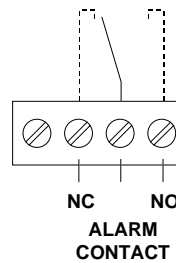
Figure 9   Relay contact alarm diagram

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

General

Type number:	1200 S 24 P067
Approvals:	CE, TÜV, UL

Power

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

Physical

Dimensions:	433 x 88 x 385 mm (W x H x D) 17.05 x 3.46 x 15.16 in (W x H x D)
Weight:	11 kg (24.2 lb)
Fuse dimensions:	32 x 6.3 mm (1.26 x 0.25 in)

Environment

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)

Input

Inrush current:	< 40 A

Output

Output voltage:	24 Vdc with dual overvoltage protection
Ripple and noise:	Max. 5 mV rms, 15 mV p-p

Technical data (continued)

Output (cont.)	Output current:	45 A at –20°C to +50°C (–4°F to +122°F) when mounted vertically
		45 A at –20°C to +40°C (–4°F to +104°F) when mounted horizontally
	Derating of output current:	to 68% at 60°C (140°F) when mounted vertically
		to 54% at 60°C (140°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
Isolation	Input to output:	3750 V rms (1 min.)
	Input to case:	2500 V rms (1 min.)
	Output to case:	500 Vdc

Left blank intentionally.

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.
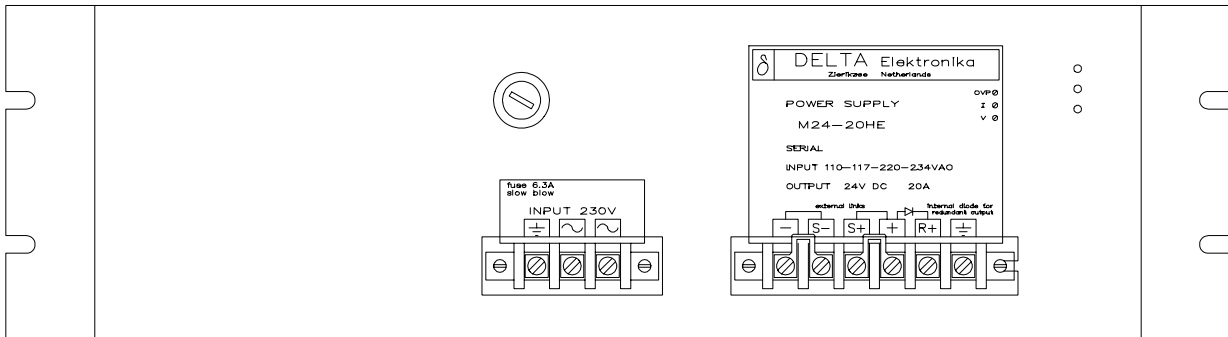
Figure 1   Front view

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).
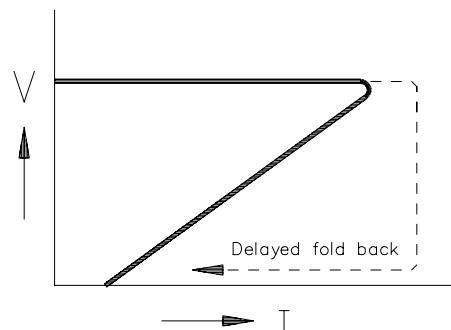
Figure 2   Delayed foldback

Derating curve

The derating curve of the M24-20HE power supply is as follows:
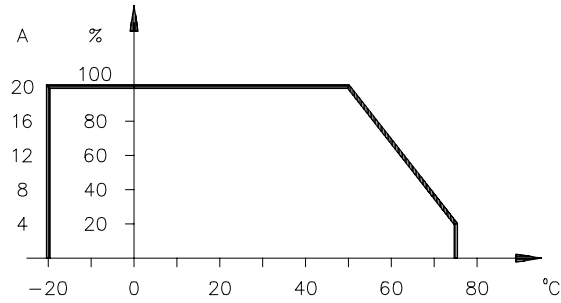
Figure 3   Derating curve (current & percentage of load vs. ambient temperature)

Connections

The transformer connections of the M24-20HE power supply are as follows:
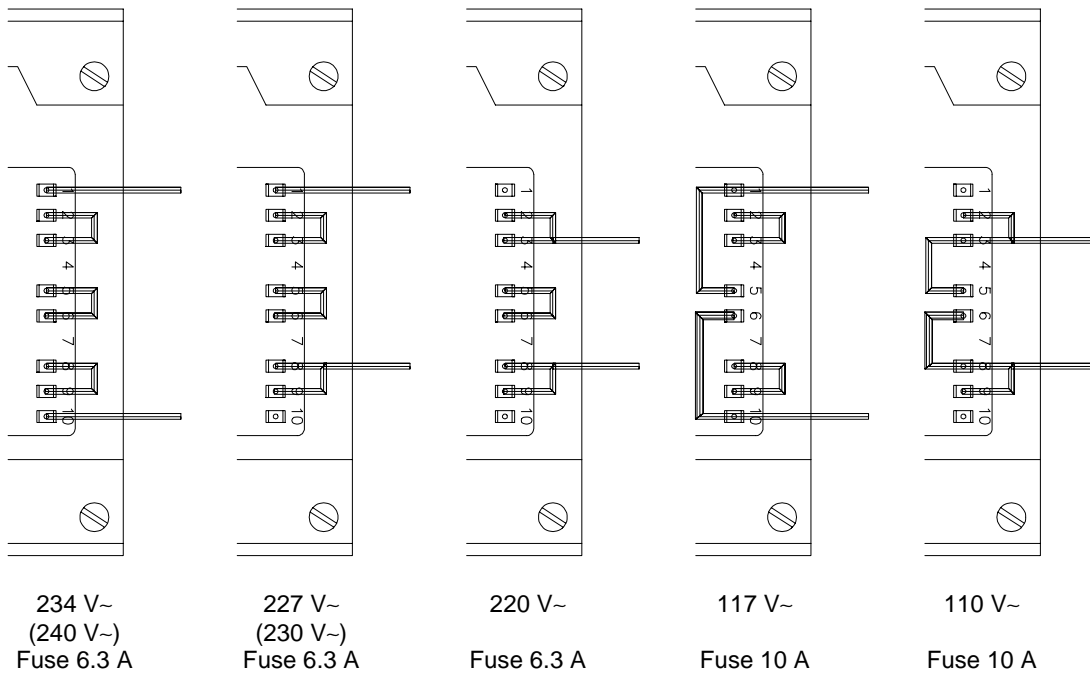
234 V~	227 V~	220 V~	117 V~	110 V~
(240 V~)	(230 V~)			
Fuse 6.3 A	Fuse 6.3 A	Fuse 6.3 A	Fuse 10 A	Fuse 10 A

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).
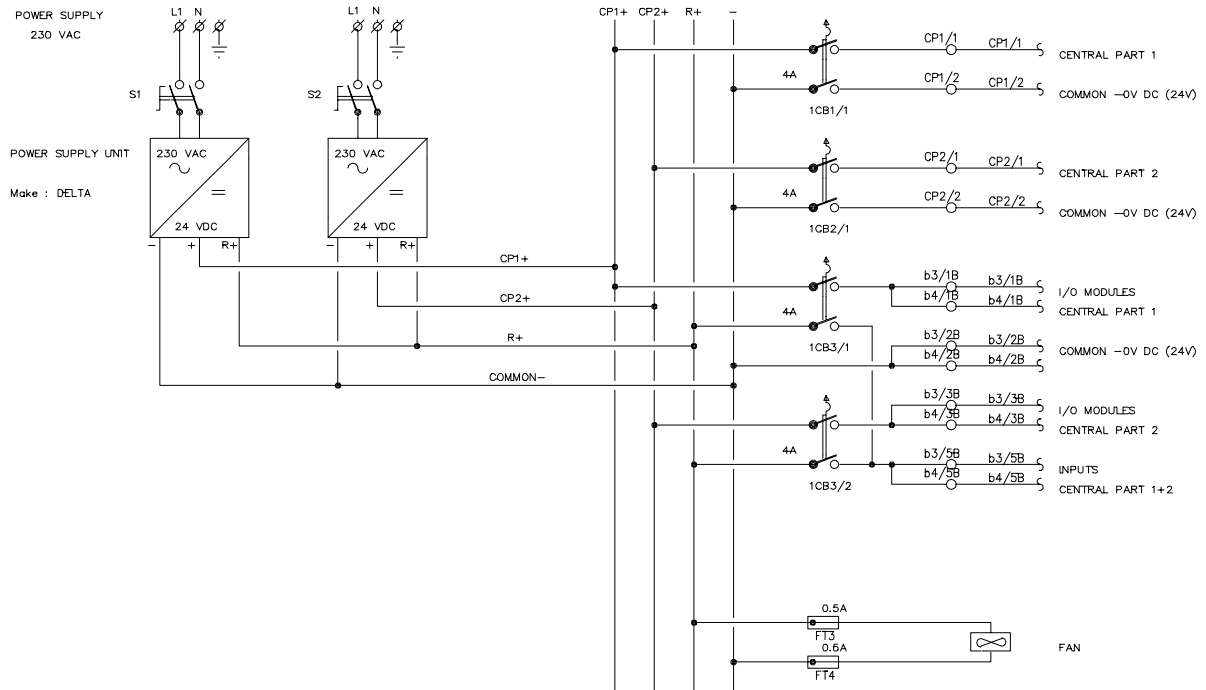
Figure 5   24 Vdc power distribution example

Technical data

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

General

Type number:	M24-20HE
Approvals:	CE, TÜV, UL

Power

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)

Physical

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)

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Technical data (continued)

Environment	Ambient temperature:	–20°C to +60°C (–4°F to +140°F)
Input	Input current:	3.7 A at 220 Vac
	Inrush current:	< 80 A at 220 Vac
	Crest factor:	1.9
Output	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%
Isolation	AC input to case:	2500 Vac
	DC output to case:	500 Vdc

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.
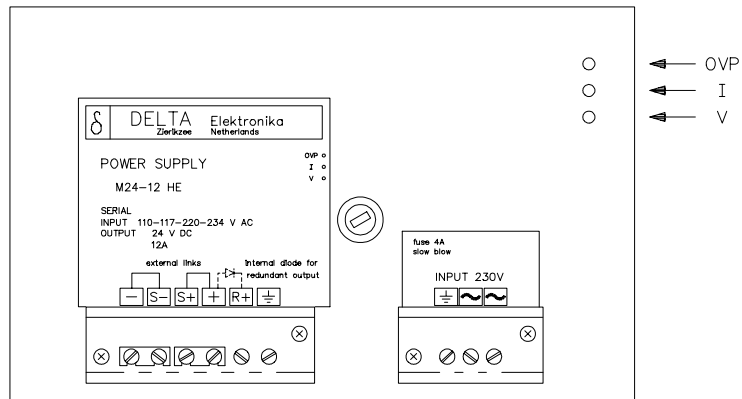
Figure 1   Back view

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.

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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).
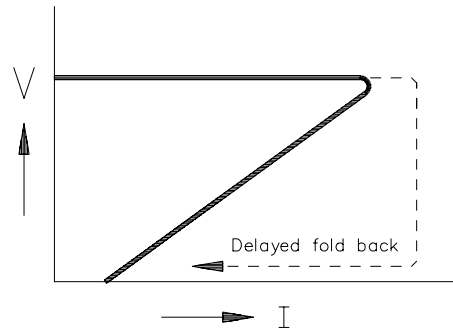
Figure 2   Delayed foldback

Derating curve

The derating curve of the M24-12HE power supply is as follows:
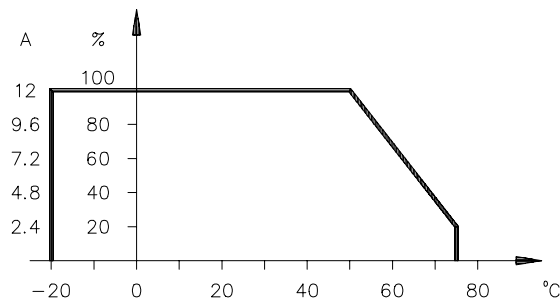
Figure 3   Derating curve (current & percentage of load vs. ambient temperature)

Connections   The transformer connections of the M24-12HE power supply are as follows:
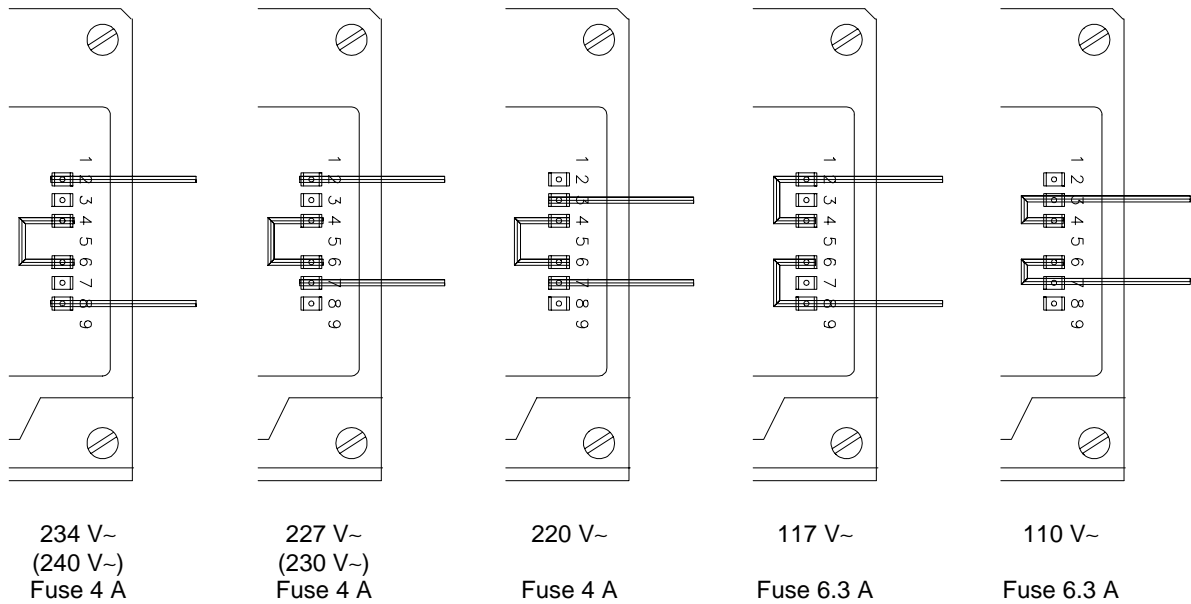
234 V~	227 V~	220 V~	117 V~	110 V~
(240 V~)	(230 V~)			
Fuse 4 A	Fuse 4 A	Fuse 4 A	Fuse 6.3 A	Fuse 6.3 A

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).
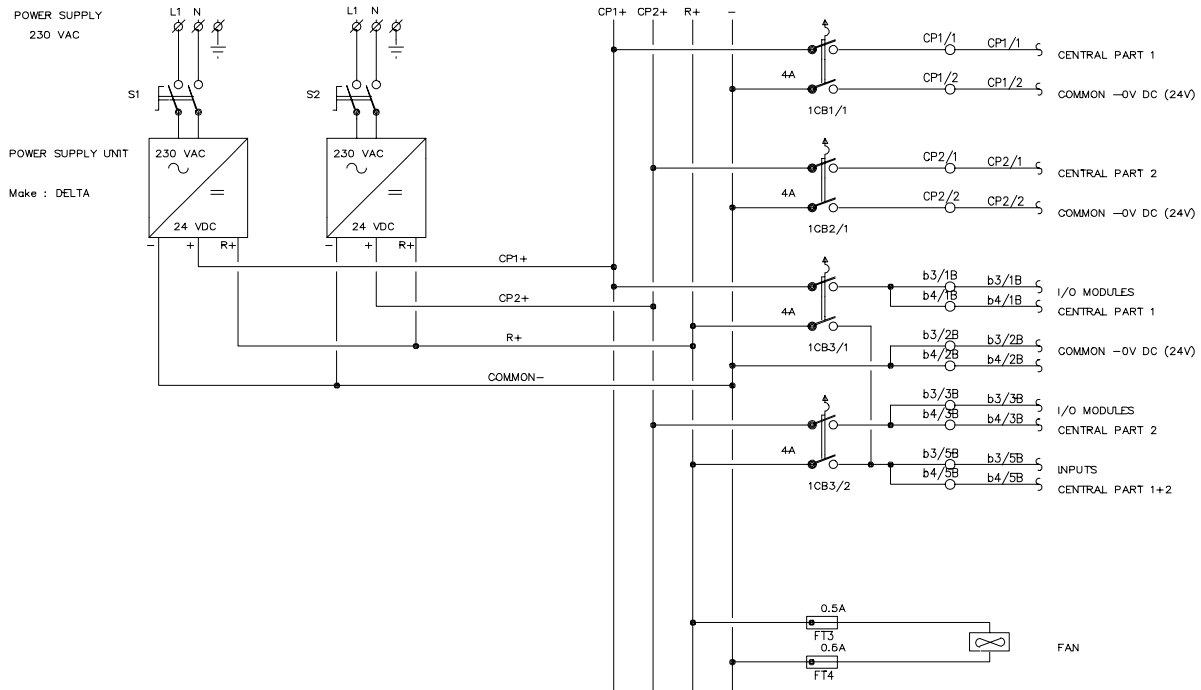
Figure 5   24 Vdc power distribution example

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

General

Type number:	M24-12HE
Approvals:	CE, TÜV, UL

Power

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)

Physical

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)

Environment	Ambient temperature:	–20°C to +60°C (–4°F to +140°F)
Input	Input current:	2.2 A at 220 Vac
	Inrush current:	< 40 A at 220 Vac
	Crest factor:	1.8
Output	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%
Isolation	AC input to case:	2500 Vac
	DC output to case:	500 Vdc

Left blank intentionally.

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

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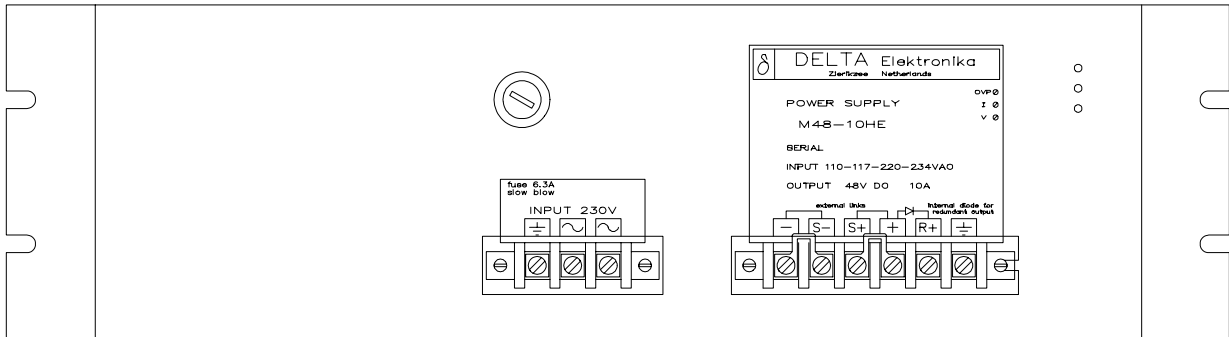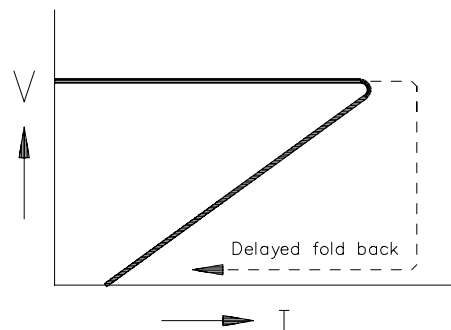
Derating curve   The derating curve of the M48-10HE power supply is as follows:
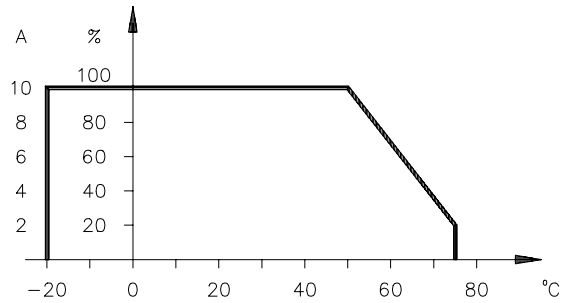
Figure 3   Derating curve (current & percentage of load vs.
ambient temperature)

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

234 V~	227 V~	220 V~	117 V~	110 V~
(240 V~)	(230 V~)			
Fuse 6.3 A	Fuse 6.3 A	Fuse 6.3 A	Fuse 10 A	Fuse 10 A
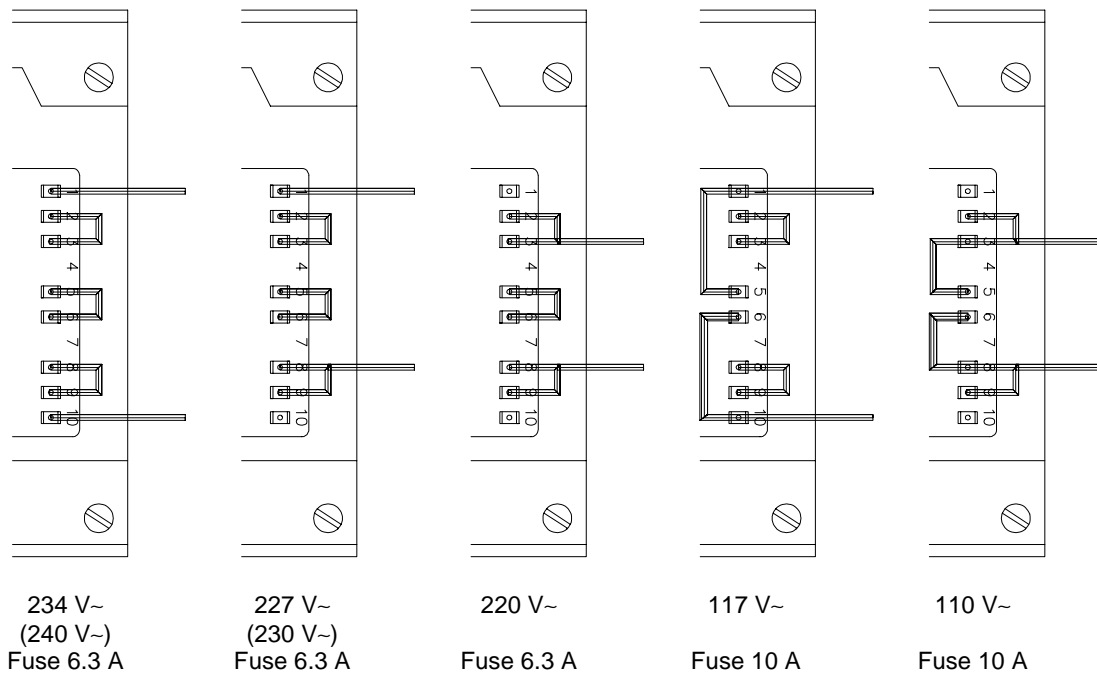
Figure 4   Transformer connections

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

General	Type number:	M48-10HE
	Approvals:	CE, TÜV, UL
Power	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)
Physical	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)
Environment	Ambient temperature:	–20°C to +60°C (–4°F to +140°F)
Input	Input current:	3.7 A at 220 Vac
	Inrush current:	< 80 A at 220 Vac
	Crest factor:	1.9
Output	Output voltage:	48 Vdc with overvoltage protection
	Ripple content:	< 0.2 V p-p
	Output current:	10 A at –20°C to +50°C (–4°F to +122°F) 7 A at 50°C to 60°C (122°F to 140°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%
Isolation	AC input to case:	2500 Vac
	DC output to case:	500 Vdc

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 '0VP' 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.
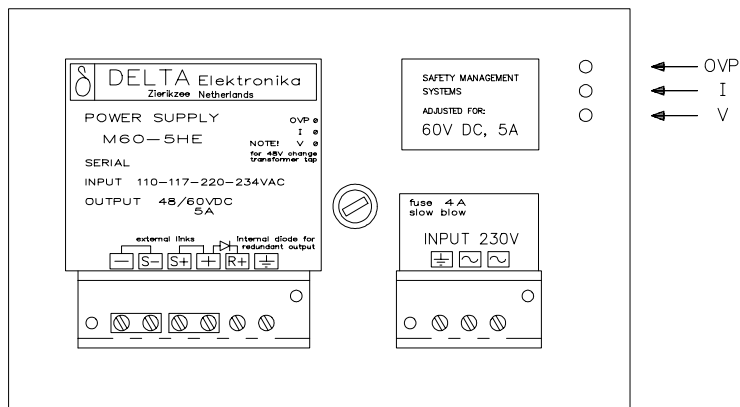
Figure 1   Back view

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.

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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).
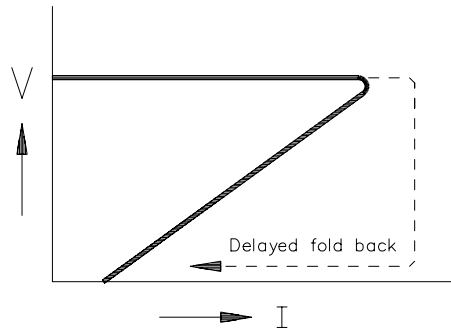
Figure 2   Delayed foldback

Derating curve

The derating curve of the M60-5HE power supply is as follows:
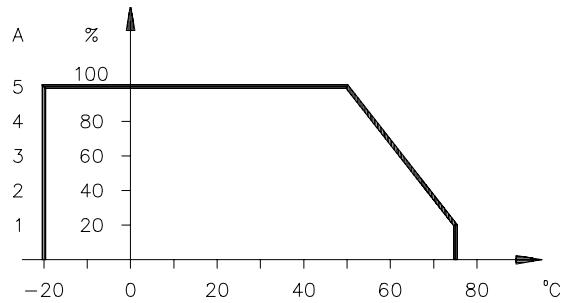
Figure 3   Derating curve (current & percentage of load vs. ambient temperature)

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

234 V~	227 V~	220 V~	117 V~	110 V~
(240 V~)	(230 V~)			
Fuse 4 A	Fuse 4 A	Fuse 4 A	Fuse 6.3 A	Fuse 6.3 A
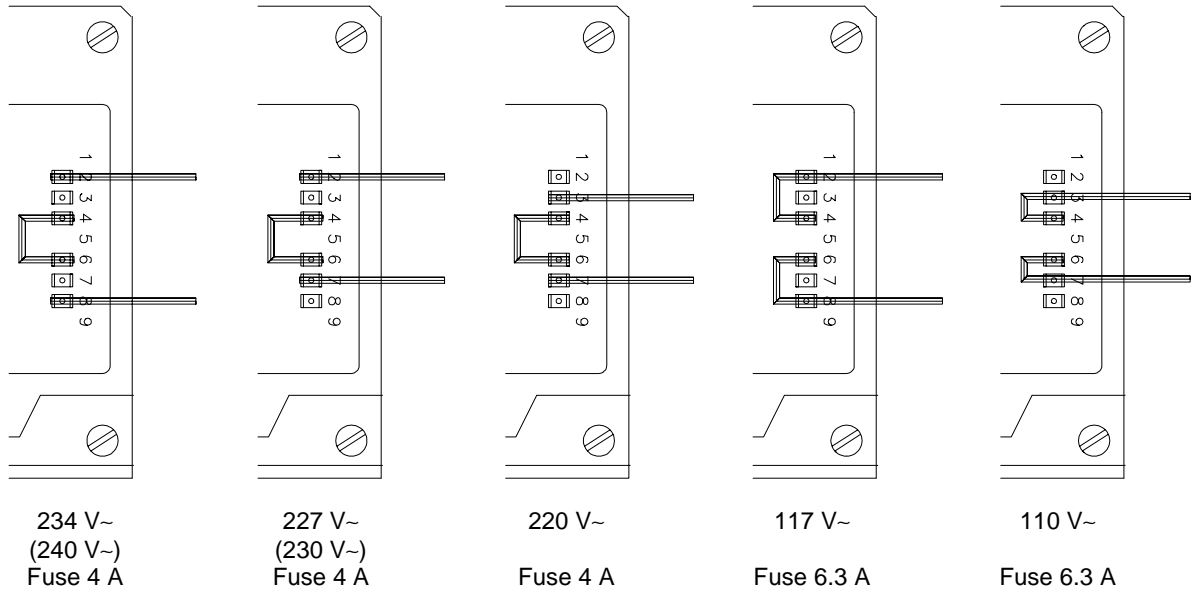
Figure 4   Transformer connections: primary side

for 60 VDC

for 48 VDC
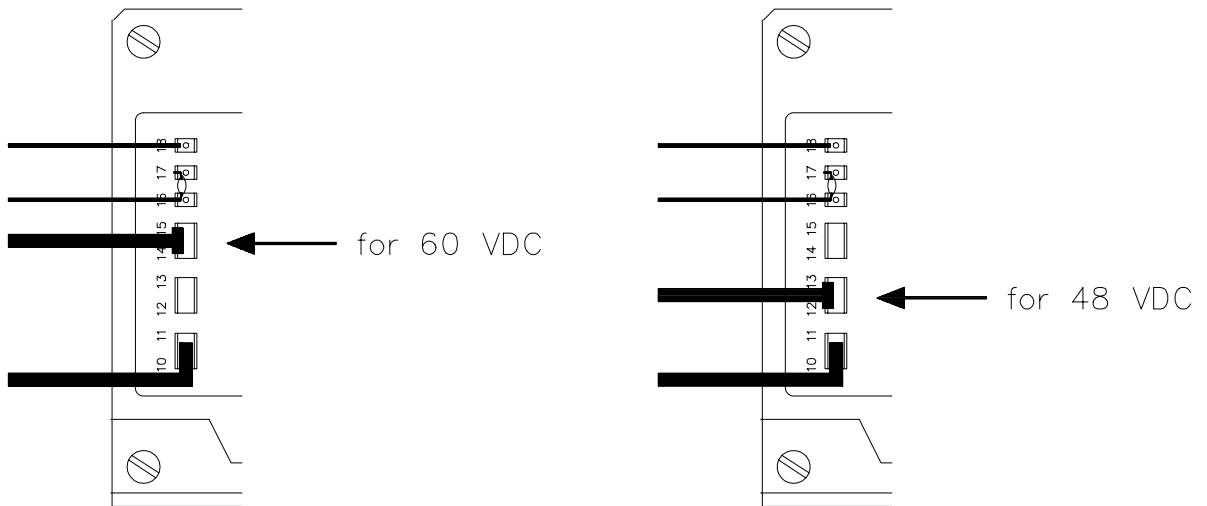
Figure 5   Transformer connections: secondary side

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Technical data   The M60-5HE power supply has the following specifications:

General   Type number: M60-5HE
                Approvals: CE, TÜV, UL

Power   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)

Physical   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)

Environment Ambient temperature: –20°C to +60°C (–4°F to +140°F)

Input   Input current: 2.2 A at 220 Vac
                Inrush current: < 40 A at 220 Vac
                Crest factor: 1.8

Output   Output voltage: 48 Vdc or 60 Vdc with overvoltage
                                          protection
                Ripple content: < 0.2 V p-p
                Output current: 5 A at –20°C to +50°C
                                                  (–4°F to +122°F)
                                          3.5 A at 50°C to 60°C
                                                  (122°F to 140°F)
                Hold-up time: Nominal AC input voltage, see Figure 4
                                          15 ms at full load
                                          30 ms at half load

Technical data (continued)

Output (cont.)	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%
Isolation	AC input to case:	2500 Vac
	DC output to case:	500 Vdc

Left blank intentionally.

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.
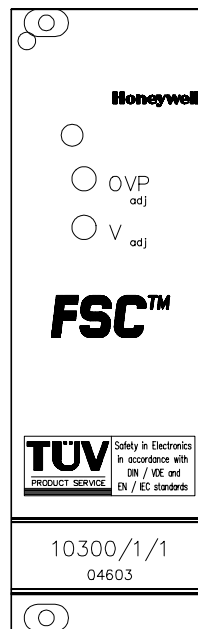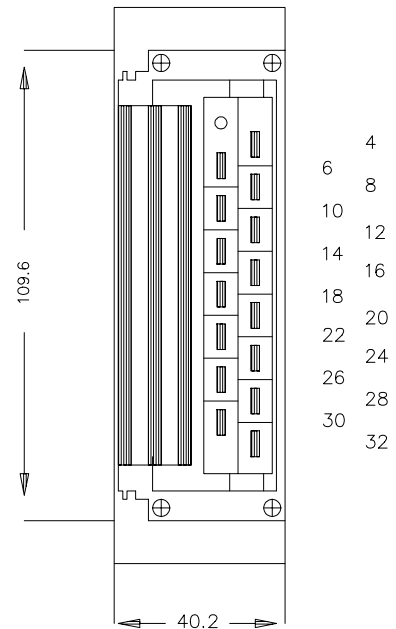
Figure 1   Front view   Figure 2   Back view

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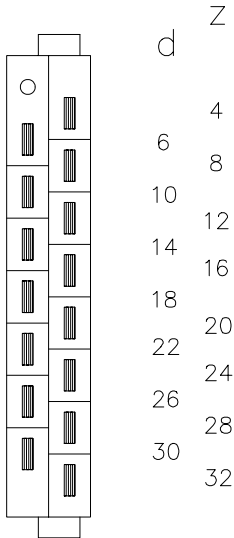
d6	+ sense	z4	Supply 5 Vdc
d10	– sense	z8	Supply 5 Vdc
d14	*(see note below)*	z12	GND 5 Vdc
d18		z16	GND 5 Vdc
d22		z20	
d26	Supply 0 Vdc	z24	Supply 0 Vdc
d30	Supply 24 Vdc	z28	Supply 24 Vdc
		z32	Earth

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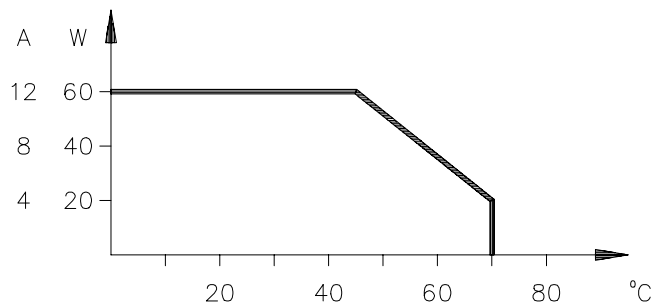
Figure 3   Derating curve (current and power vs. ambient temperature)

Wiring diagram   The 10300/1/1 module is wired in accordance with the wiring diagram below:
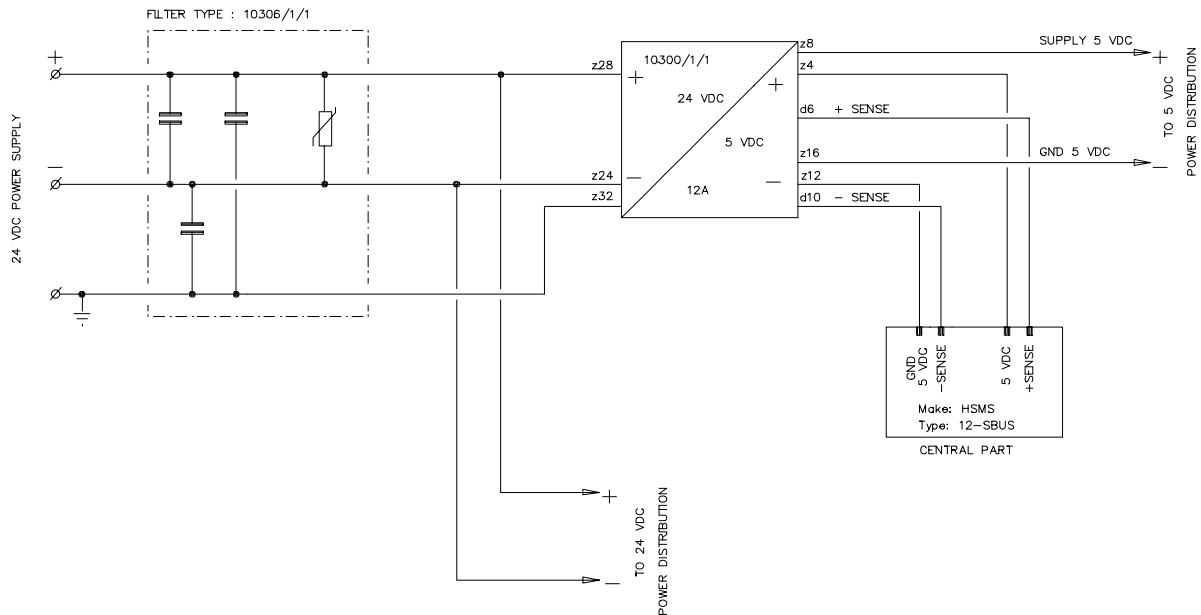
Figure 4   Wiring diagram

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 (± 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 mm² (AWG 14)

- up to 12 A: 6 mm² (AWG 10)

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

General
Type number:	10300/1/1 04603*
Approvals:	CE, TÜV, UL**
Software versions:	all
Space requirements:	8 TE, 3 HE (= 8 HP, 3U)

Power
Power requirements:	current < 3.9 A at 24 Vdc
	voltage 24 Vdc (–15%...+30%)
Inrush current:	< 18 A

Environment
Ambient temperature:	0°C to 60°C (32°F to 140°F)
	(see derating curve, Figure 3)

Output
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

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Section 3: Buses and Backplanes

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.
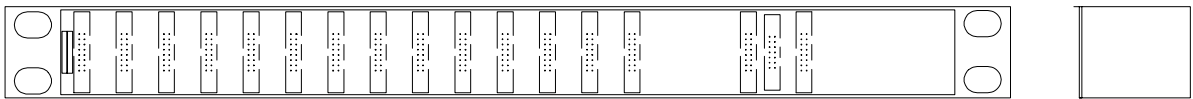
Figure 1   Front and side views

Connections

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

ESD 0 Vdc ◯	◯ ESD 24 Vdc	} 24 Vdc level
RESET 24 Vdc ◯	◯ RESET 0 Vdc	
GND 5 Vdc ◯	◯ ESD 5 Vdc	} 5 Vdc level
WDG OUT ◯	◯ GND 5 Vdc	
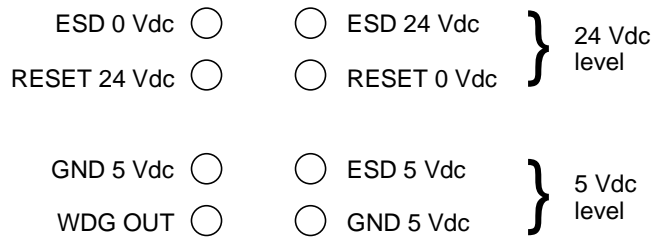
Figure 2   Back view of watchdog pins

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).

WDG
from S-BUS

WDG inputs of
output modules
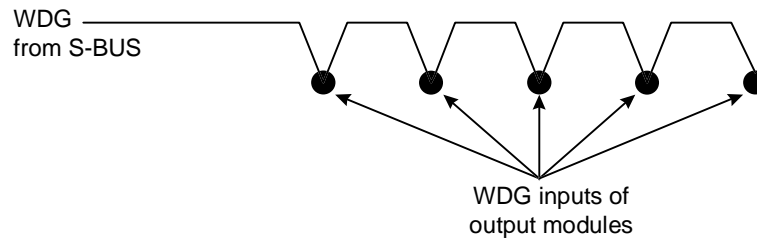
Figure 3   Watchdog wiring

Technical data

The S-BUS has the following specifications:

General

Type number:	S-BUS
Approvals:	CE, TÜV, UL
Space requirements:	84 TE (full rack), 1 HE (= 84 HP, 1U)

Power

Power requirements:	Included in SBD (10007/1/1) specification

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.
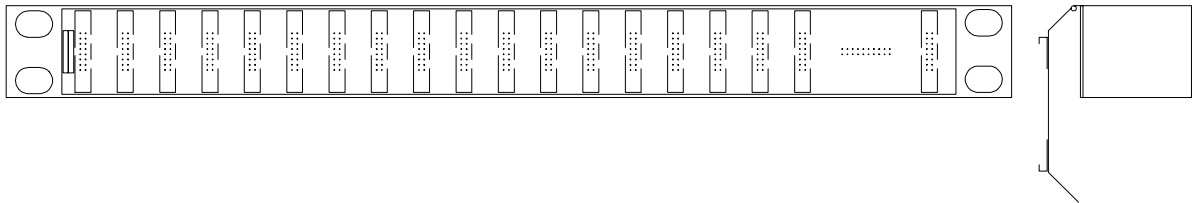
Figure 1   Front and side views

Technical data   The 1-BUS has the following specifications:

General

Type number:	1-BUS
Approvals:	CE, TÜV, UL
Space requirements:	84 TE (full rack), 1 HE (= 84 HP, 1U)

Power

Power requirements:	Included in HBD (10100/1/1 or 10100/2/1) specification

Left blank intentionally.

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.
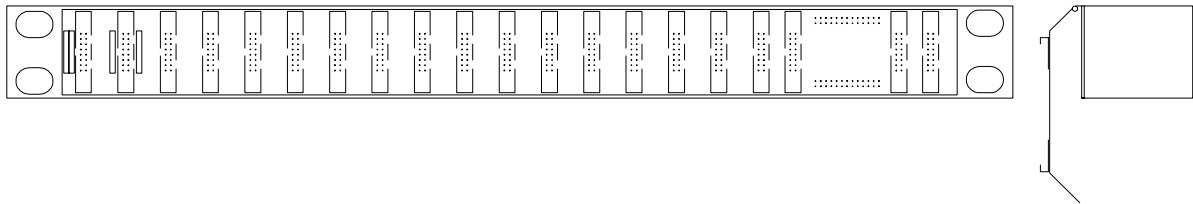
Figure 1   Front and side views

Technical data   The 2-BUS has the following specifications:

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

Left blank intentionally.

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.
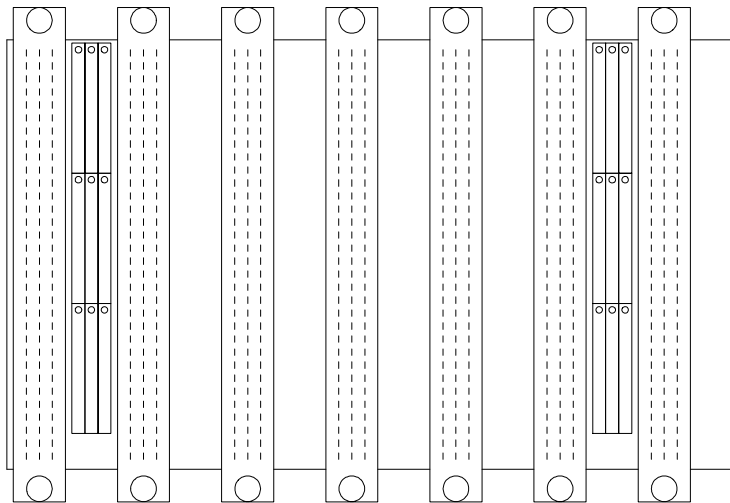
Figure 1   System bus (7-SBUS) front view
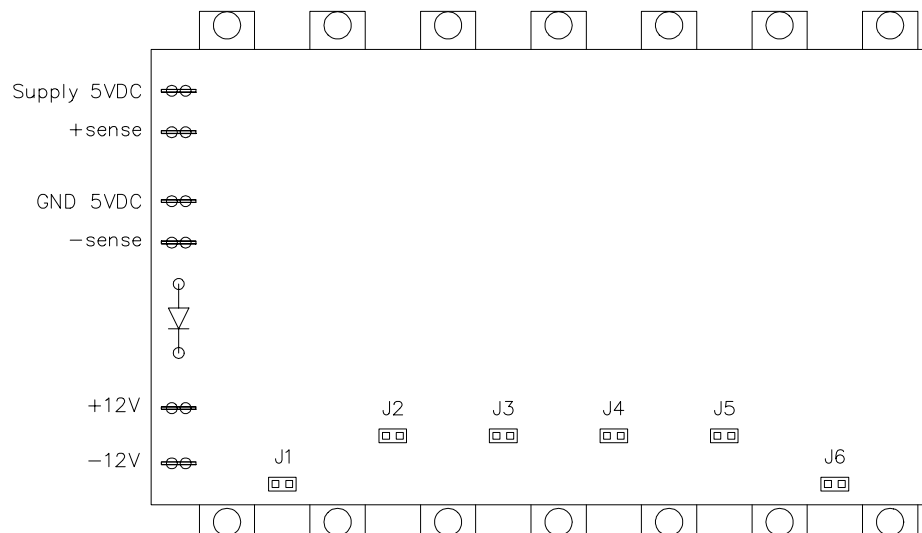
Figure 2   System bus (7-SBUS) back view with jumpers and faston terminations

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

Left blank intentionally.

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).

Rack	Cabinet	NonRed Vbus
1	CP	1.16
2	NonRed I/O	2.21
3	NonRed I/O	3.21
4	NonRed I/O	4.21
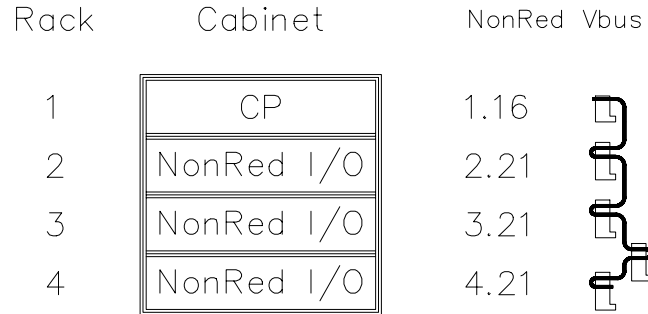
Figure 1   V-Buses example 1

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.
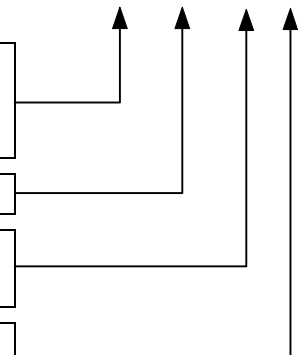
Example 2:

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).

Rack	Cabinet	Red Vbus of CP1	Red Vbus of CP2	NonRed Vbus
1	CP1	1.16		1.15
2	CP2		2.16	2.15
3	Red I/O	3.20	3.21	
4	Red I/O			
5	Red I/O	5.20	5.21	
6	NonRed I/O			6.21
7	NonRed I/O			7.21
8	NonRed I/O			8.21
9	NonRed I/O			9.21
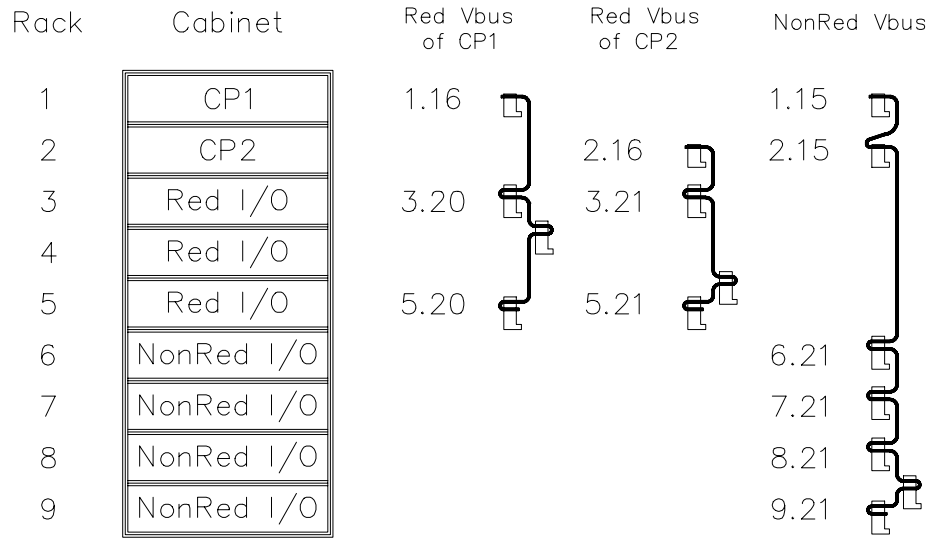
Figure 2   V-Buses example 2

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:

VBUS 3 / 2 / 3 0

This V-Bus must connect the VBD in position 1.16 to the HBDs in positions 3.20 and 5.20.

I/O backplanes with 10100/2/1 HBDs

V-Bus for Central Part 1 of configuration with redundant CPs and redundant I/O.

No rack is skipped between the (bottom) CP and the first involved I/O rack.
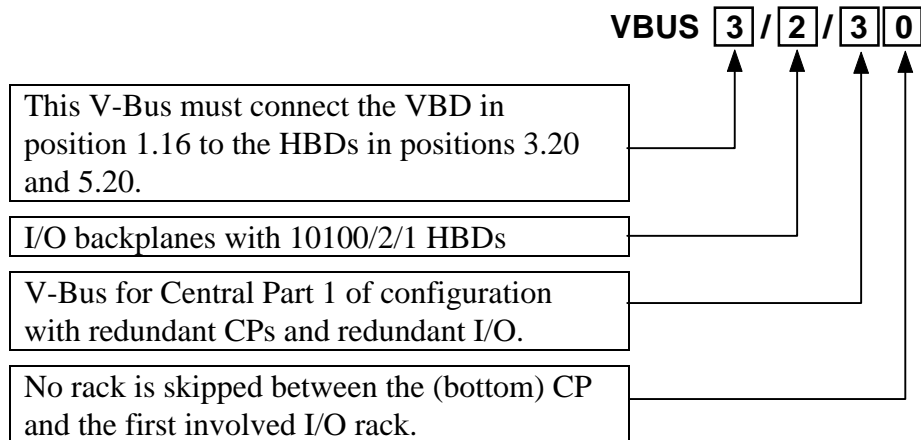
The ordering code to be used for the V-Bus of the redundant I/O part for CP 2 is:

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⟩

This V-Bus must connect the VBDs in position 1.15 and 2.15 to the HBDs in positions 6.21, 7.21, 8.21 and 9.21.

I/O backplanes with 10100/2/1 HBDs

Configuration with redundant CPs and non-redundant I/O

Three racks (3, 4 and 5) are skipped between the bottom CP and the first HBD involved.
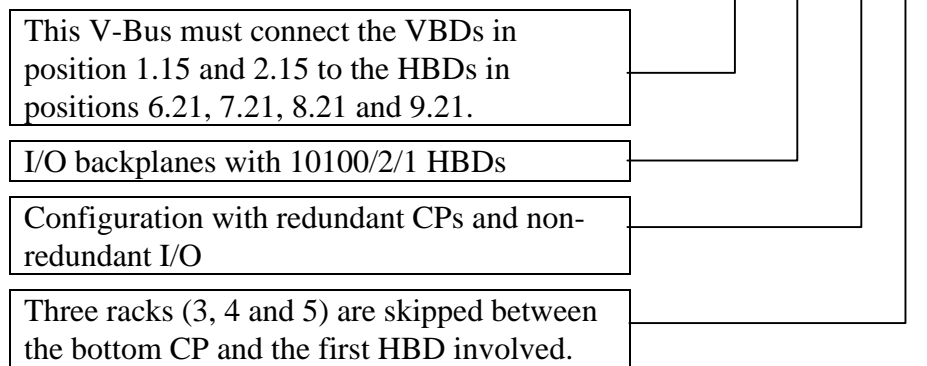
Example 3:

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).
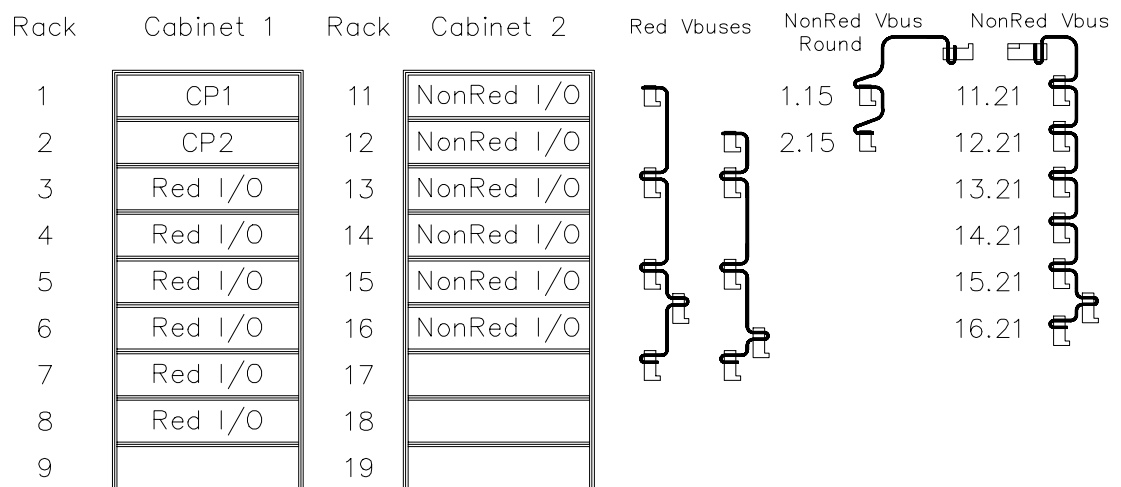
Figure 3   V-Buses example 3

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 / 3 0

(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 / 4 0

(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 / 3 0

This V-Bus has two VBDs in positions 1.15 and 2.15.

Round cable

The length of the round cable must be 3 m (= 30 x 10 cm).
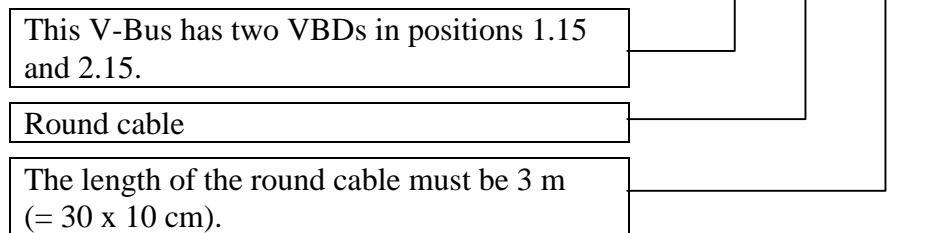
As the distance between the CP1 connector and the CP2 connector is 20 cm (7.9 in), the round cable will have a total length of approx. 320 cm (10.5 ft).

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

VBUS $\boxed{6}$ / $\boxed{2}$ / $\boxed{2}$ $\boxed{9}$

This V-Bus has no VBDs and six HBDs in positions 11.21, 12.21, 13.21, 14.21, 15.21 and 16.21.

I/O backplanes with 10100/2/1 HBDs

Configuration with redundant CPs and non-redundant I/O

The involved I/O rack is placed in a dedicated I/O cabinet.
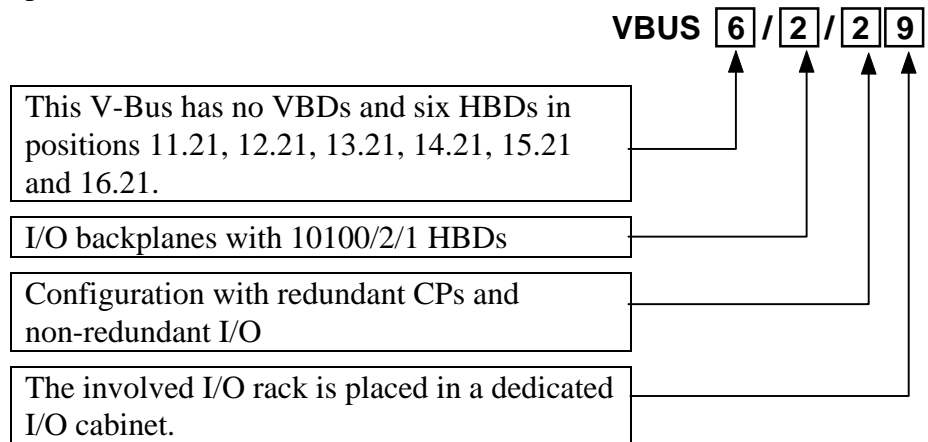
Example 4:

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.

Rack	Cabinet	Red Vbus of CP1	Red Vbus of CP2	NonRed Vbus
1	CP1	1.13		1.14
2	CP2		2.13	2.14
3	Annunciator panel			
4	NonRed I/O			4.21
5	Red I/O	5.20	5.21	
6	NonRed I/O			6.21
7	NonRed I/O			7.21
8	Red I/O	8.20	8.21	
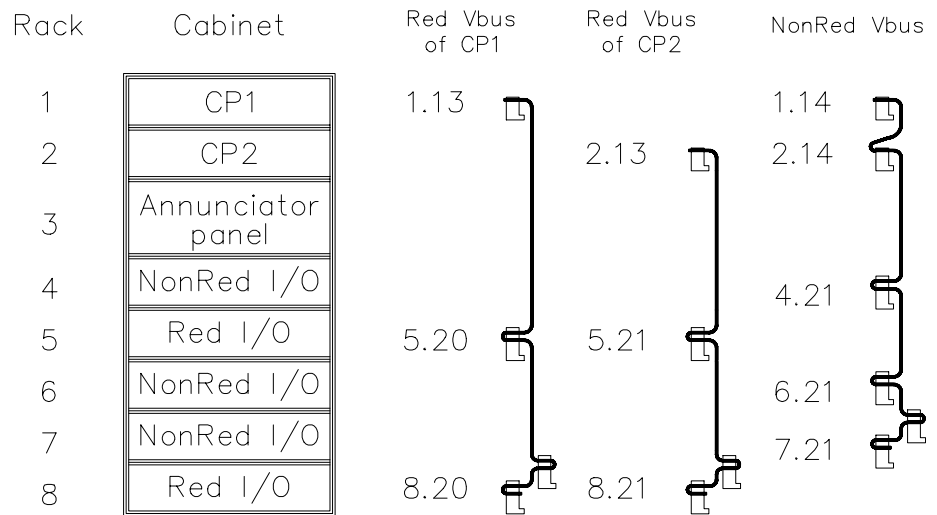
Figure 4   V-Buses example 4

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".

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)   *I/O module*   *I/O backplane (CN)*

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

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 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 mm², AWG 14), e.g. directly to the nearest bolt on the 19-inch I/O rack.

Figure 3   Back view detail
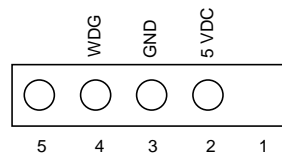
Figure 4   Connector CN22 (detail)

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:

General

Type number:	10314/1/1 20501*
Approvals:	CE, TÜV, UL
Space requirements:	84 TE (full rack), 3 HE (= 84 HP, 3U)

Power

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.

Honeywell

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.
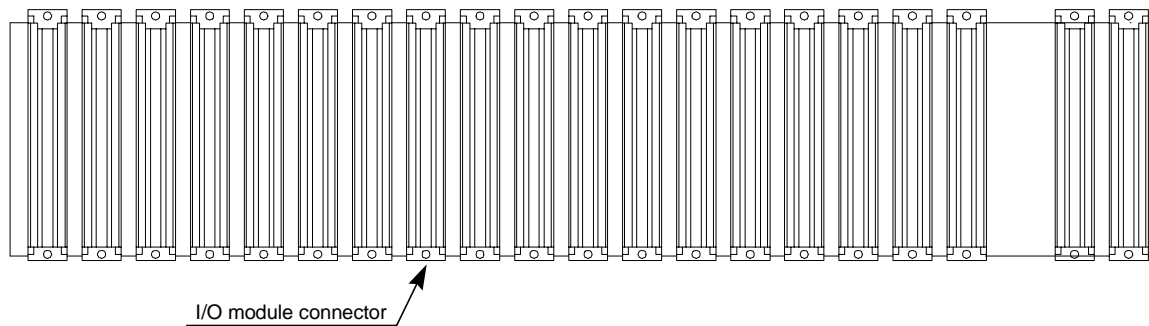
Figure 1   Front view

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

Honeywell

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)	I/O module			I/O backplane (CN)	

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

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 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.
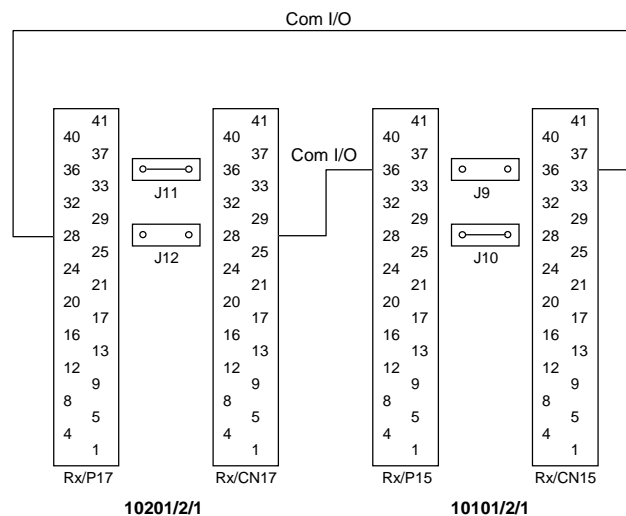
Figure 3   Example of 'Com I/O' configuration

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:
$((2 * (24 \text{ V}_{int} * 0.035 \text{ A})) + (2 * (24 \text{ V}_{ext} * 2 * 0.025 \text{ A}))) +$
$(2 * (5 \text{ V} * 0.012 \text{ A})) + (1.3 \text{ V} * 6 \text{ A}) = 12 \text{ W}$
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).

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.

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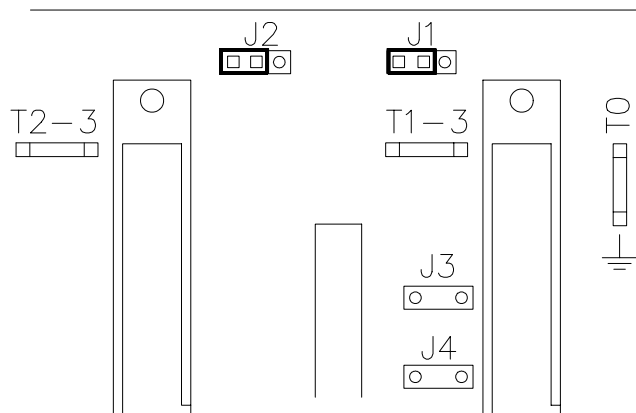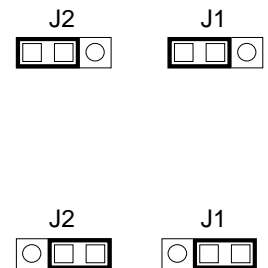
Figure 4   Location of jumpers J1 and J2
(set to their standard position)

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 mm², AWG 14), e.g. directly to the
nearest bolt on the 19-inch I/O rack.
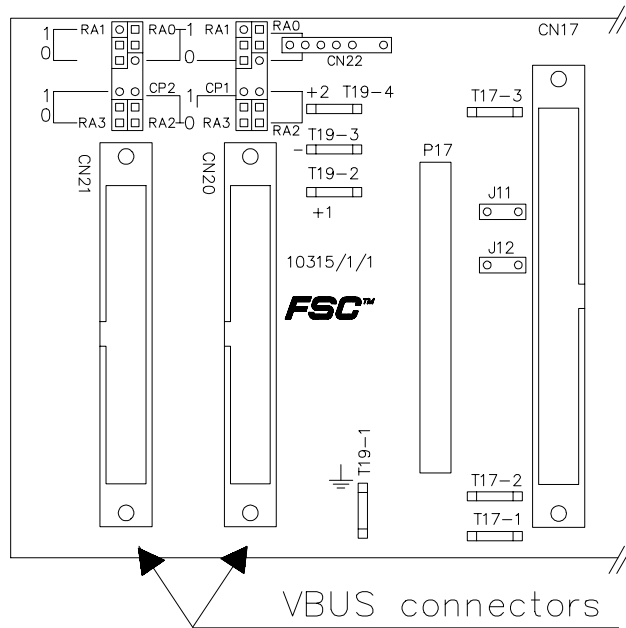
Figure 5   Back view detail
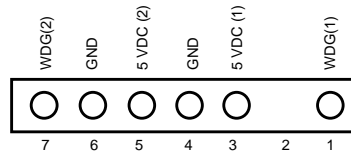
Figure 6   Connector CN22 (detail)

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

General   Type number: 10315/1/1   20601*
                  Approvals: CE, TÜV, UL
                  Space requirements: 84 TE (full rack), 3 HE (= 84 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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* 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.

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.

(front view)   *(back view)*
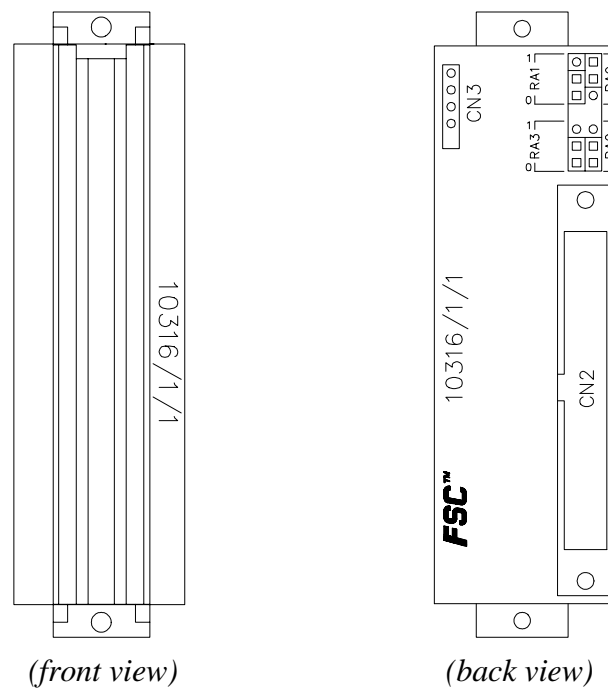
Figure 1   Front and back views

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).
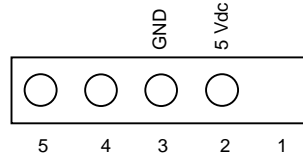
Figure 2   Connector CN3 (detail)

> **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:

General

Type number:	10316/1/1 21100
Approvals:	CE, TÜV;
	UL approval pending
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Current consumption:	none

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.

(front view)   *(back view)*
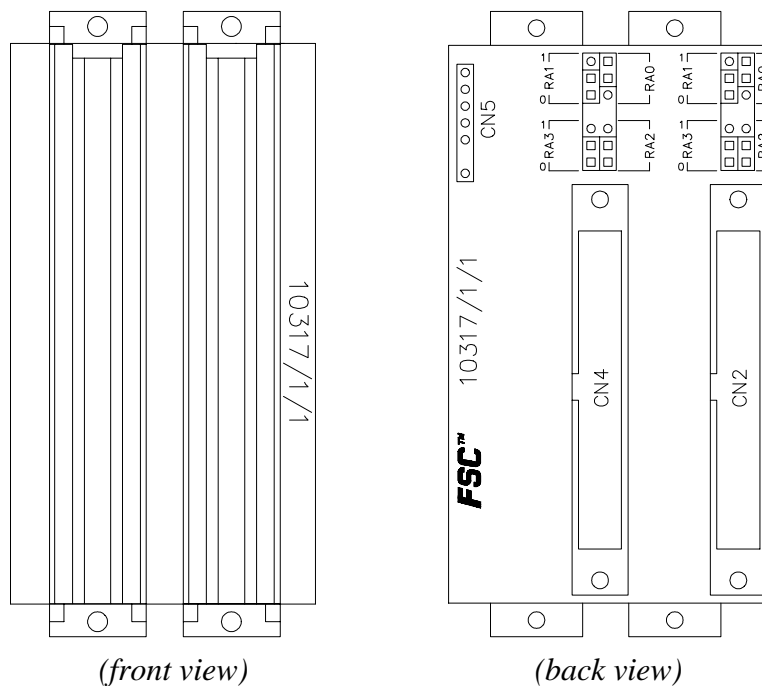
Figure 1   Front and back views

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).
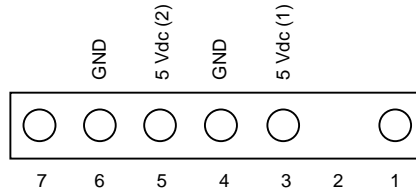
Figure 2   Connector CN5 (detail)

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:

General   Type number: 10317/1/1   21200
Approvals: CE, TÜV;
UL approval pending
Space requirements: 8 TE, 3 HE (= 8 HP, 3U)

Power   Current consumption: none

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.
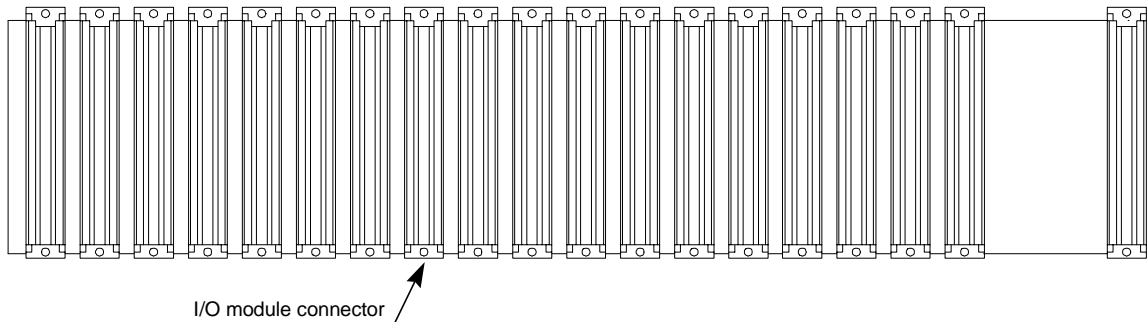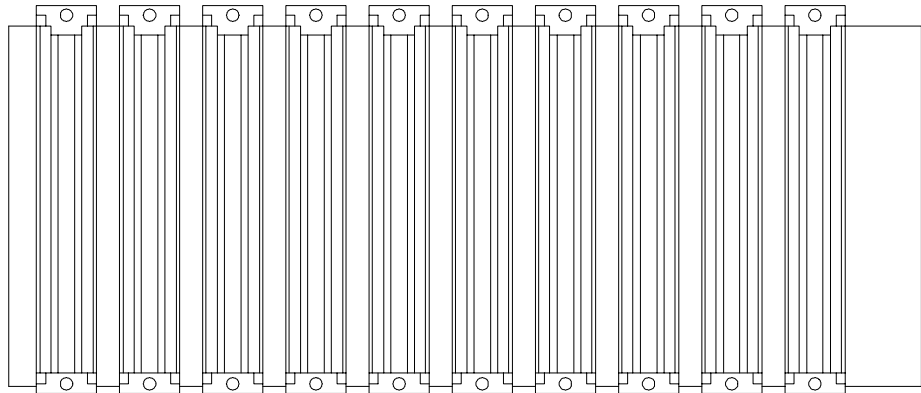

Figure 1   Front view

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

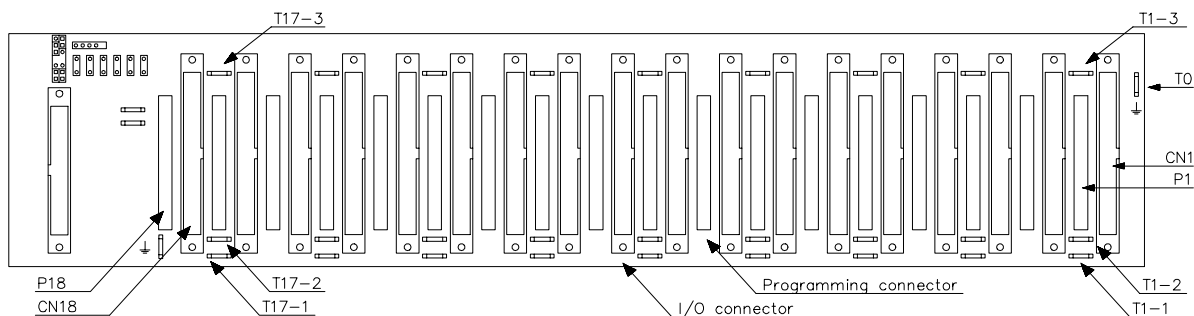- signal conversion (e.g. analog input converter module 10102/A/.).

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)   *I/O module*   *I/O backplane (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

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 mm², AWG 14), e.g. directly to the nearest bolt on the 19-inch I/O rack.
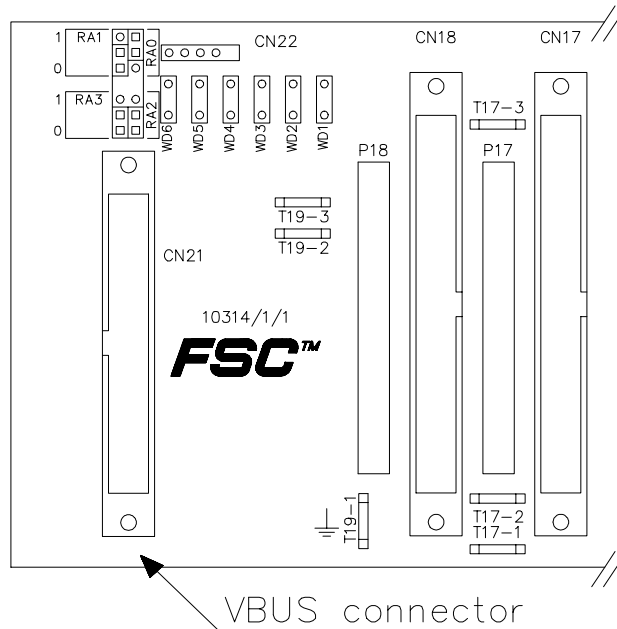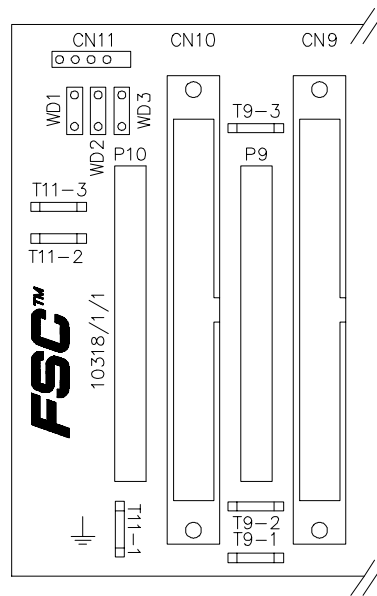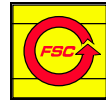
Figure 3   Back view detail
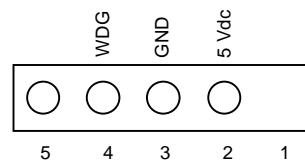
Figure 4   Connector CN11 (detail)

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.
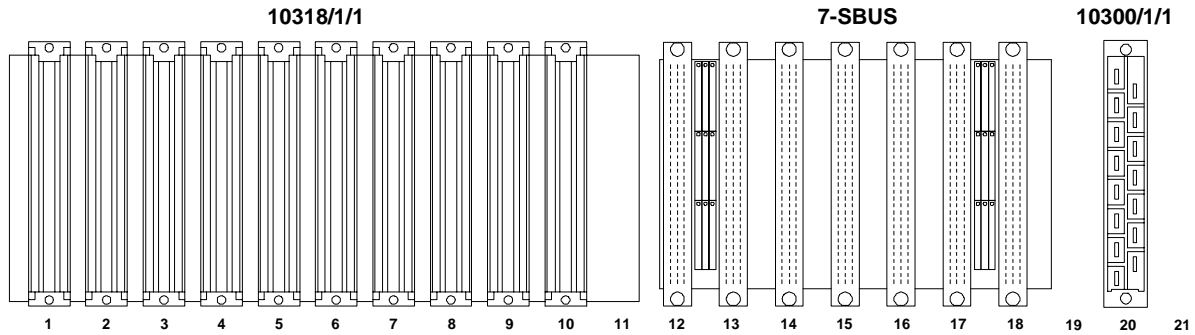
Figure 5   Front view of Central Part with I/O backplane and system bus
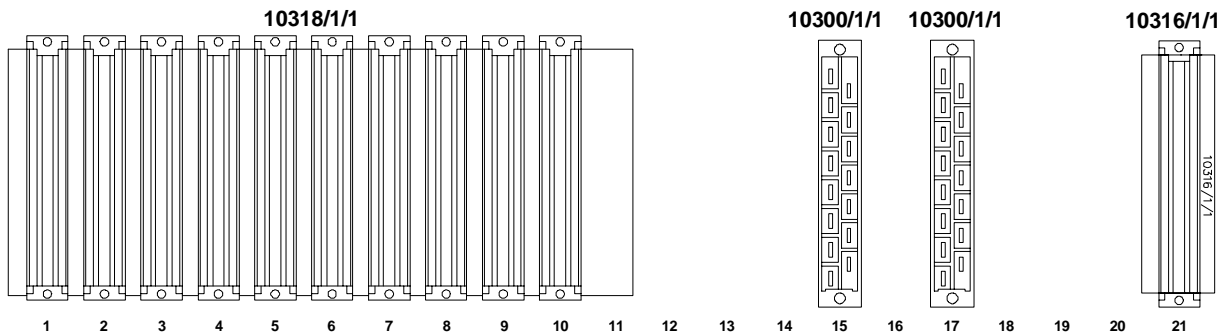
Figure 6   Front view of non-redundant I/O rack with HBD and I/O backplane

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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Helping You Control Your World

Fail Safe Control

Hardware Manual

Section 4:
Central Part Modules

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Revision 02 (10/97)

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Section 4: Central Part Modules

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).

FSC™

10001/1/1

ON

FSC™
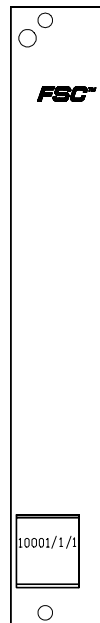
10001/R/1

Figure 1
Front view (10001/1/1)
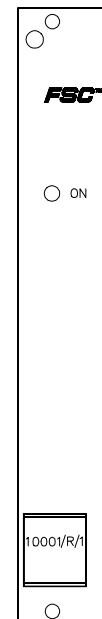
Figure 2
Front view (10001/R/1)

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.
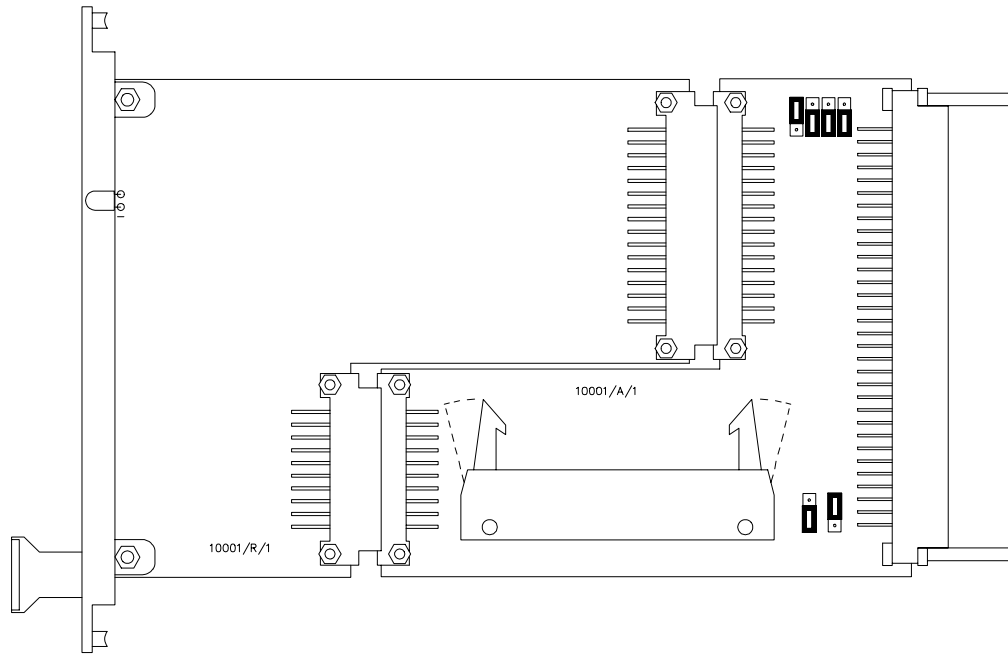
Figure 3   Layout of 10001/R/1 module

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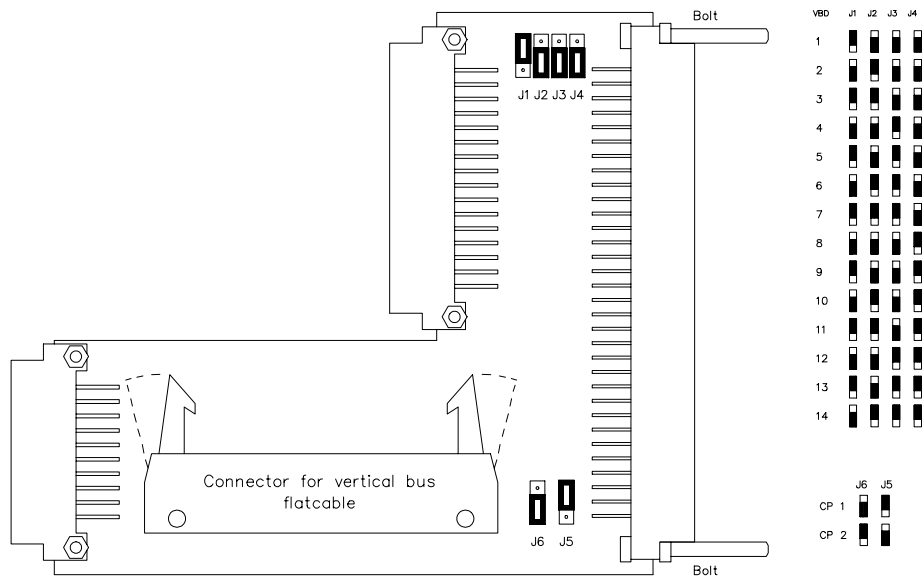
Figure 4   Jumper setting on 10001/A/1 module for CP 1, VBD 1

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

	Non-redundant CP	**Redundant CP**
Non-redundant I/O	10001/1/1 or 10001/R/1	10001/R/1
Redundant I/O	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.

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

General   Type number: 10001/1/1
Approvals: CE, TÜV, UL
Software versions: all
Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   Power requirements: 5 Vdc   225 mA
Ripple content: < 50 mV p-p

General   Type number: 10001/R/1
Approvals: CE, TÜV, UL
Software versions: all
Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   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.

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: $64 \text{ k} * 8$ (512 Kb)

- 27010 / 27C1001: $128 \text{ k} * 8$ (1 Mb)

- 27C2001: $256 \text{ k} * 8$ (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.
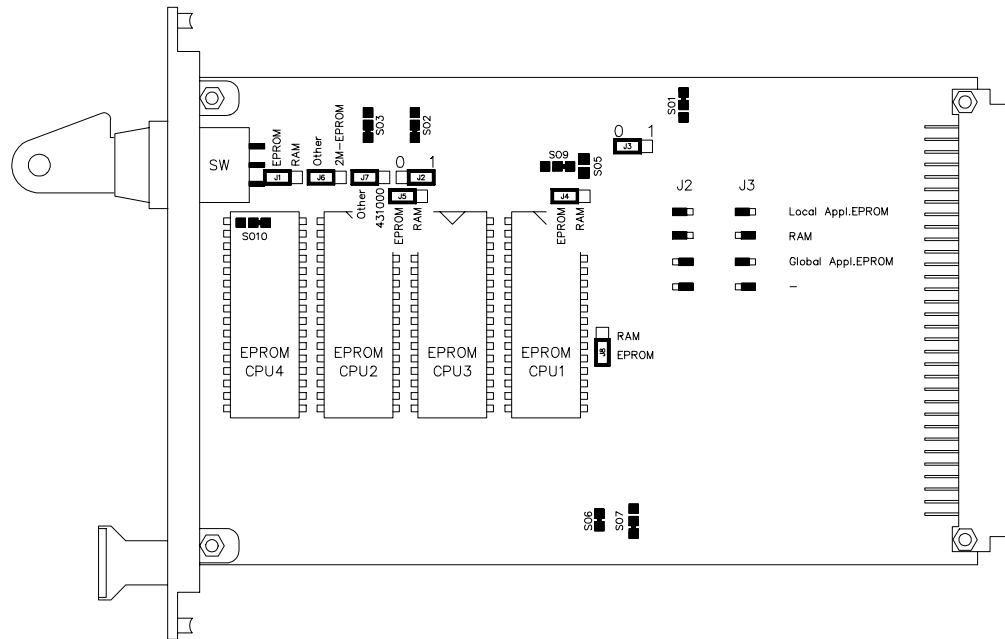
Figure 1   Jumper settings

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

General

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

Power

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.

Left blank intentionally.

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.
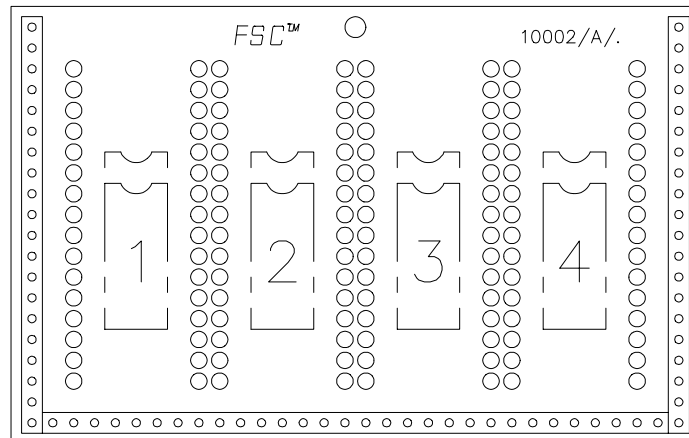
Figure 1   Memory sockets on 10002/A/1

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.
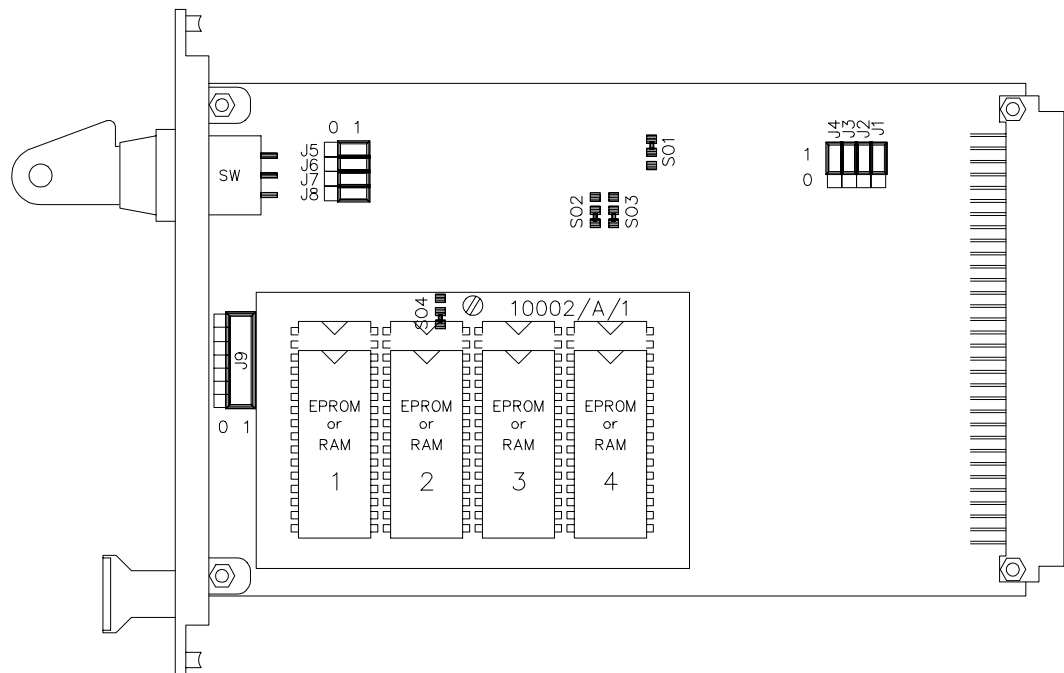
Figure 2   Location of jumpers

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.

Application program on CPU
512K EPROMs

Application program on CPU
1Meg or 2Meg EPROMs

Application program on CPU
4Meg EPROMs

Application program on CPU
(0.5Meg) smd–RAMs

Application program on CPU
1Meg RAMs

Application program on CPU
4Meg RAMs

Application program on MEM

default
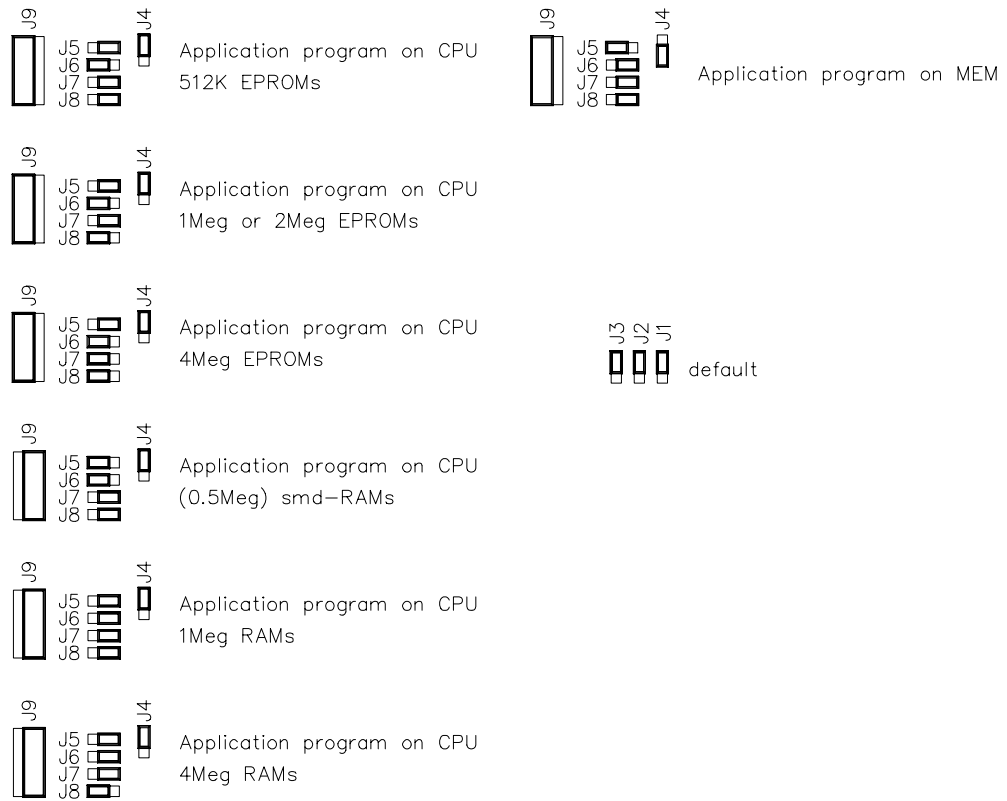
Figure 3   Jumper settings

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

General

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)

Power

| Power requirements: | 5 Vdc   1 A (incl. 10002/A/1 module) |
| Ripple content: | < 50 mV p-p |

Physical

| Dimensions of 10002/A/1: | 84 x 54 x 12 mm (3.31 x 12 x 0.05 in) |

Memory

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.

Left blank intentionally.

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.
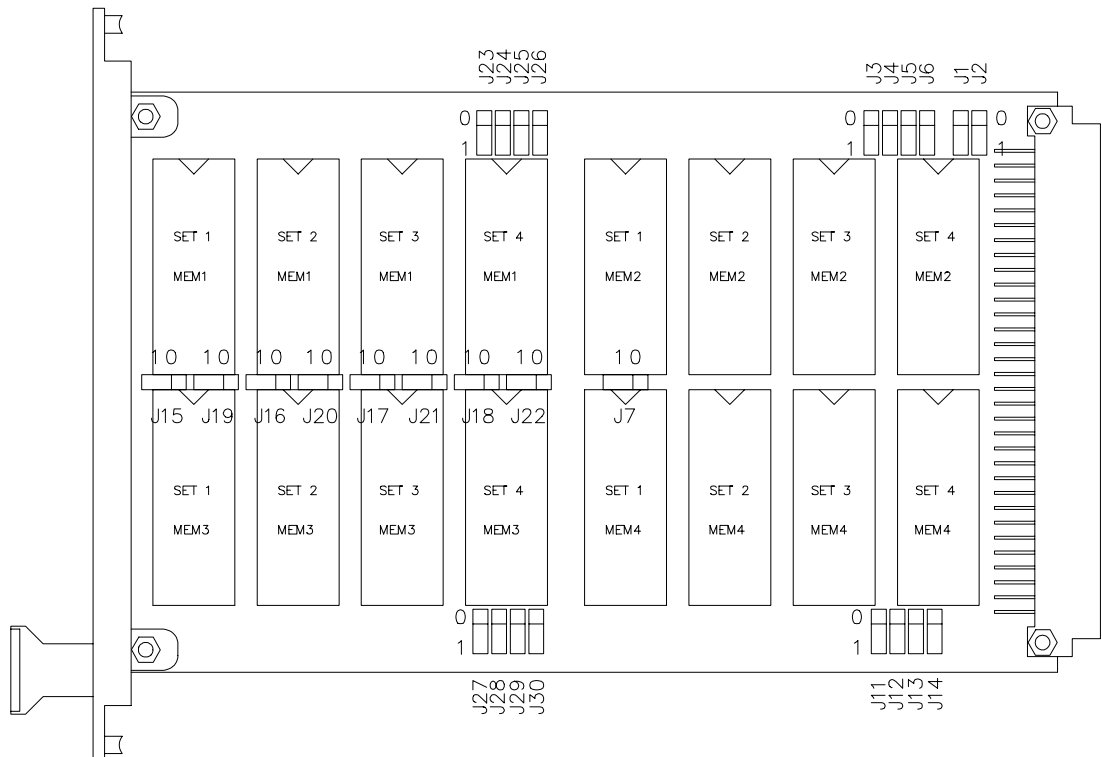
Figure 1   Memory module with jumper and memory locations

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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).

```
0           FIRST MEMORY MODULE
1
J1 J2

0           SECOND MEMORY MODULE
1
J1 J2

0           THIRD MEMORY MODULE
1
J1 J2

0           FOURTH MEMORY MODULE
1
J1 J2
```
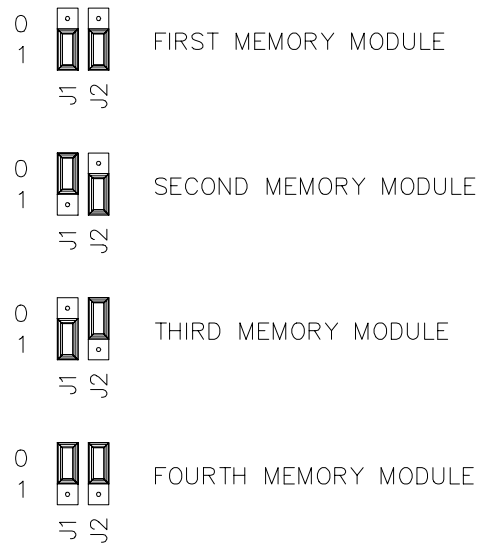
Figure 2   Jumper setting for memory module number setting

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
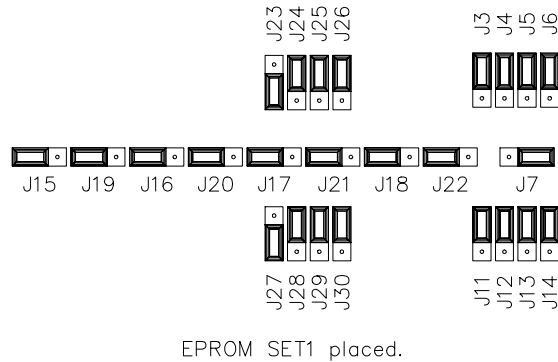
EPROM SET1 placed.

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

EPROM SET1 and SET2 placed.
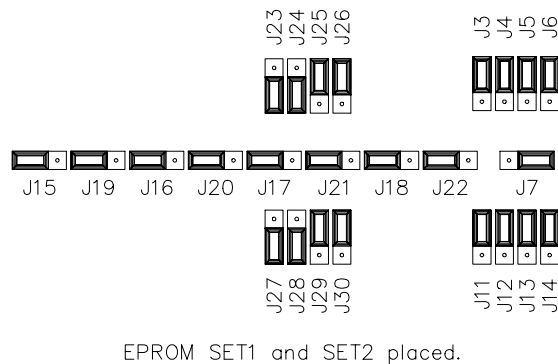
Figure 4   Jumper setting for two sets of EPROMs on the first application program module
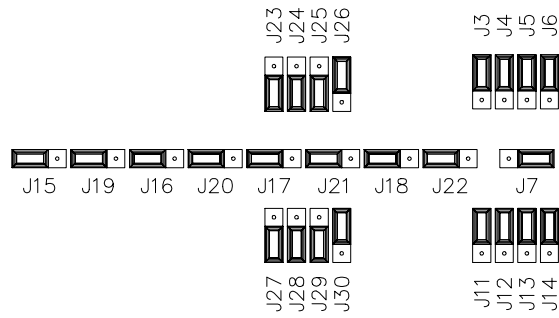
EPROM SET1, SET2 and SET3 placed.

Figure 5   Jumper settings for three sets of EPROMs
on the first application program module
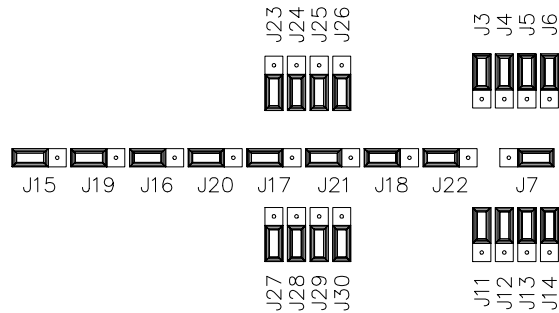
EPROM SET1, SET2, SET3 and SET4 placed.

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
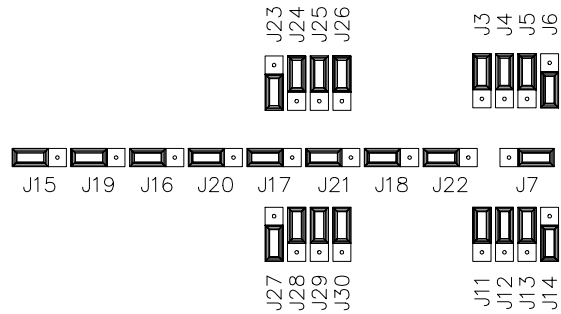
EPROM SET1 placed.

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
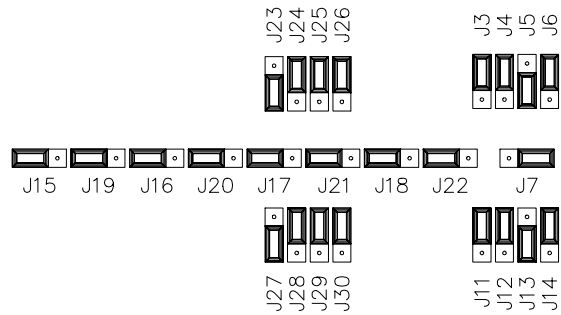
EPROM SET1 placed.

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
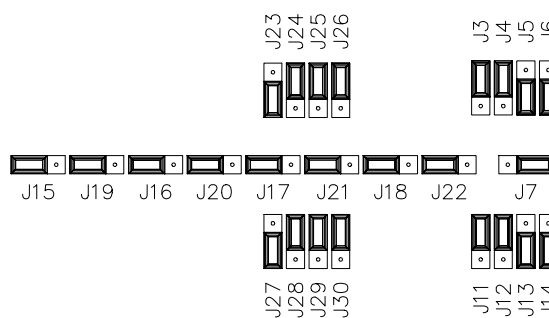
EPROM SET1 placed.

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.
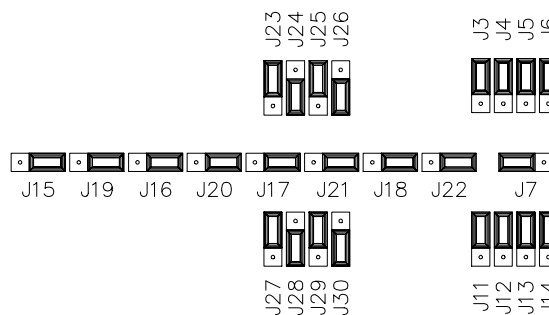
RAM SET1, SET2, SET3 and SET4 placed.

Figure 10   Jumper setting for the first application RAM module

J23 J24 J25 J26 J3 J4 J5 J6

J15 J19 J16 J20 J17 J21 J18 J22 J7

J27 J28 J29 J30 J11 J12 J13 J14
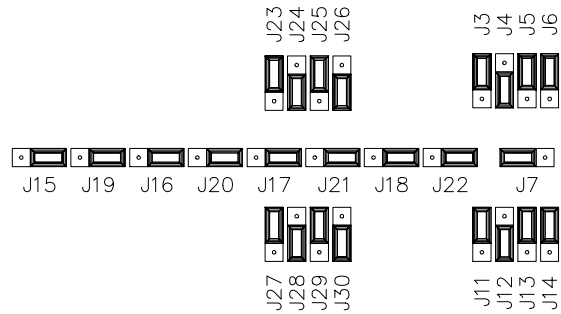
RAM SET1, SET2, SET3 and SET4 placed.

Figure 11   Jumper setting for the second application RAM module

J23 J24 J25 J26 J3 J4 J5 J6

J15 J19 J16 J20 J17 J21 J18 J22 J7

J27 J28 J29 J30 J11 J12 J13 J14
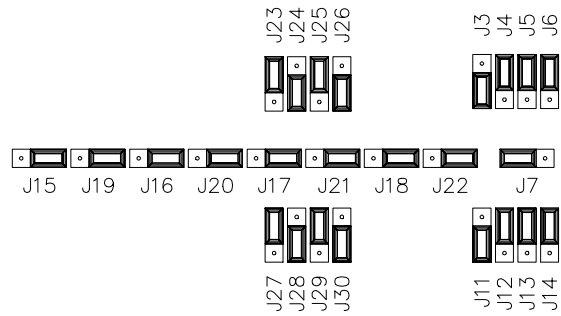
RAM SET1, SET2, SET3 and SET4 placed.

Figure 12   Jumper setting for the third application RAM module

J23 J24 J25 J26 J3 J4 J5 J6

J15 J19 J16 J20 J17 J21 J18 J22 J7

J27 J28 J29 J30 J11 J12 J13 J14
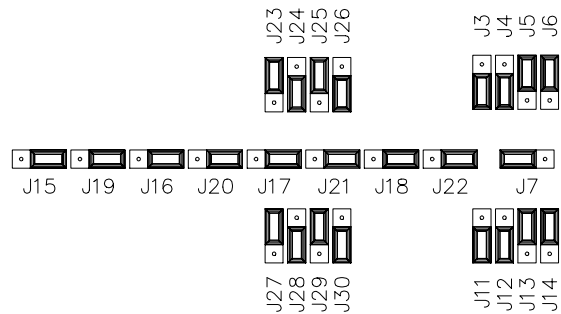
RAM SET1, SET2, SET3 and SET4 placed.

Figure 13   Jumper setting for the fourth application RAM module

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

General

Type number:	10003/1/1
Approvals:	CE, TÜV
Software versions:	all (> 1 MEM module ≥ 2.80b)
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

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

Memory

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.

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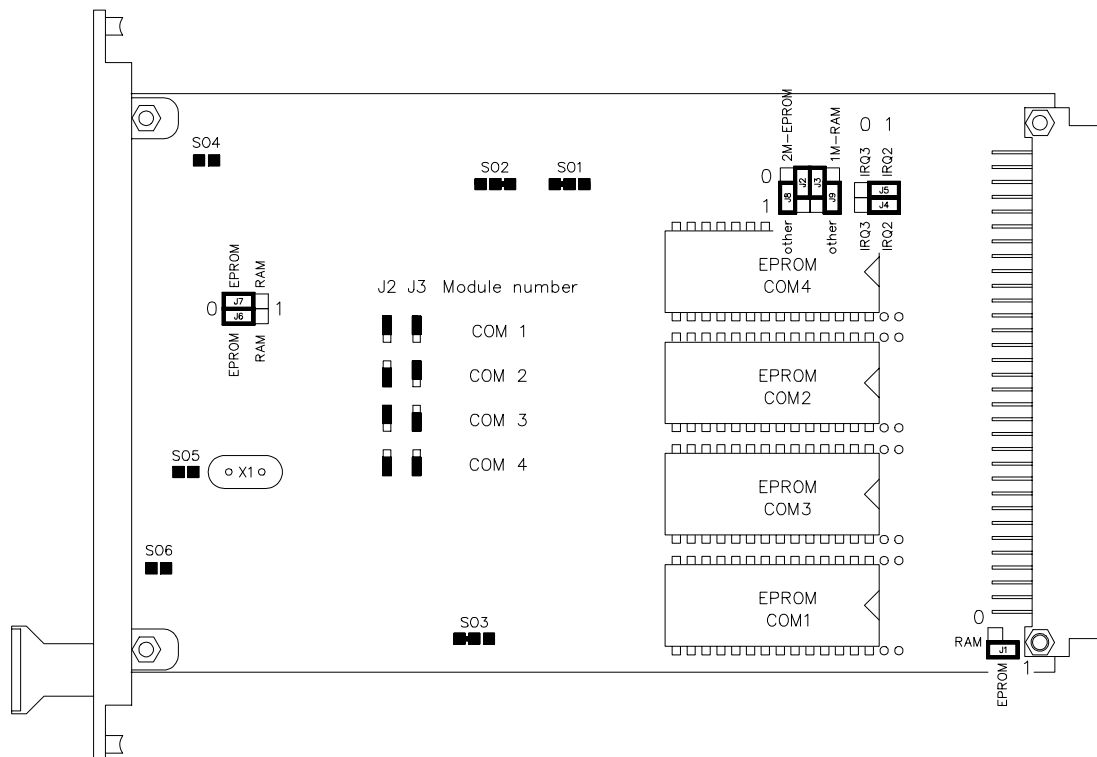
Figure 1   Jumpers and EPROM sockets on 10004/1/1 module

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.
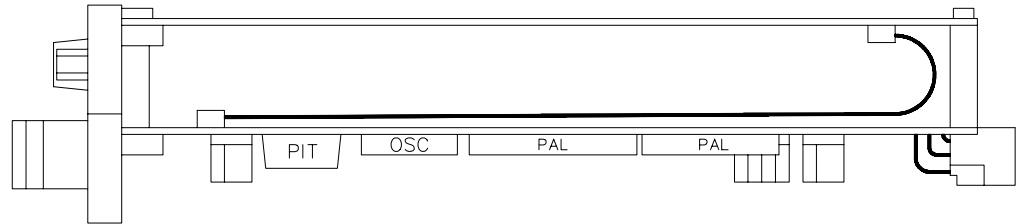
Figure 2   Top view of COM module with interface modules
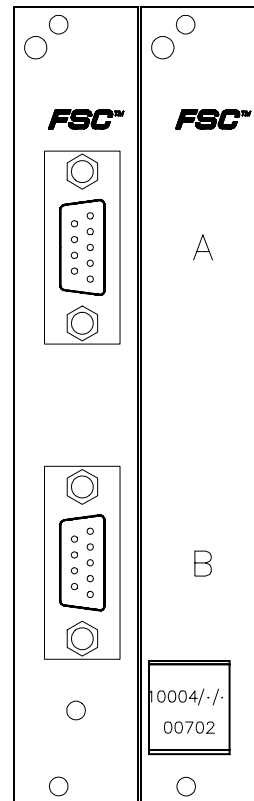
Figure 3   Front view of COM module with two interface modules

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

General   Type number: 10004/1/1   00702*
Approvals: CE, TÜV, UL
Software versions: all
Space requirements: 8 TE, 3 HE (= 8 HP, 3U) (with interfaces)

Power   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.

10004/B/1 RS232C interface

Honeywell

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.

Pin	Signal
9	N.C.
8	CTS
7	RTS
6	N.C.
5	GND
4	DTR
3	–TxD
2	–RxD
1	DCD
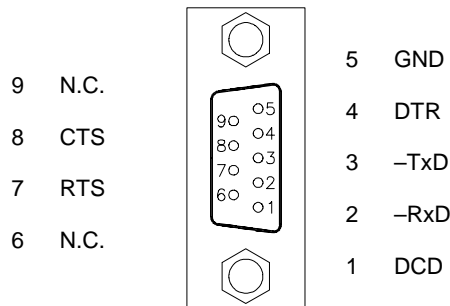
Figure 1   Front view of 10004/B/1 connector

Connections

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

```
FSC-system                        IBM (compatible) PC
RS232C (10004/B/1)                COM1:
9-pin connector male              9-pin connector female


RxD    2 ──────────────╲  ╱──────────── 2   RxD
TxD    3 ──────────────  ╳  ──────────── 3   TxD
                              ╱  ╲       8   CTS
RTS    7 ─┐             ┌───────────────  1   DCD
DCD    1 ─┘             │
CTS    8 ──────────────┘    ┌─────────── 4   DTR
GND    5 ──────────────────────────────── 5   GND
```

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

```
FSC—system                                    IBM (compatible) PC
RS232C (10004/B/1)                            COM1:
9—pin connector male                          25—pin connector female


R̄x̄D̄    2 ────────────────────╳─────────────── 3    R̄x̄D̄
T̄x̄D̄    3 ────────────────────╳─────────────── 2    T̄x̄D̄
                                          ┌──── 5    CTS
RTS    7 ─────────────────────────────────┘  8    DCD
DCD    1 ──────────┐
CTS    8 ──────────┘                         20    DTR
GND    5 ─────────────────────────────────── 7    GND
```

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

```
FSC—system                                    IBM (compatible) PC
RS232C  (10004/B/1)                           COM1:
9—pin connector male                          9—pin connector female


R̄x̄D̄    2 ────────────────────╳─────────────── 2    R̄x̄D̄
T̄x̄D̄    3 ────────────────────╳─────────────── 3    T̄x̄D̄

GND    5 ─────────────────────────────────── 5    GND
```

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

```
FSC—system                                    Printer
RS232C  (10004/B/1)
9—pin connector male                          25—pin connector male


R̄x̄D̄    2 ────────────────────╳─────────────── 2 (3)  R̄x̄D̄
T̄x̄D̄    3 ────────────────────╳─────────────── 3 (2)  T̄x̄D̄
                                          ┌──── 5     CTS
RTS    7 ─────────────────────────────────○  8     DCD
DCD    1 ──────────┐
CTS    8 ──────────○                         20    DTR
GND    5 ─────────────────────────────────── 7     GND
```

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                                    Printer
RS232C  (10004/B/1)
9-pin connector male                          25-pin connector male


RxD        2 ──────────────╲  ╱──────────── 2 (3)   RxD
TxD        3 ──────────────  ╳  ──────────── 3 (2)   TxD

GND        5 ──────────────────────────────── 7       GND
```

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

Left blank intentionally.

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.

9	+20 mA (2)		5	GND
8			4	+20 mA (1)
7	LED in +		3	OUT
6	LED in –		2	
			1	
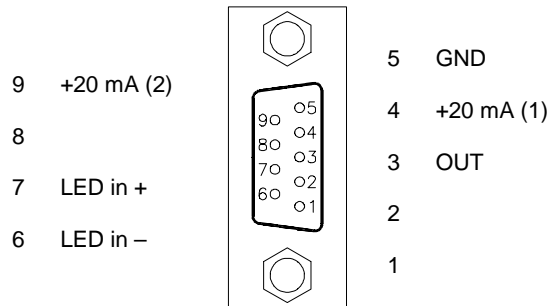
Figure 1   Front view of 10004/E/1 connector

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

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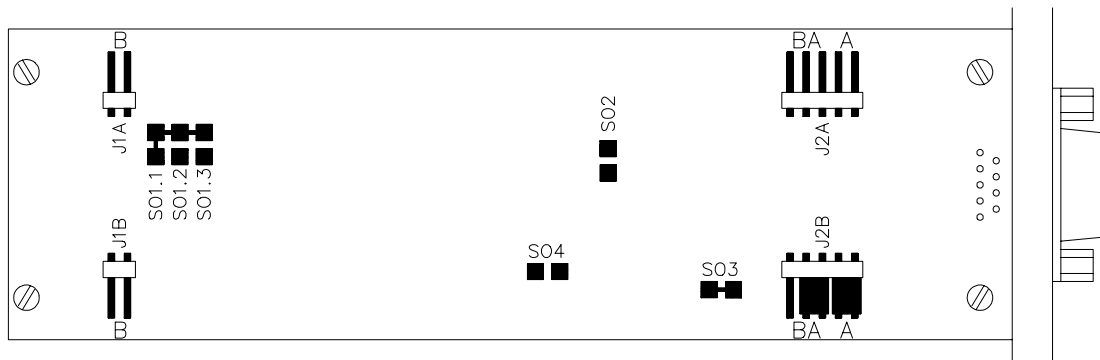
Baud rates
Table 1 shows the baud rates that are supported by the 10004/E/1 interface. It also provides the maximum cable length for each baud rate. The lengths indicated only apply if proper cable types are used, e.g. Belden 8723.

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:

Output active

Output passive

Input active

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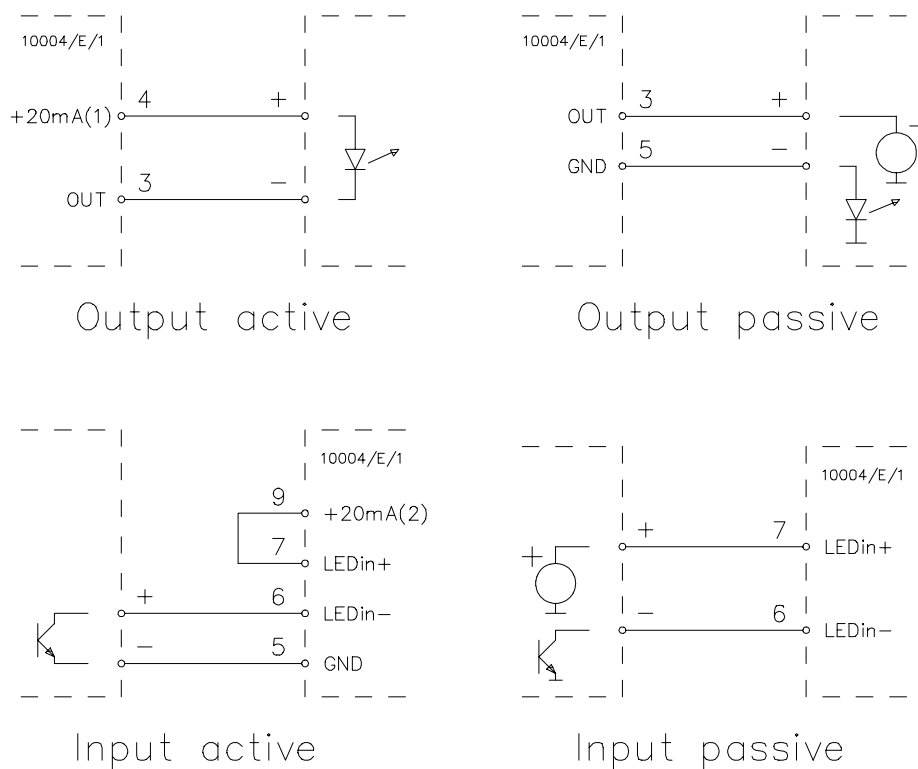
Figure 3   Wiring diagrams for the connection of the 10004/E/1

Connections   The connections of the duplex current loop are as follows:
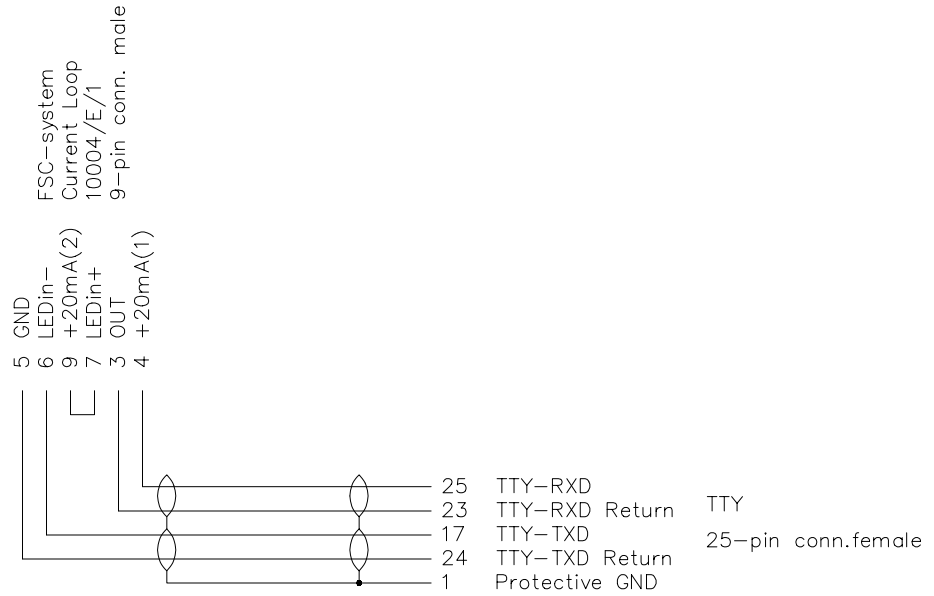
Figure 4   Duplex current loop connection
(TTY passive, FSC active)
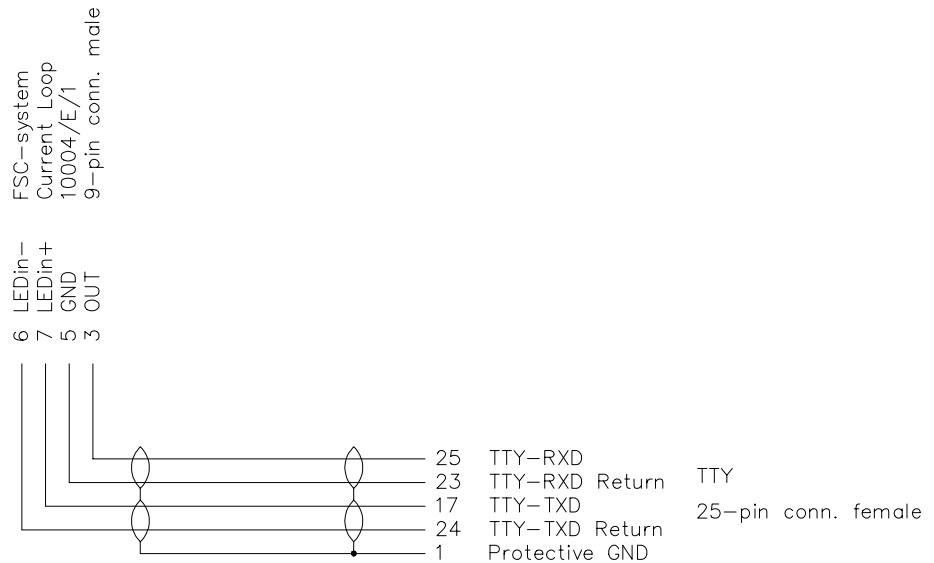
Figure 5   Duplex current loop connection
(TTY active, FSC passive)

Honeywell

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

General
Type number:	10004/E/1
Approvals:	CE, TÜV, UL
Software versions:	≥ 2.78e
Space requirements:	4 TE (= 4 HP), half height
Maximum baud rate:	19.2 Kbaud

Power
Power requirements:	5 Vdc 350 mA
Ripple content:	< 50 mV p-p

Source
Current source:	20 mA ± 10%
Maximum load:	1 kOhm
Open voltage:	max. 25 V

Output transistor
Maximum voltage:	50 V
On current:	> 20 mA (internally limited)
Voltage drop:	< 3 V at 20 mA

LED
LED input voltage:	< 2 V at 20 mA
Maximum current:	100 mA
Off current:	< 3 mA

Isolation
Galvanic isolation:	> 6 kV

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.
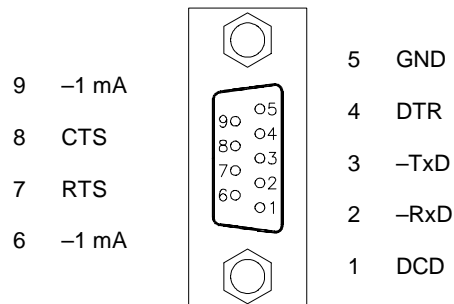
Figure 1   Front view of 10004/F/1 connector

Connections   Figure 2 to Figure 8 show the connections of the various cables.
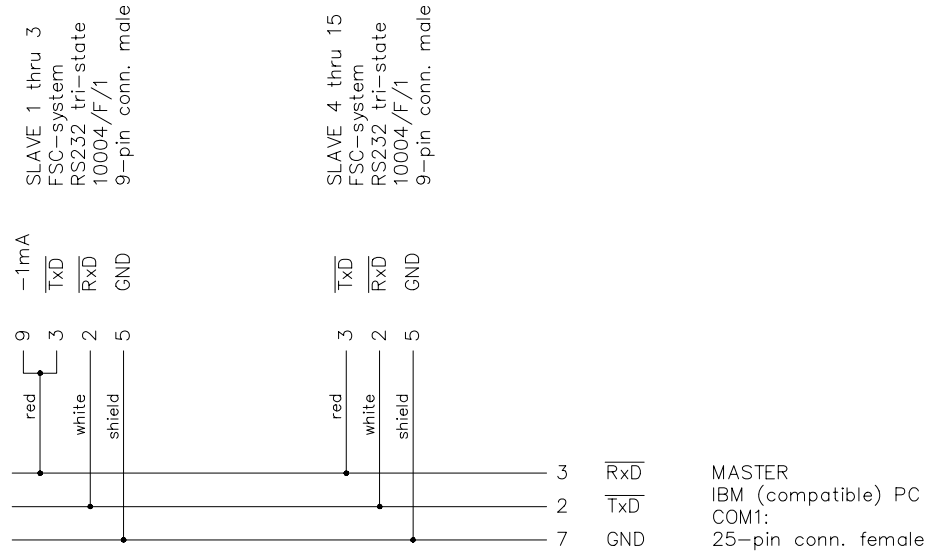
Figure 2   Cable between FSC systems and IBM (compatible) PC
25-pin connector without hardware handshake
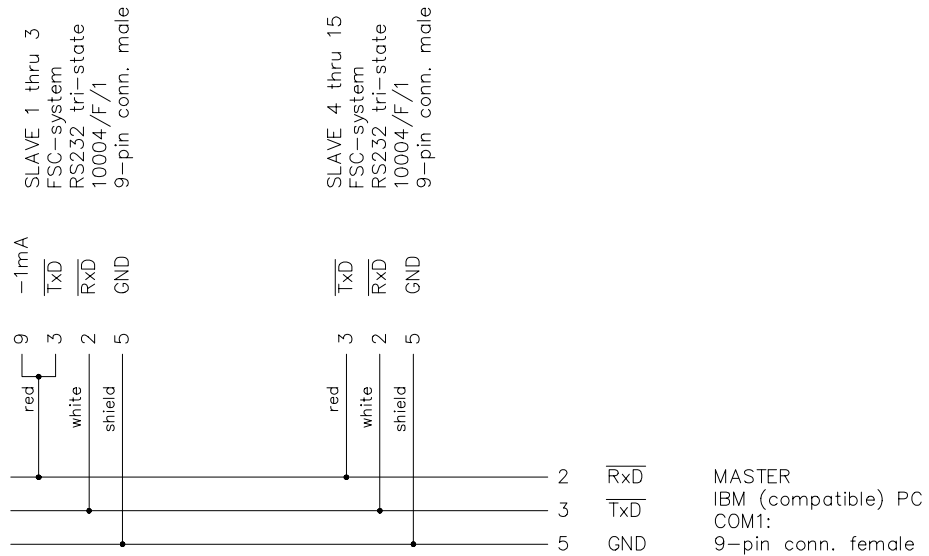
Figure 3   Cable between FSC systems and IBM (compatible) PC
9-pin connector without hardware handshake

Figure 4 — Cable between FSC systems and DCS system (Figure 4 block)

Central Part 1
FSC–system
RS232 tri–state
10004/F/1
9–pin conn. male

−1mA
−1mA
$\overline{TxD}$
$\overline{RxD}$
GND

6
9
3
2
5

red
white
shield

Central Part 2
FSC–system
RS232 tri–state
10004/F/1
9–pin conn. male

−1mA
−1mA
$\overline{TxD}$
$\overline{RxD}$
GND

6
9
3
2
5

red
white
shield

$\overline{RxD}$
$\overline{TxD}$
GND

MASTER
DCS
Note: Add links for CTS and DCD as required by DCS when operating without hardware handshake.
Note: Some DCS–systems require the additional link with pin 6 (on FSC side).
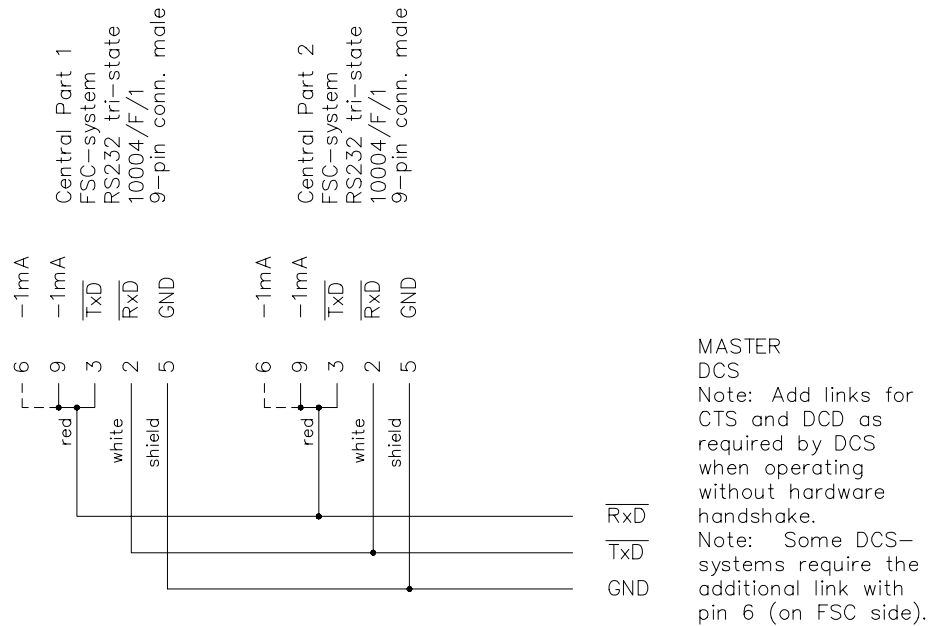
Figure 4   Cable between FSC systems and DCS system,
without hardware shaking

Slave 1 thru 3
FSC–system
RS232 tri–state
10004/F/1
9–pin conn. male

−1mA
$\overline{TxD}$
$\overline{RxD}$
CTS
DCD
RTS
−1mA
GND

9
3
2
8
1
7
6
5

red
white
black
green
shield

SLAVE 4 thru 15
FSC–system
RS232 tri–state
10004/F/1
9–pin conn. male

$\overline{TxD}$
$\overline{RxD}$
CTS
DCD
RTS
GND

3
2
8
1
7
5

red
white
black
green
shield

2    $\overline{RxD}$
3    $\overline{TxD}$
4   DTR
8   CTS
1   DCD
5   GND

MASTER
IBM (compatible) PC
COM1:
9–pin conn. female
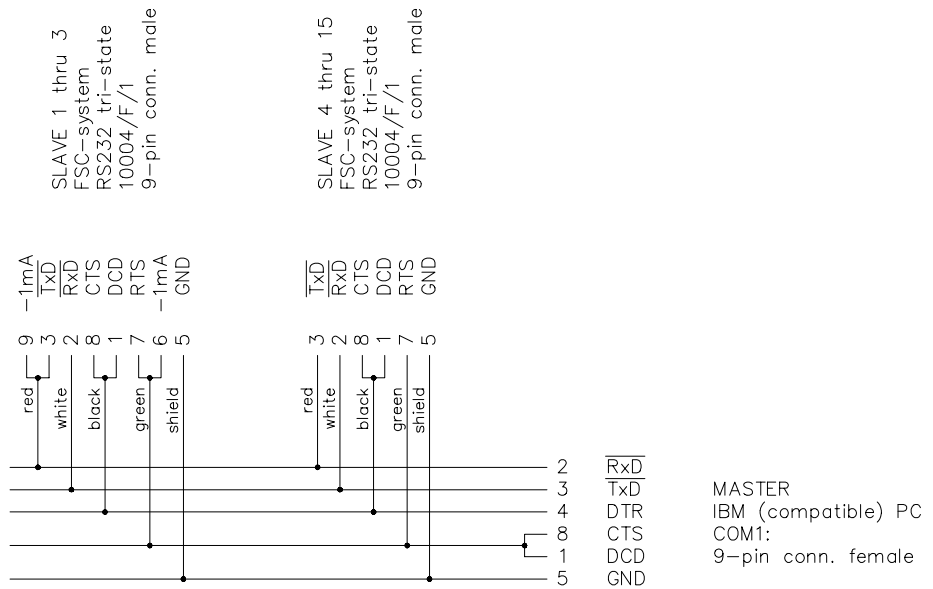
Figure 5   Cable between FSC systems and IBM (compatible) PC
9-pin connector with hardware shaking
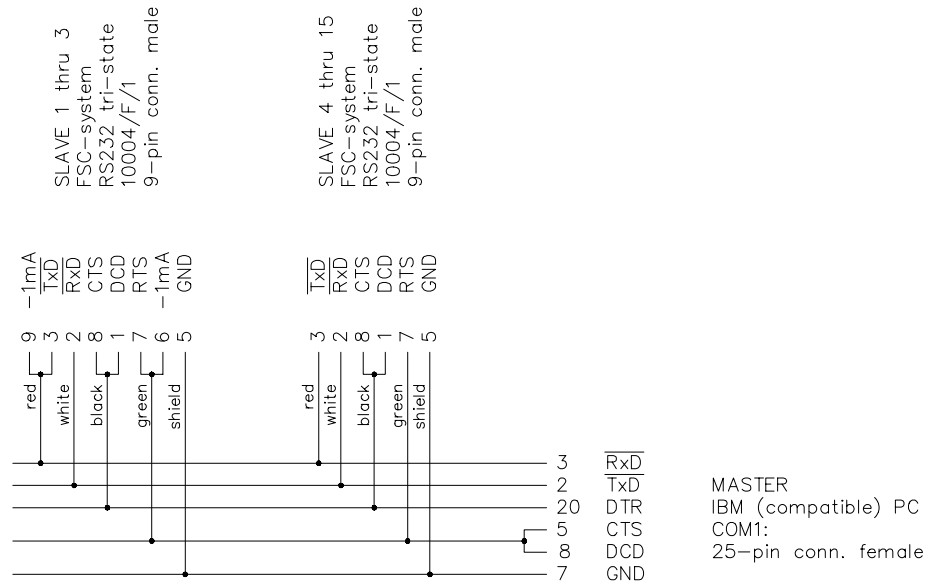
Figure 6   Cable between FSC systems and IBM (compatible) PC
25-pin connector with hardware handshake
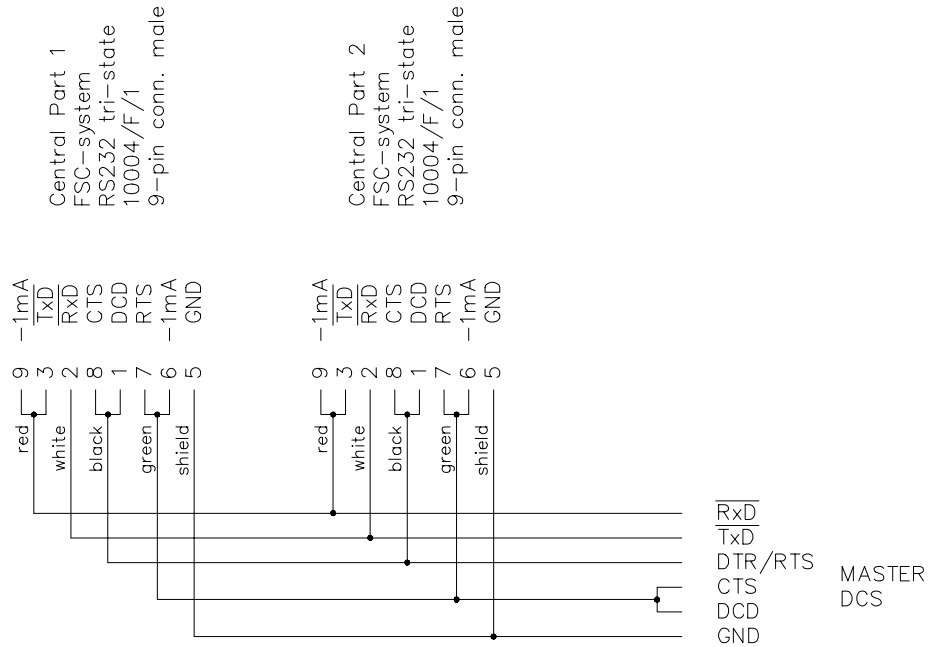
Figure 7   Cable between FSC systems and DCS system,
with hardware handshake

```
FSC-system
central part 1 and/or 2
RS232 tri-state                           Printer
10004/F/1
9-pin conn. male                          25-pin conn. male
```
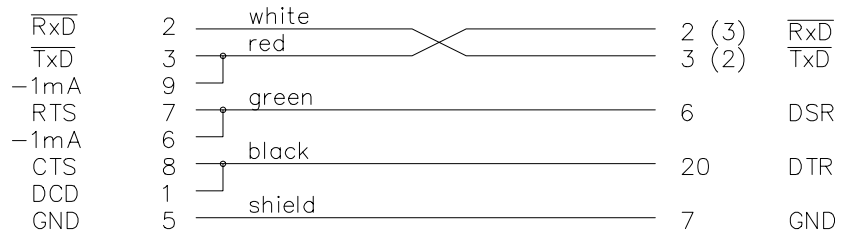
Figure 8   Cable between FSC system and printer
                    (25-pin connector) with hardware handshake

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.
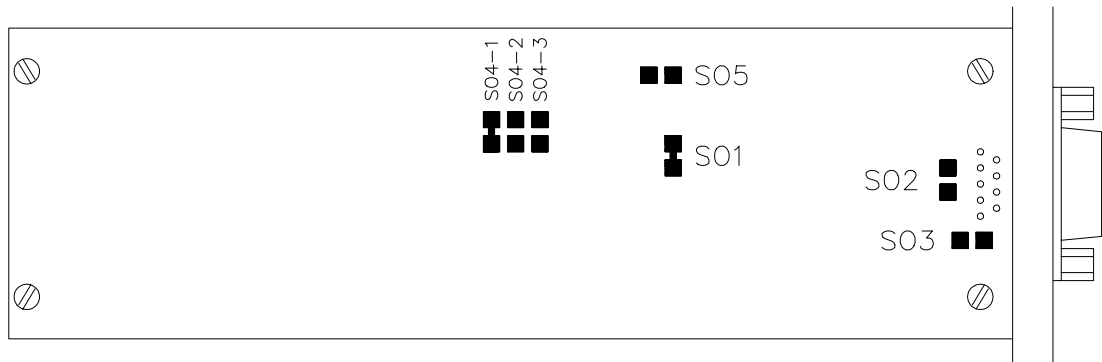
Figure 9   Solder jumpers on the 10004/F/1

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

General   Type number: 10004/F/1
Approvals: CE, TÜV, UL
Software versions: ≥ 2.77
Space requirements: 4 TE (= 4 HP), half height
Maximum baud rate: 38.4 Kbaud

Power   Power requirements: 5 Vdc 150 mA
Ripple content: < 50 mV p-p

Isolation   Galvanic isolation: > 6 kV

10004/G/1   Glass fiber interface

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 (ΣA) may not exceed the maximum permissible loss.

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

To give some calculation examples, we assume the following values:
- Connector attenuation (A_c) = 2 dB.
- 100/140 μm fiber attenuation (A_f) = 5.5 dB/km (at 820 nm).
- 50/125 μm 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).

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

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

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

Using more connectors in the loop, other types of connectors and/or other fiber qualities will result in other maximum distance calculation results.
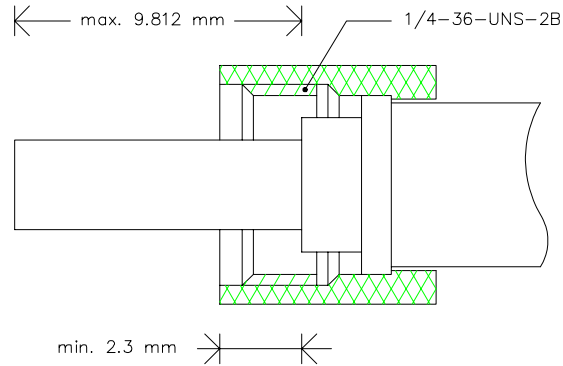
Figure 1   Cable connector type FSMA
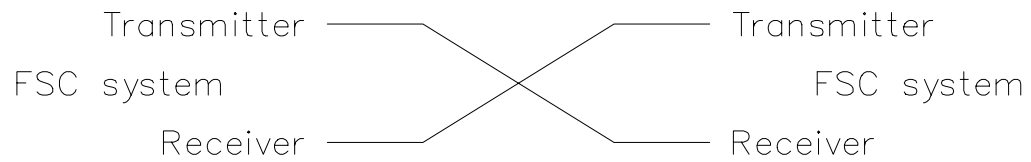
Figure 2   Optical link between two FSC systems

Jumpers

1 Mbaud or 2 Mbaud decoding is programmed by means of the jumper on the module.
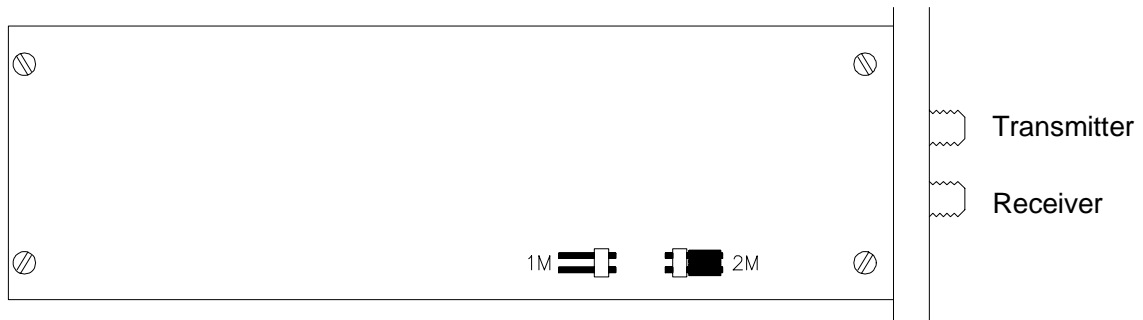
Figure 3   Jumper settings on the 10004/G/1

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:

General   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

Power   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.

Left blank intentionally.

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.

6	TxC		1	GND
7	–TxD		2	–TxC
8	–RxD		3	–TxD
9	RxC		4	RxD
			5	–RxC
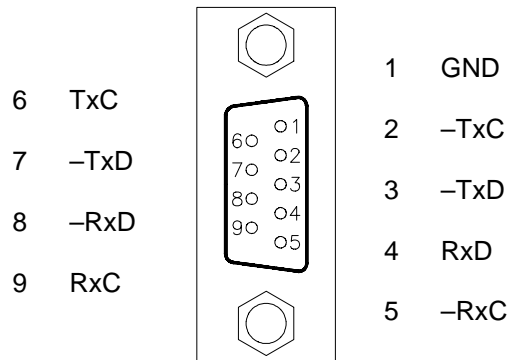
Figure 1   Front view of 10004/H/1 connector

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

-TxC   2                              2   -TxC
 TxC   6                              6    TxC
 TxD   3                              3    TxD
-TxD   7                              7   -TxD
-RxC   5                              5   -RxC
 RxC   9                              9    RxC
 RxD   4                              4    RxD
-RxD   8                              8   -RxD
 GND   1                              1    GND
```
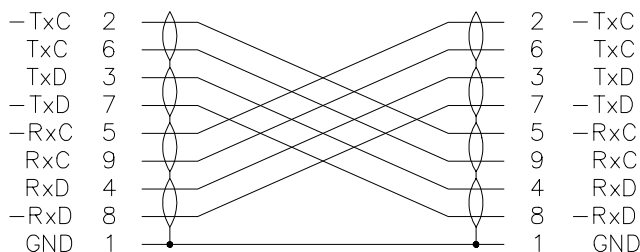
Figure 2   Cable between two Central Parts in redundant
FSC configurations

Honeywell

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

General   Type number: 10004/H/1
               Approvals: CE, TÜV, UL
               Software versions: ≥ 2.77
               Space requirements: 4 TE (= 4 HP), half height
               Maximum baud rate: 2 Mbaud

Power   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 ≤ 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.

6	nc		1	GND
7	−TxD		2	nc
8	−RxD		3	TxD
9	nc		4	RxD
			5	+5V
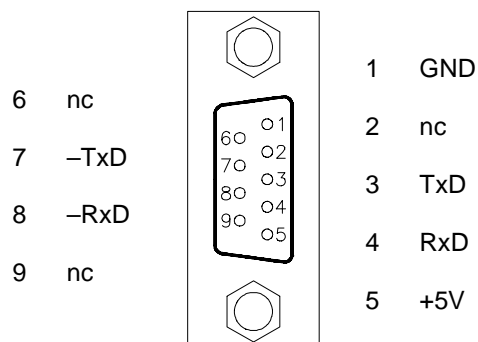
Figure 1   Front view of 10004/I/1 connector

Connections

The connections of the 10004/I/1 module are as follows:
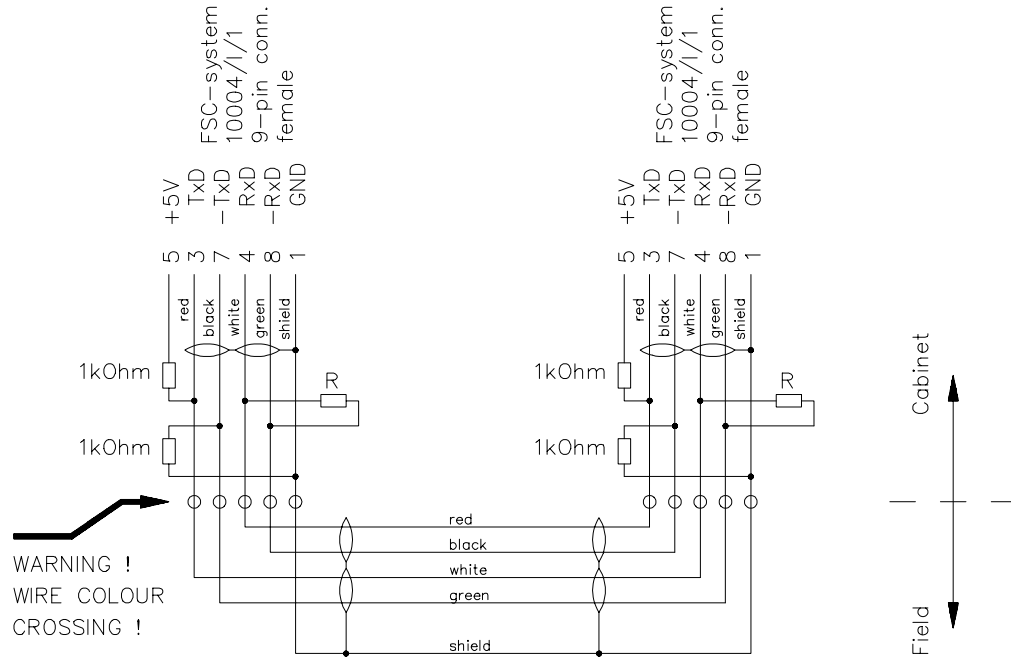
Figure 2   Point-to-point (duplex) communication cable
between two FSC systems

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°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°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
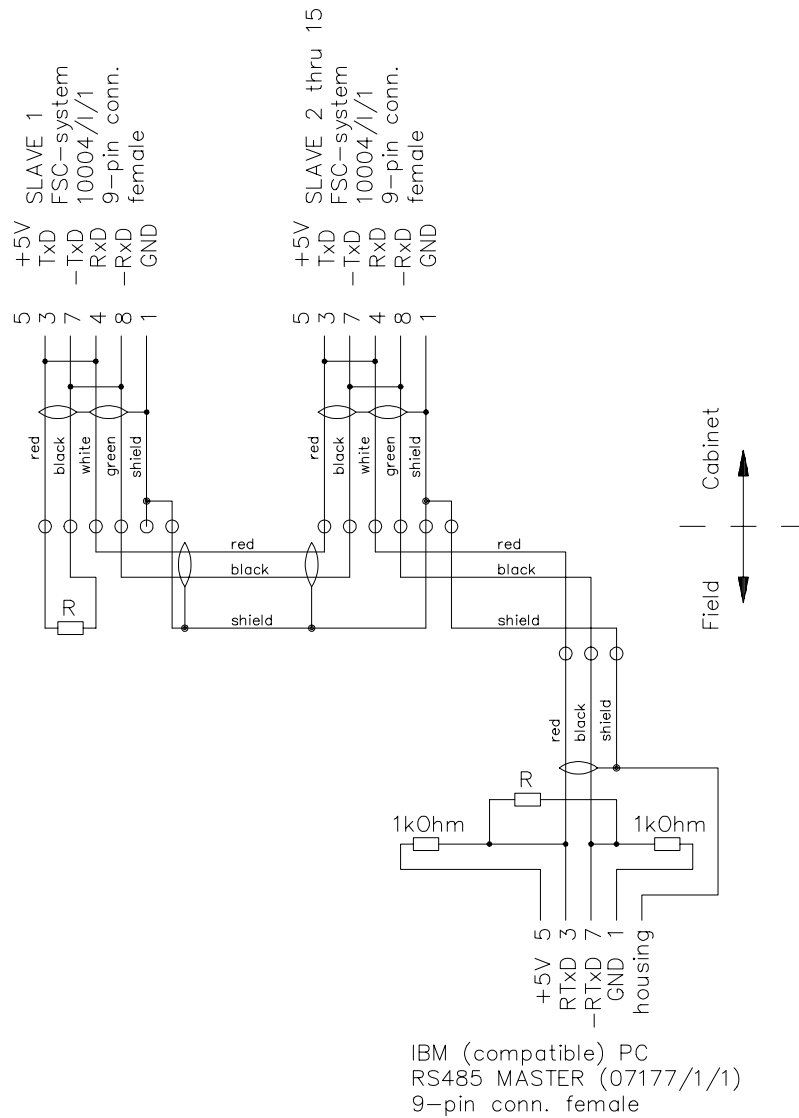
Figure 3   Communication cable (simplex) between FSC systems
and an FSC user station
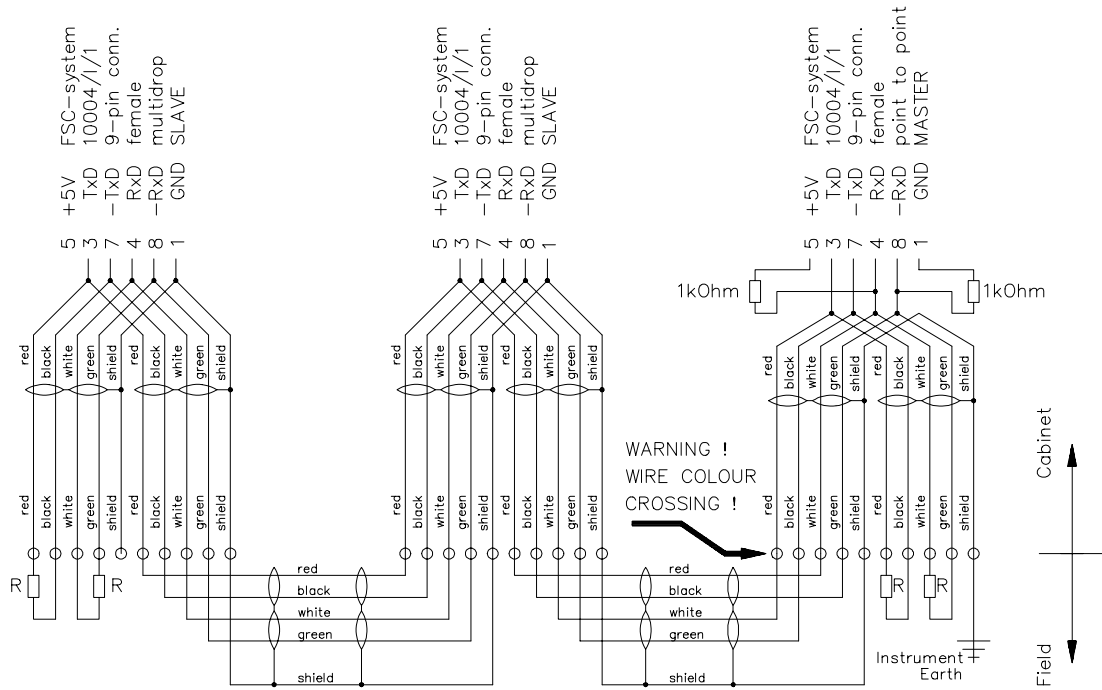
Figure 4   Multidrop (duplex) communication cable between
one master and up to 15 slaves
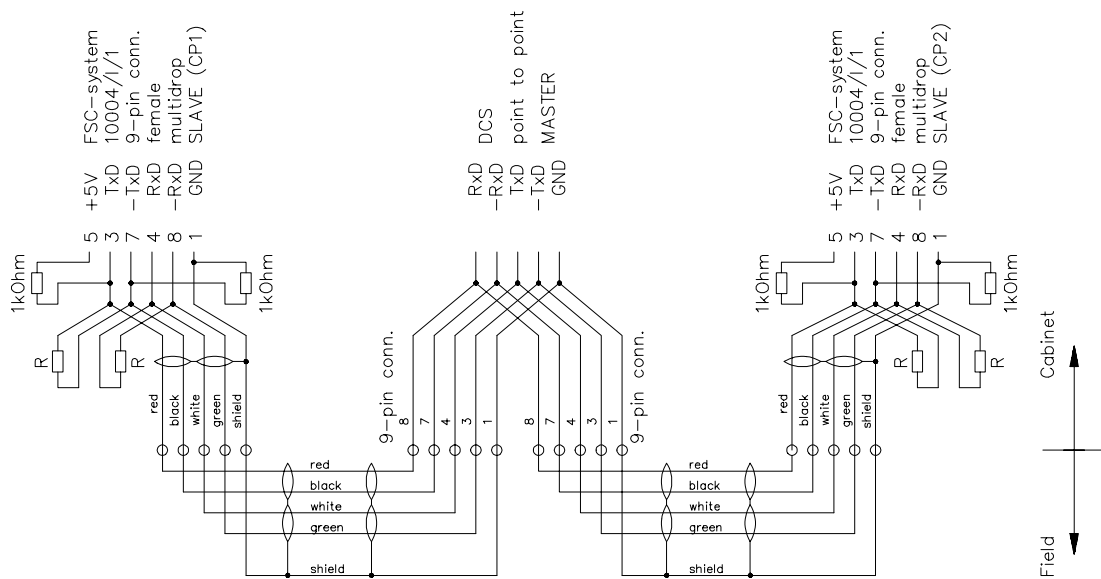
Figure 5   Communication cable between DCS and
redundant FSC system using Belden 8723 cable

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.
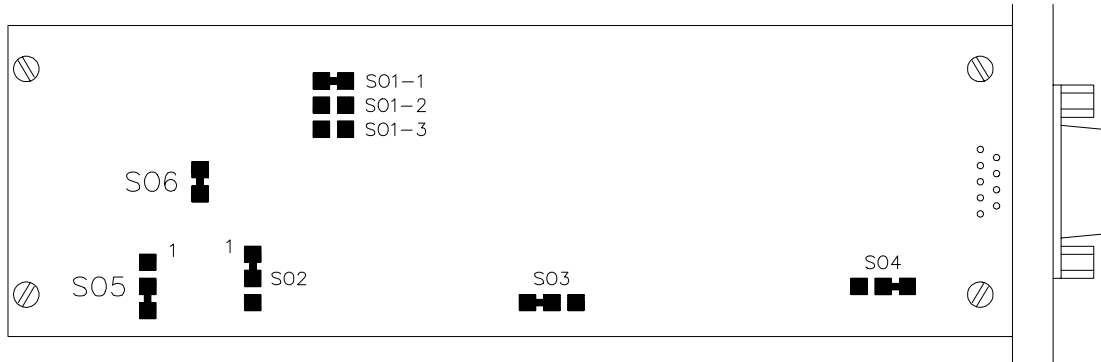
Figure 6   Solder jumpers on the 10004/I/1

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:

General
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

Power
Power requirements:	5 Vdc 300 mA
Ripple content:	$<$ 50 mV p-p

Isolation
Galvanic isolation:	$>$ 6 kV

10005/1/1   Watchdog module (WD)

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.

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.
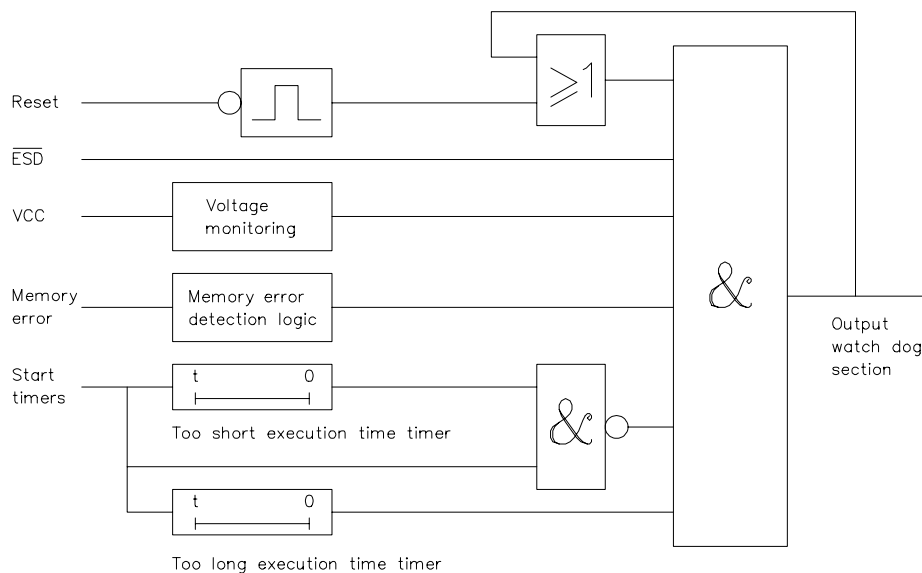
Figure 1 Watchdog section
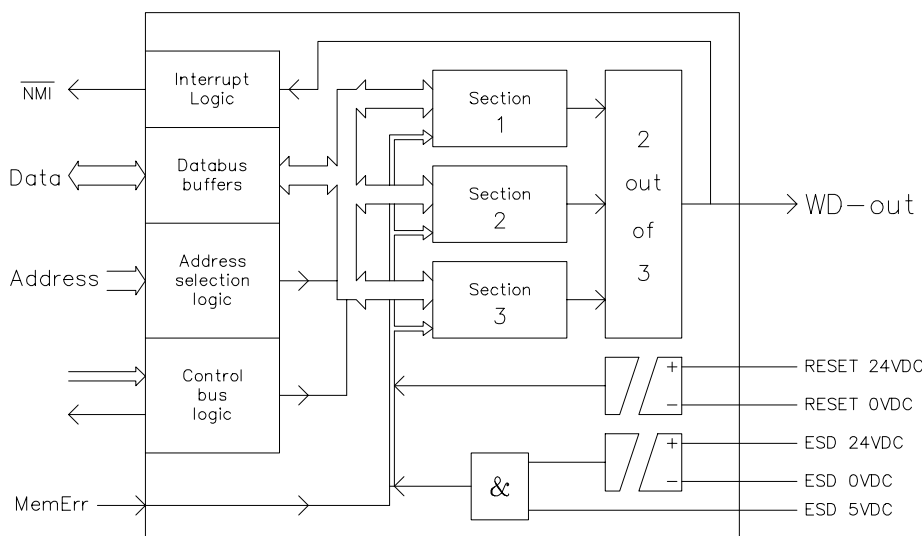
Figure 2   Watchdog module

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:
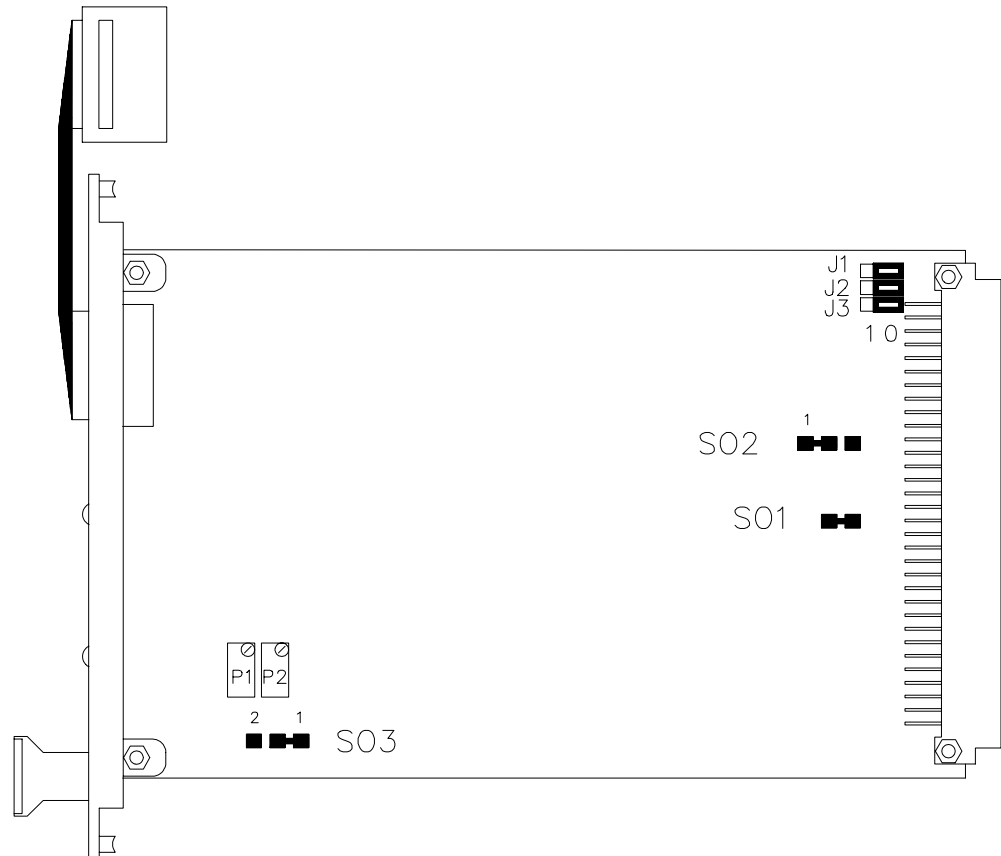
Figure 3   Jumper settings on 10005/1/1 module

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.
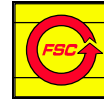
Technical data   The 10005/1/1 module has the following specifications:

General   Type number: 10005/1/1   01301*
               Approvals: CE, TÜV, UL
               Software versions: all
               Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   Power requirements: 5 Vdc   175 mA
                                   (without WDGOUT output current)
             Ripple content: < 50 mV p-p

Input   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.

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

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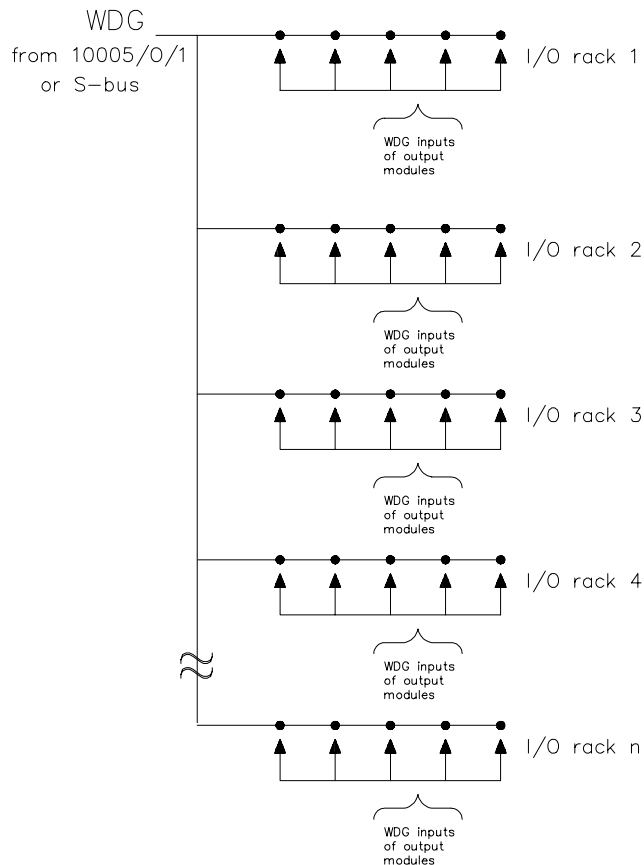
Figure 1   Schematic watchdog wiring to I/O racks and output modules

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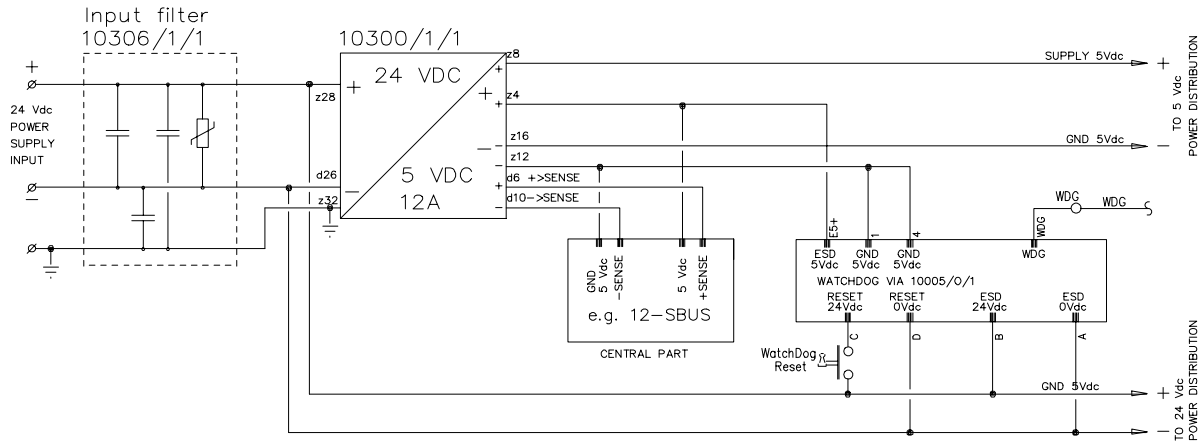
Figure 2   Connection details of 10005/O/1 for one Central Part

Pin allocation

Figure 3 shows the pin allocation of the female connector.
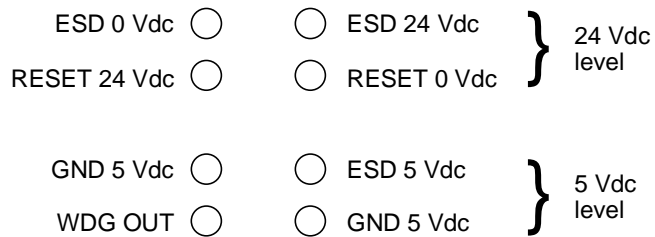
Figure 3   Back view of 10005/O/1 connector

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

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.

The diagnostic information is displayed as follows:

Top display: Signal type:

RI	Analog input fault
dI	Digital input fault
$R\sigma$	Analog output fault
$d\sigma$	Digital output fault
CP	Central part fault
EL	Temperature low
EH	Temperature high
cE	HBD correlation (address HBD not set correct)
hb	HBD fault

Figure 1   Middle display: Rack number
Front view   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

A.I.	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

Honeywell

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

General   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

Power   Power requirements: 5 Vdc   400 mA
Ripple content: < 50 mV p-p

Batteries   Back-up capacity: 4 Ah

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

Honeywell

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.

The diagnostic information is displayed as follows:

Top display: Signal type:

AI	Analog input fault
dI	Digital input fault
Ao	Analog output fault
do	Digital output fault
CP	Central part fault
tL	Temperature low
tH	Temperature high
cE	HBD correlation (address HBD not set correct)
hb	HBD fault

Figure 1
Front view

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

A.I.	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

Honeywell

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

General

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

Power

Power requirements:	5 Vdc 300 mA
Ripple content:	< 50 mV p-p

Batteries

Back-up capacity:	0.5 Ah

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

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

10006/2/2 Diagnostic and battery module (DBM) with DCF-77 interface

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.

The diagnostic information is displayed as follows:

Top display: Signal type:

AI	Analog input fault
dI	Digital input fault
Ao	Analog output fault
do	Digital output fault
CP	Central part fault
tL	Temperature low
tH	Temperature high
cE	HBD correlation (address HBD not set correct)
hb	HBD fault

Figure 1
Front view

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

$t.$	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

$A.I.$	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

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.

Honeywell

Jumpers   Jumper J1 switches the batteries in stock (OFF) or in circuit (ON).
Jumpers J2 and J3 are factory-set (closed).
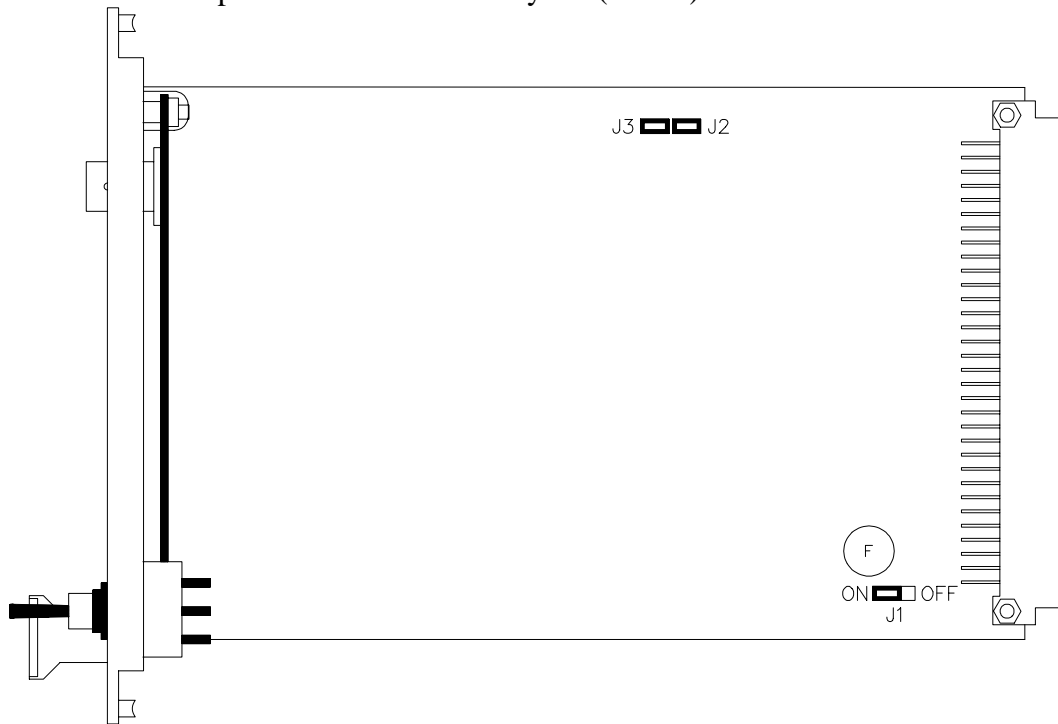
Figure 2   Jumper settings on 10006/2/2 module

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:

General

Type number:	10006/2/2 08902*
Approvals:	CE, TÜV, UL
Software versions:	≥ 2.90
Space requirements:	8 TE, 3 HE (= 8 HP, 3U)

Power

Power requirements:	5 Vdc 350 mA
Ripple content:	< 50 mV p-p

DCF

Receiver sensitivity:	10 µV
Time offset:	± 2.5 ms after DCF synchronization
Quartz accuracy:	± 10 ppm at installation start
	± 2 ppm after DCF synchronization

Aerial**

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)

Batteries

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.

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.
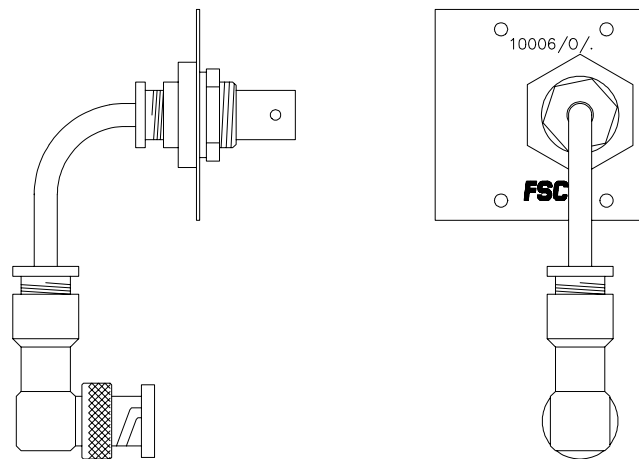
Figure 1   Side and front views

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

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.
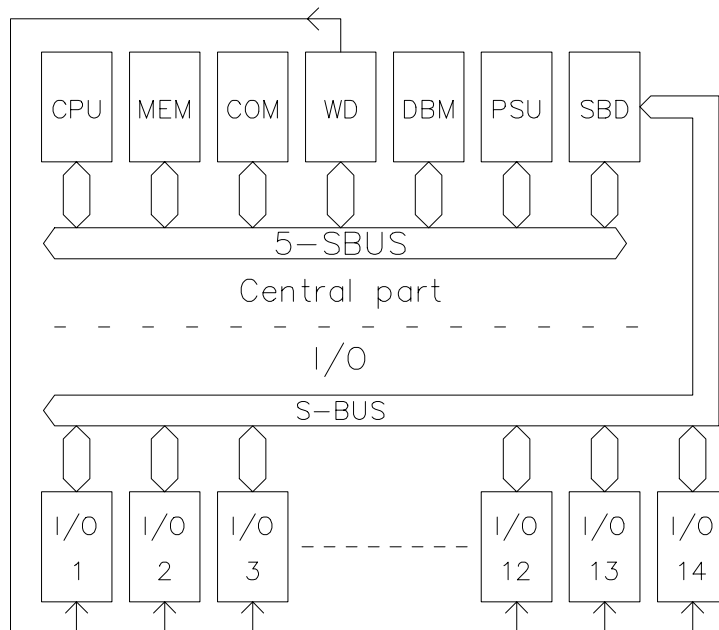
Figure 1   Typical layout

Honeywell

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).
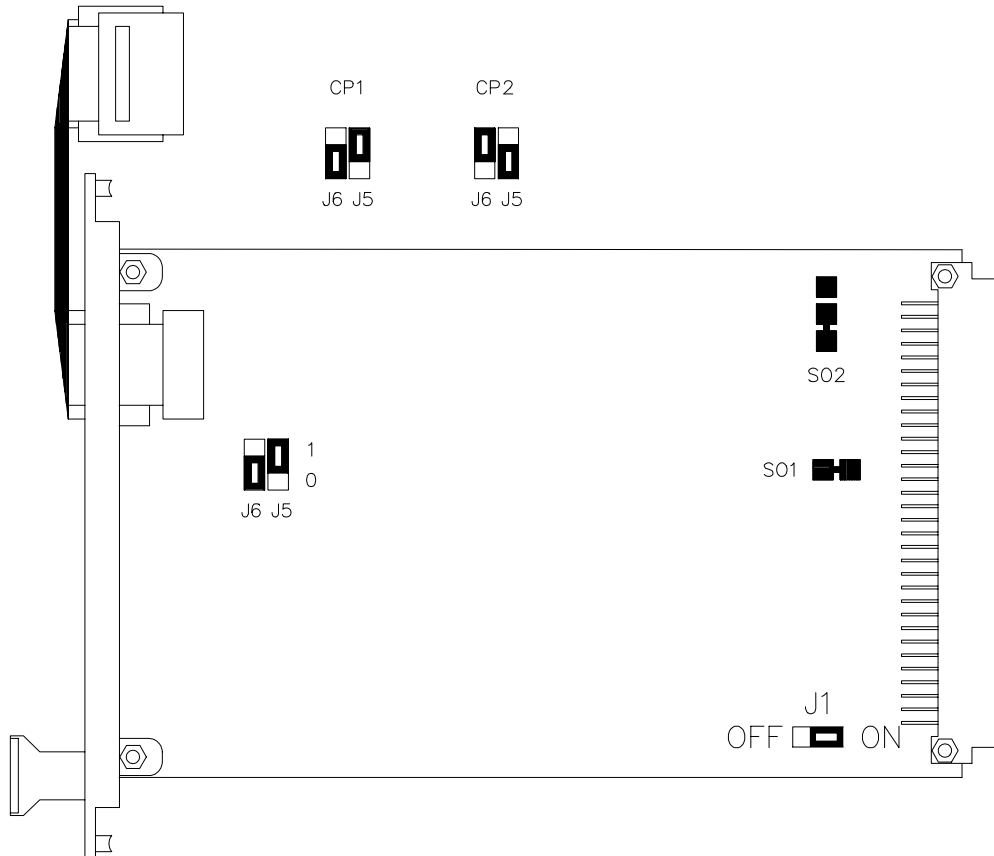
Figure 2   Jumper setting on 10007/1/1

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

General | Type number: | 10007/1/1 |
|---|---|
| Approvals: | CE, TÜV, UL |
| Software versions: | all |
| Space requirements: | 4 TE, 3 HE (= 4 HP, 3U) |

Power | Power requirements: | 5 Vdc   35 mA |
|---|---|
| Ripple content: | < 50 mV p-p |

Batteries | Back-up capacity: | 1 Ah |
|---|---|

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

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.
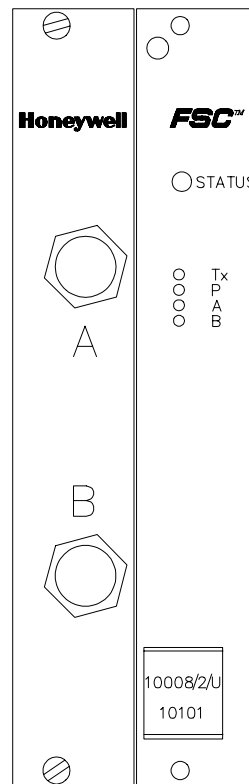
Figure 1   Front view

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).
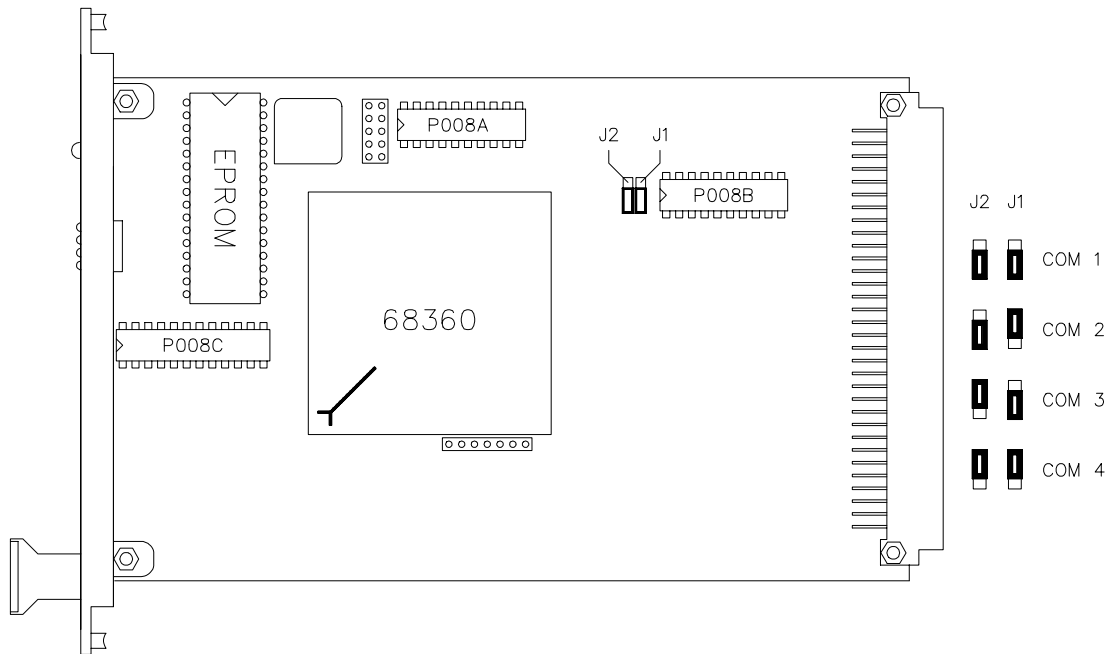
Figure 2   Jumper positions on 10008/2/U

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:

General   Type number: 10008/2/U   10101
                Approvals: CE, TÜV, UL
                FSC software version: ≥ 400
                Space requirements: 8 TE, 3 HE (= 8 HP, 3U)

Power   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.

![Honeywell logo] **Honeywell**

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).
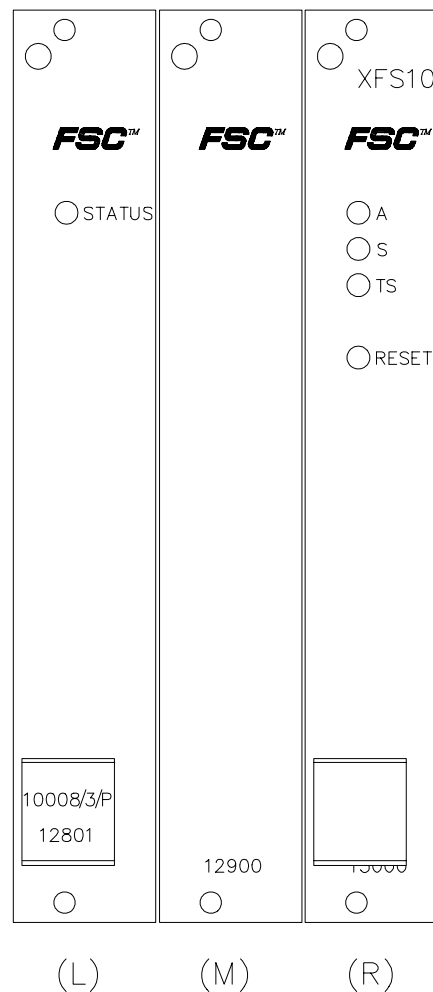
Figure 1   Front view

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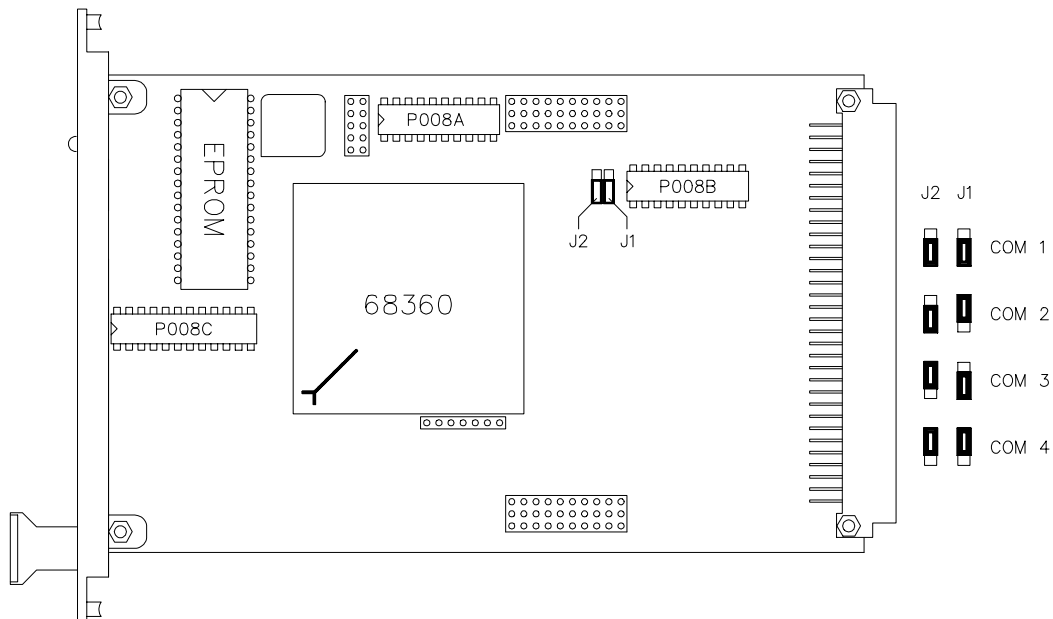
Figure 2   Jumper and EPROM positions on FSC communication board of 10008/3/P module

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).
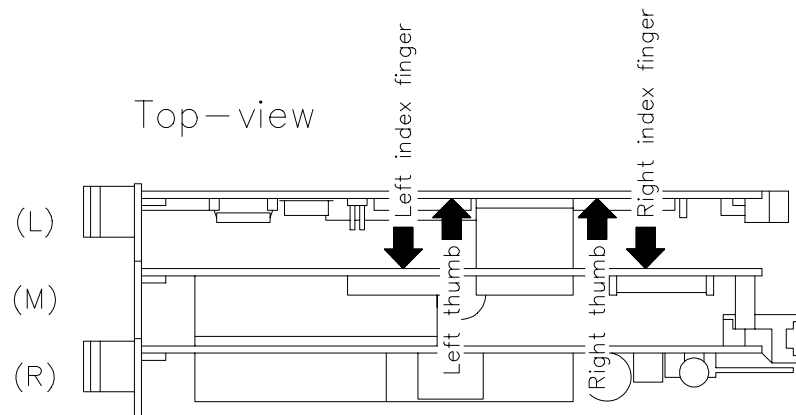
Figure 3   Pressure points at top side during disassembly of module

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).
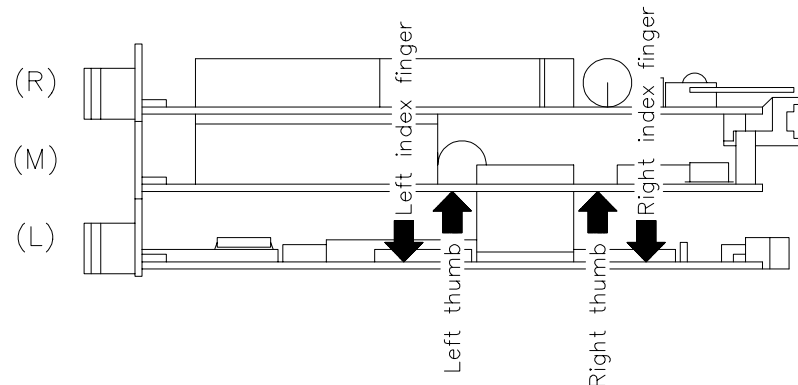
Figure 4   Pressure points at bottom side during disassembly of module

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!
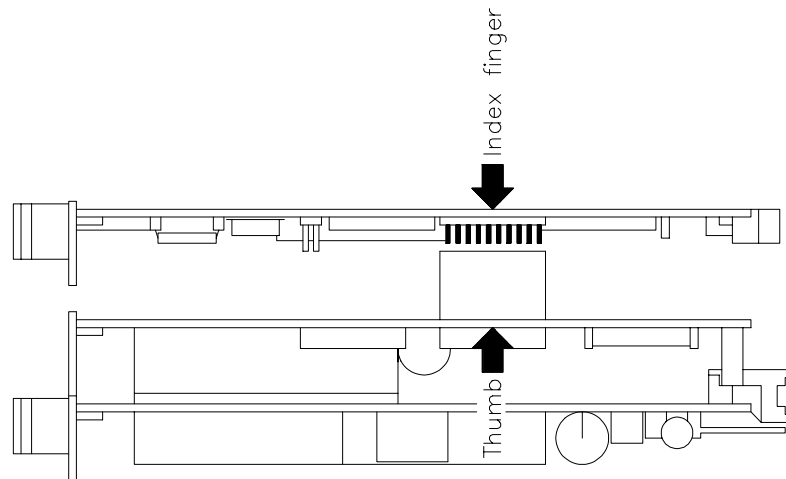
Figure 5   Pressure points during reassembly of module

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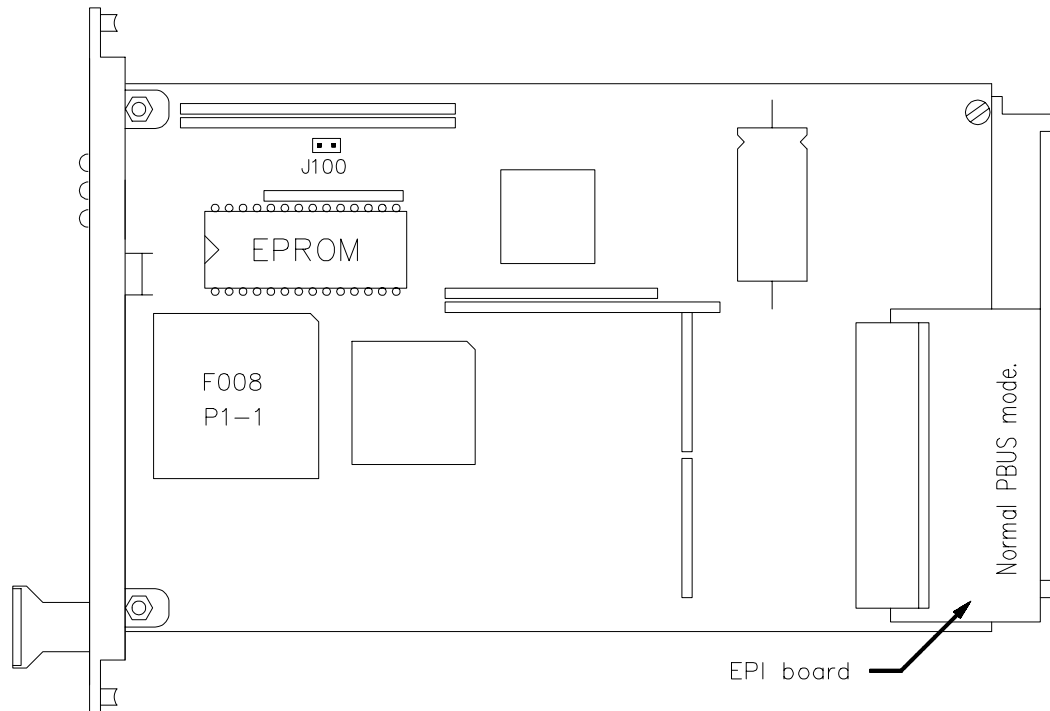
Figure 6   EPROM and EPI board position on P-bus communication
           board of 10008/3/P module

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:

General

Type number:	10008/3/P 12801
Approvals:	CE, TÜV
FSC software version:	$\geq$ 410
Space requirements:	12 TE, 3 HE (= 12 HP, 3U)

Power

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)

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.

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

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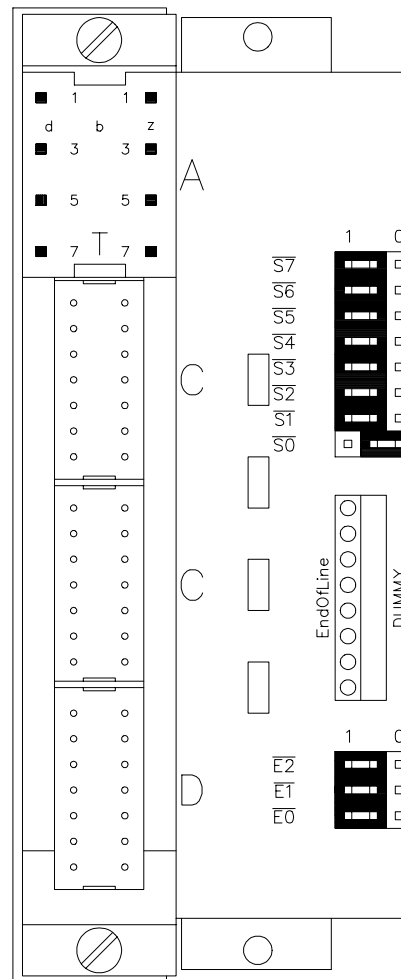
Features

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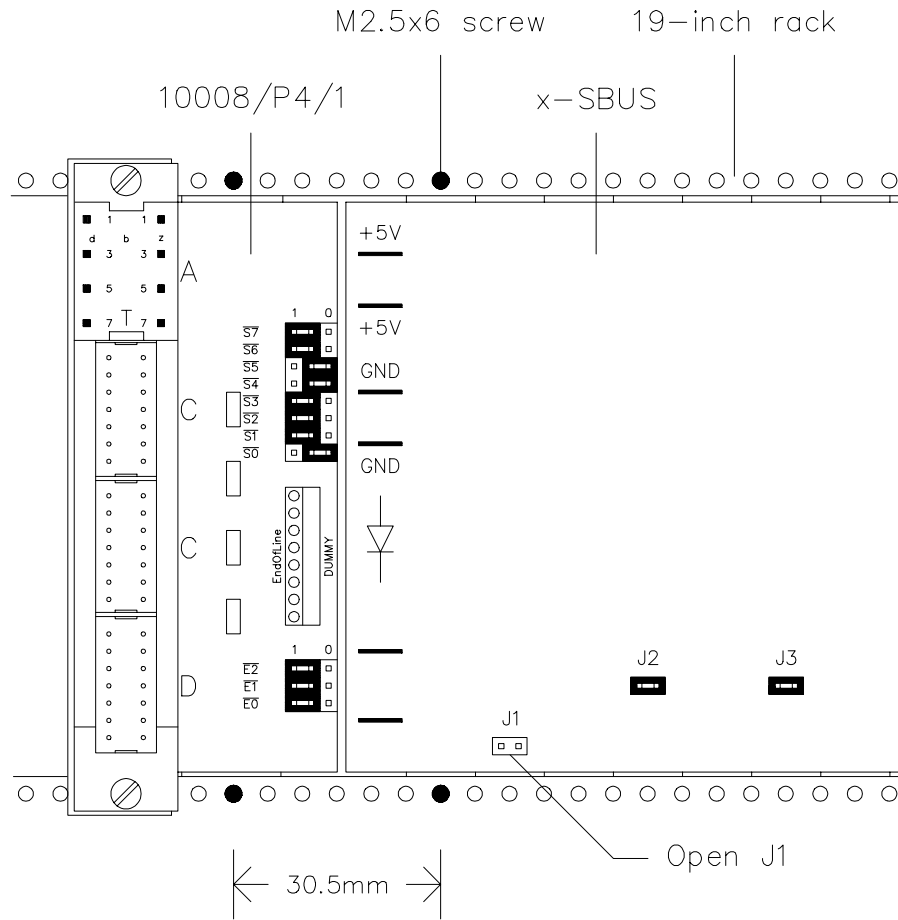
Figure 2   Back view of 19-inch rack with 10008/P4/1 module in place

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

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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 mm² (AWG 24) wires. Figure 3 shows the connection layout of the wire-wrap adapter.


```
 0 VDC    ■  1      1  ■     0 VDC
            d    b      z
 RUME     ■  3      3  ■     Earth
 Uv       ■  5      5  ■     Uv
 RUMA     ■  7      7  ■     Us
```
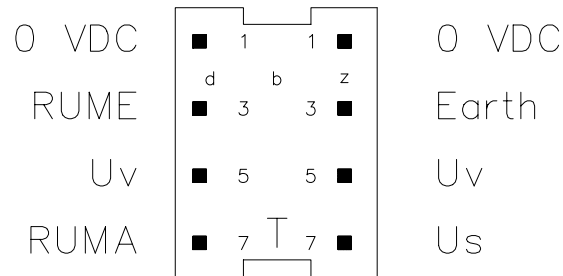
Figure 3   Wire-wrap adapter (detail)

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.

(A)   **(B)**
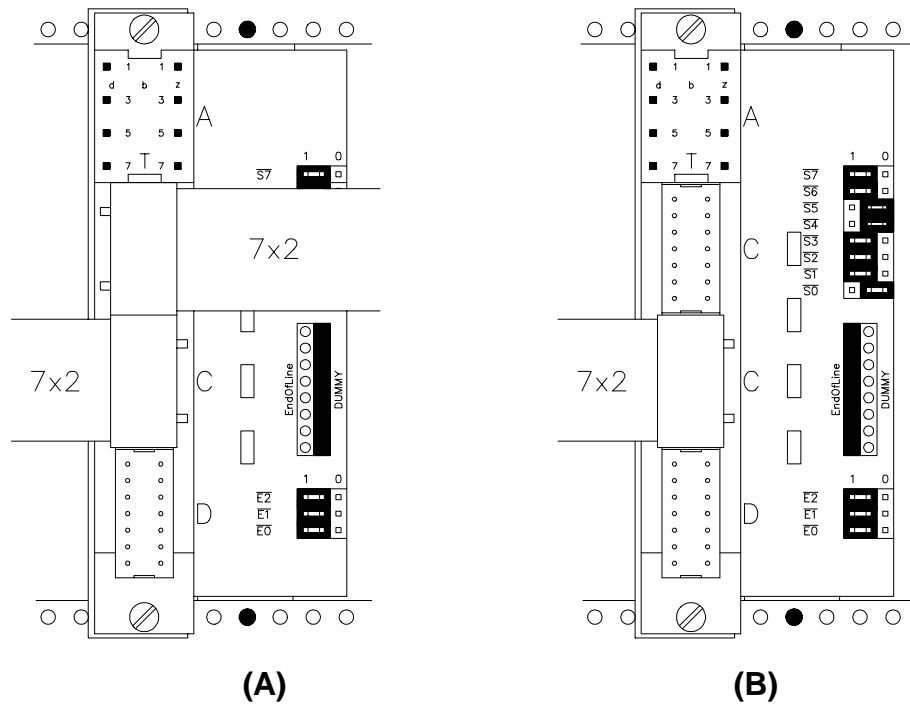
Figure 4   Location of P-bus flatcables on 10008/P4/1 module

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:

General

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)

Power

Power requirements:	none (included in 10008/3/P specifications)

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:

d	b	z		
d2	■	■ 2	z2	GND 5 Vdc
d4	■	■ 4	z4	Supply 5 Vdc
d6	■	■ 6	z6	
d8	■	■ 8	z8	RA0
d10	■	■ 10	z10	RA1
d12	■	■ 12	z12	RA2
d14	■	■ 14	z14	RA3
d16	■	■ 16	z16	
d18	■	■ 18	z18	
d20	■	■ 20	z20	
d22	■	■ 22	z22	
d24	■	■ 24	z24	
d26	■	■ 26	z26	
d28	■	■ 28	z28	
d30	■	■ 30	z30	Link
d32	■	■ 32	z32	Link
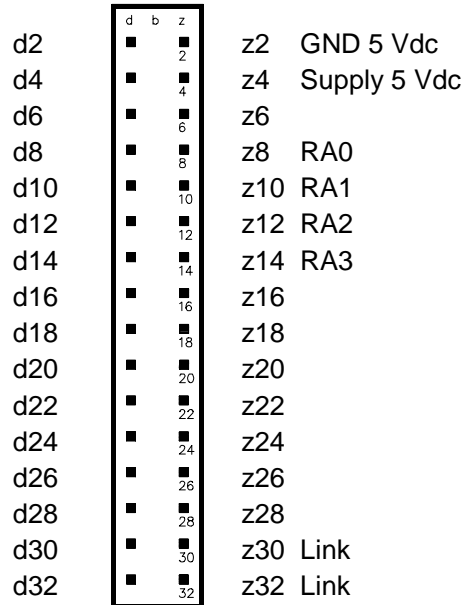
Figure 1   Back view and pin allocation

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
HBD1	0	0	0	1
HBD2	0	0	1	0
HBD3	0	0	1	1
HBD4	0	1	0	0
HBD5	0	1	0	1
HBD6	0	1	1	0
HBD7	1	0	0	0
HBD8	1	0	0	1
HBD9	1	0	1	0
HBD10	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.
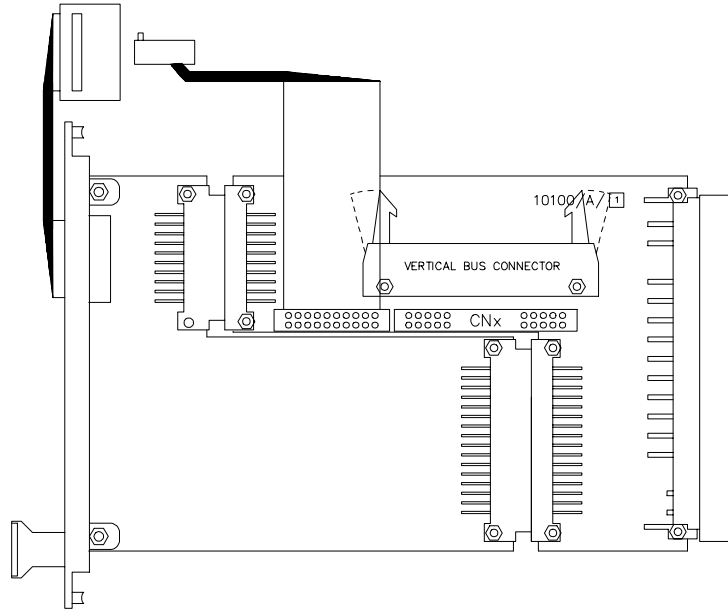
Figure 2   Schematic diagram for flatcable routing using the HBD
with 10100/A/1 (non-redundant I/O)
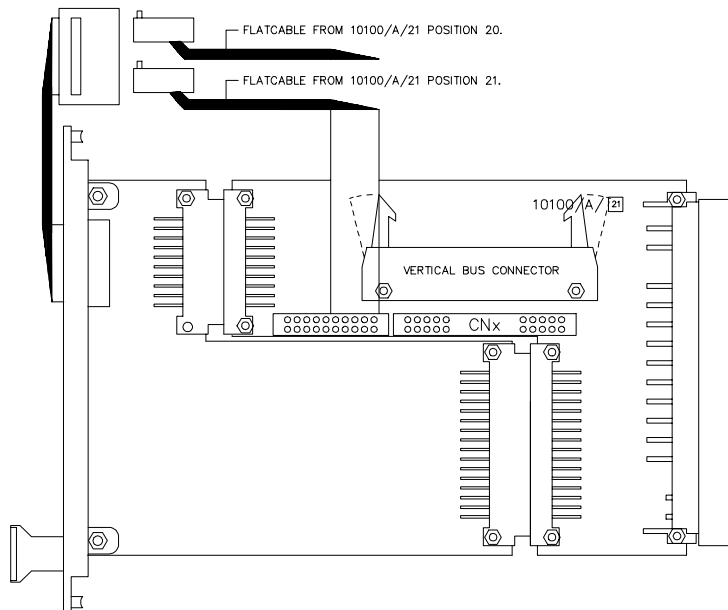
Figure 3   Schematic diagram for flatcable routing using the HBD
with 10100/A/21 (redundant I/O with one rack per HBD)
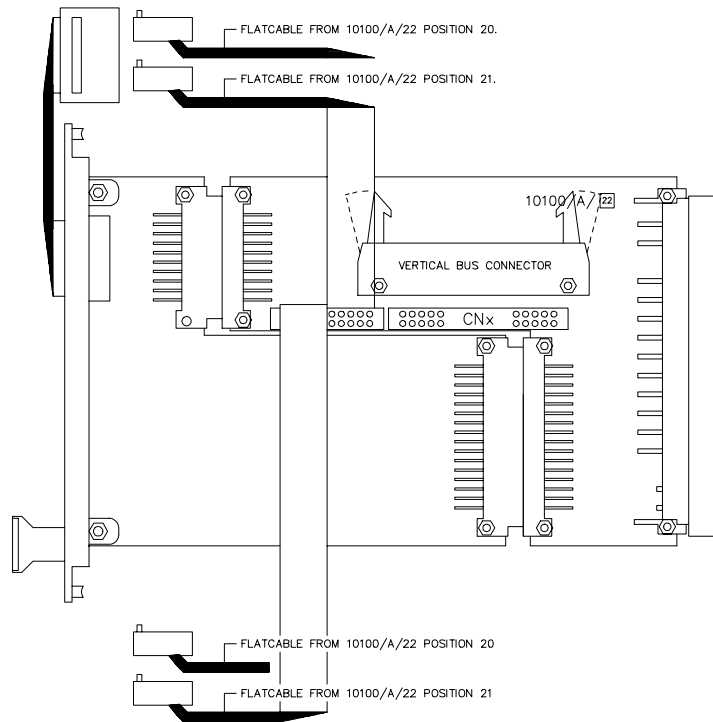
Figure 4   Schematic diagram for flatcable routing using the HBD
with 10100/A/22 (redundant I/O with two racks per HBD)

Wiring diagram

The 10100/1/1 module is wired in accordance with the wiring
diagram below.
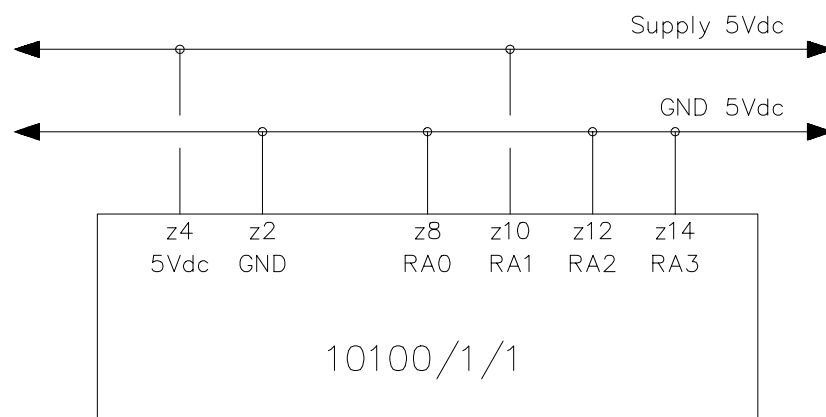
Figure 5   Wiring diagram of 10100/1/1 module with
rack address 2 (see Table 1)

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).
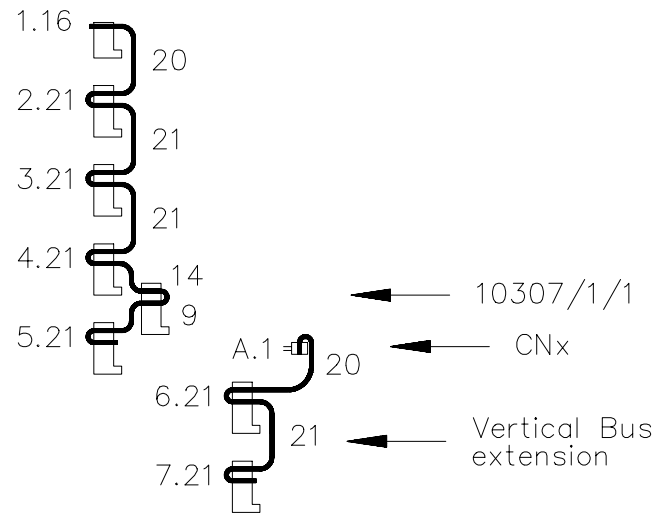
Figure 6   Vertical bus rack extension

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

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
HBD1	0	0	0	1
HBD2	0	0	1	0
HBD3	0	0	1	1
HBD4	0	1	0	0
HBD5	0	1	0	1
HBD6	0	1	1	0
HBD7	1	0	0	0
HBD8	1	0	0	1
HBD9	1	0	1	0
HBD10	1	1	0	0

0 = GND 5 Vdc   1 = Supply 5 Vdc

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Flatcable routing   Figure 2 to Figure 4 below show the flatcable routing for the various configurations.
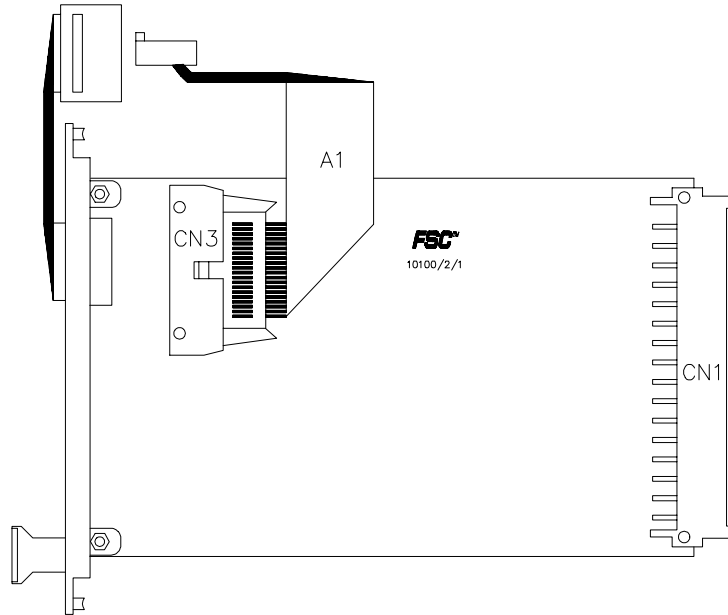
Figure 2   Schematic diagram for flatcable routing from the HBD
(non-redundant I/O)

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: ≥ 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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Helping You Control Your World

Fail Safe Control

Hardware Manual

Section 5:
FSC Input Modules

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Section 5: FSC Input Modules

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.
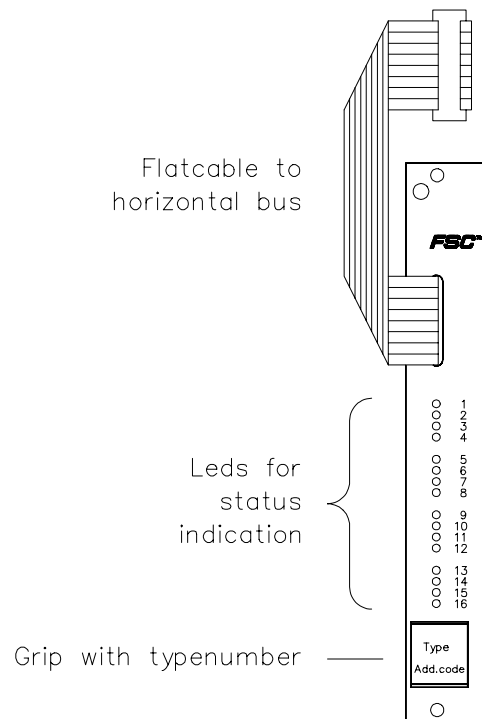
Figure 1   Front of a digital input module

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.

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
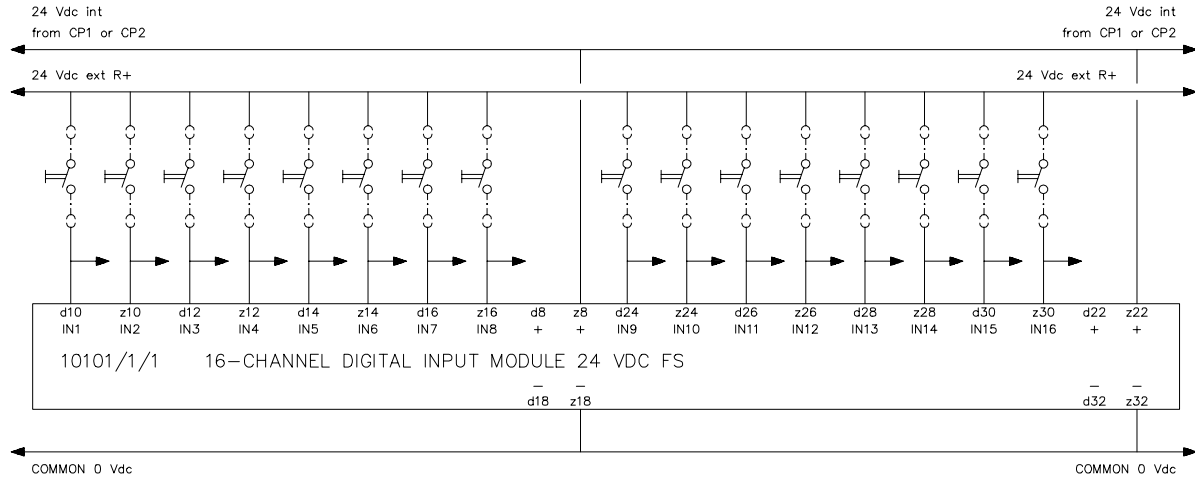
24 Vdc int
from CP1 or CP2

24 Vdc int
from CP1 or CP2

24 Vdc ext R+

24 Vdc ext R+

| d10 | z10 | d12 | z12 | d14 | z14 | d16 | z16 | d8 | z8 | d24 | z24 | d26 | z26 | d28 | z28 | d30 | z30 | d22 | z22 |
| IN1 | IN2 | IN3 | IN4 | IN5 | IN6 | IN7 | IN8 | + | + | IN9 | IN10 | IN11 | IN12 | IN13 | IN14 | IN15 | IN16 | + | + |

10101/1/1   16−CHANNEL DIGITAL INPUT MODULE 24 VDC FS

− −
d18 z18

− −
d32 z32

COMMON 0 Vdc

COMMON 0 Vdc

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:

General

Type number:	10101/1/1 01703*
Approvals:	CE, TÜV, UL
Software versions:	all*
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

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)

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:	< 9 Vdc (I < 2 mA)
Input delay:	typically 10 ms

Technical data (continued)

Key coding

(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.

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:

	d	b	z

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
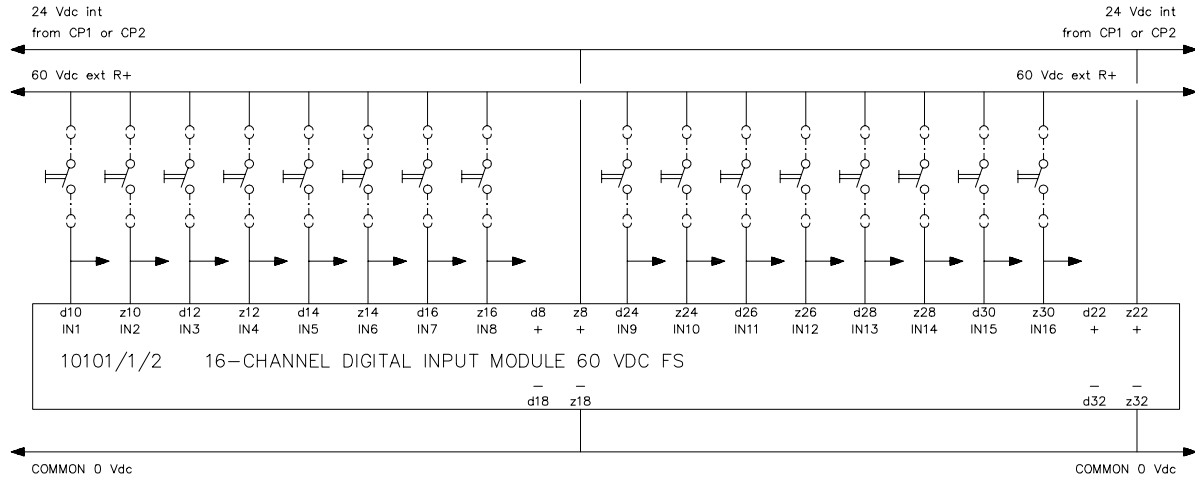
Figure 3   Connection example for redundant I/O configurations

> **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:

General

Type number:	10101/1/2 07200
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)
	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)

Fuses

Fuse values:	2x 100 mA
Fuse type:	Round, TR5-F/19370K
Fuse dimensions:	∅ 8.2 mm (0.32 in), height 7.7 mm (0.3 in)

Technical data (continued)

Input

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

Key coding

(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.

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

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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

24 Vdc int
from CP1 or CP2

24 Vdc int
from CP1 or CP2

48 Vdc ext R+

48 Vdc ext R+

| d10 IN1 | z10 IN2 | d12 IN3 | z12 IN4 | d14 IN5 | z14 IN6 | d16 IN7 | z16 IN8 | d8 + | z8 + | d24 IN9 | z24 IN10 | d26 IN11 | z26 IN12 | d28 IN13 | z28 IN14 | d30 IN15 | z30 IN16 | d22 + | z22 + |

10101/1/3   16−CHANNEL DIGITAL INPUT MODULE 48 VDC FS

d18   z18

d32   z32

COMMON 0 Vdc

COMMON 0 Vdc
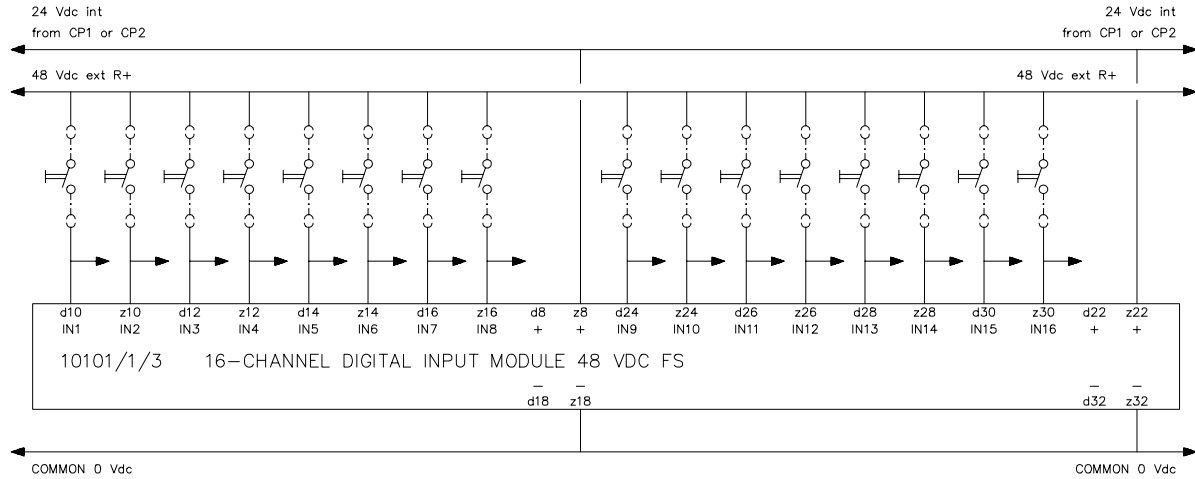
Figure 3   Connection example for redundant I/O configuration

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:	$\geq 2.80b$
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)

Key coding

(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.

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.
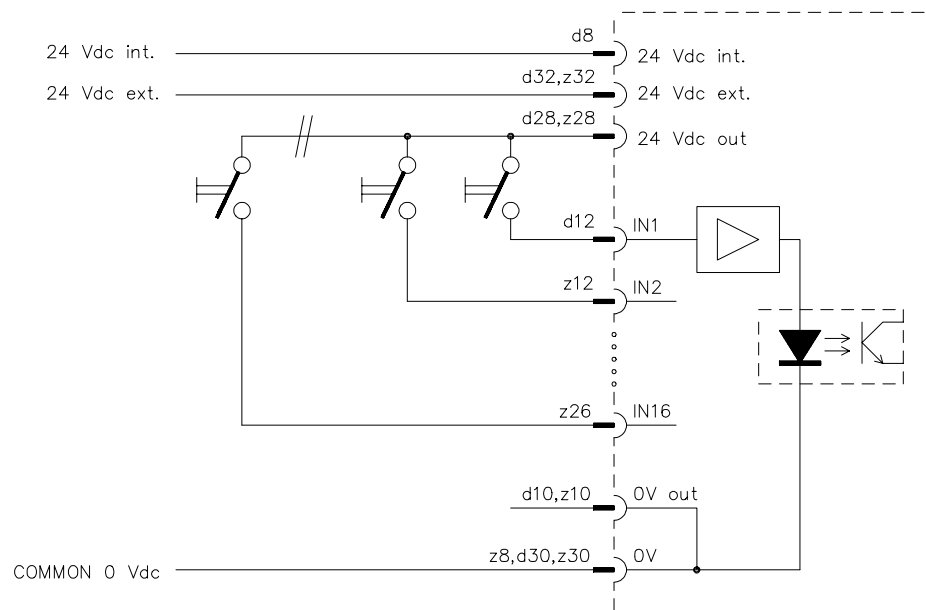
Figure 1   Schematic diagram for connection of inputs
to the 10101/2/1 module

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Pin allocation

The back view and pin allocation of the 10101/2/1 module connector are as follows:
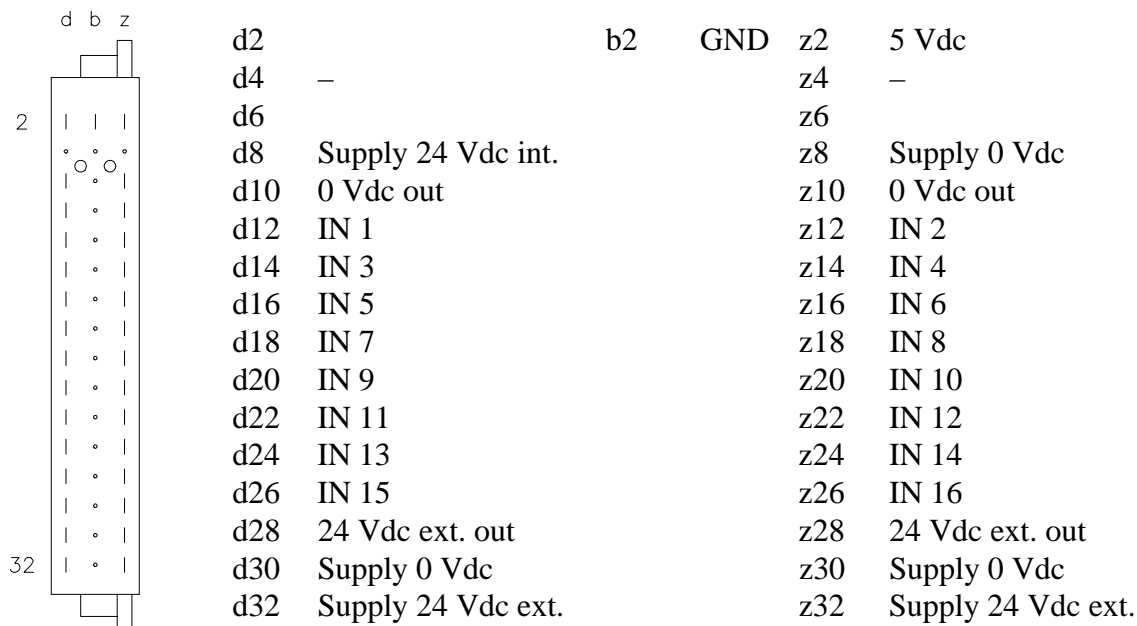
d2		b2	GND	z2	5 Vdc
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	0 Vdc out			z10	0 Vdc out
d12	IN 1			z12	IN 2
d14	IN 3			z14	IN 4
d16	IN 5			z16	IN 6
d18	IN 7			z18	IN 8
d20	IN 9			z20	IN 10
d22	IN 11			z22	IN 12
d24	IN 13			z24	IN 14
d26	IN 15			z26	IN 16
d28	24 Vdc ext. out			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.
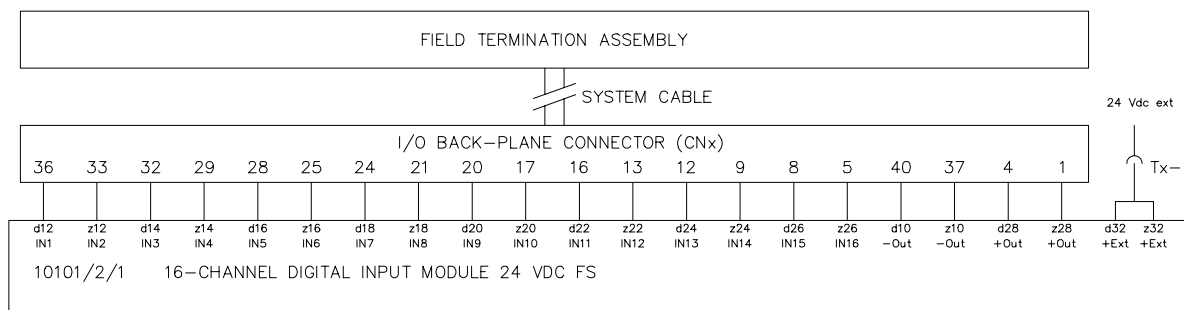
Figure 2   Connection example of 10101/2/1 module to FTA
for both non-redundant and redundant I/O configurations
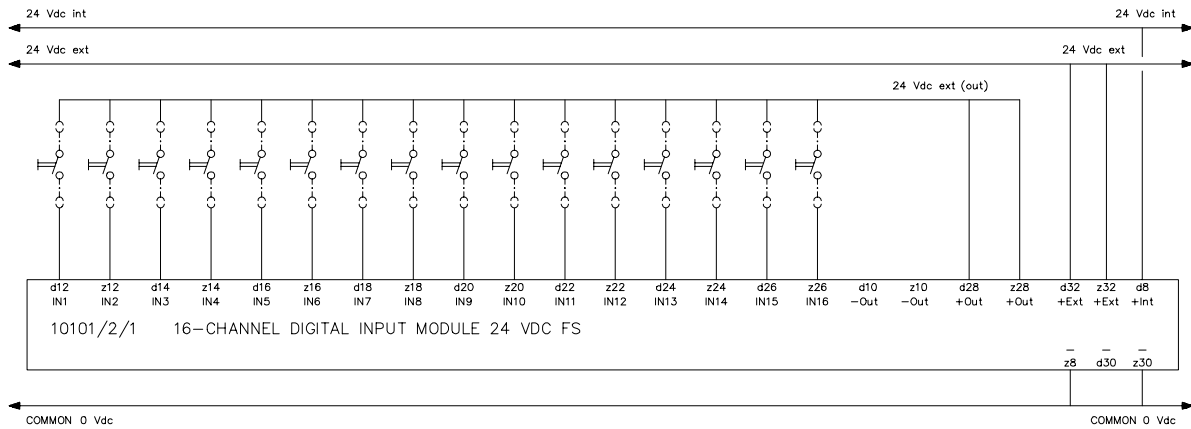
Figure 3 I/O connection example of 10101/2/1 module
for non-redundant I/O configurations
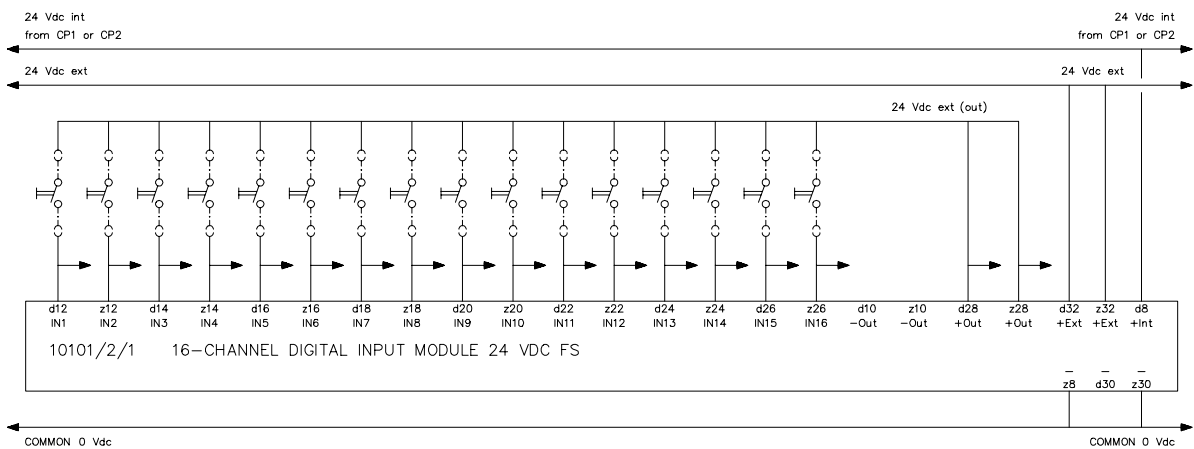
Figure 4 I/O connection example of 10101/2/1 module
for redundant I/O configurations

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:

General
Type number:	10101/2/1 11000
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power
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)

Input
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

Key coding   (See 'Key coding' data sheet)

Module connector code:
  − holes   A5, C5

Rack connector code:
  − large pins   A5, C5

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

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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.
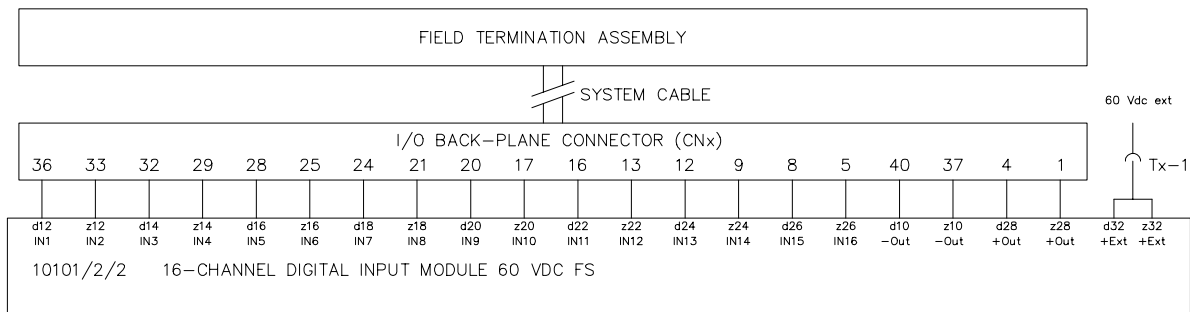
Figure 2   Connection example of 10101/2/2 module to FTA
for both non-redundant and redundant I/O configurations
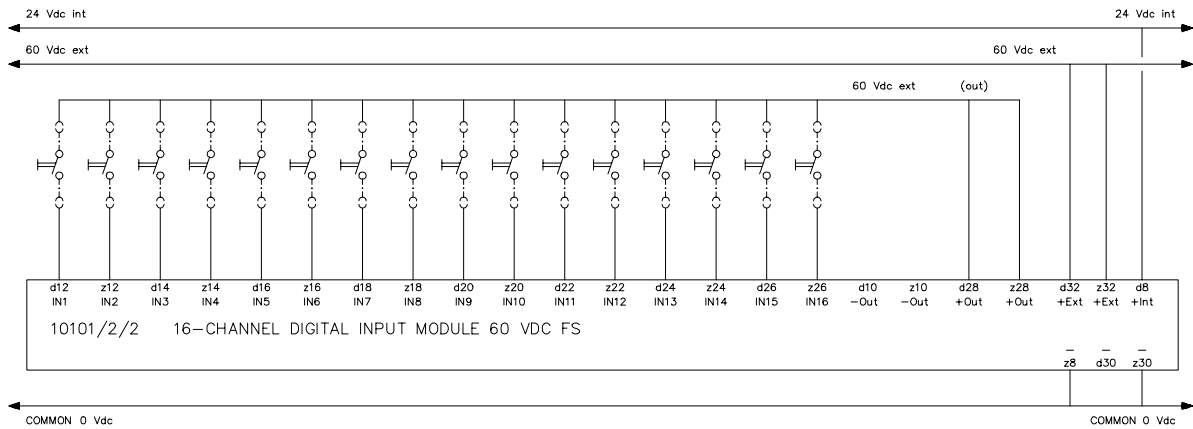
Figure 3   I/O connection example of 10101/2/2 module
for non-redundant I/O configurations
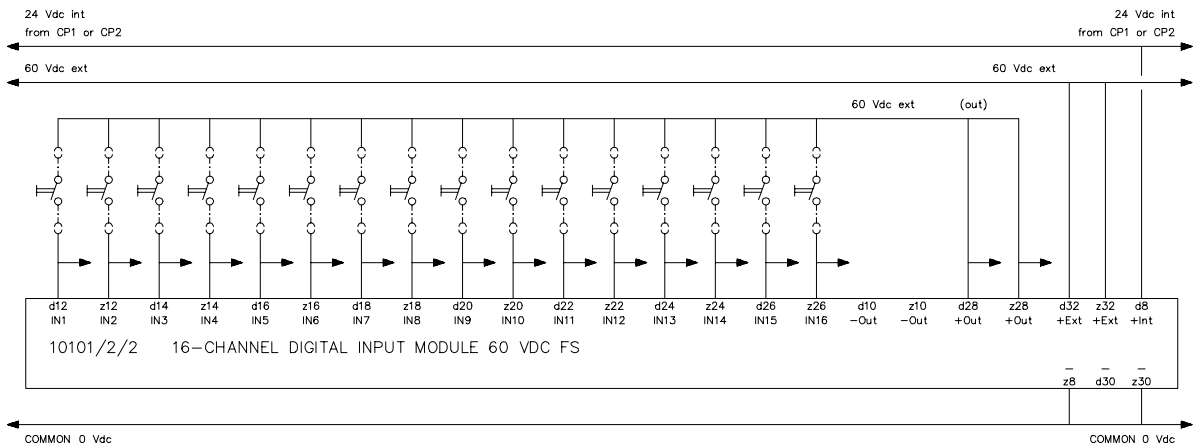
Figure 4   I/O connection example of 10101/2/2 module
for redundant I/O configurations

Note:
The 24 Vdc (internal) supply must be connected to prevent fault
detection during the self-test.

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Technical data   The 10101/2/2 module has the following specifications:

General
Type number:	10101/2/2 11100
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power
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)

Fuse
Fuse value:	1x 100 mA
Fuse type:	Round, TR5-F/19370K
Fuse dimensions:	∅ 8.2 mm (0.32 in), height 7.7 mm (0.3 in)

Input
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

Key coding

(See 'Key coding' data sheet)

Module connector code:

− holes   A5, C9

Rack connector code:

− large pins   A5, C9

![Honeywell FSC logo] # Honeywell

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:

General   Type number: 10101/2/3   11200
Approvals: CE, TÜV, UL
Software versions: ≥ 3.00
Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   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)

Input   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

Key coding   (See 'Key coding' data sheet)
Module connector code:
− holes   A5, C13
Rack connector code:
− large pins   A5, C13

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:
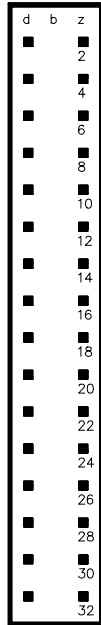
d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 0 Vdc	z8	Supply 24 Vdc
d10	Link	z10	Link
d12		z12	
d14		z14	
d16		z16	
d18	volts 1	z18	0 V1
d20	26 Vdc 1	z20	mA 1
d22	volts 2	z22	0 V2
d24	26 Vdc 2	z24	mA 2
d26	volts 3	z26	0 V3
d28	26 Vdc 3	z28	mA 3
d30	volts 4	z30	0 V4
d32	26 Vdc 4	z32	mA 4

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

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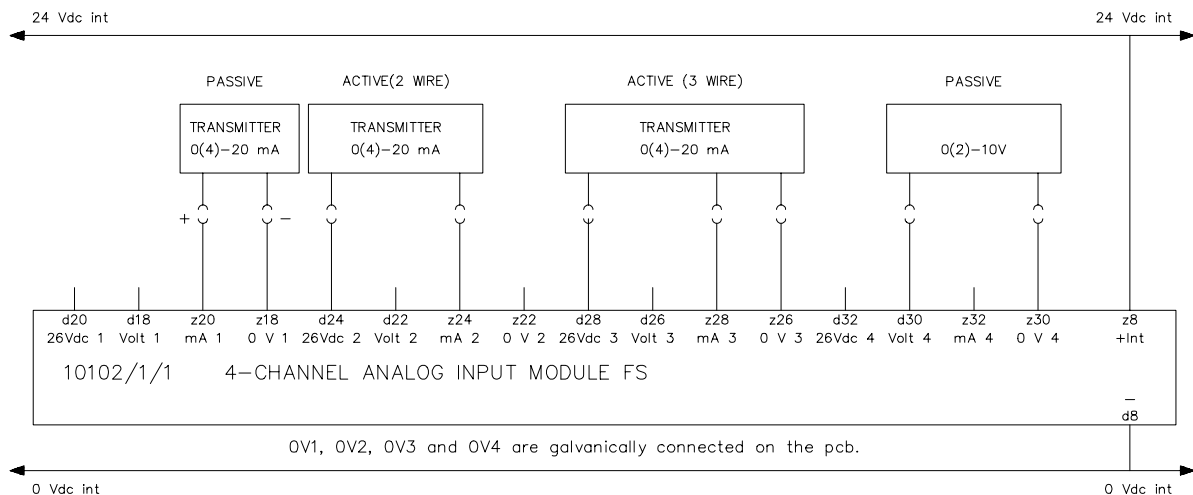
Calibration The 10102/1/1 module has potentiometers for calibration purposes (P1, P2, P4, P5). The module can be calibrated using the calibration option of the 'View FSC system and process status' program, an external calibrator, an extender module and an extender flatcable.
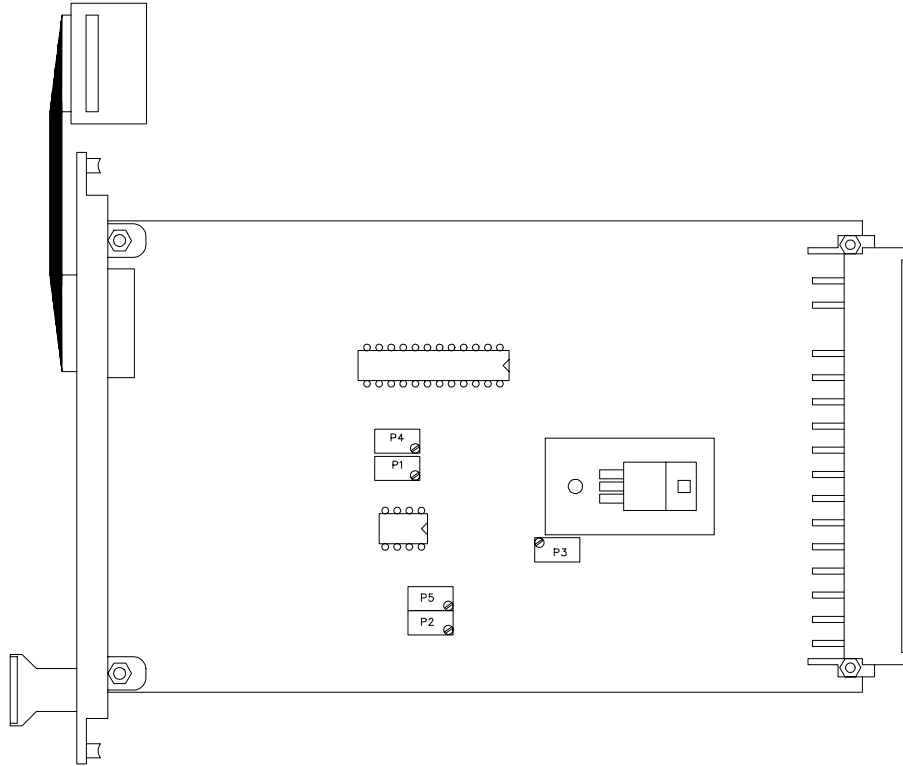
Figure 3   Location of potentiometers on 10102/1/1 module

Technical data The 10102/1/1 module has the following specifications:

General

Type number:	10102/1/1 01803*
Approvals:	CE, TÜV, UL
Software versions:	all
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 30mA
	24 Vdc 175 mA + 25 mA for each active input

Technical data (continued)

Input

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 (±1 V for 0.2mA $< I <$ 20mA)*, 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*

Key coding

(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 ± 40 Vdc on Volt inputs and a maximum input signal of ± 70 mA on mA inputs.

Left blank intentionally.

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:
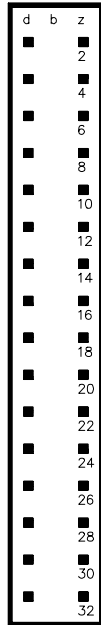
d2		z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 0 Vdc	z8	Supply 24 Vdc
d10	Link	z10	Link
d12		z12	
d14		z14	
d16		z16	
d18	IN 1	z18	0 V1
d20	26 Vdc 1	z20	Link 1 (0-10 Vdc)
d22	IN 2	z22	0 V2
d24	26 Vdc 2	z24	Link 2 (0-10 Vdc)
d26	IN 3	z26	0 V3
d28	26 Vdc 3	z28	Link 3 (0-10 Vdc)
d30	IN 4	z30	0 V4
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.
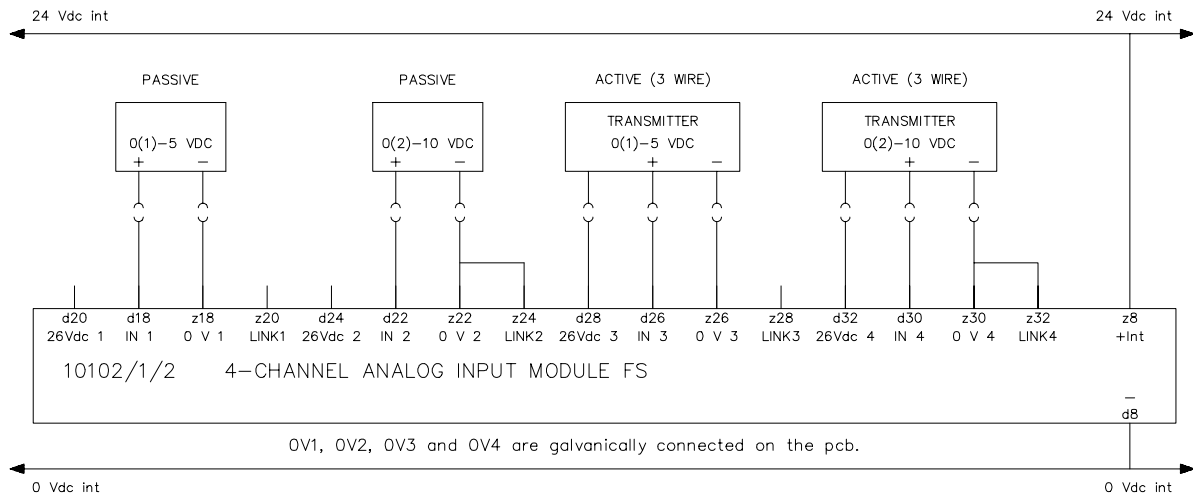
Figure 2   Connection example for non-redundant I/O configurations
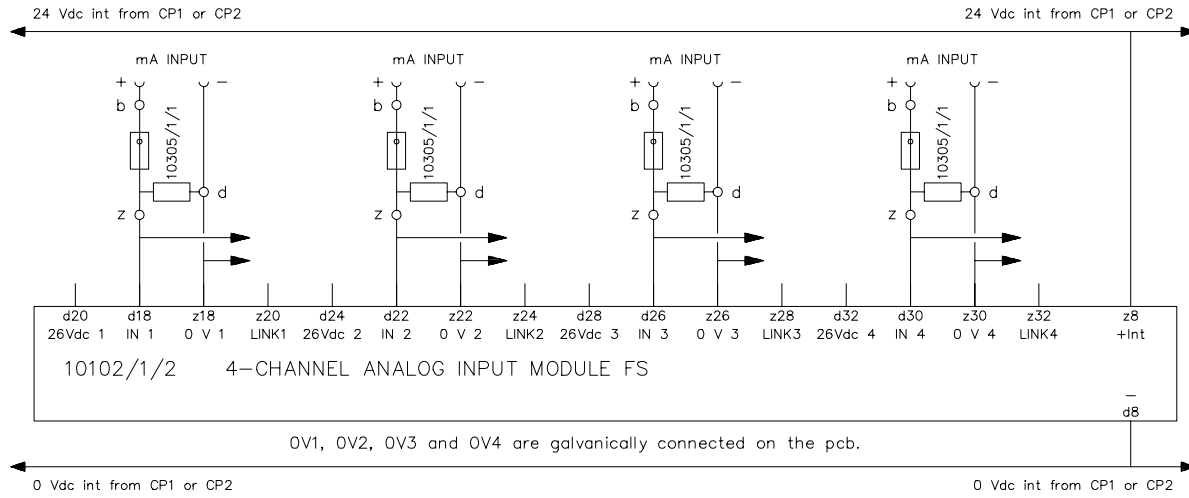
Figure 3   Connection example for redundant I/O configurations
0(4)-20 mA (passive)
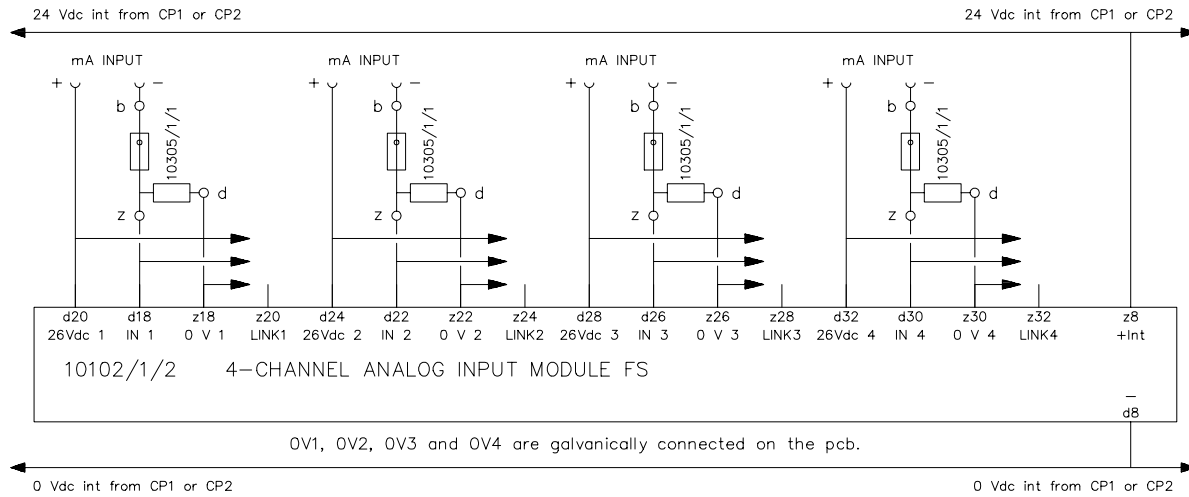
Figure 4   Connection example for redundant I/O configurations
0(4)-20 mA (active)
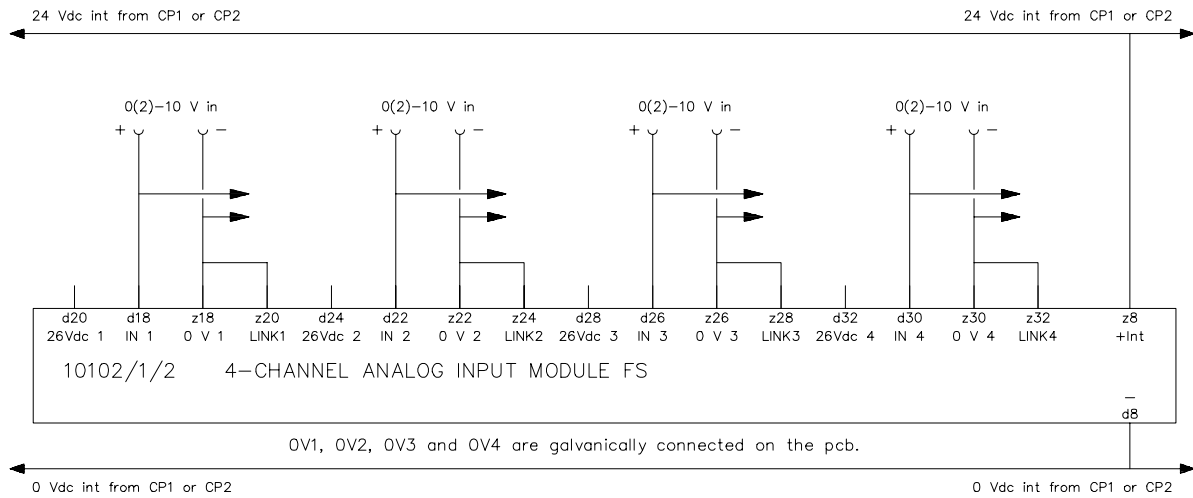
Figure 5   Connection example for redundant I/O configurations
0(2)-10 V (passive)
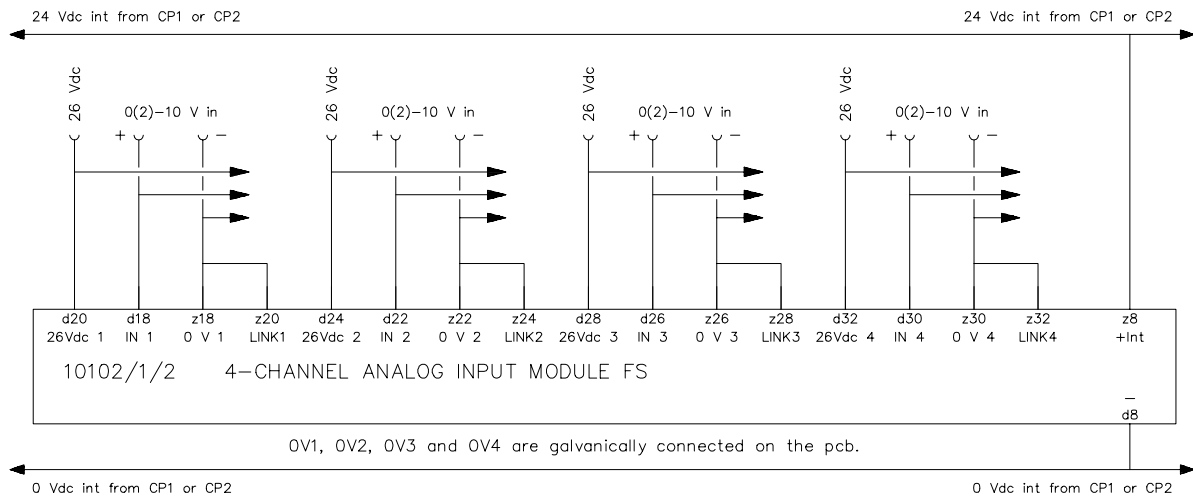
Figure 6   Connection example for redundant I/O configurations
0(2)-10 V (active)
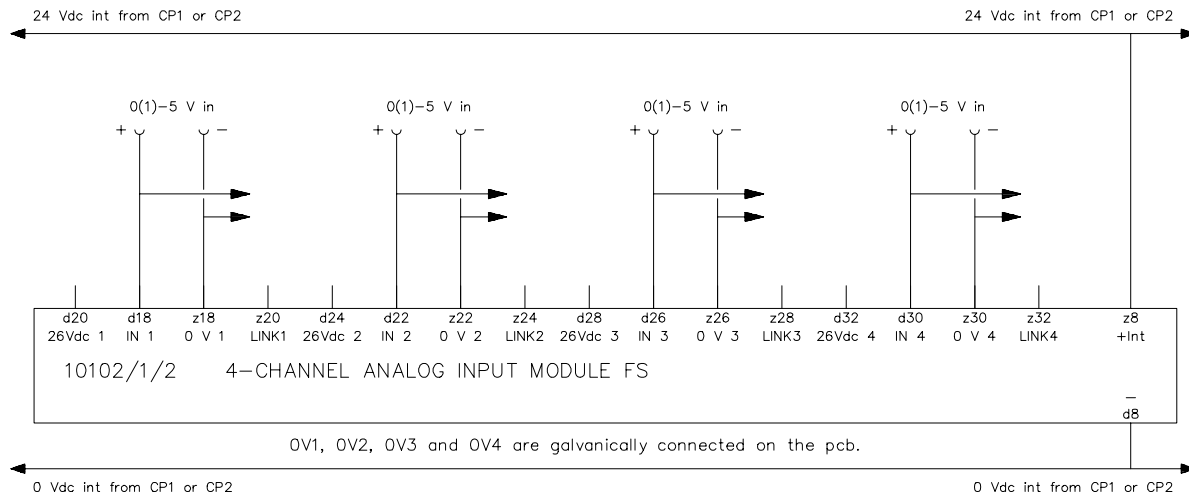
Figure 7   Connection example for redundant I/O configurations
0(1)-5 V (passive)
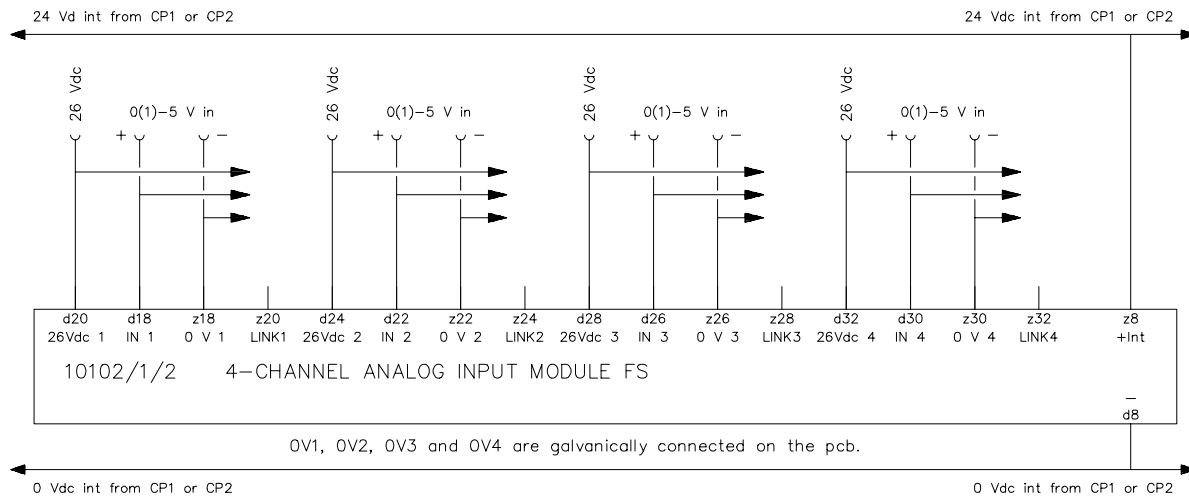
Figure 8   Connection example for redundant I/O configurations
0(1)-5 V (active)

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.
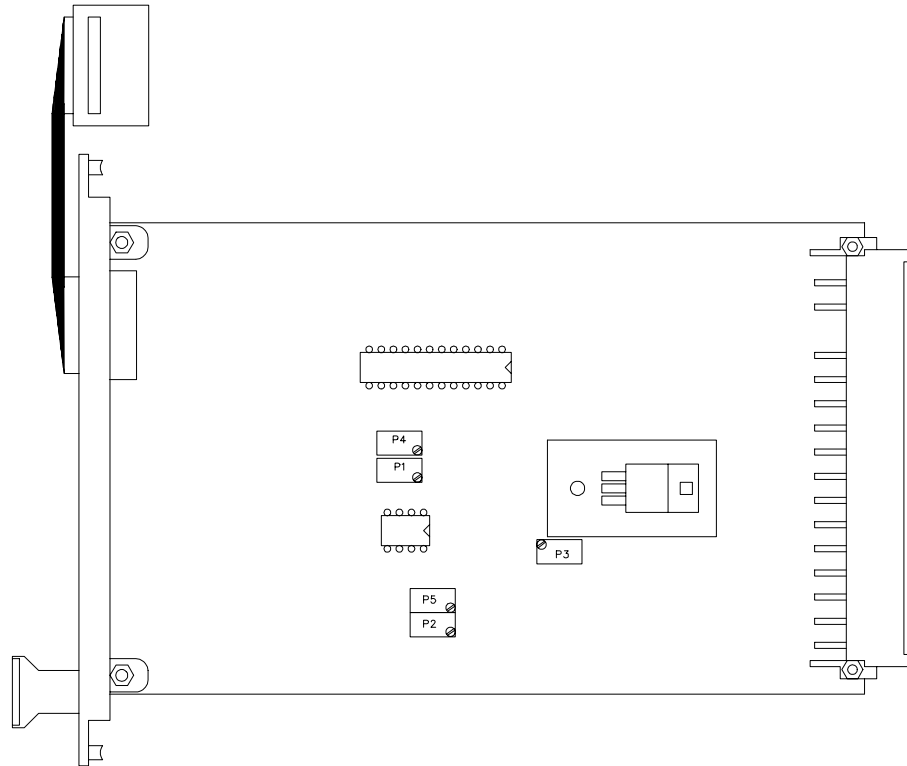
Figure 9   Location of potentiometers on 10102/1/2 module

Technical data   The 10102/1/2 module has the following specifications:

General   Type number: 10102/1/2   01903*
Approvals: CE, TÜV, UL
Software versions: ≥ 2.77
Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   Power requirements: 5 Vdc   30 mA
24 Vdc   175 mA + 25 mA for each
active input

Technical data (continued)

Input	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 (± 1 V for 0.2mA $< I <$ 20mA)*, 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*

Key coding	(See 'Key coding' data sheet)	
	Module code:	
	− hole	A27
	− pins	C11, C19, C31
	Rack code:	
	− blind stops	C3, C23, C27
	− large pin	A27

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* 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.
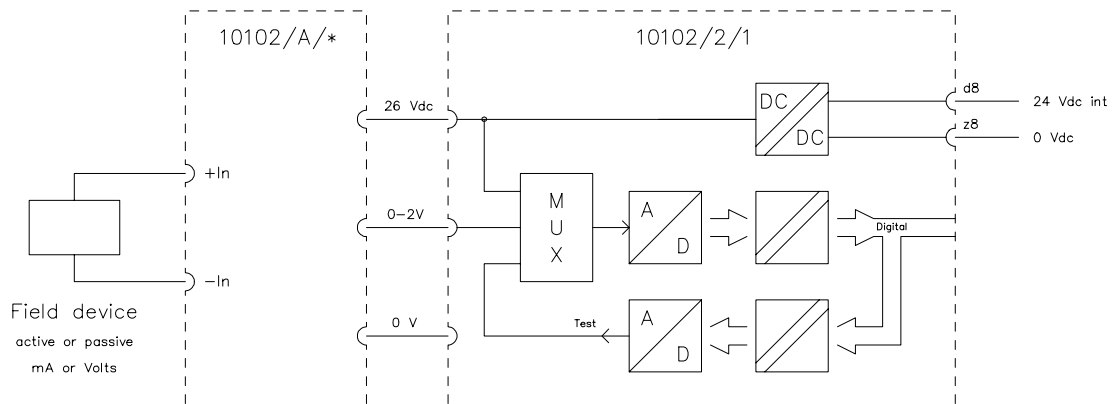
Figure 1　Schematic diagram for connection of inputs
to the 10102/2/1 module

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:
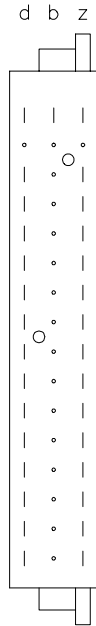
d2		b2	GND	z2	5 Vdc
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	(IN1–)			z10	(IN 1+)
d12	26 Vdc 1			z12	IN 1
d14	0 V 1			z14	0 V 2
d16	IN 2			z16	26 Vdc 2
d18	(IN 2+)			z18	(IN 2–)
d20	(IN 3–)			z20	(IN 3+)
d22	26 Vdc 3			z22	IN 3
d24	0 V 3			z24	0 V 4
d26	IN 4			z26	26 Vdc 4
d28	(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.
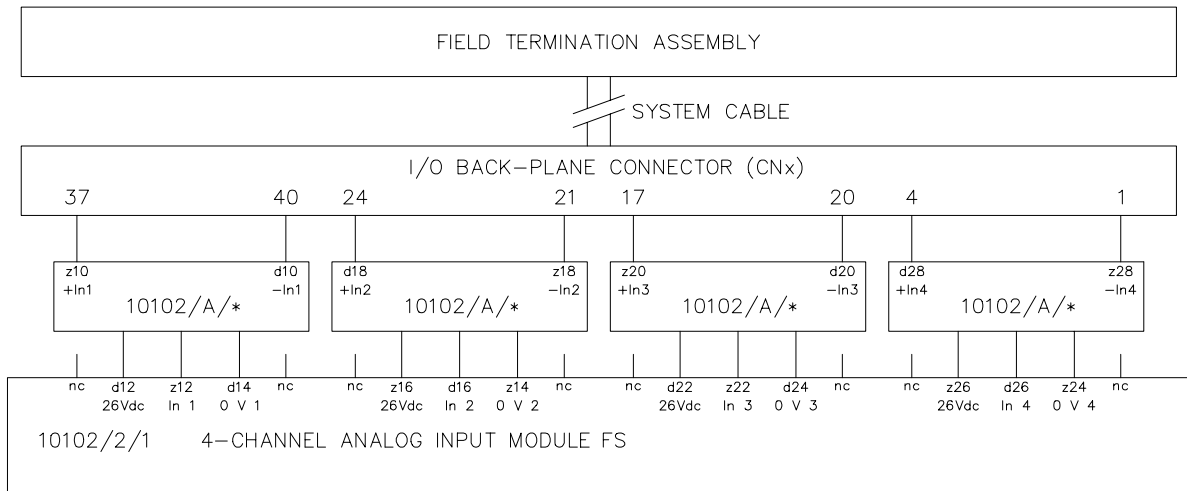
Figure 2   Connection example of 10102/2/1 module to FTA
for both non-redundant and redundant I/O configurations

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.
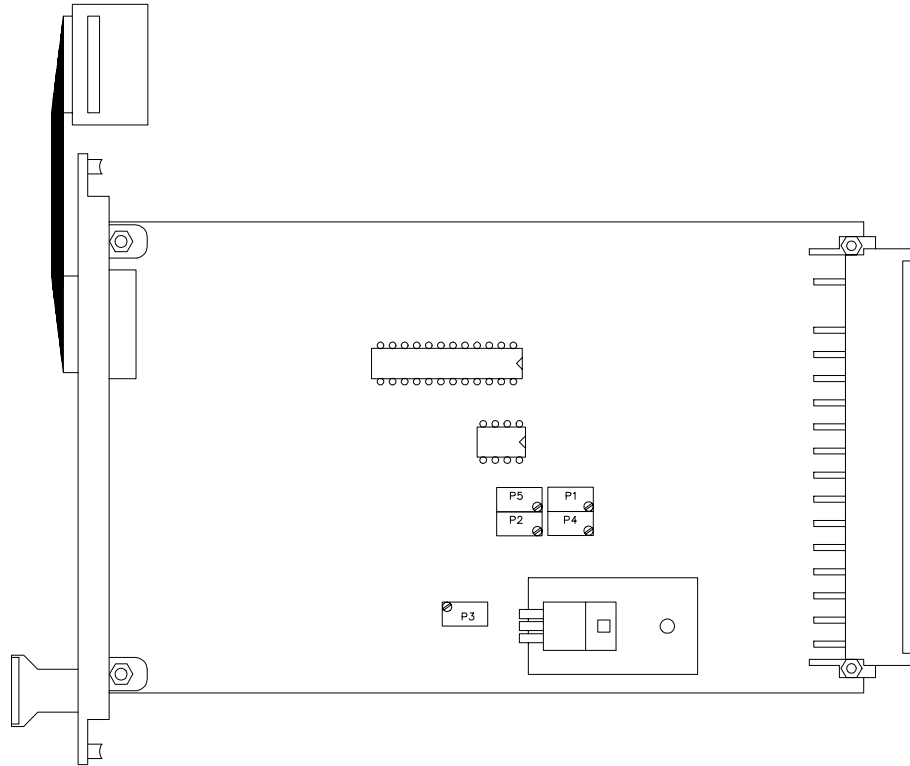
Figure 3   Location of potentiometers on 10102/2/1 module

Technical data The 10102/2/1 module has the following specifications:

General

Type number:	10102/2/1 11301*
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 30 mA
	24 Vdc 175 mA + 25 mA for each active input

Technical data (continued)

Input	Number of input channels:	4
	Input specification (V):	0-2 Vdc
	Input resistance:	> 100 kOhm
	Loop powering:	26 Vdc (±1 V for 0.2 mA < I < 20 mA), short-circuit protected
	Loop current limit:	> 21 mA solid state
	A/D converter:	12-bit
	Inaccuracy:	≤ 0.75%
	Absolute max. input signal:	± 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.

Left blank intentionally.

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 10102/2/1module.

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.
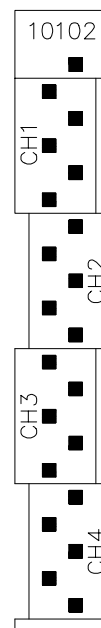
Figure 1   10102 positioning print

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.
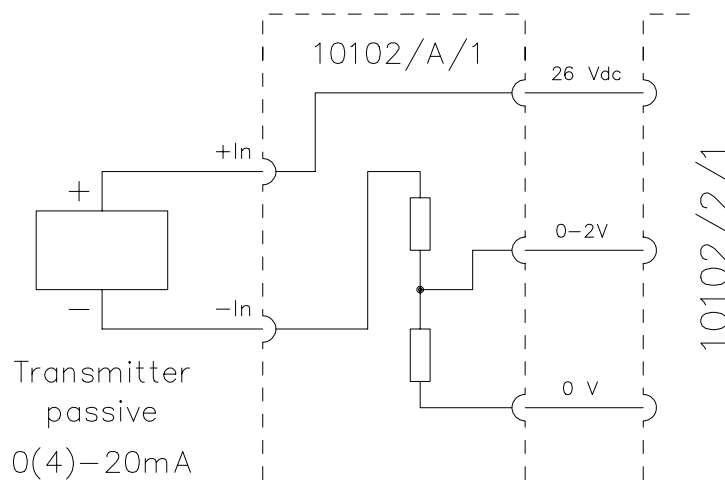
Figure 2   Schematic diagram of 10102/A/1 module

Technical data   The 10102/A/1 module has the following specifications:

General		
	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)

Power   Power requirements: 26 Vdc (supplied by 10102/2/1 module)

Input		
	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.
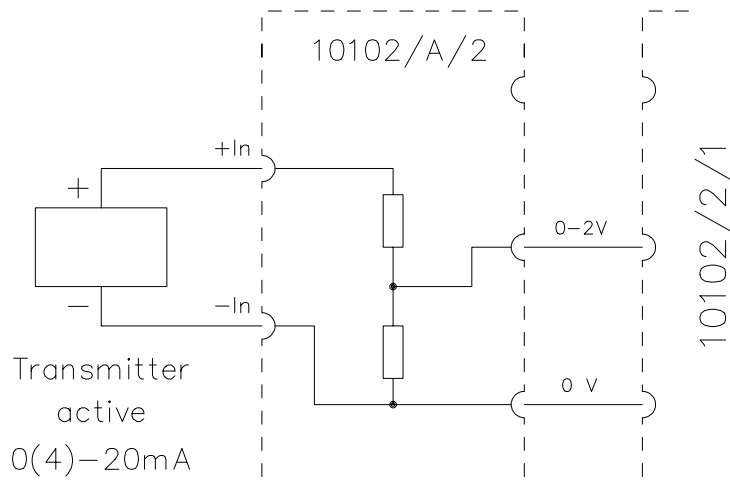
Figure 3   Schematic diagram of 10102/A/2 module

Technical data

The 10102/A/2 module has the following specifications:

General

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)

Power

Power requirements:	none

Input

Number of input channels:	1
Input current:	0-20 / 4-20 mA
Input resistance:	250 Ohm 0.1%
Absolute max. input signal:	± 50 mA

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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.
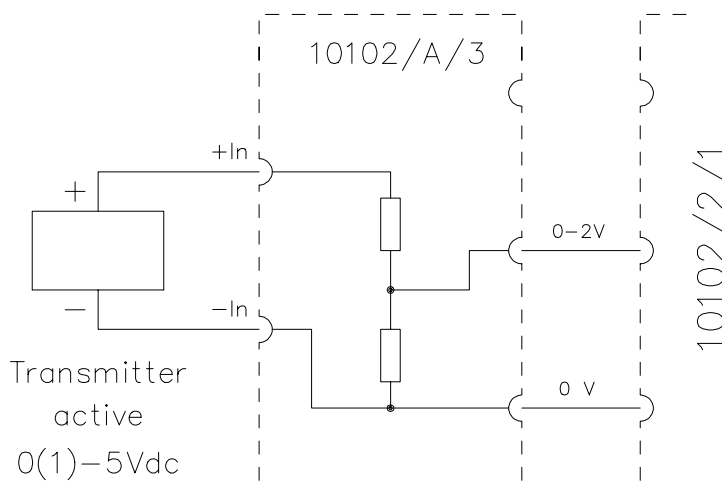
Figure 4   Schematic diagram of 10102/A/3 module

Technical data

The 10102/A/3 module has the following specifications:

General

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)

Power

Power requirements:	none

Input

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.
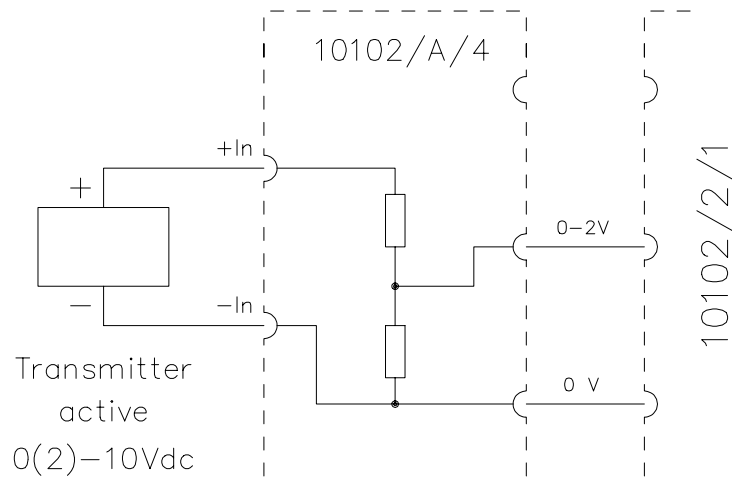
Figure 5   Schematic diagram of 10102/A/4 module

Technical data

The 10102/A/4 module has the following specifications:

General

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)

Power

Power requirements:	none

Input

Number of input channels:	1
Input voltage:	0-10 / 2-10 V
Input resistance:	5 kOhm 1%
Absolute max. input signal:	± 25 Vdc

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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).
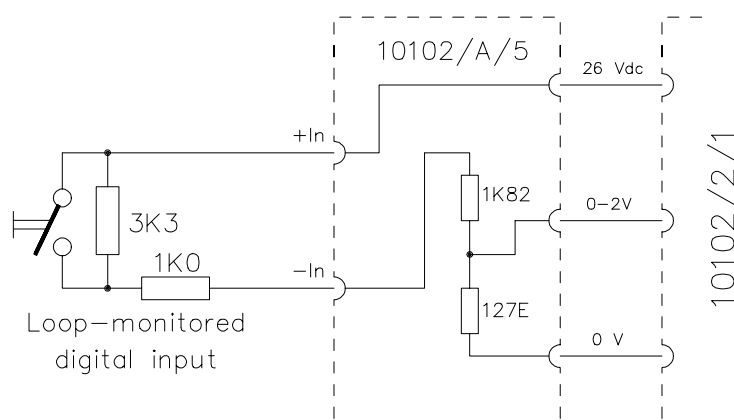
Figure 6   Schematic diagram of 10102/A/5 module

Technical data

The 10102/A/5 module has the following specifications:

General

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)

Power

Power requirements:	26 Vdc (supplied by 10102/2/1 module)

Input

Number of input channels:	1
Lead breakage voltage:	approx. 26 Vdc
Input resistance:	approx. 2 kOhm
Short-circuit current:	approx. 13 mA

Left blank intentionally.

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.
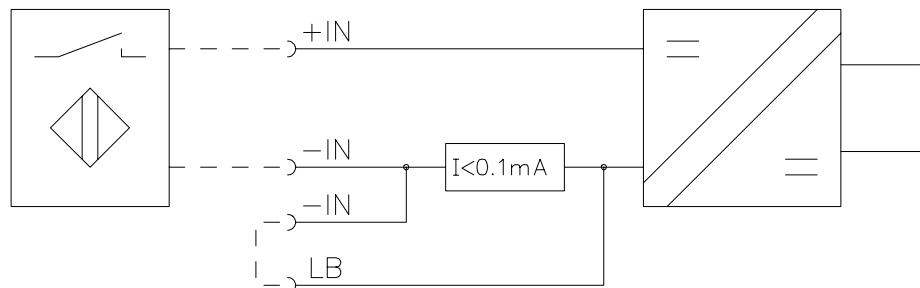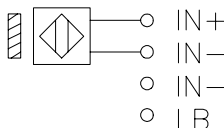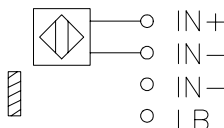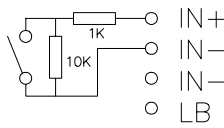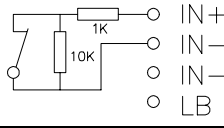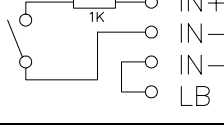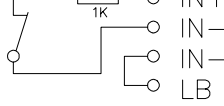
Figure 1   Schematic diagram for connection of one input
to the 10103/1/1 module

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
IN+ IN− IN− LB	OFF	YES	OFF
IN+ IN− IN− LB	ON		
1K 10K IN+ IN− IN− LB	OFF	YES	OFF
1K 10K IN+ IN− IN− LB	ON		
1K IN+ IN− IN− LB	OFF	NO	OFF
1K IN+ IN− IN− LB	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

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Technical data   The 10103/1/1 module has the following specifications:

General

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)

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 $\pm$ 50 μA

	in Eex ia applications		in EEx ib applications	
	IIB	IIC	IIB	IIC
Max. external capacitance Ce	$\leq$ 1100 nF	$\leq$ 415 nF	$\leq$ 3900 nF	$\leq$ 800 nF
Max. external inductance Le	$\leq$ 5 mH	$\leq$ 2 mH	$\leq$ 290 mH	$\leq$ 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

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.
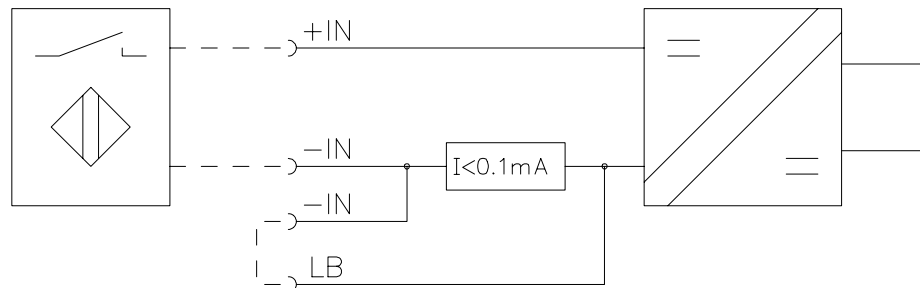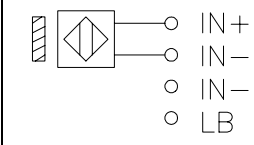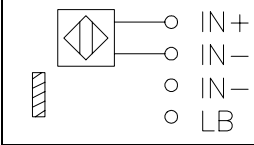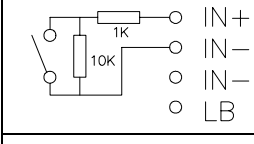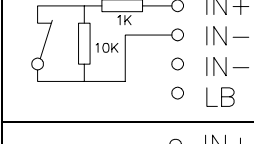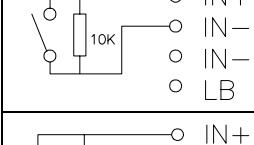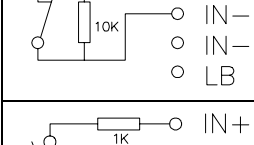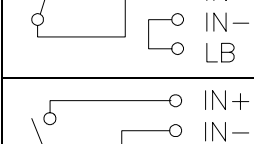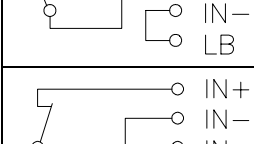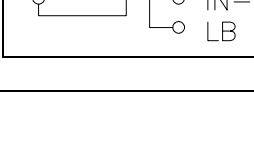
Figure 1   Schematic diagram for connection of one input
to the 10103/1/2 module

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 (± 10%) for the parallel resistor and 1 kOhm (± 10%) for the series resistor.

Table 1   Input connections and functions of 10103/1/2 module

Input connection	Channel LED	Channel during lead breakage
(diagram) IN+ IN− IN− LB	OFF	ON
(diagram) IN+ IN− IN− LB	ON	
(diagram, 1K, 10K) IN+ IN− IN− LB	OFF	ON
(diagram, 1K, 10K) IN+ IN− IN− LB	ON	
(diagram, 10K) IN+ IN− IN− LB	OFF	ON
(diagram, 10K) IN+ IN− IN− LB	ON	
(diagram, 1K) IN+ IN− IN− LB	OFF	OFF
(diagram, 1K) IN+ IN− IN− LB	ON	
(diagram) IN+ IN− IN− LB	OFF	OFF
(diagram) IN+ IN− IN− LB	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:	$1.2 \text{ mA} < I < 2.1 \text{ mA}$
Hysteresis:	approx. 0.2 mA
Input delay:	< 0.5 ms
Lead breakage setpoint:	0.1 mA $\pm 50\,\mu$A

	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

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.
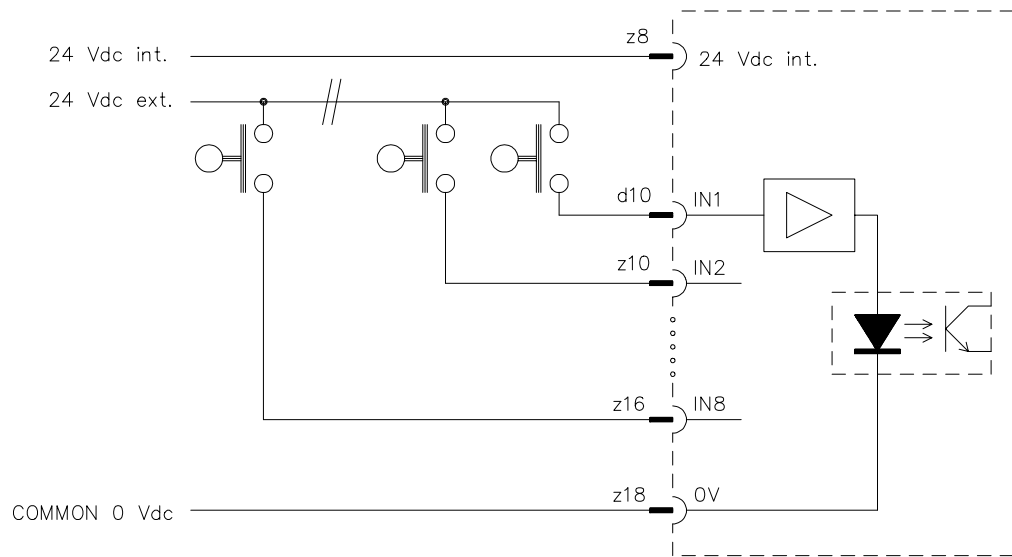
Figure 1   Schematic diagram for connection of inputs
to one input group of the 10104/1/1 module

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
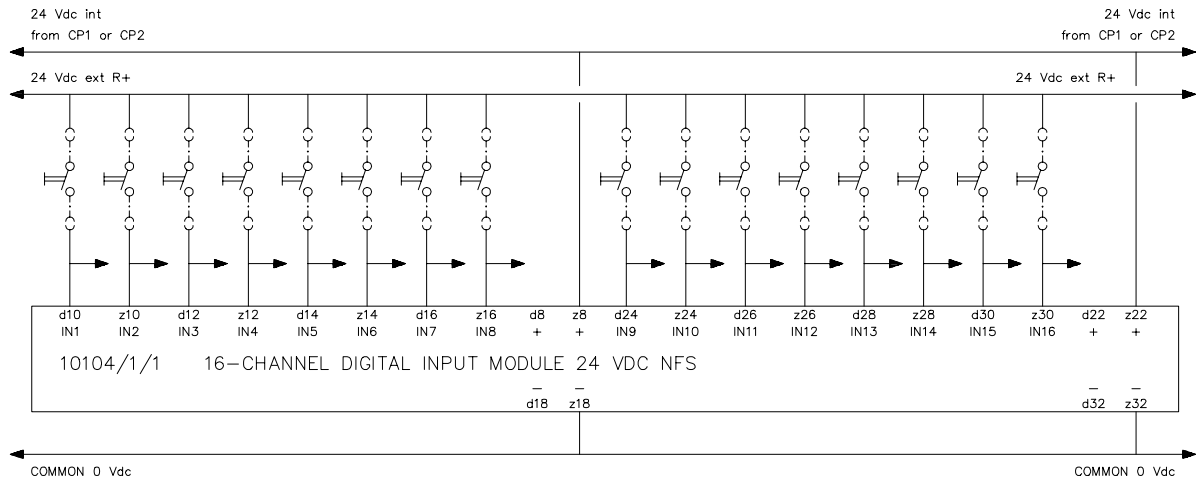
Figure 3   Connection example for redundant I/O configurations

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

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.
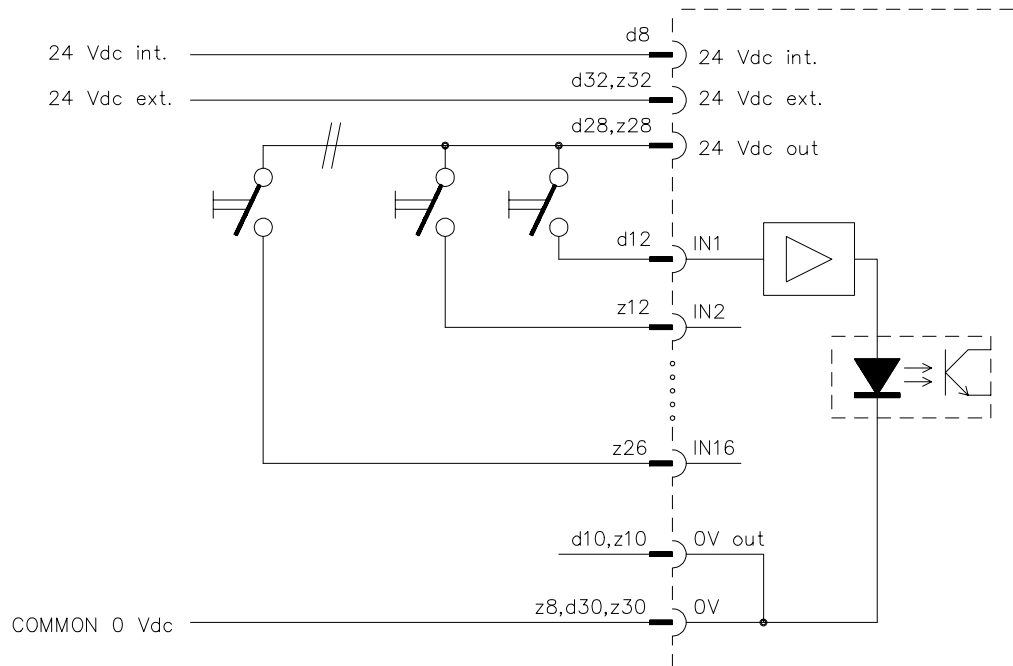
Figure 1   Schematic diagram for connection of inputs
to the 10104/2/1 module

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
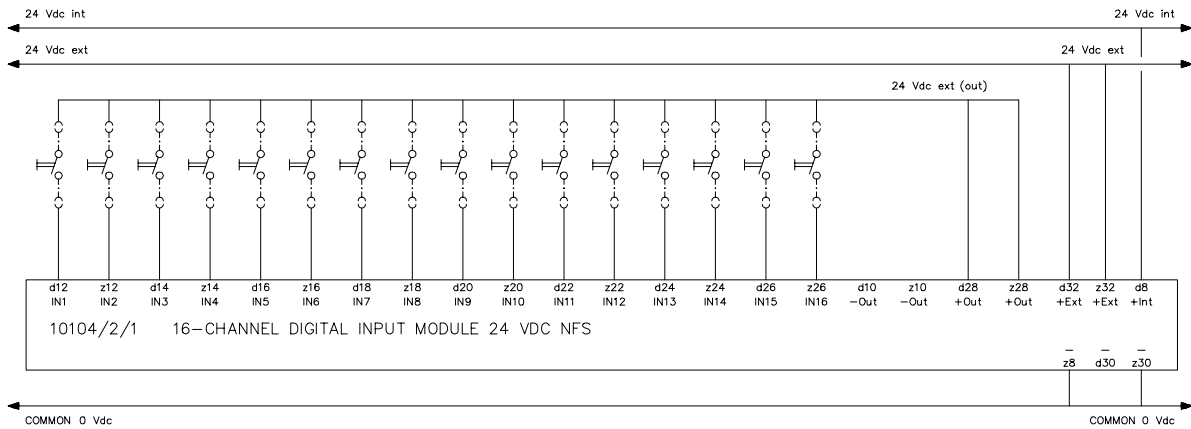
Figure 3   I/O connection example of 10104/2/1 module
for non-redundant I/O configurations
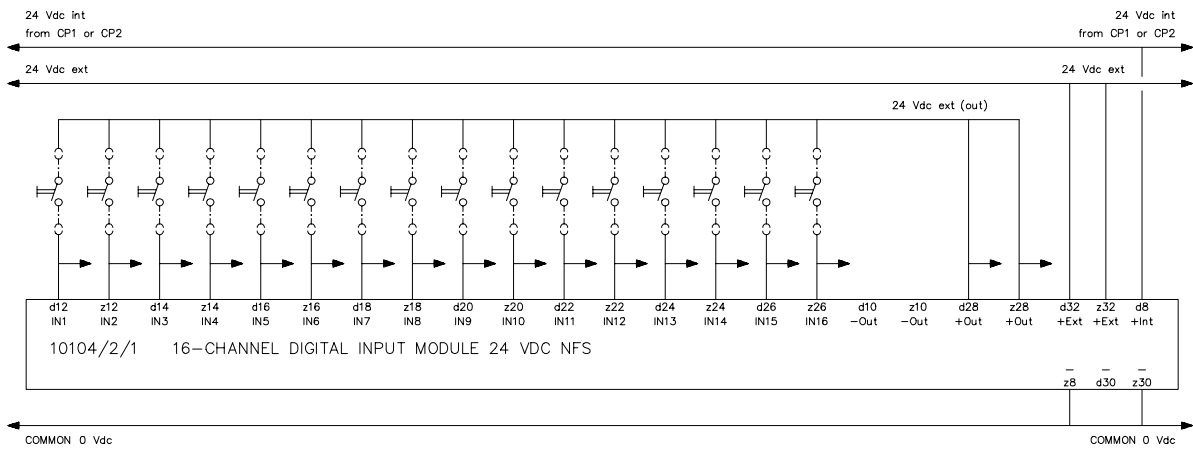
Figure 4   I/O connection example of 10104/2/1 module
for redundant I/O configurations

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Technical data   The 10104/2/1 module has the following specifications:

General
Type number:	10104/2/1 12700
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power
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)

Input
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

Key coding   (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_x) 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).
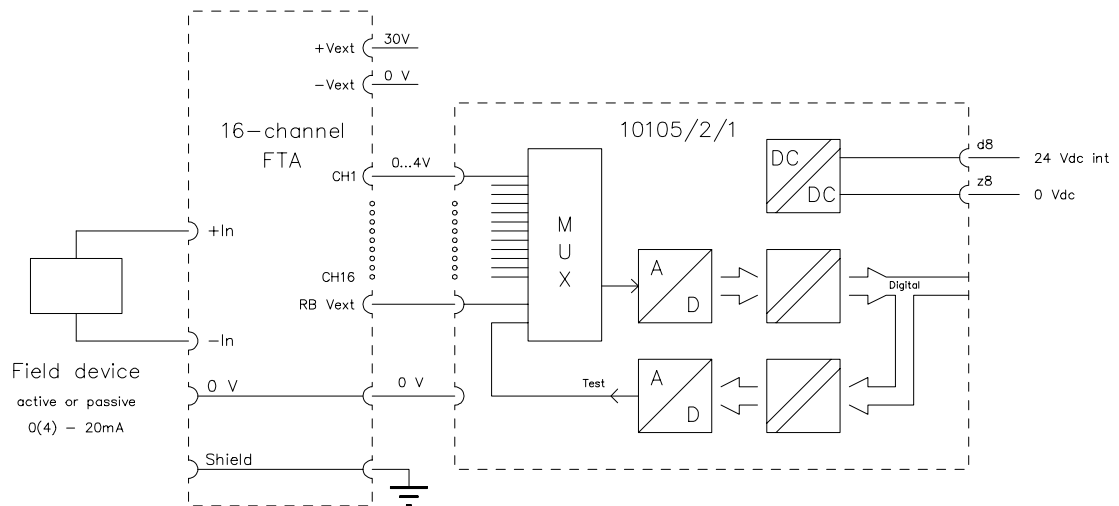
Figure 1   Schematic diagram for connection of inputs to 10105/2/1 module

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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:
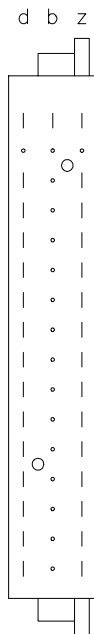
d2		b2	GND	z2	5 Vdc
d4	–			z4	–
d6				z6	
d8	Int. 24 Vdc supply			z8	Int. 0 Vdc supply
d10	Analog ground			z10	Analog ground
d12	IN 1			z12	IN 2
d14	IN 3			z14	IN 4
d16	IN 5			z16	IN 6
d18	IN 7			z18	IN 8
d20	IN 9			z20	IN 10
d22	IN 11			z22	IN 12
d24	IN 13			z24	IN 14
d26	IN 15			z26	IN 16
d28	Analog 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.

```
┌─────────────────────────────────────────────────────────────────────────┐
│                    FIELD  TERMINATION  ASSEMBLY                          │
└─────────────────────────────────────────────────────────────────────────┘
                                    ╱╱ SYSTEM CABLE

               I/O BACK-PLANE  CONNECTOR  (CNx)
   40   37   36   33   32   29   28   25   24   21   20   17   16   13   12   9   8   5   4   1

  d10  z10  d12  z12  d14  z14  d16  z16  d18  z18  d20  z20  d22  z22  d24  z24  d26  z26  d28  z28
  0V   0V   IN1  IN2  IN3  IN4  IN5  IN6  IN7  IN8  IN9  IN10 IN11 IN12 IN13 IN14 IN15 IN16 0V  RB Vext

  10105/2/1    16-CHANNEL  ANALOG  INPUT  MODULE  0-4V   FS
```
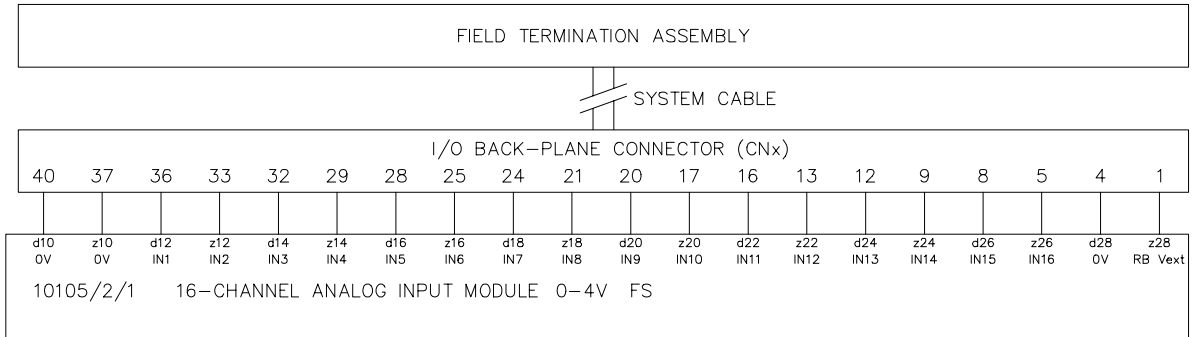
Figure 2   Connection example of 10105/2/1 module to FTA

```
                        ┌──────────────────────────┐
                        │      FIELD  TERMINALS     │
                        └──────────────────────────┘
                                    ╱╱ SYSTEM CABLE

               I/O BACK-PLANE  CONNECTOR  (CNx)
   40   37   36   33   32   29   28   25   24   21   20   17   16   13   12   9   8   5   4   1

  0V   0V   IN1  IN2  IN3  IN4  IN5  IN6  IN7  IN8  IN9  IN10 IN11 IN12 IN13 IN14 IN15 IN16 0V  RB Vext
                                      10105/A/1

  d10  z10  d12  z12  d14  z14  d16  z16  d18  z18  d20  z20  d22  z22  d24  z24  d26  z26  d28  z28
  0V   0V   IN1  IN2  IN3  IN4  IN5  IN6  IN7  IN8  IN9  IN10 IN11 IN12 IN13 IN14 IN15 IN16 0V  RB Vext

  10105/2/1    16-CHANNEL  ANALOG  INPUT  MODULE  0-4V   FS
```

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:

General

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)

Power

Power requirements:	5 Vdc 35 mA
	24 Vdc 35 mA

Input

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

Key coding   (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

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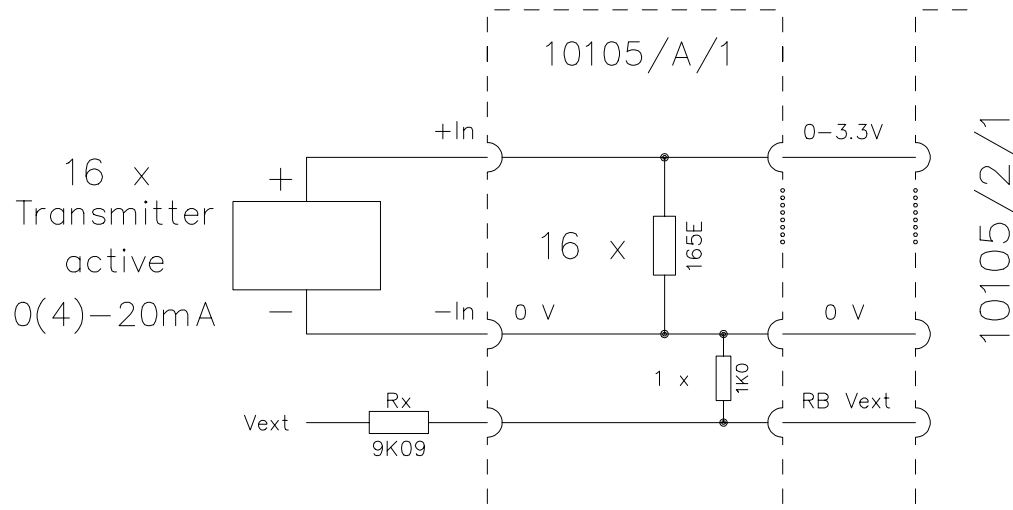
Technical data   The 10105/A/1 module has the following specifications:

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_x 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

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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.
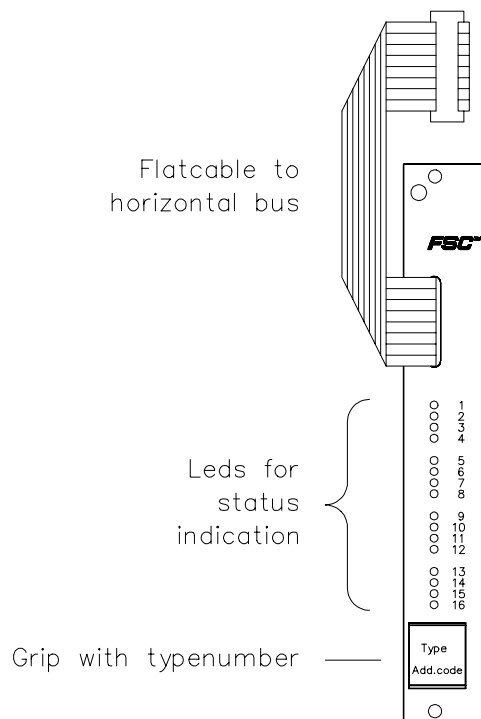
Figure 1   Front of a digital output module

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.

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.

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.
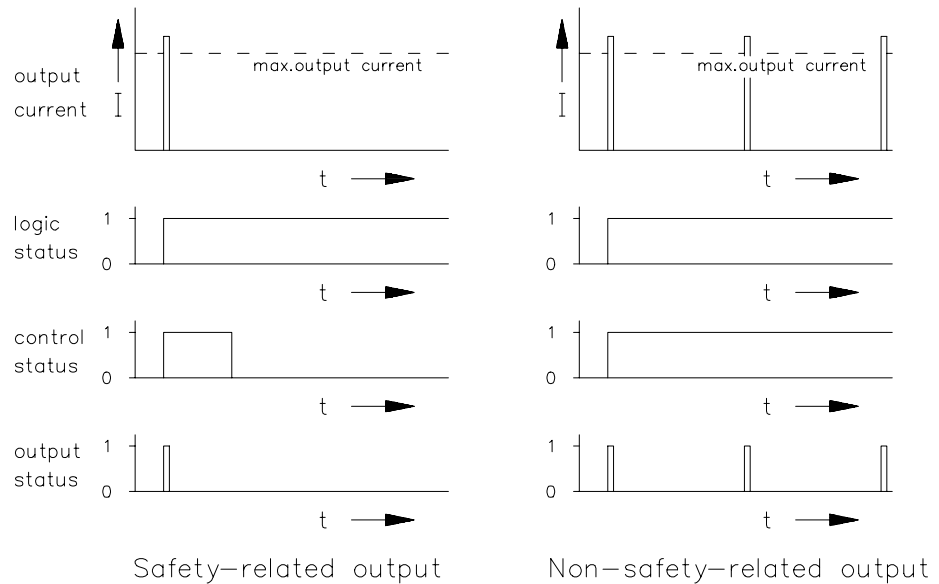
Figure 2   Output overload / short-circuit behavior

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)
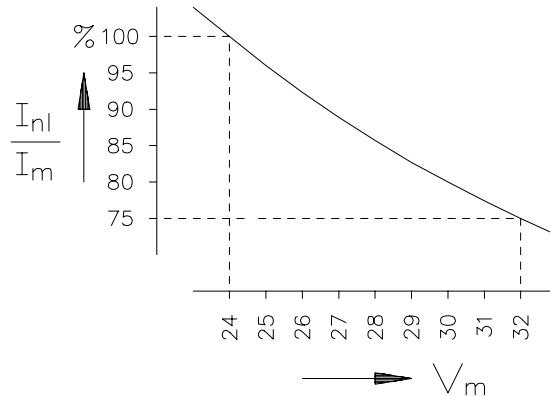
Figure 3   Maximum current derating vs.
expected maximum supply voltage

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 mA =
440 mA ($\equiv$ 10.56 W).

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.
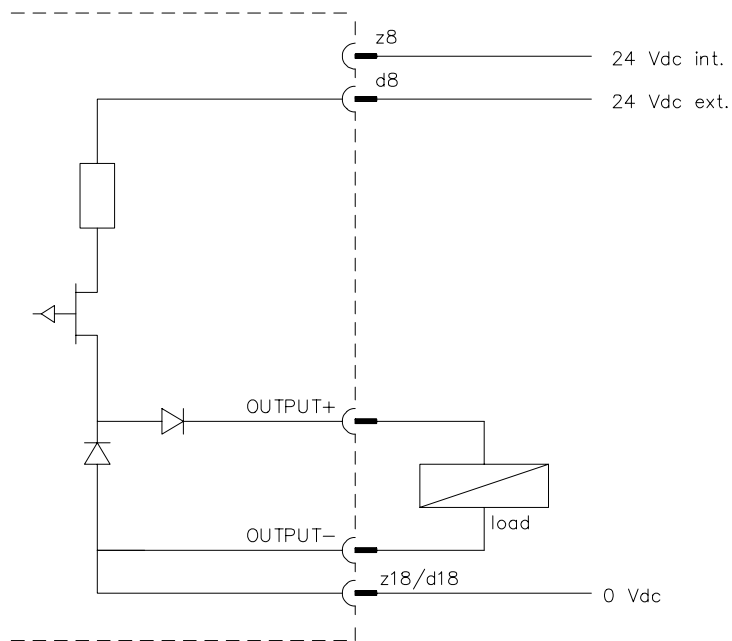
Figure 1   Schematic diagram for connection of one output (output 1-4) to the 10201/1/1 module

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:
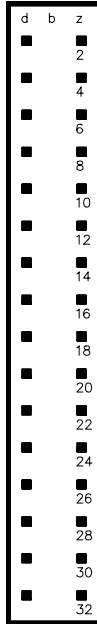
d2	WDG 1 (5 Vdc)	z2	GND 5 Vdc
d4	WDG 2 (5 Vdc)*	z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext. (1)	z8	Supply 24 Vdc int. (1)*
d10	OUT 1–	z10	OUT 1+
d12	OUT 2–	z12	OUT 2+
d14	OUT 3–	z14	OUT 3+
d16	OUT 4–	z16	OUT 4+
d18	Supply 0 Vdc (1)	z18	Supply 0 Vdc (1)
d20	Link	z20	Link
d22	Supply 24 Vdc ext. (2)	z22	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.
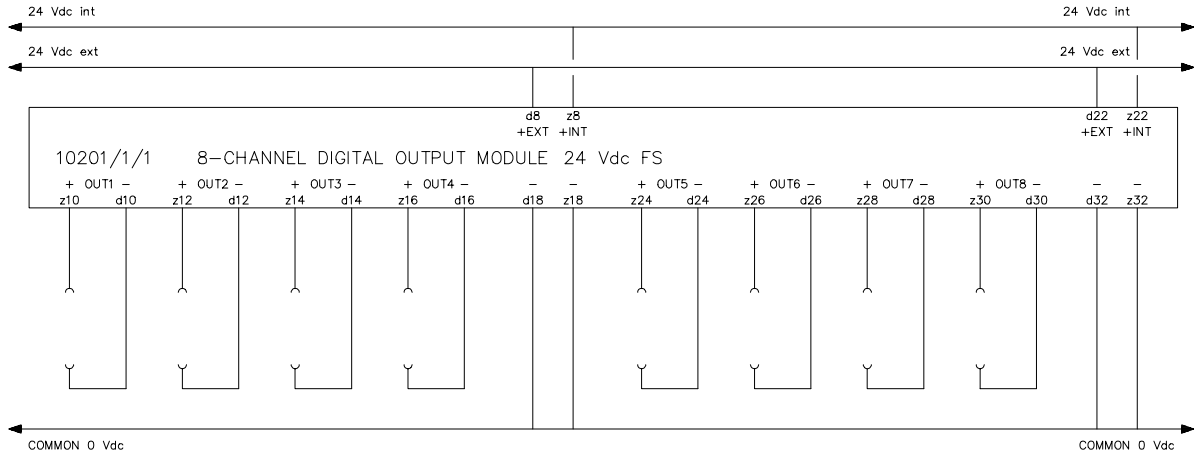
Figure 2   Connection example for non-redundant I/O configurations

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.

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Technical data   The 10201/1/1 module has the following specifications:

General   Type number: 10201/1/1   02201*
                  Approvals: CE, TÜV, UL
                  Software versions: all
                  Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   Power requirements: 5 Vdc   25 mA
                                        24 Vdc internal   2∗15 mA
                                        24 Vdc external   2∗35 mA (without
                                        output load)

Output   Number of output channels: 8 (2 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: 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

Key coding   (See 'Key coding' data sheet)
                  Module code:
                     − hole   A27
                     − pins   C3, C11, C31
                  Rack code:
                     − blind stops   C19, C23, C27
                     − large pin   A27

---

* 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.

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.
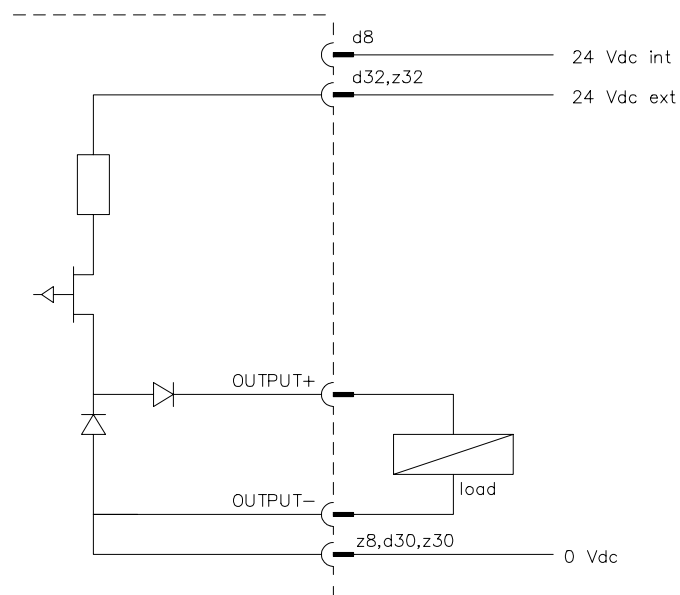
Figure 1   Schematic diagram for connection of one output
to the 10201/2/1 module

Pin allocation

The back view and pin allocation of the 10201/2/1 module connector are as follows:
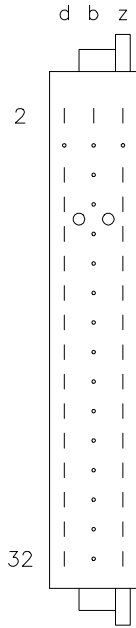
d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10	(0 Vdc)			z10	(0 Vdc)
d12	OUT 1+			z12	OUT 1–
d14	OUT 2+			z14	OUT 2–
d16	OUT 3+			z16	OUT 3–
d18	OUT 4+			z18	OUT 4–
d20	OUT 5+			z20	OUT 5–
d22	OUT 6+			z22	OUT 6–
d24	OUT 7+			z24	OUT 7–
d26	OUT 8+			z26	OUT 8–
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).

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Technical data   The 10201/2/1 module has the following specifications:

General

Type number:	10201/2/1 11501*
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 25 mA
	24 Vdc internal 25 mA
	24 Vdc external 70 mA (without output load)

Output

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

Key coding

(See 'Key coding' data sheet)
Module code:
  − holes   A9, C9
Rack code:
  − large pins   A9, C9

---

* 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..

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
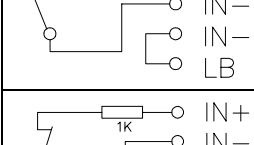- functioning of the suppression diodes.
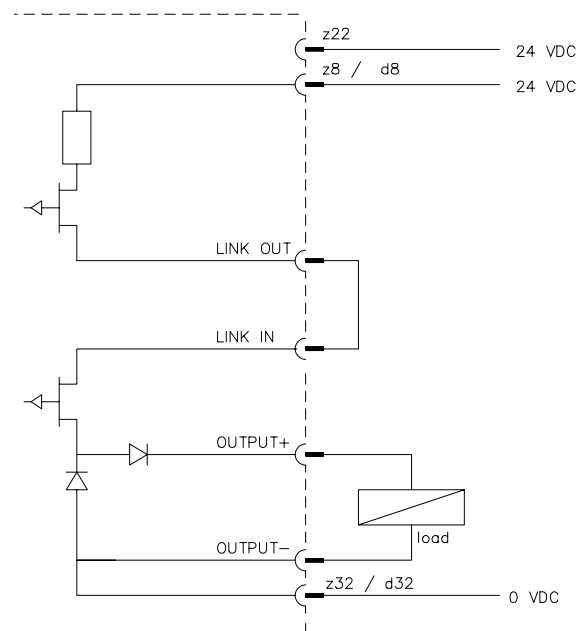
Figure 1   Schematic diagram for connection of one output to the 10203/1/2 module

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:
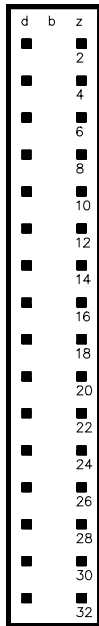
d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext.	z8	Supply 24 Vdc ext.
d10	Link OUT 2	z10	Link OUT 1
d12	Link IN 2	z12	Link IN 1
d14	OUT 2+	z14	OUT 1+
d16	OUT 2–	z16	OUT 1–
d18	(Supply 0 Vdc)	z18	(Supply 0 Vdc)
d20	Link	z20	Link
d22		z22	Supply 24 Vdc int.
d24	Link OUT 4	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
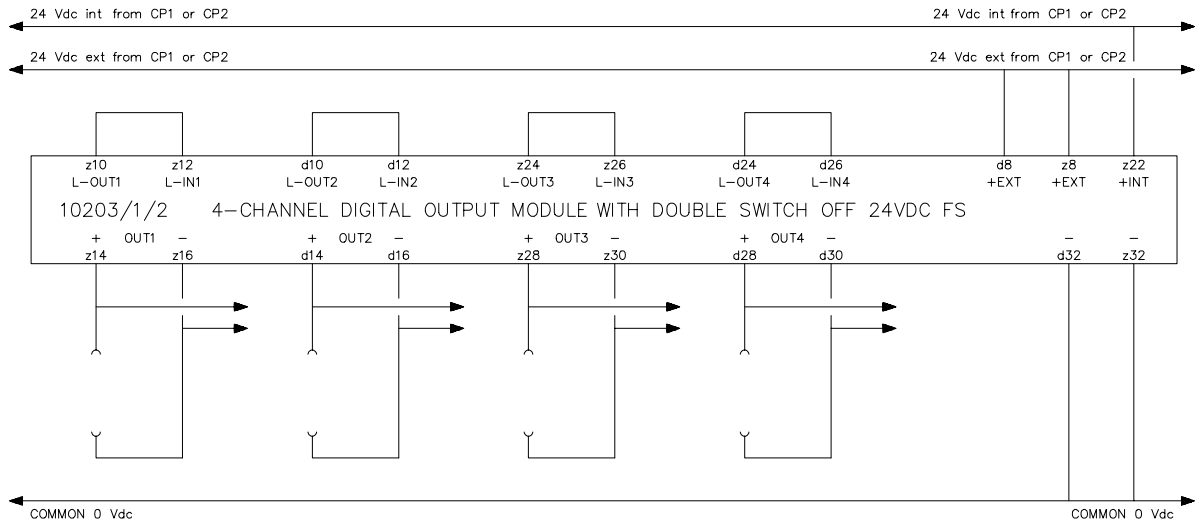
Figure 3   Connection example for redundant configurations

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:

General

Type number:	10203/1/2
Approvals:	CE, TÜV
Software versions:	≥ 2.78
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 25 mA
	24 Vdc internal 30 mA
	24 Vdc external 50 mA (without output load)

Output

Number of output channels:	4
Output specification:	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)
Max. load capacitance:	1 µF
Voltage drop:	< 2.5 Vdc at 800 mA
Off current:	< 0.1 mA
WDG input current:	8 mA

Key coding   (See 'Key coding' data sheet)

Module code:
  – hole   A27
  – pins   C11, C27, C31
Rack code:
  – blind stops   C3, C19, C23
  – large pin   A27

Note:
The soldering link is factory-set.

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 ± 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).
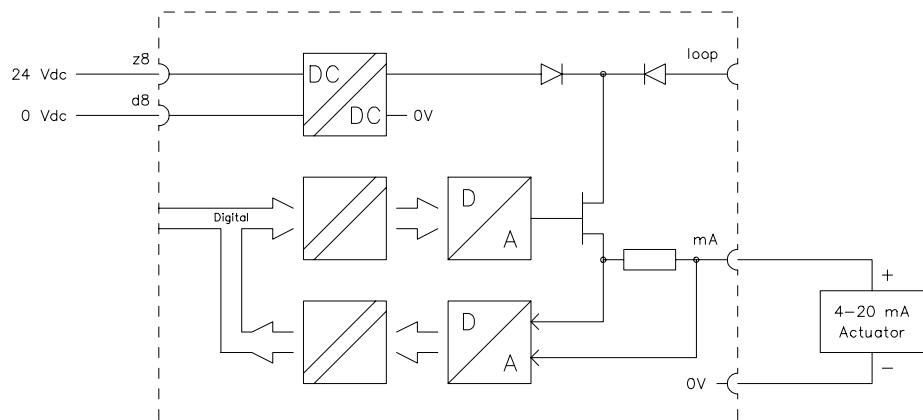
Figure 1   Schematic diagram for connection of
the 10205/1/1 module as an active output
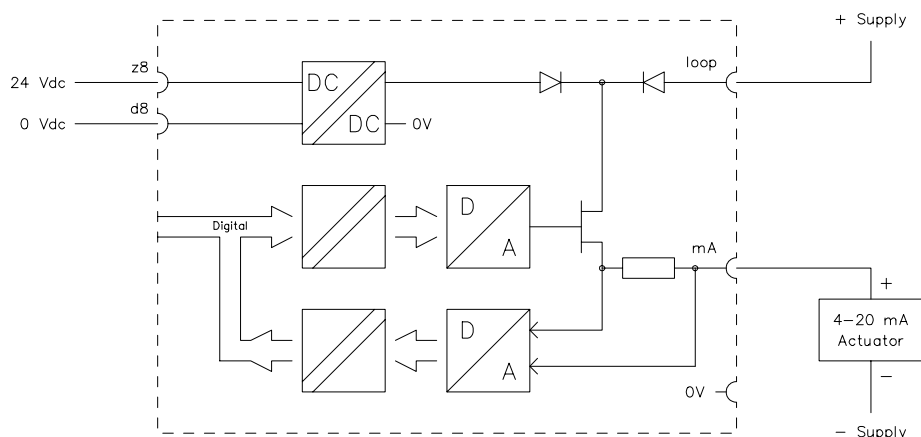
Figure 2   Schematic diagram for connection of
the 10205/1/1 module as a passive output

Pin allocation

The back view and pin allocation of the 10205/1/1 rack connector are as follows:
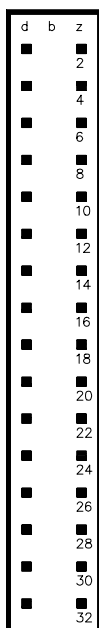
d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 0 Vdc	z8	Supply 24 Vdc
d10		z10	
d12	Link	z12	Link
d14		z14	
d16		z16	
d18		z18	
d20		z20	
d22		z22	
d24		z24	
d26		z26	0 V 1
d28	Loop 1	z28	mA 1
d30		z30	0 V 2
d32	Loop 2	z32	mA 2

Connection example

The figure below shows a connection example for the fail-safe analog output module 10205/1/1.
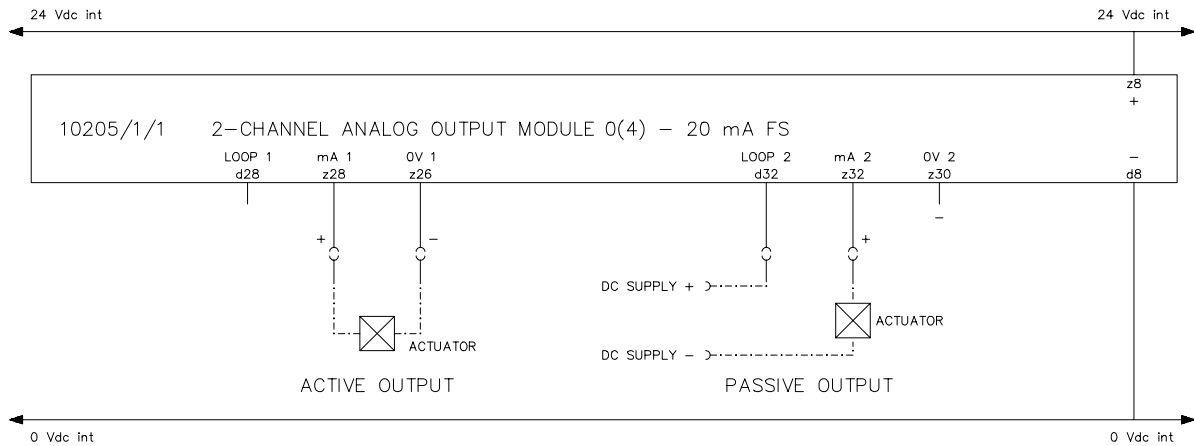
Figure 3   Connection example for non-redundant I/O configurations
(one channel active, one channel passive)

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.

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.
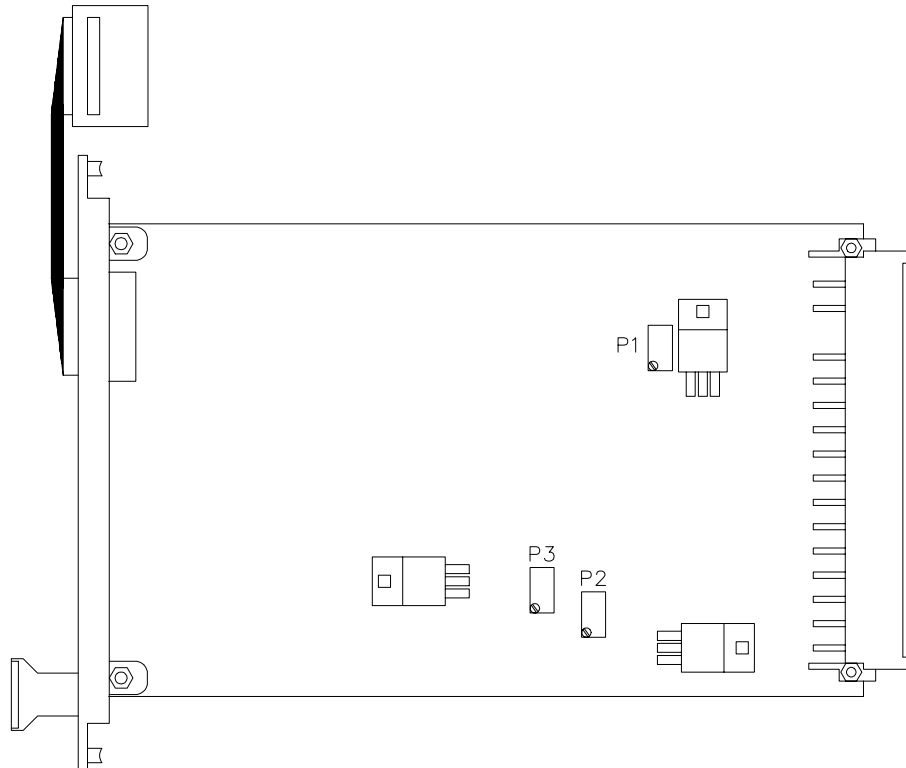
Figure 4   Location of potentiometers on 10205/1/1 module

Technical data   The 10205/1/1 module has the following specifications:

General

Type number:	10205/1/1
Approvals:	CE, TÜV, UL
Software versions:	all
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 30 mA
	24 Vdc 65 mA + 30 mA for each active output

Output

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: $\leq$ 7.5 V
WDG input current:	0.5 mA

Key coding   (See 'Key coding' data sheet)

Module code:
  − hole   A27
  − pins   C3, C23, C27
Rack code:
  − blind stops   C11, C19, C31
  − large pin   A27

Left blank intentionally.

10205/2/1 Fail-safe analog output module (0(4)-20 mA, 2 channels)

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 ± 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).
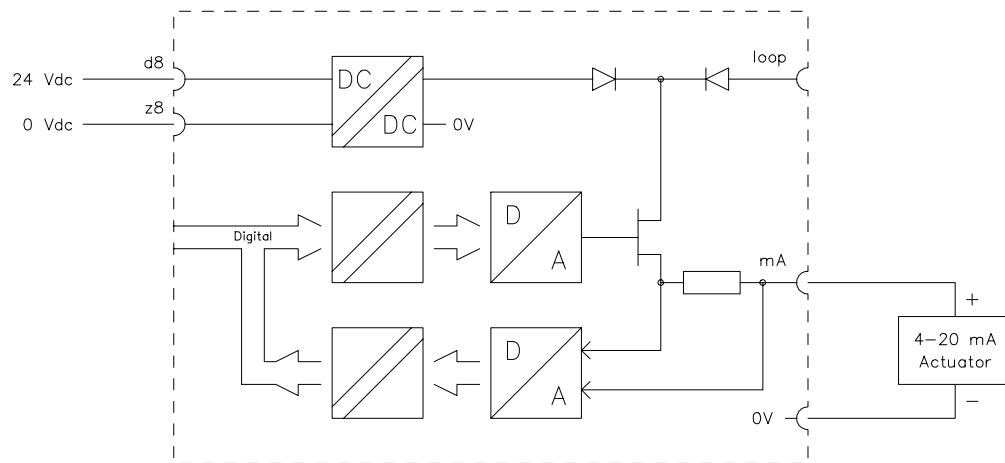
Figure 1   Schematic diagram for connection of
the 10205/2/1 module as an active output
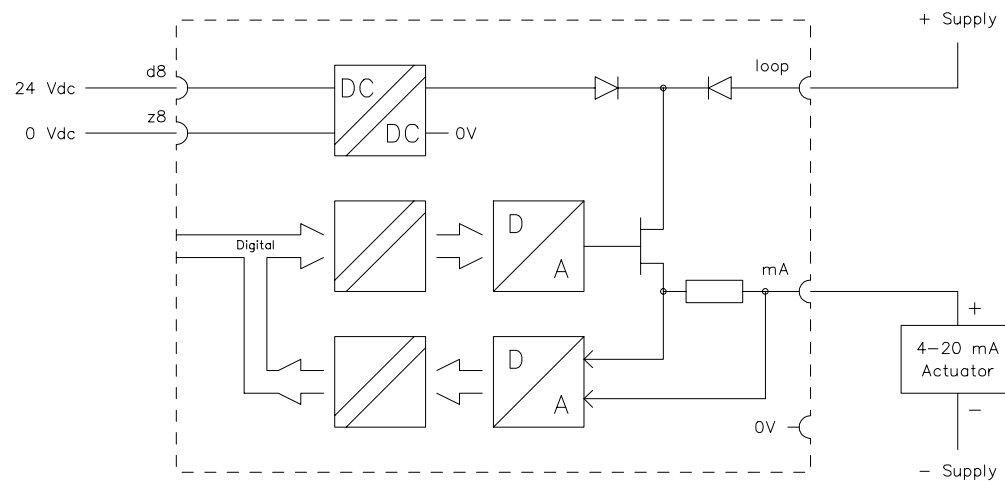
Figure 2   Schematic diagram for connection of
the 10205/2/1 module as a passive output

Pin allocation

The back view and pin allocation of the 10205/2/1 module connector are as follows:
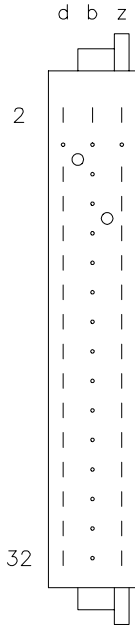
d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	(F 1+)			z12	(F 1–)
d14	0 V 1			z14	
d16	mA 1			z16	Loop 1
d18	(F 2+)			z18	(F 2–)
d20	0 V 2			z20	
d22	mA 2			z22	Loop 2
d24				z24	
d26				z26	
d28				z28	
d30				z30	
d32				z32	

Connection examples

The figures below show a number of connection examples for the fail-safe analog output module 10205/2/1.
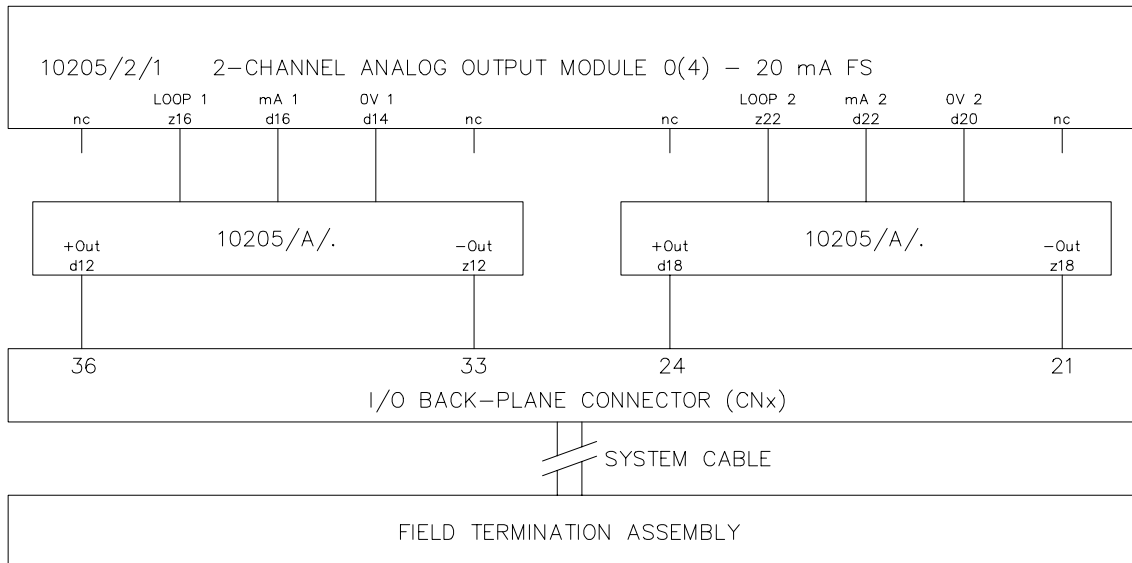
Figure 3   Connection example of 10205/2/1 module to FTA for non-redundant I/O configurations
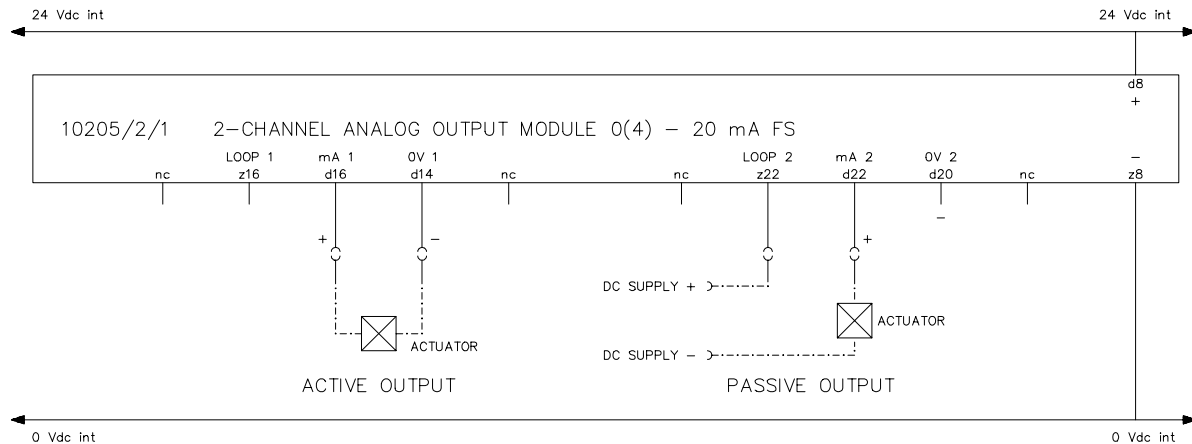
Figure 4   I/O connection example for 10205/2/1 module
for non-redundant I/O configurations
(one channel active, one channel passive)

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.
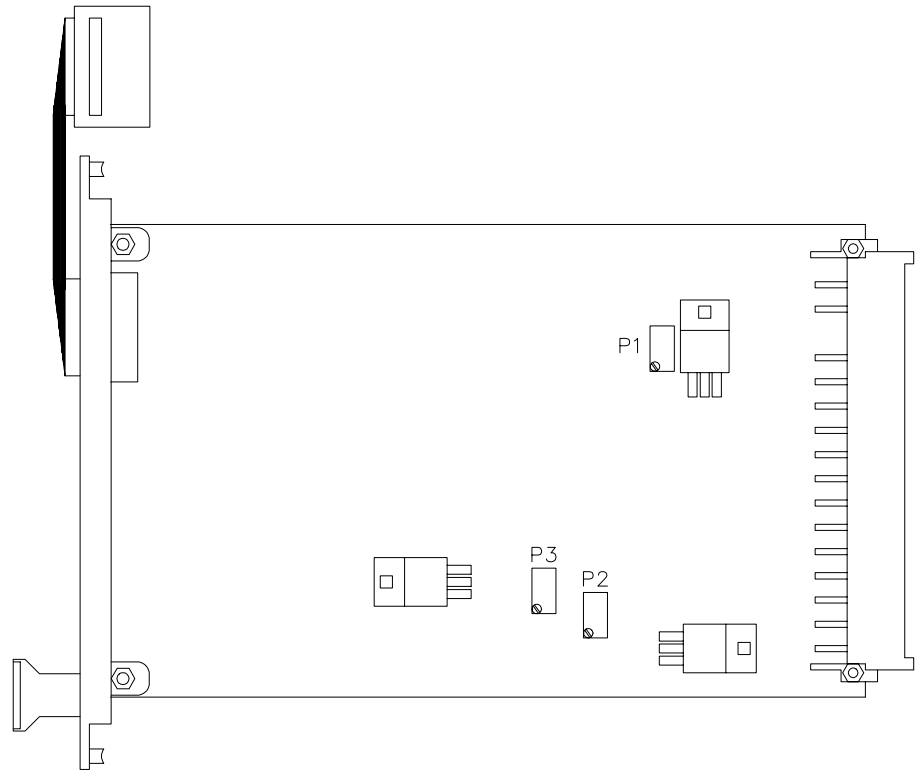
Figure 5   Location of potentiometers on 10205/2/1 module

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Technical data   The 10205/2/1 module has the following specifications:

General   Type number: 10205/2/1   11600
                   Approvals: CE, TÜV, UL
                   Software versions: ≥ 3.00
                   Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   Power requirements: 5 Vdc   30 mA
                                               24 Vdc   65 mA + 30 mA for each
                                                           active output

Output   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   maximum: 40 Vdc
                   (passive):   minimum voltage drop: ≤ 7.5 V
                   WDG input current: 0.5 mA

Key coding   (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.
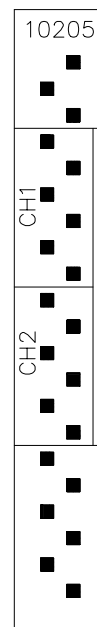
Figure 1   10205 positioning print

The printed circuit board of a 10205/A/. module should be oriented to slide into the cut-out zone of the appropriate channel.

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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.
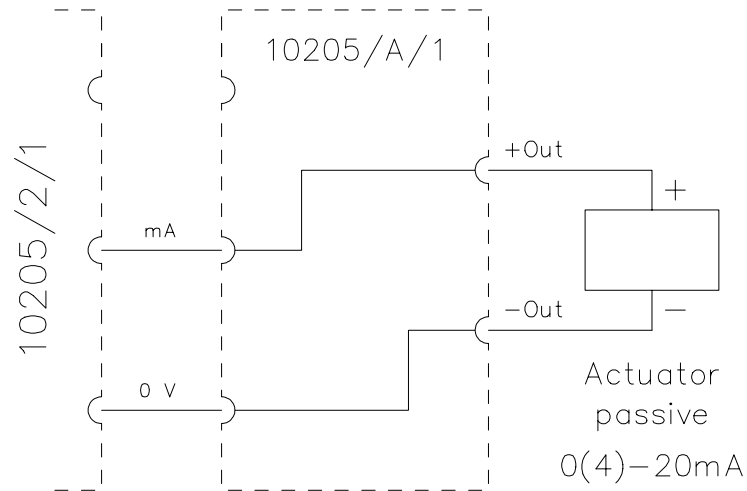
Figure 2   Schematic diagram of a 10205/A/1 module

Technical data

The 10205/A/1 module has the following specifications:

General

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)

Power

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.
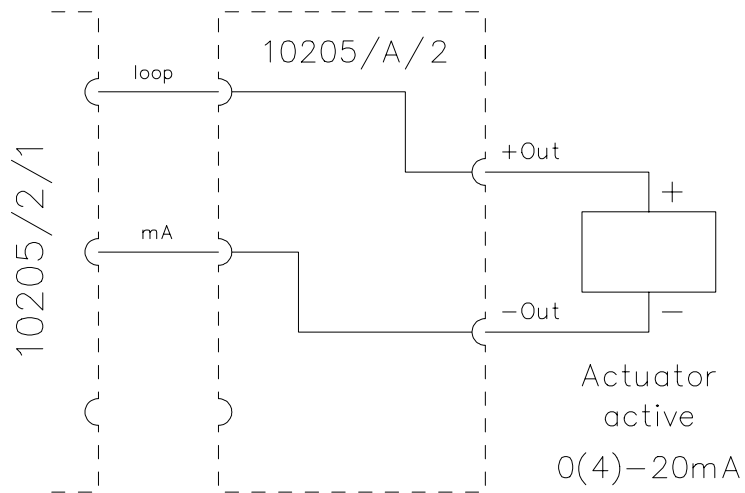
Figure 3   Schematic diagram of a 10205/A/2 module

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.
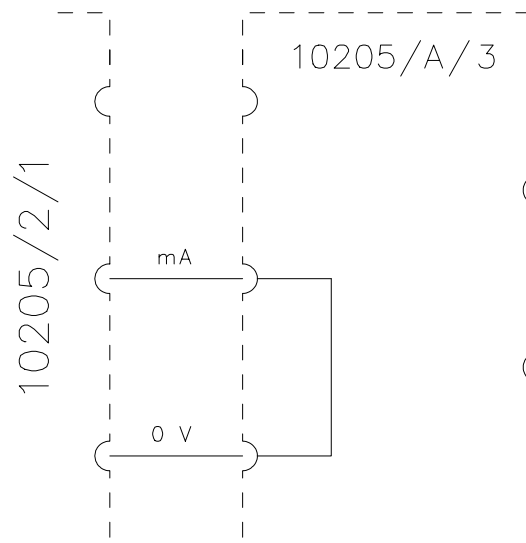
Figure 4　Schematic diagram of a 10205/A/3 module

Technical data

The 10205/A/3 has the following specifications:

General

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)

Power

Power requirements:	none

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

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Pin allocation

The back view and pin allocation of the 10206/1/1 rack connector are as follows:

d2	WDG (5 Vdc)
d4	
d6	
d8	Supply 24 Vdc (3)
d10	OUT 9
d12	OUT 10
d14	OUT 11
d16	OUT 12
d18	Supply 0 Vdc (3)
d20	Link
d22	
d24	
d26	
d28	
d30	
d32	

z2	GND 5 Vdc
z4	Supply 5 Vdc
z6	
z8	Supply 24 Vdc (1)
z10	OUT 1
z12	OUT 2
z14	OUT 3
z16	OUT 4
z18	Supply 0 Vdc (1)
z20	Link
z22	Supply 24 Vdc (2)
z24	OUT 5
z26	OUT 6
z28	OUT 7
z30	OUT 8
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:

General

Type number:	10206/1/1 02402*
Approvals:	CE, TÜV, UL
Software versions:	all
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 25 mA
	24 Vdc internal 3∗20 mA (without output load)

Output

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)

Key coding　　　　　(See 'Key coding' data sheet)

Module code:
- − hole　　　　　　　　　A27
- − pins　　　　　　　　　C3, C19, C23

Rack code:
- − blind stops　　　　　　C11, C27, C31
- − large pin　　　　　　　A27

---

* Notes:

10206/1/1modules 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.

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

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Pin allocation   The back view and pin allocation of the 10206/2/1 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					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	0 Vdc out				z24	0 Vdc out
d26	0 Vdc out				z26	0 Vdc out
d28	0 Vdc out				z28	0 Vdc out
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 digital output module 10206/2/1.
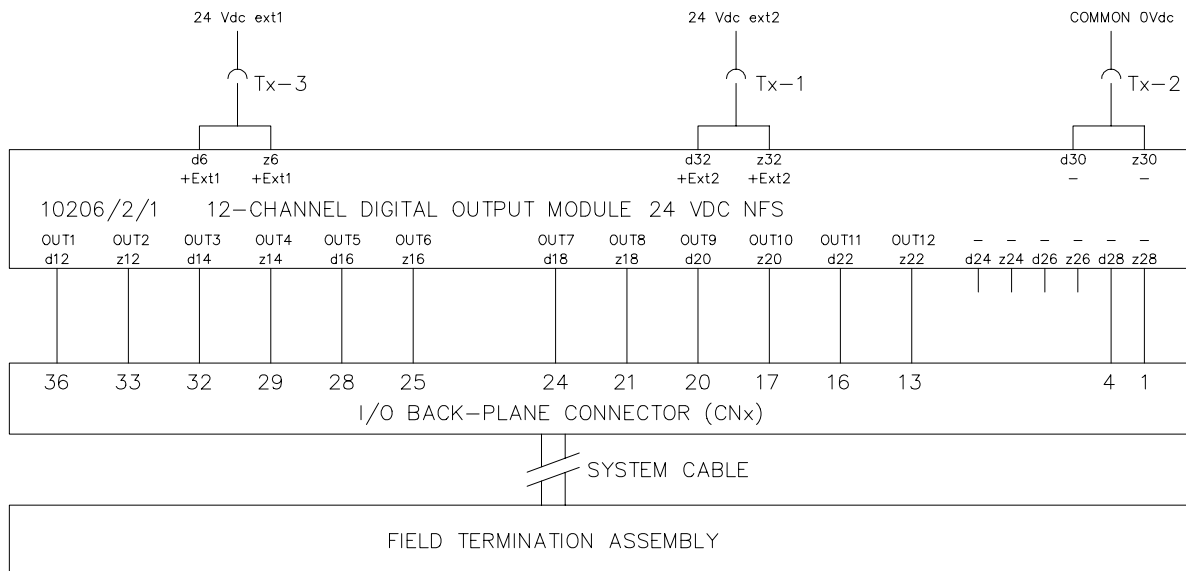
Figure 2   Connection example of 10206/2/1 module to FTA
for both non-redundant and redundant I/O configurations
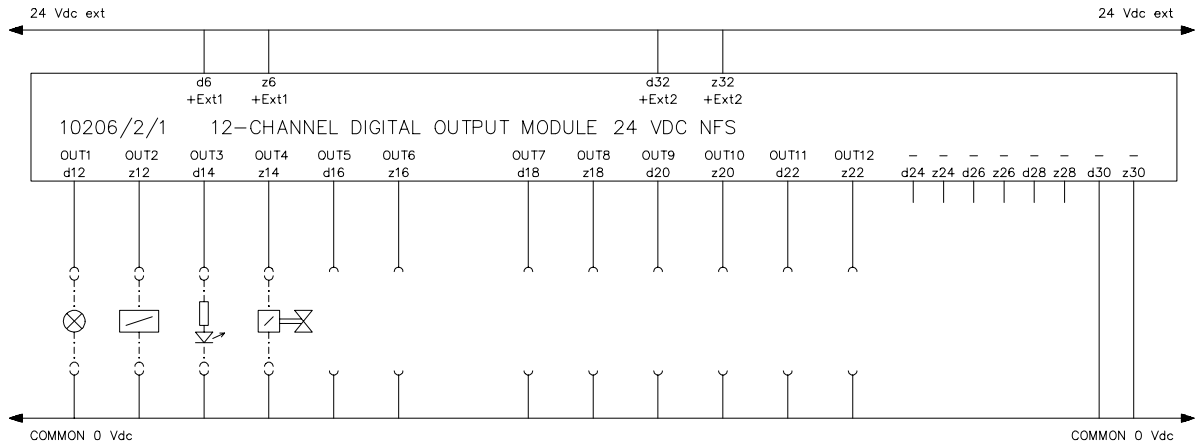
Figure 3   I/O connection example for 10206/2/1 module
for non-redundant I/O configurations
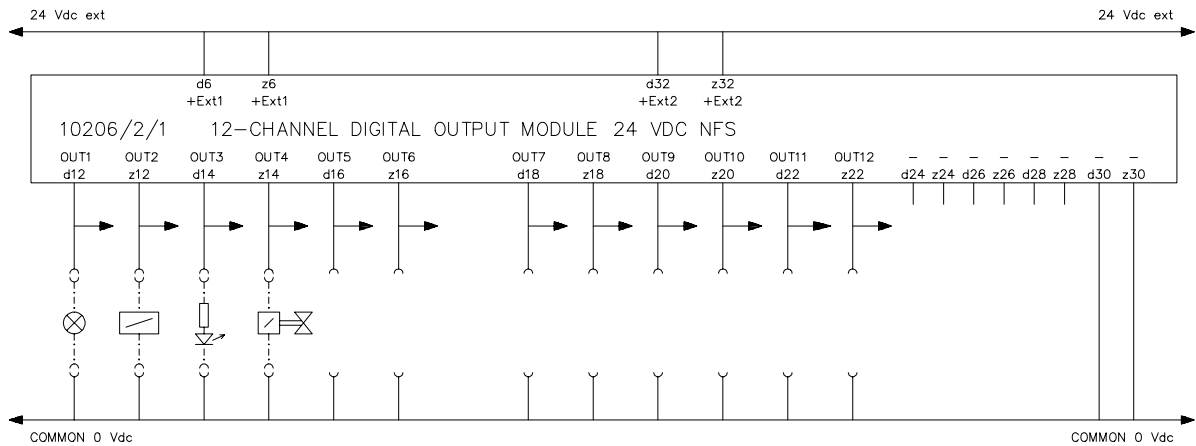
Figure 4   I/O connection example for 10206/2/1 module
for redundant I/O configurations

Technical data   The 10206/2/1 module has the following specifications:

General

Type number:	10206/2/1 11702*
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 25 mA
	24 Vdc 2∗30 mA (without output load)

Output

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.

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.
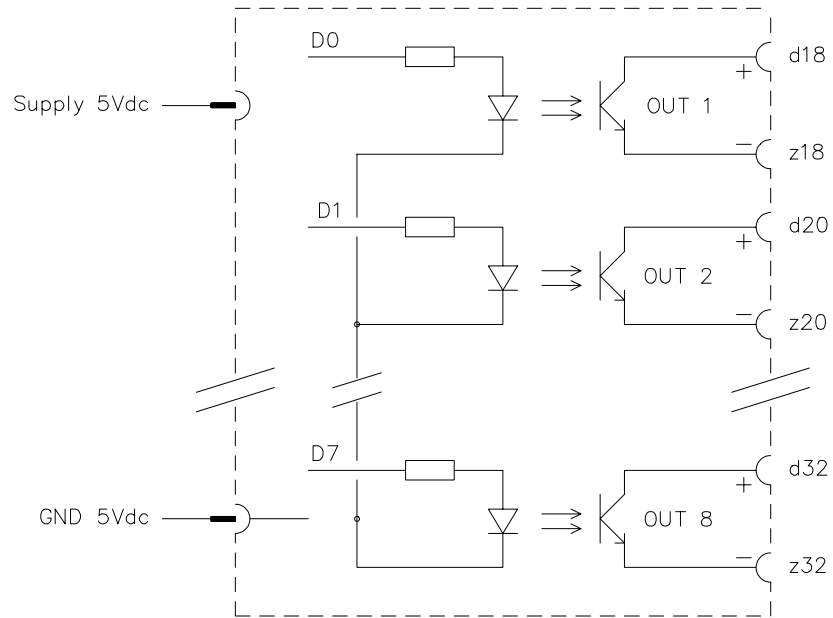
Figure 1   Schematic diagram for the 10207/1/1 module
(D0-D7 are lines on the horizontal bus)

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.

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Pin allocation

The back view and pin allocation of the 10207/1/1 rack connector are as follows:
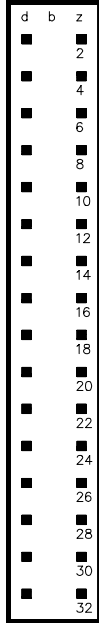
d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8		z8	
d10	Link	z10	Link
d12		z12	
d14		z14	
d16		z16	
d18	OUT 1+	z18	OUT 1–
d20	OUT 2+	z20	OUT 2–
d22	OUT 3+	z22	OUT 3–
d24	OUT 4+	z24	OUT 4–
d26	OUT 5+	z26	OUT 5–
d28	OUT 6+	z28	OUT 6–
d30	OUT 7+	z30	OUT 7–
d32	OUT 8+	z32	OUT 8–

Connection example

The figure below shows a connection example for the intrinsically safe output module 10207/1/1.

10207/1/1   8-CHANNEL OPTOCOUPLER OUTPUT MODULE EExi NFS

+ OUT1 –	+ OUT2 –	+ OUT3 –	+ OUT4 –	+ OUT5 –	+ OUT6 –	+ OUT7 –	+ OUT8 –
d18 z18	d20 z20	d22 z22	d24 z24	d26 z26	d28 z28	d30 z30	d32 z32
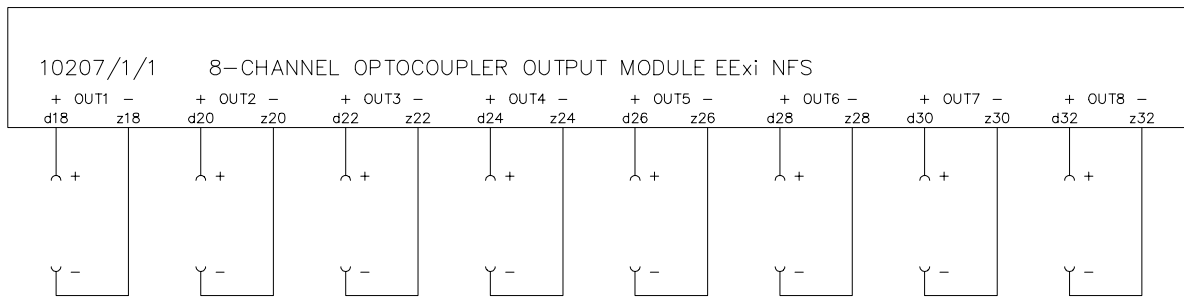
Figure 2   Connection example for non-redundant I/O configurations

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.
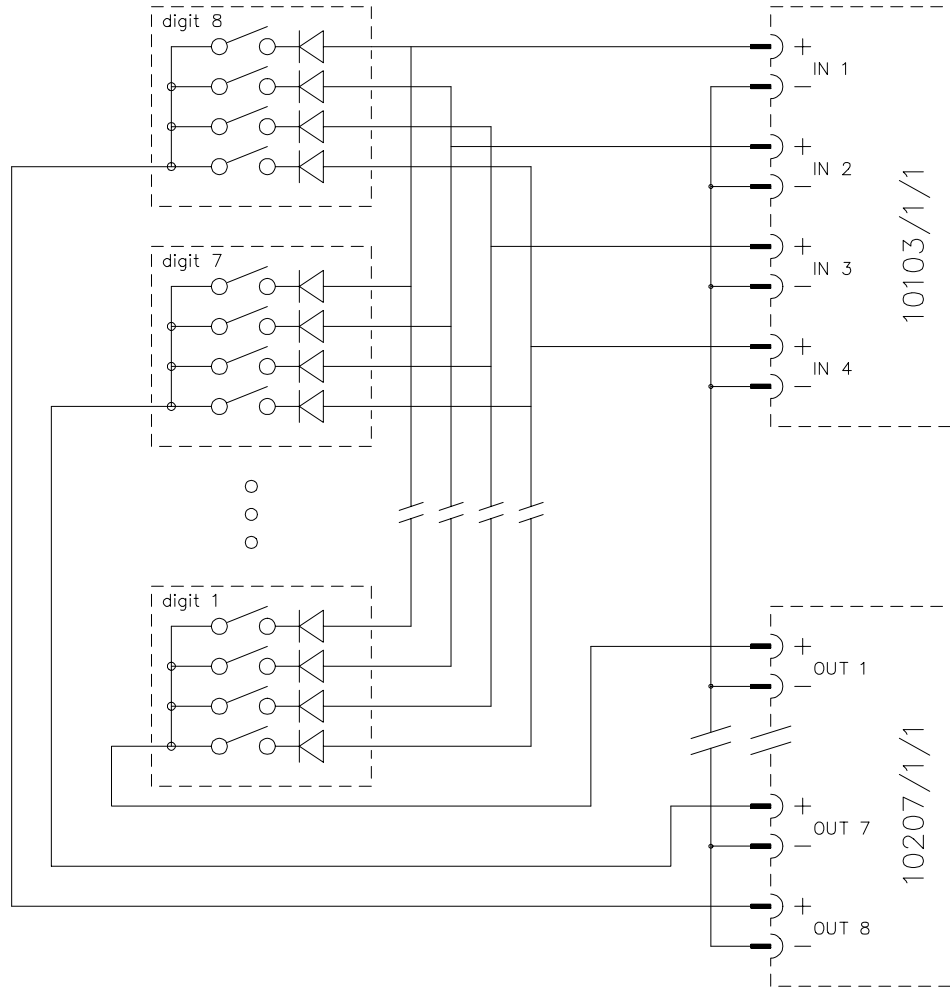
Figure 3   Input multiplexer for BCD thumbwheel switches using
10207/1/1 and 10103/1/1 modules

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Technical data

The 10207/1/1 module has the following specifications:

General

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)

Power

Power requirements:	5 Vdc 35mA
Ripple content:	< 50 mV p-p

Output

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

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.
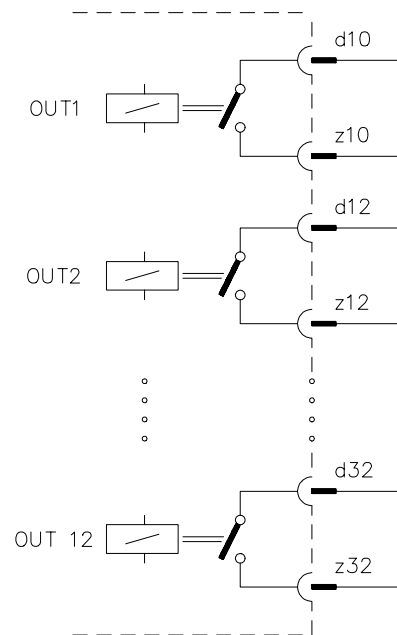
Figure 1   Schematic diagram for 10208/1/1 module

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Pin allocation

The back view and pin allocation of the 10208/1/1 rack connector are as follows:
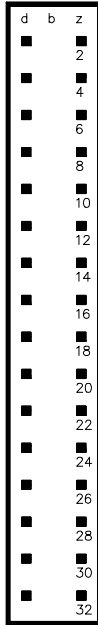
d2	WDG (5 Vdc)		z2	GND 5 Vdc	
d4			z4	Supply 5 Vdc	
d6			z6		
d8	Supply 0 Vdc		z8	Supply 24 Vdc	
d10	Common 1		z10	Normally open 1	
d12	Common 2		z12	Normally open 2	
d14	Common 3		z14	Normally open 3	
d16	Common 4		z16	Normally open 4	
d18	Common 5		z18	Normally open 5	
d20	Common 6		z20	Normally open 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.

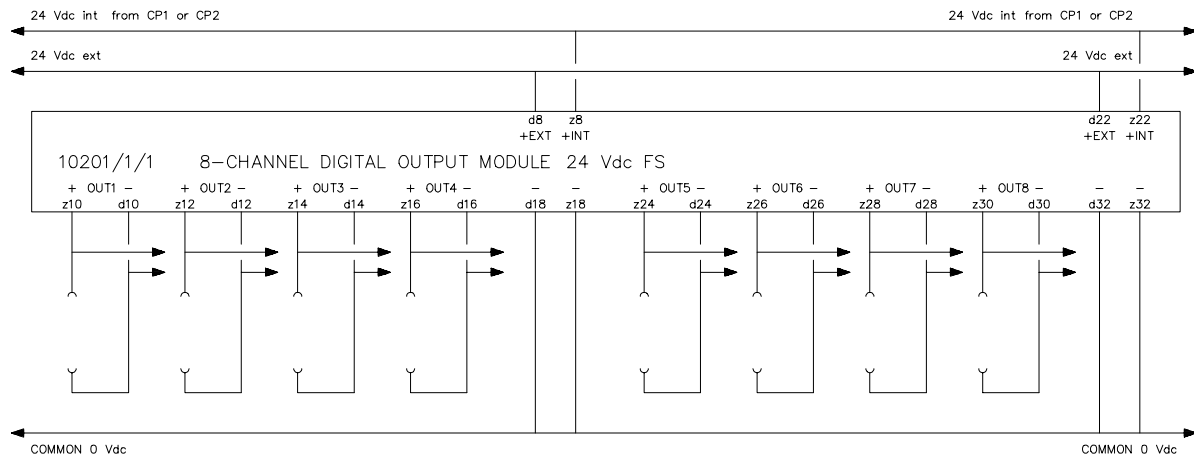Figure 2   Connection example for non-redundant I/O configurations

24 Vdc int   24 Vdc int

z8
+

10208/1/1   12—CHANNEL RELAY OUTPUT MODULE NFS

OUT1   OUT2   OUT3   OUT4   OUT5   OUT6   OUT7   OUT8   OUT9   OUT10   OUT11   OUT12   −
d8

d10   d12   d14   d16   d18   d20   d22   d24   d26   d28   d30   d32

z10   z12   z14   z16   z18   z20   z22   z24   z26   z28   z30   z32

0 Vdc int   0 Vdc int
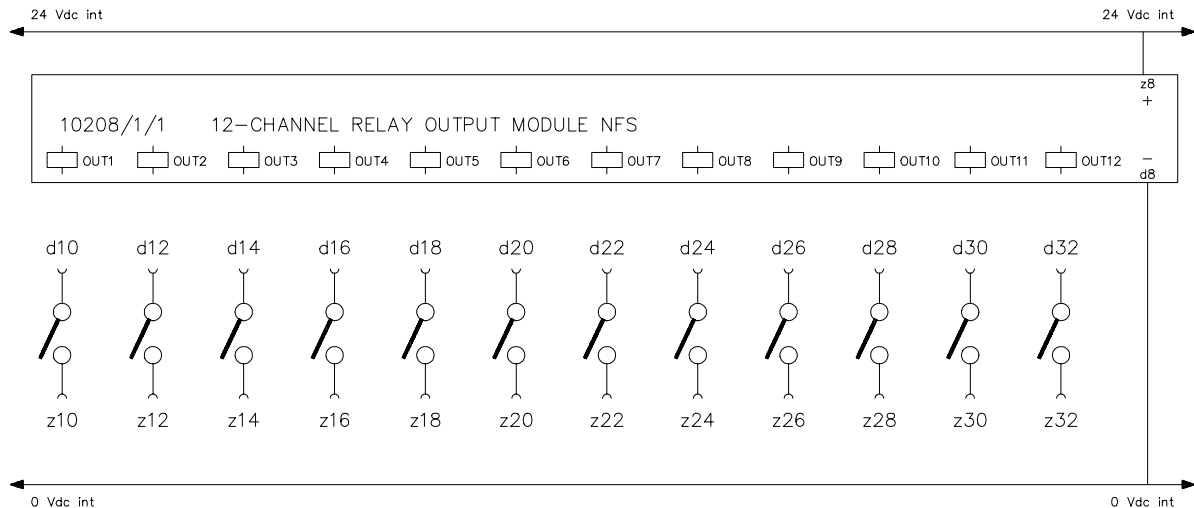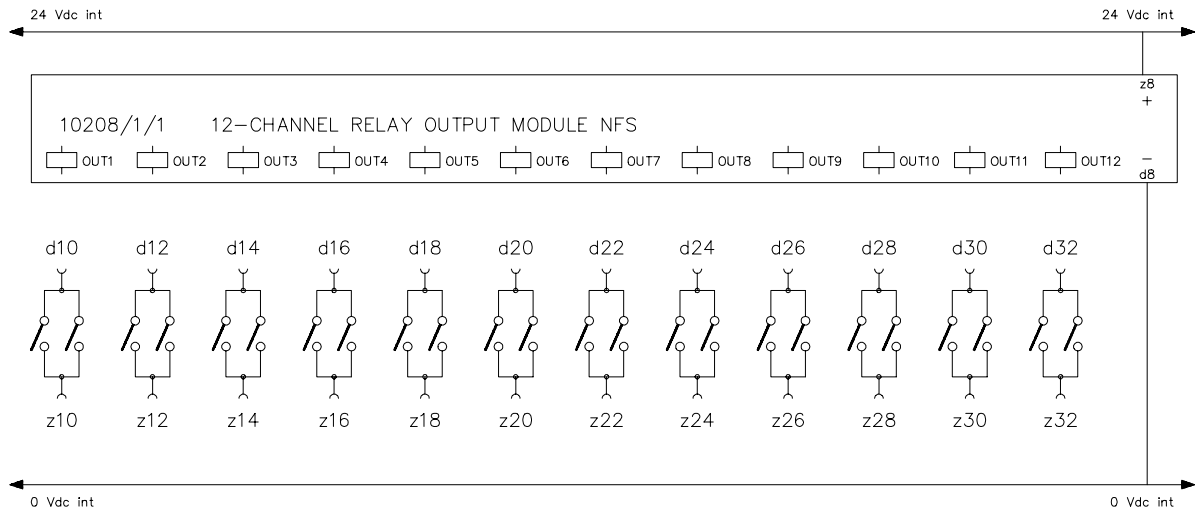
Figure 3   Connection example for redundant I/O configurations

Technical data

The 10208/1/1 module has the following specifications:

General

Type number:	10208/1/1 02601*
Approvals:	CE, TÜV, UL
Software version:	all
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 25 mA
	24 Vdc 130 mA

Output

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)

Key coding   (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.

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.
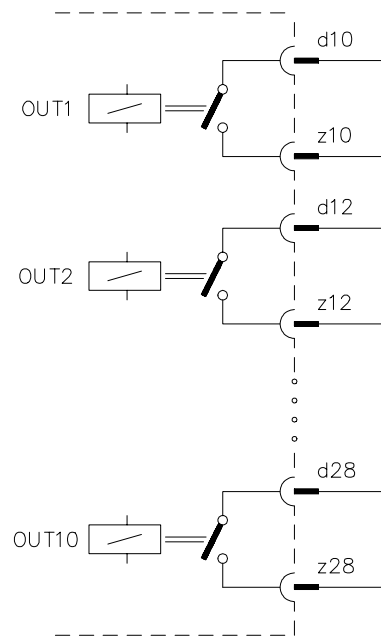
Figure 1   Schematic diagram for 10208/2/1 module

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Pin allocation

The back view and pin allocation of the 10208/2/1 module connector are as follows:
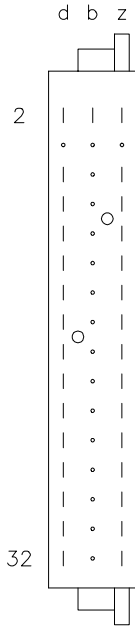
d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6				z6	
d8	Supply 24 Vdc			z8	Supply 0 Vdc
d10	Common 1			z10	Normally open 1
d12	Common 2			z12	Normally open 2
d14	Common 3			z14	Normally open 3
d16	Common 4			z16	Normally open 4
d18	Common 5			z18	Normally open 5
d20	Common 6			z20	Normally open 6
d22	Common 7			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.
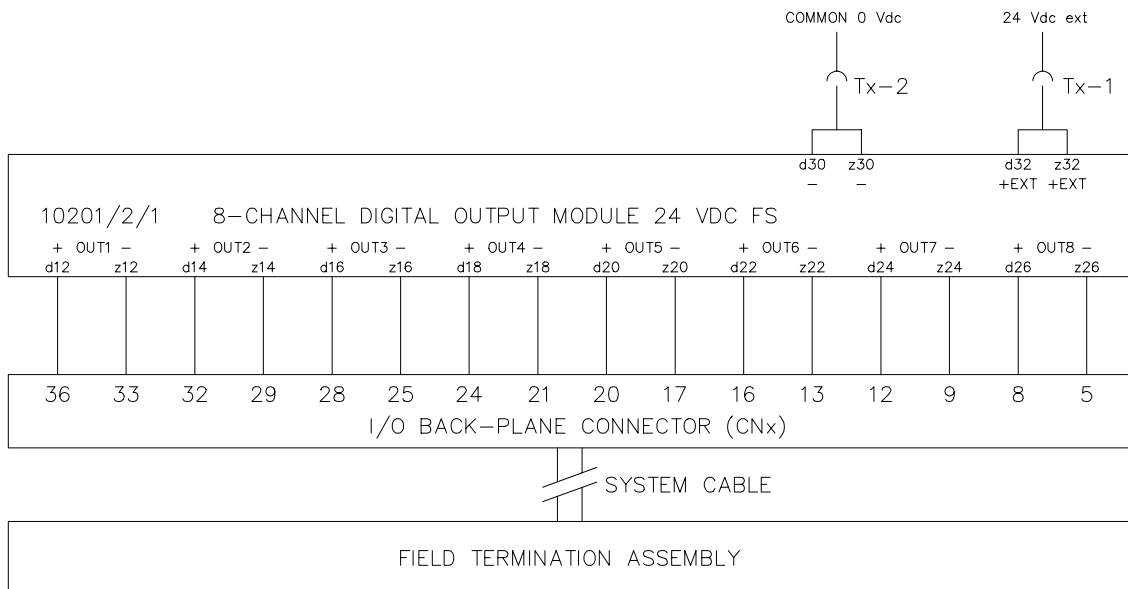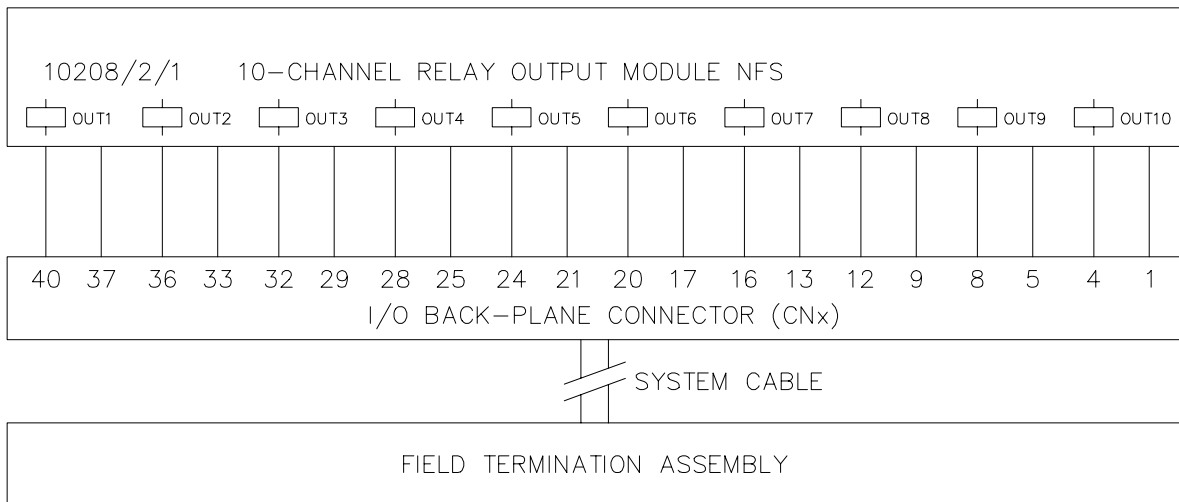

Figure 2   Connection example of 10208/2/1 module to FTA
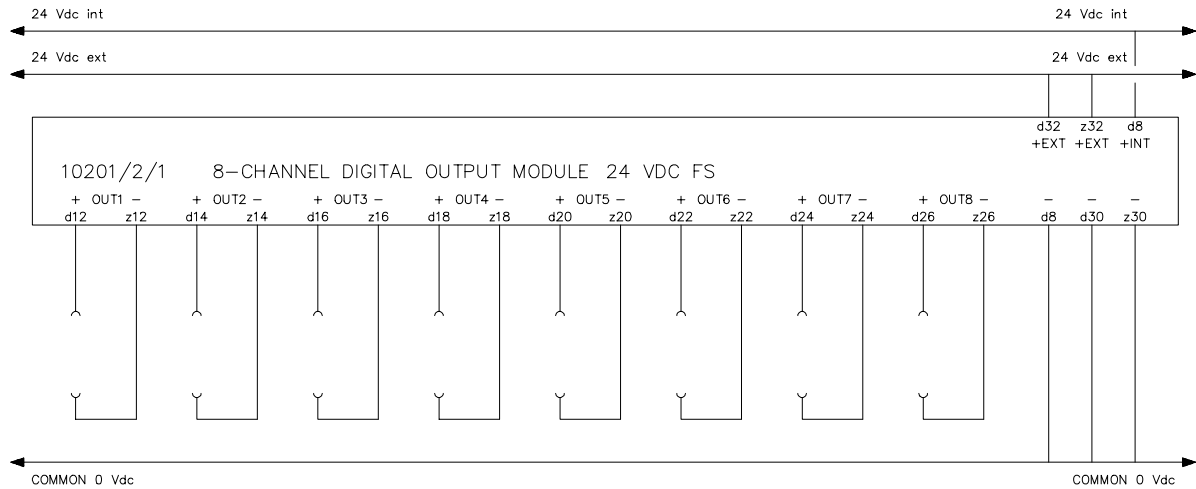for both non-redundant and redundant I/O configurations
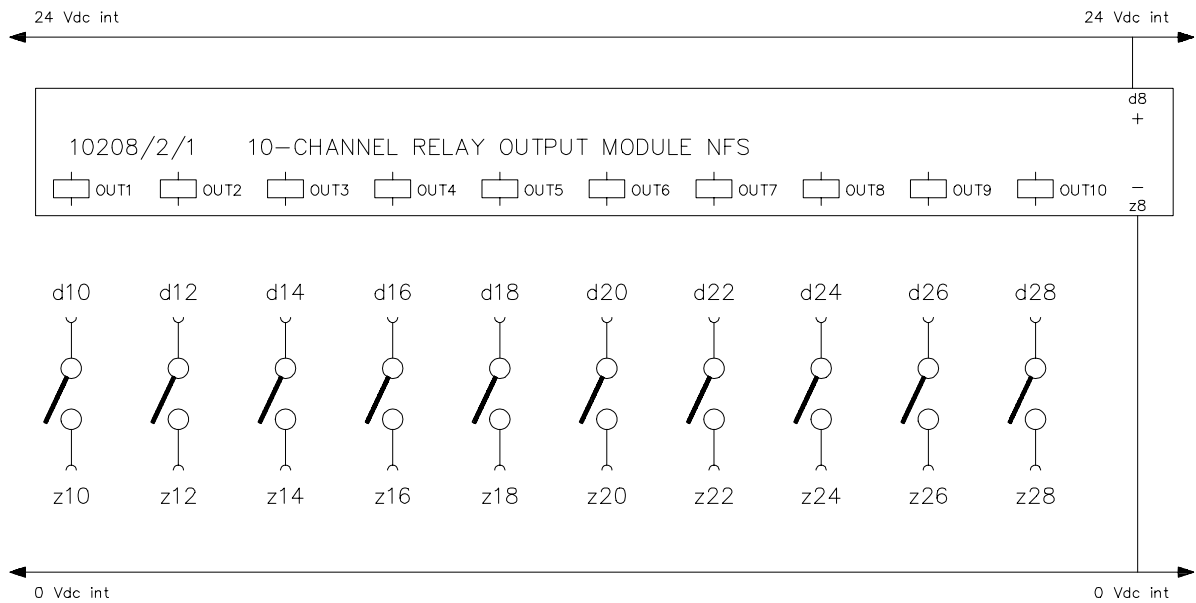
Figure 3   I/O connection example for 10208/2/1 module
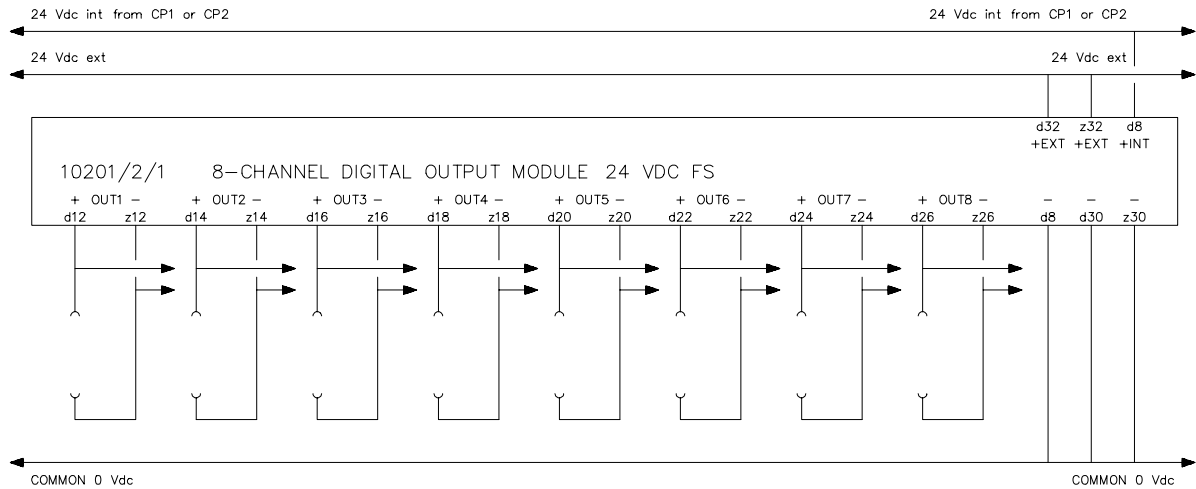for non-redundant I/O configurations
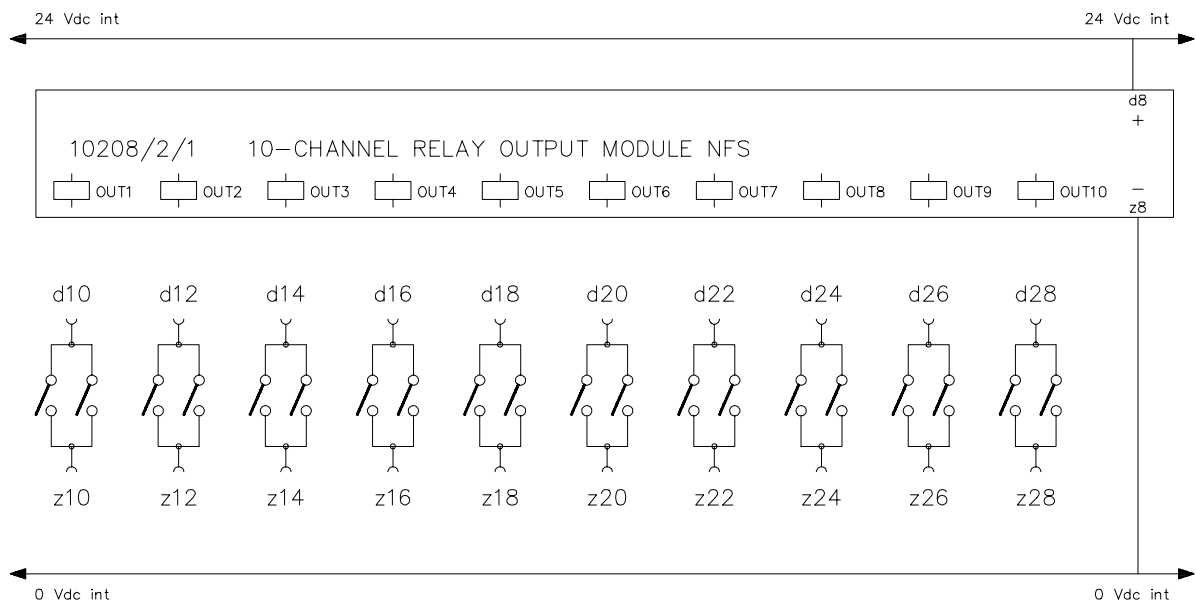
Figure 4   I/O connection example for 10208/2/1 module
for redundant I/O configurations

Technical data   The 10208/2/1 module has the following specifications:

General

Type number:	10208/2/1 11800
Approvals:	CE, TÜV, UL
Software versions:	≥ 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

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.
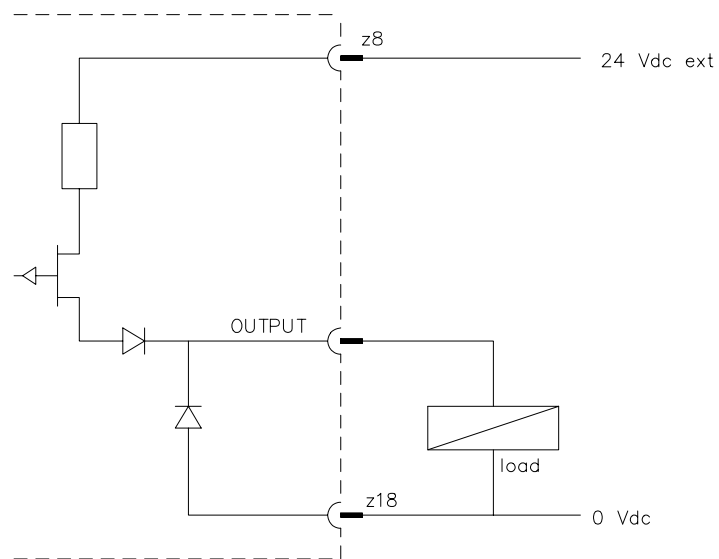
Figure 1   Schematic diagram for connection of one output (output 1-8) to the 10209/1/1 module

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Pin allocation

The back view and pin allocation of the 10209/1/1 rack connector are as follows:
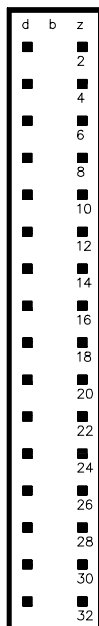
d2	WDG (5 Vdc)		z2	GND 5 Vdc
d4			z4	Supply 5 Vdc
d6			z6	
d8	(Supply 24 Vdc (1))		z8	Supply 24 Vdc (1)
d10	OUT 1		z10	OUT 2
d12	OUT 3		z12	OUT 4
d14	OUT 5		z14	OUT 6
d16	OUT 7		z16	OUT 8
d18	(Supply 0 Vdc (1))		z18	Supply 0 Vdc (1)
d20	Link		z20	Link
d22	(Supply 24 Vdc (2))		z22	Supply 24 Vdc (2)
d24	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

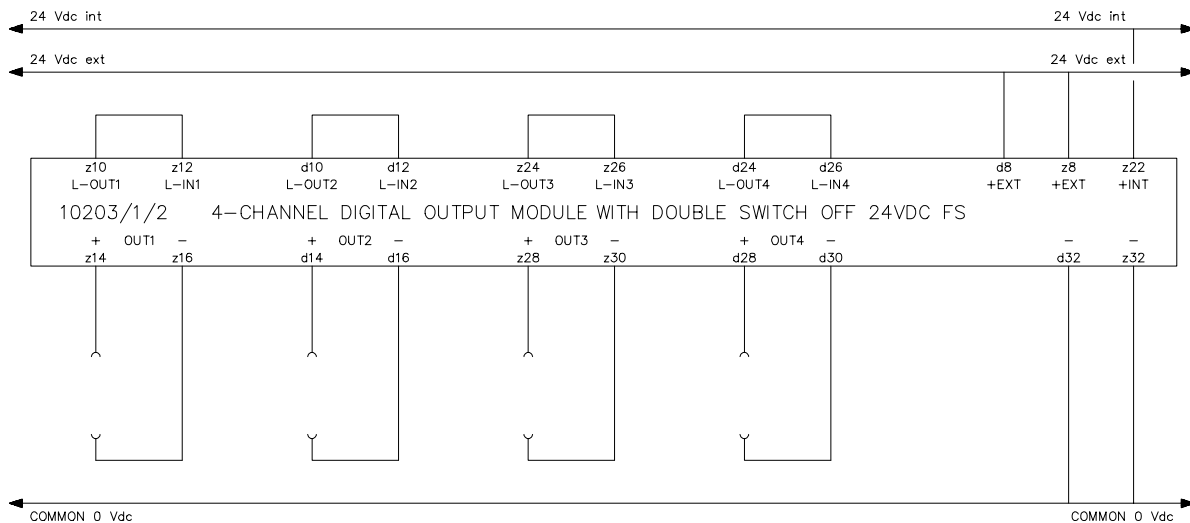The figures below show a number of connection examples for the digital output module 10209/1/1.
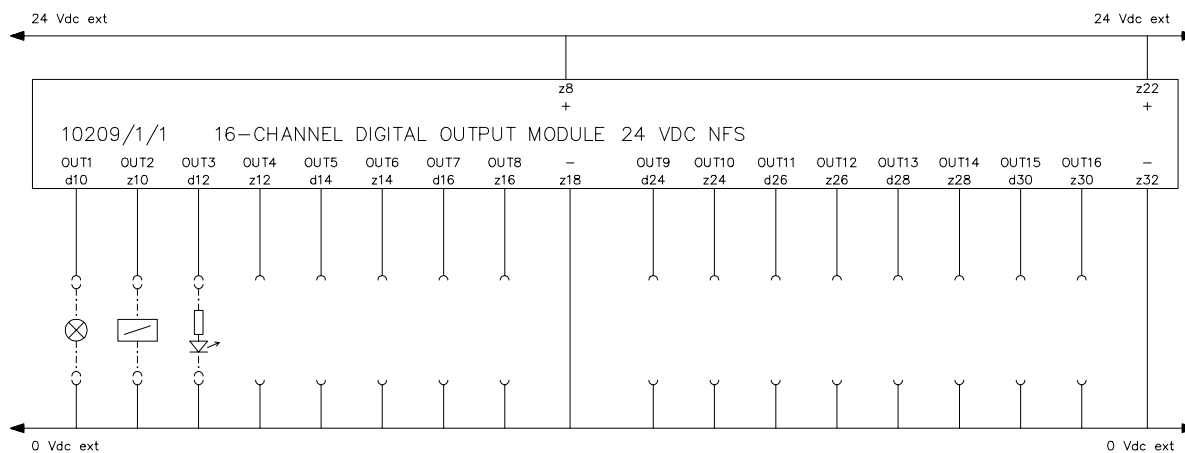
Figure 2   Connection example for non-redundant I/O configurations
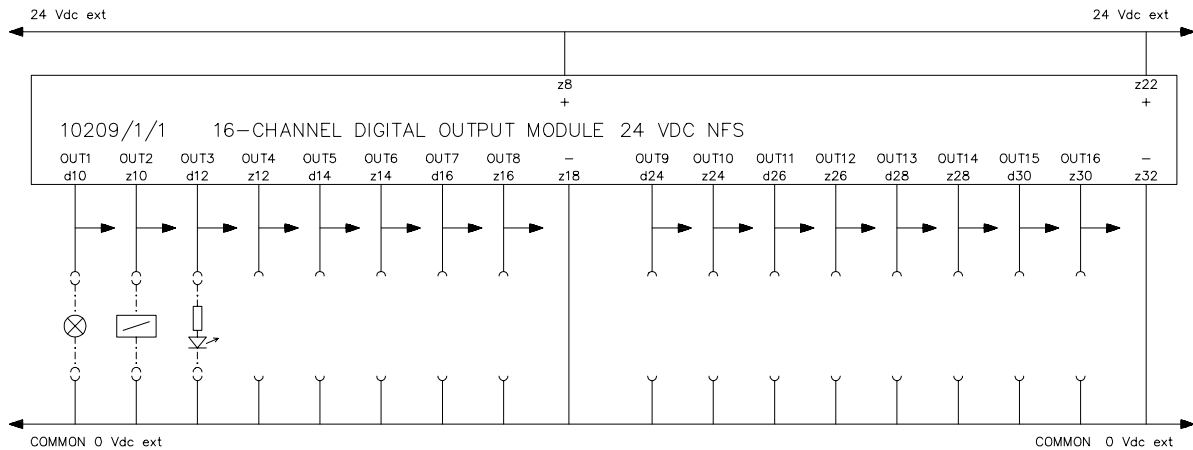
Figure 3   Connection example for redundant I/O configurations

Technical data   The 10209/1/1 module has the following specifications:

General

Type number:	10209/1/1
Approvals:	CE, TÜV, UL
Software versions:	≥ 2.77
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 35 mA
	24 Vdc $2*45$ mA (without output load)

Output

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)

Key coding	(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.
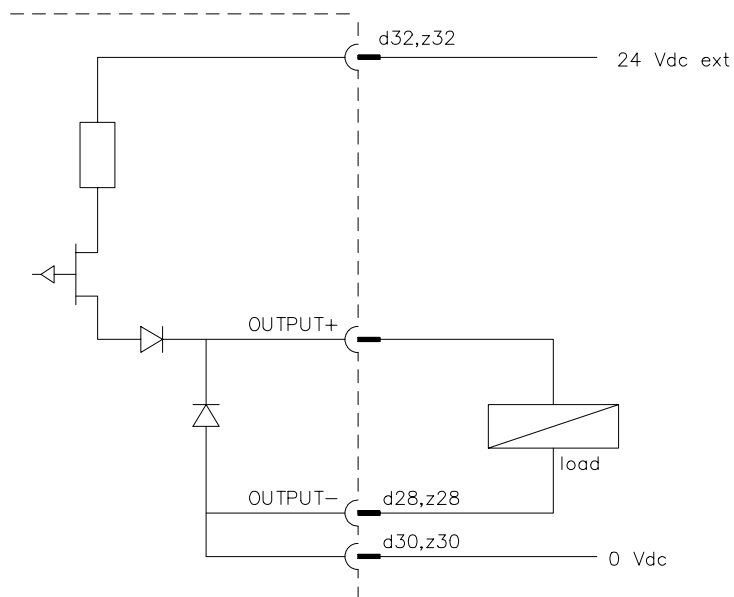
Figure 1   Schematic diagram for connection of one output
to the 10209/2/1 module

Pin allocation

The back view and pin allocation of the 10209/2/1 module connector are as follows:
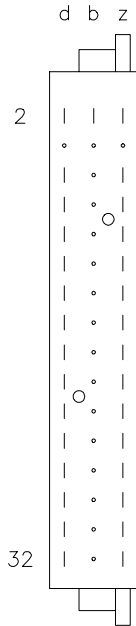
d2	WDG	b2	GND	z2	VCC	
d4	–			z4	–	
d6				z6		
d8				z8		
d10				z10		
d12	OUT 1			z12	OUT 2	
d14	OUT 3			z14	OUT 4	
d16	OUT 5			z16	OUT 6	
d18	OUT 7			z18	OUT 8	
d20	OUT 9			z20	OUT 10	
d22	OUT 11			z22	OUT 12	
d24	OUT 13			z24	OUT 14	
d26	OUT 15			z26	OUT 16	
d28	0 Vdc out			z28	0 Vdc out	
d30	Supply 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.
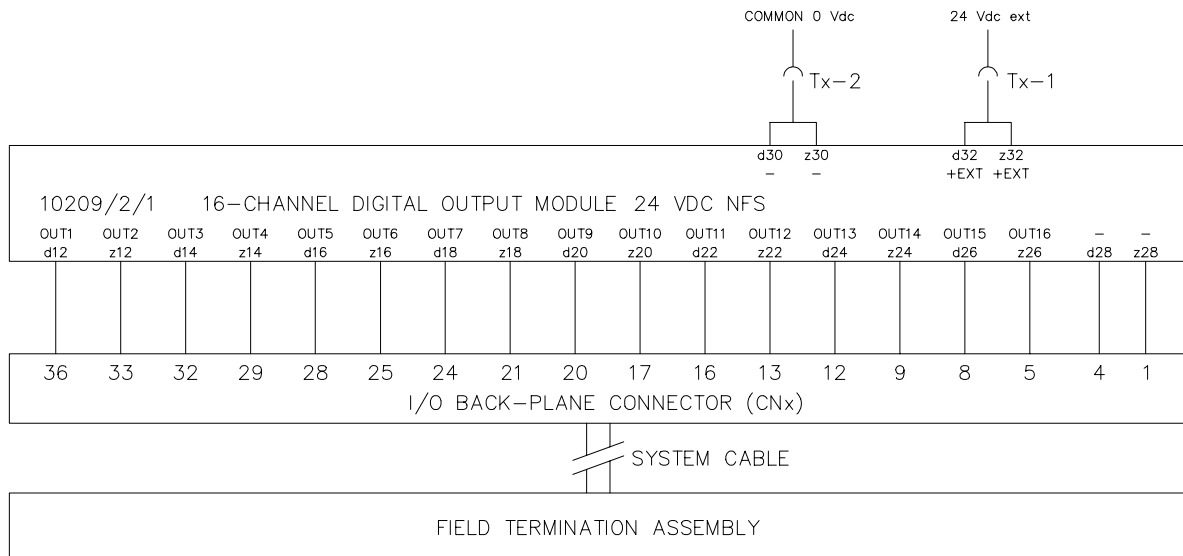
Figure 2   Connection example of 10209/2/1 module to FTA
for both non-redundant and redundant I/O configurations
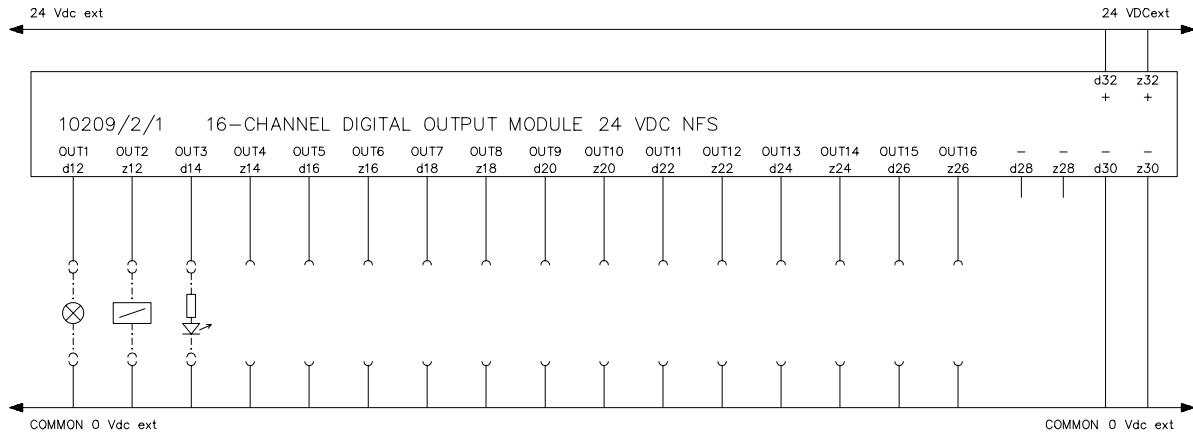
24 Vdc ext   24 VDCext

                                                                        d32   z32
                                                                         +   +

10209/2/1   16—CHANNEL DIGITAL OUTPUT MODULE 24 VDC NFS

OUT1 OUT2 OUT3 OUT4 OUT5 OUT6 OUT7 OUT8 OUT9 OUT10 OUT11 OUT12 OUT13 OUT14 OUT15 OUT16 —   —   —   —
d12   z12   d14   z14   d16   z16   d18   z18   d20   z20   d22   z22   d24   z24   d26   z26   d28 z28 d30 z30

COMMON 0 Vdc ext   COMMON 0 Vdc ext

Figure 3   I/O connection example for 10209/2/1 module
for non-redundant I/O configurations

24 Vdc ext   24 VDCext

                                                                        d32   z32
                                                                         +   +

10209/2/1   16—CHANNEL DIGITAL OUTPUT MODULE 24 VDC NFS

OUT1 OUT2 OUT3 OUT4 OUT5 OUT6 OUT7 OUT8 OUT9 OUT10 OUT11 OUT12 OUT13 OUT14 OUT15 OUT16 —   —   —   —
d12   z12   d14   z14   d16   z16   d18   z18   d20   z20   d22   z22   d24   z24   d26   z26   d28 z28 d30 z30

COMMON 0 Vdc ext   COMMON 0 Vdc ext
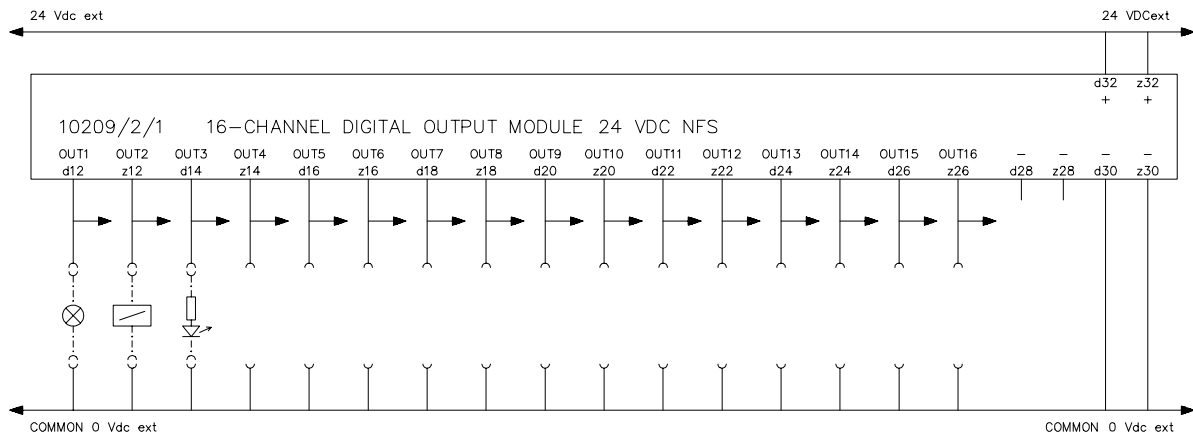
Figure 4   I/O connection example for 10209/2/1 module
for redundant I/O configurations

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Technical data   The 10209/2/1 module has the following specifications:

General
Type number:	10209/2/1 11900
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power
Power requirements:	5 Vdc 35 mA
	24 Vdc 85 mA (without output load)

Output
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

Key coding
(See 'Key coding' data sheet)

Module code:
− holes   A9, C21

Rack code:
− large pins   A9, C21

10212/1/1 Digital output module (24 Vdc, 0.9 A, 8 channels)

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.
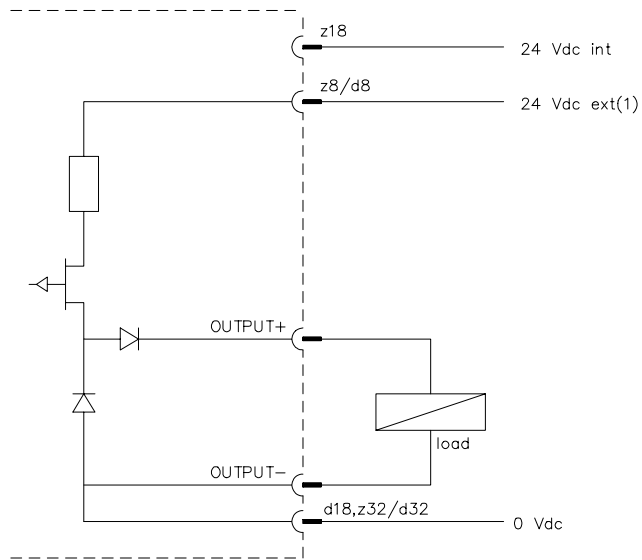
Figure 1   Schematic diagram for connection of one fail-safe
output (1-4) to the 10212/1/1 module
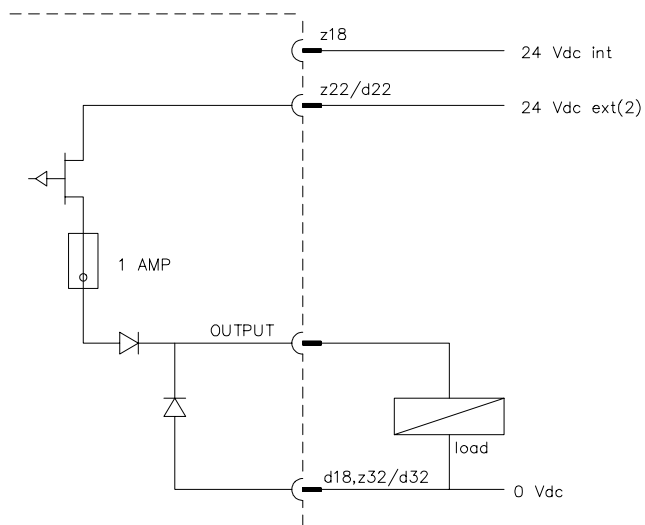
Figure 2   Schematic diagram for connection of one non-fail-safe
output (5-8) to the 10212/1/1 module

Pin allocation

The back view and pin allocation of the 10212/1/1 rack connector are as follows:

d2	WDG 1 (5 Vdc)	
d4	WDG 2 (5 Vdc)*	
d6		
d8	Supply 24 Vdc ext. (1)	
d10	OUT 1–	
d12	OUT 2–	
d14	OUT 3–	
d16	OUT 4–	
d18	Supply 0 Vdc	
d20	Link	
d22	Supply 24 Vdc ext. (2)	
d24	OUT 5–	
d26	OUT 6–	
d28	OUT 7–	
d30	OUT 8–	
d32	Supply 0 Vdc	

z2	GND 5 Vdc
z4	Supply 5 Vdc
z6	
z8	Supply 24 Vdc ext. (1)
z10	OUT 1+
z12	OUT 2+
z14	OUT 3+
z16	OUT 4+
z18	Supply 24 Vdc int. *
z20	Link
z22	Supply 24 Vdc ext. (2)
z24	OUT 5+
z26	OUT 6+
z28	OUT 7+
z30	OUT 8+
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.

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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:

General

Type number:	10212/1/1 02801*
Approvals:	CE, TÜV
Software versions:	all
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 25mA
	24 Vdc 70 mA (without output load)

Output

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

Key coding

(See 'Key coding' data sheet)	
Module code:	
− hole	A27
− pins	C11, C23, C31
Rack code:	
− blind stops	C3, C19, C27
− large pins	A27

Left blank intentionally.

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

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Pin allocation

The back view and pin allocation of the 10213/1/1 rack connector are as follows:
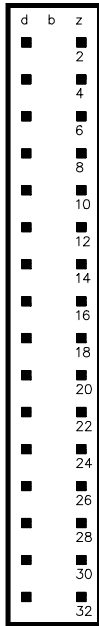
d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Link	z8	Link
d10	(Supply 110 Vdc ext.)	z10	
d12	Supply 110 Vdc ext.	z12	Supply 110 Vdc int.
d14	Supply 0 Vdc ext.	z14	Supply 0 Vdc int.
d16	(Supply 0 Vdc ext.)	z16	
d18		z18	
d20	OUT 1–	z20	OUT 1+
d22		z22	
d24	OUT 2–	z24	OUT 2+
d26		z26	
d28	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
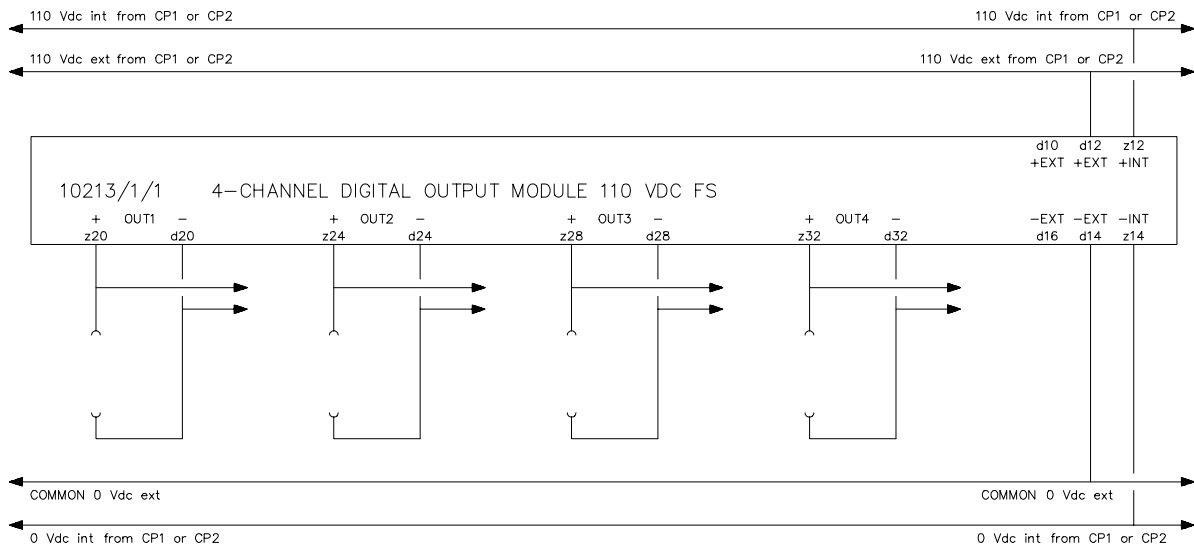
110 Vdc int from CP1 or CP2 110 Vdc int from CP1 or CP2

110 Vdc ext from CP1 or CP2 110 Vdc ext from CP1 or CP2

```
                                                            d10   d12   z12
                                                            +EXT  +EXT  +INT
10213/1/1    4-CHANNEL DIGITAL OUTPUT MODULE 110 VDC FS
      +  OUT1  -        +  OUT2  -        +  OUT3  -        +  OUT4  -       -EXT  -EXT  -INT
   z20        d20    z24        d24    z28        d28    z32        d32     d16   d14   z14
```

COMMON 0 Vdc ext COMMON 0 Vdc ext

0 Vdc int from CP1 or CP2 0 Vdc int from CP1 or CP2

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:

General

Type number:	10213/1/1 02902*
Approvals:	CE, TÜV, UL
Software versions:	≥ 2.78
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

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)

Fuses

Fuse values:	1x 1.6 A
	3x 40 mA
Fuse type:	Round, TR5-F/19370K
Fuse dimensions:	$\varnothing$ 8.2 mm (0.32 in), height 7.7 mm (0.3 in)

Technical data (continued)

Output	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 μF
	Voltage drop:	< 2.5 Vdc at 300 mA
	Off current:	< 0.1 mA
	WDG input current:	5 mA

Key coding	(See 'Key coding' data sheet)	
	Module code:	
	− hole	A11
	− pins	C3, C11, C19
	Rack code:	
	− blind stops	C23, C27, C31
	− large pin	A11

* 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%).

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.
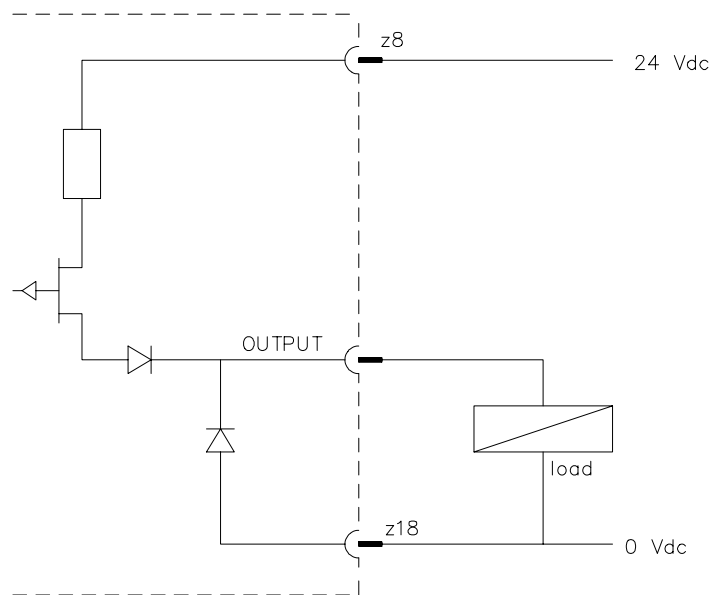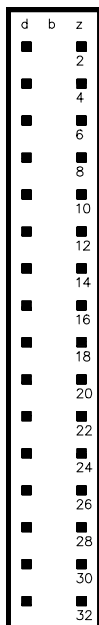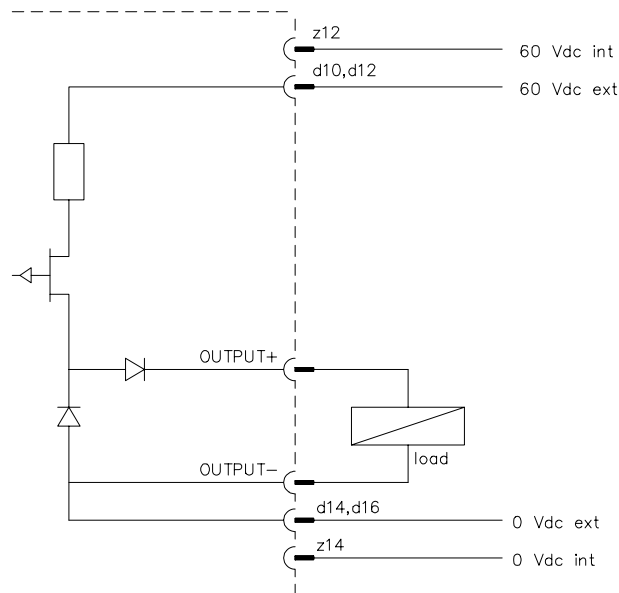

Figure 1   Schematic diagram for connection of one output
to the 10213/1/2 module

Pin allocation

The back view and pin allocation of the 10213/1/2 rack connector are as follows:
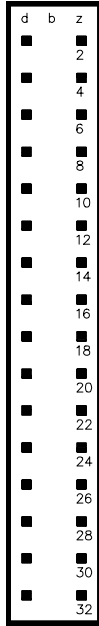
d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Link	z8	Link
d10	Supply 60 Vdc ext.	z10	
d12	Supply 60 Vdc ext.	z12	Supply 60 Vdc int.
d14	Supply 0 Vdc ext.	z14	Supply 0 Vdc int.
d16	Supply 0 Vdc ext.	z16	
d18		z18	
d20	OUT 1–	z20	OUT 1+
d22		z22	
d24	OUT 2–	z24	OUT 2+
d26		z26	
d28	OUT 3–	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.
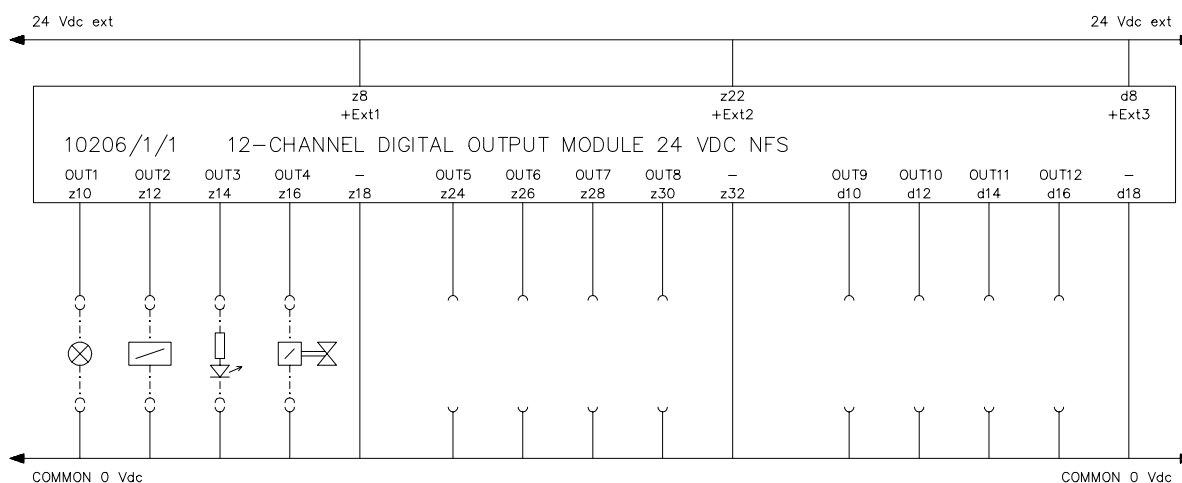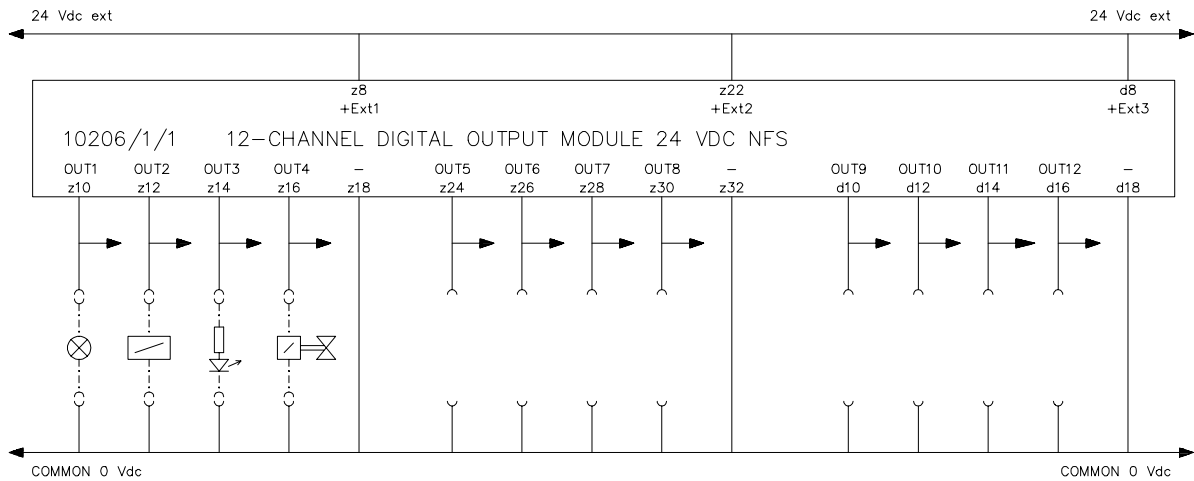
Figure 2   Connection example for non-redundant I/O configurations

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:

General

Type number:	10213/1/2 07001*
Approvals:	CE, TÜV, UL
Software versions:	$\geq$ 2.80b
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Supply voltage:	60 Vdc $\pm$ 15%
Power requirements:	5 Vdc 25 mA
	60 Vdc internal 20 mA
	60 Vdc external 20 mA (without output load)

Fuses

Fuse values:	1x 3.15 A
	3x 40 mA
Fuse type:	Round, TR5-F/19370K
Fuse dimensions:	$\varnothing$ 8.2 mm (0.32 in), height 7.7 mm (0.3 in)

Technical data (continued)

Output

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

Key coding

(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%).

![Honeywell FSC logo] **Honeywell**

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.
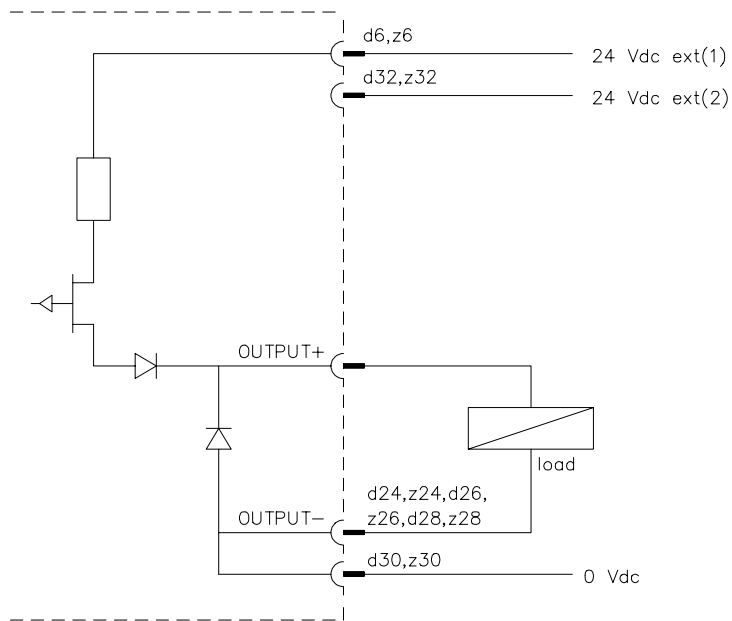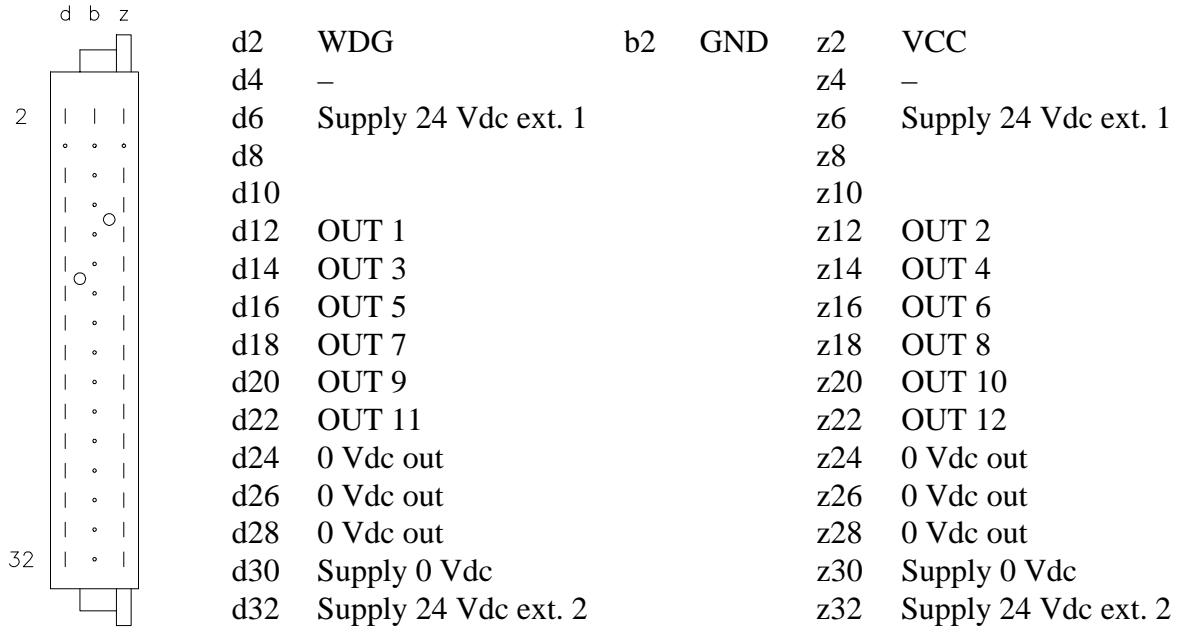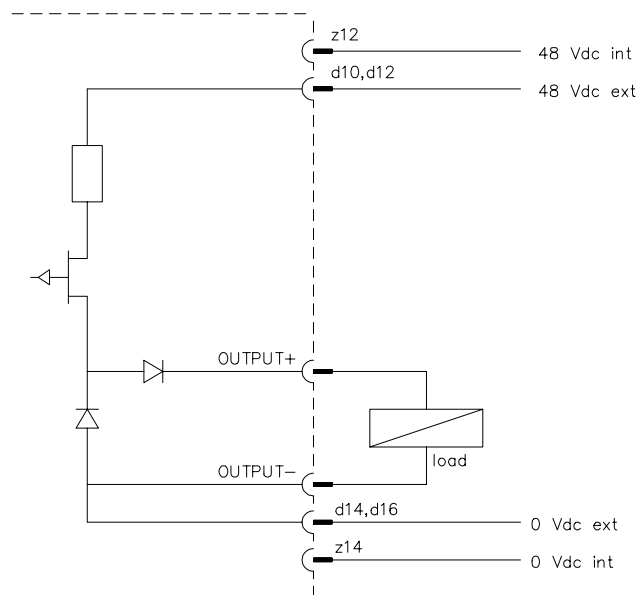

Figure 1   Schematic diagram for connection of one output to the 10213/1/3 module

Pin allocation

The back view and pin allocation of the 10213/1/3 rack connector are as follows:
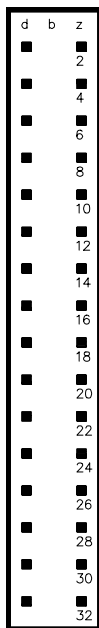
d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Link	z8	Link
d10	Supply 48 Vdc ext.	z10	
d12	Supply 48 Vdc ext.	z12	Supply 48 Vdc int.
d14	Supply 0 Vdc ext.	z14	Supply 0 Vdc int.
d16	Supply 0 Vdc ext.	z16	
d18		z18	
d20	OUT 1–	z20	OUT 1+
d22		z22	
d24	OUT 2–	z24	OUT 2+
d26		z26	
d28	OUT 3–	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

48 Vdc int from CP1 or CP2

48 Vdc ext from CP1 or CP2

48 Vdc int from CP1 or CP2

48 Vdc ext from CP1 or CP2

```
                                                                          d10  d12  z12
                                                                          +EXT +EXT +INT
  10213/1/3    4—CHANNEL DIGITAL OUTPUT MODULE 48 VDC FS
     +   OUT1  —        +   OUT2  —        +   OUT3  —        +   OUT4  —    —EXT  —EXT  —INT
    z20       d20      z24       d24      z28       d28      z32       d32   d16   d14   z14
```

COMMON 0 Vdc ext

0 Vdc int from CP1 or CP2

COMMON 0 Vdc ext

0 Vdc int from CP1 or CP2

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:	$\geq$ 2.80b
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Supply voltage:	48 Vdc $\pm$ 15%
Power requirements:	5 Vdc 25 mA
	48 Vdc internal 20 mA
	48 Vdc external 20 mA (without output load)

Technical data (continued)

Output

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

Key coding

(See 'Key coding' data sheet)

Module code:

- hole   A3
- pins   C3, C11, C19

Rack code:

- blind stops   C23, C27, C31
- large pin   A3

---

* 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.
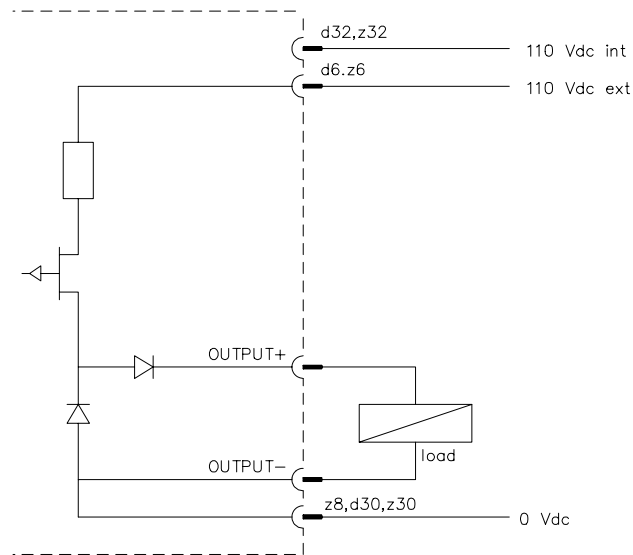
Figure 1   Schematic diagram for connection of one output to the 10213/2/1 module

Pin allocation

The back view and pin allocation of the 10213/2/1 module connector are as follows:
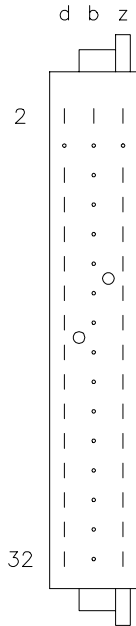
d2	WDG		b2	GND	z2	VCC
d4	–				z4	–
d6	Supply 110 Vdc ext.				z6	Supply 110 Vdc ext.
d8					z8	Supply 0 Vdc
d10					z10	
d12	(0 Vdc)				z12	(0 Vdc)
d14	OUT 1+				z14	OUT 1–
d16	(0 Vdc)				z16	(0 Vdc)
d18	OUT 2+				z18	OUT 2–
d20	(0 Vdc)				z20	(0 Vdc)
d22	OUT 3+				z22	OUT 3–
d24	(0 Vdc)				z24	(0 Vdc)
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.
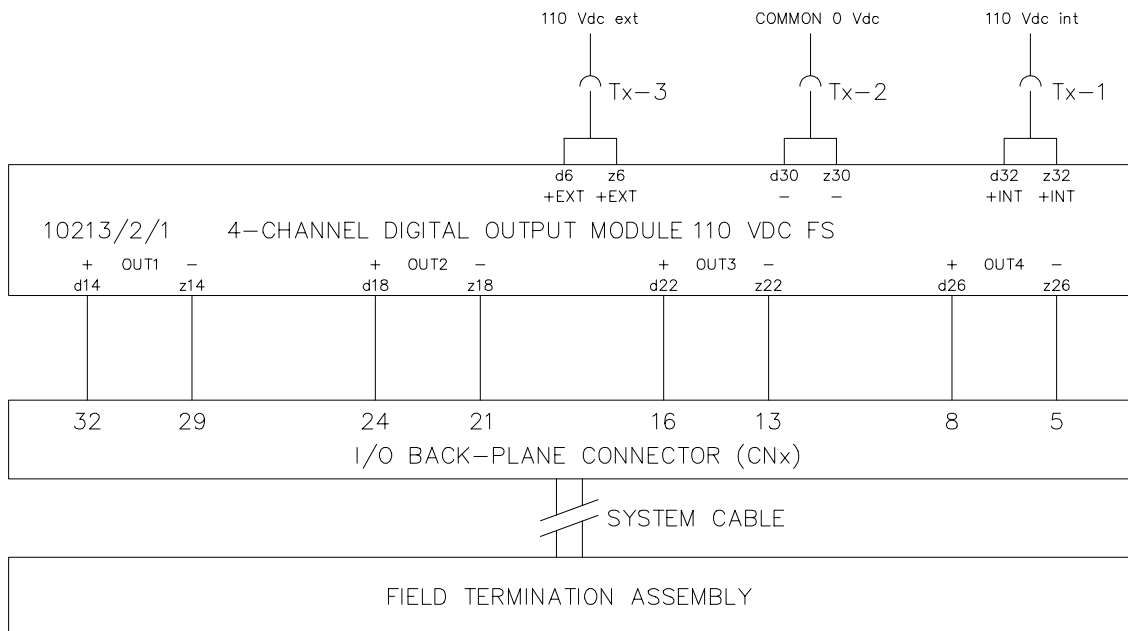
Figure 2   Connection example of 10213/2/1 module to FTA
for both non-redundant and redundant I/O configurations

Figure 3   I/O connection example for 10213/2/1 module
for non-redundant I/O configurations
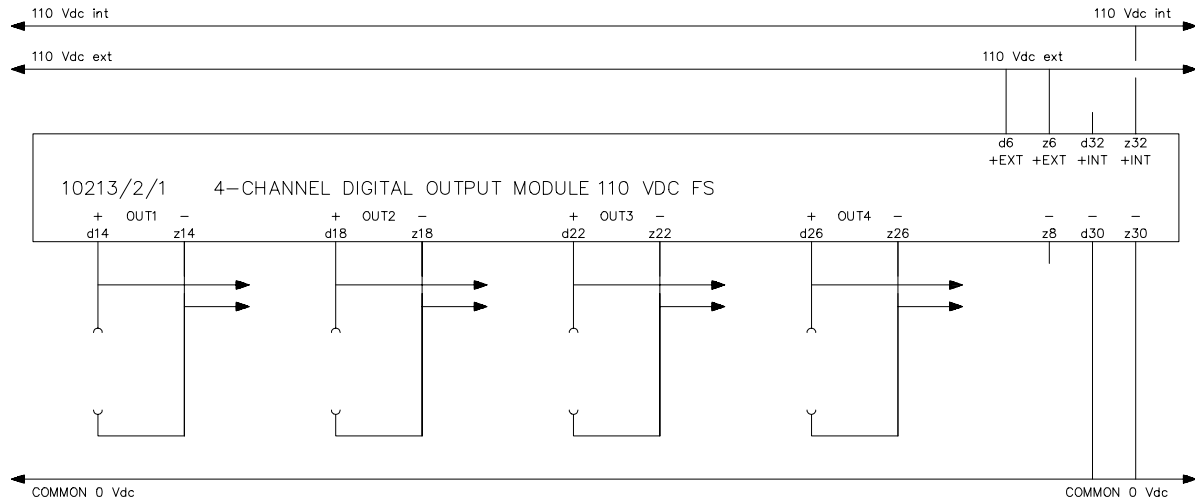
Figure 4   I/O connection example for 10213/2/1 module
for redundant I/O configurations

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).

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Technical data   The 10213/2/1 module has the following specifications:

General
Type number:	10213/2/1 12002*
Approvals:	CE, TÜV;
	UL approval pending
Software versions:	≥ 310
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power
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)

Fuses
Fuse values:	1x 1.6 A
	3x 40 mA
Fuse type:	Round, TR5-F/19370K
Fuse dimensions:	$\varnothing$ 8.2 mm (0.32 in), height 7.7 mm (0.3 in)

Output
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

Key coding   (See 'Key coding' data sheet)
Module code:	
− holes	A13, C17
Rack code:	
− large pins	A13, C17

---

* 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

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Pin allocation

The back view and pin allocation of the 10213/2/2 module connector are as follows:

```
   d  b  z
2  | | |
```
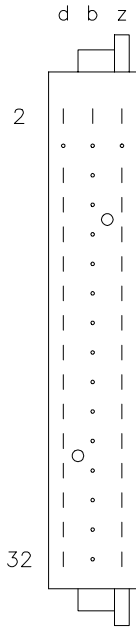
d2	WDG		b2	GND	z2	VCC
d4	–				z4	–
d6	Supply 60 Vdc ext.				z6	Supply 60 Vdc ext.
d8					z8	Supply 0 Vdc
d10					z10	
d12	(0 Vdc)				z12	(0 Vdc)
d14	OUT 1+				z14	OUT 1–
d16	(0 Vdc)				z16	(0 Vdc)
d18	OUT 2+				z18	OUT 2–
d20	(0 Vdc)				z20	(0 Vdc)
d22	OUT 3+				z22	OUT 3–
d24	(0 Vdc)				z24	(0 Vdc)
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.
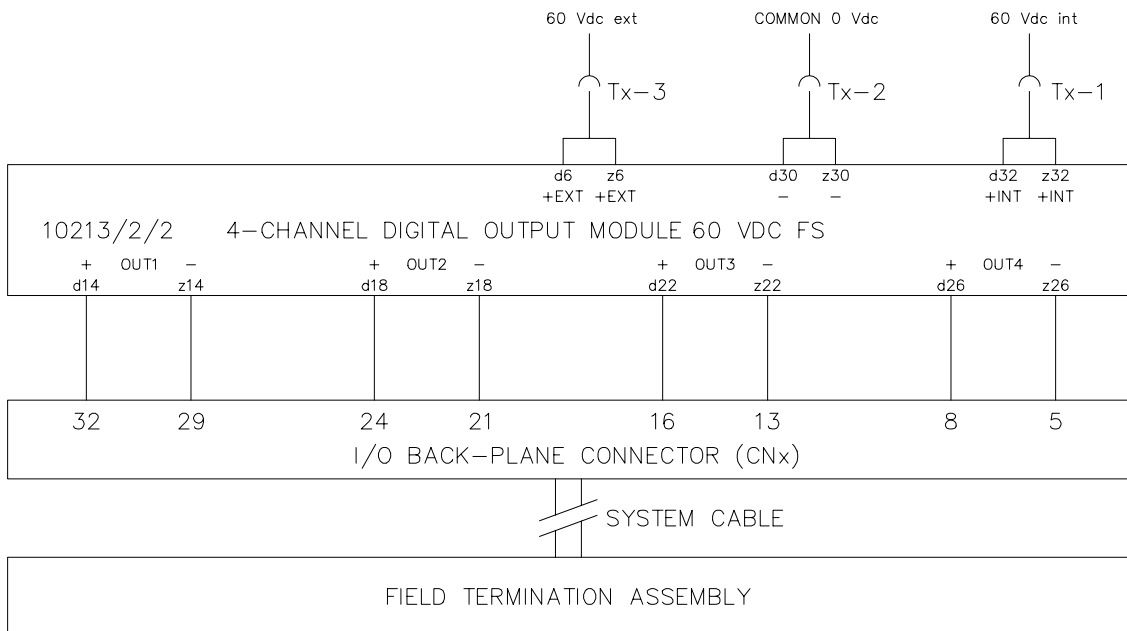
Figure 2   Connection example of 10213/2/2 module to FTA for both non-redundant and redundant I/O configurations

Figure 3   I/O connection example for 10213/2/2 module
for non-redundant I/O configurations
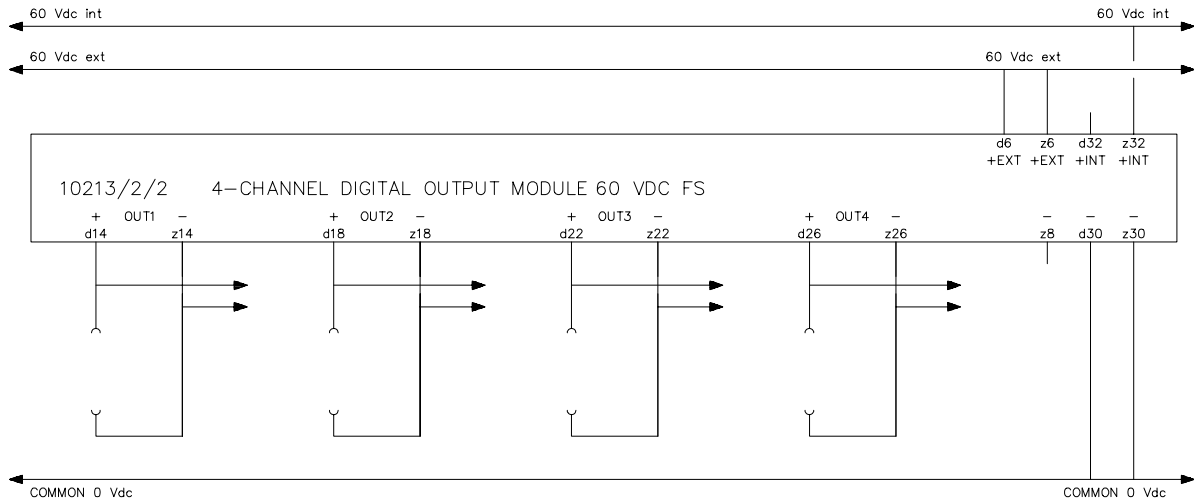
Figure 4   I/O connection example for 10213/2/2 module
for redundant I/O configurations

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).

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Technical data The 10213/2/2 module has the following specifications:

General

Type number:	10213/2/2 12101*
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Supply voltage:	60 Vdc $\pm$ 15 %
Power requirements:	5 Vdc 25 mA
	60 Vdc internal 20 mA
	60 Vdc external 20 mA (without output load)

Fuses

Fuse values:	1x 3.15 A
	3x 40 mA
Fuse type:	Round, TR5-F/19370K
Fuse dimensions:	$\varnothing$ 8.2 mm (0.32 in), height 7.7 mm (0.3 in)

Output

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

Key coding

(See 'Key coding' data sheet)

Module code:	
− holes	A9, C25
Rack code:	
− large pins	A9, C25

---

* Note:
10213/2/2 modules with suffix code 12101 have improved voltage readback near the minimum supply voltage (60 Vdc –15%).

Left blank intentionally.

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:
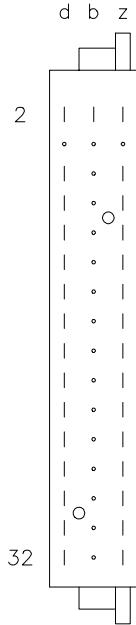
d2	WDG		b2	GND	z2	VCC
d4	–				z4	–
d6	Supply 48 Vdc ext.				z6	Supply 48 Vdc ext.
d8					z8	Supply 0 Vdc
d10					z10	
d12	(0 Vdc)				z12	(0 Vdc)
d14	OUT 1+				z14	OUT 1–
d16	(0 Vdc)				z16	(0 Vdc)
d18	OUT 2+				z18	OUT 2–
d20	(0 Vdc)				z20	(0 Vdc)
d22	OUT 3+				z22	OUT 3–
d24	(0 Vdc)				z24	(0 Vdc)
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.
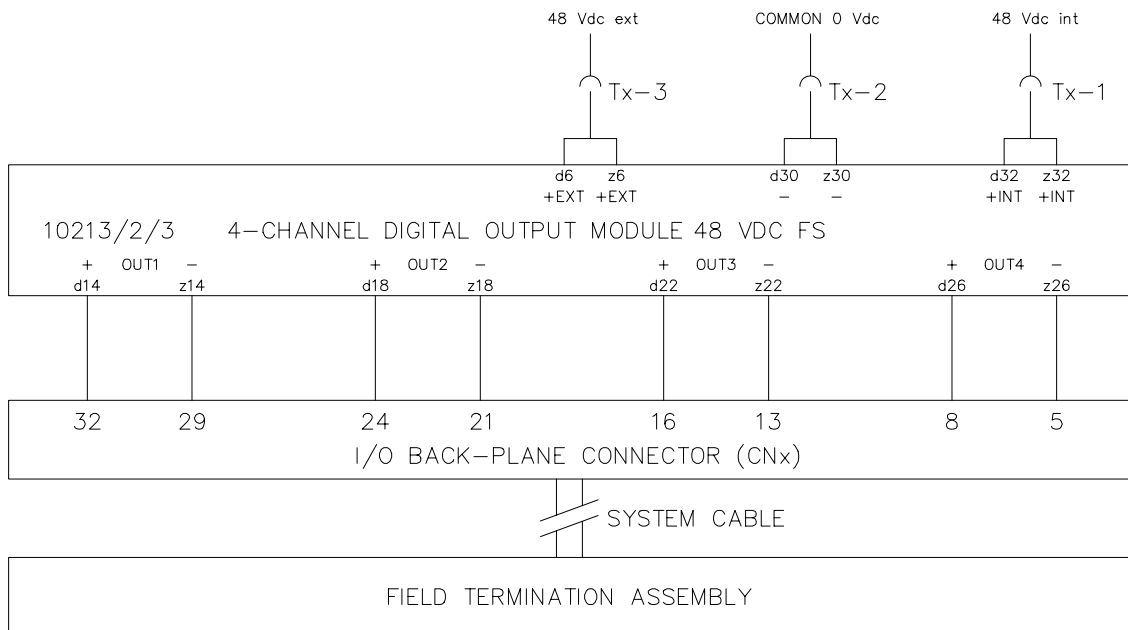
Figure 2   Connection example of 10213/2/3 module to FTA
for both non-redundant and redundant I/O configurations
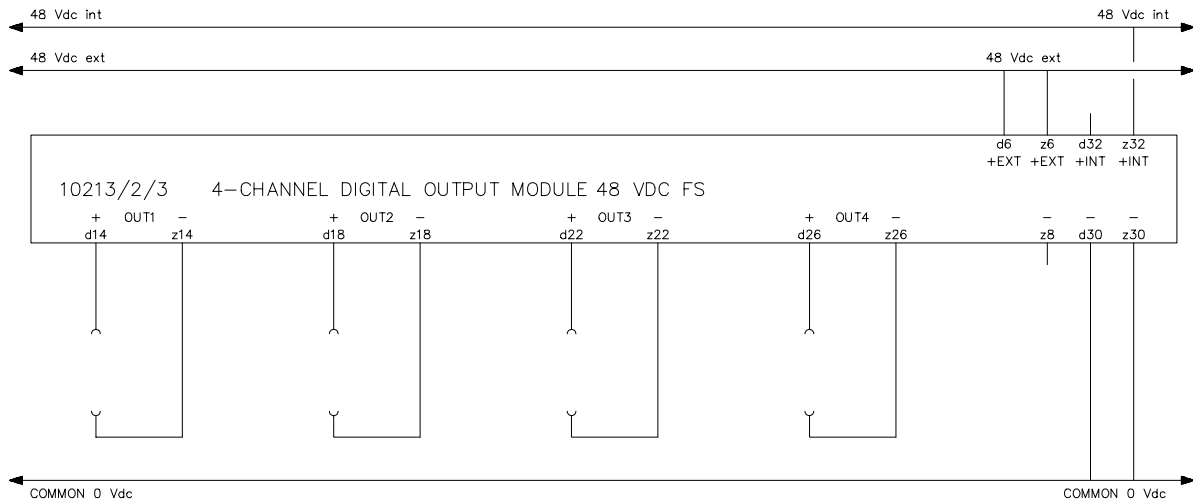
Figure 3   I/O connection example for 10213/2/3 module
for non-redundant I/O configurations
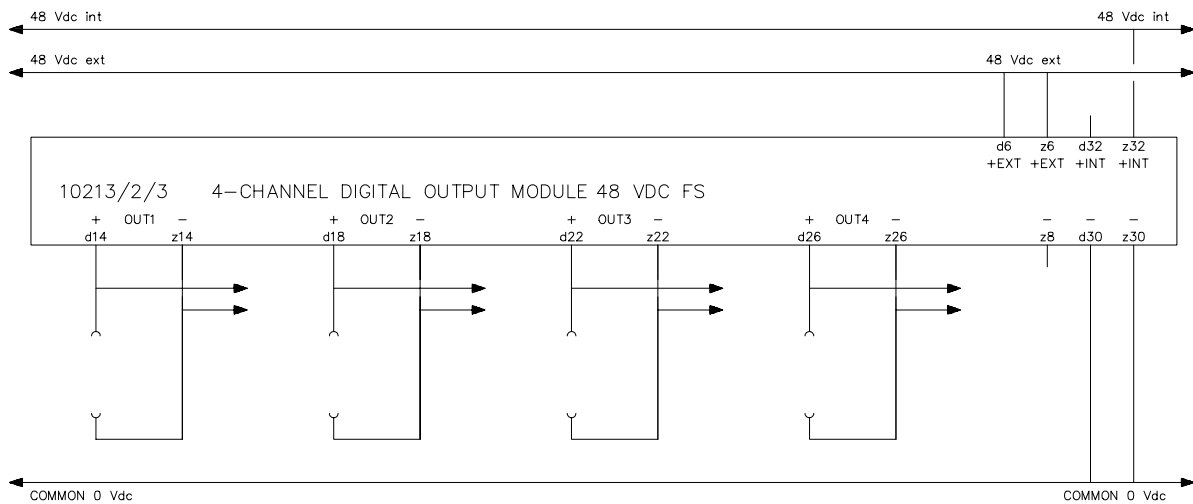
Figure 4   I/O connection example for 10213/2/3 module
for redundant I/O configurations

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:

General	Type number:	10213/2/3 12201*
	Approvals:	CE, TÜV, UL
	Software versions:	≥ 3.00
	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)

Output	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

Key coding	(See 'Key coding' data sheet)	
	Module code:	
	− holes	A9, C29
	Rack code:	
	− large pins	A9, C29

---

* Note:
10213/2/3 modules with suffix code 12201 have improved voltage readback near the minimum supply voltage (48 Vdc –15%).

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.
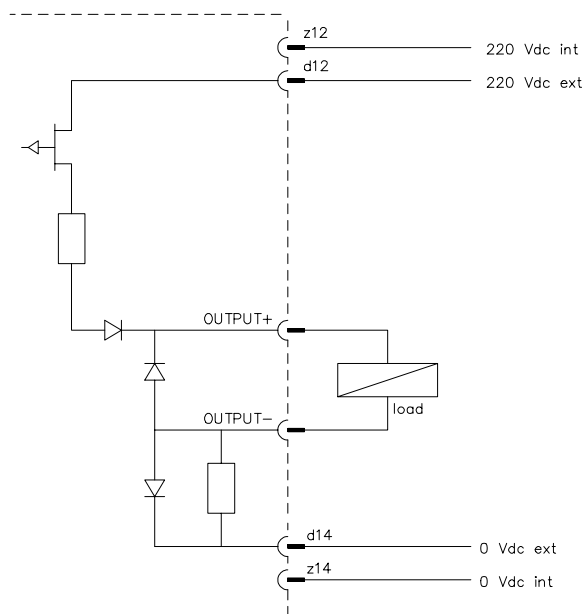
Figure 1   Schematic diagram for connection of one output to the 10214/1/2 module

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 (± 10%, 0.5 W),

- redundant channels: 50 kOhm (± 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:
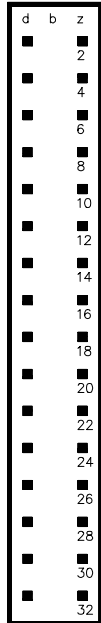
d2	WDG (5 Vdc)		z2	GND 5 Vdc	
d4			z4	Supply 5 Vdc	
d6			z6		
d8	Link		z8	Link	
d10			z10		
d12	Supply 220 Vdc ext.		z12	Supply 220 Vdc int.	
d14	Supply 0 Vdc ext.		z14	Supply 0 Vdc int.	
d16	P1.1		z16	P1.2	
d18	P1.3		z18	P1.4	
d20	OUT 1–		z20	OUT 1+	
d22	P2.1		z22	P2.2	
d24	P2.3		z24	P2.4	
d26	OUT 2–		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

220 Vdc int from CP1 or CP2   220 Vdc int from CP1 or CP2

220 Vdc ext from CP1 or CP2   220 Vdc ext from CP1 or CP2

```
                                                                           d12   z12
                                                                           +EXT  +INT

10214/1/2    3-CHANNEL DIGITAL OUTPUT MODULE   220 VDC FS

  +OUT1_  P1.1 P1.2 P1.3 P1.4 dummy    +OUT2_  P2.1 P2.2 P2.3 P2.4 dummy    +OUT3_  P3.1 P3.2 P3.3 P3.4 dummy    -EXT  -INT
  z20  d20 d16 z16 d18 z18 b20         z26  d26 d22 z22 d24 z24 b26         z32  d32 d28 z28 d30 z30 b32          d14   z14
```

LINK CURRENT RANGE SETTING

50 kOhm

Spare channel

COMMON 0 Vdc ext   COMMON 0 Vdc ext

0 Vdc int from CP1 or CP2   0 Vdc int from CP1 or CP2
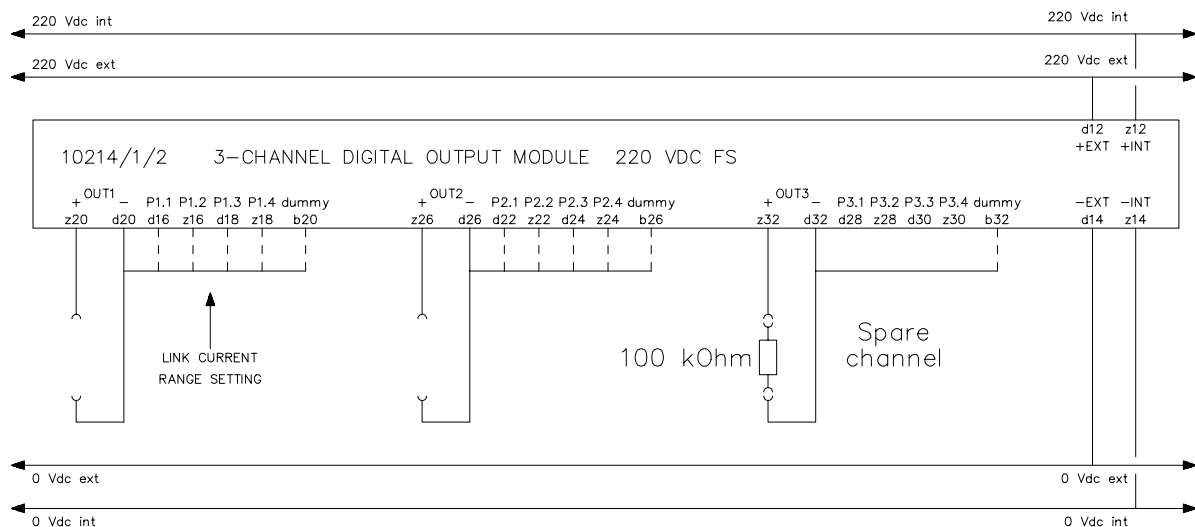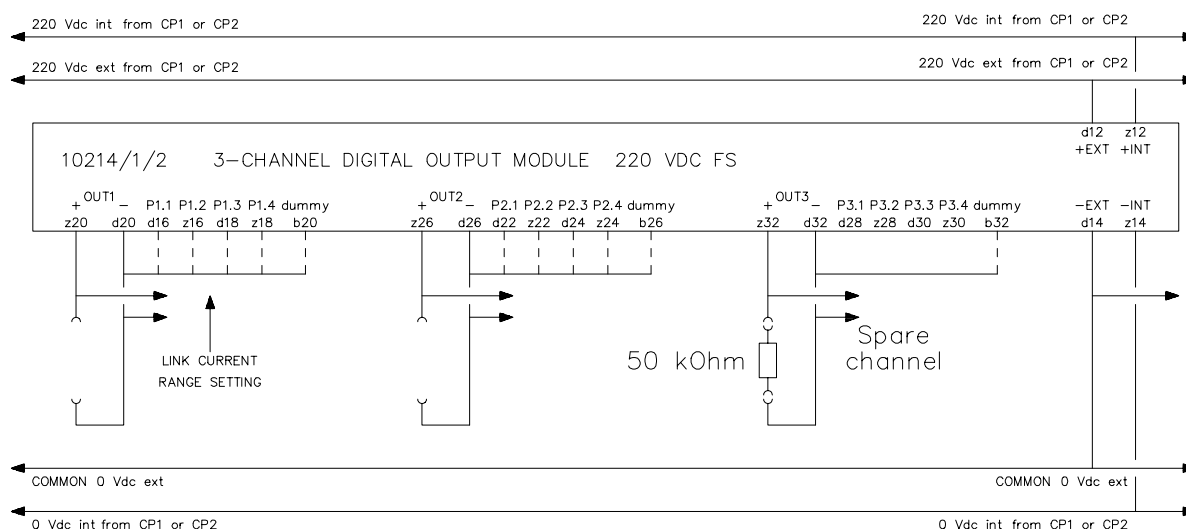
Figure 3   Connection example for redundant I/O configurations

---

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:

General

Type number:	10214/1/2 03201*
Approvals:	CE, TÜV
Software versions:	≥ 2.78e
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

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)

Fuses	Fuse values:	1x 1.0 A
		3x 40 mA
	Fuse type:	Round, TR5-F/19370K
	Fuse dimensions:	$\varnothing$ 8.2 mm (0.32 in),
		height 7.7 mm (0.3 in)

Output	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.

Left blank intentionally.

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.
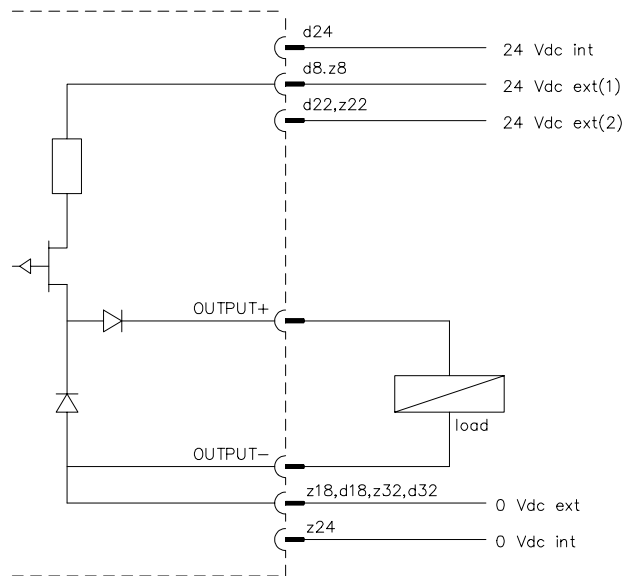
Figure 1   Schematic diagram for connection of one output (output 1-2) to the 10215/1/1 module

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:
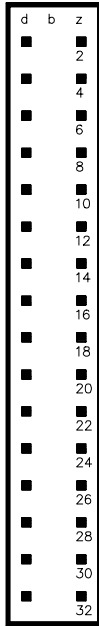
d2	WDG 1 (5 Vdc)	z2	GND 5 Vdc
d4	WDG 2 (5 Vdc)	z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext. (1)	z8	Supply 24 Vdc ext. (1)
d10		z10	
d12	OUT 1–	z12	OUT 1+
d14	(0 Vdc)	z14	(0 Vdc)
d16	OUT 2–	z16	OUT 2+
d18	Supply 0 Vdc	z18	Supply 0 Vdc
d20	link	z20	link
d22	Supply 24 Vdc ext. (2)	z22	Supply 24 Vdc ext. (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.
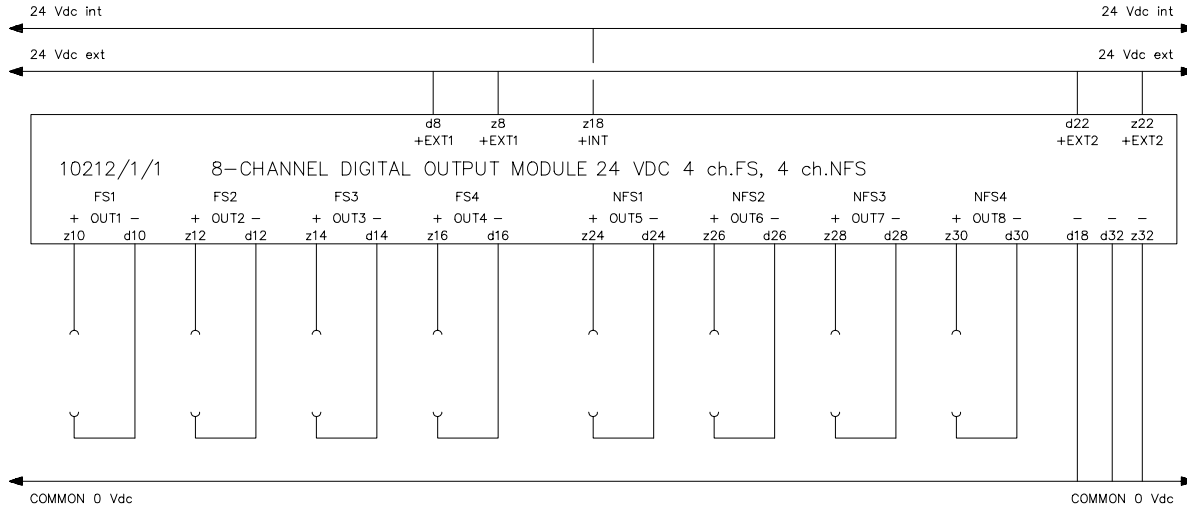

Figure 2   Connection example for non-redundant I/O configurations
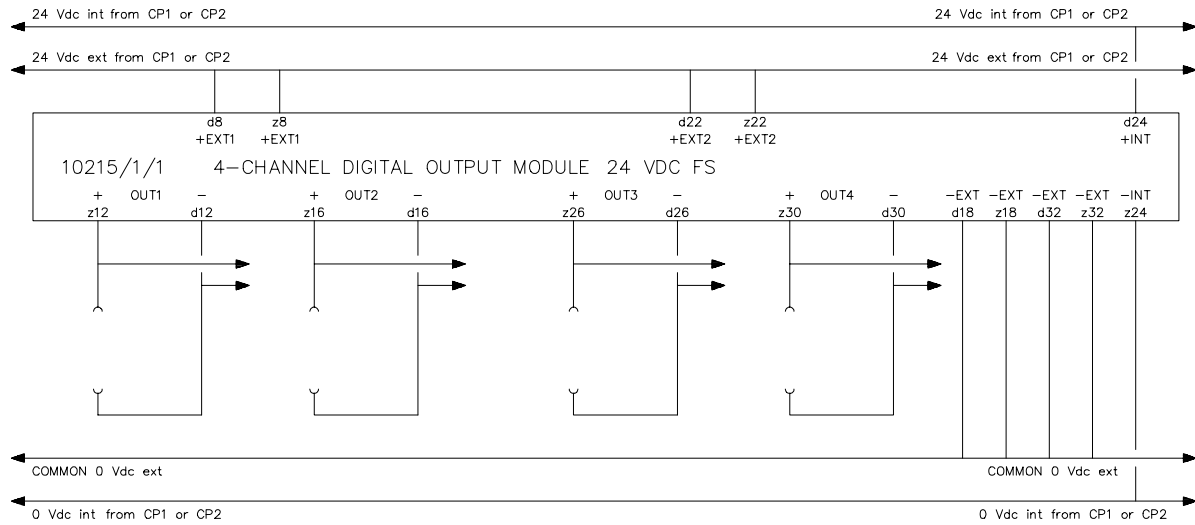
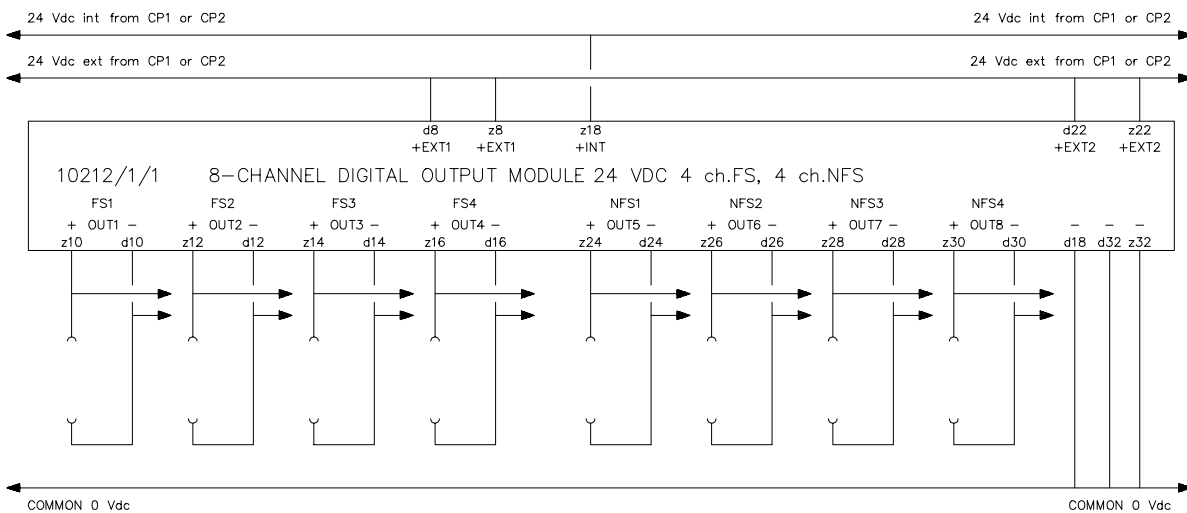Figure 3   Connection example for redundant I/O configurations

---

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:

General

Type number:	10215/1/1 05701*
Approvals:	CE, TÜV, UL
Software versions:	≥ 2.78f
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 12 mA
	24 Vdc internal 35 mA
	24 Vdc external 2∗25 mA (without output load)

Technical data (continued)

Output	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 µF
	Voltage drop:	< 1.3 Vdc at 2 A
	Off current:	< 0.1 mA
	WDG input current:	2∗4 mA

Key coding	(See 'Key coding' data sheet)	
	Module code:	
	− hole	A27
	− pins	C19, C23, C31
	Rack code:	
	− blind stops	C3, C11, C27
	− large pin	A27

* Note:
10215/1/1 modules with suffix code 05701 have an improved
external power voltage range.

Honeywell

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.
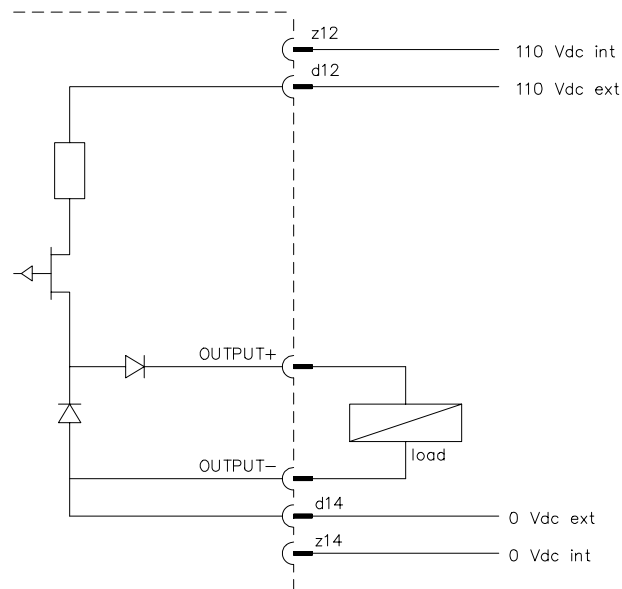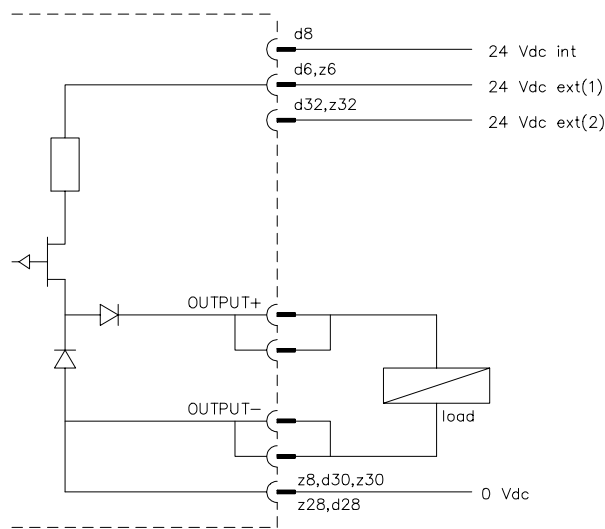

Figure 1   Schematic diagram for connection of one output (output 1-2) to the 10215/2/1 module

Honeywell

Pin allocation

The back view and pin allocation of the 10215/2/1 module connector are as follows:
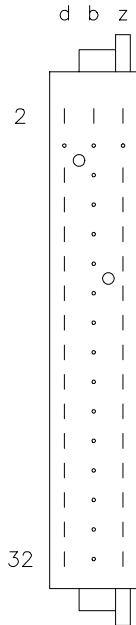
d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 24 Vdc ext. 1			z6	Supply 24 Vdc ext. 1
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	OUT 1+			z12	OUT 1–
d14	OUT 1+			z14	OUT 1–
d16	OUT 2+			z16	OUT 2–
d18	OUT 2+			z18	OUT 2–
d20	OUT 3+			z20	OUT 3–
d22	OUT 3+			z22	OUT 3–
d24	OUT 4+			z24	OUT 4–
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.
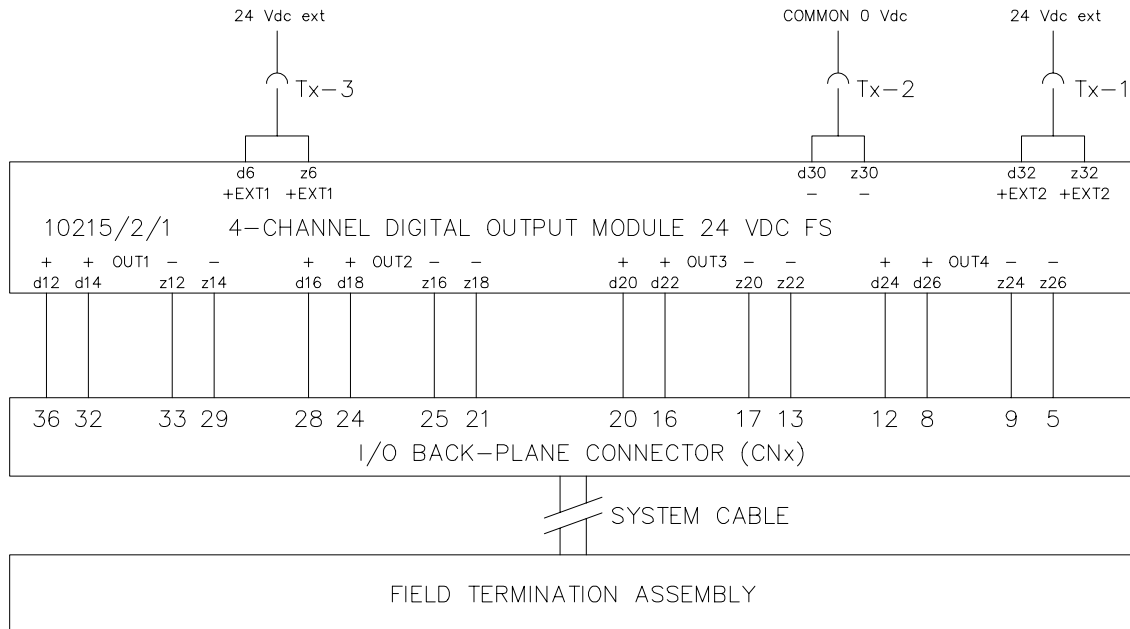
Figure 2   Connection example of 10215/2/1 module to FTA
for both non-redundant and redundant I/O configurations

24 Vdc int   24 Vdc int

24 Vdc ext   24 Vdc ext

```
                    d6    z6                          d32   z32                        d8
                   +EXT1 +EXT1                       +EXT2 +EXT2                       +INT

  10215/2/1    4-CHANNEL DIGITAL OUTPUT MODULE 24 VDC FS

   +   +  OUT1  -   -      +   +  OUT2  -   -      +   +  OUT3  -   -      +   +  OUT4  -   -    -EXT  -EXT  -EXT  -EXT  -INT
  d12 d14     z12 z14    d16 d18     z16 z18    d20 d22     z20 z22    d24 d26     z24 z26   d28  z28  d30  z30  z8
```

COMMON 0 Vdc   COMMON 0 Vdc

Figure 3   I/O connection example for 10215/2/1 module
for non-redundant I/O configurations

24 Vdc int from CP1 or CP2   24 Vdc int from CP1 or CP2

24 Vdc ext   24 Vdc ext

```
                    d6    z6                          d32   z32                        d8
                   +EXT1 +EXT1                       +EXT2 +EXT2                       +INT

  10215/2/1    4-CHANNEL DIGITAL OUTPUT MODULE 24 VDC FS

   +   +  OUT1  -   -      +   +  OUT2  -   -      +   +  OUT3  -   -      +   +  OUT4  -   -    -EXT  -EXT  -EXT  -EXT  -INT
  d12 d14     z12 z14    d16 d18     z16 z18    d20 d22     z20 z22    d24 d26     z24 z26   d28  z28  d30  z30  z8
```

COMMON 0 Vdc   COMMON 0 Vdc

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
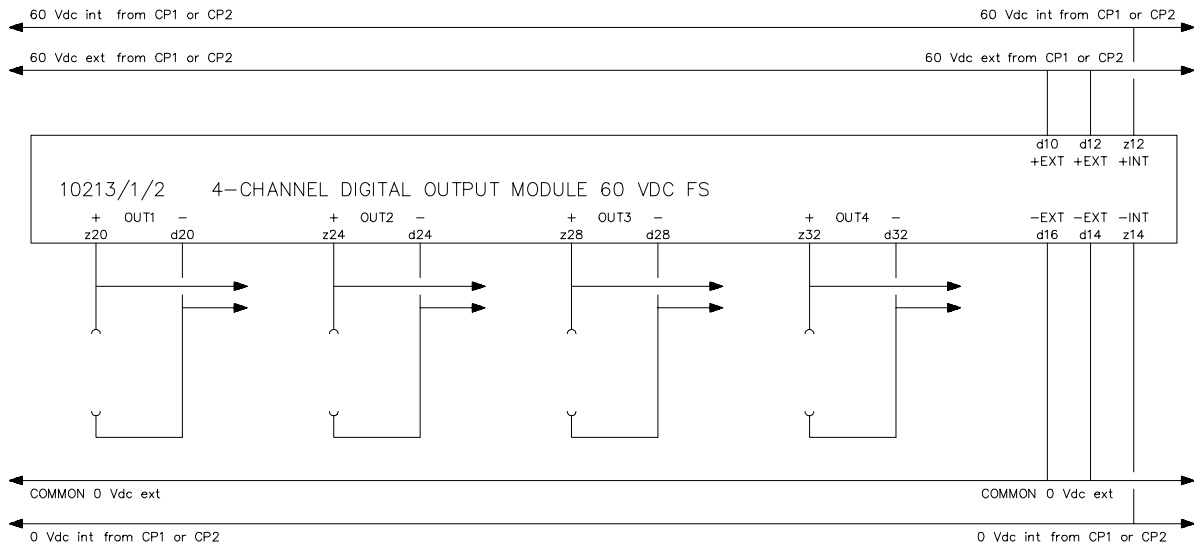connected to both output groups to prevent fault detection during
the self-test of the output module (pins d6/z6, d8, d30/z30 and
d32/z32)

Honeywell

Technical data   The 10215/2/1 module has the following specifications:

General

Type number:	10215/2/1 12302
Approvals:	CE, TÜV, UL
Software versions:	≥ 3.00
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power

Power requirements:	5 Vdc 12 mA
	24 Vdc internal 35 mA
	24 Vdc external 2 ∗ 25 mA (without output load)

Output

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 μF
Voltage drop:	< 1.3 Vdc at 2 A
Off current:	< 0.1 mA
WDG input current:	8 mA

Key coding

(See 'Key coding' data sheet)

Module code:	
− holes	A13, C5
Rack code:	
− large pins	A13, C5

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.
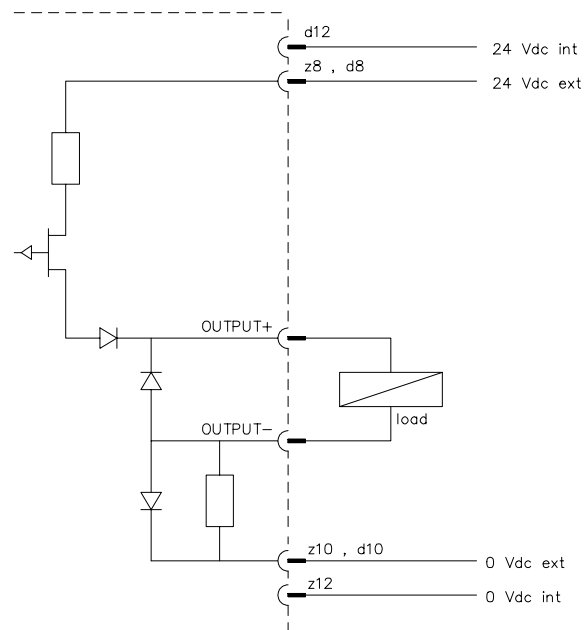
Figure 1   Schematic diagram for connection of one output to the 10216/1/1 module

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
$\geq$ 4.8 W	$\geq$ 200 mA	$\geq$ 9.6 W	$\geq$ 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:
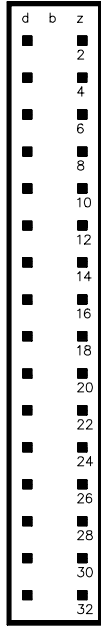
d2	WDG (5 Vdc)	z2	GND 5 Vdc
d4		z4	Supply 5 Vdc
d6		z6	
d8	Supply 24 Vdc ext.	z8	Supply 24 Vdc ext.
d10	Supply 0 Vdc ext.	z10	Supply 0 Vdc ext.
d12	Supply 24 Vdc int.	z12	Supply 0 Vdc int.
d14	P1.1	z14	P2.1
d16	P3.1	z16	P4.1
d18	P1.2	z18	P2.2
d20	P3.2	z20	P4.2
d22	P1.3	z22	P2.3
d24	P3.3	z24	P4.3
d26	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.
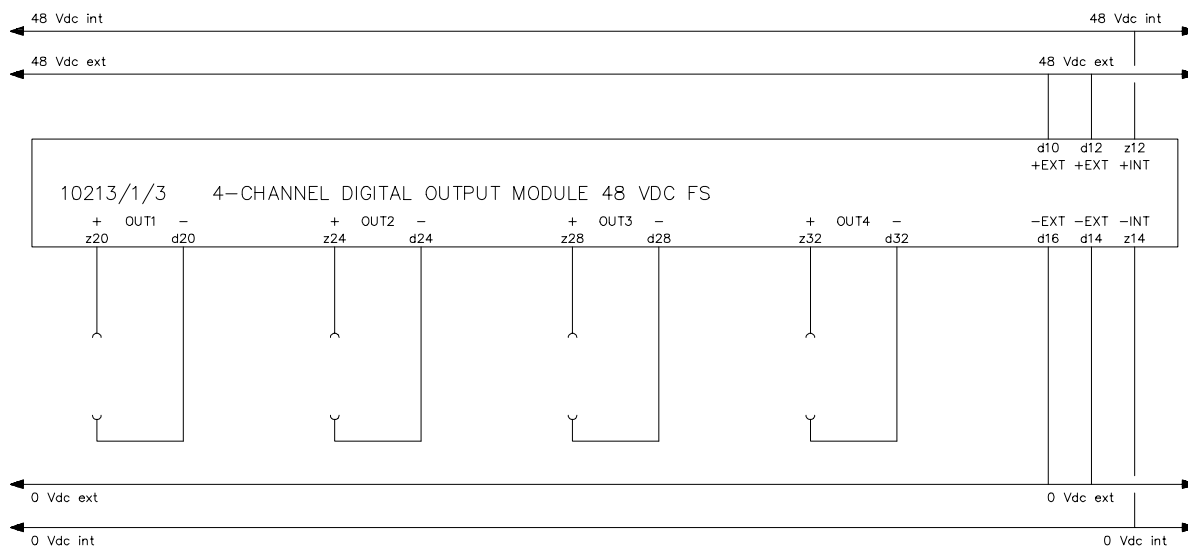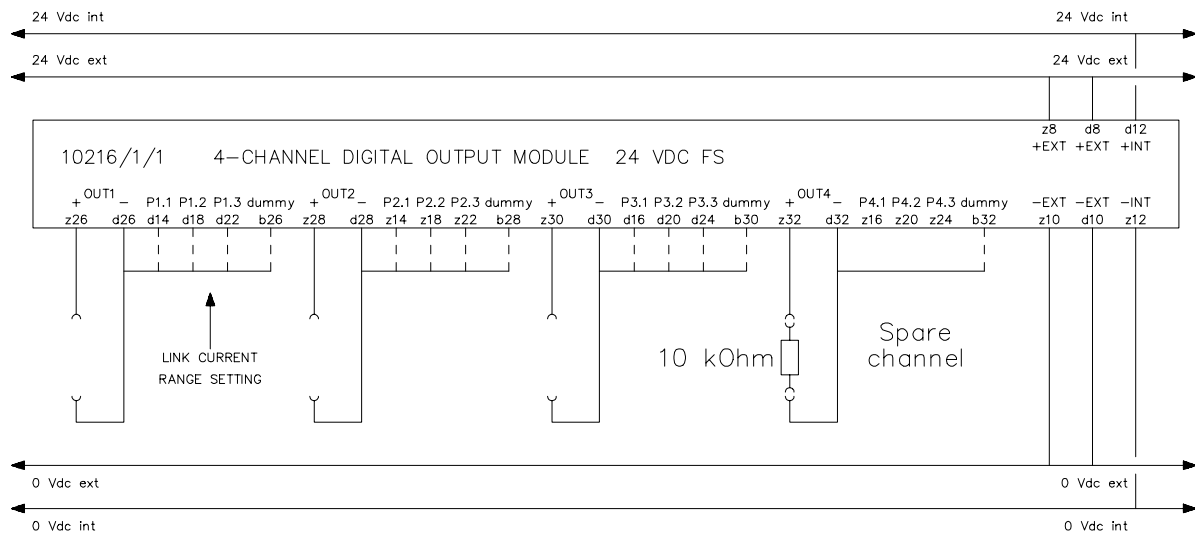

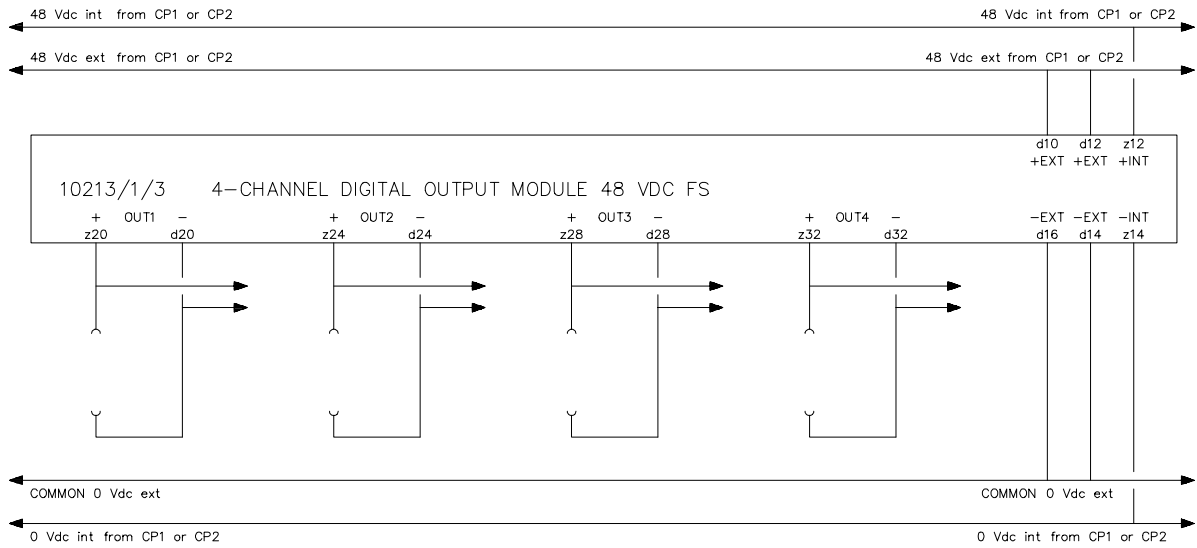Figure 2   Connection example for non-redundant I/O configurations
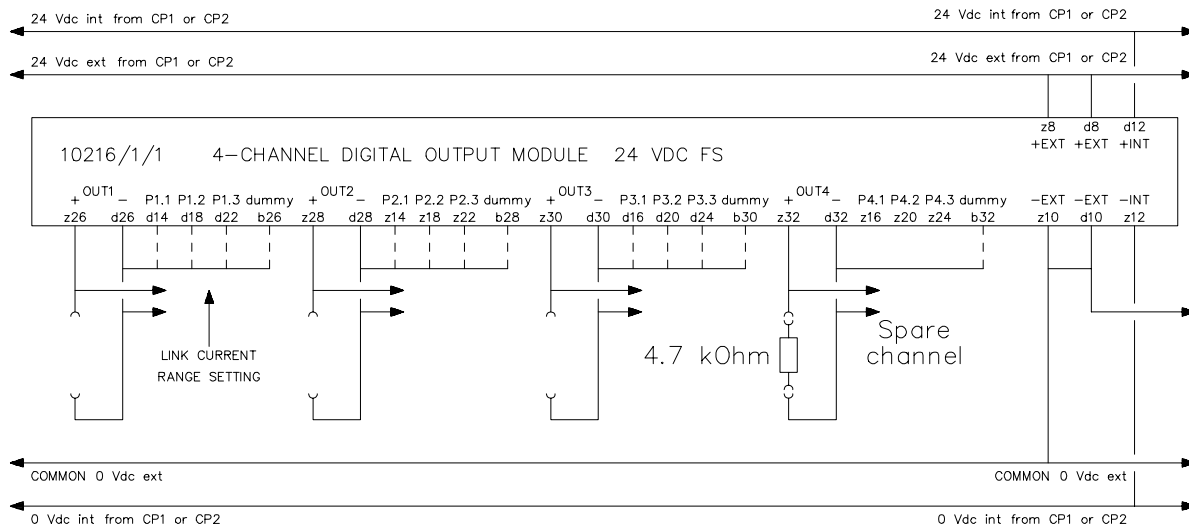
Figure 3   Connection example for redundant I/O configurations

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)

Output	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 µF
	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

Key coding	(See 'Key coding' data sheet)	
	Module code:	
	− hole	A19
	− pins	C3, C11, C23
	Rack code	
	− blind stops	C19, C27, C31
	− large pin	A19

* 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.

Left blank intentionally.

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.
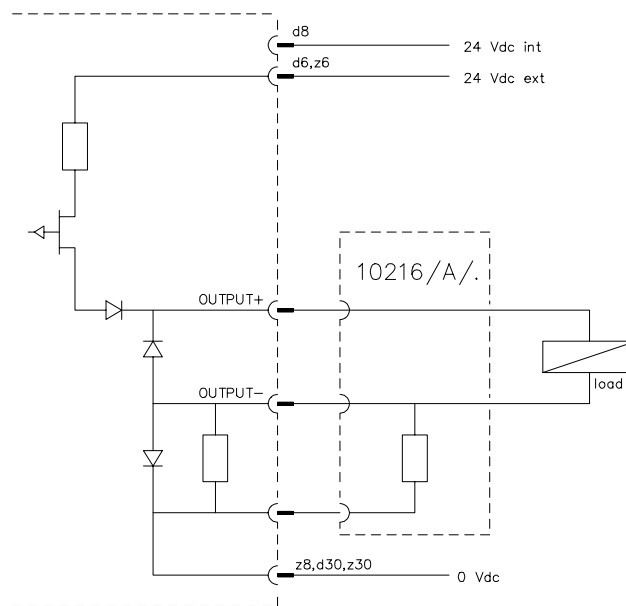
Figure 1   Schematic diagram for connection of one output
to the 10216/2/1 module

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:
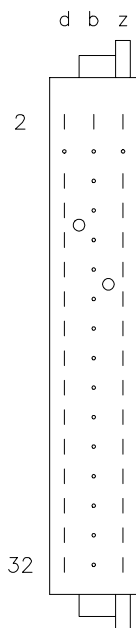
d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 24 Vdc ext.			z6	Supply 24 Vdc ext.
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	(0 Vdc)			z12	(0 Vdc)
d14	OUT 1+			z14	OUT 1–
d16	0 Vdc			z16	0 Vdc
d18	OUT 2+			z18	OUT 2–
d20	0 Vdc			z20	0 Vdc
d22	OUT 3+			z22	OUT 3–
d24	0 Vdc			z24	0 Vdc
d26	OUT 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
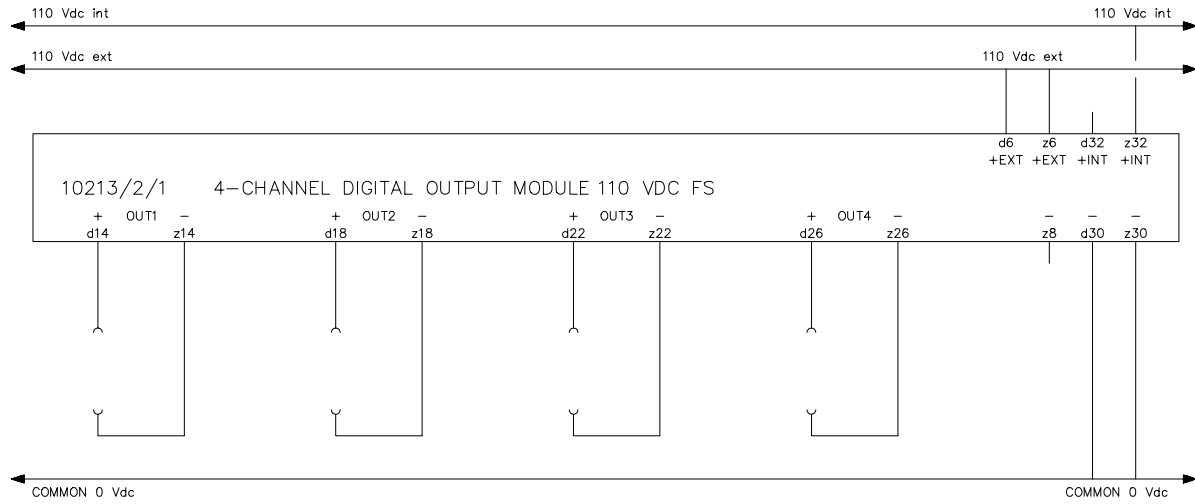for both non-redundant and redundant I/O configurations

---

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.

Honeywell

Technical data The 10216/2/1 module has the following specifications:

General
Type number:	10216/2/1 12400
Approvals:	CE, TÜV, UL
Software versions	≥ 3.00
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)

Output
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 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

Key coding
(See 'Key coding' data sheet)
Module code:
− holes	A13, C9

Rack code:
− large pins	A13, C9

Honeywell

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.
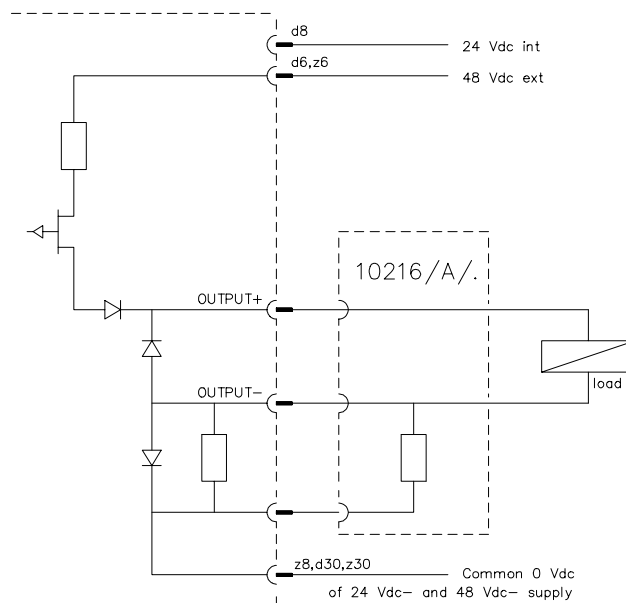
Figure 1   Schematic diagram for connection of one output to the 10216/2/3 module

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.
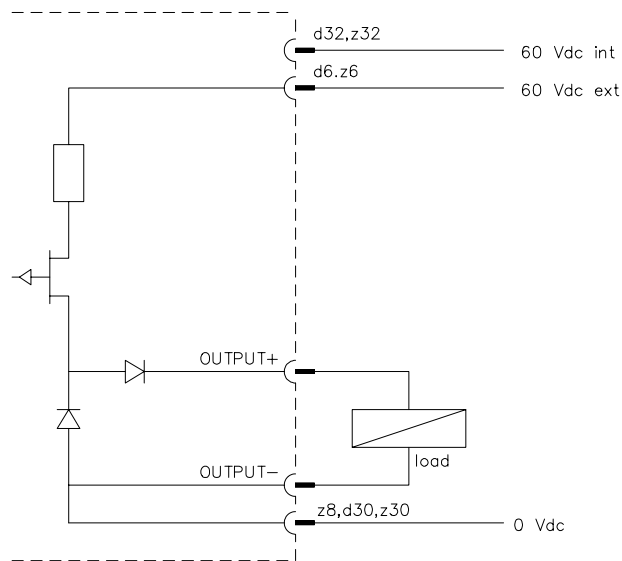
Notes:
The 10216/2/3 module can only be used in combination with an I/O backplane in the rack, since the outputs require a 10216/A/. module.
The 24 Vdc (internal) and the 48 Vdc (external) must have a common 0 Vdc connection.

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:
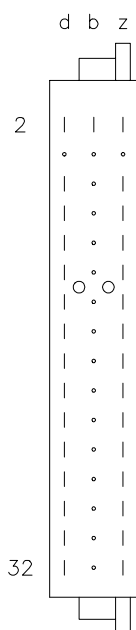
d2	WDG	b2	GND	z2	VCC
d4	–			z4	–
d6	Supply 48 Vdc ext.			z6	Supply 48 Vdc ext.
d8	Supply 24 Vdc int.			z8	Supply 0 Vdc
d10				z10	
d12	(0 Vdc)			z12	(0 Vdc)
d14	OUT 1+			z14	OUT 1–
d16	0 Vdc			z16	0 Vdc
d18	OUT 2+			z18	OUT 2–
d20	0 Vdc			z20	0 Vdc
d22	OUT 3+			z22	OUT 3–
d24	0 Vdc			z24	0 Vdc
d26	OUT 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
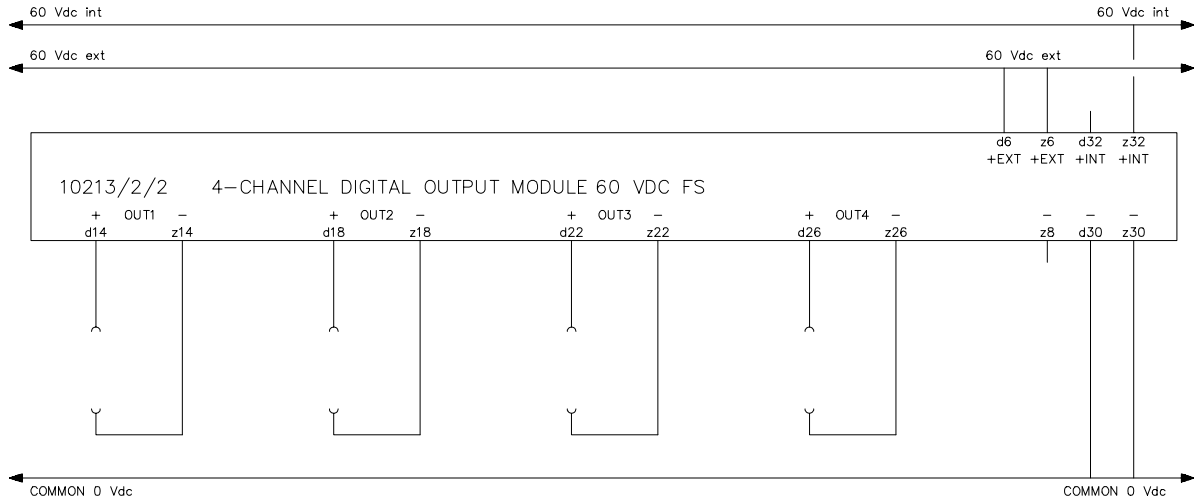for both non-redundant and redundant I/O configurations

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:

General
Type number:	10216/2/3 13400
Approvals:	CE, TÜV, UL
Software versions:	≥ 310
Space requirements:	4 TE, 3 HE (= 4 HP, 3U)

Power
Power requirements:	5 Vdc 15 mA
	24 Vdc internal 50 mA
	48 Vdc external 15 mA (without output load)

Output
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

Key coding
(See 'Key coding' data sheet)
Module code:
− holes	A13, C13

Rack code:
− large pins	A13, C13

10216/A/.   Range-setting modules

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.
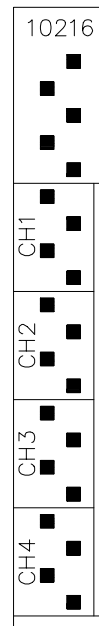
Figure 1   10216 positioning print

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.

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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.
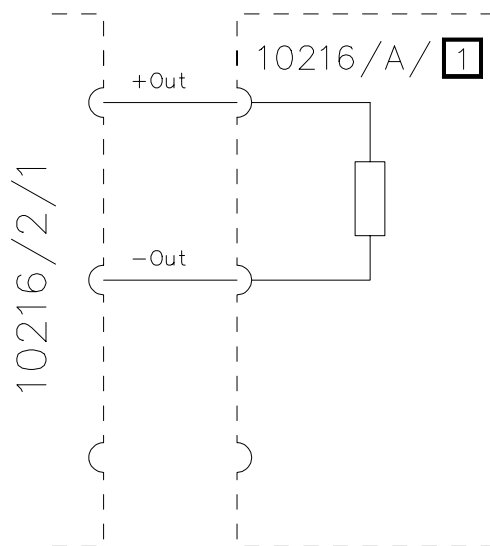
Figure 2   Schematic diagram of a 10216/A/1 module

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.
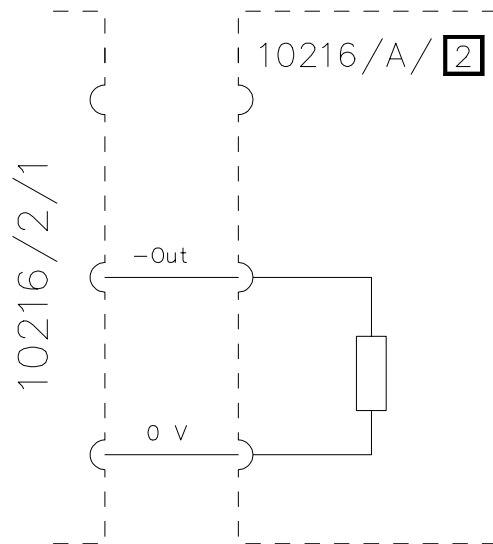
Figure 3   Schematic diagram of a 10216/A/2 module

Technical data

The 10216/A/2 module has the following specifications:

General

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)

Power

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

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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.
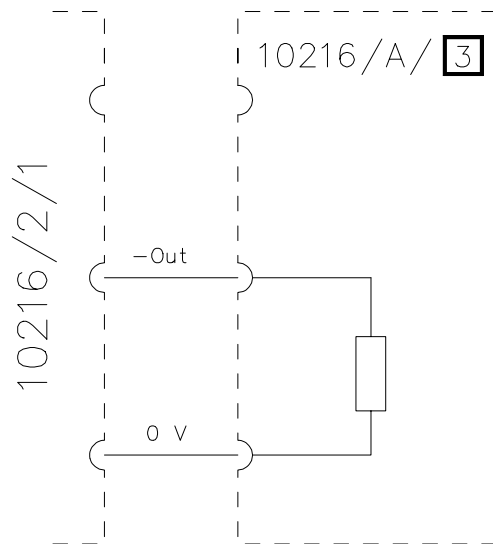
Figure 4   Schematic diagram of a 10216/A/3 module

Technical data

The 10216/A/3 module has the following specifications:

General

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)

Power

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.
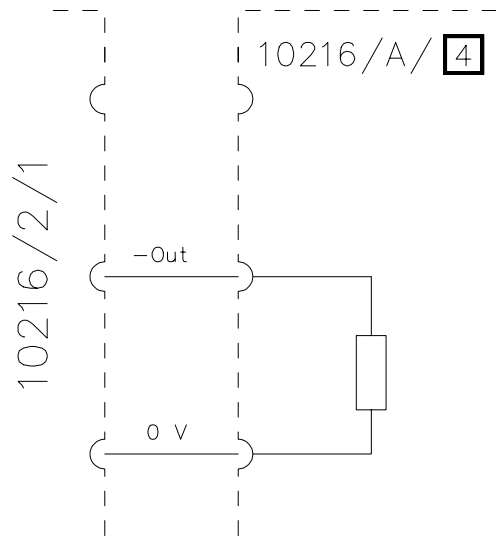
Figure 5   Schematic diagram of a 10216/A/4 module

Technical data

The 10216/A/4 module has the following specifications:

General

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)

Power

Power requirements:	none
Load range:	≥ 200 mA
	≥ 4.8 W at 24 Vdc
	≥ 9.6 W at 48 Vdc

.

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Section 7:
FSC Modules for Special Functions

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Section 7: FSC Modules for Special Functions

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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
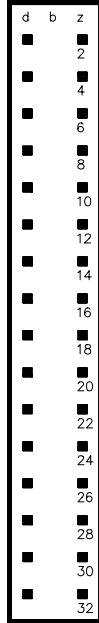
d2   WDG1 (5 Vdc)   z2   GND 5 Vdc
d4   WDG2 (5 Vdc)   z4   Supply 5 Vdc
d6   z6
d8   GND 5 Vdc   z8   GND 5 Vdc
d10 WDR OUT   z10   WDR OUT
d12 GND 5 Vdc   z12   GND 5 Vdc
d14   z14
d16   z16
d18   z18
d20   z20
d22   z22
d24 Link   z24   Link
d26   z26
d28   z28
d30 Supply 24 Vdc   z30
d32 Supply 0 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

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:
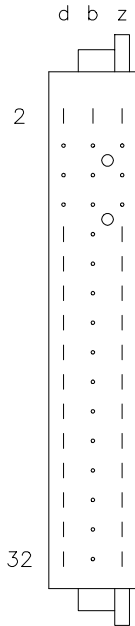
d2		b2	GND 5 Vdc	z2	Supply 5 Vdc
d4	–			z4	–
d6	–			z6	–
d8	–			z8	–
d10	(GND 5 Vdc)			z10	(GND 5 Vdc)
d12	WDG1 IN			z12	WDG2 IN
d14	GND 5 Vdc			z14	(GND 5 Vdc)
d16	WDG OUT			z16	(GND 5 Vdc)
d18	(GND 5 Vdc)			z18	(GND 5 Vdc)
d20				z20	
d22				z22	
d24				z24	
d26				z26	
d28				z28	
d30	Supply 0 Vdc			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

Honeywell

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 mm² (AWG 14).

The PSD module may only be exchanged with the power supply to its PSU switched off.
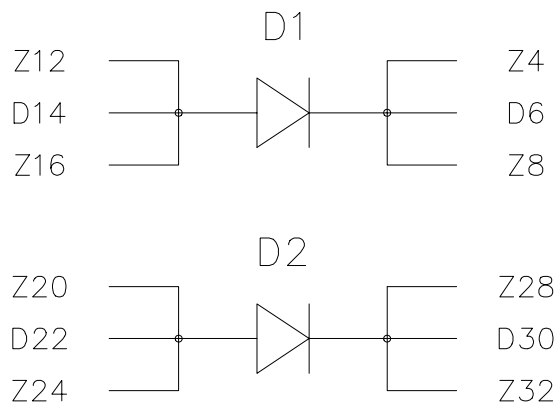
Figure 1   Schematic diagram of 10303/1/1 module

Technical data   The 10303/1/1 module has the following specifications:

General   Type number: 10303/1/1   03501*
                Approvals: CE, TÜV, UL
                Software versions: all
                Space requirements: 4 TE, 3 HE (= 4 HP, 3U)

Power   Power requirements: none
                Max. current: 20 A (module dissipation limit)*
                Max. forward voltage drop: 0.55 V
                Max. reverse voltage: 30 V

Connector   Connector type: DIN 41612-H 15 P (faston)
                Max. connector current: 10 A per pin

---

* Note:
10303/1/1 modules without a suffix code have a maximum
current of 12 A.

Honeywell

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.
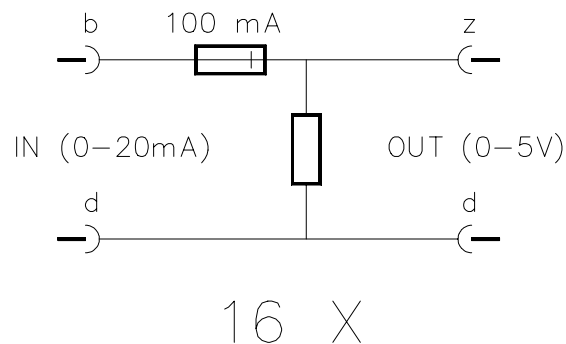
Figure 1   Schematic diagram of one 10305/1/1 channel

Pin allocation

The back view and pin allocation of the 10305/1/1 rack connector are as follows:
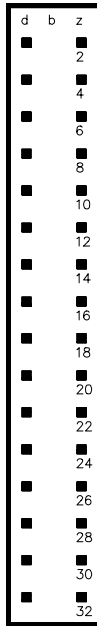
d2	GND 16	b2	IN 16	z2	OUT 16
d4	GND 15	b4	IN 15	z4	OUT 15
d6	GND 14	b6	IN 14	z6	OUT 14
d8	GND 13	b8	IN 13	z8	OUT 13
d10	GND 12	b10	IN 12	z10	OUT 12
d12	GND 11	b12	IN 11	z12	OUT 11
d14	GND 10	b14	IN 10	z14	OUT 10
d16	GND 9	b16	IN 9	z16	OUT 9
d18	GND 8	b18	IN 8	z18	OUT 8
d20	GND 7	b20	IN 7	z20	OUT 7
d22	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:

General
Type number:	10305/1/1
Approvals:	CE, TÜV, UL
Software versions:	≥ 2.77
Space requirements	4 TE, 3 HE (= 4 HP, 3U)

Power
Power requirements:	none (passive)

Input/output
Number of channels:	16
Input:	0-25 mA
Output:	0-6.25 V
Resistor value:	250 Ohm 0.1% 2.5 W

Key coding   (See 'Key coding' data sheet)

Module code:
- hole   A27
- pins   C11, C19, C27

Rack code:
- blind stops   C3, C23, C31
- large pin   A27

Left blank intentionally.

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).
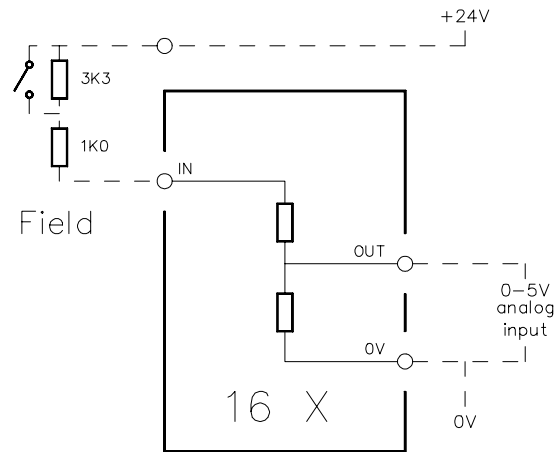
Figure 1   Schematic diagram for connection to the 10305/1/2 module

Pin allocation

The back view and pin allocation of the 10305/1/2 rack connector are as follows:
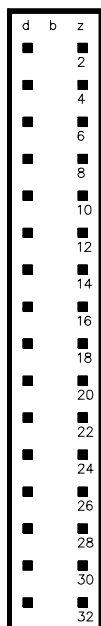
d2	IN 16	b2	0 V 16	z2	OUT 16
d4	IN 15	b4	0 V 15	z4	OUT 15
d6	IN 14	b6	0 V 14	z6	OUT 14
d8	IN 13	b8	0 V 13	z8	OUT 13
d10	IN 12	b10	0 V 12	z10	OUT 12
d12	IN 11	b12	0 V 11	z12	OUT 11
d14	IN 10	b14	0 V 10	z14	OUT 10
d16	IN 9	b16	0 V 9	z16	OUT 9
d18	IN 8	b18	0 V 8	z18	OUT 8
d20	IN 7	b20	0 V 7	z20	OUT 7
d22	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:

General   Type number: 10305/1/2   08300
                Approvals: CE, TÜV, UL

Power   Input voltage (+ to 0 V):   max. 36 V
                Input current: max. 12 mA at 24 Vdc

Connector   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)

Key coding (See 'Key coding' data sheet)
                Module code:
                  – hole   A23
                  – pins   C3, C19, C23
                Rack code:
                  – blind stops   C11, C27, C31
                  – large pin   A23

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

Top view   Side view   Bottom view
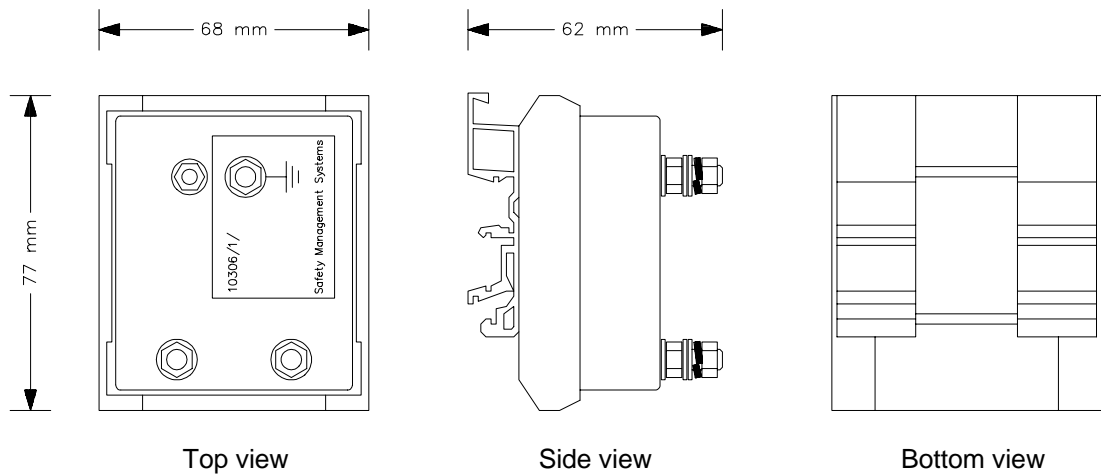
Figure 1   10306/1/. mechanical layout

The 10306/1/. modules have a universal snap-in facility for standard DIN EN rails.
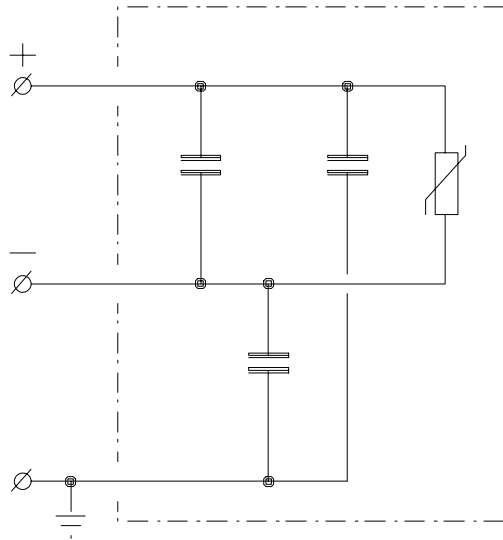
Figure 2   10306/1/. circuit

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 mm² (AWG 10) and a maximum length of 10 cm (4 in).
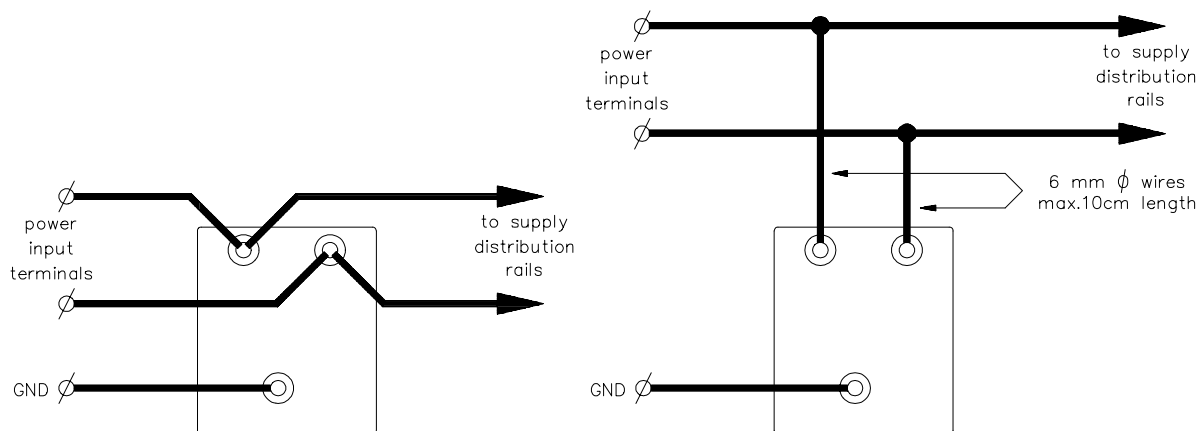
Figure 3   Wiring examples for 10306/1/. modules

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Technical data The 10306/1/. modules have the following specifications:

General
Type number:	10306/1/1 to 10306/1/5
Approvals:	CE, TÜV, UL

Physical
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)

Power
Power requirements:	none
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

Terminations
Connection type:	M5

Left blank intentionally.

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).
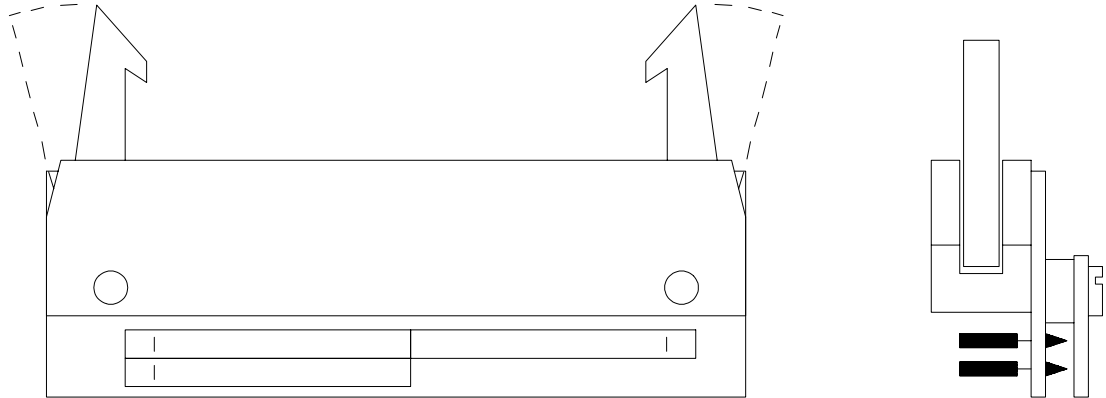
Figure 1   Mechanical layout

Technical data

The 10307/1/1 module has the following specifications:

General	Type number:	10307/1/1
	Approvals:	CE, TÜV, UL
Power	Power requirements:	50 mA (from 5 Vdc of vertical bus driver, VBD)
Physical	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)

Left blank intentionally.

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.
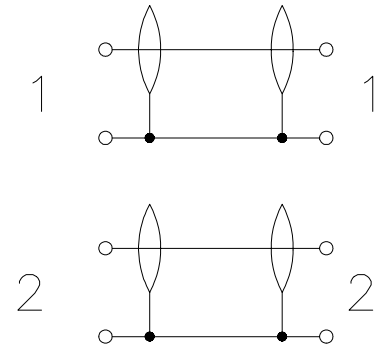
Figure 1

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.
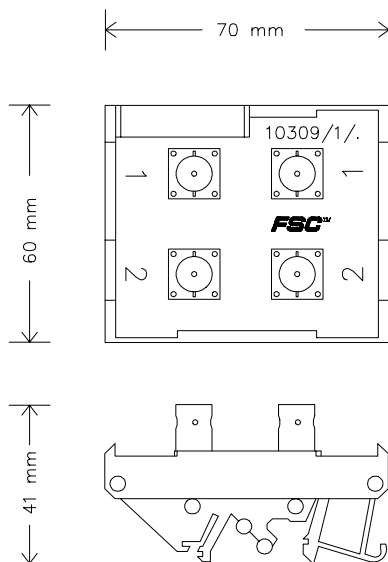
Figure 2
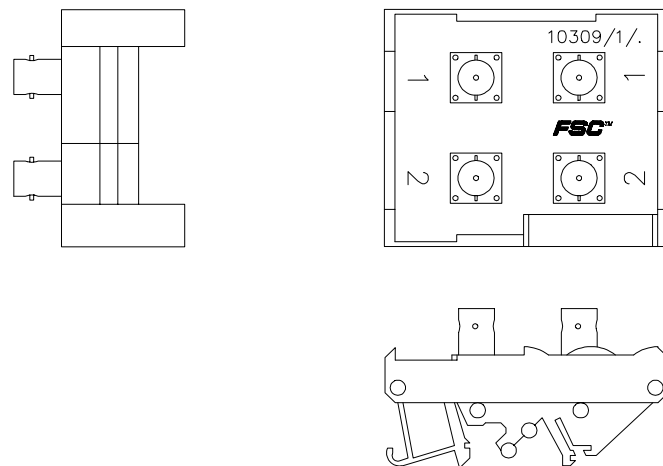
Figure 3

Technical data   The 10309/1/1 module has the following specifications:

General   Type number: 10309/1/1   09600
                Approvals: CE, TÜV, UL

Physical   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)

Connectors BNC connectors: 50/75 Ohm jack
                Frequency range: DC ... 50 MHz

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).
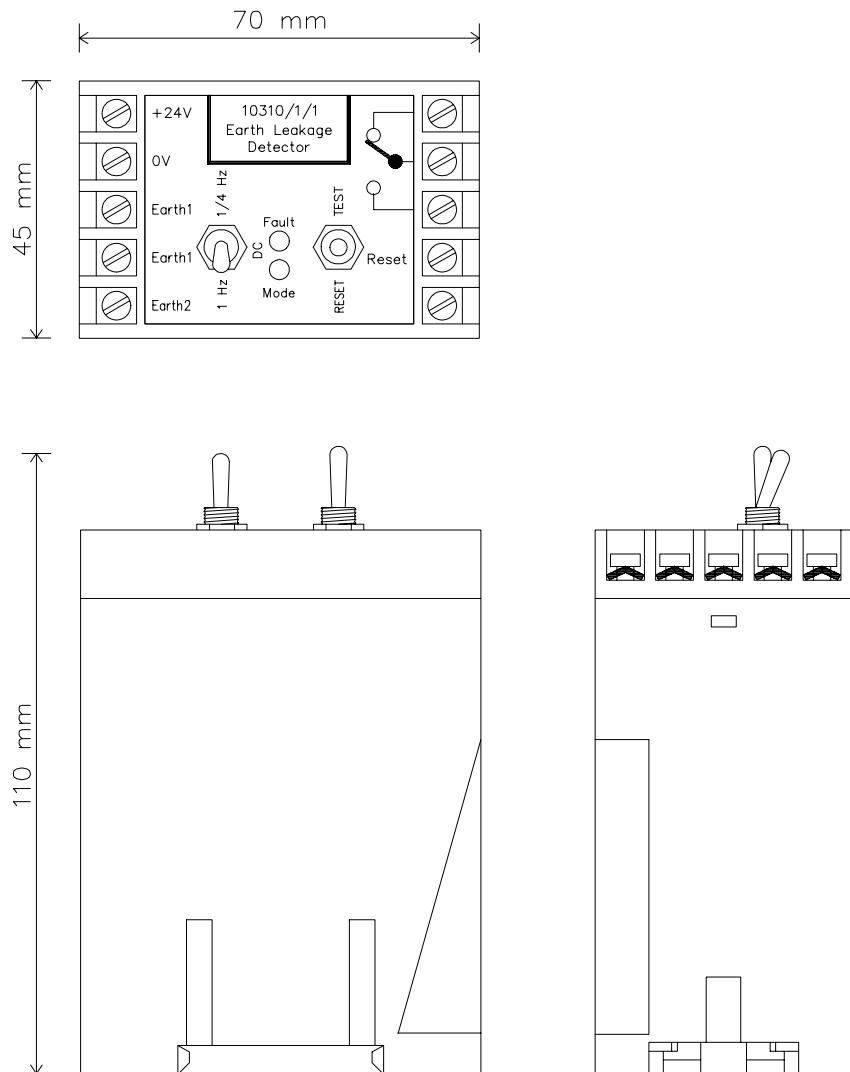
Figure 1   Module layout

The module has a universal snap-in facility for standard 35 mm DIN EN rails.

The ELD module connects earth level with –12 Vdc (referenced to the 0 V connection of the 24 Vdc supply). This connection is:

- continuous (switch 1 in 'DC' position), or

- interrupting at 1 Hz (switch 1 in '1 Hz' position), or

- interrupting at 0.25 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 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 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).

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.
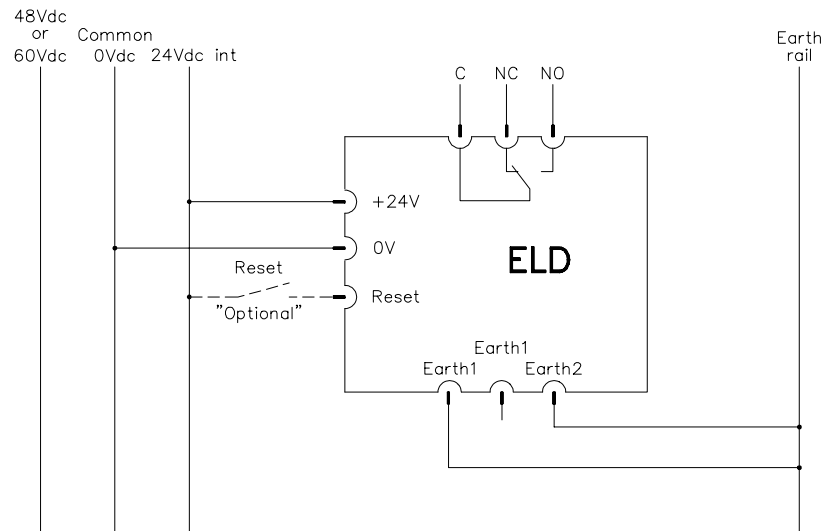
Figure 3   24 Vdc with 48 Vdc or 60 Vdc monitoring
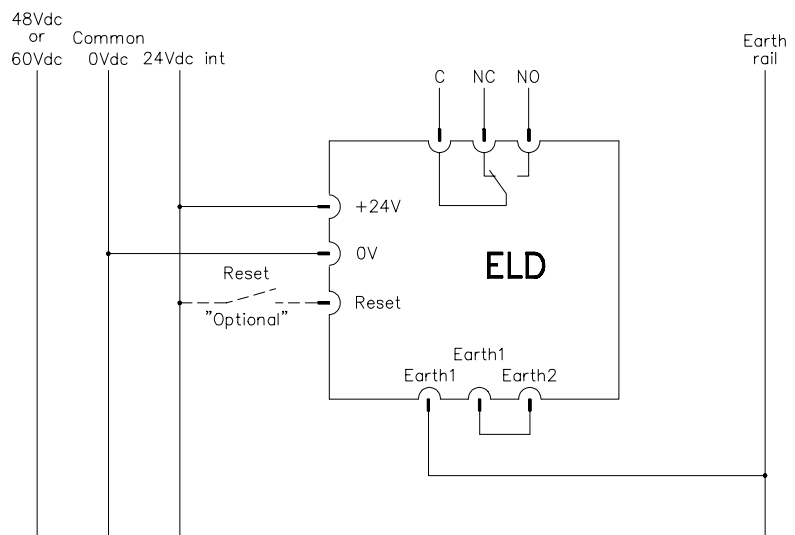
Figure 4   ELD with single earth wire

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Technical data   The 10310/1/1 module has the following specifications:

General	Type number:	10310/1/1 09700
	Approvals:	CE

Power	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

Earth	Earth voltage:	–12 Vdc (no earth fault)
		–30...+70 Vdc (earth fault)
	Earth fault threshold:	5.5 mA (± 1 mA)
	Max. earth current:	25.0 mA (± 5 mA)
	Tightening torque of earth connections:	1 Nm (0.74 ft-lb)

Physical	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)

Output contact	Max. output voltage:	115 Vdc
	Max. output current:	2 A

Relay contact	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)

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).
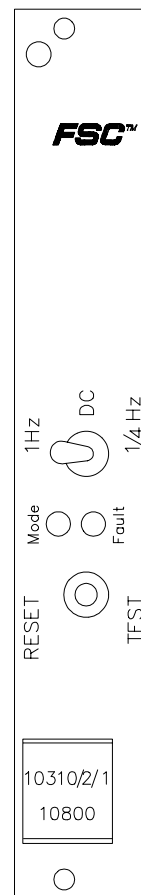
Figure 1   Front view

The ELD module connects earth level with –12 Vdc (referenced to the 0 V connection of the 24, 48, 60 and/or 110 Vdc supply). This connection is:

- continuous (switch 1 in 'DC' position), or
- interrupting at 1 Hz (switch 1 in '1 Hz' position), or
- interrupting at 0.25 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 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.
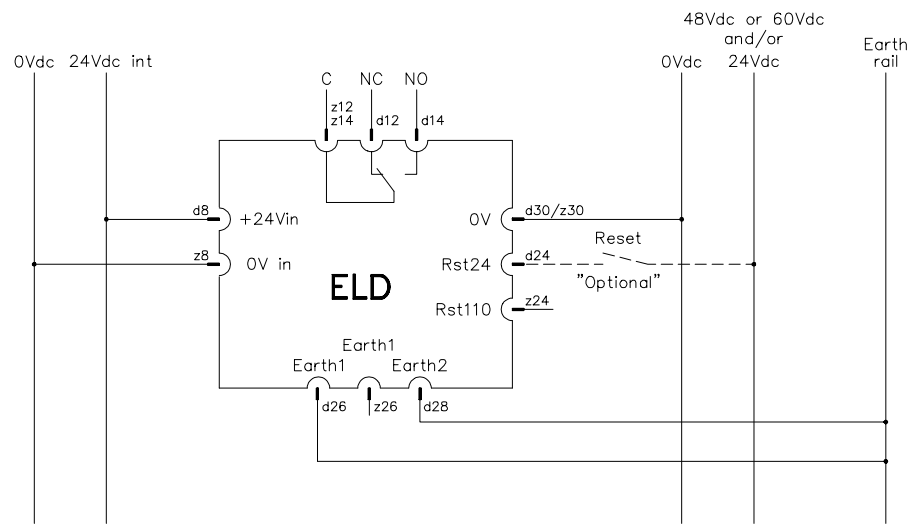
Figure 3   24 Vdc with 48 Vdc and/or 60 Vdc monitoring
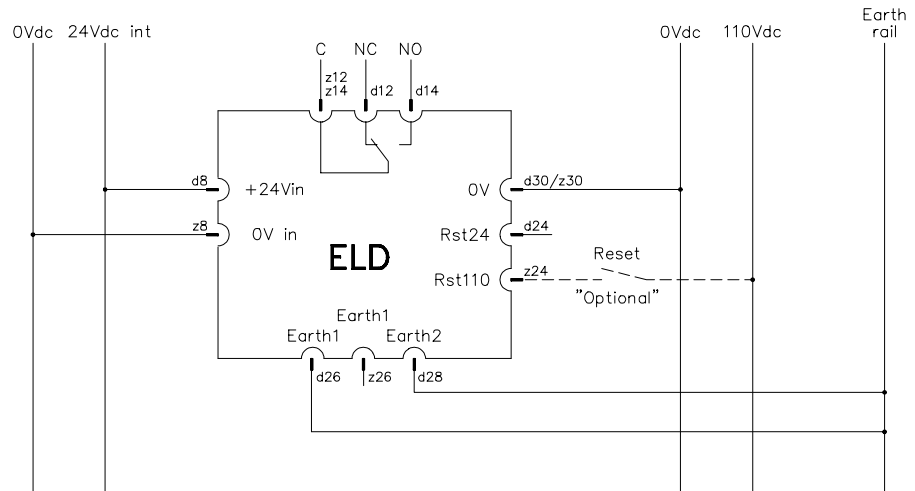
Figure 4   110 Vdc monitoring

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Pin allocation

The back view and pin allocation of the 10310/2/1 module connector are as follows:
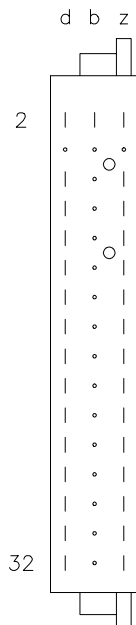
d2		b2		z2	
d4	–			z4	–
d6				z6	
d8	+24 Vin			z8	0 Vin
d10				z10	
d12	NC			z12	C
d14	NO			z14	C
d16				z16	
d18				z18	
d20				z20	
d22				z22	
d24	Rst24			z24	Rst110
d26	Earth 1			z26	Earth 1
d28	Earth 2			z28	
d30	0 V			z30	0 V
d32				z32	

Technical data

The 10310/2/1 module has the following specifications:

General

Type number:	10310/2/1 10800
Approvals:	CE, UL

Power

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

Earth

Earth voltage:	–12 Vdc (no earth fault)
	–30...+125 Vdc (earth fault)
Earth fault threshold:	5.5 mA (± 1 mA)
Max. earth current:	25.0 mA (± 5 mA)

Technical data (continued)

Output contact	Max. output voltage:	115 Vdc
	Max. output current:	2 A

Relay contacts	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

Key coding	(See 'Key coding' data sheet)	
	Module code:	
	− holes	A5, A11
	Rack code:	
	− large pins	A5, A11

Left blank intentionally.

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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.
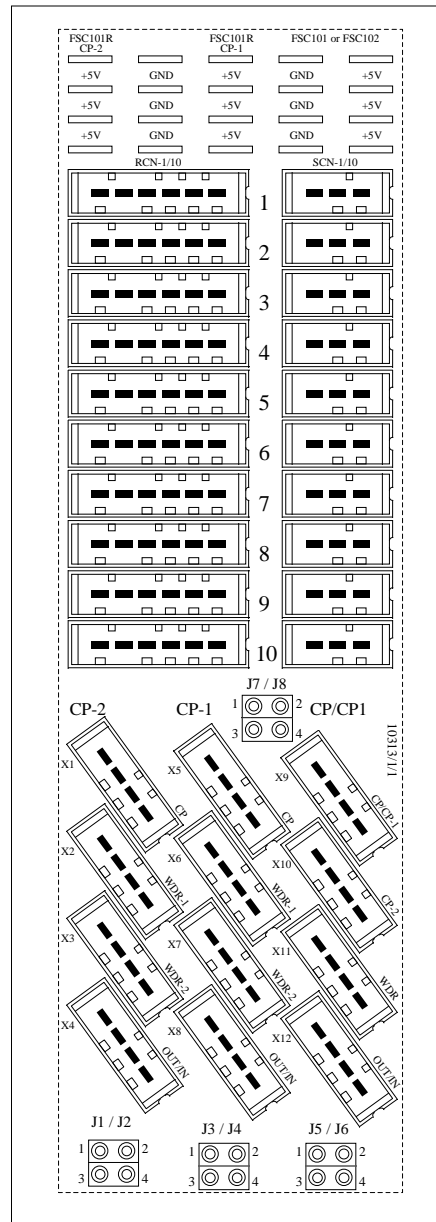
Figure 1   Top view

The module has a universal snap-in facility for standard DIN EN rails.

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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.

1 : WDG (CP2)	4 : GND
2 : GND	5 : +5V (CP1)
3 : +5V (CP2)	6 : WDG (CP1)
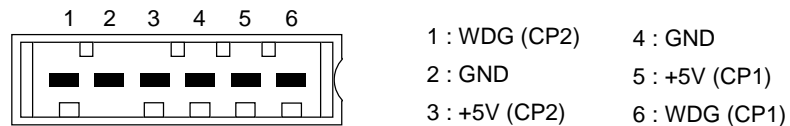
Figure 2   Pin connections of RCN-x

SCN-x

Figure 3 below shows the pin connections of the SCN-x connectors, which are used to connect non-redundant I/O backplanes.

1 : WDG
2 : GND
3 : +5V
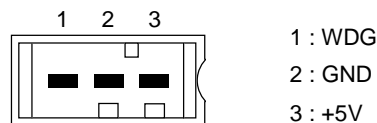
Figure 3   Pin connections of SCN-x

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.


```
1   2   3   4        1 : WDG
                     2 : GND
                     3 : GND
                     4 : +5V
```
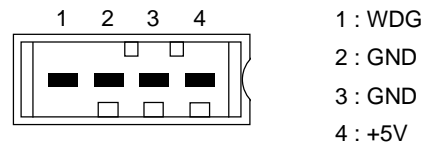
Figure 4   Pin connections of 'CP' and 'CP/CP-1' connector

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.

1 2 3 4

1 : WDG (1)
2 : GND
3 : WDG (2)
4 : WDROUT
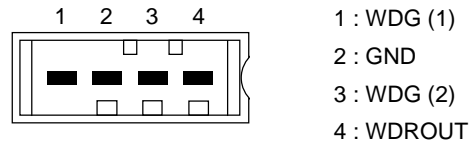
Figure 5   Pin connections of 'WDR', 'WDR-1'
and 'WDR-2' connectors

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.

1 2 3 4

1 :
2 : GND
3 : GND
4 : WDG
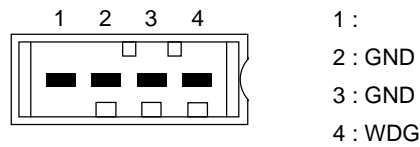
Figure 6   Pin connections of 'OUT/IN' connectors

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.
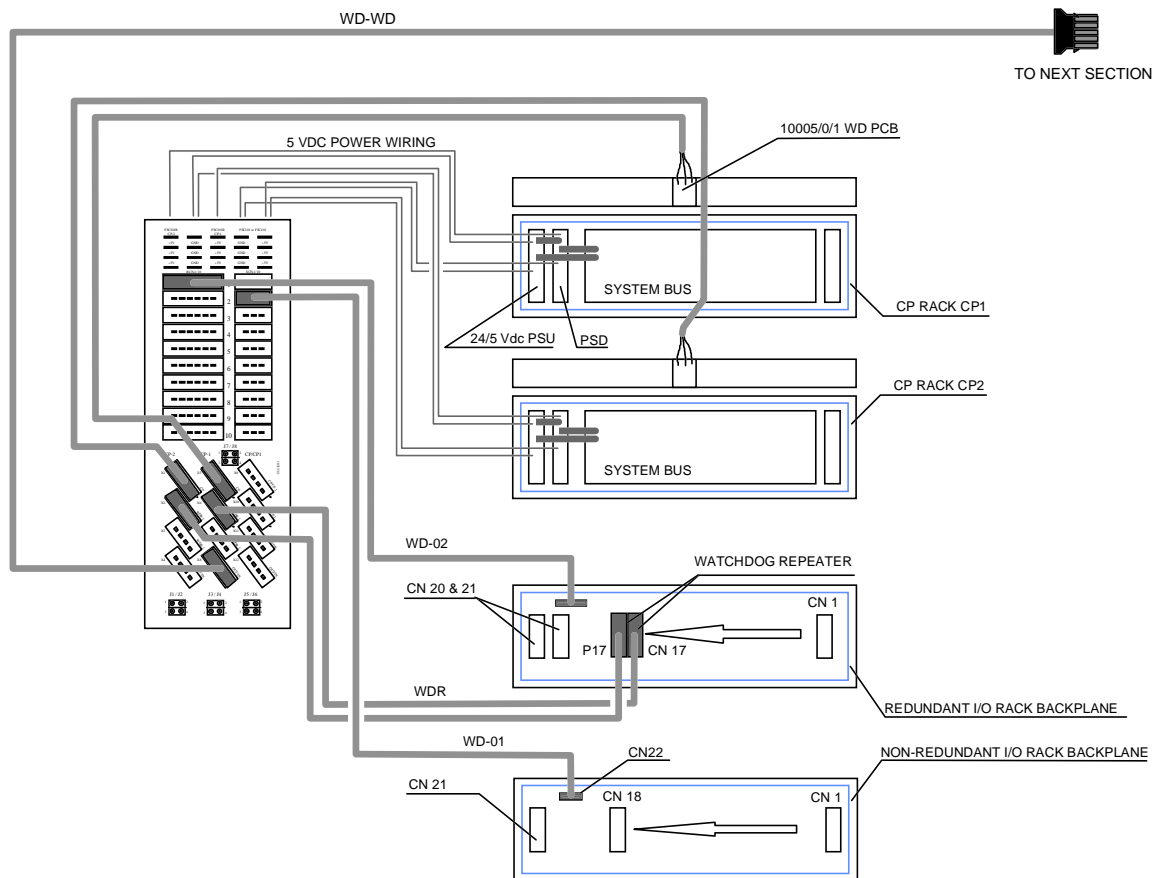
Figure 7   Concept diagram of 5 Vdc & watchdog distribution

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:

SINGLE-SECTION SYSTEM — SECTION 1: 10313

DUAL-SECTION SYSTEM — SECTION 1: 10313 X12 — WD-WD — SECTION 2: 10313 X12

TRIPLE-SECTION SYSTEM — SECTION 1: 10313 X12 — WD-WD — SECTION 2: 10313 X12 X11 — WD-WD — SECTION 2: 10313 X12

Jumper:	1x WDR	No WDR	with only +5V	No WDR		No WDR
J1/J2	not placed	not placed	not placed	not placed		not placed
J3/J4	not placed	not placed	not placed	not placed		not placed
J5/J6	not placed	1 - 3	3 - 4	1 - 3		not placed
J7/J8	not placed	not placed	not placed	not placed		not placed

Section 1

Section 1   Section 2

Section 1   Section 2   Section 3

Function of jumper settings:

J5/J6 in section 1, setting 1-3:   to connect the WDG line to the I/O racks via the SCN connectors.

J5/J6 in section 1, setting 3-4:   to connect the 5 Vdc to the WDG lines of the I/O racks via the SCN connectors.

J5/J6 in section 2, setting 1-3:   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:

SECTION 1

SINGLE-
SECTION
SYSTEM
| 10313 |

SECTION 1   SECTION 2

DUAL-
SECTION
SYSTEM
| 10313 | | 10313 |
X12 —————————————— WD-WD ——————————————— X12

SECTION 1   SECTION 2   SECTION 3

TRIPLE-
SECTION
SYSTEM
| 10313 | | 10313 | | 10313 |
X12 ——— WD-WD ——— X12 X11 ——— WD-WD ——— X12

| **Section 1** |

| **Section 1** | | **Section 2** |

| **Section 1** | | **Section 2** | | **Section 3** |

Jumper:	1x WDR	No WDR		No WDR		No WDR
J1/J2	not placed	not placed		not placed		not placed
J3/J4	not placed	not placed		not placed		not placed
J5/J6	not placed	3 - 4		1 - 3		not placed
J7/J8	not placed	not placed		not placed		not placed
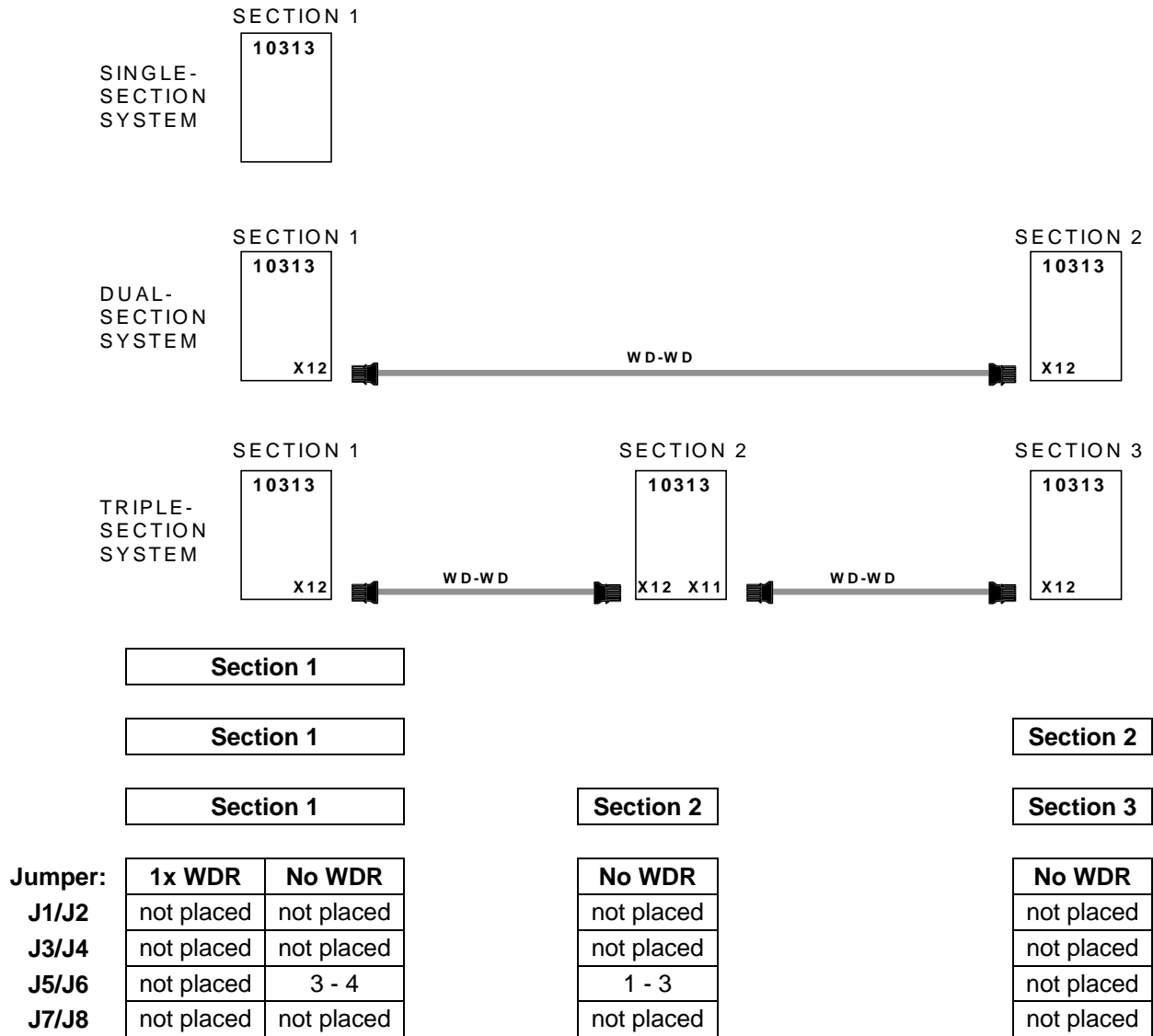
Function of jumper settings:

J5/J6 in section 1, setting 3-4:   to connect the 5 Vdc to the WDG lines of the I/O racks via the SCN connectors.

J5/J6 in section 2, setting 1-3:   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:
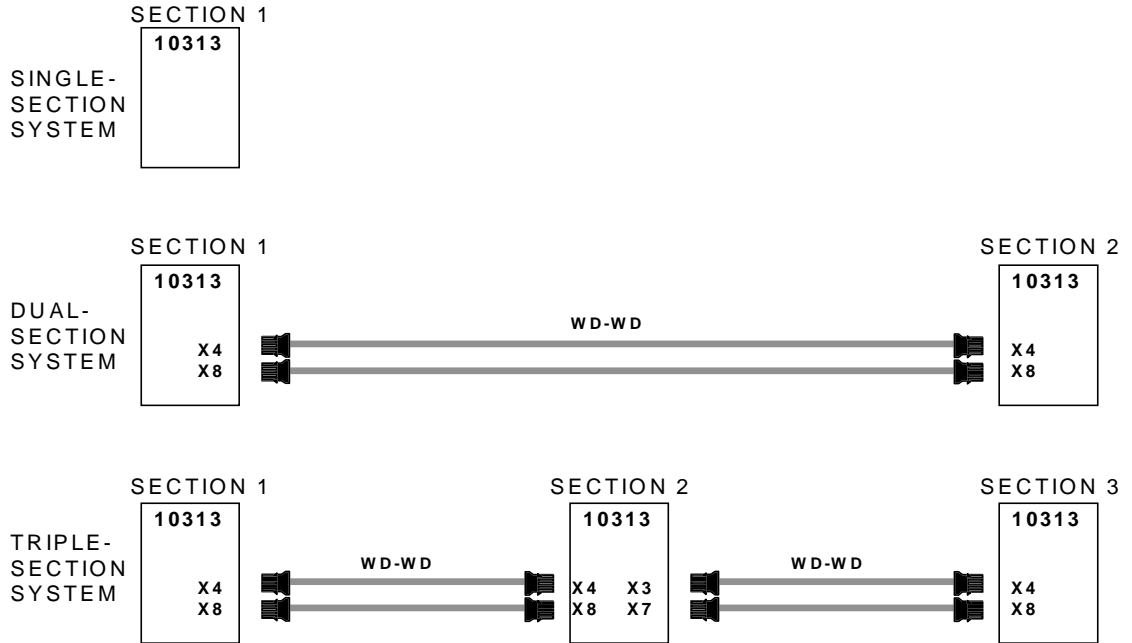
Jumper:	2x WDR	1x WDR	No WDR	No WDR		No WDR
J1/J2	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4		not placed
J3/J4	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4		not placed
J5/J6	not placed	not placed	not placed	not placed		not placed
J7/J8	not placed	not placed	not placed	not placed		not placed

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:
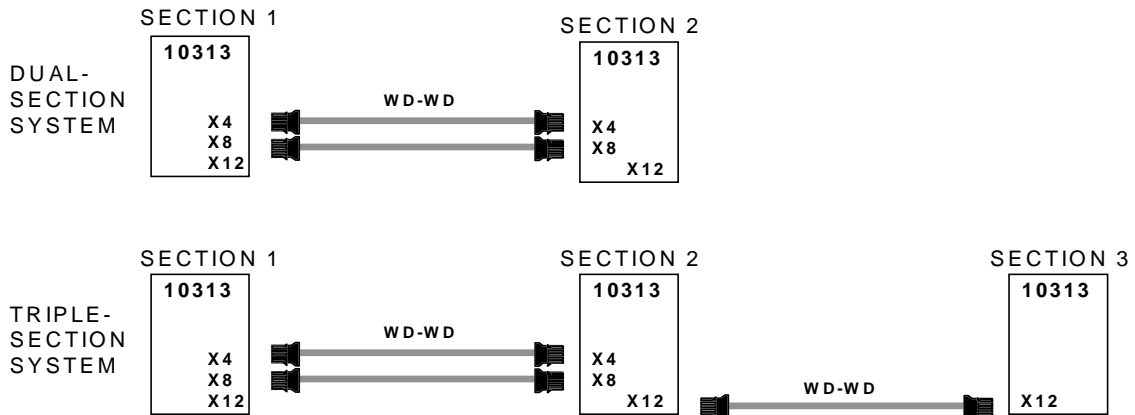
Jumper:	(2 +0) x WDR	(1 + 0) x WDR	(0 + 0) x WDR	(0 + 1) x WDR	(0 + 0) x WDR	(0 + 0) x WDR
	Section 1			**Section 2**		**Section 3**
J1/J2	1 - 2	1 - 2 3 - 4	1 - 3	1 - 3	not placed	not placed
J3/J4	1 - 2	1 - 2 3 - 4	1 - 3	1 - 3	not placed	not placed
J5/J6	not placed	not placed	not placed	not placed	3 - 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:
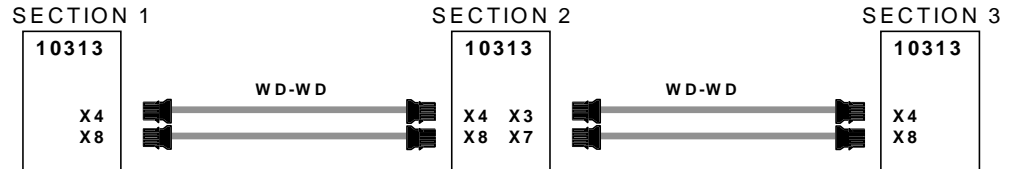
Jumper:	(2 +0) x WDR	(1 + 0) x WDR	(0 + 0) x WDR	(0 + 0) x WDR	(0 + 1) x WDR	(0 + 0) x WDR
	Section 1			Section 2	Section 3	
J1/J2	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4	1 - 3	not placed
J3/J4	1 - 2	1 - 2 3 - 4	1 - 3	3 - 4	1 - 3	not placed
J5/J6	not placed	not placed	not placed	not placed	not placed	3 - 4
J7/J8	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.

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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 mm² (AWG 24), or

− 0.5 mm² (AWG 20).

Technical data   The 10313/1/1 module has the following specifications:

General

Type number:	10313/1/1 20701*
Approvals:	CE, TÜV;
	UL approval pending

Power

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

Physical

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)

* Note:
10313/1/1 modules with suffix code 20700 have a different connector layout.

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Helping You Control Your World

Fail Safe Control
Hardware Manual

Section 8:
System Interconnection Cables

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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			

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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.
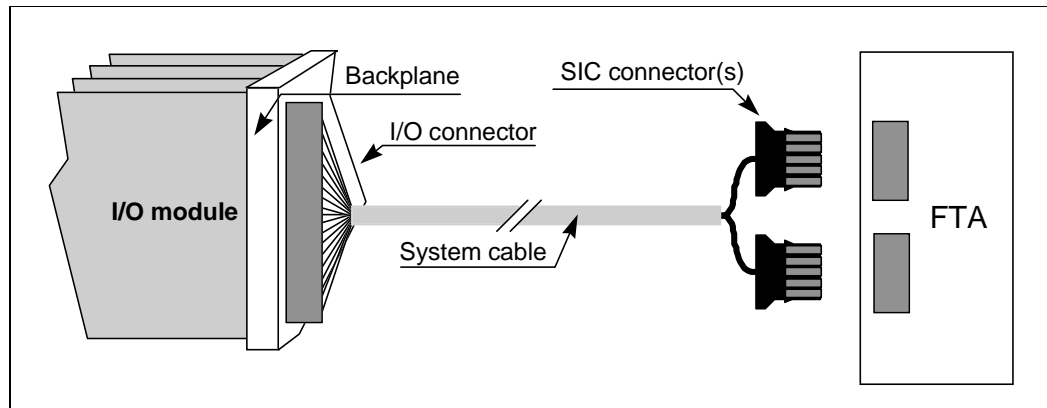
Figure 1   Principle of SIC-C connection method

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.
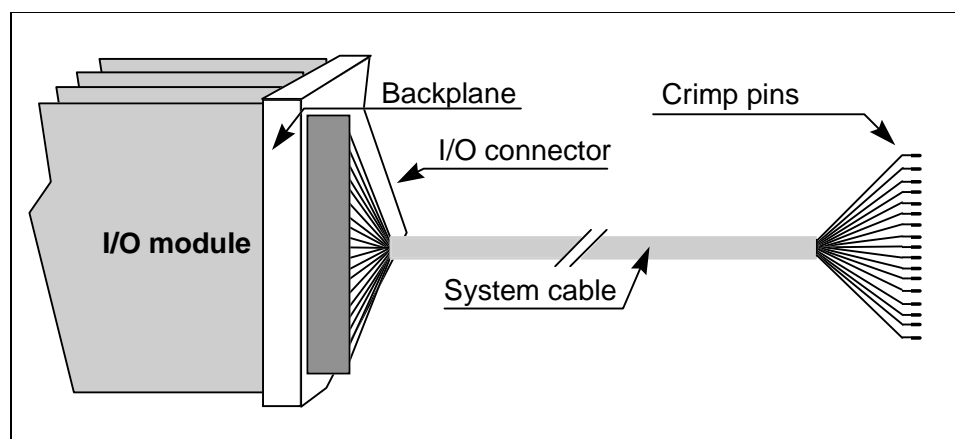
Figure 2   Principle of SIC-P connection method

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.
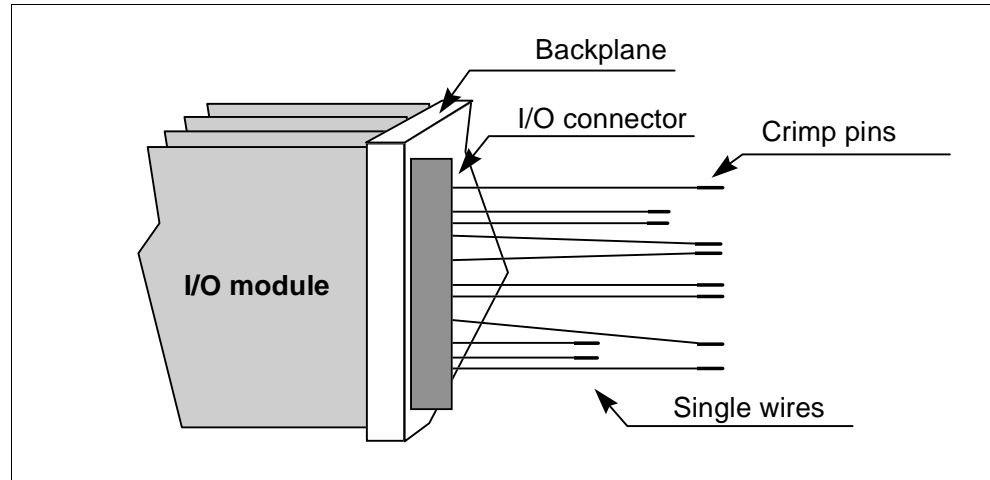
Figure 3   Principle of single-wire connection method

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.

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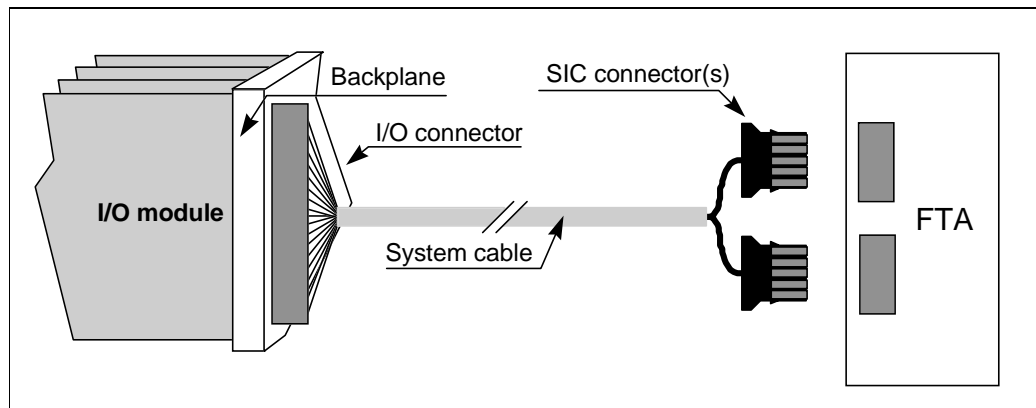
SIC-C cable types   SIC-C cables (i.e. SIC cables terminating in one or more connectors) are available in five layout types:

1) SIC-C cable with one I/O connector and one 10-pin FTA connector:

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:
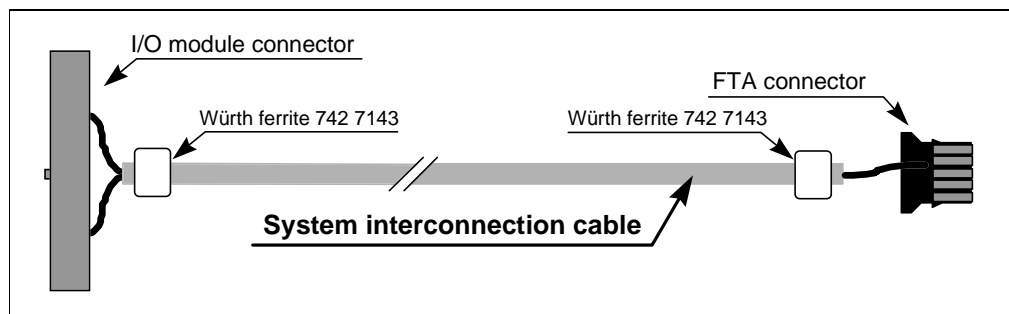
Figure 3   SIC-C cable, layout type 2

3) SIC-C cable with one I/O connector and one 20-pin FTA connector:
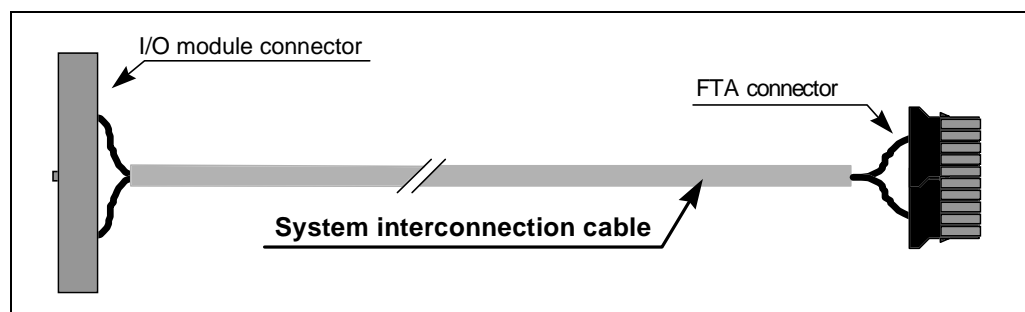
Figure 4   SIC-C cable, layout type 3

4) SIC-C cable with one I/O connector and two 10-pin FTA connectors (marked 'a' and 'b'):
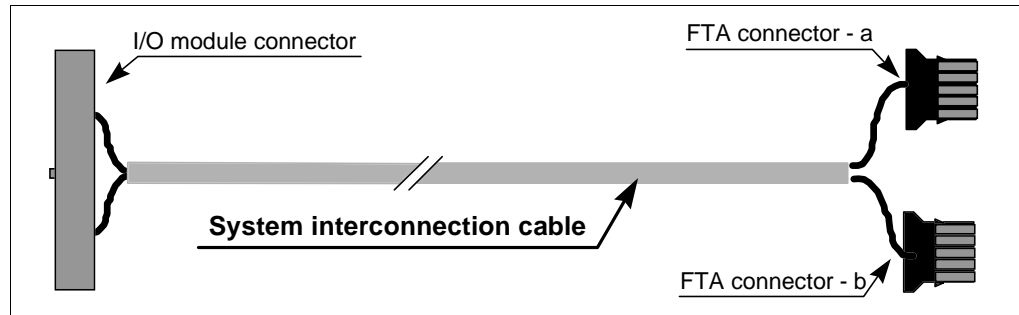
Figure 5   SIC-C cable, layout type 4

5) SIC-C cable with two I/O connectors (marked 'a' and 'b') and one 10-pin FTA connector:
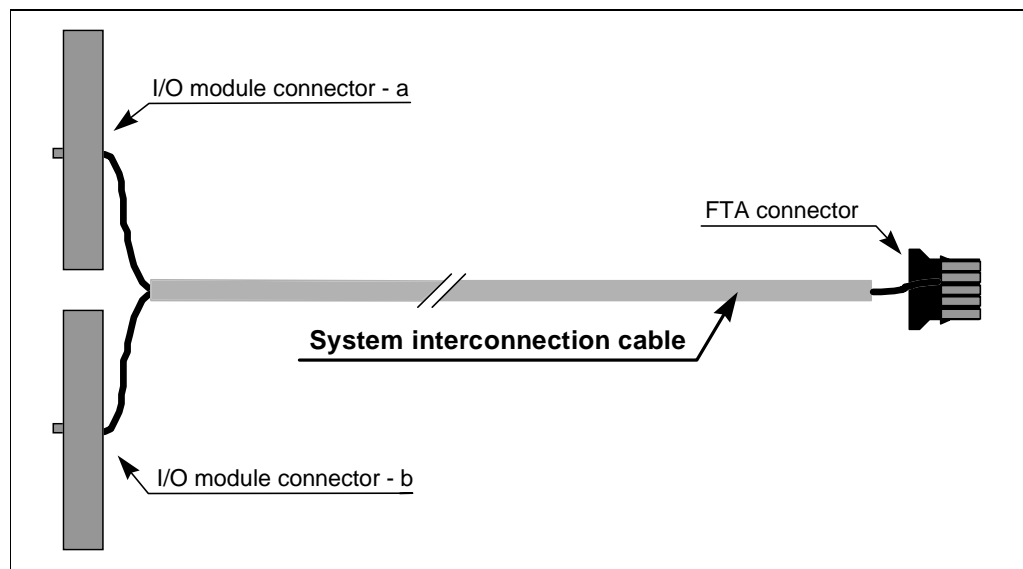
Figure 6   SIC-C cable, layout type 5

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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 (see fig. 2 to 6)
SIC-C-01/Lx	18 x 0.25 mm²	unshielded	7.90 (± 0.20)	4
SIC-C-02/Lx	16 x 0.5 mm²	unshielded	8.00 (± 0.20)	4
SIC-C-03/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	5
SIC-C-04/Lx	20 x 0.5 mm²	unshielded	9.80 (± 0.20)	4
SIC-C-05/Lx	8 x 0.5 mm²	shielded	4.90 (± 0.15)	1
SIC-C-06/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-C-07/Lx	18 x 0.5 mm²	unshielded	9.40 (± 0.20)	4
SIC-C-08/Lx	18 x 0.25 mm²	unshielded	7.90 (± 0.20)	4
SIC-C-09/Lx	*18 x 0.25 mm²*	*unshielded*	*7.90 (± 0.20)*	***OBSOLETE***
SIC-C-10/Lx	10 x 0.25 mm²	unshielded	6.50 (± 0.20)	1
SIC-C-11/Lx	8 x 0.5 mm²	unshielded	6.80 (± 0.20)	1
SIC-C-12/Lx	20 x 0.25 mm²	screened and shielded	9.90 (± 0.20)	3

Usable wire types:
0.25 mm²   =   AWG 24
0.5 mm²   =   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 mm² (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 : Outer diameter: Cable layout :	16 x 0.5 mm² (AWG 20), unshielded 8.90 (± 0.20) mm 0.350 (± 0.008) in Figure 5 SIC-C cable, layout type 4	
10201/2/1 signal	10215/2/1 signal	I/O module connector pin	FTA connectors a and b 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 : Outer diameter: Cable layout :	4 x 2 x 0.25 mm² (AWG 24), shielded, twisted pairs (STP) 6.60 (± 0.20) mm 0.260 (± 0.008) in Figure 6 SIC-C cable, layout type 5	
	10205/2/1 modules 1 and 2 signal	I/O module connectors a and b pin	FTA connector 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

SIC-C-04/Lx	Cable type :	20 x 0.5 mm² (AWG 20), unshielded	
	Outer diameter :	9.80 (± 0.20) mm, 0.386 (± 0.008) in	
	Cable layout :	Figure 5 SIC-C cable, layout type 4	
	10208/2/1 signal	I/O module connector pin	FTA connectors a and b 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

SIC-C-05/Lx	Cable type :	8 x 0.5 mm² (AWG 20), shielded	
	Outer diameter :	4.90 (± 0.20) mm, 0.193 (± 0.008) in	
	Cable layout :	Figure 2 SIC-C cable, layout type 1	
10213/2/2 10213/2/3 signal	10216/2/1 10216/2/3 signal	I/O module connector pin	FTA connector pin
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

SIC-C-06/Lx	Cable type :	4 x 2 x 0.25 mm² (AWG 24), shielded, twisted pairs (STP)	
	Outer diameter :	6.60 (± 0.20) mm, 0.260 (± 0.008) in	
	Cable layout :	Figure 3 SIC-C cable, layout type 2	
	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

10101/2/. signal	10209/2/1 signal	10206/2/1 signal	I/O module connector pin	FTA connectors a and b pin
	Cable type :	18 x 0.5 mm² (AWG 20), unshielded		
	Outer diameter :	9.80 (± 0.20) mm, 0.386 (± 0.008) in		
	Cable layout :	Figure 5 SIC-C cable, layout type 4		
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 : Outer diameter : Cable layout :	18 x 0.25 mm² (AWG 24), unshielded 7.90 (± 0.20) mm, 0.311 (± 0.008) in 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 mm² (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 mm² (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 mm² (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 mm² (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

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.
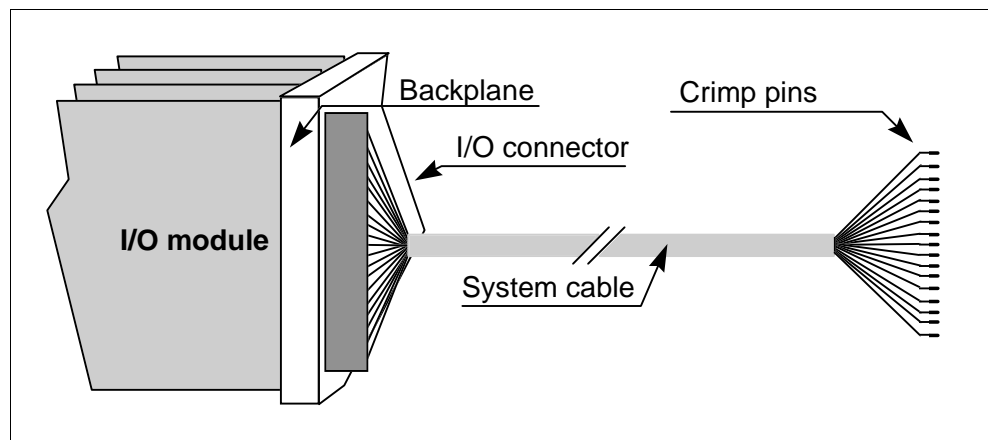
Figure 1   Principle of SIC-P connection method

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:
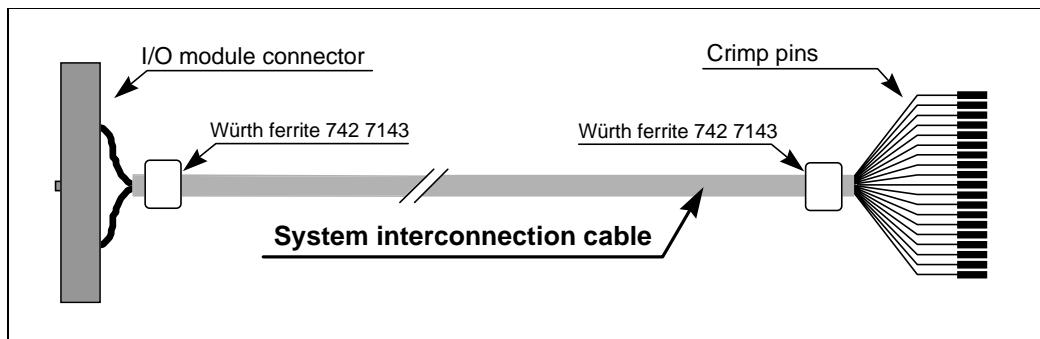
Figure 3   SIC-P cable, layout type 2

3) SIC-P cable with two I/O connectors (marked 'a' and 'b'):

I/O module connector (a)

Crimp pins

System interconnection cable

I/O module connector (b)

Figure 4   SIC-P cable, layout type 3

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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 mm²	unshielded	7.90 (± 0.20)	1
SIC-P-02/Lx	16 x 0.5 mm²	unshielded	8.00 (± 0.20)	1
SIC-P-03/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	3
SIC-P-04/Lx	20 x 0.5 mm²	unshielded	9.80 (± 0.20)	1
SIC-P-05/Lx	8 x 0.5 mm²	shielded	4.90 (± 0.15)	1
SIC-P-06/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-P-07/Lx	18 x 0.5 mm²	unshielded	9.40 (± 0.20)	1
SIC-P-08/Lx	18 x 0.25 mm²	unshielded	7.90 (± 0.20)	1
SIC-P-09/Lx	*18 x 0.25 mm²*	*unshielded*	*7.90 (± 0.20)*	***OBSOLETE***

Usable wire types:
0.25 mm²   =   AWG 24
0.5 mm²   =   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 mm² (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

SIC-P-02/Lx	Cable type : Outer diameter : Cable layout :	**16 x 0.5 mm² (AWG 20), unshielded** **8.90 (± 0.20) mm 0.350 (± 0.008) in** **Figure 2 SIC-P cable, layout type 1**	
10201/2/1 signal	10215/2/1 signal	I/O module connector pin	Color code crimp 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

SIC-P-03/Lx	Cable type : Outer diameter : Cable layout :	**4 x 2 x 0.25 mm² (AWG 24), shielded** **twisted pairs (STP)** **6.60 (± 0.20) mm 0.260 (± 0.008) in** **Figure 4 SIC-P cable, layout type 3**	
	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

SIC-P-04/Lx	Cable type	:	20 x 0.5 mm² (AWG 20), unshielded
	Outer diameter	:	9.80 (± 0.20) mm, 0.386 (± 0.008) in
	Cable layout	:	Figure 2 SIC-P cable, layout type 1

	10208/2/1 signal	I/O module connector pin	Color code 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

SIC-P-05/Lx	Cable type	:	8 x 0.5 mm² (AWG 20), shielded
	Outer diameter	:	4.90 (± 0.20) mm, 0.193 (± 0.008) in
	Cable layout	:	Figure 2 SIC-P cable, layout type 1

10213/2/. signal	10216/2/1 10216/2/3 signal	I/O module connector pin	Color code crimp pin
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

SIC-P-06/Lx	Cable type :	4 x 2 x 0.25 mm² (AWG 24), shielded twisted pairs (STP)	
	Outer diameter:	6.60 (± 0.20) mm, 0.260 (± 0.008) in	
	Cable layout :	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

SIC-P-07/Lx		Cable type :	18 x 0.5 mm² (AWG 20), unshielded	
		Outer diameter:	9.80 (± 0.20) mm, 0.386 (± 0.008) in	
		Cable layout :	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

SIC-P-08/Lx	Cable type :	18 x 0.25 mm² (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

Table 10   Standard SIC-P-09 cable   *(OBSOLETE)*

SIC-P-09/Lx	Cable type :	18 x 0.25 mm² (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

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).
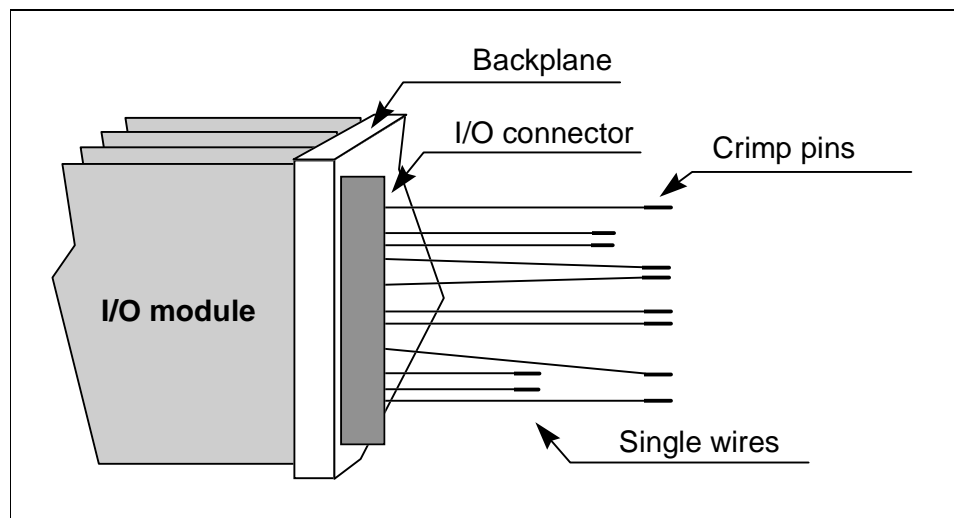
Figure 1   Principle of single-wire connection method

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

	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

–	–
–	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

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

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Table 1   Connections to I/O backplane connector (continued)

10206/2/1 signal	10208/2/1 signal	10209/2/1 signal	10213/2/. signal	10215/2/1 signal	10216/2/. + 10216/A/1 signal	I/O backplane connector pin	I/O module connector pin
					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 mm² (AWG 24)
	0.34 mm² (AWG 22)
	0.5 mm² (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

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.

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).

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 mm²	unshielded	7.90 (± 0.20)	4
SIC-C-02/Lx	16 x 0.5 mm²	unshielded	8.00 (± 0.20)	4
SIC-C-03/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	5
SIC-C-04/Lx	20 x 0.5 mm²	unshielded	9.80 (± 0.20)	4
SIC-C-05/Lx	8 x 0.5 mm²	shielded	4.90 (± 0.15)	1
SIC-C-06/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-C-07/Lx	18 x 0.5 mm²	unshielded	9.40 (± 0.20)	4
SIC-C-08/Lx	18 x 0.25 mm²	unshielded	7.90 (± 0.20)	4
SIC-C-09/Lx	*18 x 0.25 mm²*	*unshielded*	*7.90 (± 0.20)*	***OBSOLETE***
SIC-C-10/Lx	10 x 0.25 mm²	unshielded	6.50 (± 0.20)	1
SIC-C-11/Lx	8 x 0.5 mm²	unshielded	6.80 (± 0.20)	1
SIC-C-12/Lx	10 x 2 x 0.25 mm²	shielded	9.90 (± 0.20)	3

Usable wire types:
0.25 mm²   =   AWG 24
0.5 mm²   =   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).

Note:
For details on FTAs refer to section 9 ("Field Termination Assembly Modules") of the FSC Hardware Manual.

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

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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	A	B	ELCO FTA (FTA-E)		Terminal FTA (FTA-T)	
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

* Length limitations apply
(see applicable FTA data sheets).

** requires converter:
loop-monitored digital input   10102/A/5

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
16   = 1 connector, 16 signals

Number of signals per FTA, specified by FTA connector: F=fused
Examples: 6 x 4 = 6 connectors, 4 signals each
            2Fx8 = 2 connectors, 8 signals each and common fuse per 8 signals
            3Fx8 = 3 connectors, 8 signals each and common fuse per 8 signals

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

** requires analog output converter:
0(4)-20 mA internal power   10205/A1
0(4)-20 mA external power   10205/A2
Dummy   10205/A3

Number of signals per module

Number of signals per SIC cable, specified by connector (where appropriate).
Examples:
8 / 8   = 2 FTA connectors, 8 signals each.
8 / 4   = 2 FTA connectors, 1st connector 8 signals,
                 2nd connector 4 signals used.
4   = 1 FTA connector, 4 signals.
2* / 2* = 2 I/O module connectors, 2 signals each

(4÷2)   = 2 signals, since two wire pairs must be used per signal

Number of signals per FTA and per FTA connector   F=fused
Examples: 6 x 4 = 6 connectors, 4 signals each
                 5Fx5 = 5 connectors, 5 signals each and common fuse per 5 signals
                 1x4F = 1 connector of 4 signals, with one fuse per signal
                 1x8F = 1 connector of 8 signals, with one fuse per signal

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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.
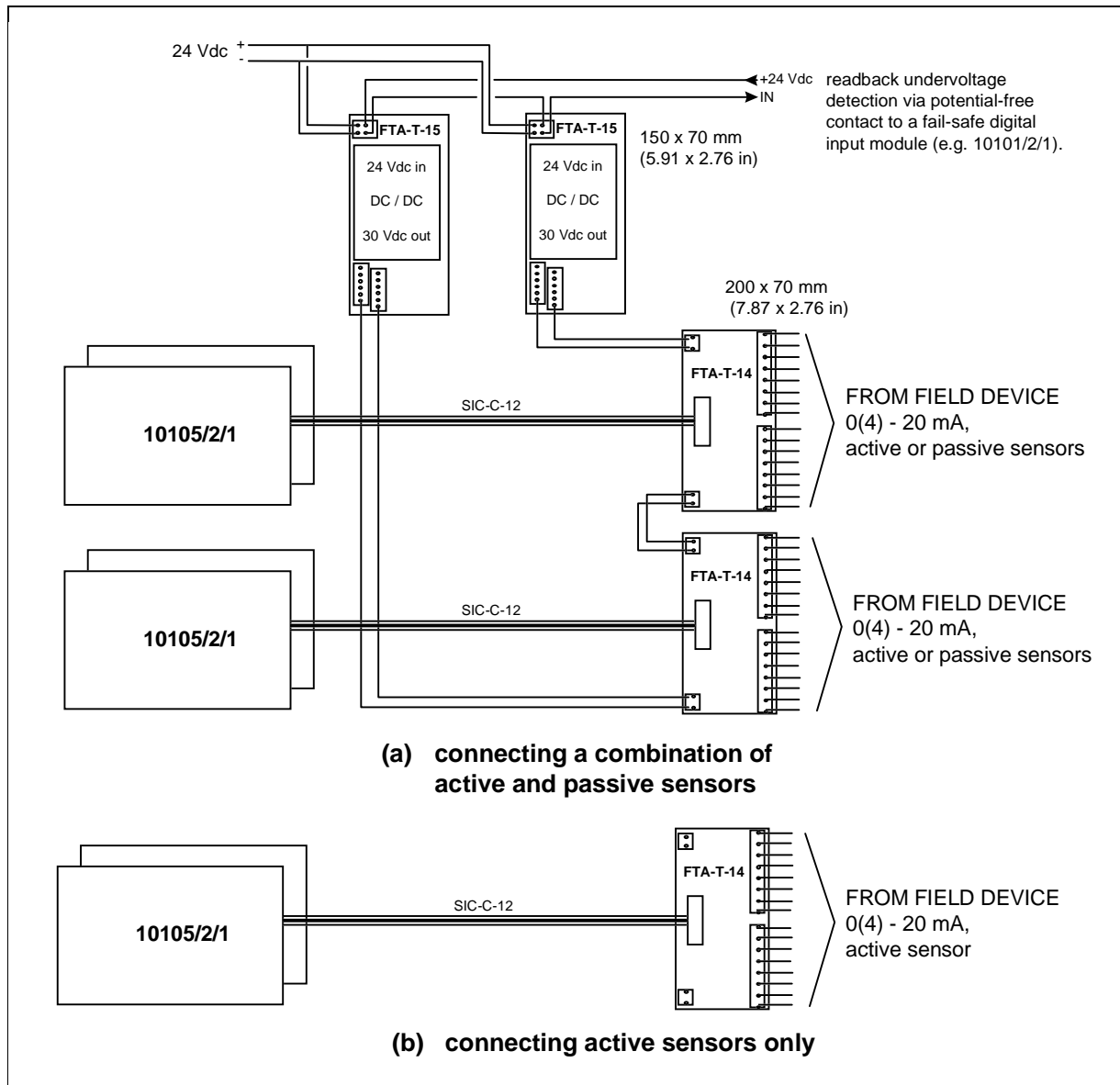
Figure 1   Relationship between FTA-T-14 and FTA-T-15

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.
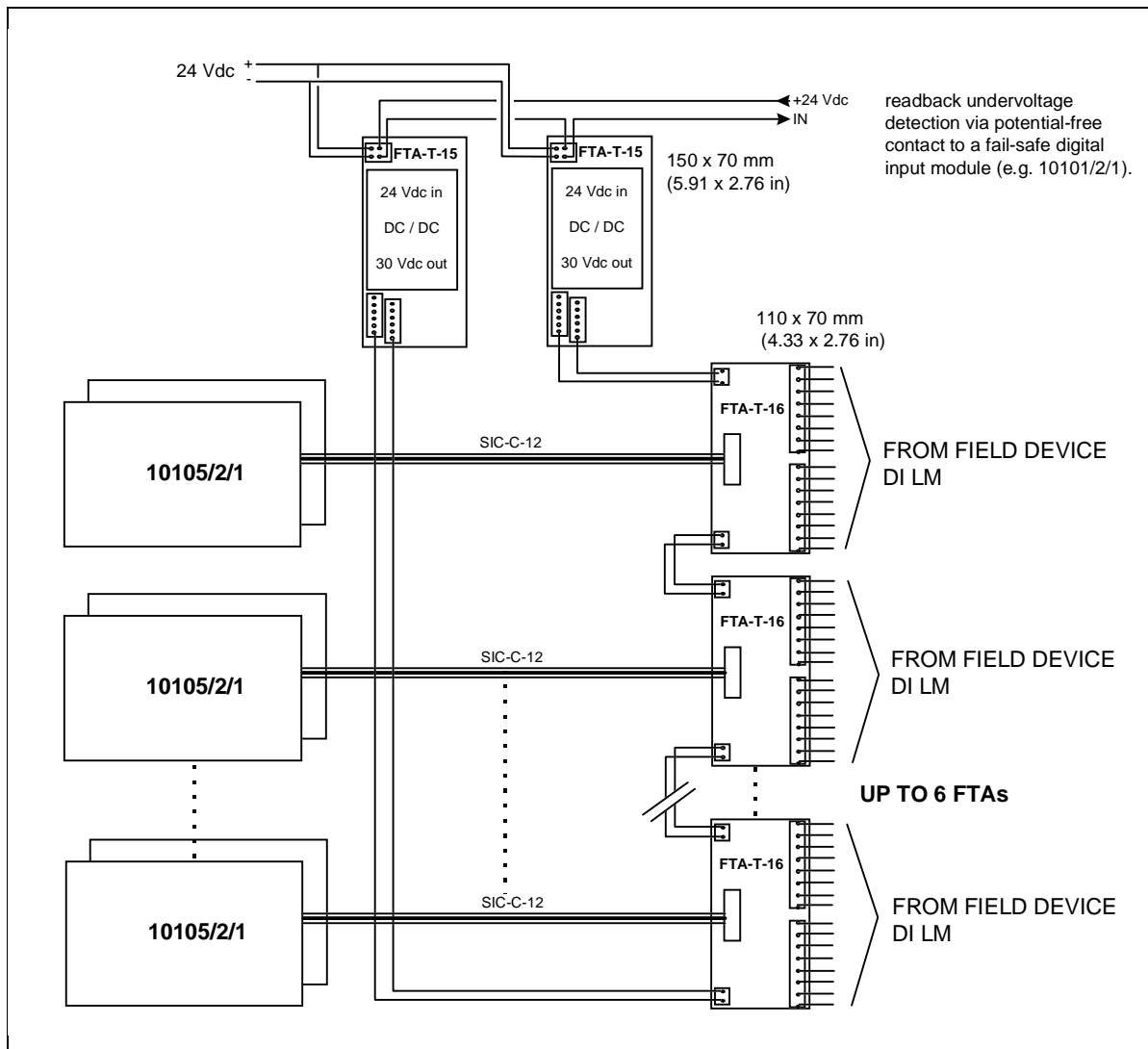
Figure 2   Relationship between FTA-T-16 and FTA-T-15

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SIC to pin applications

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:
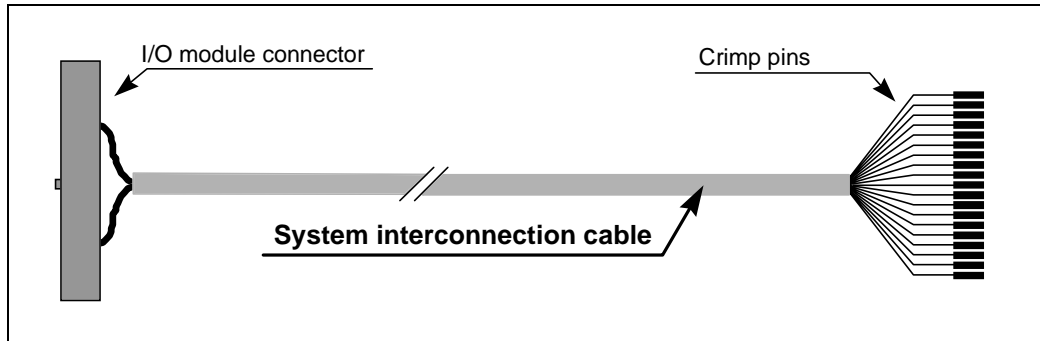
1. SIC-P cable with one I/O connector,

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).
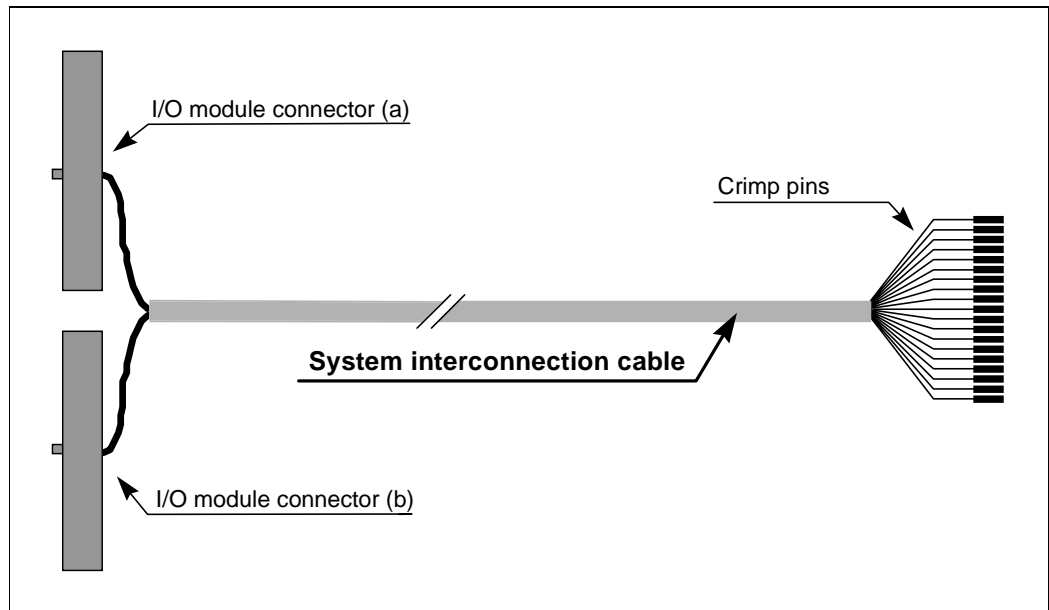
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SIC-P cable characteristics

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 mm²	unshielded	7.90 (± 0.20)	1
SIC-P-02/Lx	16 x 0.5 mm²	unshielded	8.00 (± 0.20)	1
SIC-P-03/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	3
SIC-P-04/Lx	20 x 0.5 mm²	unshielded	9.80 (± 0.20)	1
SIC-P-05/Lx	8 x 0.5 mm²	shielded	4.90 (± 0.15)	1
SIC-P-06/Lx	4 x 2 x 0.25 mm²	shielded twisted pair (STP)	6.60 (± 0.20)	2
SIC-P-07/Lx	18 x 0.5 mm²	unshielded	9.40 (± 0.20)	1
SIC-P-08/Lx	18 x 0.25 mm²	unshielded	7.90 (± 0.20)	1
SIC-P-09/Lx	*18 x 0.25 mm²*	*unshielded*	*7.90 (± 0.20)*	*OBSOLETE*

Usable wire types:
0.25 mm²   =   AWG 24
0.5 mm²   =   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

```
* requires converter:
  loop-monitored digital input       10102/A/5
```

```
Number of signals per module
```
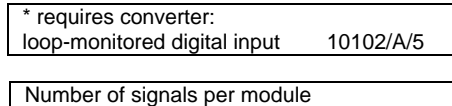
Selection table for analog field inputs

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

```
* requires 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
```
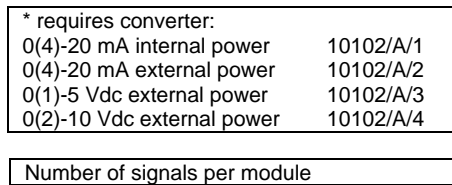
Selection table for field outputs

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		
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

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Section 9: Field Termination Assembly Modules

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

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:

CONNECTIONS DIAGRAM FTA-E-01					
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Elco pin number
				IN 1+ (via fuse F1)	A
1A	A5	CH1		IN 1-	B
1A	B5	CH2		IN 2+ (via fuse F1)	C
1A	A4	CH3		IN 2-	D
1A	B4	CH4		IN 3+ (via fuse F1)	E
1A	A3	CH5		IN 3-	F
1A	B3	CH6		IN 4+ (via fuse F1)	H
1A	A2	CH7		IN 4-	J
1A	B2	nc		IN 5+ (via fuse F1)	K
1A	A1	CH8		IN 5-	L
1A	B1	+24 Vdc	0.25 AT	IN 6+ (via fuse F1)	M
				IN 6-	N
				IN 7+ (via fuse F1)	P
				IN 7-	R
				IN 8+ (via fuse F1)	S
				IN 8-	T
				IN 9+ (via fuse F2)	U
				IN 9-	V
				IN 10+ (via fuse F2)	W
1B	A5	CH9		IN 10-	X
1B	B5	CH10		Shield	Y
1B	A4	CH11		nc	Z
1B	B4	CH12		IN 11+ (via fuse F2)	a
1B	A3	CH13		IN 11-	b
1B	B3	CH14		IN 12+ (via fuse F2)	c
1B	A2	CH15		IN 12-	d
1B	B2	nc		IN 13+ (via fuse F2)	e
1B	A1	CH16		IN 13-	f
1B	B1	+24 Vdc	0.25 AT	IN 14+ (via fuse F2)	h
				IN 14-	j
				IN 15+ (via fuse F2)	k
				IN 15-	l
				IN 16+ (via fuse F2)	m
				IN 16-	n
				IN 17+ (via fuse F3)	p
				IN 17-	r
				IN 18+ (via fuse F3)	s
				IN 18-	t
				IN 19+ (via fuse F3)	u
2A	A5	CH17		IN 19-	v
2A	B5	CH18		IN 20+ (via fuse F3)	w
2A	A4	CH19		IN 20-	x
2A	B4	CH20		IN 21+ (via fuse F3)	y
2A	A3	CH21		IN 21-	z
2A	B3	CH22		IN 22+ (via fuse F3)	AA
2A	A2	CH23		IN 22-	BB
2A	B2	nc		IN 23+ (via fuse F3)	CC
2A	A1	CH24		IN 23-	DD
2A	B1	+24 Vdc	0.25 AT	IN 24+ (via fuse F3)	EE
				IN 24-	FF
				nc	HH
				nc	JJ
				nc	KK
				nc	LL
				nc	MM
				nc	NN

nc = not connected

Figure 2   Connections diagram

Technical data   The FTA-E-01 module has the following specifications:

General   Type number: FTA-E-01
Approvals: CE, UL

Power   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)

Physical   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)

Fuses   Rating: 250 mAT (slow-acting)
Dimensions: 5 x 20 mm (0.2 x 0.79 in) or
5 x 25 mm(0.2 x 0.98 in)

Termination   ELCO socket: 8016 series, 56 pins

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

CONNECTIONS DIAGRAM FTA-E-02					
SIC connector				Field terminals	
Connector	Pin number	Signals	One wire pair per channel	Signals	Elco pin number
1A	A5	CH1+			
1A	B5	CH1-			
1A	A4	CH2+			
1A	B4	CH2-			
1A	A3	CH3+		OUT 1a	A
1A	B3	CH3-		OUT 1b	B
1A	A2	CH4+		OUT 2a	C
1A	B2	CH4-		OUT 2b	D
1A	A1	nc		OUT 3a	E
1A	B1	nc		OUT 3b	F
				OUT 4a	H
1B	A5	CH5+		OUT 4b	J
1B	B5	CH5-		OUT 5a	K
1B	A4	CH6+		OUT 5b	L
1B	B4	CH6-		OUT 6a	M
1B	A3	CH7+		OUT 6b	N
1B	B3	CH7-		OUT 7a	P
1B	A2	CH8+		OUT 7b	R
1B	B2	CH8-		OUT 8a	S
1B	A1	nc		OUT 8b	T
1B	B1	nc		OUT 9a	U
				OUT 9b	V
2A	A5	CH9+		OUT 10a	W
2A	B5	CH9-		OUT 10b	X
2A	A4	CH10+		Shield	Y
2A	B4	CH10-		nc	Z
2A	A3	CH11+		OUT 11a	a
2A	B3	CH11-		OUT 11b	b
2A	A2	CH12+		OUT 12a	c
2A	B2	CH12-		OUT 12b	d
2A	A1	nc		OUT 13a	e
2A	B1	nc		OUT 13b	f
				OUT 14a	h
2B	A5	CH13+		OUT 14b	j
2B	B5	CH13-		OUT 15a	k
2B	A4	CH14+		OUT 15b	l
2B	B4	CH14-		OUT 16a	m
2B	A3	CH15+		OUT 16b	n
2B	B3	CH15-		OUT 17a	p
2B	A2	CH16+		OUT 17b	r
2B	B2	CH16-		OUT 18a	s
2B	A1	nc		OUT 18b	t
2B	B1	nc		OUT 19a	u
				OUT 19b	v
3A	A5	CH17+		OUT 20a	w
3A	B5	CH17-		OUT 20b	x
3A	A4	CH18+		OUT 21a	y
3A	B4	CH18-		OUT 21b	z
3A	A3	CH19+		OUT 22a	AA
3A	B3	CH19-		OUT 22b	BB
3A	A2	CH20+		OUT 23a	CC
3A	B2	CH20-		OUT 23b	DD
3A	A1	nc		OUT 24a	EE
3A	B1	nc		OUT 24b	FF
				nc	HH
3B	A5	CH21+		nc	JJ
3B	B5	CH21-		nc	KK
3B	A4	CH22+		nc	LL
3B	B4	CH22-		nc	MM
3B	A3	CH23+		nc	NN
3B	B3	CH23-			
3B	A2	CH24+			
3B	B2	CH24-			
3B	A1	nc			
3B	B1	nc			

nc = not connected

Figure 2   Connections diagram (one wire pair per channel)

Connections diagram

CONNECTIONS DIAGRAM FTA-E-02					
SIC connector				Field terminals	
Connector	Pin number	Signals	Two wire pairs per channel	Signals	Elco pin number
1A	A5	CH1+			
1A	B5	CH1-			
1A	A4	CH1+			
1A	B4	CH1-			
1A	A3	CH2+		OUT 1a	A
1A	B3	CH2-		OUT 1b	B
1A	A2	CH2+		OUT 1a	C
1A	B2	CH2-		OUT 1b	D
1A	A1	nc		OUT 2a	E
1A	B1	nc		OUT 2b	F
				OUT 2a	H
1B	A5	CH3+		OUT 2b	J
1B	B5	CH3-		OUT 3a	K
1B	A4	CH3+		OUT 3b	L
1B	B4	CH3-		OUT 3a	M
1B	A3	CH4+		OUT 3b	N
1B	B3	CH4-		OUT 4a	P
1B	A2	CH4+		OUT 4b	R
1B	B2	CH4-		OUT 4a	S
1B	A1	nc		OUT 4b	T
1B	B1	nc		OUT 5a	U
				OUT 5b	V
2A	A5	CH5+		OUT 5a	W
2A	B5	CH5-		OUT 5b	X
2A	A4	CH5+		Shield	Y
2A	B4	CH5-		nc	Z
2A	A3	CH6+		OUT 6a	a
2A	B3	CH6-		OUT 6b	b
2A	A2	CH6+		OUT 6a	c
2A	B2	CH6-		OUT 6b	d
2A	A1	nc		OUT 7a	e
2A	B1	nc		OUT 7b	f
				OUT 7a	h
2B	A5	CH7+		OUT 7b	j
2B	B5	CH7-		OUT 8a	k
2B	A4	CH7+		OUT 8b	l
2B	B4	CH7-		OUT 8a	m
2B	A3	CH8+		OUT 8b	n
2B	B3	CH8-		OUT 9a	p
2B	A2	CH8+		OUT 9b	r
2B	B2	CH8-		OUT 9a	s
2B	A1	nc		OUT 9b	t
2B	B1	nc		OUT 10a	u
				OUT 10b	v
3A	A5	CH9+		OUT 10a	w
3A	B5	CH9-		OUT 10b	x
3A	A4	CH9+		OUT 11a	y
3A	B4	CH9-		OUT 11b	z
3A	A3	CH10+		OUT 11a	AA
3A	B3	CH10-		OUT 11b	BB
3A	A2	CH10+		OUT 12a	CC
3A	B2	CH10-		OUT 12b	DD
3A	A1	nc		OUT 12a	EE
3A	B1	nc		OUT 12b	FF
				nc	HH
3B	A5	CH11+		nc	JJ
3B	B5	CH11-		nc	KK
3B	A4	CH11+		nc	LL
3B	B4	CH11-		nc	MM
3B	A3	CH12+		nc	NN
3B	B3	CH12-			
3B	A2	CH12+			
3B	B2	CH12-			
3B	A1	nc			
3B	B1	nc			

nc = not connected

Figure 3   Connections diagram (two wire pairs per channel)

Technical data   The FTA-E-02 module has the following specifications:

General   Type number: FTA-E-02
               Approvals: CE, UL

Power   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

Physical   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)

Termination ELCO socket: 8016 series, 56 pins

Left blank intentionally.

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

	CONNECTIONS DIAGRAM FTA-E-03			
SIC connector				**Field terminals**

Connector	Pin number	Signals	Digital output module (16 channels)	Signals	Elco pin number
1A	A5	CH1		OUT 1a	A
1A	B5	CH2		OUT 1b	B
1A	A4	CH3		OUT 2a	C
1A	B4	CH4		OUT 2b	D
1A	A3	CH5		OUT 3a	E
1A	B3	CH6		OUT 3b	F
1A	A2	CH7		OUT 4a	H
1A	B2	nc		OUT 4b	J
1A	A1	CH8		OUT 5a	K
1A	B1	0 Vdc		OUT 5b	L
				OUT 6a	M
				OUT 6b	N
				OUT 7a	P
				OUT 7b	R
				OUT 8a	S
				OUT 8b	T
				OUT 9a	U
				OUT 9b	V
1B	A5	CH9		OUT 10a	W
1B	B5	CH10		OUT 10b	X
1B	A4	CH11		Shield	Y
1B	B4	CH12		nc	Z
1B	A3	CH13		OUT 11a	a
1B	B3	CH14		OUT 11b	b
1B	A2	CH15		OUT 12a	c
1B	B2	nc		OUT 12b	d
1B	A1	CH16		OUT 13a	e
1B	B1	0 Vdc		OUT 13b	f
				OUT 14a	h
				OUT 14b	j
				OUT 15a	k
				OUT 15b	l
				OUT 16a	m
				OUT 16b	n
				OUT 17a	p
				OUT 17b	r
				OUT 18a	s
				OUT 18b	t
2A	A5	CH17		OUT 19a	u
2A	B5	CH18		OUT 19b	v
2A	A4	CH19		OUT 20a	w
2A	B4	CH20		OUT 20b	x
2A	A3	CH21		OUT 21a	y
2A	B3	CH22		OUT 21b	z
2A	A2	CH23		OUT 22a	AA
2A	B2	nc		OUT 22b	BB
2A	A1	CH24		OUT 23a	CC
2A	B1	0 Vdc		OUT 23b	DD
				OUT 24a	EE
				OUT 24b	FF
				nc	HH
				nc	JJ
				nc	KK
				nc	LL
				nc	MM
				nc	NN

nc = not connected

Figure 2   Connections diagram
(for 16-channel digital output modules)

![Honeywell]

Connections diagram

CONNECTIONS DIAGRAM FTA-E-03					
SIC connector				**Field terminals**	
Connector	Pin number	Signals	Example for 12-channel digital output module 10206/2/1	Signals	Elco pin number
1A	A5	CH1		OUT 1a	A
1A	B5	CH2		OUT 1b	B
1A	A4	CH3		OUT 2a	C
1A	B4	CH4		OUT 2b	D
1A	A3	CH5		OUT 3a	E
1A	B3	CH6		OUT 3b	F
1A	A2	CH7		OUT 4a	H
1A	B2	nc		OUT 4b	J
1A	A1	CH8		OUT 5a	K
1A	B1	0 Vdc		OUT 5b	L
				OUT 6a	M
				OUT 6b	N
				OUT 7a	P
				OUT 7b	R
				OUT 8a	S
				OUT 8b	T
				OUT 9a	U
				OUT 9b	V
1B	A5	CH9		OUT 10a	W
1B	B5	CH10		OUT 10b	X
1B	A4	CH11		Shield	Y
1B	B4	CH12		nc	Z
1B	A3	0 Vdc		OUT 11a	a
1B	B3	0 Vdc		OUT 11b	b
1B	A2	0 Vdc		OUT 12a	c
1B	B2	nc		OUT 12b	d
1B	A1	0 Vdc		0 Vdc	e
1B	B1	0 Vdc		0 Vdc	f
				0 Vdc	h
				0 Vdc	j
				0 Vdc	k
				0 Vdc	l
				0 Vdc	m
				0 Vdc	n
				OUT 13a	p
				OUT 13b	r
				OUT 14a	s
				OUT 14b	t
2A	A5	CH13		OUT 15a	u
2A	B5	CH14		OUT 15b	v
2A	A4	CH15		OUT 16a	w
2A	B4	CH16		OUT 16b	x
2A	A3	CH17		OUT 17a	y
2A	B3	CH18		OUT 17b	z
2A	A2	CH19		OUT 18a	AA
2A	B2	nc		OUT 18b	BB
2A	A1	CH20		OUT 19a	CC
2A	B1	0 Vdc		OUT 19b	DD
				OUT 20a	EE
				OUT 20b	FF
				nc	HH
				nc	JJ
				nc	KK
				nc	LL
				nc	MM
				nc	NN

nc = not connected

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:

General	Type number:	FTA-E-03
	Approvals:	CE, UL
Power	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
Physical	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)
Termination	ELCO socket:	8016 series, 56 pins

Left blank intentionally.

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

CONNECTIONS DIAGRAM FTA-E-04					
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Elco pin number
1A	A5	CH1 c		OUT 1a	A
1A	B5	CH1 no		OUT 1b	B
1A	A4	CH2 c		OUT 2a	C
1A	B4	CH2 no		OUT 2b	D
1A	A3	CH3 c		OUT 3a	E
1A	B3	CH3 no		OUT 3b	F
1A	A2	CH4 c		OUT 4a	H
1A	B2	CH4 no		OUT 4b	J
1A	A1	CH5 c		OUT 5a	K
1A	B1	CH5 no		OUT 5b	L
				OUT 6a	M
1B	A5	CH6 c		OUT 6b	N
1B	B5	CH6 no		OUT 7a	P
1B	A4	CH7 c		OUT 7b	R
1B	B4	CH7 no		OUT 8a	S
1B	A3	CH8 c		OUT 8b	T
1B	B3	CH8 no		OUT 9a	U
1B	A2	CH9 c		OUT 9b	V
1B	B2	CH9 no		OUT 10a	W
1B	A1	CH10 c		OUT 10b	X
1B	B1	CH10 no		Shield	Y
				nc	Z
2A	A5	CH11 c		OUT 11a	a
2A	B5	CH11 no		OUT 11b	b
2A	A4	CH12 c		OUT 12a	c
2A	B4	CH12 no		OUT 12b	d
2A	A3	CH13 c		OUT 13a	e
2A	B3	CH13 no		OUT 13b	f
2A	A2	CH14 c		OUT 14a	h
2A	B2	CH14 no		OUT 14b	j
2A	A1	CH15 c		OUT 15a	k
2A	B1	CH15 no		OUT 15b	l
				OUT 16a	m
2B	A5	CH16 c		OUT 16b	n
2B	B5	CH16 no		OUT 17a	p
2B	A4	CH17 c		OUT 17b	r
2B	B4	CH17 no		OUT 18a	s
2B	A3	CH18 c		OUT 18b	t
2B	B3	CH18 no		OUT 19a	u
2B	A2	CH19 c		OUT 19b	v
2B	B2	CH19 no		OUT 20a	w
2B	A1	CH20 c		OUT 20b	x
2B	B1	CH20 no		OUT 21a	y
				OUT 21b	z
3A	A5	CH21 c		OUT 22a	AA
3A	B5	CH21 no		OUT 22b	BB
3A	A4	CH22 c		OUT 23a	CC
3A	B4	CH22 no		OUT 23b	DD
3A	A3	CH23 c		OUT 24a	EE
3A	B3	CH23 no		OUT 24b	FF
3A	A2	CH24 c		OUT 25a	HH
3A	B2	CH24 no		OUT 25b	JJ
3A	A1	CH25 c		nc	KK
3A	B1	CH25 no		nc	LL
				nc	MM
				nc	NN

nc = not connected

Figure 2   Connections diagram

Technical data   The FTA-E-04 module has the following specifications:

General   Type number: FTA-E-04
                Approvals: CE, UL

Power   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

Physical   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)

Termination ELCO socket: 8016 series, 56 pins

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.
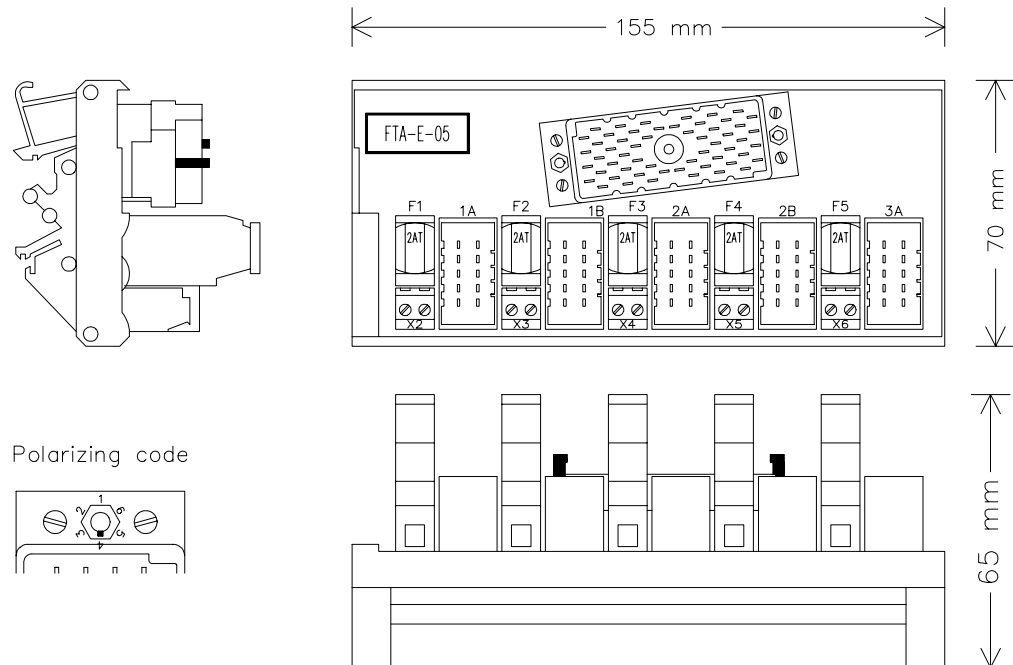
Figure 1 Mechanical layout

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.
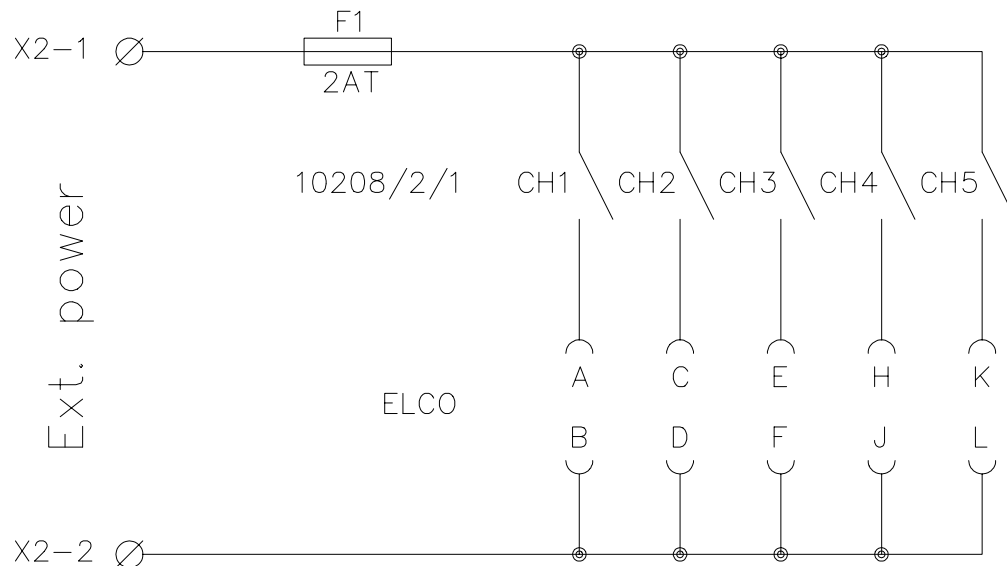
Figure 2   Schematic diagram of one group

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

CONNECTIONS DIAGRAM FTA-E-05					
SIC connector				Field terminals	
Connector	Pin number	Signals		Signals	Elco pin number
			2 AT		
X2	1	+ Vext			
X2	2	- Vext			
1A	A5	CH1 c			
1A	B5	CH1 no			
1A	A4	CH2 c			
1A	B4	CH2 no			
1A	A3	CH3 c			
1A	B3	CH3 no			
1A	A2	CH4 c			
1A	B2	CH4 no		OUT 1a	A
1A	A1	CH5 c		OUT 1b	B
1A	B1	CH5 no		OUT 2a	C
			2 AT	OUT 2b	D
X3	1	+ Vext		OUT 3a	E
X3	2	- Vext		OUT 3b	F
				OUT 4a	H
1B	A5	CH6 c		OUT 4b	J
1B	B5	CH6 no		OUT 5a	K
1B	A4	CH7 c		OUT 5b	L
1B	B4	CH7 no		OUT 6a	M
1B	A3	CH8 c		OUT 6b	N
1B	B3	CH8 no		OUT 7a	P
1B	A2	CH9 c		OUT 7b	R
1B	B2	CH9 no		OUT 8a	S
1B	A1	CH10 c		OUT 8b	T
1B	B1	CH10 no		OUT 9a	U
			2 AT	OUT 9b	V
X4	1	+ Vext		OUT 10a	W
X4	2	- Vext		OUT 10b	X
				Shield	Y
2A	A5	CH11 c		nc	Z
2A	B5	CH11 no		OUT 11a	a
2A	A4	CH12 c		OUT 11b	b
2A	B4	CH12 no		OUT 12a	c
2A	A3	CH13 c		OUT 12b	d
2A	B3	CH13 no		OUT 13a	e
2A	A2	CH14 c		OUT 13b	f
2A	B2	CH14 no		OUT 14a	h
2A	A1	CH15 c		OUT 14b	j
2A	B1	CH15 no		OUT 15a	k
			2 AT	OUT 15b	l
X5	1	+ Vext		OUT 16a	m
X5	2	- Vext		OUT 16b	n
				OUT 17a	p
2B	A5	CH16 c		OUT 17b	r
2B	B5	CH16 no		OUT 18a	s
2B	A4	CH17 c		OUT 18b	t
2B	B4	CH17 no		OUT 19a	u
2B	A3	CH18 c		OUT 19b	v
2B	B3	CH18 no		OUT 20a	w
2B	A2	CH19 c		OUT 20b	x
2B	B2	CH19 no		OUT 21a	y
2B	A1	CH20 c		OUT 21b	z
2B	B1	CH20 no		OUT 22a	AA
			2 AT	OUT 22b	BB
X6	1	+ Vext		OUT 23a	CC
X6	2	- Vext		OUT 23b	DD
				OUT 24a	EE
3A	A5	CH21 c		OUT 24b	FF
3A	B5	CH21 no		OUT 25a	HH
3A	A4	CH22 c		OUT 25b	JJ
3A	B4	CH22 no		nc	KK
3A	A3	CH23 c		nc	LL
3A	B3	CH23 no		nc	MM
3A	A2	CH24 c		nc	NN
3A	B2	CH24 no			
3A	A1	CH25 c			
3A	B1	CH25 no			
no = normally open				nc = not connected	

Figure 3   Connections diagram

Technical data   The FTA-E-05 module has the following specifications:

General   Type number: FTA-E-05
Approvals: CE, UL

Power   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)

Fuses   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)

Physical   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)

Termination   ELCO socket: 8016 series, 56 pins

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).

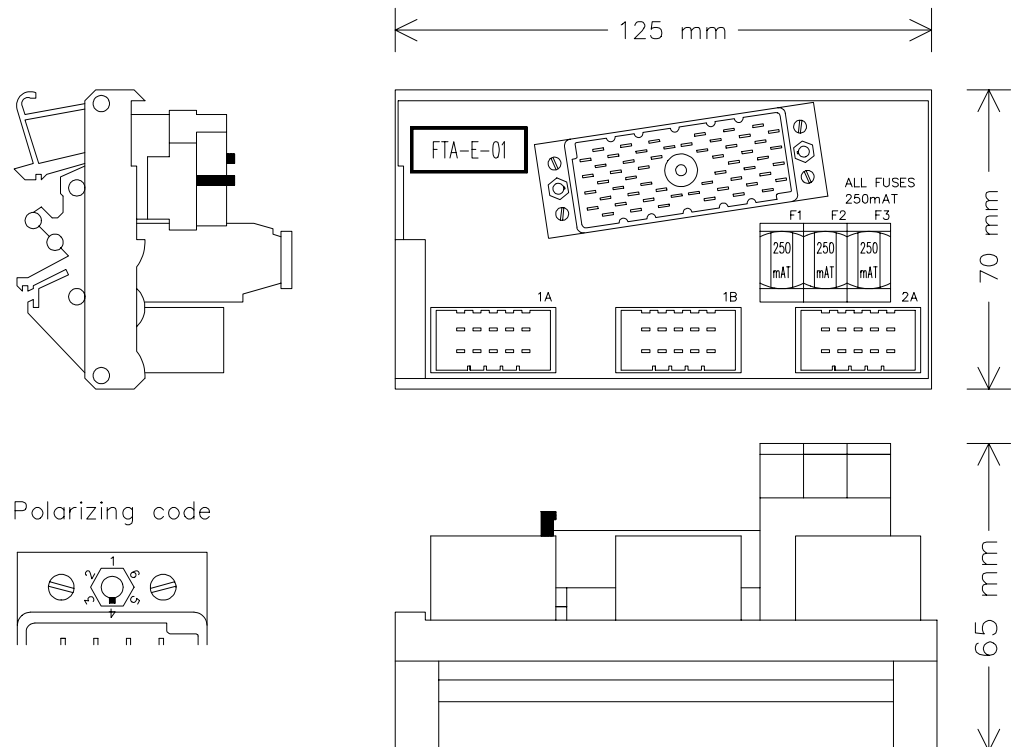The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.
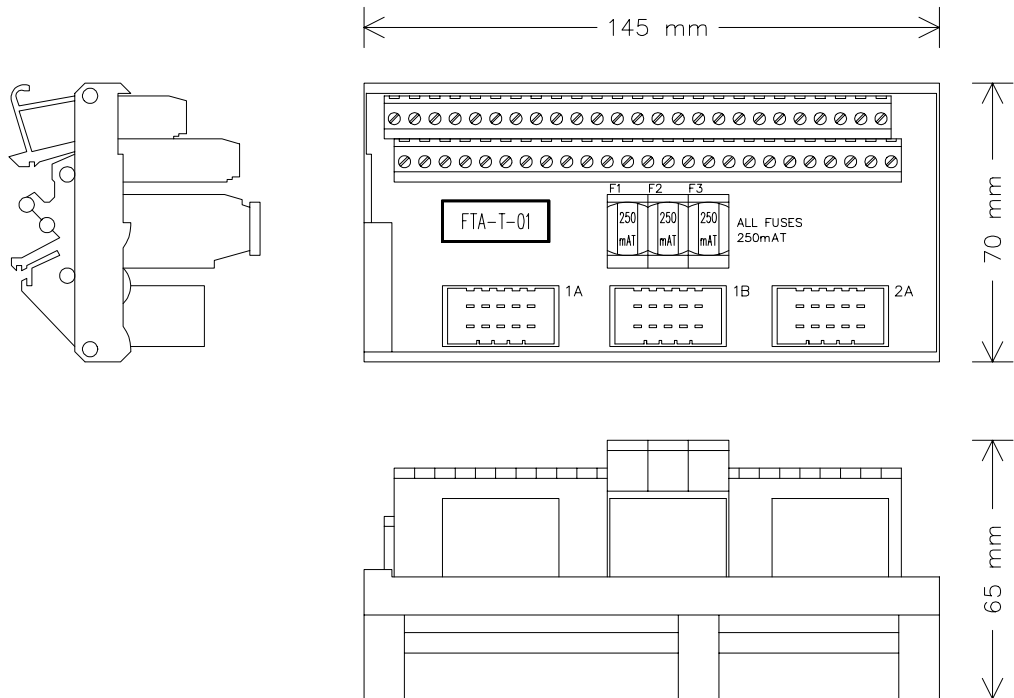
Figure 1   Mechanical layout

Applications

For details on applications and connection options for the FTA-T-01 module refer to the 'SIC to FTA applications' data sheet.

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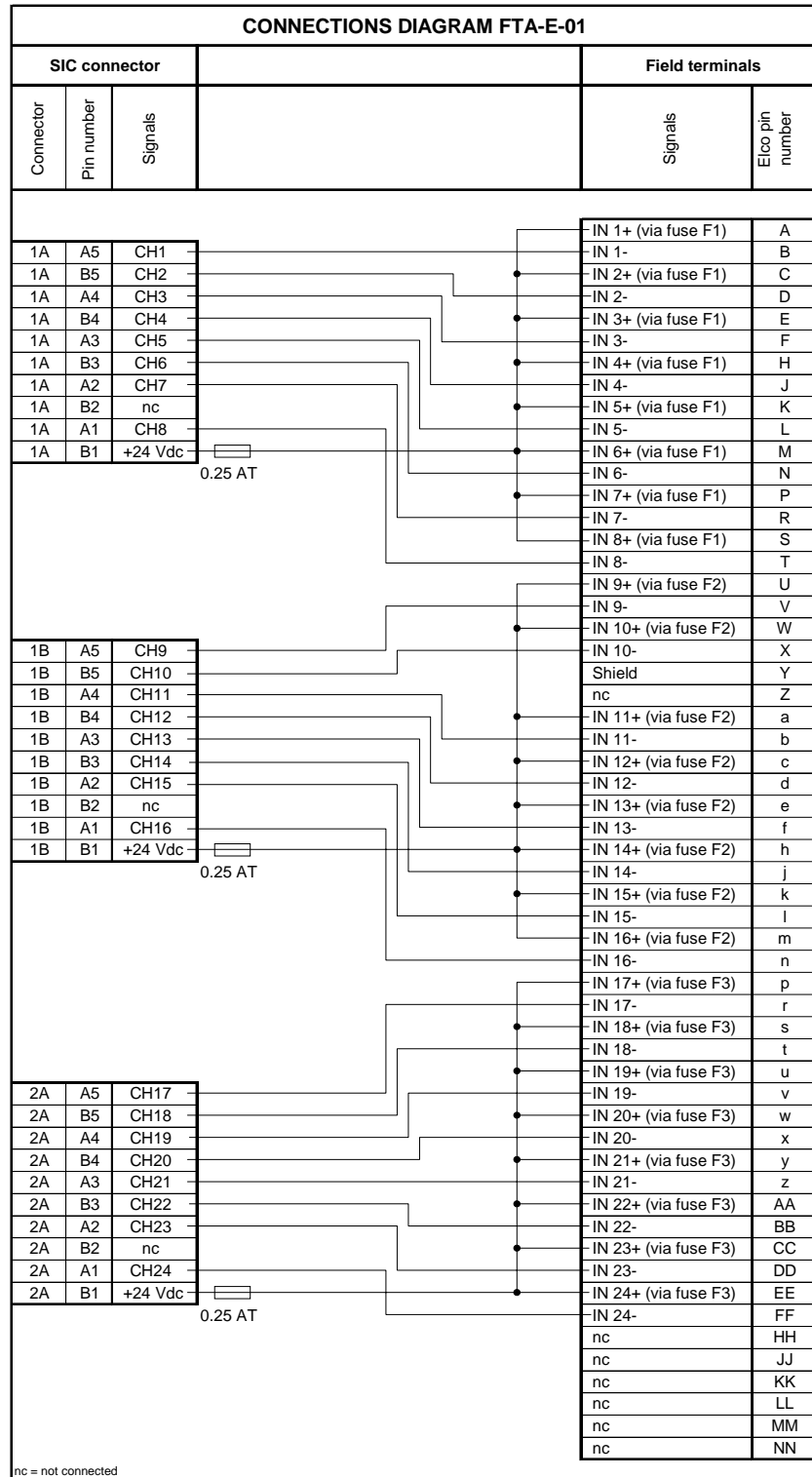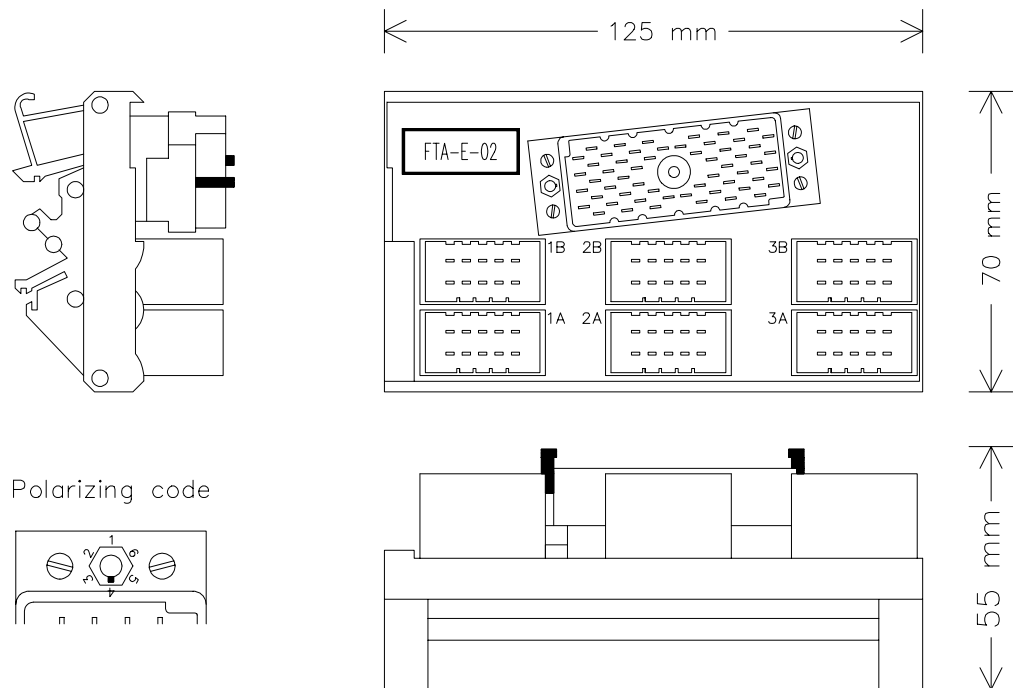**Connections**   The connections diagram of the FTA-T-01 module is as follows:

CONNECTIONS DIAGRAM FTA-T-01					
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Terminal number
				IN 1+ (via fuse F1)	1
1A	A5	CH1		IN 1-	2
1A	B5	CH2		IN 2+ (via fuse F1)	3
1A	A4	CH3		IN 2-	4
1A	B4	CH4		IN 3+ (via fuse F1)	5
1A	A3	CH5		IN 3-	6
1A	B3	CH6		IN 4+ (via fuse F1)	7
1A	A2	CH7		IN 4-	8
1A	B2	nc		IN 5+ (via fuse F1)	9
1A	A1	CH8		IN 5-	10
1A	B1	+24 Vdc	0.25 AT	IN 6+ (via fuse F1)	11
				IN 6-	12
				IN 7+ (via fuse F1)	13
				IN 7-	14
				IN 8+ (via fuse F1)	15
				IN 8-	16
				IN 9+ (via fuse F2)	17
				IN 9-	18
				IN 10+ (via fuse F2)	19
1B	A5	CH9		IN 10-	20
1B	B5	CH10		IN 11+ (via fuse F2)	21
1B	A4	CH11		IN 11-	22
1B	B4	CH12		IN 12+ (via fuse F2)	23
1B	A3	CH13		IN 12-	24
1B	B3	CH14		IN 13+ (via fuse F2)	25
1B	A2	CH15		IN 13-	26
1B	B2	nc		IN 14+ (via fuse F2)	27
1B	A1	CH16		IN 14-	28
1B	B1	+24 Vdc	0.25 AT	IN 15+ (via fuse F2)	29
				IN 15-	30
				IN 16+ (via fuse F2)	31
				IN 16-	32
				IN 17+ (via fuse F3)	33
				IN 17-	34
				IN 18+ (via fuse F3)	35
				IN 18-	36
				IN 19+ (via fuse F3)	37
2A	A5	CH17		IN 19-	38
2A	B5	CH18		IN 20+ (via fuse F3)	39
2A	A4	CH19		IN 20-	40
2A	B4	CH20		IN 21+ (via fuse F3)	41
2A	A3	CH21		IN 21-	42
2A	B3	CH22		IN 22+ (via fuse F3)	43
2A	A2	CH23		IN 22-	44
2A	B2	nc		IN 23+ (via fuse F3)	45
2A	A1	CH24		IN 23-	46
2A	B1	+24 Vdc	0.25 AT	IN 24+ (via fuse F3)	47
				IN 24-	48
				Shield	49
				Shield	50

nc = not connected

Figure 2   Connections diagram

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Technical data   The FTA-T-01 module has the following specifications:

General	Type number:	FTA-T-01
	Approvals:	CE, UL
Power	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)
Physical	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)
Fuse	Rating:	250 mAT (slow-acting)
	Dimensions:	5 x 20 mm (0.2 x 0.79 in) or
		5 x 25 mm(0.2 x 0.98 in)
Termination	Screw terminals:	
	− max. wire diameter	2.5 mm² (AWG 14)
	− strip length	7 mm (0.28 in)
	− tightening torque	0.5 Nm (0.37 ft-lb)

Left blank intentionally.

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).

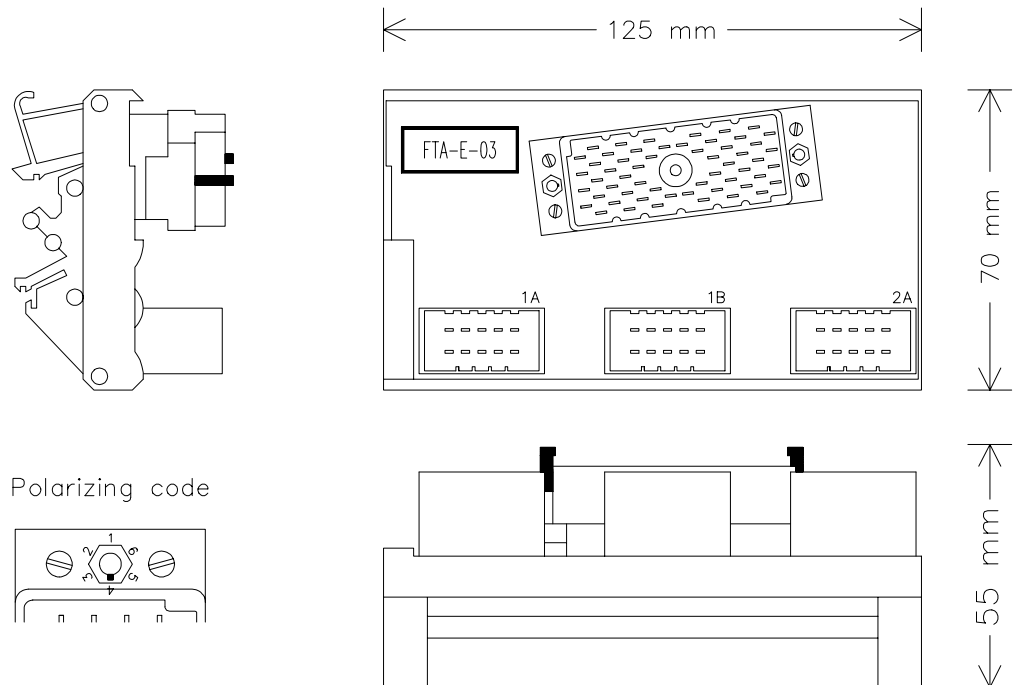The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

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:

CONNECTIONS DIAGRAM FTA-T-02

Connector	Pin number	Signals		Signals	Terminal number
			SIC connector / **Field terminals**		
1A	A5	CH1+			
1A	B5	CH1-			
1A	A4	CH2+			
1A	B4	CH2-			
1A	A3	CH3+			
1A	B3	CH3-			
1A	A2	CH4+		OUT 1a	1
1A	B2	CH4-		OUT 1b	2
1A	A1	nc		OUT 2a	3
1A	B1	nc		OUT 2b	4
				OUT 3a	5
1B	A5	CH5+		OUT 3b	6
1B	B5	CH5-		OUT 4a	7
1B	A4	CH6+		OUT 4b	8
1B	B4	CH6-		OUT 5a	9
1B	A3	CH7+		OUT 5b	10
1B	B3	CH7-		OUT 6a	11
1B	A2	CH8+		OUT 6b	12
1B	B2	CH8-		OUT 7a	13
1B	A1	nc		OUT 7b	14
1B	B1	nc		OUT 8a	15
				OUT 8b	16
2A	A5	CH9+		OUT 9a	17
2A	B5	CH9-		OUT 9b	18
2A	A4	CH10+		OUT 10a	19
2A	B4	CH10-		OUT 10b	20
2A	A3	CH11+		OUT 11a	21
2A	B3	CH11-		OUT 11b	22
2A	A2	CH12+		OUT 12a	23
2A	B2	CH12-		OUT 12b	24
2A	A1	nc		OUT 13a	25
2A	B1	nc		OUT 13b	26
				OUT 14a	27
2B	A5	CH13+		OUT 14b	28
2B	B5	CH13-		OUT 15a	29
2B	A4	CH14+		OUT 15b	30
2B	B4	CH14-		OUT 16a	31
2B	A3	CH15+		OUT 16b	32
2B	B3	CH15-		OUT 17a	33
2B	A2	CH16+		OUT 17b	34
2B	B2	CH16-		OUT 18a	35
2B	A1	nc		OUT 18b	36
2B	B1	nc		OUT 19a	37
				OUT 19b	38
3A	A5	CH17+		OUT 20a	39
3A	B5	CH17-		OUT 20b	40
3A	A4	CH18+		OUT 21a	41
3A	B4	CH18-		OUT 21b	42
3A	A3	CH19+		OUT 22a	43
3A	B3	CH19-		OUT 22b	44
3A	A2	CH20+		OUT 23a	45
3A	B2	CH20-		OUT 23b	46
3A	A1	nc		OUT 24a	47
3A	B1	nc		OUT 24b	48
				Shield	49
3B	A5	CH21+		Shield	50
3B	B5	CH21-			
3B	A4	CH22+			
3B	B4	CH22-			
3B	A3	CH23+			
3B	B3	CH23-			
3B	A2	CH24+			
3B	B2	CH24-			
3B	A1	nc			
3B	B1	nc			

nc = not connected

Figure 2   Connections diagram

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Technical data   The FTA-T-02 module has the following specifications:

General

Type number:	FTA-T-02
Approvals:	CE, UL

Power

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

Physical

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)

Termination

Screw terminals:

− max. wire diameter	2.5 mm² (AWG 14)
− strip length	7 mm (0.28 in)
− tightening torque	0.5 Nm (0.37 ft-lb)

Left blank intentionally.

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).

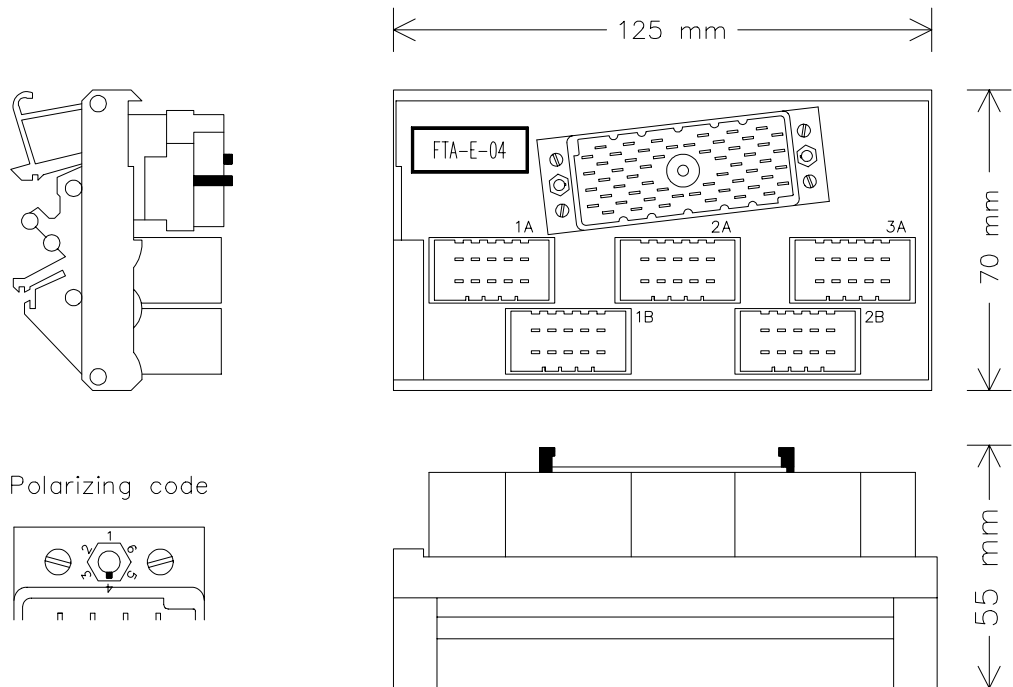The FTA module has a universal snap-in facility for standard DIN EN rails, and screw terminals for connecting field wiring.

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.
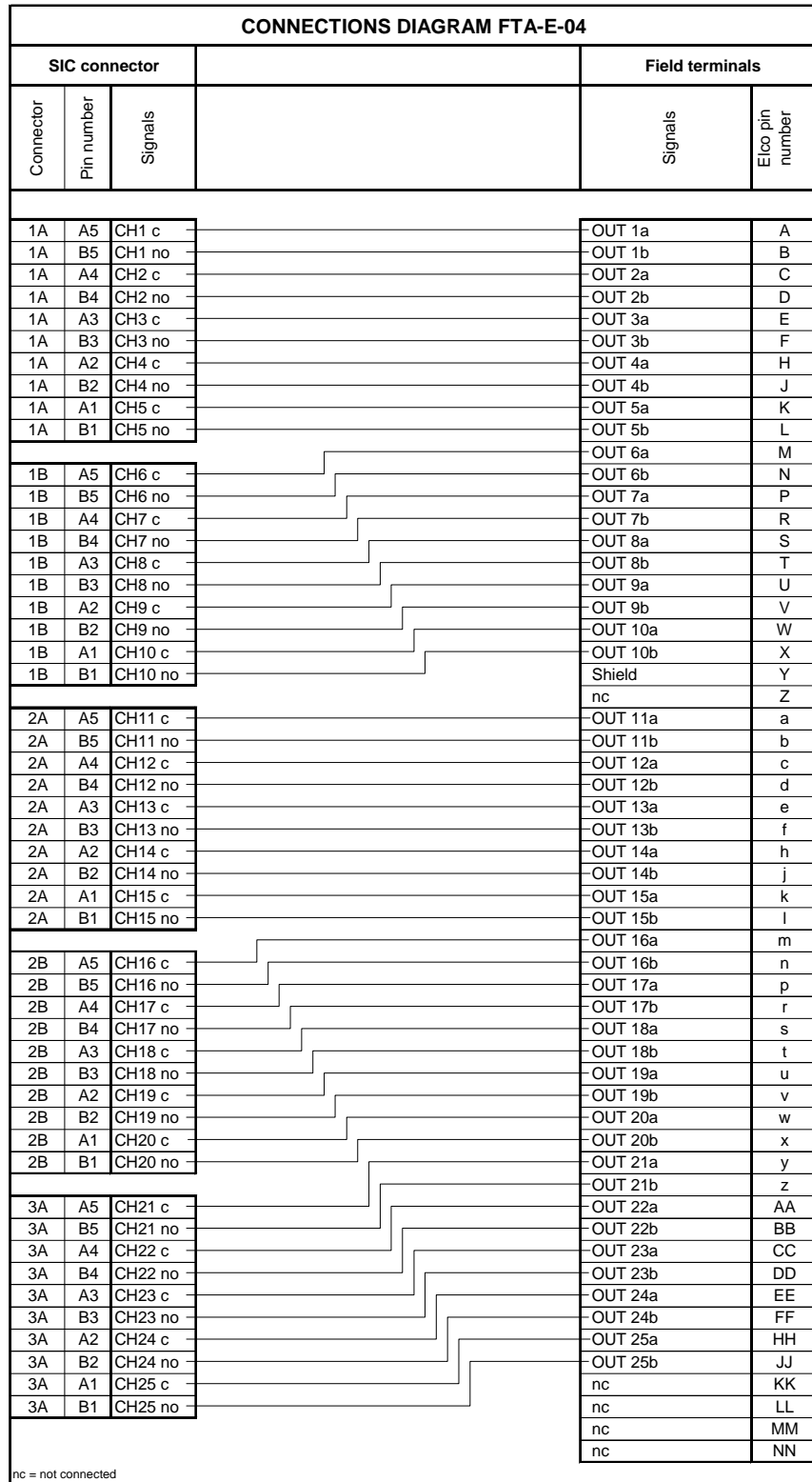
Connections diagrams

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

CONNECTIONS DIAGRAM FTA-T-03					
SIC connector				**Field terminals**	
Connector	Pin number	Signals	Digital output module (16 channels)	Signals	Terminal number
1A	A5	CH1		OUT 1a	1
1A	B5	CH2		OUT 1b	2
1A	A4	CH3		OUT 2a	3
1A	B4	CH4		OUT 2b	4
1A	A3	CH5		OUT 3a	5
1A	B3	CH6		OUT 3b	6
1A	A2	CH7		OUT 4a	7
1A	B2	nc		OUT 4b	8
1A	A1	CH8		OUT 5a	9
1A	B1	0 Vdc		OUT 5b	10
				OUT 6a	11
				OUT 6b	12
				OUT 7a	13
				OUT 7b	14
				OUT 8a	15
				OUT 8b	16
				OUT 9a	17
				OUT 9b	18
1B	A5	CH9		OUT 10a	19
1B	B5	CH10		OUT 10b	20
1B	A4	CH11		OUT 11a	21
1B	B4	CH12		OUT 11b	22
1B	A3	CH13		OUT 12a	23
1B	B3	CH14		OUT 12b	24
1B	A2	CH15		OUT 13a	25
1B	B2	nc		OUT 13b	26
1B	A1	CH16		OUT 14a	27
1B	B1	0 Vdc		OUT 14b	28
				OUT 15a	29
				OUT 15b	30
				OUT 16a	31
				OUT 16b	32
				OUT 17a	33
				OUT 17b	34
				OUT 18a	35
				OUT 18b	36
2A	A5	CH17		OUT 19a	37
2A	B5	CH18		OUT 19b	38
2A	A4	CH19		OUT 20a	39
2A	B4	CH20		OUT 20b	40
2A	A3	CH21		OUT 21a	41
2A	B3	CH22		OUT 21b	42
2A	A2	CH23		OUT 22a	43
2A	B2	nc		OUT 22b	44
2A	A1	CH24		OUT 23a	45
2A	B1	0 Vdc		OUT 23b	46
				OUT 24a	47
				OUT 24b	48
				Shield	49
				Shield	50

nc = not connected

Figure 2   Connections diagram
(for 16-channel digital output modules)

Connections diagram

CONNECTIONS DIAGRAM FTA-T-03					
SIC connector				Field terminals	
Connector	Pin number	Signals	Example for 12-channel digital output module (10206/2/1)	Signals	Terminal number
1A	A5	CH1		OUT 1a	1
1A	B5	CH2		OUT 1b	2
1A	A4	CH3		OUT 2a	3
1A	B4	CH4		OUT 2b	4
1A	A3	CH5		OUT 3a	5
1A	B3	CH6		OUT 3b	6
1A	A2	CH7		OUT 4a	7
1A	B2	nc		OUT 4b	8
1A	A1	CH8		OUT 5a	9
1A	B1	0 Vdc		OUT 5b	10
				OUT 6a	11
				OUT 6b	12
				OUT 7a	13
				OUT 7b	14
				OUT 8a	15
				OUT 8b	16
				OUT 9a	17
				OUT 9b	18
1B	A5	CH9		OUT 10a	19
1B	B5	CH10		OUT 10b	20
1B	A4	CH11		OUT 11a	21
1B	B4	CH12		OUT 11b	22
1B	A3	0 Vdc		OUT 12a	23
1B	B3	0 Vdc		OUT 12b	24
1B	A2	0 Vdc		0 Vdc	25
1B	B2	nc		0 Vdc	26
1B	A1	0 Vdc		0 Vdc	27
1B	B1	0 Vdc		0 Vdc	28
				0 Vdc	29
				0 Vdc	30
				0 Vdc	31
				0 Vdc	32
				OUT 13a	33
				OUT 13b	34
				OUT 14a	35
				OUT 14b	36
2A	A5	CH13		OUT 15a	37
2A	B5	CH14		OUT 15b	38
2A	A4	CH15		OUT 16a	39
2A	B4	CH16		OUT 16b	40
2A	A3	CH17		OUT 17a	41
2A	B3	CH18		OUT 17b	42
2A	A2	CH19		OUT 18a	43
2A	B2	nc		OUT 18b	44
2A	A1	CH20		OUT 19a	45
2A	B1	0 Vdc		OUT 19b	46
				OUT 20a	47
				OUT 20b	48
				Shield	49
				Shield	50

nc = not connected

Figure 3   Connections diagram
(example for 12-channel digital output module 10206/2/1)

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Technical data   The FTA-T-03 module has the following specifications:

General
Type number:	FTA-T-03
Approvals:	CE, UL

Power
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

Physical
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)

Termination
Screw terminals:
− max. wire diameter	2.5 mm² (AWG 14)
− strip length	7 mm (0.28 in)
− tightening torque	0.5 Nm (0.37 ft-lb)

Left blank intentionally.

![Honeywell FSC logo]

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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.
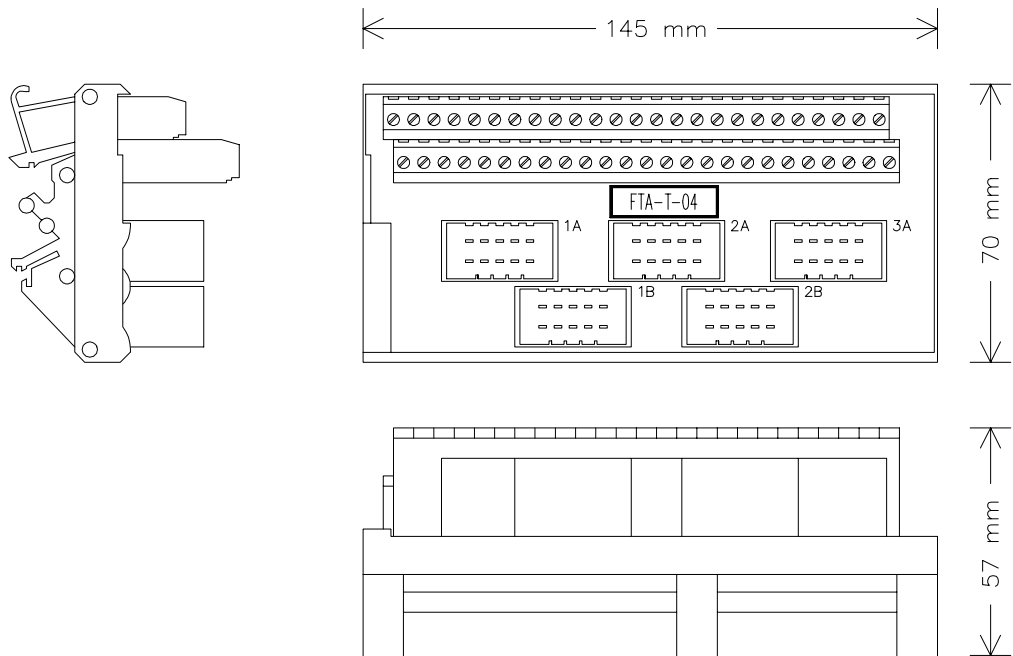
Figure 1   Mechanical layout

Applications   For details on applications and connection options for the FTA-T-04
module refer to the 'SIC to FTA applications' data sheet.

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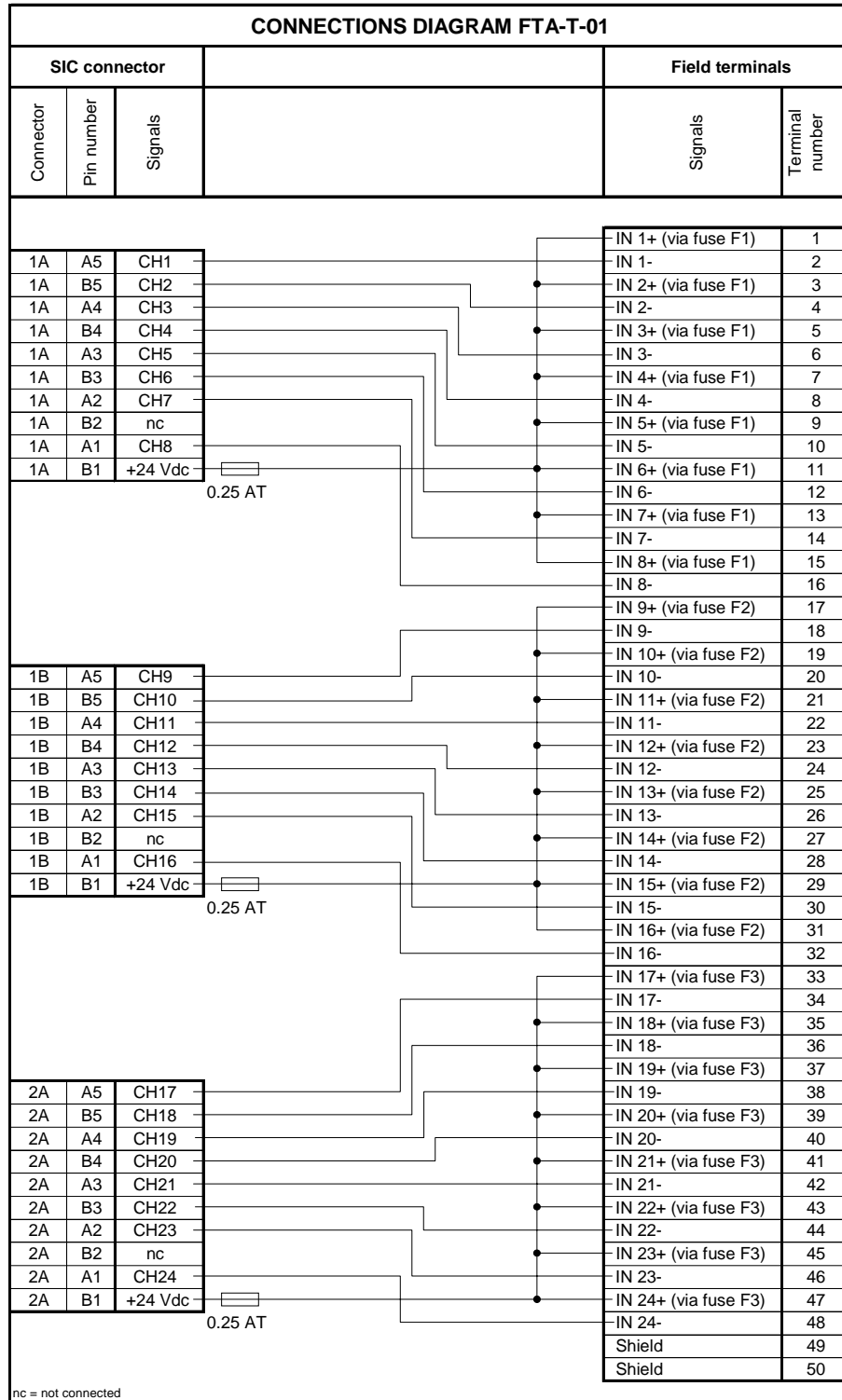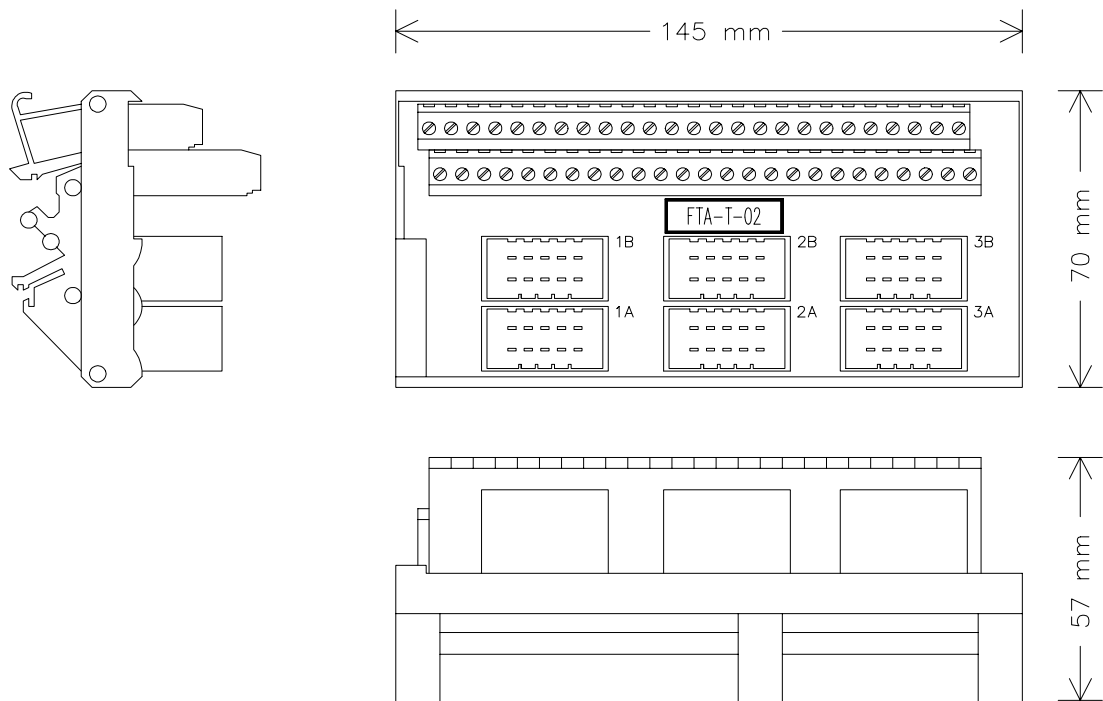**Connections**

The connections diagram of the FTA-T-04 module is as follows:

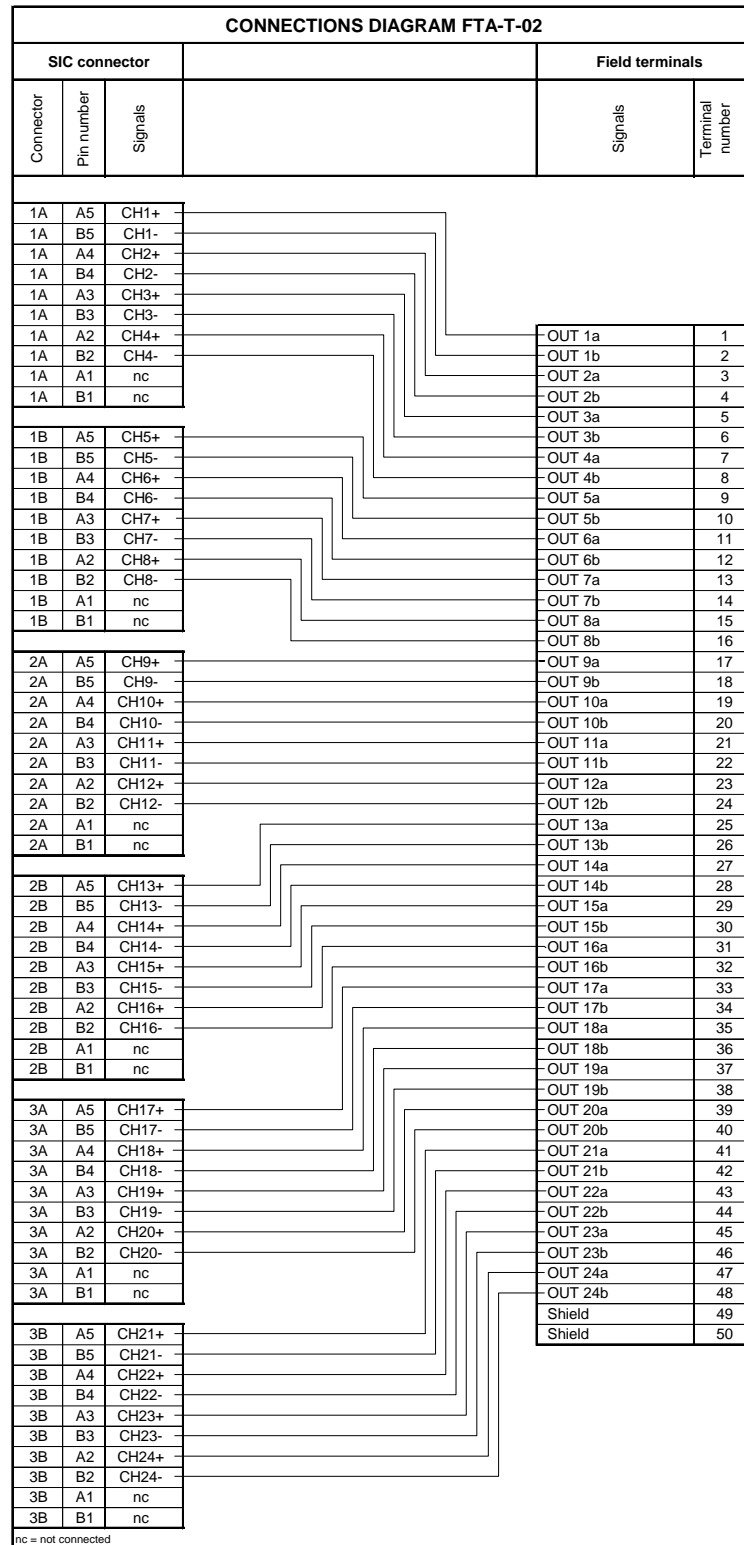| CONNECTIONS DIAGRAM FTA-T-04					
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Terminal number
1A	A5	CH1 c			
1A	B5	CH1 no			
1A	A4	CH2 c		OUT 1a	1
1A	B4	CH2 no		OUT 1b	2
1A	A3	CH3 c		OUT 2a	3
1A	B3	CH3 no		OUT 2b	4
1A	A2	CH4 c		OUT 3a	5
1A	B2	CH4 no		OUT 3b	6
1A	A1	CH5 c		OUT 4a	7
1A	B1	CH5 no		OUT 4b	8
				OUT 5a	9
1B	A5	CH6 c		OUT 5b	10
1B	B5	CH6 no		OUT 6a	11
1B	A4	CH7 c		OUT 6b	12
1B	B4	CH7 no		OUT 7a	13
1B	A3	CH8 c		OUT 7b	14
1B	B3	CH8 no		OUT 8a	15
1B	A2	CH9 c		OUT 8b	16
1B	B2	CH9 no		OUT 9a	17
1B	A1	CH10 c		OUT 9b	18
1B	B1	CH10 no		OUT 10a	19
				OUT 10b	20
2A	A5	CH11 c		OUT 11a	21
2A	B5	CH11 no		OUT 11b	22
2A	A4	CH12 c		OUT 12a	23
2A	B4	CH12 no		OUT 12b	24
2A	A3	CH13 c		OUT 13a	25
2A	B3	CH13 no		OUT 13b	26
2A	A2	CH14 c		OUT 14a	27
2A	B2	CH14 no		OUT 14b	28
2A	A1	CH15 c		OUT 15a	29
2A	B1	CH15 no		OUT 15b	30
				OUT 16a	31
2B	A5	CH16 c		OUT 16b	32
2B	B5	CH16 no		OUT 17a	33
2B	A4	CH17 c		OUT 17b	34
2B	B4	CH17 no		OUT 18a	35
2B	A3	CH18 c		OUT 18b	36
2B	B3	CH18 no		OUT 19a	37
2B	A2	CH19 c		OUT 19b	38
2B	B2	CH19 no		OUT 20a	39
2B	A1	CH20 c		OUT 20b	40
2B	B1	CH20 no		OUT 21a	41
				OUT 21b	42
3A	A5	CH21 c		OUT 22a	43
3A	B5	CH21 no		OUT 22b	44
3A	A4	CH22 c		OUT 23a	45
3A	B4	CH22 no		OUT 23b	46
3A	A3	CH23 c		OUT 24a	47
3A	B3	CH23 no		OUT 24b	48
3A	A2	CH24 c		OUT 25a	49
3A	B2	CH24 no		OUT 25b	50
3A	A1	CH25 c			
3A	B1	CH25 no			

Figure 2   Connections diagram

Technical data   The FTA-T-04 module has the following specifications:

General   Type number: FTA-T-04
               Approvals: CE, UL

Power   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

Physical   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)

Termination   Screw terminals:
                  − max. wire diameter   2.5 mm² (AWG 14)
                  − strip length   7 mm (0.28 in)
                  − tightening torque   0.5 Nm (0.37 ft-lb)

Left blank intentionally.

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.
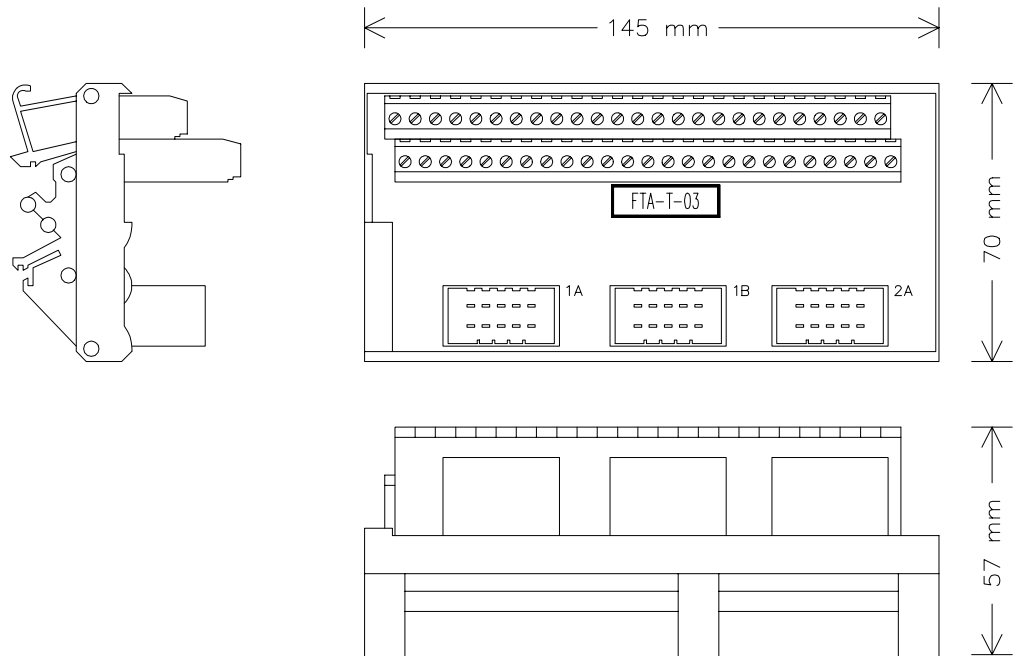

Figure 1   Mechanical layout

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:

	CONNECTIONS DIAGRAM FTA-T-05				
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Terminal number
1A	A5	CH1+			
1A	B5	CH1-			
1A	A4	CH1+			
1A	B4	CH1-			
1A	A3	CH2+			
1A	B3	CH2-			
1A	A2	CH2+			
1A	B2	CH2-			
1A	A1	nc			
1A	B1	nc			
1B	A5	CH3+			
1B	B5	CH3-			
1B	A4	CH3+			
1B	B4	CH3-			
1B	A3	CH4+			
1B	B3	CH4-			
1B	A2	CH4+			
1B	B2	CH4-		OUT 1a	1
1B	A1	nc		OUT 1b	2
1B	B1	nc		OUT 2a	3
				OUT 2b	4
2A	A5	CH5+		OUT 3a	5
2A	B5	CH5-		OUT 3b	6
2A	A4	CH5+		OUT 4a	7
2A	B4	CH5-		OUT 4b	8
2A	A3	CH6+		OUT 5a	9
2A	B3	CH6-		OUT 5b	10
2A	A2	CH6+		OUT 6a	11
2A	B2	CH6-		OUT 6b	12
2A	A1	nc		OUT 7a	13
2A	B1	nc		OUT 7b	14
				OUT 8a	15
2B	A5	CH7+		OUT 8b	16
2B	B5	CH7-		OUT 9a	17
2B	A4	CH7+		OUT 9b	18
2B	B4	CH7-		OUT 10a	19
2B	A3	CH8+		OUT 10b	20
2B	B3	CH8-		OUT 11a	21
2B	A2	CH8+		OUT 11b	22
2B	B2	CH8-		OUT 12a	23
2B	A1	nc		OUT 12b	24
2B	B1	nc		Shield	25
3A	A5	CH9+			
3A	B5	CH9-			
3A	A4	CH9+			
3A	B4	CH9-			
3A	A3	CH10+			
3A	B3	CH10-			
3A	A2	CH10+			
3A	B2	CH10-			
3A	A1	nc			
3A	B1	nc			
3B	A5	CH11+			
3B	B5	CH11-			
3B	A4	CH11+			
3B	B4	CH11-			
3B	A3	CH12+			
3B	B3	CH12-			
3B	A2	CH12+			
3B	B2	CH12-			
3B	A1	nc			
3B	B1	nc			
nc = not connected					

Figure 2 Connections diagram

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Technical data   The FTA-T-05 module has the following specifications:

General

Type number:	FTA-T-05
Approvals:	CE, UL

Power

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

Physical

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)

Termination

Screw terminals:

− max. wire diameter	2.5 mm² (AWG 14)
− strip length	7 mm (0.28 in)
− tightening torque	0.5 Nm (0.37 ft-lb)

Left blank intentionally.

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.
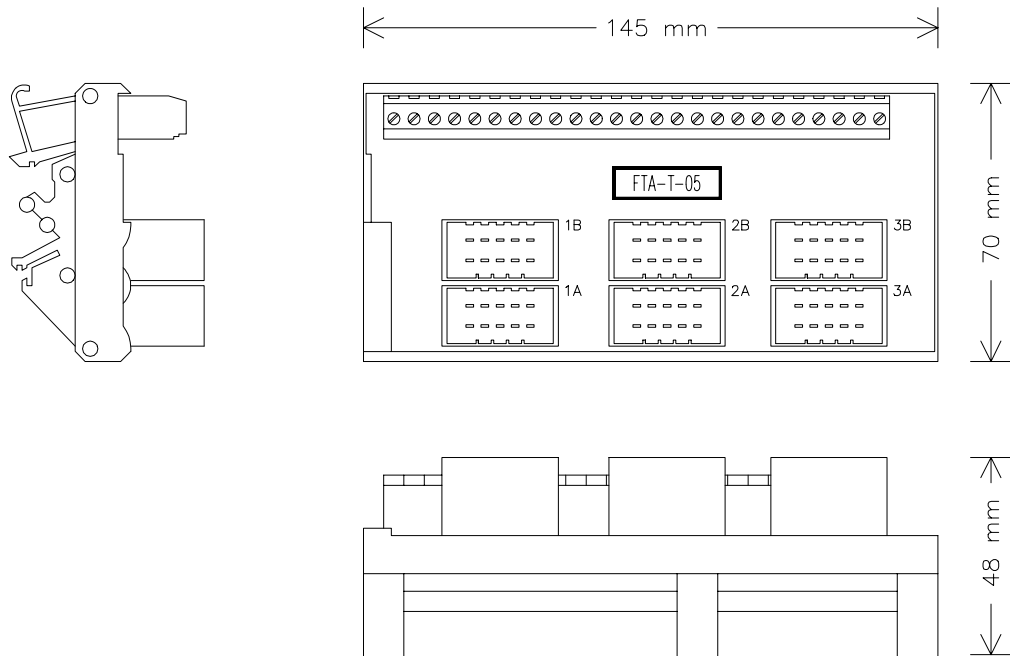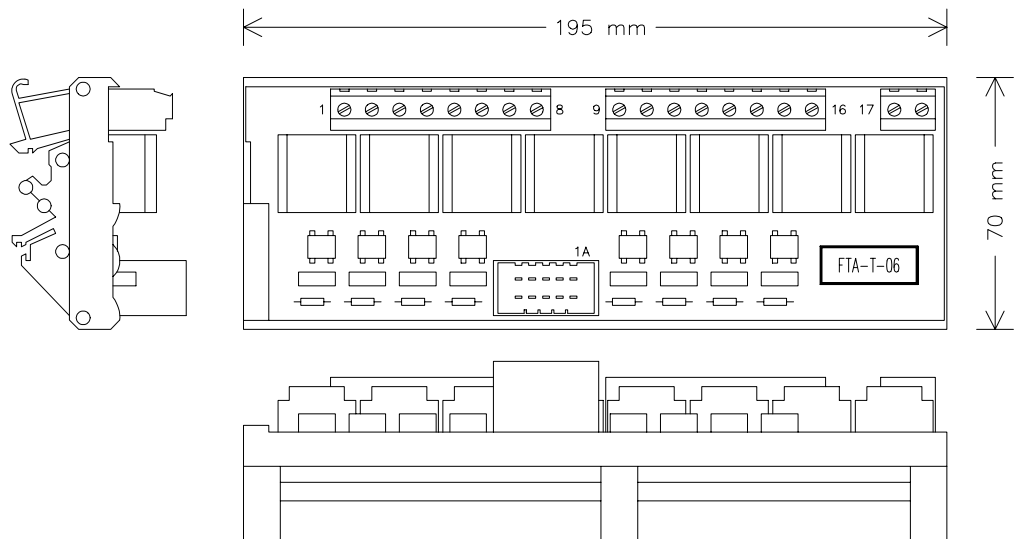

Figure 1   Mechanical layout
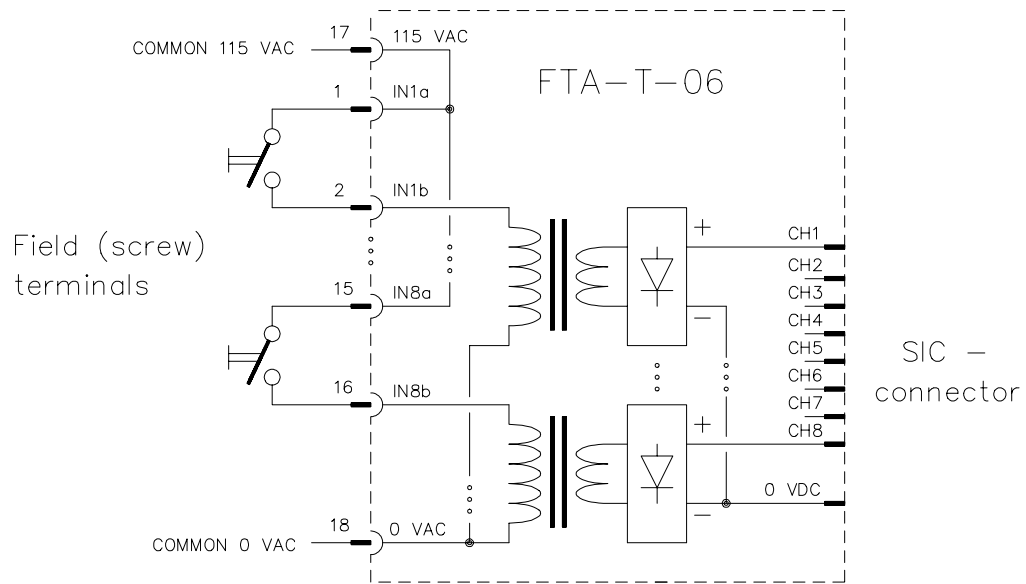
Figure 2   Schematic diagram

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:

$$L_{max} = \frac{I_{low}}{V_{max} * 2 * \pi * f * C_{typ}}$$

where:
L_{max} = maximum allowable cable length
I_{low} = maximum 'LOW' current
V_{max} = maximum supply voltage
f = supply frequency
C_{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.
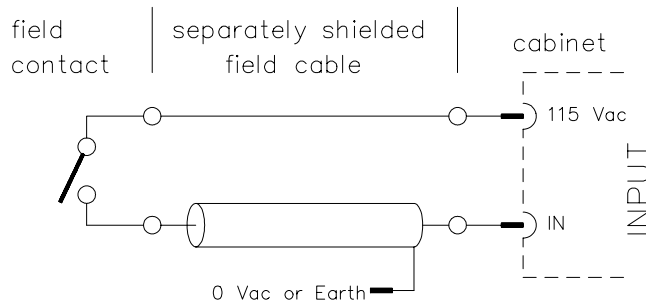
Figure 4   Field cable with separately shielded wires

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:

CONNECTIONS DIAGRAM FTA-T-06					
SIC connector				Field terminals	
Connector	Pin number	Signals		Signals	Terminal number
				IN 1a	1
				IN 1b	2
				IN 2a	3
				IN 2b	4
1	A5	CH1		IN 3a	5
1	B5	CH2		IN 3b	6
1	A4	CH3		IN 4a	7
1	B4	CH4		IN 4b	8
1	A3	CH5			
1	B3	CH6		IN 5a	9
1	A2	CH7		IN 5b	10
1	B2	0 Vdc		IN 6a	11
1	A1	CH8		IN 6b	12
1	B1	nc		IN 7a	13
				IN 7b	14
				IN 8a	15
				IN 8b	16
				COMMON 115 Vac	17
				COMMON 0 Vac	18

nc = not connected
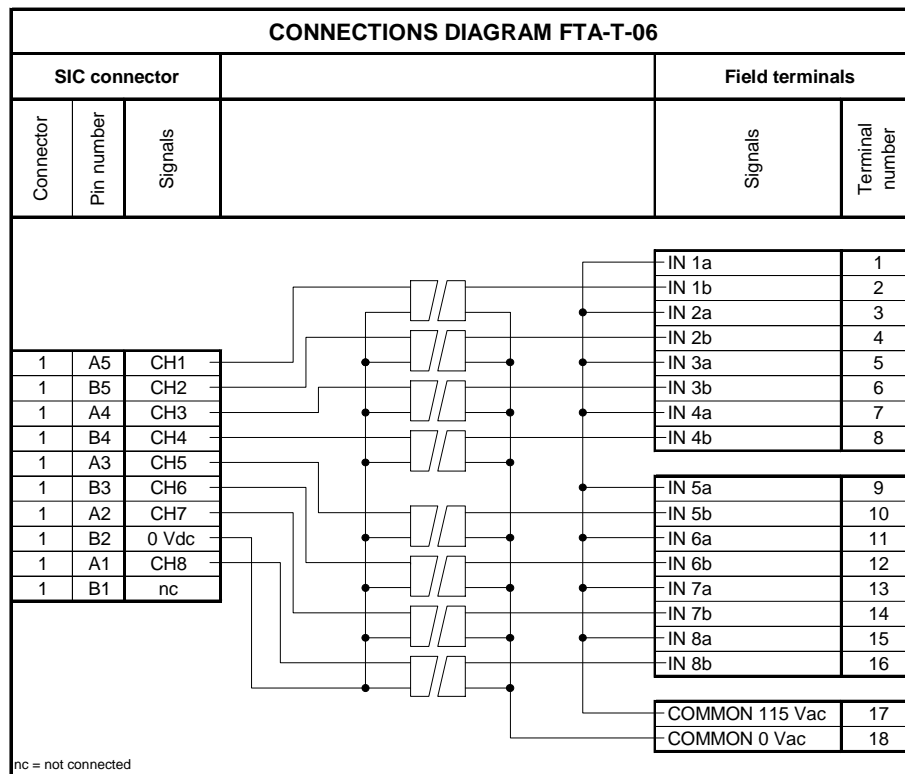
Figure 5   Connections diagram

Technical data   The FTA-T-06 module has the following specifications:

General   Type number: FTA-T-06
                Approvals: CE, TÜV, UL

Input   Number of input channels: 8
                Input voltage: 115 Vac, ± 15%
                Input frequency: 50-60 Hz
                Input current: < 16 mA at 115 Vac
                Input LOW: I ≤ 1 mA *(see 'Field cable length' section in this data sheet)*

Physical   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)

Termination Screw terminals:
                − max. wire diameter   2.5 mm² (AWG 14)
                − strip length   7 mm (0.28 in)
                − tightening torque   0.5 Nm (0.37 ft-lb)

Left blank intentionally.

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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.
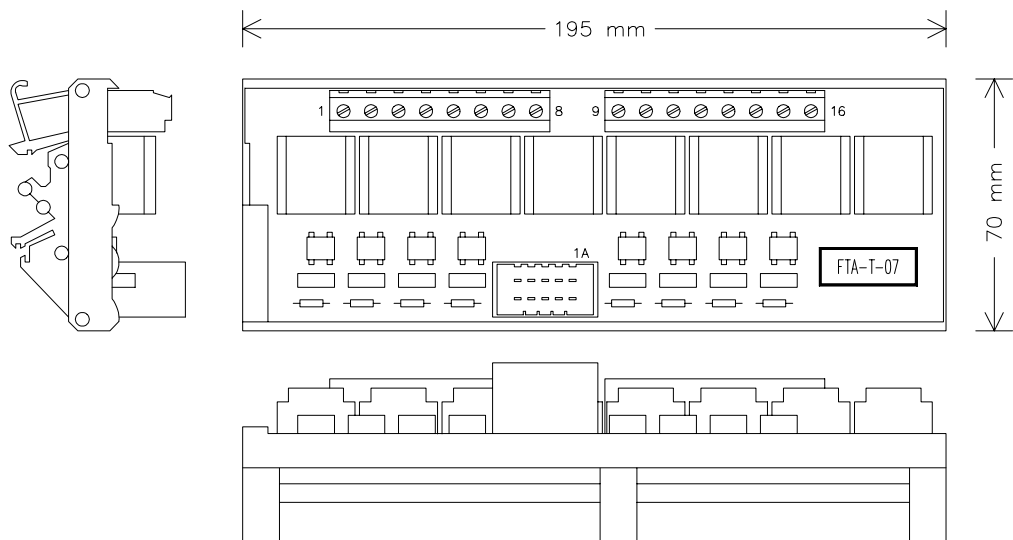
Figure 1   Mechanical layout
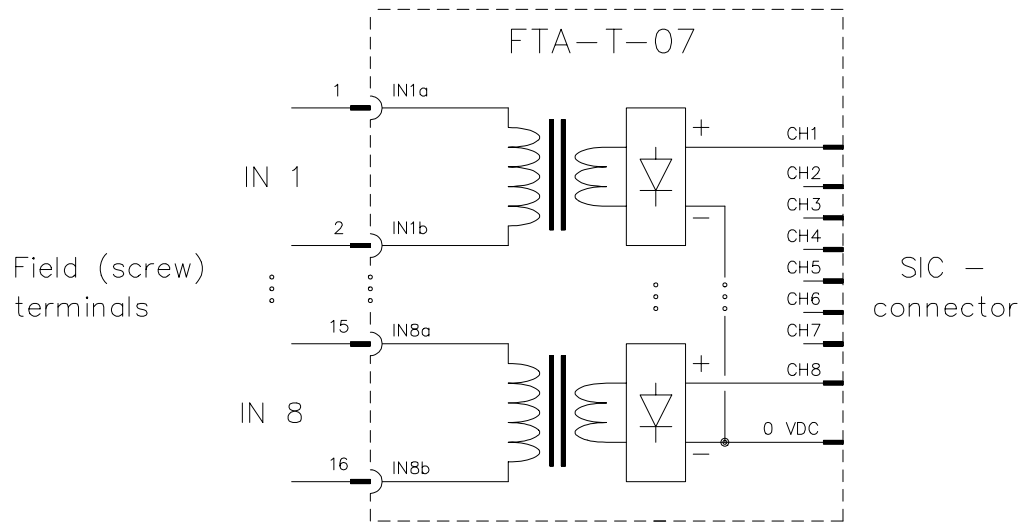
Figure 2   Schematic diagram

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:

$$L_{max} = \frac{I_{low}}{V_{max} * 2 * \pi * f * C_{typ}}$$

where:
L_{max} = maximum allowable cable length
I_{low} = maximum 'LOW' current
V_{max} = maximum supply voltage
f = supply frequency
C_{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:

CONNECTIONS DIAGRAM FTA-T-07

SIC connector				Field terminals	
Connector	Pin number	Signals		Signals	Terminal number
				IN 1a	1
				IN 1b	2
				IN 2a	3
1	A5	CH1		IN 2b	4
1	B5	CH2		IN 3a	5
1	A4	CH3		IN 3b	6
1	B4	CH4		IN 4a	7
1	A3	CH5		IN 4b	8
1	B3	CH6			
1	A2	CH7		IN 5a	9
1	B2	0 Vdc		IN 5b	10
1	A1	CH8		IN 6a	11
1	B1	nc		IN 6b	12
				IN 7a	13
				IN 7b	14
				IN 8a	15
				IN 8b	16

nc = not connected

Figure 6   Connections diagram

Technical data   The FTA-T-07 module has the following specifications:

General   Type number: FTA-T-07
Approvals: CE, TÜV, UL

Input   Number of input channels: 8
Input voltage: 115 Vac, ± 15%
Input frequency: 50-60 Hz
Input current: < 16 mA at 115 Vac
Input LOW: I ≤ 1 mA *(see 'Field cable length' section in this data sheet)*

Physical   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)

Termination   Screw terminals:
– max. wire diameter   2.5 mm² (AWG 14)
– strip length   7 mm (0.28 in)
– tightening torque   0.5 Nm (0.37 ft-lb)

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

Honeywell
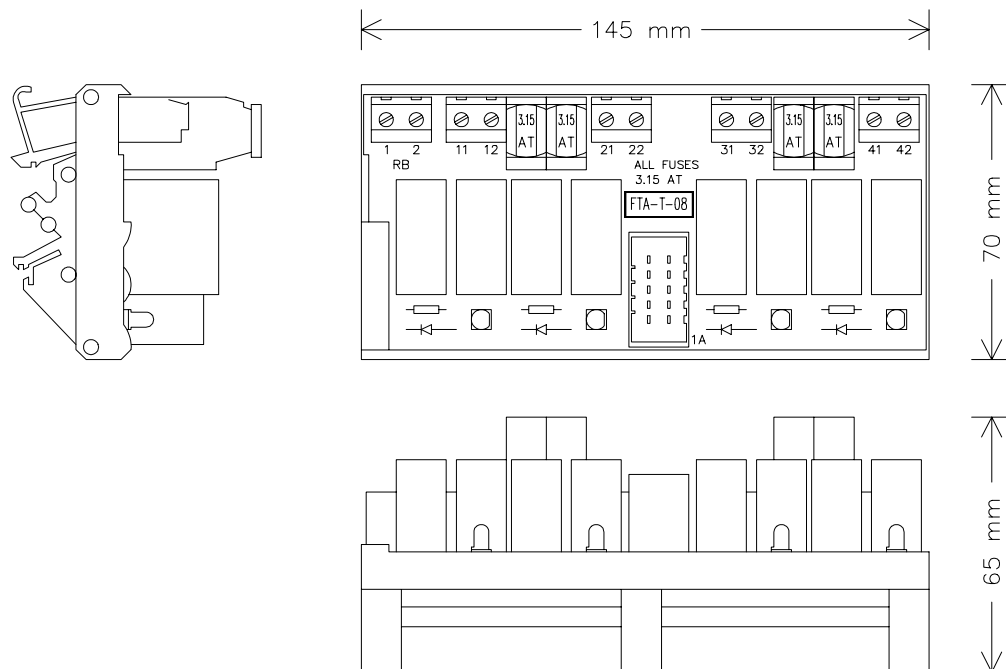
Each channel consists of:
- two relays of different manufacturers,
- a fused NO field contact (3.15 AT), and
- a status indicator LED.

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:

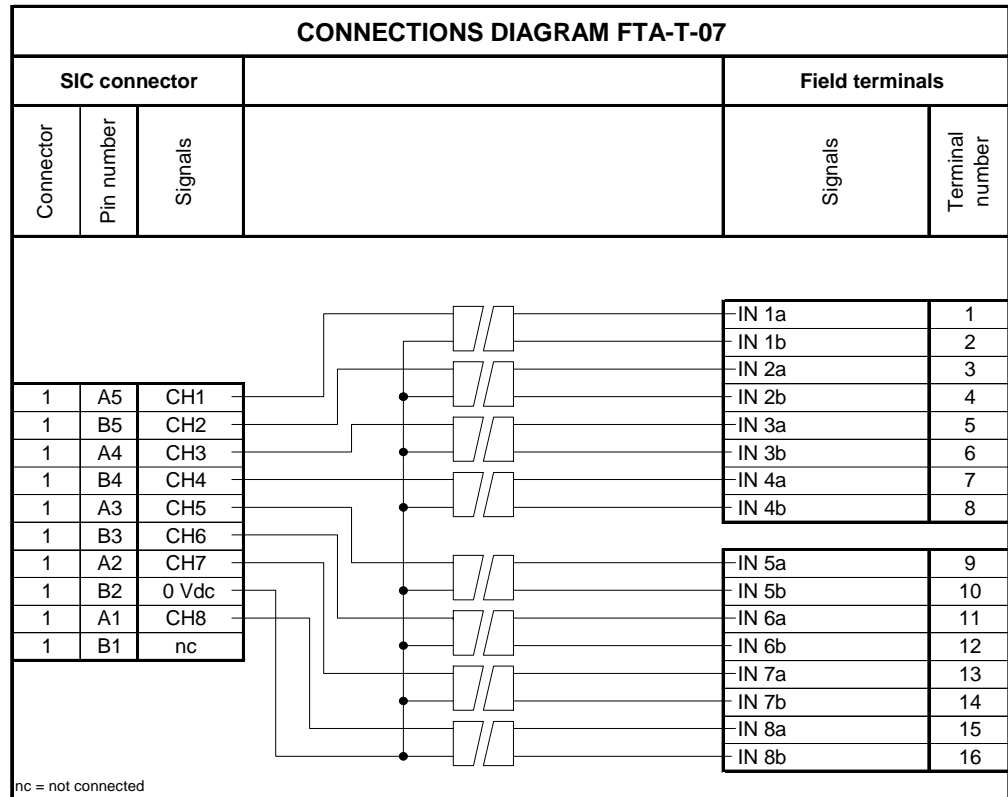| CONNECTIONS DIAGRAM FTA-T-08					
SIC connector				Field terminals	
Connector	Pin number	Signals		Signals	Terminal number
				Readback 1	1
				Readback 2	2
			ALL FUSES 3.15 AT		
1	A5	CH1+		OUT 1a	11
1	B5	CH1-		OUT 1b (fused)	12
1	A4	CH2+		OUT 2a (fused)	21
1	B4	CH2-		OUT 2b	22
1	A3	CH3+		OUT 3a	31
1	B3	CH3-		OUT 3b (fused)	32
1	A2	CH4+		OUT 4a (fused)	41
1	B2	CH4-		OUT 4b	42
1	A1	nc			
1	B1	nc			
nc = not connected					
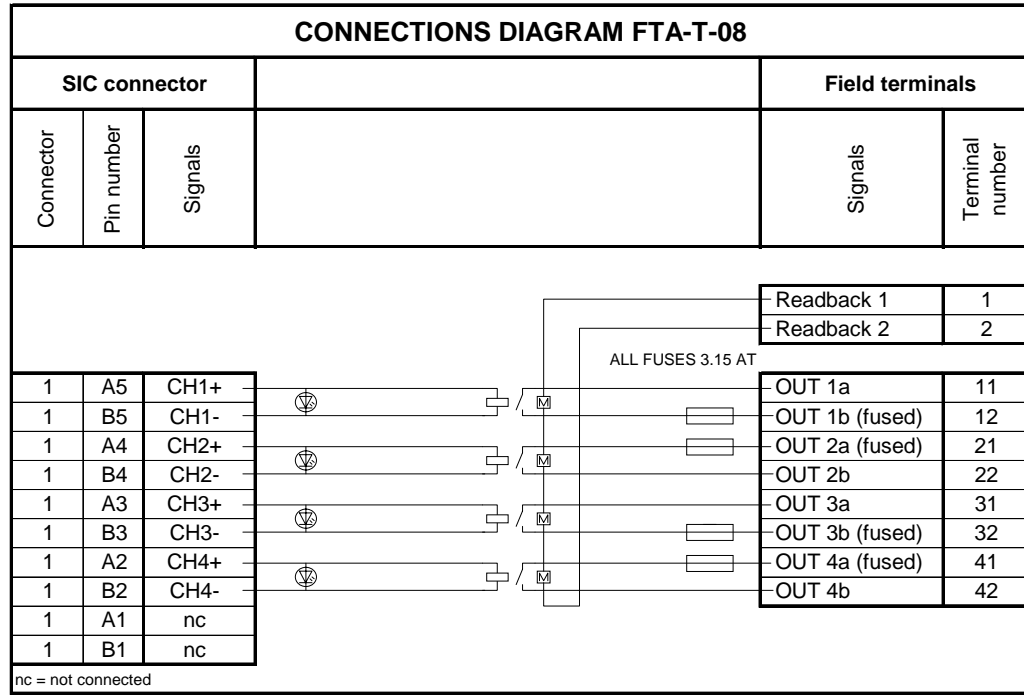
Figure 3   Connections diagram

Technical data The FTA-T-08 module has the following specifications:

General

Type number:	FTA-T-08
Approvals:	CE, TÜV, UL

Input

Nominal input voltage:	24 V
Max. input voltage:	31 V
Relay cut-in voltage:	19 V
Input current:	typically 50 mA at 24 V

Output

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)

Fuses	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)
Physical	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)
Termination	Screw terminals:	
	− max. wire diameter	2.5 mm² (AWG 14)
	− strip length	7 mm (0.28 in)
	− tightening torque	0.5 Nm (0.37 ft-lb)
Relay contact	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

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.
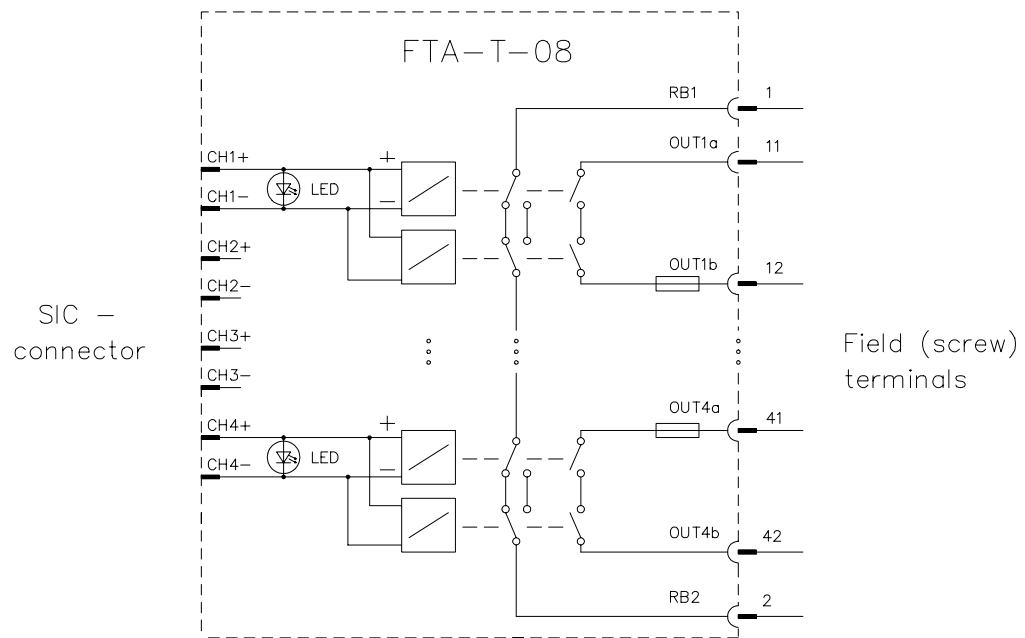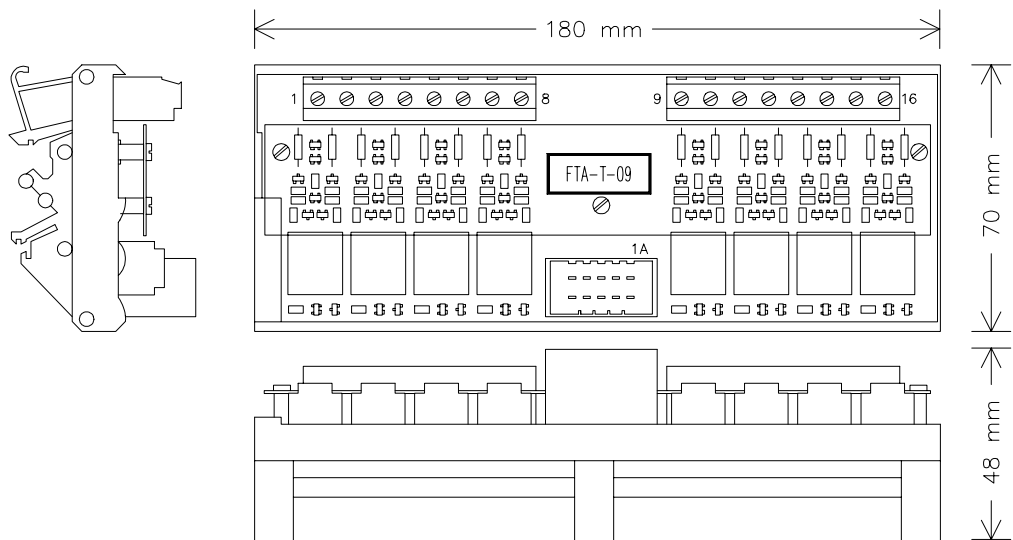

Figure 1   Mechanical layout
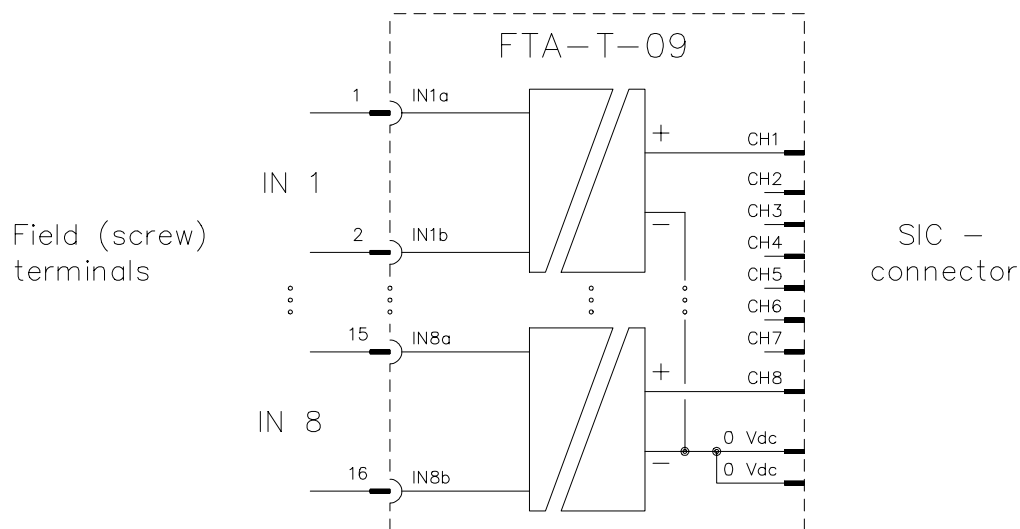
Figure 2   Schematic diagram

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:

$$L_{max} = \frac{I_{low}}{V_{max} * 2 * \pi * f * C_{typ}}$$

where:

L_{max} = maximum allowable cable length
I_{low} = maximum 'LOW' current
V_{max} = maximum supply voltage
f = supply frequency
C_{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:

CONNECTIONS DIAGRAM FTA-T-09					
SIC connector				Field terminals	
Connector	Pin number	Signals		Signals	Terminal number
				IN 1a	1
				IN 1b	2
				IN 2a	3
1	A5	CH1		IN 2b	4
1	B5	CH2		IN 3a	5
1	A4	CH3		IN 3b	6
1	B4	CH4		IN 4a	7
1	A3	CH5		IN 4b	8
1	B3	CH6			
1	A2	CH7		IN 5a	9
1	B2	0 Vdc		IN 5b	10
1	A1	CH8		IN 6a	11
1	B1	0 Vdc		IN 6b	12
				IN 7a	13
				IN 7b	14
				IN 8a	15
				IN 8b	16

Figure 6   Connections diagram

Honeywell
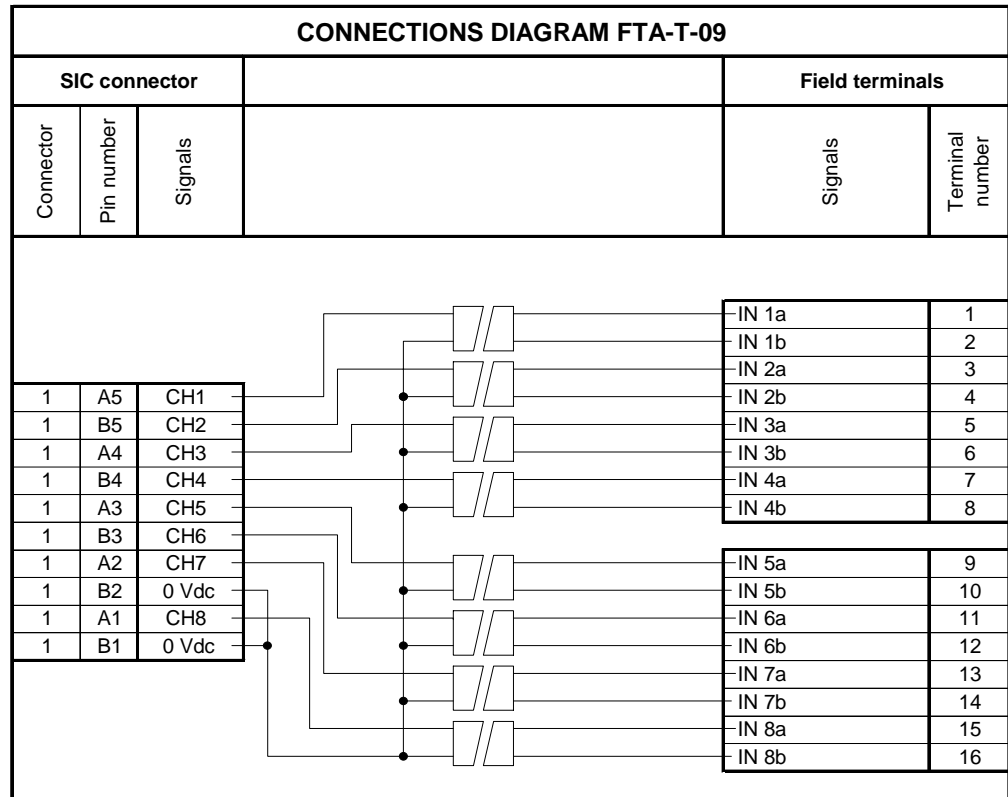
Technical data

The FTA-T-09 module has the following specifications:

General

Type number:	FTA-T-09
Approval:	CE, TÜV

Input

Number of input channels:	8
Input voltage:	115 V, –15% ... + 30%
Input frequency:	DC or 40...300 Hz
Input current:	7.5 mA (± 1 mA) at 115 V
Input impedance:	non-inductive, > 9 kOhm
Input LOW:	U ≤ 15 V or
	I ≤ 1.2 mA *(see 'Field cable length' section in this data sheet)*

Physical

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)

Isolation

Isolation input to output:	2 kV

Termination

Screw terminals:

– max. wire diameter	2.5 mm² (AWG 14)
– strip length	7 mm (0.28 in)
– tightening torque	0.5 Nm (0.37 ft-lb)

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.
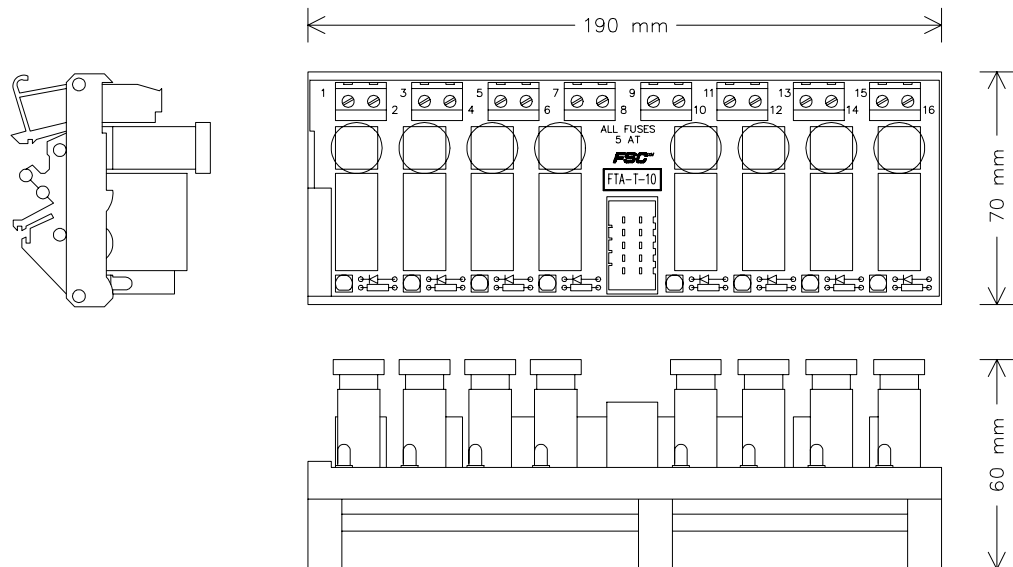
Figure 1   Mechanical layout

Each channel consists of:
- one relay,
- a fused NO field contact (5 AT), and
- a status indicator LED.
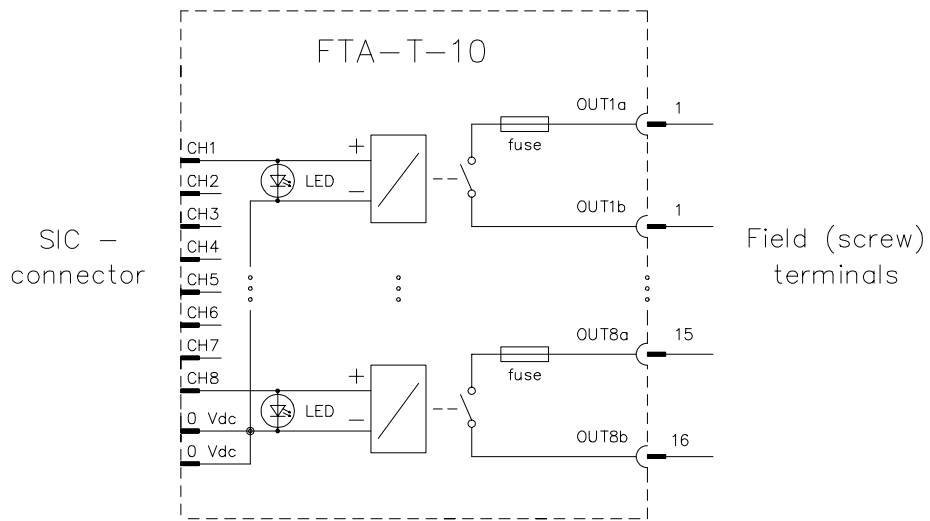
![Honeywell logo]

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:

CONNECTIONS DIAGRAM FTA-T-10					
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Terminal number
			ALL FUSES 5 AT	OUT 1a (fused)	1
				OUT 1b	2
				OUT 2a (fused)	3
1	A5	CH1		OUT 2b	4
1	B5	CH2		OUT 3a (fused)	5
1	A4	CH3		OUT 3b	6
1	B4	CH4		OUT 4a (fused)	7
1	A3	CH5		OUT 4b	8
1	B3	CH6			
1	A2	CH7		OUT 5a (fused)	9
1	B2	0 Vdc		OUT 5b	10
1	A1	CH8		OUT 6a (fused)	11
1	B1	0 Vdc		OUT 6b	12
				OUT 7a (fused)	13
				OUT 7b	14
				OUT 8a (fused)	15
				OUT 8b	16

Figure 3   Connections diagram

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Technical data The FTA-T-10 module has the following specifications:

General
Type number:	FTA-T-10
Approvals:	CE, TÜV; UL approval pending

Input
Nominal input voltage:	24 Vdc
Max. input voltage:	31 Vdc
Relay cut-in voltage:	19 Vdc
Input current:	typically 27 mA at 24 Vdc

Output
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)

Fuses
Rating:	5 AT (slow-acting)
Dimensions	5 x 20 mm (0.20 x 0.79 in)

Physical
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)

Termination

Screw terminals:
− max. wire diameter	2.5 mm² (AWG 14)
− strip length	7 mm (0.28 in)
− tightening torque	0.5 Nm (0.37 ft-lb)

Relay contacts
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

U = Switching voltage (DC)
I = Switching current
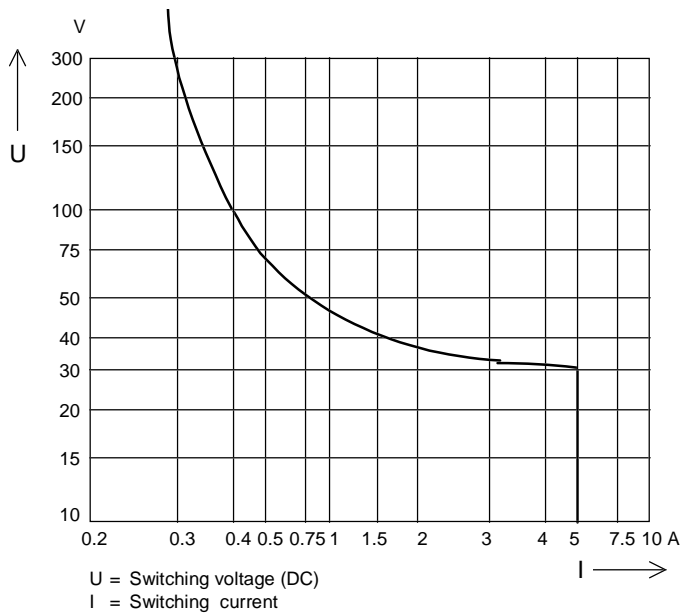
Figure 4   Maximum DC switched power curve for FTA-T-10 module

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.

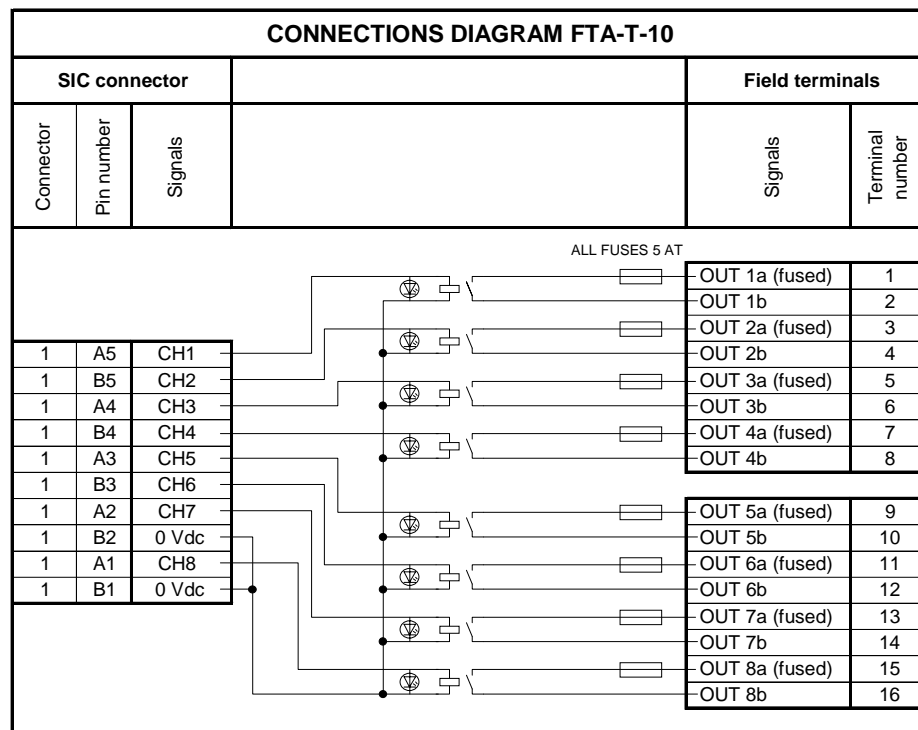**Connections**   The connections diagram of the FTA-T-11 module is as follows:

CONNECTIONS DIAGRAM FTA-T-11					
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Terminal number
1A	A5	CH 1-			
1A	B5	CH 1+			
1A	A4	CH 2+			
1A	B4	CH 2-		OUT 1a	1
1A	A3	CH 3-		OUT 1b	2
1A	B3	CH 3+		OUT 2a	3
1A	A2	CH 4+		OUT 2b	4
1A	B2	CH 4-		OUT 3a	5
1A	A1	nc		OUT 3b	6
1A	B1	nc		OUT 4a	7
				OUT 4b	8
2A	A5	CH 5-		OUT 5a	9
2A	B5	CH 5+		OUT 5b	10
2A	A4	CH 6+		OUT 6a	11
2A	B4	CH 6-		OUT 6b	12
2A	A3	CH 7-		OUT 7a	13
2A	B3	CH 7+		OUT 7b	14
2A	A2	CH 8+		OUT 8a	15
2A	B2	CH 8-		OUT 8b	16
2A	A1	nc			
2A	B1	nc			
nc = not connected					

Figure 2   Connections diagram

Technical data   The FTA-T-11 module has the following specifications:

General	Type number:	FTA-T-11
	Approvals:	CE, TÜV

Power	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

Physical	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)

Termination	Screw terminals:	
	− max. wire diameter	2.5 mm² (AWG 14)
	− strip length	7 mm (0.28 in)
	− tightening torque	0.5 Nm (0.37 ft-lb)

Left blank intentionally.

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.

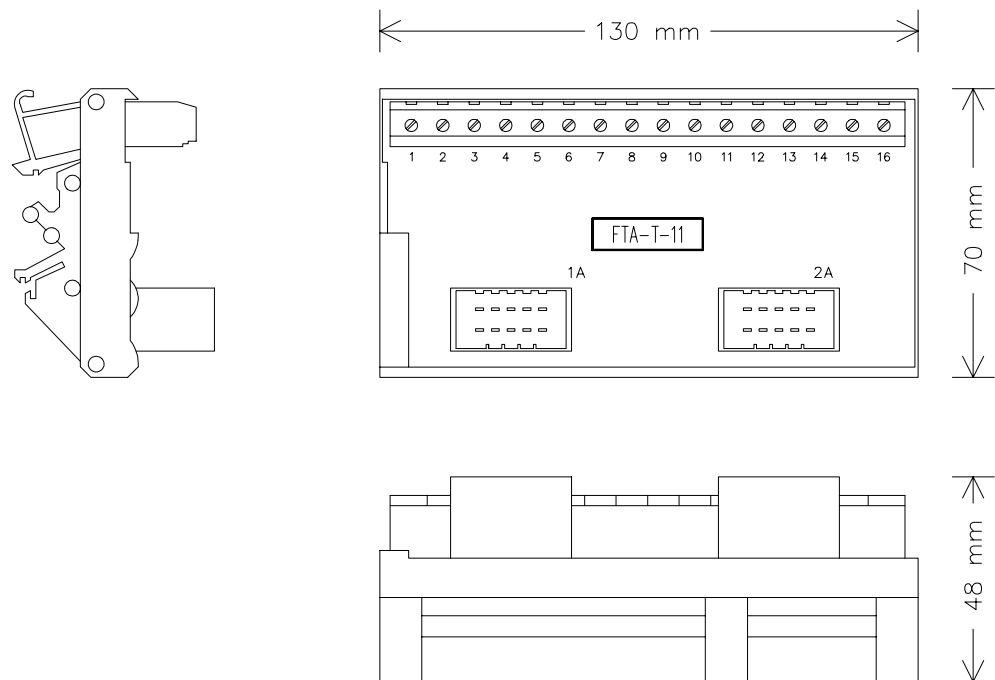Figure 1   Mechanical layout

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

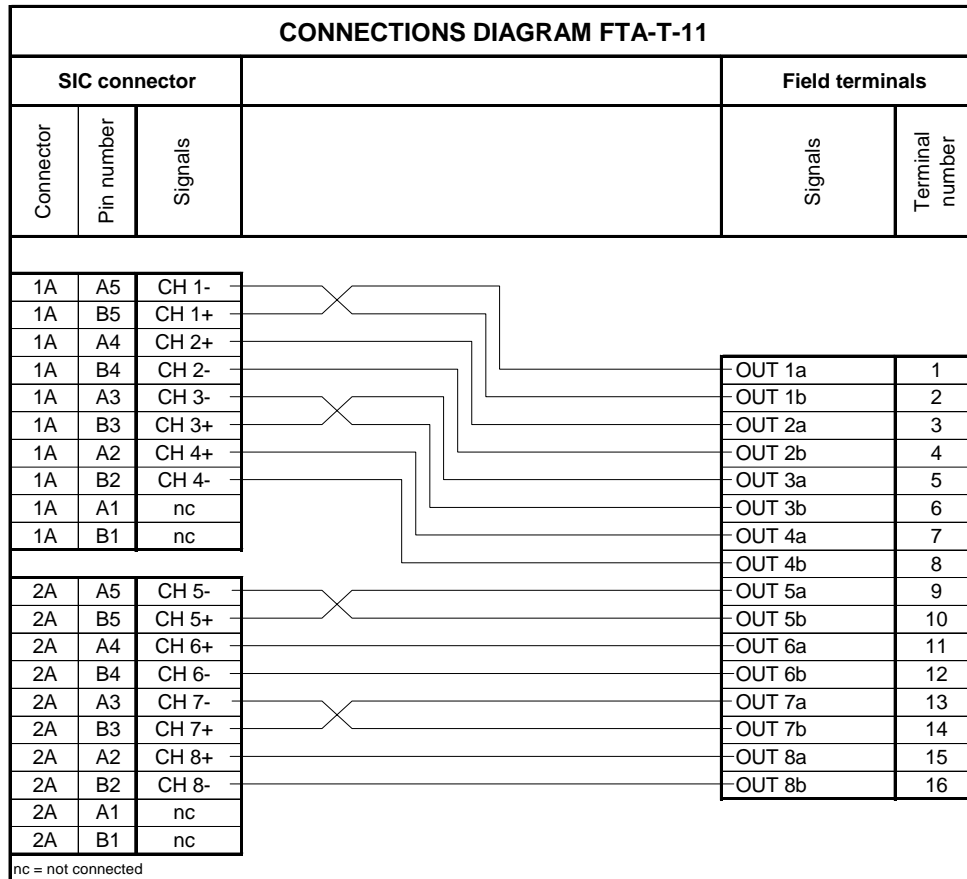The connections diagram of the FTA-T-12 module is as follows:

Figure 3   Connections diagram

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Technical data   The FTA-T-12 module has the following specifications:

General

Type number:	FTA-T-12
Approvals:	CE, TÜV; UL approval pending

Input

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

Output

Output voltage:	0.1 to 36 V
Output current:	10 μA to 1 A
Contact material:	gold-clad silver alloy

Physical

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

Termination

Screw terminals:

− max. wire diameter	2.5 mm² (AWG 14)
− strip length	7 mm (0.28 in)
− tightening torque	0.5 Nm (0.37 ft-lb)

Isolation

Galvanic isolation:

− input to output	1000 Vac
− input to input	1000 Vac

Left blank intentionally.

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.
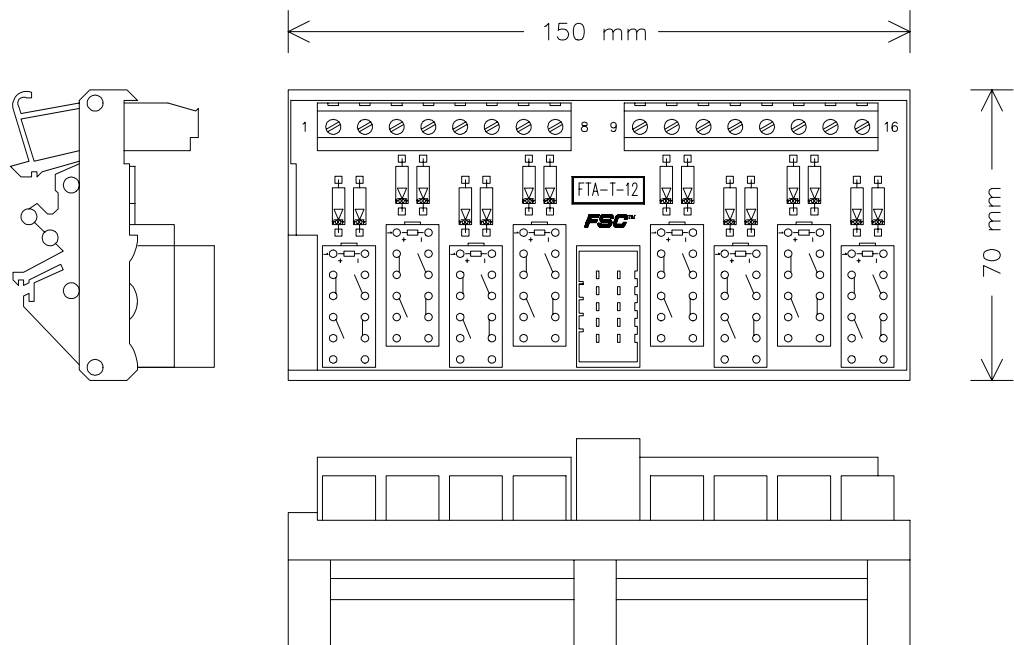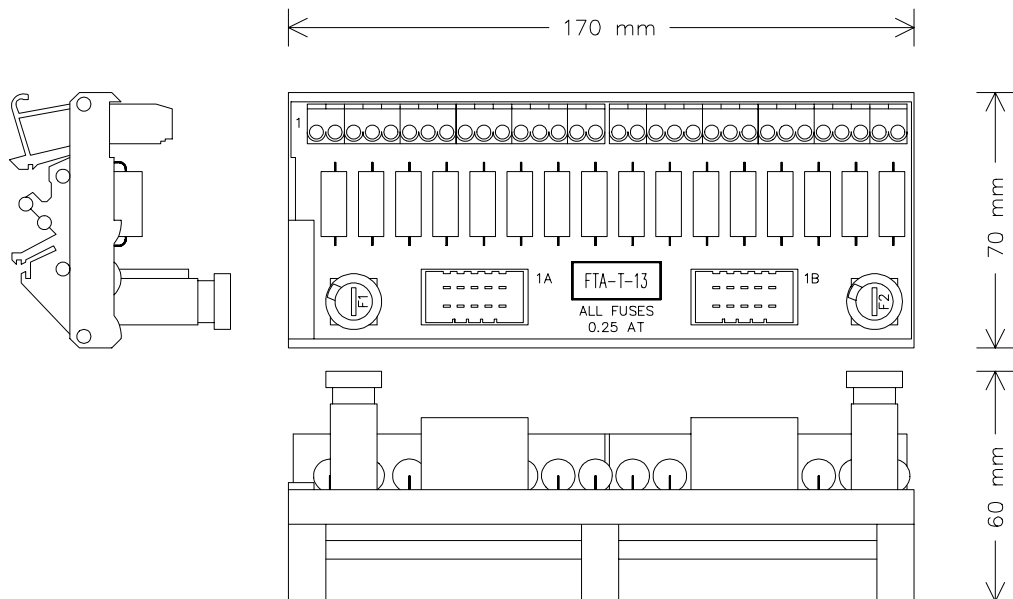
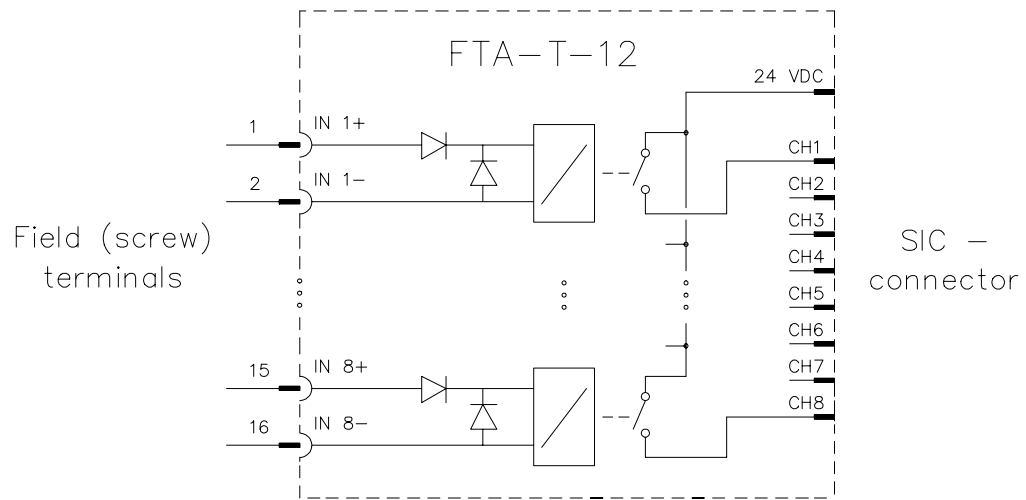

Figure 1   Mechanical layout

Applications
For details on applications and connection options for the FTA-T-13 module refer to the 'SIC to FTA applications' data sheet.

Connections
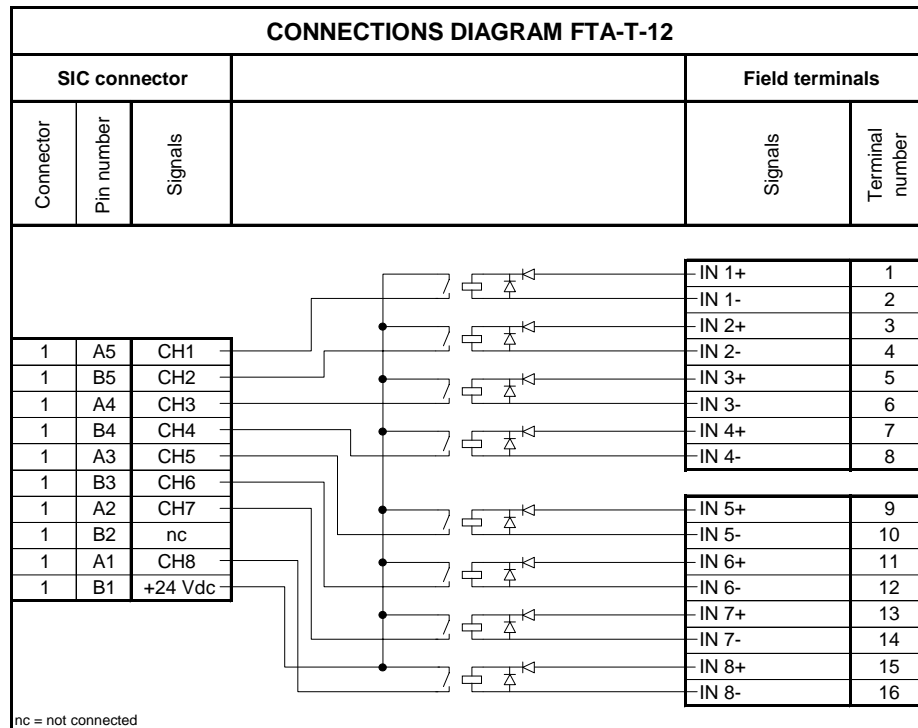The connections diagram of the FTA-T-13 module is as follows:

CONNECTIONS DIAGRAM FTA-T-13					
SIC connector				Field terminals	
Connector	Pin number	Signals		Signals	Terminal number
			R		
				CH1+ (via fuse 1)	1
1A	A5	CH1		CH1-	2
1A	B5	CH2		CH2+ (via fuse 1)	3
1A	A4	CH3		CH2-	4
1A	B4	CH4		CH3+ (via fuse 1)	5
1A	A3	CH5		CH3-	6
1A	B3	CH6		CH4+ (via fuse 1)	7
1A	A2	CH7		CH4-	8
1A	B2	nc		CH5+ (via fuse 1)	9
1A	A1	CH8		CH5-	10
1A	B1	+24 Vdc		CH6+ (via fuse 1)	11
		0.25 AT		CH6-	12
				CH7+ (via fuse 1)	13
				CH7-	14
				CH8+ (via fuse 1)	15
				CH8-	16
				CH9+ (via fuse 2)	17
				CH9-	18
				CH10+ (via fuse 2)	19
				CH10-	20
				CH11+ (via fuse 2)	21
1B	A5	CH9		CH11-	22
1B	B5	CH10		CH12+ (via fuse 2)	23
1B	A4	CH11		CH12-	24
1B	B4	CH12		CH13+ (via fuse 2)	25
1B	A3	CH13		CH13-	26
1B	B3	CH14		CH14+ (via fuse 2)	27
1B	A2	CH15		CH14-	28
1B	B2	nc		CH15+ (via fuse 2)	29
1B	A1	CH16		CH15-	30
1B	B1	+24 Vdc		CH16+ (via fuse 2)	31
		0.25 AT		CH16-	32
nc = not connected					

Figure 2   Connections diagram

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Technical data   The FTA-T-13 module has the following specifications:

General   Type number: FTA-T-13
Approvals: CE, TÜV;
UL, FM approvals pending

Input   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)
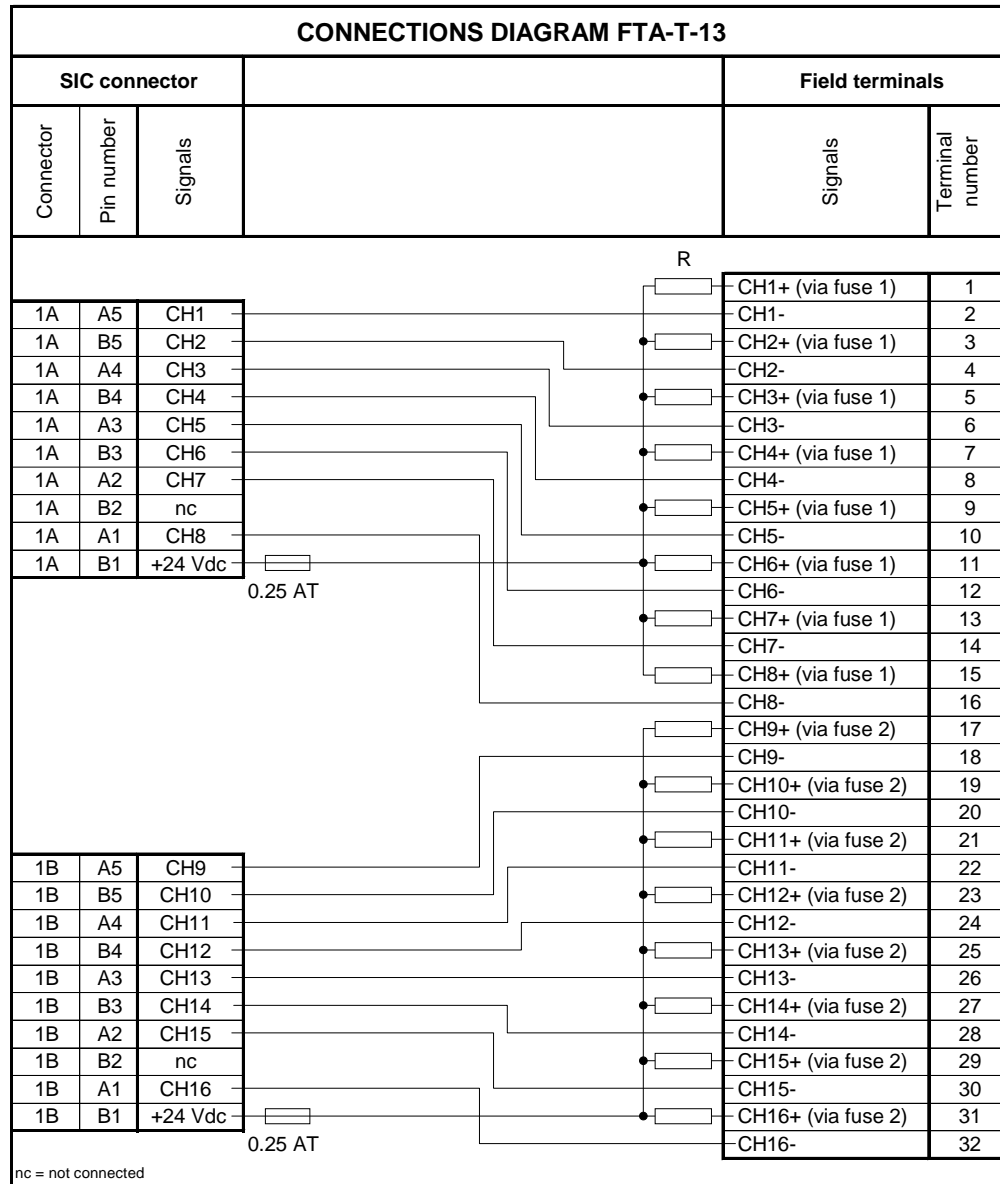Igniting current per channel: < 100 mA at 24 Vdc +30%

Termination   Screw terminals:
− max. wire diameter   2.5 mm² (AWG 14)
− strip length   7 mm (0.28 in)
− tightening torque   0.5 Nm (0.37 ft-lb)

Physical   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

Field signal specifications   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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Left blank intentionally.

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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.
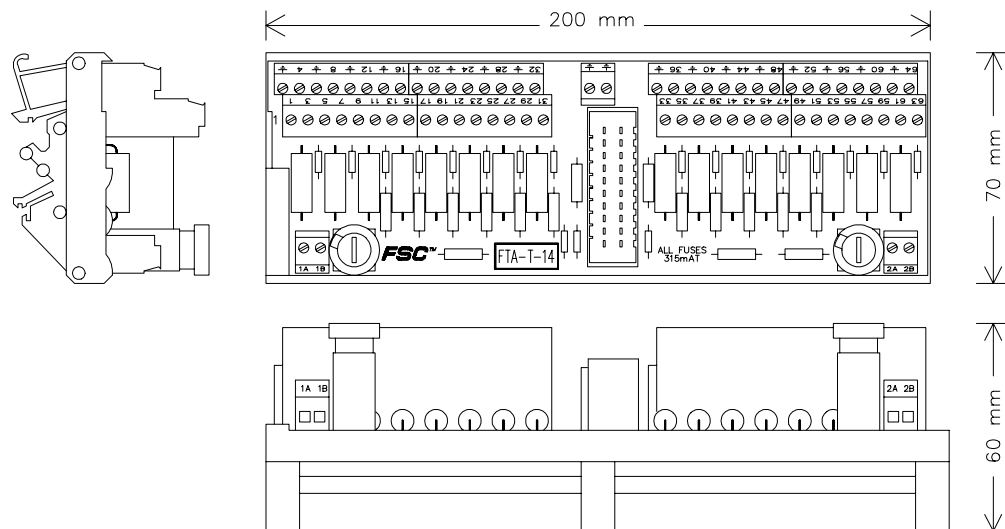

Figure 1   Mechanical layout

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).

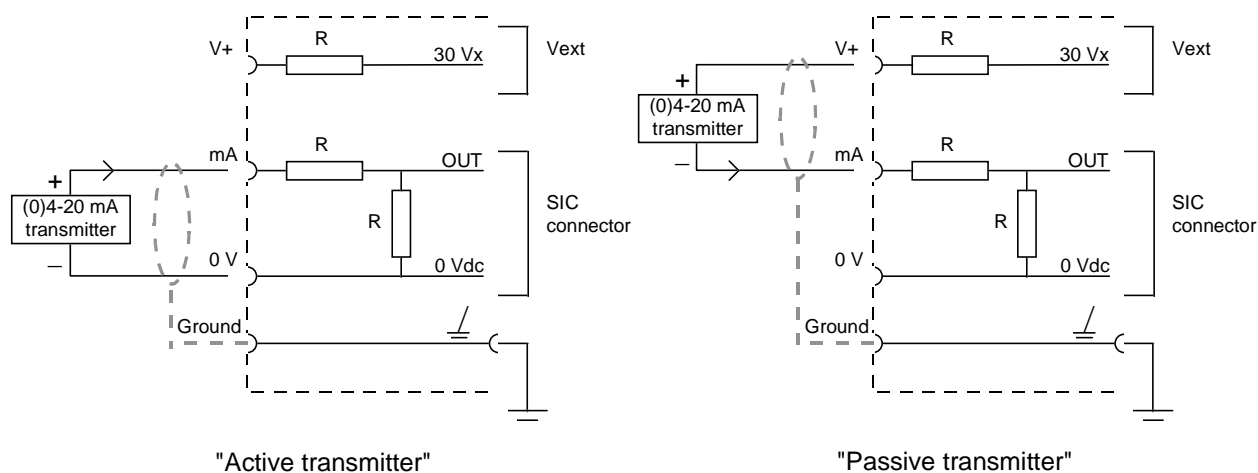"Active transmitter"   "Passive transmitter"

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.
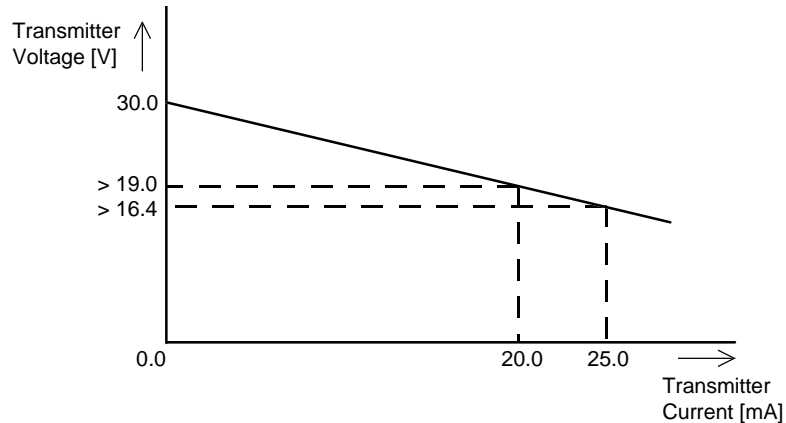
Figure 3   Transmitter voltage for passive transmitters

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.
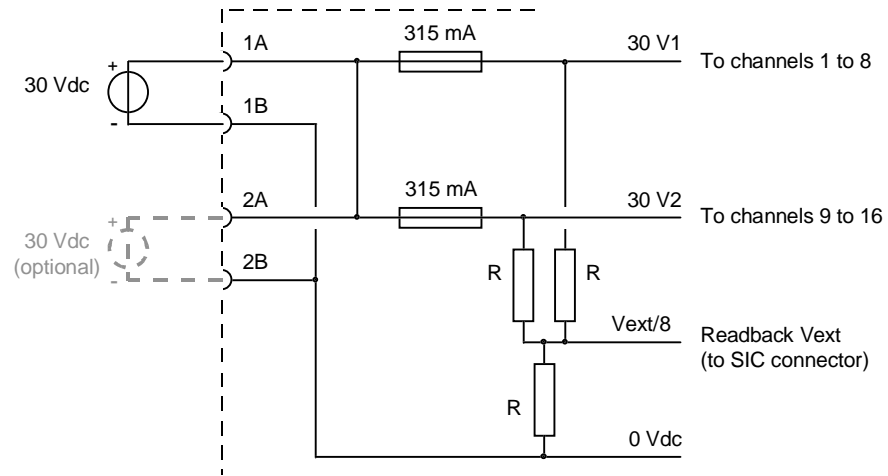
Figure 4   Schematic diagram for power distribution with monitoring

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 (Vext) and ground are connected to the following screw terminals (marked '1A', '1B', '2A', '2B' and '⏚' on the FTA):

Screw terminal	Function
1A	30 Vdc Vext
1B	0 Vdc Vext
2A	30 Vdc Vext
2B	0 Vdc Vext
⏚	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

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Technical data   The FTA-T-14 module has the following specifications:

General
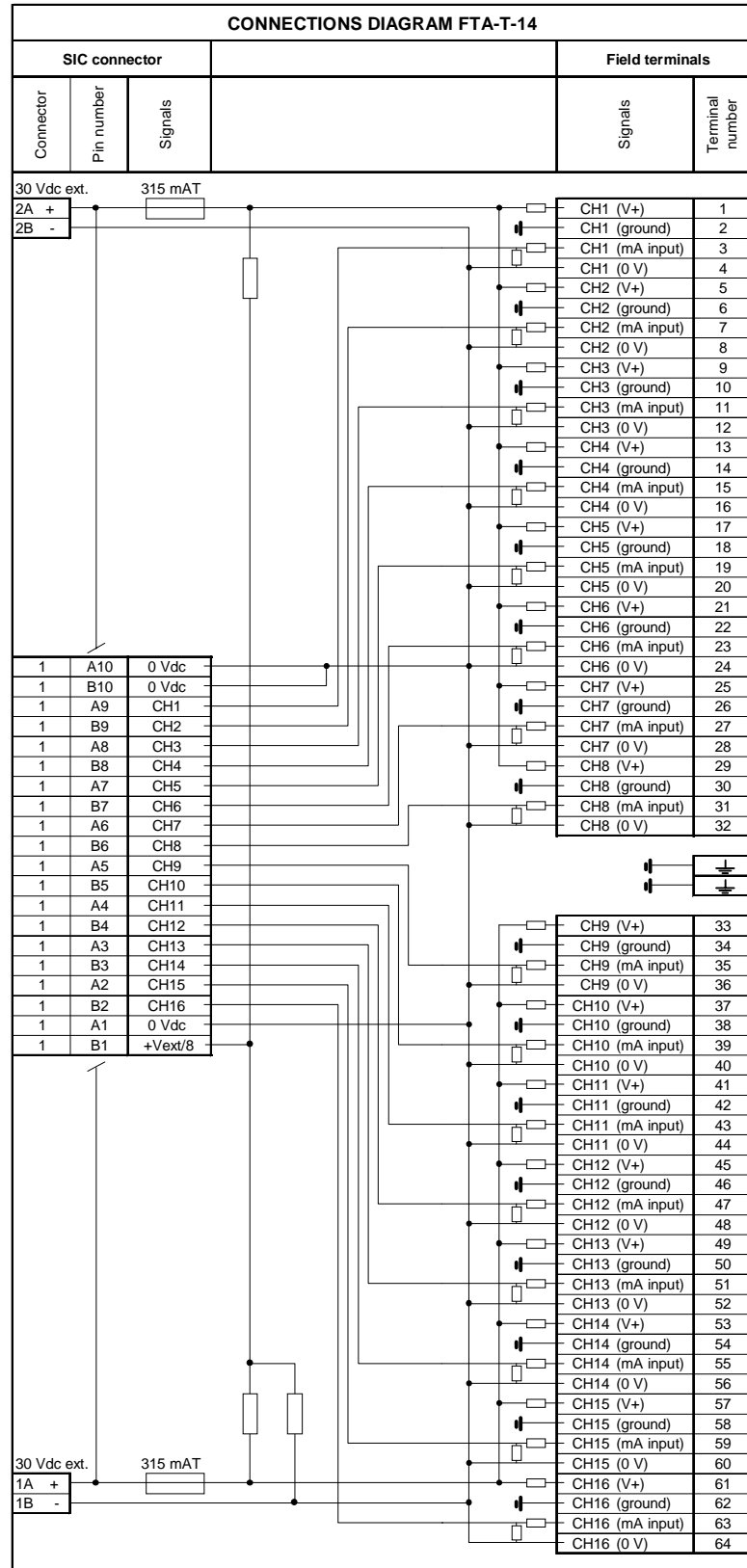|	
Type number:	FTA-T-14
Approvals:	CE; UL, FM, TÜV approvals pending

Input
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 (± 1%)

Output

To passive transmitters (Vext):
- output resistance: 270 Ohm (± 5%)
- igniting current per channel: < 120 mA at 30 Vdc

To 10105/2/1 module:
- output voltage   0 to 4 Vdc

Fuses
Rating:	315 mAT (slow-acting)
Dimensions:	5 x 20 mm (0.20 x 0.79 in)

Physical
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)

Termination

Screw terminals:
- max. wire diameter   2.5 mm² (AWG 14)
- strip length   7 mm (0.28 in)
- tightening torque   0.5 Nm (0.37 ft-lb)

Field signal specifications

HYDROGEN (Group A & B):
- max. loop inductance   6 mH
- max. loop capacitance   0.25 µF

NON-HYDROGEN (Group C & D):
- max. loop inductance   20 mH
- max. loop capacitance   5 µF

Left blank intentionally.

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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.
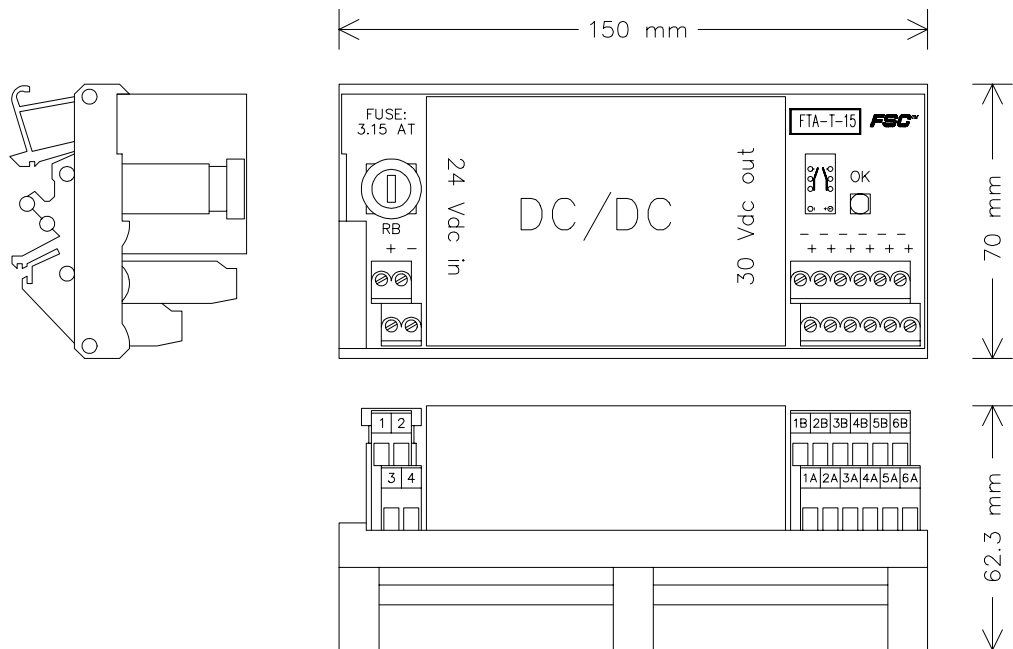
Figure 1   Mechanical layout

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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:

General

Type number:	FTA-T-15
Approvals:	CE, UL, TÜV approvals pending
Safety class:	AK1-6
MTBF:	approx. 400,000 hours

Input

Nominal input voltage:	24 Vdc
Input voltage range:	18 to 36 Vdc
Inrush current:	≤ 4 A *(see note below)*

Output

Output voltage:	30 Vdc, ± 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 ≤ 31 V
Long-term stability (after 30 min. operation):	< 0.3%
Efficiency:	> 75%
Switching frequency:	> 25 kHz

Physical

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)

Fuse

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.

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Technical data (continued)

Termination	Screw terminals:	
	– max. wire diameter	2.5 mm² (AWG 14)
	– strip length	7 mm (0.28 in)
	– tightening torque	0.5 Nm (0.37 ft-lb)
Isolation	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.)
Environment	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
Alarm functions	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
Readback	Relay contact rating:	36 Vdc / 40 mA, 30 Vac / 40 mA

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.
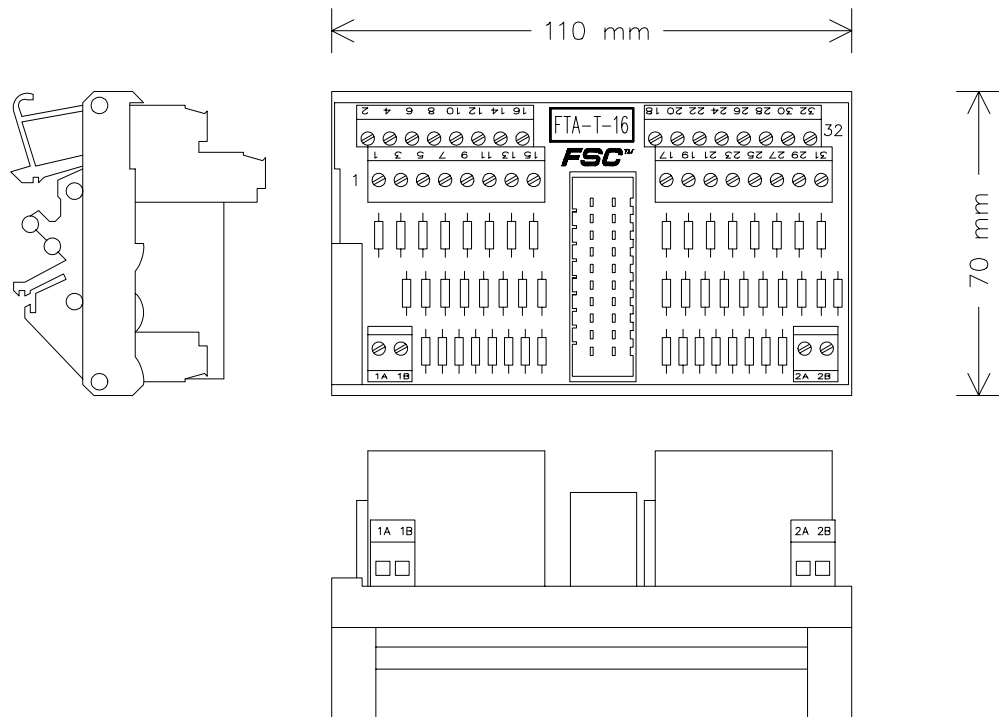

Figure 1   Mechanical layout

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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.
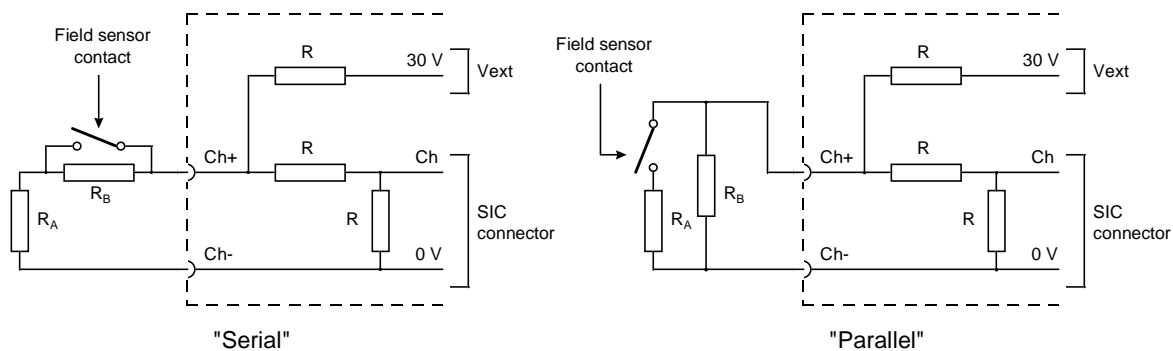
Figure 2   Schematic diagrams for connecting serial and parallel resistor configurations

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.
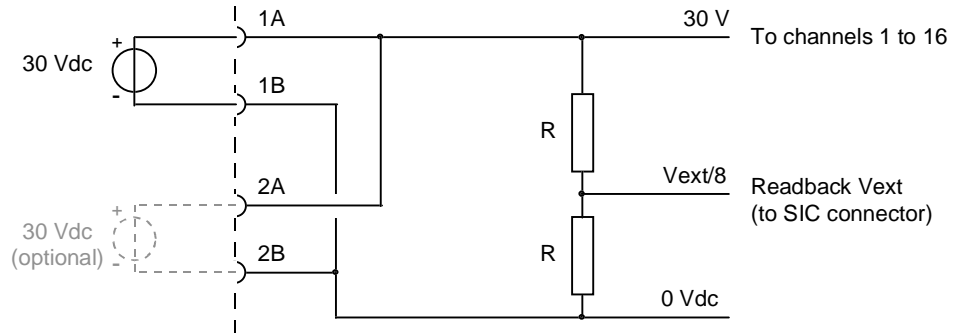
Figure 3   Schematic diagram for power distribution with monitoring

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 (Vext) is connected to the following screw terminals (marked '1A', '1B', '2A' and '2B' on the FTA):

Screw terminal	Function
1A	30 Vdc Vext
1B	0 Vdc Vext
2A	30 Vdc Vext
2B	0 Vdc Vext

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:

CONNECTION DIAGRAM FTA-T-16

SIC connector					Field terminals	
Connector	Pin number	Signals			Signals	Terminal number

30 Vdc ext.

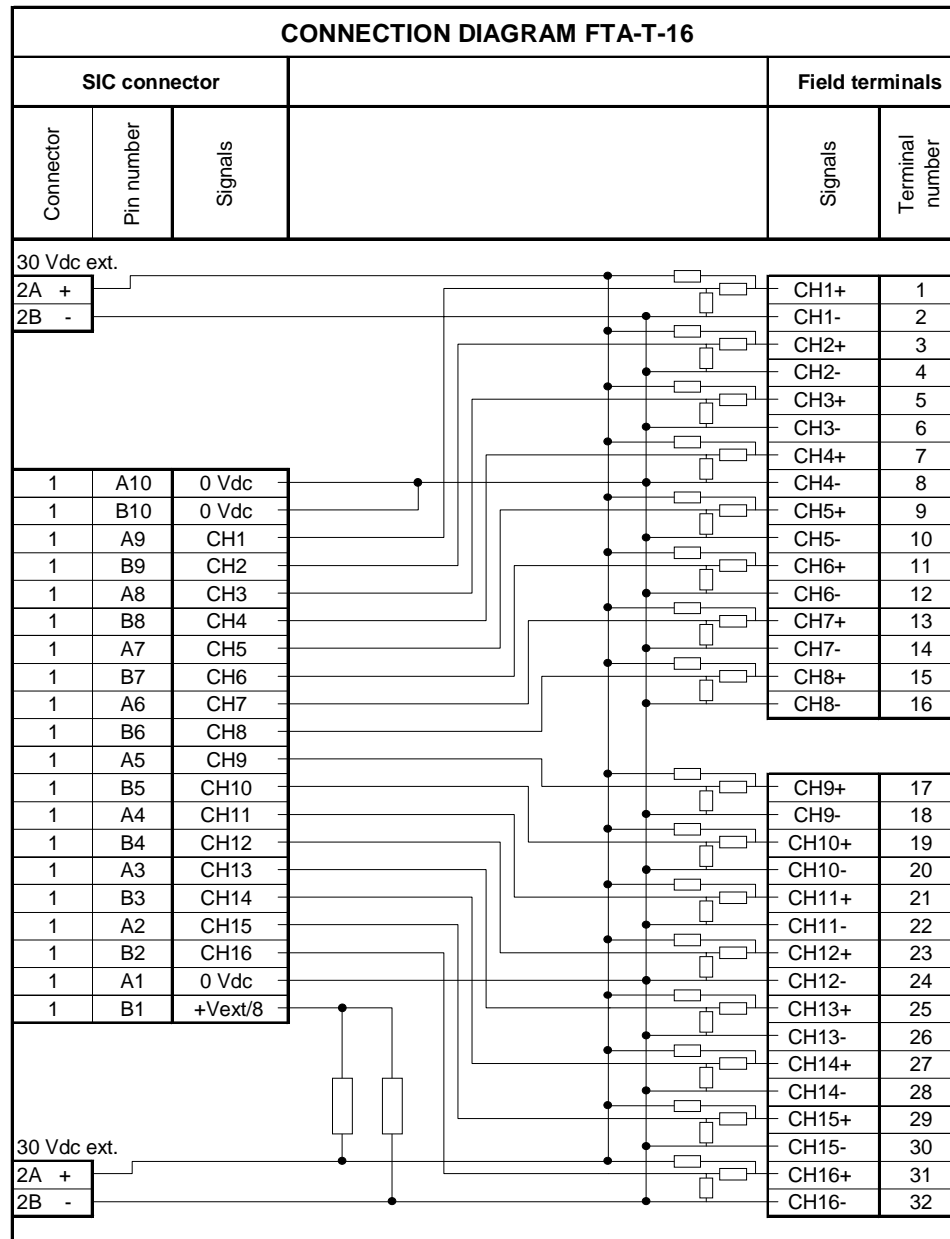| Connector	Pin number	Signals			Signals	Terminal number
2A	+				CH1+	1
2B	-				CH1-	2
					CH2+	3
					CH2-	4
					CH3+	5
					CH3-	6
					CH4+	7
1	A10	0 Vdc			CH4-	8
1	B10	0 Vdc			CH5+	9
1	A9	CH1			CH5-	10
1	B9	CH2			CH6+	11
1	A8	CH3			CH6-	12
1	B8	CH4			CH7+	13
1	A7	CH5			CH7-	14
1	B7	CH6			CH8+	15
1	A6	CH7			CH8-	16
1	B6	CH8				
1	A5	CH9				
1	B5	CH10			CH9+	17
1	A4	CH11			CH9-	18
1	B4	CH12			CH10+	19
1	A3	CH13			CH10-	20
1	B3	CH14			CH11+	21
1	A2	CH15			CH11-	22
1	B2	CH16			CH12+	23
1	A1	0 Vdc			CH12-	24
1	B1	+Vext/8			CH13+	25
					CH13-	26
					CH14+	27
					CH14-	28
					CH15+	29
30 Vdc ext.					CH15-	30
2A	+				CH16+	31
2B	-				CH16-	32

Figure 4   Connections diagram

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Technical data   The FTA-T-16 module has the following specifications:

General

Type number:	FTA-T-16
Approvals:	CE; UL, FM, TÜV approvals pending

Input

Number of input channels:	16
Power requirements:	30 Vdc external 150 mA (all inputs closed)
Max. current per channel:	< 12 mA at 30 Vdc

Output

To passive transmitters (Vext):

− open voltage	typically 24 Vdc

To 10105/2/1 module:

− output voltage	0 to 3.5 Vdc

Physical

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)

Termination

Screw terminals:

− max. wire diameter	2.5 mm² (AWG 14)
− strip length	7 mm (0.28 in)
− tightening torque	0.5 Nm (0.37 ft-lb)

Field signal specifications

Field wire resistance:	< 500 Ohm

Field device resistance (see Figure 2):

− R_A	1k0 (serial or parallel), ± 10%
− R_B	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

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.
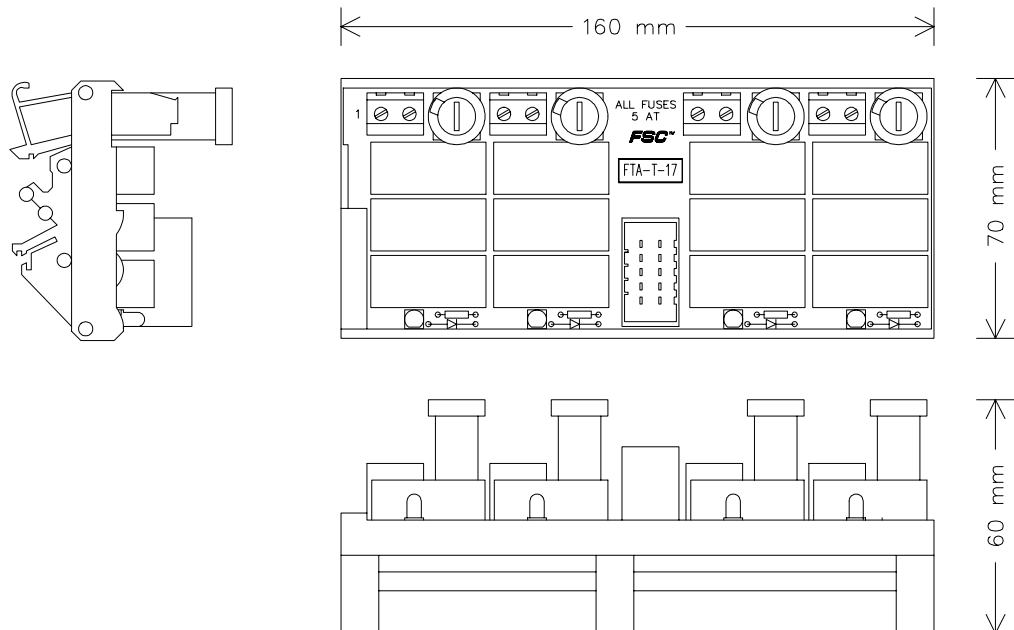

Figure 1   Mechanical layout

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.
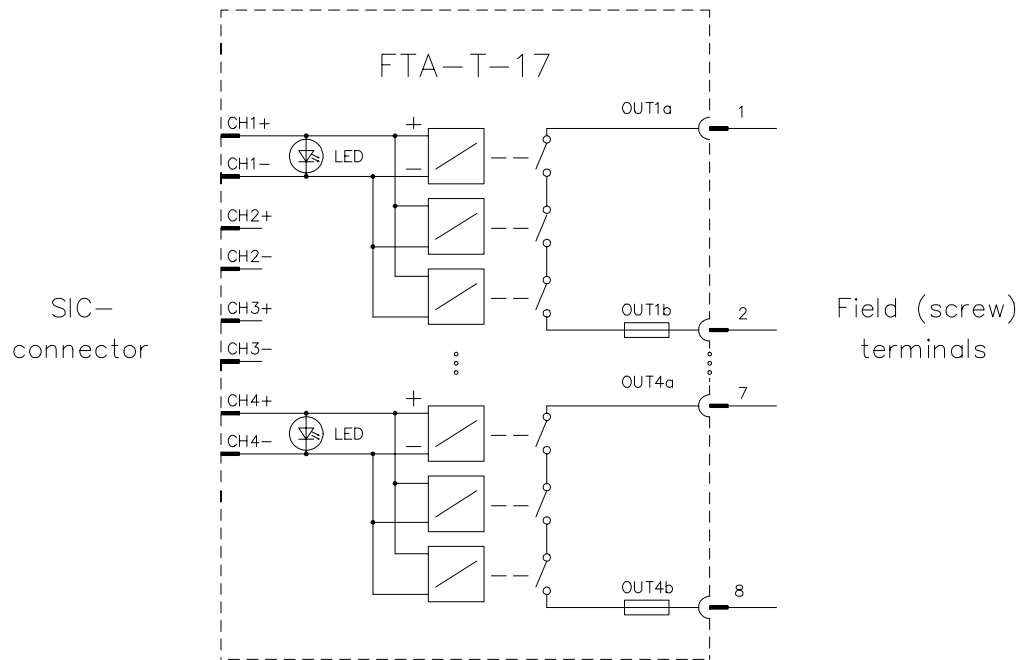

Figure 2   Schematic diagram

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:

CONNECTIONS DIAGRAM FTA-T-17					
SIC connector				**Field terminals**	
Connector	Pin number	Signals		Signals	Terminal number
			ALL FUSES 5 AT		
1	A5	CH1+		OUT 1a	1
1	B5	CH1-		OUT 1b (fused)	2
1	A4	CH2+		OUT 2a	3
1	B4	CH2-		OUT 2b (fused)	4
1	A3	CH3+		OUT 3a	5
1	B3	CH3-		OUT 3b (fused)	6
1	A2	CH4+		OUT 4a	7
1	B2	CH4-		OUT 4b (fused)	8
1	A1	nc			
1	B1	nc			
nc = not connected					

Figure 3   Connections diagram

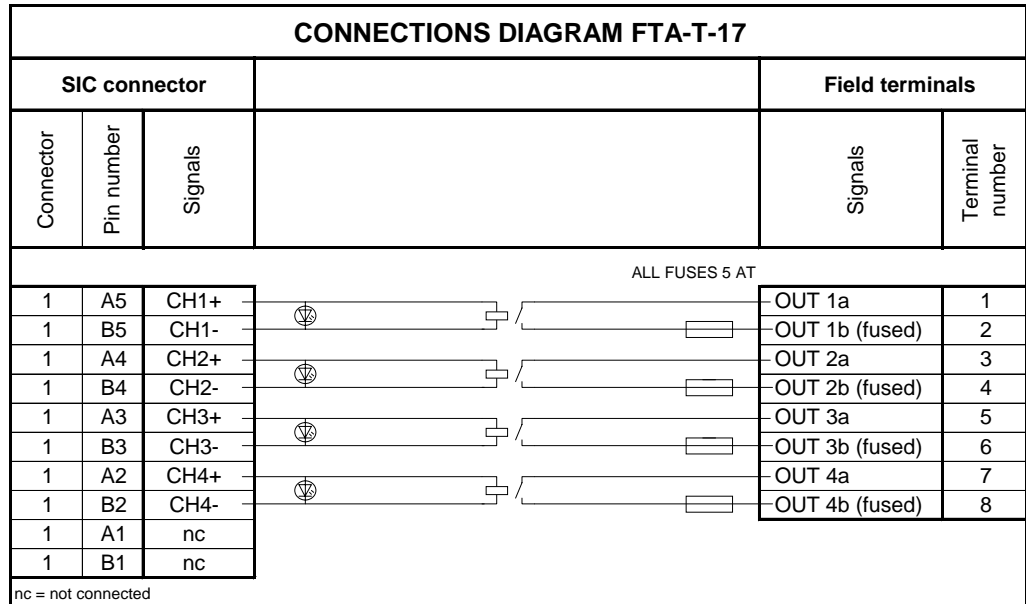**Technical data**   The FTA-T-17 module has the following specifications:

General   Type number: FTA-T-17
                   Approvals: CE;
                                               UL, FM, TÜV approvals pending
                   Safety class: AK1-6

Input   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

Output   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)

Fuses   Rating: 5 AT (slow-acting)
                   Dimensions: 5 x 20 mm (0.2 x 0.78 in)

Physical   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)

Termination   Screw terminals:
                   − max. wire diameter: 2.5 mm² (AWG 14)
                   − strip length: 7 mm (0.28 in)
                   − tightening torque   0.5 Nm (0.37 ft-lb)

Environment   Ambient temperature: −5°C to +60°C (23°F to 140°F)

Isolation   Isolation:
                   − coil to contact   3750 Vac
                   − contact to contact   1200 Vac

Technical data (continued)

Relay contact

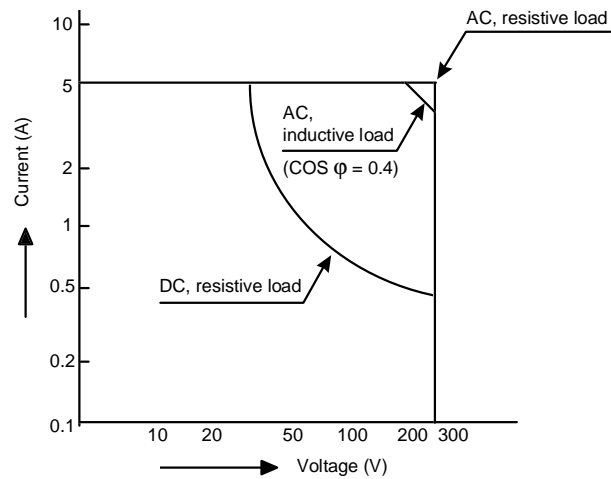|	
Max. current:	8 A
Max. switched voltage:	250 Vac / 250 Vdc
Max. switched load:	2000 VA / 150 W
Max. switch frequency:	20 Hz
Expected life:	
− electrical	100,000 switch operations
− mechanical	10,000,000 switch operations
Contact material:	gold flash over silver alloy

Figure 4   Maximum switched power

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Hardware Manual

Section 10:
User Station Modules

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Revision 02 (10/97)

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Section 10: User Station Modules

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).
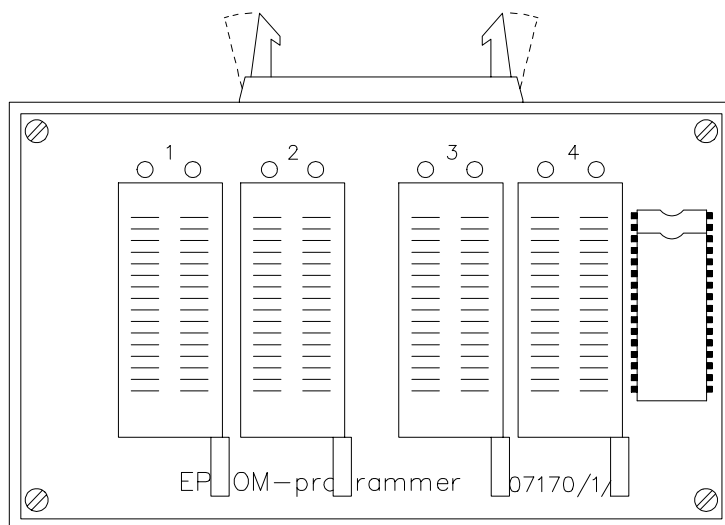

Figure 1   Top view

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:

```
GND    o  o    NC
NC     o  o    NC
CA3    o  o    CA2
CA1    o  o    NC
GND    o  o    IOW\
GND    o  o    IOR\
GND    o  o    CS
GND    o  o    READY
+5V    o  o    +5V
+5V    o  o    +12V
+12V   o  o    +12V
NC     o  o    NC
NC     o  o    NC
CD7\   o  o    CD6\
CD5\   o  o    CD4\
CD3\   o  o    CD2\
CD1\   o  o    CD0\
```
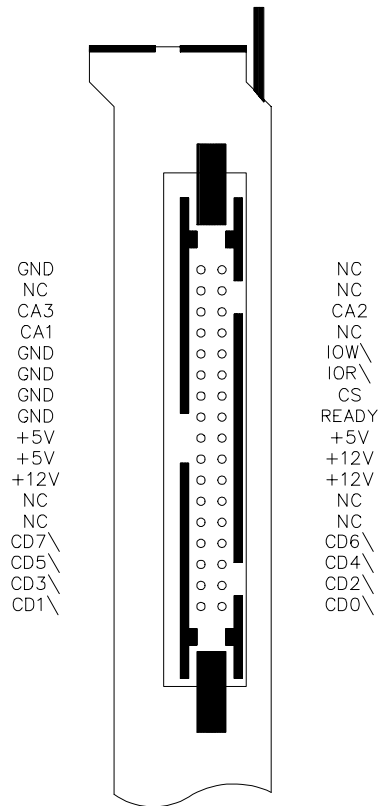
Figure 2   Pin allocation of 07170/1/1 connector

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.
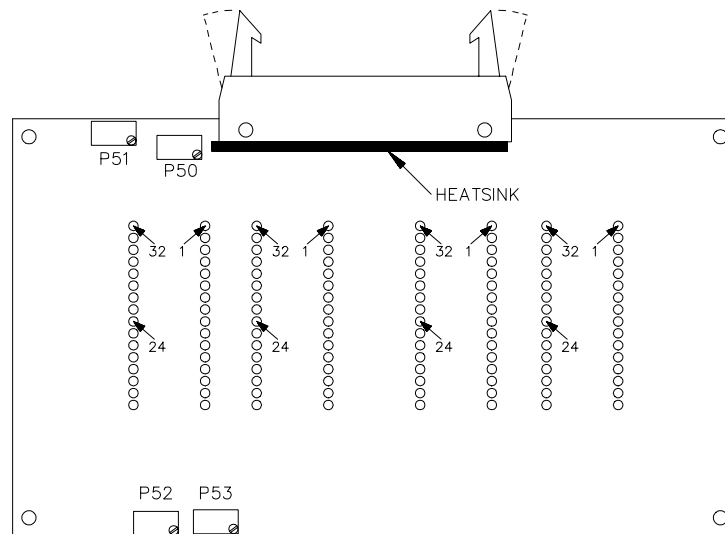

Figure 3   Location of potentiometers on EPROM programmer

Technical data   The 07170/1/1 EPROM programmer has the following specifications:

General

Type number:	07170/1/1
Approvals:	CE
Software versions:	all; supported EPROM types vary*
Connector:	34-pin male

Power

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.

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).
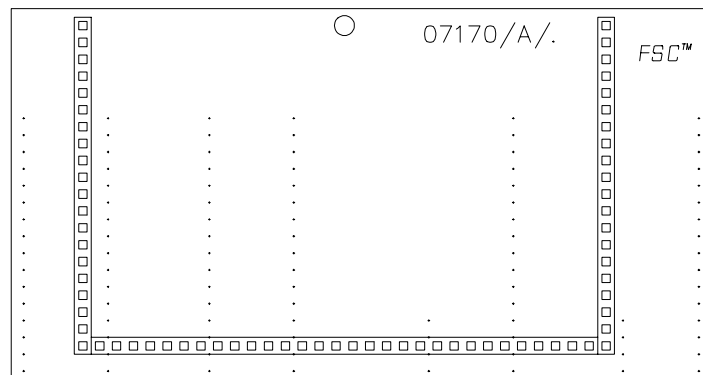

Figure 1   Top view

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)

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.
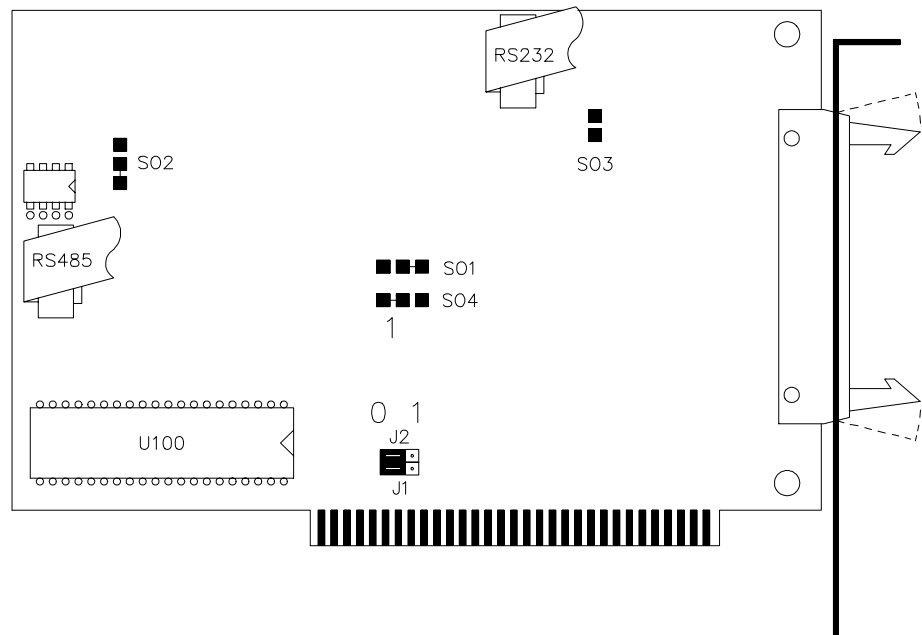
Figure 1   Location of connectors and jumpers on 07177/1/. module

Solder jumpers SO1 and SO2 are factory-set.
If solder jumper SO3 is closed, the DTR is set high as soon as power is available.

Solder jumper SO4 in position 1 (as shown in Figure 1) enables decoding of 2 Mbaud communication on RS485 channel. SO4 in the other position enables decoding of 1 Mbaud communication on RS485 channel.

Jumpers J1 and J2 define the 07177/1/. module's base address (see Table 1).

Table 1   Base address of 07177/1/. module

Jumper settings		Base address
J1	J2	
0	0	300
1	0	320
0	1	340

Interface connectors

Figure 2 shows the EPROM programmer interface connector and the communication connectors of the 07177/1/1 module.
Figure 3 shows the EPROM programmer interface connector of the 07177/1/3 module.

Figure 2   Front view of connectors of 07177/1/1 module

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

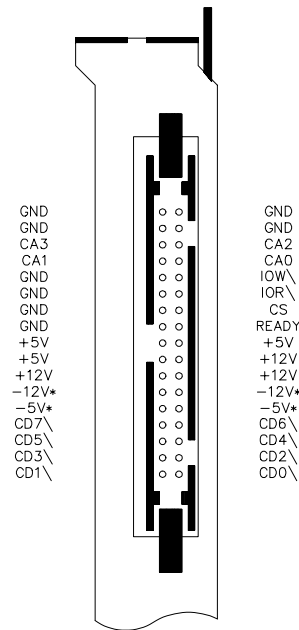An RS232C interface (on the 07177/1/1 module or one of the PC's COM ports) can be used to connect the FSC user station to the FSC system (see also 10004/B/1 and 10004/F/1 data sheets). In these data sheets, the colors in the figures with cable examples refer to Belden 8723 cable. Figure 4 below shows the pin connections of the male RS232C connector.
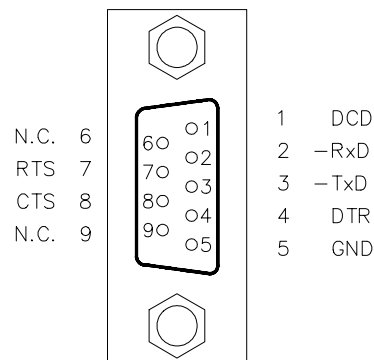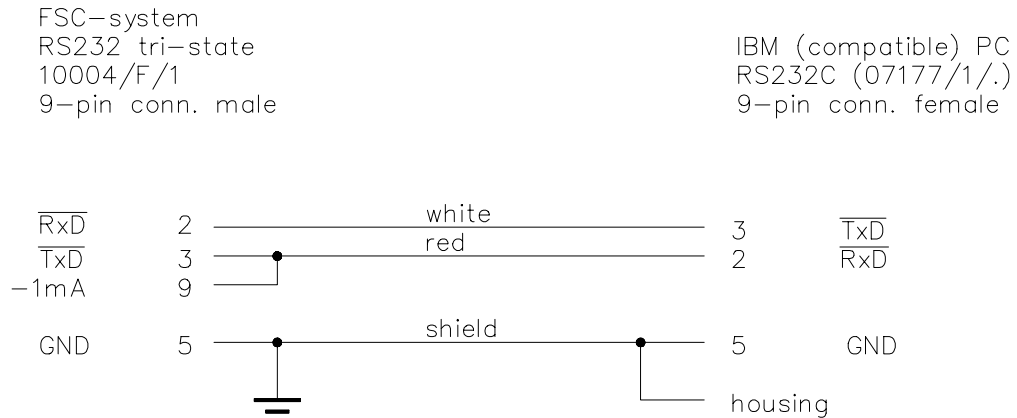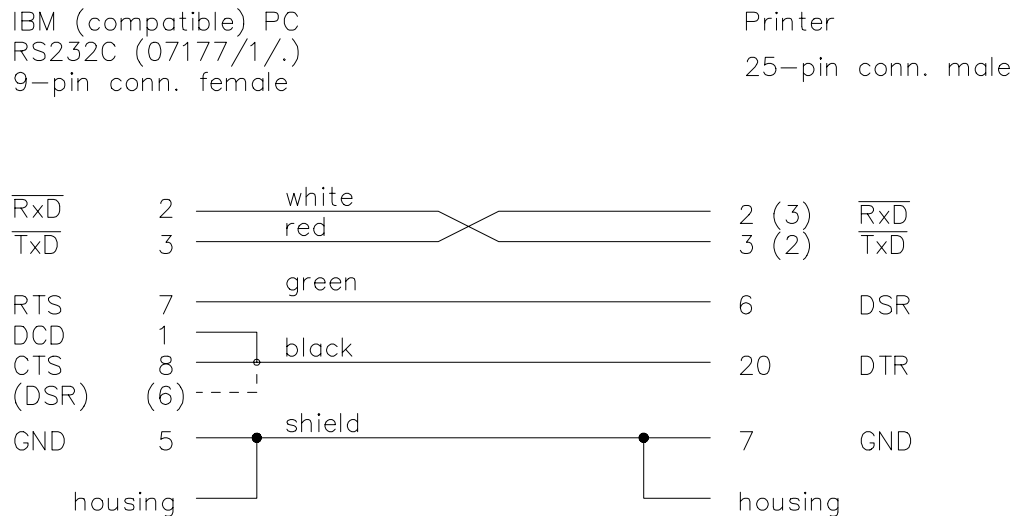

Figure 4   Front view of male RS232C connector

The cable connections are as follows:

```
FSC-system
RS232 tri-state
10004/F/1                                    IBM (compatible) PC
9-pin conn. male                             RS232C (07177/1/.)
                                             9-pin conn. female

                              white
R̄x̄D̄      2  ─────────────────────────────  3    T̄x̄D̄
T̄x̄D̄      3  ─────────────red─────────────  2    R̄x̄D̄
-1mA     9

GND      5  ──────────shield─────────────  5    GND

                                                 housing
```

Figure 5   Cable between FSC system and IBM-compatible PC
9-pin connector, without hardware handshake

```
IBM (compatible) PC                          Printer
RS232C (07177/1/.)
9-pin conn. female                           25-pin conn. male

                              white
R̄x̄D̄      2  ─────────────────────────      2 (3)   R̄x̄D̄
T̄x̄D̄      3  ──────────red────────────      3 (2)   T̄x̄D̄

                              green
RTS      7  ─────────────────────────      6        DSR
DCD      1  ─┐
             │black
CTS      8  ─┘                             20       DTR
(DSR)   (6) ----

                              shield
GND      5  ─────────────────────────      7        GND

         housing                           housing
```
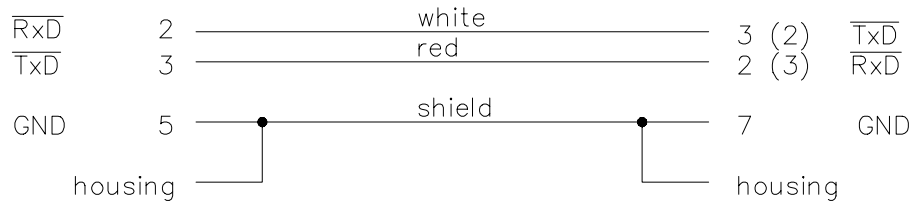
Figure 6   Cable between IBM-compatible PC and printer
25-pin connector, with hardware handshake.

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                              Printer
RS232C (07177/1/.)
9-pin conn. female                          25-pin conn. male
```



```
R̄x̄D̄   2 ─────────── white ──────────── 3 (2)   T̄x̄D̄
T̄x̄D̄   3 ─────────── red ────────────── 2 (3)   R̄x̄D̄

GND   5 ────────── shield ──────────── 7        GND

      housing ─┘              └─ housing
```

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.


```
N.C.   6                  O1        1   GND
-RTxD  7        6O        O2        2   N.C.
N.C.   8        7O        O3        3   RTxD
N.C.   9        8O        O4        4   N.C.
                9O        O5        5   +5V
```
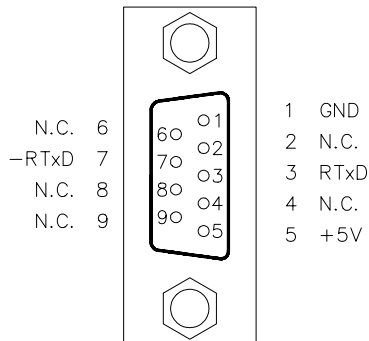
Figure 8   Front view of male RS485 connector

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: ≥ 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

* Note:
CE approval requires plastic covers to be placed on unused 9-pin communication connectors.

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