

CMZ hardware

TS1002

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PURPOSE OF THE USER GUIDE

This guide describes the hardware of the controller system **TS1002**. Information of a general nature is given regarding its functions as well as its structure. All data and specifications to be complied with for connections and setting up are also given.

NOTE

It is suggested, before starting the installation, to consult the manual “Electromagnetic Disturbances” containing some advice on how to wire TS1002 to the other devices in order to minimize the influence of disturbances.

section 1. INTRODUCTION

The TS1002 is a controller system with touch-screen terminal. Like other CMZ products it may be used both as a normal PLC and as a master of a decentralised control network (e.g. a CAN network); it may also be used as a slave terminal for implementing the MMI (Man Machine Interface).

The main distinguishing features are:

- the interface towards the operator accomplished through a touch screen
- the power of the CPU QUICC (Quad Integrated Communication Controller) MOTOROLA M68360 with 32 bit and 32 MHz
- the high capacity of communication with other systems, thanks to the simultaneous presence of the communication ports RS232 (2), CAN (2) and the optional Profibus, HDLC and Ethernet (the last two are not yet available at the time of preparing this guide)
- the large screen size
- the compactness with regard to depth

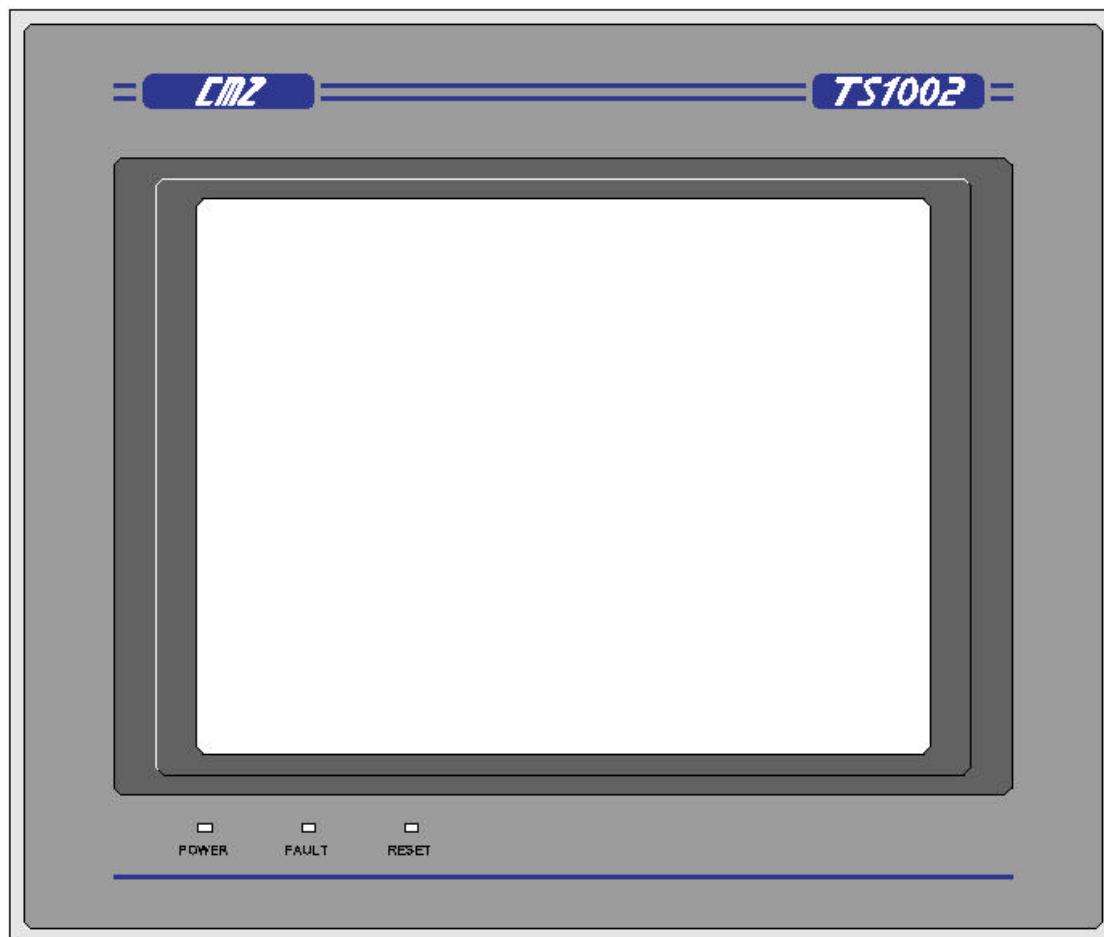


Fig. 1.1 TS1002 front view

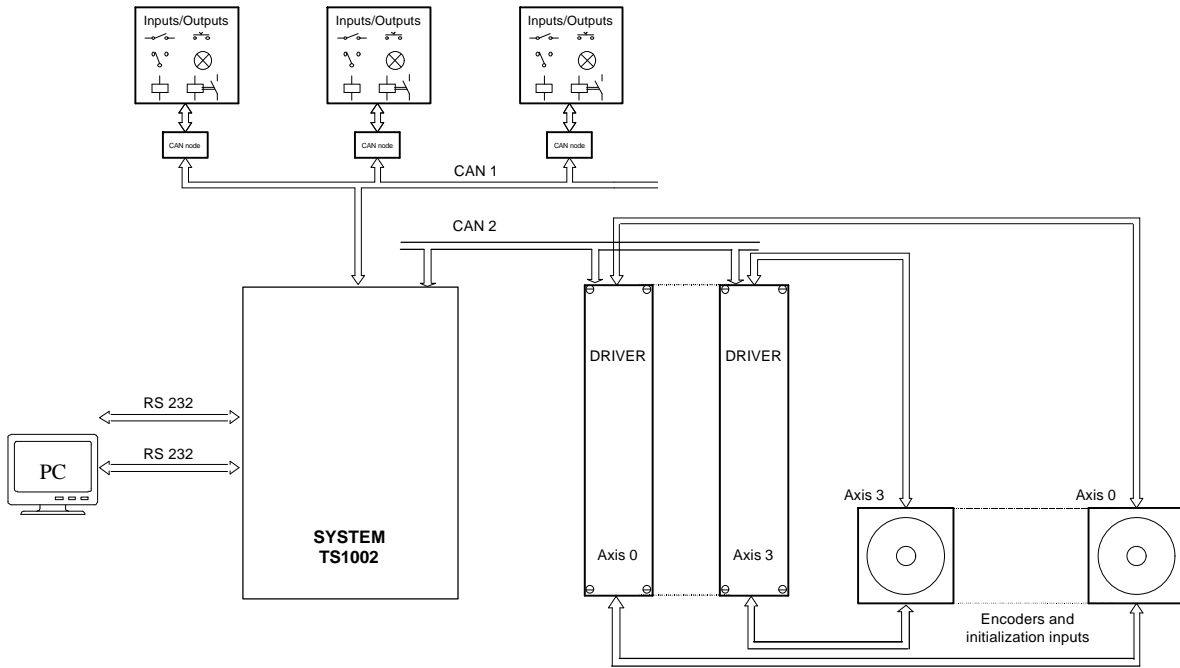


Fig. 1.2 Possible application of the TS1002 system

section 2. THE TS1002 SYSTEM

2.1 STRUCTURE AND BLOCK DIAGRAM

The configuration of the TS1002 is as follows:

- **mechanical structure** comprising:
 - painted external frame
 - LCD support
 - anodised sheet metal rear box
- **power supply unit** 18 Vac / 24 Vdc for a maximum output of 60 W
- **user interface**, comprising:
 - *colour LCD (TFT)* 10.4" 640x480 pixels
 - *touch panel*, anti-glare, scratchproof, touch-sensitive resistive analog front panel
- **central processing unit** comprising:
 - Microprocessor - Motorola MC68360 32 bit 32 MHz
 - 8 Mbyte Flash EPROM (operating system – application programs and data)
 - 2 Mbyte SRAM buffered (application programs and data)
 - 4kbyte I²C EEPROM (system parameters)
 - Real-time clock
 - Mathematical coprocessor MC68882 with 32MHz (optional)
 - Lithium battery (1/2AA) with supervisor for protection
- **peripheral units:**
 - 2 opto-isolated RS232C ports 115 kbaud - DSUB9F connector
 - microcontroller dedicated to CAN communication
 - 2 opto-isolated CAN ports 1 Mbaud - DSUB9M connector
 - microcontroller for touch-panel control and temperature control
 - forced ventilation under software control
 - 1 port for Compact Flash Type I 3.3Vdc/ 5Vdc with ATA driver 16 bit
- **options:**
 - 1 RS232C/RS422/RS485 port or 1 HDLC port (not yet available at the time of preparing this guide)
 - 1 Profibus-DP port on Anybus-S HMS module or one Ethernet port (contact CMZ for the details for the latter)
 - 1 Device-Net port on Anybus-S HMS module

section 3. CONNECTIONS

3.1 POWER SUPPLY

3.1.1 General information

The power supply section is obtained through a power supply unit PWTSTB, integrated into the actual system, capable of absorbing a maximum power of 60W. This power supply unit provides voltage for the:

- motherboard (5V)
- cooling fan (12V)
- LCD inverter (12V)

A green LED is present on the panel where the power supply connector is located, which indicates the presence of voltage at the power supply unit input.

3.1.2 Technical data

PWTSTB power supply unit technical data

Input voltage - rated value - range	18 Vac / 24 Vdc ± 20 %
Main frequency - rated value - range	50 Hz / 60 Hz ± 5 %
Input current - typical steady state value - typical value during initial peak - typical duration of initial peak - typical value during initial transient - typical duration of initial transient	2A rms 16A 8 msec 6A 80 msec
Total input power - maximum value	60W
Lithium buffer battery - size (std. ANSI) - rated voltage - rated capacity - battery cut-out device for storage - min. storage duration with T _{amb} = 25°C - storage T _{amb} (range)	½AA 3.6 Vdc 0.85 Ah dipswitch 1 year -10°C ÷ 50°C
Short-circuit protection	Electronic
Primary circuit protection	2 self-resetting fuses I _{Hold} = 4 A @ T _{amb} = 20 °C
Earth galvanic separation	No
Voltage present LED	green

CAUTION

The power supply stage being capacitive, start-up of the TS1002 is distinguished by considerable absorption (see the table above). A transformer (or stabiliser) capable of providing the required current is therefore recommended.

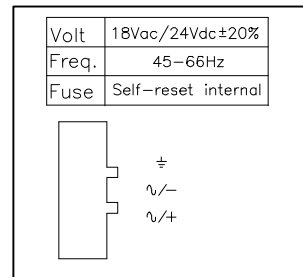
3.1.3 Installation notes

3.1.3.1 Description of the connector

The power supply is connected in the printed circuit through a 90°, 3-pin male connector of the Phoenix MSTB 2.5/3 GF-5.08 type. This connector requires use of a MSTB 2.5/3 STF-5.08 plug to which the power cables should be connected, preferably terminated with wire terminals.

Power supply connector

PIN	SIGNAL	DESCRIPTION
1	PE	Protective earth
2	-VIN	18 Vac / 0 Vdc
3	+VIN	18 Vac / 24 Vdc



3.1.3.2 Connection notes

The earth connection must be carried out, both through the power supply connector and through the functional earthing screw, in order to ensure best performance of the system with regard to interference (cf. appendix A on SAFETY). This connection also guarantees that the whole metal casing of the TS1002 is equipotential with the protective earth of the installation. A transformer (or stabiliser) should be used that can supply the required current during start-up, which, being the stage of capacitive type power supply, is characterised by considerable absorption (cf. par. 3.1.2 Technical data).

3.1.3.3 Lithium battery

The TS1002 system has a lithium battery (1/2AA) with supervisor for protection /CE SRAM and signal management V_{batt} , *Watch-Dog*, */Reset*. If the battery is replaced, particular attention should be paid to its polarity, which should correspond to the indications given on the system box. To replace the battery, remove the relative flap on the rear of the system, as shown in the figure.

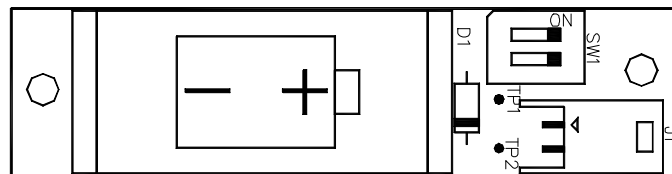


Fig. 3.1 Lithium battery diagram

CAUTION

The system comes with connected battery. If the system is not to be used for a long period, cut out the battery by putting both settings of the dipswitch SW1 to OFF (see figure above) in order to conserve the charge.

3.2 RS232 SERIAL COMMUNICATION PORTS

3.2.1 General information

The TS1002 system offers 2 optoisolated *RS232 serial communication ports* for programming purposes or as communication interface with other intelligent units.

This port may also be converted into RS422/485 by means of a small external adapter (ADP422 and ADP485 respectively).

3.2.2 Installation notes

3.2.2.1 Description of connectors

RS232 connector (DSUB 9-pin female) for port0 and port1

PIN	SIGNAL	DESCRIPTION
1	DCD (only on PORT 0)	Data carrier detect (only on PORT 0)
2	TXD	Transmit data
3	RXD	Receive data
4	-	-
5	SGND	Signal ground
6	VCC	Power supply +5 Vdc
7	CTS	Clear to send
8	RTS	Request to send
9	-	-

The DCD signal is only present on PORT 0 (pin 1 is not connected on PORT 1).

3.2.2.2 Connection notes

The figure below shows the serial connection cables in minimum configuration towards a host PC. The maximum data rate is 115200 baud, for an allowed cable length of 10 m.

A screened cable is recommended (mod. 8104 BELDEN ELECTRONICS), the shield of which should be connected to the DSUB connector shell on both ends of the cable.

Should there be any difference at all between the potential reference (protective earth PE) of the TS1002 and the potential reference of the connected system (e.g. a PC), the shield of the serial cable must be connected to the TS1002 connector only.

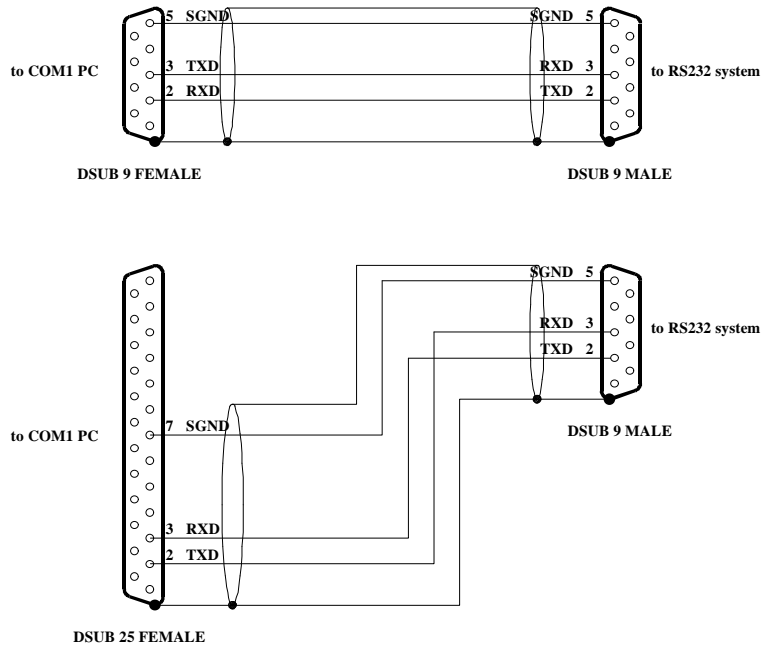


Fig. 3.2 Connection cable RS232 between TS1002 and PC

3.2.2.3 Adapters ADP422 and ADP485

These adapters are an economic, compact solution for converting serial channel signals from RS232 to RS422/485.

The power supply is provided from the same port RS232 of the TS1002 and is protected against short-circuit.

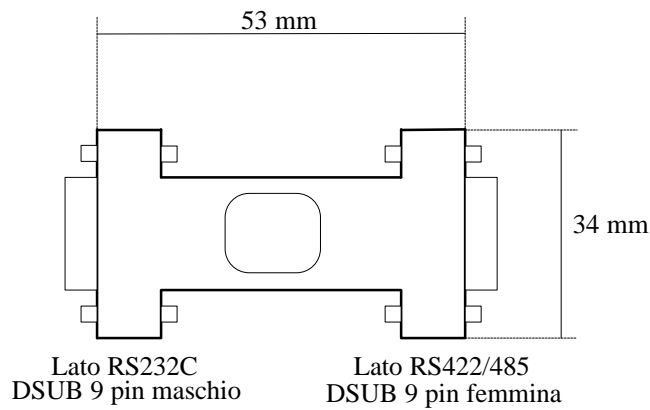


Fig. 3.3 ADP422-ADP485

3.3 CAN SERIAL COMMUNICATION PORTS

3.3.1 General information

The TS1002 offers 2 CAN (Controller Area Network) *serial communication interfaces*.

Thanks to this field network the peripherals of a system can be expanded with easy decentralisation, reduced wiring costs and considerable performance in terms of bit rate (up to 1 Mbit/s) and communication precision.

The TS1002 is designed to act as CANopen master for this network, although there are no reasons why it should not also become (alternatively or simultaneously) SDO server of a network supervisor (e.g. a PC).

The system can communicate with the other nodes both according to the CANopen protocol and according to other proprietary protocols, provided that these protocols are implemented with suitable SW libraries.

In the case of the CANopen in particular, the network can be set up with either CANopen nodes produced by CMZ or with CANopen nodes available on the market.

3.3.2 Technical data

Characteristics of the serial connection

Connection	CAN protocol (ISO-11898 Ver. 2.0 Part B)
Galvanic isolation	With optical couplers
Termination resistor	Connection by means of dipswitch

In respect of the general features of the serial connection, the topology, maximum number of connectable nodes, the baud rate / length ratio and the specifications of the transmission medium, refer to the specific user guide “Rete CANopen peripherals” for the CANopen protocol, or to the user guide related to the protocol being used.

3.3.3 Installation notes

3.3.3.1 Description of the connector

CAN connector (DSUB 9-pin male)

PIN	SIGNAL	DESCRIPTION
1	-	-
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	-
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	-
9	-	-

3.3.3.2 Connection notes

The specifications for setting up this type of network are also given in the above-mentioned specific guide. Regarding the termination resistors in the TS1002 this resistor is on-board and may be connected by means of a suitable SW_CAN dipswitch to be found between the connectors of PORT2 and PORT3 (the system comes with the resistor connected).

CAN network termination resistor (PORT 2)

Bit 1	(SW_CAN)
ON	Resistor connected
OFF	Resistor not connected

CAN network termination resistor (PORT 3)

Bit 2	(SW_CAN)
ON	Resistor connected
OFF	Resistor not connected

N.B. Upon delivery the switches are in the positions indicated in **bold type**.

3.4 PROFIBUS-DP SERIAL COMMUNICATION PORT

3.4.1 General information

The TS1002 system can house an expansion board that makes a Profibus-DP serial communication port available. A model available on the market is used in order to ensure compatibility with the standard Profibus-DP EN 50170 (DIN 19245). Communication is therefore possible between the TS1002 and other non-CMZ systems, which provide for this standard protocol (PLC in particular).

The module front-end is shown in Fig. 3.4.

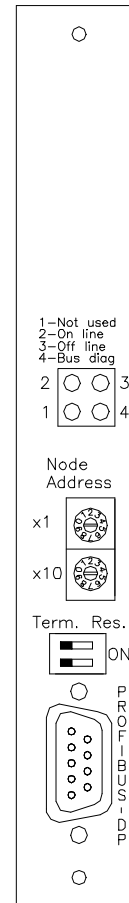


Fig. 3.4 Profibus Module

3.4.2 Technical data

The communication rate on the Profibus-DP network is selected automatically (via software) from among 9 different values, from a minimum of 9.6 Kbaud to a maximum of 12 Mbaud locking on to the network rate.

Main characteristics of the transmission medium and of the connection

Connection	RS485
Galvanic isolation	With optical couplers
Medium	Screened twisted-pair cable
Screening	Mixed: film and braid
Number of pairs	1
Characteristic impedance Z_0	150 Ω
Network termination	220 Ω on board
Recommended models	3079A BELDEN ELECTRONICS

3.4.3 Installation notes

3.4.3.1 Description of connector

Profibus-DP connector (DSUB 9-pin female)

PIN	SIGNAL	DESCRIPTION
Shell	SHLD	Connected to PE
1	-	-
2	-	-
3	BUS_H	Signal high
4	RTS	Request to send
5	SGND	Signal ground
6	+VCC	+5 Vdc
7	-	-
8	BUS_L	Signal low
9	-	-

3.4.3.2 Connection notes

The following specifications must be observed when implementing this type of network:

- The network units must be cascaded, under all circumstances avoiding star connections or stubs. If the system occupies an intermediate position within the network, the stub should therefore be wired externally to the connector, otherwise transmission is unreliable.

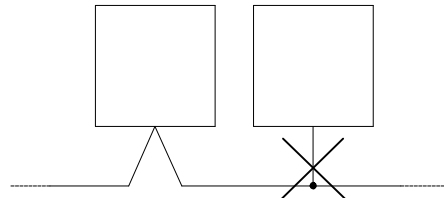


Fig. 3.5 Detail of correct connection between systems with Profibus-DP

- Use the same type of cable for the whole installation.
- The BUS_H and BUS_L pins should be connected to the same twisted pair; the cable shield should be connected to the connector shell.

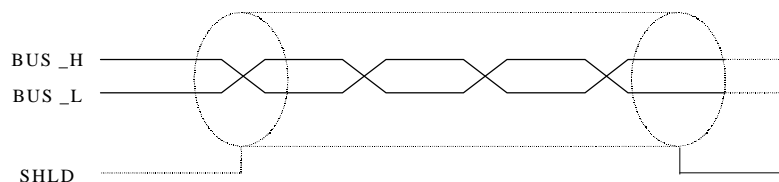


Fig.3.6 Cable connection for Profibus-DP

- In systems that are at the start and end of the line, connect the on-board termination resistor using the setting device that is accessible from the exterior.

Termination resistor

SETTING	
ON	Resistor connected
OFF	Resistor not connected

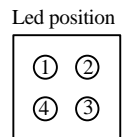
Upon delivery the switches are in the positions indicated in **bold type**.

In addition, wire a 390Ω 1/4W pull-up resistor between BUS-H (pin 3) and +5Vdc (pin 6), and a 390Ω 1/4W pull-down resistor between BUS-L (pin 8) and SGND (pin 5).

- Each network node is assigned a different number to allow its addressing. In the TS1002 system this number is assigned by using 2 rotary switches, which allow a number to be set anywhere between 1 and 99 in decimal format (0 is reserved to allow numbering via software). The switch marked “x1” is used to set the units and the one marked “x10” for the tens. **The address cannot be changed during operation.**

3.4.3.3 LED description

There are 4 LEDs that indicate the status of the Profibus-DP expansion module; ; their positions are described on the figures on the right; their functions are given in the table below:



PIN	NAME	COLOUR	DESCRIPTION
1	Not used	-	Not used
2	On-line	Green	On- indicates that the module is On-line in the Fieldbus Off- indicates that the module is not On-line
3	Off-line	Red	On- indicates that the module is Off-line in the Fieldbus Off- indicates that the module is not Off-line
4	Fieldbus diagnostics	Red	Indicates various states of the Fieldbus: Blinking 1 Hz- configuration error: the length of the INs or OUTs set during module initialization is not the same as that set during network configuration. Blinking 2 Hz- User Parameter data error: the length/content of User Parameter data set during module initialization is not the same as that set during network configuration. Blinking 4 Hz- initialization error of Profibus communications ASIC. No blinking- no diagnostics present

3.5 DEVICE-NET SERIAL COMMUNICATION PORT

3.5.1 General information

The TS1002 system may house an expansion board that makes a Device-Net serial communication port available. A module is used that is available on the market and ensures compatibility with the standard Device-Net. In particular, the module is in compliance with the ODVA (Open DeviceNet Vendor Association) test. In this way communication is possible between the TS1002 and other non-CMZ systems (PLC in particular).

3.5.2 Technical data

Main technical characteristics for the TS1002 Device-Net

Connection	CAN
Galvanic isolation	with optical couplers
Maximum number of nodes	64
Medium	screened, twisted-pair cable
Screening	mixed: film and braid
Number of pairs	2
Conducting material	Tinned copper
Characteristic impedance Z_0	120Ω ($100 \Omega \leq Z_0 \leq 150 \Omega$)
Network termination	Resistance 120Ω -1/4 W (equal to Z_0)
Recommended models	3082A BELDEN ELECTRONICS (trunk cable or thick cable) 3084A BELDEN ELECTRONICS (drop cable or thin cable)

3.5.3 Installation notes

3.5.3.1 Description of connector

The Device-Net module has a removable 5-pin screw connector, the pin configuration of which is given in the table below.

It should be noted that the supply voltage for the profibus module is provided by the bus and the acquisition section is isolated from the logic section through photo-couplers.

Device-Net connector (removable 5-pin screw connector)

PIN	SIGNAL	DESCRIPTION
1	V-	Negative supply voltage
2	CAN_L	CAN_L bus line
3	SHIELD	Cable Shield
4	CAN_H	CAN_H bus line
5	V+	Positive supply voltage (+24VDC)

3.5.3.2 Connection notes

The physical specifications related to the protocol specified by ODVA (Open DeviceNet Vendor Association) must be observed when implementing a DeviceNet network.

A DeviceNet network may have varying degrees of freedom; the main ones are:

- the choice of cable (thick, thin, flat cable)
- the number of nodes (max. 64) and type (isolated or not isolated)
- the number of power supply sources (from the bus or not)
- the number of possible stubs

The length of the network may vary according to these parameters.

With the recommended cable 3082A BELDEN ELECTRONICS the following can generally be obtained:

Bit rates	Distance with line using cables 3082A (thick cable)
125Kbaud	500m
250Kbaud	250m
500Kbaud	100m

The following is recommended in particular:

- Use the same type of cable for the whole installation (the model 3082A BELDEN ELECTRONICS - trunk cable or thick cable - ensures best performance).
- The CAN_H and CAN_L pins should be connected to the same twisted pair; *the cable shield should be connected to pin 1 of the connector*. The signals V+ and V- serve to provide an external power supply to the module.

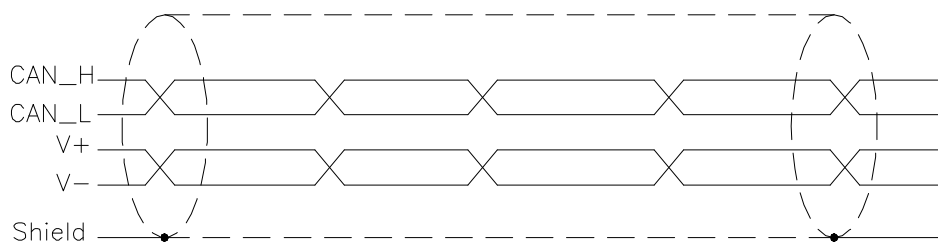


Fig. 3.7 Cable connection for Device-Net

- Connect a 120 ohm termination resistor externally between CAN_H and CAN_L near nodes that are at the start and end of the line.

3.5.3.2 Dipswitch and LED description

Each node is assigned a different number to allow its addressing. The bit rate of the network to which the module belongs may also be selected. In the TS1002 system there is an eight-bit dipswitch for setting not only the node number but also its bit rate (see tables below). The node number and bit rate may be selected via software *by putting all the dipswitch settings to ON*. **The address cannot be changed during operation.**

Dipswitch identifying the communication rate of the Device-Net network

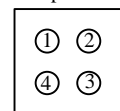
BIT 1	BIT 2	BIT RATE
OFF	OFF	125 kbit/s
OFF	ON	250 kbit/s
ON	OFF	500 kbit/s
ON	ON	Reserved

Dipswitch identifying the node number in the Device-Net network

BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	BIT 8	NODE IDENTIFICATION
OFF	OFF	OFF	OFF	OFF	OFF	Node 0 (factory default)
OFF	OFF	OFF	OFF	OFF	ON	Node 1
OFF	OFF	OFF	OFF	ON	OFF	Node 2
OFF	OFF	OFF	OFF	ON	ON	Node 3
ON	OFF	OFF	ON	OFF	OFF	Node 4
ON	ON	ON	ON	ON	OFF	Node 62
ON	ON	ON	ON	ON	ON	Node 63

There are **4 two-colour LEDs** in the module, which indicate the status of the Device-Net expansion module and of the network to which it is connected; their positions are described on the figures on the right; the table below gives their functions:

Led position



PIN	NAME	COLOUR	FREQUENCY	DESCRIPTION
1	Not used	-		Not used
2	Module status	Off Green Red Red	- ON ON Intermittent	Device not powered Device operative Irrecoverable error Minor error
3	Network status	Off Green Green Red Red	- ON Intermittent ON Intermittent	Device not in line / not powered Connection OK, on line, device connected to the network Device on line but not connected Critical connection problem Connection timeout
4	Not used	-		Not used

3.6 COMPACT FLASH

The TS1002 system includes an interface towards a Compact Flash Storage Card designed to load the system configuration parameters.

The table below gives the main characteristics of the Compact Flash that may be used in the system; it should be noted that the useable Compact Flash must be in conformity with the specifications indicated by the Compact Flash Association.

Technical data

<ul style="list-style-type: none"> - Model - size (mm) - supply voltage - storage type - Standard - Red LED 	Compact Flash Type I with ATA 16Bit driver 42.8 x 36.4 x 3.3 3.3 Vdc non volatile storage Compact Flash specification On during CF access
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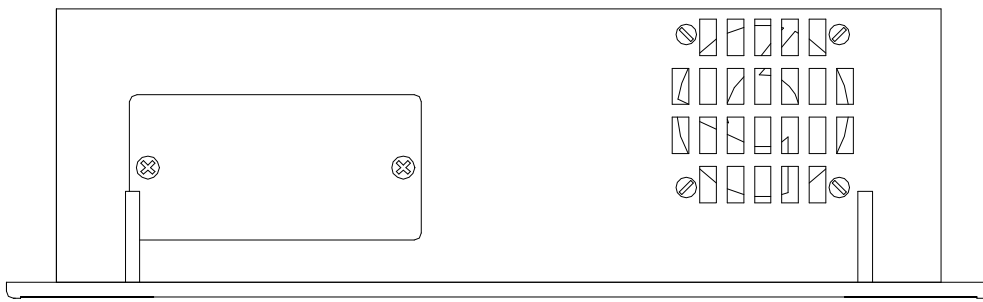


Fig. 3.8 Panel for Compact Flash

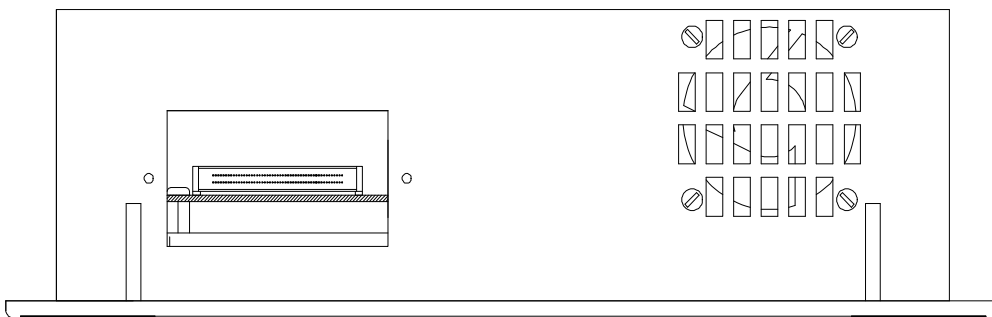


Fig. 3.9 Compact Flash housing

To insert the Compact Flash just remove the panel shown in fig. 3.8 and insert the card into the housing shown in fig. 3.9.

CMZ can provide the Compact Flash together the system.

section 4. OPERATOR - FRONT PANEL INTERFACE

4.1 TECHNICAL DATA

Touch Pannel

Membrane - resolution - touch speed - life cycles - tactile sensation	Minimum 1024 points per axis Typical 20 mSec 100 millions touches in one location acoustic signalling
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LCD

Model - technology - type - resolution - backlighting	TFT graphic 640 x 480 pixel CCFL
Visual characteristics - visible area - brightness (max.) - contrast control	211.2 x 158.4 mm 250 cd/m ² autom. temp. compensation
Enviromental features	Ambient temperature ambiente 5 °C ÷ 45 °C Relative humidity Rh2 (5 % ÷ 95 % @T<40°C) Rh2 (5 % ÷ 85 % @ 40<T<45°C) Degree of pollution II Altitude ≤ 2000 m s.l.m.

Status LEDs

LED POWER	Green
LED FAULT	Yellow
LED RESET	Red

4.2 MEANING OF THE STATUS LEDs (POWER/FAULT/RESET)

The **POWER LED** indicates the ON status of the system.

The **FAULT LED** may have various meanings:

- if the LED is on, the system is in the boot stage; should this status last for more than 10 sec. it indicates a serious HW/firmware problem;
- if the LED is off, the system has been correctly started;
- if the LED blinks, the system is warning of an anomaly or malfunctioning and sends an alarm code, indicated by the number of blinks emitted at the frequency of 1 blink/sec. at intervals of 3 sec.; these codes are given in the following table:

Alarm code

NUMBER OF BLINKS	MEANING OF ALARM
1	Lack of AUTOSTART marker or lack of TASK word
2	Discharged Lithium battery
3	LCD initialization error
4	System internal temperature > 60 °C

5	Motherboard option error
6	Slot error (profibus)
> 6	Reserved

Should several alarms be triggered at the same time, their codes are emitted in sequence.

The **RESET LED** indicates the CPU reset status; intermitting blinking indicates that the watch-dog has intervened.

4.3 TOUCH PANEL

This is a slender touch-sensitive, resistive analog panel overlying the LCD. The position where pressure is being applied is detected through “eight-wire” technology, resulting in a precise analog measurement. It is therefore possible to achieve layouts of any form on the display without the restrictions of matrices.

The polyester film (PET) on the exterior of the panel is covered by an acrylic based hardcoat. This coat greatly improves resistance to abrasion, to the most common chemical agents (see note) and to UV rays. The touch panel, however, remains unsuitable for applications that envisage continuous exposure to direct sunlight, which would cause yellowing and a decrease in mechanical strength.

MANUFACTURER’S NOTE

The touch panel has been placed in continuous contact with various chemical agents and under different conditions of temperature and humidity. The visual effect remained the same after tests carried out with: coffee, liquid detergent, sweat, acetic acid, brake fluid, acetates, ethanol, isopropyl alcohol, petrol, concentrated HCl, diesel oil, petroleum, trichloroethane 111. 40% sodium hydroxide caused slight corrosion.

For better viewing, periodically remove dust, dirt and fingerprints from the panel. Avoid prolonged or repeated contact with abrasive materials.

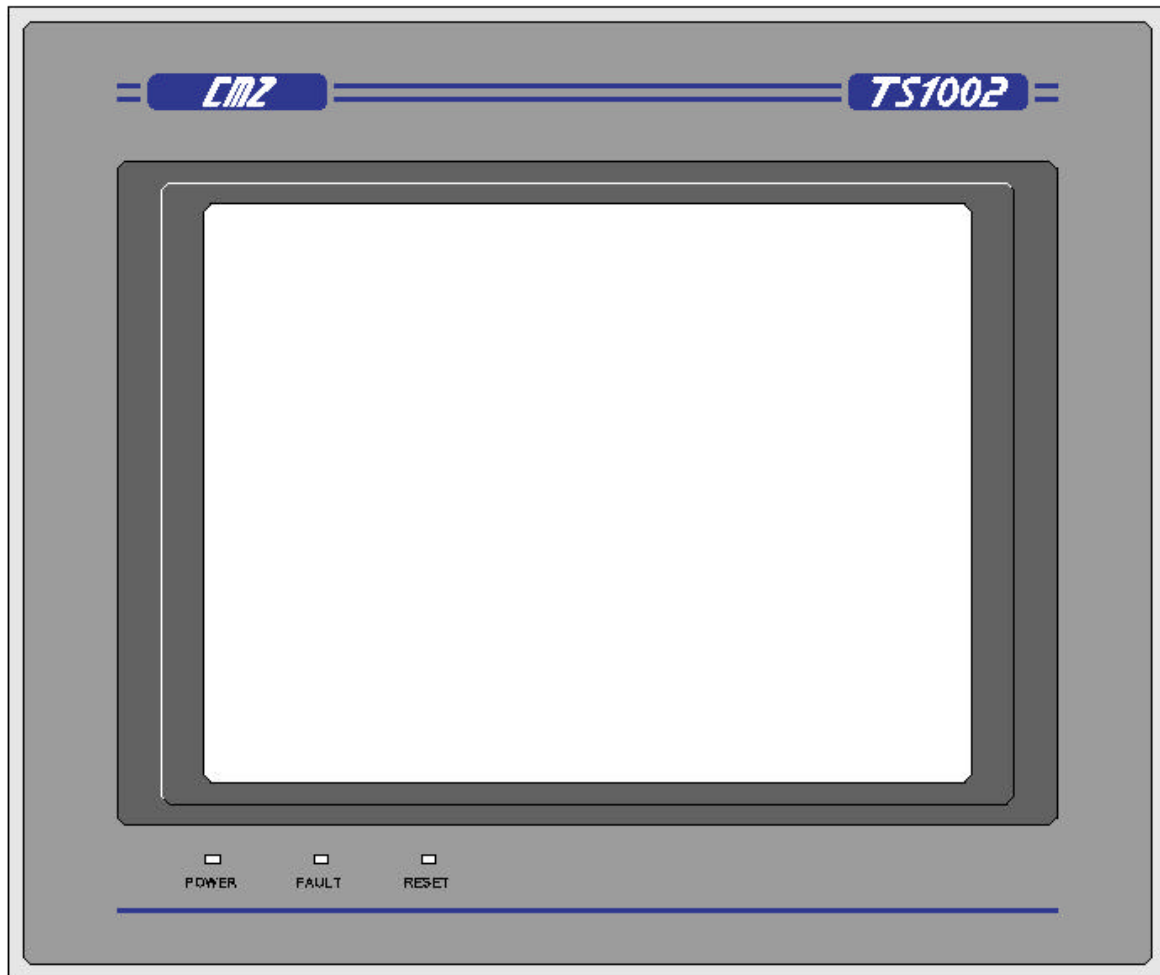
A non-abrasive, clean, damp cloth should be used for cleaning. Solutions commonly available on the market may be used to clean the windows, **provided they do not contain ammonia**. Apply the solution on a cloth rather than spray it directly on the panel.

It should be noted that the TS1002 may also be used without an operator panel, that is, as a simple intelligent terminal. For this type of configuration, refer to the order code on the last page of the guide.

ATTENTION

The front panel should be cleaned with a soft cloth soaked in ethyl alcohol. Under no circumstances use the following chemical products:

- Concentrated mineral acids - Concentrated caustic solution*
- High-pressure steam over 100°C - Benzyl alcohol - Methylene chloride*

section 5. MECHANICAL CHARACTERISTICS**Fig. 5.1 Front view**

Note: all the measurements are given in mm.

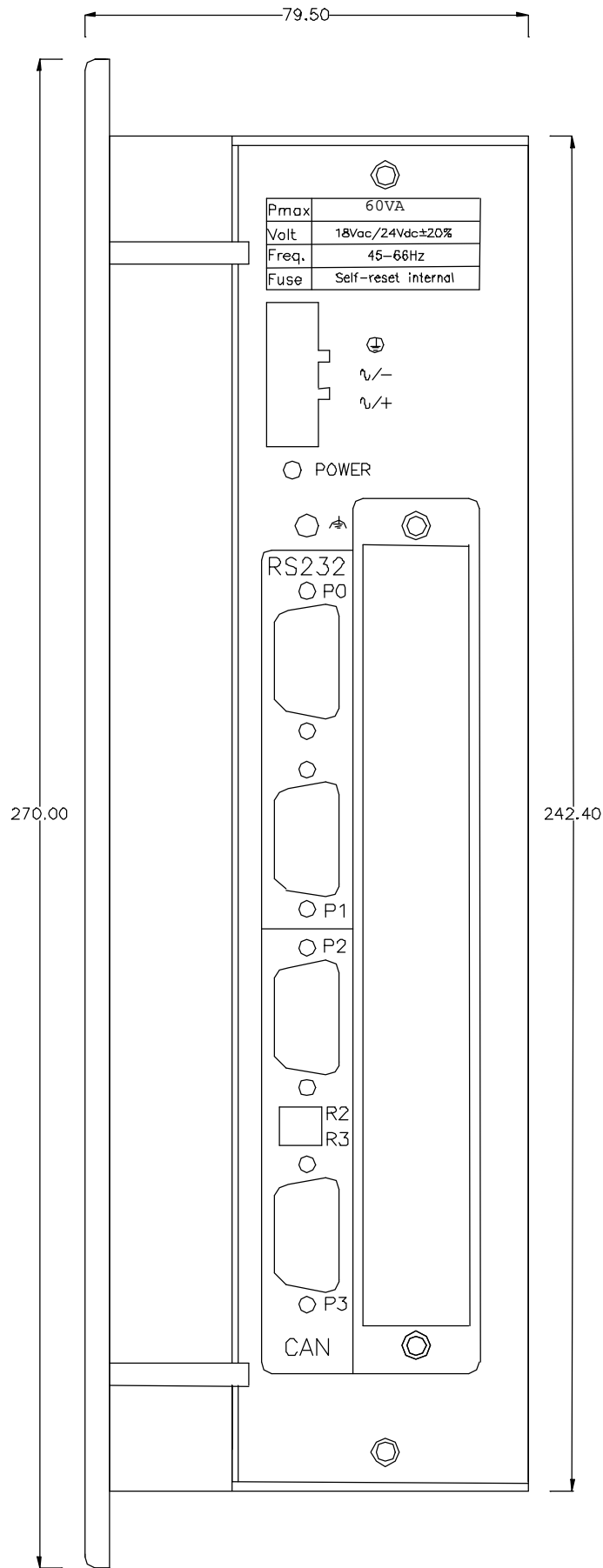


Fig. 5.2 Side view

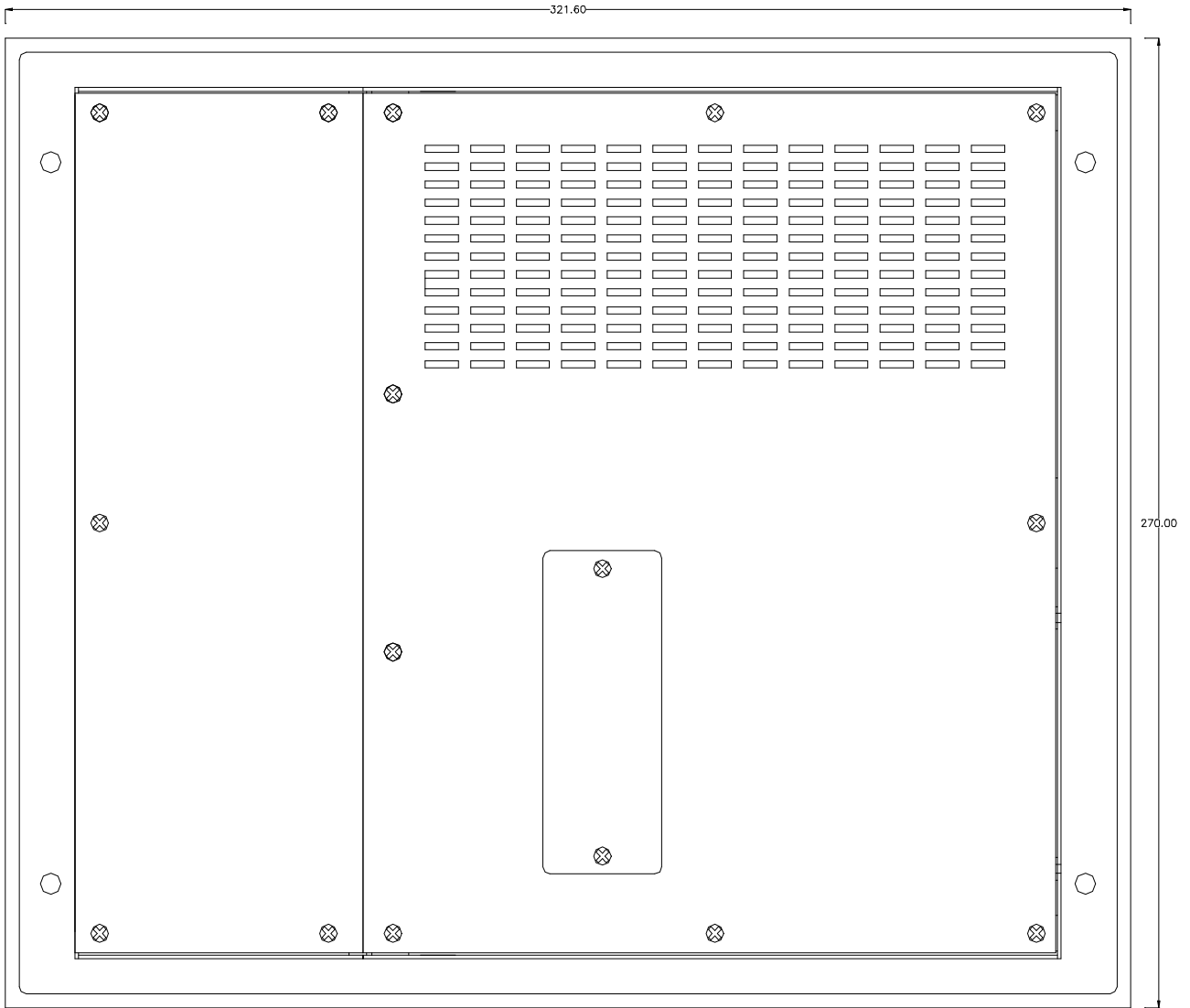


Fig. 5.3 Rear view

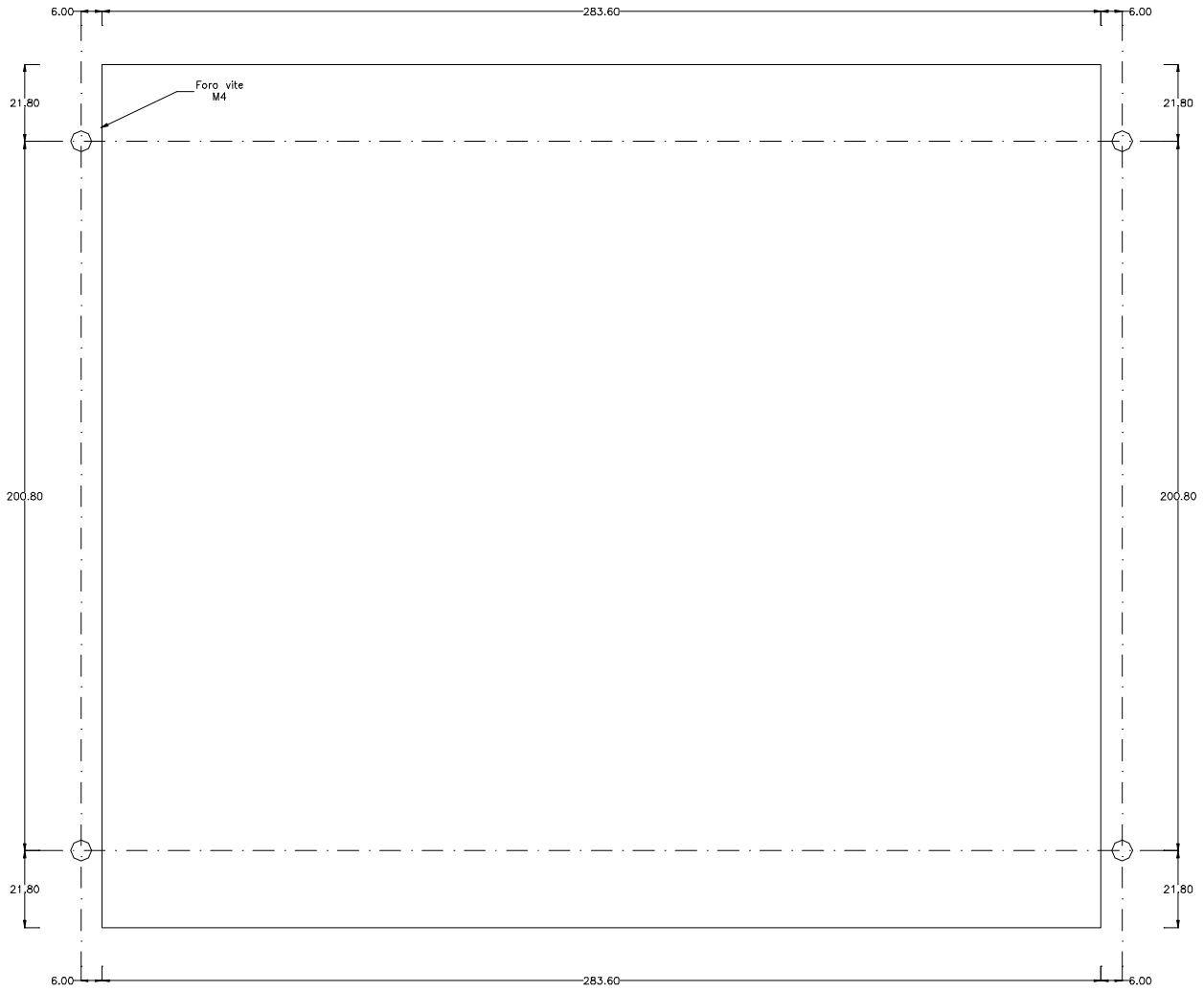


Fig. 5.4 Drilling template

appendix A. SAFETY

A.1 INTRODUCTION

The TS1002 system is in compliance with the following European standards:

- **CEI EN 61131-2 Programmable controllers
Part 2: Equipment specifications and tests**
- **CEI EN 60204-1 Machine safety - Electrical equipment of machines
Part 1: General rules**

The TS1002 is a *CLASS III* device, for which protection against the risk of electrical discharge is ensured by the presence of low-voltage circuits.

A.2 CONDITIONS OF DUTY AND REQUIREMENTS RELATED TO THE PHYSICAL ENVIRONMENT

The TS1002 system has been designed to be safe in the following conditions:

- Ambient temperature $5\text{ °C} \div 45\text{ °C}$
- Relative humidity Rh2 (5 % ÷ 95 %)
- Degree of pollution II
- Altitude $\leq 2000\text{ m}$ above sea level

A.3 ELECTRICAL REQUIREMENTS



CAUTION

The electrical requirements, the fields of use and the installation and maintenance methods of the sections making up the TS1002 are described in detail in the specific paragraphs. For safety purposes, the following instructions should also be observed.

- Connect the power cable socket correctly to the relative connector, observing the indications shown on the actual panel (cf. par. 2.2.1.1). To improve system behaviour with regard to interference, ground the equipment using the screw terminal to be found beside the power supply connector
- Before powering the device, ensure that the actual power supply system corresponds to the specifications given in par. 2.2 (18 Vac / +24 Vdc).
- Take particular care when replacing the lithium battery (cf. par. 2.2.1.3). Short-circuiting the terminals, reversal of polarity or exposure to sources of heat could cause the battery to explode. The new battery must be identical or of an equivalent type to the replaced one

appendix B. ELECTROMAGNETIC COMPATIBILITY

B.1 INTRODUCTION

The TS1002 complies with the specifications of the directive on electromagnetic compatibility 89/336 EEC, which in the industrial sphere entails application of the following European standards:

- **EN 50081-2 (standard on emission)**
- **EN 50082-2 (standard on immunity)**

In compliance with these standards, the tests passed by the system in question are given below:

- **Electrostatic discharge immunity test (standard EN 61000-4-2)**
- **Radiated electromagnetic field immunity test (standard ENV 50140)**
- **Conducted electromagnetic field immunity test (standard ENV 50141)**
- **Fast transient/burst immunity test (standard EN 61000-4-4)**
- **Conductive emission test in the frequency range 0.15 - 30 MHz (standard EN-55011)**
- **Irradiated emission test in the frequency range 30 - 1000 MHz (standard EN 55011)**

B.2 TEST SPECIFICATIONS

The main parameter values for each type of test carried out on the system are given in the tables below.

B.2.1 System electrostatic discharge immunity test.

Reference standard EN 61000-4-2

Applied voltage:	4 KV (contact discharge) 8 KV (air discharge)
------------------	--

The conductive parts and the insulating surfaces of the system have been tested

B.2.2 System radiated electromagnetic field immunity test

Reference standard ENV 50140

Amplitude modulated applied field:	10 V/m
Frequency range	80 MHz ÷ 1000 MHz
Pulse modulation applied field	10 V/m
Frequency range	900 MHz ± 5 MHz

The system has been tested in standard configuration.

B.2.3 System conducted electromagnetic field immunity test

Reference standard ENV 50141

Amplitude modulated applied field:	10 V/m
Frequency range:	0.15 MHz ÷ 80 MHz

The system power supply and signal cables have been tested.

B.2.4 System fast transient immunity test (BURST type pulses)

Reference standard EN 61000-4-4

Parameters of the pulse applied to the main power cable 18 Vac	Voltage: 2 KV Spike repetition frequency: 5 KHz
Parameters of the pulse applied to the signal cable	Voltage: 2 KV Spike repetition frequency: 5 KHz

The system has been tested in standard configuration

B.2.5 Conductive emission test in the frequency range 0.15 MHz ÷ 30 MHz

Reference standard EN 55011

Frequency range: 0,15 MHz ÷ 0,5 MHz	Limits: 79 db(µV) quasi-peak 66 db(µV) average value
Frequency range: 0.5 MHz ÷ 30 MHz	Limits: 73 db(µV) quasi-peak 60 db(µV) average value

The system power cable has been tested

B.2.6 Irradiated emission test in the frequency range 30 MHz ÷ 1000 MHz

Reference standard EN 55011

Frequency range: 30 MHz ÷ 230 MHz	Limits: 40 db(µV) quasi-peak
Frequency range: 230 MHz ÷ 1000 MHz	Limits: 47 db(µV) quasi-peak

The system casing has been tested at a distance of 10 m from the antenna.

CAUTION

The tests were carried out grounding the TS1002 casing by means of a special cable with section $\geq 1.5 \text{ mm}^2$. In the fast transient immunity test, the RS232C, RS422/RS485 and CAN serial communication cables are screened and of the type recommended by the manufacturer.

Recommended transmission media used for the tests

TYPE OF CONNECTION	RECOMMENDED CABLE
Serial RS232C/ RS422/RS485	8104 BELDEN ELECTRONICS
Serial CAN	8132 BELDEN ELECTRONICS

ORDER CODE

SYSTEM TS1002.00000

THE EXPANSIONS PROVIDED FOR IN THE SYSTEM ARE GIVEN BELOW:

Order code:

- TS1002.abcde

with the following meaning:

- | | | |
|-------|--|--|
| a = 0 | | without mathematical coprocessor |
| a = 1 | | with 32MHz mathematical coprocessor MC68882 |
| b = 0 | | without interface |
| b = 1 | | with Profibus-DP slave interface |
| b = 2 | | with Ethernet interface (<i>check availability with Sales Office</i>). |
| b = 3 | | with Device-Net interface (<i>check availability with Sales Office</i>). |
| | | |
| c = 0 | | without expansion module |
| c = 1 | | with HDLC module (<i>check availability with Sales Office</i>) |
| c = 2 | | with RS232C module (<i>check availability with Sales Office</i>) |
| c = 3 | | with RS232C + HDLC module (<i>check availability with Sales Office</i>) |
| d = 0 | | with operator panel |
| d = 1 | | without operator panel |
| e = 0 | | future expansion |

N.B.: *All envisaged options require the insertion of surface-mounted components; the required options must therefore be specified at the time of ordering.*