

CMZ hardware

Rete CANopen Peripherals

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IMPORTANT

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PURPOSE OF THE USER GUIDE

This guide describes the hardware of CMZ CANopen network peripherals.

Information of a general nature is given regarding network functions as well as the structure, plus a description of the peripherals made available by CMZ. CMZ also provides technicians assigned to installation with all data and specifications to be complied with for connections between the individual components and setting up of the network.

section 1. INTRODUCTION

A CAN field network is a network that uses the serial communication protocol that has the same name and is distinguished by its high reliability and high transmission speed.

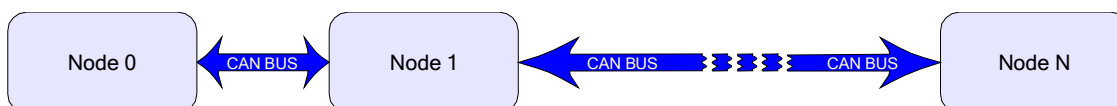


Fig. 1.1 Rete CAN

In the automation sphere, the **CAN networks** are particularly suitable for implementing an efficient control in real time, also due to their configuration flexibility.

In this case the network nodes consist of:

- a controller (*master*)
- some interfaces that receive/send signals of status/measurement/control from/to the machines

The CAN network is most useful in implementing decentralised control networks, shown in the figure 1.2; single local peripherals (also called Communication Interfaces) directly control an equal number of systems, while another controller, called Master, at a higher hierarchical level, coordinates or supervises the operation of the local controllers. This is the basic concept of the **CANopen network**.

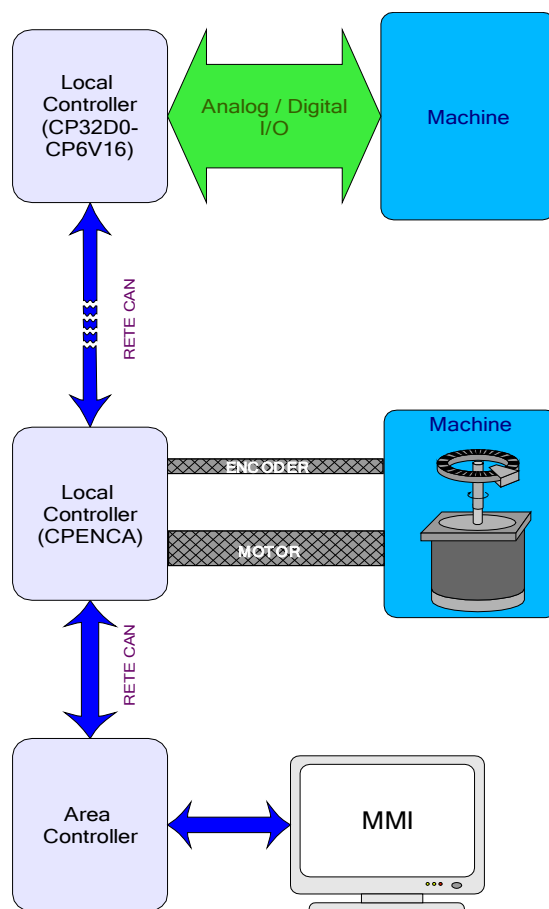


Fig. 1.2 Representation of the CANopen network

The peculiarities of the CAN protocol (which have permitted a fast expansion of its applications from the automotive sector to industrial control), which also distinguish the CANopen network, may be summed up as follows:

- 1) **Configuration flexibility**: the network nodes do not use information related to the system configuration and this allows their structure to be changed easily without important hardware or software variations. Each message that is sent is associated with an identifier, which does not define the destination but the priority assigned to the actual message.
- 2) **Multimaster structure with access to the priority bus**: when the bus is acknowledged as free, each node may commence communication; in the event of contention, the message is transmitted from the node with the highest priority. Each transmitter compares the priority of the sent message with that of the message monitored on the bus: if the priority is the same, it continues the transmission; if a message with higher priority has been transmitted, this node immediately releases the bus. In this way the bus is always used, also when required by the contentions. This arbitration mechanism permits very high speeds (up to 1000 KBit/s) without jeopardising the precision of the transmitted information. In this case the network master may be considered the node with the highest priority.
- 3) **High degree of safety**: to ensure maximum precision of the data transfer, each CAN network node implements control, error warning and self-diagnosis functions.

The implemented check tests for various possibilities of error:

- **bit error**: detected when the transmitted and the monitored bit differ (except for bus contention);
- **stuffbit error**: detected when the “bit stuffing” encoding rule is broken (which provides for the complement of the transmitted bit in the event of equal consecutive five-bit sequences);
- **CRC error**: (15 bit Cyclic Redundancy Check): detected if the CRC sequence sent by the transmitter does not correspond to the one calculated by at least one of the receivers;
- **frame error**: detected when a message with a default format has one or more illegal bits;
- **acknowledgement error**: detected when the transmitter does not receive the correct message acknowledgement bit from the receivers.

The probability that a message is not acknowledged as corrupted is thus less than:

$$4.7 \cdot 10^{-11} \cdot (\text{message error rate})$$

Each network node that detects a wrong communication sends an error on the bus warning; this results in the subsequent automatic retransmission of the incriminated message.

The CAN protocol also implements a **fault confinement strategy**, which locates any malfunctioning node, discriminates whether the cause of the fault is temporary or permanent and if necessary cuts out the defective node from the network.

The above characteristics ensure a very high degree of efficiency in terms of baud rate, sturdiness and versatility, even under the difficult operating conditions of industrial field applications.

section 2. CMZ CANopen PERIPHERALS

The CMZ CANopen network is a field network conceived for the distributed command and control of industrial installations. The standard network comprises:

1. A main system, called Master, which acts as controller and to which the highest priority within the network is assigned.
2. A variable number of peripherals, each of which has a defined priority set by the dipswitch NODE ID (see section 3); the maximum number varies according to certain parameters that will be dealt with later on.
3. The cable, which physically connects the Master to the peripherals.

The peripherals CP6V16 and CP32D0 have a standard structure, shown in the figure 2.1, consisting of a *Communication Unit* and a *Peripheral Unit*. The first carries out all the control and interface functions for the serial communication according to the CANopen protocol, both between peripherals and master and with the required automation; the second block is instead specific according to the particular function of the peripheral and will be described in detail for each one. The peripheral CPENCA, has got the same basis features but not the same structure. We describe it in the chapter 6.

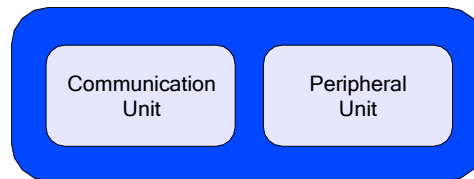


Fig. 2.1 General diagram of the CMZ CANopen peripherals

The CMZ CANopen peripherals are highly flexible since they can be controlled by the CMZ Master or not thanks to the standard form of the *communication unit*, which will be seen in the next section. CMZ makes 2 peripherals available, which act as interface, implemented in the form described above and summed up in the table below together with the main characteristics. The CPENCA, discussed in the chapter 6 peripheral is in a different form.

Summary table of CMZ peripherals:

MODULE	FUNCTION
CP32D0	16 inputs and 16 outputs, opto-isolated digital, 24 Vdc (unprotected outputs)
CP6V16	8 inputs and 8 outputs, opto-isolated digital, 24 Vdc (protected outputs) 2 analog ± 10 Vdc resolution 12 bit 6 opto-isolated mains voltage slicer outputs 245Vac/220Vac/110Vac, 50/60Hz SGACQA interface for Strain Gage Acquisition
CPENCA	Encoder input, analog output, 6 inputs and 4 outputs

2.1 IMPLEMENTATION OF THE CANOPEN NETWORK

The following points must be observed when implementing a CANopen network:

- Master and network communication peripherals should be connected in cascade, without shunts/stubs or star connections (as shown in the figure 2.2). Stubs are only envisaged in special cases and in any case for lengths not exceeding 0.3m.
- The Master usually is in a terminal position (initial or final).
- A different priority level should be assigned to each unit (by setting suitable dipswitches), otherwise the network will not operate.
- The number of nodes should not exceed the maximum number envisaged for each Master, otherwise the network will not operate.

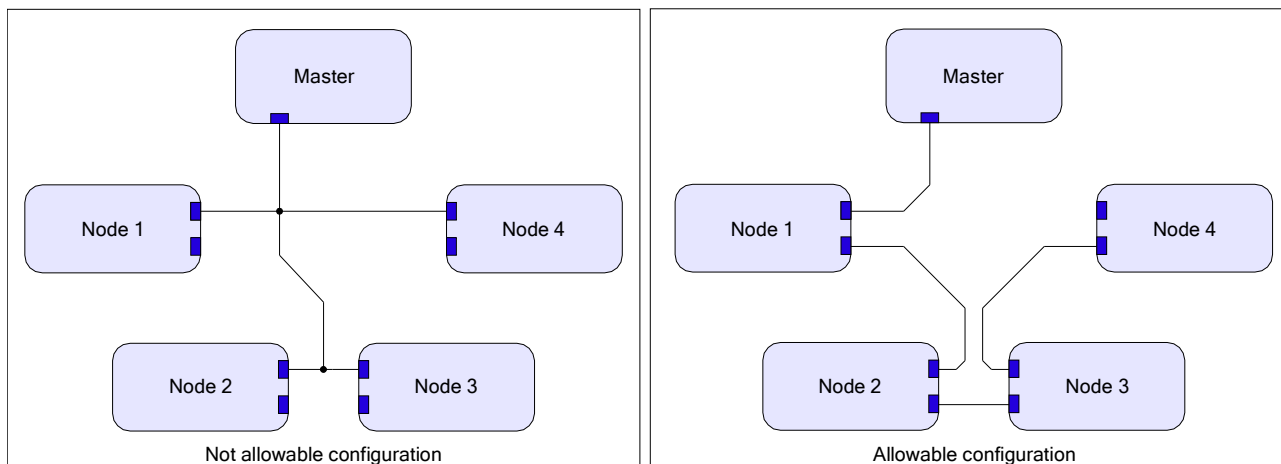


Fig. 2.2 CAN network allowed configuration

2.2 TRANSMISSION MEDIUM

The transmission medium used for the physical connection should consist of a **screened quadded** cable as shown in the figure 2.3. Just one type of cable must be used for one network.

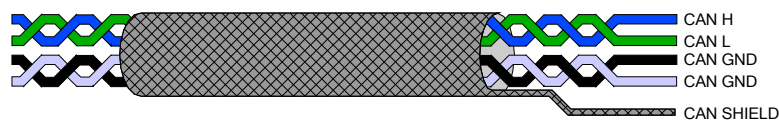


Fig. 2.3 Screened quadded cable

The table below gives the characteristics of a cable suitable for connection in a CANopen network. They give a general indication of the transmission medium to be used, but the choice should be made according to the application, basically taking into consideration the required number of nodes and the data transfer rate; CMZ recommends three different cables, indicated in the figure, and explains their correct use in the following paragraph.

Characteristics of the transmission medium:

Medium	Screened twisted-pair cable
Shield	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 -1/4W (equal to Z_0)
Recommended models	8132 BELDEN ELECTRONICS 2170 264 Unitronic BUS CAN LAPP KABEL (fix application) 2170 273 Unitronic BUS CAN LAPP KABEL (mobile application)

N.B. Connection of the shield

It should be noted that the cable **shield** must be connected to the connector **shell** on the **master end only**, while it should be connected to the **pin shield** (pin 5 in the DSUB connector for CP6V16 and CP32D0 or pin 3 in the five pin removable connector in the CPENCA) on the **peripheral end**. The shield is therefore not grounded at any point in the network, this connection having already been accomplished with connection inside the devices after having complied with the foregoing conditions.

2.3 BIT RATE

The bit rate of the CANopen network may vary between 10 Kbit/s and 1000 Kbit/s in discrete mode, according to the standard values given in the tables in the SW manuals; the maximum useable baud rate is generally in relation to the network length and the number of peripherals required by the application.

In theory this number, with 8 dipswitches, is 127 (plus the master), although in actual fact the commercial drivers, allows 112 nodes to be controlled at the most. Taking this limit as a foregone conclusion, the maximum length that can be achieved for the CANopen network is therefore basically limited by two main factors:

- delays in signal propagation in the components inside the peripherals, which should be added to the propagation delay in the cable;
- the voltage drop in the connection cable, which deteriorates the signal to be transmitted.

Obviously at high transfer speeds, the first factor limits the maximum network length, while at lower speeds and with greater lengths the second also comes into play.

The electrical characteristics of the cable that affect the two factors are on the one hand the characteristic impedance Z_0 and the rated capacity C_0 and on the other the rated resistance per metre: C_0Z_0 is the propagation delay of the unloaded line given in ns/m, while the series resistor of the line is the cause of the voltage drop that may deteriorate the signal.

In the tables below are shown the maximum lengths that may be achieved with Belden 8132 **cable**, on function of the bit-rate for three different baud rate: 1000Kbit/s, 800Kbit/s and 500Kbit/s.

The first three tables are valid just for network with CMZ master and CMZ nodes (CANopen peripheral, CANopen drivers) that haven't got isolated CAN section. CP32D0 and CP6V16 haven't isolated CAN section. For CMZ drivers see the corresponding manuals.

CMZ peripheral with not isolated CAN section (CP32D0, CP6V16)

Maximum length at 1000KBit/s changing the number of peripheral:

NUMBER OF PERIPHERALS	LENGTH
112	16m
64	20m
32	23m
16	25m
8	26m
4	27m
2	27m

Maximum length at 800KBit/s changing the number of peripheral:

NUMBER OF PERIPHERALS	LENGTH
112	39m
64	44m
32	48m
16	50m
8	51m
4	52m
2	52m

Maximum length at 500KBit/s changing the number of peripheral:

NUMBER OF PERIPHERALS	LENGTH
112	40m
64	62m
32	80m
16	91m
8	96m
4	99m
2	101m

CMZ Sistemi Elettronici provides CANopen nodes that have got an isolated CAN section like CPENCA and MM750-347 peripheral. The maximum lengths achievable on network with isolated CAN section nodes are shown in the following tables.

CMZ peripherals with isolated CAN section (CPENCA and MM750-347)

Maximum length at 1000KBit/s changing the number of peripheral:

NUMBER OF PERIPHERALS	LENGTH
112	9
64	13
32	16
16	17
8	18
4	19
2	19

Maximum length at 800KBit/s changing the number of peripheral:

NUMBER OF PERIPHERALS	LENGTH
112	32
64	36
32	40
16	42
8	43
4	44
2	44

Maximum length at 500KBit/s changing the number of peripheral :

NUMBER OF PERIPHERALS	LENGTH
112	40
64	62
32	80
16	91
8	96
4	99
2	101

ATTENTION

CMZ recommend the use of the 8132 cable; furthermore the tables are correct just in the conditions written above. If in the CAN network there are other peripherals one should contact CMZ for knowing the maximum length achievable. The master should be CMZ too.

section 3 COMMUNICATION UNIT

3.1 GENERAL INFORMATION

The term **Communication Unit** means the block that is **common to each** CMZ peripheral which allows communication with the other nodes and with the master; this is obtained through an internal controller, which helps the master in the usual control operations (the latter in any case has priority). The Communication Unit has a standard structure in THE CP32D0 e CP6V16 peripherals. The CPENCA has got a little different structure and will be described in the chapter 6. The considerations made in this chapter are just for the CP32D0 and CP6V16.

Every peripheral to be connected to the network is characterised by an identifier, which determines the priority of the actual peripheral and of the information to be transmitted. The identifier is set through the dipswitch NODE_ID with seven bits present in the Communication Unit; the table below shows the allowed configurations.

NODE_ID: *Dipswitch identifying the node number in the CANopen network:*

BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	NODE IDENTIFICATION
OFF	OFF	OFF	OFF	OFF	OFF	OFF	Not allowed
ON	OFF	OFF	OFF	OFF	OFF	OFF	Node 1 (factory default)
OFF	ON	OFF	OFF	OFF	OFF	OFF	Node 2
ON	ON	OFF	OFF	OFF	OFF	OFF	Node 3
OFF	OFF	ON	OFF	OFF	OFF	OFF	Node 4
ON	ON	ON	ON	ON	ON	OFF	Node 63
OFF	OFF	OFF	OFF	OFF	OFF	ON	Node 64
OFF	ON	ON	ON	ON	ON	ON	Node 126
ON	ON	ON	ON	ON	ON	ON	Node 127

With seven bits, 127 allowed configurations are obtained, although in actual fact the maximum number of useable peripherals is determined by the conditions mentioned previously and is equal to 112, which is therefore the maximum limit from a hardware point of view.

Once the maximum necessary distance is known, the communication speed in CMZ peripherals may be set using the dipswitch identified by B_RATE:

B_RATE: *Dipswitch that identifies the communication speed upon locking of the CAN network:*

BIT 1	BIT 2	BIT 3	BIT RATE
OFF	OFF	OFF	10 kbit/s
ON	OFF	OFF	20 kbit/s
OFF	ON	OFF	50 kbit/s
ON	ON	OFF	125kbit/s
OFF	OFF	ON	250kbit/s
ON	OFF	ON	500kbit/s
OFF	ON	ON	800kbit/s
ON	ON	ON	1000 Kbit/s (factory default)

In the CMZ masters this rate may be set via software.

3.2 POWER SUPPLY

3.2.1 General information

The Communication Unit incorporates the block that provides the necessary supply voltages to the peripheral. This block in turn should be powered singly from the outside; it is advisable for the power supply to be obtained (directly or rectified) from a dedicated secondary, separate from other users (see figure 3.1).

This power supply unit should be able to supply a power of 10W to the peripheral; it should be noted, however, that the peripheral being a capacitive type load, it is necessary to satisfy the characteristics indicated in the technical data related to the input current. A green LED is present on the power connector, indicating the presence of voltage at the power supply unit input.

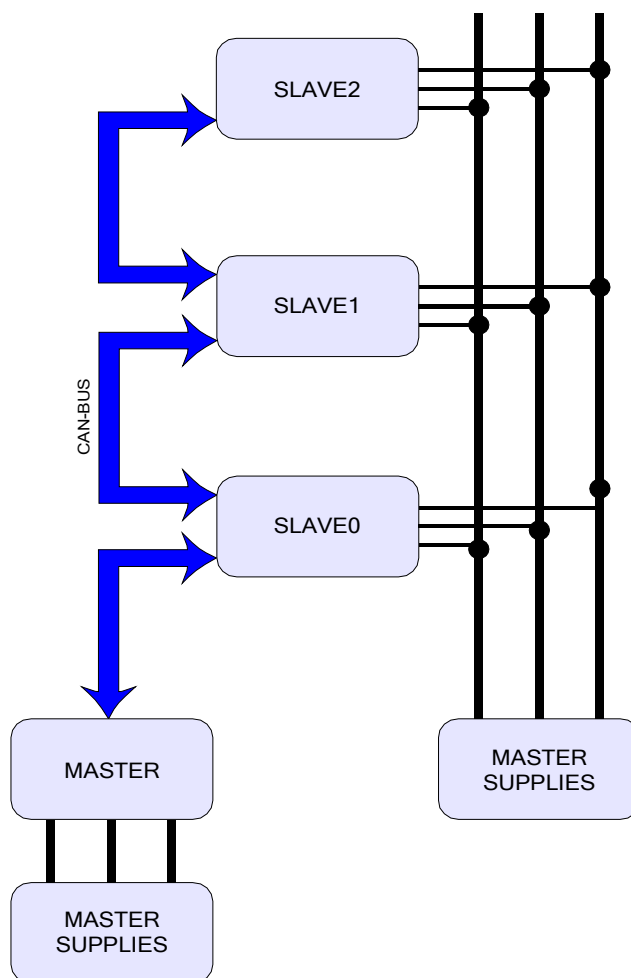


Fig. 3.1 Power supply section in a CAN open network

3.2.2 Technical data

Power supply section:

Input voltage - rated value - range	+24 Vdc / 18 Vac ± 20 %
Frequency - rated value - range	50 Hz / 60 Hz ± 10 %
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	0.5 A rms 2.5 A pk 5 msec 0.6 A rms 100 msec
Total input power - maximum value	10W
Reverse polarity protection	Yes
Short-circuit protection	Electronic
Primary circuit protection	1 self-resetting fuse $I_{Hold} = 650mA @ T_{amb} = 20\text{ °C}$
Ground galvanic separation	Yes
POWER LED	Green

3.2.3 Installation notes

3.2.3.1 Description of the connector

The power supply is connected by means of a 3-pin connector of the type Sauro CIM030A1 5 with screw fastening, the pin configuration of which is given in the table below.

Power supply connector:

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

3.2.3.2 Connection notes

The earth connection must be carried out in order to ensure best performance of the system with regard to electromagnetic interference.

This connection also guarantees that the whole metal casing of the peripheral 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 capacitive type stage of power supply, is characterised by considerable absorption (cf. par. 3.2.2 Technical data).

3.3 CAN SERIAL COMMUNICATION PORTS

3.3.1 General information

The Communication Unit of every CMZ peripheral offers 2 CAN (Controller Area Network) serial communication interfaces for cascade connection to the preceding node (or to the Master) and to the subsequent node respectively, as described previously.

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

3.3.2 Technical data

Characteristics of the serial connection:

Protocol	CAN (ISO-11898 Ver. 2.0 Part B)
Galvanic isolation	No
Termination resistor	May be inserted through dipswitch RT

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, these have already been dealt with in the previous section.

3.3.3 Installation notes

3.3.3.1 Description of connectors

CAN_IN connector

CAN DSUB 9-pin female connector from master or preceding node:

PIN	SIGNAL	DESCRIPTION
1	-	Internally connected to pin 1 of CAN_OUT
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	Not connected
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	Not connected
9	-	Internally connected to pin 9 of CAN_OUT

CAN_OUT connector

CAN DSUB 9-pin male connector to subsequent node:

PIN	SIGNAL	DESCRIPTION
1	-	Internally connected to pin 1 of CAN_IN
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	Not connected
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	Not connected
9	-	Internally connected to pin 9 of CAN_IN

3.3.3.2 Connection notes

The figure 3.2 shows the connection cables to be used for the input and output ports related to the CANopen protocol. **Screened twisted-pair cables** are recommended (as recommended in the previous section and in the appendix related to electromagnetic compatibility) and in particular one pair for the CAN_H and CAN_L signals and the other for GND.

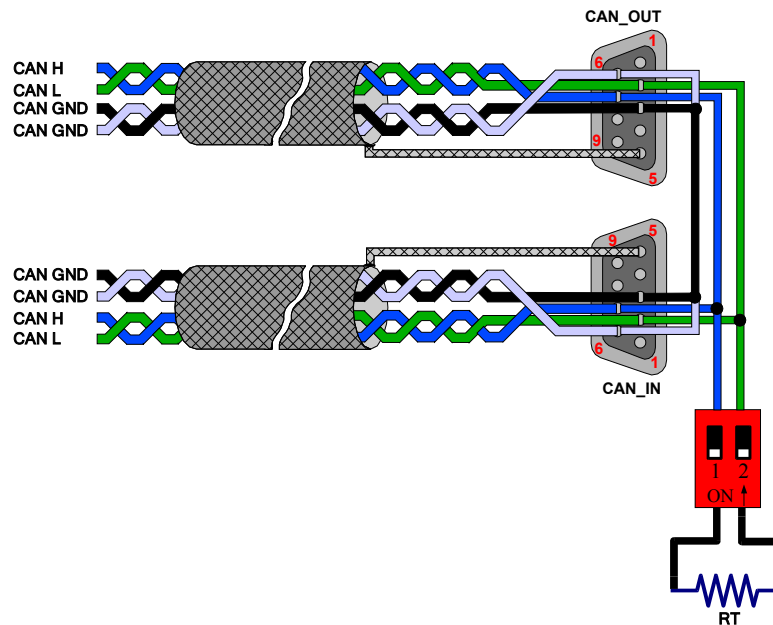


Fig. 3.2 CANopen network

N.B. Connection of the shield

Connection of the **cable shield** to the shield pin (i.e. No. 5) of the connector is also recommended; this is always applicable when connecting two CMZ CANopen peripherals.

Only when connecting **master and peripheral** should the cable **shield** be connected to the connector **shell** on the master end and the shield pin on the peripheral end.

When cascading the CANopen network, it must be terminated at both ends by a termination resistor. This can easily be obtained by putting to ON **both** bits of the RT dipswitch of the nodes at the ends of the network (see table).

RT Dipswitch:

BIT 1	BIT 2	RT STATUS
ON	ON	Resistor connected
ON	OFF	Resistor not connected
OFF	ON	Resistor not connected
OFF	OFF	Resistor not connected (factory default)

3.4 SERIAL COMMUNICATION PORT RS232 (OPTIONAL)

3.4.1 General information

The Communication Unit offers 1 RS232 serial communication port for programming purposes or as communication interface with other intelligent units (for example software download, debugging ...). At the time of preparing this guide, this control has not yet been implemented.

3.4.2 Installation notes

3.4.2.1 Description of connectors

RS232 RJ45-BP-V 8-pin connector:

PIN	SIGNAL	DESCRIPTION
1	NC	-
2	RTS	Request to send
3	PE	Protective earth
4	Tx	Transmit data
5	Rx	Receive data
6	GND	Ground
7	NC	-
8	NC	-

3.4.2.2 Connection notes

The figure 3.3 shows the serial connection cables in minimum configuration towards a host PC. A screened cable is recommended, the shield of which should be connected to the DSUB (of the PC) and the RJ45 (of the board) connector shells on both ends of the cable.

Should there be any difference at all between the potential reference (protective earth PE) of the Communication Unit of the board in question and the potential reference of the connected system (e.g. a PC), the shield of the serial cable must be connected to the RJ45 connector of the board only.

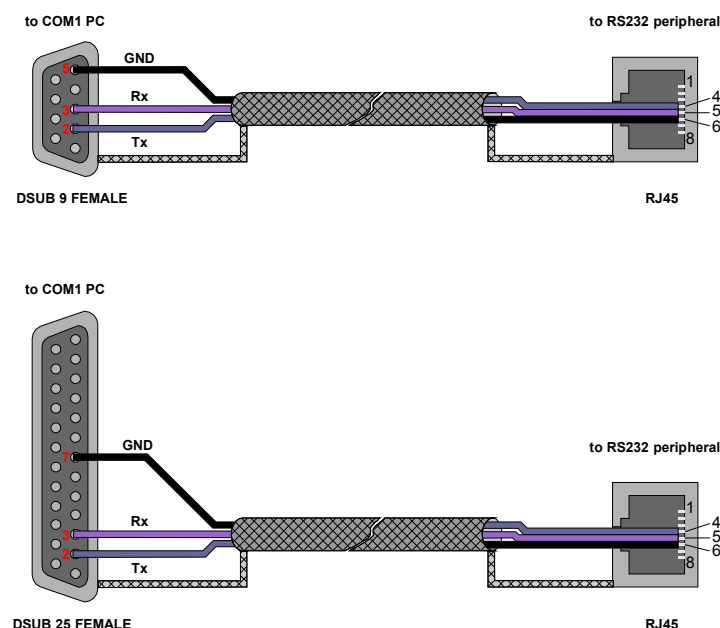


Fig. 3.3 Connection cable for port RS232

3.5 AUXILIARY COMMUNICATION PORT

3.5.1 General information

The Communication Unit offers an auxiliary communication port, which uses **CAN_H** and **CAN_L** **E GND** transmission protocol signals used for communication with the expansion modules (module SGACQA for load cell acquisition is currently available and is dealt with in appendix A). In some cases this port may also be used to carry the necessary supply voltage for powering the above-mentioned modules. This will be described in detail for each peripheral.

3.5.2 Installation notes

3.5.2.1 Description of connectors

AUX-COM connector

This connector may be used not only for the communication signals **CAN_H (BC_H)** and **CAN_L (BC_L)** and **GND** but also for powering expansion modules with consumption up to 200mA. It should be noted that it is not a question of three separate power supplies, but of one power supply carried along three wires. It is recommended to use screened cables with four twisted pairs, which may also be supplied by CMZ. The pairs are indicated in the following table.

CAN RJ45-BP-V 8-pin connector towards expansion modules:

PIN	SIGNAL	DESCRIPTION
1	VCC	Power supply output (pair 1)
2	VCC	Power supply output (pair 1)
3	VCC	Power supply output (pair 2)
4	GND	Power and signal ground (pair 3)
5	GND	Power and signal ground (pair 3)
6	GND	Power and signal ground (pair 2)
7	BC_H	Auxiliary CAN high (pair 4)
8	BC_L	Auxiliary CAN low (pair 4)

3.5.2.2 Connection notes

The envisaged termination resistor is set through a dipswitch, as indicated in the table below.

Dipswitch for connecting the termination resistor of the AUX-COM port signals.

BIT	BIT STATUS	DESCRIPTION
1	ON	CAN termination resistor secondary connected
1	OFF	Not used

3.6 DESCRIPTION OF LEDS

There are another two LEDs in the Communication Unit, which provide information on correct peripheral operation. A red LED and a yellow one. The meaning of the blinking is specified in the next sections changing by peripherals. The blinking have got a 1 second period with 50% of duty cycle; between one sequence and the next there is always a further interval of 3s.

section 4. CP32D0 PERIPHERAL

4.1 GENERAL INFORMATION

The peripheral CP32D0 (Can Peripheral 32 I/O type 0) offers **16 inputs and 16 outputs, all digital and opto-isolated**, through two Sauro removable connectors.

The power supply of the I/O (24 Vdc) section is supplied externally and is protected by a self-resetting fuse; correct presence of the power supply is shown by a green led lighting up. Any *power failure* is indicated to the controller.

The inputs are protected against power supply polarity reversal.

The activation of each input or output is indicated through red LEDs.

The **mechanical size of** the peripheral is (in mm): $200 \times 127 \times 65$.

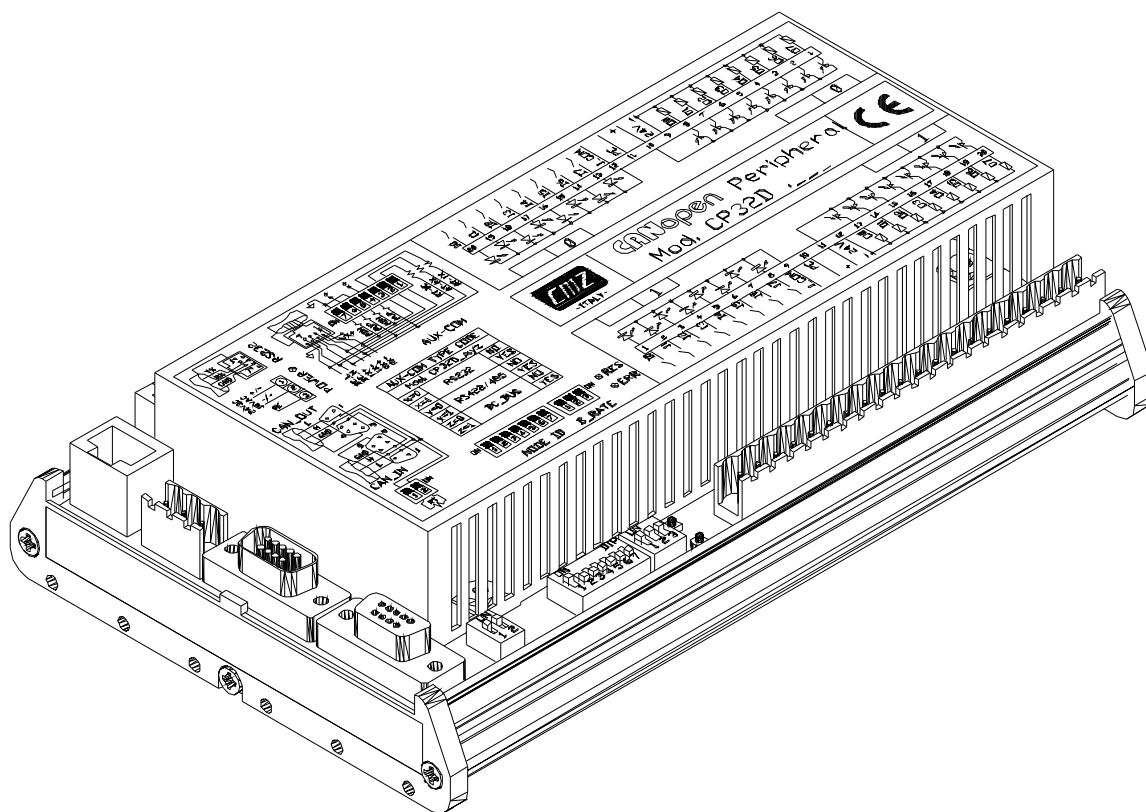


Fig. 4.1 CP32D0 peripheral

4.2 TECHNICAL DATA

Digital inputs:

Type of input	PNP
Number of inputs	16
Galvanic isolation	With optical couplers
Input voltage	
- rated	+24 Vdc
- for LOW signal	-30 ÷ +6 Vdc
- for HIGH signal	+11 ÷ +30 Vdc
Input current	2 ÷ 6 mA
Delay time	< 2 msec
Polarity reversal protection	Yes

Digital outputs:

Type of output	PNP
Number of outputs	16
Galvanic isolation	With optical couplers
Supply voltage VS	
- rated	+24 Vdc
- range	+18 Vdc ÷ +30 Vdc
- max. ripple	±20%
Power supply input protection	Self-resetting fuse $I_{hold} = 4\text{ A}$ @ $T_{amb} = 20\text{ °C}$
Power supply polarity reversal protection	Yes
Short circuit protection	No
Output current	
- rated	200 mA
- maximum per output	300 mA
POWER I/O LED	Green (for each bank)
STANDARD LED (I/O)	Red (for each input and output)

CAUTION

The power supply must be present for the POWER I/O LED to be active, which indicates correct powering of the two digital I/O banks.

4.3 LED

On board there are two LED: one red and one yellow. The table below shows the LED meaning:

LED	Meaning	DESCRIPTION
Red	Reset	Board in RESET condition
Yellow	Alarm on board	1 blink: I/O supply under minimum voltage 2 blinks : 24 Volt missing on digital output in bank 0 3 blinks : 24 Volt missing on digital output in bank 1 4 blinks: Communication error (time out nodeguard, warning or bus-off)

4.4 INSTALLATION NOTES

4.4.1 Description of connectors

Changing the order code one can choose different type of connectors (see the order code section).

I/O digital connector Bank 0: J1

DIGITAL I/O 20-pin removable:

PIN	SIGNAL	DESCRIPTION	PIN	SIGNAL	DESCRIPTION
1	O7	Digital output 7	11	PE	Protective earth
2	O6	Digital output 6	12	I COM	Ground input bank 0
3	O5	Digital output 5	13	I7	Digital input 7
4	O4	Digital output 4	14	I6	Digital input 6
5	O3	Digital output 3	15	I5	Digital input 5
6	O2	Digital output 2	16	I4	Digital input 4
7	O1	Digital output 1	17	I3	Digital input 3
8	O0	Digital output 0	18	I2	Digital input 2
9	GND	Ground output bank 0	19	I1	Digital input 1
10	+24V	Power supply bank 0 +24Vdc	20	I0	Digital input 0

I/O digital connector Bank 1: J8

DIGITAL I/O 20-pin removable:

PIN	SIGNAL	DESCRIPTION	PIN	SIGNAL	DESCRIPTION
1	I0	Digital input 0	11	+24V	Power supply bank 1 +24Vdc
2	I1	Digital input 1	12	GND	Ground output bank 1
3	I2	Digital input 2	13	O0	Digital output 0
4	I3	Digital input 3	14	O1	Digital output 1
5	I4	Digital input 4	15	O2	Digital output 2
6	I5	Digital input 5	16	O3	Digital output 3
7	I6	Digital input 6	17	O4	Digital output 4
8	I7	Digital input 7	18	O5	Digital output 5
9	I COM	Ground input bank 1	19	O6	Digital output 6
10	PE	Protective Earth	20	O7	Digital output 7

4.4.2 I/O connection notes

The following connection diagrams are applicable for each of the two I/O banks (Fig. 4.2 e 4.3); it should be noted that there is a **ground pair for each bank, one for the inputs and one for the outputs**. If just one input voltage of 24V has to be used, the grounds of the inputs and outputs must be connected to each other and to that of the actual input voltage.

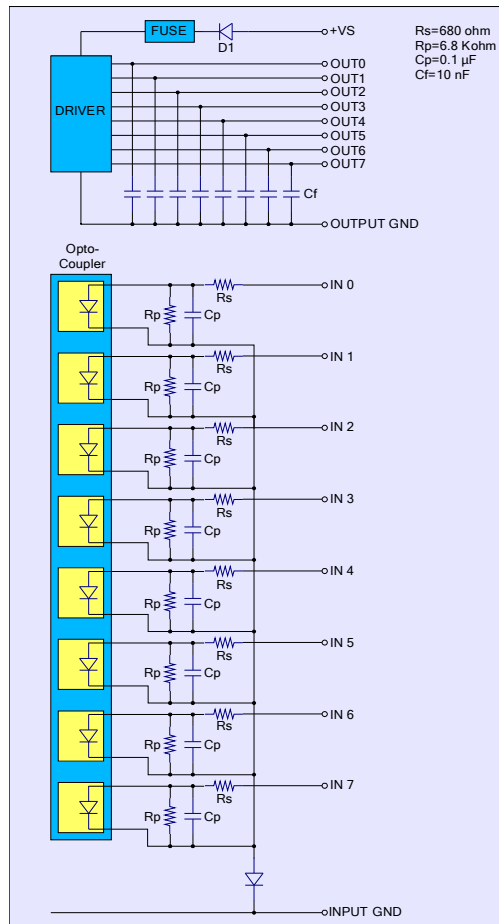


Fig. 4.2 Wiring diagram of standard input and output stages

CP32D0: digital I/O connector

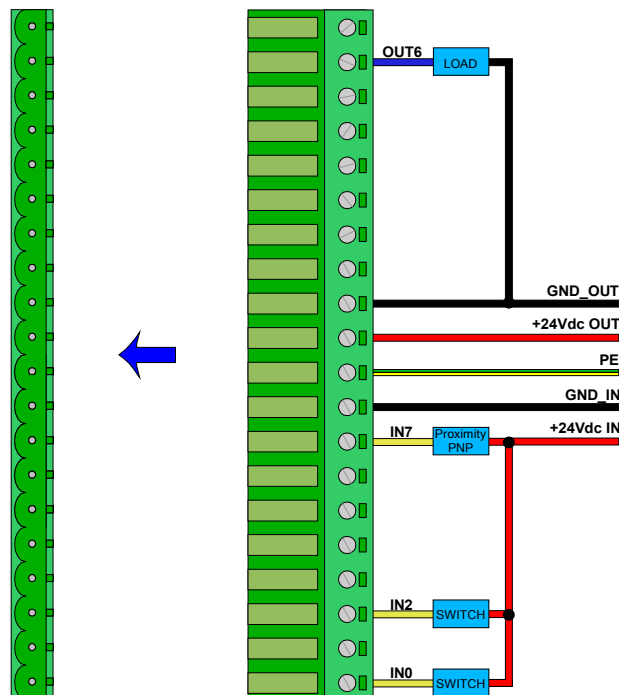


Fig. 4.3 Example of I/O connection

section 5. CP6V16 PERIPHERAL

5.1 GENERAL INFORMATION

The peripheral CP6V16 provides:

- 6 **opto-isolated mains voltage slicer outputs** 245Vac/220Vac/110Vac, 50/60Hz
- 8 **digital outputs** PNP 24Vdc 200mA, opto-isolated and protected (brush solenoid valve command, basket opening, etc.)
- 8 **digital inputs** PNP 24Vdc, opto-isolated and protected (product level photocell acknowledgements, basket alarms, etc.)
- 2 **analog outputs** $\pm 10\text{Vdc}$ 11-bit resolution plus sign (conveyor belt inverter command or other)
- open-frame** implementation for mounting on DIN guide
- 1 AUX-COM port for communication with SGACQA (max. 2)

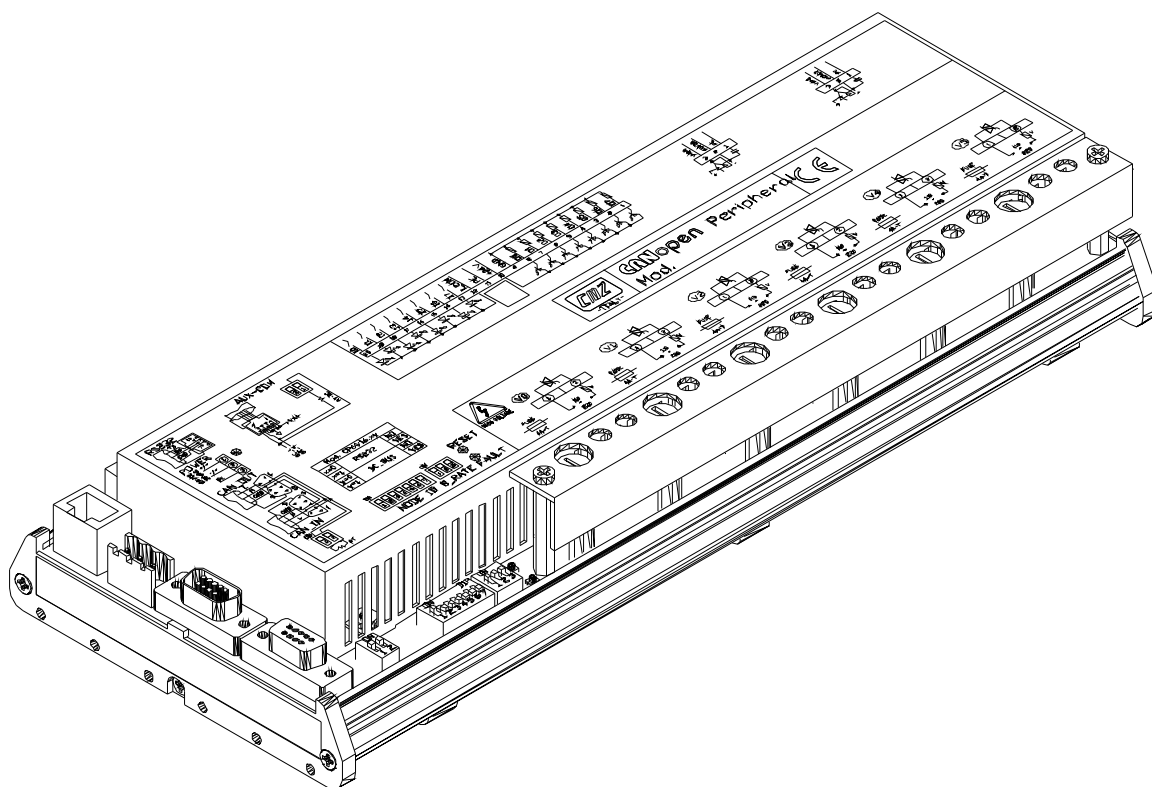


Fig. 5.1 CP6V16 Peripheral

The opto-isolated outputs for slicing the mains are protected by a fuse in the event of c.c.. They also provide information regarding any board malfunctioning through the lighting up of a yellow LED. The digital inputs are protected against power supply polarity reversal and against overloads. The digital outputs are electronically protected against c.c., overheating, inductive load¹, reversal of polarity and have a diagnostics function, which warns the controller of any malfunction among those

¹ Protection to the inductive load is available if, for each output, the following relation is respected: $1/2 * L * i^2 < 200\text{mJ}$, where i is the current for each output. Otherwise it is necessary to add an external diode in parallel to the inductive load.

just mentioned. The activation of each input or output is indicated by the lighting up of red LEDs. The power supply of the I/O section (24 Vdc) is provided externally and is protected by means of a self-resetting fuse; correct presence of the power supply is shown by a green LED and is also monitored via software.

The two ± 10 Vdc analog outputs, provided through two three-pin connectors, have a resolution of 11 bits plus sign and are opto-isolated overall from the logic section, (not isolated from each other).

The peripheral CP6V16 may communicate with the load cell acquisition expansion module SGACQA (see appendix A - at the most 2 modules), through the auxiliary port AUX-COM. The board CP6V16 receives digital information through the auxiliary serial bus CAN (BC_BUS) regarding the weight acquired by the module SGACQA, which makes a direct measurement on the load cell. It also provides the power supply to the module through the same connector.

The **mechanical size** of the peripheral is (in mm): $305 \times 127 \times 65$.

5.2 TECHNICAL DATA

Digital inputs:

Type of input	PNP
Number of inputs	8
Galvanic isolation	With optical couplers
Input voltage	
- rated	+24 Vdc
- for LOW signal	-30 ÷ +6 Vdc
- for HIGH signal	+11 ÷ +30 Vdc
Input current	2 ÷ 6 mA
Delay time	< 2 msec
Overload protection	Yes
Polarity reversal protection	Yes

Digital outputs:

Type of output	PNP
Number of outputs	8
Galvanic isolation	With optical couplers
Supply voltage VS	
- rated	+24 Vdc
- range	+18 Vdc ÷ +30 Vdc
- max. ripple	±20%
Threshold voltage for undervoltage lockout	+9 Vdc
Power supply input protection	Self-resetting fuse $I_{hold} = 4$ A @ $T_{amb} = 20$ °C
Power supply polarity reversal protection	Yes (maximum reverse voltage 50V)
Overload and short-circuit protection	Yes
Overheating protection	Yes
Control diagnostics logic	Yes
Output current	
- rated	200 mA
- maximum per output	350 mA
- maximum per quartet 0÷3 / 4÷7	700 mA
POWER I/O LED	Green
Digital I/O STANDARD LED	Red

N.B. 24Vdc power failure is monitored except for gaps of less than 1ms

Analog outputs:

Output voltage	±10 Vdc
- range	5 mVdc
- resolution	
Galvanic isolation	With optical couplers
Min. resistive load	1 kΩ
Max. capacitive load	10 nF
Load connection	Towards analog GND

Mains slicer analog outputs:

Output voltage	Minimum: 100Vac Maximum: 270Vac (see note 1)
Voltage frequency	50/60Hz
Galvanic isolation	With optical couplers
Maximum current	2A
Maximum inductive load necessary for TRIAC trigger with 10% of partialization	0.8H @100Vac 1.5H @270Vac

Note 1: with voltages of 245Vac it is advisable to use vibrators with the magnetic element connected to the soft iron vibrating part and not with a packed latten structure

5.3 LED

There are two LED that indicate faults on board: one red and one yellow. The table below shows the LED meaning:

LED	Meaning	DESCRIPTION
Red	Reset	Board in RESET condition
Yellow	Alarm on board	1 blink: Communication error (time out nodeguard, warning or bus-off) 2 blinks : 24 Volt missing on digital output 3 blinks: Short circuit/ overcurrent on the output section

5.4 INSTALLATION NOTES

5.4.1 Description of connectors

Changing the order code one could choose different types of connectors (see the order code section).

I/O digital connector: J1

DIGITAL I/O 20-pin removable:

PIN	SIGNAL	DESCRIPTION	PIN	SIGNAL	DESCRIPTION
1	O7	Digital output 7	11	PE	Protective earth
2	O6	Digital output 6	12	I COM	Ground input
3	O5	Digital output 5	13	I7	Digital input 7
4	O4	Digital output 4	14	I6	Digital input 6
5	O3	Digital output 3	15	I5	Digital input 5
6	O2	Digital output 2	16	I4	Digital input 4
7	O1	Digital output 1	17	I3	Digital input 3
8	O0	Digital output 0	18	I2	Digital input 2
9	GND	Ground output	19	I1	Digital input 1
10	+24V	Power supply +24Vdc	20	I0	Digital input 0

CAUTION

The power supply must be present for the POWER I/O LED to be active, which indicates correct powering of the two digital I/O banks.

Analog out 0 connector: J2

Analog output 3-pin connector removable:

PIN	SIGNAL	DESCRIPTION
1	PE	Protective earth
2	AGND0	Ground analog out 0
3	VAN0	Analog output 0

Analog out 1 connector: J3

Analog output 3-pin connector removable:

PIN	SIGNAL	DESCRIPTION
1	PE	Protective Earth
2	AGND1	Ground analog out 1
3	VAN1	Analog output 1

V0 – V5 connectors

Voltage slicer output connectors 110/220 Vac Phoenix PH-MKDS 5/2-9.5 with screw fastening provided:

PIN	SIGNAL	DESCRIPTION
1	LINE	Line ~110/220 Vac input
2	LOAD	Load output

5.4.2 Notes for digital I/O connection

The following diagrams of the necessary connections are applicable for the general I/O bank (see fig. 5.2 and 5.3); it should be noted that there is an earth or ground pair for each bank, one for the inputs and one for the outputs.

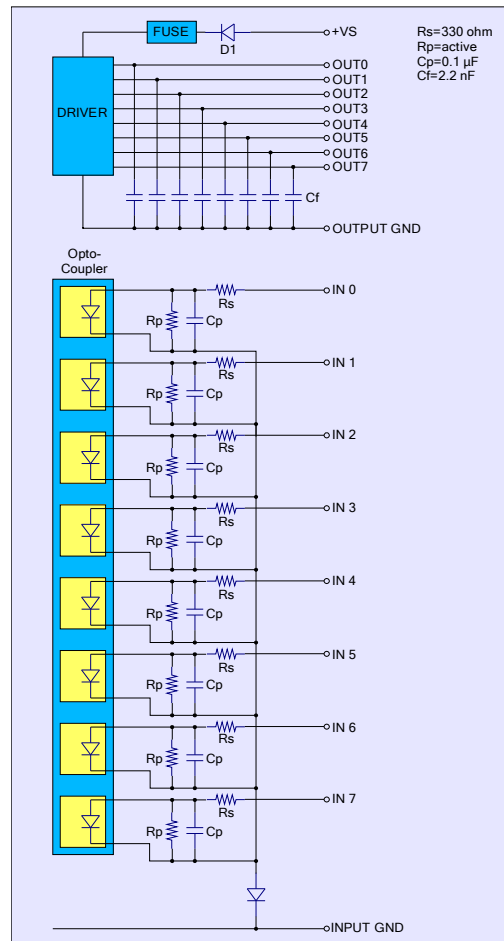


Fig. 5.2 Wiring diagram of standard input and output stages

CP6V16: digital I/O connector

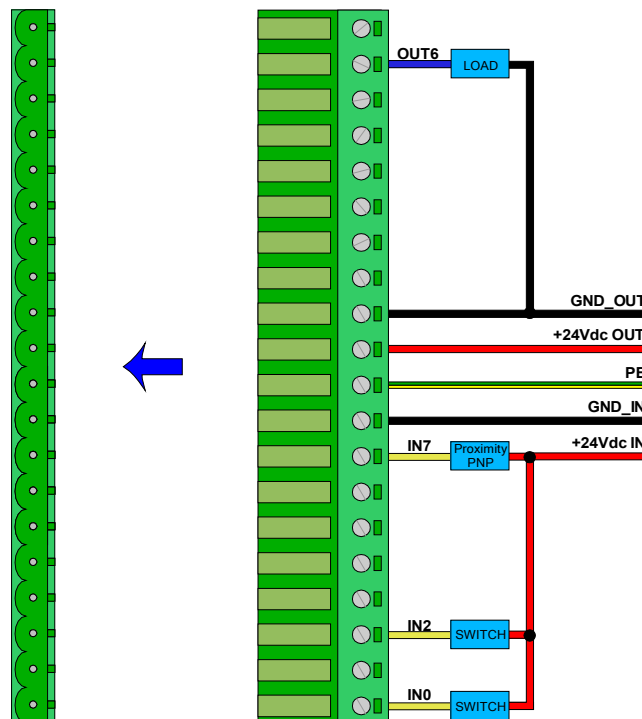


Fig. 5.3 Example of I/O connection

If just one input voltage of 24V has to be used, the grounds of both the inputs and outputs, GND IN and GND OUT, must be connected to each other and with the GND of the 24Vdc voltage used.

5.4.3 Notes for analog output connection

The load connection for analog outputs is indicated in the figure 5.4, in which both outputs are shown. A **screened twisted-pair cable** is recommended and in particular the **9841 BELDEN ELECTRONICS** cable. It is very important that the shield is connect to the earth. For this purpose it is sufficient to connect the cable shield to pin 1 of the connector and to the dedicated terminal Z1 to the earth (see the figure 5.4; connections to this terminal of pin 1 of the two connectors are already accomplished internally).

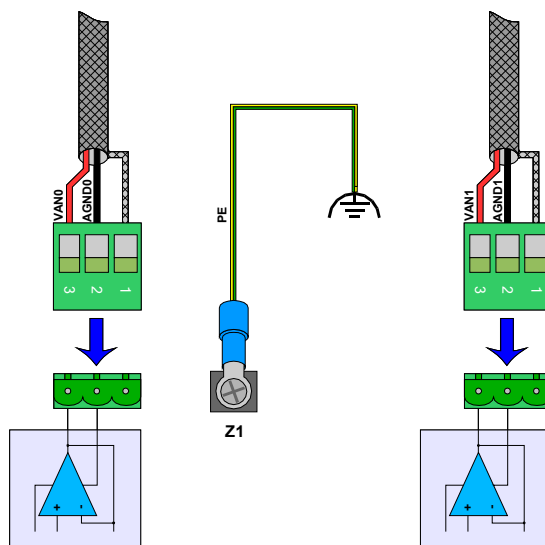


Fig. 5.4 Analog output connections

5.4.4 Notes for mains slicer output connection

The mains slicer outputs shown in the figure 5.5 below just need connection of the load to terminal 2 and to the line neutral and of terminal 1 to the line phase. These outputs are also independent, thus allowing star connection of the loads, as shown in the lower part of the figure. Cables with a suitable cross section should be used according to the load current, but in any case not exceeding the specifications to be found in the technical data. Fig. 5.5 Connections for mains slicer outputs

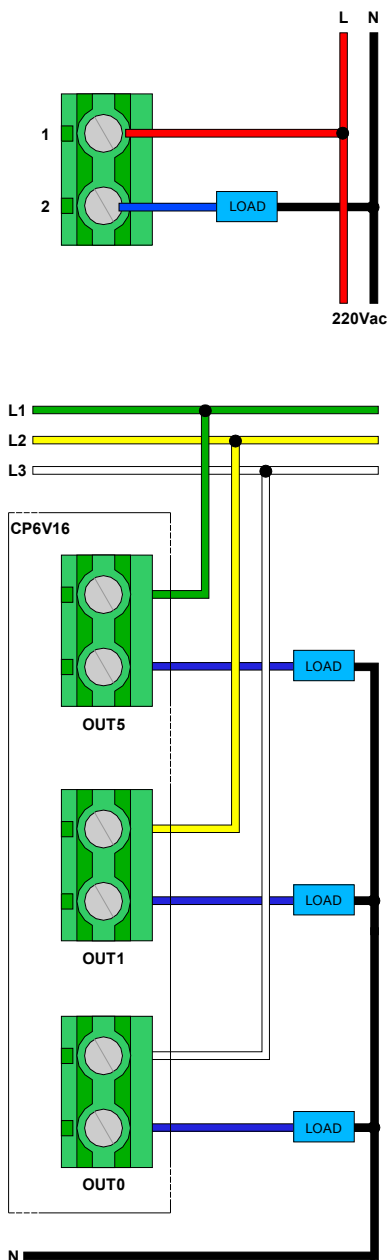


Fig. 5.5 Connections for mains slicer outputs

section 6. CPENCA PERIPHERAL

6.1 GENERAL INFORMATION

The peripheral CPENCA provides:

- 3 **digital outputs PNP 24Vdc** 200mA, opto-isolated and protected. One of this is still the analog output driver enable
- 1 **digital outputs PNP 24Vdc** 30mA, opto-isolated
- 4 **digital inputs PNP 24Vdc**, opto-isolated and protected against the polarity inversion
- 1 **analog outputs $\pm 10\text{Vdc}$** 11-bit resolution plus sign
- 1 **incremental or single-ended encoder input**
- Din rail support or mechanical mounting**

The **mechanical size** (see fig. 6.1) of the peripheral with the DIN clip is (in mm): 42.5× 130.3 × 125.1. Without the DIN clip the size is 42.5× 130.3x110.1mm.



Fig. 6.1 CPENCA peripherals

6.2 POWER SUPPLY

The module needs 24Vdc or 18Vac power supply that are isolated from the internal logic supply. The module has a Power supply polarity reversal protection, Primary circuit protection and electronic Short-circuit protection.

6.2.1 Technical data

Power supply section:

Input voltage - rated value - range	+Vdc / 18 Vac ±20 %
Mains frequency - rated value - range	50 Hz / 60 Hz ± 1 %
Input current - typical steady state value - typical value during initial peak - typical duration of initial peak - typical value during initial transient - typical duration of the initial transient	0.35 A rms 5 A pk 5 msec 0.5 A rms 100 msec
Total input power - maximum value	8W
Short-circuit protection	Electronic
Power supply polarity reversal protection	yes
Primary circuit protection	1 self-resetting fuses $I_{Hold} = 1.35 \text{ A @ } T_{amb} = 20 \text{ °C}$
Earth galvanic separation	Yes
POWER LED	Green

6.2.2 Installation notes

6.2.2.1 Description of the connector

The power supply is connected by means of a 3 pin removable connector. The pins are depicted in the table above.

Power supply connector:

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

6.2.2.2 Connection notes

The earth connection and the functional earth must be carried out in order to ensure best performance of the board with regard to electromagnetic interference. This connection also guarantees that the whole metal casing of the peripheral 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 capacitive type stage of power supply.

6.3 PORTE DI COMUNICAZIONE SERIALE CAN

6.3.1 Generality

The CPENCA offers 1 CAN (Controller Area Network) serial communication interfaces for the connection to the other peripherals in the CAN network. The CPENCA has got a 5 removable pin connector for the CAN port. The CAN section is opto-isolated from the internal logic, so this can decrease the maximum length achievable in the network (see section 2.3). The network can be made with either CANopen nodes produced by CMZ or with CANopen nodes available on the market.

6.3.2 Technical data

Characteristics of the serial connection:

Connection	Protocol CAN (ISO-11898 Ver. 2.0 Part B)
Galvanic isolation	With optical couplers
Termination resistor	Insertable through dip-switch

With regard to the general characteristics of the serial connection, the topology, the maximum number of connectable nodes, the baud rate/length relation and the specifications of the transmitting means, refer to the section 2.

6.3.3 Installation notes

6.3.3.1 Description of the connector

Can connector:

PIN	SIGNAL	DESCRIPTION
1	CAN_GND	CAN ground
2	CAN_L	CAN low
3	CAN_SHIELD	CAN shield
4	CAN_H	CAN high
5	-	-

6.3.3.2 Connection notes

Figure 6.2 describe the cable connection that should be used for the CAN port on the CPENCA connector. **Screened twisted-pair cables** are recommended (as recommended in the section 2 and in the appendix related to electromagnetic compatibility) and in particular one **pair for the CAN_H and CAN_L signals and the other for GND**.

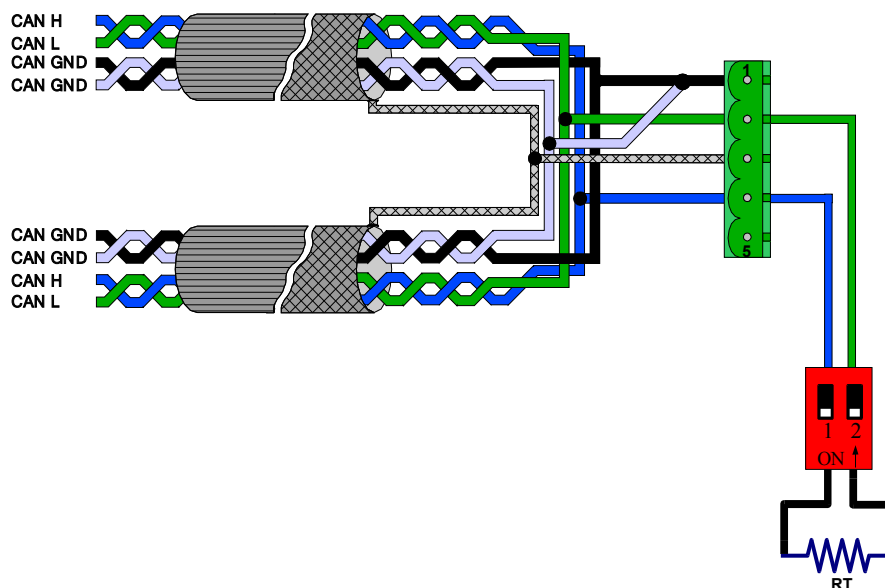


Fig. 6.2 Cable on the CANopen connector

N.B. Connection of the shield

Connection of the **cable shield** to the shield pin (i.e. No. 3) of the connector is also recommended; this is always applicable when connecting two CMZ CANopen peripherals.

Only when connecting **master and peripheral** should the cable **shield** be connected to the connector **shell** on the master end and the shield pin on the peripheral end.

When cascading the CANopen network, it must be terminated at both ends by a termination resistor. This can easily be obtained by putting to ON **both** bits of the RT dip-switch of the nodes at the ends of the network (see table).

RT Dip-switch:

BIT 1	BIT 2	RT STATUS
ON	ON	Resistor connected
ON	OFF	Resistor not connected
OFF	ON	Resistor not connected
OFF	OFF	Resistor not connected (factory default)

6.4 HARDWARE FEATURES

6.4.1 General information

By means of an 8 pin connector the boards offers an I/O digital section:

- two digital inputs PNP 24V ($t_p < 10\mu s$)
- two digital inputs PNP 24V ($t_p < 2ms$)
- one digital outputs PNP 24Vdc

By means of an 9 pins DSUB male connector the boards offers **one analog outputs $\pm 10Vdc$** 11-bit resolution plus sign with three **digital outputs PNP 24Vdc and two digital inputs**. The analog output is isolated from the logic and is enabled by one of the digital output. One digital input of the PNP type, +24 Vdc, galvanically separated by means of an optoisolator, is generally used for managing axis initialisation microswitches; one isolated digital input and the digital output described are used for DRIVER_READY and DRIVER_ENABLE signals respectively (whenever envisaged by the driver). The other two outputs are used for general-purpose output.

At the end, by means of a 9-pin DSUB female connector the board offers one input for incremental encoder with zero mark. The encoder may be differential or single-ended, powered by the system at +5 Vdc or externally at +5V or at +12V; simulated encoders are also allowed. With incremental encode it is possible to know if the encoder are well connected reading a memory cell in the microcontroller (see the details in the software manuals). By means of a dip-switch it is possible to set the termination resistor and to give externally the power supply from the CPENCA (see above)

6.4.2 Technical data

Digital inputs:

Type of input	PNP
Number of inputs	4
Galvanic isolation	With optical couplers
Input voltage	
- rated	+24 Vdc
- for LOW signal	-30 ÷ +6 Vdc
- for HIGH signal	+11 ÷ +30 Vdc
Input current	4÷15mA @ 11V÷30V
Delay time	10us for IN2/IN3 2ms for IN0/IN1
Polarity reversal protection	Yes

Digital output:

Type of output	PNP
Galvanic isolation	With optical couplers
Supply voltage VS	
- rated	+24 Vdc
- range	+18 Vdc ÷ +30 Vdc
- max. ripple	±20%
Power supply input protection	Self-resetting fuse $I_{hold} = 100mA @ T_{amb} = 20\text{ }^{\circ}C$
Power supply polarity reversal protection	Yes (max 50V)
Short circuit protection	No
Nominal output current	30 mA

Analog outputs:

Output voltage	
- range	± 10 Vdc
- resolution	5 mVdc
Galvanic isolation	With optical couplers
Min. resistive load	1 k Ω
Max. capacitive load	10 nF
Load connection	Towards analog GND

Homing and DRIVER_READY input:

Type of input	PNP
Input voltage	
- rated	+24 Vdc
- for LOW signal	-30 Vdc ÷ +6 Vdc
- for HIGH signal	+11 Vdc ÷ +30 Vdc
Input current	4÷15mA @ 11V÷30V
Galvanic isolation	With optical couplers
Delay time	< 10usec for homing input < 2ms for driver_ready input
Polarity reversal protection	Yes

DRIVER_ENABLE and digital output:

Type of output	PNP
Number of output	3
Galvanic isolation	With optical couplers
Supply voltage VS	
- rated	+24 Vdc
- range	+18 Vdc ÷ +30 Vdc
- max. ripple	$\pm 20\%$
Threshold voltage for undervoltage lockout	+9 Vdc
Power supply input protection	Self-resetting fuse $I_{hold} = 2,5$ A @ $T_{amb} = 20$ °C
Power supply polarity reversal protection	Yes (maximum reverse voltage 50V)
Overload and short-circuit protection	Yes
Overheating protection	Yes
Output current	
- rated	200 mA
- maximum per output	350 mA
- maximum per quartet 0÷2	700 mA

Encoder input:

Type of allowed encoder	Differential or single-ended, incremental at 5V or 12V
ΔV_{min} for differential encoders	0.5 V
$V_{H min}$ and $V_{L max}$ for single-ended encoders	$V_{H min} = 3V$ $V_{L max} = 2V$
Power supply	+5 Vdc $\pm 10\%$
Max. current consumption	200 mA
Power supply protection	Self-resetting fuse $I_{hold} = 650$ mA @ $T_{amb} = 20$ °C
Primary wave maximum frequency	Single-ended: 100Kz Differential: 120Khz
Zero mark	Yes
Termination resistors	Insertable with dip-switch

6.5 INSTALLATION NOTES

6.5.1 Description of connectors

I/O digital connector

8 pin removable connector:

PIN	SIGNAL	DESCRIPTION
1	IN0	Digital input 0
2	IN1	Digital input 1
3	IN2	Digital input 2
4	IN3	Digital input 3
5	GND_IN	GND input
6	+24Vdc	Power supply for the digital output
7	GND_O	GND output
8	OUT0	Not protected digital output 0

Analog output and protected digital output connector

SERVO OUT connector (DSUB 9 pin male):

PIN	SIGNAL	DESCRIPTION
1	DR	DRIVER_READY input
2	+24 Vdc	Input +24 Vdc for DRIVER_ENABLE output
3	IC	Homing microswitch input
4	V _A	Analog output with enable (relay)
5	POUT2	Protected digital output 2
6	GNDD	GND inputs 1, 2, 3
7	DE/POUT0	DRIVER_ENABLE output or protected output 0
8	GNDA	GND analog output
9	POUT1	Protected digital output 1

ENCODER connector

ENCODER connector (DSUB 9 pin female):

PIN	SIGNAL	DESCRIPTION
1	TZ+	Positive zero mark
2	FA-	Negative A phase
3	VCC	Encoder power supply +VCC
4	GND	Encoder power supply ground
5	FB-	Negative B phase
6	FB+	Positive B phase
7	FA+	Positive A phase
8	TZ-	Negative zero mark
9	-	-

6.5.2 Notes for connecting digital I/O

For the I/O digital section it should be used the following wiring diagram scheme (fig.6.3); in the fig.6.4 instead is shown an example of I/O connection.

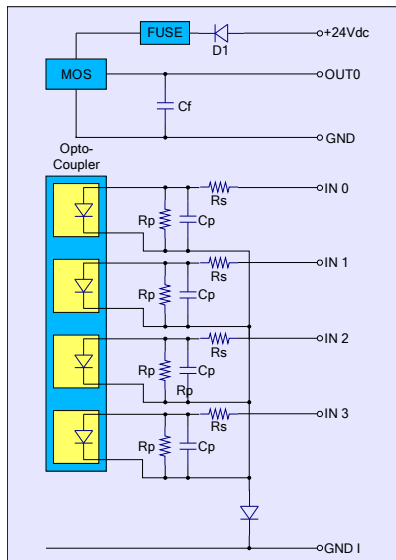


Fig. 6.3 Wiring diagram of input and output stages

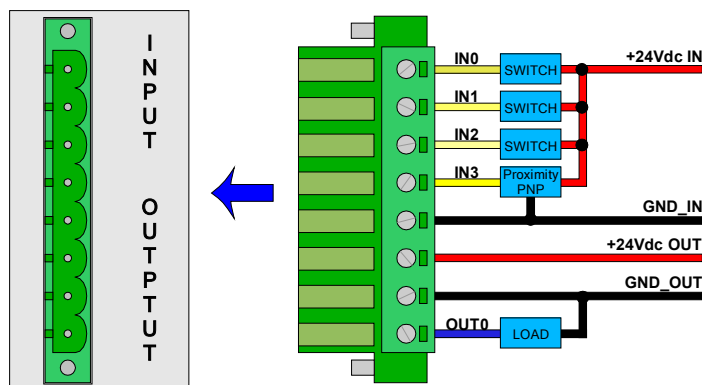


Fig. 6.4 Example of I/O connection

If just one input voltage of 24V has to be used, the grounds of both the inputs and outputs, GND IN and GND OUT, must be connected to each other and with the GND of the 24Vdc voltage used.

6.5.3 Notes for connecting the encoder

The encoder-input stages of the CPENCA may acquire differential or single-ended encoders. The system provides a power supply at +5 Vdc (max. 200 mA). By means of an encoder dip-switch (see fig.6.5) it is possible to set the termination resistor and to provide the +5V for the external encoder.

NOTE

The encoder outputs may be of the NPN, NPN Open-Collector, TTL-compatible, Push-Pull, Line Driver type; they must not be the PNP type.

ATTENTION

If the encoder requires a different supply voltage or a greater current than the maximum that can be delivered, it must be powered externally; the allowed external supply voltage are +12V and +5V.

Differential encoder

Differential encoder powered by CPENCA at +5V:

The connection should be carried out as shown in the figure 6.5: each pair should carry the encoder signal and its negation (e.g.: 1st pair FA+ and FA-, 2nd pair FB+ and FB-, 3rd pair TZ+ and TZ-). The power supplies pair VCC and GND should always be connected. The bits 1, 2, 3 of encoder dip-switch should be set ON for set the termination resistor. The bit 4 should be set ON for give the power supply to the encoder.

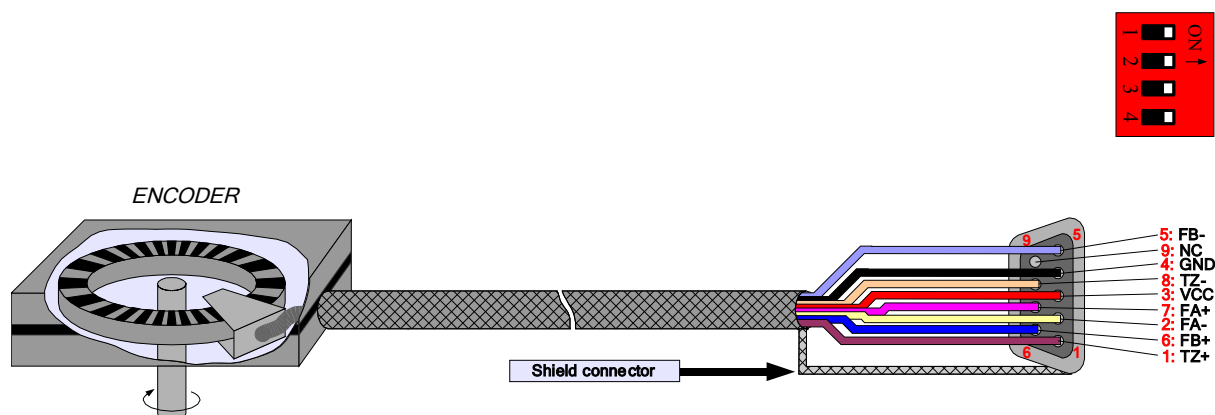


Fig. 6.5 Connection of differential encoder powered by CPENCA

Differential encoder powered externally at +5V or at +12V or simulated encoder:

The connection should be carried out as shown in the figure 6.6: each pair should carry the encoder signal and its negation (e.g.: 1st pair FA+ and FA-, 2nd pair FB+ and FB-, 3rd pair TZ+ and TZ-). GND should be carried out but VCC should not be connected. The bits 1, 2, 3 of encoder dip-switch should be set ON for set the termination resistor. The bit 4 should be set OFF (externally power supply to the encoder).

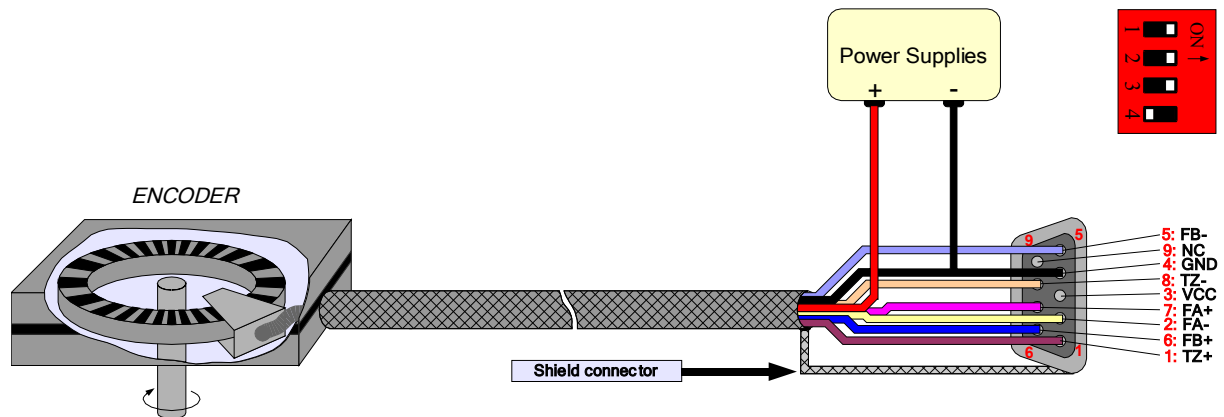


Fig. 6.6 Connection of differential encoder externally powered or simulated encoder

Single-ended encoder

ATTENTION

For greater operating reliability in surroundings with EMI, Line Driver type differential encoders should be used. If single-ended encoder is required it should be used +12V ones.

Single-ended encoder powered by CPENCA:

The connection should be carried out as shown in the figure 6.7: the A, B phases and the zero mark signals should be connected to pins FA+, FB+ and TZ+ respectively. The power supplies pair VCC and GND should always be connected. The bits 1, 2, 3 of encoder dip-switch should be set OFF (the termination resistor should not be used). The bit 4 should be set ON to provide power supply to the encoder by CPENCA.

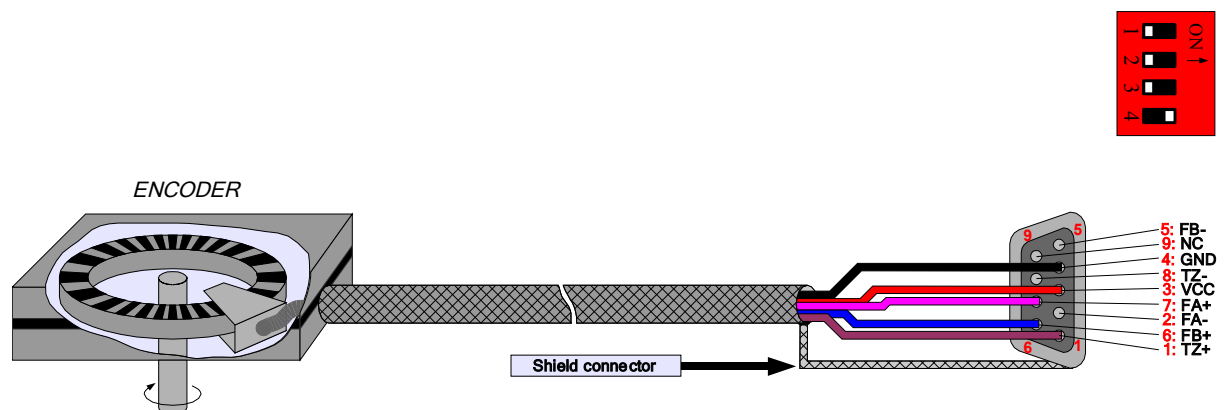


Fig. 6.7 Connection of single-ended encoder powered by CPENCA

Single-ended encoder powered externally:

The connection should be carried out as shown in the figure 6.8: the A, B phases and the zero mark signal should be connected to pins FA+, FB+ and TZ+ respectively. GND should always be connected. +5V power should not be connected to the Vcc signal. The bits 1, 2, 3 of encoder dip-switch should be set OFF. The bit 4 should be set OFF (externally power supply to the encoder).

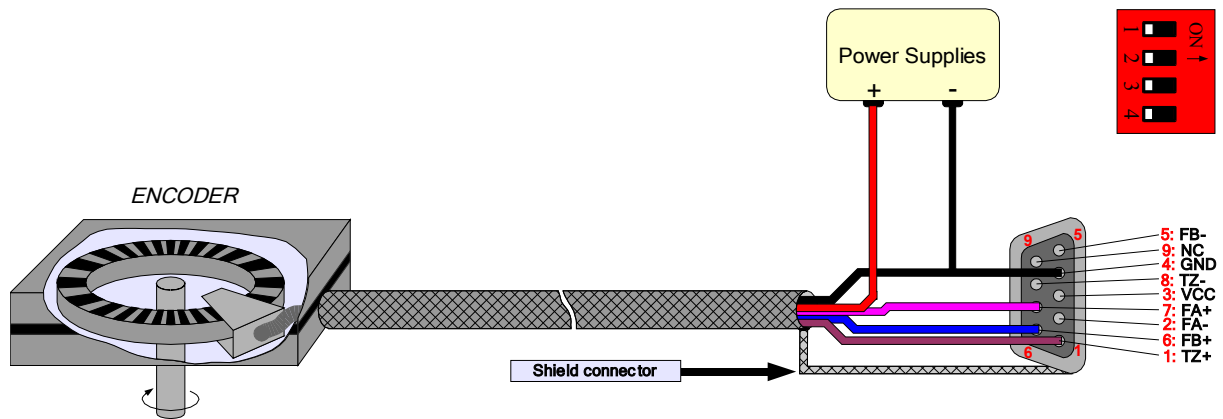


Fig. 6.8 Connection of single-ended encoder externally powered

It is emphasized that a shielded cable with twisted pairs should be used (recommended model 8104 BELDEN ELECTRONICS), with the cable shielding connected to the connector shell at the CPENCA.

6.5.4 Notes for connecting the driver interface

For the analog output a shielded cable with twisted pair should be used (e.g. model 9841 BELDEN ELECTRONICS), with the cable shielding connected to the shell of the SERVO OUT connector of the CPENCA module, as shown in the figure 6.9.

Furthermore, under no circumstances should the polarity of the analog outputs be inverted, (due to the presence of protection circuits on the analog ground).

In the figure 6.10 are described the wiring connection for the digital output Driver Enable/POU0 and POUT1/2 too.

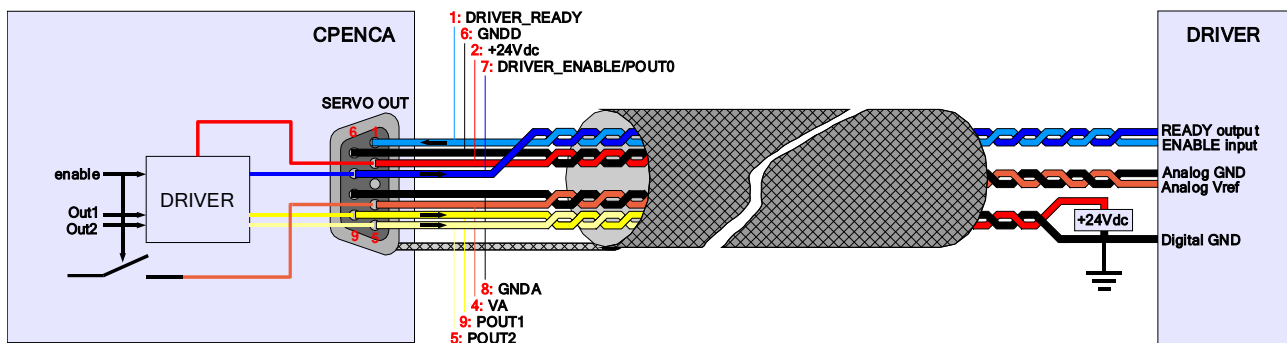


Fig. 6.9 CPENCA – driver connection

6.5.4.1 Notes for connecting the initialisation input

The figure 6.10 shows the connection of the axis initialisation inputs: this configuration permits home search with or without the help of the encoder zero mark.

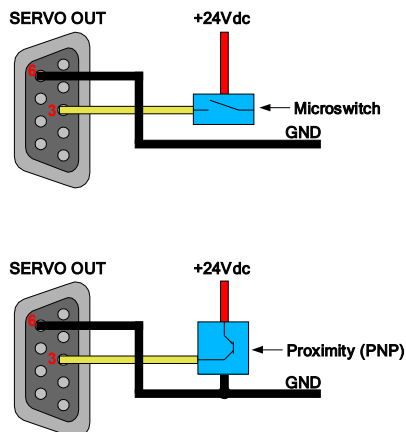


Fig. 6.10 Examples of connections of microswitch or proximity switch for setting axes to home

In the fig. 6.11 is shown the configuration of the homing and driver ready input and the protected output. The hardware filters are different and the propagation delay too.

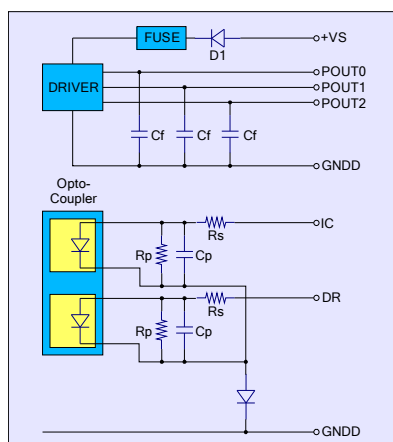


Fig. 6.11 Collegamenti degli I/O digitali nella sezione servo out

6.6 LED AND DIP SWITCH

In the figure 6.12 and 6.13 are depicted the frontal and lateral view of CPENCA.

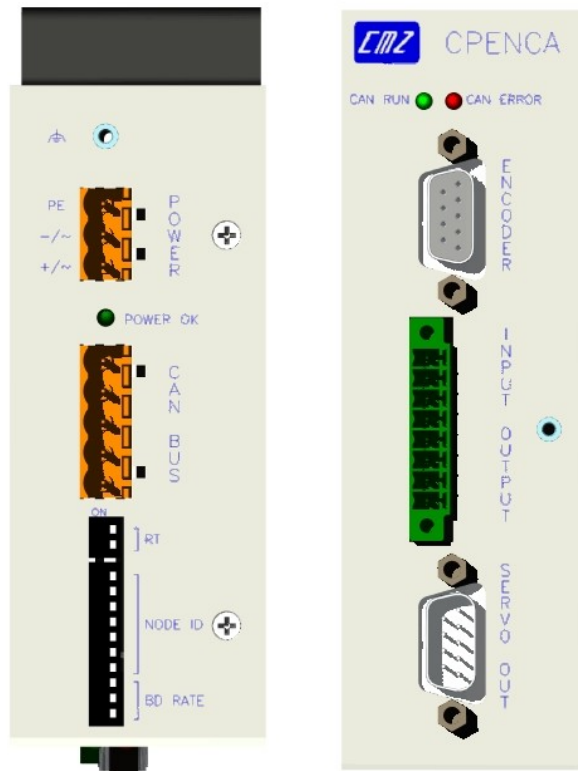


Fig. 6.12 CPENCA front view

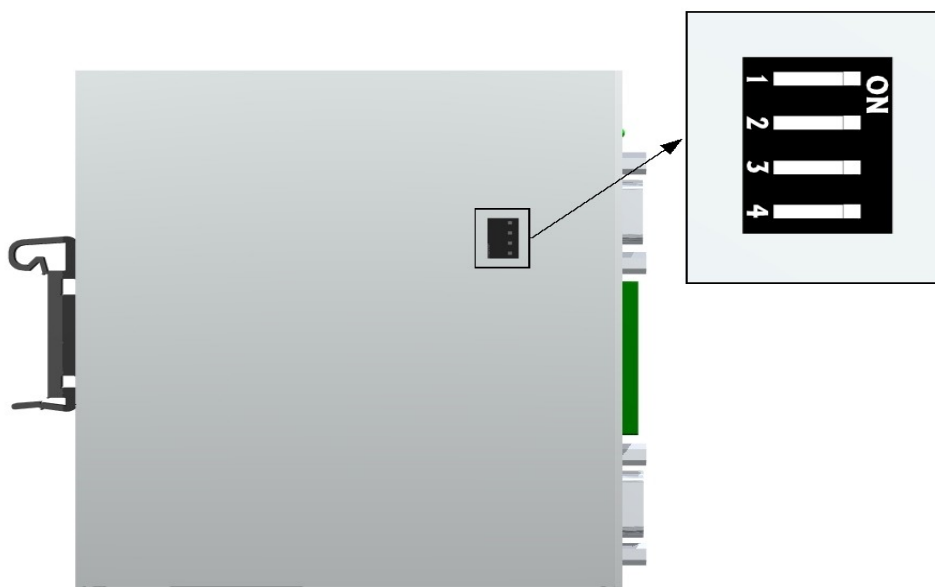


Fig. 6.13 CPENCA lateral view

6.6.1 LED description

In the CPENCA are present 3 LEDs for the following indication:

- Power OK (green)
- CAN run (green)
- CAN error (red)

CAN RUN and CAN ERROR are conforming to the CANopen standard CiA DR303-3 version 1.0 *Indicator Specification*.

CAN Run Led (green): indicate the state of communication in the drive:

CAN RUN LED	COMMUNICATION STATE
Single flash	Stopped
Blink (2.5 Hz)	Pre-Operational
ON	Operational

CAN Error Led (red): provides the state on the network and indicates the errors caused to the lack of the message of *Nodeguard*:

CAN ERROR LED	NETWORK STATE	DESCRIPTION
OFF	No error	Correct communication
Single blink	Warning level	Errors in the network (the communication could be with problem)
Double blink	Error	Error in the Nodeguard control
ON	Bus off	Too many errors: communication interrupted

6.6.2 Dip-switch description

CPENCA has got 3 group of dip-switch (see fig.6.13):

In the CAN section there is a 10-bit dip-switch:

- The first 7 bit are used for the node identification (NODE_ID)
- The last 3 bit are for setting the baud rate in the CPENCA (B_RATE)

The termination resistor dip-switch is provided in the CAN section.

In the next table are described the meanings of the dip-switches.

NODE_ID e B_RATE dip-switch: first 7 bits:

BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	NODE ID
OFF	OFF	OFF	OFF	OFF	OFF	OFF	Not allowed
ON	OFF	OFF	OFF	OFF	OFF	OFF	Node 1 (factory default)
OFF	ON	OFF	OFF	OFF	OFF	OFF	Node 2
ON	ON	OFF	OFF	OFF	OFF	OFF	Node 3
OFF	OFF	ON	OFF	OFF	OFF	OFF	Node 4
ON	ON	ON	ON	ON	ON	OFF	Node 63
OFF	OFF	OFF	OFF	OFF	OFF	ON	Node 64
OFF	ON	ON	ON	ON	ON	ON	Node 126
ON	ON	ON	ON	ON	ON	ON	Node 127

NODE ID e BRATE dip-switch: last 3 bits:

BIT 8	BIT 9	BIT 10	BIT RATE
OFF	OFF	OFF	10 kbit/s
ON	OFF	OFF	20 kbit/s
OFF	ON	OFF	50 kbit/s
ON	ON	OFF	125kbit/s
OFF	OFF	ON	250kbit/s
ON	OFF	ON	500kbit/s
OFF	ON	ON	800kbit/s
ON	ON	ON	1000 Kbit/s (factory default)

Termination resistor:

BIT 1	BIT 2	(SW CAN)
ON	ON	Resistor inserted
ON	OFF	Resistor not inserted
OFF	ON	Resistor not inserted
OFF	OFF	Resistor not inserted

In the encoder section there is a 4 bits dip-switch that give the possibility to set the termination resistors for the encoder phases and to provide or not the +5V power supply from the CPENCA to the encoder. In the notes for connecting the encoder we have descibed the use of thies dip-switch with differential or single-ended encoder. The following table describe all the bits:

DIP-SWITCH encoder:

BIT 1	ON	Phase A termination resistor inserted
	OFF	Phase A termination resistor not inserted
BIT 2	ON	Phase B termination resistor inserted
	OFF	Phase B termination resistor not inserted
BIT 3	ON	Zero mark termination resistor inserted
	OFF	Zero mark termination resistor not inserted
BIT 4	ON	+5V Power supply provided from CPENCA to encoder
	OFF	No power supply provided from CPENCA

appendix A EXPANSION MODULE SGACQA

A.1 GENERAL INFORMATION

The module SGACQA (Strain Gage ACQuisition board, version A) is an intelligent module that acquires and converts in a ratiometric way the differential weight signal from a load cell. Real-time digital filtering operations may be carried out on weight samples. The processed data item is sent via Can bus.

The board SGACQA may be connected to the peripheral CP6V16, which not only communicates but also powers the same module; alternatively it may be used in communication with a general CANopen controller with the help of an external power supply (CANPWA see app. B).

The CP6V16 may communicate with 2 SGACQA modules at the most, supplying the stabilised voltage 6Vdc $\pm 10\%$ 200mA (with dc protection) through the same port (RJ45-BP-V 8-pin connector). If more than 2 SGACQA boards are to be used, the CANPWA power supply unit (described in appendix B) must be used, which can power up to 16 boards (see app. D for connection notes).

An important feature of the module is its **small size allowing direct mounting on the load cell** and possibility to inhibit the calibration process. Module dimensions are: 75x95x51 (mm).

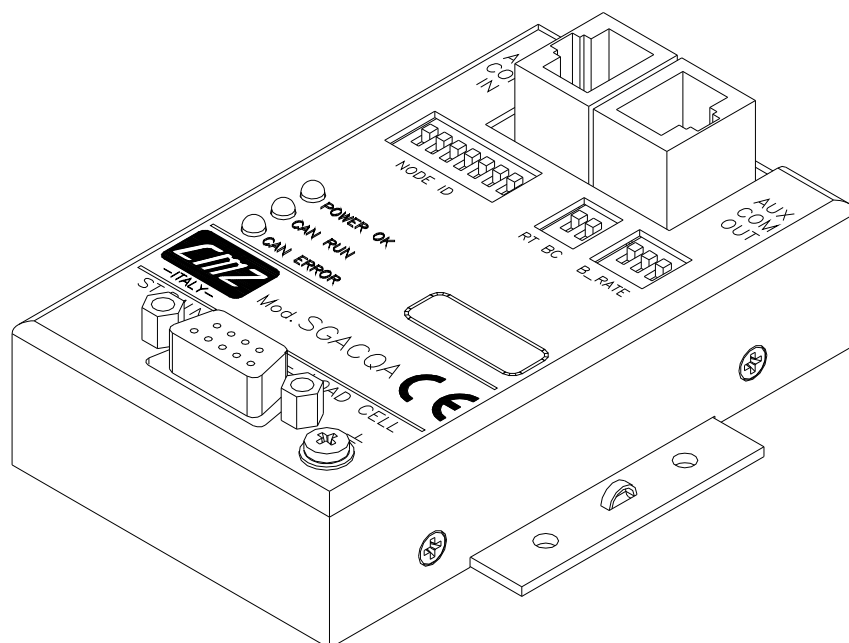


Fig. A.1 Module SGACQA

In the figure A.2 is described the SGACQA schemattick block:

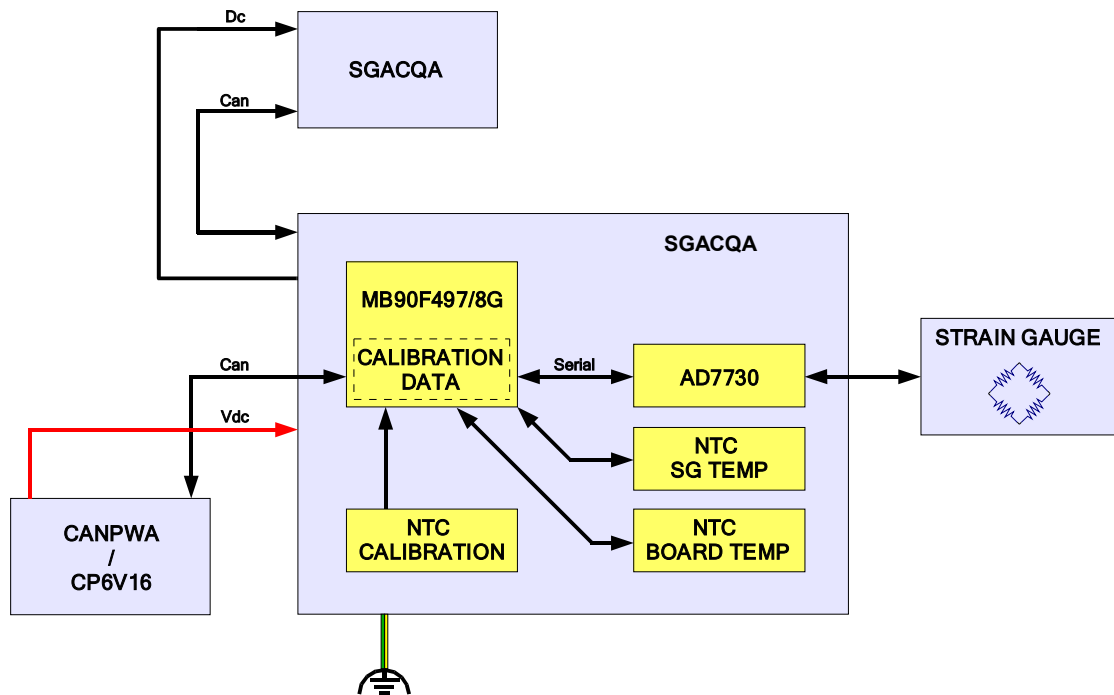


Fig. A.2 SGACQA schematic block

In the Fig. A.3 is shown the module drilling template:

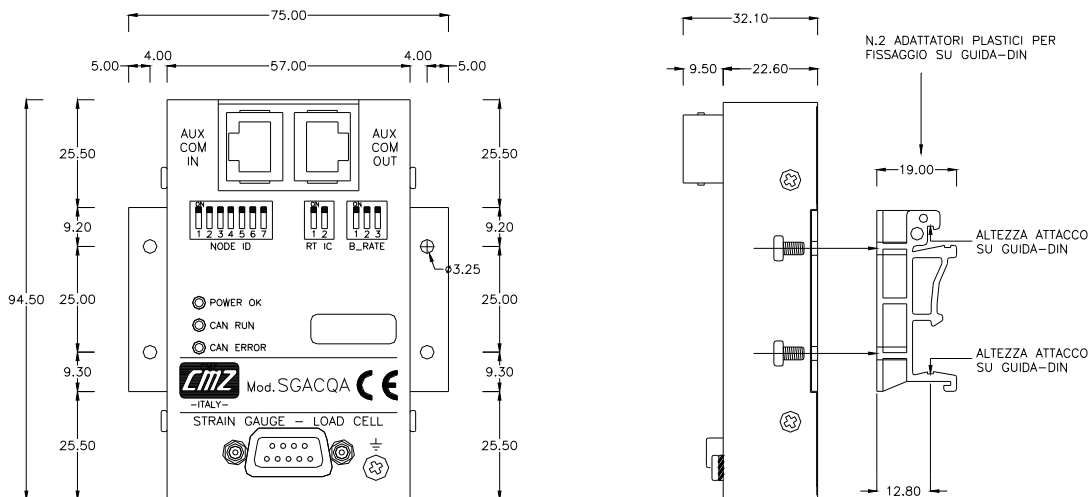


Fig. A.3 SGACQA drilling template

The board is *sealable* for the certification of weight system with the covering that inhibits the setting of the control dipswitch and the removing of the board from the electrical rack.

A.2 TECHNICAL DATA

Power supply section and LEDs:

Input voltage	6 Vdc / 7.5V
Input current	
- typical steady state value	100 mA
Total input power	
- maximum value	0.6W
Short-circuit protection	Yes, self-resetting fuse $I_{hold} = 400mA @ T_{amb} = 20\text{ }^{\circ}C$
POWER LED	Green
ERROR LED	Green (Yellow on Rev. 0-1-2)
RESET LED	Red

Acquisition section:

Load cell power supply voltage	5Vdc
Load cell excitation	5VDC (unipolar) or $\pm 5VAC$ (bipolar)
Weight differential max. deviation (for cell gain 2mV/V)	$\pm 10mV$
Working temperature range	$-10^{\circ}C \div 50^{\circ}C$
Weight differential band width	2.2kHz
Reference differential band width	2.2kHz
ESD protection	Yes
Calibration inhibition	With dipswitch
Cell gain thermal drift (typical)	20ppm/ $^{\circ}C$
Cell repeatability (typical)	0.01%

Conversion section:

Converter	$\Sigma\Delta$ AD7730
Type of conversion	Ratiometric
Input range	bipolar : $\pm 10mV, \pm 20mV, \pm 40mV, \pm 80mV$
Maximum rated peak-peak resolution:	
- chopper mode with input range $\pm 80mV$	- 230,000 counts / 18 bit
- non chopper mode with input range $\pm 80mV$	- 165,000 counts / 17.5 bit
- chopper mode with input range $\pm 10mV$	- 80,000 counts / 16.5 bit
- non chopper mode with input range $\pm 10mV$	- 55,000 counts / 16 bit
D/A resolution offset/tare compensation (ref. 5V)	2.5mV / 5 bit + sign
Offset/tare compensation range	$-80mV \div +77.5mV$

Other features of SGACQA:

- tare offset integrated compensation, under software control - disconnected or short-circuited sensor alarm - thermal sensor: 10Kohm thermistor - load cell temperature analog signal acquisition - Data calibration stored in FE memory - differential signal acquisition with high-impedance input
--

Other characteristics of the load cell:

- thermal sensor: 10Kohm thermistor - maximum cell length-SGACQA: 2m (this length may be less for certain load cells) - minimum input impedance: 300ohm (for configurations that use paralleled load cells, contact the CMZ Sistemi Elettronici assistance office) - 6-wire or 4-wire connection (see figures below)

A.3 INSTALLATION NOTES

A.3.1 Description of connectors

AUX-COM IN connector

CAN signals and RJ45-BP-V power supply 8-pin connector from preceding CP6V16, CANPWA or SGACQA:

PIN	SIGNAL	DESCRIPTION
1	VCC	Power supply input
2	VCC	Power supply input
3	VCC	Power supply input
4	GND	Power and signal ground
5	GND	Power and signal ground
6	GND	Power and signal ground
7	BC_H	Auxiliary CAN high
8	BC_L	Auxiliary CAN low

AUX-COM OUT connector

CAN signals and RJ45-BP-V power supply 8-pin connector towards next SGACQA:

PIN	SIGNAL	DESCRIPTION
1	VCC	Power supply output
2	VCC	Power supply output
3	VCC	Power supply output
4	GND	Power and signal ground
5	GND	Power and signal ground
6	GND	Power and signal ground
7	BC_H	Auxiliary CAN high
8	BC_L	Auxiliary CAN low

CMZ can supply on request the patch cable.

Strain-gage – Load cell

DSUB 9-pin female connector towards the strain gage or load cell:

PIN	SIGNAL	DESCRIPTION
1	SHIELD	Cable shield
2	VR-	Voltage reference negative input
3	TEMP_SG	Strain gage temperature
4	DP+	Differential signal positive input
5	VP+	Power supply positive or AC output
6	VP-	Power supply negative or AC output
7	AGND	Analog ground
8	DP-	Differential signal negative input
9	VR+	Voltage reference positive input

Screened, twisted-pair cables are recommended (one pair is obviously formed by two differential signals). It is inadvisable to use cables consisting of several pieces (joints) with intermediate terminals. The maximum length between the load cell and the board is 2m, but this also depends on the type of load cell being used (check the rated data element directly from the cell data sheets) and the characteristics of the cable. In any case the shortest possible cables should be used with the SGACQA located near the cell.

CAUTION

The shield of the load cell connection cable should be connected:

- to the pin 1 of the DSUB connector of the SGACQA if the load cell transducer is supplied with grounded shield (fig. A.4 and A.6)
- to the casing of the DSUB connector (earth) of the SGACQA if the load cell transducer is supplied with floating shield (fig. A.5 and A.7)

It is recommended to use DSUB connectors with metallic casing for shielding to the external environment and to verify the electricity continuity of the whole shield in the conductor.

It is also recommended that these cables be wired far from power or high-frequency wiring.

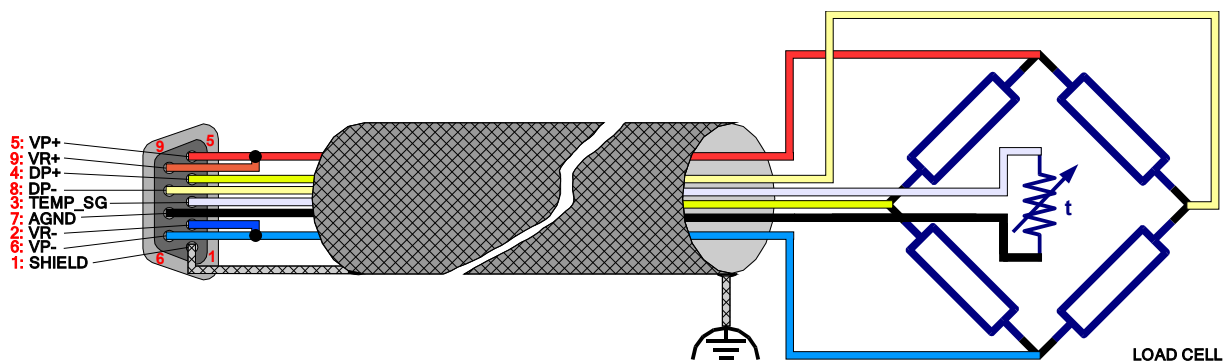


Fig. A.4 Four wire load cell: shield on load cell side grounded

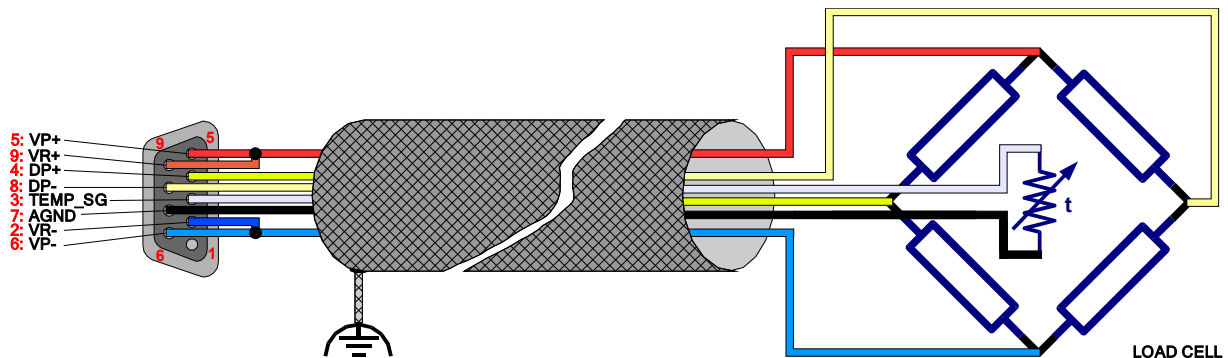


Fig. A.5 Four wire load cell: shield on load cell side not grounded

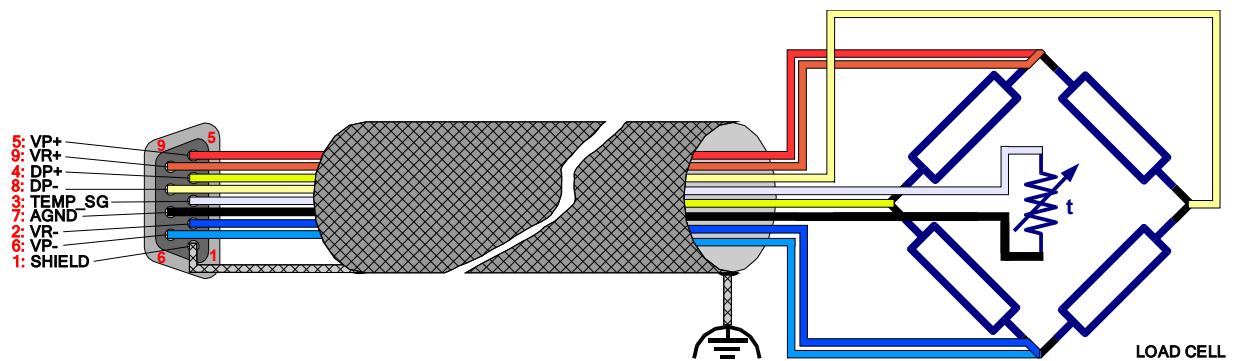


Fig. A.6 Six wire load cell: shield on load cell side grounded

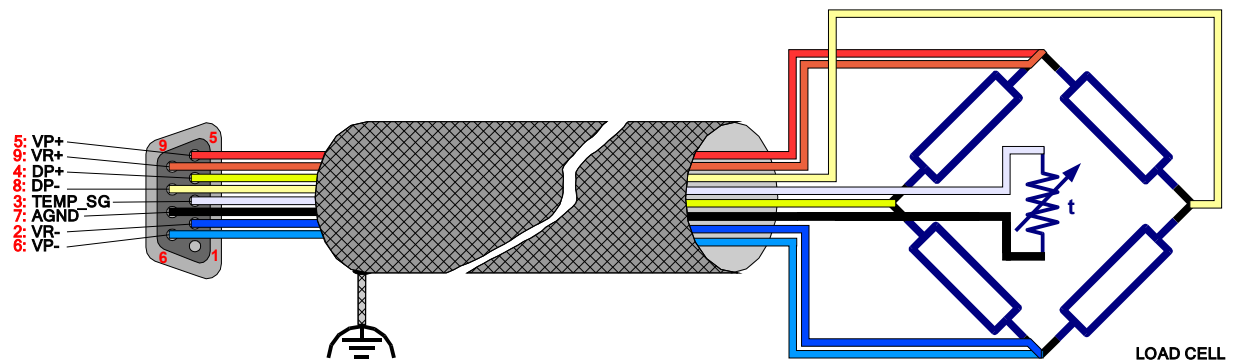


Fig. A.7 Six wire load cell: shield on load cell side not grounded

A.3.2 Description of dip-switches

RT_BC: Dipswitch for connecting the terminal resistors of the AUX-COM IN port signals:

BIT	BIT STATUS	RT STATUS
1A	ON	CAN termination resistor connected
1A	OFF	CAN termination resistor not connected (factory default)
2A	ON	Possible calibration
2A	OFF	Calibration inhibited

NODE ID: Dipswitch identifying the node number in the CANopen network:

BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	NODE IDENTIFICATION
OFF	OFF	OFF	OFF	OFF	OFF	OFF	Not allowed
ON	OFF	OFF	OFF	OFF	OFF	OFF	Node 1 (factory default)
OFF	ON	OFF	OFF	OFF	OFF	OFF	Node 2
ON	ON	OFF	OFF	OFF	OFF	OFF	Node 3
OFF	OFF	ON	OFF	OFF	OFF	OFF	Node 4
ON	ON	ON	ON	ON	ON	OFF	Node 63
OFF	OFF	OFF	OFF	OFF	OFF	ON	Node 64
OFF	ON	ON	ON	ON	ON	ON	Node 126
ON	ON	ON	ON	ON	ON	ON	Node 127

B RATE: Dipswitch identifying the bit rate upon locking-on of the CAN network:

BIT 1	BIT 2	BIT 3	BIT RATE
OFF	OFF	OFF	10 kbit/s
ON	OFF	OFF	20 kbit/s
OFF	ON	OFF	50 kbit/s
ON	ON	OFF	125kbit/s
OFF	OFF	ON	250kbit/s
ON	OFF	ON	500kbit/s
OFF	ON	ON	800kbit/s
ON	ON	ON	1000 Kbit/s (factory default)

A.3.3 Description of LEDs

Depending on the revision of the modules there are different meanings for the LED. In the date of issue of this manual the last module revision is 3. Above is described the meanings of the LED in all the older revision.

Revision 0, 1 and 2:

INDICATION	COLOUR	DESCRIPTION
POWER	Green	ON: power supply present OFF: power supply not present or insufficient
FAULT	Yellow	1 blink every 3 seconds: WARNING on the CAN network or timeout master NODEGUARD OFF: no error
RESET	Red	ON: power supply not present or insufficient 1 blink: watch-dog not present due to a temporary not presence of the supply voltage or a lock of program OFF: no problems

Revision 3:

INDICATION	COLOUR	DESCRIPTION
POWER OK	Green	ON: power supply present Blink: temporary power supply not present OFF: power supply not present or insufficient
CAN RUN	Green	ON: OPERATIONAL state Continues blinking : PRE-OPERATIONAL state Blink: 1 every second: STOPPED state OFF: firmware not run
CAN ERROR	Red	ON: BUSOFF state in the CAN network Blink: 1 every second: WARNING state in the CAN network Blink: 2 every second: timeout on the reception of a master NODEGUARD OFF: no error

A.3.4 Connection notes

For possible connection configurations and applications of the SGACQA expansion module, refer to appendix D.

appendix B power supply unit CANPWA

B.1 GENERAL INFORMATION

The power supply unit CANPWA (Fig. B.1) has been designed for the dual purpose of providing power to other modules while also acting as link for the communication signals related to the CAN protocol.

It receives an input voltage of $24\text{VDC} \pm 20\%$ or $18\text{VAC} \pm 20\%$ and has an output voltage of **7.5VDC $\pm 10\%$ at 2A insulated and protected** against short circuits; it can supply a maximum power of 15 W. There is a green LED on the supply connector, which indicates the presence of voltage at the power supply unit input. A self-resetting fuse in series with the power supply ensures overload protection of the primary and protection against polarity reversal is also provided for.

There are also other connectors (AUX-COM IN, AUX-COM OUT, CAN_IN and CAN_OUT) that are used for communication or power supply with the Master, peripheral boards such as CP6V16, or expansion modules (e.g. SGACQA).

The power supply unit is made with suitable mechanics and may be mounted on a DIN guide.

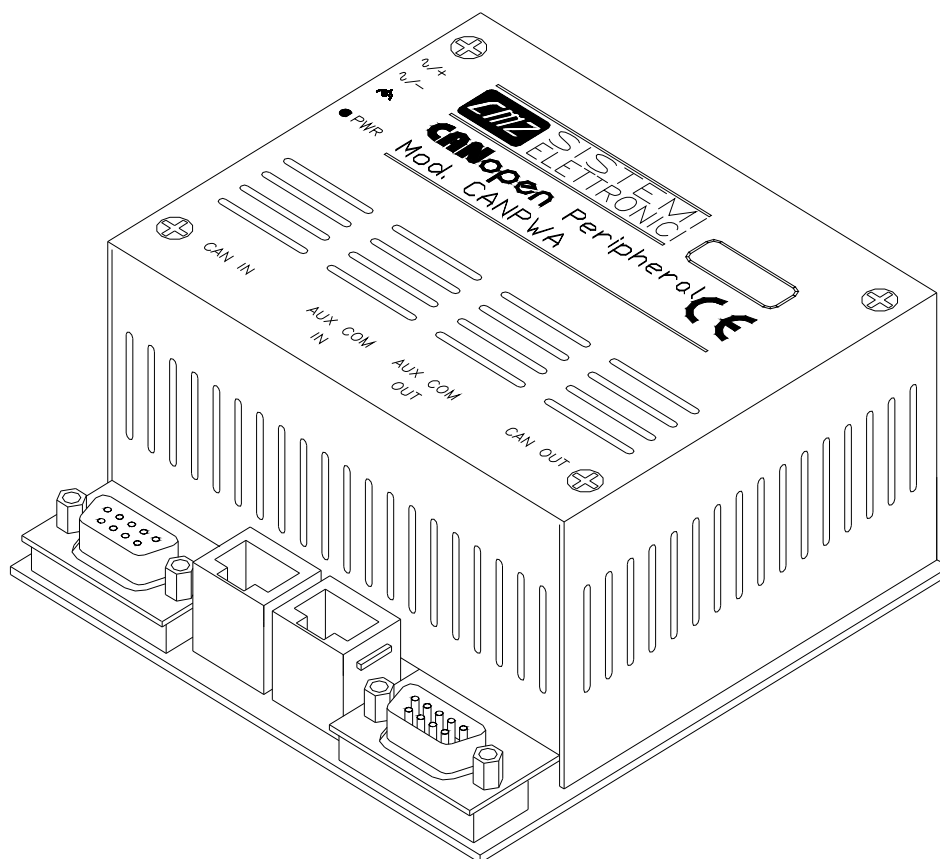


Fig. B.1 Power supply unit CANPWA

B.2 TECHNICAL DATA

Power supply section:

Input voltage - rated value - range	24 Vdc / 18 Vac ± 20 %
Grid frequency - rated value - range	50 Hz / 60 Hz ± 10 %
Input current - typical steady state value - typical value during initial peak - typical duration of initial peak - typical value during initial transient - typical duration of the initial transient	1 A rms 15 A pk. 5 msec 3 A rms 100 msec
Total input power - maximum value	35W
Short-circuit protection	Electronic
Primary circuit protection	Self-resetting fuse $I_{Hold}=2.5A@T_{amb}=20^{\circ}C$
Ground galvanic separation	Yes
Voltage present LED	Green

B.3 INSTALLATION NOTES

B.3.1 Description of power supply connector

The power supply is connected by means of a removable 3 pins connector, the pins configuration of which is given in table 2.2.

Power supply connector:

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

B.3.1.1 Earth connection

The earth connection must be carried out in order to ensure best performance of the system with regard to electromagnetic interference. This connection also guarantees that the whole metal casing of the CANPWA 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.B.2 Technical data).

B.3.2 Description of communication connectors

The power supply unit CANPWA has 4 connectors, which offer the possibility of interfacing the BC_H, BC_L, GND signals from the power supply unit to:

- network Master
- peripheral board (e.g. CP6V16)
- expansion modules (e.g. SGACQA)

AUX-COM IN connector

This serves to carry the BC_H, BC_L, GND signals from a CP6V16 or SGACQA to the power supply unit, which only acts as link towards the other connectors (see app. D for connections).

CAN RJ45-BP-V 8-pin signals connector from SGACQA:

PIN	SIGNAL	DESCRIPTION
1	-	Not connected
2	-	Not connected
3	-	Not connected
4	GND	Power and signal ground
5	GND	Power and signal ground
6	GND	Power and signal ground
7	BC_H	Auxiliary CAN high
8	BC_L	Auxiliary CAN low

AUX-COM OUT connector

Used to carry the BC_H, BC_L, GND signals from the power supply unit to an expansion module (e.g. SGACQA), also providing a 7.5V power supply. This has been done using the pins 1,2,3 so that this voltage may also be used for sufficient lengths to satisfy normal applications (compare with appendix C). Also the return path GND consists of three cables (pins 4,5,6).

CAN signals and power supply towards SGACQA RJ45-BP-V 8-pin connector:

PIN	SIGNAL	DESCRIPTION
1	VCC	Power supply output
2	VCC	Power supply output
3	VCC	Power supply output
4	GND	Power and signal ground
5	GND	Power and signal ground
6	GND	Power and signal ground
7	BC_H	Auxiliary CAN high
8	BC_L	Auxiliary CAN low

CMZ can supply the patch cable.

CAN_IN connector

CAN DSUB 9-pin female connector from master or preceding node:

PIN	SIGNAL	DESCRIPTION
1	-	Internally connected to pin 1 of CAN_OUT
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	Internally connected to pin 4 of CAN_OUT
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	Internally connected to pin 8 of CAN_OUT
9	-	-

CAN_OUT connector

CAN DSUB 9-pin male connector towards next node:

PIN	SIGNAL	DESCRIPTION
1	-	Internally connected to pin 1 of CAN_IN
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	Internally connected to pin 4 of CAN_IN
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	Internally connected to pin 8 of CAN_IN
9	Vcc	Power supply output

N.B. Connection of the shield

The **cable shield** must be connected to the shield pin (i.e. No. 5) of the connector when connecting the CANPWA to a CMZ CANopen peripheral.

Only when connecting **master and CANPWA** should the cable **shield** be connected to the connector **shell** on the master end and the shield pin on the power supply unit end.

B.3.3 Connection notes

For possible connection configurations and applications of the power supply unit in relation to the expansion module SGACQA, see appendix D.

appendix C The adapter card CANADT

C.1 GENERAL INFORMATION

The card CANADT (Fig. C.1) is a module used to facilitate connections between:

- power supply unit CANPWA
- acquisition module SGACQA
- peripheral CP6V16 or Master

This is useful for those applications where the module SGACQA is not in a position that can be easily interfaced or where shunts/stubs of the CAN communication line are necessary.

In practice it provides a link between SGACQA and CP6V16 (or master), carrying the communication signals BC_H, BC_L, GND (as well as the Vdc voltage to power the SGACQA boards).

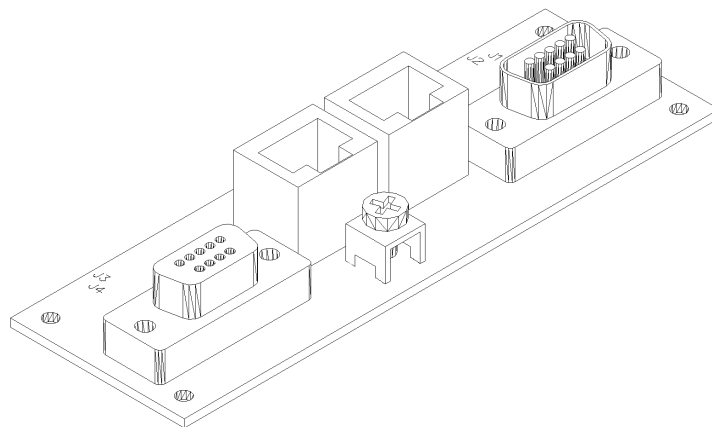


Fig. C.1 CANADT adapter

Compact size and open-frame construction on DIN guide or support are further features of the CANADT card.

C.2 INSTALLATION NOTES

C.2.1 Description of the communication connectors

There are 4 connectors in the CANADT card, which offer the possibility of interfacing the signals BC_H, BC_L, GND and Vdc between

- power supply unit CANPWA
- network master
- peripheral board (CP6V16)
- expansion modules (e.g. SGACQA)

AUX-COM IN connector

This acts as link for the BC_H, BC_L, GND signals, but also VDC. It should be noted that unlike CANPWA it also acts as link for the power supply voltage.

CAN RJ45-BP-V signals 8-pin connector from SGACQA:

PIN	SIGNAL	DESCRIPTION
1	VCC	Power supply output
2	VCC	Power supply output
3	VCC	Power supply output
4	GND	Power and signal ground
5	GND	Power and signal ground
6	GND	Power and signal ground
7	BC_H	Auxiliary CAN high
8	BC_L	Auxiliary CAN low

AUX-COM OUT connector

This serves to carry the BC_H, BC_L, GND signals to an expansion module (e.g. SGACQA). The necessary 7.5V power supply is also carried to the actual expansion module.

CAN signals and power supply towards SGACQA RJ45-BP-V 8-pin connector:

PIN	SIGNAL	DESCRIPTION
1	VCC	Power supply output
2	VCC	Power supply output
3	VCC	Power supply output
4	GND	Power and signal ground
5	GND	Power and signal ground
6	GND	Power and signal ground
7	BC_H	Auxiliary CAN high
8	BC_L	Auxiliary CAN low

CMZ can supply the patch cable.

CAN_IN connector

CAN DSUB 9-pin female connector from preceding node:

PIN	SIGNAL	DESCRIPTION
1	-	Internally connected to pin 1 of CAN_OUT
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	Internally connected to pin 4 of CAN_OUT
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	Internally connected to pin 8 of CAN_OUT
9	-	Internally connected to pin 9 of CAN_OUT

CAN_OUT connector

CAN DSUB 9-pin male connector towards next node:

PIN	SIGNAL	DESCRIPTION
1	-	Internally connected to pin 1 of CAN_IN
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	-	Internally connected to pin 4 of CAN_IN
5	CAN_SHLD	CAN shield
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	-	Internally connected to pin 8 of CAN_IN
9	-	Internally connected to pin 9 of CAN_IN

N.B. Connection of the shield

The **cable shield** must be connected to the shield pin (i.e. No. 5) of the connector when connecting the CANADT card to a CMZ CANopen peripheral or to the power supply unit CANPWA. **Only** when connecting **master and CANADT** should the cable **shield** be connected to the connector **shell** on the master end and the shield pin on the card end.

C.2.2 Connection notes

For possible connection configurations and applications of the module in relation to the expansion module SGACQA, see appendix D.

appendix D Notes for connecting expansion modules

D.1 GENERAL INFORMATION

There are basically three applications that use the expansion module SGACQA:

- **linear weigher**, in which the peripheral CP6V16 powers up to two expansion modules (Fig. D.1)
- **general industrial weigher**, in which more than two SGACQA may be powered from a general Master and with the help of the power supply unit CANPWA (described in the previous appendix) and if necessary an adapter card (Fig. D.2)
- **multiple heads with PP**, in which a similar configuration to that of the linear weigher is envisaged, but with a new peripheral that powers an acquisition board (Fig. D.3).

D.1.1 Linear weigher

Two weigher boards SGACQA may be used at the most in this application. As can be seen in the figure, a connection is made from the CAN-OUT connector of a general master to the CAN-IN connector of the board CP6V16 communicating through the CANopen communication protocol. Using the auxiliary connector AUX_COM of the CP6V16, communication is then made through AUX_COM_IN with the first SGACQA, at the same time carrying its power supply. From here it is then possible to communicate with (and power) another SGACQA.

Three cables of the flat and three pins of the connector RJ45 are used to carry the power supply and the GND in order not to have excessive voltage drops with the increase in distances, which could give rise to lower than required minimum power supply voltages for the acquisition boards. In reality the problem is greater when there are more than two boards (see general industrial weigher), while in this case lengths are possible of up to 10 m between the CP6V16 and the first SGACQA and between the two SGACQA.

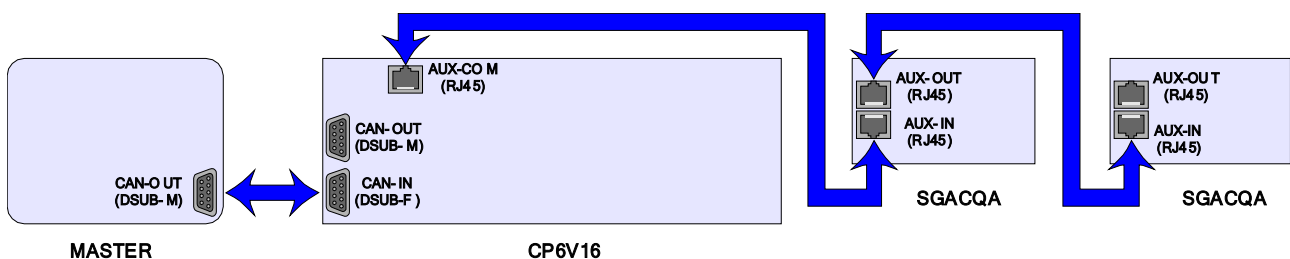


Fig. D.1 Linear weigher

D.1.2 General industrial weigher

This application requires the use of more than two SGACQA and therefore the power supply unit CANPWA described in appendix B.

The figure D.2 and D.3 show all the possible ways of connecting a Master, SGACQA boards and power supply unit CANPWA.

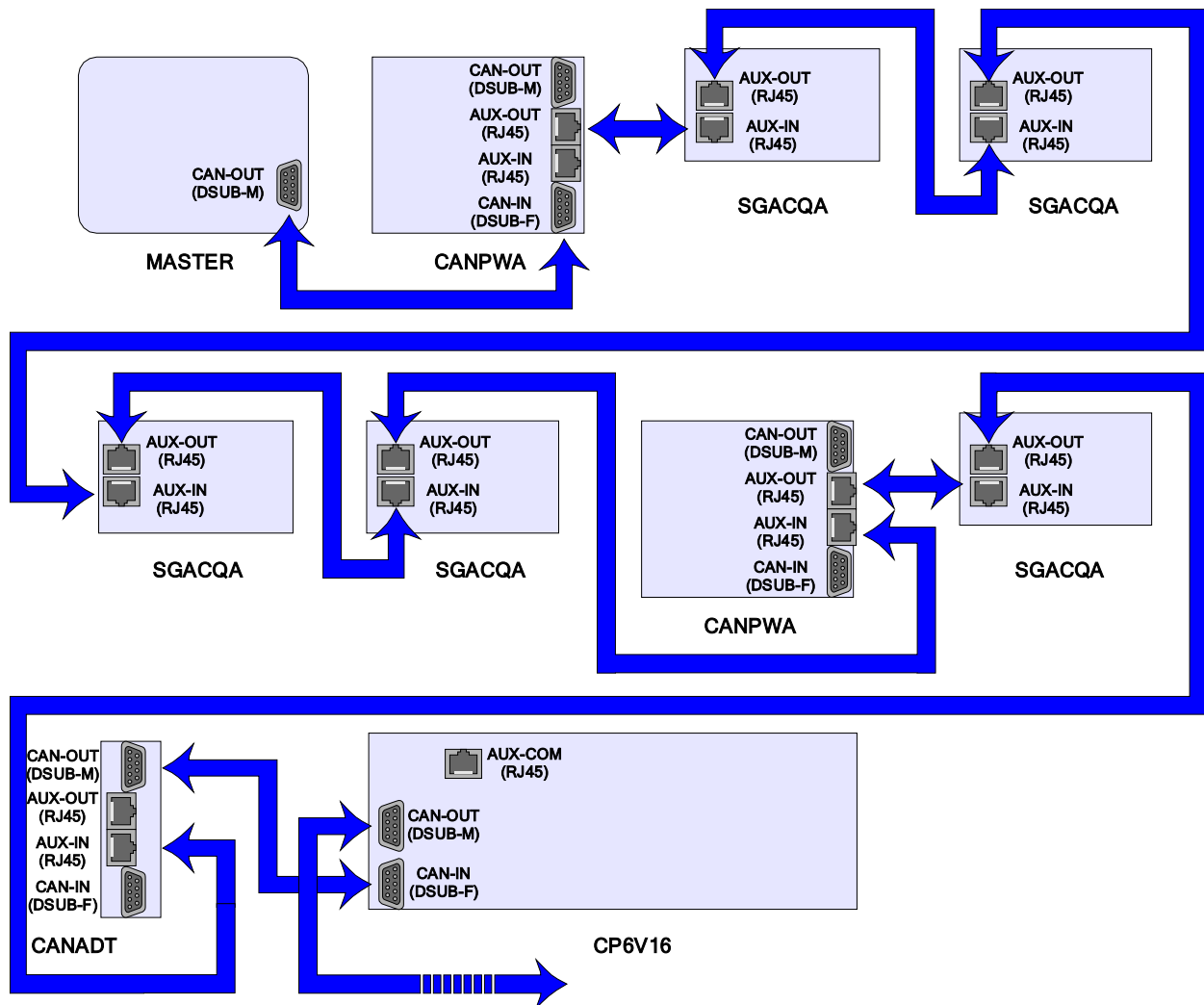


Fig. D.2 Industrial weigher

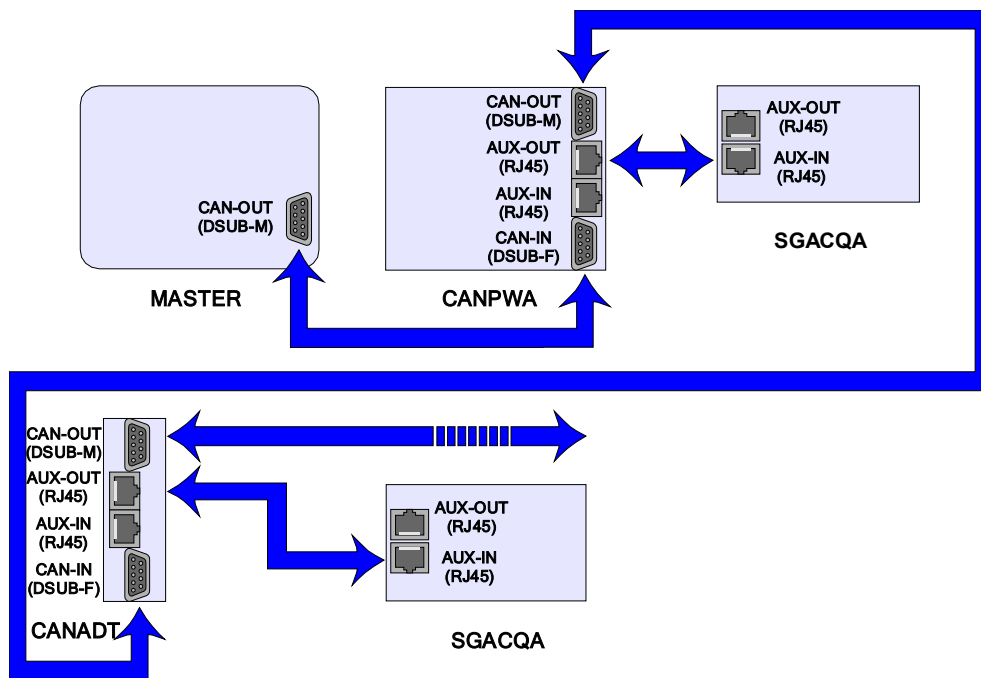


Fig. D.3 Industrial weigher with shunts/stubs

The figure D.2 shows the application in which the SGACQA boards are connected without requiring shunts or stubs. They are powered by the power supply unit CANPWA as long as their number and the distances involved allow it (see below). As soon as the supply voltage is insufficient to power a SGACQA, a new power supply unit may be connected and other acquisition boards applied. A CP6V16 may also be connected through the card CANADT (appendix C).

The figure D.3 instead shows the application in which shunts or stubs are necessary for accessing the SGACQA modules. The adapter card CANADT (appendix C) is used. As can be seen, the stubs must be **shorter than 0.3m** otherwise there is the risk of the actual network not working.

The power supply unit CANPWA not only carries the communication signals BC_H, BC_L and GND, but also provides the power supply for up to 16 SGACQA boards (limit set by the maximum current output of the power supply unit CANPWA). It is important, however, to bear in mind that there is a physical limit to the maximum length of the cables connecting the power supply unit and the last SGACQA board. The voltage drop caused by the current on the conductor cables increases with the length of the actual cable and with the number of connected boards. Three wires have been used for Vcc and three for GND, thereby reducing the resistance of a cable by three times in order to obtain relatively long lengths.

Using the ASSMANN patch cable series A-MCS 80, the resistance per unit of length of three of its wires in parallel is equal to $R_L=0.05\Omega/m$. Every SGACQA absorbs 100mA and the formula to calculate the **voltage drop** along the whole line (from the power supply unit to the last SGACQA) in relation to the maximum number of modules and the lengths involved is therefore

$$V_R=[L_0*N+ L_{12}*(N-1)+ L_{23}*(N-2)+.....+ L_{(N-1)N}] *R_L* 2*0.1 \quad (a)$$

where

$$R_L=0.05\Omega/m$$

L_0 is the distance between the power supply unit CANPWA and the first SGACQA board

L_{XY} is the distance between the X-nth SGACQA and Y-nth SGACQA

N is the number of the SGACQA

0.1 is the consumption of one board (100mA)

The following condition is therefore necessary for correct power supply of one SGACQA

$$V_R \leq 1.5V \quad (b)$$

Two significant examples are given to give a clearer idea; let's take the case of one single board connected to the power supply unit: $N=1$

(a) and (b)

$$V_R = R_L * 2 * L_0 * 0.1 \leq 1.5V$$

gives

$$L_0 \leq 1.5 / (2 * 0.05 * 0.1) = 150m$$

One SGACQA board may be connected to the power supply unit CANPWA at a distance of up to 150m.

In the case of 16 powered boards (maximum) at an equal distance apart L with the power supply unit CANPWA also at the distance L from the first SGACQA:

$$V_R = 0.1 * R_L * 2 * L * [16 + 15 + 14 + \dots + 1] \leq 1.5V$$

giving

$$L \leq 1.1m$$

If the distances between the boards are different, the general formula must be used and the condition checked. As can be seen from the first figure, once the maximum number of boards that can be powered in relation to the distances involved has been calculated, if (b) is not obtained then the use of another power supply unit is necessary to provide a "strengthened" voltage for the excess modules, thereby ensuring the links for the BC_H, BC_L and GND signals.

For applications in which the SGACQA board is not easily accessible, an adapter card CANADT (see appendix B) has been created, which allows stubs on each SGACQA board. It should be noted that the stub **must not exceed 0.3m**, as required by the CAN protocol.

In this situation the power supply and the signals are carried by paired cables with DSUB connectors. Depending on the cable used, the resistance varies per unit of length R_L , which should be inserted in the formula (a). The table below gives the values for the three recommended cables.

TYPE OF CABLE	RESISTANCE PER UNIT OF LENGTH
8132 BELDEN ELECTRONICS	0.3
2170 264 Unitronic BUS CAN LAPP KABEL	0.13
2170 273 Unitronic BUS CAN LAPP KABEL	0.15

NB the values also take into account the contact resistance of the connectors

appendix E. ELECTROMAGNETIC COMPATIBILITY

E.1 INTRODUCTION

The boards or cards dealt with in this guide comply with the specifications of the directive on electromagnetic compatibility 89/336 EEC, which in the industrial sphere entails application of the following European standards:

1 **EN 50081-2 (standard on emission)**

1 **EN 50082-2 (standard on immunity)**

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

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

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

The boards and cards dealt with in this guide have been designed to be safe under the following conditions:

- | | |
|------------------------------|--|
| 1 Ambient temperature | 5 °C 1 45 °C |
| 1 Relative humidity | 5 % 1 95 % without condensation |
| 1 Degree of pollution | II |
| 1 Altitude | 1 2000 m above sea level |

ORDER CODES**CANOPEN PERIPHERALS****1 - Peripheral 16IN /16OUT CP32D0.000**Order code:

CP32D0.xyz with:

x = 0	RS232 port not implemented
x = 1	RS232 port implemented
y = 0	future expansions (BC-BUS not implemented)
z = 0	screw connectors
z = 1	spring connectors

2 - Board 6 mains slicers, 8IN/8OUT..... CP6V16.010Order code:

CP6V16.xyz with:

x = 0	RS232 port not implemented
x = 1	RS232 port implemented
y = 1	BC-BUS implemented
z = 0	screw connectors
z = 1	spring connectors

3 –BOARD with encoder input, analog output, 4IN/4OUT...CPENCA.00Order code:

CPENCA.x with:

x = 0	with DIN rail support
x = 1	without DIN rail support
y	future expansion

EXPANSION MODULES / ACCESSORIES

1 - Load cell acquisition.....SGACQA.0

Order code:

- x = 0 with DIN rail support
x = 1 without DIN rail support

2 - Accessory for cover the SGACQA module.....SGACOV

3 - Power supply unit for weigh acq. modules.....CANPWA

4 - Adapter module.....CANADT