Techno Trade

TBOX

-

Technical Specifications

&

Cabling

version : UK 6.03

Disclaimer

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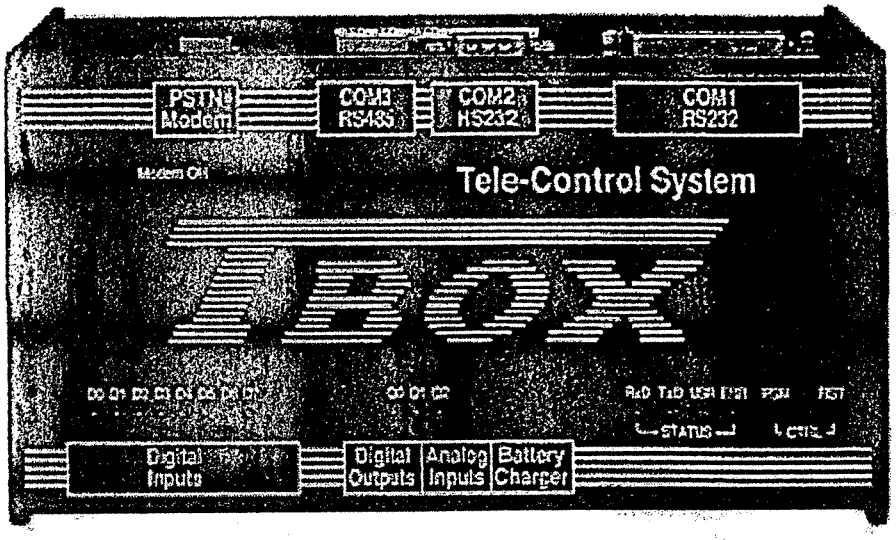
CPU

CPU	Ref: CPU-XXX



Technical Specifications

General Specifications

- 32 K of Flash EPROM memory for program.
- 32 K of Flash EPROM memory for HTML & backup of document.
- 64 K of Flash EPROM memory for Loader and Operating System.
- 128 K of RAM memory for data.
- Temperature:
  - Stocking environment: -20°C to 70°C.
  - Working environment: 0°C to 50°C (w/o extension rack). Maximum temperature depends on consumption.
- Built-in battery charger, consumption: **90 mA**. **(For lead battery only)**.
- RTC clock saved by Lithium battery (10 years).
- Built-in power supply for the TBox Terminal (COM2).
- Surface mount, CMOS technology.
- Over surge protection to 4kV, conforming to IEC801-4 standard.
- Degree of protection: **IP10**.
- Maximum consumption:
  - Without internal modem: **120 mA**.
  - With internal modem: **150mA**.
- DIN rail mounting.
- Dimensions (L X H X W): **198 x 94 x 106** mm (without holding clips and connectors).

CPU – POWER SUPPIES

CPU – Main Power supplies

3 models of main power supplies are available:

- 230 VAC.
- 48 VDC.
- -48 VDC (usually used for TELECOM applications).

If the current is insufficient for the cards and I/Os needed, you can use a Booster (see next).

230VAC CPU power supply

- Integrated to CPU with LED indication of presence of 15 VDC after the transformer.
- Incoming voltage: **230 VAC.**
- Outgoing voltage: **13.8 VDC.** Can be used to power I/Os.
- Maximum output current for cards and I/Os: **1 A**
- Primary fuse: **500 mA.**
- Protection against short circuit.

48VDC CPU power supply

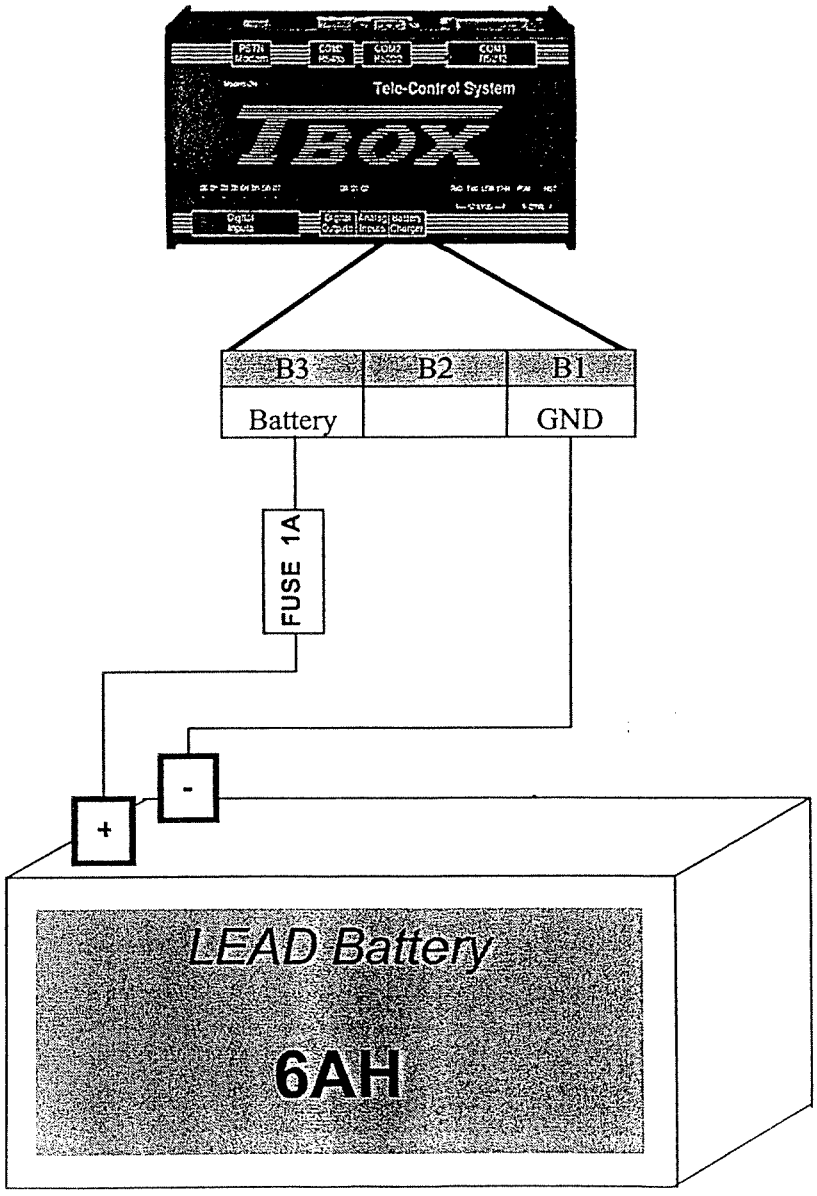
- Incoming voltage: **20 to 56 VDC** to a DC/DC converter.
- **No isolation** between Input and Output stage of the DC/DC converter.
- Output voltage of the DC/DC converter: **14.4VDC.**
- Efficiency of the DC/DC converter: **80 %.**
- Outgoing voltage: **13.8 VDC.** Can be used to power I/Os.
- Maximum output current for cards and I/Os: **2 A.**
- Primary fuse: **1,6 A.**
- Protection against short circuit.

-48 VDC CPU power supply

- Incoming voltage: **-24 to -60 VDC.**
- **No isolation** between Input and Output stage of the DC/DC converter.
- Outgoing voltage: **13.8 VDC.** Can be used to power I/Os;
- Total current available: **0.6 A.**
- Primary fuse: **1 A.**
- Protection against short circuit.

CPU - External Battery

- Provides power supply if the main power supply breaks down.
- Must be a lead battery. For example **6 AH**.
- The charger is included in the CPU.
- Connections are **B3 (+)** and **B1 (-)**.

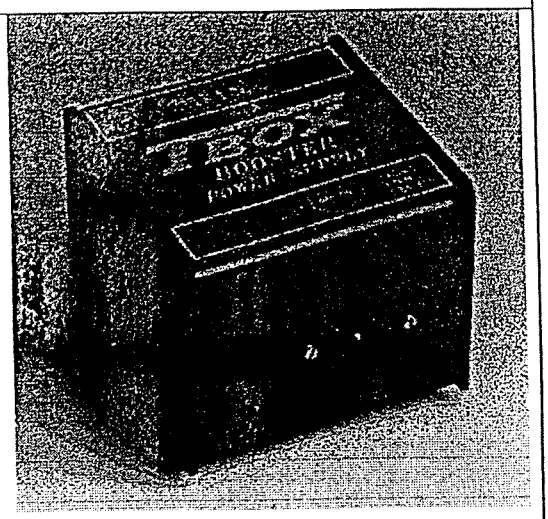


CAUTION : The '+' of the battery must be protected by an external 1 A fuse.

BOOSTER POWER SUPPLY

Ref: CPU-BOOST

Enables powering of **additional racks** of I/Os if Power supply of the CPU is insufficient.
It can be inserted directly between extension racks.
If a **cable** is needed to connect together 2 extension racks, a **Booster must be used** between the cable and the farest extension racks. In that particular case, the cable must be as short as possible (**MAX: 1.5m**) and shielded on booth sides (Please call your local distributor).

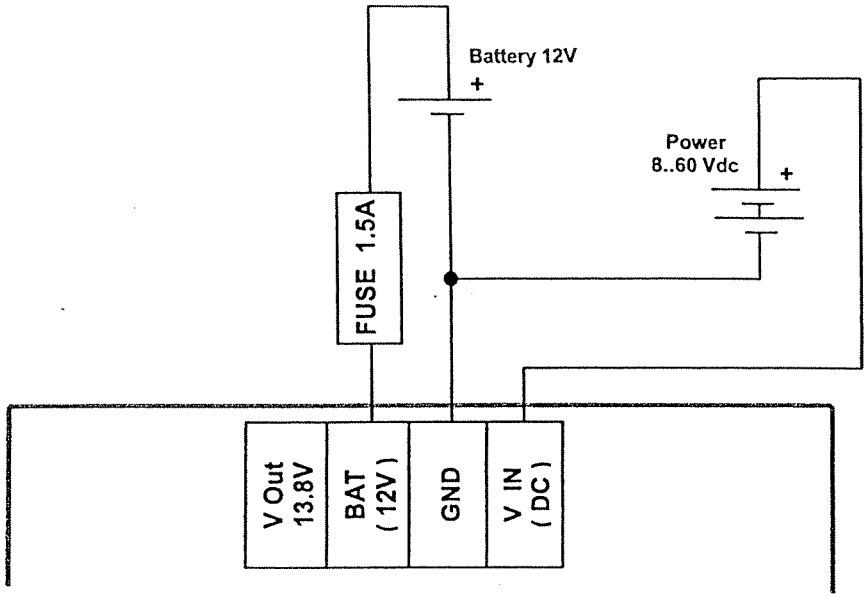


Technical Specifications

- LED indication of 13.8VDC presence.
- Incoming power: each Booster is equipped to be powered in VAC **OR** in VDC.
  - Incoming VAC: use the **230 VAC** triangle connector.
  - Incoming VDC: **18 to 60 VDC**. Use the connections **'V in'** and **'GND'**.
- Outgoing power: 13.8 VDC. on pin: **'V out'** and **'GND'**. It can be used to power I/Os
- Maximum output current: **1,5 A**.
- Built-in battery charger, with constant voltage charge: **90mA**.(**for lead battery only**) on connections **'BAT'** and **'GND'**.
- Primary fuse: **0.5 A**.
- Secondary fuse: **1.5 A**.
- Assures a 'rebufferisation' of all bus signals for I/Os racks.
- Automatic detection of racks located downstream.
- As opposed to a normal power supply, the booster can be powered without damaging the CPU and the racks between these two elements. Also, a lack of power to the booster does not adversely affect the CPU and the racks between these two elements.
- In case of a power break of the CPU and not of the Booster, the output after the former will stay in the state where they were before the power break.
- Surface mount, CMOS technology for the rebufferisation section.
- Degree of protection: **IP20**.
- Dimensions (H X L X W): **112** x **94** x **106** mm (without holding clips and connectors).

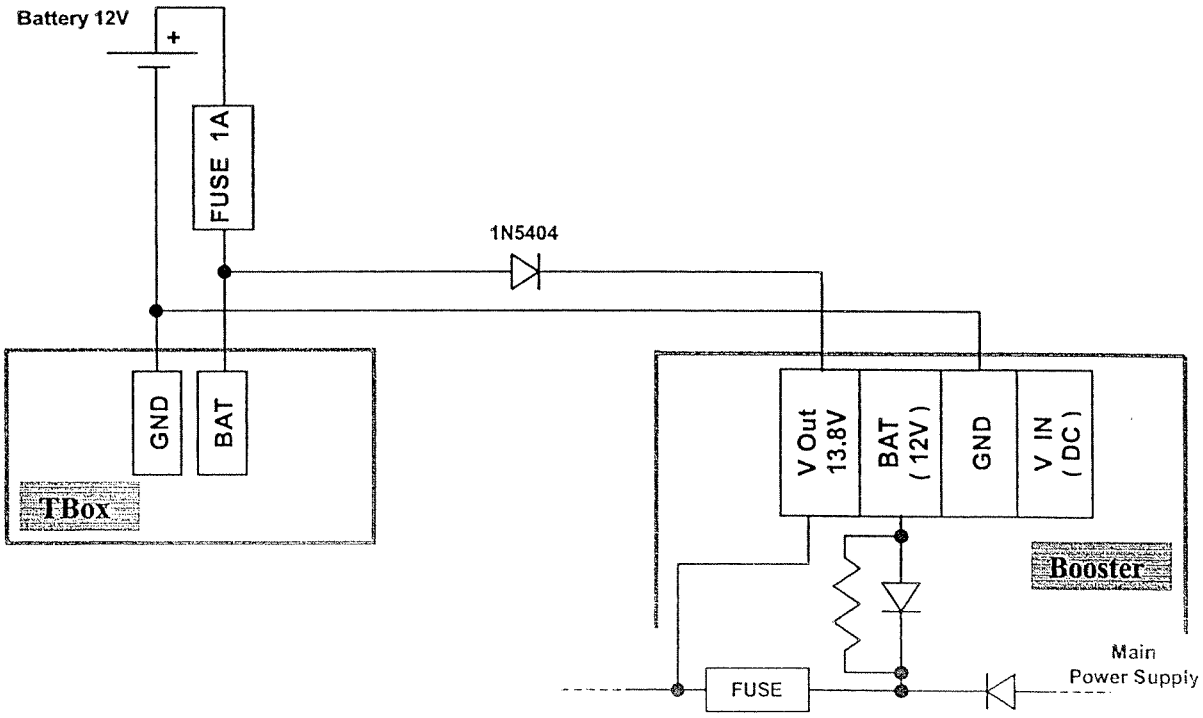
Cabling

- **Incoming DC and battery to Booster.**



A Battery connection to a Booster must **absolutely be protected by a FUSE (1.5 A)**

- **Cabling to the battery of a CPU.**



If an external battery of a TBox is used as back-up voltage for a Booster, it must be connected through a **diode** in serie as explained in the schematic. The internal circuit of the Booster explains the reason of cabling to '**V Out**'.

CPU – COMMUNICATION PORTS

COM 1 (RS232)

Introduction

The port COM 1 of the TBox is a **non standard** RS232 port, it means that gender changer cannot be used to change from DB9 to DB25 and reciprocal..
COM1 is used for local connection at speed from 200Bps to 115200Bps to PC, Printer, External modems, or any local equipment to a distance up to 12 meters.

Pin out of COM1:

Pin	Description
2	TxD
3	RxD
4	RTS
5	CTS
7	GND
8	DCD
20	DTR
25	12 VDC

Signals vary from -9VDC to + 9VDC.

Connecting TBox to a PC

TBox - COM 1			PC - DB 9	
TxD	2	——	2	RxD
RxD	3	——	3	TxD
RTS	4	⌐	8	CTS
CTS	5	⌙	7	RTS
GND	7	——	5	GND

TBox - COM 1			PC - DB 25	
TxD	2	——	3	RxD
RxD	3	——	2	TxD
RTS	4	⌐	5	CTS
CTS	5	⌙	4	RTS
GND	7	——	7	GND

Connecting TBox to an external modem

TBox - COM 1		MODEM - DB 25	
TxD	2	2	TxD
RxD	3	3	RxD
RTS	4	4	RTS
CTS	5	5	CTS
GND	7	7	GND
DCD	8	8	DCD
DTR	20	20	DTR

COM 2 (RS232)

Introduction

The port COM 2 of the TBox is a **non standard** RS232 port, it means that gender changer cannot be used to change from DB9 to DB25 and reciprocal..
COM2 is used for local connection at speed from 200Bps to 115200Bps to PC, Printer, External modems, or any local equipment to a distance up to 12 meters.
According to the type of connection (local or external modem), the pin out is different:

Pin Out of COM2

Pin out of COM2 (local):

Pin	Description
2	TxD
3	RxD
5	GND
7	CTS
8	RTS
9	12 VDC

Pin out of COM2 (external modem):

Pin	Description
2	TxD
3	RxD
5	GND
7	DCD
8	DTR
9	12 VDC

Signals vary from -9VDC to + 9VDC.

Connecting TBox to a PC

TBox - COM 2		PC - DB 9	
TxD	2	2	RxD
RxD	3	3	TxD
GND	5	5	GND
CTS	7	7	RTS
12 VDC	9	8	CTS

TBox - COM 2		PC - DB 25	
TxD	2	3	RxD
RxD	3	2	TxD
GND	5	7	GND
CTS	7	4	RTS
12 VDC	9	5	CTS

Connecting TBox to a Printer

TBox - COM 2		PRINTER - DB 25	
TxD	2	3	RxD
RxD	3	2	TxD
RTS	8	5	CTS
CTS	7	4	RTS
GND	5	7	GND

Connecting TBox to an external modem

TBox - COM 2		MODEM - DB 25	
TxD	2	2	TxD
RxD	3	3	RxD
		4	RTS
		5	CTS
GND	5	7	GND
DCD	7	8	DCD
DTR	8	20	DTR

Connecting TBox to a GSM DATA FALCOM

TBox - COM 2		GSM A1 - DB 9	
TxD	2	3	TxD
RxD	3	2	RxD
GND	5	5	GND
DCD	7	1	DCD
DTR	8	4	DTR
12 VDC	9	7	RTS

Connecting TBox to a GSM DATA WAVECOM

TBox - COM 2		WAVECOM - DB15 - HD	
TxD	2	2	TxD
RxD	3	6	RxD
GND	5	9	GND
DCD	7	1	DCD
DTR	8	8	DTR
12 VDC	9	12	RTS

COM 3 (RS485)

The RS 485 connection allows network configuration to other TBox's, remote modules and/or any other device equipped with an RS 485 connection.

Technical specification

- Communication Half Duplex with **3 wires** [TR (+); TR (-); GND]. Note: on some TBox Units, TR+ and TR- are noted as **A** and **B**.
- Speed : from **200Bps to 115200Bps**
- Multi point connection in a **serial topology** (Star topology is not allowed).
- Maximum voltage TR (+), TR (-) in common mode: **-7V and +12V.**
- Typical voltage of TR (+) and TR (-) in relation to GND: **0V and +5V.**
- Minimum received voltage in the gamma **-7V to +12V**:
- Level TR (+) greater than (>) 200mV with regard to TR (-) = TRUE
- Level TR (+) less than (<) 200mV with regard to TR (-) = FALSE
- Maximum number of stations: **32 TBox.**
- The RS485 interface is **not isolated** from the Power Supply of the TBox; this means that in case of connection with TBox on different sites, with different GROUND voltages, an isolator must be use (Please call your local distributor).

Cabling

- 100 Ω to 130 Ω shielded and **twisted pair** with 1 pair for A and B.
- Capacitance less than **60pF/meter.**
- Minimum section: **0.22mm²**. Example of reference: Li2YCY (TP) 2 * 0.22mm².
- Relation length of cable versus data rate: **1200m/100Kbps**. This distance can be increased if the speed is reduced. One must check that the cable used is of good quality. In fact, due to the capacitance of the cable, the delay of the signal is of 1.5 nS/30cm. In practice, it is possible to work at **9600Bps on a 10-Km network.**
- **Termination of 120** at each end of the network. In the majority of the cases, they are not necessary, but they can increase the quality of the signals for long distance connections.

COM 4 (modem)

PSTN Lines

- Modes supported: **V21** (300 Bps), **V22** (1200 Bps), **V22bis** (2400 Bps) and V23 (Minitel).
- Auto-mode, Auto-answer, Auto-dial, DTMF/Pulse.
- Internal modem Off-hook LED indication.
- Built-in speaker with the modes: Always On, On until CD, Always Off.
- Recognition and sending out of signals (DTMF).

LEASED Lines

- Modes: **Multi points** (Maximum 10 TBox stations) or **point to point**.
- Maximum distance: 50km.
- Insertable into CPU housing.
- Point to point (V22-DPSK-1200bds) communication or multi points (V23-FSK-1200bds)

Cabling

The 2 wires of the telephone are directly connected to COM4. There is no polarity. Usually, on RJ11 connectors, the 2 wires in the middle are the TEL lines.

COM 5 (Modem Network)

2-wires network communications between several TBox units under ModBus protocol. The modem works only on PTT Leased Lines or private lines.

- Modes: **Multi points** (Maximum 10 TBox stations) or **point to point**
- Maximum distance: **50km**
- Insertable into CPU housing
- Point to point communication in **V22-DPSK-1200bds.**
  Multi points communication in **V23-FSK-1200bds.**
- Input impedance = **600 Ω**
- Minimum Rx level = **25mV pp**
- Maximum Tx level = **3V pp**
- Average Tx level = **1 V pp** (Typical - default adjustment)
- Adjustment potentiometer of Tx level on the CPU. (Default: Tx at average level. To decrease the Tx level turn clock wise, to increase level turn counter clock wise) .
  The utility MODCAL.EXE in the directory of TWinSoft allows to adjust the level according to the distance and the cabling (see next).
- Consumption: **30mA.**
- Surface mount, CMOS technology.

Cabling

A RJ 11 connector is used (4 wires connector). The wires must be inserted to the 2 points in the middle of the connector. There is no polarity.

The adjustment.

The utility software MODCAL.EXE (in the directory of TWinSoft) allows to test the lines used and to adjust the level of the transmission of the Network modem according to the quality of the lines. It is send by a PC to the TBox which generates a sinus on the Network modem.

The sending of a Carrier (sinusoidal oscillation at a fixed frequency) carries out a modem transmission. When the Carrier is established, it is modulated according to the information's to send. Therefor, a modem is an analog transmission and it is very important to adjust the level of the Carrier to insure proper data's transmission.

Before starting MODCAL, check that the OS of the TBox is stopped:

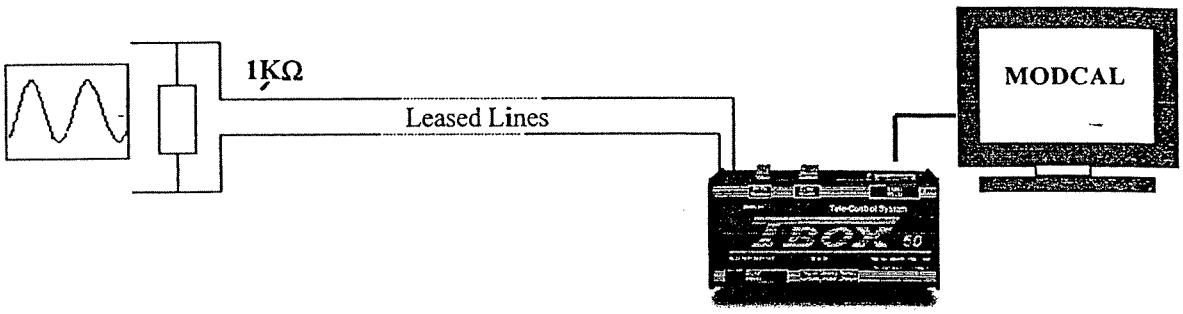
- Press and maintain the button PGM.
- Press and release the button RST.
- Let TxD and RxD flash 4 times.
- Release the button PGM.
- At this moment, the LED USR is ON and the LED ERR flashes.

MODCAL is launched from a DOS session, specifying the COM port of the PC used to communicate with the TBox.

Example : `MODCAL COM1`

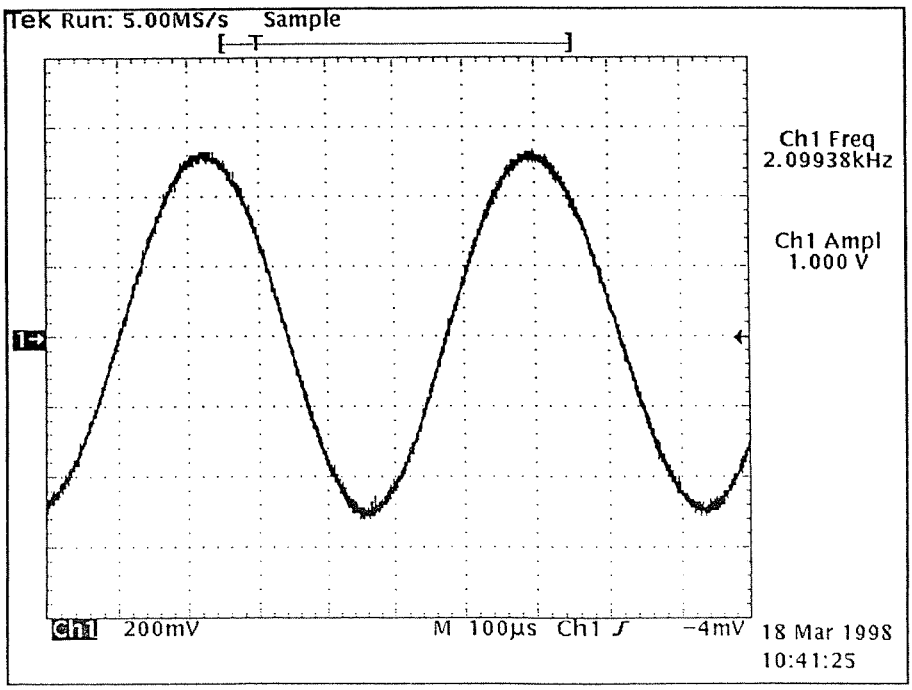
NOTE: when the test is finished, press the button RST to restart the TBox.

When MODCAL is correctly sent, it returns the message « done » and generate a sinus of 2100 Hz through the modem Network of the TBox. On the other end, where the other TBox will be placed, we put a charge (1KΩ resistor) to simulate its impedance.



Adjust the potentiometer of the Network modem, indicated "LEVEL" on the CPU, beneath the connector of the digital inputs. This potentiometer adjusts the level of transmission. You must obtain a 1V peak to peak signal at the other end.

Example of sinus :



For a **point to point** network, this adjustment must be carried out for both CPU's.
For a **multipoints** network, this adjustment must be carried out for the Master, measuring the signal at the farest place of the network and for each Slaves, measuring at Master's place

COM 5 (PCMCIA)

3 models of PCMCIA modems are available:

- PSTN modem.
- ISDN modem.
- GSM modem.

WARNING : PCMCIA modems are Hot swapable, but TBox needs to be powered OFF/ON if a card is changed with TBox powered.

PSTN modem Technical Specifications

- PCMCIA **slot II** type.
- Consumption: maximum **150 mA**.
- Modes supported: **V22** (1200 Bps), **V22bis** (2400Bps), **V23** (Minitel), **V32** (9600 Bps), **V32bis** (14400 Bps), and as an option **V34** (33600Bps).
- Factory configuration:

B0	if used in V22 mode
W2	result code is DCE rate
&C1	normal CD mode
&D2	normal DTR mode
%C0	NO compression
\N0	Normal mode
&K0	No flow control
S0=2	Answer incoming call after 2 rings

It can be checked with the help of 'Terminal' mode in the 'Communication' menu of TWinSoft. To access the configuration, the **knowledge of modem configuration is needed**.

ISDN modem Technical Specifications

- PCMCIA **slot II** type
- Consumption: maximum **150 mA**.
- B channel used.
- Mode **V120**.
- Factory configuration:

S122=2	V120 mode
S125=2	V120 mode
S0=2	Answer incoming call after 2 rings

It can be checked with the help of 'Terminal' mode in the 'Communication' menu of TWinSoft. To access the configuration, the **knowledge of modem configuration is needed**.

GSM modem Technical Specifications

- PCMCIA slot II type
- Consumption: maximum **300 mA**.
- Power Class 4 (2W)
- Transfer rate up to 9600 Bps
- Factory configuration:

B0	if used in V22 mode
W2	result code is DCE rate
&C1	normal CD mode
&D2	normal DTR mode
%C0	NO compression
%E0	disable auto-retrain
\N0	Normal mode
&K0	No flow control
S0=1	Answer incoming call after 2 rings
+CBST=7,0,0	mode V32 (9600 Bps), without RLP

It can be checked with the help of 'Terminal' mode in the 'Communication' menu of TWinSoft. To access the configuration, the **knowledge of modem configuration is needed.**

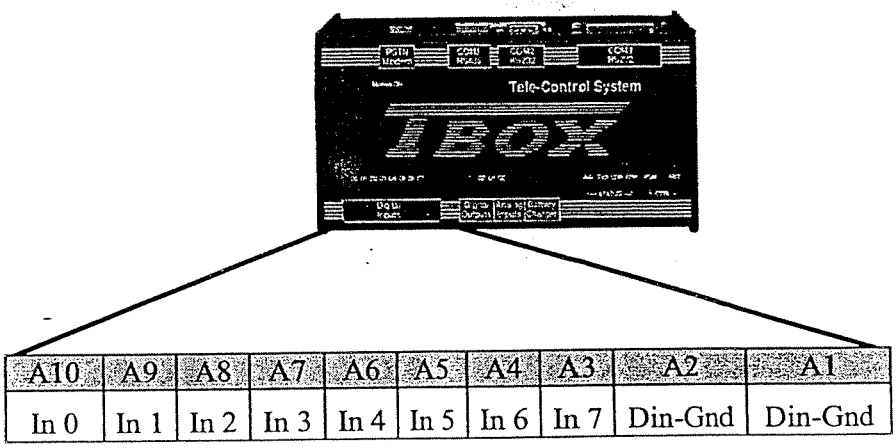
All models are configured with factory settings to work properly with TBox. If needed, specific configurations can be defined in Modem profiles menu.

CPU – I/Os

CPU - 8 Digital Inputs

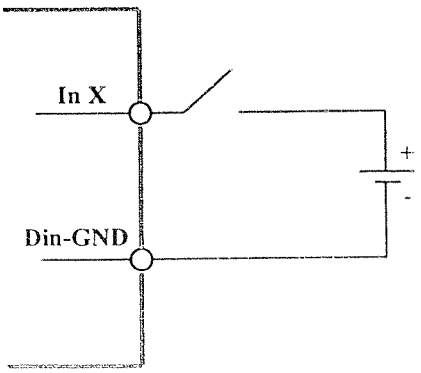
Technical specifications

- **8 inputs** available.
- **Ground is common** and isolated from the main DC power of the CPU.
- Individual indicative **LED**'s on front panel
- Voltage range of inputs: **0 to 20 VDC**
- Activation threshold: **10 VDC**.
- Resistance per input: Min. **1.5 KΩ**.
- Isolation to 4 kV by group of 8 inputs.
- Counting capability: **100 Hz** (warning: bounce suppression not integrated).



A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
In 0	In 1	In 2	In 3	In 4	In 5	In 6	In 7	Din-Gnd	Din-Gnd

Cabling



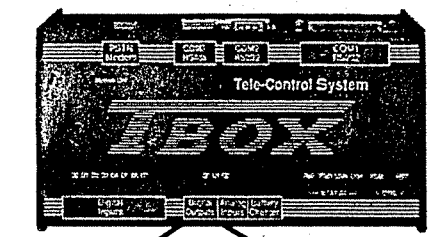
GND is common to the eight inputs and isolated from the 0V. of the CPU.

The +13.8 VDC output of the CPU can be used to power the inputs (D1 – D2).

CPU - 3 Digital Outputs

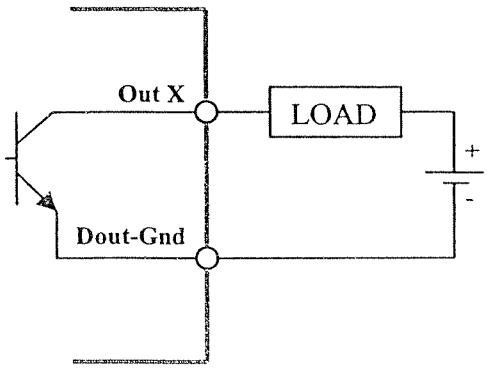
Technical specifications

- 3 NPN **transistors** outputs with open collector output. **Current sinking** outputs.
- **Ground is common** and isolated from the main DC power of the CPU
- Individual **LEDs** on front panel.
- Maximum voltage supported: **60 VDC**.
- Maximum current: **200 mA** total. (Common over surge protection to 3 outputs).
- Isolation to 4 kV by group of 3 outputs.
- In case of inductance charge (relay inductors, etc.), **NO internal protection diodes**.



B10	B9	B8	B7
Dout-Gnd	Out 0	Out 1	Out 2

Cabling



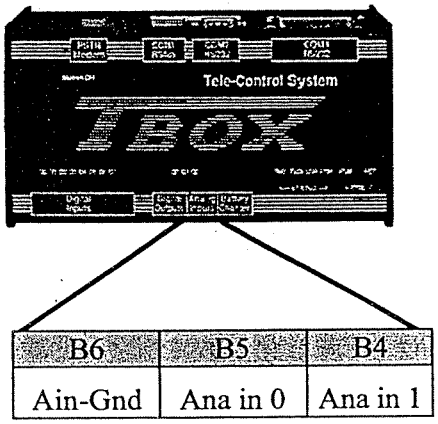
GND is common to the three outputs and isolated from the 0V. of the CPU.

WARNING : if the digital outputs of the CPU are used to lead inductive charges (relays, coils, etc.) an external protection diode must be provided in parallel with the charge.

CPU - 2 Analog Inputs

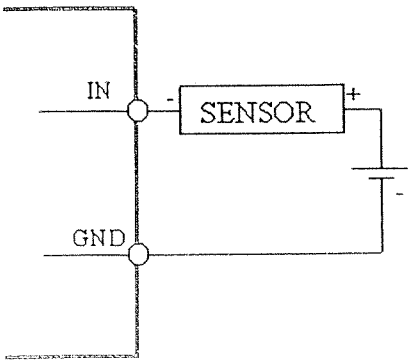
Technical specifications

- **2 analog inputs** available.
- **Ground is not isolated** from the main DC power of the CPU.
- **0-20 mA or 4-20 mA** closed loops.(with software conversion according to the type of input selected in the Tag definition).
- **8 Bits** Analog/Digital converter (256 steps or 0.4% precision).
- Impedance per input: **240 Ω**.
- Guaranteed sampling frequency according to the cycle time of Ladder with a max. frequency of 25 Hz.
- Type of measurement is ground-referenced and current to voltage converter.



Cabling

- **Passive input with 2 wires sensor:**

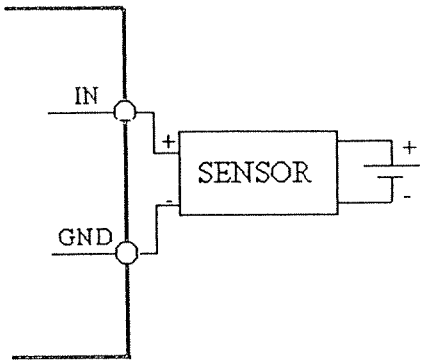


With this cabling you have to check the voltage needed by the Sensor.

Example:

The power supply used for the sensor is 12 VDC. At 20 mA on the input resistor of 240 Ω, the voltage is 4.8 volts. You still have 7.2 volts for the sensor. Check that it is sufficient. If not, use a Sensor that accepts a higher voltage (24 VDC).

- **Passive input with 4 wires sensor:**



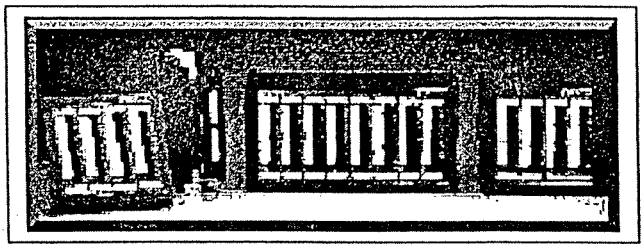
GND is common to the two inputs and to the power of the CPU.

EXTENSION RACKS

Extension Racks (4 & 8 cards)

Ref: BL1-4 (Rack for 4 Cards)
Ref: BL1-8 (Rack for 8 Cards)

Racks are local extension blocks for insertion of extra I/O cards. There are 2 models:
- 4 I/O cards rack.
- 8 I/O cards rack.



Technical Specifications

Racks are locally connected to TBox. The first one is connected to the right side of the TBox, to the DB25 connector. The next racks are connected one in the other on the same way. Each rack has its own address (see jumper selection next).

- Using cable between racks.

If the cabinet where the TBox is placed is not large enough, you can place the racks on 2 rails, connecting the last rack of the first rail to the first rack of the second rail with a cable. Please call your distributor for the cable.

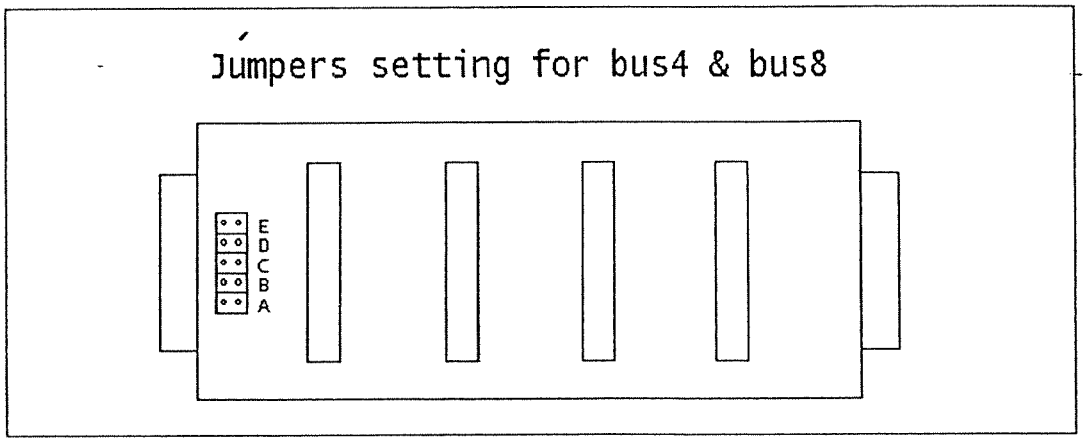
- **Only one cable can be used.**
- **A booster is needed after the cable** (...rack → CABLE → BOOSTER → rack...).
- **The total length of racks & cable cannot exceed 3 meters.**

- Front panel in Red Plexiglas.
- Easy front opening for card changing. (WARNING: **not Hot swapable**, Power must be OFF).
- Surface mount, CMOS technology.
- Degree of protection **IP20**.
- Consumption: **5mA**.
- Dimensions of Rack4:
  - 112 x 108 x 94 mm (w/o holding clips and connectors).
  - 112 x 133 x 94 mm (with cards and connectors).
- Dimensions of Rack8:
  - 198 x 108 x 94 mm (w/o holding clips and connectors).
  - 198 x 133 x 94 mm (with cards and connectors).

Cabling

Addressing of the racks: racks must have a unique address, with the help of jumpers inside the rack:

Jumper selections:

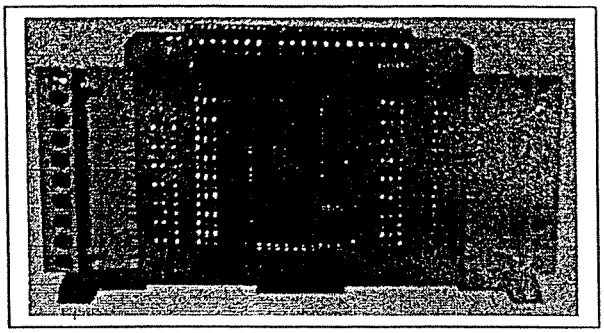


Rack n°	A	B	C	D	E
1	x	-	-	-	-
2	-	x	-	-	-
3	x	x	-	-	-
4	-	-	x	-	-
5	x	-	x	-	-
6	-	x	x	-	-
7	x	x	x	-	-
8	-	-	-	x	-
9	x	-	-	x	-
10	-	x	-	x	-
11	x	x	-	x	-
12	-	-	x	x	-
....					

16 Digital Inputs Card

Ref: CO1-DI16

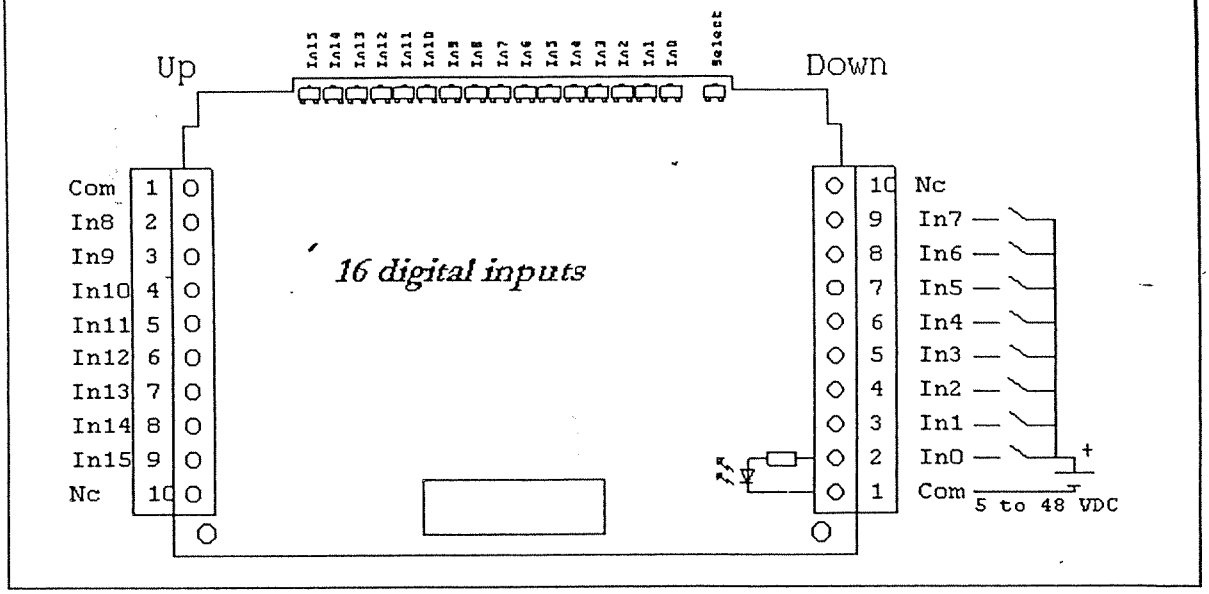
The card can be inserted in extension rack 4 or 8 cards for managing 16 digital inputs.



Technical Specifications

- 8 DC voltage inputs with common negative.
- General selection LED and input state LEDs.
- Voltage range of inputs: **0 to 56 VDC.**
- Activation threshold:**5 VDC.**
- Resistance per input: minimum **12 KΩ.**
- Bounces suppression filter for each input, frequency of the filter: **20 Hz.**
- Surface mount, CMOS technology.
- Isolation to 4kV per group of 8 inputs.
- Consumption: **40 mA** all inputs active, **5 mA** all inputs passive.
- Card is **not Hot swapable.**

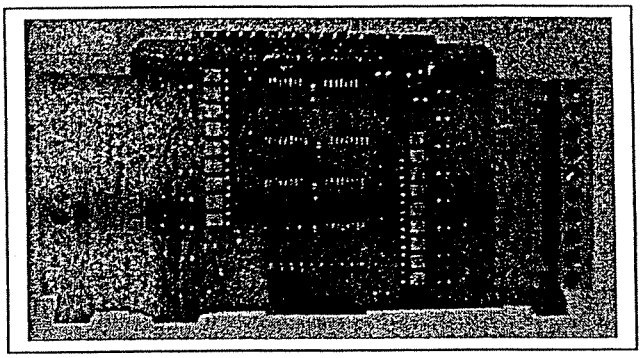
Cabling


Up
Down
In15 In14 In13 In12 In11 In10 In9 In8 In7 In6 In5 In4 In3 In2 In1 In0 Select
Com 1
In8 2
In9 3
In10 4
In11 5
In12 6
In13 7
In14 8
In15 9
Nc 10
16 digital inputs
10 Nc
9 In7
8 In6
7 In5
6 In4
5 In3
4 In2
3 In1
2 In0
1 Com
+
5 to 48 VDC

16 Digital Outputs Card

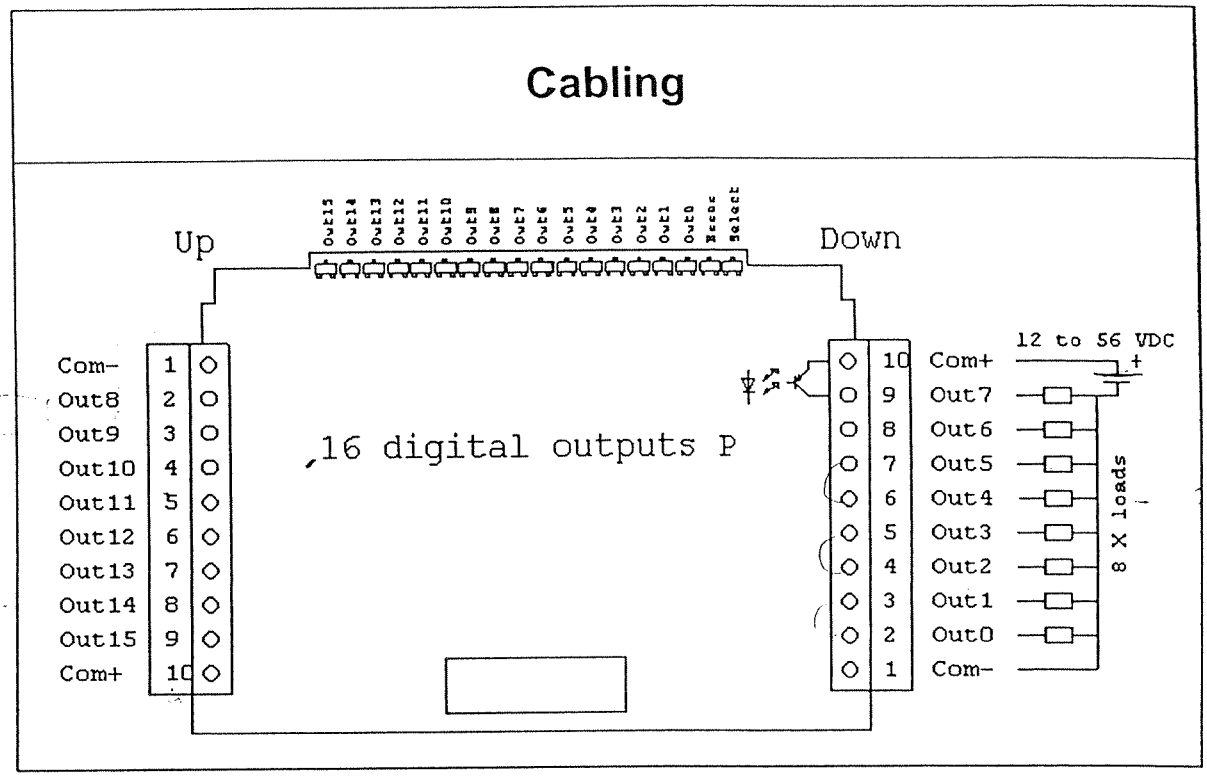
Ref: CO2-DO16-P

The card can be inserted in extension rack 4 or 8 cards for controlling 16 digital outputs with transistors.



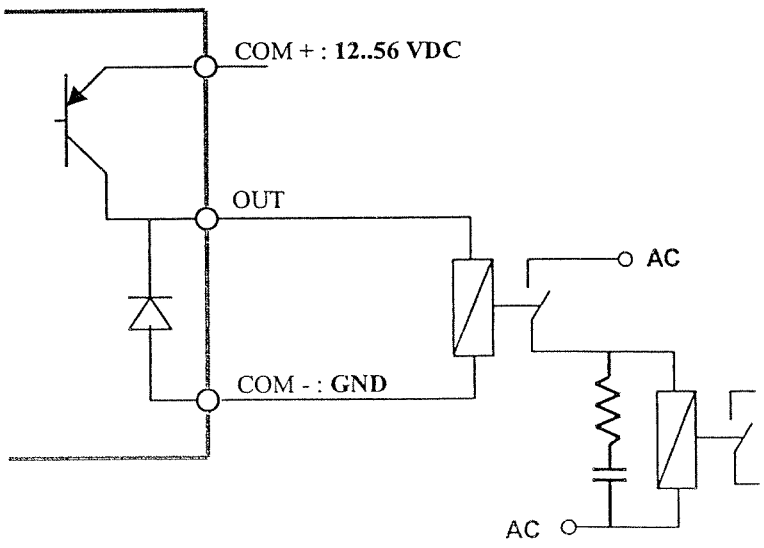
Technical Specifications

- 16 PNP transistors with open collector output. **Current sourcing** outputs
- General selection LED, over surge protection LED and output state LED's
- **Over surge protection** for 2 blocks of 8 outputs (0 to 7 and 8 to 15) with indication (LED n°2) and possibility of a software restart.
- Maximum voltage per output: **56 VDC**.
- Minimum voltage for COM+: **12 VDC**.
- Maximum current per group of 8 outputs: **1.4 A**.
- Maximum current for 1 output: **1.4A**.
- Current over surge threshold: between 1.5 A and 2.5 A.
- Software restart with: IOD - <rack n°> - <card n°> <address 16> to restart the first block of 8 outputs and <address 24> to restart the second block.
  If the IOD = 1 the corresponding block of outputs is in short circuit, writing 0 in the address restart the outputs.
- Minimum time between 2 restarts = **1 sec**.
- **Built-in Protection diode** for each output.
- Surface mount, CMOS technology.
- Isolation to 4KV per group of 8 outputs.
- Consumption: **40 mA** all outputs active, **5 mA** all outputs passive.
- Card is **not Hot swapable**.



The card 16 digital Outputs - old (NPN transistor – Current sinking) is no longer available.

- **Cabling to relays**

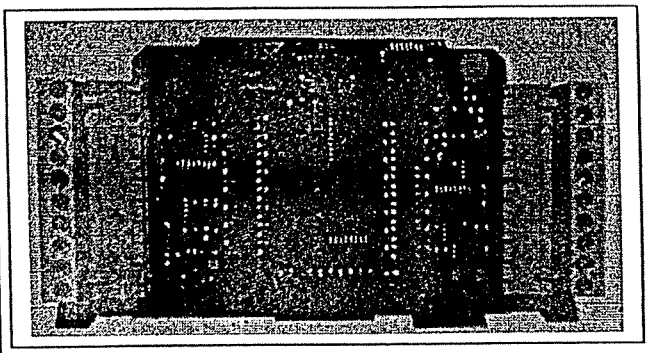


The output is protected by an internal diode. It is **indispensable to protect the secondary relay** with a RC (in case of AC relay) or with a diode (in case of DC relay) otherwise, it can affect the output stage of the card.

2 Analog Output Card (8 bits)

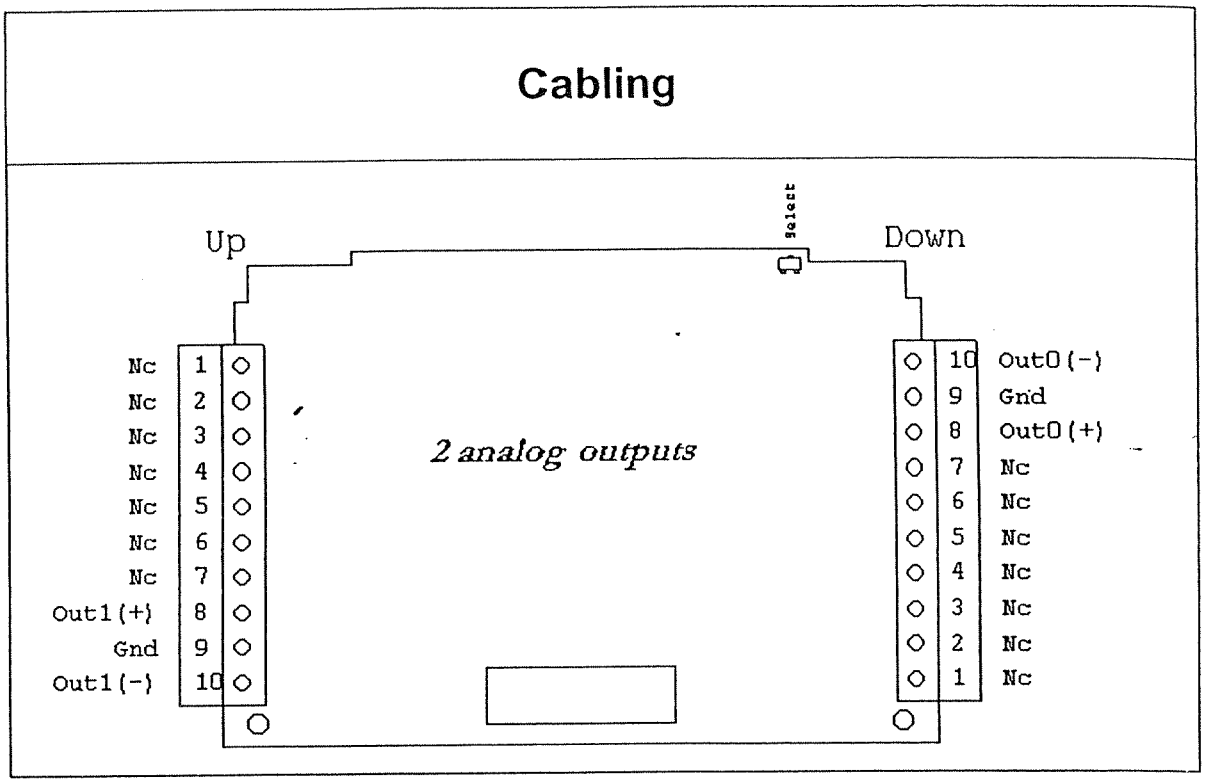
Ref: CO4-AO02

This card can be inserted in extension rack 4 or 8 cards for generating 2 current loops outputs: **4..20 mA** (standard), or voltage: **0..10 V** (on demand).

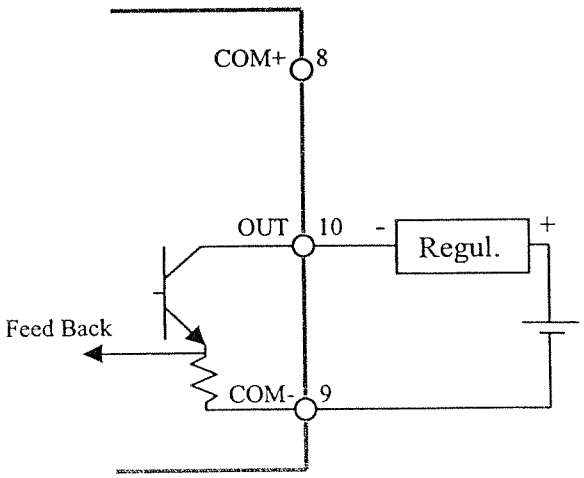


Technical Specifications

- 2 outputs isolated from each other.
- **8-bits** digital to analog converter (256 steps or 0.4% resolution and 1% precision).
- Current loop generated by **internal 12 VDC** power source.
- General selection LED.
- Maximum charge allowed per current loop: **500 Ω.**
- Surface mount, CMOS technology.
- Isolation to 0.5 kV per output. (3KV protection is optional).
- Consumption: **50 mA.**
- Card is **not Hot swapable.**



- **Passive output – 'Current'**



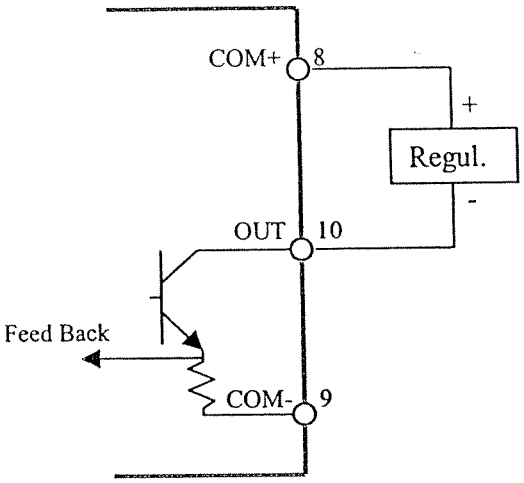
Outputs:

0..20mA.
4..20mA (**Standard**).
0..2.5mA.

Feed Back resistor:

0..20mA : 2.2 Ω.
4..20mA : 2.2 Ω.
0..2.5mA: 14 Ω.

Active output – 'Current'



Outputs:

0..20mA.
4..20mA (**Standard**).
0..2.5mA.

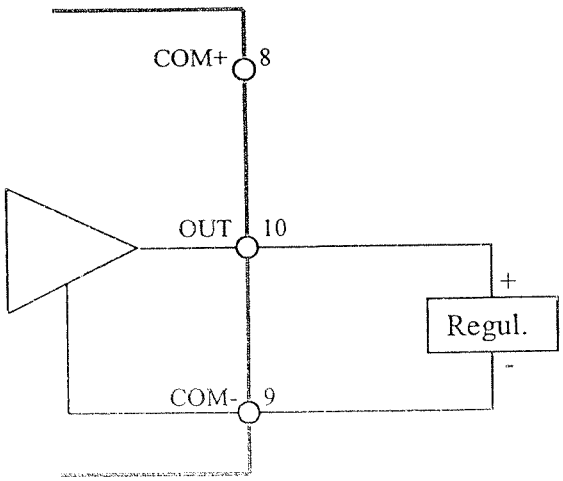
Feed Back resistor:

0..20mA : 2.2 Ω.
4..20mA : 2.2 Ω.
0..2.5mA: 14 Ω.

Voltage:

maximum 60 VDC above COM-.

- **Output – 'Voltage'**



Output:

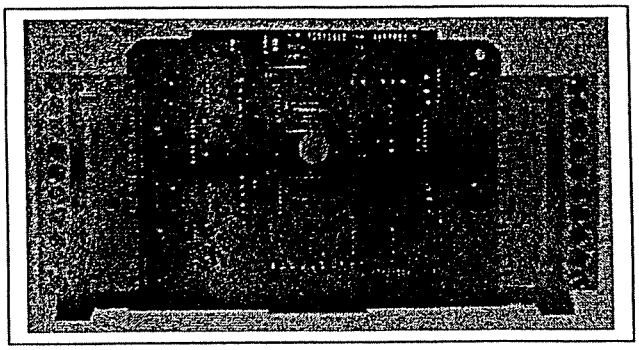
0..10 V active only.

4 Analog Input Card (8 bits)

Ref: CO3-AI04-P → Passive

Ref: CO3-AI04-A → Active

The card can be inserted in extension rack 4 or 8 cards for acquiring 4 current loops inputs **4..20mA** (standard), **0..20mA** (on demand), or voltage level **0...10V** (on demand).



Technical Specifications

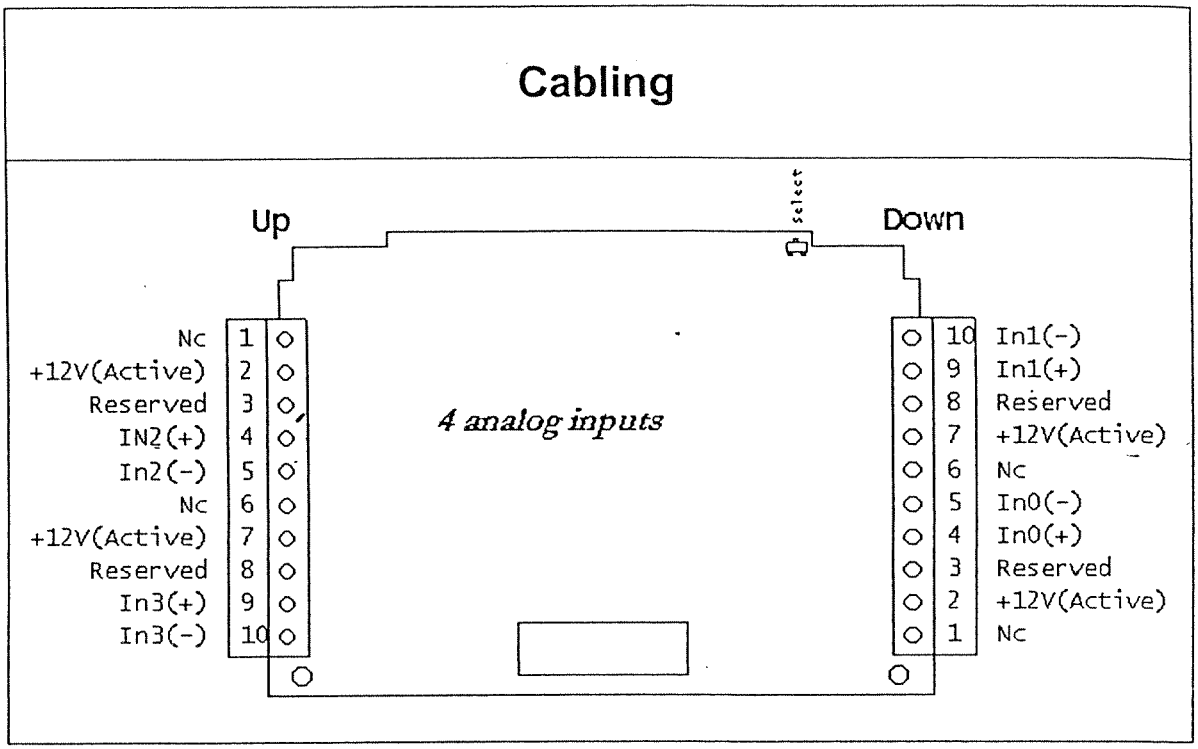
- 4 Inputs **isolated** from each other.
- **8-bits** analog to digital converter (256 steps or 0.4% resolution and 0.1% of precision).
- General selection LED.
- Hardware cut-off frequency for each input: **25Hz**.
- Sampling frequency guaranteed to **100Hz**.
- Consumption:
  - passive card: **10 mA**
  - active card: **25 mA (25mA per input** must be added if the sensor is powered by the card).
- Card is **not Hot swapable**.

Card with 4 passive inputs: acquisition at **4..20 mA** (standard).

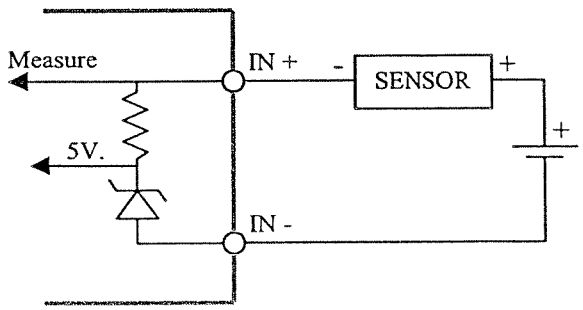
- Needs sensors powered outside the cards.
- Electronic powered from the current loop.
- Input impedance: **100 Ω**.
- Isolation to 4 kV per input

Card with 4 active inputs: acquisition at **0..20 mA** or **0..10V** (on demand).

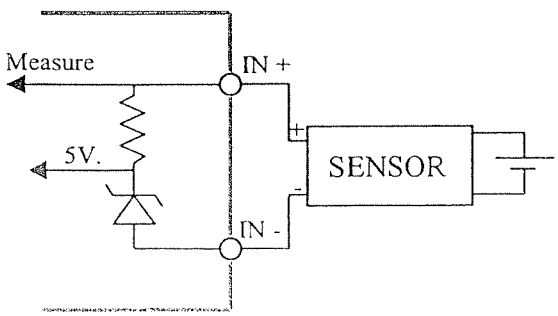
- Needed in 3 cases:
  - To power the input stage when working with 0..10 V or 0..20 mA sensors.
  - To power the input stage in order to reduce the voltage drop on the input (max. 3 volts).
  - To power a 2 wires sensor from the card.
- Conversion powered from the card through a DC/DC converter.
- Input impedance:
  - Current input: **150 Ω**.
  - Voltage input : **151 KΩ**
- Isolation to 0.5 kV per input for active cards.
- Surface mount, CMOS technology.



- **Passive input 4..20mA - 2 wires.**



- **Passive input 4..20mA - 4 wires.**



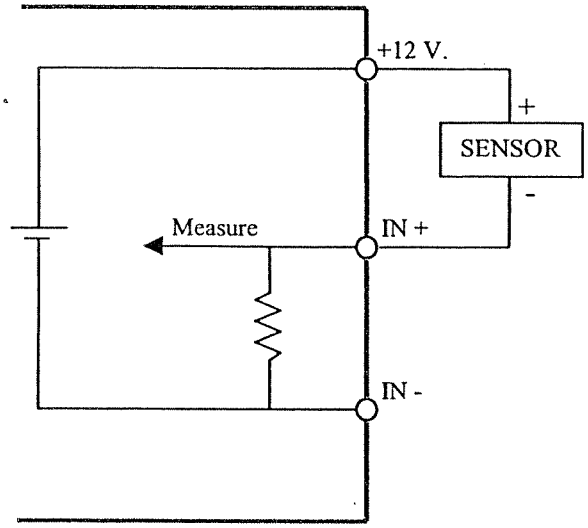
The current of the loop is used to power the input circuit with the help of the Zener diode.

With the cabling to 'passive' inputs you have to check the voltage needed by the Sensor.

Example:

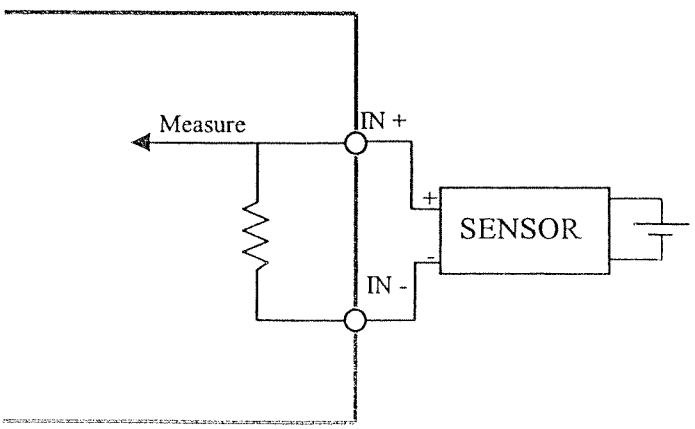
The power supply used for the sensor is 12 VDC. At 20 mA the input voltage is 7 volts (5 volts for the zener and 2 volts on the 100 Ω resistor. You still have 5 volts for the sensor. Check that it is sufficient. If not, use a Sensor that accepts a higher voltage (24 VDC) or use 'active' inputs (see next).

- **Active input 4..20mA.**

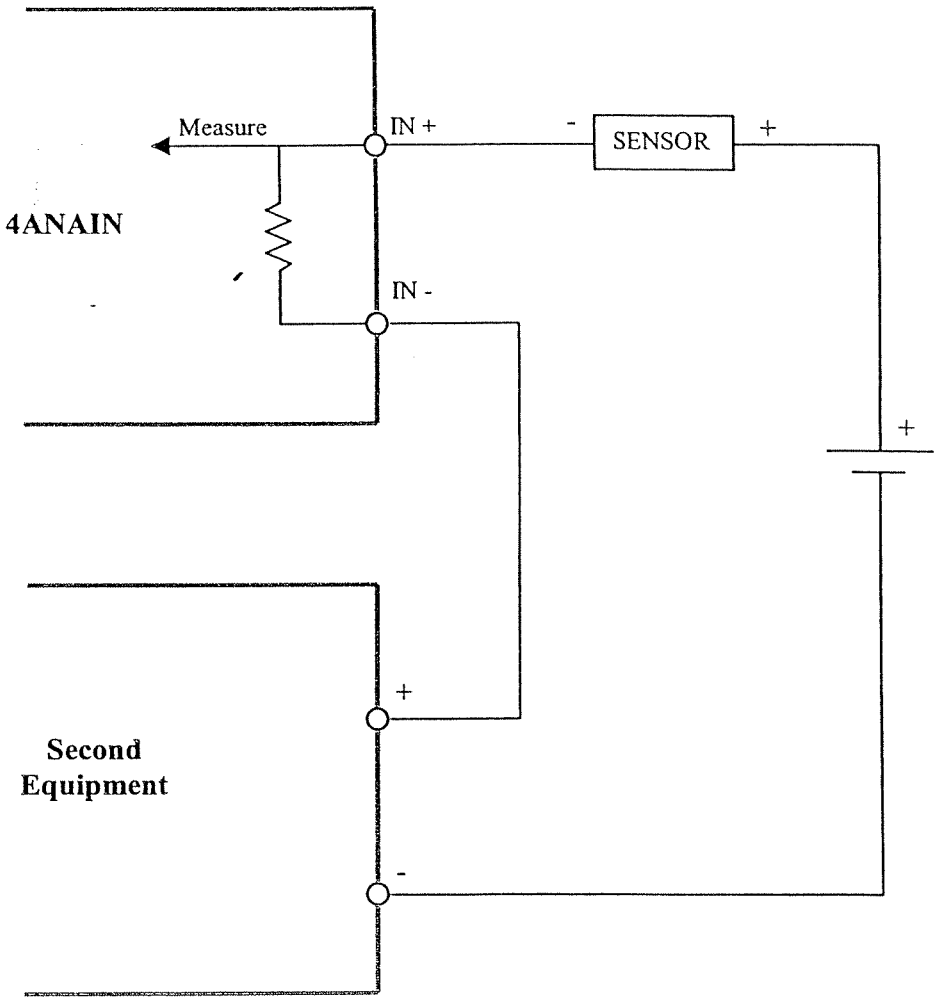


- The current is delivered **from the card.**
- The 'active' inputs can also be cabled like passive inputs (IN+ and IN-) if a lower voltage drop is needed : 150 Ω x I, instead of [100 Ω x I] + 5 V. (Zener).

- **Input 0..10V.**



- **Cabling 4..20mA sensor to 2 equipment.**

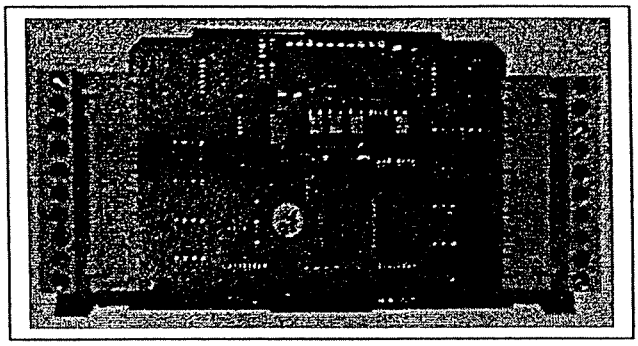


- This cabling is only possible with 'active' inputs.
- The second equipment does not need to be isolated, as 4ANAIN inputs are isolated.

8 Analog Input Card (12 bits)

Ref: CO3-AI08

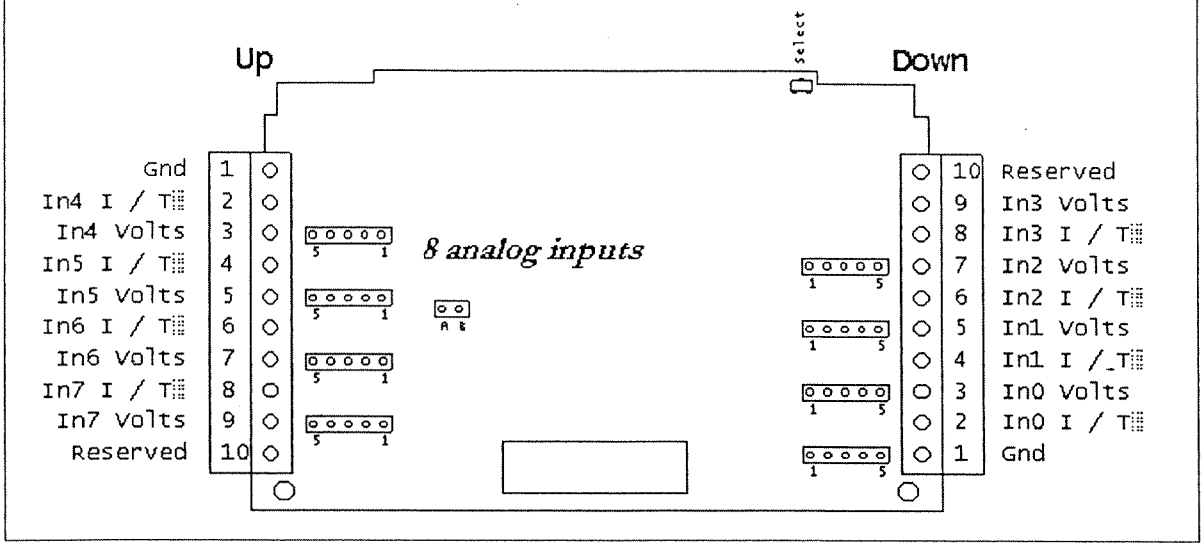
This card can be inserted in extension rack 4 or 8 cards for acquiring current loops **4..20mA**, **0..20mA** and **-20..+20 mA**, voltage level **0..10V** and **-10..+10V** and temperatures in 2 wires mode (probes **Pt100**, **Pt1000**, **Ni100** and **Ni1000**).



Technical Specifications

- **8 passive Inputs** with **common ground**.
- **12 bits** analog to digital converter (4096 steps in unipolar mode and 2048 steps in bipolar mode).
- **Software calibration** executed in our factory for all inputs.
- **User scaling** saved in the card memory (with the help of TWinSoft → card configuration).
- Input Impedance for current loops: **10 Ω**.
- Input Impedance for voltage input: **>100 KΩ**.
- Sampling frequency guaranteed: **10 KHz**.
- Hardware cut-off frequency for each type of input: **25 Hz**.
- Memory protection (calibration and scaling) with a jumper & software protection of calibration.
- Resolution in unipolar linear mode (I,V) (inputs current and voltage): 0,025% (according to the scaling).
- Precision in unipolar linear mode: + or - 0,050% guarantee (+ or - 0,025% typical).
- Acquisition speed: 7 times / second for each input.
- General selection LED.
- Surface mount, CMOS technology.
- Isolation to 0.5 kV per group of 8 inputs.
- Maximum consumption: **80 mA**.
- Card is **not Hot swapable**.

Cabling



I: Input Current.
T°C: Input temperature.
Volts: Input voltage.

Jumpers

- **Jumpers 1...5**

Type of I/O	Jumper position
Pt100, Ni100	1 - 2
Pt1000, Ni1000	2 - 3
Voltage or Current	4 - 5

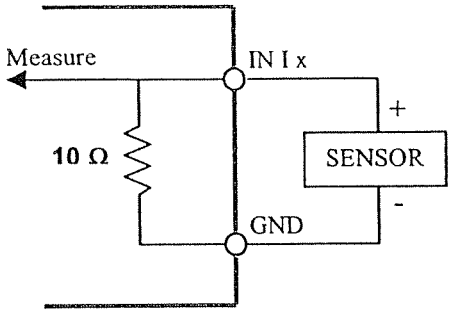
- **Jumpers A..B**

Mode	Jumper position
Configuration mode	close
Working mode	open

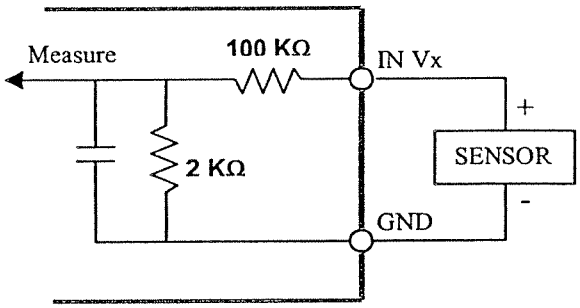
The card needs also to be configured from TWinSoft : from the 'Resources', create then select the card. Right click the card and select 'Configure'.

When the card is configured, remove the jumper A..B.

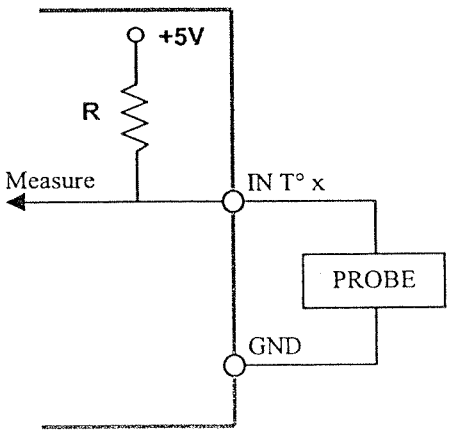
- **Cabling as 'Current' Input**



- **Cabling as 'Voltage' Input**



- **Cabling as 'Temperature' Input**

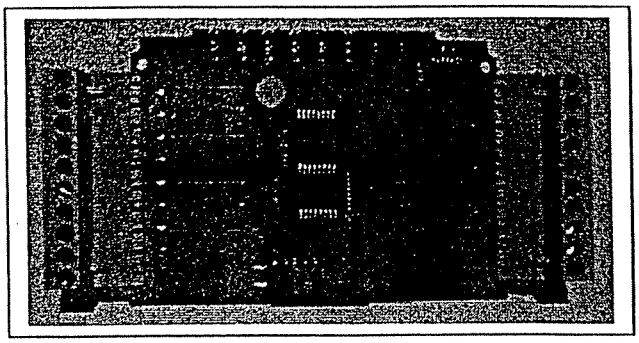


Resistance R:
PT100, NI100 : 3.9 KΩ
PT1000, NI1000 : 39 KΩ

8 Digital Outputs Card (relay)

Ref: CO2-DO08

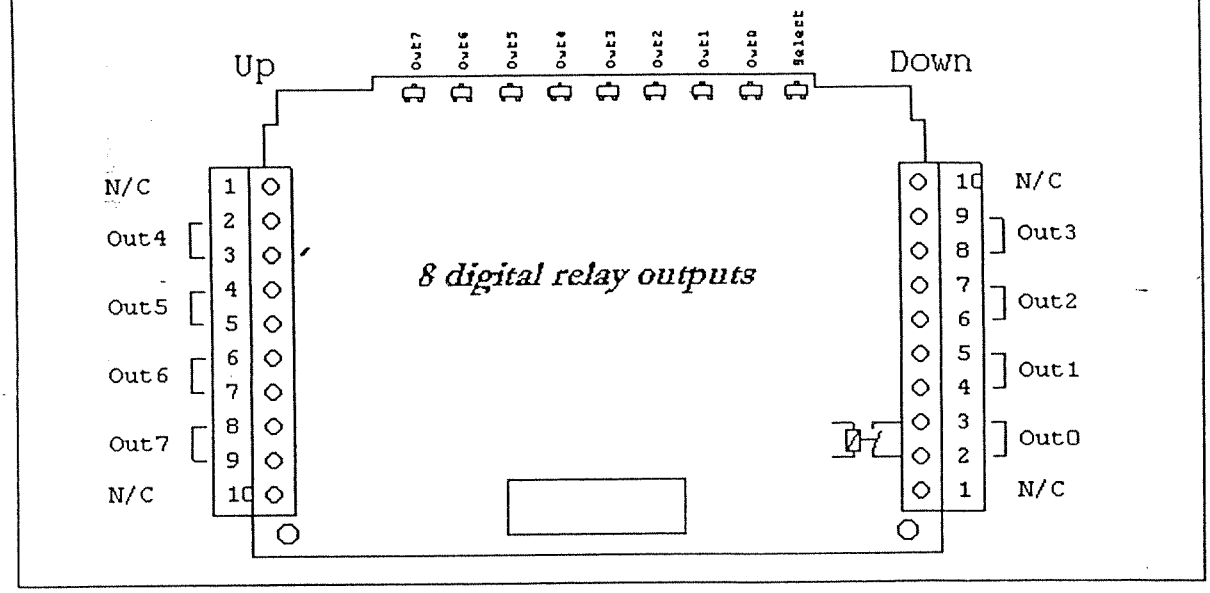
This card can be inserted in extension rack 4 or 8 cards for controlling 8 digital relay outputs.



Technical Specifications

- **8 relay** outputs.
- Low power relay.
- General selection LED and output state LEDs.
- Maximum voltage per output: **250 VAC.**
- Maximum current per output: **2 A.**
- Surface mount, CMOS technology.
- Isolation to 3 kV per output.
- Consumption: **20 mA per active relay.**
- Card is **not Hot swapable.**

Cabling


Up
Out7
Out6
Out5
Out4
Out3
Out2
Out1
Out0
Select
Down
N/C
1
2
3
4
5
6
7
8
9
10
Out4
Out5
Out6
Out7
N/C
8 digital relay outputs
10
9
8
7
6
5
4
3
2
1
N/C
Out3
Out2
Out1
Out0
N/C

Summary of consumption

EQUIPMENT	DESCRIPTION	CONSUMPTION
CPU	With internal modem Without internal modem	150mA. 120 mA.
Battery charger		90 mA.
Network modem (COM5)		30 mA.
PCMCIA modem (COM5)	Slot PCMCIA Modem ISDN/PSTN Modem GSM	30 mA. 150 mA. 300 mA.
Terminal	With backlighting Without backlighting	130 mA. 30 mA.
Card 16 Digital Inputs	All inputs passive All inputs active (16)	5 mA. 40 mA.
Card 16 Digital Outputs	All inputs passive All inputs active (16)	5 mA. 40 mA.
Card 8 Relay Outputs	Per relay	20 mA.
Card 4 Analog Inputs	Passive Inputs (the whole card) Active Inputs: - the whole card. - per sensor if powered by the card.	10 mA. 25 mA. 25mA.
Card 8 Analog Inputs	The whole card	80 mA.
Card 2 Analog Outputs	The whole card	50 mA.
Extension racks (4 & 8 slots)		5 mA.

GENERAL PRECAUTIONS

General

The electromagnetic compatibility of the TBox is its ability to function trouble-free in a hostile environment (prone to interference). There is a distinction between interference that comes from the outside, interference imposed *by* the outside environment, and interference imposed *on* the outside environment. Regarding accepted interference, the construction of the equipment follows strict standards, which have been laboratory proven and approved. For generated interference real measures are recommended.

To avoid serious damage to the system, you should particularly be sure:

- to unplug the TBox before changing or inserting any input-output cards
- to unplug the TBox before disconnecting one or more blocks
- about the direction in which the cards are inserted into the blocks
- to guard the power modules against lightning, for example the entry point of the telephone lines.

The following recommendations apply to all interconnected equipment, to obtain trouble-free operation. Applying these measures to only one unit among several interconnected ones is not sufficient.

Be sure to verify :

- TBox power supply
- validation power of the input-output cards
- power of the digital inputs
- power of the digital outputs
- power of the analog inputs
- power of the analog outputs
- external power of the 4-wire analog probes
- power of networked or serially connected PCs
- power of the other TBox stations on the RS485 network
- TBox terminal console

There is reason to understand how these power sources are generated, and how they are referenced. Important: the digital inputs of the TBox CPU, unlike the cards, do not use Schmidt triggers; special care must be taken regarding the quality of the intercoupled signals.

Grounding

Grounds must dissipate dangerous currents produced by faults or surges (lightning), while maintaining the zone. The equipotential ground serves as a reference for the shields and passive metallic parts. The ground must dissipate any harmful currents before they enter the electronic components. The electric grounding network's purpose is to protect personnel. The equipotential liaison does not act as a protection conductor; it guarantees proper functioning, and serves as an anti-spike measure.

Connection methods

The connection of two nearby devices is not necessarily achieved by a conductor. It can be established via electromagnetic transmission and/or by conduction (framework, housing, chassis, electrical wire, etc.). Conductors can be direct-coupled, capacitive or inductive. It is appropriate to verify which construction standard each connected element conforms to. In the event of interference, it is not enough to be concerned only with the device that is interfered with, but to search for the source of the interference, to stop it at the source. To discover the interfering device, the solution, sometimes long and tedious, is to return to a minimal system, then to isolate the path taken by the interference.

Specifically, check for:

- proper connection of the cables
- the quality of the shielding
- the presence of equipotential
- the quality of the ground connections
- that the input-output cards are firmly seated
- that the connectors are firmly connected to the cards
- that the cables are correctly clamped on the connectors
- that the devices are properly placed in the cabinet
- the quality of the communication connections' shielding
- the presence of fluorescent lighting

Disturbances

Spurious signals come from short rate variations in an electrical circuit, free oscillations which the wave absorbs. You must be wary of old habits, in particular the frequency whose passbands (in the face of spurious signals) are different than analog circuits. Electricity is particularly sensitive to problems due to symmetrical mode.

An inverter must be connected to the secondary input of a BT/BT isolation transformer with a screen on a neutral distribution to ground TN. To avoid spikes from switching coils, install "free wheel diodes" for those that are DC, and RC circuit suppression for those that are AC powered. Thus, all digital outputs from the CPU must always use external diodes when using inductive charges (relays, coils, etc.)

Origin of the spurious signal	Cause	Interference due to
Switch	Contacts, coils	Spurious sector, magnetic field
Electric motor	Collector, coiling	Electrical and magnetic fields
Post of electrical soldering	Contacts, transformer	Electrical and magnetic fields, spurious sector , leakage currents
Power supply	Commutation	Electrical and magnetic fields (20 to 100 kHz), sector spikes
High frequency device	Commutation	Electrical field
Emitter (portable, radiodiffusion) .	Antenna	Electrical field
Differences in potential, between the ground and reference	Difference in potential	leakage currents
User	Body charged with static electricity	leakage currents discharged, electrical field
Heavy power cables (motor cable, etc.)	Density of courant, tensions spikes	Electrical and magnetic fields, sector spikes
Lightning	natural	µcuts/surges
Correction/Rectification to thyristors	Abrupt variations in rate	Harmonics
Induction ovens	Narrow band frequencies	Magnetic fields
Currents of default		Magnetic fields

Example:

Outage coils 24V= : Interference : 800 V=

Outage coils 230V~ : Interference: > 1.000 V~

Electrostatic discharge : a charge of 20 kV from a person can cause a discharge of 20 A!

Harmonic currents

Equipment like variable speed motor controllers, fluorescent light ballast's, as well as inverters supply *non-linear charges*, which introduce *harmonics*.

The harmonics of a distribution system combine with the fundamental frequency to form *sinusoidal currents*. Their importance is bound to the amplitudes and the frequency of the harmonics that are created. A non-linear charge absorbs the current as impulses, and not as sinusoidal. Impulses create harmonics that amplify the phenomena.

Harmonics are conveyed by the conductors of neutral adversely affect the equilibrium of the distributions. They can be found in transformers, motors, generators, retiming phase capacitors of phase or they are occur by elevations in temperature susceptible to interference.

When neutral and ground are reversed, electronic devices, with potentials of reference to ground, are interfered with (robots, computers, etc.).

In a tri-phased distribution, it is the conductors of neutral which support the harmonics of devices connected between phase and neutral. In the normal case, the currents of phases at the fundamental frequency cancel each other in the neutral. On the other hand, certain pairs not only don't cancel each other, but add to each other in the neutral. The third harmonic and its odd multiples (9^{th}, 15^{th}, 21^{st},) belonging in this category.

In certain cases, it is possible that the current in the neutral will be higher than that of the phases, indicating that there are harmonics. Therefore, an larger current in the neutral will be translated by a fall in the abnormal power between neutral and ground, while they are different. Starting at 5 V~, it makes sense to verify which charges produce harmonics. Note that measurement instruments that do not read effective true values ("*true RMS*"), indicate lower values in case of distortions due to harmonics. Errors of 20% are frequent; errors of 50% are possible.

Therefore, it is important to measure the effective true current and instantaneous peak, then make a report of it and compare it to the one obtained by a pure sinusoid.

While in the rate of neutral, and able to avoid non-linear charges, it is possible to improve the grounding while increasing the sections of the conductors (up to 16^2 for robots), in order to limit the changes in power of reference potential.

Try not to connect the electro-computer receptors, generators of harmonics, except with an isolation transformer, and between phases with a direct connection to ground.

Equipotential and ground

Metallic masses separated by less than two meters should be electrically connected to each other, even if each of them is connected to the equipotential network (protection of personnel).

Equipotential is preferred to a weak resistance link which implies the circulation of current. Remember that there is a distinction between the resistance of low ground and impedance of high frequency, which is more difficult to measure. The current recommendations suggest a protection conductor separated by a power cable.

Very long cables can justify/require intermediate grounds (in the openings of the boxes and cabinets, for example, or every 20 meters). For the TBox system, and other attached devices, it is recommended to use a section of 10^2. For the variators, 16^2 is required because they contain a part power with the thyristors, and their ground must be separate from those of the other interconnected elements. Analog ground should be distinguished from digital ground.

The obstacles to ground continuity can be due to:

- paint,
- oxidation (rust, etc.)
- grease,
- dust
- a bad connection
- absence of notched disk
- the presence of silent blocks
- tightness of seals
- the presence of a mural fixing (something attached to a wall)

A variable magnetic field inducts power in metallic masses (chassis). If a conductor is grounded, the current leaked via the cable inducts a magnetic field opposed to the cause and the limit, as long as the path to ground is good. Therefore, it is important to assure maximum conduction between passive metallic elements.

The connection to ground of passive metallic masses allows the use of these metallic masses a shields, and concerning masses of actuators, branching/deriving spikes at their source.

The link to ground of the chassis where the TBox system is found derailing interference at the source. It is the last point before harm is done to the electronics.

Precautions should be taken when placing the equipotential between a new installation and an existing one. Only fibber optic connections allow the freeing of a equipotential.

The equipotential should be linked in a "star" formation; if not, be sure to respect the rule of the sections. The connection to ground of elements of power should never be put in series with those of power elements. Their connections to ground must be separate.

A collection of automation equipment must be grounded in a single place. The floating chassis, for example, can be tied to ground via non-polarized capacitors of 500V/1µF to disperse high frequency disturbances.

Shielding

The distribution of low AC power must be shielded and tied to ground. Cables carrying the Digital 24V signals, longer than 10 meters must be shielded. The lines carrying low-level (<15V) analog or digital signals must be twisted pair with shielding tied to ground.

The grounding of a shield at one end protects the conductors from low frequency interference, avoids circulation's of currents and capacitive couplings. In this case, the shielding should be tied to the side with the highest impedance, which is normally the receiving side (electronic), where the decay is maximum. In certain cases, a non polarized capacitor of 500V/μF can be installed on the untied side, to protect the effect of the shield at high frequencies (analog AM signals).

Grounding at two ends protects the conductors from high frequency interference. In this case, there is a risk of differential circulation of currents that must be solved by placing equipotentials of sufficient section (up to 16^2 according to the connected devices).

Most interference is at frequencies higher than 10 kHz, which suggests a connection to ground with a large surface; this can be done using metal collars.

To enhance the effectiveness of the shielding, they should be connected before entering the cabinet. That will avoid propagation of interference by radiation in the cage or housing. Housings of shielded cable connectors must be metallic and connected to the shielding.

When there is a variator, a shield should be placed as close as possible to the variator, and the shield should be connected with 16^2 to the ground.

When the cards do not have a contact point for the shielding, it must be tied directly to the chassis or to the closest grounding rod. Attach the shielding to a bare metallic surface to assure proper contact.

Unused conductors should not protrude from the shielding. Shielding should not serve to conduct signals, as power, or as an equipotential.

Shielded cables must have an isolated exterior gain.

Cable placement

Relay cables, power from contactor coils, etc. create interference, and should not lead into the entry points with wires susceptible to interference. Use pathways of metal cables to benefit from the shadow, in the face of electromagnetic interference. Be sure that the interference-causing cables are perpendicular to the sensitive cables.

Signal cables must be kept at a distance from high tension cables (> 500 V) or strong currents. There must be at least 20 cm between signal cables and cables > 500 V. If not, a shield at ground will be necessary. At 30 cm and beyond, all connections between interference-causing cables and sensitive signals are virtually suppressed.

Magnetic interference carried by cables gets worse as the cables get longer, as the current's intensity grows, according to the current difference, the power difference, and the length of common trajectory. Cables must also be limited to their proper length to limit capacitive and inductive coupling.

Digital signal cables outside of buildings must be shielded and tied to ground at both ends. Analog signal cables outside buildings must be have double shielding, whose inner shielding is tied only to the electronics side, and the external shielding to both sides. The equipotential impedance in this case should not exceed 10% of that of the braided shielding, or their roles will be reversed.

Plan for protection for cables outside of buildings, using resistors or surge suppressors, where the cables enter the building. The signal cables and the equipotential cables must present as small a surface as possible.

The connection of the conductors to terminals and connectors is often a source of interference, and should be watched out for. Also watch for immunity in the installed and standby cables. These must to be grounded on one side only.

Placement of the cabinet

The TBox must be distanced from generators of electrical arcs or from switching otherwise a metallic shield must be connected to the ground by 10^2. The devices must be sufficiently far away from one another so that they do not affect each other by radiation (more than 30 cm is usually sufficient).

Separate the command and power parts in a significant manner, or place a shield between them, referenced to ground.

Take care when using fluorescent lighting, whose ballast's generate interference-causing frequencies. Replace with other lighting if possible. All equipment should be placed in such a manner that their heat dissipation does not have a detrimental effect on each other.

Concept of cabinets

Cabinets soldered with a continuous bead are preferable to those soldered by seals, rivets or screws. Panels screwed on with airtight seals require a three-part braid of grounding.

Cabinets placed next to one another must be made interdependent with a good electrical contact (careful of paint). If not, use braids of tinned copper.

In case of doubt, using braids of tinned copper is recommended. A copper wire, even one of the appropriate size, will not have the same result for high frequencies.

Sector filters

Sector filters are effective against defaults in common mode and in symmetrical mode. To limit the amplitudes of transitory impulses, use surge suppressers (zener diode with strong charge current, or non-linear zinc oxide resistors (varistors). The sector filters must be placed near the entry point of the distribution into the cabinet to limit the length of cables susceptible to interference.

The placement of the housing of the filter must have a large enough surface area to absorb high frequency interference. Do not mix sector-filtered cables with non-filtered ones.