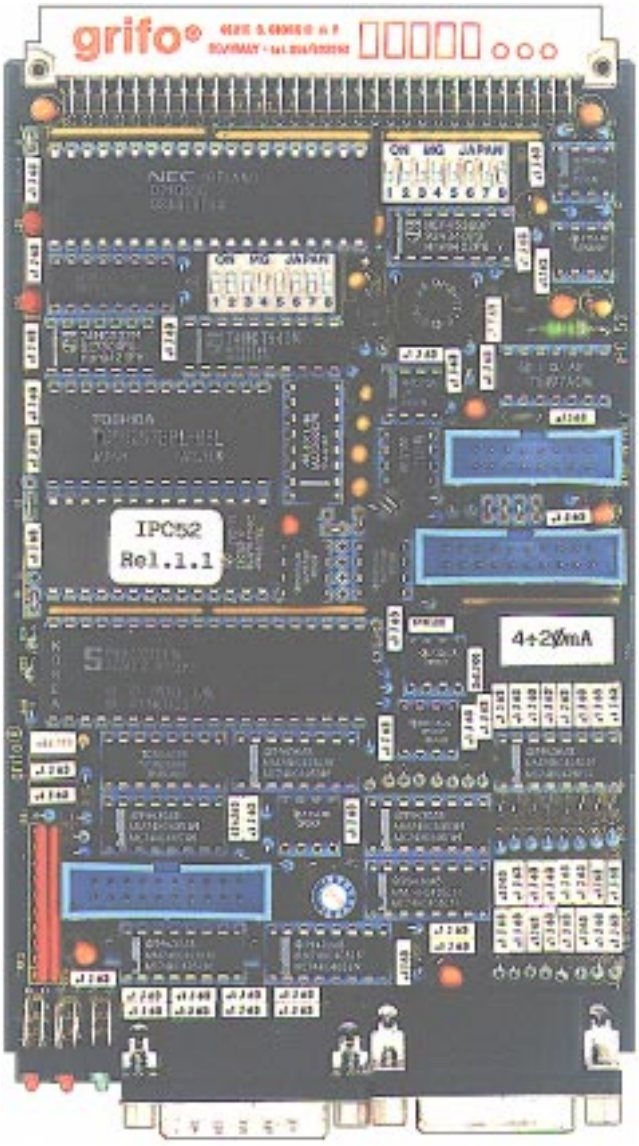
IPC 52

Intelligent Peripheral Controller fam. 51

USER MANUAL



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IPC 52 Edition 5.20 *Rel. 29 September 1999*

IPC 52

Intelligent Peripheral Controller fam. 51

USER MANUAL

Intelligent peripheral card for 24 analog inputs acquisition (8 PT100 and/or PT1000; 8 thermocouple (type J,K,S,T); 8 voltage and/or current inputs); 8 bit BUS interface; RS 232, 422, 485 or Current Loop serial line; high resolution of the A/D converter (16 bit + sign); 16 TTL I/O lines; optional THERMOSTAT function; 5 acquisitions per second; resolution of 0.1 °C across the entire temperature measurement range; powerfull and versatile firmware.

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IMPORTANT

Although all the information contained herein have been carefully verified, **grifo®** assumes no responsibility for errors that might appear in this document, or for damage to things or persons resulting from technical errors, omission and improper use of this manual and of the related software and hardware.
grifo® reservs the right to change the contents and form of this document, as well as the features and specification of its products at any time, without prior notice, to obtain always the best product.
For specific informations on the components mounted on the card, please refer to the Data Book of the builder or second sources.

SYMBOLS DESCRIPTION

In the manual could appear the following symbols:

Attention: Generic danger

Attention: High voltage

Trade marks

abaco®, **GPC®**, **grifo®** : are trade marks of **grifo®**.
Other Product and Company names listed, are trade marks of their respective companies.

GENERAL INDEX

FIGURE INDEX

INTRODUCTION

The use of these devices has turned - IN EXCLUSIVE WAY - to specialized personnel.

The purpose of this handbook is to give the necessary information to the cognizant and sure use of the products. They are the result of a continual and systematic elaboration of data and technical tests saved and validated from the Builder, related to the inside modes of certainty and quality of the information.

The reported data are destined- IN EXCLUSIVE WAY- to specialized users, that can interact with the devices in safety conditions for the persons, for the machine and for the enviroment, impersonating an elementary diagnostic of breakdowns and of malfunction conditions by performing simple functional verify operations , in the height respect of the actual safety and health norms.

The informations for the installation, the assemblage, the dismantlement, the handling, the adjustment, the reparation and the contingent accessories, devices etc. installation are destined - and then executable - always and in exclusive way from specialized warned and educated personnel, or directly from the TECHNICAL AUTHORIZED ASSISTANCE, in the height respect of the builder recommendations and the actual safety and health norms.

The devices can't be used outside a box. The User must always insert the cards in a container that rispect the actual safety normative. The protection of this container is not threshold to the only atmospheric agents, but specially to mechanic, electric, magnetic, etc. ones.

To be on good terms with the products, is necessary guarantee legibility and conservation of the manual, also for future references. In case of deterioration or more easily for technical updates, consult the AUTHORIZED TECHNICAL ASSISTANCE directly.

To prevent problems during card utilization, it is a good practice to read carefully all the informations of this manual. After this reading, the User can use the general index and the alphabetical index, respectly at the begining and at the end of the manual, to find information in a faster and more easy way.

CARD AND FIRMWARE VERSION

The present handbook is reported to the following version numbers:

- **IPC 52** card release **200295** and later.
- **Firmware** release 1.6 and later

The validity of the bring informations is subordinate to the number of the card release. The user must always verify the correct correspondence among the two denotations. On the card the relase number is present in more points both board printed diagram (serigraph) and printed circuit (for example above the CN2 in the component side).

GENERAL FEATURES

The **IPC 52** is an intelligent peripheral card included in the wide and powerful family of **ABACO®** industrial boards. The **IPC 52** has the stand-alone capability to solve any problems associated with the acquisition of analog signals applied to its inputs, and to oversee all linearizing operations performed on the signal received from probes, also cold junction compensation, etc., supplying the master system with data that is constantly updated and ready for further processing. The **IPC 52** will accept various types of analog input signals, to the end of monitoring **temperature**, **pressure**, **humidity**, **PH**, etc., and any another analogically quantifiable parameter. With sophisticated self-calibration algorithms and the high resolution of the **A/D** converter (**16 bit + sign**), the **IPC 52** is ensured exceptional operating characteristics, affording resolution of 0.1 °C across the entire temperature measurement range. **IPC 52** card is a very powerful card that can manages all the various user requirements that has two important feautures: the first is the low price and the second is the comfortable and easy use of the card; through **IPC 52** programs and its software tools, the card can be used and set without problems. All operating data can be stored in the on-board serial **EEPROM**, which will hold no less than 310 different parameters. These parameters define with details the type, features and acquisition mode of each one of the 24 available analog inputs. By virtue of imaginative design, the **IPC 52** is able to operate either as a stand-alone processor or interlocked to an external CPU system. The communication with a master CPU system can be performed through **ABACO® BUS** (parallel communication) or a serial line (serial communication). Both methods can be used with equal facility, according to the type of application for which the **IPC 52** is selected. There are no limits regarding type of external master remote controller, so use can be made of any electronic device capable of serial communication, like a standard **PC** or a **PLC**. Operating with **RS 485** or **Current Loop** serial line, through the logic protocol included in the card management program, it is possible to control an high number of **IPC 52** with only two wires and one master system. This features allow regulators networking using a master-multislave type protocol, also when distances are very high, simply by spreading the serial communication cable. The **IPC 52** can be interrogated even during normal operation, and the parameters altered, without in any way affecting the acquisition cycle. Accordingly, any complex situation calling for dynamic control profiles can be dealt with simply and effectively. Used as an interface with thermocouples and RTD, the **IPC 52** in effect replaces **APT 100**, **JKT 07** and **JKT PTC** boards, relegating these to more marginal tasks. In this instance, there is no longer any need for an external A/D converter avoiding the main CPU to effect all linearizing operations on the input signals. The **IPC 52** performs these steps using its own resources, supplying the master CPU with data ready for processing at a higher level. Maximum specifications for the **IPC 52** are:

- Single EURO size pcb measuring 100x160 mm
- Interface with **ABACO® industrial BUS**
- **RS 232** or **RS 422-485** or **Current Loop** serial line
- Facility of networking up to **127 IPC 52** modules using RS 485
- One **dip switch** for card configuration, with 8 dips
- Configuration with serial **EEPROM** storing 310 operating parameters
- On board **Buzzer** signalling malfunctions
- **16** MHz **80C32** CPU with **64K EPROM**
- Up to **32K RAM** with optional **RTC** and Lithium backup battery
- Local **Data-Loggin** on the on board 32K RAM
- Operating as stand-alone system, or intelligent peripheral connected to master CPU
- Programming and dialogue by **parallel BUS**, or using **serial line**
- Set up and configuration operation performed through serial line
- The data acquisition operations don’t disturbe the conversion and other operation execution

- Onboard **watchdog** controlled entirely by main program
- **A/D** converter section giving **16 bits + sign** resolution
- Acquisition speed of **5 conversions per second**
- **Cold junction** compensation by way of **LM35** local temperature sensor
- Possibility to read card **working temperature**
- **Ten** different and indipendent classes of signal can be acquired at the same time
- **24** indipendent **analogic input lines**
- Possibility to select a continuos acquisition of a programmable number of inputs from 1 to 24. The acquisition rate can be programmed from **10** to **2560 seconds**
- Operation as **detector** and **linearizing** device for various types of input probes
- Standard **ABACO® 20 ways** analogic connector for 8 input signals. On this connector can be linked both **tension signals** (±2.5V), or **current signals** (0÷20 or 4÷20 mA) assembling a proper conversion module.
- **26 ways** high density female D connector for connection of **8 RTD probes**. The RTD can be PT 100 or PT 1000 type, with 2 or 3 wires and the acquisition ranges are:

PT 100 RTD	from	-200°C	to	+850°C
PT 1000 RTD	from	-200°C	to	+450°C

- **15 ways** male D connector for connection of **8 thermocouple probes**. Moreover on this connector can be linked very slow analogic signals, setting 3 different amplification factors. The acquisition ranges for the connectable probes are:

J DIN thermocouple	from	-200°C	to	+900°C
J USA thermocouple	from	-210°C	to	+1200°C
K thermocouple	from	-270°C	to	+1372°C
S thermocouple	from	-50°C	to	+1767°C
T thermocouple	from	-270°C	to	+400°C
Analogic channel, **amplification**	type **1**			±85 mV
Analogic channel, **amplification**	type **2**			±25 mV
Analogic channel, **amplification**	type **3**			± mV

- Standard **16 ways** connector for serial communication
- Standard **Abaco® 20 ways I/O** connector with 16 TTL I/O lines
- **16 I/O TTL** digital lines, directly available to the user
- **8** front **LEDs** indicating line currently in acquisition
- **4** front **LEDs** indicating type of probes in acquisition
- Option of special designs with customized programs, even for small quantities
- Single power supply voltage: **+5 Vdc** ±5%, **195 mA**

CPU

On the card is mounted the INTEL 80c32. This 8 bits microprocessor have an extended instruction set, fast execution time, easy use of all kind of memory and an efficient interrupt management. The CPU controls all card operations: acquisitions, linearizing operations, cold junction compensation etc. so the MASTER must only control the high level process.

I/O LINES

The card has 16 TTL I/O lines (8 lines are only for OUTPUT operations). These lines are completely available to the User, if correctly set (for further information please refer the paragraph "SET-UP" in the chapter "Descriptions software"), and he/she can use them for manage alarms, acquire special conditions from the field, setting outputs etc.

MEMORY DEVICES

On the card are mounted 3 memory devices:
IC16 -> EPROM for program code.
IC12 -> work RAM.
IC22 -> EEPROM for configuration parameters.
The memory devices size is fixed and so the user can' t modify any different memory configuration.

SERIAL COMMUNICATION

The serial communication with the external world could be managed through a serial line. The full duplex asyncronous serial line is hardware configurable in fact connecting some jumpers, the User can select the electric standard interface between RS 232, RS 422, RS 485 and Current loop; for RS 422-485 the transmitter activation and the line direction can be set by software. Concerning the comunication protocol,it is varying only the BAUD-RATE (1200÷19200 BAUD) while the other parameters are fixed (NO PARITY, 1 STOP BIT, 8 BITs LENGTH). Please remember that exploiting the serial line configured in RS 485 or Current-Loop and thank to the development of a powerful comunication protocol, is possible to connect in net up to 127 **IPC 52**, stretching only two wires. This characteristic consents the use of intelligient unity also to notable distance, so the User can acquire a very tall number of lines, stretching only one serial communication cable. Normally the card is provided with RS 232 interfaces and a different configuration must be specified when ordering.

ABACO® BUS

One of the most important features of **IPC 52** is its possibility to be interfaced to industrial **ABACO®** BUS. Thanks to its standard **ABACO®** BUS connector, the card can be connected to some of the numerous **Grifo®** CPU boards. So, **IPC 52** becomes the right component for each industrial automation systems, in fact **ABACO®** BUS makes the card easily expandable with the best price/ performance ratio. For further information please refer to chapter "HARDWARE DESCRIPTION".

ANALOG INTERFACE

This section has all the circuitry for the signals treatment and acquisition. Simply observing the figure 1 of the manual, the user can understand that this section can manage 24 analog inputs that are divided in three groups, each of which can acquire different input types:
A) Thermoresistance (PT100, PT1000).
B) Thermocouple (J, K, S, T) or low voltage inputs ±85 mV, ±50 mV, ±25 mV.
C) Tension (± 2 V) and/or CURRENT (0 ± 20 mA) inputs.
On the card there is a local temperature sensor (LM35) used to acquire the on board temperature (cold junction compensation for thermocouple). The **IPC 52** has the stand-alone capability to solve any problems associated with the acquisition of analog signals applied to its inputs, and to oversee all linearizing operations performed on the signal received from probes, also cold junction compensation, etc., supplying the master system with data expressed in tenth of celsius or fahrenheit degrees, that are constantly updated and ready for further processing.

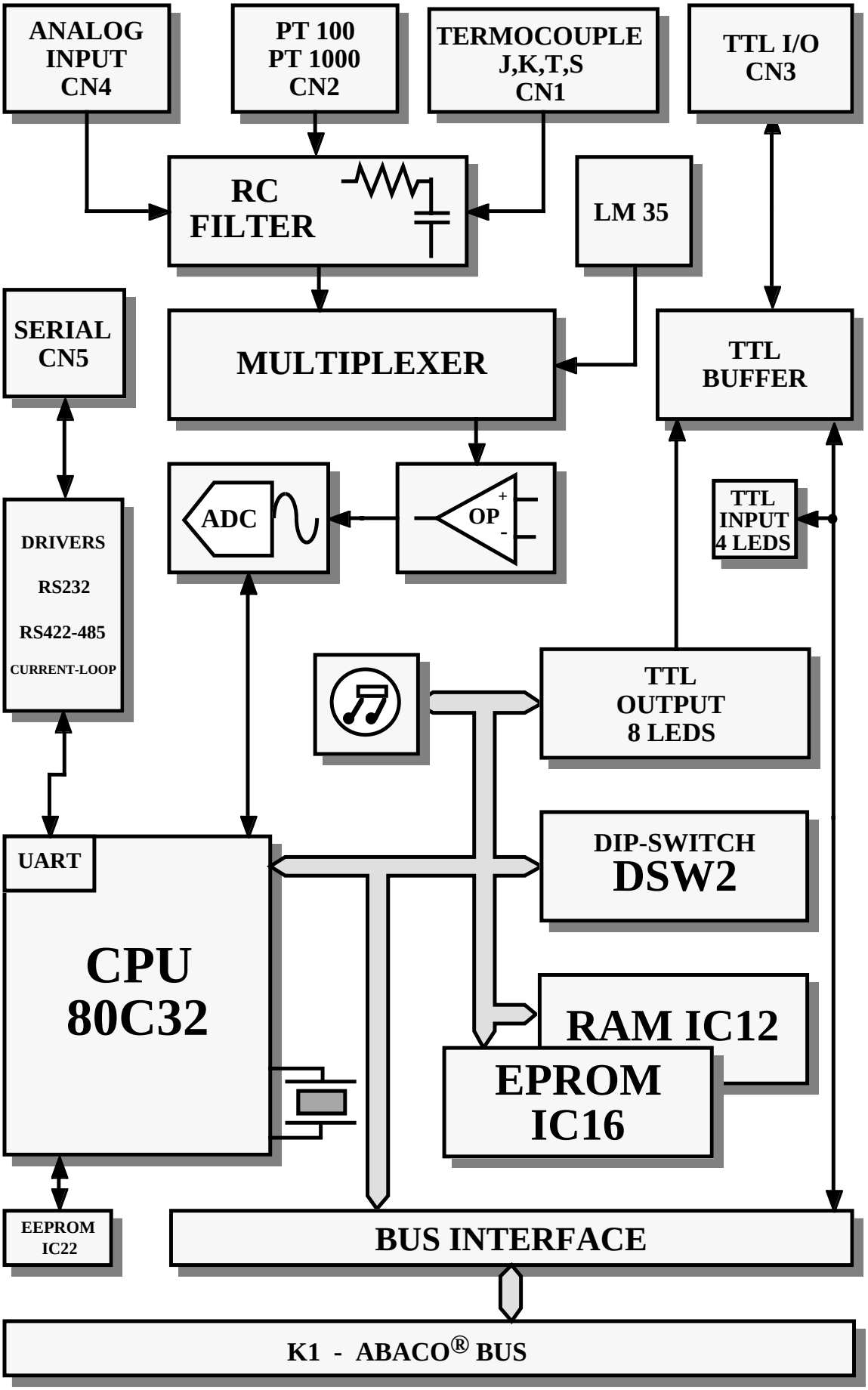


FIGURE 1: BLOCK DIAGRAM

TECHNICAL FEATURES

GENERAL FEATURES

Devices:

8	Analog inputs for PT100 and PT1000.
8	Analog inputs for thermocouple (J,K,S,T) or low voltage inputs (±85 mV, ±25 mV, ±50 mV).
8	Analog inputs for tension signals (±2 Vdc), or current signals (0÷20 or 4÷20 mA)
1	A/D converter section with 16 bits + sign resolution
1	LM35 (local temperature sensor)
8	Programmable TTL Output lines
8	Programmable TTL Input/Output lines
1	Watch-Dog
1	Buzzer
1	Bidirectional RS 232, RS 422-485 or current loop serial line
1	Dip switches with 8 dips
8	Red LEDs used to visualize the acquired channels or the 8 programmable TTL Output lines status
4	Green LEDs used to visualize the type of acquired channels or the 4 programmable TTL Input/Output lines status
1	Red LED used to visualize the BUS interrupt status.
1	Red LED used to visualize the BUS comunication status.

Memory:

IC 12: 32K x 8 RAM
IC 16: 64K x 8 EPROM
IC 22: 512 bytes SERIAL EEPROM

CPU: INTEL 80c32 at 14.7456 MHz

PHYSICAL FEATURES

Size: Single EURO card (100 x 160 mm)

Weight: 224 g

Connectors:

K1: 64 pins DIN 41612 for BUS
CN1: 15 pins, male, 90°, D connector
CN2: 26 pins, female, 90°, high density D connector
CN3: 20 pins, male, vertical, low profile connector
CN4: 20 pins, male, vertical, low profile connector
CN5: 16 pins, male, vertical, low profile connector

Temperature range: 0 ÷ 70 °C

Relative humidity: 20% ÷ 90% (without condense)

ELECTRIC FEATURES

Power supply tension: +5 Vdc

Consumption on +5 Vdc: 195 mA

RS 422-485 Termination Network:

pull-up resistor	= 3.3 KΩ
pull-down resistor	= 3.3 KΩ
line termination resistor	= 120 Ω

A/D Voltage Input Impedance: Please contact **grifo**® for more informations

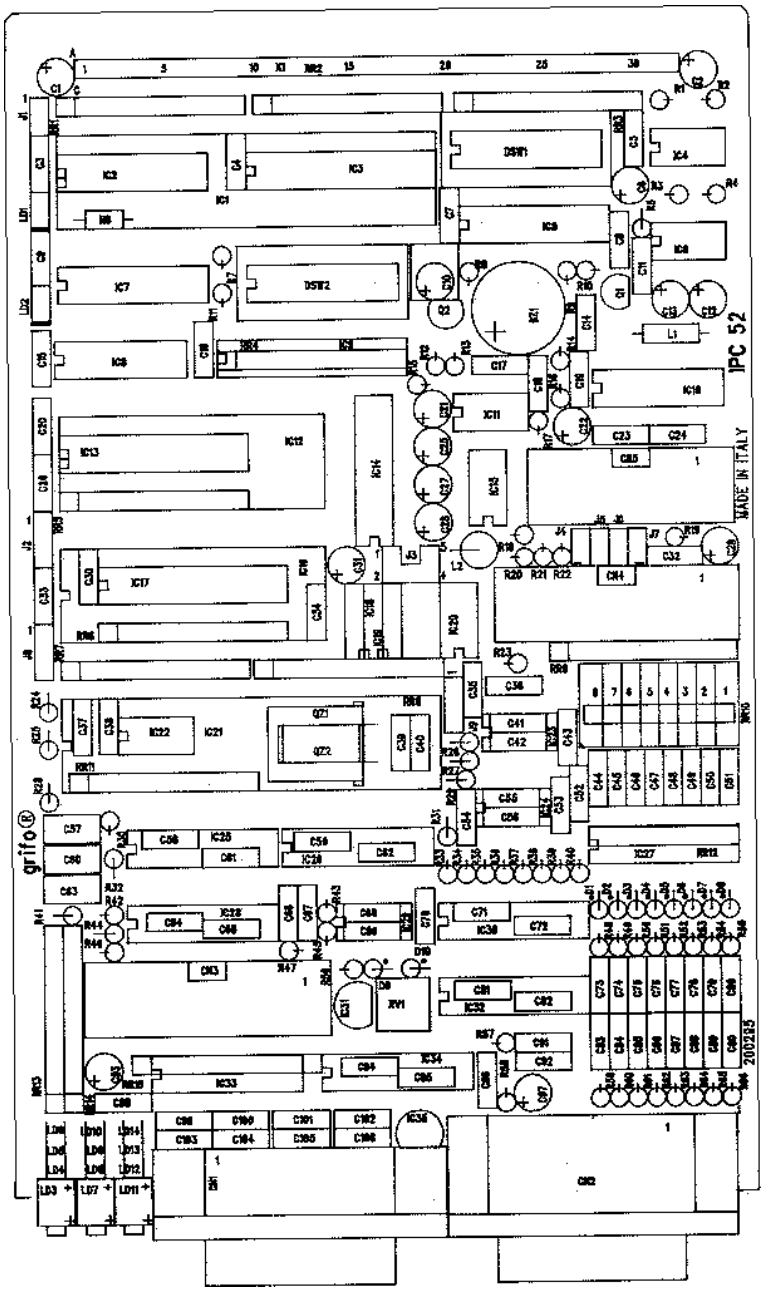


FIGURE 2: COMPONENTS MAP

INSTALLATION

In this chapter there are all informations for a right installation and correct use of the card. The User can find the location and functions of each connectors, LEDs, jumpers and some explanatory diagrams.

CONNECTIONS

The **IPC 52** module has five connectors that can be linkeded to other devices or directly to the field, according to system requirements. In this paragraph there are connectors pin out, a brief signals description (including the signals direction) and connectors location (see figure 7).

CN1 - CONNECTOR FOR THERMOCOUPLE AND LOW VOLTAGE SIGNALS

CN1 is a 15 pins, male, 90°, D connector. On CN1 connector are available the input signals to connect thermocouple (J,K,S,T) and/or low voltage signals (±85 mV, ±25 mV, ±50 mV)

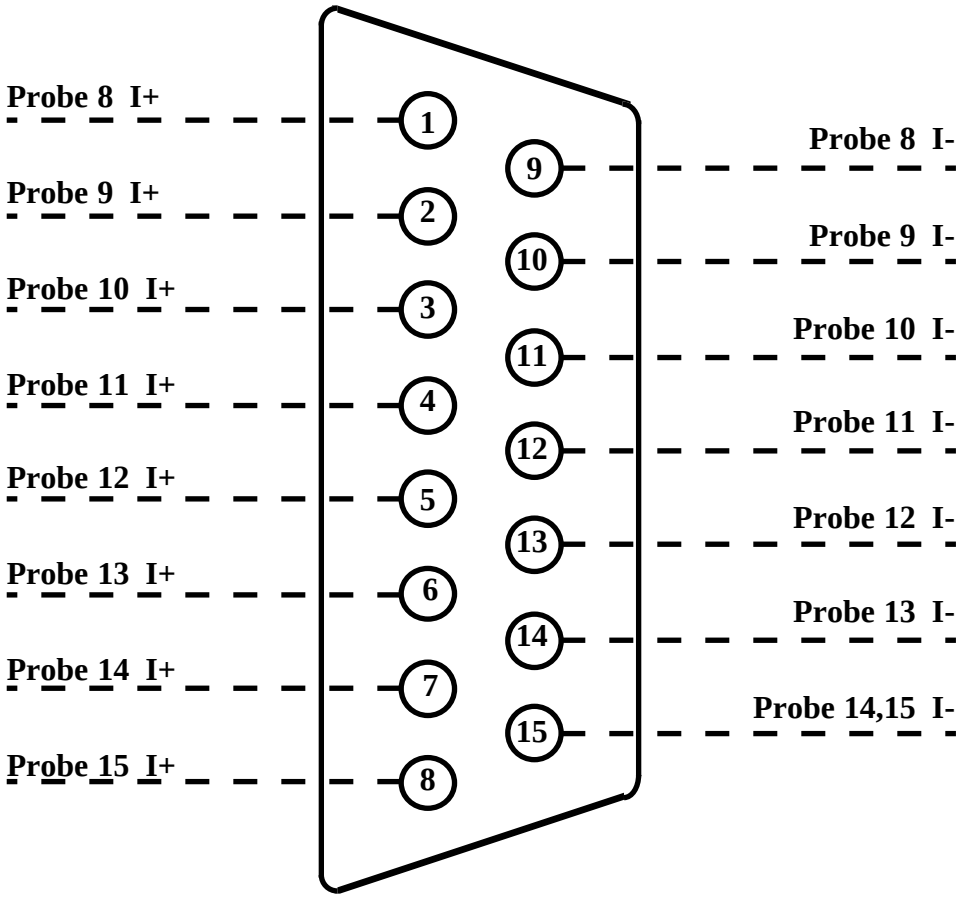


FIGURE 3: CN1 - CONNECTOR FOR THERMOCOUPLE AND LOW VOLTAGE SIGNALS

Signals description:

Probe n I+ = I - POSITIVE input
Probe n I- = I - NEGATIVE input

CN2 - CONNECTOR FOR THERMORESISTANCE

CN2 is a 26 pins, female, 90°, high density D connector. On CN2 connector are available the input signals to connect 8 thermoresistance (PT100, PT1000) both 2 or 3 wires. If the user use a 2 wires thermoresistance he must connect together the Comp. and I- probe signals.

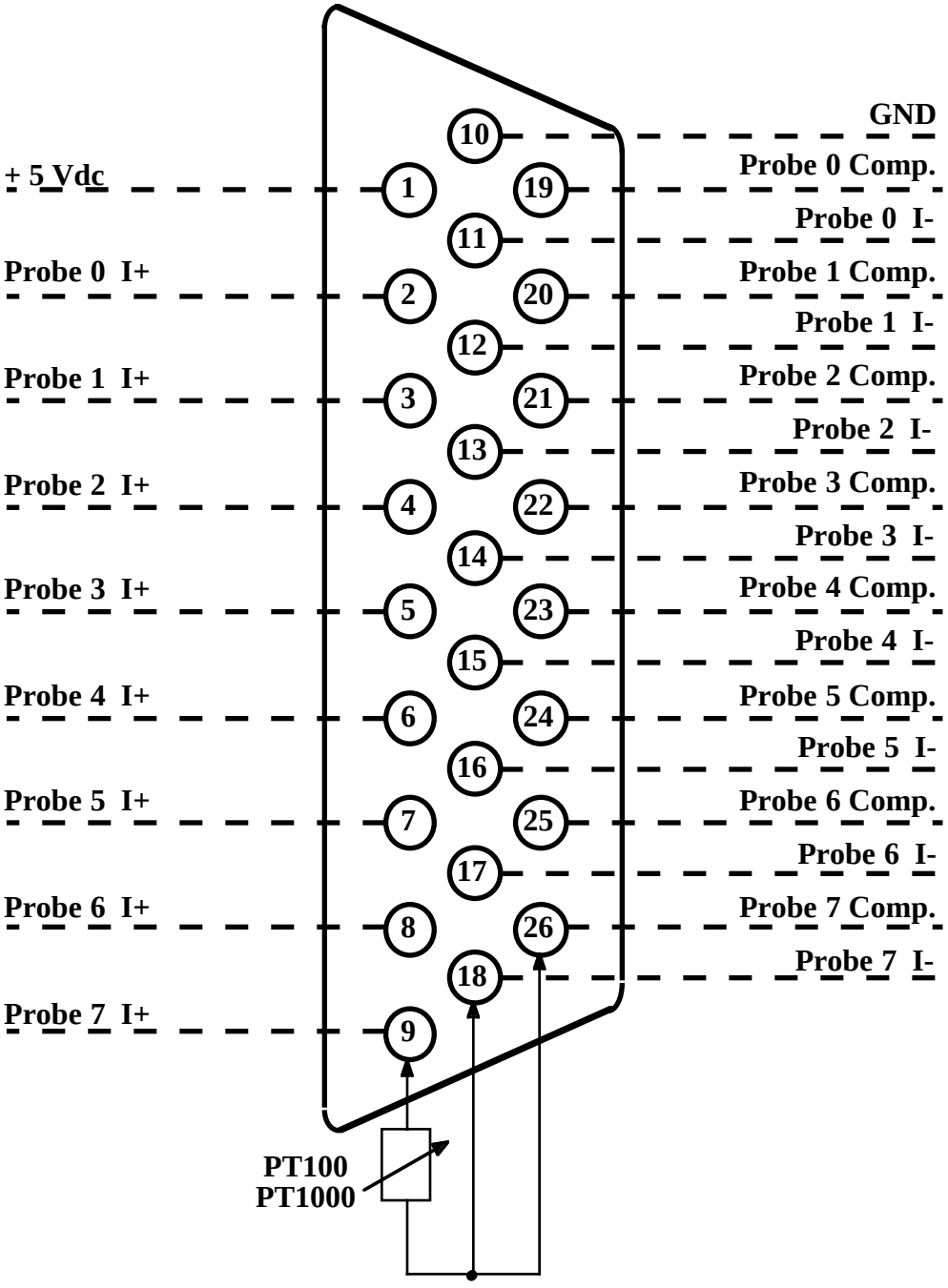


FIGURE 4: CN2 - CONNECTOR FOR THERMORESISTANCE

Signals description:

Probe n I+	=	I	- POSITIVE input
Probe n I-	=	I	- NEGATIVE input
Probe n Comp.	=	I	- COMPENSATION input

K1 - CONNECTOR FOR ABACO® BUS

K1 is a 64 pins, male, 90°, DIN 41612 connector with 2.54 pitch. On K1 are available all the industrial **ABACO®** BUS signals and it can be used for connections to many other cards. In the table below there are the standard pin outs both for 8 bits and 16 bits CPU and the signal connected on **IPC 52**. All signals follow TTL standard.

A 16 bits BUS	A 8 bits BUS	A IPC 52	PIN	C IPC 52	C 8 bits BUS	C 16 bits BUS
GND	GND	GND	1	GND	GND	GND
+5 Vdc	+5 Vdc	+5 Vdc	2	+5 Vdc	+5 Vdc	+5 Vdc
D0	D0	D0	3			D8
D1	D1	D1	4			D9
D2	D2	D2	5			D10
D3	D3	D3	6	/INT	/INT	/INT
D4	D4	D4	7		/NMI	/NMI
D5	D5	D5	8		/HALT	D11
D6	D6	D6	9		/MREQ	/MREQ
D7	D7	D7	10	/IORQ	/IORQ	/IORQ
A0	A0	A0	11	/RD	/RD	/RDLDS
A1	A1	A1	12	/WR	/WR	/WRLDS
A2	A2	A2	13		/BUSAK	D12
A3	A3	A3	14		/WAIT	/WAIT
A4	A4	A4	15		/BUSRQ	D13
A5	A5	A5	16		/RESET	/RESET
A6	A6	A6	17	/M1	/M1	/IACK
A7	A7	A7	18		/RFSH	D14
A8	A8		19		/MEMDIS	/MEMDIS
A9	A9		20		VDUSEL	A22
A10	A10		21		/IEI	D15
A11	A11		22			RESERVED
A12	A12		23		CLK	CLK
A13	A13		24			/RDUDS
A14	A14		25			/WRUDS
A15	A15		26			A21
A16			27			A20
A17			28			A19
A18			29		/R.B.	/R.B.
+12 Vdc	+12 Vdc		30		-12 Vdc	-12 Vdc
+5 Vdc	+5 Vdc	+5 Vdc	31	+5 Vdc	+5 Vdc	+5 Vdc
GND	GND	GND	32	GND	GND	GND

FIGURE 5: K1 - CONNECTOR FOR ABACO® BUS

Signals description:

8 bits CPU

A0-A15	=	O	- Address BUS
D0-D7	=	I/O	- Data BUS
INT	=	I	- Interrupt request
NMI	=	I	- Non Maskable Interrupt
HALT	=	O	- Halt state
MREQ	=	O	- Memory Request
IORQ	=	O	- Input Output Request
RD	=	O	- Read cycle status
WR	=	O	- Write cycle status
BUSAK	=	O	- BUS Acknowledge
WAIT	=	I	- Wait
BUSRQ	=	I	- BUS Request
RESET	=	O	- Reset
M1	=	O	- Machine cycle one
RFSH	=	O	- Refresh for dynamic RAM
MEMDIS	=	I	- Memory Display
VDUSEL	=	O	- VDU Selection
IEI	=	I	- Interrupt Enable Input
CLK	=	O	- System clock
R.B.	=	I	- Reset button
+5 Vdc	=	I	- Power supply at +5 Vdc
+12 Vdc	=	I	- Power supply at +12 Vdc
-12 Vdc	=	I	- Power supply at -12 Vdc
GND	=		- Ground signal

16 bits CPU

A16-A22	=	O	- Address BUS
D8-D15	=	I/O	- Data BUS
RD UDS	=	O	- Read Upper Data Strobe
WR UDS	=	O	- Write Upper Data Strobe
IACK	=	O	- Interrupt Acknowledge
RD LDS	=	O	- Read Lower Data Strobe
WR LDS	=	O	- Write Lower Data Strobe

CN3 - CONNECTOR FOR I/O

CN3 is a 20 pins, male, vertical, low profile connector with 2.54 mm pitch. On CN3 connector are available the 16 TTL I/O lines (remember that 8 lines are for only OUTPUT).

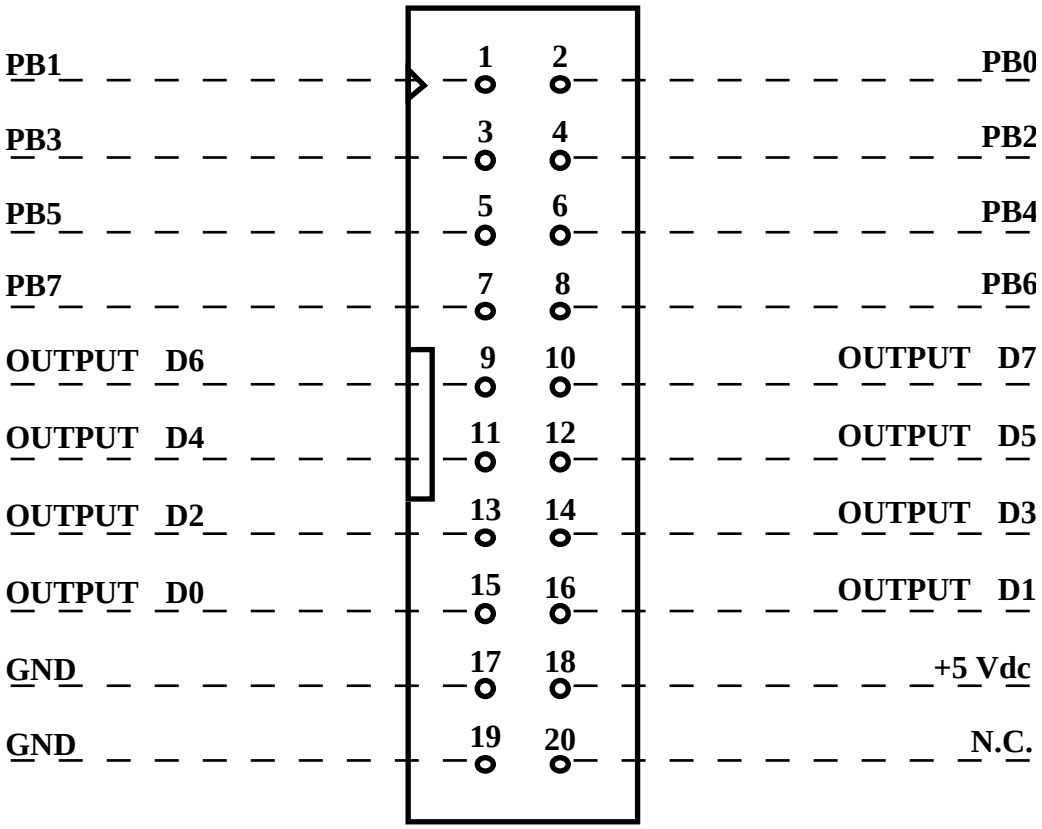


FIGURE 6: CN3 - CONNECTOR FOR I/O

Signals description:

PBn	=	I/O	- Digital line n of PPI 82C55 port B.
OUTPUT Dn	=	O	- Digital line n (only OUTPUT).
+5 Vdc	=	O	- Line connected to +5 Vdc.
GND	=		- Digital ground signal.
N.C.	=		- Not connected.

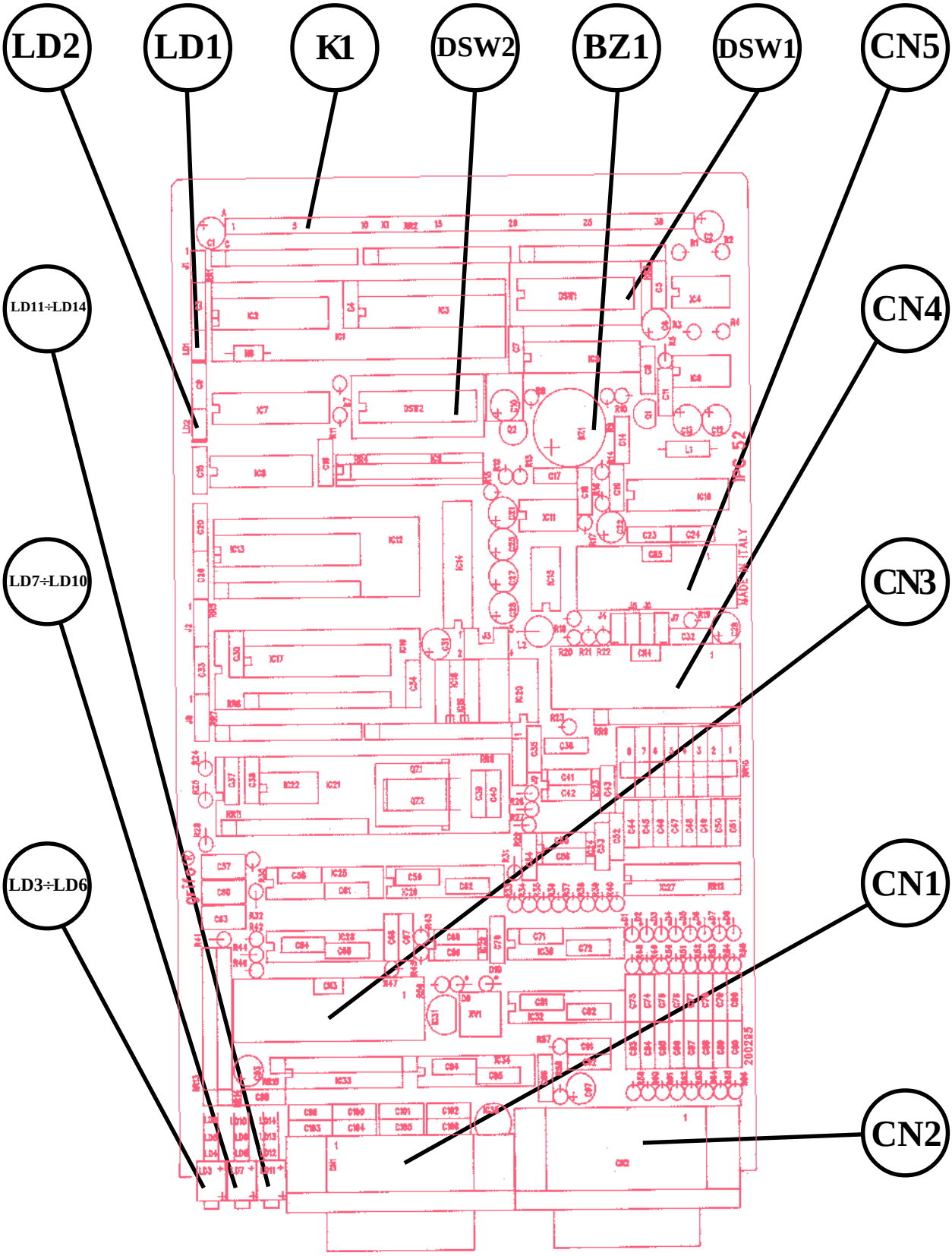


FIGURE 7: LEDS, BUZZER, DIP SWITCHES AND CONNECTORS LOCATION

CN4 - CONNECTOR FOR TENSION SIGNALS AND CURRENT SIGNALS

CN4 is a 20 pins, male, vertical, low profile connector with 2.54 mm pitch. On CN4 connector are available the input signals to connect 8 analog lines (TENSION/CURRENT).

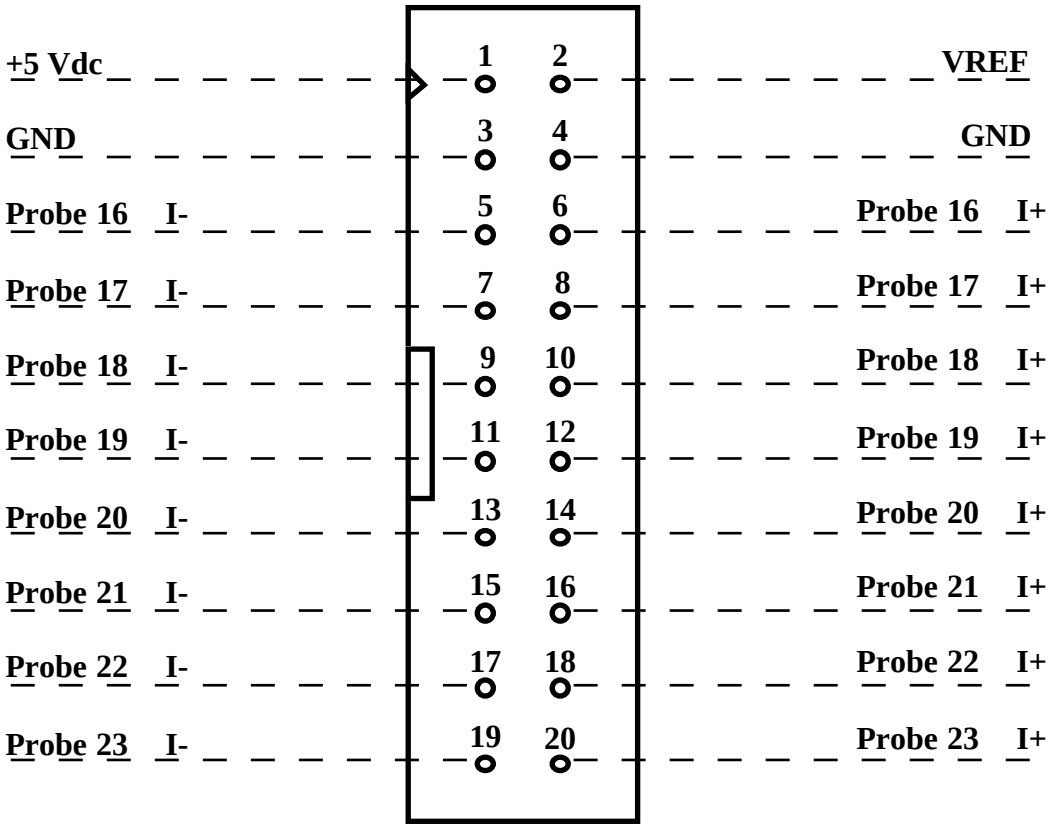


FIGURE 8: CN4 - CONNECTOR FOR TENSION SIGNALS AND CURRENT SIGNALS

Signals description:

Probe n I+	=	I	- POSITIVE input
Probe n I-	=	I	- NEGATIVE input
VREF	=	O	- Reference voltage (+2.490 Vdc)
+5 Vdc	=	O	- Line connected to +5 Vdc.
GND	=		- Digital ground signal.

CN5 - CONNECTOR FOR SERIAL COMMUNICATION

CN5 is a 16 pins, male, vertical, low profile connector with 2.54 mm pitch. On CN5 connector are available the buffered signals for RS 232, RS 422, RS 485 or Current Loop serial communication.

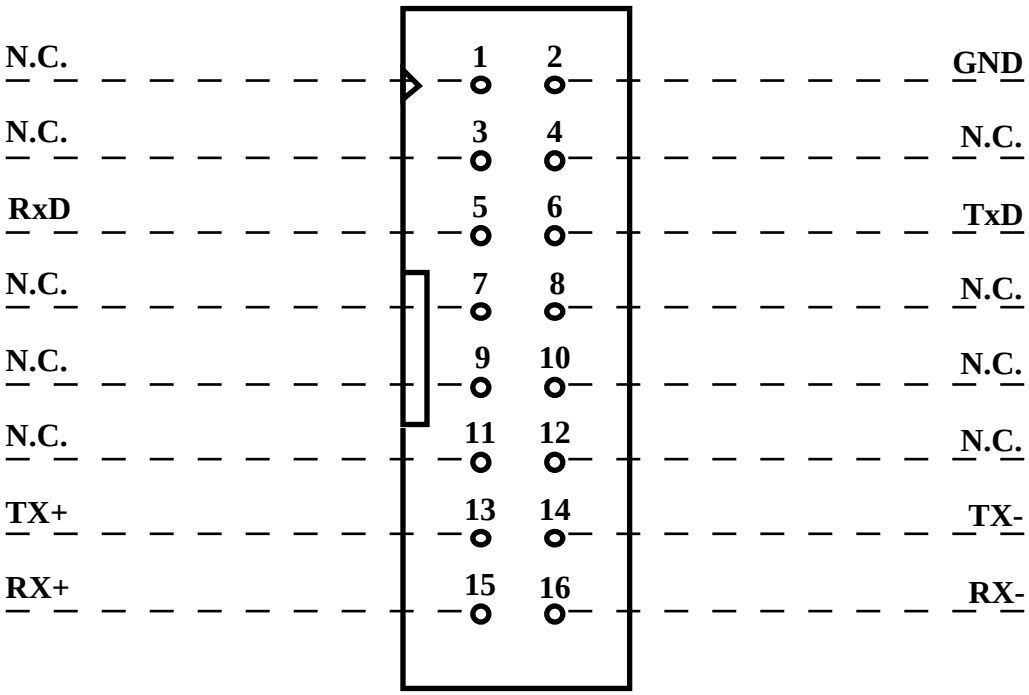


FIGURE 9: CN5 - CONNECTOR FOR SERIAL COMMUNICATION

Signals description:

RxD	=	I	- Receive Data for RS 232
TxD	=	O	- Transmit Data for RS 232
RX-	=	I	- Receive Data Negative for RS 422-485 or Current Loop
RX+	=	I	- Receive Data Positive for RS 422-485 or Current Loop
TX-	=	O	- Transmit Data Negative for RS 422-485 or Current Loop
TX+	=	O	- Transmit Data Positive for RS 422-485 or Current Loop
N.C.	=		- Not connected.
GND	=		- Digital ground signal.

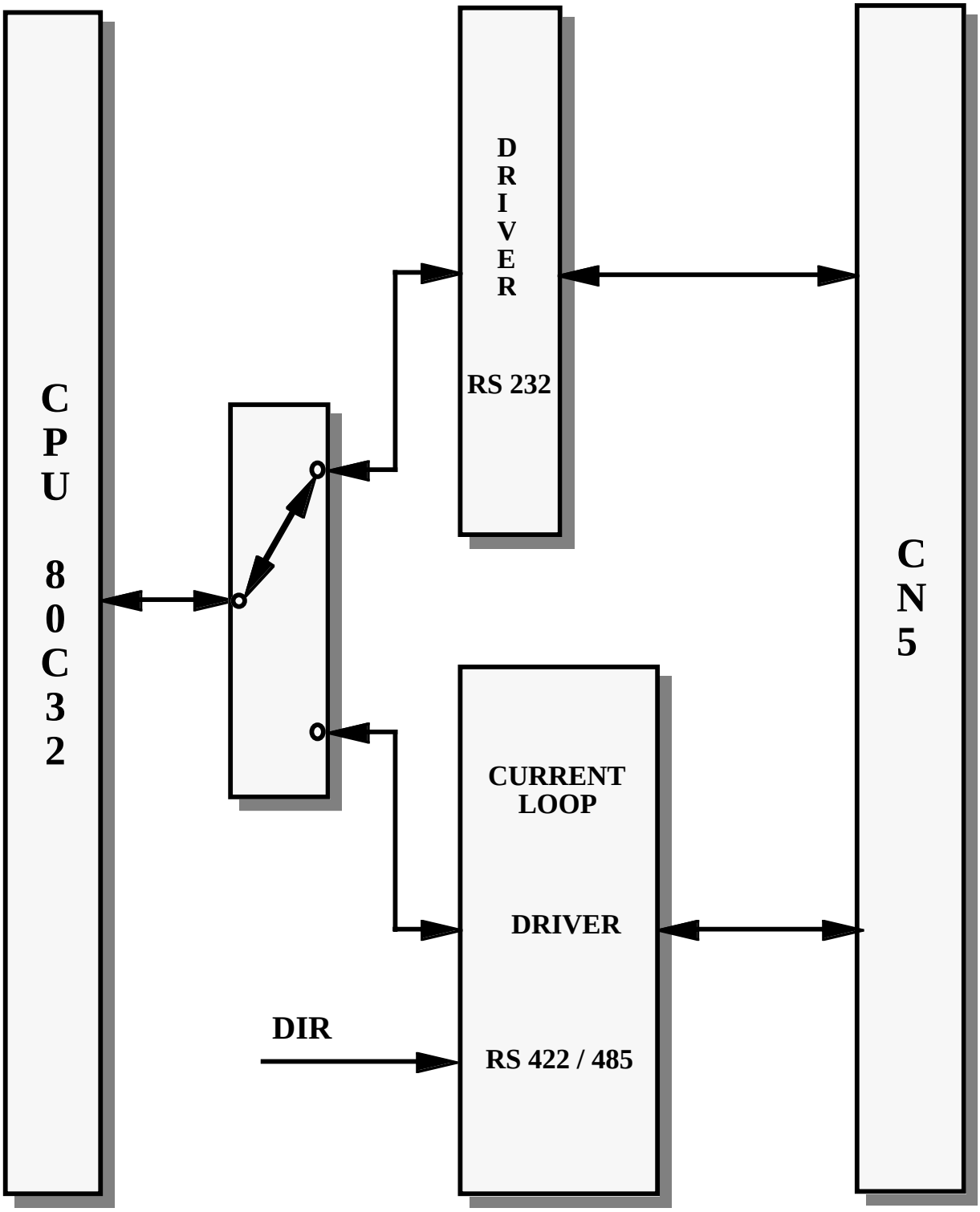


FIGURE 10: SERIAL COMMUNICATION DIAGRAM

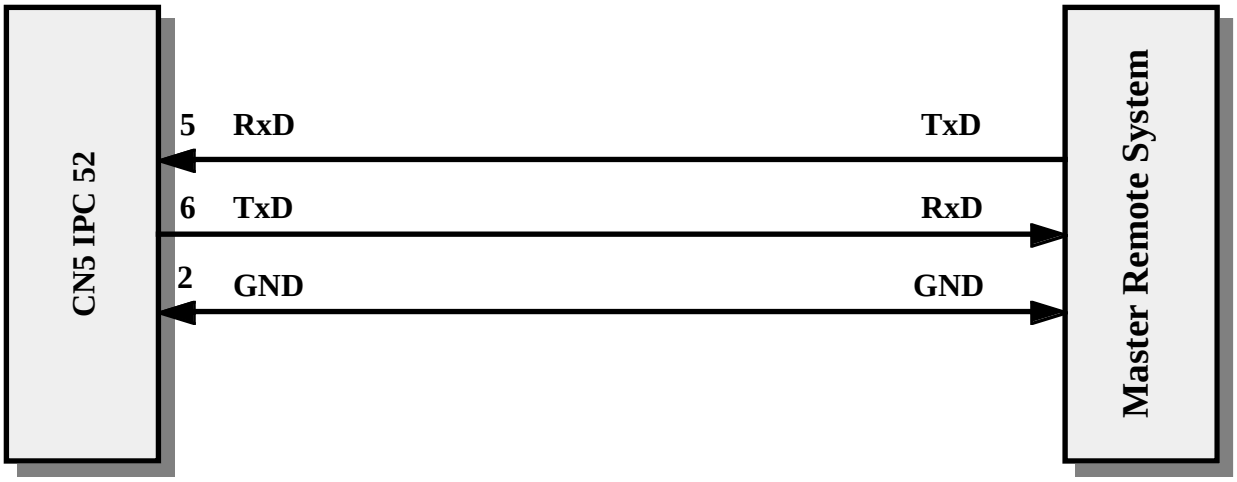


FIGURE 11: RS 232 POINT TO POINT CONNECTION EXAMPLE

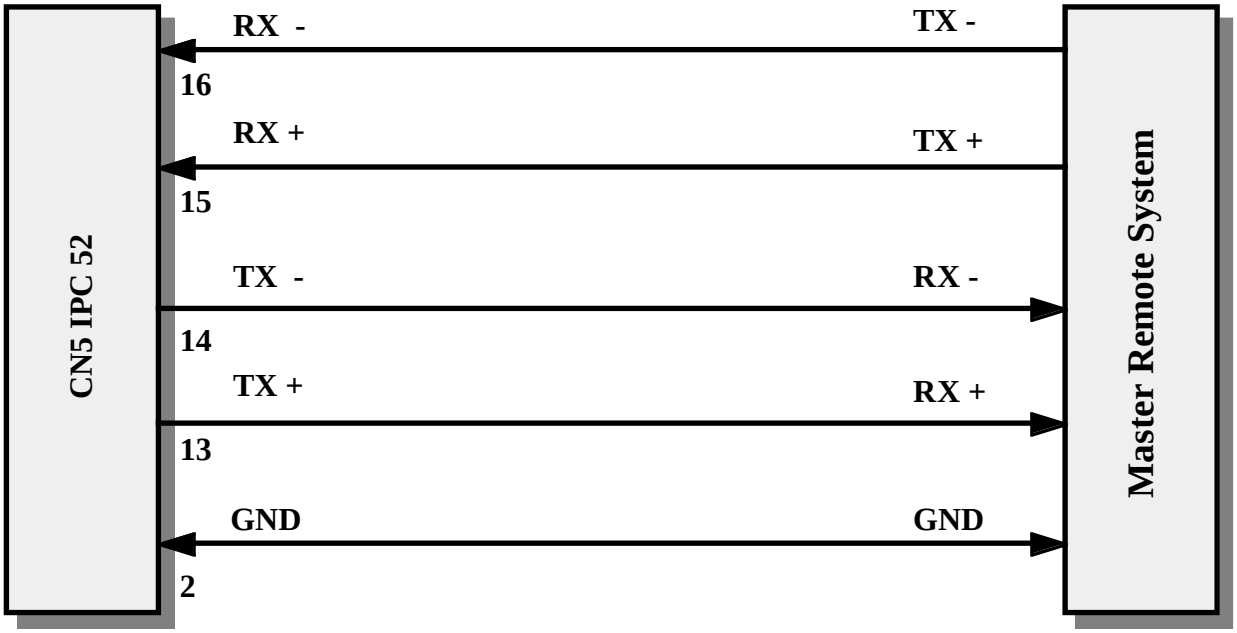


FIGURE 12: RS 422 POINT TO POINT CONNECTION EXAMPLE

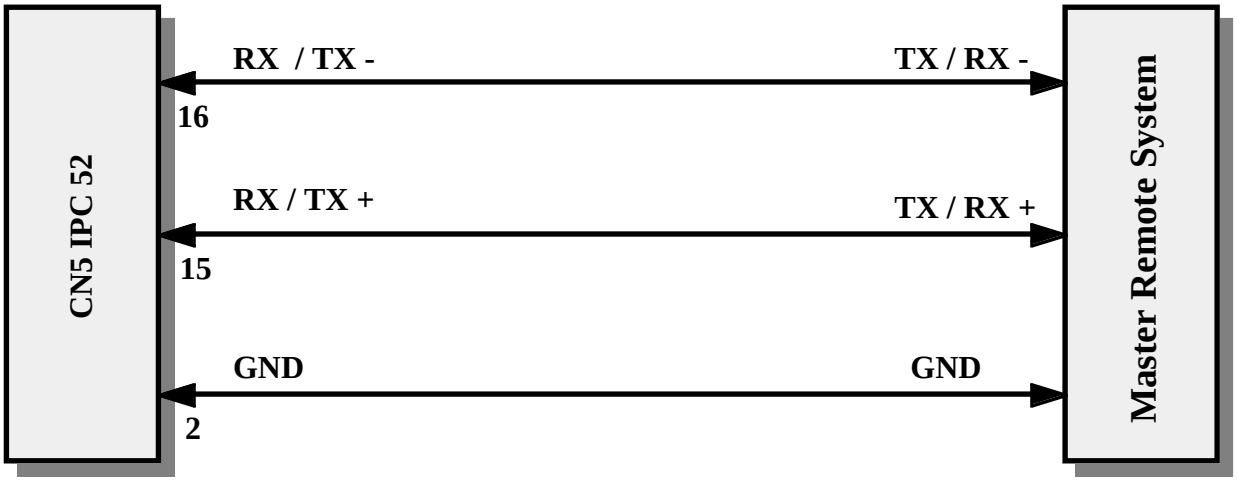


FIGURE 13: RS 485 POINT TO POINT CONNECTION EXAMPLE

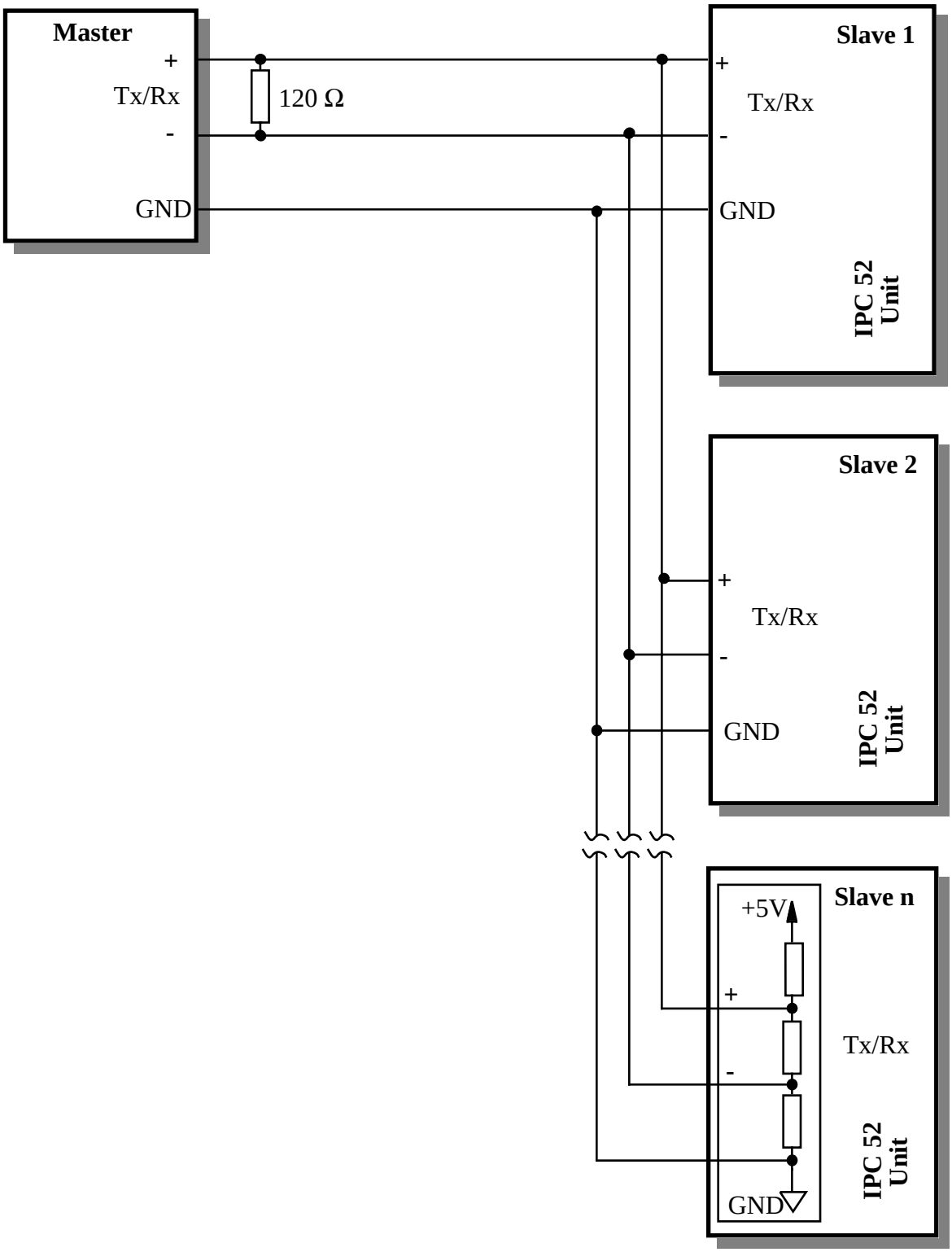


FIGURE 14: RS 485 NET CONNECTION EXAMPLE

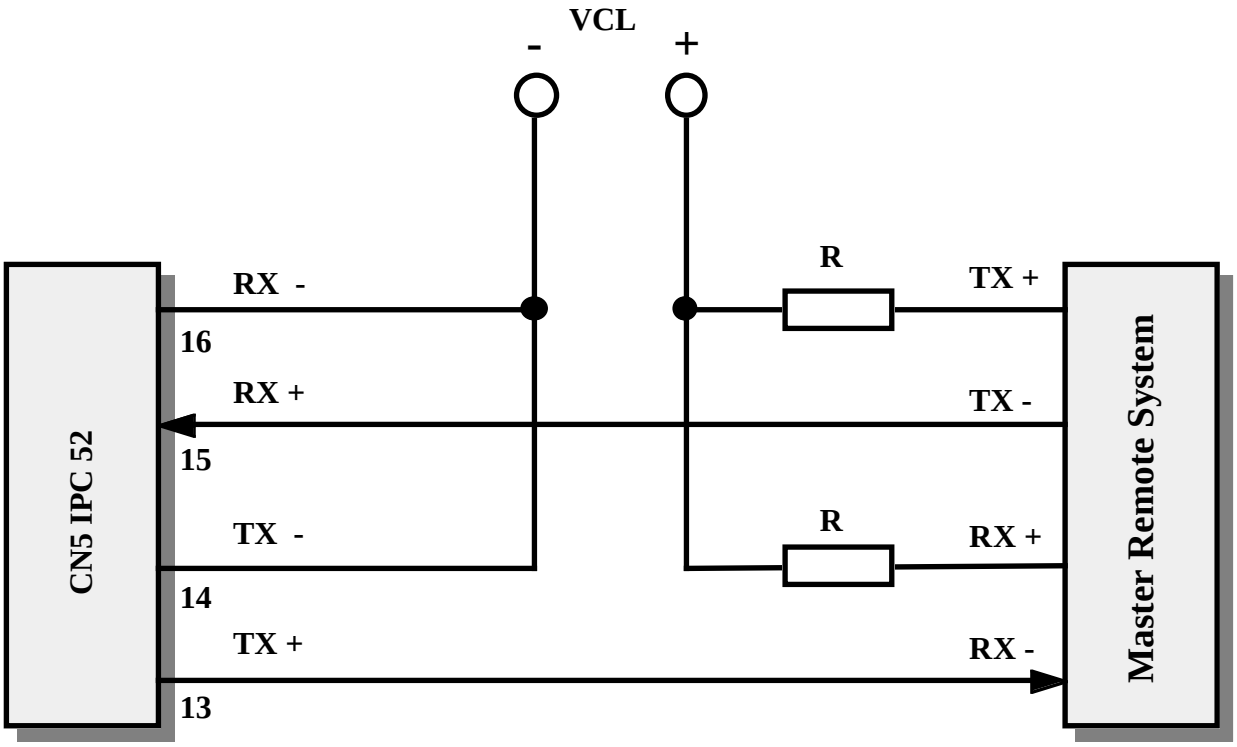


FIGURE 15: 4 WIRES CURRENT LOOP POINT TO POINT CONNECTION EXAMPLE

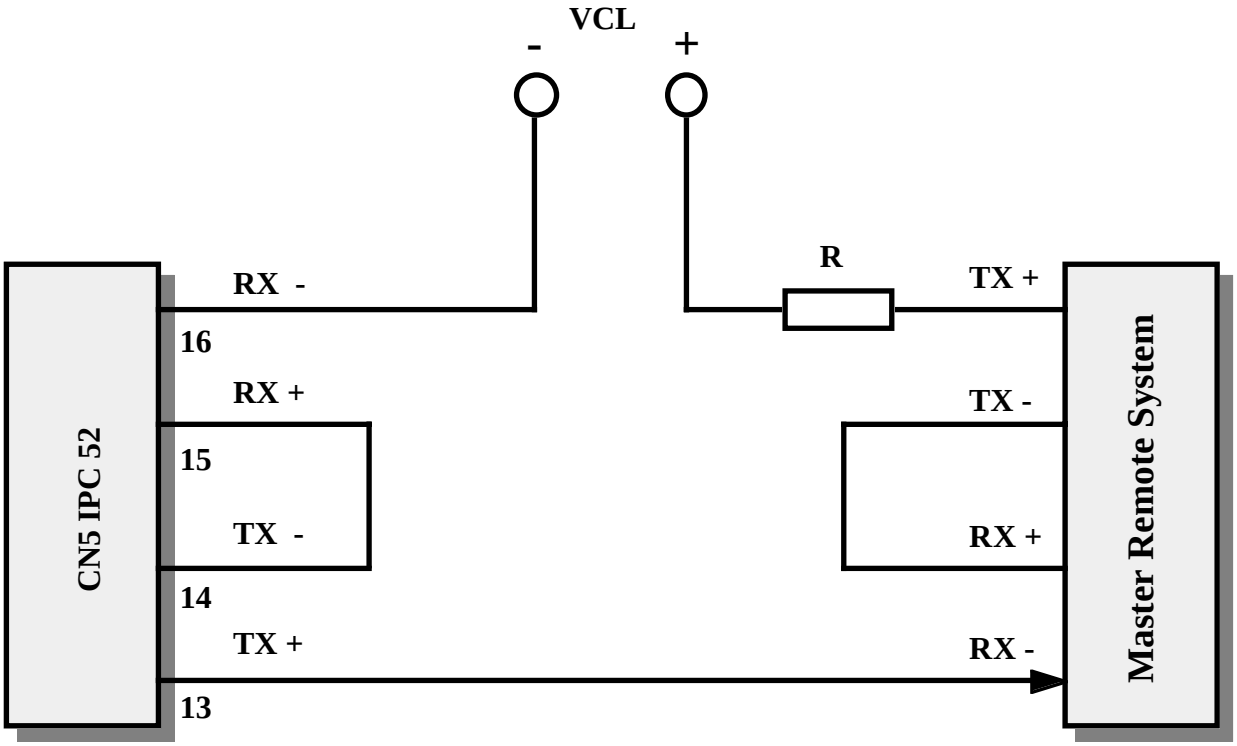


FIGURE 16: 2 WIRES CURRENT LOOP POINT TO POINT CONNECTION EXAMPLE

LEDS

On **IPC 52** there are 14 LEDs that show some of the card status information, as described in the following table:

LEDS	COLOUR	FUNCTION
LD1	Red	In parallel communication it is activated when the IPC 52 receives a character.
LD2	Red	It is activated when there is a parallel communication interrupt (INTERRUPT request from IPC 52 to MASTER CPU).
LD3...LD10	Red	They show the actual acquisition channel or the 8 user output status on CN3 (the selection of this function is made with a special software command).
LD11...LD14	Green	They show the type of the actual acquisition channel or the PB0, PB1, PB2, PB3 status on CN3 (the selection of this function is made with a special software command).

FIGURE 17: LEDS TABLE

The main function of these LEDs is to inform the User about card status, with a simple visual indication and in addition to this, LEDs make easier the debug and test operations of the complete system.

JUMPERS

On **IPC 52** there are 9 jumpers for card configuration. Connecting these jumpers, the User can define for example the memory type and size, the peripheral devices functionality, the serial communication interface and so on. Here below is the jumpers list, location and function:

JUMPERS	PIN N°	USE
J1	2	Enable BUS interrupt.
J2	3	Selects IC12 (RAM) size between 2, 8, 32 KBytes.
J3	5	Select direction and operating modes for RS 422-485 serial line.
J4, J5	2	Connects termination resistors to RS 422-485 serial line (IC18).
J6, J7	2	Connects termination resistors to RS 422-485 serial line (IC20).
J8	3	Selects IC12 (RAM) size between 2, 8, 32 KBytes.
J9	3	Select receveing driver (IC20 or IC18) for RS 422-485 line.

FIGURE 18: JUMPERS SUMMARIZING TABLE

The following tables describe all the right connections of **IPC 52** jumpers with their relative functions. To recognize these valid connections, please refer to the board printed diagram (serigraph) or to figure 2 of this manual, where the pins numeration is listed; for recognizing jumpers location, please refer to figure 22 and appendix A.

5 PINS JUMPERS

JUMPERS	CONNECTION	FUNCTION	DEF.
J3	position 1-2 & 3-4	Select RS 485 serial communication (2 wires).	
	position 2-3 & 4-5	Select RS 422 serial communication (4 wires).	

FIGURE 19: 5 PINS JUMPERS TABLE

The "*" denotes the default connection, or on the other hand the connection set up at the end of testing phase, that is the configuration the User receives.

2 PINS JUMPERS

JUMPERS	CONNECTION	USE	DEF.
J1	not connected	Disable BUS interrupt.	*
	connected	Enable BUS interrupt.	
J4, J5	not connected	Termination resistors not connected to RS 422-485 serial line (IC18).	*
	connected	Termination resistors connected to RS 422-485 serial line (IC18).	
J6, J7	not connected	Termination resistors not connected to RS 422-485 serial line (IC20).	*
	connected	Termination resistors connected to RS 422-485 serial line (IC20).	

FIGURE 20: 2 PINS JUMPERS TABLE

3 PINS JUMPERS

JUMPERS	CONNECTION	FUNCTION	DEF.
J2	position 1-2	Configures IC12 for 2 KBytes RAM.	
	position 2-3	Configures IC12 for 2, 8, 32 KBytes RAM.	*
J8	position 1-2	Configures IC12 for 2 or 8 KBytes RAM.	
	position 2-3	Configures IC12 for 32 KBytes RAM.	*
J9	position 1-2	Select IC20 driver for RS 422-485 receveing.	
	position 2-3	Select IC18 driver for RS 422-485 receveing.	

FIGURE 21: 3 PINS JUMPERS TABLE

The "*" denotes the default connection, or on the other hand the connection set up at the end of testing phase, that is the configuration the User receives.

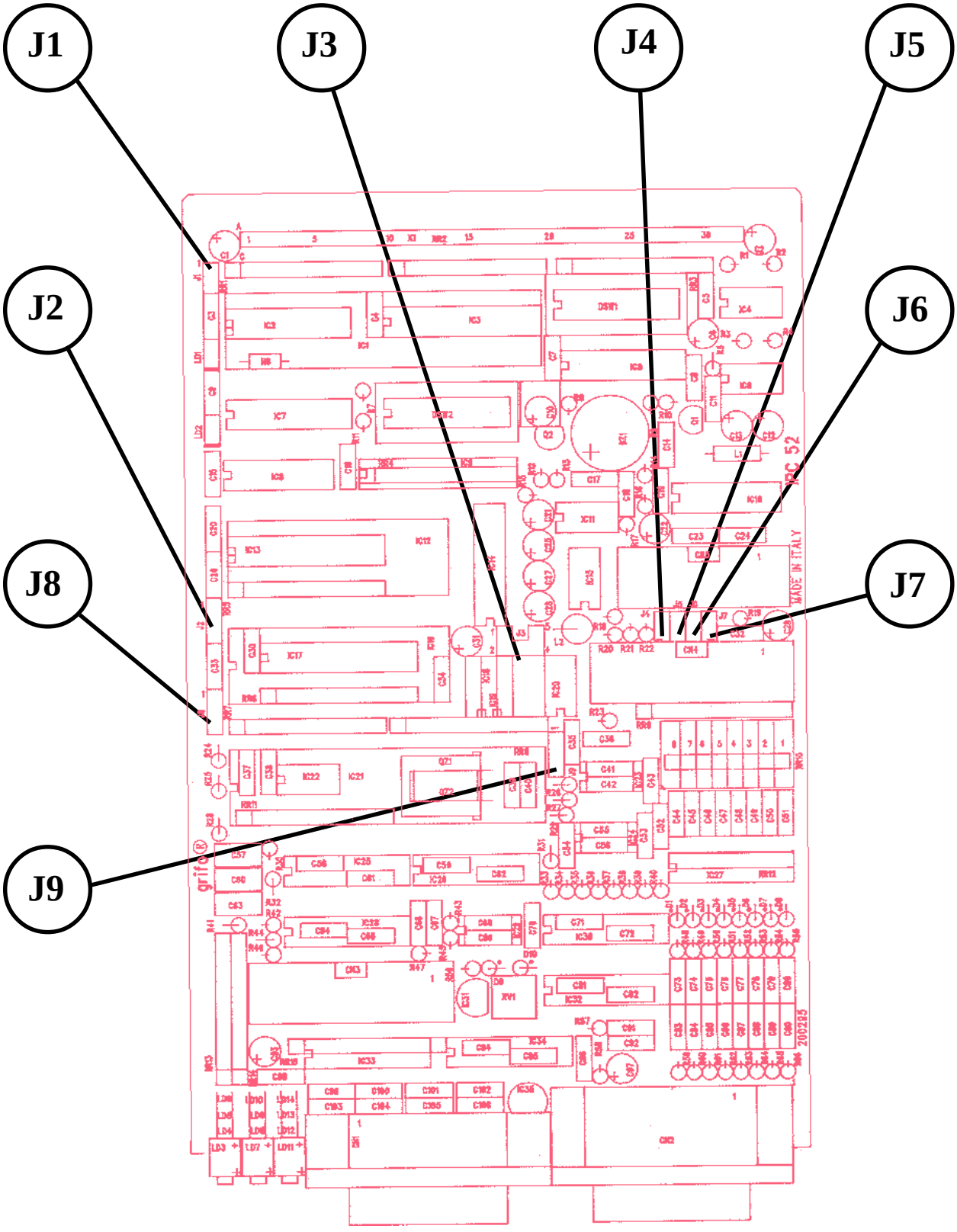


FIGURE 22: JUMPERS LOCATION

NOTE

In the following chapters there are some detailed explanations of card settings and a description of the right procedures to perform these settings.

TENSION AND/OR CURRENT SIGNALS SELECTION

One of the **IPC 52** particular features of is the possibility to acquire tension and/or current signals (channels 16÷23). The CURRENT signals selection is made by mounting the relative **100 Ω** resistrors on the card (please refer to the board printed diagram 1,2,3,4,5,6,7,8 under CN4) with the following correspondence:

1 ---> channel 16 resistor (CURRENT INPUT)
2 ---> channel 17 resistor (CURRENT INPUT)
3 ---> channel 18 resistor (CURRENT INPUT)
4 ---> channel 19 resistor (CURRENT INPUT)
5 ---> channel 20 resistor (CURRENT INPUT)
6 ---> channel 21 resistor (CURRENT INPUT)
7 ---> channel 22 resistor (CURRENT INPUT)
8 ---> channel 23 resistor (CURRENT INPUT)

If the resistor is not mounted (default) the channel can acquire a TENSION signal in the range ±2 V (for more informations about input impedance please contact **grifo**®). If the resistor is mounted the channel can acquire a CURRENT signal in the range 0÷20 mA.

SERIAL COMMUNICATION SELECTION

The **IPC 52** serial line can be buffered in RS 232, RS 422, RS 485 or Current Loop. By hardware can be selected which one of these electric standard is used, through jumpers connection (as described in the previous table). By software the serial lines can be programmed to operate with standard baud rates (1200, 2400, 4800, 9600, 19200), the other parameters are fixed. In this paragraph follows a detailed hardware configuration description of each serial line electric standards.

- RS 232 (default)

J3	=	don't care	IC 18 =	no component
J9	=	don't care	IC 20 =	no component
			IC 15 =	no component
			IC 19 =	no component
			IC 14 =	MAX 232 driver

- CURRENT LOOP

J3	=	don't care	IC 18 =	no component
J9	=	don't care	IC 20 =	no component
			IC 15 =	HCPL 4200 driver
			IC 19 =	HCPL 4100 driver
			IC 14 =	no component

The current loop serial line is a passive line, so during connection the User must provide an external power supply.

- RS 422

J3	=	2-3; 4-5	IC 18 =	SN 75176 driver
J9	=	2-3	IC 20 =	SN 75176 driver
			IC 15 =	no component
			IC 19 =	no component
			IC 14 =	no component

- RS 485

J3	=	1-2; 3-4	IC 18 =	SN 75176 driver
J9	=	2-3	IC 20 =	no component
			IC 15 =	no component
			IC 19 =	no component
			IC 14 =	no component

With RS 485 communication line, on CN5 the pin 16 has the double function of RX-/TX- and pin 15 has the double function of RX+/TX+. All the transmitted characters are at the same time received when the User uses RS 485 on **IPC 52**; in this way the line conflict can be immediately recognized simply testing the received character after each transmission.

With jumpers J4, J5, J6 and J7 the RS 422 line or the RS 485 line can be terminated with a suitable resistor. The line termination must be added only at the beginning and at the end of the physical line, by connecting the jumpers. Normally these jumpers must be connected in point to point networks, or on the farther cards in multipoints networks.

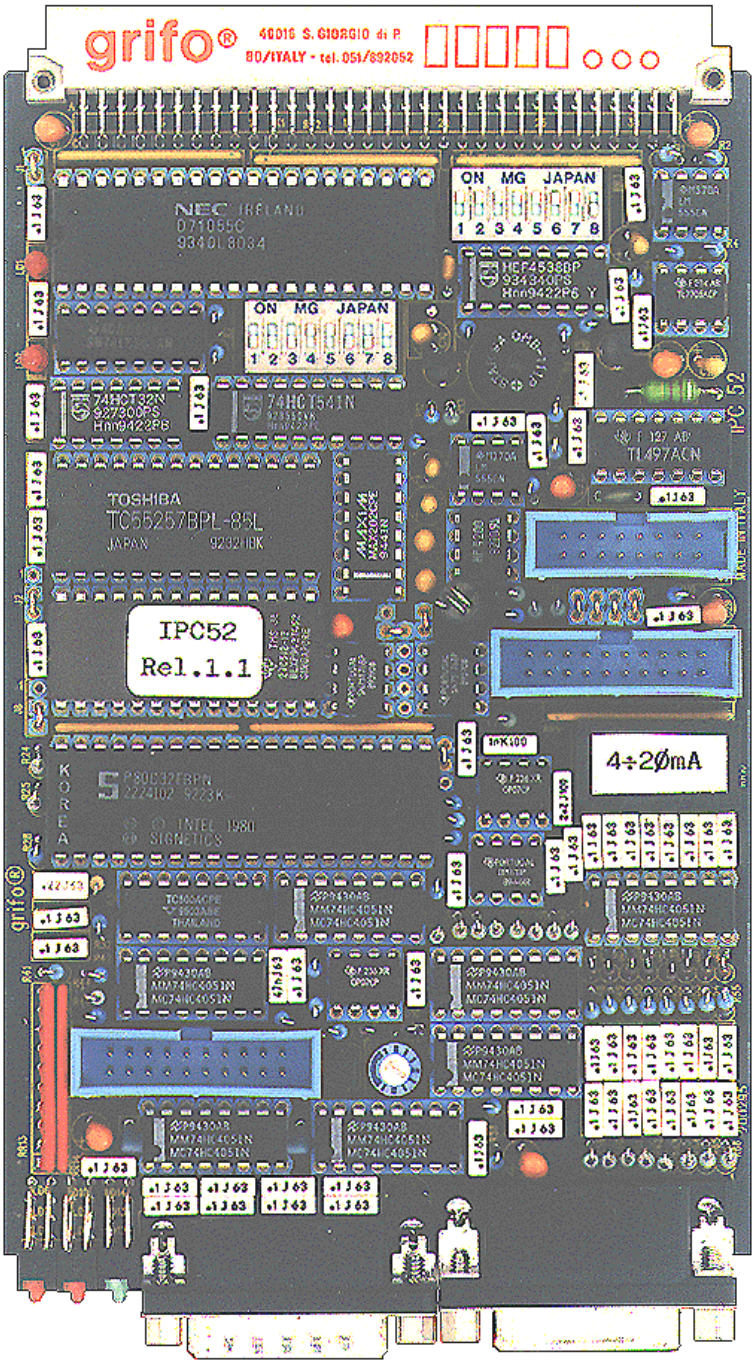


FIGURE 23: CARD PHOTO

SOFTWARE

The user can communicate with the **IPC 52** with the serial line or with the **ABACO® industrial BUS.** Before card alimentation the User must configure the **IPC 52** through the dip-switch DSW2 for select the communication type (serial or parallel), the baud-rate, the work mode (SET-UP MODE or RUN MODE), etc.
The DATA FORMATS for the acquisition channels are the subsequernt:

-Temperatures: = CELSIUS decimal degrees or FAHRENHEIT decimal degrees.
-Low voltage inputs: = amplified input 1 combination (±61675).
amplified input 2 combination (±61626).
amplified input 3 combination (±59244).
-Tension inputs: = combination (±49253).
-Current inputs: = combination (0÷8191).

DSW2 (CONFIGURATION DIP-SWITCH)

DSW2 is read from the firmware, only at the power-on time so if the user modify his setting, the IPC 52 ignore them until the subsequent power-on.

DIP1 = Free.

DIP2 = OFF ----------> SERIAL communication.
ON ----------> BUS communication.

DIP3	DIP4	DIP5	BAUD-RATE (BAUD)
OFF	OFF	OFF	1200
OFF	OFF	ON	2400
OFF	ON	OFF	4800
OFF	ON	ON	9600
ON	OFF	OFF	19200

DIP6 = OFF ----------> CELSIUS degreeses.
ON ----------> FAHRENHEIT degreeses.

DIP7 = OFF ----------> Communication without CRCfunction.
ON ----------> Communication with CRCfunction.

DIP8 = OFF ----------> RUN MODE.
ON ----------> SET-UP MODE.

SET-UP MODE.

This mode is entered, when the DIP 8 of DSW2 is in ON position. In SET-UP mode the user can configure the card in fact there are all the commands that allow the type probe selection for the 24 channels (thermoresistance, thermocouple, etc.), the calibration, the thermostat function configuration, the I/O lines function selection, etc. In SET-UP mode, the card can't be connected in a communication network because the logic protocol doesn' t support it. In SET-UP mode the CRC function is not available (the DIP 7 of DSW2 has no function) **and really important, there is an echo of the received characters, so to prevent comunication errors the master, before send a character to the card, must wait the echo of the last transmitted character**. The SET-UP mode logic protocol is different from the RUN mode one in fact the "card identification name" is not managed and the command parameters are comunicated in BYTES and not in NIBBLES. Also, all the temperatures given in SET-UP mode don't count the cold junction (LM 35) temperature.
Below there is a list of all the available commands in this mode:

READ IDENTIFICATION NAME

Code: 65 Mnemonic: A
Number of parameters bytes: 0
Number of returned bytes without echo: 1
Description:
After the reception of the code (65) the card return 2 bytes:
byte 1 -> echo command code (65)
byte 2 -> card identification name used in RUN mode communication (080H÷0FFH).

SET IDENTIFICATION NAME

Code: 66 Mnemonic: B
Number of parameters bytes: 1
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (66) the master must transmit 1 byte (080H÷0FFH) that is the card identification name used in RUN mode communication.

CHANNELS CONFIGURATION

Code: 67 Mnemonic: C
Number of parameters bytes: 2
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (67) the master must transmit 2 bytes (0H÷017H, 0H÷0DH). The first byte is the channel number and the second byte is the configuration code.
Below there is a configuration code description for the channels:
Channels: 0÷7 ----------> 0= Deactivates channel.
----------> 1= Thermoresistance: PT100 with decimal (-70.0 ÷ 400.0 C°).
----------> 9= Thermoresistance: PT100 without decimal (-200.0 ÷ 850.0 C°).
----------> 10= Thermoresistance: PT1000 (-200.0 ÷ 450.0 C°).

Channels: 8÷15 ----------> 0= Deactivates channel.
----------> 2= Thermocouple: J EUR (-200.0 ÷ 900.0 C°).
----------> 3= Thermocouple: J USA (-210.0 ÷ 980.0 C°).
----------> 4= Thermocouple: K (-270.0 ÷ 1372.0 C°).
----------> 5= Thermocouple: S (-50.0 ÷ 1767.0 C°).
----------> 6= Thermocouple: T (-270.0 ÷ 400.0 C°).
----------> 11= Amplified input type 3 (± 50 mV).
----------> 12= Amplified input type 2 (± 25 mV).
----------> 13= Amplified input type 1 (± 85 mV).

Channels: 16÷23 ----------> 0= Deactivates channel.
----------> 7= Voltage input (± 2 V).
----------> 8= Current input (0 ÷ 20 mA).

START CALIBRATION

Code: 68 Mnemonic: D
Number of parameters bytes: 0
Number of returned bytes without echo: 0
Description:
Start to the calibration procedure (the calibration is possible only for the channels 16 ÷23).
For further information refer to "CALIBRATION PROCEDURE" paragraph.

OFFSET CALIBRATION

Code: 69 Mnemonic: E
Number of parameters bytes: 1
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (69) the master must transmit 1 byte (040H÷047H) that is the channel number (16÷23) where the offset calibration must be done.
For further information refer to "CALIBRATION PROCEDURE" paragraph.

GAIN CALIBRATION

Code: 70 Mnemonic: F
Number of parameters bytes: 1
Number of returned bytes without echo: 1
Description:
After the reception of the echo command code (70) the master must transmit 1 byte (040H÷047H) that is the channel number (16÷23) where the gain calibration must be done. When the gain calibration is complete (the calibration cycle belong some second) the card transmit the "$" (024H) character. For further information refer to "CALIBRATION PROCEDURE" paragraph.

STOP CALIBRATION

Code: 71 Mnemonic: G
Number of parameters bytes: 0
Number of returned bytes without echo: 0
Description:
Stop to the calibration procedure.
For further information refer to "CALIBRATION PROCEDURE" paragraph.

SET THE LM35 ADJUST READING

Code: 72 Mnemonic: H
Number of parameters bytes: 3
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (72) the master must transmit 3 bytes:

- byte 1 -> Reference temperature Sign (0=positive, 1=negative).
- byte 2 -> Reference temperature HIGH byte (0H÷0FFH).
- byte 3 -> Reference temperature LOW byte (0H÷0FFH).

The reference temperature must be transmitted in decimal fahrenheit degreeses. For example if the reference temperature is 68,0 F° (20,0 C°) the bytes to transmit are: 0H, 02H, 0A8H.

READ CARD CONFIGURATION

Code: 73 Mnemonic: I
Number of parameters bytes: 0
Number of returned bytes without echo: 31
Description:
After the reception of the code (73) the card return 32 bytes:

byte 1 -> Echo command code (73)
byte 2 -> Degree type selection for the temperature data transmission:
0 = CELSIUS
1 = FAHRENHEIT
byte 3 -> Channel 0 configuration:
0 = Deactivates channel.
1 = Thermoresistance: PT100 with decimal (-70.0 ÷ 400.0 C°).
9 = Thermoresistance: PT100 without decimal (-200.0 ÷ 850.0 C°).
10 = Thermoresistance: PT1000 (-200.0 ÷ 450.0 C°).
bytes 4÷10 -> As byte 3 but for the following channels (byte 4 = channel 1 ...
byte 10 = channel 7).
byte 11 -> Channel 8 configuration:
0 = Deactivates channel.
2 = Thermocouple: J EUR (-200.0 ÷ 900.0 C°).
3 = Thermocouple: J USA (-210.0 ÷ 980.0 C°).
4 = Thermocouple: K (-270.0 ÷ 1372.0 C°).
5 = Thermocouple: S (-50.0 ÷ 1767.0 C°).
6 = Thermocouple: T (-270.0 ÷ 400.0 C°).
11 = Amplified input type 3 (± 50 mV).
12 = Amplified input type 2 (± 25 mV).

13 = Amplified input type 1 (± 85 mV).

bytes 12÷18 -> As byte 11 but for the following channels (byte 12 = channel 9 ... byte 18 = channel 15).

byte 19 -> Channel 16 configuration:
0 = Deactivates channel.
7 = Voltage input (± 2 V).
8 = Current input (0 ÷ 20 mA).

bytes 20÷26 -> As byte 19 but for the following channels (byte 20 = channel 17 ... byte 26 = channel 23).

byte 27 -> Channels 0÷7 activation state byte (bit = 0 -> channel not in acquisition; bit = 1 -> channel in acquisition):
bit 0 = channel 0 state
bit 1 = channel 1 state
bit 2 = channel 2 state
bit 3 = channel 3 state
bit 4 = channel 4 state
bit 5 = channel 5 state
bit 6 = channel 6 state
bit 7 = channel 7 state

byte 28 -> As byte 27 but for the channels 8÷15.

byte 29 -> As byte 27 but for the channels 16÷23.

byte 30 -> No function Byte.

byte 31 -> 8 OUTPUT lines (red LEDs) function byte:
0 = LD3÷LD10 used to visualize the acquired channels (the user can' t use the 8 output lines).
1 = LD3÷LD10 used to visualize the 8 programmable TTL Output lines status (the user can use the 8 output lines).

byte 32 -> 8 INPUT/OUTPUT lines (PBn, green LEDs) function byte:
0 = LD11÷LD14 used to visualize the type of acquired channels.
LD11 = ON channels 0÷7 (thermoresistances) in acquisition.
LD12 = ON channels 8÷15 (thermocouples) in acquisition.
LD13 = ON channels 16÷23 (voltage/current inputs) in acquisition.
1 = 8 INPUT/OUTPUT Lines used as USER OUTPUT.
2 = 8 INPUT/OUTPUT Lines used as USER INPUT.
3 = 8 INPUT/OUTPUT Lines used as OUTPUT for THERMOSTAT FUNCTION.
4 = 8 INPUT/OUTPUT Lines used as OUTPUT for SOFT-START THERMOSTAT FUNCTION.

READ LM35 (COLD JUNCTION)

Code: 74 Mnemonic: J
Number of parameters bytes: 0
Number of returned bytes without echo: 3
Description: After the reception of the code (74) the card return 4 bytes:

byte 1 -> Echo command code (74)
byte 2 -> On board temperature HIGH byte (0H÷0FFH).
byte 3 -> On board temperature LOW byte (0H÷0FFH).
byte 4 -> On board temperature Sign (0=positive, 1=negative).

8 OUTPUT LINES FUNCTION SELECTION

Code: 75 Mnemonic: K
Number of parameters bytes: 1
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (75) the master must transmit 1 byte :

48 = LD3÷LD10 used to visualize the acquired channels (the user can't use the 8 output lines).
49 = LD3÷LD10 used to visualize the 8 programmable TTL Output lines status (the user can use the 8 output lines).

READ 24 CHANNELS VALUES AND THEIR ACTIVATION STATE

Code: 76 Mnemonic: L
Number of parameters bytes: 0
Number of returned bytes without echo: 76
Description:
After the reception of the code (76) the card returns 76 bytes:

byte 1 -> Echo command code (76)
byte 2 -> Channel 0 temperature HIGH byte (0H÷0FFH).
byte 3 -> Channel 0 temperature LOW byte (0H÷0FFH).
byte 4 -> Channel 0 temperature Sign (0=positive, 1=negative).
bytes 5÷73 -> As bytes 2, 3, 4 but for the channels 1÷23.
byte 74 -> Channels 0÷7 activation state byte (bit = 0 -> channel not in acquisition; bit = 1 -> channel in acquisition):
bit 0 = channel 0 state
bit 1 = channel 1 state
bit 2 = channel 2 state
bit 3 = channel 3 state
bit 4 = channel 4 state
bit 5 = channel 5 state
bit 6 = channel 6 state
bit 7 = channel 7 state
byte 75 -> As byte 26 but for the channels 8÷15.
byte 76 -> As byte 26 but for the channels 16÷23.

SET THE ADJUST TEMPERATURE READING FOR A SPECIFIC CHANNEL

Code: 79 Mnemonic: O
Number of parameters bytes: 4
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (79) the master must transmit 4 bytes:

byte 1 -> Channel number (0H÷017H).
byte 2 -> Reference temperature Sign (0=positive, 1=negative).
byte 3 -> Reference temperature HIGH byte (0H÷0FFH).

byte 4 -> Reference temperature LOW byte (0H÷0FFH).

The reference temperature must be transmitted in decimal fahrenheit degrees. For example if the channel 8 temperature is 20,0 C° and the user wants read 25,0 C° the bytes to transmit are: 08H, 0H, 0H, 05AH. (25,0 C° - 20,0 C° = 5,0 C°= 41,0 F° -> 41,0 F° - 32,0 F° = 9,0 F°)

8 INPUT/OUTPUT LINES (PBN) FUNCTION SELECTION

Code: 80 Mnemonic: P
Number of parameters bytes: 1
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (80) the master must transmit 1 byte :

48 = LD11÷LD14 used to visualize the type of acquired channels.
LD11 = ON channels 0÷7 (thermoresistances) in acquisition.
LD12 = ON channels 8÷15 (thermocouples) in acquisition.
LD13 = ON channels 16÷23 (voltage/current inputs) in acquisition.
49 = 8 INPUT/OUTPUT Lines used as USER OUTPUT.
50 = 8 INPUT/OUTPUT Lines used as USER INPUT.
51 = 8 INPUT/OUTPUT Lines used as OUTPUT for THERMOSTAT FUNCTION.
52 = 8 INPUT/OUTPUT Lines used as OUTPUT for SOFT-START THERMOSTAT FUNCTION.

READ CHANNELS ADJUST AND THERMOSTAT FUNCTION CONFIGURATION

Code: 81 Mnemonic: Q
Number of parameters bytes: 0
Number of returned bytes without echo: 153
Description:
After the reception of the code (81) the card return 154 bytes:

byte 1	->	Echo command code (81)
byte 2	->	Channel 0 adjust temperature LOW byte (0H÷0FFH).
byte 3	->	Channel 0 adjust temperature HIGH byte (0H÷0FFH).
byte 4	->	Channel 0 adjust temperature Sign (0=positive, 1=negative).
bytes 5÷73	->	As bytes 2, 3, 4 but for the channels 1÷23.
byte 74	->	Byte LOW of the I/O line 0 Set-Point (thermostat function).
byte 75	->	Byte HIGH of the I/O line 0 Set-Point (thermostat function).
byte 76	->	Sign (0=positive, 1=negative) of the I/O line 0 Set-Point (thermostat function).
bytes 77÷97	->	As bytes 74, 75, 76 but for the I/O lines 1÷7.
byte 98	->	Byte LOW of the I/O line 0 Hysteresis (thermostat function).
byte 99	->	Byte HIGH of the I/O line 0 Hysteresis (thermostat function).
byte 100	->	Sign (0=positive, 1=negative) of the I/O line 0 Hysteresis (thermostat function).
bytes 101÷121	->	As bytes 98, 99, 100 but for the I/O lines 1÷7.
byte 122	->	I/O line 0 associate Channel number (thermostat function).
bytes 123÷129	->	As byte 122 but for the I/O lines 1÷7.
byte 130	->	Byte LOW of the I/O line 0 Intrinsic Limit (thermostat function).

byte 131	->	Byte HIGH of the I/O line 0 Intrinsic Limit (thermostat function).
byte 132	->	Sign (0=positive, 1=negative) of the I/O line 0 Intrinsic Limit (thermostat function).
bytes 133÷153	->	As bytes 130, 131, 132 but for the I/O lines 1÷7.
byte 154	->	Ramp Step Repeating for SOFT-START thermostat function (1÷255). (1 ramp cycle = 1575 ms)

ASSOCIATION BETWEEN 8 INPUT/OUTPUT LINES (PBN) AND CHANNELS (THERMOSTAT FUNCTION)

Code: 82 Mnemonic: R
Number of parameters bytes: 2
Number of returned bytes without echo: 0
Description:
This command can be used only in THERMOSTAT function and it associate one channel to one I/O line. So with this command is possible to have an ON/OFF control on a specific channel and use the relative I/O line as thermostat OUTPUT.
After the reception of the echo command code (82) the master must transmit 2 bytes:

byte 1	->	I/O line number (0H÷07H).
byte 2	->	Channel number (0H÷017H).

SET SET-POINTS FOR THERMOSTAT FUNCTION

Code: 83 Mnemonic: S
Number of parameters bytes: 4
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (83) the master must transmit 4 bytes:

byte 1	->	I/O line number (0H÷07H).
byte 2	->	Sign (0=positive, 1=negative) of the I/O line Set-Point (thermostat function).
byte 3	->	Byte HIGH of the I/O line Set-Point (thermostat function).
byte 4	->	Byte LOW of the I/O line Set-Point (thermostat function).

The Set-Point must be transmitted in decimal fahrenheit degrees. For example if the Set-Point value is 68,0 F° (20,0 C°) the bytes to transmit are: 0H, 02H, 0A8H.

SET HYSTERESIS FOR THERMOSTAT FUNCTION

Code: 84 Mnemonic: T
Number of parameters bytes: 4
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (84) the master must transmit 4 bytes:

byte 1	->	I/O line number (0H÷07H).
byte 2	->	Sign (0=positive, 1=negative) of the I/O line Hysteresis (thermostat function).

byte 3 -> Byte HIGH of the I/O line Hysteresis (thermostat function).
byte 4 -> Byte LOW of the I/O line Hysteresis (thermostat function).

The Hysteresis must be transmitted in decimal fahrenheit degrees. For example if the Hysteresis value is 68,0 F° (20,0 C°) the bytes to transmit are: 0H, 02H, 0A8H.

SET INTRINSIC LIMITS FOR SOFT-START THERMOSTAT FUNCTION

Code: 85 Mnemonic: U
Number of parameters bytes: 4
Number of returned bytes without echo: 0
Description:
After the reception of the echo command code (85) the master must transmit 4 bytes:

byte 1 -> I/O line number (0H÷07H).
byte 2 -> Sign (0=positive, 1=negative) of the I/O line Intrinsic Limit (thermostat function).
byte 3 -> Byte HIGH of the I/O line Intrinsic Limit (thermostat function).
byte 4 -> Byte LOW of the I/O line Intrinsic Limit (thermostat function).

The Intrinsic Limit must be transmitted in decimal fahrenheit degrees. For example if the Intrinsic Limit value is 68,0 F° (20,0 C°) the bytes to transmit are: 0H, 02H, 0A8H.

SET RAMP STEP REPEATING FOR SOFT-START THERMOSTAT FUNCTION

Code: 86 Mnemonic: V
Number of parameters bytes: 1
Number of returned bytes without echo: 0

Description:
After the reception of the echo command code (86) the master must transmit 1 bytes:

byte 1 -> Ramp Step Repeating for SOFT-START thermostat function (1÷255).

The ramp is done at the beginnig of SOFT-START THERMOSTAT FUNCTION and before the power OUTPUT arrives to 50%.
Note that 1 ramp cycle = 1575 ms.

RUN MODE.

This mode is entered, when the DIP 8 of DSW2 is in OFF position. RUN MODE is the normal work state and thanks to the supported logical protocol the card can be connected in a communication network. In RUN mode the CRC function is available **and it is really important: there is an echo of the received characters, so to prevent comunication errors, the master before sending a character to the card must wait the echo of the last transmitted character**.

The user to transmit a command to the IPC 52 must execute the following operations:
1) Transmit the card identification name (128÷255).
2) Wait the card identification name echo (128÷255).
3) Transmit the command code (16÷127).
4) Wait the command code echo (16÷127).
5) Transmit the HIGH NIBBLE of the first parameter (0÷15).
6) Wait the HIGH NIBBLE echo (0÷15).
7) Transmit the LOW NIBBLE of the first parameter (0÷15).
8) Wait the LOW NIBBLE echo (0÷15).
.
.
N) Transmit the HIGH NIBBLE of the last parameter (0÷15).
N+1) Wait the HIGH NIBBLE echo (0÷15).
N+2) Transmit the LOW NIBBLE of the last parameter (0÷15).
N+3) Wait the LOW NIBBLE echo (0÷15).
N+4) Transmit the HIGH NIBBLE of the CRC (0÷15).
N+5) Wait the HIGH NIBBLE echo (0÷15).
N+6) Transmit the LOW NIBBLE of the CRC (0÷15).
N+7) Wait the LOW NIBBLE echo (0÷15).
Naturally if the CRC function is not active (dip 7 of DSW2 in OFF position) the user must not transmit the CRC nibbles. To have a correct CRC the user must do a sum without carry of all the bytes transmitted except the card identification name.

The IPC 52 transmit the possible answer with this format:
1) Transmit the HIGH NIBBLE of the first parameter (0÷15).
2) Transmit the LOW NIBBLE of the first parameter (0÷15).
.
.
N) Transmit the HIGH NIBBLE of the last parameter (0÷15).
N+1) Transmit the LOW NIBBLE of the last parameter (0÷15).
N+2) Transmit the HIGH NIBBLE of the CRC (0÷15).
N+3) Transmit the LOW NIBBLE of the CRC (0÷15).
Naturally if the CRC function is not active (dip 7 of DSW2 in OFF position) the user don' t receive the CRC nibbles. To have a correct CRC the user must do a sum without carry of all the parameters bytes received.

Remember that in the following pages the word DATA rappresent in realty the transmission or the reception of two bytes (first byte= NIBBLE HIGH, second byte= NIBBLE LOW).
Below there is a list of all the available commands in this mode:

SET CHANNELS STATE (ON/OFF)

Code: 16 Mnemonic: DLE
Number of parameters DATA: 3
Number of returned DATA without echo: 0
Description:
After the reception of the echo command code (16) the master must transmit 3 DATA:

DATA 1 -> Channels 0÷7 activation state byte (bit = 0 -> channel not in acquisition; bit = 1 -> channel in acquisition):
bit 0 = channel 0 state
bit 1 = channel 1 state
bit 2 = channel 2 state
bit 3 = channel 3 state
bit 4 = channel 4 state
bit 5 = channel 5 state
bit 6 = channel 6 state
bit 7 = channel 7 state

DATA 2 -> As DATA 1 but for the channels 8÷15.
DATA 3 -> As DATA 1 but for the channels 16÷23.

SET SET-POINTS FOR THERMOSTAT FUNCTION

Code: 17 Mnemonic: DC1
Number of parameters DATA: 4
Number of returned DATA without echo: 0
Description:
After the reception of the echo command code (17) the master must transmit 4 DATA:

DATA 1 -> I/O line number (0H÷07H).
DATA 2 -> Sign (0=positive, 1=negative) of the I/O line Set-Point (thermostat function).
DATA 3 -> Byte HIGH of the I/O line Set-Point (thermostat function).
DATA 4 -> Byte LOW of the I/O line Set-Point (thermostat function).

The Set-Point must be transmitted in decimal fahrenheit degrees. For example if the Set-Point value is 68,0 F° (20,0 C°) the bytes to transmit are: 0H, 02H, 0A8H.

SET HYSTERESIS FOR THERMOSTAT FUNCTION

Code: 18 Mnemonic: DC2
Number of parameters DATA: 4
Number of returned DATA without echo: 0
Description:
After the reception of the echo command code (18) the master must transmit 4 DATA:

DATA 1 -> I/O line number (0H÷07H).
DATA 2 -> Sign (0=positive, 1=negative) of the I/O line Hysteresis (thermostat function).
DATA 3 -> Byte HIGH of the I/O line Hysteresis (thermostat function).
DATA 4 -> Byte LOW of the I/O line Hysteresis (thermostat function).

The HYSTERESIS must be transmitted in decimal fahrenheit degrees. For example if the Hysteresis value is 68,0 F° (20,0 C°) the bytes to transmit are: 0H, 02H, 0A8H.

SET 8 I/O (PBN) LINES

Code: 19 Mnemonic: DC3
Number of parameters DATA: 1
Number of returned DATA without echo: 0
Description:
After the reception of the echo command code (19) the master must transmit 1 DATA:

DATA 1 -> bit 0 = I/O line 0 OUTPUT state
bit 1 = I/O line 1 OUTPUT state
.
.
bit 7 = I/O line 7 OUTPUT state

The user can use this command only if the 8 I/O (PBN) lines have been configured as USER OUTPUT with the relative command in SET-UP MODE (code 80).

SET 8 OUTPUT LINES

Code: 20 Mnemonic: DC4
Number of parameters DATA: 1
Number of returned DATA without echo: 0
Description:
After the reception of the echo command code (20) the master must transmit 1 DATA:

DATA 1 -> bit 0 = line 0 OUTPUT state
bit 1 = line 1 OUTPUT state
.
.
bit 7 = line 7 OUTPUT state

The user can use this command only if the 8 OUTPUT lines have been configured as USER OUTPUT with the relative command in SET-UP MODE (code 75).

8 I/O (PBN) LINES READING

Code: 21 Mnemonic: NAK
Number of parameters DATA: 0
Number of returned DATA without echo: 1
Description:
After the reception of the code (21) the card return the echo command code (21) and 1 DATA:

DATA 1 -> bit 0 = I/O line 0 INPUT state
bit 1 = I/O line 1 INPUT state
.
.
bit 7 = I/O line 7 INPUT state

The user can use this command only if the 8 I/O (PBN) lines have been configured as USER INPUT with the relative command in SET-UP MODE (code 80).

ACTIVATION OF THE TIMED CHANNELS ACQUISITION TRANSMISSION

Code: 22 Mnemonic: SYN
Number of parameters DATA: 3
Number of returned DATA without echo: 0
Description:
This command can be used only in a point to point network.
After the reception of the echo command code (22) the master must transmit 3 DATA:

DATA 1 -> Byte HIGH of the TIME CONSTANT.
DATA 2 -> Byte MIDDLE of the TIME CONSTANT.
DATA 3 -> Byte LOW of the TIME CONSTANT.

After the reception of this command, the IPC 52 trasmit every TIME CONSTANT * 10 ms, the last 24 channels temperature acquired (72 DATA) and their activation states (3 DATA) as for command code 34.
For example if the user wants receive the DATA each minute, he must transmit to the card these parameter bytes: 0H, 0H, 02H, 0EH, 0EH, 0H (12000*5ms = 60000ms = 1 minute).

DEACTIVATION OF THE TIMED CHANNELS ACQUISITION TRANSMISSION

Code: 23 Mnemonic: ETB
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
Timed transmission in OFF.

SAMPLE RATE DATA LOGHER READING

Code: 24 Mnemonic: CAN
Number of parameters DATA: 0
Number of returned DATA without echo: 1
Description:
After the reception of the code (24) the card return the echo command code (24) and 1 DATA:

DATA 1 -> SAMPLE RATE CONSTANT (0H=10 sec ÷ 0FFH=2560 sec).
SAMPLE RATE = (SAMPLE RATE CONSTANT+1) * 10 sec.

SAMPLE RATE DATA LOGHER SETTING

Code: 25 Mnemonic: EM
Number of parameters DATA: 1
Number of returned DATA without echo: 0
Description:
After the reception of the echo command code (25) the master must transmit 1 DATA:

DATA 1 -> SAMPLE RATE CONSTANT (0H=10 sec ÷ 0FFH=2560 sec).
SAMPLE RATE = (SAMPLE RATE CONSTANT+1) * 10 sec.

For example if the user wants save the last 24 channels temperature acquired each minute, he must transmit to the card these parameter bytes: 0H, 6H (6*10 sec = 1 minute).
This command reset the DATA LOGHER FUNCTION.

ACQUISITION IN DECIMAL CELSIUS DEGREES

Code: 26 Mnemonic: SUB
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
After this command the card return and receive the temperature DATA in decimal Celsius degrees.

ACQUISITION IN DECIMAL FAHRENHEIT DEGREES

Code: 27 Mnemonic: ESC
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
After this command the card return and receive the temperature DATA in decimal Fahrenheit degrees.

DATA LOGHER LENGTH READING

Code: 28 Mnemonic: FS
Number of parameters DATA: 0
Number of returned DATA without echo: 2
Description:
After the reception of the code (28) the card return the echo command code (28) and 2 DATA:

DATA 1 -> Byte HIGH of the Data Logher length value
DATA 2 -> Byte LOW of the Data Logher length value

A valid Data Logher length value range is 0÷447.

DATA LOGHER READING

Code: 29 Mnemonic: GS
Number of parameters DATA: 1
Number of returned DATA without echo: N
Description:
After the reception of the echo command code (29) the master must transmit 1 DATA:

DATA 1 -> Channel number (0H÷017H).

After the reception of the parameter DATA the card return N DATA:

DATA 1 -> Byte HIGH of the LAST value acquired
DATA 2 -> Byte LOW of the LAST value acquired
DATA 3 -> Sign of the LAST value acquired (0=positive, 1=negative)
.
DATA N-5 -> Byte HIGH of the FIRST value acquired
DATA N-4 -> Byte LOW of the FIRST value acquired
DATA N-3 -> Sign of the FIRST value acquired (0=positive, 1=negative)
DATA N-2 -> END Byte (0AAH)
DATA N-1 -> END Byte (0AAH)
DATA N -> END Byte (0AAH)

The temperature DATA are always transmitted in decimal Fahrenheit degrees and the Data Logher function is not reset.

COMMAND 29 ABORT

Code: 30 Mnemonic: RS
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
The command 29 can require many time to transmit all the DATA so the user with this command can abort the transmission.

READ CARD CONFIGURATION

Code: 31 Mnemonic: US
Number of parameters DATA: 0
Number of returned DATA without echo: 29
Description:
After the reception of the code (31) the card return the echo command code (31) and 29 DATA:

DATA 1 -> No function

DATA 2 -> Degree type selection for the temperature data transmission:
0 = CELSIUS
1 = FAHRENHEIT

DATA 3 -> Channel 0 configuration:
0 = Deactivates channel.
1 = Thermoresistance: PT100 with decimal (-70.0 ÷ 400.0 C°).
9 = Thermoresistance: PT100 without decimal (-200.0 ÷ 850.0 C°).
10 = Thermoresistance: PT1000 (-200.0 ÷ 450.0 C°).

DATA 4÷10 -> As DATA 3 but for the following channels (DATA 4 = channel 1 ... DATA 10 = channel 7).

DATA 11 -> Channel 8 configuration:
0 = Deactivates channel.
2 = Thermocouple: J EUR (-200.0 ÷ 900.0 C°).
3 = Thermocouple: J USA (-210.0 ÷ 980.0 C°).
4 = Thermocouple: K (-270.0 ÷ 1372.0 C°).
5 = Thermocouple: S (-50.0 ÷ 1767.0 C°).
6 = Thermocouple: T (-270.0 ÷ 400.0 C°).
11 = Amplified input type 3 (± 50 mV).
12 = Amplified input type 2 (± 25 mV).
13 = Amplified input type 1 (± 85 mV).

DATA 12÷18 -> As DATA 11 but for the following channels (DATA 12 = channel 9 ... DATA 18 = channel 15).

DATA 19 -> Channel 16 configuration:
0 = Deactivates channel.
7 = Voltage input (± 2 V).
8 = Current input (0 ÷ 20 mA).

DATA 20÷26 -> As DATA 19 but for the following channels (DATA 20 = channel 17 ... DATA 26 = channel 23).

DATA 27 -> Channels 0÷7 activation state byte (bit = 0 -> channel not in acquisition; bit = 1 -> channel in acquisition):
bit 0 = channel 0 state

bit 1 = channel 1 state
bit 2 = channel 2 state
bit 3 = channel 3 state
bit 4 = channel 4 state
bit 5 = channel 5 state
bit 6 = channel 6 state
bit 7 = channel 7 state

DATA 28 -> As DATA 27 but for the channels 8÷15.
DATA 29 -> As DATA 27 but for the channels 16÷23.

READ LM35 (COLD JUNCTION)

Code: 32 Mnemonic: SP
Number of parameters DATA: 0
Number of returned DATA without echo: 3
Description:
After the reception of the code (32) the card return the echo command code (32) and 3 DATA:
DATA 1 -> On board temperature HIGH byte (0H÷0FFH).
DATA 2 -> On board temperature LOW byte (0H÷0FFH).
DATA 3 -> On board temperature Sign (0=positive, 1=negative).

READ LAST VALUE ACQUIRED ON A SPECIFIC CHANNEL

Code: 33 Mnemonic: !
Number of parameters DATA: 1
Number of returned DATA without echo: 3
Description:
After the reception of the echo command code (33) the master must transmit 1 DATA:
DATA 1 -> Channel number (0H÷017H).
After the reception of the parameter DATA the card return 3 DATA:
DATA 1 -> Byte HIGH of the last value acquired
DATA 2 -> Byte LOW of the last value acquired
DATA 3 -> Sign of the last value acquired (0=positive, 1=negative)

READ LAST 24 CHANNELS VALUES ACQUIRED

Code: 34 Mnemonic: "
Number of parameters DATA: 0
Number of returned DATA without echo: 75
Description:
After the reception of the code (34) the card return the echo command code (34) and 75 DATA:
DATA 1 -> Channel 0 last value acquired HIGH byte (0H÷0FFH).
DATA 2 -> Channel 0 last value acquired LOW byte (0H÷0FFH).
DATA 3 -> Channel 0 last value acquired Sign (0=positive, 1=negative).
DATA 4÷72 -> As DATA 1, 2, 3 but for the channels 1÷23.
DATA 73 -> Channels 0÷7 activation state byte (bit = 0 -> channel not in acquisition;

bit = 1 -> channel in acquisition):
bit 0 = channel 0 state
bit 1 = channel 1 state
bit 2 = channel 2 state
bit 3 = channel 3 state
bit 4 = channel 4 state
bit 5 = channel 5 state
bit 6 = channel 6 state
bit 7 = channel 7 state

DATA 74 -> As DATA 73 but for the channels 8÷15.
DATA 75 -> As DATA 73 but for the channels 16÷23.

TURN OFF BUZZER

Code: 35 Mnemonic: #
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
After this command the card turn off the on board buzzer.

TURN ON BUZZER

Code: 36 Mnemonic: $
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
After this command the card turn on the on board buzzer.

BEEP

Code: 37 Mnemonic: %
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
After this command the card generate a beep with the on board buzzer.

STOP CHANNELS SCANNING (LEDS SYNCHRONIZATION)

Code: 38 Mnemonic: &
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
See next command.

START CHANNELS SCANNING (LEDS SYNCHRONIZATION)

Code: 39 Mnemonic: &
Number of parameters DATA: 0
Number of returned DATA without echo: 0
Description:
If the user system have many IPC 52 that start the acquisition at the same time, after some hours the ACQUISITION STATE LEDS of the cards can be not in synchrony. To resolve this aesthetical problem the user must transmit to all the cards the command code 38 followed by the comman code 39 each time the problem appears.

READ MINIMUM VALUE ACQUIRED ON A SPECIFIC CHANNEL

Code: 40 Mnemonic: (
Number of parameters DATA: 1
Number of returned DATA without echo: 3
Description:
After the reception of the echo command code (40) the master must transmit 1 DATA:
DATA 1 -> Channel number (0H÷017H).
After the reception of the parameter DATA the card return 3 DATA:
DATA 1 -> Byte HIGH of the MINIMUM value
DATA 2 -> Byte LOW of the MINIMUM value
DATA 3 -> Sign of the MINIMUM value (0=positive, 1=negative)

READ MAXIMUM VALUE ACQUIRED ON A SPECIFIC CHANNEL

Code: 41 Mnemonic:)
Number of parameters DATA: 1
Number of returned DATA without echo: 3
Description:
After the reception of the echo command code (41) the master must transmit 1 DATA:
DATA 1 -> Channel number (0H÷017H).
After the reception of the parameter DATA the card return 3 DATA:
DATA 1 -> Byte HIGH of the MAXIMUM value
DATA 2 -> Byte LOW of the MAXIMUM value
DATA 3 -> Sign of the MAXIMUM value (0=positive, 1=negative)

RESET MINIMUM/MAXIMUM FUNCTION ON A SPECIFIC CHANNEL

Code: 42 Mnemonic: *
Number of parameters DATA: 1
Number of returned DATA without echo: 0
Description:
After the reception of the echo command code (42) the master must transmit 1 DATA:
DATA 1 -> Channel number (0H÷017H).

THERMOSTAT AND SOFT-START FUNCTIONS

If the user order the card with these options the **IPC 52** can work as a thermostat (ON/OFF controls) on 8 channels . For the controls the user must set for each channel a SET POINT, an HYSTERESIS and the I/O line used as thermostat OUTPUT.
Remember that in thermostat function the on board 8 I/O lines are used for the thermostat and so the user can' t use them for other functions.
If the user applications require to arrive at 100% output power in a gradual mode, the IPC 52 SOFT-START function can be used.
With this SOFT-START function the output power at the beginning increases with a time programmable ramp (defined by "SET RAMP STEP REPEATING FOR SOFT START THERMOSTAT FUNCTION") and reaches the 50% output power; then when the input value exceeds the INTRINSIC LIMIT, output power is set at 100%.

CALIBRATION

The user can calibrate only the **Tension** and **Current** inputs (channels 16÷23).
Below there is a right procedure for each channel calibration:

A) Set the card in SET-UP mode.
B) Transmit the "D" code (044H= Start calibration).
C) If the channel to calibrate is configured as Tension the user must connect a 2 V reference signal else a 20 mA reference signal.
D) Wait about 10 seconds.
E) Transmit "F" (046H) code and the channel number "@"÷"G" (040H= channel 16 ... 047H=channel 23) code.
F) Wait the "$" code (024H= End gain calibration).
G) Transmit the "G" code (047H= Stop calibration).

CODE	PARAMETERS	N. BYTES RETURNED WITHOUT ECHO	FUNCTION
65	0	1	Read identification name.
66	1	0	Set identification name.
67	2	0	Channels configuration.
68	0	0	Start calibration.
69	1	0	Offset calibration.
70	1	1	Gain calibration.
71	0	0	Stop calibration.
72	3	0	Set the LM35 adjust reading.
73	0	31	Read card configuration.
74	0	3	Read LM35 (cold junction).
75	1	0	8 output lines function selection.
76	0	75	Read 24 channels values and their activation state.
79	4	0	Set the adjust temperature reading for a specific channel.
80	1	0	8 input/output lines (PBN) function selection.
81	0	153	Read channels adjust and thermostat function configuration.
82	2	0	Association between 8 input/output lines (PBn) and channels (thermostat function).
83	4	0	Set SET-POINTS for thermostat function.
84	4	0	Set HYSTERESIS for thermostat function.
85	4	0	Set INTRINSIC LIMITS for thermostat function.
86	1	0	Set ramp step repeating for soft-start thermostat function.

FIGURE 24: SET-UP MODE COMMANDS SUMARIZING TABLE

CODE	N. DATA PARAMETERS	N. DATA RETURNED WITHOUT ECHO	FUNCTION
16	3	0	Set channels state (On/Off).
17	4	0	Set SET-POINTS for thermostat function.
18	4	0	Set HYSTERESIS for thermostat function.
19	1	0	Set 8 input/output (PBn) lines.
20	1	0	Set 8 OUTPUT lines.
21	0	1	8 input/output (PBn) lines reading.
22	3	0	Activation of the timed channels acquisition transmission.
23	0	0	Deactivation of the timed channels acquisition transmission.
24	0	1	Sample rate Data Logher reading.
25	1	0	Sample rate Data Logher setting.
26	0	0	Acquisition in decimal CELSIUS degrees.
27	0	0	Acquisition in decimal FAHRENHEIT degrees.
28	0	2	Data Logher length reading.
29	1	Variable	Data Logher reading.
30	0	0	Command 29 abort.
31	0	29	Read card configuration.
32	0	3	Read LM35 (cold junction).
33	1	3	Read last value acquired on a specific channel .
34	0	75	Read last 24 channels values acquired.
35	0	0	Turn OFF Buzzer.
36	0	0	Turn ON Buzzer.
37	0	0	Beep.
38	0	0	Stop channels scanning (LEDS synchronization).
39	0	0	Start channels scanning (LEDS synchronization).
40	1	3	Read MIN. value acquired on a specific channel.
41	1	3	Read MAX. value acquired on a specific channel .
42	1	0	Reset MIN./MAX. function on a specific channel.

FIGURE 25: RUN MODE COMMANDS SUMARIZING TABLE

HARDWARE DESCRIPTION

IPC 52 BUS ADDRESSES

IPC 52 allocates 2 bytes on BUS **Abaco®** addressing space. The first byte is used to read the communication STATE (read only register) and the second is used to read or write a DATA on the card.
To set the **IPC 52** BUS address the user must configure the dip-switch DSW1 as described below:

SW1.1 -> manage /**M1** BUS signal
SW1.2 -> Bit A1
SW1.3 -> Bit A2
SW1.4 -> Bit A3
SW1.5 -> Bit A4
SW1.6 -> Bit A5
SW1.7 -> Bit A6
SW1.8 -> Bit A7

Remember that dip ON position corresponds to logic state 0 and dip OFF position corresponds to logic state 1.
The dip DSW1.1 is used to manage the /**M1** BUS signal.
The dips DSW1.2 ... DSW1.8 are used to select the BASE BUS ADDRESS (128 available addresses= 0...254 --> 0, 2, 4,..., 254).
For example if the user wants set the **IPC 52** to the 192 BUS address and the master card have the /M1 signal, DSW1 must be set as follow:

SW1.1 -> ON
SW1.2 -> ON
SW1.3 -> ON
SW1.4 -> ON
SW1.5 -> ON
SW1.6 -> ON
SW1.7 -> OFF
SW1.8 -> OFF

IPC 52 BUS REGISTERS

REGISTER	ADDRESS	R/W	FUNCTION
STATE	<indbase>+00	R	IPC 52 STATE register.
DATA	<indbase>+01	R/W	IPC 52 DATA register.

FIGURE 26: IPC 52 BUS REGISTERS TABLE.

Where <indbase> is the address set with DSW1.

To prevent communication errors the user must take care to don't allocate cards to the same addresses on BUS.
STATE register description:

```
          bit0  bit1  bit2  bit3  bit4  bit5  bit6   bit7
BYTE = NU  NU  NU   NU   NU  NU  IBF   OBF
```

NU = Not used.
IBF = if active (1) the **IPC 52** is ready for data receiving.
OBF = if active (1) the **IPC 52** has sent on BUS a data (BUSY BUS).

Remember that at the beginning of the comunication, the user must verify that IBF=1 and OBF=0, (**IPC 52** is inizialized). Below there are a examples procedures (CBZ 80 language) for the BUS communication between the master and the **IPC 52**:

```
"SENDTOIPC"
REM Begin
      FOR nd%=2% TO dat%(1%)+1%
        DO
            st%=INP(sipc%): REM Wait bit IBF.
        UNTIL ((st% AND &040)=&040)
        OUT dipc%, dat%(nd%)
      NEXT nd%
REM End
RETURN

"RECFROMIPC"
REM Begin
      st%=INP(sipc%): REM Read OBF state.
      IF ((st% AND &080)=&080) THEN recdat%=INP(dipc%) ELSE recdat%=-1
REM End
RETURN
```

EXTERNAL DEVICES FOR IPC 52

IPC 52 can be connected to a wide range of **Grifo®** cards and to many system of other companies. Hereunder these cards are listed, for further information please call **Grifo®**.

GPC® 15A

General Purpose Controller 84C15

Full CMOS card, 10÷20 MHz 84C15 CPU; 512K EPROM or FLASH; 128K RAM; 8K RAM and RTC backed; 8K serial EEPROM; 1 RS 232 line or RS 422-485 or Current Loop line; 32 or 40 TTL I/O lines; CTC; Watch dog; 2 Dip switches; Buzzer.

GPC® 51 - GPC® 51D

General Purpose Controller 51 family

11 MHz 51 INTEL or 22 MHz 320 DALLAS µP BASIC type included; 16/24 TTL I/O lines; 1 or 2 RS 232 lines; Buzzer; RTC and 32K RAM backed Lithium battery; EPROM and EEPROM programmer; readable dip switch; 3 Timer Counter; 4 11 bit A/D lines and Keyboard Display Controller.

GPC® 68

General Purpose Controller 68000

1 RS 232 LINE, 1 RS 232 or RS 422-485 line with settable Baud Rate up to 38K Baud; 3 8 bits parallel ports and 3 timer counter; 10 MHz 68000 CPU; 768 KBytes RAM EPROM; disconnectable Watch dog.

GPC® 81F

General Purpose Controller 84C00

Z80 µP, from 8 to 10 MHz, full CMOS; 512K EPROM or FLASH; 64K RAM; 8K RAM and RTC backed; 8K serial EEPROM; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 24 TTL I/O lines; 4 A/D lines at 11 bits; Watch dog; 1 Dip switch.

GPC® 188F

General Purpose Controller 80C188

80C188 µP 20 MHz; 256K FLASH; 256K RAM Lithium battery backed; 8K serial EEPROM; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 24 TTL I/O lines; RTC; 8 A/D lines at 12 bits; Watch dog; 8 Dip switch; 3 Timer Counter.

GPC® 552

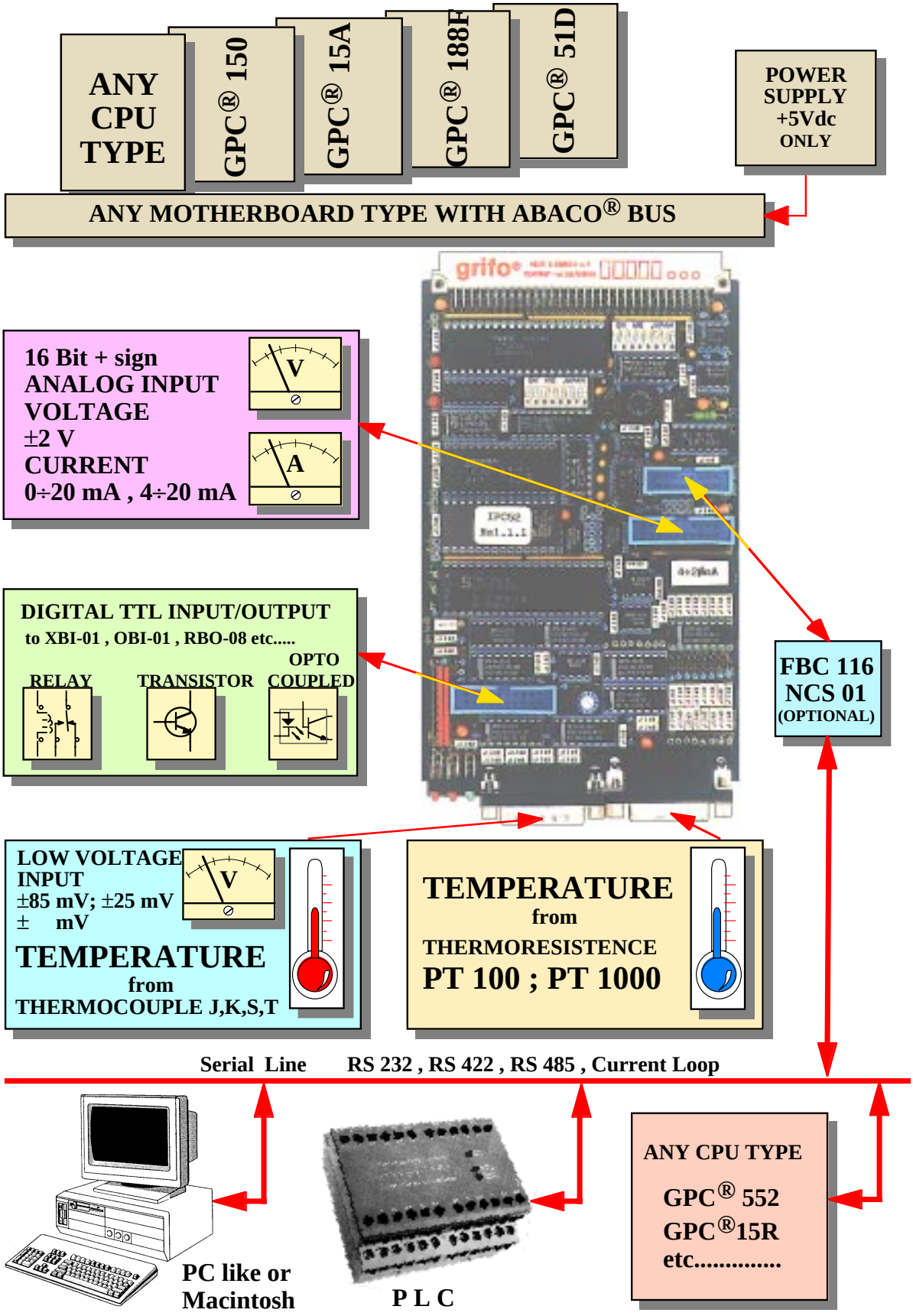
General Purpose Controller 80C552

80C552 µP 22 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 44 TTL I/O lines; 8 A/D lines at 10 bits; 3 Timer Counter; RTC; 64K EPROM; 64K RAM (32K RAM Lithium battery backed); 8K serial EEPROM; Buzzer; 2 PWM lines; Watch dog; 8 readable Dip switch; LCD interface.

GPC® 15R

General Purpose Controller 84C15 with Relays

84C15 µP 16 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 24 TTL I/O lines; 16 Opto-in 8 Relays; 4 Opto Coupled Timer Counter; RTC; 512K EPROM or FLASH; 512K backed RAM; 8K serial EEPROM; 8K Backed RAM Modul; Buzzer; Watch dog; 12 readable Dip switch; LCD interface.



IPC 52 Interconnections Blocks Diagram

FIGURE 27: AVAILABLE CONNECTION DIAGRAM

GPC® 011

General Purpose Controller 84C011

84C011 µP 8 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485; 40 TTL I/O lines; 4 A/D lines at 11 bits; 4 Timer Counter; RTC; 256K EPROM or RAM; 256K RAM (256K RAM Lithium battery backed); Watch dog; 8 readable Dip switch; LCD interface.

GPC® 153

General Purpose Controller 84C15 (3 TYPE)

84C15 µP 16 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 16 TTL I/O lines; 8 A/D lines at 12 bits; 4 Timer Counter; RTC; 512K EPROM or FLASH; 512K backed RAM; 8K serial EEPROM; Buzzer; Watch dog; 8 readable Dip switch; LCD interface.

GPC® 183

General Purpose Controller Z180 (3 TYPE)

Z180 µP 16 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 24 TTL I/O lines; 11 A/D lines at 12 bits; 2 Timer Counter; RTC; 512K EPROM or FLASH; 512K backed RAM; 8K serial EEPROM; Buzzer; Watch dog; 4 readable Dip switch; LCD interface.

GPC® 323D

General Purpose Controller 80C320 (3 TYPE)

80C320 µP 33 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 24 TTL I/O lines; 11 A/D lines at 12 bits; 3 Timer Counter; RTC; 64K EPROM; 64K RAM (32K backed RAM-32K DIL EEPROM); 8K serial EEPROM; Buzzer; Watch dog; 5 readable Dip switch; LCD interface.

GPC® 553

General Purpose Controller 80C552 (3 TYPE)

80C552 µP 33 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 16 TTL I/O lines; 8 A/D lines at 10 bits; 3 Timer Counter; RTC; 64K EPROM; 64K RAM (32K backed RAM-32K DIL EEPROM); 8K serial EEPROM; 2 PWM lines; Watch dog; 5 readable Dip switch; LCD interface.

GPC® 114

General Purpose Controller 68HC11 (4 TYPE)

68HC11 µP 16 MHz; 1 RS 232 or RS 422-485; 18 TTL I/O lines; 8 A/D lines at 8 bits; 3 Timer Counter; RTC; 32K EPROM; 32K backed RAM; 512 DIL EEPROM; Watch dog; 1 readable Dip switch; LCD interface.

GPC® 324

General Purpose Controller 80C32 (4 TYPE)

80C32 µP 14 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 16 TTL I/O lines; 3 Timer Counter; 64K EPROM; 64K RAM (32K backed RAM-32K DIL EEPROM); 8K serial EEPROM; Watch dog; 1 readable Dip switch; LCD interface.

GPC® 884

General Purpose Controller 80C188ES (4 TYPE)

80C188ES µP 40 MHz; 1 RS 232 line; 1 RS 232 or RS 422-485; 16 TTL I/O lines; 11 A/D lines at 12 bits; 3 Timer Counter; RTC; 512K EPROM or FLASH; 512K backed RAM; 8K serial EEPROM; Watch dog; 1 readable Dip switch; LCD interface.

RBO 08 TBO 08

Relays or Transistor BLOCK Output

Interface for **Abaco**® standard I/O 20 pins connector; 8 displayed Relays 3 A with MOV or 8 optocoupled Transistors 3 A open collectors; screw terminal; Connection for DIN C Type and Ω rails.

XBI R4 XBI T4

miXed BLOCK Input-Output

Interface for **Abaco**® standard I/O 20 pins connector; 4 Relays 3 A with MOV or 4 optocoupled Transistors 3 A open collectors; 4 input lines optocoupled; I/O lines dispayed; screw terminal; Connection for DIN C Type and Ω rails.

OBI 01 - OBI 02

Opto BLOCK Input NPN-PNP

Interface between 16 NPN, PNP optocoupled and displayed input lines, screw terminal, and **Abaco**® standard I/O 20 pins connector; power supply section; connection for DIN C type and Ω rails.

FBC xxx

Flat BLOCK Contact

This interconnection system “wires to board” allows the connection to many types of flat cable connectors to a terminal for external connections. Other interfacing for most popular connectors such as D, mini DIN, ACCESS.bus™, and so on, are available. Connection for DIN C Type and Ω rails.

IBC 01

Interface Block Communication

Conversion card for serial communication, 2 RS 232 lines; 1 RS 422-485 line; 1 optical fibre line; selecatble DTE/DCE interface; quick connection for DIN C type and Ω rails.

DEB 01

Didactis Experimental Board

Supporting card for 16 TTL I/O lines use. It includes: 16 keys, 16 LEDs, 4 digits, 16 keys matrix keyboard, Centronics printer interface, LCD display and fluorescent display interface, **GPC**® **68** I/O connector, field connection with screw terminal.

ABB 03

ABACO® Block BUS 3 slots

3 slots **ABACO**® mother board; 4 TE pitch connectors; **ABACO**® I/O BUS connector; screw terminal for power supply; connection for DIN C type and Ω rails.

ABB 05

ABACO® Block BUS 5 slots

5 slots **ABACO**® mother board with Power Supply. Double power supply built-in; 5Vdc 2,5A section for powering the on-board logic; second section at 24Vdc 400mA galvanically coupled, for the optocoupled input lines. Auxiliary connector for **ABACO**® I/O BUS. Housing with hooks for DIN Ω rails.

MB3-01 MB4-01 MB8-01

Mother Board 3, 4, 8 slots **ABACO**® BUS

ABACO® Industrial BUS mother board; 3 slots 4 TE pitch connector; 4 and 8 slots 5 TE pitch connector. 3 LEDs supplies display and external Reset connector. Holes for connection to Rack.

BIBLIOGRAPHY

In this chapter there is a complete list of technical books, where the User can find all the necessary documentations on the components mounted on **IPC 52**.

Data book TEXAS INSTRUMENTES:	*The TTL Data Book - SN54/74 Families*
Data book TEXAS INSTRUMENTES:	*RS-422 and RS-485 Interface Circuits*
Data book TEXAS INSTRUMENTES:	*Linear Circuits Data Book - Volume 1 and 3*
Data book NEC:	*Microprocessors and Peripherals - Volume 3*
Data book NEC:	*Memory Products*
Data book HEWLETT PACKARD:	*Optoelectronics Designer's Catalog*
Data book MAXIM:	*New release Data Book - Volume 4*
Data book XICOR:	*Data Book*
Data book PHILIPS:	*80C51 - Based 8-Bits Microcontrollers*
Data book NATIONAL SEMICONDUCTOR:	*Linear Data Book - Volume 2*
Data book MOTOROLA SEMICONDUCTORS:	*Cmos Logic Data*
Data book SGS-THOMSON MICROELEC.:	*Industrial and Computer peripheral ICs*
Data book TELEDINE SEMICONDUCTOR:	*Precision analog and power control IC handbook*

APPENDIX A: JUMPERS AND SERIAL DRIVERS LOCATION

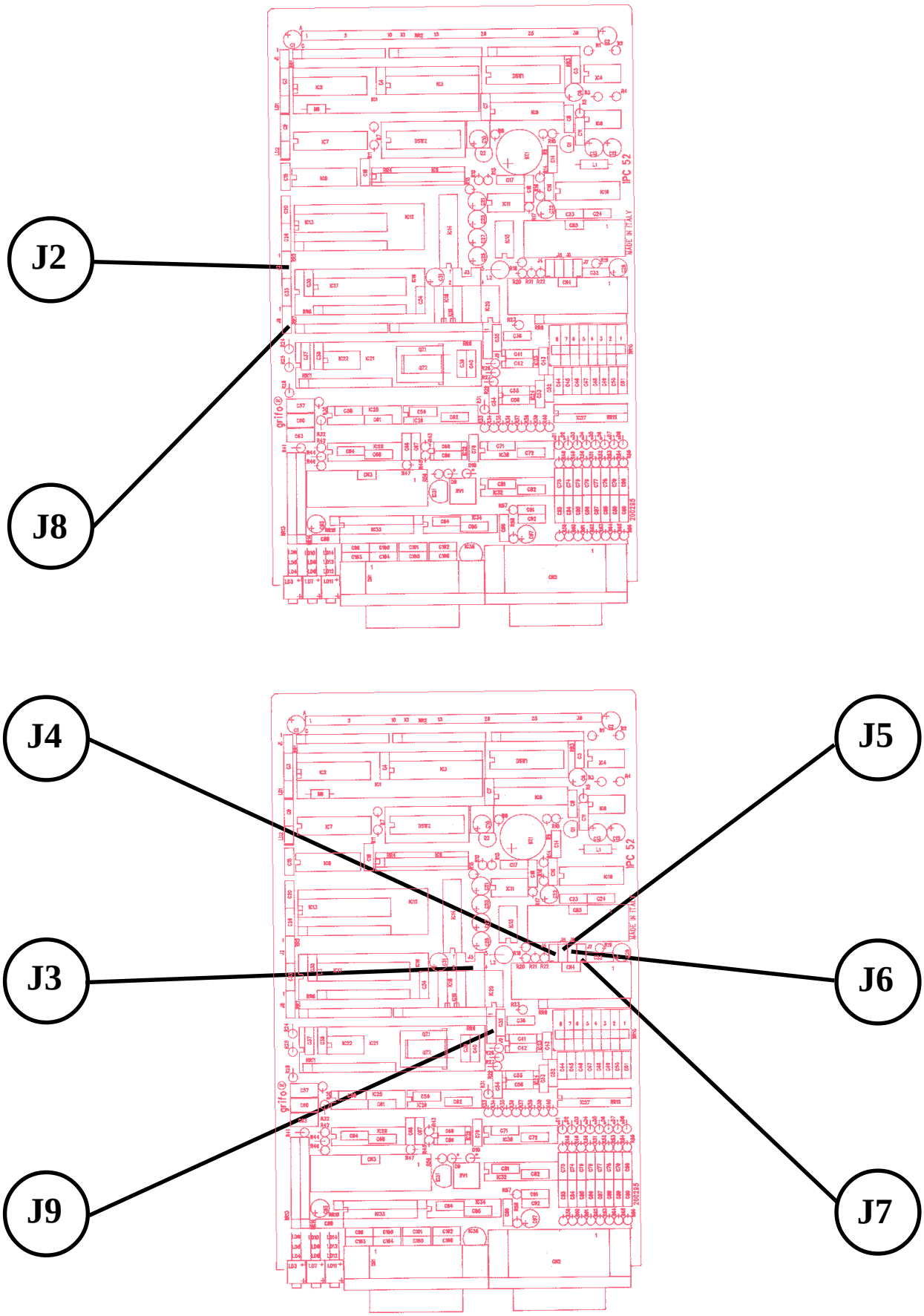
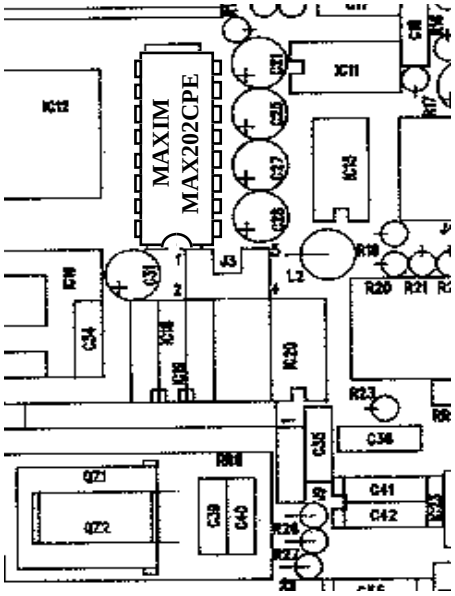
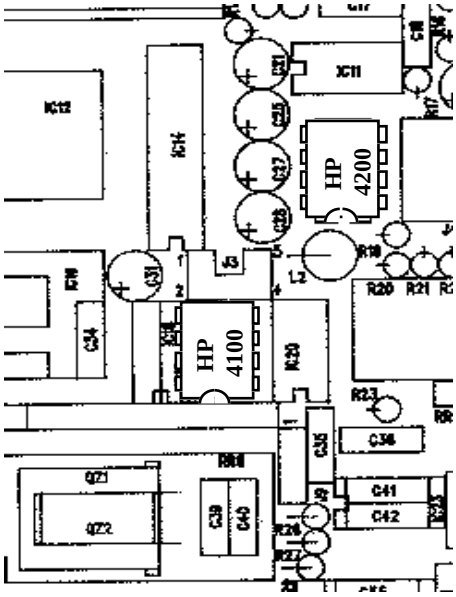


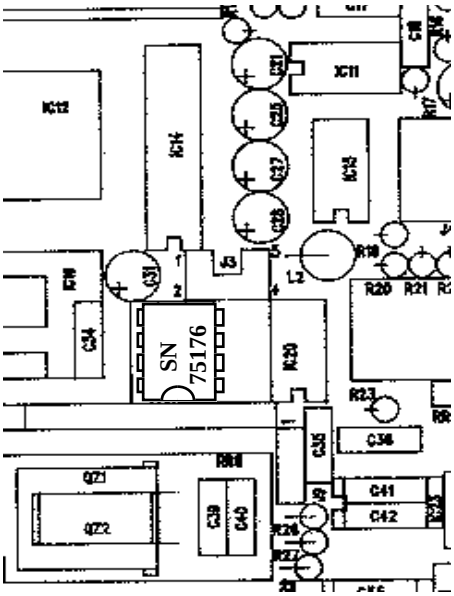
FIGURE 29: SERIAL COMMUNICATION JUMPERS LOCATION



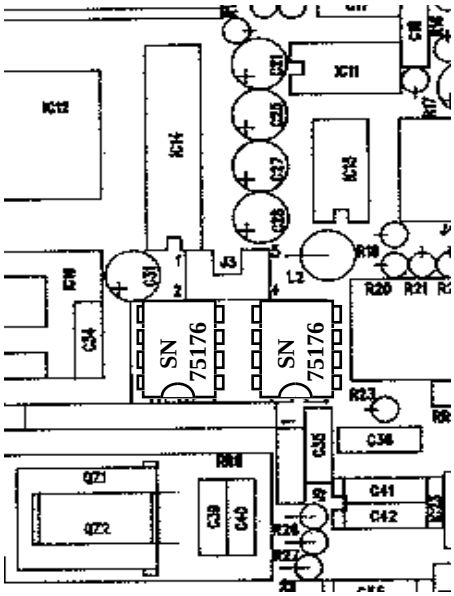
RS232



Current Loop



RS485



RS 422

FIGURE 30: SERIAL DRIVERS LOCATION

APPENDIX B: ALPHABETCAL INDEX

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