PRELIMINARY GPC® 188D

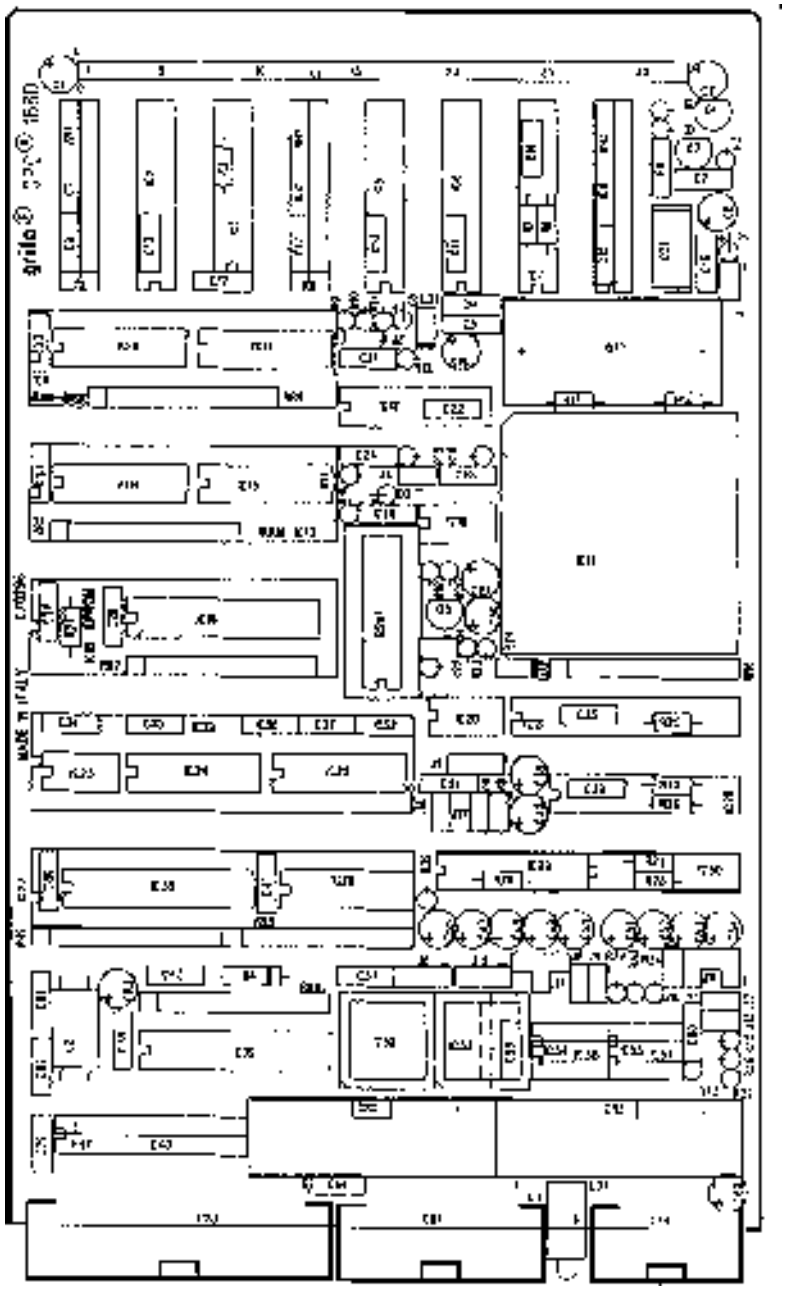


FIGURE ?: COMPONENTS MAP

TECHNICAL FEATURES

GENERAL FEATURES

On board resources:

24 TTL Input/Output programmable (PPI 82C55)
2 Timer Counter TTL resolution 16 bit
1 Timer resolution 16 bit
1 bidirectional RS 232 serial line
1 bidirectional RS 232,RS 422,RS 485 or current loop serial line
1 hardware Watch Dog astable/monostable
1 Real Time Clock
1 Dip switch featuring 8 pins
2 activity LEDs
BUS industrial **ABACO®**
Back up circuitery with Lithium battery
1 **ABACO®** I/O BUS interface

Addressable memory:

IC 18:	EPROM from 128Kx8 to 256Kx8 FLASH EPROM from 128Kx8 to 256K x8
IC 13:	backed SRAM from 32Kx8 to128Kx8
IC 9:	backed protected SRAM from 32Kx8 to 128Kx8
IC 23:	serial EEPROM from 256 byte to 8192 byte

On board CPU: INTEL 80C188

CPU quartz frequency: 40 MHz to obtain a 20 MHz clock

PHYSICAL FEATURES

Size: EUROCARD format 100 x 160 mm

Weight: 230 g

Connectors:

K1: BUS 64 pins DIN 41612 type C
CN1: 16 pins low profile 90 degreeses M
CN2: 20 pins low profile 90 degreeses M
CN3: 26 pins low profile 90 degreeses M
CN4: 10 pins low profile vertical M
CN5: 20 pins low profile vertical M

Temperature range: from 0 to 70 centigrad degreeses

Relative humidty: 20% up to 90% (without condense)

Watch dogintervent time:

650 msec (short intervent time)
2200 msec (long intervent time)

ELECTRIC FEATURES

Power supply:	+5 Vdc	
Current consumption on +5 Vdc:	530 mA	
Back up current:	1,5 μA	
Termination network RS 422-485:	Line termination resistor	=125 Ω
	Positive pull up resistor	=3.3 KΩ
	Negative pull down resistor	=3.3 KΩ

INSTALLATION

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

CONNECTIONS

The **GPC® 188D** module has 6 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 short signals description (including the signals direction) and connectors location (see figure ?).

CN1 - SERIAL LINES RS 232 AND TIMER COUNTERS CONNECTOR

CN1 is a 20 pins, male, 90 degreeses, low profile connector with 2.54mm pitch.
On CN1 are available the two RS 232 serial lines signals and the two on board timer counter signals.
Serial lines can be programmed by hardware and software by programming some registers of SCC 85C30 or connecting and connecting opportunely specific jumpers.
These signals follow TTL standard or are CCITT normatives compliant.

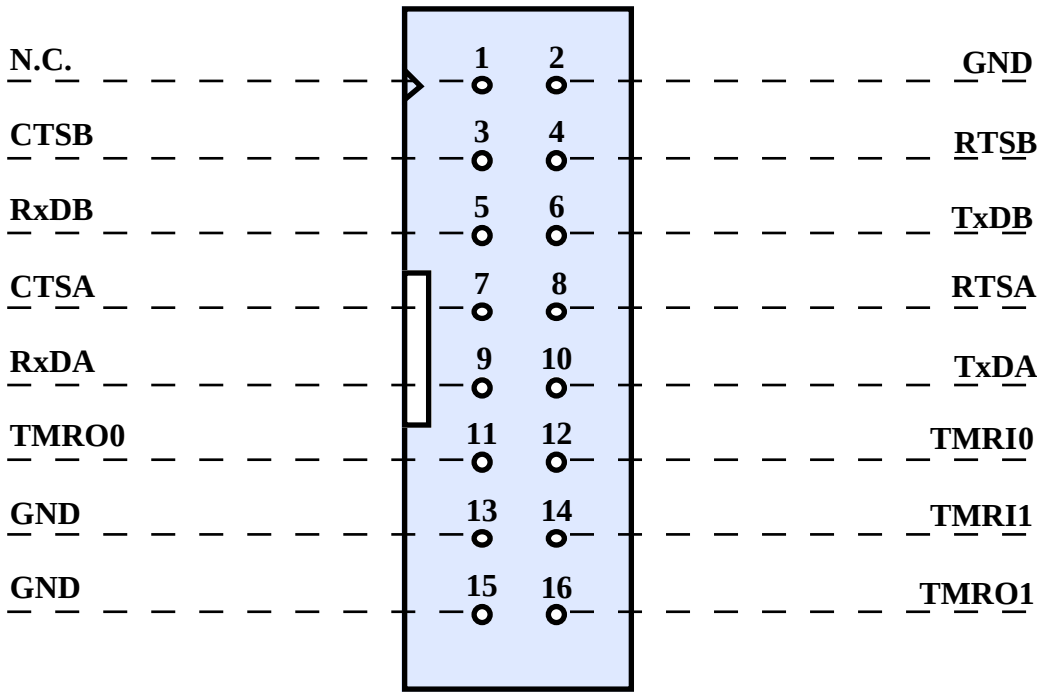


FIGURE ?: CN1 - SERIA LINES RS 232 AND TIMER COUNTERS CONNECTOR

Signals description:

TMRI0,1	=	I	- Timer counter 0,1 TTL inputs
TMRO0,1	=	O	- Timer counter 0,1 TTL outputs
CTSA,B	=	I	- Clear To Send of serial lines A and B
RTSA,B	=	O	- Request To Send of serial lines A and B
RxD A,B	=	I	- Receive Data of serial lines A and B
TxD A,B	=	O	- Trasmit Data of serial lines A and B
GND	=		- Ground
N.C.	=		- Not connected

CN2 - PORTS A AND C OF PPI 82C55 CONNECTOR

CN2 is a 20 pins, male, 90 degreeses, low profile connector with 2.54mm pitch.
On CN1 are available two 8 bits port (A and C) of digital TTL signals driven by PPI 82c55.
All functional parameters of this component (signals direction, data management, etc.) can be programmed by software.
These signals follow TTL standard.

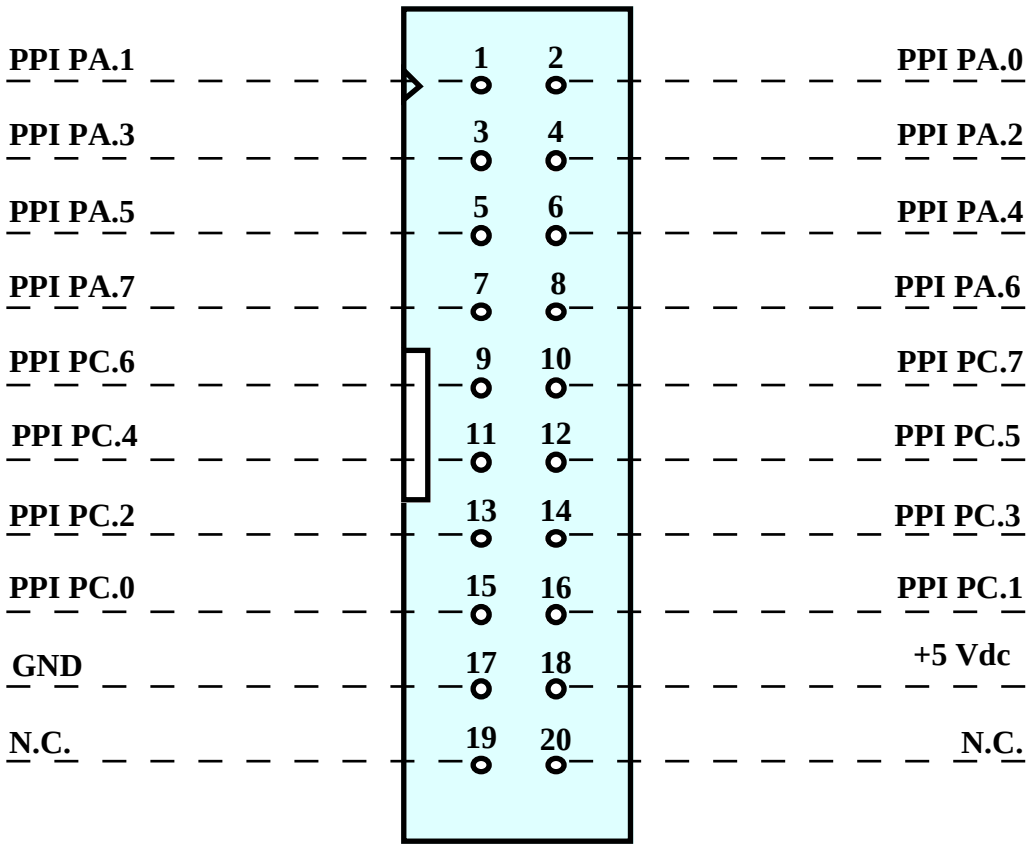


FIGURE ?: CN2 - PORTS A AND C OF PPI 82C55 CONNECTOR

Signals description:

PPI PA.n	= I/O	- n-th TTL digital signal of PPI 82c55 port A
PPI PC.n	= I/O	- n-th TTL digital signal of PPI 82c55 port C
+5 Vdc	= O	- Power supply +5 Vdc
GND	=	- Ground
N.C.	=	- Not connected

CN5 - PORT B PPI 82C55 CONNECTOR

CN5 is a 20 pins, male, vertical, low profile connector with 2.54mm pitch.
On CN5 is available one 8 bits port (B) of digital TTL signals driven by PPI 82c55.
All functional parameters of this component (signals direction, data management, etc.) can be programmed by software.
These signals follow TTL standard.

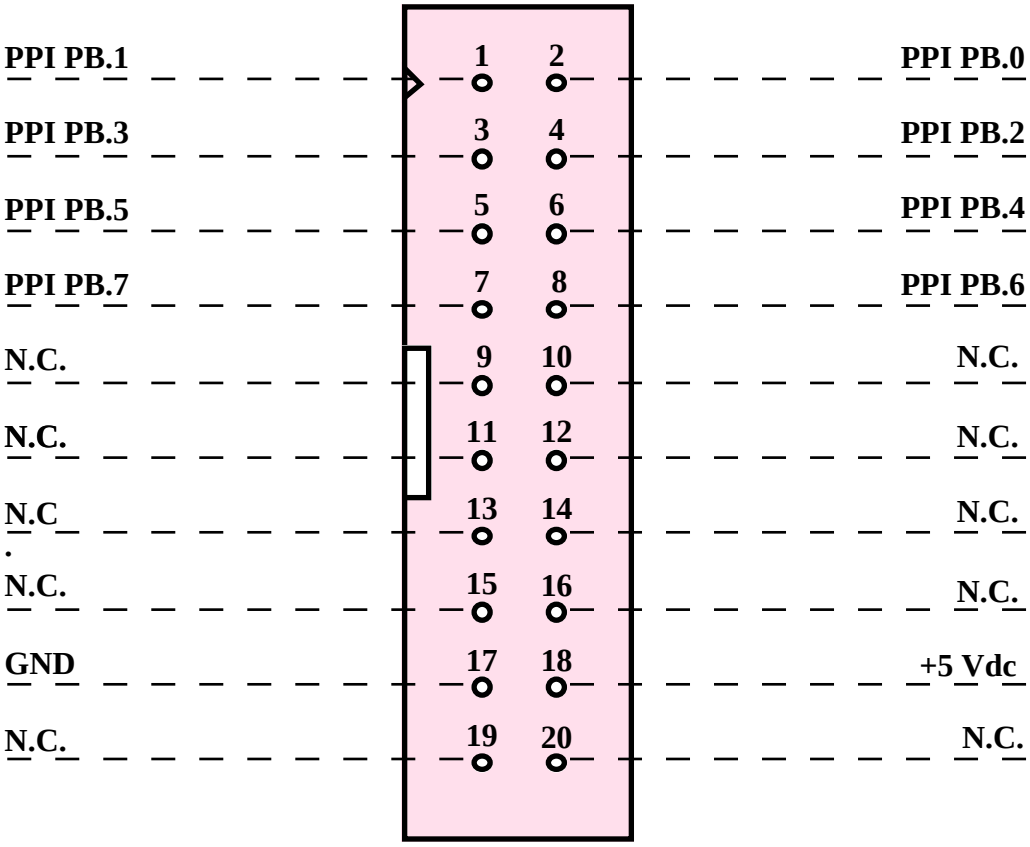


FIGURE ?: CN5 - PORT B OF PPI 82C55 CONNECTOR

Signals description:

PPI PB.n = I/O - n-th TTL digital signal of PPI 82c55 port B
GND = - Ground
N.C. = - Not connected

CN3 - ABACO® I/O BUS CONNECTOR

CN3 is a 26 pins, male, vertical, low profile connector with 2.54mm pitch.
Through CN3 the card can be connected to some of the numerous **grifo®** boards,both intelligent and not. All this connector signals are at TTL level.

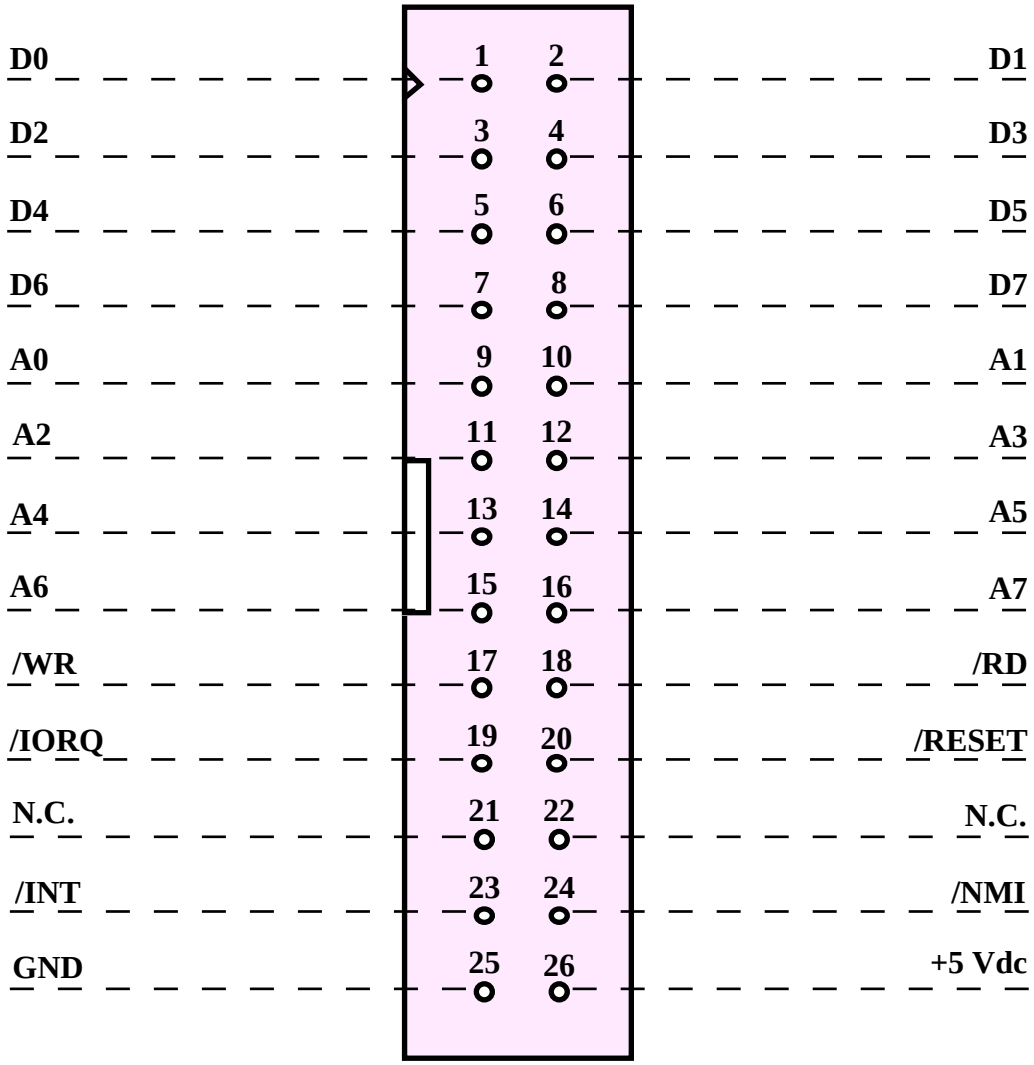


FIGURE ?: CN3 - ABACO® I/O BUS CONNECTOR

Signals description:

A0-A7	=	O	- Address BUS.
D0-D7	=	I/O	- Data BUS.
/INT	=	I	- Interrupt request (open collector type).
/NMI	=	I	- Non maskable interrupt (open collector type).
/IORQ	=	O	- Input output request.
/RD	=	O	- Read cycle status.
/WR	=	O	- Write cycle status.
/RESET	=	O	- Reset.
+5 Vdc	=	O	- +5 Vdc power supply.
GND	=		- Ground signal.

CN4 - SERIAL LINE B IN RS 422, RS 485 OR CURRENT LOOP CONNECTOR

CN4 is a 10 pins, male, vertical, low profile connector with 2.54mm pitch.
On CN4 are available all the signals for RS 422, RS 485 and current loop communication
Signals placement has been designed to reduce interferences and to easy the connections to the field.
These signals are compliant to their specific normatives.
Please remark that current loop is passive.

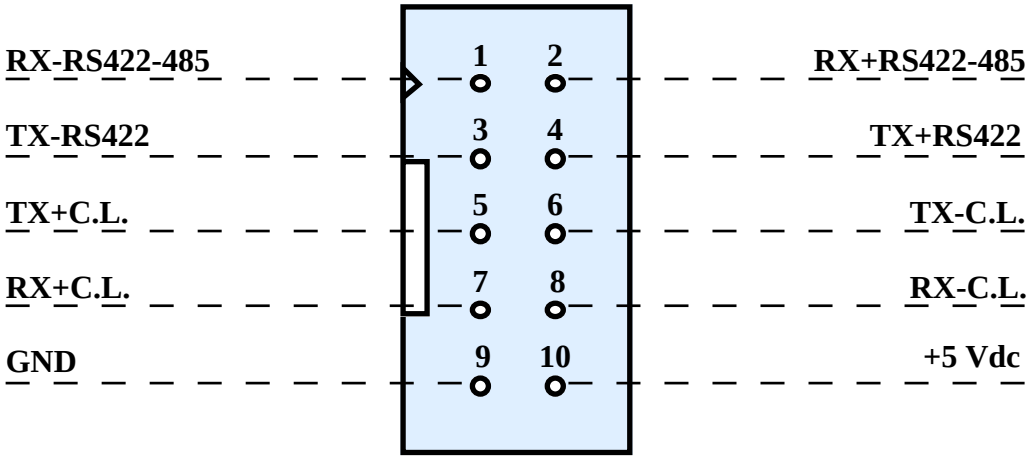


FIGURA ?: CN4 -SERIAL LINE B IN RS 422, RS 485 OR CURRENT LOOP CONNECTOR

Signals description:

RX-RS422-485 = I - Receive Data Negative in RS 422, RS 485
RX+RS422-485 = I - Receive Data Positive in RS 422, RS 485
TX-RS422 = O - Trasmit Data Negative in RS 422
TX+RS422 = O - Trasmit Data Positive in RS 422
RX-C.L. = I - Receive Data Negative in current loop
RX+C.L. = I - Receive Data Positive in current loop
TX-C.L. = O - Trasmit Data Negative in current loop
TX+C.L. = O - Trasmit Data Positive in current loop
+5 Vdc = O - Power supply +5 Vdc
GND = - Ground

K1 - CONNECTOR FOR BUS ABACO®

The connector for **ABACO® industrial BUS**, called K1 on board,is a DIN 41612, male, a 90 °, type C, A+C.
Here follows the pin-out of the connector installed on **GPC® 550**, in addition there is the standard 8 bits and 16 bits**ABACO®** BUS pin-out.
Please remark that all the signals here described are TTL, except for the power supplies.

A 16 bit BUS	A 8 bit BUS	A GPC 188D	PIN	C GPC 188D	C 8 bit BUS	C 16 bit 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	N.C.	-	D8
D1	D1	D1	4	N.C.	-	D9
D2	D2	D2	5	N.C.	-	D10
D3	D3	D3	6	/INT	/INT	/INT
D4	D4	D4	7	/NMI	/NMI	/NMI
D5	D5	D5	8	N.C.	/HALT	D11
D6	D6	D6	9	/MREQ	/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	N.C.	/BUSAK	D12
A3	A3	A3	14	/WAIT	/WAIT	/WAIT
A4	A4	A4	15	N.C.	/BUSRQ	D13
A5	A5	A5	16	/RESET	/RESET	/RESET
A6	A6	A6	17	N.C.	/M1	/IACK
A7	A7	A7	18	N.C.	/RFSH	D14
A8	A8	A8	19	N.C.	/MEMDIS	/MEMDIS
A9	A9	A9	20	N.C.	VDUSEL	A22
A10	A10	A10	21	N.C.	/IEI	D15
A11	A11	A11	22	N.C.	-	-
A12	A12	A12	23	N.C.	CLK	CLK
A13	A13	A13	24	N.C.	-	/RDUDS
A14	A14	A14	25	N.C.	-	/WRUDS
A15	A15	A15	26	N.C.	-	A21
A16	-	A16	27	N.C.	-	A20
A17	-	A17	28	A19	-	A19
A18	-	A18	29	/R.T.	/R.T.	/R.T.
+12 Vdc	+12 Vdc	N.C.	30	N.C.	-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 ?: K1 - BUS ABACO® CONNECTOR

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

NOTE
Directionality indications as above stated are referred to a master (**GPC®**) board and have been kept untouched to avoid ambiguity in case of multi-boards systems.

I/O CONNECTION

To prevent possible connecting problems between **GPC® 188D** and the external systems, the user has to read carefully the previous paragraph information and he must follow these instrunctions:

- For RS 232, RS 422, RS 485, Current Loop and CAN signals the user must follow the standard rules of each one of these protocols;

- For all TTL signals the user must follow the rules of this electric standard. The connected digital signal must be always referred to card digital ground and if an electric insulation is necessary, then an opto coupled interface must be connected. For TTL signals, the 0V level corresponds to logic state 0, while 5V level corrisponds to logic state 1.

VISUAL SIGNALATIONS

GPC® 188D features the 4 LEDs described in the following table:

LED	COLOUR	PURPOSE
LD1	Red	When lit, indicates the activation of on board /INT1 line.
LD2	Red	When lit, indicates the activation of on board watch dog circuitery.
LD3	Green	Software managed activity LED.
LD4	Green	Software managed activity LED.

FIGURE ?: LEDS TABLE

The main function of 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.
Please remark that LED LD1 it timed, to evidence the activation of interrupt line.
To recognize the LED location on the card, please refer to figure ?.

BOARD CONFIGURATION

To make the board and the application program configurable, an 8 pins dip switch, called DSW1, has been installed.
The software can acquire the switches reading the 8 bits at the I/O address assigned to the peripheral and use it to manage different conditions with an unique program (like different languages, program parameter, operating modalities, etc.).
Please remark that reading is in complemented logic (bit 0 means switch ON, bit 1 means switch OFF).
In addition, four digital inputs are available for similar purposes; these are connected to jumpers described in the following paragraph.
For further information please refer to paragraph “I/O mapping”, while to easily locate jumpers and dip switch please refer to figure ?.

JUMPERS

On **GPC® 188D** there are 18 jumpers and one dip switch for card configuration:

JUMPERS	N. PINS	PURPOSE
J1	2	Connects Lithium battery to back up circuitery
J2	2	Enables write protect circuitery for SRAM on IC9
J3	2	Selects watch dog circuitery working mode
J4	2	Selects watch dog circuitery intervent time
J5	3	Selects reset circuitery connection
J6	3	Selects frequency generator for communication baud rate
J7	4	Selects communication type for serial line B (RS 232, RS 422, RS 485, current loop).
J8	2	Connects RS 422-485 termination circuitery to pin 1 of CN4
J9	2	Connects RS 422-485 termination circuitery to pin 2 of CN4
J10	2	Forces status of handshake CTSB
J11	5	Selects directionality and activation mode for serial line B in RS 422-485
J12	2	Connects RS 422-485 termination circuitery to pin 4 of CN4
J13	2	Connects RS 422-485 termination circuitery to pin 3 of CN4
J15	3	Selects reception driver for serial line B in RS 422-485
J16	2	Selects status of handshake /DCDA
J17	2	Selects status of handshake /DCDB
J18	2	Selects status of handshake /SYNCA
J19	2	Selects status ofhandshake /SYNCB

FIGURA ?: TABELLA RIASSUNTIVA JUMPERS

The following tables describe all the right connections of **GPC® 188D** jumpers with their relative functions.
To recognize these valid connections, please refer to the board printed diagram (serigraph) or to figure ? of this manual, where the pins numeration is listed; for recognizing jumpers location, please refer to figure ?.

2 PINS JUMPERS

JUMPERS	CONNECTION	PURPOSE	DEF.
J1	not connected	Disconnects battery BT1 from back up circuitery	*
	connected	Connects battery BT1 from back up circuitery	
J2	not connected	Disables write protect circuitery	
	connected	Enables write protect circuitery	*
J3	not connected	Sets watch dog as monostable	
	connected	Sets watch dog as astable	*
J4	not connected	Selects short watch dog intervent time	*
	connected	Selects long watch dog intervent time	
J8	not connected	Disconnects termination circuitery from pin 1 of CN4	*
	connected	Connects termination circuitery from pin 1 of CN4	
J9	not connected	Disconnects termination circuitery from pin 2 of CN4	*
	connected	Connects termination circuitery from pin 2 of CN4	
J10	not connected	Does not force status of handshake CTSB	*
	connected	Force as active the status of handshake CTSB	
J12	not connected	Disconnects termination circuitery from pin 4 of CN4	*
	connected	Connects termination circuitery from pin 4 of CN4	
J13	not connected	Disconnects termination circuitery from pin 3 of CN4	*
	connected	Connects termination circuitery from pin 3 of CN4	
J16	not connected	Sets logic status 1 on line /DCDA	*
	connected	Sets logic status 0 on line /DCDA	
J17	not connected	Sets logic status 1 on line /DCDB	*
	connected	Sets logic status 0 on line /DCDB	
J18	not connected	Sets logic status 1 on line /SYNCA	*
	connected	Sets logic status 0 on line /SYNCA	
J19	not connected	Sets logic status 1 on line /SYNCB	*
	connected	Sets logic status 0 on line /SYNCB	

FIGURE ?: 2 PINS JUMPERS TABLE

3 PINS JUMPERS

JUMPERS	CONNECTION	PURPOSE	DEF.
J5	position 1-2	Connects watch dog circuitery to reset circuitery	
	position 2-3	Connects reset signal of **BUS ABACO®** (pin 29C of K1) to reset circuitery	*
J6	not connected	Selects quartz on IC 32 for baud rate generation	*
	position 1-2	Selects miniature quartz on IC 33 for baud rate generation	
	position 2-3	Selects miniature quartz on IC 32 for baud rate generation	
J15	position 1-2	Selects driver of IC 37 for RS 422 - RS 485 reception	
	position 2-3	Selects driver of IC 36 for RS 422 - RS 485 reception	*

FIGURA ?: 3 PINS JUMPERS TABLE

4 PINS JUMPERS

JUMPERS	CONNECTION	PURPOSE	DEF.
J7	position 1-2	Sets serial line B as current loop	
	position 2-3	Sets serial line B as RS 232	*
	position 2-4	Sets serial line B as RS 422, RS 485	

FIGURA ?: 4 PINS JUMPERS TABLE

5 PINS JUMPERS

JUMPERS	CONNESSIONE	UTILIZZO	DEF.
J11	position 1-2 and 3-4	Selects communication on serial line B as RS 485 (2 wires half duplex)	
	position 2-3 and 4-5	Selects communication on serial line B as RS 422 in full duplex or 4 wires half duplex	*

FIGURA ?: 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.

NOTE

Here follow some indications that describe in detail which operations are to perform to configure correctly the card.

INTERRUPTS

A remarkable feature of **GPC® 188D** card is the powerful interrupt management.
Here follows a short description of which devices can geneate interrupts and their modalities; for further information about interrputs management please refer to the microprocessor data sheet.

- Real Time Clock -> Generates an interrupt on CPU INT2 signal.

- SCC 85c30 -> Generates an interrupt on CPU INT1 signal.

- **ABACO® BUS** -> Generates /INT and /NMI (please see connector K1) if connected respectively to signals INT0 and NMI of microprocessor.

- **ABACO® I/O BUS** -> Generates /INT and /NMI (please see connector CN3) if connected respectively to signals INT3 and NMI of microprocessor.

Please remark that above mentioned connection sare performed by a specific interface circuitery that makes compatible all several signal types in logic level, timings, etc..

WATCH DOG WORKING MODE SELECTION

GPC® 188D features a very efficent and easy to use watch dog circuitery.
In specific, jumper J3 selects its working mode between astable (when timeout occours, circuitery activates, remains active for a reset time duration and deactivates) and monostable (when timeout occours, circuitery activates and remains active until next reset or a power on).
Jumper J5 selects the /RESET source (one of the sources is this circuit), while jumper J4 selects the intervent time between short (650 msec) or long (2200 msec).
Please remark that reset signal reaches also all the eventual peripheral cards on BUS **ABACO®** and **ABACO®** I/O BUS to warrant overall reset of the whole system.
For information about how to retrigger the external watch dog circuitery, please refer to paragraph “Watch Dog” of chapter “PERIPHERAL DEVICES SOFTWARE DESCRIPTION”.

SERIAL COMMUNICATION SELECTION

Serial line A can be buffered only as RS 232 while serial line B can be buffered in RS 232, RS 422, RS 485 or Current Loop. By hardware can be selected which one of these electric standards is used, through jumpers connection (as described in the previous tables) and drivers installation. By software the serial line can be programmed to operate with all the standard physical protocols, in fact the bits per character, parity, stop bits and baud rates can be decided by setting opportunes SCC 85c30 internal registers. In the following paragraphs there are all the informations on serial communication configurations.
Some devices needed for RS 422, RS 485 and Current Loop configurations are not mounted on the board in standard configuration; this is why each fist non-standard (non-RS 232) serial configuration for line A must be always performed by **grifo®** technicians. This far the User can change in autonomy the configuration following the informations below:

- SERIAL LINE B IN RS 232 (default configuration)

J7	=	position 2-3	IC 29	= driver MAX 202
J8, J9	=	indifferent	IC 34	= no device
J11	=	indifferent	IC 35	= no device
J12, 13	=	indifferent	IC 36	= no device
J15	=	indifferent	IC 37	= no device

- SERIAL LINE B IN CURRENT LOOP (option .CLOOP)

J7	=	position 1-2	IC 29	= no device
J8, J9	=	indifferent	IC 34	= driver HCPL 4200
J11	=	indifferent	IC 35	= driver HCPL 4100
J12, 13	=	indifferent	IC 36	= no device
J15	=	indifferent	IC 37	= no device

Please remark that Current Loop serial interface is passive, so it must be connected an active Current Loop serial line, that is a line provided with its own power supply, like described in figures ?÷?. Current Loop interface can be employed to make both point-to-point and multi-point connections through a 2-wires or a 4-wires connection.

- SERIAL LINE B IN RS 422 (option .RS 422)

J7	=	position 2-4	IC 29	= no device
J8, J9	=	(*)	IC 34	= no device
J11	=	position 2-3 and 4-5	IC 35	= no device
J12, 13	=	(*)	IC 36	= driver SN 75176 or MAX 483
J15	=	position 2-3	IC 37	= driver SN 75176 or MAX 483

Status of signal /RTSB (software managed), allows to enable or disable the transmitter:

/RTSB = DIR= low level = logic state 0 -> transmitter enabled
/RTSB = DIR= high level = logic state 1 -> transmitter disabled

In point-to-point connections, signal /RTSB can be always kept low (trasnmitter always enabled), while in multi-point connections transmitter must be enabled only when a transmission is requested.

- SERIAL LINE B IN RS 485 (option .RS 485)

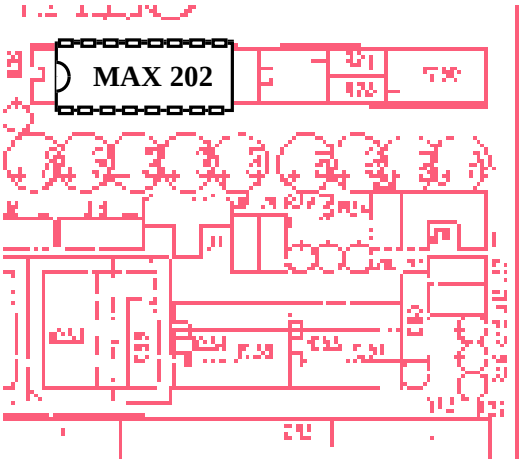
J7	=	position 2-4	IC 29	= no device
J8, J9	=	(*)	IC 34	= no device
J11	=	position 1-2 and 3-4	IC 35	= no device
J12, 13	=	(*)	IC 36	= driver SN 75176 or MAX 483
J15	=	position 2-3	IC 37	= no device

In this modality the signals to use are pins 1 and 2 of connector CN4, that become transmission or reception lines according to the status of signal /RTSB, managed by software, as follows:

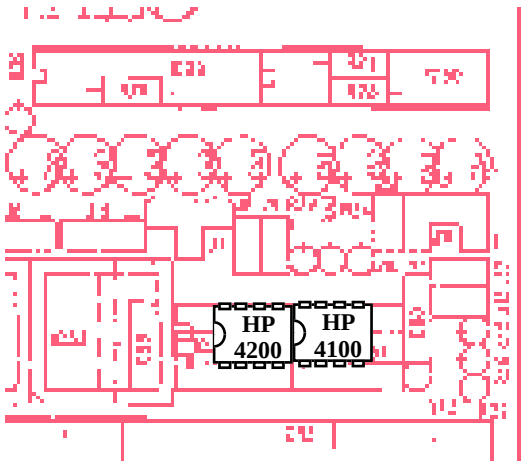
/RTSB = DIR=low level	= logic state 0	->	transmitter enabled
/RTSB = DIR=high level	= logic state 1	->	transmitter disabled

This kind of serial communication can be used for multi-point connections, in addition it is possible to listen to own transmission, so the user is allowed to verify the succes of transmission. In fact, any conflict on the linecan be recognized by testing the received character after each transmission.

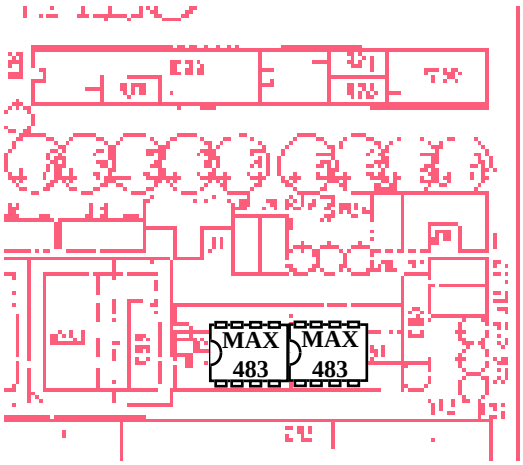
(*) If using the RS 422 or RS 485 serial line, it is possible to connect the terminating and forcing circuit on the line by using J8, J9, J12 and J13. This circuit must be always connected in case of point-to-point connections, while in case of multi-point connections it must be connected olny in the farest boards, that is on the edges of the commmunication line.
J8 must always be connected like J9 and J12 must always be connected like J13 to assure a proper working of the card.
During a reset or a power on, signal /RTSB = DIR is at logic level high, so during these phases driver RS 485 is in reception or transmission driver RS 422 is disabled, to avoid confilcts on line.



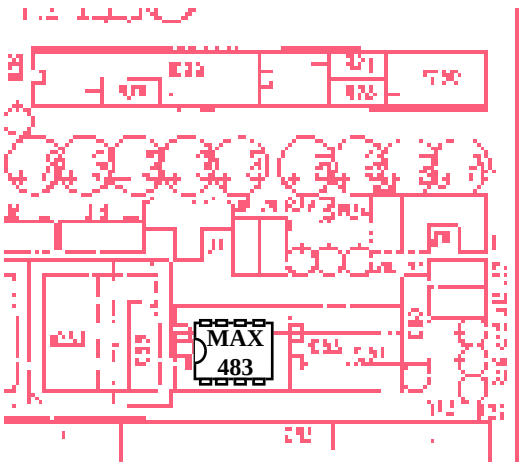
Serial A in RS 232



Serial A in current loop



Serial A in RS 422



Serial A in RS 485

FIGURE ?: DRIVER FOR SERIAL COMMUNICATION LOCATION

ADDRESSES AND MAPS

INTRODUCTION

In this chapter are reported all information about card use, related to hardware features of **GPC® 188D**. For example, the registers addresses, the memory allocation and peripheral devices software management are described below.

ADDRESSES

The card devices addresses are managed from a control logic, realized with programamble logic. This control logic allocates memory and peripheral devices with very low power consumption, in two separate manners.
The 80c188 microprocessor addresses 1M bytes of memory and 64K bytes of I/O addresses and the control logic provides on board memory and peripheral devices allocation inside the 512 Kbytes maximum addresses spaces.
This management is performed by software programming CPU internal circuitery that allows to set size, type and addresses of every device.
In specific, the possiblilty of 80c188 to generate 7 signals for /CS of I/O and 3 signals for /CS memory access when occurs an access to address programmed by the user is used.
So board mapping is completely programmed by the CPU, this is why here is reported the connection between devices and CPU signals.
The user can completely configure and use the board just with the 80c188 technical manual.
Summarizing the devices allocated on the board are:

DEVICE	SOCKET	PIN 80C188
EPROM or FLASH EPROM	IC 18	/UCS
SRAM	IC 13	/MCS0
SRAM	IC 9	/MCS1
EEPROM	IC 23	/PCS0
PPI 82C55	IC 22	/PCS4
SCC 85C30	IC 27	/PCS1
ABACO® I/O BUS	IC 38,40	/PCS3
RTC 72421	IC 3	/PCS5
WRITE PROTECT SRAM IC 9	IC 14	/PCS6
DIP SWITCH DSW1	IC 19	/PCS6
ACTIVITY LED	IC 15	/PCS6
WATCH DOG	IC 16	/PCS0
DMA	IC 15	/PCS2

The addresses listed here and in the following paragraphs cannot be reallocated.

BUS ABACO® MAPPING

GPC® 188D control logic manages also BUS **ABACO®** addressing; as shown in figure ?, it is available in the addresses range 0000H÷EFFFH.
Accesing any address in this range enables signal /IORQ and all the other control signals of K1.

I/O ADDRESSES

I/O addresses are located in the 64K bytes microprocessor I/O addressing space, through on board control logic.
Control logic also avoids to use microprocessor internal locations to prevent conflicts.
Next table shows addresses, meanings and direction of peripheral devices registers (only the external ones to microprocessor):

DEVICE	REG.	ADDRESS	R/W	PURPOSE
W.DOG	RWD	INDPCS0+00H	R	Watch dog retrigger
EEPROM	RE2	INDPC0+00H	R/W	Serial EEPROM access
SCC 85C30	RSB	INDPCS1+00H	R/W	Serial line B status register
	RDB	INDPCS1+01H	R/W	Serial line B data register
	RSA	INDPCS1+02H	R/W	Serial line A status register
	RDA	INDPCS1+03H	R/W	Serial line A data register
DMA	DMA	INDPCS2+00H	R/W	Disable DMA request register
ABACO® I/O BUS	IOBUS	INDPCS3	R/W	**ABACO® I/O BUS** management addresses
PPI 82C55	PA	INDPCS4+00H	R/W	Port A data register
	PB	INDPCS4+00H	R/W	Port B data register
	PC	INDPCS4+00H	R/W	Port C data register
	RC	INDPCS4+00H	R/W	Command and control register

FIGURE ?: I/O ADDRESSING TABLE - PART 1

DEVICE	REG.	ADDRESS	R/W	PURPOSE
RTC 72421	S1	INDPCS5+00H	R/W	Units of seconds register
	S10	INDPCS5+01H	R/W	Decines of seconds register
	MI1	INDPCS5+02H	R/W	Units of minutes register
	MI10	INDPCS5+03H	R/W	Decines of minutes register
	H1	INDPCS5+04H	R/W	Units of hours register
	H10	INDPCS5+05H	R/W	Decines of hours and AM/PM register
	D1	INDPCS5+06H	R/W	Units of days register
	D10	INDPCS5+07H	R/W	Decines of day register
	MO1	INDPCS5+08H	R/W	Units of month register
	MO10	INDPCS5+09H	R/W	Decines of month register
	Y1	INDPCS5+0AH	R/W	Units of year register
	Y10	INDPCS5+0BH	R/W	Decines of year register
	W	INDPCS5+0CH	R/W	Day of week register
	REGD	INDPCS5+0DH	R/W	Status and control D register
	REGE	INDPCS5+0EH	R/W	Status and control E register
	REGF	INDPCS5+0FH	R/W	Status and control F register
WR PROT	WRP	INDPCS6+00H	W	Disable rite protection register
DIP SWITCH	DSW1	INDPCS6+00H	R	Acquisition dip switch register
ACTIVITY LEDS	LED	INDPCS6+40H	W	Activity LEDs management register

FIGURE ?: I/O ADDRESSING TABLE - PART 2

For further information about register meanings, please refer to next paragraph called "PERIPHERAL DEVICES SOFTWARE DESCRIPTION".
Please remark that the above table reports the description of external devices registers only, for a description of microcontroller internal regisers please refer to manufacturer documentation.

ABACO® I/O BUS MAPPING

GPC® 188D control logic manages also BUS **ABACO®** I/O BUS addressing; as shown in figure ?, it is available in the 128 bytes in the addresses range F180H÷F1FFH.
For this reason, if a peripheral card uses all the 8 addressing signals A0÷A7, it will have to be mapped in an address in the range 128÷255 (80H÷FFH)

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

In the previous paragraphs are described the external registers addresses, while in this one there is a specific description of registers meaning and function (please refer to I/O addresses table, for the registers names and addresses values). For a more detailed description of the devices, please refer to manufacturing company documentation; for microprocessor internal peripheral devices, not described in this paragraph, refer to appendix B. In the following paragraphs the **D7÷D0** and **.0÷7** indications denote the eight bits of the combination used in I/O operations.

WATCH DOG

To retrigger the external watch dog circuitery, just perform a read operation from register RWD.
This register share its address with serial EEPROM control register, but the simple read operation creates no confilcts.
Data read during retrigger has no meaning.
Retrigger must happen periodically before the intervent time is elapsed; otherwise, if jumper J5 connects watch dog to reset circuitery, the board is reset. Default intervent time is 560 ms.

ACTIVITY LEDS

Control logic allows to manage activity LEDs LD3 and LD4, performing a write operation to bits D0 and D1 of register LED.
Setting to 0 will turn off the LED, setting to 1 will turn it ON.
Other bits of the register are not used, so their value is not important.
Bits D0 and D1 are set to 0 after a reset or a power on, turning off the LEDs.

DIP SWITCH DSW1

The on board DSW1 Dip Switch status can be obtained by software, through a simple "read operation" at the DSW1 register address.
The corrispondence between register bits and Dip Switch is as follows:

D7 -> DSW1.8
D6 -> DSW1.7
D5 -> DSW1.6
D4 -> DSW1.5
D3 -> DSW1.4
D2 -> DSW1.3
D1 -> DSW1.2
D0 -> DSW1.1

Reading DIP register by software, the user obtains a complemented combination, in fact "**ON**" position corresponds to **0** logic status and "**OFF**" position cooresponds to **1** logic status.