

QTP 03

Quick Terminal Panel 3 Keys

USER MANUAL



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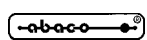
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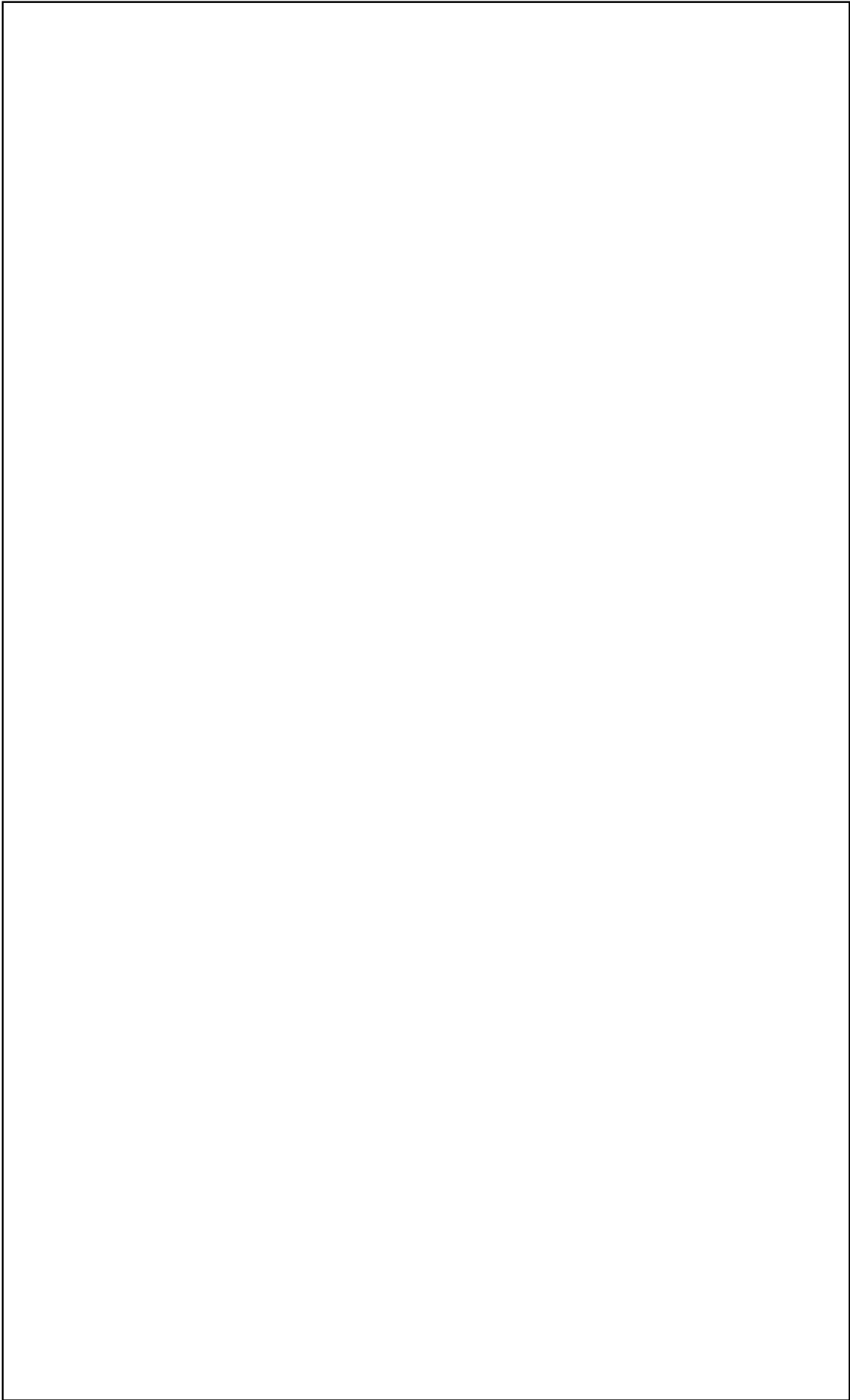
QTP 03

Rel. 5.10

Edition 12 December 2002



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USER MANUAL

Complete user panel with two really important features: very low size and a very cheap price; equipped with Fluorescent or LCD display, LEDs backlite, 20x2, 20x4 or 40x2 characters. RS 232 or TTL serial line; EEPROM for set up parameters and messages; full management of 3 external keys, connected through wires; buzzer driven by software; autorepeat and keyclick functions; local setup for operating modalities setting; up to 239 different characters can be displayed. Front size equal to used display dimensions; some models can be inserted in proper **QTP 72144** or **QTP 72144** containers. Single power supply of +5 Vdc; low consumption. Wide range of available software commands.

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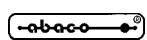
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For specific informations on the components mounted on the card, please refer to the Data Book of the builder or second sources.

SYMBOLS DESCRIPTION

In the manual could appear the following symbols:

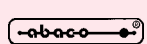


Attention: Generic danger



Attention: High voltage

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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 manufacturer, 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 environment, 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 manufacturer 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 respect 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.

FIRMWARE VERSION

This handbook make reference to firmware version **1.3** and following ones. The validity of the information contained in this manual is subordinated to the firmware release number, so the user must always verify the correct correspondence between the notations. Inside the device, the firmware release number is written on the label stuck on the CPU or it can be obtained by a proper command sent through the serial line.

GENERAL INFORMATION

QTP 03 is a complete low cost operator panel with small overall dimension, specifically designed for industrial use and for direct mounting on automatic machinery. It is a video terminal suitable to be the direct interface between operator and machinery in any of the control, command, visualization operations which could be necessary in many civil and/or industrial applications.

QTP 03 is available with **alphanumeric Fluorescent** or **LEDs back lite LCD** displays, with 20 characters for 2 or 4 lines or with 40 characters for 2 lines. **QTP 03** is directly connected with the display, so it has an overall frontal dimension equal to the selected display used for visualization. For the mechanic fixing the user must use the onboard displays holes.

Moreover **QTP 03** is really usefull in all those applications where few function keys are required in fact it manages **three external keys**, suitable for minimal user interaction. Whenever the data inputs is more complex different **QTP** models can be used or the management software can be changed by adding sliding characters, increasing/decreasing digits, menu, etc.

QTP 03 allows, with its **EEPROM**, the capability to directly store about **100 messages**. These messages can be recalled by dedicated commands received through the serial line and visualized on the display. With this feature the CPU work time and the program space are optimized, in fact messages must not be sent to the panel every time, they are just stored in EEPROM. Furthermore it is possible to get messages back through the serial line and read them again. So **QTP 03** can be used as a little mass memory devices where the user can save and read system set up informations, passwords, identification codes, etc.

Some models of **QTP 03** can be enclosed inside a proper metallic container, named **QTP 72144** and **QTP 96192**, obtaining a compact apparatus with **IP 56** frontal protection and with remarkable mounting facilities.

The **QTP 03** is able to execute an entire range of display commands, including clear screen, cursor position, cursor movements, cursor activation, etc., with code compatibility to **ADDS View Point** standard.

Main features of **QTP 03** are as follows:

- **Small overall dimension**: same of the selected display
- Very low **price**
- 7 different alphanumeric **display** available:
 - QTP 03-C2**: LCD display, back lighted , with **20** characters for **2** lines
 - QTP 03-C4**: LCD display, back lighted , with **20** characters for **4** lines
 - QTP 03-C4B**: LCD display, back lighted , with **20 big** characters for **4** lines
 - QTP 03-C24**: LCD display, back lighted, with **40** characters for **2** lines
 - QTP 03-F2**: **Fluorescent** display with **20** characters for **2** lines
 - QTP 03-F4**: **Fluorescent** display with **20** characters for **4** lines
 - QTP 03-F24**: **Fluorescent** display with **40** characters for **2** lines
- Complete management of **3 user keys** connected by external wires
- **Autorepeat** and **keyclick** functions on stroked keys
- **Buzzer** programmable as **BELL** or to sound with keystroke
- Serial **EEPROM**, up to 2 Kbyte capacity, for permanent storage of set up, messages, etc.
- Memorization on **EEPROM** and visualization of **100** different **messages**
- **RS 232** or **TTL** serial line
- **Local set up** for operating modalities (Baud Rate, Stop bits, Keyclick, etc.)
- Up to **239** different **characters** predefined on display that can be visualized
- Some models can be ordered already inserted in **QTP 72144** and **QTP 96192** containers
- Single **+5 Vdc** power supply

- Low current consumption from **140** to **275 mA** (the current depends on selected display)
- Customized program packages

Here follows a description of the board's functional blocks, with an indication of the operations performed by each one.

SERIAL COMMUNICATION

The communication with remote units is by standard asynchronous serial line that can be configured both in RS 232 or TTL electrical protocol, through jumpers. The physical protocol of the serial line is partly selectable through the proper local set up program, that allows the user to choose between the available values, as described on GENERAL FEATURES and LOCAL SET UP paragraphs, by simply using the external keys.

BUZZER

QTP 03 has a circuitry that generates a steady sound, based on a capacitive buzzer. The said circuitry can be activated by software through a specific comand for generating a simple beep or it can be linked to a key pressure, just to get the **keyclick** function, or it can signalize possible malfunctions.

In the last case when, after a power on, the card generates an intermittent sound and it doesn't work correctly, there is a wrong condition that must be resolved: please contact **grifo®** technicians.

DISPLAY

QTP 03 is available with **Fluorescent** or backlite **LCD** alphanumeric displays with different characters number and different characters size. In detail the following displays can be mounted: Fluorescent 20x2, Fluorescent 20x4, Fluorescent 40x2, LCD 20x2, LCD 20x4, LCD 20x4 big or LCD 40x2 characters. The LEDs backlight of LCD models ensures a good visibility even when the environmental lighting changes and if it necessary the user can modify the contrast regulation by acting on a specific trimmer. Another important features of **QTP 03** displays is their wide viewing angle that allows a good visibility from each frontal position. Further information on each display are reported in TECHICAL FEATURES chapter.

The user must choose the right display (so the right **QTP 03** model) that is sufficient for the information to visualize and for his visibility requirements. For specific requirements on current consumption, visibility and price the card can be provided with LCD display not backlighted: for detailed information about these options and their availability, please contact directly **grifo®** offices.

KEYBOARD

QTP 03 has three input lines that can be directly connected to external keys. The user can add any type of push buttons according to machine requirements and he can even mount these buttons away from the card, adding simple connection wires, as described in figure 7; in this way the mechanical mounting is really simplified. The keys management is completely automatic with comfortable **autorepeat** feature, and there is also the possibility to change the code returned on the serial line for each key stroke, through software by using a proper command. Furthermore there is the possibility to switch on/off the key click function, i.e the buzzer activation each time a key is pressed.

Thanks to the management of this simple keyboard, the **QTP 03** can cheaply solve the data exchange problems especially when those data are homogeneous and easy. By using industrial keys and push buttons the problems can be solved even in strong environmental applications and functionality is guaranteed in each operating conditions.

EEPROM

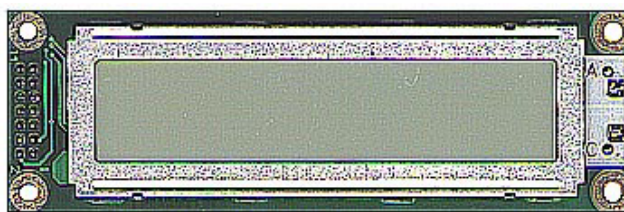
QTP 03 has on board EEPROM (the size vary from 256 Bytes to 2 KBytes) for storing set up, communication protocol, keys codes, messages, and so on. Many of the stored data have vital importance so a serial EEPROM has been chosen to obtain the best warranties on validity and maintenance of the saved information, even when power supply is not available.

It is possible to memorize up to 100 messages of 20 characters that can be first saved on EEPROM and then read or shown on the display at any moments, just giving a proper command to the terminal, with the right message identification number. For detailed information about messages please read **COMMANDS FOR MESSAGES MANAGEMENT** paragraph.

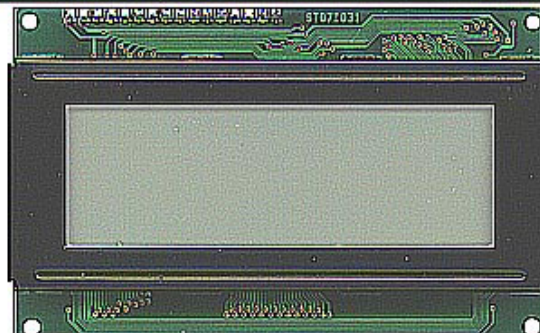
The EEPROM size must be chosen considering the application to realize or the specific requirements of the user. Normally the card is equipped with 512 Bytes of EEPROM and the other configuration must be specified from the user, at the moment of the order, by using the following indications:

512 Bytes EEPROM	->	-
1024 Bytes EEPROM	->	-
2048 Bytes EEPROM	->	.MEX option

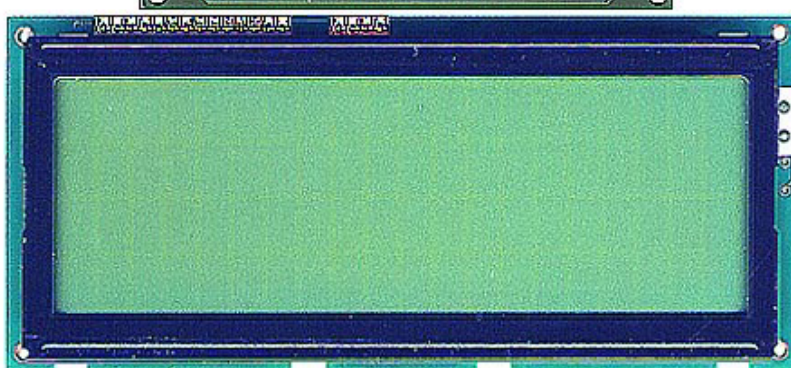
QTP 03-C2



QTP 03-C4



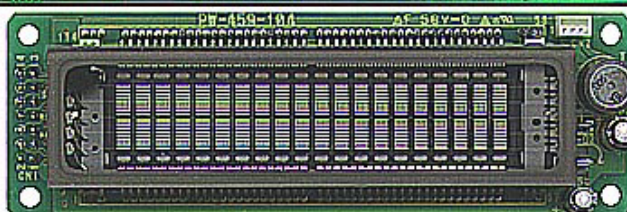
QTP 03-C4B



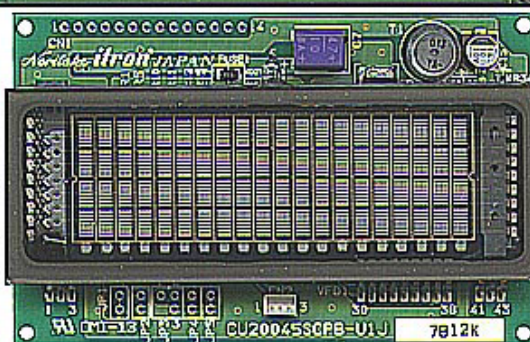
QTP 03-C24



QTP 03-F2



QTP 03-F4



QTP 03-F24

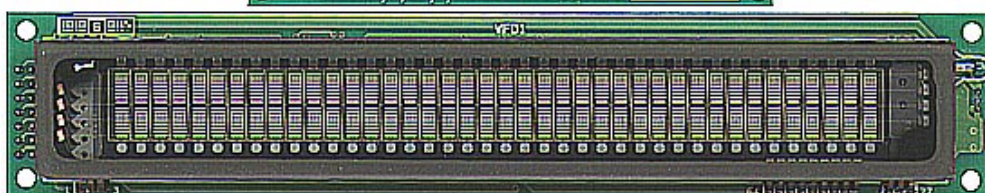


FIGURE 1: QTP 03 PHOTO IN ALL AVAILABLE MODELS

TECHNICAL FEATURES

GENERAL FEATURES

On board resources:	<p>Signals for 3 externa keys management</p> <p>Buzzer for bell and keyclick</p> <p>Full duplex RS 232 or TTL serial line</p> <p>EEPROM for set up, messagges and so on (2K Bytes max.)</p> <p>Alphanumeric display in 7 different models</p> <p>Trimmer for contrast regulation of LCD display</p>
Displays:	<p>LCD : 20x2, 20x4, 20x4 big or 40x2, with LEDs backlite</p> <p>Fluorescent: 20x2, 20x4 or 40x2</p>
CPU:	89C2051 with 14.7456 MHz Crystal.
Communication protocol:	<p>Baud rate: 1200, 2400, 4800, 9600, 19200, 38400</p> <p>Stop bit: 1 or 2</p> <p>Parity: none</p> <p>Bits x chr: 8</p> <p><i>Default: 19200 Baud, 1 Stop, No parity, 8 Bits</i></p>
Receive buffer dimension:	30 characters

PHYSICAL FEATURES

Size:	<p>Display 20x2: 116 x 37 x 30 mm (W x H x D)</p> <p>Display 20x4: 98 x 61 x 30 mm (W x H x D)</p> <p>Display 20x4 big: 146 x 63 x 28 mm (W x H x D)</p> <p>Display 40x2: 182 x 34 x 34 mm (W x H x D)</p> <p><u>See outline dimension in APPENDIX C</u></p>
Characters size:	<p>LCD 20x2: 5 x 7 dots, 3.20 x 4.85 mm (W x H)</p> <p>LCD 20x4: 5 x 7 dots, 2.95 x 4.75 mm (W x H)</p> <p>LCD 20x4 big: 5 x 7 dots, 5.00 x 8.50 mm (W x H)</p> <p>LCD 40x2: 5 x 7 dots, 3.20 x 5.55 mm (W x H)</p> <p>Fluorescent 20x2: 5 x 7 dots, 2.40 x 4.70 mm (W x H)</p> <p>Fluorescent 20x4: 5 x 7 dots, 2.40 x 4.70 mm (W x H)</p> <p>Fluorescent 40x2: 5 x 7 dots, 2.30 x 4.70 mm (W x H)</p>
Weight:	160 g max.
Mounting:	Through display mounting hole (<u>outline dimension in APPENDIX C</u>)

Keys connection cable lenght:	30 cm max.
Keys autorepeat:	After 500 ms and then every 100 ms
Temperature range:	From 0 to 50 °C
Relative humidity:	20% up to 90% (without condense)
Connectors:	<p>CN3: 4+4 pins AMP Mod II, 90°, Male</p> <p>The female connector for CN3 can be directly ordered to grifo® with the code CKS.AMP8 (kit composed by a female AMP Mod II 4+4 pins plus 8 contact to crimp), or to AMP dealer by using P/N 280365 and P/N 182206-2</p>

ELECTRIC FEATURES

Power voltage:	+5 Vdc \pm 5%
-----------------------	-----------------

Hereunder is listed the **QTP 03** power consumption referred to the different display types :

<i>DISPLAY type</i>	<i>Current consumption</i>
LCD 20x2 Backlite QTP 03-C2	180 mA
LCD 20x4 Backlite QTP 03-C4	140 mA
LCD 20x4 BIG Backlite QTP 03-C4B	160 mA
LCD 40x2 Backlite QTP 03-C24	170 mA
Fluorescent 20x2 QTP 03-F2	150 mA
Fluorescent 20x4 QTP 03-F4	255 mA
Fluorescent 40x2 QTP 03-F24	275 mA

FIGURE 2: CURRENT CONSUMPTION TABLE

Please remind that to reduce consumption, the **QTP 03** can be ordered also with LCD display not backlit: whenever necessary please contact directly **grifo®** for price and availability.

INSTALLATION

In this chapter there are the information for a right installation and correct use of the terminal **QTP03**. In detail there are the locations and functions of each connector, of the user settable jumpers and of the trimmer. For the connectors it is described the pin outs, the meaning of the connected signals and some connection examples, that simplify and speed the installation phase.

CN3 - INTERFACE CONNECTOR

The connecor named **CN3** is an AMP Mod II 4+4 pins, 90°, male with 2.54 mm pitch.

It must be used for all the **QTP 03** connections in fact it includes the power supply, the serial communication and external keys signals. Placing of the signals has been designed to reduce interference and electrical noise and to simplify connections with other systems.

The female connector for CN3 can be directly ordered to **grifo®** (code **CKS.AMP8**) or acquired directly from AMP dealer by using P/N 280365 (female AMP Mod II 4+4 pins) and P/N 182206-2 (crimping contact).

In the following figures are described all these signals, divided according with their functionality.

POWER SUPPLY CONNECTION

The below figure shows the CN3 signals used to power supply the **QTP 03**:

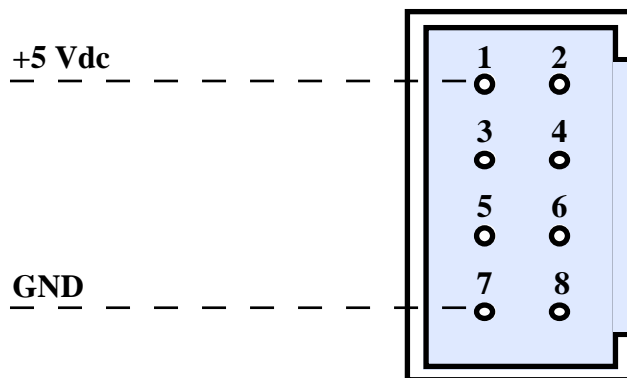


FIGURE 3: CN3 - POWER SUPPLY PINS

Signals description:

+5 Vdc = I - +5 Vdc power supply signal for on board logic.
GND = - Power supply ground signal.

SERIAL LINE CONNECTION

The below figure shows the CN3 signals used to connect a serial line, RS 232 or TTL, to **QTP 03**. These signals follow the CCITT normative defined for each one of the available electric protocols.

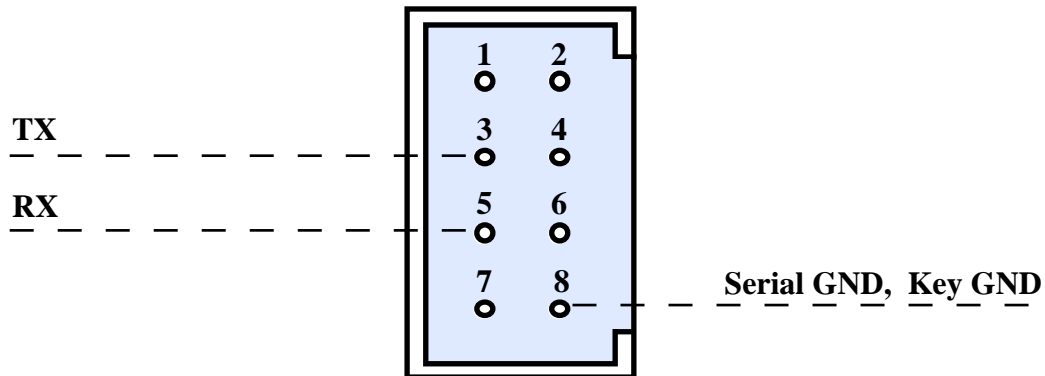


FIGURE 4: CN3 - SERIAL LINE PINS

Signals description:

RX	= I - RS 223 or TTL serial receive data.
TX	= O - RS 223 or TTL serial transmit data.
Serial GND	= - Serial communication ground signal.
Key GND	= - External keys ground signal.

The Serial GND and the Key GND signals are physically connected to GND signal always on CN3 connector: two separate pins have been provided to facilitate connections.

To avoid wrong connection and possible consequent damages, the selection of **QTP 03** electric protocol must be performed following the information of SERIAL LINE CONFIGURATION JUMPERS paragraph.

The following figure shows an RS 232 connection example diagram with a generic master unit:

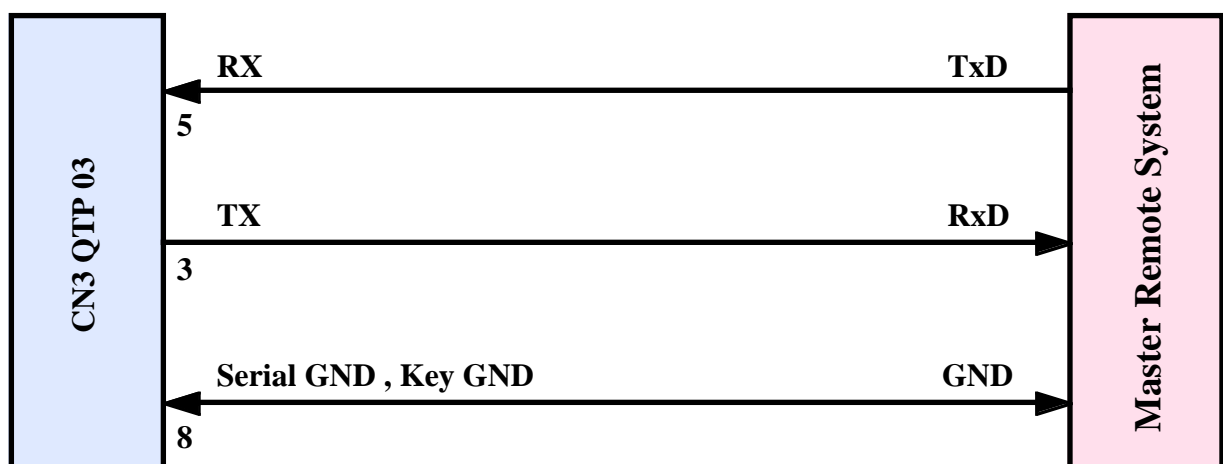


FIGURE 5: RS 232 SERIAL CONNECTION EXAMPLE

EXTERNAL KEYS CONNECTION

The below figure shows the CN3 signals used to connect the external keys. These are TTL signals and they can be connected to any type of normally open key or push button, that ensure a low contact resistance, by interposing the connection wires described on figure 7. The maximum lenght of this connection cable is 30 cm, except when the external environment is well disposed and enlargement become possible.

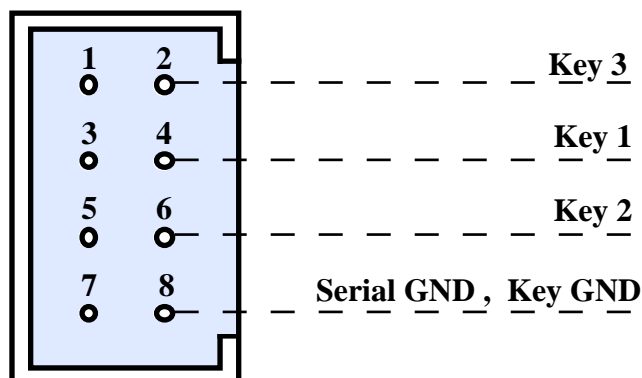


FIGURE 6: CN3 - PC KEYBOARD PINS

Signals description:

Key 1	= I - External key n. 1 connection signal.
Key 2	= I - External key n. 2 connection signal.
Key 3	= I - External key n. 3 connection signal.
Serial GND	= - Serial communication ground signal.
Key GND	= - External keys ground signal.

The three external keys must be connected with a pin directly connected to ground signal and with the other pin connected to the proper input signal; in this way when a key is pressed the respective **Key x** is connected to ground. The following figure shows a connection diagram:

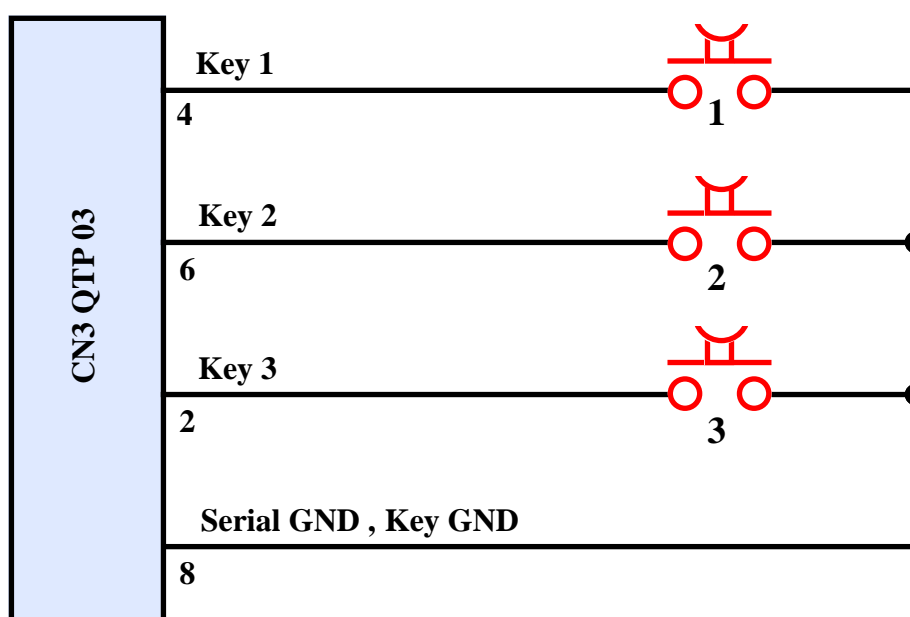
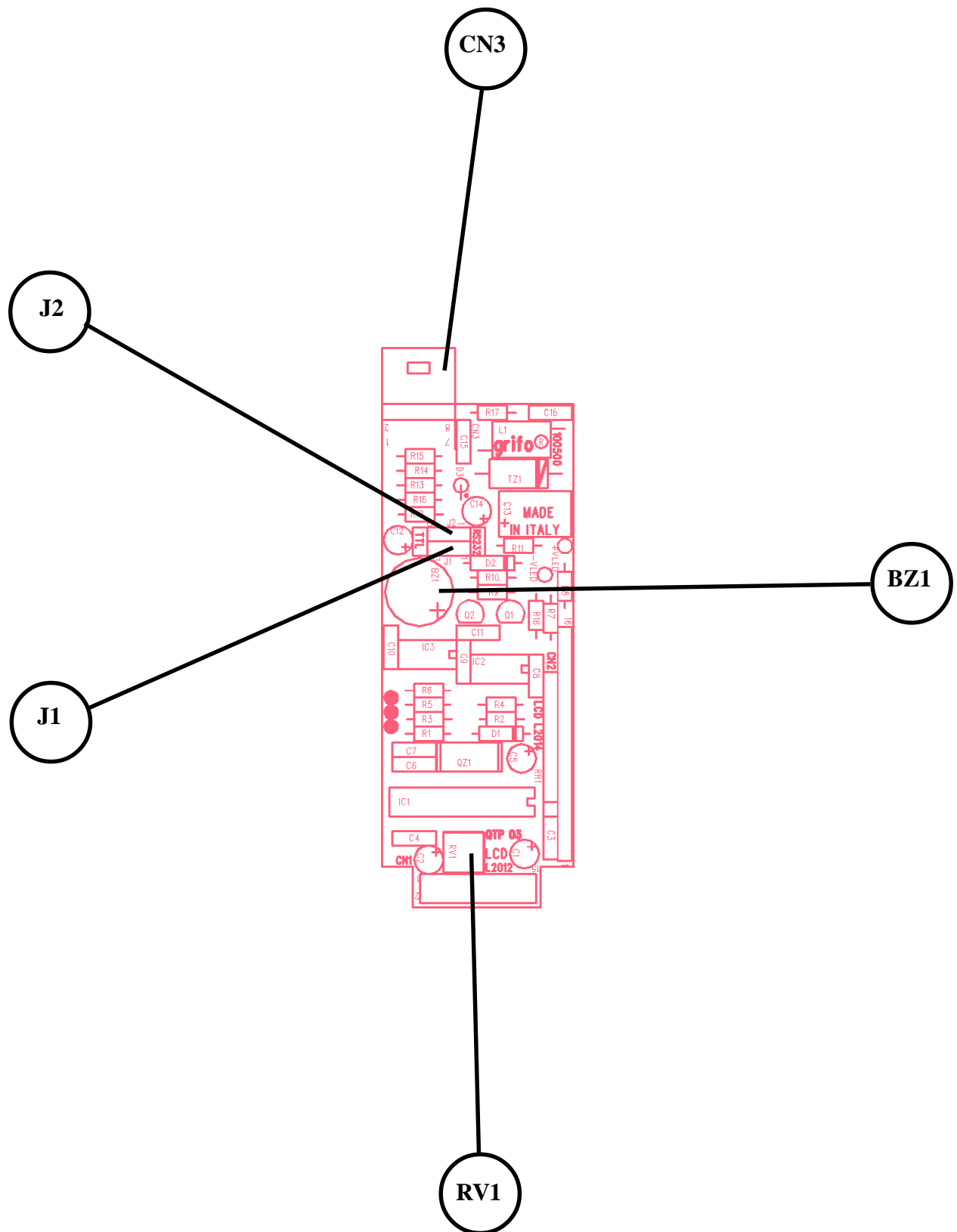


FIGURE 7: EXTERNAL KEYS CONNECTION DIAGRAM

**FIGURE 8: JUMPERS, CONNECTOR, TRIMMER LOCATION**

SERIAL LINE CONFIGURATION JUMPERS

The **QTP 03** terminal has a communication serial line that can be electrically configured in **RS 232** or **TTL**, through the configuration of two jumpers named **J1** and **J2**.

The following table describes all the right connections of these jumpers with their respective functions. To recognize the valid connections, please refer to the board printed diagram (serigraph) or to figure 11 of this manual, where the pins numeration is listed; for recognizing jumpers location, please refer to figure 8.

JUMPERS	CONNECTION	FUNCTION	DEF.
J1	Position 1-2	Configures the serial transmission line (TX), with RS 232 electric protocol.	*
	Position 2-3	Configures the serial transmission line (TX), with TTL electric protocol.	
J2	Position 1-2	Configures the serial reception line (RX), with RS 232 electric protocol.	*
	Position 2-3	Configures the serial reception line (RX), with TTL electric protocol.	

FIGURE 9: SERIAL LINE CONFIGURATION JUMPERS

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.

The two electric protocols RS 232 and TTL are incompatible, so we suggest to configure them taking many care and to always check the electric protocol used by the external system that must be connected to **QTP 03**.

If you are not sure, please remind that the connection of an external system in RS 232 to **QTP 03** configured in TTL (J1 and J2 in position 2-3), can damage the on board electronic circuit.

CONTRAST REGULATION TRIMMER

On **QTP 03** board there is a trimmer that defines the contrast on LCD displays. This trimmer, named RV1 is setted by **grifo®** to obtain the best display visibility in each working conditions and normally the user must not change its position. In case of specific requirements, as external light very low or very high, RV1 can be changed by little rotation in both directions until the visibility is improved. For recognizing the location of contrast regulation trimmer, please refer to figure 8.

SOFTWARE DESCRIPTION

As already said **QTP 03** terminal is a complete video terminal and for this reason any characters received from serial line, if it is not a command, is shown on the display and codes of any pressed external keys, are transmitted to the control master unit. These operations are automatically performed by on board firmware that is programmed and executed by the **QTP 03** CPU. The on board firmware manages also a local set up which allows to set the physic communication protocol by using the keys and the display. This manual contains, in addition to the description of the different functions, a complete list of the recognized comand sequences, to be used to benefit of the main features of **QTP 03**. For each code or codes sequence, there is a double description i.e: the mnemonic one through the ASCII characters and the numerical one under decimal and hexadecimal form.

The said commands respect the **ADDS View Point** standard so all the sequences begin with **ESC** character corresponding to the **27** decimal code (**1B Hex**).

KEYS NAME CONVENTION

In the folloing pages of this manual the three external keys that can be connected to **QTP 03** are always named **KEY 1**, **KEY 2** and **KEY 3**, with the following relation:

KEY 1	->	External key connected to pin 4 of CN3
KEY 2	->	External key connected to pin 6 of CN3
KEY 3	->	External key connected to pin 2 of CN3

LOCAL SET UP

Thanks to a proper local set up mode, some parameters of communication protocol and the key click mode can be setted by the user with the simple use of some external keys.

To enter set up mode the user must power on the **QTP 03** and simultaneously he must press the **KEY 1** and **KEY 2** for at least half of a second.

When the set up mode is entered, on the display appears the "**-Setup-**" string and with two keys the configuration parameters shall be changed as below described:

KEY 1: It changes the current menu, recognized by the following messages:

" BAUD "	->	to change the communication baud rate
" STOP "	->	to change the stop bit number
" BEEP "	->	to change the key click mode
" *Exit* "	->	to exit from set up mode

KEY 2: It changes the current value of the selected menu, with the following possibilities:

BAUD	->	38400, 19200, 9600, 4800, 2400 or 1200 baud (<i>default=19200</i>)
STOP	->	1 or 2 (<i>default=1</i>)
BEEP	->	ON or OFF (<i>default=ON</i>)
Exit	->	exits from set up mode and configures QTP 03 with selected parameters

When set up mode is exit, the selected parameters are saved on EEPROM and they are maintained until another local set up is executed and then terminal starts its normal functionality.

The *default* values before reported are those setted at the end of testing phase, that is the configuration the user receives.

NOTE

Please remind that set up mode can be entered only during power up, when previously described condition are recognized in fact if KEY 1 and KEY 2 are pressed at the same time during normal operation the set up mode will not start and the code of the pressed keys will be transmitted on the serial line.

The local ser up is normally executed only one time after the first installation, so the required two external keys can be connected only during this phase and thereafter the **QTP 03** can be used without keys as a simple display unit.

CHARACTERS VISUALIZATION ON THE DISPLAY

QTP 03 shows on his display all the received characters having a code included in the range **0÷255** (**00÷FF Hex**) but only 239 are meaningfully, in detail those from **16÷255** (**10÷FF Hex**) as below described. The character is visualized on the current cursor position and this latter will go to the next position; if it is placed on the last character of the display (right down corner), it will be placed on home position (left up corner). The cursor position automatic increment really simplifies the representation, especially when long strings or messages must be displayed; moreover a powerfull command set makes easier each type of operation, as described in the following paragraphs. The correspondence between codes and displayed characters is defined by the following rules:

Codes	Characters
0 ÷ 15 (00÷0F Hex)	User not defined
16 ÷ 32 (10÷1F Hex)	Special and different according with installed display
27 (1B Hex)	Not shown
32 ÷ 127 (20÷7F Hex)	Standard ASCII
128 ÷ 255 (80÷FF Hex)	Special and different according with installed display

To allow representation of special characters, that have same codes of some one character commands, a specific command has been provided that selects the operating mode of **QTP 03** among the two available:

command the special characters are not displayed and the relative commands are executed;
representation the special characters are always displayed.

After a power on it is automatically selected the command mode to make immediately utilizable each functionality. The commands composed by a sequence of two or more characters, that always start with ESC = 27 = 1BH, are anyhow interpreted and executed independently from the selected operating mode.

Each models of **QTP 03** have 8 user characters (each associated with two different codes) that can't be defined; when they are shown on the display will it appear strange characters, furthermore variable, so they must not be used. The representation of user characters have been provided only to maintain compatibility with other **QTP** models, where the user can define them.

About special characters please refer to APPENDIX B and remind that it is possible to get different display models, provided of different special characters, but everything must be directly arranged with **grifo®**.

RECEIVE BUFFER

QTP 03 is provided of a receive buffer that simplify the management, in fact it reduces the waiting time of the connected master unit. Each received characters is immediately saved inside this buffer (30 bytes long) and after processed at the end of the currently executed operation.

Naturally when commands that requires a long execution time (delete commands, EEPROM management commands, etc.) are continuously received, the buffer will become full and it overflows. When overflow occurs last location of the buffer is overwritten by each next received characters, and these are definitively lost.

The master unit must stop the transmission until the **QTP 03** has emptied the receive buffer and it is still ready to receive other data. In practice the user must insert suitable delays between the commands transmission, to leave sufficient time to **QTP** for executing the required operations and to avoid the complete filling of the receive buffer.

KEYBOARD ACQUISITION

When **QTP 03** recognizes an external key pressure, it translate it and then transmits the determinated code on serial line, by using the rules described in the following paragraph.

Moreover an **auto repeat** function of the stroked key is implemented so when **QTP 03** recognizes the pressure on a key for a time grater than **0.5 sec.** it will start the serial transmission of its code about each **0.1 sec.** and it lasts until that specific key is released.

If the **keyclick** function is enabled when the code of the pressed key is transmitted, the on board buzzer also generates a loud beep that sonorously signalize the event to the user.

KEYS CODES

Here are the table wich shows the codes that **QTP 03** send on serial line when a key is pressed:

<i>KEY</i>	<i>CODE</i>	<i>HEX CODE</i>	<i>MNEMONIC</i>
1 (Pin 4 CN3)	49	31	1
2 (Pin 6 CN3)	50	32	2
3 (Pin 2 CN3)	51	33	3

FIGURE 10: DEFAULT KEY CODES

Said codes are those transmitted under default condition, i.e. the configuration the user receives, but they can be comfortably reconfigured by using a specific command. This features really simplifies the management software development in fact the mater unit can change the codes according with his requirements and it can also disable the keys.

COMMANDS FOR CURSOR POSITION

Here follows the list of the cursor positioning commands.

CURSOR LEFT

Code: 21
Hex code: 15
Mnemonic: NACK

The cursor is shifted of one position to the left without modifying the display contents. If the cursor is in Home position, it will be placed in the last position of the last row of the display.

CURSOR RIGHT

Code: 6
Hex code: 6
Mnemonic: ACK

The cursor is shifted of one position to the right. If the cursor is placed in the last position of the last row, it will be moved to the Home position.

CURSOR DOWN

Code: 10
Hex code: A
Mnemonic: LF

The cursor will be moved to the line below but it will remain in the same column. If the cursor is in the last display line, it will be moved to the first display line.

CURSOR UP

Code: 26
Hex code: 1A
Mnemonic: SUB

The cursor will be moved to the line above but it will remain in the same column. If the cursor is in the first display line, it will be moved to the last display line.

HOME

Code: 1
Hex code: 1
Mnemonic: SOH

The cursor is moved to Home position i.e first line, first column of the display, or on the other hand the up, left corner

CARRIAGE RETURN

Code: 13
Hex code: D
Mnemonic: CR

The cursor is moved to the beginning of the line where it was located.

CARRIAGE RETURN+LINE FEED

Code: 29
Hex code: 1D
Mnemonic: GS

The cursor is moved to the beginning of line above the one where it was located. If the cursor is at the last display line, it will be moved to the beginning of the first line i.e Home position.

ABSOLUTE CURSOR PLACEMENT

Code: 27 89 r c
Hex code: 1B 59 r c
Mnemonic: ESC Y ASCII(r) ASCII(c)

The cursor is moved to the absolute position indicated by **r** and **c**.

These characters are the row and column values of the new desired position referred to coordinate 0, 0 of the Home position, plus a constant offset of **32 (20 Hex)**.

If, for example, the user wants to place the cursor on the second line, third column, the following byte sequence must be sent:

27 89 33 34 or **1B 59 21 22 Hex** or **ESC Y ! "**

If row and/or column values are not compatible with the installed display, the command is ignored.

COMMANDS FOR CHARACTERS ERASURE

Below are described all the commands that deletes one or more characters from the display.

BACKSPACE

Code: 8
Hex code: 8
Mnemonic: **BS**

This command moves the cursor one character position to the left and it erase the contents of the reached cell.

If the cursor is in Home position, it will be erased the last character of the last row of the display.

CLEAR PAGE

Code: 12
Hex code: C
Mnemonic: **FF**

This command clears all data on the display and it moves the cursor to Home position.

CLEAR LINE

Code: 25
Hex code: 19
Mnemonic: **EM**

This command erases all characters displayed on the current line and it moves the cursor to the first column of the said line.

CLEAR END OF LINE

Code: 27 75
Hex code: 1B 4B
Mnemonic: **ESC K**

This command erases all characters displayed from the current cursor position to the end of line inclusive. The cursor maintains the previous position.

If, for example, the cursor is at the beginning of a display line, the complete line will be erased.

CLEAR END OF PAGE

Code: 27 107
Hex code: 1B 6B
Mnemonic: **ESC k**

This command erases all characters displayed from the current cursor position to the end of display inclusive. The cursor maintains the previous position.

If, for example, the cursor is at Home position, the complete display will be erased.

COMMANDS FOR CURSOR ATTRIBUTES MANAGEMENT

Below are listed the command that define the possible cursor attribute.

CURSOR OFF

Code: **27 80**
Hex code: **1B 50**
Mnemonic: **ESC P**

The cursor is not active and it is not more visible.

STEADY STATIC CURSOR ON

Code: **27 79**
Hex code: **1B 4F**
Mnemonic: **ESC O**

The cursor is activated so it is visible. Now it is a not blinking line placed under the current position character.

NOTE: This command is not available if **QTP 03-F4**, with fluorescent 20x4 display, is used.

BLINKING BLOCK CURSOR ON

Code: **27 81**
Hex code: **1B 51**
Mnemonic: **ESC Q**

The cursor is enabled and it is visible. The selected cursor type is a blinking rectangular block that is alternatively visualized with the character displayed on the current cursor position.

COMMANDS FOR EEPROM

In the following paragraphs are described all the commands that manage the data saved on **QTP 03** on board EEPROM; there are other commands that indirectly use this memory device but they are described in next paragraphs.

REQUEST FOR EEPROM WRITING POSSIBILITY

Code: 27 51
Hex code: 1B 33
Mnemonic: ESC 3

This command checks if the **QTP 03** is ready for writing data on its on board **EEPROM**. This command must be executed any time there are data to be saved on this type of memory.

When **QTP 03** receives this command, it answers with the following codes:

6	(06 Hex)	(ACK)	->	QTP 03 ready
21	(15 Hex)	(NACK)	->	QTP 03 not ready

If the **QTP 03** sends back the NACK code, it is not yet possible to memorize a new data on EEPROM.

WRITING OF PRESENCE BYTE

Code: 27 33 78 byte
Hex code: 1B 21 4E byte
Mnemonic: ESC ! N ASCII(byte)

This command sets the card presence byte with the value indicated in the **byte** parameter that must be included in **0÷255** range.

This byte has a reserved allocation on the on board EEPROM that, once it is set with the desired value, it allows for example, to verify that **QTP 03** runs correctly, or if there are some communication problems on the serial line.

NOTE: This command writes data on the on board EEPROM, so before executing it is better to check the EEPROM writing possibility through the proper command; in fact if it is not ready the command is ignored.

READING OF PRESENCE BYTE

Code: 27 33 110
Hex code: 1B 21 6E
Mnemonic: ESC ! n

The **QTP 03** sends back on the serial line the value of its presence byte.

For example, this command can be useful to verify the presence or the correct running of the terminal.

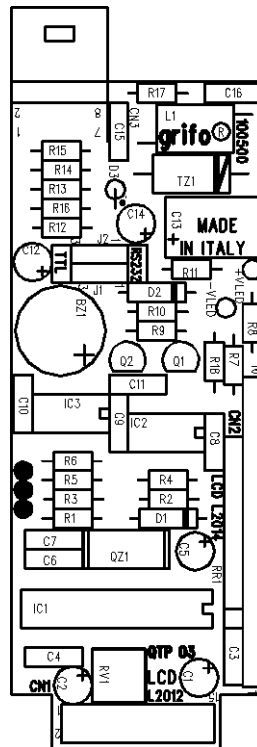


FIGURE 11: COMPONENTS SIDE MAP

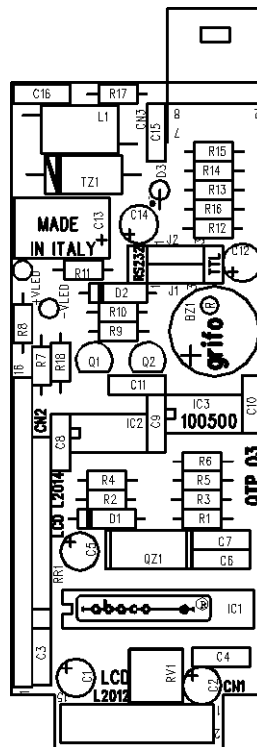


FIGURE 12: SOLDER SIDE MAP

COMMANDS FOR GENERAL FUNCTIONS

In the following paragraphs are described all the general purpose commands that manage some of the **QTP 03** features.

READING OF VERSION NUMBER

Code: 27 86
Hex code: 1B 56
Mnemonic: ESC V

On the serial line is returned a string of 3 characters containing the program managing version that is resident and executed by **QTP 03**. For example with a 1.3 firmware version the following characters will be transmitted:

49 46 51 or 31 2E 33 Hex or 1.3

BEEP

Code: 7
Hex code: 7
Menomonic: BEL

The buzzer is enabled for a time of 0.1 second.

OPERATING MODE SELECTION

Code: 27 65 mode
Hex code: 1B 41 mode
Mnemonic: ESC A ASCII(mode)

It defines the operating mode for the special characters (provided of code less than 32 = 20H) and the single character commands. The selected modality is defined by **mode** value, with the following correspondence:

0	(00 Hex)	->	Command mode
255	(FF Hex)	->	Representation mode

If **mode** value is not one of the above described, the command is ignored. Further information about operating mode are available inside CHARACTER VISUALIZATION ON THE DISPLAY paragraph.

COMMANDS FOR KEYBOARD MANAGEMENT

Below are described the commands that can be used to manage the external keys, connected to **QTP 03**. Detailed information about keys management and codes transmitted by the terminal, are available in KEYBOARD ACQUISITION paragraph.

KEY RECONFIGURATION

Code: 27 55 *key n. code*
Hex code: 1B 37 *key n. code*
Mnemonic: ESC 7 *ASCII(key n.) ASCII(code)*

When the selected **key n.** is reconfigured, each time it is pressed, the card will send the new specified **code** on serial line. The value of **key n.** to be reconfigured is below described, it must be included in the range **0÷2** (0÷2 Hex) otherwise the command is ignored, and it will substitute the codes described in figure 10.

KEY 1 (pin 4 of CN3) -> **key n. = 0**
KEY 2 (pin 6 of CN3) -> **key n. = 1**
KEY 3 (pin 2 of CN3) -> **key n. = 2**

The **code** value can vary in the range **0÷254 (00÷FE Hex)** as the **255** value (**FF Hex**) indicates that the key is disabled and when it will be pressed the **QTP** will not send any codes.

NOTE: This command writes data on the on board EEPROM, so before executing it is better to check the EEPROM writing possibility through the proper command; in fact if it is not ready the command is ignored.

KEYCLICK ON WITHOUT MEMORIZATION

Code: 27 53
Hex code: 1B 35
Mnemonic: ESC 5

The **keyclick** function is switched on so there is a sound feedback when a key is pressed. This setting is not saved inside the on board EEPROM so if the terminal is powered off and on it goes back to the previous condition, defined and saved in local set up mode.

KEYCLICK OFF WITHOUT MEMORIZATION

Code: 27 54
Hex code: 1B 36
Mnemonic: ESC 6

The **keyclick** function is disabled so there is not sound feedback when a key is pressed. This setting is not saved inside the on board EEPROM so if the terminal is powered off and on it goes back to the previous condition, defined and saved in local set up mode.

COMMANDS FOR MESSAGE MANAGEMENT

In the following paragraphs are described all the commands that manage messages on **QTP 03**. The messages are 20 characters sequence that can be saved on board EEPROM and then reloaded or represented on display, simply by suppling the same message identification number. The most important function of messages is the possibility to show constant information on the display (i.e. allarms, equipment status, etc.) without the transmission of the numerous characters of this information but only the few characters of the commands. Furthermore a comfortable program for PC, named **QTP EDIT**, allows any user to edit the messages, save and load them on PC disks and transmit/receive them directly to/from **QTP** serially connected to PC.

QTP 03 can accept some EEPROM with different size: from 512 bytes to 2048 bytes. The last is denoted by **.MEX** option, that must be specified in the order.

READING OF THE LAST STORAGED MESSAGE NUMBER

Code: 27 110
Hex code: 1B 6E
Mnemonic: ESC n

This comand returns on the serial line the number of the last messages that can be saved on EEPROM. It varies in comply with the size of the EEPROM installed on the card, as reported in the below table:

<i>Version</i>	<i>EEPROM size</i>	<i>Last message n°</i>
-	512 Bytes	22 (16 Hex)
-	1024 Bytes	47 (2F Hex)
.MEX	2048 Bytes	99 (63 Hex)

FIGURE 13: NUMBER OF MESSAGES STORAGEABLE ON EEPROM

MESSAGE STORAGE

Code: 27 33 67 mess.n. chr. 0... chr.19
Hex code: 1B 21 43 mess.n. chr. 0... chr.13
Mnemonic: ESC ! C ASCII(mess.n.) ASCII(chr.0)...ASCII(chr.19)

This command stores the 20 characters message **chr. 0...chr.19**, with number indicated by **mess.n.**, inside the on board EEPROM. The 20 chars codes which form the message must be visualizable on the display, so they must be included in the range **16÷255 (10÷FF Hex)**. The message number must be included in the range **0÷max. n.**, where max.n. is the number of the last stored message just previously described in figure 13.

NOTE: This command writes data on the on board EEPROM, so before executing it is better to check the EEPROM writing possibility through the proper command; in fact if it is not ready the command is ignored.

MESSAGE READING

Code: 27 33 69 *n.mess.*
Hex code: 1B 21 45 *n.mess.*
Mnemonic: ESC ! E ASCII(*n.mess.*)

This command reads the 20 characters message corresponding to **n.mess.** from EEPROM and it send this message on serial line, beginning from the first char of the string. At the end of the message, the **CR+LF** codes are sent, too.

The message number must be included in the range of **0÷max. n.**, where max.n. is the number of the last stored message previously described in figure 13. If this number is not compatible with the **QTP 03** installed EEPROM size, this command is ignored.

MESSAGE VISUALIZATION

Code: 27 33 68 *n.mess. n*
Hex code: 1B 21 44 *n.mess. n*
Mnemonic : ESC ! D ASCII(*n.mess.*) ASCII(*n*)

This command visualizes **n** 20 characters messages on the display, beginning from current cursor position.

The first of the **n** messages is the one corresponding to **n.mess.** while the remaining messages are those ones immediately subsequents in EEPROM.

The message number must be included in the range **0÷max.n.**, where max.n. is the value described in figure 13. If this number is not compatible with the **QTP 03** installed EEPROM size, this command is ignored.

The **n** quantity of messages to be visualized depends only on the model of the display and it is included in these ranges:

20x2 display	n between 1÷2
20x4 or 40x2 display	n between 1÷4

If the **n** value is not compatible with the installed display model, the command is ignored. The cursor is placed in the next position of the last character visualized; if the last character of the said message occupies the last position of the display, the cursor will be placed in Home position.

For example; if you wish to visualize the messages number 10 and 11, it will be necessary to send the following sequence:

27 33 68 10 2 or 1B 21 44 0A 02 Hex or ESC ! D LF STX

EXTERNAL CARDS

The typical application of **QTP 03** are those that requires interaction between operator and controlled machine for data, status, measures, information exchanges. The card can be connected to a wide range of programmable devices provided of one serial communication line produced by **grifo**[®], or to many system of other companies.

Hereunder some of these cards are briefly described; ask the detailed information directly to **grifo**[®], or search it on **grifo**[®] CD or web site, if required.

GPC[®] 553

General Purpose Controller 80C552

80C552 μ P, 22÷33 MHz; 1 RS 232 line (software); 1 RS 232 or RS 422-485 or Current Loop line; 16 TTL I/O lines; 8 A/D 10 bits lines; 3 Timers Counters; 64K EPROM; 64K RAM; 32K RAM and RTC backed; 32K DIL EEPROM; 8K serial EEPROM; 2 PWM lines; 1 Activity LED; Watch dog; 5 readable DIPs; LCD Interface; **ABACO**[®] I/O BUS.

GPC[®] 323

General Purpose Controller 51 family

80C32 μ P, 14 MHz; Full CMOS; 1 RS 232 line (software); 1 RS 232 or RS 422-485 or Current Loop line; 24 TTL I/O lines; 11 A/D 12 bits lines; 3 Timers Counters; 64K EPROM; 64K RAM; 32K RAM and RTC backed; 32K DIL EEPROM; 8K serial EEPROM; Buzzer; 2 Activity LED; Watch dog; 5 readable DIPs; LCD Interface; **ABACO**[®] I/O BUS.

GPC[®] 153

General Purpose Controller Z80

84C15 μ P, 10÷16 MHz; Full CMOS; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 16 TTL I/O lines; 8 A/D 12 bits lines; 2÷4 Timers Counters; 512K EPROM or FLASH; 512K RAM and RTC backed; 8K serial EEPROM; Buzzer; 1 Activity LED; Watch dog; 8 readable DIPs; LCD Interface; **ABACO**[®] I/O BUS.

GPC[®] 184

General Purpose Controller Z80195

Microprocessor Z80195 at 22 MHz; implementation completely CMOS; 512K EPROM or FLASH; 512K RAM; Back-Up with Lithium battery internal or external; 1 serial line RS 232 + 1 RS 232 or RS 422-485 or current loop + 1 TTL; 18 I/O TTL; 4 timer/counter 8 bits; 2 timer 16 bits; Watch Dog; Real Time Clock; activity LED; EEPROM; interface for **ABACO**[®] I/O BUS.

GPC[®] 154

“4” Type General Purpose Controller Z80

84C15 μ P, 10 MHz; full CMOS; 1 RS 232 line; 1 RS 232 or RS 422-485 line; 16 TTL I/O lines; 512K EPROM or FLASH; 512K RAM and RTC backed; 8K serial EEPROM; 2÷4 timers/counters; Watch dog; 2 readable DIPs; LCD Interface; **ABACO**[®] I/O BUS; 5Vdc power supply. Size 100x50 mm.

GPC[®] 324/D

“4” Type General Purpose Controller 80C32/320

80C32 or 80C320 μ P, 14÷22 MHz; Full CMOS; 1 RS 232 line; 1 RS 232 or RS 422-485 or Current Loop line; 4÷16 TTL I/O lines; 3 Timers Counters; 64K EPROM; 64K RAM; 32K RAM backed; 32K DIL E2; 8K serial EEPROM; Watch dog; 1 readable DIP; LCD Interface; **ABACO**[®] I/O BUS; 5Vdc Power supply; Size: 100x50 mm.

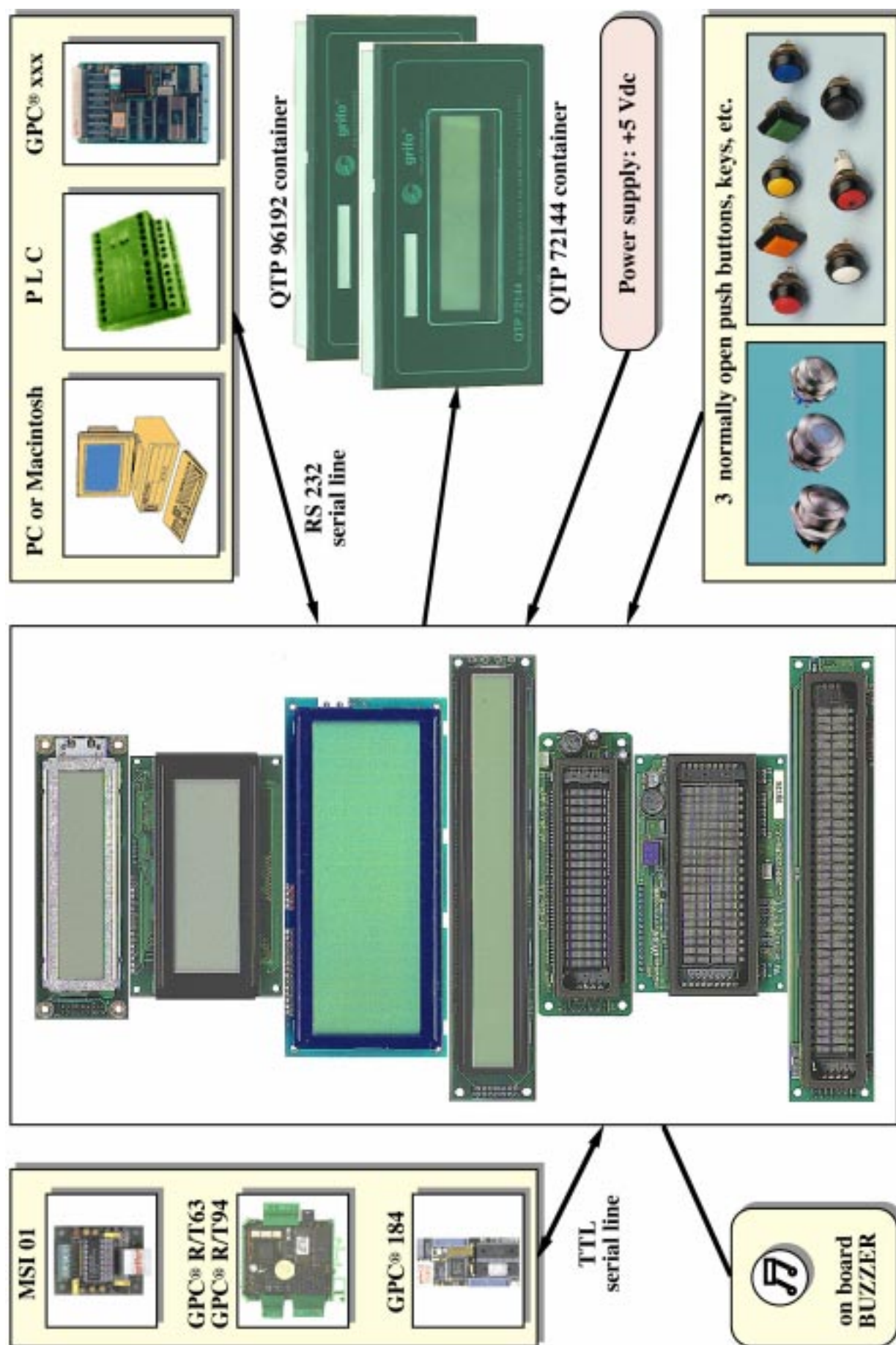


FIGURE 14: AVAILABLE CONNECTIONS DIAGRAM

GPC® 884

General Purpose Controller Am188ES

Microprocessor AMD Am188ES up to 40 MHz; 16 bits; implementation completely CMOS; serie 4 format; 512K EPROM or FLASH; 512K SRAM backed with Lithium battery; RTC; 1 RS 232 serial line + 1 RS 232 or RS 422-485 or current loop; 16 I/O TTL; 3 timer/counter; watch dog; EEPROM; 11 signals A/D converter with 12 bit resolution; interface for **ABACO®** I/O BUS.

GPC® 114

General Purpose Controller 68HC11

Microprocessor 68HC11A1 at 8 MHz; type 4 format; 32K EPROM; 32K SRAM backed with Lithium battery; 32K EPROM, SRAM, EEPROM; RTC; 1 serial line RS 232, RS 422 or RS 485; 10 TTL I/O lines; 3 timers/counters; watch dog; 8 A/D converter signals with 8 bits resolution; 1 synchronous serial line; extremely low power consumption; interface for **ABACO®** I/O BUS.

GPC® AM4

General Purpose Controller ATmega103

Microprocessor ATmega103 at 5.5 MHz; CMOS implementation; 128K internal FLASH; 32K SRAM; Back-Up with Lithium battery internal or external; 4K internal EEPROM; 1 serial line RS 232, RS 422, RS 485 or current loop; 16 I/O TTL; 8 linee A/D resolution 10 bits; 3 timers/counters; Watch Dog; Real Time Clock; **ABACO®** I/O BUS expansion. Interface for ISP programming.

MSI 01

Multi Serial Interface 1 line

Interface card for TTL serial line that is buffered in RS 232, RS 422, RS 485, or current loop line. The TTL line is on a mini screw connector and the buffered one is on standard plug connector.

IBC 01

Interface Block Communication

Conversion card for serial communication, 2 RS 232 lines; 1 RS 422 or RS 485 line; 1 optical fibre line; selectable DTE/DCE interface; quick connection for DIN 46277-1 and 3 rails.

GPC® 188F

General Purpose Controller 80C188

80C188 μ P 20MHz; 1 RS 232 line; 1 RS 232, RS 422-485 or Current Loop line; 24 TTL I/O lines; 1M EPROM or 512K FLASH; 1M SRAM Lithium battery backed; 8K serial EEPROM; RTC; watch dog; 8 dip switch; 3 timer counter; 8 13 bit A/D lines; Power failure; activity LEDs.

GPC® 15A

General Purpose Controller 84C15

Full CMOS card, 10÷20 MHz 84C15 CPU; 512K EPROM or FLASH EPROM; 128K RAM; 2K or 8K backed RAM+RTC; 8K serial EEPROM; 1 RS 232 serial line; 1 RS 232, RS 422, RS 485 or current loop line; 40 TTL I/O lines; 2 counters timers; 2 watch dogs; 2 dip switches, buzzer.

GPC® R/T94

General Purpose Relays/transistors 9 inputs 4 outputs

CMOS card, 14 MHz 89C4051 CPU; 4K FLASH; 128 byte RAM; 256 byte SRAM+RTC backed through battery; 1K serial EEPROM; 1 RS 232, RS 422, RS 485 or current loop line; 9 optocoupled NPN inputs; 4 relays outputs (5 A) or transistor (4A 45 Vdc) optocoupled; I/O lines displayed by LEDs; 1 counter timer.+5 Vdc power supply or 8÷24 Vac wide range; plastic container for Ω rails.

APPENDIX A: COMMAND CODES SUMMARY TABLES

The tables of this appendix list a summary of all the command sequences recognized by QTP 03.

<i>COMMAND</i>	<i>CODE</i>	<i>HEX CODE</i>	<i>MNEMONIC</i>
Home	01	01	SOH
Cursor left	21	15	NACK
Cursor right	06	06	ACK
Cursor down	10	0A	LF
Cursor up	26	1A	SUB
Carriage return	13	0D	CR
Carriage return+line feed	29	1D	GS
Absolute cursor position	27 89 r c	1B 59 r c	ESC Y ASCII(r) ASCII(c)
Back space	08	08	BS
Clear page	12	0C	FF
Clear line	25	19	EM
Clear end of line	27 75	1B 4B	ESC K
Clear end of page	27 107	1B 6B	ESC k
Cursor off	27 80	1B 50	ESC P
Steady cursor on	27 79	1B 4F	ESC O
Blinking block cursor on	27 81	1B 51	ESC Q
Beep	07	07	BEL
Reading of version number	27 86	1B 56	ESC V
Operating mode selection	27 65 mode	1B 41 mode	ESC A ASCII(mode)

FIGURE A1: COMMAND CODES SUMMARY TABLE (1 OF 2)

COMMAND	CODE	HEX CODE	MNEMONIC
Request for EEPROM writing	27 51	1B 33	ESC 3
Writing of presence byte	27 33 78 byte	1B 21 4E byte	ESC ! N ASCII(byte)
Reading of presence byte	27 33 110	1B 21 6E	ESC ! n
Key code reconfiguration	27 55 key n. code	1B 37 key n. code	ESC 7 ASCII(key n.) ASCII(code)
Keyclick on without memorization	27 53	1B 35	ESC 5
Keyclick off without memorization	27 54	1B 36	ESC 6
Reading of max message number	27 110	1B 6E	ESC n
Message storage	27 33 67 mess.n. chr.0...chr.19	1B 21 43 mess.n. chr.0...chr.13	ESC ! C ASCII(mess.n.) ASCII(chr.0)...ASCII(chr.19)
Message reading	27 33 69 mess.n.	1B 21 45 mess.n.	ESC ! E ASCII(mess.n.)
Visualization of n messages	27 33 68 mess.n. n	1B 21 44 mess.n. n	ESC ! D ASCII(mess.n.) ASCII(n)

FIGURE A2: COMMAND CODES SUMMARY TABLE (2 OF 2)

APPENDIX B: DISPLAY CHARACTERS

The following tables shows the characters sets displayed on **QTP 03** for all the possible received characters, according with ordered display and model.

Even the not ASCII characters (or special characters) change when the display type changes and if the user requires a character set different from those described in the following figures, he can take a direct contact with **grifo®**.

		D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
		D6	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1	
		D5	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	
		D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	
32-0 00000			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0	User chr 0	!		0	a	P	\	P	Δ	E		—	9	E	0	P	
0001	1	User chr 1	!	!	1	A	0	a	4	Δ	e	e	7	7	4	a	4	
0010	2	User chr 2	!	"	2	B	R	b	r	Δ	E	7	イ	ツ	×	E	0	
0011	3	User chr 3	!	#	3	C	S	c	s	Δ	R	]	ウ	テ	E	e	∞
0100	4	User chr 4	!	\$	4	D	T	d	t	Δ	e	e	\	!	!	!	!	
0101	5	User chr 5	!	%	5	E	U	e	u	E	0	=	!	!	!	!	!	
0110	6	User chr 6	!	&	6	F	V	f	v	0	*	7	カ	ニ	ヨ	P	Z	
0111	7	User chr 7	!	'	7	G	W	g	w	0	7	7	7	7	7	7	7	
1000	8	User chr 0	!	(	8	H	X	h	x	0	!	!	!	!	!	!	!
1001	9	User chr 1	!	)	9	I	Y	i	y	0	!	!	!	!	!	!	!
1010	A	User chr 2	!	*	*	J	Z	j	z	0	!	!	!	!	!	!	!	
1011	B	User chr 3	!	+	+	K	L	k	l	0	!	!	!	!	!	!	!	
1100	C	User chr 4	!	,	,	<	L	*	!	!	!	!	!	!	!	!	!	
1101	D	User chr 5	!	—	—	M	I	m	)	7	+	+	+	+	+	+	+
1110	E	User chr 6	!	.	.	>	H	^	n	+	+	+	+	+	+	+	+	
1111	F	User chr 7	!	/	/	?	0	_	o	+	+	+	+	+	+	+	+	

FIGURE B1: QTP 03-F2, F4, F24 CHARACTERS TABLE

		D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		
		D6	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1		
		D5	0	0	1	1	0	0	1	1	0	0	1	0	0	1	1		
		D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1		
32-0 00000			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0000	0	User chr 0			0	a	P	`	P					-	9	E	o	P	
0001	1	User chr 1		!	1	A	Q	a	4					=	7	7	4	4	9
0010	2	User chr 2		"	2	B	R	b	r					7	4	7	7	9	9
0011	3	User chr 3		#	3	C	S	c	s					7	7	7	7	7	7
0100	4	User chr 4		\$	4	D	T	d	t					7	7	7	7	7	7
0101	5	User chr 5		%	5	E	U	e	u					7	7	7	7	7	7
0110	6	User chr 6		&	6	F	V	f	v					7	7	7	7	7	7
0111	7	User chr 7		'	7	G	W	g	w					7	7	7	7	7	7
1000	8	User chr 0		(	8	H	X	h	x					7	7	7	7	7	7
1001	9	User chr 1		)	9	I	Y	i	y					7	7	7	7	7	7
1010	A	User chr 2		*	*	J	Z	j	z					7	7	7	7	7	7
1011	B	User chr 3		+	+	K	L	k	l					7	7	7	7	7	7
1100	C	User chr 4		,	<	L	*	l	l					7	7	7	7	7	7
1101	D	User chr 5		-	=	M	I	m	>					7	7	7	7	7	7
1110	E	User chr 6		.	>	N	^	n	+					7	7	7	7	7	7
1111	F	User chr 7		/	?	O	_	o	+					7	7	7	7	7	7

FIGURE B2: QTP 03-C4B, C24 CHARACTERS TABLE

		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	User chr 0	±		0	0	P	'	P	5	5	5			1	1	3
	1	User chr 1	±	.	1	A	0	a	a	0	a	1			1	1	y
	2	User chr 2	7	"	Z	B	R	b	r	6	6	6	*	*	6	6	2
	3	User chr 3	2	#	C	S	c	s	5	5	5	5			7	7	e
	4	User chr 4	7	*	4	D	T	a	t	5	5	5			4	7	5
	5	User chr 5	7	2	E	E	U	e	u	5	5	5	5	5	2	2	n
	6	User chr 6	7	6	F	U	T	u	t	5	5	5	5	5	6	6	0
	7	User chr 7	7	'	7	G	W	a	w	5	5	5	5	5	x	x	u
	8	User chr 0	7	(	6	H	N	n	5	5	5	5	5	5	+	+	5
	9	User chr 1	7	)	5	I	V	i	v	5	5	5	5	5	1	7	u
	A	User chr 2	5	*	5	J	Z	j	z	5	5	5	5	5	7	7	5
	B	User chr 3	7	+	5	K	L	k	l	5	5	5	5	5	5	7	5
	C	User chr 4	5	.	<	L	\	1	1	5	5	5	5	5	5	5	5
	D	User chr 5	5	-	5	M	m	5	5	5	5	5	5	5	5	5	5
	E	User chr 6	5	.	>	N	n	5	5	5	5	5	5	5	5	5	5
	F	User chr 7	5	/	7	O		5	5	5	5	5	5	5	5	5	5

FIGURE B3: QTP 03-C2, C4 CHARACTERS TABLE

APPENDIX C: MOUNTING OUTLINE DIMENSIONS

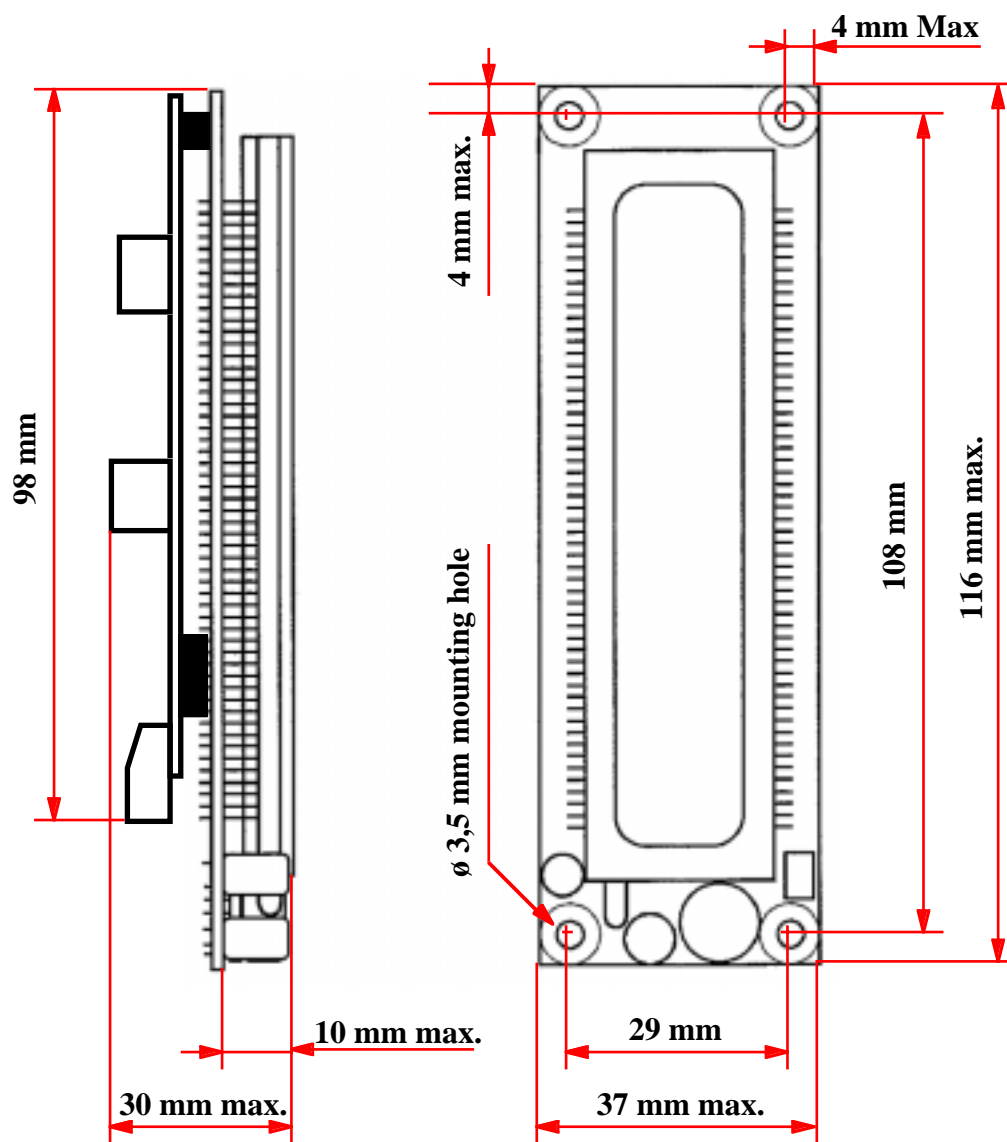


FIGURE C1: QTP 03-C2, F2 DIMENSIONS

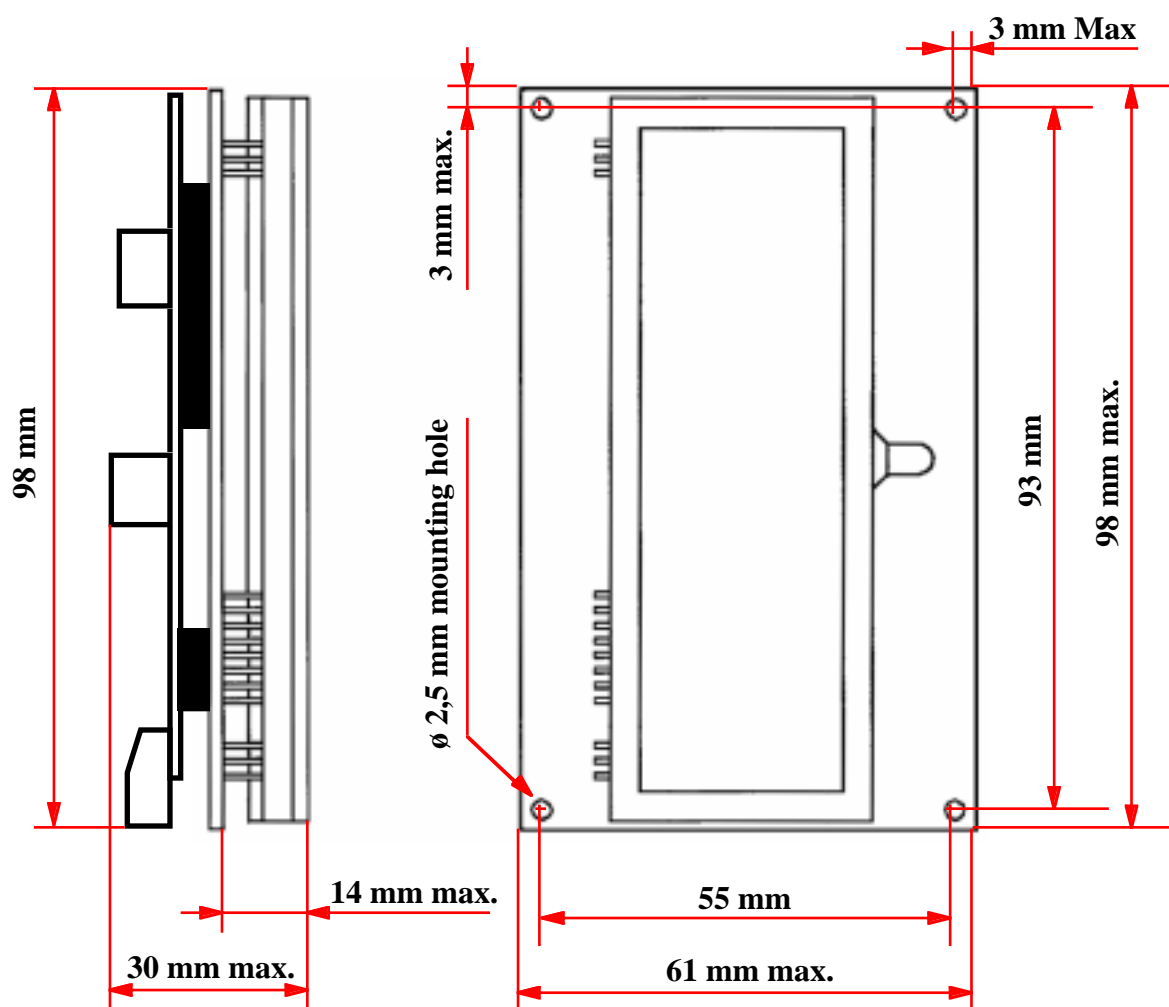


FIGURE C2: QTP 03-C4, F4 DIMENSIONS

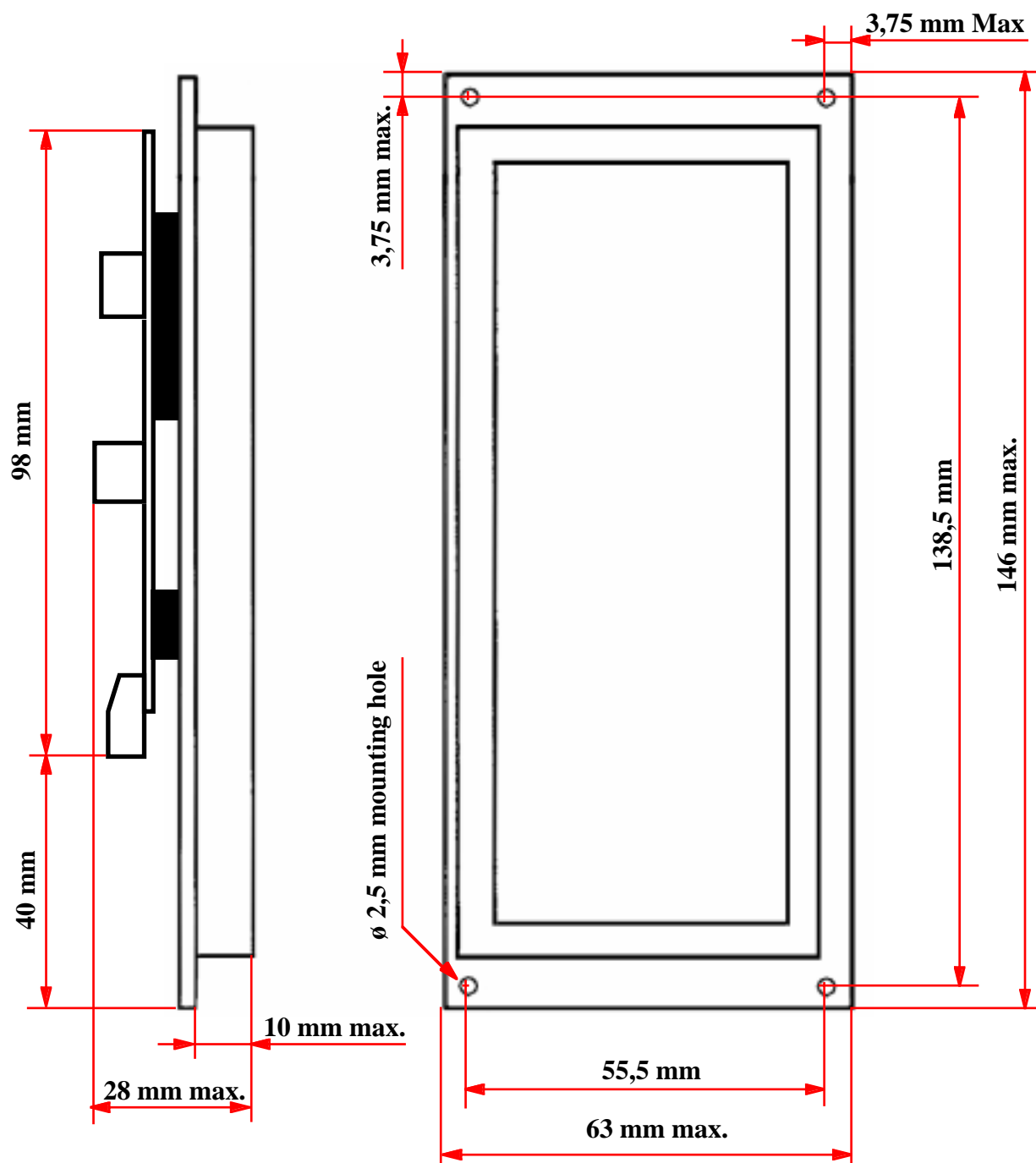


FIGURE C3: QTP 03-C4B DIMENSIONS

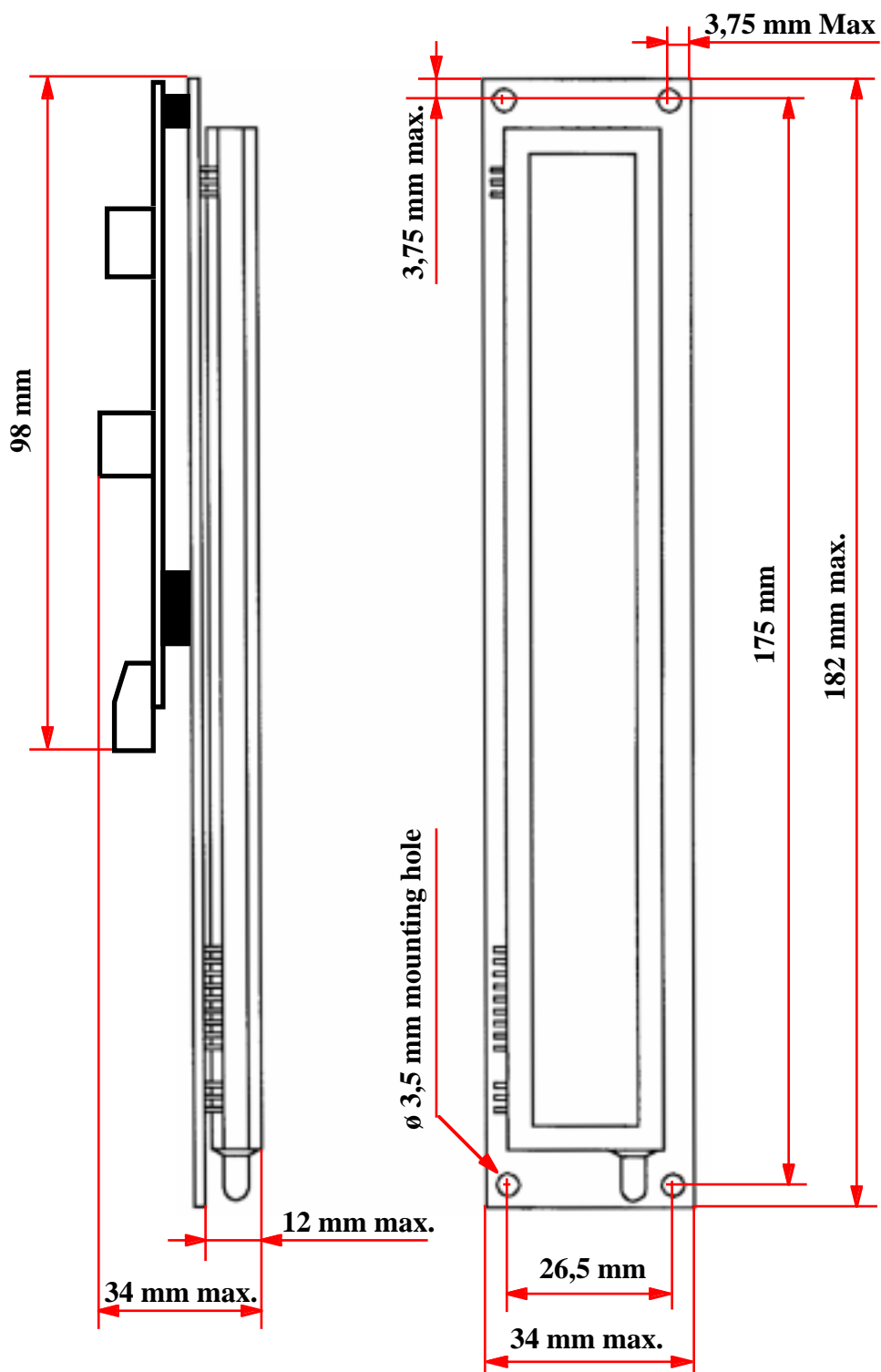


FIGURE C4: QTP 03-C24, F24 DIMENSIONS

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