QTP 03
Quick Terminal Panel  3 I/O, I2C BUS

USER MANUAL

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QTP 03 is a complete low cost operator panel with small overall dimension.
It is a video terminal suitable for a direct interface between operator and
machine. It is available with **fluorescent** or backlit **LCD displays**, with
the formats **20x2, 20x4, 20x4 Big** and **40x2** characters. Supports three
different serial communication types: **RS 232, TTL** or **I2C BUS**. It has
a serial **EEPROM** for settings and messages. Complete management of
three digital **I/O Signals**, configurable as **Keys**, simple inputs, simple
outputs or **Visualization Inputs**. Shows autonomously both a possible
power on message and messages associated to visualization inputs.
Autorepeat and keyclick function for key pressed. Local setup for
configuration and restore of operation modalities. Up to **256** different
characters can be displayed; **8** of these can be defined by the user. Buzzer
driven by software. Overall dimensions equal to selected Display size.
Some models can be inserted in proper containers **QTP 72144** or
**QTP 96192**. Single **+5 Vdc** power supply.
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® reserves 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
- Attention: ESD sensitive device

Trade Marks

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GENERAL INDEX

INTRODUCTION ................................................................................................................... 1

HARDWARE AND FIRMWARE VERSION .............................................................................. 3

GENERAL INFORMATION ................................................................................................. 4
  BUZZER .............................................................................................................................. 5
  COMMUNICATION ........................................................................................................... 5
  EEPROM .......................................................................................................................... 5
  DISPLAY ........................................................................................................................... 6
  KEYBOARD ...................................................................................................................... 6
  TTL I/O LINES .................................................................................................................. 8

TECHNICAL FEATURES ......................................................................................................... 10
  GENERAL FEATURES ...................................................................................................... 10
  PHYSICAL FEATURES ................................................................................................... 11
  ELECTRIC FEATURES .................................................................................................... 12

INSTALLATION ................................................................................................................... 13
  CN3: INTERFACE CONNECTOR ....................................................................................... 13
    POWER VOLTAGE CONNECTION ................................................................................. 14
    TTL, RS 232 COMMUNICATION LINE CONNECTION ................................................... 16
    I2C BUS COMMUNICATION LINE CONNECTION ....................................................... 18
    DIGITAL I/O CONNECTION .......................................................................................... 20
    EXTERNAL KEYS CONNECTION ................................................................................... 22
    COMMUNICATION TYPE SELECTION ............................................................................ 24
      JUMPERS FOR SERIAL LINE CONFIGURATION .......................................................... 25
      CONTRAST REGULATION TRIMMER ......................................................................... 26

SOFTWARE DESCRIPTION .................................................................................................. 27
  KEYS NAME CONVENTION .............................................................................................. 27
  LOCAL SETUP ................................................................................................................... 27
  KEYBOARD ACQUISITION ............................................................................................... 28
    KEYS CODES ................................................................................................................ 29
  CHARACTERS VISUALIZATION ON DISPLAY ................................................................ 29
  COMMUNICATION MODALITIES ...................................................................................... 30
    TTL, RS 232 COMMUNICATION .................................................................................... 30
    I2C BUS COMMUNICATION ......................................................................................... 32
  COMMUNICATION BUFFERS ............................................................................................. 35
  DATA STORED ON EEPROM ........................................................................................... 35
  HOW TO START ............................................................................................................... 36
  DEMO PROGRAMS .......................................................................................................... 37

COMMANDS .......................................................................................................................... 38
  COMMANDS FOR CURSOR POSITION ............................................................................ 38
    CURSOR LEFT ................................................................................................................ 38
    CURSOR RIGHT ............................................................................................................. 38
CURSOR DOWN ................................................................. 38
CURSOR UP ........................................................................ 39
HOME .............................................................................. 39
CARRIAGE RETURN .......................................................... 39
CARRIAGE RETURN+LINE FEED ....................................... 39
ABSOLUTE PLACEMENT OF CURSOR ................................ 39
COMMANDS FOR CHARACTERS ERASURE .................. 40
BACKSPACE ....................................................................... 40
CLEAR PAGE ...................................................................... 40
CLEAR LINE ....................................................................... 40
CLEAR END OF LINE ....................................................... 40
CLEAR END OF PAGE ..................................................... 40
COMMANDS FOR EEPROM ........................................... 41
REQUEST FOR EEPROM AVAILABILITY .......................... 41
WRITE OF PRESENCE BYTE ............................................ 41
READ PRESENCE BYTE .................................................. 41
COMMANDS FOR GENERAL FUNCTIONS ....................... 42
READ FIRMWARE VERSION .............................................. 42
FLUORESCENT DISPLAY BRIGHTNESS SETTING ............. 42
BEEP ............................................................................... 42
BUZZER ACTIVATION ...................................................... 43
OPERATING MODE SELECTION ....................................... 43
COMMANDS FOR MESSAGES MANAGEMENT ................. 44
READING OF MAX MESSAGES NUMBER ....................... 44
MESSAGE STORAGE ......................................................... 44
MESSAGE READING ......................................................... 45
VISUALIZATION OF N MESSAGES .................................... 45
SCROLLING MESSAGES VISUALIZATION ...................... 46
COMMANDS FOR CURSOR ATTRIBUTES MANAGEMENT .... 47
CURSOR OFF ...................................................................... 47
STEADY STATIC CURSOR ON ............................................ 47
BLINKING BLOCK CURSOR ON ......................................... 47
COMMANDS FOR KEYBOARD MANAGEMENT .................. 48
KEY CODE RECONFIGURATION ........................................ 48
KEYCLICK ON WITH MEMORIZATION ............................... 48
KEYCLICK OFF WITH MEMORIZATION ................................ 49
KEYCLICK ON WITHOUT MEMORIZATION ....................... 49
KEYCLICK OFF WITHOUT MEMORIZATION ..................... 49
COMMANDS FOR USER CHARACTERS ............................. 50
DEFINITION OF USER CHARACTER ................................ 50
DEFINITION AND MEMORIZATION OF USER CHARACTER ... 51
COMMANDS FOR DIGITAL I/O SIGNALS MANAGEMENT .... 52
CONFIGURATION OF DIGITAL I/O SIGNALS .................... 52
WRITE DIGITAL OUTPUTS .................................................. 53
ACQUIRE DIGITAL INPUTS ............................................... 53
SET VISUALIZATION FROM I/O SIGNALS ..................... 54

APPENDIX A: COMMANDS SUMMARY TABLES ................ A-1
APPENDIX B: DISPLAY CHARACTERS ........................................................................... B-1

APPENDIX C: MOUNTING NOTES ............................................................................... C-1
METALLIC CONTAINER ............................................................................................. C-1
TERMINAL DIMENSIONS ......................................................................................... C-3

APPENDIX D: ALPHABETICAL INDEX ........................................................................ D-1
FIGURES INDEX

FIGURE 1: LOCATION OF HARDWARE AND FIRMWARE VERSION ................................................................. 3
FIGURE 2: PHOTO OF MODELS WITH LCD DISPLAYS .................................................................................. 7
FIGURE 3: PHOTO OF MODELS WITH FLUORESCENT DISPLAYS ............................................................... 9
FIGURE 4: TABLE WITH DIMENSIONS AND WEIGHTS ................................................................................. 11
FIGURE 5: CONSUMPTIONS TABLE .............................................................................................................. 12
FIGURE 6: CKS.AMP8 CONNECTION ACCESSORY ....................................................................................... 13
FIGURE 7: AMP8.CABLE CONNECTION ACCESSORY ................................................................................... 13
FIGURE 8: CN3 - POWER SUPPLY PINS ........................................................................................................ 14
FIGURE 9: COMPONENTS MAP SOLDER SIDE ............................................................................................... 15
FIGURE 10: COMPONENTS MAP COMPONENTS SIDE .................................................................................. 15
FIGURE 11: CN3 - TTL, RS 232 COMMUNICATION PINS ............................................................................... 16
FIGURE 12: CONNECTION EXAMPLE FOR RS 232 COMMUNICATION .......................................................... 16
FIGURE 13: CONNECTION EXAMPLE FOR TTL COMMUNICATION .............................................................. 17
FIGURE 14: JUMPERS, CONNECTORS, TRIMMER, MODIFICATIONS, ETC. LOCATION .................................. 17
FIGURE 15: CN3 - I2C BUS COMMUNICATION PINS ................................................................................... 18
FIGURE 16: CONNECTION EXAMPLE FOR I2C BUS POINT TO POINT COMMUNICATION ............................ 18
FIGURE 17: CONNECTION EXAMPLE FOR I2C BUS NETWORK COMMUNICATION ......................................... 19
FIGURE 18: CN3 - DIGITAL I/Os PINS WITH TTL, RS 232 COMMUNICATION ............................................... 20
FIGURE 19: CN3 - DIGITAL I/Os PINS WITH I2C BUS COMMUNICATION .................................................. 20
FIGURE 20: DIGITAL I/Os CONNECTION DIAGRAM ...................................................................................... 21
FIGURE 21: CONNECTION EXAMPLE FOR DIGITAL I/Os ............................................................................. 21
FIGURE 22: EXTERNAL KEYS CONNECTION ............................................................................................... 22
FIGURE 23: AVAILABLE CONNECTIONS DIAGRAM .................................................................................. 23
FIGURE 24: MODIFICATIONS FOR COMMUNICATION SELECTION ............................................................. 25
FIGURE 25: JUMPERS FOR SERIAL LINE CONFIGURATION ........................................................................... 26
FIGURE 26: KEYS NAME ............................................................................................................................... 27
FIGURE 27: DEFAULT KEY CODES ............................................................................................................... 29
FIGURE 28: FLOW CHART FOR COMMUNICATION MASTER <-> QTP 03 IN TTL, RS 232 ......................... 31
FIGURE 29: FLOW CHART FOR COMMUNICATION MASTER -> QTP 03 IN I2C BUS ................................. 32
FIGURE 30: FLOW CHART FOR COMMUNICATION QTP 03 -> MASTER IN I2C BUS ................................. 33
FIGURE 31: I2C BUS NETWORK CONNECTION ........................................................................................... 34
FIGURE 32: RS 232 CONNECTION WITH PC ................................................................................................ 36
FIGURE 33: NUMBER OF MESSAGES ON EEPROM .................................................................................... 44
FIGURE 34: USER CHARACTERS PATTERN .................................................................................................. 50
FIGURE 35: EXAMPLE OF VISUALIZATION FROM I/O SIGNALS ................................................................. 55
FIGURE A1: COMMANDS CODES SUMMARY TABLE (1 OF 3) ........................................................................ A-1
FIGURE A2: COMMANDS CODES SUMMARY TABLE (2 OF 3) ....................................................................... A-2
FIGURE A3: COMMANDS CODES SUMMARY TABLE (3 OF 3) ....................................................................... A-3
FIGURE B1: QTP 03-F2, F4, F4B, F24 CHARACTERS TABLE ............................................................................ B-1
FIGURE B2: QTP 03-C2, C4, C24 CHARACTERS TABLE .................................................................................. B-2
FIGURE B3: QTP 03-C4B CHARACTERS TABLE ............................................................................................ B-3
FIGURE C1: MOUNTING THROUGH METALLIC CONTAINER ......................................................................... C-1
FIGURE C2: QTP 96192 CONTAINER AND DISPLAYS .................................................................................... C-2
FIGURE C3: QTP 03-C2 DIMENSIONS ........................................................................................................ C-3
FIGURE C4: QTP 03-C4 DIMENSIONS ........................................................................................................ C-4
FIGURE C5: QTP 03-C4B DIMENSIONS ....................................................................................................... C-5
FIGURE C6: QTP 03-C24 DIMENSIONS ........................................................................................ C-6
FIGURE C7: QTP 03-F2 DIMENSIONS ........................................................................................ C-7
FIGURE C8: QTP 03-F4 DIMENSIONS ........................................................................................ C-8
FIGURE C9: QTP 03-F4B DIMENSIONS ....................................................................................... C-9
FIGURE C10: QTP 03-F24 DIMENSIONS ..................................................................................... C-10
INTRODUCTION

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

This device is not a **safe component** as defined in directive **98-37/CE**.

![ATTENTION ESD PROTECTED AREA](image)

Pins of module are not provided with any kind of ESD protection. Many pins of the card are directly connected to their respective pins of on board's components and these last are sensitive to electrostatic noises. So personnel who handles the product is invited to take all necessary precautions that avoid possible damages caused by electrostatic discharges.

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 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 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.
HARDWARE AND FIRMWARE VERSION

This handbook make reference to printed circuit version 100500 and to firmware version 2.0 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. The version numbers are reported in several places and following figure shows the most accessible ones:

![Figure 1: Location of hardware and firmware version](image)

The firmware version number can be also directly required to the terminal by using a dedicated command.

Normally the QTP 03 is always supplied with the latest firmware version that is available but, for specific requirements, the user can receive also a different version; he must carefully specify this particular condition in the order phase.
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 for a direct interface between operator and machine in any of the control or command operations which could be necessary during running or diagnostic of the same machine. Some new features make it suitable for interesting application fields as a stand alone message visualizer that are previously saved and then displayed by the digital I/O signals available on the card.

QTP 03 is available with alphanumeric Fluorescent or LCD displays, backlit with LEDs panel, with 20 characters for 2 or 4 lines or with 40 characters for 2 lines. QTP 03 is directly connected to the display, so it has an overall frontal dimension equal to the selected display used for visualization. The mechanic mounting is performed through the on board displays holes.

QTP 03 is really useful in those applications where the user must visualize some messages and must manage no more than 3 keys for user interaction. QTP 03 allows, with its EEPROM, the capability to store more than 90 messages. These messages can be then displayed in two different ways: by dedicated commands received by the master unit, through the communication line, or by the status change of the proper digital signals. With this feature the master work time and its program space are optimized or even erased, in fact messages must not be sent to the panel every time, they are already stored inside EEPROM of the QTP 03. Furthermore it is possible to get messages back through the communication line and read them again. So QTP 03 can be used as little mass memory where the user can save and read set-up informations, passwords, identification codes, etc. The horizontal scrolling attribute for the saved messages, let the user displays more information on less space: on the first row of the display up to 200 characters can be shown in a self managed sliding modality.

Some models of QTP 03 can be inserted in the proper metallic container QTP 72144 or QTP 96192 obtaining an enclosed product that have: a protected front side, a back openings for connections and an easy mounting in front panel modality.

The QTP 03 is able to execute an entire range of display commands, as clear screen, cursor position, etc., with code compatibility to ADDS View-Point standard and moreover it recognizes and execute many other commands.

Main features of QTP 03 are as follows:
  - Overall dimension: same of the selected display.
  - Very low price.
  - The operator panel is available with different alphanumeric displays:
    - QTP 03-C2: LCD display, backlit, with 2 lines for 20 characters.
    - QTP 03-C4: LCD display, backlit, with 4 lines for 20 characters.
    - QTP 03-C4B: LCD display, backlit, with 4 lines for 20 Big characters.
    - QTP 03-C24: LCD display, backlit, with 2 lines for 40 characters.
    - QTP 03-F2: Fluorescent display, with 2 lines for 20 characters.
    - QTP 03-F4: Fluorescent display, with 4 lines for 20 characters.
    - QTP 03-F4B: Fluorescent display, with 4 lines for 20 Big characters.
    - QTP 03-F24: Fluorescent display, with 2 lines for 40 characters.
  - LEDs backlit of LCD display to ensure a long life of the product.
  - Working mode as dumb terminal: the characters received from the master unit, if they aren't commands, are directly shown on display while the key pressed or the possible commands results are directly returned to master.
  - Tens of commands dedicated to visualization and other functions, compatible with ADDS View-Point standard.
  - Management of 3 signal of digital I/O with different functions selectable by user:
Keys, connected through external wires;
Digital output with user defined status;
Digital inputs acquired by user;
Visualization inputs provided of autonomous show functions.
- Autorepeat and keyclick functions for stroked keys.
- Possibility to enable up to 8 different autonomous visualization, configurable between:
  - single message;
  - static messages sequence (screen);
  - auto scrolling messages sequence.
- Buzzer programmable as BELL or to sound with keystroke or for acoustic indications, driven by software.
- Serial EEPROM for permanent storage of setup, messages, user characters, etc. available in some different sizes, up to 2K Bytes.
- Memorization on EEPROM and visualization on display of maximum 97 different messages, even with auto scrolling mode.
- Up to 256 different characters defined on display and thus visible on display.
- 8 user characters provided of selectable pattern.
- Communication line configurable as asynchronous serial, at TTL or RS 232 level, or as I2C BUS.
- Network connection through I2C BUS protocol.
- Local setup for operating modalities, communication protocol and parameters.
- Single +5 Vdc power supply.
- Total power consumption change according with selected display, from 180 to 885 mA.
- On board protection against voltage peaks by TransZorb.
- Optional container QTP 72144 or QTP 96192.
- Customized keyboard and program packages (please contact grifo®).
- For specific requirements about consumption and price, the LCD display can be not backlit (please contact grifo®).

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

BUZZER

QTP 03 has a circuit that generates a steady sound, based on a capacitive buzzer. This circuit can be activated by software, through specific commands, obtaining the following functionalities: it generates a simple beep; it can be disabled, enabled and intermittent; it can be linked to a key pressure, just to get the keyclick function; it can signalize possible malfunctions.
In latter case, when after a power on, the card generates a fixed or intermittent sound and it doesn't work correctly, there is a wrong condition that must be resolved: please contact grifo® technicians.

COMMUNICATION

The communication with master unit is supported in two different modes:
- **TTL, RS 232** communication = it is an asynchronous serial line with electric protocol selectable by configuration jumpers and with physic protocol selected by local setup. This mode allows only point to point communication.

- **I2C BUS** communication = it is a synchronous serial line with physic protocol selected by local setup. This mode allows point to point, and also network, communication.

The physic protocol of the described communication mode is partially configurable through the proper setup mode; this allows the selection of the values described in TECHNICAL FEATURE chapter, through the simple use of two external keys.

Further information on **QTP 03** communication are available in paragraphs CN3 - INTERFACE CONNECTOR, COMMUNICATION TYPE SELECTION and LOCAL SETUP.

The numerous configurations of serial line offer a wide expansion and interconnection possibilities, including development of cheap networks with master slave communication.

**EEPROM**

**QTP 03** has on board EEPROM (with variable size from 512 to 2K Bytes) for storing setup, communication protocol, identification name, keys codes, messages, user characters 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.

A very interesting feature is the management of 20 characters messages 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, or associating them to visualization inputs. For detailed information about messages please read the paragraphs COMMANDS FOR MESSAGES MANAGEMENT and DIGITAL I/O COMMANDS.

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:

\[
\text{2048 Bytes EEPROM} \rightarrow \text{.MEX option}
\]

Other sizes can be installed on the board but they are OEM configurations that must be previously arranged with grifo®.

**DISPLAY**

**QTP 03** is available with **Fluorescent** or backligt **LCD** alphanumeric displays, with different characters number and different characters size. In detail the following displays can be mounted: Fluorescent 20x2, Fluorescent 20x4, Fluorescent 20x4 big, 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.
FIGURE 2: PHOTO OF MODELS WITH LCD DISPLAYS
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 TECHNICAL FEATURES chapter.

If the number of display characters is not sufficient please remind that the available firmware, as described in COMMANDS chapter, manages also the scrolling messages: on a single line of display can be shown more text that continuously shift from right to left.

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 also with LCD display not backlighted: for detailed information about these options and their availability, please contact directly grifo® offices.

**KEYBOARD**

QTP 03 has three digital input lines that can be directly connected to external keys. The user can add any type of normally open push buttons, according to machine requirements, and he can even mount these buttons away from the card, adding simple connection wires. 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 communication 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.

Keyboard is completely managed by on board firmware, as detailed described in SOFTWARE DESCRIPTION and COMMANDS chapters, that solves the typical problems of: rebound, timing, encoding, etc.

Moreover, two keys are used for the local setup of working parameters, as described in the homonimous paragraph.

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.

**TTL I/O LINES**

On the single connector of QTP 03 are always available 3 digital I/O lines at TTL level. Each one of these lines, can be easily and separately configured by the user, as:

- **Keys** with the features described in paragraph KEYBOARD;
- **digital outputs** with status defined by the user;
- **digital inputs** with status acquired by the user;
- **digital inputs** provided of autonomous visualization function: the user can associate the lines status to different type of visualizations and QTP 03 autonomously shows them on display when the set condition is met. The possible visualizations provided are a single message, a static messages sequence (screen) and a auto-scrolling messages sequence, as described in SET VISUALIZATION FROM I/O SIGNALS.

Both the 3 lines configuration and successive management of the selected functionality, are performed through specific commands, completely described in paragraphs: DIGITAL I/O CONNECTION and COMMANDS FOR DIGITAL I/O MANAGEMENT.
Figure 3: Photo of models with fluorescent displays
TECHNICAL FEATURES

GENERAL FEATURES

Resources: 3 digital I/O signals configurable as:
- external keys
- TTL digital outputs
- TTL digital inputs
- TTL visualization inputs

Buzzer for beep, feedback and keyclick driven by software
Asynchronous bidirectional serial line, in RS 232 or TTL
Synchronous serial line in I2C BUS
EEPROM up to 2 KBytes for setup, messages, code, etc.
Alphanumeric display in 8 different models
Trimmer to set LCD display contrast
ADDS Viewpoint compatible commands

Displays:
- Alphanumeric LCD 20x2, LED backligt
- Alphanumeric LCD 20x4, LED backligt
- Alphanumeric LCD 20x4 Big, LED backligt
- Alphanumeric LCD 40x2, LED backligt
- Alphanumeric fluorescent 20x2
- Alphanumeric fluorescent 20x4
- Alphanumeric fluorescent 20x4 Big
- Alphanumeric fluorescent 40x2

CPU: 89C4051 with 14.7456 MHz crystal

Power on time: 280 msec

EEPROM max write time: 10 msec

Timing precision: 2.5 msec

Keys autorepeat: After 500 msec and then every 100 msec

Vis. inputs debouncing time: 500 msec

Buzzer intermittently time: 500 msec

Messages shift time: 500 msec

Receive buffer size: 28 bytes

Transmit buffer size: 20 bytes

Messages number: 97

Units n° on I2C BUS network: 128
Communication: Selectable between TTL, RS 232, I2C BUS

Default: RS 232

Physic communication protocol
TTL, RS 232:
- Baud rate: 1200, 2400, 4800, 9600, 19200, 38400
- Stop bit: 1 or 2
- Parity: none
- Bits x chr: 8
  Default: 19200 Baud, 1 Stop, No parity, 8 Bits

Physic communication protocol
I2C BUS:
- Bit rate: 500 ÷ 15000 Bits/sec
- Mode: slave
- Slave Address: 00H ÷ FEH
  Default: Slave Address = 80H

PHYSICAL FEATURES

<table>
<thead>
<tr>
<th>MODEL (display)</th>
<th>Dimension (W x H x D mm)</th>
<th>Characters dimensioni (W x H mm)</th>
<th>Characters matrix (pixels x pixels)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QTP 03-C2 (LCD 20x2)</td>
<td>115 x 36 x 30</td>
<td>3,2 x 4,9 + cursor</td>
<td>5 x 7 + cursor</td>
<td>86</td>
</tr>
<tr>
<td>QTP 03-C4 (LCD 20x4)</td>
<td>98 x 60 x 30</td>
<td>2,9 x 4,2 + cursor</td>
<td>5 x 7 + cursor</td>
<td>102</td>
</tr>
<tr>
<td>QTP 03-C4B (LCD 20x4 big)</td>
<td>146 x 62,5 x 30</td>
<td>4,8 x 8,1 + cursor</td>
<td>5 x 7 + cursor</td>
<td>158</td>
</tr>
<tr>
<td>QTP 03-C24 (LCD 40x2)</td>
<td>182 x 33,5 x 30</td>
<td>3,2 x 4,9 + cursor</td>
<td>5 x 7 + cursor</td>
<td>116</td>
</tr>
<tr>
<td>QTP 03-F2 (Fluorescent 20x2)</td>
<td>116 x 37 x 30</td>
<td>2,4 x 4,7 + cursor</td>
<td>5 x 7 + cursor</td>
<td>79</td>
</tr>
<tr>
<td>QTP 03-F4 (Fluorescent 20x4)</td>
<td>98 x 60 x 30</td>
<td>2,4 x 4,7</td>
<td>5 x 7</td>
<td>102</td>
</tr>
<tr>
<td>QTP 03-F4B (Fluorescent 20x4 big)</td>
<td>146 x 62,5 x 30</td>
<td>3,6 x 7,7 + cursor</td>
<td>5 x 7 + cursor</td>
<td>190</td>
</tr>
<tr>
<td>QTP 03-F24 (Fluorescent 40x2)</td>
<td>182 x 33,5 x 34</td>
<td>2,3 x 4,7 + cursor</td>
<td>5 x 7 + cursor</td>
<td>112</td>
</tr>
</tbody>
</table>

**Figure 4: Table with dimensions and weights**

Detailed information on QTP 03 dimensions for all the available models, are available in the figures of APPENDIX C.

Mounting: Through display mounting holes (dimensions in APPENDIX C)

TTL connection length: 50 cm max (in normal condition)

Temperature range: From 0 to 50 °C
Relative humidity: 20% up to 90% (without condense)

Connectors: CN3: 4+4 pins AMP Mod II, 90°, Male
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), the code AMP8.Cable (complete connector with 8 coloured wires, 1 metre length) or to AMP dealer by using P/N 280365 and P/N 182206-2

ELECTRIC FEATURES

Power voltage: +5 Vdc ± 5%

Current consumption: see next table

RS 232 extravoltage protection: ±15 KV

I2C BUS termination circuit: pull-up resistor on SDA, SCL: 10 KΩ

<table>
<thead>
<tr>
<th>MODEL (display)</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>QTP 03-C2 (LCD 20x2 backlight)</td>
<td>180 mA</td>
</tr>
<tr>
<td>QTP 03-C4 (LCD 20x4 backlight)</td>
<td>300 mA</td>
</tr>
<tr>
<td>QTP 03-C4B (LCD 20x4 big backlight)</td>
<td>520 mA</td>
</tr>
<tr>
<td>QTP 03-C24 (LCD 40x2 backlight)</td>
<td>290 mA</td>
</tr>
<tr>
<td>QTP 03-F2 (Fluorescent 20x2)</td>
<td>235 mA</td>
</tr>
<tr>
<td>QTP 03-F4 (Fluorescent 20x4)</td>
<td>385 mA</td>
</tr>
<tr>
<td>QTP 03-F4B (Fluorescent 20x4 big)</td>
<td>885 mA</td>
</tr>
<tr>
<td>QTP 03-F24 (Fluorescent 40x2)</td>
<td>465 mA</td>
</tr>
</tbody>
</table>

FIGURE 5: CONSUMPTIONS TABLE

To reduce consumptions of QTP 03 with LCD display it is possible to order particular models without backlighting: for further information please contact directly grifo®.
The data are referenced to 20°C environmental work temperature (for further information please refer to paragraph POWER VOLTAGE CONNECTION).
In this chapter there are the information for a right installation and correct use of the terminal **QTP 03**. In detail there are the locations and functions of each connector, of the jumpers, of the trimmer and each other information about hardware configuration of the product.

**CN3: INTERFACE CONNECTOR**

The connector 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 communication signals, the digital I/Os and the possible external keys. Placing of the signals has been designed to reduce interference and electrical noise and to simplify connections with any other systems on the field.

The female connector for CN3 is directly available between grifo® accessories, and it can be ordered by using the codes:

- **CKS.AMP8** kit composed by female AMP Mod II 4+4 pins, plus 8 contacts to crimp;

![Figure 6: CKS.AMP8 Connection Accessory](image)

- **AMP8.Cable** complete connector with 8 coloured wires, 1 metre length;

![Figure 7: AMP8.Cable Connection Accessory](image)

or acquired from AMP dealers by using P/N 280365 and P/N 182206-2.
In the following figures and paragraphs are described all the CN3 signals, divided according with relative section of the same terminal.

**POWER VOLTAGE CONNECTION**

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

![Figure 8: CN3 - Power Supply Pins](image)

Signals description:

+5 Vdc = 1 - +5 Vdc power supply signal for on board logic.

GND = - Power supply ground signal.

The power supply voltage for **QTP 03** provides energy for all sections of the board: control logic, display, backlighting, communication interfaces, buzzer, EEPROM, possible external keys, digital I/Os, etc.

This power supply coincides with a 5 Vdc ± 5% stabilized voltage, that must be provided by an external source, through CN3 connector (polarity described in figure 8 must be respected). Among the possible power supply sources there are laboratory power supplies, wall socket AC/DC adapters, other cards, industrial power supplies, etc.

It is important to underline that the card requires a single power supply and thus it has a single ground signal: in other words the signals GND, SER GND, I2C GND, IO GND are electrically connected on the board. In the figures of the manual, different names have been used to denote the right pin to connect on CN3, according with the external system that must be linked; this always ensures the best cable lay up and subsequent best reliability of the entire system.

**QTP 03** is always provided with a TransZorb™ based protection circuit to avoid damages from incorrect voltages and break-down of power supply section. It is also provided with a distributed filtering circuitry that saves the terminal from disturbs or noise from the field, improving the overall system performances.

For further information please refer to paragraph ELECTRIC FEATURES.
Figure 9: Components map solder side

Figure 10: Components map components side
TTL, RS 232 COMMUNICATION LINE CONNECTION

The below figure shows the CN3 pins used to connect the TTL, RS 232 serial line of QTP 03. The signals follow the CCITT normative defined for each one of these standard communication protocols.

![Figure 11: CN3 - TTL, RS 232 Communication Pins](image)

**Signals description:**

- **TX RS232** = 0 - Transmit data for RS 232 communication.
- **RX RS232** = 1 - Receive data for RS 232 communication.
- **TX TTL** = 0 - Transmit data for TTL communication.
- **RX TTL** = 1 - Receive data for TTL communication.
- **SER GND** = - Ground signal for TTL, RS 232 communication.
- **IO GND** = - Ground signal for digital I/Os.

Please remind that the ground signals SER GND and IO GND are physically connected to GND signal always on CN3: two separate pins have been provided to facilitate wiring.

The base version, that the user receive, is configured for an RS 232 communication. If the user needs a different communication, and he wants to avoid wrong connections and possible consequent damages, he must strictly follow the information in paragraphs COMMUNICATION TYPE SELECTION and JUMPER FOR SERIAL CONFIGURATION.

The following figures show a connection example diagram with a generic master unit, both in RS 232 and TTL:

![Figure 12: Connection Example for RS 232 Communication](image)
**Figure 13:** Connection example for TTL communication

**Figure 14:** Jumper, connectors, trimmer, modifications, etc. location
I2C BUS COMMUNICATION LINE CONNECTION

The below figure shows the CN3 pins used to connect the I2C BUS line of QTP 03. The signals follow the international normative defined for this standard communication protocol.

![Figure 15: CN3 - I2C BUS Communication pins](image)

**Figure 15: CN3 - I2C BUS Communication pins**

Signals description:

- **SDA** = I/O - Data signal for I2C BUS communication.
- **SCL** = I - Clock signal for I2C BUS communication.
- **I2C GND** = - Ground signal for I2C BUS communication.
- **IO GND** = - Ground signal for digital I/Os.

Please remind that the ground signals I2C GND and IO GND are physically connected to GND signal always on CN3: two separate pins have been provided to facilitate wiring.

The base version, that the user receive, is configured for an RS 232 communication. Before connecting the I2C BUS line the user must select this type of communication, by following the information in paragraph COMMUNICATION TYPE SELECTION.

The following figures show a connection example diagram with a generic I2C BUS master unit, both in point to point and network mode:

![Figure 16: Connection example for I2C BUS point to point communication](image)
Please remind that in a I2C BUS network two termination circuits must be connected at the net extremes, respectively near the master unit and the slave unit at the greatest distance from the master. Termination circuit is always present on QTP 03 in default configuration and it must be removed on those units that are not on the line extremities, as explained later.
For further information please refer to document "THE I2C-BUS SPECIFICATIONS", from PHILIPS semiconductors.
DIGITAL I/OS CONNECTION

The below figures show the CN3 pins used to connect the three digital input and/or output signals of QTP 03. The I/O signals connections change according with selected communication type, thus all the following figures are double: one for TTL, RS 232 communication and the other for I2C BUS communication.

**FIGURE 18: CN3 - DIGITAL I/Os PINS WITH TTL, RS 232 COMMUNICATION**

**FIGURE 19: CN3 - DIGITAL I/Os PINS WITH I2C BUS COMMUNICATION**

Signals description:

<table>
<thead>
<tr>
<th>IO1</th>
<th>= I/O - Digital I/O signal number 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO2</td>
<td>= I/O - Digital I/O signal number 2.</td>
</tr>
<tr>
<td>IO3</td>
<td>= I/O - Digital I/O signal number 3.</td>
</tr>
<tr>
<td>SER GND</td>
<td>= - Ground signal for TTL, RS 232 communication.</td>
</tr>
<tr>
<td>I2C GND</td>
<td>= - Ground signal for I2C BUS communication.</td>
</tr>
<tr>
<td>IO GND</td>
<td>= - Ground signal for digital I/Os.</td>
</tr>
</tbody>
</table>

Please remind that the ground signals SER GND, I2C GND and IO GND are physically connected to GND signal always on CN3: two separate pins and four different names have been provided to facilitate wiring.

The base version, that the user receive, is configured for an RS 232 communication. So, if the user doesn’t intervene, the digital I/O signals are those described in figure 18.
The following figures show the connection circuit of digital I/Os performed on QTP 03 board and a connection example diagram with a generic external system. In both figures there is the distinction of the selected communication mode:

**FIGURE 20: DIGITAL I/Os CONNECTION DIAGRAM**

The digital I/Os signals are at TTL level with pull up resistor and they can be connected to any interface compatible with this electric standard or to pure contacts downto ground. The interposed connection cable must be at most 50 cm long, unless external favourable conditions allow its extension.

**FIGURE 21: CONNECTION EXAMPLE FOR DIGITAL I/Os**

It is important to remind the numerous and powerfull functionalities of the digital I/O signals, that can be configured by software as:

- external keys,
- TTL digital output,
- TTL digital inputs,
- TTL visualization inputs.
EXTERNAL KEYS CONNECTION

As preannounced in previous paragraph the three digital I/O signals available on CN3 can be connected to three external keys that are then managed by QTP 03 firmware with debouncing, autorepeat, keyclick, etc. services. The I/O signals configuration is performed by software and so the user can decide to configure and connect even a lower number of keys; the remaining digital I/Os can be still configured with the other functionalities. In this way the flexibility and the convenience of the terminal is really the best.

As described in the connection diagram of figure 20, the digital I/Os configured as keys 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 22. The maximum length of this connection cable is 50 cm, except when the external environment is well disposed and enlargement become possible.

![Figure 22: External keys connection](image)

The figure distinguishes the keys connections according with selected communication type, in fact when the last changes, the digital I/O signals change too.

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 IOx is connected to ground.

The base version, that the user receive, is configured for an RS 232 communication and with all the three digital I/Os configured as external keys. So, if the user doesn't intervent, the keys can be connected as described in left side of figure 22.
Figure 23: Available Connections Diagram
COMMUNICATION TYPE SELECTION

As described in previous paragraphs the QTP 03 terminal can receive/transmit information from/to master unit in three different serial communication types. About selection of physic protocol of the communication please read LOCAL SETUP paragraph, while below are reported the information regarding the electric protocol selection.

The communication electric protocol used by QTP 03 is selected by a list of hardware configurations that interest some elements of the card and normally it is performed from the user at the beginning, before using it.

- RS 232 communication (default configuration)
  RR1.5, RR1.6 = connected
  R12 = connected
  J1 , J2 = position 1-2
  Connection = see figures 11,12

- TTL communication
  RR1.5, RR1.6 = connected
  R12 = connected
  J1 , J2 = position 2-3
  Connection = see figures 11,13

- I2C BUS communication: point to point or network extremities
  RR1.5, RR1.6 = connected (*)
  R12 = not connected
  J1 , J2 = position 2-3
  Connection = see figures 15, 16, 17

- I2C BUS communication: network not at extremities
  RR1.5, RR1.6 = not connected (*)
  R12 = not connected
  J1 , J2 = position 2-3
  Connection = see figures 15, 17

(*) When the I2C BUS communication is used, the RR1.5, RR1.6 resistors coincide with the termination circuit of the line. This circuit must be always connected in case of point to point connections, while in case of multi points (network) connections it must be connected only in the farest boards, that is on the extremities of the communication line.

If, for example, it is realized a network composed by a master unit and four QTP 03, these resistors must be connected on the master, must be connected on the last QTP 03 (those at the longest distance from the master), while they must be removed on the remaining three QTP 03.

The base version, that the user receive, is configured for an RS 232 communication and the user must intervene only when he needs a different communication type.

To recognize the elements interested by the described configurations, please use the figures 14 and 24: all them are placed on QTP 03 printed circuit, on the component side.

In detail the configuration of J1 nad J2 jumpers doesn't require specific explanations, while for the configurations of R12, RR1.5 and RR1.6 the follwing instructions must be religiously attended, in
order to avoid card breakdown and consequent malfunctions:

- **connected components** = the component connection must be performed by using a low power soldering tool, provided of a thin bit, and a non corrosive tin. It is suggested the use of a proper solder flux that facilitate the connection of the interested points and, at the same time, avoid possible short circuit with adjacent pads.

- **not connected components** = the no connection of component must be performed with thin and sharp cutter, that makes two cuts on the rheofore which connect the component to the board. The first of these cuts must be as near as possible to the printed circuit and the second lightly upstairs to prevent contact of the two sides. Please make much attention to don't break the communed resistors RR1, by avoiding force and pressure on it.

The following figure shows the exact points where the user must execute the described operations:

![Figure 24: Modifications for communication selection](image-url)
JUMPERS FOR SERIAL LINE CONFIGURATION

When **QTP 03** is configured for asynchronous serial communication (R12, RR1.5, RR1.6 connected) the user can select the communication electric protocol between **RS 232** and **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 9 of this manual, where the pins numeration is listed; for recognizing jumpers location, please refer to figure 14.

<table>
<thead>
<tr>
<th>JUMPER</th>
<th>CONNECTION</th>
<th>FUNCTION</th>
<th>DEF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>Position 1-2</td>
<td>Configures the serial transmission line (TX), with RS 232 electric protocol</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Position 2-3</td>
<td>Configures the serial transmission line (TX), with TTL electric protocol TTL, or I2C BUS</td>
<td></td>
</tr>
<tr>
<td>J2</td>
<td>Position 1-2</td>
<td>Configures the serial reception line (RX), with RS 232 electric protocol</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Position 2-3</td>
<td>Configures the serial reception line (RX), with TTL electric protocol, or I2C BUS</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE 25: JUMPERS FOR SERIAL LINE CONFIGURATION**

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 set 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, it 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 14.
SOFTWARE DESCRIPTION

The terminal **QTP 03**, as previously stated, is a complete video terminal and for this reason any characters received from communication line is shown on the display, except the commands that are on the contrary executed; on the same communication line, it transmit the codes of any pressed keys, or the possible results of the executed commands. In addition, it provides some local functionalities, independent from communication, that allow the use of **QTP 03** as message visualizer driven by digital I/O signals. All these operations are automatically performed by on board firmware that is programmed and executed by the CPU mounted on the card.

This chapter describes the main features of **QTP 03**, while the following one reports a detailed description of the recognized command sequences, that can be used to benefit of all these functionalities. In correspondence of the first order, on the received **grifo®** CD, are supplied many complete and usefull demo programs either in executable and source format; these can be used as received with no modifications, for a first test of the product and then changed, or partially used, to develop the user application program.

KEYS NAME CONVENTION

In all the 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:

<table>
<thead>
<tr>
<th>Key name</th>
<th>Connected to: (TTL, RS 232 communication)</th>
<th>Connected to: (I2C BUS communication)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY 1</td>
<td>Pin 4 of CN3</td>
<td>Pin 3 of CN3</td>
</tr>
<tr>
<td>KEY 2</td>
<td>Pin 6 of CN3</td>
<td>Pin 5 of CN3</td>
</tr>
<tr>
<td>KEY 3</td>
<td>Pin 2 of CN3</td>
<td>Pin 2 of CN3</td>
</tr>
</tbody>
</table>

**FIGURE 26: KEYS NAME**

LOCAL SETUP

Thanks to a proper local set up mode, some parameters of communication protocol, the key click mode and EEPROM initialization can be set by the user with the simple use of 2 external keys.

To enter set up mode the user must execute the following steps:

1) press and maintain contemporaneously pressed the KEY 1 and KEY 2;
2) supply power to terminal;
3) wait activation of the on board buzzer;
4) release the two keys;
5) wait deactivation of the on board buzzer;
6) press again, and maintain contemporaneously pressed, the KEY 1 and KEY 2;
7) wait activation of the on board buzzer;
8) release the two keys.

When the set up mode is entered, on the display appears the “**Local Setup V.x.y**” string (**x.y** coincides with version of the executed firmware) and with the same two keys, the configuration parameters shall be changed as below described:
KEY 1: Changes current menu, identified by the following messages:

"COMMUNICATION" changes the communication type
"BAUD RATE" changes the communication baud rate
"STOP BIT" changes the stop bit number
"KEY-CLICK" selects the keyclick mode
"SL.ADD.(Hex)" first digits of hexadecimal I2C BUS slave address
"SL.ADD.(Hex)" second digits of hexadecimal I2C BUS slave address
"EEPROM DATA" initializes data on EEPROM
"SAVE and EXIT" to exit from setup mode

KEY 2: Changes current value of menu, with the following possibilities:

COMMUNICATION: Norm. or I2C for TTL, RS232 or I2C BUS comm. (def=Norm.)
BAUD RATE: 38400, 19200, 9600, 4800, 2400 or 1200 baud (def=19200)
STOP BIT: 1 or 2 (def.=1)
KEYCLICK: ON or OFF (def=ON)
SL.ADD.(Hex): Changes digits enclosed in "<>" from 0÷F Hex (def=80H)
EEPROM DATA: NOINI or INIT (def=NOINI)
SAVE and EXIT: exits set up and configures QTP 03 with selected parameters

Once exited from setup mode, the selected parameters are saved on EEPROM and they are maintained until another local setup is executed; immediately after the terminal starts its normal functionality. The default values before reported are those set at the end of testing phase, that is the configuration the user receives.

The options available in BAUD RATE and STOP BIT menus define the physical communication protocol for TTL, RS 232 communication, that has other two parameters unchangeable and set to 8 bits per character and no parity.

The options of remaining menus are instead described in the following paragraphs.

NOTE
Please remind that set up mode can be entered only during power up, when previously described condition is recognized; in fact if the KEY 1 and 2 are pressed at the same time during normal operation of QTP 03, the set up mode will not start and the code of the pressed keys will be transmitted on the serial line.

The local set up is normally executed only one time after the first installation, so it regards expert staff and not the final user of QTP 03, that exploit it as a simple operator interface unit. The required two external keys can be connected only during the setup phase and thereafter removed; so the QTP 03 can be used without keys as a simple display unit and/or it can be connected to digital I/Os.

KEYBOARD ACQUISITION

The keyboard management of QTP 03 is subordinated to configuration of digital I/O signals as keys and connection of the last to connector CN3. Please remind that, as described in figures 22, 26 the external keys connection changes according with selected communication type.

When QTP 03 is configured to manages external keys and firmwares recognize a key pressure, it transmits its code. This happens immediately if TTL, RS 232 communication is used, while in case of I2C BUS the code is saved in transmission buffer and then returned to master unit when specifically requested, with the format described in next paragraphs.
Moreover an auto repeat function of the stroked key is implemented so when QTP 12/R84 firmware recognizes the pressure on a key for a time grater than 0.5 seconds it will return its code about each 0.1 seconds and it lasts until that key is released. If the keyclick function is enabled when the code of the pressed key is returned, the on board buzzer also generates a loud beep that sonorously signalize the event to the user. If buzzer was already enabled then it is disabled for a little time period, to ensure the acoustic event recognition in any circumstance.

When more than one key are contemporaneously pressed it is transmitted only the code of the key with higher number, or on the other end, KEY 3 is priority on KEY 2 that is priority on KEY 1. The status of more keys pressed can be anyway acquired by using the command ACQUIRE DIGITAL INPUTS, as reported in homonimous paragraph.

Another features provided by QTP 03 is the complete reconfiguration of the key codes performed by user application program; in other words it is possible to change the code returned when a key is pressed and even disable the key.

KEYS CODES

The following figures show a table with the default codes that QTP 03 returns when a key is pressed. As for the command sequences the codes are shown in decimal, hexadecimal and ASCII mnemonic format.

<table>
<thead>
<tr>
<th>KEY NAME</th>
<th>CODE</th>
<th>HEX CODE</th>
<th>MNEMONIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY 1</td>
<td>49</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>KEY 2</td>
<td>50</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>KEY 3</td>
<td>51</td>
<td>33</td>
<td>3</td>
</tr>
</tbody>
</table>

**Figure 27: Default key codes**

Said codes are those transmitted under default condition, i.e. the configuration the user receives, but they can be comfortabaly reconfigured by using a specific command. This features really simplifies the development of master unit management software.

CHARACTERS VISUALIZATION ON DISPLAY

The QTP 03 show on its display all the received characters having a code included in the range 0÷255 (00÷FF Hex) including the one that identifies a command sequence (27 = 1BH).

The character is visualized on the current cursor position and this latter will go to 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 correspondence between codes and displayed characters is defined by the following rules:
Codes Characters
0 ÷ 15 (00÷0F Hex) User defined
16 ÷ 31 (10÷1F Hex) Special and different according with installed display
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.

Through the frirmwares every model of QTP 03 has 8 user characters that can be defined and/or stored and shown on the display, as further explained in the paragraph USER CHARACTERS COMMANDS.

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®.

COMMUNICATION MODALITIES

The QTP 03 provides two different communication modalities:

Norm.=TTL, RS 232: the communication is asynchronous and it occurs with 8 bits per character, no parity, plus stop bit and baud rate selected by the user through local setup. This communication mode is suitable for point to point connections in TTL and RS 232. Detailed information about this mode are reported in proper paragraph TTL, RS232 COMMUNICATION.

I2C=I2C BUS: the communication is synchronous and it occurs with a bit rate variable from 500 to 15000 Bits/second, as slave (either receive or transmit) with a 7 bits slave address selected by the user through local setup. This communication mode is suitable for point to point or network connections.
Detailed information about this mode are reported in proper paragraph I2C BUS COMMUNICATION.

Local set up allows to select communication modality, as described in the specific paragraph, while electric protocol must be defined by hardware, as described in COMMUNICATION TYPE SELECTION paragraph.
TTL, RS 232 COMMUNICATION

The system that communicates with **QTP 03** in this mode must only transmit the characters to visualize and/or the command sequences to execute, and manages the reception of characters that are the codes of the possible key pressed and/or the possible answers to the supplied commands. This mode doesn't require any synchronization between the two systems in communication and each events is immediately processed from **QTP 03**, as illustrated in the following flow chart:

**Figure 28: Flow chart for communication master <-> QTP 03 in TTL, RS 232**
I2C BUS COMMUNICATION

The system that communicates with QTP 03 in this modality must operate as master, either in transmit and receive mode, following the rules of I2C BUS standard protocol detailed described in the document "THE I2C-BUS SPECIFICATIONS", from PHILIPS semiconductors. This modality requires a synchronization between the systems in communication as illustrated in the following flow charts:

**Figure 29: Flow Chart for Communication Master -> QTP 03 in I2C BUS**
The master must perform a communication with write data direction to supply the characters to visualize and/or the command sequences to execute, and perform a communication with read data direction to get the possible codes of key pressed and/or the possible answers to the supplied commands.

Each communication involves only the QTP 03 with the slave address equal to those defined in local setup of the terminal, inside "SL.ADD.(Hex)" menus. When an I2C BUS network is used, each QTP 03 must be set with a different slave address, and different from the slave addresses of the other possible I2C BUS devices connected to same network.

In order to simplify the complete management, the first data returned by QTP 03 after a read communication, always coincides with the number of characters available in the transmission buffer, that is the number of data the master must receive. Thus the muster unit could terminate the communication with proper STOP sequence, only when it has received all these data.

**Figure 30: Flow chart for communication QTP 03 -> master in I2C BUS**
NOTES:

1) To ensure right commands execution, between a communication and the next one it is necessary to wait for a time that is proportional to the number of commands sent and type of operations they involve.

2) If the scrolling messages mode is enabled, the time between two communication, in addition to the time indicated at point 1, must be about 12 msec.

3) During a communication from master unit to QTP 03 it can be transferred many characters to visualize and command to execute, taking care to doesn't overflow the receive buffer, as described in paragraph COMMUNICATION BUFFERS.

4) The communications from QTP 03 to master unit must be planned to doesn't overflow the transmit buffer, as described in paragraph COMMUNICATION BUFFERS.

5) The slave address defined in local setup is 7 bits wide but it is managed as 8 bits value, with the least significant bit (R/W) fixed to 0; so 128 different even values can be selected, in the range 00÷FEH.

6) When an I2C BUS network connection is used, performs all the modifications described in COMMUNICATION TYPE SELECTION paragraph, in order to ensure that the line is correctly terminated, from the electric point of view.

7) The QTP 03 doesn't support the enhancements of I2C BUS protocol (as 10 bits addressing, fast mode, high speed mode, etc.) and the reserved slave addresses: these feature can't be used by master unit.

**FIGURE 31: I2C BUS NETWORK CONNECTION**
COMMUNICATION BUFFERS

The QTP 03 is provided with two communication buffers that improves the capabilities of the card and simplify the management from master unit side, by reducing the waiting time on the same side. The first is a receive buffer, it is **28 bytes long**, it stores the data received from master and it is processed at the end of the currently executed operation. When commands that requires a long execution time (delete commands, EEPROM management commands, messages shift, etc.) are continuously received, the buffer will become full and will overflow. When overflow occours the first locations of the buffer are overwritten by each next received characters, and the first are definitely 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 reception buffer.

The second is a transmit buffer, it is **20 bytes long**, it stores the data to transmit to master and so it is filled with pressed keys codes and answers of the commands. When TTL, RS 232 communication type is used the transmit buffer is not used in fact data are immediately transmitted to master; viceversa, when communication is in I2C BUS, the data stay in transmission buffer until the master requires them. In the last circumstance, if master doesn't receive data from QTP 03, the buffer will become full and will overflow. When overflow occours all the successive data are not saved and they are definitely lost. So the master unit must perform a data reception from QTP 03 at least in two conditions: before to transmit commands with answers (to empty the buffer for the same answers) and periodically (to get the possible keys pressed).

DATA STORED ON EEPROM

The on board EEPROM of QTP 03 is used to store data used and/or changed through the specific commands. The choice of EEPROM memory type has been performed to obtain the best warranties on data validity and endurance, naturally even when power supply is not available. The detailed description on each one of the data saved on EEPROM is reported in the following chapter, in the paragraphs relative to commands that use them. When the card is received from an order or a reparation, the EEPROM is supplied already set with its default values, that are:

- presence byte -> 255 (FFH)
- digital I/Os functionality -> external keys (03H)
- keys codes -> those reported in table of figure 27
- power on visualization -> none
- digital I/Os visualization -> none
- patterns of user defineable characters -> 255 (FFH)
- messages -> 255 (FFH)

Whenever the user desires to reset the default configuration on all data saved in EEPROM, the firmwares provide this possibility through the menu EEPROM DATA of local setup. The described data can be left unchanged by selecting the NOINI option, or they can be set to their default values, by selecting the INIT option. When INIT option has been selected, once exit from local setup a string is shown on the display with a scrolling bar of * (asterisk) that inform about the status progress of the operation. The number of displayed * and execution time of initialization phase change according with mounted EEPROM size, up to a maximum of 20 seconds approximately. The user must be very careful with EEPROM initialization, in fact all previously saved data are definitely lost.
HOW TO START

In this paragraph are listed the operations that must be performed to start using the QTP 03 in a practical and fast way, solving the typical beginners problems. The paragraph contains interesting information even for the users that already know the product and its operating modes, in fact there is the description of a fast functional test. The following steps assume that a standard Personal Computer (provided of one free RS 232 serial line and a generic operating system, up to Windows 98) is available, to allow any user to execute them.

A) Communication line connection:
A1) Perform the serial connection described in figure 32 or on the other hand connect the two communication signals (TX RS232, RX RS232) and the reference ground signal (SER GND), to free COMx serial port of the PC.

A2) Connects the external keys always to CN3 connector, as described on figure 22: this step is not necessary but suggested to evaluate and test the product in a more complete manner.

A3) Supply power voltage on CN3 and check that buzzer is immediately disabled and a blinking block cursor is displayed in the left up corner of the display.

A4) Press the eventual keys connected to QTP and check that the relative keyclick is generated by on board buzzer.

B) Use of demo program:
B1) On the floppy disks or grifo® CD rom received with the first purchase, it is available the file PRQTP03.EXE, that contains the executable code for a demo program for PC that comunicate through RS 232 line with QTP. This file once found, must be copied in a comfortable folder on the hard disk of the used PC.

B2) Execute the program copied at point B1 and compile its start questions, by selecting the mounted display type. A this point press a key on PC to continue without execute the local setup, in fact the shown configuration coincides with the default one already set on the received QTP 03.

B3) Carry on demo program execution and check that the operations described on PC monitor are correctly executed on QTP; when required interact with the same program in order to test all the available commands, until the end of demo program is reached.
C) Use of terminal emulation:
C1) Found the HYPERTERMINAL communication program on the PC, that normally is located on Windows menu: "Start | Program | Accessories | Communication", and execute it.

C2) Through the HYPERTERMINAL properties windows, setup the communication parameters to:
- Connect directly to COM x (those used at point A1)
- Bit rate 19200
- Data Bits 8
- Parity No
- Stop Bit 1
- Flow control None

and wait the presentation of communication window.

C3) At this point type something on PC keyboard and check that pressed keys are shown on QTP 03 display and that pressing the possible QTP keys, their codes appear on PC monitor. For completeness it can be tested also the effects of some commands by typing their codes sequences always on PC keyboard (this operation is simplified by contemporaneous pression of ALT key and of digits of the decimal code, on the numeric pad: for example to transmit the clear page command with decimal code 12, you can press contemporaneously the ALT key and first the keys 1 and then 2).

When during execution of the steps above described a problem or a malfunction is found, we suggest to read and repeat again all the steps carefully and ensure that default configuration values are saved, through local setup. If malfunction persists please contact directly grifo® technician.

DEMO PROGRAMS

In correspondence of the first purchase together with QTP 03 it is supplied a floppy disk or a grifo® CD where are saved numerous demo programs that allow to test and estimate immediately the received product. These programs are provided both in executable and source format and they are coded with many high level programming languages (C, PASCAL, BASIC, etc.) either for PC platforms or grifo® microprocessor cards (as GPC®, Mini Module, etc).

As described in HOW TO START paragraph the programs named PRQTP03.* use all the commands of QTP through a simple iteration with the user; but many other demos are supplied capable, for example, to: drive QTP connected to an I2C BUS network, manage messages, perform scenographic presentation, etc. The user can examine the remarks of these demos and decide himself if they are interesting.

All the demo programs can be used directly, or modified, or partially used, according to applications requirements, without any authorization, license or additional cost. Furthermore in case of unusual requirements or combinations, specific new demo programs can be obtained, after proper agreement with grifo®.
COMMANDS

This chapter describes all the commands available in QTP 03 firmware and each relative input and output parameters. The commands are divided in subgroups according with their functions and for each code, or codes sequence, there is a double description: the mnemonic one through the ASCII characters and the numeric one under decimal and hexadecimal format.

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

A rich list of demo programs (supplied in source and executable format) shows the practical use modalities of commands: we suggest to add these demo programs, received during first purchase on CD or floppy disk, to this chapter documentation.

A summarized descriptions of all the available commands, their parameters and possible results answers, are reported in the table of APPENDIX A.

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 that is the first position in the first row.

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 that is the 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 below 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 PLACEMENT OF CURSOR

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 parameters.

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). The valid values of the passed coordinates change according to used display and their respective ranges are: 32+35 and 32+71.

If, for example, the user wants to place the cursor on the second line, third column (row 1, column 2), then the following 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 and discharged.
COMMANDS FOR CHARACTERS ERASURE

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

BACKSPACE

<table>
<thead>
<tr>
<th>Code:</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hex code:</td>
<td>8</td>
</tr>
<tr>
<td>Mnemonic:</td>
<td>BS</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code:</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hex code:</td>
<td>C</td>
</tr>
<tr>
<td>Mnemonic:</td>
<td>FF</td>
</tr>
</tbody>
</table>

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

CLEAR LINE

<table>
<thead>
<tr>
<th>Code:</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hex code:</td>
<td>19</td>
</tr>
<tr>
<td>Mnemonic:</td>
<td>EM</td>
</tr>
</tbody>
</table>

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

CLEAR END OF LINE

<table>
<thead>
<tr>
<th>Code:</th>
<th>27  75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hex code:</td>
<td>1B  4B</td>
</tr>
<tr>
<td>Mnemonic:</td>
<td>ESC  k</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code:</th>
<th>27  107</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hex code:</td>
<td>1B  6B</td>
</tr>
<tr>
<td>Mnemonic:</td>
<td>ESC  k</td>
</tr>
</tbody>
</table>

This command erases all characters displayed from the current cursor position to the end of display inclusive. The cursor mantains the previous position.
If, for example, the cursor is at Home position, the complete display will be erased.
COMMANDS FOR EEPROM

In the following paragraphs are described the commands that directly 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 AVAILABILITY

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

This command checks if the QTP 03 is ready for management of its on board EEPROM. This command must be executed any time there are data to rewrite on this type of memory. When QTP 03 firmware 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 firmware sends back the NACK code, it is not yet possible to memorize a new data on EEPROM.

WRITE 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.

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

READ PRESENCE BYTE

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

The firmware sends back the value of its presence byte.
For example, this command can be useful to verify the presence, or the correct running, of the card and its firmware.
COMMANDS FOR GENERAL FUNCTIONS

In the following paragraphs are described all the general purpose commands that manage some features of QTP 03 terminal. These commands do not come into the other subgroups and for this reason they are described in a dedicated paragraph.

READ FIRMWARE VERSION

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

The firmware returns a string of 3 characters containing the management firmware version that is resident and executed by QTP 03. For example with firmware version 2.0 the following characters will be returned:

50 46 48 or 32 2E 30 Hex or 2.0

FLUORESCENT DISPLAY BRIGHTNESS SETTING

*Code:* 27 108 lum  
*Hex code:* 1B 6C lum  
*Mnemonic:* ESC l ASCII(lum)

Sets fluorescent display brightness to one of the four possible values, passed in lum parameter:

0 (00 Hex) -> Brightness at 100%  
1 (01 Hex) -> Brightness at 75%  
2 (02 Hex) -> Brightness at 50%  
3 (03 Hex) -> Brightness at 25%

If parameter is not valid, command is ignored.

**NOTE** This command is available only with models provided of fluorescent display. In case of LCD display the command must not be sent because it produces the visualization of an undesired character and a shift in all the next received data.

BEEP

*Code:* 7  
*Hex code:* 7  
*Mnemonic:* BEL

The buzzer is enabled for a time of 0.1 second. If buzzer was already enabled, then it is disabled for the same time period, so the audible effect of this command is always recognizable.
BUZZER ACTIVATION

   Code:           27 50 255  attr
   Hex code: 1B 32 FF  attr
   Mnemonic: ESC 2 ASCII(255) ASCII(attr)

The on board buzzer status is modified using attribute specified in attr parameter, that can assume the following values:

   0 (00 Hex) -> buzzer OFF
   255 (FF Hex) -> buzzer ON
   85 (55 Hex) -> buzzer intermittent

If parameters is not valid, command is ignored.
The intermittent function is completely autonomous and it doesn't requires any intervent from user side.
For example, to activate the buzzer with intermittent attribute, the following sequence must be sent:

   27 50 255 85  or  1B 32 FF 55 Hex  or  ESC 2 ASCII(255) U

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 (those provided of code less than 32 = 20H) and the single character commands. The selected modality is defined by value of mode parameter, 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 reported in CHARACTER VISUALIZATION ON THE DISPLAY paragraph.
COMMANDS FOR MESSAGES MANAGEMENT

In the following paragraphs are described all the commands that manage messages, available on QTP 03. The messages are 20 characters sequences 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 command. The QTP 03 firmware manages the scrolling messages visualization, too; with this feature on a single line of display can be shown more text that continuously shift from right to left.

Additionally the messages coincide with the entity used by visualization from I/O signals command, described in the homonymous paragraph.

Please remind that 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 same PC.

The QTP 03 can install an EEPROM with a size of 512 bytes, that is the default configuration, and 2048 bytes that is the configuration with .MEX option; the last is a configuration that must be specified in the order of the card. When the user has special requirements about EEPROM size, other different dimensions can be obtained, but they must be previously concerted with grifo®.

READING OF MAX MESSAGES NUMBER

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

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

<table>
<thead>
<tr>
<th>Version</th>
<th>EEPROM size</th>
<th>Last message n° (max. n.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>512 Bytes</td>
<td>19 (13 Hex)</td>
</tr>
<tr>
<td>.MEX</td>
<td>2048 Bytes</td>
<td>96 (60 Hex)</td>
</tr>
</tbody>
</table>

**Figure 33: Number of Messages on EEPROM**

The valid message numbers that can be used with QTP 03 range from 0 to Last message n°, equal to 20 messages in the default configuration and 97 messages in .MEX version.

MESSAGE STORAGE

| Code: | 27 33 67 mess.n. chr.0 ÷ chr.19 |
| Hex code: | 1B 21 43 mess.n. chr.0 ÷ chr.13 Hex |
| Mnemonic: | ESC ! C ASCII(mess.n.) ASCII(chr.0) ÷ ASCII(chr.19) |
This command stores the 20 characters message, identified by mess.n. parameter, on the on board EEPROM. The 20 chars which form the message must be visualizable on the display so they must be included in the range $0$÷$255$ ($0$÷$FF$ Hex). The message number must be included in the range $0$÷max. n. (where max.n. is the number of the last message just described in figure 33), to select one of the available messages. If this number is not compatible with the QTP 03 installed EEPROM size, this command is ignored.

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

MESSAGE READING

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

This command reads the 20 characters message identified by mess.n. parameter, from the EEPROM and it returns this message, beginning from the first char of the string.
The message number must be included in the range of $0$÷max. n. (where max.n. is the number of the last message, just described in figure 33), to select one of the available messages. If this number is out of range, the command is ignored.

VISUALIZATION OF N MESSAGES

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

This command visualizes n 20 characters messages on the display, beginning from current cursor position.
The first of the n messages is that one having the number corresponding to mess.n. while the remaining messages are those immediately subsequents in EEPROM.
The mess.n. value and the number of the following messages defined by n, must be included in the range $0$÷max. n. (where max.n. is the number of the last message, just described in figure 33), to select only the available messages. If these number are out of range the command is ignored.
The n quantity of messages to be visualized depends only on the model of the used display and it is included in these ranges:

- $20\times2$ display
  - $n$ between $1$÷$2$
- $20\times4$ or $40\times2$ display
  - $n$ between $1$÷$4$

If the n value is not compatible with the installed display model, the command is ignored.

Once the command is executed 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, 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
SCROLLING MESSAGES VISUALIZATION

Code: 27 33 83 mess.n. n.chr
Hex code: 1B 21 53 mess.n. n.chr
Mnemonic: ESC ! S ASCII(mess.n.) ASCII(n.chr)

This command visualizes a \texttt{n.chr} characters string on the display first line, in sliding mode. The string is shifted from right to left and so the user can visualize on a single line (the first) more information than the normal 20 or 40 characters.

The string of \texttt{n.chr} characters, begins with the first character of the \texttt{mess.n.} message already stored in EEPROM and continues with next characters always saved in following EEPROM messages. The \texttt{mess.n.} value must be included in the range \(0\)÷\text{max. n.} (where \text{max.n.} is the number of the last message, just described in figure 33), to select one of the available messages. If the value is out of range this command is ignored.

Instead the \texttt{n.chr} parameter must range in the following values:

- \texttt{0} Stops the scrolling messages visualization (the \texttt{mess.n.} value doesn’t care).
- \texttt{20-200} If a \texttt{20} characters per row display is installed on QTP 03
- \texttt{40-200} If a \texttt{40} characters per row display is installed on QTP 03

If \texttt{n.chr.} value is out of the specified ranges or it points after the last character of the last message stored in EEPROM, the command will be ignored.

The scrolling messages visualization is always performed on the first display line and the cursor position and attributes are maintained.

For example, if you wish to visualize a 35 characters string in sliding mode, composed by message 10 (20 characters) and by the first 15 characters of message 11, it will be necessary to send the following sequence:

\[\text{27 33 83 10 35}\]  or  \[\text{1B 21 53 0A 23 Hex}\]  or  \[\text{ESC ! S LF #}\]

NOTE: Scrolling a message involves a continuous display updating; this operation increments the firmware execution time and consequently slows the interpretation of commands coming from the communication line.

So if a great amount of informations must be sent to QTP 03 and a message is scrolling on the display, it is suggestable to wait for some msec between the transmission of a 20+28 bytes data block and the next one, to assure that the terminal has the time to interpretate correctly the transmitted data, with no overflow of the receive buffer.
COMMANDS FOR CURSOR ATTRIBUTES MANAGEMENT

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

CURSOR OFF

Code: 27 80
Hex code: 1B 50
Mnemonic: ESC P
The cursor is disabled and it is not more visible.

STEADY STATIC CURSOR ON

Code: 27 79
Hex code: 1B 4F
Mnemonic: ESC O
The cursor is enabled and so it is visible as 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; in this condition the command has no effects.

BLINKING BLOCK CURSOR ON

Code: 27 81
Hex code: 1B 51
Mnemonic: ESC Q
The cursor is enabled and so it is visible as a blinking rectangular block that is alternatively visualized with the character displayed on the current cursor position.
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 activation, management and codes returned by the firmware, are available in KEYBOARD ACQUISITION paragraph.

KEY CODE 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 firmware will return the new specified code.

The value of key n. is below described, it must be included in the range 0÷2 (00÷02 Hex) otherwise the command is ignored.

```
key n. = 0 -> KEY 1
key n. = 1 -> KEY 2
key n. = 2 -> KEY 3
```

If the code value is included in range 0÷254 (00÷FE Hex) then the firmware return this code when the relative key is pressed; but if code parameter has 255 (FF Hex) value then the key is disabled and when it will be pressed nothing happen.

Figures 26 and 27 reports the keys connections and the default key codes while the paragraph DATA STORED ON EEPROM indicates how to restore these codes in case of unwanted changes.

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

KEYCLICK ON WITH MEMORIZATION

```
Code: 27 33 53
Hex code: 1B 21 35
Mnemonic: ESC ! 5
```

The keyclick function is switched on so there is a sound feedback when a key is pressed: in detail the buzzer is enabled for a short time if it was disabled and viceversa it is disabled for a short time if it was enabled. So the audible effect of keyclick is always recognizable.

The command store this setting on the on board EEPROM and so maintained also after a power or initialization.

NOTE: This command uses the on board EEPROM, so before executing it is better to check the EEPROM availability through the proper command; in fact if it is not ready the command is ignored.
KEYCLICK OFF WITH MEMORIZATION

| Code:  | 27 33 54  |
| Hex code: | 1B 21 36 |
| Mnemonic: | ESC ! 6 |

The keyclick function is disabled so there is not sound feedback when a key is pressed. The command store this setting on the on board EEPROM and so maintained also after a power or initialization.

NOTE: This command uses the on board EEPROM, so before executing it is better to check the EEPROM availability 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: in detail the buzzer is enabled for a short time if it was disabled and viceversa it is disabled for a short time if it was enabled. So the audible effect of keyclick is always recognizable. This setting is not saved inside the on board EEPROM so after a power or initialization it goes back to the previous condition, already saved on this memory.

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 after a power or initialization it goes back to the previous condition, already saved on this memory.
COMMANDS FOR USER CHARACTERS

**QTP 03** lets the user define and show up to 8 user characters; those characters can be used to represent on display special characters, pseudo graphic characters, special symbols, etc. that are not still available in the same display (please refer to table in APPENDIX B). The user characters can be defined and saved with a pattern equal to a 5 x 8 pixels matrix, so organized:

![Figure 34: User Characters Pattern](image)

The user characters representation is really simple in fact it is sufficient to send the proper code (0 to 7 equal to 8 to 15) with a previous setting of representation mode, through OPERATING MODE SELECTION command.

When the user character are saved their patterns are written on EEPROM and then they are reloaded on display, any time the terminal is powered on.

**NOTE:** On **QTP 03** with fluorescent display the character have a 5 x 7 pixels matrix (Pat 0+Pat 6) and the last row of the pattern is not displayed. Moreover on **QTP 03-F2**, **QTP 03-F4B** and **QTP 03-F24** the value of Pat 7.4 pixel defines the status of all the five pixels Pat 7.4+Pat 7.0, or in other words it defines the status of underline attribute of the defined character.
DEFINITION OF USER CHARACTER

**Code:** 27  66  nchar  Pat 0 ÷ Pat 7
**Hex code:** 1B  42  nchar  Pat 0 ÷ Pat 7
**Mnemonic:** ESC  B  ASCII(nchar)  ASCII(Pat 0) ÷ ASCII(Pat 7)

After the two command identification codes, other 9 bytes must be sent with the following meaning:

- **nchar** (0÷7) (00÷07 Hex) -> Number of user character to define
- **Pat 0** (0÷31) (00÷1F Hex) -> First byte of pattern equal to first high row of character.
- **Pat 7** (0÷31) (00÷1F Hex) -> Seventh byte of pattern equal to last low row of character.

This command loads on the display the pattern of the user character nchar with the value placed in the eight bytes Pat 0 ÷ Pat 7, as described in figure 34; the pattern is only defined but not saved, so if QTP 03 is turned off and on, the user character nchar doesn't maintain the supplied pattern.

For example to define the user character 5 as an empty rectangle with maximum size, the following sequence has to be sent:

```
27  66   5   31  17  17  17  17  17  17  31
```

**DEFINITION AND MEMORIZATION OF USER CHARACTER**

**Code:** 27  33  66  nchar  Pat 0 ÷ Pat 7
**Hex code:** 1B  21  42  nchar  Pat 0 ÷ Pat 7
**Mnemonic:** ESC  !  B  ASCII(nchar)  ASCII(Pat 0) ÷ ASCII(Pat 7)

After the three command identification codes, other 9 bytes must be sent with the following meaning:

- **nchar** (0÷7) (00÷07 Hex) -> Number of user character to define and save
- **Pat 0** (0÷31) (00÷1F Hex) -> First byte of pattern equal to first high row of character.
- **Pat 7** (0÷31) (00÷1F Hex) -> Seventh byte of pattern equal to last low row of character.

This command loads on the display the pattern of the user character nchar with the value placed in the eight bytes Pat 0 ÷ Pat 7, as described in figure 34; the pattern is also saved on EEPROM, so if QTP 03 is turned off and on, the user character nchar mantain the supplied pattern.

**NOTE:** This command uses the on board EEPROM, so before executing it is better to check the EEPROM availability through the proper command; in fact if it is not ready the command is ignored.

Execution time of the command is about **80 msec**. When after the command transmission, several other commands must follow, it is better to insert a delay to avoid receive buffer overflow.
COMMANDS FOR DIGITAL I/OS MANAGEMENT

Below are listed the commands that manage the maximum three digital I/O signals available on QTP 03. The purpose of these commands is the solution of other typical problems of industrial automation, both for the user interface and the machine interface. Among the most frequently applications of these commands, we remind: the signals acquisition from the field (alarms, machine status, stop and start commands, etc.); the setting of field signals (warning lights, LEDs, electric sounders, semaphores, electric valves, etc.); the autonomous visualization of presaved messages, associated to signals status.

As described in all following paragraphs the digital I/Os are referenced by the same name used in connectors descriptions (see figures 18+21) and when required, a sequential numeration starting from 1.

CONFIGURATION OF DIGITAL I/O SIGNALS

**Code:** 27 179 signal cnf  
**Hex code:** 1B B3 signal cnf  
**Mnemonic:** ESC ASCII(179) ASCII(signal) ASCII(cnf)

Defines the configuration of digital I/O identified by signal parameter, using the following correspondence with CN3 signals:

1 -> IO1  
2 -> IO2  
3 -> IO3

The pin configuration, passed in cnf parameter, defines its functionality among the four provided by firmware, and below described:

<table>
<thead>
<tr>
<th>cnf</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Digital inputs with autonomous visualization functions</td>
</tr>
<tr>
<td>1</td>
<td>Digital output with user defined status</td>
</tr>
<tr>
<td>2</td>
<td>Digital input acquired by user</td>
</tr>
<tr>
<td>3</td>
<td>External key</td>
</tr>
</tbody>
</table>

Whenever the command sequence sent to firmware includes not valid data, the command is ignored, viceversa the signals is immediately configured with the passed function and this is also saved on EEPROM; so if QTP 03 is turned off and on, the signal will maintain the function already set.

If, for example, the digital signal IO1 must be configured as digital input, then the following sequence must be sent:

27 179 1 2 or 1B B3 01 02 Hex or ESC ASCII(179) SOH STX

**NOTE:** This command uses the on board EEPROM, so before executing it is better to check the EEPROM availability through the proper command; in fact if it is not ready the command is ignored.

Independently from the preset function for the digital I/Os, after a power on the two signals IO1 and IO2 are used for the verification of the setup entry condition, as described in homonimous paragraph. This entry is subordinated to a quite articulated sequence of status and timings in order to avoid unwanted execution of local setup; the user must anyway ensure that the connected signals don’t generate the described sequence.
WRITE DIGITAL OUTPUTS

Code: 27 166 out
Hex code: 1B A6 out
Mnemonic: ESC ASCII(166) ASCII(out)

All the digital I/Os configured as digital outputs (see CONFIGURATION OF DIGITAL I/O SIGNALS paragraph) are set with out value, according to following correspondence:

\[(\text{MSB}) \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad \text{IO3} \quad \text{IO2} \quad \text{IO1} \quad (\text{LSB})\]

Where IOn stands for the logic state 0 (low signal) or 1 (high signal), that the respective outputs on CN3, must assume.

When the command sequence contains invalid data the command is ignored.

If, for example, only the IO3 and IO1 outputs must be enabled, then the following sequence must be sent:

27 166 05 or 1B A6 05 Hex or ESC ASCII(166) ENQ

NOTE: Please remind that during the power on phase and during the following phase of setup entry condition verification, the IOn signals are always set as inputs and they assume a logic state 1 (high signal). The user must consider this initial condition for example by assuming the digital output are active with a 0 logic state (low signal), in order to maintain the outputs disabled during the described phases.

ACQUIRE DIGITAL INPUTS

Code: 27 167
Hex code: 1B A7
Mnemonic: ESC ASCII(167)

The command first acquires and then returns the status of all digital I/O signals, independently from their configurations (see CONFIGURATION OF DIGITAL I/O SIGNALS paragraph). The status is returned as a value with the following correspondence:

\[(\text{MSB}) \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad \text{IO3} \quad \text{IO2} \quad \text{IO1} \quad (\text{LSB})\]

Where the bits IN0n, stand for the logic state 0 (low signal) or 1 (high signal), currently found on the relative digital lines on CN3.

When more than one digital I/O is configured as external keys, this command is really useful also to check the contemporaneous pression of more keys; this feature adds many other interesting possibilities, that aren’t available with the normal keyboard procedures. In this condition the IOn bits status coincide with the status of the connected keys: the value 0 is equal to key pressed and vice versa.

If, for example, on CN3 the signals I01 and IO2 are low and IO3 is high, then the following data is returned as answer of the command:

4 or 04 Hex or EOT
SET VISUALIZATION FROM I/O SIGNALS

Code: 27 150 cmb messn length shift r c
Hex code: 1B 96 cmb messn length shift r c
Mnemonic: ESC ASCII(150) ASCII(cmb) ASCII(messn) ASCII(length) ASCII(shift) ASCII(r) ASCII(c)

This command sets the visualization autonomously performed by QTP 03, when the status passed in cmb parameter coincides with the status of the digital I/Os configured as visualization inputs (see CONFIGURATION OF DIGITAL I/O SIGNALS paragraph). The correspondence between the status signals and the cmb value is a binary combination type, as below described:

<table>
<thead>
<tr>
<th>IO3</th>
<th>IO2</th>
<th>IO1</th>
<th>cmb</th>
<th>Visualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-&gt; 0</td>
<td>Visualization from combination 0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-&gt; 1</td>
<td>Visualization from combination 1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-&gt; 2</td>
<td>Visualization from combination 2</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>-&gt; 3</td>
<td>Visualization from combination 3</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>-&gt; 4</td>
<td>Visualization from combination 4</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>-&gt; 5</td>
<td>Visualization from combination 5</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>-&gt; 6</td>
<td>Visualization from combination 6</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-&gt; 7</td>
<td>Visualization from combination 7</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-&gt; 8</td>
<td>Power on visualization</td>
</tr>
</tbody>
</table>

With power on visualization is referenced a possible representation that is automatically displayed, immediately after a power on phase, and that stay on display until the first data is received from external master system.

In this paragraph the term visualization and representation always refer to the visual results on the display and it can be selected among many possibilities, defined by the proper parameters requested by the command. In detail it is possible to display: a single message in any position, a static messages sequence (screen) in any position and an auto scrolling messages sequence only on the first row.

For this purpose the parameters have the following meaning:

messn it coincides with the number of the first message to show and the possible others, are those immediately successive on EEPROM. The messn value, in order to be valid, must respect the conditions below described:

0 ≤ messn ≤ max.n. -> to enable visualization or, in other words, it must select an available message (where max.n. is the number of the last message, described in figure 33)

messn=255 (FFH) -> to disable visualization

length it coincides with the length of visualization and it is expressed in a different way according with visualization attribute:

- static visualization (shift=0): it is expressed in messages number. The length value, in order to be valid, must respect the following conditions:

messn+length ≤ max.n. -> it must select available messages (where max.n. is the number of the last message, described in figure 33)

1 ≤ length ≤ 2 -> if display type is 20x2 characters, or
1 ≤ length ≤ 4 -> if display type is 20x4 or 40x2 characters, or on the other hand it must not be greater than display dimension
Visualization associated to I/O combination 000B=0. For example a status message on row 4 of display, without scrolling.

Visualization associated to I/O combination 001B=1. For example an information string on row 2 and 3 of display, without scrolling.

Visualization associated to I/O combination 011B=3. For example an information screen on all the 4 rows of display, without scrolling.

Visualization associated to I/O combination 111B=7. For example a scrolling message on the row 1 of display.

**Figure 35: Example of visualization from I/O signals**
scrolling visualization (shift=255): it is expressed in characters number. The length value, in order to be valid, must respect the following conditions:

- \( \text{length}=0 \) -> stops the scrolling in execution
- \( 20 \leq \text{length} \leq 200 \) -> if display with 20 characters rows
- \( 40 \leq \text{length} \leq 200 \) -> if display with 40 characters rows

\( \text{shift} \) it coincides with the scrolling visualization attribute and it can assume two possible values:
- 0 00H NUL -> static visualization
- 255 FFH ASCII(255) -> scrolling visualization

\( r \) it coincides with the row where the visualization starts when the representation is static (shift=0) and it change according with selected display in the ranges 0-1 or 0-3. When the visualization has the scroll attribute (shift=255) the representation occurs always on the first line of display and the parameter value doesn’t care.

\( c \) it coincides with the column where the visualization starts when the representation is static (shift=0) and it change according with selected display in the ranges 0-19 or 0-39. When the visualization has the scroll attribute (shift=255) the representation occurs always on the first line of display and the parameter value doesn’t care.

Whenever in the received sequence there are not valid data, the command is ignored viceversa the visualization from I/O signals is immediately saved on EEPROM in order to maintain it when power off and on occurs. In fact a frequent use of this command is the arrangement of QTP 03 as stand alone visualization system, that can operate even without the master unit, and for this reason each visualization must be saved, recalled and managed by the single terminal.

The visualizations managed by QTP 03 firmware can be at maximum 9 equal to recognized I/O combinations plus power on. When some of these visualization show messages on position already used by other visualizations, on display it will be visible only the latest.

The QTP 03 periodically checks the digital I/Os configured as visualization inputs and if they have a status equal to the combinations of the active visualizations from I/O, it shows the messages on the display. At the end the cursor is placed in the position that follows the last displayed character, in case of static visualization, while it remains on previous position in case of scrolling visualization.

When a digital I/O signal is not configured as visualization input, in the combination associated to visualization from I/O, it always assumes the logic status 1, indipendently from the real level of the corresponding line IOn.

Please remind that visualization from I/O signals doesn't apply to fast external events in fact, in order to facilitate the reading of the same representations, the QTP 03 use a debouncing time of 500 msec for visualization inputs. In other words a visualization is displayed only if its input combination remains stable for all the described time.

Each representations from I/O signals stops the possible scrolling message visualization that was already under execution and it disables cursor. These choices involve a remarkable aesthetics advantage and cause a little compiliation in user program executed on master unit: re-enable the cursor, through the proper command, when necessary.

For example, if you wish to enable a static visualization of messages 10 and 11 on the second row of display 40x2, when all the IOn signals are high (i.e. from digital I/Os combination 7), it will be necessary to send the following sequence:

\[
27 150 7 10 2 0 1 0 \quad \text{or} \quad 1B 96 07 0A 02 00 01 00 \text{Hex} \quad \text{or} \quad \text{ESC ASCII}(150) \text{ BEL LF STX NUL SOH NUL}
\]
NOTE: This command uses the on board EEPROM, so before executing it is better to check the EEPROM availability through the proper command; in fact if it is not ready the command is ignored.

The visualization from I/O signals, especially those with scrolling attribute, involves a randomic and/or periodic display updating; this operation increments the firmware execution time and consequently slows the interpretation of commands coming from the communication line. So if a great amount of informations must be sent to QTP 03 and the visualization from digital I/Os is enabled, it is suggestable to wait for some msec between the transmission of a 20÷28 bytes data block and the next one, to assure that the terminal has the time to correctly interpret the transmitted data, with no overflow of the receive buffer.
APPENDIX A: COMMANDS SUMMARY TABLES

The following tables list a summary of all the commands recognized by QTP 03 firmware. Please remind that these commands are compatible with ADDS Viewpoint standard. As in all the other descriptions of the manual, the codes are reported in three formats: decimal, hexadecimal and mnemonic, while the last column reports the number of data returned by command.

<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
<th>HEX code</th>
<th>Mnemonic</th>
<th>Ret.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>01</td>
<td>01</td>
<td>SOH</td>
<td>0</td>
</tr>
<tr>
<td>Cursor left</td>
<td>21</td>
<td>15</td>
<td>NACK</td>
<td>0</td>
</tr>
<tr>
<td>Cursor right</td>
<td>06</td>
<td>06</td>
<td>ACK</td>
<td>0</td>
</tr>
<tr>
<td>Cursor down</td>
<td>10</td>
<td>0A</td>
<td>LF</td>
<td>0</td>
</tr>
<tr>
<td>Cursor up</td>
<td>26</td>
<td>1A</td>
<td>SUB</td>
<td>0</td>
</tr>
<tr>
<td>Carriage return</td>
<td>13</td>
<td>0D</td>
<td>CR</td>
<td>0</td>
</tr>
<tr>
<td>Carriage return+line feed</td>
<td>29</td>
<td>1D</td>
<td>GS</td>
<td>0</td>
</tr>
<tr>
<td>Cursor absolute position</td>
<td>27  89 r c</td>
<td>1B 59 r c</td>
<td>ESC Y ASCII(r) ASCII(c)</td>
<td>0</td>
</tr>
<tr>
<td>Back space</td>
<td>08</td>
<td>08</td>
<td>BS</td>
<td>0</td>
</tr>
<tr>
<td>Clear page</td>
<td>12</td>
<td>0C</td>
<td>FF</td>
<td>0</td>
</tr>
<tr>
<td>Clear line</td>
<td>25</td>
<td>19</td>
<td>EM</td>
<td>0</td>
</tr>
<tr>
<td>Clear end of line</td>
<td>27  75</td>
<td>1B 4B</td>
<td>ESC K</td>
<td>0</td>
</tr>
<tr>
<td>Clear end of page</td>
<td>27  107</td>
<td>1B 6B</td>
<td>ESC k</td>
<td>0</td>
</tr>
<tr>
<td>Cursor off</td>
<td>27  80</td>
<td>1B 50</td>
<td>ESC P</td>
<td>0</td>
</tr>
<tr>
<td>Steady cursor on</td>
<td>27  79</td>
<td>1B 4F</td>
<td>ESC O</td>
<td>0</td>
</tr>
<tr>
<td>Blinkling block cursor on</td>
<td>27  81</td>
<td>1B 51</td>
<td>ESC Q</td>
<td>0</td>
</tr>
<tr>
<td>Read version number</td>
<td>27  86</td>
<td>1B 56</td>
<td>ESC V</td>
<td>3</td>
</tr>
<tr>
<td>Operating mode selection</td>
<td>27  65 mode</td>
<td>1B 41 mode</td>
<td>ESC A ASCII(mode)</td>
<td>0</td>
</tr>
<tr>
<td>Fluorescent display brightness setting</td>
<td>27  108 lum</td>
<td>1B 6C lum</td>
<td>ESC 1 ASCII(lum)</td>
<td>0</td>
</tr>
<tr>
<td>Beep</td>
<td>07</td>
<td>07</td>
<td>BEL</td>
<td>0</td>
</tr>
<tr>
<td>BUZZER activation</td>
<td>27  50 255 attr</td>
<td>1B 32 FF attr</td>
<td>ESC 2 ASCII(255) ASCII(attr)</td>
<td>0</td>
</tr>
</tbody>
</table>

**FIGURE A1: COMMANDS CODES SUMMARY TABLE (1 OF 3)**
<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
<th>HEX code</th>
<th>Mnemonic</th>
<th>Ret.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request of EEPROM availability</td>
<td>27  51</td>
<td>1B  33</td>
<td>ESC  3</td>
<td>1</td>
</tr>
<tr>
<td>Write presence byte</td>
<td>27  33 78 byte</td>
<td>1B  21 4E byte</td>
<td>ESC  !  N  ASCII(byte)</td>
<td>0</td>
</tr>
<tr>
<td>Read presence byte</td>
<td>27  33 110</td>
<td>1B  21 6E</td>
<td>ESC  !  n</td>
<td>1</td>
</tr>
<tr>
<td>Key code reconfiguration</td>
<td>27  55 key n.  cod.</td>
<td>1B  37 key n.  cod.</td>
<td>ESC  7 ASCII(key n.) ASCII(cod.)</td>
<td>0</td>
</tr>
<tr>
<td>Keyclick on without memorization</td>
<td>27  53</td>
<td>1B  35</td>
<td>ESC  5</td>
<td>0</td>
</tr>
<tr>
<td>Keyclick off without memorization</td>
<td>27  54</td>
<td>1B  36</td>
<td>ESC  6</td>
<td>0</td>
</tr>
<tr>
<td>Keyclick on with memorization</td>
<td>27  33 53</td>
<td>1B  21 35</td>
<td>ESC  !  5</td>
<td>0</td>
</tr>
<tr>
<td>Keyclick off with memorization</td>
<td>27  33 54</td>
<td>1B  21 36</td>
<td>ESC  !  6</td>
<td>0</td>
</tr>
<tr>
<td>Definition of user character</td>
<td>27  66 nchar Pat0÷Pat7</td>
<td>1B  42 nchar Pat0÷Pat7</td>
<td>ESC  B ASCII(nchar) ASCII(Pat0÷ASCII(Pat7))</td>
<td>0</td>
</tr>
<tr>
<td>Definition and memorization of user character</td>
<td>27  33 66 nchar Pat0÷Pat7</td>
<td>1B  21 42 nchar Pat0÷Pat7</td>
<td>ESC  !  B ASCII(nchar) ASCII(Pat0÷ASCII(Pat7))</td>
<td>0</td>
</tr>
<tr>
<td>Reading of max message number</td>
<td>27  110</td>
<td>1B  6E</td>
<td>ESC  n</td>
<td>1</td>
</tr>
<tr>
<td>Message storage</td>
<td>27  33 67 mess.n.  chr.0÷chr.19</td>
<td>1B  21 43 mess.n. chr.0÷chr.13</td>
<td>ESC  !  C ASCII(mess.n.) ASCII(chr.0÷ASCII(chr.19))</td>
<td>0</td>
</tr>
<tr>
<td>Message reading</td>
<td>27  33 69 mess.n.</td>
<td>1B  21 45 mess.n.</td>
<td>ESC  !  E ASCII(mess.n.)</td>
<td>20</td>
</tr>
<tr>
<td>Visualization of n messages</td>
<td>27  33 68 mess.n.  n</td>
<td>1B  21 44 mess.n.  n</td>
<td>ESC  !  D ASCII(mess.n.) ASCII(n)</td>
<td>0</td>
</tr>
<tr>
<td>Scrolling messages visualization</td>
<td>27  33 83 mess.n.  n.chr</td>
<td>1B  21 53 mess.n.  n.chr</td>
<td>ESC  !  S ASCII(mess.n.) ASCII(n.chr)</td>
<td>0</td>
</tr>
</tbody>
</table>

**Figure A2: Commands codes summary table (2 of 3)**
<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
<th>HEX code</th>
<th>Mnemonic</th>
<th>Ret.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Configuration digital I/O signals</strong></td>
<td>27 179</td>
<td>1B B3</td>
<td>ESC ASCII(179) ASCII(signal) ASCII(cnf)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>signal cnf</td>
<td>signal cnf</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27 166</td>
<td>1B A6</td>
<td>ESC ASCII(166) ASCII(out)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Write digital outputs</strong></td>
<td>27 166</td>
<td>1B A6</td>
<td>ASCII(out)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>out</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Acquire digital inputs</strong></td>
<td>27 167</td>
<td>1B A7</td>
<td>ESC ASCII(167)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Set visualization from I/O signals</strong></td>
<td>27 150</td>
<td>1B 96</td>
<td>ESC ASCII(150) ASCII(cmb) ASCII(messn) ASCII(length) ASCII(shift) ASCII(r) ASCII(c)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>cmb messn length shift r c</td>
<td>1B 96</td>
<td>ASCII(cmb) ASCII(messn) ASCII(length) ASCII(shift) ASCII(r) ASCII(c)</td>
<td>0</td>
</tr>
</tbody>
</table>

**Figure A3: Commands codes summary table (3 of 3)**
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 and according with functionality mode, preselected through proper commands.

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 directly contact grifo®.

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**Figure B2: QTP 03-C2, C4, C24 Characters Table**
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**Figure B3: QTP 03-C4B Characters Table**
APPENDIX C: MOUNTING NOTES

QTP 03 is a single element with the mounted display and, as stated in different points of the manual, for the mechanical mounting it must be used the four holes provided in the display corners. In this appendix firstly are proposed some products that simplify the terminal mounting and secondly are reported the outline dimensions necessary for the user that autonomously perform this operation.

METALLIC CONTAINER

Some models of QTP 03 can be inserted in specific metallic containers with protected front side, with back holes for connections and with predisposition for three visible push button. These containers are accessories for QTP 03 and they can be ordered through the proper codes:

- QTP 72144 for the mounting of QTP 03-C2 and QTP 03-F2 models
- QTP 96192 for the mounting of QTP 03-C4B and QTP 03-F4B models

For detailed information about these products, please consult the relative technical manuals, complete of dimension, assembly instructions, personalization possibilities, etc. Thanks to these accessories you obtain a product that can be easily installed on a panel in a surface or front side mode, or alternatively at sight on a bearing surface, as illustrated in following figures.

FIGURE C1: MOUNTING THROUGH METALLIC CONTAINER
The following figure shows the accessory **QTP 96192** complete of **QTP 03-C4B**, assembled with three push button applied on the front side. In the photo the product has been placed side by side to a **QTP 03-C2** and a **QTP 03-C4B** without container just to underline the mounting facilitations offered by the described accessories.

**FIGURE C2: QTP 96192 CONTAINER AND DISPLAYS**
TERMINAL DIMENSIONS

The following figures report the dimensions, in **mm** and scale is 1:1, of all QTP 03 models.

**FIGURE C3: QTP 03-C2 DIMENSIONS**
Figure C4: QTP 03-C4 Dimensions
FIGURE C5: QTP 03-C4B DIMENSIONS
**FIGURE C6: QTP 03-C24 DIMENSIONS**

- 33.5 mm
- 26.5 mm
- 3.5 mm
- 175 mm
- 3.5 mm
- 182 mm
- ø 3.5 mm mounting hole
- 147.5 mm
- 175 mm
- 182 mm
- 83 mm
- 98 mm
- 3.5 mm
- 11.5 mm
- 3.5 mm
- ø 3.5 mm mounting hole

**Dimensions:**
- 33.5 mm
- 26.5 mm
- 3.5 mm
- 175 mm
- 3.5 mm
- 182 mm
- ø 3.5 mm mounting hole
- 147.5 mm
- 175 mm
- 182 mm
- 83 mm
- 98 mm
- 3.5 mm
- 11.5 mm
- 3.5 mm
- ø 3.5 mm mounting hole
**FIGURE C7: QTP 03-F2 DIMENSIONS**

- **ø 3.5 mm mounting hole**
- 11.5 mm
- 4 mm
- 37 mm
- 29 mm
- 70.8 mm
- 108 mm
- 116 mm
- 17 mm
- 30 mm
- 10 mm
- 98 mm

Dimensions shown in millimeters (mm).
FIGURE C8: QTP 03-F4 DIMENSIONS
**Figure C9: QTP 03-F4B Dimensions**

- **Dimensions:**
  - Length: 99.6 mm
  - Width: 139 mm
  - Height: 146 mm
- **Mounting Hole:** ø 2.5 mm
- **Other Measurements:**
  - ø 0.6 mm
  - ø 0.8 mm
  - ø 8.8 mm
  - ø 7.7 mm
  - ø 3.6 mm

---

**QTP 03**
**Rel. 6.00**

Page C-9
FIGURE C10: QTP 03-F24 DIMENSIONS

- 138.8 mm
- 175 mm
- 182 mm
- 83 mm
- 98 mm
- 33.5 mm
- 26.5 mm
- 3.5 mm
- ø 3.5 mm mounting hole

3.5 mm
11.5 mm
3.5 mm
2.3 mm
0.5 mm
0.4 mm
4.7 mm
5.5 mm
22 mm
APPENDIX D: ALPHABETICAL INDEX

Symbols

.MEX  6, 44

A

ABSOLUTE PLACEMENT OF CURSOR, command  39
Accessories  13, C-1
ACQUIRE DIGITAL INPUTS, command  53
Addressing  34
ADDS Viewpoint  38, A-1
AMP8.Cable  13
ASCII  30, B-1
Assistance  1
Autorepeat  8, 10, 29

B

Backlight  6, 8, 12
BACKSPACE, command  40
Baud rate  11, 28, 37
BEEP, command  42
Bit rate  11, 30
Bits per character  11, 28, 37
BLINKING BLOCK CURSOR ON, command  47
Brightness  42
Buffers  10, 35
Buzzer  5, 17, 29, 42, 48
BUZZER ACTIVATION, command  43

C

Cable length  11, 13, 22
CARRIAGE RETURN, command  39
CARRIAGE RETURN+LINE FEED, command  39
CCITT  16
CD rom  27, 36
Characters  11, 29, 50, B-1
CKS.AMP8  13
CLEAR END OF LINE, command  40
CLEAR END OF PAGE, command  40
CLEAR LINE, command  40
CLEAR PAGE, command  40
CN3  13, 36, 52
  Digital I/Os  20
  External keys  22
  I2C BUS communication line  18
  Power voltage  14
TTL, RS 232 communication line 16
Column 39, 56
Command mode 30, 43
Commands 30, 38, A-1
Characters erasure 40
Cursor attributes 47
Cursor position 38
Digital I/Os management 52
EEPROM 41
General functions 42
Keyboard management 48
Message management 44
User characters 50
Communication 5, 11, 16, 30
I2C BUS 6, 32
Logic protocol 27, 31, 32
Physic protocol 11, 28, 30, 37
TTL, RS 232 6, 31, 36
Type 24, 28
Components map 15
Components side 15
COMx 36, 37
CONFIGURATION OF DIGITAL I/O SIGNALS, command 52
Connections 13, 23
Connectors 12, 17
Container 1, C-1
Contrast 26
CPU 10
Crystal 10
Cursor 11, 38, 39, 47, 56
CURSOR DOWN, command 38
CURSOR LEFT, command 38
CURSOR OFF, command 47
CURSOR RIGHT, command 38
CURSOR UP, command 39

D
Data endurance 35
Debouncing 10, 56
Default configuration 11, 24, 26, 29, 35, 44
DEFINITION AND MEMORIZATION OF USER CHARACTER, command 51
DEFINITION OF USER CHARACTER, command 51
Delays 34, 35, 46, 51, 57
Demo programs 36, 37
Digital I/Os 20, 35, 52
Digital inputs 20, 52
Digital outputs 20, 52
Dimensions 11, C-3
Dimensions QTP 03-C2 C-3
Dimensions QTP 03-C24 C-6
Dimensions QTP 03-C4 C-4
Dimensions QTP 03-C4B C-5
Dimensions QTP 03-F2 C-7
Dimensions QTP 03-F24 C-10
Dimensions QTP 03-F4 C-8
Dimensions QTP 03-F4B C-9
Directive 1
Display 6, 10, B-1, C-1

E
EEPROM 6, 10, 27, 35, 41, 44, 48, 50, 52, 57
ESC 30, 38
ESD 1, 14
Extra voltages 12, 14

F
Features
   Electric 12
   General 4, 10
   Physical 11, C-3
   Technical 10
Filters 14
Firmware 3, 31, 32, 42, A-1
Firmware initialization 27
First purchase 37
Flow charts 31, 32, 33
Flow control 37
Fluorescent 6, 10, B-1
FLUORESCENT DISPLAY BRIGHTNESS SETTING, command 42

G
Ground 14, 16, 18, 20, 22

H
Handshake 37
Hardware 3
Holes C-3
HOME, command 39
How to start 36
Humidity 12
HYPERTERMINAL 37
I

I2C BUS 6, 11, 18, 24, 28, 32, 35
Information 4
Installation 13
Introduction 1

J

Jumpers 17, 26

K

KEY CODE RECONFIGURATION, command 48
Keyboard 8, 22, 28, 48
Keyclick 5, 27, 29, 49
KEYCLICK OFF WITH MEMORIZATION, command 49
KEYCLICK OFF WITHOUT MEMORIZATION, command 49
KEYCLICK ON WITH MEMORIZATION, command 48
KEYCLICK ON WITHOUT MEMORIZATION, command 49
Keys 22, 29, 52
Keys codes 29, 35, 48

L

LCD 6, 10, B-2
License 37
Local setup 27
Location 17

M

Malfunctions 5, 26, 37
Map 15
Master 31, 32
MESSAGE READING, command 45
MESSAGE STORAGE, command 44
Messages 10, 35, 44, 54
Microcontroller 10
Modifications 25
Mounting 11, C-1, C-3

N

Network 10, 19, 33, 34
Noisy 14
Norm. 28, 30
Normative 16, 19, 32
O
Operating mode 30, 43
OPERATING MODE SELECTION, command 43
Options 6, 44, C-1
Overflow 35, 46, 51, 57

P
Parity 11, 28, 37
Patterns 35, 50
PC 37
PC connection 36
Physic protocol 11, 28, 37
Power on 5, 10, 50, 52, 54
Power on visualization 54
Power supply 12, 14
Precision 10
Presence byte 35, 41
PRQTP03.* 36, 37

Q
QTP 72144 C-1
QTP 96192 C-1
QTP EDIT 44
Quotes C-3

R
Read data 33
READ FIRMWARE VERSION, command 42
READ PRESENCE BYTE, command 41
READING OF MAX MESSAGE NUMBER, command 44
Receive buffer 10, 35, 46, 51, 57
Remarks 37
Representation mode 30, 43
REQUEST FOR EEPROM AVAILABILITY, command 41
Resources 10
Row 39, 56
RS 232 16, 24, 26, 31, 36
Rules 1

S
Safety 2
Scale C-3
Scrolling 46, 56
SCROLLING MESSAGES VISUALIZATION, command 46
Serial line 36
SET VISUALIZATION FROM I/O SIGNALS, command 54
Setup 27
Size 11, C-3
Slave address 11, 28, 33, 34
Software 27, 31, 32, 37
Solder side 15
Sound 5, 42, 48, 49
Special characters 30, B-1
STEADY STATIC CURSOR ON, command 47
Stop bit 11, 28, 37
Synchronization 31, 32

T
Temperature 11
Terminal emulation 37
Termination 12, 19
Timing 10, 29
Transmit buffer 10, 35
TransZorb™ 14
Trimmer 17, 26
TTL 8, 11, 16, 21, 24, 26, 31

U
User characters 30, 35, 50, B-1

V
Version 3, 42
Visibility 8, 26
Visualization inputs 21, 35, 54
VISUALIZATION OF N MESSAGES, command 45
Voltages 12

W
Warranty 1
Weight 11
Write data 33
WRITE DIGITAL OUTPUTS, command 53
WRITE OF PRESENCE BYTE, command 41