INTRODUCTION

BASIC 52 is a powerful software tool developed by grifo®, capable of managing a BASIC high level programmation of all Intel 51 family based cards. It is a "romated" software that generates "romable" software in an easy to use environment; it also reduces the necessity of external hardware (in circuit emulator, EPROM programmer, etc.) and at the same time it speeds up the debugging phase of the User application program.

BASIC 52 is referred to generic software tools, but each card has a specific version of software associated to their hardware features; so for each card the name BASIC 52 become BASIC followed by the card final name.

This documentation must be read as "additional up-grade" BASIC 52 manual.

**BASIC 52 FOR GPC® 552 = BASIC 552**

Here follows a summary of the differences between original MCS BASIC 52 and BASIC 552:

<table>
<thead>
<tr>
<th>Removed commands</th>
<th>Removed instructions</th>
<th>Removed operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST#</td>
<td>BAUD</td>
<td>None</td>
</tr>
<tr>
<td>FPROG</td>
<td>PRINT#</td>
<td></td>
</tr>
<tr>
<td>FPROG1</td>
<td>PH0.#</td>
<td></td>
</tr>
<tr>
<td>FPROG2</td>
<td>PH1.#</td>
<td></td>
</tr>
<tr>
<td>FPROG3</td>
<td>PWM</td>
<td></td>
</tr>
<tr>
<td>FPROG4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPROG5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPROG6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Added commands**

- **ERASE** -> Deletes EEPROM content removing all the application program saved in with command PROG, PROG1, ..., PROG6.

**Added instructions**

- **GES_RTC** -> Manages RTC initialize and read.
- **ALARM** -> Manages the several RTC alert modes.
- **A_D** -> Manages the on board A/D acquisitions.
- **SET_PWM** -> Manages CPU PWM lines.
- **BY_EE** -> Performs a byte read or write operation on serial EEPROM.
- **BL_EE2** -> Performs a data block read or write operation on serial EEPROM.
**Added instructions**

- **RW_SFR**
  - Function: Performs SFR read or write operation.
- **COM2**
  - Function: Manages INPUT on the software serial line.
- **PRINT@**
  - Function: Manages OUTPUT on the software serial line.
- **P8255**
  - Function: Manages 82C55 initialization.
- **DISPLAY**
  - Function: Selects and initializes a display.
- **KEYB**
  - Function: Manages all the keyboard operations.
- **Output console redirection**
  - Function: Manages LCD or fluorescent display through BASIC high level instructions.

**Added operators**

- **None**
  - Function: -

**AUTORUN AND DEBUG MODE**

For executing an application program in AUTORUN mode (automatic start after power on or reset), the User must move the DIP 8 on the dip switch **DSW1** to **ON**. While if BASIC 552 must be executed when an AUTORUN condition is present, the User must move the DIP 8 on the dip switch **DSW1** to **OFF**. For summarizing:

- **DSW1.8 OFF**: DEBUG mode.
- **DSW1.8 ON**: RUN mode.

DEBUG mode is really interesting when, for example, a working system must be changed or updated: in this condition the User can simply connect target card to P.C., selecting the DEBUG mode and with BASIC 552, loading, testing and saving a new application program and then set again RUN mode. No hardware must be changed on target card, being possible to make these operations directly "on the field". For setting a program in AUTORUN mode follow these steps:

- Select DEBUG mode (DSW1.8 OFF).
- Type: ERASE <enter>.
- Load the program in memory.
- Type: PROG <enter>
- Type: PROG4 <enter>

**ADDITIONAL INSTRUCTION SYNTAX DESCRIPTION**

To BASIC 552 have been added some new procedures which allow management of GPC® 552 on board hardware. Some external SRAM locations are used for parameters interchange between application program and added procedures and for the same procedures own requirements. This SRAM area is located in **07E00H÷07FFF** addresses range. Before writing an application program, that uses the additional procedures, the User must absolutely execute the command: **MTOP=07DFFH** to avoid overlap between interchange area and BASIC 552 work SRAM area.

The User must not change internal ram locations 018H÷021H because implement the new tokens. The next pages describes additional procedures with information about parameters and execution.
A/D CONVERSION MANAGEMENT PROCEDURE

Syntax: A_D <expr>

Procedure description:
It performs an A/D conversion of one of the eight GPC® 552 analog inputs. The conversion is made on the requested channel, and the result (with 10 bits resolution = 0÷1023), is returned to main program.

Parameters description:

<expr> --> Channel number (0÷7).

Procedure output description (values that must extract through POP ... instruction):

OUTPUT: 0÷1023 --> Conversion result value.
65535 --> Parameter error.

Example:

0   REM ***** Example of A/D conversion.
10  A_D 3 : REM Conversion on channel 3.
20  POP A : REM It reads the conversion value.
30  IF A<>65535 THEN PRINT A : REM It prints the value.
CPU PWM LINES MANAGEMENT PROCEDURE

**Syntax:** SET_PWM <expr1>, <expr2>, <expr3>

**Procedure description:**

It generates PWM signals on CPU line 0 and 1. For calculating the PWM signal frequency and duty cycle the following formulas can be used:

\[
F_{PWM} = \frac{22118400}{(2 \times (1 + PWMP) \times 255)}.
\]

Low/high ration of /PWMn = (PWMn / 255) - PWMn

**Parameters description:**

- `<expr1>` --> PWM line selection (0÷1).
- `<expr2>` --> Frequency (169÷43369 Hz with a 22118400 Hz crystal).
- `<expr3>` --> Duty Cycle (0÷100%).

If `<expr2>` and `<expr3>` are both set to 0 the PWM line is set and maintained at "0" logic value.
If `<expr2>` and `<expr3>` are both set to 1 the PWM line is set and maintained at "1" logic value.

**Procedure output description (values that must extract through POP ... instruction):**

OUTPUT: None.

**Examples:**

0 REM ***** Demo program for generating PWM signal on CPU line 0.
10 SET_PWM 0, 180, 50 : REM It sets PWM0; 180 Hz; 50%.

0 REM ***** Demo program for generating PWM signal on CPU line 1.
10 SET_PWM 1, 180, 50 : REM It sets PWM1; 180 Hz; 50%.

0 REM ***** Demo program for setting PWM line 0 to "0" logic value.
10 SET_PWM 0, 0, 0 : REM It sets PWM0 to "0";

0 REM ***** Demo program for setting PWM line 0 to "1" logic value.
10 SET_PWM 0, 1, 1 : REM It sets PWM0 to "1";

0 REM ***** Demo program for setting PWM line 1 to "0" logic value.
10 SET_PWM 1, 0, 0 : REM It sets PWM1 to "0";

0 REM ***** Demo program for setting PWM line 1 to "1" logic value.
10 SET_PWM 1, 1, 1 : REM It sets PWM1 to "1";
RTC MANAGEMENT PROCEDURE

Syntax: GES_RTC <expr1>, <expr2>, <expr3>, <expr4>, <expr5>, <expr6>, <expr7>, <expr8>

Procedure description:

Initializes the Real Time Clock or returns date or time. Please remark that also when reading data the User must supply all the parameters even if they are not significant.

Parameters description:

<expr1> --> 0 = Read hours, minutes, seconds.
--> 1 = Read day of week, day, month, year.
--> 2 = Clock initialization.
<expr2> --> New value for hours (0÷23).
<expr3> --> New value for minutes (0÷59).
<expr4> --> New value for seconds (0÷59).
<expr5> --> New value for day of week (0÷6).
<expr6> --> New value for day of month (1÷31).
<expr7> --> New value for month (1÷12).
<expr8> --> New value for year (0÷3).

Procedure output description (values that must extract through POP ... instruction):

OUTPUT INITIALIZATION: 0 --> Initialization OK.
<>0 --> The device is not recognized.

OUTPUT READING: 0÷255 --> Read OK.
>255 --> The device is not recognized.

Example:

0 REM ***** Demo program for setting and reading the on board clock.
10 GES_RTC 2,23,59,30,6,31,12,2 : REM Clock initialization.
20 POP A : REM Read the result of the operation
30 IF A<>0 THEN PRINT "INITIALIZATION ERROR" : END
40 GES_RTC 1,0,0,0,0,0,0,0 : REM Date reading.
50 POP SET : POP GIO : POP MES : POP ANN
60 IF (SET>255.OR.GIO>255.OR.MES>255.OR.ANN>255) THEN 120
80 GES_RTC 0,0,0,0,0,0,0,0 : REM Time reading.
90 POP A : POP B : POP C
100 IF (A>255.OR.B>255.OR.C>255) THEN 120
120 PRINT "CLOCK READING ERROR." : END
SERIAL EEPROM BYTE READ/WRITE PROCEDURE

Syntax: 
BY_EE <expr1>, <expr2>, <expr3>

Procedure description:
It performs a byte read or write operation on serial EEPROM (IC24) or on PCF 8583 (IC25) at a specified address.
The User must remember that in read procedure the <expr3> parameter must be given even if it has no meaning.

Parameters description:

<expr1> --> 0 = Reading of a byte.
--> 1= Writing of a byte.
<expr2> --> Location address (0÷<last device address>.
<expr3> --> Byte to write (0÷255).

Serial EEPROM and SRAM RTC addresses range:
0000H÷00FFH -> selection SRAM RTC (IC25)
0430H÷04FFH -> selection EEPROM 24c02 (IC24)
0430H÷05FFH -> selection EEPROM 24c04 (IC24)
0430H÷07FFH -> selection EEPROM 24c08 (IC24)

Procedure output description (values that must extract through POP ... instruction):

OUTPUT WRITING: 0 --> Writing OK.
1 --> Wrong parameters.
2 --> The device is not recognized.

OUTPUT READING: 0÷255 --> Reading OK.
256 --> Wrong parameters.
257 --> The device is not recognized.

Examples:

0 REM ***** Demo for WRITING the byte 85 at address 100 of serial EEPROM
10 BY_EE 1,100,85 : REM It selects WRITE operation
20 POP A : REM It reads the operation result

0 REM ***** Demo for READING the byte at address 100 of serial EEPROM
10 BY_EE 0,100,0 : REM It selects READ operation
20 POP A : REM It reads the value and the operation result
SERIAL EEPROM DATA BLOCK READ/WRITE PROCEDURE

Syntax:  BL_EE2 <expr1>, <expr2>, <expr3>

Procedure description:

It performs a data block read or write operation at a specified address, on serial EEPROM (IC24) or on PCF 8583 (IC25). The W/R data buffer is located in EXTERNAL SRAM in 07E00H-07EFF addresses range.

Parameters description:

<expr1> --> 0 = Reading of a data block.
--> 1= Writing of a data block.
<expr2> --> Initial location address (0÷<last device address).
<expr3> --> Number of bytes to write or read (1÷255).

Serial EEPROM and SRAM-RTC addresses range:

0000H÷00FFH -> selection SRAM RTC (IC25)
0430H÷04FFH -> selection EEPROM 24c02 (IC24)
0430H÷05FFH -> selection EEPROM 24c04 (IC24)
0430H÷07FFH -> selection EEPROM 24c08 (IC24)

Procedure output description (values that must extract through POP ... instruction):

OUTPUT:  0 --> Reading/Writing OK.
         1 --> Wrong parameters.
         2 --> The device is not recognized.

Examples:

0 REM ***** Demo for WRITING 3 bytes starting from address 100 of SRAM RTC.
10 XBY(07E00H)=1
20 XBY(07E01H)=2
30 XBY(07E02H)=3
10 BL_EE2 1,100,3 : REM Performs block write.
20 POP A : REM It reads the operation result.

0 REM ***** Demo for READING 3 bytes starting from address 100 of SRAM RTC.
10 XBY(07E00H)=0 : REM Sets reception buffer content to zero.
20 XBY(07E01H)=0
30 XBY(07E02H)=0
40 BL_EE2 0,100,3 : REM Performs block read.
50 POP A : REM It reads the operation result.
60 FOR I=07E00H TO 07E02H : REM Prints Reception buffer content.
70 PRINT XBY(I),
80 NEXT I
SPECIAL FUNCTION REGISTERS READ OR WRITE PROCEDURE

Syntax: RW_SFR <expr1>, <expr2>, <expr3>

Procedure description:

It performs a special function register (SFR) read or write operations. The User should remember that in "read procedure" the <expr3> parameter must be given even if it has no meaning. The SFR identification byte is a numeric code, with the following meaning:

<table>
<thead>
<tr>
<th>SFR NAME</th>
<th>IDENTIFICATION SFR BYTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTCON</td>
<td>0</td>
</tr>
<tr>
<td>CTH3</td>
<td>1</td>
</tr>
<tr>
<td>CTH2</td>
<td>2</td>
</tr>
<tr>
<td>CTH1</td>
<td>3</td>
</tr>
<tr>
<td>CTH0</td>
<td>4</td>
</tr>
<tr>
<td>CMH2</td>
<td>5</td>
</tr>
<tr>
<td>CMH1</td>
<td>6</td>
</tr>
<tr>
<td>CMH0</td>
<td>7</td>
</tr>
<tr>
<td>CTL3</td>
<td>8</td>
</tr>
<tr>
<td>CTL2</td>
<td>9</td>
</tr>
<tr>
<td>CTL1</td>
<td>10</td>
</tr>
<tr>
<td>CTL0</td>
<td>11</td>
</tr>
<tr>
<td>CML2</td>
<td>12</td>
</tr>
<tr>
<td>CML1</td>
<td>13</td>
</tr>
<tr>
<td>CML0</td>
<td>14</td>
</tr>
<tr>
<td>IEN1</td>
<td>15</td>
</tr>
<tr>
<td>IP1</td>
<td>16</td>
</tr>
<tr>
<td>RTE</td>
<td>17</td>
</tr>
<tr>
<td>S1ADR</td>
<td>18</td>
</tr>
<tr>
<td>S1DAT</td>
<td>19</td>
</tr>
<tr>
<td>S1STA</td>
<td>20</td>
</tr>
<tr>
<td>S1CON</td>
<td>21</td>
</tr>
<tr>
<td>STE</td>
<td>22</td>
</tr>
<tr>
<td>TMH2</td>
<td>23</td>
</tr>
<tr>
<td>TML2</td>
<td>24</td>
</tr>
<tr>
<td>TM2CON</td>
<td>25</td>
</tr>
<tr>
<td>TM2IR</td>
<td>26</td>
</tr>
<tr>
<td>T3</td>
<td>27</td>
</tr>
<tr>
<td>P4</td>
<td>28</td>
</tr>
<tr>
<td>P5</td>
<td>29</td>
</tr>
</tbody>
</table>

Parameters description:

<expr1> --> 0÷1 = R/W selection byte (0=Reading; 1=Writing).
<expr2> --> 0÷29 = SFR identification byte.
<expr3> --> 0÷255 = Byte to write (must be provided also for writing operations).
Procedure output description (values that must extract through POP ... instruction):

OUTPUT WRITING:
- 0 = Writing OK.
- 65535 = Wrong parameters.

OUTPUT READING:
- 0÷255 = Read value.
- 65535 = Wrong parameters.

Examples:

0 REM ***** Demo for writing byte 85 in P4
10 RW_SFR 1,28,85 : POP A

0 REM ***** Demo for P4 reading
10 RW_SFR 0,28,0 : POP A
20 IF A<>65535 THEN ? "P4= ",A

PROCEDURE FOR 82C55 INITIALIZATION USED IN REDIRECTION OF INPUT AND OUTPUT

Syntax: P8255 <expr>

Procedure description:

This instruction initializes the 82c55 for managing the QTP24P operator panel. Please remember that this function must be called only once before using operator panel management instructions like KEYB, DISPLAY, UO1.

Parameters description:

- <expr> --> 0 = PORTB in INPUT.
- --> 1 = PORTB in OUTPUT.

Examples:

0 REM ***** Demo for managing QTP 24P.
5 P8255 0 : REM 82c55 initilaized for PORTB in INPUT.
7 XBY(0FFFCH)=XBY(0FFFCH).OR.1 : REM PULL-UP actived on the lines.
10 DISPLAY 5 : REM Display LCD20x4 selected.
20 UO1 : REM OUTPUT redirection enabled
30 PRINT "GRIFO", : REM Prints a string on the display
40 UO0 : REM OUTPUT redirection disabled
KEYBOARD MANAGEMENT PROCEDURE

**Syntax:**  KEYB <expr>

**Procedure description:**

It enables or disables the matrix keyboard scanning and reads the possible key pressed code. This procedure can start or stop a periodic QTP 24P keyboard scanning, with debouncing on the pressed key, or it can return the pressed key code (0 if no key is pressed) through the stack. The device managed is a 4*6 matrix keyboard directly connected to CN2 of GPC® 552. The following table shows the ASCII code returned with relative I/O lines:

<table>
<thead>
<tr>
<th>CN2-PIN 11 (PC.4)</th>
<th>CN2-PIN 12 (PC.5)</th>
<th>CN2-PIN 9 (PC.6)</th>
<th>CN2-PIN 10 (PC.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN2-PIN 5 (PA.5)</td>
<td>68</td>
<td>66</td>
<td>65</td>
</tr>
<tr>
<td>CN2-PIN 6 (PA.4)</td>
<td>72</td>
<td>70</td>
<td>69</td>
</tr>
<tr>
<td>CN2-PIN 3 (PA.3)</td>
<td>76</td>
<td>74</td>
<td>73</td>
</tr>
<tr>
<td>CN2-PIN 4 (PA.2)</td>
<td>54</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>CN2-PIN 1 (PA.1)</td>
<td>13</td>
<td>57</td>
<td>56</td>
</tr>
<tr>
<td>CN2-PIN 2 (PA.0)</td>
<td>55</td>
<td>53</td>
<td>49</td>
</tr>
</tbody>
</table>

**Parameters description:**

<expr> --> 0 = Keyboard scanning OFF.
--> 1 = Keyboard scanning ON.
--> 2 = Return the pressed key code (0 if no key is pressed) through the stack.

The keyboard scanning is enabled if it was OFF.

**Procedure output description (values that must extract through POP ... instruction):**

OUTPUT:  
0 = No key pressed.
nn = Pressed key code (refer to the terminal keys map).
65535 = Wrong parameter.

**Example:**

In the following demo program, it is enabled the matrix keyboard scanning and a loop is performed. In this loop the pressed key is controlled and when the 48 key code is pressed, the loop is terminated and the keyboard scanning is disabled.

0 REM ***** Demo for external keyboard management.
5 P8255 0 : REM 82c55 initialization with PORTB in INPUT.
7 XBY(0FFFCH)=XBY(0FFFCH).OR.1 : REM Activation PULL-UP on the lines.
10 KEYB 1 : POP A : REM It enables keyboard scanning
20 KEYB 2 : POP A : REM It reads the key pressed code
30 IF A<>48 THEN 20
40 KEYB 0 : POP A : REM It disables keyboard scanning
50 END
QTP 24P TERMINAL KEYS MAP

N° 0  N° 1  N° 2  N° 3  N° 12  N° 13  N° 14  N° 15
N° 4  N° 5  N° 6  N° 7  N° 16  N° 17  N° 18  N° 19
N° 8  N° 9  N° 10  N° 11  N° 20  N° 21  N° 22  N° 23
### KEYS CODES ON QTP 24P

<table>
<thead>
<tr>
<th>KEY N°</th>
<th>CODE</th>
<th>HEX CODE</th>
<th>MNEMONIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>65</td>
<td>41</td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>66</td>
<td>42</td>
<td>B</td>
</tr>
<tr>
<td>2</td>
<td>67</td>
<td>43</td>
<td>C</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>44</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>69</td>
<td>45</td>
<td>E</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>46</td>
<td>F</td>
</tr>
<tr>
<td>6</td>
<td>71</td>
<td>47</td>
<td>G</td>
</tr>
<tr>
<td>7</td>
<td>72</td>
<td>48</td>
<td>H</td>
</tr>
<tr>
<td>8</td>
<td>73</td>
<td>49</td>
<td>I</td>
</tr>
<tr>
<td>9</td>
<td>74</td>
<td>4A</td>
<td>J</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
<td>4B</td>
<td>K</td>
</tr>
<tr>
<td>11</td>
<td>76</td>
<td>4C</td>
<td>L</td>
</tr>
<tr>
<td>12</td>
<td>49</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>50</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>51</td>
<td>33</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>52</td>
<td>34</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>53</td>
<td>35</td>
<td>5</td>
</tr>
<tr>
<td>17</td>
<td>54</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>18</td>
<td>55</td>
<td>37</td>
<td>7</td>
</tr>
<tr>
<td>19</td>
<td>56</td>
<td>38</td>
<td>8</td>
</tr>
<tr>
<td>20</td>
<td>27</td>
<td>1B</td>
<td>ESC</td>
</tr>
<tr>
<td>21</td>
<td>57</td>
<td>39</td>
<td>9</td>
</tr>
<tr>
<td>22</td>
<td>48</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>13</td>
<td>0D</td>
<td>CR</td>
</tr>
</tbody>
</table>
DISPLAY SELECTION AND INITIALIZATION PROCEDURE

**Syntax:** DISPLAY <expr>

**Procedure description:**

Initializes the selected display. Please remark before using output redirection (UO 1) the User must invoke this function to select the display.

**Parameters description:**

<expr> -->

<table>
<thead>
<tr>
<th>Value</th>
<th>Display Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>FUTABA 20x2</td>
</tr>
<tr>
<td>1</td>
<td>FUTABA 40x1</td>
</tr>
<tr>
<td>2</td>
<td>FUTABA 40x2</td>
</tr>
<tr>
<td>3</td>
<td>FUTABA 40x4</td>
</tr>
<tr>
<td>4</td>
<td>LCD 20x2</td>
</tr>
<tr>
<td>5</td>
<td>LCD 20x4</td>
</tr>
<tr>
<td>6</td>
<td>LCD 40x1</td>
</tr>
<tr>
<td>7</td>
<td>LCD 40x2</td>
</tr>
<tr>
<td>8</td>
<td>LCD 40x4</td>
</tr>
</tbody>
</table>

**Procedure output description (values that must extract through POP ... instruction):**

OUTPUT: None.

**Example:**

10  DISPLAY 5 : REM Selects display LCD20x4.
20  UO1 : REM OUTPUT redirection enabled
30  PRINT "GRIFO", : REM Prints a string to the display
40  UO0 : REM OUTPUT redirection disabled
SOFTWARE SERIAL LINE MANAGEMENT PROCEDURE

Syntax:  COM2 <expr>

Procedure description:

This procedure manages all the operations on the software serial line (TXB=PIN 1 on CN5; RXB=PIN 2 on CN5). For the transmission on this line the User must use the PRINT@ ... instruction, while for the reception, there is a buffer (64 characters long) allocated in the EXTERNAL SRAM in 07F00H÷07F3FH addresses range. If the software serial line management is active, the User can't use the TIMER 0 instructions because this timer is used as baud rate generator.

Parameters description:

<expr> --> 0 = It disables the software serial line
1 = It enables the software serial line at 1200 BAUD
2 = It enables the software serial line at 2400 BAUD
3 = It enables the software serial line at 4800 BAUD
4 = It reads the number of characters already saved in the reception buffer
5 = It resets the reception buffer

Procedure output description (values that must extract through POP ... instruction):

OUTPUT:         0 = Operation OK if <expr>=0, 1, 2, 3, 5.
0÷63 = Number of received characters if <expr>=4.
65535 = Wrong parameters.

Example:

0 REM ***** Demo for the software serial line
10 COM2 1 : POP B : REM It enables the software serial line management at 1200 BAUD
20 A=GET
30 IF A=0 THEN GOTO 70 : REM Has a character been received from the serial line ?
40 IF A=70 THEN GOTO 140 : REM Is "F" the received character ?
50 PRINT@ CHR(A), : REM Transmission of the character on the software serial line
60 GOTO 20
70 COM2 4 : POP A : REM Request of the number of received characters
80 IF A<>1 THEN 20
90 FOR I=0 TO A-1
100 PRINT CHR(XBY(07F00H+I)),
110 NEXT I
120 COM2 5 : POP B : REM It resets the reception buffer
130 GOTO 20
140 COM2 0 : POP B : REM It disables the software serial line management
150 END
RTC INTERRUPT MANAGEMENT PROCEDURE

Syntax:    ALARM <expr1>, <expr2>, <expr3>, <expr4>, <expr5>, <expr6>, <expr7>, <expr8>

Procedure description:

This procedure enables the RTC (IC25) interrupt, so it is possible to use this procedure to generate time bases or manage alarms. For further informations about how to use the RTC, please refer to the manufacturer documentation.

Please remark that RTC interrupt management is possible on GPC® 552 only connecting jumper J13 in position 1-2. In this situation the RTC interrupt signal will be connected to CPU signal /INT1, which will be managed by function ONEX1 of BASIC 552.

Parameters description:

<expr1>  -->  0 = Sets NO CLOCK ALARM (ALARM MODE).
              1 = Sets DAILY ALARM (ALARM MODE).
              2 = Sets WEEKDAY ALARM (ALARM MODE).
              3 = Sets DATED ALARM (ALARM MODE).
              4 = Sets TIMER (TIMER MODE).
              5 = Resets ALARM flag.

TIMER MODE
<expr2>  -->  0÷99 = Count value.
<expr3>  -->  0 = No timer.
              1 = Counts "HUNDREDTH OF SECOND".
              2 = Counts "SECONDS".
              3 = Counts "MINUTES".
              2 = Counts "HOURS".
              2 = Counts "DAYS".

ALARM MODE
<expr2>  -->  Value for hours (0÷23).
<expr3>  -->  Value for minutes (0÷59).
<expr4>  -->  Value for seconds (0÷59).
<expr5>  -->  Value for day of week (0÷6).
<expr6>  -->  Value for day of month (1÷31).
<expr7>  -->  Value for month (1÷12).
<expr8>  -->  Value for year (0÷3).

Procedure output description (values that must extract through POP ... instruction):

OUTPUT:    0 = OK
            1 = Error accessing RTC.
            2 = Wrong parameters.
Examples:

0  REM ***** Demo for generating a time base of 1 second.
10  MTOP=07DFFH
20  B=1 : REM Initialization interrupts number counter.
30  ALARM 4, 1, 2, 0, 0, 0, 0, 0, 0, 0 : POP C : REM Trigger on interrupt each second.
40  ONEX1 100
50  GOTO 50
100  ? "Number of interrupts counted= ", B
110  B=B+1
120  ALARM 5, 0, 0, 0, 0, 0, 0, 0, 0, 0 : POP C : REM Resets alarm flag
130  RETI

0  REM ***** Demo for generating an interrupt at a specified date and time.
10  MTOP=07DFFH
20  ALARM 3, 12, 30, 0, 0, 3, 25, 12, 1 : POP C : REM Interrupt on December 25th 1997 12:30:00.
30  ONEX1 100
40  GOTO 40
100  ? "Alarm triggered."
110  ALARM 5, 0, 0, 0, 0, 0, 0, 0, 0, 0 : POP C : REM Resets alarm flag
120  RETI
USER OUTPUT REDIRECTION PROCEDURE

BASIC 552 includes specific software procedures to solve the User interface problems. In the standard industrial applications, the User interface is realized with displays and custom keyboards; so BASIC 552 provides high level procedure for these components. Normally BASIC performs User interface or console operations through the target card serial line, but at the same time it has the possibility to redirect console operations to other hardware devices, thanks to specific software (for further information, please read UO0, UO1 instructions).

The User output can be redirected to fluorescent or LCD displays, simply using the PRINT instruction.

Example:

5 P8255 0 : REM 82C55 initialization for operator panel management.
7 XBY(0FFFCH)=XBY(0FFFCH).OR.1 : REM Actication of PULL-UP on the lines.
10 DISPLAY 5 : REM LCD20x4display selection.
20 UO1 : REM It enables output redirection.
30 PRINT "Hello" , : REM It prints a string on the display.
40 PRINT "Grifo" , : REM It prints a string on the display.
50 PRINT CHR(1) , : REM Cursor in HOME position.
60 PRINT CHR(27) , PRINT CHR(80) , : REM Cursor OFF.
70 UO0 : REM It disables output redirection.

QTP 24P shows on its display all the characters having a code in the range $32\div255$ ($20\divFF$ Hex); if it is sent a code not included in this range and this latter is not a command, it is ignored. The characters of the codes in the range $32\div127$ ($20\div7F$ Hex) correspond to the ones of the standard ASCII table, while characters associated to $128\div255$ ($80\divFF$ Hex) codes, may show different symbols depending on the type of the display installed. This is the reason why it is opportune to refer to the Tables at the end of this documentation.

The character is visualized in the at-the-moment cursor position and this latter will go the the next position; if it is placed in the last character down on the right of the display, it will be placed to the Home position.
COMMANDS FOR CURSOR POSITIONING

CURSOR LEFT

*Code:* 21 (15Hex)
*Mnemonic:* NACK

The cursor is shifted of one position on the left without modifying the display contents. If the cursor is in Home position, it will be placed in the last character at the down-right position of the display.

CURSOR RIGHT

*Code:* 06
*Mnemonic:* ACK

The cursor is shifted of one position on the right. If the cursor is placed on the last display character, down-right, it will be placed on the Home position.

CURSOR DOWN

*Code:* 10 (0A Hex)
*Mnemonic:* LF

The cursor will be placed on the next line of the one it is now but it will remain in the same column. If the cursor is in the last display line, it will be placed at the first display line.

CURSOR UP

*Code:* 26 (1A Hex)
*Mnemonic:* SUB

The cursor will be placed in the previous line of the one it is now, but it will remain in the same column. If the cursor is on the first display line, it will be placed on the last display line.

HOME

*Code:* 01
*Mnemonic:* SOH

The cursor is on Home position i.e. first line, first column of the display.
CARRIAGE RETURN

*Code:* 13 (0D Hex)  
*Mnemonic:* CR

The cursor is placed at the beginning of the line where it is.

CARRIAGE RETURN+LINE FEED

*Code:* 29 (1D Hex)  
*Mnemonic:* GS

The cursor is placed at the beginning of next line at which it was placed. If the cursor is at the last display line, it will be placed at the beginning of the first line i.e Home position.

CURSOR ABSOLUTE POSITIONING WITH 20H OFFSET

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

The cursor is placed at the absolute point indicated through "r" and "c". These codes are referred to line and column values of the display at which the 32 (20 Hex) offset must be add. If, for example, you wish to place the cursor at Home position (0 line, 0 column) the next sequence is necessary 27 89 32 32. If line and column values are not compatible to the installed display, that command is ignored.
COMMANDS FOR CHARACTERS ERASURE

BACKSPACE

*Code:* 08
*Mnemonic:* BS

The cursor shifts a character on the left by erasing the contents of the reached cell. If the cursor is at Home position, the character placed in the last cell, down-on the right of the display, will be erased.

CLEAR PAGE

*Code:* 12 (0C Hex)
*Mnemonic:* FF

Complete erasure of the display and the cursor returns to Home position.

CLEAR LINE

*Code:* 25 (19 Hex)
*Mnemonic:* EM

The complete line where cursor is placed is erased and then the cursor goes at the beginning of the said line.

CLEAR END OF LINE

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

All characters on the line where the cursor is placed are erased starting from cursor position up to the end of the line. The cursor stays on the position as it was when Clear End of Line code arrives. If, for example, the cursor is at the beginning of a display line, the complete line will be erased.

CLEAR END OF PAGE

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

All characters starting from the Cursor point up to the end of the display, are erased. The cursor stays in the same position as it was before the Clear End of Page code arrival. If, for example, the cursor is at Home position, the display will be completely erased.
COMMANDS FOR CURSOR ATTRIBUTES MANAGEMENT

CURSOR OFF

*Code:* \[27 80 \text{(1B 50Hex)}\]  
*Mnemonic:* ESC P

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

STATIC CURSOR ON

*Code:* \[27 79 \text{(1B 4F Hex)}\]  
*Mnemonic:* ESC O

The cursor is started so it is visible. Now it is a not blinking line placed under the char.

*Note:* This command is not available if *Futaba 40x4* display is installed.

BLINKING "UNDERLINE" CURSOR

*Code:* \[27 77 \text{(1B 4D Hex)}\]  
*Mnemonic:* ESC M

The cursor is started so it is visible. Now it is a blinking line placed under the char.

*Note:* This command is available only for *Futaba* displays: 20x2 and 40x1 type.

BLINKING "BLOCK" CURSOR

*Code:* \[27 81 \text{(1B 51 Hex)}\]  
*Mnemonic:* ESC Q

The cursor is started so it is visible. Now it is a blinking rectangular form and it is alternatively visualized with the char put on the same.

*Note:* This command is available only for *LCD* displays otherwise is ignored.
COMMANDS FOR LEDS MANAGEMENT

LED ACTIVATION

**Code:** 27 50 n.LED Attr. (1B 32 n.LED Attr. Hex)

**Mnemonic:** ESC 2 ASCII(n.LED) ASCII(Attr.)

The LED shown in “n.LED” with the specified attribute in “Attr.” is started.
If you use the QTP 24P card LEDs numbers are included in a range of 0÷15 as shown in the picture of the card.
The attributes available are as follows:

- 0 Not enabled LED
- 255 (FF Hex) Enabled LED
- 85 (55Hex) Blinking LED

ex. If you wish to enable LED n.5 with blinking attribute, the following sequence has to be sent: 27 50 5 85.
If the parameter with LED number or that one with the attribute, it is not valid, the command is ignored.

LED MASK ACTIVATION

**Code:** 27 52 byte1 byte2 byte3 (1B 34 byte1 byte2 byte3 Hex)

**Mnemonic:** ESC 4 ASCII(byte1) ASCII(byte2) ASCII(byte3)

All QTP 24P LEDs are contemporarily managed as indicated in "byte1", "byte2" and "byte3" following this code:

- byte1 (bit 0...7) LED 0...LED 7
- byte2 (bit 0...7) LED 8...LED 15
- byte3 (bit0...5) Reserved

If a bit is placed in 0 position, the correspondent LED is OFF, vice versa it will be ON if the correspondent bit is on 1 position.
If there are some LEDs having the blinking attribute, this latter will be desabled.
For QTP 24P the "byte3" must be always sent even if it has no meaning for running the 16 LEDs of the said terminal.
COMMANDS FOR KEYBOARD MANAGEMENT

KEY RECONFIGURATION

*Code:* 27 55  key no. code  (1B 37  key no. code  Hex)
*Mnemonic:* ESC 7 ASCII( key no.) ASCII(code)

When the selected key is reconfigured, each time it is pressed, the card will send the new specified code in serial mode. The number of the key to be reconfigured is obtainable by looking at the QTP 24P picture and it must be included in a range of 0÷23 (0÷17 Hex) if this is not done the command is ignored. The code value can vary in a range of 0÷254 (0÷FE Hex) as the 255 value (FF Hex) indicates that the key must be desabled so when it is pressed the card will not send any codes.

P.S.
The said command needs a data writing on the on-board EEPROM so before executing it, it is better to be sure that the card is ready for a new writing on such device otherwise the command will be ignored.
BXC51 COMPILER REL. 5.0 USE

BXC51 compiler Rel. 5.0 is a software tool used to compile a BASIC 52 source program obtaining a directly executable code for the target card. In this way the application program execution speed is notably incremented, in fact the program is not interpreted by BASIC 52, but directly executed by microprocessor.

BXC51 can be used with the BASIC 552 new features, typing some options on the command line as described below:

BXC51 -2 -b<BAUD> -c7F00 -u7DFF -bCRUNxxyy <File Name> (SRAM=32K)

CRUNxxyy.BXL is a library delivered by grifo® where xx indicates the crystal frequency and yy is the version number. This library is supplied with BXC51 package.

The option -b<BAUD> informs the compiler that automatic baud rate search routine must not be inserted in the generated code and it must initialize serial line with a fixed baud rate = BAUD. The allowed value for BAUD parameter are: 1200, 2400, 4800, 9600, 19200.

Please remark that if the crystal frequency is 22118400 Hz the real baud rate will be twice the declared baud rate. For example: if the declared baud rate is 19200 (-b19200) then the real baud rate will be 38400 BAUD.

If the frequency of the on board crystal is not multiple of 11059200 Hz, the option -b<BAUD> has the only effect to avoid to generate the code for automatic baud rate detection.

Moreover to set correctly the desired baud rate, in the BASIC source program must be added the instruction to set directly the internal microprocessor register. Here follows an example for a card running at 14.7456 MHz:

0      REM ***** Original source program
10     PRINT "Hello word"

0      REM ***** Source program modified for BXC51 compiler
5      TIMER1=0FCFCH : REM Baud=19200.
10     PRINT "Hello word"

For further information on the other BXC51 command line options please refer to BXC51 documentation.
### QTP 24P Command Codes Summary Table

<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
<th>HEX Code</th>
<th>Mnemonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOME</td>
<td>01</td>
<td>01</td>
<td>SOH</td>
</tr>
<tr>
<td>CURSOR LEFT</td>
<td>21</td>
<td>15</td>
<td>NACK</td>
</tr>
<tr>
<td>CURSOR RIGHT</td>
<td>06</td>
<td>06</td>
<td>ACK</td>
</tr>
<tr>
<td>CURSOR DOWN</td>
<td>10</td>
<td>0A</td>
<td>LF</td>
</tr>
<tr>
<td>CURSOR UP</td>
<td>26</td>
<td>1A</td>
<td>SUB</td>
</tr>
<tr>
<td>CARRIAGE RETURN</td>
<td>13</td>
<td>0D</td>
<td>CR</td>
</tr>
<tr>
<td>CR+LF</td>
<td>29</td>
<td>1D</td>
<td>GS</td>
</tr>
<tr>
<td>Cursor absolute positioning with 20H OFFSET</td>
<td>27 89 r c</td>
<td>1B 59 r c</td>
<td>ESC Y ASCII(r) ASCII(c)</td>
</tr>
<tr>
<td>BACKSPACE</td>
<td>08</td>
<td>08</td>
<td>BS</td>
</tr>
<tr>
<td>CLEAR PAGE</td>
<td>12</td>
<td>0C</td>
<td>FF</td>
</tr>
<tr>
<td>CLEAR LINE</td>
<td>25</td>
<td>19</td>
<td>EM</td>
</tr>
<tr>
<td>CLEAR END OF LINE</td>
<td>27 75</td>
<td>1B 4B</td>
<td>ESC K</td>
</tr>
<tr>
<td>CLEAR END OF PAGE</td>
<td>27 107</td>
<td>1B 6B</td>
<td>ESC k</td>
</tr>
<tr>
<td>Cursor OFF</td>
<td>27 80</td>
<td>1B 50</td>
<td>ESC P</td>
</tr>
<tr>
<td>Static cursor ON</td>
<td>27 79</td>
<td>1B 4F</td>
<td>ESC O</td>
</tr>
<tr>
<td>Blinking &quot;UNDERLINE&quot; cursor</td>
<td>27 77</td>
<td>1B 4D</td>
<td>ESC M</td>
</tr>
<tr>
<td>Blinking &quot;BLOCK&quot; cursor</td>
<td>27 81</td>
<td>1B 51</td>
<td>ESC Q</td>
</tr>
<tr>
<td>LED activation</td>
<td>27 50</td>
<td>n.LED Attr.</td>
<td>1B 32 n.LED Attr.</td>
</tr>
<tr>
<td>LEDS mask activation</td>
<td>27 52</td>
<td>byte1 byte2 byte3</td>
<td>1B 34 byte1 byte2 byte3</td>
</tr>
<tr>
<td>Key reconfiguration</td>
<td>27 55</td>
<td>key no. cod.</td>
<td>1B 37 key no. cod.</td>
</tr>
</tbody>
</table>
## DISPLAYS CHARACTERS TABLES

### LCD 20x2 CHARACTERS TABLE

<table>
<thead>
<tr>
<th>Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG RAM (1)</td>
<td>!</td>
<td>@</td>
<td>#</td>
<td>$</td>
<td>%</td>
<td>^</td>
<td>&amp;</td>
<td>*</td>
<td>(</td>
<td>)</td>
<td>_</td>
<td>+</td>
<td>=</td>
<td>?</td>
<td>`</td>
<td>-</td>
</tr>
<tr>
<td>CG RAM (2)</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
<td>!</td>
</tr>
</tbody>
</table>

**BASIC 552 Rel. 3.2**
## LCD 20x4 and 40x2 Characters Table

<table>
<thead>
<tr>
<th>Lower 16-bit</th>
<th>Upper 16-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0AP fh</td>
<td>-7i0p</td>
</tr>
<tr>
<td>!1Aoa q</td>
<td>7a4a q</td>
</tr>
<tr>
<td>#2Brbr</td>
<td>「イ」xp</td>
</tr>
<tr>
<td>#3DScs</td>
<td>ウテクス</td>
</tr>
<tr>
<td>#4DTdt</td>
<td>イフフ</td>
</tr>
<tr>
<td>%5EUeu</td>
<td>オジウ</td>
</tr>
<tr>
<td>&amp;6FUVv</td>
<td>ハコペ</td>
</tr>
<tr>
<td>7GWw</td>
<td>AEFjG</td>
</tr>
<tr>
<td>8HXhx</td>
<td>イフフ</td>
</tr>
<tr>
<td>9IYiy</td>
<td>トウリィ</td>
</tr>
<tr>
<td>*!JZjz</td>
<td>エクプラ</td>
</tr>
<tr>
<td>+JECk</td>
<td>オウコ</td>
</tr>
<tr>
<td>&lt;LYII</td>
<td>ピンフ</td>
</tr>
<tr>
<td>=MINm</td>
<td>ヨウル</td>
</tr>
<tr>
<td>&gt;MNtn</td>
<td>ヨウル</td>
</tr>
<tr>
<td>J7O_0t</td>
<td>トウト</td>
</tr>
</tbody>
</table>
### LCD 40x1 AND 40x4 CHARACTERS TABLE

<table>
<thead>
<tr>
<th>Lower 4-bit</th>
<th>Upper 4-bit</th>
<th>Characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 (0)</td>
<td>0000 (1)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>0001 (1)</td>
<td>0001 (2)</td>
<td>A B C D</td>
</tr>
<tr>
<td>0010 (2)</td>
<td>0010 (3)</td>
<td>E F G H</td>
</tr>
<tr>
<td>0011 (3)</td>
<td>0011 (4)</td>
<td>I J K L</td>
</tr>
<tr>
<td>0100 (4)</td>
<td>0100 (5)</td>
<td>M N O P</td>
</tr>
<tr>
<td>0101 (5)</td>
<td>0101 (6)</td>
<td>Q R S T</td>
</tr>
<tr>
<td>0110 (6)</td>
<td>0110 (7)</td>
<td>U V W X</td>
</tr>
<tr>
<td>0111 (7)</td>
<td>0111 (8)</td>
<td>Y Z A B</td>
</tr>
<tr>
<td>1000 (8)</td>
<td>1000 (9)</td>
<td>C D E F</td>
</tr>
<tr>
<td>1001 (9)</td>
<td>1001 (A)</td>
<td>G H I J</td>
</tr>
<tr>
<td>1010 (A)</td>
<td>1010 (B)</td>
<td>K L M N</td>
</tr>
<tr>
<td>1011 (B)</td>
<td>1011 (C)</td>
<td>O P Q R</td>
</tr>
<tr>
<td>1100 (C)</td>
<td>1100 (D)</td>
<td>S T U V</td>
</tr>
<tr>
<td>1101 (D)</td>
<td>1101 (E)</td>
<td>W X Y Z</td>
</tr>
<tr>
<td>1110 (E)</td>
<td>1110 (F)</td>
<td>[ ] ^ _</td>
</tr>
</tbody>
</table>

*Note: The characters are displayed in a 4x10 matrix format.*
<table>
<thead>
<tr>
<th>DDD DDD DDD DDD</th>
<th>0 1 2 3 4 5 6 7 8 9</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>D7   D6   D5   D4</td>
<td>0 0 0 0 0 0 0 0 0 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0 0 0 0 0 0 1 1 1 1</td>
<td>1 0 0 0 0 1 1 1 1 1</td>
<td>1</td>
<td>0 0 1 1 0 1 0 1 0 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 1 1 1 1 0 0 1 0</td>
<td>0 0 1 0 1 0 1 0 1 0 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fluorescent 20x2 Characters Table**
**Fluorescent 20x4 Characters Table**

<table>
<thead>
<tr>
<th>DEC</th>
<th>CHARACTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0000</td>
</tr>
<tr>
<td>1</td>
<td>0001</td>
</tr>
<tr>
<td>2</td>
<td>0010</td>
</tr>
<tr>
<td>3</td>
<td>0011</td>
</tr>
<tr>
<td>4</td>
<td>0100</td>
</tr>
<tr>
<td>5</td>
<td>0101</td>
</tr>
<tr>
<td>6</td>
<td>0110</td>
</tr>
<tr>
<td>7</td>
<td>0111</td>
</tr>
<tr>
<td>8</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>1001</td>
</tr>
<tr>
<td>A</td>
<td>1010</td>
</tr>
<tr>
<td>B</td>
<td>1011</td>
</tr>
<tr>
<td>C</td>
<td>1100</td>
</tr>
<tr>
<td>D</td>
<td>1101</td>
</tr>
<tr>
<td>E</td>
<td>1110</td>
</tr>
<tr>
<td>F</td>
<td>1111</td>
</tr>
</tbody>
</table>

**Table Legend:**
- **D7-D0:** Binary code for each character.
- **CHARACTER:** Corresponding character in the table.
### Fluorescent 40x1 and 40x2 Characters Table

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<tr>
<th>Code</th>
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**DP**

**DC1**

**DC2**

**DEF**

**DIM**

**DOS**

**HT**

**LA**

**LF**

**LC**

**CR**

**EOL**

**RST**
### FLUORESCENT 40x4 CHARACTERS TABLE

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**BASIC 552 Rel. 3.2**

**Page 33**