ST623x-EMU2

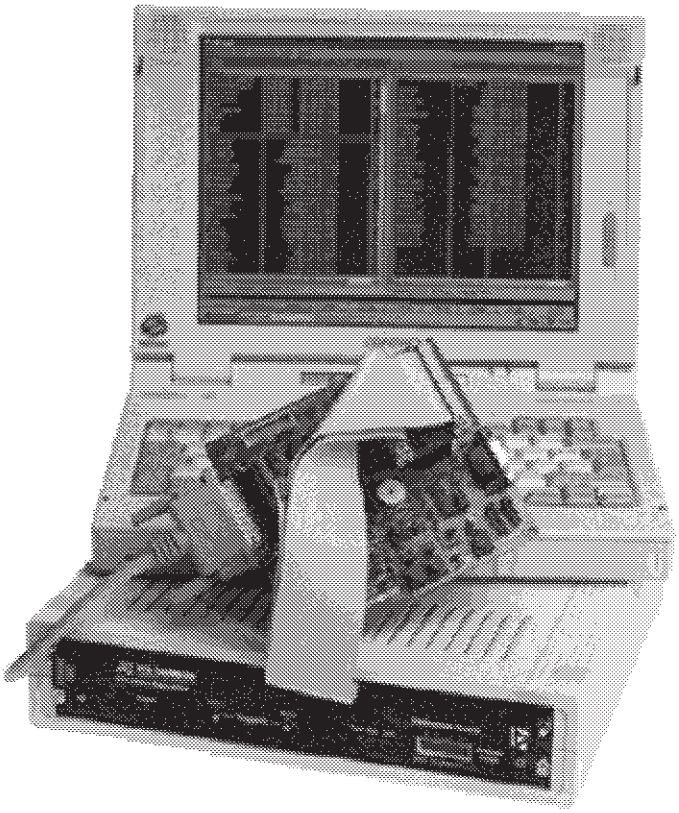
REAL TIME EMULATION DEVELOPMENT TOOLS FOR ST6218/ST6228/ST623x MCUs

HARDWARE FEATURES

- Supports ST62 and ST63 family
- Real time emulation
- 32 KBytes of emulation memory
- Breakpoint on a single address or on an address area
- Break events can be defined on Program Space, Data space mixed with up to 4 external signals
- 2 full programmable output for synchronisation
- Read/Write registers on the fly (without wait state)
- Selective trace in Range or Start/Stop
- Break on Stack Overflow
- 1K of real trace memory
- Tracing of up to 32 bits including 4 external signals

SOFTWARE FEATURES

- Symbolic debugger at source level
- On-line assembler/disassembler
- Log files capable of storing any displayed screen
- Command files able to execute a set of debugger commands



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1 DELIVERY CHECK

This development tool is able to emulate the ST623X devices and those belonging to the ST6228 family.

The probes are delivered for emulating DIL and SO footprints, for emulating QFP 52 package, the probe must be separately ordered.

When receiving a whole ST638X development tool or a ST638X-DBE please refer to the “PRODUCT DELIVERY” to check the content of the package.

Instructions for use - Warning

This development tool conforms with the EN55022 emissions standard for ITE, and with generic 50082-1 immunity standards. Then, it complies with the 89/336/EEC directive.

The product is a A Class apparatus. In a residential environment this device may cause radioelectrical disturbance which may require that the user adopts appropriate precautions.

2 ST6 HDS2 NEW MAINFRAME EMULATOR

The new ST6 HDS2 mainframe (with MB097 main Board) has been designed to replace the HDS1 version. The main modifications are:

– Communication transfer rate: it is now much faster thanks to the use of parallel port.

– Dimension and weight: the old 3 boards, basic part of the system, have been redesigned in one board.

– The cost of the overall system has been well reduced.

In the second version of ST6 HDS2, (metal box with MB174 main Board) modified for CEM conformity, these new features have been introduced:

– Read/ Write registers on the fly during execution of program without any wait state.

– Selective record of bus in logical analyser in Range or Start/Stop mode.

– Output OUT1 and OUT2 for synchronisation of an external equipment, programmable in the same way as Selective trace, in Range or Start/ Stop mode.

– Stack overflow: a break is automatically generated (by default) in case of stack overflow.

– Break execution: in this new version, the program stops before the execution of the fetch.

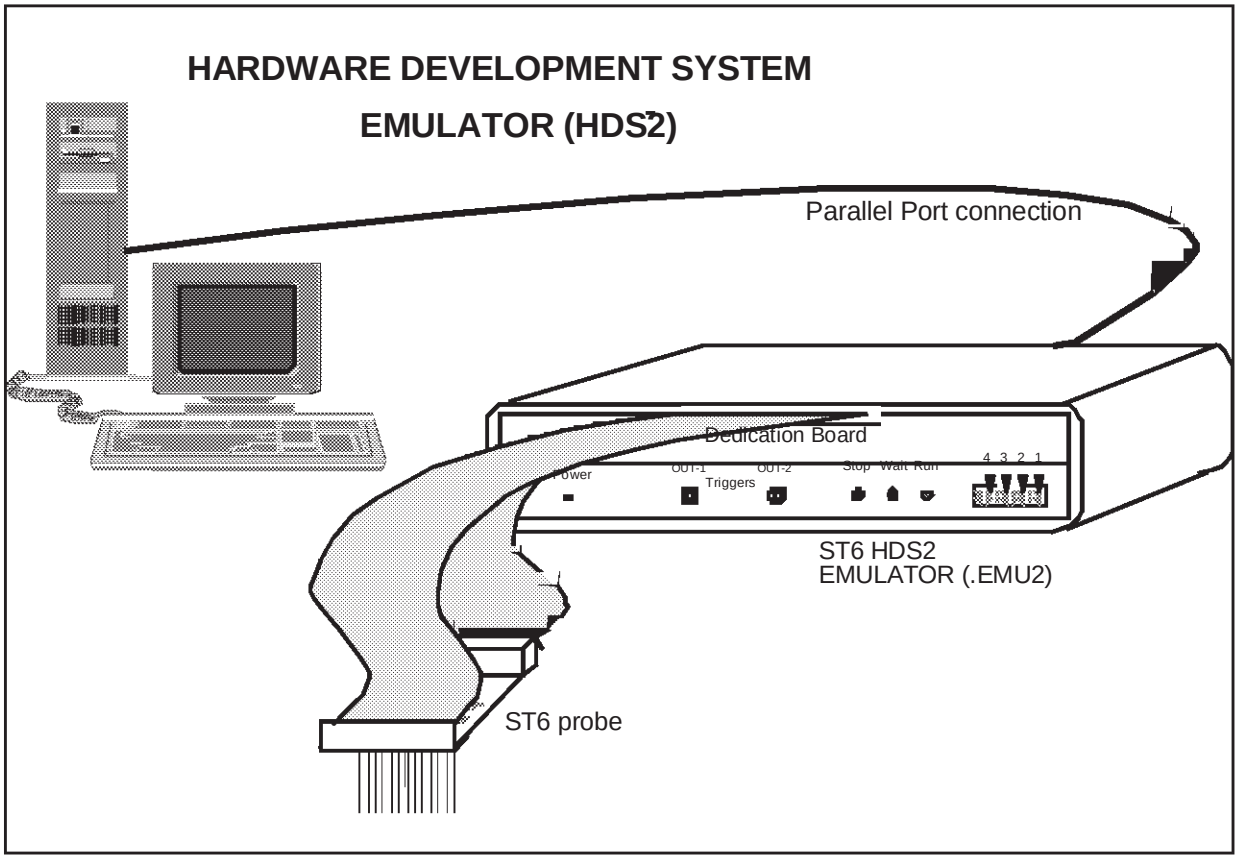
These main frame consist of a basic part, common to all ST6 devices, and one ST62 or ST63 sub family dedicated board depending on the specific device to emulate. This new emulator is full compatible with existing dedicated boards, excepting ST631XX-DBE which have been designed in 2 boards.

Only the dedicated board has to be changed to emulate a new device within the ST62/ST63 sub families.

The use of parallel port allows a very faster communication transfer rate. The symbolic debugger, software part of the real time emulation tool, can be run on a PC, and is common to all ST62 and ST63 devices.

The debugger uses a windowed menu driven interface, and enables the user to set the configuration of the emulator.

Figure 1. Hardware Development System Emulator



2.1 MAIN BOARD

The Main board controls the emulator thanks to a ST9 central processing unit which executes commands coming from host computer through the parallel line.

The board contains all emulation resources, the core of the ST6, the Program ROM emulation, the break point logic, the trace memory, the automaton and all necessary logic for a real time emulation.

Two connectors, J1 and J2, are used to exchange signals with the dedication board.

The amount of program memory in the main board is factory set at 32k, in fact the size of the memory depends on the dedication board, which contains the Program Rom Pagination Register (PRPR) if it exists (no PRPR for memory size lower than 4k).

No configuration jumpers are required.

2.2 ST6 HDS2 MAIN BOARD

On the rear panel there is:

– a power plug to connect power: 5 Volts 3 Amp min. (The delivered power is 100 volts to 240 volts input and 5 Amp output).

– a power switch.

– a parallel connector for an IBM PC(TM) compatible.

On front panel:

– a led “POWER ON” signal.

– OUT 1 and OUT 2 signals which can be used for synchronizing an external equipment.

– 2 leds indicating when the ST6 core is in “STOP” or “WAIT” mode.

– a 16 pin connector for data acquisition signals. The explanation of these signals is done in the debugger manual.

2.2.1 External output: OUT1 and OUT2

For debugging hardware it is very useful to have synchronization signals. The goal of the outputs 1 and 2 is to offer this feature to the user. They can be programmed differently whether the debugger used is the DOS debugger ST6NDB or the Source Level Debugger WGDB6, as explained in the two following paragraph. They are full programmable with WGDB6.

Output OUT1 and OUT2 under ST6NDB

When using old DOS Version of debugger ST6NDB:

This feature is programmable thanks to Hardware Breakpoint Menu. The breakpoint MENU allows to define breaking events. These events will generate an actual breakpoint only if break enable is ON. When break is off, these events are existing in the development tool. In the HDS2 emulator version up to 4.3, the signals OUT1 and OUT2 are connected to these internal breaking events. Therefore these signals can be used to synchronize an external device while running (breakpoint off).

Output OUT1 and OUT2 under WGDB6

When using WGDB6 new Version of debugger at source level under WindowsTM:

This feature is full programmable thanks to Hardware Events/Trigger Menu. Output OUT1 and OUT2 can be programmed in two ways:

– Events for synchronisation: it allows to the user to preset pulses synchronisation for an external equipment. The events can be defined by addresses or by range of addresses.

– Events for Timing Measure: it allows to the user to measure time elapsed during a subroutine for example. In this case, output OUT2 is SET on a user defined address, and RESET on an other one, OUT1 is the ST6 clock cycle gated by OUT2.

These 2 functioning modes are clearly displayed on screen.

2.2.2 Data acquisition signals

In a same way as are recorded Buses, Flags, Bank registers in the trace memory, the ST6 HDS2 offers the possibility to record 4 external signals. These signals must be connected on the pin 1,3,5,7 of the Analyser probe connector on the front panel of the HDS2, as shown below. A flat cable with probe tip is delivered with the emulator.

These inputs are CMOS compatible at 5 Volts

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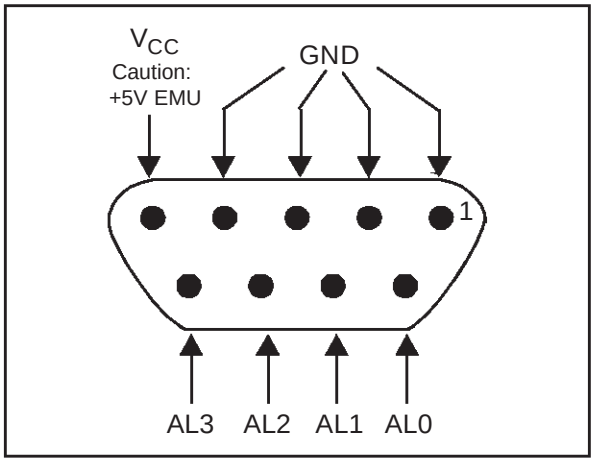


2.2.3 LEDs RUN, STOP, WAIT

Three leds have been added to indicate to the user the state of the core or of the development tool during emulation.

First at power up, the red led is ON and becomes OFF after a few time. It lights one short time during connection establishment between ST6 HDS2 emulator and host computer. After that, the Run led must be OFF.

If the LED RUN remains ON after power up, it will cause a default in initialisation of emulator, this default can be caused by:

– The emulation is in Reset: if the emulator is connected on a target application, this application must have been powered before.

– There is no clock: see chapter about clock source selection.

After a correct initialisation:

When user's program is running (in real time), led RUN is on.

When ST6 core is in WAIT mode, led WAIT is ON.

When ST6 core is in STOP mode, both leds STOP and WAIT are ON.

2.3 INSTALLING AN ST6 EMU2 DEVELOPMENT TOOL

– When receiving a whole development tool, the dedication board is delivered inside the mainframe.

– You have just to:

– connect the power supply to the mains(100 to 240 volts).

– connect the output (5Volts) of power supply on the DIN connector of the rear panel

– connect the parallel cable between the parallel connector and the host computer.

For installing the probe, please refer to the appropriate item in the Dedication Board chapter.

2.4 INSTALLING A DEDICATION BOARD IN AN ST6 HDS2

If there is already a dedication board in the development tool, you have simply to:

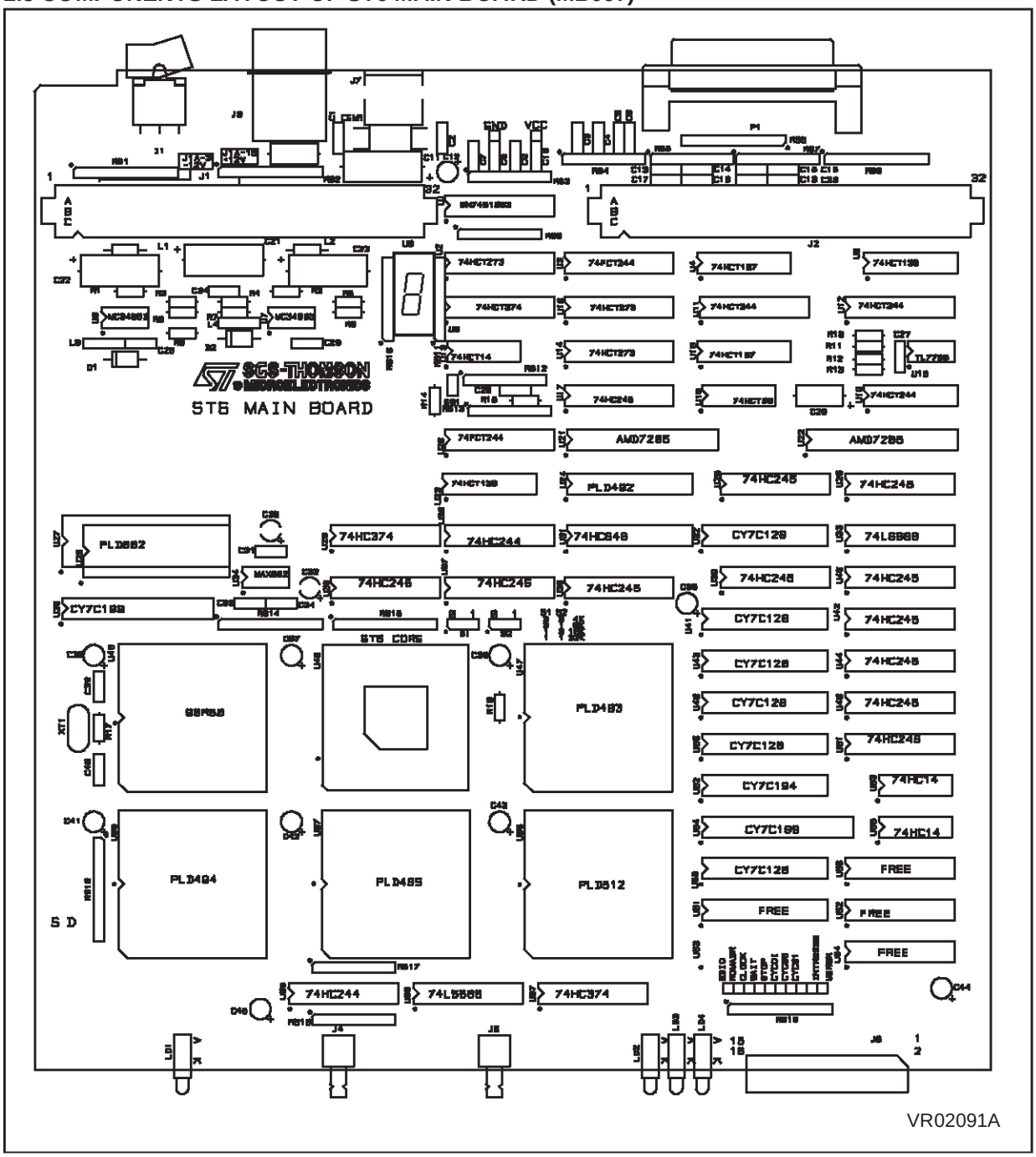
– unscrew the 2 screws on each side of the dedication board, and press outward on the release buttons to extract the board.

Then insert the new dedication board in the guide rods and push it hardly in the backplane, and:

– screw the 2 screws on each side of the dedication board.

For installing the probe, please refer to the chapter "Installing the probe".

2.5 COMPONENTS LAYOUT OF ST6 MAIN BOARD (MB097)



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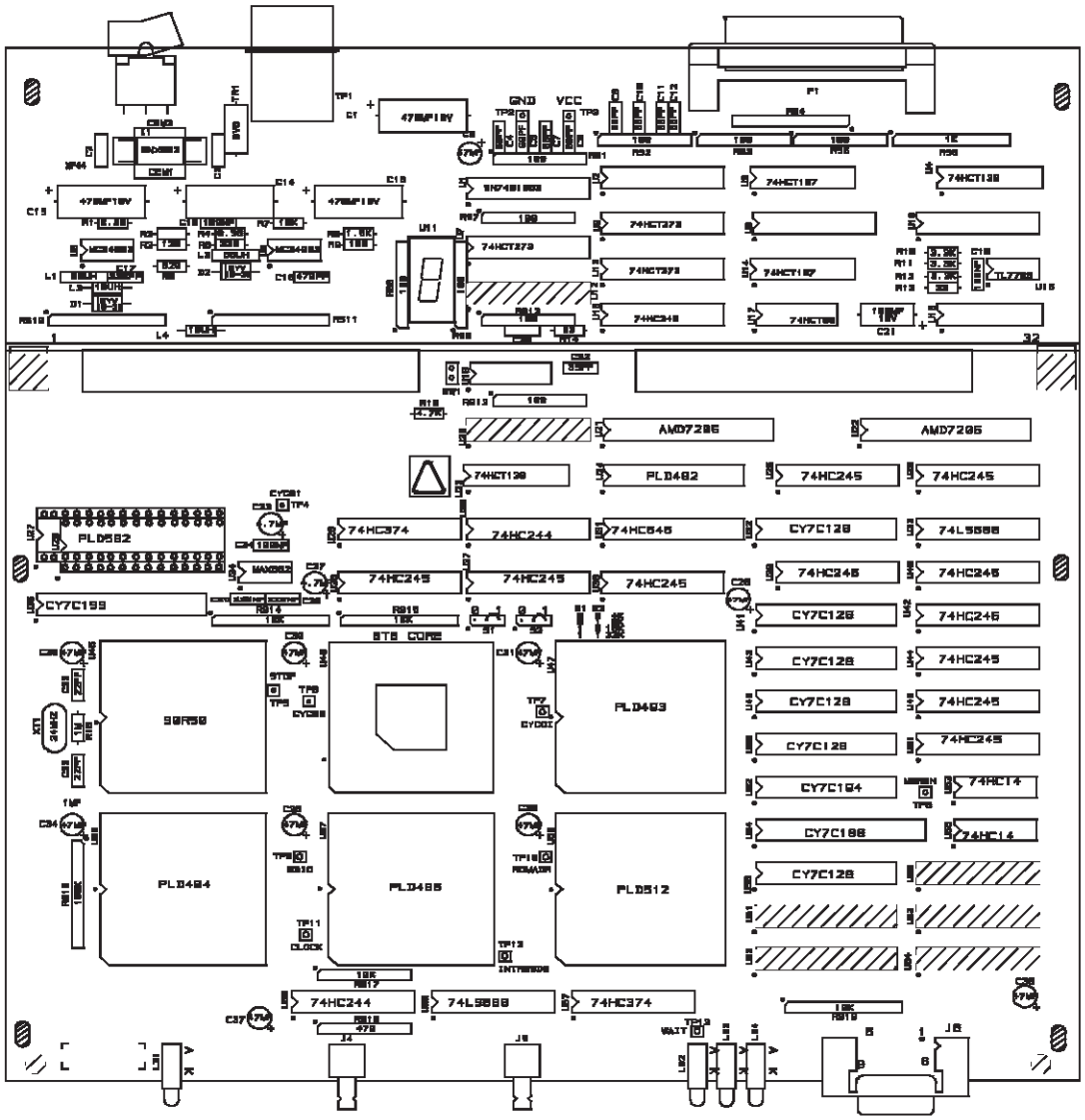
2.6 COMPONENTS LAYOUT OF ST6 MAIN BOARD (MB174)



3 ST6 MAINFRAME EMULATOR (FIRST GENERATION)

The ST6 mainframe emulator contains positions for 5 boards :

– CLZ80 board must be inserted on the first (bottom) position

– GPFM/3 board must be on second position

– interface N (DB014) must be inserted on third position

– dedication board ST638X (MB167) inserted in one of the two top position

On the rear panel there is :

– a main-power selector to select 110 volts or 220 volts.

– a power plug

– a power switch

On front panel :

– the RS232 connector to link the emulator with an IBM PC

– EXT-SIG connector that allows you to choose between 3 groups of 4 signals to be memorize on trace memory. These signals are independent from the probe data acquisition signals. The explanation of these signals is done in the debugger manual

– Z80 reset push button

– ST6 INT push-button

3.1 CLZ80 BOARD

The CLZ80 board controls the mainframe emulator and it is linked to an IBM PC through an RS232 line. On this board only 2 connectors are used :

– J5 connected to the front panel RS232 25 pin connector

– J4 connected to the front panel Z80-RESET push-button

3.2 GPFM/3 BOARD

GPFM/3 board contains the emulation resources :

Program ROM emulation, break point, trace memory.

Two connectors, J3 and J4, are used to exchange signals with the interface board.

When emulating ST62XX or ST63XX, the interface board is an N-WELL interface board.

The two connectors are used.

For emulating components of other families, the interface board can be a P-WELL interface board: in this case only one connector is used, the jumpers of W2 must be plugged.

JUMPERS SETTING for ST62XX and ST63XX emulation:

W1:

All jumpers must be removed.

W2 :

One jumper only must be set to link pin 1 to pin 16.

CONNECTORS :

J3 and J4 :

Used to link this board with the N-WELL interface board.

J5 :

Used to connect the data acquisition probe.

3.3 INTERFACE BOARD

The interface board emulates the CPU-core.

JUMPERS SETTINGS:

S1:

– not used in emulation mode

– allows the definition of the type of EPROM (27256/27128) used in stand-alone (without CLZ80 and GPFM/3 boards) mode

S2, S3: size of emulation program ROM

The position reference names depend on the version of the board. For S2 they can be identified as 0 and 1 or OLD and NEW on the board.

For S3 it can be 0 and 1 or 4K and 8K.

S2	S3	Size	Comment
0 or OLD	0 or 4K	4K	
0 or OLD	1 or 8K	8K	
1 or NEW	0 or 4K	16K	normal setting
1 or NEW	1 or 8K	32K	not supported

The purpose of this jumper is to allow the emulator to check the amount of emulation program ROM that is used.

TEST/NO TEST: must be in NO TEST position

CONNECTORS:

J1 and **J4** to link this board to GPFM/3 board.

J2: receives signals from J1-EXT SIG. connector situated on the front panel of the ST6 emulator.

J3: is connected to ST6-RESET, ST6-INT push-buttons, STOP-LED and WAIT-LED situated on the front panel of the ST6 emulator.

3.4 INSTALLING AN ST6 HDS1 DEVELOPMENT TOOL

When receiving a whole development tool, the dedication board is delivered inside the mainframe, it is plugged in one of the two top position in the backplane.

– First of all, it is mandatory to verify the mainframe:

– remove the 2 screws on the rear panel of the main frame

– lift the lid on the side of the rear panel

– pull the lid from the rear panel, it dissociates it from the front panel

– remove the lid, pay attention to the wire for the ground connection

Verify that all boards are correctly inserted in the backplane of the mainframe in the right order:

– CLZ80 board must be inserted on the first (bottom) position

– GPFM/3 board must be on second position

– Interface N (DB014) must be inserted on third position

– The two top positions are intended to receive one or a couple of dedication boards in order to emulate one family of components: in this case, only the new DBE board must be in one of the two top positions.

For installing the probe, please refer to the appropriate chapter in the Dedication Board part.

After installation of a probe, the flat cables must be parallel.

3.5 INSTALLING A DEDICATION BOARD IN AN HDS1 DEVELOPMENT TOOL

When receiving only a dedication board, this board must be installed as described below.

Open the main frame by removing the lid:

– remove the 2 screws on the rear panel of the main frame

– lift the lid on the side of the rear panel

– pull the lid from the rear panel, it dissociates it from the front panel

– remove the lid, pay attention to the wire for the ground connection

Then remove the dedication board or the two dedication board which are plugged in the two top position of the backplane.

After that, plug the new dedication board in one of the two top positions of the backplane.

For installing the probe, please refer to the appropriate item in the Dedication Board chapter.

4 DEDICATION BOARD (DBE)

This board contains the specific functions for ST623X or ST6228 family emulation.

All the functions are listed below, for using these peripherals please refer to the data sheet of the appropriate device:

– 192 bytes RAM: 2 dynamic and one static page of 64 bytes RAM
– 128 bytes EEPROM (Byte mode and parallel mode)
– a 8 bit timer with 7 bit prescaler: Timer 1
– Watchdog
– 8 bit Analog to Digital Converter
– Port A: 8 Bits fully software programmable I/O with 2 or 4 analog inputs
– Port B: 8 Bits fully software programmable I/O with 8 analog inputs
– Port C: 4 Bits fully software programmable I/O with 4 analog inputs
– Port D: 8 Bits fully software programmable I/O with 8 analog inputs
– Port E: 8 Bits fully software programmable I/O
– External non Maskable Interrupt
– Program Rom Pagination Registers for addressing 8k of user ROM
– 8 bit Synchronous Peripheral Interface (SPI)
– Five Interrupt Vectors

The Oscillator Safe Guard (OSG) of the ST6228 is not emulated, the use of this feature must be tested with the EPROM device.

Depending on the choice between emulation of ST623X or ST6228 family, the following peripherals are different:

– UART: 8 bit Asynchronous Peripheral Interface
ST623X: 11 bit frame
ST6228: 10 bit or 11 bit frame.
– The Auto Reload Timer is an AR Timer 16 bit in ST623X or 8 bit in ST6228.

On the board, a white dot indicates the position 1 for all jumpers and components.

Note for the VCC pin:

This input is used as a reference voltage by the emulator. When a probe emulating the oscillator function is used, if it is not connected in an application, it must be powered at 5 Volts(2 or 3 mA). This oscillator must be carefully used due to parasitic capacitors. In all case the generated clock must be checked.

Notes on write-only registers:

Several Data Space registers of the emulated ROM device are write-only, however, to offer more flexibility to the user, they are readable when commands such as “watching register” are used.

4.1 VOLTAGE FUNCTIONING RANGE

This board has been designed to emulate the ROM device in the range of 4 to 6 Volts.

When the input power VCC pin is connected, this input is used as a reference voltage by the emulator. This reference voltage is amplified thanks to an operational amplifier and an emitter follower for powering the output buffers, and for giving the high reference voltage to the ADC.

Then all the outputs of the peripherals are fully compatible at CMOS level with an application which is powered in the range from 4 to 6 Volts.

Note for the VCC pin:

When this input is not connected, all buffers can be powered with 5 volts, depending on W7 jumper, please refer to 5.2.7 chapter. This input is used as a reference voltage by the emulator. When a probe emulating the oscillator function is used, if it is not connected in an application, it must be powered at 5 Volts (2 or 3 mA). This oscillator must be carefully used due to parasitic capacitors. In all case the generated clock must be checked.

4.2 JUMPER DESCRIPTION ON DEDICATION BOARD

Jumpers on the board are used to:

– select the emulation of a family of device: in this case ST623X or ST6228 family.

– emulate some bit of the “Option Register” of the EPROM device, or metal MASK OPTION of the ROM device.

– or to chose a specific functioning mode for a peripheral.

This chapter explains how to select these features, for each peripheral.

4.2.1 ST623X/ST6228 emulation selection: W8

The two families ST623X and ST6228 have the same features except for 2 peripherals:

The Auto Reload Timer:

– It is an AR Timer 16 bit in ST623X.

– It is an AR Timer 8 bit in ST6228.

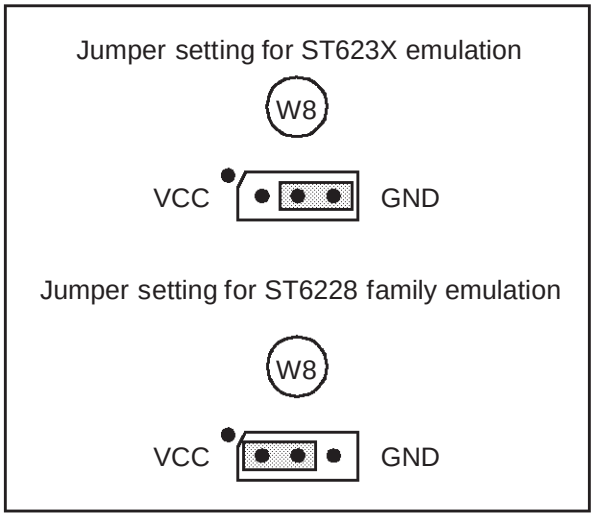
The Asynchronous Peripheral Interface (UART):

– It is an UART with fixed 11 bit frame in ST623X.

– It is an UART with option selectable frame 10 bit or 11 bit in ST6228.

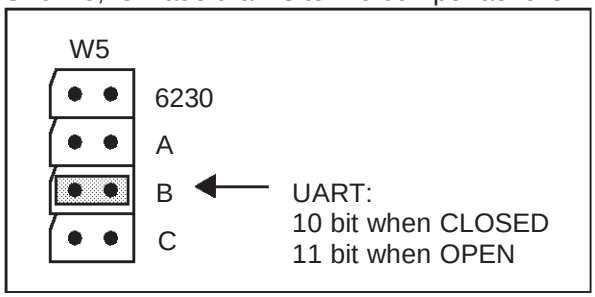
The devices in each family differ from the others by the amount of memory and the footprint.

For selecting the emulation of one family between ST623X or ST6228, the jumper W8 must be set as follow:



4.2.2 UART 10 bit/11bit frame (only for ST6228): W5

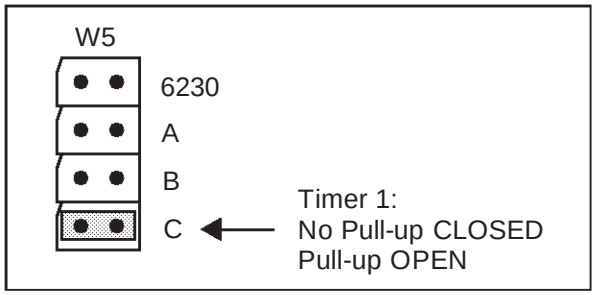
The choice of the frame option, only available for ST6228, is made thanks to W5 Jumper as follow.



4.2.3 Timer 1 pullup: W5

The pin dedicated to Timer 1, can be pullup or not, in the device (by mask option for the ROM device or by properly programming the option byte in the EPROM device).

This feature is emulated thanks to W5 selector when set as follow:



4.2.4 Clock Source Selection: W2

The system CLOCK can be chosen between internal on board oscillator and clock issued from the probe.

This jumper setting is clearly printed on board, with INT for INTERNAL clock and EXT for clock issued from the probe.

If the jumper is connected between:

1-2 In this case the clock coming from the probe is selected

2-3 The internal clock at 8 Mhz is selected.
In this case the internal clock is made thanks to an oscillator with a quartz, this quartz XT1, can be exchanged if desired by the user.

Note for CLOCK “issued from the probe”:

If the user uses a probe made by STMicroelectronics, this probe is able to send the clock to the dedication board in two ways:

– a clock made by the on board oscillator on the probe

– a clock directly issued from the application

4.2.5 Reset delay duration: W6

For as long as the reset pin is kept at the low level, the processor remains in the reset state.

After the pin reset has been released, a counter provides a delay between the detection of the reset high level and the release of the MCU reset: a jumper on W6 permits to select the duration of this delay.

The standard delay is 2048 oscillator cycles: for this delay, the jumper must be on pin 9 and 10, as delivered.

For delay of 4096, 8192, 16384 or 32768 cycles, the jumper must be on 7-8, 5-6, 3-4, 1-2 respectively. These values are clearly printed on board.

4.2.6 WATCHDOG: W1

The jumper W1 permits to emulate the “Hardware WATCHDOG” or the “Software WATCHDOG”.

In ST6 devices, the watchdog can be activated in two ways:

– The software Watchdog is activated by setting, by software, bit 0 of the watchdog register.

– The other way is to be in “watchdog HARD”, it means the watchdog is automatically armed after RESET (generated by watchdog or not).

For the ST623X devices the watchdog is always HARDWARE, then the jumper must be on HARDWARE. (factory setting).

Jumper setting:

1-2 Watchdog is automatically activated by HARDWARE (Factory setting)

2-3 Watchdog is only activated by SOFTWARE

The jumper setting is clearly printed on board.

Note:

When activating watchdog, STOP instructions are automatically executed as WAIT instructions by the processor, see following chapter for special use of STOP mode.

4.2.7 ADC: W3, W4, W7

The purpose of these jumpers is to minimize error when using Analog to Digital converter.

W3: AVDD SELECTION, HIGH REFERENCE VOLTAGE FOR ADC.

The High reference voltage for adc is not connected when emulating 28 pin packages.

Then this jumper permits to put the AVDD input either at AVDD pin if it exists (QFP52 package), or at VCC application voltage in case of other packages.

1-2 AVDD, the high reference voltage for ADC is the AVDD pin.

2-3 VCE, the high reference voltage for ADC is VCE, which is the voltage following the application voltage.

The jumper setting is clearly printed on board.

W4: AVSS, VREF SELECTION, LOW REFERENCE VOLTAGE FOR ADC.

The Low reference voltage for ADC is not connected when emulating 28 pin packages.

Then this jumper permits to put the AVSS input either at AVSS pin if existing, or at GND in case of other packages.

When **OPEN**: AVSS, the low reference voltage for ADC is the pin AVSS.

When **CLOSED**: 0 volt, the low reference voltage for ADC is GND.

The jumper setting is clearly printed on board.

W7: VDD input.

When the probe is not connected, in order to have a default voltage of 5 volts for VCC in the board, a pullup resistor to 5 Volts has been added to the voltage follower powering the output buffers. When using ADC this Pullup resistor introduces an error of a few percent, then in this case probe must be powered and W7 must be OPEN.

To eventually remove this pullup resistor, jumper W7 has been added.

Jumper setting:

When W7 is **CLOSED**: 5 Volts the pullup resistor is connected.

When W7 is **OPEN**: the pullup resistor is not connected, application voltage is directly applied to the voltage follower without error.

4.3 PROBES

Two kinds of probe are existing:

– The new Probe made with Printed circuit Board DB324 which support DIL20, DIL28 and SDIL42 packages. On this probes DB324, an oscillator, now fully on probe, permits eventually to the user to put his own crystal, resonator or RC in order to have the same frequency with emulator as the application with device.

– Probe made with Printed circuit Board DB174 which support DIL28 and SDIL42 packages.

When using clock generated by probe, the dedication board must be set on EXTernal clock.

4.3.1 DB324 Probe

The delivered probes are corresponding to the most frequently used footprints of devices which can be emulated thanks to the ST623X-DBE Dedication Board: these footprints are DIL20, DIL28 and SDIL42. They have been designed to emulate the devices listed in the following chapter or a subset of same footprint. With these new DB324 probes, it is possible to reconstitute an oscillator at the same frequency as on application: an on board oscillator, designed in an “open” schematic permits to place on the probe, the Crystal or the resonator or an RC as on target application.(see schematic in Annex).

When the target application must run at a different frequency of the internal 8 MHz of the Dedication Board, the clock must come from the probe, then two choices are possible:

– The Clock source is Oscin pin (must be CMOS compatible)

– The oscillator on the board is used.

Two Selectors permit to configure the probe depending on this choice:

W1: Choice between on board oscillator or Oscin.

– Oscilla: the oscillator is used. Taking into account the schematic of DB324 shown in ANNEX, the user must add his own components to make an oscillator using the furnished gate(HC04).

– If the user wants to use a clock coming from application at CMOS level on OSCIN input: the user must place the jumper on OSCIN.

W2: Disable oscillator.(Disable when delivered) If the oscillator is not used, it is preferable to disable it for noise and EMC reason. (Jumper W2 forces input oscillator to “0”)

WARNING on probe oscillator:

When the probe is used, it must be connected to an application or powered through VCC pin, to give power to the on board oscillator. If the on board oscillator is never used, IC1 can be removed by the user.

4.3.2 DB174 Probe

This probe is able to emulate DIL28 and SDIL42 packages.

When external clock is chosen on dedication board, the clock is coming from this probe, and can be selected in two ways:

– When jumper is near input: the clock is coming from OSCIN input of the probe

– When jumper is near quartz: the clock is coming from the on board oscillator using a crystal on application. But this solution is not recommended because the parasitic capacitors between probe up to the application are critical.

WARNING on probe oscillator: When the probe is used, it must be connected to an application or powered through VCC pin, to give power to the on board oscillator. If the on board oscillator is never used, IC1 can be removed by the user.

4.4 INSTALLING A PROBE

The four delivered probes have been designed to offer the most frequently used footprints of the devices belonging to the ST6228 or ST623X families at this date

– Only the QFP52 probe, for ST6232 QFP52 and ST6235 must be separately ordered.

Then the delivered probes are:

– for ST6218 device footprint: the DIP20 probe.

– for ST6228 and ST6230 devices footprint: the DIP28 probe.

– for ST6232 device footprint: the SDIP42 probe.

For SO footprint, adaptors are delivered:

– a DIL20 to SO20 adaptor for emulating SO20 device.

– a DIL28 to SO28 adaptor for emulating SO28 device.

For installing a probe, it is mandatory to follow these instructions:

– Plug a flat cable delivered with probe on J1 of Dedication Board

– Plug the second flat cable on J2 of Dedication Board. A bump on connectors imposes to set them correctly.

After that, in the same way:

– Take the flat cable connected on J1 of dedication board and plug it into J1 on probe.

– Take the second flat cable on J2 of Dedication Board and plug it into J2 on probe. After installation of a probe, the 2 flat cables must be parallel.

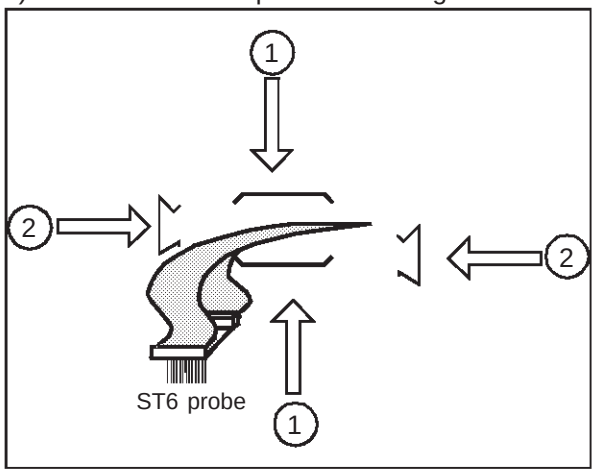
WARNING: to respect EMC compliance, the Ferrite for flat cable delivered with the development tool can be put on both J1 and J2 flat cable.(see following chapter)

4.5 PROBE: INSTALLING THE FERRITE COIL FOR EMC COMPATIBILITY

To be conform to the EMC directive, particularly in emission, the delivered ferrite coil must be placed as follow:

1) Place each part on each side of the flat cables

2) Place the metal clip to fix them together



4.6 EMULATED PERIPHERALS

4.6.1 Program Rom

To offer more flexibility to the user, when debugging software, up to 32 k bytes of program ROM are available, it means that 4 bit are available in the PRPR when emulating with the development tool.

4.6.2 Data Space Memory

The memory available in range 0 to 3F in data space, is accessed through the Data Ram/Eeprom Banking Register.

4.6.2.1 EEPROM

Pages of EEPROM are selected with:

Bits 0, 1 and for EEPROM.

4.6.2.2 RAM

For this device, there is two bank RAM of 64 Bytes, it means Bit 2 and 3 of Data Ram/Eeprom Banking Register are available.

4.6.3 Timer 1, Timer 2, Timer 3, Watchdog

Internal Clock (CK/12) for these devices are voluntarily validated only during emulation, it provides to see the evolving values of them. Therefore pay attention that in NEXT mode the values of counters can be slightly different of a real time session because of setting ON and OFF emulation.

For using these peripherals, please, refer to data sheet of the corresponding ROM DEVICE.

4.6.4 Timer 16

The internal basis clock for this device, equal to Fosc of the ST6, is voluntarily validated only during emulation, it provides to see the evolving values of its registers. Therefore pay attention that in STEP mode the values of counters can be slightly different of a real time session because of setting ON and OFF emulation.

For more details about this peripheral, please, refer to Data Sheet of the Device.

4.6.5 Analog to Digital Converter

This peripheral is available on bit 4 to 7 of A Port, all bits of B Port, all bits of D port, bit 4 to 7 of C.(PC6 and PC7 are not Analog input in ST6228).

The ADC input can be connected at one of these inputs, by properly programming the registers of this port (one at a time).

If more than one ADC input are selected, they will be short circuited each other's, in an other way, this feature can be used to multiplex analog values.

The analog to Digital Converter converts the input value in about 50µS at 8 Mhz of Xtal clock. Clock conversion is always present, it means that a data conversion is always accomplished after writing a start conversion even if it is made in NEXT mode of emulation.

It allows to the user to convert analog input step by step.

Note on ADC voltage reference:

The high voltage reference for the ADC is the applied voltage on the pin VCC internally buffered in the board.

The low voltage reference is a line directly connected from the ADC GROUND to the PROBE GROUND.

Then to have a conversion result of 0FFH, the voltage at the analog input must be equal to the voltage of the VCC pin.

4.6.6 I/O Port A, B, C, D, E

The functioning mode of each bit of these ports is selected by properly programming the three associated registers: Data Register (DRX), Data Direction Register (DDRX), and Option Register (ORX) as described in the following table.

When a port is not complete(less than 8 bit), it is essential to mask the non existing bit by software for calculation, because non existing bits are read as a random value.

Note that Analog Input are not available for all I/O. For details, please, refer to the Data Sheet of the corresponding ROM Device.

DDR	OPR	DR	I/O Mode
0	0	1	Input without pullup, interrupt disabled
0	1	0	Input with pullup, interrupt enabled
0	0	0	Input with pullup, interrupt disabled
0	1	1	Analog Input
1	1	X	Push Pull Output
1	0	X	Open Drain NMOS output

Beware of mixing input and output modes in the same port, in this case do not use SET or RES instructions on Data Registers:

When a port bit is in input mode, the data read is the state of the pin of the device (or the

probe); when a port bit is in output mode, the data read is the data register, so when using a

read/modify/write instruction, a bit port mode can be changed from input mode to analog input

mode unintentionally!.

For more details about this peripheral, please, refer to Data Sheet of the corresponding ROM Device.

5 TROUBLESHOOTING

5.1 AT POWER UP

At the beginning of an emulation session, on screen of PC must appear the debugger message up to the end of software connection establishment.

If a "TIMEOUT" message is encountered, there is a connection problem, which can come from one of these reasons:

with ST6HDS2

– ST6 development Tool is not power ON

– The parallel line is not well connected

or with old main frame:

– verify that the delivered cable is actually connected directly to the Main Frame.

– and if necessary there is another cable which is either a "wire to wire" connection or an 25 to 9 pin adaptor.

– The serial line is not connected the right I/O port of the computer.

5.2 DURING EMULATION: PROBLEM WITH PROGRAM COUNTER

In case of "Check Hardware Jumpering" or wrongly executing code in step mode:

Most of the time, this problem occurs with HDS1 emulator or with HDS2 plastic BOX up to 4.3 version, it is coming from that the development tool is in RESET state, it can be caused by:

– The application where probe is connected is not powered on, then the schmitt trigger on pin Reset is active and causes the RESET

– The pin Reset of emulated device is at low level

– A probe is connected, but is not powered either by an application or by a voltage on the VCC input.

For properly emulating RESET please refer to the following chapter.

5.3 RESET EMULTATION IN REAL TIME

With ST6HDS2 new metal box, it is now possible to begin an emulation session even if application is off, it is required particularly in MONITOR or TV applications.

With old ST6 HDS1 emulator, or with HDS2 plastic BOX up to 4.3 Version, if the application requires that software must be executed just after power ON, it is mandatory to proceed as follow:

– not connect, or remove probe from application.

– power ON emulator.

– begin emulation session: load program.

– then start execution of program in Real Time.

– plug the probe in the application (which is off), at this time the ST6 emulator is in reset state, because Reset and VCC pins are at low level.

– Power ON the application, then the execution of software will start.

5.4 DISCREPANCIES BETWEEN EMULATOR AND ROM OR EPROM DEVICE

When some differences of behavior are appearing between the emulator and the ROM device, in most cases, it comes from using read/modify/write instructions on

– registers in which some bits are writable, and some bits readable.

For these registers, trouble are caused, because when reading, a random value is read by the CPU, after calculating the mask, this random value is written in the register, changing it unintentionally!

The same problem can occur with registers, where some bits have a different function during writing or during reading.

Example for Ports:

When reading a bit port in input mode, the read value is the level of the pin.

When reading a bit port in output, the read value is the value of the corresponding bit in the Data Register.

In case of problems check if each used register is correctly accessed. The principle ST6 registers (depending on the family), with which care must be taken, are listed below:

– The EEPROM control registers

– The two control registers of the 2 SPIs

– The Data registers of the 3 Ports A, B and C

– Analog to Digital Converter Control Register

– The Sync Processor

– The 9 PWM D/A control registers

– The 14 bits (PWM+BRM) D/A converter

– The NMI/PWR/VSYNC Interrupt Register

– The Interrupt Option Register

– The Program Rom Pagination Registers

– The Data RAM/EEPROM Banking Register

– The Data ROM window Register

To offer more flexibility to the user, all of these registers are readable outside of real time.(undefined bits are read as ”0” value).

5.5 AVOID THE MOST FREQUENT PROBLEMS WHEN PROGRAMMING ST6 MICROS!

5.5.1 Execution of Interrupt

If interrupt are not executed, in most cases, it comes from:

– The core is not in normal mode: after RESET the core is in NMI mode, to enter the normal mode which let execute interrupt, the core must execute a RETI instruction.

– The global enable interrupt bit has not been SET, or has been unintentionally cleared, then the IOR register must be checked. The default value to enable Interrupts is 010H.

– The enable interrupt bit of the desired peripheral has not been SET, or has been unintentionally cleared.

– The Interrupt Option Register is write only, and has been wrongly written by a read/modify/write instruction, only LDI is permitted.

5.5.2 Execution of WAIT and STOP instructions

In WAIT mode, led WAIT is ON, in STOP mode the 2 led WAIT and STOP are ON (on the front panel of the emulator).

If STOP or WAIT instructions are not exited, it comes from:

– The core is not in normal mode: after RESET the core is in NMI mode, to enter the normal mode which let execute interrupt to exit from these states, the core must execute a RETI instruction.

Explanation: the only way to go out of STOP or WAIT state is to have an INTERRUPT or a RESET, it is the reason why, to execute these instructions the interrupt must have been validated.

Notes: