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EMUL-SUPER10-PC/PODTR133
Getting Started Guide

Version 1

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Warranty Information

All Nohau hardware is sold with a one-year warranty starting from the date of purchase. Defective components under warranty will either be repaired or replaced at Nohau's discretion.

Pods that use a bond-out processor are also warranted for one year from the date of purchase except for the processor. The bond-out processor will be replaced once if Nohau determines that the failure in the bond-out processor was not due to the user's actions. This replacement limit does not apply to the rest of the pod.

Each optional adapter, cable, and extender is sold with a 90-day warranty, except that it may be subject to repair charges if damage was caused by the user's actions.

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Chapter 1 - Description of the Nohau EMUL-SUPER10-PC/PODTR133 Emulator

Some Background: the Nohau EMUL-SUPER10-PC/PODTR133 Emulator

The EMUL-SUPER10-PC/TR133 emulator consists of an emulator pod-trace board that contains the special STMicroelectronics bondout controller and various logic in the form of advanced CPLD and FPGAs. The current maximum speed of the board is 160 MHz. The photo on the front cover of this document shows the complete emulator in its case. The emulator is configured and operated by the Nohau user interface, Seehau. Seehau also contains the firmware for the CPLD and FPGAs of the emulator. This makes firmware updates easy and complete with each new release of Seehau.

The EMUL-SUPER10-PC/PODTR133 is the fourth in a series of emulators from Nohau that support STMicroelectronics. The first, the EMUL-ST10-PC supports ST10 derivatives up to 50 MHz. The second, the EMUL-ST10-FA-PC provides similar support up to 90 MHz. The third, the EMUL-SUPER10-PC supports ST's SUPER10 up to 100MHz. Nohau has been shipping STMicroelectronics emulators since the summer of 1998 and is the world leader.

The Emulator Pod-Trace Board

The emulator pod-trace board has various jumpers, LEDs and test points to configure the emulator hardware to your specifications. Figure 1 is a photo of the top of the emulator pod-trace board and shows some of the user jumpers, connectors, other features and the bondout controller.

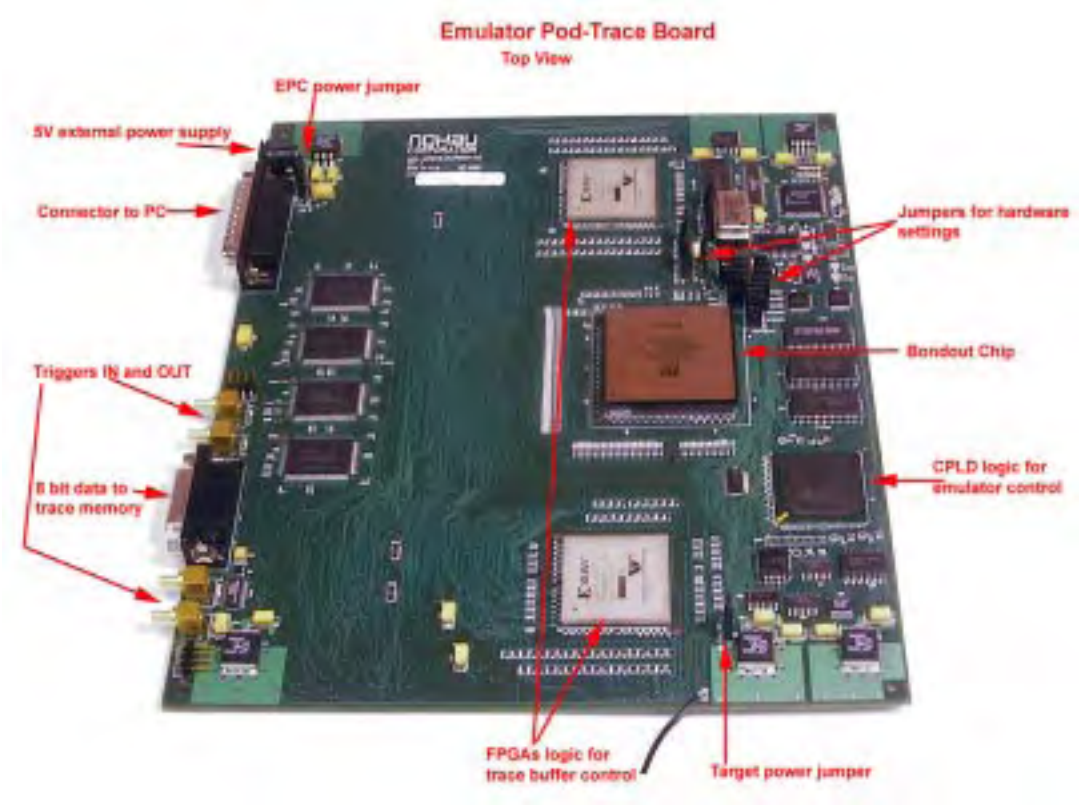


Figure 1

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The Target Adapter Connectors

On the bottom of the emulator pod-trace board are 4 connectors in an industry standard configuration designed to connect the bondout emulation controller to the target hardware. The physical dimensions are the same as the Nohau emulators for the STMicroelectronics ST10 and Infineon C166 families. This connection can be direct with the appropriate connectors designed on the target board, or through various adapters available from Nohau.

Figure 2 is a photo of the bottom of the emulation board with the bottom case not installed. Note the 4 large connectors (J8 to J11).

Figures 3 and 4 document the signals to the sockets. Figure 3 is the view looking down onto a target board. Figure 4 is the mirror image and represents the view looking at the bottom of the emulator.

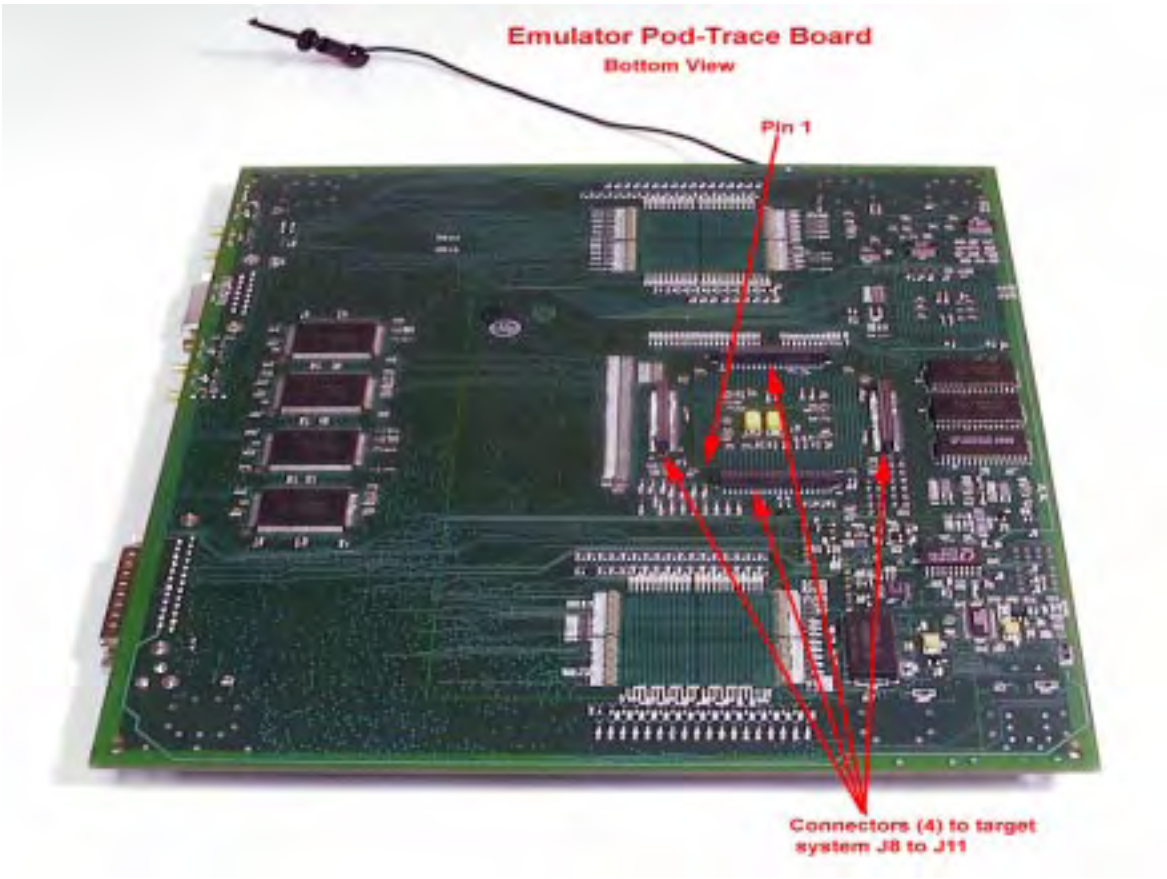


Figure 2

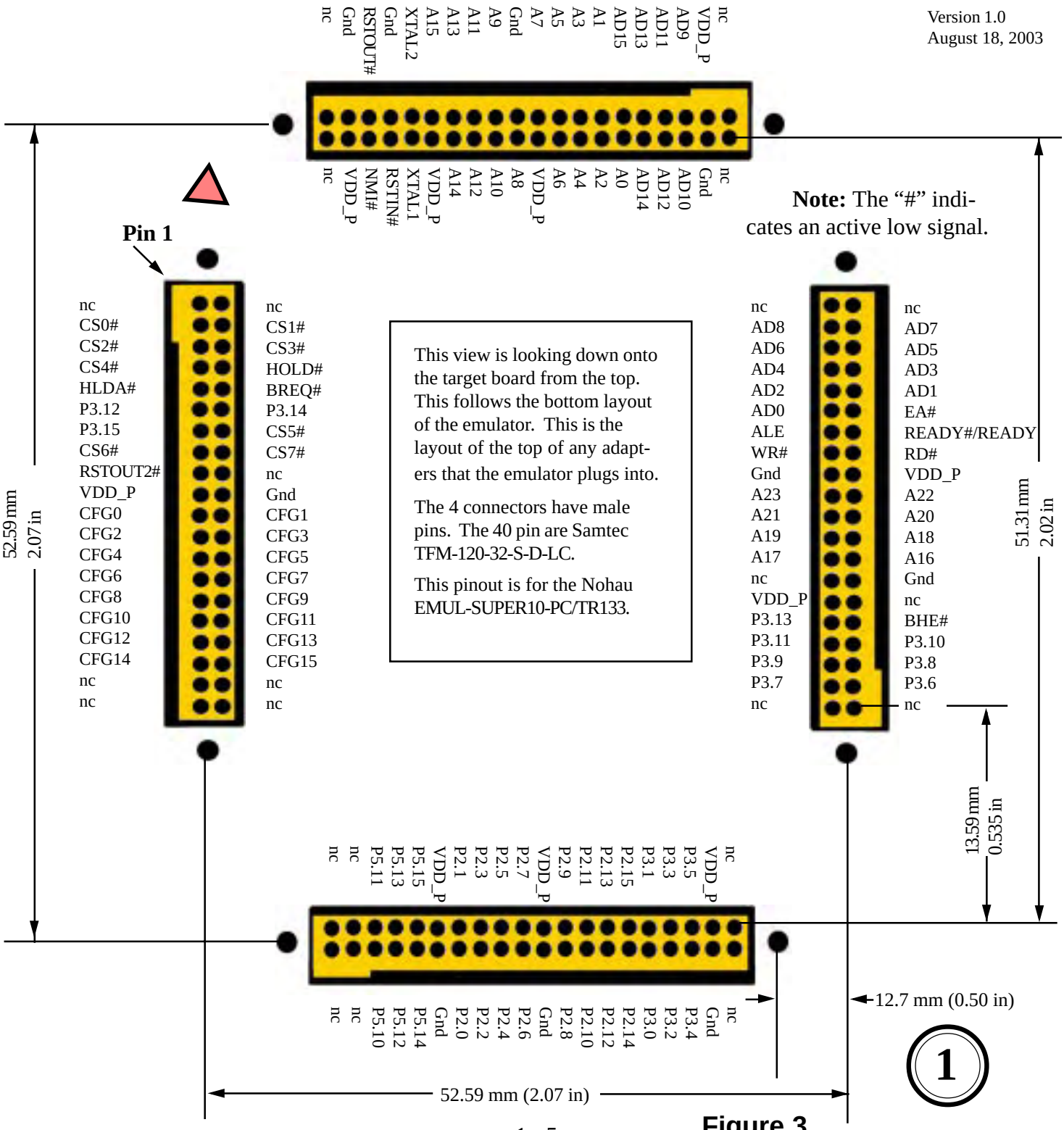
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EMUL-SUPER10-PC/TR133 Emulator Layout
This is the top view of the customer target board layout if a direct one to one connection to Nohau emulator for the Super10 family is used.

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August 18, 2003



Note: The "#" indicates an active low signal.

This view is looking down onto the target board from the top. This follows the bottom layout of the emulator. This is the layout of the top of any adapters that the emulator plugs into.

The 4 connectors have male pins. The 40 pin are Samtec TFM-120-32-S-D-LC.

This pinout is for the Nohau EMUL-SUPER10-PC/TR133.

Figure 3

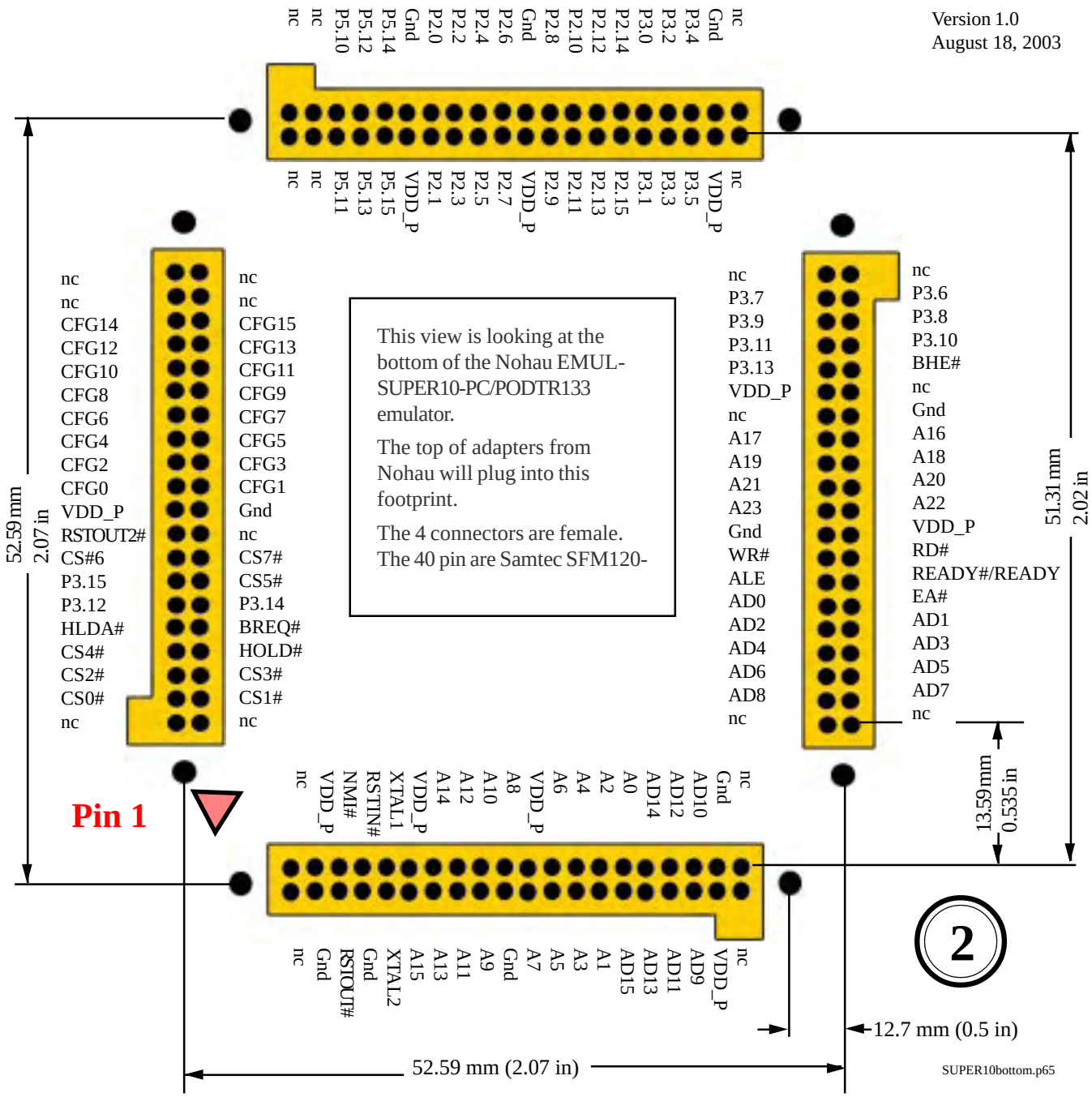
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EMUL-SUPER10-PC/TR133 Emulator Layout
This is the bottom view of the emulator board layout if a direct one to one connection to the Nohau emulator for the Super10 family is used.

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Note: The "#" indicates an active low signal.

Figure 4

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The Emulator Jumpers

Figure 5 is a line drawing of the emulator board. Figure 6 is an enlarged version and has descriptions of the edge jumpers. Default ON jumpers are TARG PWR (JP8), EPC PWR (JP22), READY (JP20), /CS1 (JP13), /CS2 (JP14), /CS3 (JP15) and /CS4 (JP16). /RSTIN (JP21), /CS0 (JP12), /CS5 (JP17), /CS6 (JP18) and /CS7 (JP19) are OFF. JP5 and JP6 are on POD positions. JP25 is on POD position. JP9 is on PLL position. JP7 is on OSC position.

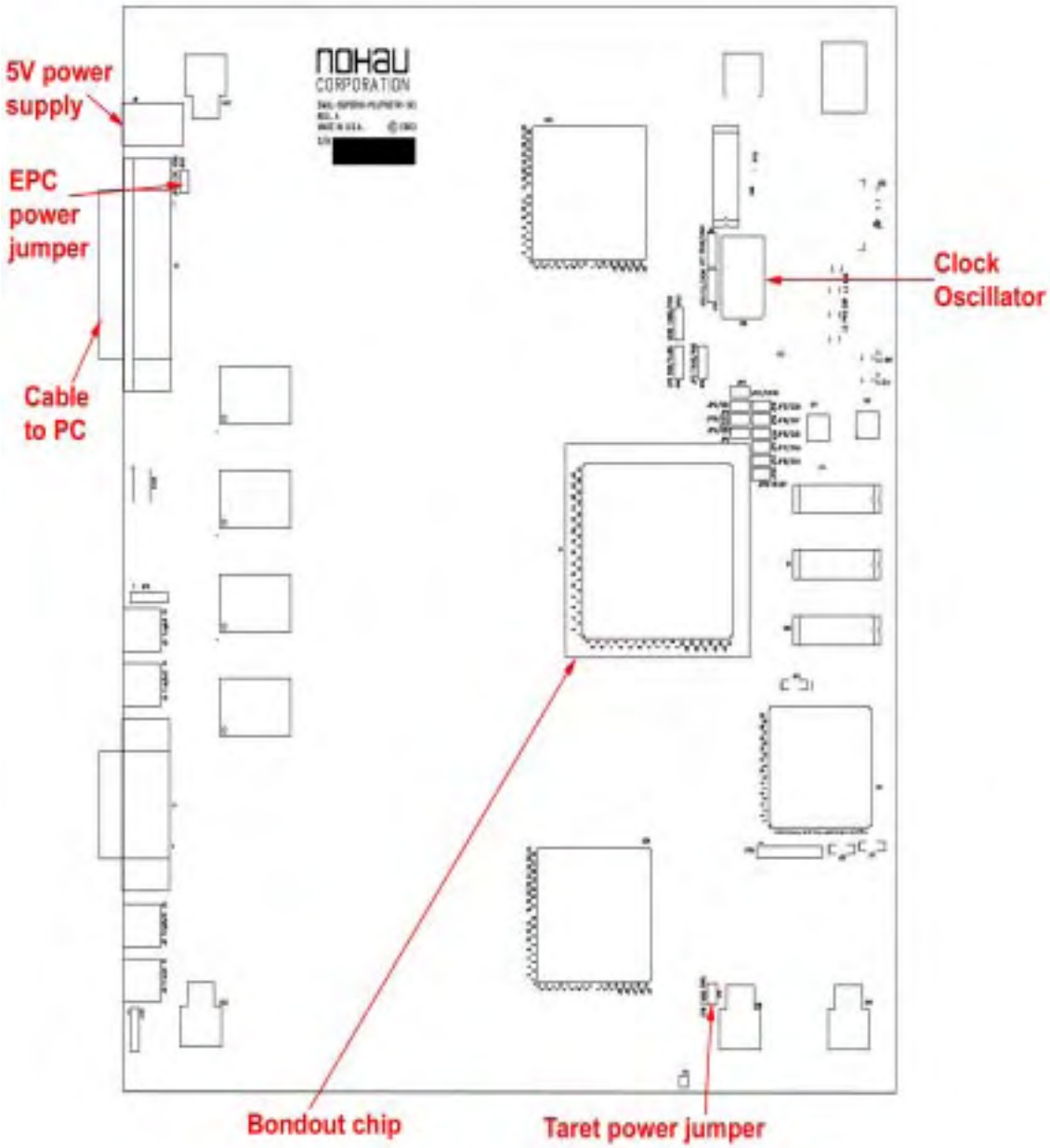


Figure 5

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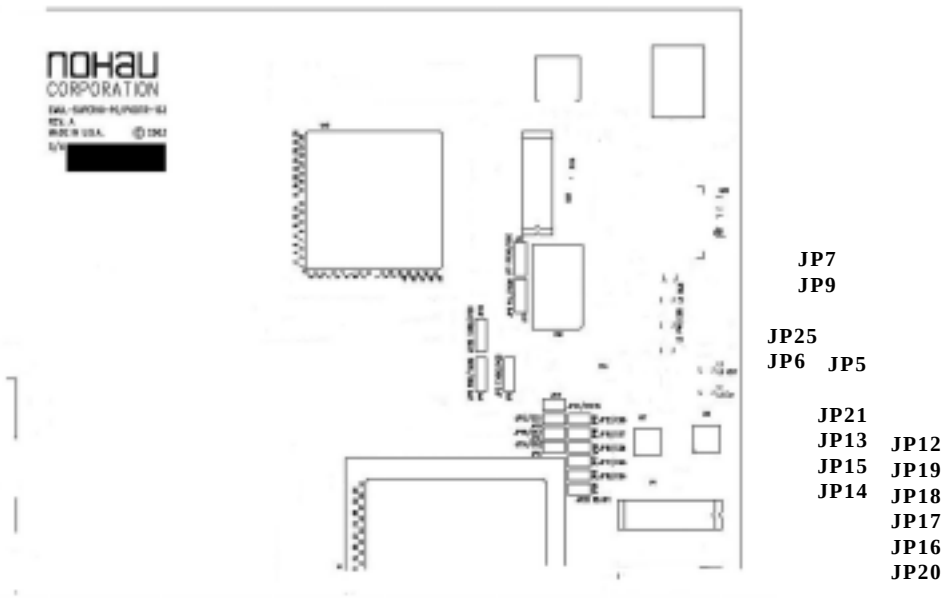


Figure 6

Emulator Jumpers Description - refer to Figures 5 and 6

JP5 and JP6 (set as a pair): This selects the emulator clock or the target clock. Contact Nohau technical support if you need the change the clock.

JP7: This selects the emulator oscillator clock or the emulator programmable clock. Contact Nohau technical support if you need the change the clock.

JP9: This selects the clock generated by the FPGA's DCM with the SUPER10 bondout chip's PLL mode bypass or the clock selected by JP7, JP5 and JP6 with the SUPER10 bondout chip's PLL mode. Contact Nohau technical support if you need the change the clock.

JP25: This selects the emulator clock (30MHz) or the target clock (30MHz) for the FPGA's DCM. Contact Nohau technical support if you need the change the clock.

/CS0(JP12) through /CS7 (JP19): These jumpers physically connect the bondout controller chip select pins to the target adapter. These jumpers are JP12 through JP19.

READY (JP20): This connects the target READY signal to the bondout READY input pin. If you are having trouble getting the emulator to run, try removing this jumper.

RST# (JP21): This connects the target reset signal to the bondout RST# input pin. If you are having trouble getting the emulator to run, try removing this jumper in case your reset time is excessive.

TARG PWR (JP8): This connects the bondout controller power pins to the emulator 3.3 volt supply. This jumper needs to be connected for stand-alone operation. If this jumper is unconnected, power for the bondout must be supplied from the target power supply via the connection adapter. Make sure the power is properly sequenced. Never supply bondout power from the target without the emulator powered up. The top pin connects to the bondout VCC and is a handy place to check the integrity of this voltage source. The bottom pin connects to the 3.3 volt emulator power connector.

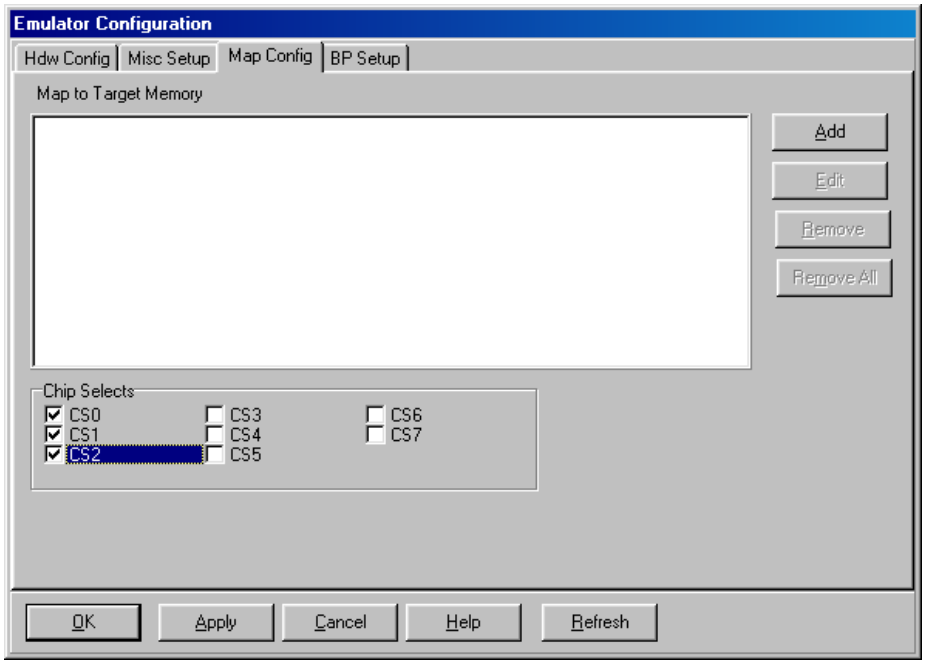
EPC PWR(JP22): This jumper supplies 5 volt power to the EPC cable. Remove when using a ISA card.

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Memory Mapping to Emulation or Target Memory:

The emulator bondout can access memory located on the target or emulation RAM located in the emulator. By default the emulation RAM is accessed. The method of mapping memory to the target hardware uses the chip select pins on the bondout controller. These pins are physically connected to the target via jumpers CS0# through CS7# (JP12 through JP19). Note the "#" indicates an active low signal. The memory space assigned to each chip select is assigned by the contents of the TCONCSx, FCONCSx and ADDRSELx registers. These registers can be programmed during the user initialization sequence or at reset time with the register window. Each individual chip select pin is enabled with the check boxes located in the Config, Emulator under the Mem map Config tab as shown in Figure 7. If a box is not checked, then the bondout accesses emulation memory.

Figure 7



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Seehau: The Nohau Debugger

The Seehau Macro based GUI is designed to provide a consistent user friendly interface for all Nohau in-circuit emulator families. Seehau is a High Level Language (HLL) debugger that allows you to load, run, single-step and stop programs, set and view trace and triggers, modify and view memory contents including SFRs, and set software and hardware breakpoints. Seehau runs under Windows 95, 98, and 2000 and is a 32 bit application.

Seehau has the capability to run over a TCP/IP stack. Seehau is also an OLE Automation server. This means that Seehau based emulators can be manipulated from an application developed in any environment that supports OLE Automation. OLE (Object Linking and Embedding) Automation allows one application to drive another application. The driving application is known as an automation client or automation controller, and the application being driven is known as an automation server or automation component. You can control Seehau from C++, Java, Delphi or Visual Basic. Seehau will also function with ActiveX components from other vendors such as RTOS developers. See the Nohau website www.icetech.com for more information.

Getting Started: Loading and configuring the emulator software Seehau.

The commands and data used to configure Seehau when it is started is contained in the file startup.bas. The file startup.bas is an ASCII file in the default directory c:\Nohau\SeehauST10\Macro. This file is created by the Seehau Configuration program using user supplied information about the emulator and its environment. It is not created when Seehau is initially installed. The file seehau.ini in the c:\Nohau\SeehauST10 directory specifies this startup file.

The configuration can be started by clicking on the Seehau Config icon on your desktop. If you start Seehau itself and startup.bas does not exist, Seehau will start the configuration program. This is a good method to restart the emulator configuration over. Simply delete or rename startup.bas and you can create a new one.

Note you do not need to have the emulator connected to the PC to run the Seehau Config program. You do need the emulator connected and with the jumpers properly set in for the Seehau regular executive to operate properly. For more information on macros; see the Macro Section in this manual.

You can access the emulator and trace setup windows from within Seehau under the Config menu item in the main window. Click on Emulator or Trace for the appropriate setup desired. Note that a more detailed setup is available this way.

This manual assumes you are able to load the Seehau software. Make sure this is done now. If you have trouble loading from diskettes, copy them to a temporary directory on your hard disk and install from there.

It is better to get familiar with the emulator in stand-alone mode before attempting to connect to a target hardware system. The added complications of the target hardware may cause you undue problems at this time. Once you have gained some skills at operating the emulator, it will be easier to connect to your target.

There is some documentation available concerning issues connecting to targets. These are available in the Seehau on-line help or on the Nohau website.

1) Click on the Seehau Config icon on your desktop. You do not need the emulator connected at this time.

2) A blank Figure 10 will open. You will now configure the emulator. You will need to know what interface connector you are using.

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3) Change the settings as indicated. The EPC cable and the LC ISA card are the only appropriate choices for the EMUL-SUPER10-PC/PODTR133. Figure 8 shows the settings used if you are using the EPC cable. The EPC cable is distinguished by a male/female connector on the end that plugs into your PC parallel port.

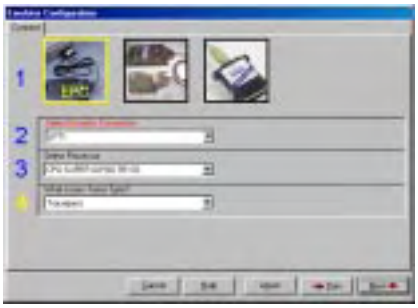


Figure 8

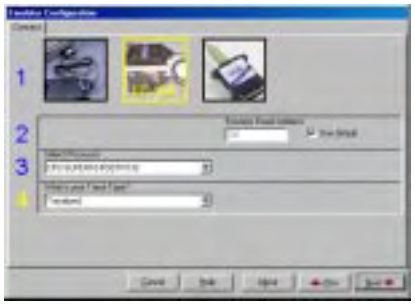


Figure 9

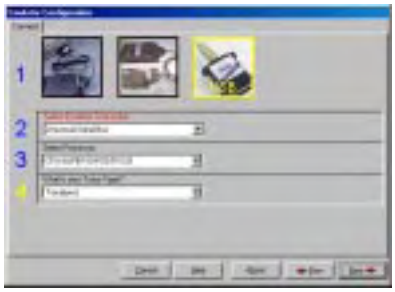
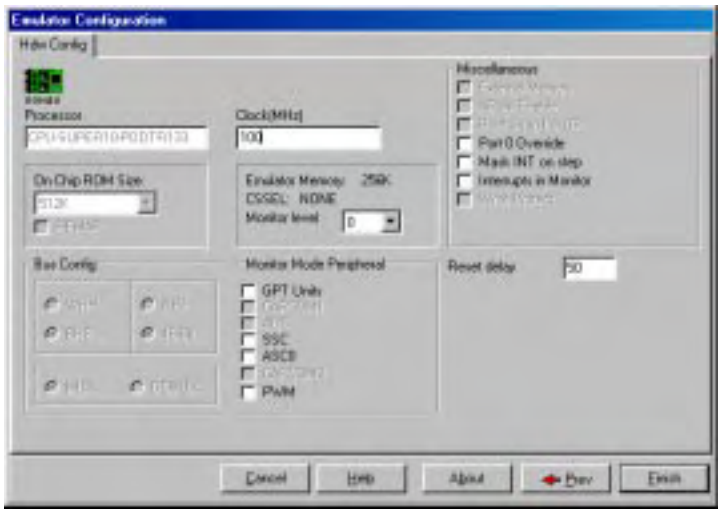


Figure 10

Figure 9 shows the settings for the LC ISA card. The Emulator Board Address dialog box is for the address of the internal communication link from your computer. For the ISA card, the most common address is 200. This setting can be changed on the board. If you are having trouble getting Seehau to startup, you may have conflicts with a sound or ethernet card. If this is happening, change the address. A new value of 208 or 210 seems to work for many people. If you are using the EPC (Enhanced Parallel Cable), this address is not applicable. The EPC cable uses address 378 which represents the LPT1 port on your PC. Figure 10 shows the settings if you are using the USB interface. When all the information has been entered in Figure 8 or 9 or 10, pressing Next will open up Figure 11.

Figure 11



4) Confirm your settings are the same as in Figure 11. This entry only effects the trace timestamp. It does not effect any other part of the emulator.

5) There are plenty of interesting configuration settings here but we will return to them later. Here are the meanings of these boxes:

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uP Clock: The internal CPU clock. This is usually the clock multiplied by 2.5 if the controller is in PLL mode. If your crystal is 20 MHz, then the CPU clock is 50 MHz. Set it to 50 (the default) for the SUPER10. This setting is used for the calculation of the Trace board. It has no effect on the operating speed of the emulation bondout controller except under certain operating modes.

Contact Nohau Technical Support if you need to change the clock frequency of the emulator. There are specific instructions on changing the clock speed. support@icetech.com

Processor: This is set to CPU-SUPER10/PODTR133. This can be changed only through the configuration program as in Step 3 or be editing the file startup.bas.

ON Chip ROM size: this tells Seehau the size of the onchip ROM or FLASH memory in your controller. The default is 512K and this is a preset value.

Reset Delay: The emulator must be able to start in a certain period. An excessive RESET time caused by the RESET line from the target can cause the emulator hardware to timeout. This can be avoided by removing the RESET jumper or setting this value appropriately.

6) Click on Next to enter the data. When Seehau will ask if you are done, click on Yes.

7) Seehau configuration program creates Startup.bas and Seehau is now configured to run your emulator.

10) The Seehau configuration program shuts down. Seehau is ready to properly run the emulator.

If all this completed without any errors, you are ready to run the Seehau User Interface after you have connected and powered up the emulator.

The emulator is powered by 5 volts regulated at the standard power supply socket. The center pin is positive. The jumper settings will be the default for this part of the manual. The CPU fan must operate or the bondout CPU will overheat and be damaged. This will not be covered under the warranty. Do not connect the power supply to the emulator at this time.

Important Software and Hardware Notes:

Always use Uninstall to unload any existing version of Seehau from your computer before loading in another copy. Do not simply delete the Seehau files and/or folders. Do not install Seehau on top of an existing copy. Under My Computer select Control panel, then Add/Remove Programs. After Uninstall has run, you probably should delete any files and folders that Uninstall did not delete. Save your personal macros and source files first. Pay particular attention to startup.bas in the Macro directory. You may not want to use your old copy if it has any corrupted data.

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Do not leave the pod powered for extended periods of time without Seehau active. The pod will be in an uninitialized state with unpredictable results. There are no reports of damage resulting from this.

Pay attention to the power-up and power-down sequences of the emulator and a target system. When powering up or down the system: the target must never be powered when the pod is not. Power flowing from the target into the bondout controller will damage it. Always power up the pod first, and power it down last.

Starting the Emulator and Seehau

1) The two clock jumpers must be in the "POD" position. See Figure 6 for details.

2) TARG PWR must be connected. This jumper supplies power to the bondout CPU. See Figure 5 for its location.

3) If you are using the EPCor the USB, the EPC PWR jumper must be connected to send power to the EPC or the USB. This jumper is located between the PC connector and the power supply socket. If you are using the ISA card, this jumper must be left open. Otherwise, the power from the ISA will conflict with the emulator 5 volt supply.

4) Connect the cable between the PC and the 25 pin connector on the emulator board.

5) It might be a good idea to double check your settings.

6) Plug in the Nohau 5 volt power supply.

7) The fans will start immediately.

8) Double click on the Seehau ST10 icon on your PC desktop.

9) Seehau will configure itself from startup.bas and may present this message asking if you want to reset the emulator. "Macro" will show up at the bottom of the Seehau screen while startup.bas is being executed. The two green LEDs on either side of the trace card near the emulator oscillator will illuminate indicating the startup sequence for the trace card is complete.

10) Position and size the main window to your preference. You can open up new windows. They are found in the New menu item on the main Seehau window.

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Problems ?

Problems are usually from the EPC PWR, TARG PWR, the clock or the memory map jumpers incorrectly connected. Review instructions 1, 2 and 3. Make sure the cable to the PC is correctly connected. If are using the EPC, try it without a printer connected. Do not have the emulator connected to a target system or adapter. You should have a 20 MHz oscillator module installed to get a 50 MHz CPU frequency.

Try another PC. Reload Seehau. If you do this, use the Windows Remove Programs found under My Computer, System. This way, all files and registry entries are properly deleted.

If all this fails, please contact your Nohau representative for technical support at support@icetech.com.

I got my emulator to work and I set my windows up as in Figure 12. I resized the existing windows to suit my computer screen resolution. You can open up a Trace window or any other window if you prefer.

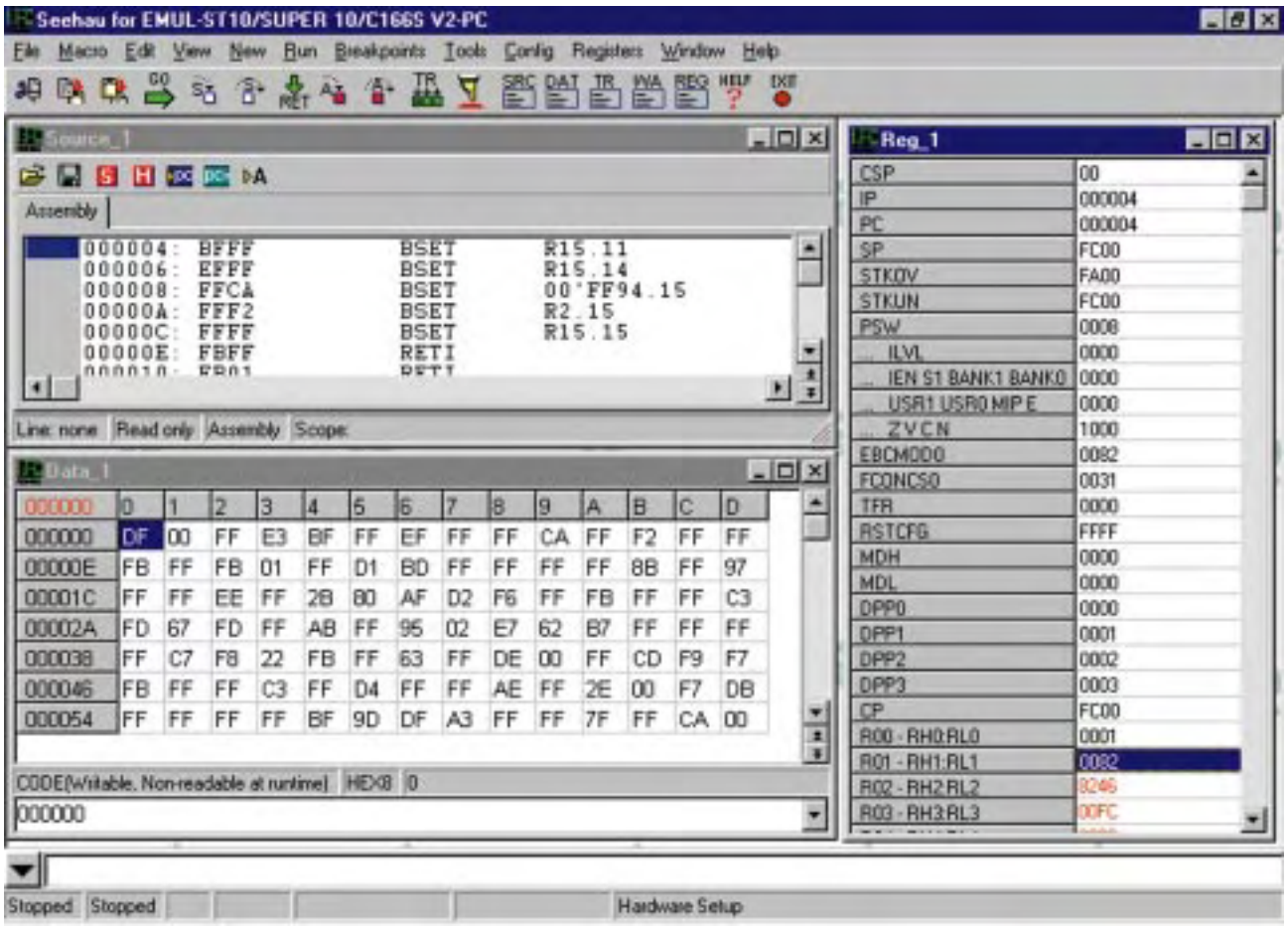


Figure 12

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Shutting down Seehau:

1) Click on the X in the upper right corner or select the menu item File, Exit. Figure 13 will appear.

2) You can save your setup in startup.bas or a macro file of your own naming.

3) If the box Use as Default? is enabled, this file will be used when Seehau is started. This information is stored in the file seehau.ini.

4) This macro will save those items enabled in the Macro Save Type area.

5) Select No Save and exit from Seehau. This will enable a fresh start for the examples.

5) You can specify the startup file to use when starting up Seehau by having a dialog box open up. Open the menu Config, Environment menu and under the Preferences tab, select the "Use Startup dialog?" box. Click on OK to close this window and enter your selection.

Figure 13

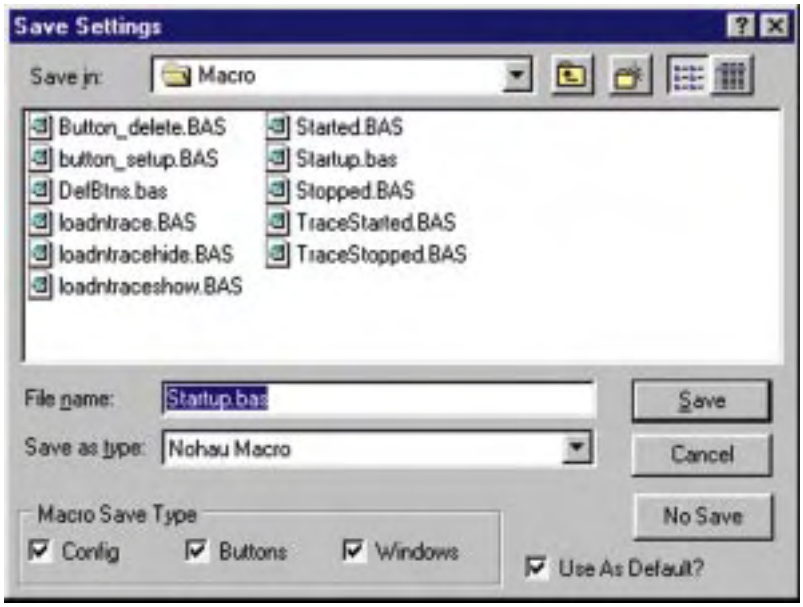


Figure 13

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Chapter 2: Trace Memory and Trigger Mechanism

Introduction

The Nohau EMUL-SUPER10-PC/PODTR133 emulator is an advanced emulator with speeds of up to 160 MHz. This application note describes the trace and trigger configuration menus for this emulator and many features are similar for the EMUL-ST10-PC, the EMUL-ST10-FA and the EMUL-SUPER10-PC emulators.

The EMUL-SUPER10-PC/PODTR133 emulator pod-trace board contains the bondout controller, adapter connections, Trace Buffer RAM, Triggers and support logic. This chapter concerns the configuration and description of the trace and trigger mechanisms.

The trace and trigger mechanisms contains its own housekeeping microcontroller. This allows the trace to be started and stopped and other functions to be operated without stealing cycles from the emulation controller. Nohau trace boards can be configured and viewed in real-time and on-the-fly.

Overall Description

Figure 1 gives an overview of the trace and trigger mechanism. There are four basic trigger mechanisms present in the SUPER10 bondout microcontroller as shown in Figure 2. They are Level 1 to 4 Breakpoints and Triggers, MAC triggers, Instruction Pointer Control (1 to 16) and Data Address (DA) Control (1 to 32). This mechanism provides for the hardware breakpoints but not the software breakpoints which are provided by Nohau software. The trace card is optional and can easily be added later.

Qualifier data can be entered as addresses, data, SFRs and external signals. They can be entered as numerical hex values or symbols, all with additional values. For example, *timer.sec + 6* is valid. These are combined and compared in each of the four selection mechanisms and sent to the Trigger State Machine. These signals from the selection mechanisms are then combined in an AND/OR Output Array and then sent to the emulator hardware. The External Input signals are sent to each of the four levels of breakpoints if they are enabled.

The four levels of triggers and breakpoints can be operated independently or can be pre-qualified by other levels. In the EMUL-ST10 (50MHZ) and the EMUL-ST10-FA emulators only the preceding level could be the pre-qualifier. *This is important.* This means, for example, that in order for Level 6 to happen, it can be configured such that Level 5 must have already occurred. Or, each level can be independent of the other. In the SUPER10 bondout, each level can be pre-qualified by any other level and not necessarily the preceding one.

There are two general modes of operation: Standard and Advanced. They are selected by the button found at the bottom right corner of Figure 3. The Standard mode presets some of the Advanced mode settings making setup simpler. The Advanced settings offer all the features of the SUPER10 bondout trigger mechanism. This manual uses the Advanced setting throughout. The Standard setting will remove many of the window boxes from view. These window boxes are preset with default values to simplify trigger setup.

You can use the triggers to perform these types of operations:

- Break emulation if a specified address and/or data pattern is encountered.
- Record specific CPU cycles in the trace buffer.
- Determine if certain operations take too much or too little time to execute.
- Calculate the time taken for a specified operation such as a function or functions.
- Start and stop the trace recording.
- Send a signal out as certain conditions happen or cause an external input to cause a trigger.
- You can save any number of trace configurations and easily recall them with a button.
- Various combinations of qualifiers are possible to provide sophisticated qualifiers.
- Temporarily “park” a trigger with a simple mouse click.
- Trigger and record certain MAC accummulator results and testing MAC flags.

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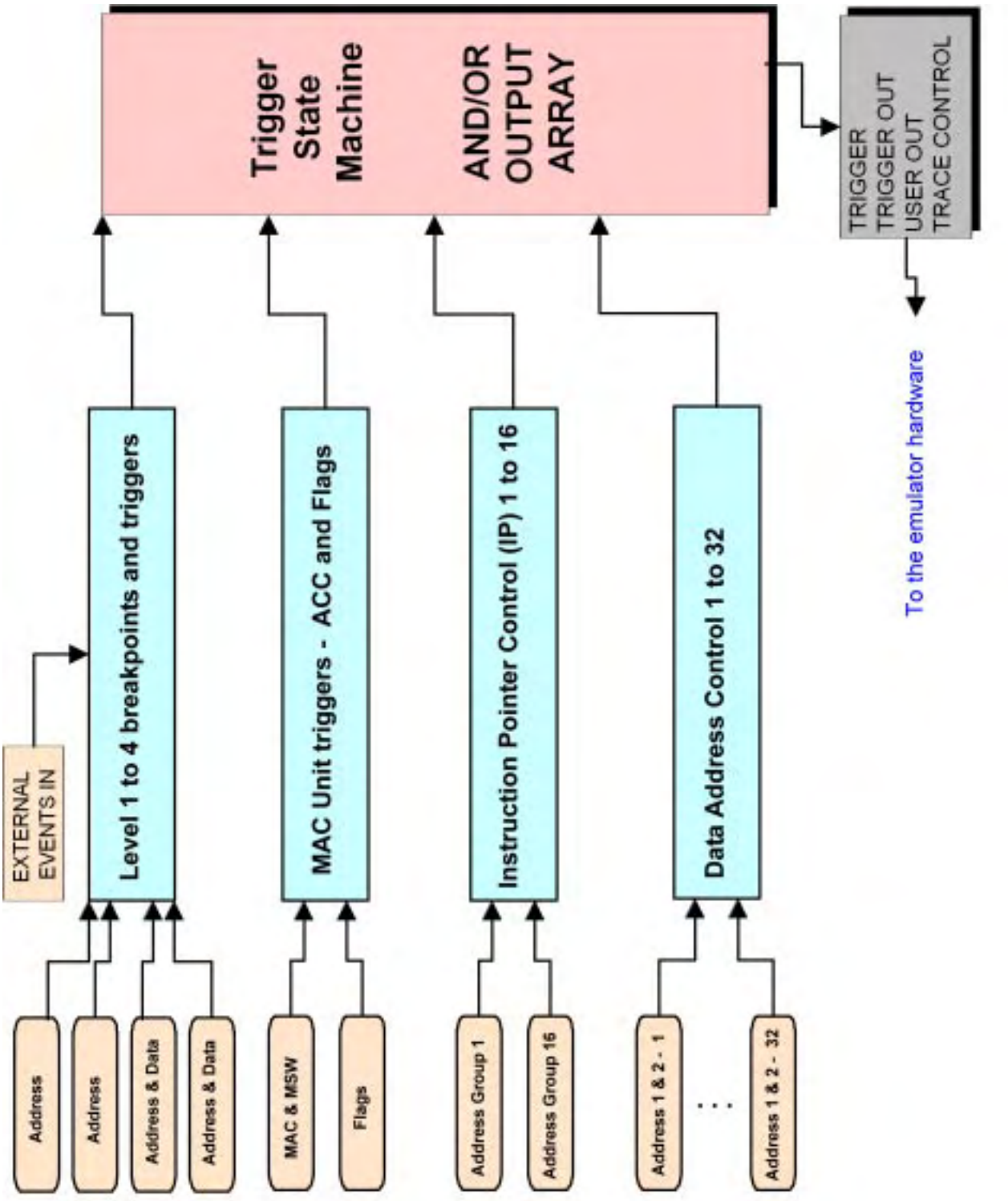


Figure 1

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Main Trace Menu

The Trace Configuration window shown in Figure 2 is found under the Config,Trace menu item. It can also be selected by a right mouse click while the cursor is positioned on the Trace window. This window is for the STMicroelectronics ST10 and Super10 family. This discussion is for the Advanced mode. The Standard mode has many of these values either not available or have unchangeable default values. Click on the button in the bottom right corner button to switch modes.

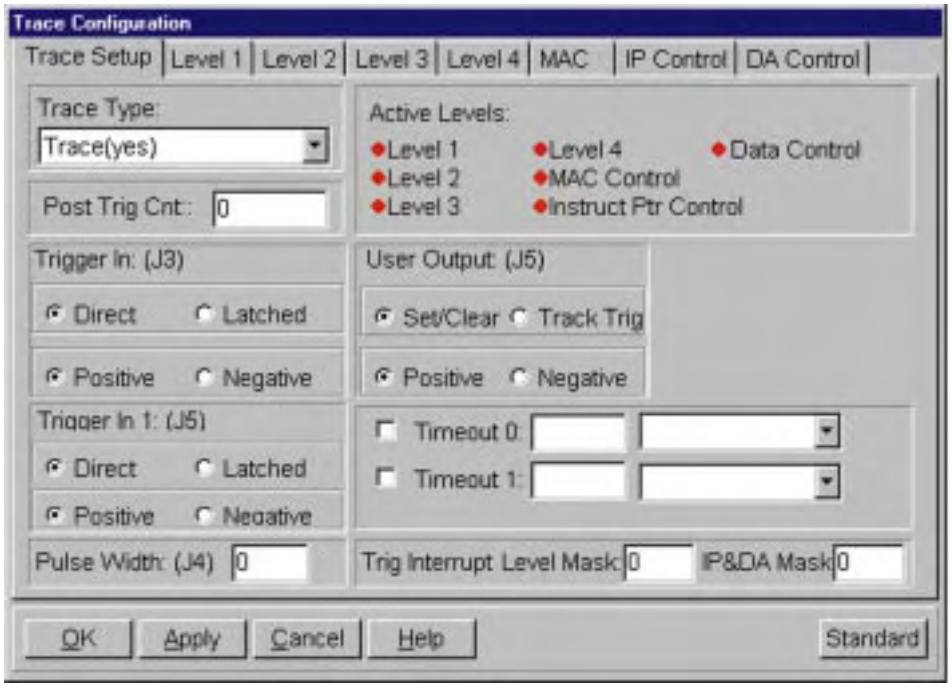


Figure 2

Trace Setup

Trace Type:

This check box indicates to Seehau if the trace board is installed. There is one type of trace board so you do not need to specify anything other than it exists or not. In the Super10 emulator systems, trace memory is an optional add-on board to the emulator pod. The Trace_TraceBoard command is found in the startup.bas file which is executed when the Seehau software is started and specifies this attribute.

Active Levels:

The status of the various levels is indicated here. A red dot means the specified level is disabled while a green dot indicated it is enabled. A check box in each qualifier in each level tab is used to toggle these values. The various levels are discussed later in this manual.

Post Trig Cnt:

This selects how many frames are recorded in the trace memory after the trigger has occurred. Triggers are programmed to occur when a particular condition is true. Example*: address 500F is written with the value 5E*. This can be viewed as the "when something happens". When this becomes true, the emulator performs an action according to what the user has programmed. This could be to break emulation, start or stop the trace or send an external signal to the outside world. Look at this as "what will then be done".

This can be useful to see what happened not only before the trigger occurred, but also what happened afterwards. If this is set to 7 for example, then the trace will record the cycle of interest plus the next six cycles that follow. The exact number of cycles recorded can vary a small amount depending on the state of the CPU pipeline which is fully decoded in the EMUL-SUPER10-PC/PODTR133 emulator. A decimal number is entered up to 128K.

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Trigger IN: (J3)

An external TTL level signal can be used as an input to cause a trigger. This connector is J3. This input signal can be positive or negative edge sensing according to the setting selected here. The signal can either be latched or free floating (Direct) according to the setting selected. This signal is sampled during each processor frame and cleared at this time.

Trigger IN: (J5)

An external TTL level signal can be used as an input to cause a trigger. This connector is J5. This input signal can be positive or negative edge sensing according to the setting selected here. The signal can either be latched or free floating (Direct) according to the setting selected. This signal is sampled during each processor frame and cleared at this time.

Trigger OUT: (J4)

There is a Trigger output connector (J4) on the trace board that is pulsed when a trigger occurs in a level when the "Trigger - stop trace and pulse Trigger Out" is checked in that level. The trigger OUT will be active even after the trace has stopped.

Pulse Width:

This box sets the pulse width of the pulse sent out to J4. This value is 5 bits and is entered 1 to 20 Hexadecimal (1 to 20) and its units are in CPU cycles. A "1" gives a pulse width of approximately 140 ns and 20 gives 2.2 usec. This results from a 50 MHz CPU clock. This sets the USER OUT width also. This effect may change in the future.

User Output: (J5)

There is a USER output connector (J5) on the trace board that can be set or cleared according to how it is set in the triggers. This area in Figure 2 sets the characteristics of this TTL level output. This output works even if the trace has been stopped.

Pulse Width: See Pulse Width above under Trigger OUT (J4) for details.

Set/Clear:

If Set/Clear is set, the value of the USER output will change according to the "Turn User output ON" and the "Turn User output OFF" options in the Level tabs which are discussed later. When this output is turned on for instance, it will stay in this state until the Clear option occurs. Normally two triggers are used to turn the USER off and on. This feature is mutually exclusive to the Track Trig feature.

Track Trig:

Track Trig provides for an output pulse that is active only when the trigger condition is true and the "Turn User output ON" option is selected. The output waveform "tracks" the state of the trigger. This occurs on a cycle by cycle basis. The pulse width is selected in the Pulse Width window.

Positive/Negative:

The polarity of the output can be selected either Positive or Negative and is effective for both the Set/Clear and Track Trig options.

Timeout:

There are two 12 bit timers used to create a true trigger condition if an event's timing is over or under a user selected number of CPU instruction cycles. Examples: an ISR (interrupt service routine) takes too long (or too short) to occur or takes too long (or too short) in its execution time. These timers are 12 bits in length and values from 0 to 3FF can be entered.

There are two enable click boxes just before the Timeout 0: and Timeout 1: titles. The next box is for the timeout value in instruction cycles of the target CPU. The last box holds values for the prescaler of the timers. The prescaler value is selected by clicking on the arrow and clicking on the appropriate selection. Values are divide by 1, 2^10, 2^20 and 2^30. The timers are selected under the Level tabs.

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Trigger Interrupt Level & Mask

This gives the Trigger State Machine a priority within the microcontroller interrupt structure. This setting can be used to block a trigger when a interrupt service routine is at a lower level than the Trigger State Machine. The Trigger State Machine is essentially the entire trigger mechanism of the bondout controller. The Trigger State Machine can be assigned to respond if the CPU interrupt level is at a certain level.

IP&DA Mask

This gives the Instruction Pointer Control (IP) and Data Address Control (DA) mechanisms a priority within the microcontroller interrupt structure. This setting can be used to block a trigger when a interrupt service routine is at a lower level than the Trigger State Machine. The Trigger State Machine is essentially the entire trigger mechanism of the SUPER10 bondout controller. The IP and the DA mechanism can be assigned to respond if the CPU interrupt level is at a certain level.

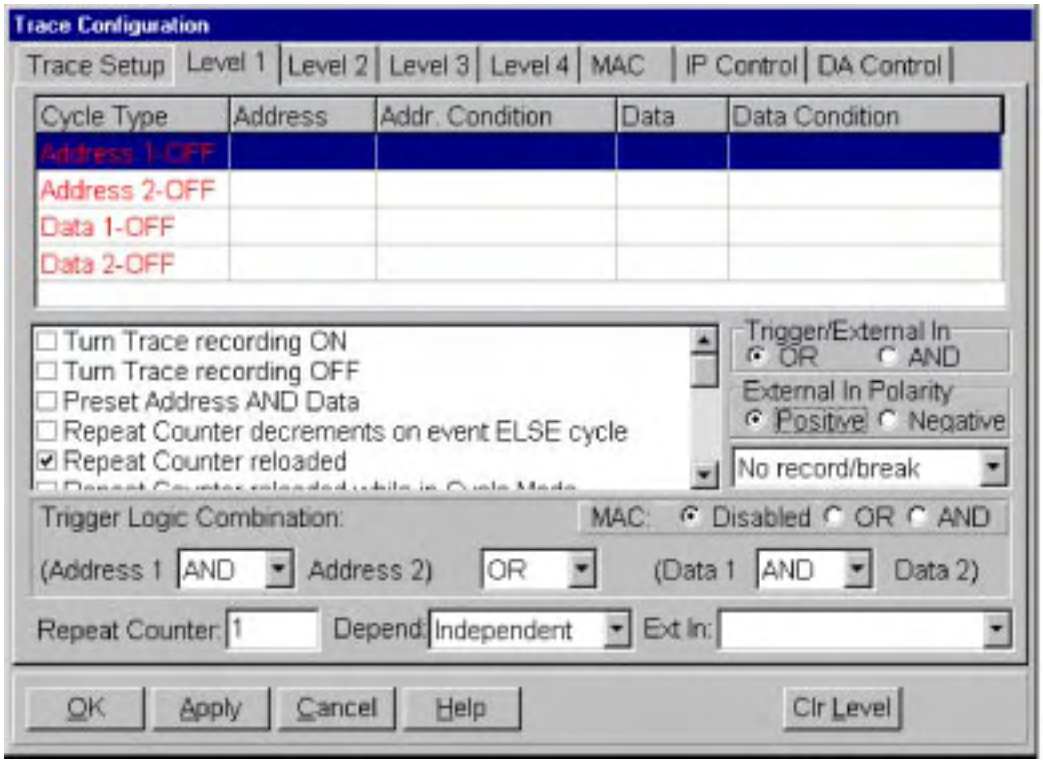
Level 1 through Level 4

Overview:

The SUPER10 bondout processor provides for four levels of triggers. These are represented by the four Level tabs in Figure 3. These four levels are provided by the bondout chip and are controlled through the Seehau interface. Level 1 is shown selected in Figure 3.

The 4 levels are equal in priority and independant to each other unless the “Depend” box has an entry in it. Associated with each level are two data qualifiers and two address qualifiers. These are shown as “Level 1 to 4 Breakpoints and Triggers” in Figure 1. You can include external signals, other levels (even itself), flags, timers and an external input. Figure 4 is a block diagram showing one of the six levels. Figure 5 is the same block diagram but with the “Preset Address AND Data” mode selected. The only difference is that Address 2 and Data 1 are swapped with each other when Preset Address AND Data” box is checked. This mode allows an address qualifier to be AND’d directly with a data qualifier.

Figure 3



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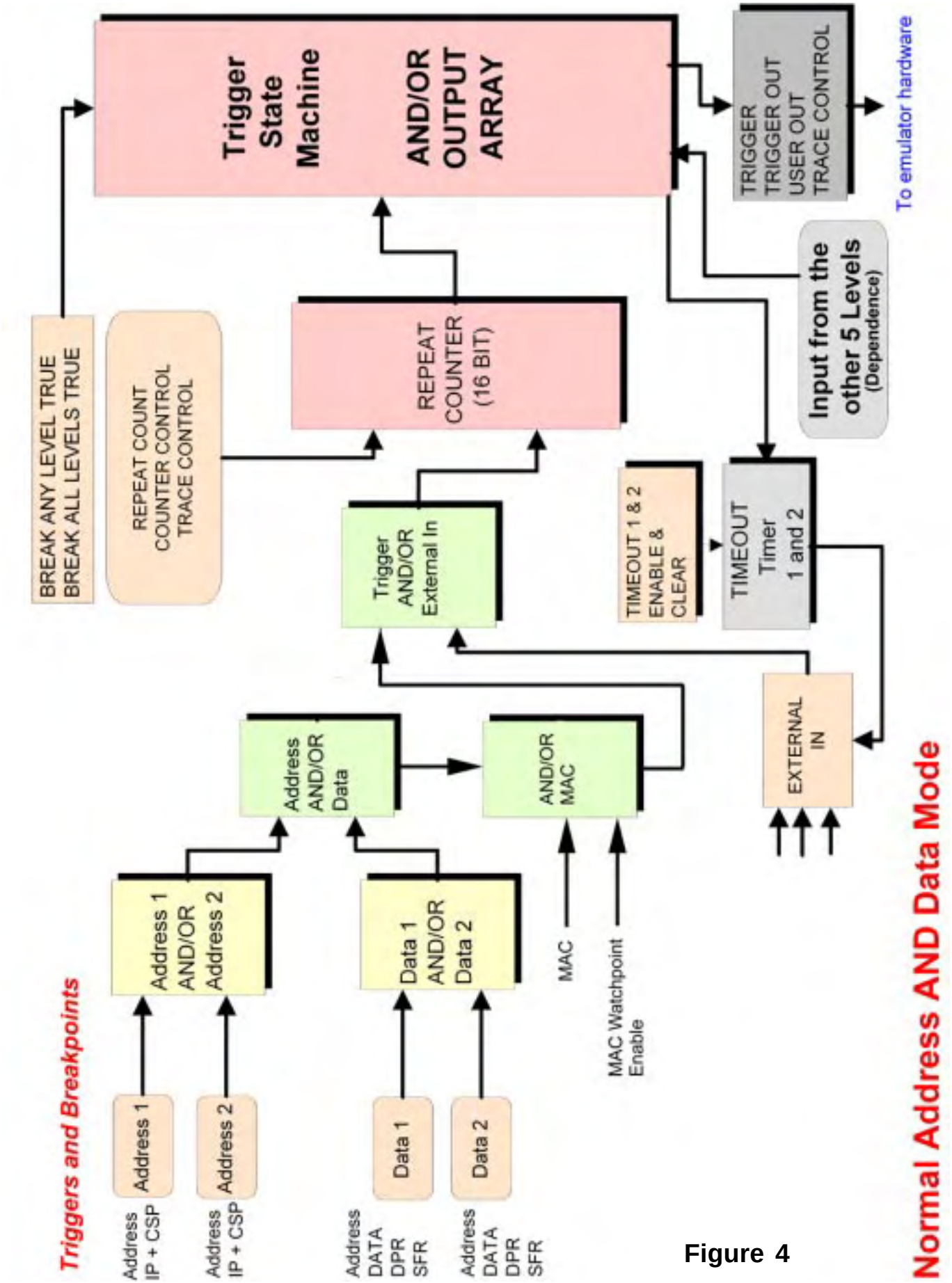


Figure 4

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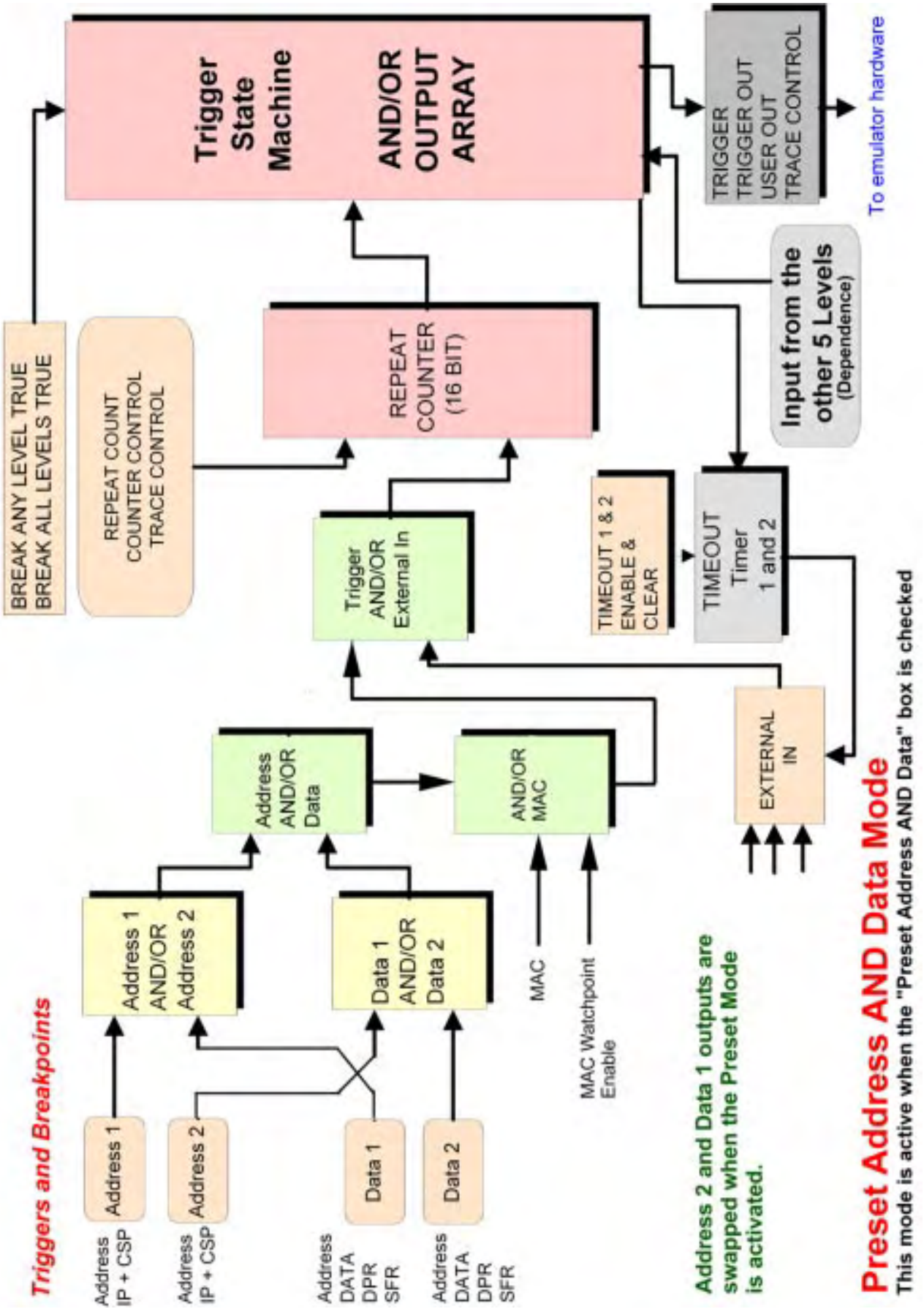


Figure 5

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Definitions

Qualifier:

The specifications that partially define a condition you want to examine. "If address = 5012" is a qualifier. "If address = 5012 AND data write = FE" is also a qualifier. You can make many types of qualifiers.

Event:

This is the qualifier becoming true. You now choose what is to be done.

Task:

What is to be done when the qualifier becomes an event. When the qualifier becomes true and therefore the event happens: do a specified task. A task is specified by you in the trace configuration window. There are plenty of examples of tasks. To "record this level in the trace" is a good example. A trigger is a signal passed to the trace hardware to tell it to stop recording the trace memory and other to precipitate other tasks.

The trigger is also available as a TTL output signal on a connector (J4) and can be used to trigger an oscilloscope or provide a signal to external hardware. A break is a signal to the emulator hardware to stop the emulation. A task can be a flag used to pass information about an event to another qualifier. An example is when one event has occurred and this fact is needed as input by another qualifier somewhere else. "Previous level must become true first" is a good example.

Note: When most people mention a trigger, they are usually referring to the qualifier or the entire system.

Definitions of the Trace Configuration Menu - Level 1 - 4

Please refer to Figure 3.

CYCLE TYPE

Address 1-OFF & Address 2-OFF

Each is an address or an address range that are OR'd or AND'd together. Breakpoint occurs before execution for a break event and after execution for a trigger event. These are not the same breakpoints as set in the Source window. Double-click or press the right mouse button to enter or modify data. The OFF shown will turn to an ON when data is entered and the Enabled boxes in the edit windows are checked.

Data 1-OFF & Data 2-OFF

Each is an address or an address range that are OR'd or AND'd together. Events occur after execution for a qualifier becoming true. Double-click or press the right mouse button to enter or modify data. The OFF shown will turn to an ON when data is entered and the Enabled boxes in the edit windows are checked.

TASK OPTIONS WINDOW

These settings activate specific tasks of the trigger system. Most are registers in the ST bondout chip. If a box is selected with a check mark, then the associated statement is TRUE.

Turn Trace recording ON

This setting starts the trace recording when the trigger qualifier becomes true. This is the same as Window mode used in other Nohau emulators. Associated with the trace buffer control.

Turn Trace recording OFF

This setting stops the trace recording when the trigger qualifier becomes true. Normally one level is used to turn the trace on and another to turn it off. One trigger is used to start the recording when it becomes true and a second trigger is used to stop the trace when it then becomes true.

This is often used to record the cycles occurring not only inside a specified function, but also those of any functions called by this function. In contrast, the "Record this level in the trace buffer" will record only those cycles executed within the function as configured. Combinations with external events such as the Trigger IN are legal. Associated with the trace buffer control.

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Preset Address AND Data

Refer to Figure 4. Note that Address 1 and Address 2 can be AND'd or OR'd with each other. Data 1 and Data 2 can also be AND'd or OR'd with each other. These two outputs can then further be AND'd or OR'd together, producing an output that is then fed into the Trigger AND/OR External In logic. These attributes are configured in the Trigger Logic Combination field shown in Figure 3. This is the only entry here that is not a task. In previous ST10 emulators it was not possible to change the OR and AND selections.

Preset Address AND Data provides for a special configuration not provided for in the aforementioned combinations which is shown in Figure 5. If Preset Address AND Data is set, it swaps Address 2 and Data 1.

Refer to Figure 5. This is the configuration resulting when Preset Address AND Data is enabled. Note Address 2 can be AND'd or OR'd with Data 2. Address 1 can also be AND'd or OR'd with Data 1. This was not possible with the configuration available in Figure 4. Address 2 is swapped with Data 1. The Trigger Logic Combination field will change appropriately when this attribute is set or unset. See Figure 6.

Repeat Counter - a description.

Each level has a 16 bit counter that essentially determines how often an event must happen before the trigger is generated. The value used in this counter is called the Repeat Count and is entered in the Repeat Counter field shown in Figures 3 and 6. For example, If the Repeat Level Count = 4, then the trigger will be activated by the qualifiers becoming true 4 times. If the Repeat Counter = 0, the trigger will not occur. The largest number that can be entered is FFFF. The following three entries are associated with the Repeat Counter.

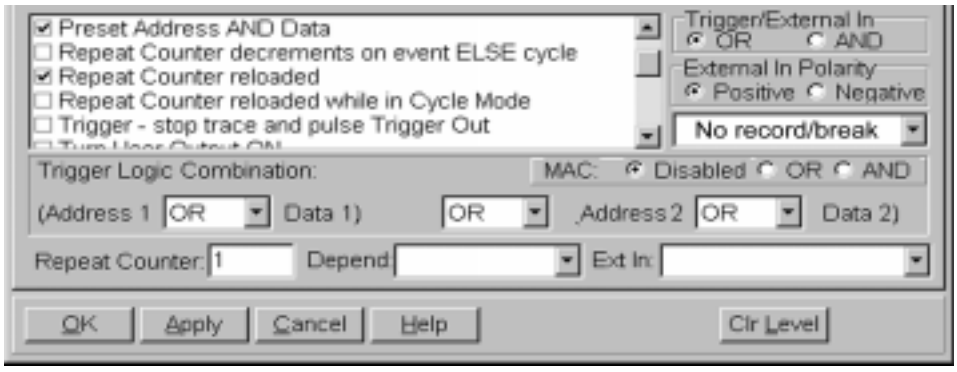
Repeat Counter decrements on event ELSE cycle

This selects whether the repeat counter decrements in the Event or Cycle mode. Cycle Mode is a counter decrement on each instruction cycle. Event Mode is a decrement on each event. The event results from a signal which is the input to the counter from the block is labeled "Trigger AND/OR External In" in Figure 5 when a qualifier becomes true. If checked, it is in event mode. Is associated with the Repeat Counter.

Repeat Counter reloaded

This is a binary attribute input defining if the repeat counter should be reloaded with the Repeat Counter value once the counter has cycled and sent a trigger signal to the Trigger State Machine. If this box is checked, the counter will be reloaded once the counter limit is reached and the action can be repeated. If it is not checked, the counter is not reloaded. Essentially, the trigger will then occur only once in this case and can be called a one-shot mode. This box should be checked for general purpose trace and trigger operation. Associated with the Repeat Counter.

Figure 6



Repeat Counter reloaded while in Cycle Mode

This binary attribute input determines if the counter is reloaded or not when qualifier becomes not true when the counter is in the Cycle mode. Cycle Mode is a counter decrement on each instruction cycle and is set by "Repeat Counter decrements on event ELSE cycle" described above. If "Repeat Counter reloaded while in Cycle Mode" is checked, it is in Atomic mode. If it is not checked, it is in Cumulative mode.

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The input to the counter is the event signal which occurs each time a qualifier becomes true (an event). While this event is true (asserted), each instruction cycle will result in a decrement of the Repeat Counter. If the counter reaches zero, a trigger signal is sent to the Trigger State Machine.

If the counter does not reach zero by the time the event becomes not true, (not asserted), it will be either reloaded (Atomic mode) or not changed (Cumulative mode).

In Atomic mode, the counter must reach zero in the prescribed number of instruction cycles (the counter contents) in order for it to make an event. This is useful if you are looking for events that take longer than this prescribed number of cycles. If the event signal does not stay asserted for long enough, no matter how many times it occurs, an event will not be created.

In Cumulative mode, the counter is not reloaded when the event becomes not true. The next time the event does become true, the counter will continue to decrement form the existing counter value. When the required number of instruction cycles have occurred, even if they are not of any certain duration, an event will eventually be generated. If this box is checked, the counter is reloaded. Associated with the Repeat Counter.

Trigger State Machine - a description.

This mechanism feeds signals from each level to the AND/OR array which determines how the Repeat Counter signals will be used. There is only one AND/OR Array in the emulator and all levels share it. Each Repeat Counter output for any individual level is used for the Trace Control, USER OUT and the Trigger OUT connectors. The Trigger signal (not the same signal as Trigger OUT) is used as a signal for the rest of the emulator hardware and is generally used to stop the trace recording. The following twelve attributes found in the Task Options window configure the Trigger State Machine. They are actually registers in this machine and there is a set for each of the six Trigger State Machines. See Figure 4 for the block diagram.

Trigger - stop trace and pulse Trigger Out

This attribute sets the trigger to be active when the associated qualifiers become true. This trigger signal is used to activate the specified task and is provided on the trigger output connector (J4) on the trace board. This attribute is always in Track Trig mode therefore the output signal tracks the event. Check the box to activate this feature.

Turn User Output ON

This attribute sets the user output connector (J6) on the trace board. This output will go high when a qualifier is asserted. This output will be latched high until turned off. Check the box to activate this feature.

Turn User Output OFF

This attribute clears the user output connector (J6) on the trace board. This output will go low when a qualifier is asserted. Check the box to activate this feature.

TIMEOUT - a description

There are two 12 bit timeout counters 0 and 1 in the AND/OR array. This means they are shared by all levels. They are set in the Trace Setup window. See Figure 2. The timeout commands are always in the Set/Clear mode. These timers clear the Repeat Counters when they count up to 3FF and if enabled for a given level. The timeout counters are connected to the particular level via the External In dialog box found in Figure 3. The Timeout timers get their clocking input from the output at the Trigger AND/OR External In logic which becomes true when a qualifier becomes true. The timer load value and prescaler is entered in Figure 2.

Enable Timeout 0

This attribute is used to enable the timeout counter 0. It is loaded with the value set in Figure 2. The counter increments each time an event happens. It clears the Timer Counter when it reaches 3FF if “Timeout x clears the Repeat Counter” is enabled.

Disable Timeout 0

This attribute is used to clear the timeout counter 0 when a specified event happens.

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Enable Timeout 1

This attribute is used to enable the timeout counter 1. It is loaded with the value set in Figure 2. The counter increments each time an event happens. It clears the Timer Counter when it reaches 3FF if "Timeout x clears the Repeat Counter" is enabled.

Disable Timeout 1

This attribute is used to clear the timeout counter 0 when a specified event happens.

Timeout 0 clears the Repeat Counter, Status Register

This enables Timeout 0 to clear the Timer Counter when it reaches 3FF. The Status Register is a register that indicates to the Seehau software events that have become true. This attribute clears this register.

Timeout 1 clears the Repeat Counter, Status Register

This enables Timeout 0 to clear the Timer Counter when it reaches 3FF. The Status Register is a register that indicates to Seehau events that have become true. This attribute clears this register.

Priority Control

Time for me to read the bondout specs. Answer is coming soon.

Record/Break Control - a description.

Each level can be used to record the event in the trace buffer or to stop emulation when its qualifier becomes true. This is set in the dialog box shown in Figure 6 that contains "No record/break". Other choices from the pull down menu are "Record this level" and "BK Emul if level true". If this filed is blank, it acts as if "No record/break" is selected.

No record/break

No action is taken concerning recording or break emulation when this level becomes true. Other attributes in the TASK OPTIONS WINDOW are still legal.

Record this level

When the event becomes true, the instruction or event will be recorded in the trace buffer. This is also called "filtering" in other Nohau emulators.

Bk emul if level true (Break emulation if this level is true)

When the event happens (i.e. the qualifier becomes true) emulation will be halted and the trace board will be stopped. This attribute is OR'd with the other level break emulation attributes.

MAC: - a description.

A given level can trigger on MAC results and flags. This field can select Disabled, OR or AND. Refer to Figure 4. This attribute configures the box labelled AND/OR MAC.

Depend - a description.

This drop-down menu refers to the "dependency" feature. This connects a given level to other levels or the two Trigger IN connectors. The default is blank or "Independent". This was called "Previous Level Dependency" in previous ST10 emulators. In the SUPER10 emulator, dependency is restricted to only the previous level number. Any level can be used as a pre-qualifier.

EXT In: - a description.

This drop-down box is used to select external events to the trigger mechanism. The default is blank or No external source. The possible inputs are the two external Trigger IN connectors and TIMEOUT 1 and 2 count to the value of 3FF.

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Entering Data into Level 1-4

Figure 7 shows the Level 1 Trace Configuration window. This is similar to Figure 3 but has a qualifier entered in Data 1. Each level has 2 address and 2 address/data qualifiers and they are shown here. The ON or OFF in the label field indicates if this particular qualifier is enabled or not. Figure 7 shows a Data qualifier enable for a write of 3400 to address 5017.

To enter or edit data either double click on required address or data line or right mouse click on the line. The right mouse click also enables you to remove the line. Figure 8 will open up. Figure 8 is for Data: Address has the data windows greyed out and two new check boxes called Fast Reg 0 and Fast Reg 1.

If the two enable check boxes are unchecked, the qualifier will be disabled, the word OFF will appear in Figure 7 and if the other 3 qualifiers are disabled, the green enable light will go off in Figure 2.

You can type the symbol name in place of the 5017 and show + 7 can also be used. You can also copy the symbol name from the symbol browser found under the View menu item. Note the various combinations that can be entered in this window. Examples using these windows are given at the end of this chapter.

Figure 7

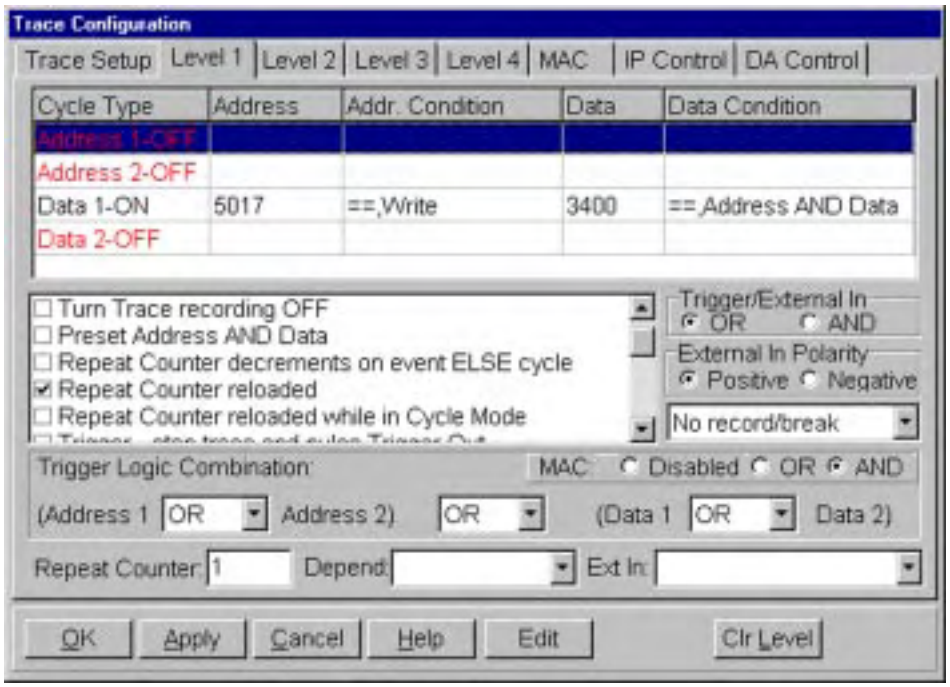
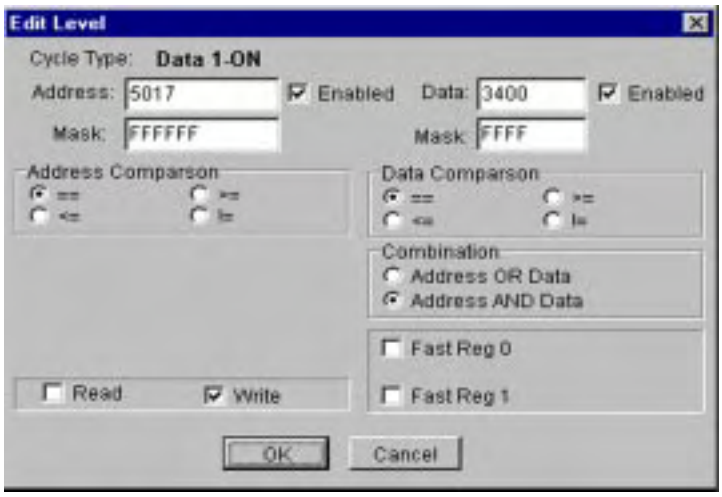


Figure 8



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MAC Watchpoints

The MAC tab is used to enter values for the MAC watchpoints. The emulator is able to trigger on MAC accumulator values as w ell as the MAC flags. Figure 9 shows the MAC configuration window.

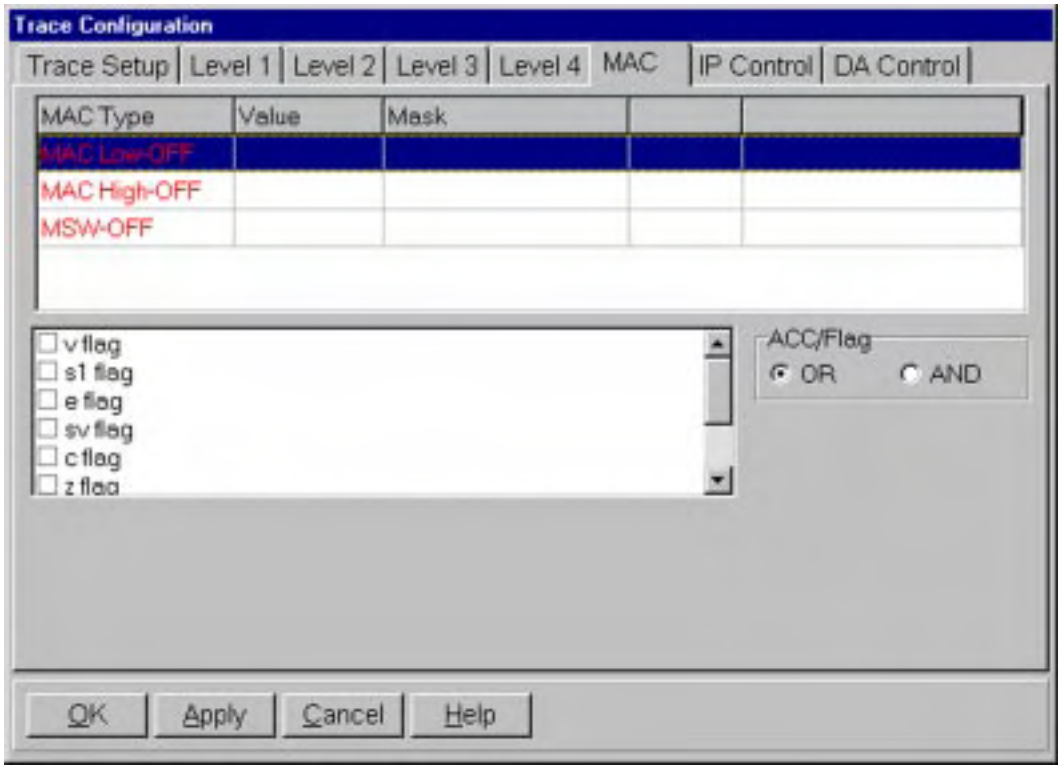


Figure 9

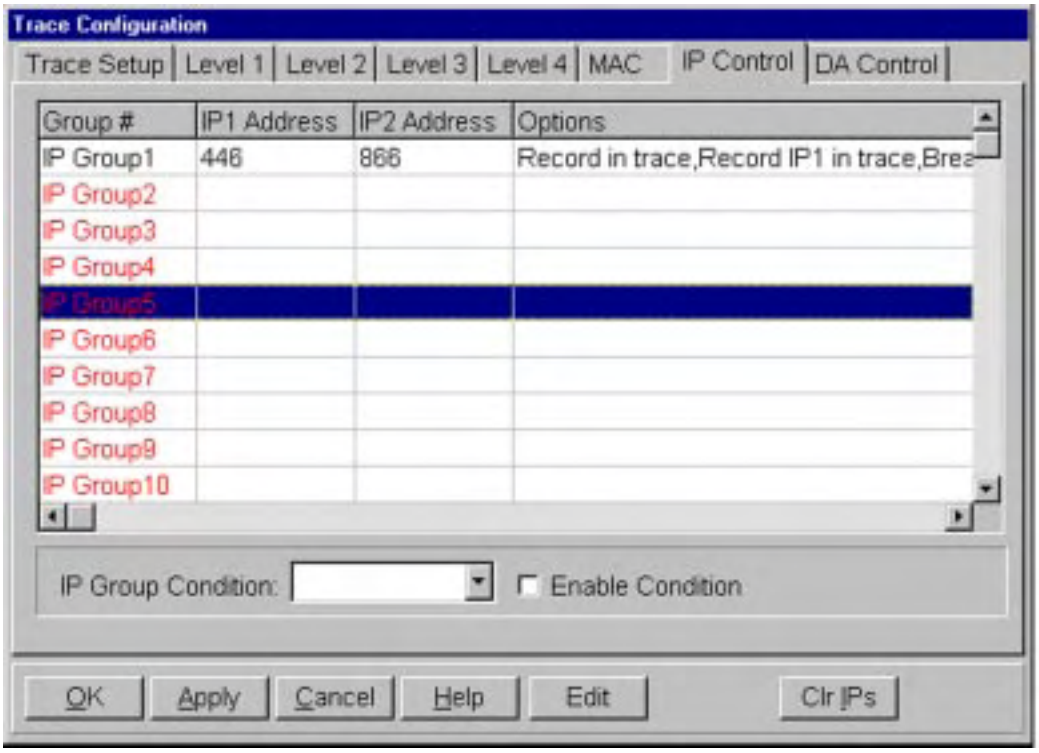
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IP Control: Instruction Pointer Control

The last tab in the Trace Configuration menu is the IP Control breakpoints. This is the bondout facility used for the hardware breakpoints used in the Source window. There are 16 groups and each group consists of 2 address qualifiers. These two address qualifiers can be used for two address comparisons or one range comparison with the CPU Instruction Pointer. Data values are not used as qualifiers. Groups are only available in the Advanced Trace mode.

The IP Control tab in the Trace Configuration window is shown in Figure 10. This window is available under the Config, Trace menu item. An example address is entered in Group 1.

Figure 10



Group

These 16 fields contain addresses used as qualifiers. Each group is OR'd together.

IP Group Condition

This qualifies the 16 Groups to Levels 1 through 4 events. This is global to all 16 group members. The specified Level must be true for any Group member to become true.

Enable Condition

This enables or disables the Group Condition.

Editing a Group Member

Click on one of the Group Type to highlight its line. Double-click on this line and Figure 15 opens up. This window is where the address qualifiers are entered. You can also right click on it to get the remove and edit functions. A simple example is provided at the end of this chapter.

IPG0 Address: and IPG1 Address:

IPG0 and IPG1 are the two address qualifiers. Each can selectively be enabled with the Enable check box.

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Range:

The Range mode compares IPG0 and IPG1 with the current CPU instruction pointer following this equation:

IPG0 =< current IP < IPG1

If a match occurs, the following actions can be selected:

Trigger:	This is a signal that causes the trace recording to stop.
Record in trace:	This signal is used to turn the trace recording on while the qualifier is true.
Turn User ON:	This signal is sent to the USER Output connector J6 on the Trace board. USER is set high by this selection. See Figure 2.
Turn User OFF:	This signal clears the USER Output connector J6.
Break emulation:	This selection causes the emulation to stop.

Equality:

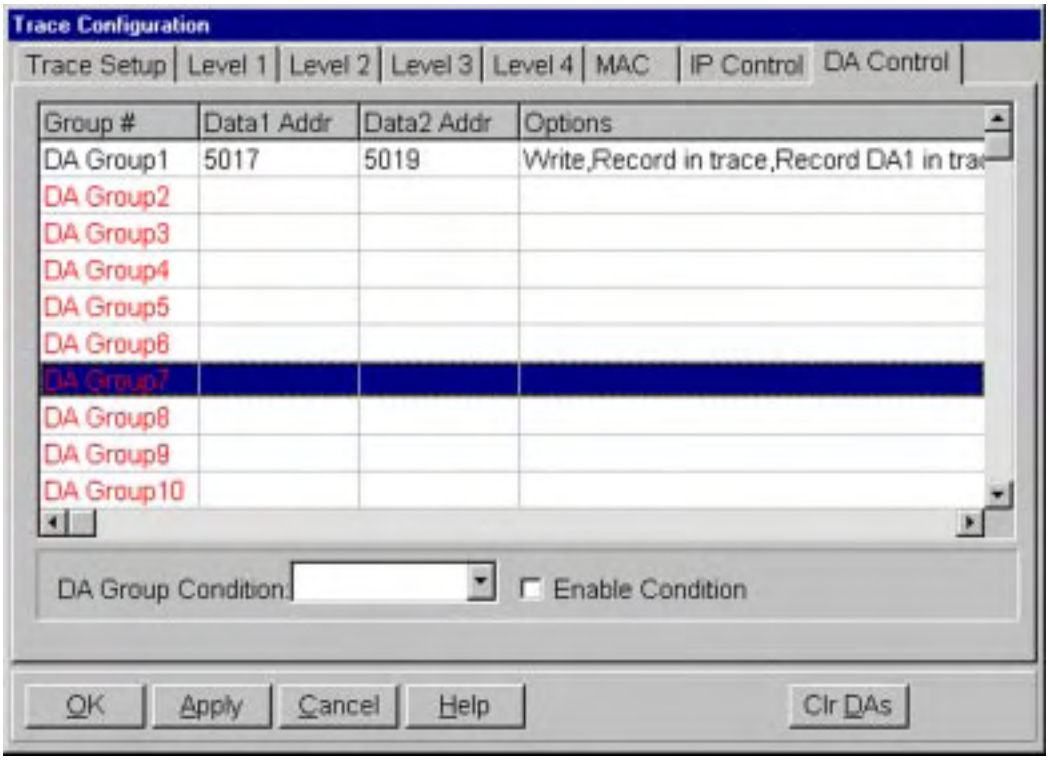
IPGP0 and IPGP1 can be configured as the Range or Equality mode. Equality is comparing IPGP0 and IPGP1 with the instruction pointer and creating an event if a match is made. An event will create an action. These actions are listed and are shown in Figure 15 under the Equality: title.

Record IP1 in trace:	When IPGP0 becomes true, the cycles responsible are recorded in the trace memory.
Record IP2 in trace:	When IPGP1 becomes true, the cycles responsible are recorded in the trace memory.
Break if IP1 true:	When IPGP0 becomes true, the emulation will be stopped.
Break if IP2 true:	When IPGP1 becomes true, the emulation will be stopped.

DA Control: Instruction Pointer Control

The last tab in the Trace Configuration menu is the DA Control breakpoints. Only data values can be triggered on such as operations of specified data values. *More to come later.*

Figure 11



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Saving the Trace Configuration

The entries you have made can be saved to a macro. This macro can be started manually under the Macro, Run menu item or a button can be created on the toolbar. There are two methods of making a macro:

1) Manually by creating the text file filename.bas

This method is not recommended as a detailed knowledge of the macro commands will be needed. It is easier to make this *.bas file with the macro recorder found in the Macro/Start Recording menu. Manually editing an existing file is easy and recommended with the built-in macro editor under the Macro, Show menu item or with any ASCII text editor.

2) Using the built-in Macro Recorder

In the Macro menu item, there are two items used to start and stop the macro recording. All your keystrokes will be saved to a filename.bas file of your choosing. Such a file is run either with a button you create or manually with the Macro, Run menu item. See Figure 16.

A macro can also be created from a configuration window that has an Apply button. The present settings of the configuration menu will be saved at one time. This is useful for saving a series of settings that have been subsequently modified and the exact key sequence is not available.

Quick Saving a Configuration Macro using the Apply Button

1) The configuration menu must be open and the Apply button visible. Figure 12 is an excellent example.
2) In the Macro menu item, select Start Recording. The configuration window will disappear.
3) Reopen the configuration window from the appropriate menu item. Click on Apply. The settings associated with this window will be saved.
4) In the Macro menu, select Stop Recording.
5) The Save Macro window will open giving you the opportunity to choose the filename for the newly created macro. Enter a filename of your choosing and click on Save. The macro is ready to use and will accurately recreate your configuration settings. You can also easily make a button to activate your macro. This feature is found under Config, Buttons.

You can also save emulator and trace configurations in the Config menu.

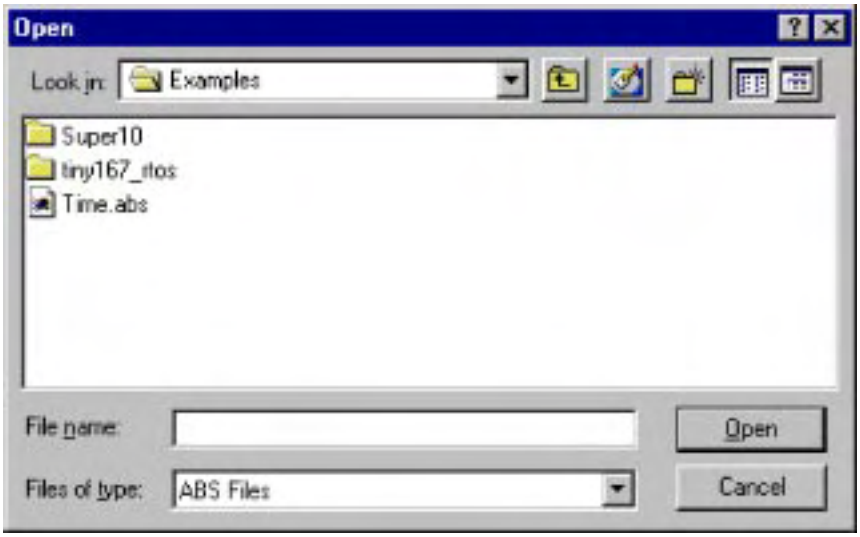
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Chapter 3 - Running the sup_time.abs Example Program

Running the example program SUP_TIMER.ABS

1) Nohau provides a small example program called sup_timer.abs. It is found in the c:\nohau\seehauST10\Examples\Super10 default directory. The source code, Sup_Time.c is also present in this directory. This file is needed to display the source code in the source and trace windows. This program is similar to those used in other Nohau emulators.
2) Start the emulator. Refer to Chapter 1 page 12: *Starting the Emulator and Seehau.*
3) Resize the windows as in Chapter 1 Figure 13 and do not add the Trace or Watch windows.
4) Open the menu item File, Load Code or press CTRL L.
5) A window similar to Figure 1 opens up.

Figure 1



6) Double-click on the directory SUPER10 to open it. Click on the arrow at the end of the "Files of type" box and select ABS Files if necessary.
7) Highlight sup_time.abs and click on Open. You can also double-click on sup_time.abs. sup_time.abs will load into the emulator. The source window will show a JMPS at the reset vector (00000). The jump is to _CSTART_TASK. This is at memory location 6E6 and you may scroll there to see it or click on the Assembly Step Into (or Over) Icon . Press the RESET icon  to return to 0000 if you advance the program counter to 6E6.
8) Select File, Verify Loaded Code to confirm sup_timer.abs was properly loaded into the emulator emulation RAM. This is useful to see if your data is being corrupted by program bugs such as writing to the code area.
9) Click on the Step Into icon  and the program will run to MAIN similar to Figure 2.
10) Note that the sup_time.c tab appears on the Source window. You can easily switch between assembly and source language by clicking on these tabs.
11) Right click on the source window with sup_time.c tab selected and select Mixed Mode or select the Mixed Mode icon  on the Source window. You will see assembly code mixed in with the appropriate source lines as in Figure 2. Note the program counter (IP) indicated by the blue block at the start of MAIN. This instruction has not been executed yet.

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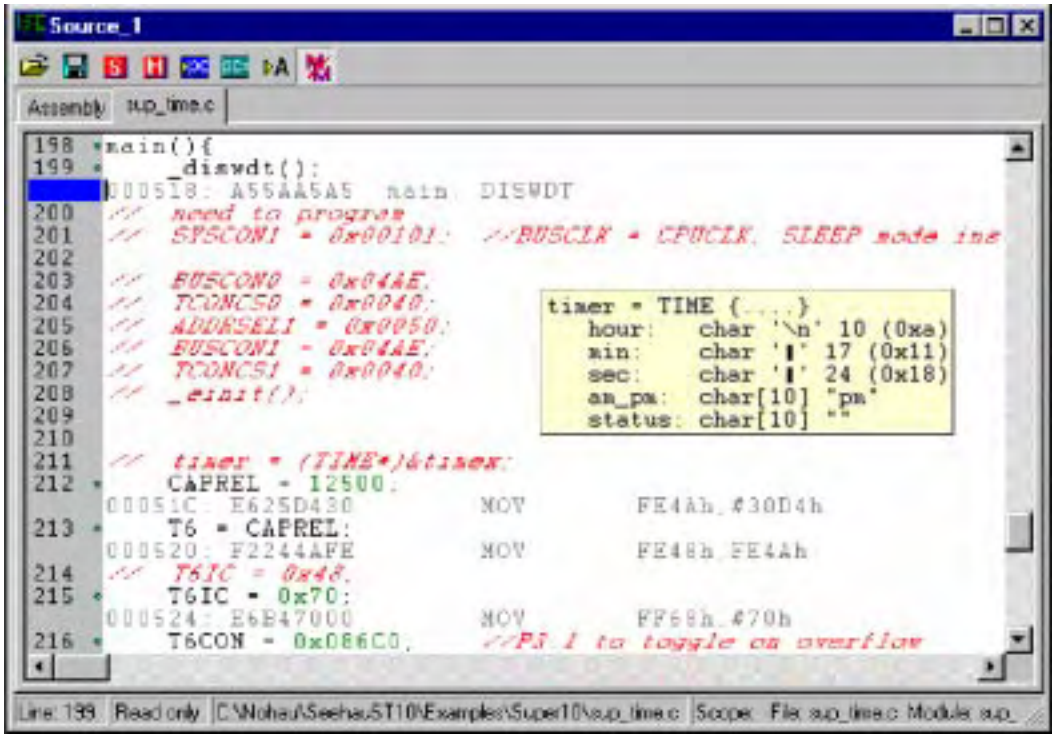
12) Remove the Mixed Mode from the Source window so only the C source code remains.

13) Click on the Source Step Into icon repeatedly and the program counter will advance through the CPU initialization code. Note that where there is assembly code only, the steps are at that level.

14) Click on GO, then STOP after a few seconds. Hold the cursor over a variable or a structure in the Source window and its location and contents will be displayed. This is shown as the yellow box in Figure 2 and this example is of the structure TIME.

Setting Hardware and Software Breakpoints

Figure 2



The Nohau EMUL-SUPER10 allows you to set both hardware and software breakpoints. The number of possible breakpoints is effectively unlimited. All breakpoints are no skid. This means the instruction a breakpoint is set on is not executed when the program counter reaches it. Hardware breakpoints are the only way to set breakpoints in ROM should your target have some.

Note the two small green dots beside some of the line numbers as in Figure 2. This indicates that there is at least one assembly instruction that a breakpoint can be set on. There are no dots beside lines 200 through 211 as these are only C comments.

Click on another green dot while holding down the ALT key. This line number gets blocked with a cross-hatched red box indicating a hardware breakpoint has been set.

You can also list, set, unset, park and maintain the breakpoints in the Breakpoints menu item in the main Seehau window.

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Watching Data During Run-Time with the Shadow RAM

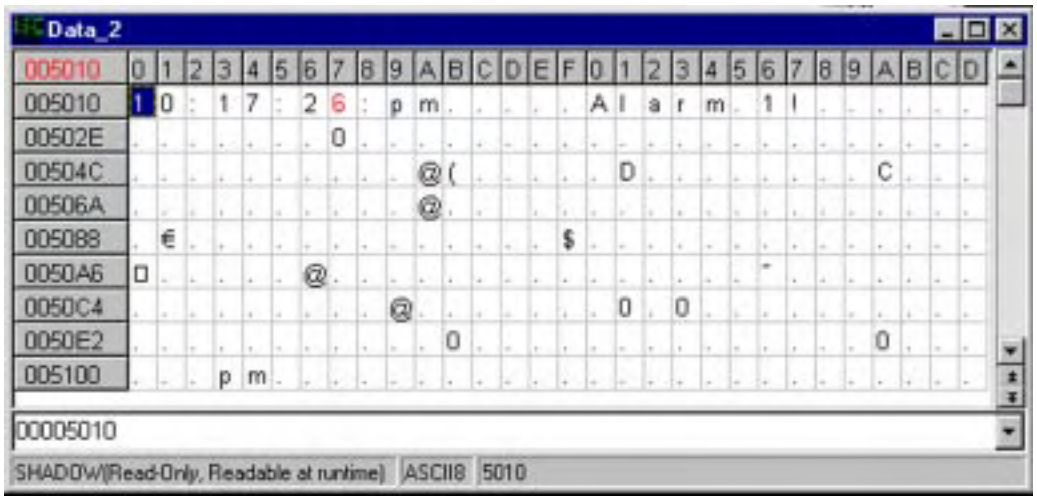
The Nohau Shadow RAM feature allows you to view memory contents while the emulation is running. This example assumes you have completed all the steps so far in this manual and that sup_time.abs is still loaded in your emulator. If the data does not display correctly, make sure all the CSx chip select entries are cleared. These entries are found in the Mem Map Config tab under the Config, Emulator ... menu item.

1) Open a Data window either by clicking on the Data icon  or selecting New, Data.

2) A window similar to Figure 3 will appear. The data will be in hex: not ASCII as shown. Resize it as needed. In the address box at the bottom, highlight the existing address and type *show* and press Enter. *show* will change to the physical address 5010.

3) Right mouse click on the Data window and Figure 4 shows. The idea is to change the Data window

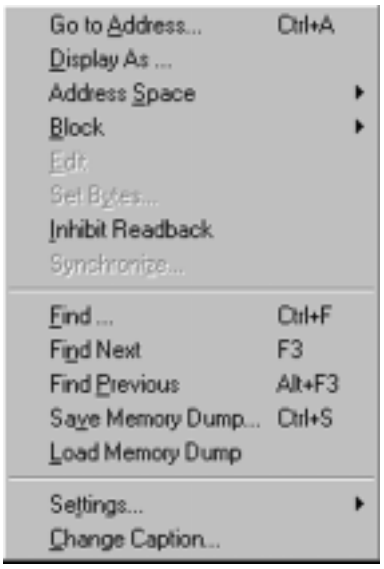
Figure 3



to display the data in ASCII format and retrieve the data from the Shadow RAM. Note you can select these items from the margin display areas in the Data window as in Figure 3.

Note the viewing options available in this window. The Settings selection allows you to configure the Data window.

Figure 4

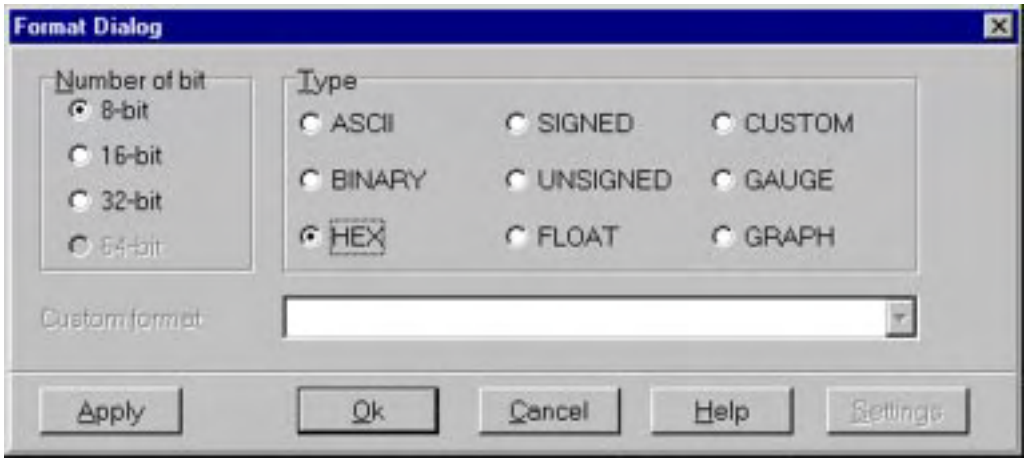


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4) Select Display As ... or click on the margin area in Figure 3 labelled ASCII8. Figure 5 opens up. Select ASCII. Note the viewing options available in this window. Click OK.

5) Right mouse click again and select Address Space ... and select SHADOW. You can also click on the margin area in Figure 3 labelled SHADOW...

Figure 5



6) The address at the upper left corner represents where the mouse is pointing to. The box highlighted in blue at location 5010 in Figure 3 is the last location where you clicked the mouse on. Data in red indicates that which has been modified by the last instruction executed. You will not see ASCII data shown if sup_time.c has not been executed yet..

7) Click on the GO icon or press F9. The program sup_time will run.

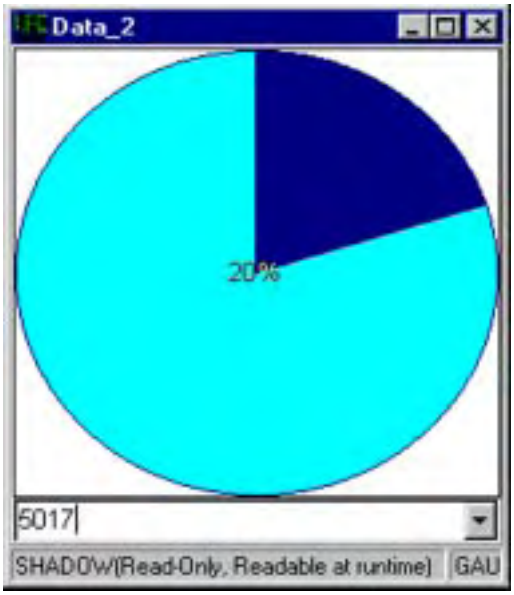
8) The time will be updated in as the program executes. The CPU is interrupted for extremely short periods of time. The STMicroelectronics bondout chip allows Nohau to inject a read instruction directly into the decode stage of the CPU pipeline. No fetch cycle is used therefore the CPU intervention is slight and not noticeable.

Graphical Display of Data: Gauge

Seehau can display data in various graphical methods during program run-time.

1) Open a new Data window by clicking on the data icon or select Data in the View menu item.

Figure 6



2) In the Data window margin areas where ASCII is selected: change this to Gauge. Note you can do this while emulation is running. Seehau does not interrupt the bondout CPU for normal housekeeping functions.

3) Size the window similar to Figure 6.

4) Make sure Shadow is selected and set the address at the bottom left of 5017 or *show+7*.

5) The gauge will display the value of 5017 in terms of its percentage of FF hex.

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6) The range is not very suitable in this case. Note that the 5017 values range from 30 to 39 hex which corresponds to 48 to 57 decimal. These represent the ASCII characters 0 through 9.

7) Right click on this Data window and select Setting, Gauge. Enter the range of 48 and 57 for the Min and Max values. Note you can change the display mode to various types of charts. Click on OK.

8) The display will be more suitable looking.

9) Right click on the Data window and select Change Caption and do so. You can have as many data windows as you like and you can save them and recall them with a button.

Graphical Display of Data: Graph

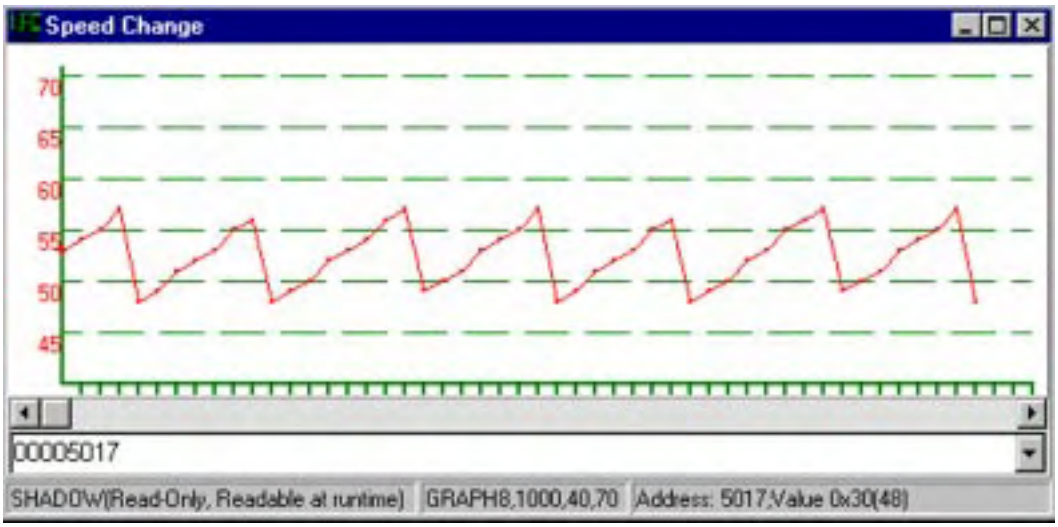
1) Open another Data window.

2) Select Graph from the local menu or in the margin of the Data window.

3) Figure 7 will appear. Resize it to a suitable size. Once again note you do not have stop emulation to create and to configure these windows.

4) Set the range to around 40 to 70 to get a display range similar to Figure 7. Figure 7 also had the colour changed to red for easier readability.

Figure 7



5) Note you can make many of the same changes as you can for the graph display in Figure 6.

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Watch Window

Watch windows allow you to view data variables and structures. Multiple Watch windows can be opened and they can contain multiple variables and structures. Figure 8 shows the Watch window we will now create.

1) Open a Watch window by clicking on the Watch window icon or selecting the New, Add Watch menu item. Position it according to your preferences. You can also select View, Watch.
2) Click on the plus (+) sign to add symbol name. Type show. This information is added as in Figure 8. Try timer, timer.sec and timer.hour.
3) The red check mark is used to "park" the symbol name.
4) An alternative method of creating a Watch window is to block the variable name in the source window and right click on it and select Debug Windows , Add to Watch.
5) You can also double click on a symbol in the Symbol Browser which is found under View, Symbol Browser.

Figure 8



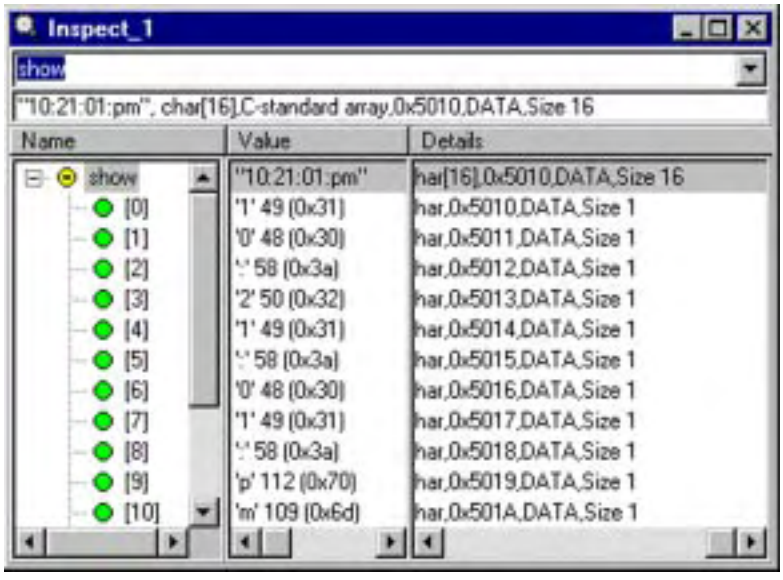
Inspect Window

An Inspect window is used to view the contents of only one variable or structure. The contents of the variable or of an element can be modified but not in real-time while emulation is running. Data can be modified in real-time with the Run Time Data and Shadow windows.

Opening the Inspect Window

1) Select the New, Inspect menu item. A window similar to Figure 9, but empty, will open.
2) Enter timer in the top data entry bar. Click on the small yellow icon . The contents of the structure time will display similar to Figure 9. (Nohau is enhancing these debugging windows.
3) Run, then stop the sup_timer.c program and the data values will change. Only the sec element will change unless you run the program for greater than one minute.

Figure 9



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Modifying the Data in the Inspect Window

1) Block the hour element and make a right mouse click. Select Modify from the menu.
2) Enter a new value and click on OK. The new value will be entered into the Inspect window.
3) You can also block a variable name, right mouse click and select Inspect to accomplish the same thing.

Viewing more members of the structure

If you double click on a structure element name or click on the yellow icon, this element will be expanded. If the element is a structure within a structure, this new structure will be displayed.

Updating the Data in Real-Time

Right mouse click on the Inspect window to open the local menu and select Update During Runtime. The Inspect window will use the Shadow RAM facility to update the values as they are modified by CPU writes.

Other Inspect Features

Right mouse click on the Inspect window to open the local menu to see other options available. Locate in Data Window is particulary useful.

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Chapter 4 - Trace and Trigger Examples

Trace Memory Example Background

1) When the sup_time.abs program has been running, the Trace Memory has been operating in the background also in real-time. This is assuming you have the trace card installed.

2) Many emulators can not view the trace without stealing cycles or even stopping the emulation. The Nohau emulator can do this in real-time. It uses a dedicated microcontroller to do all the Trace and Trigger housekeeping chores rather than stealing cycles from the bondout controller. You can start and stop the trace recording, view the trace contents, set or delete or modify trigger conditions including breakpoints (called IP Breakpoints) without stopping or delaying the emulation of your target code.

3) Ensure the emulator is running the *sup_time.abs* program. The two boxes in the bottom left hand corner of the main window will contain “Running” instead of “Stopped”. The GO and TRACE icons will both be red in color. You should have a Data window open and displaying the time changing during run-time as described in Chapter 3.

4) Open up the Trace window. You can click on the New Trace icon or in the menu New, Trace.

5) Position the trace and Data windows so they are visible similar to Figure 1.

6) The Trace window is empty since there is no updating as the Trace buffer is being filled. It is not possible to view the Trace contents at this time. The dialog bar at the bottom of the trace window will show the number of trace frames collected and how many triggers events have occurred. In Figure 1 the trace buffer is already full with 131,071 frames and is wrapping around in a circular buffer.

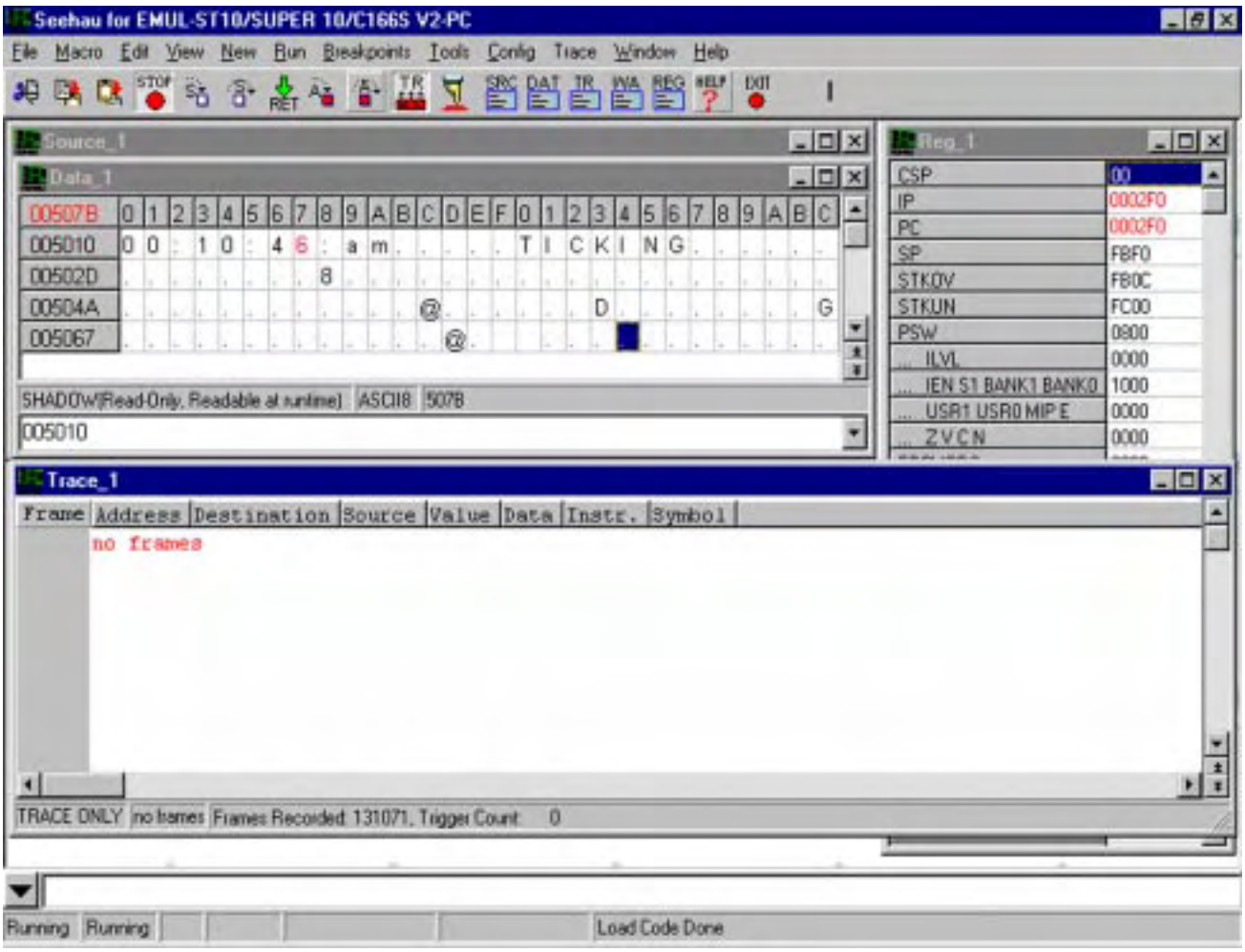


Figure 1

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7) The Trace window has several columns activated from the default. Right click on the Trace window and a default Figure 2 will open up.

8) Click on the various menu items to match Figure 2. If you want to see the timestamp, you can click on these items now or come back later and activate them. Note the timestamp can be in time or CPU cycles and relative to one instruction to the next or accumulated time.

9) Select Display mode and select Mixed (Trace and Source).

10) Select Settings, Colors and set the Trace Line with Source Info to display in red.

11) Click on the Stop Trace icon. Note that while the changing time values in the Data window may appear to stumble: this is only in the display. The emulation controller was not slowed down at all. This is genuine real-time operation.

12) The Trace window now contains recorded controller cycles. Figure 3 shows the Trace Memory received with one arbitrary trace run.

13) Note that in Figure 3 labels, registers and addressing modes are all displayed. Note the trace window have the ability to display C source code with the resulting assembly code.

14) The Destination field is the address the instruction sent data to or operated on. The Source field is the address the data came from. The Value is the operand value used by the CPU and the Data field is the operand and data that is disassembled in the Instr. (Instruction) field.

15) Start the Trace memory by clicking on the Start Trace icon. Note the time does not stop or slow down. Once again, the trace memory is being continuously overwritten with new values. The trace memory is a circular buffer. This will continue until the recording is stopped either manually or with a trigger event. Note the triggers have the ability to start and stop the trace recording according to criteria

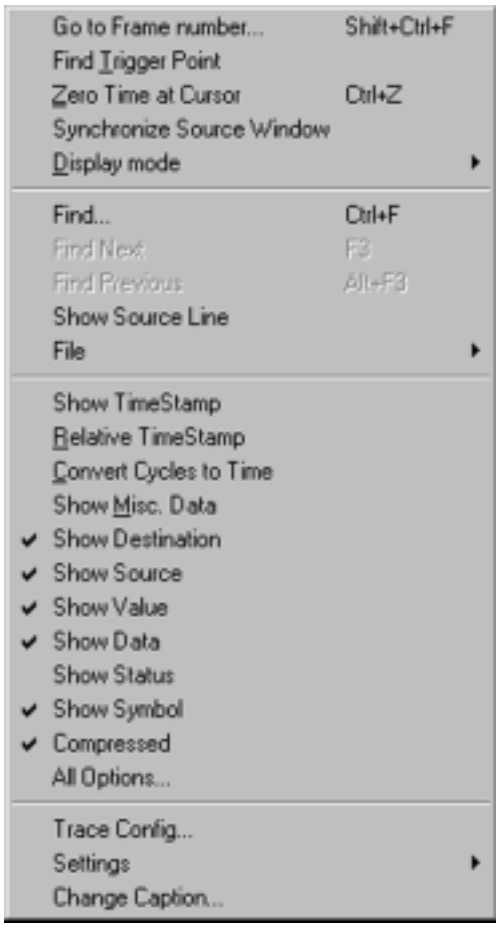


Figure 2

The Super10 emulator has extensive trigger facilities to start and stop the trace as well as perform program breaks. The triggers can control cycle recording so that only specified cycles are recorded. The apparent size of the trace memory can be magnified many times by using carefully selected trigger qualifiers. The triggers can send out external signals and can be activated with signals from external sources.

External events can be recorded in the trace (8 bits) or used as trigger qualifiers.

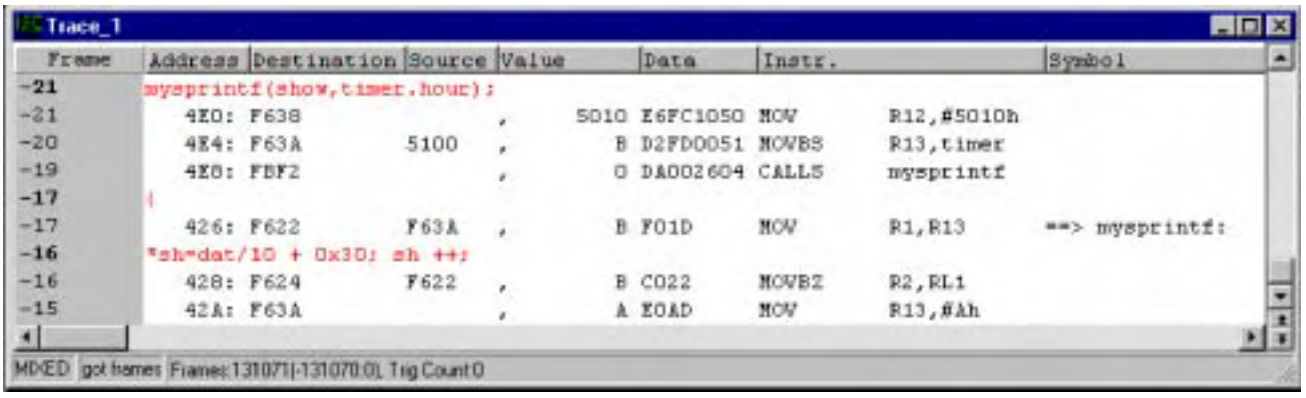


Figure 3

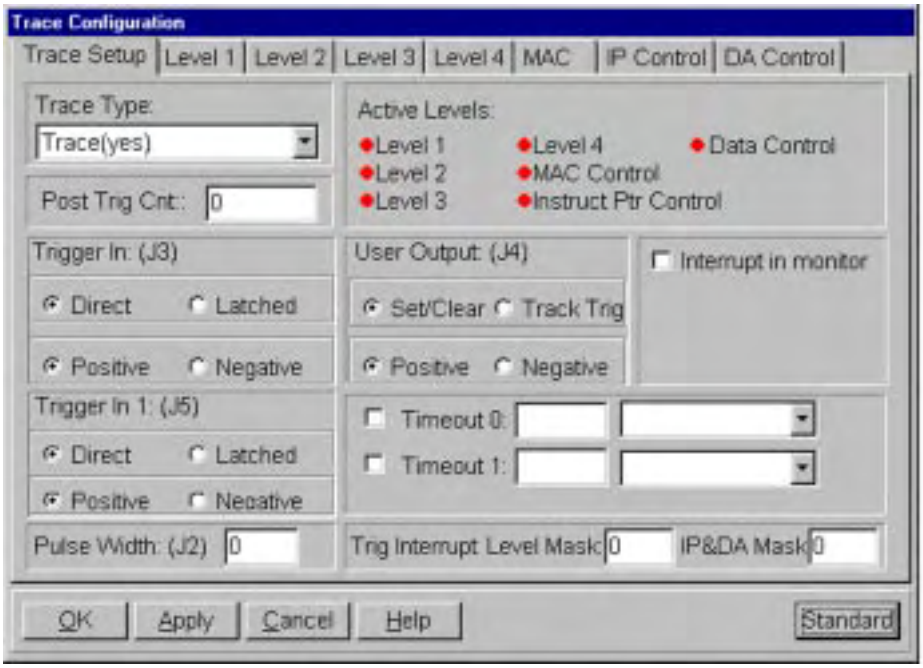
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Setting an Example Trigger

All Nohau emulators contain sophisticated and versatile triggers. The EMUL-ST10 and the EMUL-Super10 emulators offer unparalleled trigger capabilities. You can configure the triggers in real-time. The triggers test for qualified events and start and stop the trace without stealing cycles from the emulation controller (bondout). The application program always runs at full speed. A break in emulation, by definition, affects real-time operation. This example will show how to setup a simple yet effective trigger. The emulation will stop when the seconds MSB memory location is written the value of 4 ASCII (34 Hex). The bus cycle responsible for this write will be recorded in the trace memory.

1) Start Seehau and run sup_time.abs as described previously in this manual. The Shadow RAM in the Data window should update as the program is running.
2) Open the Trace Configuration menu under Config, Trace or right clicking on the trace window and selecting the Trace Config item. A window similar to Figure 4 opens up. Note the button labeled Advanced. There are two versions of the trace window for the Super10 emulator: Standard and Advanced. Click on this button to see the Advance features. We will use the Advanced mode here.
3) Note there are 4 levels of triggers, MAC triggers plus an IP Control and DA Control.(Advanced only).

Figure 4

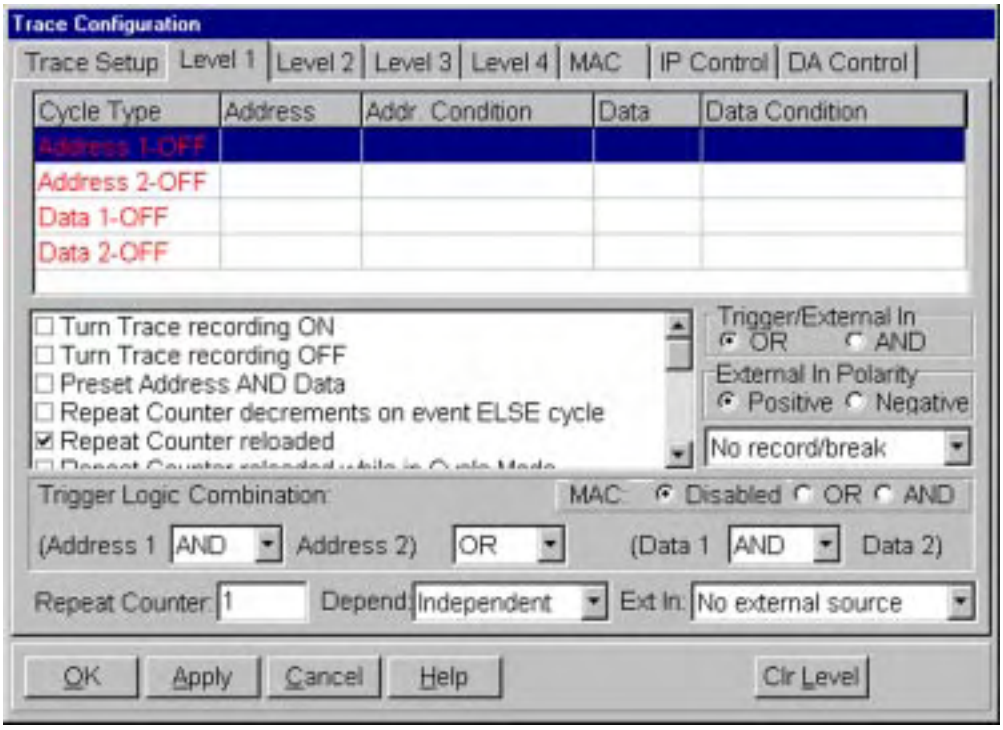


We will use only Level 1 in this example. The red dot will change to green once we have entered and enabled the qualifier for Level 1. The boxes in Figure 4 are described in Chapter 2. The menu in Figure 4 is diagramed in Chapter 2 Figure 1.

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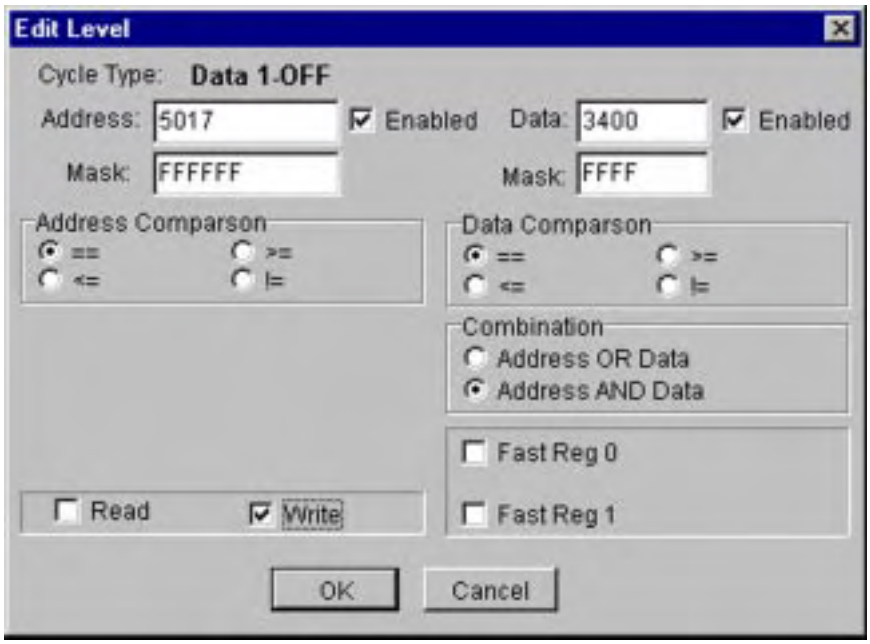
4) Click on the Level 1 tab and the window opens up as in Figure 5. Address 1 and Address 2 are address only qualifiers. These qualifiers are break before the instruction they are set to is executed (no-skid). Data 1 and Data 2 are address and data qualifiers. We will use Data 1 and Data 2 in this example. All qualifiers are disabled at this point. Chapter 2 Figures 4 and 5 represent the menu in this menu.

Figure 5



5) Click on the Data 1 line and right click on the highlighted line. Figure 6 will open up. Enter the fields as shown and ensure the Enabled boxes are checked. Pay attention to the Address AND data and the Write checkbox. Address and data are not case sensitive. You need to fill in the Address, Data, and check the Address AND Data and the Write boxes. Press OK.

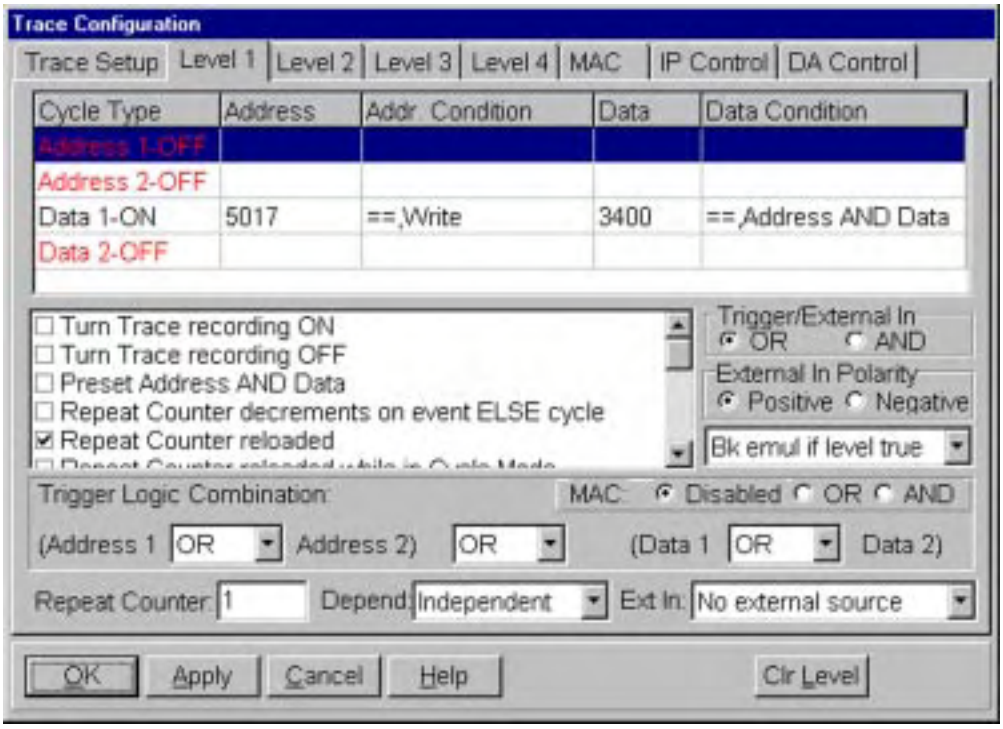
Figure 6



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6) A modified Figure 7 will appear. Note that both Data 1 is enabled with the appropriate data. The qualifier is now properly set. When a data value of 3400 is written to address 5017, the trigger mechanism will cause something to happen. This will be determined in the next step.

Figure 7



7) Make sure 1 is entered in the Repeat Counter. This box must have a value of at least 1 or no trigger will ever occur. Repeat Counter is the number of times an event must occur before a trigger will happen.

8) Select the *Bk emul if level true* in the indicated box. This will break the emulation when a write of 3400 to memory location 5017. Make sure the Repeat Counter reloaded checkbox is selected. If not, there will be one trigger and the trigger will never happen again since the counter is never reloaded. This is a good method to implement a one-shot trigger. Click on OK to close the Trace Configuration window.

9) Click on GO and the emulation will run. When the value at address 5017 becomes ASCII 4 (hex 34), the emulation will break and the trace will be displayed as in Figure 8. Frame -3 shows the data write of 3400 (Value) to address 5017 (Destination) at the time shown (Abs time). The instruction that caused this write is MOVB [R12],RL1 at address 44E (Address).

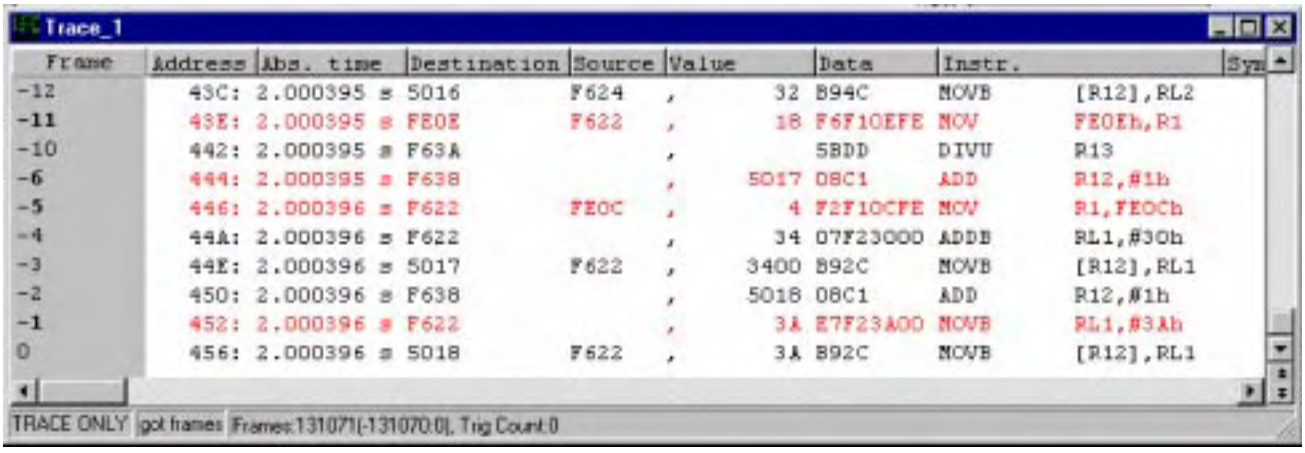


Figure 8

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10) Click on GO again and the emulator will run. It will immediately stop since the trigger becomes true again at the next write of 3400 since this write is updated many times each time it advances.

Setting an Example Filter

11) In the Trace Configuration menu in the Level 1 tab, change *Bk emul if level true* to Record this level so the emulation will not be stopped and only writes of 3400 to 5017 will be recorded in the trace buffer. Note you could make this change "on-the-fly" without losing real-time performance. You have to stop and start the trace to activate your changes but the emulation itself is not stopped.

12) Click on the GO icon to restart emulation.

13) Note the number of cycles recorded in the trace memory increasing as the value in 5017 equals 3400. This information is shown at the bottom of the trace window. If you have a Shadow RAM data window you can see the frames increase when the seconds equals "4". Stop the trace by clicking on the Trace icon and the cycles will be displayed as in Figure 9. Each cycle has a time stamp indication when it occurred and is visible if this field is selected.

14) Remember that not all cycles have been recorded: only those selected in the trigger qualifiers. This is only a small part of the trigger facilities of the Super10 emulator. This example does not begin to show the true capabilities of the emulator.

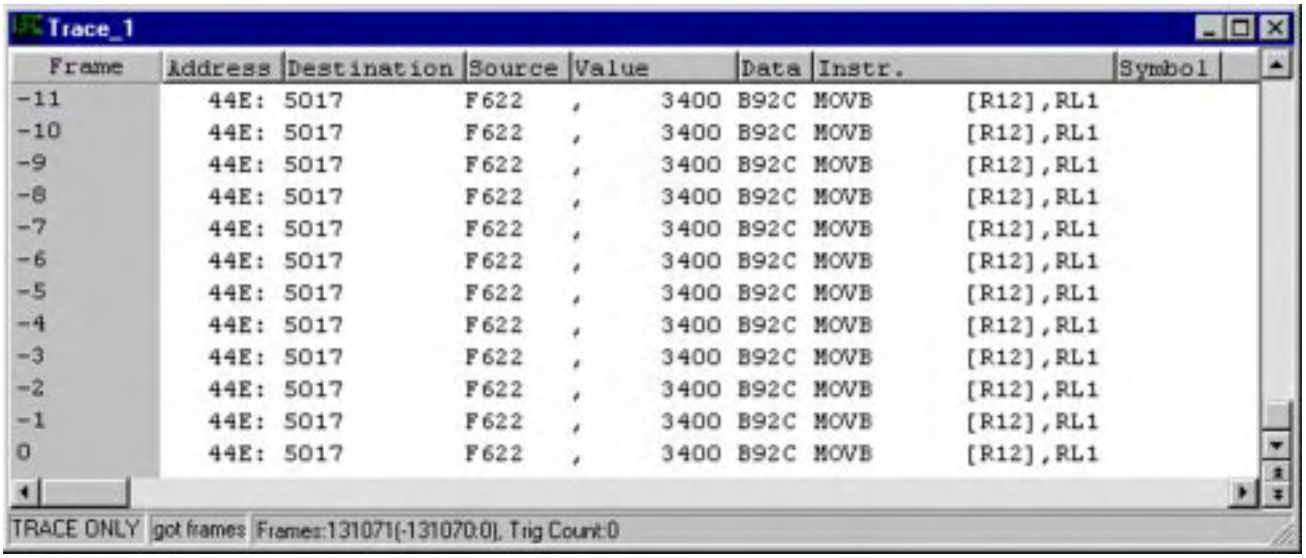


Figure 9

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