User Manual

Tektronix

92A96 & 92C96 Acquisition Module

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

Injury Precautions

Use Proper Fuse To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Avoid Exposed Circuitry To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

Product Damage Precautions

Do Not Operate With Suspected Failures If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual These terms may appear in this manual:

***WARNING.** Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:

DANGER High Voltage	Protective Ground (Earth) Terminal	ATTENTION Refer to Manual	Double Insulated

Preface

This manual describes how to use the 92A96 or the 92C96 Data Acquisition Module as part of a Tektronix Digital Analysis System (DAS) or with the Tektronix TLA 500 series logic analyzers.

Since there are only minor functional differences between the 92A96 and the 92C96 Data Acquisition Modules, this document refers to both modules as 92A96 Modules, except where noted otherwise.

How to Use This Manual

This manual is designed around the menus and overlays associated with the 92A96 Module software.

It is assumed that you know how to select menus, how to move within the menus and overlays, and how to use fields to make selections. If you are not familiar with these operations, refer to either the *DAS System User Manual* or to the user manual for your TLA 500 series logic analyzer. Also, refer to those manuals for a list of error and prompt messages and for a complete description of the main-frame hardware and software.

This manual contains the following information:

- *Chapter 1: Getting Started.* Provides a general overview of the 92A96 Module and how to connect probes to the 92A96 Module and to the system under test.
- *Chapter 2: Operating Basics.* Provides a description of the 92A96 Module operating cycle, a general overview of the setup and display menus, and an operational overview of using the 92A96 Module.
- *Chapter 3: Reference.* Describes the menus and features provided for the configuration and operation of the 92A96 Module. All setup menus and their associated overlays are described here.
- *Appendix A: Specifications.* Lists the environmental physical, and electrical properties of the 92A96 Module and probes.
- *Appendix B: Accessories.* Lists all standard and optional equipment available with the 92A96 Module and probes
- *Appendix C: User Service.* Provides user service information for replacing probes and podlets.

Related Documentation

This user manual is intended to supply information on using the 92A96 Module as part of the DAS/NT and DAS/XP Digital Analysis Systems or the TLA 500 series logic analyzers. You may need to refer to the following documentation for more information on the DAS and TLA systems:

- The *DAS System User Manual* provides information on the DAS system-level menus, basic operating information, and installation instructions.
- The *TLA 510 & 520 User Manual* provides information on the TLA 510 and TLA 520 Logic Analyzer system-level menus, basic operating information, and installation instructions.
- A series of Instruction Manuals, each of which describes a specific microprocessor support packages.
- A series of application software user manuals that describe the various application software packages.

On-Line Documentation

On-line documentation is available in the form of on-screen notes for the fields and function keys for each menu. Access the information by highlighting a field with the cursor and then selecting the Notes on-screen button at the bottom of each menu. Refer to the *Tutorial* in either the *DAS System User Manual* or the user manual for your TLA 500 series logic analyzer for more information.

Manual Conventions

The following terms and conventions are used throughout this manual:

- Module. A module is a self-contained unit consisting of one or more circuit cards. In this manual a module refers to one or more 92A96 or 92C96 circuit cards that make up the 92A96 Data Acquisition Module (92A96 Module).
- Logic Analyzer. The term logic analyzer is a generic reference to the DAS/NT or DAS/XP Digital Analysis Systems and to the TLA 500 series logic analyzers.

Getting Started

The 92A96 and 92C96 Data Acquisition Modules are data analysis application modules for the Tektronix Digital Analysis System (DAS) and for the TLA 500 Series Logic Analyzer that sample, qualify, store, and display digital data from a system under test. The Modules are available in the following versions:

- 92A96–96 channels with 8K-deep memory
- 92A96D or 92C96D–96 channels with 32K-deep memory
- 92A96XD or 92C96XD–96 channels with 128K-deep memory
- 92A96SD or 92C96SD–96 channels with 512K-deep memory
- 92A96UD-96 channels with 2M-deep memory

The main difference between the 92A96 Modules and the 92C96 Modules is that the 92C96 Modules can be upgraded to have more memory (up to 512K–deep memory). For example a 92C96D Module can be upgraded to have 128K- or 512K-deep memory and the 92C96XD Module can be upgraded to have 512K-deep memory.

Since there are only minor functional differences between the different acquisition modules, references to the 92A96 Module apply equally to the 92C96 Module unless noted otherwise. All modules in this manual are referred to as 92A96 Modules.

Product Description

The DAS 9200 is a highly modular digital analysis system. Combined with available application modules and application software packages, it can perform data acquisition and pattern stimulation for designing, maintaining, analyzing, or repairing complex digital equipment.

The TLA 500 Series Logic Analyzers are compact, preconfigured versions of the DAS. A TLA 510 Logic Analyzer has a single 92C96 Module while a TLA 520 Logic Analyzer has two 92C96 Modules.

Because the TLA 500 Series Logic Analyzers operate identically to a DAS, all references to the DAS apply to the TLA logic analyzers unless stated otherwise.

User Interfaces

There are three user interfaces available with the DAS and TLA logic analyzers: menu-driven (stand-alone) system operation, networked operation (where the system is controlled by a remote workstation), or programmatic command language (remote) system operation. Stand-alone system uses a color X terminal to access functional menus and view acquired data. When used as a remote peripheral device, the system is controlled using its Programmatic Command Language (PCL) via a host computer's GPIB, RS-232C, or LAN interface.

Local System Operation. The system is controlled locally by a set of interactive menus. System-level menus (resident in the system software) are used to select and define the operation of all system-level tools. With these menus you can accomplish the following tasks:

- Define interactions between modules.
- Select the module (or cluster of modules) to work with.
- Select a system utility tool or software application.

For complete instructions on using system-level menus, refer to the respective system user manuals for the DAS or TLA 500 Series Logic Analyzers.

Remote System Operation. With remote system operation, the system is controlled by the PCL. The PCL is a set of system commands (including a command interpreter) that control the system the same as the system-level menus.

This manual does not discuss how to use the PCL interface to control 92A96 Module operations. For complete instructions on using the Programmatic Command Language interface, refer to the *DAS 9200 Programmatic Command Language User Manual*.

Networked Operation. The DAS/NT and TLA logic analyzers with the 92XTERM networking software allow you to use a Sun-4 Workstation using an X11R4 or OpenWindows server to control the system. The server takes the place of the standard graphics terminal and displays all menus in a window on the server. With the networking software installed, the system functions the same as it would connected to an X terminal. The main difference is that the menus are controlled from a workstation with a mouse and keyboard interface rather than a terminal.

Application Modules

Application modules function as individual data acquisition or vector pattern generation units. A module can consist of one or more circuit board cards. Some modules of the same type can be combined to create a multicard module formation (for example, two 92A96 Modules) that increases the number of available channels. Or you can combine single modules of different types to create clusters that operate together to perform a specific application (for example, a stimulus and response unit using the 92S16 and 92A96).

Each application module installed in the system has a set of specific menus (and PCL commands). These menus control the operation of the specific module you are working with. The 92A96 Module menus are described in this manual.

The 92A96 Data Acquisition Module has many useful features that make it ideally suited for high-speed timing analysis, software analysis, other types of state analysis, and microprocessor support.

Operating Modes

The 92A96 Module offers two modes of logic analyzer operation, depending on the software support you select in the Configuration menu. The General Purpose support is intended for software analysis and the High-Speed Timing support is intended for timing analysis.

Sampling Rates

All 92A96 Modules offer General Purpose (refer to *General Purpose* on page-3–4 for more information) software support with internal and external sample rates up to 100 megasamples per second (MS/s). You can also select the High-Speed Timing software support to operate the 92A96 Module with internal sample rates up to 200 MS/s or 400 MS/s.

Variable-Width and Clustered Configurations

You can combine up to three 92A96 Modules (installed adjacent to one another in the DAS 9200) or two 92C96 Modules in a TLA 520 Logic Analyzer to create a variable-width or multicard module formation. General Purpose support provides up to 288 channels of acquisition in a three-card module formation. The 200 MHz High-Speed Timing support provides up to 144 channels of acquisition in a three-card module formation. And the 400 MHz High-Speed Timing support provides up to 72 channels of acquisition in a three-card module formation.

You can also group 92A96 Modules into a cluster with other application modules to start and stop as a unit and perform time-correlated acquisition and display.

Module Correlation Guidelines

Use the following guidelines when time-correlating 92A96 Modules with other modules in a DAS (because the TLA 520 Logic Analyzer has only two 92C96 Modules, these guidelines are less restrictive to TLA users):

- Only 92A96, 92A60/90, and 92A16 Modules can be correlated together in a module cluster.
- Each module can only appear once in a correlation set.

- A maximum of ten modules can be correlated in a single cluster, with at most three being 92A16 Modules.
- You can correlate a maximum of six 92A16 Modules within a multiclustered configuration.
- A 92A16 Module must be paired with another module.
- No other modules can be correlated with a 92A16 that is already correlated with another 92A16 Module.

A 92A96 Module correlates with a 92A16 Module under the following conditions:

- You have to select the 92A16 Module first.
- The 92A96 Module must be located in the adjacent lower-numbered slot to the 92A16 Module.

Probe Cable Types

The passive probing system comes standard with ribbon-type probe cables that have a minimum input signal swing of ± 600 mV. Optionally, coaxial-type probe cables can be ordered that have a ± 300 mV minimum input signal swing. See *Appendix A: Specifications*, for the specifications of each.

Microprocessor Support

All versions of the 92A96 Module support 32-bit microprocessor disassembly. See the individual microprocessor support user manuals for complete microprocessor-specific information.

Other Key Features

The 92A96 Module provides these tools to make complex digital analysis tasks easier:

- Real-time Control—controls the real-time acquisition of data using the Trigger menu. It offers state machine triggering, with up to 16 states. You can place the trigger precisely where it is needed to solve your problem.

  Use the Trigger menu to do the following tasks:

  - Time the duration of an event or measure the elapsed time between two events.
  - Count the number of occurrences of an event or sequence of events.
  - Send signals to other modules or receive signals from other modules under user-specified conditions (for example, you can set up to trigger on the reception of a signal).
- Storage Qualification—controls which data gets stored by using the Trigger menu to qualify or disqualify any data acquired under specific conditions. This avoids filling the acquisition memory with unwanted data.

- Timestamping—allows delta- or elapsed-time measurements by using the data timestamp. A timestamp is saved with every data acquisition that measures and stores the elapsed time from the start of an acquisition to the acquisition clock of each cycle. It has up to a 2.5 ns resolution and provides time correlation between modules in a cluster. Use the timestamp values to calculate the elapsed time between any two acquisition cycles.
- Symbolic Data—allows you to represent data symbolically by creating a symbol table to link symbolic names to specific data values or to a range of values. These symbolic names can then be used to specify trigger setups and to evaluate acquired data. Symbol tables must be created (using the Symbol Editor utility menu or downloaded from a host computer) before a symbolic radix can be used in the module setup and display menus.

Accessories

Refer to *Appendix B: Accessories* for a complete list of options and accessories for the 92A96 Modules.

Installing the Hardware

If you purchased a TLA 500 Series Logic Analyzer or a DAS system with the 92A96 Modules already installed, you only have to connect the probes and install the application software. The following hardware installation procedures only apply if you need to install a 92A96 Module inside a DAS Mainframe. If you do not need to install the 92A96 Modules in a mainframe, skip to *Connecting the Probes* on page 1–8.

The information in this section is intended to make you aware of the configuration and installation guidelines for the 92A96 Modules. Be sure you read and understand these guidelines before you install a module in the DAS. Refer to the *User Service* chapter of the *DAS System User Manual* for the actual installation procedures.

***NOTE**. Refer to the DAS System User Manual for detailed information on card placement and for information on efficient use of cooling resources.*

Card Placement Guidelines

Place the modules in the card cage for even distribution of cooling resources. The general rule for placement is, if there are any open slots in the mainframe, try to make the slot directly below (one slot lower) the 92A96 Module the open slot. Figure 1–1 shows the specific card placement guidelines.

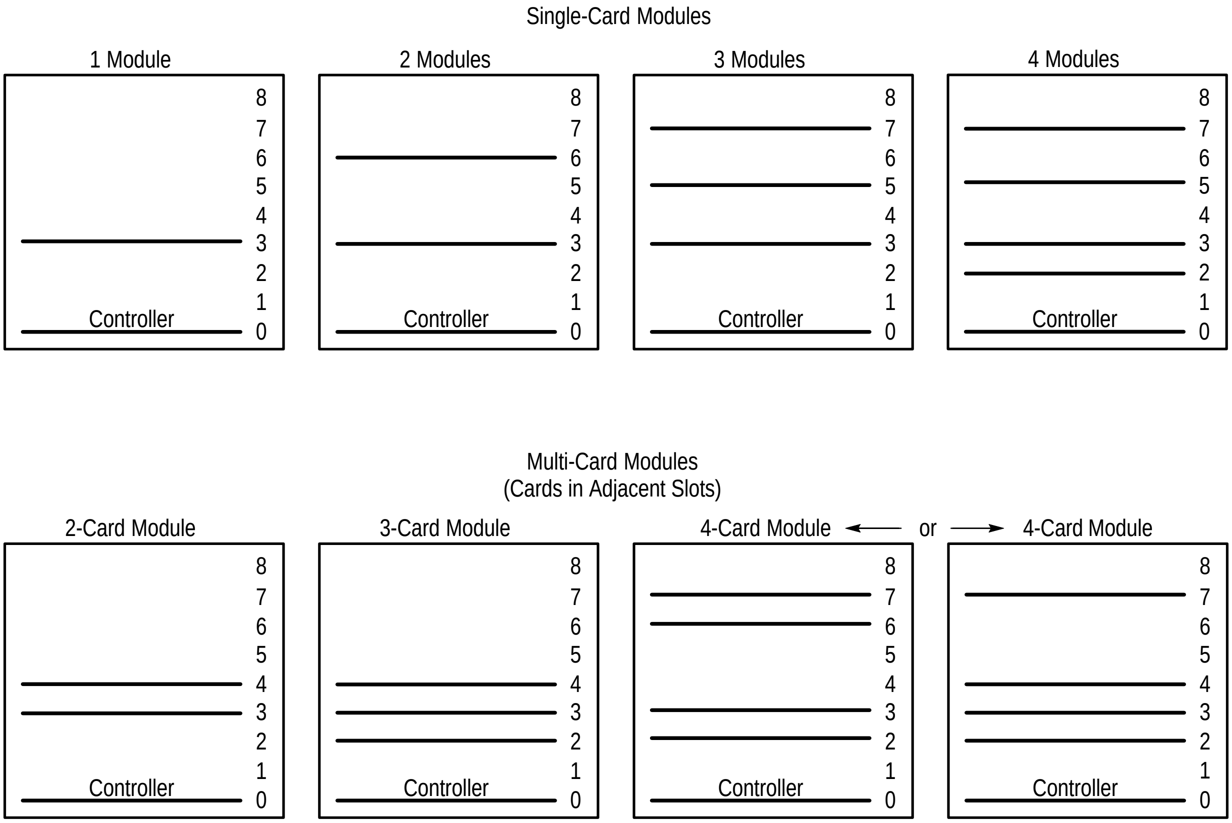

Figure 1–1: Card Placement Guidelines for Optimum Cooling

Configuration Restrictions

A specific power supply is required for certain module configurations within either the DAS Master mainframe or Expansion mainframe (see Table 1–1). The following general configuration rules cannot be violated or the system shuts down:

- If you have four 92A96 Modules in a Master mainframe or an Expansion mainframe, then you cannot have another instrument module in the same mainframe.
- If you have three 92A96 Modules in a Master mainframe or an Expansion mainframe, then you cannot have more than one other module in the same mainframe.
- The 92S32 Pattern Generators cannot be placed in the next higher-numbered slot above a 92A96 Module.

Table 1–1: Power Supply Required for Configuration

Number of 92A96 Modules	Power Supply Required in Mainframe	Power Supply Required in Expansion Mainframe
1	any	any
2	any	any
3	1A or A1–A5 or 1B [1]	any
4	1B [1]	A1–A5 or 1B [1]

[1] **The 1B power supply option was discontinued effective SN B061162 and above**

Additional guidelines are as follows:

- Correlating a 92A96 Module with a 92A16 Module requires the 92A96 Module to be located in the next lower slot to the 92A16 card (this correlated pair has a 80 MHz maximum sampling rate).
- When combining a 92A96UD Module with 92A96, 92A96D, 92A96XD, or 92A96SD Modules to create a multicard module, place the 92A96UD Module in the higher-numbered slot.
- If your DAS configuration consists of modules other than 92A96 Modules, install those modules before installing the 92A96 Modules.

Creating Multiple-Card Modules

The 92A96 Module can be used as a single-card or as a multiple-card module. You create multiple-card modules by installing multiple 92A96 Module cards in adjacent slots of the DAS mainframe; the system software automatically recognizes their positions and configures them together. The System Configuration menu shows the resultant configuration for such installations.

The following list describes installation guidelines you must follow if you intend to use multiple 92A96 cards in a module.

***NOTE**. DAS 9200 modules must be installed according to certain guidelines. The arrangement of modules within a mainframe is critical. Do not install your 92A96 Module until you have read these guidelines.*

- You can install up to three 92A96 cards in a DAS mainframe as a module.
- All cards in a module must be in adjacent slots.
- All cards in a module must be installed in the same DAS Master mainframe or Expansion mainframe (multiple-card modules cannot stretch across mainframe boundaries, but you can have more than one multiple-card module in a mainframe).

- Due to power requirements, you cannot use more than four 92A96 cards in a mainframe (regardless of whether or not you are using them in a single-card module).

Installing the Software

The 92A96 software is part of the system software and should already be installed on the DAS or TLA systems. If you need to install or upgrade the system software, refer to *Loading System Software* in the system user manuals for the DAS or TLA 500 series logic analyzers.

If you purchased any application software (such as one of the microprocessor disassembler packages or the performance analysis software), you must install the application software on the hard disk using the Disk Services Menu. Refer to the documentation that came with you application software package for instructions on installing the application software.

Connecting the Probes

The 92A96 Module uses a four probe system with each probe assembly composed of four major parts: a probe cable, a probe interface housing, three 8-channel probes, and a clock probe. You connect the probe cable from the card probe connector to the interface housing, and you connect the 8-channel probes and clock probe between the interface housing and the system under test (see Figure 1–2).

NOTE. *Although the illustrations in this section show a DAS mainframe, the procedures for connecting the probes to a TLA 500 series logic analyzer are the same as connecting probes to a DAS mainframe.*

Each probe assembly contains 24 acquisition channels (three 8-channel probes) and a clock probe. You can separate the 8-channel probes into individual channel podlets. Each podlet contains a signal and ground reference connector.

The probe cables come in two types: ribbon and coaxial. The ribbon cables are standard with the 92A96 Module, while the coaxial cables are optional. The standard ribbon cable offers 1.2 volt (p-p) input signal sensitivity for TTL environments and the coaxial cable offers 600 millivolt (p-p) input signal sensitivity for ECL environments.

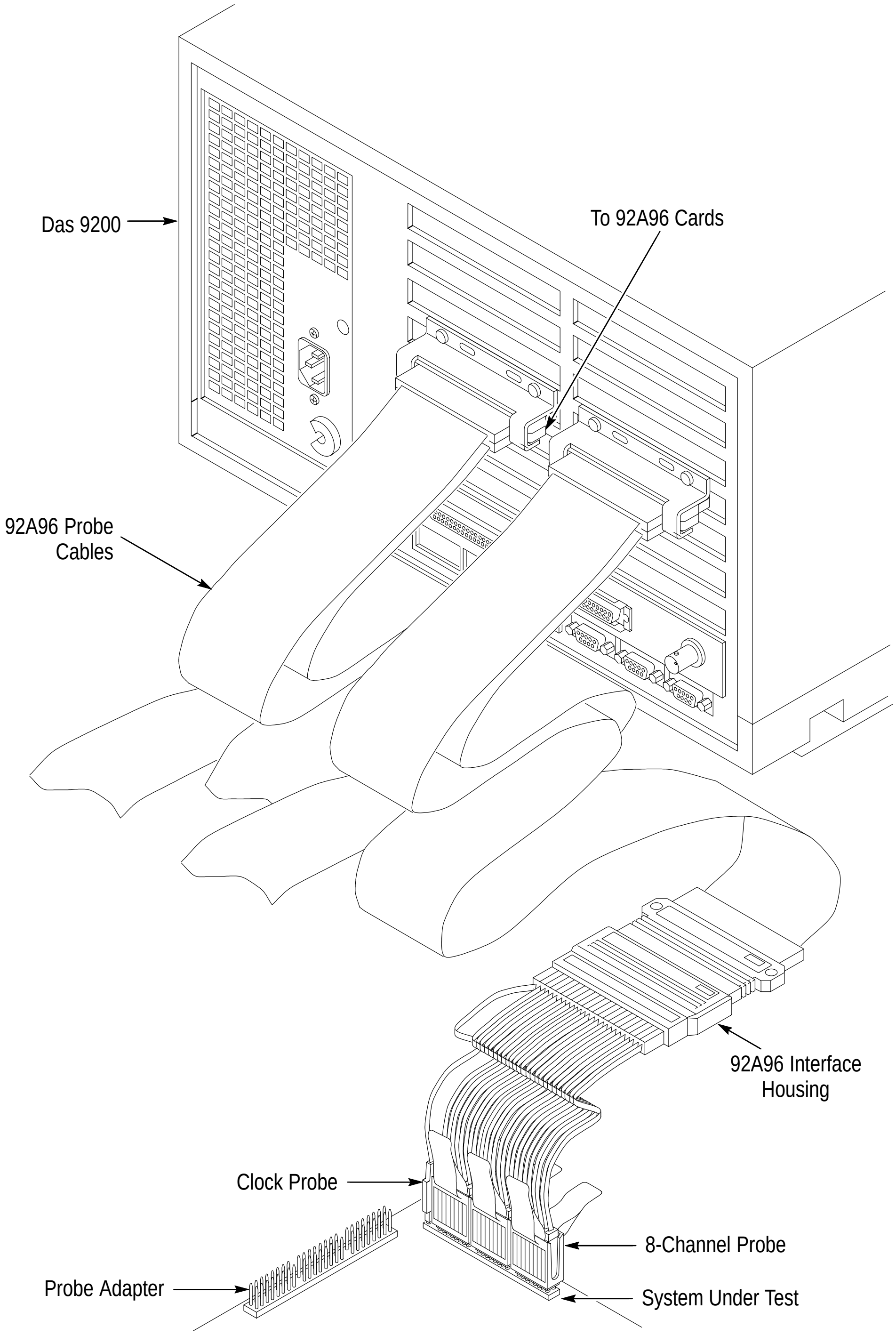

Figure 1–2: Connections to the System Under Test

Labels

The four probe connectors, cables, and interface housings for the 92A96 Module have color-coded labels supplied that you can affix to identify your probe connections. Table 1–2 shows the color of both the probe connector and interface housing labels, as well as the module card section and clock assignments.

Table 1–2: Probe Label Information

Label Color	Sections	Clock	Probe Cable
Orange	A0, A1, C0	Ck 0	A
Green	A2, A3, C1	Ck 1	B
Blue	D0, D1, C2	Ck 2	C
Gray	D2, D3, C3	Ck 3	D

If you purchased the 92A96 Module separately, locate the supplied Probe Locations label and affix it to the top of your DAS mainframe. This label references each probe cable assembly to the appropriate 92A96 Module connector. See Figure 1–5 for the appropriate label location.

Individual 8-channel probes are labeled with ground and channel assignments (7–0) only. Ground and channel number order identification is marked on the podlet holder. Each channel (podlet) within an 8-channel probe is color-coded, using the standard resistor-value color code, on the signal side of the podlet body to identify its channel number (see Figure 1–3). Each interface housing connects to three 8-channel probes and a single clock probe.

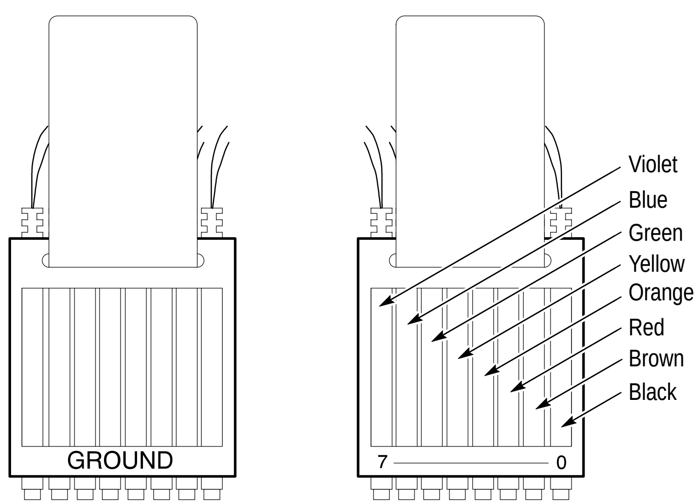

Figure 1–3: Probe Channel Color and Labels on an 8-Channel Probe

You should apply slot number labels as shown in Figure 1–4 if there is more than one 92A96 Module in the system. These slot numbers help you identify which module is connected to a particular system under test in a multimodule system.

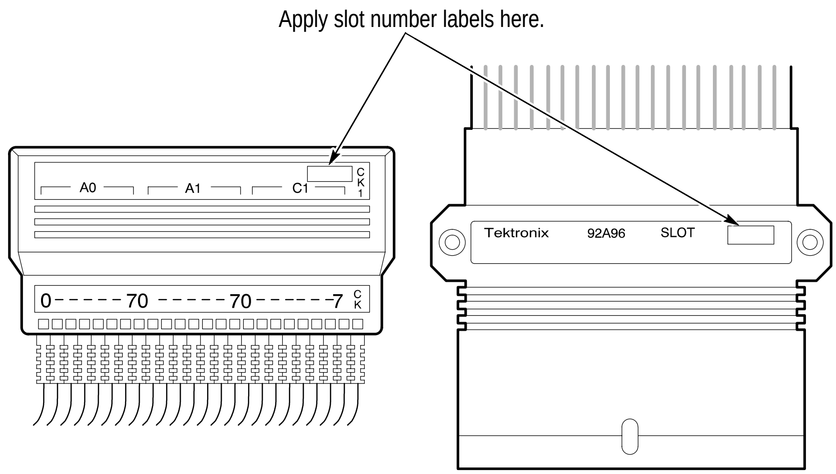

Figure 1–4: Applying Slot Number Labels

Connecting the Probes to the 92A96 Module

A probe cable connects directly to a probe connector on the back of the 92A96 Module. Each individual module has four probe connectors. Refer to Figure 1–5 for probe connector locations on the 92A96 Module.

NOTE*. It is important to connect the probe cables to the 92A96 Module in a specific color sequence and orientation to avoid miskeying them. The sequence is gray, blue, green, and orange. At the same time, make sure the key for each cable connector is pointed down toward the baseplate of the mainframe.*

After you connect the probe cables to the 92A96 Module, use the provided bracket clamps to hold the probe cables in place; this ensures that the cables are properly connected and helps reduce the wear on the probe cable connectors.

To mount the bracket clamp, refer to Figure 1–2 on page 1–9 and take the following steps.

1. Find the two screw holes just above the opening the probe cables go into.
2. Place the bracket clamp over the two probe cable connectors.
3. Use a #1 Phillips screwdriver to mount the bracket (two screws are provided with the bracket).

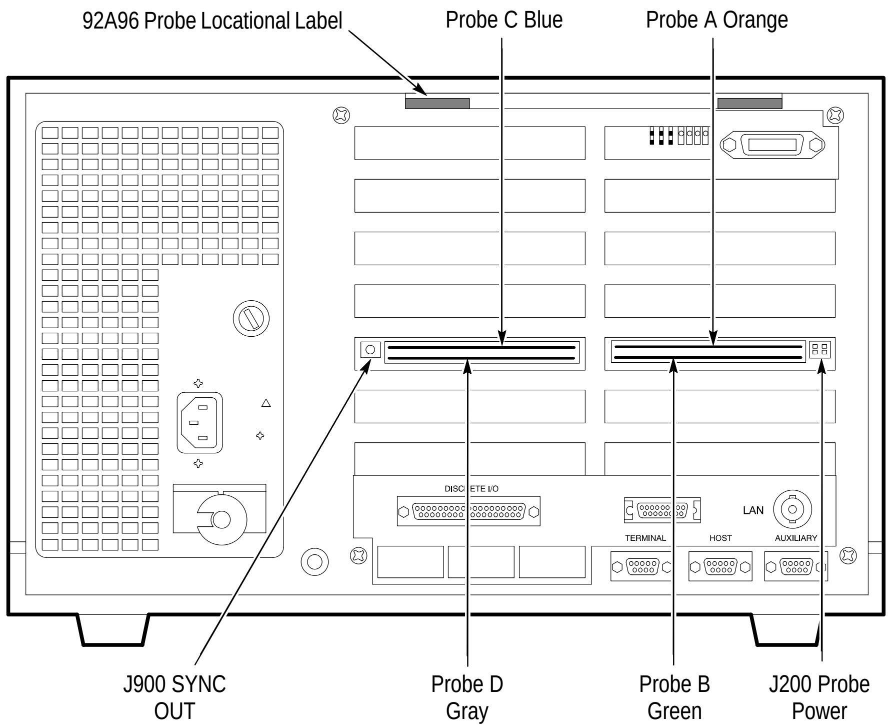

Figure 1–5: Probe Connector Locations

Connecting the Probe Interface Housings

The probe cables and interface housings may already be connected when you receive the 92A96 Module. If they are not connected, refer to Figure 1–6 and follow this procedure:

1. Select an interface housing with a label color that matches a label color on one of the probe cables.
2. Line up the key on the loose connector end of the probe cable with the key slot on the interface housing and connect them.
3. Repeat steps 1 and 2 for each of the three remaining probe cables.

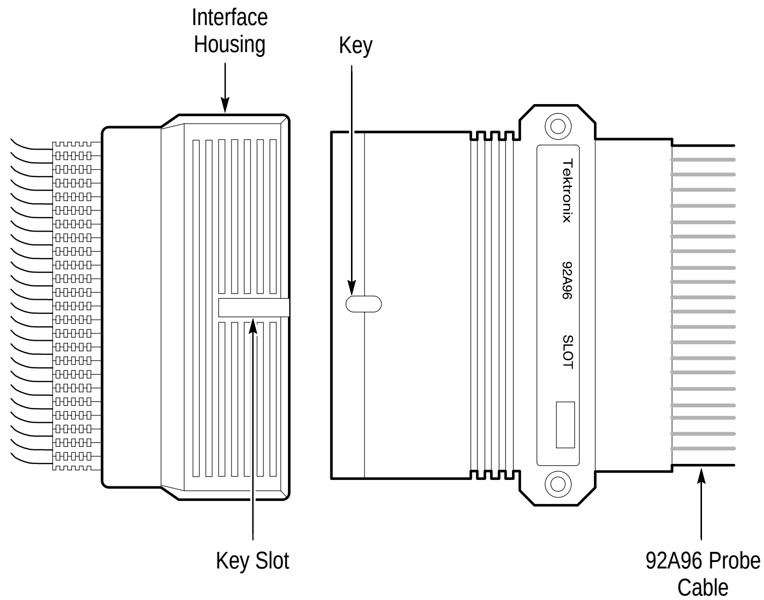

Figure 1–6: Connecting the Interface Housing to the 92A96 Probe Cable

Connecting the 8-Channel and Clock Probes to the System Under Test

If your system under test has test pins pre-configured with the proper spacing for the 8-channel and Clock probes, then they can be connected directly to the system under test (SUT). In most cases, however, lead sets or lead sets with KlipChip tips are necessary (and supplied) to provide more flexible connection capability (see Figure 1–7).

Single-Channel Lead Sets. If your SUT has 0.025-inch square pins (0.030 diagonal max.) or 0.020- to 0.030-inch round pins, but they aren't configured for single probe podlets (pins in 2X1 matrix on 0.10-inch centers), you can connect the supplied single-channel lead sets from the podlets to the appropriate (signal and ground) connectors on the SUT. The signal lead is color-coded white and ground lead is color-coded black (see Figure 1–7).

8-Channel Lead Sets. If your SUT has 0.025-inch square pins (0.030 diagonal max.) or 0.020- to 0.030-inch round pins, but they are not configured for 8-channel probes (pins in 2X8 matrix on 0.10-inch centers), you can order an optional 8-channel lead set that connects directly to the 8-channel probe. It has eight individual signal leads and two ground leads to connect to your SUT. The signal leads are color-coded white and the ground leads are color-coded black (see Figure 1–7).

KlipChip Tips. If your SUT does not have the recommended pins types and sizes, you must use KlipChip tips to make the necessary connections (to ensure good electrical contact). The tips connect to the lead sets and clip on to the SUT (see Figure 1–7).

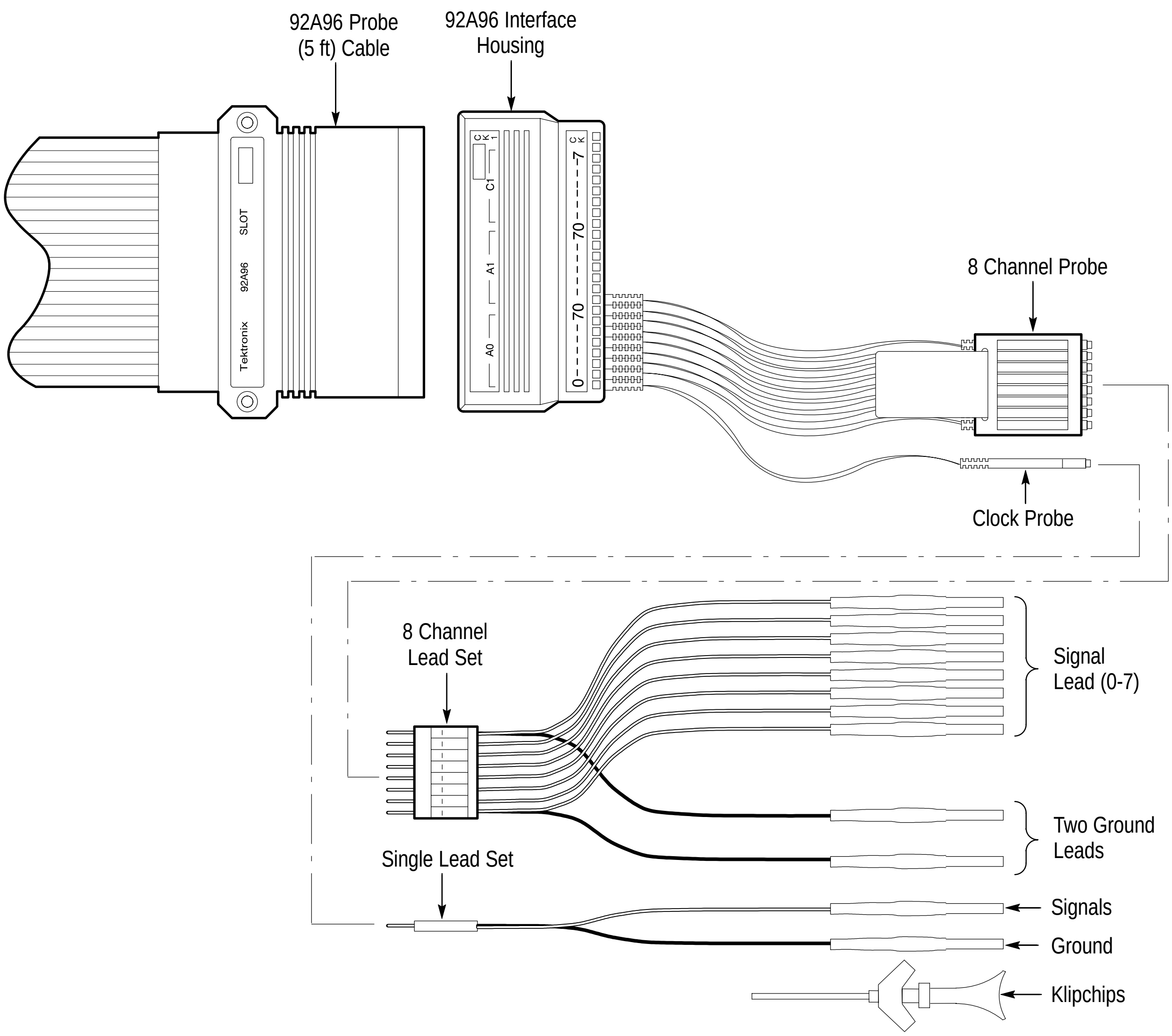

Figure 1–7: A 92A96 Probe Assembly and Lead Sets

Connecting Two Leads to One Signal. You may want to use a signal from the system under test in multiple channel groups. To do this you must connect a separate input channel lead to the signal for each channel group to which you want to assign that signal.

If your 92A96 Module consists of multiple 92A96 cards and you use external clocking, you must connect the clock leads of each card to the same clock source. For example, assuming that you use CLK1, you could connect the CLK1 lead from both cards to a single KlipChip tip; then connect the KlipChip tip to the external clock source.

Probing Techniques Using the Passive Probing System

To ensure that your 92A96 Module acquires TTL or CMOS data reliably from your system under test, follow these setup guidelines:

- When acquiring data, ensure that the mainframe, ribbon cables, and podlets are operating in a static controlled environment.
- When acquiring data, move devices that generate high amounts of radiated energy away from the ribbon cables; for instance, a soldering iron.
- Connect the chassis of the mainframe to the chassis of your SUT with a grounding strap. This ensures that the chassis' of the two systems are at the same potential and provides better noise immunity for the acquisition.
- When acquiring ECL-level signals, use the optional coaxial-type probe cables instead of the ribbon cables to avoid in soft errors.
- Avoid probing multiple threshold levels with a single 92A96 Module using the ribbon cable (for example, concurrently acquiring both ECL and TTL level signals), use the optional coaxial-type probe cables instead.
- In a general purpose probing environment, use a minimum of four ground connections up per cable (including the ground on the clock input when running in External clock mode).
- Connect all the grounds to avoid degrading the performance of the 92A96 Module.

***NOTE**. The ground on the podlets is a "soft" signal ground. There is a 216 Ω resistor in series with the ground pin. This prevents damage to an ECL/TTL/CMOS output if you accidently connect the ground lead of the podlet to the signal side, instead of the ground side.*

Connecting a 90-Channel Interface

The optional 90-Channel Interface lets you connect to certain microprocessor probe adapters. Use the following procedure to accomplish this.

1. Disconnect the probe cable from the interface housing.
2. Reconnect the probe cable to the 90-Channel Interface as indicated by the four-color label on the 90-Channel Interface housing.

3. Connect the 90-Channel Interface ID probe power cable from J200 on the back of the 92A96 Module (see Figure 1–5 for the location of J200) to the 90-Channel Interface power connector.

***NOTE**. Be careful to match the keying on each end of the probe ID/power cable to the keying of J200 and the 90-Channel Interface power connector (a 180° difference in orientation exists between J200 and the 90-Channel Interface power connector).*

4. Connect the 90-Channel Interface to the Microprocessor Housing of the probe adapter (see Figure 1–8). Refer to your microprocessor-specific user manual for specific instructions.

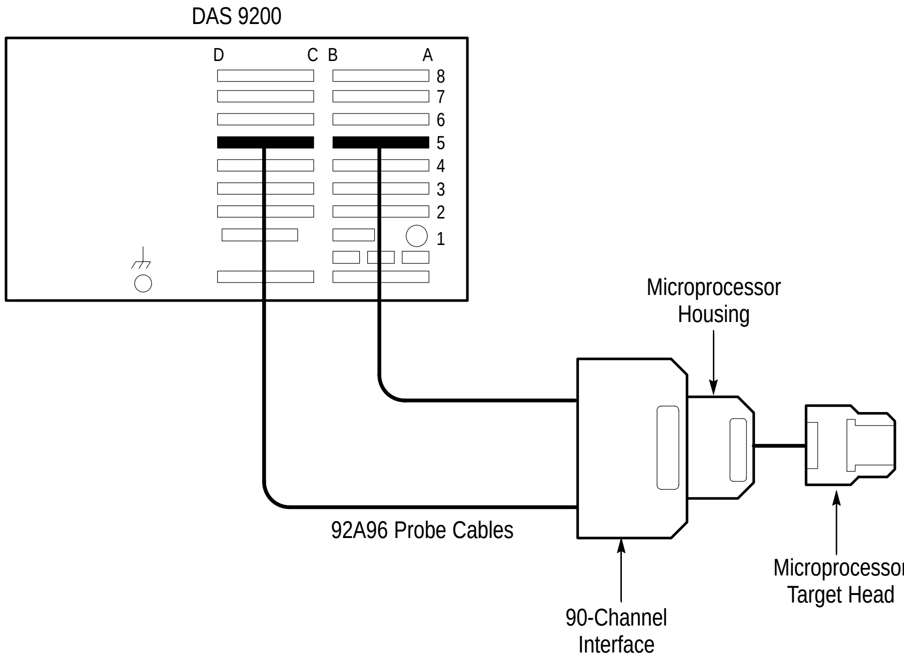

Figure 1–8: Connecting the 90-Channel Interface to a Probe Adapter

Installing a 90-Channel Interface-Compatible DIN Connector

You can install a commercially available standard DIN connector (with standard pinout) or a reverse DIN connector (with reverse pinout) in your system under test in order to accommodate the 90-Channel Interface. Figure 1–9 shows two methods of installing a female DIN connector into your system under test.

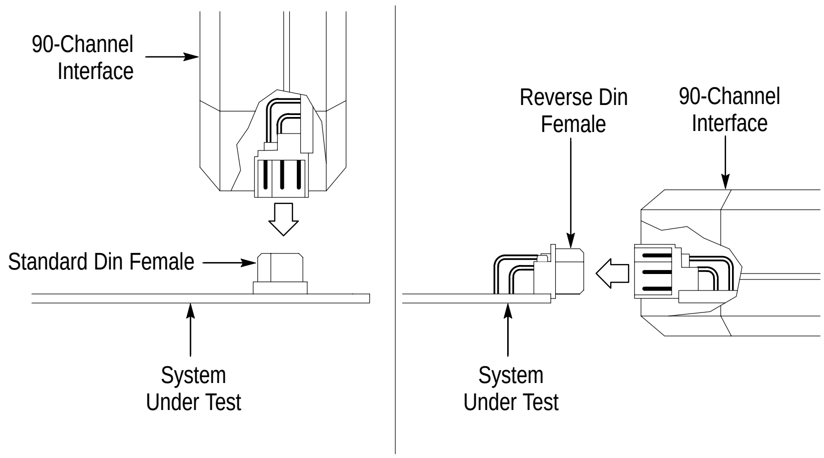

Figure 1–9: Installing a DIN Connector in your System Under Test

The left side of Figure 1–9 shows a DIN connector installed on a circuit board that is easily accessed from either side (top or bottom). The right side of Figure 1–9 shows a reverse DIN connector installed on a circuit board that is difficult to access (for example, cards closely slotted together).

Before you define which of the signals to monitor or how you want to group the signals of the system under test, you should refer to Table 1–3. Table 1–3 shows the 92A96 channel names, the 90-Channel Interface Probe Adapter DIN Connectors, and the 92A90 Channel names. The pin numbers listed are for the standard DIN 41412 connector (type C-96). If you install a reverse pinout DIN connector, you must reverse the pinout order (for example, pin A01 becomes A32, pin A02 becomes A31, and so on).

Keep the following points in mind when defining the connections:

- Any clock channels not used as edge-sensitive clocks can be used as additional level–sensitive qualifiers.
- Any qualifier channels (C2_3, C2_2, C2_1, or C2_0) when not used as qualifiers can be used as any general purpose acquisition channels.

Table 1–3: 92A96 90-Channel Interface Pin Assignments

92A96 Channel Name	90-Channel Interface DIN Connector	92A90 Channel Name
Clock_3	B21	CLK(3)
C1_4 – data	B21	
Clock_2	B19	CLK(2)
C1_0 – data	B19	
Clock_1	B23	CLK(1)
C0_4 – data	B23	
Clock_0	A22	CLK(0)
C0_0 – data	A22	
C2_3 – qual	B11	QUAL(3)
C3_4 – data	B11	
C2_2 – qual	A9	QUAL(2)
C3_0 – data	A9	
C2_1 – qual	C10	QUAL(1)
C2_4 – data	C10	
C2_0 – qual	C11	QUAL(0)
C2_0 – data	C11	
C0_5	C27	C0(3)
C0_3	B25	C0(2)
C0_2	A24	C0(1)
C0_1	C25	C0(0)
A3_7	B14	A3(7)
A3_6	A14	A3(6)
A3_5	C15	A3(5)
A3_4	A15	A3(4)
A3_3	B15	A3(3)
A3_2	A16	A3(2)
A3_1	C16	A3(1)
A3_0	C17	A3(0)
A2_7	C20	A2(7)
A2_6	C19	A2(6)
A2_5	C18	A2(5)
A2_4	B17	A2(4)

Table 1–3: 92A96 90-Channel Interface Pin Assignments (Cont.)

92A96 Channel Name	90-Channel Interface DIN Connector	92A90 Channel Name
A2_3	B18	A2(3)
A2_2	A17	A2(2)
A2_1	A19	A2(1)
A2_0	A18	A2(0)
A1_7	A1	A1(7)
A1_6	B1	A1(6)
A1_5	B2	A1(5)
A1_4	C1	A1(4)
A1_3	C2	A1(3)
A1_2	B3	A1(2)
A1_1	C3	A1(1)
A1_0	A2	A1(0)
A0_7	A30	A0(7)
A0_6	B30	A0(6)
A0_5	B32	A0(5)
A0_4	A32	A0(4)
A0_3	C31	A0(3)
A0_2	C32	A0(2)
A0_1	A31	A0(1)
A0_0	B31	A0(0)
D3_7	A13	D3(7)
D3_6	A12	D3(6)
D3_5	B13	D3(5)
D3_4	A11	D3(4)
D3_3	C12	D3(3)
D3_2	C14	D3(2)
D3_1	C13	D3(1)
D3_0	B12	D3(0)
D2_7	A3	D2(7)
D2_6	A4	D2(6)
D2_5	B6	D2(5)
D2_4	C4	D2(4)

Table 1–3: 92A96 90-Channel Interface Pin Assignments (Cont.)

92A96 Channel Name	90-Channel Interface DIN Connector	92A90 Channel Name
D2_3	B5	D2(3)
D2_2	C6	D2(2)
D2_1	A5	D2(1)
D2_0	C5	D2(0)
D1_7	C23	D1(7)
D1_6	C22	D1(6)
D1_5	C21	D1(5)
D1_4	A20	D1(4)
D1_3	A23	D1(3)
D1_2	A21	D1(2)
D1_1	B24	D1(1)
D1_0	C24	D1(0)
D0_7	C28	D0(7)
D0_6	B27	D0(6)
D0_5	A29	D0(5)
D0_4	A27	D0(4)
D0_3	C29	D0(3)
D0_2	C30	D0(2)
D0_1	B29	D0(1)
D0_0	A28	D0(0)
C3_7	B9	C1(8)
C3_6	A8	C1(7)
C3_5	A6	C1(6)
C3_3	B8	C1(5)
C3_2	A7	C1(4)
C3_1	C9	C1(3)
C2_7	C8	C1(2)
C2_6	C7	C1(1)
C2_5	B7	C1(0)
C1_3	A10	C0(8)
C1_2	A25	C0(7)
C1_1	C26	C0(6)

Table 1–3: 92A96 90-Channel Interface Pin Assignments (Cont.)

92A96 Channel Name	90-Channel Interface DIN Connector	92A90 Channel Name
C0_7	A26	C0(5)
C0_6	B26	C0(4)
C1_7	nc	spare
C1_6	nc	spare
C1_5	nc	spare
	B20	–10V
	B4	GND
	B10	GND
	B16	GND
	B22	GND
	B28	GND

P6041 Probe

In addition to data acquisition probes, a P6041 Sync Out cable is included with every mainframe. The P6041 offers a female SMB connector to connect to the 92A96 Module J900 male connector (see Figure 1–5 for the location of J900) and a male BNC to connect to an external device.

The Sync Out cable lets you send a signal, called the 92A96 Module Sync Out Signal, to an external device. The Trigger menu lets you specify when the signal is asserted at the SMB connector on the 92A96 Module.

Ground Strap

Included as a standard accessory to the 92A96 Module is a ground strap that helps reduce electromagnetic susceptibility to radiated emissions by improving the signal to noise ratio between the mainframe and your system under test. Connect the ground strap between the ground lug at the rear of the mainframe and your system under test.

Functional Check

Diagnostics are run at power on to test for proper card configuration (illegal configurations shut the system down) and then to check the functionality of mainframe components, operating software, and all installed module cards. When the diagnosticshave been successfully completed, most instrument functions are verified.

Diagnostics take approximately 10 seconds per installed module. Use the Diagnostics menu to view the results of the power-on diagnostics (see Figure 1–10). This menu reports the diagnostic results with a PASS or FAIL indication and a four-digit error code. If a diagnostic error is found, record all error information and contact your local Tektronix service representative.

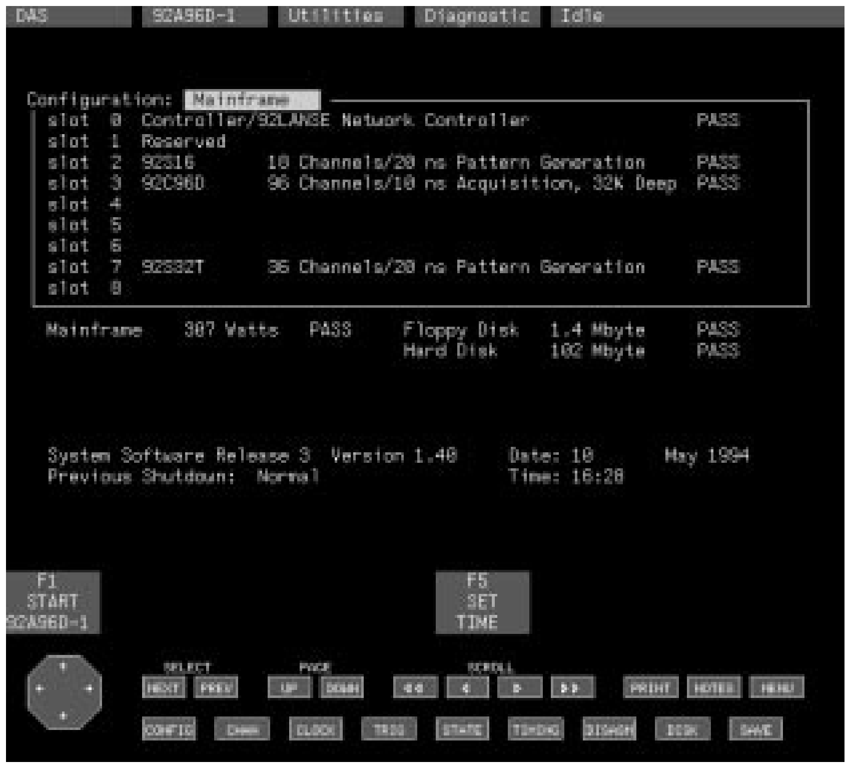

Figure 1–10: Diagnostics Menu Showing Results of Diagnostic Testing

***NOTE**. On earlier versions of the DAS, the Diagnostics menu was known as the Power-up menu.*

Functional Overview

This chapter comprises of three sections:

- *Functional Overview* uses a block diagram approach to describe how the 92A96 Module acquires and stores data from a system under test.
- *92A96 Module Menu Overview* provides brief descriptions of the menus and overlays available with the 92A96 Module.
- *Operational Overview* provides general operating instructions for using the 92A96 Module to acquire and display data from a system under test.

The basic operation is divided into three stages: acquiring data, triggering and storage qualification, and storing data. Refer to the functional block diagram in Figure 2–1 while reading about these basic module operations.

Stage 1: Acquiring Data

When you select function key F1: START to start an acquisition, the clocking state machine, connected to the system under test via the acquisition probes, begins monitoring data from the channels to which it is connected. Each time a sample clock occurs, data is sampled. Sampled data is then sent to the trigger and storage qualification functional blocks.

Stage 2: Triggering and Storage Qualification

The trigger condition looks at sampled data for specific events and decides what action to take. You can set up the trigger condition to look for the following: data values, data ranges, or signals from another module. You can use event data to start internal counters or timers to delay triggering until the counter or timer reaches a desired value.

When the trigger condition is satisfied, the 92A96 Module enables its post-trigger delay counter (described in Stage 3) to post-fill the acquisition memory (before stopping acquisition).

The storage qualification functional block looks at sampled data. If the storage conditions are met, a storage qualifier signal enables sampled data to pass into the acquisition memory as qualified data. Any unqualified sampled data drops out. If the post-trigger delay counter is enabled (by the trigger signal), its value is incrementally increased each time a data sample is qualified. Refer to *Using Storage Qualification* on page 3–47 for detailed information.

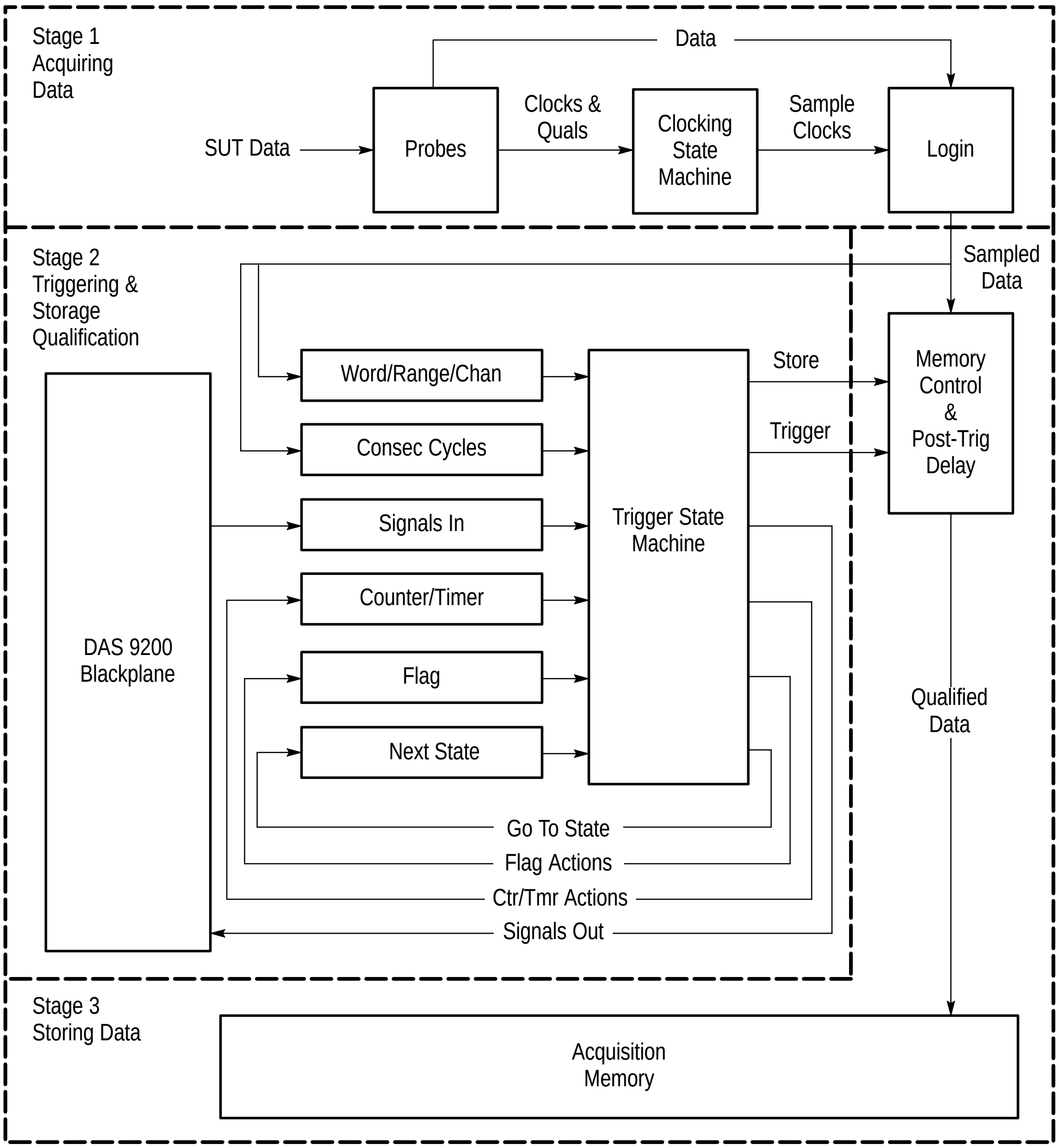

Figure 2–1: Block Diagram of 92A96 Module Acquisition and Storage

Stage 3: Storing Data

The acquisition memory works like a first-in first-out (FIFO) buffer, storing every qualified data sample until the entire memory is full. After that, each new data sample overwrites the oldest existing sample. This process continues until the trigger event is found and the post-trigger delay counter reaches the specified (trigger) value, which stops acquisition. During acquisition, you can monitor the progress of the data storage process via the Monitor menu.

After storing the data you can display the acquired data in the following formats: state table, timing diagram, graph display, and microprocessor disassembly.

92A96 Module Menu Overview

The 92A96 Module user interface is a menu-driven system based on the DAS or TLA mainframe. The system software provides the menus to organize and control system-level module interaction. The 92A96 Module provides the menus (using the 92A96 Support Software) to control its data acquisition, qualification, storage and display. Refer to the user manual for your DAS or TLA 500 series logic analyzer for information on how to access menus. All of the 92A96 Module menus are described in detail in the *Reference* Chapter of this manual.

The 92A96 Modules are compatible with the system software versions described in Table 2–1. Before using the 92A96 Module with your DAS or TLA logic analyzer, verify that the system software of you logic analyzer is compatible with your version of the 92A96 Module.

Table 2–1: 92A96 Module Version and System Software Compatibility

92A96 Module Version	System Software Version
Standard 92A96 Module	Release 2, Version 1.50, or higher
92A96D and 92A96XD Modules	Release 2, Version 1.51, or higher
92A96SD Modules	Release 3, Version 1.10, or higher
92C96 Modules (all versions)	Release 3, Version 1.40, or higher
92A96UD Modules	Release 3, Version 1.51, or higher

Two primary types of menus for the 92A96 Module are available:

- Setup menus. These menus control how the module acquires new data.
- Display menus. These menus show acquired data in a variety of forms.

There is also a third type of menu, the Monitor menu. This menu tracks the current operational state of the module while it is performing an acquisition.

Setup Menus

There are four setup menus that control how the 92A96 Module samples and stores data. Each menu has its own set of fields that can be use to define the data acquisition module setups.

Configuration Menu. The Configuration (Config) menu shows the current configuration of the module and specifies operating modes. In this menu you select the software support mode you want, the default memory size, and whether or not you want to capture signal glitches. This menu shows you the name and type of module you have, including the number of channels available, and it indicates the intermodule signals you have defined.

Channel Menu. The Channel menu lets you arrange the acquisition channels into logical groups for input and display purposes. You can also assign names to individual channel and define polarities and threshold voltages.

Clock Menu. The Clock menu lets you specify the internal or external clocks used to sample data. You select the sample clock source and the internal clock period or the external clock equation and qualifiers. If you have microprocessor support installed, you can choose microprocessor-specific clocking options.

Trigger Menu. The Trigger menu lets you define the trigger position, trigger program (including states, events, and actions) and the type of storage qualification you want. You can also use trigger libraries that contain templates for trigger programs.

Display Menus

Display menus let you view acquired data in several formats. You can choose any data source and start and stop data acquisitions in each of the display menus.

After an acquisition, the acquired data is automatically displayed in the State menu (power on default) or in the last selected display menu.

State Menu. The State menu displays the logical values of channel groups in table form. The channels are organized as defined in the Channel menu and the data is displayed in the radix you select.

Timing Menu. The Timing menu displays each input channel as a digital (two-state) waveform. It also shows you the bus value of all the channel groups defined in the Channel menu.

Graph Menu. The Graph menu gives a graphic overview of the data for one or two channel groups. Each data sample value is plotted against its location in acquisition memory.

Disassembly Menu. The disassembly menu shows translated logic input for system under test operations and control. General Purpose disassembly support is provided, but microprocessor-specific support is available with custom setups for clocking, triggering, channel grouping, and display. Refer to the microprocessor-specific Disassembly menus in their respective user manuals for their operating information.

Overlays

Some menus have function overlays associated with them. Overlays are actually submenus that you can use to control relevant parameters without leaving the current menu.

Monitor Menu

When an acquisition is not completed within a few seconds, the Monitor menu appears. It contains information that describes the current state of the module during acquisition.

This kind of information can be used to debug trigger programs. For example, if a trigger program contains a loop so that it never triggers, this menu can help you see the internal loop occurring.

Operational Overview

This section takes you through a typical start-up operating cycle for the 92A96 Module. It describes some ways that you can manipulate the display of acquired data to help you in its analysis. It also recommends changing the 92A96 Module setup parameters to acquire new data for a different look at your system under test. This basic operating cycle (see Figure 2–2) is required for hardware analysis or software analysis, with variations in clocking and display selections.

These steps are written for occasional or experienced users of the 92A96 Module. However, references to the detailed descriptions of these tasks are included for new users.

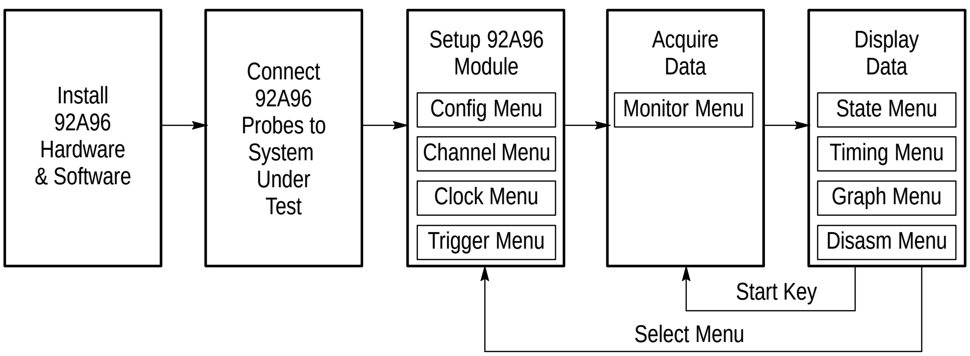

Figure 2–2: A Start-Up Operating Cycle for the 92A96 Data Acquisition Module

Install Hardware and Software

If you have a DAS/NT or a DAS/XP you may have to install the 92A96 Module inside the mainframe. Refer to *Installing the Hardware* beginning on page 1–5 for information on installing the 92A96 Module in a DAS Mainframe. If you have a TLA 500 series logic analyzer, the 92A96 Modules are already installed.

The system software should already be installed. However, if you purchased any of the disassembly software or application software, you may need to install the software through the Disk Services menu. For instructions on installing the application software, refer to the user manual for your DAS system or TLA 500 series logic analyzer or to the documentation for your software application.

Connect the Probes

After installing the hardware and software the next step is to connect the acquisition probes from the 92A96 Module to the system under test. Refer to *Connecting the Probes* on page 1–8 or to your application instruction manual for information on connecting the probes.

Set Up the 92A96 Module

The settings for the Config, Channel, Clock, and Trigger setup menus must be considered before acquiring data. The settings determine what data you will acquire. In the discussion of these menus the default settings are recommended; they give you a snapshot of your system under test data (asynchronously sampled at 10 ns and displayed in a state table format).

Select the Software Support Mode

Use the Config menu to choose one of the software supports modes you need for your application.

General Purpose Support. This mode uses all 92A96 Module functions with a maximum sample rate of up to 100 megasamples per second (MS/s) for up to 288 channels.

High-Speed Timing Support. This mode places the 92A96 Module in a special timing mode. It can sample data at a faster rate (up to 400 MS/s asynchronously) with greater effective memory depth (up to four times). However, fewer channels are available.

Microprocessor Support. This mode is available only if you install additional software support packages (using the Disk Services menu). The additional software support packages include various microprocessor support packages. Refer to individual microprocessor support instruction manuals for more information on using microprocessor support software.

Define Channel Groups

Use the Channel menu to assign input channels to desired channel groups for easier recognition and interpretation of acquired data.

1. Select the Channel menu and choose the section(s) and channel(s) you want included in each channel group. The default channel groups for General Purpose support are Address, Data, and Control.

2. Assign other meaningful names to each group, or use the default group and channel names. You can change individual channel names using the Channel Definition overlay.

3. Select the display radix for data in each group.

4. Change the polarity of channels that require it with the Channel Definition overlay.

5. Define the input voltage threshold levels for the clock and data channels with the Threshold Definition overlay.

Select the Clocking Mode

Use the Clock menu to select one of two basic clocking modes Internal or External. A third choice, Custom, is selectable if an optional microprocessor application support software package is installed. The clocking modes are defined below:

- Internal. A step timebase is internally generated. This mode enables clock periods from 1 ms to 10 ns to control the asynchronous sampling rate (1 kHz–100 MHz) of monitored channels. When you select High-Speed Timing support, two additional clock periods are selectable, 5 ns and 2.5 ns.
- External. A signal (or signals) generated by the system under test is used as the sample clock. This setting allows external signals with periods as short as 10 ns to control the synchronous sampling rate (up to 100 MHz) of monitored channels.
- Custom. Enables and disables a variety of microprocessor-specific clock cycle types (for example, DMA cycles). Refer to the instructions that came with your microprocessor-support software for a detailed description of the Custom selection in the Clock menu (not shown in this manual).

1. Select the Clock menu and choose the clocking mode.

2. Choose the desired clock period (that is, the sample rate) if you select internal clocking.

3. Specify the clock equation(s), edge, and source if you select external clocking.

Select the Trigger Parameters

Use the Trigger menu to create programs to control when (or where) the trigger occurs and what sampled data is qualified for storage in the 92A96 Module.

1. Select the Trigger menu and specify a trigger position. The trigger position can be either at 12.5% default intervals within memory or at a precise value (point) entered in cycles.

2. Specify storage qualification conditions in the Store field. For example, choose All Cycles to store all sampled data.

3. Specify trigger condition. Set the event statement (If) of the trigger program clause. For example, the power-up default “don’t care” word event is true for every sample clock cycle.

4. Set the action statement (Then) of the trigger program clause. For example, the default trigger action causes the 92A96 Module to trigger when the event portion of the clause is true; in this case, that's on the first data sample.

Acquire Data

Use the Start key to begin an acquisition.

1. Select the F1: START key. A successful acquisition automatically brings up a display menu.

2. Watch for the Monitor menu . This menu indicates the trigger has not occurred. If you have used the default settings to this point, this condition can only occur when you have a diagnostics failure that requires servicing (go back to the Diagnostics menu and check).

Display Data

After satisfying the trigger conditions and filling the acquisition memory, data displays in the format used last (note: the State format is the power on default).

1. Select the appropriate display menu for the 92A96 Module. For example, choose the Timing menu for hardware timing analysis of acquired data.

2. Select the horizontal display magnification in the Mag field of the Timing (or Graph) menu. For example, choose a larger value for better resolution.

3. If you choose the internal clock mode in the Clock menu, select a new sample rate by changing the clock period in the Timing menu clock period field. For example, choose a 20 ns clock period for a new acquisition at 50 MS/s and acquire the data at the new sampling rate.

Change the Display of Data

Once you acquire and display data, you can change the display to help you view it in ways that assist in its analysis.

Tracking Cursor Position in Data

Use the Cursor (sequence) field to track your position in the data. This field is included in all displays to indicate the sequence number (memory location) of the data that the cursor is positioned on.

To quickly move through displayed data, type in a desired sequence number (the number you type appears in this field), then press the Return key. The data surrounding that sequence position displays.

Changing Radixes

The State and Timing menu channel groups use the same group radixes you selected in the Channel menu (Input Radix field). But you can change the group radixes in the State or Timing Format Definition overlay.

To change the display radix, follow these steps:

1. Select function key F5: DEFINE FORMAT to open the State or Timing Format Definition overlay.
2. Choose Edit Groups as the format definition function. Then open the radix field of the group you want to change and select the desired radix.
3. After you make the desired selections, select function key F8: EXIT & SAVE. This returns you to the State or Timing menu.

You can only select the symbolic radix format if you created a symbol table for the module you are using. A symbol table is composed of numeric values or ranges and symbolic names, each name associated with a value or range.

If you select a symbolic radix, you must also select the file name of the symbol table that the symbolic values or ranges are in. Use one symbol table per group.

Tracking Acquisition Parameters

You can display a set of acquisition parameters to the upper-left of the display menus. The acquisition parameter information includes the final status of any counter or timer trigger actions used and whether the data was acquired with Latch mode turned on.

To change the display selections, including acquisition parameters, perform the following steps:

1. Select function key F5: DEFINE FORMAT to open the State or Timing Format Definition overlay.
2. Choose Select Options as the format definition function. Then choose which Display Selections you want from the Select Options window of the State or Timing Format Definition overlay.
3. After you make the desired selections, select function key F8: EXIT & SAVE. This returns you to the State or Timing menu.

Searching for Data

Use the State or Timing Search Definition overlays to define the specific data you want to see in either the State or Timing displays. The search types follow:

- Value
- Not Value
- Memory Difference

- Qualification Gap
- Timestamp

To search for specific data, follow these steps:

1. Select function key F6: DEFINE SEARCH to open the State or Timing Search Definition overlay.
2. Select the search type in the Search for field of the State or Timing Search Definition overlay. Then enter the desired search parameters. For example, select Value as the search type and specify the search value and range (additional fill-in fields appear).
3. After you enter the desired search parameters, select function key F8: EXIT & SAVE. This returns you to the State or Timing menu.
4. To execute the search, select either function key F7: SEARCH BACKWARD or F8: SEARCH FORWARD.

Creating User Marks

Marking data lets you keep track of the data samples that have a special significance in your application.

You can place a mark on individual sequences of the State menu or on any column sequence of the Timing or Graph menus. Use marks to make delta time measurements or to move quickly through the data by jumping from mark to mark. The display of marks can be turned on or off from the Select Options function of the State or Timing Format Definition overlays.

To place a mark, position the cursor where you want the mark and select function key F4: MARK DATA. Then choose a mark label from the selection field.

Refer to *User Marks* on page 3–75 for more details on user marks.

Measuring Delta Time

You can measure the delay time between any two data points. Turn Delta Time measurements on using the Select Options function in the State or Timing Format Definition overlay, and then select the measurement reference points. For example, you can measure the time between the cursor and a delta (Δ) mark you place (see user marks above), or you can measure the time between the cursor and the trigger. In fact, you can select any of the following locations as the start- or end-point of the measurement:

- Cursor
- Trigger
- First Acq

- Last Acq
- Delta Mark

Refer to *Delta Time* on page 3–76 for more details on using Delta Time measurements..

Timestamping Data

When viewing data in the State menu, the 92A96 Module offers a timestamp. The timestamp is a timer that starts when you select function key F1: START. It measures the time between the start of acquisition and each sequence (absolute time), the time between the delta mark and each sequence (delta time), or the time between each sequence (previous time). The timestamp value is stored with every acquisition cycle and can be displayed in its own column in the State menu.

To add a timestamp group (column) to the display, follow these steps:

1. Select function key F5: DEFINE FORMAT to open the State Format Definition overlay.

2. Select the State Format Definition overlay and select Edit Groups as the format definition function. Select the group name field where you want the new group, select function key F4: ADD GROUP, and then select the timestamp.

Printing Screens

A printer support overlay is generic to most menus. Although some printer support overlays have slightly different labels and fields, each is basically the same. Use the printer support overlay to specify the parameters necessary to transfer the current menu's contents to a line printer or to a file.

To display a printer support overlay, follow these steps:

1. Select the on-screen Print button while in a setup or display menu (except the Graph menu).

2. To print a menu after you've set the printing parameters, select F5: PRINT.

Splitting the Display

You can split the display vertically or horizontally, dividing it into two data windows. Each window has its own cursor, user marks, source of data and display type. You can switch windows freely, making one active and the other inactive. All appropriate format definition and search definition overlays are available too. Refer to the *Split-Screen Definition Overlay* on page 3–111 for details.

To split the screen, select function key F2: SPLIT DISPLAY to open the Split-Screen overlay from the State, Timing, or Disassembly menus. Then select either function key F5: SPLIT HORIZ to select a horizontal split, or function key F6: SPLIT VERT to select a vertical split. When you select either of these keys, a new field is added to the overlay that lets you adjust the size of each window. Finally, select function key F8: EXIT & SAVE to view the selected menu(s).

Readjusting Setup Parameters

After you review the acquired data, you may want to look at your system under test in a different way. Go back to one or more of the Setup menus and change the setup parameters necessary to give you a new data perspective. For example, you may want to include additional bus signals in a particular channel group. In this case, go back to the Channel menu and add the new channels to the desired channel group. When you select function key F1: START to make another acquisition, your new settings take effect.

Setup Menus

This chapter comprises of the following sections:

- *Setup Menus* describes the setup menus and overlays available with the 92A96 Module.
- *Display Menus* describes the display menus and overlays available with the 92A96 Module.
- *High-Speed Timing Support* describes the additional features of the setup and display menus while using the High-Speed Timing support.

This section describes the 91A96 Setup menus and overlays in detail. For specific information on the fields of the menus or overlays, use the on-line notes system. That is, highlight the field in the menu and then select the Notes on-screen button to display a brief description of the function of the field, field selection, or function key.

Configuration Menu

The Config(uration) menu gives you an overview of the 92A96 Module you are using (see Figure 3–1). Generally, this is the first menu you use to initially set up the 92A96 Module.

The Config menu contains fields that describe your module and a field to select the software applications you want to use. It also allows you to define the memory size allocated for acquisition.

To select the Config menu from the Menu Selection overlay, select the 92A96 Module in the Modules column in the overlay and then point the mouse at the Config on-screen button and press the left mouse button. You can also point the mouse at the Config menu selection under the setup column and press the left mouse button or select function key F4: MOVE TO SETUP.

Figure 3–1: Config Menu

The Config menu has the following fields and features:

- Module Name field. This field displays the name of the module you are using. The default name for this module is 92A96–n where n is the nth module of this type installed in the system. You can rename the module using the System Config menu.
- Module Type field. This field displays the module type, the number of channels in the module (including multicard module formations), and the module acquisition rate.
- Software Support field. This field specifies the software support mode for the module. This field has two selections when no microprocessor software support is installed: General Purpose and High-Speed Timing (these modes are described following the function key description). Any compatible custom software application packages installed on the hard disk are also listed under this field.
- Acquisition Memory field. This field specifies the default memory depth. The selections available depend on the memory depth of the 92A96 Module, the software support mode selected, and whether you have a multicard module formation.

- Latch Mode field. Enables or disables the capture of glitches (described later). Off is the default condition. Latch mode On only works with internal clocking (a label reminds you).
- Module Input and Output Signals. Lists the input signals and output signals (up to two each for triggering) defined for the module in the Signal Definition overlay under the system Cluster Setup menu.

  The Sync Out signal (output signal) is always available in addition to the two output signals. It is applied to the SMB connector on the 92A96 Module. For more information on using the Sync Out signal, refer to *Intermodule Signals* on page 3–42 and to *P6041 Probe* on page 1–21.
- F1: START Function key. This function key starts acquisition for the module (or cluster). The function key legend also contains the name of the module (or cluster). The key changes to STOP once the module starts acquiring data. Function key F1: STOP stops acquisition.

Module Type Channel Count

The number of acquisition channels available for the 92A96 Modules depends on the acquisition rate of the module and on the number of modules in a multi-module formation. DAS systems can have up to three modules in a multi-module formation. The TLA 520 Logic Analyzer has two 92A96 Modules while the TLA 510 Logic Analyzer has only one 92A96 Module. Table 3–1 summarizes the maximum number of channels.

Table 3–1: Module Type Channel Count

Number of Cards	Channels in General Purpose	Channels in High-Speed with ≥5 ns Clock Period	Channels in High-Speed with 2.5 ns Clock Period
1	96	48	24
2	192	96	48
3	288	144	72

For example, the default value of Module type field at power-on is “92A96–96 channels at 100 MHz” for a single 92A96 Module (it powers up in General Purpose software support).

Selecting High-Speed Timing software support enables internal clock selections of 5 ns and 2.5 ns.

Software Support

The Software Support field lets you configure the 92A96 Module into one of three logic analyzer modes: General Purpose, High-Speed Timing, or microprocessor. General Purpose and High-Speed Timing support are both standard, while microprocessor application software support packages are optional.

General Purpose. General Purpose support is the default operating mode. It configures the 92A96 Module for 96 channels per card with 8K (92A96), 32K (92A96D), 128K (92A96XD), 512K (92A96SD), or 2M (92A96UD) per channel of acquisition memory. It provides asynchronous (internal) or synchronous (external) clocking from a 1 ms period (1 kHz) to a 10 ns period (100 MHz) (selected in the Clock menu). This software support is recommended for hardware or software analysis.

High-Speed Timing. High-Speed Timing support configures the 92A96 Module for 48 channels per card with 2X the base acquisition memory depth at up to a 5 ns asynchronous clock period (200 MS/s). Or it configures the 92A96 Module for 24 channels with 4X the base acquisition memory depth at a 2.5 ns asynchronous clock period (400 MS/s). This software support is especially for timing analysis. See *Acquisition Memory* later in this section and *High-Speed Timing* beginning on page 3–117 for more information.

Microprocessor Software Support. Various microprocessor support packages provide custom clocking and disassembly support especially for software analysis. You can install these software support packages using the Disk Services menu. Refer to the individual microprocessor support user manuals for more information.

Software Support Considerations. The Channel, Clock, and Trigger menus have various parameters that are affected by changing the software support mode. For example, changing to High-Speed Timing support eliminates the selection of range events in the Trigger menu because channel availability is reduced. Other parameters affected by the software support mode are acquisition memory depth, and clock and trigger source availability. You will be prompted to verify your selection to change software support modes.

A module formation must contain the exact number of channels needed by the support software package you have installed or an error message displays to tell you to use a narrower or wider module formation, whichever is necessary. You cannot select the application package until you have the the appropriate number of channels available. Use the System Config menu to change your module configuration. Refer to the user manual for your DAS or TLA 500 series logic analyzer for information on how to change the module configuration.

Acquisition Memory

The default memory depth values shown in the Acquisition Memory field of the Config menu depend on the amount of acquisition memory available, the software support mode, and the clock rate in High-Speed Timing support. Selecting High-Speed Timing support changes the memory depth values. High-Speed Timing support clock settings at 5 ns or greater (as selected in the Clock menu) double the memory depth values, while a 2.5 ns clock quadruples the memory depth. Table 3–2 shows the selectable memory depths for a 92A96 Module with 8K per channel of memory.

Table 3–2: Memory Depth Selections for 8K Modules

Operating Mode/Clock Rate		
General Purpose	**High-Speed Timing**	
1 ms – 10 ns	**1 ms – 5 ns**	**2.5 ns**
8192	16,394	32,768
4096	8192	16,384
2048	4096	8192
1024	2048	4096
512	1024	2048
256	512	1024
128	256	512
64	128	256
	64	128
		64

Table 3–3 shows the selectable memory depths for a 92A96D Module with 32K per channel of memory.

Table 3–3: Memory Depth Selections for 32K Modules

Operating Mode/Clock Rate		
General Purpose	**High-Speed Timing**	
1 ms to 10 ns	**1 ms – 5 ns**	**2.5 ns**
32,768	65,536	131,072
16,384	32,768	65,536
8192	16,384	32,768
4096	8192	16,384
2048	4096	8192
1024	2048	4096
512	1024	2048
256	512	1024
128	256	512
64	128	256
	64	128
		64

Table 3–4 shows the selectable memory depths for a 92A96XD Module with 128K per channel of memory.

Table 3–4: Memory Depth Selections for 128K Modules

Operating Mode/Clock Rate		
General Purpose	**High-Speed Timing**	
1 ms to 10 ns	**1 ms – 5 ns**	**2.5 ns**
131,072	262,144	524,288
65,536	131,072	262,144
32,768	65,536	131,072
16,384	32,768	65,536
8192	16,384	32,768
4096	8192	16,384
2048	4096	8192
1024	2048	4096
512	1024	2048
256	512	1024
128	256	512
64	128	256
	64	128
		64

Table 3–5 shows the selectable memory depths for a 92A96SD Module with 512K per channel of memory.

Table 3–5: Memory Depth Selections for 512K Modules

Operating Mode/Clock Rate		
General Purpose	**High-Speed Timing**	
1 ms to 10 ns	**1 ms – 5 ns**	**2.5 ns**
524,288	1,048,576	2,097,132
262,144	524,288	1,048,576
131,072	262,144	524,288
65,536	131,072	262,144
32,768	65,536	131,072
16,384	32,768	65,536
8192	16,384	37,268
4096	8192	16,384
2048	4096	8192
1024	2048	4096
512	1024	2048
256	512	1024
128	256	512
64	128	256
	64	128
		64

Table 3–6 shows the selectable memory depths for a 92A96UD Module with 2M per channel of memory.

Table 3–6: Memory Depth Selections for 2M Modules

Operating Mode/Clock Rate		
General Purpose	**High-Speed Timing**	
1 ms to 10 ns	**1 ms – 5 ns**	**2.5 ns**
2,097,132	4,194,304	8,388,608
1,048,576	2,097,132	4,194,304
524,288	1,048,576	2,097,132
262,144	524,288	1,048,576
131,072	262,144	524,288
65,536	131,072	262,144
32,768	65,536	131,072
16,384	32,768	65,536
8192	16,384	37,268
4096	8192	16,384
2048	4096	8192
1024	2048	4096
512	1024	2048
256	512	1024
128	256	512
64	128	256
	64	128
		64

Latch Mode

Latch mode captures single 180 degree transitions with respect to the input threshold level (first order glitches) that occur between clock cycles. When a glitch occurs, it is represented in the display of the next clock cycle as the opposite logic level of the level displayed in the previous clock cycle; this is your only indication that a glitch has occurred. For example, if a glitch occurs after a positive logic level, the next logic state will be displayed as a negative logic level. In this way, if you know what to expect from your system under test, you can recognize that some type of glitch activity has occurred between clock samples.

Latch mode is only available with internal clocking in General Purpose support mode.

A label can be shown in the State or Timing menus to remind you when the displayed data was acquired with Latch mode turned on (in the Config menu). This label is displayed in the Acquisition Parameters lines at the top left of the display menu. It displays whenever the Acquisition Parameters selection is turned on in the State or Timing Format Definition overlays.

Channel Menu

The Channel menu selects individual acquisition channels and organizes them into logical (channel) groups. The Channel menu is shown in Figure 3–2.

Use the Channel menu to group the address channels, the data channels, and the control channels and assign meaningful names to each group. You can also assign names to the individual channels, determine the display radix for data in each group or change the polarity or threshold voltage levels for certain channels.

Use the fields in the Channel menu to change module parameters related to individual channels or to channel groups.

The Channel menu contains the Threshold Definition overlay to change the threshold levels of the clock and data channels. The Channel menu also contains the Channel Definition overlay to define individual channel names and polarities.

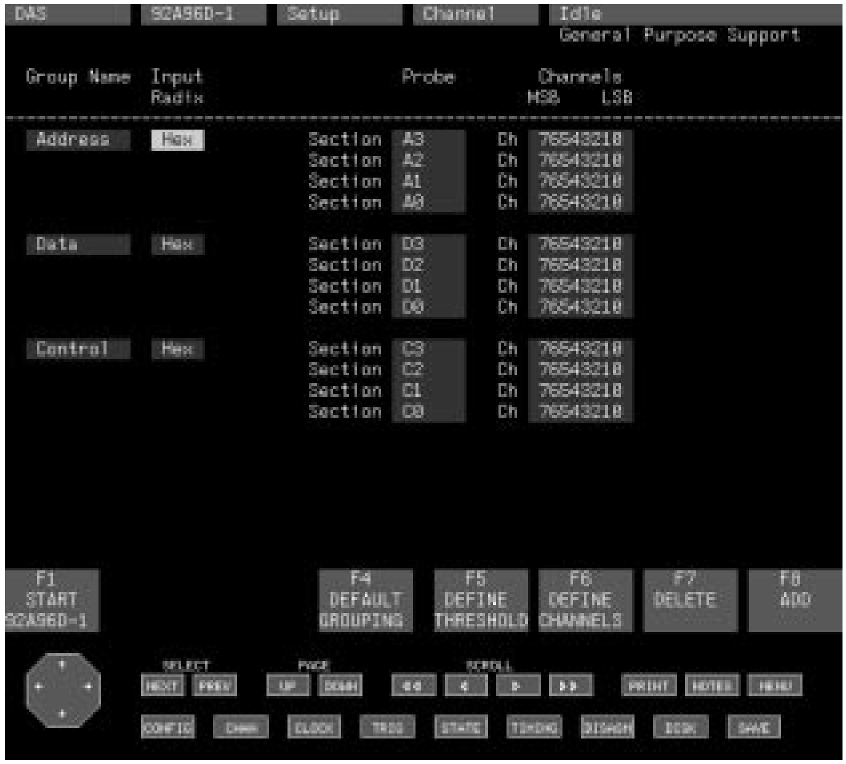

Figure 3–2: Channel Menu

The Channel menu has the following fields and features:

- Group Name fields. The Group Name fields specify the names of the channel groups. Enter up to eight alphanumeric characters in a name with no spaces. The group names must be unique. For the default names in multicard modules, the last alphanumeric character represents the number of an individual card in the multicard module. If more groups exist than can be displayed in the group definition window, you can use the mouse to scroll up or down.
- Input Radix fields. These fields specify the input radixes of the channel groups. Selections are: Hex (hexadecimal), Bin (binary), Oct (octal), Dec (unsigned decimal), Sym (symbolic) and Off.

  For example, selecting Sym enables a File field (below the Input Radix field) from which to select a previously created symbol table to use with the channel group.
- Probe Section fields. These fields specify the sections you want to include in the channel groups. Open the fields to display a list of all probe sections and unused channels. The slot number is added to the section number if you have a module formation.

- Channel Number fields. These fields specify the probe channels included in the channel groups. Each section can include up to eight channels, numbered from 0 to 7. If you select a channel that has been assigned elsewhere, it is removed from the previous group.
- F4: DEFAULT GROUPING function key. Select this key to restore the Channel menu to a default setup based on the current software support mode.
- F5: DEFINE THRESHOLD function key. Select this key to call the Threshold Definition overlay to change the threshold levels for the clock and data channels.
- F6: DEFINE CHANNELS function key. Select this key to call the Channel Definition overlay to name individual channels and define their polarities.
- F7: DELETE function key. This function key displays a pop-up menu with two selections: Delete Group and Delete Section From Group. Delete Group deletes the group the cursor is positioned on. Delete Section From Group deletes the section from the group the cursor is positioned on. Press the Return key to execute the delete operation or press the Escape key to abort the operation.
- F8: ADD function key. This function key displays a pop-up menu with two selections: Add Group and Add Section To Group. Add Group adds a new channel group below the current cursor position. Add Section To Group adds a new section to the current channel group. Press the Return key to execute the add operation. Press the Escape key to abort the operation.

Creating Channel Groups

The Channel menu lets you specify the number and names of the channel groups to use in the Display menus and elsewhere. Each channel group has a Group Name field, Input Radix field, and one or more Probe Section fields (with corresponding Channel fields).

To add a new channel group, select function key F8: ADD and select Add Group. This adds a new channel group field below the channel group field the cursor is currently on. You can define a maximum of 20 channel groups.

To delete an entire channel group, move the cursor to any field in the group, select function key F7: DELETE, and then select Delete Group.

Probe Sections. Because the 92A96 Probe contains a large number of channels, the probe is divided into sections. These sections are intended to help you keep track of the individual channels; they do not restrict you from mixing channels from various sections when creating new groups.

Table 3–7 lists the probe sections and the channels in each section that you can use when creating groups for a 92A96 Module.

Table 3–7: 92A96 Module Probe Sections

Section	Channels
A3	76543210
A2	76543210
A1	76543210
A0	76543210
D3	76543210
D2	76543210
D1	76543210
D0	76543210
C3	76543210
C2*	76543210
C1	76543210
C0	76543210

*** Channels 0–3 can be used as data channels and as external clock qualifier inputs.**

The probe sections that are available to acquire data depend on the software support mode selected in the Config menu. Table 3–8 shows which sections are available for the two primary timing modes and the general purpose mode.

Table 3–8: Probe Section Availability

	Address Section				Data Section				Control Section			
Software Support	**A3**	**A2**	**A1**	**A0**	**D3**	**D2**	**D1**	**D0**	**C3**	**C2**	**C1**	**C0**
General Purpose	X	X	X	X	X	X	X	X	X	X	X	X
High-Speed Timing (1 ms–5 ns)	X	X	X	X							X	X
High-Speed Timing (2.5 ns)			X	X								X

X = section available

The Section field (under the Probe column) lets you select the sections of the probe that you want to include in each channel group. Figure 3–3 shows an example of the list that appears when you open the Section field.

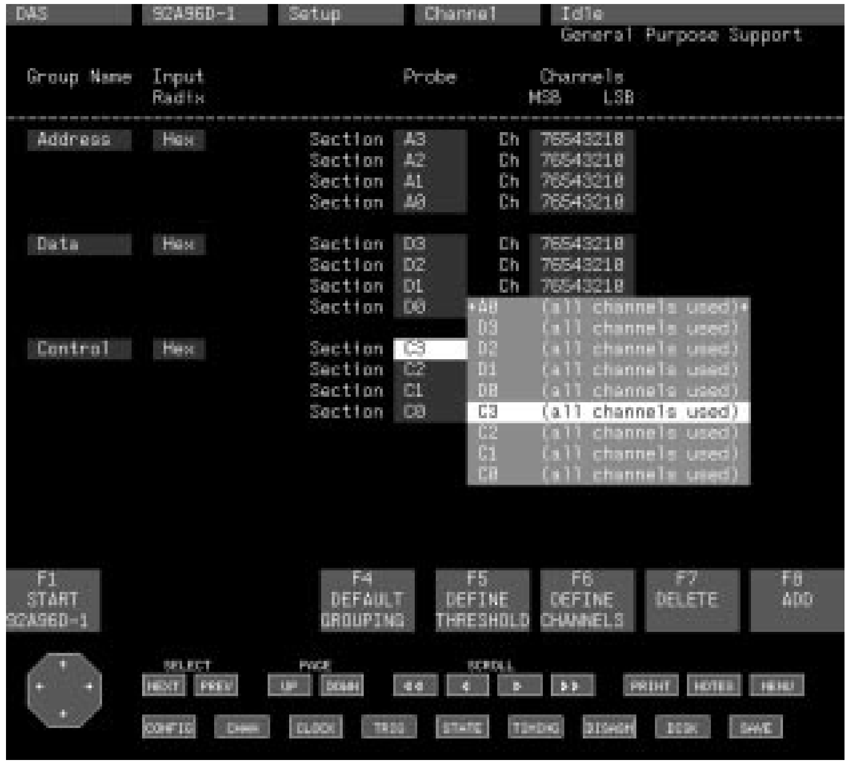

Figure 3–3: The Opened Section Field (Channel Menu)

The sections listed depend on the number of modules in a module formation.

To add more sections to a group, move the cursor to any field in the group, select function key F8: ADD and select Add Section To Group. The new Section and Channel fields appear on the line below the cursor.

You can add a maximum of 32 sections to one group. You can name the same section more than once when you want to change the relative significance of channels within the group by reordering the assignment of channels in the group, or you can add 32 sections with one channel each.

To delete a section from a group, move the cursor to the Section field you want to delete, select function key F7: DELETE, and select Delete Section From Group.

A Slot_Sect label appears under the Probe label to map the card slot numbers to the sections in the module when you have created a module formation with more than one 92A96 Module.

Channels. The Channels list lets you select the channels you want grouped together from a given section.

After you select a section for a group, move the cursor to the Channel field and type in the numbers of the channels you want to use from that section. You cannot assign a test input to more than one channel group unless it is connected to more than one probe input channel.

Channels can only be used in one group at a time; when you press the Return key to exit this field, any channels that were previously assigned are deleted from their old group. However, you can assign one input to two groups by attaching two leads to the input.

The order of the channels determines their significance. The top leftmost channel in the group is most significant, and the bottom rightmost channel in the group is least significant. You can include a maximum of 32 channels in a channel group.

Group Name. The group names you enter in the Channel menu are used by the other menus that refer to channel groups. If you want to change a group name, you must change it in this menu. Enter up to eight alphanumeric characters in the Group Name field. The order in which you list channel groups in this menu determines their order in the Trigger menu and their default order in the display menus.

Input Radix. Channel group radixes defined in the Channel menu are used by default in most other menus that display channel group fields (except a decimal radix selection in the Channel menu appears as hex in the other menu displays). However, some menus let you change the radix. For example, you can select Hex as the input radix for a group in the Channel menu, then use a binary display radix for the same group in the State menu.

Select one of the display radix parameters that appear when the Input Radix field is opened (see Figure 3–4). Select Off to suppress the selected channel group from appearing in the Trigger or display menus.

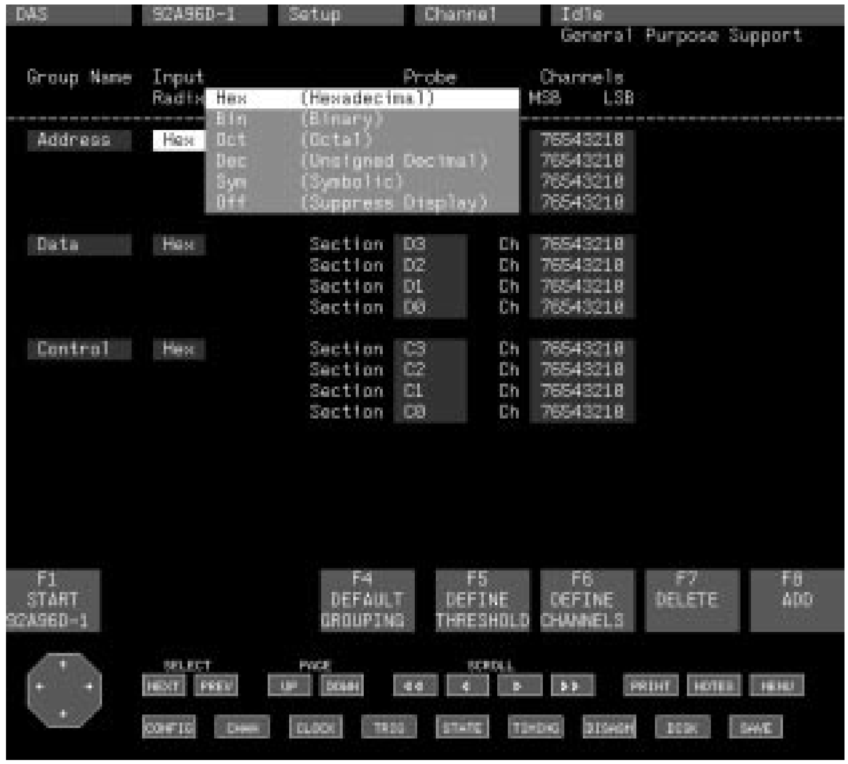

Figure 3–4: The Opened Input Radix Field (Channel Menu)

To use Symbolic input radixes, create a symbol table using the Symbol Editor menu, or download a previously created symbol table from a host computer. A symbol table is composed of numeric values and symbolic names. Each name is associated with a value or range of values. When you select the Symbolic input radix, a File field appears that lets you enter the name of the symbol table file you want to use.

Two types of symbol table files are possible: range and pattern. Range-type files assign each symbolic name to a range of data values. Pattern-type files match each symbol name to a specific data pattern.

You cannot mix range and pattern symbols in the same symbol table file. However, you can use both types of symbol tables in the same menu when they are used with different channel groups.

Range symbol tables are made up of symbolic names and two columns of numeric values that let you specify the range of data values associated with each symbol name. For example, if you want to track when your program executes a function that always resides between addresses 0000 and 00FE, you can enter the Symbol Editor utility menu and create a range symbol table. Select a symbolic name, such as "function-1" in the symbol name column, enter 0000 as the lower bound for the range, and enter 00FE as the upper bound value. After you save the symbol table, you can specify it by name in the Channel menu for the address group and then specify the range by its symbolic name in the Trigger menu.

Pattern symbol tables are made up of numeric values and symbolic names associated with each value. For example, if you frequently use a certain value as a test vector but the value is too long to memorize, you can enter the value in a symbol table and give it a symbolic name. You can then call that value by name when you need it.

Threshold Definition Overlay

Use the Threshold Definition overlay to select the voltage thresholds for the clock and data channels for each 92A96 Module in a multicard module formation. Figure 3–5 shows an example of the Threshold Definition overlay.

Figure 3–5: Threshold Definition Overlay (with the Clock Threshold Field Open)

The Threshold Definition overlay has the following fields and features:

- Clock Threshold field. The Clock Threshold field sets the threshold voltage for all clock channels in the module. In General Purpose mode the default value is always TTL, in other software support modes the default value depends on the software support package. Other threshold selections are ECL, CMOS, or VAR.
- Data Threshold field. The Data Threshold field sets the threshold voltage for the data channels of the 92A96 Module in the specified slot. In General Purpose mode the default value is always TTL, in other software support modes the default value depends on the software support package. Other threshold selections are ECL, CMOS, or VAR. When using multiple module formations, set the data threshold for each card at the same level when using external clocking.
- Threshold Value field. The Threshold Value field displays the voltage value for the threshold selection. If the threshold selection is TTL, the voltage value is +1.50 V. If the threshold selection is ECL, the voltage value is —1.30 V. If the threshold selection is CMOS, the voltage value is +2.50 V. If the threshold selection is VAR (variable), you can select any voltage from —4.00 V to +8.75 V in increments of 0.05 V.
- Function keys. Select function key F1: ESCAPE & CANCEL to exit the overlay and return to the Channel menu without saving changes. Select function key F8: EXIT & SAVE to return to the Channel menu saving all changes made to the overlay.

Channel Definition Overlay

Use the Channel Definition overlay to specify a channel name and a channel polarity for the individual channels in a section. The channel names are used in the Clock and Trigger menus and as the default names in the display menus. Figure 3–6 shows an example of the Channel Definition overlay.

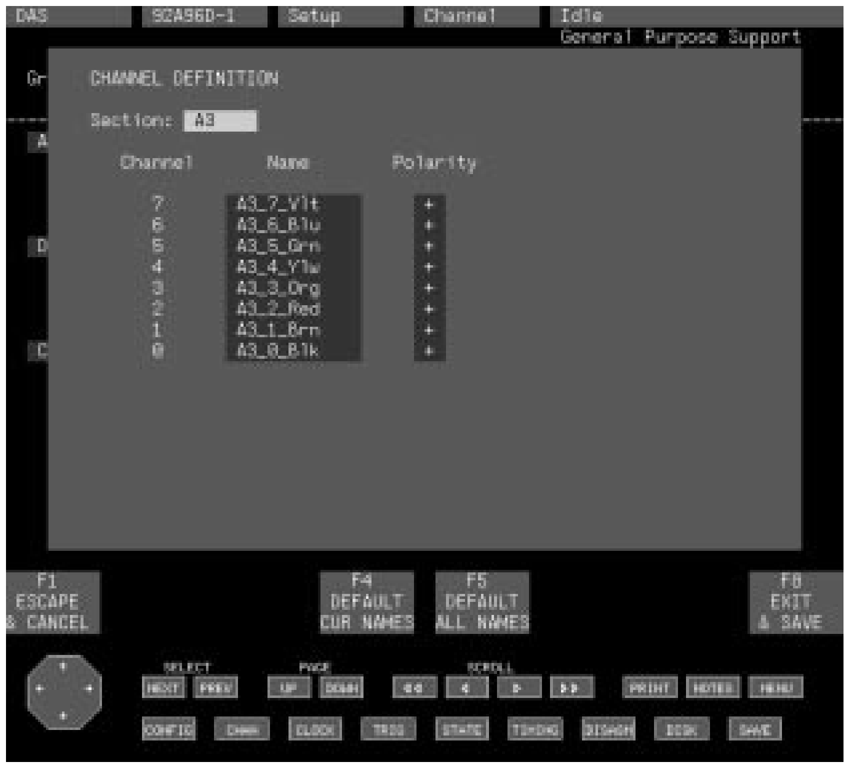

Figure 3–6: Channel Definition Overlay (Section Field Open)

The Channel Definition overlay has the following fields and features:

- Section field. Specifies the probe section. Open the field to display a list of the available sections.
- Channel column. Lists the number of each channel in the section.
- Channel Name fields. The Channel Name fields specify each of the channel names (up to 11 alphanumeric characters with no spaces). If you use the General Purpose software support mode, the default channel names consist of the slot number (for multicard modules only), section number, channel number, and color code. The default name for the clock channels contains a number representing the clock line. Default channel names for the microprocessor support mode depend on the microprocessor support package. Each channel must have a unique name.

- Channel Polarity field. The channel polarity field specifies the polarity of each channel.
- Function keys. Select function key F1: ESCAPE & CANCEL to exit the overlay without saving changes. Function key F4: DEFAULT CUR NAMES sets the channel names in the current section to their default names based on the current software support mode. Function key F5: DEFAULT ALL NAMES. sets all of the channel names to their default values based on the current software support mode. Function key F8: EXIT & SAVE exits the overlay and saves all changes.

For channel polarity, in general, a (+) polarity is specified for active-high signals and a (–) polarity is specified for active-low signals. Selecting a polarity that is the opposite of the actual sampled data inverts it when it is displayed and when it is evaluated by a resource recognizer. However, the channel polarity does not affect the Clock menu.

Examples of how menus are affected are given below. In each example it is assumed that you selected a negative (–) polarity for the channels involved.

- Trigger menu, word event — if you enter a 1 as the value to search for on a channel in a word event, the 92A96 Module looks for a low value (below the threshold voltage).
- Trigger menu, channel event — if set to Asserted, the channel event is true when the signal is low.
- Timing menu — a low value is displayed high and a high value is displayed low.
- State menu — a low value is displayed as a 1 and a high value is displayed as a 0.

Clock Menu

The Clock menu defines the acquisition clock that controls data sampling.

You can set the Clock menu to three different modes. The acquisition clock modes are:

- Internal. A 1-2-5 step time base that is internally generated.
- External. A signal (or signals) generated by the system under test that is used as the sample clock.
- Custom. A variety of microprocessor-specific clock cycle types (for example, DMA cycles). Refer to the instructions that came with your microprocessor-support software for a detailed description of the Custom selection.

Table 3–9 summarizes the the clock selections for the different software support modes.

Table 3–9: Clock Type Selections

Software Support Selected	Clocking Selectable
General Purpose	Internal, External
High-Speed Timing	Internal
Custom	Internal, External, and Custom

Internal Clocking

Use internal clocking to asynchronously acquire data from a system under test. This type of clocking can produce high resolution timing diagrams of the system under test signals. Sample the signals at an internal clock rate that is much faster than the clock in the system under test to get better timing resolution. Figure 3–7 shows an example of the Clock menu with Internal clocking selected.

Figure 3–7: The Clock Menu with Internal Clock Window Displayed

In the General Purpose support mode the Internal Clock selections are from 10 ns (default) to 1 ms. In High-Speed Timing support, the selections are from 2.5 ns to 1 ms (5 ns is the default). Refer to *Configuration Menu* beginning on page 3–1 for software support selection information.

The Clock menu also displays the number of acquisition channels available. If you create a multicard module formation, the number of cards will also be displayed. The default width for a single 92A96 Module is 96 channels in General Purpose support, 48 channels with 5 ns (or slower) clocking in High-Speed Timing support, and 24 channels with 2.5 ns clocking in High-Speed Timing support.

In addition to the number of acquisition channels available, the Clock menu also displays the amount of memory available. The displayed value depends on the software support mode and the memory depth of the 92A96 Module (you set the default acquisition depth in the Config menu).

When you use High-Speed Timing support, selections of 5 ns (200 MS/s) and 2.5 ns (400 MS/s) are also available. However, changing to High-Speed Timing causes some feature changes to occur; the number of available acquisition channels is reduced and the available acquisition memory size is increased. For example, changing a 92A96 Module with 8K of acquisition memory for 96 channels of acquisition in General Purpose support to High-Speed Timing support (in the Config menu) causes these memory size and channel availability changes:

- 16K of available memory for 48 channels of acquisition using 5 ns or slower clocking.
- 32K of available memory for 24 channels of acquisition using 2.5 ns clocking.

External Clocking

Use external clocking to synchronously acquire data from a system under test. This type of clocking is best for producing state table diagrams of the system under test. Figure 3–8 shows a sample Clock menu setup with External clocking.

Figure 3–8: The Clock Menu with External Clock Window Displayed

The External Clock menu uses clock equations to specify the values of one of the four clock channels and up to three qualification channels to determine when to sample and log data. The external clock equations are evaluated as Boolean algebra expressions. A sample clock can be composed of up to four clock equations, each equation takes up one line.

Within the clock equation, you can select the rising or falling edge of the clock, the clock channel, and the clock qualifiers. Clock qualifier inputs are always ANDed with clock inputs.

You can use external qualifiers to selects the qualifier input you want to use. Select either an active-high or active-low level for each input (an example is Clock_0 or /Clock_0, where the slash (/) indicates an active-low level).

You can logically combines qualifier inputs together (AND or OR). Brackets show that the result of the two leftmost qualifiers is evaluated. That result is then ANDed or ORed with the last qualifier. As a group, qualifier inputs are ANDed with the clock input.

If you have more than one 92A96 Module in the module formation, a message is displayed near the bottom of the menu. The message is to remind you to connect clock and qualifier leads having the same section and channel number from each module to the same clock or qualifier test point.

You can restore the Clock menu to its default setup using function key F4: DEFAULT CLOCKING. The default setup is the rising edge of Clock_3. This function key is only available in External clock mode.

Function key F7: DELETE CLK LINE deletes the clock line containing the cursor from the clock equation. If you delete the first (only) clock line (equation), the 92A96 defaults to the rising edge of Clock_3. Function key F8: ADD CLK LINE adds a clock line to the clock equation below the line containing the cursor. You can have a maximum of four clock lines.

External clocking synchronizes data sampling with the operation of the system under test and allows you to be more selective about the data you sample.

Clock Lines. The 92A96 Probes provide four edge-sensitive clock lines (Clock_0, Clock_1, Clock_2, and Clock_3) that you can connect to any signal point on the system under test. Two clock source examples are listed below:

- To clock a data acquisition using an address strobe signal, connect the Clock_3 lead to the address strobe pin, then specify External clocking using Clock_3. Select the proper clock edge to sample data when it is valid.

- To acquire data during each phase of a two-phase clock system, connect the Clock_3 lead to one phase clock pin, the Clock_2 lead to the other phase clock pin, and then select External clocking using Clock_3 ORed with Clock_2. Select the proper clock edges to sample data when it is valid. If either clock line 3 or clock line 2 is asserted, then the sample clock occurs.

Qualifier Lines. The 92A96 Probes provide four level-sensitive qualifier lines that connect to any signal point on the system under test. Qualifiers C2_3, C2_2, C2_1, and C2_0, and their internally generated complements (/C2_3, /C2_2, /C2_1, and /C2_0), are available as external qualifier terms. Additionally, the four clocks and their internally generated complements are available as level-sensitive (rather than edge-sensitive) qualifiers in the External Qualifier fields.

You can use qualifiers to more accurately determine when to sample the data. For example, you can eliminate all direct memory access cycles from an acquisition by clocking only when the lines that indicate a direct memory access are unasserted. To achieve this, connect one qualifier to the direct memory access enable line, and then AND it with the clock term in the sample clock equation.

Clock Equations. The External clock mode lets you create clock equations to define the sample clock. Clock equations are composed of clock and qualifier line inputs that are logically joined in a Boolean type equation using AND and OR operators.

A clock equation contains one clock term ANDed with up to three external qualifier terms (see Figure 3–8).

To select the clock term, choose between Clock_0, Clock_1, Clock_2, or Clock_3 in the Clock Select field. Selecting a clock in the Clock Select field inhibits its selection, along with its associated qualifiers, in the Qualifier fields. For example, if Clock_3 is selected in the Clock Select field, then Clock_3, /Clock_3, C2_3, and /C2_3 are not selectable in the Qualifier fields.

To select the external qualifier terms, choose between the remaining clocks and their complements, or the remaining qualifier lines and their complements in the Qualifier fields. Selecting a clock or its associated qualifiers in the Qualifier field inhibits its selection in the Clock Select field. For example, if /C2_3, C2_3, Clock_3, or /Clock_3 are selected in a Qualifier field, then Clock_3 is not selectable in the Clock Select field.

NOTE. *At least one clock is always selected, so at least two qualifiers and their associated active-lows are always unselectable.*

Multiple Module External Clocking. If you use external clocking with a multiple module formation and you use a single external clock source, you must connect the clock probe from each module to the same clock source. For example, if you create a multicard module containing two 92A96 Modules and you use Clock_3 as your clock, you must connect the Clock_3 leads from *both* modules to the same clock source. In fact, this condition is also true for all signal lines in the clock equation; the qualifier lines as well as the clock lines.

Custom Clocking

Custom clocking is used with microprocessor-support software. The custom clocking features and selections are discussed in detail in the microprocessor support documentation that comes with the support software. Refer to that documentation for information on the capabilities of the custom clocking for your particular software support.

Trigger Menu

The Trigger menu lets you create programs to control when the trigger occurs and what sampled data is qualified for storage in the 92A96 Module.

Use the Trigger menu to specify trigger conditions and storage qualification conditions, to select a trigger position, to control counters and timers, and to communicate with other modules. You can also use the Trigger menu Library overlay (called from this menu) to save and restore trigger programs that you create, or to load standard trigger programs provided by the library.

Figure 3–9 shows an example of the default Trigger menu for a single card 92A96 Module.

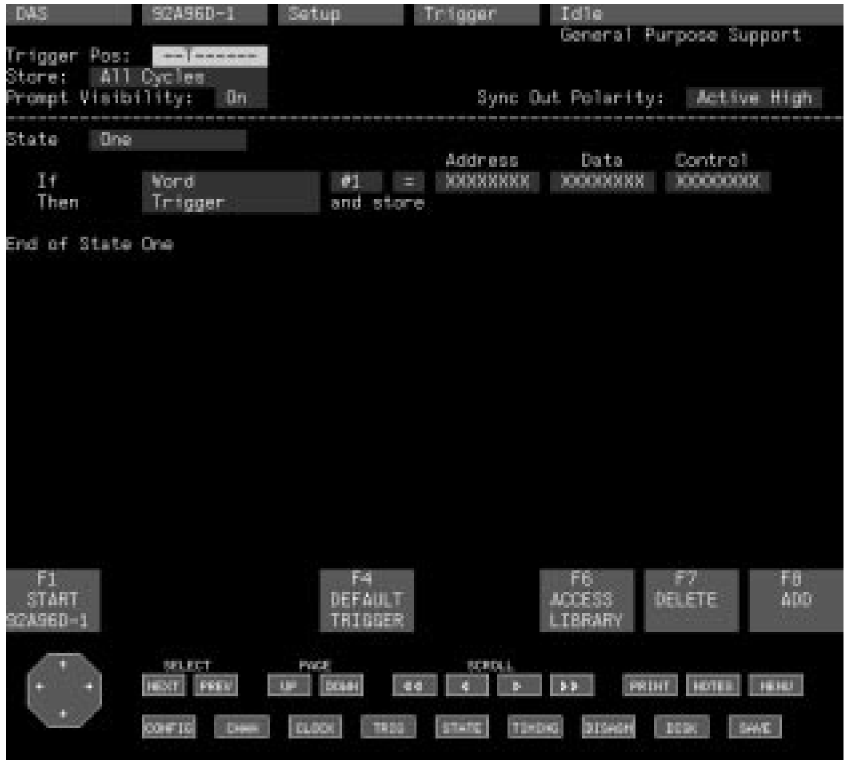

Figure 3–9: Trigger Menu

The default Trigger menu has the following fields and features:

- Trigger Position Indicator. The Trigger Position indicator selects the trigger position in acquisition memory; the position can be one of nine predefined locations (12.5% of the memory size apart) or a precise value entered in cycles. Refer to *Setting Trigger Position* on page 3–29.
- Store field. The Store field selects the type of storage qualification you want to use. The storage mode (method) affects what fields are available in the Trigger menu. Refer to *Using Storage Qualification* on page 3–47.
- Prompt Visibility field. The Prompt Visibility field lets you display prompts that help you remember data values to enter in the Trigger menu. You can create or delete prompts using the F8: ADD or F7: DELETE function keys when prompt visibility is On. Refer to *Trigger Prompts* on page 3–63.
- Sync Out Polarity field. The Sync Out Polarity field lets you select the polarity of the Sync Out signal.

- State Names. Trigger programs are made up of trigger states. The trigger states can be named by the default names (for example, One, Two, Three, ... Sixteen) or you can create your own names. You can enter up to 13 alphanumeric characters with no spaces. Up to 16 states are possible. If more states exist than can be displayed on screen, use the arrow keys to scroll. Refer to *Creating a Trigger Program* on page 3–31.

- Trigger Clauses. A trigger clause is an if-then program statement that relates input events to 92A96 Module actions. If the event portion of the clause is true, then the action is performed. Up to eight clauses can be defined in each state.

- Trigger Events. A trigger event contains one or more conditions to be recognized by the 92A96 Module. When all the event conditions are satisfied, the action(s) in the clause is executed. Table 3–13 on page 3–32 lists the possible events. Use function keys F7: DELETE or F8: ADD to delete or add events to a clause. You can have a maximum of eight events in a single clause.

- Trigger Actions. Trigger actions list the activity to be performed when the associated event is true. Table 3–14 on page 3–37 lists the possible actions. For example, in a Go To State action you can select the state name that you want to move to. Use function keys F7: DELETE or F8: ADD to delete or add actions to a clause. You can have a maximum of eight actions in a single clause.

- Function key F4: DEFAULT TRIGGER restores the Trigger menu program to its default condition (If Word-Then Trigger). Selecting this function key does not affect the trigger position (Trigger Pos) or storage (Store) method settings.

- Function key F7: DELETE displays the selection of delete options listed in Table 3–10. Function key F8: ADD displays the selection of Add options in Table 3–11. Use the selections from the tables to edit the Trigger menu.

Table 3–10: Trigger Menu Delete Options

Selection	Description
Delete If-Then Clause	Deletes the If-Then clause from the state where the cursor is positioned.
Delete Event	Deletes the event the cursor is on.
Delete Action	Deletes the action the cursor is on.
Delete State	Deletes the state the cursor is on.
Delete Not From Event	Removes the Not label from the event portion of the clause.
Delete Prompt	Deletes a prompt from the event or action the cursor is positioned on.

Table 3–11: Trigger Menu Add Options

Selection	Description
Add If-Then Clause	Adds an If-Then clause to the state where the cursor is positioned.
Add Event	Adds a new event to the event the cursor is on. Events are added with an AND or OR field separating them.
Add Action	Adds a new action below the action the cursor is on.
Add State	Adds a new state below the state the cursor is on. If the cursor is not positioned on a state, the new state becomes the first state in the trigger program.
Add Not To Event	Adds a Not label to the event portion of a clause. If there is more than one event in the clause, the Not applies to the entire event portion of clause, not just the first event – that is Not (A or B) rather than (Not A or B).
Add Prompt	Adds a prompt from the event or action the cursor is positioned on.

Setting Trigger Position

The trigger position setting determines the number of data samples stored after the trigger occurs. The trigger is your reference in the acquired data. You can select from nine trigger positions, or enter a precise number of sample cycles.

NOTE. *The accuracy of the trigger position depends on the software support. In General Purpose support or in any microprocessor support, the trigger position accuracy is ± 0 samples.*

The accuracy in High-Speed Timing support is ± 1 sample; or ± 2 samples, if the clock period is 2.5 ns.

For example, when you select “T————”, all but a few of the stored samples occur after the trigger; when you select “————T”, all but a few of the stored samples occur before the trigger. Each increment in the trigger position display represents a change of approximately 12.5%. The memory depth selected in the Config menu determines the exact number of data samples that this represents. For example, if the memory depth selected is 8192, each trigger position represents approximately 1024 samples.

If the approximate trigger positions do not fit your needs, you can define the exact number of cycles to be stored after the trigger by selecting “Defined” in the Trigger Position field. This selection causes a new field to appear so you can enter a value. The maximum value for this field depends on the memory size you specified in the Config menu. (Remember, this value varies with the memory capacity and the software support mode you’ve selected. Refer to *Acquisition Memory* on page 3–5 for details.)

As an example, Figure 3–10 shows the top portion of a Trigger menu with the trigger set to 6144 samples before the end of the acquisition memory.

Figure 3–10: Trigger Position Field with Defined Selected

NOTE*. If you press F1: STOP before the acquisition memory is full, the 92A96 Module halts acquisition and places a "stop" trigger at the end of acquisition memory, thus the trigger position you selected is ignored.*

A Trigger Range field will be displayed to the right of the Trigger Position field when you select memory depths greater than 128K as shown in Figure 3–11. This field will not be displayed for memory depths of 128K or less. The Range field reflects the Trigger Position field with respect to the total amount of acquisition memory.

Figure 3–11: Trigger Position Field with Trigger Range Field Displayed

Be aware that when you select memory depths greater than 128K, you will observe limitations of the trigger positions. Table 3–12 shows when these limitations occur with various 92A96 Modules.

Table 3–12: Memory Depth Trigger Position Limitations

		High-Speed Timing	
Module	**General Purpose**	**1 ms – 5 ns**	**2.5 ns**
92A96SD, 92A96UD	128K	256K	512K
92A96XD	—	—	—
92A96X	—	—	—
92A96	—	—	—

The trigger location is always within the last 128 K locations of the acquisition memory. If you want to store more samples than the Defined selection allows, you can define a counter or counters in the trigger program to delay the actual trigger by the desired number of sample cycles. You could also use one of the Trigger Library selections, such as “Trigger on Anything with Extended Postfill,” to store more samples after an event is recognized (refer to *Trigger Library Overlay* on page 3–57 for information on using the Trigger Library).

Since the trigger position only guarantees the amount of memory filled after the trigger occurs, you can encounter situations where the trigger occurs soon after acquisition begins and little or no data is acquired before the trigger position setting in acquisition memory. In this case, you may only fill a portion of the acquisition memory. For example, if you set the trigger position at 50% of acquisition memory, start the acquisition, and the trigger occurs almost immediately, only half the acquisition memory is filled with post-trigger data, and little or no pre-trigger data is acquired in acquisition memory. Thus the trigger location is approximately at the lowest numbered sequence displayed.

Creating a Trigger Program

Use the Trigger menu to create trigger programs that specify trigger conditions. A trigger program contains states which control when a reference or trigger point is defined within the sampled data and what other related actions should occur.

All clauses in the active state are evaluated simultaneously during each clock cycle; if any events are true, all related actions are executed in the same cycle.

A trigger program can include one state or up to 16 linked states. Each state is made up of one clause or up to eight clauses. Each clause contains an event portion (an If statement) and an action portion (a Then statement). The event portion can contain one event or up to eight events that are either ANDed or ORed together. The action portion can contain one action or up to eight actions that are all performed simultaneously when the event occurs.

Only one state is active at a time. Control remains in the active state until an explicit user-defined action is performed to cause a transition to a different state. The event portion specifies the condition to look for, and the action portion specifies the actions to be performed by the module when the associated event occurs (is true). Thus the events and actions define the state.

Choosing Events. The 92A96 Module provides nine types of events to choose from in an Event field. Events have parameter fields that require you to select or enter a value. Select fields require you to choose from a list of options. Fill-in fields require you to enter a data value in the radix you have selected for the channel group in the Channel menu (except for counter and timer fields). Table 3–13 lists the events and their associated fields or selections.

Table 3–13: Events Available in the Event Field

<table>
<tr><th>Event Type</th><th>Associated Fields and Description</th></tr>
<tr><td>Word</td><td>Address Data Control
{#1 | 2 | 3 |... 8} {=|≠} xxxxxxxx xxxxxxxx xxxxxxxx
Look for a specified word at the input channels. The ID number identifies a unique hardware register that is assigned the target value to match. Enter the value you wish to look for, leaving Xs in the digits you are not concerned with.</td></tr>
<tr><td>Range</td><td>Bound1 Bound2
<group name> {In|Not In|=|≠|>|≥|<|≤} nnnnnnnn nnnnnnnn
Look for values on a subset of qualified input channels (up to 32) that are inside or outside the specified range of word values; enter the lower limit of the range in one of the two bound fields, and the upper limit of the range in the other bound field. For a single-ended range, select the operator and enter one value. Group names are from the Channel menu. Range is not selectable in High-Speed Timing support.</td></tr>
<tr><td>Channel</td><td><channel name> is {Asserted|Unasserted|Don’t Care}
Look for the condition of a single channel. Available channel names are those defined in the Channel menu.</td></tr>
<tr><td>Counter</td><td>{#1|#2} {≥|<} <counter value>
Look for (decimal) value on the selected counter (from 1 to 4,294,967,295). The ID number identifies a unique hardware register that is assigned the target counter value.</td></tr>
<tr><td>Timer</td><td>{#1|#2} {≥|<} <timer value>
Look for the specified time on the selected timer (from .07 μsec to 42,949,672.95 μsec). The ID number identifies a unique hardware register that is assigned the target timer value.</td></tr>
<tr><td>Flag</td><td>is {Set|Clear|Don’t Care}
Check status of flag.</td></tr>
<tr><td>Signal</td><td><signal name> is {Asserted|Unasserted|Don’t Care}
Look for a signal from another module.</td></tr>
<tr><td>Consec Cycles</td><td>{Sections|Groups|<group name> channels} are {equal|not equal}
Look for consecutive cycles being equal/unequal on the set of active channels from all sections, all qualified groups, or a specific qualified group.</td></tr>
<tr><td>Anything</td><td>no associated fields
All sampled data make this event true.</td></tr>
</table>

Word Events. Use the word events to find a specific data word on the input channels you specified in the Channel menu (active channels only). The default value for a word is all Xs (don't cares).

When the group radix defined in the Channel menu is a range symbol table, the word event uses the lower bound of the range as the word value and displays a new field in which to specify an offset (address) value for the group. For more information, refer to *Input Radix* on page 3–15.

A word value must be stable at the probe tip for a certain amount of time to guarantee recognition by the word event (this is also true for the range and channel events). Refer to *Appendix A: Specifications* for details. Other word event guidelines are listed below:

- For external clock conditions, a word must satisfy setup and hold times with respect to the external clock.
- For internal clock conditions in General Purpose support, a word must be present at the probe tip for one clock period, plus about 5 ns, to compensate for channel-to-channel skew.
- For internal clock conditions in High-Speed Timing support, a word must be present at the probe tip for two clock periods or 12.5 ns, whichever is greater.

Range Events. Use the range events to find a specific data word inside or outside the specified range of word values. The default value for a range is all zeros for single-ended (0000...) and zeros and ones for double-ended (0000... and FFFF...). Xs are not allowed in range group fields. The group name used is from the Channel menu.

When the group radix defined in the Channel menu is a range symbol table, double-ended range events (In and Not In operators) use both the upper and lower bounds specified for the symbol in the symbol table. Single-ended range events (=/≠/>/≥/</≤ operators) only use the lower bound value specified for the symbol. No offset value field is displayed for either double- or single-ended range events. Pattern symbol table files cannot be used with range events.

Range events use hexadecimal input radixes for groups assigned pattern symbol tables in the Channel menu. For more information, refer to *Input Radix* page 3–15.

Range events are monitored only on qualified channel groups. The following qualification criteria must be met:

- The group must have one or more active channels in it.
- The group radix must not be Off.
- All channels in the group must be from the same 92A96 card.

- All channels in the group must be either from all Data sections (D3–D0) or from all Address sections (A3–A0). You can't have a group that has some channels from Address sections and some from Data sections. You can't apply a range event to a group of channels from Control sections.
- All of the channels in the group must be in normal hardware order. There can be missing channels. Hardware order from the Address sections would be A3 (most significant) to A0, with channel order within each section going from channel 7 (most significant) to 0. Data section hardware order is similar. The default channel grouping in General Purpose support places channels in hardware order.

***NOTE**. Avoid modifying channel groups used by a range event. Any change to the channel groups can affect the range event operation.*

Channel Events. Use the channel events to recognize a specific logic level on an active channel. The list of active channels depends on the software support selected in the Config menu, the internal clock period selected in the Clock menu, and the number of cards in the module formation. Generally, the more cards you have in General Purpose support, the more channels you can choose from. High-Speed Timing support limits the available channels.

Counter Events. Use the counter events to detect a (decimal) value on the selected counter (from 1 to 4,294,967,295). Do not enter commas in the value. However, after pressing return to enter a value, the number is redisplayed with commas added in the appropriate places. The counter operator field selects when the event should be true. There are at most two counters available. Counters are controlled by their corresponding trigger program actions.

Timer Events. Use the timer event to recognize when a timer has reached a specified target value (from .07 μsec to 42,949,672.95 μsec). Do not enter commas in the value. However, after you press return to enter a value, the number redisplays with commas added in the appropriate places. There are at most two timers available. Timers are controlled by their corresponding trigger program actions.

Flag Events. Use the flag event to check the status of the flag. Flags are useful for noting when a desired condition has been reached. The flag is controlled by its corresponding trigger program actions.

Signal Events. Use the signal event to recognize a signal from another module. The list of available signals depends on what signals you defined in the Cluster Setup menu (see *Intermodule Signals* on page 3–42 for details). The signal is controlled by its corresponding trigger program actions.

Consec Cycles Event. Use the consec cycles event to compare consecutive cycles to see if they are the same or different on a set of active channels from all sections, all qualified groups, or a specific qualified group. There can be only one unique consec cycles event specified in the trigger program. However, the event can be used multiple times. Any change made to the event in one instance affects all other instances of the event (except Equal and Not Equal fields). Also, any changes in the channel grouping can alter the list of channel groups, thus making the current selection invalid. When this occurs, the Consecutive Group Name field changes to "Sections."

Use the consec cycles event only after State One in trigger programs. This assures that at least one cycle has been taken for comparison.

The "Sections" selection is the default value for the Consecutive Group Name field. This selection causes the 92A96 Module to monitor all active 92A96 channels (whether or not they are assigned to a channel group).

The "Groups" selection causes the 92A96 Module to monitor all valid channel groups. The selection will not be available if no valid channel group exists. For a channel group to be considered valid, the following criteria must be met:

- The group must have one or more active channels in it.
- The group radix must not be Off.
- If a channel of an 8-channel section is used in the group, all channels from that section must be included in the group (no partial sections).
- When a Control section is included in a group, it must have its associated Control section (as defined in the 92A96 Module hardware) also included in the group. Control sections C3 and C2 are associated pairs, as are C1 and C0 (on the same card). This rule is not applicable in High-Speed Timing support when 2.5 ns clocking is selected because only one Control section is enabled per 92A96 Module.

Channels in the sections in Consecutive Cycle groups are not required to be in the hardware order. Also, the groups can contain sections from multiple modules.

A third category of selections for the Consecutive Group Name field can exist. If this selection exists, it will be followed by one or more selections containing the name of a qualifying Consecutive Cycles channel group and the word "channels" (for example "Address1 channels" or "Data1 channels"). If you select a specific channel group, the Consecutive Cycles event will only apply to the channels of that group.

NOTE. *Avoid modifying channel groups that are used by a consec cycles event. Any change to the channel groups can affect the consec cycles event operation.*

Refer to High-Speed Timing Support beginning on page 3–117 for specific information about how consec cycles operates in that mode.

Anything Events. Use the anything events to specify an action or actions that you want executed every cycle.

Event Parameters. You should be aware of some considerations that can affect what or how you enter or select event parameters.

- Since an event can be used in more than one place in the trigger program, a change to one instance of the event can automatically cause a modification of the corresponding parameter in other instances of the same event.
- If you change the radix for a group in the Channel menu, the field width and the group value are changed in the Trigger menu.

  For example, if you specify a symbolic radix for a group in the Channel menu, you can select a symbol name for the group value in the Trigger menu. When you select a symbolic radix for a group in the Channel menu, the select fields for that group in the event fields in the Trigger menu become as long as the longest symbol in the symbol table file (up to 32 characters). You can now select the desired symbol from the appropriate field. When you select a symbolic value in this field, the 92A96 Module looks through the specified symbol table for the matching symbol. The 92A96 Module uses the corresponding value for the group value. If the defined symbol value is wider than the channel group, the least significant bits of the symbol value are used. If the defined symbol value is narrower than the channel group, the symbolic value is placed in the least significant bits of the channel group and the remaining more significant bits are set to Don't Cares (for word events) or zeros (for range events). In a symbolic field, Xs are interpreted as letters rather than as Don't Cares, and a blank symbol name represents Don't Care values.
- A dollar sign ($) represents an individual digit that cannot be resolved because of a combination of Don't Care bits and non-Don't Care bits in an event parameter fill-in field.
- The number of channels represented by a digit in a group value depends on the radix you select for the group in the Channel menu. For more information, refer to *Input Radix* on page 3–15.

Choosing Actions. The 92A96 Module provides 16 types of actions to select from in an Action field (see Figure 3–9 on page 3–27). Actions have parameter fields that require you to select from a list of options. Table 3–14 lists the actions and their associated fields or selections.

Table 3–14: Actions Available in the Action Field

Action Type	Associated Fields and Description
Trigger	no associated fields Store the data sampled on this cycle and mark it to identify the trigger position. This action overrides any storage qualification that has been specified in the trigger menu. That is, this action forces storage each time it is specified.
Incr Counter	{#1|#2} Increments the specified counter by one.
Reset Counter	{#1|#2} Sets the specified counter to zero.
Restart Timer	{#1|#2} Sets the selected timer to zero and starts it (and thus require two clock cycles to execute). Timers have a resolution of 10 ns.
Resume Timer	{#1|#2} Causes the specified timer to resume running after it has been stopped by a Stop Timer action. The timer isn't reset to zero, it starts where it left off.
Stop Timer	{#1|#2} Stops a running timer. The timer value isn't reset to zero.
Go To State	<state name> Passes program control to the indicated state. A Go To State action is invalid for transitions to undefined states and is ignored.
Set Flag	Sets the flag for later reference.
Clear Flag	Clears the flag previously set by the Set Flag action.
Assert Signal	<signal name> Assert forces the signal to a true condition. The default signal is Module Sync Out. You can also select any output signal you have set up in the Signal Definition overlay (in the Cluster Setup menu) for this module. The signal remains asserted until you unassert it.
Unassert Signal	<signal name> Unassert forces the signal to a false condition. The default signal is Module Sync Out. You can also select any output signal you have set up in the Signal Definition overlay (in the Cluster Setup menu) for this module. The signal remains unasserted until you assert it.

Table 3–14: Actions Available in the Action Field (Cont.)

Action Type	Associated Fields and Description
Pulse Signal	<signal name> Pulse asserts the output signal for one cycle or 10 ns (whichever is longer), and then unasserts it until another pulse signal action is executed. However, execution of this action on consecutive cycles causes the signal to remain continuously asserted until there is a cycle in which this action is not performed. The default signal is Module Sync Out. You can also select any output signal you have set up in the Signal Definition overlay (in the Cluster Setup menu) for this module.
Store	no associated fields Stores the data sampled wherever this action is executed. Overrides other storage qualifications.
Don't Store	no associated fields Prevents storage of the sample. Overrides other storage qualification except when a trigger action occurs in the same clause (which forces storage).
Begin Again	no associated fields Resets all counters and timers to zero, restarts timers, unasserts any asserted signals, clears the flag, and returns to the first state in the trigger program. If the trigger has already occurred, post-trigger countdown continues.
Do Nothing	no associated fields Do Nothing works as a placeholder so that you do not have to delete an action to temporarily disable it.

Action Operating Considerations. Actions of the active state are performed simultaneously when their corresponding events are true, this can cause some unexpected results. For instance, if State One asks for any word to restart a timer, every sample clock cycle will be true and the timer will restart at each clock cycle. Thus the timer will never run.

Since most actions are only performed when their corresponding event is true in the active state, subsequent states must have the action repeated in order to have them occur again. Thus, a counter set to incrementally increase on an event when State One is active must be set to incrementally increase again for the event in State Two when it is active. Additionally, the effects of actions performed in one state are carried over into other states. For instance, if a timer is started in State One and the trigger program is advanced to State Two, then the timer will continue to run until it is explicitly stopped with the Stop Timer action.

Counter, Timer, and Flag Resources. The 92A96 Module provides two counter/timers and one flag that you can monitor with events and control with actions. The final status of any counter or timer can be shown in the State and Timing menus by selecting their Acquisition Parameters in the Format Definition menus (their current status is also shown in the Monitor menu). If a counter or timer is used as a trigger (event), its final status is “event.”

The counters and timers share a common resource. You can use two counters, two timers, or one timer and one counter in a single trigger program. The flag operates independently of the counter/timer resources.

***NOTE**. Counter and timer actions are executed for each clock cycle in which the associated event is true (i.e., level sensitive rather than edge sensitive).*

The counter value is controlled by the incr counter and reset counter actions. You can define a counter event that is true or false, based on the current counter value. For example, you could use a counter to trigger on the sixth execution of a subroutine by advancing the counter each time the subroutine is called and then execute a trigger action when the counter reaches the value six (6). Figure 3–12 shows an example of a trigger program that uses a counter.

The trigger program in Figure 3–12 uses Counter #1 in an event and an action. It causes the module to trigger on the cycle following the sixth occurrence of address 1300.

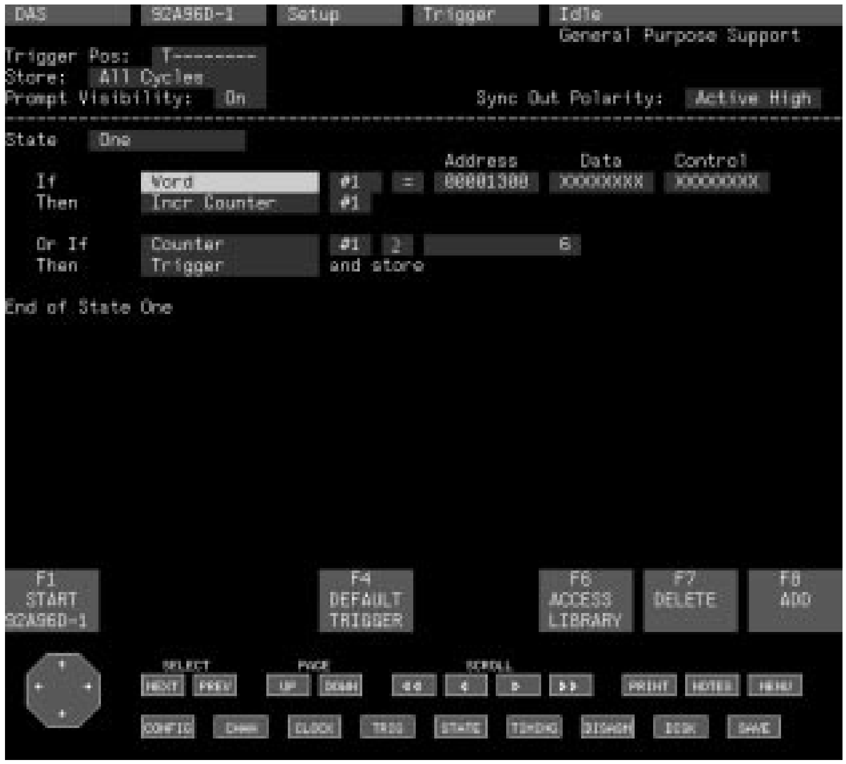

Figure 3–12: Trigger Program Using a Counter

The timer value is controlled by the resume timer, restart timer and stop timer actions. You can define a timer event that is true or false, based on the current timer value. For example, you might want to capture the data surrounding a slow execution of the code between addresses 1300 and 1500. To do this, set up a trigger program as shown in Figure 3–13.

***NOTE**. You can't resume, restart, or stop a timer within 30 ns following another such command in a trigger program; otherwise, the resulting operation is unpredictable. And, when you restart a timer and then stop a timer, you must add 10 ns to the indicated time. Also, you must allow 70 ns from restarting a timer until you check the timer as an event condition (in an If statement).*

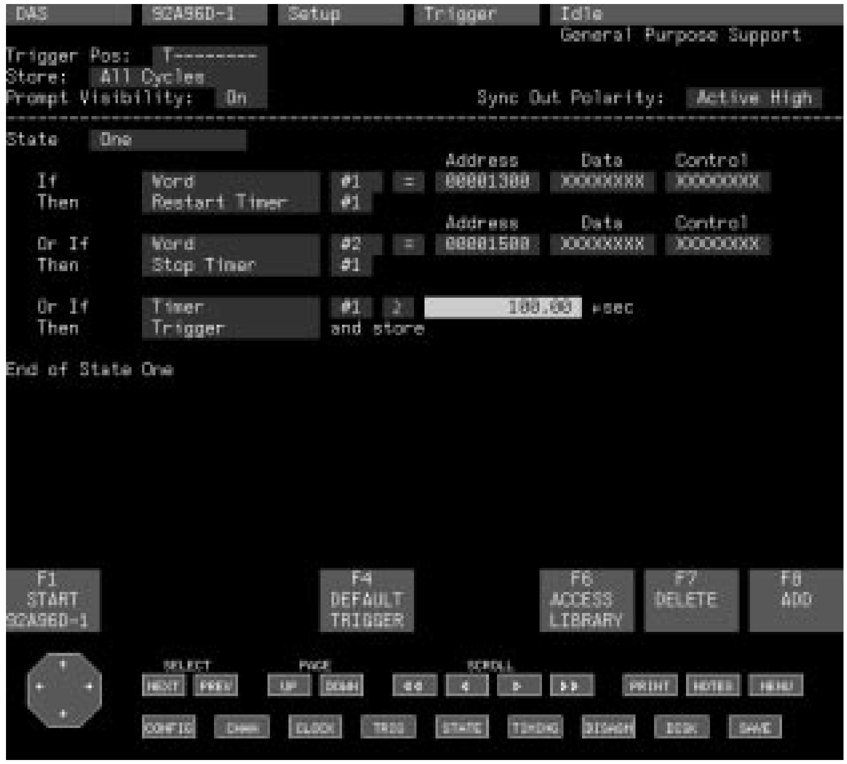

Figure 3–13: Trigger Program Using a Timer

The flag value is controlled by the set flag and clear flag actions. You can define a flag event that is true or false, based on the current flag value. For example, you might want to set the flag when an inter-module signal occurs, then check the status of the flag as an additional qualifier later on. Figure 3–14 shows an example using the flag.

The trigger program in Figure 3–14 causes the module to trigger when address 5000 is accessed, except between accesses to addresses 1300 and 1500.

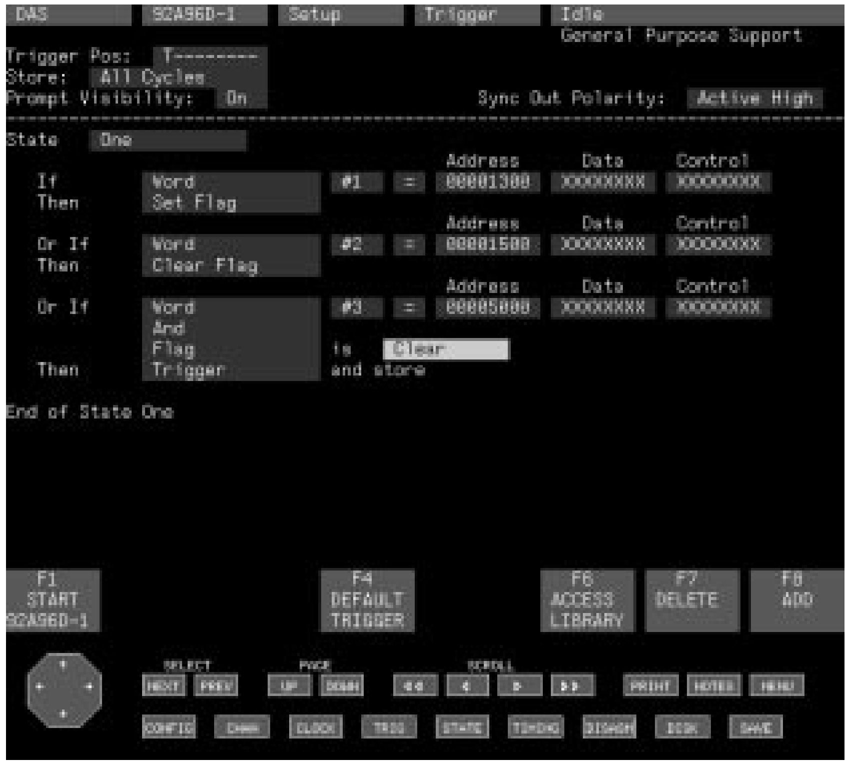

Figure 3–14: Trigger Program Using a Flag

Intermodule Signals. Input and output signals provide various types of user-defined communication between cards in the logic analyzer. As shown in Tables 3–13 and 3–14 on pages 3–32 and 3–37, the Trigger menu lets you select signal events and actions. When you use a signal event or action, you must select it by the name you gave it in the Signal Definition overlay in the Cluster Setup menu. (You must first define a cluster in the Cluster Definition overlay in the System Configuration menu. Refer to the user manual for your DAS or TLA 500 series logic analyzer for information on how to create clusters.)

You can use the Signal Definition overlay to define two signal outputs (from the 92A96 Module) and two signal inputs (to the 92A96 Module) for each 92A96 Module. (Refer to the discussion of the Signal Definition overlay in your DAS or TLA 500 series logic analyzer user manual.) The names and types of each signal you defined for your module are listed in the Config menu.

You cannot pulse and assert/unassert the same signal in a trigger program. Figure 3–15 shows an example of the use of signals.

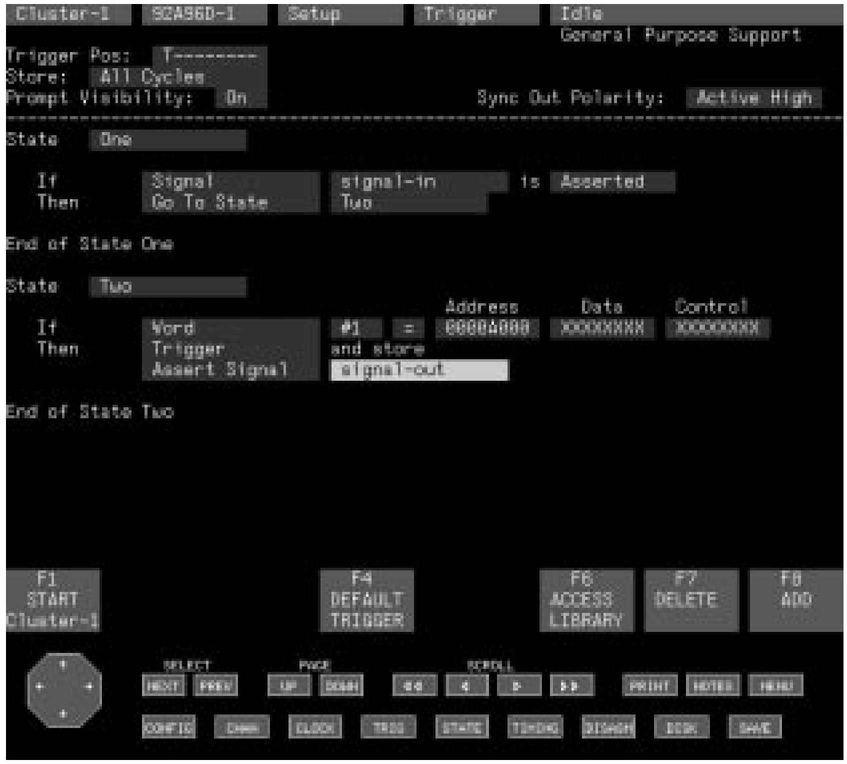

Figure 3–15: Trigger Program Using Signals

The program in Figure 3–15 causes the module to trigger and assert an output signal when address A000 is accessed after the reception of an input signal.

The Trigger menu also allows you to select an output signal named module sync out. The module sync out signal is a default output signal for the 92A96 Module (you do not have to define it in the Signal Definition overlay). The signal is TTL-DC coupled and is applied to the SMB connector (J900) on the back of each 92A96 Module in a multicard module formation.

A sync out cable, P6041, is provided with the mainframe. The P6041 offers a SMB connector to connect to the 92A96 Module J900 Sync Out connector and a BNC connector to let you apply the module sync out signal to trigger an external device (such as an oscilloscope) or your system under test, or both (in multicard module formations).

Multiple Clauses. A trigger state can contain up to eight clauses (event/action statements). Figure 3–16 shows a state with multiple clauses.

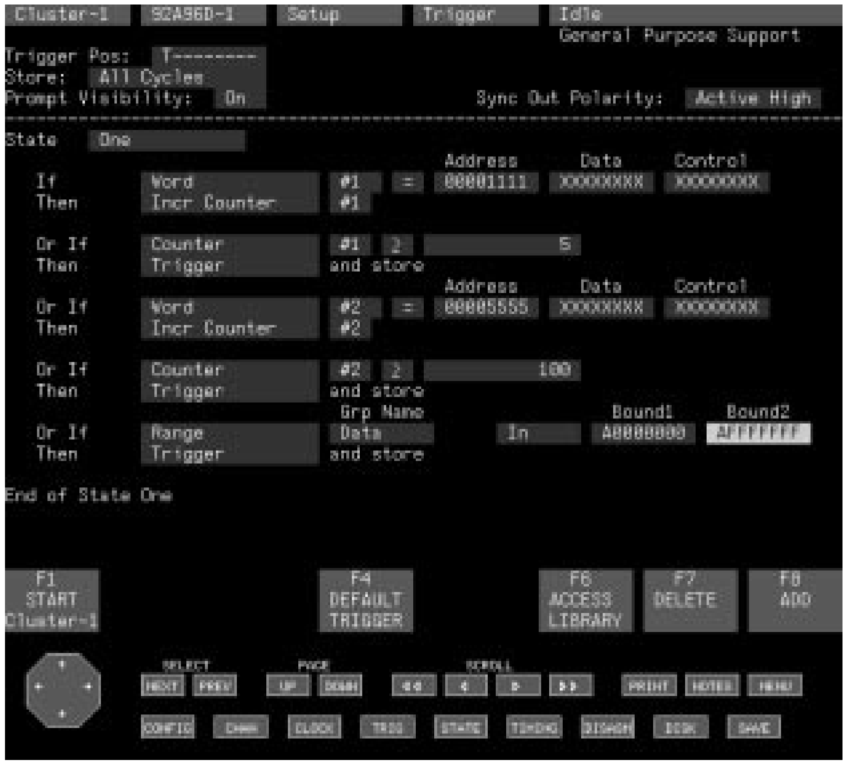

Figure 3–16: A Multiclause State

The program in Figure 3–16 uses multiple clauses in a single state to cause the module to trigger if address 00001111 is accessed 5 times, or if address 00005555 is accessed 100 times, or if the value of the data group is within the range A0000000 through AFFFFFFF.

The first clause in a state is always labeled “If.” When you add more clauses to the state, they are labeled “Or If.”

A state is not like a section of code that executes top-down, line-by-line. Every clause in a multiclause state is looked at simultaneously. If the event portion of any clause is true, the action(s) for that clause is executed, regardless of the position of the clause within the state. If more than one clause is true in a cycle, the actions for every true clause are executed, unless the actions are conflicting (refer to *Conflicting Actions* on page 3–45).

Compound Events and Actions. A compound event consists of two to eight events combined using the logical operators AND or OR in a single clause. All of the events in a compound event are evaluated simultaneously.

To create a compound event, go to the Event, select function key F8: ADD, and select Add Event. The And/Or field appears on the line below (where the default value is And) and the new Event field appears on the second line.

A compound action consists of two to eight actions logically ANDed in a single clause. All of the actions in a compound action are executed simultaneously when the event portion of the clause is true.

To create a compound action, go to the Action, select function key F8: ADD, and select Add Action. The new Action field appears on the line below (where the default value is Trigger). Compound actions are always logically ANDed.

The following example shows three different ways to build compound events and actions.

State One	State One	State One
If Event 1	If Event 1	If Event 1
Or	Then Action 1	And
Event 2	Action 2	Event 2
Then Action 1		Then Action 1
		Action 2
End Of State One	End Of State One	End Of State One

Conflicting Actions. Whenever the 92A96 Module attempts to perform more than one action in a cycle, some of the selected actions may conflict with each other when their events are true concurrently. For example, you could set up two clauses in a state where one clause specifies “Go To State Two” and the other clause specifies “Go To State Three.”

If two or more actions conflict, the one that occurs first in the program is executed and the others are not executed. Only the conflicting actions are affected, all other actions in other clauses are unaffected and execute normally.

The following example shows how conflicting actions occur in multiple clauses. When Word #1 is true, counter #1 is to increase by one, but at the same time the second clause is evaluated and when Counter #1 is found to be greater than or equal to 1000 (also true), Counter #1 should be reset to zero. However, only the first action, Incr Counter #1, is implemented because the actions conflict.

```
State One
       Address Data Control
If     Word #1 = XXXXXXXX XXXXXXXX XXXXXXXX
Then   Incr Counter #1

Or If  Counter #1 ≥ 1,000
Then   Reset Counter #1
       Go To State Two
End Of State One
```

Note, if Word #1 (above) was changed to a specific value, when that value was true, the counter would be increased by one for each clock cycle that it remained true. When the counter reached 1000 and Word #1 was true, there would be a conflict with the action in the second clause, so the counter wouldn't be reset. But when Word #1 became false, the action in the second clause would execute and the counter would be reset.

Linking States. You can link states to define more specific trigger conditions so you can find the exact data your interested in. You can link up to 16 states in a trigger program. Link states by using the Go To State action. Figure 3–17 shows an example of a two-state trigger program.

The program in Figure 3–17 uses two states to cause the module to trigger when data in the range A0000000 through AFFFFFFF is present between the time that address 00001111 is accessed and address 00005555 is accessed.

Only one state controls the 92A96 Module at any time. A state remains in control until another state is jumped to, the acquisition ends (following the trigger), or when you select function key F1: STOP.

NOTE*. All states in a trigger program are in the same menu. Use the mouse or the cursor keys to scroll to states that do not appear on screen.*

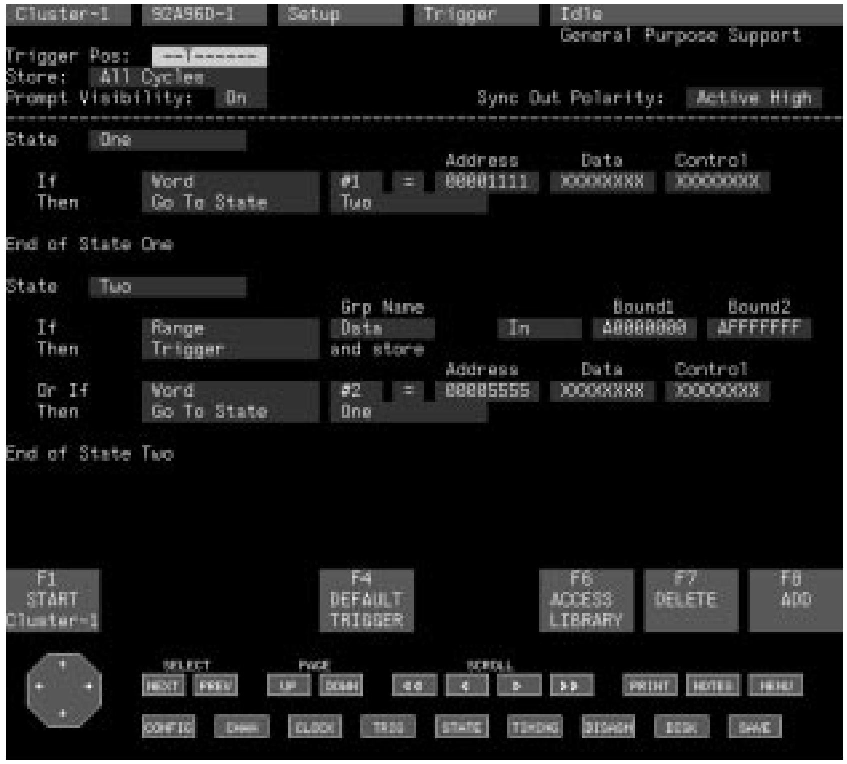

Figure 3–17: Trigger Program Using Multiple States

Using Storage Qualification

Use storage qualification to avoid filling up your the acquisition memory with data samples that do not interest you. For example, if the type of events you are interested in only occur in one percent of your samples, the samples stored in the acquisition memory will only contain a small number of examples of the events you want to see. You can use storage qualification to disqualify the unwanted data samples and fill memory only with the desired data.

The Store field in the Trigger menu lets you select the type of storage qualification you want to use:

- All Cycles. All cycles are stored.
- Store Event. A Store event section field is added to the trigger program. Only samples that match the event set up in the Store Event are stored.
- By State. Each state in the trigger program has a State Store field added. You can choose to store or not store sampled data while that state is in control.
- Combination. The Store Event and the State Store fields are added to the trigger program. If either condition is satisfied, the sampled data is stored.
- No Cycles. Nothing is stored. This selection is provided to let you store only when a store or trigger action is executed.

Figure 3–18 shows the Trigger menu with the Store Event and the State Store fields added. This trigger program only stores samples when the address is in the range A0000000 through AFFFFFFF, or when in trigger state two. Trigger State Two is active between accesses to address 00001111 and 00005555.

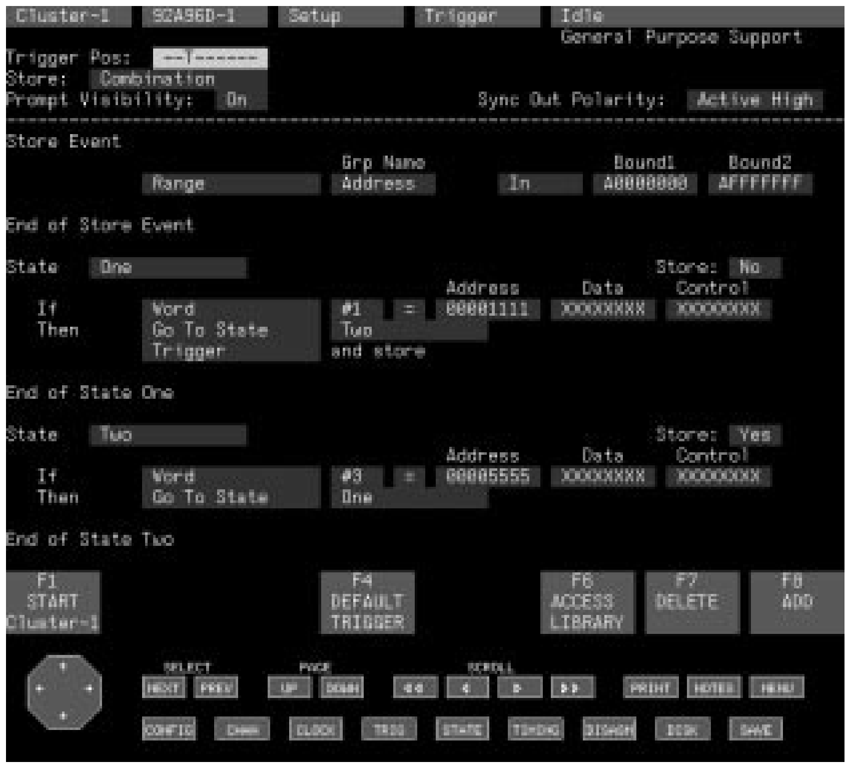

Figure 3–18: Combination Storage Qualification

The Store Event fields define the storage event. You can define a simple or a compound event. Each state also has a State Store field added when you select By State or Combination in the Store field. You can select Yes (default setting) to store and No not to store.

Store Event Qualification. When you set up a Store Event, sampled data must match the condition you set up in order to be stored. If the Store Event is true, the cycle is stored.

For example, you can set up the Store Event so that only specific cycle types are stored. To do this, you need to identify the signal lines (channels) that control that cycle type; enter the value that is present when that cycle type occurs into the channel group fields of the Store Event word event, and then enter Xs (don't cares) into all other channels of the word event.

Event resources used in the Store Event count against the eight event resources available in each state of a trigger program.

The Store Event can also be a compound event. This means that you can AND or OR up to eight conditions together. For example, you could add a range event to the previous example to specify a range of addresses in which to recognize the desired cycle type. You would thus capture only the specific cycle types that fall within (or outside) the given range with the same channel group value.

State Qualification. You can store or discard data acquired while under the control of any state of a trigger program.

For example, you can set up a two-state trigger program. If you select No in the State Store field of the first state and Yes in the State Store field of the second state, only the data that is sampled while you are in the second state of the program is stored.

Combined Qualification. When you select Combination in the Store field, both the Store Event and State Store fields are added to the Trigger menu. In this mode, the two types of storage qualification are ORed together; if either condition is true, the sample is stored.

For example, Figure 3–18 shows that while the 92A96 Module is in the control of State One, only words that meet the Store Event condition or the trigger condition are stored. While the 92A96 Module is in the control of State Two, all samples are stored.

Storage Qualification Interaction with the Trigger Program. Use Store and Don’t Store actions in the trigger program to enhance or fine tune any of the basic storage methods you set up through the selection in the Store field (described above). For example, the No Cycles selection in the Store field takes advantage of this feature, allowing you to store only those cycles that you qualify with the Store action. Also, use the Don’t Store action to disqualify data beyond that disqualified by the Store Event and state storage.

Trigger Program Constraints

The Trigger menu event selections share internal hardware pattern recognizer resources that create some constraints on trigger program operations. Figure 3–19 shows the allocation of event resources.

Each unique word and channel event uses one recognizer resource. Therefore, unique word and channel events can be specified up to the eight recognizer hardware limit (thus, ID numbers 1 through 8).

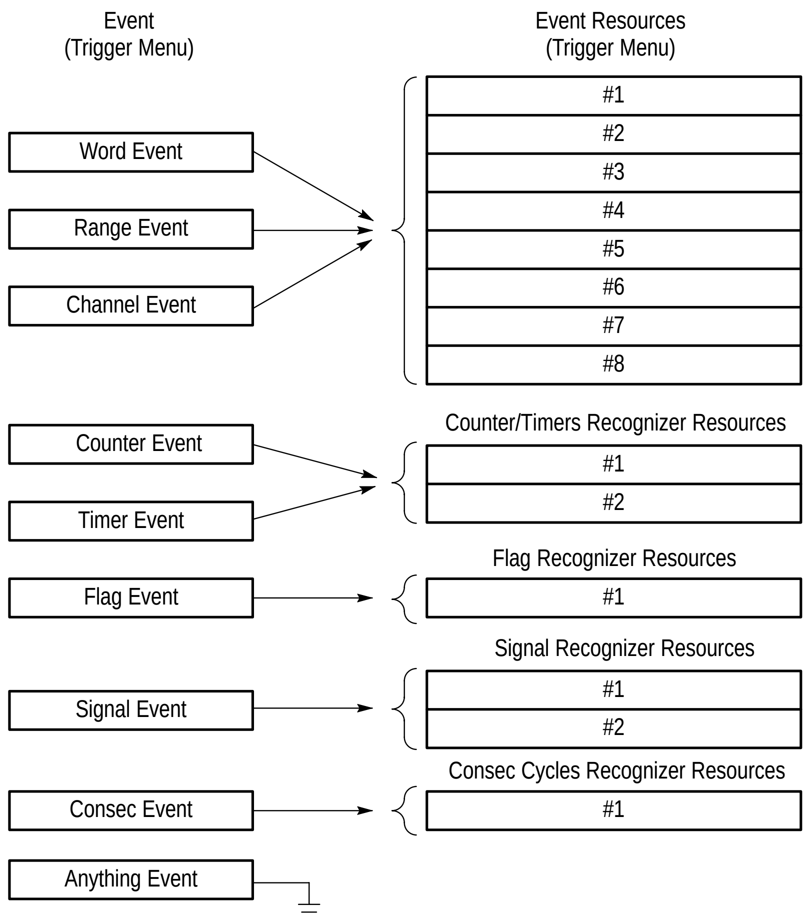

Figure 3–19: Trigger Menu Event Resource Allocations

Range events can only use up to four of the eight recognizer resources. Each unique single-ended range event uses one recognizer resource. Each unique double-ended range event uses two recognizer resources. Therefore, you can only specify up to four single-ended or two double-ended range events.

Counter and timer events must each use one of the two available counter/timer recognizer resources.

The trigger location is always within the last 128 Kbytes of the acquisition memory. If you want to store more samples before or after the trigger than the defined selection allows, you can define one or more counters in the trigger program to delay the actual trigger by the desired number of sample cycles. Use one of the Trigger Library selections, such as "Trigger on Anything with Extended Postfill," to store more samples after an event is recognized (refer to *Trigger Library Overlay* on page 3–57 for information on using the Trigger Library).

Since the trigger position only guarantees the amount of memory filled after the trigger occurs, you can encounter situations where the trigger occurs soon after acquisition begins and little or no data is acquired before the trigger position setting in acquisition memory. In this case, you may only fill a portion of the acquisition memory. For example, if you set the trigger position at 50% of acquisition memory, start the acquisition, and the trigger occurs almost immediately, only half the acquisition memory is filled with post-trigger data, and little or no pre-trigger data is acquired in acquisition memory. Thus the trigger location is approximately at the lowest numbered sequence displayed.

A specific event can be used several times in a trigger program. For example, though you are limited to eight unique word events, each one can be used several times throughout the trigger program with the value remaining the same in each instance. This applies to the other event types too.

Channel, flag, and signal events all allow a target value of Don't Care. While this value is selected, the event won't consume a recognizer resource (since the event is always true).

Event Resource Combination Limitations. There are limits on the number and combination of recognizer resources that can be used within a single state and within the trigger program as a whole.

- You can use up to eight unique event resources in a state.
- You can use up to eight unique event resources in the Store Event.
- Since the Store Event is in effect in all states, the number of unique event resources used in the state plus the number used in the Store Event must be ≤8. For example, if there are four unique event resources used in the Store Event, each state can use at most four other unique event resources.
- By default, range recognizers are displayed as double-ended. If you use seven event resources in a single clause and want to add a single-ended range recognizer, you must temporarily change one of the events to an "anything" event. You must then add the range recognizer and then set the "anything" event to the desired event.
- In general, the total number of unique event resources that can be used in the trigger program is eight.

  Using more than eight unique event resources in the trigger program is possible, but depends on the combination of event resources used and which ones are used in various states. As you define the trigger program, the allocation of event resources is optimized by the software to maximize the total number of event resources that can be used.

Trigger Program Size. With 16 states, 8 clauses per state, and 8 events and 8 actions per clause, the number of fields and screen lines required to display the largest theoretical trigger program is very large. In practice, the Trigger menu places a limit on the size of the trigger program that can be created. This limit is based on the number of fields required to display the program. Although this limitation makes it impossible to define the largest theoretical trigger program, it is easily possible to accommodate any realistic trigger program. An error message to that effect displays when you reach the limit.

Trigger Programming Techniques

The Trigger menu offers flexible and powerful programming capabilities that can result in complex trigger programs. You can create trigger programs that are sophisticated enough to require debugging, much like what's required with any advanced programming language.

There are programming tools available with the 92A96 Module that can help you create effective trigger programs; the Monitor menu and the Trigger Library overlay (described on page 3–57).

The Monitor menu is useful as a trigger program debugging tool. From this menu, you can view the current status of various resources of the 92A96 Module during acquisition. However, be aware that rapid changes in trigger state, counter values, timer values, and the flag value cannot be accurately displayed in real time in the Monitor menu.

You can use the Trigger Library overlay to look at actual trigger programs that perform specific advanced triggering functions. The trigger programs in the library make excellent templates to build other trigger programs.

Trigger Program Examples. State-based triggering is an excellent mechanism for tracking and analyzing complex, real-life problems encountered in both hardware and software analysis. Use the Trigger menu to create a state machine-oriented program (process algorithm) to solve your logic analysis problem.

The trigger programs on pages 3–53 through 3–56 show some programming techniques for common applications.

Figure 3–20 shows a trigger program that counts the number of times event C (Word #3) occurs between the first recognition of event A (Word #1) and the first recognition of event B (Word #2). The recognition of event B causes a trigger and a transition to a trigger state that does nothing but wait for the acquisition memory to fill with post-trigger data.

If necessary, scroll to see the entire trigger program. The Specify comments remind you to enter a word value.

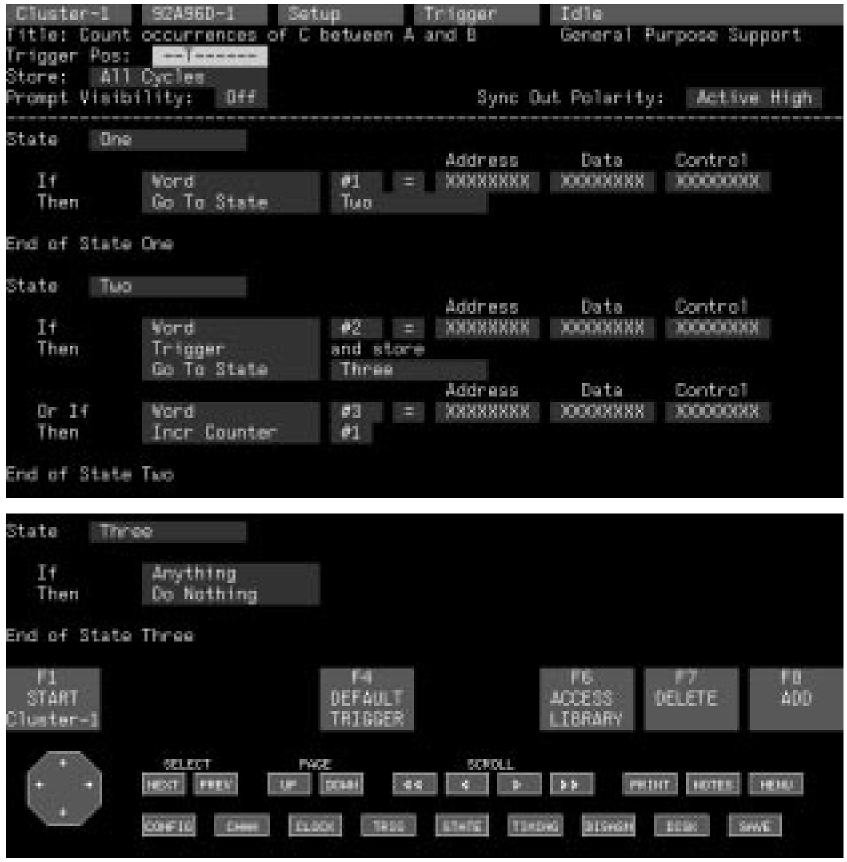

Figure 3–20: Counting Occurrences

Figure 3–21 shows a trigger program that triggers when event B (Word #2) occurs after event A (Word #1) and within time T of the occurrence of event A. If the time between event A and event B is greater than time T, a trigger will not occur.

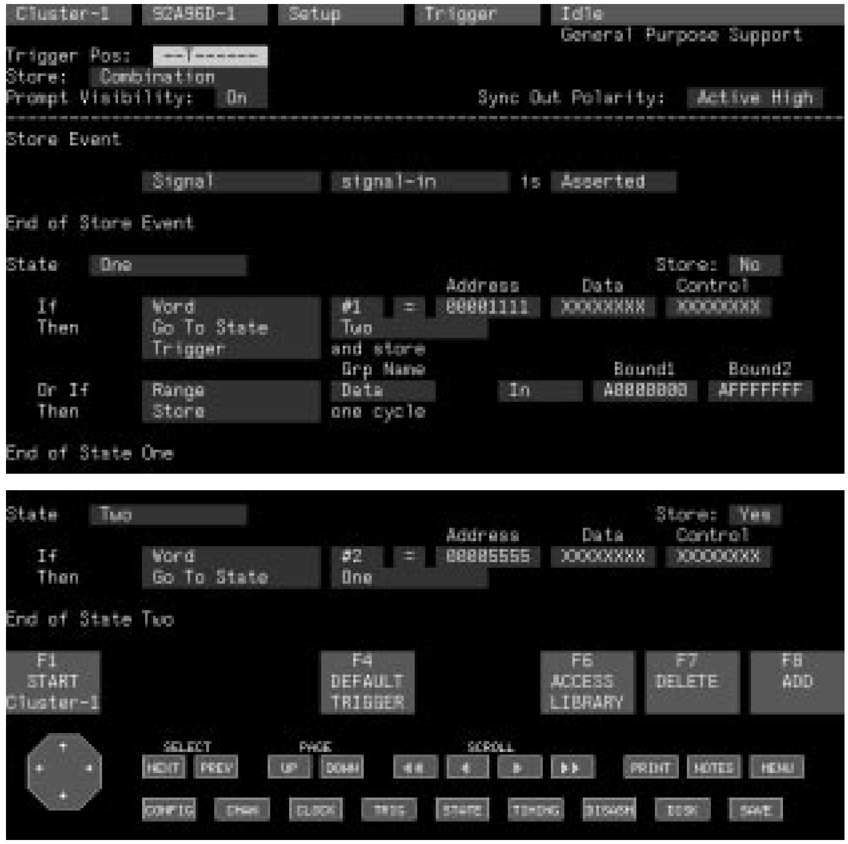

Figure 3–21: Detecting a Sequence of Events Within Time Constraints

Figure 3–22 shows a trigger program that stores samples when one of the following conditions is met: when the input signal “signal-in” is asserted, when in trigger state two (between addresses 00001111 and 00005555), or when the data group value is in the range A0000000 through AFFFFFFF.

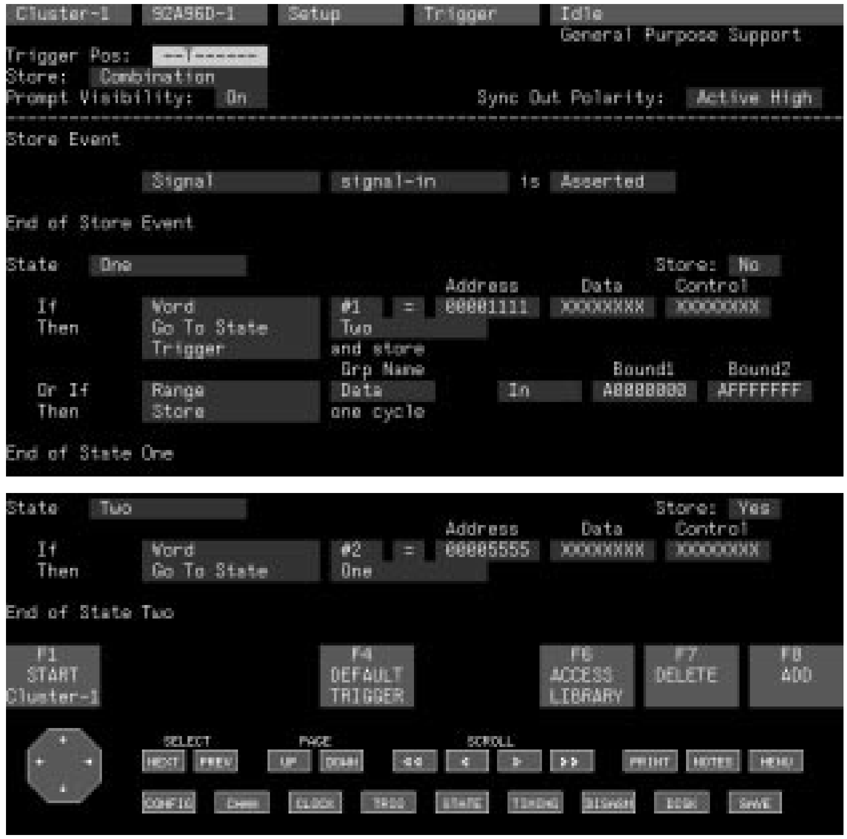

Figure 3–22: Advanced Storage Qualification Trigger Program

Figure 3–23 shows a trigger program that uses timer #1 to run the module for exactly 15 seconds. During this time, timer #2 is used to accumulate the total amount of time spent between addresses 00002222 and 00007777. Later, you can calculate the percentage of time spent between addresses 00002222 and 00007777 by dividing the ending value of timer #2 by the total acquisition time (15 seconds).

Figure 3–23: Measuring the Time Between Words

Avoiding Trigger Program Problems. The following list contains trigger programming techniques and operating characteristics that, when combined, lead to unexpected operating behavior. Make a special effort to either avoid them or to take extra care in creating programs that contain these conditions:

- Conflicting actions. Be careful when you create programs where more than one clause could be true at the same time. The actions for the events may conflict in a way you don’t want.
- Undefined trigger states. Don’t create programs with a GO TO STATE action that references a state you don’t have.
- Trigger state references. Don’t delete states that you have referenced GO TO STATE actions to unless you change the reference to another appropriate state or delete the GO TO STATE action.

- Trigger and store. Don't expect any other storage qualifications to be executed when you use a Trigger action, it always forces acquisition storage at that cycle.
- Default trigger. Don't expect the Store field setting to go to its default setting when you press F2: DEFAULT TRIGGER, only the fields below the dotted line in the Trigger menu are affected.
- Start and stop timers. Don't forget to explicitly start (restart) and stop timers, they do not start and stop automatically at the beginning and end of the acquisition, nor when the trigger occurs.
- Monitor menu accuracy. Don't expect the timer value to necessarily be the end of the acquisition memory, the timers require an explicit Stop action so its value continues to increase (and possibly wrap) until stopped. Also, rapid transitions between states can occur which cause the counter, timer, and flag values to be inaccurately displayed.

Trigger Library Overlay

The Library overlay offers a set of standard trigger programs for you to use. It also saves your own trigger programs for later recall. However, the Library overlay is not a replacement for the system Save/Restore menu. If the trigger program being saved depends on any other setup menus (such as saving a symbolic radix in the Channel menu), then you should use the Save/Restore menu instead.

Figures 3–24 and 3–25 show the Library overlay with a system-defined (for example, Tek) library and a user-defined library selected.

The library name field displays the name of the library. A description of the system-defined programs and user-defined programs makes up the rest of the menu. You cannot alter the descriptions of system-defined programs. For more information about a particular trigger program, place the cursor on the program name and select the Notes on-screen button to display the on-screen notes for that selection.

You can scroll through the table if more than 20 library items exist.

Function key F1: ESCAPE & CANCEL closes the overlay and returns to the original Trigger menu *without* loading a trigger program from the library. Function key F5: RESTORE ITEM replaces the current trigger program setup (in the Trigger menu) with the trigger program the cursor is on.

Function key F7: ADD NEW ITEM adds a new library. Figure 3–25 shows an example of a new (user-defined) library. Note that the user-defined library has two additional function keys that the system-defined library does not have.

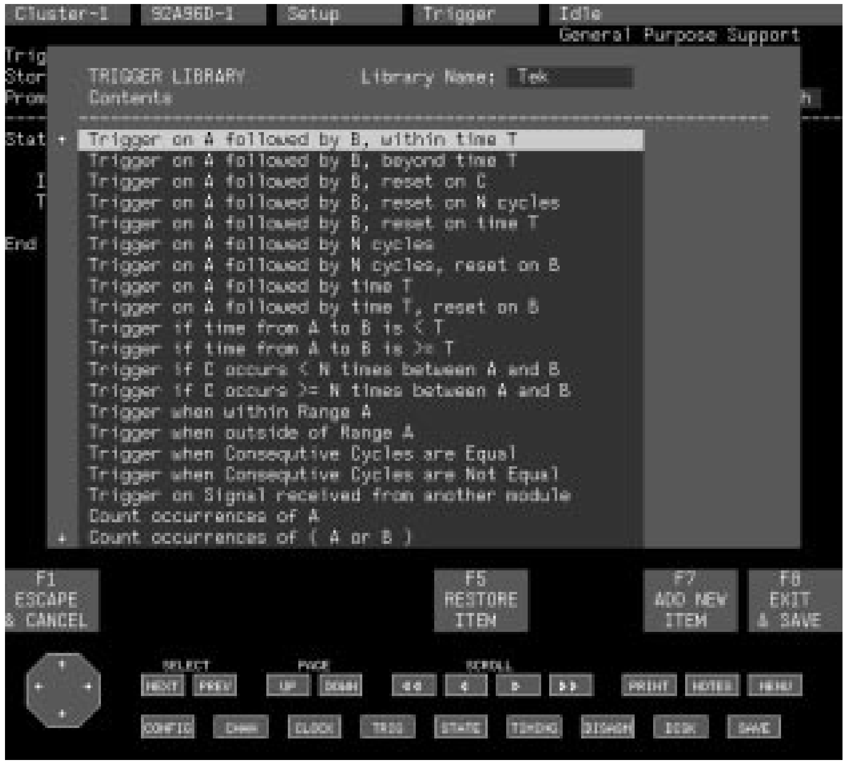

Figure 3–24: Library Overlay

The function keys for the user-defined library differ from the standard library as described below:

- In addition to closing the library overlay without loading a trigger program from the library, function key F1: ESCAPE & CANCEL deletes any recently added user-defined library programs and restores library programs that you have deleted since entering the current user-defined library. However, if you remove an entire user library and select F1, the deleted user library is not restored to the Library overlay. If you remove an item from a library, go to another library, and then select function key F1, the item is not restored to the first library.
- Function key F4: REPLACE ITEM overwrites the trigger library program that the cursor is positioned on with the trigger program currently loaded in the Trigger menu. This operation is applicable to user-defined libraries only.

- Function key F5: RESTORE ITEM replaces the current trigger program setup (in the Trigger menu) with the trigger program the cursor is on. Not all parameters of the restored trigger program may be restored if the setup conditions for other menus have changed since the trigger program was originally saved. For example, symbols are only restored if the Channel menu group ordering and radix specifications are the same as when the trigger library item was saved. Otherwise, the values that the symbols currently represent are used.
- Function key F6: DELETE ITEM displays a pop-up menu with two selections, Delete User Library and Delete Library Item. The first selection deletes an empty user-defined library and the second selection deletes the trigger program the cursor is positioned on.
- Function key F7: ADD NEW ITEM displays a pop-up menu with two selections, Add User Library and Add Library Item. The first selection adds a new user library and the second selection adds a line for a new trigger program description.
- Function key F8: EXIT & SAVE closes the overlay and returns to the Trigger menu. The Trigger menu will contain the last trigger program loaded, if any, by the F5: RESTORE ITEM key.

Figure 3–25: User-Defined Trigger Library Overlay

Using Programs From the Library. The system- or user-defined trigger programs can offer simple or complex trigger setups.

To use one of the trigger programs, follow this procedure:

1. Enter the Library overlay.
2. Select the appropriate library (Tek or user-defined). A list of trigger programs appears on the screen (unless the library is newly defined and does not contain any trigger programs).
3. Position the cursor on the appropriate program and select function key F5: RESTORE ITEM.
4. After the trigger program is restored to the Trigger menu, select function key F8: EXIT & SAVE. The first State of the selected trigger program is displayed and on-screen prompts show you where to enter the necessary values for your setup (such as Address, Data, and Control group values for each word or event, a Counter value N, a Time value T).

Saving Programs in the Library. You can save any number of trigger programs to a user-defined library; however, you cannot add or delete programs in the Tek trigger library. To save custom trigger programs, you must first create a library.

In general, if you want to save a specific trigger setup, use the Save/Restore utility menu to save your setup. If you want to define a more general but commonly used template for trigger programs, store the trigger program in your user-defined trigger library.

There are two ways to create trigger programs; restore an existing trigger program or build your own in the Trigger menu.

To restore an existing trigger program, follow this procedure:

1. Select function key F6: ACCESS Library and look through the trigger library (Tek or user-defined).
2. Select a program from the list that matches exactly or closely resembles the trigger setup of your choice.
3. Select function key F5: RESTORE ITEM to restore the selection.
4. Select function key F8: EXIT & SAVE to return to the Trigger menu.
5. Enter values as prompted in the Event or Action fields, or modify the program according to your needs and save it to a user-defined library.

To create a trigger library, follow this procedure:

1. Select function key F6: ACCESS LIBRARY to access the Library overlay.

2. Select function key F7: ADD NEW ITEM.

3. Select Add User Library and enter a library name. Once you create a trigger library, you can create and save trigger programs in it.

To save a trigger program, follow this procedure:

1. Select function key F6: ACCESS LIBRARY to access the Library overlay.

2. Select the appropriate library from the selections of the Library Name field.

3. Select function key F7: ADD NEW ITEM.

4. Select Add Library Item. The Tek library trigger program name appears as the default user-defined library name.

5. To change the program name, open the line and enter a new name in the Description field. You can enter any alphanumeric description up to 52 characters.

6. After determining the program name, select function key F8: EXIT & SAVE; your trigger program is saved.

The other way to create a trigger program is to build it directly in the Trigger menu and save it when you're ready.

To save the completed trigger program, follow this procedure:

1. Select function key F6: ACCESS LIBRARY.

2. Select the appropriate user-defined library.

3. Select function key F7: ADD NEW ITEM.

4. Select Add Library Item. A line appears that reads: Enter your description here. Enter any alphanumeric description up to 52 characters long in the Description field.

5. After entering the name of the trigger program, select function key F8: EXIT & SAVE to save the new trigger program.

The following figures show two trigger programs from the Tek library.

Figure 3–26 shows a simple trigger program from the Tek library. The Prompt Visibility field of the Trigger menu is turned on.

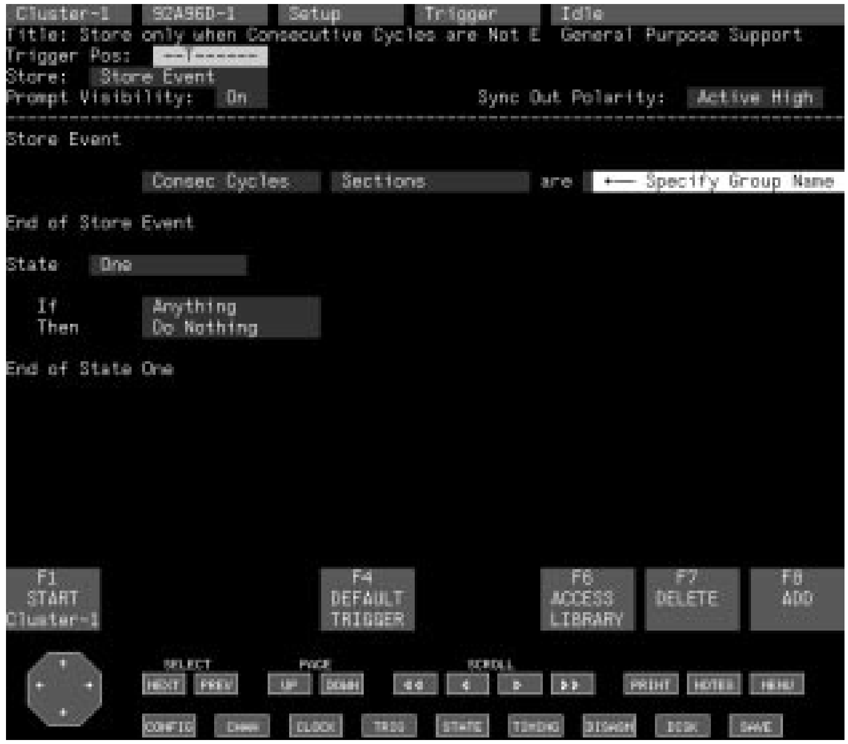

Figure 3–26: Simple Trigger Program (Trigger Menu)

Figure 3–27 shows a complex trigger program from the Tek library. It may be necessary to scroll through lengthy trigger programs. In this example the trigger program is one-and-a-half screens in length.

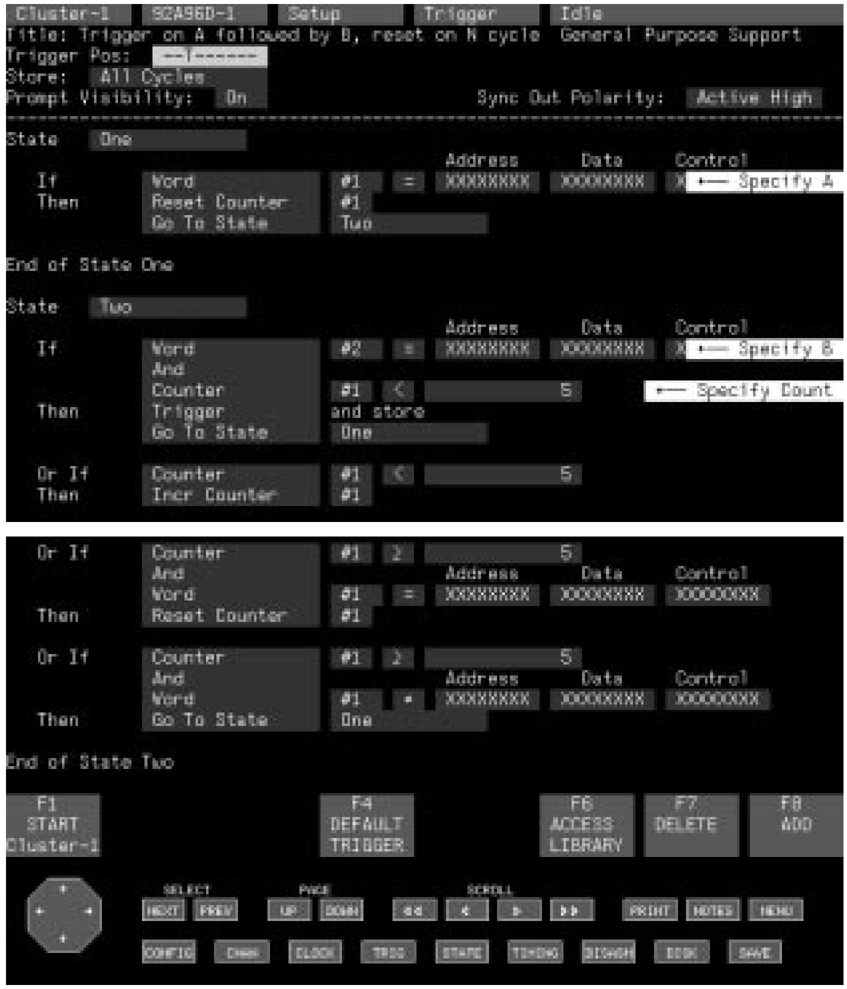

Figure 3–27: Complex Trigger Program (Trigger Menu)

Trigger Prompts. You can use prompts to add comments to a trigger program in the same manner that a programmer might add comments to a program (for example, to clarify or explain an entry whose meaning isn't readily apparent). You can add up to 20 prompts to a trigger program.

There are two types of prompts that appear in trigger programs: system defined and user defined. After restoring a Tek library trigger program, system-defined prompts appear along the right side of the screen indicating areas that require you to add some type of value. For example, if you restored a program with two word recognizers and one counter, a prompt (Specify A) appears on the first word recognizer line, another prompt (Specify B) appears on the second word recognizer line, and a third prompt (Specify Counter Value) appears on the counter event line. When you enter a value for Word #1, all occurrences of Word #1 take on that value (within that trigger program), and so on. Look at Figure 3–26 or 3–27 to see system-defined prompts.

To add a prompt, follow this procedure:

1. Position the cursor on the line you want the prompt to appear on.
2. Select function key F8: ADD, and select Add Prompt. A line appears that reads: Enter prompt text.
3. Enter any alphanumeric description up to 32 characters. To change an existing prompt, the line that appears on the screen will say: Enter new prompt text here.

Setup Print Overlay

Use the Setup Print overlay (see Figure 3–28) to print data from the setup menus. You can direct output (ASCII equivalent of the menu) to a printer connected to the RS-232C Auxiliary port or to a file. On a network, you can send the data to a network file or to a network printer with a TCP/IP-compatible lpr spooler.

If you print to a local file, you can use the Disk Services menu to access the file in the Print Output directory. To print data to a network file, include the internet address (or host name), user name, and path name in the supplied fields.

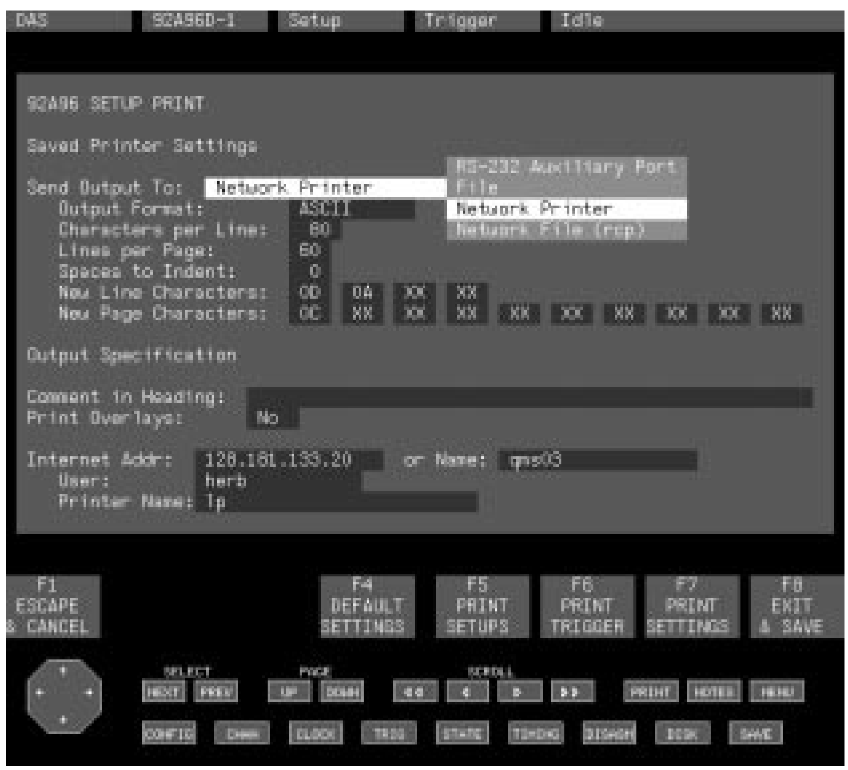

Figure 3–28: Setup Print Overlay

Refer to *Printer and Hardcopy General Use* in your DAS or TLA 500 series logic analyzer user manual for information on working with ASCII or PostScript files. Refer to the *Capturing and Printing Menus* in the same manual for information on using the Print Screen tool to capture and print individual menus.

The Setup Print overlay has the following fields and features:

- Output Specification field. Use this field to select the destination for the print data; the choices are: RS-232 Auxiliary Port, File, Network Printer, and Network File.

  When you select the auxiliary port, the print data is directed to the printer connected to the Auxiliary port connector. When you select Network Printer, the print data is directed to the network printer specified by the settings in the Internet Addrs field, Name (host) field, and Printer Name field.

  When you select Network File (rcp), the print data is directed to the file (specified by the File Name field) on the host (specified by the Internet Addrs field) for the user (specified by the User field) and the optional path (specified by the Remote Path field). You must include the internet address in the Internet Addrs field or the host name in the Name field (if there is an appropriate entry in the /etc/hosts file on the logic analyzer).

- Output Format. This field specifies the output format of the print data. Selections are ASCII (default) and PostScript.

- Characters per Line. This field specifies the number of characters per line to print. The maximum number of characters per line is 300 for ASCII format, and 80 for PostScript format. The minimum is 64; the default is 80.

- Lines per Page. This field specifies the number of lines per page to print. The maximum number of lines per page is 99 for ASCII format, and 60 for PostScript format. The minimum is 10; the default is 60.

- Spaces to Indent. This field specifies the number of spaces the printer will indent from the left edge of the page. The minimum indent setting is 0 spaces (default). The maximum number of indent spaces depends on the number of characters-per-line. For example, if the characters-per-line is set to 80 and the minimum characters-per-line is 64, then a maximum of 16 spaces is available for indentation.

- New Line Characters. This field specifies the hexadecimal characters (four maximum) to print at the end of each line. The default characters are 0D 0A XX XX (ASCII carriage return and new line characters). The characters XX represent “don’t care” values and are not sent to the printer. The “don’t care” values cannot be followed by character values. For example, the line characters 0D XX 0A XX are not valid. If you enter a bad value into a field, the field will return to its default value. Any hexadecimal numbers from 01 to FF are valid; 00 is not a valid number. The new line character fields are not available in PostScript format.

- New Page Characters. This field specifies the hexadecimal characters (ten maximum) to print at the end of each page. The default characters are 0C (ASCII form feed characters). Enter the character or sequence of characters to cause the printer to go to the top of the next page. The characters XX represent "don't care" values and are not sent to the printer. The "don't care" values cannot be followed by character values. If you enter a bad value into a field, the field will return to its default value. Any hexadecimal numbers from 01 to FF are valid; 00 is not. The new page character fields are not available in PostScript format.
- Comment. This field specifies a comment located in the header at the top of each printed page. The maximum number of characters is 52.
- Print Overlays. This field lets you print the supported overlays associated with the setup menu(s) when you select "Yes". Note, however, you cannot print a trigger library with the Setup Print overlay.
- Function keys. Function key F4: DEFAULT SETTINGS loads the default print overlay settings into the print overlay. However, selecting this function key does not load any values or characters into the Output Specification fields.

  Function key F5: PRINT SETUPS sends all the setup menus to an output file or to the printer via the RS-232C auxiliary port. You can also print supported overlays when you select "Yes" in the Print Overlays field. Function key F6 sends the menu to an output file or to the printer via the RS-232C auxiliary port. The label on the F6 function key changes according to the menu that you call the print overlay from. Function key F7: PRINT SETTINGS prints the Setup Print overlay settings, including the Output Specification fields entries.

Sending Data to a Local File

To send data to a local file, set the Send Output To field to "File" and specify a file name (the default name is "output"). After selecting a file name, you can specify the output format of the file as ASCII or PostScript. Select either the F5 or F6 function keys to send the data to a file that will be saved in the Print_Output directory. You can then transfer the file to a host computer for future manipulation.

Sending Data to a Network File

To send data to a network file perform the following steps:

1. Set the Send Output To field to "Network File (rcp)" and specify a file name (the default name is "output").
2. Select the output format of the file in the Output Format field.
3. Enter the internet address of the remote host in the Internet Addrs field or the name of remote host in the Name field.

4. Enter the name of the user in the User field.
5. If desired, enter the path in the Remote Path field.
6. Select either the F5 or F6 function keys to send the data to a file on the network host.

Printing a Menu to a Local Printer

To print data to a printer connected to the Auxiliary port of the mainframe, perform the following steps:

1. Select “RS-232 Auxiliary Port” in the Send Output To: field.

***NOTE**. If you direct the output to a printer connected to the RS-232C Auxiliary Port, use the Communications menu to make sure that the transmission baud rate and handshaking protocol matches that of your printer.*

---

2. Select the output format of the file in the Output Format field.
3. Define the printer settings.
4. Select either the F5 or the F6 function key to print.

   Printing begins when all data has been prepared by the logic analyzer. The print data starts with two header lines containing the current date, module type, user comments, and page number.

5. To stop printing, select the STOP PRINT key (use the key that was used to start printing).

   Selecting the STOP PRINT key aborts the entire print request; no data is printed.

***NOTE**. The logic analyzer cannot communicate with the printer and therefore will not give any warning or error messages if the print sequence cannot be completed.*

Because the logic analyzer does not communicate with the printer directly, it can appear to hang up when the printer detects a problem. For example, if the printer runs out of paper while printing, the logic analyzer cannot detect this and will not respond to the STOP PRINT keys until you turn off the printer. A similar situation is when the printer is either turned off or is off line when you select the F5 or F6 function keys to start a print operation. The logic analyzer can appear to hang and not respond to the STOP PRINT keys unless you turn on the printer and set it to on line.

Printing a Menu to a Network Printer

To print data to a network printer with a TCP/IP-compatible lpr spooler, perform the following steps:

1. Select "Network Printer" in the Send Output To: field.
2. Select the output format of the file in the Output Format field.
3. Enter the internet address of the remote host in the Internet Addrs field or enter the name of the remote host in the Name field.
4. Enter the name of the network printer (if one exists) in the Printer Name field.
5. Enter the name of the user in the User field.
6. Define the printer settings.
7. Select either the F5 or the F6 function key to print.

   Printing begins with two header lines containing the current date, module type, user comments, and page number.
8. To stop printing, select the STOP PRINT key (use the key that was used to start printing). The entire print request is aborted.

Monitor Menu

The Monitor menu (Figure 3–29) displays each time you start an acquisition that takes more than a few seconds to trigger.

While the acquisition is running, the Monitor menu shows the progress of the acquisition. When the trigger occurs and the remainder of acquisition memory is filled, the State, Timing, or Graph menu (depending on which was last selected) is displayed. You can move from the Monitor menu to any other menu (for example, the Trigger menu) while the acquisition is running.

If you want to perform additional menu programming and do not care to see the display results, you can stop the acquisition by selecting function key F1: STOP. When you stop the acquisition, the logic analyzer does not automatically switch to a display menu. Subsequent changes to the setup menus are not displayed in the current Monitor menu until a new acquisition is started.

The Monitor menu displays a list of all trigger states as they appear in the Trigger menu. The state currently in control of the acquisition is highlighted. If the Trigger program is jumping from state to state at a high rate of speed, highlighting may not be seen.

The current values and target values of all counters and timers as they are used in the Trigger menu are also displayed. The status of any flags are shown (if used).

Figure 3–29: Monitor Menu

A Memory Status indicator shows the amount of acquisition memory being used and displays a status message. If the orange bar has not reached the trigger point (marked by T), the trigger condition has not occurred. If the bar is past the T, the trigger has occurred and the remainder of memory is filling (unless there are qualification problems affecting data storage).

If the message “Shows unused memory due to Early Trigger” appears below the Memory Locations Unfilled field, the prefill conditions were not satisfied. When this occurs, the left side of the memory status indicator will be displayed in orange, and the right side of the bar will be displayed in-gray (indicating the unused memory due to the early trigger). The Delay Count field displays the amount of memory that remains unfilled.

When you start an acquisition, the Monitor menu shows how the acquisition is proceeding. The trigger state currently in control is highlighted at the top of this display. As control is passed from state to state, the highlighting changes to reflect the new state in control (the state currently in control may change without ever storing qualified data samples). Note that when state to state transitions occur too fast, the state highlighting may not occur.

Only qualified data samples are stored in the acquisition memory. Newly acquired data overwrites this memory until the trigger event is found. Since the post-trigger delay cannot exceed the size of memory, the sample associated with the trigger cannot be overwritten. After the trigger event is found, the post-trigger delay cycles are acquired and the results are displayed.

When the trigger is programmed to one of the nine trigger positions, each step in the trigger position represents a change of approximately 12.5%. If, for example, the trigger position was set in the center of an acquisition memory containing 1024 samples, the unfilled locations after the trigger are approximately half that amount. As the acquisition progresses and more qualified data samples are stored, the number of unfilled memory locations decreases.

When the trigger position selected is “Defined,” you can specify the exact number of cycles to be stored after the trigger. The Delay Count field starts counting down from the size of the memory chosen in the Config menu. The delay counter continues to count down until one of the following happens:

1. It fills up the pre-trigger memory locations and the counter stops counting down until the trigger occurs.

2. The trigger occurs and the counter continues counting down until the post-trigger memory locations are filled or the module is stopped.

Display Menus

This section describes the 92A96 Module display menus, their common and unique features, and how to use the split-screen display mode.

Features of the Display Menus

The Display menus let you view the data from various perspectives and search for pertinent data. An overview of the features common to the 92A96 Module Display menus (exceptions are noted) follows. Refer to Figures 3–32 and 3–39 to see examples of these features.

Overlays

The format definition overlays for the display menus are used to make major changes to the display format. After you make format changes you can exit and save them or change your mind and escape and cancel them. The State and Timing menus also have search definition overlays to define the parameters of a data search and a Split-Screen Definition overlay to format the display for split-screen mode (the Graph menu does not offer these features). In addition, there are separate overlays to print the State menu and the Timing menu.

Cursor Sequence Field

The Cursor (sequence) field shows the sequence number for the data under the cursor. This represents its relative position within acquisition memory. When you scroll through the data, the data cursor is always on a row or a column. The data stored in a row in the State menu or in a column in the Timing and Graph menus normally represents a single location within the acquisition memory (depending on the horizontal magnification selected, refer to *Magnification* on page 3–93 for more information).

To quickly move through displayed data, type the desired sequence number (in the Cursor field), then press the Return key. The data surrounding the position is displayed. If that sequence number is not accessible, the data surrounding the next-lower number is displayed.

In addition to using the mouse or scroll keys, there are other ways to move the cursor in the displayed data using the Cursor field. For example:

- Type a mark label (A through M) to move to that mark in the display (refer to *User Marks* on page 3–75)
- Type a T (upper or lower case) to move to a trigger location
- Type a $ to move to the end of memory
- Type a ^ to move to the delta mark (Δ)

You can also specify a move relative to the cursor's current position by entering an offset number in the Cursor field. For example:

- Type +100 to move the cursor forward 100 sequences in the data display
- Type –100 to move the cursor backwards 100 sequences
- Subsequent moves using the same offset value can be made by simply typing the appropriate sign (+ for forward and – for backward)

Table 3–15 summarizes the methods for moving through displayed data. The "n" represents any whole decimal number.

Table 3–15: Cursor Field Operations

Field Entry	New Cursor Location
n	sequence location n
+n	n sequences forward
–n	n sequences backward
+	last n sequences forward
–	last n sequences backward
$	end of memory
0	first sequence in memory
^	delta mark (Δ) (if one exists)
t or T	trigger position (if one exists)

You can type a question mark (?) in the Cursor Sequence field for information about the sequence that the cursor is positioned on. The information displays along the bottom of the screen and tells you which module acquired the sample, the sequence number of the sample before correlation, and how far the sample is from the trigger. You can use the question mark with correlated data to help you determine the offset value in the Memory Differences ± field of the format definition overlay of the State and Timing menus.

Memory Domain Indicator

A memory domain indicator located at the top of each display menu shows which part of acquisition or reference memory is currently displayed on the screen. Figure 3–30 shows the top of a display menu with an example of the Memory Domain Indicator field.

The data on the screen may represent only a fraction of the total acquisition memory (using the State menu) or it may represent an entire acquisition (using a horizontal magnification of 1 in the Timing menu).

Figure 3–30: The Memory Domain Indicator field (State Menu)

The size of the domain window tells you approximately what portion of the total data you see. In the Timing and Graph menus, the window size changes as you change the magnification (Mag) value. The position of the domain window tells you approximately where you are in the acquisition memory. It shifts as you scroll through data. A T is displayed in the Memory Domain Indicator field to show the location of the trigger event. Its position reflects your choice of trigger positions in the Trigger menu.

Correlated Modules Data Display

In a module cluster, the data from all time correlated modules are displayed in a single window. Also, the State and Timing menus allow you to suppress the display of data from selected correlated modules. Refer to *Module Suppression* on page 3–82 for instructions on how to suppress the display of correlated module data.

Displays containing data from more than one module look and function similar to displays containing data from one module.

There are some cases where the accuracy of correlated modules is limited. The limitations are as follows:

- Correlation accuracy is reduced whenever correlation is across DAS mainframes.
- Correlation may be inaccurate when there are few or no samples stored in one of the modules in a correlated set.
- Correlation with 92A16 Modules is only accurate with the direct correlated module; correlation with other modules within the correlated set will be less accurate.
- Correlation accuracy is reduced by the number of modules physically installed between a 92A16 Module and the direct correlated module.
- Correlation accuracy is reduced if you manually stop the acquisition.
- The 92A16 Module samples should be completely overlapped by the memory of the direct correlated module; correlation of 92A16 Module samples outside the overlap regions and near the beginning and end of memory may be inaccurate in many cases.

- When triggering a 92A16 Module in a DAS expansion mainframe with a signal from a 92A96 Module in the DAS master mainframe, the correlation relationship between the acquired data in the state display is incorrect.
- When correlating a 92A16 Module in one DAS mainframe with a 92A96 Module in another DAS mainframe, there is a correlation error of about 20 ns. Also, even when the 92A96 Module is in the same mainframe, the correlation error could be up to 15 ns.

Trigger Labels

The trigger position for all correlated modules is labeled in the displayed data of the State, Timing, and Graph menus.

For State and Timing menus, the main module trigger is labeled with a white T. All other module triggers are labeled with a gray T. For Graph displays, the main module trigger is displayed in white for the first group, red for the second group, and blue for coincident triggers.

If you stop the acquisition before the trigger condition is filled, a "stop" trigger is placed at the end of the acquisition memory.

Acquisition Parameters

You can use the State and Timing menus to display a set of acquisition parameters. These parameters are turned on and off from the format definition overlays. The acquisition parameter information includes the final status of any counters or timers used and the Latched Data label, if Latch mode was turned on in the Config menu. The final value of a counter or timer is Event when it is used as an event (rather than an action) in the trigger program.

Figure 3–31 shows what these acquisition parameters might look like (without the Latched Data label enabled). These fields can be displayed in the State and Timing menus.

Figure 3–31: Acquisition Parameters (State Menu)

Qualified Data

When you use storage qualification through the Trigger menu, time gaps occur between samples due to the qualifications. When this occurs, no gap appears in the sequence numbers of a State or Timing menu; however, a single gray bar can be displayed on the first sequence after the qualification gap to indicate that samples were qualified out. Turn this parameter on and off from the format definition overlays.

Memory Differences

Whenever you turn on Memory Differences in the State or Timing Format Definition overlays, your current data is compared with itself, another acquisition module, or with a specified reference memory. Differences are displayed as red characters in the source data.

User Marks

User marks let you keep track of the data samples that have a special significance in your application. You can place a mark on individual sequences of the State menu or on any column of the Timing or Graph menus. Use marks to make delta time measurements or to move quickly through the data by jumping from mark to mark.

To place a mark, position the cursor where you want the mark and select function key F4: MARK DATA. Then choose a mark label from the selection field.

When you place a mark, it is labeled with the next available letter from the set of letters A through M, and Δ. You can change the default label by selecting another letter from the list of available letters that displayed when you placed the mark. When you try to define more than 13 marks, the next (new) mark defined replaces the first (original) mark and assumes its label. This effectively moves the mark. You can also move a mark by reassigning its label.

You can remove marks with the Select Options function of the State, Timing, or Graph Format Definition overlay. While in the overlay, select function key F2: REMOVE MARKS to delete all marks.

If the Delta Time measurement feature is on, the Δ (delta) mark can be used in delta-time measurements.

User marks are associated with the data source rather than with a particular display. This means that a mark placed in one type of display appears in the same location for all displays of that data. You can turn the display of marks on and off in the format definition overlays.

If two user marks are placed on the same sample (row or column), the mark displayed is the one with the lowest letter in the alphabet. For example, if you marked a sample with a B and later marked the same sample with an E, only the B will be displayed as a user mark for that sample. The user mark E is still attached to the sample but is not visible.

When viewing the State menu with only the Timestamp group (no data) displayed, a user mark may not appear immediately after marking a sample. The mark will not be visible until you add at least one channel group to the display.

Delta Time

You can measure the delay time between any two data points (called Delta Time) by selecting the measurement reference points. For example, you can measure the time between the cursor and a mark you placed, or you can measure the time between the cursor and the trigger. In fact, you can select any of the following locations as the start- or end-point of the measurement:

- Cursor
- End Acq
- Trigger
- Δ Mark
- Beg Acq

When you select Δ (delta) Mark and no Δ mark exists, a message prompts you that one isn't defined and the reference is set to sequence 0.

The display and measurement reference point selections for Delta Time are accessed in the format definition overlays. The Delta Time readout is displayed at the upper-left of the State and Timing menus (see Figure 3–32). The measurement reference points can also be changed in the Delta Time readout start- and end-point fields. The delta measurement is given in time units (the smallest Delta Time possible for the 92A96 Module is 1.25 ns, which is rounded up to 2 ns in the menus). A minus (–) sign is placed before values where the first reference point is at a later sequence than the second reference point. When the 92A96 Module is correlated with a 92A16 Module (no timestamp), Delta Time may be displayed in cycles rather than time units.

State Menu

The State menu shows the values of the data samples for each channel group. The values are displayed in a columnar table.

When you select the State menu to display acquired data, its content and format are derived from your previous selections in the setup and display menus. For example, the groups shown in the State menu are those selected in the Channel menu.

Figure 3–32 shows a sample State menu.

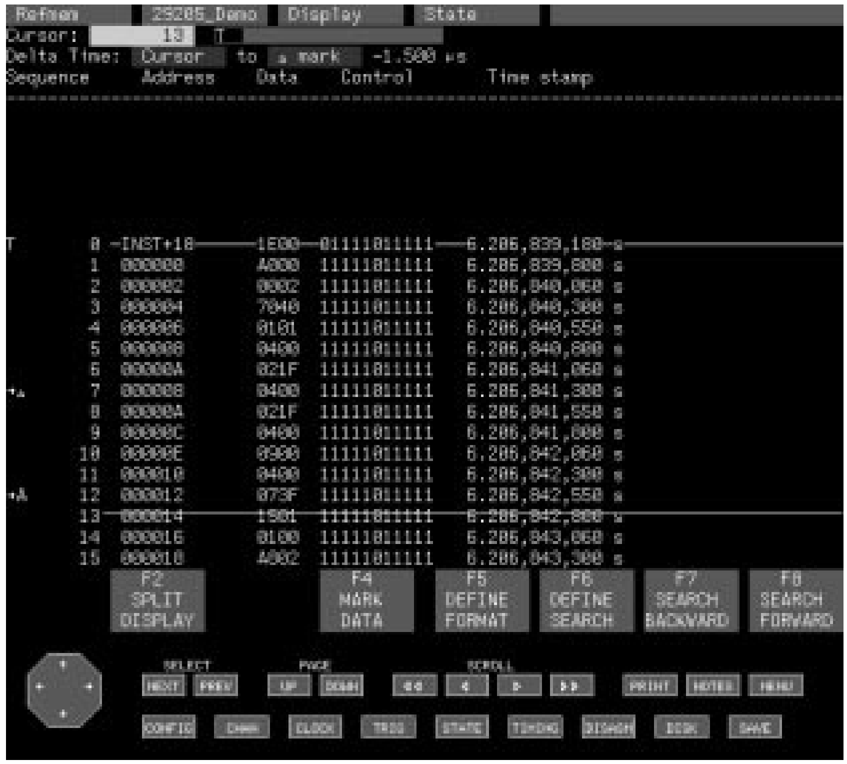

Figure 3–32: State Menu

The State menu has the following key fields and features:

- Cursor Sequence field. This field displays the sequence number of the data where the cursor is positioned. You can move the cursor to a new location by typing in a desired sequence number here, then pressing the Return key. The sequence number you enter appears in this field and the data is displayed around that location. You can also type in other characters as explained in the *Cursor Sequence Field* on page 3–71 and *User Marks* on page 3–75.
- Delta Time fields. These fields display the delta time between the selected measurement points. See *Delta Time* on page 3–76.
- Acquisition Parameters. When turned on, the acquisition parameters show the final value of any counters and timers and the Latched Data label (if data was acquired with latch mode on). See *Acquisition Parameters* on page 3–74 for more information.
- Sequence Numbers. The sequence numbers show the acquired data for each sequence. If there is a gap in sequence numbers, it indicates that you have suppressed a module(s) from the display of a correlated-module acquisition. See *Module Suppression* on page 3–82 for more information.

- Trigger Mark. The T shows where the trigger occurred in the acquired data.
- Qualification Gaps. Qualification gaps appear as gray highlighting and indicate that data samples were not stored due to storage qualification or Don't Store trigger actions. See *Qualified Data* 3–74 for more information.
- Timestamp Data. Timestamp data can be defined as TS_Abs (relative to the start of an acquisition), TS_Delta (relative to a delta mark), or TS_Prev (relative to the previous sequence). Timestamp values can be expressed in 1 ns increments. See *Timestamp* on page 3–79 for more information.
- F2: SPLIT DISPLAY Function key. This function key calls the Split-Screen Definition overlay that lets you split the display, define the size and content of each window of the split display, lock cursors between split displays, or return to a single menu display. See *Split-Screen Definition Overlay* on page 3–111 for more information.
- F4: MARK DATA Function key. Use this function key to place a mark at the cursor position. See *User Marks* on page 3–75 for more information on marking data.
- F5: DEFINE FORMAT Function key. This function key calls the State Format Definition overlay for the State menu. Refer to the *State Format Definition Overlay* on page 3–80 for information on using the overlay.
- F6: DEFINE SEARCH Function key. This function key calls the State Search Definition overlay for the State menu. After defining the search parameters use function key F7: SEARCH BACKWARD to search for data from the sequence before the cursor toward the first sequence number or use function key F8: SEARCH FORWARD to search for data from the sequence after the cursor toward the last sequence number.

Radixes

Radixes displayed in the State menu are based on the group radix values you selected in the Channel menu (Input Radix field). To change the group display radix values, use the Edit Groups function (Radix field) in the State Format Definition overlay.

You can select the symbolic radix format only if you have created a symbol table for the module you are using. A symbol table is composed of numeric values or ranges and symbolic names, each name associated with a value or range. Symbolic radixes are available for the State and Disassembly menus. Refer to *Input Radix* on page 3–15 for more information.

When you select a symbolic radix, enter the file name of the symbol table that the symbolic values or ranges are in. You can use one symbol table per group.

The 92A96 Module timestamp groups are displayed using special radixes. Timestamp radixes allow you to specify time measurements made relative to the start of the acquisition (TS_Abs), to a delta mark (TS_Delta), or to the previous sequence (TS_Prev). Timestamp radixes are available in the State and Disassembly menus.

If you encounter problems using the symbolic radix in the display menus, verify that you have the symbolic radix selected in the Channel menu as well as the State Format Definition overlay or the Disassembly Format Definition overlay.

Timestamp

The 92A96 Modules offer a feature called a timestamp. The timestamp is a timer that starts when you start the acquisition. The timestamp value is stored with every acquisition cycle; this value can then be displayed in its own column in the State menu. The timestamp has a resolution of 10 ns in General Purpose mode, 5 ns with a 5 ns or slower clock period selected in High-Speed Timing mode, or 2.5 ns with a 2.5 ns clock period selected in High-Speed Timing mode. The timestamp values round up to the nearest nanosecond.

Each timestamp value is displayed using a specific format. For example, a display that reads 2:4:6.111,222,335 s shows the time units are in seconds (the displayed units always correspond to the number immediately left of the decimal point). In this example, the sequence of numbers to the left of the decimal point (separated by colons) indicates 2 hours, 4 minutes, and 6 seconds. The sequence of numbers to the right of the decimal point (separated by commas) indicates 111 milliseconds, 222 microseconds, and 335 nanoseconds.

To add a timestamp group, perform the following steps:

1. Go to the State Format Definition overlay.

2. Select Edit Groups in the Function field.

3. Position the cursor on the group name field where the new group will be added.

4. Select function key F4: ADD GROUP.

5. Use the mouse or the scroll keys to highlight the timestamp selection.

6. Press the Return key. Figure 3–32 on page 3–77 shows how the timestamp is displayed in the State menu.

State Format Definition Overlay

Use the State Format Definition overlay to change the display format in the State menu. For example, you can set up delta time measurements or change the display order and radix of channel groups.

This overlay controls two major types of functions:

- Select Options. Use this function to specify measurement and display features.
- Edit Groups. Use this function to edit and reorder the group displays.

Select Options Function. Use the Select Options function to choose the measurement and display features you want. Figure 3–33 shows the fields and function keys when you choose Select Options in the State Format Definition overlay.

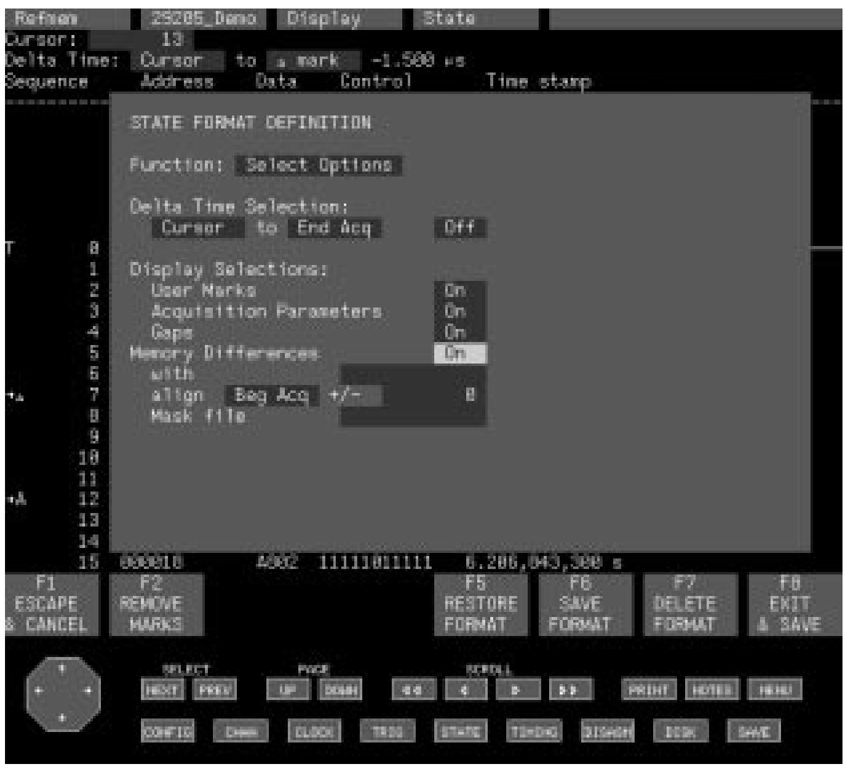

Figure 3–33: State Format Definition Overlay, Select Options Function

The State Format Definition overlay has the following fields and features:

- Function field. Use this field to select either the Select Options or Edit Groups functions of the overlay.

- Delta Time Selection. Use the these fields to turn the Delta Time measurement feature on and off and select the start and end points of the measurement. See *Delta Time* on page 3–76 for more information.

- Memory Differences. This field appears when you select Memory Differences On. It indicates the acquisition module or reference memory data file that will be compared with the current data source. The data width of the items being compared must match (for example, a reference memory compared with an acquisition memory). Memory differences are displayed as red characters in the source data.

- Align field. The Align field lets you align the samples of the displayed memory with the samples of the comparison memory starting at the first sample or at the trigger location.

  When you compare the differences between two memories and each has portions that do not overlap the other, the portions that do not overlap are not included in the comparison and do not show any memory differences. Acquisition memory depth, trigger position, and the alignment of the starting point for memory differences between the compare file and compare source can cause the memories not to overlap.

  For information on how to calculate the memory differences offset value for correlated data, refer to the description of *Memory Differences* on page 3–83.

- Memory Difference Offset. You can specify an offset value that is applied to each sequence of the selected compare file. The offset gives you a finer alignment than just using the beginning of an acquisition or the trigger position. A positive number is compared against later samples in the compare source. A negative number is compared against earlier samples in the compare source. For more information about how to calculate the offset for memory differences between correlated modules, refer to the description on *Memory Differences* on page 3–83.

- Mask File. The Mask File field lets you select a mask file to use during a comparison. A blank field indicates that the comparison between the selected module and the reference memory will not use a mask file. Presently, mask files are created on a host computer and downloaded to the logic analyzer.

- F2: REMOVE MARKS Function key. Use this function key to remove all user marks in the current active data window. Marks are associated with the display source rather than with a display type; if you remove the marks in one display, they are removed from all displays of that data in the same window. Marks cannot be restored using function key F1: ESC & CANCEL.

- F5: RESTORE FORMAT Function key. This function key displays a list of saved State display format files to restore. To select and load a previously saved format file, select function key F5: RESTORE FORMAT and select the saved format from the list. The selections for both State format functions (Edit Groups and Select Options) are restored. The default settings for the State format functions can be restored by selecting the Default item.
- F6: SAVE FORMAT Function key. Use this function key to save the selections made using the Edit Groups and Select Options functions of the State Format Definition overlay. Selections for both functions are saved on the hard disk. To save a file of the current state format selections, select function key F6: SAVE FORMAT and enter a file name.
- F7: DELETE FORMAT Function key. This function key displays a list of saved State display format files. To delete a format file, select function key F7: DELETE FORMAT and select the file to delete. To confirm the operation, press the Return key.

Module Suppression. You can suppress the display of data from one or more of the modules in a correlated set of modules by using the Select Options function in the State Format Definition overlay. Figure 3–34 shows the top part of a menu with the fields that appear when you correlate data from two modules. Displays of data from multiple modules look and function similar to displays of data from one module.

Figure 3–34: Module Suppression Fields (State Format Definition Overlay)

To suppress specific module data from the display, use one of the following methods:

- Select Suppress in the Module Suppression field of the State Format Definition overlay.
- Select a menu that applies exclusively to a single module.

For example, the Disassembly menu of any microprocessor support package contains data (sequences) from a 92A96, a 92A16, or a 92A60/90 module only. Data from other modules are not displayed (suppressed). If you were to look at the same data in the State, Timing, and Graph menus, data from the other modules would be present.

When sequences are suppressed, the remaining sequences are not renumbered. The gap in the numbers shows how many sequences are missing.

When acquiring data with multiple correlated modules, a master sequence number is generated for each sample that is acquired from any module in the correlated set. The number of the cursor position is displayed in the Cursor (sequence) field. If you suppress correlated modules from the display, the master sequence numbers for the remaining modules are not changed.

Memory Differences. When you use memory differences to display data from correlated modules, the offset is calculated before the data is correlated. When viewing correlated data, the sequence numbers reflect the sample position in the interleaved data. You cannot use the sequence numbers from correlated data to determine the offset value between the compare file and the compare source.

You can use the question mark (?) in the cursor field to view information about the sample that the cursor is positioned on before the data is interleaved for correlation. The information displays along the bottom of the screen and tells you which module acquired the sample, the sequence number of the sample before correlation, and how far the sample is from the trigger. You can use the question mark with correlated data to help you determine the offset value in the Memory Differences ± field of the State Format Definition overlay.

Edit Groups Function. Use the Edit Groups function to edit the display radix or to reorder the display of groups in the State menu. Figure 3–35 shows the fields and function keys that appear when you select Edit Groups in the State Format Definition overlay.

The fields above the dashed line make up the edit line. Use the mouse or the scroll keys to scroll through the list of channel groups and update the information in the edit line. Any change made to an Order or Radix field in the edit line appears in the channel groups listed below. Changes you make in the edit line do not appear in the State menu until you select function key F8: EXIT & SAVE.

The line cursor identifies the channel group to edit; numbering order starts at 0. For example, if you enter a 2 in the Order field, the remaining information for group number 2 appears and the line cursor moves to that order number.

The channel group names (set in the Channel menu) are listed under the Channel Name column for the channels assigned to that group. Each group can contain a maximum of 32 channels.

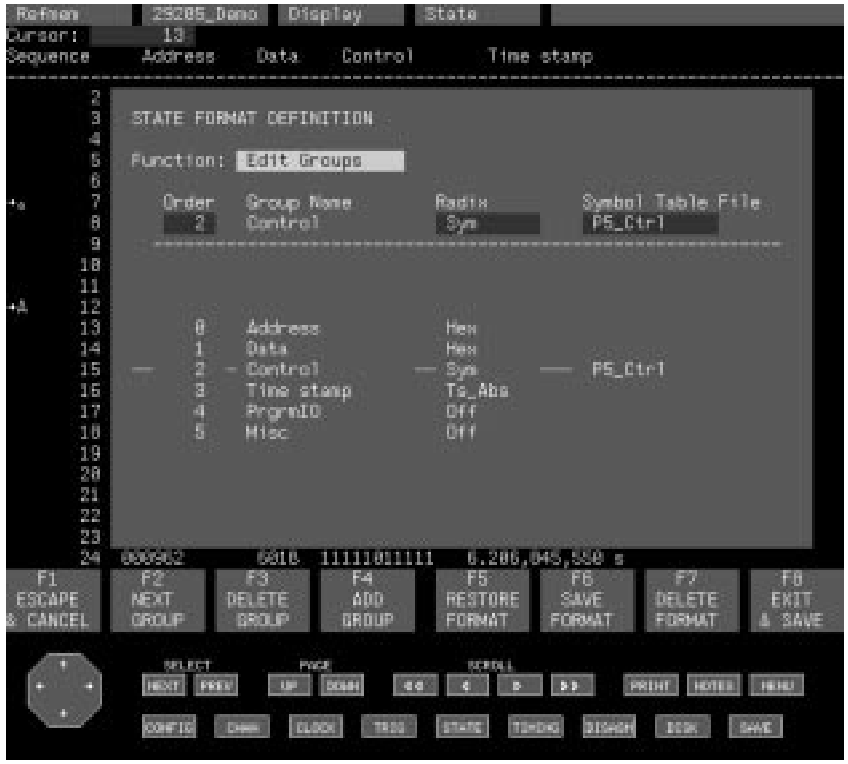

Figure 3–35: State Format Definition Overlay, Edit Groups Function

The Radix field lets you select the group display radix. Selections are Bin, Oct, Hex, ASCII, Sym, and Off. If you select Off, the group is not displayed.

When you add a timestamp group from the overlay, the group is assigned one of the following radixes: TS_Abs (absolute), TS_Delta, or TS_Prev (previous). The absolute radix specifies an absolute time measurement from the start of the acquisition. The delta radix specifies a time measurement from the delta mark to that sequence. The previous radix specifies a time measurement since the last sequence. If a measurement relative to the trigger is desired, place the delta mark on the trigger sequence and select the TS_Delta timestamp radix. All future measurements for that timestamp group will be relative to the trigger.

Use the Symbol Table File field to select the symbol table file for the group you are editing. You can use one symbol table per group.

Use function key F2: NEXT GROUP to insert the next default group after the line cursor. Use this function key to rebuild or reorder the default display order of the channel groups.

Use function key F3: DELETE GROUP to delete the group associated with the current position of the line cursor from the display listing. The deleted group still exists in the list of all possible groups. All groups move up one position in the order. The State menu does not update until you press F8: EXIT & SAVE.

Use function key F4: ADD GROUP to display a list of default groups from which you can select a group to add to the current group listing. The list can contain a maximum of 50 groups. The same group can be added to the list more than once. To add a group, position the line cursor on the group where the next group will be added, select function key F4: ADD GROUP, and select the desired group. All groups after the cursor are moved down one position and the selected group is added after the cursor.

State Search Definition Overlay

Use the State Search Definition overlay to search the State menu for selected parameters. When you define a state search, each search type has its own menu functions and associated fields. The search types are:

- Timestamp
- Memory Difference
- Value
- Qualification Gap
- Not Value

Examples of search type menus are shown in Figures 3–36 and 3–37 (Timestamp and Value, respectively), along with a description of their operations. The remaining search types are described after the Timestamp and Value types.

***NOTE**. Searches in correlated data sets apply to the main module (the card selected in the Module field of the Menu Selection overlay).*

Timestamp Search. Use the timestamp search type to find the data at a specified time. Figure 3–36 shows the fields and function keys that appear when you select Timestamp as the state search type.

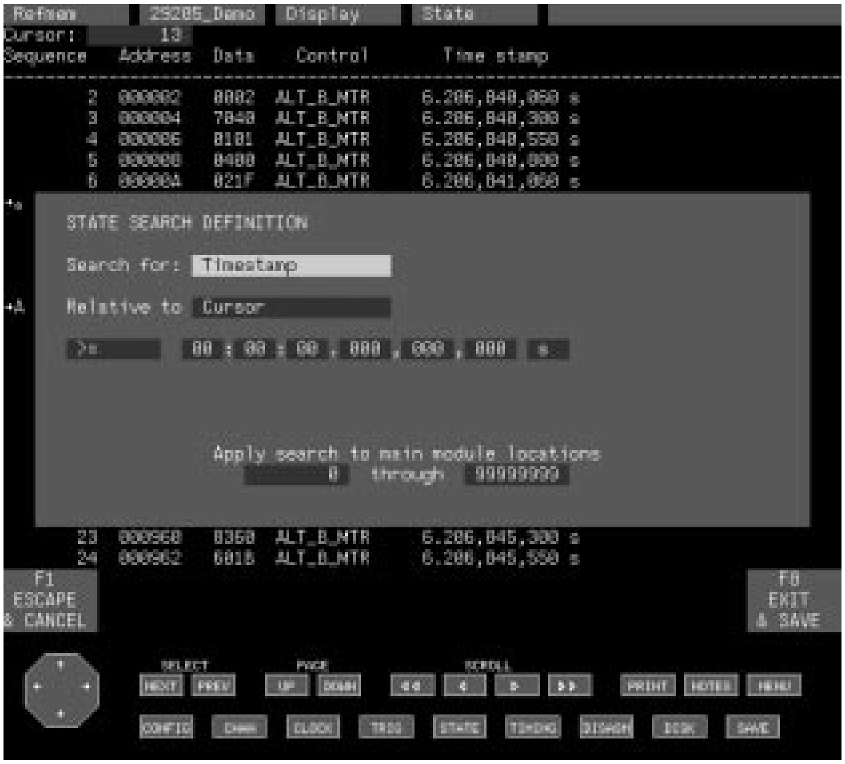

Figure 3–36: State Search Definition Overlay with the Timestamp Search Type

Use the Search Type field to select the type of search to perform. The Relative to field designates where or how to apply the search. The choices are relative to the cursor or relative to the previous sequence. Use the field directly below the Relative to field to qualify where to apply the search; either relative to the cursor or to the previous timestamp sequence. For Relative to Previous Timestamp searches, the choices are ≥ or ≤. For Relative to Cursor searches, the choices are ≥, ≤, or nearest.

The largest valid timestamp value allowed is 97:44:03.720,888,315 s (97 hours, 44 minutes, 03 seconds, 720 milliseconds, 888 microseconds, and 315 nanoseconds). However, the 92A96 Module only allows a maximum value of 48:52:01.860,444,400 s before it wraps back to 0.

Use the Search Range fields to specify the lower- and upper- bound sequences of the range you want to search. The default value is the entire acquisition memory.

To search for timestamps, select Timestamp as the current search type. Select either relative to the cursor or relative to the previous sequence. You can qualify the search by adding a condition (≥, ≤, or nearest) to the timestamp you specify. Timestamps do not need to be displayed during the search operation.

When you select Relative to the Cursor Searches, the logic analyzer looks for a user-specified timestamp relative to the timestamp of the sequence the cursor is currently on. For example, you can perform a search to find a timestamp nearest to 500 ns from the cursor. As you scroll the cursor and apply the search, the search will locate the first timestamp nearest to 500 ns from the cursor. If you use the ≥ qualifier in this example, the search looks for the first timestamp 500 ns or more away from the cursor. And, if you use the ≤ in this example, the search looks for the last timestamp sequence within 500 ns from the cursor.

When you select Relative to the Previous Sequences Searches, the logic analyzer subtracts the timestamp of the previous sequence from the timestamp of the current sequence. If the difference meets the qualified timestamp conditions, the search is successful and the cursor moves to that sequence. If the difference does not meet the qualified timestamp conditions, the search continues advancing through the acquisition data sequence-by-sequence until the search is either successful or fails (cannot find the specified timestamp).

The fill-in timestamp value fields are to the right of the qualifier field. Select one of four units of time to define the timestamp, from seconds to nanoseconds. The number of fields available for numeric entry decreases as the unit of time gets smaller. (You could not enter a time value as large as a second, a millisecond, or a microsecond if you selected nanoseconds. The nanosecond portion of a timestamp must be divisible by five.)

Because there are four units of time available, there is more than one way to enter some timestamp values. You can enter 20 milliseconds as 00:00:00.020,000,000 s (seconds) or 020.000.000 ms (milliseconds) because both values represent the same time interval. The leading pairs of zeros separated by colons in this example represent hours, minutes, and seconds (00:00:00).

Value Search. Use the Value search type to find a specific word value within a range of data sequences. Figure 3–37 shows the fields and function keys that appear when you select Value as the search type.

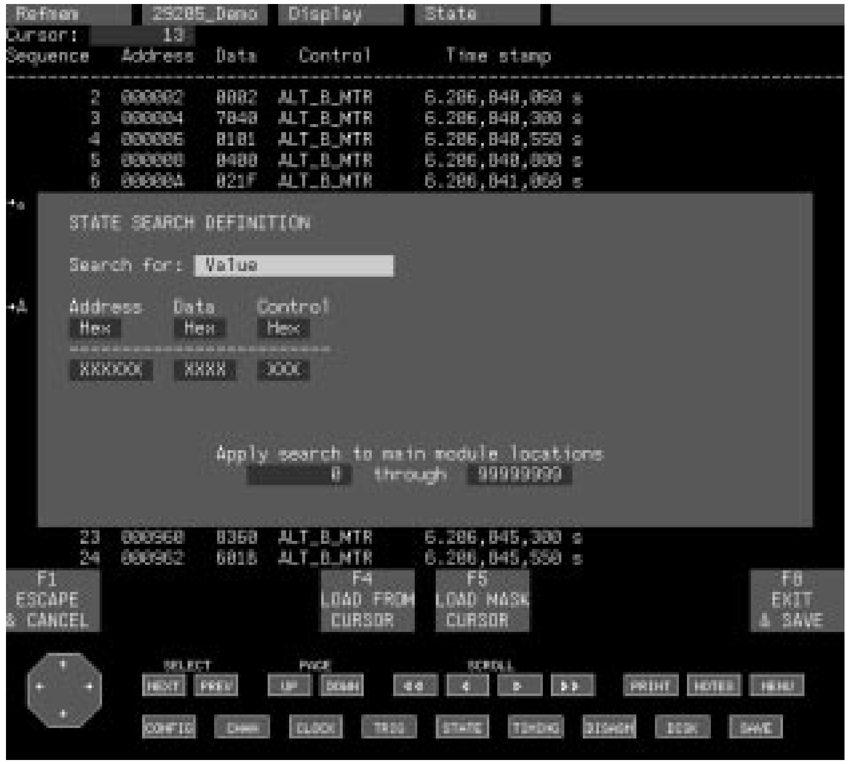

Figure 3–37: State Search Definition Overlay with the Value Search Type Selected

To search for a specific word value, select Value as the current search type. Then define a word value to search for and a range of data sequences to search in. Save the search parameters with function key F8: EXIT & SAVE. Select either function key F8: SEARCH FORWARD or F7: SEARCH BACKWARD to execute the search.

Use function key F4: LOAD FROM CURSOR to load the data values under the data cursor (corresponding to the main module) into the search value fill-in fields. The “don’t care” (X) mask entries are *not* retained. Function key F5: LOAD MASK CURSOR loads the data values under the data cursor (corresponding to the main module) into the search value window’s fill-in fields; however the “don’t care” (X) mask entries are retained.

Not Value Search. Use the search for Not Value to search for a sequence containing data that does not match the patterns entered in the search group fields. For example, suppose you have data group values that should be the same throughout acquisition memory, but you suspect there could be a different value occurring at some point in time. You can define the expected value for Not Value search and only the different sequence would be found.

Memory Difference Search. Use the Memory Difference as the current search type to locate the first data location in the source data that does not match the comparison data. Source data and comparison data can come from either an acquisition memory or a reference memory file. The search applies to the displayed data in the main module of a correlated set of modules.

This selection is valid only if Comparison Data is specified in the With field of the State Format Definition overlay. You have to turn on the Memory Differences display selection in the format definition overlay to enable a search.

Qualification Gap Search. Use the Qualification Gap as the current search type to locate the first occurrence of a data qualification gap in the main module's data. This selection is only valid when the main module in a correlated set of modules is a 92A96, 92A60/90 or 92A16. You do not have to turn on the Gaps display selection in the State Format Definition overlay to enable a search.

State Table Print Overlay

Use the State Table Print overlay to print the State menu. You can direct output (ASCII equivalent of the menu) to a printer connected to the RS-232C Auxiliary port or to a file. If you print to a file, you can use the Disk Services menu to access the file in the Print Output directory.

***NOTE**. When working with a split-screen menu, you can only print the active window of split-screen display.*

Figure 3–38 shows an example of the State Table Print overlay. Most of the fields and function keys of the overlay are similar to the Setup Print overlay. However, the State Print overlay also lets you specify a sequence number range where you can specify the beginning and ending sequence numbers of the data that you want to print. Function key F7: PRINT SETTINGS prints the State Table Print overlay settings, including the Output Specification fields.

For more information on the fields and function keys of the State Print overlay refer to the discussion of the fields and function keys of the *Setup Print Overlay* beginning on page 3–64.

Printing begins with two header lines containing the date, module type, user comments, and page number. The State display is printed beginning with the first group displayed on the left of the screen. Groups that are not visible on the left of the State display (scrolled off screen) are not printed. Groups that are not displayed on the right of the State display can be printed if the total number of characters per line specified does not exceed the printer paper width.

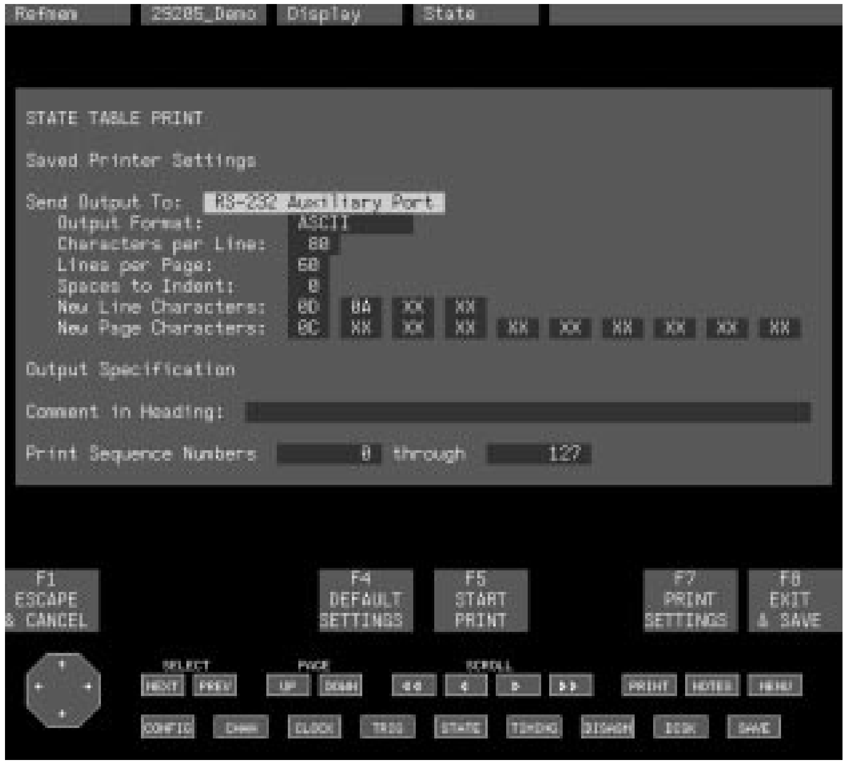

Figure 3–38: State Table Print Overlay

Printed data looks nearly identical to data displayed on the terminal screen. Printed data has the following format characteristics:

- The order of groups and their display radixes match the current selections.
- Color is not represented in the printed output; memory differences and gaps are not represented.
- A T in the far left column indicates the trigger position.
- A Q in the far left column indicates Qualified data (if any). A Q is printed only when gaps are turned on in the Format Definition overlay.
- The symbol > indicates that the data exceeds the specified line length (maximum 300 characters).
- If you define more characters per line than can fit on a page, the data prints either on the next line or runs off the page, depending on the type of printer.

Timing Menu

The Timing menu shows the values of the data samples for each individual channel in a digital (two-state) waveform. It also lets you see channel groups as bus values. The Timing menu is the best tool for determining the relative timing between individual channels.

The number of channels in a group determines the default format of the traces and bus forms in the Timing menu. By default, any single channel group is shown as a trace, any group with two to fifteen channels is shown as individual traces and in the form of a bus, and any group with sixteen or more channels is shown in the form of a bus. If you change the format of the Timing menu, all the default bus forms and channel traces are available as selections.

Figure 3–39 shows a sample Timing menu.

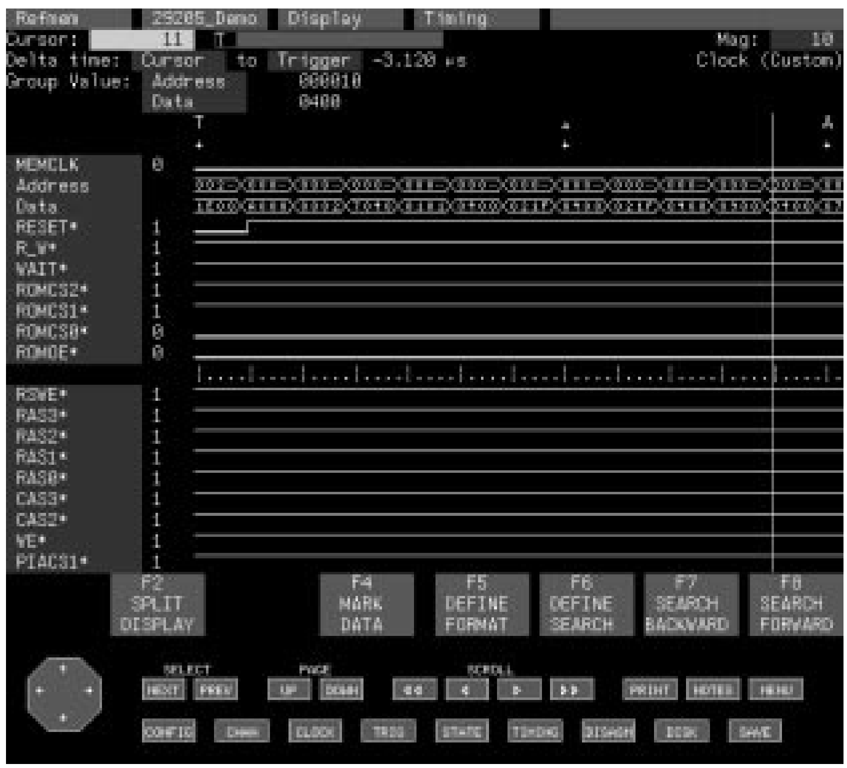

Figure 3–39: Timing Menu

The Timing menu has the following fields and features:

- Magnification field. This field controls horizontal magnification. At the highest magnification, a minimum of six samples are displayed in a screen. See *Magnification* on page 3–93 for details.

- Clock Mode field. This field shows the clock mode selected in the Clock menu for this module; possible modes are internal, external, and custom (for microprocessor support). If internal clocking is selected for the current acquisition, you can select a clock rate here and acquire data at the new sampling rate (rather than going back to the Clock menu to make the change). Clock selections range from 10 ns to 1 ms. The 2.5 ns and 5 ns clock rates are selectable when High-Speed Timing support is selected in the Config menu. In a split-screen display, changes to the Clock field are not shown in the inactive window until new data is acquired.
- Memory Domain Indicator. This graphic indicator shows which part of acquisition or reference memory is displayed. The T indicates the trigger position. See *Memory Domain Indicator* on page 3–72 for details.
- The Cursor Sequence field. This field displays the sequence number of data at the cursor location. You can scroll the cursor, or you can move to a new location by typing the desired sequence number, mark label, + number, – number, $, or a t (for trigger) in this field. See *Cursor Sequence Field* on page 3–71 for details.
- Delta Time fields. These fields display the delta time between the selected measurement points. See *Delta Time* on page 3–76 for details.
- Group Value fields. These fields display the value of the selected group at the cursor location. Select from the groups defined in the Channel menu.
- Acquisition Parameters. When turned on, the acquisition parameters show the final value of any counters and timers and the Latched Data label (if data was acquired with latch mode on). See *Acquisition Parameters* on page 3–74 for more information.
- User Generated Marks. These marks show the location of a mark. A mark is labeled with a letter A – M or with the Δ (delta). The delta mark can be used for delta time measurements. See *User Marks* on page 3–75 and *Delta Time* on page 3–76 for details.
- Trigger Mark. The T shows where the trigger occurred in the acquired data.
- Data Cursor. The data cursor appears as a thin vertical line.
- Trace Name. Shows the name of the trace. The default trace names are the channel names you assigned in the Channel Definition overlay or group derived. If you change the trace name in this select field, the selected trace name is displayed at this position. You can also insert blanks into your timing display by choosing the blank trace item.
- Vertical Readout. The vertical readout displays the value of each trace at the cursor position; either logic state 1, logic state 0, or blank (unknown). Turn vertical readout on or off in the Timing Format Definition overlay.

- Bus Values. Bus values displays the value of the channel group at each cycle. A bus value trace automatically appears for each channel group. You can select the bus value trace just like any trace. The value radix is always hexadecimal. Convergent line points indicate a transition in one or more of the channels within the group.
- Graticule. A dot, bar, or asterisk character horizontal line grid can be displayed for reference purposes. See *Graticule* on page 3–93 for details.
- Qualification Gaps. Qualification gaps appear as gray highlighting and indicate that data samples were not stored due to storage qualification or Don't Store trigger actions. See *Qualified Data* 3–74 for more information.
- F2: SPLIT DISPLAY Function key. This function key calls the Split-Screen Definition overlay that lets you split the display, define the size and content of each window of the split display, lock cursors between split displays, or return to a single menu display. See *Split-Screen Definition Overlay* on page 3–111 for more information.
- F4: MARK DATA Function key. This function key places a mark at the cursor position. See *User Marks* on page 3–75 for more information on marking data.
- F5: DEFINE FORMAT Function key. This function key calls the Timing Format Definition overlay. Refer to the *Timing Format Definition Overlay* on page 3–94 for information on using the overlay.
- F6: DEFINE SEARCH Function key. This function key calls the Timing Search Definition overlay. Define the search parameters and then use function key F7: SEARCH BACKWARD to search for data from the sequence before the cursor toward the first sequence number or use function key F8: SEARCH FORWARD to search for data from the sequence after the cursor toward the last sequence number.

Magnification

The Mag field is used to set the horizontal magnification factor for displaying data in the Timing menu (also in the Graph menu as described later in this section). A smaller magnification number gives more samples per location and more data samples in a single screen; a larger number gives higher resolution and fewer data samples in a single screen. For example, a Mag setting of 20 means that only 1/20 (one-twentieth) of the acquisition memory is currently displayed on-screen. The highest value depends on the size of the acquisition memory.

Graticule

A horizontal line grid, called a graticule, can be displayed for reference purposes. The grid marks indicate that a varying number of sample points are represented by each column in the display. A dotted line represents a continued sample at each column, a vertical bar represents individual sample points at each column, and an asterisk (*) represents multiple samples in each column.

If you use internal clocking, the distance between grid marks represents the amount of time specified as your internal clock rate. If you use external clocking, the distance between grid marks represents one clock cycle.

Turn the graticule on or off in the Timing Format Definition overlay.

Timing Format Definition Overlay

Use the Timing Format Definition overlay to make major format changes to the Timing menu.

This overlay controls two major types of functions:

- Select Options. This function lets you set measurement and display features.
- Edit Traces. This function lets you edit and reorder traces in the Timing menu.

Select Options Function. Use the Select Options function to choose the measurement and display features. Figure 3–40 shows the fields and functions when you choose Select Options in the Timing Format Definition overlay.

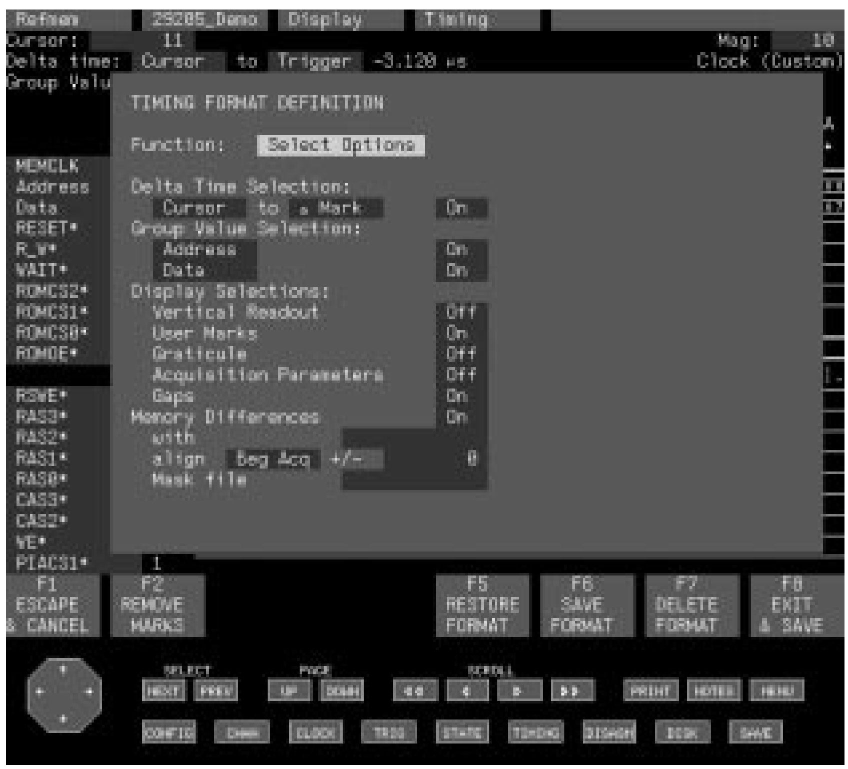

Figure 3–40: Timing Format Definition Overlay, Select Options Function

The Timing Format Definition overlay has the following fields and features:

- Function field. Use this field to select either the Select Options or the Edit Traces functions of the overlay.
- Delta Time Selection. Use these fields to turn the delta-time measurement feature on and off and select the start and end point of the measurement. See *Delta Time* on page 3–76 for details.
- Group Value Selection. Use these fields to select one or two groups in the Timing menu to display as state table values (in the current radix), rather than as timing waveforms. The displayed radix value is taken from selections made in the Channel menu, but can also be changed using the Edit Groups function in the State Format Definition overlay. To control the display of state values, select On or Off.
- Memory Differences. This field appears when you select Memory Differences On. It indicates the acquisition module or reference memory data file that is compared with the current data source. The data width of the items being compared must match (for example, a reference memory compared with an acquisition memory). Memory differences are displayed as red characters in the source data.
- Align field. The Align field lets you align the samples of the displayed memory with the samples of the comparison memory starting at the first sample or at the trigger location.

  When you compare the differences between two memories and each has portions that do not overlap the other, the portions that do not overlap are not included in the comparison and do not show any memory differences. Acquisition memory depth, trigger position, and the alignment of the starting point for memory differences between the compare file and compare source can cause the memories not to overlap.

  For information on how to calculate the memory differences offset value for correlated data, refer to the description of *Memory Differences* on page 3–83.

- Memory Difference. You can specify an offset value that is applied to each sequence of the selected compare file. The offset gives you a finer alignment than just using the beginning of an acquisition or the trigger position. A positive number is compared against later samples in the compare source. A negative number is compared against earlier samples in the compare source. For more information about how to calculate the offset for memory differences between correlated modules, refer to the description of *Memory Differences* on page 3–83.
- Mask File. The Mask File field lets you select a mask file to use during a comparison. A blank field indicates that the comparison between the selected module and the reference memory will not use a mask file. Mask files are created on a host computer and downloaded to the logic analyzer.

- F2: REMOVE MARKS Function key. This function key deletes all user marks in the active data window. After selecting this function key, confirm the deletion. You cannot restore marks with function key F1: ESC & CANCEL.
- F5: RESTORE FORMAT Function key. This function key displays a list of Timing display format files that you can restore. To restore a previously saved format file, select function F5: RESTORE FORMAT and select the saved format from the list. The selections for both timing format functions (Edit Traces and Select Options) are restored. The default settings for the Timing format functions can be restored by selecting the Default item.
- F6: SAVE FORMAT Function key. This function key saves the selections made using the Edit Traces and Select Options functions of the Timing Format Definition overlay. Selections for both functions are saved on the hard disk. To save a file, select function key F6: SAVE FORMAT and enter a file name.
- F7: DELETE FORMAT Function key. This function key deletes saved Timing display format files. To delete a format file, select function key F7: DELETE FORMAT and select the file from the displayed list. To confirm the operation, press the Return key again.

Edit Traces Function. Use the Edit Traces function to edit or reorder the display of groups in the Timing menu. Figure 3–41 shows the fields and functions that appear when you select Edit Traces in the Timing Format Definition overlay.

The fields above the dashed line make up the edit line. Use the mouse to scroll through the list of channel groups and update the information in the edit line. Any change made to an Order or Radix field in the edit line is reflected in the channel groups listed below. Changes you make in the edit line are not reflected in the State menu until you select function key F8: EXIT & SAVE.

The line cursor identifies the channel group to edit; numbering order starts at 0. For example, if you enter a 22 in the Order field, the remaining information for trace number 22 appears in the edit line and the line cursor moves to that order number.

The channel group names (set in the Channel menu) are listed under the Channel Name column for the channels assigned to that group. Each group can contain a maximum of 32 channels.

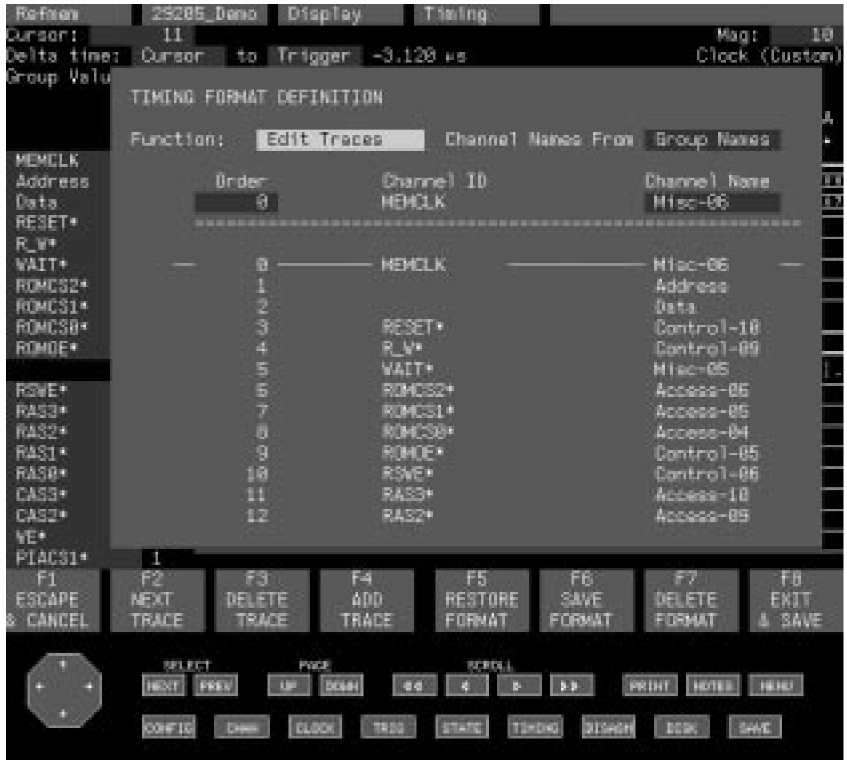

Figure 3–41: Timing Format Definition Overlay, Edit Traces Function

The default value of the group name matches the channel name you assigned in the Channel Definition overlay in the Channel menu or is group derived. You can rename a channel by typing the new name in the Channel Name field; however, group names are changed in the Channel menu. (Note: Changes made to group names in the Channel menu are not reflected in the Timing menu until the next acquisition.)

The Channel Name From field selects the source for channel names. The selection Group Names creates group-derived channel names and the selection Channel IDs imports channel names from the Channel Setup definitions for the acquisition (any default names are updated immediately). Channel names then appear in the trace name column of the main timing menu after you select function key F8: EXIT & SAVE. (Note: Any channel names you have assigned in the Timing menu retain their names.)

Function key F2: NEXT TRACE inserts the next default trace after the line cursor. Use this function key to rebuild the default display order of the trace listing.

Use function key F3: DELETE TRACE to delete the trace associated with the current position of the line cursor from the displayed listing. The trace, however, still exists in the list of all possible traces. The next trace in the listing becomes the new trace assigned to that position in the order. The Timing menu is updated when you press F8: EXIT & SAVE.

Use function key F4: ADD TRACE to displays a list of traces from which you can select a trace to add to the current trace listing. You can add the same trace to the trace listing as many times as you desire. To add a trace, position the line cursor above the trace line to be added and select function key F4: ADD TRACE and select desired trace. The highlighted trace is then added below the line cursor.

Timing Search Definition Overlay

Use the Timing Search Definition overlay to define searches you want to execute in the Timing menu. When you define a timing search, each search type has its own menu functions and associated fields. The search types follow:

- Timestamp
- Memory Difference
- Value
- Qualification Gap
- Not Value

The Timing Search Definition overlay works exactly like the State Search Definition overlay. Refer to the *State Search Definition Overlay* on page 3–85 for information on the overlay and how to search for data.

Timing Print Overlay

Use the Timing Print overlay to print timing waveforms for selected sequences. Timing print support differs from other print support in that the Timing menu is printed sideways on a page or strip of pages using a graphics or PostScript printer. Each strip contains up to 63 (34 for PostScript) traces per page for as many pages as are required to print the specified sequences. Sequence numbers are printed on the top and bottom of the page with the timing waveform for each signal extending from left to right.

Figure 3–42 shows an example of the Timing Print overlay.

Figure 3–42: Timing Print Overlay

In addition to the fields in the Setup Print overlay and the State Print overlay, the Timing Print overlay has the following fields and features:

- Output Format field. This field specifies the type of printer output format; the formats supported are the Epson FX (9 pin), Epson LQ (24 pin), PostScript, and IBM Proprinter-compatible.

***NOTE**. Timing menus (diagrams) are output in one of the graphic formats defined in the Output Format field. Your printer must be compatible in one of these formats.*

- Paper Width field. Use this field to specify the paper width; the possible widths are 8.5 inches and 14 inches. An 8.5-inch paper width will print 34 traces per strip of paper; a 14-inch paper width will print 63 traces per strip of paper. The PostScript output is limited to 8.5-inch paper width.
- Number of Traces field. Use this field to specify the number of traces to print, beginning with the trace at the top of the Timing menu. The number of traces to print includes any blank traces added with the Timing Format Definition overlay and any bus value lines.

- Skip Perforations field. Use this field to specify whether to insert blank spaces before and after page perforations. The default choice is “No.” If you specify PostScript as the output format, the Skip Perforations selection is forced to “Yes.”

Graph Menu

The Graph menu plots acquired channel group values against their locations in acquisition or reference memory. You get a visual overview of an acquisition for one or two selected groups. Some possible uses of the Graph menu follow:

- Plotting address values against their locations to see patterns in a program, such as, when the program jumps to the operating system or to error handling subroutines
- Saving a graph of a good system to compare to acquisitions from other systems
- Using two correlated 92A96 Modules to acquire data from two microprocessors, you can plot the address group data for both microprocessors to see where they are executing and when activity takes place between them
- Plotting the data groups from two microprocessors to see if data transfers take place properly
- Verifying a test suite that should exercise certain addresses in a section of code; you can quickly see the addresses that were not executed

Figure 3–43 shows a sample Graph menu using the Sample Point plotting mode (see *Sample Point Mode* on page 3–103 for an explanation of Sample Point mode).

***NOTE**. The Graph menu does not support split-screen displays or search operations.*

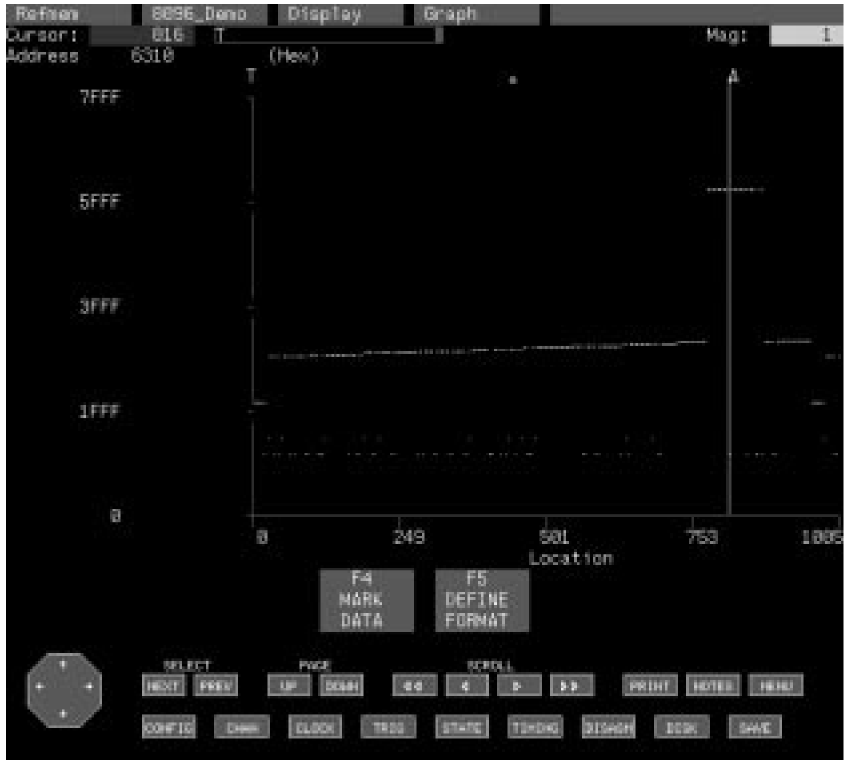

Figure 3–43: Graph Menu; Control Group Plot Using Sample Point Mode

The Graph menu has the following fields and features:

- Magnification field. This field changes the horizontal resolution of the display. Change the magnification to a higher value to show less data in greater detail; each point represents fewer samples. The highest value of magnification depends on the depth of the acquisition memory. The highest value shows one memory location per horizontal pixel.

  Change the magnification to a lower value to show more data in less detail; each point represents multiple samples.

- Memory Domain Indicator. The memory domain indicator shows which part of acquisition or reference memory is displayed. The T indicates the trigger position.

- Cursor field. This field displays the sequence number of data at the cursor location. At the highest magnification, the cursor represents only one sequence. At the lowest magnification, the cursor can represent multiple sequences; in this case, the lowest sequence number under the cursor is listed.

You can scroll the cursor or move to a new location by typing the desired sequence number, Mark label, + number, – number, $, or a **t** (for trigger) in this field, then pressing the Return key. See *Cursor Sequence Field* on page 3–71 for more details.

- Channel Group Name and Value fields. These fields show the name and value of each displayed channel group at the cursor location. When one group is displayed, all group-related information is shown in white. If a second group is simultaneously displayed, its group-related information is shown in red. Plotted points that represent the intersection of data from group one (white) and group two (red) are displayed in blue.
- Trigger Mark. The Trigger mark shows where the trigger occurred.
- User Generated Marks. User marks show the location of a mark. See *User Marks* on page 3–75.
- Data Cursor. The data cursor is represented by a thin vertical line.
- Axis. The horizontal axis shows the memory locations of the samples being plotted. The vertical axis shows the group values of the samples being plotted. Use the Graph Format Definition overlay to control the range of values shown in the vertical axis.
- Function keys. Use function key F4: MARK DATA to mark the current cursor position. See *User Marks* on page 3–75. Use function key F5: DEFINE FORMAT to call the Graph Format Definition overlay. The overlay lets you select different groups for plotting; the group data range, and the plotting mode. Other function keys operate the same as in other menus.

Graph Format Definition Overlay

Use the Graph Format Definition overlay to select the channel group(s) you want to display and the range of group values you want to see. You can also use the overlay to set the plotting mode. Figure 3–44 shows an example of the Graph Format Definition overlay.

The Channel Group Range fields specify the range of values you want to plot for each selected channel group. You can have different value ranges for each group. For example, you might want to plot the full range of values from a data group against a limited range of values from an address group. Range values are displayed in hexadecimal and octal formats. You can change the radixes using the State Format Definition overlay.

The Channel Group Name fields specify the group(s) you want to see. You can select any groups (except for groups with 0 channels) from the Channel menu of the data sources you are using. To remove a group from the display, select None.

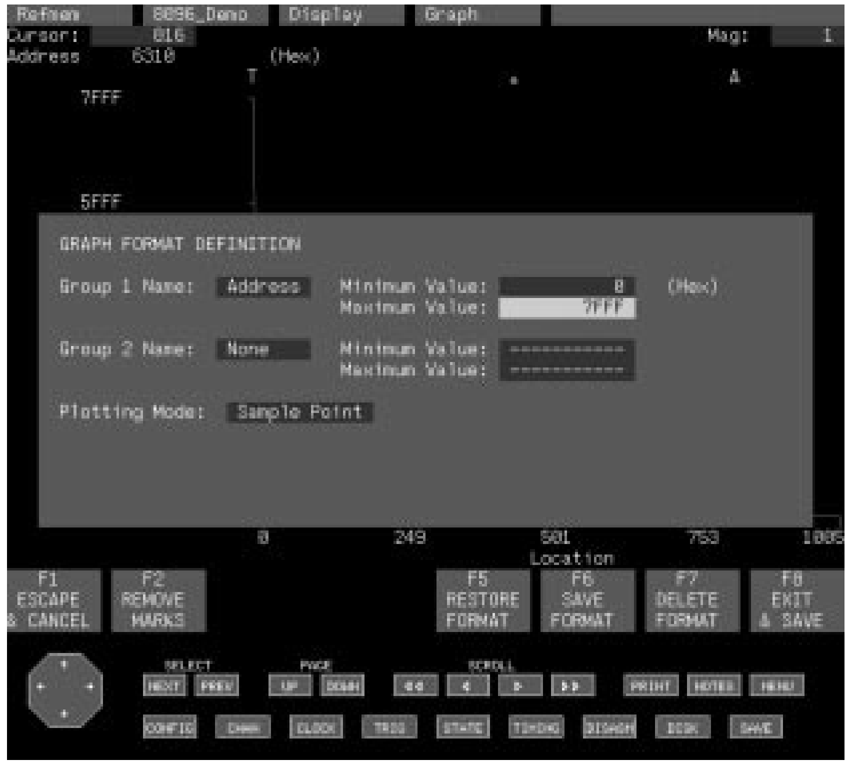

Figure 3–44: Graph Format Definition Overlay

The Plotting Mode field specifies the mode in which the acquisition or reference memory locations are plotted against the group values. Sample Point plots sampled data in a dot format. Range Bar draws a vertical line between the minimum and maximum group values plotted for each representative range of acquisition or reference memory locations.

The function keys to the overlay operate similar to those in the State and Timing Format Definition overlays.

Sample Point Mode

The Sample Point mode plots acquisition or reference memory locations (in a dot format) against group values.

Acquisition memory locations are plotted evenly across the horizontal axis of the screen. Several memory locations may be represented by each point, depending on the selected magnification factor. Group values are plotted on the vertical axis according to their magnitude; you can also plot non-quantitative group values (for example, a group representing control lines).

Since only one sample point or dot can be plotted for each representative memory location, other samples included in the range of memory locations are not shown. Therefore, the Sample Point display shows a sampling of all possible points and does not provide the most accurate resolution for displaying data until you select the highest power of magnification available (the highest magnification plots only one acquisition memory location per pixel column across the horizontal axis of the screen).

Due to the nature of the sample point display mode, there may be several data points not displayed for each pixel column. Without using the highest magnification factor you cannot be sure whether data points that are not displayed are actually missing. They could be missing because of an actual lack of data or because of the way in which a representative sample was picked for display.

Range Bar Mode

Use the Range Bar mode to see the range of group values for a range of memory locations (see Figure 3–45). Since a horizontal pixel usually represents multiple group values (except at the highest magnification), the Range Bar mode draws a line between the maximum and minimum group values (on the vertical axis) represented by each horizontal pixel column and plots it against its memory location (on the horizontal axis). At the highest horizontal magnification (one data point per pixel column), the the Range Bar mode is equivalent to the Sample Point plotting mode.

If both the minimum and maximum points are outside of the display range, the vertical line stretches the entire height of the data display area. This can be misleading when these two points are plotted, causing the display to appear as though there may be additional group values between these two points. To determine if there is additional data, increase the magnification to the highest number possible and display one memory location per horizontal pixel column.

Figure 3–45 shows Data group values in the Range Bar plotting mode. This example shows all Data group values plotted against their locations in acquisition memory. The number of points represented in each horizontal pixel column depends on the magnification level.

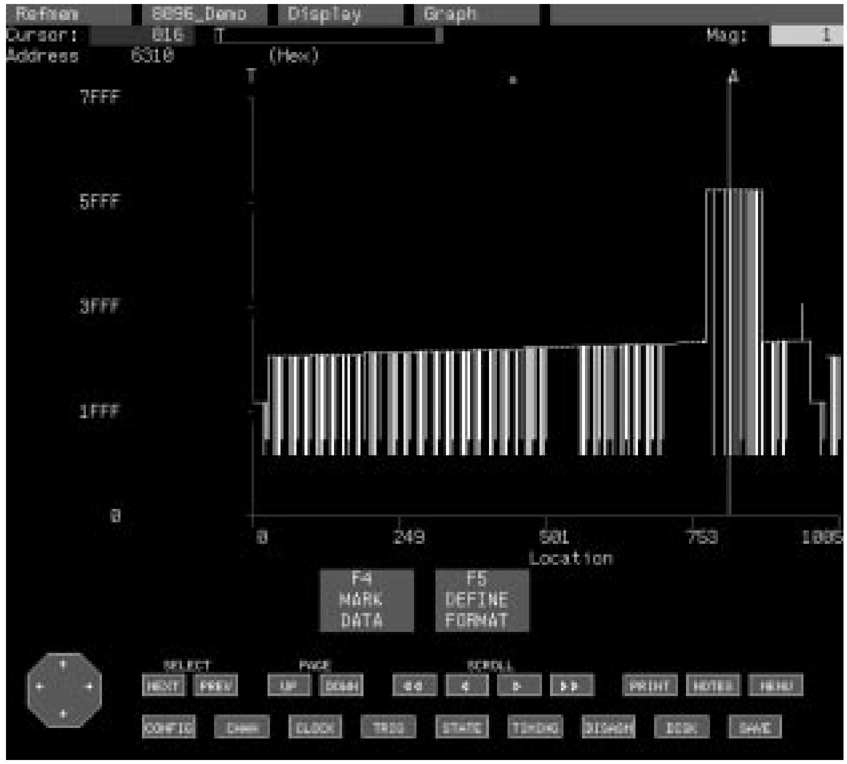

Figure 3–45: Graph Menu; Data Group Plot Using Range Bar Mode

Disassembly Menu

The Disasm (disassembly) menu for General Purpose support provides basic, generic microprocessor disassembly support. It shows the data samples for the Address (bus), Data (bus), and Control (signals) groups in a table format. Instruction mnemonics from the Control group that identify cycle types are displayed in the Mnemonics column. Data group mnemonics are displayed in the Mnemonics column on cycles when the symbolic Control group value is FETCH.

A Disassembly Format Definition overlay lets you define the display to make it more useful in your particular application. For example, you can define a hexadecimal or symbolic display radix for the Address group or choose whether you want to display the timestamp values for all data sequences.

The contents of the disassembly table are derived from your definitions in the Config and Channel menus; they are derived from symbol tables you create for the Control and Data groups with the Symbol Editor menu. Control group or Data group values are shown in the Mnemonic column in the menu.

Figure 3–46 shows an example of the General Purpose Disasm menu.

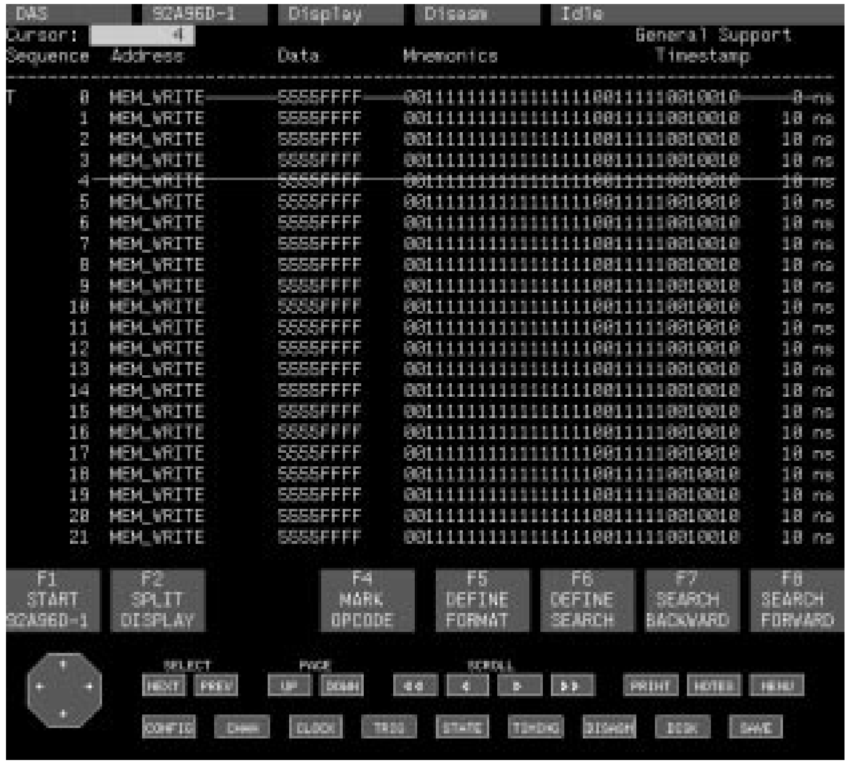

Figure 3–46: General Purpose Support Disassembly Menu

The Disassembly menu has the following fields and features:

- Cursor field. Displays the sequence number of data at the cursor location.
- Sequence column. The sequence column shows the sequence numbers of the displayed data.
- Address Group. The Address group shows the address bus data. Use the Format Definition overlay to select a hexadecimal or symbolic radix.
- Data Group. The Data group shows the data bus data in hexadecimal radix only.
- Mnemonics Column. The Mnemonics column shows the binary value of the Control group-and nothing else if no symbol exists for the Control group value. If a symbol exists for the Control group value, it is displayed (in parentheses) beside its binary value.

  If you see the Control group symbol FETCH in the Mnemonics column, you do not have a symbol table defined for the Data group. The binary or symbolic value for the Data group is displayed next to the Control group binary value, instead.

A “>” symbol at the end of a Mnemonics column row indicates the symbol or value was truncated (no more character space).

- Timestamp Group column. The timestamp group shows the timestamp value for each sequence.

The function keys for the Disassembly menu operate similar to those in the State menu.

Creating Symbol Tables for General Purpose Disassembly

You must create symbol tables for the Control group and for the Data group in order to provide disassembly of the system under test. You can also download a symbol table from a host computer.

To use symbol tables, follow these steps:

1. Move to the Channel menu and create at least these three groups: Address (bus), Data (bus), and Control (signals). The group names must be exactly as written here. The Control group should contain the signal lines (channels) necessary to identify cycle types (instruction fetch, memory read, memory write, etc.).
2. Go to the Symbol Editor menu and create a pattern symbol table for the Control group with symbol names and bit patterns that identify the cycles types. The symbol for an instruction fetch must be named FETCH (all capital letters because this is a reserved symbol).
3. Create a pattern symbol table for the Data group with symbol names and bit patterns that identify instruction opcodes. You can be general (for example, ADD 01XXXXX to match all variations of ADD instructions) or specific (ADD_R0_R1 0100 0001, ADD_R0_R2 0100 0010).
4. Go to the Channel menu and select the symbolic radix and specify the appropriate symbol table file for both the Control and Data groups.

After completing these steps, acquiring data, and moving to the Disasm menu, you should see Data group symbol names displayed in the Mnemonics column for FETCH cycles next to the Control group value displayed in binary. For all other cycles, you will see the appropriate Control group symbol.

You can interactively add new symbols representing opcodes to the disassembler by toggling between the Disam menu and the Symbol Editor menu and adding new symbols for opcodes not displayed symbolically.

Disassembly Format Definition Overlay

Use the Disassembly Format Definition overlay to select the display radix for the Address group, to select whether and how to display the timestamp for the data sequences, and to select whether to show or suppress the display of disassembly data for a specific range of acquisition memory locations (see Figure 3–47).

Figure 3–47: Disassembly Format Definition Overlay

The Disassembly Format Definition overlay is described in detail in the Disassembler Instruction manuals that accompany various microprocessor disassembler application software packages. The field selections for the overlay of the General Purpose Disassembly menu are a subset of the fields of specific microprocessor packages.

The Disassembly Format Definition overlay has the following fields and features:

- Mode field. Hardware disassembly is the forced disassembly mode.
- Register Display field. The display of registers is forced off.
- Scroll By field. This field shows that scrolling through data is by memory location. This is the only selection enabled.
- Address Radix field. This field specifies the radix of the Address group (bus), hexadecimal or symbolic. If you select symbolic, a field appears to enable selection of the symbol table file.
- Timestamp Display field. This field enables display timestamps of data and determines whether the values are absolute (with respect to acquisition start) or relative (to the preceding sample).

- Highlighting field. The Highlight function is forced off.
- Display Operation. This field specifies whether to show or suppress the display of particular disassembly data (refers to address bus values). The default is all possible address bus values.
- Range of Display. These fields specify the range of address bus values to show or suppress.
- Add Display Operation field. This field specifies additional display operations for other address bus ranges. This allows focused views of particular address ranges (up to three).

Disassembly Search Definition Overlay

Use the Disassembly Search Definition overlay to set up a search in the Disassembly menu for a bus value or a range of bus values on the address or data buses (see Figure 3–48). You can also specify the range of sequence numbers from which to search for specific values. Function keys F7 and F8 in the Disassembly menu execute the search.

To search forward through acquired data, enter the beginning range sequence number in the Cursor field, close the overlay with function key F8: EXIT & SAVE, and then select function key F8: SEARCH FORWARD. To search backward through acquired data, enter the ending range sequence number in the Cursor field, close the overlay, and select function key F7: SEARCH BACKWARD.

The Search Definition overlay also lets you save search patterns in a format file. This is useful if you want to search for values or ranges on a regular basis. Use function key F6: SAVE SEARCH to save a search pattern in a format file. You can use function key F5: RESTORE SEARCH to restore a previously saved search format file. To delete a search format file use function key F7: DELETE SEARCH.

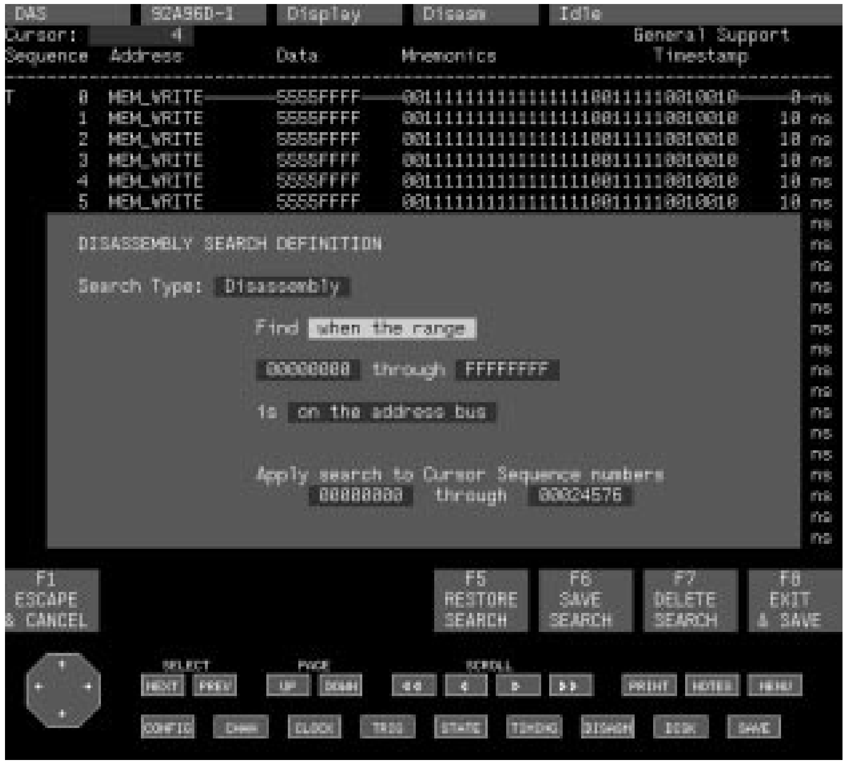

Figure 3–48: Disassembly Search Definition Overlay

Disassembly Print Overlay

The Disassembly Print overlay lets you specify printer output settings to use while printing disassembly data. This overlay operates like the Setup Print overlay. Refer to *Setup Print Overlay* on page 3–64 for instructions on how to use the print overlay.

There is one notable feature addition to this print overlay. Select Yes in the Print Overlay field (an Output Specification) to print the Disassembly Format Definition overlay before and in addition to the Disassembly menu.

Figure 3–49 shows an example of the Disassembly Print overlay.

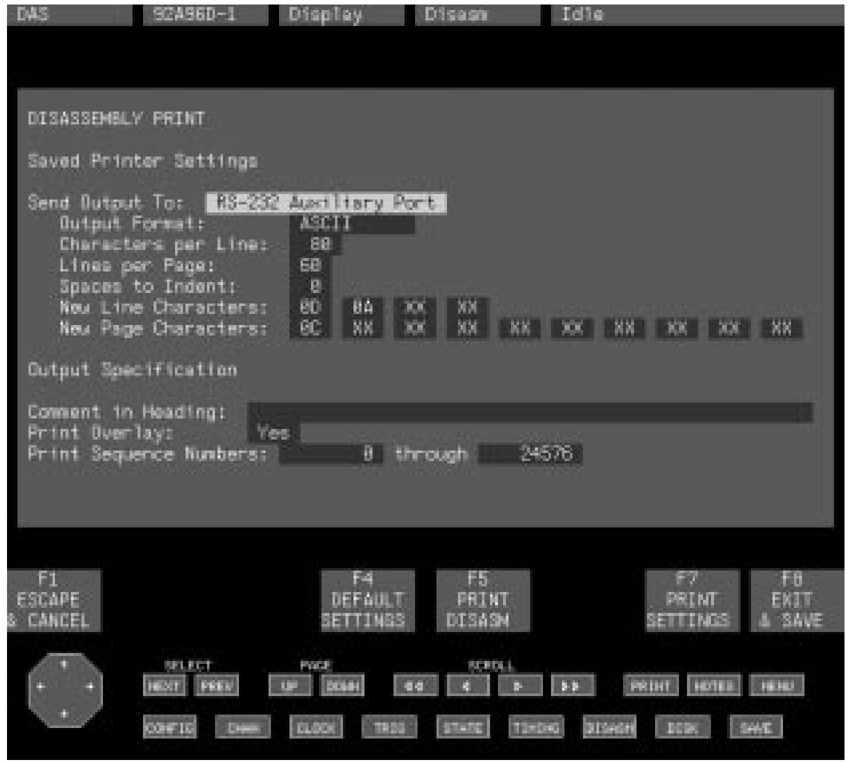

Figure 3–49: Disassembly Print Overlay

Split-Screen Definition Overlay

The Split-Screen Definition overlay lets you split the display vertically or horizontally, dividing it into two data windows. Each window has its own cursor and user marks, and can have its own source of data and its own display type. When you split the display, you can switch windows freely, making one active and the other inactive.

The overlay can be called from the State, Timing, or Disassembly menus; however, you cannot split the Graph menu. Use function key F2: SPLIT DISPLAY to call the Split-Screen Definition overlay from one of the display menus.

Possible uses of a split-screen display include the following:

- Look at two different areas of an acquisition at once. For example, you can use State menus to display the start of an acquisition in one window and the end of the acquisition in the other.
- Look at two different types of display menus for one acquisition. For example, you can display the same data in both State and Timing menus.

- Compare two different acquisitions. For example, you could compare State menu displays for acquisitions from two different 92A96 Modules.

Use the overlay to select a module and display type for each window. As with regular displays, when you select a module from a cluster, data from all correlated modules is brought into the display. (You can use the State or Timing Format Definition overlay to suppress data from unwanted modules). All appropriate format definition and search definition overlays are available from either window of a split display.

Figure 3–50 shows the Split-Screen Definition overlay. This example shows the state menu of an acquisition memory about to be viewed next to the Timing menu of a the same module.

Figure 3–50: Split-Screen Definition Overlay

The Split-Screen Definition overlay has the following fields and features:

- Active Window label. This label shows the active window of the display. If you exit the overlay to a split display, you can scroll the data in the active window. If you exit the overlay to a display that is not split, the display will show the last Active window.

- Scroll Arrows. When arrows appear at the top or bottom of the Module column, there are more modules or reference memories available off the screen; use the mouse or the cursor movement keys to scroll to the selections off the display.

- Module and Display Columns. Each window has its own set of Module and Display columns. Use the module columns to select the module, cluster, or reference memory from which you want to display data in each window. For correlated data sets, all modules are listed under the refmem or cluster name. You can select which of these will be the main module (since most operations apply only to the main module, like searches) in the Module or Refmem field of this overlay.

  Use the Display column to select the State, Timing, or Disassembly display for each window.

- Split Indicator. This indicator shows where the split falls. Select function key F5: SPLIT HORIZ to split the display horizontally or function key F6: SPLIT VERT to split the display vertically; the indicator appears after you select one of these function keys.

  Use the mouse or Press one of the Adjust function keys (F3 or F4) to adjust the space given to each window in either vertical or horizontal split.

- F2: LOCK CURSORS Function key. This function key causes the data cursors in each window to follow each other on a sequence-by-sequence basis. (Scrolling 10 sequence numbers in one window causes you to scroll 10 sequence numbers in the other window.) Function key F2: UNLOCK CURSORS takes you out of the locked-cursor mode.

- F7: UNSPLIT DISPLAY Function key. This function key removes the field that lets you adjust the space given to each window. If you exit the overlay when no split adjust field is shown, you will return to the active window in an unsplit display.

Figure 3–51 shows a vertically split display. The position of the dividing line depends on how you split the screen.

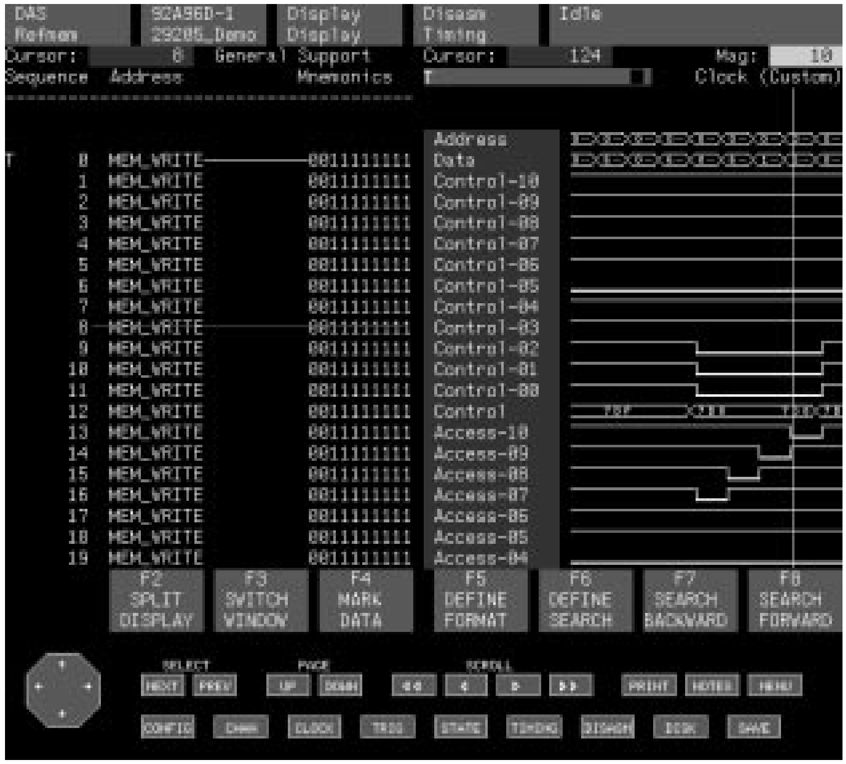

Figure 3–51: Vertically Split Display

Split-Screen Display Sizes. The total display area is 80 columns wide and 26 rows deep. The default vertical split is 40 columns for the left half and 39 columns for the right half (40–39). Each half can have as few as 20 columns (20–59).

The default horizontal split is 13 rows in the top half and 12 rows in the bottom (13–12). Each half can have as few as 6 rows (6–19).

Figure 3–52 shows a horizontally split display. All appropriate Format and Search Definition overlays are available from either section of a split display.

When you split a display, function key F3: SWITCH WINDOW is added to both windows. This function key lets you move from one window to the other. The window that you move to becomes the active window.

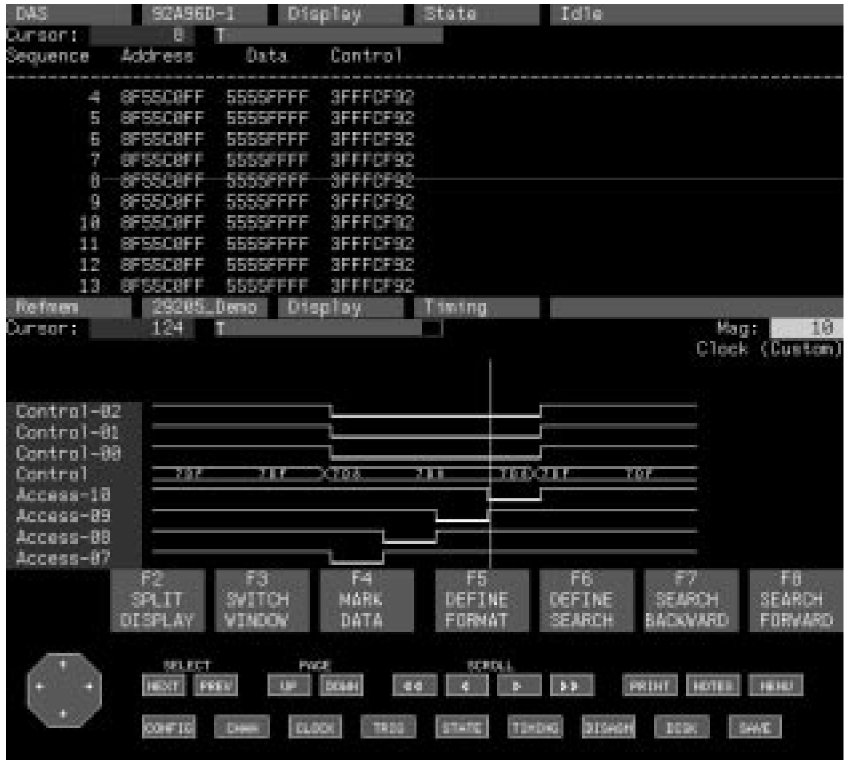

Figure 3–52: Horizontally Split Display

Split-Screen Scrolling. As with single-window displays, split-screen scrolling follows sequence numbers. You can lock or unlock the cursors to scroll data in a split display.

When you lock cursors, moving the cursor in one window causes the cursor in the other window to move an equal amount of sequence numbers. For example, moving the cursor in one window 10 sequences causes the cursor in the other window to move 10 sequences.

When you select different data sources within the split overlay, cursors automatically lock at their current positions and scrolling is relative to the active window's position. When you use the same data source in both display windows, a pop-up menu appears that allows you to choose between lock cursors at the same sequence or lock cursors at the current positions. No pop-up menu is available if one of the data sources is not time-stamped (for example, a non-correlated refmem).

When you lock cursors at the same sequence, you effectively time-align the data cursors from each display window. This repositions the inactive window cursor to the same sequence number as the cursor in the active window. This mode is only available when you view data in both halves of a split display from correlated modules within the same cluster or when you view data from the same module.

NOTE. *Changing to different data sources in the display windows unlocks the cursors and displays a warning message. However, when you change the data source from the Menu Selection overlay, the cursors are unlocked but no warning message displays.*

When you lock cursors at the current positions, the cursor in the inactive window is not repositioned. The cursor is locked at its current position and scrolls relative to the active window’s position.

If you unlock cursors, cursor movement in one display window has no effect on the other display window. Switching the active window between display windows does not move the cursors.

High-Speed Timing Support

In addition to providing general purpose data acquisition operation and microprocessor disassembly support, the 92A96 Module provides special high–speed operation called High-Speed Timing support.

High-Speed Timing support can acquire data at faster internal sampling rates than General Purpose support. You can acquire data at 200 megasamples per second (5 ns) sampling rate or at 400 megasamples per second (2.5 ns) sampling rate. High-Speed Timing support also doubles the effective acquisition memory for clock settings at 5 ns (or slower rates) and quadruples the effective acquisition memory at the highest clock setting, 2.5 ns. The faster sample rate and the increased memory depth enable higher resolution timing analysis.

When you select the higher sampling rates, the number of available acquisition channels in a single 92A96 Module is reduced to 48 channels at 5 ns and 24 channels at 2. 5 ns. You can have more channels by using additional 92A96 Modules in adjacent DAS slots to create a multimodule formation. If you have a TLA 520 Logic Analyzer you can use two modules instead of a single card module.

While various operating details of High-Speed Timing support are described elsewhere in this manual, this section focuses on the setup, acquisition, and display considerations you will encounter when choosing this software support. Specific areas of consideration follow:

- sample rate
- memory depth
- number of available channels

Setup Considerations

When you select High-Speed Timing support in the Config menu, the modules are placed into a special timing mode and makes several changes in the Setup menus.

***NOTE**. Unless specifically stated in this section, all setup menu fields and parameters are identical to those in General Purpose support.*

Configuration Menu

Select High-Speed Timing support in the Software Support field of the Config menu (see Figure 3–53). Changing the software support automatically changes the Clock and Trigger menus to their default values for High-Speed Timing support. A message asks you to confirm your selection when you change the Software Support field.

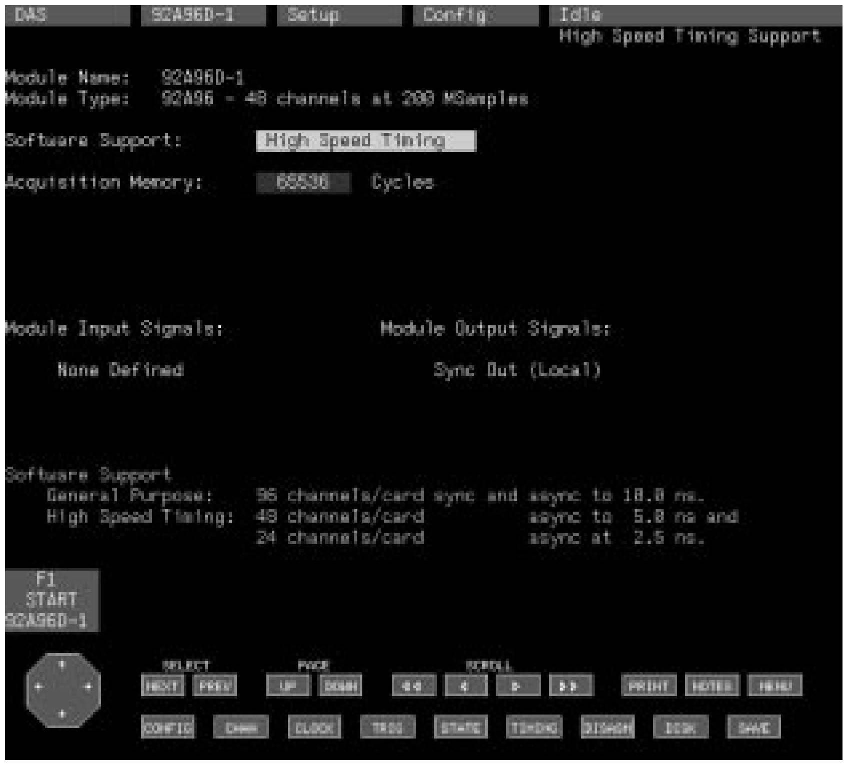

Figure 3–53: High-Speed Timing Support Is Selected In the Config Menu

Selecting High-Speed Timing support changes the memory depth values in the Acquisition Memory field of the Config menu (see Figure 3–53). High-Speed Timing support clock settings at 5 ns or slower (as selected in the Clock menu) double the memory depth values, while a 2.5 ns clock quadruples the memory depth. The default memory depth values depend on the amount of acquisition memory available in the card, the software support mode, and the clock rate (period) in High-Speed Timing support. For example, the selectable memory depths for an 32K 92A96 Module are summarized in Table 3–16. For information on the selectable memory depths of other 92A96 Modules, refer to Tables 3–2 through 3–6 on pages 3–5 through 3–9.

Table 3–16: Memory Depths for 32K Modules

	General Purpose	High-Speed Timing	
	1 ms – 10 ns	1 ms – 5 ns	2.5 ns
Number of Stored Acquisition Cycles (selectable)	32768	65536	131072
	16384	32768	65536
	8192	16384	32768
	4096	8192	16384
	2048	4096	8192
	1024	2048	4096
	512	1024	2048
	256	512	1024
	128	256	512
	64	128	256

Unlike the General Purpose Support, Latch mode is not available in High-Speed Timing support. Notice that the Latch Mode field is not present in the menu.

Channel Menu

Selecting High-Speed Timing support changes the number of acquisition channels available. The channel menu shows which channels are unavailable by labeling them as unused channels. These channels will not be displayed in the Trigger and display menus.

When you select a clock rate of 5 ns or slower in High-Speed Timing support, the unused channels are displayed as "Unused in HS Timing." If you select the 2.5 ns clock rate, the unused channels are displayed as "Unused at 2.5 ns." These labels are removed when you leave High-Speed Timing support. Figures 3–54 and 3–55 show examples of the Channel menu in High-Speed Timing support.

The Channel menu lets you move between the General Purpose and High-Speed Timing support without destroying their respective channel setups.

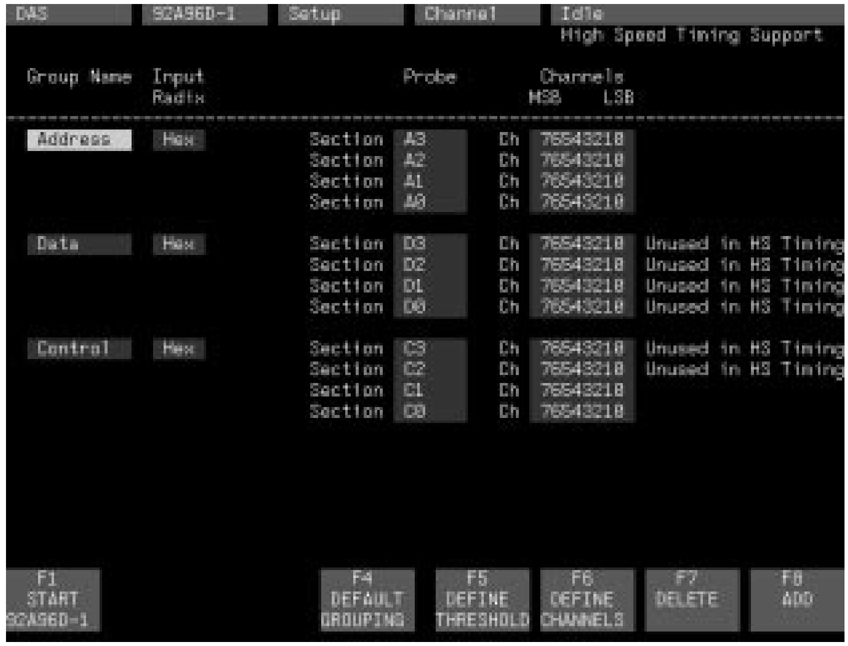

Figure 3–54: Channel Menu with 5 ns Clock Selected

Figure 3–55: Channel Menu with 2.5 ns Clock Selected

High-Speed Timing support affects which probe sections (eight channels each) are usable. This may require you to reconfigure your probe connections or to change channel groups. Table 3–17 shows which probe sections are available for use in the three different operating modes.

Table 3–17: Probe Selection Availability

	Address Selection				Data Selection				Control Selection			
Software Support	A3	A2	A1	A0	D3	D2	D1	D0	C3	C2	C1	C0
General Purpose	X	X	X	X	X	X	X	X	X	X	X	X
High-Speed Timing (1 ms – 5 ns)	X	X	X	X							X	X
High-Speed Timing (2.5 ns)			X	X								X

X = section available

Clock Menu

When you select High-Speed Timing support, the 92A96 Module only supports internal clocking. You can select clock periods from 1 ms to 2.5 ns (5 ns and 2.5 ns are unselectable in General Purpose support).

When you select the 2.5 ns clock period, channel width and the acquisition memory depth change. A message displays to inform you that additional channels become unused when you select the 2.5 ns clock period.

Figure 3–56 shows the clock menu with the available clock periods in the clock period field.

Figure 3–56: Clock Menu With Internal Clock Periods in High-Speed Timing Support

Trigger Menu

The Trigger menu is heavily affected by the other setup menus. For example, the Channel menu determines the group names and channel widths which are used in some trigger events. Also, High-Speed Timing support changes the Trigger menu. Also, changing the Software Support selection in the Config menu resets the Trigger menu to its default settings.

Trigger Position Field. The Trigger Position field serves the same purpose in High-Speed Timing support as in the General Purpose support. However, in the High-Speed Timing support the accuracy of the trigger position varies. At a 5 ns period, the trigger position accuracy is ± 1 sample; at 2.5 ns, the accuracy is ±3 samples (while in General Purpose or microprocessor support, the trigger position accuracy is ± 0 samples).

The maximum value of the Defined Trigger field depends on the current memory depth as selected in the Acquisition Memory field in the Config menu (refer to Table 3–16 on page 3–119).

Changing the memory depth in the Config menu resets the Defined Trigger field if the defined trigger value is larger than the new acquisition depth.

Trigger Events. The resource widths of the trigger event recognizer are narrowed to match the reduced channel count in the High-Speed Timing support. Some event operations requiring special considerations follow:

- Word Events. In High-Speed Timing support, the event must be present for twice the sample period + 2.5 ns or 12.5 ns, whichever is greater. For 2.5 ns clocking, the event must be present for four times the sample period + 2.5 ns. If the event is not stable for the required amount of time, it might be missed as an event.
- Range Events. Range events are not available in High-Speed Timing support.
- Channel Events. Inactive channels are not available in channel events.
- Consec Cycles Events. Inactive channels cannot participate in the event. The Section selection is 48 channels wide for a 5 ns or slower clock period and 24 channels wide for a 2.5 ns clock period (in a single-card module).

  When the clock period is 5 ns or slower, each cycle is actually composed of two adjacent samples so the consec cycles event becomes true when the concatenation of samples N and N+1 is identical to the concatenation of samples N+2 and N+3. In this case, the consec cycles event is never true if there are less than four consecutive samples that are the same, sometimes true if four consecutive samples are the same, and guaranteed to be true (at least once) if five or more samples are the same.

  When the clock period is 2.5 ns, each cycle is actually composed of four adjacent samples so the consec cycles event becomes true when the concatenation of samples N, N+1, N+2, and N+3 is identical to the concatenation of samples N+4, N+5, N+6, and N+7. In this case, the consec cycles event is never true if there are less than eight consecutive samples that are the same, sometimes true if eight, nine, or ten consecutive samples are the same, and guaranteed true (at least once) if eleven or more consecutive samples are the same.

Acquisition Considerations

For normal General Purpose operations, the 92A96 Module accurately monitors trigger events at sample rates up to 100 MHz (a 10 ns period). When you select High-Speed Timing support, trigger events must exist for at least 12.5 ns or twice the sample rate, whichever is greater, or the trigger position accuracy is reduced. When you select 2.5 ns clocking in High-Speed Timing support, the trigger event must exist for at least four times the sample rate + 2.5 ns or the accuracy is reduced. For example, if you are running the 92A96 Module in High-Speed Timing support with the internal sample clock set at 1 μs, a trigger event must be stable for 2 μs to be guaranteed recognition.

Display Considerations

In most cases after you start acquiring data, the 92A96 Module triggers and switches to a display menu. The High-Speed Timing support uses the same display menus as General Purpose support (State, Timing, and Graph); however, there are some differences in the menu parameters.

When you select High-Speed Timing support, the 5 ns and 2.5 ns clock periods become selectable in the Timing menu Clock period field. You can normally select any clock from 1 ms to 5 ns in the Timing menu; however, when data is acquired using a 2.5 ns clock period, the only clock period then selectable in the Timing menu clock period field is 2.5 ns. This is because the number of available channels and the memory depth is different than the other High-Speed Timing support clock periods. If you do try to select any other clock period, a warning message appears on the Timing menu reminding you to return to the Clock menu to make any changes.

The trigger position accuracy in High-Speed Timing support is ±1 sample or, if the clock period is 2.5 ns, ±2 samples. This can affect the accuracy of your Delta Time measurements whenever you use the trigger position as a reference.

Appendix A: Specifications

This appendix contains specifications for the 92A96 Modules and 92C96 Modules in the following tables:

- Table A–1 Safety
- Table A–2 Environmental
- Table A–3 Physical
- Table A–4 Electrical

Specifications for the DAS 9200 mainframe are located in the *DAS System User Manual*. Specifications for the TLA 500 series logic analyzers are located in the user manual for the specific TLA 500 series logic analyzer.

Table A–1: Safety

Characteristic	Description
Safety and EMI Ratings	This module complies with all safety and EMI ratings for the DAS and TLA 510 & TLA 520 mainframes. Refer to the *DAS System User Manual* or to the *TLA 510 & TLA 520 User Manual* for details.

Table A–2: Environmental

Characteristic	Description
Temperature	
Maximum Operating	+104° F (+40° C) [probe only, +55° C]
Minimum Operating	+50° F (+10° C) [probe only, –15° C]
Non-Operating	–40° F to +122° F (–40° C to +50° C) [probe only, –62° C to +85° C]
Humidity	As per Tektronix standard 062-2847-00 10–90% relative humidity (non operating) ≤80% relative humidity (2 hrs before operating)
Altitude	As per Tektronix standard 062-2847-00
Operating	15,000 ft (4.5 km) maximum
Non-Operating	50,000 ft (15 km) maximum

Table A–3: Physical

Characteristic	Description
Overall Dimensions	
Width	Approximately 10 in (25.4 cm)
Length	Approximately 15.5 in (39.4 cm)
Probe Length-ribbon or coaxial cable (including podlets)	Approximately 72 in (184 cm)
90-Channel Interface	
Width	Approximately 7.5 in (39.3 cm)
Length	Approximately 5.1 in (13 cm)
Height	Approximately 1.14 in (2.9 cm)

The Performance Requirements column items are product specifications that can be verified using the verification and adjustment procedures (refer to a qualified service technician). These procedures are found in the service manuals for the DAS and TLA 500 series logic analyzers. The Supplemental Information column provides pertinent characteristic operating details that are not guaranteed.

Table A–4: Electrical

Characteristic	Performance Requirements	Supplemental Information
INPUT (at probe, all channels)		
Input Resistance		100 kΩ nominal
Input Capacitance		9.4 pF nominal, 10 pF maximum
Bandwidth (minimum probe)		140 MHz
Absolute maximum voltage limits		±15 V_{p-p}
Min. TTL signal input (ribbon cables)		1.2 V_{p-p} nominal (centered on threshold)
Min. ECL signal input (coaxial cables)		600 mV_{p-p} nominal (centered on threshold)
Threshold levels		–4.0 V to +8.75 V; 50 mV steps
DC threshold accuracy		±75 mV
Max. operating input amplitude		10 V_{p-p}; for signals above 5.5 V_{p-p} threshold must be set to $\left(\frac{V_{iH}V_{iL}}{2}\right) \pm .1$ Volt

Table A–4: Electrical (Cont.)

Characteristic	Performance Requirements	Supplemental Information
SYNCHRONOUS		
Minimum Setup time	5.5 ns ECL (ribbon cables) 5.0 ns TTL [1, 2]	5.0 ns ECL (coaxial cables)
Minimum Hold time	0 ns [1, 2]	
Minimum time between clock edges	10 ns	With multiple clock edges
Maximum external clock rate	100 MHz	Using single-edge clock
Minimum clock pulse width	4.9 ns ECL	4.3 ns TTL, high or low, measure at threshold [2]
Setup and Hold time — Clock Qualifiers (external clock and 'before' edge mode):		
Clock as Qualifier (Clock 0, 1, 2, 3)		
Setup time	5 ns [2]	
Hold time	0 ns [2]	
Qualifier (C2: 0, 1, 2, 3)		
Setup time	6.5 ns [2]	
Hold time	0 ns [2]	
Maximum transaction rate	100 MHz (10 ns)	
ASYNCHRONOUS		
Channel to channel skew	2.5 ns	Timing accuracy; 2X the sample period + 3.5 ns
Pulse width guaranteed to be sampled (multichannel) Pulse width guaranteed to be triggered (multichannel)	Sample period + 2.5 ns [1]	General Purpose: sample period + 3.5 ns High Speed (5 ns or slower): 2X sample period + 3.5 ns High Speed (2.5 ns): 4X sample period + 3.5 ns
Glitch pulse width guaranteed to be sampled		3.5 ns, 1st order (two edges in sample interval)
Max. asynchronous clock rate		
96 Channels	100 MHz (10 ns)	
48 Channels	200 MHz (5 ns)	
24 Channels	400 MHz (2.5 ns)	
Time base accuracy		
100 MHz or greater		$\pm$300 ps $\pm$0.05%
50 MHz or less		DAS 9200 mainframe specification (Time Base 0–3)

Table A–4: Electrical (Cont.)

Characteristic	Performance Requirements	Supplemental Information
COUNTERS/TIMERS		
Counter accuracy	± 0 counts, +1 state clock for event generation	
Timer accuracy (event generation)	+1/–0 state clock, +1/–1 timer clock, ±0.05%	
Time base accuracy (internal)		DAS mainframe specification (Time Base 0–3)
SYNC OUT		
Delay (from probe tip)	75 ns maximum	68 ns typical
Min. pulse width		8.5 ns; External clock ±1.5 ns
Voltage range with 1 MΩ load	0 V ±0.5 V 5 V ±0.5 V	
Output source impedance		50 Ω nominal
TIMESTAMP		
Time base accuracy		
Short term	±3 ns	
Long term	±1 count, (MCLK) ±0.05%	
Timestamp resolution	10 ns	
Timestamp width	44 bits	
Timestamp range	2 days	
Module-to-module relative accuracy		25 ns; skew between multiple 92A96s in a single mainframe
Max. sample rate when correlated with a 92A16		70 MHz
POWER REQUIREMENTS		
92A96 Board		
8K card		150 watts maximum
32K card		140 watts maximum
128K card		140 watts maximum
512K card		150 watts maximum
2M card		150[3] watts maximum

Table A–4: Electrical (Cont.)

Characteristic	Performance Requirements	Supplemental Information
92C96 Board (All Versions)		150[3] watts maximum
Power available to probe adapter		
–15 volt supply		0.5 A maximum
+5 volt supply		0.1 A maximum

[1] **Minimum slew rate: 0.8 V/ns to guarantee Setup and Hold times (degrades S/H below this value)**

[2] **Measured with 1.6 V (p-p) input signal**

[3] **Module power requirements reduced to 140 W max. effective SN B061162 and above**

Table A–5: 90-Channel Interface Electrical

Characteristic	Performance Requirements	Supplemental Information
Clock rate	50 MHz Maximum	TTL signals of +0.8 V to +2.4 V min. swing
Buffered signals		All signals are passively buffered
Threshold level		+1.5 V nominal (TTL)
Voltage limits (operating)		–0.5 V to +0.8 V (low) +2.4 V to +6.0 V (high)
Voltage limits (non-operating, non-destructive)		DAS power on: –0.5 V to +6.0 V DAS power off: –0.5 V to +6.0 V
Input capacitance		
CLK & Qual	35 pF maximum	30 pF typical
all others	25 pF maximum	20 pF typical
Input impedance		
CLK & Qual	50 kΩ nominal	Minimum AC impedance
all others	100 kΩ nominal	>100 Ω for all channels except CLK 0, 1, 2, 3
AC characteristics		Refer to 92A96 specifications
Min. Setup time (with respect to CLK 0, 1, 2, or 3)		92A96 setup time + 5 ns
Min. Hold time (with respect to CLK 0, 1, 2, or 3)		92A96 hold time +1 ns

Appendix B: Options and Accessories

Table B–1: 92A96 Module Options

Option	Description
01	Includes 90-Channel Microprocessor Interface
02	Adds a set of 4 coaxial-type probe cables
1D	Deletes 92A96 Probe Assembly
2D	Deletes Lead Sets and KlipChip Adapters
3S	Substitutes the 90-Channel Microprocessor Interface for the 92A96 Probe Set
4S	Substitutes a set of 4 coaxial-type probe cables for the 4 ribbon-type probe cables

Table B–2: Standard Accessories for the 92A96 Module

Description	Quantity	Part Number
Probe Set (100 Podlets)	1	010-0492-XX
92A96 Probe Cable	4	174-2117-XX
Single-channel Clock Lead Set	12	196-3347-XX
8-Channel Data Lead Set	12	174-2527-XX
Cable Bracket and Screws	2	407-4096-XX
Ground Strap	1	196-3353-XX
KlipChip Adapters	144	206-0364-XX
Four-Color Rear-Panel Label	1	334-8030-XX
Cable Label (blue)	4	334-8244-XX
Cable Label (green)	4	334-8245-XX
Cable Label (gray)	4	334-8246-XX
Cable Label (orange)	4	334-8247-XX
Channel Grouping Label (blue)	1	334-8248-XX
Channel Grouping Label (green)	1	334-8249-XX
Channel Grouping Label (gray)	1	334-8250-XX
Channel Grouping Label (orange)	1	334-8251-XX
92A96 & 92C96 Module User Manual	1	070-9185-XX
Slot Ident Label	1	334-8029-XX

Table B–3: Standard Accessories for the 90-Channel Microprocessor Interface

Description	Quantity	Part Number
Probe Adapter Latch	4	105-1034-XX
Power Cable	1	174-2348-XX

Table B–4: 92C96 Module and 92A96UD Module Options

Option	Description
1D	Deletes Podlets and Probe Accessories
2D	Deletes Probe Accessories
1P	Add Six 8-Channel Lead Sets, 72 KlipChip Adapters and 12 1-Channel Lead Sets
4S	Substitute Four Coaxial Cables for Four Ribbon Cables

Table B–5: Standard Accessories for the 92C96 Module and 92A96UD Module

Description	Quantity	Part Number
Probe Set (100 Podlets)	1	010-0492-XX
92C96 Probe Cable	4	174-2117-XX
Single-Channel Clock Lead Set	12	196-3347-XX
8-Channel Data Lead Set	6	012-1424-XX
Cable Bracket and Screws	2	407-4096-XX
KlipChip Adapters	72	206-0364-XX
Cable Label (blue)	4	334-8244-XX
Cable Label (green)	4	334-8245-XX
Cable Label (gray)	4	334-8246-XX
Cable Label (orange)	4	334-8247-XX
Channel Grouping Label (blue)	1	334-8248-XX
Channel Grouping Label (green)	1	334-8249-XX
Channel Grouping Label (gray)	1	334-8250-XX
Channel Grouping Label (orange)	1	334-8251-XX
92A96 & 92C96 Module User Manual	1	070-9185-XX
Slot Ident Label	1	334-8029-XX

Table B–6: Optional Accessories for the 92A96 and 92C96 Modules

Description	Tektronix Part Number
P6041 Passive Probe, used as Sync Out cable, SMB-to-BNC, 3.5 ft., 50 ohm impedance.	
25-Channel Probe Set	020-1890-XX
Single-Channel Clock Lead Sets, Package of 12	020-1888-XX
KlipChip Adapters, Package of 12	020-1386-XX
92A96 Probe Ribbon Cables Antistatic Application Kit	020-1939-XX
92A96 & 92C96 Service Manual	070-8247-XX
90-Channel Microprocessor Interface	010-0508-XX
Generic Pod Replacement kit	050-2796-XX
Replacement Podlet (black)	010-0493-00
Replacement Podlet (brown)	010-0493-01
Replacement Podlet (red)	010-0493-02
Replacement Podlet (orange)	010-0493-03
Replacement Podlet (yellow)	010-0493-04
Replacement Podlet (green)	010-0493-05
Replacement Podlet (blue)	010-0493-06
Replacement Podlet (purple)	010-0493-07
Replacement Podlet (plain)	010-0493-08
Probe Set, 25 Podlets	010-0492-10
8-Channel Lead Sets, Package of Six	020-2107-XX
Six 8-Channel Lead Sets, 12 Y-Cables, 72 KlipChip Adapters	020-2108-XX
50 Channel Probe Set with Lead Sets, KlipChip Adapters, Y-Cables, Ribbon Cables	020-2109-XX
Coaxial Cables, Set of Four	198-5761-XX

Appendix C: User Service

This appendix describes the simple service procedures for the 92A96 and 92C96 Data Acquisition Modules. It also provides information for removing and replacing podlets. The basic module service procedures are intended for DAS users. The acquisition modules for the TLA 500 series logic analyzers must be installed by qualified service personnel at a Tektronix field office.

Initial Inspection (DAS Users Only)

The modules are inspected both mechanically and electrically before shipment. They should be free of marks or scratches and should meet or exceed all electrical specifications. To confirm this, inspect each module card for physical damage incurred during transit. Always retain the product packaging in case reshipping is necessary. Also, retain any antistatic card packaging in case you need to store module cards outside of your mainframe.

Repacking for Shipment

NOTE. *If your 92A96 Module is not functioning correctly, a Tektronix service technician can repair the unit at your site or you can ship it to Tektronix for repairs.*

If a module is to be shipped to a Tektronix field office for repair, attach a tag to the module card showing the owner's name and address, the instrument serial number, and a description of the problem(s) encountered and/or service required. Always return the module and the probes so that the entire system can be tested.

When packing a module card for shipment, use the original packaging. If it is unavailable or not fit for use, contact your Tektronix representative to obtain new packaging.

Preventive Maintenance

The electrical performance of the acquisition module should be checked once every 1.5 years of operation by a qualified service technician using the procedures outlined in the service manuals for the DAS and TLA 500 series logic analyzers.

Mechanical inspection and cleaning should be performed as often as the operating environment dictates. Cleaning procedures for the module are listed in the *DAS Technician's Reference Manual* and in the service manual for the TLA 500 series logic analyzer. These procedures should be performed whenever the module has been subjected to abnormally dirty conditions for any significant amount of time. In a very clean environment, you can operate the module for extended periods without cleaning.

Removing and Replacing Podlets

Each 8-channel probe consists of 8 single-channel podlets ganged together in a podlet holder. You may need to remove these podlets from the 8-channel probe to use them for alternate connections to the system under test.

You can also use these procedures to replace a defective clock probe or a defective podlet from an 8-channel probe.

Removing a Clock Probe or 8-Channel Probe Podlet from the Interface Housing

Use Figure C–1 and the following procedure to remove a clock probe or an 8-channel probe podlet from the interface housing.

1. Power down the system under test. It is not necessary to power down the logic analyzer.
2. Use a small pointed tool such as a ballpoint pen, pencil, or straightened paper clip to press down on the latch detent of the podlet through an opening on the interface housing.
3. Gently pull the podlet connector out of the housing with one hand while pressing down on the latch detent with the pointed tool. Do not pull on the end of the probe podlet, rather, grasp the podlet strain relief portion near the connector housing to remove it.

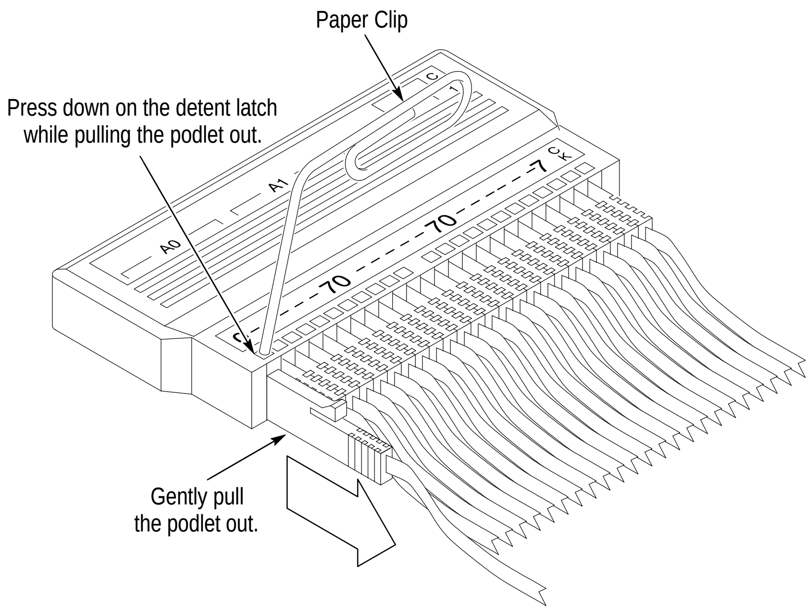

Figure C–1: Removing a Clock or an 8-channel Podlet from the Interface Housing

Replacing a Clock Probe

Refer to Figure C–1 and the following step to replace a clock probe.

To replace a clock probe, insert a new clock probe into the same clock channel position on the interface housing. Insert the clock probe into the interface housing with the detent latch oriented to the label side of the housing.

Removing 8–Channel Probe Podlets from the Podlet Holder

Refer to Figure C–2 and the following procedure to remove the 8-channel probe podlets from the podlet holder.

1. To remove podlets from the podlet holder, grasp the white plastic pull tab on each side of the podlet holder and gently spread the sides of the holder open just enough to clear a podlet.

CAUTION. *Only spread the holder open wide enough to clear and remove the podlets. Excessive pulling on the sides can deform the podlet holder.*

2. Remove the middle two podlets from the podlet holder by pushing up on the metal pin receptacles.
3. Release the tabs on the podlet holder.
4. Remove the remaining podlets by turning and extracting each one at a time.

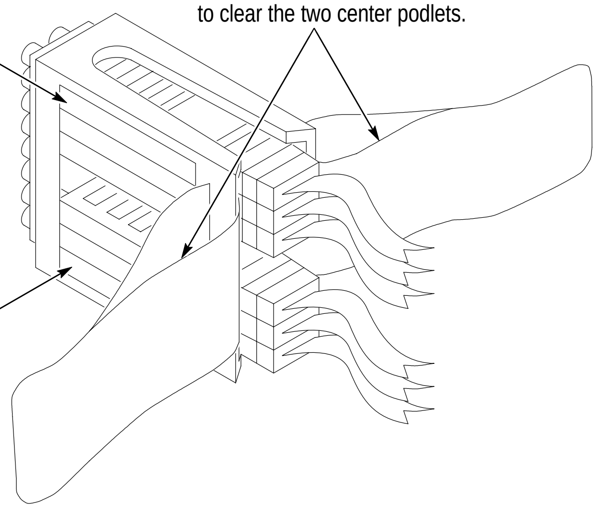

Figure C–2: Ganging the 8-channel Probe Podlets Together

Replacing 8-Channel Probe Podlets

The channel podlets must retain the same channel order on both the interface housing and in the podlet holder. Be sure to replace the old podlet with a podlet of the same color. Table C–1 shows the color code and channel number of each podlet for an 8-channel probe.

Table C–1: Podlet-to-Channel Color Code

Podlet Color	Channel
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7

Refer to Figure C–2 and the following procedure to replace an 8-channel probe podlet.

1. Insert the appropriately colored podlet into the interface housing with the detent latch oriented to the label side of the housing.

2. If you are replacing a single podlet, orient the podlet connector marked GND towards the side of the podlet holder labeled GROUND.
3. Grasp the clear plastic pull tab on each side of the holder and gently spread the sides of the holder open just enough to clear the podlet.
4. Hold the podlet body with the other hand and place it in the holder in the correct channel order. Do not grasp and turn the podlet cable.
5. If you are reganging all the podlets of an 8-channel probe, begin ganging the podlets together starting with either channel 0 or channel 7. Orient the podlet connector marked GND towards the side of the podlet holder labeled GROUND.
6. Hold the podlet body, turn the podlet body parallel to the sides of the holder, move it into the holder, and use your fingers to press it into place perpendicular to the sides of the holder. Be sure to gang the podlets in the correct channel order according to the channel label on the podlet holder and podlet color code, with all ground connectors toward the Ground side of the holder. Do not place the podlet into the holder by grasping the podlet cable.

CAUTION. *To prevent damage to the podlets, keep the podlet cables parallel to each other when ganging them into the holder. Avoid twisting the podlet cables between the interface housing and the podlet holder.*

7. Continue placing the next two podlets, one at a time in channel order, in the podlet holder. Orient all ground connectors toward the Ground side of the holder.
8. The fourth podlet should be either channel 0 or 7, whichever one is not already placed in the holder. Place this podlet in the other end of the podlet holder. Orient the ground connector correctly.
9. Continue placing the next two podlets, one at a time, in channel order, in the podlet holder. Continue orienting the ground connectors correctly.
10. Grasp the clear plastic pull tab on each side of the holder and gently spread the sides of the holder open just enough to clear a podlet.

CAUTION. *Spread the holder open only wide enough to clear the podlet. Excessive pulling on the sides can deform the podlet holder.*

11. Place the last pair of podlets (channels 3 and 4) in the podlet holder in proper channel order, orienting the ground connectors to the Ground side of the holder.

Glossary

92A96
The 96-channel, 8 k memory, 100 MHz data acquisition module.

92A96D
The 96-channel, 32 k memory, 100 MHz data acquisition module.

92A96XD
The 96-channel, 128 k memory, 100 MHz data acquisition module.

92A96SD
The 96-channel, 512 k memory, 100 MHz data acquisition module.

92A96UD
The 96-channel, 2 M memory, 100 MHz data acquisition module.

92C96D
The configurable 96-channel, 32 k memory, 100 MHz data acquisition module. This module can be easily upgrade for a memory depth of 128K or 512K.

92C96XD
The configurable 96-channel, 128 k memory, 100 MHz data acquisition module. This module can be easily upgrade for a memory depth of 512K.

92C96SD
The 96-channel, 512 k memory, 100 MHz data acquisition module.

Acquisition
The capturing of data from a system under test by a logic analyzer. Data is conditionally stored in acquisition memory in preparation for formatting by the user. (Data may be clocked into the logic analyzer, yet qualified out before it can be stored in acquisition memory.) Use the trigger menu of the appropriate acquisition module to specify whether or not data is stored.

Acquisition Cycle
A complete data acquisition sequence including start, search, capture, and stop phases.

Acquisition Memory
The RAM located on each acquisition card where data from an acquisition is stored.

Acquisition Memory Sequence
A single sample of acquired data to which a unique identification number is assigned. As data is acquired, each sample is assigned a consecutive sequence number.

Active Module
The module highlighted by the cursor in the Menu Selection overlay.

Address
A number or expression that designates a specific location in a storage or memory device.

Application Software
Software packages designed specifically to aid in certain tasks. The application software resides on the hard disk as part of system software and can be loaded from floppy disks.

Assert
To cause a signal or line to change from its logic false state to its logic true state.

Asynchronous Acquisition
An acquisition made using a periodic clock signal generated internally by the logic analyzer; such a signal is therefore asynchronous to the user's circuit and should be considerably faster than the user's data rate to avoid aliasing.

Card
An individual circuit board which occupies a single slot in the logic analyzer mainframe. An individual card may or may not constitute a module; some modules consist of multiple-card sets.

Clause
A trigger specification term. The combination of an Event and an Action. When the Event is satisfied, the Action is performed.

Clock Cycle
A clock sequence that includes both high- and low-going transitions.

Clock Equation
The Boolean combination of events needed to generate a storage clock. You can define a variety of clock inputs and link them using Boolean operators. Data will only be sampled and stored in memory when this clock equation is true.

Clock Qualification
The process of filtering out irrelevant data by combining an acquisition clock with one or more bus signals.

Clock Qualifier
An external signal that acts as a gate for the acquisition clock. When the external signal is false, the acquisition clock is not allowed to load acquired data into the acquisition memory.

Cluster
A group of modules started and stopped as a unit. Use the system Config menu to create clusters.

Compound Action
Two or more simple actions executed simultaneously.

Compound Event
A Boolean combination of two or more simple events.

Correlation
The tracking of independent events captured by different acquisition modules and indicating how they relate to each other in time. Specifically, the chronological interleaving of data from different acquisition modules into a single display. Shows real-time interactions between independently clocked circuits.

Correlation Bus
Passes signals for time correlation between acquisition modules.

Counter
A circuit or device that records occurrences of some specified input.

DAS/NT
The networked version of the Digital Analysis System. The system operation is controlled by a workstation on a network.

DAS/XP
The stand-alone version of the Digital Analysis System. The system operation is controlled by an X terminal.

Data Sample
The data logged in during one occurrence (or one cycle) of the acquisition clock. A data sample contains one bit for every channel. In asynchronous mode, data is sampled at an internal clock rate selected by the user. In synchronous mode, data is sampled at a rate determined by an external system clock.

Delay Counter
Determines the number of data samples stored in the acquisition memory after the trigger occurs. You select a trigger position, and when the post-trigger delay counter reaches the value for that position, the acquisition ends.

Delta Mark
A user-placed mark (appears as a triangular delta symbol) on a timing diagram display that can be used as either the start-point or end-point of a delta time measurement.

Delta Time
The time difference between two points in memory. For example, the difference between a trigger point and the data cursor in a timing diagram display.

Demultiplex
To identify and separate multiplexed signals (for instance, some signals from a microprocessor). To separate different signals sharing the same line and organize those signals into useful information.

Don’t Care
A symbol (X) used in place of a numeric character to indicate that the value of a channel or character is not to be considered.

Edge
A signal transition from low to high, or high to low.

Event Filter
A trigger specification feature that lets you specify the amount of time an event must be present in order to be considered true.

External Clock
A clock external to the logic analyzer and usually synchronous with the system under test.

External Clocking
A clock mode in which the sampling of input logic signals is synchronized with the activity of the system under test. The representation of the signals is stored in memory by what is commonly called the external (or synchronous) clock (that is, a signal supplied externally to the logic analyzer).

Flag
A bit that can be set as a marker. A flag can be used as either an event or an action in a trigger specification program. When used as an event, a flag is tested for true/false value like any other event; when used as an action, a flag can simply be set or cleared as the result of a condition being satisfied.

Glitch
A signal that makes a transition through the threshold voltage two or more times between successive sample clocks. Signals that are faster than the sampling rate, such as noise spikes or pulse ringing, can be captured by a logic analyzer as glitches (only applicable to asynchronous acquisitions).

Internal Clock
A clock mode in which the sampling of input logic signals occurs asynchronously to the activity of the system under test. The representation of the signals is stored in memory by what is commonly called the internal (or asynchronous) clock.

Level-sensitive
A trigger specification term. An event recognizer is said to be level-sensitive when the event is only true in an acquisition cycle in which the selected channels are true for a specified amount of time.

Microprocessor Support
Optional microprocessor support software that allows the logic analyzer to disassemble data acquired from microprocessors.

Mnemonic Disassembly
A display format for data acquired from a microprocessor or a data bus (for example, GPIB). A logic analyzer decodes bus activity and displays it as cycle types, instruction names, interrupt levels, etc. Advanced forms of mnemonic disassembly can detect queue flushes, and provide a display that resembles the original assembly language source code listing.

Module
One or more functioning acquisition or pattern generation units. When a module consists of more than one circuit board the individual boards work together as a unit to provide increased channel capability while giving you full use of all instrument functions.

Overlay
A temporary display that partially covers the currently displayed menu usually opened by selecting a function key.

Paged Memory
Acquisition memory can be divided into pages, with each page containing a given number of samples. Allows you to make multiple acquisitions around the trigger within a single acquisition memory.

Podlet
A circuit contained in a flex lead and attached to a probe that provides square-pin connections to the circuit under test for one data acquisition channel (or one pattern generation channel) and a ground pin.

Post-fill
A requirement that a logic analyzer continue to acquire data after the trigger until a predetermined number of samples has been taken. When the trigger position is programmed to occur in the center of memory, a logic analyzer will take enough data samples after the trigger to fill one half of the acquisition memory.

Post-processing
Any type of acquisition (or reference) memory analysis that occurs after, rather than during, the acquisition.

Pre-fill
A requirement that a logic analyzer fill a predetermined number of acquisition memory sequences with new data before accepting a trigger. With the trigger programmed to occur in the center of memory, one-half of the memory must be filled before the trigger.

Probe
An input (acquisition) or output (pattern generation) device, constructed as a separate unit. As an input device it transmits the input signal from the circuit under test to the logic analyzer. As an output device it transmits the output signal from the logic analyzer to the circuit under test.

Probe Adapter
A microprocessor-specific lead set that connects the acquisition module Probe to a system under test. For example, the 80286 Probe Adapter.

Refmem
An abbreviation for Reference Memory.

Reference Memory
Acquired data that has been stored in a file for use as a reference base (for instance, to compare with future acquisitions).

Sample Clock
Determines the points in time when the 92A96 Module samples data. A sample clock can be set up to occur at regular intervals specified by an internal clock (asynchronous acquisition), or to occur when a Boolean expression combining an external clock and qualifier signals is “true” (synchronous acquisition).

Sampling Rate
The frequency at which data is logged into the logic analyzer.

Scrolling
A method of positioning a portion of a data display too lengthy to be contained on the screen in its entirety.

Signal Event
When a trigger menu includes a signal from another module in an event clause, that signal is called a signal event.

Simple Action
A trigger specification term. Any action that can be performed by an acquisition module running in real time.

Simple Event
Any of several conditions (events) that can be detected by a running acquisition module. Examples of simple events include: word recognizers, timer/counters, external triggers, and signals passed from other modules. Simple events can be combined with Boolean operators to create Compound Events.

Skew
The relative time difference between input channels, specified in terms of one edge relative to another; the misrepresentation of data caused by parallel channels with different propagation delays.

Split-screen
A feature available in some display menus that lets you divide the screen display area into two data windows (split either horizontally or vertically). Each window has its own cursor and can display its own source of data and its own display type.

Stand-alone
A self-contained logic analysis system, rather than a remote host configuration in which the logic analyzer acts as a peripheral to a host computer.

State
A trigger specification term. Only one state (or step) in a trigger specification program is active at any one time. Usually expressed in the form of an *if...then* construction.

Storage Qualification
The process of filtering out data that has been acquired but which you do not want to store in acquisition memory. This allows you to avoid filling up your module’s acquisition memory with irrelevant data samples.

Symbolic Radix
A format that allows you to substitute mnemonics (names) for radix numbers when using menus. You enter your own mnemonics into the Symbol Table menu. The logic analyzer will replace radixes throughout the menu structure with these assigned values.

Synchronous Acquisition
An acquisition made using a clock external to the logic analyzer; such a clock is usually generated by the user’s circuitry and is therefore synchronous to it. This external clock may or may not be periodic.

Time Base
Source of the acquisition clock. The time base can be selected to be an internal source, a single external source, or a Boolean combination of several external signals.

Timer
A device that lets you make time measurements during a data acquisition.

Timestamp
A separate clock value stored with each acquisition cycle. Provides performance analysis features and time correlation for multiple acquisition memories and timing measurements.

Timing Display
Graphic representation of data states and timing relationships as digital (two-state) waveforms.

TLA 510 Logic Analyzer
A self-contained 100 MHz Logic Analyzer. The TLA 510 Logic Analyzer operates similar to a DAS mainframe with a single 92C96 Data Acquisition Module. Setups from the TLA 510 Logic Analyzer can be restored to a DAS mainframe with one or more 92C96 Data Acquisition Modules.

TLA 520 Logic Analyzer
A self-contained 100 MHz Logic Analyzer. The TLA 520 Logic Analyzer operates similar to a DAS mainframe with two 92C96 Data Acquisition Modules. Setups from the TLA 520 Logic Analyzer can be restored to a DAS mainframe with two or more 92C96 Data Acquisition Modules.

Trigger
Determines which block of the sampled data is stored in memory. It establishes a reference point in the acquired data around which pre- and post-trigger data points are included in the acquisition memory.

Trigger Event
The last (or only) event in the sequence of events that causes a data acquisition module to trigger.

Trigger Position
Where the trigger resides in acquisition memory. Electing to place the trigger in the center of memory means that half of the acquisition consists of data that occurred after the trigger.

Trigger Specification Program
The highest level of triggering control. A trigger specification program is composed of one or more States.

Unassert
To cause a signal or line to change from its logic true state to its logic false state.

Word Recognition
The matching of a specific data word with the presence or absence of that word in signals acquired by the logic analyzer.

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