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DAS 9100 SERIES
OPERATOR'S MANUAL WITH OPTIONS

This Tektronix manual supports the following products.

INSTRUMENT MODULES

91A32—Data Acquisition
91A08—Data Acquisition
91P16—Pattern Generator
91P32—Pattern Generator

MAINFRAMES

DAS 9129—Color
DAS 9109—Basic
DAS 9119—ATE

OPTIONS

OPTION 01—Tape Drive
OPTION 02—I/O Interface
OPTION 03, 04—+5 V Power Supply
OPTION 05—Rackmount

PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL.

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MANUAL REVISION STATUS

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This manual supports the following versions of this product: All

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PREFACE

This manual describes the Tektronix Digital Analysis System (DAS) 9100 Series. It provides installation and operating procedures for both the DAS9129 (color) and DAS 9109 (monochrome) mainframes, and for all available modules, probes, and options. It also provides GPIB operating information, especially useful for DAS9119 ATE mainframes.

The 062-5847-00 manual set is a package consisting of loose leaf binders with manuals and addenda. Each manual and addendum in the set has its own part number starting with the prefix 070. You can find your manual part number in the bottom left corner of the manual title page.

Two additional documents that you may find useful are provided in the front pouch of the manual binder a part of the 062. package.

DAS 9100 Series Operator's Reference Guide	070-3694-02
DAS 9100 Series GPIB Reference Guide	070-3781-02

Color Displays. This manual is printed in black and white, except for the tabbed page in the back of Section 2. The tabbed page titled Color Displays, provides several examples of the DAS9129 color displays. The Operator's Reference Guide also incorporates color display examples.

About This Manual. This manual is designed around the menu-driven interface of the DAS mainframe. Each menu has its own manual section which provides all relevent set-up and operating procedures. Specific sections are also devoted to product installation and checkout, and to GPIB programming.

A special section, Application Examples, provides a learning guide to the major DAS functions. This section can help new users to become familiar with the operating interface.

How To Use This Manual. Each section in this manual is preceded by a tabbed page so that information can be referenced quickly. Other reference aids include:

- **Manual Table of Contents**—refer to the Table of Contents at the beginning of the manual for a breakdown of sections.

- **Section Table of Contents**—refer to the Table of Contents at the beginning of each section for a detailed breakdown of section content. The Table of Contents for each section is located on the tabbed page preceding that section.

- You can also order a second operator's binder by using P/N 016-0788-00.

- **Index**—refer to the index at the back of the manual for reference to specific subjects.

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GENERAL INFORMATION 1

This section provides the specifications for the DAS 9100 Series mainframes, modules, probes, and options. It also describes the available DAS 9100 Series models and modes of operation.

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GENERAL INFORMATION

DESCRIPTION

The Digital Analysis System (DAS) 9100 Series is a family of programmable logic analysis instruments useful in the design, manufacture, and service of digital products. The series features a modular system architecture which allows various instrument configurations, each tailored to meet specific testing requirements. A DAS 9100 may be configured as a logic analyzer, as a pattern generator, or as a combination of the two. Optional GPIB, RS-232, and hard copy interfaces, as well as a tape drive unit, are also available.

DAS modularity is built around the 9100 Series of microprocessor-controlled mainframes. These units house the selected modular components and options and provide the logic circuitry and firmware necessary to integrate their functions. The keyboard, which folds down from the front of the mainframe, is used interactively with the display monitor for controlling DAS setup and operation.

Instrument functions and their required power supplies are added to the mainframe in modules. Up to six data acquisition and pattern generator modules may be installed, so long as they do not exceed the maximum of 104 acquisition or 80 stimulus channels.

Available instument modules include:

- **91A32 Data Acquisition Modules**—32 data channels at 25 MHz (three maximum).
- **91A08 Data Acquisition Modules**—8 data/glitch channels at 100 MHz (four maximum).
- **91P16 Pattern Generator Module**—16 output channels at 25 MHz (one maximum).
- **91P32 Pattern Generator Expander Modules**—32 output channels at 25 MHz (two maximum).

Once installed, all modules and their functional parameters are controlled by interactive menus which are displayed on the monitor screen.

Five menus are provided for controlling the DAS data acquisition functions:

- **Channel Specification**—a menu for controlling the display format of data acquisition channels. It divides channels into groups, and sets display radix and polarity values. It also determines probe input thresholds.
- **Trigger Specification**—a menu for controlling the modules used during the acquisition operation. It specifies which modules are used, their clock rates, clock qualifier, and trigger parameters.
- **State Table**—a menu for displaying data in a tabular-radix format. It displays acquisition memory, reference memory, or a comparison of the two.
- **Timing Diagram**—a menu for displaying data in a logic-waveform format. It displays acquisition memory and 91A08 glitch memory.
- **Define Mnemonics**—a menu for building mnemonic tables and displaying them on the State Table.

One menu is provided for controlling the DAS pattern generator functions:

- **Pattern Generator**—a menu for entering the pattern generator program, and for selecting the output clock and strobe signals. It also enables the pattern generator's interrupt, pause, and inhibit signals.

One menu is provided for controlling the DAS I/O functions:

- **Input Output**—a menu for controlling the DAS tape drive (Option 01), and for setting up master/slave transmission via the RS-232 interface (Option 02).

In addition to the menu control, the DAS also allows remote control via GPIB commands sent over the RS-232 or GPIB interface (Option 02).

Instrument modules and options may be added to the selected mainframe to fit your exact application needs. Modular flexibility and expanded menu control offer a wide range of test capabilities in a variety of operating modes.

MODES OF OPERATION

All modes of operation are controlled via the DAS menus. Refer to the individual menu sections later in this manual for detailed operation procedures. The following paragraphs describe the various operations in general terms.

DATA ACQUISITION

The DAS operates as a high-performance logic analyzer, acquiring up to 104 channels of parallel data. The number of acquisition channels, and clock and trigger functions, are a direct result of the number and type of data acquisition modules installed in the mainframe.

Using from one to three 91A32 modules, the DAS acquires and stores from 32 to 96 input channels with 2 to 6 clock qualifiers. In this mode, all modules may be run from the same internal clock set at intervals ranging from 40 ns to 5 ms, or from the same external clock's rising or falling edge (40 ns maximum). A special split-clock feature is also provided for setting each 91A32 module to a different external clock, such as those belonging to multiplexed bus structures. Three word recognizers may be specified on all channels and used in several different triggering sequences.

Using from one to four 91A08 modules, the DAS acquires and stores from 8 to 32 input channels with 1 to 4 clock qualifiers. All modules may run at a 100 MHz maximum clock rate, using the DAS internal clock or an external clock's rising or falling edge. The 91A08 modules also acquire and store glitches on all acquisition channels. Word recognition may be set to generate a trigger on data or glitches.

Two modes are provided for using the 91A32 and 91A08 modules together. The AND mode runs the modules simultaneously using the 91A32's clock and word recoginizer functions. The ARMS mode runs the two modules simultaneously, but at different clock rates. In this mode, the 91A32 trigger enables the 91A08 trigger to produce a display effect similar to an oscilloscope's delayed sweep.

In all acquisition modes, triggering may be positioned at the beginning, center, or end of acquisition memory; or it may be delayed for up to 32,767 clock cycles. Two BNC connectors on the mainframe's back panel also provide trigger output and input signals.

ACQUISITION AND REFERENCE MEMORY DISPLAY

Once in memory, acquired data is displayed in either a Timing Diagram or State Table format.

In the Timing Diagram format, the DAS displays data in logic waveforms representing the high and low states at each clock cycle. Up to 16 of these waveforms are displayed at one time. Screen editing functions are available for viewing different portions of memory, for labeling and rearranging channel order, and for altering display magnification. The Timing Diagram also displays 91A08 glitch information.

With the State Table format, data is displayed in hexadecimal, octal, or binary radices. In this format, up to 16 words appear on the screen at one time, with channel widths as wide as 104 bits. Up to 256 mnemonic definitions can be specified and incorporated into the display. As with the Timing Diagram, screen editing functions are provided for moving, modifying, or reformatting this display.

DAS reference memory is also displayed in hexadecimal, octal or binary radices. Data may be loaded into reference memory from acquisition memory. Reference memory data and newly acquired data appear on the screen as two adjacent state tables. Any differences in bit values are highlighted on the acquisition memory portion of the display. Bit masking and editing functions are provided for altering reference memory to represent any desired bit value.

PATTERN GENERATION

When used as a pattern generator, the DAS outputs clock, data, and strobe signals to a system under test. The 91P16 module provides 2 clocks, 16 data output lines, and 2 strobe lines. The addition of one or two 91P32 expander modules increases the output to 6 clocks, 48 data output lines, and 6 strobe lines; or to 10 clocks, 80 data output lines, and 10 strobe lines.

The output clock and data signals run from the master pattern generator clock (25 MHz maximum). The master clock can be supplied by the DAS internal clock or an external clock source.

Data output is synchronous to the clock edge. The data program may be entered in hexadecimal, octal, or binary. Special commands are available for compressing this direct in-line code through the use of goto, call, return, repeat, hold, and count functions.

Strobes are programmed asynchronously on a cycle-by-cycle basis, and can be inserted in positive- or negative-true formats. Their leading and trailing edges may be positioned independently within the cycle boundaries.

The pattern generator also recognizes external signal requests. It accepts external interrupt, pause, or inhibit signals. This allows interactive communication between the generator and the system under test.

RS-232 AND GPIB INTERFACING

All DAS test operations may be extended through the use of the RS-232, GPIB, and Hard Copy Interface (Option 02).

A GPIB interface allows parallel data transmission between the DAS and any compatible host controller. In this mode, the DAS serves as a talker and listener, while the host controller automatically controls all menu setup and test functions.

The RS-232 interface allows two DAS systems to be linked together for master/slave transmission. The master DAS serves as the controller for setting up and operating another DAS in a remote location. Either system can have a monochrome or color mainframe.

The RS-232 interface may also be used for transmitting GPIB commands.

A composite video output for hard copy units or video terminals is the third interface on the board. This feature allows documentation of results and operating parameters.

TAPE DRIVE

The tape drive (Option 01) may be used to save specific DAS setups. You can store information from the DAS on file, and then restore that information to the DAS at any time. You can store the entire instrument status, or you can store individual menus or reference memory.

DAS 9100 COMPONENTS, AND OPTIONS

All DAS 9100 Series models are comprised of a mainframe, instrument modules, and options. They may be configured individually from the list of available components. No matter which DAS model is chosen, it can be later modified or upgraded through the addition of more modules or options.

MAINFRAME STANDARD COMPONENTS

When reading the following lists, refer to Figure 1-1 for positioning of mainframe components, available modules, and options. All probes are connected through back-panel openings.

Keyboard—a functionally encoded keyboard located on the front of the mainframe. When lowered, this unit serves as the operator's interface. Keystrokes are provided for calling up the application-oriented menus, for entering valid operating parameters, and for starting or stopping the test functions.

When folded, the keyboard serves as a protective front cover when the system is not in use.

Display Monitor—a 9-inch raster scan CRT with 24, 80-character lines of display. The monitor displays the various DAS menus and provides highlighted, reverse video, and blinking screen prompters. The DAS9129 color monitor also features a color-coded display using green, yellow, and red.

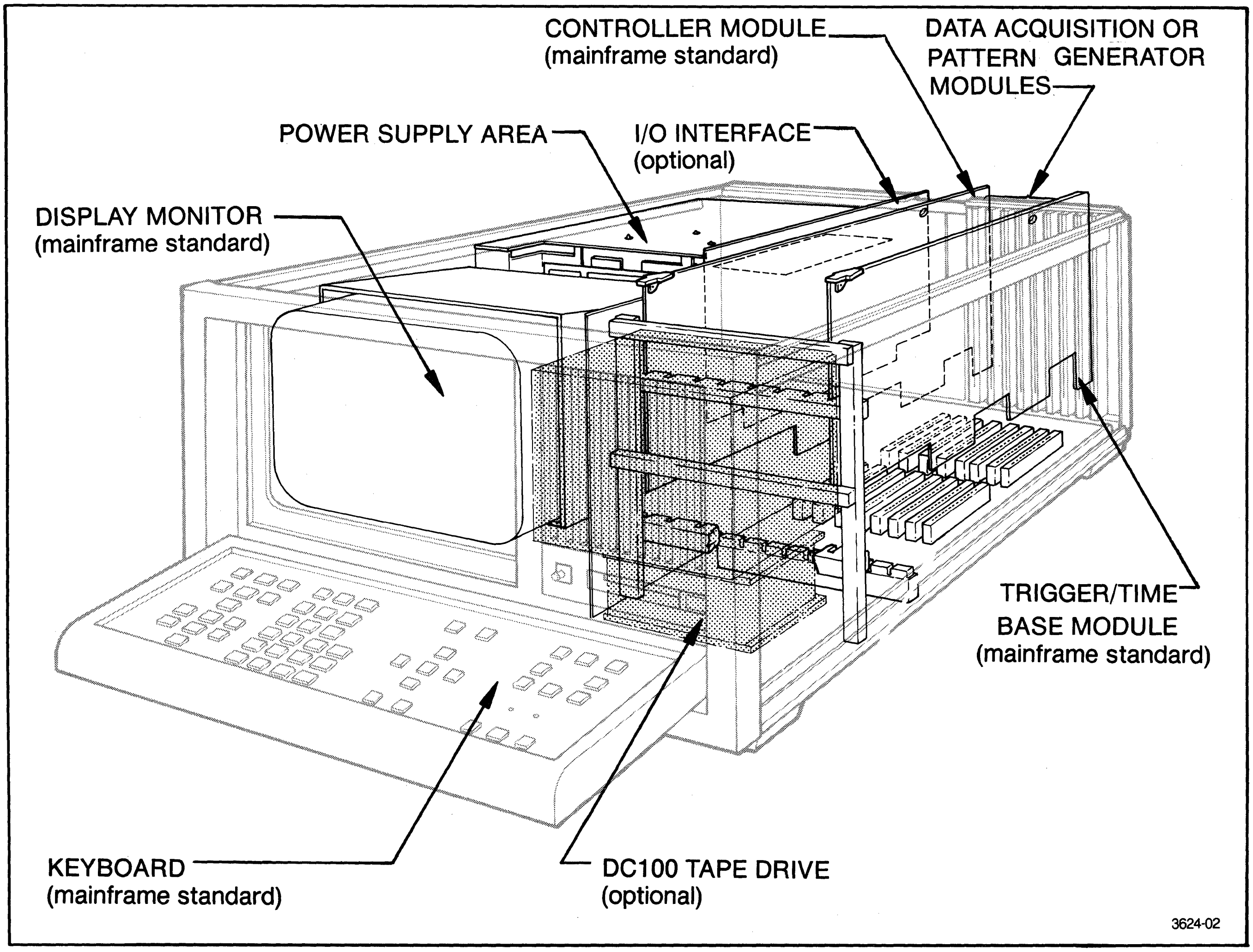


Figure 1-1. Mainframe components, modules, and options. The data acquisition and pattern generator modules are operator installable.

Interconnect—an etched circuit board fixed at the bottom of the mainframe. This board provides the module bus slots used for installing data acquisition and pattern generator modules. The board holds the Controller Module, the Trigger/Time Base Module, and up to six data acquisition or pattern generator modules.

Main Power Supply—a circuit board providing the power needed for all mainframe components except module bus slots 1-6. The Main Power Supply provides all operating power to the bus slots occupied by the Controller and Trigger/Time Base Modules (slots 0 and 7). Operating power for all other module bus slots is provided by additional +5 V Power Supply modules.

+5 V Power Supply Module—a plug-in circuit module providing all operating power for two contiguous module bus slots. If more than two modules are to be used, more power must be added as specified under Options 03 and 04.

Controller—a plug-in circuit module containing the system's Z80 microprocessor, firmware, and memory. It communicates over a 72-pin CPU bus on the Interconnect board, and controls all system modules including the keyboard and CRT interfaces and the tape drive unit.

Trigger/Time Base—a plug-in circuit module with one P6452 Data Acquisition Probe. As its name implies, this module performs two basic functions. One of its functions is to determine the occurrence of a specified trigger sequence, then generate an acquisition stop/store signal. The other is to provide the internal or external clock sources required by any installed data acquisition or pattern generator modules.

INSTRUMENT MODULES

The following data acquisition and pattern generator modules may be installed in the mainframe by the operator. Procedures are given in the Operating Instructions section of this manual.

91A32 Data Acquisition—a plug-in circuit module with four P6452 Data Acquisition Probes. It features acquisition rates of up to 25 MHz with 32 data input lines and two clock qualifiers. It has a 32 channel memory width, and a 512 word depth. (Three 91A32 modules maximum).

91A08 Data Acquisition—a plug-in circuit module with one P6452 Data Acquisition Probe. It features acquisition rates of up to 100 MHz with 8 data-glitch channels and one clock qualifier. It has separate data and glitch memories, both of which have an 8-channel memory width and 512 word depth. (Four 91A08 modules maximum.)

91P16 Pattern Generator—a plug-in circuit module with two P6455 TTL/MOS Pattern Generator Probes. This special purpose microprogrammable computer features 16 data output lines, 2 clocks output lines, and 2 strobe lines. It outputs at rates of up to 25 MHz and has capabilities for recognizing external interrupt, inhibit, and pause lines. (One 91P16 module maximum.)

91P32 Pattern Generator Expander—a plug-in circuit module with four P6455 TTL/MOS Pattern Generator Probes. This module works in conjunction with the 91P16 to provide 32 additional data output lines, 4 clock output lines, and 4 strobe lines. (Two 91P32 modules maximum.)

NOTE

The 91P32 Pattern Generator Modules are operable only if a 91P16 module is installed in the mainframe.

MAINFRAME OPTIONS

All of the following options, except the tape drive, may be installed in the mainframe by qualified service personnel in accordance with the procedures outlined in the DAS 9100 Service Manual.

Option 01, Tape Drive for DC100-type Cartridges—this unit resides in a reserved space located at the right-front of the mainframe. Its recording medium is a DC100-type tape cartridge, inserted into the driver through a slot on the Mainframe's front panel.

DAS91F1 is the field-installed version of Option 01. DAS91F1 must be installed at a Tektronix Field Service Center.

Option 02, I/O Interface—a plug-in circuit module providing GPIB, RS-232, and hard copy interfaces. When this option is installed, connectors serving each interface are mounted on the mainframe's back panel.

DAS92F2 is the field-installed version of Option 02 for the DAS9129 (color) Mainframe. DAS91F2 is the field-installed version of Option 02 for the DAS9109 (monochrome) Mainframe. DAS92F2 and DAS91F2 may be installed by any qualified service technician.

Option 03, One +5 V Power Supply—a circuit module providing operating power for two instrument bus slots. By combining this module with the power supply already in the mainframe, six of the eight bus slots receive operating power.

Option 04, Two +5 V Power Supply—two circuit modules providing operating power for four instrument bus slots. By combining these modules with the power supply already in the mainframe, all eight of the bus slots receive operating power.

Option 05, Rackmount Hardware

Option A1, European Plug, 220V/16A

Option A2, United Kingdom Plug, 240V/13A

Option A3, Australian Plug, 240V/10A

Option A4, North American Plug, 240V/15A

STANDARD AND OPTIONAL ACCESSORIES

MAINFRAME

Standard Accessories:

The following items are provided with any DAS mainframe, whether ordered separately or as part of a preconfigured system.

1	016-0729-00	Vol I Binder
1	016-0788-00	Vol II Binder
1	062-5847-01	DAS 9100 Series Operator's Manual
1	P6452	Data Acquisition Probe (with clock cable attached)
1	012-1000-00	Diagnostic Lead Set (10 in.)
1	214-3154-00	Ejector, Circuit Board

In a preconfigured system which contains one or more 91A08 Data Acquisition module, the following item is also a standard accessory.

1	P6454	100 MHz Clock Probe

Optional Accessories:

062-5848-01	DAS 9100 Series Service Manual Vol. I and II
119-1350-01	Tape Cartridges, DC100-type (package of 5)
012-0630-01	Interconnect Cable (2 meter GPIB cable)
012-0630-02	Interconnect Cable (4 meter GPIB cable)
012-0815-00	Interconnect Cable (2 meter RS-232 cable)
012-0820-00	Interconnect Cable (null modem)
012-0074-00	Cable Assembly (75 Ω coaxial, 42 in., for hard copy unit)
175-2753-00	Cable Assembly (75 Ω coaxial, 120 in., for hard copy unit)
P6452	Data Acquisition Probe
P6454	100 MHz Clock Probe
P6455	TTL/MOS Pattern Generator Probe
P6456	ECL Pattern Generator Probe

91A32 DATA ACQUISITION MODULE

Standard Accessories:

1	070-3627-00	91A32 Instructions
4	P6452	Data Acquisition Probes

Optional Accessories:

There are no optional accessories to the 91A32 module.

91A08 DATA ACQUISITION MODULE

Standard Accessories:

1	070-3612-00	91A08 Instructions
1	P6452	Data Acquisition Probe
1	012-0987-00	Flying lead set (5 in.)
1	012-0989-00	Ground (or V_L) sense lead (5 in. with Pomona hook tip)

Optional Accessories:

There are no optional accessories to the 91A08 module.

91P16 PATTERN GENERATOR MODULE

Standard Accessories:

1	070-3613-00	91P16 Instructions
2	P6455	TTL/MOS Pattern Generator Probes

Optional Accessories:

There are no optional accessories to the 91P16 module.

91P32 PATTERN GENERATOR EXPANDER MODULE

Standard Accessories:

1	070-3614-00	91P32 Instructions
4	010-6455-01	P6455 TTL/MOS Pattern Generator Probes

Optional Accessories:

There are no optional accessories to the 91P32 module.

P6452 DATA ACQUISITION PROBE

Standard Accessories:

1	070-3615-00	P6452 Instructions
1	012-0747-00	Flying lead set (10 wide, 10 in.)
1	020-0720-00	Grabber tips; package of 12
2	012-0989-00	Ground (or V_L) sense lead (5 in. with Pomona hook tip)
2	344-0046-00	Clip (alligator), electrical
1	334-4174-00	External Clock Probe label
1	343-1048-00	Flat Cable Mounts

Optional Accessories:

012-0987-00	Flying lead set (10 wide, 5 in.)
012-0800-00	Harmonica lead set (10 wide, 10 in.)
012-0968-00	Harmonica lead set (10 wide, 5 in.)
012-1000-00	Diagnostic lead set (10 in.)
012-0989-01	Ground (or V_L) sense leads (5 in. with Pomona hook tips); package of 10
103-0209-01	GPIB connector
003-0709-00	DIP clip, IC (16-pin test clip)
015-0330-00	Test clip adapter (16 DIP, 30 cm., low profile)
015-0339-02	Test clip adapter (40 DIP, 10 cm., low profile)
015-0339-00	Test clip adapter (40 DIP, 30 cm., low profile)

P6454 100 MHz CLOCK PROBE

Standard Accessories:

1	070-3837-00	P6454 Instructions
1	195-3659-00	Lead with Grabber tips; package of 2

Optional Accessories:

195-2234-06	High-Speed hook tips (DIP); package of 10
195-1943-06	High-Speed hook tips (flat pack); package of 10

P6455 TTL/MOS PATTERN GENERATOR PROBE

Standard Accessories:

1	070-3616-00	P6455 Instructions
1	012-1053-00	Pattern generator lead set (9 in.)
1	020-0720-00	Grabber tips; package of 12
1	012-0989-00	Ground (or V_L) sense lead (5 in., black, with Pomona hook tip)
1	012-0990-00	Ground (or V_H) sense lead (5 in., green, with Pomona hook tip)
1	343-1048-00	Flat Cable Mounts

Optional Accessories:

012-0747-00	Lead set (10 wide, 10 in.)
012-1000-00	Diagnostic lead set (10 in.)
012-0551-00	High-speed pattern generator lead set (10 wide, 5 in., harmonica)
012-0989-01	Ground (or V_L) sense leads (5 in., black, with Pomona hook tip); package of 10
012-0990-01	Ground (or V_H) sense leads (5 in., green, with Pomona hook tip); package of 10

P6456 ECL PATTERN GENERATOR PROBE

Standard Accessories:

1	070-3753-00	P6456 Instructions
1	012-0926-00	Pattern generator lead set (9 in.)
1	012-0551-00	High-speed pattern generator lead set (10 wide, 5 in., harmonica)
1	020-0720-00	Grabber tips; package of 12
1	012-0989-00	Ground (or V_L) sense lead (5 in., black, with Pomona hook tip)
1	012-0990-00	Ground (or V_H) sense lead (5 in., green, with Pomona hook tip)
1	343-1048-00	Flat Cable Mounts

Optional Accessories:

012-1000-00	Diagnostic lead set (10 in.)
012-0989-01	Ground (or V_L) sense leads (5 in., black, with Pomona hook tip); package of 10
012-0990-01	Ground (or V_H) sense lead (5 in., green, with Pomona hook tip); package of 10

SPECIFICATIONS

DAS9129 AND DAS9109 MAINFRAMES

Table 1-1
MAINFRAME ELECTRICAL SPECIFICATIONS: MAINFRAME POWER

Characteristic	Performance Requirements	Supplemental Information
Primary Power Input		90 V to 132 V (Low) or 180 V to 250 V (High), 48 to 63 Hz, Single Phase 1000 VA max, 10 A max.

Table 1-2
MAINFRAME ELECTRICAL SPECIFICATIONS: CONTROLLER MODULE

Characteristic	Performance Requirements	Supplemental Information
Characters per Line		80
Lines per Screen		24

Table 1-3
MAINFRAME ELECTRICAL SPECIFICATIONS: TRIGGER/TIME BASE MODULE

Characteristic	Performance Requirements	Supplemental Information
Word Recognizer Output		
Output level		TTL
Propogation delay		53 ns ±10 ns
Cycle delay		Output signal occurs 3 clock cycles after word is clocked in at probes
Trigger Enable Input		
Triggering level		TTL (rising edge)
Cycle Offset		The trigger is enabled on the fifth data word proceding the clock cycle in which the Trigger Enable Input is received.
Trigger "Event 1" Occurrence Counter		1 Count, min.; 32,767 Counts, max.;
Delay Counter		1 Count, min.; 32,767 Counts, max.
91A32 Internal Clock	200 Hz to 25 MHz ±1%	

Table 1-3 (cont)

Characteristic	Performance Requirements	Supplemental Information
91A08 Internal Clock	200 Hz to 25 MHz ±1%	
External Clock Inputs:		
Pulse Period	40 ns, min.	
Pulse High	19 ns, min.	
Pulse Low	19 ns, min.	
Trigger Enable		TTL (high-true enable)
Module-to-Probe Signals		
Threshold Reference Voltage (VTHLD)		For clocks and control signals
Fixed (TTL)		Screen Displays +1.4 V
Variable (VAR)		Screen displays −2.5 V to +5.0 V in 50 mV steps. Default is −1.3 V
Auxiliary (MOS)		Screen displays −10 V to +20 V in 200 mV steps. Selected by slide switch on probe in AUX position.
TTL and VAR Threshold Accuracy (at Module Output)	(Menu-selected value) x (−0.25) ±1% ±5 mV	
MOS Threshold Accuracy (at Module Output)	(Menu-selected value) x (−1) ±3% ±20 mV	
TTL and VAR Threshold Accuracy (to input of attached probe)		Menu-selected Value ±(2% ±100 mV)
MOS Threshold Accuracy (to input of attached probe)		Menu-selected Value ±(4% ±160 mV)

Table 1-4
MAINFRAME ENVIRONMENTAL SPECIFICATIONS

Characteristic	Description
Temperature	
Operating	0°C to +50°C
Storage	−40°C to +65°C
Altitude	
Operating	10,000 ft.—DAS9109; 15,000 ft.—DAS9129
Storage	15 km max. (50,000 ft.)

Table 1-5
DAS9129 MAINFRAME PHYSICAL SPECIFICATIONS

Characteristic	Description
Weight (w/o Accessories)	23.13 kg (51 lbs.)
Overall Dimensions	See Figure 1-2.

Table 1-6
DAS9109 MAINFRAME PHYSICAL SPECIFICATIONS

Characteristic	Description
Weight (w/o Accessories)	21.77 kg (48 lbs.)
Overall Dimensions	See Figure 1-2

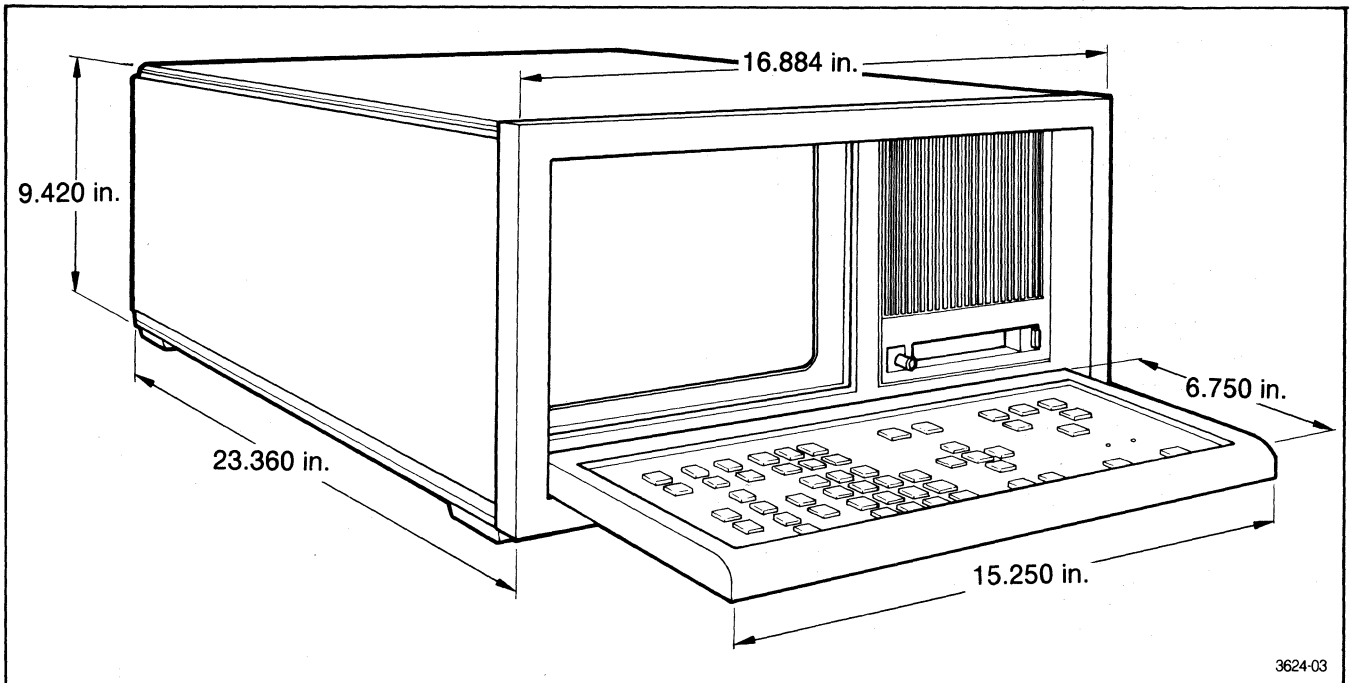


Figure 1-2. Mainframe dimensional drawing.

Table 1-7
91A32 ELECTRICAL SPECIFICATIONS: DATA ACQUISITION AND STORAGE

Characteristic	Performance Requirements	Supplemental Information
Maximum Sampling Rate	25 MHz with internal or external clock (40 ns cycle time)	20 Mhz with qualifiers enabled
Acquisition Memory		
Memory Depth		512 words
Memory Width		32 channels data (1 module, 4 probes); expandable to 96 channels data (3 modules, 12 probes)
Data Set-up (period data valid prior to external clock edge)	29 ns, min. with data acquisition probe attached	
Data Hold (period data valid beyond external clock edge)	0 ns, min. with data acquisition probe attached	

Table 1-7 (cont)

Characteristic	Performance Requirements	Supplemental Information
Storage Qualifiers		2 per module (6 max. with 3 modules)
Qualifier Polarity		Selectable: positive or negative true
Qualifier Set-up Time	29 ns, min. with data acquisition probe attached	
Qualifier Hold Time	0 ns, max. with data acquisition probe attached	
Clock		Clock is actually a function of the mainframe Trigger/Time Base Module
Source		Selectable from one internal and three external sources through the Trigger/Time Base. With external clock selected, at least one 91A32 module must be using CLK1. CLK1 is acquired through the External Clock Probe.
Clock Polarity (external)		Selectable: rising or falling edge
Clock Period (internal)		Selectable: 40 ns, or 50 ns through 5 ms in 16 steps (1-2-5 sequence) or off
Minimum External Clock Pulse Width	19 ns, min.	

Table 1-8
91A32 ELECTRICAL SPECIFICATIONS: CLOCK AND TRIGGER

Characteristic	Performance Requirements	Supplemental Information
Trigger		
Trigger Types		1, 2, and 3-level word recognition and pattern-sequence comparison
Word Recognizers		Three: "Event 1", "Event 2", and "Event 3"
Recognizer Word Width		Same as memory width
Recognizer Bit Condition Selection		Logic 1, logic 0, or X (don't care)
Trigger Position		BEGIN, CENTER, END, and DELAY. In DELAY mode the 91A32 trigger sequence number is assigned as follows: Trigger sequence = 504-DELAY value.
Trigger Delay		Selectable from 1 to 32,767 sample periods after trigger
Pattern Sequence Comparison		Compare until equal or until not equal

Table 1-8 (cont)

Characteristic	Performance Requirements	Supplemental Information
Pattern Sequence Length		From 1 to 512 words
Trigger Modes		
91A32 AND 91A08		Must have both 91A32 and 91A08 modules in the system. The 91A08 qualifier is disabled. "Event 2" and "Event 3" trigger words are not supported on the 91A08 module. The 91A08 is restricted to the specifications of the 91A32, with the following exception: in AND mode the 91A08 module has a hold time of 20 ns. In the AND mode, the 91A08 modules always use the master CLK1 from the External Clock Probe. 91A08 pods cannot be in the same group(s) as 91A32 pods.
91A32 ARMS 91A08		After 91A32 recognizes its trigger event, the 91A08 is enabled to begin looking for its trigger. 91A32 and 91A08 setup and hold restrictions are unchanged in this mode. If any qualifiers are enabled in this mode, you will get a separation fence display.
91A32 EXT-SPLIT Clocks		In order for the data from different 91A32 modules to be displayed in the correct time relationship, all clocks used in this mode must run at the same frequency and be phase related. CLK1 defines the cycle boundary. Clocks CLK2 and CLK3 must fall within the cycle times of CLK1. Clocks CLK2 and CLK3 must occur 40 ns prior to the next CLK1 boundary. Each 91A32 module must meet setup and hold specifications individually. The rightmost 91A32 module that uses CLK1 in the Trigger Specification menu's CLOCK ASSIGNMENT field is the master 91A32 module. Only 91A32 modules using CLK1 in the same polarity as the master 91A32 may have qualifiers.

Table 1-9
91A32 ELECTRICAL SPECIFICATIONS: PROBE INTERFACE AND SUPPORT

Characteristic	Performance Requirements	Supplemental Information
Threshold Reference Voltage (VTHLD)		For data and qualifiers
Fixed (TTL)		Screen displays +1.4 V
Variable (VAR)		Screen displays −2.5 V to +5.0 V in 50 mV steps. Default is −1.3 V.
Auxiliary (MOS)		Screen displays −10 V to +20 V in 200 mV steps. Selected by putting the slide switch on the probe in AUX position.
TTL and VAR Threshold Accuracy (at Module Output)	(Menu-selected value) x (−0.25) ±1% ±5 mV	
MOS Threshold Accuracy (at Module Output)	(Menu-selected value) x (−1) ±3% ±20 mV	
TTL and VAR Threshold Accuracy (to input of attached probe)		Menu-selected value ±(2% ±100 mV)
MOS Threshold Accuracy (to input of attached probe)		Menu-selected value ±(4% ±160 mV)

Table 1-10
91A08 ELECTRICAL SPECIFICATIONS: DATA ACQUISITION AND STORAGE

Characteristic	Performance Requirements	Supplemental Information
Maximum Sampling Rate	100 MHz with internal or external clock	66 MHz with qualifiers enabled. Valid from 0°C to 40°C
Acquisition Memory		
Memory Depth		512 words
Memory Width		8 channels data, 8 channels glitch (1 module, 1 probe); expandable to 32 channels data, 32 channels glitch (4 modules and 4 probes)
Data Set-up (period data valid prior to external clock edge)	9 ns using one to four 91A08 modules	
Data Hold (period data valid beyond external clock edge)	0 ns, max.	
Minimum Glitch Width	7 ns	At threshold
Storage Qualifiers		1 per module (4 max. with 4 modules)
Qualifier Polarity		Selectable: positive or negative
Qualifier Set-up Time	15 ns, min., using one to four 91A08 modules	Valid from 0°C to 40°C
Qualifier Hold Time	0 ns, max. with data acquisition probe attached	

Table 1-11
91A08 ELECTRICAL SPECIFICATIONS: CLOCK AND TRIGGER

Characteristic	Performance Requirements	Supplemental Information
Clock		Clock is actually a function of the Trigger/Time Base Module
Source		Selectable from two internal and two external sources (91A32 CLK1 from the Trigger/Time Base Module or the 100 MHz Clock Probe)
Clock Polarity (external)		Selectable: rising or falling edge
Clock Period (internal)		Selectable: 10 ns, 20 ns, 40 ns or 50 ns through 5 ms in 16 steps (1-2-5 sequence) or off
Accuracy (internal clock)		Specified rate ±(1% ±1 ns)

Table 1-11 (cont)

Characteristic	Performance Requirements	Supplemental Information
Trigger		
Trigger Types		Single-level word recognition
Word Recognition		Single-level data word or glitch word, externally armable (from 91A32 trigger)
Word Width		Same as memory width
Bit Specification		
Word Recognition		Logic 1 or logic 0, or X (don't care)
Glitch Recognition		Logic 1 or X (don't care)
Trigger Position		BEGIN, CENTER, END, and DELAY. In DELAY mode, the 91A08 trigger sequence number is assigned by the user as follows: trigger sequence = 508-DELAY value
Stop-store Delay		Selectable from 1 to 32,767 sample periods after trigger
Pattern-Sequence Comparison		Compare until equal or until not equal
Pattern Length		From 1 to 512 words
External Clock		
Pulse Period	10 ns min.	
Pulse High	5 ns min.	
Pulse Low	5 ns min.	
AND Mode Characteristics		
Setup Time		29 ns
Hold Time		20 ns
Maximum Clock Rate (Internal or External)		20 MHz (50 ns)
ARMS Mode Characteristics		The 91A08 trigger will be armed within 10 91A32-clock cycles after the occurrence of the 91A32 trigger

Table 1-12
91A08 ELECTRICAL SPECIFICATIONS: DATA PROBE INTERFACE AND SUPPORT

Characteristic	Performance Requirements	Supplemental Information
Threshold Reference Voltage (VTHLD)		
Fixed (TTL)		Screen displays +1.4 V
Variable (VAR)		Screen displays −2.5 V to +5.0 V in 50 mV steps
Auxiliary (MOS)		Screen displays −10 V to +20 V in 200 mV steps. Selected by slide switch on probe in AUX position.
TTL and VAR Threshold Accuracy (at module output)	(Menu-selected value) x (−0.25) ±1% ±5 mV	
MOS and VAR Accuracy (at module output)	(Menu-selected value) x (−1) ±3% ±20 mV	
TTL and VAR Threshold (Accuracy to input of attached probe)		Menu-selected value ±(2% ±100 mV)
MOS Threshold Accuracy (to input of attached probe)		Menu selected value ±(4% ±160 mV)

Table 1-13
91P16 AND 91P32 ELECTRICAL SPECIFICATIONS: PATTERN DATA

Characteristic	Performance Requirements	Supplemental Information
Pattern Data Width		16 parallel channels (1 91P16, 2 probes); expandable to 80 channels (1 91P16, 2 91P32s and 10 probes)
Data Channel Skew	10 ns, max., at Probe Output	All data channels will be valid at the probe outputs within 10 ns of each other.
Pattern Compression Techniques		The following instructions are available to specify the sequence of data output: COUNT, REPEAT, HOLD, GOTO, CALL, RETURN, HALT
REPEAT, HOLD, and Data-Increment COUNT		Programmable from 2 to 255 clock cycles

Table 1-13 (cont)

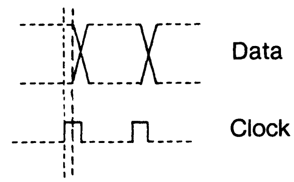
Characteristic	Performance Requirements	Supplemental Information
Data-Clock Timing	Data changes a minimum of 2 ns and a maximum of 15 ns after the transition of the selected clock edge	 10 ns typical
Maximum Number of Unique COUNT, HOLD, and REPEAT Values		6 total
Maximum Number of Nested Subroutines and Interrupts		16
Maximum Number of Labels		32

Table 1-14
91P16 AND 91P32 ELECTRICAL SPECIFICATIONS: STROBE AND CLOCK OUTPUTS

Characteristic	Performance Requirements	Supplemental Information
Number of Strobes		2 individual strobes (1 module, 2 probes); expandable to 10 strobes (3 modules, 10 probes)
Strobe Start Time		Selectable from 70 ns to 40.910 μs in 40 ns steps
Strobe Pulse Width		Selectable from 40 ns to 40.880 μs in 40 ns steps
Maximum Pulse Width plus Strobe Delay		40.950 μs
Probe Pulse Polarity		Selectable: positive or negative
Strobe Enable Time		First strobe edge must be programmed 70 ns or greater after the beginning of the cycle boundary
Strobe Delay Accuracy	Menu-selected value $\pm$(10% $\pm$6 ns)	
Strobe Width	Menu-selected value $\pm$(10% $\pm$6 ns)	
Clock Output		One clock line (rising edge signifies beginning of each cycle)

Table 1-14 (cont)

Characteristic	Performance Requirements	Supplemental Information
Clock Output Pulse Width (using internal clock)		⩾14 ns, min.
Clock Output Pulse Width (using external clock)		Input clock pulse width ±6 ns (clock pulse comes from External Clock Probe)
Clock Skew Between Output Clocks of Different Probe Pods		±5 ns

Table 1-15
91P16 AND 91P32 ELECTRICAL SPECIFICATIONS: TIMING

Characteristic	Performance Requirements	Supplemental Information
Operating Rate, RUN Mode		Up to 25 MHz (40 ns cycle time), determined by selected clock
Clock		
Source		External or internal, menu-selectable
Polarity		Rising or falling edge, menu-selectable
External Clock		
Pulse Period	40 ns, min.	
Pulse High	19 ns, min.	
Pulse Low	19 ns, min.	
Internal Clock		Obtained from Trigger/Time Base Module of the mainframe

Table 1-16
91P16 AND 91P32 ELECTRICAL SPECIFICATIONS: INPUT CONTROL SIGNALS

Characteristic	Performance Requirements	Supplemental Information
External Clock Input		1 external clock line (edge selectable), 19 ns min. pulse width
Pause Input		1 pause line, selectable high- or low-true (pattern generator maintains current output conditions while pause line remains true).

Table 1-16 (cont)

Characteristic	Performance Requirements	Supplemental Information
Pause Input Hold Time		12 ns. If pause line is held true for 12 ns after the pattern generator external clock transition, then the next cycle's output data will pause. That is, output data will be held constant and output clocks will stop until the pause line goes false. Typical hold time is 7 ns.
Pause Input Minimum Pulse Width		19 ns
Interrupt Input		1 interrupt line from External Clock Probe selectable for rising- or falling-edge assertion.
Interrupt Processing Cycle Delay		4 cycles. When a valid interrupt request is logged in, the first interrupt vector appears at the probe tip in the fourth following cycle unless the instruction on that cycle is a GOTO, CALL, or RETURN. If so, the first interrupt vector will not appear until these instructions have been executed.
Interrupt Minimum Pulse Width		19 ns
Interrupt Input Set-up Time Relative to the Pattern Generator External Clock Input		7 ns min. Assert the interrupt request 7 ns prior to the selected edge of the pattern generator external clock. Typical value = 0 ns.
Interrupt Input Set-up Time Relative to the Pattern Generator Clock		72 ns min. Assert interrupt request 72 ns prior to clock rising edge output. Typical value = 60 ns.
Interrupt Latency		4 cycle times. After an interrupt, the pattern generator must begin to execute the interrupt routine without receiving another interrupt. After the interrupt has begun, it is valid to intrrupt again. Interrupts sent at an invalid time are ignored.
Inhibit Delay Time		70 ns. When the pattern generator external inhibit line is asserted, the pattern generator data outputs will be inhibited or tri-stated a maximum of 70 ns later.
Inhibit Input Minimum Pulse Width		19 ns

NOTE

Inhibit capability may only be used with the P6455 TTL/MOS Pattern Generator Probe.

Table 1-17
P6452 ELECTRICAL SPECIFICATIONS

Characteristic	Performance Requirements	Supplemental Information
Maximum Input Threshold Control Voltage		±10 V
Input Resistance		1 MΩ ±1%
Input Capacitance		5 pF nominal, Lead set adds ≈5 to 10 pF
Maximum Non-Destructive Input Voltage Range		±40 V peak
Operating Input Voltage Range		From −40 V to input threshold voltage +10 V (+30 V for RS-232 only)
Small Signal Gain		100 mV input around programmed input threshold yields a minimum gain of 5 (across differential outputs)
Ratio of Input Voltage to Threshold Control Voltage	4:1 ±1%	
Threshold Offset	±80 mV (±40 mV 20°C to 30°C)	

Table 1-18
P6452 ENVIRONMENTAL SPECIFICATIONS

Characteristic	Description
Temperature	
Operating	0°C to +50°C
Storage	−55°C to +75°C
Altitude	
Operating	4.60 km (15,000 ft)
Non-operating	15 km (50,000 ft)
Cables	
Flex Life	1000 cycles at 120° flex with 0.68 kg (1.5 lb) weight
Pull Test	15.88 kg (36 lbs) axial pull at 1 minute duration
Electrical Discharge	10 kV max. from 200 pF with 2 kΩ series resistance

Table 1-19
P6452 PHYSICAL SPECIFICATIONS

Characteristic	Description
Dimensions (approx):	
POD	11.5 cm (4.5 in.) L x 5.6 cm (2.2 in.) W x 2.2 cm (0.85 in.) T
Cable (Flat Ribbon)	2 m (78.75 in.)
Weight	340 gm (12 oz)

Table 1-20
P6454 ELECTRICAL SPECIFICATIONS
(INCLUDES CIRCUITRY ON 91A08 MODULE)

Characteristic	Performance Requirements	Supplemental Information
Number of Channels		1
Transconductance		2 mA/V nominal
Bandwidth	150 MHz, min. to 3 dB point	
Probe Delay Time		Approximately 9 ns
Probe Input Impedance		
Input Resistance at Tip of Probe Lead		1 MΩ ±5%
Input Capacitance		5 pF ±1 pF
Reference Input Characteristic at Tip		Floating reference input
Maximum Non-Destructive Voltage to Either Input		25 V (dc + peak ac)
Maximum Non-Destructive Voltage to V_{ref}		25 V (dc + peak ac)
Voltage Range		
Operating Input		−4 V to +7 V (dc + peak ac)
Common Mode		−2 V to +5 V (dc + peak ac)
Input Sensitivity	700 mV p-p	700 mV p-p, centered on threshold will provide full ECL swing at output of receiver
Threshold Accuracy	±50 mV ±3% of threshold setting	
Clock Rise Time/Fall Time (Terminated in 50 Ω to +3 V)		1.0 ns max 20-80% in response to a 700 mV p-p square wave centered about V_{ref}
Minimum Input Signal Slew-Rate		50 V/μs

Table 1-21
P6454 ENVIRONMENTAL SPECIFICATIONS

Characteristic	Description
Temperature	
Operating	0°C to +50°C
Storage	−55°C to +75°C
Altitude	
Operating	4.6 km (15,000 ft.)
Non-operating	15 km (50,000 ft.)
Electrical Discharge	12 kV, max.; 1 kΩ series resistance +500 pF
Cables	
Flex Life	10,000 cycles at 120° flex with 0.40 kg (0.882 lb.) weight
Pull Test, Hybrid Pod	4.54 kg (10 lbs.)

Table 1-22
P6454 PHYSICAL SPECIFICATIONS

Characteristic	Description
Length	
Probe Tip to Connector	Electrically cut to length
Input Leads	38 mm (1.5 in)
Weight	
Probe Assembly	23 gm (0.81 oz)

Table 1-23
P6455 ELECTRICAL SPECIFICATIONS

Characteristic	Performance Requirements	Supplemental Information
Number of Channels		10
Maximum Frequency	25 MHz at V_L=0, V_H=5 V	
Minimum Pulse Width		15 ns
Signal Transit Time		21.5 ns ±5 ns Measured with V_H=5 V, V_L=0 V with load 1 MΩ, 15 pF
Inhibit, Uninhibit Delay Time		≤10 ns (after transit time) measured with V_H=5 V, V_L=0 V Load: 100 Ω to +2.5 V C ≤15 pF
User Logic Supply Power to POD		
Logic high (V_H) Range	0 V to +15 V	
Logic low (V_L) Range	−15 V to 0 V	
VDIF (V_H-V_L) Range	3 V to 25 V	
Current Drain	User load current +120 mA, max.	
Maximum Non-Destructive Voltages		V_H: ±20 V VDIF: ±25 V V_L: −20 to +5 V
Drive Configurations		
TTL or MOS		Active pull-up and pull-down
Tri-state		High impedance (>100 kΩ)
Output Drive Current Maximum Source or Sink Current for probe output		FOR VDIF RANGE (3 to 5 V) 20 mA (>5 to 25 V) 10 mA
Output Levels		
Logic Low (VOL)	V_L to V_L + 0.5 V with current load of 10 mA, VL +0.6 V @ 20 mA	
Logic High (VOH)	V_H to V_H − 1.6 V with current load of 20 mA	
Short Circuit Protection		Between V_L +5 V and V_L −0.5 V in low state. Between V_H −5 V and V_H +0.5 V in high state

Table 1-23 (cont)

Characteristic	Performance Requirements	Supplemental Information
Output Rise/Fall Time		
TTL and MOS (Vdiff 5 V to 15 V)		Slew rate >0.5 V per ns, 15 pF load. Measured from 10%-90% of steady state voltage.
Inhibited Output		
Leakage		<100 μA
Capacitance		10 pF, nominal without lead set. Lead set adds ≈10 pF

Table 1-24
P6455 ENVIRONMENTAL SPECIFICATIONS

Characteristic	Description
Temperature	
Operating	0°C to +50°C
Storage	−55°C to +75°C
Altitude	
Operating	4.6 km (15,000 ft.)
Non-operating	15 km (50,000 ft)
Electrical Discharge	12 kV max. from 500 pF with 1 kΩ series resistance
Cables	
Flex Life	1000 cycles at 120° flex with 0.68 kg (1.5 lb) weight
Pull Test	15.88 kg (35 lbs) axial pull at one minute duration

Table 1-25
P6455 PHYSICAL SPECIFICATIONS

Characteristic	Description
Dimensions (approx)	
POD	11.5 cm (4.5 in.) L x 5.6 cm (2.2 in.) W x 2.2 cm (0.85 in.) T
Cable (Flat Ribbon)	2 m (78.75 in.)
Weight	
Probe	340 gm (12 oz)

Table 1-26
P6456 ELECTRICAL SPECIFICATIONS

Characteristic	Performance Requirements	Supplemental Information
Number of Channels		10
Maximum Frequency	25 MHz	
Minimum Pulse Width		15 ns
Signal Transit Time		18.2 ns ±5 ns measured with V_H = 0 V, V_L = 5 V with load 50 Ω to −2 V, ≤15 pF
User Logic Supply Power to Adapter		
V_H		0 V to 5.5 V
V_L		−5.5 V to 0 V
Maximum Non-Destructive Input		V_H ±15 V V_L ±15 V VDIFF ±10 V
Output Levels		
Logic High (VOH)	V_H −0.60 V to V_H −1.00 V	With 50 Ω load to (VH −2 V)
Logic Low (VOL)	V_H −1.65 V to V_H −2.00 V	With 50 Ω load to (VH −2 V)
Current Drain		
V_H		User load +130 mA, max. with VDIFF = 5.2 V ±5%
V_L		230 mA, max. with VDIFF = 5.2 V ±5%
Protection (output short circuit)		To between V_H +0.5 V and V_L −0.5 V

Table 1-27
P6456 ENVIRONMENTAL SPECIFICATIONS

Characteristic	Description
Temperature	
Operating	0°C to +50°C
Storage	−55°C to +75°C
Altitude	
Operating	4.6 km (15,000 ft)
Non-operating	15 km (50,000 ft)
Electrical Discharge	12 kV max. from 500 pF with 1 kΩ series resistance
Cables	
Flex Life	1000 cycles at 120° flex with 0.68 kg (1.5 lb) weight
Pull Test	15.88 kg (35 lbs) axial pull at one minute duration

Table 1-28
P6456 PHYSICAL SPECIFICATIONS

Characteristic	Description
Dimensions (approx)	
POD	11.5 cm (4.5 in.) L x 5.6 cm (2.2 in.) W x 2.2 cm (0.85 in.) T
Cable (Flat Ribbon)	2 m (78.75 in.)
Weight	
Probe	340 gm (12 oz)

Table 1-29
TAPE DRIVE ELECTRICAL SPECIFICATIONS

Characteristic	Performance Requirements	Supplemental Information
Cartridge Capacity		160K bytes
Data Cartridge Data Format		
Characters Per Record		256 8-bit bytes
Character Format		8-bit serial with LSB first and MSB last
Tape Transport		
Drive Type		Digitally controlled servo motor
Drive Method		Single capstan drive on cartridge drive roller

Table 1-30
TAPE DRIVE ENVIRONMENTAL SPECIFICATIONS

Characteristic	Description
Temperature	
Operating	0° to +50°C max. ambient
Storage	−40° to +65°C (without tape)
Altitude	
Operating	Up to 4.60 km (15,000 ft)
Storage	Up to 15 km (50,000 ft)

Table 1-31
I/O INTERFACE ELECTRICAL SPECIFICATIONS: RS-232 LINES

Characteristic	Performance Requirements	Supplemental Information
Baud Rates (keyboard select)		300, 600, 1200, 2400, 4800, and 9600 baud
Inputs		Input impedance; $3\ k\Omega \leqslant Z_{in} \leqslant 7\ k\Omega$
Pin 3 Received Data		MARK or OFF: $-25\ V \leqslant V_{in} \leqslant -3\ V$
Pin 5 Clear To Send		SPACE or ON: $+3\ V \geqslant V_{in} \geqslant +25\ V$
Pin 6 Data Set Ready		
Pin 8 Data Carrier Detect		
Outputs		With load impedance: Rload $\geqslant 3\ k\Omega$
Pin 2 Transmitted Data		MARK or OFF: $V_{out} \leqslant -6\ V$
Pin 4 Request To Send		SPACE or ON: $V_{out} \geqslant +6\ V$
Pin 20 Data Terminal Ready		
Other		
Pin 1 Ground		Case ground
Pin 7 Signal Ground		Instrument ground

Table 1-32
I/O INTERFACE ELECTRICAL SPECIFICATIONS: GPIB BUS SIGNALS

NOTE

The electrical specifications of this interface conform to the electrical specifications contained in the IEEE 488-1978, "Standard Digital Interface for Programmable Instrumentation."

Table 1-33
I/O INTERFACE ELECTRICAL SPECIFICATIONS: COMPOSITE VIDEO

Characteristic	Performance Requirements	Supplemental Information
V_{on}		1.4 V to 1.6 V, nominal 1.5 V
V_{off}		0.3 V to 0.7 V, nominal 0.5 V
V_{sync}		0 V to 0.1 V, nominal 0 V
T_{hsync}		63.5 μs $\pm$0.1 μs
T_{vsync}		16.5 ms $\pm$0.1 ms

OPERATING INSTRUCTIONS 2

This section describes how to set up a DAS mainframe, modules, and probes. It also describes the instrument's keyboard, connectors, and indicators.

In this section you will find: **Page**

OPERATING INSTRUCTIONS

MAINFRAME INSTALLATION

Most DAS 9100 models are preconfigured and sent from the factory with modules already installed in the mainframe. All you have to do is set up the mainframe.

POWER REQUIREMENTS

All DAS mainframes operate from a nominal 115 or 230 V, 50 to 60 Hz, single-phase power source. Before connecting the mainframe to a power source, verify that the line-voltage indicator on the mainframe's back panel is showing the correct nominal voltage for the power source you are using. Figure 2-1 shows the back-panel location of the line-voltage indicator.

CAUTION

If the line-voltage indicator shows the wrong voltage for the power source to be used, refer the instrument to qualified service personnel for fuse adjustment.

POWER CORDS

All DAS mainframes come with a 3-wire power cord with a 3-contact plug for connection to the power source and to protective ground. The plug protective-ground contact connects to the accessible metal parts of the instrument through the power cord protective grounding conductor. For protection against electrical shock, insert this plug into a power source socket that has a securely grounded protective-ground contact.

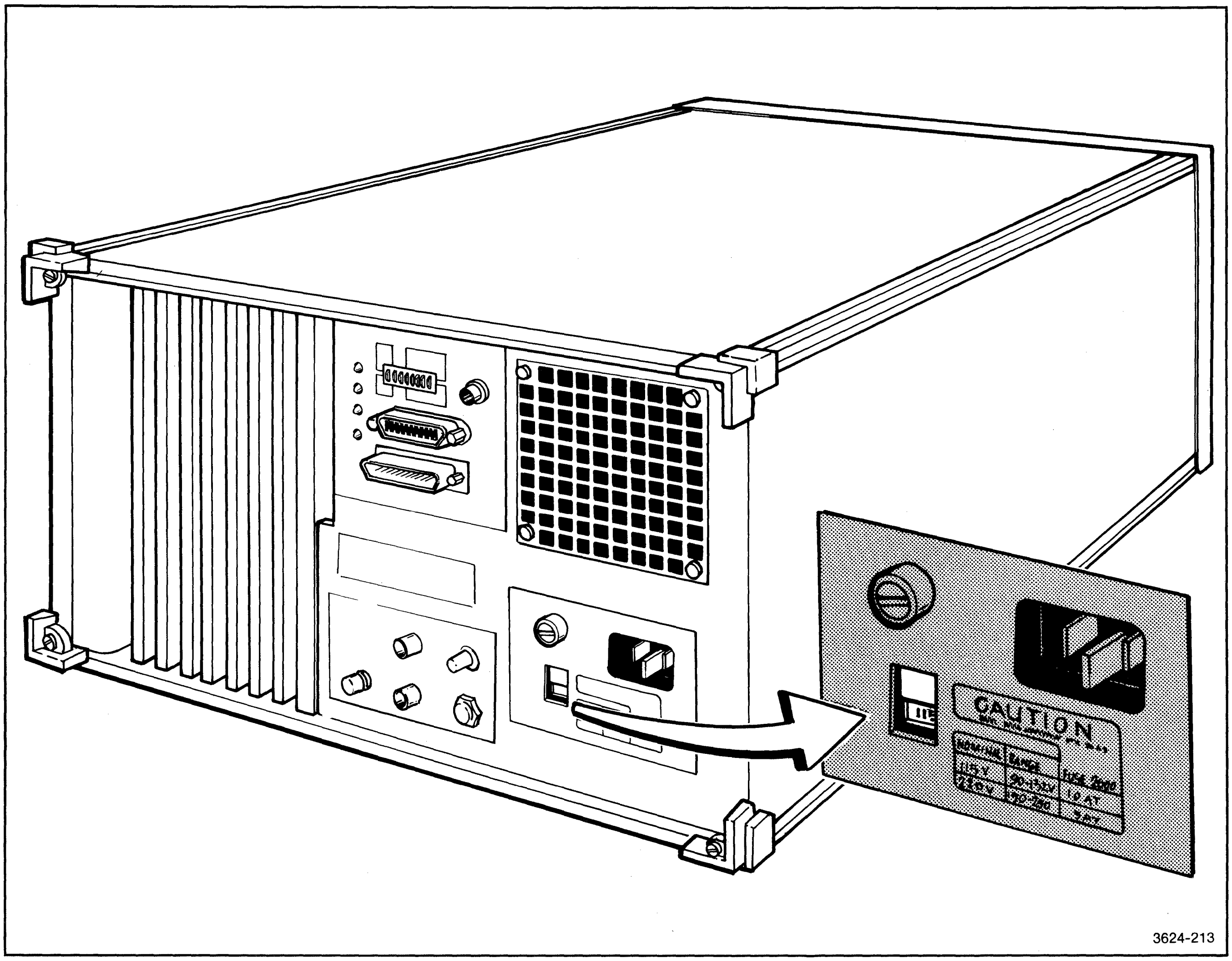


Figure 2-1. Location of the line-voltage indicator.

WARNING

Hazardous voltages may be present on the exposed metal surfaces of the mainframe if the power source socket's protective ground connection is not securely grounded.

The power cord is attached via the mainframe's back panel, as shown in Figure 2-2.

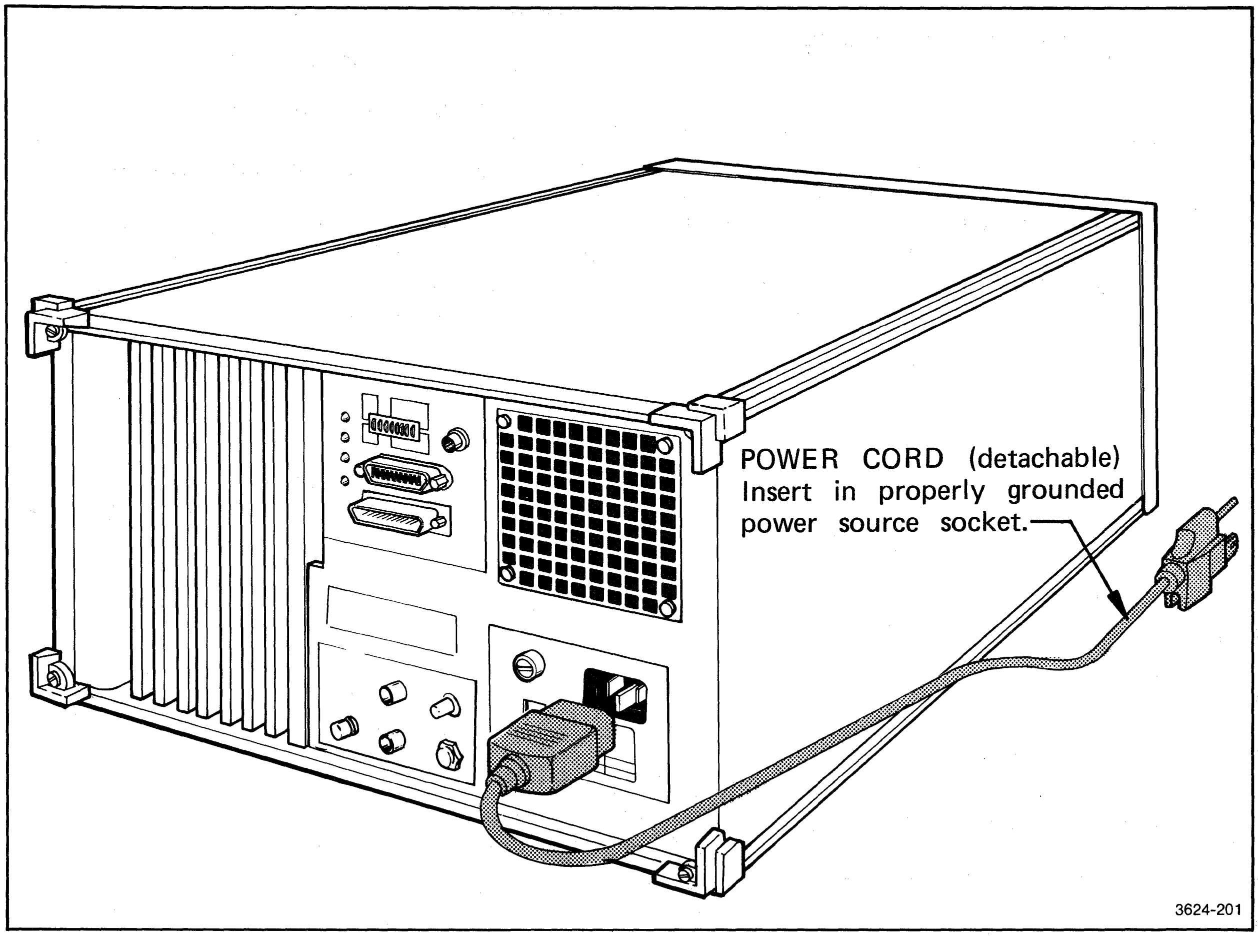


Figure 2-2. Connecting the power cord.

The DAS mainframes are shipped with a 115 V power cord unless otherwise ordered. Other power cords that can be used with the mainframe are shown in Figure 2-3. For information on these power cords, contact your Tektronix representative or your local Tektronix Field Office.

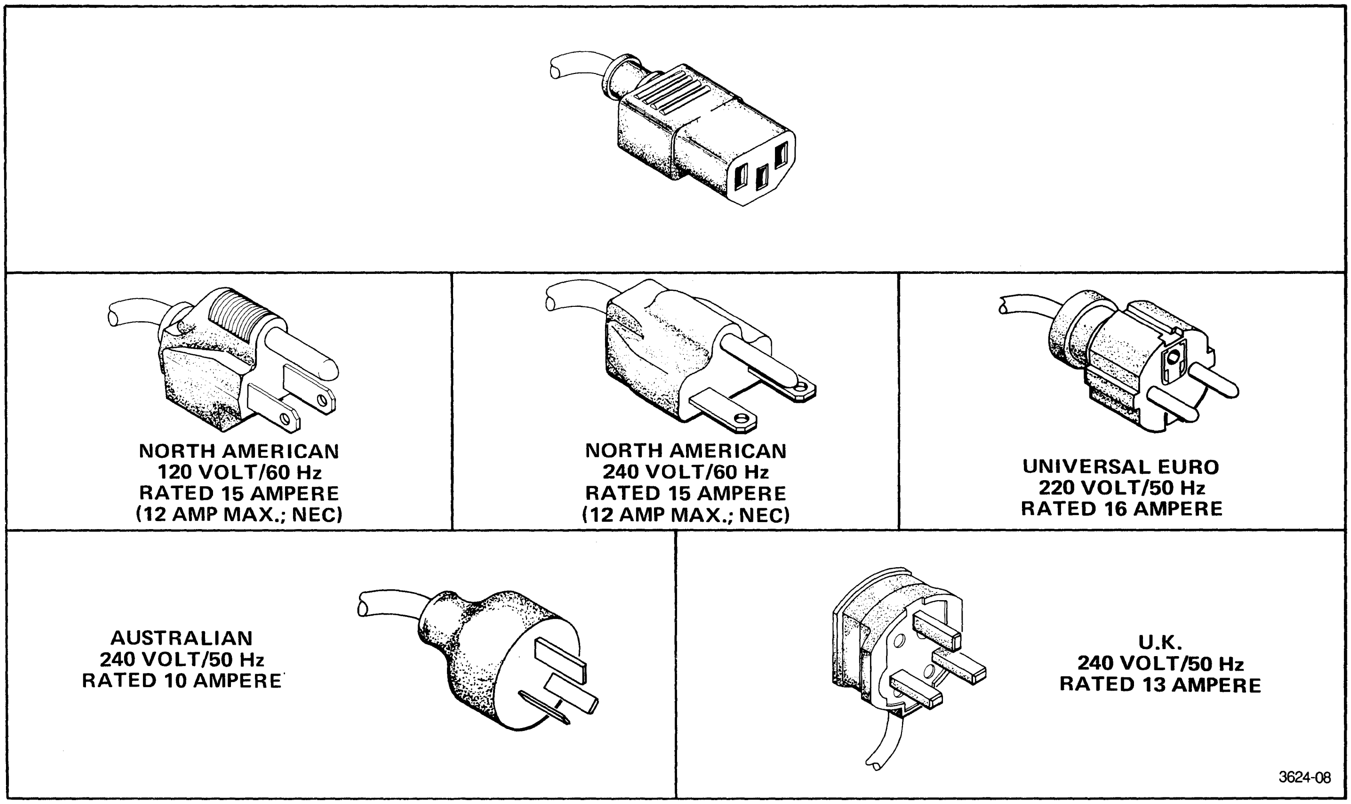


Figure 2-3. Optional DAS power cords.

MAINFRAME GROUND

As shown in Figure 2-4, DAS mainframes provide a back-panel ground post. This post can be used to establish a common ground between the mainframe and other instrumentation. Use the post connector to avoid ground loop problems.

REPACKAGING INFORMATION

You may at some time need to ship a DAS mainframe, module, or probe. If so, repackage the product in its original transportation package. If the original transportation packaging is no longer fit for use, contact your nearest Tektronix Field Office and obtain new DAS packaging.

NOTE

You do not need to ship the whole mainframe if only a module or probe is in need of repair. You may ship these items separately using anti-static packaging material ONLY.

When shipping a product to a Tektronix Service Center, you should always attach an identifying tag to the product (inside the packaging). This tag should provide the following information: your name; the name and address of your company; the name and serial number of the enclosed product; and a description of the service requested.

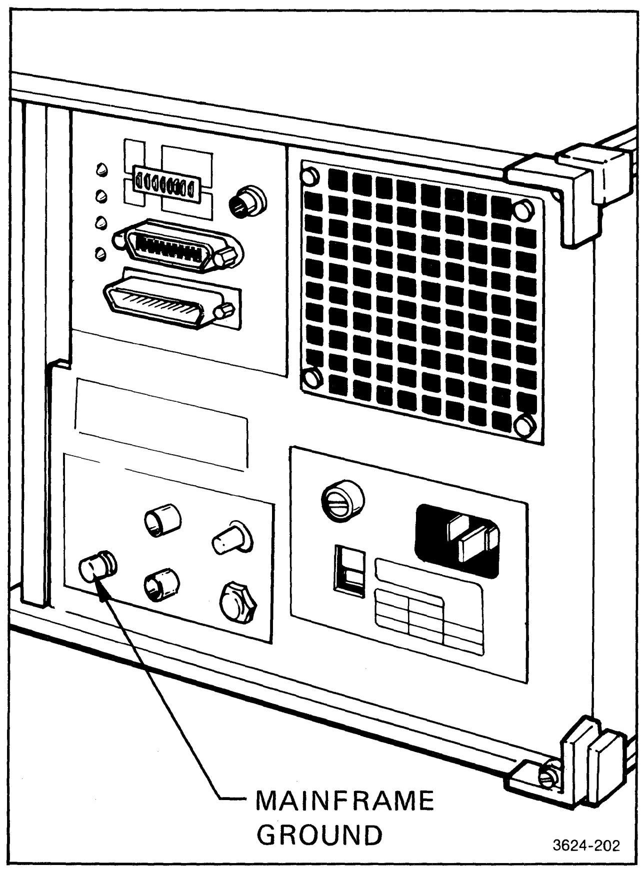


Figure 2-4. Location of the mainframe ground connector.

MODULE INSTALLATION

If you order data acquisition or pattern generator modules separately from a mainframe, you may install them yourself or you may elect to have them installed at a Tektronix Service Center. All data acquisition and pattern generator modules may be installed by the operator. The operator may not install or move any other parts or components of the instrument.

Before you attempt the procedures for installing a module, unplug the mainframe from its power source. While the mainframe's module compartment contains no hazardous voltages (it is low voltage/low power), the voltages present may damage the module being installed.

CAUTION

Damage to the module circuitry may occur if the module is installed or removed while the mainframe is receiving power.

REMOVING THE MODULE COMPARTMENT COVER

To install a data acquisition or pattern generator module, you must first remove both the mainframe's top panel and its inner module compartment cover.

WARNING

To change instrument modules, the operator may gain access to the module compartment only. Other compartments within the mainframe contain hazardous voltages.

Figure 2-5 illustrates the steps used when removing the module compartment cover. Refer to this figure while reading the following paragraphs.

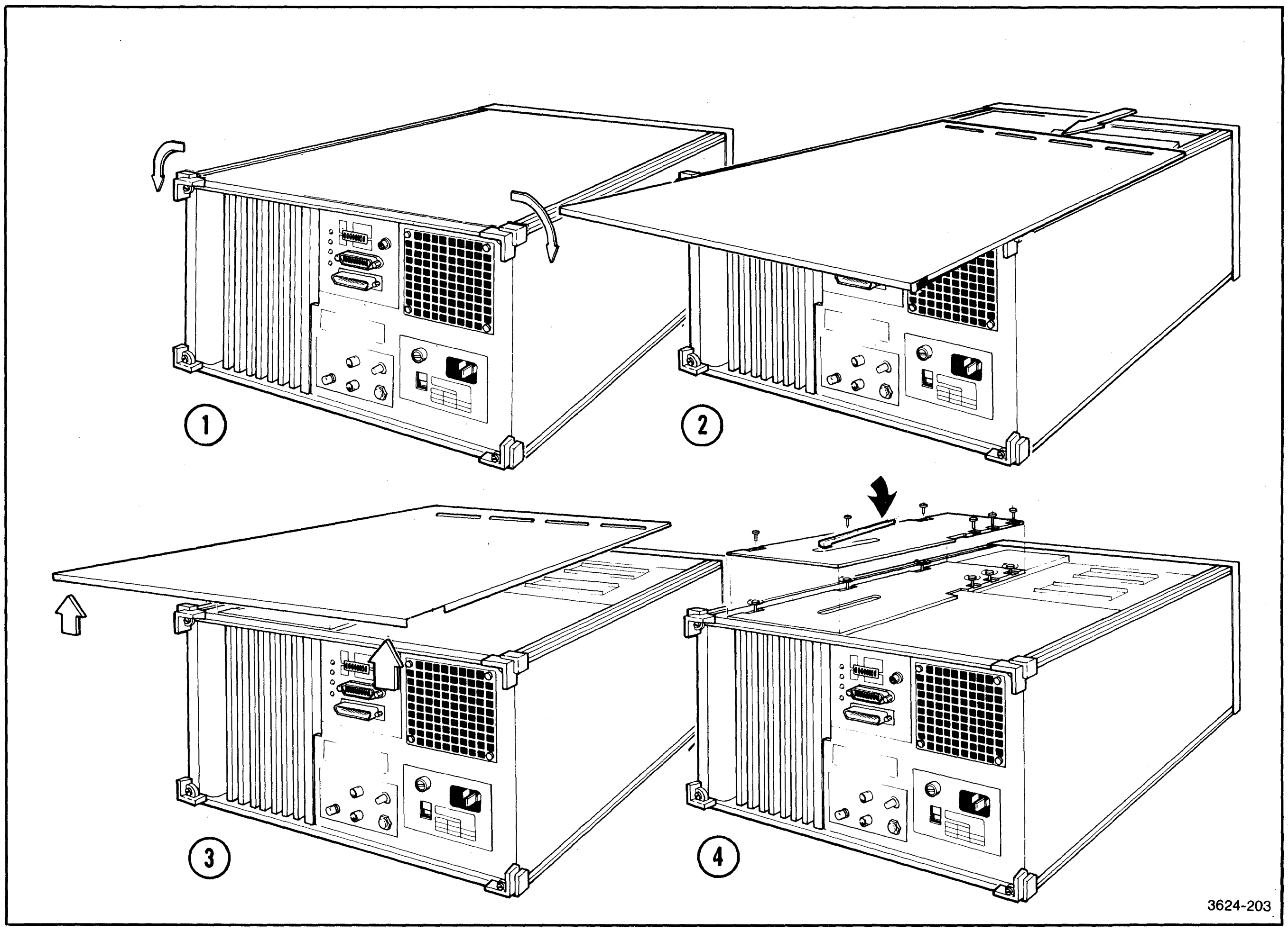


Figure 2-5. Removing the module compartment cover. (This figure shows the DAS9129 color mainframe; the DAS9109 monochrome mainframe is similar.)

To remove the module compartment cover:

1. Loosen the screws located in upper right and left corners of the mainframe's back panel. Then rotate the plastic brackets behind these screws until they no longer block the back edge of the top panel.

2. Grasp the back edge of the top panel and pull it back a few inches so that the front edge disengages from the mainframe.

3. Lift the panel up and off.

4. Loosen the screws on the inner cover labeled MODULE COMPARTMENT. Grasp the front edge of this cover and lift it off the mainframe.

CONFIGURATION GUIDELINES

Figure 2-6 shows the inside of a DAS mainframe. This view is from the front of the mainframe.

The module compartment contains eight bus slots labeled 0-7. These bus slots may be identified by the white numbers on the fan housing in front of the module compartment. Each bus slot consists of two parallel connectors located at the bottom of the mainframe on the interconnect board.

Bus slot 0 is dedicated to the Controller Module, while slot 7 is dedicated to the Trigger/Time Base Module. These two modules are standard with the mainframe and must always be installed in their dedicated slots.

Bus slots 1-6 are reserved for data acquisition and pattern generator modules. Table 2-1 provides guidelines for positioning the modules within the six bus slots. These guidelines match factory configurations and, therefore, other DAS instruments. The configuration compatibility between two instruments is especially useful when transferring magnetic tape files from one instrument to another (see the Input Output Menu section of this manual).

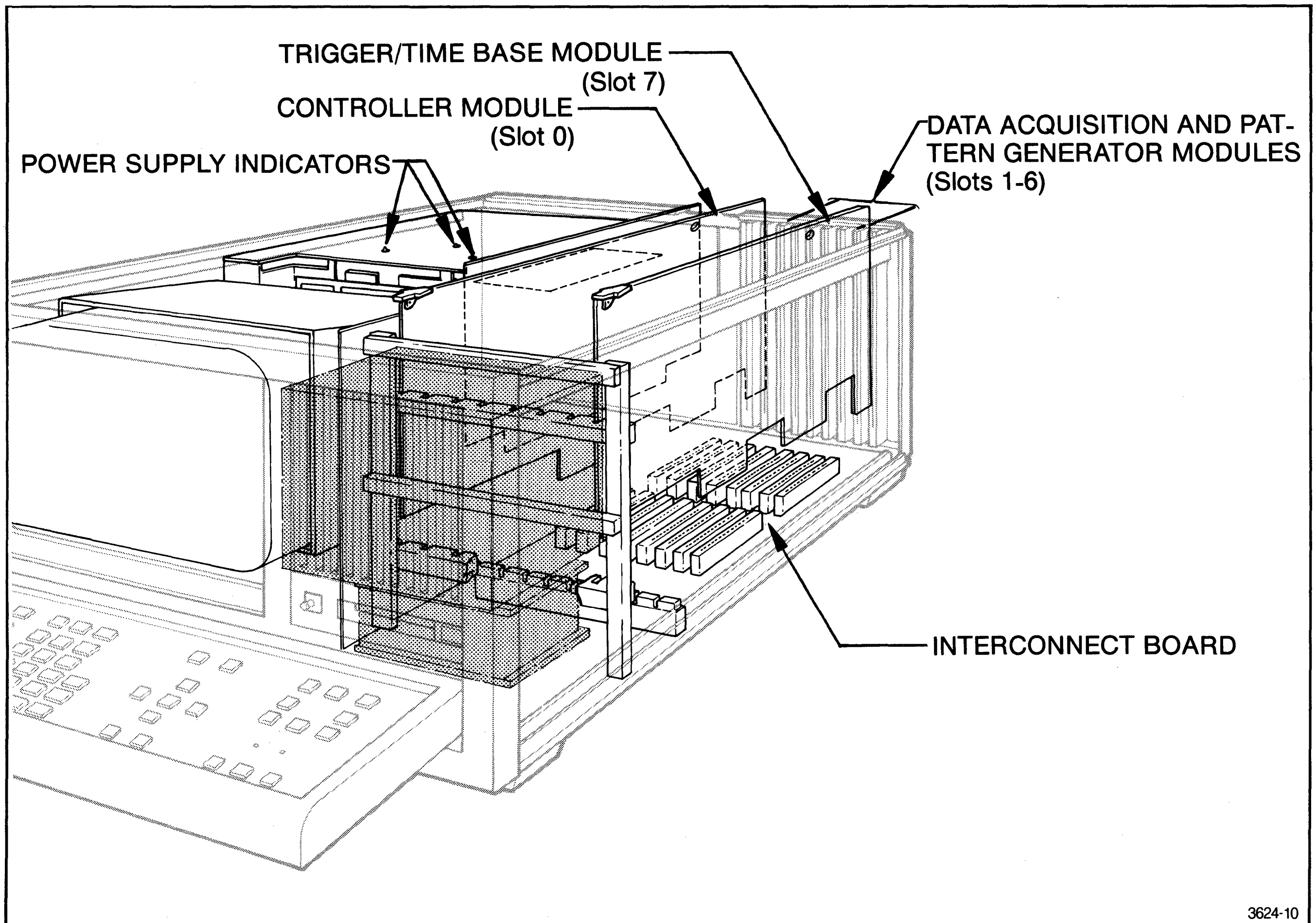


Figure 2-6. Internal structure of a DAS mainframe.

Table 2-1
Configuration Guidelines

Module	Max. per Mainframe	Recommended Bus Slot(s)	Functional in Bus Slot(s)	Comments
Controller	1	0	0	Required
Trigger/Time Base	1	7	7	Required
91A08	4	6(5,4,3)	6(5,4,3)	Required: first 91A08 in slot 6, additional 91A08s in descending slots (5,4,3)
91A32	3	2-6	1-6	
91P16	1	1	1-6	
91P32	2	2-6	1-6	Will not function without a 91P16 installed.

Remember, power to bus slots is modular. Verify that the selected slot has power before installing the module.

For a module to work, it must be installed in a bus slot that is powered. The power for bus slots 1-6 is modular, so you should always check which bus slots are powered before you install a module.

WARNING

To avoid contact with hazardous voltages, the operator must not remove the black covering over the power supply area. For installation or removal of power supply modules, refer to qualified service personnel.

You may see which bus slots are powered by looking at the three power supply holes located in the black covering over the power supply area. Each modular power supply supports two bus slots. The label next to each power supply indicator tells you which bus slots that power supply supports. A power supply is present if a chrome stem is visible in the hole.

INSTALLING OR REMOVING A MODULE

Figure 2-7 illustrates the steps used when installing a module in a bus slot. Refer to this figure while reading the following procedures.

To install a module:

1. Position the module over the bus slot, with the ejector tab pointing toward the front of the mainframe. The ejector tab must be pushed down so that it is parallel to the module.
2. Insert the module between the module guides at the top of the mainframe. This procedure is easiest if you align the module with the back guide first.
3. Slide the module down through the guides until the two connectors are resting on top of the bus slot connectors.
4. Apply sufficient pressure to push the module into the bus slot connectors. The module is in place when it is flush with the tops of the other installed modules.

After you have positioned the modules within the mainframe, be sure to replace the mainframe covers as described earlier. Do not operate the mainframe without both the module compartment cover and top panel in place.

Figure 2-8 illustrates the steps used when removing a module from a bus slot. Refer to this figure while reading the following procedures.

To remove a module:

1. Position the circuit board ejector tool in the small hole located in the upper-rear corner of the module. (It is best to position the tool on the side of the module which does not contain components.)
2. Brace the ejector tool on the back of the mainframe.
3. Use the ejector tool to pry up the back edge of module, while, at the same time, pulling up on the inside edge of the ejector tab. You will feel the module disengage from the connectors.
4. Grasp the top of the module and carefully pull it out of the mainframe.

NOTE

A special groove is located in the top of the DAS9129's and DAS9109's module compartment cover. This groove is used to store the circuit board ejector tool.

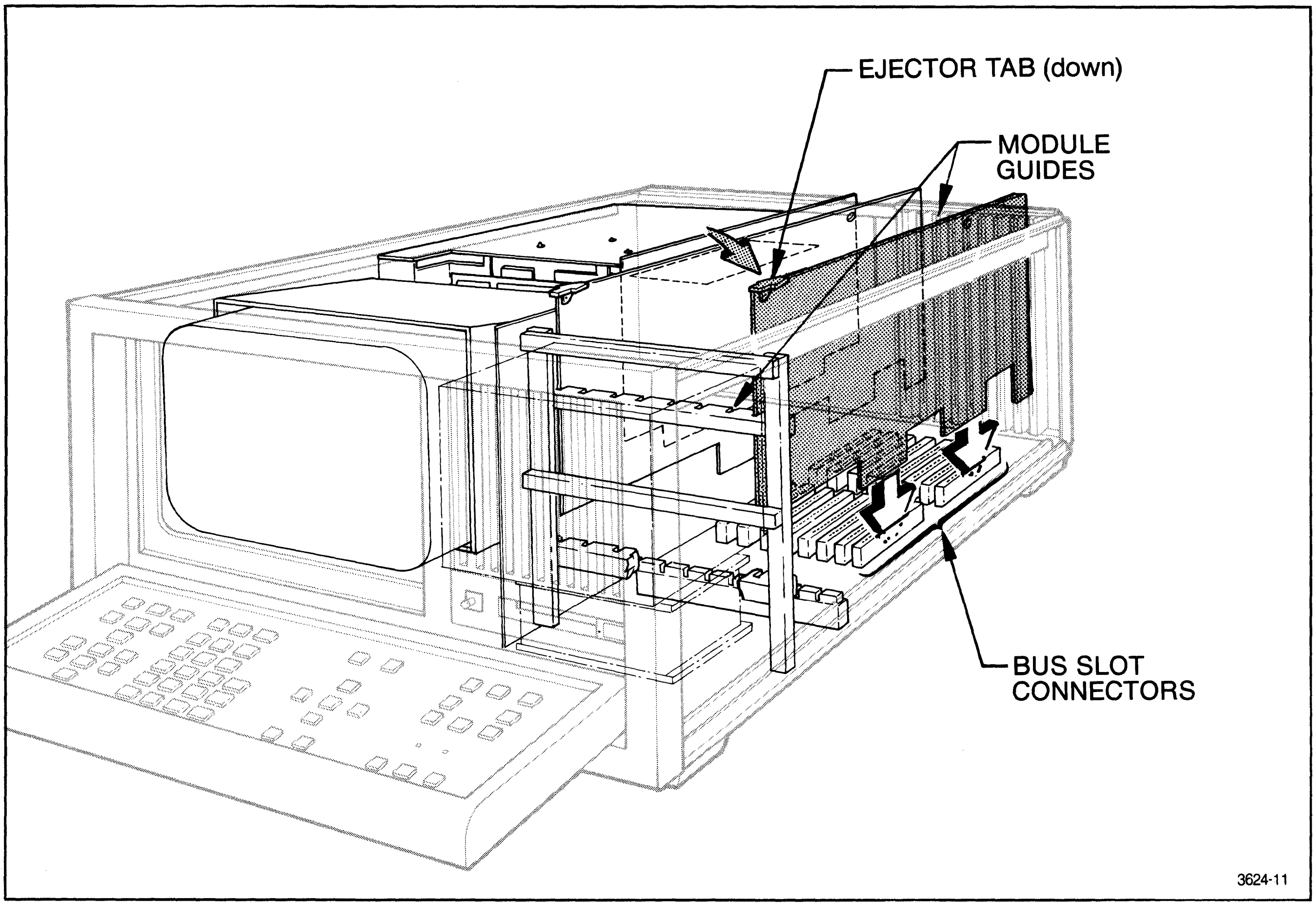


Figure 2-7. Installing a module in a bus slot.

MODULE CONFIGURATION LABEL

All DAS mainframes provide a module configuration label similar to the one shown in Figure 2-9. The DAS9129's (color mainframe) configuration label is located on the fan housing in front of the internal module compartment. The DAS9109's (monochrome mainframe) configuration label is located on the mainframe back panel.

The module configuration label is used to specify the mainframe's module configuration, firmware version, options, and serial numbers. Any changes made to the mainframe should be written on this label. Use a grease pencil so that the information can be easily changed.

PROBE CONNECTIONS

CONNECTING A PROBE TO THE DAS

The DAS probes are attached to their respective modules via the mainframe back panel. Bus slot openings on the back panel allow access to the pod connectors located on the back edge of each module.

Each back-panel bus slot provides room for up to four pod connector locations, labeled A-D. Depending on the module installed in the bus slot, one or all of these pod connector locations may be used.

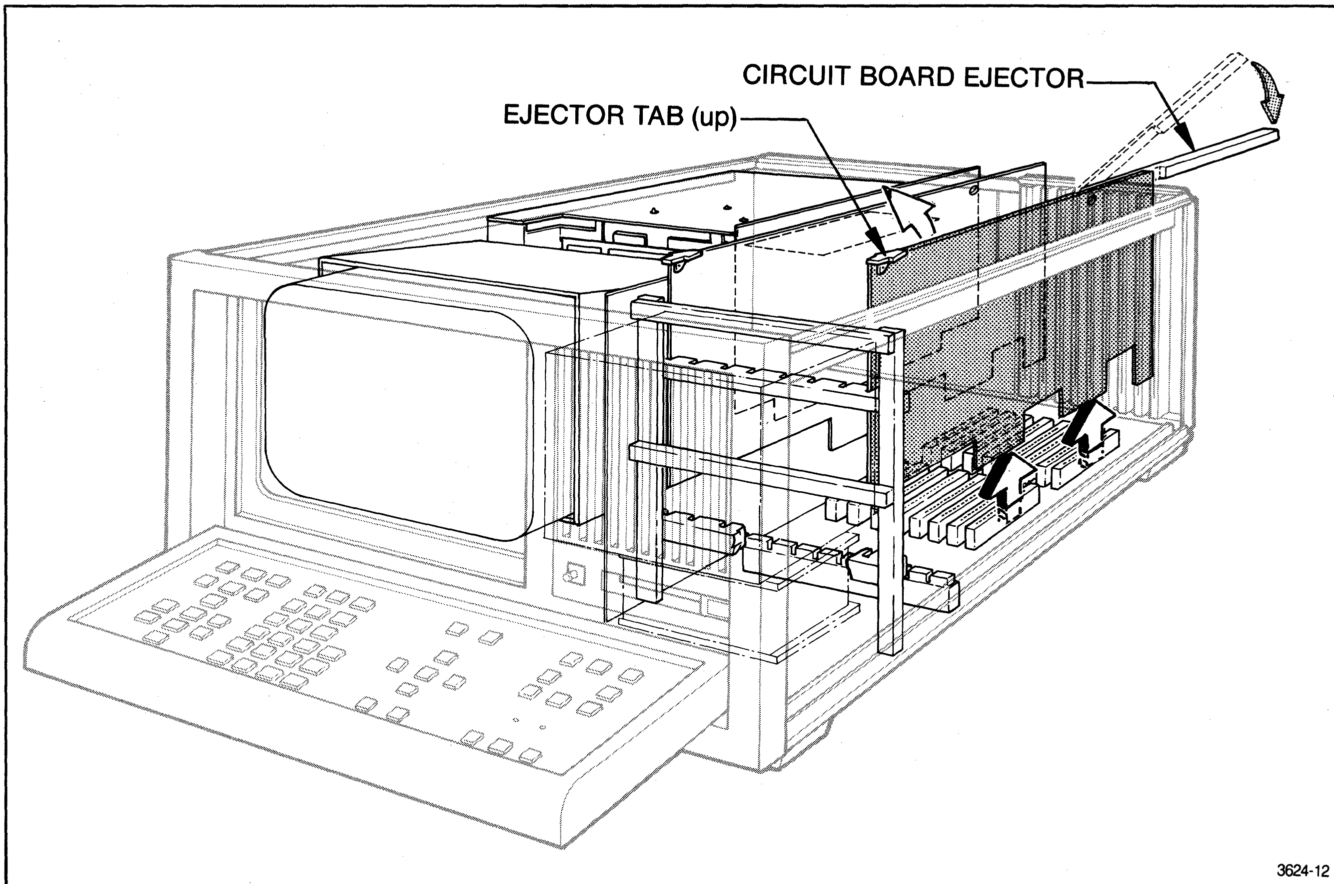


Figure 2-8. Removing a module from a bus slot.

Table 2-2 lists the various probe types, which modules they support, and where they are connected.

When connecting a probe to a module, first find the bus slot where that module is installed. This information should be written on the module configuration label.

Once you have determined the bus slot, look through the back-panel opening and locate the pod connectors.

Figure 2-10 illustrates how to attach a probe to a pod connector. Refer to this figure while reading the following procedures.

NOTE

When connecting probes to a module with more than one pod connector, it is easiest to connect the first probe to the bottom connector and then work up.

To connect a probe:

1. Grasp the probe's cable holder.

2. Align the cable holder with the pod connector. Be sure the raised tab on the cable holder is facing towards bus slot 0, and is aligned with the opening on the pod connector.

3. Gently push the cable holder onto the pod connector. Do not force the connection.

If the DAS is turned on when you are connecting a probe, the monitor will beep and display that probe's POD ID (see following description of POD ID) on the second line of the screen. If an acquisition probe is connected to a pattern generator module (or vice versa) the monitor will beep continuously until the probe disconnected.

To disconnect a probe from a pod connector, simply grasp the probe by its cable holder and gently pull it off the pod connector.

CAUTION

Damage may occur to the probe cable if you disconnect the probe by pulling on the cable rather than on the cable holder.

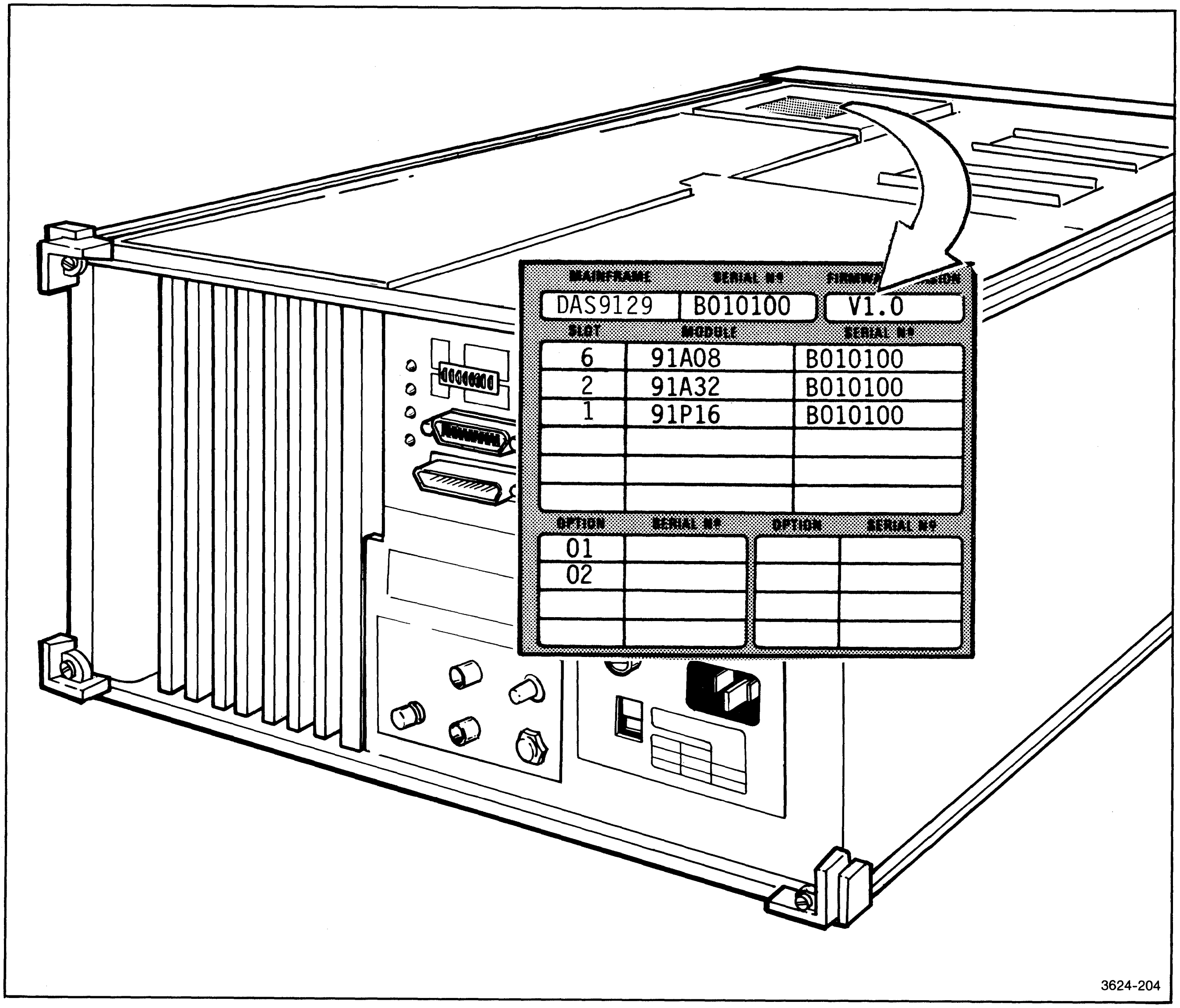


Figure 2-9. The module configuration label. (The DAS9129 is shown here; the DAS9109's label is located on the mainframe back panel.)

Table 2-2
DAS Probes and Their Pod Connections

Probe Type	Module	Pod Connectors
P6452 External Clock Probe	Trigger/Time Base Module	C
P6452 Data Acquisition Probe	91A32 Data Acquisition Module 91A08 Data Acquisition Module	A B C D C
P6455 TTL/MOS Pattern Generator Probe	91P16 Pattern Generator Module 91P32 Pattern Generator Expander Module	B C A B C D
P6456 ECL Pattern Generator Probe (Available as an option)	91P16 Pattern Generator Module 91P32 Pattern Generator Module	B C A B C D
P6454 100 MHz Clock Probe	91A08 Data Acquisition	Does not use a pod connector. Attach to the coaxial connector located on the 91A08 module installed in bus slot 6.

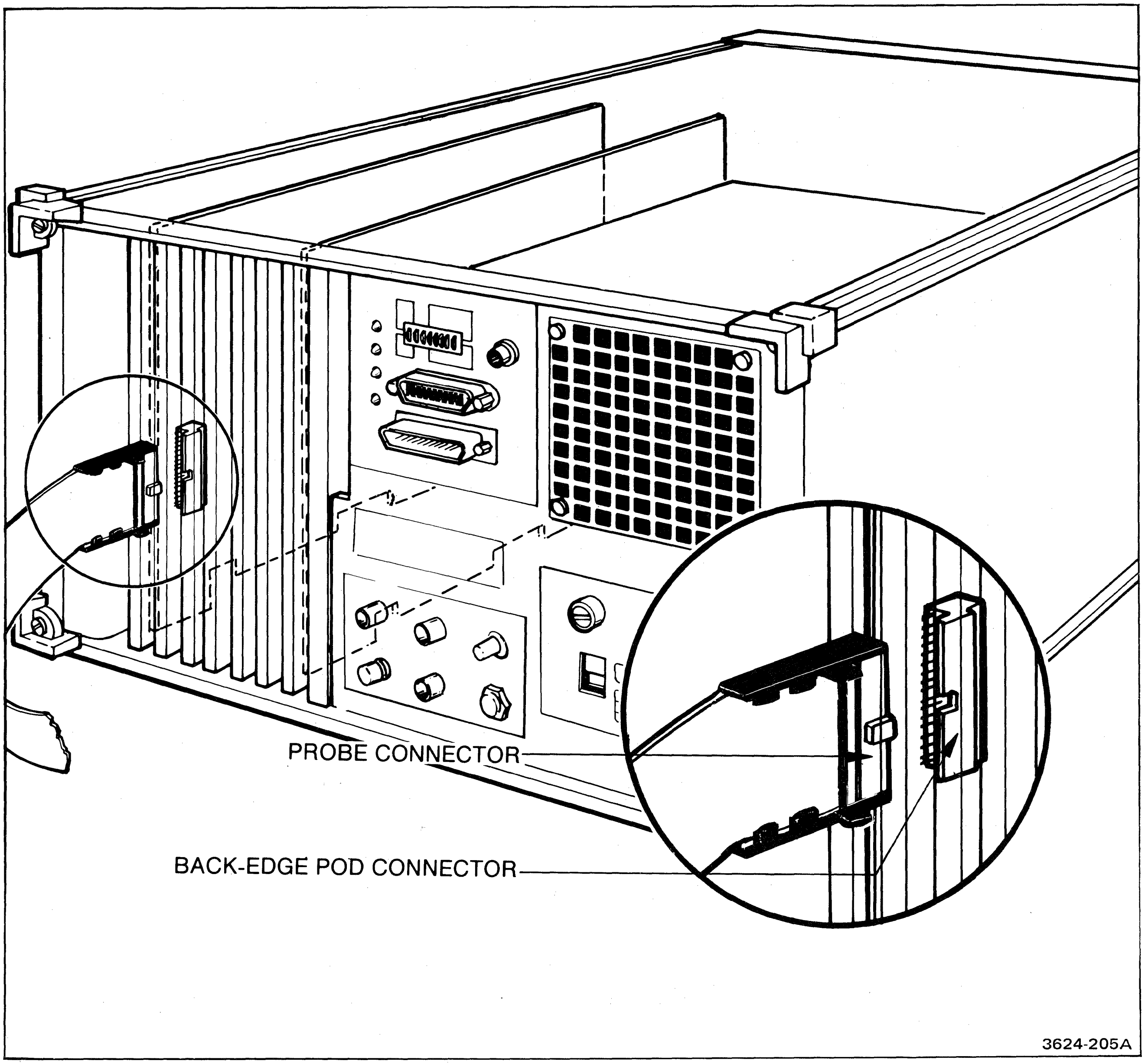


Figure 2-10. Connecting a probe to a pod connector.

To avoid frequent connecting and disconnecting of probes and lead sets, you can use the Channel Specification menu to rearrange the display order of data acquisition channels without reconnecting probe leads. (Refer to Channel Specification Menu section of this manual for procedures.)

Connecting the 100 MHz Clock Probe. The 100 MHz Clock Probe is not attached to a pod connector. This probe is attached to a special coaxial connector located on the 91A08 module's back edge. It should only be attached to the 91A08 module installed in bus slot 6. One 100 MHz Clock Probe supports all installed 91A08 modules.

POD ID

Each connected probe (except for the 100 MHz Clock Probe) has a 2-character POD ID. The ID consists of a bus slot number and a pod connector letter. The POD IDs for each possible probe location are written on the mainframe's back panel next to each bus slot opening.

A POD ID button is provided on the back of each probe (except the 100 MHz Clock Probe). When the DAS is turned on, you may press this button to obtain a screen readout of a specific probe's POD ID.

Figure 2-11 illustrates a probe's POD ID location and POD ID button.

NOTE

Any time the DAS refers to a probe in a menu or a screen message, it uses the probe's POD ID.

P6452 EXTERNAL CLOCK PROBE

The Trigger/Time Base Module comes with one P6452 Data Acquisition Probe. This probe is provided with a gummed label which reads P6452 EXT CLOCK PROBE. You should affix this label over the DATA ACQUISITION PROBE label already on the probe.

NOTE

Any P6452 probe may serve as either a data acquisition probe or an external clock probe. If used as the External Clock Probe, the appropriate label should be attached.

Figure 2-12 illustrates how the P6452 probe and its accessories are assembled for use with the Trigger/Time Base Module. The probe comes with a 10 inch flying lead set, 12 grabber tips, and two 5 inch ground leads with two Pomona hook tips and two alligator clips.

Signal Lines. The External Clock Probe acquires seven control signals. Three of these signals are used by the 91A32 Data Acquisition Modules, and four are used by the pattern generator modules.

Table 2-3 describes the seven signal lines and their pulse characteristics. These characteristics refer to the input signal from an external source.

The procedures on how to employ the three 91A32 clock lines are provided in the Trigger Specification Menu section of this manual. The pattern generator clock and signal lines are discussed in the Pattern Generator Menu section.

Table 2-3
External Clock Probe Signal Lines

Input Signals	Description	Pulse Characteristics
CLK1	Master external clock line for 91A32 Data Acquisition.	19 ns minimum external pulse width 25 MHz maximum clock rate.
CLK2	Additional external clock for 91A32 modules. May only be used for EXT SPLIT clock (see Trigger Specification Menu section.)	19 ns minimum external pulse width. Maximum clock rate is dependent on CLK1 signal.
CLK3	Additional external clock for 91A32 modules. May only be used for EXT SPLIT CLOCK (see Trigger Specification Menu section.)	19 ns minimum external pulse width. Maximum clock rate is dependent on CLK1 signal.
PG CLK	Master external clock for pattern generator modules	19 ns minimum external pulse width. 25 MHz maximum clock rate.
PG PAUSE	Pause (hold) request to pattern generator modules.	19 ns minimum external pulse width. 7 ns minimum set-up time relative to pattern generator clock.
PG INTERRUPT	Interrupt request to pattern generator modules.	19 ns minimum external pulse width. 7 ns minimum set-up time and 14 ns minimum hold time relative to pattern generator clock.
PG INHIBIT	Inhibit (tri-state) request to pattern generator modules.	19 ns minimum external pulse width.

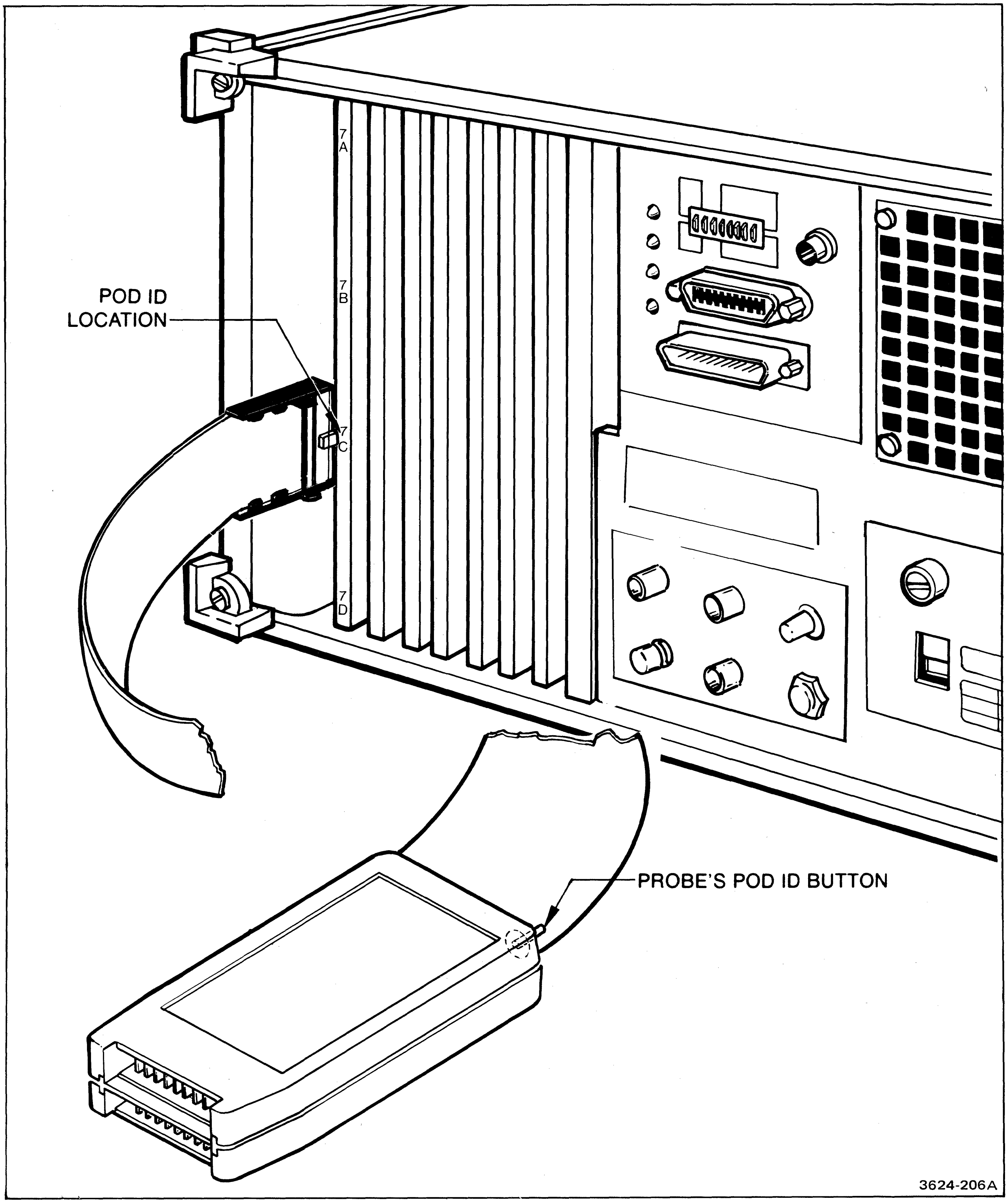


Figure 2-11. POD ID location and POD ID button.

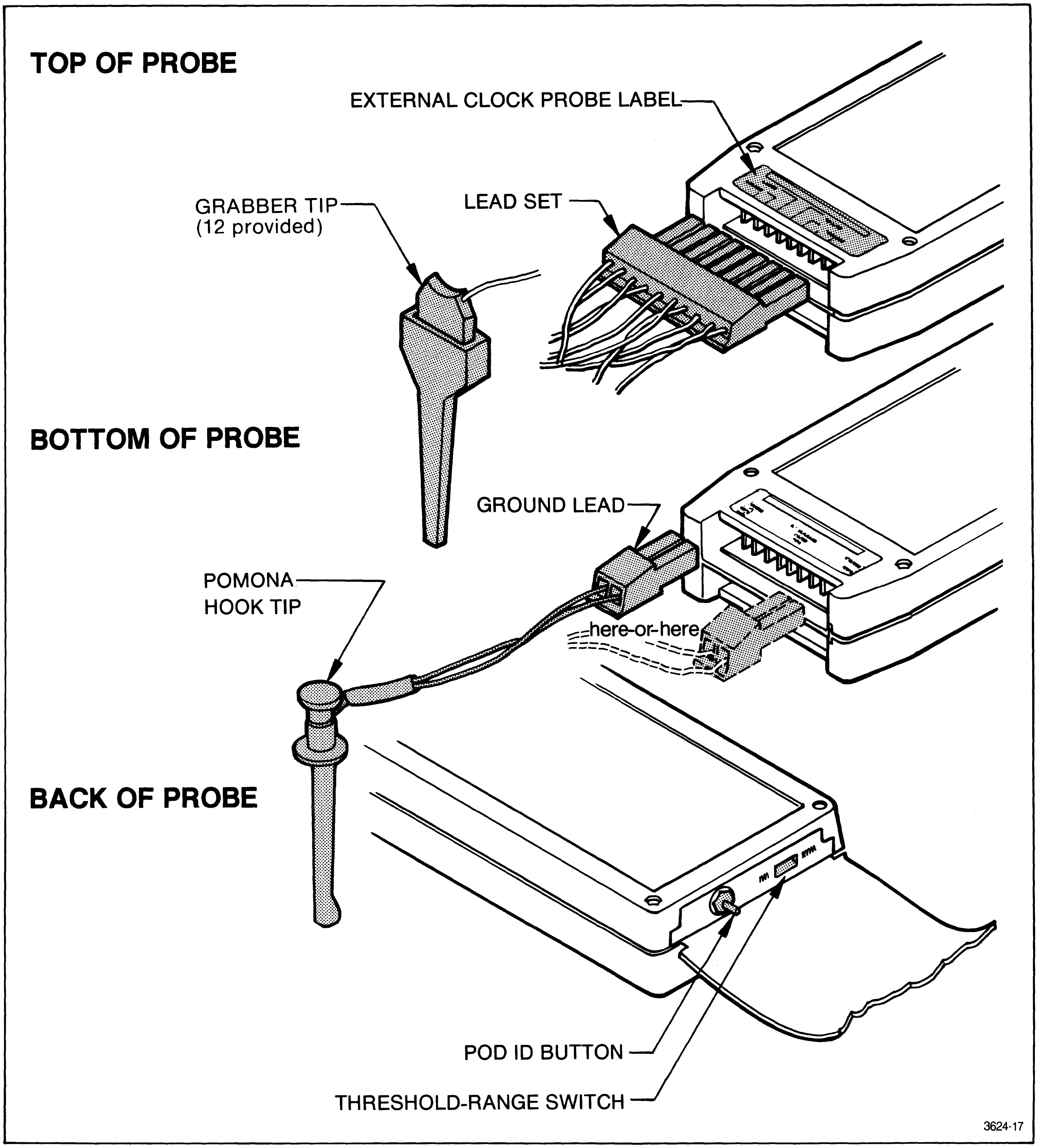


Figure 2-12. P6452 External Clock Probe.

Ground. The External Clock Probe requires one connected ground lead for clock rates <10 MHz. The probe requires two connected ground leads for clock rates $\geqslant 10$ MHz. These leads can be attached to the probe at the two GND SENSE locations.

The GND DIAGNOSTIC location should only be used when the probe is connected to the diagnostic lead set. Information on the diagnostic lead set is provided later in this section under the Operator's Checkout Procedure.

Threshold Range. The threshold-range switch on the back of the probe is used for selecting between a NORM (TTL/VAR) and AUX (MOS) threshold. The maximum threshold control voltage for this probe is −2.50 V to +5 V in the NORM position or −10 V to +20 V in the AUX position.

The threshold voltage levels may be selected via the Trigger Specification menu (91A32 ONLY mode) or the Pattern Generator menu.

Maximum Non-Destructive Input Voltage. The maximum input voltage which may be used with this probe is a ±40 V peak.

CAUTION

If the P6452 probe is connected to a voltage greater than a ±40 V peak, the probe circuitry may be damaged.

Impedance. The input impedance of the P6452 probe is a 1 MΩ input resistance with a 5 pF nominal input capacitance. The lead set adds approximately 5 pF additional input capacitance.

P6452 DATA ACQUISITION PROBE

The P6452 Data Acquisition Probe may be used with either a 91A32 or 91A08 Data Acquisition Module. Four of these probes are standard with every 91A32 module, while one is provided with every 91A08 module.

Figure 2-13 illustrates how this probe and its accessories are assembled. The probe comes with a 10 inch flying lead set, 12 grabber tips, and two 5 inch ground leads with two Pomona hook tips and two alligator clips. Each 91A08 module also provides an extra 5 inch flying lead set.

For acquisition rates ⩽25 MHz, the probe can be used with the 10 inch flying lead set and one ground lead. For acquisition rates >25 MHz, a second ground lead should be used. For acquisition rates >50 MHz, the 5 inch flying lead set and two ground leads should be used.

Signal Lines. The P6452 Data Acquisition Probe uses nine input lines. Eight of these lines are used for acquiring data, while one serves as a clock qualifier line.

All input signals to this probe must meet setup and hold requirements. The setup requirement refers to the duration for which data must have a constant assigned value before the clock transition. The hold requirement refers to the time that the assigned value must remain after the clock transition. See Figure 2-14 for an example of setup and hold time computation.

Table 2-4 describes the input lines of this probe and their setup and hold requirements.

When the probe is attached to a 91A08 module, glitches are acquired on all data channels (7-0). A glitch is defined as two or more transitions between a given clock cycle. To be recognized, the glitch must be ⩾5 ns in width, and it must overdrive the threshold by at least 350 mV. Figure 2-15 illustrates the minimum detectable glitch.

Table 2-4
P6452 Data Acquisition Probe Lines

Input Signals	Description	Pulse Characteristics
7-0	Data Channels.	Data Set-up Time: 29 ns minimum (91A32) 9 ns minimum (91A08) Data Hold Time: 0 ns maximum (91A32) 0 ns maximum (91A08)
Q	Clock qualifier line when attached to pods A and B of 91A32 module, or pod C of 91A08 module.	Qualifier Set-up Time: 29 ns minimum (91AP32) 15 ns minimum (91A08) Qualifier Hold Time: 0 ns maximum (91A32) 0 ns maximum (91A08)

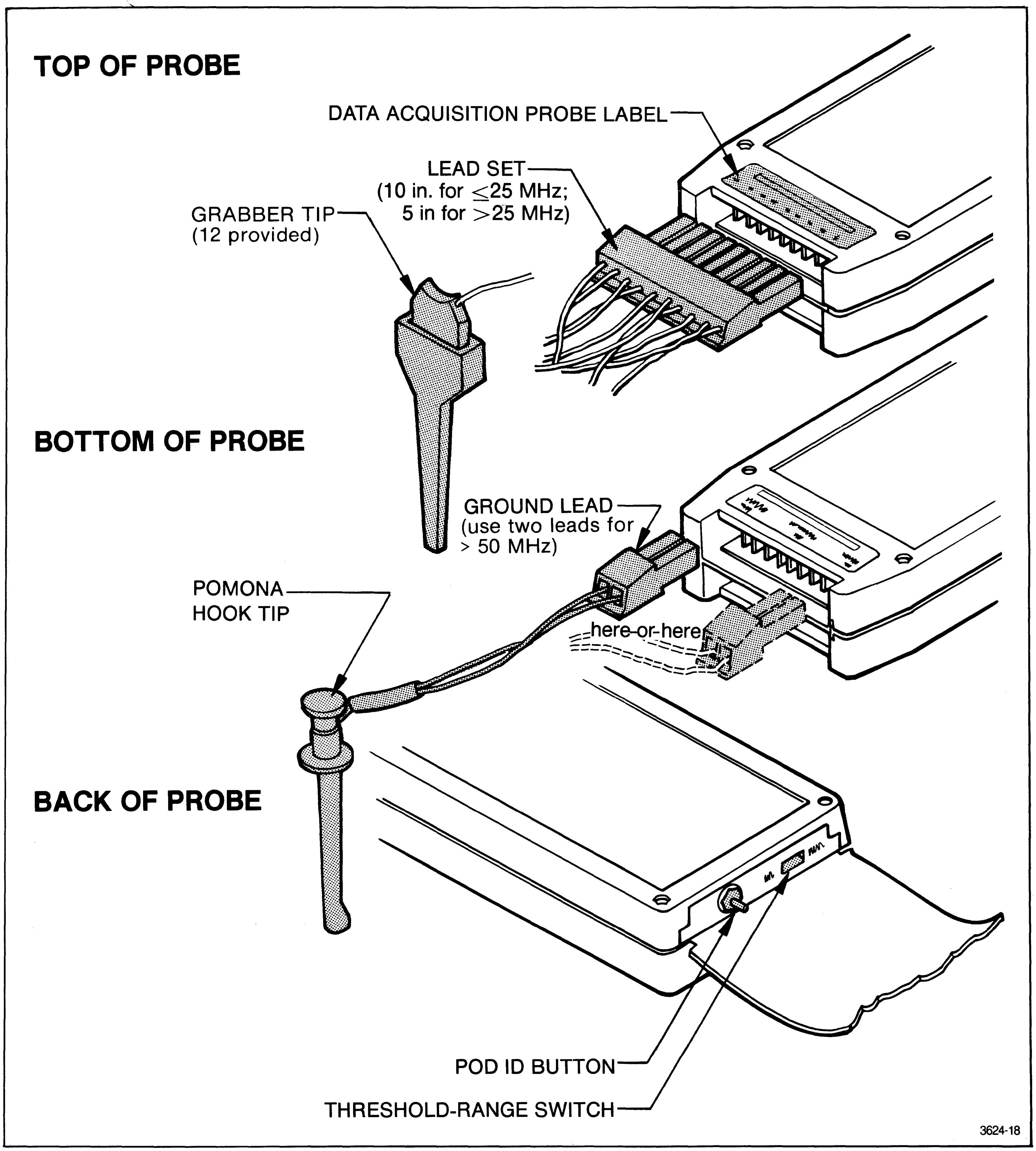


Figure 2-13. P6452 Data Acquisition Probe.

Ground. If used for acquisition rates ≤25 MHz, the probe requires one ground lead connected at either GND SENSE location. If used for acquisition rates >25 MHz, the probe requires two ground leads—one for each GND SENSE location.

The GND DIAGNOSTIC location should only be used when the probe is connected to the diagnostic lead set. Information on the diagnostic lead set is provided later in this section under the Operator's Checkout Procedure.

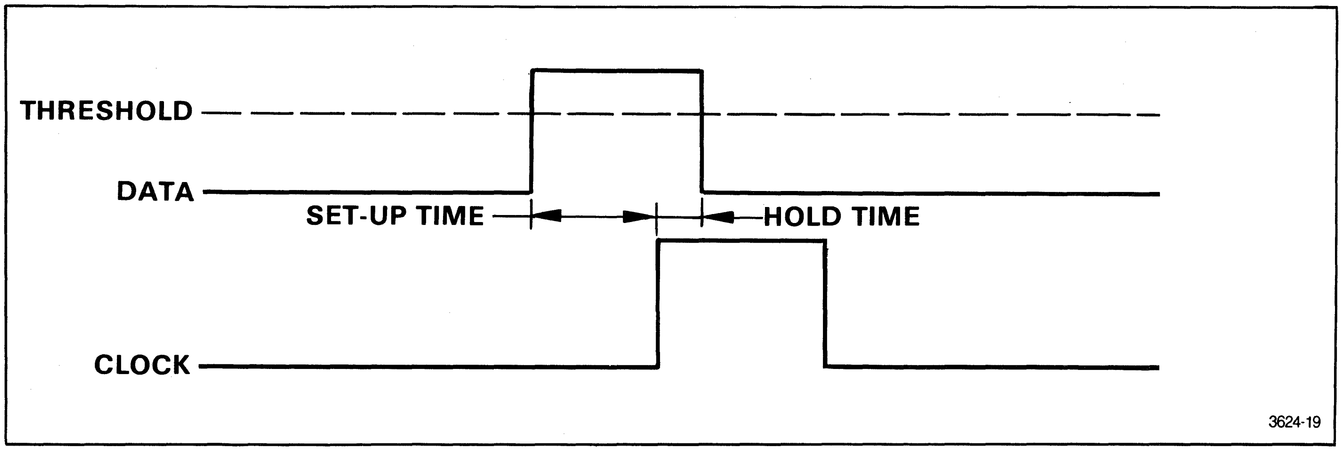


Figure 2-14. Definition of setup and hold time.

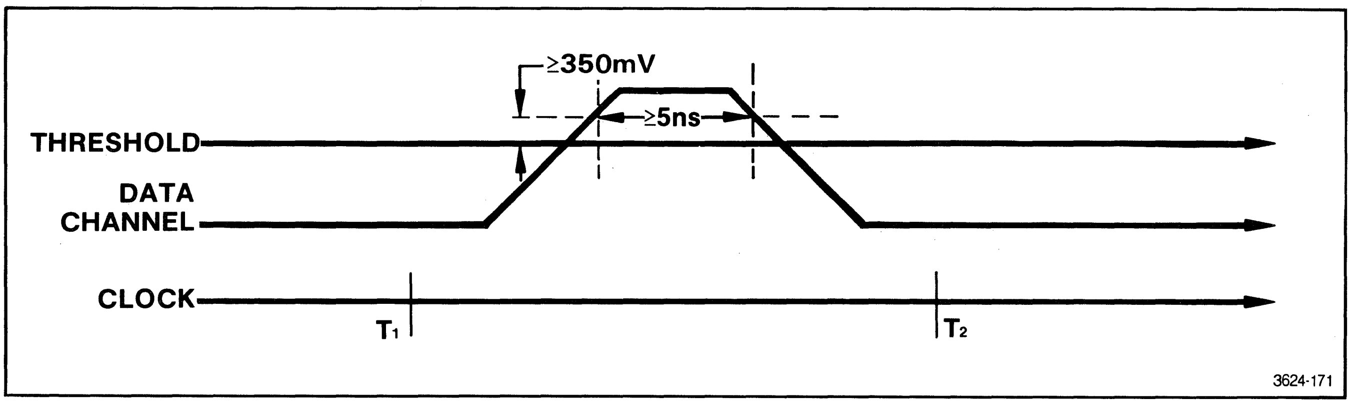


Figure 2-15. Minimum detectable glitch.

Threshold Range. The threshold-range switch on the back of the probe is used for selecting between a NORM (TTL/VAR) and AUX (MOS) threshold. The maximum threshold control voltage is −2.50 V to +5 V in the NORM position or −10 to +20 V in the AUX position.

The threshold voltage selections are made in the Channel Specification menu.

Maximum Non-Destructive Input Voltage. The maximum input voltage which may be used with the P6452 Data Acquisition Probe is a ±40 V peak.

CAUTION

If the P6452 Data Acquisition Probe is connected to a voltage greater than a ±40 V peak, probe circuitry may be damaged.

Impedance. The input impedance of the P6452 Data Acquisition Probe is a 1 M Ω input resistance with a 5 pF nominal input capacitance. The lead set adds approximately 5 pF additional input capacitance.

P6454 100 MHz CLOCK PROBE

The P6454 100 MHz Clock Probe provides the external clock signal for all installed 91A08 modules. It should be attached to the 91A08 module installed in bus slot 6.

Figure 2-16 shows the various elements and features of the probe. The probe comes with two leads with grabber tips. One lead serves as the clock input (labeled IN), and the other serves as the ground (labeled REF).

IN (Clock). The P6454 100 MHz Clock Probe provides one input clock signal. This signal serves as the external clock line for all 91A08 modules.

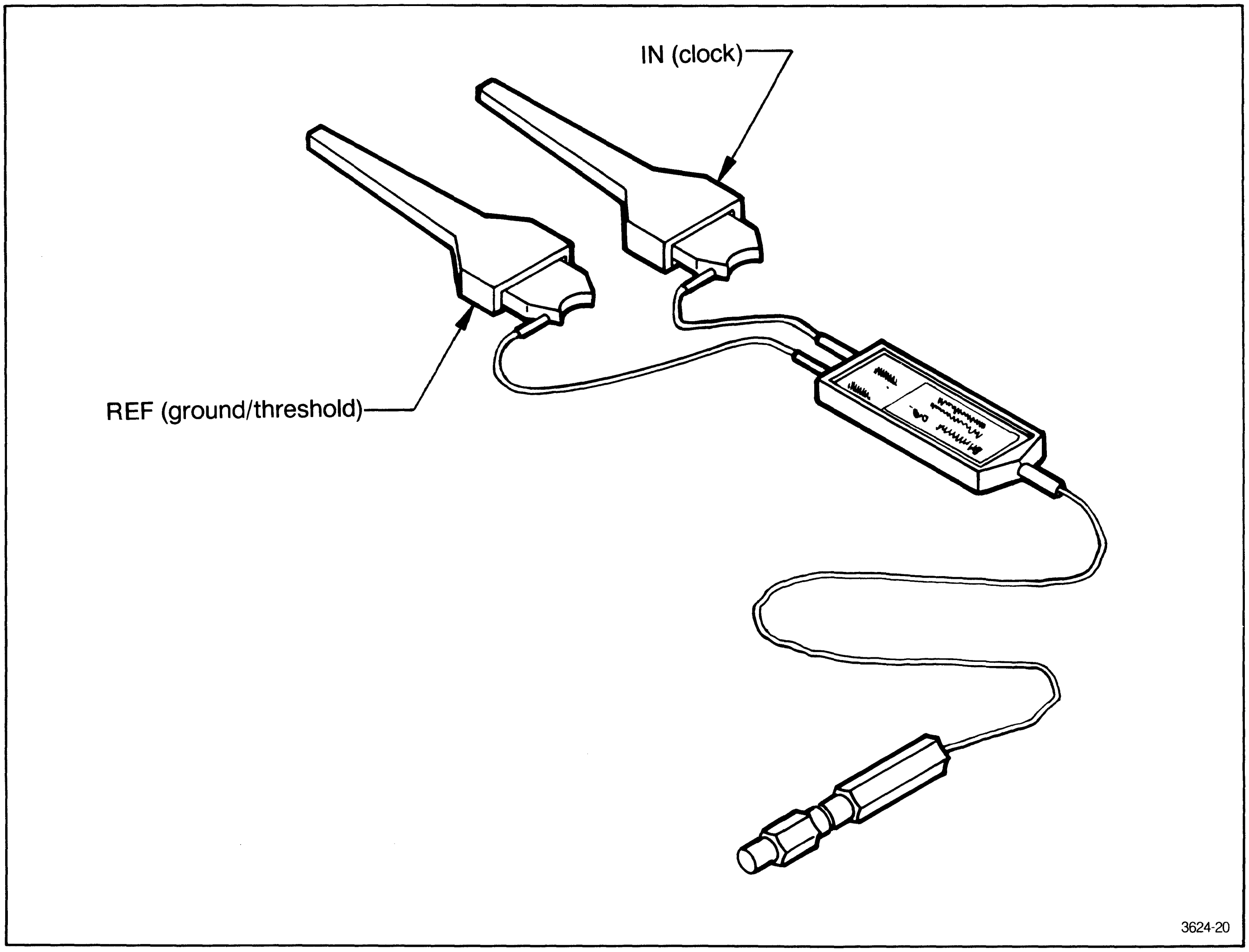


Figure 2-16. P6454 100 MHz Clock Probe.

The maximum clock rate of this probe is 100 MHz (10 ns). The signal must be at least 700 mV peak-to-peak, centered around the threshold.

REF (Threshold/Ground). The reference lead establishes the probe threshold. If this lead is connected to ground, the clock probe has the same threshold voltage as the 91A08 module to which it is connected. If the lead is connected to a voltage source (25 V maximum), the clock probe has a threshold equal to the 91A08 threshold plus the selected voltage.

Maximum Non-Destructive Voltage. The maximum input voltage which may be used with the P6454 100 MHz Clock Probe is a ±25 V peak.

CAUTION

Probe circuitry may be damaged if the P6454 100 MHz Clock Probe is connected to a voltage greater than a ±25 V peak.

Impedance. The input impedance of the P6454 100 MHz Clock Probe is 1 M Ω input with a 5 pF nominal input capacitance. The probe lead adds approximately 5 pF additional input capacitance.

P6455 TTL/MOS PATTERN GENERATOR PROBE

The P6455 TTL/MOS Pattern Generator Probe may be used with either a 91P16 Pattern Generator module or a 91P32 Pattern Generator Expander module. Two of these probes are provided as standard with a 91P16 module, while four are provided with a 91P32 module.

Figure 2-17 shows how the probe and its accessories are put together. The probe comes with one 9 inch twisted signal/ground lead set and 12 grabber tips; one 5 inch V_L (voltage low) sense lead and Pomona hook tip, and one 5 inch V_H (voltage high) sense lead and Pomona hook tip.

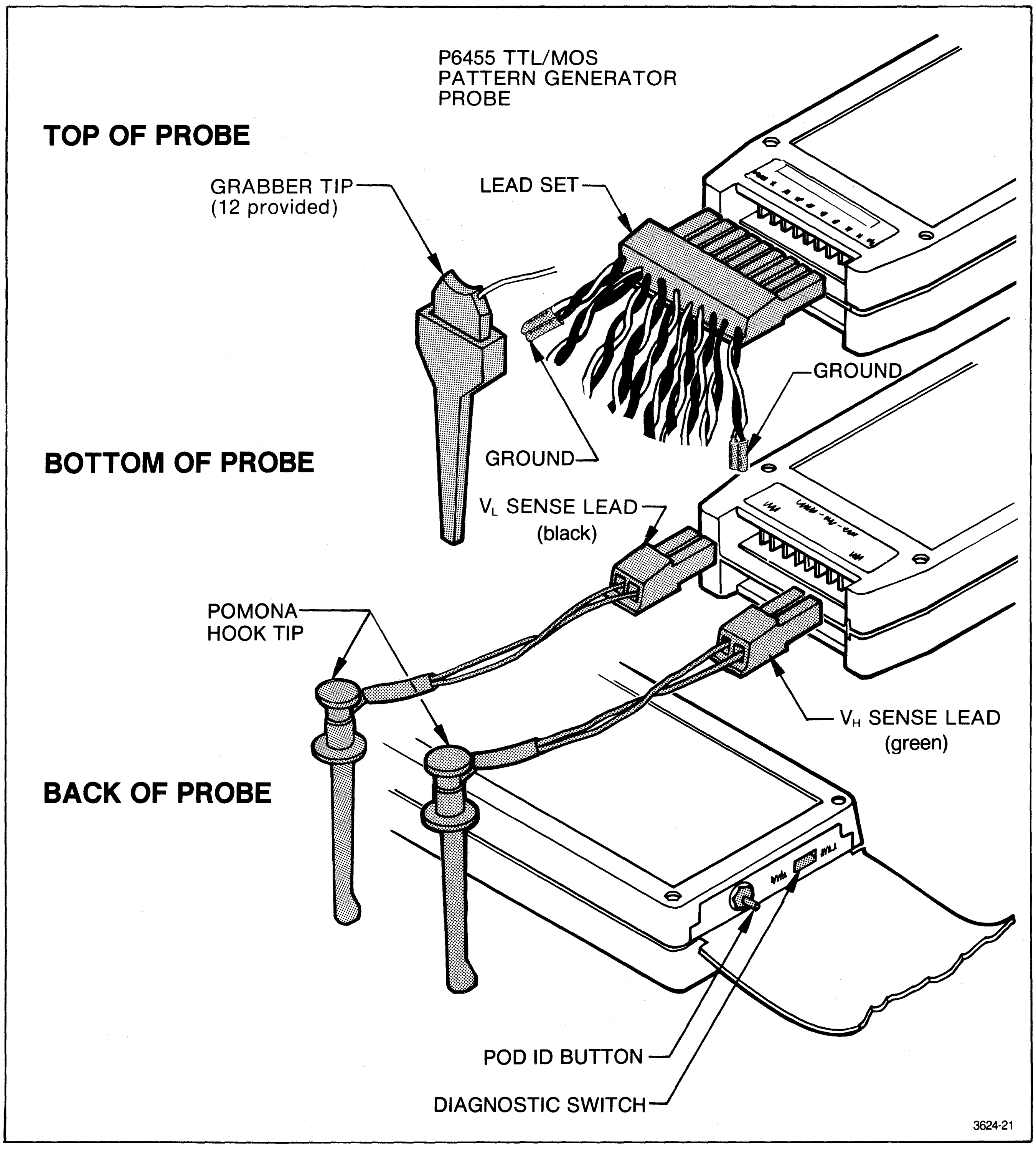


Figure 2-17. P6455 TTL/MOS Pattern Generator Probe.

The following paragraphs discuss the various elements of this probe. Read these paragraphs carefully before attempting to connect the probe to a system under test.

Signal Lines. The P6455 is an active, 10-channel probe used with the pattern generator modules. The stimulus output of the probe consists of 8 data channels, one clock line, and one strobe line.

For information on how to set up and use these signals, refer to the Pattern Generator Menu section of this manual.

Lead Sets and Ground. The CLK and STRB signal leads are combined with a black ground lead. For most applications using an output clock rate slower than 500 ns, these two ground leads do not need to be connected. For faster clock rates, however, you should connect both of these leads to ensure adequate clock fidelity.

NOTE

Some combinations of active and capacitive loads at clock rates greater than 100 ns require use of the high-speed harmonica lead set to maintain adequate clock fidelity. This can be determined by examination with an oscilloscope.

V_L/V_H Sense Leads. The V_L and V_H sense leads must be used in order to provide power and threshold sensitivity to the probe. The V_L lead serves as voltage low and may be connected to a voltage range of −15 V to 0 V. The V_H lead serves as voltage high and may be connected to voltage range of 0 V to +15 V. The maximum voltage difference between V_L and V_H is 25 V.

Diagnostic Switch. A diagnostic switch is located at the back of the probe. This switch should always be set to NORM, unless you are using the diagnostic lead set. Procedures on how to use the diagnostic lead set are contained later in this section under the Operator's Checkout Procedure.

P6456 ECL PATTERN GENERATOR PROBE

The P6456 ECL Pattern Generator Probe is available as an optional accessory to the mainframe. It may be used with either a 91P16 Pattern Generator Module or a 91P32 Pattern Generator Expander Module.

NOTE

A combination of P6455 TTL/MOS and P6456 ECL probes may be used on the same pattern generator module.

Figure 2-18 shows how the P6456 probe and its accessories are assembled. The probe comes with one 9 inch twisted signal/ground lead set and 12 grabber tips; one high-speed harmonica lead set; one 5 inch V_L (voltage low) sense lead with Pomona hook tip; and one 5 inch V_H (voltage high) sense lead with Pomona hook tip.

The following paragraphs discuss the various elements of the probe. Read these paragraphs carefully before attempting to connect the probe to a system under test.

Signal Lines. The signal lines of the P6456 probe are identical to those of the P6455 TLL/MOS Pattern Generator Probe.

Lead Sets and Ground. The P6456 probe is provided with two lead sets: a 9 inch twisted signal/ground lead set, and a 5 inch high-speed harmonica lead set.

The 9 inch lead set may be used for most applications with 100 Ω loads or more. The two ground leads provided with the CLK and STRB signal leads should be connected.

The high-speed lead set should be used with clock rates greater than 200 ns with 50 Ω loads. This high-speed lead set provides ground with every signal lead, and ensures adequate clock fidelity.

NOTE

The necessity of using the high-speed lead set is best determined by inspecting the fidelity with an oscilloscope.

V_L/V_H Sense Leads. The V_L and V_H sense leads must be used in order to provide power and threshold sensitivity to the probe. The V_L lead serves as voltage low and may be connected to a voltage range of −5.50 V to 0 V. The V_H lead serves as voltage high and may be connected to a voltage range of 0 to +5.50 V. The maximum voltage between V_L and V_H is 5.50 V.

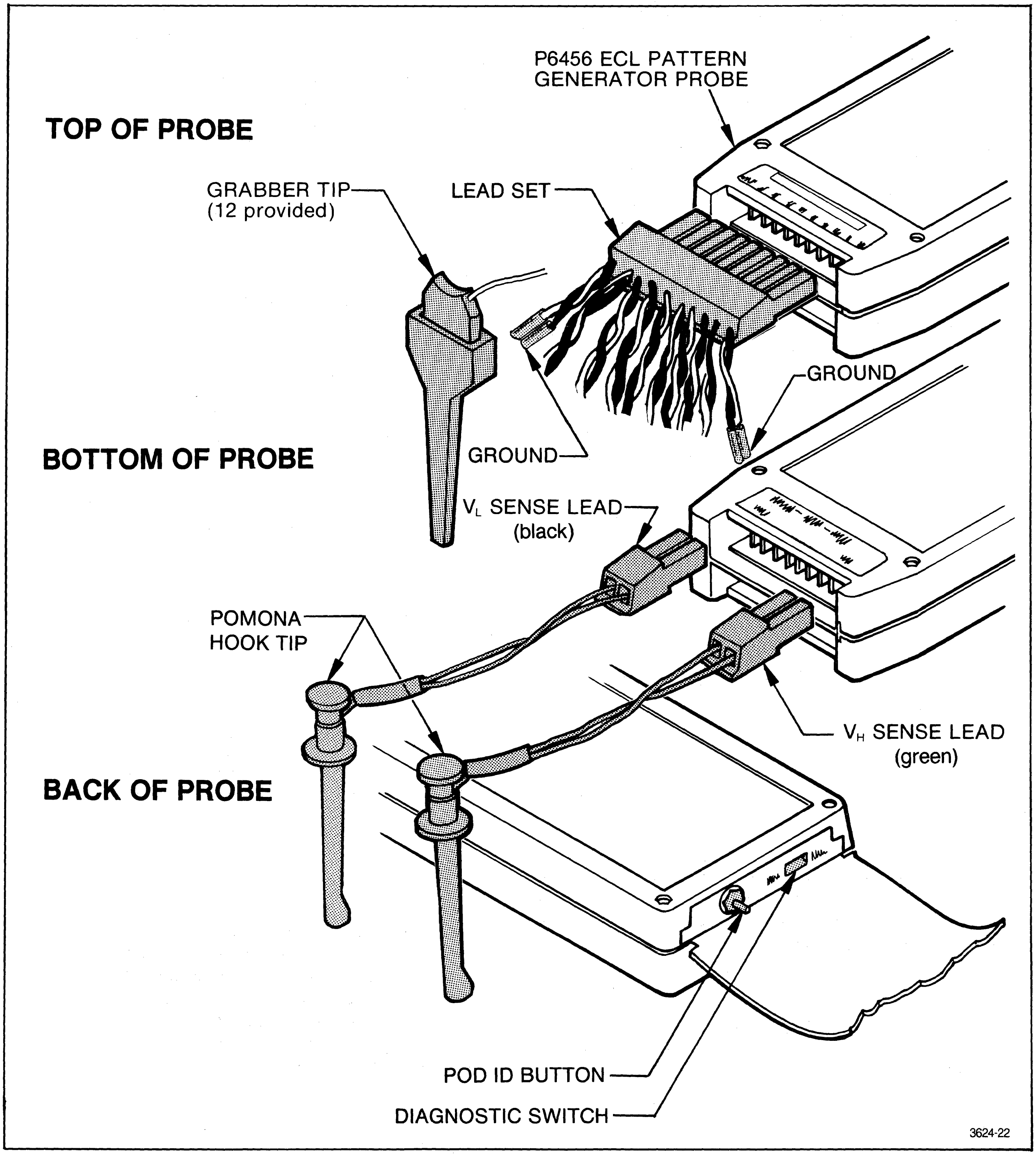


Figure 2-18. P6456 ECL Pattern Generator Probe.

STANDARD AND OPTIONAL I/O CONNECTORS

WORD RECOGNIZER OUTPUT AND TRIGGER INPUT CONNECTORS

Figure 2-19 shows the back-panel location of the Word Recognizer Output and the Trigger Input connectors.

The Word Recognizer Output connector (BNC) outputs a rising edge whenever Event 1 is recognized. The duration of the output is the same number of clock cycles for which Event 1 remains true. Event 1 is produced whenever a 91A32 module is used during acquisition (including AND and ARMS modes). For more detailed information, refer to the Trigger Specification Menu section of this manual.

The Trigger Input connector (BNC) may be used to enable the 91A32 trigger during acquisition (including AND and ARMS modes). A high-level signal enables the trigger.

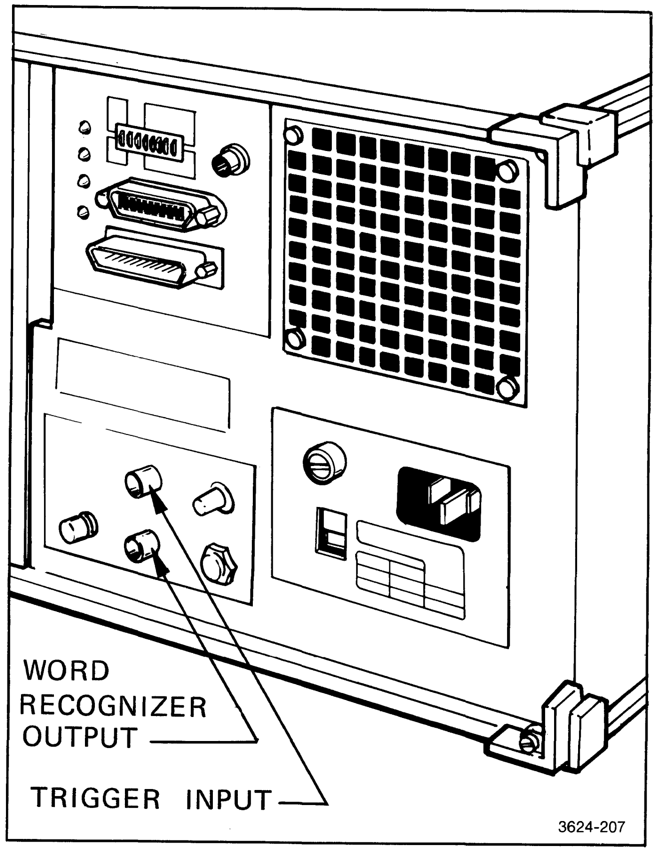


Figure 2-19. Location of the Word Recognizer Output and Trigger Input connectors.

TAPE DRIVE CONTROLS

The tape drive controls are present if your DAS contains an Option 01, Tape Drive for DC100-type Cartridges.

As shown in Figure 2-20, the tape drive has two front-panel controls: a tape slot and a tape eject button. These two controls allow the insertion and removal of a tape cartridge.

Tape Slot. The tape slot is used for inserting any DC100-type tape cartridge. The tape is simply pushed through the slot. The design of the tape drive ensures that a tape can not be inserted upside down.

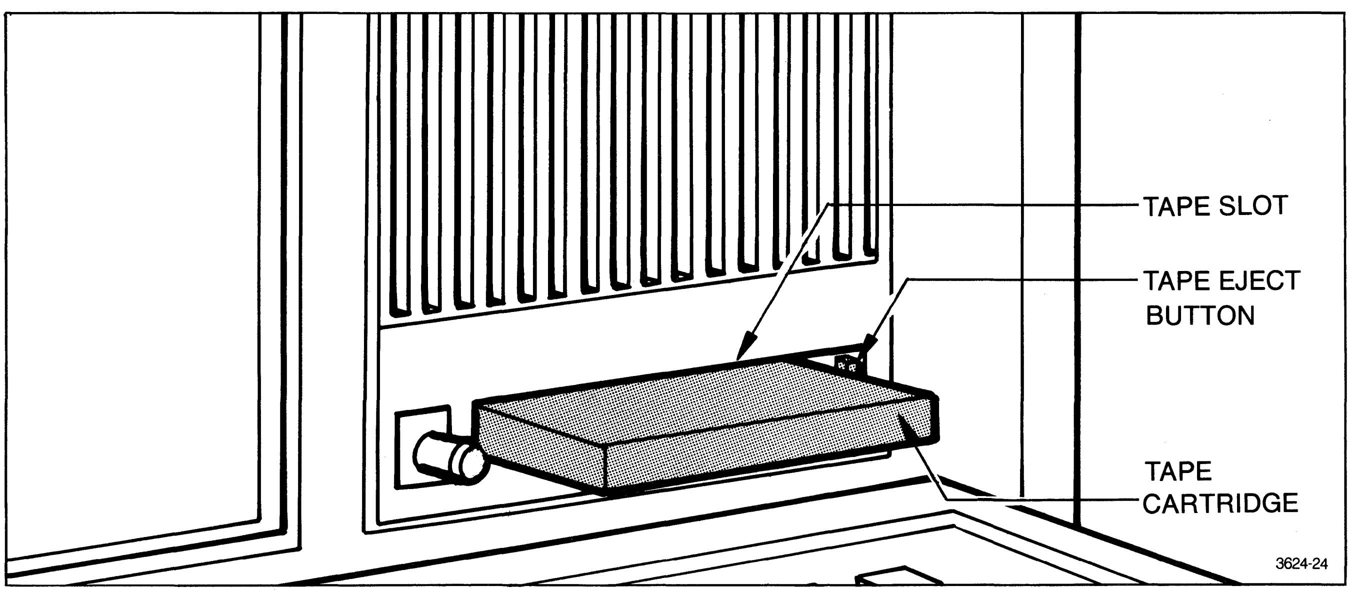


Figure 2-20. The tape drive controls.

Tape Eject Button. The tape eject button is used when removing the tape cartridge. When this button is depressed, the tape is ejected. Tapes should be ejected before the keyboard is folded up.

DC100-Type Cartridges. Two tape cartridges are provided with Option 01. You may use these two cartridges or any DC100-type cartridge with the DAS tape drive.

Cleaning the Tape Drive. In order to minimize oxide and foreign matter accumulation, the tape head should be cleaned regularly. Frequency of cleaning depends on frequence of use and upon cleanliness of the area in which the tape drive is used. Recommended cleaning intervals are once a month for units that are used moderately; once a week for units that are used in areas where high foreign matter accumulations occur. The read/write head should be cleaned with reagent grade 91% isopropyl alcohol and a cotton swab.

CAUTION

Damage to the tape drive's read/write head may occur if any solvent other than isopropyl alcohol is used in cleaning.

RS-232 INTERFACE

The RS-232 connector is provided as part of Option 02. This connector provides a serial data interface for use with the DAS. It may be used to establish master/slave transmission between two DAS systems, or it may be used for transmitting GPIB instructions between a DAS and a host controller.

For information on how to establish DAS master/slave transmission, refer to the Input Output menu section of this manual. For GPIB information, refer to the GPIB Programming section.

The RS-232 connector is located on the mainframe's back panel as shown in Figure 2-21. Only eight pins are used:

Pin 1 —Case Ground
Pin 2 —Transmitted Data
Pin 3 —Received Data
Pin 4 —Request to Send
Pin 5 —Clear to Send
Pin 7 —Signal Ground
Pin 8 —Carrier Detect
Pin 20—Data Terminal Ready

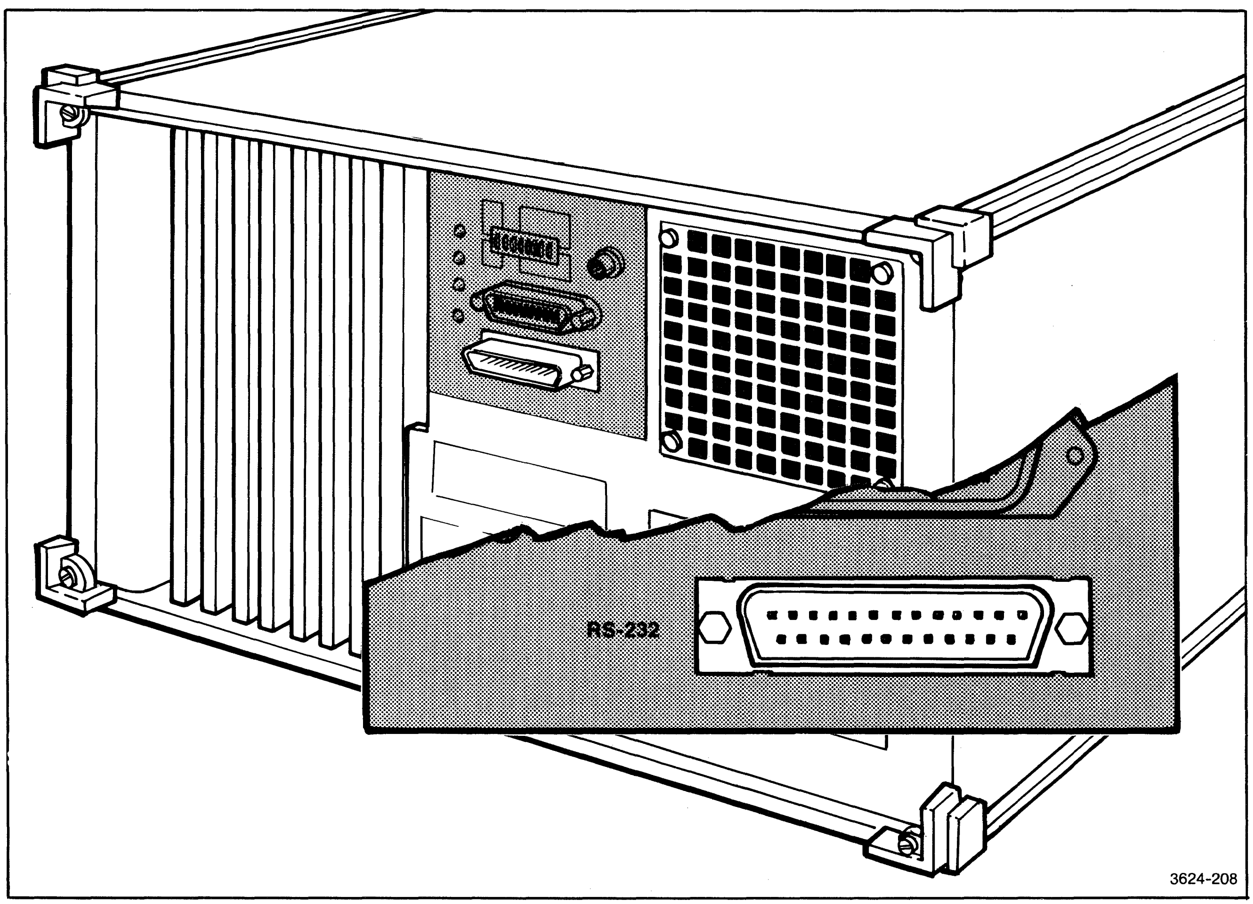


Figure 2-21. RS-232 interface connector.

NOTE

The modem should be configured for: No Auto Disconnect, No Loss of Carrier Detect, and No Abort Time Disconnect.

The RS-232 connector can also be used in a null-modem mode, where the lines are connected without use of a modem. For this purpose, you can use the null-modem optional accessory or you can wire the communicating interfaces as shown below.

RS-232 Connector	RS-232 Connector
Case Ground Pin 1	Pin 1 Case Ground
Transmitted Data Pin 2	Pin 3 Received Data
Received Data Pin 3	Pin 2 Transmitted Data
Request to Send Pin 4	Pin 8 Carrier Detect
Clear to Send Pin 5	Pin 20 Data Terminal Ready
Signal Ground Pin 7	Pin 7 Signal Ground
Carrier Detect Pin 8	Pin 4 Request to Send
Data Terminal Ready Pin 20	Pin 5 Clear to Send

When the RS-232 interface is used for GPIB transmission, only pins 2, 3, and 7 need to be connected. If a null modem is used, it must cross pins 2 and 3. Pin 20 can be toggled by the host controller to inhibit DAS character transmissions.

GENERAL PURPOSE INTERFACE BUS (GPIB)

A General Purpose Interface Bus (GPIB) is provided as part of Option 02. With this bus, the DAS can communicate with any GPIB-compatible controller. The DAS operates as a talker and listener, but not a controller.

For detailed GPIB information, refer to the GPIB Programming section of this manual.

Figure 2-22 indicates the GPIB connectors and indicators located on the mainframe's back panel.

GPIB Switches. The eight DIP switches are used for setting the DAS talker/listener address on the bus. They are also used for specifying the end-of-message terminator character.

Switches 4-8—select the DAS talker/listener address.

Switch 1 —selects the end of message terminator.

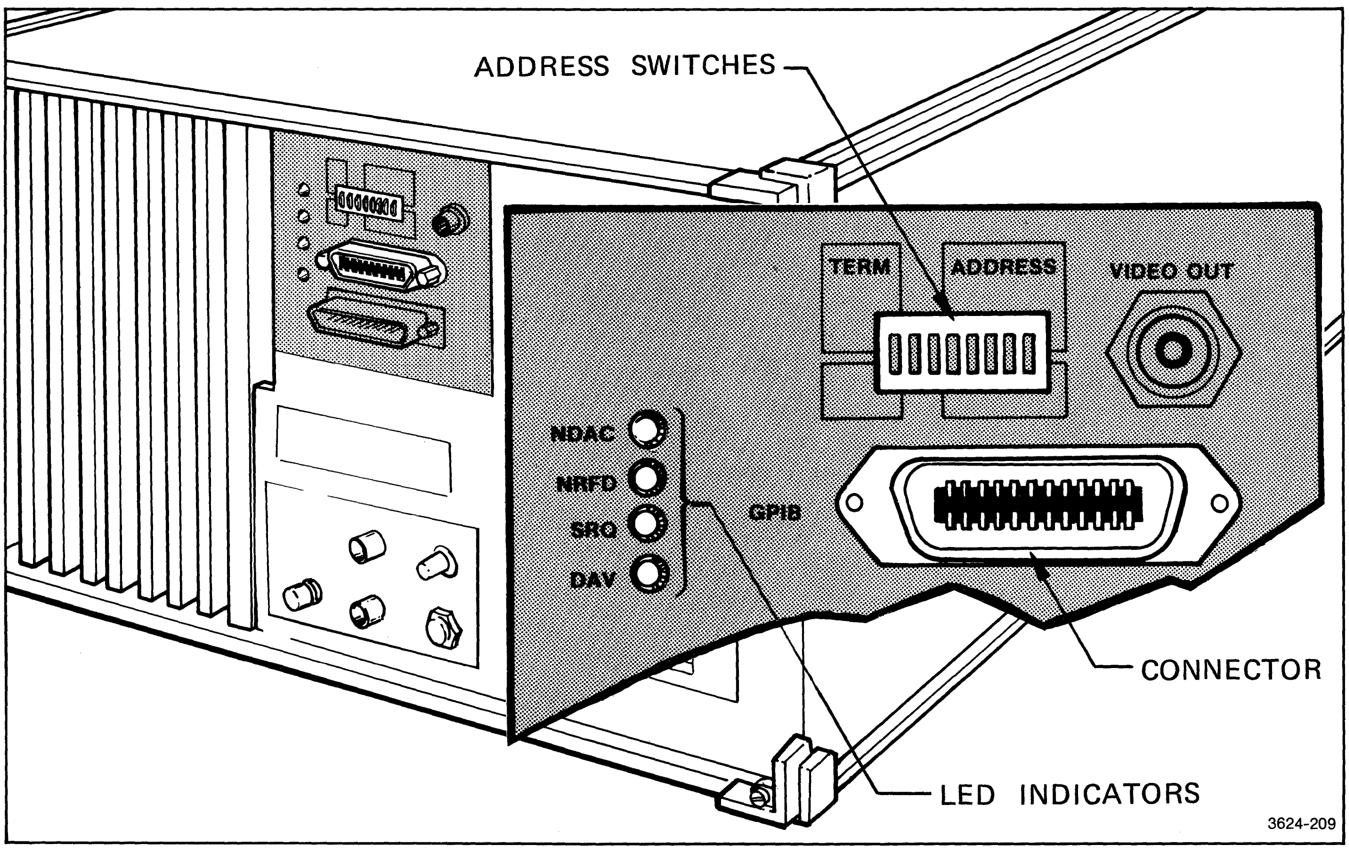


Figure 2-22. GPIB connectors and indicators.

GPIB LEDs. The four LEDs indicate the current handshaking protocol in use between the DAS and the GPIB bus. They also indicate if a Service Request (SRQ) is present.

- SRQ ← Service Request
- NDAC
- NRFD — Handshaking Protocol
- DAV

GPIB Connector. The contact assignments for the GPIB connector are as follows:

Contact	Signal Line
1	DI01
2	DI02
3	DI03
4	DI04
5	EOI
6	DAV
7	NRFD
8	NDAC
9	IFC
10	SRQ
11	ATN
12	SHIELD
13	DI05
14	DI06
15	DI07
16	DI08
17	REN
18	GROUND (6)
19	GROUND (7)
20	GROUND (8)
21	GROUND (9)
22	GROUND (10)
23	GROUND (11)
24	GROUND, LOGIC

COMPOSITE VIDEO INTERFACE

The composite video BNC connector provided with Option 02 may be used with any compatible hard copy or monitor unit. This connector is located on the mainframe's back panel as shown in Figure 2-23. Control of this interface is handled via the connected hard copy or monitor instrument.

NOTE

Be sure to read the composite video specifications carefully to ensure compatibility between the DAS video composite signal and a hard copy or monitor unit. These specifications are located in the first section of this manual under Specifications.

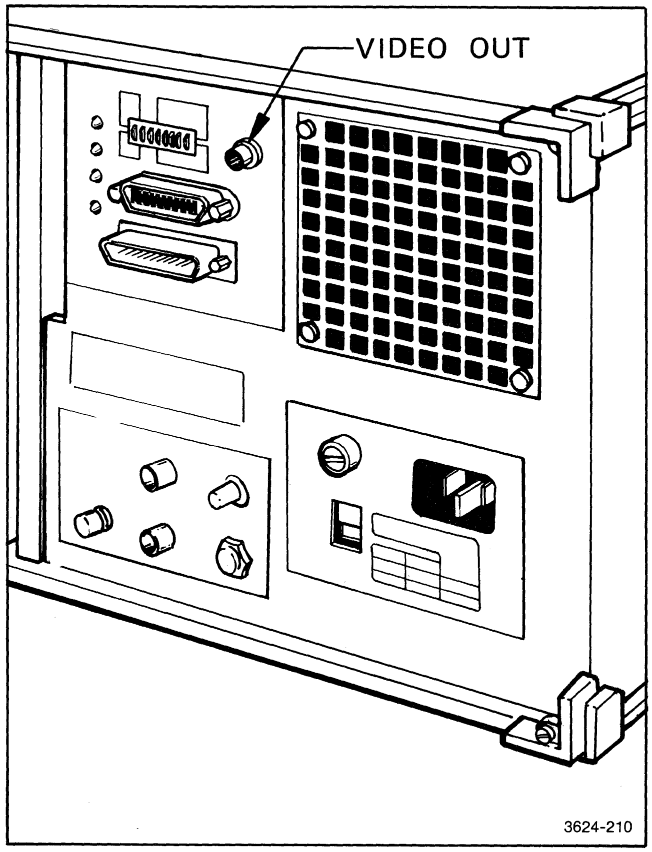


Figure 2-23. Location of the composite video BNC connector.

COLOR MONITOR CONTROLS (DAS9129 COLOR MAINFRAME ONLY)

DEGAUSS CONTROL

If the DAS9129 Mainframe is exposed to a magnetic field (or is moved to a different orientation in the earth's magnetic field), the purity of the color display may be affected. The colors may appear to bleed or shift out of alignment. If so, the degauss button located on the mainframe's back panel (see Figure 2-24) can be used to neutralize the residual magnetism on the components, and therefore, adjust the display. The degauss button should be depressed for at least five seconds.

BRIGHTNESS CONTROL

The DAS9129 Mainframe provides a brightness control (see Figure 2-24) which can be used to adjust the intensity of the color display. The recommended brightness setting under normal ambient conditions is mid-scale. Prolonged operation of the instrument set to maximum bightness should be avoided.

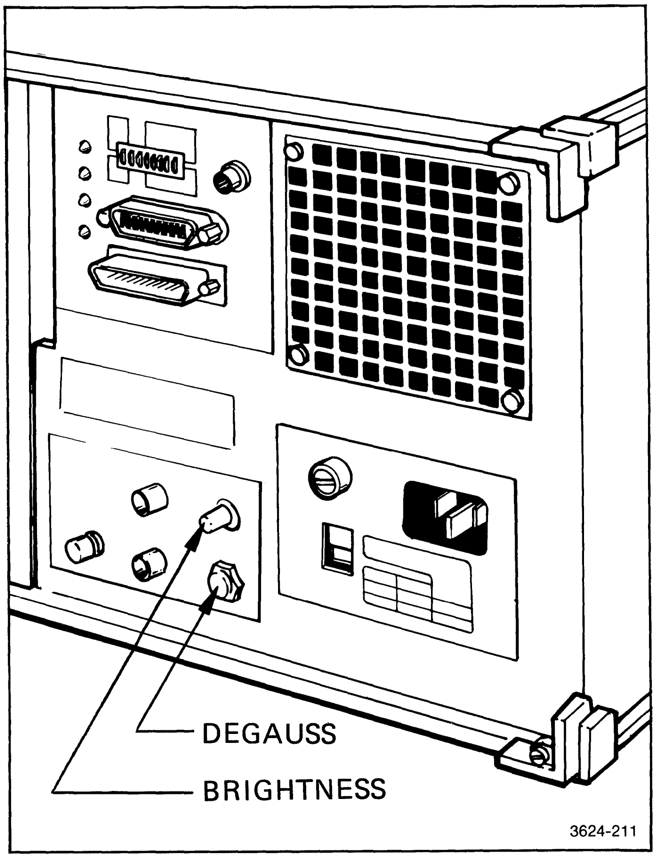


Figure 2-24. Location of the degauss and brightness controls for the color monitor. (Applies to the DAS9129 Color Mainframe only.)

KEYBOARD CONTROLS AND INDICATORS

The DAS keyboard folds up and latches to the mainframe's front panel to serve as a protective cover. To access the keyboard, simply press down on the front-panel latch and gently lower the keyboard.

Figure 2-25 illustrates the keyboard layout. The keyboard is divided into seven functional areas: Menu Selection, Pattern Generator Instructions, Data Entry, Editing, Cursor, Scroll, and System Control. Each of these functional keyboard areas and their associated keys are described in the following paragraphs.

MENU SELECTION

All DAS operations, except GPIB, are menu driven. You may set up operating parameters by displaying the various menus on the DAS screen and making field alterations. Fields are alterable menu elements which appear in reverse video.

NOTE

For specific information on how to use the various menus, refer to the individual menu sections later in this manual.

Five DAS menus support the data acquisition operation. The functions of these menus only apply if at least one data acquisition module is installed in the mainframe. The five menus include:

(1) **CHANNEL SPEC**—This key accesses the Channel Specification menu and displays it on the DAS screen.

The Channel Specification menu provides fields for organizing the data acquisition channels into logic groups and establishing their display radix and polarity. This organization is reflected in the State Table, Trigger Specification, and Define Mnemonics menus.

The Channel Specification menu also provides fields for setting up the data acquisition probe thresholds.

(2) **TRIGGER SPEC**—This key accesses the Trigger Specification menu and displays it on the DAS screen.

The Trigger Specification menu provides fields for selecting the acquisition mode, clock rate, trigger, and qualifier parameters. This menu determines which data is stored in aquisition memory, and thus available for display.

(3) **STATE TABLE**—This key accesses the State Table menu and displays it on the DAS screen.

The State Table menu displays the data stored in acquisition and reference memory. It displays each memory separately, or in comparison. The display is in a tabular format.

(4) **TIMING DIAGRAM**—This key accesses the Timing Diagram menu and displays it on the DAS screen.

The Timing Diagram menu provides a logic-waveform display of data stored in acquisition memory. It also displays any glitch information acquired via 91A08 modules.

(5) **DEFINE MNEMONICS**—This key accesses the Define Mnemonics menu and displays it on the DAS screen.

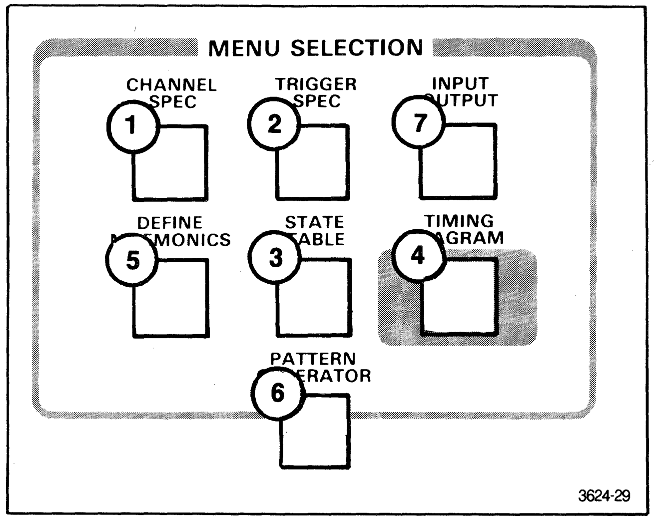


Figure 2-26. Menu selection keys.

The Define Mnemonics menu provides tables for entering mnemonic definitions. The mnemonics are disassembled on the State Table menu's display.

One DAS menu supports the pattern generator operations. The functions of this menu only apply if a 91P16 Pattern Generator Module is installed in the mainframe.

(6) **PATTERN GENERATOR**—This key accesses the Pattern Generator menu and displays it on the DAS screen.

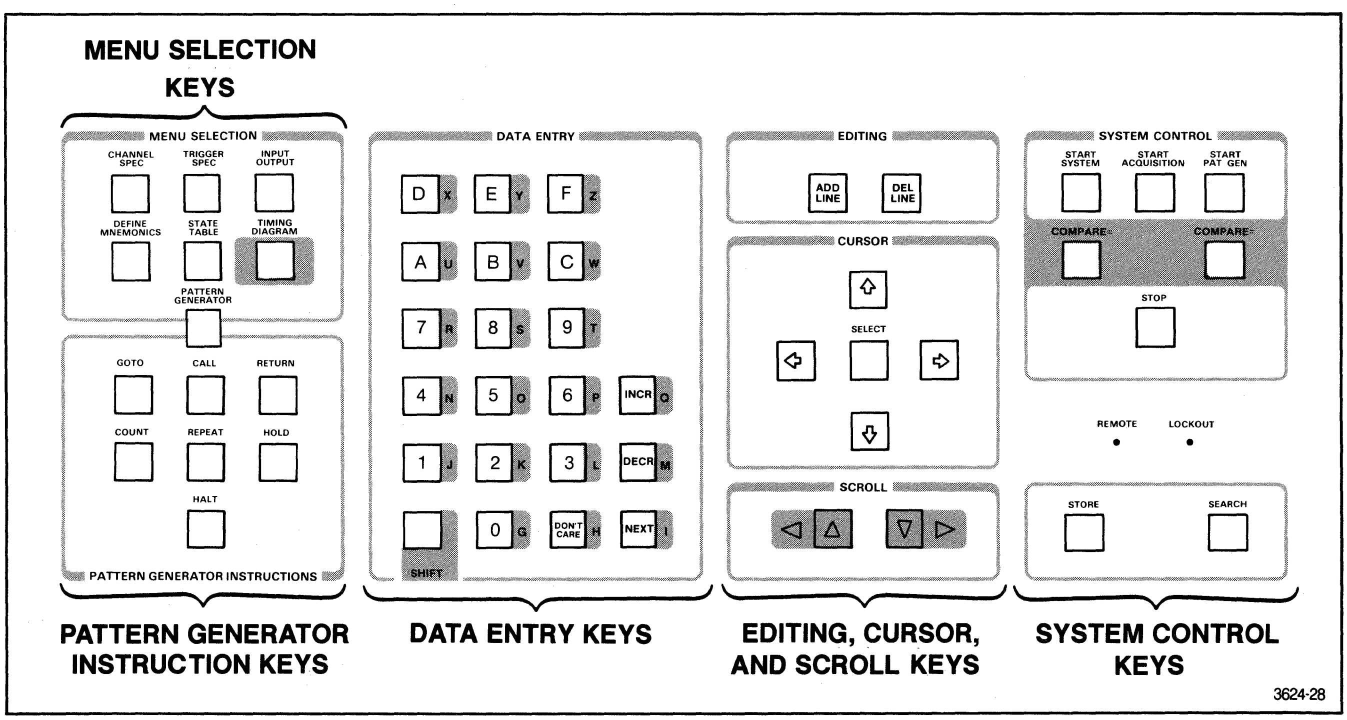


Figure 2-25. DAS keyboard functional layout.

The Pattern Generator menu is used for entering an output program. Fields are provided for selecting the output clock rate, data values, program instructions, and strobe characteristics. Fields are also provided for enabling the external input signals: interrupt, pause, and inhibit.

One DAS menu supports I/O operations involving the tape drive (Option 01) and the RS-232 interface (Option 02). The functions of this menu only apply if the appropriate options are installed in the mainframe.

(7) **INPUT OUTPUT**—This key accesses the Input Output Specification menu and displays it on the DAS screen.

The Input Output menu is used for controlling tape drive operations which include tape formatting, file saves and restores, and file deletions. The menu is also used for setting up and controlling RS-232 master/slave transmission.

PATTERN GENERATOR INSTRUCTIONS

The pattern generator instruction keys are only usable when the Pattern Generator menu is displayed on the DAS screen. These keys enter specific instruction values into the menu's program.

NOTE

For detailed information on how to use the pattern generator instructions, refer to the Pattern Generator Menu section of this manual.

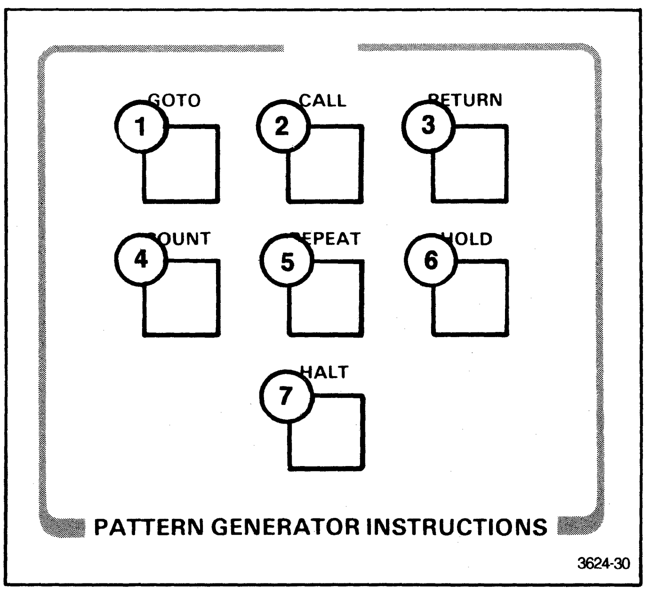


Figure 2-27. Pattern generator instruction keys.

(1) **GOTO**—This key enters a GOTO instruction into the pattern generator program. GOTO tells the pattern generator to jump from one program line to another, then continue program execution from that point.

(2) **CALL**—This key enters a subroutine CALL instruction into the pattern generator program. CALL tells the pattern generator to jump to the first program line of the subroutine, then continue program execution from that point until a RETURN instruction is encountered. When a RETURN is encountered, the pattern generator jumps back to the next sequential program line from where it was CALLed.

(3) **RETURN**—This key enters a RETURN instruction into the pattern generator program. RETURN should only be used in conjunction with a CALL instruction.

(4) **COUNT**—This key enters a COUNT instruction into the pattern generator program. COUNT provides a program compression function which tells the pattern generator to stay on the same program line and output incrementing values for up to 255 clock cycles.

(5) **REPEAT**—This key enters a REPEAT instruction into the pattern generator program. REPEAT provides a program compression function which tells the pattern generator to stay on the same program line and output its data value for up 255 clock cycles.

(6) **HOLD**—This key enters a HOLD instruction into the pattern generator program. HOLD tells the pattern generator to stay on the same program line and hold its value for up to 255 clock cycles. The output clock signals from the 91P16 Pattern Generator Module are also held. The clock signals from the expander modules continue.

(7) **HALT**—This key enters a HALT instruction into the pattern generator program. HALT tells the pattern generator to stop data and clock output.

DATA ENTRY

The data entry keys are only usable if a menu is displayed on the DAS screen.

Keys 0-9, A-F, and all 20 shiftable values are used for entering values into certain menu fields. Entries may take the form of hexadecimal, octal, binary, decimal, or alphanumeric values.

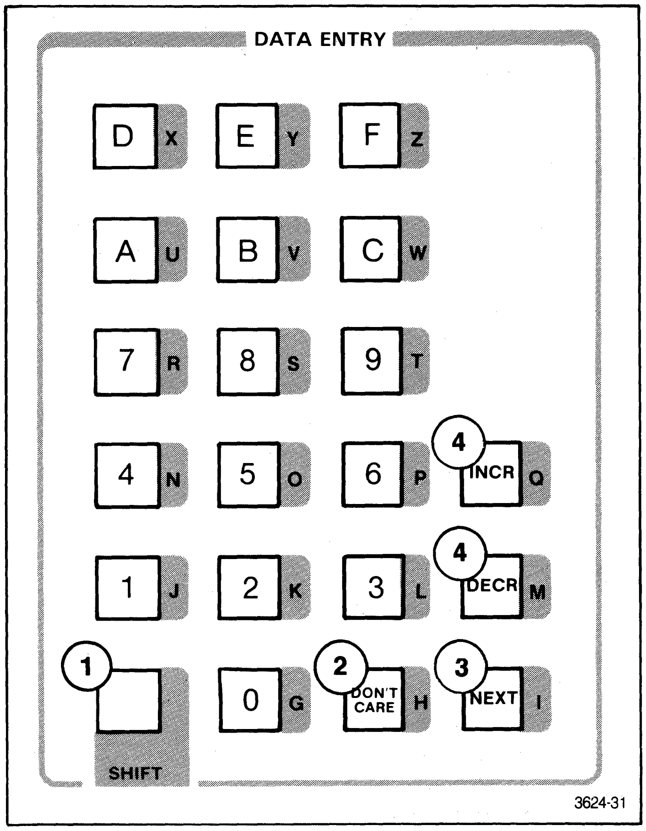


Figure 2-28. Data entry keys.

(1) **SHIFT**—This key is used with any of the other 20 data entry keys to obtain the shiftable values G-Z. The SHIFT key may also be used with the SELECT key to obtain symbols from the DAS character set (see Appendix B).

(2) **DON'T CARE**—This key is used for entering don't care status in place of digits when specifying data for word recognition and display.

In the Pattern Generator menu, don't care is used to enter tri-state into the pattern generator program.

In all other data entry fields, don't care is used to delete field values.

(3) **NEXT**—This key advances the screen cursor to the next menu field to the right. If the next field is on a lower line, the cursor will move to that line. In some cases, the NEXT key skips over fields which are not often used. Use the cursor keys to reach these fields.

(4) **INCR and DECR**—These two keys are used in certain menu fields to step through predetermined numerical values.

EDITING, CURSOR, AND SCROLL

The editing, cursor, and scroll keys are only usable if a menu is displayed on the DAS screen. These keys are used for manipulating certain menu fields.

(1) **SELECT**—This key is used in some menu fields to select between predetermined field values.

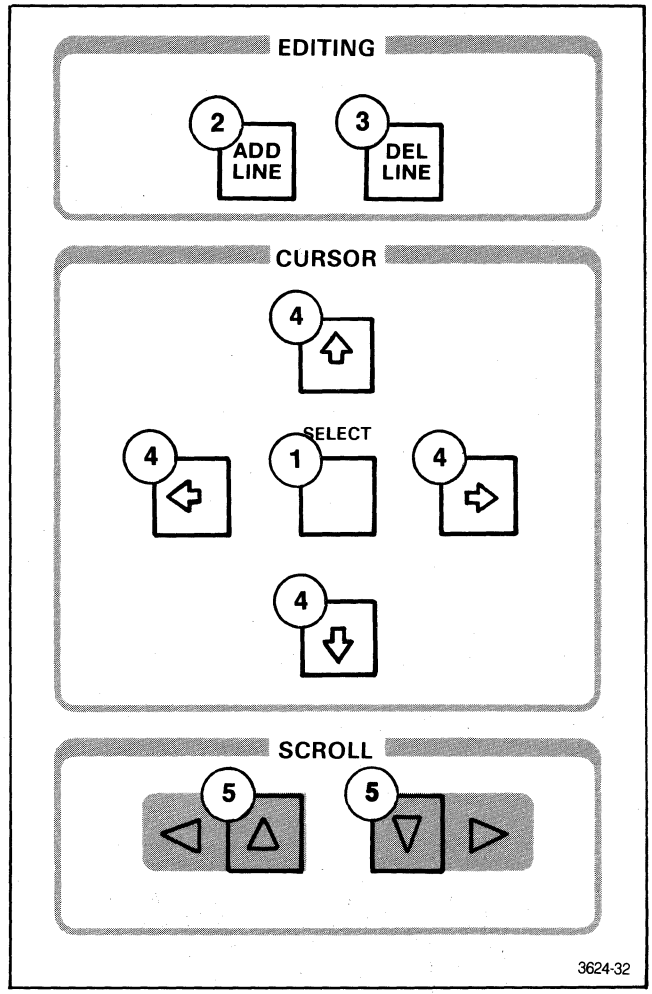


Figure 2-29. Editing, cursor, and scroll keys.

(2) **ADD LINE**—This key is used to insert lines or spaces in some menu fields.

(3) **DEL LINE**—This key is used to delete lines and values from some menu fields.

(4) ⇩ ⇧ ⇦ ⇨ The four directional keys are used for moving the screen cursor from one menu field to another. The screen cursor must be residing a field before changes to that field may be made.

(5) △ ▽ —These two keys are used to vertically scroll through the table portions of the Channel Specification, State Table, Define Mnemonics, Pattern Generator, and Input Output menus.

In the Timing Diagram menu, the two keys are used to horizontally scroll through displayed data.

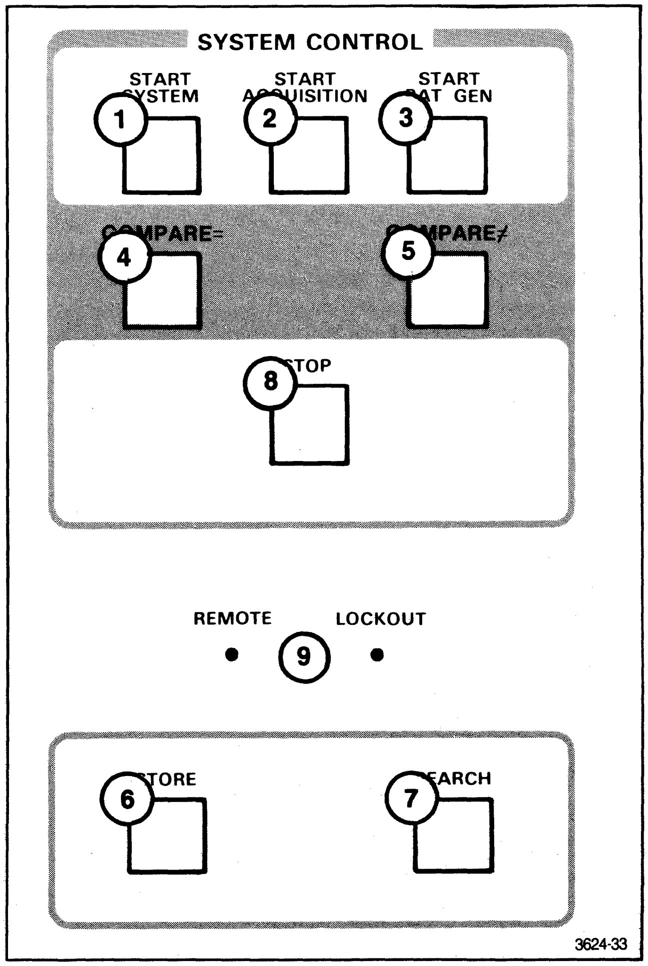


Figure 2-30. System control keys.

SYSTEM CONTROL

The system control keys are used to initiate DAS operations. Except for the START PAT GEN and STOP keys, the functions of this group all require that at least one data acquisition module be installed in the mainframe.

NOTE

Refer to the Start and Stop section of this manual for detailed information on how to use these keys to control data acquisition and pattern generator operations.

(1) **START SYSTEM**—This key starts data acquisition and pattern generator operations simultaneously. If no pattern generator modules are installed, the key starts data acquisition. The key will not start the pattern generator if no data acquisition modules are installed.

(2) **START ACQUISITION**—This key starts data acquisition only. If the pattern generator modules are running, the key will not affect their operation.

(3) **START PAT GEN**—This key starts pattern generation only. The key will not start the pattern generator if the data acquisition modules are running.

(4) **COMPARE** = —This key starts data acquisition comparisons. When the key is pressed, an acquisition occurs and is compared to reference memory. If the memories are equal, the comparisons stop. If they are unequal, a new acquisition occurs. The acquisitions continue until the two memories are equal.

The start function for this key is either START SYSTEM or START ACQUISITION, whichever was last used.

(5) **COMPARE** ≠—This key works like the COMPARE = key, except that new acquisitions are taken until the two memories are unequal.

(6) **STORE**—This key transfers the contents of acquisition memory into reference memory. Any data previously stored in reference memory is lost.

(7) **SEARCH**—This key is used to start memory search functions in the State Table or Timing Diagram menus.

(8) **STOP**—This key stops data acquisition or pattern generator operations. It also stops the SEARCH key function.

The SHIFT/STOP key combination displays the power-up configuration display on the screen.

(9) **LOCKOUT and REMOTE**—These two indicators specify whether the DAS is in a local, remote, or lockout mode.

When the DAS is in a local mode, both lights are off. This means the DAS is being operated from the keyboard.

The REMOTE light comes on when:

- The RS-232 port is transmitting or receiving data.

- The DAS is remote-addressed by the GPIB.
- The tape drive is formatting a tape (the REMOTE light blinks).
- The DAS is in a self-test mode.

The LOCKOUT light comes on when:

- The Lockout command is sent over the RS-232 port.
- The Universal Addressed Command Local Lockout is sent over the GPIB.
- The DAS is in a self-test mode.

When the REMOTE and LOCKOUT lights are both on, the DAS does not respond to the keyboard.

OPERATOR'S CHECKOUT PROCEDURE

POWER ON/OFF

The DAS power switch is located on the mainframe's front panel as shown in Figure 2-31. To power up the DAS simply pull out the switch.

POWER-UP SELF TEST

The DAS has internal diagnostic tests which run automatically every time the mainframe is powered up. These tests check out the major mainframe components and operating firmware.

During the first phase of self test, the DAS tests the major blocks of system RAM and ROM and initializes I/O ports. The LOCKOUT indicator on the keyboard is illuminated while the RAMs are being tested, and the REMOTE indicator is illuminated while the ROMs are being tested. After the RAM/ROM tests, both indicators are illuminated while the DAS finishes system initialization.

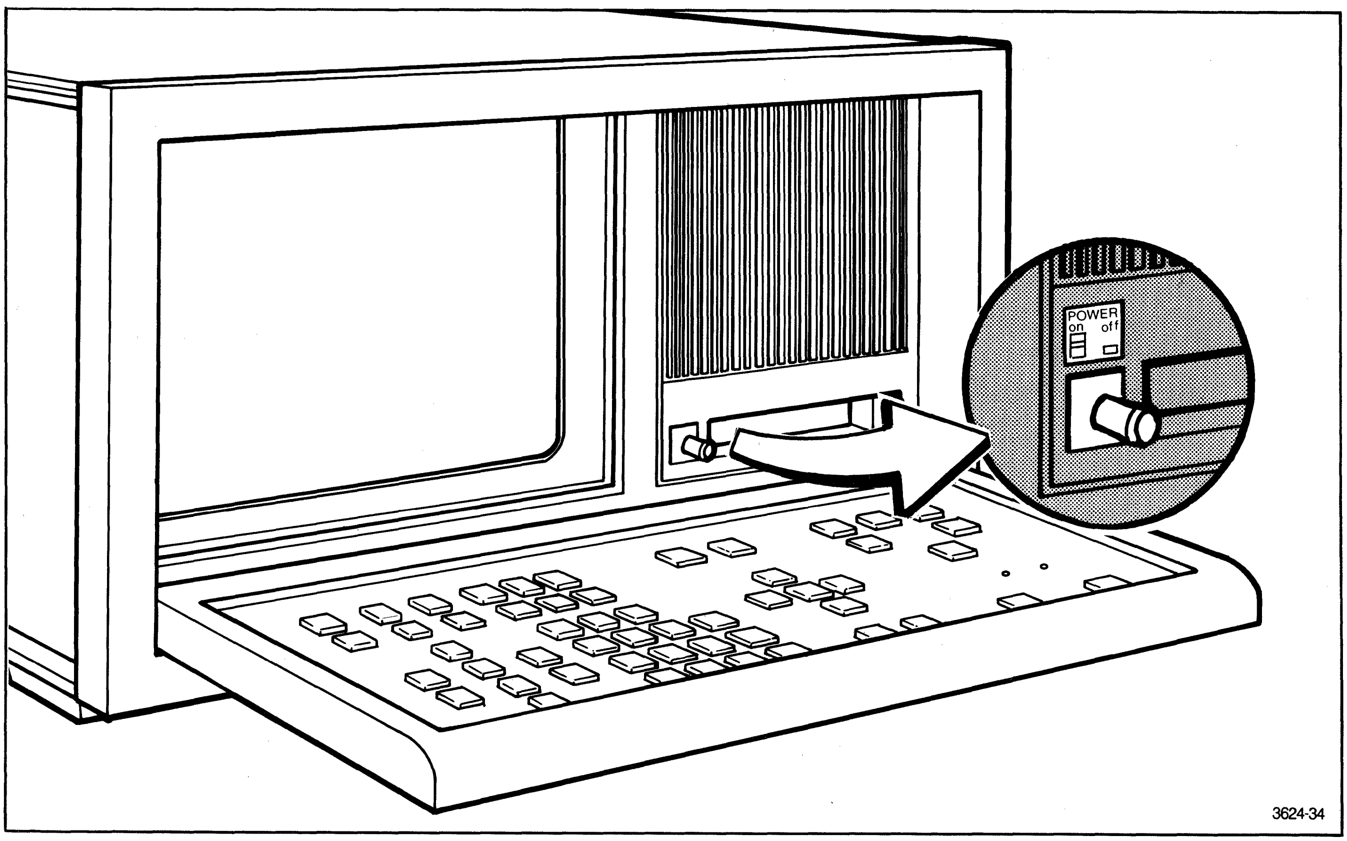


Figure 2-31. Location of the power switch.

The screen display does not appear until both indicators are off and the initialization is complete (approximately 20 seconds). The display shows a configuration listing. Each installed module is listed on the screen along with its bus slot number. The mainframe's firmware version number is also listed in the top right corner of the screen. At the top of the screen, a message appears reading DAS 9100 SERIES SELF TEST IN PROGRESS.

Each listed module (except the I/O board) is tested and given a PASS or FAIL notation. PASS means that the module test was successful, while FAIL means that the test was unsuccessful.

If a ROM checksum test failed during initialization, an error message will appear in the upper-right portion of the screen reading ROM CHECKSUM ERROR.

When the tests are finished, the DAS screen displays a message reading DAS 9100 SERIES SELF TEST COMPLETE.

Table 2-5 lists and defines the possible power-up errors. Some of these errors only inhibit a portion of the DAS functions.

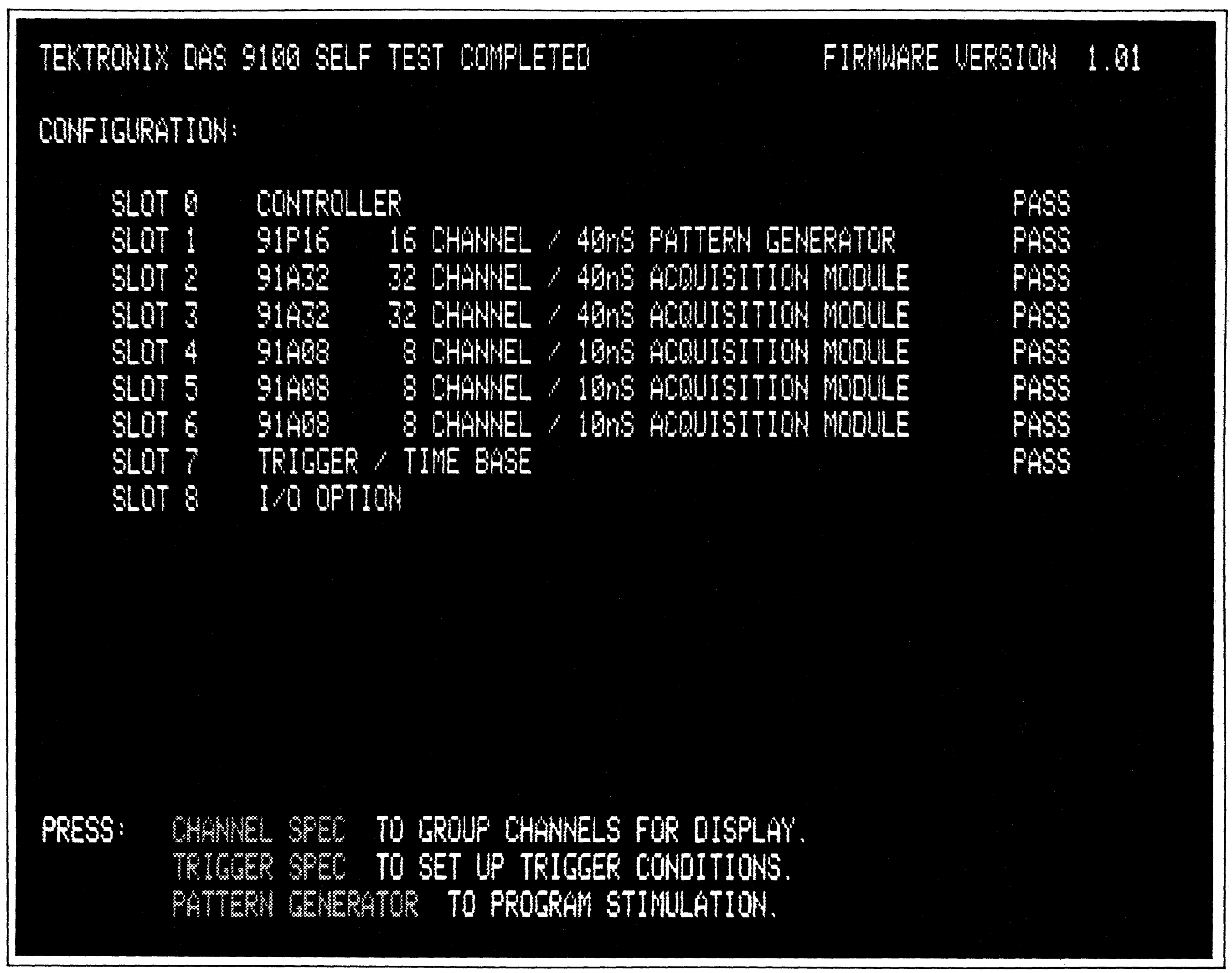
Figure 2-32 illustrates how the DAS screen appears when no errors are found during self-test. You may now enter any of the menus or begin operation.

Table 2-5
Power-Up Error Conditions

Error Condition	Definition
A display does not appear on the screen (and the REMOTE and/or LOCKOUT indicator is on).	An error occurred on the Controller board. Power down the DAS, then turn it back on. If the display still does not appear, refer the instrument to qualified personnel.
ROM CHECKSUM ERROR 0,..	An error occurred on the Controller boad, and the instrument will not operate properly. Refer the instrument to qualified service personnel.
1-6,..	An error occurred on the module installed in the specified slot (1-6). The module will not operate properly. (See descriptions of module failure listed below.)
7,..	An error occurred on the Trigger/Time Base Module, and the instrument will not operate properly. Refer the instrument to qualified service personnel.
RAM ERROR	The lower 16 K of RAM did not pass the RAM power-up test. The instrument will not operate properly. Refer the instrument to qualified service personnel.
ROM ADDRESS ERROR	The Trigger, Channel, or Start ROM's cannot be addressed or are missing. The instrument will not operate properly. Refer the instrument to qualified service personnel.
Controller FAIL	The keyboard has failed the power-up test. Turn the DAS off and on again, making sure no key is depressed on the keyboard. If the failure continues, refer the instrument to qualified service personnel.
Trigger/Time Base Module FAIL	The Trigger/Time Base Module has failed the power-up test. The instrument will not operate properly. Refer the instrument to qualified service personnel.
91A32 Data Acquisition Module FAIL	The 91A32 module has failed the power-up test. The module will not operate properly, but the rest of the instrument is not affected. Refer the module to qualified service personnel.

Table 2-5 (cont)

91A08 Data Acquisition Module FAIL	The 91A08 module has failed the power-up test. The module will not operate properly, but the rest of the instrument is not affected. Refer the 91A08 module to qualified service personnel. If the 91A08 module which failed is in slot 6, remove the module and place the functioning 91A08 modules in descending slot order 6 through 3.
91P16 Pattern Generator Module FAIL	The 91P16 module has failed the power-up test. The module will not operate properly. This does not affect data acquisition modules, but it does affect the operation of 91P32 modules. 91P32 modules cannot operate without a 91P16. Refer the 91P16 module to qualified service personnel.
91P32 Pattern Generator Expander Module FAIL	The 91P32 module has failed the power-up test. The module will not operate properly, but the rest of the instrument is not affected. Refer the 91P32 module to qualified service personnel.



3624-35

Figure 2-32. Successful completion of the Power-Up Self Test.

Figure 2-33 illustrates how the DAS screen appears when an error occurs during self-test. If the error which occurred does not affect the DAS operations you wish to perform, press the DON'T CARE key. The screen will revert to a display similar to that shown in Figure 2-32.

If the error which occurred prohibits DAS operations, refer to a qualified service person. The system diagnostics are explained in the DAS 9100 Series Service Manual.

PROBE SELF-TEST

The DAS provides a special probe self-test capability. The test requires that your DAS contains a 91P16 Pattern Generator Module, one data acquisition module, and a diagnostic lead set. (The diagnostic lead set is provided as standard with every mainframe.)

The probe self-test operates in the following way. One pattern generator probe and one data acquisition probe are connected together via the diagnostic lead set. The DAS is started. A special power-up program is sent out from the pattern generator and acquired by the data acquisition probe. This program creates a specific display pattern. If the pattern is correct, then the two probes are performing properly.

The following paragraphs describe the various steps to this test. Read these paragraphs carefully before attempting to test a probe.

Connecting the Probes to the DAS. The pattern generator probe to be tested must always be connected to the 91P16 module's pod connector B.

The data acquisition probe should be connected to pod A of the 91A32 module installed closest to the Trigger/Time Base Module. If no 91A32 modules are installed in the mainframe, then the data acquisition probe should be connected to pod C of the 91A08 module installed in bus slot 6.

NOTE

If you use other data acquisition probe locations, make sure that the Trigger Specification menu is set in the appropriate trigger mode for the module being used (see the Trigger Specification Menu section of this manual).

Figure 2-33. Failure in the Power-Up Self Test.

Connecting the Diagnostic Lead Set. Figure 2-34 illustrates how the pattern generator and data acquisition probes are connected to the diagnositc lead set. Make sure all of the following conditions are true:

1. The data acquisition ground lead from the diagnostic lead set is connected to the GND DIAGNOSTIC location.
2. The pattern generator ground lead from the diagnostic lead set is connected to the V_L location if using a P6455 TTL/MOS probe, or to the V_H location if using a P6456 ECL probe.
3. The threshold range switch on the data acquisition probe is set to NORM.
4. The diagnostic switch on the pattern generator probe is set to AUX.

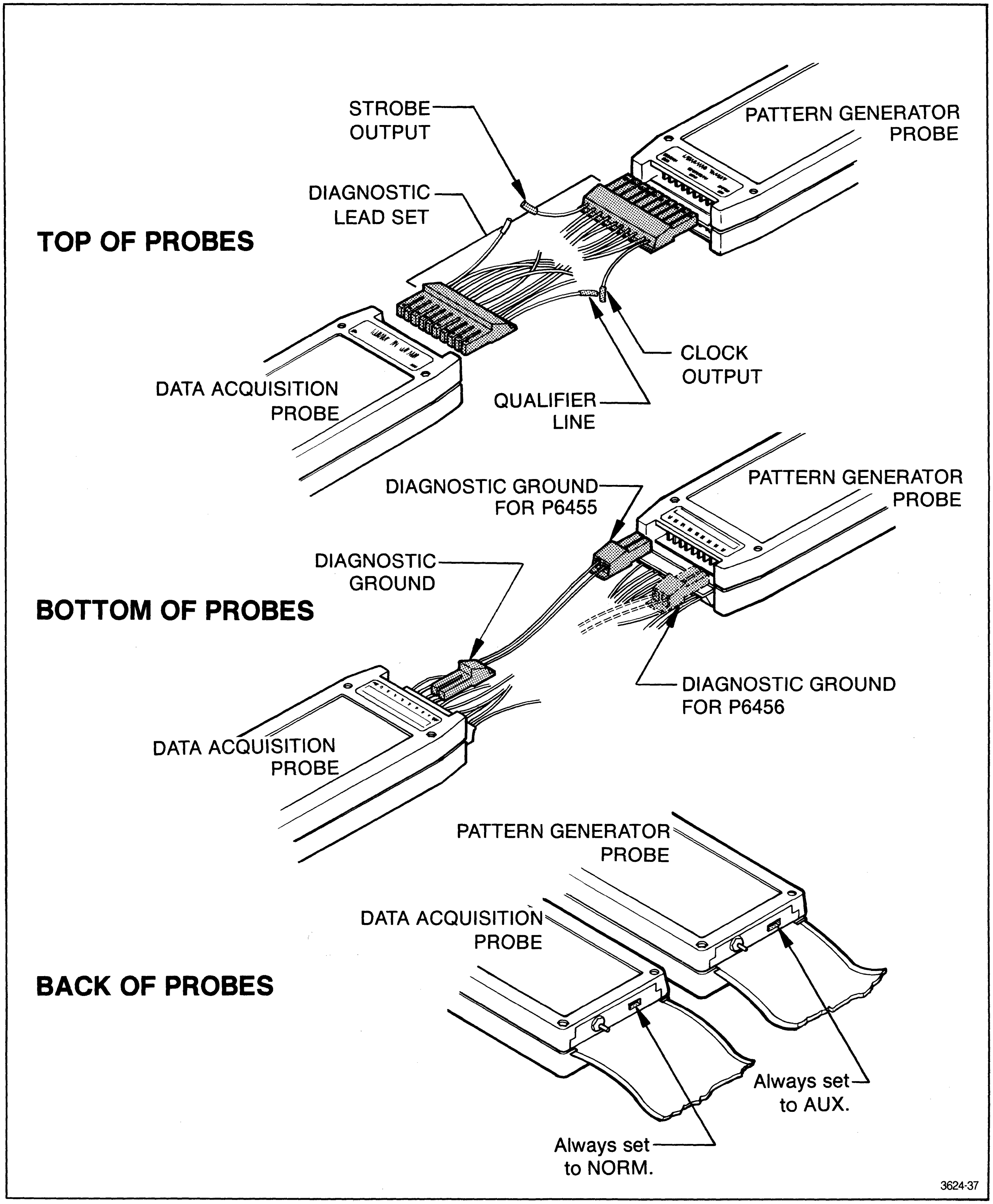


Figure 2-34. Connecting the diagnositic lead set.

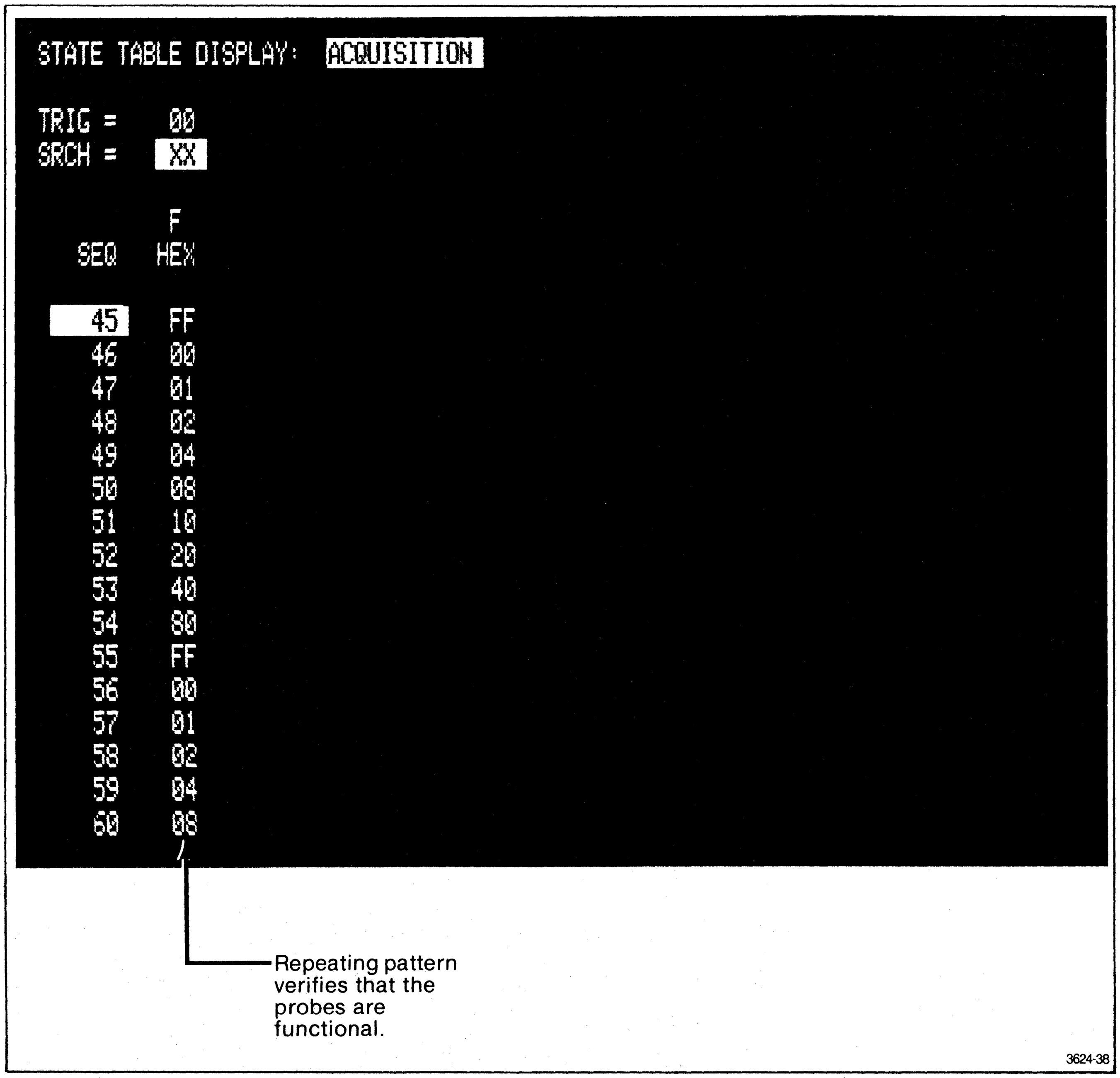


Figure 2-35. State Table display of probe self test.

NOTE

If you are using a P6456 ECL Pattern Generator Probe, you should enter the Channel Specification menu and set the data acquisition probe's threshold to variable. (Refer to the Channel Specification Menu section of this manual for procedures.)

Starting the Probe Test. Once the probes have been connected, press the START SYSTEM key. This key starts the data acquisition and pattern generator functions simultaneously. A message appears at the top of the screen reading ACQUISITION AND PATTERN GENERATOR STARTED.

Displaying the Test Pattern. When the operation is completed, the DAS automatically displays the State Table menu. Figure 2-35 illustrates how this menu should appear. The data from the data acquisition probe being tested should show the repeating pattern: 00, 01, 02, 04, 08, 10, 20, 40, 80, FF, 00, and so on.

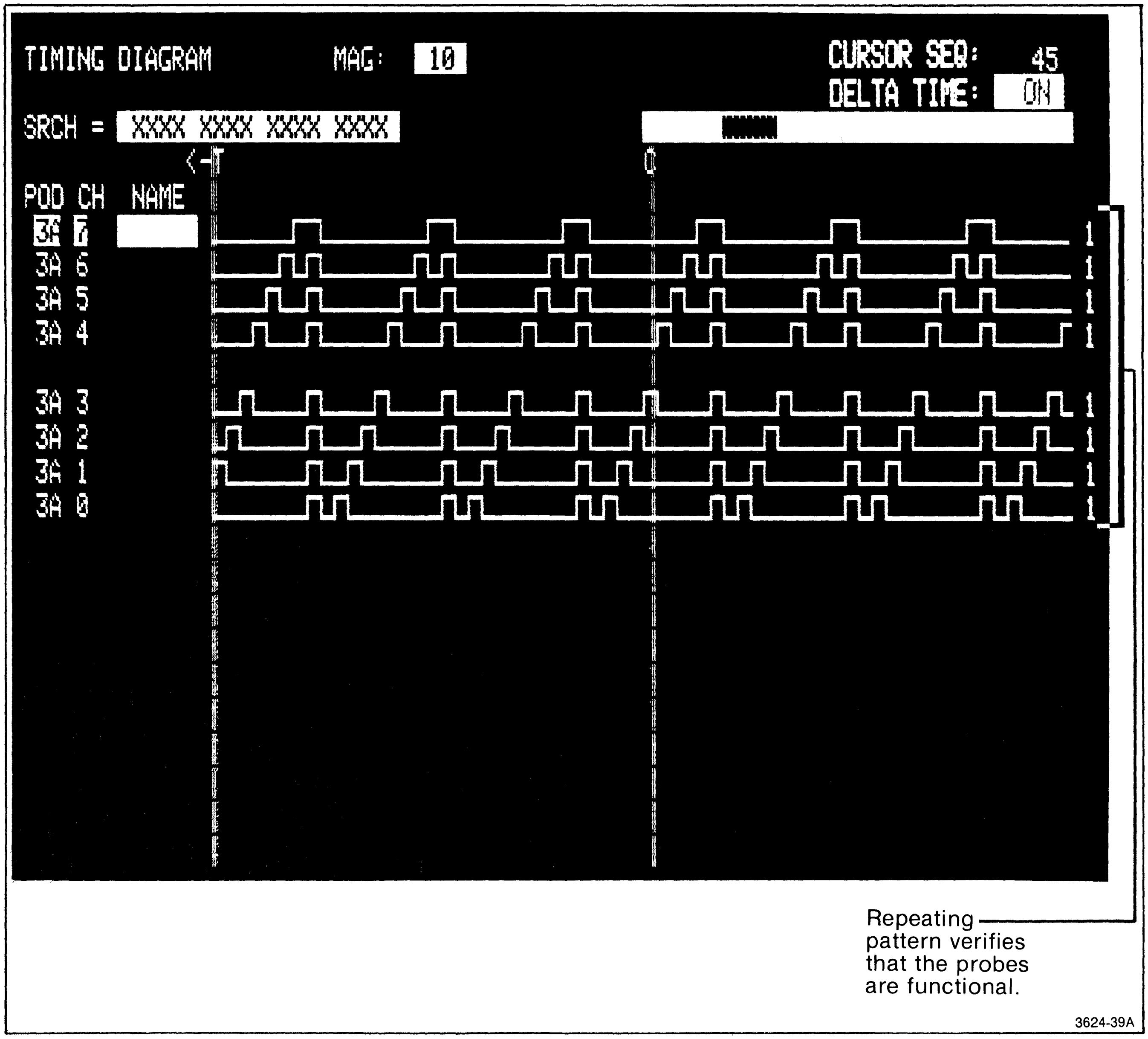


Figure 2-36. Timing Diagram display of probe self test.

To view the pattern in the Timing Diagram menu, press the TIMING DIAGRAM menu key. Figure 2-36 illustrates a display of this pattern. To achieve a similar display, you must increase the waveform magnification of the menu to 10. This is accomplished by positioning the cursor in the menu's MAG field and pressing the INCR key.

NOTE

When using the Timing Diagram menu display, you may need to enter the active data acquisition channels into the menu's POD and CH fields. (Refer to the Timing Diagram Menu section of this manual for procedures.)

Other Uses for the Diagnostic Lead Set. The diagnostic lead set may be used to learn both the pattern generator and data acquisition functions of the DAS. Several examples are given in the Application Examples section of this manual.

OPERATOR'S FAMILIARIZATION

The DAS is a menu-driven system. This means that all operations are set up via menus which are displayed on the monitor screen. There are five menus for setting up the data acquisition operation, one menu for setting up the pattern generator, and one menu for controlling I/O functions.

The following paragraphs briefly describe these menus and how they affect the overall operation of the DAS.

DATA ACQUISITION

The block diagram in Figure 2-37 illustrates the five menus controlling data acquisition. Refer to this diagram when reading the following paragraphs.

Channel Specification Menu. The Channel Specification menu serves two basic functions.

First, the menu determines the way in which acquisition channels are organized for the State Table display. It organizes the channels into logical groups, and sets display radices and polarity. This information is then used by: the Trigger Specification menu for organizing the word recognition channels; the State Table menu for organizing the data display; and the Define Mnemonics menu for organizing the mnemonic tables.

The channel organization in the menu is independent of the order in which channels are connected to the system under test. The organization only affects display, not the actual acquisition. Changes can be made to the data display after the data has been acquired.

The second major function of the Channel Specification menu is to determine probe input thresholds.

Trigger Specification Menu. The Trigger Specification menu sets up the major acquisition parameters. First, it specifies which modules will used during acquisition. Then, it specifies the acquisition clock (external or internal), and enables clock qualifier lines.

The Trigger Specification menu also controls all word recognition and triggering parameters.

State Table Menu. The State Table menu provides access to acquisition memory and reference memory. It allows three display formats: acquisition memory, reference memory, or acquisition and reference memory comparison.

If the Define Mnemonics menu is used, the State Table sends the data through the mnemonic tables for appropriate readout on the display.

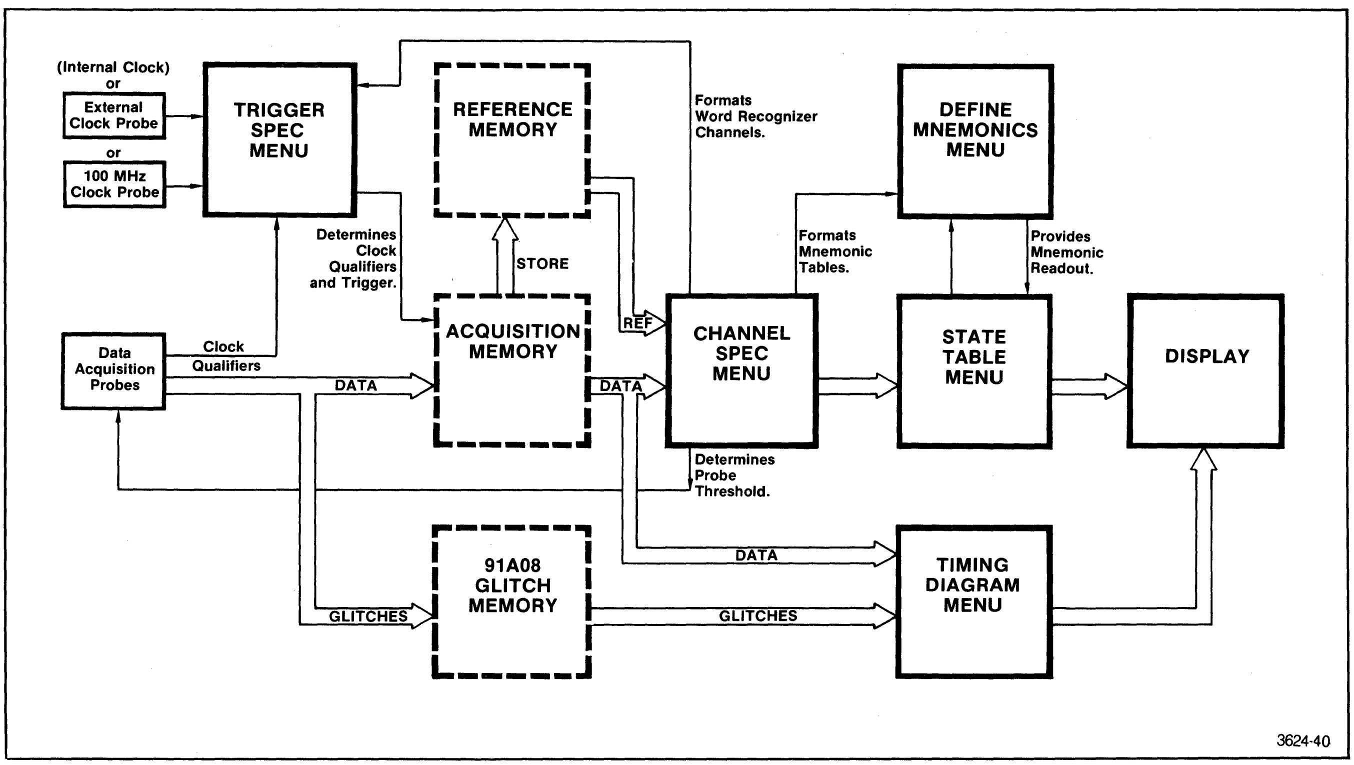


Figure 2-37. Functional overview of the DAS acquisition menus.

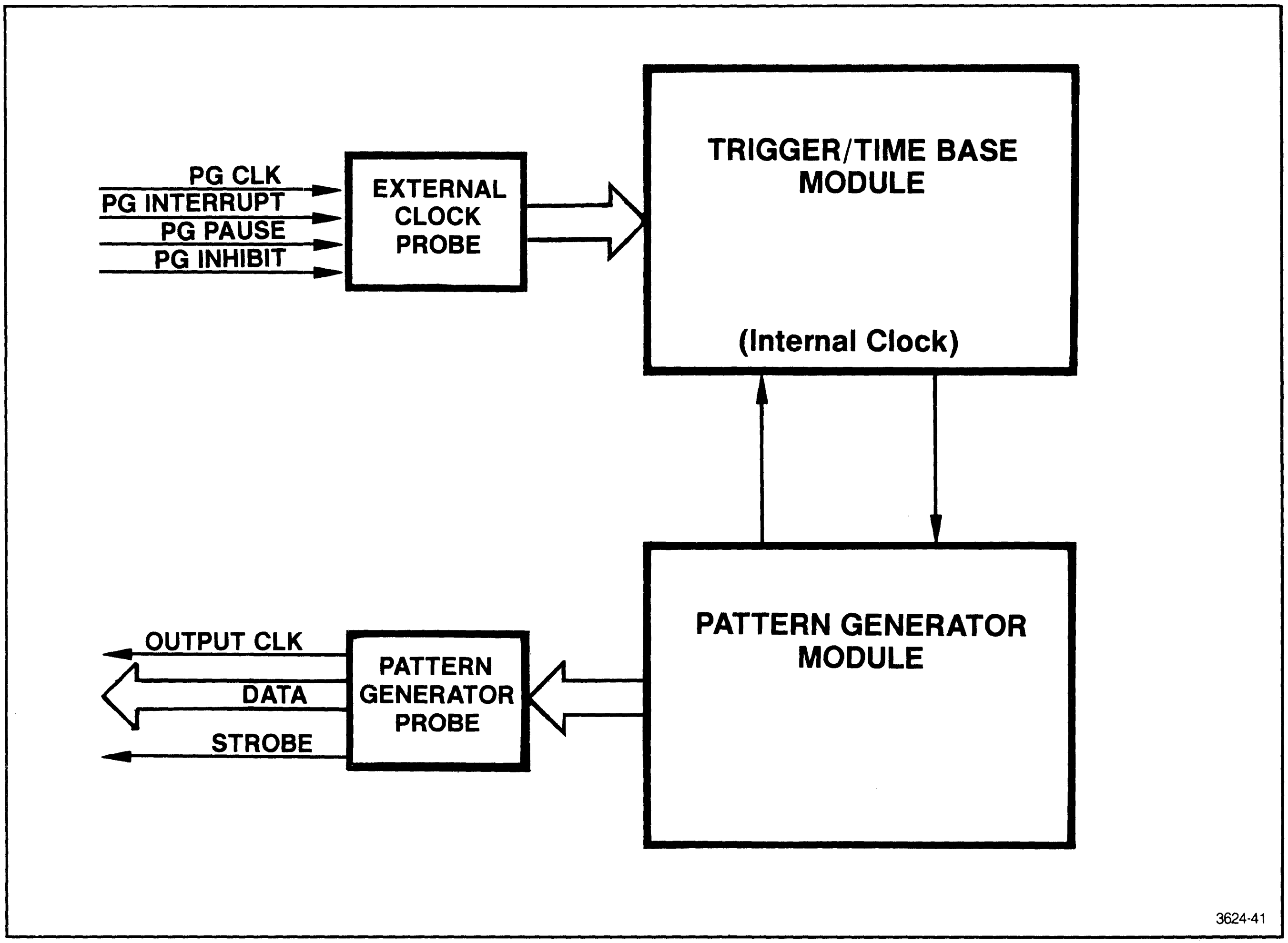


Figure 2-38. Functional overview of the pattern generator.

Timing Diagram Menu. The Timing Diagram menu provides access to acquisition memory and 91A08 glitch memory. The data is presented in a logic-waveform format.

NOTE

The 91A08 glitch memory is only available if 91A08 modules were used during the acquisition. 91A08 modules always acquire glitches when they are used.

Define Mnemonics Menu. The Define Mnemonics menu is used to build mnemonic tables for the State Table menu. The tables are organized by the Channel Specification menu to match the channel group organization.

PATTERN GENERATOR

The pattern generator is used to exercise a system under test. For this purpose, it outputs data, clock, and strobe signals which may be used to stimulate circuit elements. It also responds to three external signals supplied via the External Clock Probe: interrupt, pause, and inhibit.

Figure 2-38 illustrates the input and output signals of the pattern generator. All of these signals are selected and enabled via the Pattern Generator menu.

As shown in the block diagram, the pattern generator may run from the DAS internal clock or an external clock supplied via the External Clock Probe. This input clock is then used by the pattern generator as an output clock signal. The data output is synchronous to this clock output.

Output strobe signals are programmable within the clock-cycle boundaries. Their leading and trailing edges may be programmed from the rising edge of the output clock. Plus, they may be inserted as postive-true or negative-true signals.

The three external signals (interrupt, pause, and inhibit) are supplied via the External Clock Probe. These signals may be enabled and used to interrupt the pattern generator's program.

I/O FUNCTIONS

The tape drive operations and the RS-232 master/slave transmission are controlled via the INPUT OUTPUT menu. GPIB transmission, over the GPIB or RS-232 interface, is controlled via the connected controller unit.

MENU CHARACTERISITCS

There are certain characteristics and terms common to all menus. The following paragraphs discuss these common characteristics and their meaning.

POWER-UP CONFIGURATION DISPLAY

When the DAS is first powered up, it lists the mainframe bus slots and identifies all installed modules. When setting up the various menus, you may often want to refer back to this power-up display. This is accomplished by pressing the SHIFT and STOP keys simultaneously.

MENUS AND SUB-MENUS

Each DAS menu is displayed on the monitor screen by pressing its associated menu key on the keyboard.

Some of the menus are comprised of several parts called sub-menus. These sub-menus are individual screen displays which may be selected only after the menu is entered. For example, the Input Output menu has two sub-menus: one for controlling the tape drive and one for controlling RS-232 master/slave transmission. To display either of these sub-menus, you must first enter the Input Output menu.

MENU DEFAULT DISPLAYS

On system power up, the DAS assigns each menu with default operating parameters. When you enter the menu, the menu and its default parameters appear on the DAS screen. This initial menu display is called the menu's default display.

If no changes are made to the menu's default display, the DAS will use the default parameters during the various operations.

MENU FIELDS AND THE SCREEN CURSOR

When a menu is displayed on the DAS screen, the menu's changeable parameters appear as reverse-video fields. Before making any changes in a specific field, you must first move the blinking screen cursor to that field.

The screen cursor moves from field to field, in any direction. It is controlled via these keys:

- ⇧,⇩,⇦ or ⇨ which move the cursor one space up, down, left, or right.
- NEXT key—which moves the cursor one field to the right.

NOTE

The NEXT key has special applications within the Define Mnemonics and Pattern Generator menus. Refer to those menu sections for more information.

Once the screen cursor is located in a specific field, you may change the field value. The common useage of keys in making field changes are:

- Data entry keys—which are used in fields that have a string of numeric or alphanumeric values.
- SELECT key—which is used in fields with predetermined values.
- INCR and DECR keys—which are used in fields that have specific incrementing or decrementing numerical values.

ERROR MESSAGE READOUT

The DAS has a comprehensive set of error and prompter messages. These messages appear on the second line of the screen and are displayed in highlighted video. The messages are also accompanied by a beeping sound from the monitor.

A complete listing of error and prompter messages may be found in Appendix A of this manual.

POD MESSAGES

There are three pod messages which may appear on the second line of the screen. They are:

- POD ID—which appears when a probe's POD ID button pressed.
- POD DISCONNECTED—which appears when a probe is disconnected from the back panel of the DAS.
- POD CONNECTED—which appears when a probe is connected to the back panel of the DAS.

In these messages, the probes are always identified by their POD ID (bus slot number, pod connector letter). The messages appear in highlighted video and are accompanied by a beeping sound from the monitor.

CHANNEL SPECIFICATION MENU 3

This menu is designed to support DAS data acquisition operations. While the menu may be displayed on the monitor screen at any time, it is useful only if data acquisition modules are installed in the mainframe.

This section describes the Channel Specification menu and its functions. Before reading this section, you should first read the Operating Instructions section of this manual for an overview of keyboard controls and menu characteristics.

In this section you will find: **Page**

CHANNEL SPECIFICATION MENU

The Channel Specification menu is designed to support the data acquisition operation. It has two major functions:

- **Display Format**—the menu controls the way in which incoming data is formatted and used by the Trigger Specification, State Table, and Define Mnemonics menus.
- **Thresholds**—the menu specifies the input thresholds used by the probes to determine high and low logic states.

Figure 3-1 illustrates how the Channel Specification menu interacts with other DAS menus controlling data acquisition.

NOTE

The Channel Specification menu does not affect the Timing Diagram display. This display is controlled via the Timing Diagram menu.

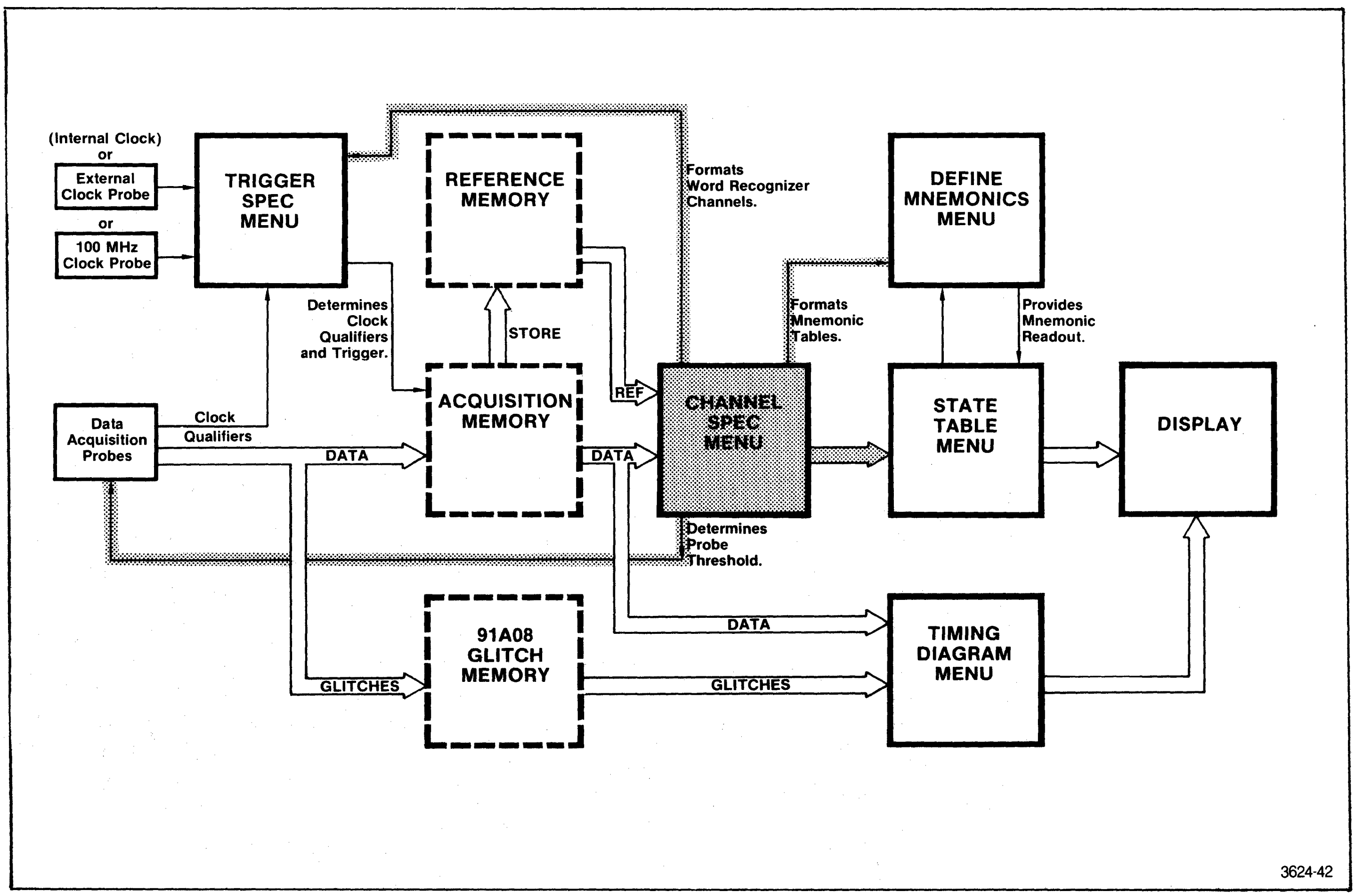


Figure 3-1. Functional overview of the Channel Specification menu. This menu determines the way data is used by Trigger Specification, State Table, and Define Mnemonics menus. It also sets probe input thresholds.

MENU DEFAULT DISPLAY

When the DAS is powered up, the Channel Specification menu assumes default operating values. It organizes the data acquisition channels into logical display groups, and sets default parameters for data input and formatting. These display groups are then reflected in the Trigger Specification, State Table, and Define Mnemonics menus.

You may view the menu on the monitor screen by pressing the CHANNEL SPEC key.

Figure 3-2 illustrates a typical default display of the Channel Specification menu.

READING THE MENU

Refer to the example display in Figure 3-2 when reading the following paragraphs.

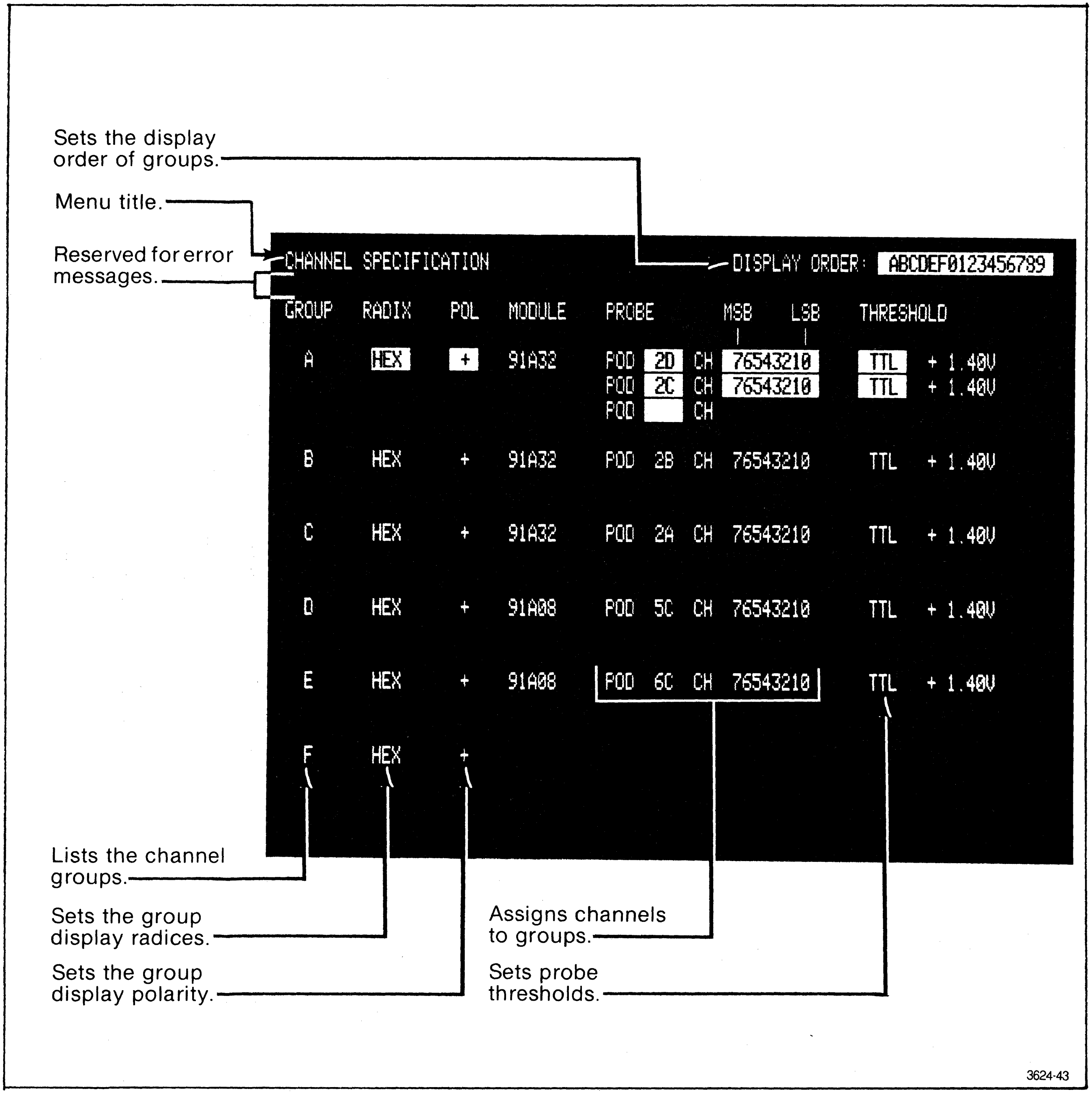


Figure 3-2. Default display of the Channel Specification menu. This menu organizes channels into logical groups and sets display radix, polarity, and probe threshold values.

The menu title, CHANNEL SPECIFICATION, always appears in the top left corner of the screen. The line directly below this title is reserved for any highlighted error or prompter messages that may occur.

Directly across from the menu title, in the top right corner of the screen, the menu provides a field labeled DISPLAY ORDER. This field controls the order in which the channel groups appear in the Trigger Specification and State Table menus. In default, the field specifies a group display order of A-F and 0-9.

The values for the channel groups are specified in the menu's group table. This table begins on the third line of the menu and has six major column headings: GROUP, RADIX, POL, MODULE, PROBE, and THRESHOLD.

The group table is read left-to-right, starting with the GROUP column.

The GROUP column designates the various channel groups. There are 16 groups labeled A-F and 0-9, though not all groups appear on the menu at the same time. More groups may be viewed by using the scroll keys.

The RADIX and POL columns indicate the display radices and logic polarity assigned to each channel group. In default, all groups are set at hexadecimal radix and positive polarity values.

The MODULE column indicates the type of data acquisition module used in forming the groups.

The PROBE column indicates which probes are assigned to each group. The probes are identified by their back-panel POD ID location (bus slot number, pod connector letter). For example, POD 2D refers to the probe attached to pod D on the module installed in bus slot 2.

The probe's channels are listed to the right of the POD ID.

The last column of the table, THRESHOLD, specifies the input thresholds assigned to the probes. In default, all probes are assigned a TTL threshold level.

Pod Status Readout. In forming the channel groups, the menu lists all pod connector locations—whether or not a probe is attached. If any pod connectors are empty, the menu displays a message at the bottom of the screen which lists the empty pods. For example:

DISCONNECTED PODS: 2D, 2C

The above message means that pod connectors 2D and 2C are not connected to probes.

DEFAULT OPERATION

The power-up default values of the Channel Specification menu support immediate data acquisition. You can leave the menu in its default configuration and, without making any changes, acquire and display data in a manner suitable to most TTL functions.

Figure 3-3 shows how the menu default values affect the way data is used by the Trigger Specification, State Table, and Define Mnemonics menus.

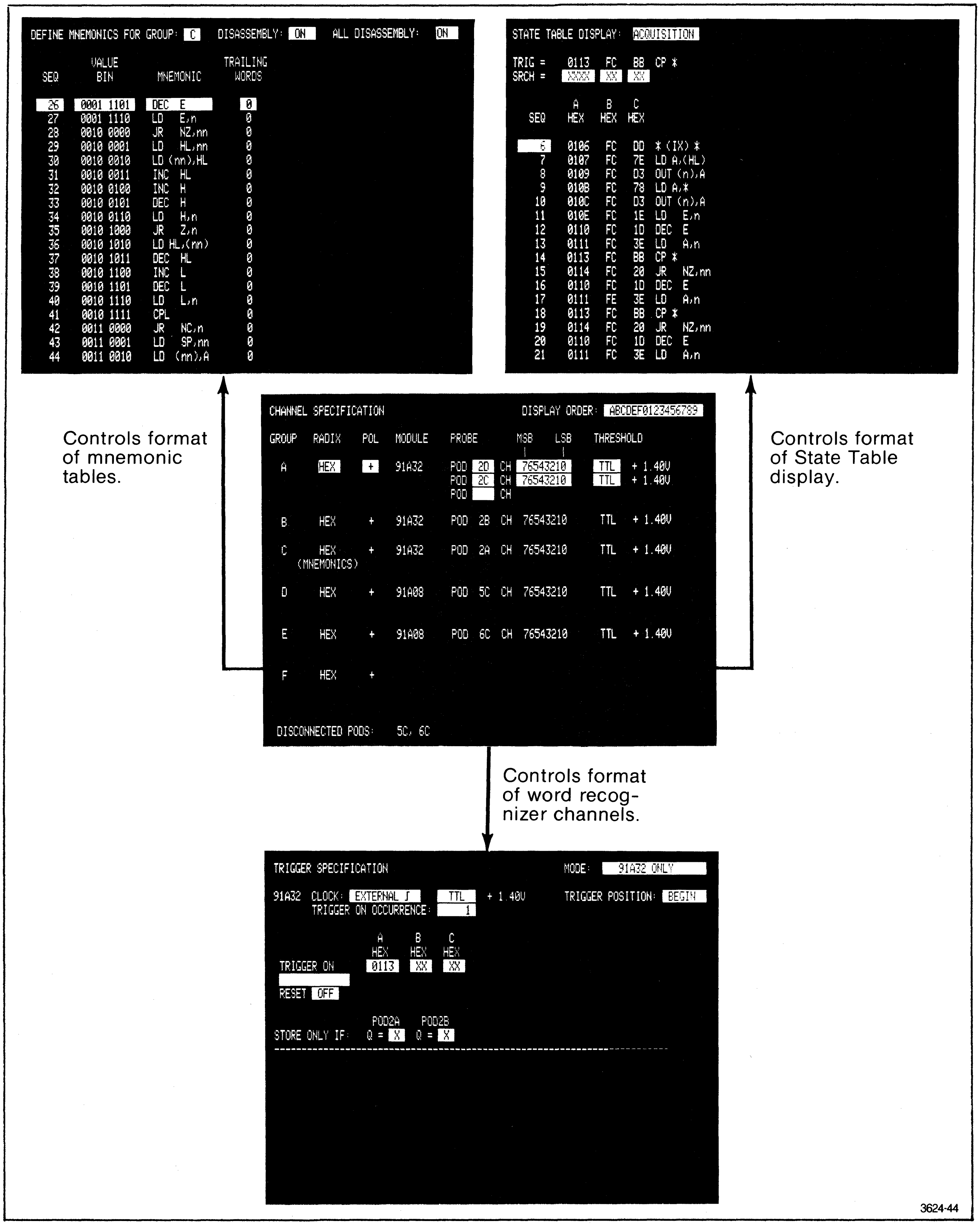


Figure 3-3. The Channel Specification menu's effect on data display. This menu formats the Trigger Specification menu's word recognizer channels, the State Table menu's data display, and the Define Mnemonics disassembly tables.

MENU FIELDS AND VALUES

At any time, you can use the Channel Specification menu to change the way in which data is displayed. You can reorganize channel groups, and set new radix and polarity values without acquiring new data.

Figure 3-4 illustrates the menu and its fields. The fields appear on the screen in reverse video and are designated throughout the text by brackets [ ]. The screen cursor moves from field to field in any direction, and is controlled via the four directional cursor keys and the NEXT key.

Refer to the numbered callouts in Figure 3-4 when reading the following paragraphs. These numbers are intended as a visual reference, and do not imply sequence of use.

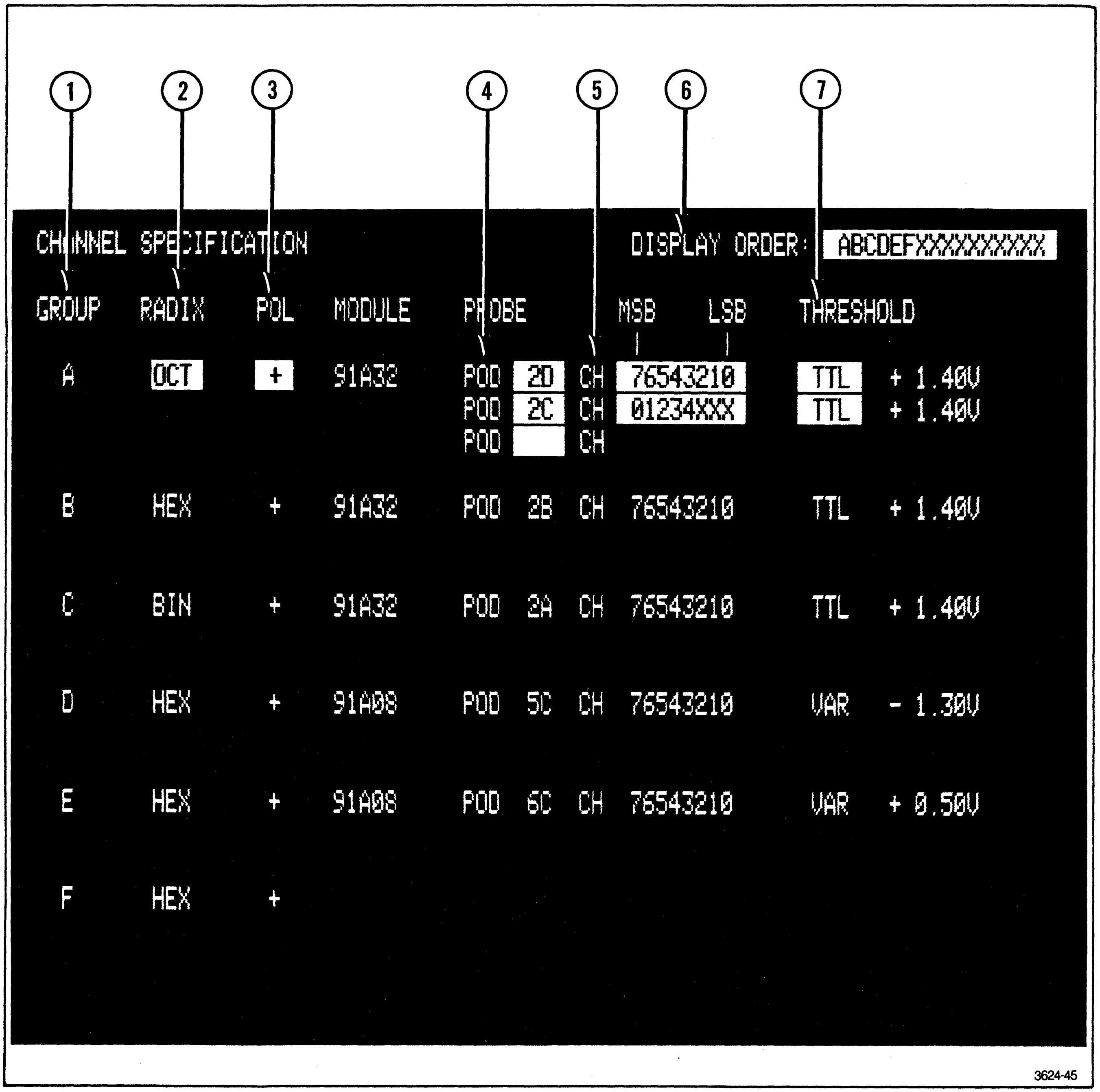


Figure 3-4. Channel Specification menu and its reverse-video fields.

(1) GROUP and Display Scrolling

Groups are used to divide the channels into logical display blocks (e.g., address, data, control lines, etc.).

Altogether, the menu provides 16 possible groups, labeled A-F and 0-9. Not all of the groups, however, appear on the menu at one time.

You may view more groups by using the scroll keys.

To view more groups:

1. Press Δ or ∇

   The DAS scrolls up or down through the groups.

NOTE

Channel assignments for the groups are made in the PROBE POD and CH fields.

(2) RADIX Field

Each channel group has a RADIX field. This field determines the radix used when displaying the data channels in the Trigger Specification and State Table menus.

In default, all channel groups are set to a hexadecimal radix. You may also set any group to either an octal or binary radix.

To select a radix value:

1. Move the screen cursor to the RADIX field you want to change.

   [HEX]

2. Press the SELECT key until the desired value appears in the field.

   The DAS displays optional values in this order:

   [HEX]
   [OCT]
   [BIN]

NOTE

If a group is assigned mnemonics in the Define Mnemonics menu, the word MNEMONICS appears under that group's RADIX field. (See the Define Mnemonics Menu section later in this manual.)

(3) POL (Polarity) Field

Each channel group has a polarity field. This field determines the logic polarity used when displaying data in the State Table menu.

NOTE

The Trigger Specification menu automatically adjusts the word recognizers to match the specified polarity.

In default, all channel groups are set to a positive (+) logic polarity. This means that acquired data is displayed as high (1) if it is above the probe input voltage threshold, and low (0) if it is below the threshold level.

You may also set any channel group to a negative (−) polarity value. This means that data is displayed as low (0) if it is above the probe threshold, and high (1) if it is below.

To select a polarity value:

1. Move the screen cursor to the POL field you want to change.

   [+]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

   [+]
   [−]

(4) PROBE POD Field

The PROBE POD field is used for assigning pods to groups. With this field, you can manipulate the way channels are grouped together irrespective of the order in which channels were connected to the system under test.

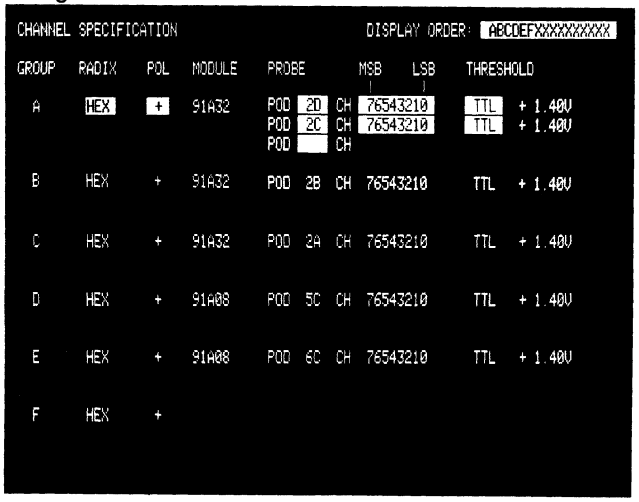
The only restriction when using this field, is that pods from different types of data acquisition modules (e.g., from 91A32 and 91A08 modules) cannot be combined in the same group.

NOTE

Changing the number of channels assigned to a group will cause any previously entered word recognizer values to be set to don't care (see the Trigger Specification Menu section of this manual).

The POD field is manipulated by using the data entry, ADD LINE, DEL LINE, and DON'T CARE keys. With this field, you may move a pod from one group to another, insert a pod between two other pods, or delete a pod.

The following examples illustrate some of the ways you can use the POD field. For these examples, the menu is configured as shown below.



3624-46

To move a pod from one group to another:

1. Move the screen cursor to the POD field where you want to add the pod. For example, the empty field below POD 2B in group B.

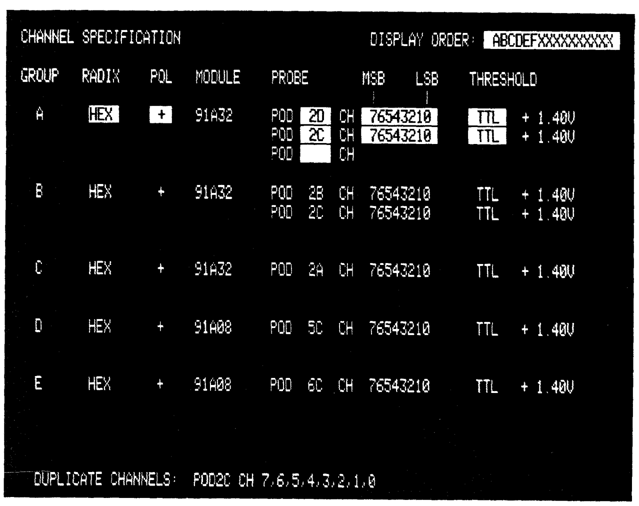
   POD [2B] CH [76543210]
   POD [ ] CH

2. Use the data entry keys to enter the POD ID of the pod you want to add. For example, 2C.

   The DAS enters the pod and its channels at the cursor location

   POD [2B] CH [76543210]
   POD [2C] CH [76543210]

The following illustration shows how the menu appears after POD 2C has been entered in group B.



3624-47

When POD 2C was entered into group B, the menu displayed a message at the bottom of the screen reading DUPLICATE CHANNELS: POD2C CH 7, 6, 5, 4, 3, 2, 1, 0. This message appeared because POD 2C is assigned to two groups: group A and B. To remove the message, POD 2C must be deleted from either group A or B.

NOTE

The DUPLICATE CHANNEL message must be removed before the menu may be exited.

To delete a pod from a group:

1. Move the screen cursor to the POD field you want to delete. For example, POD 2C in group B.

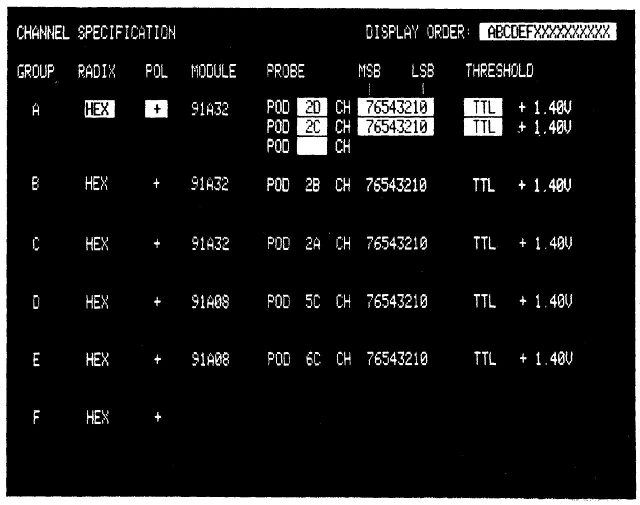
   POD [2B] CH [76543210]
   POD [2C] CH [76543210]

2. Press the DEL LINE or DON'T CARE key.

   When either key is pressed, the DAS deletes the pod at the cursor location.

   POD [2B] CH [76543210]
   POD [ ] CH

The following illustration shows how the menu appears when POD 2C has been deleted from group B. Notice that the DUPLICATE CHANNEL message has been erased from the bottom of the menu.



3624-48

The POD field may also be used to insert a pod between two other pods. This is accomplished by using the ADD LINE key.

To insert a pod between two other pods:

1. Move the screen cursor to the POD field where you want to insert the new pod. For example, POD 2C in group B.

   POD [2B]   CH   [76543210]
   POD [2C]   CH   [76543210]

2. Press ADD LINE.

   The DAS inserts an empty POD field at the cursor location, and moves the previous pod down one line.

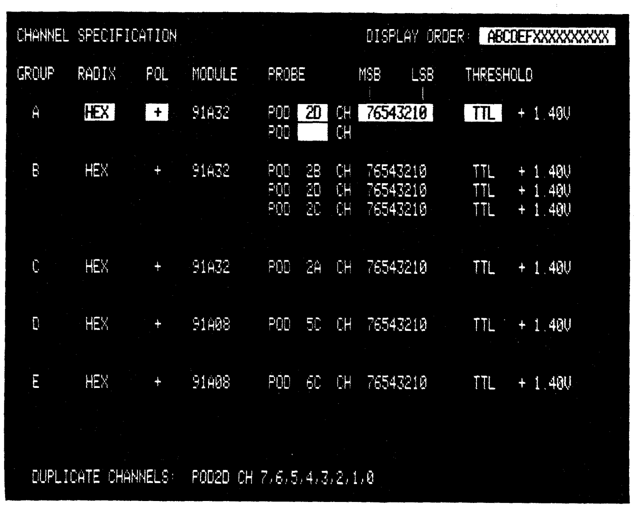
   POD [2B]   CH   [76543210]
   POD [   ]   CH
   POD [2C]   CH   [76543210]

3. Use the data entry keys to enter the POD ID of the pod you want to insert. For example, 2D.

   The DAS enters the pod and its channels into the newly created field.

   POD [2B]   CH   [76543210]
   POD [2D]   CH   [76543210]
   POD [2C]   CH   [76543210]

The illustration below shows how the menu appears when POD 2D is inserted between the two pods in group B. A DUPLICATE CHANNEL message appears at the bottom of the screen because POD 2D is assigned to both group A and B. This message will be erased when POD 2D is deleted from either group A or B.



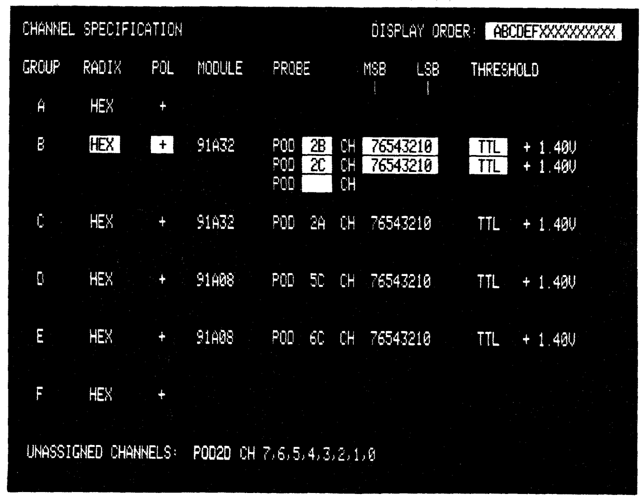
3624-49

In addition to rearranging pods, you can use the POD field to set any pod to don't care display status. This is accomplished by deleting the pod from the channel groups. Any pod which is not assigned to a channel group is ignored for display in the Trigger Specification and State Table menus.

NOTE

Don't care only affects the display of the pod within the Trigger Specification and State Table menus; it does not affect acquisition. Data is still acquired via that pod and stored in memory.

The illustration below shows how the menu appears when POD 2D is deleted from the channel groups.



3624-50

When POD 2D was deleted from the channel groups, a message appeared at the bottom of the display reading UNASSIGNED CHANNELS: POD2D 7, 6, 5, 4, 3, 2, 1, 0. You may leave the channels unassigned and thus inhibit their display, or you may reassign the pod to a group. When reassigned, the pod's data will be available for display.

(5) PROBE CH (Channel) Field

While the POD field may be used to rearrange the order or pods, the CH field may be used to rearrange the order of channels.

In default, each pod's channels are organized in a 7-0 sequence, where 7 is the most significant bit (MSB) and 0 is the least significant bit (LSB). With the CH field, you may change this channel sequence order to fit any application. You may reorder the bit significance, split channels between two groups, or set channels to don't care display status.

The CH field is manipulated using the data entry keys 0-7 and the DON'T CARE key. The following examples illustrate some of the ways this field can be used.

One use for the CH field is to set specific channels to don't care display status. This procedure only affects the channel display, not the input of data on those channels. Data is still acquired and stored in memory.

To set channels to don't care status:

1. Move the screen cursor to the CH field and position it over the channel you want to set to don't care. For example, channel 4.

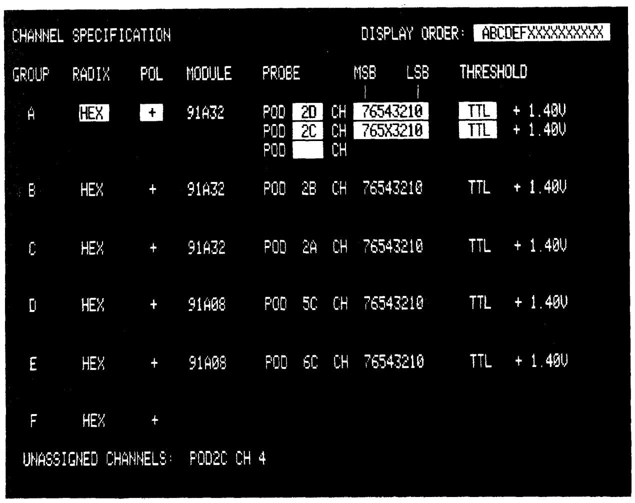
   POD [2C]   CH   [765**4**3210]

2. Press the DON'T CARE key.

   The DAS enters an X at the cursor location.

   POD [2C]   CH   [765**X**3210]

The illustration below shows how the menu appears when this channel is set to don't care. Notice the message at the bottom of screen, UNASSIGNED CHANNELS: POD2C 4. You may leave this channel unassigned or you can reassign it to a group.



3624-51

Another use for the channel field is to reorder the channel bit significance.

To change the channel order:

1. Move the screen cursor to the CH field and position it over the first channel you want to change. For example, channel 7.

   POD [2D]   CH   [**7**6543210]

2. Use the data entry keys enter any value 0-7. For example, 6.

   The DAS enters the value at the cursor location then shifts the cursor one space to the right.

   POD [2D]   CH   [**6**6543210]

3. Continue entering values until you have the desired channel order. For example, 7.

   POD [2D]   CH   [6**7**543210]

When you are reordering channels, the UNASSIGNED CHANNELS and DUPLICATE CHANNELS messages may appear at the bottom of the screen. The UNASSIGNED CHANNELS message may remain, but any DUPLICATE CHANNELS message must be removed before the menu is exited. This is accomplished by deleting the duplicated channels from all but one location.

By using the POD and CH fields together, you can split a pod's channels between groups. This is accomplished by first entering a pod into two group locations. Then, using the DON'T CARE key, assign a portion of the channels to one group and a portion to the second. For example:

POD [2D]   CH   [7654XXXX]
POD [2C]   CH   [76543210]

POD [2B]   CH   [76543210]
POD [2D]   CH   [3210XXXX]

Bit Significance. The bit significance for the channel groups is determined as follows:

In any given row of channels the leftmost bit is the most significant, while the rightmost bit is the least significant.

msb→76543210←lsb

In any given group of channels the top leftmost bit is the most significant, while the bottom rightmost bit is the least significant.

msb→76543210
       76543210←lsb

(6) DISPLAY ORDER Field

The DISPLAY ORDER field is used to specify the display order for the channel groups.

In default, the channel groups are set in an A-F 0-9 display order, where group A is the leftmost group in the display.

NOTE

Though the DISPLAY ORDER field specifies the order of all 16 groups A-F and 0-9, only those groups which are assigned channels will appear in the Trigger Specification and State Table menus.

By entering the DISPLAY ORDER field, you may change the order in which the groups are displayed. This is especially useful when many channels are used in acquisition and only a portion of them will fit on the display.

The DISPLAY ORDER field is manipulated by using the data entry keys A-F and 0-9 and the DON'T CARE key.

To change the order in which groups appear in the display:

1. Move the cursor to the DISPLAY ORDER field, and position it over the first group you want to change. For example: group B.

    DISPLAY ORDER: [A**B**CDEF0123456789]

2. Use the data entry keys to enter the group you want to appear at that location. For example: group 4.

    The DAS places group 4 at the cursor location (group B), and sets the position previously held by group 4 to don't care status (X). Group B is deleted.

    DISPLAY ORDER: [A**4**CDEF0123**X**56789]

In the previous example, group B was deleted from the DISPLAY ORDER field. This group could be reassigned or it could be left unassigned. If left unassigned, the group has a don't care display status.

NOTE

Don't care only affects the display of a group; it does not affect acquisition. Data is still acquired by the channels in that group.

You may also use the DON'T CARE key to set any group to a don't care display status.

To set a specific group to don't care status:

1. Move the screen cursor to the DISPLAY ORDER field, and position it over the group you want set to don't care. For example: Group E.

    DISPLAY ORDER: [A4CD**E**F0123X56789]

2. Press the DON'T CARE key.

    The DAS enters an X at the cursor location.

    DISPLAY ORDER: [A4CD**X**F0123X56789]

(7) THRESHOLD Field

Each data acquisition probe has a threshold switch. If this switch is set to NORM, the probe has a TTL/VAR threshold. If set to AUX, the probe has a MOS threshold.

Once the probe switch is set, the THRESHOLD field in the Channel Specification menu may be used to select the varying voltage levels for the thresholds. These voltage levels are then used to determine the high (1) and low (0) states of incoming data.

TTL/VAR Thresholds. When the probe threshold switch is set to NORM, the THRESHOLD field defaults to a TTL +1.40 V. You may change this threshold to VAR (variable).

Probes from the same module must have the same TTL or VAR threshold. Therefore, if a threshold value is changed for one probe, the thresholds for all probes associated with the same module will automatically change.

To change threshold:

1. Move the screen cursor to the THRESHOLD field you want to change.

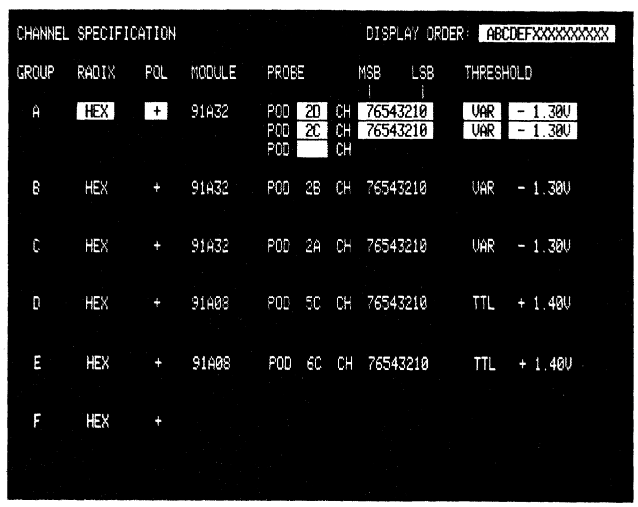
    [TTL] +1.40 V

2. Press the SELECT key until the desired value rotates to the field.

    The DAS displays optional values in this order:

    [TTL] +1.40 V
    [VAR] [−1.30 V]

The following illustration shows how the menu appears when POD 2D in group A was set to a VAR threshold. Notice how PODs 2C, 2B, and 2A were also changed. This occurred because all four pods belong to the same 91A32 module.



3624-53

When a VAR threshold is selected, a new field appears for setting the variable voltage level. The settings for this field range between −2.50 V to +5.00 V. The voltage level may be changed using the INCR and DECR keys.

To increase or decrease the variable voltage level:

1. Move the screen cursor to the new voltage field to the right of VAR.

   [VAR]   [−1.30 V]

2. Press the INCR key to increase the voltage, or press DECR to decrease the voltage.

   The DAS displays increasing or decreasing voltage values in 0.05 V increments between the range of +5.00 V to −2.50 V.

MOS Thresholds. Any probe may be set to a MOS threshold by changing its threshold switch to AUX. When this occurs, the THRESHOLD field may be used to select the MOS voltage level. The available voltage range is −10.00 V to +20.00 V.

To change MOS voltage levels:

1. Move the screen cursor to the voltage field to the right of MOS.

   MOS [−5.20 V]

2. Press the INCR key to increase the voltage, or press DECR to decrease the voltage.

   The DAS displays increasing or decreasing voltage values in 0.20 V increments between the range of +20.00 V to −10.00 V.

If you set a probe from a specific module to MOS, it is recommended that you also set the other probes belonging to that module to MOS. If you elect not to do this, however, the other probes will automatically operate at one fourth the MOS threshold voltage.

USING THE CHANNEL SPECIFICATION MENU

The major purpose of the Channel Specification menu is to give you front-panel control over the display format of the data acquisition channels. Once probes have been connected to a system under test, you can use this menu to control the display of data channels without manually reconnecting the probe leads.

You can use the Channel Specification menu before or after data has been acquired. All menu values (except thresholds) only affect the way data is displayed, not acquired. You can view the same data in several ways just by reformatting the State Table display in the Channel Specification menu.

Figure 3-5 illustrates the versality of this menu with several State Table displays of the same acquisition memory data. Each display is formatted differently by using the Channel Specification menu.

For more information on how the Channel Specification menu affects data display, refer to the Trigger Specification, State Table, and Define Mnemonics Menu sections of this manual.

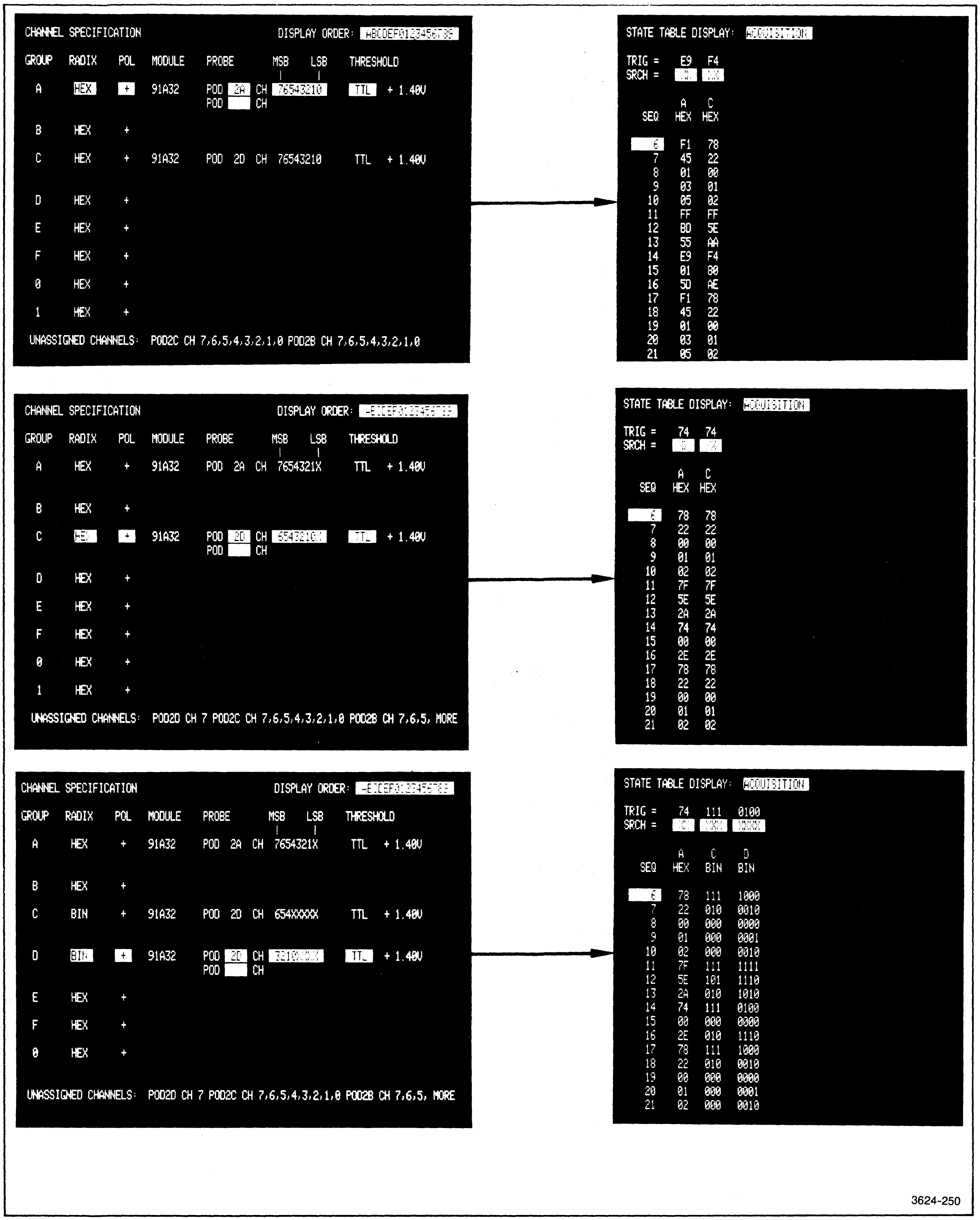


Figure 3-5. Using the Channel Specification menu. The same memory data may be displayed many different ways by changing the Channel Specification menu.

TRIGGER SPECIFICATION MENU 4

This menu is designed to support DAS data acquisition functions. The menu may be displayed on the monitor screen only if data acquisition modules are installed in the mainframe.

This section describes the Trigger Specification menu and its functions. Before reading this section, you should first read the Operating Instructions section of this manual for an overview of keyboard controls and menu characteristics.

In this section you will find: **Page**

TRIGGER SPECIFICATION MENU

The Trigger Specification menu is used for setting up data acquisition and storage conditions. It determines which data is stored in acquisition memory; and this, in turn, determines which data may be displayed in the State Table or Timing Diagram menu.

As shown in Figure 4-1, the Trigger Specification menu is used to control the following:

- **Trigger Modes**—the menu determines which type of data acquisition modules are used during the acquisition.
- **Clocks**—the menu determines the clock rate used to sample incoming data.
- **Clock Qualifiers**—the menu determines which clock qualifier lines (if any) are enabled and asserted during acquisition.
- **Word Recognition**—the menu determines the word recognition values for the trigger, and establishes the trigger's position relative to memory.

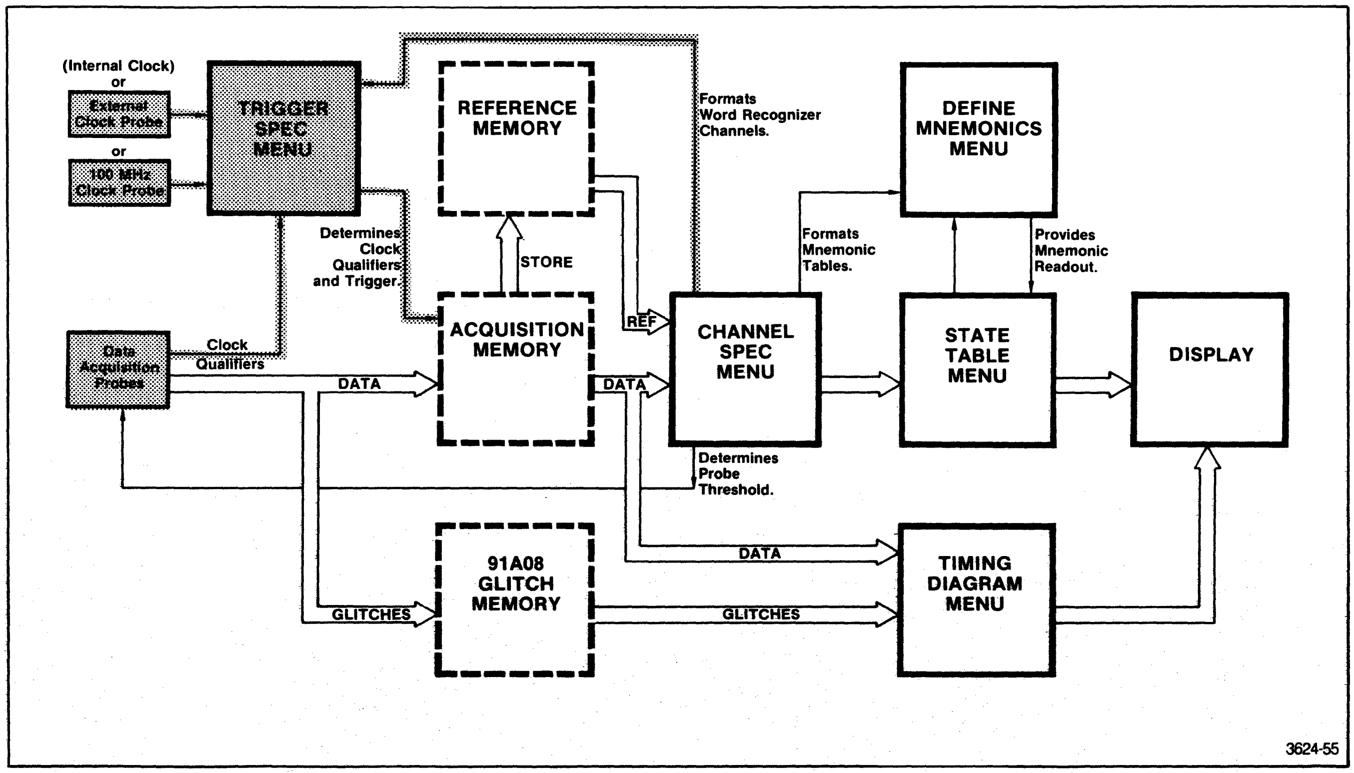


Figure 4-1. Functional overview of the Trigger Specification menu. This menu establishes the trigger mode, clock rate, qualifier, and trigger logic.

SUB-MENU SELECTIONS

The Trigger Specification menu is comprised of a series of sub-menu displays, each designed to support a specific acquisition operating mode. The available sub-menu displays and operating modes are determined by the type of data acquisition modules installed in your DAS mainframe.

Once the TRIGGER SPEC key has been pressed, the sub-menu displays are selected by using the reverse-video MODE field in the top right corner of the screen. If only one type of data acquisition module is installed in the mainframe, this field will not appear in reverse video and cannot be changed.

To change trigger modes:

1. Move the screen cursor to the MODE field.
2. Press the SELECT key until the desired trigger mode rotates to the field.

   When the trigger mode changes, the sub-menu format on the screen updates to support that trigger mode.

The following parts of this section describe each trigger mode and its sub-menu.

91A32 ONLY SUB-MENU DEFAULT DISPLAY

When the Trigger Specification menu is set in the 91A32 ONLY mode, it assumes a sub-menu format which supports the operation of from one to three (maximum) 91A32 Data Acquisition Modules. Each of these modules is individually capable of acquiring 512 words, 32 channels wide, at sampling rates up to 25 MHz. If the maximum number of 91A32 modules are installed, the sub-menu supports a total of 96 parallel acquisition channels.

Figure 4-2 illustrates a typical 91A32 ONLY sub-menu display and its power-up default values. These default values are always the same—whether one, two, or three 91A32 modules are installed—except for the number of channels used in word recognition and the number of available clock qualifiers (two per module). For this example, the DAS is configured with two 91A32 modules for a total of 64 acquisition channels and four storage qualifiers.

READING THE SUB-MENU

Refer to Figure 4-2 when reading the following paragraphs.

The menu title, TRIGGER SPECIFICATION, appears in the top left corner of the screen. The line directly below the title is always reserved for highlighted error or prompter messages.

Directly across from the title, in the top right corner of the screen, is the MODE field. This field designates which sub-menu is being displayed (in this example, 91A32 ONLY).

The third line of the screen holds the 91A32 CLOCK field. This field specifies the acquisition clock, either internal or external. In default, the field is set to the DAS internal clock at 1 μs intervals.

The TRIGGER POSITION field, also on the third line of the screen, designates the trigger's position relative to acquisition memory. In default, the field is set to BEGIN, so that the trigger is positioned in the beginning of memory.

The TRIGGER ON OCCURRENCE field, located on the fourth line of the screen, serves as a trigger counter. This field specifies the number of times a trigger event must occur before the trigger is generated. In default, this field is set to 1, so that a trigger is generated on the first trigger event.

The trigger event is specified in the word recognizer fields located in the middle of the screen. The 91A32 modules provide three separate event triggers which may be used in various sequences. The event triggers are designated on the screen as: TRIGGER ON, the empty field below TRIGGER ON, and RESET.

In default, only the first event trigger (TRIGGER ON) is used. This event trigger is set to don't care (X) status, and so causes a trigger event on the first data word stored.

The STORE ONLY IF fields, located on the bottom of the screen, are used to enable and assert the 91A32 clock qualifier lines. In default, all clock qualifiers are set to don't care (X).

DEFAULT OPERATION

If no changes are made to the 91A32 ONLY sub-menu, the DAS will acquire data on all 91A32 modules using an asynchronous (internal) clock rate of 1 μs. It will generate a trigger event on the first data word stored and position that trigger in the beginning of memory.

NOTE

For more detailed information on the acquisition start and stop process, refer to the Start and Stop section of this manual.

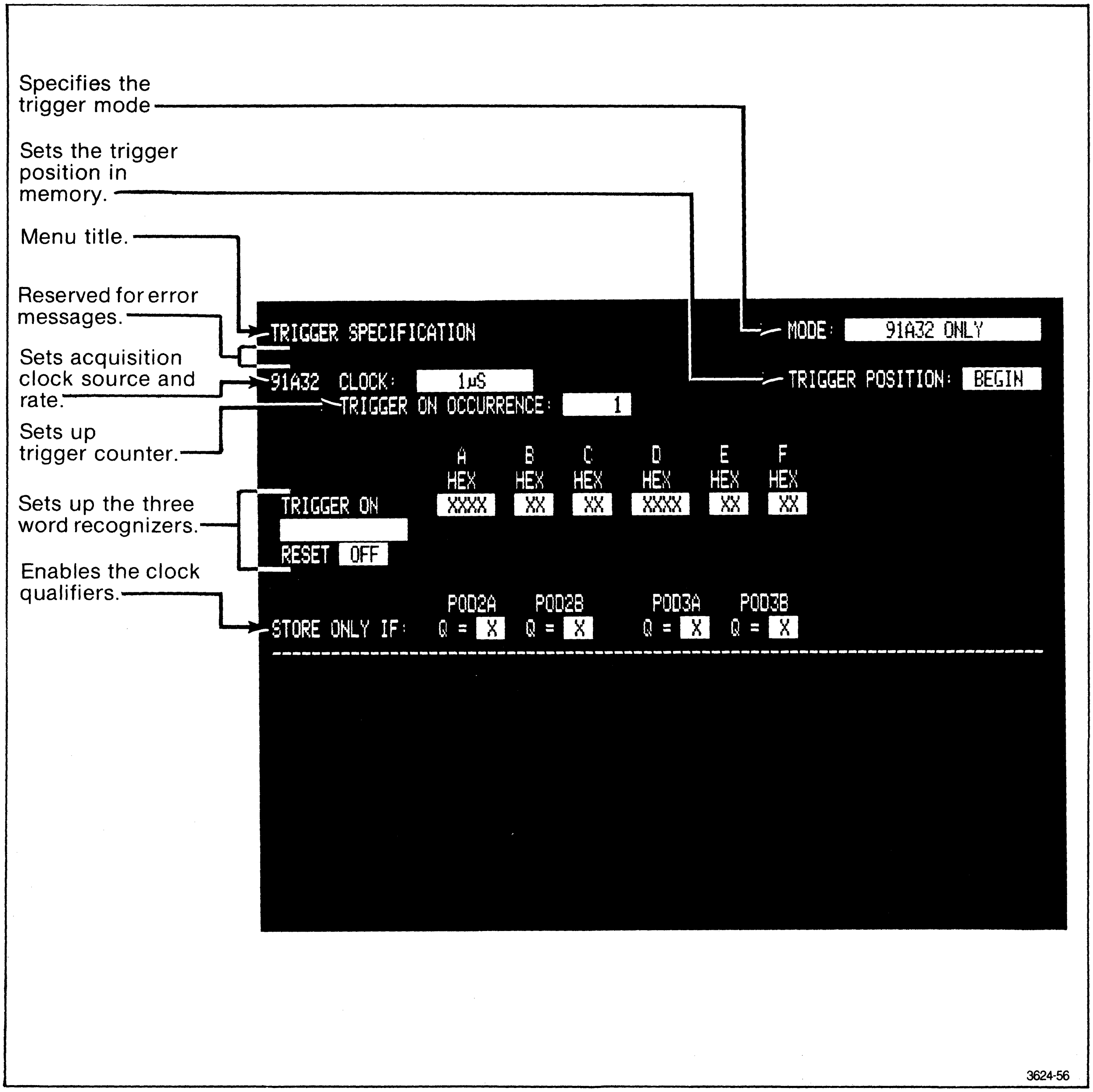


Figure 4-2. Default display of the 91A32 ONLY trigger sub-menu. This sub-menu supports acquisition using up to three 91A32 modules for 96 parallel acquisition channels. It provides 91A32 clock, qualifier, and trigger fields.

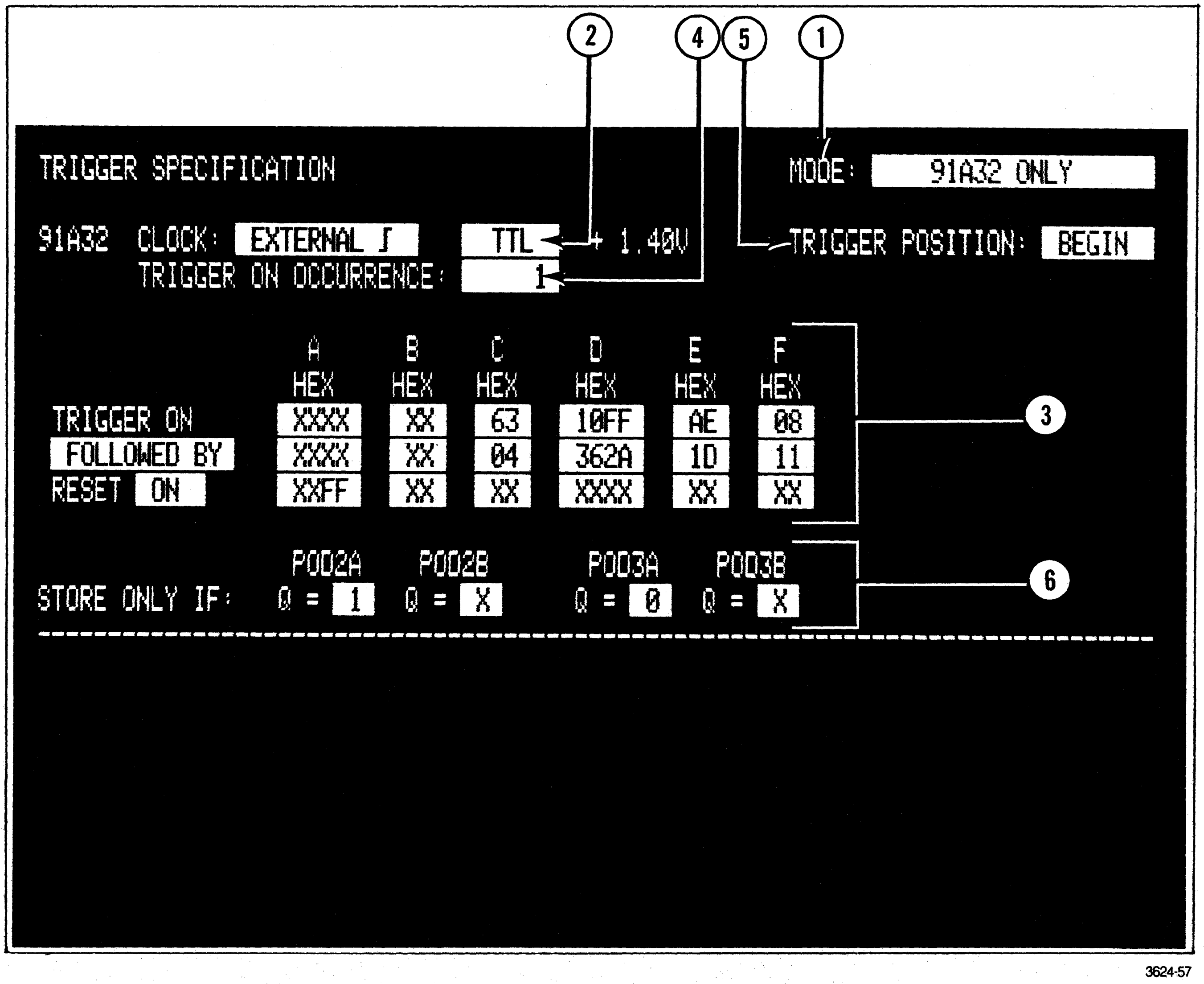


Figure 4-3. The 91A32 ONLY sub-menu and its fields.

91A32 ONLY FIELDS AND VALUES

The following paragraphs describe how to use the 91A32 ONLY sub-menu to set up clock and trigger parameters. They discuss each sub-menu field and explain their optional values.

Figure 4-3 illustrates the 91A32 ONLY sub-menu and its fields. The fields, which appear on the screen in reverse video, will be designated throughout the text by brackets [ ]. The screen cursor will move from field to field in any direction, and is controlled by the four directional cursor keys and the NEXT key.

Refer to the numbered callouts in Figure 4-3 when reading the following paragraphs. These numbers are intended as a visual reference, and do not imply sequence of use.

(1) MODE Field

The MODE field is used to select between the sub-menu displays. This field only appears in reverse video if more than one type of data acquisition module is installed. Other sub-menus can be displayed by using the SELECT key.

(2) 91A32 CLOCK Field

The 91A32 CLOCK field is used to specify the rate at which incoming data is sampled and stored in memory. In the 91A32 ONLY mode, the DAS may be set to the internal (asynchronous) clock at intervals ranging from 5 ms to 40 ns; or, it may be set to an external (synchronous) clock at intervals no faster than 40 ns.

In default, the 91A32 CLOCK field is set to the DAS internal clock at 1 μs sampling intervals. This internal sampling interval can be increased or decreased between a 5 ms to 40 ns range by using the INCR and DECR keys.

To increase or decrease the internal sampling intervals:

1. Move the screen cursor to the 91A32 CLOCK field.

   91A32 CLOCK: [1 μS]

2. Press the INCR key to increase the interval value, or press the DECR key to decrease the interval value.

   The DAS displays increasing or decreasing values in a 1-2-5 sequence between the range of 5 ms to 40 ns.

In addition to the internal clock, the 91A32 modules can be run synchronous to an external clock source. These external clocks are supplied by the Trigger/Time Base Module's External Clock Probe lines: CLK1, CLK2, and CLK3. The available external clock values include:

- **EXTERNAL⌠**—which sets all 91A32 modules to the rising edge of CLK1.
- **EXTERNAL⌡** —which sets all 91A32 modules to the falling edge of CLK1.
- **EXT SPLIT**—which sets the 91A32 modules to different clocks using CLK1, CLK2, and CLK3. This clock value is only available if more than one 91A32 module is installed in the mainframe. Otherwise, it will not appear as a field option.

To select an external clock source:

1. Move the screen cursor to the 91A32 clock field.

   91A32 CLOCK: [1 μS]

2. Press the SELECT key until the desired clock value rotates to the field.

   The DAS displays the available clock source values in this order:

   [1 μS]
   [EXTERNAL⌠]
   [EXTERNAL⌡]
   [EXT SPLIT]

Setting the External Clock Threshold. If any external clock source is selected, a new field appears directly to the right of the 91A32 CLOCK field. This new field is used for setting the threshold of the External Clock Probe.

NOTE

The pattern generator modules also receive input from the External Clock Probe. Therefore, any changes made to the probe's threshold will be automatically reflected in the Pattern Generator menu's CLOCK field. (Refer to the Pattern Generator Menu section of this manual.)

The External Clock Probe has a threshold-range switch. If this switch is set to NORM, the probe has a TTL/VAR threshold. If set to AUX, the probe has a MOS threshold. Once the probe switch has been set, the threshold field may be used to select the varying voltage levels for the thresholds.

If the probe is set to NORM, the threshold field defaults to a TTL +1.40 V. You may change this threshold to VAR (variable).

To change between TTL and VAR thresholds:

1. Move the screen cursor to the new threshold field.

   [EXTERNAL⌠] [TTL] +1.40 V

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional threshold values as:

   [TTL] +1.40 V
   [VAR] [−1.30 V]

When a VAR threshold appears in the field, the DAS displays another new field for setting the variable voltage level. The field appears directly to the right of the threshold field and assumes a −1.30 V (ECL level) default value. This voltage value may be increased or decreased between a +5.00 V to −2.00 V range using the INCR and DECR keys.

To increase or decrease the variable voltage level:

1. Move the screen cursor to the new voltage field.

   [VAR] [−1.30 V]

2. Press INCR to increase the voltage, or press DECR to decrease the voltage.

   The DAS displays increasing or decreasing voltage values in 0.05 V increments between the range +5.00 V to −2.00 V.

If the probe's switch is set to AUX, the threshold field shows a MOS setting. This setting may be changed to a voltage level between the range of +20.00 V to −10.00 V.

To change MOS voltage levels:

1. Move the screen cursor to the voltage field.

   MOS [−5.20 V]

2. Press the INCR key to increase the voltage, or press the DECR key to decrease the voltage.

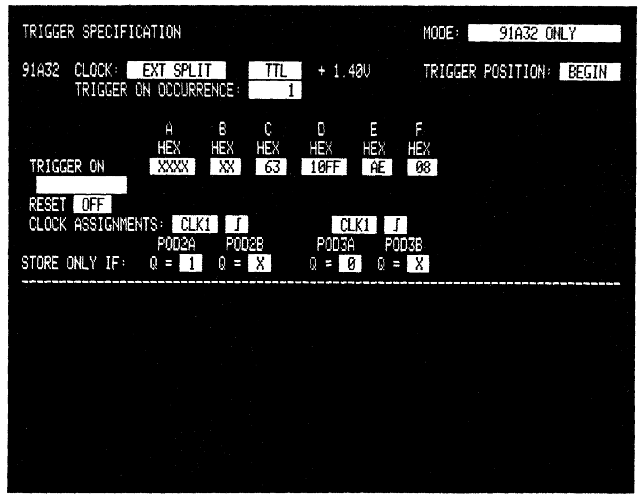
   The DAS displays increasing or descreasing voltage values in 0.20 V increments between the range of +20.00 V to −10.00 V.

Using the External Split Clock. The EXT SPLIT clock value only appears as a field option when the DAS contains more than one 91A32 module. This value provides a special clock condition which allows each installed module to be set to a different external clock signal, such as those used in a multiplexed bus structure.

If the EXT SPLIT clock value is selected, the DAS displays new clock fields for every installed 91A32 module. These new fields are labeled CLOCK ASSIGNMENT, and they appear directly above the STORE ONLY IF fields as shown in the illustration below.

Each module's new CLOCK ASSIGNMENT field may be identified by that module's POD ID (bus slot number, pod connector letter). For example, the CLOCK ASSIGNMENT field directly above Pods 2A and 2B belong to the 91A32 module installed in bus slot 2. The field above Pods 3A and 3B belong to the 91A32 module installed in bus slot 3.

All of the new CLOCK ASSIGNMENT fields assume a CLK1 default value. At least one 91A32 module must retain this CLK1 value and serve as the master clock. The other modules may be assigned to either CLK1, CLK2, or CLK3.



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Before selecting the clock lines, make sure that they meet the following requirements:

1. The CLK1 line is connected to the master clock and used to define the beginning and end of the multiplexed bus cycle.

   NOTE

   If you assign two CLK1s, one rising edge and one falling, the CLK1 in the rightmost clock assignment field serves as the master clock.

2. For every occurrence of CLK1 there is one and no more than one occurrence of CLK2 and/or CLK3.

3. CLK2 and/or CLK3 must occur at least 40 ns prior to the next occurrence of CLK1.

Figure 4-4 illustrates the requirements of these clock signals.

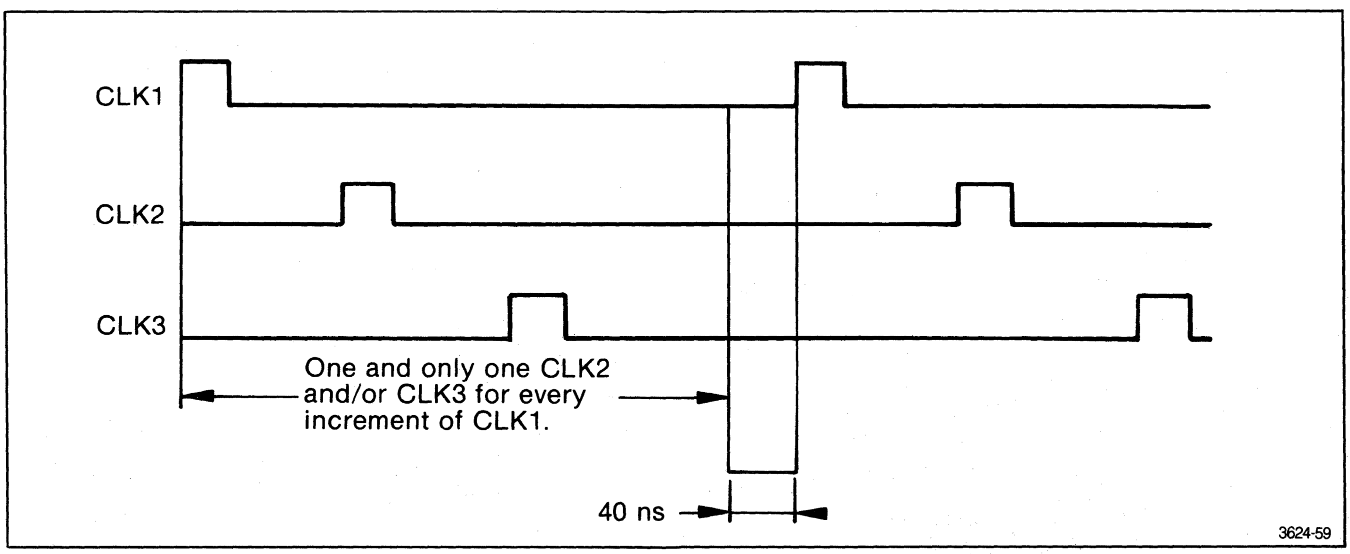


Figure 4-4. Setting up the 91A32 EXT SPLIT clocks.

NOTE

When using the EXT SPLIT clocks, always check the clock lines to make sure they are receiving appropriate signals before data is acquired.

To change the clock assignment of any specific module:

1. Move the screen cursor to the module's CLOCK ASSIGNMENT field.

   [CLK1]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

   [CLK1]
   [CLK2]
   [CLK3]

Then, to change the clock edge for any of the clock assignments:

1. Move the screen cursor to the clock edge field.

   [CLK1] [_/‾]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

   [CLK1] [_/‾]
   [‾_]

NOTE

When using the EXT SPLIT clocks, only the clock qualifier lines associated with the master CLK1 can be enabled and asserted. The other clock qualifiers no longer appear in reverse video.

(3) TRIGGER ON—RESET Fields

The three fields located in the middle of the sub-menu display are used for setting up the 91A32 trigger event. These fields include: TRIGGER ON, the empty field below TRIGGER ON, and RESET. Each of these fields represents a separate event trigger, and all or part of them may be used to specify a trigger event. For this discussion, the three fields and their corresponding word recognizers will be referred to as:

```
EVENT 1 —> TRIGGER ON
EVENT 2 —> [              ]
EVENT 3 —> RESET [ OFF ]
```

EVENT 1, designated by the TRIGGER ON field, serves as the main word recognizer. It may be used independently for a simple one-word trigger, or it may be used in complex sequences with Events 2 and/or 3. In default, Event 1 is set to don't care (X) values and Events 2 and 3 are turned off. Thus, the DAS generates an immediate trigger on the first data word stored.

EVENT 2, designated by the empty field below TRIGGER ON, may be used to set one of the three following conditions:

- **FOLLOWED BY**—a trigger occurs if Event 2 is recognized after Event 1 is recognized. There can be any number of states between the two events.
- **OR**—a trigger occurs if either Event 1 or Event 2 is recognized.
- **THEN NOT**—a trigger occurs when any word other than that specified for Event 2 is recognized after Event 1.

To select a condition for Event 2:

1. Move the screen cursor to the field below TRIGGER ON.

   [   ]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays the optional values in this order:

```
[              ] (off)
[ FOLLOWED BY ]
[ THEN NOT    ]
[ OR          ]
```

EVENT 3, designated by the RESET field, may be used with Event 1 or a combined Event 1 and 2 sequence. If turned on, this field specifies a trigger reset condition on Event 3. This means the trigger will reset to the beginning of a sequence every time Event 3 is recognized before the trigger occurs.

RESET on Event 3 has priority over Event 1. Therefore, if Event 3 is set to don't care, a trigger will not occur (see special case noted below). Also, a trigger will not occur if Event 3 and Event 1 occur at the same time.

NOTE

In a FOLLOWED BY sequence, Event 3 can be set to don't care to specify that a trigger only occurs if Event 1 is directly followed by Event 2 (no states between the two words).

Event 2 has priority over Event 3 in FOLLOWED BY and THEN NOT sequences. If the two events occur at the same time, Event 2 is recognized and a trigger occurs. In OR sequences, Event 3 has priority over both Event 1 and Event 2.

To enable the reset condition:

1. Move the screen cursor to the RESET field:

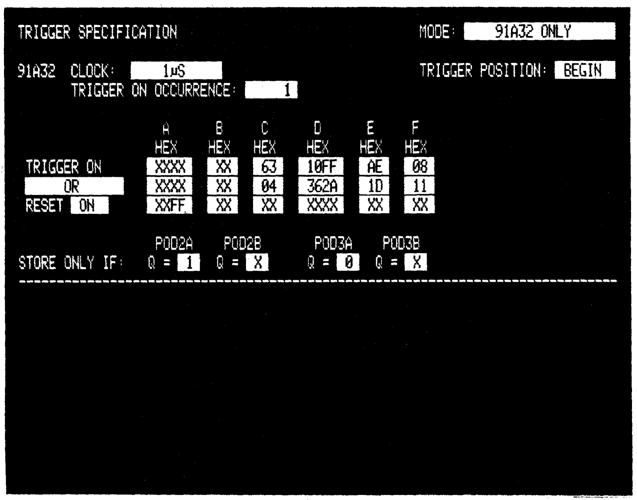
   RESET [OFF]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

   [OFF]
   [ON]

Programming the Word Recognition Channels. Each event trigger has corresponding word recognizer channel fields. If all three events are turned on, the channel fields appear on the screen in a format similiar to that shown below.



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The number of available word recognizer channels, as well as their group format, is determined by the Channel Specification menu. The letter above each channel column indicates the column's correlating channel group. The radix notation below each letter indicates the radix which must be used when entering channel values.

If channels are set to octal or binary radix, they may not all fit on the screen. If this occurs, a message appears at the end of the channel fields reading MORE. You should enter the Channel Specification menu and change the radix values or rearrange the DISPLAY ORDER field.

NOTE

If you change the number of channels assigned to a group in the Channel specification menu, affected word recognizer channels will be automatically set to don't care (X) in the Trigger Specification menu.

To enter values on the word recognizer channels:

1. Move the screen cursor to the channel field you want to program.

   [XXXX]

2. Use the data entry keys to enter the desired channel value (in the specified radix base). For example, F.

   The DAS enters the value at the cursor location, then shifts the screen cursor one space to the right.

   [FXXX]

Using the above procedures you can continue to enter all desired word values. Any channels set to don't care (X) are ignored during word recognition. Don't care values are entered by using the DON'T CARE key.

A special error may occur when entering word values. Even though you are using the appropriate radix, an error message may appear reading ENTER A SMALLER VALUE. This occurs because the Channel Specification menu may have fewer channels than is apparent under the radix. If the error appears, enter a smaller value in the channel field and then check the channel assignments in the Channel Specification menu.

Once values are entered on the word recognizer channels, they are retained in memory. You may turn a word recognizer off, then on again, and the entered channel values will reappear in the fields.

(4) TRIGGER ON OCCURRENCE Field

The TRIGGER ON OCCURRENCE field is used in conjunction with the event triggers to provide yet another trigger condition. This field sets up a counter condition which specifies the number of times an event must be recognized before a trigger can occur. By entering a numeric value (n) in this field, you set up the following counter conditions:

n (Event 1)	A trigger occurs when the nth Event 1 is recognized. RESET, if used, would reset the trigger counter every time Event 3 was recognized.

n (Event 1) FOLLOWED BY Event 2	A trigger occurs when Event 2 is recognized after the nth occurrence of Event 1. RESET, if used, would reset the trigger counter every time Event 3 was recognized.
n (Event 1 OR Event 2)	A trigger occurs on the nth occurrence of Event 1 or 2. RESET, if used, would reset the trigger counter every time Event 3 was recognized.
n (Event 1) THEN NOT Event 2	A trigger occurs when any word other than Event 2 is recognized after the nth occurrence of Event 1. RESET, if used, would also reset the trigger counter every time Event 3 was recognized.

In default, the TRIGGER ON OCCURRENCE field is set to a value of 1. This means the trigger is generated on the first occurrence of word recognition. Using the data entry keys, you may also set this field to any count value up to 32,767.

To enter a count value:

1. Move the screen cursor to the TRIGGER ON OCCURRENCE field.

   TRIGGER ON OCCURRENCE: [1]

2. Use the data entry keys to enter the desired count value. For example, 20.

   The DAS enters the value into the field.

   TRIGGER ON OCCURRENCE: [20]

To remove a count value:

1. Move the screen cursor to the TRIGGER ON OCCURRENCE field.

   TRIGGER ON OCCURRENCE: [20]

2. Press the DON'T CARE key.

   The DAS removes the count value and sets the counter to 0.

   TRIGGER ON OCCURRENCE: [0]

3. Now enter a new count value. The field must be set to a count value of at least 1.

(5) TRIGGER POSITION Field

Once a trigger has occurred, the TRIGGER POSITION field determines when the resulting stop/store is generated. It does this by establishing the trigger's position relative to acquisition memory.

There are four trigger positions which may be selected with this field, including:

- **BEGIN**—where the trigger is positioned as word 14 at the beginning of memory (word 15 in FOLLOWED BY or THEN NOT sequences). Words 0-13 are data which preceded the trigger, words 15-511 are data which followed the trigger.
- **CENTER**—where the trigger is positioned as word 254 at the center of memory (word 255 in FOLLOWED BY or THEN NOT sequences). Words 0-253 are data which preceded the trigger, words 255-511 are data which followed the trigger.
- **END**—where the trigger is positioned as word 494 at the end of memory (word 495 in FOLLOWED BY or THEN NOT sequences). Words 0-493 are data which preceded the trigger, words 495-511 are data which followed the trigger.
- **DELAY**—where the trigger is delayed up to 32,767 clock cycles. The delay counter starts at word 504.

In default, the TRIGGER POSITION field is set to BEGIN. It may also be set to any of the other available values by using the SELECT key.

To select the trigger's position in memory:

1. Move the screen cursor to the TRIGGER POSITION field.

   TRIGGER POSITION: [BEGIN]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

   [BEGIN]
   [CENTER]
   [END]
   [DELAY]

Using the Trigger Delay. If the DELAY value is selected in the field, a new field appears. This field is used for specifying how many cycles the trigger will be delayed. You may specify a delay of up to 32,767 clock cycles.

NOTE

The 91A32 delay counter starts at word 504. Accordingly, if the DELAY field is set to 1, the trigger position will be word 503. A delay of 10 is equivalent to the END trigger position, a delay of 250 is equivalent to the CENTER trigger position, and a delay of 490 is equivalent to the BEGIN trigger position.

To specify a trigger delay:

1. Move the screen cursor to the newly created field below the DELAY value.

```
TRIGGER POSITION: [ DELAY ]
                  [ 1     ]
```

2. Use the data entry keys to enter the delay value. For example, 200.

   The DAS enters the value in the new field.

```
TRIGGER POSITION: [ DELAY ]
                  [ 200   ]
```

To remove the delay value:

1. Move the screen cursor to the field.

```
TRIGGER POSITION: [ DELAY   ]
                  [ 200     ]
```

2. Press the DON'T CARE key.

   The DAS removes the delay value and sets the field to 0.

```
TRIGGER POSITION: [ DELAY   ]
                  [ 0       ]
```

3. Now enter a new delay value. The field must be set to a delay value of at least 1.

(6) STORE ONLY IF Field

The STORE ONLY IF fields are used for setting up the 91A32 clock qualifier lines. Each installed module has two lines, one on pod A and the other on pod B. You may identify which field belongs to which line by reading the POD ID notations above the fields.

In default, the clock qualifiers are set to don't care (X). You may enable and assert any or all of the qualifiers during acquisition. If the qualifiers are asserted, then the DAS clocks in data only when the qualifier conditions are true. The conditions of the qualifier lines are ANDed.

NOTE

If the qualifiers are used, word recognition is only compared to the data which is actually stored.

Each clock qualifier line may be asserted as either positive true (1) or negative true (0), or set to don't care (X).

To enable and assert a clock qualifier:

1. Move the screen cursor to the STORE ONLY IF field for the line you want to assert.

   Q = [X]

2. Use the data entry keys to enter 1 (positive true) or 0 (negative true), or press DON'T CARE. For example, enter 1.

   The DAS displays a 1 in the field.

   Q = [1]

With this value, data will only be stored in memory when the qualifier signal is positive true.

91A08 ONLY SUB-MENU DEFAULT DISPLAY

When the Trigger Specification menu is set in the 91A08 ONLY mode, it assumes a sub-menu format which supports the operation of from one to four (maximum) 91A08 Data Acquisition Modules. Each of these modules is individually capable of acquiring 512 words, 8 channels wide, at sampling rates up to 100 MHz (using an asynchronous or synchronous clock). Each module also acquires glitch information on all 8 data channels and stores it in a separate memory.

NOTE

A glitch is defined as two or more transitions occurring within any given clock cycle. These glitches may be displayed only in the Timing Diagram menu.

Figure 4-5 illustrates a typical 91A08 sub-menu display and its power-up default values. These default values are always the same—whether one, two, three, or four modules are

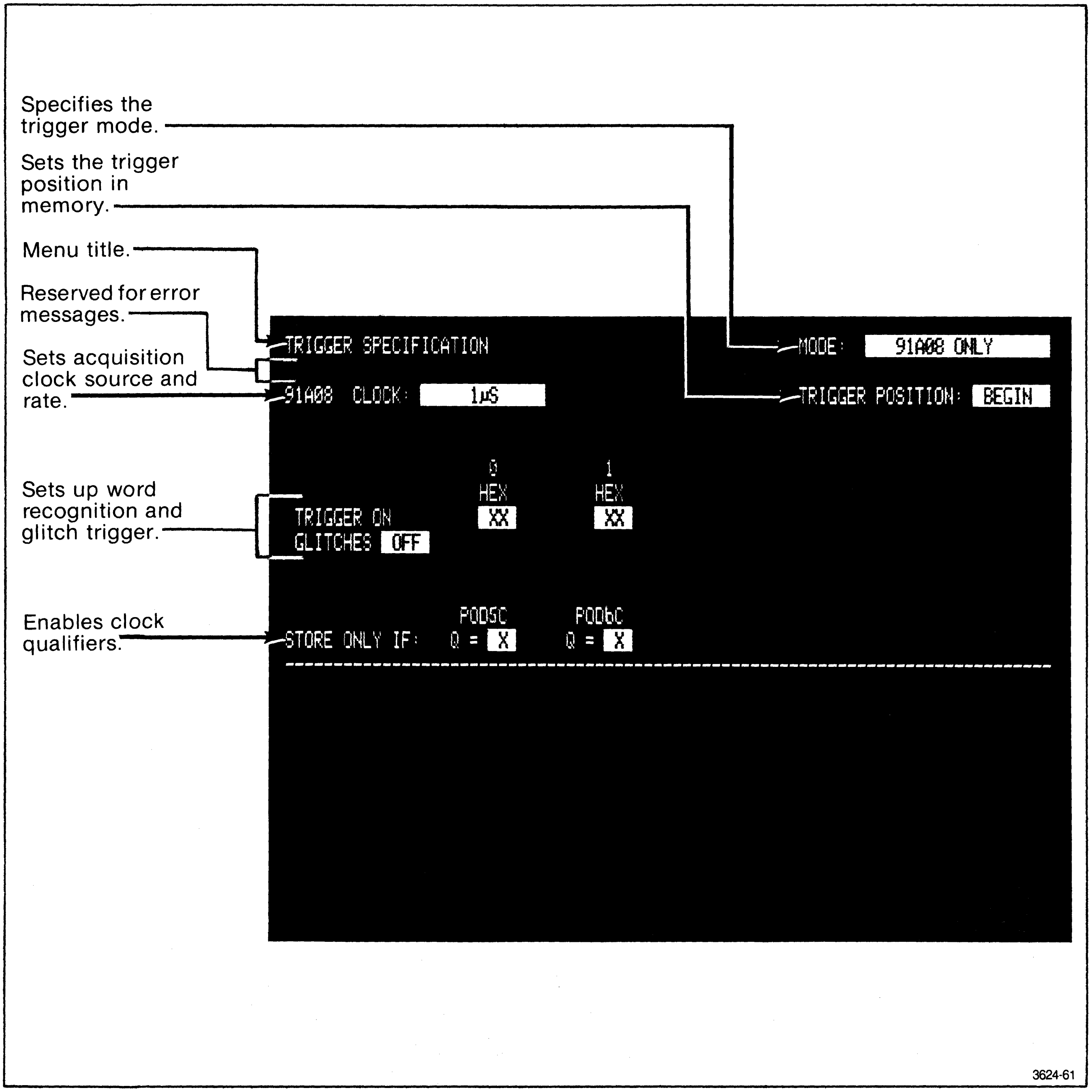


Figure 4-5. Default display of the 91A08 ONLY trigger sub-menu. This sub-menu supports acquisition using up to four 91A08 modules. It provides the 91A08 clock, qualifier, and trigger fields.

installed—except for the number of available word and glitch recognizer channels, and the number of clock qualifier lines (one per module). In this example, the DAS is configured with two 91A08 modules for 16 data/glitch channels and two clock qualifiers.

READING THE SUB-MENU

Refer to Figure 4-5 when reading the following paragraphs.

The menu title, TRIGGER SPECIFICATION, appears in the top left corner of the screen. The line directly below the title is always reserved for highlighted error or prompter messages.

Directly across from the title, in the top right corner of the screen, is the MODE field. This field designates which sub-menu is being displayed (in this example, 91A08 ONLY).

The third line of the screen holds the 91A08 CLOCK field. This field specifies the acquisition clock, either internal or external. In default, the field is set to the DAS internal clock at 1 μs intervals.

The TRIGGER POSITION field, also on the third line of the screen, designates the trigger's position relative to acquisition memory. In default, the field is set to BEGIN, so that the trigger is positioned in the beginning of memory.

The TRIGGER ON field, located in the middle of the screen, is used to specify the word recognizer values for the trigger event. In default, the word recognizer is set to don't care, and so causes a trigger event on the first data word stored.

The GLITCHES field, located below the word recognizer, is used to specify triggering on glitches. In default, this field is turned off.

NOTE

The 91A08 modules always acquire glitches whether or not the GLITCHES field is turned on. The GLITCHES field only specifies triggering on glitches.

The STORE ONLY IF fields, located on the bottom of the screen, are used to enable and assert the 91A08 clock qualifier lines. In default, all clock qualifiers are set to don't care (X).

DEFAULT OPERATION

If no changes are made to the 91A08 ONLY sub-menu, the DAS will acquire data and glitches on all 91A08 modules using an asynchronous (internal) clock rate of 1 μs. It will generate a trigger event on the first data word stored and position that trigger in the beginning of memory.

91A08 ONLY FIELDS AND VALUES

The following paragraphs describe how to use the 91A08 ONLY sub-menu to set up clock and trigger parameters. They discuss each sub-menu field and explain their optional values.

Figure 4-6 illustrates the 91A08 ONLY sub-menu and its fields. The fields, which appear on the screen in reverse video, will be designated throughout the text by brackets [ ]. The screen cursor will move from field to field in any direction, and is controlled via the four directional cursor keys and the NEXT key.

Refer to the numbered callouts in Figure 4-6 when reading the following paragraphs. These numbers are intended as a visual reference, and do not imply sequence of use.

(1) MODE Field

The MODE field is used to select between the sub-menu displays. This field only appears in reverse video if more than one type of data acquisition module is installed. Other sub-menus can be displayed by using the SELECT key.

(2) 91A08 CLOCK Field

The 91A08 CLOCK field determines the rate at which incoming data is sampled and stored in memory. In the 91A08 ONLY mode, data may be acquired using the DAS internal clock set at intervals ranging from 5 ms to 10 ns, or it may be acquired using an external clock source set at intervals no faster than 10 ns.

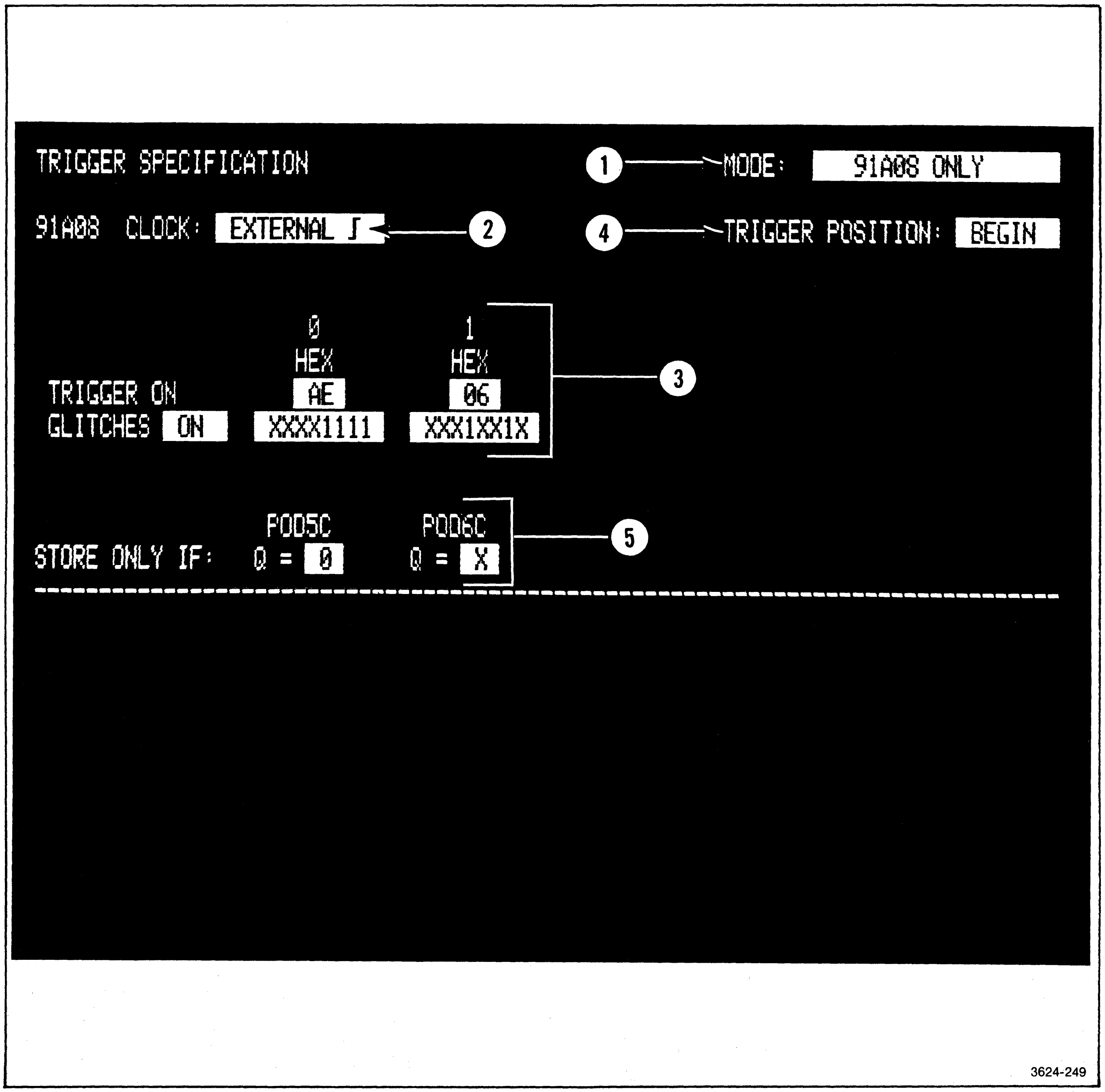


Figure 4-6. The 91A08 ONLY sub-menu and its fields.

NOTE

For clock rates >50 MHz, the clock signal should have a 50% duty cycle.

In default, the 91A08 CLOCK field is set to the DAS internal clock at a 1 μs sample interval. This internal sample rate may be increased or decreased between a 5 ms to 10 ns range.

To increase or decrease the internal sampling intervals:

1. Move the screen cursor to the 91A08 CLOCK field.

   91A08 CLOCK: [1 μS]

2. Press the INCR key to increase the interval value, or press the DECR key to decrease the interval value.

The DAS displays increasing or decreasing values in a 1-2-5 sequence between the range of 5 ms to 10 ns.

In addition to the internal clock, the 91A08 modules may be run synchronous to the rising or falling edge of an external clock source. This external clock is supplied via the 100 MHz Clock Probe attached to the 91A08 module installed in bus slot 6.

To select an external clock source:

1. Move the screen cursor to the 91A08 CLOCK field:

   91A08 CLOCK: [1 μS]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

   [1 μS]
   [EXTERNAL_/‾]
   [EXTERNAL‾_]

NOTE

The threshold for the 100 MHz Clock Probe is determined by the probe's REF lead. Refer back to the probe descriptions contained in the Operating Instructions section of this manual.

(3) TRIGGER ON and GLITCHES Fields

The 91A08 modules provide both a word (TRIGGER ON) and a glitch (GLITCHES) trigger. These two triggers may be used separately, or they may be combined in an OR sequence. In default, TRIGGER ON is set to don't care, while GLITCHES is turned off. Thus, the DAS generates a trigger event on the first data word stored.

The number of channels available in these two fields, as well as their group format, is determined by the Channel Specification menu. The letter above the TRIGGER ON channels indicates the correlating channel group, while the radix notation below the letter indicates the radix which must be used when entering channel values. The GLITCHES field is always set to a binary radix.

NOTE

If you change the number of channels assigned to a group in the Channel Specification menu, affected word and glitch channels will be automatically changed to don't care (X) in the Trigger Specification menu.

To enter values on the word recognizer channels:

1. Move the screen cursor to the channel fields next to TRIGGER ON.

   [XXXX]

2. Use the data entry keys to enter the desired channel value (in the specified radix base). For example, 3.

   The DAS enters the value at the cursor location, then shifts cursor one space to the right.

   [3XXX]

Using the above procedures, you can continue to enter the desired word value. Don't care values are entered by pressing the DON'T CARE key.

A special error may occur when entering the word value. Even though you are using the appropriate radix, an error message may appear reading ENTER A SMALLER VALUE. This occurs because the Channel Specification menu may have fewer channels than is apparent under the radix. If the error appears, enter a smaller value in the channel field. Then check the channel assignments in the Channel Specification menu.

The GLITCHES field is used to specify glitch recognition for triggering. Glitches may be specified on one or more channels. The glitch recognizers operate in an OR condition with each other and with the word value.

To specify glitch recognition:

1. Move the screen cursor to the GLITCHES field.

   GLITCHES [OFF]

2. Press the SELECT key.

   The DAS turns on the glitch recognizer and its channel fields.

   GLITCHES [ON] [XXXXXXXX]

3. Move the screen cursor to the channel fields you want to use in glitch recognition.

   GLITCHES [ON] [XXXXXXXX]

4. Use the data entry keys to enter a 1 in the channel field. (A 1 specifies glitch recognition on that channel.)

   The DAS displays the value of 1 in the field.

   GLITCHES [ON] [1XXXXXXX]

Using the above procedures you may specify glitch recognition on any or all of the channels.

NOTE

The 91A08 modules will always acquire and store glitches, whether or not the GLITCHES field is turned on.

(4) TRIGGER POSITION Field

Once a trigger has occurred, the TRIGGER POSITION field determines when the resulting stop/store is generated. It does this by establishing the trigger's position relative to acquisition memory.

There are four trigger positions which may be selected with this field:

- **BEGIN**—where the trigger is positioned as word 18 at the beginning of memory. Words 0-17 are data which preceded the trigger, words 19-511 are data which followed the trigger.
- **CENTER**—where the trigger is positioned as word 258 at the center of memory. Words 0-257 are data which preceded the trigger, words 259-511 are data which followed the trigger.
- **END**—where the trigger is positioned as word 498 at the end of memory. Words 0-497 are data which preceded the trigger, words 499-511 are data which followed the trigger.
- **DELAY**—where the trigger is delayed up to 32,767 clock cycles. The 91A08 delay counter starts at word 508.

In default, the TRIGGER POSITION field is set to the center of memory. It may also be set to any of the other available values by using the SELECT key.

To select the trigger's position in memory:

1. Move the screen cursor to the TRIGGER POSITION field.

   TRIGGER POSITION: [BEGIN]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

```
[ BEGIN  ]
[ CENTER ]
[ END    ]
[ DELAY  ]
```

Using the Trigger Delay. If the DELAY value is selected in the field, a new field appears. This field is used for specifying how many cycles the trigger will be delayed. You may specify a delay of up to 32,767 clock cycles.

NOTE

The 91A08 delay counter starts at word 508. Accordingly, if the DELAY field is set to 1, the trigger will be positioned at word 507. A delay of 10 is equivalent to the END trigger position, a delay of 250 is equivalent to the CENTER trigger position, and a delay of 490 is equivalent to the BEGIN trigger position.

To specify a trigger delay:

1. Move the screen cursor to the newly created field below the DELAY value.

```
TRIGGER POSITION: [ DELAY ]
                  [ 1     ]
```

2. Use the data entry keys to enter the delay value. For example, 200.

   The DAS enters the value in the new field.

```
TRIGGER POSITION: [ DELAY ]
                  [ 200   ]
```

To remove the delay value:

1. Move the screen cursor to the field.

```
TRIGGER POSITION: [ DELAY ]
                  [ 200   ]
```

2. Press the DON'T CARE key.

   The DAS removes the delay value and sets the field to 0.

```
TRIGGER POSITION: [ DELAY ]
                  [ 0     ]
```

3. Now enter a new delay value. The field must be set to a delay value of at least 1.

(5) STORE ONLY IF Field

The STORE ONLY IF fields are used for setting up the 91A08 clock qualifier lines. Each installed module has one qualifier line, supplied via pod C. You may identify which field belongs to which line by reading the POD ID notation above the field.

In default, the clock qualifiers are set to don't care (X). You may enable and assert any or all of the qualifiers during acquisition. If qualifiers are asserted, the DAS stores data only when the qualifier conditions are true. The conditions of the qualifier lines are ANDed.

NOTE

If qualifiers are used, word recognition is only compared to the data words which are actually stored.

A clock qualifier may be asserted as either positive true (1), negative true (0), or set to don't care (X).

NOTE

The 91A08 qualifier lines have a required setup time of 15 ns minimum.

To enable and assert a clock qualifier:

1. Move the screen cursor to the STORE ONLY IF field for the qualifier you want to assert.

   Q = [X]

2. Use the data entry keys to enter 1 (positive true), 0 (negative true), or press DON'T CARE. For example, enter 1.

   The DAS displays a 1 in the field.

   Q = [1]

   With this value, data will only be stored in memory when the qualifier signal is positive true.

91A32 AND 91A08 SUB-MENU DISPLAY

When the Trigger Specification menu is set in the 91A32 AND 91A08 mode, it assumes a sub-menu format which allows simultaneous acquisition on all 91A32 and 91A08 modules. Any combination of modules may be used in this mode, as long as they do not exceed their individual limits or the maximum of 104 acquisition channels.

Figure 4-7 illustrates a typical 91A32 AND 91A08 sub-menu display. In this example, the DAS is configured with two 91A32 modules and two 91A08 modules.

READING THE SUB-MENU

As shown in Figure 4-7, the AND sub-menu is similar to the 91A32 ONLY sub-menu. The only difference is that the 91A08's word recognizer has been added to the 91A32's TRIGGER ON field.

The AND sub-menu is set up in a manner identical to the 91A32 ONLY sub-menu. Therefore, detailed set up procedures will not be discussed here. You should refer to the 91A32 ONLY Fields and Values part of this section.

The following paragraphs describe special operating characteristics associated with the AND mode.

CLOCKING

The clocks available in this mode are the 91A32 internal clock set at intervals ranging from 5 ms to 50 ns, and the external clocks: EXTERNAL ⎽⎺ EXTERNAL ⎺⎽, and EXT SPLIT.

NOTE

Because the 91A08 has a 20 ns hold time when operated in the AND mode, the modules should be to set run at a clock rate no faster than 50 ns (20 MHz)—whether you are using the internal or an external clock.

If the EXT SPLIT clock is used, the 91A08 modules run from the master CLK1 line. If both a CLK1 / and a CLK1 are selected, the 91A08 modules run from the rightmost designated CLK1 field.

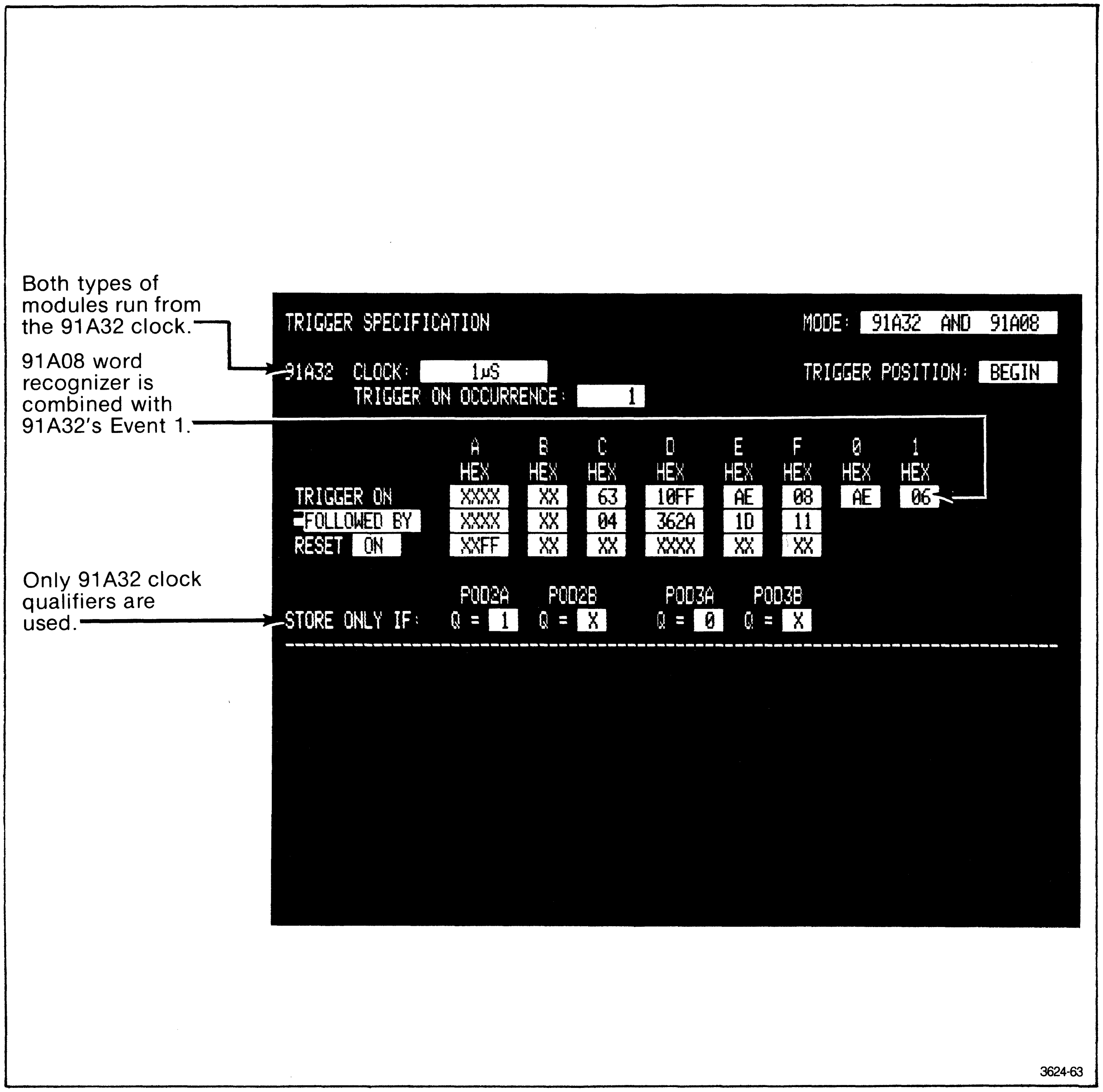


Figure 4-7. Display of the 91A32 AND 91A08 trigger sub-menu. This sub-menu allows simultaneous acquisition using both types of modules.

TRIGGERING

The three event triggers, the trigger counter, and the trigger positioning are identical to the 91A32 ONLY mode. The 91A08's word recognizer is ANDed to the TRIGGER ON field.

NOTE

The 91A08 modules acquire glitches in this mode, even though glitch triggering on 91A08 modules is not available.

CLOCK QUALIFICATION

In this mode, only the clock qualifiers of the 91A32 modules are available for assertion. The 91A08 qualifiers are ignored.

91A32 ARMS 91A08 SUB-MENU DISPLAY

The ARMS mode is used to acquire 91A32 and 91A08 data using two different clock rates. The two modules acquire data simultaneously, but the 91A08 clock runs at least twice as fast as the 91A32 clock. In addition, the two types of modules act as linked logic analyzers, with the 91A32 trigger arming the 91A08 trigger.

The ARMS mode supports any combination of the 91A32 and 91A08 modules, as long as they do not exceed their individual limits or the maximum of 104 acquisition channels.

Figure 4-8 illustrates a typical display of the 91A32 ARMS 91A08 sub-menu. In this example, the DAS is configured with two 91A32 modules and two 91A08 modules.

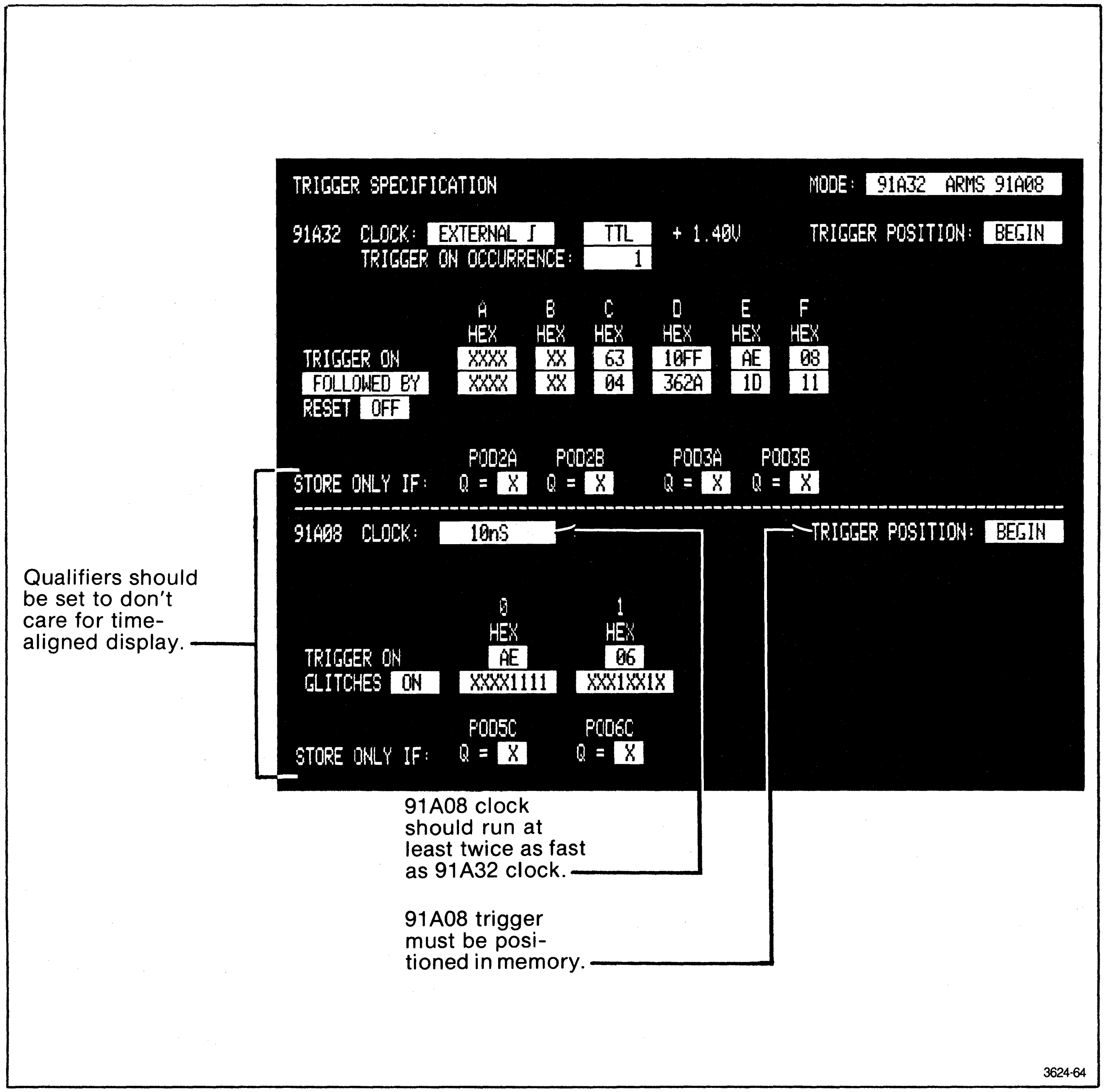


Figure 4-8. Display of the ARMS mode sub-menu. This sub-menu allows simultaneous acquisition using both types of modules at different clock rates.

READING THE SUB-MENU

As shown in Figure 4-8, the ARMS mode sub-menu is really a combined 91A32 ONLY and 91A08 ONLY sub-menu. The top half of the screen corresponds to the 91A32 ONLY sub-menu, while the bottom half corresponds to the 91A08 ONLY sub-menu.

Except for certain rules, the ARMS mode sub-menu is set up in a manner identical to the procedures described under the 91A32 ONLY and 91A08 ONLY sub-menus. Therefore, detailed set up procedures will not be discussed here. You should refer back to the 91A32 ONLY Fields and Values and the 91A08 ONLY Fields and Values parts of this section.

The following paragraphs describe the ARMS operating characteristics and restrictions. You should read these paragraphs carefully before attempting an ARMS acquisition.

CLOCKING

Both the 91A32 and 91A08 modules have the same clock capabilities as in their respective ONLY modes. When using the ARMS mode, however, you must run the 91A08 clock as least as twice as fast as the 91A32 clock.

TRIGGERING

In the ARMS mode, the 91A32 and 91A08 modules act as linked logic analyzers. While both modules start acquiring data simultaneously, their triggers occur separately. The 91A32 trigger occurs first, and then arms the 91A08 to begin looking for its trigger.

In this mode, the 91A08 trigger must be positioned in memory. The 91A32 can be delayed, but to ensure a time-aligned display you should also position this trigger in memory. For a time-aligned display, the 91A32 and 91A08 triggers must occur so that at least five 91A32 clock cycles are overlapped by 91A08 clock cycles.

CLOCK QUALIFICATION

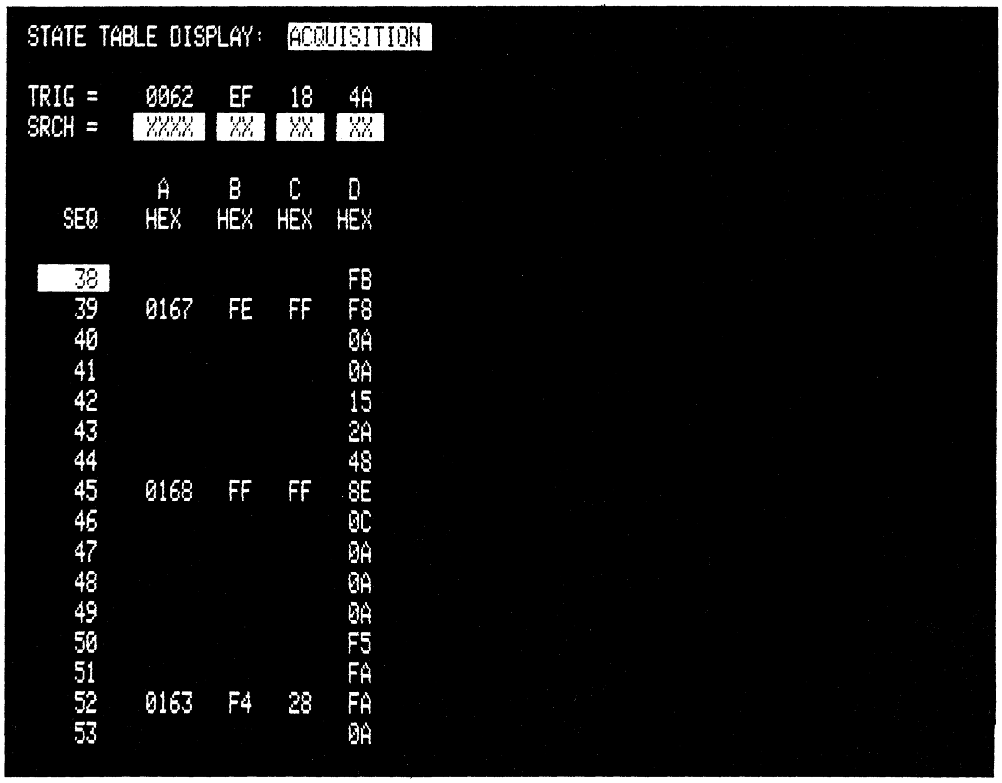
The clock qualifier lines from both types of modules are available. However, for a time-aligned display, no qualifiers should be used.

ARMS MODE DISPLAY EXAMPLES

If all clock, trigger, and qualifier conditions are met, the State Table and Timing Diagram menus will display the ARMS acquisition in its proper time relationship. Figure 4-9 illustrates a time-aligned display in these two menus.

If the slow- and fast-clocked data were not acquired at the same time, the State Table and Timing Diagram menus will not display the ARMS acquisition in a time-aligned format. Instead, they will show a fence display as illustrated in Figure 4-10. In this display a fence separates the two memories. The memory which was acquired first is shown in the top half of the State Table display (and in the left half of the Timing Diagram display).

STATE TABLE MENU



TIMING DIAGRAM MENU

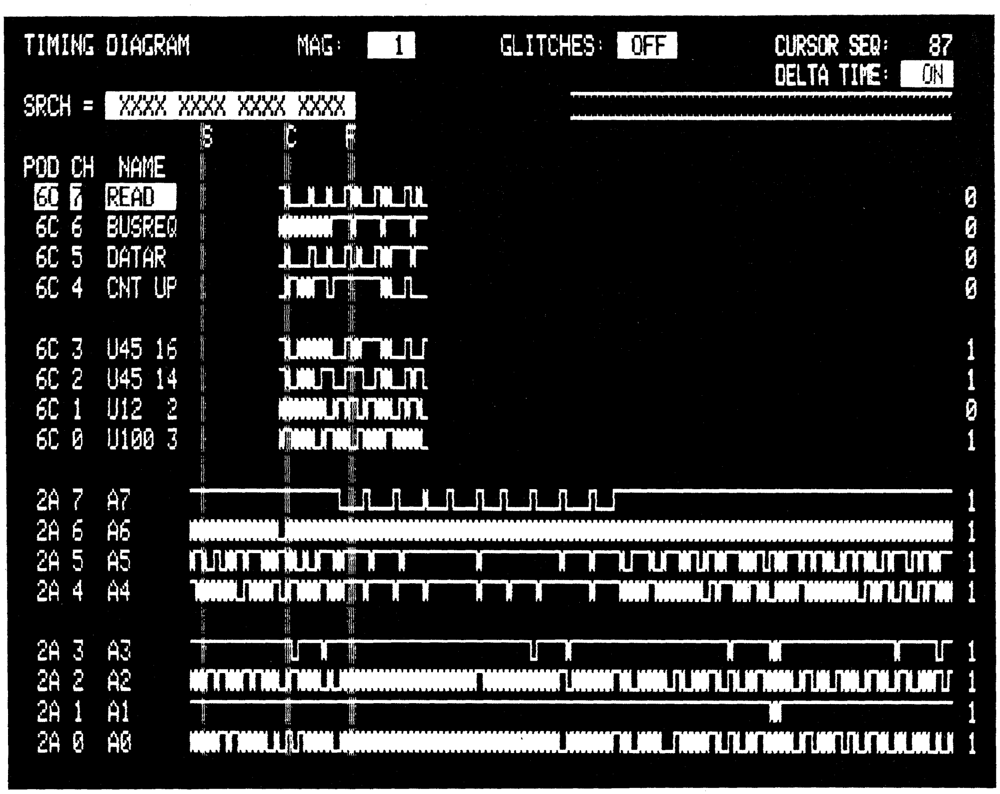


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Figure 4-9. ARMS acquisition display in the State Table and Timing Diagram menus. Data is displayed in a proper time alignment.

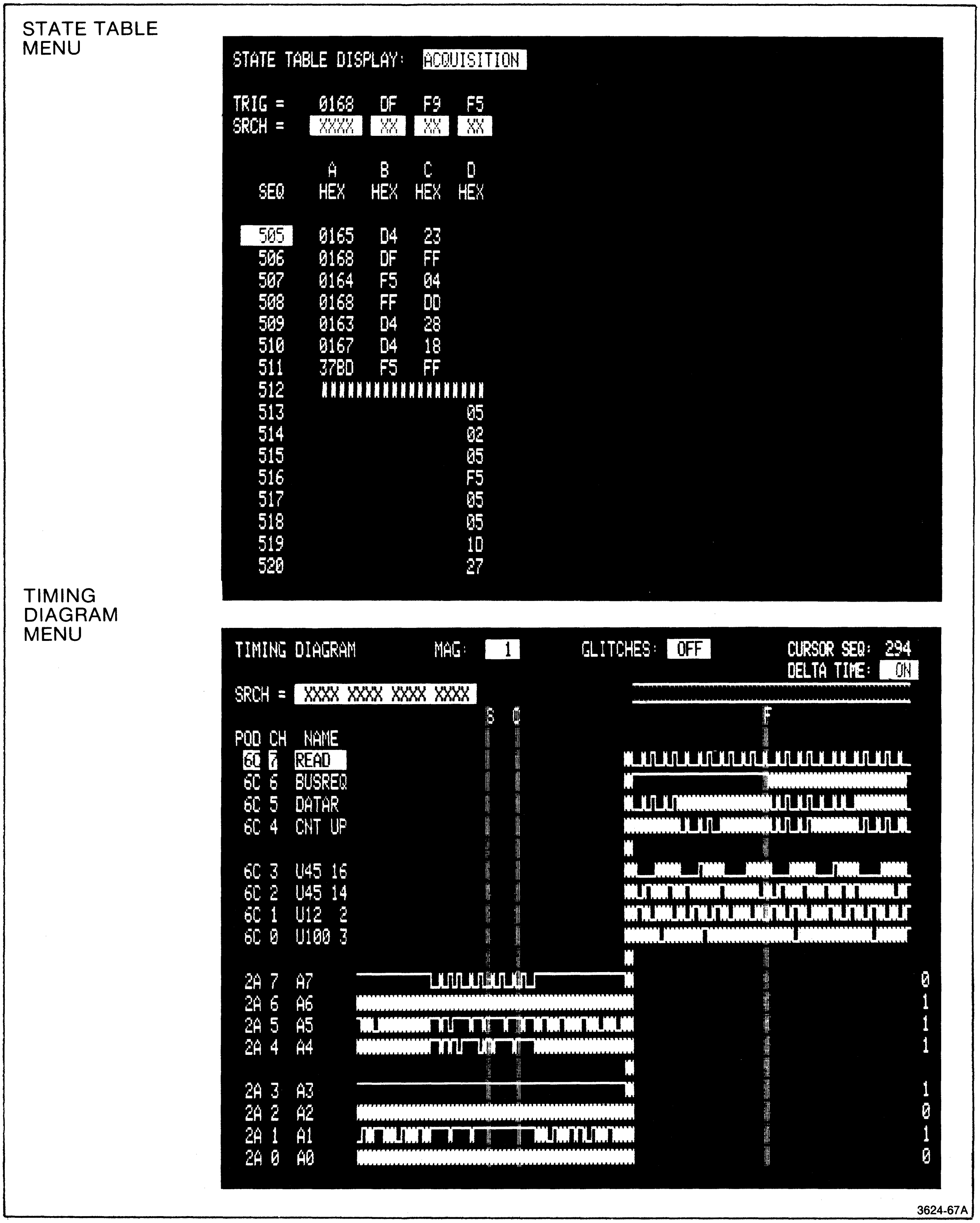


Figure 4-10. Fence display of ARMS acquisition. A fence divides the slow- and fast-clocked data.

STATE TABLE MENU 5

This menu is designed to support DAS data acquisition functions. While the menu may be displayed on the monitor screen at any time, it is useful only if data has been acquired in memory.

This section describes the State Table menu and its display capabilities. Before reading this section, you should first read the Operating Instructions section of this manual for an overview on keyboard controls and menu characteristics. You should also read the Start and Stop section for procedures on how to acquire data and store it in memory.

In this section you will find: **Page**

STATE TABLE MENU

The DAS provides two menus for viewing acquired data: State Table and Timing Diagram. This section concentrates on the State Table menu and its display capabilities.

As shown in Figure 5-1, the State Table menu provides access to DAS acquisition and reference memories. It may be used to view each of these memories separately or in comparison.

The following parts of this section describe how to read, change, and use the State Table menu and its display formats.

SUB-MENU SELECTIONS

When the DAS first acquires data after system power-up, it automatically displays the State Table menu. As more acquisitions are taken, the DAS will automatically display either the State Table or Timing Diagram menu depending on which was last used.

If not already viewing the State Table, you may also enter the menu by pressing the STATE TABLE key.

The State Table menu is comprised of three sub-menu displays. They include:

- **ACQUISITION**—which is used to display acquisition memory. It features a tabular format and provides fields for moving through the memory display.
- **REFERENCE**—which is used to display reference memory after the STORE key has been pressed. It provides the same display format as that used in the Acquisition sub-menu, plus it provides fields for setting up memory comparison conditions.
- **ACQ & REF**—which is used to display a comparison of data stored in acquisition and reference memories. It displays the memories side-by-side, and highlights any differences.

Only one sub-menu appears on the DAS screen at any one time. You may select between the sub-menus by entering the DISPLAY field directly to the right of the menu title.

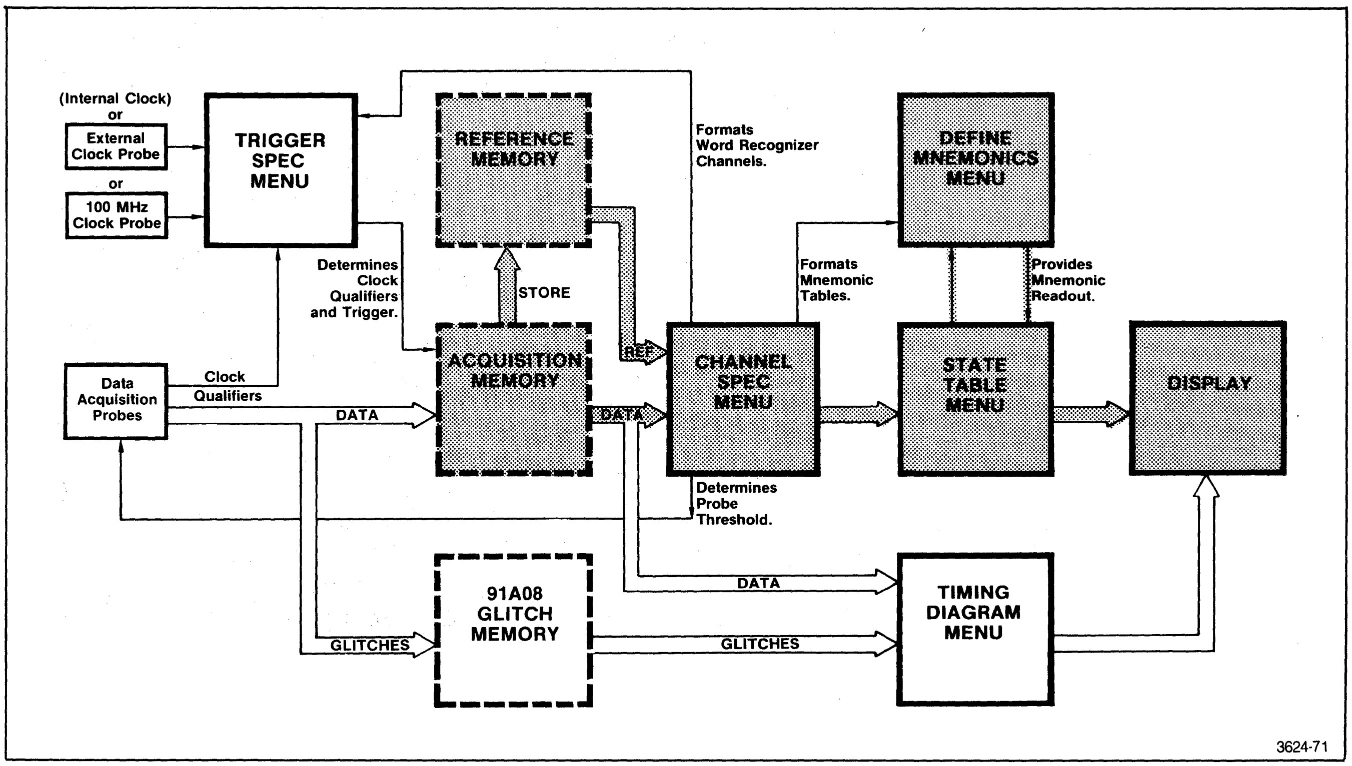


Figure 5-1. Functional overview of the State Table menu. This menu provides access to DAS acquisition and reference memories.

To change sub-menu displays:

1. Move the screen cursor to the DISPLAY field directly to the right of the menu title:

   STATE TABLE DISPLAY: [ACQUISITION]

2. Press the SELECT key until the desired sub-menu appears.

The DAS displays the sub-menu values in this order:

[ACQUISITION]
[REFERENCE]
[ACQ & REF]

As each sub-menu value appears in the field, the DAS automatically changes the sub-menu display format.

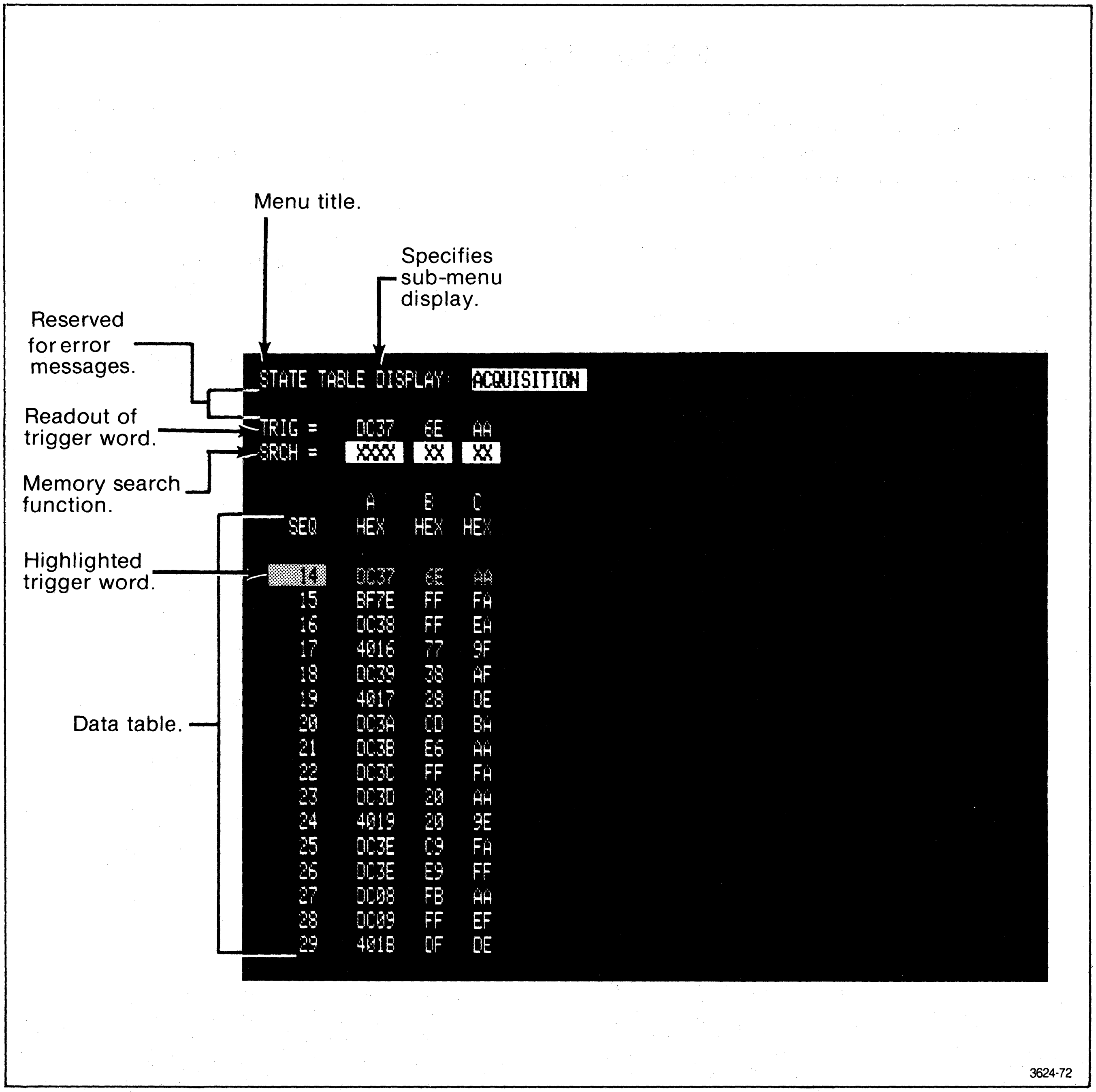


Figure 5-2. Display of the State Table's Acquisition sub-menu. This sub-menu displays the most recently acquired data and provides fields for moving through memory.

ACQUISITION SUB-MENU DISPLAY

Figure 5-2 illustrates a typical sub-menu display of acquisition memory. In this example, the menu is displaying 32 channels of data acquired via one 91A32 module.

READING THE SUB-MENU

Refer to Figure 5-2 when reading the following descriptive paragraphs.

The menu title, STATE TABLE, appears in the top left corner of the screen. The DISPLAY portion of the title is the field used in selecting the sub-menus (in this example, ACQUISITION).

The line directly below the title is always reserved for highlighted error or prompter messages which may occur.

A readout of the trigger word is provided on the third line of the screen, next to TRIG =. This word also appears in highlighted video within the data table.

If the trigger word is not in memory, the space next to TRIG = is left blank and no word is highlighted within the data table. Rather, when the sub-menu is first displayed after acquisition, a highlighted message appears on the second line of the screen reading:

- **STOPPED—TRIGGER NOT IN MEMORY**—if the STOP key was used to stop acquisition; or
- **TRIGGER NOT IN MEMORY**—if the trigger position was delayed until it was outside of memory.

The SRCH (search) field, located on the fourth line of the screen, is used to search through memory for a specific data word. In default, this field is set to don't care.

The rest of screen is devoted to the tabular display of acquisition memory data. The SEQ (sequence) fields running down the left side of the display designate the order in which data was acquired (with SEQ O representing the beginning of memory). Up to 16 words appear at any one time.

If the Trigger Specification menu was entered before data was acquired, the State Table menu centers the trigger word (if any) in the middle of the display. Otherwise, it displays the sequences last viewed.

The radix, polarity, and group format of the data table is determined by the Channel Specification menu. Headings above each column indicate their correlating channel group and its radix. You may enter the Channel Specification menu and change groups, radix, or polarity at any time.

DISPLAY EXAMPLES

The basic elements of the acquisition memory display are always the same. The displayed data, however, can vary greatly in content and format.

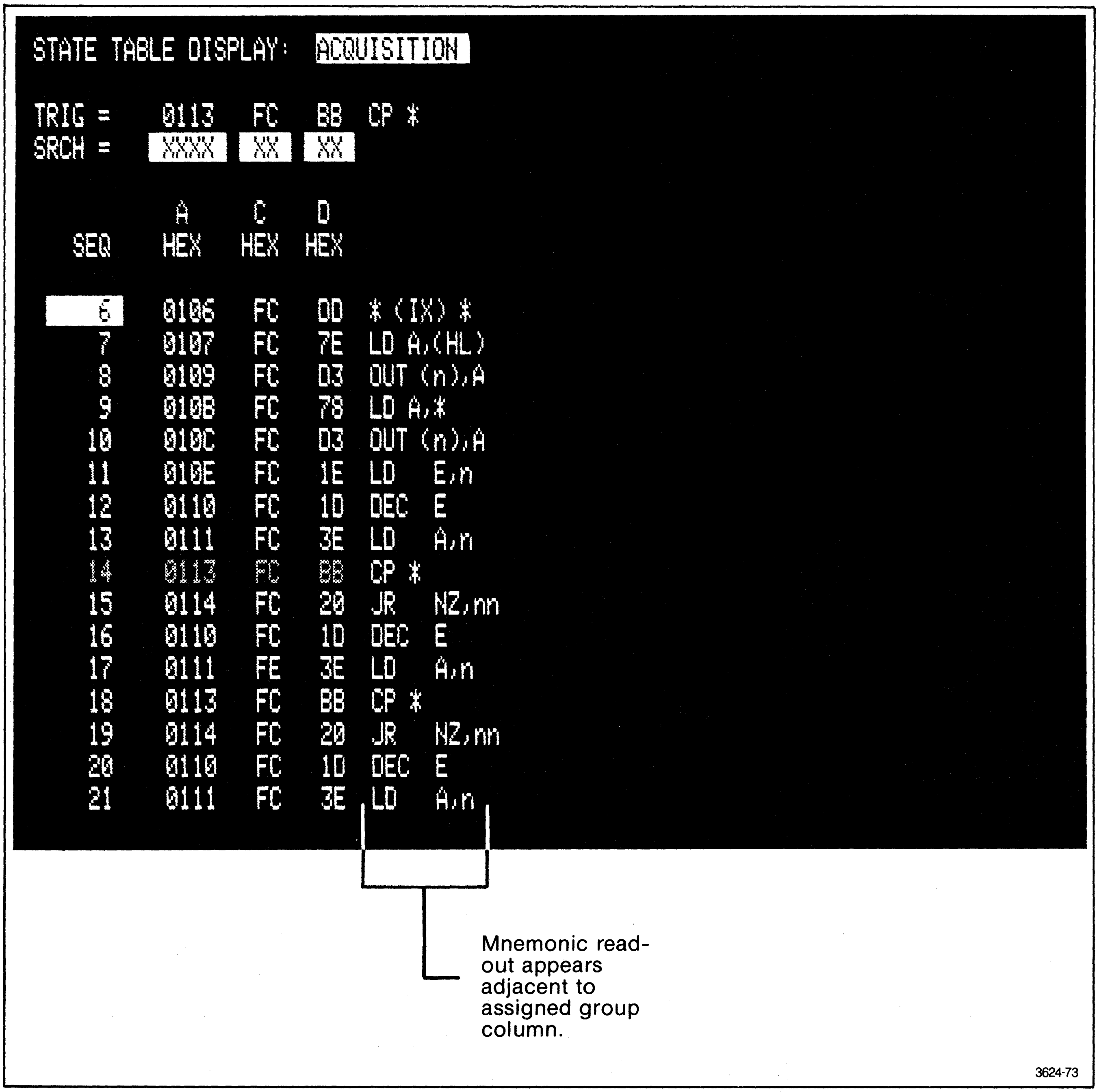


Figure 5-3. Mnemonic readout on the State Table.

Mnemonic Display. One element that can be used to enchance the State Table display is the Define Mnemonics menu. This menu lets you define mnemonics for the data columns. Figure 5-3 illustrates how the mnemonics appear on the State Table.

ARMS Acquisition Display. Another format of the State Table is the ARMS acquisition display. in this format, the differing time relationship between the slow-clocked and fast-clocked data is incorporated into the display. Figure 5-4 illustrates a State Table display of ARMS acquisition data.

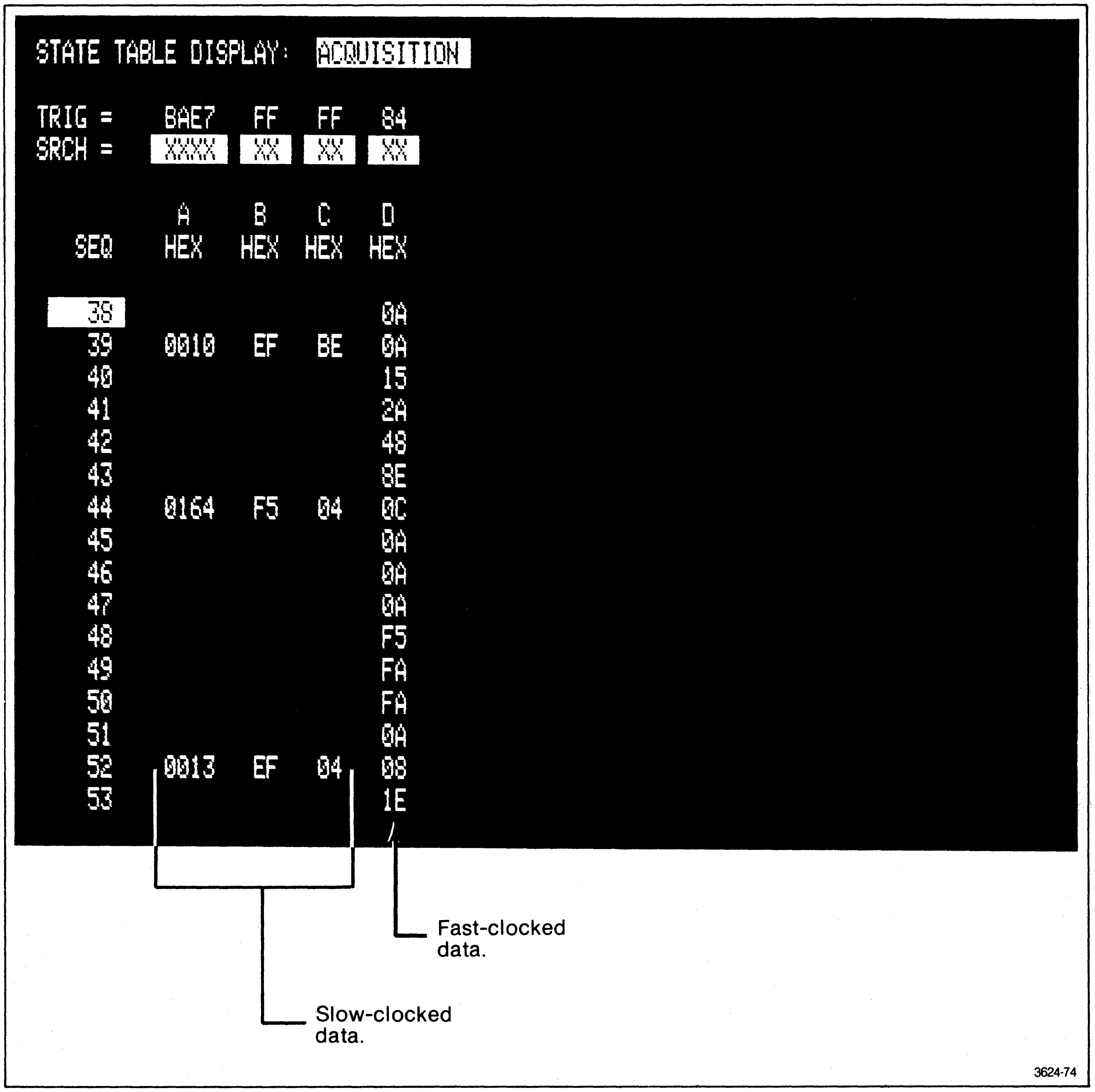


Figure 5-4. A State Table display of ARMS acquisition. The State Table provides a time-aligned display of slow- and fast-clocked data.

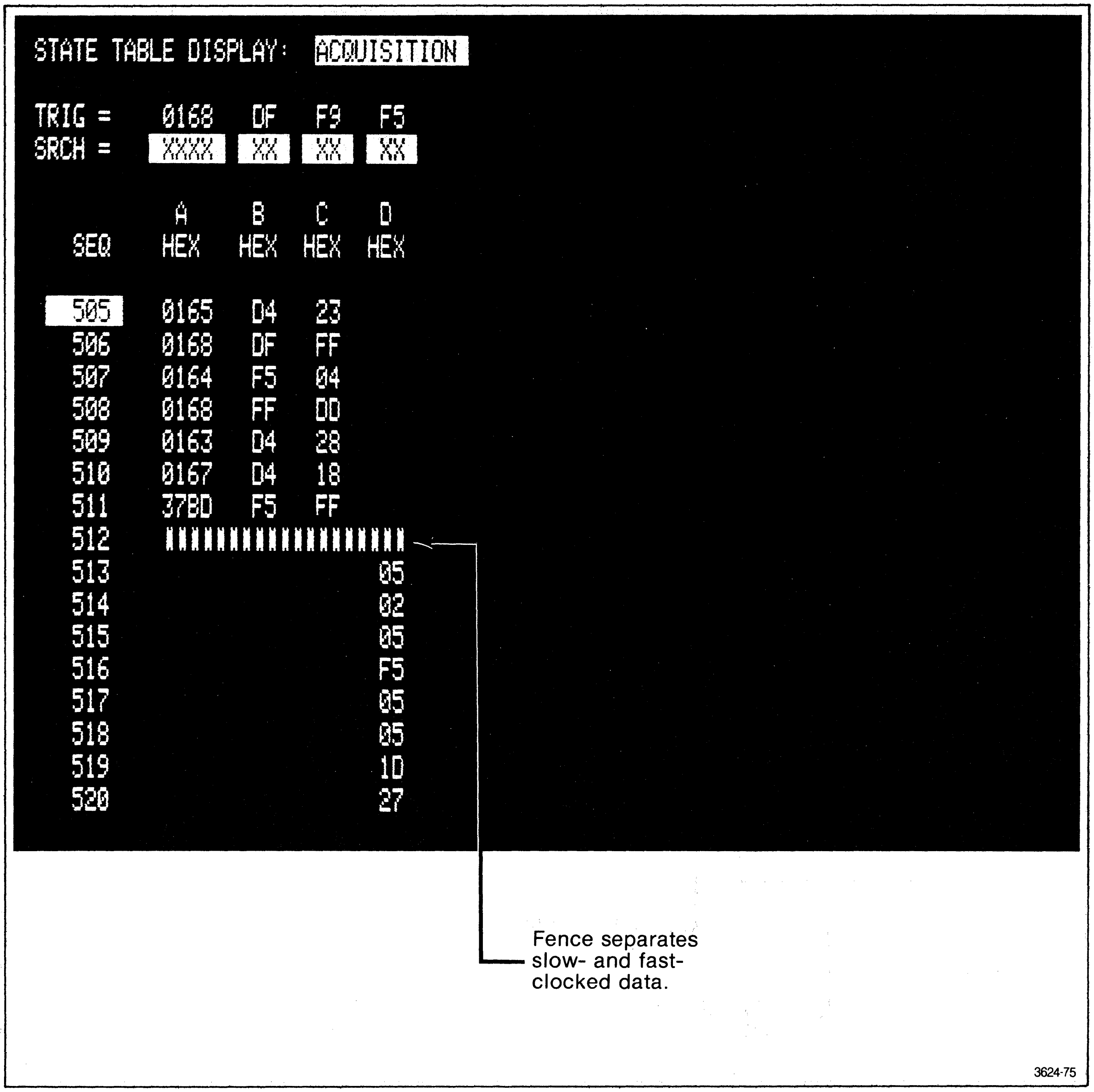


Figure 5-5. The State Table's fence display of ARMS acquisition. If the two memories do not overlap, the State Table separates the two memories with a fence.

If the slow-clocked and fast-clocked memories do not overlap, the State Table shows a fence display of ARMS data. As shown in Figure 5-5, a fence appears at SEQ 512, separating the two memories.

NOTE

Refer to the Trigger Specifications Menu section of this manual for information on how to properly set up an ARMS mode acquisition.

ACQUISITION SUB-MENU FIELDS AND VALUES

The following paragraphs describe how to change and use the Acquisition sub-menu display. They discuss the sub-menu fields and their optional values, and show how to scroll the display.

Figure 5-6 illustrates the Acquisition sub-menu display and its fields. The fields, which appear on the screen in reverse video, are designated throughout the text by brackets [ ].

The screen cursor moves from field to field in any direction, and is controlled via the four directional cursor keys and the NEXT key.

Refer to the numbered callouts in Figure 5-6 when reading the following paragraphs. These numbers are intended as a visual reference, and do not imply sequence of use.

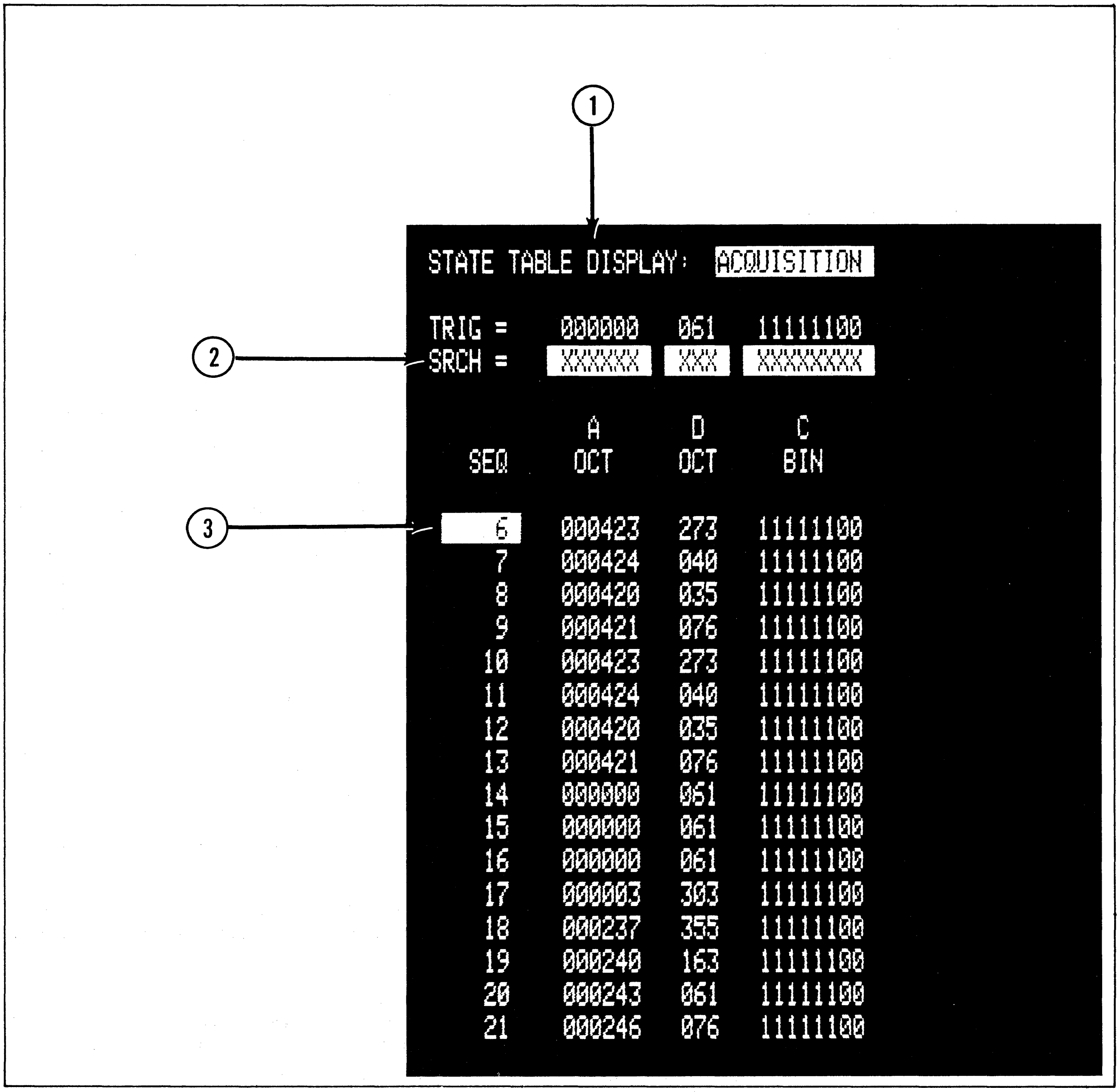


Figure 5-6. The State Table's Acquisition sub-menu and its fields.

(1) DISPLAY Field

The DISPLAY field, designated as part of the menu title, is used to select the sub-menu displays. Refer to the Sub-Menu Selections earlier in this section.

(2) SRCH (Search) Field

The SRCH (search) field is used for searching through acquisition memory for a specific data word. This is accomplished by entering the word value into the SRCH field, then pressing the SEARCH key on the keyboard.

The word entered into the SRCH field may be any combination of data and don't care values. The group columns and radices used in the SRCH field are formatted to match the columns in the data display.

To search for a specific data word:

1. Move the screen cursor to the SRCH field and position it over the channels you want to specify.

   SRCH = [XXXX][XX][XX]

2. Use the data entry keys to specify channel values, or press DON'T CARE to ignore channels during the search. For example, enter 3.

   The DAS enters a 3 at the cursor location, then shifts the cursor one space to the right.

   SRCH = [3XXX] [XX][XX]

3. Continue entering the rest of the data value. For example, enter OAE FF C2.

   SRCH = [30AE] [FF] [C2]

4. Press the SEARCH key.

   The search starts one sequence below the cursor location (designated by the reverse-video SEQ field) and moves towards the end of memory. If the end of memory is encountered before the word is found, the search wraps around to the beginning of memory and continues until the reverse-video SEQ location is reached.

   If the word is found, the DAS moves the word to the topmost sequence position and updates the display.

   If the word is not found, the DAS leaves the sequences at their current location and displays a message on the second line of the screen reading WORD NOT FOUND.

During the searching process, the DAS will only respond to the STOP key. This key stops the memory search. In most cases, the searching process takes less than 30 seconds.

(3) SEQ (Sequence) Field and Display Scrolling

The sub-menu displays up to 16 data words at any one time. The SEQ (sequence) fields on the left side of the display indicate which acquisition memory locations are being shown. The reverse-video SEQ field indicates the cursor's position in acquisition memory.

If the number in the reverse-video SEQ field changes, the display changes to show new memory locations.

NOTE

When the cursor is moved through memory in the State Table, its movement is automatically reflected in the Timing Diagram menu. Therefore, you can always switch between the two menu displays and view the same cursor position. The value of the reverse-video SEQ field is designated in the Timing Diagram by the CURSOR SEQ readout.

One method of moving through memory is provided by the scroll keys. These keys can be used at any time and in any field.

To scroll through memory:

1. Press Δ or ∇.

   The DAS scrolls the memory display up or down the screen.

A special condition may arise when scrolling through a display containing mnemonics and trailing words. If you are scrolling the sequences down the display (towards SEQ 0), the menu does not track the breakdown of trailing words. Stop scrolling with a mnemonic at the top of the display, then press the STATE TABLE menu key; the menu will update the mnemonic display.

Training words are tracked automatically when you are scrolling the sequences up the display.

A second method for moving through memory is provided by the SEQ field. This field lets you move forward or backward in sequence blocks.

To move forward to a higher numbered block of sequences:

1. Move the screen cursor to the SEQ number you want to change to a higher number. For example, SEQ 15.

   [15]

2. Use the data entry keys to enter the SEQ number you want to display. For example 300.

   The DAS displays SEQ 300 in place of SEQ 15, and then updates the rest of SEQ numbers following that position.

6
7
8
9
10
11
12
13
14
[300] SEQ 15 is changed to SEQ 300 and the rest
301 of the SEQ numbers update following that
302 positon
303
304
305
306

To move backward to a lower numbered block of sequences:

1. Move the screen cursor to the SEQ number you want to change to a lower number. For example, 300.

   [300]

2. Press the DON'T CARE key.

   The DAS enters a 0 at the cursor location.

   [0]

3. Use the data entry keys to enter the sequence number you want to display. For example, 40.

   The DAS displays SEQ 40 at the cursor location, and then updates the rest of the SEQ numbers from that position.

6
7
8
9
10
11
12
13
14
[40] SEQ 300 is changed to SEQ 40 and the rest
41 of the SEQ numbers update from that
42 position.
43
44
45
46

When using the SEQ field to move forward or backward through the sequences, there is one rule you must follow. If the cursor is positioned below the top SEQ number, you must enter a number larger than the number directly above the cursor location.

REFERENCE SUB-MENU DISPLAY

The DAS reference memory is loaded from acquistion memory when the STORE key is pressed. This process rewrites the acquisition memory contents into reference memory. When a store takes place, any data previously stored in reference memory is lost.

You may view reference memory contents by displaying the Reference sub-menu. Figure 5-7 illustrates a typical display of this sub-menu.

NOTE

Reference memory may only be displayed if the trigger mode used for the stored reference data matches the trigger mode of the current acquisition.

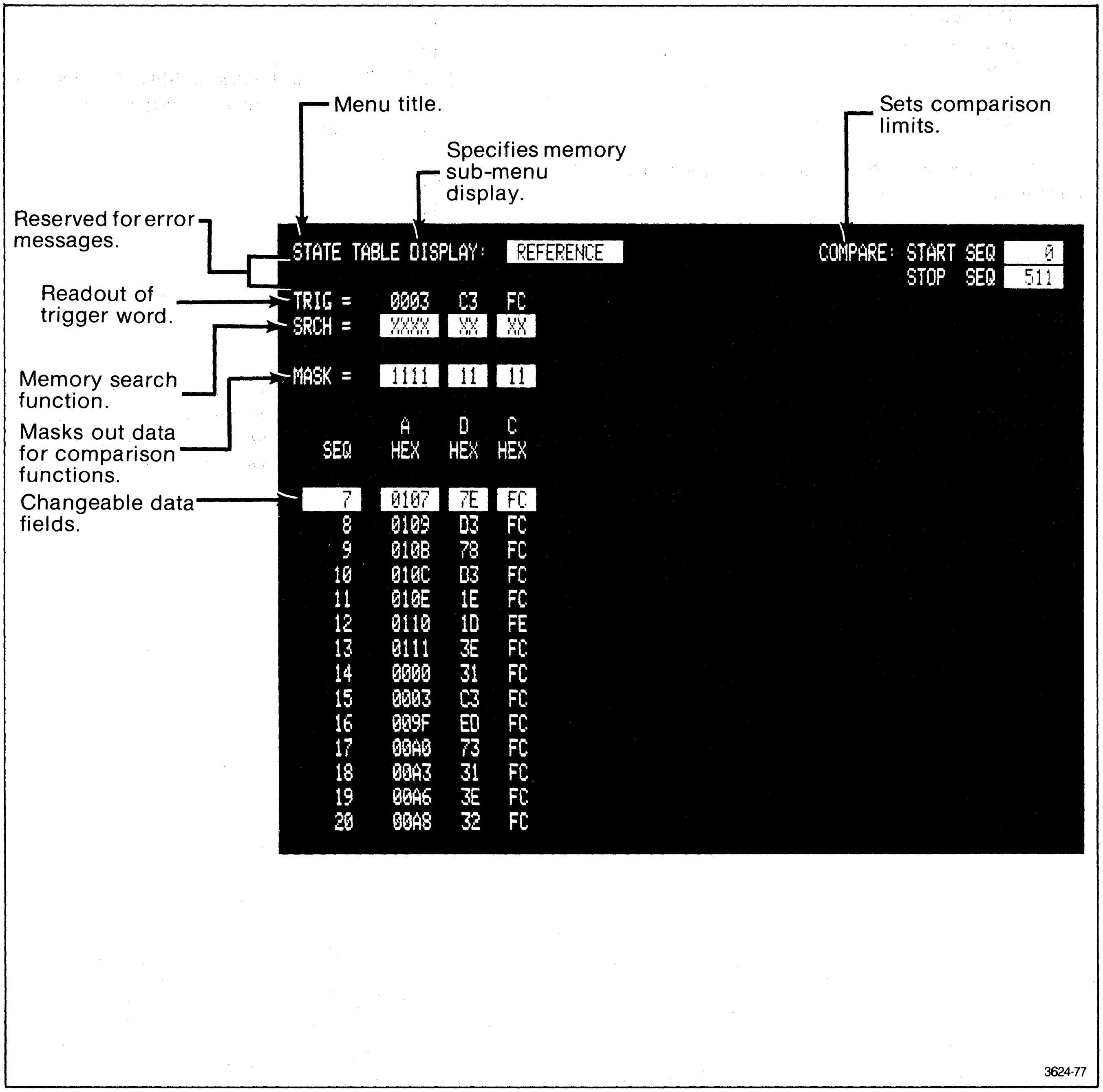


Figure 5-7. Display of the State Table's Reference sub-menu. This sub-menu displays reference memory data after the STORE key has been pressed.

READING THE SUB-MENU

As shown in Figure 5-7, the Reference sub-menu has all the fields associated with the Acquisition sub-menu, plus several additional fields. The additional fields let you set up and edit reference memory for later comparisons with newly acquired data (see the ACQ & REF Sub-Menu later in this section).

The data table in the Reference sub-menu reflects the organization of the data table in the Acquisition sub-menu.

Changes in the Channel Specification menu affect the reference data as well as the acquisition data. In addition, mnemonic disassembly, if used, appears next to the reference data as well as next to the acquisition data.

The trigger word (if any) of the most recent acquisition is displayed after TRIG = in the Reference sub-menu.

The SRCH (search) and SEQ (sequence) fields are used in a manner identical to the way they are used in the Acquisition sub-menu (refer back to Acquisition Sub-Menu Fields and Values). The reverse-video SEQ field is the same in both sub-menu displays.

Additional fields provided in the Reference sub-menu include COMPARE and MASK. The COMPARE field is used to determine which memory sequences will be stored in reference memory when the STORE key is pressed. It also determines which memory sequences will be used in later comparison functions.

The MASK field is used to mask out any columns during reference memory display and comparisons.

REFERENCE SUB-MENU FIELDS AND VALUES

The following paragraphs describe how to use the Reference sub-menu to set up comparison conditions. They discuss the sub-menu fields and their optional values.

Figure 5-8 illustrates the Reference sub-menu and additional fields. Only the fields labeled 4-6 are discussed here, since they are different from the Acquisition sub-menu fields. For information on how to manipulate fields labeled 1-3, refer back to the Acquisition Sub-Menu Fields and Values part of this section.

(4) COMPARE Field

The COMPARE field serves two purposes. First, it determines which sequences from acquisition memory are stored in reference memory when the STORE key is pressed. Second, it determines which block of sequences is used during ACQ & REF display and comparison functions (i.e., COMPARE = and COMPARE ≠).

If acquisition memory was acquired via an ONLY or AND trigger mode, up to 512 sequences (maximum) can be stored in reference memory. For 91A32 and 91A08 modules, the compare limits may be set to any sequences between sequence 0 to 511, inclusive.

If acquisition memory was acquired via an ARMS trigger mode, the maximum number of sequences which may be stored in reference memory is sequence 0 through the last sequence stored (1024 maximum).

NOTE

A quick way to find the last sequence number of an ARMS mode acquisition is to enter the Timing Diagram menu, set it at a magnification level of 1, then scroll the cursor (C) to the end of the data display. (See the Timing Diagram Menu section of this manual.)

Once you have stored data in reference memory, you may leave the compare limits at the current values or change them. When a comparison function takes place, however, the DAS will only compare data up to the limits set at the time the STORE occurred. This means that increasing the compare limits will have no effect, but decreasing them will.

In addition, the DAS only compares those sequences (within the limits) which contain data in both acquisition and reference memory. If either memory has data stored in sequences that the other does not, these extra sequences are ignored.

To specify the compare limits:

1. Move the screen cursor to the COMPARE START SEQ field.

   COMPARE: START SEQ [0]

2. Use the data entry keys to enter the beginning sequence of the compare limit. For example, 200.

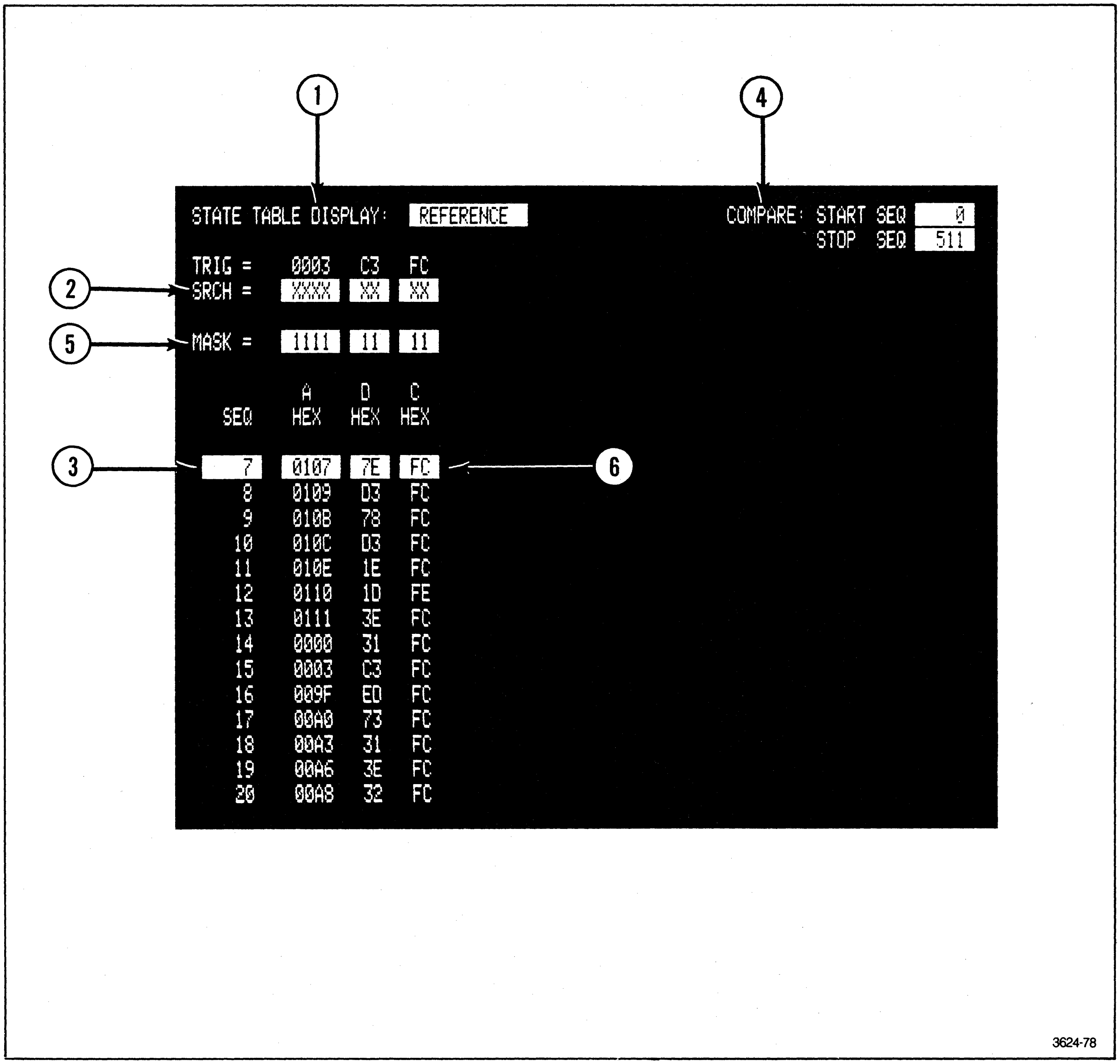


Figure 5-8. The State Table's Reference sub-menu and its fields.

The DAS enters the value into the field.

COMPARE: START SEQ [200]

3. Move the screen cursor to the COMPARE: STOP SEQ field.

COMPARE: STOP SEQ [511]

4. Use the data entry keys to enter the last sequence of the compare limit. For example, 300.

The DAS enters the value into the field.

COMPARE: STOP SEQ [300]

When entering the compare limits, there is one rule that must always be followed. The START SEQ value must be a number less than or equal to the STOP SEQ value.

(5) MASK Field

The MASK field is used to mask out columns of data during a comparison function. In default, the MASK field set to a value of 1 on all columns. This means that all columns will be considered during a memory comparison.

You may also choose to mask out columns so that they are ignored during a memory comparison. This is accomplished by entering don't cares (Xs) into the MASK field.

To mask out channels during comparison:

1. Move the screen cursor to the MASK field, and position it over the column to be masked out.

   MASK [1111]   [11]   [11   ]

2. Press the DON'T CARE key to mask out the column.

   The DAS enters an X value at the cursor location and updates the display.

   MASK [X111]   [11] [11   ]

When a column is masked out, it is shown as a blank column in the reference memory display. You may display masked-out columns at any time by re-entering a 1 in the MASK field.

NOTE

If the DAS is equipped with firmware version 1.09 the state table reference memory display is not affected, therefore blanking does not occur.

(6) Editing the Data Table

The data table within the Reference sub-menu may be edited. You can change the data values on any sequence line. The only restriction is that new values must be entered in the specified radix for that group. Don't care is not an acceptable value.

To edit data Values:

1. Move the screen cursor to the data values you want to change.

   [FFFF]

2. Use the data entry keys to enter new values. For example, 3.

   The DAS enters the value at the cursor location.

   [3FFF]

Using the above procedures, continue to change as many data values as you want. This editing process allows you to tailor reference memory to fit any data pattern.

ACQ & REF SUB-MENU DISPLAY

You may display acquisition and reference memory together using the ACQ & REF sub-menu. Figure 5-9 illustrates a typical display.

READING THE SUB-MENU

In this sub-menu, both memories are shown side-by-side. Acquisition memory is shown on the left side of the display under the heading ACQ. Reference memory is shown on the right side of the display under the heading REF.

The table format for both memories is identical. Any differences in the displayed data are highlighted on the ACQ side and designated by a ≠ sign. If columns were masked in the reference memory sub-menu, they will appear as blank columns on the REF side of the display.

The sub-menu provides two fields: SRCH (search) and SEQ (sequence). These two fields are manipulated in the manner described under the Acquisition Sub-Menu Fields and Values part of this section.

USING THE COMPARISON FUNCTIONS

The DAS provides two methods for continuously acquiring new data until compare conditions are met with reference memory. These methods are provided by the COMPARE = and COMPARE ≠ keys.

NOTE

For detailed information on how the comparison keys are used, refer to the Start and Stop section of this manual.

When the COMPARE = key is pressed, the DAS acquires and stores data. This data is then compared to reference memory to see if the two memories are equal. If the memo-

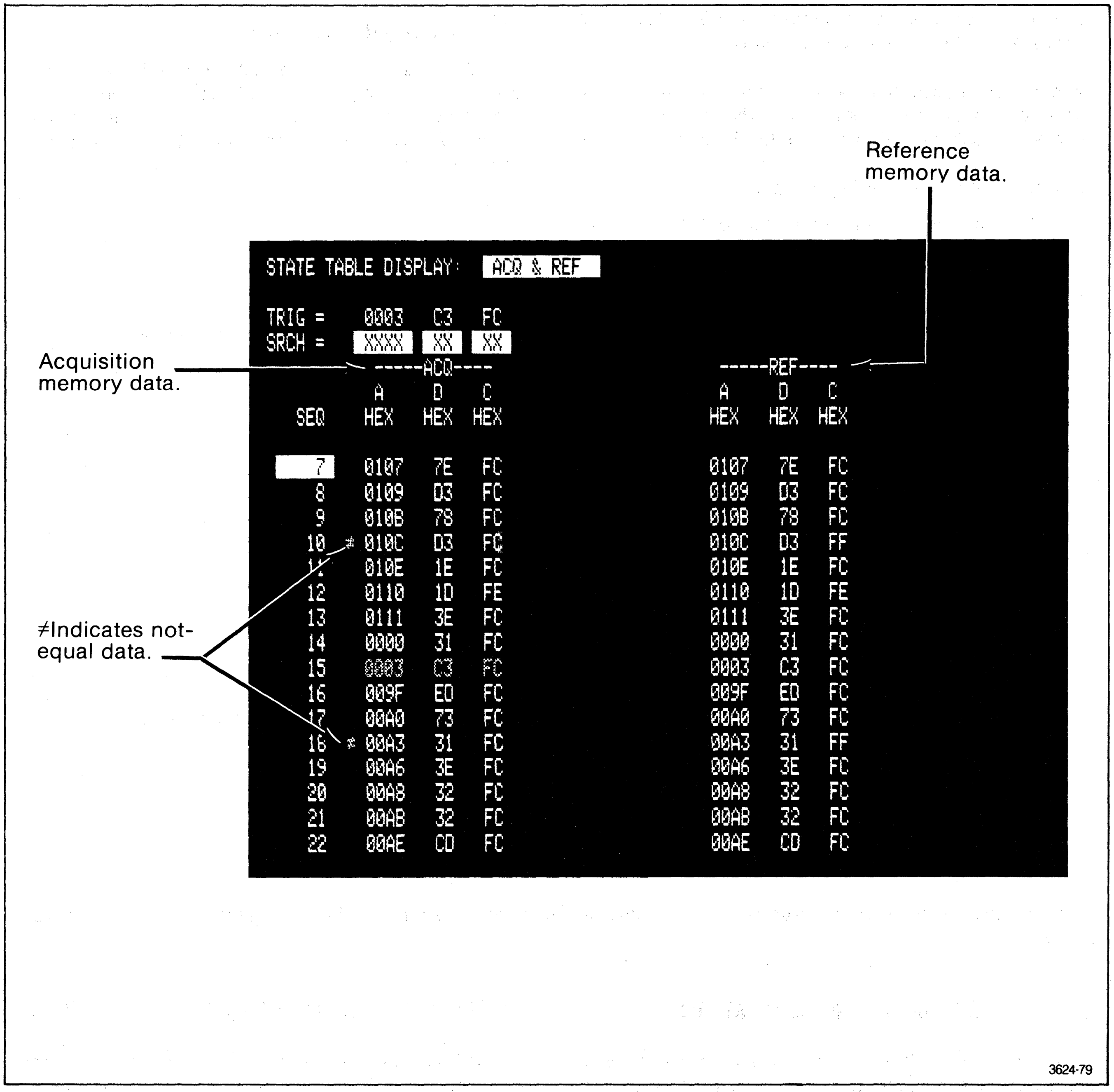


Figure 5-9. Display of the State Table's Acquisition and Reference sub-menu. This sub-menu shows acquisition and reference memories side-by-side and highlights any differences.

ries are equal, acquisition stops. If the memories are not equal, however, a new acquisition is taken. New acquisitions are taken until the memories are equal.

The COMPARE ≠ key works like COMPARE =, except that new acquisitions are taken until the two memories are not equal. When the not-equal condition is met, the DAS enters the State Table display and positions the first not equal data value in the topmost sequence position.

While either comparison function is in progress, the DAS displays a RESTARTS count on the screen. This counter shows up to 65,535 RESTARTS. When comparison conditions are met, the most recent RESTARTS count appears on the second line of the screen, no matter which menu is being displayed.

ARMS Mode Comparisons. If comparing data acquired in an ARMS trigger mode, the DAS first compares the position of slow clocks acquired with respect to the fast clock. If identical to the position of slow clocks stored in reference memory, the menu then compares the acquisition and reference data.

Figure 5-10 illustrates a comparison of ARMS mode data. Both the slow- and fast-clocked data columns are compared. If data does not appear on the same clock cycle in both memories, highlighted blank spaces are used to designate the difference.

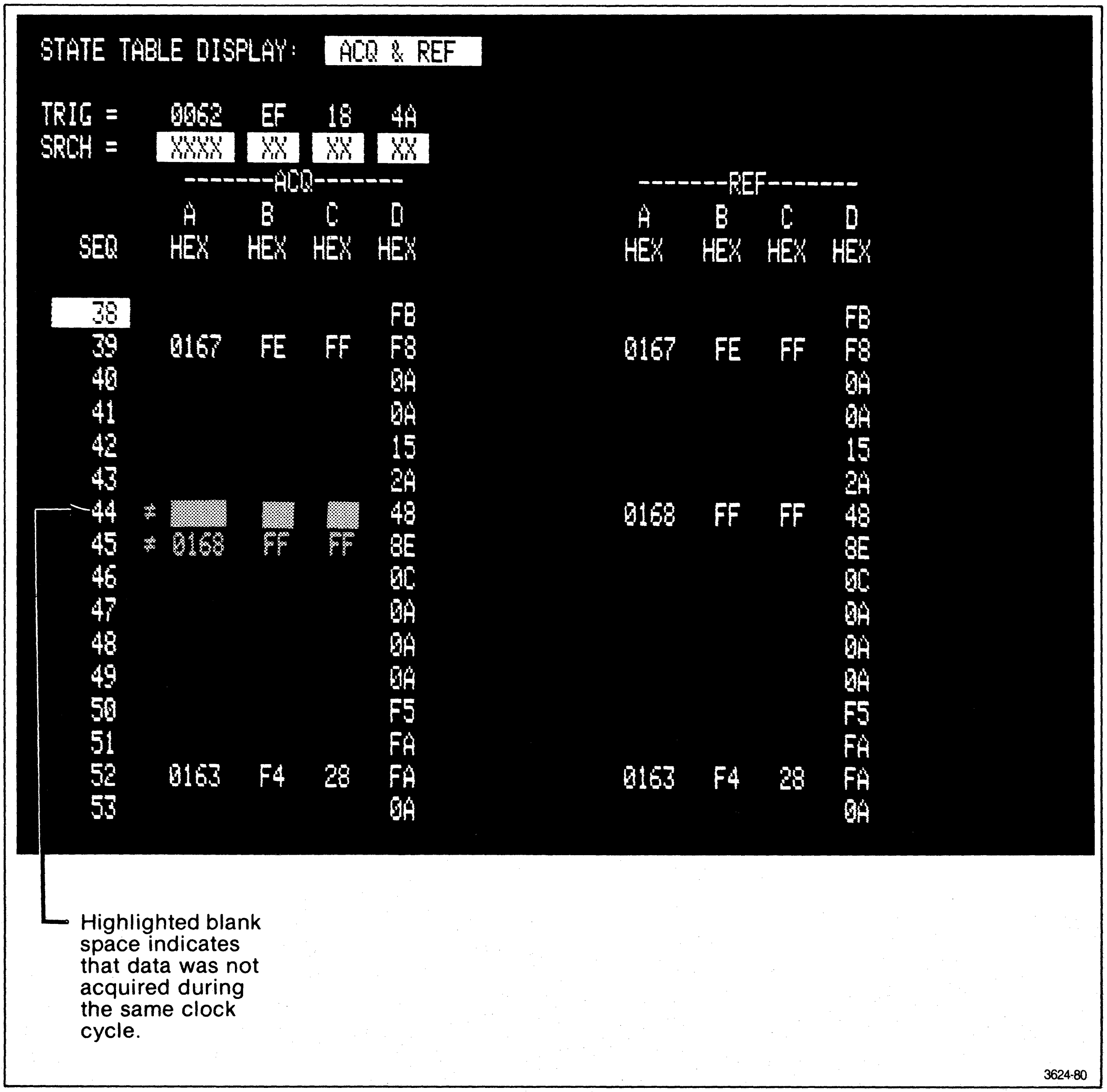


Figure 5-10. Comparison display of ARMS mode data.

TIMING DIAGRAM MENU 6

This menu is designed to support the data acquisition functions. While the menu may be displayed on the monitor screen at any time, it is useful only if data has been acquired in memory.

This section describes the Timing Diagram menu and its display capabilities. Before reading this section, you should first read the Operating Instructions section of this manual for an overview on keyboard controls and menu characteristics. You should also read the Start and Stop section for procedures on how to acquire data and store it in memory.

In this section you will find: **Page**

TIMING DIAGRAM MENU

The DAS provides two menus for displaying acquired data: Timing Diagram and State Table. This section discusses the Timing Diagram menu and its display capabilities.

As shown in Figure 6-1, the Timing Diagram menu provides access to two memories:

- **Acquisition Memory**—which contains the most recently acquired data.
- **Glitch Memory**—which contains the glitch information acquired on 91A08 channels.

NOTE

The glitch memory is available only if 91A08 modules were used during acquisition. 91A08 modules always acquire glitches along with data (whether or not glitches are specified in the 91A08 trigger).

The Timing Diagram menu presents the data and glitch information in a logic-waveform format. Up to 16 channels are displayed, with data and glitches appearing in horizontal trace lines.

The Timing Diagram menu can be used to view the entire memory content of the display channels, or it can be used to magnify a specific area of interest. In addition, its memory cursor is tied to the State Table, so you can switch back and forth between the two menus and see the same area of memory.

The following parts of this section describe how to read, change, and use the Timing Diagram menu display.

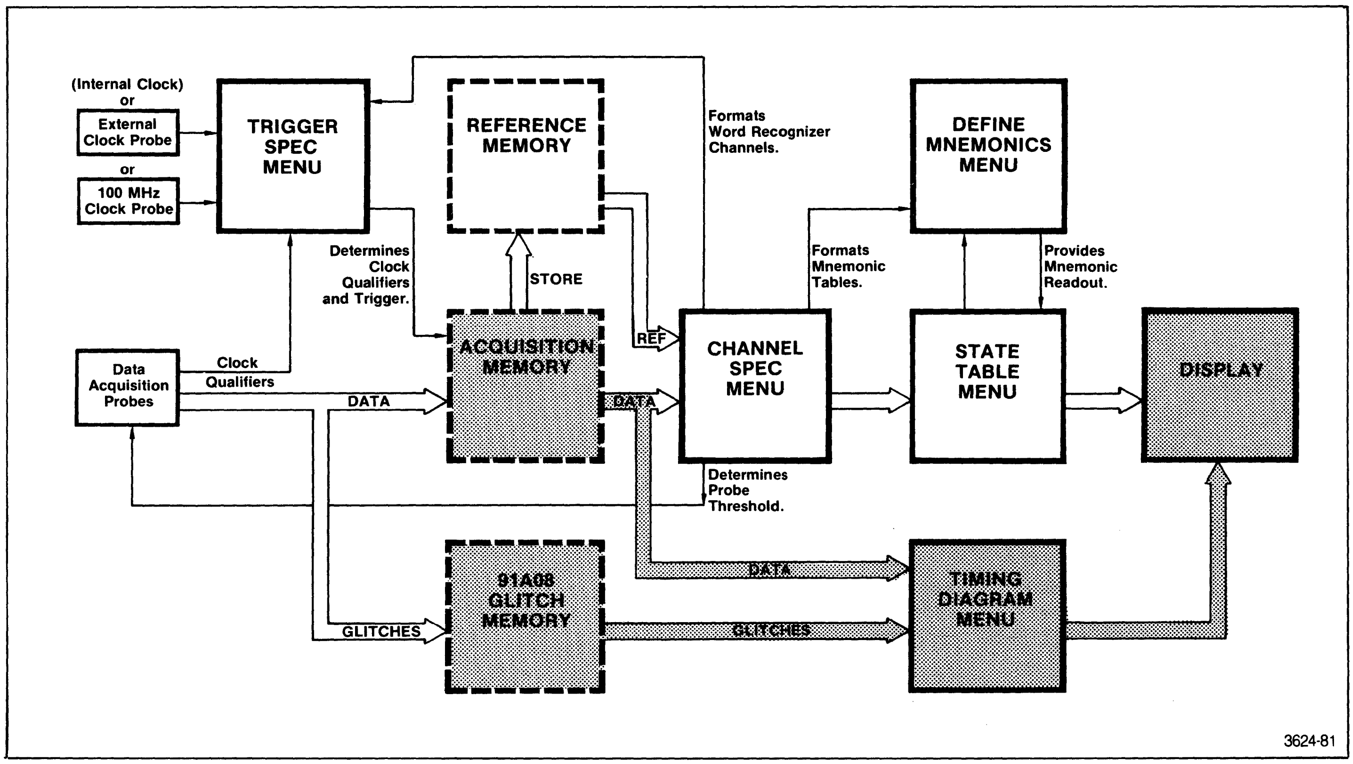


Figure 6-1. Functional overview of the Timing Diagram menu. This menu provides access to acquisition memory and 91A08 glitch memory.

MENU DISPLAY

When the DAS first acquires data after system power-up, it automatically displays the State Table menu. As more acquisitions are taken, the DAS will automatically display either the State Table or Timing Diagram menu depending on which was last used.

You may also enter the Timing Diagram menu at any time by pressing the TIMING DIAGRAM menu key.

When the Timing Diagram menu first appears on the screen it may or may not immediately show any data. If no data is displayed, an error message appears on the second line of the screen reading PODS DISPLAYED HAVE NO ACQUIRED DATA. This does not necessarily mean that no data has been acquired in memory; it means that the data channels being displayed were not used for acquisition. You may view other channels by entering them into the menu's POD and CH fields. (See the procedures described later under Menu Fields and Values).

Figure 6-2 shows a typical display of the Timing Diagram menu. In this example, the maximum number of channels, 16, are being displayed.

READING THE MENU

Refer to Figure 6-2 when reading the following paragraphs.

The menu title, TIMING DIAGRAM, is displayed in the top left corner of the screen. The line directly below the title is always reserved for any highlighted error or prompter messages which may occur.

Directly to the right of the menu title is the MAG (magnification) field. This field determines the resolution of the waveform display. In default, this field is set to the lowest magnification level (1). At this level, the entire memory content for each channel trace is displayed.

The GLITCHES field, located next to the MAG field, appears on the menu only if 91A08 modules were used during the acquisition. In default, this field is turned off. If it is turned on, glitch information will be incorporated on all 91A08 channel traces.

In the top right corner of the screen, the menu provides a readout of the memory cursor's address location. The CURSOR SEQ value corresponds to the sequence numbers in the State Table menu. In the Timing Diagram, the memory cursor is designated by the vertical C (cursor) line.

On the third line of the screen, the menu provides a field labeled SRCH (search). This field is used for searching through memory for a specific data value. In default, this field is set to don't care.

Directly across from the SRCH field, the menu provides a memory window. This window shows which area of memory is being displayed relative to the entire acquisition memory content. In default, the entire memory content for each channel trace is being shown.

The POD and CH (channel) fields, running down the left side of the menu, designate which channels are being displayed. POD refers to a back-panel POD ID location, while CH refers to the specific channel number.

The NAME field, located next to the POD and CH fields, is used for labeling the channel traces. In default, this field is empty.

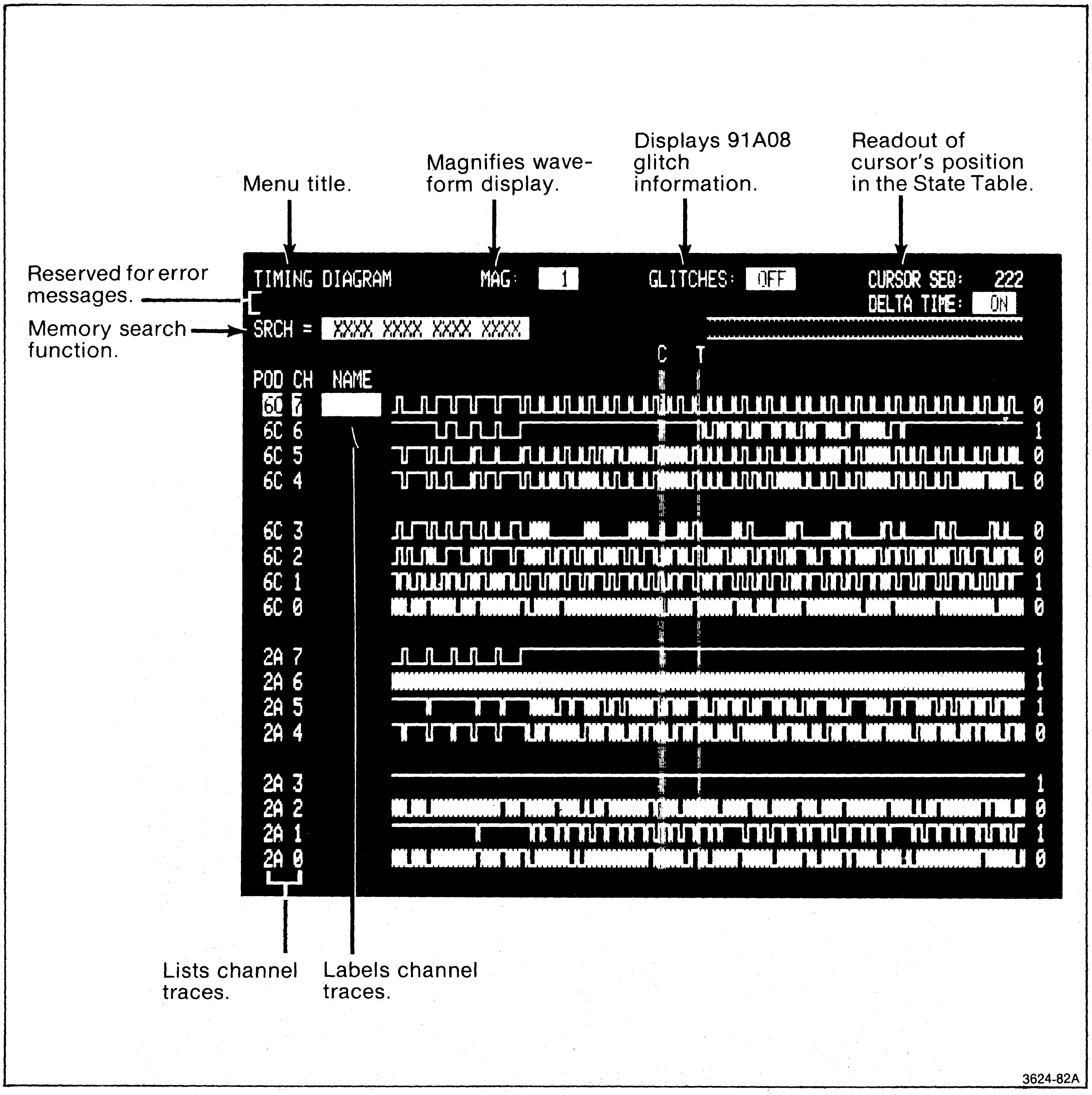


Figure 6-2. Default display of the Timing Diagram menu. This menu displays up to 16 channel traces, presenting data in a logic-waveform format.

TIMING DIAGRAM WAVEFORMS

Figure 6-3 identifies the major elements of the logic-waveform display. As shown in this figure, the left side of the display represents the beginning of memory, while the right side represents the end of memory.

The two vertical lines running through the channel traces represent the trigger position (T) and the memory cursor position (C). If the trigger is not in memory, the trigger position will not be shown, and a message will appear on the second line of the screen reading:

STOPPED—TRIGGER NOT IN MEMORY, if the trigger did not occur and the the STOP key was used; or

TRIGGER NOT IN MEMORY, if the trigger was delayed outside of memory.

The binary numbers at the end of each channel trace respresent the data value at the memory cursor position.

In default, the data on the channel traces may appear fuzzy because the menu is set to its lowest magnification setting. Increased magnification will increase the display's resolution.

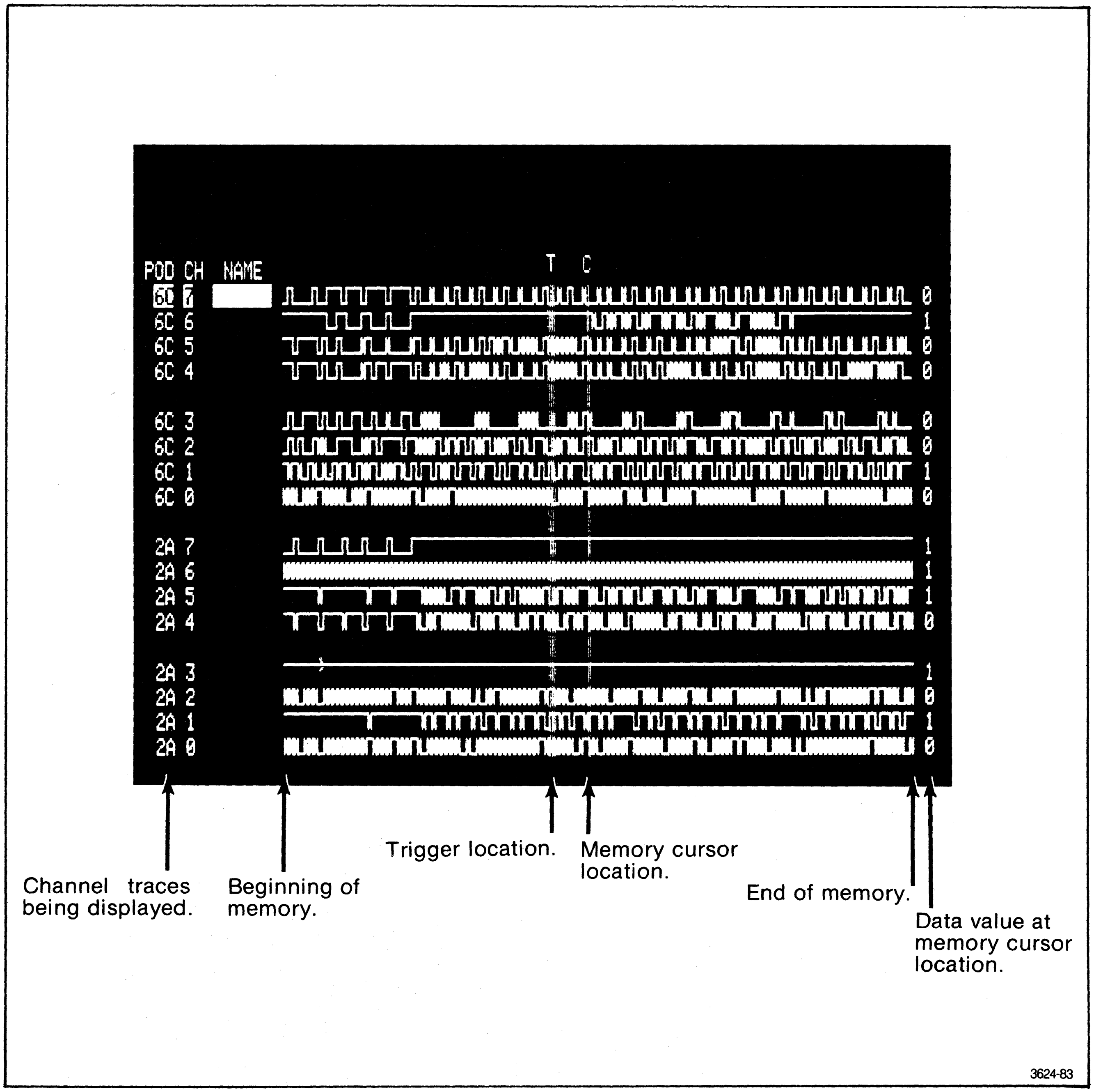


Figure 6-3. The logic-waveform display.

MENU FIELDS AND VALUES

The following paragraphs describe how to use and change the various elements of the Timing Diagram menu. They discuss menu fields and their optional values and show how to make timing measurements.

Figure 6-4 illustrates a typical Timing Diagram menu display and its various elements. The menu fields, which appear on the screen in reverse video, are designated throughout the text by brackets [ ]. The screen cursor moves from field to field in any direction, and is controlled via the four directional cursor keys and the NEXT key.

Refer to the numbered callouts in Figure 6-4 when reading the following paragraphs. These numbers are a visual reference only, and do not imply sequence of use.

(1) MAG (Magnification) Field

The MAG (magnification) field is used to increase the resolution of the displayed waveforms.

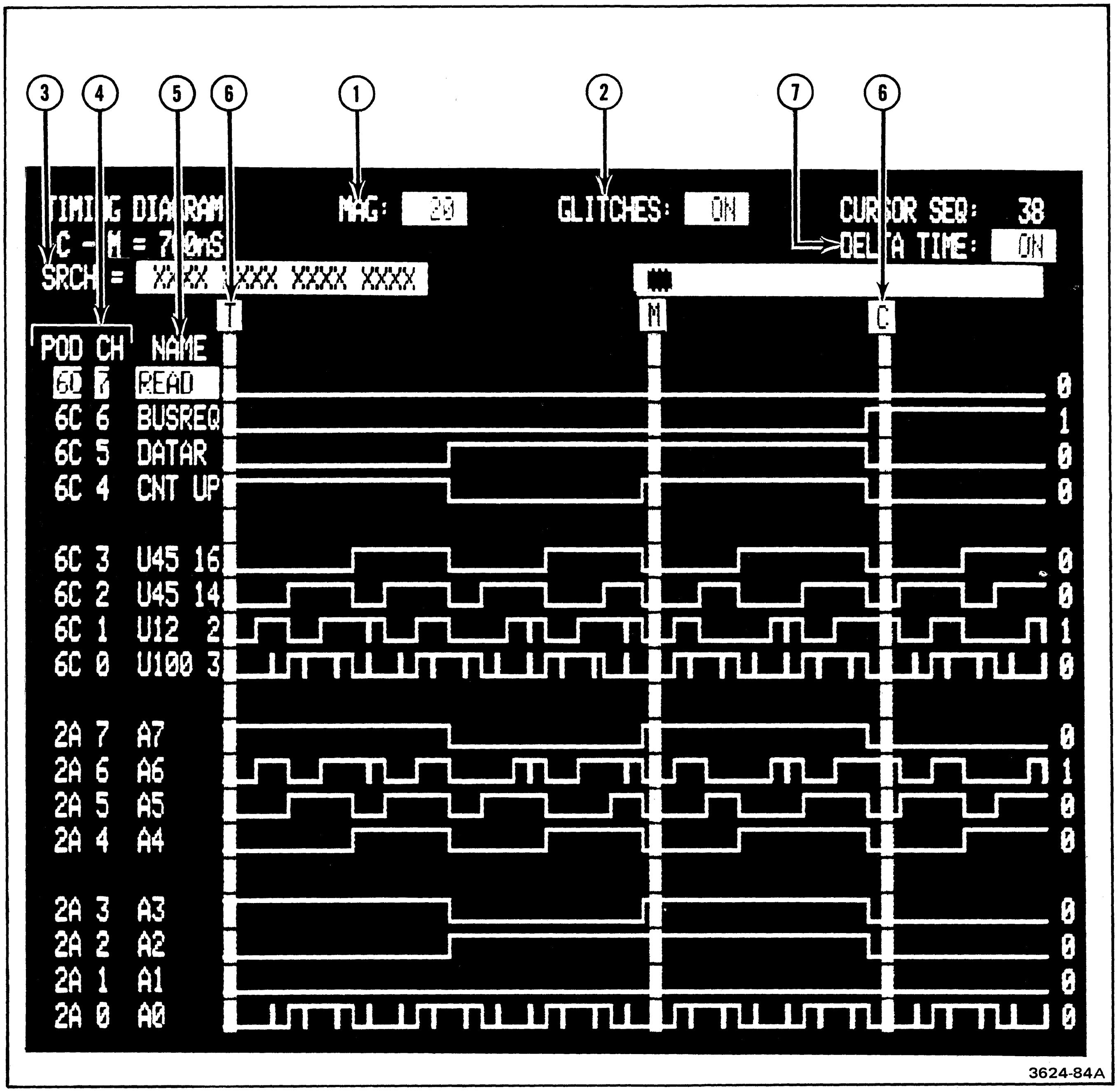


Figure 6-4. The Timing Diagram menu and its fields.

In default, the MAG field is set to the lowest magnification level (1). At this level, the entire memory content of each channel is shown. You can quickly see how much data was acquired and identify where the major data transitions occurred.

NOTE

At the MAG 1 level, fuzzy waveform characters may indicate the presence of glitches (91A08 channels only). To view these glitches, use the GLITCHES field as described later in this section.

By increasing the magnification levels, you see less memory content at a higher waveform resolution. When magnification is increased, the memory cursor (C) remains fixed, and as much surrounding data is shown as the magnification level allows. The display magnifies in a 1-2-5 sequence up to 10K maximum (one ten-thousandth of the entire memory content).

To change the magnification of the waveform display:

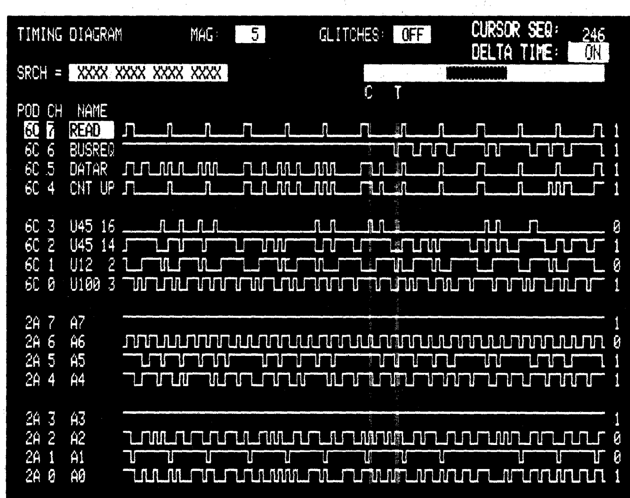
1. Move the screen cursor to the MAG field:

   MAG [1]

2. Press the INCR or DECR keys until the desired magnification appears in the field.

   The DAS displays increasing or descreasing magnification levels in a 1-2-5 sequence between the range of 1 to 10K.

The following illustration shows the display when it has been magnified to 5 (one fifth of the entire memory content).



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(2) GLITCHES Field

The GLITCHES field only appears on the menu if 91A08 modules were used during acquisition. The field is used to display glitches on 91A08 channel traces.

NOTE

Glitches are always acquired on 91A08 data channels, whether or not glitches are specified in the 91A08 trigger.

In default, the GLITCHES field is turned OFF. You may turn the field ON, and so display any acquired glitch information on the 91A08 channels.

To display glitches:

1. Move the screen cursor to the GLITCHES field:

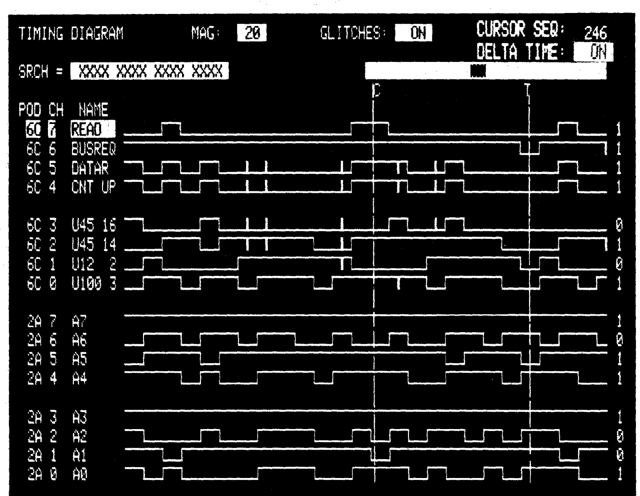
   GLITCHES [OFF]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays values in this order:

   [OFF]
   [ON]

When displayed, the glitches appear as vertical marks within the clock cycle in which they occurred. In the DAS9129 color display, glitches appear in green so that they are easily distinguished from the yellow waveforms. The following illustration shows how glitches appear on the channel traces.



3624-86A

When glitches are being displayed, it is helpful to increase the magnification of the display in order to obtain a clearer resolution.

(3) SRCH (Search) Field

The SRCH (search) field is used for searching through acquisition memory. This is accomplished by entering a value into the SRCH field, then pressing the SEARCH key on the keyboard.

With the Timing Diagram, you can do two types of searches. You can search for the next change in data values (from the memory cursor location), or you can search for a specific data word.

If you leave the SRCH field set to don't care, you can search for the next change in data values. This process is especially useful when data has been acquired with a fast internal clock rate. You can quickly move to the next area of interest, without continual scrolling.

To search for the next change in data values:

1. Leave the SRCH field in its don't care (X) default setting.

2. Press the SEARCH key.

   The DAS immediately displays a message on the second line of the screen reading SEARCHING.

   The search starts at the memory cursor location (C), and proceeds towards the end of memory looking for the next change in values. If the end of memory is encountered before a change in values, the search wraps around to the beginning of memory and continues until the memory cursor location is reached.

   If a change in data values is encountered, the DAS moves the memory cursor to that location and updates the display.

   If no change in data values is found, the DAS terminates the search and leaves the memory cursor at its original location.

In addition to searching for a change in data values, you may search for any specific data word. This word may be any combination of data and don't care values.

Entries made in the SRCH field must be made in binary. The leftmost bit of the SRCH field corresponds to the topmost displayed channel trace, while the rightmost bit corresponds to the bottom channel trace.

To search for a specific word:

1. Move the screen cursor to the SRCH field and position it over the bits you want to specify in the word. For example, the leftmost bit (top trace line):

   SRCH = [XXXX XXXX XXXX XXXX]

2. Use the data entry keys to enter 1 or 0, or press DON'T CARE (X). For example, enter 1.

   The DAS enters the value 1 at the cursor location, then shifts the cursor one space to the right.

   SRCH = [1XXX XXXX XXXX XXXX]

3. Continue entering the rest of the word value. For example, enter 011 0000 1100.

   SRCH = [1011 0000 1100 XXXX]

4. Press the SEARCH key.

   The DAS immediately displays a message on the second line of the screen reading SEARCHING.

   The search starts at the memory cursor location (C) and proceeds toward the end of memory looking for a change in data values. Once a change in data values occurs, the DAS begins its search for the specified word, wrapping around at the end of memory.

   If the word is found, the DAS moves the memory cursor (C) to that word location and updates the display.

   If the word is not found, the DAS leaves the memory cursor (C) at its original location and displays a message on the second line of the screen reading WORD NOT FOUND.

During the searching process, the DAS will respond only to the STOP key. This key stops the memory search.

In most cases, the searching process takes approximately 30 seconds.

(4) POD and CH (Channel) Fields

The POD and CH (channel) fields, located on the left side of the menu, identify which data channels are being displayed. The POD field identifies the back-panel POD ID location for the probe being used, while the CH field identifies the individual channel numbers.

Up to 16 channel traces can be displayed at one time. You may use the POD and CH fields to display any channels traces, in any order. When changes are made to the POD and CH fields, the DAS immediately updates the associated trace display.

Entering Channel Traces. When entering a channel for display, you must first specify the POD ID location of the probe to which the channel belongs. This is accomplished by entering the POD ID (bus slot number and pod connector letter) into the POD field.

To designate a specific pod:

1. Move the screen cursor to the POD field on the trace line you want to change.

   [6C]

2. Use the data entry keys to enter the desired POD ID (bus slot number and pod connector letter). For example, 2D.

   The DAS enters the POD ID into the POD field. If the trace line being changed is the top trace line, the associated CH field defaults to 7.

   [2D] [7]
   [6C] [6]

   If the line being changed is lower than the top trace line, the CH field defaults to a value one less than the CH value above the trace line.

   [6C] [7]
   [2D] [6]

   Once you have entered the POD ID, you can leave the channel number unchanged or you can enter a different one. The CH field accepts any value 7-0.

To enter a specific channel:

1. Move the screen cursor to the CH field on the trace you want to change.

   [2D] [7]

2. Use the data entry keys to enter the desired channel number 0-7. For example, 1.

   The DAS enters the channel number into the CH field.

   [2D] [1]

A special feature is provided in the CH field to let you quickly enter successive channel traces from any given pod. This is accomplished by using the INCR or DECR.

To enter successive channel traces:

1. Move the screen cursor to the CH field where you want to begin the channel sequence. For example:

   [2D] [1]

2. Press the INCR key to enter the next highest channel number, or press the DECR key to enter the next lowest channel number. For example, press DECR:

   The cursor moves to the next trace line and inserts the pod's next lowest channel number.

   [2D] [1]
   [2D] [0]

Using the above procedures you may quickly enter all channels of pod 2D in successive order. If DECR is being used, the DAS enters channels in descending order, starting with 7 (most significant channel) and ending with 0 (least significant channel). If INCR is being used, the DAS enters the channels in ascending order.

Editing Keys. Rather than entering a new trace over one that is already displayed, you may wish to insert a trace between two other traces. This may be accomplished using the ADD LINE key.

To insert a trace line:

1. Move the screen cursor to the POD or CH field on the line where you want to insert a new line. For example, pod 6C channel 6:

   [6C] [7]
   [6C] [6]

2. Press the ADD LINE key.

   The DAS inserts an empty POD and CH field at the cursor location. The trace previously at that location, as well as the following traces, all move down one line so that the bottom trace is pushed off the screen.

   [6C] [7]
   [   ] [   ]
   [6C] [6]

In addition to inserting a trace line, you may delete any trace line by using the DEL LINE or DON'T CARE key.

To delete a trace line:

1. Move the screen cursor to the POD field of the trace line you want to delete. For example, pod 4D channel 6:

   [4D] [7]
   [4D] [6]
   [4D] [5]

2. Press the DEL LINE or DON'T CARE key.

   If the DEL LINE key is pressed, the DAS deletes the trace line and moves all of the following traces up one line. The bottom trace line becomes empty.

   [4D] [7]
   [4D] [5]

   If the DON'T CARE key is pressed, the DAS deletes the trace but leaves an empty line at the cursor location.

   [4D] [7]
   [   ] [   ]
   [4D] [5]

(5) NAME Field

The NAME field is used for labeling the individual channel traces. You may enter a label for each displayed channel trace. The label may be up to six characters wide, using the data entry keys 0-9 and A-Z.

To enter a label for a specific channel trace:

1. Move the screen cursor to the NAME field associated with the channel trace. For example:

   [6C] [7] [   ]

2. Use the data entry keys to enter up to six characters 0-9 or A-Z. For example, READ:

   The DAS enters the label into the field, one character at a time.

   [6C] [7] [READ]

To remove a label from a channel trace:

1. Move the screen cursor to the NAME field associated with the channel trace. For example:

   [6C] [7] [READ]

2. Press the DON'T CARE key.

   The DAS erases the label from the field.

   [6C] [7] [   ]

You can enter up to 16 labels, one for each channel trace displayed. If you enter a POD and CH value which is already displayed and labeled, the trace's label will automatically appear on the new line. If you delete a trace, the label for that trace will also be deleted.

(6) T (Trigger), C (Cursor), and Scrolling

There are two vertical lines running through the waveform display: T (trigger) and C (cursor). These two lines are highlighted in red on the DAS9129's color display.

The T line indicates the trigger's position in memory. If the trigger is not in memory, this line will not appear.

NOTE

If ARMS acquisition data is being displayed, there will be two trigger lines: S and F. Refer to the ARMS Acquisition Display examples later in this section.

The C line indicates the memory cursor's location. The CURSOR SEQ readout in the top right corner of the screen indicates the cursor's State Table sequence location.

The binary value at the cursor sequence location appears at the end of each channel trace.

Scrolling the Display. Two methods are provided for moving the cursor within memory. Both of these methods are a function of the ◁ and ▷ scroll keys.

NOTE

The memory cursor moves simultaneously within the Timing Diagram and State Table menus. Therefore, you can always switch between the two menu displays and view the same cursor position.

The first method lets you move the cursor left or right across the display. If the cursor reaches the edge of the display, then the waveforms will scroll behind the cusor.

To move the cursor across the display:

1. Press the ◁ or ▷ scroll key.

   If ◁ is pressed, the cusor moves to the left across the display. The rate of scrolling increases the longer the key is held down.

   If ▷ is pressed, the cursor moves to the right across the display. Again, the rate of scrolling increases the longer the key is held down.

The second method for moving the cursor is afforded by scroll key's SHIFT function. This method leaves the cursor stationary on the screen and scrolls the waveform display. (This method may be used only when the MAG field is set a value greater than 1.)

To move the waveform display:

1. Press the SHIFT and ◁ keys simultaneously.

   The DAS scrolls the waveforms to the left until the end of memory is reached. The rate of scrolling increases the longer the keys are held down.

2. Press the SHIFT and ▷ keys simultaneously.

   The DAS scrolls the waveforms to the right until the beginning of memory is reached. The rate of scrolling increase the longer the keys are held down.

As the cursor is moved through memory, the CURSOR SEQ readout at the top of the menu changes to reflect the new cursor position.

7 DELTA TIME Field Firmware version 1.07 & up

The DELTA TIME is used to make timing measurements.

To turn DELTA TIME on:

Press the SELECT key. When the field is turned ON, a marker line (M) appears at the cursor (C) position. As the cursor is scrolled away from the marker, the distance between C and M is computed and displayed on the screen.

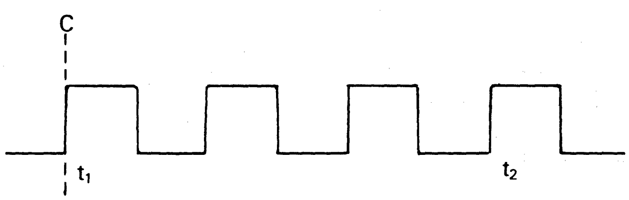
If the DAS internal clock was used for the acquisition, the distance is computed in nanoseconds, microseconds, or milliseconds -- depending on the clock rate specified. The distance is computed in sequences if an external clock was used for acquisition, if an ARMS mode was used, or if any qualifiers were specified.

MAKING TIMING MEASUREMENTS
Firmware version 1.05 & below

The following procedures describe how to make a timing measurement between two given locations (t_1 and t_2) in the waveform display.

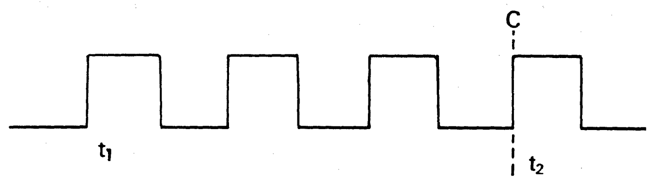
To make timing measurements:

1. Move the memory cursor (C) to location t_1.



2. Note the CURSOR SEQ value in the top right corner of the screen.

3. Move the memory cursor (C) to location t_2.



4. Note the CURSOR SEQ value in the top right corner of the screen.

5. Subtract the CURSOR SEQ values:

   $t_2 - t_1 = \Delta$**t**.

6. Multiply the value Δt by the clock rate used in acquiring data:

   Δt x clock rate = T

7. The value T equals the elapsed time between locations t_1 and t_2.

ARMS ACQUISITION DISPLAY

When the ARMS mode is used in the Trigger Specification menu, data is acquired at two different clock rates. In the Timing Diagram menu, the proper time relationship is incorporated in the display. Figure 6-5 illustrates a Timing Diagram menu display of ARMS mode data.

As shown in this figure example, the Timing Diagram menu stretches out the slow-clocked data to show the proper time relationship with the fast-clocked data in the overlap area of the display. The slow-clock cycles are based on an average scaling factor from the overlap area, and thus appear in regulated cycles (even though an irregular external clock was used).

At lower magnification levels, the display is usually fuzzy due to the amount of data being shown. The magnification level should be increased for higher resolution.

The menu provides two trigger lines: S, representing the trigger word for the slow-clocked data; and F, representing the trigger word for the fast-clocked data.

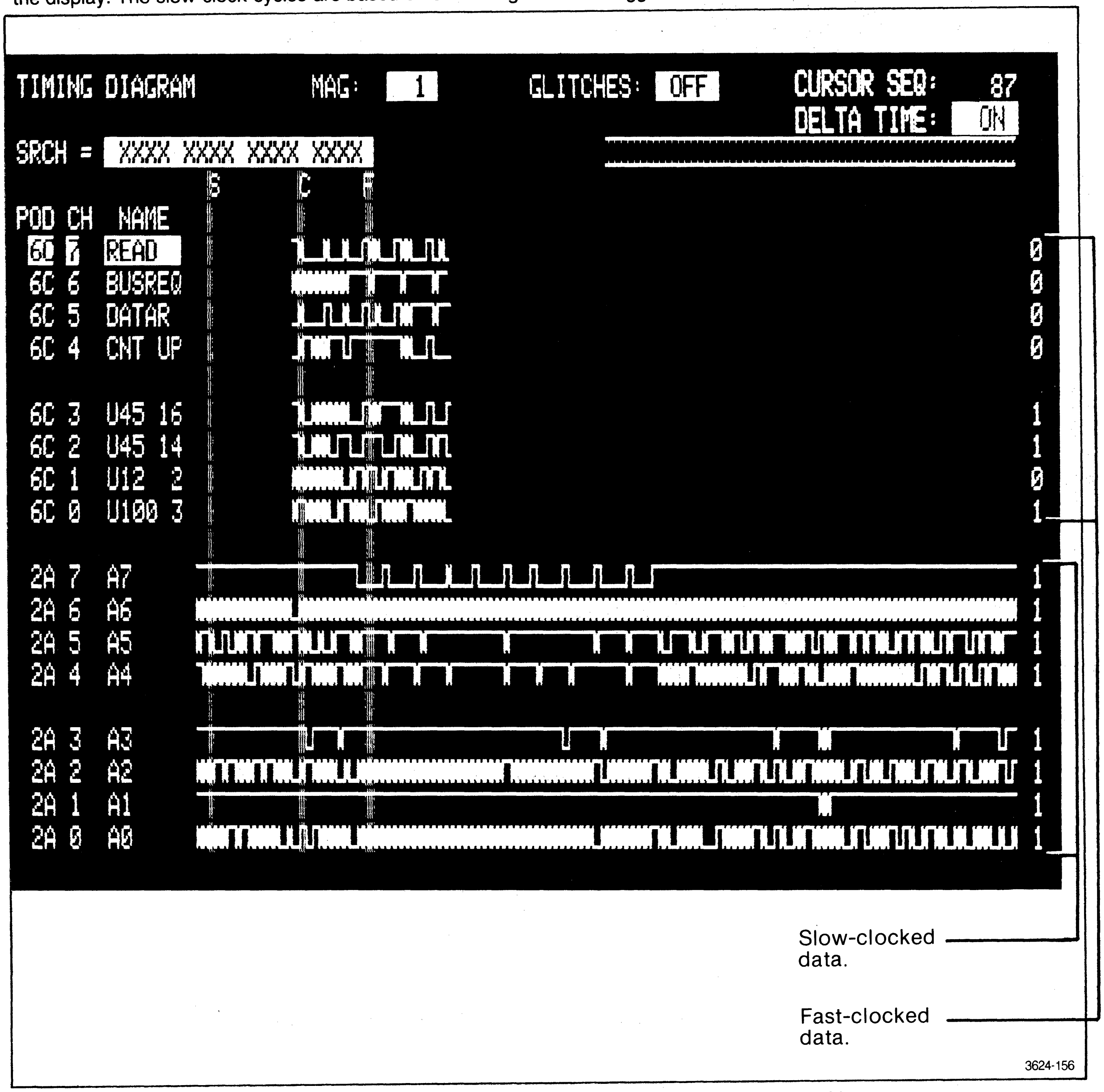


Figure 6-5. Timing Diagram display of successful ARMS mode acquisition.

If the slow- and fast-clocked memories do not overlap, the Timing Diagram menu shows a fence display. As shown in Figure 6-6, a fence appears in the middle of the display, separating the slow- and fast-clocked data.

NOTE

Refer to the Trigger Specification Menu section of this manual for information on how to properly set up an ARMS mode acquisition.

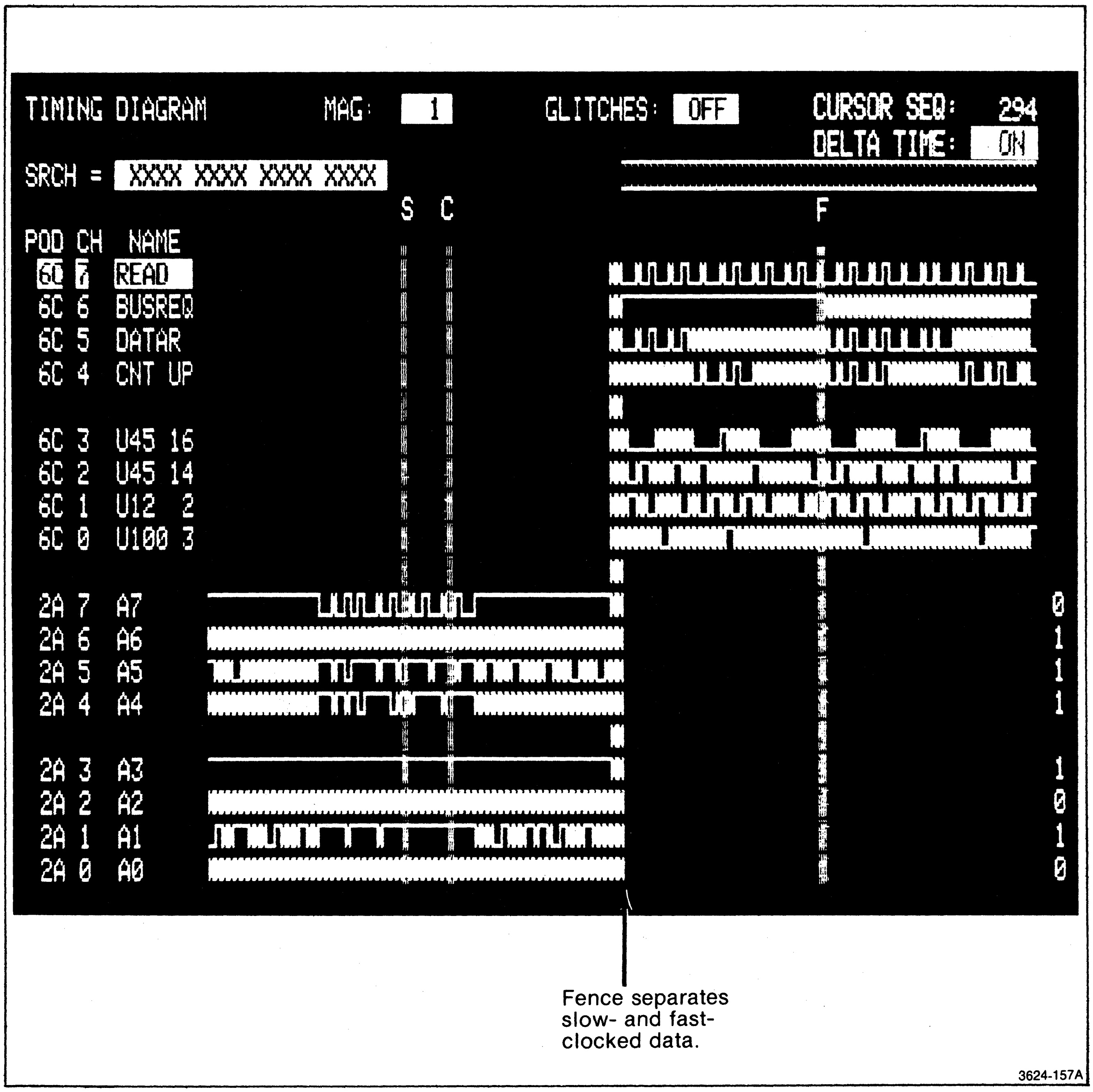


Figure 6-6. Timing Diagram menu's fence display of ARMS mode acquisition.

DEFINE MNEMONICS MENU 7

This menu is designed to support the data acquisition functions. While the menu may be displayed on the monitor screen at any time, it is useful only if data acquisition modules are installed in the mainframe.

This section describes the Define Mnemonics menu and its functions. Before reading this section, you should first read the Operating Instructions section of this manual for an overview on keyboard controls and menu characteristics.

In this section you will find: **Page**

DEFINE MNEMONICS MENU

The Define Mnemonics menu is used to set up disassembly tables for the State Table display. With this menu, you can define up to 256 mnemonics and control the disassembly of the State Table.

Figure 7-1 illustrates how the Define Mnemonics menu works. First, the Define Mnemonics menu reads the Channel Specification menu to find out how the data channels are grouped together. It then provides a mnemonic table for each valid channel group A-F or 0-9. A valid channel group must have at least one and no more than 32 assigned channels.

You can enter the total of 256 mnemonic definitions under one group table, or you can divide them between several. When the mnemonics are read out on the State Table, they will appear adjacent to their assigned group columns.

Figure 7-2 shows the display relationships between the Define Mnemonics, Channel Specification, and State Table menus.

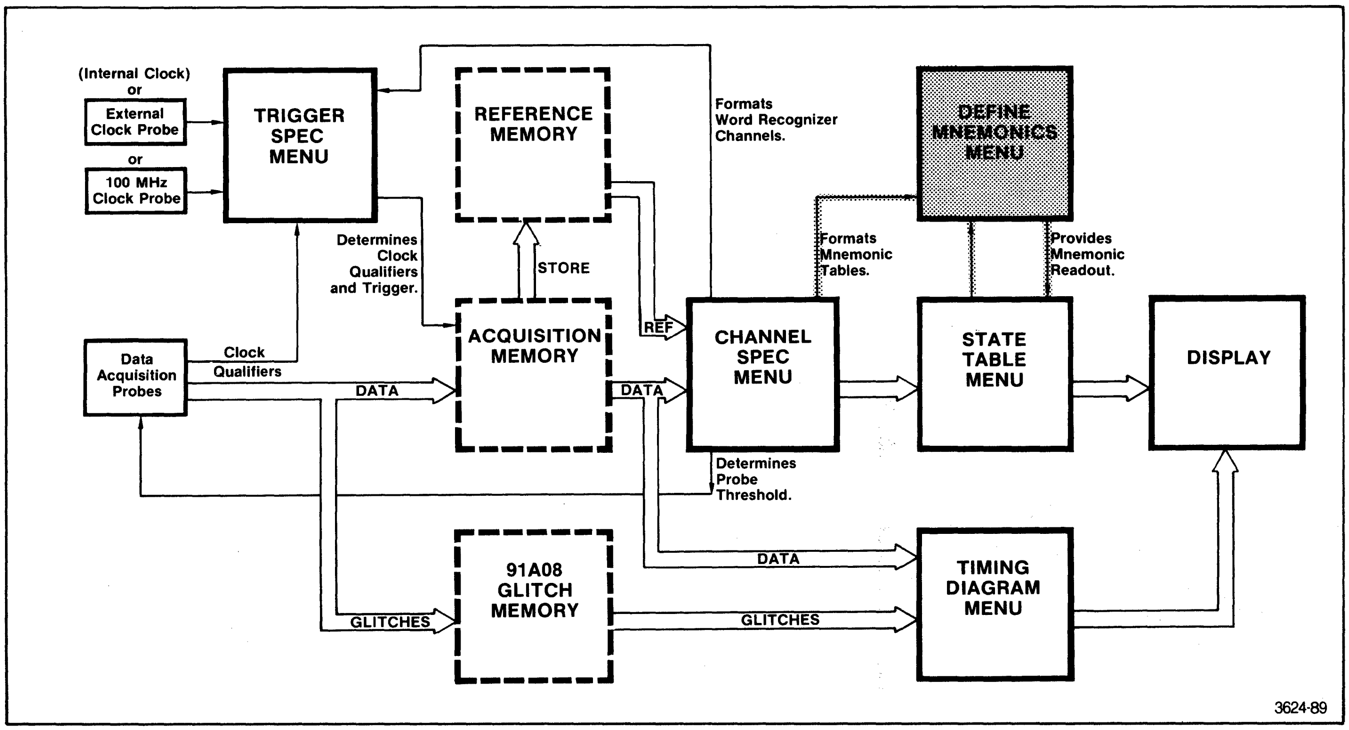


Figure 7-1. Functional overview of the Define Mnemonics menu. This menu reads the channel group information from the Channel Specification menu and provides a mnemonic table for each valid group. The mnemonic tables then appear in the State Table display.

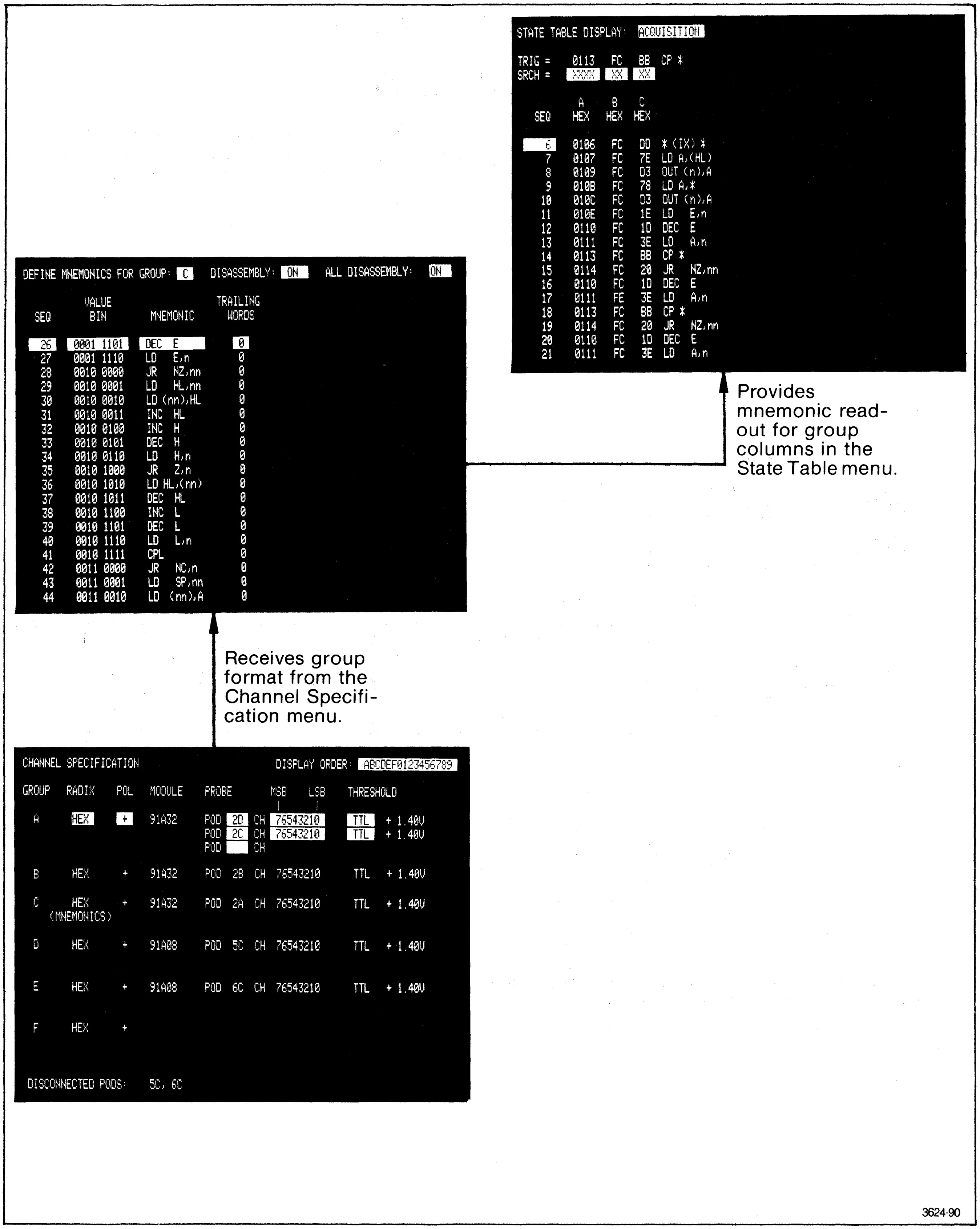


Figure 7-2. The effect of the Define Mnemonics menu on the Channel Specification and State Table menus. When the mnemonics are read out on the State Table, they appear next to their assigned group columns.

MENU DEFAULT DISPLAY

At system power up, the Define Mnemonics menu is empty. To enter mnemonic definitions, you must display the menu on the DAS screen by pressing the DEFINE MNEMONICS key.

Figure 7-3 illustrates a typical default display of this menu. In this example, the menu is displaying the table for group A. The menu displays only one group table at a time.

READING THE MENU

Refer to the example display in Figure 7-3 when reading the following paragraphs.

The menu title, DEFINE MNEMONICS, is located in the top left corner of the screen. The line directly below this title is always reserved for any highlighted error or user-prompter messages.

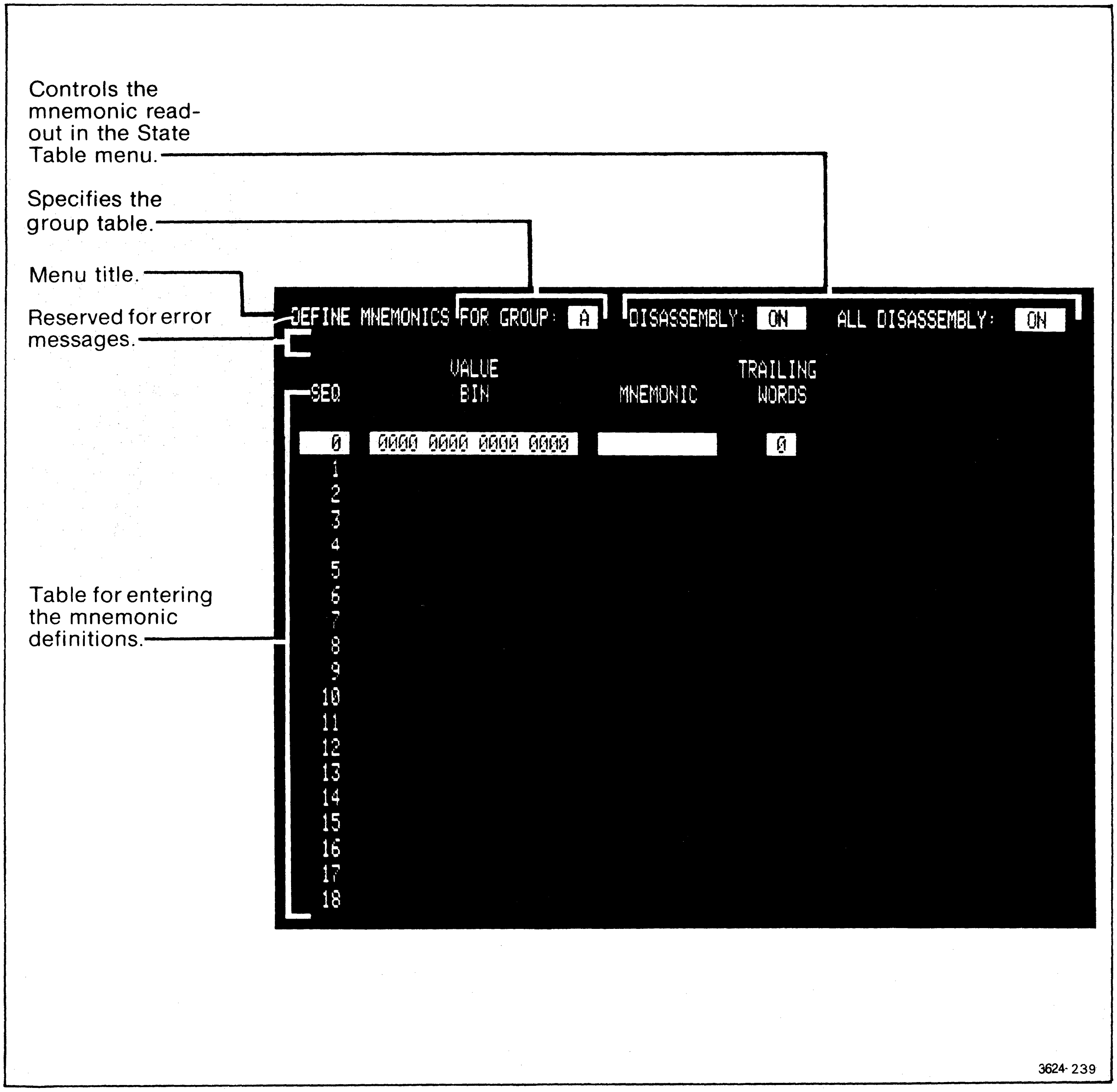


Figure 7-3. Default display of the Define Mnemonics menu. The menu provides group tables for entering data values and their associated mnemonics. Only one group table is displayed at one time (in this example, group A).

Next to the menu title is the FOR GROUP field. This field is used to select the individual group tables A-F or 0-9. If the group in this field is changed, the rest of the menu changes to provide that group's table.

The group table begins on the third line of the screen. This table consists of four column headings, each of which is a field. They include: SEQ (sequence), VALUE, MNEMONIC, and TRAILING WORDS. Each line of the table corresponds to one mnemonic definition.

Finally, in the top right corner of the display, the menu provides two more fields for controlling the group's disassembly on the State Table. These two fields are DISASSEMBLY and ALL DISASSEMBLY.

MENU FIELDS AND VALUES

The following paragraphs show how to select a specific group table and set up mnemonic disassembly. They discuss each menu field and explain their optional values.

Figure 7-4 illustrates the Define Mnemonics menu and its fields. Refer to the numbered callouts in this figure when reading the following paragraphs. The fields, which appear on the screen in reverse video, are designated throughout the text by brackets [ ]. The screen cursor moves from field to field in any direction, and is controlled via the four directional cursor keys and the NEXT key.

(1) FOR GROUP Field

The FOR GROUP field is used to specify which group table you want to define. There are 16 group tables, labeled A-F and 0-9. You may specify any one of these, provided it has been assigned at least one and no more than 32 channels. These channel assignments are made in the Channel Specification menu.

A group is entered in the FOR GROUP field by using the data entry keys. If the entered group has an acceptable number of channels, the display will then change to that group's table. If the group does not have an acceptable number of channels, however, an error message will appear on the second line of the display reading GROUP CANNOT HAVE A TABLE.

To specify a group table:

1. Move the screen cursor to the FOR GROUP field.

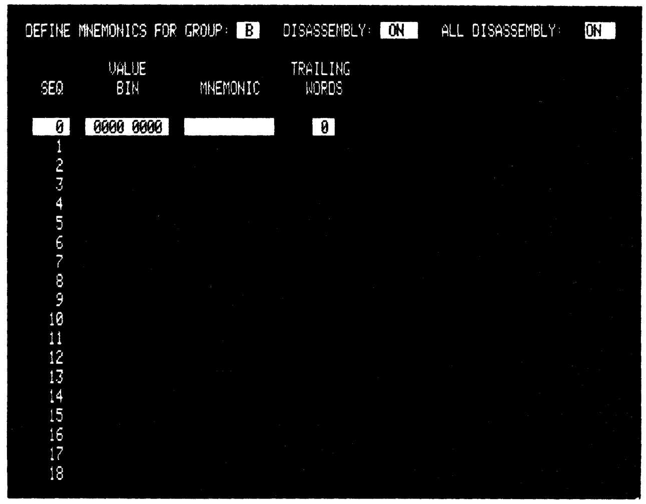
   DEFINE MNEMONICS FOR GROUP [A]

2. Use the data entry keys to enter any value A-F or 0-9. For example, B.

   If this group contains at least one and no more than 32 channels, the DAS enters the group into the FOR GROUP field and updates the rest of the menu.

   DEFINE MNEMONICS FOR GROUP [B]

The following illustration shows how the menu appears when group B is exchanged for group A. If you compare this display with the one shown in Figure 7-4, you can see that the menu has updated the group table to match the channel configuration of group B.



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(2) SEQ (Sequence) Field and Table Editing

The SEQ (sequence) field consists of the numbers running down the left side of the display. Each sequence corresponds to one mnemonic definition. For every sequence there is one VALUE, one MNEMONIC, and one TRAILING WORDS field.

Altogether, there are 256 sequences labeled 0-255. Only nineteen of these sequences appear on the display at one time.

Several methods are provided for viewing more sequence lines. The first method is provided by the scroll keys. These keys can be used at any time and in any field.

To scroll through the sequence lines:

1. Press Δ or ∇.

   The DAS scrolls the sequence lines up or down the display.

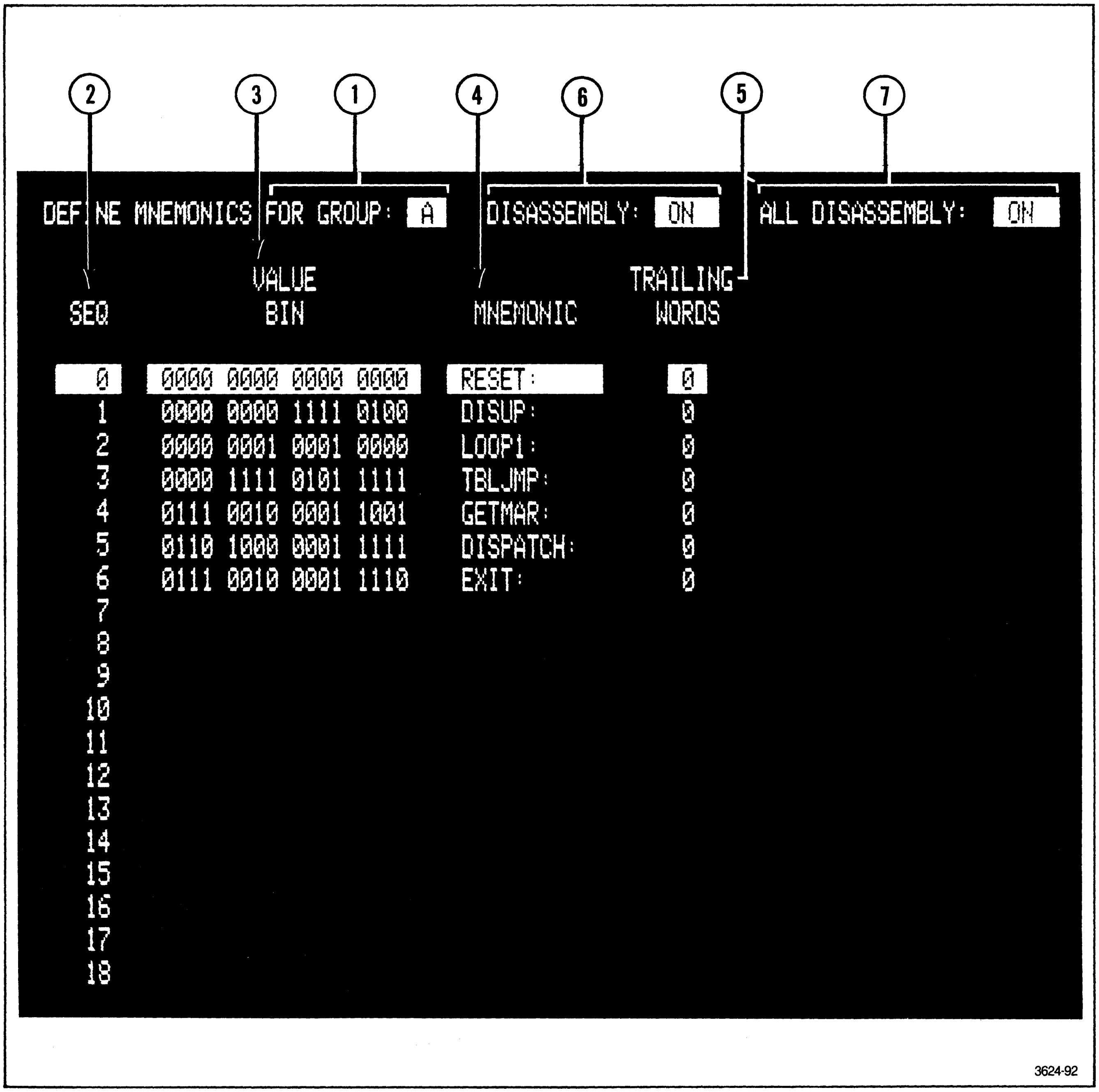


Figure 7-4. The Define Mnemonics menu and its fields.

A second method for moving the sequence lines is provided by the SEQ field. Using this field, you can jump forward or backward to specific blocks of sequence lines.

To move forward to higher numbered sequences:

1. Move the screen cursor to the sequence number you want to change. For example, 11:

   [11]

2. Use the data entry keys to enter the sequence number you want to display. For example, 200.

   The DAS displays sequence 200 in place of sequence 11, and then updates the rest of the sequences following that position. For example:

```
   0
   1
   2
   3
   4
   5
   6
   7
   8
   9
  10
[ 200 ] Sequence 11 is changed to 200 and the rest
  201   of the sequences update from that position
  202   to the bottom of the display.
  203
  204
  205
  206
  207
```

To move backward to lower numbered sequences:

1. Move the screen cursor to the sequence number you want to change. For example, 200.
   [200]
2. Press the DON'T CARE key.
   The DAS displays a 0 in place of sequence 200.
   [0]
3. Use the data entry keys to enter the sequence number you want to display. For example, 22.

   The DAS displays sequence 22 in place of 0, and then updates the rest of the sequences following that position. For example.

```
   0
   1
   2
   3
   4
   5
   6
   7
   8
   9
  10
[ 22 ] Sequence 200 is changed to 22 and the rest
  23   of the sequences are updated from that
  24   position.
  25
  26
  27
  28
  29
```

When using these procedures to move forward or backward through the sequence lines, there are two rules you must follow. First, the sequence number you enter at the cursor location must be a number which is larger than the number directly above the cursor location. Second, the entered sequence number cannot be greater than 255.

Adding and Deleting Sequence Lines. Two editing functions are provided for the mnemonic table. These two functions include adding and deleting sequence lines.

To add a sequence line:

1. Move the screen cursor to the sequence line where you want to add a new line. For example, SEQ 0:

```
[ 0 ] [ 1011 001  ] [ JUMP ] [ 0  ]
```

2. Press the ADD LINE key.

   The DAS moves the values associated with SEQ 0 down one line, and inserts a new empty line at the cursor location.

```
[ 0 ] [ 0000 0000 ] [      ] [ 0  ]
  1     1011 0001     JUMP     0
```

If a value is entered on SEQ 255, the DAS will not add a new sequence line. Rather, an error message appears on the second line of the screen reading ADD LINE WOULD ELIMINATE SEQ 255. To add a new line when SEQ 255 is full, you must first delete a sequence line.

To delete a sequence line:

1. Move the screen cursor to the sequence line you want to delete. For example SEQ 0.

```
[ 0 ] [ 0000 0000 ]          [ 0  ]
  1     1011 0001     JUMP     0
```

2. Press the DEL LINE key.

   The DAS deletes that line from the table, and moves all following sequences up one line.

```
[ 0 ] [ 1011 0001 ] [ JUMP ] [ 0  ]
```

(3) VALUE Field

The VALUE field is used to enter the data words to be recognized as mnemonics. Up to 256 values, maximum, may be entered in the tables. All 256 values can be entered under one table, or they can be divided between several.

If you attempt to enter more than 256 values, an error message appears on the second line of the screen reading 256 VALUES EXCEEDED.

The values must be entered in a binary radix and can be any combination of high (1), low (0), and don't care. For convenience, Table 7-1 provides a radix conversion chart.

Table 7-1
Radix Conversion Chart

Hexadecimal	Octal	Binary	Decimal
0	0	0000	0
1	1	0001	1
2	2	0010	2
3	3	0011	3
4	4	0100	4
5	5	0101	5
6	6	0110	6
7	7	0111	7
8	10	1000	8
9	11	1001	9
A	12	1010	10
B	13	1011	11
C	14	1100	12
D	15	1101	13
E	16	1110	14
F	17	1111	15

The number of programmable bits provided in the VALUE field is determined by the number of channels assigned to the table's associated channel group. For example, if the group A is assigned with 16 channels, 16 bits will appear in the VALUE field.

In default, the VALUE field associated with SEQ 0 is set to a binary low (0) state. You may leave this value, or you may change it to any other combination of high (1), low (0) or don't care states.

To enter a data value:

1. Move the screen cursor to the VALUE field and position it over the bits you want to change. For example, position the cursor over the leftmost bit.

   [0000 0000]

2. Use the data entry keys to enter a 1 or 0, or press the DON'T CARE key. For example, enter 1.

   The DAS enters the value at the cursor location, then moves the cursor one space to the right.

   [1000 0000]

In addition to entering values one bit at a time, the menu provides a method for quickly incrementing or decrementing them. This method involves the use of the INCR and DECR keys.

To increment or decrement values:

1. Move the screen cursor to any bit location in the VALUE field.

   [1000 0000]

2. Press the INCR or DECR key.

   If the INCR key is pressed, the DAS increments the value by 1.

   [1000 0001]

   If the DECR key is pressed, the DAS decrements the value by 1.

   [0111 1111]

Another special feature is provided for entering successive, incrementing data values. This feature is provided by the NEXT key. When the NEXT key is pressed, the screen cursor moves to the MNEMONIC field. Then, when the key is pressed again, the cursor moves to the next lowest VALUE field and enters an incremented data value.

To use the NEXT function:

1. Enter a VALUE and a MNEMONIC. For example:

   [1000 0011] [JUMP]

2. Now, with the screen cursor in the MNEMONIC field, press the NEXT key.

   The DAS moves the screen cursor to the VALUE field on the next line, then automatically enters an incremented value.

   [1000 0011] [JUMP]

   [1000 0100] [ ]

With the features of the VALUE and MNEMONIC fields, you can quickly enter a table of mnemonic definitions.

(4) MNEMONIC Field

Once a bit value has been entered, the MNEMONIC field is used to enter that value's corresponding mnemonic definition. The mnemonic may be up to 10 characters wide.

When entering the mnemonic, you may use any characters A-Z and 0-9. You can also use any of the DAS 9100 Character Set symbols. The character set is accessible through the SHIFT/SELECT key function.

NOTE

Procedures for accessing the DAS Character Set are provided in Appendix B of this manual.

To enter a mnemonic definition:

1. Move the screen cursor to the MNEMONIC field.

   [1011 0001] [ ]

2. Use the data entry keys A-Z and 0-9, or the SHIFT/SELECT function to enter the desired mnemonic. For example JUMP.

   The DAS displays the entered value in the field.

   [1011 0001] [JUMP]

   The data value of 1011 0001 is now assigned the mnemonic definition of JUMP.

A special feature is provided with the MNEMONIC field. If you move the screen cursor down the MNEMONIC field column and make successive entries, the corresponding VALUE fields will automatically enter successive incremented data values.

To remove a mnemonic:

1. Move the screen cursor to the MNEMONIC field.

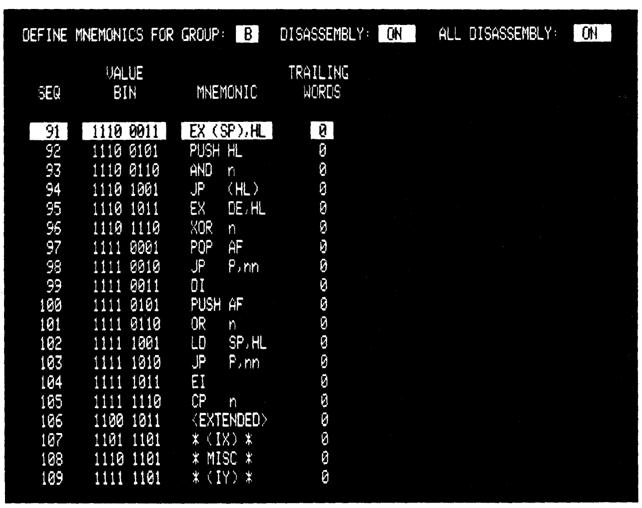
   [1011 0001] [JUMP]

2. Press the DON'T CARE key.

   The DAS removes the mnemonic definition.

   [1011 0001] [ ]

The following illustration shows a typical mnemonic table.


DEFINE MNEMONICS FOR GROUP: B DISASSEMBLY: ON ALL DISASSEMBLY: ON

SEQ	VALUE BIN	MNEMONIC	TRAILING WORDS
91	1110 0011	EX (SP),HL	0
92	1110 0101	PUSH HL	0
93	1110 0110	AND n	0
94	1110 1001	JP (HL)	0
95	1110 1011	EX DE,HL	0
96	1110 1110	XOR n	0
97	1111 0001	POP AF	0
98	1111 0010	JP P,nn	0
99	1111 0011	DI	0
100	1111 0101	PUSH AF	0
101	1111 0110	OR n	0
102	1111 1001	LD SP,HL	0
103	1111 1010	JP P,nn	0
104	1111 1011	EI	0
105	1111 1110	CP n	0
106	1100 1011	<EXTENDED>	0
107	1101 1101	* (IX) *	0
108	1110 1101	* MISC *	0
109	1111 1101	* (IY) *	0

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(5) TRAILING WORDS Field

The TRAILING WORDS field adds another dimension to the mnemonic table. It lets you specify whether a given mnemonic definition applies to more than one data value.

Many assembly languages use a series of data words for one instruction. Therefore, you may wish to specify a mnemonic on the first word of the series, then disable disassembly on the rest of the series. With the TRAILING WORDS field, you may disable disassembly on up to 9 trailing words.

To designate trailing words:

1. Move the screen cursor to the TRAILING WORDS field.

   [1000 0011] [JUMP] [0]

2. Use the data entry keys to enter a value up to 9. For example, 2.

   The DAS enters the value in the field.

   [1000 0011] [JUMP] [2]

Now, when the mnemonic JUMP appears on the State Table, the next two data words following the mnemonic will be disabled from the disassembly. Figure 7-5 illustrates the effect of trailing words.

(6) DISASSEMBLY Field

The DISASSEMBLY field is used to control the group table's disassembly on the state table. This field affects only the group table specified in the FOR GROUP field.

NOTE

Turning off the disassembly for one group table does not affect the other group tables.

To control the individual group table's disassembly:

1. Move the screen cursor to the DISASSEMBLY field.

   DISASSEMBLY: [ON]

2. Press the SELECT key.

   The DAS displays optional values in this order:

   [ON]
   [OFF]

(7) ALL DISASSEMBLY Field

The ALL DISASSEMBLY field is used to specify whether any of the group tables are disassembled. This field, no matter which group table is currently displayed, will turn on or off all table disassembly.

To turn off all group table disassembly:

1. Move the screen cursor to the ALL DISASSEMBLY field.

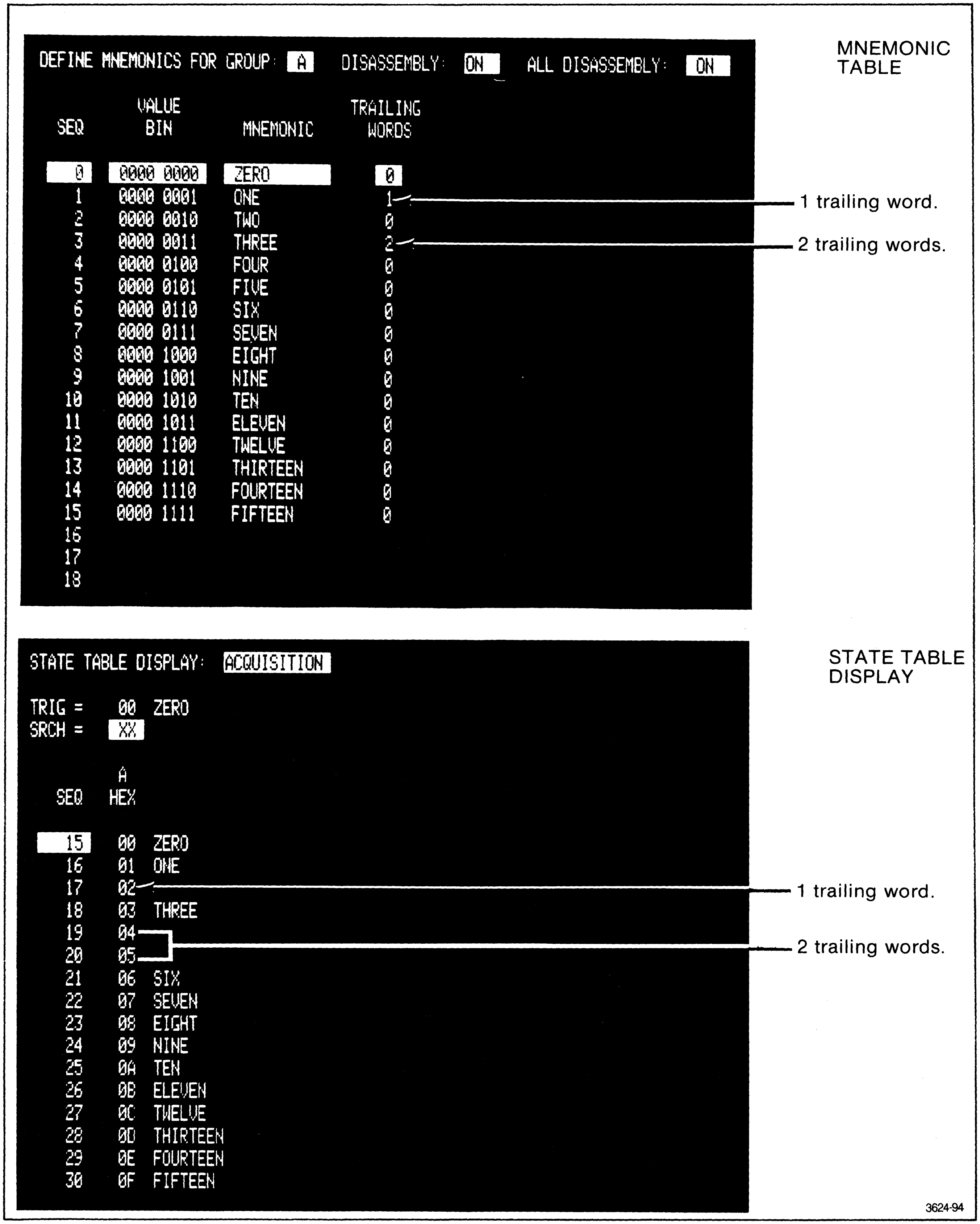


Figure 7-5. Disassembly of trailing words. The State Table disables disassembly on the specified number of trailing words.

ALL DISASSEMBLY: [ON]

2. Press the SELECT key.

   The DAS displays optional values in this order:

   [ON]
   [OFF]

If this field is turned OFF, no mnemonics are available for display on the State Table. If turned ON, all available group tables (as specified by the DISASSEMBLY field) are displayed on the State Table.

MNEMONIC READOUT ON THE STATE TABLE

The following paragraphs describe how the State Table uses the mnemonic tables when disassembling data. They also describe how changes in the Channel Specification menu may affect existing mnemonic tables.

TABLE ORGANIZATION

When a group table is assigned mnemonics, those mnemonic values are stored sequentially by bit significance and don't care masks. A don't care has the highest value, then 1, and finally 0. The mnemonic with the least significant bit value is stored first.

NOTE

The order in which mnemonics are stored and used by the State Table is solely dependent on the mnemonic's bit value. The order in which mnemonics are entered into the table does not affect their order of disassembly.

The following list of mnemonic values illustrates how the bit significance is used in determing their order of disassembly.

Entered Values		**Order of Disassembly**	
IOT	0000	IOT	0000
JUMP	X110	FETCH	0001
NOP	0111	NOP	0111
FETCH	0001	READ	100X
READ	100X	JUMP	X110

During disassembly, the mnemonic table is searched sequentially. This ensures that specific bit values are found before any values containing don't care masks.

USING DON'T CARE VALUES

When entering a mnemonic value, don't cares may be used to mask out bits during disassembly. For example, if you have entered:

XXXX 0011 JUMP

The State Table only cares about the four least significant bits of the data word when assigning the JUMP mnemonic; the upper four bits can be any data combination.

When using don't cares you should be aware that the State Table always gives priority to specified bit values over don't cares. For example, if you have entered:

XXXX 0011 JUMP
0000 0011 ADD

The State Table menu will assign the ADD mnemonic (rather than the JUMP mnemonic) to the value of 0000 0011. If the value is 0001 0011, the JUMP mnemonic is assigned.

The State Table menu also gives priority to the least significant bit. For example, if you have entered:

0000 000X JUMP
X000 0000 ADD

The State Table menu will assign the JUMP mnemonic (rather than the ADD mnemonic) to the value of 0000 0000.

DUPLICATE VALUES

If you enter the same value more than once in the same table, the DAS displays a message on the second line of the screen reading DUPLICATE VALUE. This is a prompter message only, and you may disregard it if you prefer.

If you leave duplicate values in the table, the State Table will disassemble using the mnemonic associated with the first entered value. For example, if you have entered:

0000 0000 JUMP
0000 0000 ADD

The State Table menu will assign JUMP to all values of 0000 0000. The ADD mnemonic is ignored.

REORGANIZING CHANNELS

Once a mnemonic table has been defined for a channel group, changes to that group in the Channel Specification menu may affect the table's disassembly. The following paragraphs describe the effect of reorganizing, adding, or deleting the channels of a defined group.

Throughout this discussion, it is assumed that the changes made to the channels do not violate the criteria of at least 1 and no more than 32 channels per defined group.

NOTE

At all times the defined channel group must be assigned with at least one and no more than 32 channels. If changes are made in the Channel Specification menu to violate these criteria, the group's defined table will be deleted the next time the Define Mnemonics menu is entered.

Reorganizing Channels. The reorganization of channels within a defined group does not affect the mnemonic table.

Adding Channels. When channels are added to a defined group, a corresponding number of bits is added to the mnemonic table (so long as they do not exceed 32 channels maximum). The value of the added bits is zero (0).

Deleting Channels. When channels are deleted from a defined group, a corresponding number of bits are masked out in the mnemonic table display. These bits are not deleted from the stored table, however, and are still used in determining the sequential order of disassembly.

For example, if you had entered the following mnemonic values:

Entered Values		Order of Disassembly	
FETCH	0001 0011	FETCH	0001 0011
WRITE	100X 0011	WRITE	100X 0011
IO	X001 0011	IO	X001 0011

Then deleted for channels:

Entered Values		Order of Disassembly	
FETCH	0011	FETCH	0001 0011
WRITE	0011	WRITE	100X 0011
IO	0011	IO	X001 0011

The four bits associated with those values are masked out in the table display. They are not deleted from the stored table, however, and so are still used in determining the sequential order of disassembly.

Now, if values are added to the table, they are automatically given four upper bits to match the number of bits in the stored table (even though these bits do not appear on the display). These four bits are set to 0.

For example, if you added the mnemonic value of READ 0011 to the table, this value would be stored as:

Entered Values		Order of Disassembly	
FETCH	0011	READ	0000 0011
WRITE	0011	FETCH	0001 0011
IO	0011	WRITE	100X 0011
READ	0011	IO	X001 0011

Because the four upper bits of the READ value are automatically set to 0, the mnemonic is stored in the table before 0001 0011,100X 0011, and X001 0011.

PATTERN GENERATOR MENU 8

This menu is designed to support DAS pattern generator functions. The menu may be displayed on the monitor screen only if a 91P16 Pattern Generator module is installed in the mainframe.

This section describes the Pattern Generator menu and its functions. Before reading this section, you should first read the Operting Instructions section of this manual for an overview of keyboard controls and menu characteristics. You should also read the Start and Stop section for procedures on how to start and stop the pattern generator.

In this section you will find: **Page**

PATTERN GENERATOR MENU

SIGNAL CHARACTERISTICS

The purpose of the pattern generator is to exercise a system under test. The pattern generator outputs clock and data signals which can be used to simulate circuit bus activity, or to directly stimulate circuit elements. At the same time, it interacts with the system under test by responding to external interrupt, pause, and inhibit signals.

Figure 8-1 illustrates the basic functions of the pattern generator and its input and output signals. The characteristics of these signals are set up and enabled via the Pattern Generator menu.

CLOCKING

The pattern generator is associated with two types of clocks: the master input clock and the output clocks.

The pattern generator's master input clock controls the rate of the output clock and data. The master clock may be the DAS internal clock or the rising or falling edge of an external clock source. The external clock is supplied via the External Clock Probe's PG CLK line (from the Trigger/Time Base Module). The maximum rate of the clock is 25 MHz.

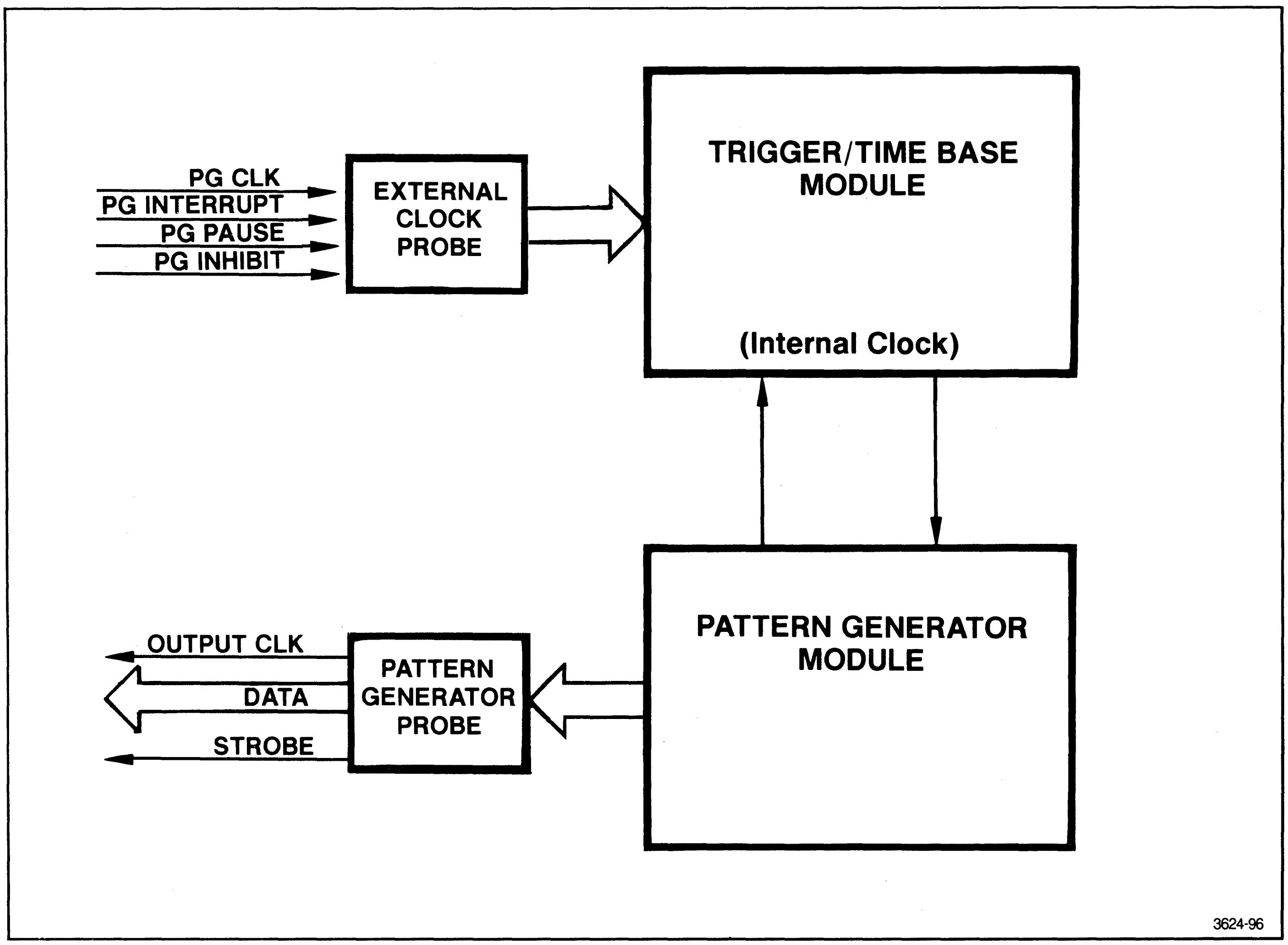


Figure 8-1. Functional overview of the Pattern Generator menu. This menu controls the pattern generator's data and clock output, and enables external signals.

The output clock signals are derived from the master input clock. The output clock's rising edge is synchronized with the selected master clock edge, whether rising or falling. For example, Figure 8-2 illustrates how the output clock is derived from an external master clock.

Each pattern generator probe provides one output clock line, labeled CLK.

DATA OUTPUT

Data output from the pattern generator is parallel on all channels. This data is tied to the output clock signal. All data transitions occur synchronously with the output clock's rising edge.

Figure 8-3 illustrates the relationship between data and clock signals.

Each pattern generator probe provides eight data channels, labeled 0-7.

STROBES

The pattern generator's strobes serve as extra output clock signals. These signals are programmable within the clock-cycle boundaries. The strobe's delay from the clock edge is programmable, as are its width and its shape (high or low).

Figure 8-4 illustrates the programmable elements of the strobe output signals.

Each pattern generator probe provides one output strobe line, labeled STRB.

INTERRUPT, PAUSE, AND INHIBIT

During operation, the pattern generator responds to three types of external signals:

- **Interrupt**—which can be used to interrupt the pattern generator and call a program routine.
- **Pause**—which can be used to temporarily halt the pattern generator.
- **Inhibit**—which can be used to temporarily tri-state the pattern generator probes.

All three of the signals are supplied by the Trigger/Time Base Module's External Clock Probe.

SUB-MENU SELECTION

The Pattern Generator menu consists of the following two sub-menu displays:

- **Program**—which is used to program clock and data outputs to the pattern generator probes, and to enable and assert any strobe lines. Also, this sub-menu is used to enable the interrupt, pause, and inhibit signals.
- **Timing**—which is used to set up the characteristics of the strobes asserted in the Program sub-menu. It is also used to select the pattern generator's start mode.

When the PATTERN GENERATOR menu key is first pressed after power-up, the Program sub-menu appears on the screen. You may enter the Timing sub-menu by moving the screen cursor to the field located next to the menu title and pressing the SELECT key.

To change sub-menu displays:

1. Move the screen cursor to the field directly to the right of the menu title.

   PATTERN GENERATOR: [PROGRAM]

2. Press the SELECT key until the desired sub-menu rotates to the field.

   [PROGRAM]
   [TIMING]

Only one sub-menu appears on the screen at a time.

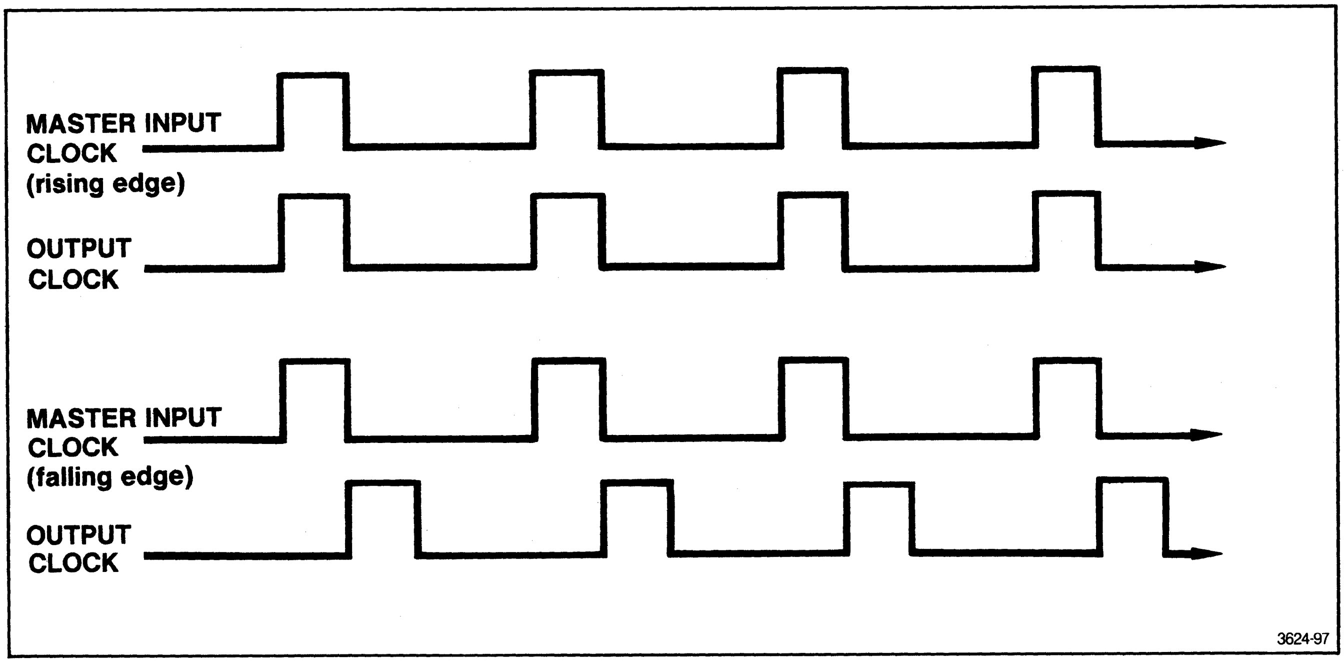


Figure 8-2. Output clock from the pattern generator. The rising edge of the output clock is derived from the pattern generator's master input clock, whether rising or falling edge.

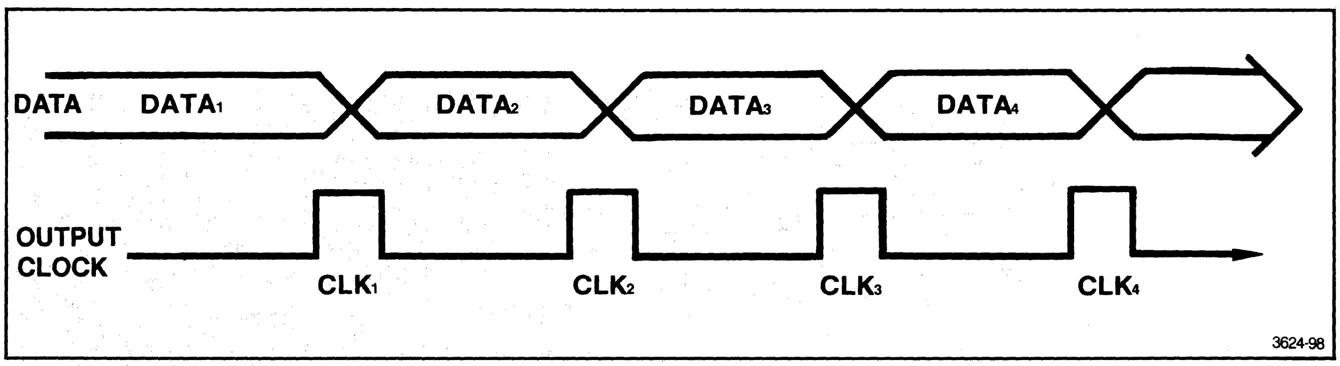


Figure 8-3. Clock and data output from the pattern generator. The data transitions are tied to the rising edge of the output clock signals.

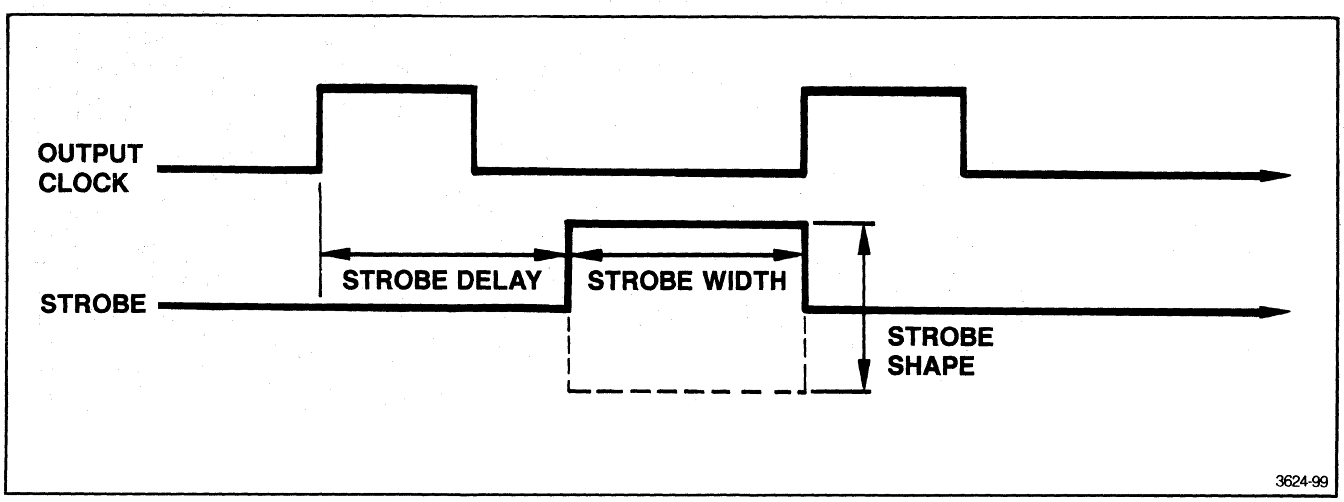


Figure 8-4. Strobe output from the pattern generator. The strobe's delay from the clock edge is programmable, as are its width and its shape.

PROGRAM SUB-MENU DEFAULT DISPLAY

Figure 8-5 illustrates a typical default display of the Program sub-menu. In this example the DAS is configured with one 91P16 Pattern Generator Module. You may also use one or two 91P32 Pattern Generator Expander Modules.

The menu title, PATTERN GENERATOR, appears in the top left corner of the screen. The field directly to the right of the title indicates which sub-menu is being displayed (in this example, PROGRAM).

READING THE SUB-MENU

Refer to figure 8-5 when reading the following paragraphs.

The line directly below the menu title is reserved for any highlighted error or prompter messages which might occur.

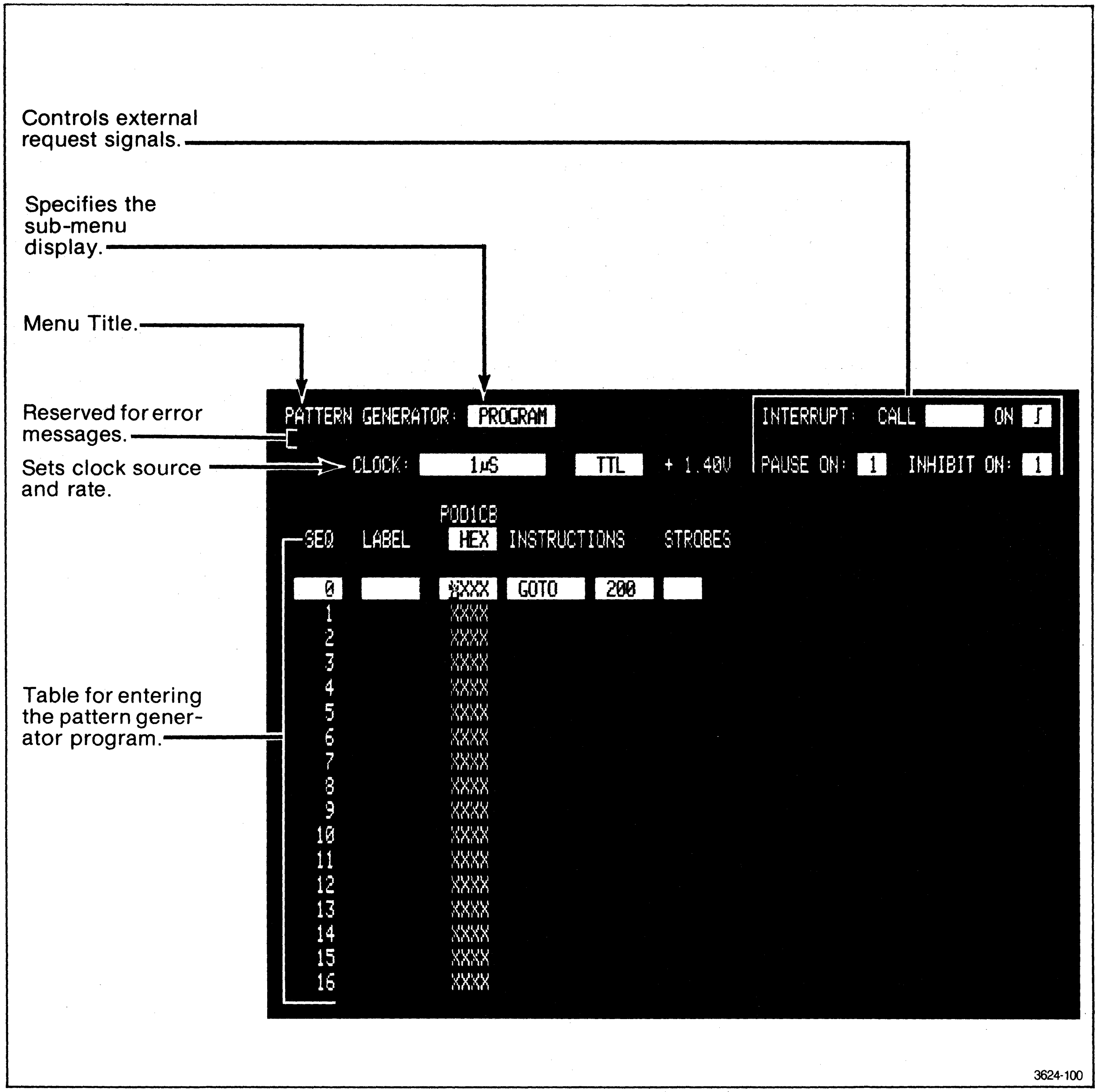


Figure 8-5. Default display of the pattern generator's Program sub-menu. This sub-menu controls the clock, data, and strobe output, and enables external signals.

On the third line of the display is a CLOCK field. This field specifies the pattern generator's master input clock, either internal or external. In default, this field is set to the DAS internal clock at 1 μs intervals.

Directly to the right of the CLOCK field is a field for setting the threshold for the External Clock Probe (connected to the Trigger/Time Base Module). The External Clock Probe supplies the pattern generator's external clock line and external interrupt, pause, and inhibit lines.

In the top right portion of the screen, fields are provided for enabling the interrupt, pause, and inhibit signals. In default, the INTERRUPT field is off, while the PAUSE and INHIBIT fields are set to recognize a high (1) logic state.

Beginning with the fifth line of the display, the sub-menu provides a columnar table for entering the pattern generator's output program. The table consists of five columns, each of which is a field. SEQ (sequence), LABEL, POD, INSTRUCTIONS, and STROBES. In default, the table is loaded with the probe self-test routine.

PROBE SELF-TEST ROUTINE

When the DAS is first powered up, the Pattern Generator menu is loaded with an 8-bit probe self-test routine. This routine starts on the first SEQ (sequence) line of the Program sub-menu, with a GOTO 200 instruction.

NOTE

The procedures for using this routine and the diagnostic lead set are outlined in the Operating Instructions section of this manual. Refer to that section for more information.

While you are learning to use the pattern generator, you may want to modify the probe self-test routine and run it using the diagnostic lead set. If so, you should be aware of the following restrictions:

1. The diagnostic lead set cannot operate at clock rates faster than 1 μs. Be sure to set the pattern generator clock accordingly.

2. The diagnostic lead set cannot recognize a tri-state condition (from the pattern generator) because it does not have the necessary pull-up or -down resistors.

3. The pattern generator probe's diagnostic switch must be set to AUX when used with the diagnostic lead set.

If a part of the probe self-test program does not suit your purposes, you may delete the program as you enter new values.

Examples for using the diagnostic lead set are provided in the Application Examples section of this manual.

PROGRAM SUB-MENU FIELDS AND VALUES

The following paragraphs show how to use the Program sub-menu to set up the pattern generator program. They discuss each menu field and explain its optional values.

Figure 8-6 illustrates the Program sub-menu and its fields. The fields, which appear in reverse video on the screen, are designated by brackets [ ] throughout the text. The four directional cursor keys and the NEXT key can be used to move the blinking screen cursor from one field to another.

Refer to the numbered callouts in Figure 8-6 when reading the following paragraphs. These numbers are intended as a visual reference, and do not imply sequences of use.

(1) PATTERN GENERATOR Field

The field directly to the right of the menu title is used to select either the Program or the Timing sub-menu display

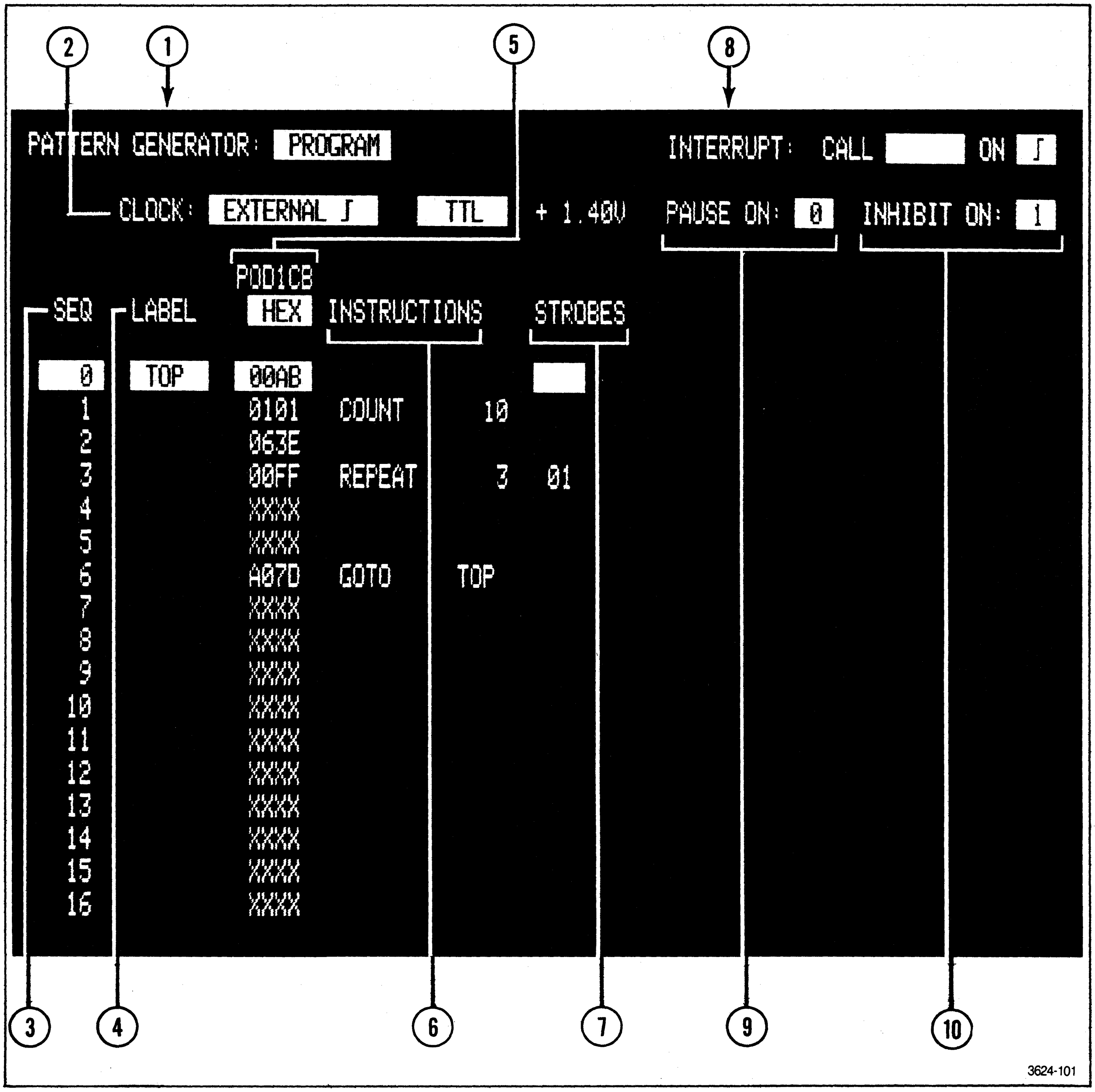


Figure 8-6. The pattern generator's Program sub-menu and its fields.

(refer to the description of the Sub-Menu Selections earlier in this section).

(2) CLOCK Field and Threshold

The CLOCK field is used to select the master input clock to be used by the pattern generator. This clock is fed into the pattern generator, and is used to control the rates of clock and data output signals.

The CLOCK field can be set to the DAS internal clock at intervals ranging from 5 ms to 40 ns; or an external clock source at intervals of 40 ns maximum.

NOTE

The DAS provides two internal clocks. These are shared by the 91A32 and 91A08 Data Acquisition Modules and the pattern generator modules. Accordingly, if you are operating the data acquisition and pattern generator modules simultaneously, you must make sure that no more than two internal clock rates are specified. Refer to the Start and Stop section for details.

The default CLOCK setting is the DAS internal clock, with an interval of 1 μs. Using the INCR and DECR keys, you may increase or decrease the internal clock rate between a 5 ms to 40 ns range.

To increase or decrease the internal clock rate:

1. Move the screen cursor to the CLOCK field.

   CLOCK [1 μs]

2. Press the INCR key to increase the value, or press the DECR key to decrease the value.

   The DAS displays increasing or decreasing clock values in a 1-2-5 sequence between the range of 5 ms to 40 ns.

You may also select an external clock source in this field, set to either a rising (_┌) or falling (┐_) edge. The external clock is supplied by the External Clock Probe's PG CLK line.

To select an external clock source:

1. Move the screen cursor to the CLOCK field.

   CLOCK [1 μs]

2. Press the SELECT key until the desired clock value rotates to the field.

   The DAS displays the available clock values in this order:

   [1 μs]
   [EXTERNAL_┌]
   [EXTERNAL┐_]

Threshold. The field directly to the right of the CLOCK field is used to set the threshold level for the External Clock Probe.

NOTE

When the pause and inhibit lines on the External Clock Probe are unconnected, the DAS sets these lines to ground (0 V).

If you then set the Pattern Generator clock threshold to VAR +0.00 V or lower, you must also change the PAUSE ON and INHIBIT ON values to 0. If left in the default value of 1, the pause and inhibit signals are acquired as 1s (true), inhibiting the pattern generator.

When the pause and inhibit lines are connected, leave the PAUSE ON and INHIBIT ON values set to 1 (default).

This probe supplies the pattern generator's external clock line, plus the external interrupt, pause, and inhibit lines.

NOTE

The External Clock Probe is also used for conveying external clock signals to the 91A32 Data Acquisition Modules. Therefore, any changes made to the probe's threshold will also affect the 91A32 external clock threshold. (Refer back to the Trigger Specification menu section of this manual, under the 91A32 ONLY sub-menu.)

The External Clock Probe has a threshold-range switch. If this switch is set to NORM, the probe operates with a TTL/VAR threshold. If set to AUX, the probe operates with a MOS threshold. Once the probe switch has been set, the threshold field can be used to select the varying voltage levels for the thresholds.

If the probe is set to NORM, the threshold field defaults to TTL +1.40 V. This threshold can be changed to VAR (variable).

To change between TTL and VAR threshold:

1. Move the screen cursor to the threshold field.

   [TTL] +1.40 V

2. Press the SELECT key until the desired threshold level rotates to the field.

   The DAS displays optional threshold values in this order:

   [TTL] +1.40 V
   [VAR] [−1.30 V]

When a VAR threshold is selected, a new field appears for setting the variable voltage level. The settings for this field range between +5.00 V and −2.50 V. The voltage level may be changed with the INCR and DECR keys.

The DAS displays increasing or decreasing voltage values in 0.05 V increments between the range of +5.00 V to −2.50 V.

If the probe's switch is set to AUX, the threshold field shows a MOS setting. This setting may be changed to a voltage level between the range of +20.00 V to −10.00 V.

To change MOS voltage levels:

1. Move the screen cursor to the voltage field.

   MOS [−5.20 V]

2. Press INCR to increase the voltage, or press DECR to decrease the voltage.

   The DAS displays increasing or decreasing voltage values in 0.20 V increments between the range of +20.00 V and −10.00 V.

③ SEQ (Sequence) Field and Editing Keys

The SEQ field consists of a column of numbers running down the left side of the display. Each number in this column corresponds to one program line. The program lines are displayed sequentially starting with SEQ 0.

Altogether, there are 254 sequences, labeled 0-253. Only a portion of these sequences appear on the display at any time.

Several methods are provided for viewing more program lines. The first method is afforded by the scroll keys. These keys can be used at any time and in any field.

To scroll through the sequences:

1. Press Δ or ∇.

   The DAS scrolls the sequence lines up or down the display.

The second method for viewing more program lines is a function of the SEQ field. Using this field, you can jump forward or backward to specific blocks of sequence lines.

To move forward to higher numbered sequences:

1. Move the screen cursor to the sequence number you want to change. For example, SEQ 11.

   [11]

2. Use the data entry keys to enter the sequence number you want to display. For example, 200.

   The DAS displays SEQ 200 in place of SEQ 11, then updates the rest of the sequences following that position.

```
  0
  1
  2
  3
  4
  5
  6
  7
  8
  9
 10
[ 200 ] SEQ 11 is changed to SEQ
  201   200 and the rest of the
  202   sequence numbers are up-
  203   dated from that position to
  204   the bottom of the display.
  205
```

To move backward to a lower numbered block of program lines:

1. Move the screen cursor to the sequence number you want to replace with a lower number. For example, SEQ 200.

   [200]

2. Press the DON'T CARE key.

   The DAS enters a 0 at the cursor location.

   [0]

3. Use the data entry keys to enter the sequence number you want to display. For example, 15.

   The DAS displays SEQ 15 at the cursor location, then updates the rest of the sequences from that position.

```
  0
  1
  2
  3
  4
  5
  6
  7
  8
  9
 10
[ 15 ] SEQ 200 is changed to SEQ
  16   15, and the rest of the
  17   sequence numbers are up-
  18   dated from that position.
  19
  20
```

When using the above procedures, there are two rules you must follow. First, if the cursor is positioned below the top sequence number, you must enter a number larger than the number directly above the cursor location. Second, the sequence number entered cannot be greater than 253.

Adding or Deleting Lines. Two editing functions are provided to make program entry easier. These two functions include adding and deleting sequence lines.

NOTE

When using the add and delete functions, you can position the screen cursor to coincide with any field associated with the line being changed.

To add a sequence line:

1. Move the screen cursor to the sequence line where you want to add a new line. For example, SEQ O.

```
[ O ]   [ SUB1 ]  [ 630F ]   [ COUNT ]   [ 5 ]    [ 0  ]
```

2. Press the ADD LINE key.

   The DAS moves the values associated with SEQ 0 down one line, and inserts a new empty line at the SEQ 0 location.

```
[ 0 ]   [         ] [ XXXX ]                           [    ]
  1       SUB1      630F      COUNT        5          0
```

NOTE

When you add a sequence line, any values associated with SEQ 253 are pushed out of the pattern generator's program memory.

To delete a program line:

1. Move the screen cursor to the sequence line you want to delete. For example, SEQ 0.

```
[ 0 ]   [         ] [ XXXX ]                           [    ]
  1       SUB1      630F      COUNT        5          0
```

2. Press the DEL LINE key.

   The indicated line is deleted, and all preceding lines are moved up one line.

```
[ 0 ]   [ SUB1 ]  [ 630F ]   [ COUNT ]   [ 5 ]    [ 0  ]
```

(4) LABEL Field

The LABEL field is used for labeling specific program lines. These labels serve as destinations for three pattern generator functions: GOTO, CALL, and INTERRUPT CALL. All three of these functions must be able to access a specific program line via its label.

In all, you can assign up to 32 labels. Each label may be up to four characters wide, using A-Z and 0-9.

To assign a label for a specific program line:

1. Move the screen cursor to the LABEL field associated with the program line.

```
[ 0 ]  [          ]  [ 110F    ]
```

2. Use the data entry keys to enter the label. For example, SUB1.

   The DAS displays SUB1 in the LABEL field.

```
[ 0 ]  [ SUB1 ]  [ 110F    ]
```

To remove a label:

1. Move the screen cursor to the LABEL field you want deleted.

```
[ 0 ]  [ SUB1 ]  [ 110F    ]
```

2. Press DON'T CARE.

   The DAS deletes the label from the field.

```
[ 0 ]  [          ]  [ 110F    ]
```

(5) POD Column Fields

The POD columns on the menu are used to enter program data values. These values are entered line-by-line, and displayed in numerical sequence. The data transistions are synchronous with the output clock's rising edge.

The number of channels provided in the POD fields is determined by the number of pattern generator modules installed in your mainframe. Each POD column contains 16 channels. The column headings indicate which pods are assigned to which columns. The pods are designated by their back-panel POD ID location (bus slot number, pod connector letter).

The rightmost POD column is the least significant, and always consists of the two pods of the 91P16 module. Within the individual columns, the rightmost bit is least significant (channel 0 of the rightmost pod).

For example:

```
                    POD 1CB
                    [ HEX   ]
          msb—      [ XXXX  ]  —lsb
(Channel 7 of Pod 1C)          (Channel 0 of Pod 1B)
```

Selecting Program Radix. Below the POD heading of each column is a radix field. The value of this field determines the radix used when entering data. In default, all POD columns are set to hexadecimal. Columns can also be set to octal or binary.

NOTE

If the 91P16 and two 91P32 expander modules are installed, the radix must be set to hexadecimal to fit all 80 channels on the display.

To change the radix for the POD field:

1. Move the screen cursor to the radix field below the POD column heading.

   POD1CB
   [HEX]

2. Press the SELECT key until the desired radix value rotates to the field.

   The DAS displays optional radix values in this order:

   [HEX]
   [OCT]
   [BIN]

Entering Tri-State Values. In default, the program lines are set to a tri-state value, designated by a row of Xs. This tri-state value means that output on the data channels (including data) will be undefined, neither high nor low. Clock and strobes do not tri-state.

NOTE

Tri-state as indicated by a row of Xs does not apply to the P6456 ECL Pattern Generator probe. An ECL tri-state is a row of 0s.

If a program line includes one pod which has been set to tri-state, then all pods on that line will go tri-state. You may enter tri-state on any program line by using the DON'T CARE key.

To enter a tri-state condition:

1. Move the screen cursor to any POD field on the program line you want to be tri-state.

   [0000]

2. Press the DON'T CARE key.

   The DAS sets all channels associated with that program line to tri-state (X).

   [XXXX]

Entering Data Values. When you enter data on a program line, you must adhere to the radices specified under the individual POD columns.

To enter data on any program line:

1. Move the screen cursor to the line's POD fields, and position it over the channels to be programmed. For example:

   [XXXX]

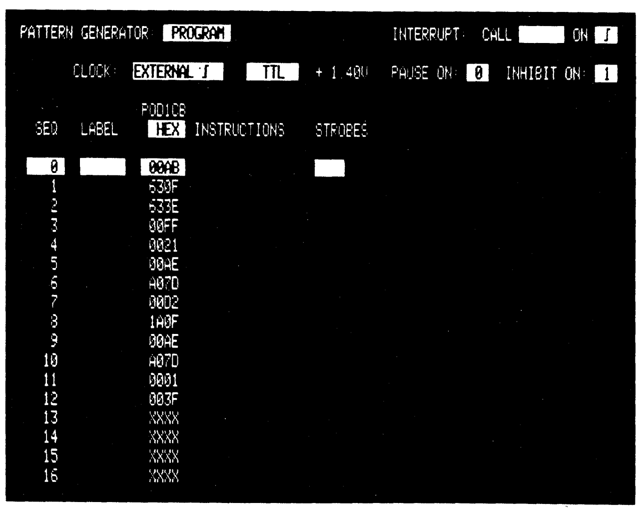
2. Use the data entry keys to enter the data value. For example, 3.

   The DAS enters the value at the cursor location, then shifts the cursor one space to the right. The DAS automatically sets all other channels on that line to 0.

   [3000]

3. Continue entering data values until you get to the end of the line. Then press the NEXT key and the cursor will move to the first data field of the next line.

Using the above procedure, you can continue entering data values. The following illustration shows a simple program example.



3624-102

In this example program, the pattern generator will start at SEQ 0, then output data through SEQ 12. After that, it will tri-state until SEQ 253 is reached. The pattern generator automatically executes a halt after SEQ 253, stopping both data and clock output. The last data value is held at the probe tips.

(6) INSTRUCTIONS Field

The DAS keyboard provides seven pattern generator instruction keys. They are: HALT, REPEAT, HOLD, COUNT, GOTO, CALL, and RETURN.

You may enter an instruction on a program sequence line by pressing its corresponding instruction key. The instruction entered is displayed under the INSTRUCTIONS field. Only one instruction is allowed per line.

NOTE

When entering an instruction, you may position the screen cursor on any reverse-video field associated with the sequence line. The INSTRUCTIONS field appears in reverse video only after the instruction has been entered.

To enter an instruction on a sequence line:

1. Move the screen cursor to a field on the line where you want to enter the instruction.

2. Press the desired instruction key.

   The DAS creates a reverse-video INSTRUCTIONS field for that line, and displays the instruction in it.

To remove an instruction from a sequence line:

1. Move the screen cursor to the INSTRUCTIONS field you want to delete.

2. Press the DON'T CARE key.

   The DAS deletes the instruction and its reverse-video field.

Each pattern generator instruction has individual performance characteristics. Several of them, when entered, require additional parameters. The following paragraphs briefly describe each instruction and its capabilities.

NOTE

Pattern generator programming examples are provided in the Application Examples section of this manual.

When using the pattern generator instructions, there are two basic rules you should be aware of:

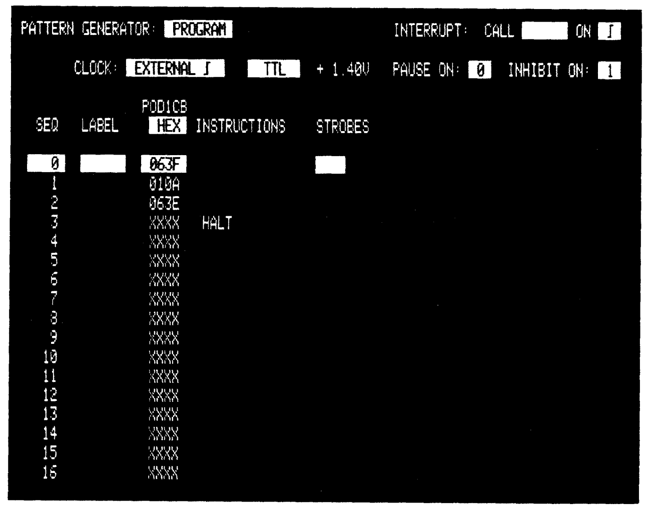
1. The REPEAT, HOLD, and COUNT instructions require numerical parameters. These three instructions share the same six value registers. Therefore, no more than six unique numerical parameters can be shared among them.

2. The GOTO and CALL instructions refer to LABEL field values. Any referenced values must be entered in a LABEL field before the menu can be exited or the pattern generator started.

HALT. Normally, the pattern generator runs through all 254 sequences before stopping program output. With the HALT instruction, you may program the pattern generator to stop on any specific line.

When the pattern generator encounters a HALT instruction, it outputs the data and any strobe values associated with the HALT line but not the output clocks. The data value associated with the HALT line is sent out to the probe tips, but no clock transition occurs.

The following illustration shows how the HALT instruction can be used.



3624-103

In this example, the pattern generator outputs three data words (SEQ 0-2), then goes tri-state and executes a HALT (SEQ 3). The tri-state value associated with the HALT is sent out to the probes, but is not followed by an output clock.

Figure 8-7 illustrates how the data and clock output is affected by the HALT.

REPEAT. The REPEAT instruction offers a program compression technique. This instruction tells the pattern generator to send out the same data value for a specified number of clock cycles. A clock transition occurs with each value.

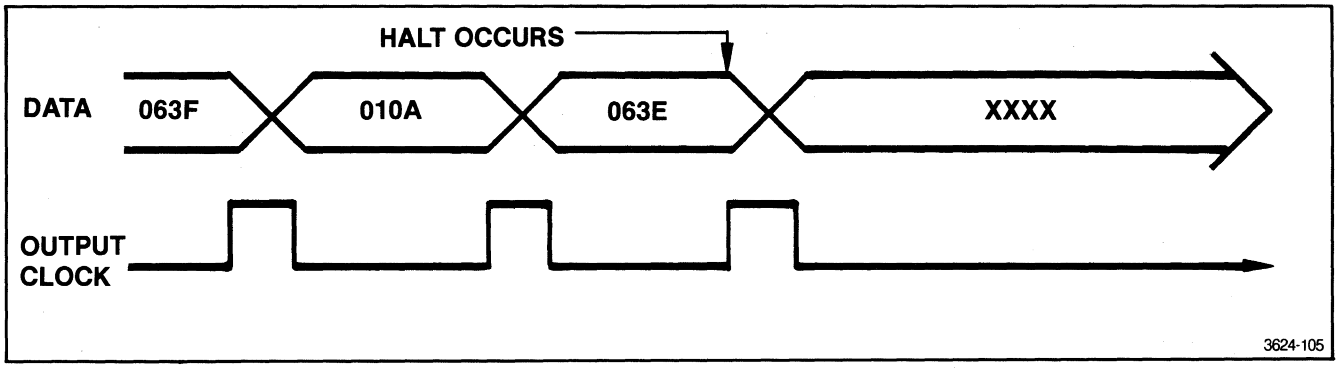


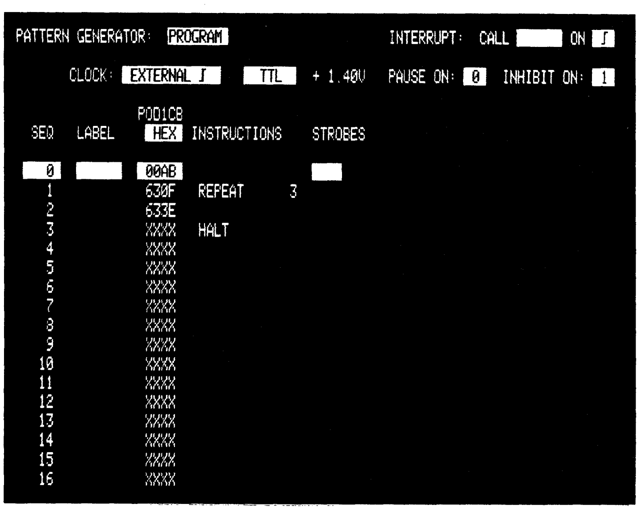
Figure 8-7. Using the HALT instruction. The HALT instruction stops data and clock output, and the HALT value is held at the probe tips.

When entered on a program line, the REPEAT instruction appears as:

[630F]   [REPEAT]   [0   ]

The field which appears next to REPEAT is used for entering the number of clock cycles for which the value 630F will be repeated. You may repeat a value from 2 to 255 cycles. The number of cycles is entered by using the data entry keys.

The following illustration shows a program using the REPEAT instruction.



3624-106

In this example, the pattern generator outputs the first data word (SEQ 0), then outputs the second word 3 times (SEQ 1), then continues through the program until HALT is encountered.

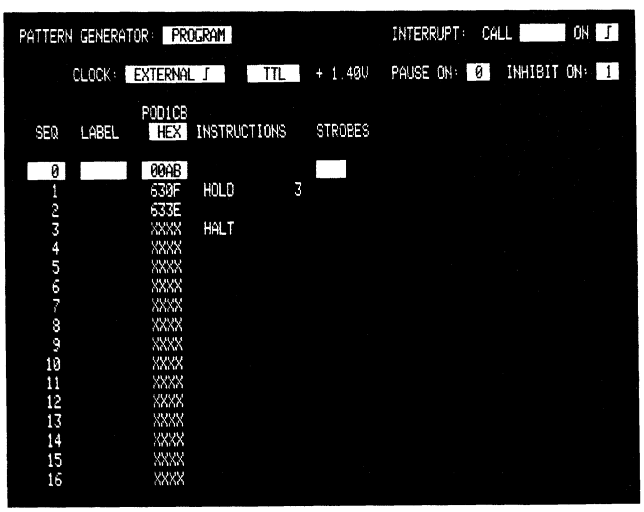
HOLD. The HOLD instruction works like the REPEAT instruction, except that no clock transitions are output on the 91P16 clock lines. The instruction tells the pattern generator to hold all outgoing data values and 91P16 clock levels for a specified number of clock cycles. It does not hold the clock levels from the 91P32 modules. Strobe output (if any) continues on both modules.

When entered on a program line, the HOLD instruction appears as:

[630F]   [HOLD]   [0]

The field which appears next to HOLD is used for entering the number of clock cycles for which data and clock levels will be held. Data and clock levels may be held from 2 to 255 cycles. The number of cycles is entered by using the data entry keys.

The following illustration shows a program using the HOLD instruction.



3624-116

In this example, the pattern generator outputs the first data word (SEQ 0), outputs the second word (SEQ 1), holds it and the 91P16 clocks for 3 cycles, then continues through the program until HALT is encountered.

Figure 8-8 illustrates the differences between HOLD and REPEAT.

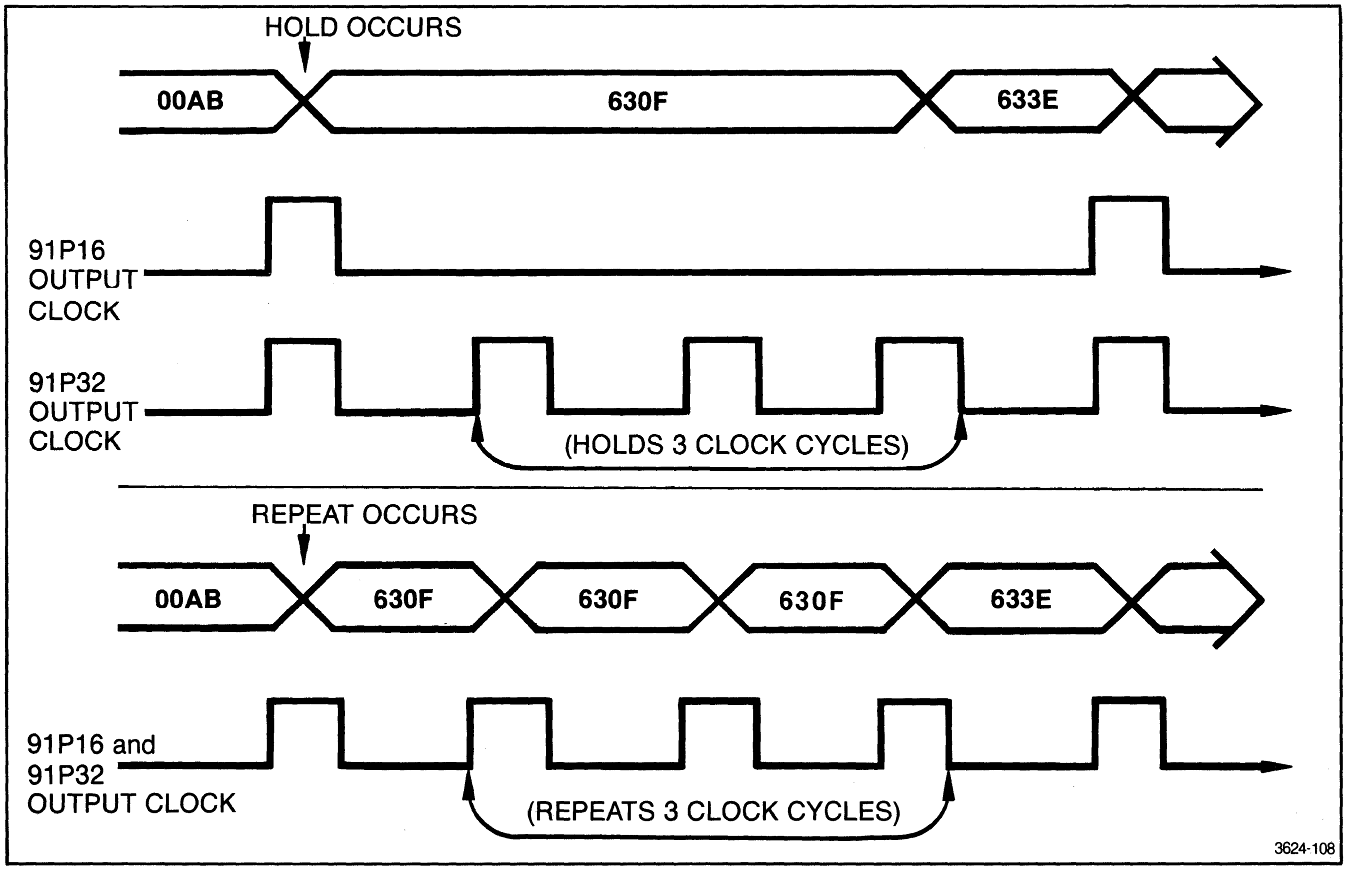


Figure 8-8. Using the HOLD and REPEAT instructons. The HOLD instruction holds data values and 91P16 clocks, while the REPEAT instruction outputs data and clock transitions with each cycle.

COUNT. The COUNT instruction constitutes another program compression technique. This instruction tells the pattern generator to output incrementing data values in stepwise fashion for a specified number of clock cycles. Each value is accompanied by a clock transition.

NOTE

The COUNT function uses the 16 bits from the 91P16 module. Bits from the 91P32 modules are held at their current level.

When entered on a program line, the COUNT instruction appears as:

[0001]   [COUNT]   [0]

The field which appears next to COUNT is used for entering the number of clock cycles the incrementing procedure is to be repeated. You may specify from 2 to 255 cycles. The number of cycles is entered by using the data entry keys.

NOTE

The value associated with the COUNT instruction is read as the first count value by the pattern generator.

The following illustration shows how the COUNT instruction may be used.

3624-109

In this example, the pattern generator outputs the first data word (SEQ 0), then outputs three sequentially increasing data words (000A, 000B, 000C on SEQ 1), then continues through the rest of the program until a HALT is encountered.

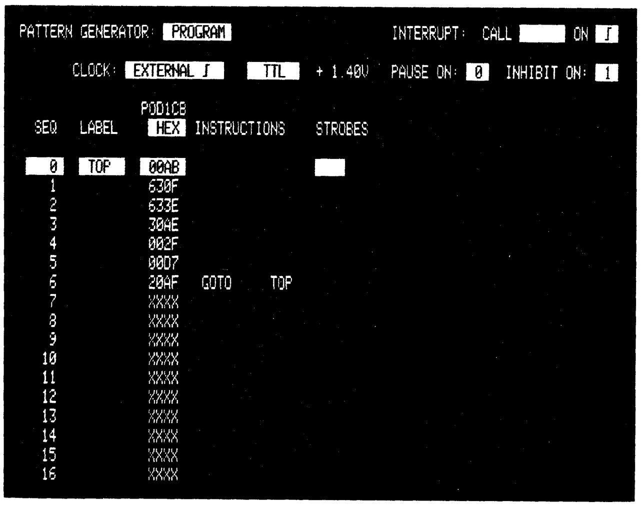
GOTO. The GOTO instruction is used to implement progam jumps. Normally, the pattern generator outputs data in a straightforward line-by-line sequence. The GOTO instruction, however, alters this sequential flow by specifying a jump from one program line to another. Sequential program execution then resumes from that point.

When entered on a program line, the GOTO instruction appears as:

[A1FF] [GOTO] [ ]

The empty field next to GOTO is used for entering a line's LABEL field value. This label tells the pattern generator where to jump. The label is entered by using the data entry keys.

The following illustration shows how the GOTO instruction may be used.



3624-110

In this example, the pattern generator outputs the data words sequentially (SEQ 0-6), then loops back to the beginning and starts over.

CALL and RETURN. The CALL and RETURN instructions are used together to implement progam routines. CALL tells the pattern generator to save the next program line on a stack, then jump to a specified program line. RETURN tells the pattern generator to jump back to the program line stacked by the most recently executed CALL instruction.

NOTE

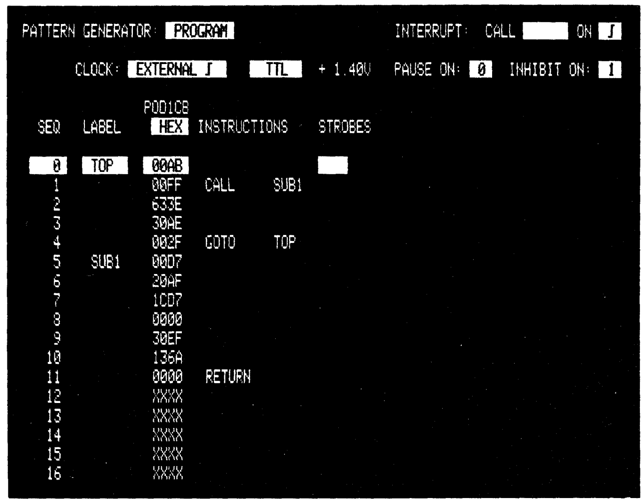
Do not execute a RETURN instruction unless you have executed a CALL. If the program encounters a RETURN which was not preceded by a CALL, the program sequence is lost.

When entered on a program line, the CALL instruction appears as:

[00FF] [CALL] [ ]

The empty field appearing next to CALL is used for entering the LABEL field value of a specific program line. This called line is the first line of the routine.

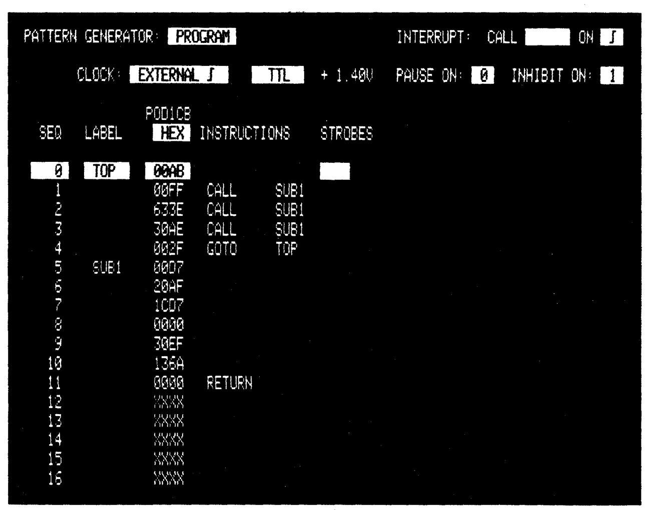
The following illustration shows how the CALL and RETURN instruction may be used.



3624-111

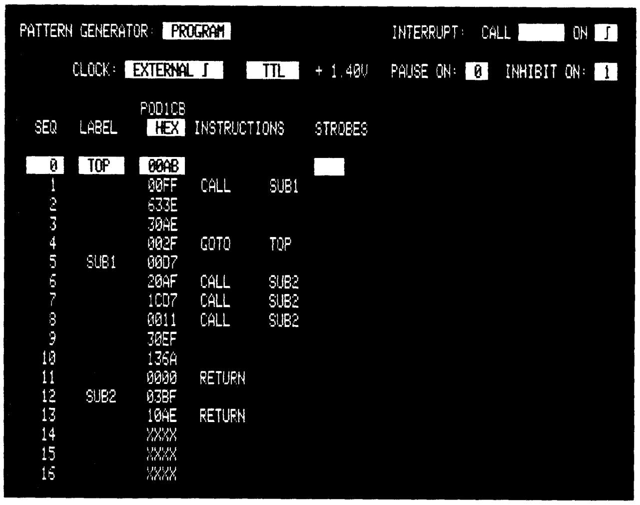
In this example, the pattern generator outputs the first data word (SEQ 0), followed by the second data word (SEQ 1), then jumps to the line labeled SUB1 (SEQ 5). It then executes the routine until a RETURN is encountered (SEQ 5-11). Execution then RETURNs to the line following that in which the CALL occurred (SEQ 2), and continues in a straightforward sequence. The GOTO instruction was included to ensure that the RETURN would not be executed without a CALL.

The following illustration shows another example of the CALL and RETURN instructions. Notice how the program CALLs the same routine several times.



3624-112

More complex uses of these instructions also allow up to 15 levels of routine nesting. This means that as many as 15 CALL instructions can be executed before a RETURN is encountered. The following illustration shows an example of routine nesting.



3624-113

(7) STROBES Field

The STROBES field is used to assert the output strobe signals. You may assert one or more strobes in conjunction with any program line.

NOTE

When the pattern generator is started, any strobes asserted on SEQ 0 are ignored. These strobes will be output if SEQ 0 is accessed again by a loop or call.

Strobes are asserted by entering the desired strobe numbers (0-9) in the line's associated STROBE field. To find the strobe numbers, inspect the pattern generator's Timing submenu.

NOTE

Strobe numbers (0-9) are listed in the Timing submenu. Refer to the description of the Timing Sub-Menu Default Display in another part of this section.

To assert a strobe:

1. Move the screen cursor to the STROBES field.

STROBES
[ ]

2. Use the data entry keys to enter any of the available strobe numbers as shown in the Timing Sub-Menu. For example, 0.

STROBES
[0]

Using the above procedure, you may assert one or more strobes on any of the program lines. Then, when the DAS executes the program, the strobes will be enabled during that program line (clock cycle).

Depending on the characteristics assigned in the Timing sub-menu, a strobe may exceed the clock cycle. If this occurs, the DAS does not output any new strobes until all asserted strobes are finished. Therefore, if asserting a strobe which exceeds the clock cycle, you should not assign a new strobe on any program lines within the strobe's cycle length.

(8) INTERRUPT Field

The interrupt signal is supplied via the External Clock Probe (from the Trigger/Time Base Module). This signal must be connected to an external source. There are some rules you should be aware of when using this signal:

1. To be asserted, the interrupt must have a 72 ns setup time relative to the rising edge of the output clock.
2. The first line of the interrupt's routine is executed four clock cycles following assertion of the interrupt. If a GOTO, CALL, or RETURN instruction coincides with this fourth cycle, the interrupt waits for the next clock cycle not containing one of these three instructions.
3. After an interrupt has been asserted, the pattern generator will not recognize another interrupt until four clock cycles have elapsed.

The INTERRUPT field is divided into two parts: CALL, which specifies the interrupt's routine; and ON, which specifies whether the interrupt will occur on the rising or falling edge of the external signal.

The interrupt is enabled only when you have specified a CALL routine. The routine is specified by entering the LABEL value of its first program line. A RETURN at the end of the routine will cause the pattern generator to return to the point in the program at which it was interrupted.

NOTE

The first line of the interrupt routine cannot contain an instruction.

To enable an interrupt:

1. Move the screen cursor to the CALL field.

   INTERRUPT: CALL [ ] ON [⌐]

2. Use the data entry keys to enter the LABEL value of the routine's first program line. For example, SUB1.

   The DAS enters the label into the field.

   INTERRUPT: CALL [SUB1] ON [⌐]

To specify an interrupt on a rising or falling edge:

1. Move the screen cursor to the ON field.

   INTERRUPT: CALL [SUB1] ON [⌐]

2. Press the SELECT key until the desired value appears in the field.
   The DAS displays optional values in this sequence:

   INTERRUPT: CALL [SUB1] ON [⌐]
   [¬]

(9) PAUSE Field

The pause signal is supplied from the External Clock Probe. If you are using this line, it must be connected to an external source.

NOTE

When the pause and inhibit lines on the External Clock Probe are unconnected, the DAS sets these lines to ground (0 V).

If you then set the Pattern Generator clock threshold to VAR +0.00 V or lower, you must also change the PAUSE ON and INHIBIT ON values to 0. If left in the default value of 1, the pause and inhibit signals are acquired as 1s (true), inhibiting the pattern generator.

When the pause and inhibit lines are connected, leave the PAUSE ON and INHIBIT ON values set to 1 (default).

To be asserted, the pause signal must have 72 ns set-up time relative to the rising edge of the output clock.

The pause signal works like a HOLD instruction except that it holds the clock signals from both 91P16 and 91P32 modules. During the pause, all pattern generator data and clock signals are held at their current levels.

The PAUSE field is used to specify whether a pause is enabled on a positive-true (1) or negative-true (0) condition. In default, a pause occurs on a positive-true condition.

To set the pause condition:

1. Move the screen cursor to the PAUSE ON field.

   PAUSE ON: [1]

2. Use the data entry keys to enter a 0 (negative-true). The DAS enters a 0 into the field.

   [0]

(10) INHIBIT Field

The inhibit signal is supplied from the External Clock Probe. If you are using this signal, it must be connected to an external source.

NOTE

When the pause and inhibit lines on the External Clock Probe are unconnected, the DAS sets these lines to ground (0 V).

If you then set the Pattern Generator clock threshold to VAR +0.00 V or lower, you must also change the PAUSE ON and INHIBIT ON values to 0. If left in the default value of 1, the pause and inhibit signals are acquired as 1s (true), inhibiting the pattern generator.

When the pause and inhibit lines are connected, leave the PAUSE ON and INHIBIT ON values set to 1 (default).

The external inhibit line causes an external signal to initiate a tri-state condition in the pattern generator. In tri-state, the probe output is in an undefined state, neither high nor low.

NOTE

During an inhibit signal, the pattern generator's program continues to execute.

The INHIBIT field is used to specify whether the inhibit signal is enabled on a positive-true (1) or negative-true (0) condition. In default, the field is set to positive true.

To set the inhibit condition:

1. Move the screen cursor to the INHIBIT ON field.

   INHIBIT ON: [1]

2. Use the data entry keys to enter a 0 (negative true).

   A 0 appears in the field.

   [0]

TIMING SUB-MENU DEFAULT DISPLAY

Figure 8-9 illustrates a typical default display of the Timing sub-menu. In this example, the DAS is configured with one 91P16 module, and accordingly provides two strobe output lines.

READING THE SUB-MENU

Refer to Figure 8-9 when reading the following descriptive paragraphs.

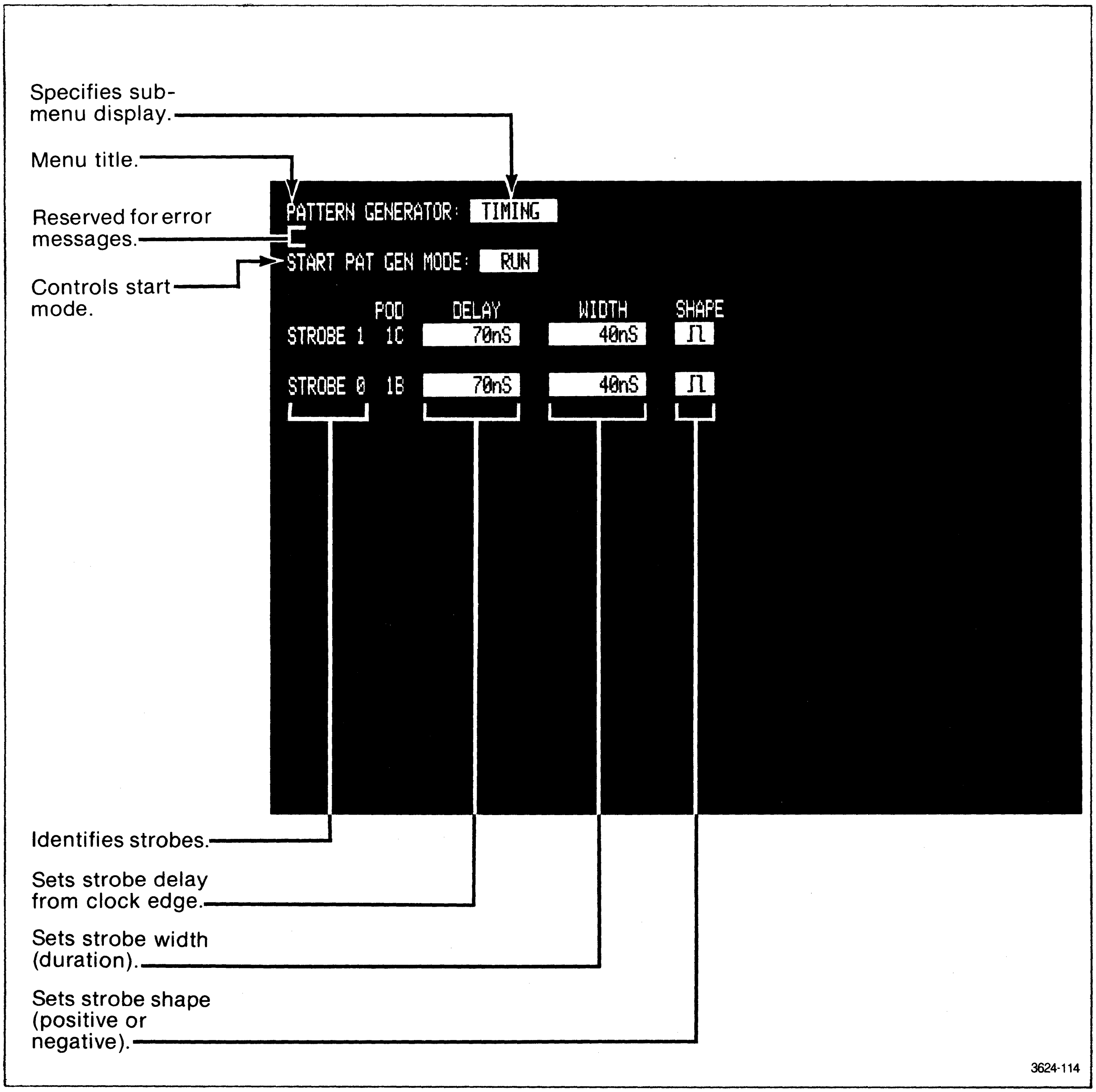


Figure 8-9. Default display of the pattern generator's Timing sub-menu. This sub-menu establishes strobe characteristics and the pattern generator's start mode.

The menu title, PATTERN GENERATOR, appears in the top left corner of the screen. The field directly to the right of this title designates which sub-menu is being displayed (in this example, TIMING).

The line directly below the menu title is always reserved for highlighted error or prompter messages which may occur.

The third line of the display provides a field labeled START PAT GEN MODE.

This field is used to designate whether the pattern generator will run in a real-time or single-step mode. In default, this field is set to real-time (RUN).

All available strobes are listed down the left side of the display. Each of these strobes is assigned an index number (0-9).

NOTE

The strobe index numbers (0-9) are used to identify the strobes in the Program sub-menu.

The POD column identifies which strobes belong to which probes. The identification consists of the probe's back panel POD ID location (bus slot number, pod connector letter).

A DELAY field, a WIDTH field, and a SHAPE field are associated with each strobe. These fields are used to specify the strobe's signal characteristics. In default, each strobe exhibits a 70 ns delay from the clock edge, a 40 ns width, and a positive-true shape.

TIMING SUB-MENU FIELDS AND VALUES

The following paragraphs show how to use the Timing sub-menu. They describe each sub-menu field and explain its optional values.

Figure 8-10 illustrates the Timing sub-menu and its fields. The fields which appear on the screen in reverse video, are designated throughout the text by brackets [ ]. The screen cursor moves from field to field in any direction and is controlled via the four directional cursor keys and the NEXT key.

When reading the following field descriptions, refer to the numbered callouts in Figure 8-10. These numbers are intended as a visual reference, and do not imply sequence of use.

(1) PATTERN GENERATOR Field

The field directly to the right of the menu title refers to either the Program or the Timing sub-menu display. Refer to the description of the Sub-Menu Selections earlier in this section.

(2) DELAY Field

A strobe signal is output asynchronous to the rising edge of the output clock. The DELAY field is used to specify when the strobe will occur in relation to the rising edge of the output clock.

In default, all strobes have a delay value of 70 ns. With the DELAY field, you may specify a strobe delay anywhere from 70 ns to 40.910 μs. A separate delay value can be specified for each strobe.

NOTE

Any delay value between 40.910 μs and 70 ns can be specified for a strobe so long as the combined delay and width values for the strobe do not exceed 40.950 μs.

To increase or decrease the strobe delay:

1. Move the screen cursor to the DELAY field.

   [70 nS]

2. Use the INCR key to increase the delay value, or the DECR key to decrease it.

   The DAS rotates increasing or decreasing values into the field in 40 ns increments, between bounds of 40.910 μs to 70 ns.

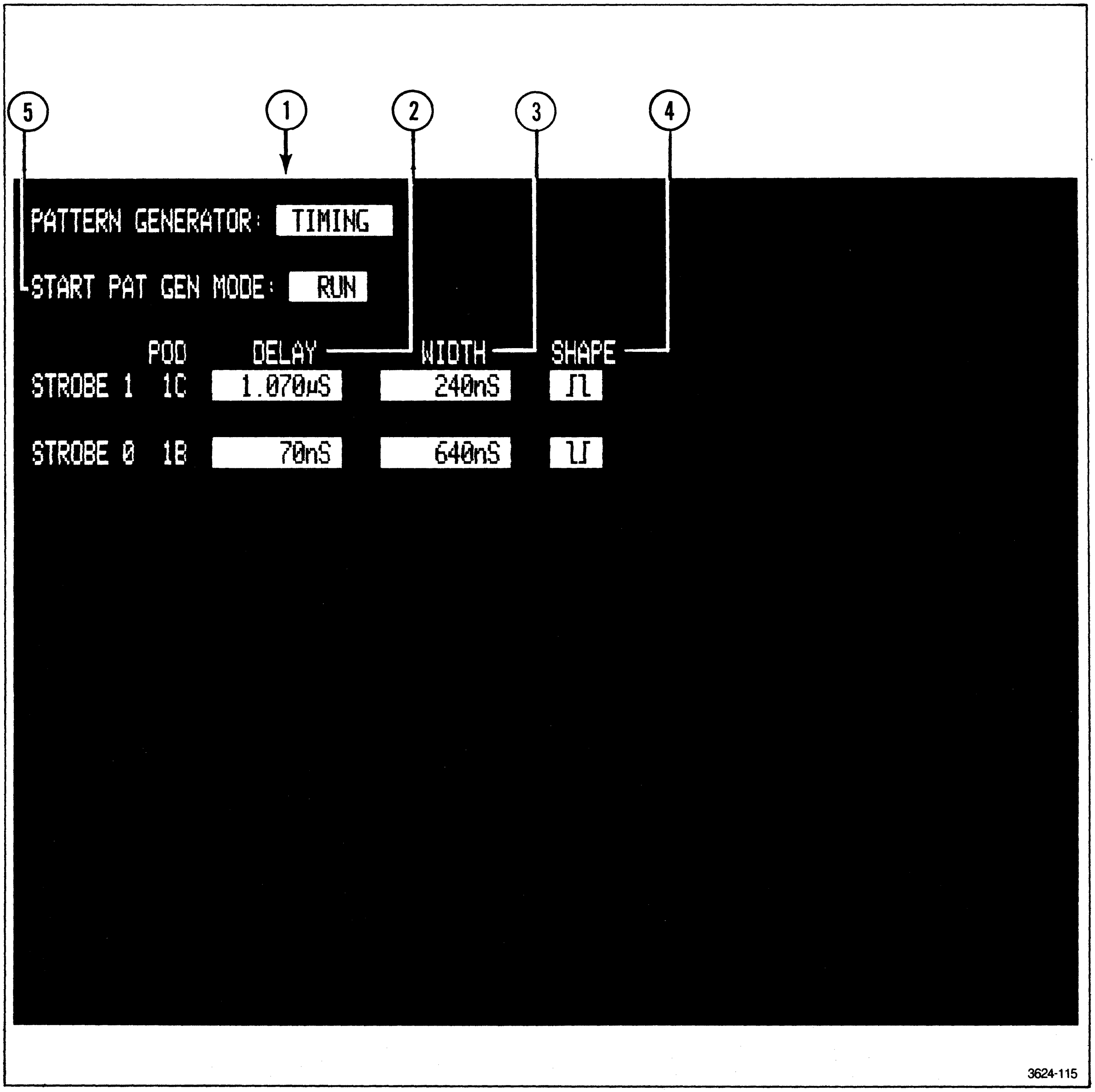


Figure 8-10. The pattern generator's Timing sub-menu and its fields.

(3) WIDTH Field

The WIDTH field is used to determine the width (duration) of the strobe signal. In default, the width of each strobe is set to 40 ns. Using the INCR or DECR keys, you may set the width to a value between the range of 40.880 µs and 40 ns. Each strobe may have a different width value.

NOTE

Any width value between 40.880 µs and 40 ns can be specified for a strobe, so long as the strobe's combined delay and width values do not exceed 40.950 µs.

To increase or decrease the strobe's width:

1. Move the screen cursor to the WIDTH field.

   [40 nS]

2. Press the INCR key to increase the width value, or press the DECR key to decrease the width value.

   The DAS rotates increasing or decreasing values into the field in 40 ns increments, between the range of 40.880 μs to 40 ns.

(4) SHAPE Field

The SHAPE field is used to specify whether the strobe will be asserted as positive true (⎍) or negative true (⊔). In default, all strobes are positive-true signals.

To specify a strobe's shape

1. Move the screen cursor to the SHAPE field.

   [⎍]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional values in this order:

   [⎍]
   [⊔]

(5) START PAT GEN MODE Field

In addition to strobe characteristics, the Timing sub-menu provides a field for selecting the pattern generator's start mode.

Normally the pattern generator outputs data in real-time fashion, in sync with the clock signal. This mode of operation is designed RUN. You may also set the pattern generator to output data in a single-step fashion. This mode of operation is designated STEP.

To select the start mode:

1. Move the screen cursor to the START PAT GEN MODE field.

   START PAT GEN MODE: [RUN]

2. Press the SELECT key until the desired value rotates into view.

   Optional values are displayed in this sequence:

   [RUN]
   [STEP]

Using The STEP Mode. When the pattern generator is operating in the STEP mode, it will output data in single-step. Every time the START PAT GEN key is pressed, the pattern generator will output one data word. This output is sequential. You may start over at SEQ 0 at any time by pressing the STOP key.

NOTE

When the START SYSTEM key is used to start the pattern generator, data is output in real time (whether the RUN or STEP mode is currently selected).

A special feature of the STEP mode is vector readout. This readout appears on the second line of the DAS screen no matter which menu is being displayed. The vector readout appears as:

SEQ: 0 VECTOR: XXXX

XXXX ↑ indicates data word being output.

0 ↑ indicates sequence program line.

The STEP mode can be used in combination with the vector readout to inspect the actual output of the pattern generator. This allows you to trace the program lines and data values.

NOTE

For more information regarding the pattern generator's start modes, refer to the Start and Stop section of this manual.

START AND STOP 9

This section describes the start and stop sequences for data acquisition and pattern generation. It describes how to use both operations, either separately or together. Before reading this section, you should first read the Operating Instructions section of this manual for an overview of keyboad controls.

In this section you will find: **Page**

START AND STOP

The DAS provides five basic start functions as outlined on the keyboard. They include:

- **START ACQUISITION**—This key starts a data acquisition operation independent of the pattern generator.
- **START PAT GEN**—This key starts the pattern generator independent of data acquisition.
- **START SYSTEM**—This key starts acquisition and pattern generation simultaneously. It also starts data acquisition if no pattern generator modules are installed. (If no data acquisition modules are installed, the key is inoperable and will not start the pattern generator.)
- **STORE**—This key loads data from acquisition memory into reference memory.
- **COMPARE = and COMPARE ≠**—These keys start data comparison functions between acquisition memory and reference memory.

The following parts of this section discuss the various start functions and stop procedures.

Start Message Readout. Throughout the rest of this section reference is made to start-message readout. When an operation is in progress, these messages occupy the top two lines of the DAS screen. These messages appear no matter which menu is currently displayed on the screen.

START ACQUISITION

An acquisition operation can be started by pressing either the START ACQUISITION or START SYSTEM control keys. This part of the section discusses the functions of the START ACQUISITION key.

The START ACQUISITION key starts the data acquisition operation independently of the pattern generator. If the pattern generator is running when the key is pressed, it will continue to run with no interruption.

When the START ACQUISITION key is pressed, the screen cursor disappears and the DAS displays a message on the top line of the screen reading ACQUISITION STARTED. Once an acquisition is started no other operation can be started until the acquisition is finished.

There are four basic steps to the acquisition operation: 1) acquiring data and clocking it into memory, 2) generating a trigger, 3) generating a memory stop/store, and 4) displaying data.

The following paragraphs describe each of these four basic steps and how they are achieved.

ACQUIRING DATA

When acquisition starts, the DAS immediately begins to acquire data using the modules specified in the trigger mode. This mode is determined by the Trigger Specification menu.

The incoming data is compared to the probe thresholds in order to determine high and low logic states. These thresholds are specified in the Channel Specification menu.

The parallel bits of high and low logic are clocked into memory at the rate specified in the Trigger Specification menu. If clock qualifiers are used, the data is only clocked in when all qualifier conditions are true.

NOTE

If an ARMS acquisition mode is used, the slow and fast-clock qualifiers operate separately and only affect their respective memories.

WAITING FOR THE TRIGGER

When data is clocked into memory, it is compared to the word recognizers specified in the Trigger Specification menu. Then, when the word recognizer conditions are met, a trigger occurs.

NOTE

The 91A32 trigger may also be enabled by applying a high-level signal to the Trigger Input connector on the mainframe's back panel.

If a trigger is not generated immediately, the DAS displays a message on the second line of the screen reading WAITING FOR 91AXX TRIGGER. If an ARMS mode is being used, the DAS first waits for the slow module's trigger, then the fast module's trigger.

When the trigger is generated, the message disappears.

WAITING FOR STOP STORE

When a trigger occurs, the DAS waits for the stop/store. This is determined by the trigger's position relative to acquisition memory. When the trigger reaches its position as specified in the Trigger Specification menu, acquisition stops and the most currently acquired data is stored in memory.

If a stop/store does not occur immediately, the DAS displays a message on the second line of the screen reading WAITING FOR STOP STORE. This message usually is caused by a long trigger delay coupled with a slow clock. When the stop/store is generated, this message disappears.

A stop/store may also be generated manually by pressing the STOP key. You may want to use this key if either the trigger or the stop/store does not occur.

DATA DISPLAY

When acquisition is finished, the DAS immediately displays the acquired data. Directly after system power up, the DAS assumes the State Table menu display. After that, it assumes the last display menu used: either the State Table menu or the Timing Diagram menu.

If the trigger was positioned in memory, the trigger word is highlighted on the display. In the State Table menu, the trigger word value is given and the trigger word is highlighted within the data table. In the Timing Diagram menu, the trigger word is highlighted by a vertical line positioned over the timing waveforms.

If the trigger is not in memory, a message appears on the second line of the screen (in either menu) reading TRIGGER NOT IN MEMORY.

If the STOP key was used to stop acquisition, a message appears on the second line of the screen reading STOPPED—TRIGGER NOT IN MEMORY.

SLOW ACQUISITION

While acquisition is in progress, the DAS may display a message reading SLOW ACQUISITION. This message appears when an acquisition clock has not been received for approximately 500 ms.

The SLOW ACQUISITION message does not necessarily mean there is an acquisition error. The message may be the result of a slow external clock, or it may be caused by qualifier conditions.

START PATTERN GENERATOR

The pattern generator may be started as long as an acquisition operation is not in progress. If the DAS is acquiring data, it will ignore all other start functions.

The pattern generator can be started by pressing the START PAT GEN key. It can also be started by the START SYSTEM key if data acquisition modules are installed in the mainframe. This part of the section concentrates on the functions of the START PAT GEN key.

The pattern generator can operate in one of two start modes as selected by the Pattern Generator menu. It can operate in a RUN mode, where data and clocks are output in real-time to the pattern generator clock; or, it can operate in a STEP mode, where data words are output in single-step.

The functions of the START PAT GEN key are dependent on which start mode is selected. The following paragraphs will describe each mode and how they are used.

USING THE RUN MODE

If the pattern generator is set to the RUN mode, it outputs data in real-time. When the START PAT GEN key is pressed, the pattern generator starts at SEQ 0 and outputs the program in sequence. If the pattern generator is set in a looping cycle, this output will continue until the pattern generator is stopped.

NOTE

You may acquire data via the START ACQUISITION key without disrupting the pattern generator. The START SYSTEM key, however, will stop and restart the pattern generator.

When the pattern generator is in the RUN mode, it may be stopped in several ways:

- **HALT Instruction**—The pattern generator stops if a HALT is encountered in the program. A HALT instruction is automatically programmed in the end of program memory so that the pattern generator stops after SEQ 253. This HALT may be avoided by using the GOTO.
- **STOP Key**—The pattern generator stops whenever the STOP key is pressed.
- **START SYSTEM Key**—The pattern generator stops whenever the START SYSTEM key is pressed. This key restarts both data acquisition and pattern generation.
- **PATTERN GENERATOR Menu Key**—The pattern generator stops whenever the pattern generator menu is entered. If you are already displaying the menu, the pattern generator stops when changes are made to the menu fields.
- **COMPARE =, COMPARE ≠ Keys**—If the last acquisition was stated by the START SYSTEM key, the two COMPARE keys will stop and restart the pattern generator (see comparison descriptions later in this section).
- **Clock Changes**—If the acquisition modules are set to the same internal clock as the pattern generator, changes to the acquisition clock (in the Trigger Specification menu) will stop the pattern generator.

When the pattern generator is stopped by any means other than a HALT, a message appears on the second line of the screen reading PATTERN GENERATOR STOPPED. The last word output by the pattern generator is retained on the probe tips.

When the pattern generator is restarted, it always starts at the beginning of the program (SEQ 0).

USING THE STEP MODE

When set in the STEP mode, the pattern generator outputs the program in single-step starting with SEQ 0. One data word is output every time the START PAT GEN key is pressed.

NOTE

When the START SYSTEM key is used, the pattern generator runs in real-time (even if set in the STEP mode).

The STEP mode outputs the data word in sequence. As each data word is output, a readout of the word value appears on the second line of the DAS screen. The readout appears as:

```
SEQ XXX VECTOR XXXX
     ▲          ▲
     |          └identifies current data value.
     |
     └identifies current sequence line.
```

You may reset the STEP mode to SEQ 0 by pressing the STOP key. The mode will also reset to SEQ 0 if the pattern generator menu is entered or changed.

If you change from the STEP mode to the RUN mode, the pattern generator will always start from SEQ 0. It will not continue from where the single-step stopped.

START SYSTEM

The START SYSTEM key affects both data acquisition and pattern generation. This key starts both functions simultaneously. If the pattern generator is running when this key is pressed, it is restarted along with data acquisition.

The START SYSTEM key also starts data acquisition if no pattern generator are installed. If no data acquisition modules are installed, the key is inoperable and will not start the pattern generator.

USING ACQUISITION AND PATTERN GENERATION TOGETHER

When the START SYSTEM key is used to start both operations the DAS displays a message on the top line of the screen reading ACQUISITION AND PATTERN GENERATOR STARTED. The pattern generator is always restarted to the beginning of its program.

After the initial start message, the data acquisition and pattern generator modules continue to operate in a manner identical to that described for each independent operation.

STOP PROCEDURES

The STOP key stops both operations simultaneously. When this occurs, the DAS displays a message reading STOPPED—TRIGGER NOT IN MEMORY.

If acquisition is stopped by a word recognizer trigger, the pattern generator is not affected. The pattern generator will continue to run until it is stopped by the conditions outlined earlier under START PAT GEN. When the pattern generator stops independently, the DAS displays a message reading PATTERN GENERATOR STOPPED.

CLOCKING RESTRICTIONS

The pattern generator and data acquisition modules share two internal clocks. Therefore, when running both operations simultaneously, you can only specify two internal clock rates. For example, if two internal clock rates have been specified for acquisition in the ARMS mode, the pattern generator must be set to an internal clock matching one of the acquisition clocks or to an external clock.

If you specify more than two internal clocks, the DAS displays an error message when you attempt to start the system. The message reads: INVALID CLOCK COMBINATION—START NOT PERFORMED.

REFERENCE MEMORY COMPARISONS

Once an acquisition operation has been completed, you may load the reference memory from acquisition memory by pressing the STORE key.

When data is loaded into reference memory, it may be stored until the DAS is turned off (or indefinitely on a DC100-type tape cartridge). Every STORE function rewrites the memory so that previously stored data is lost.

SETTING UP COMPARISON CONDITIONS

The main purpose of the reference memory is to allow old-new data comparisons. For this purpose, special capabilities are provided in the State Table menu for setting up comparison address limits, and for editing and masking reference memory data. For detailed information refer to the State Table Menu section of this manual.

When data is loaded into the reference memory, the memory also stores the trigger mode used during the original acquisition. Therefore, in order to make new-old data comparison, the new data must be acquired in the same mode as used originally. Otherwise, the reference memory is not available for comparison displays. The trigger modes are specified in the Trigger Specification menu.

COMPARE =, COMPARE ≠

The DAS provides two comparison start keys: COMPARE = and COMPARE ≠. The COMPARE = key, if pressed, acquires new data and compares it to reference memory to see if they are equal. If the memories are unequal, the DAS will continue to take new acquisitions until the memories are equal. The COMPARE ≠ key, if pressed, works in a similar manner except that new acquisitions are taken until the memories are not equal.

Data acquisition starts when either of the comparison keys is pressed. The start function will be identical to START ACQUISITION or START SYSTEM, depending on which key was last used.

During the comparison operation, the DAS displays a RESTARTS message indicating how many acquisitions have been taken. When the comparison is finished, the RESTARTS message counter value remains on the screen.

INPUT OUTPUT MENU 10

This menu supports the tape drive and RS-232 master/slave operations. While the menu may be displayed on the screen at any time, it is useful only if the tape drive (Option 01) or RS-232 interface (Option 02) is installed in the mainframe.

This section describes the DAS Input Output menu and its functions. Before reading this section, you should first read the Operating Instructions section of this manual for an overview of I/O controls, keyboard controls, and menu characteristics.

In this section you will find: **Page**

INPUT OUTPUT MENU

FUNCTIONAL OVERVIEW

The Input Output menu is designed to support the DAS tape drive and RS-232 master/slave operations. It is used to control these two devices, their operations, and operating parameters.

The following paragraphs provide an overview of the major menu functions and the optional devices it supports.

TAPE DRIVE OPTION

A tape drive unit and two DC100 tape cartridges are provided with the DAS Option 01. The two tape cartridges, and any other DC100-type cartridges, may be used with the DAS so long as they are formatted. Formatting is handled through a simple menu procedure.

A DC100-type cartridge has an approximate 640 to 680 block length (at 256 bytes per block). Four of these blocks are reserved for DAS format and directory information. The rest of the blocks are used for file storage.

Menu procedures are provided for storing and retrieving DAS setup conditions. This includes all menu setups (except the Input Output menu) and reference memory. Acquisition memory cannot be stored on tape.

Detailed procedures for formatting, saving, restoring, and deleting files are provided later in this section under Tape Drive Sub-Menu Fields and Values.

RS-232 OPTION

The RS-232 interface is provided as part of the DAS Option 02 Interface package. The RS-232 interface may be used two ways: for master/slave between two DAS systems, or for transmitting GPIB commands between a DAS and a controller. The master/slave function is controlled by the Input Output menu, while the GPIB function is controlled by the selected controller unit.

NOTE

For information on how to use the RS-232 for transmitting GPIB commands, refer to the GPIB Programming section of this manual.

With the Input Output menu, two DAS systems may be linked together for master/slave transmission. This feature allows a slave DAS to be connected to and operated by a master DAS in another location. The screen and keyboard of the master DAS reflect the screen and keyboard of the slave system. Procedures are provided for setting up master/slave status, baud rate, and establishing the link.

GPIB ADDRESS READOUT

The Input Output menu displays the current GPIB talker/listener address whenever the GPIB, RS-232, and Hard Copy Interface (Option 02) is installed in the mainframe. This address is selected via the GPIB address switches on the mainframe's back panel. For information on the GPIB address switches and their use, refer to the GPIB Programming section of this manual.

SUB-MENU SELECTIONS

The Input Output menu is divided into two sub-menu displays. They are:

- **Tape Drive**—which is used for controlling the tape drive operations, including tape formatting.
- **RS-232**—which is used for setting up the master/slave operation and establishing the communication link.

When the INPUT OUTPUT menu key is first pressed after power-up, the Tape Drive sub-menu is displayed. After that, the menu displays the sub-menu last used.

If the DAS does not contain a tape drive option, a highlighted message apears on the second line of the display reading TAPE DRIVE NOT PRESENT. In this case, the blinking screen cursor is locked to the sub-menu's DEVICE field. The Tape Drive sub-menu is inoperable.

If the DAS does not contain an RS-232 option, a highlighted message appears on the second line of the RS-232 sub-menu reading IO BOARD NOT PRESENT. Again, the blinking screen cursor is locked to the sub-menu's DEVICE field, and the RS-232 sub-menu is inoperable.

Only one sub-menu appears on the screen at one time. You may select between the sub-menus by entering the DEVICE field and pressing the SELECT key.

To change sub-menu displays:

1. Move the screen cursor to the DEVICE field.

   DEVICE: [TAPE DRIVE]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays optional sub-menu values in this order:

   DEVICE: [TAPE DRIVE]
   DEVICE: [RS-232]

As the sub-menu value changes in the field, the DAS changes the rest of the display to that sub-menu format.

TAPE DRIVE SUB-MENU DISPLAY

Figure 10-1 illustrates a typical display of the Tape Drive sub-menu. In this example, a tape cartridge with previously stored files has been inserted into the drive unit.

READING THE SUB-MENU

Refer to Figure 10-1 when reading the following paragraphs.

The menu title, INPUT OUTPUT SPECIFICATION, appears in the top left corner of the screen. The line directly below the title is reserved for any highlighted error or prompter messages which may occur.

Four highlighted messages may appear when the sub-menu is entered. They include:

- **TAPE DRIVE NOT PRESENT**—which means the mainframe does not have a tape drive unit, and therefore, the sub-menu is inoperable.
- **NO TAPE IN DRIVE**—which means a tape cartridge has not yet been inserted.
- **TAPE UNFORMATTED, PLEASE FORMAT IT**—which means an unformatted tape has been inserted.
- **NOT A DAS TAPE**—which means a tape has been inserted which is formatted for use with an instrument other than the DAS. Such a tape must be bulk erased before it can be formatted for the DAS.

The DEVICE field, located on the third line of the screen, designates which sub-menu is being displayed (in this example, TAPE DRIVE).

The OPERATION field is used to select the various tape operations. Operations include restoring, saving, or deleting files, and formatting tapes.

The FILE NAME field is used to designate which files are to be used in the various tape operations.

Finally, at the bottom of the screen, the sub-menu lists out a DIRECTORY of the tape files present on the currently inserted tape. The file names, their type and sizes are listed. Eight files appear on the screen at one time, but others may be viewed by using the scroll keys.

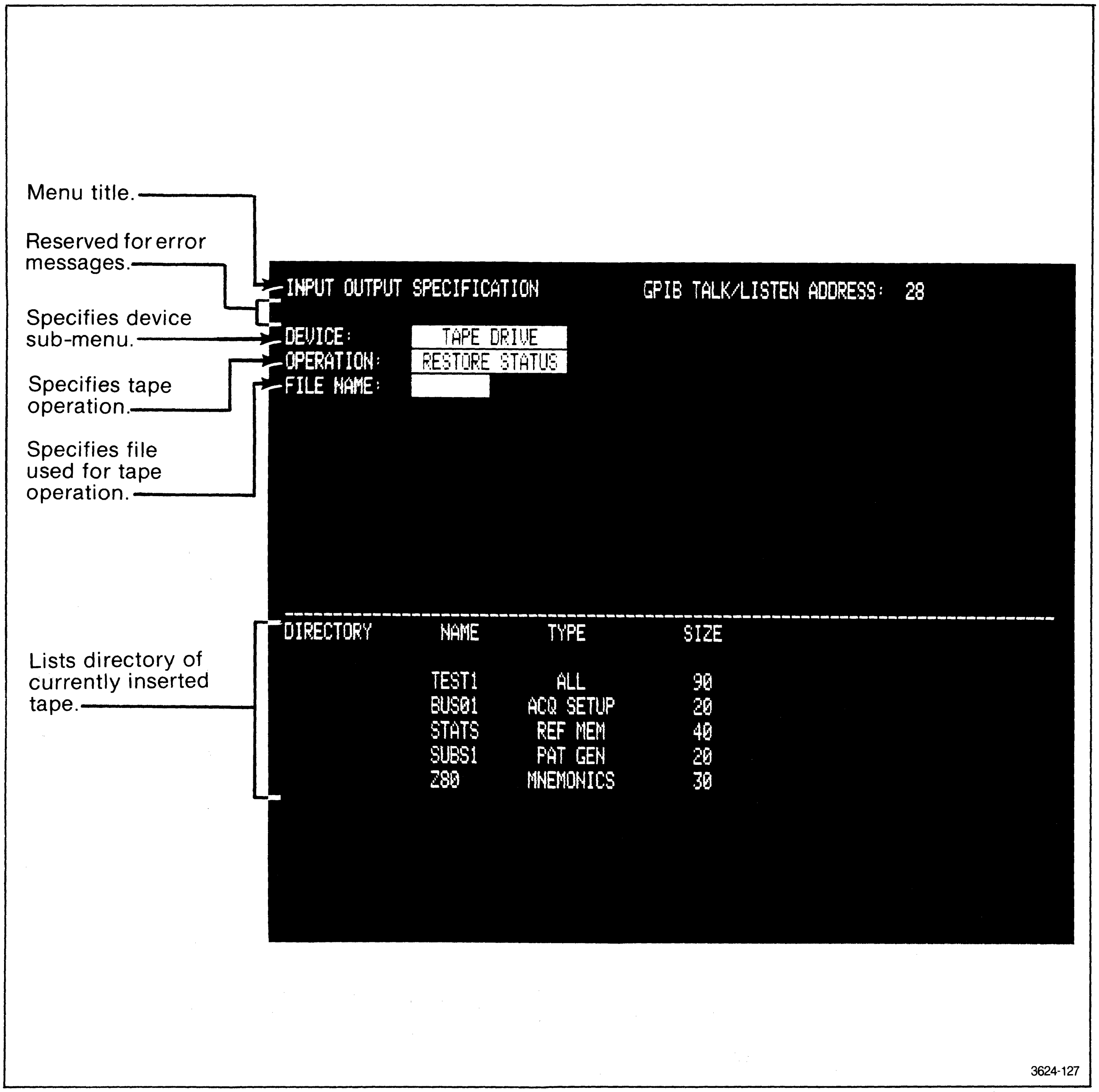


Figure 10-1. Display of the Tape Drive sub-menu. This sub-menu provides fields for selecting the tape operation and file name. It also displays the directory of the currently installed tape.

TAPE DRIVE SUB-MENU FIELDS AND VALUES

The following paragraphs describe how to set up the Tape Drive sub-menu. They discuss each sub-menu field and their optional values.

Figure 10-2 illustrates the Tape Drive sub-menu and its fields. The fields, which appear on the screen in reverse video, will be designated throughout the text by brackets [ ]. The screen cursor moves from field to field in any direction, and is controlled by the four directional cursor keys and the NEXT key.

Refer to the numbered callouts of Figure 10-2 when reading the following paragraphs. These numbers are intended as a visual reference, and do not imply sequence of use.

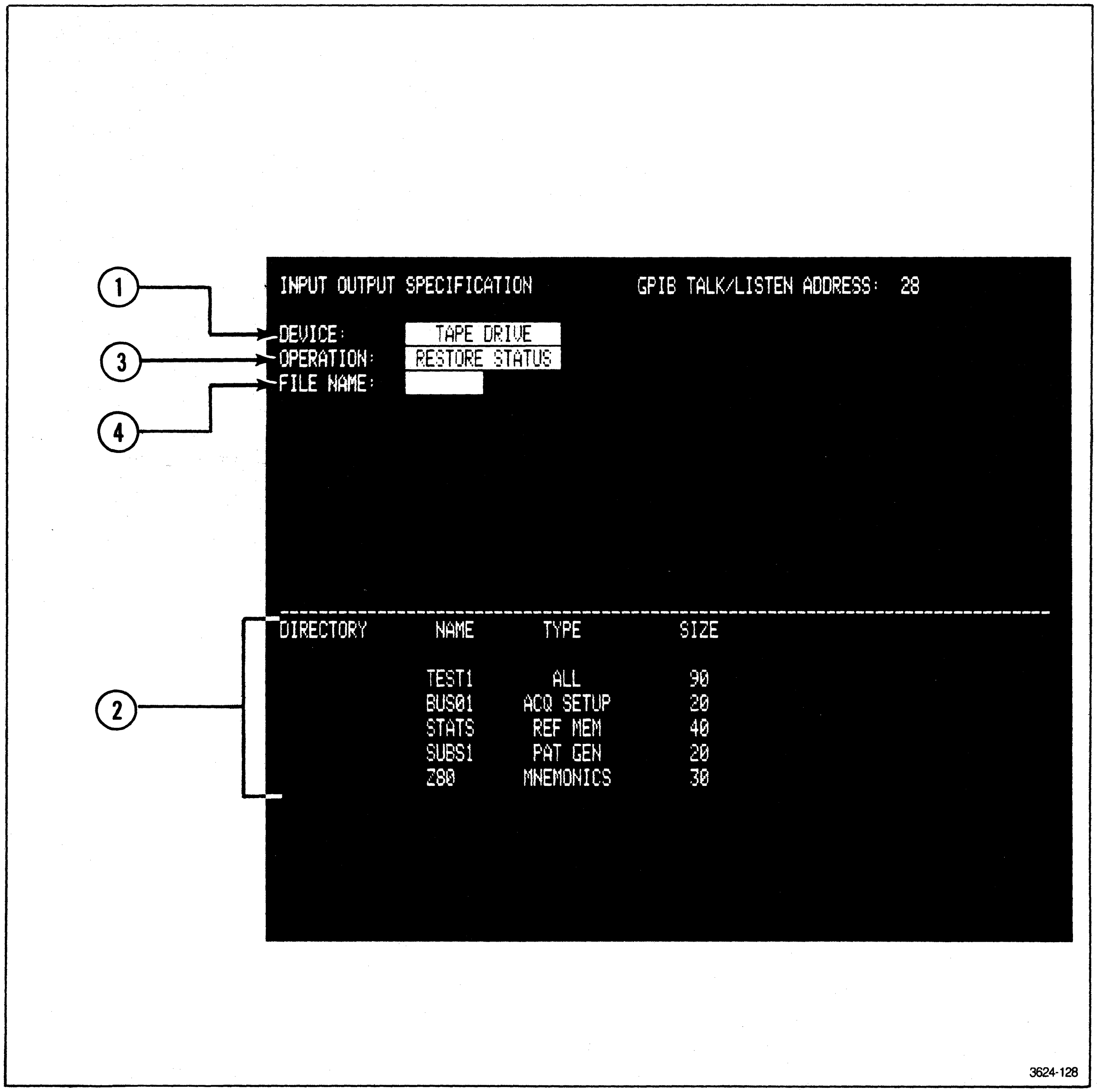


Figure 10-2. Tape Drive sub-menu and its fields.

(1) DEVICE Field

The DEVICE field is used to select between the sub-menu displays. Refer to the description of the Sub-Menu Selections earlier in this section.

(2) DIRECTORY

The bottom half of the sub-menu is used for displaying the directory of the currently inserted tape. This directory lists the names of the files, their types and block sizes. Only eight files are listed at any one time. You may use the scroll keys to view any other files.

To view other files in the directory:

1. Press Δ or ∇.

   The DAS scrolls up or down through the tape directory, displaying the various files.

(3) OPERATION Field

The OPERATION field is used to select the various tape operations. Several operations are available and are selected using the SELECT key.

NOTE

Detailed information for each of these operations is provided later in this section under Tape Drive Operations.

To specify the tape operation:

1. Move the screen cursor to the OPERATION field:

   OPERATION: [RESTORE STATUS]

2. Press the SELECT key until the desired operation rotates to the field.

   The DAS displays the operations in this order:

   [RESTORE STATUS]
   [SAVE STATUS]
   [FILE STATUS]
   [DELETE FILE]
   [FORMAT TAPE]

All of the above operations, except FORMAT TAPE, require the additional specification in the FILE NAME field.

(4) FILE NAME Field

The FILE NAME field is used to specify which tape file will be used during the operation. For the SAVE STATUS operation, this file is a new name. For other operations, this file should already be existing on the tape. A name can have up to six characters, using A-Z and 0-9.

To specify the tape file to be used in the operation:

1. Move the screen cursor to the FILE NAME field.

   FILE NAME: [ ]

2. Enter up to six characters using A-Z and 0-9. For example, SUBS1.

   The DAS enters the file name into the field, then uses that file during the operation.

   FILE NAME: [SUBS1]

To remove a file name:

1. Move the screen cursor to the FILE NAME field.

   FILE NAME: [SUBS1]

2. Press DON'T CARE.

   The DAS deletes the file name from the field.

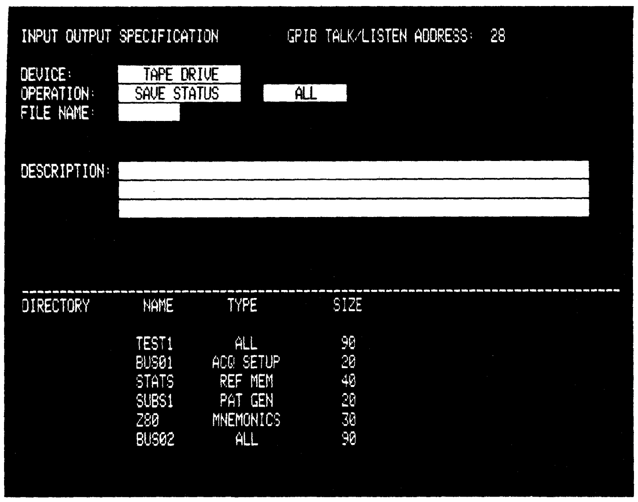
   FILE NAME: [ ]

TAPE DRIVE OPERATIONS

The following paragraph describe each operation and its associated parameters.

SAVE STATUS

Once a tape has been formatted, it may be used for storing DAS files. The SAVE STATUS operation is used for this purpose. The following illustration shows how the menu appears when this operation is selected.



3624-129

A new file is identified by three elements: a file name, a file type, and a description.

The file name is entered in the FILE NAME field. This name must be unique from other file names already existing on the tape: otherwise the DAS will attempt the save operation, but will not save the file.

The file type is specified in the field which appears next to SAVE STATUS. The file type options include:

- **ALL**—which saves the current status of all DAS menus, except for the Input Output menu. It also saves DAS reference memory contents. The acquisition memory contents cannot be loaded onto tape.

- **ACQ SETUP**—which saves the current status of the Channel Specification, Trigger Specification, and Timing Diagram menus. Only the field values of the Timing Diagram menu are saved, not the displayed data since this resides in acquisition memory.

- **REF MEM**—which saves the current status of the State Table menu and reference memory contents. Again, only the field values of the State Table are saved along with reference memory.

- **PAT GEN**—which saves the current status of the Pattern Generator menu. This includes the pattern generator program and strobes.

- **MNEMONICS**—which saves the current status of the Define Mnemonics menu and its defined tables.

To specify the type of file to be saved:

1. Move the screen cursor to the field directly right of SAVE STATUS.

   OPERATION: [SAVE STATUS][ALL]

2. Press the SELECT key until the desired file type rotates to the field.

   The DAS displays optional values in this order:

   [ALL]
   [ACQ SETUP]
   [REF MEM]
   [PAT GEN]
   [MNEMONICS]

The file description is entered into the field located in the middle of the sub-menu. You may enter up to 180 characters into this field, using the data entry keys A-Z and 0-9. When the file is saved, the description is also saved.

NOTE

The SHIFT/SELECT key function may be used to enter any of the DAS 9100 Character Set symbols into the DESCRIPTION field. For procedures, refer to Appendix B.

To enter a file description:

1. Move the screen cursor to the DESCRIPTION field.

   DESCRIPTION: [ ]
   [ ]
   [ ]

2. Enter up to 180 characters using A-Z and 0-9.

   The DAS enters the description into the field, then saves it along with the file.

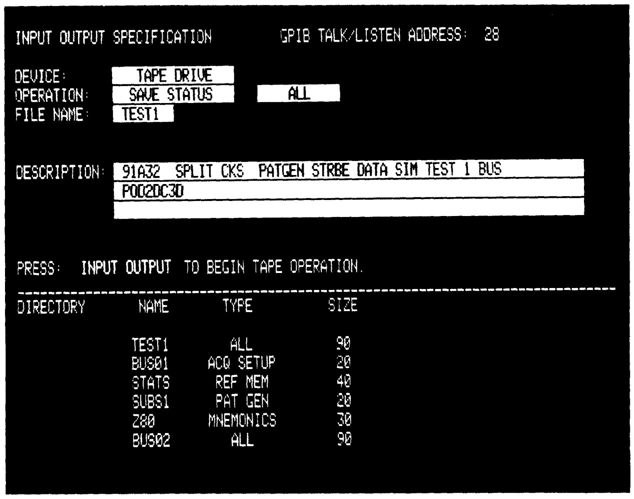
To remove a description:

1. Move the screen cursor to the line you want deleted in the DESCRIPTION field.

2. Press DON'T CARE.

   The DAS deletes that line of the DESCRIPTION field.

The following illustration provides an example of how the fields appear when saving a file.

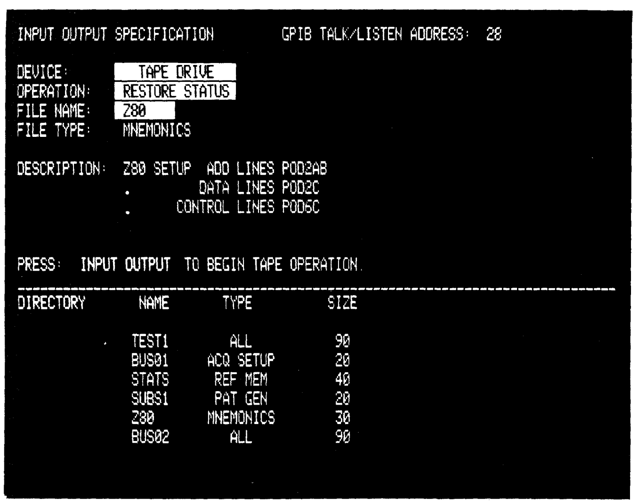


3624-130

RESTORE STATUS

The RESTORE STATUS operation is used to restore the DAS to the setup of a specified tape file. For this operation, you should enter the file you want restored, then start the operation.

As the file is restored, the sub-menu displays the file type and description. The following illustration shows how the sub-menu appears after this operation is performed.



3624-140

NOTE

Tapes made from color and monochrome mainframes are interchangeable, so long as the mainframes meet the configuration conditions listed below.

When the DAS restores a file, it first determines what type of file is being used. If the file is an ALL, ACQ SETUP, or REF MEM type, the DAS checks the mainframe's current data acquisition module configuration. In order to restore any acquisition menu setups, the mainframe's current configuration must match the acquisition module configuration which was used when the tape was originally saved.

The following four conditions may result if the data acquisition module configurations do not match:

- **TAPE OPERATION HAS MODIFIED THE MODULE CONFIGURATION**—appears when the tape file uses fewer data acquisition modules than are installed in the mainframe. The tape only looks for the modules which match the correct configuration of when the tape was made. When this type of restore takes place, the DAS menus reflect the module structure on the tape and any additional modules in the instrument are ignored. Modules that have been ignored cannot be used until they are specified by another tape restore, or until the DAS is powered down and back up.

- **CONFIGURATION ERROR**—appears because the DAS mainframe does not have the correct data acquisition modules installed in the correct bus slots to match the tape. No restore occurs when this message appears.

- **PARTIAL RESTORE IN PROGRESS**—appears when acquisition menu setups cannot be restored, but a mnemonics and pattern generator menu setup can. This occurs only during ALL restores. The pattern generator modules do not have to match a specific bus slot configuration.

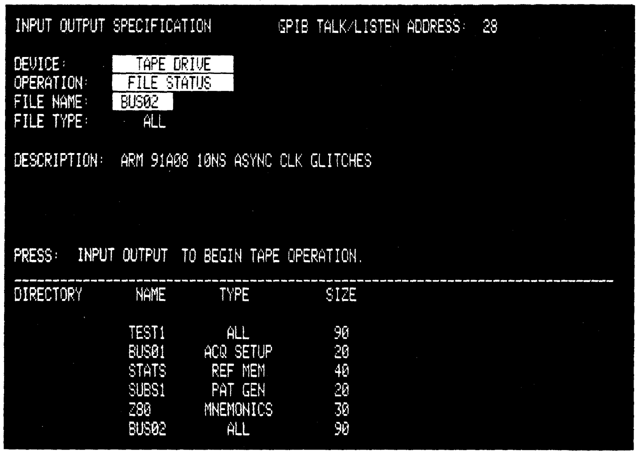
- **FIRMWARE VERSION ERROR**—appears when the firmware version of the mainframe does not match the firmware version used when the tape was made. No restore will occur.

If an error occurs during a restore operation, do not exit the menu. Rather, try the restore over again by pressing the INPUT OUTPUT key.

FILE STATUS

The FILE STATUS operation lets you display the type and description of an existing tape file without performing a restore. For this operation, you should enter an existing tape file into the FILE NAME field, then start the operation.

The following illustration shows how the sub-menu appears when this operation is performed.



3624-141

DELETE FILE

The DELETE FILE operation is used to delete any existing files. For this operation, you must enter the name of the file you want to delete, then start the operation. The DAS then deletes the file from the tape.

FORMAT TAPE

The FORMAT TAPE operation is only used when you format a new or bulk-erased tape for use with the DAS. The following illustation shows how the sub-menu appears when this operation is selected.

3624-142

For this operation the FILE NAME field disappears. The only action required is to start the operation. A prompt message appears in the middle of the screen which tells you to press the INPUT OUTPUT menu key to begin the operation.

If you have inserted a tape cartridge that has already been formatted, the prompt message will not appear. The DAS will not try to reformat an already formatted tape, even if the INPUT OUTPUT key is accidentally pressed.

When the formatting operation is started, the DAS displays a message on the second line of the screen reading TAPE OPERATION IN PROGRESS. The DAS first winds and rewinds the tape to get the proper tension, then the screen goes blank for approximately 30 seconds while formatting takes place. When the menu reappears on the screen it will again display TAPE OPERATION IN PROGRESS for a few seconds. When the operation is over, the message disappears and the monitor beeps. The whole operation takes approximately 45 seconds.

STARTING THE OPERATION

When you have entered the necessary file name parameter for any given operation, a message appears in the middle of the sub-menu reading PRESS: INPUT OUTPUT TO BEGIN OPERATION.

At this point, you may start the operation by pressing the INPUT OUTPUT key.

When the operation starts, the DAS displays a message on the top line of the screen reading TAPE OPERATION IN PROGRESS. While this message is displayed, the screen cursor disappears. After a few seconds, the message will disappear and the DAS will rewind the tape.

When a tape operation is completed, the DAS monitor beeps and the screen cursor reappears.

USING WRITE-PROTECT

Each DC100 tape cartridge has a write-protect function labeled RECORD. If this function is enabled, the tape is not available for any operations except RESTORE STATUS or FILE STATUS.

RS-232 SUB-MENU DISPLAY

The RS-232 master/slave operation involves two DAS systems. These systems must be connected via their respective RS-232 interfaces. Procedures for connecting these interfaces are provided in the Operating Instructions section of this manual. Refer to the section for more information.

NOTE

Color and monochrome DAS mainframes can be used together in the master/slave operation.

The master/slave operation works in the following way. One DAS is set up as the master, while the other is set up as the slave. The baud rate is selected, then a link is made.

When the link is established, the screen and keyboard of the master DAS are tied into the slave DAS. The user of the master DAS has complete remote control over the slave DAS. The user of the slave DAS still has keyboard and screen functions, and any changes made are sent back to the master DAS. The master DAS may or may not have any data acquisition and pattern generator modules installed.

The setup and control of the master/slave operation is handled via the RS-232 sub-menu. This sub-menu is illustrated in Figure 10-3.

READING THE MENU

Refer to Figure 10-3 when reading the following paragraphs.

The menu title, INPUT OUTPUT SPECIFICATION, appears in the top left corner of the screen. The line directly below the title is reserved for highlighted error or prompter messages that may occur.

The DEVICE field, on the third line of the display, indicates which sub-menu is being displayed (in this example, RS-232).

The STATUS field is used for designating whether the instrument will operate as master or slave. The OFF value is used when transmitting GPIB over the RS-232.

The BAUD RATE field is used for selecting the master/slave transmission baud rate.

RS-232 SUB-MENU FIELDS AND VALUES

The following paragraphs describe how to set up the RS-232 sub-menu and use the master/slave operation. Each sub-menu field is discussed along with its optional values.

Figure 10-4 illustrates the RS-232 sub-menu and its fields. The fields, which appear in reverse video on the screen, will be designated by brackets [ ] throughout the text. The screen cursor moves from field to field in any direction, and is controlled via the four directional cursor keys and the NEXT key.

Refer to the numbered callouts in Figure 10-4 when reading the following paragraphs. These numbers are intended as a visual reference, and do not imply sequence of use.

(1) DEVICE Field

The DEVICE field is used to select between the sub-menu displays. Refer to the description of the Sub-Menu Selections earlier in this section.

(2) STATUS Field

The STATUS field is used to specify whether the DAS is to be master or slave.

To specify the DAS master/slave status:

1. Move the screen cursor to the STATUS field.

   STATUS: [OFF]

2. Press the SELECT key until the desired value rotates to the field.

   The DAS displays the optional values in this order:

   STATUS: [OFF]
   [MASTER]
   [SLAVE]

NOTE

The OFF status is used when the RS-232 is transmitting GPIB commands. Refer to the GPIB Programming section of this manual for more information.

(3) BAUD RATE Field

The BAUD RATE field is used to specify the speed at which the master and slave systems will transmit information.

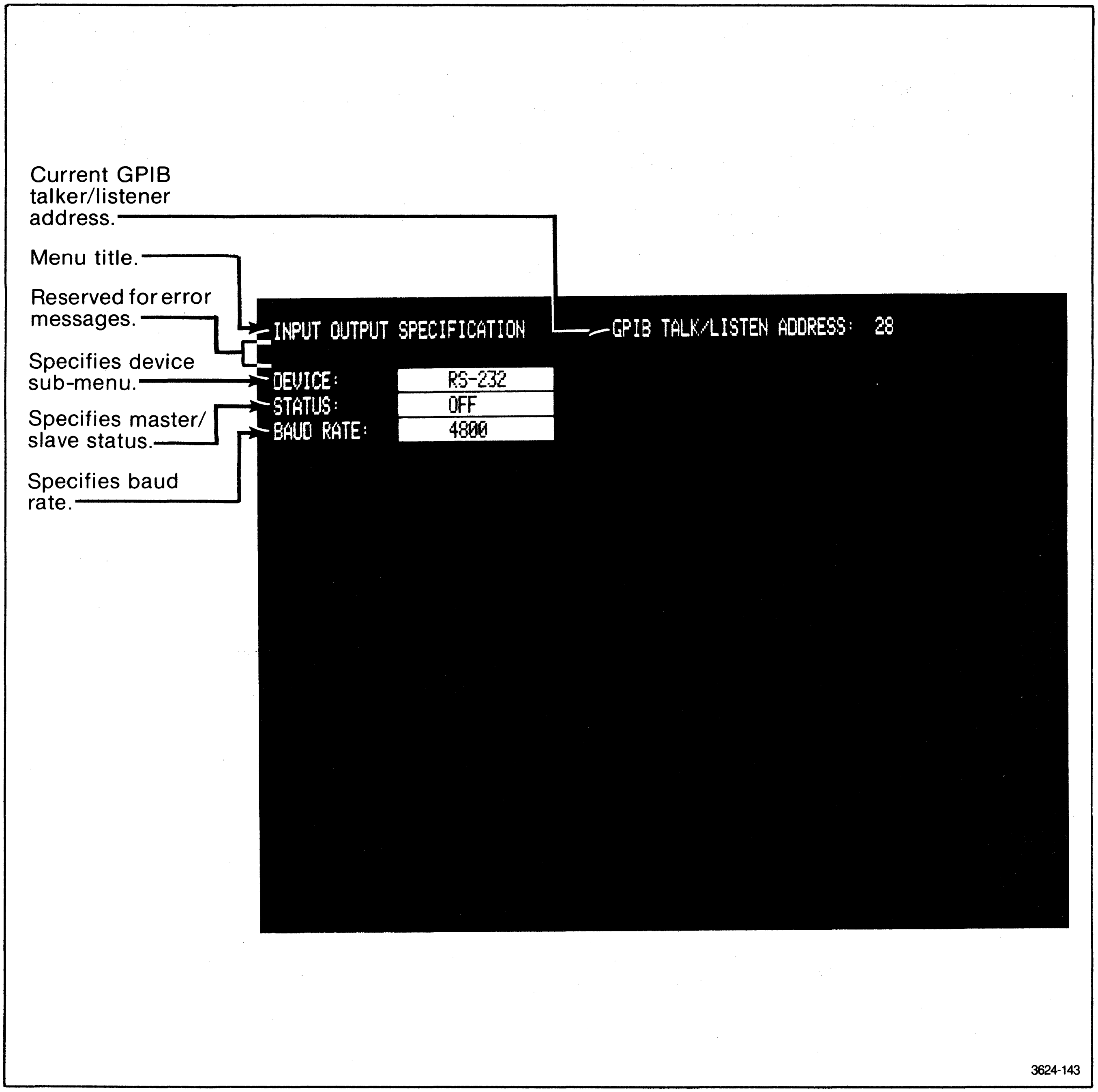


Figure 10-3. Display of the RS-232 sub-menu. This sub-menu provides fields for selecting master/slave status and for specifying baud rate.

To specify the baud rate:

1. Move the screen cursor to the BAUD RATE field.

   BAUD RATE: [4800]

2. Press the SELECT key until the desired baud rate appears in the field.

The DAS displays optional values in this order:

[4800]
[9600]
[300]
[600]
[1200]
[2400]

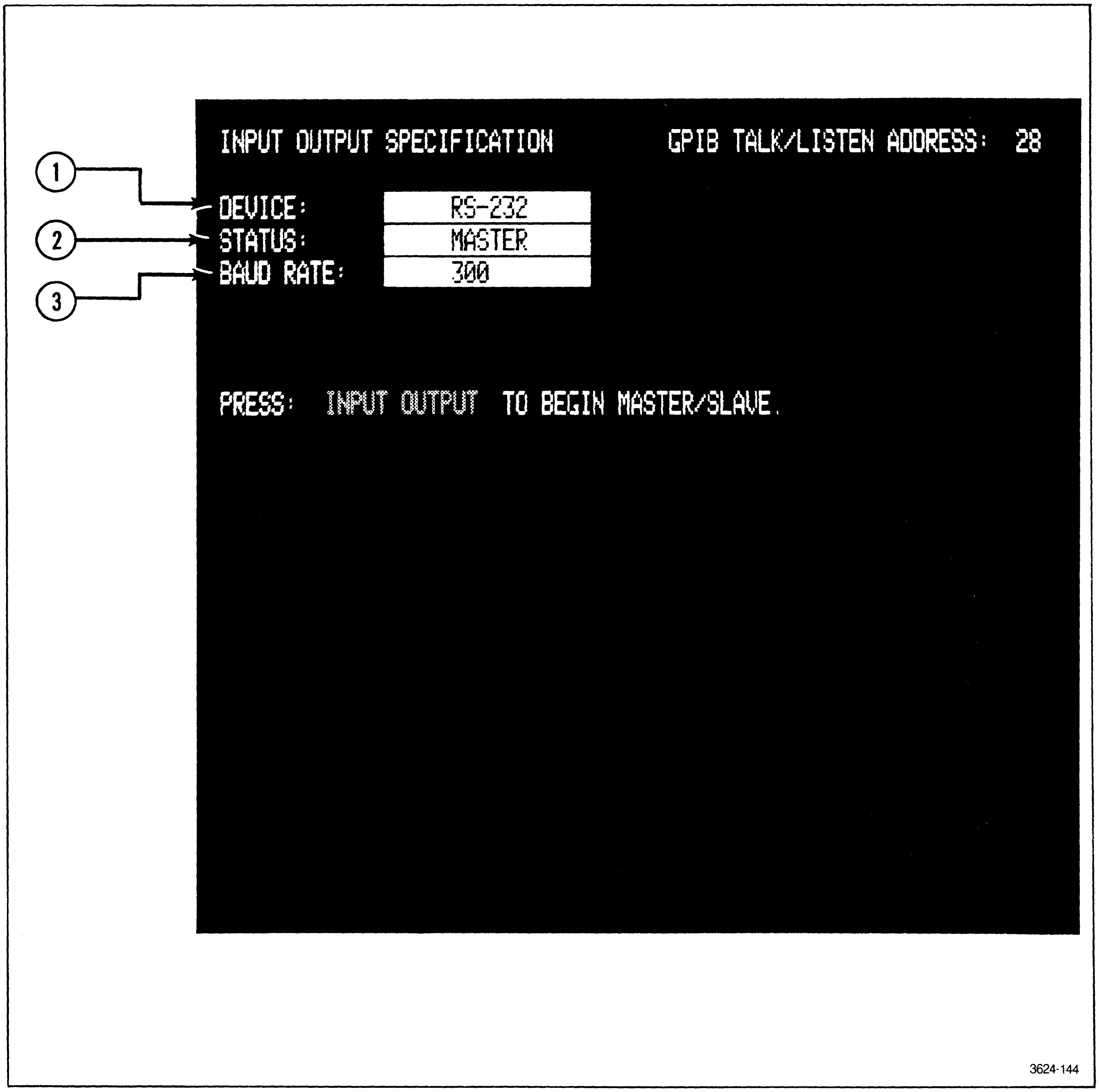


Figure 10-4. The RS-232 sub-menu and its fields.

ESTABLISHING THE LINK

Once you have specified the status and baud rate for two systems, you can establish the master/slave link. A message appears in the middle of the screen reading PRESS: INPUT OUTPUT TO BEGIN MASTER/SLAVE. The INPUT OUTPUT keys of both DAS systems must be pressed to initiate the link.

NOTE

To establish a master/slave link, the GPIB address switches on both systems must be set to an address between 0 and 30 inclusive. A master/slave link cannot be made if either system is set to GPIB address 31, since this is the RS-232's GPIB address. Refer to the GPIB Programming section of this manual for procedures on how to set the GPIB address switches.

As the DAS systems initiate a link, a message appears on the second line of both screens, reading TRYING TO LINK. While this message is displayed, the two systems are in a handshaking process. The master DAS sends a message to the slave and waits for a response.

Carrier detect must be present for the handshake to take place. If carrier detect is not present, an error message appears on the DAS screen reading COMMUNICATION ERROR, PRESS STOP TO EXIT. At this point, you can press the STOP key and terminate the link. You can then try for a new link by pressing INPUT OUTPUT.

NOTE

The COMMUNICATION ERROR message appears whenever the carrier detect is lost. You can terminate the link (if necessary) by pressing the STOP key.

If the carrier detect is present and the handshake complete, a message appears on both screens, reading LINK ESTABLISHED. This means the master/slave hookup is in operation.

DATA COMMUNICATION

When the master/slave hookup is in operation, the screen and keyboard of the master DAS become, in effect, a second screen and keyboard for the slave DAS. Any action initiated on the master DAS is reflected with the slave system. The instrument functions of the master DAS are not accessible until the link is terminated.

The keyboard and screen of the slave DAS always remain operational. Any screen changes effected by the slave system are sent to the master DAS. This way, the two screens remain identical.

Phone Messages. In addition to all the regular functions, a special command is available during the master/slave operation. By pressing the SHIFT/INPUT OUTPUT keys together, you can write a message to the other DAS screen which reads PICK UP THE PHONE. This message tells the user of the other DAS that you want to relay information via a phone conversation.

NOTE

For the phone messages feature, the modem being used must be configured for: No Auto Disconnect, No Loss of Carrier Detect Disconnect, and No Abort Time Disconnect.

TERMINATING THE LINK

At any time, either DAS system can terminate the master/slave link. This is accomplished by hanging up the phone, or by entering the RS-232 sub-menu and changing the STATUS field to OFF.

APPLICATION EXAMPLES 11

This section provides application examples which illustrate the various operating features. Before reading this section, you should first be familiar with the various DAS menus and their setup procedures.

In this section you will find: **Page**

APPLICATION EXAMPLES

This section serves as a learning guide to the effective use of the DAS data acquisition and pattern generator operations. The examples center around these two operations, their timing relationships, and start functions.

Examples Using the Diagnostic Lead Set. Many examples in this section use the diagnostic lead set to exercise the various data acquisition and pattern generator features. These examples provide an overview of the two operations. You may duplicate any of these examples so long as your DAS contains data acquisition and pattern generator modules.

The examples using the diagnostic lead set are progressive, building on each other. Therefore it is recommended that you start with the first example and work through. The examples appear in the following order:

- **Using the Diagnostic Lead Set**—this example shows how the lead set and clock lines are connected. It also lists the rules and restrictions on using the diagnostic lead set.
- **Running the Probe Self-Test Routine**—this example tests to make sure that the probes, diagnostic lead set, and clock lines are connected and operating properly.
- **Using the Pattern Generator Instructions**—these examples discuss the seven pattern generator instructions.
- **Using the Pattern Generator Interrupt**—this example illustrates the use of the pattern generator's external interrupt request signal.
- **Using the ARMS Trigger Mode**—this example illustrates how to use the ARMS mode and how to read the resulting display.

Examples Using the Tektronix MicroLab I. Two examples at the end of this section illustrate how the DAS can be used in testing microprocessor-based circuits. These examples use the Tektronix MicroLab I as the system under test. You may duplicate these examples exactly if you have the MicroLab, the appropriate personality cards, and the appropriate data acquisition and pattern generator capabilities. Otherwise, you can refer to these examples for an overview of how the DAS can be used in the microprocessor environment.

One example uses the MicroLab I with a 6800/02/08 Personality Card:

- **Simulating 6802 Microprocessor Bus Activity**—this example uses the pattern generator to take the place of the 6802 microprocessor. The pattern generator strobes are used to clock the system under test.

One example uses the MicroLab I with a Z8000 Personality Card:

- **Using the 91A32 External-Split Clocks**—this example uses two 91A32 modules, each set to a different external clock. The two modules are used to acquire address and data information from the Z8002's multiplexed address/data bus.

USING THE DIAGNOSTIC LEAD SET

The following paragraphs describe how to set up the probes and clocks for the examples using the diagnostic lead set. They also explain how to set up the acquisition display menus.

You may wish to modify some of the examples using the diagnostic lead set. If so, you should be aware of the following restrictions:

1. The diagnostic lead set cannot operate at clock rates faster than 1 μs. Be sure to set both the acquisition and pattern generator clocks accordingly.

2. The diagnostic lead set cannot recognize a tri-state condition (from the pattern generator) because it does not have the necessary pull-up or -down resistors.

SETTING UP THE PROBES

In the examples using the diagnostic lead set, the data acquisition and pattern generator probes are connected as shown in Figure 11-1. The examples use a P6452 Data Acquisition Probe and a P6455 TTL/MOS Pattern Generator Probe. If you are duplicating these examples, make sure that the following conditions are true:

1. The acquisition ground lead from the diagnostic lead set is connected to the GND DIAGNOSTIC location.

2. The pattern generator ground lead from the diagnostic lead set is connected to the V_L location.

NOTE

If you substitute a P6456 ECL Pattern Generator probe, you should connect the ground lead from the diagnostic lead set to the V_H location. Additionally, the acquisition probe should be set a VAR −1.30 V (ECL) threshold in the Channel Specification menu.

3. The threshold-range switch on the data acquisition probe is set to NORM.

4. The diagnostic switch on the pattern generator probe is set to AUX.

In the examples, the data acquisition probe is connected to POD A of the 91A32 module residing in bus slot 2. The POD ID for this probe throughout the examples is POD 2A (bus slot 2, pod connector A).

NOTE

If you do not have a 91A32 module, substitute a 91A08 module installed in bus slot 6. The POD ID for the probe would then be POD 6C.

The pattern generator probe is connected to pod B of the 91P16 module residing in bus slot 1. The POD ID for this probe throughout the examples is POD 1B (bus slot 1, pod connector B).

SETTING UP THE CLOCKS

In the examples using the diagnostic lead set, the probes are set up to use an asynchronous (DAS internal) or a synchronous (external) acquisition clock. The synchronous (external) clock source will be derived from the pattern generator's output clock signal.

To obtain the external clock, the pattern generator's output clock line must be connected to CLK1 on the External Clock Probe (connected to the Trigger/Time Base Module).

NOTE

If the 91A08 module is used, connect the pattern generator's output clock line to the IN lead on the 100 MHz Clock Probe (connected to the 91A08 module installed in bus slot 6).

Figure 11-2 illustrates how to connect the clock lines. The pattern generator's output clock lead (grey flying lead from the diagnostic lead set) is connected to the External Clock Probe's CLK1 input (black lead). The two leads are connected by square pins. You can also connect the leads by using any appropriately conductive wire, such as a piece of transistor lead.

To ensure an accurate clock input, the External Clock Probe should by grounded by a ground lead attached to the probe's GND SENSE location.

NOTE

If you are using the 91A08 module and 100 MHz Clock Probe, you should ground the clock probe using the REF lead.

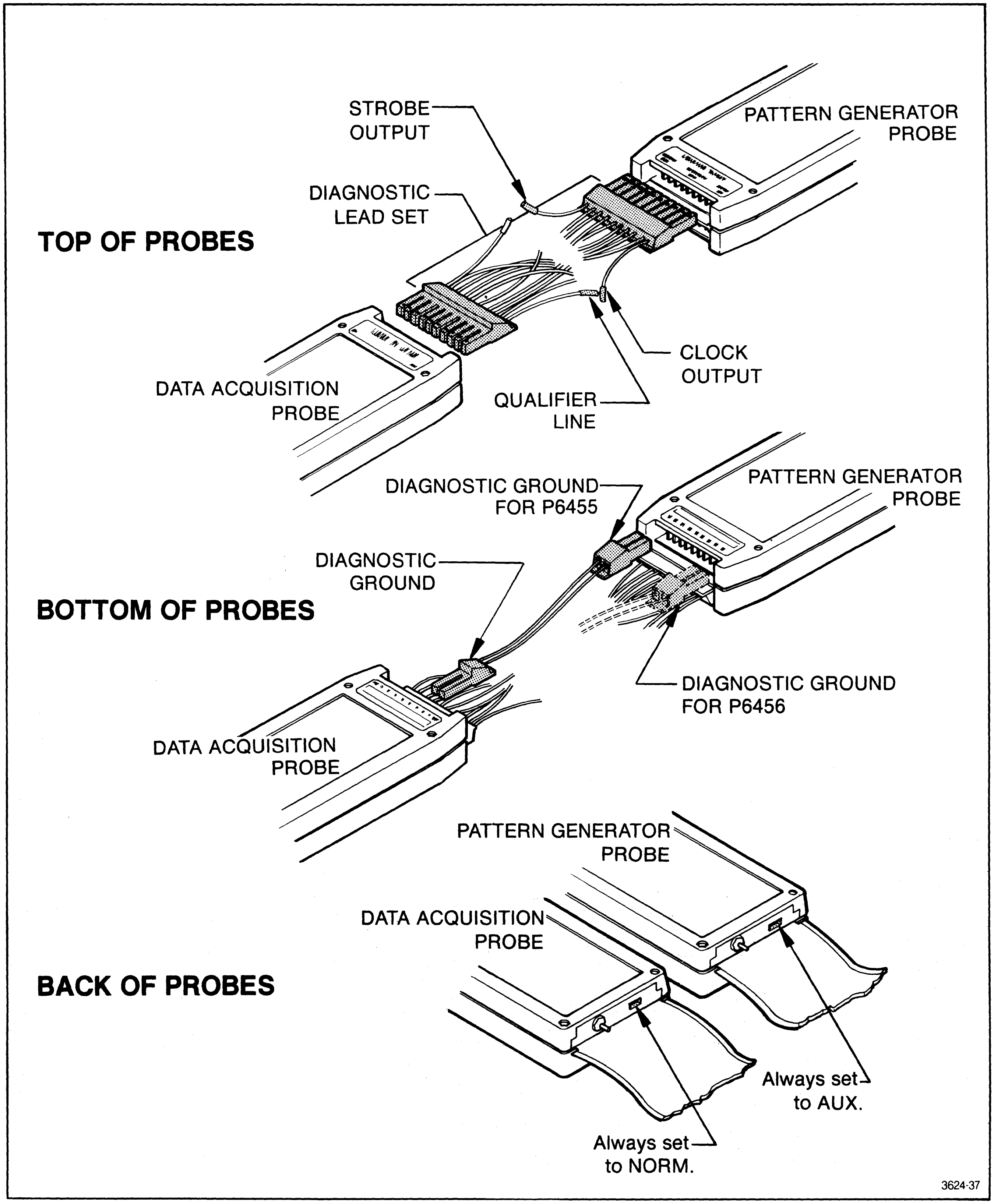


Figure 11-1. Connecting the diagnostic lead set.

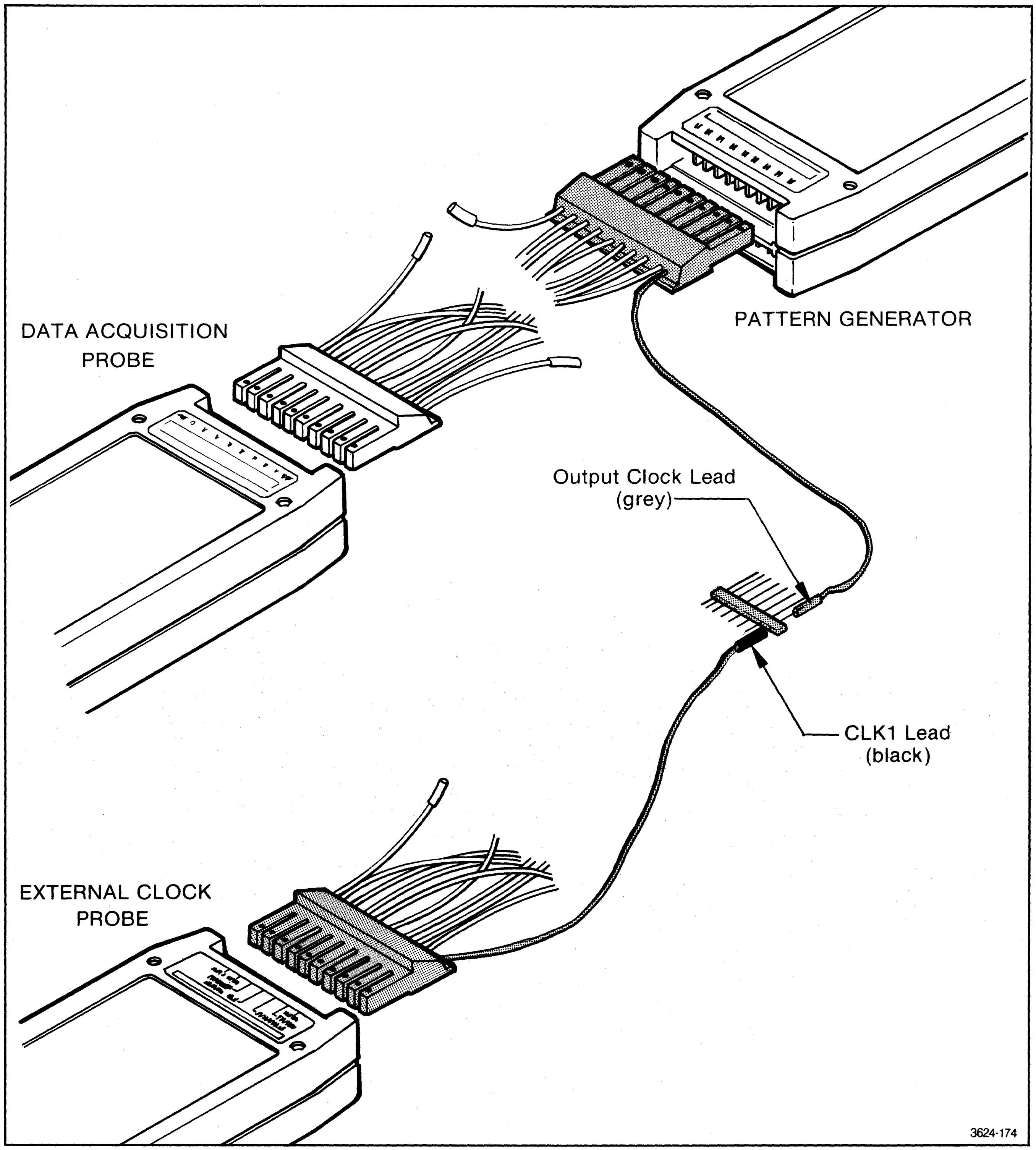


Figure 11-2. Connecting the data acquisition and pattern generator clock leads.

SETTING UP THE ACQUISITION DISPLAY

In the examples using the diagnostic lead set, acquired data is displayed in the State Table menu. Therefore, the State Table menu is set up to display only the data acquired via POD 2A (the connected acquisition probe).

The State Table display is controlled through the Channel Specification menu. As shown in Figure 11-3, the DISPLAY ORDER field is limited to group C because this group contains POD 2A. All other groups in the DISPLAY ORDER field are set to don't care. The display radix for group C is set to hexadecimal and the polarity is set to positive. The probe's threshold is set to TTL +1.40 V.

NOTE

If you are using a P6456 ECL Pattern Generator Probe change the acquisition probe's threshold to VAR −1.30 V.

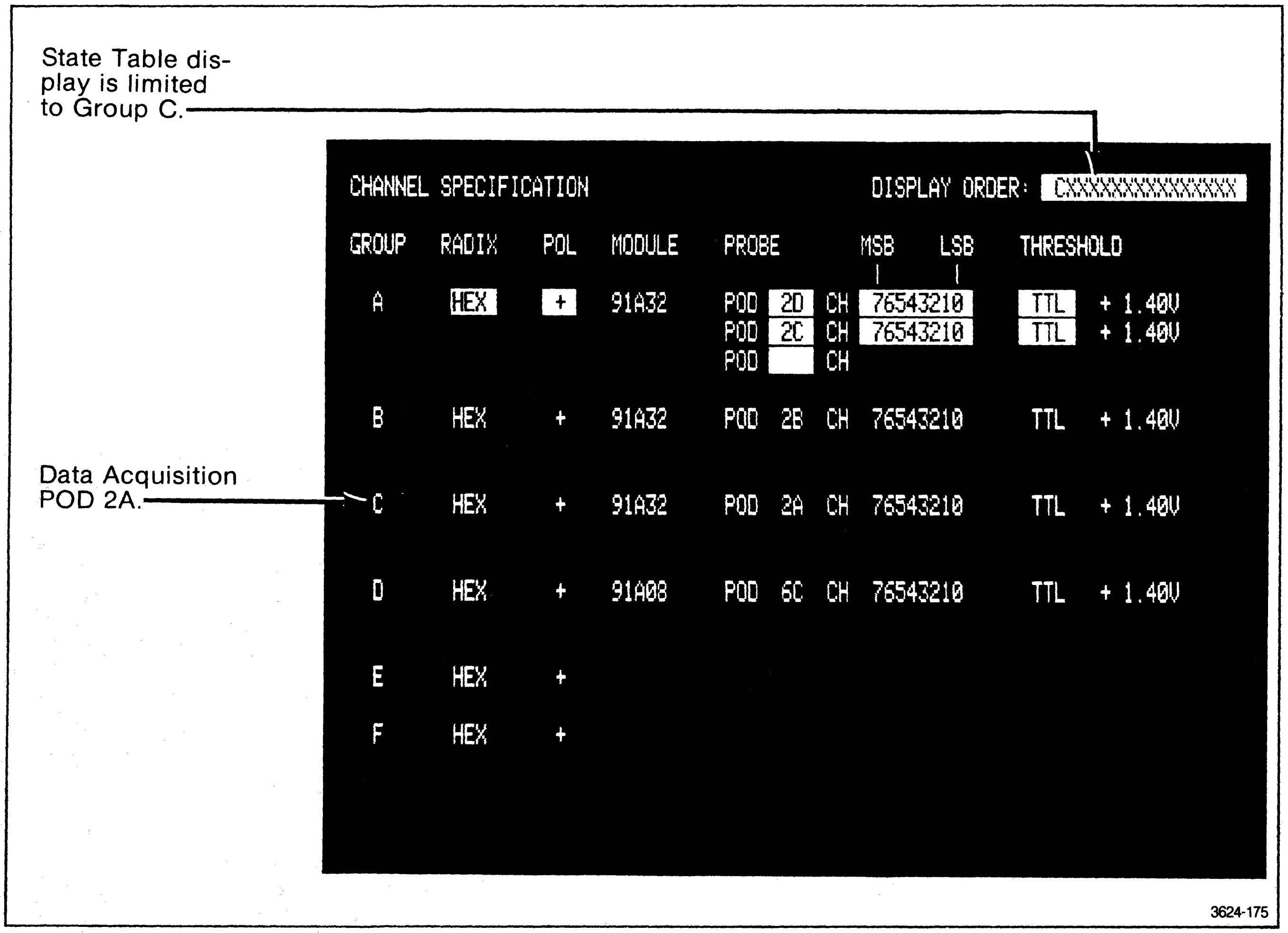


Figure 11-3. Setting up the State Table display.

RUNNING THE PROBE SELF-TEST ROUTINE

The following example will verify that the probes, the diagnostic lead set, and the clock lines are connected and functioning properly.

In this example, the probe self-test routine from the pattern generator is acquired by the acquisition module—using first the internal clock and then the pattern generator's output clock. The start function for the example is START SYSTEM.

THE PROBE SELF-TEST ROUTINE

Figure 11-4 shows how the probe self-test routine appears in the Pattern Generator menu. This routine is automatically entered into the menu whenever the system is powered up.

The probe self-test routine is designed to output a repeating data pattern. When the pattern generator is started, it outputs the value at SEQ 0, jumps to the sequence line labeled 200, and then outputs the values at SEQ 200-209. At SEQ 209, the pattern generator jumps back to the sequence line labeled 200, and continues in the looping cycle.

The pattern generator clock is set to the DAS internal clock at 1 μs.

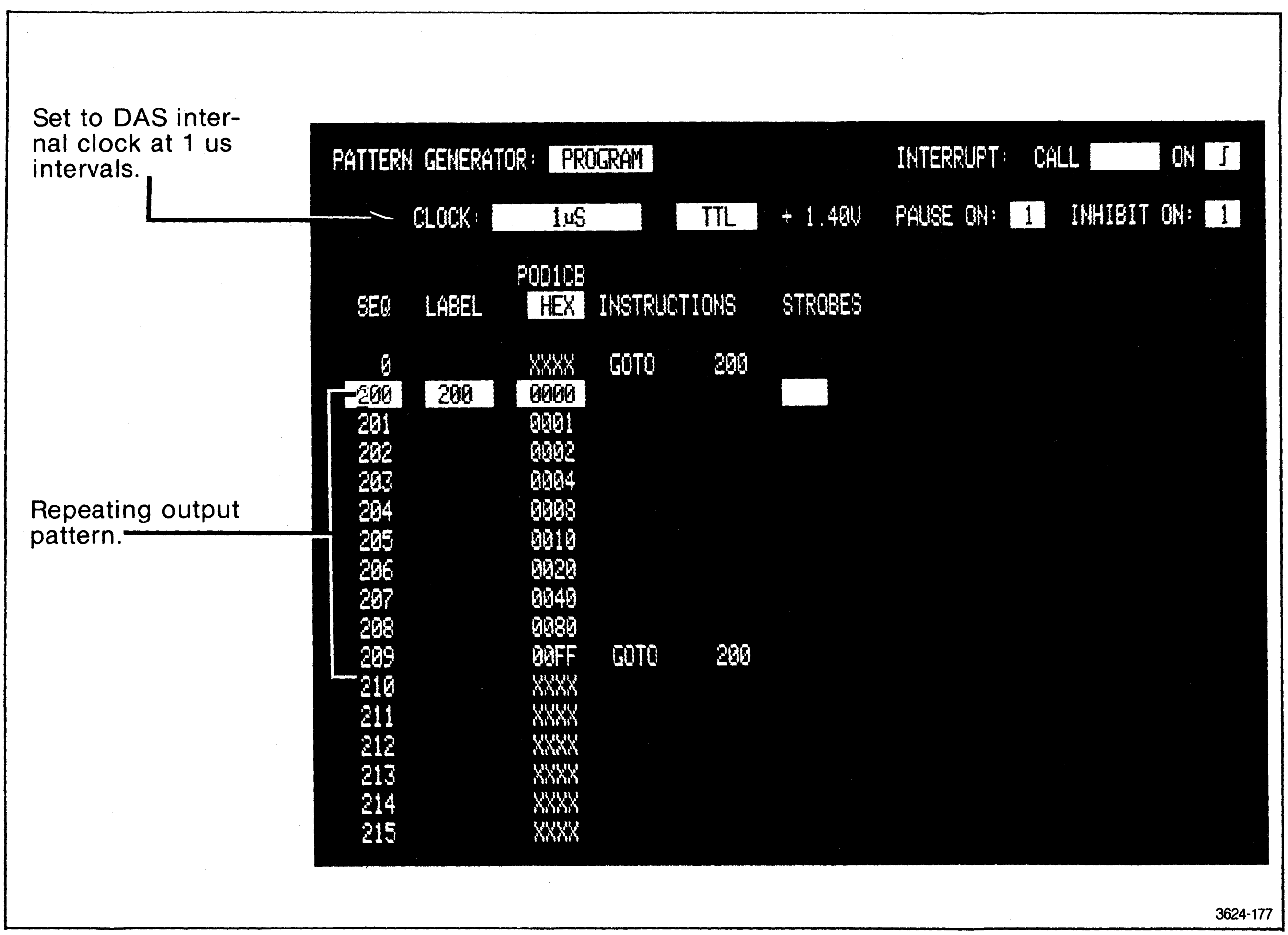


Figure 11-4. The probe self-test routine in the Pattern Generator menu.

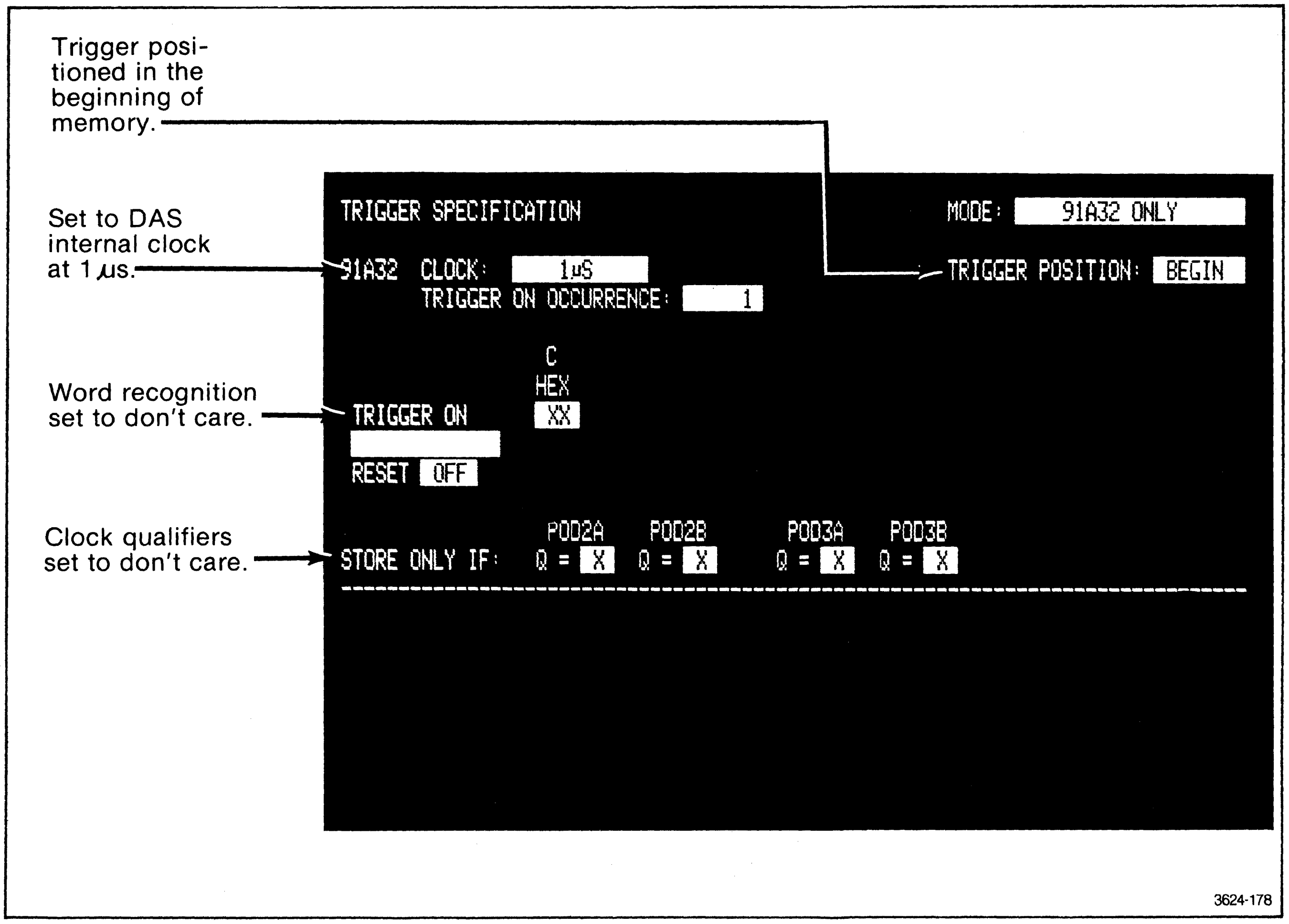


Figure 11-5. Setting up the acquisition internal clock.

ACQUISITION WITH THE INTERNAL CLOCK

Figure 11-5 illustrates how the acquisition is set up to use the DAS internal clock. The Trigger Specification menu is left in its default configuration.

The 91A32 CLOCK field is set to the DAS internal clock at 1 μs and so is synchronized to the clock used by the pattern generator.

The word recognizer fields are set to don't care, and the TRIGGER POSITION field is set to the beginning of memory. This means a trigger will be generated on the first acquired word and that word will be positioned as word 14 in the beginning of memory. The STORE ONLY IF fields are set to don't care, and so no clock qualifier lines are used.

Starting the Acquisition. Once the Trigger Specification menu is set up, press the START SYSTEM key to begin the operation. When this key is pressed, the data acquisition and pattern generator operations start simultaneously.

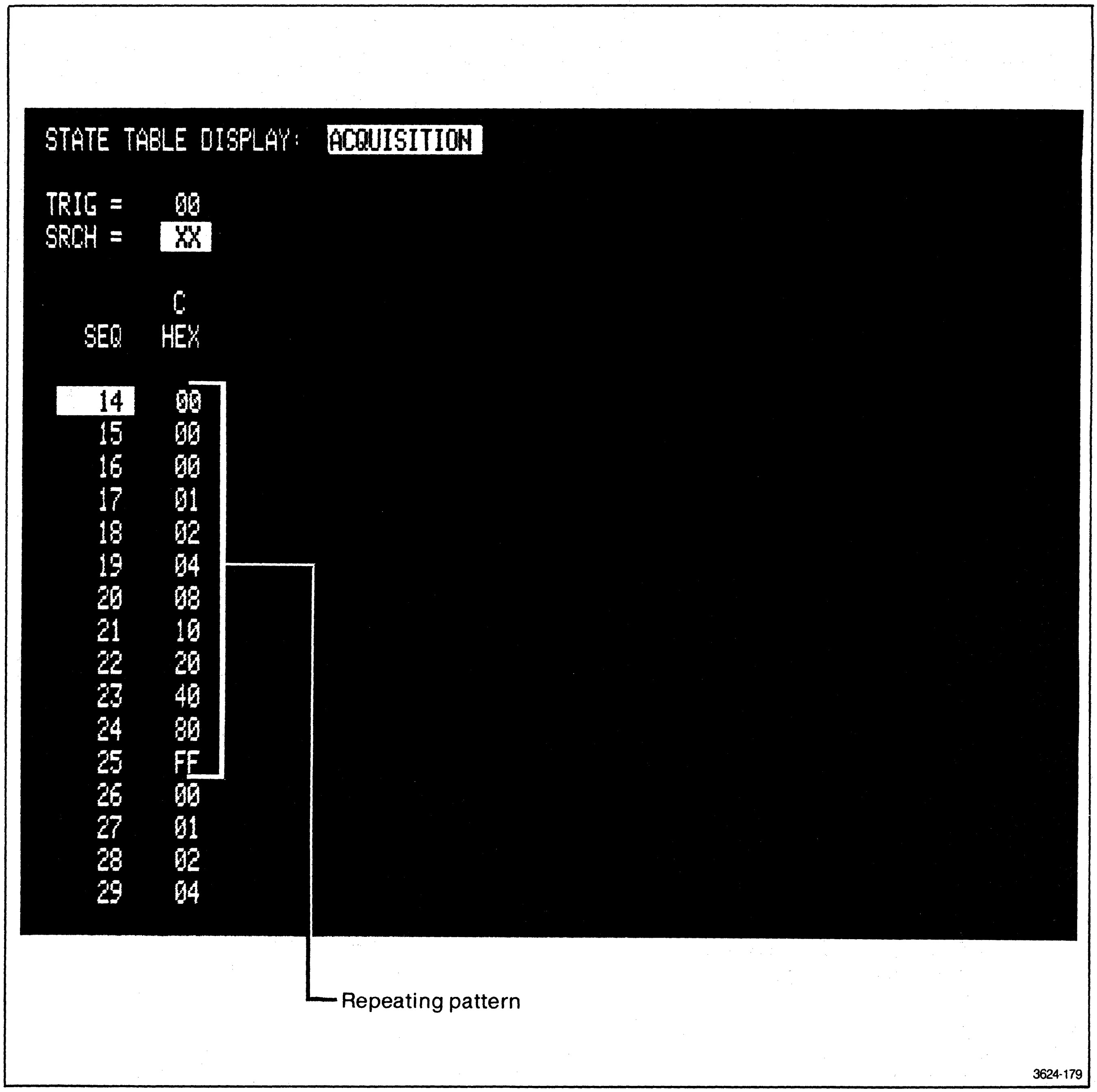


Figure 11-6. Display of probe self-test routine using an internal acquisition clock.

Figure 11-6 illustrates how the probe self-test pattern appears in the State Table menu when the operation is complete. The acquired pattern verifies that the probes and internal clock are functioning properly.

NOTE

When the data acquisition and pattern generator modules are using the same clock (internal or external), the acquisition modules start one clock cycle in front of the pattern generator's output clock. Therefore, in this example display, the first data word output from the pattern generator is acquired twice.

ACQUIRING WITH THE EXTERNAL CLOCK

To verify the external clock connections, the data acquisition modules are set to acquire the pattern using the external clock source (the output clock signal from the pattern generator).

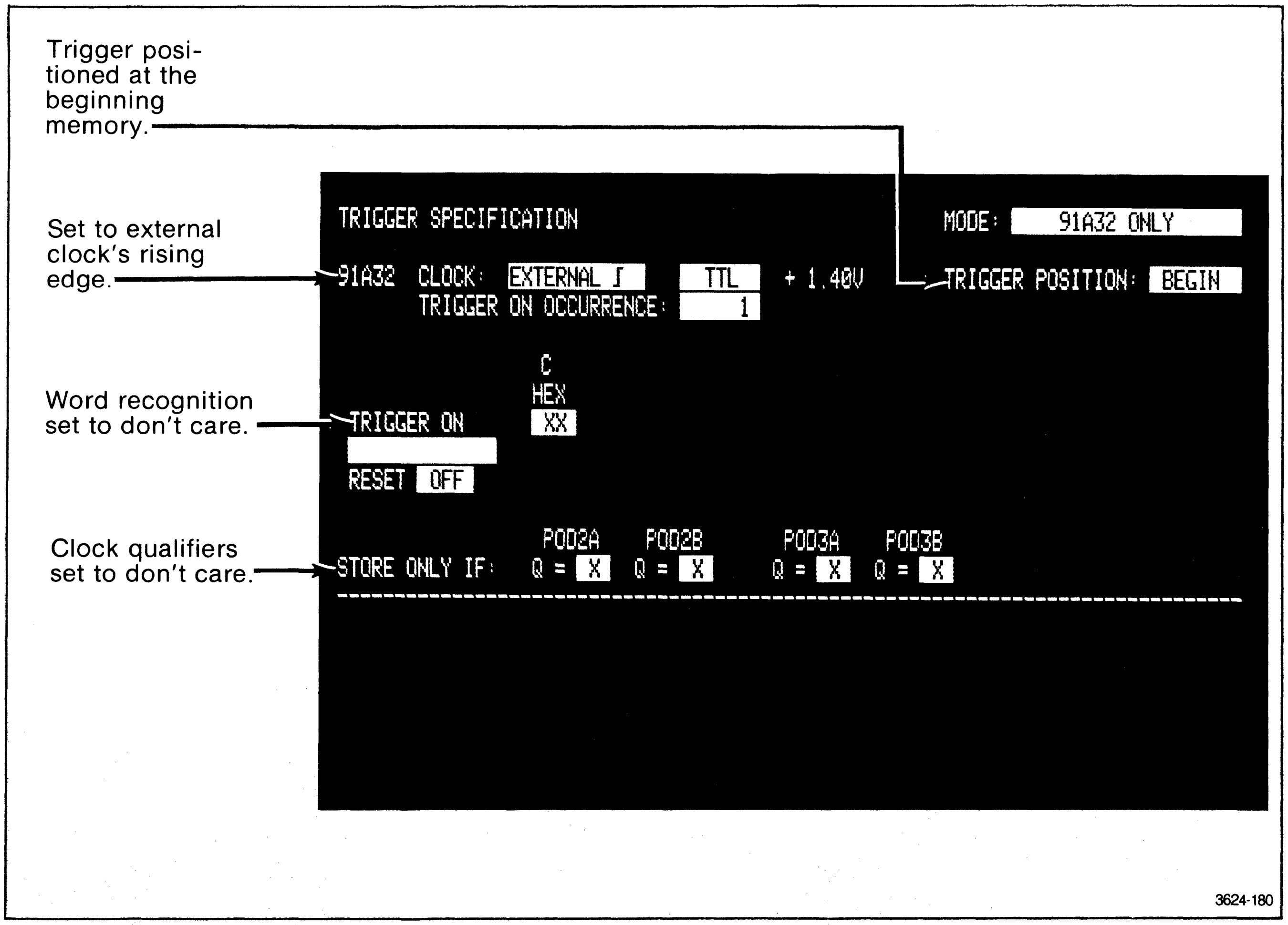


Figure 11-7. Setting up the acquisition external clock.

Figure 11-7 illustrates how to set up the acquisition for an external clock. The 91A32 CLOCK field in the Trigger Specification menu is set to EXTERNAL⌠ (rising edge). Whenever you are acquiring data using the pattern generator's output clock, you should use the rising edge of the signal.

NOTE

If you have substituted a P6456 ECL Pattern Generator Probe, the External Clock Probe's threshold should be set to VAR −1.30 V since it is connected to the ECL probe. This threshold change can be made in the Trigger Specification menu's clock threshold field or in the Pattern Generator menu's clock threshold field.

Again, in this example, word recognition is set to don't care with the trigger positioned in the beginning of memory.

Starting the Acquisitiion. In this example, when the START SYSTEM key is pressed, the data acquisition probe acquires data identical to that acquired with the internal clock. The only difference is that SEQ 0 is only acquired once, since the data acquisition is running from the pattern generator's output clock.

Figure 11-8 illustrates how the probe self-test appears in the State Table when the operation is complete. The acquired pattern verifies that the external clock lines are connected properly.

If the clock lines are not connected properly, a SLOW ACQUISITION message will appear on the monitor screen when the START SYSTEM key is pressed. This means that the acquisition module is not receiving a clock, and no data is acquired. If this occurs, press the STOP key, then adjust the clock leads and try the operation again.

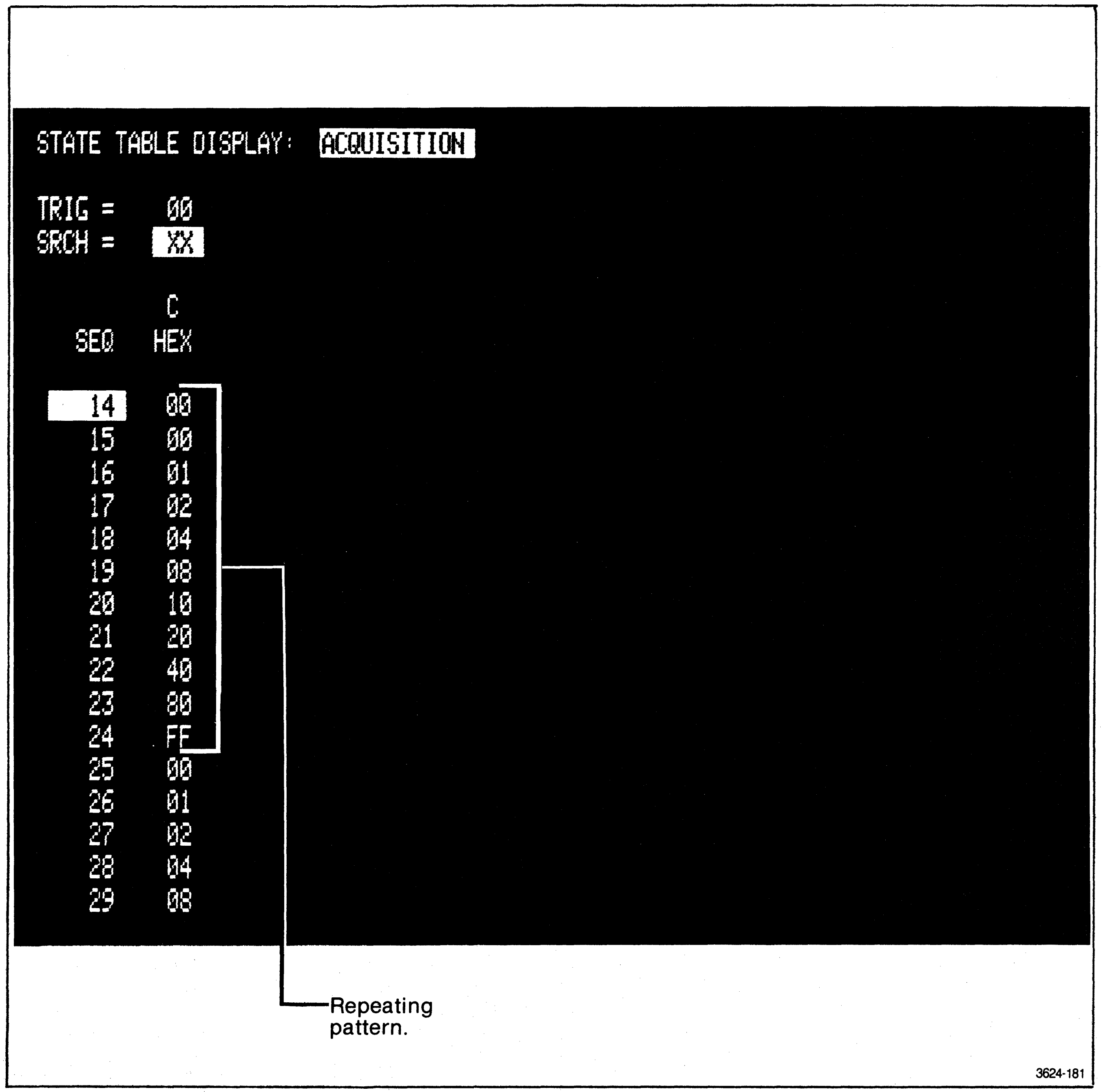


Figure 11-8. Display of probe self-test routine using an external acquisition clock.

USING THE PATTERN GENERATOR INSTRUCTIONS

The following examples illustrate the pattern generator instructions and their timing characteristics. They show how the instructions can be used to affect the pattern generator's data, clock, and strobe output.

All of the following examples use the diagnostic lead set, connected in the manner described earlier under Connecting the Diagnostic Lead Set.

During these examples, reference is made to an internal and an external acquisition clock. The internal acquisition clock is always the DAS internal clock set to 1 μs (refer to Figure 11-5). The external clock is always supplied via the pattern generator's clock output signal (refer to Figure 11-7).

Throughout the examples, the acquisition word recognizers are set to don't care, and the trigger is positioned in the beginning of memory.

HALT

Normally, the pattern generator outputs all of program memory (SEQ 0-253) before stopping. The HALT instruction can be used to stop the pattern generator's output at any given program line.

When a HALT is encountered by the pattern generator, the data value and any strobes associated with the HALT line are sent out to the probe tips. However, there is no output clock at the end of the HALT cycle.

This means that if a system under test is running from the pattern generator's output clock, the data value associated with the HALT line will not be clocked into the system. If a system under test is running from a different clock, it will acquire the data value of the HALT line continuously, since this value is sent out and held at the probe tips.

Figure 11-9 illustrates a typical example of how the HALT instruction can be used. In this example, the probe self-test routine is deleted from the Pattern Generator menu, and a

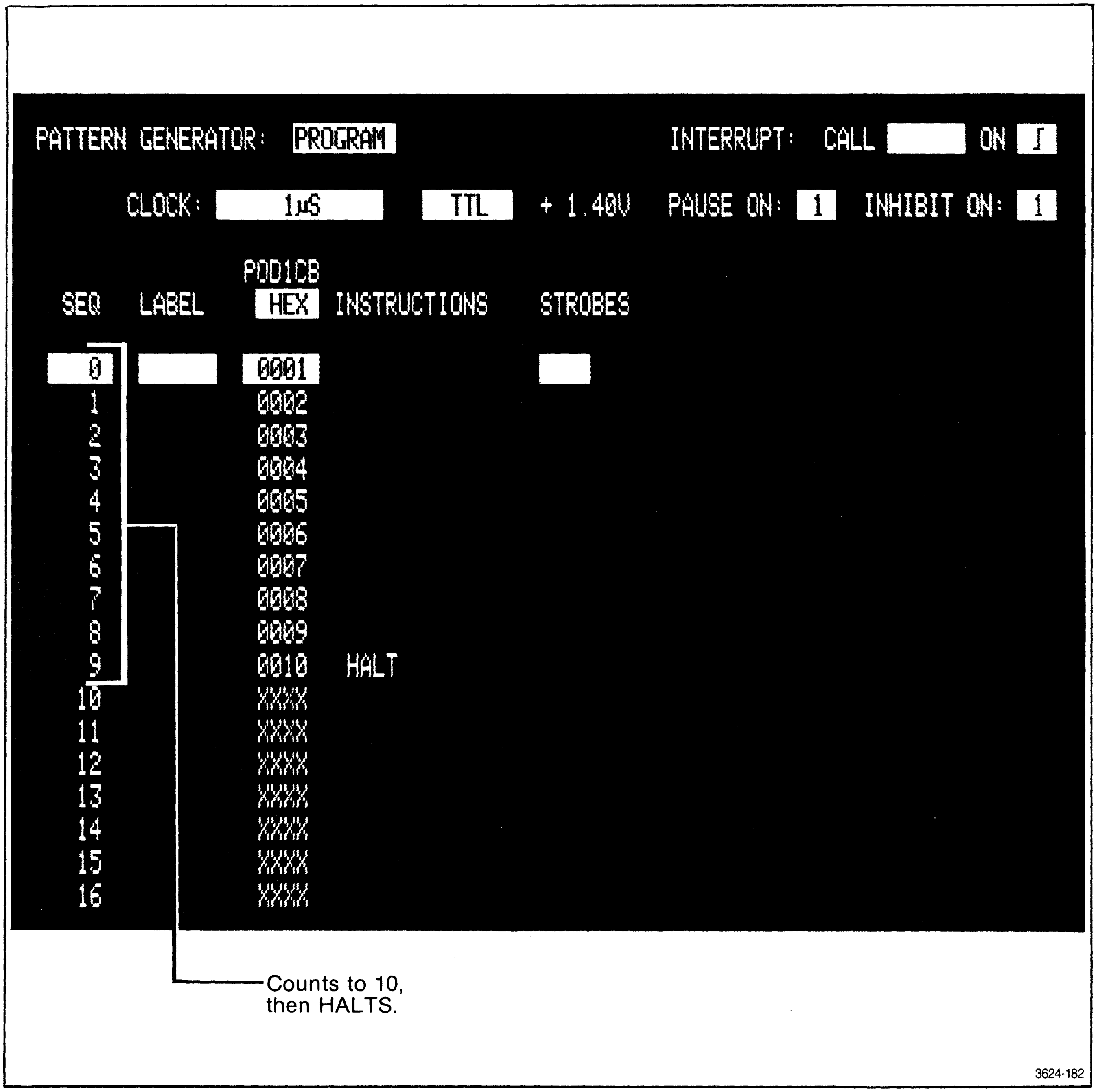


Figure 11-9. Using the pattern generator's HALT instruction.

10-line program is entered. The HALT instruction is entered on the last sequence line of this program.

With the program in Figure 11-9, the pattern generator operates in the following way. It outputs the list of data words (SEQ 0-9), then halts. No output-clock transition occurs following SEQ 9.

Acquiring the HALT Example Program. Figure 11-10 illustrates how the HALT example program appears when it is acquired. The first acquisition used the DAS internal clock set at 1 μs (see Figure 11-5). The second used the external pattern generator's output clock (see Figure 11-7). For both acquisitions, the START SYSTEM key is used.

By acquiring the HALT program with the internal acquisition clock, you can see how the program appears to a system under test that is running from its own clock. When the HALT is encountered at SEQ 9, the data value (10) at SEQ 9 is sent to the pattern generator probe. The value is then acquired continuously until the acquisition stops.

By acquiring the HALT program with the external acquisition clock, you can see how the program appears to a system under test that is running from the pattern generator's output clock. The data value (10) at SEQ 9 is never acquired because there is no following clock transition.

NOTE

The data value preceding the HALT instruction also does not appear on the display. This occurs because the acquisition module has a one-word pipeline. The preceding data value would be clocked into a system under test.

When the external clock is used, the acquisition must be manually stopped with the STOP key. This occurs because too few words are acquired to generate an acquisitiion stop/store. Two messages will appear on the screen during the acquisition.

- **WAITING FOR STOP STORE**—which means the acquisition module is waiting for a stop/store signal.
- **SLOW ACQUISITION**—which means the acquisition module is not receiving a clock.

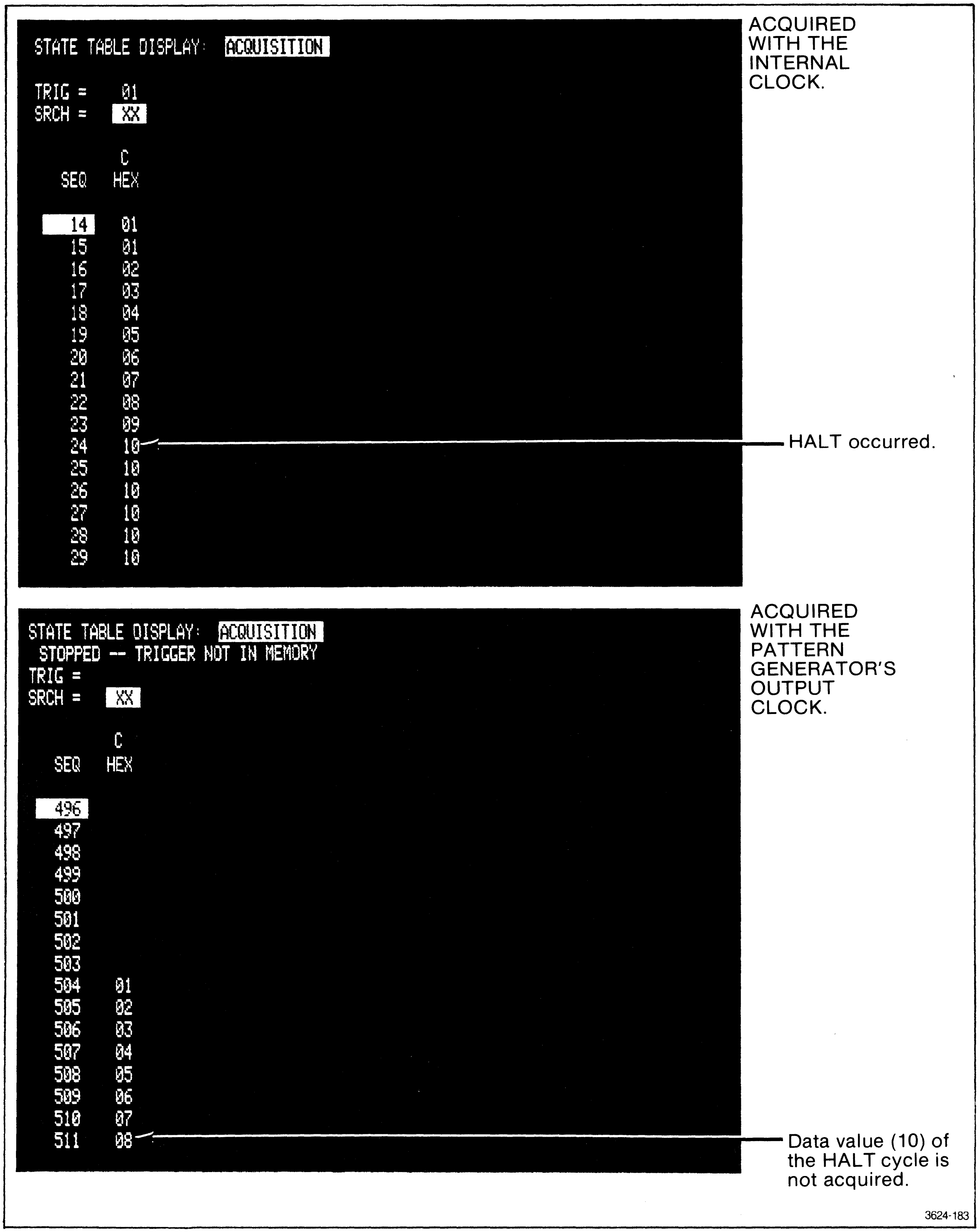


Figure 11-10. Acquiring the pattern generator's HALT example program.

GOTO

The GOTO instruction is used to break the sequential flow of the pattern generator program. It causes the program to jump from one sequence line to another. The most common use of the GOTO instruction is in building a program looping cycle that can continue indefinitely.

Figure 11-11 illustrates how the GOTO instruction may be implemented. In this program, the HALT instruction is replaced with GOTO TOP. The TOP label is entered at SEQ 0.

With the program in Figure 11-11, the pattern generator outputs the data values of SEQ 0-9, then jumps back to the TOP line and starts over. This loop continues until the pattern generator is stopped.

Acquiring the GOTO example program. Figure 11-12 shows how the GOTO example program appears when it is acquired. In this example, the acquisition module is running from the pattern generator's output clock signal (see Figure 11-7). The START SYSTEM key is used for the acquisition.

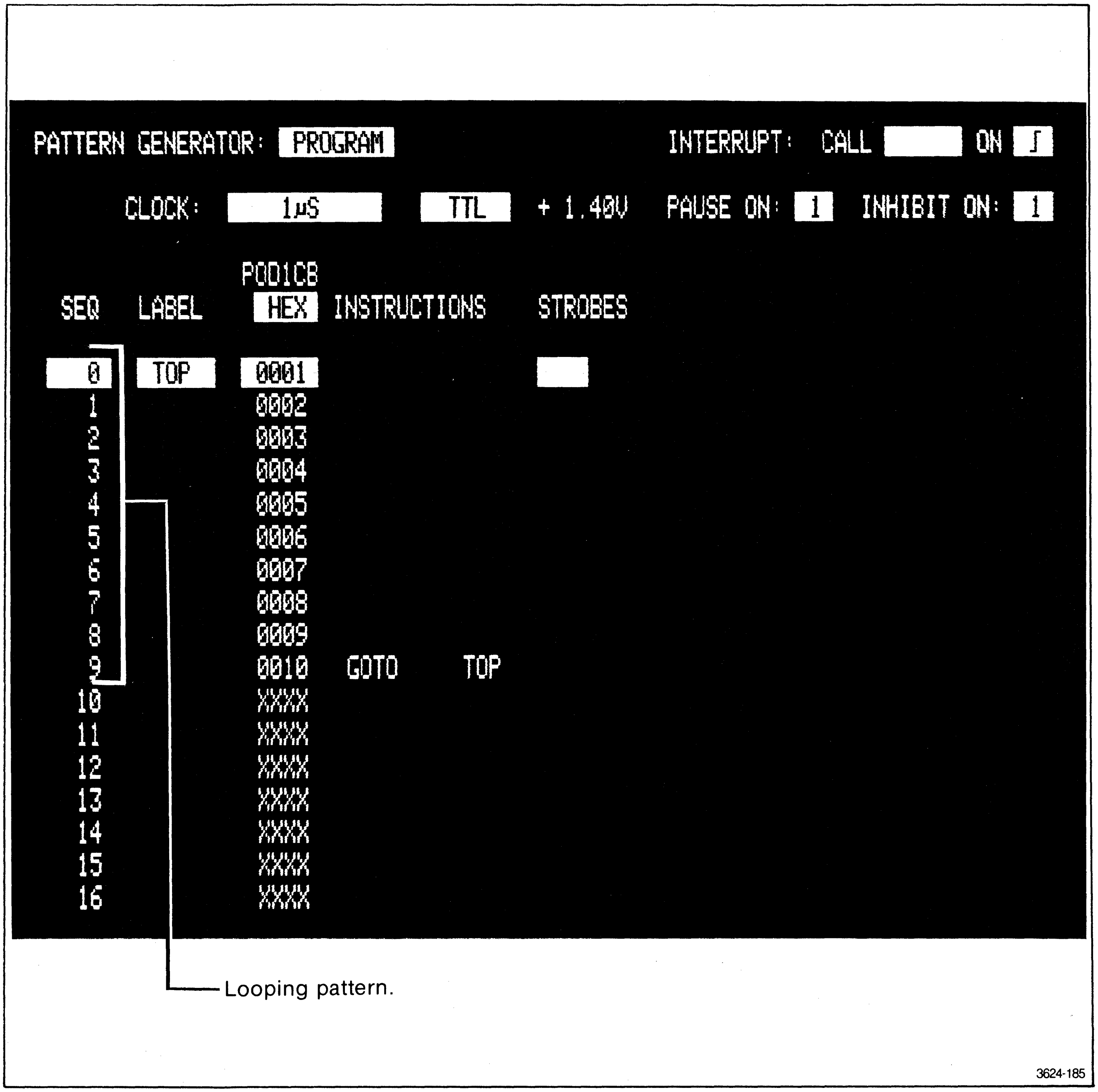


Figure 11-11. Using the pattern generator's GOTO instruction.

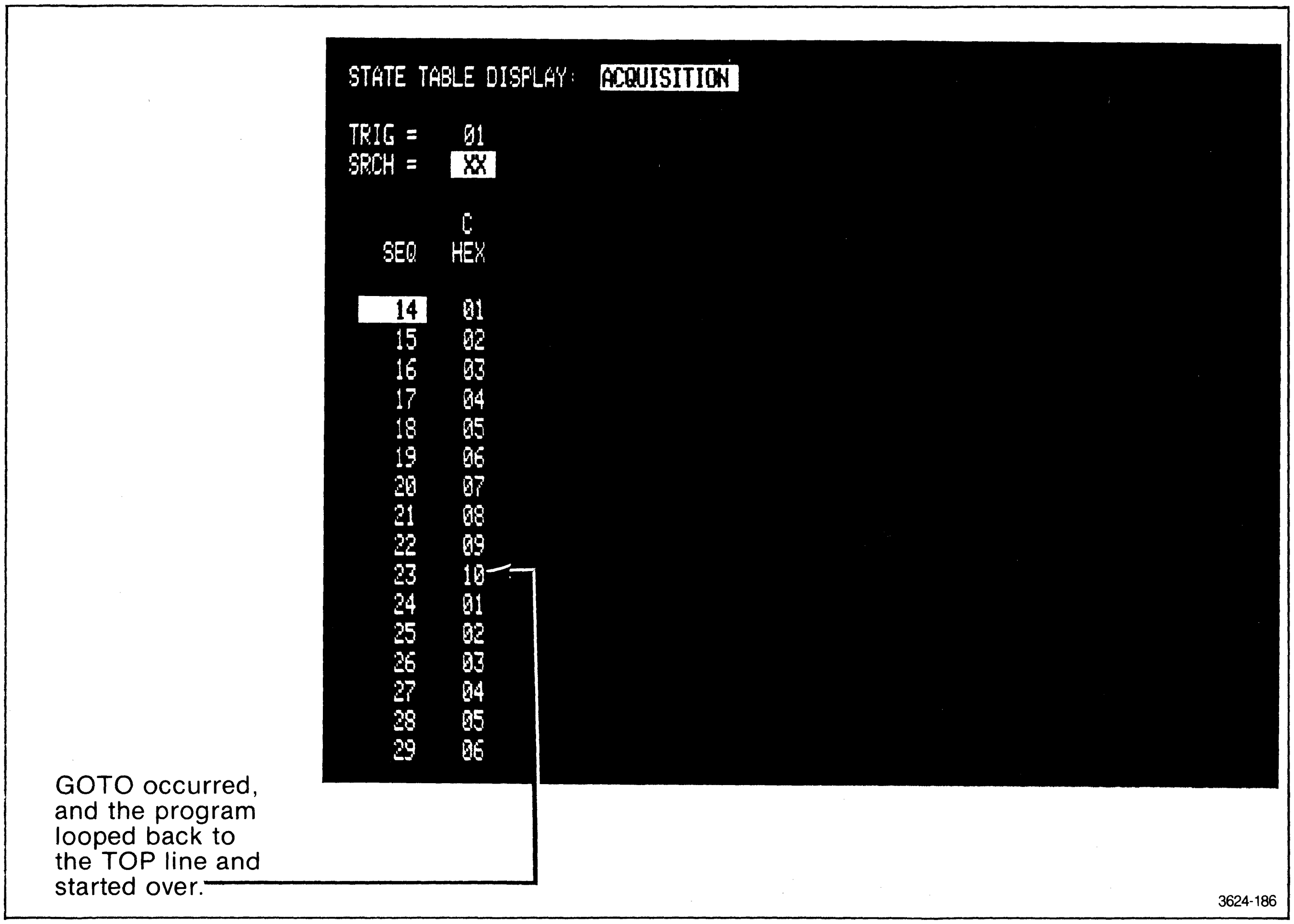


Figure 11-12. Acquiring the GOTO looping program.

REPEAT AND HOLD

The REPEAT and HOLD instructions are similar except in the way they affect the pattern generator's output clock.

The REPEAT instruction tells the pattern generator to stay on the same program line and output the data value for the specified number of clock cycles (from 2 to 255). The output clock and any strobes associated with the program line are also output for the specified number of cycles.

The HOLD instruction also tells the pattern generator to stay on the same progam line and output the data value for a specified number of clock cycles (from 2 to 255). The difference is that the output clocks from the 91P16 module are held at a constant level and do not occur for the specified number of cycles. The 91P32 output clocks and any strobes associated with the program line do occur.

Figure 11-13 illustrates a pattern generator program which uses both the REPEAT and HOLD instructions. A REPEAT 5 instruction is entered at SEQ 2, and a HOLD 5 instructiion is entered on SEQ 3.

With the program in Figure 11-13, the pattern generator operates in the following way. It starts at the top of the program and outputs data sequentially. At SEQ 2, it REPEATs the same data output for 5 clock cycles. At SEQ 3, it HOLDs the same data output levels (and 91P16 clock levels) for 5 clock cycles. It then outputs the rest of the program until the GOTO TOP instruction is reached. At that point, it jumps back to the TOP program line and starts over.

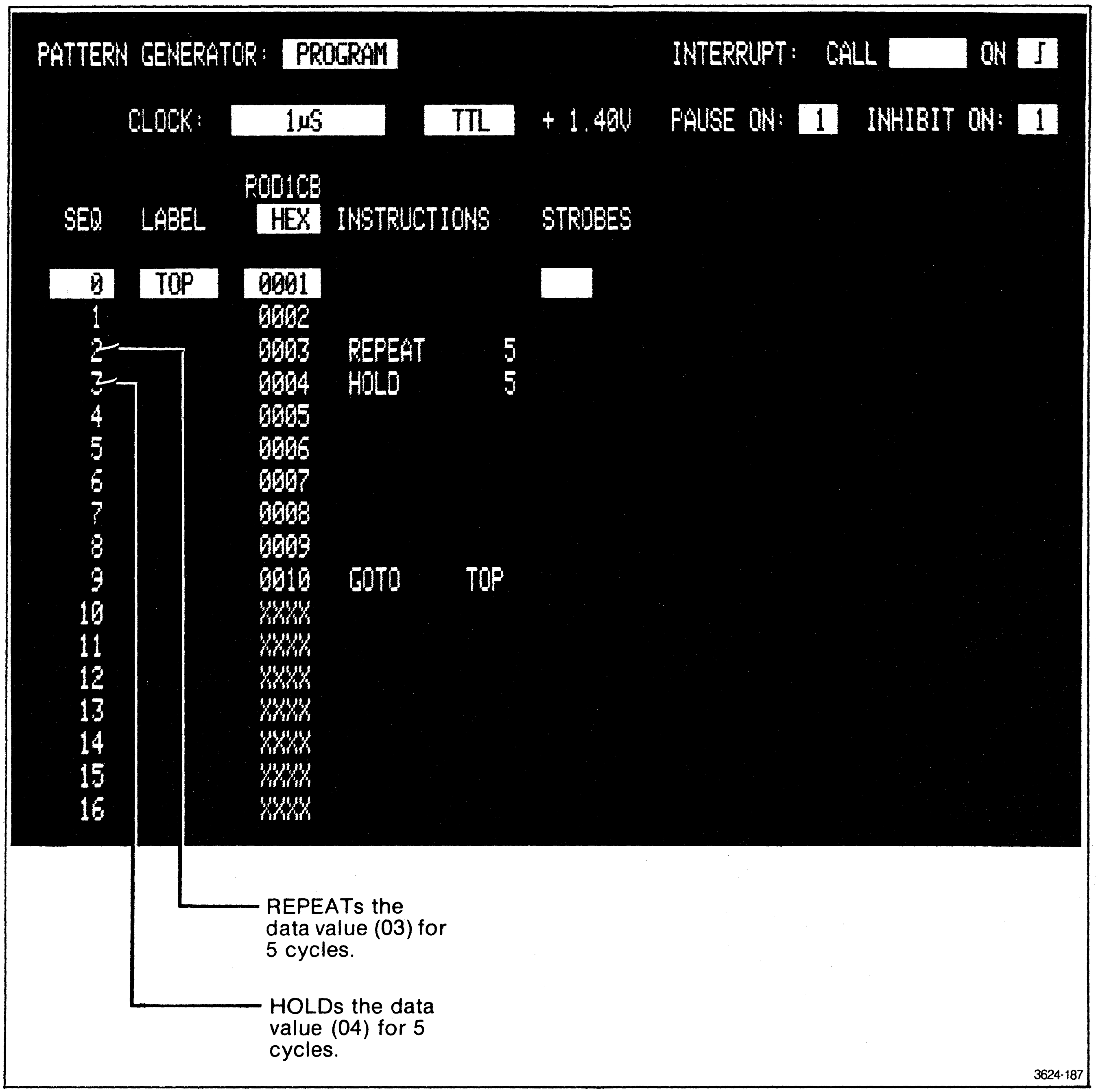


Figure 11-13. Using the pattern generator's REPEAT and HOLD instructions.

Acquiring the REPEAT and HOLD example program. Figure 11-14 illustrates two acquisitions of the REPEAT and HOLD example. The first acquisition uses the DAS internal clock set at 1 µs (see Figure 11-5). The second uses the pattern generator's output clock (see Figure 11-7). The START SYSTEM key is used for both acquisitions.

By using the internal acquistion clock, you can see how the REPEAT and HOLD instructions appear to a system under test that uses its own clock. As shown in the resulting display, no difference appears between the REPEAT value (03) and the HOLD value (04).

By using the external clock, you can see how the instructions appear to a system under test that uses the pattern generator's external clock. As shown in the resulting display, the REPEAT value (03) is acquired, but the HOLD value (04) is not.

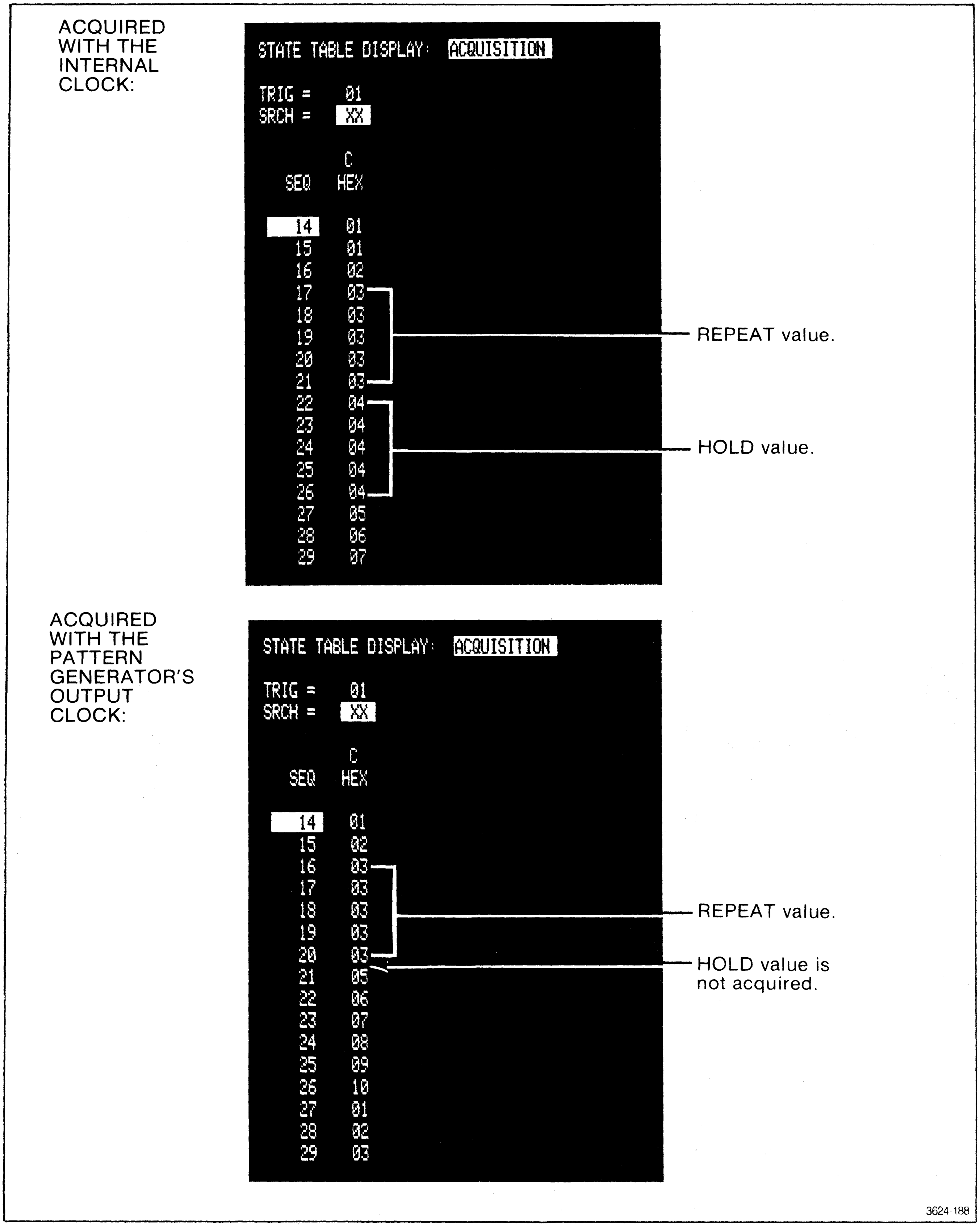


Figure 11-14. Acquiring the REPEAT and HOLD example program.

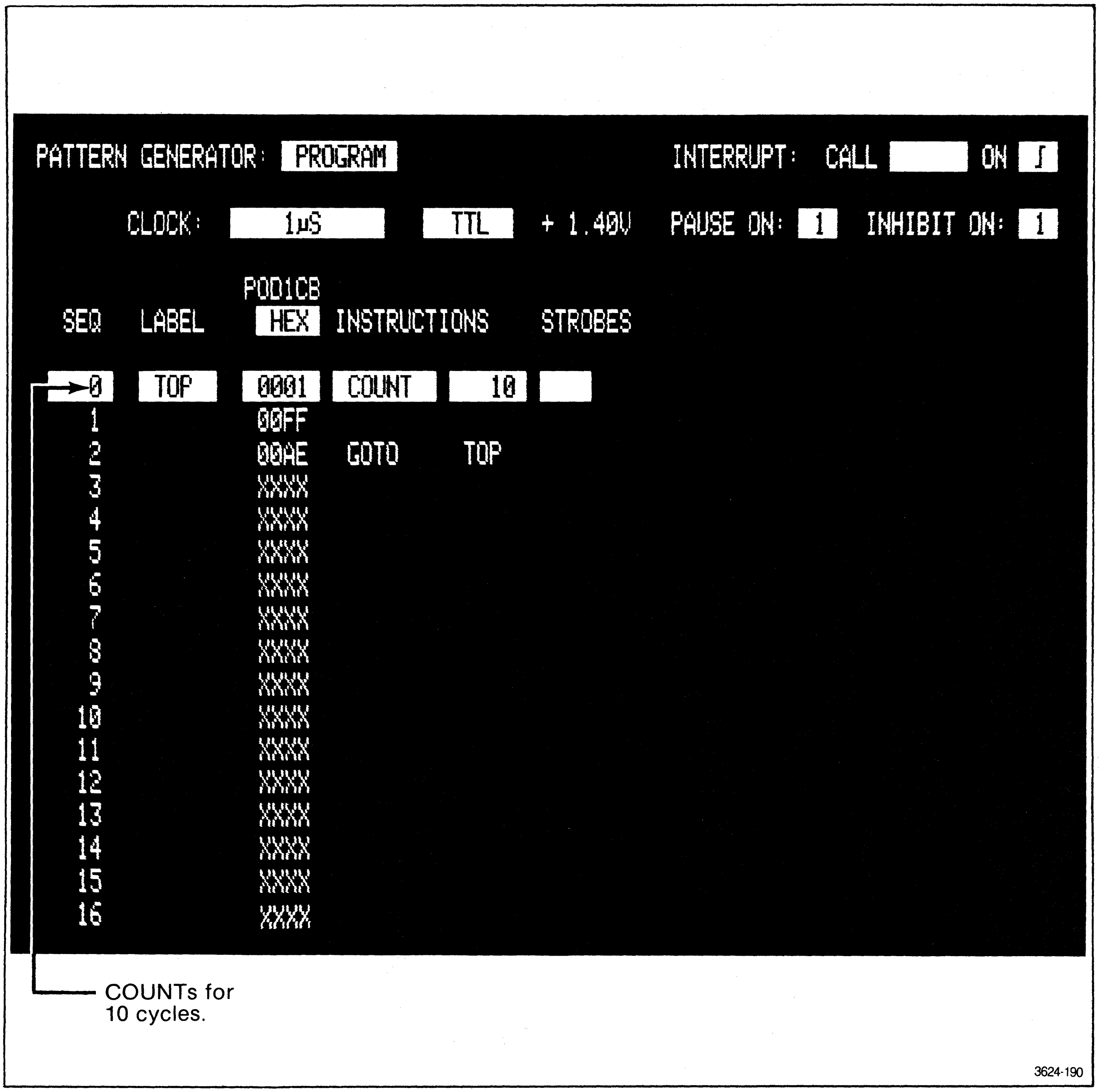


Figure 11-15. Using the pattern generator's COUNT instruction.

COUNT

The COUNT instruction provides a program compression technique. This instruction tells the pattern generator to stay on the same program line and output incrementing data values for a specified number of clock cycles (2 to 255). The data value associated with the COUNT line is recognized as the first word in the counting sequence.

The counting always occurs on the 16 bits associated with the 91P16 module. The data values for the 91P32 modules stay at the same level.

Figure 11-15 illustrates a pattern generator program which uses the COUNT instruction. (The previous REPEAT and HOLD example has been deleted.)

With the program in Figure 11-15, the pattern generator outputs the data value associated with SEQ 0 (01), and then outputs nine more incrementing values (02-0A). After the count, it continues to output the rest of the program unitl the GOTO TOP is reached. At that point, it jumps back to the TOP program line and starts over.

Acquiring the COUNT Example Program. Figure 11-16 illustrates how this program appears when it is acquired using the pattern generator's output clock (see Figure 11-7). The START SYSTEM key is used for the acquisition.

CALL AND RETURN

The CALL and RETURN instructions are used together to implement program subroutines. CALL tells the pattern generator to save the next sequential program line on a stack, then jump to another program line. RETURN tells the pattern generator to jump back to the program line stacked by the most recently executed CALL.

NOTE

RETURN instruction should only be encountered with relationship to a CALL. If a RETURN instruction is encountered by the program when no CALL has been executed, the program sequence will be unpredictable.

Figure 11-17 illustrates how the CALL and RETURN instructions may be implemented. (The previous COUNT example program was deleted.)

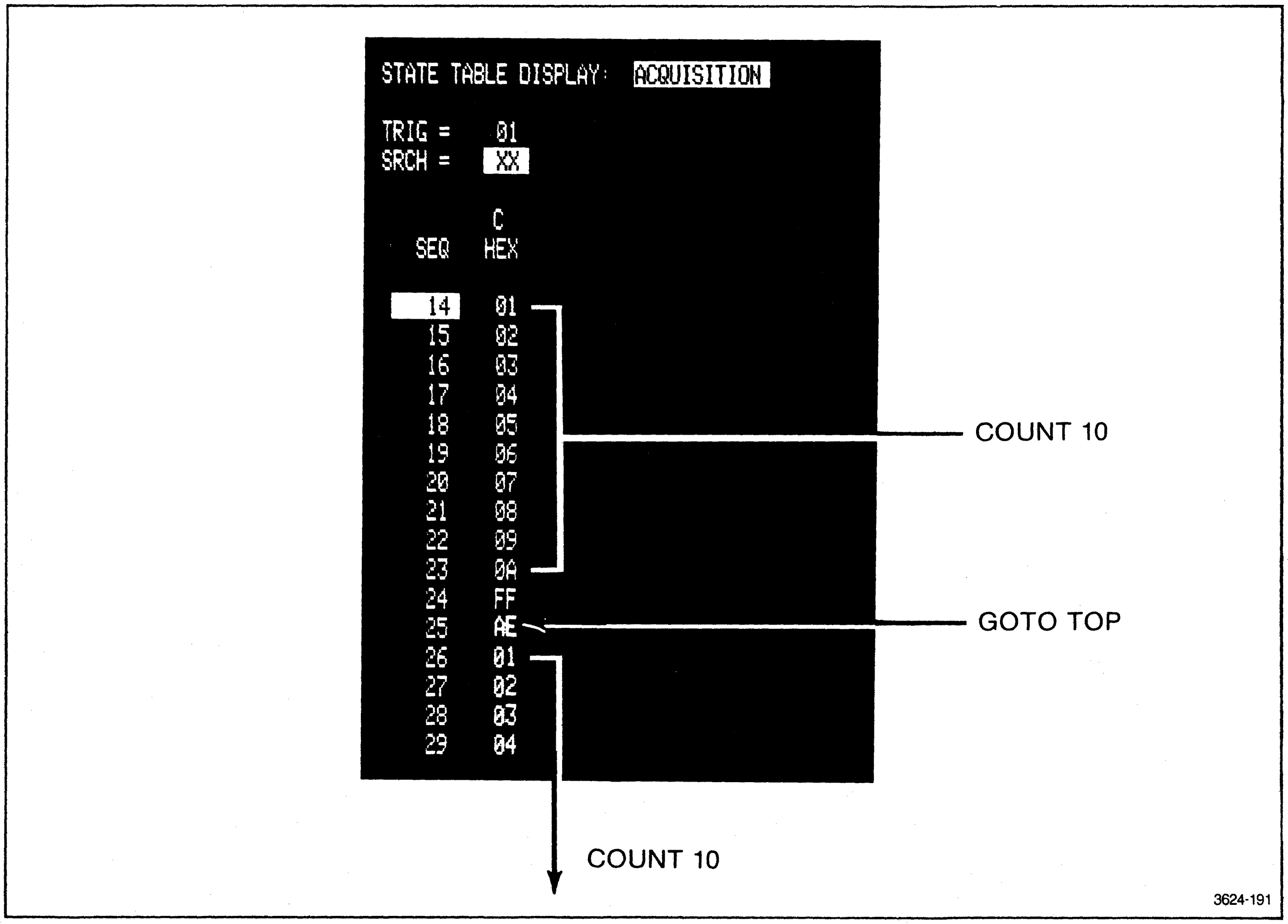


Figure 11-16. Acquiring the COUNT example program.

With the program in Figure 11-17, the pattern generator outputs the following sequence. First, it outputs the data value for SEQ 0, then loads SEQ 1 (the next program line) onto the stack. It then jumps to the line labeled SUB (SEQ 6) and outputs data until the RETURN is encountered (SEQ 9). When the RETURN is encountered the pattern generator jumps back to SEQ 1 (the line most recently loaded onto the stack). At SEQ 1, the line labeled SUB is called again and the same procedure continues.

Acquiring the CALL and RETURN Example Program. Figure 11-18 illustrates how this program appears when it is acquired using the DAS internal clock (see Figure 11-5). The START SYSTEM key is used for this acquisition.

Subroutine Nesting. In addition to calling each routine separately, the pattern generator allows up to 15 levels of nesting. Nesting is a technique whereby one subroutine calls another subroutine which, in turn, calls another subroutine, and so on. Up to 15 subroutines can be called before a RETURN is encountered.

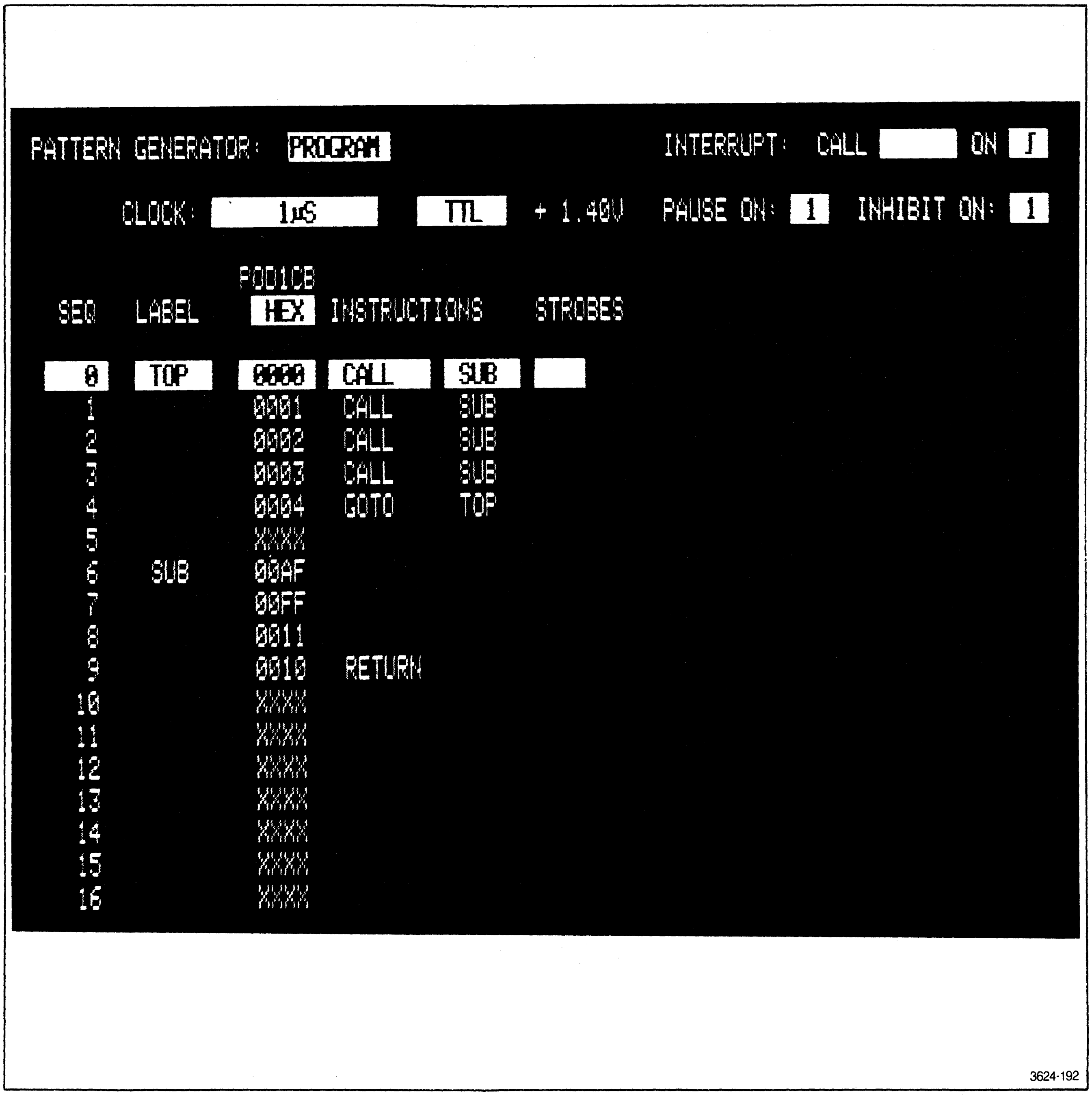


Figure 11-17. Using the CALL and RETURN instructions.

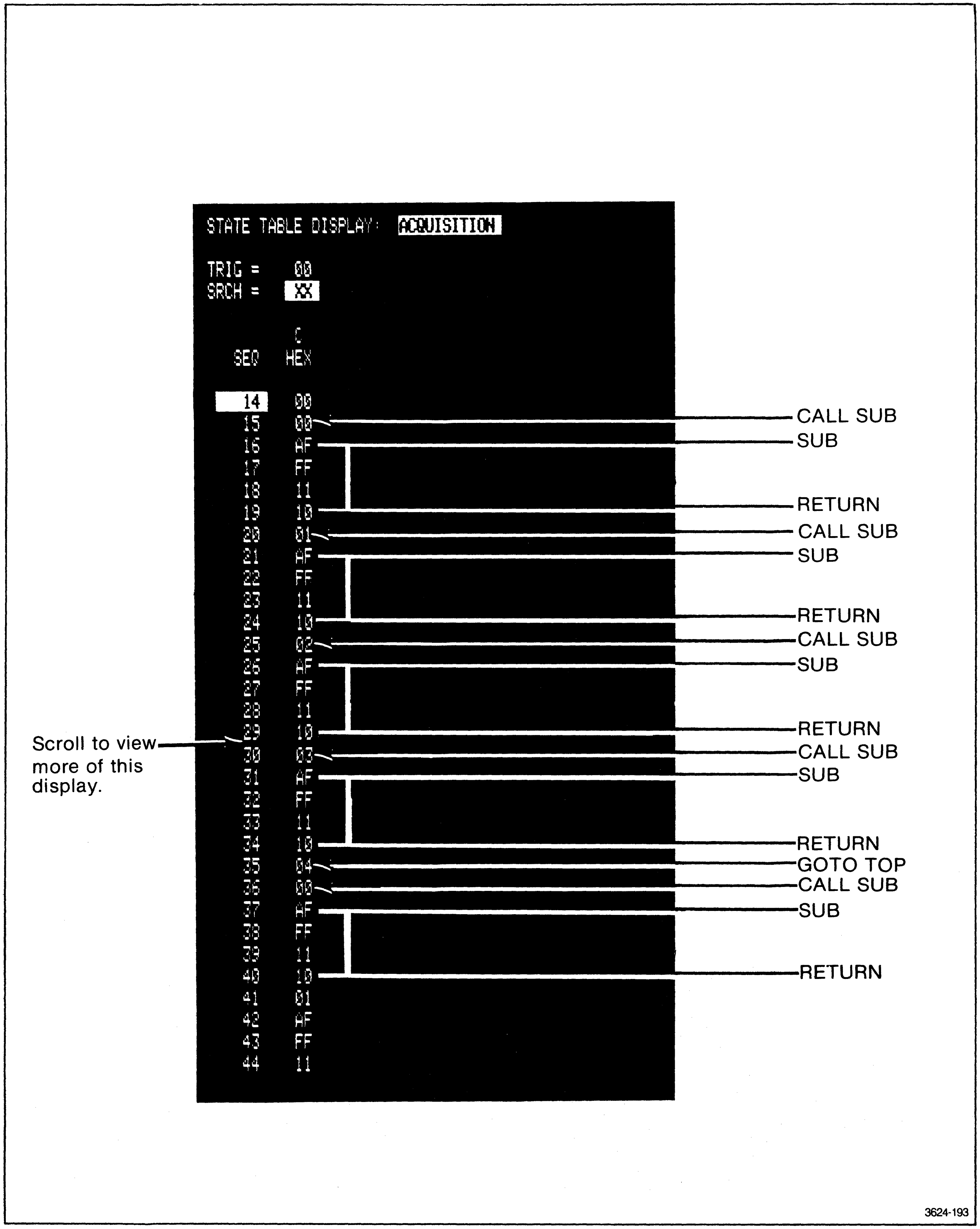


Figure 11-18. Acquisition of the CALL and RETURN example program.

Figure 11-19 illustrates a program with nested subroutines. In this program, the ADD subroutine calls the PUSH and POP subroutines. When a RETURN is encountered, it always jumps back to the most recently CALLed line.

Acquiring the Nested Subroutine Program. The display in Figure 11-20 shows how this program appears when it is acquired. This acquisition used the pattern generator's output clock (see Figure 11-7).

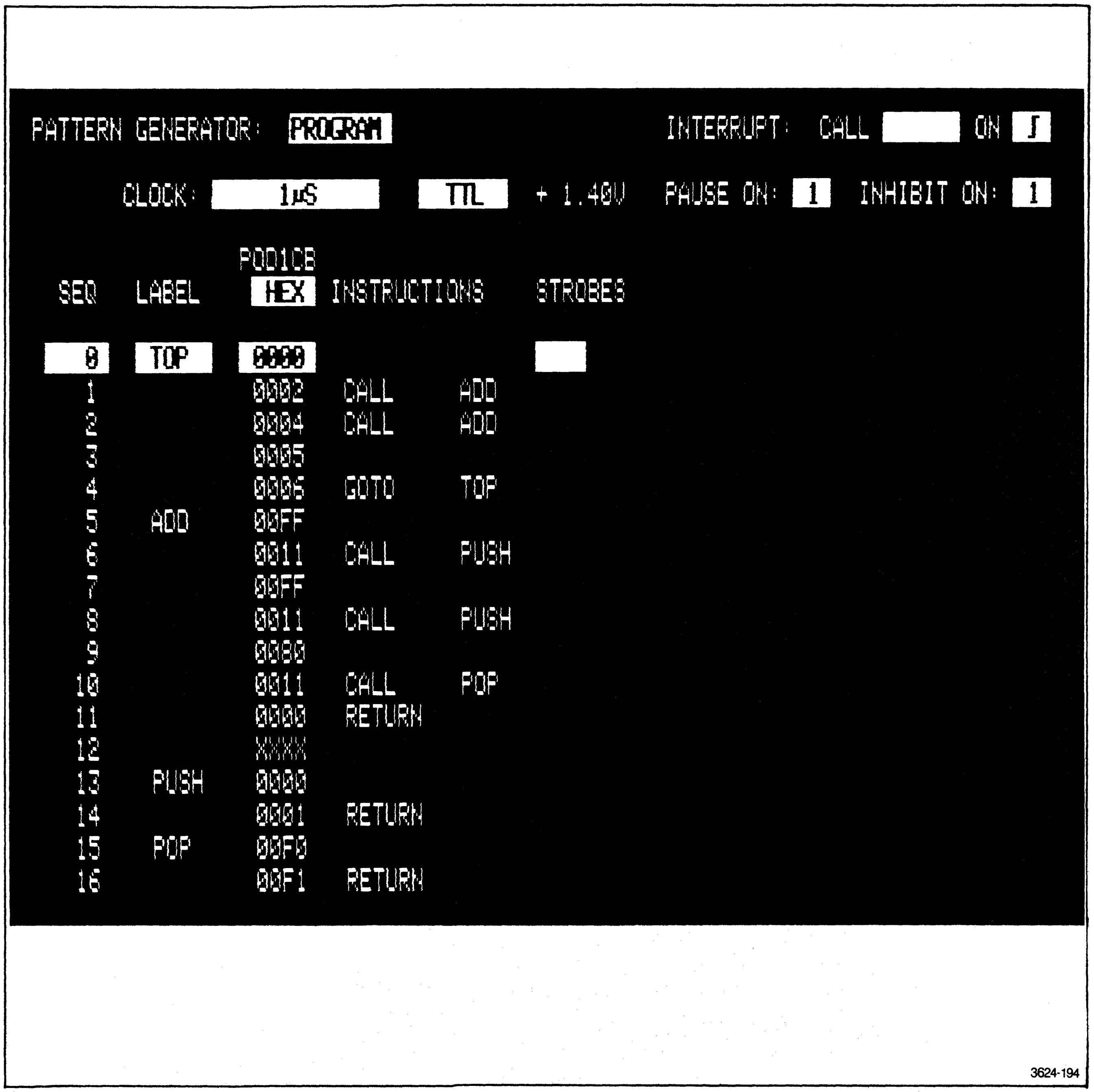


Figure 11-19. Using CALL and RETURN for nested subroutines.

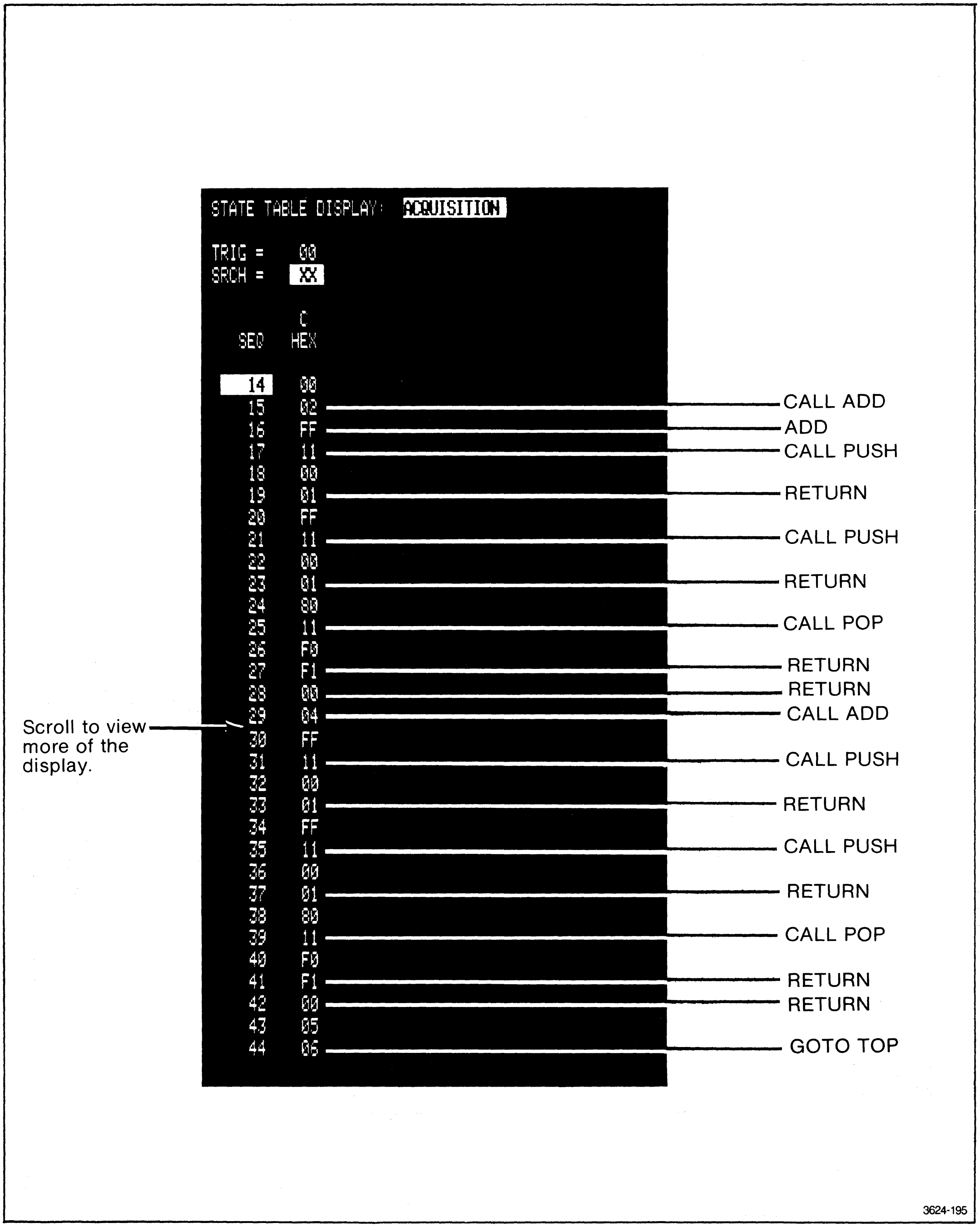


Figure 11-20. Acquisition display of the nested subroutine program.

USING THE PATTERN GENERATOR INTERRUPT

The following example illustrates the signal characteristics of the pattern generator's external interrupt request. It describes how this signal may be used and explains the interrupt timing specifications.

The interrupt signal is implemented when a signal is applied to the PG Interrupt line located on the External Clock Probe (from the Trigger/Time Base Module). This signal, when fed into the pattern generator, interrupts the program and specifies that a specific program line be CALLed. If a RETURN is encountered, the program will then jump back to the program line stacked by the interrupt CALL.

APPLYING THE INTERRUPT SIGNAL

To obtain an interrupt, a signal must be applied to the PG Interrupt line of the External Clock Probe. The pattern generator's output strobe signal (white flying lead from the diagnostic lead set) is connected to the PG Interrupt line (orange lead of the External Clock Probe). These two leads can be connected using any appropriately conductive wire.

The characteristics of the strobe signal are programmed in the pattern generator's Timing sub-menu. Figure 11-21 illustrates the strobe characteristics for this example. The strobe being used is STROBE 0 (from POD 1B). It is a positive-true signal, with a 70 ns delay from the output clock edge and a 40 ns width.

ENABLING THE INTERRUPT IN THE PROGRAM

Once the interrupt line has been connected, the signal is enabled via the pattern generator's Program sub-menu.

Figure 11-22 illustrates the interrupt program used in the example. (The previous program is deleted.)

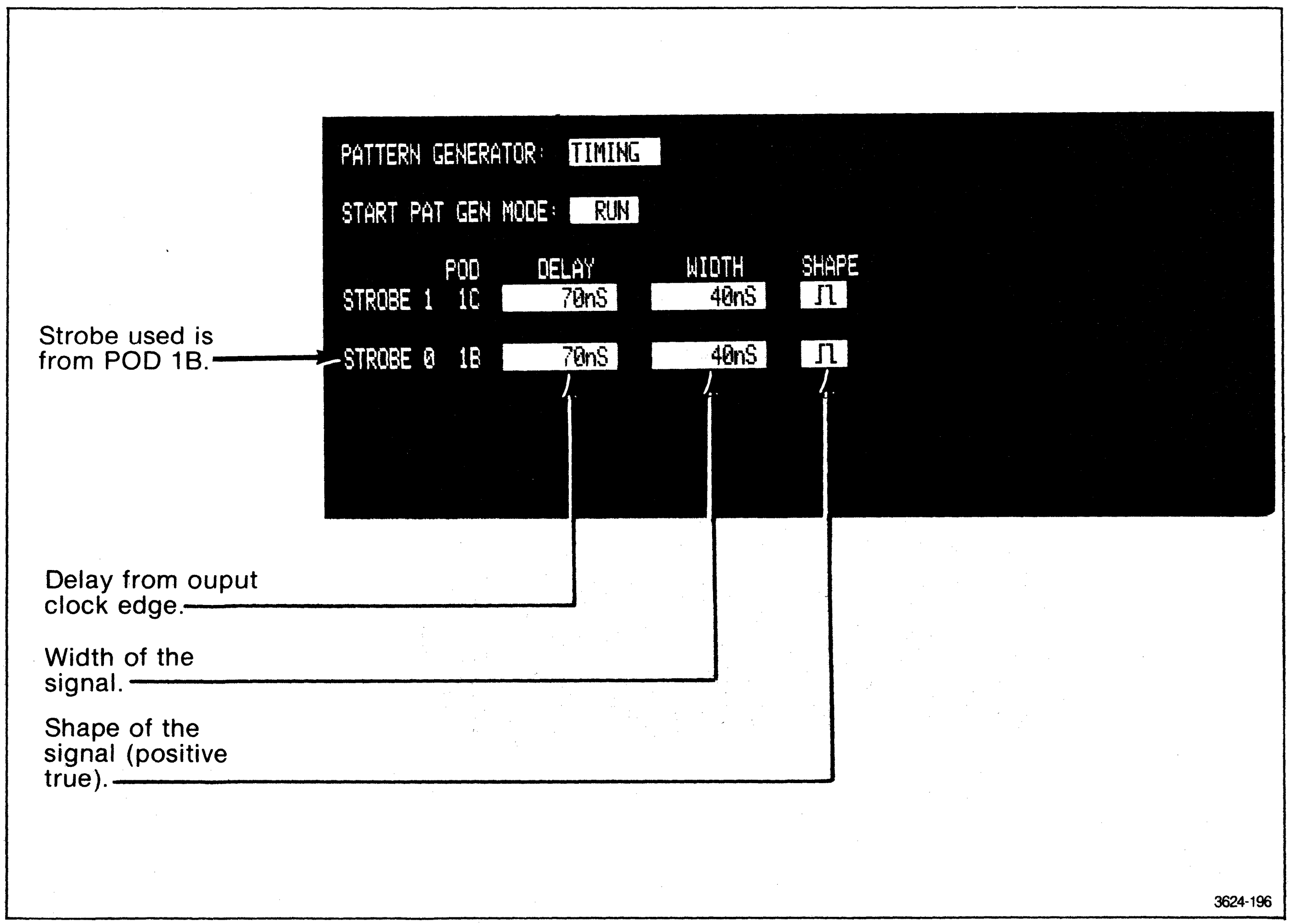


Figure 11-21. The characteristics for the interrupt signal.

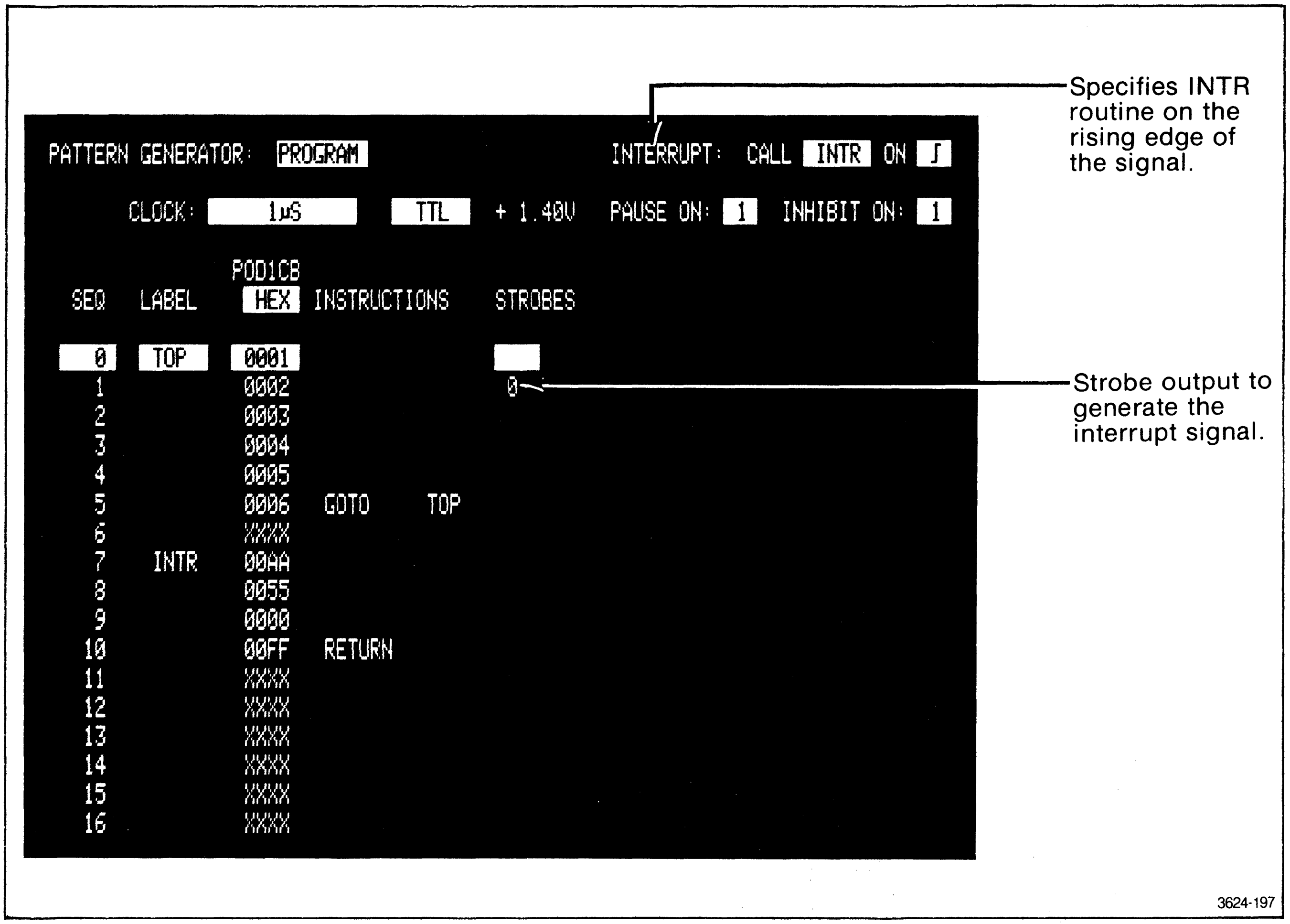


Figure 11-22. Setting up the example interrupt program.

In the top right corner of the menu, the interrupt is enabled by entering an INTERRUPT CALL value. This field is set to CALL the line labeled INTR whenever an external signal (Strobe 0) is applied. Further, the ON field specifies that the signal must be a rising edge.

When the program line at SEQ 1 is executed, the strobe (0) will be output, and thus apply a signal to the interrupt input line.

INTERRUPT TIMING CHARACTERISTICS

When the interrupt signal is applied to the probe tip, there is a 72 ns delay to when it is recognized by the pattern generator. Once the signal is recognized, there is a four clock-cycle delay before the CALLed interrupt routine is output.

NOTE

Once an interrupt is recognized, the pattern generator will not recognize another interrupt for 4 clock cycles.

EXECUTING THE INTERRUPT PROGRAM

Figure 11-23 illustrates how the interrupt program appeared when it was acquired. The interrupt signal was sent out in conjunction with the 02 data value (SEQ 1) and the first line of the interrupt routine (AA) was output on the fourth following cycle. When the RETURN is encountered (FF), the program jumped back to the next sequential program line (06).

This acquisition uses the pattern generator's output clock (see Figure 11-7). The START SYSTEM is for this acquisition.

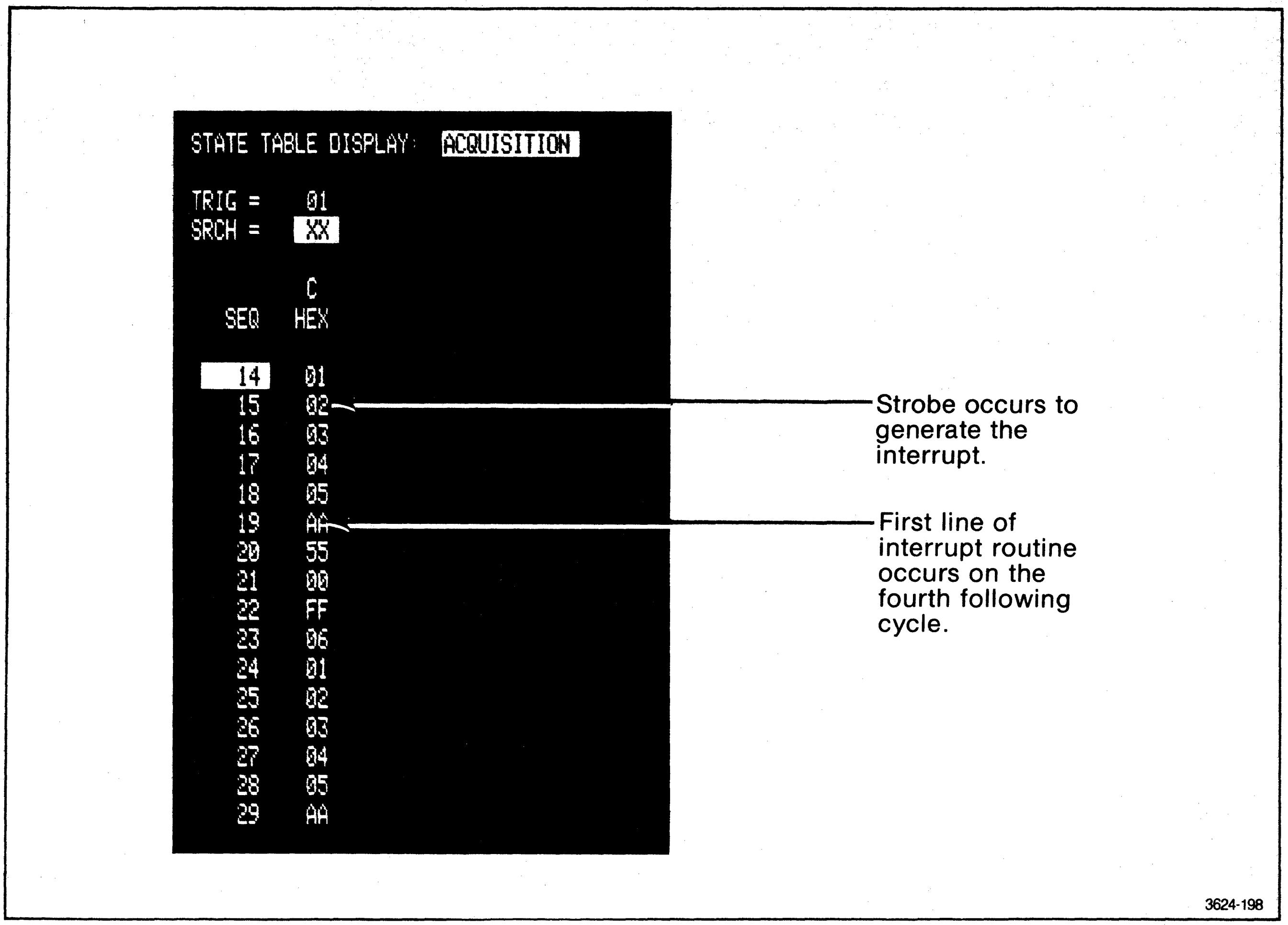


Figure 11-23. Acquisition display of the example interrupt program.

USING THE ARMS TRIGGER MODE

The following example illustrates the characteristics of the ARMS trigger mode. It shows how to set up the ARMS trigger and clocks, and it illustrates the resulting time aligned display.

SETTING UP THE PROBES

This example uses POD 2A of the 91A32 Data Acquisition Module installed in bus slot 2; POD 6C of the 91A08 Data Acquisitiion Module installed in bus slot 6; and POD 1B of the 91P16 Pattern Generator Module installed in bus slot 1. The External Clock Probe from the Trigger/Time Base Module is also used.

The 91A32 probe (POD 2A) and the pattern generator probe (POD 1B) are connected via the diagnostic lead set (refer to Figure 11-1). In addition, the CLK1 lead from the Trigger/Time Base Module's External Clock Probe is connected to the output clock lead from the pattern generator probe (refer to Figure 11-2).

Two channels from the 91A08 probe are also connected to the pattern generator probe. One 91A08 channel (0) is connected to the pattern generator's output clock lead. A grabber tip is used for this connection, since the output clock lead is already connected to the CLK1 lead of the External Clock Probe.

The other 91A08 channel (1) is connected to the pattern generator probe's output strobe lead.

The following list specifies the probe connections for this application:

91P16 POD 1B

CH 0	0 CH	91A32 POD 2A via diagnostic lead set
CH 1	1 CH	
CH 2	2 CH	
CH 3	3 CH	
CH 4	4 CH	
CH 5	5 CH	
CH 6	6 CH	
CH 7	7 CH	
PG CLK	CLK1 EXT CLOCK PROBE 0 CH 91A08 POD 6C	
PG STRB	1 CH 91A08 POD 6C	

SETTING UP THE PROGRAM

With the probes connected in the described manner, you may perform the following ARMS example.

1. The 91A32 probe will acquire the probe self-test from the pattern generator. This acquisition will run from the pattern generator's output clock signal. The clock signal is supplied via the CLK1 line from the External Clock Probe.

2. At the same time, the 91A08 probe will acquire the pattern generator's output clock and strobe signals. To do this, the 91A08 module will run at a fast internal clock rate.

Figure 11-24 illustrates the pattern generator program used in this example. The strobe output at SEQ 204 is STROBE 0 from POD 1B. This signal is programmed for a 190 ns delay from the output clock edge, a 120 ns width, and a positive-true shape.

The pattern generator's clock rate is set to the DAS internal clock at 1 μs.

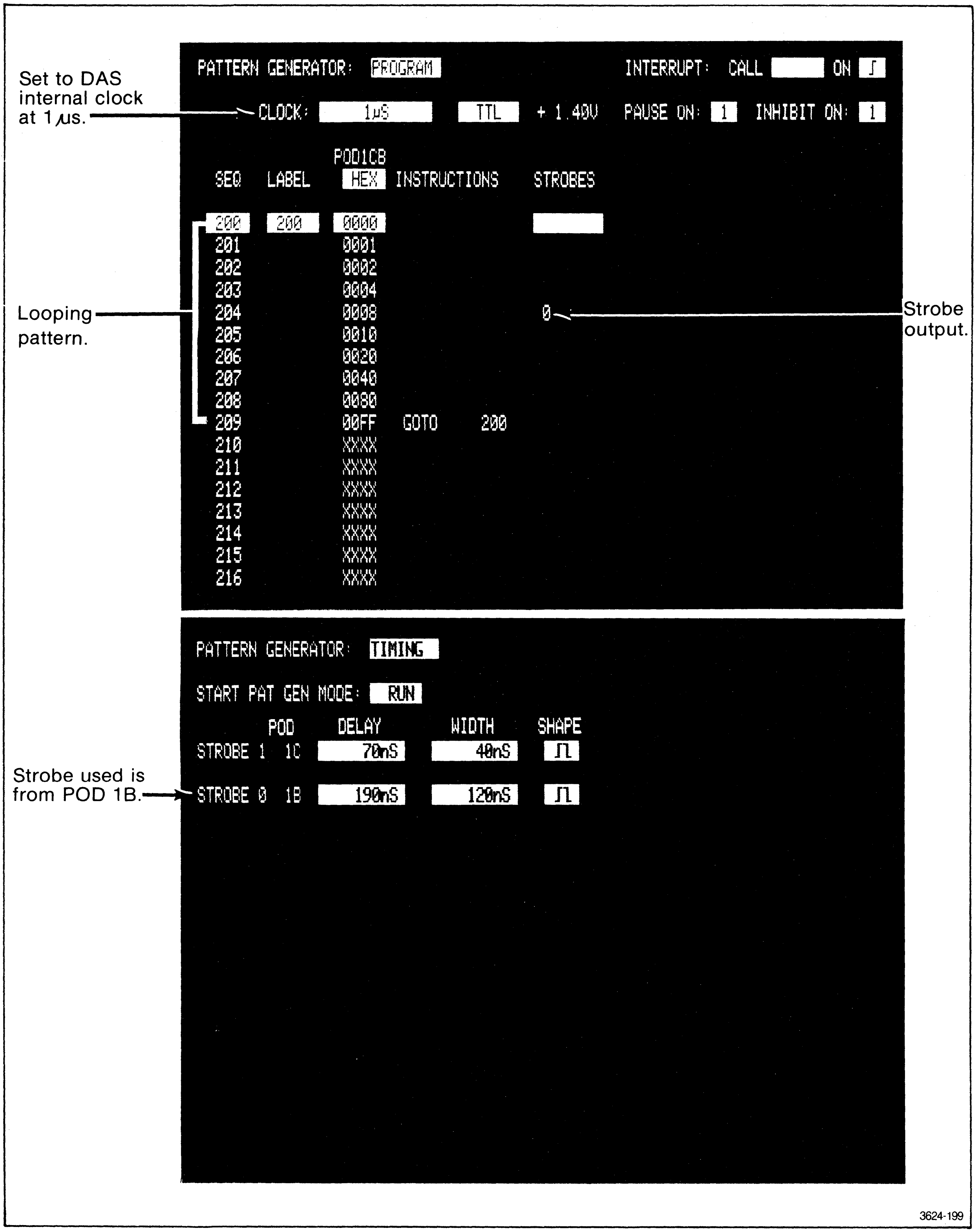


Figure 11-24. The program used for the ARMS example.

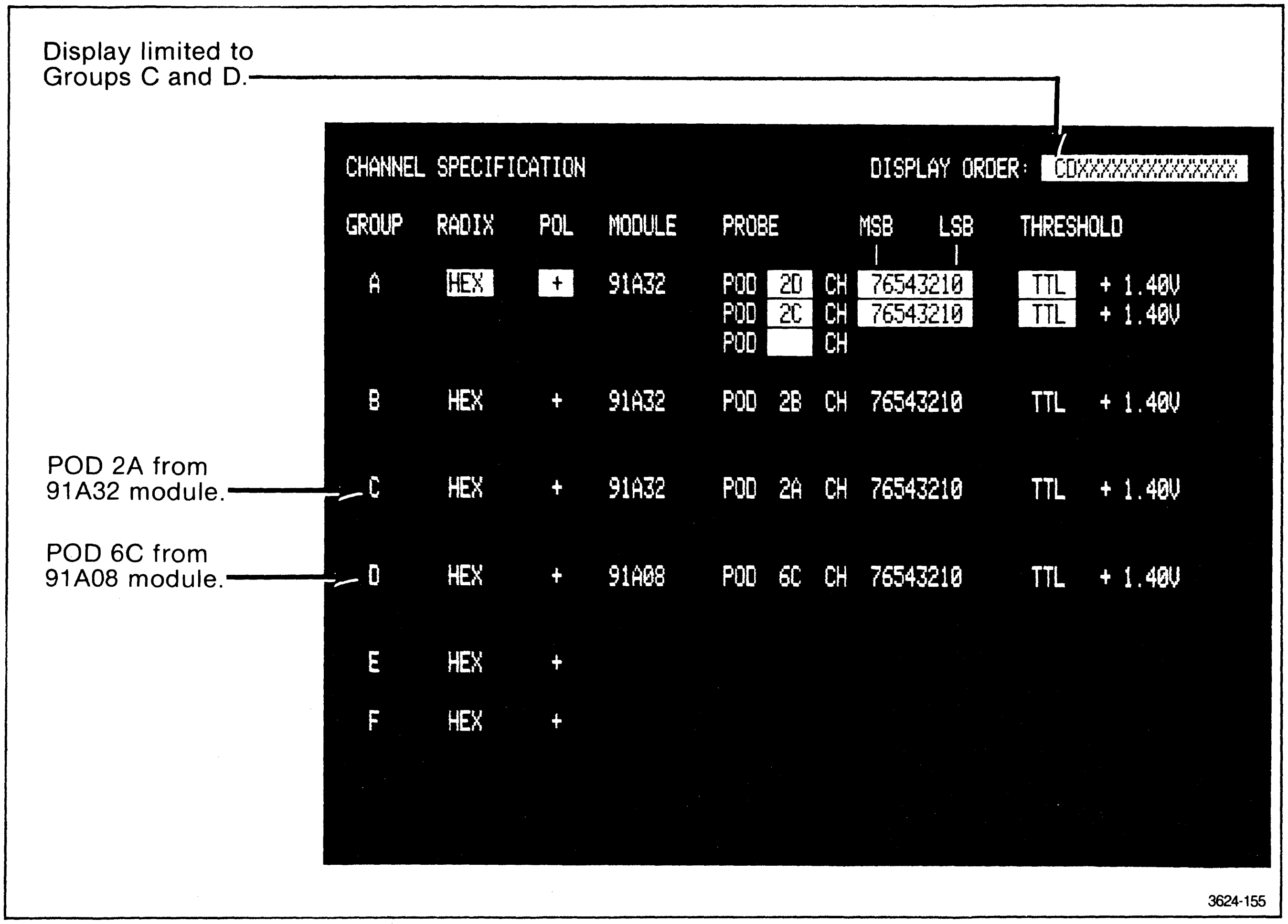


Figure 11-25. Setting up the Channel Specification menu.

SETTING UP THE ARMS ACQUISITION

Before setting up the ARMS trigger, the number of channels being displayed in the Trigger Specification and State Table menus is limited to the pods being used. Figure 11-25 illustrates how to set up the Channel Specification menu to limit the display to POD 2A and 6C.

To set up the ARMS trigger, the Trigger Specification menu is set to the 91A32 ARMS 91A08 mode. As shown in Figure 11-26, this trigger sub-menu is divided into two parts, one for setting up the 91A32 module and one for setting up the 91A08.

The 91A32 module is set to acquire data using the rising edge of the external clock. The external clock is supplied by the pattern generator's output clock which, in turn, is running at 1 μs intervals.

The 91A08 module is set to the DAS internal clock at 50 ns intervals. By acquiring at the rate, the 91A08 is able to capture the pattern generator's clock and strobe output.

NOTE

For a time-aligned display, the 91A08 module must be set to a clock rate at least twice as fast as the 91A32 clock rate.

Both the 91A32 and 91A08 modules are set to trigger on don't care and their triggers are positioned in the beginning of memory. All qualifier lines are set to don't care.

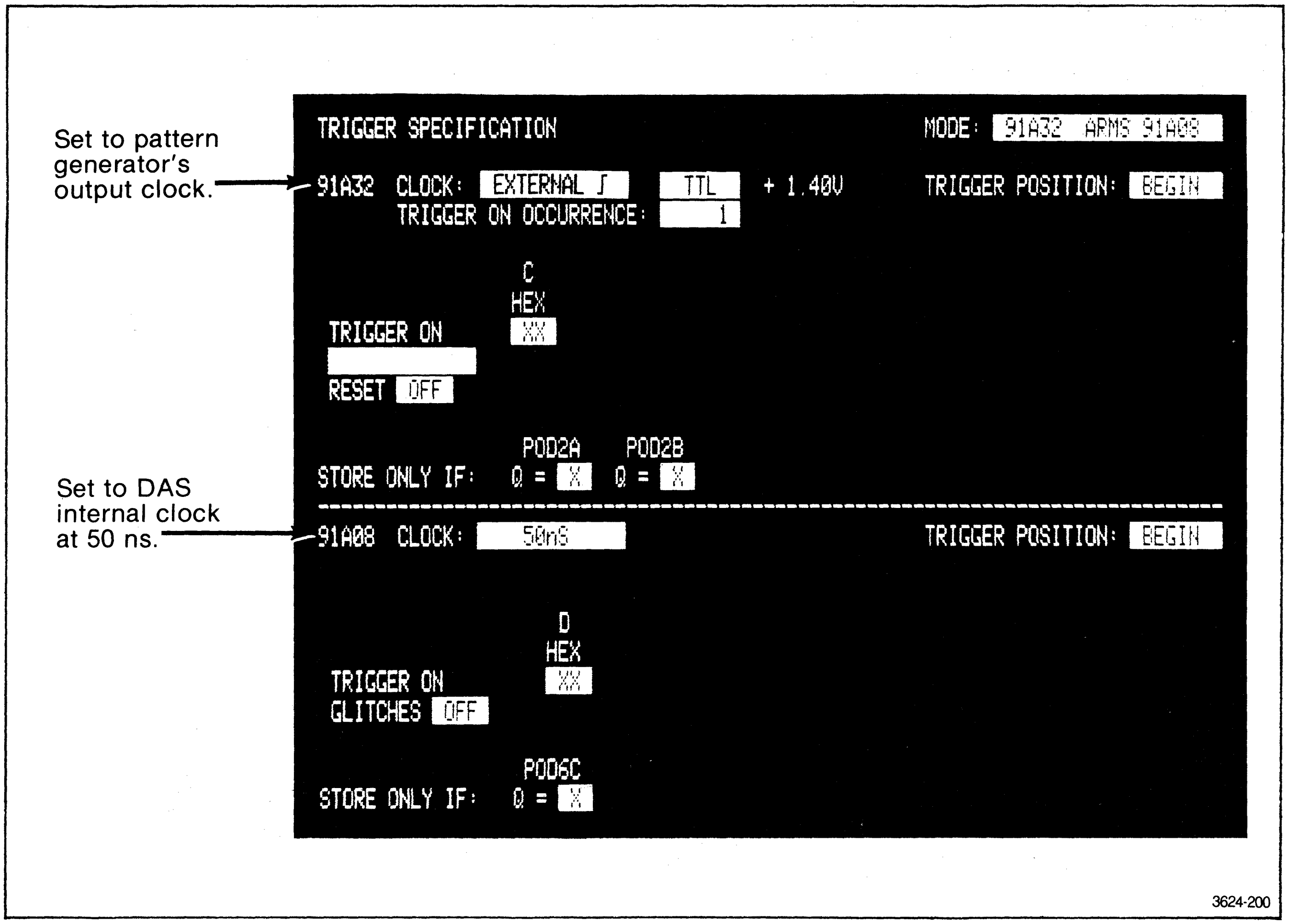


Figure 11-26. Setting up the ARMS trigger mode.

DISPLAYING THE TIME-ALIGNED DATA

To acquire the ARMS data, the START SYSTEM key is pressed. When this occurs, the 91A32 and 91A08 modules immediately begin to acquire data, while the 91P16 module immediately begins to output data.

After the system is started, the DAS waits for a 91A32 trigger. When it occurs, the DAS then waits for a 91A08 trigger. Acquisition stops once both memories have been filled.

Figure 11-27 illustrates the resulting State Table and Timing Diagram displays of the ARMS acquisition. Both menus present the data in a time-aligned display, where slow- and fast-clocked data overlap.

To view the overlap portion in the State Table menu the display is scrolled to SEQ 181. The Timing Diagram menu is magnified to 100, and the appropriate channels are entered in the menu's POD and CH fields. Additionally, labels are entered in the NAME fields to identify the individual traces.

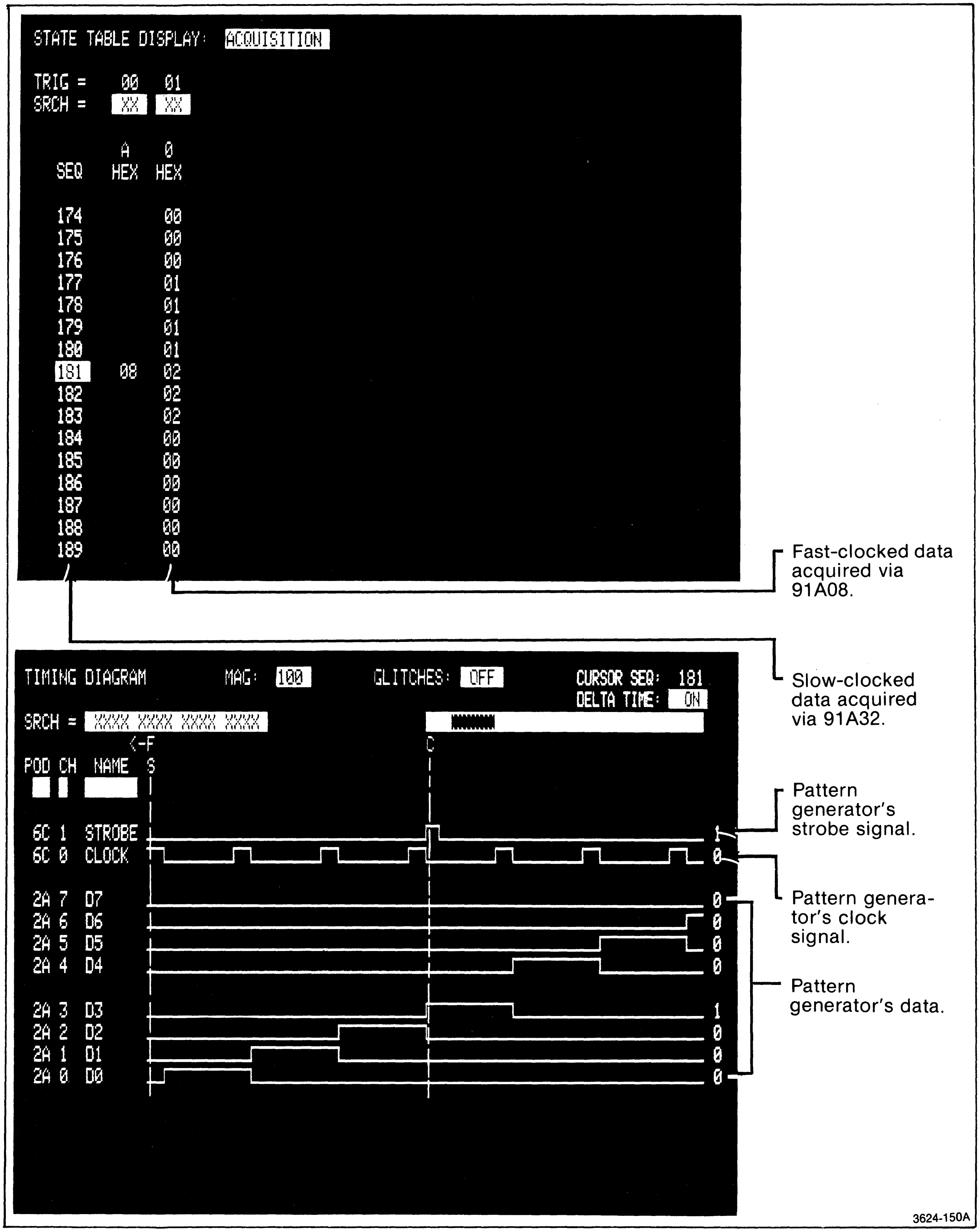


Figure 11-27. Display of the ARMS acquisition.

SIMULATING 6802 MICROPROCESSOR BUS ACTIVITY

This application example shows how the pattern generator can be used to exercise a system under test. The system under test is the Tektronix MicroLab I with a 6800/02/08 Personality Card.

NOTE

For specific information on the Tektronix MicroLab I and its operation, refer to the MicroLab I Instruction Manual and its 6800/02/08 Personality Card Supplement. These documents are published by Tektronix, Inc.

In this application, the microprocessor is removed from the personality card, and the pattern generator is used to stimulate the microprocessor socket pins. A program written in code compatible to the 6802 microprocessor, is entered into the pattern generator and output to the card. This program repeatedly blinks the word HELP on the MicroLab's 7-segment LED display.

The clock for the microprocessor bus is supplied by the pattern generator's output strobe.

CONNECTING THE PROBES

Table 11-1 lists the pin connections used in this application. Only POD 1B from the 91P16 module is used.

As shown in Table 11-1, one pattern generator probe (POD 1B) is connected to the data bus lines D0-D7. Data from this probe will be used to write characters to the LED display.

Two of the address lines, A13 and A14, are tied high (1), and the rest are tied low (0). This establishes a constant address of 600 (hexadecimal); the microprocessor's display-write address.

NOTE

The address lines could also be supplied via pattern generator probes if your DAS has a 91P32 Pattern Generator Expander module.

The BA (bus available) and $\overline{RESET}$ lines are also tied high (1). The $R/\overline{W}$ (read/write) line is tied low.

The pattern generator's strobe (from POD 1B) is connected to both the E (enable) line and the VMA (valid memory address) lines. This strobe is used to clock the data into the system under test.

The probe is grounded by connecting V_L to pin 1 and V_H to pin 8.

Table 11-1
6802 Pin Connections

Pin	Name	Definitions	Connections	
33	D7	Data Line	CH 7	
32	D6	Data Line	CH 6	
31	D5	Data Line	CH 5	
30	D4	Data Line	CH 4	91P16
29	D3	Data Line	CH 3	POD 1B
28	D2	Data Line	CH 2	
27	D1	Data Line	CH 1	
26	D0	Data Line	CH 0	
37	E	Enable	PG STRB (0)	
5	VMA	Valid Memory Address	PG STRB (0)	
8	V_{CC}	Power	V_H	
1	V_{SS}	Power	V_L	
9-20	A1-A11	Address Lines	Tied Low (0)	
22	A12	Address Lines	Tied Low (0)	
23	A13	Address Line	Tied High (1)	
24	A14	Address Line	Tied High (1)	
25	A15	Address Line	Tied Low (0)	
7	BA	Bus Available	Tied High (1)	
34	$R/\overline{W}$	Read/Write	Tied Low (0)	
40	$\overline{RESET}$	Reset	Tied High (1)	

PROGRAMMING THE PATTERN GENERATOR

Figure 11-28 illustrates the pattern generator program used in this example. This program works in the following way.

At SEQ 0, the program CALLs the CLR (clear) routine and puts SEQ 1 on the call stack. This routine, from SEQ 9 through SEQ 16, outputs a clear code for each of the 8 LED characters.

At SEQ 16, the program RETURNs to SEQ 1 and continues execution.

SEQ 1 writes the character H to the first LED character. SEQ 2 writes the character E to the second LED character. SEQ 3 executes a programmed wait state. SEQ 4 writes the character L to the third LED character. SEQ 5 writes the character P to the fourth LED character.

At SEQ 5, the program REPEATs the P character for 50 clock cycles. This procedure keeps the word HELP written on the LED display. After 50 clock cycles, the program once more CALLs the CLR routine.

As the program continues, it will continue to blink the word HELP on the LED display.

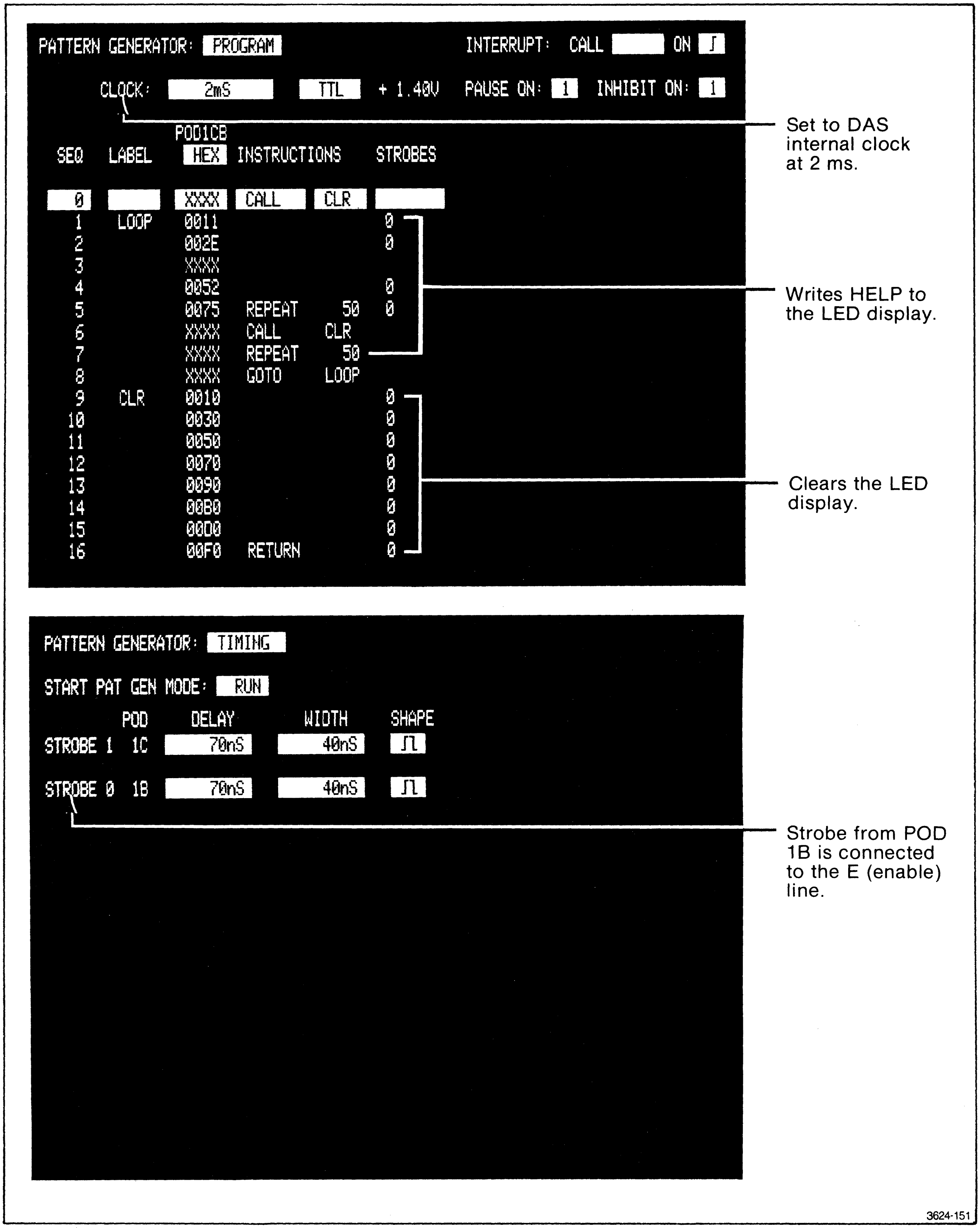


Figure 11-28. Pattern generator's program for simulating the 6802 microprocessor.

CLOCKING. The program's output clock rate is set to the DAS internal clock at 2 ms. Since the system under test is being clocked by the strobe, however, only the sequence values associated with a strobe are clocked into the system.

The strobe used is STROBE 0 from POD 1B. This signal is programmed for a 70 ns delay from the clock edge, a 40 ns width, and a positive-true shape.

USING THE 91A32 EXTERNAL-SPLIT CLOCKS

This application example illustrates how the 91A32 external-split clocks can be used to acquire address and data information from a multiplexed microprocessor bus. The system under test is the Tektronix MicroLab I with a Z8000 Personality Card. A Z8002 microprocessor is installed in the personality card socket.

NOTE

For specific information on the Tektronix MicroLab I and its operation, refer to the MicroLab I Instruction Manual and its Z8000 Personality Card Supplement. Both documents are published by Tektronix, Inc.

In this application, two 91A32 Data Acquisition Modules are used. Each of these two modules acquires information from the Z8002's bus lines AD0-AD15. One module's clock is connected to the microprocessor's address strobe, while the other's is connected to the data strobe. In addition, qualifier lines are set up so that only memory transactions are acquired.

SETTING UP THE PROBES

Table 11-2 lists the Z8002 pin connections used in this application. Four data acquisition probes are used: POD2A and 2B from the 91A32 module installed in bus slot 2; and POD 3A and 3B from the 91A32 module installed in bus slot 3.

Table 11-2
Z8002 Pin Connections

			91A32		91A32		External
Pin	**Name**	**Definition**	**POD 2B**	**POD 2A**	**POD 3B**	**POD 3A**	**Clock Probe**
8	AD15	Address/Data	CH 7		CH 7		
9	AD14	Address/Data	CH 6		CH 6		
5	AD13	Address/Data	CH 5		CH 5		
4	AD12	Address/Data	CH 4		CH 4		
3	AD11	Address/Data	CH 3		CH 3		
2	AD10	Address/Data	CH 2		CH 2		
1	AD9	Address/Data	CH 1		CH 1		
39	AD8	Address/Data	CH 0		CH 0		
38	AD7	Address/Data		CH 7		CH 7	
37	AD6	Address/Data		CH 6		CH 6	
35	AD5	Address/Data		CH 5		CH 5	
36	AD4	Address/Data		CH 4		CH 4	
34	AD3	Address/Data		CH 3		CH 3	
33	AD2	Address/Data		CH 2		CH 2	
32	AD1	Address/Data		CH 1		CH 1	
40	AD0	Address/Data		CH 0		CH 0	
20	ST1	Status Output		Q			
18	ST3	Status Output	Q				
29	$\overline{AS}$	Address Strobe					CLK1
17	$\overline{DS}$	Data Strobe					CLK2

As shown in Table 11-2, the two 91A32 modules are both connected to the microprocessor's address/data lines AD0-AD15. In addition, the qualifiers from the 91A32 module installed in bus slot 2 are connected to the ST1 and ST3 status lines.

The clocks for this example are supplied via the Trigger/Time Base module's External Clock Probe. The CLK1 lead is connected to the $\overline{AS}$ (address strobe) line from pin 29. This clock is used for the 91A32 module in bus slot 2.

NOTE

In the External-Split Clock mode, the CLK1 lead always serves as the master clock, and defines the beginning and end of the multiplexed bus cycle.

The CLK2 lead is connected to the $\overline{DS}$ (data strobe) line from pin 17. This clock is used for the 91A32 module in bus slot 3.

SETTING UP THE EXTERNAL SPLIT ACQUISITION

Before setting up the Trigger Specification menu, channels being displayed are limited to the four pods used. Figure 11-29 illustrates how to set up the Channel Specification menu to limit the display of channels to the four pods of interest. Group A (POD 2B and 2A) and group D (POD 3B and 3A) are the only channel groups used.

Figure 11-30 illustrates the trigger set up for the external split acquisition.

The 91A32 CLOCK field is set to the EXT SPLIT value. The 91A32 module installed in bus slot 2 is set to the rising edge of CLK1 ($\overline{AS}$ line). The 91A32 module installed in bus slot 3 is set to the rising edge of CLK2 ($\overline{DS}$ line).

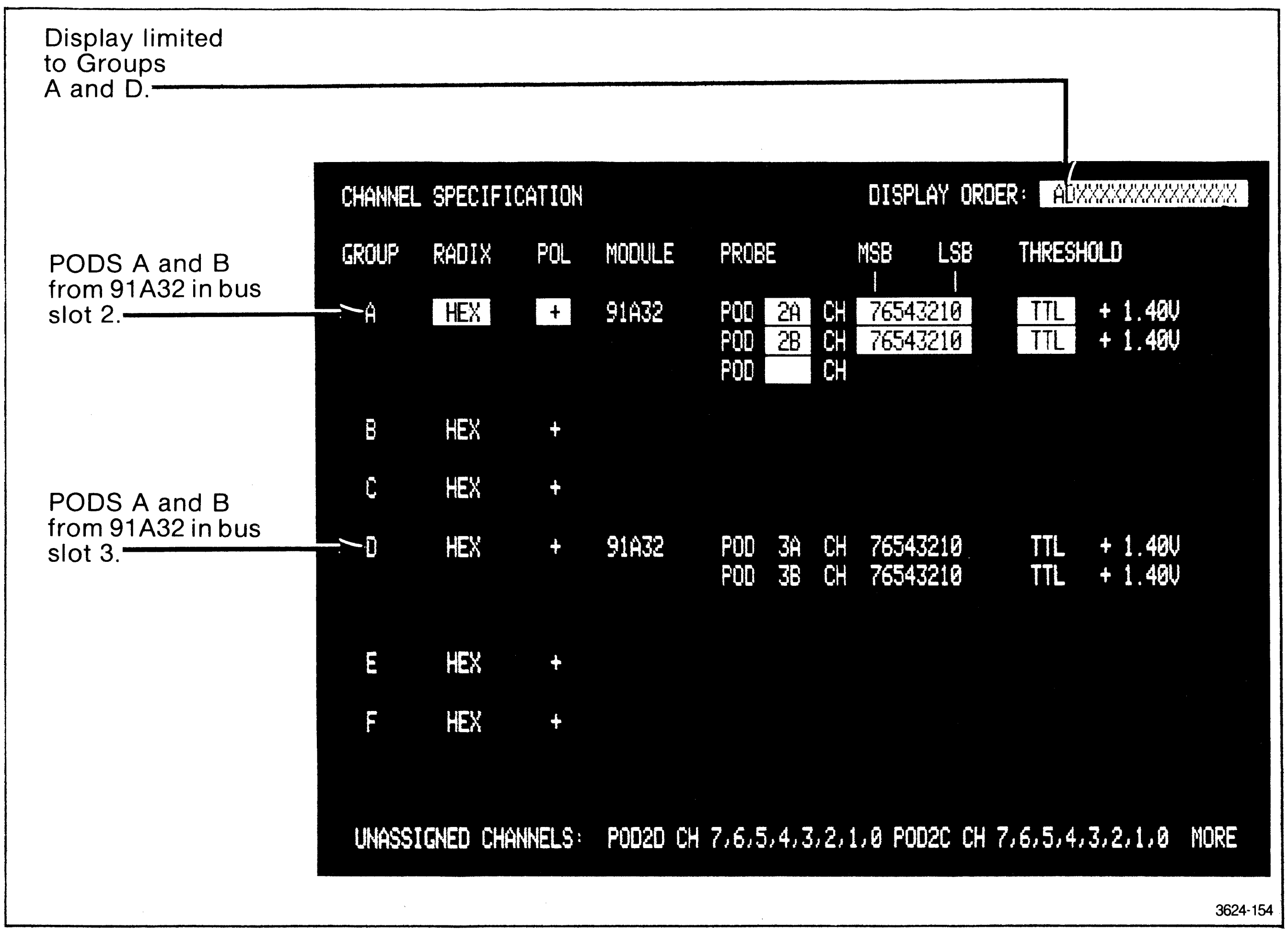


Figure 11-29. Setting up the Channel Specification menu.

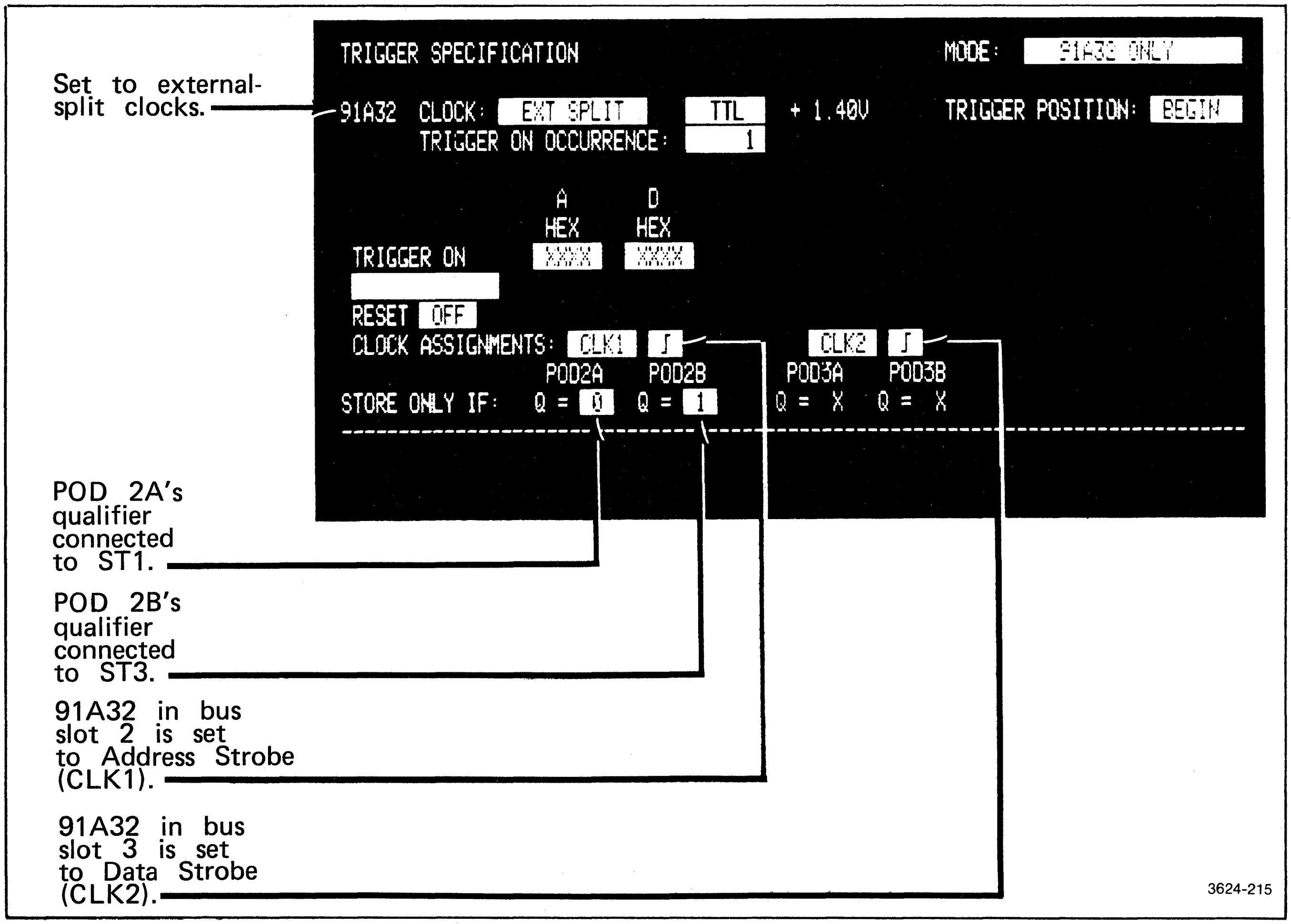


Figure 11-30. Setting up the EXT SPLIT clocks.

Only the qualifier lines for the POD 2B and 2A are available because they are the only lines running from CLK1. POD 2B's qualifier is set to an acquire when the status line (ST3) goes low. POD 2A's qualifier is set to acquire when the status line (ST1) goes high. Since these qualifiers operate in an ANDed mode, data will only be acquired during the following cycle types:

- Memory Transaction for Operand.
- Memory Transaction for Stack.
- Memory Transaction for Instruction Fetch (First Word)
- Transaction for Instruction Fetch (Subsequent Word)

The word recognizers are set to trigger on don't care, with the trigger word positioned in the beginning of memory.

ACQUIRING MULTIPLEXED BUS INFORMATION

To acquire data from the Z8002 take the following steps:

1. Press the RESET button on the MicroLab I.
2. Press the START ACQUISITION key on the DAS keyboard.
3. Release the RESET button on the MicroLab I.

The DAS triggers immediately after the RESET button is released. Figure 11-31 illustrates the resulting State Table display. The group A column is address bus information, and the group D column is data bus information.

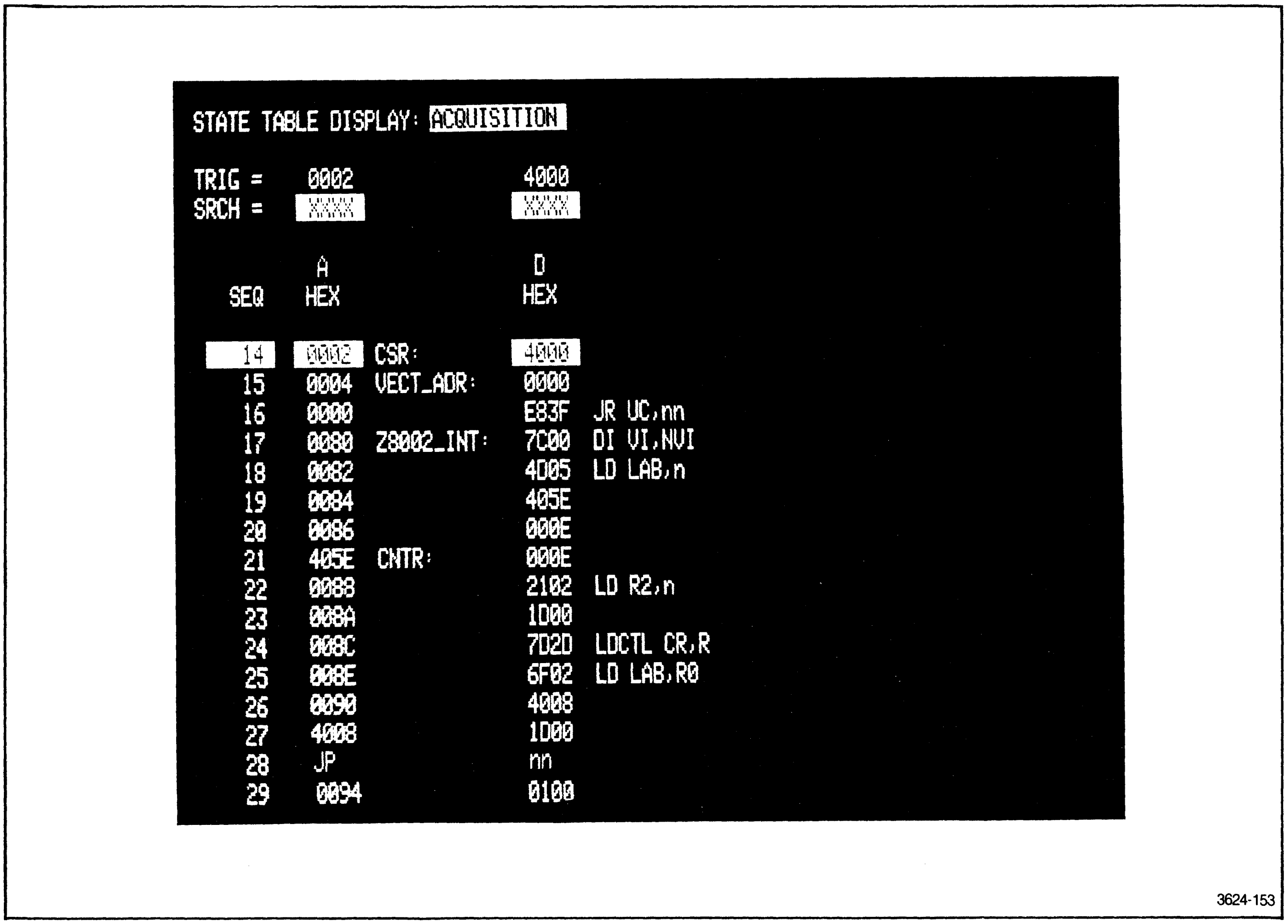


Figure 11-31. Display of EXT SPLIT clock acquistion.

GPIB PROGRAMMING 12

This section describes GPIB operational elements, and explains how the DAS and the GPIB interact. This section also describes how the DAS GPIB command language can be used via the RS-232 interface.

In this section you will find:

GPIB PROGRAMMING

The DAS operation can be controlled via the IEEE 488 General Purpose Interface Bus (GPIB) or the RS-232 Interface. For the most part, this section discusses the operational elements in terms of the IEEE 488. RS-232 is implied as an alternative whenever GPIB communication is mentioned. Any special requirements or restrictions associated with the RS-232 interfacing are detailed later in this section under the heading Special RS-232 Requirements.

GENERAL DESCRIPTION

The GPIB interface provided with Option 02 conforms to the specifications contained in the IEEE 488-1978, "Standard Digital Interface for Programmable Instrumentation." This interface is commonly referred to as a General Purpose Interface Bus, or GPIB.

This section describes GPIB operational elements only in relation to DAS communication via the bus. For information regarding GPIB electrical, mechanical, or functional information, refer to the IEEE 488-1978 standard. This document is published by:

The Institute of Electrical and Electronics Engineers, Inc.
345 East 47 Street
New York, New York 10017

The GPIB interface system uses sixteen signal lines: eight data lines, three handshake lines, and five bus management lines. Information is transferred over the bus in a bit-parallel, byte-serial format. An asychronous handshake procedure allows communication between instruments with different transfer rates so long as they conform to the handshake state diagram and other protocols defined in the IEEE 488 standard. The data transfer rate is effectively limited by the slowest active instrument on the bus. This ensures the accurate transfer of data to and from all active instruments.

The GPIB system can be connected in either a star or linear configuration, or in a combination of both. A GPIB system may consist of up to 15 instruments distributed over a total cable length of up to 20 meters.

To maintain the electrical characteristics of the bus, a device load should be connected for each two meters of cable length, and two thirds of the devices connected to the bus should be powered up.

USING THE DAS IN A GPIB SYSTEM

The DAS operates as a talker and listener on the GPIB. All data acquisition, pattern generator, and tape drive functions can be controlled remotely. Menu setups and memory contents can be transferred from the DAS to a controller for storage and analysis.

A minimum GPIB system for the DAS would consist of the DAS and a controller. The DAS operates as a talker and listener, while the controller directs all command and data transfers on the GPIB. A larger system might include, in addition to the DAS and a controller, other talkers/listeners (e.g., a counter, a line printer, a programmable signal generator, etc.).

SELECTING A CONTROLLER

A controller for the DAS must have a GPIB (or RS-232) connector and the software needed for IEEE 488-1978 communication. For binary save and restore operations (see device-dependent commands), the controller must be able to send, receive, and store all eight bits of all data bytes.

For flexibility and ease of use, the controller should be able to interrupt execution in response to a service request, poll devices serially in any order, evaluate status bytes bit-by-bit, and execute user-defined timeouts.

NOTE

RS-232 communication imposes additional restrictions on the controller. These restrictions are specified later in the section under the heading Special RS-232 Requirements.

IEEE 488 (GPIB) FUNCTIONS

The IEEE 488-1978 standard defines the GPIB interface functions and the allowed subsets of those functions. The subsets that apply to the DAS are listed in Table 12-1.

Table 12-1
IEEE 488 (GPIB) Functions

Function	Description
SH1	Source Handshake. Complete capability.
AH1	Acceptor Handshake. Complete capability.
T6	Basic Talker. Responds to Serial Poll, Untalk if My Listen Address (MLA) is received.
L4	Basic Listener. Unlisten if My Talk Address (MTA) is received.
SR1	Service Request. Complete capability.
RL1	Remote-Local. Complete capability.
PPO	Does not respond to Parallel Poll.
DC1	Device Clear. Complete capability.
DT1	Device Trigger. Complete capability.
CO	No Controller function.

REMOTE-LOCAL (RL) FUNCTIONS

The Remote-Local functions are controlled by the system controller and the DAS keyboard. There are four states associated with the Remote-Local functions: Local State; Local With Lockout State; Remote State; and Remote With Lockout State.

LOCAL STATE (LOCS). While in LOCS, the DAS keyboard is operative and keyboard settings cannot be changed via commands from the bus. The instrument will, however, respond to and execute all interface and device-dependent commands that do affect the keyboard controls.

LOCAL WITH LOCKOUT STATE (LWLS). The LWLS state of processing is achieved when the Universal Command Group's Local Lockout (LLO) is sent while the DAS is in LOCS. When the LWLS state is achieved, the DAS illuminates the Lockout indicator on the keyboard.

REMOTE STATE (REMS). The REMS state of processing is achieved when a My Listen Address (MLA) is received with the Remote Enable (REN) line asserted. When this state is achieved, the DAS illuminates the Remote indicator on the keyboard.

While in REMS, the DAS responds to and executes all interface and device-dependent commands. The DAS keyboard is still enabled.

The transition from REMS to LOCS occurs whenever a key is pressed on the DAS keyboard. This generates a Return to Local (RTL). If the DAS is in the process of receiving a GPIB command, the keystroke will be executed only after an EOI or device clear (DCL) has been received.

NOTE

Commands which have been sent to the DAS, but not yet processed, may be lost when a Return to Local is executed. If so, the DAS generates a status byte 98 (error code 202).

The transition from REMS to LOCS is also achieved by unasserting the REN line, or by sending the Address Command Group's Go to Local (GTL).

REMOTE WITH LOCKOUT STATE (RWLS). The RWLS state is achieved when the Universal Command Group's Local Lockout (LLO) is received while the DAS is in REMS. When this state is achieved, the DAS illuminates both the Remote and Lockout indicators on the keyboard.

While in RWLS, the DAS responds to and executes all interface and device-dependent commands. The DAS keyboard is disabled.

The transition from RWLS to LOCS is achieved by unasserting the REN line.

GPIB CONTROLS AND INDICATORS

ADDRESS SELECTION

The primary talker/listener address for the DAS is selected by using the address-selection switches on the DAS back panel (see Figure 12-1). The address is selected using switches 4 through 8.

The settings of the switches establish both the primary talk and listen addresses for the DAS. This address uses the five least significant bits on the GPIB data bus. The three most significant bits on the bus are used by the controller to specify when the DAS is talk- or listen-addressed (see Sending Interface Control Messages later in this section).

NOTE

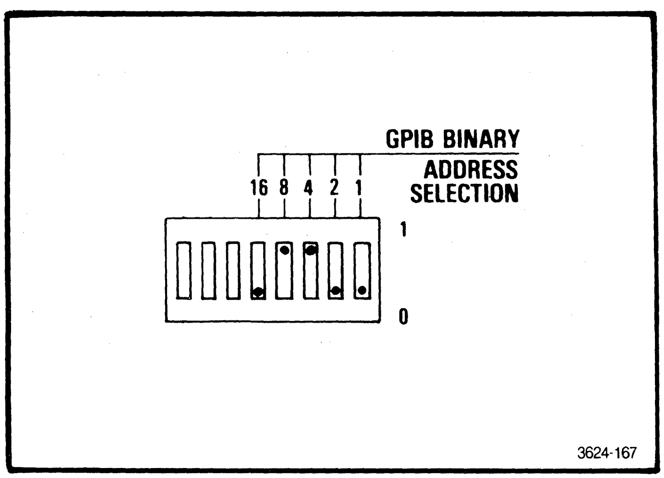
The DAS has no provision for secondary addressing as defined by the IEEE 488 Standard. Secondary addresses are ignored by the DAS.

The DAS talker/listener address can be any value between 0 and 30 (decimal) inclusive. Do not set 31 (decimal) as the address. Address 31 is reserved for use by the controller to untalk or unlisten a device. (Tektronix 4050-series graphic systems also reserve address 0 for another function.)

NOTE

Address 31 is also used to enable the RS-232 port. Refer to the RS-232 Information contained later in this section.

To set the primary GPIB address of the DAS, use a pen or other pointed object to set the address switches to the binary equivalent of the desired address. For example, to set the DAS address to 12 (decimal), set the address switches to the binary equivalent as shown below (8 + 4 = 12).



Readout of Address Selection. A readout of the GPIB address selected for the DAS is always displayed in the Input Output menu. This readout appears as:

GPIB TALK/LISTEN ADDRESS: XX

where XX = the selected decimal address.

If you are using the RS-232 interface with GPIB address 31, the readout appears as:

GPIB OFFLINE

INPUT END OF MESSAGE TERMINATOR

Switch 1 of the address-selection switches (Fig. 12-1) is used to set the DAS end of message terminator.

When the switch is set to 1, the DAS will do the following:

- Accept LF (line feed) or E0I as the end of message terminator.
- Send CR (carriage return) followed by LF at the end of every message, with E0I asserted concurrently with the LF.

When the switch is set to 0, the DAS will do the following:

- Accept E0I only as the end of message terminator.
- Assert E0I concurrently with the last byte of the message.

HANDSHAKE AND SERVICE REQUEST STATUS

There are four LEDs on the back panel of the DAS which aid in program development as well as instrument servicing. Three of the indicators show the state of the handshake protocol between the DAS and the GPIB bus, and the fourth shows when an SRQ is pending.

Figure 12-1 illustrates these back-panel LEDs. The following specifies the conditions present when the LEDs are illuminated:

- **SRQ (Service Request)**—indicates that the DAS is requesting service from the controller.
- **NRFD (Not Ready For Data)**—indicates that the DAS is not ready to accept data (i.e., the input buffer is full).

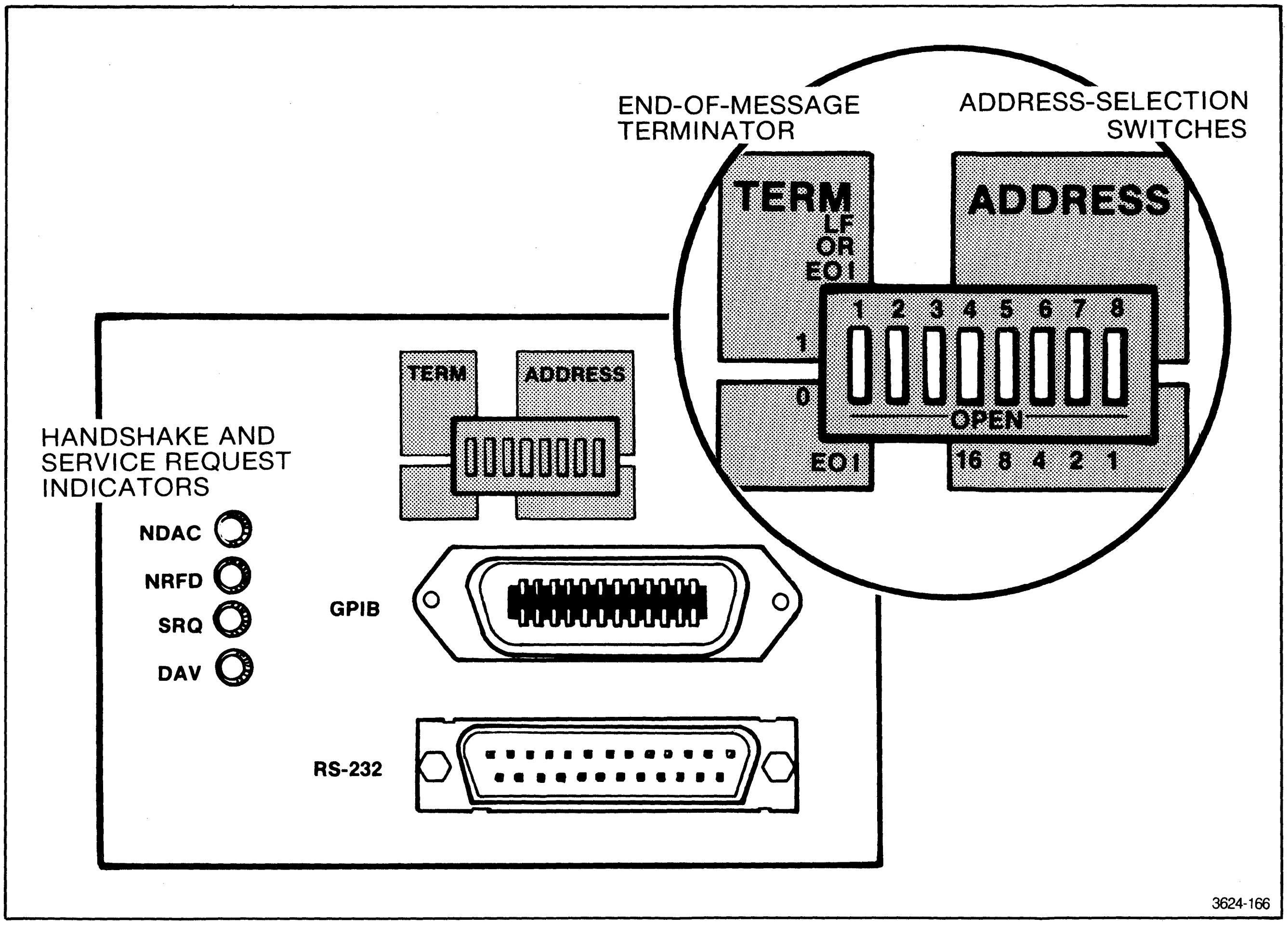


Figure 12-1. GPIB bus address and end-of-message terminator switches.

- **NDAC (Not Data Accepted)**—indicates that the DAS has not yet accepted the current data byte.
- **DAV (Data Valid)**—indicates that the DAS has valid data available for the controller.

GPIB TABLES

Four tables are provided at the back of this section under the heading GPIB Tables. These tables are referenced throughout this section.

The four tables include:

- **DAS 9100 Status Bytes and Error Codes** (Table 12-3)—this table lists and defines the DAS 9100's status bytes, their error codes, and their definitions. It also lists the priority assigned to each error code.

  A detailed description of the status-byte codes and the status reporting scheme is provided later in this section under the heading SRQ, State Bytes, and Error Codes.

- **DAS 9100 Keycodes** (Table 12-4)—this table lists the DAS 9100's keycodes and their decimal equivalents. These keycodes are used with the KEY command, and are discussed in detail later in this section under the heading Keystroke Commands.
- **DAS 9100 Character Set Conversion** (Table 12-5)—this table lists the DAS 9100 Character Set and Waveform Set, and their ASCII and hexadecimal equivalents. This table is essential when reading from or writing to the DAS screen.
- **ASCII & IEEE 488 (GPIB) CODE CHART**—this chart contains the GPIB address and command codes.

POWER-UP AND -DOWN SEQUENCE

POWER-UP SEQUENCE

When the DAS is powered up, it performs a self test routine. This routine tests the major mainframe components to see if they are operating properly. While the routine is in progress, the message DAS 9100 SERIES SELF TEST IN PROGRESS appears at the top of the screen. When the routine is completed, the message DAS 9100 SERIES SELF TEST COMPLETED appears.

The GPIB interface will not function until the power-up self test routine is completed. When the routine is completed, the DAS enters the Local State (LOCS) and asserts SRQ.

If the power-up self test was successful, the DAS responds to the serial poll with a status byte 65 (decimal). This status byte means that the tests were successful and power is on.

If the power-up self test was unsuccessful, the DAS responds to the serial poll with a status byte 99.

If a power-up error occurs which does not affect the operations you want to perform, you may clear the error by pressing the DON'T CARE key on the DAS keyboard or by sending the command which accesses the DON'T CARE key (KEY 18). If the error prohibits DAS operations, refer the instrument to a qualified service person.

NOTE

A detailed description of the power-up self test and its error codes are provided in the Operating Instructions section of this manual.

RESET UNDER PROGRAM CONTROL

The DAS may be set to its power-up default settings by sending the INIT command via the GPIB. This command always initiates a power-up self test routine.

On completion of INIT, the DAS generates a status byte 66 (operation complete). If a self-test error occurred, the DAS generates status bytes 99 and 66.

POWER-DOWN SEQUENCE

There are no special power-down sequences. The DAS powers down when it is turned off.

NOTE

The DAS does not assert SRQ when powered down.

GPIB INTERFACE MESSAGES

The following paragraphs describe the formats used for sending GPIB interface messages and show how the DAS responds. All numerical values are shown in decimal.

NOTE

For information on GPIB address and command codes, refer to the ASCII & IEEE 488 (GPIB) Code Chart listed under GPIB Tables at the back of this section.

SENDING INTERFACE CONTROL MESSAGES

There are five groups of interface control messages sent with the GPIB Attention (ATN) line asserted. They include: Talk Address Group (TAG); Listen Address Group (LAG); Address Command Group (ACG); Universal Command Group (UCG); and Secondary Command Group (SCG). The SCG control messages are not implemented in the DAS and are not discussed here.

The WBYTE form used in the following examples is for the Tektronix 4050-series graphic systems. The WBYTE statement asserts ATN with the @ symbol and unasserts ATN with the colon (:). Thus, all values listed are sent with ATN asserted.

Talk Address Group (TAG)

WBYTE @ A:—causes the DAS to talk.

where A = MTA = 64 + address (0-30)

WBYTE @ 95:—causes the DAS to untalk (UNT).

Listen Address Group (LAG)

WBYTE @ A:—causes the DAS to listen.

where A = MLA = 32 + address (0-30)

WBYTE @ 63:—causes the DAS to unlisten (UNL).

Address Command Group (ACG)

WBYTE @ A, 1,63:—Go to Local.

where A = MLA = 32 + address (0-30)
1 = GTL
63 = UNL

WBYTE @ A, 14,63—Selected Device Clear

where A = MLA = 32 + address (0-30)
14 = SDC
63 = UNL

WBYTE @ A, 8,63:—Group Execute Trigger

where A = MLA = 32 + address (0-30)
8 = GET
63 = UNL

NOTE

Parallel Poll Configure (PPC) and Take Control (TCT) are not implemented in the DAS.

Universal Command Group (UCG)

WBYTE @ A, 17,63:—Selected Local Lockout (LLO).

where A = MLA = 32 + address (0-30)
17 = LLO
63 = UNL

(This command set the DAS to RWLS if REN is true.)

WBYTE @ 17:—Local Lockout (LLO).

(This command set the DAS LWLS.)

WBYTE @ 20:—Device Clear (DCL).

WBYTE @ 24:—Serial Poll Enable (SPE).

WBYTE @ 25:—Serial Poll Disable (SPD).

NOTE

Parallel Poll Unconfigure (PPU) is not implemented in the DAS.

RESPONSE TO INTERFACE CONTROL MESSAGES

The following paragraphs describe how the DAS responds to the GPIB control messages. All of the control messages, except IFC (interface clear), are sent with ATN asserted. Again, all numerical values are shown in decimal.

DCL (20) Device Clear. The DAS responds to this message as follows:

1. All currently executing commands are terminated.
2. The DAS GPIB input and output buffers are cleared.
3. Any pending status bytes are cleared, except for the power on (65) and the device-dependent status bytes.

None of the current settings of the DAS are altered upon DCL, except during a binary restore operation. If DCL occurs during a binary restore, the DAS performs INIT (reset).

GET (08) Group Execute Trigger. This message must be preceded by a DT (Device Trigger) command (see system commands). In addition, the DAS input buffer must be clear.

If these conditions are met, the DAS will execute the GET as specified by the DT action.

If these conditions are not met, the DAS will generate a status byte 98 (error code 206).

GTL (01) Go to Local. This message causes the DAS to enter Local State (LOCS). In LOCS, the instrument executes all device-dependent commands except those which affect keyboard controls. Commands affecting the keyboard controls will generate a status byte 98 (error code 201).

LLO (17) Local Lockout. If the DAS is in Remote State (REMS), this message causes the instrument to lockout the keyboard controls. If in LOCS, this message causes the instrument to lock out the keyboard controls as soon as the instrument is set to a remote state.

SDC (04) Selected Device Clear. This message is device-specific. If this message is addressed to the DAS, the instrument will respond in a manner identical to that specified for DCL.

SPE (24) and SPD (25) Serial Poll Enable and Serial Poll Disable. These messages configure the DAS for serial poll capability.

IFC Interface Clear. This message untalks (UNT) and unlistens (UNL) all instruments on the bus. It resets DAS interface functions only; it does not affect the operating modes.

DAS 9100 DEVICE-DEPENDENT COMMANDS

DEVICE-DEPENDENT MESSAGE FORMAT

The following formatting rules apply to all DAS device-dependent messages:

- All commands and DAS responses are in ASCII characters, except for binary blocks (see Binary Transfer Commands). Any lower-case characters received by the DAS are mapped automatically to upper case.
- The parity bit (IEEE 488 bus line D108) is disregarded by the DAS when the ATN is unasserted, except where binary blocks are concerned.
- By IEEE 488-1978 convention, EOI always signals the last byte in a message.

  If the end-of-termination switch (see Figure 12-1) is set to 1, the DAS also recognizes LF (line feed) as a terminator.
- All device-dependent messages contain, at the least, a mnemonic command header.

  Two or more commands can be grouped together in a single message if separated by a semicolon.

  For example:

  HOME;DOWN;NEXT

  (A semicolon at the end of a message is optional.)
- A command is separated from its parameters (if any) by a space. Multiple parameters are delimited by commas.

  For example:

  KEY 12,48,36

  Any number of spaces, carriage return (CR), or line feeds (LF) may be inserted between the command header and parameters, between parameters, or at the end of the message.

NOTE

If the line feed (LF) character is specified as an end-of-message terminator, the LF character must not be encountered except at the end of the message.

- Literal strings, whether numeric or alphanumeric, must be enclosed by either double or single quotes.

  For example:

  MESSAGE 0,0,5, "HELLO"

  If the string includes a literal double quote, it can be enclosed by single quotes.

  For example:

  MESSAGE 0,0,5, '"HELLO"'
- A keystroke command used for making an entry in a menu field must adhere to the screen format for that field. For example, the string used for entering a value into the MNEMONIC field of the Define Mnemonics menu must contain no more than 10 characters.
- Legal numeric inputs include zero and the positive integers. Leading zeros are accepted.

SYNTAX CONVENTIONS USED

Table 12-2 lists the notational conventions used in describing the syntax of the DAS 9100 device-dependent commands. These notational conventions will be used throughout the remainder of this section.

Table 12-2
Syntax Conventions

Notation	Significance
ITEM	Required item. This string is to be used literally (no other argument is permissible.)
<item>	Required item, selected from among a family of permissible arguments.
[ITEM]	Optional item (literal).
<item>...	Repeatable item (one or more required).
[<item>...]	Repeatable item (optional).

PROGRAMMING THE INSTRUMENT FUNCTIONS

The DAS provides five basic types of device-dependent commands:

- **System Commands**—this command group provides standard system commands, such as ID?
- **Keystroke Commands**—these commands allow access to all DAS keyboard functions. Menus can be entered, the screen cursor can be moved from field to field, and field values can be changed just as they can from the DAS keyboard.

NOTE

Keystroke commands must be sent with the REN line asserted.

- **Screen Commands**—these commands allow read/write access to the DAS monitor screen. They can be used to retrieve one or all lines of the screen, or they can be used to write to any specific position on the screen.
- **ATE Control Commands**—these commands provide special features which are not available via the DAS front panel. They are specially designed to aid in ATE type applications.
- **Binary Transfer Commands**—these commands transfer binary blocks from the DAS to the controller and vice versa. The commands can save and restore menu setups and reference memory contents the same way as the DAS tape drive.

SYSTEM COMMANDS

DT (Device Trigger) Command

This command is used to specify which type of start function will occur in the DAS when the GET command (Universal Address Group) is received. If a GET is received while the DAS is modifying its settings or executing a command, the GET is ignored. When this occurs, the DAS generates a status byte 98 (error code 206).

NOTE

The DAS start functions may also be executed using the START Command (see Keystroke Commands). The START Command is queued like all other GPIB commands, and therefore does not require the DAS to be in an idle state. The START Command is recommended as an alternative to GET.

The DT command provides both a settings command and query command format.

The settings command format is:

DT <type>

where <type> is one of the following:

SYS—sets the Device Trigger to START SYSTEM.
ACQ—sets the Device Trigger to START ACQUISITION.
PGN—sets the Device Trigger to START PAT GEN.
CEQ—sets the Device Trigger to COMPARE =.
CNE—sets the Device Trigger to COMPARE ≠.
OFF—sets the Device Trigger to OFF.

The default DT status is OFF. This means that no start function is enabled.

All other available DT start types operate exactly like their equivalent keyboard controls.

To query the DAS for its Device Trigger status, the query format is:

DT?

The DAS responds to this command in the following way:

DT <type>;

This response message identifies the current DT setting. A typical example of the query and the DAS response would be:

DT?
DT SYS;—the current DT status is START SYSTEM.

ERR? (Error Query) Command

This command is used to query the DAS after the SRQ has been asserted and a serial poll performed. When queried in this manner, the DAS responds by sending the associated error code, but not its literal error-message string.

NOTE

Because the ERR? command does not return literal strings, the ERRMSG? command is recommended as an alternative in all cases.

The query format is:

ERR?

The DAS response to this command is:

ERR <errcode>;

The <errcode> is a numerical code. These numerical values and their corresponding error conditions are listed in Table 12-3, the DAS 9100 Status Bytes And Error Codes (see GPIB Tables at the back of this section). An <errcode> value of 0 indicates that no error code is present.

A typical example of this query and the DAS response:

ERR?
ERR 707;—error code 707 is present.

ERRMSG? (Error Message) Command

This command is used to query the DAS for an error condition after an SRQ has been asserted and a serial poll performed. When queried in this manner, the DAS responds by providing the SRQ's associated error code and its literal string (if any).

NOTE

It is recommended that you always use ERRMSG? in place of ERR?, since this query supplies the error message string (if any) in addition to the error code.

The command's query format is:

ERRMSG?

The DAS responds to this command:

ERRMSG <errcode>[, "<string>"];

The <errcode> is a numerical value. These numerical values and their corresponding error conditions are listed in Table 12-3, DAS 9100 Status Byte and Error Codes (see GPIB Tables at the end of this section). An <errcode> value of 0 means that no error is present.

A <string> value is provided with an <errcode> value of 207. This value is generated when an error message appears on the DAS screen. The <string> consists of the error-message readout.

A typical example of this query command and the DS response:

ERRMSG?
ERRMSG 207, "PLEASE USE THE SELECT KEY";—error code and its message.

ID? Command

This command is standard among Tektronix GPIB instruments, and is used to identify the instrument over the bus.

The query format is:

ID?

The DAS response is:

ID TEK/DAS9100,V79.1, <firmware version>;

where <firmware version> indicates the DAS 9100 firmware version present in the instrument. The V79.1 notation refers to the Tektronix Codes and Formats Standard which the DAS adheres to.

A typical example of this query command and the DAS response:

ID?
ID TEK/DAS9100,V791.1,FV1.01;

INIT Command

This command is used to reset the DAS to its power-up default settings. The DAS 9100 power-up self test is performed when the reset occurs.

The command format is:

INIT

The DAS responds to this command with a status byte 66 (operation complete). If a self-test error occurs, the DAS responds with status bytes 99 and 66.

RQS Command

This command can be used to disable or re-enable the DAS SRQ capability.

NOTE

At power-up, the instrument's SRQ capability is ON.

The command may be used as a settings command or a query.

The settings command format is:

RQS <status>

where <status> is one of the following:

ON—the instrument's SRQ capability is enabled.
OFF—the instrument's SRQ capability is disabled.

When the RQS OFF condition is active, the ERRMSG? or ERR? commands may be used to retrieve device-dependent status byte information. When the RQS is set to ON after being OFF, the DAS asserts SRQ if any conditions which normally assert SRQ occurred while RQS was set to OFF.

The query format is:

RQS?

The DAS response is:

RQS <status>;

This response message identifies the current SRQ capability status.

A typical example of this query command and the DAS response:

RQS?
RQS ON;—the current SRQ capability is ON.

KEYSTROKE COMMANDS

The Keystroke Commands provide access to every key on the DAS keyboard. The commands are broken down into functional blocks which match the functional blocks of the DAS keyboard: Menu Selection Keys; Pattern Generator Instruction Keys; Data Entry Keys; Editing, Cursor, and Scroll keys; and System Control keys. To find a specific keystroke command, look under the appropriate functional block.

MENU SELECTION COMMANDS

These commands correlate the seven menu keys on the DAS keyboard. Each command header represents a menu key.

An optional argument, HOME, may be used with the command header to specify that the screen cursor is positioned at the first field in the menu when the menu is entered. The first field is determined reading from the top left of the screen. If the argument is not used, the screen cursor is positioned where it was the last time the menu was left.

NOTE

The HOME position in the Trigger Specification menu will be the MODE field if more than one type of data acquisition module is installed; or, it will be the CLOCK field if one type is installed.

The command formats are:

CHANNEL [HOME]—the Channel Specification Menu.

TRIGGER [HOME]—the Trigger Specification menu.

STATE [HOME]—the State Table menu.

TIMING [HOME]—the Timing Diagram menu.

DEFINE [HOME]—the Define Mnemonics menu.

IO [HOME]—the Input Output menu.

PATTERN [HOME]—the Pattern Generator menu.

DEFAULT—the power-up configuration display; no self test is performed.

NOTE

The [HOME] argument is not applicable to the DEFAULT menu value since the screen cursor is not present in the screen display.

A typical example of this command:

CHANNEL HOME—the Channel Specification menu is entered and the screen cursor is positioned in the top, leftmost field in the menu.

PATTERN GENERATOR INSTRUCTION COMMANDS

These commands correlate the seven pattern generator instruction keys on the DAS keyboard. The functions of these commands are identical to the functions of their correlating keys.

NOTE

These commands should be used only when the Pattern Generator menu has been entered and the screen cursor is positioned in a valid field (see Pattern Generator Menu section of the manual). Otherwise, the DAS generates a status byte 98 (error code 207).

The command formats are:

COUNT <number>

where <number> is a numeric argument between 2 and 255, inclusive.

REPEAT <number>

where <number> is a numeric argument between 2 and 255, inclusive.

GOTO "<string>"

where <string> is an alphanumeric argument of up to four characters.

HOLD <number>

where <number> is a numeric argument between 2 and 255, inclusive.

CALL "<string>"

where <string> is an alphanumeric argument of up to four characters.

RETURN
HALT

NOTE

A <string> argument may be any valid combination of the DAS 9100 Character Set as listed in Table 12-5 at the back of this section. These characters are sent to the DAS using their ASCII equivalent.

Typical examples of this command:

GOTO "SUB1"—enters the GOTO instruction with a SUB1 alphanumeric string.

HOLD 10—enters the HOLD instruction with a numeric value of 10.

DATA ENTRY COMMANDS

These commands reference the alphanumeric keys on the DAS keyboard. The NEXT, INCR, and DECR keys are referenced under the Editing, Cursor, and Scroll command descriptions.

ALPHA Command

This command is used to send alphanumeric values to menu fields. The command accepts a string argument of ASCII values corresponding to the full DAS Character Set. The DAS Character Set and ASCII equivalents may be found in Table 12-5 at the back of this section.

NOTE

When this command is used, the screen cursor should be located in a valid data entry field. Otherwise, the DAS generates a status byte 98 (error code 207).

The command format is:

ALPHA "<string>";

where <string> is a valid combination of the DAS Character Set values. When the DAS receives this command it automatically clears the reverse-video field at the cursor location, then enters the ALPHA string value.

A typical example of this command:

ALPHA "BC,@@"; this ASCII string, when received by the DAS, is entered as BC,nn.

NUM Command

This command is used to send numeric data to menu fields. The command accepts a string comprised of any characters 0-9 or X. The value X, when entered in a numeric field, is equivalent to pressing the DON'T CARE key on the keyboard. A blank space may be left in the string to designate a CURSOR RIGHT (see Editing, Cursor, and Scroll key commands).

NOTE

When this command is used, the screen cursor should be located in a valid numeric menu field. Otherwise, the DAS generates a status byte 98 (error code 207).

The command format is:

NUM "<string>";

where <string> is a valid combination of 0-9,X, or spaces.

A typical example of this command:

NUM "12 54" this string would enter a 1 and 2, then shift the screen cursor one space to the right, then enter a 5 and 4.

EDITING, CURSOR, AND SCROLL COMMANDS

These commands are used to access the functions of the DAS editing, cursor, and scroll keys. Each command header represents a specific key and initializes the key's function.

The optional <number> argument is a decimal value between 1 and 99, inclusive, which specifies the number of times the key function is to occur. If this argument is not used, the key function will occur once.

For the ADD LINE and DEL LINE key functions, the command formats are:

ADDLINE [<number>]
DELLINE [<number>]

For the INCR and DECR key functions, the command formats are:

INCR [<number>]
DECR [<number>]

For the SELECT key function, the command format is:

SELECT [<number>]

For the scroll key functions, the command formats are:

SCROLL UP[,<number>]
SCROLL DOWN[,<number>]
SCROLL RIGHT[,<number>]
SCROLL LEFT[,<number>]
SCROLL WAVRIGHT[,<number>]
SCROLL WAVLEFT[,<number>]

(WAVRIGHT and WAVLEFT scroll the Timing Diagram waveforms. For this scroll function, the MAG field in the Timing Diagram menu must be set to a value greater than 1.)

For the cursor control keys, the command formats are:

NEXT [<number>]
LEFT [<number>]
RIGHT [<number>]
UP [<number>]
DOWN [<number>]

A typical example of this command:

SCROLL UP,3 specifies that the display will scroll up three times.

SYSTEM CONTROL COMMANDS

These commands access the system control keys on the DAS keyboard and initialize their functions.

START Command

This command is used to initiate the DAS start functions. The command allows a selected start function and a start function query.

For a selected start function, the command format is:

START <type>

where <type> =
SYS—the start function is START SYSTEM.
ACQ—the start function is START ACQUISITION.
PGN—the start function is START PAT GEN.
CEQ—the start function is COMPARE =.
CNE—the start function is COMPARE ≠.

When a SYS, ACQ, CEQ, or CNE operation is complete, the DAS generates a status byte 66 (operation complete). No SRQ is asserted on the completion of PGN.

Once the command has been used with a specified <type> argument, the command may be used without a <type> and will automatically default to the last <type> specified.

START SYS—causes the DAS to perform a START SYSTEM.

START—causes the DAS to perform another START SYSTEM.

For a start query, the command format is:

START?

The DAS response is:

START <type>; this designates the current start function value.

SEARCH Command

This command is equivalent to pressing the SEARCH key on the DAS keyboard. It is used by the State Table and Timing Diagram menus.

The command format is:

SEARCH

When the search operation is complete, the DAS genertes a status byte 66.

STORE Command

This command is equivalent to pressing the STORE key on the DAS keyboard. The STORE function causes the DAS to store the current acquisition memory in reference memory. Any data previously stored in reference memory is erased.

The command format is:

STORE

When the store operation is complete, the DAS generates a status byte 66.

STOP Command

This command is equivalent to pressing the STOP key on the DAS keyboard. The command causes the DAS to stop any current data acquisition, pattern generator, or search operations.

The command format is:

STOP

If the operation involved the data acquisition modules, the DAS asserts a status byte 66 when the operation is complete. No SRQ is asserted when the pattern generator only is stopped.

KEY Command

This command is used to send key sequences to the DAS; to query the DAS for the last key pressed on the DAS keyboard; and to enable SRQ asserted with the next key pressed on the keyboard.

For sending key sequences, the command format is:

KEY <keycode>[,<keycode>,...]

where <keycode> is a decimal number representing the key to be performed by the DAS. The decimal equivalents for each key on the DAS keyboard can be found in Table 12-4 at the back of this section.

A typical example of this command:

KEY 49—this would cause the DAS to enter the Channel Specification menu.

To query the DAS for the last key pressed on the keyboard, the command format is:

KEY?

The DAS responds to the query with:

KEY <keycode>;

where <keycode> is the decimal equivalent of the last key pressed on the keyboard.

A typical example of this query command and the DAS response:

KEY?
KEY 16;—this indicates that the DEL LINE key (16 decimal) was the last key pressed on the DAS keyboard.

To cause the DAS to assert SRQ when the next key is pressed on the keyboard, the command format is:

KEY 128;—the key code for the Keystroke SRQ.

"Learn" KEY Functions. The KEY command allows the controller to retrieve ("learn") and store a specific key sequence. If the DAS is in the Remote State (REMS) when a key is pressed, it will execute the key function, but at the same time, it will perform a Return To Local (RTL). To avoid the RTL, it is recommended that KEY 128 be used in the Remote With Lockout State (RWLS). In this mode, the controller reads the key pressed on the keyboard, echoes it back to the DAS, then prepares to read another key. With this learn mode, you can build a progam which learns keys from the keyboard for storage in the controller, and which, at a later time, can restore the key sequence to the DAS.

NOTE

An example of a "learn" KEY program is provided later in this section under the heading Sample Programs.

When in the RWLS state, the DAS responds to the KEY? and KEY 128 commands.

SCREEN COMMANDS

CRT Command

This command is used to retrieve specific line(s) of the DAS screen display. The command is implemented in two parts. The first part is a settings command which tells the DAS which lines on the screen are to be sent to the controller. The second part is a query command which asks the DAS to send the lines specified in the settings.

The settings command format is:

CRT <line>[,<number>]

The <line> argument is a decimal value which specifies a line on the DAS screen. This value may be any number 0-23, where 0 corresponds to the topmost line of the screen.

The <number> argument is optional. This argument is a decimal value which specifies the number of additional lines (from the <line> value location) which are to be sent. This value may be any number 1 through 24. If the <number> argument is not used, one line is sent.

An example of this command would be:

CRT 3,20;—this tells the DAS to prepare to send screen lines 3 through 23.

NOTE

If the value specified for <number> over runs the screen limits, the DAS sends back lines until it reaches the bottom of the screen. It does not loop back to the top screen line.

Once the CRT command has been used to specify the lines to be sent, the query form of the command is used to initiate the send.

The query format for this command is:

CRT?

The DAS responds by sending the screen lines designated in the most recent CRT settings command.

The query format may also be used to single-step through the screen lines. Each time the query, CRT?, is sent the DAS sends back the next consecutive screen line. In this mode, when the target line exceeds the bottom screen line (23), the query resets to the top line (0).

Reading Screen Information. When the DAS returns multiple lines to the controller, it concentrates the lines into one string with no special delimiter between DAS screen lines. (Each DAS screen line is 80 characters long.)

The DAS characters are sent to the controller in ASCII-equivalent form. To map the characters and their ASCII equivalents refer to Table 12-3. This table applies to all DAS characters except for the four listed below. These four characters should be mapped as follows:

Character sent from the DAS	Character received by the controller
n	n
µ	u
m	m
≠	#

Table 12-3
DAS 9100 CHARACTER SET CONVERSION

Hexadecimal	ASCII	Character Set	Waveform	Hexadecimal	ASCII	Character Set	Waveform	Hexadecimal	ASCII	Character Set	Waveform	Hexadecimal	ASCII	Character Set	Waveform
20				30	0	0		40	@	n		50	P	P	
21	!	m		31	1	1		41	A	A		51	Q	Q	
22	"	≠		32	2	2		42	B	B		52	R	R	
23	#	#		33	3	3		43	C	C		53	S	S	
24	$	∫		34	4	4		44	D	D		54	T	T	
25	%	L		35	5	5		45	E	E		55	U	U	
26	&	&		36	6	6		46	F	F		56	V	V	
27	'	'		37	7	7		47	G	G		57	W	W	
28	(	(		38	8	8		48	H	H		58	X	X	
29	)	)		39	9	9		49	I	I		59	Y	Y	
2A	*	*		3A	:	:		4A	J	J		5A	Z	Z	
2B	+	+		3B	;	µ		4B	K	K		5B	[	X	
2C	,	,		3C	<	<		4C	L	L		5C	\	|	
2D	–	-		3D	=	=		4D	M	M		5D	]	≡	
2E	.	.		3E	>	>		4E	N	N		5E	∧	^	
2F	/	/		3F	?	?		4F	O	O		5F	-	_	

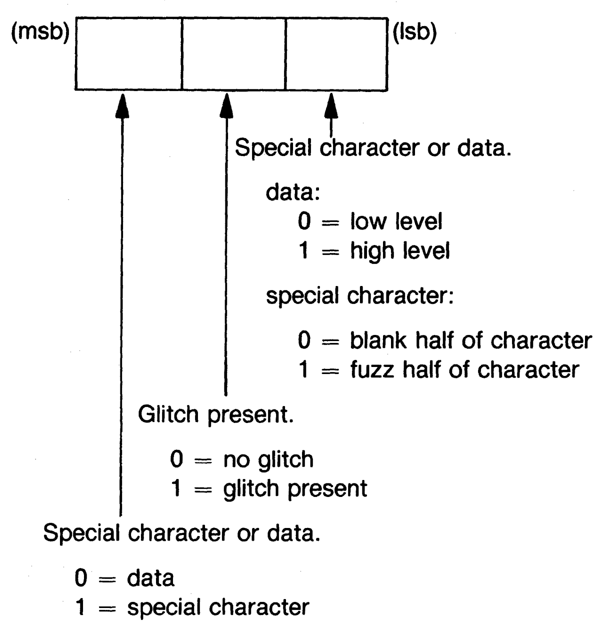
The CRT command also strips all highlighted and reverse-video information from the line before sending it to the controller.

If the information being retrieved is from the Timing Diagram menu, some of the ASCII characters will represent DAS Waveform Characters. These waveform characters are also listed in Table 12-3.

Each waveform character has a left half and a right half. Bits 0 (lsb) to 2 control the right half of the character, and bits 3 to 5 control the left half. Each of these 3-bit fields may be interpreted as follows.

NOTE

The two high-order bits will always be 00.



Typical examples:

0 0 0—represents a waveform low.
0 0 1—represents a waveform high.
1 0 0—represents a waveform blank.
1 0 1—represents a waveform fuzz character.

Table 12-4 lists all waveform conversions
B=BLANK
L=LOW
H=HIGH
G=GLITCH
F=FUZZ

Table 12-4
Waveform Conversion Table

DAS HEX	DAS VERSION OF ASCII	DAS BINARY	DAS WAVEFORM LEFT	DAS WAVEFORM RIGHT	HOST ASCII	HOST HEX
20	(space)	100000	B	L	(space)	20
21	m	100001	B	H	m	6D
22	≠	100010	B	LG	#	23
23	#	100011	B	HG	#	23
24	_┌	100100	B	B	$	24
25	┐_	100101	B	F	%	25
26	&	100110	B	B	&	26
27	'	100111	B	FG	'	27
28	(	101000	F	L	(	28
29	)	101001	F	H	)	29
2A	*	101010	F	LG	*	2A
2B	+	101011	F	HG	+	2B
2C	;	101100	F	B	;	2C
2D	-	101101	F	F	-	2D
2E	.	101110	F	B	.	2E
2F	/	101111	F	FG	/	2F
30	Ø	110000	B	L	Ø	30
31	1	110001	B	H	1	31
32	2	110010	B	LG	2	32
33	3	110011	B	HG	3	33
34	4	110100	B	B	4	34
35	5	110101	B	F	5	35
36	6	110110	B	B	6	36
37	7	110111	B	FG	7	37
38	8	111000	FG	L	8	38
39	9	111001	FG	H	9	39
3A	:	111010	FG	LG	:	3A
3B	μ	111011	FG	HG	u	75
3C	<	111100	FG	B	<	3C
3D	=	111101	FG	F	=	3D
3E	>	111110	FG	B	>	3E
3F	?	111111	FG	FG	?	3F
40	n	000000	L	L	n	6E
41	A	000001	L	H	A	41
42	B	000010	L	LG	B	42
43	C	000011	L	HG	C	43
44	D	000100	L	B	D	44
45	E	000101	L	F	E	45
46	F	000110	L	B	F	46
47	G	000111	L	FG	G	47
48	H	001000	H	L	H	48
49	I	001001	H	H	I	49
4A	J	001010	H	LG	J	4A
4B	K	001011	H	HG	K	4B
4C	L	001100	H	B	L	4C
4D	M	001101	H	F	M	4D
4E	N	001110	H	B	N	4E
4F	O	001111	H	FG	O	4F
50	P	010000	LG	L	P	50
51	Q	010001	LG	H	Q	51
52	R	010010	LG	LG	R	52
53	S	010011	LG	HG	S	53
54	T	010100	LG	B	T	54
55	U	010101	LG	F	U	55
56	V	010110	LG	B	V	56
57	W	010111	LG	FG	W	57
58	X	011000	HG	L	X	58
59	Y	011001	HG	G	Y	59
5A	Z	011010	HG	HG	Z	5A
5B	X	011011	HG	HG	[	5B
5C	|	011100	HG	B	\	5C
5D	=	011101	HG	F	]	5D
5E	^	011110	HG	B	^	5E
5F	—	011111	HG	FG	-	5F

CURSOR? Command

This command is used to query the DAS for the current screen cursor location.

The command format is:

CURSOR?

The DAS response is:

CURSOR <line>,<column>;

where <line> specifies the line and <column> specifies the column of the cursor location.

A typical example of this query command and the DAS response:

CURSOR?
CURSOR 0,0;—the cursor is positioned at the top line, leftmost column.

ERASE Command

This command is used to selectively erase one or more lines of the DAS screen.

NOTE

This command should never be used to erase a reverse-video field from the screen. If this occurs, the DAS operating firmwave will not function properly and all current settings may be lost.

The command format is:

ERASE <line>[,<number>]

The <line> argument is a numeric value which specifies a line of the screen. The value may be any number between 0 and 23, where 0 corresponds to the topmost line of the screen.

The <number> argument is optional. This argument is a numeric value which specifies how many additional lines (from the <line> value) will be erased. This value may be any number between 1 and 24. If the <number> argument is not used, one line will be erased.

An example of this command would be:

ERASE 4,3;

This command would erase lines 4 through 7 of the DAS screen.

HOME Command

This command is used to move the screen cursor to its home position (first menu field reading from the top left of the screen).

The command format is:

HOME

NOTE

The HOME position in the Trigger Specification menu will be the MODE field if more than one type of data acquisition module is installed; or, it will be the CLOCK field if one type is installed.

MESSAGE Command

This command is used to send a string message to the DAS screen.

NOTE

This command should never be used to overwrite a reverse-video field on the screen. If this occurs, the DAS operating firmware will not function properly and all current settings may be lost.

The command format is:

MESSAGE <att>,<line>,<column>,"<string>";

All four arguments must be specified in the command .

The <att> argument is used to specify which DAS attribute codes are to apply to the message. The attribute codes are:

Attribute	Code
Standard Attribute (Green)	0
Yellow	1
Blinking Attribute	2
Waveform Attribute	4
Reverse Video Attribute	16
Highlight Attribute (Red/Yellow)	64
Beeper Attribute	128
Future	8
Future	32

These attribute codes can be added together to display a message with combined attribute effects. For example, to display a reverse-video message which blinks, the <att> argument would be 18 (16 + 2).

The <line> argument is used to specify the screen line at which the message will appear. This argument is a numeric value between 0 and 23, where 0 is the topmost screen line.

The <column> argument is used to specify the screen column at which the message will start. This argument is a numeric value between 0 and 79, where 0 is the leftmost character column.

The <string> argument is used to specify the message which will be displayed. This argument can be up to 80 characters, using the ASCII code for any of the DAS Character Set (see Table 12-3). If the message is sent with the waveform attribute, the ASCII code will be converted to its waveform character equivalent.

An example of this command would be:

MESSAGE 128,0,0,"HELLO WORLD"

This command would write the message HELLO WORLD at the top, leftmost position in the DAS screen and also cause the monitor to beep.

SCREEN Command

This command is used to enable and disable the CRT. The default setting for the CRT is ON (enabled).

NOTE

When the CRT is set to OFF (disabled), the processing speed of the DAS is increased by approximately 30%. This is especially useful for ATE mainframes.

The command provides both a settings command and a query command format.

The settings command format is:

SCREEN <status>

where <status> is one of the following values:

ON—the screen is enabled.
OFF—the screen is disabled.

The query command format is:

SCREEN?

The DAS response to this command is one of the following:

SCEEN ON;
SCREEN OFF;

ATE CONTROL COMMANDS

The group of ATE Control Commands provides special features which are not available via the DAS front-panel. These commands access information directly from the DAS instrument modules. They are designed to aid ATE-type applications.

ACQMEM Command

This command is used to retrieve acquisition memory contents from the installed data acquisition modules. The memory is accessed on a per module and per pod (probe) basis.

The command is executed in two parts. First, the command is sent to the DAS as a settings command which specifies the module/pod memory to be retrieved. Then, the command is sent as a query, asking the DAS to send the specified memory.

Specifying 91A32 Acquisition Memory. The settings command format for specifying 91A32 memory is:

ACQMEM<slot>[, pod<id>]

The <slot> argument is a decimal number identifying the bus slot number where the 91A32 module is installed.

The pod<id> argument is optional. This argument is either PODD, PODC, PODB, PODA depending on the pod.

A typical example of this command:

ACQMEM 2,PODD—this tells the DAS to be ready to send the memory contents of pod D from 91A32 module installed in bus slot 2. (The memory data is sent when ACQMEM? is received by the DAS.)

When using ACQMEM? to retrieve 91A32 memory, a short-hand form is available for retrieving multiple pods. This short-hand form works in the following way.

First the 91A32 module is identified to the DAS by sending the module's bus slot number. For example:

ACQMEM 2—this tells the DAS to be ready to send the memory contents from the 91A32 module installed in bus slot 2.

After the module has been identified to the DAS, the ACQMEM? is used to retrieve the four 91A32 pods, one pod at a time.

For example:

ACQMEM?—the DAS sends the memory contents of pod D.

ACQMEM?—the DAS sends the memory contents of pod C.

ACQMEM?—the DAS sends the memory contents of pod B.

ACQMEM?—the DAS sends the memory contents of pod A.

The order of pods being returned is always D, C, B, then A. When pod A is reached, the next ACQMEM? query starts over with pod D.

Specifying 91A08 Acquisition Memory. The command format for retrieving 91A08 memory is:

ACQMEM <slot>[,GLITCH]

The <slot> argument is a number which identifies the bus slot number where the 91A08 module is installed.

The GLITCH argument is optional. If used, this argument tells the DAS to send the 91A08's glitch memory, rather than the standard data memory.

Typical examples of this command:

ACQMEM 6—this tells the DAS to be ready to send the data memory from the 91A08 module installed in bus slot 6.

ACQMEM 6,GLITCH—this tells the DAS to be ready to send the glitch memory from the 91A08 module installed in bus slot 6.

After the settings command has been used, ACQMEM? is used to retrieve the memory.

The Response To ACQMEM? The DAS response to the ACQMEM? query is in the following format:

ACQMEM%<bytecount><data bytes>
<checksum>;

The percent sign (%) indicates the data is in binary form.

The <bytecount> is two binary bytes which specify the number of bytes of data being sent, including the memory <data bytes> and the <checksum> bytes. This tells the controller how many data bytes to expect.

The <data bytes> contain the memory data. This may be up to 511 bytes, depending on how much data was acquired by the pod. The <data bytes> start at the first State Table sequence that contains data, then continue through the end of memory (sequence 511).

NOTE

The data bytes are sent in the sequence in which they were acquired. This organization is not affected by the Channel Specification menu.

The <checksum> byte governs all data bytes past the % symbol. The <checksum> may be checked by adding together all of the bytes past the % (up to and including the checksum byte). If the result is zero, the data was received correctly.

BOARDS? Command

This command is used to query the DAS for its current module configuration. When the DAS receives this command, it responds by reporting the available bus slots and their installed modules (if any).

NOTE

Bus slot 0 (the Controller module) is not reported.

The command format is:

BOARDS?

The DAS responds to this query:

BOARDS "S1/<type>,S2/<type>......S15/<type>";

The S1 through S15 notation refers to bus slots. S1 through S7 refer to the bus slots in the mainframe's module compartment. S8 refers to the I/O board location. S9 through S15 are reserved for future mainframe expansion (they are not used). The DAS always lists all 15 bus slots in its response message.

The <type> value identifies the module configuration in the bus slot. The <type> values are identified as follows:

Value	Module
80	91A32 Data Acquisition Module.
81	91A08 Data Acquisition Module.
04	91P16 Pattern Generator Module
85	91P32 Pattern Generator Expander Module.
06	Trigger/Time Base Module.
07	I/O Board.
00	No module installed.

An example response message would be:

BOARDS "S1/04,S2/80,S3/00.............";

bus slot 3, no module installed.

bus slot 2, a 91A32 module installed.

bus slot 1, a 91P16 module installed.

TEST Command

This command is used to initate a comparison of the DAS acquisition and reference memories without doing a new acquisition.

The command format is:

TEST

The DAS responds by asserting an SRQ status byte of:

193—indicating the two memories are equal;or
194—indicating the two memories are not equal.

If the status byte indicates that the two memories are not equal, the TEST? command can be used to query the DAS for the sequence numbers (in the State Table Menu) which are not equal.

The command's query format is:

TEST?

The DAS responds to this command with:

TEST <sequence>;

The <sequence> is the first sequence in the State Table that is not equal to reference memory.

A <sequence> value of −1 means that there are no unequal sequences.

Example response messages:

TEST 14;—sequence 14 is the first sequence in the State Table that is not equal to reference memory.

TEST−1;—there are no unequal sequences in the State Table.

TRIGPOS Command

This command is used to retrieve the trigger position in a particular data acquisition module's memory. The trigger position is identified by the number of sequences it is offset from the first sequence location in the State Table that contains data. For instance, if the first sequence containing data is sequence 14 and the trigger is offset by 15 sequences, then the trigger position is sequence 29 (14 + 15).

This command is executed in two parts. First, the command is sent as a settings commands which specifies a module bus slot. Then, the command is sent as a query, asking for the trigger position on the module in that bus slot.

The settings command format is:

TRIGPOS <slot>;

where <slot> is a bus slot number (i.e., 1-6).

NOTE

The bus slot specified in the TRIGPOS command should be a bus slot containing a data acquisition module.

The query command format is:

TRIGPOS?

The DAS responds to the query in the following format:

TRIGPOS <sequence>,<offset>;

The <sequence> is a numeric value which corresponds to the first sequence number in the State Table that contains data. The <offset> is a numeric value which represents the number of sequences the trigger word is offset from the <sequence> value.

A <sequence> value of −1 means either that no data has been acquired on the module, or that the TRIGPOS settings command was not performed before the query.

An <offset> value of −1 means that either the trigger is not in memory, the module has no acquired data, or the TRIGPOS settings command was not performed.

Example response messages:

TRIGPOS 14,8;—the trigger is positioned at sequence 22 (14 + 8).

TRIGPOS 14,0;—the trigger is positioned at sequence 14.

TRIGPOS −1,−1;—either the trigger is not in memory, or the module has no acquired data, or the TRIGPOS settings command was not performed.

TRIGPOS 14,−1;—the trigger is not in memory.

BINARY TRANSFER COMMANDS

The Binary Transfer Commands are used to save and restore DAS menu setups and reference memory. The DAS acquisition memory is not accessible through these commands. The acquisition memory is accessible through the ACQMEM command (see ATE Control Commands).

The information is transferred between the DAS and the controller in binary blocks. There are two types of commands available: those which save DAS setups by transferring information from the DAS to the controller; and those which restore DAS setups by transferring information from the controller to the DAS.

The following paragraphs first describe the two types of commands, then the binary-block structures used in transferring the information.

NOTE

When using the binary transfer commands, the DAS should be set to its default configuration display. Otherwise, the DAS settings may be lost. The default configuration display is set by pressing SHIFT/STOP on the DAS Keyboard; or by sending the DEFAULT Keystroke command.

Save Status Commands

The save status commands are used to retrieve binary blocks of data from the DAS.

The save status commands are identical to the save status operations available via the DAS tape drive. Therefore, for specific information regarding these commands, you should refer to the description of the tape drive's save status operation located in the Input Output Menu section of this manual.

NOTE

All of the parameters or error conditions applicable to the tape drive's save status operation are applicable to these save satus GPIB commands. (The error conditions are sent as status bytes.)

The command formats are:

ALL?—retrieves a binary block describing the current setups of all DAS menus and the contents of reference memory. (Acquisition memory is not retrieved.)

ACQSETUP?—retrieves a binary block describing the Channel Specification, Trigger specification, and Timing Diagram menus.

REFMEM?—retrieves a binary block describing the State Table menu setup and the contents of reference memory. (Acquisition memory is not retrieved.)

PATGEN?—retrieves a binary block describing the current Pattern Generator menu set up.

MNEMONICS—retrieves a binary block describing the current Define Mnemonics menu setup.

The DAS sends the binary data in end-block form. A typical example:

PATGEN @<end block>

When the DAS is sending the binary data, it indicates the end of the block by EOI asserted on the checksum byte. If the controller cannot look for EOI (or if the RS-232 is being used), the controller must scan for the following sequence of bytes:

188
0
0

After this byte is transmitted the DAS also sends a carriage return (CR) and line feed (LF) at the end of the block.

A compression algorithm is used by the DAS when sending this data to reduce the transfer time. The number of bytes transmitted depends on the contents of the various menus. In the worst case, an ALL? transfer could be as many as 20,000 bytes. The typical size of transfers, however, is approximately 5,000 bytes.

Restore Status Commands

These commands are used to restore binary blocks of information to the DAS.

The restore status commands are identical to the tape drive's restore status operations. Therefore, for detailed information regarding the functions of these commands, you should refer to the description of the tape drive's restore status operations located in the Input Output Menu section of this manual.

NOTE

All of the parameters and error conditions applicable to the tape drive's restore status operation are applicable to these GPIB restore status commands.

The command format is:

ALL @<end block>—restores a binary block that contains the saved setup of all DAS menus and reference memory.

ACQSETUP @<end block>—restores a binary block that contains a saved Channel Specification, Trigger Specification, and Timing Diagram menu setup.

REFMEM @<end block>—restores a binary block that contains a saved reference memory.

PATGEN @<end block>—restores a binary block that contains a saved Pattern Generator menu setup.

MNEMONICS @<end block>—restores a binary block that contains a saved Define Mnemonics menu setup.

SAMPLE PROGRAMS

The following sample programs were written using a Tektronix 4050-Series graphic system as the GPIB-system controller. Other controllers may require some program modifications to work properly.

All of the sample programs use variable D1 as the talker/listener address for the DAS. This variable is entered by the user when the program is run.

INTERACTIVE COMMUNICATION VIA THE GPIB

This program lets you interact with the DAS via the controller keyboard and screen. In the program, the controller is programmed to prompt for a DAS remote-control command, send it to the DAS, prompt for another command, and so on. If the command is a query, the DAS responds by displaying the status byte on the controller screen.

The program has a subroutine for handling SRQs. The program jumps to this subroutine whenever SRQ is asserted.

The sequence performed in this program can be repeated as often as desired.

100 PRINT "Enter DAS address:"; **110 INPUT D1**	1. prompt user for DAS talker/listener address
120 ON SRQ THEN 1000	2. establish SRQ interrupt subroutine
130 PRINT "Command: "; **140 INPUT C$**	3. prompt user for DAS operating command
150 PRINT @D1:C$	4. send command to the DAS
160 IF POS(C$,"?",1)=0 THEN 130 **170 INPUT @D1:R$**	5. unless command was a query, go back to step 3 and repeat
180 PRINT R$ **190 GO TO 130**	6. if query, display DAS response, then go back to step 3

SRQ Handler Routine

1000 POLL A1,B1;D1 **1020 PRINT @D1: "ERRMSG?"** **1030 INPUT @D1:E$** **1040 PRINT "STATUS = ";B1,E$** **1050 RETURN**	1. poll DAS for status; display the status byte

SETTING UP A "LEARN" KEY MODE

The following program is designed to "learn" (retrieve and store) a key sequence entered via the DAS keyboard, then restore and execute the key sequence on the DAS.

The program begins by declaring an array in the controller memory which will store the key codes entered via the keyboard. It then sets the DAS to Remote With Lockout State (RWLS) to ensure that a Return To Local (RTL) will not be generated when a key is pressed.

The program sends the DAS a KEY 128 command to produce an SRQ when a key is pressed on the keyboard. It then waits for a status byte 195 which indicates that a key was pressed.

When the status byte 195 is received, the program queries the DAS for the key code and stores it in memory. The program repeats this sequence until the STOP key is pressed on the DAS keyboard.

The second portion of the program, starting on line 2000, sends the stored key codes back to the DAS.

The first portion of the program (line 1000) is started by entering RUN; the second portion (line 2000) is started by entering RUN 2000.

1000 PRINT "Enter DAS address..." **1010 INPUT D1**	1. prompt user for the DAS talker/listener address
1020 DIM K(200)	2. allocate space for up to 200 keycodes
1030 WBYTE @17:	3. send Local Lockout (LLO)
1040 PRINT @D1: "INIT"	4. reset the DAS to its power-up default state
1050 ON SRQ THEN 3000	5. establish SRQ interrupt subroutine
1060 I=1	6. set up counter I for number of keys pressed
1070 PRINT @D1: "KEY 128" **1080 B1=0** **1090 IF B1 < >195 THEN 1090**	7. cause DAS to assert SRQ when a key is pressed, then wait for status byte 195
1100 PRINT @D1: "KEY?" **1110 INPUT @D1: K(I)**	8. query DAS for key code
1120 IF K(I)=45 THEN 1200	9. if the key is STOP, quit
1130 PRINT @D1: "KEY"; K(I)	10. send key back to the DAS, since keys press in RWLS are not executed
1140 IF K(I)<48 OR K(I)>56 THEN 1180 **1150 PRINT @D1: "HOME"** **1160 I=I+1** **1170 K(I)=124** **1180 I=I+1**	11. if the key is a menu key, then store a HOME key code following the menu key code; otherwise just store the key code
1190 GO TO 1070	12. repeat sequence
1200 STOP	

The key sequences can now be stored on tape and sent back to the DAS at a later time.

The rest of this program sends the key sequence back to the DAS. This program assumes that the key codes are array K and I is the element count. The program is started by entering RUN 2000.

2000 ON SRQ THEN 2000	1. establish SRQ interrupt priority
2010 PRINT @D1: "INIT"	2. reset the DAS to its power-up default values
2020 FOR J=1 TO 1-1 2030 PRINT @D1: "KEY";K(J) 2040 NEXT J	3. send key codes back to DAS one at a time
2050 STOP	

SRQ Handler Routine

3000 POLL A1,B1;D1 3010 IF B1=195 THEN 3030 3020 PRINT "SRQ ";B1 3030 RETURN	1. poll DAS for status; if status byte is not 195, display it

SAVING AND RESTORING BINARY DATA

The following program is designed to save and restore binary menu setup data. The program presupposes the following:

- A properly formatted tape is currently mounted in the controller's tape drive.
- If a restore operation is intended, the tape contains a file in which the desired menu setups have been saved by previous operations.
- If a save operation is intended the setups to be saved are currently established in the DAS.

The program begins by prompting the user for the DAS talker/listener address, then for a number identifying the tape file to be accessed. The user is then asked to choose between a save ("S") and a restore ("R") operation, after which the indicated operation is carried out automatically.

Again, the program has an SRQ subroutine handler.

100 PRINT "Enter DAS address: "; 110 INPUT D1	1. prompt user for DAS talker/listener address
120 ON SRQ THEN 3000	2. establish SRQ interrupt subroutine
130 PRINT "Enter file no.: "; 140 INPUT F1 150 FIND F1	3. prompt user for controller tape file number; find file
170 PRINT "Save (S) "; 180 PRINT "or Restore (R)? "; 190 INPUT Z$	4. prompt user for type of operation
200 IF Z$ < > "S" THEN 230 210 GOSUB 1000 220 GO TO 250 230 IF Z$ < > "R" THEN 170 240 GOSUB 2000	5. if response is "S", call menu save routine; if "R", call menu restore routine
250 PRINT "Done" 260 END	6. report when finished

Menu Save Routine

1000 PRINT "Save command? "; 1010 INPUT T$	a. prompt user for binary save command (PATGEN?, MNEMONICS?, REFMEM?, ACQSETUP?, ALL?)
1020 PRINT @D1: T$	b. relay command to DAS
1030 WBYTE @D1+64	c. designate DAS as talker
1040 RBYTE B 1050 PRINT @33: B 1060 If B=>O THEN 1040	d. get binary response byte-by-byte and store on tape (final EOI) sets 4050 Series sign bit negative)
1070 WBYTE @95: 1080 CLOSE 1090 RETURN	e. cancel DAS talker designation; close tape file

Menu Restore Routine

2000 WBYTE @D1+32:	a. designate DAS as listener
2010 INPUT @33: B 2020 WBYTE @63: 2030 IF B=>O THEN 2010	b. read binary data off tape byte-by-byte and relay it to DAS (final EOI) sets 4050 Series sign bit negative)
2040 WBYTE @63: 2050 RETURN	c. cancel DAS listener designation

SRQ Handler Routine

3000 POLL A1,B1;D1 3010 IF B1=66 OR B1=82 THEN 3050 3020 PRINT @D1; "ERRMSG?" 3030 INPUT @D1;E$ 3040 PRINT "STATUS = ",B1,E$ 3050 RETURN	1. poll DAS for status; display status byte, if any

SPECIAL RS-232 REQUIREMENTS

To use the RS-232 interface, the GPIB address switches should by set to address 31 (decimal). Additionally, the RS-232's STATUS field should be set to OFF in the Input Output menu.

Using RS-232 communication imposes additonal restrictions on the controller. An RS-232 controller must have the following capabilities:

- It must be capable of full-duplex asynchronous data communication.
- It must be able to send and receive all eight bits of all data bytes.
- It must halt transmission in response to a control-S (DC3) character from the DAS, and resume in response to a control-Q (DC1).

If the RS-232 controller cannot accept data as quickly as the DAS outputs data, it can slow the output rate in one of two ways:

- It can raise and lower the CTS (pin 5 of the RS-232). When the line is raised, the DAS sends information to the controller. When the line is lowered, the DAS halts its output.
- It can send the OUTBUF <number> command to the DAS, which instructs the DAS to send out only the specified number of characters and then halt until notified to continue. (See command descriptions below.)

RS-232 ONLY COMMANDS

? Command

This command is used to query the DAS for its current status byte. It is equivalent to the GPIB's Serial Poll Enable (SPE) and Serial Poll Disable (SPD) from the universal command group.

The command format is:

?

The DAS response is:

? <statusbyte> [,<statusbyte>...]

A typical example of this command:

?
?65,66;—indicating two status bytes have been asserted: 65 and 66.

LOCKOUT Command

This command is used to lockout the local operation of the DAS. In effect, the command is equivalent to setting up a GPIB Remote With Lockout State (RWLS).

The command provides both a settings command and a query format.

The settings command format is:

LOCKOUT <status>

The <status> is either ON or OFF. In default, the status is OFF.

The query format is:

LOCKOUT?

The DAS response is:

LOCKOUT <status>; —where <status> can be either OFF or ON.

A typical example of this query command and the DAS response:

LOCKOUT?
LOCKOUT ON;

OUTBUF Command

This command is used to control the flow of data from the DAS. The command specifies the number of characters which will be sent from the DAS at one time. This lets you limit DAS output to a block size comfortably handled by the controller. The command provides both a settings command and a query format.

The command format is:

OUTBUF <number>

The <number> is the total number of characters which will be sent from the DAS in one block. When the <number> value is reached, the DAS halts its output until a continue character is sent from the controller. The continue character from the controller can be any user-selected character. The carriage return (CR) is recommended for this purpose.

NOTE

If the OUTBUF is set to 0, the DAS outputs data without interruption. Zero (0) is the default <number> value.

The <number> value is reset whenever the DAS outputs an end-of-message character, and whenever an input byte is received through the RS-232 port. Therefore, each time the DAS starts to output data, it starts at the beginning and counts through the <number> value.

The query format is:

OUTBUF?

The DAS response is:

OUTBUF <number>;—where <number> is the number of characters in a DAS output block. (A zero <number> argument indicates that the DAS outputs are sent without interruption.)

RUBOUT

The RS-232 controller can send a RUBOUT character to the DAS in order to generate a condition similar to a GPIB Device Clear. The only difference is that the DAS must be in a listener mode before it will respond. If the DAS receives a RUBOUT character while listening to the RS-232 controller, it will respond as follows:

1. The input buffer is cleared.
2. Any pending status bytes are cleared, except for the power on (65) and the device-dependent status bytes.

SRQ, STATUS BYTES, AND ERROR CODES

There are two types of status bytes used by the DAS.

- **Device Dependent Status Bytes**—these status bytes do not assert the SRQ line and are used to inform the user of the general state of the DAS at the time of the serial poll.

  Example:

  > If the controller received a status byte of 129, this should indicate to the user that the DAS is currently involved in a tape operation.

- **Non-Device Dependent Status Bytes**—these status bytes do assert the SRQ line and are used to inform the user of the occurrence of a specific act.

  Example:

  > If the controller received a status byte of 66, this should indicate that the current operation (for example the tape operation above) is completed.

DESCRIPTION OF THE STATUS BYTE

Bit 5 of the status byte indicates the active status of the DAS message processor to the system controller. If this bit is set to 1 in the status byte received, it indicates that the DAS is active-processing or executing a GPIB command. Bit 5, if set, increments the status byte value by 16 (decimal).

NOTE

The universal command group's GET function will only be performed when bit 5 is set 0.

Bit 6 of the status byte is used to indicate to the controller that error condition exists in the DAS. When this bit is set to 1 in the status byte, it indicates that previous settings have left the DAS in an inoperable error state.

Bit 7 of the status byte is set to 1 when the status byte is associated with an SRQ.

STATUS REPORTING SCHEME

The DAS maintains a queue of status bytes arranged in a priority scheme and, when polled, reports the highest (1) priority status byte to the controller.

There are six priority levels in the queue, and at any one time the DAS can hold one status byte per priority level. If the DAS has a status byte entry at a given priority level and another event happens which necessitates entering a status byte at the same priority level, the new status byte will be discarded.

When the controller receives an SRQ from the DAS, it should continue to poll the DAS until a status byte is received without bit 6 of the status byte asserted.

Table 12-5 lists the DAS status bytes, their error codes, and their priority.

An error code value of 0 indicates that no error code is present.

GPIB TABLES

Table 12-5
DAS 9100 Status Bytes and Error Codes
(If the DAS is busy, status bytes are increased by 16 decimal.)

Status Byte (Decimal)	Error Code	Priority	Description
NON-DEVICE DEPENDENT CONDITIONS			
65	0	1	Indicates that the DAS has successfully passed power-up self test and is ready for GPIB commands.
97	101	2	Indicates that the DAS has received an invalid command header.
97	102	2	Indicates that the DAS did not receive a space after a command header.
97	103	2	Indicates that the DAS did not receive an argument of the appropriate class for the command currently being considered.
97	104	2	Indicates that the DAS did not receive a comma to delimit between arguments when more than one argument has been specified.
97	105	2	Indicates that a non-rumeric argument has been received when a numeric argument was expected.
97	106	2	Indicates that a necessary argument for the command was missing.
97	107	2	Proper termination for a command was not received, (i.e., a semicolon ";" or EOI/LF was not received).
97	109	2	A string argument was not received when a string argument was expected.
97	110	2	The command sent is a query command and a question mark (?) was not part of the command header.
97	111	2	An invalid character was received in a message (i.e., control characters other than <CR> or <LF>).
98	201	3	Indicates that a command was received by the DAS in LOCS which has a keyboard equivalent (keystroke commands must have REN asserted).
98	202	3	The DAS had commands pending when an RTL occurred. The pending commands were lost.
98	203	3	The DAS input and output buffers have been cleared due to a buffer over fill.
98	204	3	An illegal setting has been sent to the DAS in a binary restore packet.
98	205	3	The argument sent to the DAS in a command is not in the range of valid arguments.
98	206	3	A GET (UAG) command has been sent to the DAS when the DT function is set to DT OFF; the DAS is busy processing a command; or the DAS is not remote. The GET has no effect on the DAS.
98	207	3	An error condition exists on the DAS for which text is displayed on line 2 of the DAS screen.
99	301	3	The DAS GPIB firmware is in an inoperable, error state.
99	302	3	The DAS system firmware is inoperable due to a firmware error.
99	303	3	The DAS has a ROM checksum error.
99	304	3	A diagnostic test on the DAS has failed.

Table 12-5 (cont.)

Status Byte (Decimal)	Error Code	Priority	Description
101	0	5	The POD ID button on a probe has been pressed or a pod has been connected or disconnected.
66	0	5	An operation requested of the DAS has completed.
225	701	4	The slot number specified by ACQMEM or TRIGPOS does not contain an acquisition module.
226	702	4	There has not been a TEST setting before a TEST? query.
227	703	4	The <podid> argument to the ACQMEM setting command for a 91A32 contained an illegal pod identifier.
193	0	5	A TEST completed and the two memories were equal.
194	0	5	A TEST completed and the two memories were unequal.
228	704	4	The module in the slot specified by ACQMEM has not acquired any data in acquisition memory.
229	705	4	The binary restore packet configuration was not consistent with the current DAS configuration (equivalent to a tape-drive configuration error).
230	706	4	The binary restore packet firmware version was not consistent with the current DAS firmware version (equivalent to a tape-drive firmware version error).
195	0	5	A key was pressed on the DAS keyboard while the keystroke SRQ was enabled.
231	707	4	A command was sent to the DAS which required that there be reference memory stored and no reference memory was present.
196	0	5	A new tape has been inserted into the DAS tape drive.
232	708	4	A START command was sent to the DAS when the start function was set to START OFF.
197	0	5	A restore binary packet was sent to the DAS and only a portion could be restored (equivalent to a tape-drive partial restore).
198	0	5	The restored binary packet modified the DAS module configuration (equivalent to a tape-drive modified restore).
DEVICE DEPENDENT CONDITIONS			
129	0	7	A tape operation is currently in progress.
130	0	7	An acquisition has been started.
134	0	7	A search word operation is currently in progress.
135	0	7	Reference memory is being tested against acquisition memory.
136	0	7	A diagnostic operation or test is in progress.
139	0	7	The DAS is looking for a key to be pressed on the keyboard. Then, when the key is pressed, the DAS will assert SRQ.
140	0	7	The pattern generator is running.

Table 12-6
DAS 9100 Keycodes

Key Name	Code	Key Name	Code	Key Name	Code
0	0	SEARCH	44	SHIFT UP	87
1	1	STOP	45	SHIFT RIGHT	88
2	2	UNUSED	46	SHIFT DOWN	89
3	3	UNUSED	47	SHIFT LEFT	90
4	4	PATTERN GENERATOR	48	SHIFT SCROLL UP	91
5	5	CHANNEL SPEC	49	SHIFT SCROLL DOWN	92
6	6	TRIGGER SPEC	50	SHIFT REPEAT	93
7	7	INPUT OUTPUT	51	SHIFT COUNT	94
8	8	DEFINE MNEMONICS	52	SHIFT GOTO	95
9	9	UNUSED	53	SHIFT HOLD	96
A	10	UNUSED	54	SHIFT CALL	97
B	11	TIMING DIAGRAM	55	SHIFT RETURN	98
C	12	STATE TABLE	56	UNUSED	99
D	13	RESERVED	57	SHIFT HALT	100
E	14	RESERVED	58	UNUSED	101
F	15	RESERVED	59	SHIFT START SYSTEM	102
DEL LINE	16	UNUSED	60	SHIFT START ACQUISITION	103
ADD LINE	17	UNUSED	61	SHIFT START PAT GEN	104
DON'T CARE	18	UNUSED	62	SHIFT COMPARE =	105
NEXT	19	UNUSED	63	SHIFT COMPARE ≠	106
SELECT	20	G	64	SHIFT STORE	107
INCR	21	J	65	SHIFT SEARCH	108
DECR	22	K	66	SHIFT STOP	109
UP	23	L	67	RESERVED	110
RIGHT	24	N	68	RESERVED	111
DOWN	25	O	69	SHIFT PATTERN GENERATOR	112
LEFT	26	P	70	SHIFT CHANNEL SPEC	113
SCROLL UP	27	R	71	SHIFT TRIGGER SPEC	114
SCROLL DOWN	28	S	72	SHIFT I/O	115
REPEAT	29	T	73	SHIFT DEFINE MNEMONICS	116
COUNT	30	U	74	RESERVED	117
GOTO	31	V	75	RESERVED	118
HOLD	32	W	76	SHIFT TIMING DIAGRAM	119
CALL	33	X	77	SHIFT STATE TABLE	120
RETURN	34	Y	78	RESERVED	121
UNUSED	35	Z	79	RESERVED	122
HALT	36	SHIFT DEL LINE	80	RESERVED	123
UNUSED	37	SHIFT ADD LINE	81	HOME	124
START SYSTEM	38	H	82	UNUSED	125
START ACQUISITION	39	I	83	UNUSED	126
START PAT GEN	40	SHIFT SELECT	84	NOP	127
COMPARE =	41	Q	85	KEYSTROKE SRQ	128
COMPARE ≠	42				
STORE	43	M	86		

ASCII & GPIB CODE CHART

<table>
<tr><td>B7 B6 B5</td><td>Ø Ø Ø</td><td>Ø Ø 1</td><td>Ø 1 Ø</td><td>Ø 1 1</td><td>1 Ø Ø</td><td>1 Ø 1</td><td>1 1 Ø</td><td>1 1 1</td></tr>
<tr><td>BITS
B4 B3 B2 B1</td><td colspan="2">CONTROL</td><td colspan="2">NUMBERS SYMBOLS</td><td colspan="2">UPPER CASE</td><td colspan="2">LOWER CASE</td></tr>
<tr><td>Ø Ø Ø Ø</td><td>0
NUL
0 0</td><td>20
DLE
10 16</td><td>40 0
SP
20 32</td><td>60 16
0
30 48</td><td>100 0
@
40 64</td><td>120 16
P
50 80</td><td>140 0
`
60 96</td><td>160 16
p
70 112</td></tr>
<tr><td>Ø Ø Ø 1</td><td>1 GTL
SOH
1 1</td><td>21 LLO
DC1
11 17</td><td>41 1
!
21 33</td><td>61 17
1
31 49</td><td>101 1
A
41 65</td><td>121 17
Q
51 81</td><td>141 1
a
61 97</td><td>161 17
q
71 113</td></tr>
<tr><td>Ø Ø 1 Ø</td><td>2
STX
2 2</td><td>22
DC2
12 18</td><td>42 2
"
22 34</td><td>62 18
2
32 50</td><td>102 2
B
42 66</td><td>122 18
R
52 82</td><td>142 2
b
62 98</td><td>162 18
r
72 114</td></tr>
<tr><td>Ø Ø 1 1</td><td>3
ETX
3 3</td><td>23
DC3
13 19</td><td>43 3
#
23 35</td><td>63 19
3
33 51</td><td>103 3
C
43 67</td><td>123 19
S
53 83</td><td>143 3
c
63 99</td><td>163 19
s
73 115</td></tr>
<tr><td>Ø 1 Ø Ø</td><td>4 SDC
EOT
4 4</td><td>24 DCL
DC4
14 20</td><td>44 4
$
24 36</td><td>64 20
4
34 52</td><td>104 4
D
44 68</td><td>124 20
T
54 84</td><td>144 4
d
64 100</td><td>164 20
t
74 116</td></tr>
<tr><td>Ø 1 Ø 1</td><td>5 PPC
ENQ
5 5</td><td>25 PPU
NAK
15 21</td><td>45 5
%
25 37</td><td>65 21
5
35 53</td><td>105 5
E
45 69</td><td>125 21
U
55 85</td><td>145 5
e
65 101</td><td>165 21
u
75 117</td></tr>
<tr><td>Ø 1 1 Ø</td><td>6
ACK
6 6</td><td>26
SYN
16 22</td><td>46 6
&
26 38</td><td>66 22
6
36 54</td><td>106 6
F
46 70</td><td>126 22
V
56 86</td><td>146 6
f
66 102</td><td>166 22
v
76 118</td></tr>
<tr><td>Ø 1 1 1</td><td>7
BEL
7 7</td><td>27
ETB
17 23</td><td>47 7
'
27 39</td><td>67 23
7
37 55</td><td>107 7
G
47 71</td><td>127 23
W
57 87</td><td>147 7
g
67 103</td><td>167 23
w
77 119</td></tr>
<tr><td>1 Ø Ø Ø</td><td>10 GET
BS
8 8</td><td>30 SPE
CAN
18 24</td><td>50 8
(
28 40</td><td>70 24
8
38 56</td><td>110 8
H
48 72</td><td>130 24
X
58 88</td><td>150 8
h
68 104</td><td>170 24
x
78 120</td></tr>
<tr><td>1 Ø Ø 1</td><td>11 TCT
HT
9 9</td><td>31 SPD
EM
19 25</td><td>51 9
)
29 41</td><td>71 25
9
39 57</td><td>111 9
I
49 73</td><td>131 25
Y
59 89</td><td>151 9
i
69 105</td><td>171 25
y
79 121</td></tr>
<tr><td>1 Ø 1 Ø</td><td>12
LF
A 10</td><td>32
SUB
1A 26</td><td>52 10
*
2A 42</td><td>72 26
:
3A 58</td><td>112 10
J
4A 74</td><td>132 26
Z
5A 90</td><td>152 10
j
6A 106</td><td>172 26
z
7A 122</td></tr>
<tr><td>1 Ø 1 1</td><td>13
VT
B 11</td><td>33
ESC
1B 27</td><td>53 11
+
2B 43</td><td>73 27
;
3B 59</td><td>113 11
K
4B 75</td><td>133 27
[
5B 91</td><td>153 11
k
6B 107</td><td>173 27
{
7B 123</td></tr>
<tr><td>1 1 Ø Ø</td><td>14
FF
C 12</td><td>34
FS
1C 28</td><td>54 12
,
2C 44</td><td>74 28
<
3C 60</td><td>114 12
L
4C 76</td><td>134 28
\
5C 92</td><td>154 12
l
6C 108</td><td>174 28
|
7C 124</td></tr>
<tr><td>1 1 Ø 1</td><td>15
CR
D 13</td><td>35
GS
1D 29</td><td>55 13
−
2D 45</td><td>75 29
=
3D 61</td><td>115 13
M
4D 77</td><td>135 29
]
5D 93</td><td>155 13
m
6D 109</td><td>175 29
}
7D 125</td></tr>
<tr><td>1 1 1 Ø</td><td>16
SO
E 14</td><td>36
RS
1E 30</td><td>56 14
.
2E 46</td><td>76 30
>
3E 62</td><td>116 14
N
4E 78</td><td>136 30
^
5E 94</td><td>156 14
n
6E 110</td><td>176 30
~
7E 126</td></tr>
<tr><td>1 1 1 1</td><td>17
SI
F 15</td><td>37
US
1F 31</td><td>57 15
/
2F 47</td><td>77 UNL
?
3F 63</td><td>117 15
O
4F 79</td><td>137 UNT
_
5F 95</td><td>157 15
o
6F 111</td><td>177
DEL (RUBOUT)
7F 127</td></tr>
<tr><td></td><td>ADDRESSED COMMANDS</td><td>UNIVERSAL COMMANDS</td><td colspan="2">LISTEN ADDRESSES</td><td colspan="2">TALK ADDRESSES</td><td colspan="2">SECONDARY ADDRESSES OR COMMANDS</td></tr>
</table>

KEY

octal	25	PPU	GPIB code
	NAK		ASCII character
hex	15	21	decimal

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ERROR AND PROMPTER MESSAGES

The following table lists the error and prompter messages which may appear on the monitor screen. The messages are listed in alphabetical order.

256 VALUES EXCEEDED	The total number of allowable mnemonic values is 256.
ACQUISITION AND PATTERN GENERATOR STARTED	This message is displayed when data acquisition and pattern generation are started simultaneously via the SYSTEM START key.
ACQUISITION STARTED	This message is displayed whenever data acquisition is started.
ADD LINE WOULD ELIMINATE SEQ 255	If SEQ 255 of the Define Mnemonics table has an assigned value, an ADD LINE cannot be executed until a DEL (delete) LINE occurs.
ASSIGN AT LEAST ONE CLK1	When using the 91A32's EXT SPLIT clocks, at least one CLK1 must be assigned. This clock serves as the master clock.
CANNOT EXIT WITH DUPLICATE CHANNELS	All duplicate channel assignments must be eliminated before you can exit the Channel Specification menu.
COMMUNICATION ERROR, PRESS STOP TO EXIT	The carrier detect (CD) signal has been lost in the master/slave RS-232 transmission.
COMPARE UNTIL = STARTED	This message is displayed when the COMPARE = key is pressed.
COMPARE UNTIL ≠ STARTED	This message is displayed when the COMPARE ≠ key is pressed.
CONFIGURATION ERROR	When you restore a tape file that uses data acquisition modules, the modules must be in the same bus slots used when the file was saved. This message is displayed if modules have been removed or repositioned.
DECREASE COMPARE LIMITS	This message is displayed when the value of the STOP SEQ field is greater than the largest acquisition memory SEQ number.
DELAY PLUS WIDTH CANNOT EXCEED 40.950 μs	When programming strobes in the Pattern Generator menu, the total of the values in the DELAY and WIDTH fields cannot exceed 40.950 μs.
DIRECTORY FULL	The DC100 tape cartridge directory is full and no more files may be saved on that tape. A maximum of 48 files can be stored on a tape.
DUPLICATE LABEL AT SEQ XX	The same label value cannot be assigned to more than one sequence line in the Pattern Generator menu.
DUPLICATE VALUE	If a value is assigned to more than one sequence line in the Define Mnemonics table, only the first entered value will be used during disassembly.
ENTER A LARGER VALUE **ENTER A SMALLER VALUE** **ENTER A VALUE BETWEEN 1 AND 32767** **ENTER IN BINARY** **ENTER IN HEX** **ENTER IN OCTAL**	These prompter messages appear when you try to enter an invalid numeric value into a field.
ENTER VALUE FIRST	A value must be entered before a mnemonic can be assigned.

FAST MODULE DELAY CANNOT BE > 500	When you are using the ARMS mode in the Trigger Specification menu, the 91A08 trigger must be positioned within acquisition memory.
FILE ALREADY EXISTS	The IO Menu will not save a file if a file of the same name already exists on the tape.
FILE NOT FOUND	This message appears if you attempt to access a file not stored on the inserted tape cartridge.
FIRMWARE ERROR (XX) AT (XX)	This message indicates a system failure. Refer the instrument to qualified service personnel.
FIRMWARE VERSION ERROR	When you are restoring a tape file, the firmware version in the DAS mainframe must match the firmware version present when the file was made.
GROUP CANNOT HAVE A TABLE	To be defined with mnemonics, a channel group must be assigned at least one and no more than 32 channels.
INCREASE COMPARE LIMITS	The value of the STOP SEQ field must be greater than the value of the START SEQ field.
INVALID CHANNEL NUMBER	In the Channel Specification menu, a valid channel number is indicated by the values 0 - 7. Any other character is invalid.
INVALID CLOCK COMBINATION —START NOT PERFORMED	The 91A32 and 91A08 modules and the pattern generator modules share two internal clocks. This message is diplayed when more than two internal clock rates are specified.
INVALID POD COMBINATION	Only pods from the same types of data acquisition modules can be combined in the same channel group. 91A32 pods cannot be combined with 91A08 pods.
INVALID POD ID	The POD ID (bus slot number, pod connector letter) entered does not match the actual mainframe configuration.
IO BOARD NOT PRESENT	The RS-232 sub-menu of the Input Output menu was entered but the I/O Interface (Option 02) is not installed in the mainframe.
LINK ESTABLISHED	The RS-232 master/slave link between two DAS mainframes has been established (i.e., a message has been sent from the master to the slave and back again).
LOADING STROBES	It can take up to 30 seconds to load the strobes programmed in the Pattern Generator menu. This message is displayed during the process.
NO TAPE IN DRIVE	The tape drive sub-menu of the Input Output menu was entered but there is no DC100 tape cartridge in the tape drive.
NOT A DAS TAPE	The inserted tape is not formatted for use with the DAS. The tape must be bulk-erased and then formatted.
NOT ENOUGH BLOCKS TO STORE FILE	Not enough contiguous empty blocks remain on the DC100 tape cartridge for the file to be stored on the tape.
PARTIAL RESTORE IN PROGRESS	If you are restoring an ALL-type file and the data acquisition modules do not match the tape configuration, the tape file only restores the mnemonic and pattern generator setups.
PATTERN GENERATOR STARTED	This message is displayed whenever the pattern generator is started.
PATTERN GENERATOR STOPPED	This message is displayed when the pattern generator is stopped by any other means than a HALT instruction.
PICK UP THE PHONE	When two DAS mainframes are linked as master/slave in an RS-232 transmission, you may press SHIFT/INPUT OUTPUT to send this message to the other DAS mainframe.

PLEASE USE THE DATA ENTRY KEYS **PLEASE USE INCR OR DECR** **PLEASE USE THE SELECT KEY**	These messages appear when you use the wrong key when trying to select a field value. The messages list the valid keys.
POD (XX) CONNECTED	A probe was connected to the specified pod connector on the back panel.
POD (XX) DISCONNECTED	A probe was disconnected from the specified pod connector on the back panel.
PODS DISPLAYED HAVE NO ACQUIRED DATA	The channel traces displayed on the Timing Diagram menu were not used to acquire data. You must enter the appropriate channels (those that acquired data during the last acquisition) into the POD and CH fields.
(XXX) RESTARTS	This message is displayed on the right side of the display while a comparison is running. After the comparison condition is met or the STOP key is pressed, the message moves to the left side of the display. The value preceding the message indicates how many times new data has been acquired. If the comparison condition is not met and the system is not stopped, the RESTARTS counter will count to 65,535. At that point, restarts will continue but the number will not increase.
RESTORE IN PROGRESS—(XXXX)	This message has several variations depending on whether all DAS menu setups or an individual setup is being restored from the GPIB.
RAM ERROR	The lower 16 K of RAM did not pass the RAM test at power-up. The DAS is inoperable. Contact qualified service personnel.
REFERENCE MEMORY EMPTY	Comparison functions are inoperable if no data is stored in reference memory.
REMOVE FIRST INSTRUCTION OF INTERRUPT ROUTINE	In the Pattern Generator menu, the first line of the CALLed interrupt routine cannot have an instruction.
ROM ADDRESS ERROR	At system power-up, the Trigger, Channel, or Start ROMs cannot be addressed or are missing. The DAS is inoperable. Contact qualified service personnel.
ROM CHECKSUM ERROR	This power-up error message indicates a faulty module. Refer the module to qualified service personnel. If the module is not critical, limited operations may continue.
SAVE IN PROGRESS—(XXXXX)	This message has several variations depending on whether all DAS menu setups or an individual setup is being saved on tape.
SEARCHING	The DAS is searching for a specific data word in the State Table or Timing Diagram menu.
SLOW ACQUISITION	The external clock being used for the acquisition is slower than 500 ms. Qualifiers may also cause this to happen.
SOFT ERRORS: (XXX)	The tape drive keeps track of the number of retries to perform the current tape operation. Soft errors indicate that the tape cartridge may be dirty, the tape is worn, or the tape head needs to be cleaned. The requested operation has been performed without any loss of data.
STOPPED	Data acquisition and/or pattern generator operation has been stopped via the STOP key.
TAPE DRIVE FAILURE	The tape drive has failed to power up correctly. No tape operation will be possible. Power the DAS down then back up again. If the failure still occurs, contact qualified service personnel.

TAPE DRIVE NOT PRESENT	You entered the tape drive sub-menu of the Input Output menu and no tape drive (Option 01) is installed.
TAPE ERROR (XXX)	The number following the message indicates which tape drive error(s) have occurred. A combination of errors would cause the following numbers to be ANDed then displayed in hexadecimal.
010	Gap Detect—A gap in the data on the tape was detected in an unusual place. Gaps are normally found at the end of a data record.
020	The tape cartridge was removed during a tape operation.
040	Hole Detect—A hole was detected on the tape when the driver was not expecting one. Holes normally occur at the beginning and end of tapes and denote to the driver that the end of useable tape has been reached.
080	Servo Motor Controller Error
100	Checksum Error—This error indicates that the record header has the wrong checksum.
200	Record Number Check Error—This error indicates that the record number did not read correctly and was not readable for 33 attempts.
TAPE OPERATION HAS MODIFIED THE MODULE CONFIGURATION	A file has been restored from tape that uses less modules than those installed in the mainframe. The extra modules cannot be accessed until another file is restored which uses them or the DAS is powered down then up again.
TAPE OPERATION IN PROGRESS	The selected tape operation is being executed.
TAPE UNFORMATTED, PLEASE FORMAT IT	The inserted tape is not formatted and must be formatted for use with the DAS.
TAPE WRITE PROTECTED	The tape's RECORD switch has been set for write protect. The tape can be read but no files can be saved or deleted.
TOO MANY DUPLICATE CHANNELS	Some duplicate channels are allowed while setting up the Channel Specification menu. This message is displayed when more than 120 channels have been assigned.
TOO MANY LABELS	The maximum number of label values allowed in the Pattern Generator menu is 32.
TOO MANY MODULES—104 ACQ, 80 PG CHANNELS MAX	The maximum number of acquisition channels is 104, and the maximum of pattern generator channels is 80. Power down the DAS. No operations are allowed until this condition is remedied.
TRIGGER MODES DON'T MATCH	This message is displayed when you try to perform a COMPARE= or COMPARE≠ against a reference memory that was acquired using a different trigger mode.
TRIGGER NOT IN MEMORY	The trigger word is not in acquisition memory because a long delay was used or the STOP key was pressed.
TRYING TO LINK	This message is displayed while the RS-232 master/slave handshake is being established.
UNDEFINED LABEL	This message is displayed in the Pattern Generator menu when you try to exit the menu while an undefined CALL or GOTO label exists.
USE 0, 1 OR DON'T CARE **USE 1 OR DON'T CARE**	These prompting messages list the valid entries for certain fields.

USE ADD/DEL ONLY IN POD FIELD	The ADD LINE and DEL LINE keys may only be used in the POD field of the Channel Specification menu.
USE DON'T CARE	This message is displayed when the only valid entry for a field is don't care.
USE SELECT, INCR, OR DECR	Use the SELECT, INCR, or DECR keys in the clock fields of the Trigger and Pattern Generator menus.
WAITING FOR 91AXX TRIGGER	The system is currently waiting for a trigger event from the 91A32 or 91A08 module.
WAITING FOR STOP STORE	The trigger has been recognized and a delay is being exercised before acquisition is stopped.
WORD NOT FOUND	A search for a specific word was unsuccessful. This message is seen in the State Table and Timing Diagram menus.

DAS 9100 CHARACTER SET

DAS 9100 CHARACTER SET

n	P		0
A	Q	m	1
B	R	≠	2
C	S	#	3
D	T	∫	4
E	U	⌋	5
F	V	&	6
G	W	'	7
H	X	(	8
I	Y	)	9
J	Z	*	:
K	X	+	µ
L	|	,	<
M	=	-	=
N	^	.	>
O	_	/	?

3624-107

The DAS 9100 Character Set symbols can be entered in any of the following alphanumeric fields:

- FILE NAME and DESCRIPTION fields in the Tape Drive sub-menu of the Input Output menu.
- LABEL field in the Program sub-menu of the Pattern Generator menu.
- NAME field in the Timing Diagram menu.
- MNEMONIC field in the Define Mnemonics menu.

To enter a DAS 9100 Character:

1. Move the screen cursor to the field position where you want to enter the character.

   [ ]

2. Enter a standard keyboard character (A-Z or 0-9) listed on the same table line as the special character. For example, to enter the / character, first enter an O in the field.

   [O]

3. Move the screen cursor back to the character space. Now press the SHIFT and SELECT keys simultaneously.

   The DAS enters the next value to the right of O.

   [_]

4. Move the screen cursor back to the character space, then press SHIFT and SELECT again.

   The DAS enters the next value to the right of _.

   [/]

   The desired character is entered into the field.

Each time SHIFT and SELECT are pressed the DAS enters the next character value to the right of the character value currently at the cursor location. If the end of the character line is reached, the DAS starts over with the first character of that line.

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MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

Tektronix
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MANUAL CHANGE INFORMATION

Date: October 2, 1985 Change Reference: C11/1085

Product: DAS 9100 Series Operator's Manual Part No.: 070-3624-01

DESCRIPTION

THIS IS A PAGE PULL AND REPLACE PACKAGE

1. Remove the designated pages from your manual and insert the following pages 2-21, and 2-22.
2. Keep this cover sheet in the Change Information section at the back of your manual for a permanent record.

STANDARD AND OPTIONAL I/O CONNECTORS

WORD RECOGNIZER OUTPUT AND TRIGGER INPUT CONNECTORS

Figure 2-19 shows the back-panel location of the Word Recognizer Output and the Trigger Input connectors.

The Word Recognizer Output connector (BNC) outputs a rising edge whenever Event 1 is recognized. The duration of the output is the same number of clock cycles for which Event 1 remains true. Event 1 is produced whenever a 91A32 module is used during acquisition (including AND and ARMS modes). For more detailed information, refer to the Trigger Specification Menu section of this manual.

The Trigger Input connector (BNC) may be used to enable *only* the 91A32's trigger during acquisition (including AND and ARMS modes). This input is normally a logic low-level; therefore, a high-level signal enables the trigger.

NOTE

Do not use the Trigger Input connector with any module other than the 91A32. It will not work with 91A04, 91A08, or 91A24 modules.

You may setup the 91A32's trigger values to trigger immediately, trigger on a specific value, or trigger on a sequence of values. For a more detailed description, see the Trigger Specification Menu section of this manual.

TAPE DRIVE CONTROLS

The tape drive controls are present if your DAS contains an Option 01, Tape Drive for DC100-type Cartridges.

As shown in Figure 2-20, the tape drive has two front-panel controls: a tape slot and a tape eject button. These two controls allow the insertion and removal of a tape cartridge.

Tape Slot. The tape slot is used for inserting any DC100-type tape cartridge. The tape is simply pushed through the slot. The design of the tape drive ensures that a tape can not be inserted upside down.

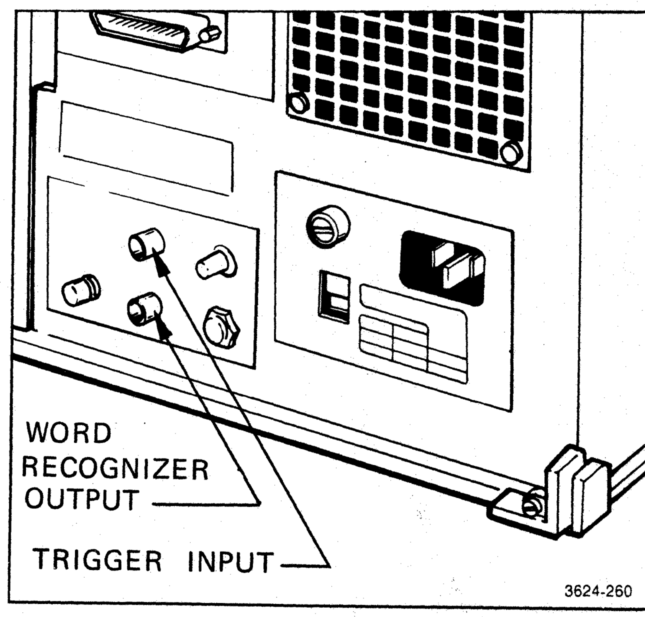

Figure 2-19. Location of the Word Recognizer Output and Trigger Input connectors.

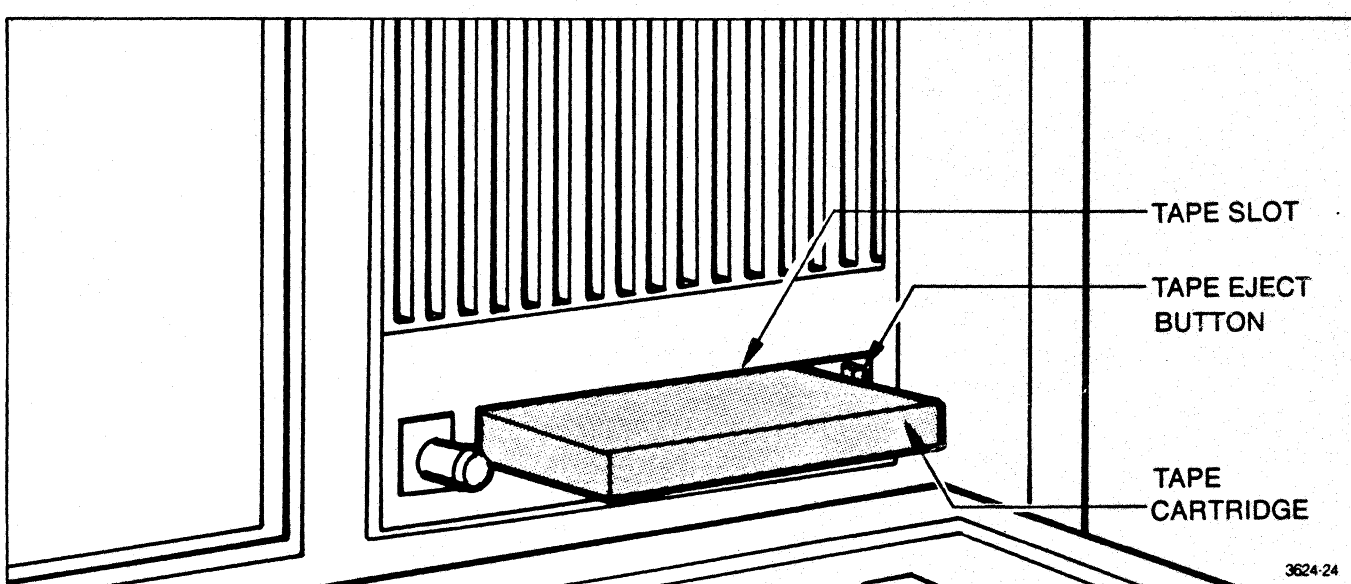

Figure 2-20. The tape drive controls.

Tape Eject Button. The tape eject button is used when removing the tape cartridge. When this button is depressed, the tape is ejected. Tapes should be ejected before the keyboard is folded up.

DC100-Type Cartridges. Two tape cartridges are provided with Option 01. You may use these two cartridges or any DC100-type cartridge with the DAS tape drive.

Cleaning the Tape Drive. In order to minimize oxide and foreign matter accumulation, the tape head should be cleaned regularly. Frequency of cleaning depends on frequence of use and upon cleanliness of the area in which the tape drive is used. Recommended cleaning intervals are once a month for units that are used moderately; once a week for units that are used in areas where high foreign matter accumulations occur. The read/write head should be cleaned with reagent grade 91% isopropyl alcohol and a cotton swab.

CAUTION

Damage to the tape drive's read/write head may occur if any solvent other than isopropyl alcohol is used in cleaning.

RS-232 INTERFACE

The RS-232 connector is provided as part of Option 02. This connector provides a serial data interface for use with the DAS. It may be used to establish master/slave transmission between two DAS systems, or it may be used for transmitting GPIB instructions between a DAS and a host controller.

For information on how to establish DAS master/slave transmission, refer to the Input Output menu section of this manual. For GPIB information, refer to the GPIB Programming section.

The RS-232 connector is located on the mainframe's back panel as shown in Figure 2-21. Only eight pins are used:

Pin 1 —Case Ground
Pin 2 —Transmitted Data
Pin 3 —Received Data
Pin 4 —Request to Send
Pin 5 —Clear to Send
Pin 7 —Signal Ground
Pin 8 —Carrier Detect
Pin 20—Data Terminal Ready

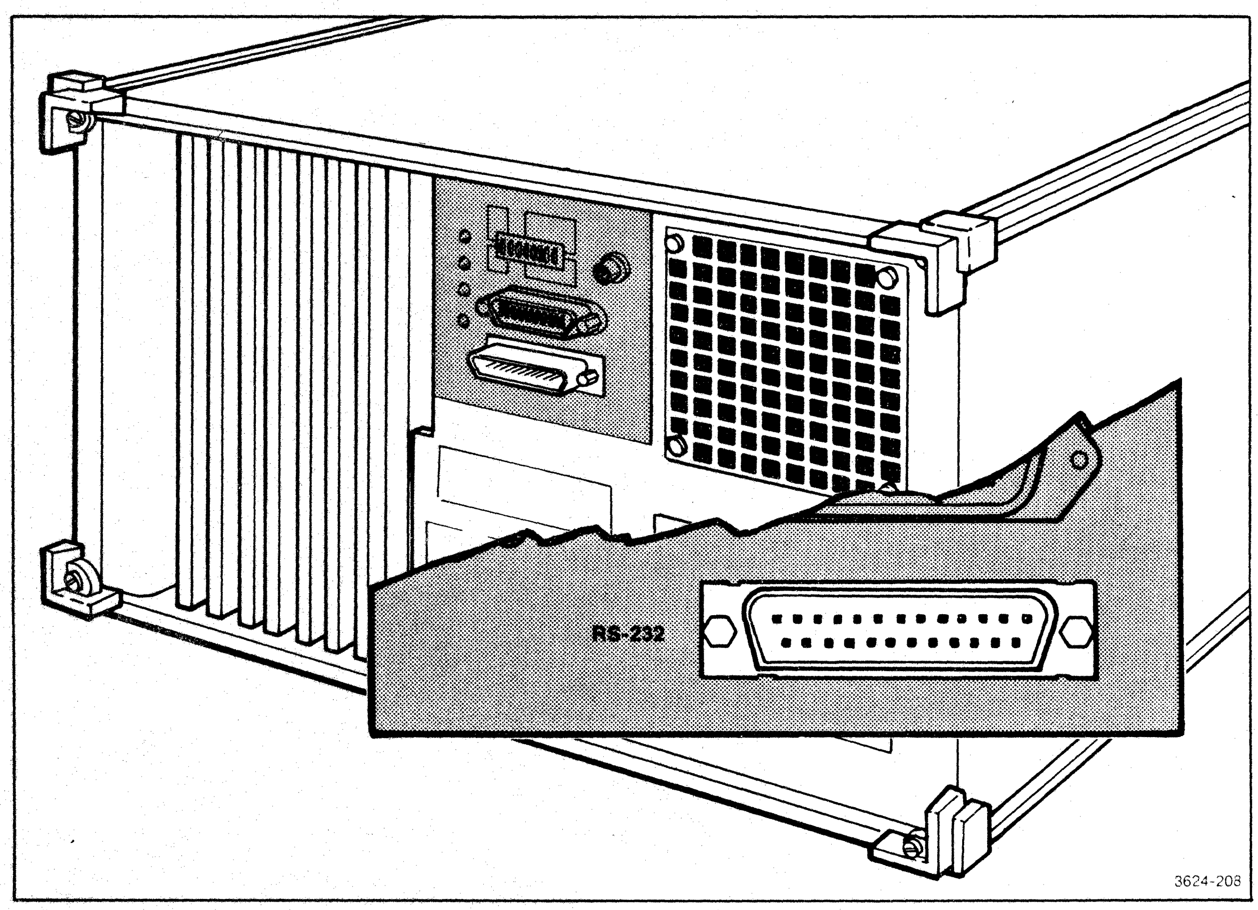

Figure 2-21. RS-232 interface connector.