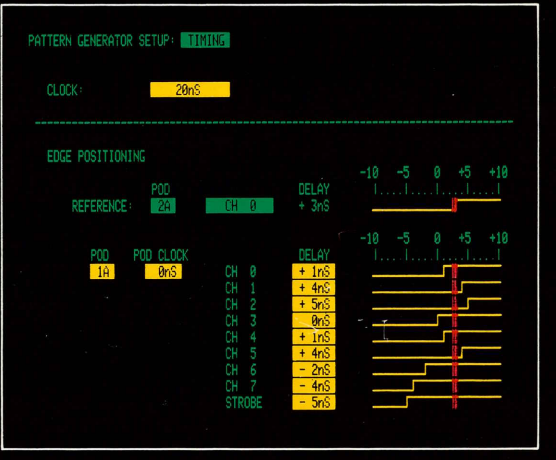
DAS 9100 SERIES

DIGITAL ANALYSIS SYSTEM | OPERATOR'S REFERENCE GUIDE

91S16
91S32

Pattern Generator Modules

P6464 Pattern Generator Probe



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INTRODUCTION

This reference guide provides a summary of the DAS 91S16 and 91S32 Pattern Generator Modules, and the P6464 Pattern Generator Probe. It assumes the reader is already familiar with the operating characteristics and capabilities of the DAS 9100. Refer to the *91S16, 91S32, and P6464 Operator's Manual Addendum* in the *DAS 9100 Series Operator's Manual* for more operating information.

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OPERATING CONVENTIONS

Menu Displays

Enter the pattern generator menus initially by pressing the PAT GEN key. Once a pattern generator menu is displayed, press any appropriate menu key.

Number Callouts

Each menu display in this reference guide has number callouts that serve as visual references between the menu fields and text. The callouts are intended as references only and do not imply sequence of use.

Brackets [ ]

In text, brackets may be used to emphasize field names that appear in reverse video on the screen.

Cursor Movement

Before any menu field may be changed, you must move the blinking screen cursor to that field location. Use the four directional cursor keys and the NEXT key to move the screen cursor.

91S16 PATTERN GENERATOR MODULE

The 91S16 is an algorithmic pattern generator that provides looping, conditional branching, and real-time interactions with the circuit under test. The 91S16 uses two P6464 probes providing 16 data output channels, two clock lines, and two strobe lines. An internal 16-bit data register (or two 8-bit data registers) can be used as a counter or as an alternate source for pattern output. Pattern memory is 1024 sequence lines deep. By using programming instructions, the 91S16 can output an unlimited number of vectors. The 91S16 instruction set contains nine instructions that may be programmed with identifier labels (up to 15 different labels possible). Only one 91S16 can be installed in the DAS, though it can be used as a controller for up to five 91S32s.

91S32 PATTERN GENERATOR MODULE

The 91S32 is a stored-pattern (RAM-based) generator that supports applications requiring lengthy or wide data patterns. Each 91S32 uses four P6464 probes, providing 32 channels of data, four strobes, and four clock lines. You can install up to six 91S32s in a single DAS for a total of 192 data channels, 24 strobes, and 24 clock lines. Pattern depth for all channels is 2048 sequence lines (vectors). However, there are features available that allow you to split the memory into two 1024-line pages and reload alternate pages of memory while the pattern generator is outputting data (this requires a 91S16).

91S16 AS CONTROLLER FOR 91S32s

One 91S16 can serve as a controller for up to five 91S32s. This configuration provides all the branching instructions and interactive features available with the 91S16, in addition to the large numbers of data channels and pattern depth afforded by the 91S32s. An instrument configured with five 91S32s can supply up to 16 data channels with a memory depth of 1024 lines, plus 160 data channels with a memory depth of 2048 lines. There are also 22 clock lines and 22 strobe lines available.

There are two different operating modes available when the 91S16 and 91S32 are used together: Sequential mode and Follows 91S16 mode. In both modes, the 91S16 supplies the master clock to the 91S32 modules. The 91S16 and 91S32 can output data according to the same clock, but the 91S32 can also be programmed to execute its program at one-half or one-fourth the 91S16 clock rate. The following paragraphs describe both of these operating modes.

Sequential Mode

This operating mode allows the 91S16 and 91S32 to operate simultaneously. In this mode, the 91S16 supplies the clock signal to the 91S32, though each card executes its program independently. When the 91S16 reaches the end of its memory, it can be set to automatically restart from the beginning. This feature keeps all data channels active during circuit testing.

Follows 91S16 Mode

This operating mode allows the 91S16 to have active control over the output of the 91S32s. In this mode, the 91S32 follows instructions governing sequence line execution that are programmed in the 91S16. If the 91S16 executes a loop, the 91S32s will also execute a loop.

In Follows 91S16 mode, the memory of the 91S32 is divided into two 1024-line pages called Page A and Page B. The size of these pages matches the memory depth of the 91S16. The 91S16 controls which memory page in the 91S32 is executed.

The Follows 91S16 mode is associated with a Pattern Download From Host feature and a Keep-Alive function. Refer to the following discussion for more information.

Pattern Download From Host. Use this feature to download a program stored on a host computer or mass-storage device into the 91S32's memory. Instructions for communicating with the host computer or external storage device are programmed into the 91S16. If the 91S32 program is too large to fit into memory, you can alternately download and execute blocks of vectors until the entire program has been executed.

Instructions for making connections and formatting the data to be downloaded to the pattern generator cards can be found under *GPIB Programming* in the *DAS 9100 Option 06: I/O Communication Interface Operator's Manual Addendum.*

There are two versions of Pattern Download From Host. Pattern download for static devices is available at all times with any legal combination of pattern generator modules. No menu selections are required. This version uses GPIB commands with either DAS 9100 Option 02 or Option 06. While a block of vectors is being downloaded from the host, no clock or data patterns are sent to the circuit under test. Pattern download for dynamic devices (Keep-Alive), requires a 91S16 and DAS Option 06 GPIB.

Keep-Alive. The 91S16/32 combination provides a Keep-Alive function to keep dynamic circuit elements active during pattern downloading. Keep-Alive is essentially a subroutine you program into the 91S16. The Keep-Alive program supplies a clock and vectors to a dynamic device under test until the 91S32 memory has been reloaded. An example of a Keep-Alive routine is provided in the *GPIB* section of the *91S16, 91S32, and P6464 Operator's Addendum.*

PROBES AND CONNECTORS

The 91S16 and 91S32 Pattern Generator Modules use two types of probes when interacting with a device under test: output probes that stimulate the device and input probes that receive external control signals. In addition, the 91S16 has two miniature phono connectors that allow an external start input and a trigger output signal.

The 91S16 has three pod (probe) connector locations; from top to bottom: A, B, and C. Connectors A and B accomodate only P6464 Pattern Generator Probes; bottom connector C is for an optional P6460 External Control Probe. Two phono connectors located under the probe connectors are TRIG OUT (top connector) and EXT START (bottom connector).

The 91S32 has four pod (probe) connector locations; from top to bottom: A, B,C, and D. Each connector accommodates one P6464 Pattern Generator Probe.

CAUTION

Stop the pattern generator before connecting or disconnecting a probe. Failure to comply may result in damage to the pattern generator module.

The 91S16 accepts external control signals through its optional P6460 External Control Probe and phono connector. The 91S32 uses the P6452 External Clock probe connected to the DAS Trigger/Time Base for its external control signals. Parameters for external control signals are programmed in the 91S16 or 91S32 Probe sub-menus. If you are not using external control signals with your pattern generator modules, you do not need to enter anything into these sub-menus.

P6464 Pattern Generator Probe outputs patterns to a device under test. The stimulus output consists of eight data channels (labeled 0–7), one clock line (labeled CLK), and one strobe line (also used as an additional data channel). The 91S16 uses two P6464 probes; the 91S32 uses four P6464 probes.

The P6464 probe receives power from your circuit through three sense leads connected to the probe. The red lead (V_H) requires a power source of −0.5 V to +5.5 V. The black lead (V_L) requires a power source of +0.3 V to −5.5 V; the difference between V_H and V_L must be 4.8 to 5.2 V. The green lead connects to ground.

CAUTION

If $V_H - V_L$ is greater than approx. 5.5 V, a fuse inside the P6464 may blow. This fuse protects the active devices in the probe tips.

P6452 External Clock Probe is used to input clock and control signals to a 91S32 from an external device. Stimulus input consists of an external clock line and three control lines: Pause, External Start, and Inhibit (tri-state). The P6452 probe attaches to the DAS Trigger/Time Base. (If 91S16 is installed, use the 91S16's P6460 probe for external inputs.)

P6460 External Control Probe is used to input clock and control signals from external devices to the 91S16. The stimulus input consists of External Jump, External Inhibit (tri-state), Interrupt Request, Interrupt Request Qualify, Pause, and External Clock. (If only 91S32s are installed, use the P6452 probe for external signal input to the 91S32s.)

TRIG OUT Phono Connector outputs a trigger signal to an external device when the 91S16 executes the TRIGGER instruction. The trigger out signal is a positive-true, TTL-level signal. The signal stays TTL-high for one cycle each time the TRIGGER instruction is executed. The trigger out phono connector is the top connector located under the 91S16's probe connectors. Use the optional 2-meter phono-to-BNC connector cable when connecting to a device such as an oscilloscope.

EXT START Phono Connector works like an external trigger to start the 91S16. If external start is enabled in the 91S16 Probe sub-menu and you press the START PAT GEN or START SYSTEM key, the 91S16 starts after receiving the External Start signal. If 91S32s are installed, they will also start. The external start phono connector is the bottom connector located under the 91S16's probe connectors. Use an external TTL-level signal as a source for the external start signal. For a configuration with only 91S32s, use the External Start line on the P6452 probe attached to the DAS Trigger/Time Base.

CLOCKS

The pattern generator is associated with two types of clocks: the master input clock and the output clocks (pod clocks). Clock parameters are programmed in the Configuration and Setup menus.

Master Input Clock

The pattern generator's master input clock controls the rate at which the pattern generator outputs clock, data, and strobe signals to the circuit under test. The master input clock (maximum rate 50 MHz) may be the DAS internal clock or the rising or falling edge of an external clock source. The external clock signal is supplied via the 91S16's P6460 External Control Probe, or via the 91S32's P6452 External Clock Probe attached to the DAS Trigger/Time Base.

When a 91S16 is controlling one or more 91S32s, the 91S16 supplies the master input clock to the 91S32s. The 91S16 and 91S32 can output data according to the same clock, but the 91S32 can also be programmed to execute its program at one-half or one-fourth the master clock rate.

Output Clocks (Pod Clocks)

Output clock signals are derived from the master input clock. An output clock's rising edge is synchronized with the selected master clock edge (rising or falling). Each P6464 probe (pod) outputs a clock signal that can be adjusted ± 5 ns relative to the master clock.

DATA AND STROBE TIMING

The Timing sub-menu allows you to adjust the timing relationships between the clock, data, and strobe lines of a single P6464 Pattern Generator Probe (pod). All timing adjustments are made relative to the master input clock. Individual data lines can be programmed ± 10 ns relative to the master clock (up to ± 5 ns relative to the output clock for that pod).

The strobe line from each P6464 can be used as an additional data channel. Strobe width is tied to the width of the data channels (set by the master clock rate). The strobe's timing, like the data channels, is adjustable up to ± 5 ns relative to the pod clock.

MAJOR SUB-MENU TYPES

Both the 91S16 and the 91S32 Pattern Generator Modules provide three basic types of sub-menus: Configuration, Setup, and Programming. In some cases, 91S16 and 91S32 sub-menus have the same name, but may not operate in exactly the same way. Some menus change depending on the number and type of pattern generator modules installed.

Configuration Sub-Menus

The 91S16 and 91S32 Configuration sub-menus are primarily used to set signal levels, signal polarities, pod delays, and various inhibit masks. They are also used to select major operating modes when 91S16 and 91S32 cards are used together.

Setup Sub-Menus

There are two types of Setup sub-menus: Probe and Timing. The Probe sub-menu allows you to enter parameters for internal and external control signals. If you are not using any external control signals with your pattern generator modules, you do not need to enter anything into this sub-menu.

The Timing sub-menu adjusts timing relationships between the clock, data, and strobe lines of a single P6464 Pattern Generator Probe. Use this sub-menu to select the master input clock and adjust to the timing relationship of various data and strobe lines to the master clock.

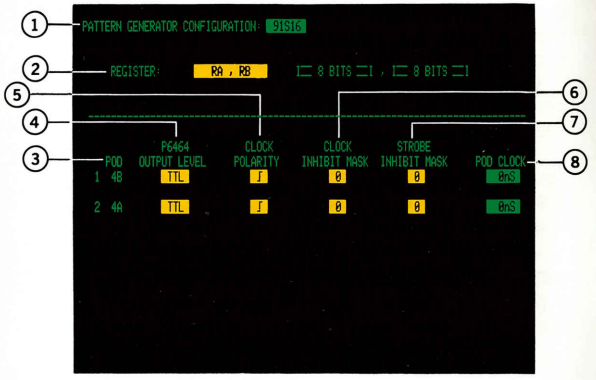
Programming Sub-Menus

There are three types of Programming sub-menus: Run, Trace, and Step. These sub-menu names reflect the three major pattern generator operating modes: Run, Trace, and Step modes. The Run mode sub-menu (default menu), displayed by pressing the PATTERN GENERATOR key, is the most frequently used sub-menu. Use the Run sub-menu to enter the pattern that will stimulate your device under test. The Run sub-menu provides block-move and copy editing commands and also has a sub-menu called TABLE BUILD you can use to modify an existing data pattern.

The remaining two Programming sub-menus are Trace and Step. These sub-menus display the number of accumulated clocks, the sequence line being executed, and the data vectors being output so you can monitor your program as it interacts with the device under test. Trace mode allows the pattern generator to execute its program automatically, but at a rate slow enough for you to see sequence jumps, loops, interrupt subroutines, and other structural demands on your pattern generator program. Step mode allows you to do exactly the same thing, but requires you to press the START PAT GEN key once for each sequence line executed.

To switch between Trace and Step modes, use the INCR and DECR keys instead of the SELECT key. This allows the pattern generator settings to be maintained while switching between operating modes.

91S16 CONFIGURATION SUB-MENU



NOTE

The 91S16 Configuration sub-menu only appears when the DAS is configured with a 91S16 Pattern Generator module.

① PATTERN GENERATOR CONFIGURATION Field

Selects either the [91S16] Configuration sub-menu or the [91S32] Configuration sub-menu.

If a 91S16 is installed with one or more 91S32s, you must enter parameters in both Configuration sub-menus. In this case, the 91S32 Configuration sub-menu displays some fields not available in a 91S32s-only Configuration sub-menu.

② REGISTER Field

Selects the configuration of the 91S16's internal register. This register may be configured as one 16-bit register (called R) or two 8-bit registers (called RA and RB); selections for these two configurations are [R = RA+RB] and [RA, RB], respectively. A diagram to the right of the REGISTER field shows the register configuration currently selected. The register may be used as an incrementing or decrementing counter, or as an alternate source of data for a program line.

NOTE

If you have programmed any instructions for one register configuration, you cannot select the other register configuration until you have deleted those instructions from the program.

③ POD Heading

Displays pod I.D. (pod identification) names that correspond to the 91S16's data probes. The 91S16 has 3 pod connectors (labeled A, B, and C) that accept probes. Each pod connector has its own pod I.D. consisting of a number and a letter. The number indicates the DAS slot where the module resides. The letter refers to the pod (probe) connector on that module.

On the 91S16, Pods A and B are reserved for P6464 Pattern Generator Probes; Pod C is reserved for the optional P6460 External Control Probe.

④ P6464 OUTPUT LEVEL Field

Selects the logic level for signals output by the P6464 Pattern Generator Probe. This probe outputs data, strobe, and clock signals to the device under test at either [TTL] or [ECL] logic levels. Selection of the output level affects each pod independently. In default, all output levels are TTL.

⑤ CLOCK POLARITY Field

Specifies a rising edge [⌐‾] or falling edge [‾⌐] clock signal (at the start of each cycle) for the device under test. Each pod has its own clock line, allowing you to set the clock edge for each pod independently. In default, all the clocks are set for rising edge signals.

⑥ CLOCK INHIBIT MASK Field

Specifies whether or not the clock output responds to the inhibit (tri-state) signal. If this field is set to [0] (unmasked), the clock signal for that data pod is tri-stated whenever the inhibit signal is asserted. If this field is set to [1] (masked), the clock signal for that data pod will continue to be output even if the inhibit signal is asserted. The default value is 0 (unmasked).

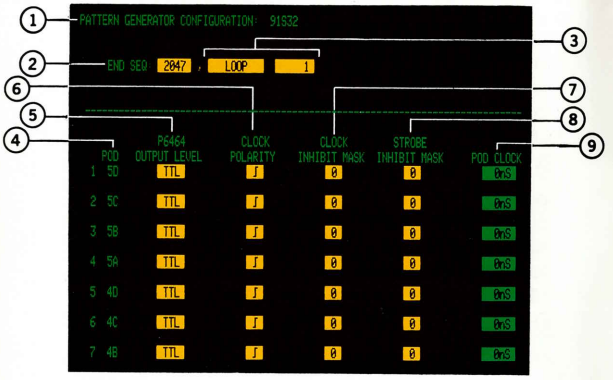
⑦ STROBE INHIBIT MASK Field

Specifies whether or not the strobe output responds to the inhibit signal. When set to [0] (unmasked), that pod's strobe line is tri-stated whenever the inhibit signal is asserted. When set to [1] (masked), that pod's strobe line is not tri-stated even if the inhibit signal is asserted. The default value is 0 (unmasked).

⑧ POD CLOCK Field

Selects a pod clock delay relative to the start of the pattern generator cycle, allowing you to adjust the timing of one pod relative to another. With this menu, you can set each pod individually to output its data, strobe, and clock signals up to 5 ns before or 5 ns after the pattern generator clock edge. Use the INCR or DECR keys to select pod clock delay values in 5 ns increments. If you want finer control of pod clock timing, use the 91S16 Timing menu. The default value for this field is 0 ns.

91S32 CONFIGURATION SUB-MENU (91S32 STAND-ALONE)



NOTE

This sub-menu appears when the DAS is configured only with 91S32 Pattern Generator modules. A slightly different version of this sub-menu is displayed if the DAS is configured with both 91S16 and 91S32 Pattern Generator modules. Refer to 91S32 Configuration Sub-Menu (When Used With 91S16) *described next if you are using both types of pattern generator modules together.*

(1) PATTERN GENERATOR CONFIGURATION Field

Indicates the title of the menu currrently displayed. The 91S32 Configuration sub-menu is the only configuration menu available when only 91S32s are installed in the DAS.

(2) END SEQ Field

Specifies an ending sequence line number where pattern execution is reset to the starting sequence line number (usually SEQ 0). Default is the end of memory. If the SEQ field in the 91S32 Run sub-menu is set to ASEQ (absolute sequence), enter an ending sequence between 0 and 2047 using the data entry keys. If the SEQ field is set to RSEQ (relative sequence), the allowable range is 0—1023 for both Pages A and B. See the 92S32 Run sub-menu SEQ field description for details about the ASEQ and RSEQ options.

You can specify a different starting sequence line number in the 91S32 Run sub-menu.

(3) LOOP Field

Specifies the 91S32 operating mode; selections are: [LOOP] and [FREE RUN]. Loop mode displays an additional field where you enter the number of times you want the pattern generator to execute its program, then stop. Maximum value for this field is 65535.

When you select [FREE RUN], the 91S32 repeatedly executes its program until you press the STOP key. Program execution begins with the sequence line programmed in the START SEQ field (default is SEQ 0) and ends with the sequence number specified in the END SEQ field (default is end of memory).

(4) POD Heading

Displays pod I.D. (pod identification) names that correspond to the 91S32's data probes. The 91S32 has 4 pod connectors (labeled A, B, C, and D) that accept P6464 Pattern Generator Probes. Each pod connector has its own pod I.D. consisting of a number and a letter. The number indicates the DAS slot where the module resides. The letter refers to the pod (probe) connector on that particular module.

(5) P6464 OUTPUT LEVEL Field

Selects the logic level for signals output by the P6464 Pattern Generator Probe. This probe outputs data, strobe, and clock signals to the device under test at either [TTL] or [ECL] logic levels. Selection of the output level affects each pod independently. In default, all output levels are TTL.

(6) CLOCK POLARITY Field

Specifies a rising edge [⌐‾] or falling edge [‾⌐] clock signal (at the start of each cycle) for the device under test. Each pod has its own clock line, allowing you to set the clock edge for each pod independently. In default, all the clocks are set for rising edge signals.

(7) CLOCK INHIBIT MASK Field

Specifies whether or not the clock output responds to the inhibit (tri-state) signal. If set to [0] (unmasked), the clock signal for that data pod is tri-stated whenever the inhibit signal is asserted. If set to [1] (masked), the clock signal for that data pod will continue to be output even if the inhibit signal is asserted. The default value is 0 (unmasked).

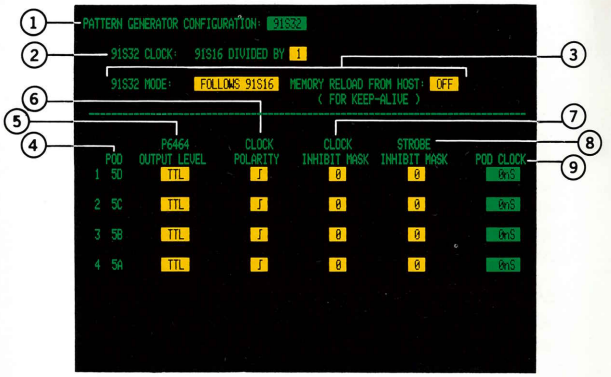
(8) STROBE INHIBIT MASK Field

Specifies whether or not the strobe output responds to the inhibit signal. When set to the [0] (unmasked), that pod's strobe line is tri-stated whenever the inhibit signal is asserted. When set to [1] (masked), that pod's strobe line is not tri-stated even if the inhibit signal is asserted. The default value is 0 (unmasked).

(9) POD CLOCK Field

Selects a pod clock delay relative to the start of the pattern generator cycle, allowing you to adjust the timing of one pod relative to another. With this menu, you can set each pod individually to output its data, strobe, and clock signals up to 5 ns before or 5 ns after the pattern generator clock edge. Use the INCR or DECR keys to select pod clock delay values in 5 ns increments. If you want finer control of pod clock timing, use the 91S32 Timing menu. The default value for this field is 0 ns.

91S32 CONFIGURATION SUB-MENU (WHEN USED WITH 91S16)



NOTE

This sub-menu only appears when both 91S16 and 91S32 modules are installed in the DAS. Refer to the 91S32 Configuration Sub-menu (91S32 Stand-Alone) *described earlier if the DAS is configured only with 91S32 Pattern Generator modules.*

(1) PATTERN GENERATOR CONFIGURATION Field

Selects either the [91S16] Configuration sub-menu or the [91S32] Configuration sub-menu.

When a 91S16 is installed with one or more 91S32s, you must enter parameters in both Configuration sub-menus. In that case, the 91S32 Configuration sub-menu displays some fields not available in a 91S32-only Configuration sub-menu.

(2) 91S32 CLOCK Field

NOTE

The 91S32 CLOCK field only appears if a 91S16 is installed in the DAS; otherwise, the 91S32's clock rate is set in the 91S32 Timing sub-menu.

Specifies a number (in a 1-2-4 sequence) that divides the 91S16 clock to create the 91S32 clock rate. The 91S32 modules, when used with the 91S16, receive their system clock signals from the 91S16 and can be programmed to operate at the same rate [1], one-half rate [2], or one-fourth the clock rate [4] of the 91S16. Use INCR or DECR to change the divisor value.

(3) 91S32 MODE Field

Specifies which operating mode the 91S32s will use: [FOLLOWS 91S16] mode or [SEQUENTIAL] mode. Follows 91S16 mode is the default selection. For more information on these operating modes, refer to *91S16 As Controller For 91S32* earlier in this reference guide.

FOLLOWS 91S16 Mode

The MEMORY RELOAD FROM HOST (KEEP-ALIVE) field should be programmed [ON] when the device under test is a dynamic device that requires refresh cycles. In this mode, the Keep-Alive feature is supported through instructions that are programmed in the 91S16 Run sub-menu.

In 91S16 Follows mode, the 91S32's memory is split into two pages, A and B. Having two independent memory pages allows a host computer to download a pattern into one memory while the other memory's pattern is being executed. When the 91S16 program encounters a CALL REMOTE command, the host computer begins filling the 91S32's alternate page of memory. The 91S16 loops in a refresh mode until the alternate memory page is full. When signalled, the 91S16 switches control to the full memory page and begins execution of those instructions.

The MEMORY FROM RELOAD HOST (KEEP-ALIVE) field should be programmed [OFF] when the device under test is a static device that does not require refresh cycles. In this mode, a HALT instruction causes the 91S16 and 91S32s to stop program execution, holding the test pattern on the probe's output lines. The host computer or mass-storage device then refills the entire memory. To continue program execution, press the START PAT GEN key.

SEQUENTIAL Mode

In this mode, the 91S16 supplies the clock signal to the 91S32; however each card executes its program independently. The 91S32s are not affected by 91S16 branch instructions, but they are affected by 91S16 halt and pause conditions since the 91S16 provides the clock.

When the 91S16 reaches the end of its memory, it can be programmed with a JUMP instruction to automatically restart from the beginning. This feature keeps all data channels active during circuit testing.

91S32 execution begins with the lowest-numbered sequence line specified in the START SEQ field of the 91S32 Run sub-menu (usually SEQ 0) and progresses sequentially until reaching the sequence number specified in the END SEQ field.

END SEQ Field. Specifies a sequence line number as the last line in your 91S32 pattern generator program. The default END SEQ is 2047 (end of memory). Use the data entry keys to enter an ending sequence line between 0 and 2047 ASEQ (absolute sequence) or Page A: 0–1023 and Page B: 0–1023 RSEQ (relative sequence). The END SEQ field format indicates the current ASEQ or RSEQ selection. Refer to the 91S32 Run sub-menu (later in this reference guide) for a description of the SEQ field and details on the ASEQ and RSEQ options.

Use the START SEQ field in the 91S32 Run sub-menu to specify a different starting sequence line.

④ POD Heading

Displays pod I.D. (pod identification) names that correspond to the 91S32's data probes. The 91S32 has 4 pod connectors (labeled A, B, C, and D) that accept P6464 Pattern Generator Probes. Each pod connector has its own pod I.D. consisting of a number and a letter. The number indicates the DAS slot where the module resides. The letter refers to the pod (probe) connector on that particular module.

⑤ P6464 OUTPUT LEVEL Field

Selects the logic level for signals output by the P6464 Pattern Generator Probe. This probe outputs data, strobe, and clock signals to the device under test at either [TTL] or [ECL] logic levels. Selection of the output level affects each pod independently. In default, all output levels are TTL.

⑥ CLOCK POLARITY Field

Specifies a rising edge [⌐‾] or falling edge [‾⌙] clock signal (at the start of each cycle) for the device under test. Each pod has its own clock line, allowing you to set the clock edge for each pod independently. In default, all the clocks are set for rising edge signals.

⑦ CLOCK INHIBIT MASK Field

Specifies whether or not the clock output responds to the inhibit (tri-state) signal. If set to [0] (unmasked), the clock signal for that data pod is tri-stated whenever the inhibit signal is asserted. If set to [1] (masked), the clock signal for that data pod will continue to be output even if the inhibit signal is asserted. The default value is 0 (unmasked).

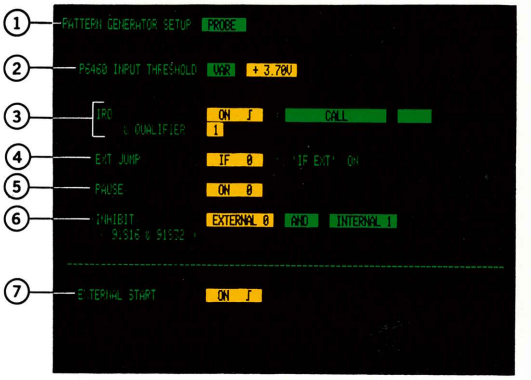
⑧ STROBE INHIBIT MASK Field

Specifies whether or not the strobe output responds to the inhibit signal. When set to [0] (unmasked), that pod's strobe line is tri-stated whenever the inhibit signal is asserted. When set to [1] (masked), that pod's strobe line is not tri-stated even if the inhibit signal is asserted. The default value is 0 (unmasked).

⑨ POD CLOCK Field

Selects a pod clock delay relative to the start of the pattern generator cycle, allowing you to adjust the timing of one pod relative to another. With this menu, you can set each pod individually to output its data, strobe, and clock signals up to 5 ns before or 5 ns after the pattern generator clock edge. Use the INCR or DECR keys to select pod clock delay values in 5 ns increments. If you want finer control of pod clock timing, use the 91S32 Timing sub-menu. The default value for this field is 0 ns.

91S16 PROBE SUB-MENU



NOTE

This sub-menu only appears when the DAS is configured with a 91S16 Pattern Generator module.

① PATTERN GENERATOR SETUP Field

Selects either the 91S16 [PROBE] or [TIMING] sub-menu. The Probe menu is used to define the parameters associated with the 91S16's P6460 External Control Probe. The 91S16's EXT START phono connector is also controlled by this sub-menu. The Timing sub-menu is used to select the master pattern generator clock and to adjust timing relationships between the clock, data, and strobe lines of a single P6464 Pattern Generator Probe.

② P6460 INPUT THRESHOLD Field

Selects the threshold level for signals input by the P6460 External Control Probe. Selections include:

[TTL] +1.40 V (default)
[VAR] [+3.70 V]
[ECL] −1.3 V

When VAR is selected, a new field appears that lets you set a variable threshold voltage from −6.40 V to +6.35 V in 50 mV increments (default is +3.70 V). Use the INCR or DECR keys to change the variable threshold voltage.

③ IRQ Field and QUALIFIER Field

The IRQ (Interrupt Request) field controls the 91S16's External Interrupt signal supplied via the P6460 External Control Probe. The QUALIFIER field (discussed later) can be used to qualify whether or not the 91S16 responds to the interrupt request. To use the External Interrupt signal, follow these three rules: 1) The interrupt is true for a given clock cycle if the external interrupt signal has a 15 ns set-up time relative to the selected edge of the external input clock. 2) The interrupt qualifier signal must stay true for 15 ns prior to the interrupt signal becoming active. 3) The interrupt mask (Run sub-menu) must be set to 0 (unmasked).

IRQ Field

The IRQ field is divided into two parts. The first part specifies whether the interrupt is set disabled or enabled. If enabled, another field appears that specifies whether the interrupt is recognized on the rising edge [ON ⌐] or on the falling edge [ON ¬] of the External Interrupt signal. The second part of the IRQ field specifies the mode the 91S16 uses to handle the external interrupts: CALL mode or IF IRQ mode.

CALL Mode and IF IRQ Mode. When IRQ is enabled, the 91S16 provides two modes for handling external interrupts: [CALL] [*label*] and [IF IRQ]. When an interrupt is detected in CALL mode, program flow is transferred to the interrupt service routine. After executing the service routine, program flow returns to the main program where the interrupt was detected. CALL mode requires that you enter a label in the 91S16 Run sub-menu naming the interrupt service routine. The last line of your servicing routine must contain a RETURN instruction.

In IF IRQ mode, use the IF IRQ JUMP command to detect and process an interrupt. When an IF IRQ JUMP command is encountered and an interrupt has been detected, execution jumps to a specified label in the program. Program flow continues from that point. Different jump destinations can be programmed for each IF IRQ JUMP instruction programmed.

NOTE

If you have IF IRQ JUMP commands programmed in the 91S16 Run sub-menu, you cannot change from IF IRQ to CALL mode in this menu. To change from one mode to the other, remove the mode-specific instructions from the 91S16 Run sub-menu and then change to the other mode in the Probe sub-menu.

QUALIFIER Field

When the IRQ field has been enabled, a QUALIFIER field appears on the screen immediately below the IRQ field. The Interrupt Qualifier signal input by the P6460 External Control Probe is used to qualify when the 91S16 will respond to the interrupt request line. Selections include [X] for don't care, [1] to qualify on a high logic state, or [0] to qualify on a low logic state. You are not required to use the qualifier line in order to use the IRQ line. The Interrupt Qualifier signal must have a 15 ns setup time relative to the selected edge of the IRQ signal. Hold time is 0 ns.

④ EXT JUMP Field

Selects either positive-true [ON 1] or negative-true [ON 0] logic states for the External Jump signal. The External Jump signal, supplied via the P6460 External Control Probe, is tested by the IF EXT JUMP instruction programmed in the 91S16 Run sub-menu. For the jump signal to be asserted, it must have a 15 ns setup time relative to the selected edge of the pattern generator clock. Hold time is 0 ns.

NOTE

The EXT JUMP field cannot be disabled if you have programmed an IF EXT JUMP instruction in the 91S16 Run sub-menu. To disable this field, first remove all IF EXT JUMP instructions.

⑤ PAUSE Field

Specifies whether a pause condition is asserted on either a positive-true [ON 1] or a negative-true [ON 0] Pause input signal. The Pause signal, supplied by the P6460 External Control Probe, causes the pattern generator to hold the test pattern on the P6464 probe's output lines. While the Pause signal is active, all pattern generator data, clock, and strobe lines maintain their current levels. To be asserted, the Pause signal must have a 15 ns setup time relative to the selected edge of the pattern generator clock. Hold time is 0 ns.

⑥ INHIBIT (91S16 & 91S32) Field

Specifies whether the internal inhibit bit and external inhibit signal are enabled on a positive-true [ON 1] or negative-true [ON 0] condition. The internal inhibit works with the I (Inhibit) column in the Run sub-menu. The external inhibit is derived from the external inhibit line on the P6460 probe.

This field also allows you to select the logical operator that combines the two inhibit signals. The inhibit signal, generated by a logical test of the internal and external inhibit signals, selectively tri-states the outputs of the P6464 Pattern Generator Probes. When this resulting inhibit signal is asserted, any data line not masked by the Inhibit Mask in the Run sub-menu is tri-stated. In addition, the pod clock and strobe line are also tri-stated unless masked in the Configuration sub-menu. The selections for the INHIBIT field include:

[EXTERNAL 0] [ONLY]
[EXTERNAL 1] [ONLY]
[INTERNAL 0] [ONLY]
[INTERNAL 1] [ONLY]

The reaction of the inhibit signal can be changed by selecting a logical operator that combines the external inhibit line from the probe and the internal inhibit bit programmed in the Run sub-menu. To select a logical operator, change the [ONLY] field to [AND] or [OR]. When either operator is selected, an additional field appears to the right of the logical operator field. This field allows you to set the asserted state for the other inhibit signal. For example:

INHIBIT: [EXTERNAL 0] [AND] [INTERNAL 1]

This combination logically ANDs the negative-true external inhibit signal with the positive-true internal inhibit bit.

NOTE

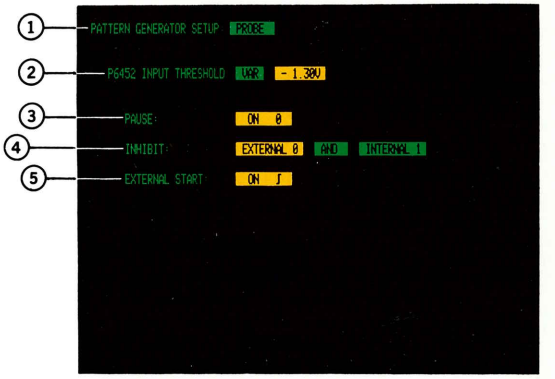
The pattern generator will continue to execute its program even though an inhibit signal has been asserted. Some data may be output by the P6464 probes while an inhibit is asserted if those bits have been protected by the Inhibit Mask in the Run sub-menu.

⑦ EXTERNAL START Field

Enables the External Start signal input to the 91S16's EXT START phono connector. The External Start signal works like an external trigger. When the EXTERNAL START field is enabled and the START SYSTEM or START PAT GEN key has been pressed, the pattern generator begins outputting patterns when the external start signal is received. Selections available allow the input signal to start program execution on either the rising edge [ON ⌐¬] or the falling edge [ON ¬⌐] of the input signal.

The EXT START input must be connected to an external TTL-level signal source. To be asserted, the external start signal must have a 15 ns pulse width.

91S32 PROBE SUB-MENU



NOTE

This 91S32 Probe sub-menu appears when 91S32 modules are the only pattern generator cards installed; it will not appear if a 91S16 is installed.

① PATTERN GENERATOR SETUP Field

Selects either the 91S32 [PROBE] or [TIMING] sub-menu. The Probe menu defines the parameters associated with the 91S32's P6452 External Clock Probe (attached to the DAS Trigger/Time Base module). The Timing sub-menu is used to adjust timing relationships between the clock, data, and strobe lines of a single P6464 Pattern Generator Probe. The Timing sub-menu also provides a field that selects the master pattern generator clock, either as a function of the DAS-supplied clock or the P6452-supplied clock.

② P6452 INPUT THRESHOLD Field

Selects a threshold level for the 91S32 pattern generator's P6452 External Clock Probe. This probe (attached to the DAS Trigger/Time Base module) supplies the 91S32's external clock, pause, external inhibit, and external start signals. The INPUT THRESHOLD field allows the following selections: [TTL], [VAR], and [MOS]. Use the INCR and DECR keys to vary voltage levels for the [VAR] and [MOS] selections.

NOTE

Changes made to the probe's threshold in this menu affect the 91A32 external clock threshold.

The P6452 External Clock Probe has a threshold-range switch with two positions: NORM and AUX. When set to NORM, the probe operates with a TTL/VAR threshold. If [TTL] is selected, the threshold voltage is set at +1.4 V. If [VAR] is selected, the threshold voltage (default is −1.30 V) may be set to a level ranging between +5.00 V and −2.50 V in 0.05 V increments. When the threshold range switch is set to AUX, the probe operates with the MOS threshold level ranging between +20.00 V and −10.00 V (in 0.20 V increments).

③ PAUSE Field

Specifies whether a pause condition is asserted on either a positive-true [ON 1] or a negative-true [ON 0] Pause input signal. The Pause signal is supplied by the P6452 External Clock Probe attached to the DAS Trigger/Time Base module. An active signal causes the pattern generator to hold the test pattern on the P6464 probe's output lines. While the Pause signal is active, all pattern generator data, clock, and strobe lines maintain their current levels. To be asserted, the Pause signal must have a 14 ns setup time relative to the selected edge of the pattern generator clock. Hold time is 5 ns (19 ns minimum pulse width).

④ INHIBIT Field

Specifies whether the internal inhibit bit and external inhibit signal are enabled on a positive-true [ON 1] or negative-true [ON 0] condition. This field also allows you to select the logical operator that combines the two inhibit signals. The inhibit signal, generated by a logical test of the internal and external inhibit signals, selectively tri-states the outputs of the P6464 Pattern Generator Probes. When the inhibit signal is asserted, any data line not masked by the INHIBIT MASK in the Run sub-menu will be tri-stated. Selections for the INHIBIT field include:

[EXTERNAL 0] [ONLY]
[EXTERNAL 1] [ONLY]
[INTERNAL 0] [ONLY]
[INTERNAL 1] [ONLY]

The reaction of the inhibit signal can be changed by selecting a logical operator that combines the external inhibit line and the internal inhibit bit programmed in the Run sub-menu. To select a logical operator, change the [ONLY] field to [AND] or [OR]. Each operator has an additional field that lets you set the asserted state for the other inhibit signal. For example:

INHIBIT: [EXTERNAL 0] [AND] [INTERNAL 1]

This combination logically ANDs a negative-true external inhibit signal with a positive-true internal inhibit.

NOTE

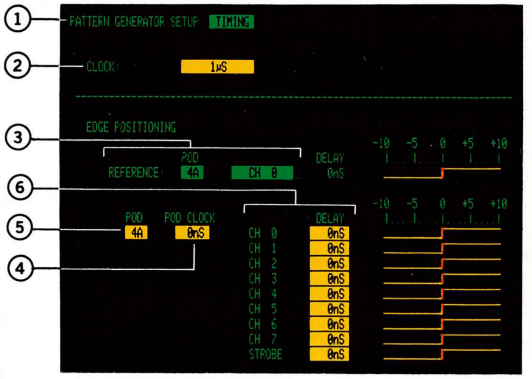
The pattern generator will continue to execute its program even though an inhibit signal has been asserted. Some data may be output by the P6464 probes while an inhibit is asserted if those bits have been protected by the INHIBIT MASK field in the Run sub-menu.

⑤ EXTERNAL START Field

Enables the External Start signal input to the 91S32 via the P6452 External Clock Probe. The External Start signal works like an external trigger. When the EXTERNAL START field is enabled, and the START SYSTEM or START PAT GEN key has been pressed, the pattern generator begins outputting patterns when the external start signal is received. Available selections allow the input signal to start program execution on either the rising edge [ON ⌐‾] or the falling edge [ON ‾⌐] of the input signal.

The EXT START input must be connected to an external TTL-level signal source. To be asserted, the external start signal must have a 15 ns pulse width.

91S16 and 91S32 TIMING SUB-MENU



NOTE

The Timing sub-menu is the same for both 91S16 and 91S32 Pattern Generator Modules.

① PATTERN GENERATOR SETUP Field

Selects either the [TIMING] or [PROBE] sub-menu. The Timing sub-menu adjusts timing relationships between the pod clock, data, and strobe lines of a single P6464 Pattern Generator Probe. The Timing sub-menu also provides fields to select the master pattern generator clock, either as a function of the DAS-supplied clock or an external clock.

The Probe sub-menu is used to define the parameters associated with an external control probe. The P6460 External Control Probe supplies external control signals when the DAS is configured with 91S16 and 91S32 pattern generator modules. When only 91S32s are installed, the P6452 External Clock Probe supplies the external control signals. For details on the [PROBE] selection, refer to the appropriate pattern generator's Probe sub-menu.

② CLOCK Field

Selects the master input clock for the pattern generator. This clock controls the output rate for the pattern generator's pod clock and data signals to the device under test. The master clock can be an internal DAS clock or an external clock signal supplied by a P6460 or P6452 probe.

The default CLOCK setting is the DAS internal clock at 1 µS. The INCR and DECR keys change clock values in a 1-2-5 sequence. When using an external clock, a field appears that allows you to specify the external clock's rising edge [EXTERNAL ⌐] or falling edge [EXTERNAL ¬] as the master clock signal.

NOTE

The DAS has two internal clocks shared by all data acquisition modules and the 91S16/32 Pattern Generator Modules. Since it is possible to specify a different clock for each of these modules, you must ensure that no more than two different clocks have been specified. Refer to the Start and Stop *section of the* DAS 9100 Series Operator's Manual *for details.*

③ REFERENCE Field

Selects any data channel, strobe, or pod clock line as a timing reference when setting the edge positioning of a particular pod's data and strobe channels. The REFERENCE field is divided into two parts: 1) a pod I.D., and 2) the data channel, strobe, or clock line from the pod being used as a reference. The default reference is [CH 0] of the 91S16's pod A. When only 91S32s are installed, the default is [CH 0] of pod A from the 91S32 installed in the lowest-numbered DAS slot. Use the data entry keys to enter the pod I.D. of the reference channel.

Use the SELECT key to specify the reference signal:

[CH 0]—[CH 7]
[STROBE]
[POD CLOCK]

The DELAY value to the right of the reference channel displays the timing of the reference signal relative to the pattern generator master clock. The value cannot be changed in this field. To change the delay value, use the POD and DELAY fields in the lower half of the menu. The rising edge signal and the vertical red bar are visual reminders of the reference signal's delay value. The default value is 0 ns.

④ POD Field

Specifies the name of the pod you want displayed. Any available pod I.D. can be entered in this field using the data entry keys. The POD field defaults to either the 91S16 Pod A when a 91S16 is installed, or Pod A for the 91S32 in the lowest-numbered DAS slot when only 91S32s are installed.

⑤ POD CLOCK Field

Simultaneously adjusts the timing of all the signals associated with this pod. The adjustment is made in relation to the pattern generator's master clock; the master clock determines the start of each cycle.

Use the INCR or DECR keys to set the POD CLOCK delay value ± 5 ns relative to the master clock. Selections include: [−5 ns], [0 ns] (default), and [+5 ns]. Each pod may have a different POD CLOCK delay value. The POD CLOCK delay values may also be changed in the Configuration sub-menu.

⑥ DELAY Field

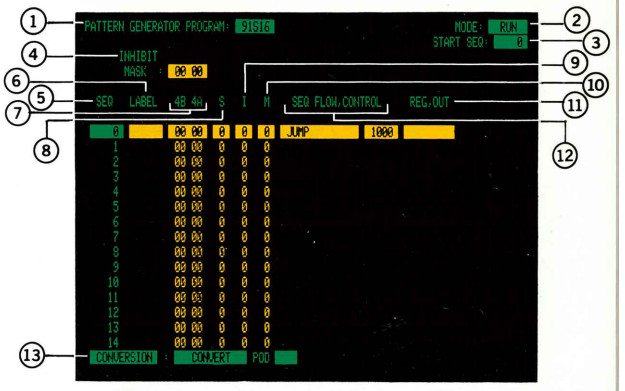
Sets the delay value for the pod's data channels and strobe relative to the pod clock. Use the INCR or DECR keys to adjust the delay value in 1 ns increments within a −5 ns to +5 ns range relative to the pod clock. Each data channel and strobe line may have a different delay value.

The DAS displays the total delay relative to the pattern generator's master clock for each channel (including the pod clock delay). The delay value for each data channel and the strobe line is represented as a rising-edge signal. In default, delays are 0 ns.

NOTE

Delay values and the graphic representation of timing relationships shown in this menu do not take into account skew values inherent in the P6464 probes. There is a deskew procedure using internal delay lines that does not affect the timing relationships shown in this menu; that procedure can be found in the DAS 9100 Series 91S16/32 Service Addendum *(P/N 070-5397-00).*

91S16 RUN SUB-MENU



NOTE

The 91S16 Run sub-menu appears only when the 91S16 Pattern Generator Module is installed.

① PATTERN GENERATOR PROGRAM Field

Selects either the [91S16] Run sub-menu or the [91S32] Run sub-menu. The 91S16 Run sub-menu is used to enter instructions and patterns for the 91S16 Pattern Generator Module.

② MODE Field

Selects the pattern generator's operating mode. Selections are [RUN], [TRACE], and [STEP]. When you select RUN mode, the pattern generator outputs data in real time, synchronously with the master input clock signal. The TRACE and STEP mode sub-menus, described later in this reference guide, are listed separately for the 91S16 and the 91S32.

③ START SEQ Field

Specifies the first sequence number the pattern generator executes when the START PAT GEN key or the START SYSTEM key is pressed. START SEQ may be programmed to any number between 0 (default) and 1023 using the data entry keys, providing that no interrupt service routine is programmed. If one has been programmed, the upper limit is 1022. To return this field to 0, press DON'T CARE.

④ INHIBIT MASK Field

Specifies whether or not the data output channels respond to the inhibit (tri-state) signal. If the inhibit mask for a given data channel is set to [0] (unmasked), the data channel is tri-stated whenever the inhibit signal is asserted. If the inhibit mask is set to [1] (masked), the inhibit signal is not recognized, and the data channel is not tri-stated. Use the data entry keys to specify an inhibit mask. The default radix is hexadecimal. To change the radix, use the DISPLAY editing command. (Refer to callout 13, Edit Field, for more information.)

⑤ SEQ (Sequence) Field

Displays numbers that correspond to your program lines. There is a total of 1024 sequence lines labeled 0–1023. Only a portion of these sequence lines are displayed at any given time.

Different methods are available that enable you to display different sequence lines. One method is to use the up (△) or down (▽) scroll keys. These keys can be used at any time, and with the cursor in any field. Pressing SHIFT △ or SHIFT ▽ scrolls up or down in 15-sequence blocks. Another method is to enter the desired sequence number directly into the SEQ field using the data entry keys. This method allows you to jump forward or backward and display specific blocks of sequence lines.

NOTE

When using the above procedures, observe the following two rules. First, use the top SEQ field in the display if you want to view sequence lines smaller than any currently displayed. To return to SEQ 0, press DON'T CARE. Second, do not enter a number greater than 1023 (1022 if IRQ CALL is used).

⑥ LABEL Field

Provides labels for specific program lines that serve as destinations for three pattern generator functions: JUMP, IF <*condition*> JUMP, IRQ CALL <*label*>. (The IF <*condition*> JUMP instructions include IF R=0, IF KEY, IF IRQ, etc.) These instructions transfer program flow to the line containing the label you specify in the LABEL field. The labels do not specify a destination according to a sequence line number.

Using the data entry keys, you can assign a total of 15 labels in a 91S16 program. Each label may be up to four characters wide, and may include letters, numbers, and spaces. To remove a label, position the cursor on the label and press the DON'T CARE key. The label will be deleted from the field.

⑦ #A and #B Pattern Fields

Specifies the data pattern you wish to output through the P6464 probes. The A field header designates the data pattern output through Pod A; the B field header designates Pod B. The number preceding the A and the B corresponds to the DAS slot where the 91S16 module resides. Enter data patterns line by line, one pod at a time, using the data entry keys. Data patterns always default to 0. The default radix is hexadecimal; use the DISPLAY edit command (described later under callout 13) to change the radix.

⑧ S (Strobe) Field

Selects whether or not the strobe channel associated with each pod will output signals when this particular program line is executed. The 91S16 Strobe field contains two bits; the left bit corresponds to Pod B, and the right bit corresponds to Pod A. Strobe transitions are synchronous with the output clock. In default, the strobe field is set to 0 (no strobes). Entering a 1 *hex* in the S (Strobe) field causes only the Pod A strobe to be output; entering a 3 *hex* causes both Pod A and Pod B strobes to be output. Use the data entry keys to program this field on a line-by-line basis, or use the FILL edit command to program entire blocks of sequence lines in one operation. Refer to the FILL edit command under callout 13 for details.

⑨ I (Inhibit) Field

Works with the internal inhibit signal specified in the Probe sub-menu; selections include [INTERNAL 1] and [INTERNAL 0]. Your entry in the inhibit column must match the logic state (1 or 0) specified in the Probe sub-menu. The bits in the inhibit column correspond to 91S16 pods. You must enter values for every sequence line of the I (Inhibit) field. The default value is 0 and the default radix is hexadecimal. The internal inhibit signal becomes effective synchronously with the output clock.

Assume the inhibit field is set to [INTERNAL 1 ONLY]. Entering a 0 in the I (Inhibit) field means that neither pod is tri-stated and both pods will continue to output data, clock, and strobe lines. Entering a 1 *hex* in this field causes the outputs of Pod A to be tri-stated; 3 *hex* causes both Pod A and Pod B to be tri-stated.

NOTE

Some data may still be output from a pod that has been tri-stated, because any value you set in the INHIBIT MASK field causes specific data lines to ignore the inhibit signal. Refer to the Inhibit Mask field described earlier for more details.

⑩ M (Interrupt Mask) Field

Masks the external interrupt signal received from the P6460 probe. In default, the M field is set to 0 (unmasked). Using the data entry keys, enter a [1] in the M field of a particular sequence line to ignore external interrupt signals during execution of that program line.

⑪ SEQ FLOW, CONTROL Fields

The SEQ FLOW and CONTROL fields correspond to the keys on the left-hand side of the DAS keyboard. The SEQ FLOW (sequence flow) key is associated with a series of programming instructions that affect the order of sequence line execution (e.g., branching, conditional branching, and halt). The CONTROL key selects instructions that control 91S32 pattern generator cards, or issue triggering cues to some external device. The CONTROL instructions appear in the same field as SEQ FLOW instructions.

Enter instructions in any order by positioning the screen cursor in this field on the desired sequence line and pressing the SEQ FLOW or CONTROL key. To add an additional CONTROL instruction field, use the ADD LINE key; remove instructions with the DON'T CARE key. To delete an added line, use the DEL LINE key.

NOTE

You may add up to two additional CONTROL fields for each sequence line (only one SEQ, FLOW instruction allowed per line).

The default for both types of instructions is no operation, meaning the SEQ FLOW, CONTROL field is blank and the pattern generator outputs its data normally before advancing to the next sequence line.

The CONTROL instructions are [TRIGGER] and [INCR PAGE] (increment page). The SEQ FLOW instructions include:

[HALT]	[IF EXT JUMP] [ ]
[JUMP] [ ]	[IF KEY JUMP] [ ]
[IF RA=0 JUMP] [ ]	[IF FULL JUMP] [ ]
[IF RB=0 JUMP] [ ]	[IF END JUMP] [ ]
[IF R=0 JUMP] [ ]	[RETURN]
[IF IRQ JUMP] [ ]	[CALL RMT]

Each SEQ FLOW and CONTROL instruction has individual performance characteristics. Several of these instructions require labels as additional parameters. The following paragraphs briefly describe each instruction and its capabilities.

HALT Instruction

This instruction causes the pattern generator to stop outputting the data and strobe values associated with that sequence line.

JUMP Instruction

This instruction alters the sequential flow of a program by specifying a jump from one program line to another. Sequential program execution then resumes at that point.

Use the empty field next to JUMP to enter the label of the sequence line where you want program execution to resume.

IF <conditional> JUMP Instruction

This instruction alters the sequential flow of a program when the conditions of the IF statement are satisfied. Program execution resumes at the sequence line containing the label specified after JUMP. The conditional tests for this JUMP instruction include:

RA=0	EXT
RB=0	KEY
R=0	FULL
IRQ	END

IF RA=0 JUMP, IF RB=0 JUMP. Instruct the pattern generator to examine the contents of register RA (or register RB) and jump to the specified label if the value in the register equals 0.

IF R=0 JUMP. Works the same as the tests described above, only this test is performed on the combined 16-bit register named "R" (where R = RA + RB). Refer to *91S16 Configuration Menu* (earlier) for more information about the 91S16's internal register.

IF IRQ JUMP. Instructs the pattern generator to examine the status of the P6460 probe's IRQ (Interrupt Request) line. If the P6460 has detected a transition on this line, the condition is considered true. A signal on the IRQ line meeting the following conditions can be recognized as an interrupt:

- the IRQ polarity and level specified in the 91S16 Probe sub-menu are satisfied,
- the QUALIFIER specified in the 91S16 Probe sub-menu is satisfied,
- the Interrupt Mask bit (M) is set to 0 (unmasked),
- the selected IRQ edge occurs 15 ns prior to the selected edge of the external clock (minimum pulse width is 15 ns).

NOTE

When IRQ is disabled or IRQ CALL <label> is selected in the 91S16 Probe sub-menu, the IF IRQ JUMP instruction is not included in the list of conditional tests.

If the first line executed contains an IF IRQ JUMP instruction, the pattern generator will not jump even if an interrupt has been requested.

IF EXT JUMP. Instructs the pattern generator to examine the status of the P6460 probe's EXT JUMP (External Jump) signal line. If the EXT JUMP line meets the threshold level specified in the 91S16 Probe sub-menu, then the condition is considered true. Program execution resumes at the sequence line containing the label specified after JUMP.

NOTE

When EXT JUMP is disabled in the 91S16 Probe sub-menu, the IF EXT JUMP conditional test is not available. If the first line executed contains an IF EXT JUMP instruction, the pattern generator will not jump even if the EXT JUMP line has been asserted.

IF KEY JUMP. Instructs the pattern generator to determine if the SHIFT START PAT GEN key (on the DAS keyboard) has been pressed. If the key was pressed before this sequence line was executed, the condition is considered to be true. With this conditional test, the user can advance control of the pattern generator from one looping routine to another by pushing the SHIFT START PAT GEN key.

IF FULL JUMP and IF END JUMP. Support the 91S16's Pattern Download From Host feature when using Keep-Alive. Refer to *91S32 Configuration Sub-Menu (When Used With 91S16)* earlier in this reference guide for a description of this feature. Refer to *GPIB Programming* in the *91S16, 91S32, and P6464 Operator's Manual Addendum* for detailed instructions about Keep-Alive programming.

IF FULL JUMP and IF FULL END are not available if the MEMORY RELOAD FROM HOST (FOR KEEP-ALIVE) field has not been set [ON]. IF FULL tests to see if the GPIB controller has sent KEY 46 to the DAS. KEY 46 indicates that the data transfer is complete. IF FULL then causes the 91S32s to switch program execution to the newly refilled memory page.

IF END tests to see if the GPIB controller has sent KEY 47 to the DAS. KEY 47 indicates that all data transfers have been completed. IF END JUMP <*label*> then transfers program execution to the sequence lines designated by the label.

RETURN Instruction

RETURN is only used in conjunction with the IRQ CALL <*label*> instruction programmed in the 91S16 Probe sub-menu. When the IRQ field is set to CALL, a label field appears. This label corresponds to a set of sequence lines that have been programmed to service the interrupt request. When an interrupt request is detected on the IRQ line from the P6460, program execution transfers to the sequence line containing the label given in the Probe sub-menu. (It is possible to mask the interrupt signal using the M field in the Run sub-menu.) The RETURN instruction programmed in the SEQ FLOW, CONTROL field is the last sequence line of the service interrupt routine.

CALL RMT Instruction

The call remote device instruction is part of the Keep-Alive feature that allows the pattern generator to reload its memory from an external device. (The other instructions associated with Keep-Alive are IF FULL JUMP and IF END JUMP.) CALL RMT is only available when you are using DAS Option 06 GPIB.

The CALL RMT instruction is enabled when you set the MEMORY RELOAD FROM HOST (FOR KEEP-ALIVE) field to [ON] in the 91S32 Configuration menu. This instruction issues a signal via the GPIB bus to a host computer or external memory device. The signal can be used to indicate that one page of the 91S32's pattern memory is ready to be reloaded.

TRIGGER Instruction

This instruction generates a signal at the TRIG OUT phono connector on the 91S16 module. Use the optional 79-inch phono-to-BNC cable to connect the trigger output connector to an external device (such as an oscilloscope). This positive-true trigger is an NRZ (non-return-to-zero) signal. It stays TTL-high for one cycle each time it is programmed.

NOTE

If the TRIGGER instruction is programmed for several consecutive sequence lines, the pulse width of the TRIGGER signal will widen in proportion to the number of TRIGGER instructions.

INCR PAGE Instruction

The increment page instruction is used when 91S32s are in Follows 91S16 mode. In this mode, the 91S32 memory is divided into two 1024-line pages called Page A and Page B. The INCR PAGE command switches 91S32 execution from one page of memory to the other.

⑫ REG, OUT Fields

The REG field and instructions correspond to the REG (register) key on the DAS keyboard. The register maintains its previous value when no REG instructions are programmed. (To configure the pattern generator register, refer to the 91S16 Configuration sub-menu.)

REG instructions (two 8-bit registers):	REG instructions (one 16-bit register):
[LOAD RA]	[LOAD R]
[INCR RA]	[INCR R]
[DECR RA]	[DECR R]
[LOAD RB]	
[INCR RB]	
[DECR RB]	

Using the ADD LINE key, you can program up to three REG or OUT instruction fields per sequence line. Use the DON'T CARE key to blank the field. If you program a SEQ FLOW or OUT instruction on the same line as a REG instruction, those instructions are performed first. Both instructions are executed, but the conditional test uses the old value for R.

Register Instructions

LOAD RA, LOAD RB. When the 91S16's internal register is configured as two 8-bit registers, the initial value loaded into either register is from the Pod A data field; the Pod B field is not used. Two sequence lines are required to load both registers. The most significant bit (MSB) of each data register corresponds to the MSB of Pod A's data field. When data is output from either RA or RB, it is delivered to the Pod A pattern generator probe; the Pod B probe receives data from the Pod B data column. When either RA or RB is output, the data value specified for Pod A is ignored.

LOAD R. When the 91S16's internal register is configured as a single 16-bit register, the initial value is loaded from both the Pod B and the Pod A data fields. When data is output from register R, it is delivered to both Pod B and Pod A probes. The register's MSB is delivered to the most significant data channel of the probe attached to Pod B. The register's least significant bit (LSB) is delivered to the least significant channel of Pod A. When register R is output, the data values for Pod B and Pod A are ignored for that sequence line.

INCR RA, INCR RB. Increments the values of the specified registers by one each time the command is executed. The range of the counters is between 0 and FF. The next INCR command following FF resets the register to 0; no carry signal is generated.

INCR R. Increments the value of register R each time the command is executed. The range for the counter is between 0 and FFFF. The next INCR command following FFFF resets the register to 0; no carry signal is generated.

DECR RA, DECR RB. Decrements the values of the specified registers by one each time the command is executed. The range of the counters is between FF and 0. The next DECR command following 0 sets the register to FF; no borrow signal is generated.

DECR R. Decrements the value of register R each time the command is executed. The range for the counter is between FFFF and 0. The next DECR command following 0 sets the register to FFFF; no borrow signal is generated.

OUT (Output Register Contents) Instructions

The OUT field and instructions are associated with the OUT (output) key on the DAS keyboard. OUT instructions include OUT R (output the contents of register R as data) and OUT REP. The OUT REP instruction causes the pattern generator to repeat whatever pattern (data value or register value) it output on the previous sequence line.

Available instructions allow you to output the contents of the 91S16's internal register as data in place of the value programmed in that sequence line's data field. The displayed options depend on the register configuration selected: two 8-bit registers RA and RB, or one 16-bit register R. Selections include:

OUT instructions (two 8-bit registers):	OUT instructions (one 16-bit register):
[OUT RA]	[OUT R]
[OUT RB]	[OUT REP]
[OUT REP]	

OUT RA, OUT RB. Sends the value in the specified register as data to the pattern generator probe connected to Pod A. Both register RA and register RB send data to the same pattern generator probe. You cannot have OUT RA and OUT RB instructions on the same sequence line.

OUT R. Sends the value in register R as data to the pattern generator probes connected to both Pod B and Pod A. The most significant register bit is sent to the Pod B channel 7 data line and the least significant register bit is sent to the Pod A channel 0 data line.

OUT REP (Out Repeat) Instruction. Causes the pattern generator to ignore its current data source for Pod A and repeat whatever vector it output for Pod A in the previous sequence line. The previous sequence line's vector may be data, a register value, or even another OUT REP instruction.

OUT REP only repeats the output of Pod A; it does not repeat the previous vector supplied to Pod B. If the previous data vector was a 16-bit value from register R, OUT REP will only repeat the 8 least significant bits (those originally supplied to Pod A); Pod B data will be supplied by the Pod B data field.

⑬ Edit Field (for 91S16 & 91S32)

Contains nine commands, designed to simplify programming, that allow manipulation of labels, patterns, and instructions. Editing commands are basically the same for the 91S16 and the 91S32, except for the 91S32's SEARCH command. Since the 91S32 Run sub-menu does not use labels or instructions, the SEARCH command is only valid for numeric values. For details, refer to the *91S16 And 91S32 Operator's Manual Addendum.*

[COPY]	[FILL]	[MOVE]
[DELETE]	[INSERT]	[SEARCH]
[DISPLAY]	[MODIFY]	[CONVERSION]

NOTE

When the 91S32s are in Follows 91S16 Mode, COPY, INSERT, MOVE, and DELETE commands do not operate across a page boundary. The page boundaries are SEQ 0—1023 for Pages A and B.

To select an edit command, move the screen cursor to the edit field at the bottom of the screen and press the SELECT, INCR, or DECR key until the desired command appears. After entering the changes for any of the edit operations, press the EXECUTE key.

COPY Command. Duplicates sequence lines or copies the data programmed for one pod to another pod. Fields associated with COPY allow you to select either [SEQ] (sequences within the Run sub-menu) or [POD] (copy one pod's data to another pod).

SEQ Sub-command. This sub-command duplicates sequence lines. When the COPY: SEQ command is executed, all sequence lines specified are duplicated and placed immediately before the given destination. The sequence numbers for the menu are then updated. Labels are retained in the duplicated lines. Before you start the pattern generator, or exit the pattern generator menus, you must remove or change these duplicate labels.

Use the data entry keys to enter starting and ending sequences, and a destination sequence. Press the EXECUTE key to initiate the COPY: SEQ command.

NOTE

Using the COPY command when all 1023 sequence lines have been programmed may cause some high-numbered sequence lines to be lost from memory.

POD Sub-command. This sub-command copies one pod's pattern in memory into a different pod's memory. If data already exists in the destination pod, it is discarded when the new pattern is copied into memory. To copy a data pattern from one pod to another, move the screen cursor to the COPY: POD field. Use the data entry keys to enter the I.D.s of the source and destination pods. Press EXECUTE to start the copy operation.

DELETE Command. Use this command to erase sequence lines. When the DELETE command is executed, all sequence lines between the given starting and ending sequence lines (inclusive) are deleted; the remaining sequence line numbers are updated.

To delete one or more sequence lines, move the screen cursor to the edit command field at the bottom of the Run sub-menu. Press the SELECT key until the DELETE field appears. Move the screen cursor to the SEQ field and, using the data entry keys, enter the sequence numbers of the first and last lines you wish to delete. If only one line is to be deleted, enter that sequence number in both fields. Press EXECUTE to start the delete operation.

NOTE

When sequence lines are removed by the DELETE command, a corresponding number of new sequence lines containing default values are created at the end of the pattern generator's memory. These new sequence lines are inserted after the last sequence line that contains programming data, in order to maintain a total of 1022 sequence lines (IRQ CALL enabled) or 1023 lines (IRQ CALL disabled).

DISPLAY Command. Selects the display radix for the following fields: data, strobe, internal inhibit, interrupt mask, and inhibit mask. Radix selections are [HEX], [OCT], [BIN], and [OFF] (no display). The default radix is hexadecimal.

FILL Command. Use this command to fill in values for the #B (data), #A (data), S (Strobe), I (Internal Inhibit), and M (Interrupt Mask) fields. The FILL command allows you to automatically enter a value in the specified data fields, instead of entering the value for each line individually. Enter a DON'T CARE in the FILL command field to protect any column's data from being affected during the editing operation.

Select the FILL command by pressing the SELECT key while the cursor is in the edit command field (at the bottom of the DAS display). Move the screen cursor to the SEQ field and, using the data entry keys, enter the starting and ending sequence numbers. Now, move the cursor to the appropriate field in the next line and enter the pattern you wish to place in all the corresponding fields within that sequence range. Press EXECUTE to start the fill operation.

INSERT Command. Use this command to insert additional sequence lines. The additional lines are inserted before the destination sequence line; SEQ numbers for all the sequence lines are then updated. Newly inserted sequence lines always contain default values.

To insert sequence lines, select the INSERT command by pressing the SELECT key while the cursor is in the edit command field (at the bottom of the Run sub-menu). Move the screen cursor to the LINE(S) field. Use the data entry keys to specify the number of lines you wish to add and the sequence line where they will be inserted. Press EXECUTE to start the insert operation.

NOTE

If you are adding sequence lines to a program already containing 1022 sequence lines (IRQ CALL enabled) or 1023 lines (IRQ CALL disabled), you will move the last sequence lines in your program out of memory.

MODIFY Command. This command uses logical operators to manipulate data already entered into the Run sub-menu. Selections for logical operators include: [AND], [OR], and [XOR] (exclusive OR). Data fields, and the S (Strobe), I (Internal Inhibit), and M (Interrupt Mask) fields can be modified by using these operators. You can also limit the modification to a range of sequence numbers.

By ANDing a particular column with 0, you can modify all the data in that column to 0s. By ORing a column with 1, you can set all the bits in that column to 1. By XORing any pattern with 1, the bit pattern in that field is inverted.

To modify a column's data, move the screen cursor to the edit command field and press the SELECT key until the MODIFY command appears. Move the screen cursor to the field immediately to the right of MODIFY and press the SELECT key until the desired logical operator is displayed. Move the screen cursor to the SEQ and THROUGH fields. Use the data entry keys to enter the number of the first and last sequence line you want to modify. Move the screen cursor down to the pattern line and enter the pattern you have chosen as a modifier.

Fields containing DON'T CAREs are not affected by the MODIFY command. Press EXECUTE to start the modify operation.

MOVE Command. Use this command to move a block of sequence lines to another location. When MOVE is executed, all the specified sequence lines are moved to a location just before the given destination sequence line. The sequence numbers are then automatically updated. Labels, data, and instructions are retained when sequence lines are moved.

Select the MOVE command by positioning the screen cursor in the edit command field (at the bottom of the Run sub-menu) and pressing the SELECT key until MOVE appears. Position the screen cursor in the SEQ field and, using the data entry keys, enter the starting, ending, and destination sequence numbers. Press EXECUTE to start the move operation.

SEARCH Command. Use this command to locate a specific entry within the Run sub-menu. The entry may be a label or an instruction (both apply only to 91S16), or a data pattern (applies to both 91S16 and 91S32). The SEARCH command allows you to specify the type of entry to search for, and the sequence range for the search. When executed, the SEARCH command compares all entries of the same type against the target string within the specified range of sequence lines. The DAS then places the screen cursor on the first sequence line containing that string and displays the total number of lines found within the specified range. The data entry keys can be used to select the second, or third, etc. occurrence of the target string when the screen cursor is in the search field (bottom right of the display). A number preceding the slash in the search field indicates which occurrence of the target string is being viewed. A number following the slash indicates the total number of occurrences to the target string.

Select the SEARCH command by moving the screen cursor to the edit command field (at the bottom of the Run sub-menu) and pressing the SELECT key until the SEARCH command appears. To select the target seach pattern, use the field immediately to the right of the SEARCH command. Press the SELECT key until the desired target group appears in the field. The DAS displays the target groups in this order:

[LABEL]	[CONTROL]
[PATTERN]	[REG]
[SEQ FLOW]	[OUT]
[JUMP LABEL]	

Move the screen cursor to the SEQ and THROUGH fields and enter the starting and ending sequence numbers for the block of program being searched. Move the screen cursor to the PATTERN sub-fields and use the data entry keys to enter the target pattern; DON'T CAREs will match any pattern. Move the screen cursor to the OUT sub-field in the lower right-hand corner of the display. Press the SELECT key until the desired OUT instruction appears in the field.

Press EXECUTE to start the search operation. The DAS will display a message at the bottom of the screen. The first number of this message indicates the line number containing the first occurrence of the target pattern. The number following the slash indicates how many lines contain the target pattern within the specified range.

CONVERSION Command. Use this command to search for and replace all data pattern values with corresponding different values (for example, replace all occurrences of FF *hex* with AA *hex*).

The CONVERSION command has two sub-commands: CONVERT and TABLE BUILD. CONVERT designates which pod's data will be converted. TABLE BUILD uses a sub-menu to specify which bit patterns will change.

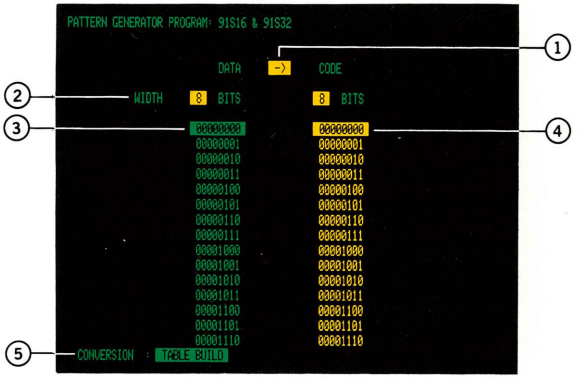
CONVERT Sub-command. Instructs the pattern generator to apply conversion rules outlined in the TABLE BUILD sub-menu to the data in a particular pod. To convert all data patterns for a 91S16 in DAS slot 1 from one code to another, first CONVERT POD 1A, and then CONVERT POD 1B. If a 91S16 is being used with 91S32s, the conversion program should be used four more times for each 91S32.

Specify the pod data to be converted by moving the screen cursor to the POD field and entering a pod I.D. with the data entry keys. Press EXECUTE to start the conversion. The DAS displays a message on the second line of the screen when the conversion is completed. The DAS also blanks the POD field to prevent accidental conversions later.

TABLE BUILD Sub-command. Modifies an existing data pattern. The menu provides two columns of 4-digit binary numbers from 0000 to 1111. Modifying the bit pattern in the CODE column and executing the CONVERT command on a pod's data causes all occurrences of the pattern in the DATA field to be converted into the pattern in the CODE field.

To invoke the TABLE BUILD sub-menu, move the screen cursor to the field containing CONVERT and press the SELECT key until the TABLE BUILD sub-menu appears.

TABLE BUILD Menu



① → **Field**

Indicates the direction for converting data. When the arrow points to the right, data in the right-hand column is used to replace the data pattern in the left-hand column. When the arrow points to the left, the pattern in the left-hand column will replace the pattern in the right-hand column.

To change the direction of the conversion arrow, move the screen cursor to the arrow field and press the SELECT key until the desired direction appears.

② WIDTH Fields

Select the bit width for the data and code columns. Using the data entry keys, specify bit widths ranging from 1 to 8 bits. The default field width is 4 bits for each column. The bit width you select determines the depth of the corresponding DATA and CODE fields. However, if you select a width of 4 bits for the DATA column and 5 bits for the CODE column, both selection fields will be 16 lines deep (16 possible patterns from 4 bits). The depth of the field always truncates to match the depth of the column the arrow points away from. Selecting 8-bit field widths for both columns generates a TABLE BUILD sub-menu with 256 lines of bit patterns.

③ DATA Column

Contains all possible bit patterns for data entered in the Run sub-menu. Bit patterns in this column represent existing data, while bit patterns in the CODE column represent intended changes to the data. (The reverse is true when the direction field has the arrow pointing to the left.)

There are different ways of displaying parts of the TABLE BUILD sub-menu. One method is to use the scroll keys on the DAS keyboard. Another method is to enter the desired new pattern into a field within the DATA column. Just as in moving through sequence lines in the Run sub-menu, the DAS displays the DATA line you have entered and fills the remaining display with DATA lines incrementing from that point.

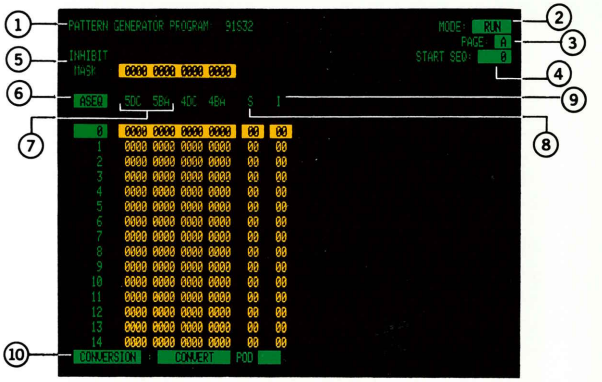
④ CODE Column

Use this column to enter the pattern you want to result from the conversion. Bit patterns in the CODE field replace the bit patterns in the DATA field immediately to their left. More than one data pattern may be converted to the same CODE pattern. However, if the same CODE pattern is entered for two different DATA patterns, data cannot be restored by switching the arrow field from → to ←.

⑤ CONVERSION Field

Use the CONVERSION field to exit the TABLE BUILD sub-menu. Position the screen cursor on the CONVERSION field and press the SELECT key. The DAS will display the 91S16 Run sub-menu.

91S32 RUN SUB-MENU



NOTE

The 91S32 Run sub-menu appears only when 91S32 Pattern Generator Modules are installed.

① PATTERN GENERATOR PROGRAM Field

Selects either the [91S16] Run sub-menu or the [91S32] Run sub-menu. The 91S32 Run sub-menu is used to enter instructions and patterns for the 91S32 Pattern Generator Module. The 91S16 Run sub-menu is the default menu display.

② MODE Field

Selects the pattern generator's operating mode. Selections are [RUN], [TRACE], and [STEP]. When you select RUN mode, the pattern generator outputs data in real time, synchronously with the master input clock signal. The TRACE and STEP mode sub-menus are described later in this reference guide.

③ PAGE Field

Indicates which page of the 91S32's memory is being displayed. You can divide the 91S32's memory into two 1024-line pages (called A and B) and use the 91S16 INCR PAGE command to switch between the two pages.

The 91S32's SEQ field provides two ways of numbering sequence lines for the 91S32: ASEQ and RSEQ. (Instructions for changing between these selections are given under callout 6.) The numbering system selected affects the PAGE field. When ASEQ (Absolute Sequence) is selected, the 91S32's program lines are numbered from 0–2047; page B will start with sequence 1024. RSEQ stands for Relative Sequence (relative to Page A or Page B). When RSEQ is selected, the 91S32's program lines are numbered from 0–1023 for Page A, and 0–1023 for Page B.

If you are using the 91S32 with its memory divided into two pages, you can select which page of data appears on the display. The default value for the PAGE field is A.

④ START SEQ Field

Specifies the first sequence number the pattern generator will execute when the START PAT GEN key or the START SYSTEM key is pressed. If the 91S32 is being used without a 91S16, or if the 91S32 is being used with a 91S16 in the Sequential mode, the number you enter in the START SEQ field determines the first sequence line executed. If the 91S32 is being used with a 91S16 in the Follows mode, you cannot set a value in this field, since the starting sequence is set by the 91S16. For an explanation of Sequential and Follows modes, refer to *91S32 Configuration Sub-Menu* earlier in this reference guide.

The START SEQ number you enter depends on the selection in the SEQ field. When set to ASEQ, enter a value between 0 and 2047. (IRQ-enabled CALL <*label*> mode reduces the number of available sequence lines by one.) When set to RSEQ, you must specify the memory page (A or B) and enter a sequence number between 0 and 1023. The START SEQ field defaults to Page A, SEQ 0.

⑤ INHIBIT MASK Field

Specifies whether or not the data output channels respond to the inhibit (tri-state) signal. If the inhibit mask for a given data channel is set to [0] (unmasked), the data channel is tri-stated whenever the inhibit signal is asserted. If the inhibit mask is set to [1] (masked), the inhibit signal is not recognized, and the data channel is not tri-stated. Use the data entry keys to specify an inhibit mask. The default radix is hexadecimal. To change the radix, use the DISPLAY editing command. (Refer to callout 13, Edit Field, for more information.)

⑥ SEQ (Sequence) Field

Displays numbers that correspond to your program lines. When the SEQ field is set to ASEQ (absolute sequence numbers), the sequence lines are numbered from 0 through 2047. When the SEQ field is set to RSEQ (relative sequence numbers), the sequence lines are divided into Page A and Page B. These sequence lines are numbered Page A: 0—1023, and Page B: 0—1023. Only a portion of the sequence lines are displayed at any given time. To select either ASEQ or RSEQ, press the SELECT key until the desired value appears.

⑦ #DC and #BA Pattern Fields

Specifies the data pattern you wish to output through the P6464 probes. Data pods A, B, C, and D are grouped into pairs. The number that appears before the pairs (labeled DC and BA) corresponds to the slot in the DAS where the 91S32 module resides. Data patterns are entered line-by-line, one pod at a time, using the data entry keys. When the pattern generator is running, all pods output data synchronously with the output clock as specified in the Edge Positioning portion of the Timing sub-menu. Use the DISPLAY editing command (described earlier) to change the radix of the data; the default radix is hexadecimal. Data patterns always default to 0.

⑧ S (Strobe) Field

Selects whether or not the strobe channels associated with each pod will output signals when this particular program line is executed. The 91S32 Strobe field allows you to individually assert the strobe signals for pods D, C, B, and A. Data pods are grouped into pairs, and each pair is represented by a column in the Strobe field. Strobe values are entered according to the display radix. When more than one 91S32 is installed, the DAS expands the width of the Strobe field.

Strobes function just like additional data lines. Strobe transitions are synchronous with the output clock. In default, the strobe field is set to 0 (no strobes). Use the data entry keys to program this field on a line-by-line basis, or use the FILL command to program whole blocks of sequence lines in one operation. For details, refer to the FILL editing command described earlier in this reference guide.

⑨ I (Inhibit) Field

Works with the internal inhibit signal specified in the Probe sub-menu; selections include [INTERNAL 1] and [INTERNAL 0]. Your entry in the inhibit column must match the logic state (1 or 0) specified in the Probe sub-menu. Each bit in the inhibit column corresponds to a 91S32 pod pair (DC or BA). You must enter values for every sequence line of the I (Inhibit) field. The default value is 0 and the default radix is hexadecimal. The internal inhibit signal becomes effective synchronously with the output clock.

Assume the inhibit field is set to [INTERNAL 1 ONLY]. Entering a 0 in the Inhibit field prevents both pods in the pair from being tri-stated; both pods will continue to output data, clock, and strobe lines. Entering a 1 *hex* causes the outputs of Pod A to be tri-stated; 3 *hex* causes both Pod A and Pod B to be tri-stated; 11 *hex* causes Pods A and C to be tri-stated. The internal inhibit signal is synchronous with the output clock.

NOTE

Some data may still be output from a pod that has been tri-stated, because any value you set in the INHIBIT MASK field causes specific data lines to ignore the inhibit signal. Inhibit mask fields for the strobe and clock lines appear in the 91S32 Configuration sub-menu described earlier.

⑩ Edit Field

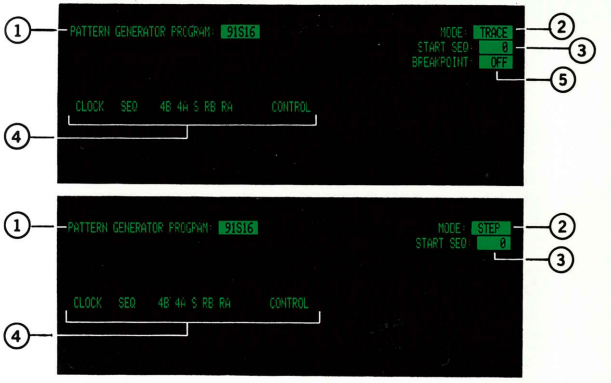
Contains nine commands that allow manipulation of patterns and instructions. These commands are designed to simplify programming of the Run sub-menu. Editing commands are basically the same for the 91S16 and the 91S32, except for the 91S32's SEARCH command. Since the 91S32 Run sub-menu does not use labels or instructions, the SEARCH command is only valid for numeric values. For details, refer to the *91S16 And 91S32 Operator's Manual Addendum.*

The DAS displays the edit commands in this alphabetical sequence:

[COPY]	[MODIFY]
[DELETE]	[MOVE]
[DISPLAY]	[SEARCH]
[FILL]	[CONVERSION]
[INSERT]	

For more information on these edit commands, refer to callout 13 in the 91S16 Run Sub-menu.

91S16 TRACE AND STEP SUB-MENUS



NOTE

The 91S16 Trace and Step sub-menus appear only when the 91S16 Pattern Generator Module is installed.

① PATTERN GENERATOR PROGRAM Field

Selects either the [91S16] or the [91S32] sub-menu. The 91S16 Run sub-menu is the default menu display.

② MODE Field

Selects one of the 91S16's three operating modes: [RUN], [TRACE], or [STEP]. In the Run mode, the pattern generator outputs data at the clock rate selected in the Configuration sub-menu. In Trace mode, the pattern generator runs on a slower clock, allowing you to monitor program execution. In Step mode, one sequence line is executed each time you press the START PAT GEN key.

NOTE

Use the INCR and DECR keys instead of the SELECT key to change between Trace and Step modes. This allows the current pattern generator settings to be maintained while switching between operating modes.

The TRACE mode allows continuous execution of the pattern generator program, at a slow clock rate, while you monitor program flow on the Trace sub-menu display. Using Trace mode, you can determine how often subroutines are called, how many times certain loops are executed, or where interrupt routines are activated. Trace mode also offers a breakpoint feature; refer to callout 4.

Use the START PAT GEN key to start Trace mode pattern execution. Execution stops when:

- keys other than SHIFT START PAT GEN are pressed, or
- a HALT instruction is encountered, or
- a breakpoint is encountered, or
- the pattern generator reaches SEQ 1023.

NOTE

Trace and Step modes do not support the CALL RMT, IF FULL JUMP, and IF FULL END commands.

③ START SEQ Field

Specifies the first sequence number to be executed when the pattern generator begins operation. Start the pattern generator by pressing either the START PAT GEN key or the START SYSTEM key. Using the data entry keys, program the START SEQ field to any number between 0 and 1023 (if no service interrupt has been programmed). If an interrupt has been programmed, select a number between 0 and 1022. Press DON'T CARE to return the field to 0.

④ Program Display Column Headings

CLOCK Heading. Shows the number of clocks generated since the pattern generator was started. The clock begins counting at 0 and is reset when it reaches 9999. Because of loops, jumps, and subroutine calls, the clock cycle may not correspond to the sequence line being executed.

SEQ Heading. Shows the sequence number of the program line that was just executed. It is the same sequence number that appears in the Run sub-menu. Use this number to monitor program flow.

#B and #A Heading. Displays the pattern delivered to the P6464 probe tips from pods A and B. The number preceding the A or B indicates the DAS slot containing the 91S16. A DON'T CARE in this field indicates that at least one channel for that pod has been tri-stated (assuming display in hexadecimal). The radix for this field can be changed by using the DISPLAY editing command in the 91S16 Run sub-menu.

S (Strobe) Heading. Displays the status of the strobe lines. An X (DON'T CARE) in this field indicates that at least one of the strobe lines has been tri-stated. The radix for this field can be changed by using the DISPLAY editing command in the 91S16 Run sub-menu.

⑤ BREAKPOINT Field

NOTE

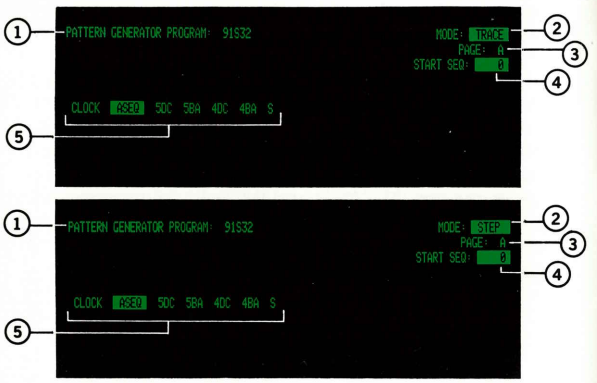
The BREAKPOINT field is only available in the Trace mode sub-menu.

Specifies a breakpoint at any sequence line in your program. First select BREAKPOINT [ON] then enter the breakpoint sequence in the field that appears on the next line. Use the data entry keys to enter a breakpoint; the default is 1023 (end of memory). Press DON'T CARE to return the breakpoint to SEQ 0. After executing the breakpoint sequence line, the pattern generator stops. Resume program execution by pressing the START PAT GEN key. The BREAKPOINT field default value is [OFF].

RB, RA, or R Heading. Displays the contents of the 91S16's two 8-bit registers, RB and RA, or one 16-bit register, R. The radices for these fields are set by the radices of the #B and #A data pattern fields. If the register's configuration is set for a single 16-bit register, the 8 most significant bits of this display column follow the radix set for #B; the 8 least significant bits follow the radix set for #A.

CONTROL Heading. Displays the CONTROL instructions as they are executed. The two CONTROL instructions are TRIGGER and INCR PAGE (increment page). For an explanation of these commands, refer to *91S16 Run Sub-Menu* earlier in this reference guide.

91S32 TRACE AND STEP SUB-MENUS



NOTE

The 91S32 Trace and Step sub-menus appear only when the 91S32 Pattern Generator Module is installed.

① PATTERN GENERATOR PROGRAM Field

Selects either the [91S32] or the [91S16] sub-menu. The 91S32 Run sub-menu is the default menu display.

② MODE Field

Selects one of the 91S32's three operating modes: [RUN], [TRACE], or [STEP]. In the Run mode, the pattern generator outputs data at the clock rate selected in the Configuration sub-menu. In Trace mode, the pattern generator runs on a slower clock, allowing you to monitor program execution. In Step mode, one program pattern sequence is executed each time you press the START PAT GEN key.

NOTE

Use the INCR and DECR keys instead of the SELECT key to change between Trace and Step modes. This allows the current pattern generator settings to be maintained while switching between operating modes.

The TRACE mode allows continuous execution of the pattern generator program, at a slow clock rate, while you monitor the program's flow on the Trace sub-menu display. Using Trace mode, you can determine how often subroutines are called, how many times certain loops are executed, or where interrupt routines are activated.

Use the START PAT GEN key to start Trace mode pattern execution. Execution stops when:

- keys other than SHIFT START PAT GEN are pressed, or
- a HALT instruction is encountered, or
- the sequence specified in the END SEQ field (91S32 Configuration sub-menu) is reached.

③ PAGE Heading

Indicates which page of the 91S32's memory is being executed.

④ START SEQ Heading

Specifies the first sequence number to be executed when the pattern generator begins operation. Start the pattern generator by pressing either the START PAT GEN key or the START SYSTEM key. Using the data entry keys, program the START SEQ field to any number between 0 and 2047 if you are using absolute sequence numbers (ASEQ). If you are using relative sequence numbers (RSEQ), the range is Page A: 0—1023, or Page B: 0—1023. For details on ASEQ and RSEQ numbers, refer to *91S32 Run Sub-Menu* earlier in this reference guide. Press DON'T CARE to return the field to 0.

⑤ Program Display Column Headings

CLOCK Heading. Shows the number of clocks generated since the pattern generator was started. The clock begins counting at 0 and is reset when it reaches 9999. Because of loops, jumps, and subroutine calls, the clock cycle may not necessarily correspond to the sequence line being executed.

SEQ Heading. Shows the sequence number of the program line that was just executed. It is the same sequence number that appears in the Run sub-menu. The heading may be ASEQ or RSEQ, depending on the selection set in the SEQ field of the 91S32 Run sub-menu.

#DC and #BA Headings. Display the pattern delivered to the P6464 probe tips from pod pairs DC and BA. The number preceding the letters indicates the DAS slot containing the 91S32. An X (DON'T CARE) in this field indicates that at least one channel for that pod has been tri-stated (assuming display in hexadecimal). The radix for this field can be changed by using the DISPLAY editing command in the 91S32 Run sub-menu.

S (Strobe) Heading. Displays the status of the strobe lines. An X (DON'T CARE) in this field indicates that at least one of the strobe lines has been tri-stated. The radix for this field can be changed by using the DISPLAY editing command in the 91S32 Run sub-menu.