Instructions

Tektronix

TLA7PG2
Pattern Generator Module

071-1306-00

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

www.tektronix.com

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General Safety Summary

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

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is indirectly grounded through the grounding conductor of the mainframe power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Symbols and Terms

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

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

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

Terms on the Product. These terms may appear on the product:

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

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

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

CAUTION
Refer to Manual

Preface

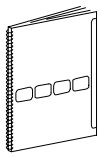
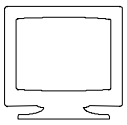
This manual provides high-level information for use of the Tektronix TLAPG2 Pattern Generator Module. Use this manual together with the Pattern Generator online help to use your Tektronix pattern generator.

Refer to the *TLA700 Series Logic Analyzer Instruction Manual* to install and configure the Tektronix pattern generator module.

Related Documentation

In addition to this instruction manual, the documentation listed in Table i is available for your Tektronix logic analyzer product. For documentation not specified in the table, contact your local Tektronix representative.

Table i: Tektronix TLAPG2 Pattern Generator Module documentation

Location	TLA Documentation
Documents available in printed form and downloadable from the Tektronix web site.	
  **tektronix.com**	Tektronix Logic Analyzer Family User Manual TLA700 Series Installation Manual TLA7PG2 Probe Instruction Manual TLA7UP Field Upgrade Kit Instructions
Documents available as PDF files on the documentation CD.	
	Tektronix Logic Analyzer Family User Manual TLA700 Series Installation Manual Tektronix Pattern Generator Programmatic Interface (PPI.com) TLA7PG2 Probe Instruction Manual PatGenVu Readme

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Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 6:00 a.m. - 5:00 p.m. Pacific time

*** This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

Pattern Generator Module Introduction

The pattern generator module adds pattern generator capability to the logic analyzer. You can generate specific data patterns to a target system and then use the logic analyzer to evaluate the resultant data from the target system.

The pattern generator module functionality can be divided into blocks as shown in Figure 1. Refer to the figure as you read about the functional blocks.

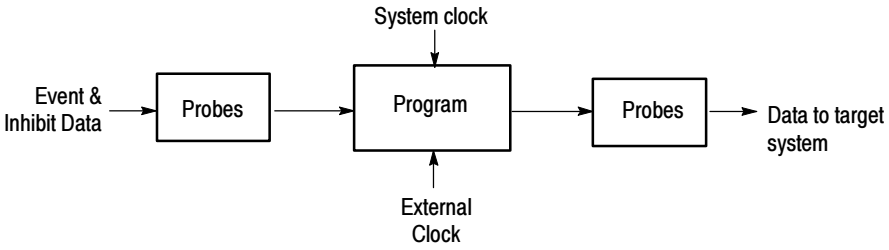


Figure 1: Block diagram of the pattern generator module

Probes

The probe interface serves two purposes: to detect event and inhibit information and to output data to a target system. In addition to sending pattern generator data to the target system, the probe also sends clock and strobe information.

You can connect up to four probes to a single module. Each probe supports either 8 or 16 channels.

For information about connecting the Pattern Generator probes to both the TLA7PG2 module and the target system, refer to the *TLA700 Series Logic Analyzer Installation Manual*.

Pattern Generator Program

The pattern generator program is the heart of the pattern generator module. You can create blocks of data vectors to work together to create complex pattern generator programs. The program uses external and internal events to determine specific actions such as loops and branches to other data blocks. The program can be controlled by an internally selected clock or by an external clock through a front-panel BNC connector.

Use the Sequence Definition page of the Program window to set up and define a sequence events that make up the pattern generator program. Each sequence line determines how the pattern generator will use blocks of data that you define in the Pattern Generator Listing or Waveform window. You can set up the program to wait for specific events or signals and then jump to a different sequence when an event is either true or false.

You can also set up the pattern generator to single step through programs and output a single set of vectors with each clock cycle. This is useful for trouble-shooting or debugging setups.

For information about installing the Pattern Generator program, refer to the *TLA700 Series Logic Analyzer Installation Manual.*

Setting Up the Pattern Generator Module

The pattern generator modules, like the LA modules, have a Setup window where you can specify the individual module setups, channel setups, probe setups, and signal setups. You should define these parameters before setting up the pattern generator program in the Program window.

Module Setup Window

Use the Module Setup window to define the channel mode, Run mode, clocking, and event setups. Figure 2 shows an example of the Module Setup window.

- Use the channel mode to select the speed and width of the logical module. Define the channel mode before defining other parameters. Otherwise, all module information will be lost when you change the channel mode.
- Set the Run mode to Step to output the patterns vectors one at a time. Use the Step button in the Status Monitor window to advance the steps. Set the Run mode to Continuous to output all vectors in a single step.
- Select the Hi-Z on Stop to cause the probes data and strobe outputs to go to a high-impedance state when the program stops.
- Use the Clocking to select an internal or external clock. When you select an external clock, you can also select the polarity and the threshold levels.
- Use the Event setups to filter out events, enable inhibit functions, and to define whether the pattern generator responds to events due to edges or levels.

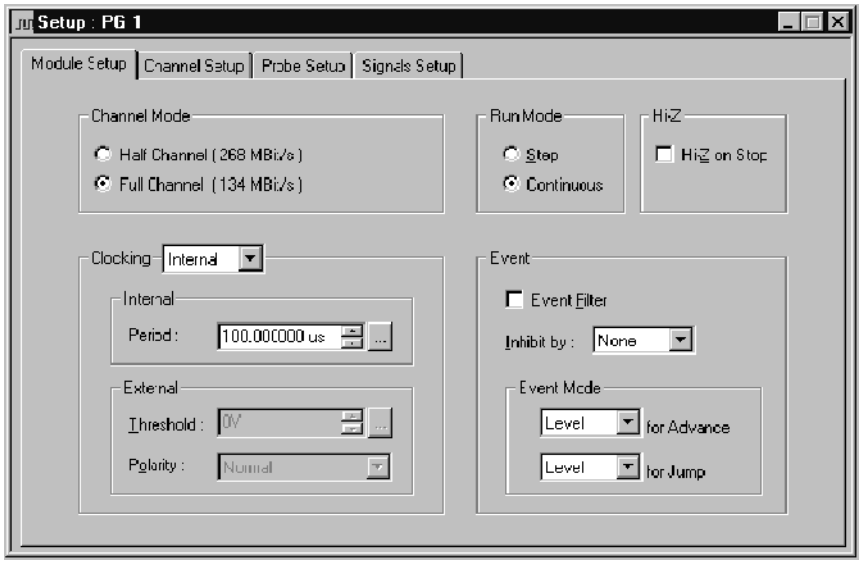


Figure 2: Module Setup window

Channel Setup Window

The Channel Setup window functions like the Channel Setup window in the LA modules. Use this window to define the channel group names, the logical grouping of channels, and the individual channel names. Figure 3 shows an example of the Channel Setup window.

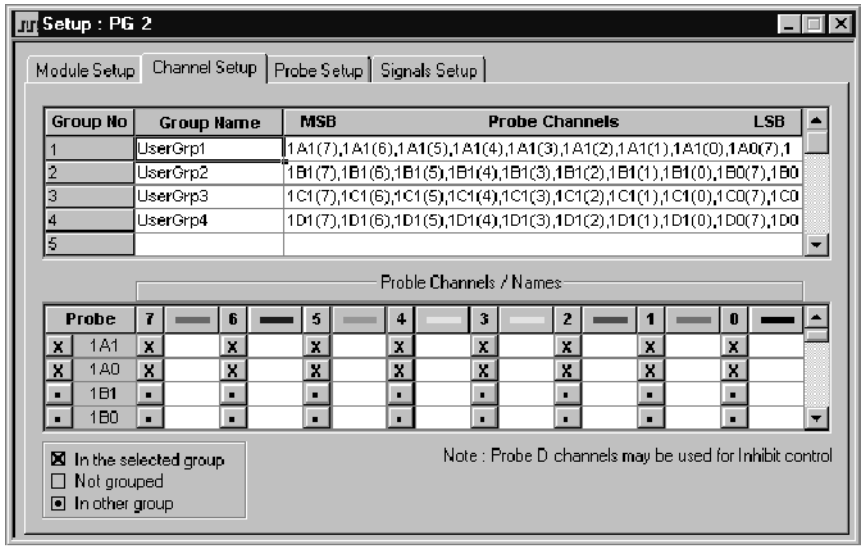
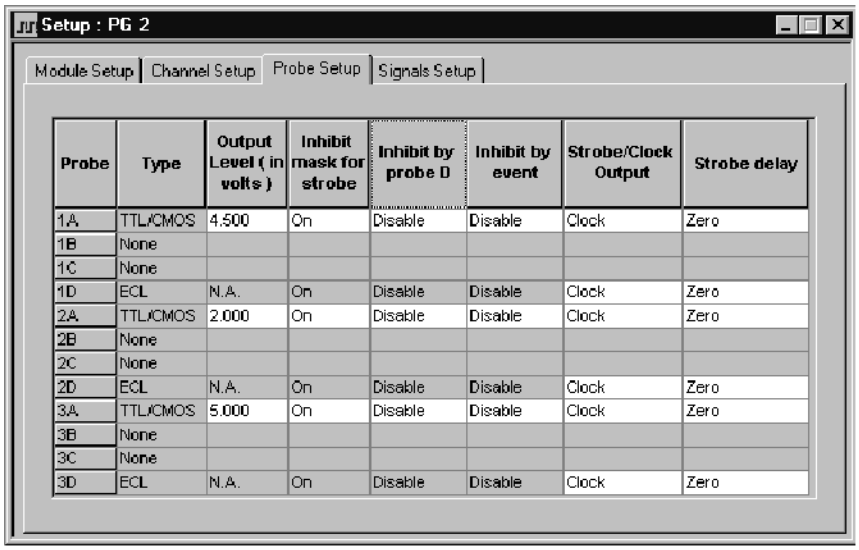


Figure 3: Channel Setup window

Probe Setup Window

Use the Probe Setup window to specify the probe details such as the output threshold voltage and inhibit information. Figure 4 shows an example of the Probe Setup window.



Probe	Type	Output Level (in volts)	Inhibit mask for strobe	Inhibit by probe D	Inhibit by event	Strobe/Clock Output	Strobe delay
1A	TTL/CMOS	4.500	On	Disable	Disable	Clock	Zero
1B	None						
1C	None						
1D	ECL	N.A.	On	Disable	Disable	Clock	Zero
2A	TTL/CMOS	2.000	On	Disable	Disable	Clock	Zero
2B	None						
2C	None						
2D	ECL	N.A.	On	Disable	Disable	Clock	Zero
3A	TTL/CMOS	5.000	On	Disable	Disable	Clock	Zero
3B	None						
3C	None						
3D	ECL	N.A.	On	Disable	Disable	Clock	Zero

Figure 4: Probe Setup window

Signal Setup Window

Use the Signal Setup window to define the input and output signals. After defining these signals, you can use them in the Program window to control the flow of the pattern generator program. You can use one of the backplane signals as an input to the pattern generator module and another backplane signal as an output signal. For more information on using signals, refer to the *Intermodule and External Signaling* section in the *Tektronix Logic Analyzer Family User Manual*.

Figure 5 shows an example of the Signal Setup window.

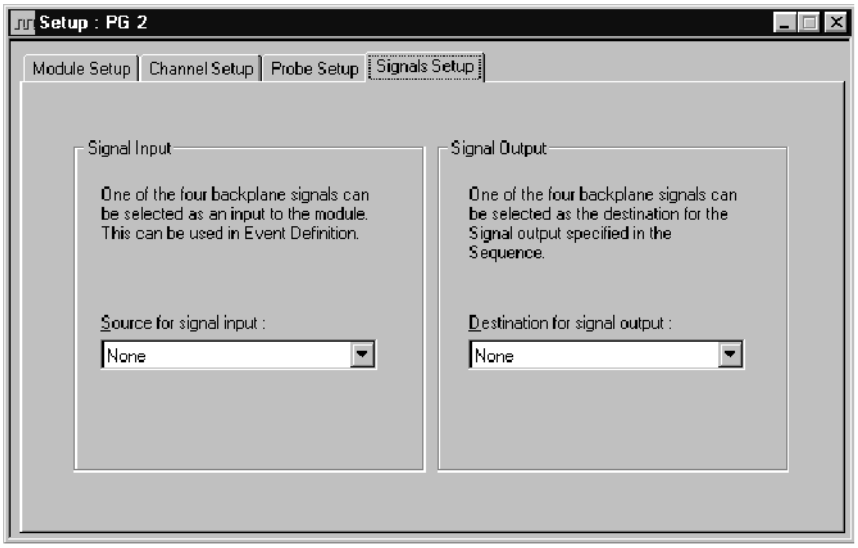


Figure 5: Signals Setup window

Setting Up the Pattern Generator Program

After you have defined the module setups, you can use the Program window to define the pattern generator program. Use the Program windows in the following sequence:

1. Use the Block Definition window together with the Listing or Waveform window to define the data blocks and the vectors in each block.
2. Use the Sequence Definition window to define a high-level sequence flow of the pattern generator program.
3. Use the Subsequence Definition window to define subsequences or macros. You can call these subsequences in the Sequence Definition window.
4. Use the Event Definition window to define how events are used with the pattern generator program.

Block Definition Window

Use the Block definition window to define blocks of output data. You can define the size of each block and assign each block a meaningful name (such as Init, Read Cycle, Interrupt). Each block has its own associated Listing or Waveform window. Figure 6 shows an example of the Block Definition window.

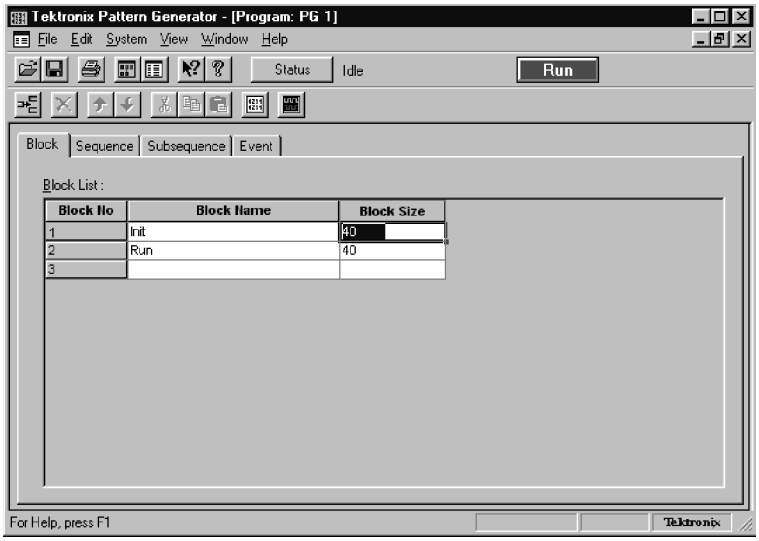
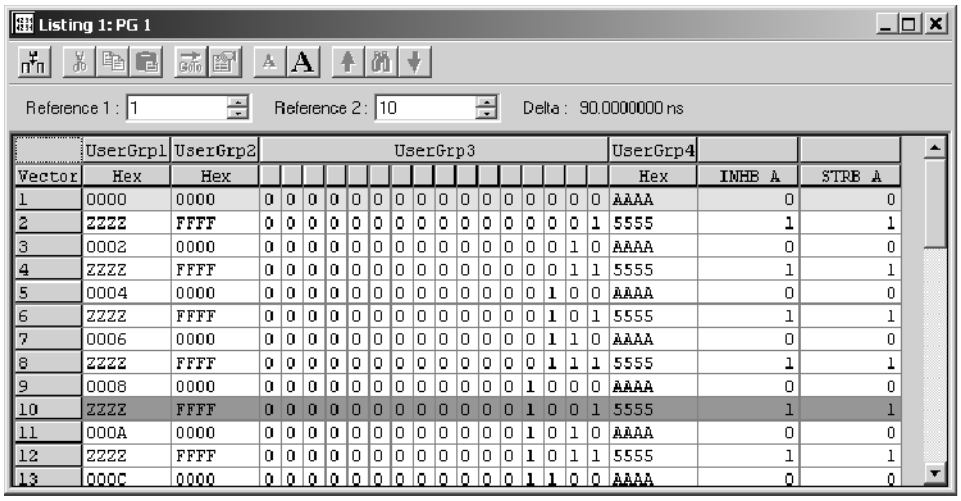


Figure 6: Block Definition window

Use the Listing and Waveform windows to enter the data vectors. Click the Listing window icon to open the Listing window for the current block and enter the vector data. You can edit the vectors in either the Listing or Waveform windows.



	UserGrp1	UserGrp2	UserGrp3															UserGrp4		
Vector	Hex	Hex																Hex	INHB A	STRB A
1	0000	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	AAAA	0	0
2	ZZZZ	FFFF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5555	1	1
3	0002	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	AAAA	0	0
4	ZZZZ	FFFF	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	5555	1	1
5	0004	0000	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	AAAA	0	0
6	ZZZZ	FFFF	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5555	1	1
7	0006	0000	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	AAAA	0	0
8	ZZZZ	FFFF	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	5555	1	1
9	0008	0000	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	AAAA	0	0
10	ZZZZ	FFFF	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	5555	1	1
11	000A	0000	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	AAAA	0	0
12	ZZZZ	FFFF	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	5555	1	1
13	000C	0000	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	AAAA	0	0

Figure 7: Listing window

Sequence Definition Window

After defining the data blocks, use the Sequence Definition window to create a high-level overview of the pattern generator program. Figure 8 shows an example of the Sequence Definition window. You can do the following tasks with sequences:

- Output the data blocks. Use the data blocks that you defined in the Block Definition window. You can specify how many times you want to output the data blocks.
- Determine the program flow. You can wait for an external event to occur before outputting the data blocks. You can also pass the program control to another sequence by jumping to a specific sequence label.
- Use Subsequences to execute or control the program flow. Subsequences are macros that you define in the Subsequence Definition window. For example, you can use a subsequence to output a read cycle five times and then output a write cycle before returning control to the main program sequence.
- Output a high or low signal to a defined event line. The event line is the one you defined in the Signal Setup window.

Each sequence has its own line. Use labels for each line to help with the program flow. Unless you set up a data block to be repeated an infinite number of times, the program flow will pass to the next sequence (or jump to a defined label). When the last sequence has been executed, the program flow stops.

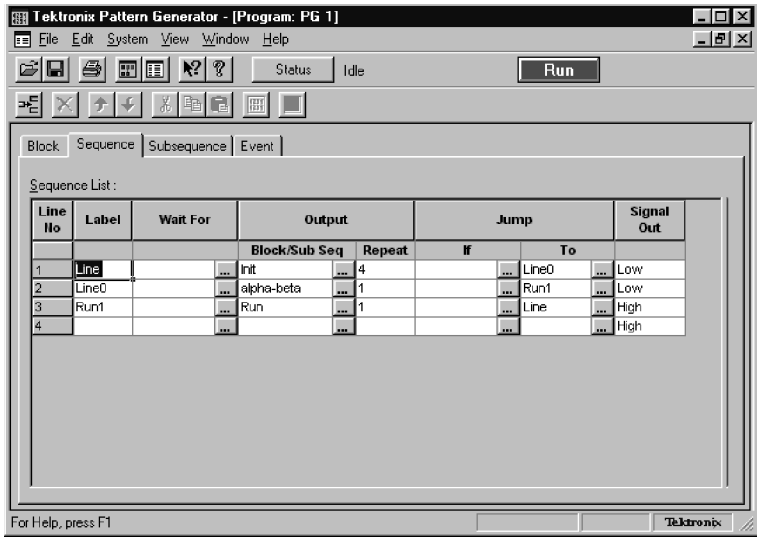


Figure 8: Sequence Definition window

After defining a sequence, you can display a graphical image of the sequence flow by clicking and dragging the vertical bar on the right side of the Sequence Definition window (see Figure 9).

The appearance of the sequence flow depends on the sequence definition. Each sequence line has its graphic (see Figure 10).

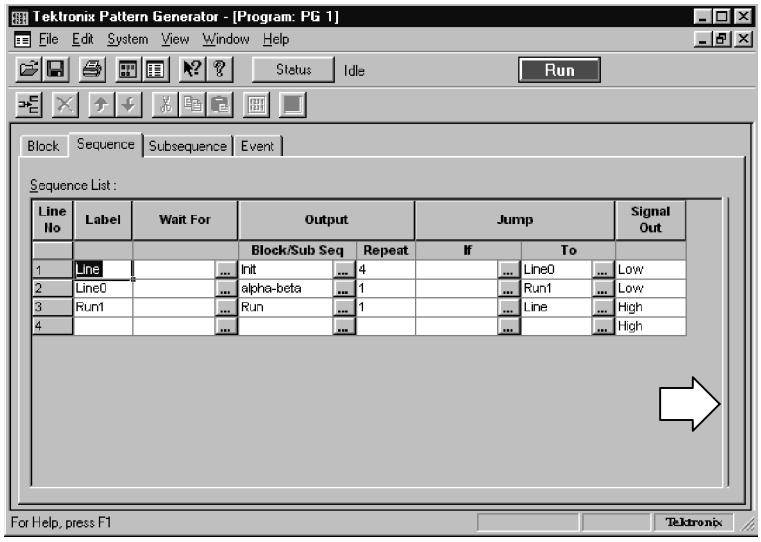


Figure 9: Drag the vertical bar to the left to display the sequence flow graphic

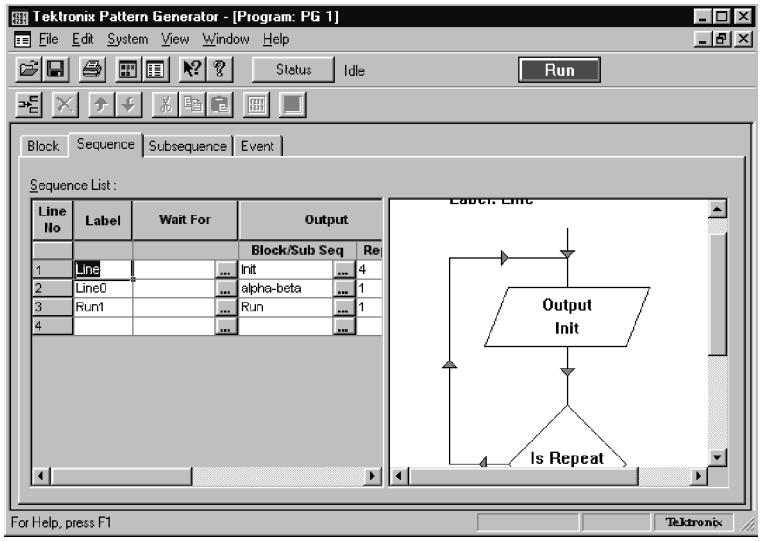


Figure 10: Sequence flow graphic

Subsequence Definition Window

Use the Subsequence Definition window to define macros to use in the Sequence Definition window. Subsequences are useful for defining tasks that you may not want to appear directly in the Sequence Definition window.

Assign a name for the subsequence in the left side of the window. This name will appear in the Sequence Definition window. Define the actual tasks (data blocks) in the right side of the window. The block names are the ones you defined in the Block Definition window. Figure 11 shows an example of the Subsequence Definition window.

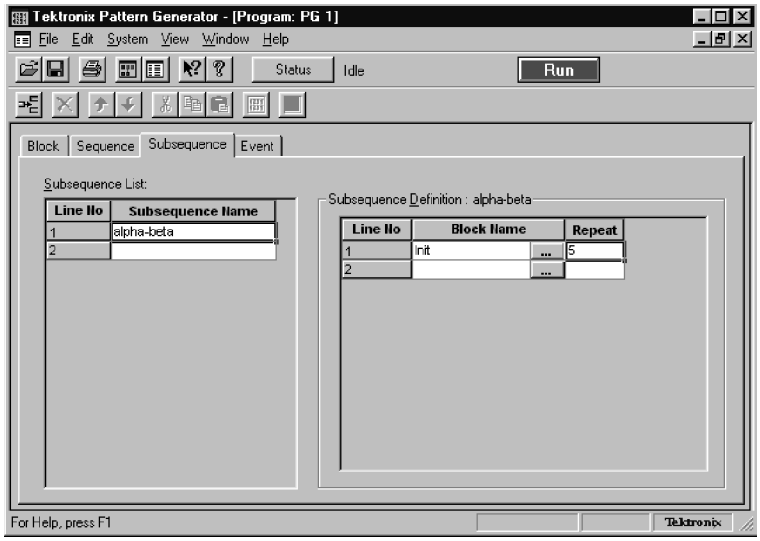


Figure 11: Subsequence Definition window

Event Definition Window

Use the Event Definition window to define events that you can use in the Sequence Definition window. Enter an event name in the left side of the window and then define events in the right side of the window.

Signal events refer to the input backplane input signal that you defined in the Signal Setups window. The Probe events refer to the input signals on each probe; each probe can have two event lines. Figure 12 shows an example of the Event Definition window.

The events in each row are logically ANDed together while the rows are logically ORed together.

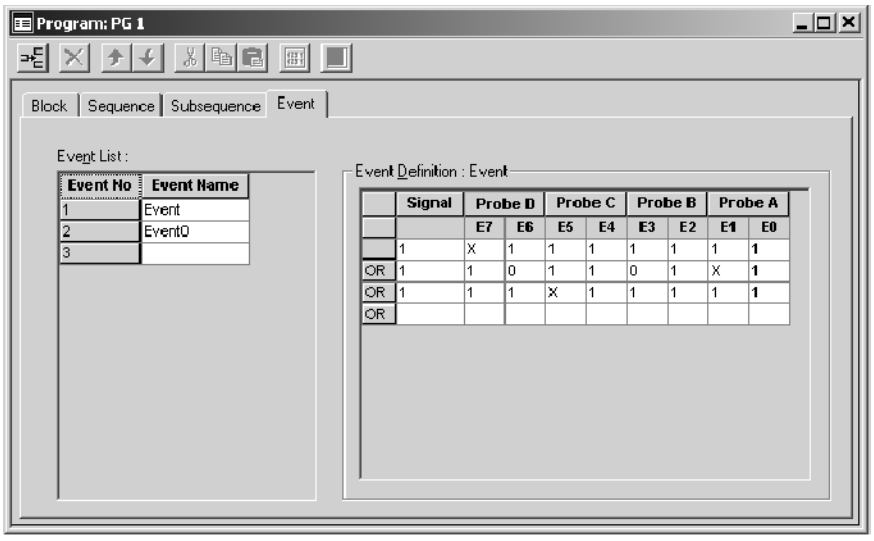


Figure 12: Event Definition window

Appendix A: TLA7PG2 Pattern Generator Module Characteristics

Tables 1 through 6 list the specifications for the pattern generator module. For information on the individual pattern generator probes, refer to *TLA7PG2 Pattern Generator Probe Instruction Manual*.

Table 1: PG module electrical specification, operational mode

Characteristic	Description	
Operational mode		
Normal	Pattern data output is synchronized by the internal/external clock input	
Step	Pattern data output is synchronized by the software command	
Output pattern		
✓ Maximum Data Output Rate Output level: 5 V Load: 1 MΩ + 1 pF Series termination resistor: 75 Ω	134 Mb/s in Full Channel Mode 268 Mb/s in Half Channel Mode	
Maximum Clock Output Frequency Output level: 5 V Load: 1 MΩ + 1 pF Series termination resistor: 75 Ω	134 MHz in Full Channel Mode 134 MHz in Half Channel Mode	
Maximum Operating Frequency	The maximum operating frequency of the module is a function of the output level, output pattern and the load condition, including the series termination resistor in the probe. Operating conditions exceeding this frequency may result in damage to the probe.	
Pattern length	40 to 262,140 (2^{18} - 4) in Full Channel Mode (standard) 80 to 524,280 (2^{19} - 8) in Half Channel Mode (standard) 40 to 1,048,572 (2^{20} - 4) in Full Channel Mode (option 1M or PowerFlex upgrade) 80 to 2,097,144 (2^{21} - 8) in Half Channel Mode (option1M or PowerFlex upgrade)	
Number of channels	64 channels in Full Channel Mode 32 channels in Half Channel Mode The pattern memory for the following data channel will be shared with strobe control/internal inhibit control	
	Probe D data output channel	*Control*
	D0:0	STRB0
	D0:1	STRB1
	D0:2	STRB2
	D0:3	STRB3
	D0:4	Inhibit probe A

Table 1: PG module electrical specification, operational mode (Cont.)

Characteristic	Description	
	D0:5	Inhibit probe B
	D0:6	Inhibit probe C
	D0:7	Inhibit probe D
Sequences	Maximum 4,000	
Number of blocks	Maximum 4,000	
Number of subsequences	Maximum 50	
Subsequences	Maximum 256 steps	
Repeat count	1 to 65,536 or infinite	

Table 2: PG module clocking

Characteristic	Description
Internal clock	
Clock Period	2.0000000 s to 7.462865 ns in Full Channel Mode 1.0000000 s to 3.7313432 ns in Half Channel Mode
Period Resolution	8 digits
Frequency Accuracy	± 100 PPM
External clock input	
Clock Rate	DC to 134 MHz in Full Channel Mode DC to 267 MHz in Half Channel Mode
Polarity	Normal or Invert
Threshold	
Range	-2.56 V to +2.54 V
Resolution	20 mV
Input Impedance	1 kΩ terminated to GND
Sensitivity	500 mV_{p-p}

Table 3: PG module event processing

Characteristic	Description
Event Action	Advance, Jump and Inhibit
Number of Event Inputs	8 External Event Inputs (2 per each probe)
Number of Event Definitions	8 (A maximum of 256 event input patterns can be OR'd to define an event)

Table 3: PG module event processing (Cont.)

Characteristic	Description
Event Mode	
for Advance	Edge or Level
for Jump	Edge or Level
Event Filter	None or 50 ns

Table 4: PG module inter-module interactions

Characteristic	Description
Signal Input	Input from backplane Selectable from Signal 1, 2, 3, and 4 Used to define the Event
Signal Output	Output to backplane Selectable from Signal 1, 2, 3, and 4 Specified as High or Low in each Sequence line

Table 5: PG module merged PG modules

Characteristic	Description
Number of modules that can be merged together	Five
External Event Input for merged module	For Jump and Advance, only the External Event Input of the leftmost module is used. For Inhibit, each module uses its own External Event Input as a source

Table 6: PG module mechanical

Characteristic	Description
Slot width	Requires two mainframe slots
Weight (Typical)	2.5 kg (5 lbs. 4 oz.)
Overall dimensions (excluding connectors)	
Height	10.32 in (262 mm)
Width	2.39 in (61 mm)
Depth	14.7 in (373 mm)
Mainframe interlock	1.4 ECI keying is implemented

Appendix B: Pattern Generator Physical-Logical Conversion

The logic analyzer and DSO modules handle signals 1, 2, 3, and 4 with a logical expression (True/False). However, the pattern generator module handles these signals with a physical expression (High/Low). Select whether to use the signals as AND or OR from the TLA application's Signals property page of the System Configuration window. Use Tables 7 and 8 to convert physical expressions to logical expressions or vice versa.

Table 7: For Signal 1, 2, and 3, 4, (logical function AND)

LA/DSO expression	Logical true	Logical false
Pattern generator signal output	High	Low
Pattern generator event definition	1	0

Table 8: For Signal 3, 4 (logical function OR)

LA/DSO expression	Logical true	Logical false
Pattern generator signal output	Low	High
Pattern generator event definition	0	1

Only one module in the system can drive Signal 1. Only one module in the system can drive signal 2. When used with an expansion mainframe, all modules that drive Signal 3 should be in the same mainframe, and all modules that drive Signal 4 should be in the same mainframe.