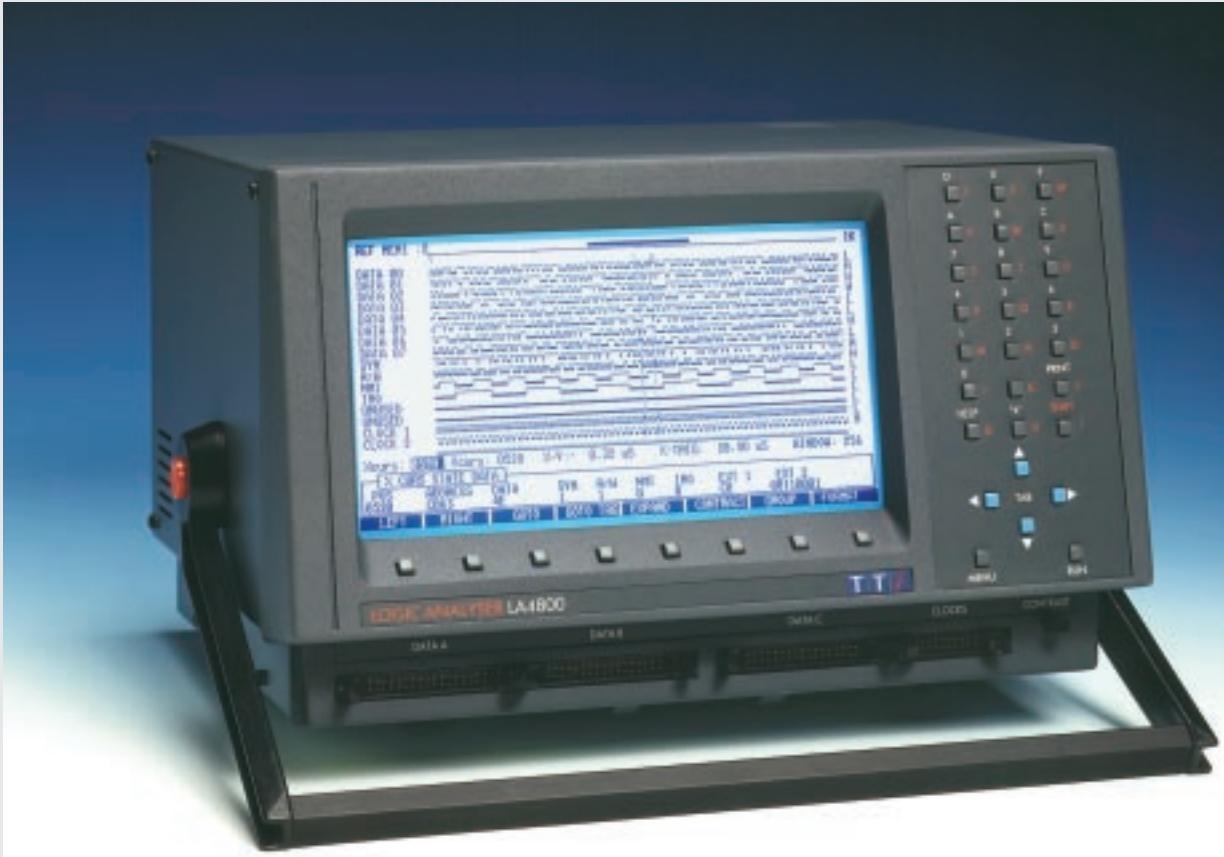# TTi

THURLBY THANDAR INSTRUMENTS

LA3200/4800

32 & 48 channel logic analysers

- 32 channels (LA3200) or 48 channels (LA4800)
- 25MHz synchronous operation on all channels
- 100MHz asynchronous operation (8 or 12 channels)
- 5ns glitch capture capability
- Multi-level trigger sequencing
- Non-volatile data and set-up memories
- Disassembler options for popular uPs
- Low costs

Until now, buying a truly low cost logic analyser meant buying a very limited specification; a limited number of channels, limited speed, limited trigger capabilities and limited display facilities.

A specification far in excess of its price

The LA3200 and LA4800 have a specification that meets the needs of all but the most demanding of applications. 32 or 48 data channels, 100MHz maximum acquisition speed, 5ns glitch capture, multi-level trigger sequencing, and many other advanced features.

An essential instrument within every area

The capabilities of a logic analyser have become important within virtually every area of electronics. Development, production, service and education all have a need for logic analysis but the high prices have discouraged many potential users from purchasing one. Now TTi have made high performance logic analysers affordable.

An exceptionally easy to use instrument

Logic analysers can be daunting. The more sophisticated the instrument, the more difficult it can be to use. TTi understand this problem, thats why the LA3200 and LA4800 have an on-screen instruction manual, pre-programmed example set-ups, and a context sensitive 'help' key. That means that even novice users can get results fast.

A big screen in a compact & lightweight package

The LA3200 and LA4800 have a 9 inch high resolution LCD screen which uses the latest cold-cathode fluorescent technology to give superb viewability in all lighting conditions. Despite this large screen, the instruments are considerably smaller and lighter than other logic analysers thus reducing bench space and improving portability.

Hard-copy output and remote interfaces

Both units have an RS-423 serial interface (RS-232 compatible) as standard. This enables data and set-up information to be transferred to and from other equipment. An IEEE-488 interface with the same capabilities is optional.

Built-in printer driver routines enable listings and screen dumps to be printed out via the serial interface and a serial to centronics converter cable is available for use with parallel input printers.

More channels and a deeper memory

TTi offers you a choice of 32 or 48 data channels at DC to 25MHz to cope with the increasing complexity of today's digital equipment. Of equal importance is the memory depth which is a full 8K on all 32 or 48 channels

100MHz asynchronous acquisition

When making timing measurements you need as much speed as you can get, so TTi gives you a full 100MHz on 8 or 12 channels.

5 nanosecond glitch capture

Glitch capture allows you to see very short pulses which are beyond the resolution of the analyser's sample clock. TTi enable you to detect glitches down to 5ns on 16 or 24 channels and provide glitch trigger. Its an important facility for finding some types of fault.

Multiple clocks for complex synchronous capture

The LA3200 and LA4800 have three external clock inputs each with its own qualifier selectable for active edge and active level respectively. This gives highly flexible clocking for synchronous data capture from DC up to 25MHz.

Multi-level trigger sequencing

The most important requirement of a logic analyser is that it should capture exactly the data that you need. That requires sophisticated triggering. TTi give you a four step sequencer with event counting and redirection on each step allowing skip and restart. Trigger words are full width and can include NOT words.

Full width trace control and data qualification

The instruments provide full width trace start and trace stop words to control the recording of data. By defining the trace stop word to be the NOT of the trace start word full width data qualification is provided. Without it you could be filling the memory with unwanted data.
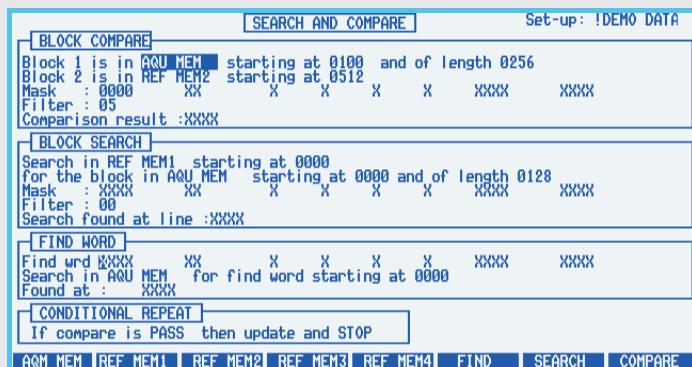
Free-format state listings

The state listing screen can be formatted exactly how you want it. Multiple groups can be defined with groups of channels appearing in differing radixes under user defined names. Input channels can be repeated within different groups enabling the same data to be displayed in several radixes simultaneously.

Powerful search and compare facilities

The analysers can search for a word or a block of any length in any memory. A block of any length and any position can be compared with with a block in any position in any memory using a bit mask and a skew filter. Acquisition can be started or stopped depending on the results of the comparison enabling an automatic 'fault-finder' mode to be set up.

```
                    ┌─ SEARCH AND COMPARE ─┐      Set-up : !DEMO DATA
 ┌─ BLOCK COMPARE ─┐
 Block 1 is in AQU MEM   starting at 0100  and of length 0256
 Block 2 is in REF MEM2  starting at 0512
 Mask  : 0000      XX       X   X   X   X    XXXX     XXXX
 Filter : 05
 Comparison result :XXXX
 ┌─ BLOCK SEARCH ─┐
 Search in REF MEM1  starting at 0000
 for the block in AQU MEM   starting at 0000 and of length 0128
 Mask  : XXXX      XX       X   X   X   X    XXXX     XXXX
 Filter : 00
 Search found at line :XXXX
 ┌─ FIND WORD ─┐
 Find wrd XXXX      XX       X   X   X   X    XXXX     XXXX
 Search in AQU MEM   for find word starting at 0000
 Found at :      XXXX
 ┌─ CONDITIONAL REPEAT ─┐
 If compare is PASS  then update and STOP
 AQM MEM │ REF MEM1 │ REF MEM2 │ REF MEM3 │ REF MEM4 │ FIND │ SEARCH │ COMPARE
```

Non-volatile data and set-up memories

Multiple non-volatile reference memories are provided for storing data. Each can be annotated with a user description. Fourteen non-volatile set-up memories are provided, also with user annotation, so that the complete configurations for a number of jobs can be stored permanently.

Easy connection to your target equipment

A logic analyser is of little use unless you can connect it easily to the equipment under test. TTi offers a range of data pods and connectors to suit virtually any requirement.

Combination data pods (AP01 for 32 channels and AP02 for 48 channels) provide a low cost solution by combining all the data and clock inputs on a single pod. These provide state or timing analysis up to 25MHz.

High Speed data pods group the data channels into blocks of 16 and provide 25MHz state, 100MHz timing and Glitch Capture. A separate clock pod is needed. These pods are available in both fixed threshold (AP03) and variable threshold (AP03V) versions with corresponding clock pods (AP04 or AP04V).

All pods come complete with colour coded connection leads which are terminated in 0.025" sockets. These are suitable for direct connection to many types of IC test clips, backplane connectors and PCB test pins. Plug-in logic grabbers are optional.
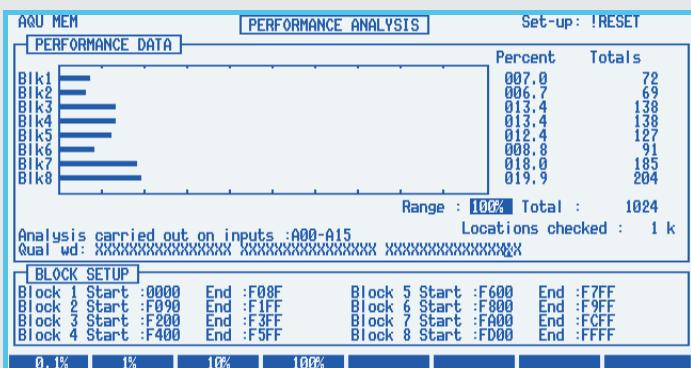
LA4800 additional features

The additional 16 channels of the LA4800 give it extra 'future proofing'. 48 channels provide for the analysis of more complex hardware systems and are essential for the disassembly of microprocessors such as the 68000.

Extra reference memories

The LA4800 has four non-volatile reference memories (the LA3200 has two).

Performance analysis

The LA4800 provides statistical analysis which is very valuable in analysing the performance of a digital system. A histogram can be generated for a group of channels over a defined number of acquisitions. The histogram shows the occurence of states within each of up to 8 user specified ranges as an absolute number and as a percentage.

```
 AQU MEM                ┌─ PERFORMANCE ANALYSIS ─┐     Set-up : !RESET
 ┌─ PERFORMANCE DATA ─┐
                                            Percent   Totals
 Blk1  ▆                                     007.0       72
 Blk2  ▆                                     006.7       69
 Blk3  ▆▆▆                                   013.4      138
 Blk4  ▆▆▆                                   013.4      138
 Blk5  ▆▆                                    012.4      127
 Blk6  ▆                                     008.8       91
 Blk7  ▆▆▆▆                                  018.0      185
 Blk8  ▆▆▆▆                                  019.9      204
                              Range : 100%  Total :     1024
                                      Locations checked :  1 k
 Analysis carried out on inputs :A00-A15
 Qual wd: XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX
 ┌─ BLOCK SETUP ─┐
 Block 1 Start :0000  End :F08F   Block 5 Start :F600  End :F7FF
 Block 2 Start :F090  End :F1FF   Block 6 Start :F800  End :F9FF
 Block 3 Start :F200  End :F3FF   Block 7 Start :FA00  End :FCFF
 Block 4 Start :F400  End :F5FF   Block 8 Start :FD00  End :FFFF
 │ 0.1% │ 1% │ 10% │ 100% │    │    │    │    │
```

Signature analysis

The LA4800 provides signature analysis which is very useful for the Go - NoGo testing of digital equipment. It enables a section of data within any of the memories to be compressed into a 4 digit hex 'signature'. Signatures are available per channel, per group of channels and per memory, and can be automatically compared with signatures from another memory.

Analog display mode

The LA4800 provides an analog display mode whereby the analog equivalent of an 8 bit digital word from the input channels is displayed. This facility can be used to reconstruct any digitised analog information such as the output of an analog to digital converter.

A wide range of microprocessor disassembler options

```
 AQU MEM                ┌─ DISASSEMBLER DISPLAY ─┐   Set-up:  DEMO DATA
 CURS   ADDR  DATA      OPERATION      NMI  IRQ  UNUSED
 0558   E1F1  8D 0F C0  STA $C00F       1    0   0000
 0562   E1F4  8D 00 10  STA $1000       1    0   0000
 0566   E1F7  20 5E E2  JSR $E25E       1    0   0000
 0572   E25E  C6 43     DEC $43         1    0   0000
 0577   E260  A5 43     LDX $43         1    0   0000
 0580   E262  29 07     AND #$07        1    0   0000
 0582   E264  AA        TAX             1    0   0000
 0584   E265  60        RTS             1    0   0000
 0590   E1FA  BD AE E3  LDA $E3AE,X     1    0   0000
 0594   E1FD  8D 00 10  STA $1000       1    0   0000
 0598   E200  B5 10     LDA $10,X       1    0   0000
 0602   E202  A8        TAY             1    0   0000
 0604   E203  B9 37 E3  LDA $E337,Y     1    0   0000
 0608   E206  E4 2A     CPX $2A         1    0   0000
 0611   E208  D0 02     BNE $E20C       1    0   0000
 0614   E20C  8D 0F C0  STA $C00F       1    0   0000
 0618   E20F  A9 C2     LDA #$C2        1    0   0000
 0620   E211  8D 06 C0  STA $C006       1    0   0000

 EXPANDED MODE : OFF

 INCREMENT │ DECREMENT │ PAGE INC │ PAGE DEC │ GOTO │ GOTO TRG │ RE-SYNCH │ OPTIONS
```

Disassembler pods with built-in firmware are available for a wide range of popular 8-bit and 16-bit microprocessors. Because the disassembler firmware is incorporated in the pod, disassemblers can be interchanged at will.

Microprocessors supported include:

Z80, 64180,

8031/8051, 8085, 8086, 8088,

6801/6803/6301/6303, H8/300,

6502, 6800/6802, 6809,

68HC11, 68000.

Technical Specifications

(LA4800 spec. in brackets where different)

SIGNAL INPUTS

Number of data channels:
32 *(48)*, 16 per connector

Number of clock inputs:
3 independent clocks, active edge can be independently selected for each. Data is stored on the OR of the three active clock edges.

Number of clock qualifiers:
3; 1 for each clock. Selectable as high, low or don't care.

Input characteristics:
See "Input Connection Options".

MEMORY ORGANISATION

Data memory size:
32 *(48)* bits x 1K deep (normal mode) or
32 *(48)* bits x 8K deep (deep mode) or
8 *(12)* bits x 1K or 8K deep (high speed mode).

Reference memory size:
2 *(4)* non-volatile memories each of 32 *(48)* bits x 1K deep.

Set-up memory:
Non-volatile storage for up to 14 set-ups.

EXTERNAL CLOCK

Frequency range:
DC to 25MHz.

Organisation:
3 independent clocks, individually qualified. Data is recorded on the logical OR of each active clock edge.

Data set-up and hold times:
15ns set-up; 0ns hold.

INTERNAL CLOCK

Clock rate:
Selectable 40ns to 10ms (25MHz to 100Hz) in 1:2:5 sequence (normal asynchronous modes). 10ns (100MHz) in high speed timing mode (requires high speed data pods).

GLITCH CAPTURE

(Only available with high speed data pods fitted)

Number of channels:
8 per pod when in glitch mode.

Minimum detectable pulse:
5ns

TRIGGERING

Trigger sequencer words:
4 words of up to 32 *(48)* bits

Trigger sequencer terms:
Each term can be the logical combination (including NOTs) of any number of the sequencer words.

Trigger sequencer steps:
Up to 4 steps with two comparisons and redirections per step, e.g. IF X THEN GOTO STEP N, IF Y THEN GOTO STEP M. Event counting on each step.

Trigger filter:
1 to 13 clock events.

Trigger position:
Selectable anywhere between 100% pre-trigger and 100% post trigger plus up to 24,000 clocks of post-trigger delay.

Trace control:
Any trigger word can be used as a trace start word or a trace stop word allowing comprehensive qualification of the data stored.

Glitch Triggering:
Glitch words can be ANDed with normal trigger words.

TIMING DISPLAY

Number of channels:
Any 16 channels plus a timing scale (channels may be repeated).

Channel labelling:
Each channel can be uniquely labelled with up to 8 characters.

Number of samples:
For normal mode the full 1K memory depth can be displayed with an expansion of x1, x4, x16 or x64. For deep mode the full 8K memory depth can be displayed with an expansion of x1, x8, x32, x128 or x256. The expansion window can be moved anywhere in the store. The position of the window is shown graphically.

Cursor system:
There are two moveable cursors and a fixed trigger marker. The display shows the absolute and relative position of each within the store with the data value at the reference cursor (selectable base format). The positions are shown graphically within the window position indicator.

Glitch display:
Glitches are displayed as narrow vertical lines.

State information:
The state of all 32 *(48)* channels at the reference cursor position is displayed in the format as set within the State Display system.

STATE DISPLAY

Channel groups:
Up to eight groups can be defined. Each group can be given a user defined name. Each group can have up to 16 channels. Channels can be randomly positioned and repeated in different groups.

Display format:
Each individual group can be displayed in its own radix of binary, octal, decimal, hex, or ASCII. Each group is displayed under a user-defined label. 16 consecutive store locations from the selected memory (main or reference) can be selected and scrolled up and down. The start line can also be selected directly from the keyboard.

SEARCH AND COMPARE

Word Search:
An individual word can be searched for in any memory. A mask can be specified.

Block Search:
A block of any length and any position can be searched for in any memory. A mask can be specified and a filter can be set.

Page Compare:
The current page can be compared with the same page in another memory. Differences are displayed in reverse video.

Block Compare:
A block of any length and any position can be compared with a block of similar length and any position within any memory. A mask can be specified and a filter can be set.

Conditional Repeat:
During data acquisition, the block compare function can be operated automatically. The acquision can be stopped on an equality or an inequality.

Mask and Filter:
A mask specifies which parts of the data are to be defaulted to don't care for the purposes of a search or a comparison. A filter specifies an allowable number of non-matching words that can exist between matching words. It is particularly useful in compensating for data position skew in asynchronous data capture.

SIGNATURE ANALYSIS
(LA4800 ONLY)

Compresses any section of data in any memory into a 4 digit hex "signature". Signatures available per channel, per group of channels or per memory.

PERFORMANCE ANALYSIS
(LA4800 ONLY)

Shows histogram of the occurence of states within each of 8 user specified ranges.

ANALOG DISPLAY MODE
(LA4800 ONLY)

Displays 8 bit digital words in analog form.

DISPLAY

9" super-twist blue mode LCD with cold cathode fluorescent backlighting. 80 columns by 25 lines in text mode, 640 by 200 pixels in graphics mode.

INTERFACES

RS-423 serial interface standard (RS-232 compatible), IEEE-488 interface optional. Output to a printer via the serial interface, optional serial to Centronics parallel interface cable available.

INPUT CONNECTION OPTIONS

Combination data pod AP01
Single pod with 32 data inputs (DC to 25MHz), 3 clock inputs, 3 clock qualifier inputs. Input impedance 100k/5pF. Threshold TTL (1.4V). Single 40-way connector with colour coded plug-on connection leads.

Combination data pod AP02
Single pod with 48 data inputs (DC to 25MHz), 3 clock inputs, 3 clock qualifier inputs. Input impedance 100k/5pF. Threshold TTL (1.4V). Single 64-way connector with colour coded plug-on connection leads.

High Speed data pods AP03
16 channels at DC to 25MHz, 8 channels at DC to 25MHz with glitch capture (5nsec), 4 channels at 100MHz (asynchronous only). Input impedance 100k/5pF. Threshold TTL (1.4V). Colour coded plug-on connection leads.

Clock pod AP04
3 clock inputs, 3 clock qualifier inputs. Input impedance 100k/5pF. Threshold TTL (1.4V). Colour coded plug-on connection leads.

AP03V and AP04V Variable threshold pods:
These are variable threshold versions of the AP03 high speed data pod and the AP04 clock pod. Threshold variable between -5V and +10V set from the analyser. Input impedance 100k/5pF.

DISASSEMBLER OPTIONS

Each disassembler pod connects directly to the microprocessor via a sprung test clip and contains the disassembly software in ROM. Microprocessors supported are:
Z80, 64180 6800/6802, 6801/03/6301/03, 68HC11, H8/300, 6809, 6502, 8085, 8086/88, 68000.

POWER

180 - 265V or 95 - 135V @ 48 - 63Hz, 65VA max.

MECHANICAL

Size - 315 x 190 x 268mm (12.4 x 7.5 x 10.5").
Weight - 5kg (11 lb).

Thurlby Thandar Instruments Ltd. operates a policy of continuous development and reserves the right to alter specifications without prior notice.

PLEASE NOTE:

The LA3200 is no longer available.