## APPENDIX B: CALIBRATION PROCEDURE

### A. EQUIPMENT NEEDED

1 ML4400S Logic Analyzer (includes one SC-4400 Standard Capture Card and one LP-4050 100-MHz Logic Pod)
1 50-MHz Pulse Generator (Wavetek 801 or equivalent)
1 BNC-to-Probe Cable
1 100-MHz Oscilloscope

### B. GENERAL

The Arium ML4400S Logic Analyzer can be calibrated for proper operation using common test equipment: a 50-MHz pulse generator (similar to a Wavetek model 801) and a 100-MHz oscilloscope. Tests are repeated sequentially for each channel (Probe 00 through 39).

The verification of data probes, the logic pod, data lines, and capture circuitry is done by generating predefined signals, then capturing and displaying the data in a waveform representation on the ML4400. This waveform should correspond to the generated signal from the pulse generator. The SC-4400 Standard Capture Card and LP-4050 100-MHz Logic Pod combination can be tested in three modes:

| | |
|---|---|
| LOGIC20 | Tests operation at a 10-ns sample rate (100 MHz) |
| LOGIC40 | Tests operation at a 20-ns sample rate (50 MHz) |
| SLOW40 | Tests operation at a 40-ns sample rate (25 MHz) |

Threshold levels can be verified by using predefined signals with varying slew rates. This trapezoidal technique produces results by matching the length of the high pulse recorded on the logic analyzer and the width of the signal on the oscilloscope at the threshold voltage level.

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Figure A-a

WAVEFORMS FOR CALIBRATING ML4400S

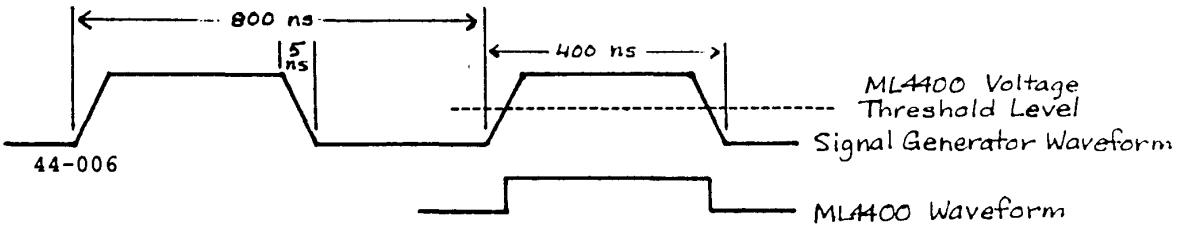
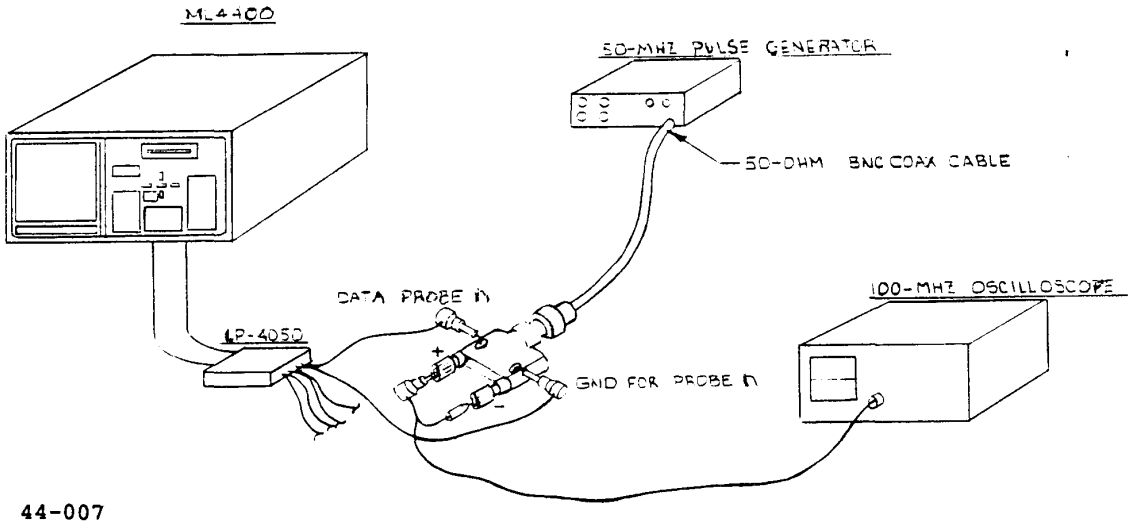


Figure A-b

EQUIPMENT CONFIGURATION FOR
ML4400 VERIFICATION PROCEDURE

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C. PULSE GENERATOR SETUP

| | | | |
|---|---|---|---|
| Mode: | Continuous | Leading/trailing edge: | 1X |
| Output port: | 50 ohms | Output: | Normal |
| Output: | Normal | Pulse width: | 400 ns |
| Voltage levels: | 0 v, 5 v | Pulse period: | 800 ns |
| Transition time: | 5 ns | | |

D. ML4400S SETUP

1. Format Screen (via FORMAT Setup key): Select either LOGIC20 (for 10-ns tests), LOGIC40 (20-ns), or SLOW40 (40-ns); this will automatically select the appropriate clocking and width parameters.

2. Trace Control Screen (via TRACE Setup key): Select a trace delay of 4096 (for LOGIC20) or 2048 (LOGIC40 & SLOW40).

3. Trigger Words Screen (via TRIG Setup key): Set all trigger words to Don't Cares via the X key.

4. Trigger Sequence Screen (via SEQ Setup key): Select Trigger Sequence 0 (rising edge of probe n), and specify n as the number of the probe currently being tested.

5. Configuration Screen (via CONFIG Setup key):

   For capture verification: Enter +1.40 v in the Threshold field, or select A (TTL, +1.40 v).
   For threshold verification: See "To Verify Threshold Voltage Adjustment" (Item F below).

E. TO VERIFY DATA CAPTURE

1. Depress START to take a data sample; the ML4400 will immediately trigger.

2. Depress TIMING twice to display the captured data; the cursor will be positioned at the trigger event (the rising edge of a pulse).

3. Depress X to set a cursor reference for the pulse's rising edge to measure the pulse width. Note that the 'Mark to cursor' field at the upper left of the screen will display time.

4. Use the right arrow key to measure the pulse width to the falling edge; this measures high pulses. The high pulses should measure 400 ns.

5. Repeat Steps 1-3 above to measure total cycle widths. Use the right arrow key and measure time until the next rising edge; time measured should be 800 ns, and should be consistent for all cycles in the Trace Buffer.

F. TO VERIFY THRESHOLD VOLTAGE ADJUSTMENT

The software-selectable threshold voltage is specified on the Configuration screen (accessed via the CONF key). The user can quickly select one of three standard voltage thresholds by cursoring to the Threshold field, then depressing A (TTL, +1.40 v), C (CMOS, +2.40 v), or E (ECL, -1.50 v). Or the user may specify any voltage within a certain range via the "Threshold" field.

The following procedure to verify threshold voltage should be used for various threshold voltage settings. For thresholds outside of the 0-5 v range, adjust the pulse generator to increase or decrease the low and high values of voltage output accordingly.

1. Set the threshold voltage to the desired test value.

2. Take a sample, starting with the leading and trailing edge adjustments on the pulse generator scaled to "times one" (1X).

3. Repeat Steps 1 through 4 of the Data Capture Verification, above.

4. Measure the time between threshold voltage levels on the oscilloscope and match it with the high pulse time displayed. These values should be the same to within measurement accuracy (probably $\pm 1$ main or division on most scopes, and 10 ns on the analyzer).

5. Adjust the slew rate of the generated pulse by changing either the leading or trailing edge adjustment. This will shorten the time between threshold points of the pulse waveform.

6. Repeat Steps 3 and 4, above. The high pulse displayed on the ML4400 should be less than 400 ns, but still the same as the time between threshold voltage levels on the oscilloscope.

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