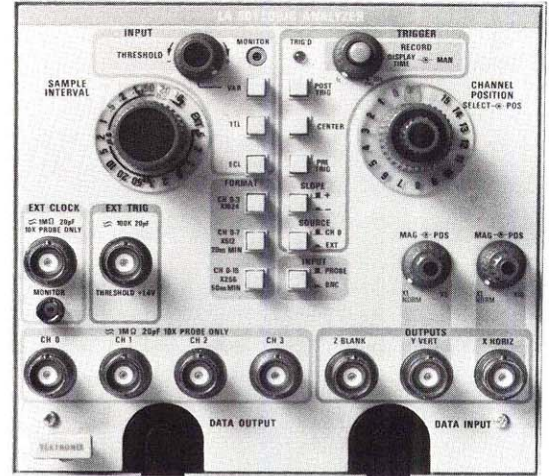


LA 501W Logic Analyzer System



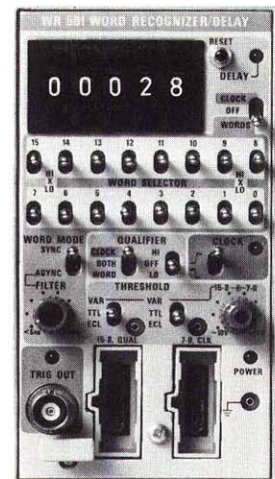
LA 501 Logic Analyzer

The LA 501W Logic Analyzer System, made up of the LA 501 Logic Analyzer and WR 501 Word Recognizer Plug-ins, operates in any 3, 4, 5, or 6-compartment TM 500-Series Power Module Mainframe. This combination complements virtually any oscilloscope or X-Y monitor to provide a versatile logic analysis system.

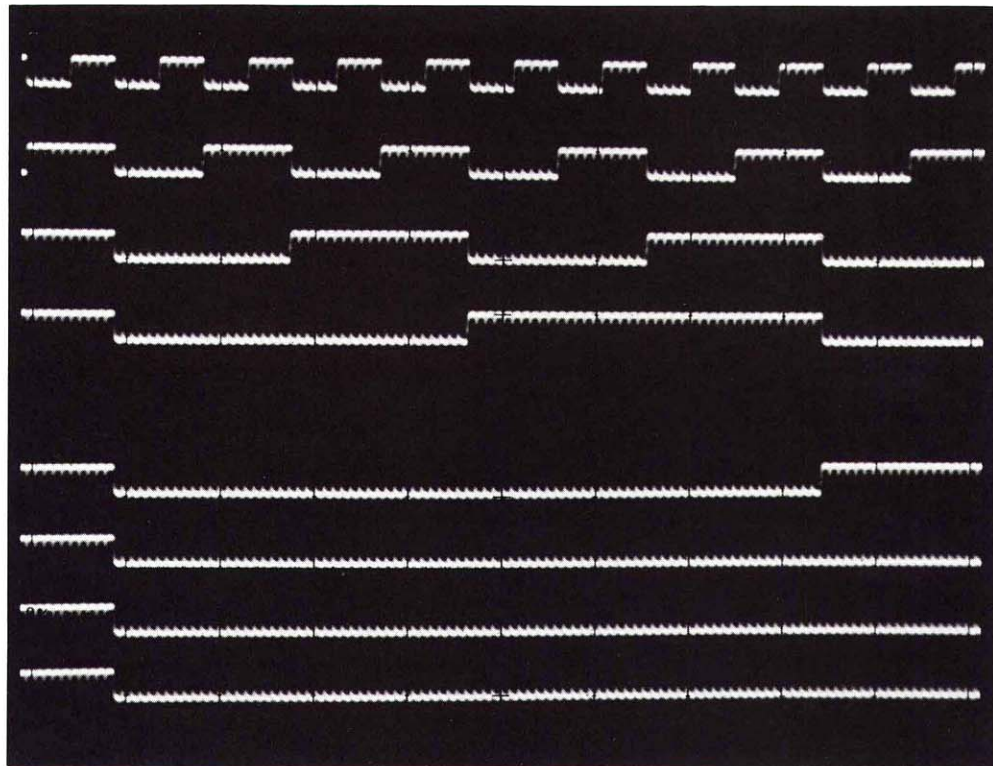
4096 bits of storage may be formatted as 4 channels x 1024 bits, 8 channels x 512 bits, or 16 channels x 256 bits to best fit your application. With a selectable asynchronous sampling rate of up to 100 MHz (for 4-chan-

nel operation), the LA 501 provides timing resolution to 15 ns. Data can also be synchronously (externally) clocked to 50 MHz. Pre-, center-, or post-trigger data can be recorded at a sample rate from 10 ns to 5 ms.

Two active P6451 probes feature a high input impedance — 1 M $\Omega$  paralleled by 5 pF. They provide a total of 18 inputs to the WR 501 — 16 data input channels, one clock input, and one qualifier input. There are separate threshold controls (TTL, ECL, and variable  $\pm 10$  V) for each probe.



Word Recognizer with Digital Delay



The LA 501W display includes biphase tick marks. These are an aid in timing comparisons (each is equivalent to one sample interval or synchronous clock), and as a quick indication of whether a line is high or low.

Stored data is displayed as a timing diagram in groups of four. Each trace displays high and low logic states. Vertical and horizontal position and magnifier controls provide the capability to zoom in on any segment of the timing diagram. Biphase timing tick marks on each channel provide excellent visual resolution and also indicate whether an inactive line is high or low. Channel-to-channel timing comparisons are easy because any trace can be moved vertically and thus positioned next to any other.

The WR 501 16-bit parallel Word Recognizer with Digital Delay produces trigger pulses when a preselected parallel word occurs. This gives you fast access to almost any unique word in the data stream.

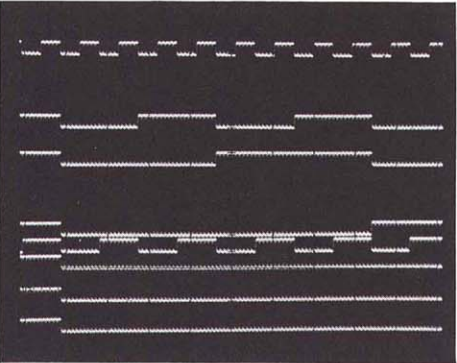
Either the LA 501 or the WR 501 may be purchased and operated separately. The LA 501 is a good choice in logic analysis when triggers are readily available from the system under test. The LA 501, when purchased separately, comes with a P6450, 16-channel passive probe.



Logic Analyzers

For minimal circuit loading when using the LA 501 above, four front-panel BNC connectors provide high impedance inputs for 10X probes. They drive channels 0 through 3 when the INPUT selector is in the BNC position.

The WR 501 can be used separately as a word recognizer to generate triggers for oscilloscopes or other measurement instruments.



A CHANNEL/POSITION selector allows you to vertically reposition any trace anywhere on the display for easier timing comparisons. Here channel 1 is repositioned between channels 4 and 5.

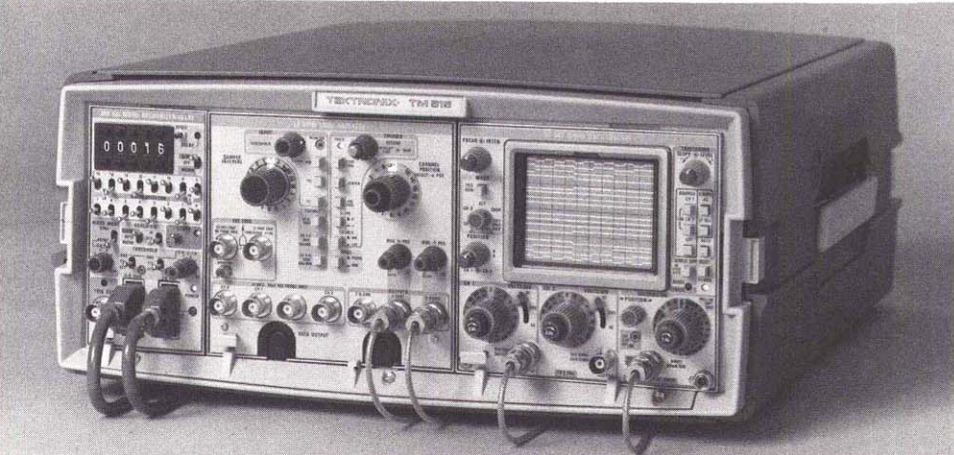
LA 501W CHARACTERISTICS

LA 501W characteristics apply to both LA 501 and WR 501 separately, except where functions of each are described separately.

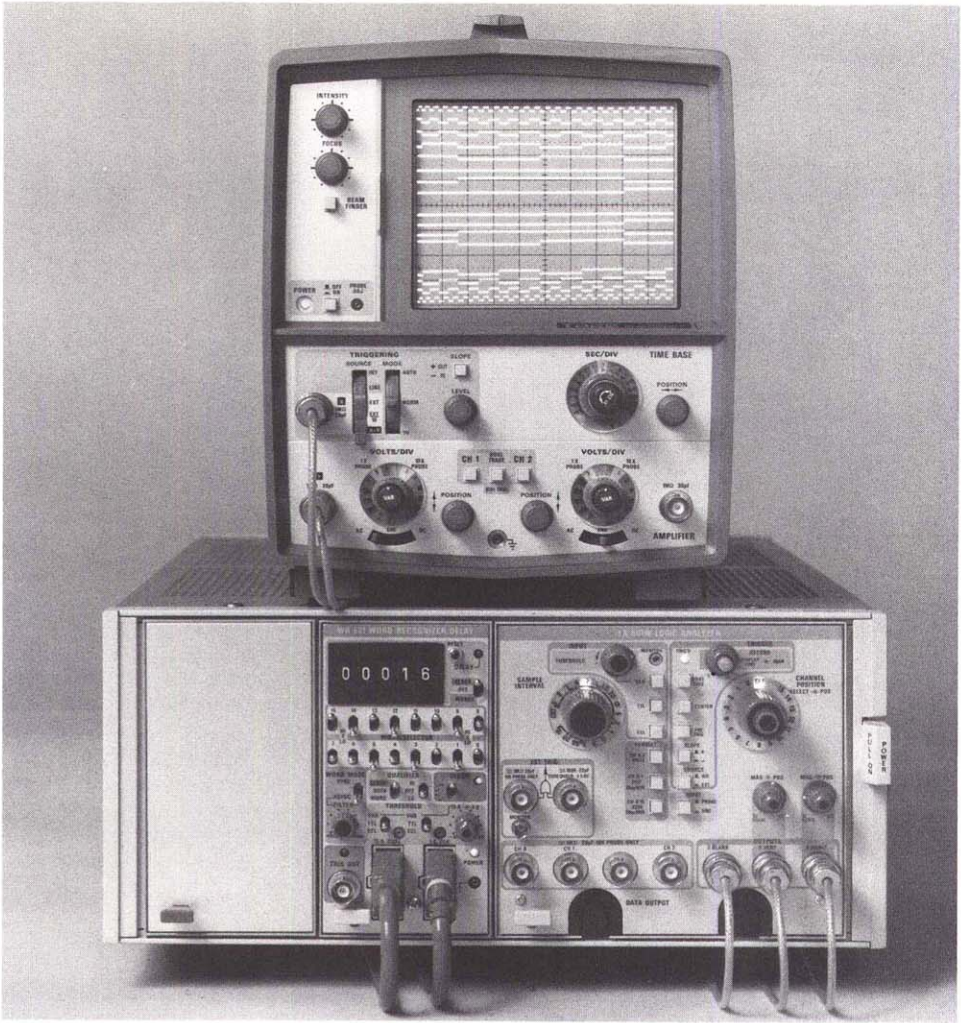
The LA 501W acquires 4, 8 or 16 channels of data and stores the data in memory. Data storage format is selectable as 4 channels x 1024 bits, 8 channels x 512 bits, or 16 channels x 256 bits.

DATA INPUTS

- Data Channels** — 16 channels divided between two probes. Channels 0-7 (and clock) are in probe 1. Channels 8-15 (and qualifier) are in probe 2.
- Input Impedance** — 1 MΩ paralleled by 5 pF.
- Sensitivity at Probe Tips** — 500 mV p-p minimum centered around threshold.
- Threshold at Probe Tips** — Fixed TTL (1.4 V ± 0.2 V) or ECL (−1.26 V ± 0.05 V), or variable (at least −10 V to at least +10 V).
- Maximum Safe Input Voltage** — ± 60 V.
- Interface** — A high-speed interface provides transfer of the incoming data signals to the LA 501 Logic Analyzer through internal cables. This enables the WR 501 probes to provide input for both plug-ins.



The TM 515 Traveler Mainframe accommodates the LA 501W and an SC 502 Oscilloscope to make a complete portable logic analysis system.



The modular LA 501W can be used with any oscilloscope or X-Y monitor with 500 kHz bandwidth. Here its display is shown on a low cost T922.

MEMORY

Format — Front Panel Selectable.

Data Channels Displayed	Bits per Channel
0-3	1024
0-7	512
0-15	256

DATA TIMING

**Asynchronous (internal clock)** — Sampling intervals are selectable from 10 ns to 5 ms (± 0.005%) in a 1-2-5 sequence.

Data Channels Displayed	Maximum Sampling Rate	Minimum Sampling Interval	Minimum Data Pulse Width
0-3	100 MHz	10 ns	15 ns
0-7	50 MHz	20 ns	25 ns
0-15	20 MHz	50 ns	55 ns

**Synchronous (external clock)**

Data Channels Displayed	Maximum Clock Freq.	Minimum Clock Width*	Minimum Data Setup Time	Minimum Data Hold Time
0-3	50 MHz	10 ns	18 ns	0 ns
0-7	50 MHz	10 ns	18 ns	0 ns
0-15	20 MHz	25 ns	23 ns	0 ns

\*High and low clock width.

TRIGGER

- Source** — WR 501 or External Trigger inputs.
- Triggered Light** — Indicates display trigger has occurred.
- Slope** — Selects positive or negative slope as the active edge external triggers. Selects word or word on WR (internal) triggers with digital delay set at 0 or OFF.



**WORD RECOGNIZER (WR 501)**

**Inputs** — 16 data inputs plus a clock and qualifier.

**Word Selection** — Made using sixteen three-position toggle switches. Positions are HI, X (don't care), and LO.

**Qualifier** — Can expand the word recognizer to 17 bits, act as a gate for the external clock or do both.

**Clock** — Selects positive- or negative-going edge of clock input signal. Used for synchronous operation.

**Modes** — Front panel selection of synchronous word recognition (a trigger is produced only when the operator selected word occurs at a clock edge. Either position, positive or negative edge, may be selected), or asynchronous word recognition (a trigger is produced anytime the recognized word occurs).

**Synchronous Mode —**

Minimum Set-up time	18 ns
Minimum Hold time	0 ns

(Filter is automatically disabled)

**Asynchronous Mode and Filter —**

Minimum coincidence time is variable from 15 ns or less to 200 ns or more.

**DIGITAL DELAY**

**Delay Selection** — Five thumbwheel switches provide selection of any delay-by-events or delay-by-words from 0 to 99,999.

**Modes** — Two delay modes (delay-by-events count or delay-by-word triggers) or OFF.

**Indicator** — An LED is lit during the delay interval.

**Reset** — Pushbutton resets the delay counter.

**Output Connector (TRIG OUT)** — The trigger from the WR 501 is available via the internal interface to the LA 501, or at a front panel BNC connector. This produces a trigger after word recognition and the delay selected. The signal is TTL compatible.

Output	Requirement
HI Level	$\geq 2.4$ V
LO Level	$\leq 0.4$ V
Impedance	$\sim 50 \Omega$

**Maximum Trigger Delay —**

Word Recognition Mode	Delay to front panel Trigger Output (referred to probe tips — digital delay set to 00,000)
Synchronous	$\leq 50$ ns from edge of clock input and word pattern match.
Asynchronous	$\leq 50$ ns + selected filter time from word pattern match.

**DISPLAY**

**Type** — Data is displayed as a timing diagram.

**Display Time** — Variable from less than 1 s to at least 10 s. A detent position provides indefinite storage of data. A new record cycle can be started at any time by pushing the MANUAL Pushbutton.

**Vertical Display Controls (VERT POS/MAG)** — A variable vertical magnifier control magnifies the on-screen display from X1 to X5. A concentric vertical position control positions the display within the graticule area.

**Horizontal Display Controls (HORIZ POS/MAG)** — A variable horizontal magnifier control magnifies the on-screen display from X1 to approximately X10. A concentric horizontal position control positions the display within the graticule area.

**DATA OUTPUT**

**Connector** — A 25 pin connector (inside LA 501W) provides output of stored data from the LA 501W. It also provides control signals necessary for transfer of that data to other equipment.

**Parallel Data** — 16 pins provide parallel access to stored data. ECL levels.

**Serial Data** — One pin provides serial access to stored data. ECL levels.

**Flag** — A positive-going edge on this pin indicates the beginning of each channel. ECL levels.

**Format** — 2 pins are used to identify the stored format as 4 channels x 1024 bits, 8 channels x 512 bits, or 16 channels x 256 bits.

**POWER**

**Line Voltage Ranges** — Determined by the TM 500-Series Mainframe.

**Power Consumption** — 45 W (LA 501W) at nominal line voltage.

**ENVIRONMENTAL**

**Temperature** — Operating: 0-40°C (0-50°C only in TM 506). Nonoperating: -40°C to +75°C.

**Altitude** — Operating: to 15,000 ft. Nonoperating: to 50,000 ft.

**Vibration** — With the operating instrument, vibration frequency swept from 10 to 50 to 10 cps at one minute per sweep. Vibrate for 15 minutes along each of the three major axes at 0.015 inch total displacement. Hold three minutes at any major resonance, or if none, at 50 cps. Total time 54 minutes.

**Shock** — Operating and nonoperating: 30g's, 1/2 sine, 11 ms duration. Two shocks in each direction along three major axes, for a total of 12 shocks.

**Transportation** — Qualified under National Safe Transit Committee test procedure 1A, Category 11.

**DIMENSIONS AND WEIGHTS (LA 501W)**

Weight	kg	lb
Net Weight	3	6.6
Dimensions	cm	in
Height	12.5	4.9
Width	20.1	7.8
Depth	30.0	11.8

**ORDERING INFORMATION**

LA 501W\* Logic Analyzer .....\$4450

LA 501W OPT 5\*  
(Add one TM 515 Power Module)....\$4775

LA 501W OPT 49\*  
(Delete one P6451 probe).....\$4150

LA 501\*\* Logic Analyzer .....\$3250

WR 501\* Word Recognizer.....\$1500

WR 501 OPT 49\*  
(Delete one P6451 probe).....\$1200

040-0806-00 LA 501/WR 501  
Interface Mod Kit .....\$185

P6108 Probe, 10X Attenuation,  
2 Meter Cable (010-6108-03).....\$49

\*Included Accessories, LA 501W and WR 501 — Two 9-channel P6451 Acquisition Probes.

\*\*Included Accessories, LA 501 — One 16-channel P6450 Passive input probe.

TM 515\*\*\* Power Module.....\$325

TM 506\*\*\* Power Module.....\$240

TM 504\*\*\* Power Module.....\$180

TM 503\*\*\* Power Module.....\$160

RTM 506\*\*\* Rackmount  
Power Module .....\$325

\*\*\*Operation of the LA 501W, LA 501 or the WR 501 requires a TM 500 Series Power Module. Details on these as well as the full line of TM 500 Series instrumentation begins on page 141. Additionally, operation of the LA 501W or LA 501 requires an X-Y display monitor or an oscilloscope.

**OPTIONAL ACCESSORIES**

**P6108** — A 10X probe (10 M $\Omega$ , 13 pF), for use with the LA 501 or DD 501 Digital Delay. Order four probes for use with the four high speed data channels of the LA 501. For the external clock input of the LA 501, order one additional probe.

(010-6108-03) .....\$49

**P6450 Probe Package** — Replacement probe for LA 501 Logic Analyzer.

(010-6450-01) .....\$250

**P6451 Probe Package** — Replacement active probe for LA 501W, WR 501, 7D01 or 7D01F. (Two probes are needed for 16-channel operation).

(010-6451-01) .....\$375

**Lead Sets** — Color coded replacement lead set for the P6450 Probe or the P6451 Active Probe. 10 leads/set. Connects probe head to 0.025 in square pins.

(012-0655-01) .....\$35

Same lead set with hook tips.

(012-0670-00) .....\$36

**BNC Cable** — 50  $\Omega$ , 18 in.

(012-0076-00) .....\$11

**Probe Holder** — Clip-on holder accommodates probe pod from P6450 or P6451.

(352-0473-01) .....\$2.40



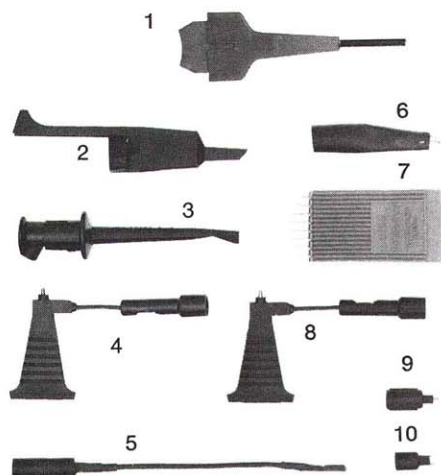
Lab Cart, Model 3



A rollabout cart which carries any 7000-Series Mainframe with 7D01F Logic Analyzer, or any laboratory or portable oscilloscope, on its top tray. Two underslung trays accept up to two TM 504 Mainframes with LA 501W Logic Analyzer and other TM 500-Series modular instrumentation.

**Model 3 Lab Cart** .....\$295

## Probe Tips



1. **Miniature Retractable Hook Tip** — Suitable for attaching P6450 to compact electronics.  
(206-0222-00) .....\$5
2. **Retractable Hook Tip** — Suitable for use with P6401 Logic Probe.  
(013-0106-00) .....\$6
3. **Pomona Hook Tip to 6-32** —  
(344-0267-00) .....\$2.60
4. **Probe Pin Tip** — Accepts 0.025 in IBM SLT pin. Slip on.  
(206-0209-00) .....\$2.50
5. **Probe Tip** — Flexible probe tip to fit 0.025 in square pin.  
(206-0193-00) .....\$5.00
6. **Miniature Alligator Clip** —  
(344-0046-00) .....\$1.00
7. **Clothes Pin IC Clip** —  
(003-0709-00) .....\$24.00
8. **Probe Pin Tip** — Accepts 0.025 in IBM SLT pin. Screw on.  
(206-0134-03) .....\$3.00
9. **Probe Ground Lead Adapter** — #6-32 to 0.025 in IBM SLT square pin.  
(206-0137-01) .....\$1.30
10. **Miniature Probe Tip Adapter** — For testing integrated circuits. Package of 10.  
(015-0201-01) .....\$2

## P6401 Logic Probe

### TTL/DTL Compatible

### Detects Steady Logic Levels

### Detects Trains of Logic Pulses

### Detects Abnormal Conditions

### Strobed Detection of Logic Pulses

### Store Mode

### Protected against Overvoltage

The small, lightweight, hand-held P6401 indicates the state of logic levels in TTL, DTL, or any other system with threshold between 0.7 and 2.15 volts. A strobe input can be used to detect the coincidence of logic signals at two points. An indication of whether a logic pulse has or has not occurred can be obtained in a "store" mode.

Power may be obtained from the unit under test or any 5 V supply.

Two bright lights in the probe tip indicate condition of the logic signal.

State or Condition	Indication
Steady high state	Steady red light
Steady low state	Steady green light
Pulse trains (normal logic switching)	Blinking red and green light at full intensity
Abnormal state (between high and low)	No lights
Open circuit	No lights
Excessive input voltage greater than 6 V	Both red and green lights lit
Alternating between high state and indeterminate state	Blinking red light
Alternating between low state and indeterminate state	Blinking green light
Single or very low duty cycle logic pulse	Using STORE mode, one light will be on initially. Event has occurred when second light is lit.



### SPECIFICATIONS

**Low State Input Voltage Range** — 0 V to  $\pm 0.7$  V  $\pm 0.125$  V.

**High State Input Voltage Range** — 2.175 V  $\pm 0.125$  V to Vcc.

**Minimum Recognizable Pulse Width** — 10 ns.

**Impedance** —  $\approx 7.5$  k $\Omega$  paralleled by  $\approx 6$  pF.

**Minimum Circuit Resistance for Open Circuit Indication** — 10 k $\Omega$ .

**Max Safe Input** —  $\pm 150$  V (dc or rms).

**Minimum Recognizable Strobe Pulse Width** — 20 ns.

**Max Safe Strobe Input** —  $\pm 30$  V (dc or rms).

**Strobe Input Impedance** — 5.6 k $\Omega$  within 20%.

### ORDERING INFORMATION

**P6401 5 ft Probe (010-6401-01) .....\$90**

Includes: Hook Tip (206-0114-00)

Strobe Lead (175-0958-01)

Strobe Lead (175-0958-00)

Probe Tip to 0.025 in square pin adapter (206-0137-01)

White Plug (348-0023-00)

2 Alligator Clips (344-0046-00)

Accessory Pouch (016-0537-00) not shown