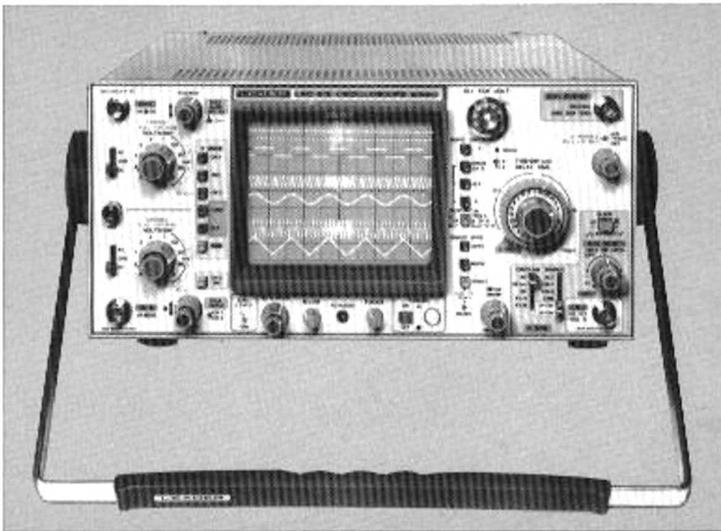


\$35

LBO-516

100 MHz delayed time
base oscilloscope



instruction manual

For professionals
who
know
the
difference.

LEADER
Instruments Corporation

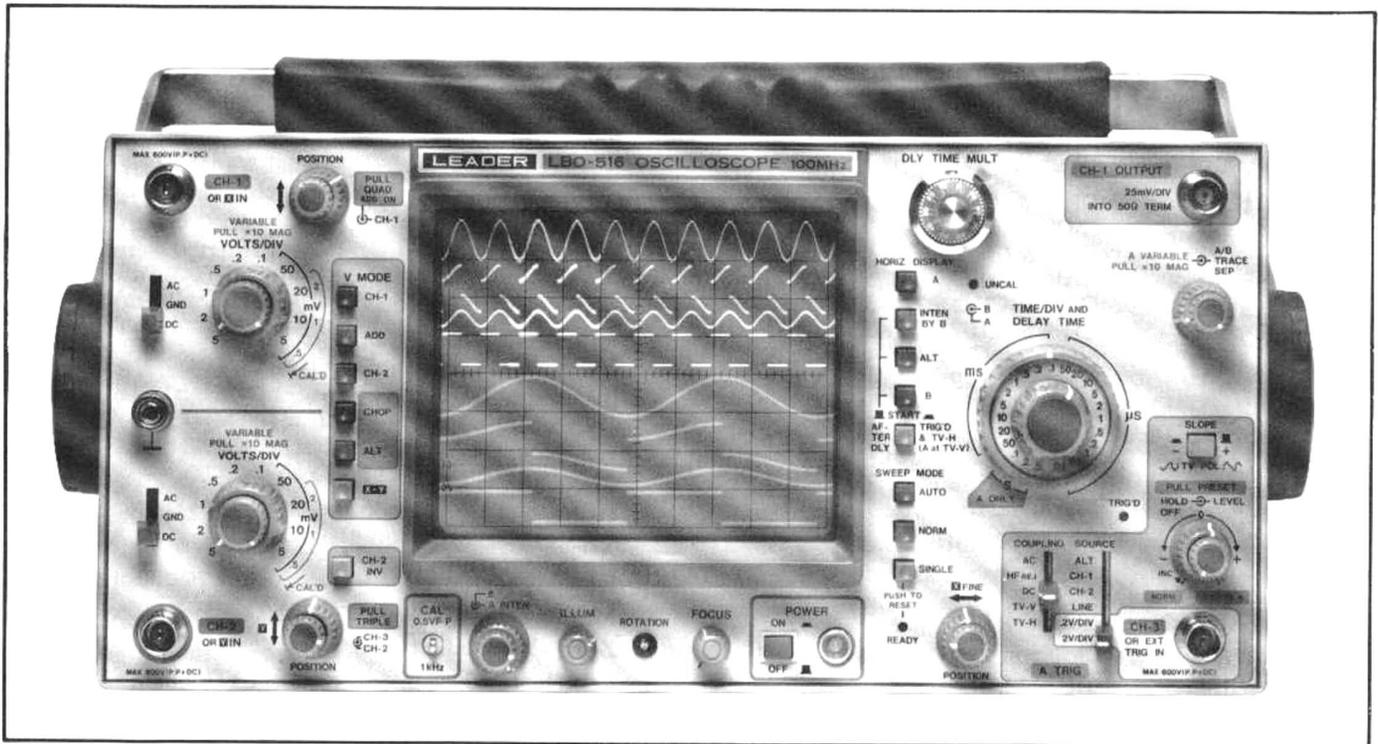


Figure 1-1.
LBO-516 Oscilloscope

1. GENERAL INFORMATION

1-1. INTRODUCTION

The LBO-516, shown in Figure 1-1, is a 100 MHz oscilloscope with all of the features normally found on a lab-grade scope: high-fidelity pulse response, stable operation, dual timebase with calibrated sweep delay, flexible triggering facilities, and a bright CRT display with illuminated internal graticule. Moreover, it also has a very unusual feature found on few scopes in any price class: it can simultaneously display up to eight traces from three different input signals! In addition to the two vertical-input channels and their difference signal, the signal used to externally trigger the main timebase can also appear on the CRT display. The alternate sweep mode, which allows the main and delayed timebases to simultaneously sweep the CRT, effectively doubles this four-trace display to an eight-trace display.

The comprehensive triggering facilities of the LBO-516 include several features that ease the problem of triggering on complex signals: a variety of frequency-selective coupling filters, a trigger holdoff-control, and a trigger pickoff that alternates between the two vertical channels.

1-2. SPECIFICATIONS

Specifications for the model LBO-516 oscilloscope are given in Table 1-1.

Table 1-1
SPECIFICATIONS

Vertical Amplifiers (Ch. 1 & 2)

Bandwidth (-3 dB)	
DC coupled	DC - 100 MHz
AC coupled	10 Hz - 100 MHz
Rise Time	3.5 nS
Deflection Coefficients	
Accuracy	5 mV/div to 5 V/div in 10 calibrated steps, 1-2-5 sequence. Continuously variable between steps. X10 magnification adds 0.5, 1, and 2 mV/div steps for frequencies below 5 MHz
Input Impedance	+3%; +5% with X10 magnification 1 megohm +2%, 25 pF +3 pF
Maximum Input Voltage	400 V (DC plus AC peak)

Signal Delay Leading edge displayed.
 Leading edge displayed. CH-1 only, CH-2 only,
 CH-1 & CH-2 displayed alternately,
 CH-1 & CH-2 chopped (at 250 kHz rate),
 CH-1 & CH-2 added, CH-1 & CH-2 subtracted,
 CH-1 & CH-2 & CH-3 displayed alternately,
 CH-1 & CH-2 & CH-3 chopped,
 CH-1 & CH-2 & CH-3 & CH-1 + CH-2 alternated,
 CH-1 & CH-2 & CH-3 & CH-1 + CH-2 chopped,
 CH-1 & CH-2 & CH-3 & CH-1 - CH-2 alternated,
 CH-1 & CH-2 & CH-3 & CH-1 - CH-2 chopped.

Common Mode Rejection 20dB at 20MHz
 CH- 1 Output 25 mV/div into 50 ohms

Horizontal Amplifier (X-Y Mode)

Bandwidth (- 3 dB) DC - 3 MHz
 DC coupled 10Hz - 3MHz
 AC coupled 120 ns
 Rise Time $\le 3^\circ$ at 100 kHz
 Phase Shift 0.5 mV/div to 5 V/div in 13 calibrated steps, 1-2-5 sequence, continuously variable between steps
 Deflection Coefficients +3% for 5 mV/div to 5 V/div, +5% for 0.5 mV/div to 2 mV/div
 Accuracy 1 megohm +2%, 25 pF +3 pF
 Input Impedance 400 V (DC plus AC peak)
 Maximum Input Voltage

Time-Base Generators

Display Modes Main timebase (TB) only,
 Main TB intensified by delayed TB,
 Delayed timebase,
 Main TB alternated with delayed TB.
 Main (A) Time Base 0.02 ns/div to 0.5 S/div in 23 calibrated steps, 1-2-5 sequence. Continuously variable between steps.
 Delayed (B) Time Base 0.2 μS/div to 50 mS/div in 20 calibrated steps, 1-2-5 sequence.
 Magnifier X10 deflection increase at any TB setting extends sweep speeds of main and delayed TB's to 2 ns/div.
 Accuracy +- 3% unmagnified
 +- 5% magnified
 Delay Time Continuously variable multiplier with 1000 divisions.
 Delayed TB Jitter 1/20,000

Trigger Circuits

Sources CH-1, CH-2, Alternate, Line, External

Modes Auto, Normal, Single-shot
 Coupling AC, DC, HF reject, TV vertical, TV horizontal
 Slope + or-
 Holdoff Normal, Variable (to greater than one sweep), B ends A
 Sensitivity
 Internal Trigger DC - 10 MHz: 0.4div
 10 - 100 MHz: 1.5 divs
 External Trigger DC - 10MHz: 100mV
 10 - 100 MHz: 400mV

External Trigger Amplifier (Ch. 3)

Bandwidth (-3 dB) DC - 100 MHz
 DC coupled 10Hz- 100 MHz
 AC coupled 3.5 ns
 Rise Time 0.2 V/div and 2 V/div
 Deflection Coefficients +-3%
 Accuracy 1 megohm +2%, 30 pF
 Input Impedance 400 V (DC plus AC peak)
 Maximum Input Voltage

Z-Axis Modulation

Level for Blanking Standard TTL high (+ 2 to + 5V)
 Coupling DC
 Maximum Input Voltage 50 Vp-p
 Input Impedance 10kΩ
 Bandwidth DC-5 MHz

Calibrator

Output Voltage 500 m Vp-p+- 2%, positive-going, ground referenced
 Frequency 1 kHz nominal
 Waveform Fast-rise rectangular wave

CRT Display

Phosphor P31 (P39 optional)
 Accelerating Potential 20 kV/2kV
 Graticule Internal 1 cm square divisions, 8 div high, 10 div wide.
 Central axis subdivided into 0.2 cm graduations.

Graticule Illumination Continuously variable
 Trace Adjustments on Rotation, focus, intensity,
 Front Panel B intensity

Other Features

"Out-of-Calibration" Main timebase
 Indicator
 Other Indicators Main timebase triggered
 Single-shot ready
 Power on

Power Requirements

Line Voltage 100/120/200 VAC 220/240 VAC
 Line Frequency 50-60 Hz
 Power Consumption 55W

Physical & Environmental Data

Case Size (WxHxD) 12.3 x 5.8 x 16 inches
 305 x 145 x 400 mm
 Overall Size (WxHxD), handle folded back 13.75 x 7.25 x 18.5 inches
 350 x 185 x 470 mm

Weight	20.9 lbs, 9.5 kg
Ambient Operating Temperature	0-40°C (32-104°F) maximum 15-35°C (60-95°F) for guaranteed specs
Vibration Tolerance	2 mmp-p displacement at 12-33 Hz and 33-35 Hz
Shock Tolerance	30g
Accessories Supplied	Instruction Manual Two (2) LP- 100X probes Two (2) BNC-to-post adaptors
Optional	LP-2017 Probe Pouch LC-2016 Protective Front Cover LR-2402 Rack Mount Adaptor LH-2015 Hood

Table 1-2 LP-100X SPECIFICATIONS	
Attenuation Ratio	10:1 +2% and 1:1, switch selectable
Input Impedance	10 megohms, 12 pF ± 10%
10X attenuation	Scope input Z plus < 150 pF
1X attenuation	3.5 ηS nominal
Rise Time (10X atten.)	<10%
Overshoot & Ringing (10X atten.)	
Bandwidth	
10X attenuation	DC- 100MHz
1X attenuation	DC - 6 MHz
Maximum Input Voltage	600 V (DC plus AC peak)
Ambient Operating Temperature	
Maximum	- 10 to + 55°C
For guaranteed Specifications	+5 to +35°C
Ambient Humidity	
Maximum	40 to 90%
For guaranteed Specifications	45 to 85%

Specifications for the model LP-100X scope probe are given in Table 1-2.

2. OPERATING INSTRUCTIONS

This section contains the information needed to operate the LBO-516 and utilize it in a variety of basic and advanced measurement procedures. Included are the identification and function of controls, connectors, and indicators, initial startup procedures, basic operating routines, and selected measurement applications.

2-1. FUNCTION OF CONTROLS, CONNECTORS, AND INDICATORS

Before turning on this instrument, familiarize yourself with the controls, connectors, indicators, and other features described in this section. The descriptions given below are keyed to the items called out in Figures 2-1 to 2-4.

2-1-1 Display Block

Refer to Figure 2-1 for reference (1) to (9).

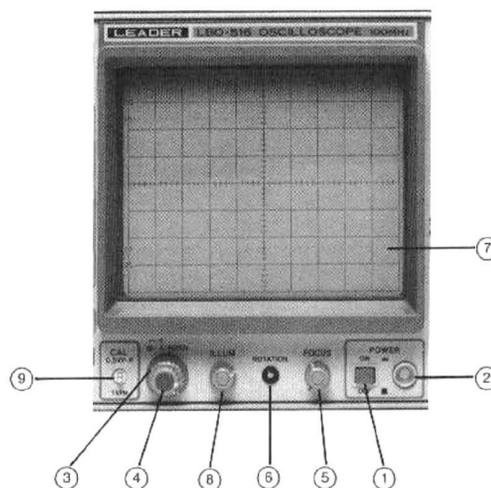
- 1** POWER switch Push in to turn instrument power on and off
- 2** POWER lamp Lamp lights when power is on
- 3** A INTEN control To adjust the overall brightness of the CRT display. Clockwise rotation increases brightness
- 4** B INTEN control Provides adjustment of CRT brightness during INTEN BY B interval and B timebase sweeps
- 5** FOCUS control To attain maximum trace sharpness. Astigmatism is automatically adjusted.
- 6** ROTATION control Provides screwdriver adjustment of horizontal trace alignment with regard to the CRT graticule lines

7 CRT

8 ILLUM control

9 CAL connector

Display device having 1 cm square graticule lines inscribed on the inner CRT surface for parallax-free measurements. Blue filter provides good contrast and pleasing display. To adjust graticule illumination. Clockwise rotation increases brightness
Provides fast-rise waveform of precise amplitude for probe adjustment and vertical amplifier calibration.



**Figure 2-1.
Display Block**