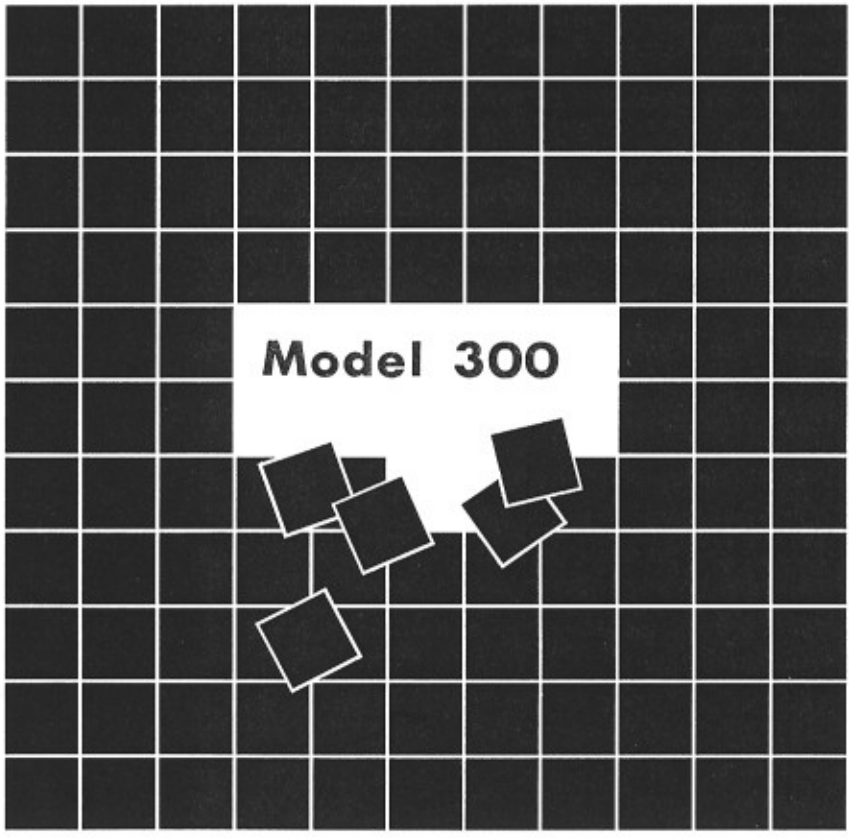
LEADER

DMM/2-Channel Oscilloscope with 30-MS/s Sampling

INSTRUCTION MANUAL



LEADER ELECTRONICS CORP.

Table of Contents

1. INTRODUCTION

1.1 General Description

The Model 300 is a portable DMM/oscilloscope featuring a digital storage oscilloscope with 30-MS/s sampling and digital multimeter functions in a single, highly portable package.

It has a full compliment of the latest features, such as a logic scope function for easy logic timing observation, memory-card memory expansion, and even an AUTO SETUP function that displays the input waveform optimally on the display screen automatically.

1.2 Features

1.2.1 DMM Section

- In addition to the six basic measurement functions (DC/AC voltage, DC/AC current, resistance, and low-power resistance), the Model 300 features a continuity beeper function to test for circuit shorts.
- Full autoranging is provided, making range selection simply a matter of applying the probes to the measurement points. Manual range selection is also possible.
- DMM measurement values can be displayed simultaneously with waveforms, and the electrical isolation between the DMM and scope sections enables simultaneous waveform observation and DMM measurements on completely different circuit parts.
- A data logger function is provided which enables printout of measured values at a given time interval. The provision for a built-in clock and the ability to determine the measurement of time is convenient in unmanned periodic production-line voltage monitoring.

1.2.2 Oscilloscope Section

- High-speed sampling (30 MS/s for one channel and 15 MS/s for two channels), and 10-MHz bandwidth for adequate coverage of the video band.
- 128 points (7 bits) of vertical-axis resolution and 180 words of horizontal-axis resolution
- The memory size can be selected as 180 words or 1800 words for observation of long waveforms.
- A high-capacity bank memory is provided, enabling storage of up to ten displayed waveforms for each channel. This is battery backed up so that contents are not lost when power is switched off.
- In addition to the bank memory, each channel can store up to 40 waveforms using a memory card, enabling easy memory expansion.
- An automatic setup function provides instant optimization of the input waveform display, by automatically optimizing the vertical-axis and horizontal-axis ranges and trigger levels.
- The currently input waveform and a waveform from bank memory can be simultaneously displayed. This enables easy waveform comparison, so that by storing a standard waveform in bank memory, a go/nogo comparison can be made on an input waveform.
- A printout of a displayed waveform can be made on a dedicated printer, a useful feature in generating reports and other documentation.
- The technique of storing an input waveform in memory and playing the waveform back (digital storage operation) is convenient in observing one-time events.
- A pretriggering function can be used to observe parts of a waveform before the trigger occurs, a feature not possible with normal oscilloscopes.

- The horizontal-axis range can be selected as slow as 20 s/div, a convenient feature in observing extremely slow-changing signals.

- An X-Y display can be obtained with CH1 serving as the X axis and CH2 serving as the Y axis, enabling Lissajous pattern observation of two signals.

1.2.3 Other Features

- A large, high-contrast LCD screen is used, providing a wide viewing angle and a sharp display even outdoors.

- A logic scope function is provided as a convenience in timing observations of logic signals.

- Battery operation is possible using just four type AA (R6) batteries, and the Model 300 is small enough and light enough to be highly portable, enabling it to be carried and used anywhere.

1.3 Specifications

1.3.1 Display

Type	STN dot-matrix liquid-crystal display
Dot configuration Waveform display area Settings display area	V: 128 dots × H: 240 dots V: 128 dots × H: 180 dots V: 128 dots × H: 60 dots
Dot size	V: 0.43 mm × H: 0.43 mm
Effective display area	V: 60 mm × H: 113 mm
Scales	V: 8 div × H: 12 div (1 div = 15 dots) (Scales displayed with half-tone contrast.)
Contrast adjustment	Located on the side panel.

1.3.2 DMM Section

Measurement functions	DC voltage, AC voltage, DC current, AC current, resistance, low-power resistance*, continuity check, diode test * Used for in-circuit resistance measurement; open-circuit resistance-measurement voltage is lower than a diode's Vth.
Maximum display	3199 (dot-matrix LCD)
Range selection	Autoranging and manual selection Autoranging operation: Up-range at 2800 to 3199 Down-ranging at 269 or lower
Polarity switching	Automatic; both + and − are displayed.
Input terminals	Three: V, Ω/mA, and COM
Sampling rate	2.5 times/s

DC voltage measurement (DCV)

Range	Resolution	Measurement Accuracy	Input Impedance
320.0 mV	100 µV	±(0.35% of rdg + 3 dgts)	100 MΩ min.
3.200 V	1 mV	±(")	Approx. 11 MΩ
32.00 V	10 mV	±(")	Approx. 10 MΩ
320.0 V	100 mV	±(0.5% of rdg + 3 dgts)	"
1000 V	1 V	±(0.6% of rdg + 3 dgts)	"

AC voltage measurement (ACV) (40 Hz to 500 Hz)

Range	Resolution	Measurement Accuracy	Input Impedance
3.200 V	1 mV	±(1.0% of rdg + 5 dgts)	Approx. 11 MΩ
32.00 V	10 mV	±(")	Approx. 10 MΩ
320.0 V	100 mV	±(")	"
750 V	1 V	±(1.2% of rdg + 5 dgts)	"

Resistance measurement (Ω)

Range	Resolution	Measurement Accuracy	Open-Circuit Voltage
320.0 Ω	100 mΩ	±(0.4% of rdg + 3 dgts)	Approx. 1.5 V
3.200 kΩ	1 Ω	±(")	0.65 V ±0.2 V
32.00 kΩ	10 Ω	±(")	"
320.0 kΩ	100 Ω	±(")	"
3200 kΩ	1 kΩ	±(1.0% of rdg + 3 dgts)	"
32.00 MΩ	10 kΩ	±(2.0% of rdg + 3 dgts)	"

Low-power resistance (LPΩ)

Range	Resolution	Measurement Accuracy	Open-Circuit Voltage
3.200 kΩ	1 Ω	±(0.5% of rdg + 3 dgts)	0.45 V max.
32.00 kΩ	10 Ω	±(")	"
320.0 kΩ	100 Ω	±(")	"
3200 kΩ	1 kΩ	±(1.0% of rdg + 4 dgts)	"
32.00 MΩ	10 kΩ	±(2.0% of rdg + 4 dgts)	"

Current measurement (DCA, ACA) (ACA: 40 Hz to 500 Hz)

Function	Range	Resolution	Measurement Accuracy
DCA	320.0 mA	0.1 mA	±(1.0% of rdg + 3 dgts)
ACA	320.0 mA	0.1 mA	±(1.5% of rdg + 3 dgts)

Resistance between input terminals: Approx.1 Ω (not including fuse resistance)

Continuity check/Diode test (⋇/·))))

Threshold level	Approx. 1 kΩ max.
Open-circuit voltage	Approx. 1.5 V
Response time	Approx. 100 ms
Display	The continuity mark is displayed on the LCD and a beeper sounds.
Other uses	Diode go/nogo checking
Print function	Displayed data can be hardcopied on a dedicated printer.

Data logger function

Interval time	5 s to 10 min., settable in 1-5-10-30 steps (6 ranges)
Number of data	10 to 200, and ∞ , settable in 1-2-5 steps (6 ranges) (10 to 200 when outputting to a memory card.)
Output method	Dedicated printer or memory card (output is possible from the memory card to the printer)

1.3.3 Oscilloscope Section

Vertical axis	Resolution: 7 bits (128 points), common to two channels
Sensitivity	5 mV/div to 20 V/div, in 1-2-5 steps (12 ranges)
Range switching	Up, down, and auto
Accuracy	3% (reference: 8 div)
Frequency response	DC coupling: DC to 10 MHz (reference: 8 div), −3 dB AC coupling: 10 Hz to 10 MHz (reference: 8 div), −3 dB
Input impedance	1 MΩ ±2%, 25 pF ±5 pF
Vertical modes	CH1, CH2, dual, add, sub, X-Y
Input withstand voltage	400 V (peak-to-peak + DC)
Input coupling	AC, DC, ground

Autoranging range	50 Hz to 10 MHz
Horizontal axis	Display resolution: 180 points
Sweep method	Automatic, triggered, single, roll, and scroll
Sweep time	0.1 µs/div to 20 s/div, in 1-2-5 steps (26 ranges) (with a memory size of 1.8 kwords: 10 µs/div to 200 s/div)
Accuracy	±(0.05% + 1/2 point)
Triggered sweep	50 ms/div to 0.1 µs/div
Range switching	Up, down, auto
Maximum conversion rate	Single trace: 30 MS/s, Dual trace: 15 MS/s
Autoranging range	1 µs/div to 50 ms/div
Triggering	
Signal source	CH1, CH2, External
Coupling	DC, HF-rej
Sensitivity	CH1, CH2: 0.5 div, DC to 10 MHz External: TTL level, DC to 10 MHz
Trigger slope	+, −
Pretrigger positions	3 points: 1 div, 6 div, and 11 div (with a memory size of 1.8 kwords: 6 div)
Memory	
Working memory	180 words × 2 CH or 1.8 kwords × 2 CH
Bank memory	180 words × 10 × 2 CH or 1.8 kwords × 1 × 2 CH with battery backup
Auto setup function	Automatic optimization of vertical-axis, horizontal-axis and vertical position settings and trigger level
Print function	Hardcopy output of the display screen to a dedicated printer
Waveform comparison function	The waveform in working memory can be displayed simultaneously with a waveform in bank memory. The waveform from bank memory is displayed with half contrast and the scales are blanked.
Overlaid display function	A newly input waveform is displayed in overlay, without erasing the old waveform.

Automatic peak-to-peak voltage measurement function	Operates at a displayed amplitude of 1 div or greater
Measurement range	5 mVp-p to 160 Vp-p
Measurement accuracy	3% + [0.07 × (VOLTS/DIV setting value]
Automatic frequency measurement function	Operates at a displayed period of 1 div or greater
Measurement range	2 Hz to 10 Hz
Measurement accuracy	0.05% + [0.07 × (TIME/DIV setting value]

1.3.4 Logic Scope Section

Sampling

Maximum sampling frequency	15 MHz

Vertical axis

Number of input channels	8 ch
Threshold voltage	H: 2.0 V min L: 0.8 V max. (TTL level)

Horizontal axis

Sweep method	Auto, triggered, and single sweep
Sweep time	1 µs/div to 50 ms/div, in 1-2-5 steps (17 ranges) (with a memory size of 1.8 kwords: 10 µs/div to 0.5 s/div)
Sweep accuracy	±(0.05% + 1/2 point)

Triggering

Signal source	CH1, CH2, and External
Coupling and sensitivity	DC coupling: H: 2.0 V min. L: 0.8 max. (TTL level)
Polarity	+, −
Pretriggering position	3 points: 1 div, 6 div, 11 div

Memory

Working memory	180 words or 1.8 kwords
Bank memory	180 words × 10 or 1.8 kwords × 1 with battery backup

Print function	Hardcopy output of the display screen to a dedicated printer
Input terminals	In common with printer output connector, special probe used (sold separately)

1.3.5 Printer Output Section (LOGIC SCOPE Input Section)

Interface	8-bit parallel (for dedicated model 710 Printer)	
Output connector	Mating cable:	Dedicated LC-2082 printer cable (used also as the input for the dedicated LP-2087 Logic Probe)

1.3.6 Memory Card (Separately Sold Option)

Storage capacity	
Oscilloscope mode	180 words × 40 × 2 ch or 1.8 kwords × 4 × 2 ch
Logic scope mode	180 words × 40 or 1.8 kwords × 4
DMM mode	Storage of up to 200 data logger mode data
Battery used	CR2016
Battery life	4 years at 25°C 9 months at 0° to 60°C

1.3.7 General Specifications

DMM-to-oscilloscope isolation withstanding voltage	1.1 kV (DC + AC peak) for one minute between the DMM input terminals and the SCOPE ground.
Probe calibration voltage	Approx. 4 Vp-p , squarewave
Auto power-off function	If not key switch operation is made for approximately 5 minutes or longer, the power is automatically shut off.
Real-time clock function	The current time is displayed in the lower left part of the screen in the HOLD condition.
Power requirements	SUM-3 (LRP6) alkali batteries (4) External DC input voltage: 6.5 V ± 10%
Power consumption	4 W, typical
Dimensions	240 (W) × 44 (H) × 165 (D) mm

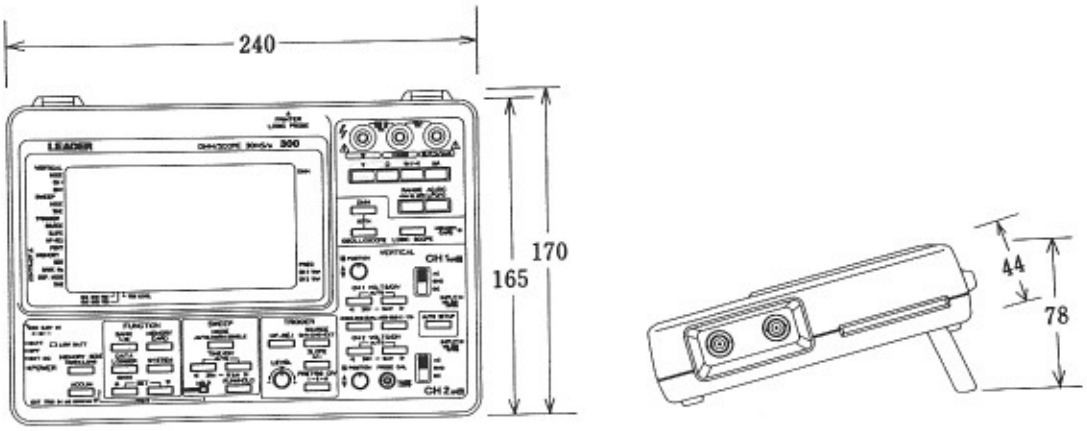


Fig. 1-1

Weight	1.2 kg (not including batteries)
Operating environment	0 to 40°C, 10 to 80% humidity
Accessories	• Arcing-protected circuit-protection fuse (0.5 A) for DMM current/resistance measurement • DMM test leads (UL approved) (1 set) • Waveform measurement probes (LP-16BX) (2) • Strap (LC-2235) • Type SUM-3 batteries (4)
Separately sold options	
Accessory kit	Carrying case (LC-2234) Memory card (LM-2900-3) AC adaptor (LPS-1910) External trigger cable (LC-2073)
Dedicated printer Model 710	Provided with printer cable for connection to the Model 300
LP-2087 Logic Probe	

2. OPERATING PRECAUTIONS

2.1 Avoiding Excessive Inputs

Take care that none of the input terminals of the Model 300 is subjected to input levels higher than the maximum specified levels, as this can cause burnout of input circuitry and damage to internal circuits.

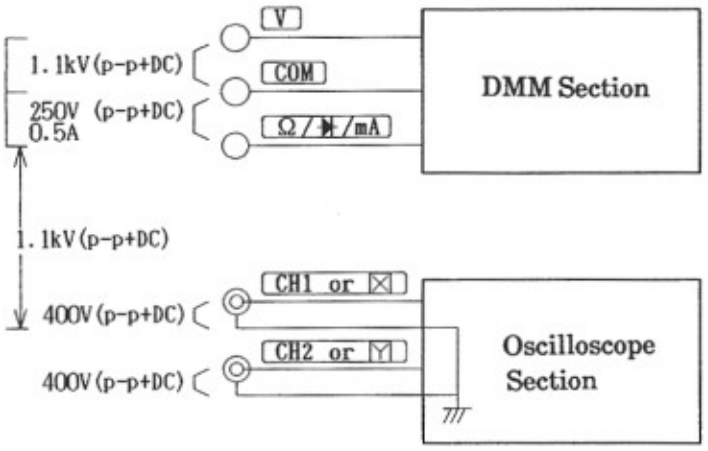


Fig. 2-1

(1) DMM Section

- Between V and COM — 1.1 kV (p-p + DC) for 1 minute
- Between Ω and COM — 250 V (p-p + DC) for 1 minute
- Between mA and COM — 0.5 A (fuse protected)

(2) Oscilloscope Section

- Vertical input terminal — 400 V (p-p + DC) , 1 kHz for 1 minute
- External trigger input — 100 V (p-p + DC), 1 kHz for 1 minute
- Probe (LP-16BX) — 600 V (p-p + DC), 1 kHz for 1 minute

(3) Isolation Withstand Voltage Between the DMM and Oscilloscope Sections

- Between DMM input and SCOPE GND — 1.1 kV (p-p + DC) for 1 minute

A "maximum of 400 V (p-p + DC)" refers to the condition, as shown in Fig. 2-2, in which the absolute value at the peak is 400 V.

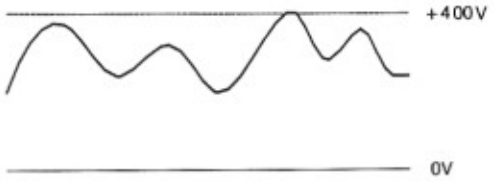


Fig. 2-2

Replacement of the Current-Measurement Terminal Protective Fuse

When the rear battery cover is opened, the fuse can be seen next to the batteries, as shown in Fig. 2-3. Replace this fuse with a spare.

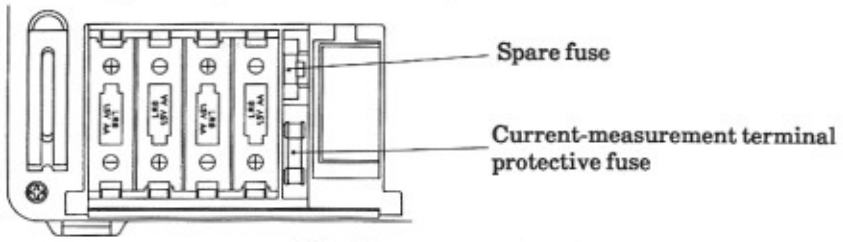


Fig. 2-3

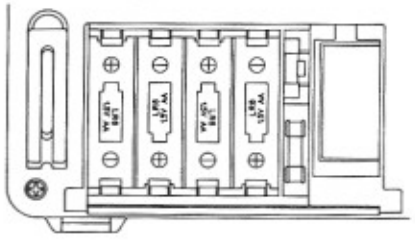
2.2 Battery Operation

(1) Battery replacement

When the battery voltage drops, the "LOW BATT" indicator on the front panel will light. If this indicator lights, it is time to replace the batteries of the Model 300.

Replace all four batteries with batteries of the same type, and avoid mixing new and old batteries.

If the Model 300 is to be left unused for a long period of time (one month or longer), be sure to remove the batteries from the Model 300 to prevent both depletion and leakage.



(1) Slide the battery cover in the "OPEN ▶ " direction to open it.

(2) Replace all batteries with new ones, taking care to observe proper polarity.

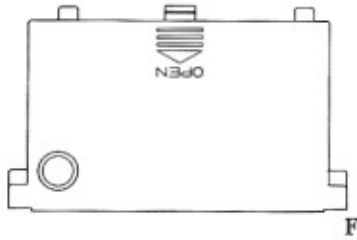


Fig. 2-4

(2) Battery Life

Battery life will depend upon the type of battery, the ambient temperature, and the measurement conditions.

Table 2-1 gives some general value to be used as a guide in battery operation with various types of batteries.

V. MODE: DUAL, SWEEP MODE: AUTO, TIME/DIV: 1ms/div

Table 2-1 Approximate Operating Times

Ambient temperature	Alkali Batteries	Manganese Batteries	Rechargeable Nicad Batteries
0°C	35 min.	No operation	1 hour
20°C	2 hour 15 min.	25 min.	1 hour 15 min.
40°C	3 hours	45 min.	1 hour 20 min.

Care is required when either the NORM or SINGLE sweep mode is selected, as the battery life is greatly shortened in the trigger wait condition.

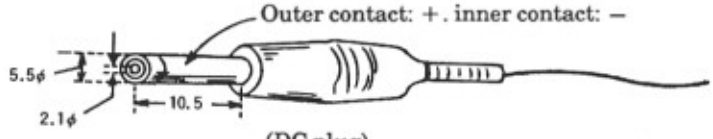
Note: Batteries will generate heat after a long period of battery operation, but this is not an abnormal condition.

2.3 External DC Power

Take care with the polarity and input voltage.

- Input voltage 6.5 V ±10%
- Maximum input voltage 7.5 V

Use only the LPS-1910 AC adaptor (6V 800mA).



(DC plug)

Fig. 2-5

2.4 High Temperature and Humidity

Use the Model 300 in its specified operating environment of 0 to 40°C and 10 to 80% humidity. Use under severe environmental conditions can cause failures.

2.5 Avoid Excessive Shock

When carrying the Model 300, take care that it is not allowed to be dropped or otherwise subjected to excessive shock, as this can cause operational or permanent failures.

2.6 LCD Contrast

The contrast of the LCD display changes with temperature, and the overall display density increases when the ambient temperature is high. If this happens, turn the CONTRAST adjustment down to lower the screen contrast.

2.7 BANK Memory Backup

The bank memory contents are backed up by a dedicated battery. If the Model 300 is powered on for 8 hours, these contents will be held for at least one month.

3. PANEL DESCRIPTIONS

This section will describe the front panel switches, knobs, and connectors of the Model 300.

Note that each time a key switch operation is accepted by the Model 300 a beeper is sounded.

The circled numbers in this section refer to number in the drawings applied to controls and connectors.

Panel markings have been indicated in all capitals in the descriptions that follow.

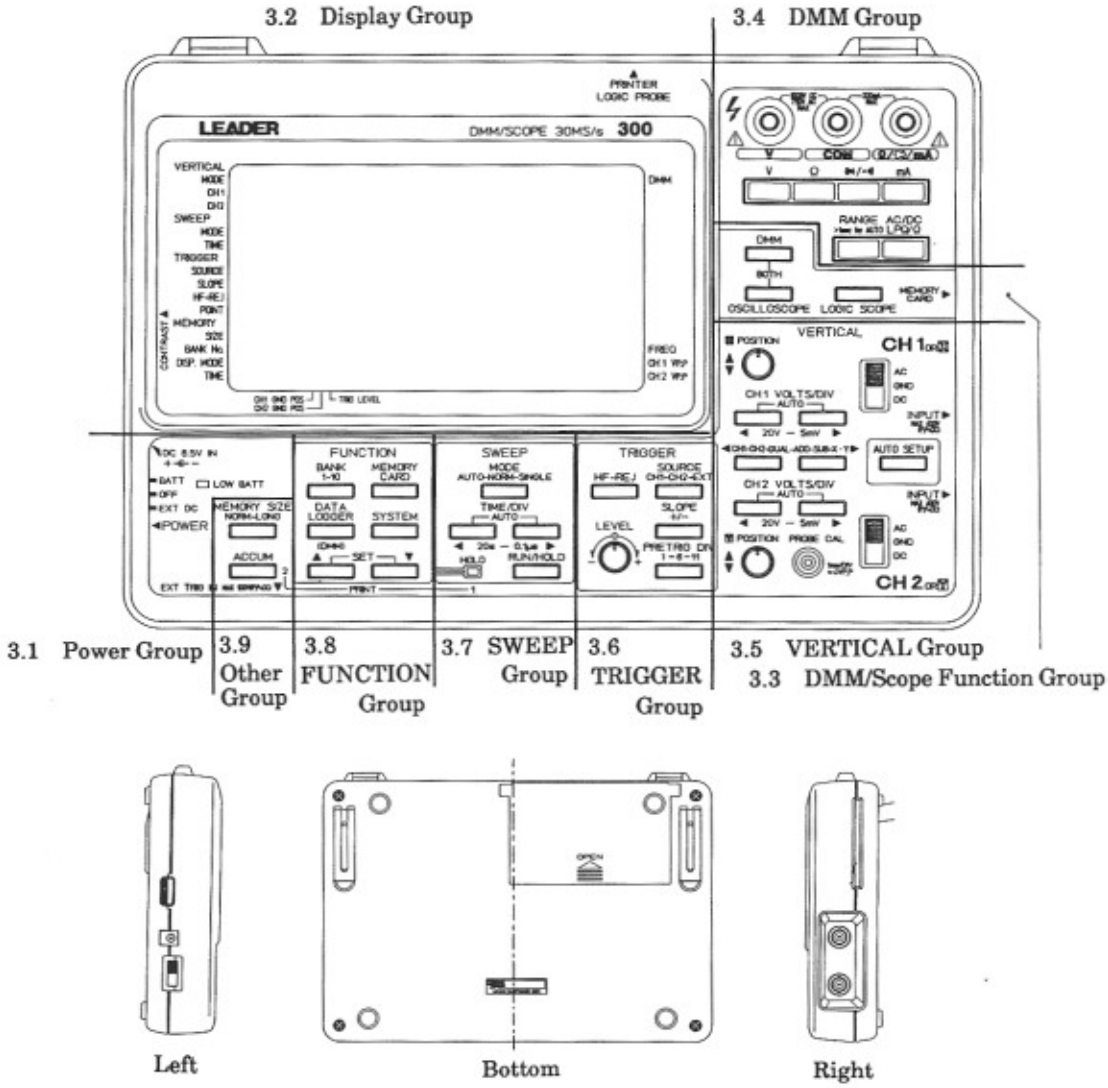


Fig. 3-1

Descriptions of the various switch and control groups follow.

3.1 Power Group

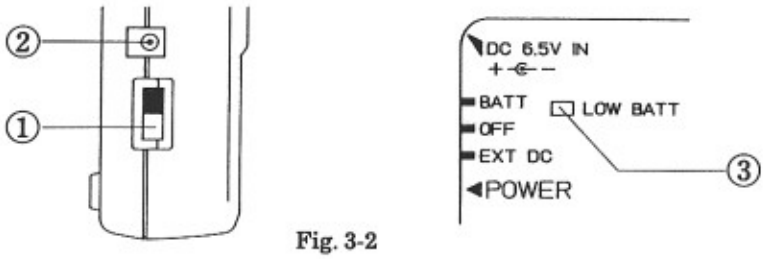


Fig. 3-2

① POWER switch (slide switch)

The positions of this switch (from the bottom) are EXT DC – OFF – BATT. In the BATT setting, the Model 300 is powered from internal batteries, and in the EXT DC setting, it is powered from an external AC adaptor.

② DC 6.5V IN connector

This is the input connector for the dedicated AC adaptor. It is used in powering the Model 300 for continuous operation from the AC line.

③ LOW BATT indicator

This indicator lights to indicate that the supply voltage has dropped.

3.2 Display Group

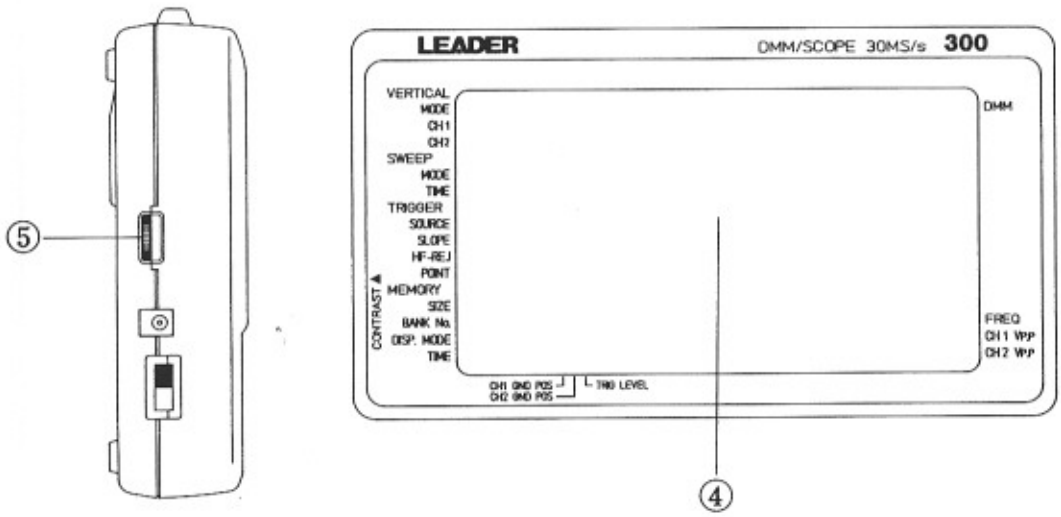


Fig. 3-3

④ LCD panel

The scales consist of 8 vertical and 12 horizontal divisions, which are displayed with half contrast.

⑤ CONTRAST knob

This potentiometer is used to adjust the contrast of the waveforms and characters displayed on the LCD. Setting it to the top increases the display density.

3.3 DMM/Scope Function Group

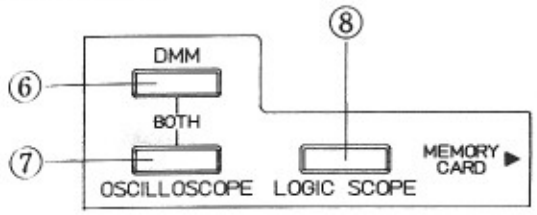


Fig. 3-4

⑥ DMM function selection switch (key switch)

This switch selects the DMM function.

⑦ OSCILLOSCOPE function selection switch (key switch)

This switch selects the OSCILLOSCOPE function.

If the DMM switch ⑥ and OSCILLOSCOPE switch ⑦ are pressed simultaneously, both functions will be displayed simultaneously.

⑧ LOGIC SCOPE function selection switch (key switch)

This switch selects the LOGIC SCOPE function.

3.4 DMM Group

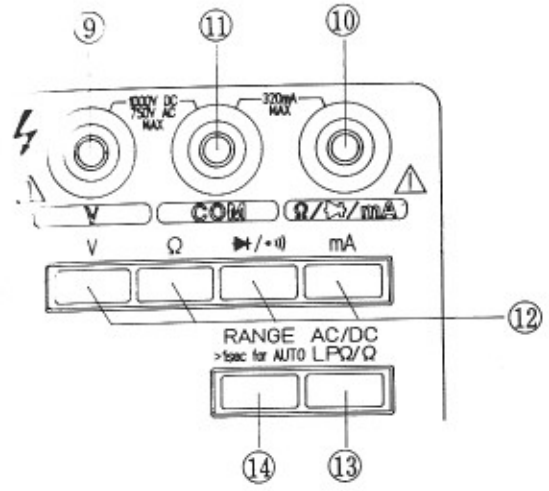


Fig. 3-5

⑨ V input terminal

⑩ Ω/ ⋇ /mA input terminal

⑪ COM input terminal

The input terminals consist of V (used for voltage measurement), Ω/ ⋇ /mA (used for resistance, continuity, and current measurements), and the common terminal COM used for a variety of measurements.

Take care that the maximum allowable applied voltages for these terminals are not exceeded.

⑫ Function selection switches (push-lock switches)

These switches are used to select the voltage (V), resistance (Ω), continuity (Ω/ ⋇ /mA), and current (A) measurement functions.

⑬ AC/DC LPΩ/Ω switch (push-lock switch)

This switch is used to select either AC or DC for voltage and current measurements, and to switch the open-circuit measurement voltage for resistance measurements.

⑭ RANGE switch (push switch)

This switch is used to switch between autoranging and manual range selection, and to switch the range in the manual range selection mode. If it is held down for more than 1 second, autoranging is selected.

3.5 VERTICAL Group

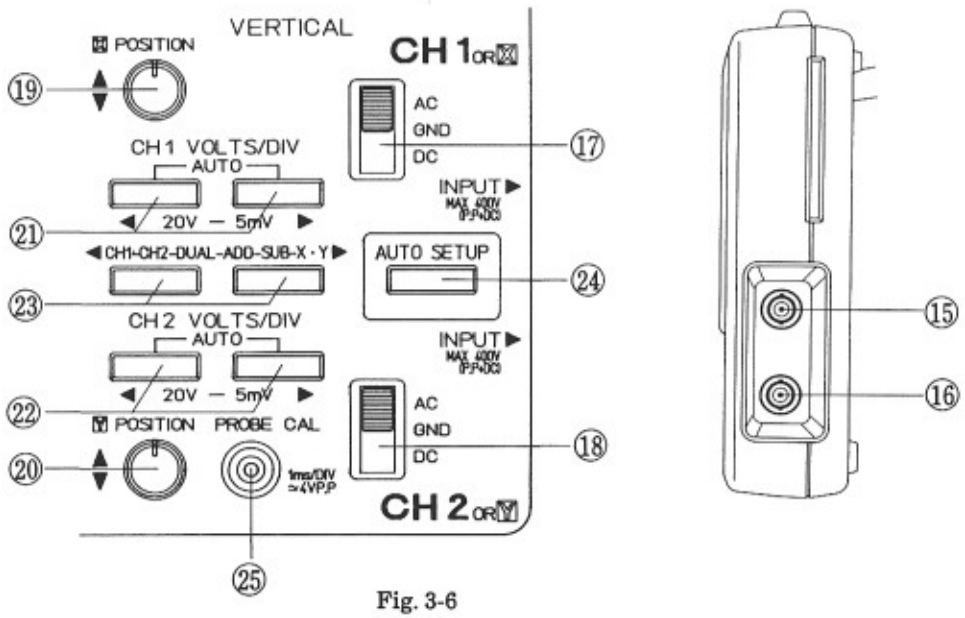


Fig. 3-6

⑮ CH1 or X IN connector

⑯ CH2 or Y IN connector

These are the vertical input connectors. Their ground contacts are internally connected. Take care not to exceed the maximum allowable applied voltage limit of these connectors.

⑰ CH1 AC-GND-DC switch (slide switch)

⑱ CH2 AC-GND-DC switch (slide switch)

These switches are used to select the coupling for the signals applied to the input connectors. DC selects DC coupling, while AC selects AC coupling through a DC-blocking coupling capacitor. In the GND setting, the input of the amplifier is grounded, and the vertical-axis input terminal is open.

⑲ CH1 POSITION adjustment (rotary potentiometer)

⑳ CH2 POSITION adjustment (rotary potentiometer)

These potentiometers are used to adjust the vertical position. Turning one of these knobs clockwise moves the waveform for that channel upward, and turning it counterclockwise moves the trace downward.

㉑ CH1 VOLTS/DIV ◀ and ▶ switches (key switches)

㉒ CH2 VOLTS/DIV ◀ and ▶ switches (key switches)

These switches are used to switch the vertical-axis input sensitivity.

VERTICAL AUTO RANGE

This function automatically sets the input sensitivity. To enable it, press both VOLTS/DIV ◀ and ▶ switches at the same time.

㉓ Vertical operating mode selection switches (◀ and ▶) (key switches)

These switches are used to select the vertical mode (CH1, CH2, DUAL, ADD, SUB, and X-Y).

㉔ AUTO SETUP switch (key switch)

This is used to automatically set the vertical-axis input sensitivity, the position, the sweep time, and the trigger level.

㉕ PROBE CAL output terminal

This terminal makes available a probe calibration signal.

3.6 TRIGGER Group

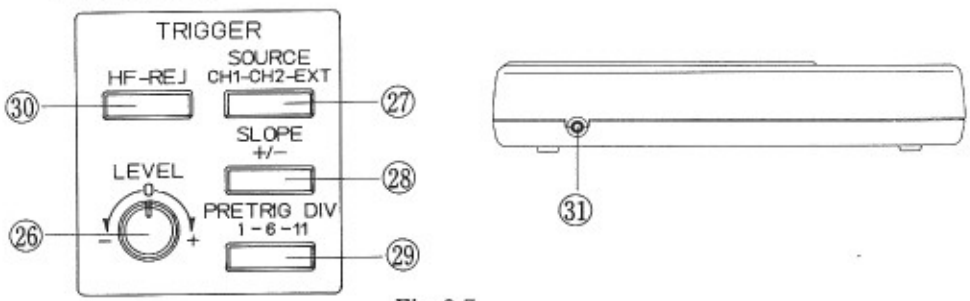


Fig. 3-7

㉖ LEVEL adjustment (rotary potentiometer)

This is used to adjust the trigger level which establishes the start of the triggered sweep.

㉗ SOURCE switch (key switch)

This switch is used to select the trigger source.

㉘ SLOPE switch (key switch)

This switch is used to select the trigger slope.

㉙ PRETRIG DIV switch (key switch)

This switch is used to establish the position of the trigger point on the sweep.

㉚ HF-REJ switch (key switch)

This is used to band-limit the trigger signal. It attenuators trigger signals above 100 kHz.

㉛ EXT TRIG IN connector

This is the connector for an external trigger signal. It accepts TTL logic level signals. Be careful not to exceed the maximum allowable applied voltage limit.
Rise time or Fall time: Input signal at 500ns or low.

3.7 SWEEP Group

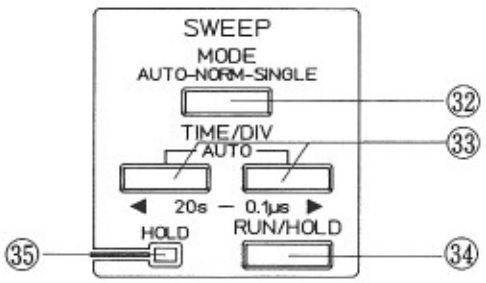


Fig. 3-8

㉜ MODE switch (key switch)

This switch is used to select the sweep function (AUTO, NORM, and SINGLE).

㉝ TIME/DIV ◀ and ▶ switches (key switches)

These switches are used to set the sweep time per division of the display.

TIME AUTO RANGE

This function sets the sweep time automatically. It is enabled by pressing both the ◀ and the ▶ switches at the same time.

㉞ RUN/HOLD switch (key switch)

This switch is used to start and stop measurements.

㉟ HOLD indicator

This indicator lights when the measurement is stopped.

3.8 FUNCTION Group

The FUNCTION group is operative when the HOLD indicator ㉘ is lighted.

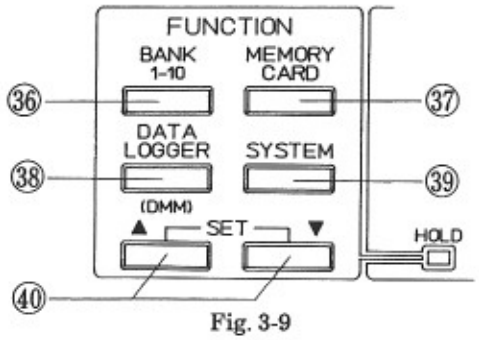


Fig. 3-9

㊱ BANK 1-10 switch (key switch)

This switch is used in the oscilloscope mode or logic scope mode to store the display screen into bank memory, and when comparing a bank memory waveform with another waveform on the display. It does not function in the DMM mode.

For details on operation, refer to Section 5.10 (Waveform Storage and Recall), Section 5.11 (Waveform Comparison), Section 6.5 (Waveform Storage and Recal), and Section 6.6 (Waveform Comparison).

㊲ MEMORY CARD switch (key switch)

This switch is used in the oscilloscope mode or logic scope mode to swap data stored in bank memory with data stored on a memory card. It does not function in the DMM mode.

In the NORM mode, the memory size is such that one swappable group consists of ten waveforms. In the LONG mode, one swappable group is consists of one waveform.

For details on operation, refer to Section 9 (MEMORY CARD).

㊳ DATA LOGGER switch (key switch)

In the DMM mode, this switch is used to print out the measured values at a fixed time interval. It is used for data logger operation, and does not function in the oscilloscope or logic scope mode.

For details on operation, refer to Section 4.5 (Data Logger Function).

㊴ SYSTEM switch (key switch)

In the oscilloscope mode or logic scope mode, this switch is used to:

- turn on or off the automatic measurement function that displays the peak-to-peak voltage and frequency of the input signal,
- turn on or off the auto power-off function, and
- change the calendar and time setting.

It does not function in the DMM mode.

For details on operation, refer to Section 5.12 (Automatic Input Signal Peak-to-Peak Voltage and Frequency Measurement), Section 7 (CALENDAR AND TIME SETTINGS), and Section 8 (AUTO POWER-OFF SETTING AND CANCELING).

㊵ SET ▲ and ▼ switches (key switches)

These switches are used to select various items and make settings when functions ㉘ to ㉝ described above are operating.

3.9 Other Group

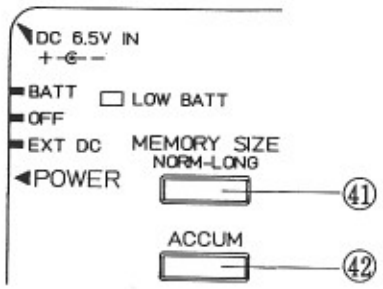


Fig. 3-10

㊶ MEMORY SIZE switch (key switch)

This switch is used to select the working memory capture size in number of words.

㊷ ACCUM switch (key switch)

In the HOLD mode, this switch serves as the PRINT switch.

In the RUN mode, this switch serves as the ACCUMULATE (overlay) switch.

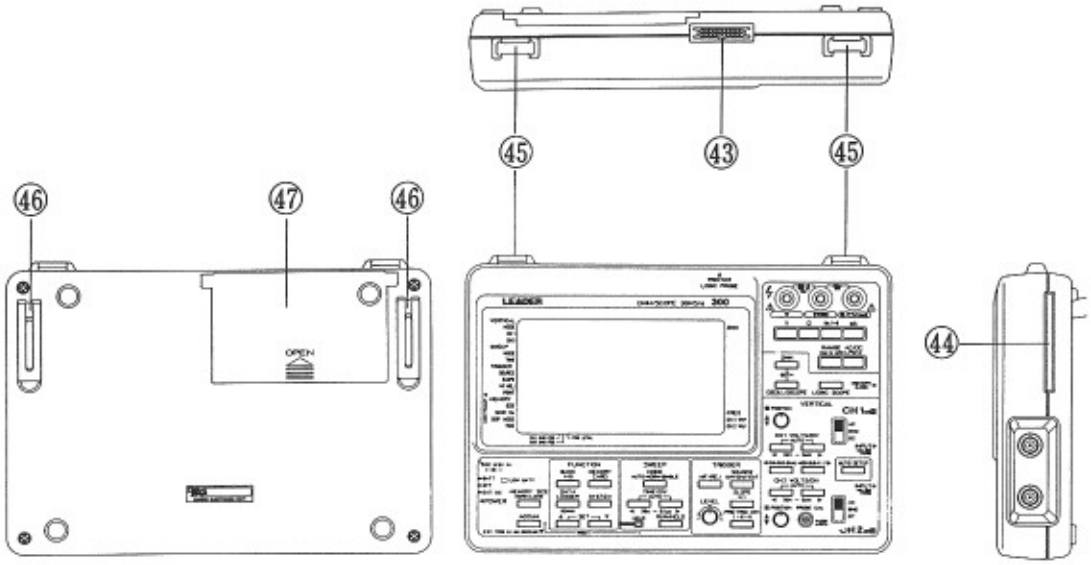


Fig. 3-11

㊸ PRINTER/LOGIC PROBE connector

This is the output connector for the dedicated printer.

It serves also as the input connector for the logic scope.

㊹ Memory card insertion slot

㊺ Strap guide

㊻ Stand feet

㊼ Battery cover

4. USING THE DMM

4.1 Panel Controls Used

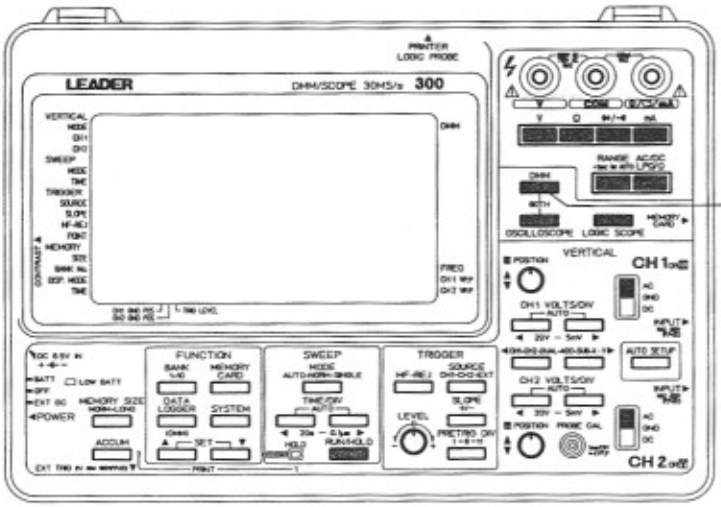


Fig. 4-1

4.2 Range Switching

When the DMM switch ⑥ is pressed to select the DMM function, the range-switching mode is set to autoranging.

In the autoranging mode, when the RANGE switch ⑭ is pressed a change is made to manual range selection.

In the manual range selection mode, each time the RANGE switch ⑭ is pressed the measurement range is up-ranged.

If the RANGE switch ⑭ is held down for longer than 1 second, a switch will be made from manual range selection to autoranging.

Ranging Operations in the Autoranging Mode

When the measurement results reach the following limits, the range is automatically switched.

Autoranging up-range:	Switch to the next higher range at 2800 to 3199 counts
Autoranging down-range:	Switch to the next lower range at below 269 counts
Warning display:	When the measurement result exceeds 3199 positive counts, the display will indicate "+ - - - -" and when it exceeds 3199 negative counts, it will indicate "– - - - -". In addition, a beeper will sound as a warning.

4.3 Low-Power Resistance Measurement (LPΩ)

Low-power resistance measurement is used in in-circuit measurement of resistances that are connected in parallel with diodes or transistors.

The resistance is measured with an open-circuit input terminal voltage of 0.45 V or lower. Note that because of the reduced measurement voltage, measurement accuracy is reduced.

In the DMM mode, press the Ω switch ⑫.

Next, press the LPΩ/Ω switch ⑬. "LP" will on the LCD display panel.

Make the measurement by connecting the resistance to be measured across the input terminals ⑩ and ⑪.

Table 4-1 shows measurement examples obtained by measuring a circuit such as shown in Fig. 4-2.

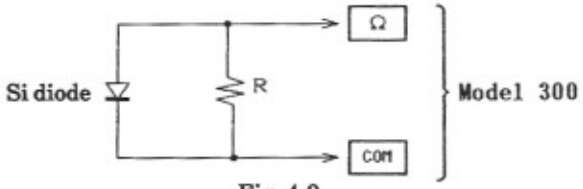


Fig. 4-2

Table 4-1

R	NORM Ω		LP Ω	
	Measured Value	Error	Measured Value	Error
22 kΩ	19.44 kΩ	−11.6%	21.72 kΩ	−1.3%
100 kΩ	90.0 kΩ	−10.0%	97.2 kΩ	−2.8%

4.4 Diode Test and Continuity

A beeper is provided to indicate circuit continuity.

This can also be used to determine diode type and perform go/nogo diode tests.

In the DMM mode, press the ⋔ /·)) (continuity) switch ⑫.

Measurement is made between the input terminals ⑩ and ⑪.

If the displayed value falls below approximate 200 (approx. 500 Ω), the beeper will sound, indicating continuity. The following values will approximately indicate the following conditions.

Open	Approx. 1500
Short	Approx. 0
Silicon diode	Approx. 550
Germanium diode	Approx. 230

4.5 Data Logger Function

Using this function, the DMM measurement value is printed on a dedicated printer or output to a memory card a specified number of times at a fixed time interval.

Data stored onto a memory card can be output to a dedicated Model 710 Printer.

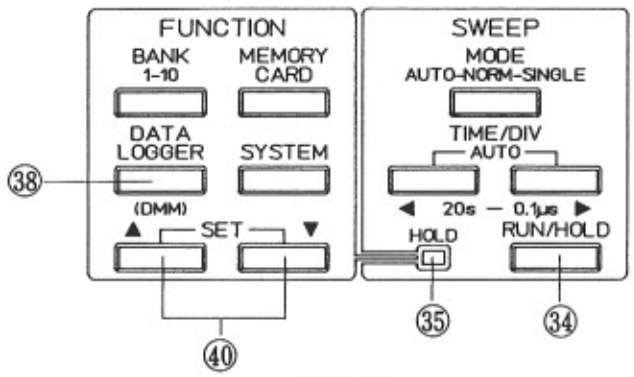


Fig. 4-3

Procedure

This function operates in the DMM mode.

(1) When the RUN/HOLD key ㉞ is pressed, the HOLD indicator ㉟ lights, indicating the HOLD condition.

(2) When the DATA LOGGER key ㊳ is pressed, the data logger mode is enabled, and the data logger mode setting menu shown in Fig. 4-4 appears.

In the data logger mode, if the DATA LOGGER key ㊳ is pressed once again, return is made to the HOLD condition.

Function	Setting	Setting value menu
	LOGGER SET	
OUTPUT	PRINTER	PRINTER/CARD
TIME	10 MIN	5/10/30 SEC 1/ 5/10 MIN
NUMBER	100	10/ 20/ 50/ 100/200/ ∞/
START	0001	DC+0.000 V
CPRINT		

Fig. 4-4

(3) Output Destination Setting

Set the output destination to either PRINTER or CARD.

Use the ▲ or ▼ keys ㊵ to bring the highlighted display section to OUTPUT of the function part of the menu.

If both the ▲ and ▼ keys are pressed at the same time for this setting, the highlighted portion of the display moves to setting value part of the display (middle column).

Use the ▲ or the ▼ key to highlight either PRINTER or CARD in the setting value part of the menu.

If both the ▲ and ▼ keys are pressed at the same time for this setting, the output destination is set. The highlighted portion of the display returns to the OUTPUT item.

(4) Interval Time Setting

The output interval can be set to 5 s, 10 s, 30 s, 1 min., 5 min., or 10 min.

Use the ▲ or ▼ keys ㊵ to bring the highlighted display section to TIME of the function part of the menu.

If both the ▲ and ▼ keys are pressed at the same time for this setting, the highlighted portion of the display moves to setting value part of the display (middle column).

Use the ▲ or the ▼ key to select the interval time from the setting value menu.

If both the ▲ and ▼ keys are pressed at the same time for this setting, the interval time is set. The highlighted portion of the display returns to the TIME item.

(5) Number of Measurements Setting

The number of measurements can be set to 10, 20, 50, 100, 200, or ∞. Note, however, that when the output destination has been set to CARD, the number of measurements cannot be set to ∞.

Use the ▲ or ▼ keys ㊵ to bring the highlighted display section to NUMBER of the function part of the menu.

If both the ▲ and ▼ keys are pressed at the same time for this setting, the highlighted portion of the display moves to setting value part of the display (middle column).

Use the ▲ or the ▼ key to select the number of measurements from the setting value menu.

If both the ▲ and ▼ keys are pressed at the same time for this setting, the number of measurements is set. The highlighted portion of the display returns to the NUMBER item.

(6) Measurement Start

When the other settings have been made, use the ▲ or ▼ key ㊵ to move the highlighted portion of the display to START.

If ▲ and ▼ are pressed simultaneously, operation is started.

When measurement is started, the number of measurements and measured value are displayed to the right of "START".

If the DATA LOGGER key ㊳ is pressed before the completion of printing, printing is stopped, and return is made to the HOLD condition.

Fig. 4-5 shows and example of a printout.

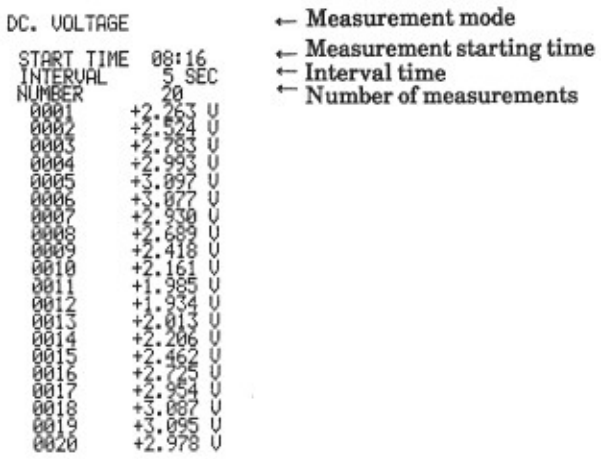


Fig. 4-5

If the output destination is set to CARD, "INIT Y/N" might appear in the setting value column. If this happens, it is necessary to initialize the memory card.

Memory Card Initialization

If you had already been using a memory card in either the oscilloscope or the logic scope mode, to prevent accidental erasing of data, "INIT Y/N" appears to verify whether it is ok to initialize the memory card.

Remember that when a memory card is initialized, all data on the memory card is erased.

A memory card that has never been used will also require initialization.

The initialization procedure is as follows.

(1) With the START of the function section of the menu highlighted, press the ▲ and the ▼ keys simultaneously so that INIT Y/N is displayed.

(2) Each time the ▲ or ▼ key is pressed, Y and N are selected alternately.

(3) Move the highlighted portion to the Y and press ▲ and ▼ at the same time to execute the initialization.

Printout From a Memory Card

It is possible to print out data that has been stored onto a memory card.

The procedure is as follows.

(1) Use the ▲ or ▼ key to move the highlighted portion of the display to the CPRINT of the function column.

(2) Press the ▲ and the ▼ keys at the same time to output data from the memory card to the printer.

4.6 Printout of the Display Screen

The display screen can be printed out on the dedicated Model 710 Printer (separately sold option).

Connections to the Model 710

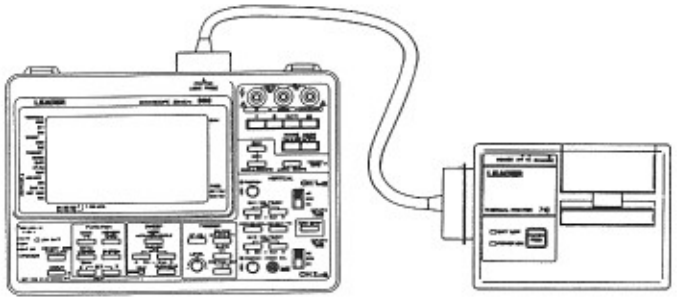


Fig. 4-6

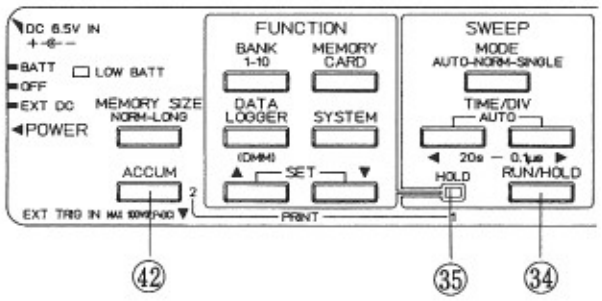


Fig. 4-7

Procedure

(1) Press the RUN/HOLD key ㉞ to light the HOLD indicator ㉟ and enable the HOLD condition.

(2) When the ACCUM key ㊷ is pressed, printout begins.

Fig. 4-8 shows a printout example

```
DC-3.192 V      ← DC voltage measurement
AC 1.895 V      ← AC voltage measurement
  224.3KΩ       ← Resistance measurement
LP 224.3KΩ      ← Low-power resistance measurement
DC+246.0mA      ← DC current measurement
```

Fig. 4-8