ALTAI Model DD 6010

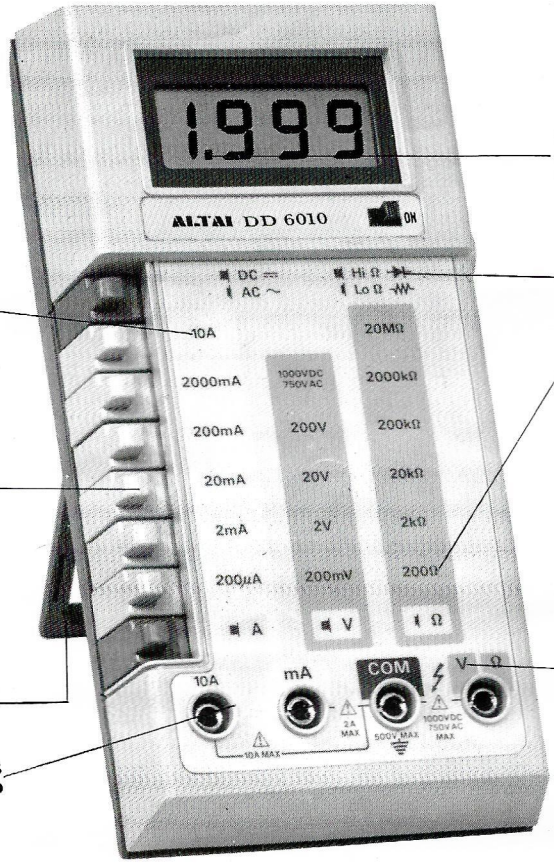
Digital Multimeter

* 3½ Digit Liquid Crystal Display
* 0.25% Basic Accuracy
* 28 Ranges
* 10A AC and DC Current Ranges
* Fully Protected (All Ranges)
* Hi/Lo Voltage Resistance Testing
* Recessed Input Jacks for Safety
* 2 00 Hour Battery Life

RELIABLE, ACCURATE MEASUREMENTS

0.25% DC-VOLT ACCURACY, 10 AMP. AC-DC RANGES!

Amazing quality at low cost !



3½ DIGIT LCD DISPLAY WITH AUTO ZERO, AUTO POLARITY, LOW BAT.

DC, AC 10 Amp MEASUREMENT

HI VOLT FOR DIODE TEST
LO VOLT FOR IN-CIRCUIT RESISTANCE MEASUREMENTS

IN LINE PUSH-BUTTONS ARE EASY TO USE. COLOR CODED BUTTONS FUNCTION PANEL ALLOW SPEEDY RANGE SELECTION

OVERLOAD PROTECTION ON ALL RANGES

UNBREAKABLE ABS PLASTIC TILT-STAND FOR BENCH-TOP USE

RECESSED INPUT JACKS AVOID SHOCK HAZARD

INSTRUMENT INCLUDES

1. 9 VOLT Battery
2. Spare Fuse
3. Safety Test Lead Set
4. Operator's Manual

* Soft Carrying case (Option)

MODEL DD 6010 SPECIFICATIONS

GENERAL

DISPLAY: 3½ dight LCD, 0.5" height, with polarity

OVERRANGE INDICATION: 3 least significant digits blanked

MAXIMUM COMMON MODE VOLTAGE: 500V peak

OPERATING ENVIRONMENT: 0° to 50°C; less than 80% relative humidity up to 35°C, less than 70% relative humidity from 35°C to 50°C

STORAGE ENVIRONMENT: -15°C to 50°C

TEMPERATURE COEFFICIENT (0° to 18°C and 28° to 50°): Less than 0.1 x applicable accuracy specification per °C.

POWER: 9V alkaline or carbon-zinc battery (NEDA 1604)

BATTERY LIFE: 100 hours typical with carbon-zinc cells, 200 hours with alkaline cells

BATTERY INDICATOR: Display indicates "LO BAT" when less than 10% of life remains

DIMENSIONS, WEIGHT: 170mm long x 89mm wide x 38mm thick (6.75" x 3.5" x 1.5"). Net weight 283g (10 oz.).

DC VOLTAGE

RANGE	RESOLUTION	ACCURACY (1 YEAR) 18° to 28°C
200mV	100 μV	
2V	1mV	
20V	10mV	±(0.25% of reading + 1d)
200V	100mV	
1000V	1V	

MAXIMUM ALLOWABLE INPUT: 1000V DC or peak DC non-switched, 750V peak switched

INPUT RESISTANCE: 10M 20V to 1000V ranges

NORMAL MODE REJECTION RATIO: Greater than 46dB at 50Hz, 60Hz (1k unbalance)

DC CURRENT

RANGE	RESOLUTION	ACCURACY (1 YR) 18 to 28 C	MAXIMUM FULL SCALE VOLTAGE DROP
200μA	100nA	±(1% rdg + 1d)	0.25 V
2mA	1μA	±(1% rdg + 1d)	0.25 V
20mA	10μA	±(1% rdg + 1d)	0.25 V
200mA	100μA	±(1% rdg + 1d)	0.25 V
2000mA	1mA	±(2% rdg + 1d)	0.5 V
10 A	10mA	±(2% rdg + 5d)	0.3 V

OVERLOAD PROTECTION: mA input, 2A fuse (250V). 10 A input; unfused up to 15A for 15 seconds.

AC VOLTAGE

RANGE	RESOLUTION	ACCURACY (1 YR) 18 to 28 C	FREQUENCY RANGE
200mV	100μV		45Hz-500Hz
2V	1mV		45Hz-500Hz
20V	10mV	±(1% of rdg + 5d)	45Hz-500Hz
200V	100mV		45Hz-120Hz
750V	1 V		45Hz-120Hz

MAXIMUM ALLOWABLE INPUT: 1000V peak non-switched, 750V peak switched; continuous except 200mV range; 15 sec max above 300V

INPUT IMPEDANCE: 10M shunted by less than 100pF 20V to 750V ranges

RESPONSE: Average responding, calibrated in rms of a sine wave

AC CURRENT

RANGE	RESOLUTION	ACCURACY (1 YR) 18 to 28 C	MAXIMUM FULL SCALE VOLTAGE DROP
200μA	100nA	±(2% rdg + 5d)	0.25V rms
2mA	1μA	±(2% rdg + 5d)	0.25V rms
20mA	10μA	±(2% rdg + 5d)	0.25V rms
200mA	100μA	±(2% rdg + 5d)	0.25V rms
2000mA	1mA	±(3% rdg + 5d)	0.5 V rms
10 A	10mA	±(3% rdg + 5d)	0.3 V rms

OVERLOAD PROTECTION: mA input, 2A fuse (250V). 10 A input; unfused up to 15A for 15 seconds.

RESISTANCE

RANGE	RESOLUTION	ACCURACY (1 YR) 18° to 28°C
200	100m ohm	±(0.5% rdg + 4d)
2k	1 ohm	+(0.5% rdg + 1d)
20K	10 ohm	±(0.5% rdg + 1d)
200K	100 ohm	+(0.5% rdg + 1d)
2000K	1K ohm	±(1 % rdg + 1d)
20M	10k ohm	±(2 % rdg + 1d)

MAXIMUM OPEN CIRCUIT VOLTAGE: 2.8V Hi, 280mV Lo, at nominal 9V bat.

MAXIMUM ALLOWABLE INPUT: 200V DC or rms

FULLY OVERLOAD PROTECTED, UL1244

Overload protection is accomplished on all ranges. For overvoltages protection a selected sparkgap with low capacitance is used which proved superior in performance to Varistors used other instruments. An inrush current limiter protects the resistance ranges. A pair of fast switching high current silicon diodes plus a fuse provide excellent protection on all current ranges. Furthermore, the input of the A/C converter is overvoltage protected and the battery eliminator input is protected against overvoltage and reverse polarity.

A 2 Amp fuse protects the 2mA through 2000mA current range. Do not replace the fuse with a higher rated value or instrument damage that is not covered by the warranty may occur.

HI-LOW RESISTANCE/DIODE CHECK

On all resistance ranges a HI (2.8V); and LOW (280mV) is available Test Voltage is push-button switch selectable (2nd function of AC/DC switch). Low voltage allows convenient in-circuit measurements of all electronic components. Without affecting semi-conductors.

NOTICE: TURN TEST CIRCUIT POWER OFF AND DISCHARGE ALL CAPACITORS BEFORE ATTEMPTING IN-CIRCUIT RESISTANCE MEASUREMENT

OPERATING INSTRUCTIONS

GENERAL

The power switch is on the right side below the display. It is recommended that for maximum battery life, the switch should be left in the off position when measurements are not being taken. The top button sets the instrument for AC operation in the "in" position, for DC in the "out" position, when measuring either current or voltage. When measuring ohms, the same button selects either a 2.8 voltage in the "out" position or a 280mV voltage in the "in" position. Use of these voltages is explained in the section entitled "Measuring Resistance" The bottom button sets the instrument for measuring voltage and current in the "Out" position® ohms in the "in" position. The light colored button selects the ranges as indicated.

On DC measurements a "–" sign in the display means the common is positive, the other lead negative.

A reading exceeding the selected range is indicated by the appearance of the left hand "1" and the absence of the three remaining digits to the right.

MEASURING DC VOLTS

1. Black lead in "COMMON", red lead in "VΩ".
2. Top button "OUT"
3. Bottom button "OUT"
4. Push range selector button to the voltage range on volt scale higher than expected voltage.

CAUTION: DO NOT MEASURE OVER 1000 VOLTS DC TO AVOID DANGER TO OPERATOR AND INSTRUMENT. DO NOT CONNECT "COMMON" TO VOLTAGE SOURCES OVER 500 VOLTS ABOVE GROUND TO AVOID RISK OF SERIOUS SHOCK.

5. Turn power "ON".
6. If a "1" shows with no other digits, scale chosen was too low; push successive higher range buttons until a 3-digit or 4-digit number appears. If the display number is less than "200", going to a lower range will increase the resolution and accuracy.
7. If "–" shows on display "COMMON" lead is "+" "VΩ" lead (Red) is "–".

MEASURING DC CURRENT

1. Black lead in "COMMON"; red lead in "mA" for 200 μA to 2000 mA (when measuring up to and more than DC 2000 mA, red lead in 10A)
2. Top button "OUT"
3. Bottom button "OUT"
4. Push range selector button to the current range on scale higher than expected current, not to exceed 2 amps. (10A at 10A range)
5. Turn power "ON".
6. If a "1" shows with no other digits, scale chosen was too low, push successive higher range buttons until a 3-digit or 4-digit number appears. If the display number is less than "200", going to a lower range will increase the resolution and accuracy.
7. If "–" shows on display "COMMON" lead is "+ " "mA ' or 10A lead (Red) is "– "

MEASURING AC VOLTS

1. One lead in "COMMON"; other lead in "VΩ"
2. Top button "IN"
3. Bottom button "OUT"
4. Push range selector button to the voltage range on volt scale higher than expected voltage.

CAUTION: DO NOT MEASURE OVER 750 VOLTS AC TO AVOID DANGER TO OPERATOR AND INSTRUMENT. DO NOT CONNECT "COMMON" TO VOLTAGE SOURCES OVER 500 VOLTS ABOVE GROUND TO AVOID RISK OF SERIOUS SHOCK.

5. Turn power "ON".
6. If a "1" shows with no other digits, scale chosen was too low; push successive higher range buttons until a 3-digit or 4-digit number appears. If the display number is less than "200", goin to a lower range will increase the resolution and accuracy.
7. Accurate readings can be taken over the range from 45Hz to 500Hz. Readings are calibrated to read RMS for sine waves only.

MEASURING AC CURRENT

1. One lead in "COMMON", the other in "mA" for 200 μA to 2000 mA (when measuring up to and more than AC 2000 mA, red lead in 10A)
2. Top button "IN"
3. Bottom button "OUT"
4. Push range selector button to the current range on left hand side scale higher than expected current, not to exceed 2 amps. (10A at 10A range)
5. Turn power "ON".
6. If a "1" shows with no other digits, scale chosen was too low; push successive higher range buttons until a 3-digit or 4-digit number appears. If the display number is less than "200", going to a lower range will increase the resolution and accuracy.
7. Accurate readings can be taken over the range from 45Hz to 500Hz. Readings are calibrated to read RMS for sine waves only.

MEASURING RESISTANCE

1. Black lead in "COMMON", red lead in "VΩ
2. Bottom button "IN"
3. Push range selector button to the resistance range on the Ω scale higher than expected resistance
4. If taking resistance readings on components that are not voltage sensitive, leave the top button out. This applies 2.8 volts to the device and gives somewhat higher accuracy. This position is also used when checking front to back ratios on semiconductors since the voltage exceeds the turn on threshold of most devices. The black lead will be negative and the red lead positive if step 1 is followed.
5. If taking resistance readings on components in a circuit where voltage sensitive components are involved, push the top button "IN" This drops the voltage at the test leads to 280mV, which is below the threshold of operation of most semiconductors.

NOTE
Make certain when taking resistance readings that circuits are de-energized and capacitors are discharged to avoid a blown fuse in this 6010 due to excessive current.

6. Turn power "ON".
7. If a "1" shows, with no other digits, scale chosen was too low. Push successive higher range buttons until a 3-digit or 4-digit number appears. If the display number is less than "200", going to a lower range will increase the the resolution and accuracy.

USE OF AC ADAPTOR

A Jack is provided on the right side of this 6010 for connection to an AC adaptor. Connection is made by means of a coaxial power plug with the center pin positive and the barrel negative. Since the 6010 may be connected to high voltages, the adaptor used must be capable of safely withstanding such voltages above ground. Additionally, the adaptor must deliver 9 volts at the very light current drain of the 6010 (typically, 9-volt, 100mA or 300mA adaptors will deliver 12 volts or higher at these very low currents).

BATTERY REPLACEMENT

CAUTION: BEFORE ATTEMPTING BATTERY REMOVAL OR REPLACEMENT, DISCONNECT TEST LEADS FROM ANY ENERGIZED CIRCUITS TO AVOID SHOCK HAZARD.

When the 9-volt battery has reached the end of its useful life, the words "LO BAT" will appear in the upper left corner of the LCD screen. To replace battery, the plastic tilt stand must first be removed. Merely squeeze the two sides to disengage the hinge pins from the back cover. To remove the battery compartment cover, press inward while sliding it downward. Unsnap the battery connector and replace on the new 9 volt transistor battery. For maximum life, alkaline cells are recommended although any standard 9 volt battery is suitable. Replace the battery compartment cover and the tilt stand.

FUSE REPLACEMENT

CAUTION: BEFORE REMOVING REAR COVER, DISCONNECT METER FROM ANY ENERGIZED CIRCUITS TO AVOID SHOCK HAZARD.

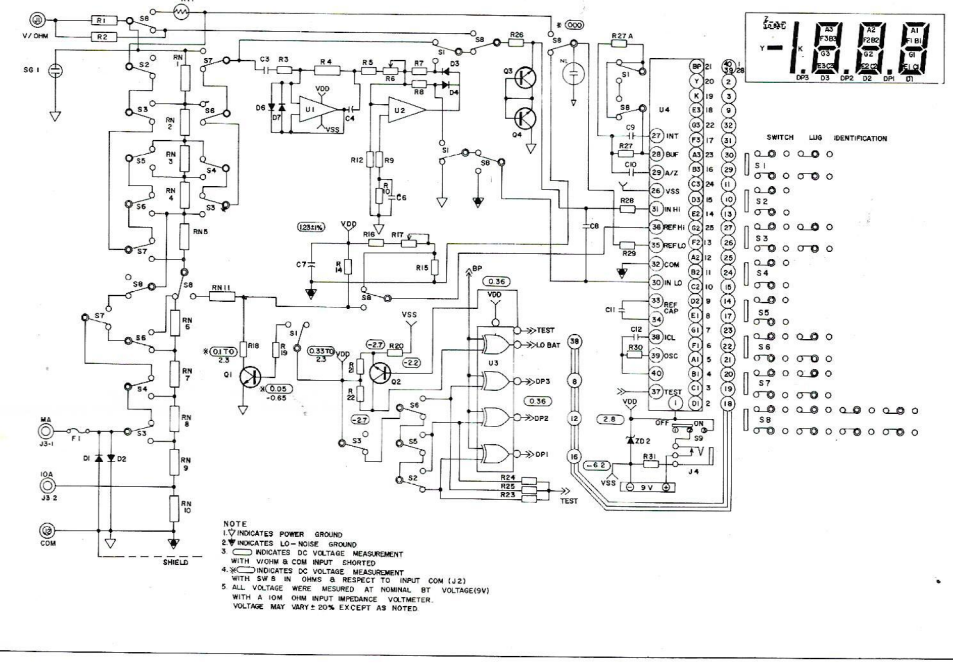
Fuse rarely need replacement and blow almost always as a result of operator error.

A spare 2 amp fuse are supplied inside the case. The 2 amp fuse protects the current measuring circuits which measure up to 2000mA. Should either require replacement, follow the disassembly procedure givenin the Calibration Procedure. If the 2 amp fuse requires replacement, pull it out of its clips and insert a new one. The spare fuse are stored in a compartment on the inside of the rear plastic cover, next to the battery compartment. They are held in place by a small piece of foam.

CALIBRATION PROCEDURE

Recalibration should not be necessary for long intervals. In no event should adjustments be made without highly accurate voltage standards (better than 0.1% accuracy). First, remove the 9 volt battery (as described above). Remove the 3 Phillips-head screws. Carefully remove the plastic back cover. Do not lose the plastic guidstrip that rests on the pushbuttons. Reconnect the 9 volt battery. With the instrument operating and set to the 200mV DC range, apply 190mV DC from an accurate source. With a small screwdriver inserted into the hole marked "D.C. ADJ", carefully turn the variable resistor into the reading until the reading reads 190mV. With the 6010 set to the 200mV AC range apply an accurate 190mV pure sine wave at a frequency between 45 and 500Hz. Insert a small screwdriver in the hole marked "A.C. ADJ." and turn carefully until meter reads 190mV. Reassemble by reversing the disassembly procedure. Make certain the plastic guide strip is fitted into the rear cover with the guide posts away from the outer edge of the cover.

SCHEMATIC DIAGRAM



PARTS LIST

PART	DESCRIPTION
U1, U2	IC, LOW POWER DUAL OP AMP
U3,	IC, C-MOS QUAD EX-OR GATE
U4,	LSI, 3½ DIGIT A/D CONVERTER
Q1–Q4	TR. Si NPN SWIT
ZD2	DIODE, ZENNER 12V 1W
D1, D2	DIODE, Si RECT. 3A 50V
D3, D4, D6, D7	DIODE, Si SWIT. 0.1A 75V
RN1–RN5	RESISTOR NETWORK 9MΩ, 900KΩ, 90KΩ, 9KΩ, 900Ω.
RN6–RN8	RESISTOR NETWORK 90 Ω 9 Ω, 0.9Ω
RN9	PRECISION RESISTOR 0.09Ω
RN10	0.01Ω Mn. W. MFG ADJ.
RN11	PRECISION RESISTOR 100 Ω
R1	RESISTOR, 100Ω 5% ¼W C.F.
R2	RESISTOR, 1M Ω 5% ¼W C.F.
R3	RESISTOR, 10KΩ 5% ¼W C.F.
R4	RESISTOR, 2.2MΩ 5% ¼W C.F.
R5	RESISTOR, 4.93KΩ 1% ¼W M.F.
R6	RESISTOR, SEMI FIXED 500Ω
R7, R8	RESISTOR, 5.62KΩ 1% ¼W M.F.
R9	RESISTOR, 5.6K 5% ¼W M.F.
R10	RESISTOR, 400KΩ 5% ¼W C.F.
R12	RESISTOR, 200K 5% ¼W C.F.
R14	RESISTOR, 1KΩ 5% ¼W C.F.
R15	RESISTOR, 1KΩ 1% ¼W C.F.
R16	RESISTOR, 10KΩ 5% ¼W C F.

PART	DESCRIPTION
R17	RESISTOR, SEMI FIXED 2KΩ
R18	RESISTOR, 50Ω 5% ¼W C.F.
R19	RESISTOR, 50KΩ 5% ¼W C.F.
R20	RESISTOR, 220KΩ 5% ¼W C.F.
R21	RESISTOR, 1MΩ 1% ¼W C.F.
R22–R25	RESISTOR, 1MΩ 5% ¼W C.F.
R26	RESISTOR, 1MΩ 5% ½W C.F.
R27 A	RESISTOR, 510KΩ 1% ¼W M.F.
R27 B	RESISTOR, 51KΩ 1% ¼W M.F.
R29	RESISTOR, 470KΩ 5% ¼W C.F.
R30	RESISTOR, 113KΩ 1% ¼W M.F.
R31	RESISTOR, 47KΩ 5% ¼W C.F.
C3	CAP, MYLAR 0.022μF 10% 1000V
C4	CAP, TANTALUM 10μF 20% 15V
C6, C8	CAP, MYLAR 0.1μF 10% 100V
C7	CAP, TANTALUM 4.7μF 20% 15V
C9	CAP, POLY PROPL 0.22μF 10% 160V
C10	CAP, MYLAR 0.22μF 10% 100V
C11	CAP, MYLAR 0.1μF 10% 100V
C12	CAP, M1CA 100pF 5% 500V
SG1	SPARK GAP 1000V PC
ST1	IN RUSH CURRENT LIMITTER 1KΩ 20% 8mA, 500V
SW1–SW8	PUSH BUTTON SWITCH SET
SW9	SLIDE SWITCH SPDT
J4	DC JACK
LCD	3½ DIGIT LCD

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE QUALITY.

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