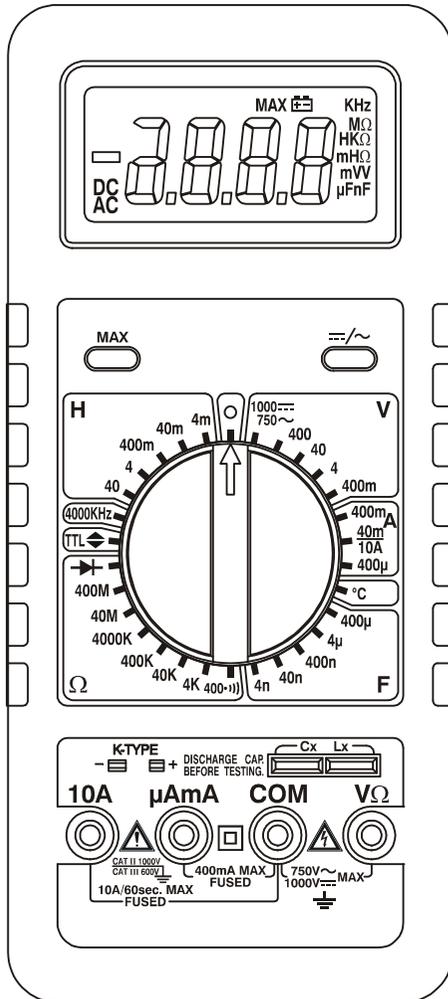


OPERATING INSTRUCTIONS

MODEL 21C

DIGITAL MULTIMETER



SAFETY INFORMATION

The following safety information must be observed to ensure maximum personal safety during the operation of this meter:

1. Do not use the meter if the meter or test leads look damaged, or if you suspect that the meter is not operating properly.
2. This meter is not recommended for high voltage industrial use; for example, not for measurements of 440VAC or 600VAC industrial power mains. The unit is intended for use with low energy circuits to 1000VDC or 750VAC or high energy circuit to 250V AC or DC. Accidental misuse by connection across a high voltage, high energy power source when the meter is set up for mA measurement may be very hazardous.
3. Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
4. Use caution when working above 60V dc or 30V ac rms. Such voltages pose a shock hazard.
5. When using the probes, keep your fingers behind the finger guards on the probes.
6. Measuring voltage which exceeds the limits of the multimeter may damage the meter and expose the operator to a shock hazard. Always recognize the meter voltage limits as stated on the front of the meter.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided the equipment may be impaired.

SPECIFICATIONS

Display: 3¾ digit liquid crystal display (LCD) with a maximum reading of 3999.

Polarity: Automatic, positive implied, negative polarity indication.

Overrange: (OL) or (-OL) is displayed.

Zero: Automatic.

Low battery indication: The "BAT" is displayed when the battery voltage drops below the operating level.

Measurement rate: 2.5 times per second, nominal.

Operating Environment: 0°C to 40°C at <70% R.H.

Storage Temperature: -20°C to 60°C, 0 to 80% R.H. with battery removed from meter.

Accuracy: Stated accuracy at 23°C±5°C, <75% R.H.

Safety: According to EN61010-1 protection class II over-voltage category (CAT II 1000V, CAT III 600V) pollution degree 2.

Power: Single standard 9-volt battery, NEDA 1604, JIS 006P, IEC 6F22.

Battery life: 150 hours typical with carbon-zinc.

Dimensions: 200mm (H) x 90mm (W) x 40mm (D).

Weight: Approx. 14 oz. (400g) including battery.

Accessories: One pair test leads, one spare fuse installed, 9V battery (installed) and Operating Instructions.

DC VOLTS

Ranges: 400mV, 4V, 40V, 400V, 1000V

Resolution: 100µV

Accuracy: ±(0.5%rdg + 1dgt)

Input impedance: 10MΩ

Overload protection:

500V DC or AC rms on 400mV range

1000VDC or 750VAC rms on all other ranges

AC VOLTS (50Hz-500Hz)

Ranges: 400mV, 4V, 40V, 400V, 750V

Resolution: 100µV

Accuracy: ±(1.0%rdg + 4dgt) on 400mV to 400V ranges

±(2.0%rdg + 4dgt) on 750V range

Input impedance: 10MΩ

Overload protection:

500V DC or AC rms on 400mV range

1000VDC or 750VAC rms on all other ranges

DC CURRENT

Ranges: 400µA, 40mA, 400mA, 10A

Accuracy: ±(1.0%rdg + 1dgt) on µA, mA, range

±(3.0%rdg + 1dgt) on 10A range

Input protection: 0.5A/250V fast blow fuse

10A/600V fast blow ceramic fuse

AC CURRENT (50Hz-500Hz)

Ranges: 400µA, 40mA, 400mA, 10A

Accuracy: ±(2.0%rdg + 4dgt) on µA, mA ranges

±(3.5%rdg + 4dgt) on 10A range

Input protection: 0.5A/250V fast blow fuse

10A/600V fast blow ceramic fuse

RESISTANCE

Ranges: 400Ω, 4KΩ, 40KΩ, 400KΩ, 4000KΩ, 40MΩ, 400MΩ

Accuracy:

±(0.8%rdg + 4dgt) on 400Ω range

±(0.8%rdg + 2dgt) on 4KΩ to 4000KΩ ranges

±(3.0%rdg + 4dgt) on 40MΩ range

±[(5.0%rdg - 20dgt) + 10dgt] on 400MΩ ranges

Open circuit volts:

0.6Vdc (3.0Vdc on 400Ω and 400MΩ ranges)

Overload protection: 500V DC or AC rms

CONTINUITY

Audible indication: less than 40Ω±20Ω

Overload protection: 500V DC or AC rms

DIODE TEST

Test current: 1.0mA±0.6mA

Accuracy: ±(3.0%rdg + 3dgt)

Open circuit volts: 3.0Vdc typical

Overload protection: 500VDC or AC rms

CAPACITANCE

Ranges: 4nF, 40nF, 400nF, 4µF, 400µF

Accuracy: ±(5.0%rdg + 10dgt) on all ranges

±(8.0%rdg + 10dgt) above 100µF

Test frequency: 4nF, 40nF ranges 1KHz

400nF, 4µF ranges 270Hz

400µF range 27Hz

INDUCTANCE

Ranges: 4mH, 40mH, 400mH, 4H, 40H

Accuracy: ±(5.0%rdg + 20dgt) on 4mH range

±(5.0%rdg + 10dgt) on other ranges

Test frequency: 4mH, 40mH ranges 1KHz

400mH, 4H ranges 270Hz

40H range 27Hz

Test conditions: quality factor >5 in 270Hz

FREQUENCY (Autoranging)

Ranges: 4KHz, 40KHz, 400KHz, 4000KHz

Accuracy: ±(0.1%rdg + 1dgt)

Sensitivity: 1V rms min

Overload protection: 500V DC or AC rms

Effect Reading: 40-3999

LOGIC TEST

Threshold: Logic Hi (2.8±0.8V)

Logic Lo (0.8±0.5V)

Indication: 40 msec beeper at logic low

Frequency response: 20MHz

Detectable pulse width: 25nS

Pulse limits: >30% & <70% duty

Overload protection: 500V DC or AC rms

TEMPERATURE

Ranges: -20°C to 750°C

Resolution: 1°C

Accuracy: ±(2.0%rdg + 3dgt) on -20°C to 500°C

±(3.0%rdg + 2dgt) on 500°C to 750°C

OPERATION

Before taking any measurements, read the Safety Information Section. Always examine the instrument for damage, contamination (excessive dirt, grease, etc.) and defects. Examine the test leads for cracked or frayed insulation. If any abnormal conditions exist do not attempt to make any measurements.

Max. Hold Feature

Press "MAX" to toggle in and out of the Maximum Hold mode. (Holding the highest reading.) In the MAX mode, the MAX annunciator is displayed and maximum reading are stored in display register, if the new reading is higher than the reading being displayed, the higher reading is transferred to the display register. A "higher" reading is defined as the reading with the higher absolute value.

The MAX hold function is also available in the frequency count mode. The counter autoranging feature is disable when MAX hold is selected.

Voltage Measurements

1. Connect the red test lead to the "VΩ" jack and the black test lead to the "COM" jack.

2. Set the Function/Range switch to the desired voltage range and press the "AC/DC" switch to toggle between

the desired voltage type. If magnitude of voltage is not known, set switch to the highest range and reduce until a satisfactory reading is obtained.

3. Connect the test leads to the device or circuit being measured.
4. For dc, a (-) sign is displayed for negative polarity; positive polarity is implied.

Current Measurements

1. Set the Function/Range switch to the desired current range and press the "AC/DC" switch toggle between to the desired current type.
2. For current measurements less than 400mA, connect the red test lead to the "µAmA" jack and the black test lead to the "COM" jack.
3. For current measurements over 400mA or greater, connect the red test lead to the "10A" jack and the black test lead to the "COM" jack.
4. Remove power from the circuit under test and open the normal circuit path where the measurement is to be taken. Connect the meter **in series** with the circuit.
5. Use caution when measuring 10 amps on 10A range for 60s, please waiting for 10 minutes for next measurement of 10 amps for safety reason.

Resistance and Continuity Measurements

1. Set the Function/Range switch to the desired resistance range or continuity position.
2. Remove power from the equipment under test.
3. Connect the red test lead to the "VΩ" jack and the black test lead to the "COM" jack.
4. Touch the probes to the test points. In ohms, the value indicated in the display is the measured value of resistance. In continuity test, the beeper sounds continuously, if the resistance is less than $40\Omega \pm 20\Omega$.
5. When using 400MΩ range; the 400.0MΩ range has a fixed 20 ± 0.1 -count offset in the reading. When the test leads are shorted together in the ranges, the meter will display 02.0. The residual reading must be subtracted from the reading obtained in step 4 when this range is used. For example, when measuring 110.0MΩ on the 400.0MΩ range, the display will read 112.0, from which the 2.0 residual is subtracted to obtain the actual resistance of 110.0MΩ.

WARNING

The accuracy of the functions might be slightly affected, when exposed to a radiated electromagnetic field environment, eg, radio, telephone or similar.

Capacitance & Inductance Measurements

1. Set the Function/Range switch to the desired Cx (capacitance) or Lx (inductance) range.
2. Never apply an external voltage to the Cx Lx sockets. Damage to the meter may result.
3. Insert the capacitor or inductor leads directly into the Cx Lx socket.
4. Read the capacitance or inductor directly from the display.

Frequency Measurements

1. Set the Function/Range switch to the 4000KHz position.
2. Connect the red test lead to the "VΩ" jack and the black test lead to the "COM" jack.
3. Connect the test leads to the point of measurement and read the frequency from the display.

Logic Measurements

1. Set the Function/Range switch to the TTL position.
2. Connect the red test lead to the "VΩ" jack and the black test lead to the "COM" jack.
3. Connect the red test lead to the test point and the black lead to the common buss of the logic circuit.
4. A "▲" on the display indicates TTL logic high and a "▼" indicates a TTL logic low. Both indicators are on when the point of measurement is toggling high and low.

Diode Tests

1. Connect the red test lead to the "VΩ" jack and the black test lead to the "COM" jack.
2. Set the Function/Range switch to the "▶" position.
3. Turn off power to the circuit under test.
4. Touch probes to the diode. A forward-voltage drop is about 0.6V (typical for a silicon diode).
5. Reverse probes. If the diode is good, display will be between 2.800V and 3.200V. If the diode is shorted, ".000" or another number is displayed.
6. If the diode is open, display will be between 2.800V and 3.200V, in both directions.
7. If the junction is measured in a circuit and a low reading is obtained with both lead connections, the junction may be shunted by a resistance of less than 1KΩ. In this case the diode must be disconnected from the circuit for accurate testing.

Transistor Gain Measurements

WARNING

Remove test leads being measured

1. Set the Function/Range switch to the "°C" position.
2. Connect a type K thermocouple to the jack on the instrument. Place the probe or thermocouple tip on or in the material to be measured and take the temperature reading directly from the display.

MAINTENANCE

WARNING

Remove test leads before changing battery or fuse or performing any servicing.

Battery Replacement

Power is supplied by a 9 volt "transistor" battery. (NEDA 1604 IEC 6F22). The "E" appears on the LCD display when replacement is needed. To replace the battery, remove the two screws from the back of the meter and lift off the battery cover. Remove the battery from battery contacts.

Fuse Replacement

If no current measurements are possible, check for a blown overload protection fuse. There are two fuses; F1 for the "mA" jack and F2 for the "10A" jack. For access to fuses, remove the two screws from the back of the meter and lift off the battery cover. Replace F1 only with the original type 0.5A/250V, fast acting fuse. Replace F2 only with the original type 10A/600V, fast acting ceramic fuse.

Cleaning

Periodically wipe the case with a damp cloth and detergent, do not use abrasives or solvents.