

Quick Facts and Features

This Micronta True RMS Multimeter is a portable $3\frac{2}{3}$ -digit meter ideally suited for field, lab, shop, bench, and home use. It makes true RMS measurements, a feature you normally find only in the most expensive test instruments, so AC measurements are as accurate as possible. Here are some features that make the meter a real pro.

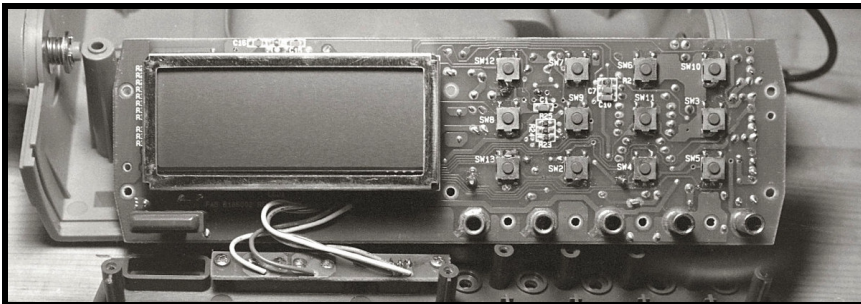
True RMS Operation — gives a more accurate reading for non-sine wave AC measurements.

Transistor-Check Function — measures the gain (hFE) of small-signal, bipolar transistors and identifies pin-out and type.

Capacitor-Check Function — measures the capacitance of low-voltage capacitors.

Frequency Counter — measures frequencies up to 2 MHz.

One-Finger Function Selector — makes it easy to use your meter when you have only one hand free.



Micronta 22-175a

Basic Operation Manual

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MEASURING HIGH-VOLTAGE CIRCUITS

When using the meter to check a high-voltage circuit, do not try to position both probes at once. Instead, clamp one probe to a neutral or ground lead of the circuit (usually a bare, green, or white lead in AC wiring circuits) with insulated alligator clips. Then, probe for voltages with the other probe. This helps prevent you from accidentally touching a hot wire, because you need concentrate on only one test probe.

WARNING: NEVER CLAMP ONTO A HOT WIRE (USUALLY RED, BLACK, OR BLUE IN AC WIRING CIRCUITS). IF YOU CLAMP ONTO A HOT WIRE AND TOUCH THE OTHER PROBE, YOU COULD RECEIVE A SHOCK.



MEASURING DC VOLTAGE

WARNING: DO NOT TRY TO MEASURE A VOLTAGE GREATER THAN 1000 VOLTS DC. YOU MIGHT DAMAGE THE METER AND EXPOSE YOURSELF TO A SEVERE SHOCK HAZARD.

Follow these steps to measure a DC voltage.

- Press **VOLTS/AMPS** to select voltage measurements. mV appears on the display.
- Press **AC/DC** to select DC measurements.
- Plug the red test lead into the V Hz terminal, and plug the black test lead into the COM terminal.
- Connect the probes to the circuit you want to test.

When you measure DC voltages, the minus sign appears if you connect the black probe to a point in the circuit that has a higher voltage potential than the point where you connect the red probe.

Note: The meter does not measure DC using dBm. If you select dBm, the meter switches to AC measurements.

MEASURING AC VOLTAGE

WARNING: DO NOT TRY TO MEASURE A VOLTAGE GREATER THAN 750 VOLTS AC. YOU MIGHT DAMAGE THE METER AND EXPOSE YOURSELF TO A SEVERE SHOCK HAZARD.

Follow these steps to measure AC voltage.

- Press **VOLTS/AMPS** to select voltage measurements. mV appears on the display.
- Press **AC/DC** to select AC measurements. [AC] appears on the display.
- Plug the red test lead into the V Hz terminal, and plug the black test lead into the COM terminal.
- Connect the probes to the circuit you want to test.
- To change the readout to dBm, press **dBm/Hz**. The display changes to show the reading in dBm. dBm replaces mV on the display.

To return to a voltage display, press **VOLTS/AMPS**. The meter displays the measurement in volts.

COMPARING COMPONENTS USING MIN/MAX AND HOLD FUNCTIONS

To determine the range of values amongst a collection of components, use the **HOLD** function in combination with **MIN/MAX** mode.

1. Insert the first component in the OHMS/DIODE/CAP socket, or attach leads appropriately.
2. Press **AUTO/MAN** to set the meter to manual range mode, then set the meter to the appropriate range. The component will be measured.
3. Press **MIN/MAX** to enter the MIN/MAX mode.
4. Press **HOLD RELATIVE** to hold the current reading. This will prevent the meter seeing an overrange condition in the next step.
5. Remove the component, and attach the next component to test.
6. Press **HOLD RELATIVE** to release hold and measure the new component.
7. Repeat steps 4, 5, and 6 until you have measured all components.

To recall the minimum and maximum measured values recorded across all components, repeatedly press **MIN/MAX**. When [MIN] appears on the display, the meter displays the minimum measured value. When [MAX] appears on the display, the meter displays the maximum measured value.

USING THE RELATIVE FUNCTION

The relative feature lets you set a reference measurement and measure additional values relative to the reference. For example, if you set the reference at 100 ohms, the meter would display a 123-ohm resistor as 23 ohms, and would display a 75-ohm resistor as -25 ohms.

Follow these steps to set a reference.

- Make a reference measurement.
- While you measure the reference value, press and hold down **HOLD/RELATIVE** for about 2 seconds. The meter beeps. After 2 seconds, the meter displays [REL] and sets the reading to 000.

The meter displays additional measurements relative to the reference value. The meter displays values greater than the reference as positive values and values less than the reference as negative values.

Note: You cannot use the MIN/MAX mode and the relative mode at the same time.

ADVANCED METER FEATURES

USING THE MIN/MAX MEMORY FUNCTIONS

The MIN/MAX feature lets you track the high and low values for a changing measurement. Follow these steps to store the high and low readings.

- Press **MIN/MAX**. The meter displays [MIN] and displays the lowest measured reading. The meter updates the display as the reading changes. Both minimum and maximum values are being stored.
- To display the maximum measured reading, press **MIN/MAX** again. The meter displays [MAX] and the highest measured reading. The meter updates the display as the readings change.
- To display the actual reading, and record maximum and minimum readings, press **MIN/MAX** again. The meter displays [MIN] and [MAX].
- To clear the minimum and maximum measurements, press and hold down **HOLD/RELATIVE** for about 2 seconds.
- To exit the MIN/MAX mode, press any other function.

Notes:

*If you press **BEEP** to turn the beep feature on or off, the meter exits the MIN/MAX mode.*

You cannot use the MIN/MAX mode and the relative mode at the same time. If you select the relative mode, the MIN/MAX function turns off. If the relative mode is already active, the meter ignores the MIN/MAX key.

The meter exits the MIN/MAX mode if you try to measure a value that is outside the currently set range or if you manually change the range.

USING THE HOLD FUNCTION

The hold feature lets you hold the current reading on the meter's display.

During any reading, press **HOLD/RELATIVE** to prevent changes in any measured value from updating the display. Press **HOLD/RELATIVE** again to resume normal operation.

MEASURING AN AC VOLTAGE ON A DC BIAS

To measure an AC voltage superimposed on a DC voltage source bias, follow the steps for measuring an AC voltage.

Caution: Never try to measure an AC voltage that is riding on a DC voltage level where the peak AC voltage exceeds 1000 V with respect to earth ground.

MEASURING 3-PHASE AC VOLTAGES

We designed this meter to measure household AC voltage. It is not intended for commercial or industrial use. If you want to measure 3-phase, line-to-line voltages, please note the following:

Because of the dangers inherent when you measure three-phase circuits, we strongly recommend you do not use this meter for such applications.

If you choose to make the measurements, use extreme care. The actual voltage can be greater than the circuits rated voltage (line-to-ground).

To determine the line-to-line voltage, multiply the rated line-to-ground voltage by 1.732. For example, if the rated voltage is 462 volts, the line-to line voltage is $462 \text{ Volts} \times 1.732 = 800 \text{ Volts}$.

This voltage exceeds the meter's range and you should not connect the meter to this circuit. (See cover; MEASURING HIGH-VOLTAGE CIRCUITS.)

Notes:

PHANTOM READING: *If you do not connect the meter's probes to a circuit, and set it to DC or AC VOLTS, the display might show a PHANTOM READING. This is normal. The meter's high input sensitivity produces a wandering effect. When you connect the test probes to a circuit, a real measurement appears.*

OVERRANGE INDICATION: *A single large number 3, fully-filled bar graph, and right arrow appear on the display when a measurement exceeds the meter's range. If you are measuring volts or amps, disconnect the meter from the circuit you are measuring or change the meter's measuring range. (See page 13, MANUALLY SELECTING THE RANGE.)*

MEASURING AC/DC CURRENT

WARNINGS: DO NOT APPLY VOLTAGE DIRECTLY ACROSS THE 10A, 400mA, or $\Omega/\mu\text{mA}$ TERMINALS. YOU MUST CONNECT THE METER IN SERIES WITH THE CIRCUIT. THE 10A TERMINAL IS NOT FUSED. A SEVERE FIRE HAZARD AND SHORT CIRCUIT DANGER EXISTS IF YOU APPLY A VOLTAGE WITH HIGH-CURRENT CAPABILITY TO THIS TERMINAL. THE METER CAN BE DESTROYED UNDER SUCH CONDITIONS.

To measure current, break the circuit and connect the probes in series with the circuit. Never connect the leads across a voltage source (in parallel). Doing so can blow the fuse or damage the circuit under test.

The maximum current input limit is 10A.

- Press **VOLTS/AMPS** to select amps. μA appears on the display.
- Press **AC/DC** to select DC or AC current measurement.
- Repeatedly press **VOLTS/AMPS** to set the range. Each time you press **VOLTS/AMPS**, the range changes.
- To measure a current that is less than or equal to 4000 μA (4 mA), plug the red test lead into the $\Omega/\mu\text{mA}$ terminal.
- To measure a current between 4.000 mA and 400.0 mA, press **VOLTS/AMPS** again to select the 40.0 mA or 400.0 mA scale and plug the red test lead into the 400 mA terminal.
- To measure a current greater than 400.0 mA, press **VOLTS/AMPS** again to select the 4.000 A or 10.00 A scale and plug the red test lead into the 10A terminal.

Note: If you are not sure how much current the circuit you are testing draws, start with the 10A range.

- Remove power from the circuit under test. Then, break the circuit at the appropriate point.
- Connect the probes in series with the circuit.
- Apply power to the circuit.
- If the measurement is greater than the selected range, the meter displays the overrange indication. (Page 3, *OVERRANGE INDICATION*.) Press **VOLTS/AMPS** to select a higher range, and plug the red test lead into the appropriate terminal.

MANUALLY SELECTING THE RANGE

The meter automatically selects the best range for most applications. For some situations, you might want to manually set the range. To switch to the manual mode, press **AUTO/MAN** so that [AUTO] disappears from the display. Then, press **RANGE[^]** or **RANGE^v** to select the range.

To return to automatic range selection, press **AUTO/MAN** so that [AUTO] appears on the display.

USING THE BAR GRAPH

In addition to the numeric display, the meter displays all measurements on a bar graph at the bottom of the display. The bar graph is updated more quickly than the digital display, and gives a better indication of levels and trends for varying measurements. The bar graph has 41 marks. The first mark is always on, and indicates 0. Each additional mark represents the first two digits in the display. For example, if the displayed value is 1.853, 19 marks appear on the bar graph.

USING THE BEEP OPTION

You can have the meter beep when any of the following occurs:

- In the MIN/MAX mode, when the meter updates the minimum or maximum value (*See page 14, USING THE MIN/MAX MEMORY FUNCTION*)
- When the meter automatically changes measurement ranges
- When you press one of the mode buttons

To have the meter beep, press **BEEP**. [BEEP] appears on the display.

To cancel the beep option, press **BEEP** again. [BEEP] disappears from the display.

The meter always beeps in the continuity mode and when you switch to the relative mode.

MEASURING FREQUENCY

WARNING: IF YOU TRY TO MEASURE THE FREQUENCY OF A SIGNAL THAT EXCEEDS 750 VOLTS AC RMS, YOU MIGHT DAMAGE, YOUR METER AND EXPOSE YOURSELF TO A SEVERE SHOCK HAZARD.

Follow these steps to measure the frequency of a signal.

- Press dBm/Hz. kHz appears in the display.
- Plug the red test lead into the V Hz terminal and the black test lead into the COM terminal.
- Connect the black probe a ground reference for the signal, and connect the red probe to the signal source.

The meter displays the measured frequency.

Notes:

Because measuring frequencies takes several seconds, the keyboard might be slow to respond to key presses.

The meter uses a 1 Hz gate signal to measure the frequency of signals below 4000 Hz. You might have to wait a few seconds for the display to stabilize.

For signals above 4000 Hz, you might have to manually set the frequency range to prevent the meter from displaying a harmonic of the actual frequency. (See page 13, MANUALLY SELECTING THE RANGE.)

The meter does not beep when it updates MIN/MAX when you measure frequency, even if you have turned on the beep option.

Notes:

If you set the meter for DC current, the (–) sign appears or disappears to indicate the polarity of the measured current.

The 400 mA and the 4000 μ A ranges are fuse-protected. The 10A range is not fuse-protected.

If the meter blows a fuse while you measure current, the meter displays the overrange indication or 0.

If the meter displays the overrange indication when you measure AC current, and the circuit does not exceed the AC current in the present range, the circuit is exceeding the meter's DC rating.

For example, if you try to measure a DC power supply's AC ripple current, the signal has both an AC and DC component. If the DC component exceeds the meter's rating, the meter displays the overrange indication. To measure this current, you must externally block the DC component.

MEASURING RESISTANCE

WARNINGS: NEVER CONNECT THE TEST PROBES TO A SOURCE OF VOLTAGE WHEN YOU HAVE SELECTED THE OHMS FUNCTION AND PLUGGED THE LEADS INTO THE $\Omega/\mu\text{mA}$ TERMINAL. BE SURE THAT THE CIRCUIT UNDER TEST HAS ALL POWER REMOVED AND THAT ANY ASSOCIATED CAPACITORS ARE FULLY DISCHARGED BEFORE YOU MAKE A RESISTANCE MEASUREMENT.

The resistance measuring circuit compares the voltage gained through a known resistance (internal) with the voltage developed across the unknown resistance. So, when you check in circuit resistance, be sure the circuit under test has all power removed (all capacitors are fully discharged).

- Press **Ω/CONT** . **M Ω** appears in the display. If there is no resistance connected to the meter, the meter sets itself to the highest measurement range and displays the overrange indication (*see page 3*).
- Plug the red test lead into the $\Omega/\mu\text{mA}$ terminal and the black test lead into the COM terminal.
- Connect the probes across the circuit to be measured or plug the resistor under test into the OHMS/DIODE/CAP socket.

If the resistance is greater than 1 megohm, the display takes a few seconds to stabilize. This is normal for high-resistance measurements.

Notes:

The meter has a fuse and a special circuit that protects the resistance ranges from over-voltage (voltages greater than 5 volts). If you blow the meter's fuse, the meter does not operate correctly in the ohms mode. Check the fuse if the meter displays 0 for all resistance measurements. When you measure the resistance of a component in a circuit, disconnect one side of the component you are testing. This prevents other components in the circuit from affecting the reading.

When you touch the probe ends together, the meter selects the 400-ohm scale and displays a small value. This value is the resistance of the test leads. Note this value and subtract it from the measured value when you measure a very small resistance. You can also use the relative function to compensate for the resistance. (See page 15, USING THE RELATIVE FUNCTION.)

High-voltage junctions in power transistors prevent correct readings. Also, the larger leads of the power transistor can damage the test socket. Do not try to determine type, pin out, and hFE for power transistors with this meter.

The meter displays a default junction type and pinout if you press hFE when you have not connected a transistor. The meter defaults to PNP and CEB with the hFE measurement given as a very large value or overflow condition. The bar graph reading is not stable – it ranges up and down while the display maintains a running average of the random readings.

Since the hFE measurement is an auto-ranging type measurement, you cannot use the MIN/MAX and relative options while in hFE mode.

hFE is affected by temperature. Try not to warm the transistor with your hand when you install the device in the socket. If the hFE reading is not stable when you first measure it, let the transistor's temperature stabilize.

WARNING: THE TRANSISTOR SOCKET IS NOT PROTECTED AGAINST OVER-VOLTAGE. YOU CAN DAMAGE THE METER AND VOID YOUR WARRANTY IF YOU BUILD AND USE EXTERNAL LEADS FOR THE TRANSISTOR SOCKET.

CHECKING TRANSISTORS

Follow these steps to determine a transistor's pinout, type, and base gain.

- Plug a transistor into the hFE socket.
- Press **hFE**. hFE appears in the display.

The meter displays the transistor type (NPN or PNP) for several seconds.

Then, the meter displays the transistor's pinout. The three letters it displays correspond to the three terminals of the hFE socket. For example, if the meter displays EbC, the far left lead is the emitter, the middle lead is the base, and the far right lead is the collector.

After a short pause, the meter displays the transistor's hFE. This value ranges from 1 to 39.999.

The meter continuously displays the hFE. If you plug in another transistor, it displays that transistor's hFE, if it is of the same type and has the same pinout. To force the meter to re-examine the transistor type and pinout, press hFE after you install a new transistor.

Notes:

Do not take the hFE reading as an absolute measurement, but rather as an indication that the transistor is operating. The true gain of a transistor depends on its operating current. This meter applies 500 to 1000 μ A to the emitter and collector and measures the base current to calculate the base gain.

Even though the meter turns off the test leads during the hFE measurement, a voltage connection might affect the hFE reading. Do not connect the test leads to a voltage source during this measurement.

You cannot measure the hFE of a transistor that is connected in a circuit.

You cannot measure the hFE of a FET or other non-bipolar transistor.

Some power darlington transistors contain internal base-to-emitter resistors. Because the meter uses two current readings to calculate hFE, any internal transistor resistance causes undependable readings.

When you measure resistances greater than 400 K ohms, your skin's resistance can affect the reading. Use the OHMS/DIODE/CAP socket to measure loose resistors, if possible. If you must hold the resistor and use the probes, do not touch both probes while you take a measurement.

Checking Continuity

Follow these steps to check a circuit's continuity:

- Press **Ω /CONT** so that [CONT] and Ω appear in the display. The meter sets itself to the 400-ohm resistance range.
- Connect the red test lead to the Ω/μ A terminal and the black test lead to the COM terminal.
- Connect the probes to the circuit you want to test.

If the circuit's resistance is less than or equal to 50 ohms, the buzzer sounds. If the resistance is greater than 50 ohms, but less than 400 ohms, the meter displays the circuit's resistance and the buzzer does not sound. The meter indicates an overrange condition if the resistance is 400 ohms or greater.

Note: The beep sounds even if you turn off the beep option. If the meter performs a battery check while the continuity tone is sounding, the tone stops for about 1/2 second.

MEASURING CAPACITANCE

Follow these steps to measure capacitance.

- Press **DIODE/CAP**. nF appears on the display.
- Plug the red test lead into the --| terminal and plug the black test lead into the COM terminal.
- Fully discharge the capacitor.
- If you are checking an electrolytic capacitor, attach the capacitor's + side to the red probe or plug into the + OHMS/DIODE/CAP socket. Then, attach the capacitor's – side to the black probe or to the – OHMS/DIODE/CAP socket.

For other capacitor types, connect the probes to the capacitors leads. Polarity does not affect the measurement of non-electrolytic capacitors. Or, install the capacitor in the OHMS/DIODE/CAP socket. Observe polarity (+ and –) when you measure electrolytic capacitors.

Notes:

If you use the test probes, do not touch the probes while you are checking the capacitor. Your body's capacitance can affect the measurement.

An electrolytic capacitor's measured capacitance changes depending upon the voltage applied to the capacitor. Because this meter cannot use rated voltages to set the electrolyte, it cannot measure the absolute capacitance value.

The lowest capacitance ranges might be offset by the meter's and test leads' capacitance. When you measure very small-value capacitors, we suggest you use the relative function to subtract the internal capacitance from the measurements. (See pages 14-15, USING THE HOLD AND RELATIVE FUNCTIONS.)

CHECKING DIODES

This function lets you check diodes and other semiconductors for opens and shorts. It also lets you determine the forward voltage for diodes. You can use this function when you need to match diodes.

- Press **DIODE/CAP** so that $\text{--}\nabla\text{--}$ appears in the display.
- Plug the red test lead into the $\text{--}\nabla\text{--}$ terminal and the black test lead into the COM terminal.
- Remove power from the circuit under test.
- Connect the probes to the component you want to check or plug the component into the OHMS/DIODE/CAP socket. If the diode is banded, connect the banded end to the black test probe or the OHMS/DIODE/CAP socket. Then, note the display.

If the display shows a value, for example, 0.2 for a germanium diode or 0.5 for a silicon diode, reverse the diode. If the meter indicates an over-range, the diode is good. The displayed number is the diode's actual forward voltage (Up to 2.5 volts).

If the display indicates an overrange condition (*see page 3*), reverse the polarity of the connection.

If the display shows a value, the device is good. The displayed value is the component's actual forward voltage (up to 2.5 volts).

If the display still indicates an overrange condition, the device is open.

If the display shows a value both before and after you reverse polarity, the device is shorted or the meter's .063-amp fuse is blown.

When you connect the diode to the meter and the meter displays the device's forward voltage, the red test lead or + OHMS/DIODE/CAP socket is connected to the diode's anode, and the black lead or – OHMS/DIODE/CAP socket is connected to the diode's cathode.

This meter supplies enough forward voltage to light most LEDs. However, if the LED's forward voltage is greater than 2.5 volts, the meter incorrectly indicates that the device is open.

The bar graph shows a maximum reading of 24, even during an overrange.