User Manual

DIGI-SENSE™

Heavy-Duty Autoranging Digital Multimeter

with Bluetooth® Mobile App and NIST-Traceable Calibration

Model 20250-64

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THE STANDARD IN PRECISION MEASUREMENT

Introduction

The Digi-Sense Heavy-Duty Autoranging Digital Multimeter with Bluetooth® Connectivity (model 20250-64) allows you to transmit data directly to your Android™ or iOS® device using our free D/S Meter app. Now you can view data at a safe distance from potentially hazardous parameters or even use your smart device as a real-time secondary display for checking measurements, eliminating the need to write down readings on paper. The results are automatically stored in the app with a date-and-time stamp and can be saved as a CSV file and emailed for future reference, manipulation, or analysis to help determine trends and conditions over a long period of time. You can also use the app to attach photos and notes to the records creating a clear reference point for your work—ideal for record keeping at large sites.

Setup is simple. Download the free D/S Meter app to your Android or iOS device. Place the multimeter in Bluetooth mode and open the app on your smart device. The meter will be sensed by your device and be listed as an available source that you can select. Once selected, the data sensed by the meter is displayed on your device and some of the instrument functions can be accessed. A full description of its operation is available for download in the app.

The Heavy-Duty Digital Autoranging Multimeter measures AC/DC voltage, AC/DC current, resistance, frequency (electrical & electronic), capacitance, diode test, and continuity. The meter also offers True RMS for more accurate current readings, temperature measurement with a type K thermocouple, and analog bar graph for viewing trends. Rugged IP67-rated waterproof design withstands heavy-duty use. This instrument is fully tested and calibrated to NIST-traceable standards for reliable measurements right out of the box, saving you time and money. Proper use and care will provide many years of reliable service.

Safety

International Safety Symbols

This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for more information.

WARNING

This **WARNING** symbol indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION

CAUTION symbol indicates a potentially hazardous situation, which if not avoided, may result in product damage.

This symbol advises the user that the terminal(s) so marked must not be connected to a circuit point at which the voltage with respect to earth ground exceeds (in this case)1000VAC or 1000VDC.

This symbol adjacent to one or more terminals identifies them as being associated with ranges that may, in normal use, be subjected to particularly hazardous voltages. For maximum safety, the meter and its test leads should not be handled when these terminals are energized.

This symbol indicates that a device is protected throughout by double insulation or reinforced insulation.

Safety Instructions

This meter has been designed for safe use but must be operated with caution. The rules listed below must be carefully followed for safe operation.

1. **NEVER** apply voltage or current to the meter that exceeds the specified maximum:

Input Protection Limits	
Function	Maximum Input
V DC or V AC	1000 VDC/1000 VAC RMS
mA AC/DC	500 mA 1000 V fast acting fuse
A AC/DC	10 A 1000 V fast-acting fuse (10A for 30 seconds max every 15 minutes)
Frequency, Resistance, CAP, Diode Test, Continuity, Temperature, Duty Cycle	250 VDC/AC RMS
Surge Protection: 8 kV peak per IEC 61010	

2. **USE EXTREME CAUTION** when working with high voltages.
3. **DO NOT** measure voltage if the voltage on the "COM" input jack exceeds 1000V above earth ground.
4. **NEVER** connect the meter leads across a voltage source while the function switch is in the current, resistance, CAP, or diode mode. Doing so can damage the meter.
5. **ALWAYS** discharge filter capacitors in power supplies and disconnect the power when making resistance or diode tests.
6. **ALWAYS** turn off the power and disconnect the test leads before opening the covers to replace the fuse or batteries.
7. **NEVER** operate the meter unless the back cover and the battery and fuse covers are in place and fastened securely.
8. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Unpacking

Check individual parts against the list of items below. If anything is missing or damaged, please contact your instrument supplier immediately.

1. Meter
2. Test leads
3. One type K temperature probe
4. One 9 V battery
5. Carrying case
6. User manual
7. NIST-traceable calibration report with data

Key Features

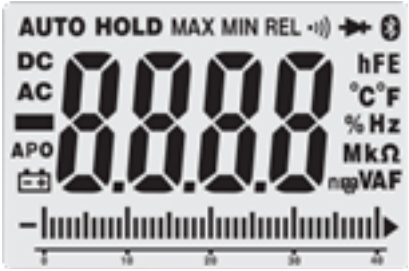
- Bluetooth interface
- User-friendly mobile app
- 4000 display count
- True RMS readings
- Electronic overload protection
- Autoranging with auto power-off
- Data Hold function
- Rugged IP67-rated double-molded housing

Meter Description

1. 4000 counts LCD
2. MAX/MIN button
3. RANGE button
4. MODE button
5. Rotary function switch
6. mA, µA and 10 A input jacks
7. COM input jack
8. Positive input jack
9. Hz and % button
10. HOLD and Backlight button
11. RELATIVE and Bluetooth button

Note: Tilt stand and battery compartment are on rear of unit.

Symbols and Annunciators



	Auto power-off
•)))	Continuity
	Diode test
	Battery status
μ	micro (10^{-6})
m	milli (10^{-3})
A	Amps
k	kilo (10^{3})
M	mega (10^{6})
Ω	Ohms
Hz	Hertz (frequency)
V	Volts

%	Percent (duty ratio)
REL	Relative
AC	Alternating current
AUTO	Autoranging
DC	Direct current
HOLD	Display hold
MAX	Maximum
MIN	Minimum
hFE	Reserved
	Bluetooth
°F	Degrees Fahrenheit
°C	Degrees Centigrade

Setup and Operation

WARNING: Risk of electrocution. High-voltage circuits, both AC and DC, are very dangerous and should be measured with great care.

1. ALWAYS turn the rotary function switch to the OFF position when the meter is not in use.
2. If **"OL"** appears in the display during a measurement, the value exceeds the range you have selected. Change to a higher range.

DC Voltage Measurements

CAUTION: Do not measure DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

1. Set the rotary function switch to the green **VDC** position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
3. Touch the black test probe tip to the negative side of the circuit and touch the red test probe tip to the positive side of the circuit.
4. Read the voltage in the display.

AC Voltage (Frequency, Duty Cycle) Measurements

WARNING: Risk of Electrocution. The probe tips may not be long enough to contact the live par ts inside some 240V outlets for appliances because the contacts are recessed deep in the outlets. As a result, the reading may show 0 volts when the outlet actually has voltage on it. Make sure the probe tips are touching the metal contacts inside the outlet before assuming that no voltage is present.

CAUTION: Do not measure AC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

1. Set the rotary function switch to the green **VAC/Hz/%** position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
3. Touch the black test probe tip to the neutral side of the circuit and touch the red test probe tip to the "hot" side of the circuit.
4. Read the voltage in the display.
5. Press the **Hz/%** button to indicate **"Hz"**.
6. Read the frequency in the display.
7. Press the **Hz/%** button again to indicate "**%**".
8. Read the percent of duty cycle in the display.

DC Current Measurements

CAUTION: Do not make 10 A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test.

1. Insert the black test lead banana plug into the negative **COM** jack.
2. For current measurements up to 4000 µA DC, set the rotary function switch to the yellow **µA** position and insert the red test lead banana plug into the **µA/mA** jack.
3. For current measurements up to 400 mA DC, set the rotary function switch to the yellow **mA** position and insert the red test lead banana plug into the **µA/mA** jack.
4. For current measurements up to 10 A DC, set the rotary function switch to the yellow **10A/Hz/%** position and insert the red test lead banana plug into the **10A** jack.
5. Press **MODE** button to indicate **"DC"** on the display.
6. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
7. Touch the black test probe tip to the negative side of the circuit and touch the red test probe tip to the positive side of the circuit.
8. Apply power to the circuit.
9. Read the current in the display.

AC Current (Frequency, Duty Cycle) Measurements

CAUTION: Do not make 10 A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test.

1. Insert the black test lead banana plug into the negative **COM** jack.
2. For current measurements up to 4000 µA AC, set the rotary function switch to the yellow **µA** position and insert the red test lead banana plug into the **µA/mA** jack.
3. For current measurements up to 400 mA AC, set the rotary function switch to the yellow **mA** position and insert the red test lead banana plug into the **µA/mA** jack.
4. For current measurements up to 10 A AC, set the rotary function switch to the yellow **10A/Hz/%** position and insert the red test lead banana plug into the **10A** jack.
5. Press the **MODE** button to indicate "**AC**" on the display.
6. Remove power from the circuit under test, then open at the point where you wish to measure current.
7. Touch the black test probe tip to the neutral side of the circuit and touch the red test probe tip to the "hot" side of the circuit.
8. Apply power to the circuit.
9. Read the current in the display.
10. Press the **Hz/%** button to indicate **"Hz"**.
11. Read the frequency in the display.
12. Press the **Hz/%** button again to indicate **"%"**.
13. Read the percent of duty cycle in the display.
14. Press the **Hz/%** button to return to current measurement.

Resistance Measurements

WARNING: To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements. Remove the batteries and unplug the line cords.

1. Set the rotary function switch to the green Ω position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive Ω jack.
3. Press the **MODE** button to indicate "Ω" on the display.
4. Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
5. Read the resistance in the display.

Continuity Check

WARNING: To avoid electric shock, never measure continuity on circuits or wires that have voltage on them.

1. Set the rotary function switch to the green Ω position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive Ω jack.
3. Press the **MODE** button to indicate "•))" and "Ω" on the display.
4. Touch the test probe tips to the circuit or wire you wish to check.
5. If the resistance is less than approximately 35 Ω, the audible signal will sound. If the circuit is open, the display will indicate **"OL"**.

Diode Test

1. Set the rotary function switch to the green Ω →|– •))) position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
3. Press the **MODE** button to indicate "→|–" and **"V"** on the display.
4. Touch the test probes to the diode under test. Forward voltage will typically indicate 0.400 to 0.700 V. Reverse voltage will indicate **"OL"**. Shorted devices will indicate near 0 V and an open device will indicate "**OL**" in both polarities.

Frequency/Duty Cycle Measurements (Electronic)

1. Set rotary function switch to the green **Hz/%** position.
2. Press the **Hz/%** button to indicate **"Hz"** on the display.
3. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **Hz** jack.
4. Touch the test probes to the circuit under test.
5. Read the frequency on the display.
6. Press the **Hz/%** button again to indicate "**%**" on the display.
7. Read the percent of duty cycle on the display.

Temperature Measurements

1. Set the rotary function switch to the green **Temp** position.
2. Insert the temperature probe into the input jacks, making sure to observe the correct polarity.
3. Press the **MODE** button to indicate **°F** or **°C**.
4. Touch the temperature probe head to the part whose temperature you wish to measure. Keep the probe touching the part under test until the reading stabilizes (about 30 seconds).
5. Read the temperature in the display.

Note: Temperature probe is fitted with a type K mini connector. Mini connector to banana connector adapter is supplied for connection to the input banana jacks.

Autoranging/Manual Range Selection

When the meter is first turned on, it automatically goes into autoranging mode. This automatically selects the best range for the measurements being made and is generally the best mode for most measurements. For measurement situations requiring that a range be manually selected, perform the following:

1. Press the **RANGE** key. The "AUTO" display indicator will turn off.
2. Press the **RANGE** key to step through the available ranges until you select the range you want.
3. To exit the manual ranging mode and return to autoranging mode, press and hold the **RANGE** key for 2 seconds.

Note: Manual ranging does not apply for the Frequency functions.

MAX/MIN Function

Note: When using the **MAX/MIN** function in autoranging mode, the meter will "lock" into the range that is displayed on the LCD when MAX/MIN is activated. If a MAX/Min reading exceeds that range, an **"OL"** will be displayed. Select the desired range BEFORE entering MAX/MIN mode.

1. Press the **MAX/MIN** key to activate the MAX/MIN recording mode. The display icon **"MAX"** will appear. The meter will display and hold the maximum reading and will update only when a new "MAX" occurs.
2. Press the **MAX/MIN** key again and the display icon **"MIN"** will appear. The meter will display and hold the minimum reading and will update only when a new "MIN" occurs.
3. To exit the MAX/MIN mode, press and hold the **MAX/MIN** key for 2 seconds.

Switching on Bluetooth® and Sending Measurements

Press and hold **REL** button until the Bluetooth symbol appears in the display. Then you can use our D/S Meter App installed on your phone to connect with the instrument.

Switching off Bluetooth

Press and hold **REL** button to switch off Bluetooth. The Bluetooth connectivity switches off as soon as the meter is switched off.

Relative Mode

The relative measurement feature allows you to make measurements relative to a stored reference value. A reference voltage, current, etc. can be stored and measurements made in comparison to that value. The displayed value is the difference between the reference value and the measured value.

1. Perform the measurement as described in this manual.
2. Press the **REL** button to store the reading in the display and the **"REL"** indicator will appear on the display.
3. The display will now indicate the difference between the stored value and the measured value.
4. Press the **REL** button to exit the relative mode.

Note: The Relative function does not operate in the Frequency function.

Display Backlight

Press and hold the **HOLD** key for >1 second to turn on or off the display backlight function. The backlight will automatically turn off after 5 minutes.

Hold Function

The Hold function freezes the reading in the display. Press the **HOLD** key momentarily to activate or to exit the Hold function.

Automatic Power-Off

In order to conserve battery life, the meter will automatically turn off after approximately 15 minutes of nonuse. To disable the auto power-off feature, hold down the **MODE** button and turn the meter on.

Low-Battery Indication

The  icon will appear in the lower left corner of the display when the battery voltage becomes low. Replace the battery when this appears.

Specifications

Function	Range	Resolution	Accuracy
DC Voltage	400 mV	0.1 mV	±(0.8% reading + 8 digits)
	4 V	0.001 V	±(1% reading + 8 digits)
	40 V	0.01 V	
	400 V	0.1 V	
	1000 V	1 V	±(0.8% reading + 8 digits)
AC Voltage (400 mV is not autoranging)			50 Hz to 400 Hz
	400 mV*	0.1 mV	±(1.5% reading + 10 digits)
	4 V	0.001 V	
	40 V	0.01 V	
	400 V	0.1 V	
	1000 V	1 V	±(1.5% reading + 10 digits)
	All AC voltage ranges are specified from 5% of range to 100% of range		
DC Current	400 µA	0.1 µA	±(1.0% reading + 3 digits)
	4000 µA	1 µA	
	40 mA	0.01 mA	
	400 mA	0.1 mA	
	4 A	0.001 A	±(1.5% reading + 3 digits)
	10 A	0.01 A	
	(10 A: 30 sec max with reduced accuracy)		
AC Current			50 Hz to 400 Hz
	400 µA	0.1 µA	±(3.0% reading + 5 digits)
	4000 µA	1 µA	
	40 mA	0.01 mA	
	400 mA	0.1 mA	
	4 A	0.001 A	±(3.0% reading + 5 digits)
	10 A	0.01 A	
	(10 A: 30 sec max with reduced accuracy)		
	All AC current ranges are specified from 5% of range to 100% of range		

Note: Accuracy is stated at 65 to 83°F (18 to 28°C) and <75% RH.

Specifications (cont.)

Function	Range	Resolution	Accuracy
Temperature (type K)	–50 to 1382°F	0.1°F	±(3.0% reading + 9°F/5°C digits) (probe accuracy not included)
	–45 to 750°C	0.1°C	
Resistance	400 Ω	0.1 Ω	±(1.2% reading + 4 digits)
	4 kΩ	0.001 kΩ	
	40 kΩ	0.01 kΩ	
	400 kΩ	0.1 kΩ	
	4 MΩ	0.001 MΩ	
	40 MΩ	0.01 MΩ	±(2.0% reading + 20 digits)
Capacitance	40 nF	0.01 nF	±(5.0% reading + 10 digits)
	400 nF	0.1 nF	±(3.0% reading + 5 digits)
	4 µF	0.001 µF	
	40 µF	0.01 µF	
	400 µF	0.1 µF	
	4000 µF	1 µF	±(5.0% reading + 10 digits)
Frequency (electronic)	9.999 Hz	0.001 Hz	±(1.5% reading + 5 digits)
	99.99 Hz	0.01 Hz	
	999.9 Hz	0.1 Hz	
	9.999 kHz	0.001 kHz	
	99.99 kHz	0.01 kHz	
	999.9 kHz	0.1 kHz	
	9.999 MHz	0.001 MHz	
	Sensitivity: 0.8 V rms min @ 20 to 80% duty cycle and<100 kHz; 5 Vrms min @ 20 to 80% duty cycle and >100 kHz.		

Note: Accuracy is stated at 65 to 83°F (18 to 28°C) and <75% RH.

Function	Range	Resolution	Accuracy
Frequency (electrical)	10.00 to 400 Hz	0.01 Hz	±(0.5% reading)
	Sensitivity: 15V rms		
Duty Cycle	0.1 to 99.9%	0.1%	±(1.2% reading + 2 digits)
	Pulse width: 100 µs to 100 ms, **Frequency:** 5 Hz to 150 kHz		

Note: Accuracy specifications consist of two elements:
(% reading) – This is the accuracy of the measurement circuit.
(+ digits) – This is the accuracy of the analog to digital converter.

General Specifications

Bluetooth version	4.0
Diode test	Test current of 0.9 mA maximum, open circuit voltage 2.8 V DC typical
Continuity check	Audible signal will sound if resistance is <35 Ω (approx.); test current <0.35 Ma
Input impedance	>10 MΩ VDC and >10 MΩ VAC
AC response	True RMS
ACV bandwidth	50 to 400 Hz
Crest factor	≤3 at full scale up to 500 V, decreasing linearly to ≤1.5 at 1000 V
Display	4000 counts LCD, backlighting and bar graph
Polarity	Automatic. No indication for positive; minus (–) sign for negative.
Measurement rate	2 times per second, nominal
Overrange indication	'OL' display
Low battery indication	 is displayed
Auto power-off	15 minutes with disable feature
Battery	One (1) 9 V (NEDA 1604) battery
Enclosure	Double molded, waterproof
Shock (drop) test	6.5 ft (2 m)
Operating temp.	41 to 104°F (5 to 40°C)
Storage temperature	–4 to 140°F (–20 to 60°C)
Operating humidity	Max 80% up to 87°F (31°C) decreasing linearly to 50% at 104°F (40°C)
Storage humidity	<80%
Operating altitude	7000 ft (2000 m) maximum
Dimensions	7 9/32" x 3 1/32" x 2 5/16" (18.2 x 8.2 x 5.9 cm) including holster
Weight	12.1 oz (342 g) including holster
Safety	This meter is intended for origin of installation use and protected, against the users, by double insulation per EN61010-1 and IEC61010-1 2 Edition (2001) to Category IV 600V and Category III 1000V; Pollution Degree 2. The meter also meets UL 61010-1, 2nd Edition (2004), CAN/CSA C22.2 No. 61010-1 2nd Edition (2004), and UL 61010B-2-031, 1st Edition (2003)

Maintenance, Recalibration, and Repair

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the back cover or the battery or fuse covers.

WARNING: To avoid electric shock, do not operate your meter until the battery and fuse covers are in place and fastened securely.

This meter is designed to provide years of dependable service, if the following care instructions are performed:

- Keep the meter dry. If it gets wet, wipe it off.
- Use and store the meter in normal temperatures. Temperature extremes can shorten the life of the electronic parts and distort or melt plastic parts.
- Handle the meter gently and carefully. Dropping it can damage the electronic parts or the case.
- Keep the meter clean. Wipe the case occasionally with a damp cloth. DO NOT use chemicals, cleaning solvents, or detergents.
- Use only fresh batteries of the recommended size and type. Remove old or weak batteries so they do not leak and damage the unit.
- If the meter is to be stored for a long period of time, remove the batteries to prevent damage to the unit.

Battery Installation

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the battery cover.

1. Turn power off and disconnect the test leads from the meter.
2. Open the rear battery cover by removing the screw using a Phillips head screwdriver.
3. Insert the battery into battery holder, observing the correct polarity.
4. Put the battery cover back in place. Secure with the screws.

WARNING: To avoid electric shock, do not operate the meter until the battery cover is in place and fastened securely.

Note: If your meter does not work properly, check the fuses and batteries to make sure that they are still good and that they are properly inserted.

Replacing the Fuses

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the fuse cover.

1. Disconnect the test leads from the meter.
2. Remove the battery cover.
3. Gently remove the old fuse and install the new fuse into the holder.
4. Always use a fuse of the proper size and value (0.5A/1000V fast blow for the 400 mA range, 10A/1000V fast blow for the 10 A range).
5. Replace and secure the rear cover, battery and battery cover.

WARNING: To avoid electric shock, do not operate your meter until the fuse cover is in place and fastened securely.

It is recommended that Digi-Sense products are calibrated annually to ensure proper function and accurate measurements; however, your quality system or regulatory body may require more frequent calibrations. To schedule your recalibration, please contact InnoCal, an ISO 17025 calibration laboratory accredited by A2LA.

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