



MTS-2000 USER'S MANUAL





USER's MANUAL - March 2010

MTS-2000 METER TEST SYSTEM



Pay special attention to the warnings and safety instructions that accompany the above symbol wherever it is found within this manual!

MTS-2000 User's Manual

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The information and specifications contained within from Manta Test Systems are believed to be accurate and reliable at the time of printing. However, because of the nature of this product, specifications and features shown in this manual are subject to change without notice.

The features and capabilities described herein reflect those available in MTS-2000 firmware release 1.00.

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1. PRODUCT OVERVIEW

The MTS-2000 is a meter test system designed to test panel meters, transducers and similar metering hardware.

All applicable quantities (voltage, current, power, frequency, phase, etc) are displayed as required.

The MTS-2000 is designed to be easily operated from the controls on the front panel. The system displays output values, operating modes, etc. The user interface makes use of a “bank machine” type menu system that can be navigated with soft-keys on the instrument. All current and voltage inputs and outputs use standard banana jacks. The MTS-2000 can also be operated by remote control from an external computer.

FEATURES:

1. 4x20 Character Display	6. Front Panel On/Off Switch and 120Vac Input
2. Front Panel Membrane with Bank Machine Style Soft-key Interface	7. One RS-232 Port
3. Keypad for Data Entry	8. Cable Storage in Lid
4. 0-150V AC/DC Voltage Output Channel	9. 0-20mA Analog Input
5. Convertible Voltage (0-150V AC or DC) or Current (0-5Aac, 0-2.5Adc) Output Channel	10. 0-20mA Analog Output
	Boot Time < 5 Seconds



2. TECHNICAL SUPPORT

Our technical support team is committed to working with you, our customers, to ensure that you have the products which best serve your specific needs. The design of this instrument reflects decades of experience in the electric power industry. Manta Test Systems recognizes, however, that there will be testing situations encountered which were not considered during product design.

Manta Test Systems encourages any user questions, problems or suggestions to be forwarded to us, via the representative through whom the product was purchased, or directly to us via the fax numbers provided on the front cover or in the customer support area of our website.

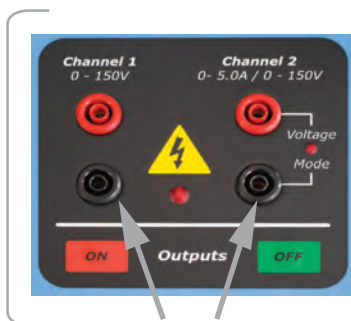
3. SAFETY CONSIDERATIONS

This instrument can generate high levels of current and voltage. Incorrect usage may cause personal injury or damage to the instrument.



The user must be qualified to work safely in the intended application environment of this instrument. Non-adherence to the following minimum requirements constitutes misuse of the MTS-2000, and the manufacturer accepts no liability for damages arising from such misuse:

- 1) The instrument case must always be effectively grounded. The integrity of the power supply cord ground should always be verified before use.
- 2) All leads and connectors should be in good condition and rated for the appropriate voltage and current carrying requirements.
- 3) The outputs must not be connected to live outputs or live equipment.
- 4) All outputs must be turned off before making changes in connections.



- 5) Note: the black (return) terminals of Channel 1 and 2 are internally connected.

4. LIMITED PRODUCT WARRANTIES

4.1 Hardware

Manta Test Systems warrants that its hardware products, and the hardware components of its products, shall be free from defects in materials and workmanship under normal use and service for a period of one year from the date such products are shipped from Manta Test Systems.

Provided that Manta Test Systems receives notice of any defects in materials or workmanship of its hardware products, or hardware components of its products, within a one-year period, Manta shall, at its option, either repair or replace the defective hardware product or hardware component, if proven to be defective.

4.2 Software & Firmware

Manta Test Systems warrants that its software products, and the software and firmware components of its products, shall not fail to execute their programming instructions under normal use and service, due to defects in materials and workmanship, if properly installed on intended hardware, for a period of one year from the date such products are shipped from Manta Test Systems.

Provided Manta Test Systems receives notice of such defects within the warranty period, it shall, at its option, either repair or replace the software or firmware media, if proven to be defective.

4.3 Separate Extended Warranty for Hardware Products

Aside from the standard warranty set forth above, Manta Test Systems offers a separate extended warranty plan for all hardware products (excluding cables, batteries and accessories) which may be purchased, and extends the standard warranty by one additional year.

The extended warranty is issued under the same terms, conditions and exclusions as the standard warranty set forth herein. Pricing is based upon the cost of the product, and the average cost of servicing and calibration. Refer to the Manta Test Systems price list available from your local representative, or Manta Test Systems, for extended warranty pricing for specific products. The extended warranty must be purchased and paid for within three months from the date the product is shipped from Manta Test Systems.

4.4 Exclusion of other Warranties

THE FOREGOING WARRANTIES ARE EXCLUSIVE, AND ARE IN LIEU OF ANY AND ALL OTHER WARRANTIES (WHETHER WRITTEN, ORAL OR IMPLIED) INCLUDING, BUT NOT LIMITED TO, WARRANTY OF MERCHANTABILITY IN OTHER RESPECTS THAN AS SET FORTH ABOVE, AND WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

4.5 Limitation of Liability and Remedies

IT IS UNDERSTOOD AND AGREED THAT MANTA TEST SYSTEMS' LIABILITY AND PURCHASER'S SOLE REMEDY, WHETHER IN CONTRACT, UNDER ANY WARRANTY, IN TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE COST OF REPAIR OR REPLACEMENT OF MANTA TEST SYSTEMS' PRODUCTS, AS SET FORTH ABOVE, AND, UNDER NO CIRCUMSTANCES, SHALL MANTA TEST SYSTEMS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, PERSONAL INJURY, PROPERTY DAMAGE, DAMAGE TO OR LOSS OF EQUIPMENT, LOST PROFITS OR REVENUE, COSTS OF RENTING REPLACEMENTS, AND OTHER ADDITIONAL EXPENSES.

FURTHERMORE, IT IS UNDERSTOOD AND AGREED THAT MANTA TEST SYSTEMS SHALL NOT BE LIABLE FOR ANY DAMAGES, LOSSES OR EXPENSES AS A RESULT OF THE PURCHASER'S OR ANYONE ELSE'S:

- I. NEGLIGENCE (WHETHER DEEMED ACTIVE OR PASSIVE),
- II. MISUSE, ABUSE, OR MODIFICATION OF MANTA TEST SYSTEMS PRODUCTS,
- III. USE OR OPERATION OF PRODUCTS NOT IN CONFORMITY WITH THE SPECIFICATIONS AND INSTRUCTIONS FURNISHED BY MANTA TEST SYSTEMS FOR ITS PRODUCTS,
- IV. REPAIR OR MAINTENANCE OF MANTA TEST SYSTEMS' PRODUCTS BY PERSONS OR ENTITIES NOT AUTHORIZED BY MANTA TEST SYSTEMS, OR
- V. DAMAGE TO, OR DESTRUCTION OF, PRODUCTS, DURING DELIVERY TO MANTA TEST SYSTEMS FOR ANY REASON.

4.6 Limitation of Warranty Regarding Software

Manta Test Systems does not warrant that the operation of the software, firmware or hardware shall be uninterrupted or error free.

4.7 Extension of Warranty

At the discretion of Manta Test Systems, the warranty may be extended for a product which has been returned for service shortly after its warranty period has expired.

5. PRIMARY MODULES

5.1 Front Panel

The “bank machine” style user interface makes use of soft-keys that are selected by pressing the button adjacent to the description. A keypad is used for direct entry of numeric values.

5.2 Display

The system uses a 4x20 character vacuum florescent display device to display output values, operating modes, etc.

5.3 RS-232 Communications

An RS-232 port is provided to allow control of the instrument using a PC and to facilitate software upgrades.

5.4 DC Current Loop Output

A 0mA to 20mA output is provided for testing current loops normally driven by a transducer.

5.5 DC Current Loop Input

A -20mA to +20mA input is provided to measure a transducer’s output.

5.6 Channels

The system houses two independent power output channels. One channel operates in voltage mode only, and can generate up to 150V (AC or DC). The other channel can generate voltage or current. In voltage mode it generates up to 150V (AC or DC). In current mode it generates up to 5Aac or up to $\pm 2.5\text{A}_{dc}$.

5.7 Power supply

The mains input is auto-ranging, power factor corrected and can operate from either 105-130 or 208-250Vac (50-60Hz).



6. SPECIFICATIONS

NOTE: Due to technical progress, specifications are subject to change without notice. All AC quantities are RMS values, except as otherwise noted. Power outputs are specified for nominal 120VAC/60Hz or 240VAC/50Hz power input, and 25°C ambient operating temperature. Derating applies for lower input power voltages and higher ambient temperatures.

For all current outputs, maximum obtainable current will vary inversely with load impedance. For extended operation at high power output levels, ensure adequate cooling (i.e. verify air intakes and exhaust ports are unrestricted).

6.1 Inputs

Mains Supply

Single phase 105-130VAC (or 208-250VAC) @400VA max, 47-63 Hz, auto-ranging

Transducer Input

Measures low level output from AC transducers

Maximum input level: $\pm 20\text{mA DC}$

Measurement accuracy: 0.04% reading + 0.01% range ($25\pm 5^\circ\text{C}$) *after 10min warmup*
(for waveforms under 2% THD)

Connector: 4mm Banana

6.2 Outputs

Transducer Output

Generates low level output for AC transducer inputs

Maximum output level: 0 - 20mA DC

Setting accuracy: 0.04% setting + 0.01% range ($25\pm 5^\circ\text{C}$) *after 10min warmup*

Compliance: $\geq 10\text{Vdc}$, ($\geq 11\text{Vdc}$ typical)

Max Load: 10k Ω (to 1mA), 2k Ω (to 4mA), 1k Ω (to 10mA), 500 Ω (to 20mA)

Connector: 4mm Banana

Voltage

2 AC or DC voltage channels

0-150V (AC or DC) per channel in independent mode

0-300V (AC or DC) when channels are connected in series

Setting resolution: 0.01Vrms, 0.1Vdc

Accuracy greater of: 0.25% of setting or 0.03 Vrms (10Hz-400Hz, DC)

1.0% of setting (400Hz-800Hz), greater than 1% of range

Power AC: 30VA max per channel, 60VA min with 2 channels in series, 60Hz.

Power DC: 15W dc max per channel, 30W dc with 2 channels in series

Noise & distortion at maximum power: $< 1\%$

Bandwidth: 3kHz (-3dB)

Protection: Overload, short circuit, over-temperature, transient overvoltage, clip indication

Surge Current (DC mode): 1A maximum (limited)

Connector: 4mm Banana

6.2 Outputs (Cont'd)

Current

1 AC or DC current channel

0-5Arms, or 0-2.5Adc, direct coupled

Setting resolution: 0.001Arms

Accuracy greater of: 0.25% of setting or 0.01 Arms (10Hz-400Hz,DC)

1% (400Hz-1000Hz)

Power: 50 VA maximum, 30W dc

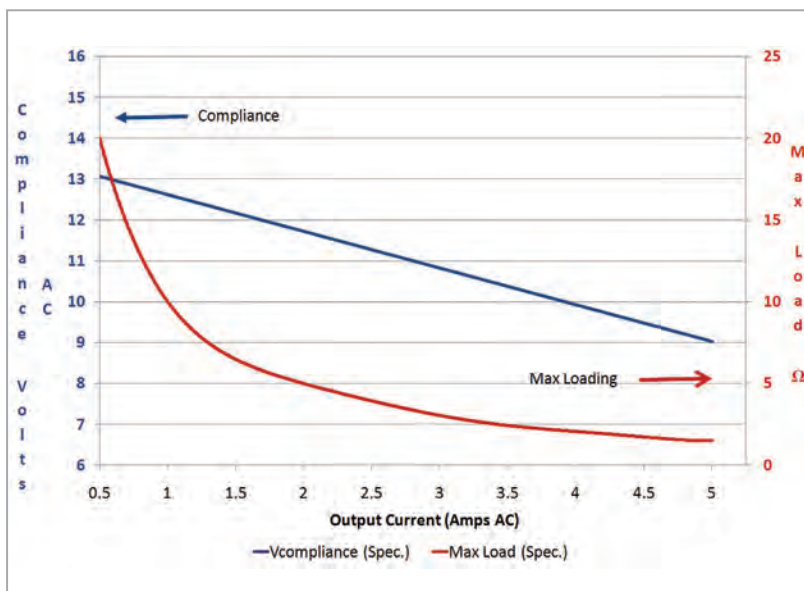
Noise & distortion at maximum power: <1%

Bandwidth: 3kHz (-3dB)

Protection: Overload, short circuit, over-temperature, transient overvoltage, clip indication

Connector: 4mm Banana

Compliance & Loading: (60Hz)



AC Outputs Frequency/Phase Angle

Frequency range: DC, 10-1000 Hz

Frequency resolution: 0.001Hz

Frequency accuracy: 50ppm

Capable of generating 2 simultaneous frequencies

Phase angle range: 0-359.9°, resolution 0.1°

Phase accuracy: 0.1° (43-65Hz), 0.5° (10-43Hz and 65-120Hz), 1.0° (120Hz-1000Hz)

6.3 Data Interfaces

All interfaces are fully isolated from AC/DC inputs and outputs. Ground, where present, is connected to frame ground.

RS-232 Serial Port

Standard 9 pin male DB-9 wired as DTE (Data Terminal Equipment)
9600 to 115,200 baud

6.4 Accessories

User's manual
AC power cord
Test lead kit and detachable storage pouch
RS-232 null modem cable – optional

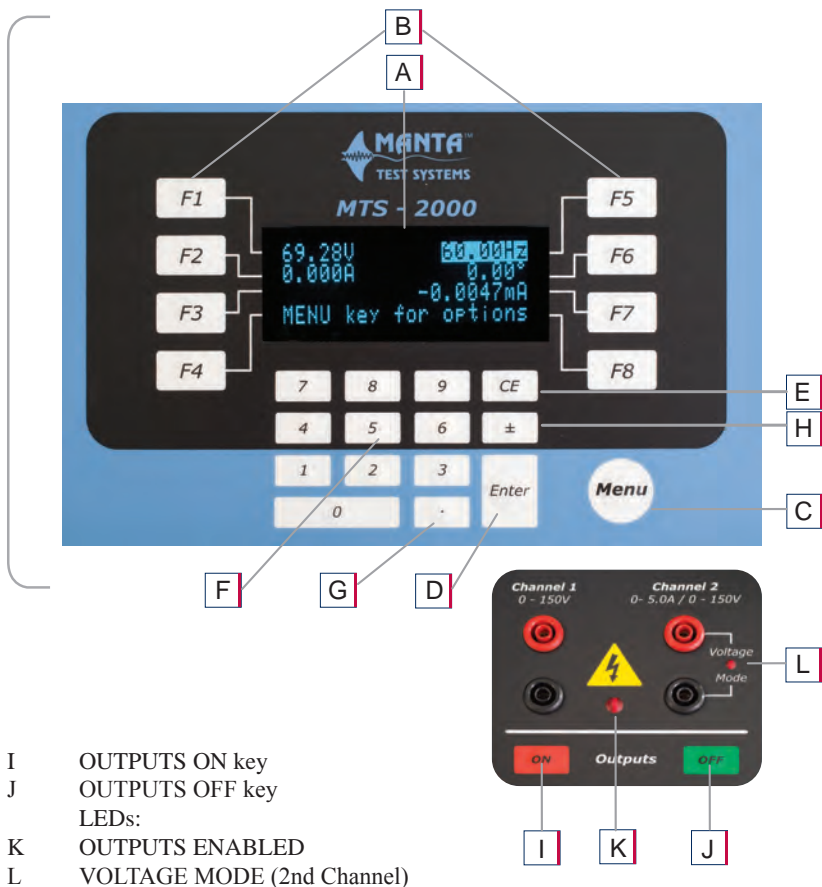
6.5 Physical Characteristics

14.9"W x 6.9"H x 12.1"D (37.9cm W x 17.5cm H x 30.8cm D)
Weight: 15 lbs (6.8 kg)
Display: 20 character by 4 line VFD
Operating temperature: 32° to 122°F (0° to 50°C)
Storage temperature: -13° to 158°F (-25° to 70°C)

7. USER INTERFACE CHARACTERISTICS

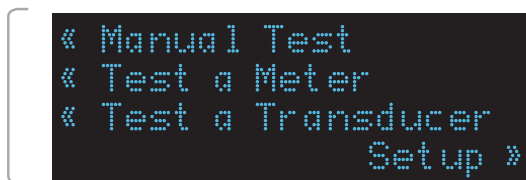
Hardware related to the front-panel user interface includes:

- A 4 line, 20 character-per-line display
- B 8 function keys, positioned to the left and right of each line on the display device
- C MENU key
- D ENTER key
- E CE (clear entry) key
- F 0-9 digit keys
- G decimal point key
- H +/- key



When the device is powered on, the manual test mode screen described later in this document is shown. To change modes or exit menus, press MENU:

Pressing the function key adjacent to a label (“Manual Test”, etc.) causes the screen described by that key’s label to appear.



Pressing the MENU key at any time will always return you to the previous place in the menu tree.

Many screens contain editable values. For example, the following screen contains four editable values: 1.000, 1.000, 5.000, 5.000



Pressing the function key next to an editable value selects that value, highlighting it in inverse text on the display. If you type a numeric key, an editing screen appears similar to this one:



The editing display shows the name of the setting being edited and its allowable range. As you type in the digits, you can change the sign or enter a decimal point. Changes are reflected between the square brackets. When finished entering a number, you may press ENTER to store it or CE to abort entry.

The OUTPUTS ON and OUTPUTS OFF keys turn the two channels on or off. Whenever the amplifier outputs are on, the ENABLED LED is on.

Some tests configure channel 2 to output current, others configure it to output voltage. The VOLTAGE MODE LED is on when the convertible amplifier is configured to output voltage.

8. OPERATING MODES

The MTS-2000 offers various operating modes that are designed to provide an easy to use interface for the particular category of testing to be performed.

The basic modes are:

1. Manual test
2. Meter test
3. Transducer test
4. Setup

8.1 Manual Test Mode

The manual test mode is used for basic meter and transducer testing. It consists of a single screen, allowing you to set voltage, current, frequency and phase angle, and displays the current loop input current. The amplifiers are configured so that channel 1 generates voltage and channel 2 generates current. The voltage and current values entered by the user are generated as displayed, with no conversion or scaling.

When the device is powered on, the manual test mode screen is shown. From the main menu, the “Manual Test” function key returns to the manual test screen, shown below.



In this mode, you may adjust the voltage, current, frequency and phase angle, and use the OUTPUTS ON and OUTPUTS OFF keys to turn the channels ON or OFF. The 0-20mA current input is shown so the user can test transducers with current outputs.

8.2 Meter Test Mode

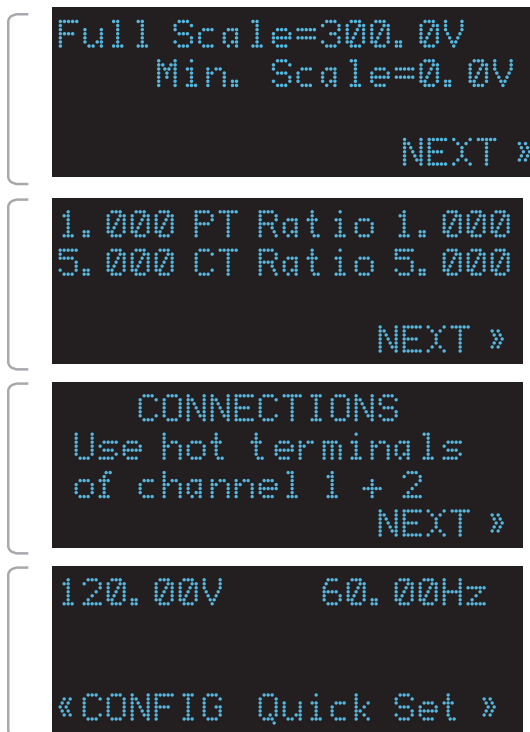
The “Test a Meter” function key in the main menu presents the user with a menu listing of available meter-specific test screens:



Each selection presents a series of screens to configure the test, including:

- Minimum and full-scale limits (V, A, W, etc.)
- CT and PT ratios
- “Connections” screen describes the channel wiring required for the specific mode, and the test screen allows the user to adjust the output levels and see the expected value on the meter.

For example, when the “Volts” function key is pressed, the following screens appear in sequence:



Pressing the CONFIG function key returns to the full scale / min scale screen.

The meter-specific test modes include a “QUICK SET” function key. Pressing it repeatedly causes the appropriate values to be generated so that the meter will read 0%, 25%, 50%, 75% and 100% of full scale.

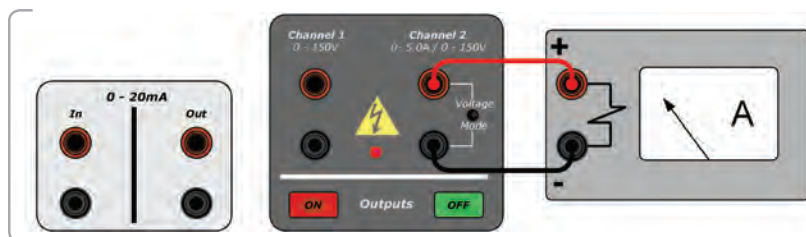
8.3 Setup Mode

The “Setup” selection in the main menu allows the user to configure the device, including:

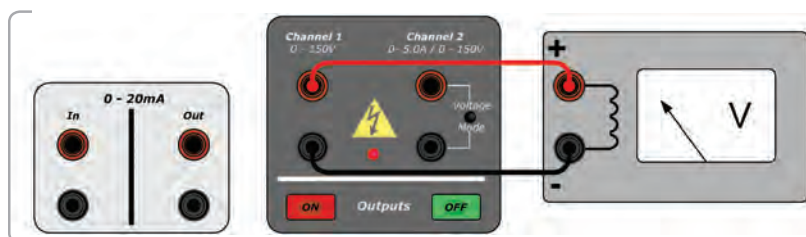
- * Calibrate the amplifiers
- * Calibrate the current loop input and output

9. EXAMPLE CONNECTION DIAGRAMS

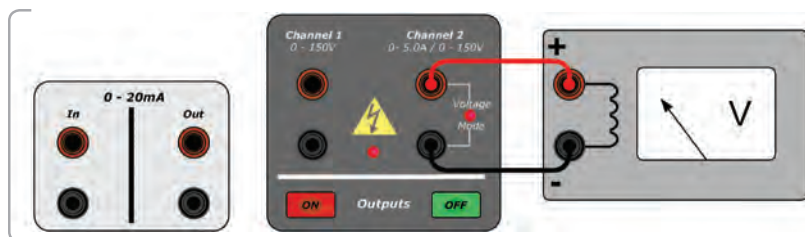
9.1 Testing an Ammeter



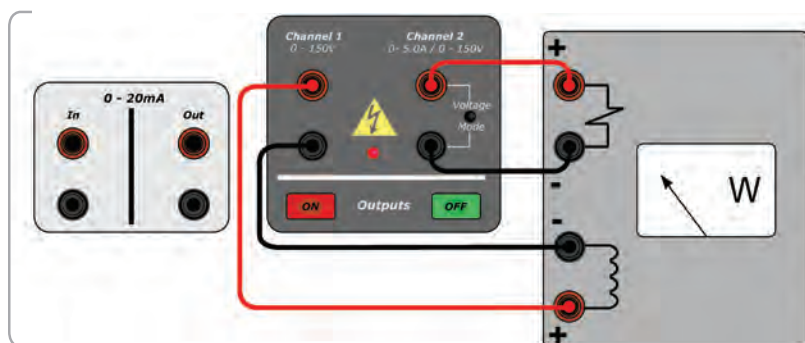
9.2 Testing a Voltmeter with Channel 1



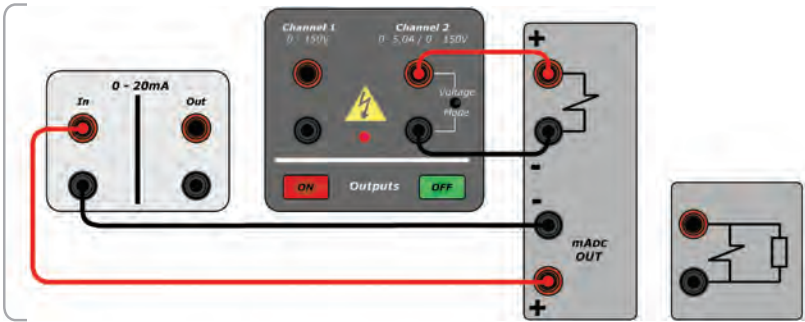
9.3 Testing a Voltmeter with Channel 2



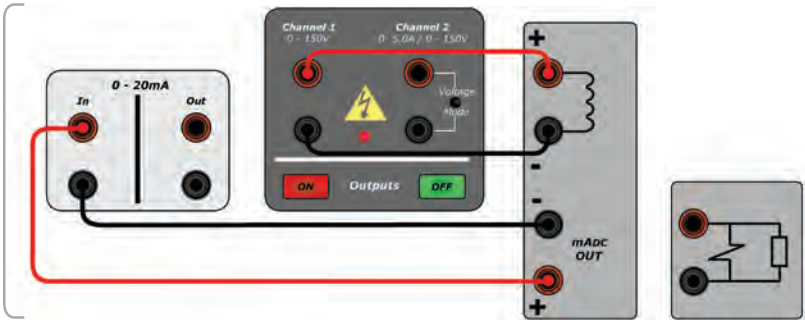
9.4 Testing a Wattmeter



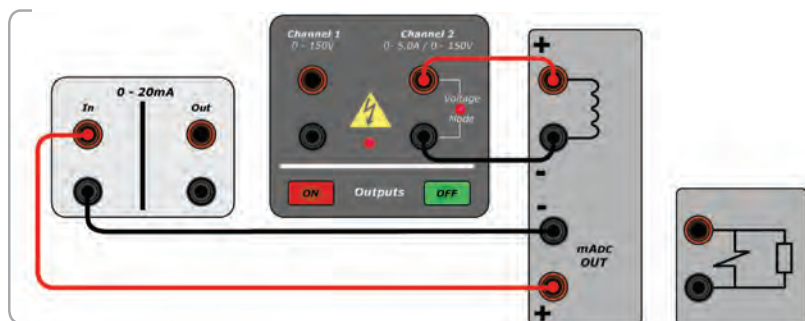
9.5 Testing a Current Transducer



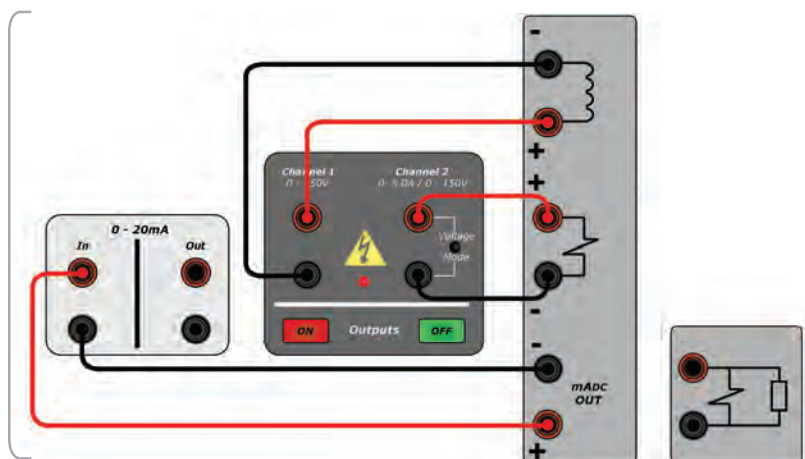
9.6 Testing a Voltage Transducer with Channel 1



9.7 Testing a Voltage Transducer with Channel 2



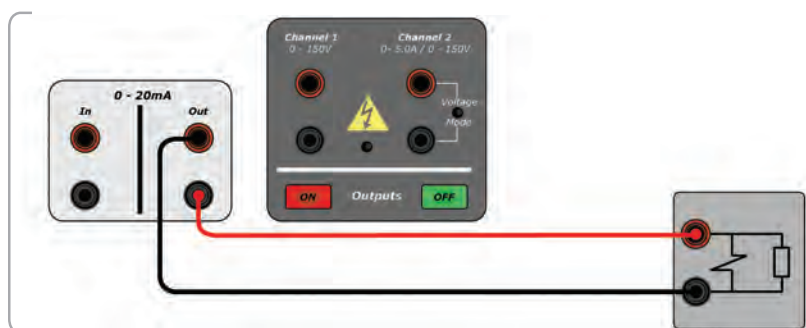
9.8 Testing a Watt Transducer



9.9 Testing a Voltage Device (0 – 300V)

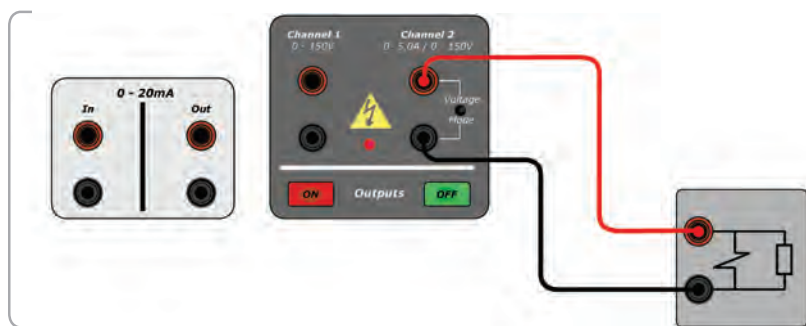


9.10 Outputting Transducer Current (0-20mA)



9.11 Outputting DC Current (0 – 2500 mA DC)

(note: Channel 2 must be set to DC)





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