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Introduction

The HA1 analyzes and tests hermetic compressors at up to 25 amps of running current. Connects directly to the compressor motor eliminating the refrigeration system start capacitor.

Features include

- 3 Ranges of 250 V AC starting capacitors between 88-301 MFD
- Dual voltage operation of 120/240 V AC
- Indicates continuity & ground faults in motor windings with LED lights
- Free locked rotors by reversing motor action
- Convenient breakout jacks for measuring voltage and resistance

Safety Notes

Before using this instrument, read all safety information carefully. In this manual the word "**WARNING**" is used to indicate conditions or actions that may pose physical hazards to the user. The word "**CAUTION**" is used to indicate conditions or actions that may damage this instrument.

- Do not attempt to measure any voltage that exceeds the category based rating of this meter
- Do not attempt to use this instrument if either the meter or the test leads have been damaged. Turn it in for repair at a qualified repair facility
- Ensure instrument leads are fully seated by making a quick continuity check of the leads prior to making voltage measurements
- Keep your fingers away from the test lead's metal probe contacts when making measurements. Always grip the leads behind the finger guards molded into the probes
- Use a current clamp adapter when measuring current that may exceed 10 amps. See the accessories in UEI's full-line catalog
- Do not open the instrument to replace batteries or fuses while the probes are connected



WARNING!

Exceeding the specified limits of this instrument is dangerous and can expose the user to serious or possibly fatal injury.

- Voltages above 60 volts DC or 25 volts AC may constitute a serious shock hazard
- Always turn off power to a circuit (or assembly) under test before cutting, unsoldering, or breaking the current path - Even small amounts of current can be dangerous
- Always disconnect the live test lead before disconnecting the common test lead from a circuit

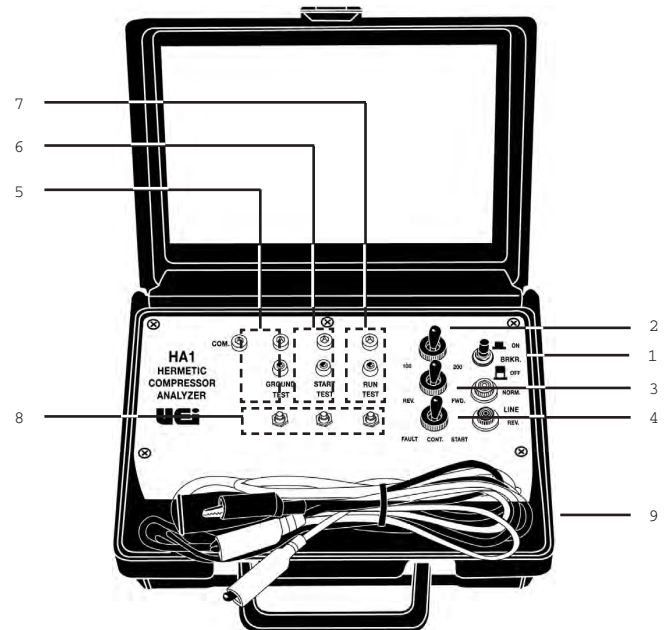
- In the event of electrical shock, **ALWAYS** bring the victim to the emergency room for evaluation, regardless of the victim's apparent recovery - Electrical shock can cause an unstable heart rhythm that may need medical attention
- Higher voltages and currents require greater awareness of physical safety hazards - Before connecting the test leads; turn off power to the circuit under test; set the instrument to the desired function and range; connect the test leads to the instrument first, then to the circuit under test. Reapply power
- If any of the following indications occur during testing, turn off the power source to the circuit under test:
 - Arcing
 - Flame
 - Smoke
 - Extreme Heat
 - Smell of Burning Materials
 - Discoloration or Melting of Components



CAUTION!

Do not attempt to remove the instruments leads from the circuit under test. The leads, the meter, or the circuit under test may have degraded to the point that they no longer provide protection from the voltage and current applied. If any of these erroneous readings are observed, disconnect power immediately and recheck all settings and connections

Controls and Indicators



1. **PWR Breaker:** This is a combination 25A circuit breaker and a POWER ON switch.
2. **CAP 100/300/200:** Selects one of the three starting capacitor ranges:

Position	Range
100MFD	88-108MFD
200MFD	161-193MFD
300MFD	249-301MFD

3. **REV/OFF/FWD:** This switch determines the mode of operation of the compressor. In the “**FWD**” position, power is applied to the compressor motor run winding, and the start capacitor is connected to the **START** cable. In the “**REV**” position, power is applied to the compressor motor start winding and the start capacitor is connected to the **RUN** cable. In the “**OFF**” position, the power circuit to the motor is broken.

The “**REV**” position is momentary. The “**OFF**” and “**FWD**” positions are sustained.

4. **FAULT/CONT./START:** This is a multi-function switch. The “**FAULT**” (momentary action) position is used to check for shorts between the “**COM**” and the “**RUN/START**” windings. The “**CONT.**” (sustained action) position is used to check for **GROUND**, **RUN** and **START** continuity. In the “**START**” (momentary action) position the start capacitor is connected to the compressor motor through the “**REV/OFF/FWD**” switch.
5. **Ground Test (Yellow):** Push-button switch tests for ground continuity between system ground and the frame of the appliance being tested.

The HA1 introduces an “artificial ground” to make possible the testing for short circuits between the motor winding and the frame of appliances which may not be directly grounded. For example, units with two wire power cords would not be connected to systems ground (unless a separate ground connection were present).

6. **Start Test (Red):** Push-button switch tests two conditions, depending on the position of the “**FAULT/CONT./START**” switch.

Switch Position	Condition Tested
FAULT	Short between START winding and frame
CONT.	Continuity of START winding

7. **Run Test (Black):** Push-button switch tests two conditions, depending on the position of the “**FAULT/CONT./START**” switch.

Switch Position	Condition Tested
FAULT	Short between RUN winding and frame
CONT.	Continuity of RUN winding

8. **Indicator Lights:** **LINE NORM** (white)/**REV** (red). These lights are used to indicate the condition of the power source to which the HA1 is connected.

Line Voltage	Indicator Light	Status
110 V AC	NORM on/REV off	Normal
	REV on/NORM off	Neutral and line wires reversed at power receptacle. Refer to section on “110 V AC” operation.
220 V AC	NORM and REV on (half intensity)	System ground open or not connected at power receptacle.
	NORM and REV on (full intensity)	Normal

9. **Test Jacks:** The four test jacks are connected directly to the test cable of the corresponding color: **COMMON** = white, **GROUND** = yellow, **START** = red, and **RUN** = black. The purpose of the test jacks is to facilitate resistance and voltage readings by enabling voltmeter/ohm meter test leads to be connected to the compressor motor circuit by inserting them into the appropriate jack at the HA1 front panel.

*Since this cable is an “artificial” ground line it is colored yellow instead of green.

Operating Instructions

NOTE: Every effort has been made to make the HA1 a safe and versatile tester. However, under some circumstances line voltage may be present on the HA1 test cables when the control switches are in the **OFF** position. For this reason it is very important to read and become familiar with the section on operation.

The following procedures have been detailed so a thorough understanding of the operation sequence may be gained. In practice, the following tests may be performed very quickly.

110 V AC Operation



CAUTION!

The HA1 is wired so that the white **COMMON** test cable is connected to the neutral side of the line. The red **START** and black **RUN** cables are connected to the hot side of the line by the “**POWER BREAKER**” switch and the “**REV/OFF/FWD**” switch. If the 110 V AC receptacle has been accidentally reverse wired, the white **COMMON** cable will be “hot” as soon as the HA1 is plugged into the power receptacle. To warn against such a condition, the red **REV LINE** indicator will light as soon as the HA1 is plugged into a grounded receptacle. In this case follow procedure B for reversed line condition.

A. Normal Test Procedure

1. The “**REV/OFF/FWD**” switch must be in the “**OFF**” position.
2. Plug the HA1 into a grounded 110 V AC receptacle and turn on the “**POWER**” switch. This is a push-on and push-off switch. The white **NORM LINE** indicator should light.

NOTE: If the receptacle is ungrounded, both the “**NORM**” and the “**REV LINE**” indicator will light, but at half intensity. The absence of a grounded line will not prevent any of the following tests from being made.

IMPORTANT: Verify that the receptacle is not also reverse wired by measuring the voltage between the white **COM** cable and a ground connection. A reversed line will measure 110 V AC. A normal line will measure zero volts. If the receptacle is reverse wired, follow procedure B.

3. Remove power to the unit which is to be tested.
4. Remove and identify the connectors going to the common, start, and run terminals of the compressor motor.

5. Connect the test cables of the HA1 to the compressor motor.
 - A. Yellow "**GROUND**" cable to compressor motor frame.
 - B. Red "**START**" cable to the start terminal.
 - C. Black "**RUN**" cable to the run terminal.
 - D. Leave the white "**COMMON**" cable disconnected until step 7.
6. Push the "**FAULT/CONT./START**" switch to the "**FAULT**" position and hold it there while pressing the red "**START TEST**" and black "**RUN TEST**" switches in turn. If either the "**START**" indicator or "**RUN**" indicator lights, there is a short between that winding and the frame. STOP the test and replace the unit.
7. Connect the white "**COMMON**" cable to the common terminal of the compressor motor.
8. Press, in turn, the "**GROUND TEST, START TEST, and RUN TEST**" switches. The appropriate indicator will light indicating continuity in the circuit being tested.

NOTE: To test for ground continuity the appliance must be plugged into a grounded 110 V AC receptacle or be grounded through an external connection

If either the run start winding indicator open, stop the test and replace the unit.

9. Select the appropriate motor start capacitor.
10. Press the "**FAULT/CONT./START**" switch to the "**START**" position and, holding it there, throw the "**REV/OFF/FWD**" switch to the "**FWD**" position. If the compressor starts, release the "**START**" switch. The compressor will continue to run. The compressor may be stopped by returning the "**REV/OFF/FWD**" switch to the "**OFF**" position.

If the compressor does not start immediately, the rotor may be locked. Release the "**START**" switch and return the "**REV/OFF/FWD**" switch to the "**OFF**" position.

11. To "**Bump**" the compressor, press the "**FAULT/CONT./START**" switch to the "**START**" position and holding it there, throw the "**REV/OFF/FWD**" switch to the "**REV**" position. If the compressor starts immediately, then release both switches. Repeat step 10 to assure that the compressor will run in the forwards direction.

If the compressor does not start immediately in reverse, then release both switches. A locked rotor will result in excessive current being drawn by the compressor.

12. Steps 10 and 11 may be repeated a few times in an attempt to free a locked rotor, but care should be taken not to overheat the motor windings. If the compressor still does not start, then it should be replaced.
13. Push the "**POWER BREAKER**" switch OFF. Disconnect the HA1 test cables from the motor.

B. Reversed Line Operation

If the 110 V AC receptacle is reverse wired the main thing to remember is that the white "**COMMON**" cable will be HOT regardless of any HA1 switch setting. Therefore, exercise extreme care.

Follow the same procedure as for Normal Operation (A) steps 1 through 6, but keep the white "**COMMON**" cable isolated to prevent accidental contact with it.

Before doing step 7, unplug the HA1 from the power receptacle, connect the white "**COMMON**" cable to the common terminal of the motor, and then plug the HA1 into the power receptacle.

Proceed with the tests outlines in steps 8 though 12, section A.

220 V AC Operation



CAUTION!

The white COM cable will be hot as soon as the HA1 line cord is connected to 220 V AC. Always make sure that power to the HA1 is shut off before connecting the HA1 cables to the compressor motor on 220 V AC operation.

1. The "**REV/OFF/FWD**" switch and the "**POWER BREAKER**" switch must be in the off position.
2. Remove power to the unit which is to be tested.
3. Some compressor units have fans mounted in the same housing as the compressor. If possible turn down the thermostat, or disconnect the fan, so that the fan will not operate during the compressor tests. The fan noise could make it difficult to listen to the action of the compressor.
4. Remove and identify the connectors going to the common, start, and run terminals of the compressor motor.
5. Connect the test cables of the HA1 to the compressor motor.
 - A. Yellow "**GROUND**" cable to compressor motor frame.
 - B. Red "**START**" cable to the start terminal.
 - C. Black "**RUN**" cable to the run terminal.
 - D. Leave the white "**COMMON**" cable disconnected until step 10.
6. Use an adapter cord of at least #14 AWG wire size to connect the HA1 to the 220 V AC input terminals.
7. Turn on the power to the HA1.

NOTE: Remember to keep the white "**COM**" cable out of the way. It will have 110 V AC on the clip.

8. Push the "**POWER BREAKER**" switch to the "**ON**" position. Both "**LINE NORM/REV**" indicators will light on.
9. Push the "**FAULT/CONT./START**" switch to the "**FAULT**" position and hold it there while pressing the red "**START TEST**" and black "**RUN TEST**" switches in sequence. If either the "**START**" indicator or "**RUN**" indicator lights, there is a short between that winding and the frame. Stop the test and replace the unit.

Maintenance

10. Turn off the 220 V AC power source to the HA1. Connect the white "**COM**" cable to the common terminal of the compressor motor.
11. Turn Power back on and Press, in turn, the "**GROUND, TEST, START TEST**", and "**RUNTEST**" switches. The appropriate indicator will light indicating continuity in the circuit being tested. If either the run or start winding indicate open, stop the test and replace the unit.
12. Select the appropriate motor start capacitor.
13. Press the "**FAULT/CONT./START**" switch to the "**START**" position and, holding it there, throw the "**REV/OFF/FWD**" switch to the "**FWD**" position. If the compressor starts, release the "**START**" switch. The compressor will continue to run. The compressor may be stopped by returning the "**REV/OFF/FWD**" switch to the "**OFF**" position.

If the compressor does not start immediately, the rotor may be locked. Release the "**START**" switch and return the "**REV/OFF/FWD**" switch to the "**OFF**" position.

14. To "**Bump**" the compressor, press the "**FAULT/CONT./START**" switch to the "**START**" position and, holding it there, throw the "**REV/OFF/FWD**" switch to the "**REV**" position. If the compressor starts immediately then release both switches. Repeat step 13 to assure that the compressor will run in the forwards direction.

If the compressor does not start immediately in reverse, then release both switches. A locked rotor will result in excessive current being drawn by the compressor.

15. Steps 13 and 14 may be repeated a few times in an attempt to free a locked rotor, but care should be taken not to overheat the motor windings. If the compressor still does not start, then it should be replaced.
16. Turn off the 220 V AC power source to the HA1. Disconnect the HA1 test cables from the motor.

Periodic Service



WARNING!

Repair and service of this instrument is to be performed by qualified personnel only. Improper repair or service could result in physical degradation of the meter. This could alter the protection from electrical shock and personal injury this meter provides to the operator. Perform only those maintenance tasks that you are qualified to do.

These guidelines will help you attain long and reliable service from your meter:

- Calibrate your meter annually to ensure it meets original performance specifications
- Keep your meter dry. If it gets wet, wipe dry immediately. Liquids can degrade electronic circuits
- Whenever practical, keep the meter away from dust and dirt that can cause premature wear
- Although your meter is built to withstand the rigors of daily use, it can be damaged by severe impacts. Use reasonable caution when using and storing the meter

Cleaning

Periodically clean your meter's case using a damp cloth. **DO NOT** use abrasive, flammable liquids, cleaning solvents, or strong detergents as they may damage the finish, impair safety, or affect the reliability of the structural components.



HA1

Hermetic Compressor Analyzer

Limited Warranty

The HA1 is warranted to be free from defects in materials and workmanship for a period of three years from the date of purchase. If within the warranty period your instrument should become inoperative from such defects, the unit will be repaired or replaced at UEi's option. This warranty covers normal use and does not cover damage which occurs in shipment or failure which results from alteration, tampering, accident, misuse, abuse, neglect or improper maintenance. Batteries and consequential damage resulting from failed batteries are not covered by warranty.

Any implied warranties, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the express warranty. UEi shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim or claims for such damage, expenses or economic loss. A purchase receipt or other proof of original purchase date will be required before warranty repairs will be rendered. Instruments out of warranty will be repaired (when repairable) for a service charge. Return the unit postage paid and insured to:

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This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

