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FACT-1

FEEDER AMMETER CLEAR TEST

Operating & Instruction Manual

HD ELECTRIC COMPANY
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IMPORTANT SAFETY NOTES

IMPORTANT! Please read the Operator's Manual thoroughly before operating the unit. Having a complete understanding of the Feeder Ammeter Clear Test (FACT-1) operation and issues that may influence its performance is key to obtaining the maximum effectiveness of this unit.

The FACT-1 outputs 120VAC to the cable under test and therefore extreme caution must be exercised to prevent electrical shock.

Never obstruct the intake or exhaust grills in the cord storage compartment.

Never attempt to close the cover while the unit is operating or while any cables are connected.

Do not connect the FACT-1 unit to a GFI protected circuit.

Before connecting the FACT to any circuit, test and ground that circuit to verify it is both de-energized and discharged.

DO NOT use the FACT-1 if any chance of a back feed exists.

The FACT-1 contains sensitive electronic parts. Although the housing is rugged, care should be taken to prevent any impact to the unit. An impact could damage the internal circuitry or display. The unit should never be opened except by the manufacturer. No user serviceable parts are inside.

FACT-1 DESCRIPTION

Alternating Current (AC) Ammeter Clear tests are used to indicate the presence of either grounds or short circuits on a primary feeder's three phase conductors or either grounds or short circuits on transformer secondaries.

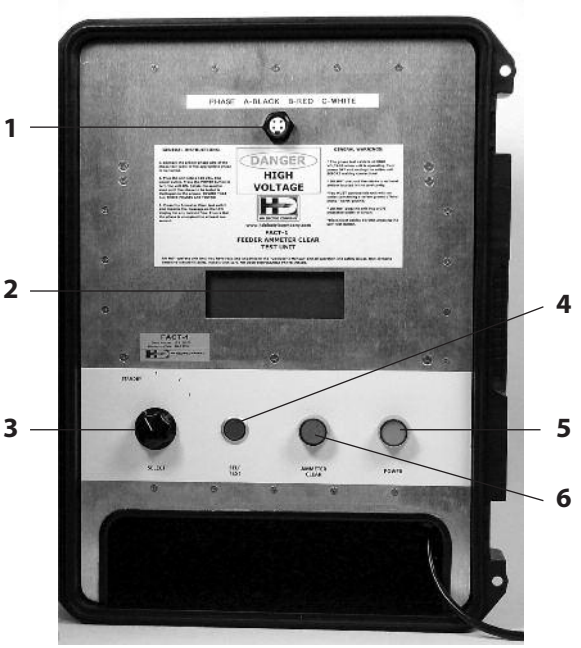
Intentional grounding of the feeder cables may occur during some types of maintenance. Failure to remove these grounds at the end of the maintenance procedure is unintentional but nevertheless could cause potential damage if an attempt is made to put the feeder back in service.

The Feeder Ammeter Clear Test Set has been specifically designed for utilities that do not or cannot disconnect their transformers from the primary cable under test. A 120V AC, 60Hz source is used to check for grounds or short circuits. The AC signal is also adequate to energize the transformers connected to the feeder sufficiently enough to detect grounds left on the secondary side of a transformer.

In the primary phase-to-ground fault scenario, the LCD ammeter display will indicate a fault current of approximately 5 Amps with a nominal line voltage of 120V. A maximum of 5 Amps is provided by the Test Set and is limited by an internal 24 ohm power resistor. In the primary phase-to-phase fault scenario, the LCD ammeter display will also indicate a fault current of approximately 5 Amps with a nominal line voltage of 120V.

In the secondary side fault scenario, a short circuit fault from a feeder transformer secondary conductor to ground occurs. This allows more current to flow through the primary windings of this transformer which current then flows through the primary feeder. The value of the current flowing will depend on the nominal voltage of the feeder being tested since the turns ratio of the transformer will vary. For example, when a 13.8kV primary feeder connected to a transformer with a 120V secondary is tested, the LCD ammeter display reading would be about four amperes while on a 27kV feeder with a transformer to 120V, the LCD ammeter display reading would be about 1.4 amperes. These are only estimates and can vary depending on feeder voltage and the type of wire (impedance) used to ground the feeder.

Under a "No Fault" condition, the LCD ammeter display will generally indicate a fault current of less than about O.3A and will indicate that No Fault has occurred. This ammeter reading would then represent the sum of transformer excitation currents on a given typical feeder should said transformers not be disconnected from feeder on the primary side.



FACT-1 FRONT PANEL DESCRIPTION

1. TEST CABLE CONNECTOR - 3 binding posts for making connections to the individual phases of the feeder. Each post is labeled to correspond to a particular phase of the feeder.

2. LCD DISPLAY - The Liquid Crystal Display (LCD) for displaying instructions, messages, and ammeter current.

3. SELECTOR KNOB - This rotary switch selects which phase is being tested at any given time. When the knob is in the STANDBY position, no phase is selected.

4. SELF-TEST - Pressing this button initiates the Feeder All Clear Test Set the self-test mode to assure proper operation. The test cable assembly must be removed during the self test.

5. POWER - This button is the master power switch for the Feeder Ammeter Clear Test Set. It is a latching pushbutton type. Pressing this button powers up all the electronics and fan for operation

6. AMMETER CLEAR - Pressing this button provides 120V AC to the selected binding post (Phase). It is a momentary pushbutton type. The button should not be pressed for long periods of time since substantial heat can develop in the unit when there is a ground on the feeder.

7. POWER CORD - Power cord for the unit. Cord must only plug into a 120V AC, 60Hz, non-GFCI 15 ampere outlet.

USING THE FACT-1

CAUTION: Steps 1 through 6 should he performed with the feeder "grounded".

1. Make sure test cable assembly is NOT connected to the FACT-1.

2. Plug the FACT-1into a 120V, 60Hz, 3-prong outlet. The outlet should be rated for a minimum of 15 Amps. Press the Red POWER switch to turn on the unit. The POWER switch should illuminate and the fan located in the cord cavity should start.

IMPORTANT: The FACT-1 is not designed to work with any type of GFCI protection device. In a situation where a ground is left connected to the feeder, the FACT-1 will output current on the corresponding phase however, the return current will be on the neutral/sheath of the feeder and/or earth ground. Therefore the GFCI device will detect the large differential in current and open the circuit, prohibiting the unit from operating.

3. Perform a "Self-Test" of the unit prior to normal operation (see "Diagnostics"). **IMPORTANT:** The test cable assembly should NOT be connected to the FACT-1 during the Self-Test or the results may be incorrect and the test leads will become energized with 120V.

4. Turn off the power to the unit by pressing the POWER switch again. The POWER switch should no longer be illuminated and the fan will stop.

CAUTION: Assure that the feeder cable being connected to the FACT-1 is not energized. The Feeder Ammeter Clear Test Set is not designed to be used or connected in the presence of voltages greater than 300V.

5. Connect the test cable assembly to the FACT-1. Connect the appropriate test leads to the A, B and C phase of the cables under test. Connect the ground lead to the neutral.

6. Turn the power on to the unit by pressing the POWER button.

NOTE: If for some reason the 3rd prong safety ground is not connected properly, a message will be displayed on the LCD to repair the 3rd prong ground before operating.

CAUTION: The Feeder grounds need to be removed at this point. Assure there is no back feed condition or voltage being applied to the feeder prior to the removal of the grounds.

IMPORTANT: The FACT-1 has been designed to also operate in situations where the polarity of the 120 VA C outlet is "reversed". When the polarity is reversed, the output post that becomes "live" when the AMMETER CLEAR button is pressed is also reversed. This will be indicated on the LCD so that the operator does not have to remember; he simply rotates the selector knob until the phase he wishes to test is indicated on the display. The table below describes the internal logic:

120V Source Polarity	Rotary Switch Position	Phase to Ground Test (Output Phase)	Phase to Phase Test (Output Phase/Return Phase)
Correct	Standby	OFF	OFF
Correct	A	PHASE A	PHASE A to PHASE B
Correct	B	PHASE B	PHASE B to PHASE C
Correct	C	PHASE C	PHASE C to PHASE A
Reversed	Standby	OFF	OFF
Reversed	A	PHASE B	PHASE B to PHASE A
Reversed	B	PHASE C	PHASE C to PHASE B
Reversed	C	PHASE A	PHASE A to PHASE C

7. After the unit initializes, rotate the Selector Knob to Position A. The LCD will indicate which phase the 120V AC voltage will be applied to.

8. Press and hold the AMMETER CLEAR button for several seconds. If there is any significant current flow, the digital ammeter will display the current flow in 0.25Amp increments. If there are no grounds connected to the phase either on the primary or secondary of a transformer, and the phase indicated is not shorted to another, then the "NO FAULT" message will be displayed:

A-ALIVE
NO FAULT DETECTED

Depending on the number of transformers connected to the network feeder during the test, some small current (<0.3Amp) could be detectable due to the excitation currents of the transformers. If the FACT-1 detects maximum current flow in the "live" (selected) phase only, a phase to ground fault exists and is displayed:

A-ALIVE
PHASE A TO GND FAULT

If the FACT-1 detects maximum equal current in the output phase and the return phase, then a phase-to-phase fault exists and is displayed:

B-ALIVE
PHASE B TO C FAULT

If the FACT-1 is operating with the transformer primaries connected to a feeder and a ground is present on the secondary, the FACT-1 will detect its presence and display only a partial reading. The actual reading obtained for a secondary fault will be dependent on the windings of the transformer (turns-ratio) and the size (gauge) of the grounding conductor. The heavier the grounding wire, the higher the current will be for secondary faults. When secondary faults exist, they will be displayed as a phase-to-phase fault.

B-ALIVE
PHASE B TO C FAULT

9. After the selected phase has been tested and the AMMETER CLEAR button is released, rotate the select knob to another position to test the other phases and repeat step 7 for each phase. The LCD will always indicate which phase that is being tested.

THERMAL OVERLOAD

The FACT-1 contains several resistors to limit the current supplied to the selected phase. Since these resistors are required to dissipate several hundred watts, significant heat can build up inside the case if the AMMETER CLEAR button is pressed for a long time on a faulted cable. If the internal sensor detects a temperature that is too high, a message will be displayed to the LCD:

Unit Temperature is Too High. Please Allow to Cool (with power switch on)

If this situation occurs, leave the FACT-1 plugged in with the POWER switch ON. This will operate the fan and reduce the internal temperature. When the unit temperature' drops to an operational level, the message will disappear and the unit may be used for testing again.

REVERSED POLARITY OPERATION

The FACT-1 has been designed to not only protect against an incorrectly wired outlet, but to operate normally if such a situation arises. If the unit detects incorrect polarity, a message is displayed to the operator to alert him of the situation. The operator must then press the SELF-TEST button momentarily to clear the notice:

NOTICE: LINE CORD POLARITY IS REVERSED PRESS SELF-TEST TO CONTINUE

DIAGNOSTICS

The FACT-1 has built-in comprehensive diagnostics to assure that the FACT-1 is operating correctly. The test cable assembly should NOT be connected to the FACT-1 during the Self-Test. The Self Test mode is entered by pressing the SELF-TEST button. If at any time, you wish to exit the Self-Test mode, simply press the SELF-TEST button a second time. The FACT-1 will guide the operator through the Self-Test procedure using messages on the LCD.

Once Self-Test mode is entered, a message will be displayed to rotate the selector knob to the correct position:

Rotate Switch to Pos A, then Press & Hold Ammeter Clear Button (Self-Test to Cancel)

If the selector knob was already in that position or if the selector knob is rotated to that position, the LCD will instruct the operator to press & hold the AMMETER CLEAR button until a test PASS or test FAIL message is displayed. Once the AMMETER CLEAR button is released, the operator will be instructed to rotate the selector knob to each of the remaining positions and to press the AMMETER CLEAR button.

At the conclusion of the test, an ALL TESTS PASSED or TEST FAILURE message will be displayed before returning to normal operation.

The FACT-1 should never be operated outside of its maximum operating temperature range of -20C to +60C (-4F to +140F). Operating the FACTS outside of its temperature range may permanently damage the unit.

LIMITED WARRANTY AND LIMITATION OF LIABILITY

This warranty applies to all products sold by HD Electric Company (the "Products"); provided, however, that the term Products does not include any third party products purchased through HD Electric Company, for which no warranties are made (the "Third Party Products"). Third Party Products may be subject to a separate manufacturer's warranty; [should you have any question regarding whether a separate warranty applies, please contact HD Electric Company].

NOTICE: READ THIS LIMITATION OF WARRANTY AND LIABILITY BEFORE BUYING OR USING THE PRODUCTS CONTAINED HEREIN.

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