Powerohm Resistors Digital HRG System

This manual provides general information, installation, operation, maintenance, and system setup information for the Powerohm Resistors Digital HRG System.

Publication 247-EN – September 2017

History of Changes

Rev. No.	Date	Description of Changes
A	September 2017	Initial Release

Equipment Application

Powerohm Resistors Digital HRG Systems are an economical means of improving a three-phase ungrounded power system by providing the following advantages:

System Protection: Offers protection by providing a ground-to-neutral connection for a three-phase power system, while still allowing it to operate as an "ungrounded system," When the neutral of a system is not grounded, the system is vulnerable to potentially damaging ground faults.

Transient Over-voltage Reduction: A high resistance grounding system reduces the magnitude of transient over-voltages that may occur during arcing ground faults. High transient over-voltages may cause failure of equipment or insulation at locations on the system other than at the point of the fault.

Ground Fault Detection Warning: Instantly provides a warning when the first ground fault occurs through an alarm signal. Form C contacts can be used to activate external alarms or annunciators. An audible horn and optional red warning beacon is available.

Ground Fault Location Simplified: A pulsing contactor allows the ground fault location to be quickly located by use of a portable clamp-on current detector. The ease and swiftness of ground fault location eliminates the need to trace faults by opening and closing secondary feeders, branch circuits, and individual loads one at a time.

Uninterrupted Service: A single line-to-ground fault left in operation may develop into a phase-to-phase fault, which is caused by the occurrence of a second ground fault on another phase before the first fault is cleared. Considerable damage may be caused by the high line-to-line fault current. The potential for quickly locating and removing faults before damage occurs to critical processes minimizes outages and costly manufacturing shutdowns.

Improved Personnel Safety: Reduced transient over-voltages, equipment arcing, fault levels, insulation failures, and fault tracing through circuit isolation schemes decreases hazards to personnel.

Installation

NOTICE Read these instructions thoroughly before installing and operating the controller. If there are still questions, contact your Powerohm Resistors factory representative for assistance.

The system has been assembled and wired at the factory with the highest workmanship standards. All wiring and functions have been thoroughly tested to insure correct operation when properly installed. All national and local electric codes should be used for proper installation, wiring, and grounding of the system prior to startup.

Receiving and Storage

Immediately upon receipt, carefully unpack and inspect the system for damage that may have occurred in shipment. If damage or rough handling is evident, file a damage claim with the transportation carrier immediately.

All packaged systems are suitable for prolonged storage. Always store the unit in the upright position (as shipped). Setting the crate on its side or top may cause damage to the resistor. Avoid stacking anything on top of the crate.

NOTE It is recommended that the unit remain crated until it reaches the job site.

Installation Instructions

CAUTION To avoid risk of **SERIOUS INJURY or DEATH,** and to avoid damage to the system, READ THIS SECTION CAREFULLY. If questions or concerns still exist, contact the Powerohm Resistors factory for further clarification.

Inspection

- Inspect the exterior of the enclosure for damage.
- Open the front door and inspect the resistor and control panel for damaged components.
- Medium voltage units have a step-down transformer in the bottom compartment; insure that the transformer is securely fastened and has not been damaged.
- Check all electrical connections to insure tightness

NOTE If damaged parts are found, contact the factory immediately. Energizing the unit may damage the resistor and create a shock hazard to personnel.

Handling

Freestanding units are supplied with removable lifting eyes for use with an overhead crane. Do not attempt to move or lift the equipment at points other than the lifting eyes or skid base. Never position the unit on its side or top, which may cause damage to the unit. Wall mounted units and open panels should also be handled with care to prevent damage to extern components. Do not stack.

Electrical Connections

DANGER Electric shock may result in **SERIOUS INJURY or DEATH**. Electrical connections should be made by a qualified electrical engineer only.

Refer to drawings supplied with the controller

All national and local electric codes should be used for proper installation, wiring, and grounding of the system

The installer is responsible for insuring no metallic foreign objects (such as drilling chips, etc.) fall inside the enclosure onto the electrical circuits. Failure to observe this could result in damage to the system and may void the warranty.

Equipment Grounding

To reduce the possibility of electrical shock, appropriate grounding practices must be adhered to. Prior to making any system connections, ground the equipment (a lug or ground strip is provided with all equipment). Insure that all ground conductors are sized per NEC and applicable standards.

Line and Control Connections

Refer to drawings supplied with the unit. Conduit entry for line connections are generally made through either the top or bottom of the enclosure to the proper internal terminals. A conduit entry drawing is available. Space is provided for line cables to run down the side without cable bends. Control power and auxiliary device connections are made to marked terminal blocks.

Neutral Connection

The neutral lead from the transformer (XO bushing) or generator is connected to a terminal strip or neutral terminal (refer to the supplied drawing for terminal location).

The connection is made directly to an internal terminal point via rigid conduit connected to the enclosure. On medium voltage units, the neutral cable is terminated to the transformer H1 terminal or a NEMA two-hole terminal with a compression type lug (customer supplied). Neutral conductor is sized per NEC §250. Location and termination of the conduit is the customer's responsibility.

NOTE The factory supplied drawing identifies the neutral and ground connection points, and the proper connection is shown schematically.

Delta Phase Connection

The phase leads from the transformer or generator are connected to a terminal strip on low voltage units (refer to the supplied drawings for terminal locations).

On medium voltage units the connection is made directly to the neutral deriving transformers via rigid conduit connected to the enclosure. The cables are terminated with a compression type lug (customer supplied) to the transformer H1 terminals. Location and termination of the conduit is the customer's responsibility.

NOTE The factory supplied drawing identifies the phase and ground connection points. This grounding equipment is not phase rotation sensitive. Any phase can connect to any H1 terminal.

Ground Connection

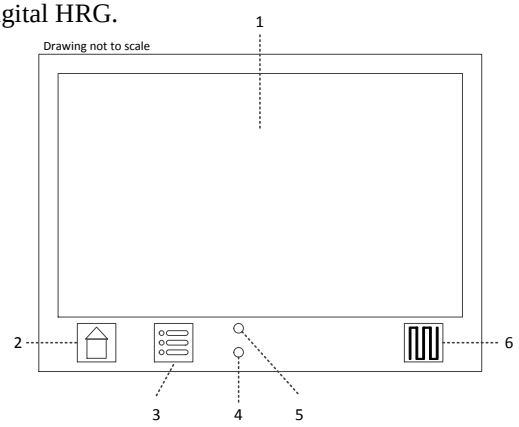
The ground lead from the resistive element to ground may be connected one of two ways:

1. On low voltage units the connection is made directly to a control panel mounted ground bus.
2. Medium voltage units have separate grounds for the high voltage ground and a low voltage ground to the secondary of the step-down transformer(s). The HV ground connection is made directly to an internal ½" ground stud via rigid conduit connected to the enclosure. The ground terminal is labeled for easy identification. A compression type lug (customer supplied) is used for ground connection. The low voltage secondary ground connection is made directly to a control panel mounted ground bus. Location and termination of the conduit is the customer's responsibility.

NOTE The factory supplied drawing identifies the neutral and ground connections.

Operator Interface Device (OID) Use and Navigation

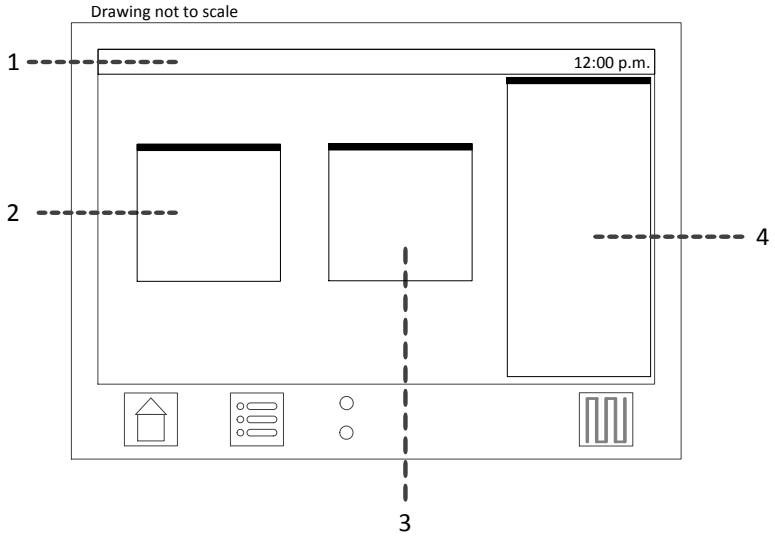
The Operator Interface Device (OID) provides visual indication of the alarms, status of system parameters, and an interface for adjusting set points to configure the Digital HRG.



Item	Description
1	LCD Touchscreen
2	Home key This key will always return the on-screen window to the Home window.
3	Main Menu key This key will always return the on-screen window to the Main Menu window.
4	Alarm LED The LED will illuminate when an alarm occurs.
5	Pulser LED This LED will illuminate when the pulser to turned on
6	Pulser key This key will turn on and turn of the pulser.

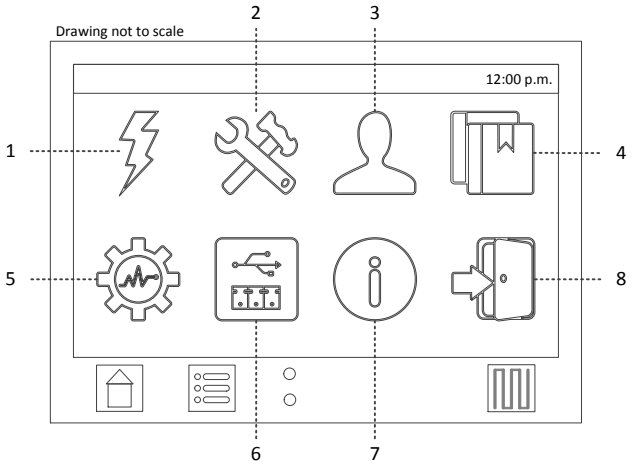
ATTENTION Touch one button at a time. Touching the touchscreen with multiple fingers may result in unintended operation.

Home Window



Item	Description
1	Window Status Bar Displays the date, time, and background activity such as downloading to a USB memory stick.
2	Current Panel Displays the neutral current and the fault current set point value. It will also blink "PULSER ON" when pulsing.
3	Voltage Panel Displays the neutral voltage and the voltage for all three phases.
4	Alarm Panel Displays the list of active and recent alarms. Touching a "cleared" alarm will remove it from the list. The panel will not be displayed if there are no active or recent alarms in the list.

Main Menu Window



Item	Description
1	Quick Start Begins the Quick Start set point configuration process for startup of system.
2	System Set Points Displays a list of all controller, motor, power, and alarm set points.
3	User Preferences Displays a list of all user preference set points.
4	Data Log Lists options for viewing the data log alarms, ground fault alarms, and diagnostic tests.
5	Diagnostics & Tests Lists options for calibrations, fault simulation, capacitive charging current test, and PCB info.
6	Devices Lists options for connected devices, such as Modbus and USB Memory Sticks.
7	About
8	Log In/Log Out

User Log In

Navigating and viewing set point configurations is allowed at all times; however, changing any set point configuration requires the user password. The user password is shown below. This password is also on a label affixed to the enclosure door on the inside.

When prompted for the user password, enter the following pin number:

1 2 3 3 3 3

Logging Out

If there is no user activity on the OID for five minutes, the login state is automatically logged out.

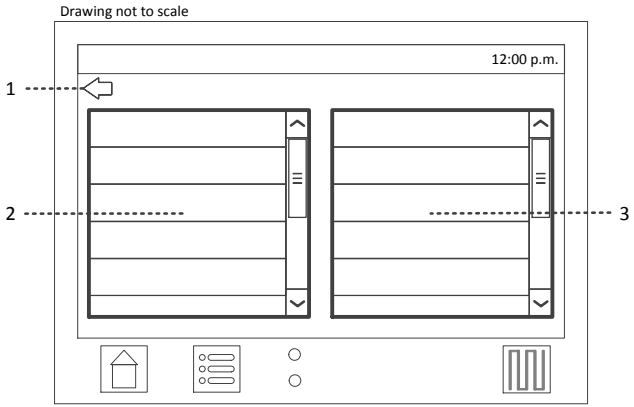
To manually log out

- From the Main Menu window, touch the *Log Out* button.

Configuring System Set Points

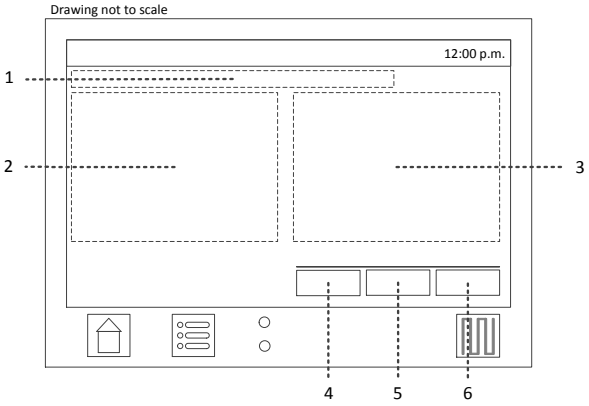
WARNING Adjustments should be performed by qualified personnel only.

Touching the *System Set Points* button or the *User Preference* button on the Main Menu Window will load a new window with the following layout:



Item	Description
1	Back Button This button will return to the previous window.
2	Category List Contains a list of high level set point categories. Touching an item will populate the Settings List with category specific set points.
3	Settings List Contains a list of set points specific to the selected category. Touching an item will load the set point configuration window.

The set point configuration window has the following layout:



Item	Description
1	Set Point Name
2	Description of Set Point
3	Configuration Area This area is specific to the set point being configured. It consists of standard user interface controls, such as list boxes, radio buttons, and spin lists, which are used to modify the set point value.
4	Default button Loads the default value for the set point, but does not close the window.
5	Cancel button Cancels any changes and returns to the previous window.
6	Set button Saves all changes and returns to the previous window.

Quick Start

The quick start feature is used to sequentially configure the primary system set points without having to navigate through the onscreen menu. The following set points are configured: TBD.

Refer to Main Menu Window, Item 1, on page 9 above.

To perform a quick start:

1. From the Main Menu window, touch *Quick Start*.
2. Configure each set point one at a time, pressing the *Next* button to move to the next set point.
3. A summary will be displayed after the last set point has been configured. Press the *Save* button to save all set points.
4. The window will return to the Main Menu window.

NOTE Canceling the Quick Start process will discard all changes.

Set Point List

System Set Point Window

Pulser Settings
- Pulse Rate

Current Trip Settings
- Current Trip Alarm Option
- Pulse Current
- Ground Fault Time Delay

Voltage Trip Settings
- Line Voltage Connections
- Voltage Trip Alarm Options
- Ground Fault Voltage Level
- Ground Fault Time Delay

Aux Programs
- Aux Program 1 – 48

User Preference Window

User Preferences
- Language
- GUI Theme
- Temperature Unit
- Date Format
- Time Format
- Idle Timeout
- Change User Password

Date & Time
- Set Date
- Set Time
- Daylight Saving Time Option
- DST Start Date
- DST End Date

Screen Settings
- Brightness
- LCD Auto Dim
- Calibrate Touch Screen

Equipment Operation

Always refer to the drawings supplied with your Digital HRG equipment to review design parameters. Drawings will include initial set up instructions pertaining to your specific unit. They will also include resistor tap information, alarm contact detail, and power connection requirements. Contact your Hubbell Powerohm Resistors factory representative if you need assistance.

Standard equipment operation is as follows:

Normal Operation

Under normal operating conditions there is no ground fault present on the system and only a small capacitance charging or magnetizing current flows. During this condition, there is no appreciable voltage present across the resistor. An illuminated green indicating light, located on the front door, verifies normal operating conditions and proper control power.

Ground Fault Condition

During a ground fault condition a red indicating light, located on the front door, will illuminate, the horn will sound, the “Ground Fault” alarm message will be displayed on the OID, and the alarm contacts will activate. The horn may be silenced by pressing the alarm silence icon on the OID. All other alarm indicators will remain activated until the ground fault is removed.

During a ground fault, voltage will appear across the resistor. The voltage across the resistor will be sensed by the 59G relay. The resistor is designed to limit the ground fault current to a low, acceptable value. Multiple taps are included with the resistor to adjust the fault current to a value slightly greater than the system magnetizing current. The resistance taps can be factory set or adjusted at time of equipment installation, and when additional loads are added to the system in the future.

Ground Fault Location

To locate the ground fault, activate the pulse contactor by pressing the PULSE key, located on the OID. This activates a cycle of 1–60 pulses per minute (user configured) to alternate the ground fault current between the fault and pulse current settings.

A portable clamp-on ammeter (optional) can be used to follow the fluctuating fault current through the system to the location of the fault source. After removing the ground fault, press the PULSE key again to stop the pulsing cycle.

The "*Ground Fault*" alarm message on the OID will display "*Touch to Clear*." Touching the message will remove it from the onscreen list of active and recent alarms. Once all alarms have been cleared, the horn will turn off and the remote alarm indicators will clear, and the green indicating light will illuminate to indicate that the system has returned to normal.

HRG System Test

To test the system under normal operating conditions:

1. From the Main Menu window, touch *Diagnostics & Tests*.
2. From the Diagnostics & Tests window, touch *Simulate Fault*.
3. Logon with the user password if prompted.
4. A confirmation message will be displayed; touch *Yes* to begin the test.

The test will last for 2–5 seconds and it will cause a ground fault alarm, including illuminating the red indicating light, sounding the horn, displaying the "*Ground Fault*" alarm message on the OID, and activing the remote alarm contacts. The horn may be silenced by pressing the alarm silence icon on the OID.

When the test is complete, the "*Ground Fault*" alarm message on the OID will display "*Touch to Clear*." Touching the message will remove it from the onscreen list of active and recent alarms. Once all alarms have been cleared, the horn will turn off and the remote alarm indicators will clear, and the green indicating light will illuminate to indicate that the system has returned to normal

Measure Capacitance and Adjust Taps

WARNING Testing for system capacitance leakage current requires that all system loads be connected. Take all necessary safety measures and follow safety practices to avoid injury.

Instructions

Preconditions

1. Connect and turn on the high resistance ground system with the factory settings or the settings based on calculations.
2. All normal loads need to be connected or their contribution to the system capacitance will not be measured.
3. Verify that no ground faults are indicated by the controller. Clear any ground faults before proceeding.

Calculate System Capacitance

1. Press the MENU key on the OID.
2. On the Main Menu window, press the *Diagnostics & Tests* icon.
3. On the Diagnostics and Tests window, press the *Charging Current* icon.
4. Logon with the user password if prompted.
5. A confirmation message will be displayed; touch *Yes* to begin the test.

At this point, the system will automatically calculate the system capacitance. The calculation will take 2–5 seconds. Once complete, a message will be displayed indicating the charging current. Use the calculated charging current to adjust the Fault Current system set point. A value 10 percent higher than the charging current is recommended.

Refer to the factory supplied drawings to determine which resistor taps to set for the fault current and pulse current.

CAUTION Isolate the controller with the disconnect switch before adjusting the resistor taps. Note that medium voltage systems do not disconnect the high voltage neutral connection to the step-down transformer, which will still feed voltage to the terminal strip and line side of the disconnect switch.

Annual Adjustments

The above test to measure the system capacitance leakage current should be performed annually, as over time additional loads may be added to the system. Maintaining the fault setting higher than the system capacitance leakage current allows the HRG to limit transient overvoltages, should an arcing fault develop on the system. Fault current settings higher than recommended by the drawing allows more damage to occur at the point of fault and may subject personnel at the point of fault to injury.

If you have questions on this procedure, contact the Hubbell Powerohm Resistors factory.

Maintenance

The Digital HRG requires monthly inspections for damage to insure that the resistor is still capable of protecting the system. Damage may occur from lightning, earthquakes, overloads, or extended service life.

The following procedure is recommended for field inspections:

1. Isolate the high resistance grounding system with the disconnect switch. Note that medium voltage systems do not disconnect the high voltage neutral connection to the step-down transformer, which will still feed voltage to the terminal strip and line side of the disconnect switch. For complete protection the system must be de-energized. These precautions are recommended to prevent a shock hazard to maintenance personnel and to prevent the system from being operated without proper grounding.
2. Inspect and test the control panel.
3. Carefully check the resistor assembly for cracked ceramics or damaged insulators. A Megger™ or Hi-Pot test is the most reliable method of ensuring that the porcelain insulation is still providing the necessary electrical isolation. Ground connections must be disconnected to perform this test.
4. Check the resistive element for continuity. An ohmmeter reading made between the neutral and the ground side of the resistor should be within 10% of the drawing values. If the resistance of the element is more than 15% off from the nameplate value, the resistors should be replaced.
5. Check all internal connections for tightness. Check wiring for signs of damage from heat or overloads.
6. Drawings can be supplied by email or fax if we are furnished with complete nameplate information. Finally check the mounting bolts for tightness.

CAUTION Maintenance work should be performed by qualified electrical personnel in compliance with national and local safety regulations. NEC requires qualified and trained electrical personnel to be available to supervise operation of this equipment.

Notes

Replacement Parts

For replacement parts, contact your local Powerohm Resistors office or the Hubbell Powerohm Resistors factory at:

Telephone: (800) 838-4694
Email: sales@powerohm.com

Technical Support

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