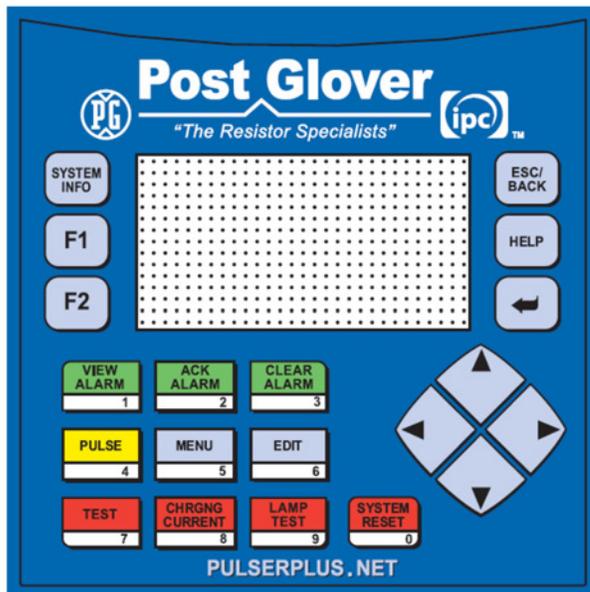


PulserPlus.Net™ Low Voltage High Resistance Grounding System

Installation, Operation and Maintenance Instructions



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Revision	Date	Changes
HR105-10		Original Release
HR105-11	6/30/2011	9.5: Added Troubleshooting section 11.2: Corrected Com Port setting procedure Added Control Screen Navigation flowchart Added new control screens 11.3: Rewording of alarm/event screen descriptions Added new event screens 11.4: Corrected the procedure and Added parameter range table 11.5: Removed detail from Data Table section 11.7: Removed detail from communication section 11.9: Added procedure to change time and date Appendix A: Changed Schematic Section Appendix D: Removed "Data Table Access via Modbus" Added Customer Connection Details
HR105-12	9/4/2012	5: Inserted note about password protection 5.4: Clarified V_{TEST} 11.1: Changed Pulse button description in the table. 11.1.1: Added procedure for disabling/re-enabling password protection 11.2.2.15: Added controller screen: RS-485 baud rate 11.4: Added descriptive detail to parameters in table 11.8: Modified the procedure to include upgrades
HR105-13	7/31/2013	8.4: Changed Resistor Check Operation Description 8.5: Added Resistor Check Setup Procedure 8.6: Moved table from 8.5 to this section. 11.2.1: Modified Control Screen Flowchart 11.2.2.16: Added Sensing Resistor Parameters Screen A.3. Revised Troubleshooting Schematic
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Section 1 – Quick Start Guide

Post Glover High Resistance Grounding Equipment coordinates the use of resistors and control devices, creating a high-resistance ground for a power system. This instruction booklet is intended as a general guidance tool for personnel installing Post Glover High Resistance Grounding Systems. However, each unit is designed for a specific application/installation. The detailed drawings provided with each unit supersede the general information provided in this booklet.

This quick start guide provides a brief overview of the steps required to use this High Resistance Grounding Equipment, but is not meant to be a substitute for reading the entire manual.

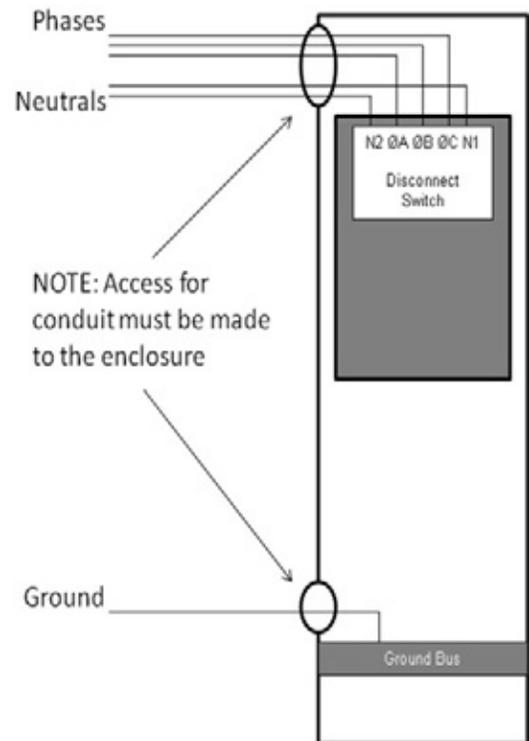
1.1 Physical Installation

Once removed from the shipping pallet and packaging, secure the unit to the floor using the provisions in the base. In one of the conduit entry areas noted on the drawing, cut an appropriate access hole to bring the three phase conductors and two neutral connections (one if not using the sensing resistor). The ground connection can be routed through the same opening or if more convenient, a second entrance can be added in another location.

1.2 Electrical connections

Connect the three phases and neutrals to the appropriate points on the disconnect switch. If a separate neutral is not run for the sensing resistor circuit, jumper the two neutral positions together. Connect the internal ground bus to the system ground.

NOTE: Opening the disconnect switch removes power to the unit but also removes the grounding resistor from the circuit. The system is ungrounded while the disconnect switch is open.



1.3 Pre-energization checks

Perform the following checks before energizing the HRG unit:

- Inspect the enclosure interior for connections that may have come loose in shipping.
- Check continuity of all fuses.
- Ensure that the transformer X0 is only connected to the HRG unit.
- Check the resistance from terminal 8 of the disconnect switch to ground. This should match the drawing value for the default resistor tap

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1.4 Post-energization setup

Perform the following after energizing the HRG unit:

- Set the unit time and date (See section 11.9).
- Disable password protection (See section 11.1.1).
- Perform a LAMP TEST, SYSTEM TEST and CHARGING CURRENT test (See sections 5 & 6).
- If the CHARGING CURRENT value exceeds the resistor tap value, increase the tap setting to a value equal to or greater than the CHARGING CURRENT. The resistor tap value may also be lowered if the CHARGING CURRENT is lower than the default 5A tap.

1.5 Default settings

The HRG unit ships from the factory configured for use at the system voltage with the fault current tap set at 5 amps and the pulsing tap set at 10 amps. The default settings for alarm and system values are in the table below. The alarm and system values should be set to desired values by the end user.

Default Alarm Settings	
Overvoltage level (Vmax)	100 V
Undervoltage level (Vmin)	0 V
Overcurrent level (Imax)	5 A
Undercurrent level (Imin)	0 A
Default System Values	
Pulse Rate	1 second
Ground Fault Time Delay	10 seconds
Alarm Resend Time Delay	20 minutes

Default Sensing Resistor Parameters					
Fault Voltage	30 V	Non-Fault Voltage	3V	Voltage Deadband	0.488V

NOTE: Any work performed on this unit should be done by qualified persons and must be done in compliance with national, regional, local and site-specific safety procedures. It is the responsibility of the owner to comply with all applicable electrical codes.

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Section 2 – Equipment Overview

2.1 Front View



- Audible alarm
- Indicating lights (System Normal, Ground Fault, Pulsing)
- Disconnect switch (disconnects power and system neutral)
- Instruction overview
- User interface
- Resistor vents

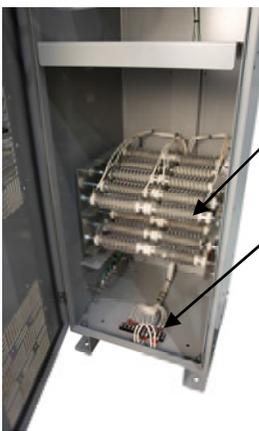
2.2 Interior View - Controls

- Disconnect switch
- Pulser Electronics Module
- Fuses (Neutral, Phases)
- Thermostat for heater
- Control power transformer



2.3 Interior View - Resistors

- Resistor elements
- Terminal strip for tap adjustment



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Section 3 – Operational Description

3.1 Normal Operation

Please refer to the drawings supplied with your unit for ratings and other information. Appendices A and B contain schematics and dimension drawings with information for standard systems. Figures A.1 and A.2 show wye-connected and delta-connected schematics respectively.

During normal operation, only a small capacitive-charging current and/or leakage current flows through the resistor (a description of capacitive-charging current is provided in Section 6). The display will show this current and/or voltage. The green NORMAL indicating lamp on the operator's panel will be illuminated.

The PulserPlus.Net™ detects Fundamental Current and/or Voltage for both over- and under-conditions. The under-conditions can be disabled by entering a 0 value. A common time delay setting is used for all alarming. Phase Voltage Monitoring relays are provided to determine the phase that a single line-to-ground fault occurs on.

3.2 Loss of Ground

When the current mentioned above goes to zero, typically this indicates a loss of ground condition (i.e. grounding wire failure). If this occurs, the electrical network will be ungrounded. The PulserPlus.Net™ controller has a sensing resistor system that detects this condition. Upon detection, the green NORMAL indicating lamp will turn off and the SYSTEM NORMAL auxiliary form-B contacts change state.

3.3 Ground Fault

When a ground fault occurs, the resistor acts to limit the ground current to a pre-determined low value. Fault current magnitude can be set by adjusting the taps provided on the resistor terminal block. Fault current shall be set so that the fault current is slightly greater than the system's capacitive-charging current (see Section 6).

The fundamental voltage appearing across the resistor or the fundamental current through the resistor is sensed by the PulserPlus.Net™ controller. To prevent nuisance indications, a variable time delay is entered via the operator's panel. When the time delay expires, the red GROUND FAULT indicator lamp will start to blink, the NORMAL indicator lamp will turn off, and an alarm horn will sound. Upon detection, SYSTEM NORMAL and GROUND FAULT auxiliary form-B contacts change state. Also, the Phase Voltage Monitoring relays will provide an alarm identifying the faulted phase.

The alarm horn can be silenced by pressing the VIEW ALARM button while searching for the cause of the ground fault. The red GROUND FAULT indicator lamp will be maintained until the ground fault is removed and the system is manually reset by pressing the SYSTEM RESET button.

3.4 Neutral Grounding Resistor (NGR) Failure

In the unlikely event that an open circuit occurs within the NGR, high resistance grounding is lost and the power system becomes ungrounded. With older technology, this ungrounded state would not be detected until a fault occurs and protective devices do not trip as expected. Also, the phase voltage monitor relays will not detect the ground fault. This could lead a maintenance technician into believing the system is unfaulted and severe injuries or death could occur. A short circuit in the NGR would create a solidly grounded system and ground faults would be cleared by the system protective devices.

Even if an open circuit occurs within the NGR, the phase voltage monitor relays will detect and alarm for ground faults.

NGR open circuit failure detection is discussed in more detail in Section 8.

3.5 Indication Matrix

Alarm Screen	Lamp			Condition	Action
	Normal	Fault	Pulse		
Current Above Limit	Off	On	Off	Ground Fault Present	Locate and Clear Faults. See Section 7 for details.
Current Below Limit	Off	Off	Off	Possible Loss of Ground	Check continuity of neutral circuit.
Phase A Fault	Off	On	Off	Ground Fault Present	Locate and Clear Faults. See Section 7 for details.
Phase B Fault	Off	On	Off	Ground Fault Present	Locate and Clear Faults. See Section 7 for details.
Phase C Fault	Off	On	Off	Ground Fault Present	Locate and Clear Faults. See Section 7 for details.
Voltage Above Limit	Off	On	Off	Ground Fault Present	Locate and Clear Faults. See Section 7 for details.
Voltage Below Limit	Off	Off	Off	Possible Loss of Ground	Check continuity of neutral circuit.

3.6 Summary of States

3.6.1 Overvoltage

- Fundamental time delay begins and expires.
- Normal light turns off.
- System Normal relay changes state.
- Ground Fault light blinks and horn sounds.
- Ground Fault Alarm relay changes state.

3.6.2 Undervoltage

- A setting of 0 disables this function.
- Fundamental timer begins and expires.
- Normal light turns off.
- System Normal relay changes state.

3.6.3 Overcurrent

- Fundamental time delay begins and expires.
- Normal light turns off.
- System Normal relay changes state.
- Ground Fault light blinks and horn sounds.
- Ground Fault Alarm relay changes state.

3.6.4 Undercurrent

- A setting of 0 disables this function.
- Fundamental timer begins and expires.
- Normal light turns off.
- System Normal relay changes state.

3.6.5 Pressing VIEW ALARM button:

- Turns off horn and Ground Fault light stops blinking.
- Opens "View Alarms Events" screen.

3.6.6 Pressing PULSE button:

- Opens "Pulse Running" screen.
- Amber light blinks.
- Pulsing relay begins.
- Only does above if currently in faulted state.
- Pressing ESC/BACK button ends pulsing.

3.6.7 Pressing SYSTEM RESET button:

- Resets output relays and lamps to normal mode.
- Only occurs if no faults currently on system.

Section 4 – Installation

Post Glover High Resistance Grounding Systems are packaged in a variety of different configurations depending on the ratings and site requirements. The typical low-voltage enclosures are shown in Appendix B. Consult all specific equipment drawings furnished by Post Glover Resistors, Inc., for your particular installation.

4.1 Receiving

Once received, the high-resistance grounding unit should be unloaded and carefully moved by overhead crane or forklift. A preliminary inspection of the crate (or enclosure) should be made at this point to ensure that the unit was handled properly during shipment. If damage is detected, contact the carrier immediately to file a claim.

4.2 Handling

Free-standing units have removable lifting angles for an overhead crane to use when moving the unit. Loosen and rotate the lifting angles 180°, and re-tighten before using to lift the unit. Do not attempt to move or lift the unit at points other than the lifting angles or base channels. Always store the unit upright to avoid damaging the enclosure and/or controls. Do not stack the units.

4.3 Storage

If the unit will be stored for some length of time, take the following precautions:

1. Remove the crate and thoroughly inspect the unit.
2. Store the unit in an area that is clean and dry and has moderate temperatures. Cover it with a heavy-duty plastic cover or cloth.
3. If the unit must be stored in a damp area, it should be completely covered and heat provided to prevent condensation of moisture in the unit. To prevent condensation, each unit should be equipped with 150-200 watts of heat for the duration of the storage period.

4.4 Inspection

Inspect the enclosure for any signs of shipping damage such as dents, scratches or chips. Inspect the inside of the enclosure for any loose wiring or bolts. Check the resistor for any signs of broken insulators or elements.

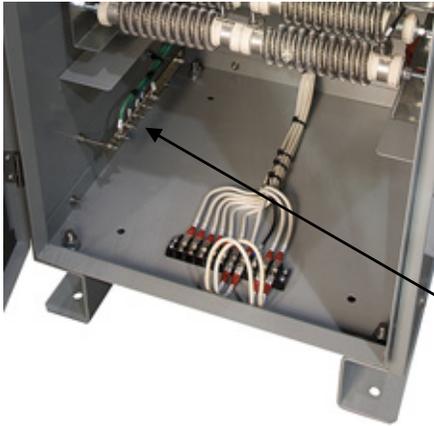
4.5 Floor Preparation

The equipment foundation must be designed with suitable strength and levelness. Sufficient height should be allowed above the unit to allow conduit to enter at the top of the unit if that is the desired entry point. The purchaser is responsible for anchoring the unit to the floor with anchors of suitable strength.

PULSERPLUS.NET™ INSTRUCTION MANUAL

4.6 Grounding... CAUTION!

To reduce the possibility of electric shock, the unit must be properly grounded before making any system power connections. Connect the system ground to the ground bus. The ground bus is located in the lower portion of the free-standing units. For the wall-mount units, the ground bus is located on the back panel of the resistor enclosure. Make sure that all ground conductors are sized per the National Electrical Code (NFPA 70).



Ground Bus in a free-standing enclosure

4.7 Line and Control Connections

Refer to application specific drawings that accompany the Post Glover system. The free-standing enclosure is designed to accommodate the line cables on the sides of the enclosure without unnecessary cable bends; cable entry can be made at either the top or the bottom of the enclosure. The control power and auxiliary device connections made to the terminal blocks are rated 30 amperes, 600 volts.

Refer to the specific diagrams furnished with the equipment for location detail.

As a final check, inspect all wiring to verify that connections are made properly and that they are clean and tight. Make sure there is adequate clearance between the external connections and all devices.

4.8 Setting Resistor Tap Connection

The resistor taps need to be adjusted at installation so that ground current with a ground fault is greater than or equal to the system capacitive-charging current. The procedure for determining capacitive-charging current (IC) is described in Section 6. Move the ground wire on the Resistor Terminal Block (TBN) to the appropriate "N" terminal on the such that the resistor current is greater than or equal to IC.

NOTE: Do not connect the neutral connection (N) directly to ground. This results in a solidly grounded system and disables any benefits and protections of the HRG system.

4.9 General

When the installation is complete and all incoming wiring has been terminated, clean the inside of the unit with a soft cloth or vacuum cleaner. Make sure any dirt or debris, such as packing material, is removed so it does not interfere with the operation of the unit. Before connecting power to the control panel, check all components to make sure all shipping devices, such as blocking or tying of relays, have been removed.

Section 5 – Start-up Procedure

Place the system in service by following these steps:

Note: The password protection will need to be disabled to perform some of the functions below. Refer to section 11.1 for more information.

5.1 Energize Circuit

Close the disconnect switch (SW1). This will connect the equipment to the power system. For the first few seconds after closing SW1, the alarm horn will sound until the controller has completed its start-up procedure. Upon completion of the controller start-up procedure, the system NORMAL green lamp will be illuminated and the horn will silence.

5.2 Entering Setup Information

Enter the setup information through the operator's panel per the instructions in Section 11. The system NORMAL green lamp should be illuminated on the operator panel, indicating the presence of power and that no fault or under-condition is present.

5.3 Lamp Test

Prior to performing a ground fault test, ensure the proper indications will be available by pressing the Lamp Test button on the keypad and visually confirming all three lights are operational.

5.4 Ground Fault Alarm Test

This test actually places a ground fault on the system within the enclosure through a test resistor. The test resistor is connected between a phase conductor and ground, so the test circuit creates a controlled ground fault. A properly installed PulserPlus.Net™ will then detect and annunciate the fault as returns from ground through the grounding resistor to the system neutral. The test resistor is locked out during an actual ground fault to avoid a potential phase-ground-phase fault during testing.

The readings on the PulserPlus.Net™ module will be lower than normal readings since the test resistor is connected in series with the neutral grounding resistor. The Overvoltage and/or Overcurrent alarm levels may need to be adjusted to properly indicate a correct installation.

The Overvoltage setting (V_{max}) for use during a Ground Fault Test needs to be calculated based on the actual resistor value. Although 100 volts is typically used for a test value, the resistor drawing provided with the PulserPlus.Net™ unit should be consulted.

The equation below can be used to determine a non-typical test value.

$$V_{test} = (V_{L-N} / (R_{GF} + R_{T-G})) R_{GF} - 10V$$

Where: V_{test} is the test voltage to be temporarily entered for the Overvoltage (V_{max}) setting
 V_{L-N} is the line-to-neutral system voltage
 R_{GF} is the resistance of the neutral grounding resistor at the chosen tap
 R_{T-G} is the test-to-ground resistance – see resistor drawing

Press and hold the TEST button on the operator's panel to activate the ground-fault circuitry. After a delay, the green NORMAL lamp should turn off and the red GROUND FAULT lamp should start to blink. In addition, the audible alarm will sound.

Release the TEST button. Press the VIEW ALARM button and the audible alarm should cease. Press the SYSTEM RESET button and the red and green lamps and auxiliary contacts should revert to their normal states.

5.5 NGR Failure Settings

The values for the sensing resistor as displayed on the "Parameters" screen have been preset for the system voltage specified. These values can be modified to account for actual system conditions.

Section 6 – Testing System Capacitive-charging Current

6.1 General

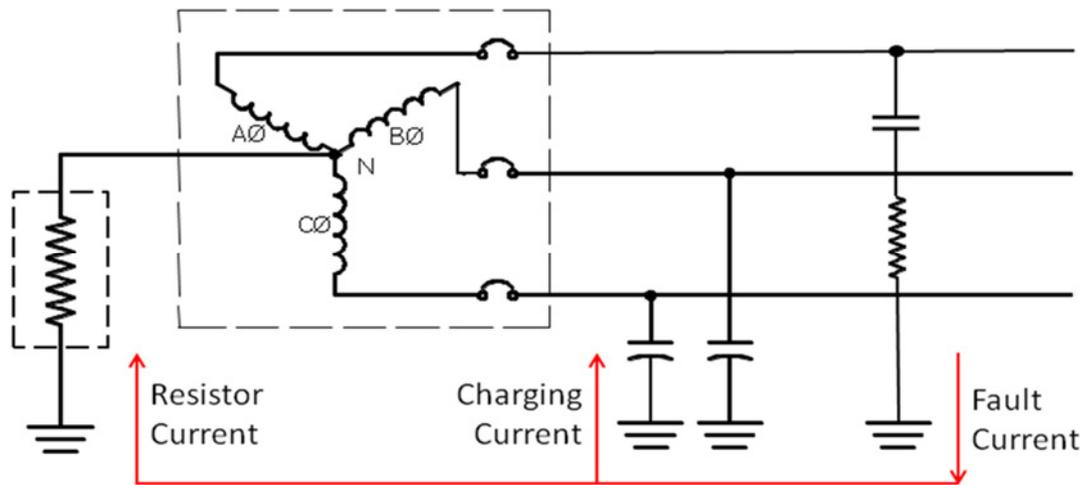
The magnitude of zero-sequence charging current is determined by the line-to-ground capacitance associated with system components. The value of this current must be known to properly coordinate the Post Glover High-Resistance Grounding System. In an industrial power system where the design and components are known, the charging current can be estimated with reasonable accuracy. With a complex array of machines and cables, this may be tedious and yield less-than-accurate results.

The most accurate way to determine the maximum value of the charging current is by test, since extreme variations can exist. The charging current per phase is represented by I_{CA}, I_{CB} or I_{CC} while I_C corresponds to the total line-to-ground charging current. To obtain the zero-sequence charging current, one phase conductor is intentionally grounded as shown in the schematic below.

6.2 Test Procedure

The test procedure is as follows:

1. Close the disconnect switch in the PulserPlus.Net™ cabinet (SW1).
1. Press and release the CHRGNG CURRENT button on the keypad.
2. Upon completion of the test, the “Parameters” screen will automatically appear showing the System Charging Current.



$$I_C = \frac{V_{RATED}}{\sqrt{3}V_R} \sqrt{I_F^2 - I_R^2}$$

Where: V_{RATED} = System Voltage taken from System Values Screen
 V_R = Measured Resistor Voltage
 I_F = Fault current measured at test resistor
 I_R = Measured Grounding Resistor Current

6.3 Test Results

The resulting value should be used to determine the minimum current for ground fault alarming. Set the resistor taps (see Section 3) so that the fault current is greater than I_C .

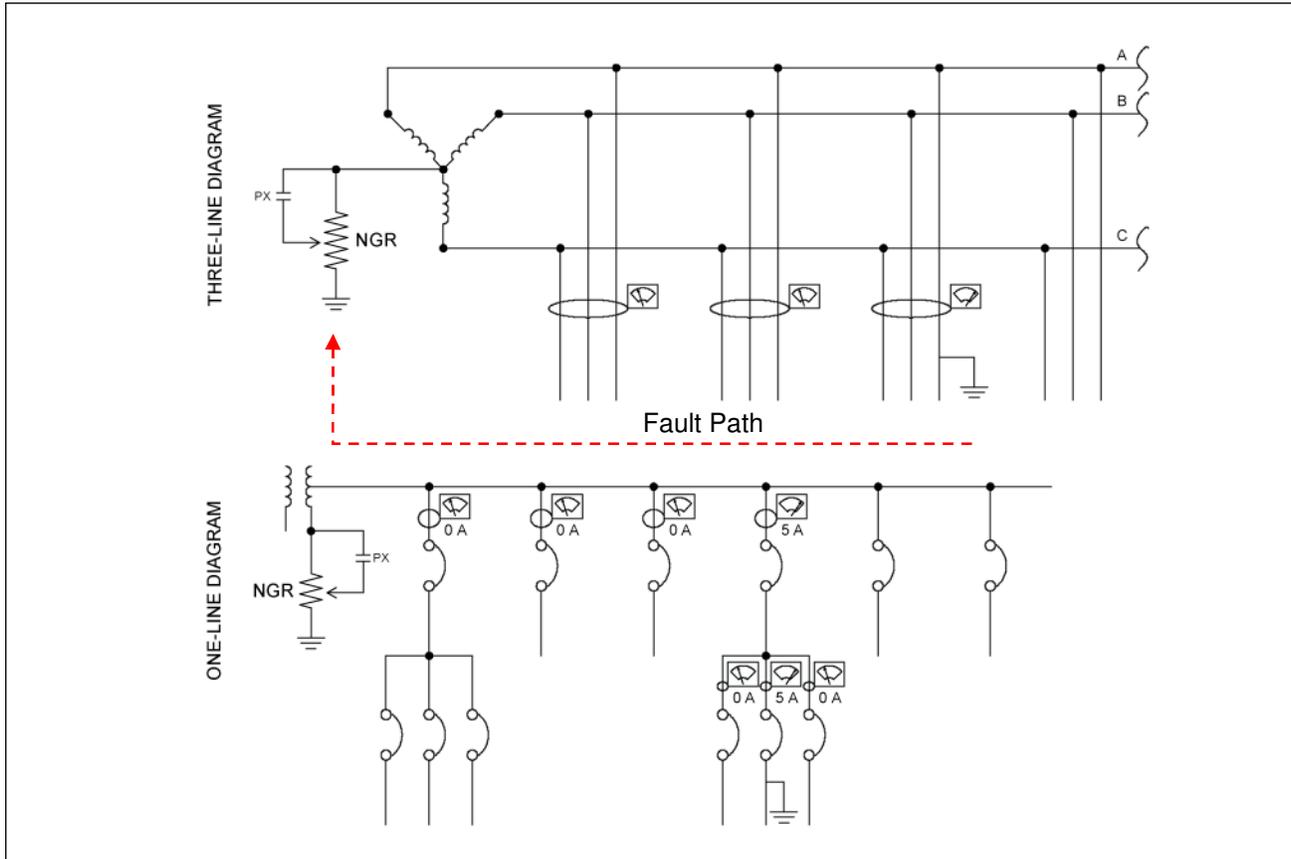
Section 7 – Locating a Ground Fault

To locate a ground fault, activate the pulsing circuit by pressing the PULSE button on the operator's panel. The pulsing circuit cannot be enabled unless there is a ground fault detected by the PulserPlus.Net. After pressing the button, the controller will display the "Pulser Running" screen. This screen shows the pulse rate in seconds and the neutral voltage and current. This activates a control circuit which causes a cyclic switching sequence. The switching sequence consists of the cycle timing of an integral pulsing relay (PX). The pulsing relay (PX) shorts out a portion of the grounding resistor (NGR) each time the relay is energized, producing a tracer signal.

The optional portable hook-on detector is then used to follow the tracer signal through the system to the point of the fault. The detector is clamped around all three phases of each individual feeder (see the schematic below). The feeder with the fault will show rhythmic fluctuations on the detector's readout. The fault can be traced to the sub-feeder and eventually to the faulted device. Once this location is determined, the pulsing contactor should be turned off by pressing the PULSE on the operator's panel. This will return the user to the "System Status" screen.

After clearing the fault, place the system in its normal operation mode by pressing the SYSTEM RESET button.

NOTE: A portable ammeter can be included as an option with the PulserPlus.Net™.



How to Locate a Ground Fault

Section 8 – NGR Failure Detection System

8.1 Introduction

The PulserPlus.Net™ contains a circuit for detecting open circuit failures of the NGR. This section describes the function of this detection circuit and provides nominal settings for each of the available system voltages offered. This detection system does not detect short circuit NGR failures. These can only be detected by a proactive preventive maintenance program.

8.2 Sensing Equipment

The Pulser Electronics Module (PEM) incorporates a circuit that contains a sensing resistor and a Transient Voltage Suppression Diode (TVSD). This circuit is connected in parallel with the grounding resistor circuit. The sensing circuitry measures the voltage across the grounding resistor, the voltage across the TVSD and the current through the resistor.

8.3 Check Parameters

There are three parameters that are used by the PulserPlus.Net to determine the resistor fault. These parameters are set on the Parameter screen as described in section 11.2.2.16.

The parameters are:

- Fault Voltage Setting
- Non-Fault Voltage Setting
- Voltage Deadband setting

The table below shows recommended settings for the fault voltage and non-fault voltage setting.

8.4 Resistor Check Operation Description

The detection logic measures the neutral volts and neutral amps in the grounding resistor and calculates the resistance value. It then compares this value to the expected resistance value determined by the fault voltage setting. The system then compares the Neutral Voltage to the Non-Fault Voltage Setting. The last check is to see if the difference in the sensing resistor volts and neutral volts exceeds the deadband setting. If the measured values exceed the expected values, the Open Circuit alarm is generated.

8.5 Resistor Check Setup Procedure

1. Set Sensing Resistor Fault Volts
 - a. Disable the password protection using the procedure in section 11.1.1 of the manual. Press ESC/BACK until back at the main screen
 - b. From the main screen, press F2 for General System Values, then Press F2 for Sensing Resistor Parameters.
2. Check the value of the resistor tap, then set the Sensing Resistor Fault Volts according to the table in section 8.5 below.
3. Set Sensing Resistor Non-Fault Volts
 - a. Check the normal value of the Neutral Volts on the screen.
 - b. Set the sensing *Resistor Non-Fault Volts slightly above this value.*
4. Set Sensing Resistor Deadband Volts
 - a. Power down the PulserPlus.Net and remove the Neutral Fuse (F1).
 - b. Power the unit back on and disable the password protection. Press ESC/BACK until back at the main screen.
 - c. From the main screen, press F2 for General System Values, then Press F2 for Sensing Resistor Parameters.
 - d. Note the difference between sensing resistor volts and neutral volts. Set the Sensing Resistor Deadband to a value slightly below this differential. The alarm should trigger in *about 10 seconds after doing this.*
 - e. Power down the unit and replace the fuse.
 - f. Restore power to the unit. Make sure the Open Resistor alarm does not occur.
 - g. If the Open Resistor alarm occurs, check the difference between sensing resistor volts and neutral volts. Readjust the deadband setting to a *value between the value with the fuse removed and the value with the fuse in.*

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8.6 Nominal Settings

The following table shows the nominal settings for the sensing resistor based upon the fault tap setting.

System Voltage (Volts)	NGR		Fault Voltage (Volts)	Non-Fault Voltage (Volts)
	Current (Amps)	Alarm Level (Volts)		
240	2	69	40	3
	3	46	30	3
	4	35	20	3
	5	28	20	3
	6	23	20	3
	8	17	20	3
480	2	139	75	3
	3	92	50	3
	4	69	40	3
	5	55	30	3
	6	46	25	3
	8	35	20	3
600	2	173	90	3
	3	116	60	3
	4	87	50	3
	5	69	40	3
	6	58	35	3
	8	43	30	3

Section 9 – Troubleshooting Guide

9.1 No information on Display:

1. Is 24VDC power available? Check the voltage at the power supply output terminals with the disconnect switch in the ON position. If there is no reading, check the fuses and the source power supply.
2. Is the controller power cable secure? Verify that the connection between the controller and base panel is firmly connected.

9.2 Normal light will not illuminate:

1. Is the Red Ground Fault light blinking? If so, locate and clear the fault and press the SYSTEM RESET button. See section 7 for details.
2. Is the pulsing light illuminated? If so, press the “PULSE” button to exit out of pulse mode.
3. Is there an undervoltage or undercurrent condition? Check the Fundamental voltage and current low limit settings. Also, check the continuity of the HRG circuit from Xo to Ground.

9.3 TEST button does not seem to function properly (no alarm):

1. Are you pressing the TEST button longer than the alarm time delay setting? If not, press the button long enough to exceed the time delay.
2. Do the voltage and current readings on the display increase? If so, the High limits may need to be lowered for the fault to register.
3. Is there heat coming from the test resistor while the button is held? Check by feeling for warm air from the exhaust vent of the resistor enclosure. If not, the neutral conductor may not be properly connected to the transformer or generator.
4. There is no voltage and current reading, but the test resistor heats up. This condition is indicative of a solidly-grounded neutral. Check the transformer Xo bushing and the switchgear to make sure that all connections between neutral and ground are removed.

9.4 Controller in fault condition (alarm horn steady):

1. Press and hold the “System Info” front panel button until the “Enter Password” screen appears. Input “1111” as the password and press the “Enter” key.
2. On the “Info Main Menu” screen, press the “2” key for the “System” menu.
3. On the “System” screen, press the “1” key for the “Mode” menu.
4. On the “Mode” screen, press the “4” key to initialize and reset the controller.
5. An “Init Confirmation” information box will display. Press enter to restart the controller.
6. A Post Glover logo screen will display and within 5 seconds will be replaced by the “System Status” screen. The controller is now reset and operating in normal condition. The alarm horn will silence.

9.5 Red light is blinking, but there is no neutral voltage or current that would indicate a fault:

1. Press the view alarms button and press F1 to review alarms.
2. Scroll through the alarms using the up and down arrow keys. Note the time and date of each alarm.
3. Determine if an intermittent fault has occurred by checking the time and date stamps versus the times and dates of equipment turning on and off in the facility.

Section 10 – Maintenance

Normally, no maintenance is necessary for the PulserPlus.Net™ high resistance grounding system. However, periodic inspections are needed to ensure that the controller is functioning correctly and the resistor is still capable of protecting the system. Post Glover Resistors recommends that the periodic inspections coincide with your normal system Preventative Maintenance schedule.

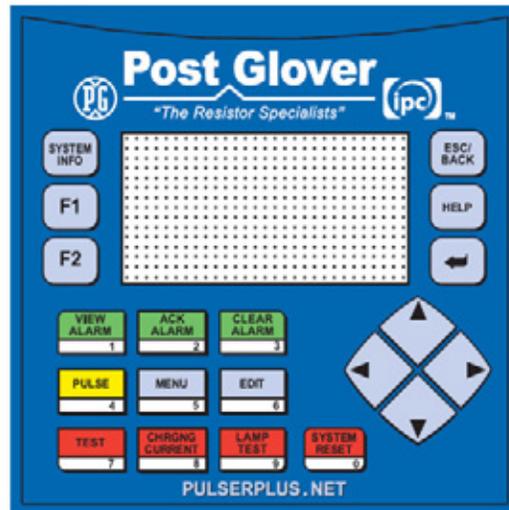
The following procedure is recommended for periodic field inspections:

1. De-energize the system being grounded. Open the disconnect switch on the PulserPlus.Net, which will de-energize the control circuits and isolate the connection between the system neutral and ground. Always use proper lock-out/tag-out procedures when working on electrical equipment.
3. Open the front door of the control enclosure. For systems with a separately mounted resistor, remove the front and rear covers of the resistor enclosure.. This will allow for a visual inspection of all internal components.
4. Check the enclosure for signs of damage from weather or rodents. Remove any dirt or debris from the inside of the enclosure using a vacuum cleaner or compressed air.
5. Carefully check for cracked insulators and resistor cores. A MEGGER or Hi-Pot test is the most reliable method of ensuring that the insulation is still providing the necessary electrical isolation. Remove any connections from the resistor elements to ground and the controller before performing one of these tests.
6. Check the resistive element for continuity. Ohmmeter readings made between each neutral tap and the ground side of the resistor should be within 10% of the values on the resistor drawing. If the resistances of the elements are more than 15% different from the drawing values, the resistors should be replaced. Any open resistors should be replaced.
7. Check all internal connections for tightness. Check wiring for signs of damage from heat or overloads.
8. Replace all side covers removed during inspection and check the mounting bolts for tightness. Close the front door of the control enclosure.
9. After re-energizing the system, perform the Test procedure in section 5.3 to verify system operation.
10. FOR REPLACEMENT PARTS OR ASSISTANCE, CALL 1-800-537-6144 (or from outside the USA, +1-859-283-0778). Please have the resistor nameplate information readily available when you call.

Section 11 – Controller Setup

11.1 Front Panel Layout

This section provides an overview of the front panel layout of the PulserPlus.Net™ controller. The function of each key will be described.



PulserPlus.Net™ Controller Faceplate Layout

<u>Key</u>	<u>Function</u>
SYSTEM INFO	This is the system information button. When held for 4 seconds and a password is input, the system information screens are accessed.
F1	This key is used for accessing a new screen from the user's current screen.
F2	This key is used for accessing a new screen from the user's current screen.
ESC/BACK	Back function: when the user is viewing a screen, the user is taken back to the previous screen. Esc function: when the user is editing data, data entry is aborted and the original value is redisplayed
HELP	Pressing this key displays the screen containing Post Glover Resistors' websites and phone numbers.
Enter	This key is used for accessing a data point for editing and for saving the data point after editing.
Arrows	The four arrow keys are used for two purposes: <ol style="list-style-type: none"> 1. When in View Alarms or View Events, scroll through alarm or event screens. 2. When in data entry mode, move among user-editable data items.

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The following table describes the color coded buttons, their associated numeric values and a description of the operation performed when pressed. The numeric value is used when data points are being edited.

BUTTON LABEL	DIGIT	PASSWORD	OPERATION
VIEW ALARM	1	Not required	When pressed, this button opens the screen controlling access to the alarms and events screens. This button is also used to silence the alarm horn.
ACK ALARM	2	Not Required	This button is used to acknowledge the currently displayed alarm or event.
CLEAR ALARM	3	Required	This button is used to clear the currently displayed alarm or event. When pressed, this record is permanently removed from either the alarm or event data tables.
PULSE	4	Not Required	Upon pressing this button, the closing and opening of the pulse contactor is initiated. Press the "PULSE" key again to stop pulsing. This button is only active in a fault condition.
MENU	5	Not required	This button is used to access the password control screens and the communication port configuration screens.
EDIT	6	Not Required	When pressed, the user is taken to the password entry screen. Upon successful entry of the password, the user is returned to the previously displayed screen. Screens where this function is accessible will be identified later.
TEST	7	Required	When pressed and held, the test resistor contact is closed. Upon release, the test resistor contact opens. This feature is disabled in the event of a ground fault.
CHRGING CURRENT	8	Required	When pressed, the test resistor contact is closed and the system charging current is calculated. Upon completion, the test resistor contact opens. This feature is disabled in the event of a ground fault.
LAMP TEST	9	Required	When pressed, all front panel lamps turn on and the alarm horn sounds. When pressed a second time, all front panel lamps return to their previous state and the alarm horn is silenced.
SYSTEM RESET	0	Required	When pressed, all alarm states are reset and the green "NORMAL" lamp turns on.

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11.1.1 Disabling/Re-enabling Password Protection

Many of the functions of the PulserPlus.NET are “locked-out” by password protection to prevent tampering. The table in section 11.1 above shows which functions are password protected.

To disable the password protection, perform the following steps:

1. From the main screen, press the MENU key.
2. Press F1 for password control
3. Press F2 for enable/disable password protection.
4. In the password entry screen, press the Enter key, type in the password (default is 1000) and press the enter key again.

The steps above can be performed in reverse to re-enable the password. Please see the control screen navigation flowchart in section 11.2.1 below for a visible representation of the control screens.

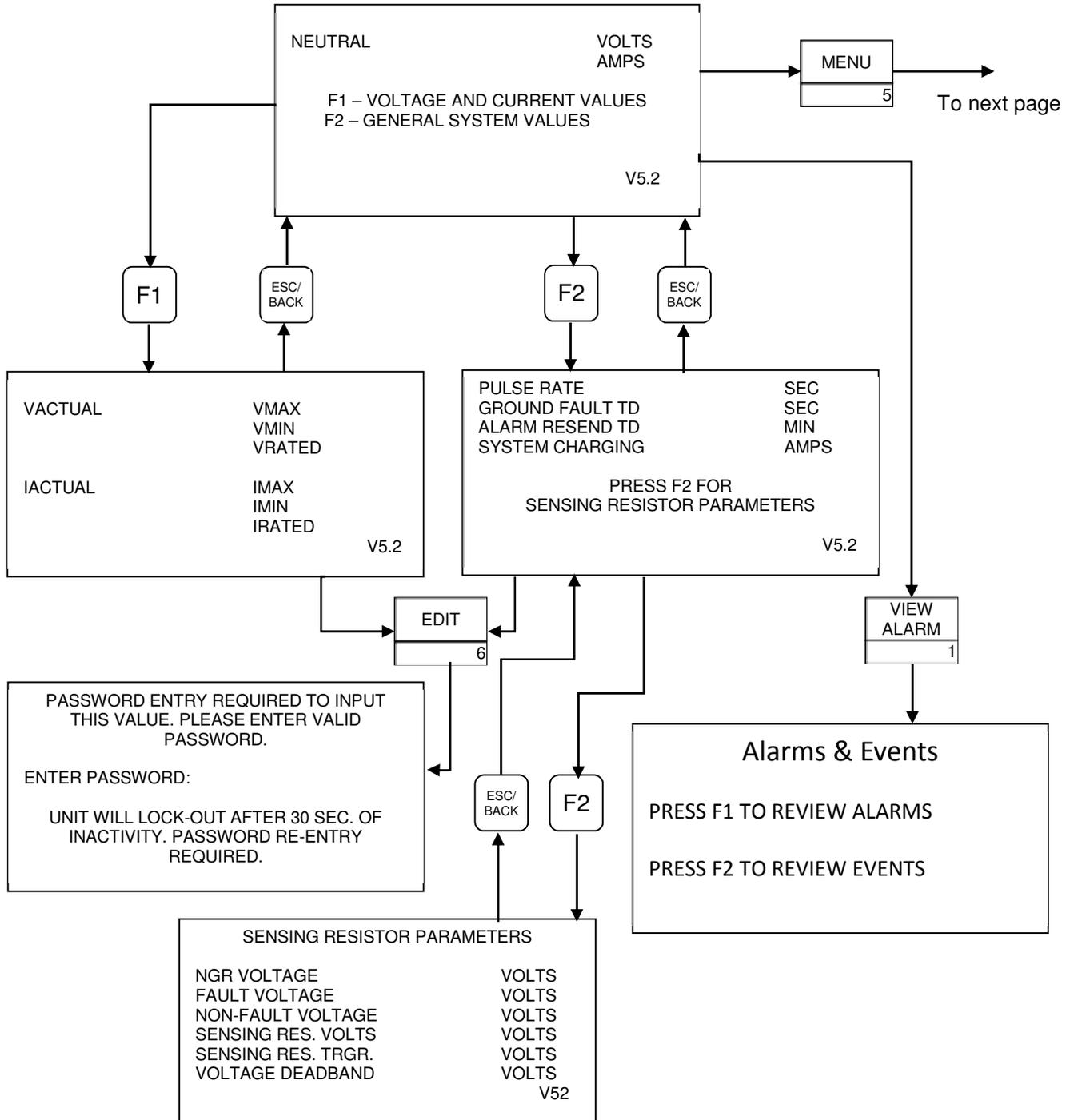
Note: To prevent tampering by unauthorized personnel, it is recommended that the password be re-enabled after any necessary work is complete.

PULSERPLUS.NET™ INSTRUCTION MANUAL

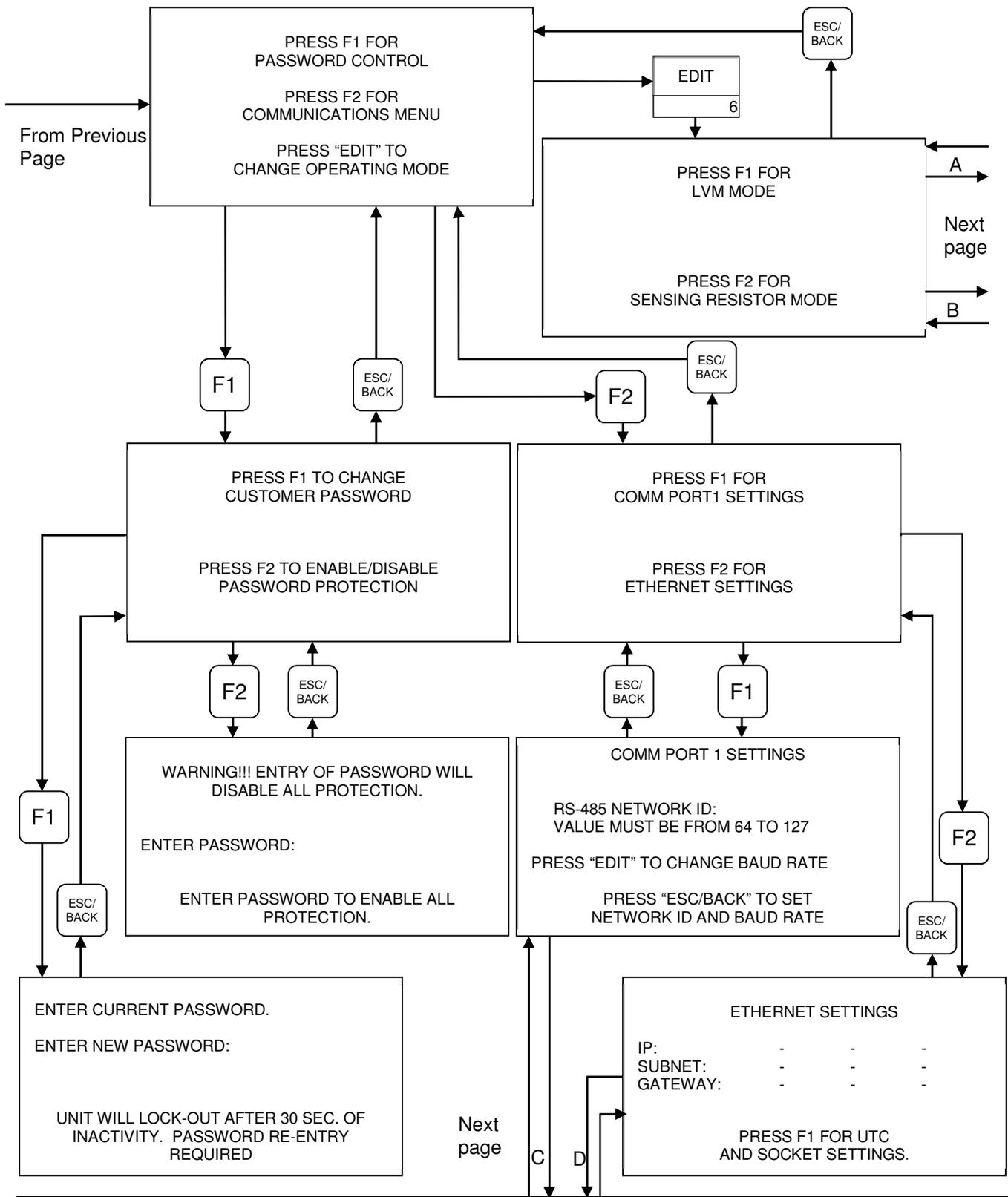
11.2 Controller Screen Information

This section provides an overview of the status, information and operation screens.

11.2.1 Control Screen Navigation Flowchart



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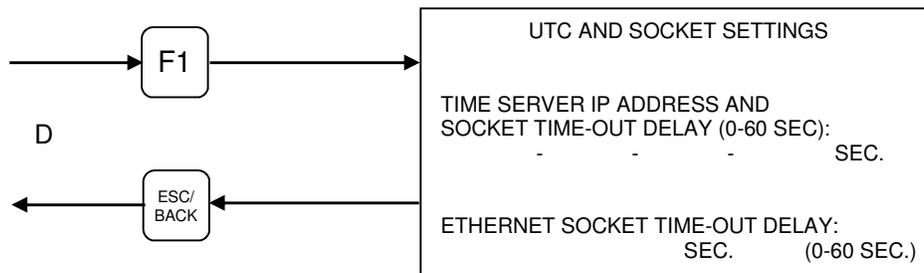
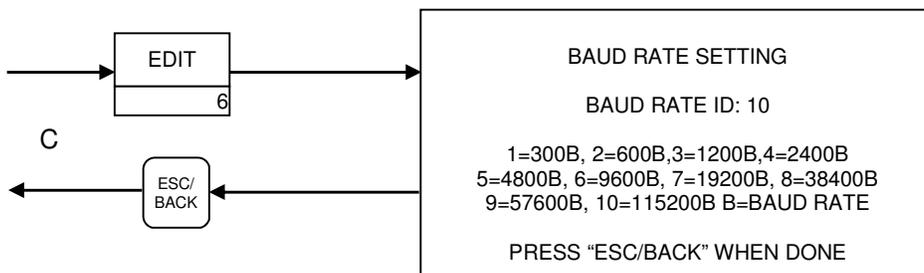
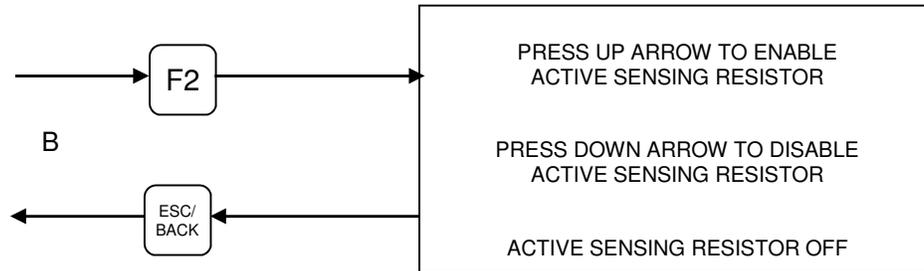
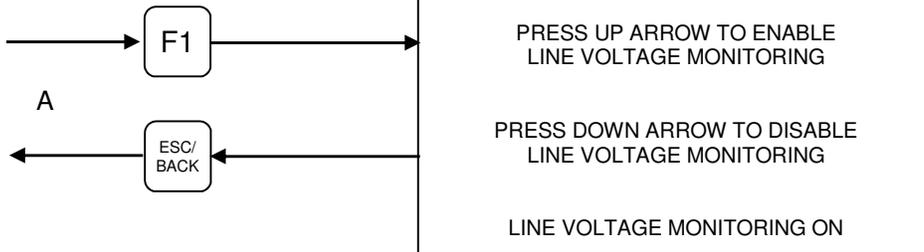


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11.2.2 Control and Data Entry Screen Descriptions

11.2.2.1 Controller Screen: “System Status”

NEUTRAL	VOLTS AMPS
F1 – VOLTAGE AND CURRENT VALUES F2 – GENERAL SYSTEM VALUES V5.2	

This is the default controller screen. This screen provides display of the real-time values for the voltage across and current through the NGR. It also provides access to the “Volts Amps” screen via the “F1” key and the “Parameters” screen via the “F2” key. The “View Alarms Events” screen is accessed via the “VIEW ALARM” key. The “Password Entry” screen is accessed via the “EDIT” key. The warning tag is displayed when the password feature has been disabled. This screen also displays the software revision number.

11.2.2.2 Controller Screen: “Volts Amps”

VACTUAL	VMAX VMIN VRATED
IACTUAL	IMAX IMIN IRATED
V5.2	

This screen is displayed when the “F1” key is pressed on the “System Status” screen. To edit “Vmax”, “Vmin”, “Vrated”, “Imax”, “Imin” and “Irated”, the user must press the “EDIT” key to access the “Password Entry” screen. Upon successful entry of the password, the user will be returned to this screen. “Vactual” and “Iactual” are not editable. The warning tag at the bottom of the screen is displayed only when the user has disabled the password on the “Disable Password” screen. The software version is also displayed on this screen. Pressing “ESC/BACK” will return the user to the “System Status” screen.

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11.2.2.3 Controller Screen: “Parameters”

PULSE RATE	SEC
GROUND FAULT TD	SEC
ALARM RESEND TD	MIN
SYSTEM CHARGING	AMPS
PRESS F2 FOR SENSING RESISTOR PARAMETERS	
V5.2	

This screen is displayed when the “F2” key is pressed on the “System Status” screen. This screen displays the Pulse Rate, Ground Fault Time Delay (TD), Alarm Resend Time Delay, and System Charging Current. To edit the “Pulse Rate”, the “Ground Fault TD”, and the Alarm Resend Time Delay, the user must press the “EDIT” key to access the password entry screen. Upon successful entry of the password, the user will be returned to this screen. The System Charging Current is not editable. The warning tag at the bottom of the screen is displayed only when the user has disabled the password on the “Disable Password” screen. The software version is also displayed on this screen. Pressing “ESC/BACK” will return the user to the “System Status” screen.

11.2.2.4 Controller Screen: “Password Extras”

PRESS F1 TO CHANGE CUSTOMER PASSWORD
PRESS F2 TO ENABLE/DISABLE PASSWORD PROTECTION

This screen is displayed when the “F1” key is pressed on the “Menu Control” screen. The user is directed to press “F1” to change the customer password and “F2” to enable or disable password protection. Pressing “ESC/BACK” will return the user to the “Menu Control” screen.

11.2.2.5 Controller Screen: “Change Password”

ENTER CURRENT PASSWORD
ENTER NEW PASSWORD
UNIT WILL LOCK-OUT AFTER 30 SEC. OF INACTIVITY. PASSWORD RE-ENTRY REQUIRED.

This screen is used to change the customer password. The user enters the existing password and the new password. If the existing password is correct, the new password will be stored in the “Customer Password” data table. This screen is accessed by pressing “F1” on the “Password Extras” screen. Pressing “ESC/BACK” will return the user to the “Password Extras” screen.

11.2.2.6 Controller Screen: “Password Entry”



This screen is used for entry of the customer password. It is accessed by pressing the “EDIT” key on the front panel. Once the password has been successfully entered, the user will be returned to the previous screen. The default password is 1000.

11.2.2.7 Controller Screen: “Disable Password”



This screen is accessed by pressing the “F2” key on the “Password Extras” screen. On this screen, entry of the customer password will disable the password function. When the password is active, the text above the entry box displays. When the password is disabled, the text below the entry box displays. To enable the password, the user enters the customer password. Pressing “ESC/BACK” will return the user to the “Password Extras” screen.

11.2.2.8 Controller Screen: “Lamp Test”



This screen is displayed while the “Lamp Test” is in progress. Upon pressing the “LAMP TEST” button, the “System Status” screen will re-appear.

11.2.2.12 Controller Screen: “CommPort1”

COMMPORT 1 SETTINGS			
RS-485 NETWORK ID: VALUE MUST BE FROM 64 TO 127			
PRESS “EDIT” TO CHANGE BAUD RATE			
PRESS “ESC/BACK” TO SET NETWORK ID AND BAUD RATE			

This screen is displayed when the “F1” key is pressed on the “Comm Menu” screen. This screen displays the RS-485 Network ID. The “RS-485 Network ID” value is user-settable. The RS-485 network ID has a range of 64 to 127. When changing the “RS-485 Network ID”, pressing “Enter” will store the new value. Pressing “ESC/BACK” will return the user to the “Comm Menu” screen.

11.2.2.13 Controller Screen: “Ethernet Port”

ETHERNET SETTINGS			
IP:	-	-	-
SUBNET:	-	-	-
GATEWAY:	-	-	-
PRESS F1 FOR UTC AND SOCKET SETTINGS.			

This screen is displayed when the “F2” key is pressed on the “Comm Menu” screen. This screen displays the IP Address, Subnet Mask and Gateway Mask for the controller’s Ethernet Port. All values are user-settable with the range of 0 to 255. Each octet must be entered individually. When changing an octet, pressing “Enter” will store the new value. Press the “F1” key to view UTC and Socket Settings. Pressing “ESC/BACK” will return the user to the “Comm Menu” screen.

11.2.2.14 Controller Screen: “Operating Mode Change”

PRESS F1 FOR LVM MODE	
PRESS F2 FOR SENSING RESISTOR MODE	

This screen is displayed when the “EDIT” key is pressed on the “Menu Control” screen. The user is directed to press “F1” to change the line voltage monitoring mode and “F2” to change the sensing resistor mode. Pressing “ESC/BACK” will return the user to the “Menu Control” screen.

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11.2.2.15 Controller Screen: “RS-485 BaudRate”

```
BAUD RATE SETTING  
BAUD RATE ID: 10  
1=300B, 2=600B,3=1200B,4=2400B  
5=4800B, 6=9600B, 7=19200B, 8=38400B  
9=57600B, 10=115200B B=BAUD RATE  
PRESS “ESC/BACK” WHEN DONE
```

This screen is displayed when the “EDIT” key is pressed on the “CommPort1” screen. Press Enter to set the baud rate and type in the desired number from the list. Press enter again to save the setting Pressing “ESC/BACK” will return the user to the “CommPort1” screen.

11.2.2.16 Controller Screen: “Sensing Resistor Parameters”

```
SENSING RESISTOR PARAMETERS  
NGR VOLTAGE VOLTS  
FAULT VOLTAGE VOLTS  
NON-FAULT VOLTAGE VOLTS  
SENSING RES. VOLTS VOLTS  
SENSING RES. TRGR. VOLTS  
VOLTAGE DEADBAND VOLTS  
V5.2
```

This screen is displayed when the “F2” key is pressed on the “Parameters” screen. This screen displays the settings and values for the sensing resistor. To edit these values, the user must press the “EDIT” key to access the password entry screen. Upon successful entry of the password, the user will be returned to this screen. The warning tag at the bottom of the screen is displayed only when the user has disabled the password on the “Disable Password” screen. The software version is also displayed on this screen. Pressing “ESC/BACK” will return the user to the “Parameters” screen.

11.2.2.17 Controller Screen: “LVM Control”

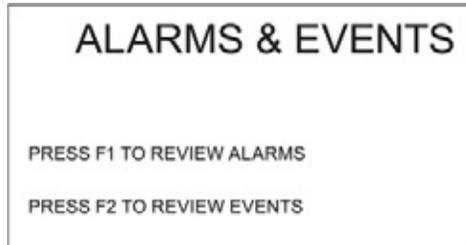
```
PRESS UP ARROW TO ENABLE  
LINE VOLTAGE MONITORING  
  
PRESS DOWN ARROW TO DISABLE  
LINE VOLTAGE MONITORING  
  
LINE VOLTAGE MONITORING ON
```

This screen is displayed when the “F1” key is pressed on the “Operating Mode” screen. The user is directed to press the “UP” arrow to enable line voltage monitoring and the “DOWN” arrow to disable line voltage monitoring. To enable/disable the monitoring system, the password must either be entered or disabled before entering this screen. The current status will be displayed at the bottom of the screen. Pressing “ESC/BACK” will return the user to the “Operating Mode” screen. Note that disabling the line voltage monitoring is typically only used for generator systems that utilize UPS control power for the PulserPlus.Net while the generator is off.

11.3 Alarms and Events

This section provides an overview of each screen and its information and function.

11.3.1 Controller Screen: “View Alarms Events”

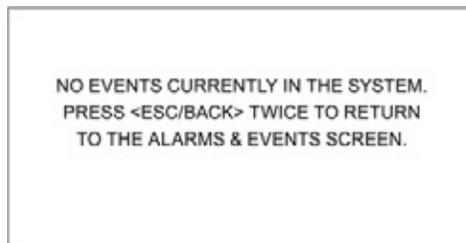


This screen is accessed by pressing the “View Alarms” key on the front panel. By pressing F1, the user has access to viewing system alarms. By pressing F2, the user has access to viewing system events. Pressing the “EDIT” key directs the user to the “Password Entry” screen. Pressing “ESC/BACK” will return the user to the “System Status” screen.

11.3.2 Event Screens

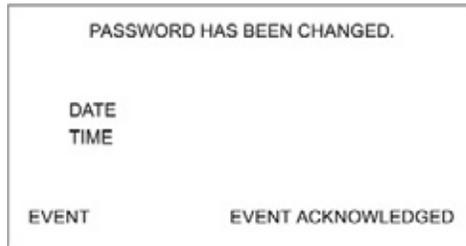
The following screens are events and can be seen in the event viewer if they have occurred. The events can be scrolled through by using the up and down arrow keys.

11.3.2.1 Event Screen: “No Events”



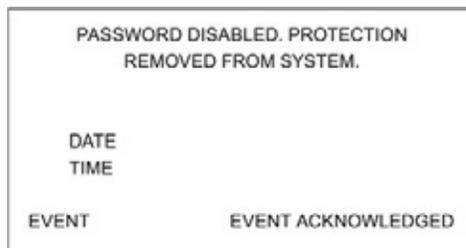
This screen is displayed when the user presses “F2” from the “View Alarms Events” screen and no events records exist in the “Events” data table. Pressing “ESC/BACK” twice will return the user to the “View Alarms Events” screen.

11.3.2.2 Event Screen: “Password Changed”



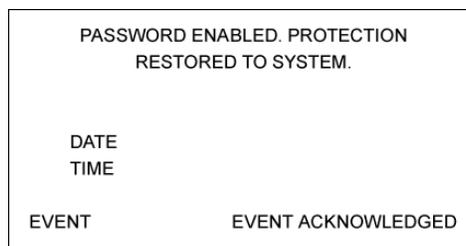
This screen is displayed when the viewed event record in the “Events” data table is for the changing of the customer password. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.3 Event Screen: “Password Disabled”



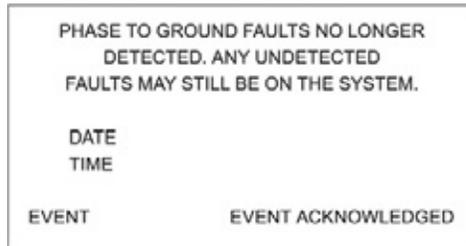
This screen is displayed when the viewed event record in the “Events” data table is for the disabling of the password function. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.4 Event Screen: “Password Enabled”



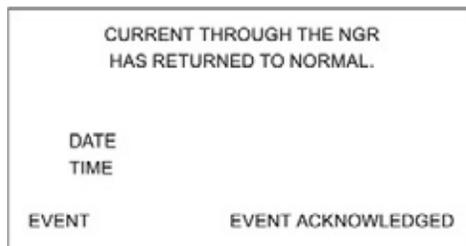
This screen is displayed when the viewed event record in the “Events” data table is for the re-activation of the password function. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.5 Event Screen: “Ground Faults Cleared”



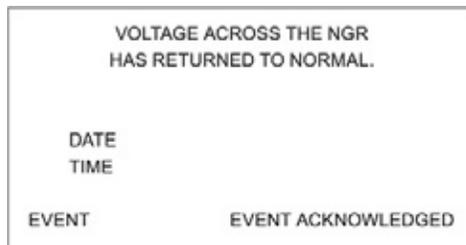
This screen is displayed when the viewed event record in the “Events” data table is a “no single-line-to-ground faults detected” condition for the phase A, B and C voltage monitoring relays. There may still be undetected faults on the system. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.6 Event Screen: “Current Within Limits”



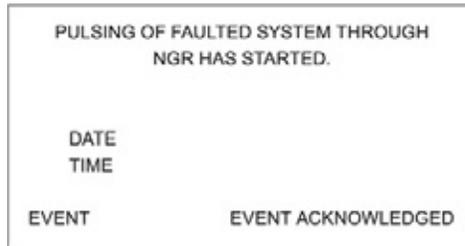
This screen is displayed when the viewed event record in the “Events” data table is an NGR normal condition. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.7 Event Screen: “Voltage Within Limits”



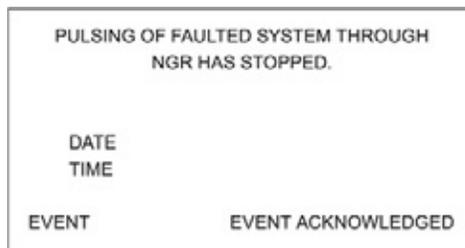
This screen is displayed when the viewed alarm record in the “Alarms” data table is an NGR return-to-normal condition. The “Alarm Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.8 Event Screen: “Pulse Start”



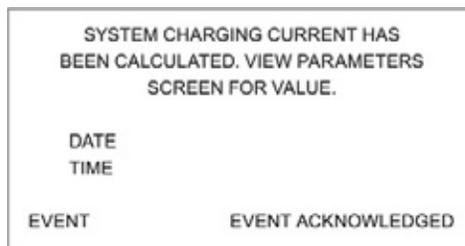
This screen is displayed when the viewed event record in the “Events” data table is for the initiation of the NGR pulse. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.9 Event Screen: “Pulse Stop”



This screen is displayed when the viewed event record in the “Events” data table is for the termination of the NGR pulse. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.10 Event Screen: “System Charging Current”



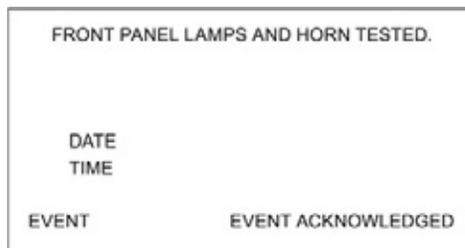
This screen is displayed when the viewed event record in the “Events” data table is for the calculation of the system charging current. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.11 Event Screen: “Test Resistor Connected”



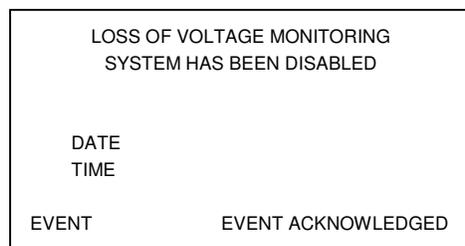
This screen is displayed when the viewed event record in the “Events” data table is for the connection of the test resistor. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.12 Event Screen: “Lamp Event”



This screen is displayed when the viewed event record in the “Events” data table is for the testing of the front panel lamps and alarm horn. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.13 Event Screen: “Voltage Monitoring Disabled”



This screen is displayed when the viewed event record in the “Events” data table is for the disabling of the loss of voltage function. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.14 Event Screen: “Voltage Monitoring Enabled”

LOSS OF VOLTAGE MONITORING SYSTEM HAS BEEN ENABLED	
DATE TIME	
EVENT	EVENT ACKNOWLEDGED

This screen is displayed when the viewed event record in the “Events” data table is for enabling of the loss of voltage function. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.15 Event Screen: “Active Sensing Disabled”

ACTIVE SENSING RESISTOR SYSTEM HAS BEEN DISABLED	
DATE TIME	
EVENT	EVENT ACKNOWLEDGED

This screen is displayed when the viewed event record in the “Events” data table is for the disabling active sensing resistor function. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.2.16 Event Screen: “Active Sensing Enabled”

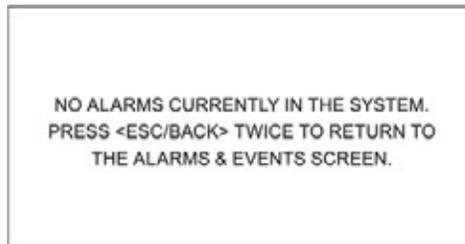
ACTIVE SENSING RESISTOR SYSTEM HAS BEEN ENABLED	
DATE TIME	
EVENT	EVENT ACKNOWLEDGED

This screen is displayed when the viewed event record in the “Events” data table is for enabling active sensing resistor function. The “Event Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.3 Alarm Screens

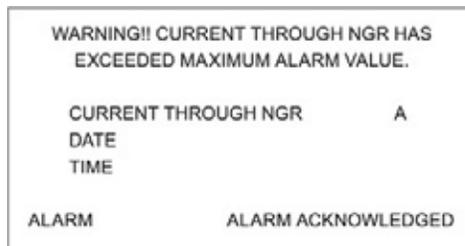
The following screens are events and can be seen in the event viewer if they have occurred. The alarms can be scrolled through by using the up and down arrows.

11.3.3.1 Alarm Screen: “No Alarms”



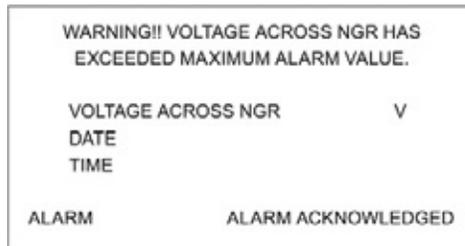
This screen is displayed when the user “F1” from the “View Alarms Events” screen and no alarms records exist in the “Alarms” data table. Pressing “ESC/BACK” twice will return the user to the “View Alarms Events” screen.

11.3.3.2 Alarm Screen: “Current Above Limit”



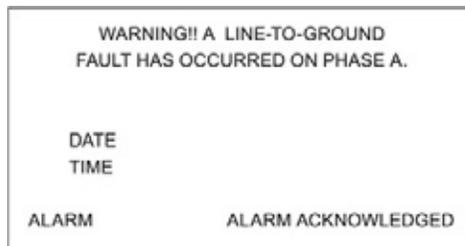
This screen is displayed when the viewed alarm record (code 21) in the “Alarms” data table is an NGR overcurrent condition. The current through the NGR in amps and the date and time of the alarm are displayed. The “Alarm Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.3.3 Alarm Screen: “Voltage Above Limit”



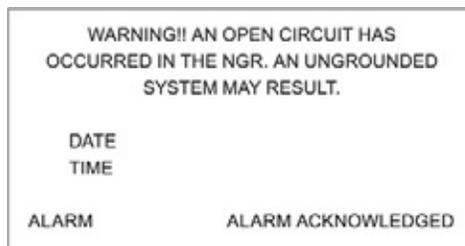
This screen is displayed when the viewed alarm record (code 11) in the “Alarms” data table is an NGR overvoltage condition. The “Alarm Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.3.4 Alarm Screen: “Phase A Fault”



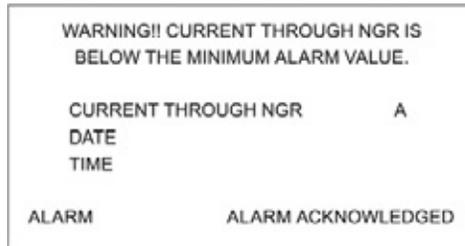
This screen is displayed when the viewed alarm record (code 71) in the “Alarms” data table is a single-line-to-ground fault detected by the phase A voltage monitoring relay. The “Alarm Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.3.5 Alarm Screen: “NGR Failure”



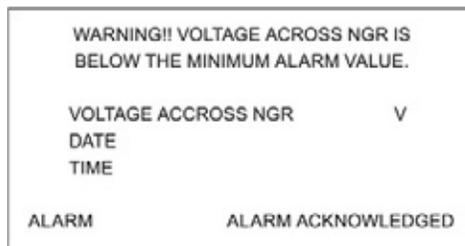
This screen is displayed when the viewed alarm record (code 113) in the “Alarms” data table is an NGR open-circuit failure condition. The “Alarm Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.3.6 Alarm Screen: “Current Below Limit”



This screen is displayed when the viewed alarm record (code 22) in the “Alarms” data table is an NGR undercurrent condition. The current through the NGR in amps and the date and time of the alarm are displayed. The “Alarm Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

11.3.3.7 Alarm Screen: “Voltage Below Limit”



This screen is displayed when the viewed alarm record (code 12) in the “Alarms” data table is an NGR undervoltage condition. The “Alarm Acknowledged” tag is only displayed when the user has previously pressed the “ACK ALARM” key. Pressing “ESC/BACK” will return the user to the “View Alarms Events” screen.

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11.4 Data Entry

This section guides the user through data entry using the front panel and display of the controller. A typical screen is shown and the method for data entry is described.

PULSE RATE	SEC
GROUND FAULT TD	SEC
ALARM RESEND TD	MIN
SYSTEM CHARGING	AMPS
SENSING RESISTOR PARAMETERS	
FAULT VOLTAGE	VOLTS
NON-FAULT VOLTAGE	VOLTS
	V3.0

This is the “Parameters” screen, accessible by pressing F2 at the “System Status” screen. All parameters on the screen are user-editable, except for “System Charging” current. To change any user-editable value on the screen, use the following procedure:

1. If the password is not already disabled or entered, press the “EDIT” key and follow the password entry instructions. The default user password is “1000”.
2. Using the arrow keys, select any highlighted value. Press the “ENTER” button to access the value.
3. Using the numbered keypad, enter the desired value. For integer values, a single entry is needed. For float values, the numerals before and after the decimal point are separately entered.
4. Press the “ENTER” button to save the value. Use the arrow keys to go to the next value.
5. Upon leaving the screen, all values are saved to the appropriate data table.

User-editable values are identified per screen in Section 11.2. Maximum, Minimum and Default values for all

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settings are given in the table below. The data tables storing these values are described in Section 11.5.

Parameter	Units	Minimum Value	Maximum Value	Default Value
V _{MAX} (Ground fault alarm setting)	Volts	0	999.9	100.0
V _{MIN}	Volts	0	999.9	0.0
V _{RATED} (System L-L rating)	Volts	0	999.9	480.0*
I _{MAX} (Ground fault alarm setting)	Amps	0	50.9	5.0
I _{MIN}	Amps	0	50.9	0.0
I _{RATED} (Resistor maximum rating)	Amps	0	50.9	10.0
PULSE RATE	Seconds	0	5	1
GROUND FAULT TD	Seconds	0	30	10
ALARM RESEND TD	Minutes	0	60	20
SENSING RESISTOR FAULT VOLTAGE SETTING	Volts	1	100	30
SENSING RESISTOR NON-FAULT VOLTAGE SETTING	Volts	1	100	3
SENSING RESISTOR VOLTAGE DEADBAND	Volts	0.000	600.999	0.488
ACTIVE SENSING RESISTOR TRIGGER	Volts	15	23	20
RS-485 NETWORK ID		64	127	64
ETHERNET SETTINGS		0	255	-

*This value is the firmware default. The correct value must be set manually.

11.5 Data Tables

Data tables are utilized to store editable system data and alarms and events records. These values are maintained even when system power cycles. By using these tables, information does not have to be re-entered by the customer when system power cycles. Refer to the PulserPlus.Net Communications Manual for the details of each data table and the values that are stored in them.

11.6 Porting Data Tables

The PulserPlus.Net™ controller is equipped with a micro-SD card reader. The reader is designed to accommodate up to 2GB micro-SD cards. The controller is delivered with a micro-SD card in the reader. The data tables are pre-loaded into the PulserPlus.Net™ controller with typical default system values. It is highly recommended that the customer replace these values with actual system-specific values. Once these values are input, the customer should back these up onto the provided micro-SD card. To save the data tables, follow the steps below:

1. Press and hold the “System Info” front panel button until the “Enter Password” screen appears. Input “1111” as the password and press the “Enter” key.
2. On the “Info Main Menu” screen, press the “2” key for the “System” menu.
3. On the “System” screen, press the “7” key for the “SD” menu.
4. On the “SD” screen, press the “2” key for the “Backup to SD” menu.
5. On the “Backup to SD” menu, press the “4” for backing up the “Whole DT” function. This will save all data tables onto the micro-SD card.
6. To enter the required password, press the “Enter” key and then input “1111” and press “Enter” again. After each “1” is input, wait until an “x” is shown before entering the next “1”.
7. The “Post Glover” logo will appear on the screen with a box showing the save progress. Upon completion of the save, the “Backup to SD” menu will reappear. Press “ESC/BACK” until the “System Status” screen appears.

Now that the data tables are saved, these values can be ported to other PulserPlus.Net™ controllers. To do this, the controllers’ versions must be compatible. In the lower right hand corner of the “System Status” screen is the version number, format “Vx.y”. If the “x” value for the second controller is the same as the first controller, the data tables can be ported. If the “x” values do not match, contact Post Glover.

To download the data tables to a new PulserPlus.Net™ controller, follow the steps below:

1. Follow steps 1 to 3 above.
2. On the “SD” screen, press the “1” key for the “Restore from SD” menu.
3. On the “Restore from SD” menu, press the “3” key for the “DT” (data tables) option. This will list the available data table files on the “DT Files” menu. The name listed should be “FULLDB”.
4. Press the “Enter” key twice and the data tables will be downloaded. The “Post Glover” logo will appear on the screen with a box showing the save progress. Upon completion of the download, the “DT Files” screen will reappear. Press “ESC/BACK” until the “System Status” screen appears.

11.7 Communications

The controller is provided with two communication ports, (1) RS-232/RS-485 and (1) Ethernet. See the PulserPlus.Net Communications Manual for details of how to set up and use these ports.

11.8 Software Back-up

The software in the PulserPlus.Net™ controller is pre-loaded at the factory and is ready to run upon installation. In the unlikely event that the software becomes corrupted and the controller operates erratically, the software can be reloaded in the field. The NGR is still connected and protecting the power system.

Software updates may also be issued by Post Glover to provide feature enhancements. The procedure below can also be used for those upgrades.

The controller is equipped with a micro-SD card reader. The reader is designed to accommodate up to 2GB micro-SD cards. The controller is delivered with a micro-SD card in the reader. This micro-SD card contains an image of the controller software package. New versions of the software can be copied from the user's PC to the SYSTEM directory of the card. This image cannot be opened and viewed on the customer PC.

To re-load or upgrade the software image, follow the steps below:

1. Press and hold the "System Info" front panel button until the "Enter Password" screen appears. Input "1111" as the password and press the "Enter" key.
2. On the "Info Main Menu" screen, press the "2" key for the "System" menu.
3. On the "System" screen, press the "7" key for the "SD" menu.
4. On the "SD" screen, press the "1" key for the "Restore from SD" menu. The other menu selection is password protected and is not accessible to the customer.
5. On the "Restore from SD" menu, press the "5" key for cloning.
6. Select the appropriate file and press enter. Press enter again at the confirmation. This loads the software image stored on the SD card.
7. Upon completion of the reloading process, the controller will reboot and be ready for operation. System data previously entered by the customer will need to be re-entered.

11.9 Setting the Time and Date

The PulserPlus.Net has a real-time clock with a battery back-up. It is important to set the time and date so the unit correctly timestamps the Events and Alarms in the alarm log. The procedure to set the time and date is as follows:

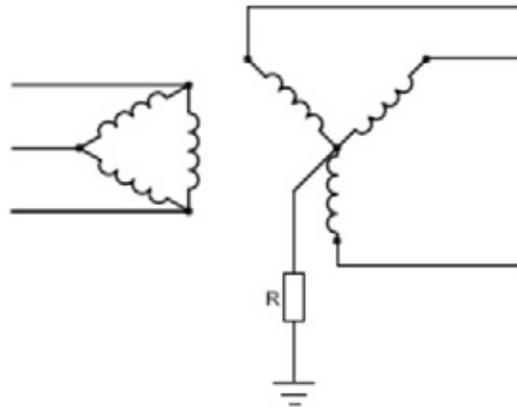
1. Press and hold the "System Info" front panel button until the "Enter Password" screen appears. Input "1111" as the password and press the "Enter" key.
2. On the "Info Main Menu" screen, press the "2" key for the "System" menu.
3. On the "System" screen, press the "4" key for the time and date.
4. Use the arrow keys to select the portions of the time and date that need to be changed.
5. Press Enter to edit the selected item.
6. Use the numbered keypad to enter the correct values. Press enter to save the new setting.
7. Press ESC/Back until the unit returns to the main screen.

Note: The date format is DD/MM/YYYY and the time format is 24-hour. The day of the week will automatically change when setting the date.

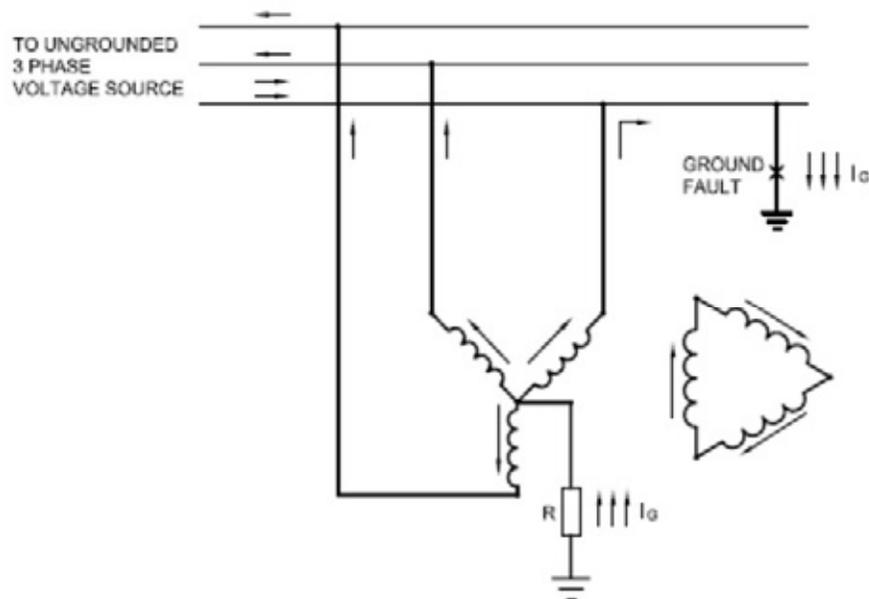
Appendix A – Schematics

The schematics in this section are general schematics. Refer to the wiring diagrams for the resistor for detailed connections.

A.1 Low-Voltage Wye-Connected

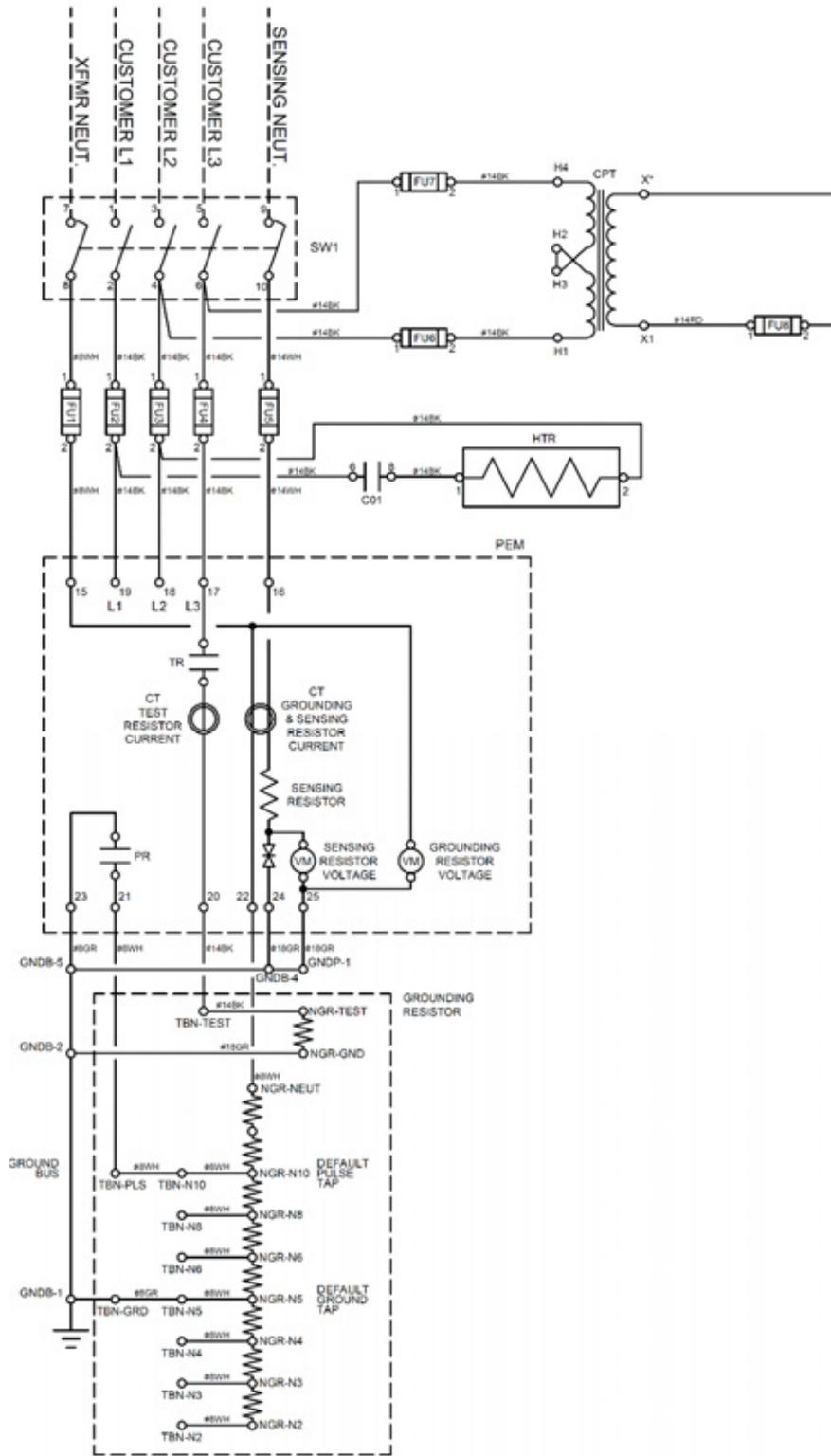


A.2 Low-Voltage Delta-Connected

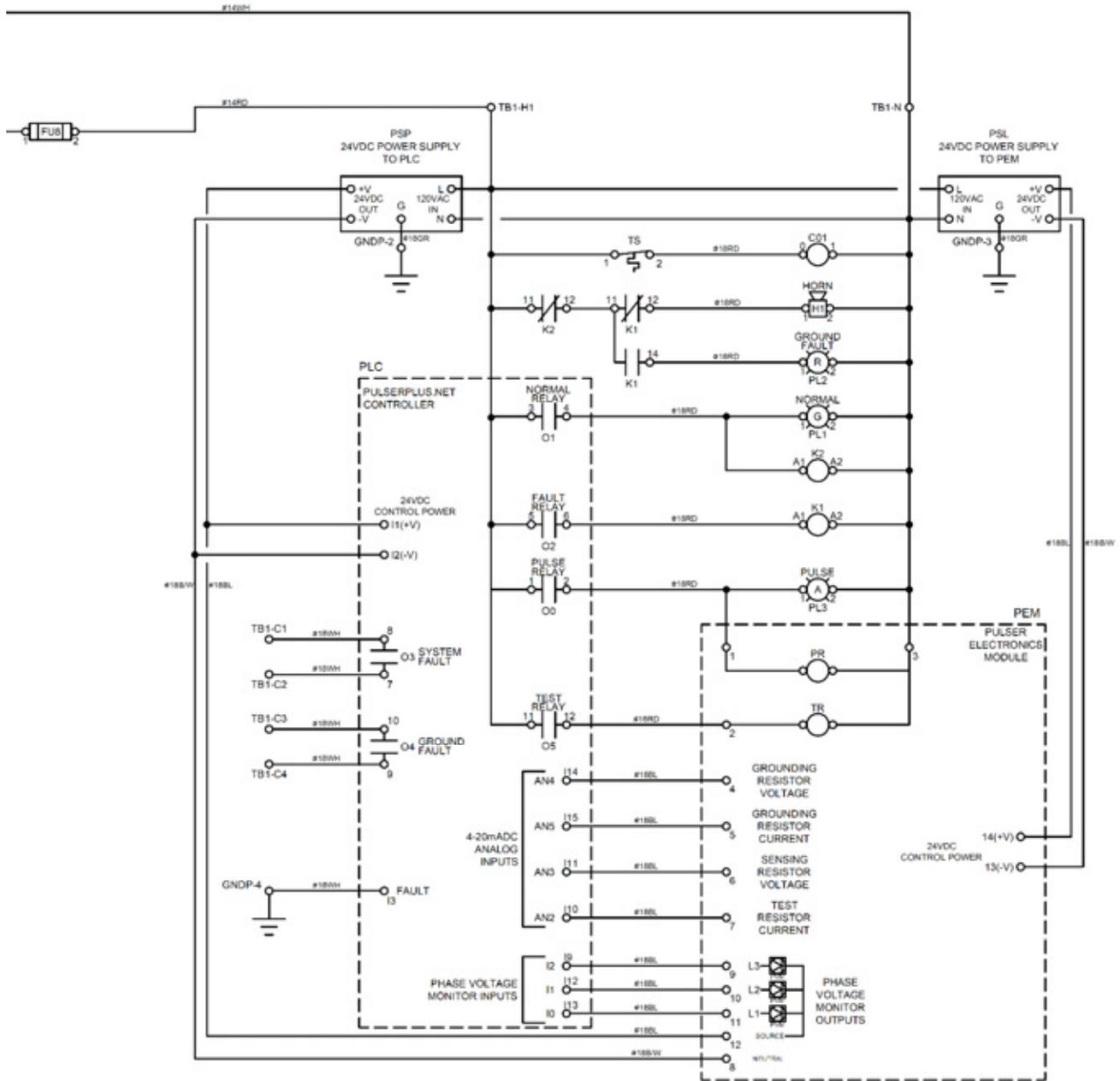


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A.3 Trouble shooting schematic



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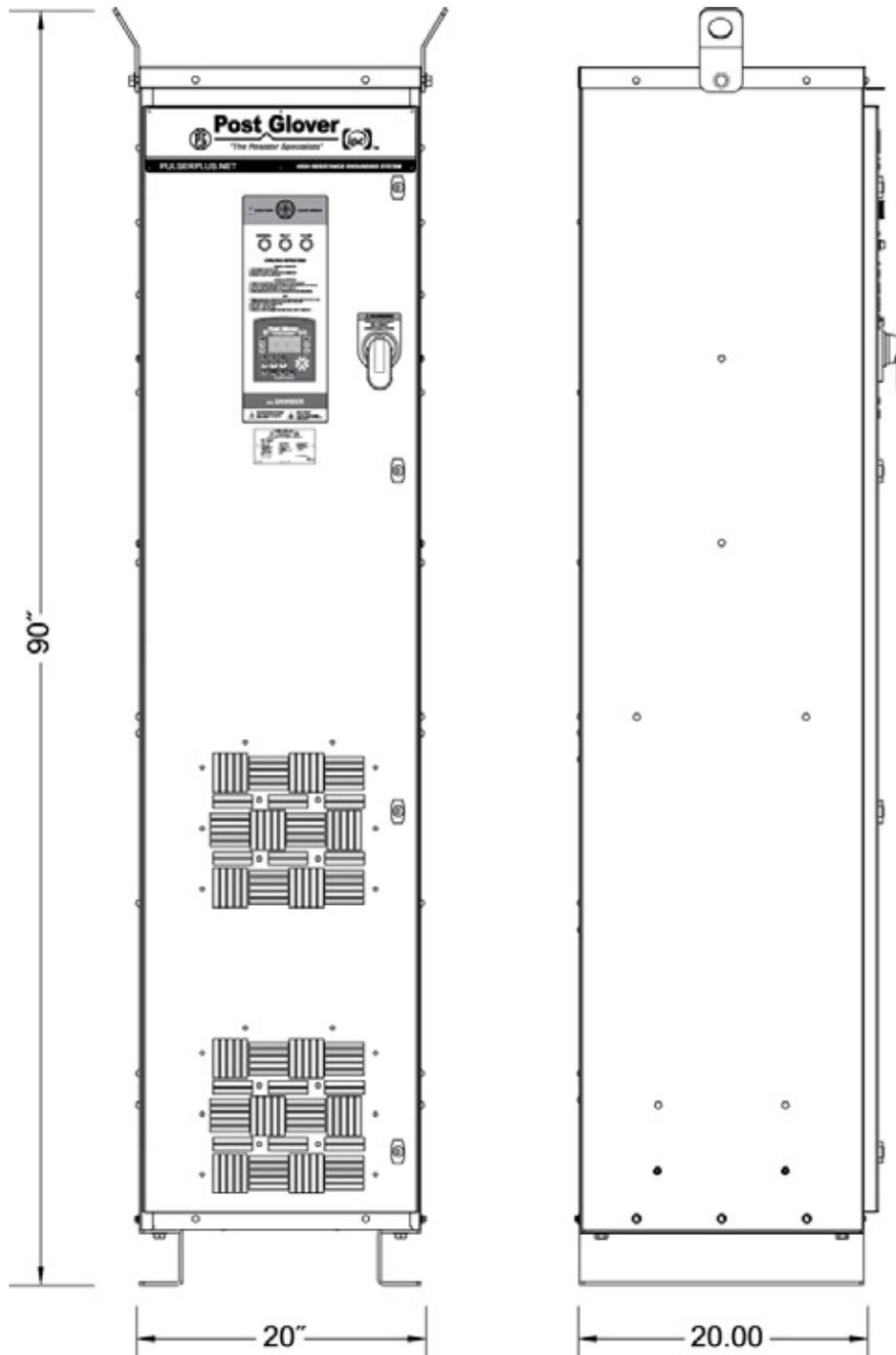


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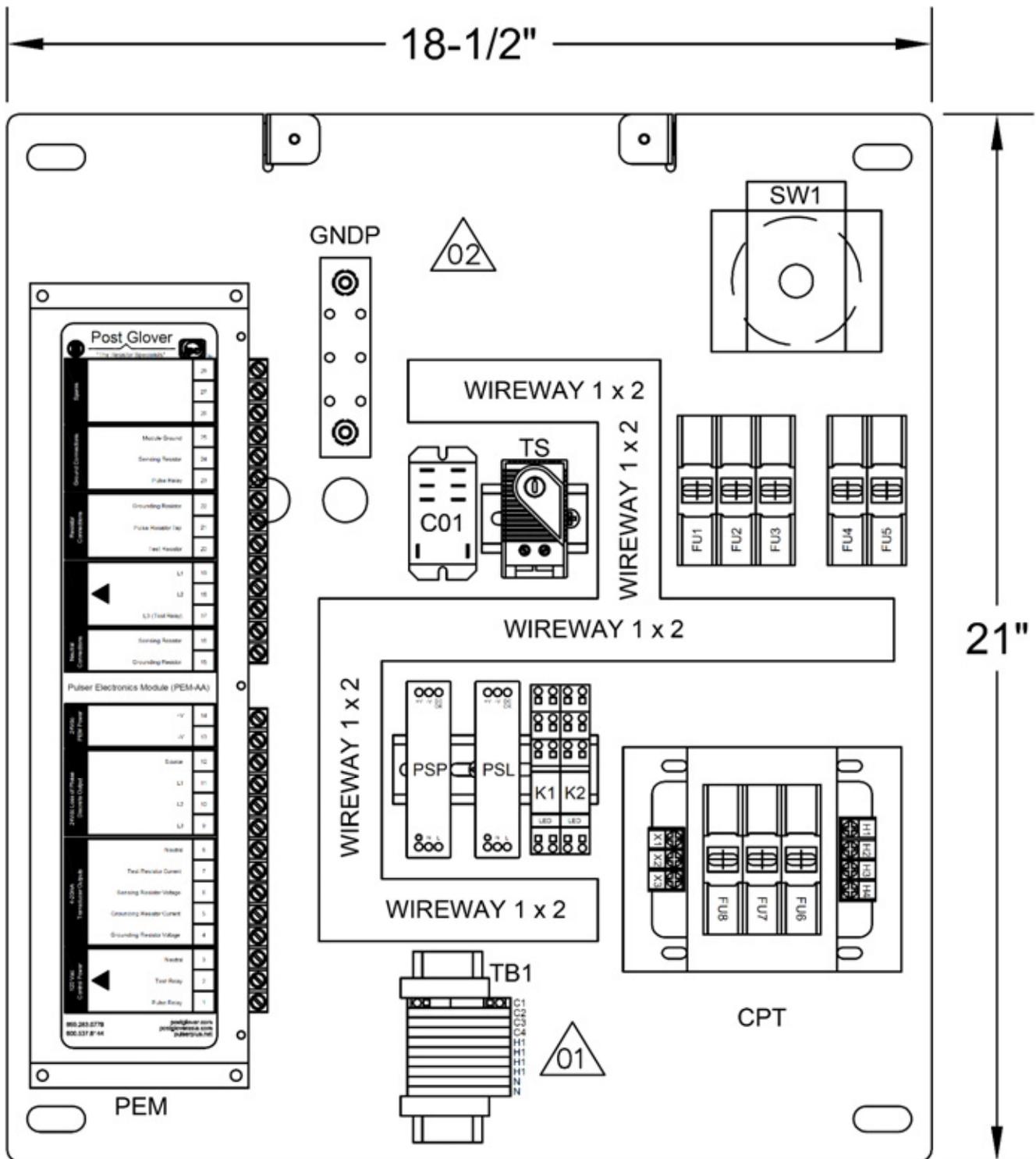
Appendix B – Dimension Drawings

B.1 Low-Voltage Enclosure



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B.2 Low-Voltage Backplate – Heater Model



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Appendix C – Control Specifications

C.1 Supply:

1. Controller: 24VDC, 165mA; 20.4VDC to 28.8VDC with less than 10% ripple
2. Pulser Electronics Module: 24VDC.

C.2 Ground Circuits:

1. Pulser Electronics Module (PEM)
 - a) Voltage Limit: 400V
 - b) Current Limit: 25A

C.3 Controller Output Relays:

1. System Normal: 5A @ 250VAC
2. Ground Fault: 5A @ 250VAC
3. Pulser: 5A @ 250VAC
4. Test: 5A @ 250VAC

C.4 Digital Inputs:

1. Nominal input voltage: 24VDC
2. Source type: 0-5VDC for Logic '0', 17-28.8VDC for Logic '1'
3. Input current: 8mA @ 24VDC

C.5 Analog Inputs:

1. 4-20mA, 243 ohm input impedance
2. Resolution: 204 to 1023 (820 units)
3. One configured input updated per scan. All analog inputs updated in 4 scans. Scan time approximately 4 to 5 ms

C.6 Communication Ports:

1. Port 1: 1 channel, RS-232/RS-485
 - a. Baud Rate: 300 to 115200 bps
 - b. RS-232
 - i. Input voltage: + 20VDC absolute maximum
 - ii. Cable length: 15m/50ft maximum
 - c. RS-485
 - i. Input voltage: -7 to +12VDC differential maximum
 - ii. Cable type: Shielded twisted pair
 - iii. Cable length: 1200m/4000ft maximum
 - iv. Nodes: Up to 32
2. Port 2: Ethernet

C.7 SD Card

1. Type of Port: Micro SD
2. Maximum Card size: 2GB

C.8 Miscellaneous

1. Real-time clock (date and time)
2. Battery back-up: 7 years typical at 25 deg. C
3. Battery: Coin-type 3V, lithium battery, CR2450
4. Maximum torque on connection screws, main disconnect switch: 15 in-lb.

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Appendix D – Customer Connection Details

D.1 Freestanding Unit

The table below indicates the wiring requirements to connect the PulserPlus.Net™ to the customer switchgear. For each wire, the ending termination locations at the PulserPlus.Net™ are given along with the wire type, size, color and termination requirements.

Terminal 1	Termination Type	Terminal 2	Termination Type	Wire Type	Wire Size	Wire Color
SW1-1	0.5" stripped wire	Swgr. L1	By customer	105C	#14	Black*
SW1-3	0.5" stripped wire	Swgr. L2	By customer	105C	#14	Black*
SW1-5	0.5" stripped wire	Swgr. L3	By customer	105C	#14	Black*
SW1-7	0.625" stripped wire	Xfmr. X ₀	By customer	90C	#8	White
SW1-9	0.5" stripped wire	Xfmr. X ₀	By customer	90C	#14	White
GNDB	AMP 324043	Ground	By customer	90C	#8	Green

*The three phase wire color can be the customer's standard colors, such as Brown Orange Yellow, etc.

D.2 Wall-Mounted Unit

In addition to the connections above, the wall-mounted unit requires connections between the wall-mounted control unit and the Freestanding resistor unit. These additional connections are in the following table.

Terminal 1	Termination Type	Terminal 2	Termination Type	Wire Type	Wire Size	Wire Color
PEM-20	Burndy YAV14	TBN-TEST	T&B 14RB10X	105C	#14	Black
PEM-21	Panduit LCA8-6-L	TBN-PLS	Panduit LCA8-10-L	90C	#8	White
PEM-22	Panduit LCA8-6-L	NGR-NEUT	AMP 324043	90C	#8	White
PEM-23	Panduit LCA8-6-L	GNDB	AMP 324043	90C	#8	Green
PEM-24	Burndy YAV14	GNDB	T&B 14RB10X	105C	#18	Green
GNDP	T&B 14RB10X	GNDB	T&B 14RB10X	105C	#18	Green

If separate open-frame resistors are used instead of separate enclosed resistors, the GNDB connection above is not made and the following connections are made.

Terminal 1	Termination Type	Terminal 2	Termination Type	Wire Type	Wire Size	Wire Color
NGR-TG	T&B 14RB10X	Ground		105C	#14	Green
TBN-GRD	Panduit LCA8-10-L	Ground		90C	#8	Green

Appendix E – Active Open Circuit Detection

E.1 Introduction

The following instruction is for setting up and using the active open circuit detection scheme. The system will check for an open neutral circuit every 60 seconds, provided that the Neutral Grounding Resistor Voltage does not exceed 10 volts.

E.2 Ensure proper hardware is installed

The active open circuit detection only works with model TR6 controllers with version 5.2 or later firmware installed. It is also only available with Pulser Electronics Module model PEM-AV.

E.3 Set the passive Sensing Resistor settings.

E.3.1 Set Sensing Resistor Fault Volts

1. Disable the password protection using the procedure in section 11.1.1 of the manual. Press ESC/BACK until back at the main screen
2. From the main screen, press F2 for General System Values, then Press F2 for Sensing Resistor Parameters.
3. Check the value of the resistor tap, then set the Sensing Resistor Fault Volts according to the table in section 8.5 of the manual.

E.3.2 Set Sensing Resistor Non-Fault Volts

1. Check the normal value of the Neutral Volts on the screen.
2. Set the sensing *Resistor Non-Fault Volts slightly above this value.*

E.4 Activate the Active Sensing Circuit

1. Press the MENU key
2. Press the EDIT key to change operating mode
3. Press F2 for Sensing Resistor Mode
4. Press the UP arrow key to enable the Active Resistor Sensing

E.5 Open Circuit Alarm

If the active sensing circuit detects an open circuit, the alarm sequence will occur. The active sensing circuit will auto disable. Pressing the VIEW ALARM button will allow the user to view the alarm.

E.6 Resetting the system

Once the cause of the open is determined and repaired, the active sensing circuit will need to be re-enabled as noted in section E.4 above. Note that the firmware requires the controller to be de-energized to fully reset the logic.

E.7 Testing the system

The system can be tested by simply turning off the disconnect switch and removing the neutral fuse (FU1). Turn on the disconnect switch to re-power the system. The unit should alarm in around 60 seconds. Remove power again, replace the fuse and restore power. Re-enable the active sensing as in section E.4 above.

E.8 Setting the Sensing Resistor Trigger setting

If the unit does not produce an alarm with the test in section E.7 above, the sensing resistor trigger will need to be adjusted. The following steps are used to adjust the setting:

1. Disable the password protection as in section 11.1.1 of the manual
2. Press ESC/Back three times to return to the main screen
3. Press F2, then F2 again to view the sensing resistor parameter screen.
4. Observe the SENSING RES. VOLTS value for the highest value. It may take a couple of minutes to see a reading.
5. Set the SENSING RES. TRGR. value to a value just below the maximum reading seen. This can be set using the arrow keys and the enter key. The value is programmable from 15-24 volts.