Vertiv™ NetSure™ IPE Series -48 VDC Outdoor Rectifier

Installation and User Manual

Specification Number: 1R482000C2-6
Model Number: R48-2000C2

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

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Admonishments Used in this Document

DANGER! Warns of a hazard the reader ***will*** be exposed to that will ***likely*** result in death or serious injury if not avoided. (ANSI, OSHA)

WARNING! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)

CAUTION! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)

ALERT! Alerts the reader to an action that ***must be avoided*** in order to protect equipment, software, data, or service. (ISO)

ALERT! Alerts the reader to an action that ***must be performed*** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)

FIRE SAFETY! Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)

SAFETY! Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

Important Safety Instructions

Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page v.

General Safety

DANGER! YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.
Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:

a) The tasks should be performed in the order indicated.

b) Remove watches, rings, and other metal objects.

c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present. Check for voltage with both AC and DC voltmeters prior to making contact.

d) Wear eye protection.

e) Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed.

CAUTION! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Voltages

AC Input Voltages

DANGER! This system operates from AC input voltage capable of producing fatal electrical shock. AC input power must be completely disconnected from the branch circuits wiring used to provide power to the system before any AC electrical connections are made. Follow local lockout/tagout procedures to ensure upstream branch circuit breakers remain de-energized during installation. DO NOT apply AC input power to the system until all electrical connections have been completed and checked.

DC Output Voltages

DANGER! This system produces DC power. Although the DC voltage is not hazardously high, the rectifier can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact an output terminal or exposed wire connected to an output terminal. NEVER allow a metal object, such as a tool, to contact more than one termination or to simultaneously contact a termination and a grounded object. Even a momentary short circuit can cause sparking and injury. Fuses may open during a short circuit event.

Personal Protective Equipment (PPE)

DANGER! AC ARC FLASH AND SHOCK HAZARD.
Appropriate PPE and tools required when working on this equipment. An appropriate flash protection boundary analysis should be done to determine the "shock hazard and arc flash hazard" category, and to select proper PPE.

Only authorized and properly trained personnel should be allowed to install, inspect, operate, or maintain the equipment.

Do not work on LIVE parts. If required to work or operate live parts, obtain appropriate Energized Work Permits as required by the local authority, per NFPA 70E "Standard for Electrical Safety in the Workplace".

Hazardous Voltage

DANGER! HAZARD OF ELECTRICAL SHOCK.
More than one disconnect may be required to de-energize the system before servicing.

Handling Equipment Containing Static Sensitive Components

ALERT! Installation or removal of equipment containing static sensitive components requires careful handling. Before handling any equipment containing static sensitive components, read and follow the instructions under "Static Warning" on page viii.

The rectifier has a service port panel that can be removed for service or access to fuses and jumpers. A wrist strap must be worn when the rectifier is serviced.

Maintenance and Replacement Procedures

CAUTION! When performing any step in the procedures that requires removal or installation of hardware, use caution to ensure no hardware is dropped and left inside the unit; otherwise, service interruption or equipment damage may occur.

NOTE! *When performing any step in the procedures that requires removal of existing hardware, retain all hardware for use in subsequent steps, unless otherwise directed.*

Static Warning

This equipment contains static sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any equipment containing static sensitive components, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor. Some wrist straps have a built-in one megohm resistor; no external resistor is necessary. Read and follow wrist strap manufacturer's instructions outlining use of a specific wrist strap.
3. Do not touch traces or components on equipment containing static sensitive components. Handle equipment containing static sensitive components only by the edges that do not have connector pads.
4. After removing equipment containing static sensitive components, place the equipment only on static dissipative surfaces such as conductive foam or ESD bag. Do not use ordinary Styrofoam or ordinary plastic.
5. Store and ship equipment containing static sensitive components only in static shielding containers.

1 Introduction

1.1 General

The Vertiv™ NetSure™ IPE Series Outdoor Rectifier supplies power to critical infrastructure in harsh environments. Factory default output voltage is 54.2 VDC. The hardened rectifier is mounted inside an environmentally protective enclosure that can be wall or pole mounted.

These instructions apply to the following rectifier versions:

- Spec. No. 1R482000C2-6, Model R48-2000C2: Quick Connect Type, with controller.

1.2 What is in the Box

Refer to Table 1.1.

Table 1.1 What is in the Box

Part Number	Description	Qty.
1R482000C2-6	Outdoor Rectifier (with controller)	1
10024600	Rectifier Only Mounting Kit - see page 15 for additional details	1
10027555	Strain Relief Plate with Hardware	1
UM1R482000C2-6	Installation and User Manual	1

NOTE! *The rectifier is equipped with plug-in cable receptacles (i.e., bulkhead quick-connect connectors). Pre-assembled cables with the appropriate mating half connector MUST be ordered separately. See "Pre-Assembled Cables" on page 2 for descriptions and part numbers.*

1.3 Accessories

1.3.1 Mounting Kit

Refer to Table 1.2.

Table 1.2 Mounting Kit

Part Number	Description
10024600	Rectifier Mounting Kit (included with rectifier)

1.3.2 Pre-Assembled Cables

For 1R482000C2-6 Rectifier

Refer to Table 1.3.

Table 1.3 Pre-Assembled Cables for 1R482000C2-6 Rectifier

Part Number	Rectifier Port Label	Description
10023420 (30 feet)	LOAD 1 OUTPUT 4	Pre-Assembled Cable (6 AWG, Type W) (Cable with Mating Half to Rectifier 'DC Output Load1 / Output4' Receptacle, other end unterminated) (2kW) (see note below)
10023471 (30 feet)	LOAD 2 LOAD 3	Pre-Assembled Cable (8 AWG, Type SOOW) (Cable with Mating Half to Rectifier 'DC Output Load2 / Load3' Receptacle, other end unterminated.) (1kW) (see note below)
10024814 (16.4 feet) 10023461 (32.8 feet)	PWR	Pre-Assembled Cable (14 AWG, Type SEOW) (Cable with Mating Half to Rectifier 'AC Input Power' Receptacle, other end unterminated.)
10039061 (32.8 feet)	COM	Pre-Assembled Cable (Cable with Mating Half to Rectifier DB15 'Alarm and COM' Receptacle, other end unterminated.)

NOTE! *DC power ports are polarized: 2kW type (Load 1, Output 4) have polarizing dimple at bottom, and 1kW type (Load 2, 3) have polarizing dimple at top.*

1.4 Rectifier Overview

The rectifier provides load power during normal operating conditions. The rectifier is a constant power design. The rectifier is rated at its maximum output power. This means that, within the normal operating ambient temperature range and input voltage range, the maximum available output power is a constant 2000 W. Within these ranges, the rectifier operates in one of three modes, depending upon load demands. Transition between modes is completely automatic. If ambient temperature rises above or input voltage falls below acceptable values, the rectifier continues to operate but at derated output power levels.

- Constant Voltage Mode: For any initial output voltage setting from -42 VDC to -58 VDC (factory set at -54.2 VDC), output voltage remains constant regardless of load. This is the normal operating condition, in which loads are being supplied. The rectifier operates in the Constant Voltage Mode unless load increases to the point where the product of load current and output voltage is approximately 2000 W.
- Constant Power Mode: As load increases above approximately 2000 W (non-adjustable), output current continues to increase, but output voltage decreases as required to maintain constant output power. The rectifier operates in the Constant Power Mode unless load continues to increase to the point where the current limit setting is reached.
- Constant Current Mode: If load increases to the current limit setting, output voltage decreases linearly to maintain output current at the current limit setting.
- Fold Back: The fold back function is necessary to protect the rectifier against excessive load. The rectifier will deliver maximum current of 41.7 A down to 42 VDC output. If the load demand exceeds 41.7 A, the rectifier output will "fold back", reducing the voltage as shown in Figure 1.1 to limit the current and protect the rectifier. (The dotted line in Figure 1.1 represents the Fold Back.)

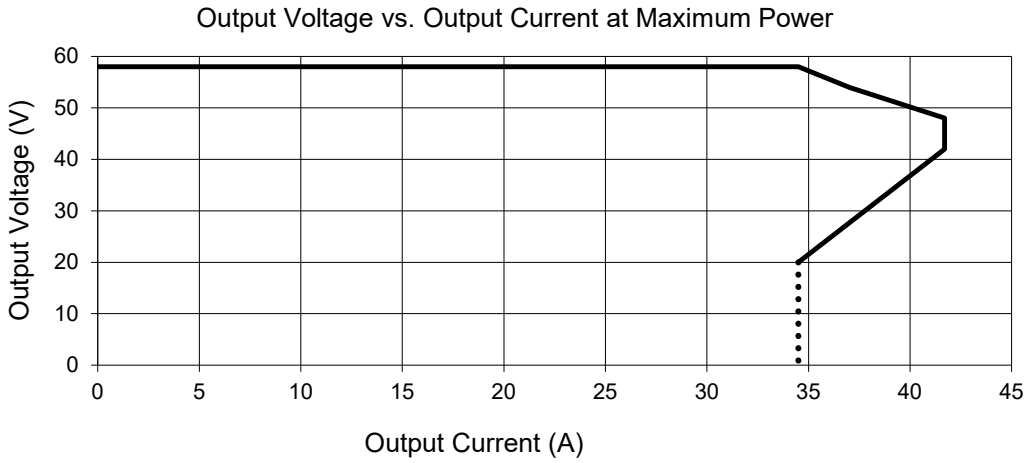
1.5 Rectifier Specifications

The specifications are for a single rectifier only, unless otherwise noted.

1.5.1 DC Output Ratings

1. Voltage: -42 VDC to -58 VDC, positive ground. Output voltage is factory set at -54.2 VDC.
2. Output Power and Current: 2000 W (41.7 A) @ 200 VAC to 250 VAC input and -48 VDC output.
3. Output Characteristics: Refer to Figure 1.1 for a graph of output voltage vs. output current.

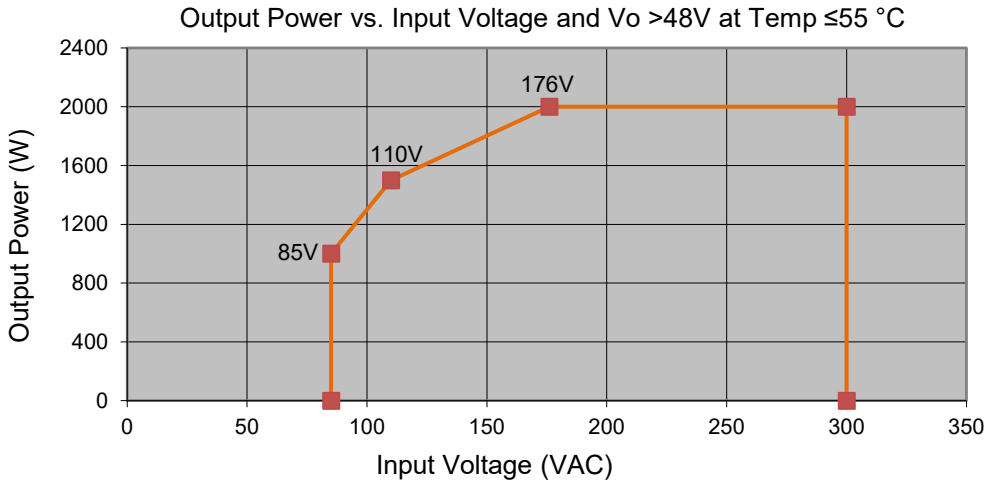
Figure 1.1 Output Voltage vs. Output Current



4. Power Derating Based on Input Voltage: The rectifier power varies with changes in input voltage. It uses an advanced power limitation method. The lower input threshold is 85 VAC. The rectifier can provide its maximum rated power (2000 W) as long as the input voltage is within the range of 176 VAC to 300 VAC. Below 176 VAC, and down to 85 VAC, the rectifier will continue to operate normally but will be in a power derating mode. The power output will derate linearly between 176 VAC to 110 VAC and then again linearly between 110 VAC to 85 VAC.

   The relationship between the output power and input voltage is illustrated in Figure 1.2.

Figure 1.2 Power Derating Based on Input Voltage



At input voltage of 85 VAC with output >48 VDC, maximum output power is 1000 W.
At input voltage of 110 VAC with output >48 VDC, maximum output power is 1500 W.
At input voltage of 176 VAC with output >48 VDC, maximum output power is 2000 W.

NOTE! *For 120 VAC Operation: Rectifier software version V1.00.16 and earlier will generate an Observational Alarm (OA) and the yellow LED will illuminate if 120 VAC nominal input voltage is utilized. This is an "AC-A Volt Low" alarm and is further explained in Table 8.1 on page* ***Error! Bookmark not defined.*** *If the situation outlined above exists, this alarm should be ignored. For software versions V1.10.03 and later, an "AC voltage" setting is available. Selection options are 120V or 230V. Selecting 120V eliminates the above-mentioned alarm when operated at 120VAC input.*

5. Power Derating Based on Temperature: The rectifier delivers full power when operating at an ambient temperature of +55 °C (+131 °F) or below. The rectifier continuously monitors the ambient temperature surrounding the power conversion circuit. If this temperature for any reason (such as a high ambient temperature) increases above approximately +55 °C (+131 °F), the rectifier will not shut down. Rather, the rectifier limits its maximum output power to maintain the temperature limit of the rectifier. Operation between +55 °C (+131 °F) and +75 °C (+167 °F) will result in output power being decreased. Full power capability is restored when the temperature decreases to below approximately +55 °C (+131 °F). Refer to Figure 1.3 to view the relationship between the output power and the ambient temperature.

WARNING! The module is rated for continuous operation at full output power up to +55 °C (+131 °F). Operation between +55 °C (+131 °F) and +75 °C (+167 °F) will result in output power decrease. Operation above +75 °C (+167 °F) is considered abnormal and should be used on a temporary[1] basis only.

[1] Temporary Operation at Abnormal Temperature: Temporary operation is defined as a period of not more than eight consecutive hours per day, and a total of not more than 15 days in a year, at a temperature above +75 °C (+167 °F). (This refers to a total of 120 hours in any given year, but no more than 15 occurrences in that one-year period.)

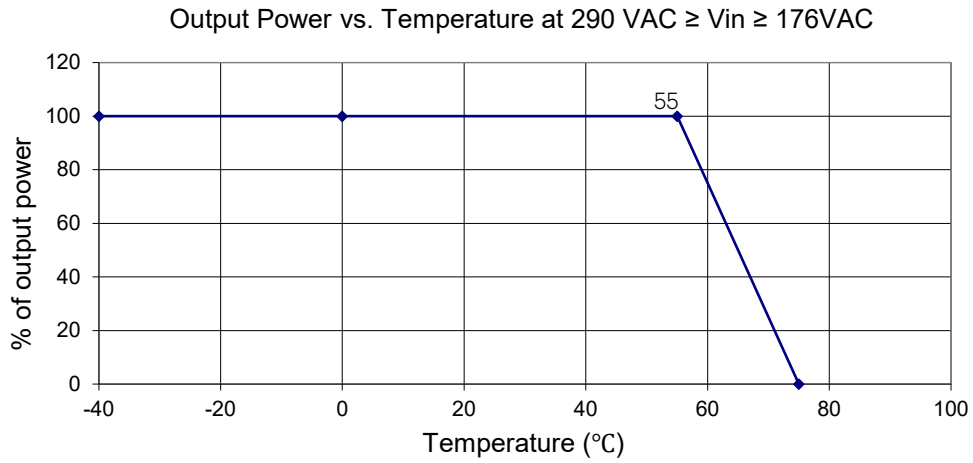
Other power rating values are as follows (refer to Figure 1.3):

a) At an ambient temperature of +55 °C (+131 °F), the power delivered by the rectifier is 2000 W.

b) At an ambient temperature between +55 °C (+131 °F) and +75 °C (+167 °F), the power is linear derated.

c) At an ambient temperature of +75 °C (+167 °F), the power delivered by the rectifier is 0 W.

Figure 1.3 Power Derating Based on Temperature



6. Regulation:

   a) Static: Steady state regulation is ±0.6% as controlled within the rectifier for any and all combinations of load from 5% to 100% load, input voltage, and input frequency at a constant ambient temperature.

   b) Dynamic: Response time ≤200 microseconds and overshoot ≤5% for load changes at 50% - 25% - 50% and 50% - 75% - 50% at rated output current.

   For any step load change within the range of 10% to 90% of full load within 50 microseconds, per Telcordia GR-947-CORE, the maximum voltage transient will not exceed 5% of the initial steady state voltage within 50±10 microseconds. Recovery to within 1% of the initial steady state voltage does not exceed 1 millisecond.

7. Filtering:

   a) Voice Band Noise: Peak-peak voltage is ≤200 mV at 0 MHz to 20 MHz and normal output voltage.

   b) Wide Band Noise: Wideband noise voltage is ≤50 mV at 3.4 kHz to 150 kHz and ≤20 mV at 0.15 MHz to 30 MHz.

1.5.2 AC Input Ratings

1. Voltage: Nominal (UL rating) 100 VAC to 250 VAC, 50 Hz / 60 Hz, with an operating range of 85 VAC to 300 VAC. The rated input voltage is 220 VAC. Acceptable input frequency range is 45 Hz to 65 Hz.

   Permitted Variation: 85 VAC to 300 VAC.

2. Harmonic Content (THD): Meets EN61000-3-2. ≤5% from 50% to 100% of rated output current at 220 VAC to 240 VAC.

3. Inrush Current: Peak does not exceed 1.5 times of the peak value of the maximum steady-state input current at full load.

4. Typical Input Data: 50 Hz input.

   a) Refer to Table 1.4.

   b) Maximum Input Current: Refer to Table 1.5.

   c) Efficiency Curve: Refer to Figure 1.4.

5. Typical Input Data: 60 Hz input.

   a) Refer to Table 1.6.

   b) Maximum Input Current: Refer to Table 1.7.

   c) Efficiency Curve: Refer to Figure 1.5.

Table 1.4 Typical Input Data with 50 Hz Input

Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Power Factor	Efficiency %	Heat Dissipation BTU/Hr
120	0	0.387	46.65	16.93			57.765
	25	4.233	507.03	504.05	0.994	93.60	110.108
	50	8.364	999.04	996.08	0.997	94.99	170.283
	75	12.647	1505.74	1501.70	0.997	94.71	271.073
	100	--	--	--	--	--	--
220	0	0.622	137.00	17.33	0.231	--	59.130
	25	2.319	510.03	500.44	0.981	94.39	95.742
	50	4.509	991.15	984.13	0.993	96.18	128.121
	75	6.740	1480.05	1474.08	0.996	96.47	177.674
	100	9.793	2147.70	2143.99	0.998	96.10	285.552
240	0	0.673	16.16	17.14	0.106	--	58.482
	25	2.146	515.05	500.64	0.972	94.23	98.527
	50	4.143	993.62	983.46	0.990	96.27	125.191
	75	6.184	1481.90	1473.96	0.995	96.55	173.689
	100	8.971	2147.12	2141.83	0.998	96.23	275.432

NOTE! *At 100% of full load with output at 54.2V as measured at the output terminals.*

Table 1.5 Maximum Input Current with 50 Hz Input

Nominal Input Voltage	Input Voltage	Input Current (Amperes)
100 VAC to 250 VAC	176 VAC	12

NOTE! *At 100% of full load with output at 54.2V as measured at the output terminals.*

Table 1.6 Typical Input Data with 60 Hz Input

Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Power Factor	Efficiency %	Heat Dissipation BTU/Hr
120	0	0.448	53.80	16.90	0.314	--	--
	25	4.234	507.12	503.98	0.994	93.54	111.048
	50	8.365	999.10	996.14	0.997	94.99	170.446
	75	12.644	1505.31	1501.07	0.997	94.74	269.287
	100	--	--	--	--	--	--
220	0	0.757	166.83	29.66	0.170	--	101.207
	25	2.338	514.04	500.56	0.973	94.41	95.474
	50	4.519	993.32	984.16	0.991	96.19	128.056
	75	6.748	1481.92	1474.51	0.995	96.46	178.062
	100	9.806	2150.63	2146.230	0.998	96.17	280.356
240	0	0.804	193.16	17.36	0.089	--	59.232
	25	2.171	521.01	500.32	0.960	94.28	97.719
	50	4.157	996.94	983.31	0.986	96.26	125.566
	75	6.194	1484.25	1473.47	0.993	96.53	174.424
	100	8.980	2148.920	2142.43	0.997	96.27	272.512

NOTE! *At 100% of full load with output at 54.2V as measured at the output terminals.*

Table 1.7 Maximum Input Current with 60 Hz Input

Nominal Input Voltage	Input Voltage	Input Current (Amperes)
100 VAC to 250 VAC	176 VAC	12

NOTE! *At 100% of full load with output at 54.2V as measured at the output terminals.*

Figure 1.4 Efficiency Curve (@ 220 VAC, 50 Hz)

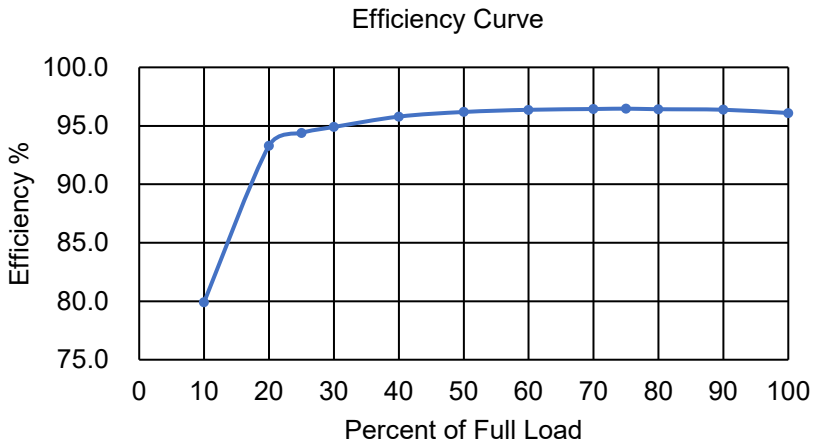
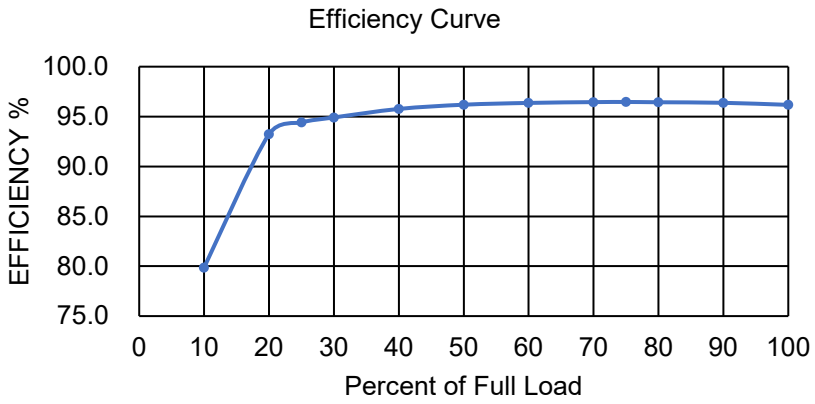


Figure 1.5 Efficiency Curve (@ 220 VAC, 60 Hz)



1.5.3 Environmental Ratings (Rectifier Only)

1. Operating Ambient Temperature Range:
   a) Without Solar Load: -40 °C (-40 °F) to +55 °C (+131 °F) with full power performance.
   b) With Solar Load: -40 °C (-40 °F) to +49 °C (+120 °F) with full power performance (GR-487 compliant).
   c) +55 °C (+131 °F) to +75 °C (+167 °F) with derating output.
   d) Output Regulation Temperature Coefficient: ±0.02% per degrees Celsius.
2. Storage Ambient Temperature Range: -25 °C (-13 °F) to +55 °C (+131 °F).
3. Relative Humidity: This rectifier is capable of operating in an ambient relative humidity range of 0% to 100%.
4. Altitude: 3000 m (9842 feet). Derating operating ambient temperature range by 3 °C per 300 m above 3000 m.
5. Surge Protection: EN61000-4-5 up to level 4, Telcordia GR-1089-Core issue 7:2017, IEEE C62.41-1999, B3.

   AC Power Terminals:

Test Level		Source Impedance	Performance Criteria
Line to Line	Line to Ground		
± 4 kV	± 4 kV	2 ohms	B
NA	± 6 kV	12 ohms	B

AC Power Port, Diff Mode and Common Mode (2 ohms impedance):

Minimum Peak Voltage (volts)	Voltage Maximum Rise/Minimum Decay Time (μs)	Minimum Peak Current per Conductor (amperes)	Current Maximum Rise/Minimum Decay Time (μs)	Repetitions, each Polarity
± 6000	1.2/50	3000	8/20	5

Criteria:
The EUT (Equipment Under Test) shall not be damaged and shall continue to operate properly after the application of the first-level surge.
The rectifier will be designed to fulfill ANSI IEEE, C62.41-1999, B3.
The test wave is 1.2/50us and 8/20us mixed 6kV/3kA.

DC Power Terminals:

Test Level		Source Impedance	Performance Criteria
Line to Line	Line to Ground		
± 500 V	± 500 V	2 ohms	B
± 800 V	± 800 V	2 ohms	B

The test method is described in EN 61000-4-5. In this test the DC-cables shall be 5 m long.

DC Power Port, Common Mode (12 ohms impedance):

Minimum Peak Voltage (volts)	Voltage Maximum Rise/Minimum Decay Time (μs)	Minimum Peak Current per Conductor (amperes)	Current Maximum Rise/Minimum Decay Time (μs)	Repetitions, each Polarity
± 1000	1.2/50	\	8/20	5

The EUT (Equipment Under Test) shall not be damaged and shall continue to operate properly after the application of the first-level surge.

6. Single Rectifier Audible Noise: At 25 °C ≤42 dB(A). Measurement made at 0.6 m distance in front of rectifier and at the center of the rectifier.
7. Overvoltage Category (per IEC/UL62368-1): III
8. Power Distribution System: TN/TT/IT
9. EMI/RFI Suppression:
   a) The rectifier conforms to the requirements of FCC rules Part 15, Class B for radiated and input conducted emissions limits.
   b) The rectifier conforms to the requirements of European Norm, EN55022, Class B for radiated and input conducted emissions limits.
10. Pollution Degree: Degree 3, as per UL/ IEC/EN62368-1.

1.5.4 Compliance Information (Rectifier Only)

1. EMC: ETSI EN 300 386, FCC CFR 47 Part 15 Class B, Telcordia GR-1089-CORE issue 7:2017.
2. EMI Load Range: 10% to 100%.
3. Safety: IEC62368-1, UL62368-1, CSA-C22.2 NO. 62368-1.
4. Compliant to EN 61000-6-2, Radiated Immunity of 10V/meter, Criteria A.
5. Designed to meet all applicable sections of NEC 2020 (NFPA 70) code as installed.
6. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
7. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

   - Reorient or relocate the receiving antenna.
   - Increase the separation between the equipment and receiver.
   - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
   - Consult the dealer or an experienced radio/TV technician for help.

1.5.5 Standard Features

1. Type of Power Conversion Circuit: High efficiency and high switching frequency.
2. Input Protection:

   a) Input Over/Under Voltage Protection: The rectifier will shut down at low or high voltage input; based on the following voltage levels:

      Low Voltage Disable Point: 80 VAC, ±5 V; hysteresis is at least 15 VAC for restart.

      High Voltage Disable Point: 305 VAC, ±5 V; hysteresis is at least 10 VAC for restart.

3. Output Protection:

   a) Overload / Reverse Current: The rectifier has four (4) fuses in the negative output DC bus. These fuses are customer replaceable.

   b) Output Current Limiting: The rectifier has a current limit function. The current limit point is factory set at 41.7 A. The current limit accuracy is ±1.5 A when the output voltage is in the range of 42 VDC to 58 VDC.

   c) Advanced Current Limit Function: The rectifier has an enhanced non settable current limit function. When a short circuit occurs at the rectifier output terminals, the rectifier will limit the current to 34.5 A. This function effectively protects the rectifier and the equipment connected to the rectifier. When the short circuit is cleared, the rectifier will automatically restore back to normal operation.

d) High Voltage Shutdown:

- Fixed Control: If rectifier output voltage exceeds 59.5 VDC, the rectifier shuts down.

  The rectifier then restarts and a HVSD restart timer starts (factory set at 5 minutes). If output voltage again exceeds the high voltage shutdown value before the HVSD restart timer expires, the rectifier shuts down and locks out. Manual restart is then required (by turning power to the rectifier off, waiting 30 seconds or more, then turning power to the rectifier on). If the rectifier does not experience a high voltage condition before the HVSD restart timer expires, the restart circuit is reset.

4. Over-Temperature Protection: The rectifier provides over temperature protection by derating output power and recovers automatically.

5. Monitoring Function: The rectifier has a built-in advanced DSP that monitors and controls the operation of the rectifier.

6. Controller: The controller is accessed via Bluetooth Low Energy (BLE). Bluetooth is default DISABLED and must be turned on via an internal jumper located under the customer access front panel. If the jumper is turned from OFF to ON, then Bluetooth can be accessed via a Vertiv™ NetSure™ app download (iOS and Android smartphones supported). The controller has a left-hand side mounted BT antenna internal to the rectifier shell that broadcasts through a plastic window. The Bluetooth allows ADMIN rights for setting changes. The controller also controls the three LED lights on the left-hand side of the unit.

1.5.6 Mechanical Specifications

Dimensions, Weight, Color

See Figure 1.6.

Indicators

The following indicators are located behind a clear plastic window on the left-hand side of the rectifier.

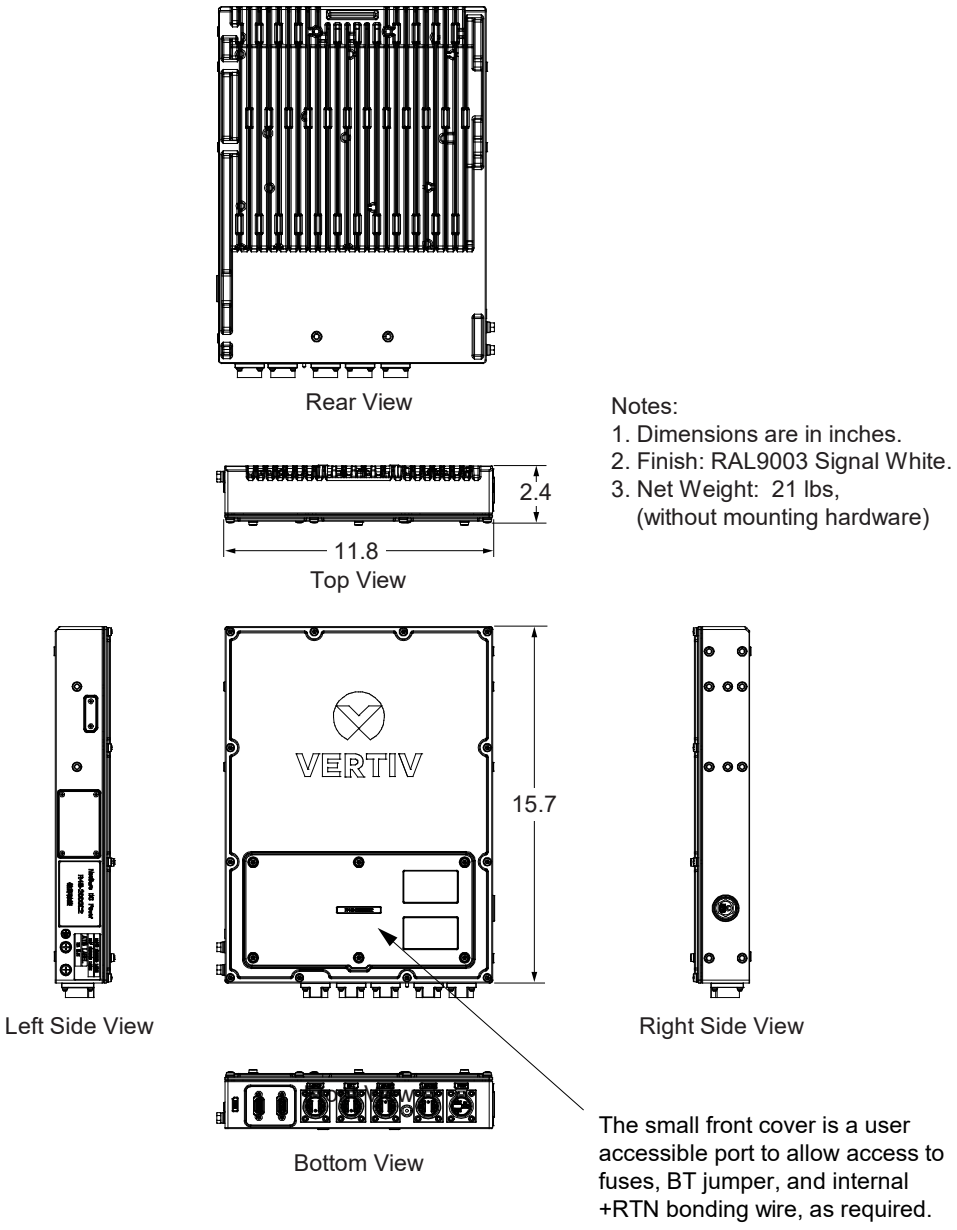
- Status (Green LED)
- Observation Alarm (Yellow LED)
- Critical or Major Alarm (Red LED)

Bluetooth Low Energy (BLE) Signal Window

The Bluetooth Low Energy (BLE) signal window is located on left-hand side of rectifier.

NOTE! *Do not block during installation. The BLE (if enabled) has limited broadcast range of approximately 10 meters (32.8 feet), maximum. Positioning the smartphone with line of sight to the BLE signal window is recommended, if possible.*

Figure 1.6 Rectifier Overall Dimensions and Weight



2 Bluetooth Jumper Setup

2.1 Setting Bluetooth Jumper Position

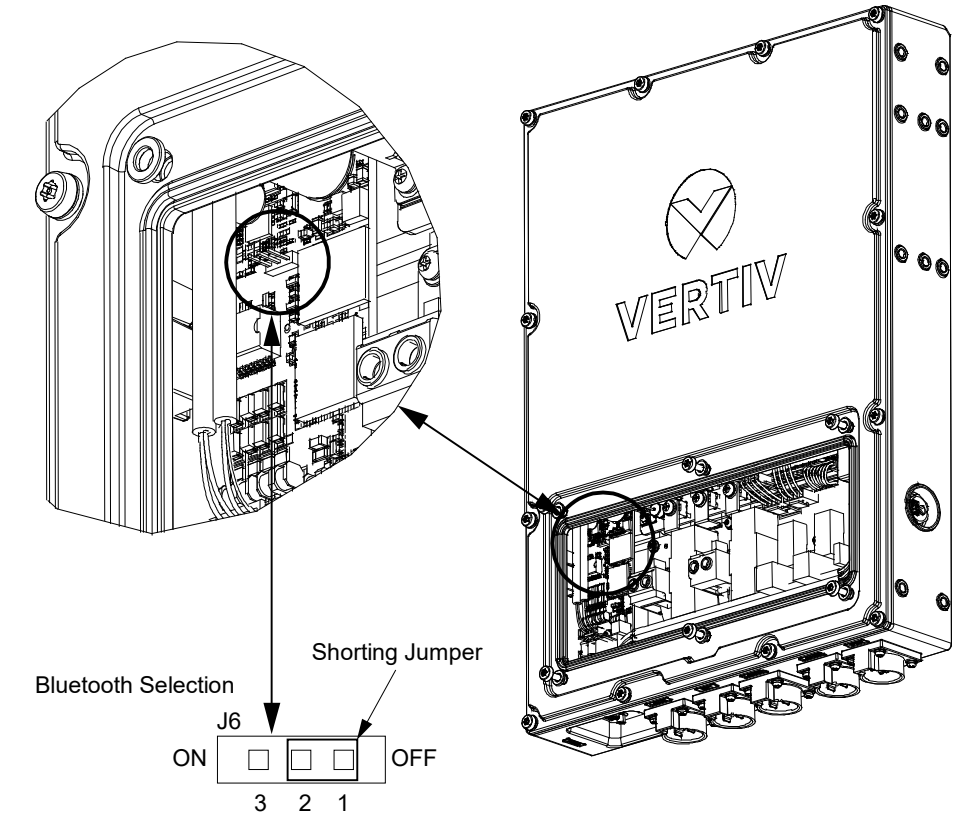
DANGER! Hazardous voltages are exposed when the cover is opened, and power is applied to the unit.

The rectifier can be connected to remotely via an App. This connection is done through a Bluetooth Low Energy (BLE) signal. Bluetooth in the rectifier is turned ON or OFF via a jumper selection inside the rectifier enclosure. Refer to the following procedure to turn Bluetooth in the rectifier ON or OFF.

Procedure

1. Refer to “Opening / Closing the Front Access Panel” on page 37, and open the rectifier enclosure front access panel.
2. Refer to Figure 2.1 and set the Bluetooth ON or OFF, as desired. **Bluetooth is OFF by default.**
   - Bluetooth ON: Jumper is placed between terminals 2 and 3 of J6.
   - Bluetooth OFF: Jumper is placed between terminals 1 and 2 of J6.
3. Refer to “Opening / Closing the Front Access Panel” on page 37, and close the rectifier enclosure front access panel.

Figure 2.1 Controller Bluetooth Jumper Setting



3 Installation

3.1 General

WARNING! Rectifier warranty will be VOID if any perimeter screw is tampered with. DO NOT loosen or remove any perimeter screw. Removal of outer perimeter screws is a safety hazard.

CAUTION! The rectifier must be installed to provide a separation distance of at least 8-inches from all persons.

SAFETY! Follow all safety rules as they pertain to applicable OSHA (CCOHS in Canada), state, local, customer, and installation company safety practices.

NOTE! *If the rectifier's front access panel is opened during installation, ensure the access panel is securely closed and the screws are torqued to 22 in-lbs.*

The rectifier can be pole mounted or secured to a suitable wall.

3.2 Tools, Test Equipment, and Materials Recommended for Installation

Refer to Table 3.1 for a list of tools, test equipment, and materials recommended for the installation of the system.

Table 3.1 Tools, Test Equipment, and Materials Recommended for Installation

Tool	Specification
Combination Wrench	Wrench Set (10#, 13#, 16#, 18#, 21#)
Hex Wrenches	7/16" and 3/8"
Hex Allen Key Wrench	M6 (for M8 screw head)
Metric Wrenches	10 mm and 13 mm
Electrician Diagonal Pliers	6-Inch
Electrician Sharp Nose Pliers	6-Inch
Tape Measure	16-Feet
Level	Normal Type
Ladder	As Required
Lifting Equipment	As Required
Lifting Sling	As Required
Torque Wrench	As Required
Insulated Screwdriver Set	#1, #2 Cross Blade Screwdriver, Small and Medium Slotted Blade Screwdriver
Non-Contact Voltage Tester	--
Wire Stripper	Maximum 6 AWG
Crimping Tools	Maximum 6 AWG
Digital Multimeter	Three-and-a-Half-Bit Digital Display
Impact Electric Drill	As Required
ESD Wrist Strap	--
Bluetooth	Requires Smartphone (iPhone or Android) and download of Vertiv™ NetSure™ app for communication.
Ground Lugs (6 AWG recommended)	2-Hole Ground Lug, Rectifier (5/16" clearance holes on 1" centers.)

3.3 Mounting Kit

3.3.1 Kit Requirements per Application

See Table 3.2.

Table 3.2 Kit Requirements per Application

Application	Pole or Wall Mount Flat	Pole or Wall Mount Flag
Rectifier Only	P/N 10024600	P/N 10024600

3.3.2 Rectifier Mounting Kit P/N 10024600

General

A rectifier mounting kit P/N 10024600 is furnished with each rectifier. This kit allows the rectifier to be mounted to a pole or wall in either a “flag” or “flat” orientation.

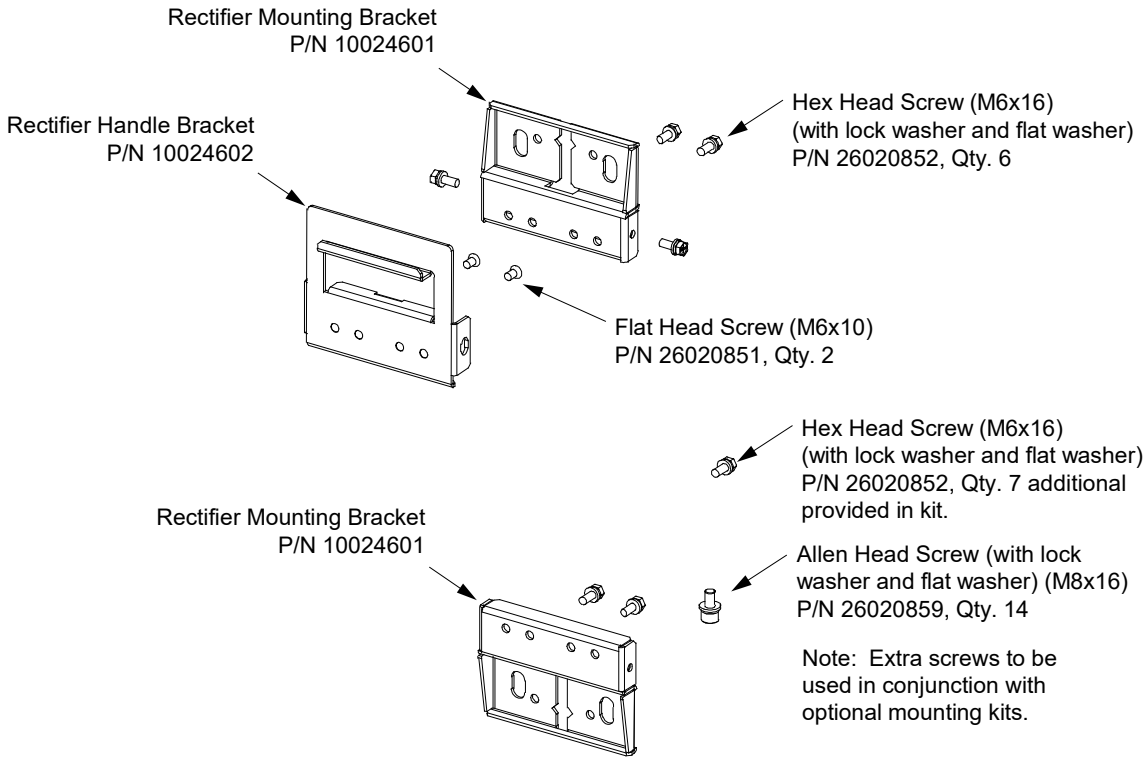
Kit Contents

Table 3.3 lists the items furnished as a part of this kit. See also Figure 3.1.

Table 3.3 Rectifier Mounting Kit P/N 10024600 Contents

P/N	Description	Qty.
10024601	Rectifier Mounting Bracket	2
10024602	Rectifier Handle Bracket	1
26020851	Flat Head Screw (M6x10)	2
26020852	Hex Head Screw (with lock washer and flat washer) (M6x16)	13
26020859	Allen Head Screw (with lock washer and flat washer) (M8x16)	14

Figure 3.1 Rectifier Mounting Kit P/N 10024600



3.4 Mounting the Rectifier to a Pole or Wall Using Mounting Kit P/N 10024600

3.4.1 General

A rectifier mounting kit P/N 10024600 is furnished with each rectifier. This kit allows the rectifier to be mounted to a pole or wall in either a “flag” or “flat” orientation. See “Rectifier Mounting Kit P/N 10024600” on page 15.

- For pole mounting, the customer needs to supply either…
  - two (2) 1/2” diameter carriage bolts or threaded rods or,
  - two (2) pole mounting bands (3/4-inch wide, stainless steel, suitable for greater than 100 lbs of support, 0.030-inch thick).
- For wall mounting, the customer needs to supply four (4) 3/8” wall anchors capable of supporting the weight of the rectifier.

NOTE! *If the rectifier’s front access panel is opened during installation, ensure the access panel is securely closed and the screws are torqued to 22 in-lbs.*

3.4.2 Pole / Wall Mounting Procedure

NOTE! *Torque all hardware to the values shown in the illustrations.*

1. Unpack the rectifier and mounting accessories.
2. Wall Mount: Drill appropriately sized holes into the wall for installation of customer provided 3/8” wall anchors. See Figure 3.2 for dimensions. Install the customer provided 3/8” wall anchors into the holes previously drilled.

3. Wall Mount: Install the top rectifier mounting bracket to the wall using the previously installed wall anchors. Refer to Figure 3.2. Torque per anchor manufacturer specifications.

   Pole Mount: Install the top rectifier mounting bracket to the pole in the desired location. Install with either a customer supplied 1/2" carriage bolt or threaded rod, or a pole mount band (see "3.4.1 General" on page 16). Refer to Figure 3.3. If using a 1/2" carriage bolt or threaded rod, refer to Figure 3.3 and drill the two (2) appropriate holes in the pole.

4. Install the rectifier handle bracket and rectifier mounting bracket to the rear or side panel of the rectifier using supplied hardware as shown in Figure 3.4. Install the strain relief plate to the rectifier using supplied hardware as shown in Figure 3.4. Note that the rectifier can be mounted "flag" or "flat" on a pole or wall.

5. Lift the rectifier up using the rectifier handle bracket (previously installed on the rectifier) and slide the rectifier handle bracket down into the rectifier mounting bracket (previously installed on the pole or wall). Note that there are tabs on the rectifier handle bracket that slide down into slots on the rectifier mounting bracket. Secure the rectifier handle bracket to the rectifier mounting bracket with the supplied hardware as shown in Figure 3.5.

6. Wall Mount: Secure the bottom of the rectifier to the wall using the previously installed wall anchors. Refer to Figure 3.6. Torque per anchor manufacturer specifications.

   Pole Mount: Secure the bottom of the rectifier to the pole with either a customer supplied 1/2" carriage bolt or threaded rod, or a pole mount band (see "3.4.1 General" on page 16) as shown in Figure 3.6.

Figure 3.2 Installing the Top Mounting Bracket to a Wall

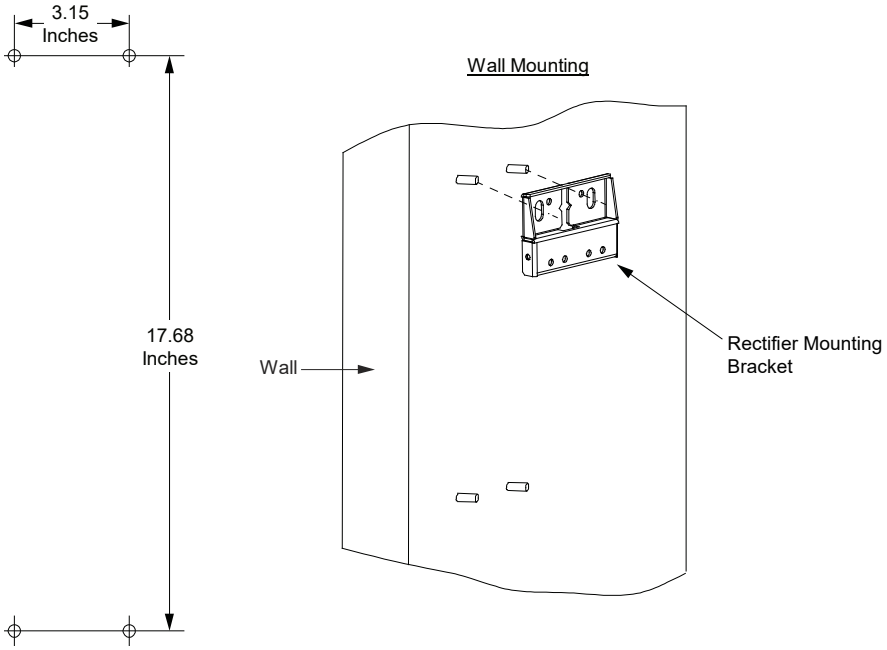


Figure 3.3 Installing the Top Mount Bracket to a Pole

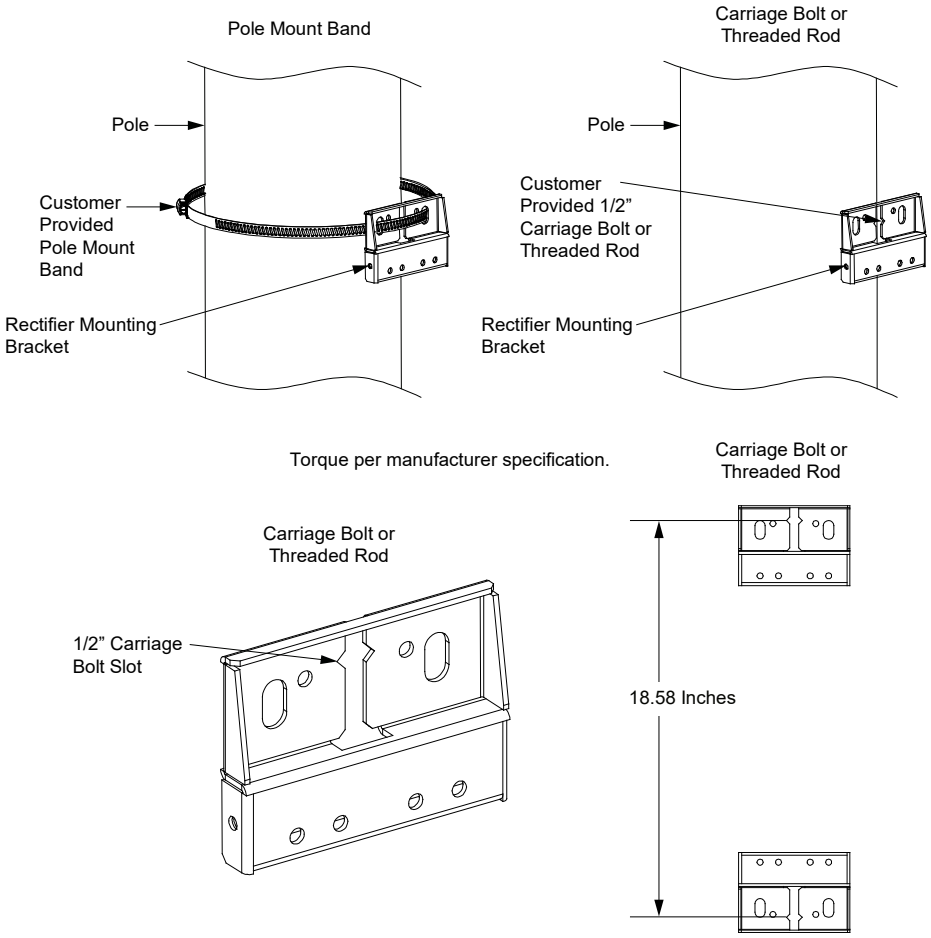


Figure 3.4 Installing the Top and Bottom Mounting Brackets and Strain Relief Plate to the Rectifier (cont'd on next page)

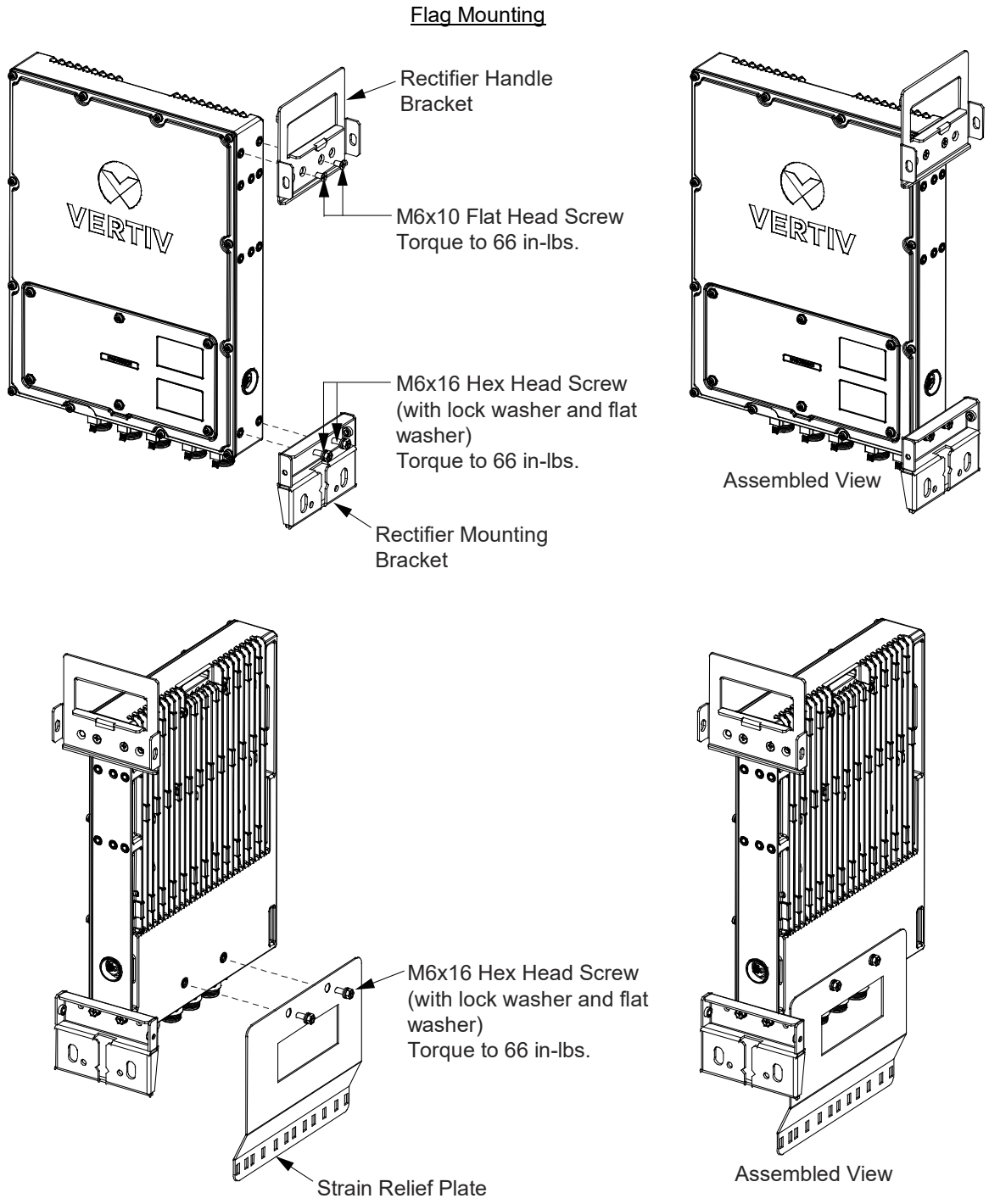


Figure 3.4 Installing the Top and Bottom Mounting Brackets and Strain Relief Plate to the Rectifier (cont'd from previous page)

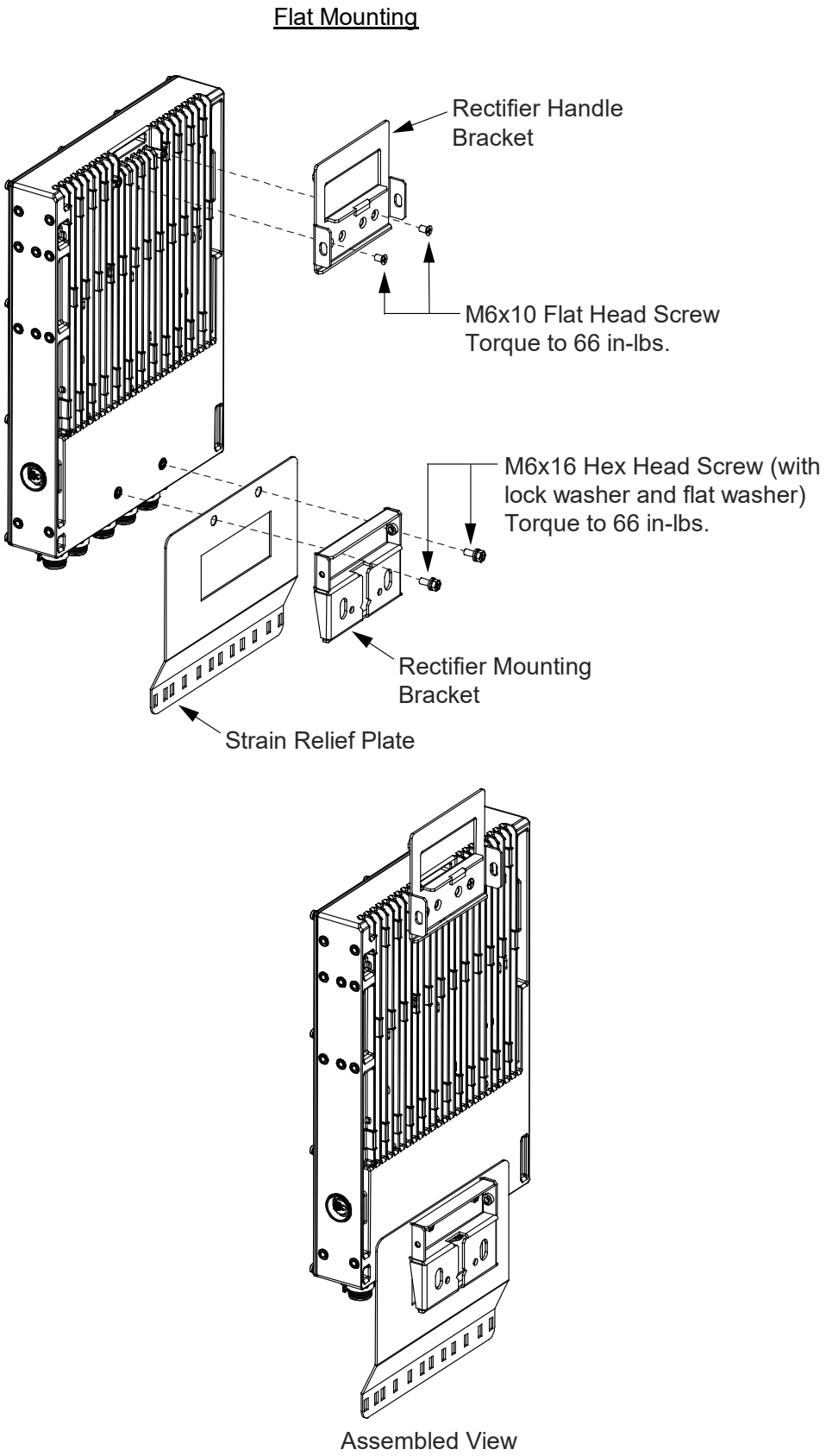


Figure 3.5 Securing the Rectifier to the Pole at the Top (Pole Mounting Shown, Wall Mounting Similar)

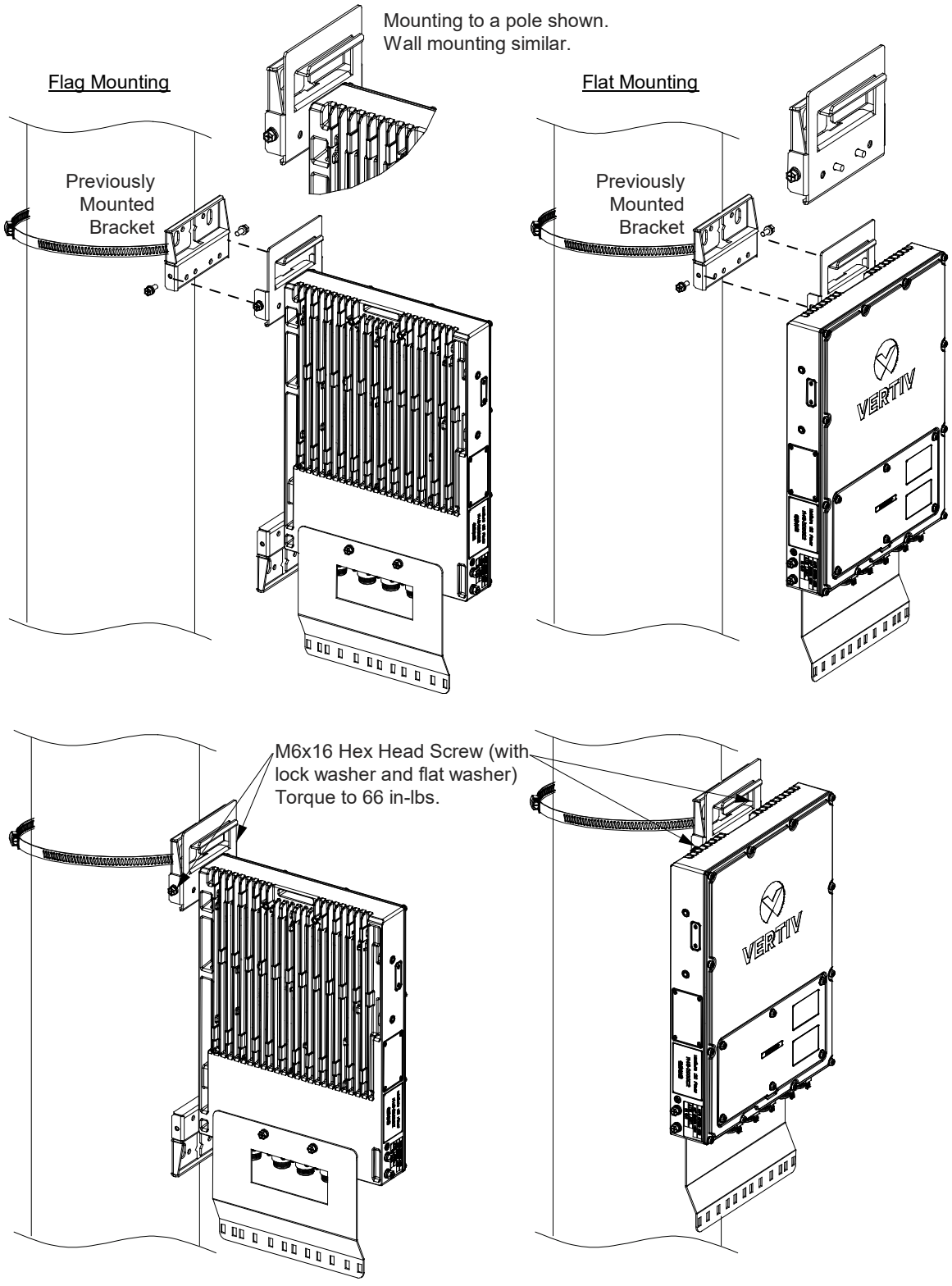
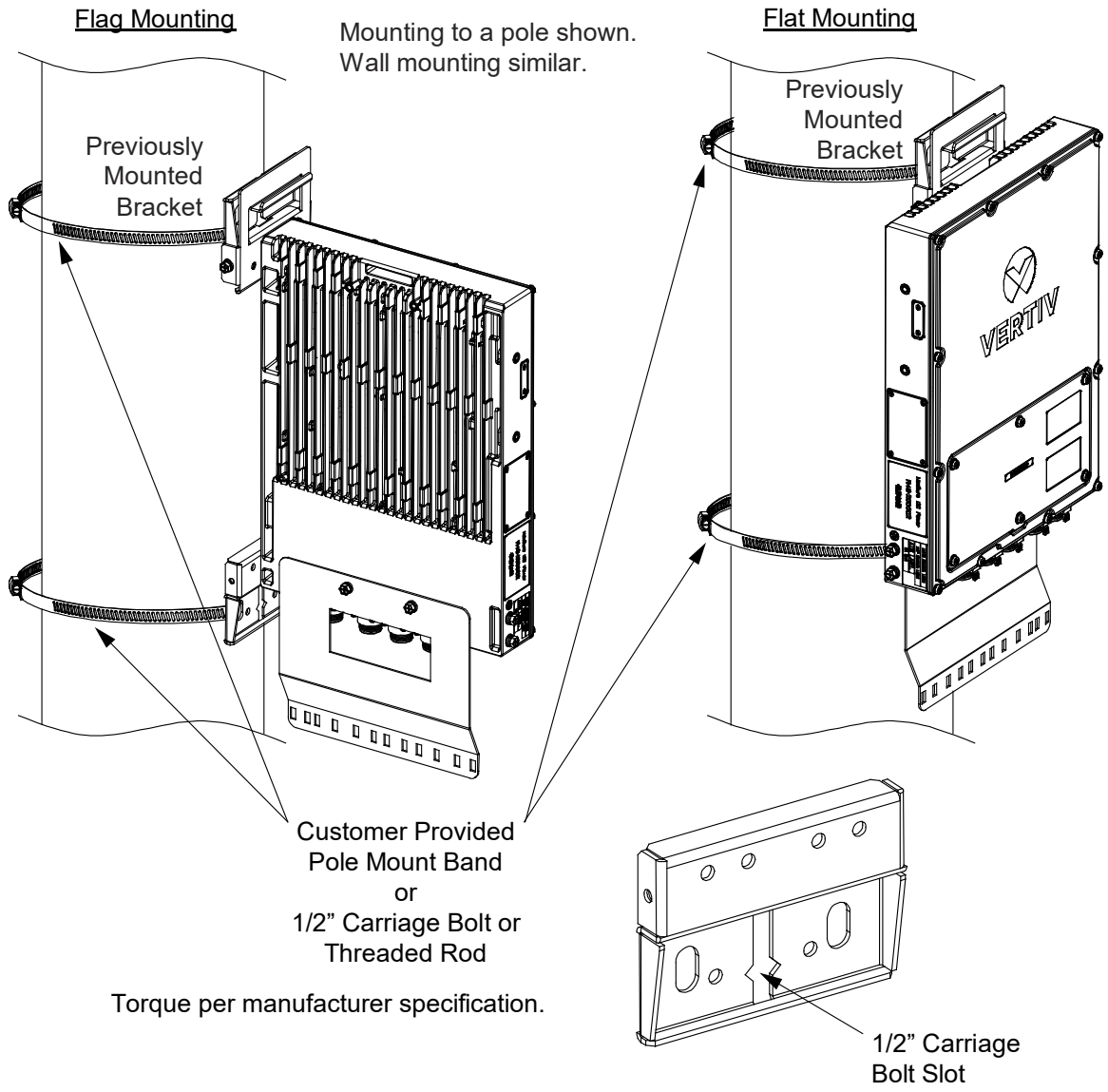


Figure 3.6 Securing the Rectifier to the Pole at the Bottom (Pole Mounting Shown, Wall Mounting Similar)



4 Making Electrical Connections

4.1 Important Safety Instructions

DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

ALERT! Wear an ESD wrist strap (see “Static Warning” on page viii).

WARNING! Rectifier warranty will be VOID if any perimeter screw is tampered with. DO NOT loosen or remove any perimeter screw. Removal of outer perimeter screws is a safety hazard.

NOTE! *If the rectifier’s front access panel is opened during installation, ensure the access panel is securely closed and the screws are torqued to 22 in-lbs. See Figure 6.3 on page 38.*

4.2 Wiring Considerations

All wiring and branch circuit protection should follow the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA 70) National Electrical Code (NEC), and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.

4.3 Electrical Connections Location Diagram

Electrical connections are made using separately ordered cable assemblies. One end of these cable assemblies contains a mating plug to the connector located on the bottom panel of the rectifier. Refer to Figure 4.1 for an electrical connection location diagram.

Figure 4.1 Electrical Connection Location Diagram

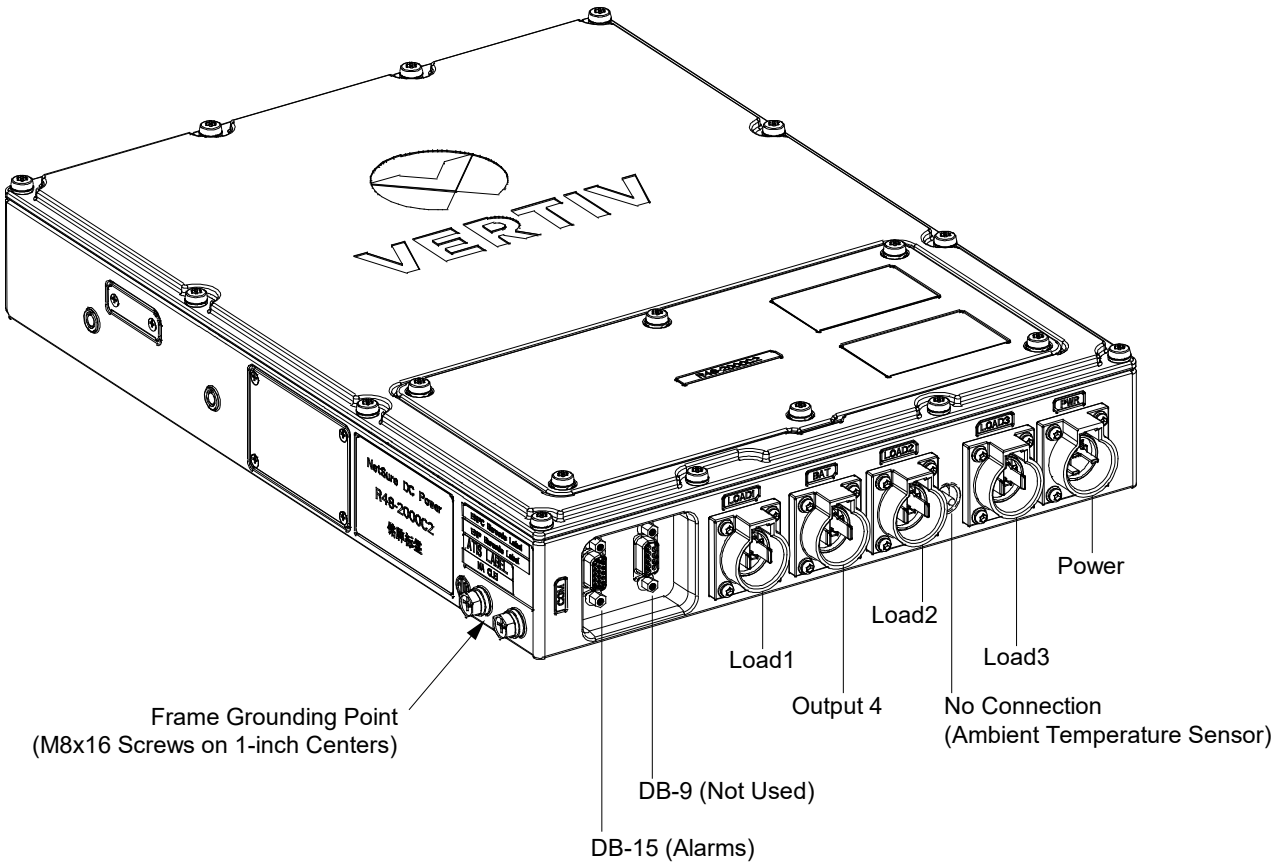


Figure 4.1 Rectifier Ground Connection

4.3.1 General

For grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

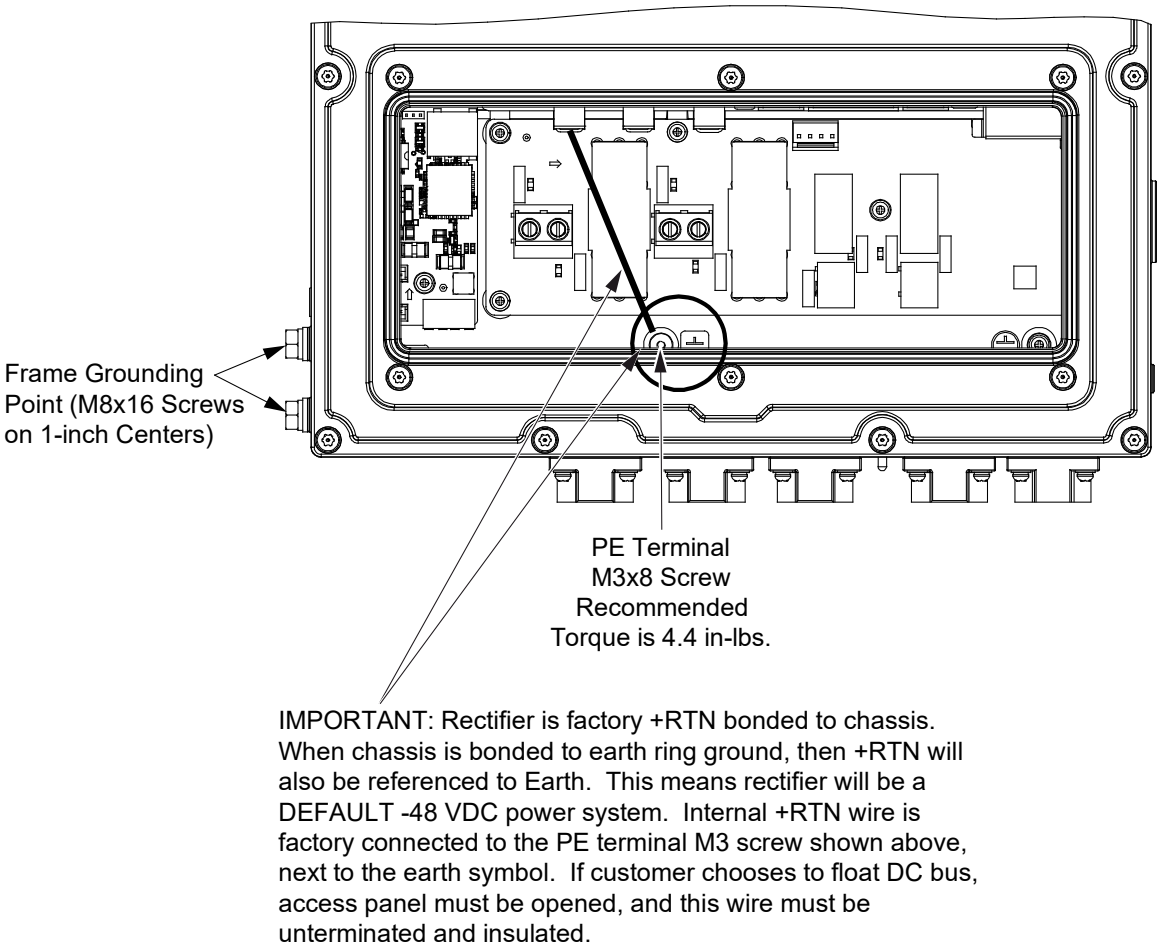
4.3.2 Positive Grounding

As default, the power system is positive grounded. The Return (+) Bar of the power system is factory default connected to the chassis PE terminal. If customer chooses to float the DC bus, perform the following procedure.

Procedure

1. Refer to "Opening / Closing the Front Access Panel" on page 37, and open the rectifier enclosure front access panel.
2. Locate the cable connected to the Return (+) Bar that is secured to the chassis PE terminal shown in Figure 4.2. Remove the cable from the chassis PE terminal and insulate and tie back the unconnected end.
3. Refer to "Opening / Closing the Front Access Panel" on page 37, and close the rectifier enclosure front access panel.

Figure 4.2 Configuring Rectifier Grounding



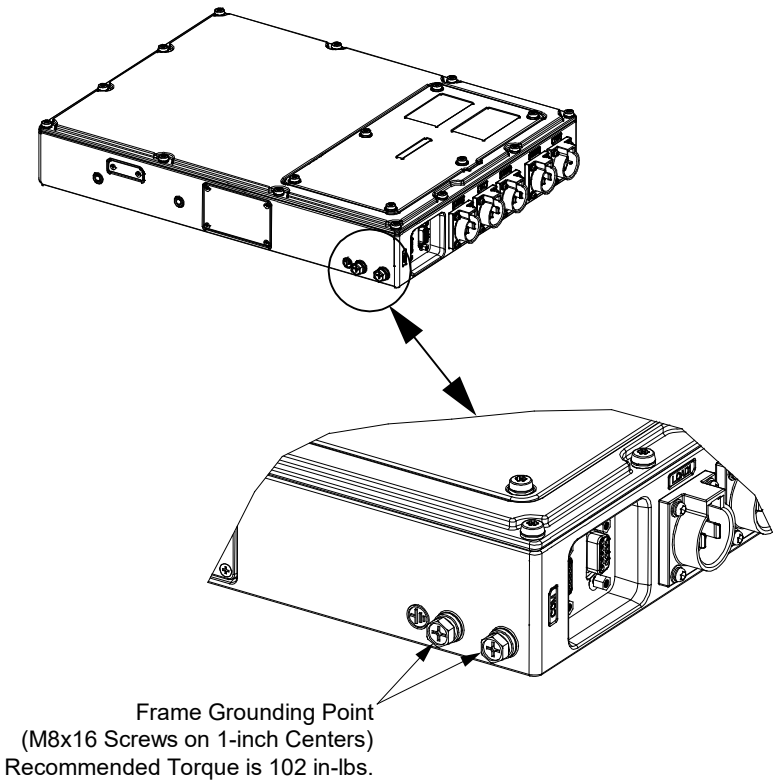
4.3.3 Rectifier Frame Grounding

Two (2) M8x16 screws are located on the rectifier left side panel for installation of a customer furnished frame ground lug. Screws are spaced on 1-inch centers.

Procedure

1. Connect the rectifier chassis to the site grounding point with a two-hole lug. Lug should be crimped per lug manufacturer's specifications. Refer to Figure 4.3 for location and recommended torque.

Figure 4.3 Rectifier Frame Grounding Location



4.4 Nominal 120 VAC / 208 VAC / 240 VAC Input Power and AC Input Equipment Grounding Connections

ALERT! AC input power must be turned off before connecting or disconnecting the AC input plug-in connector.

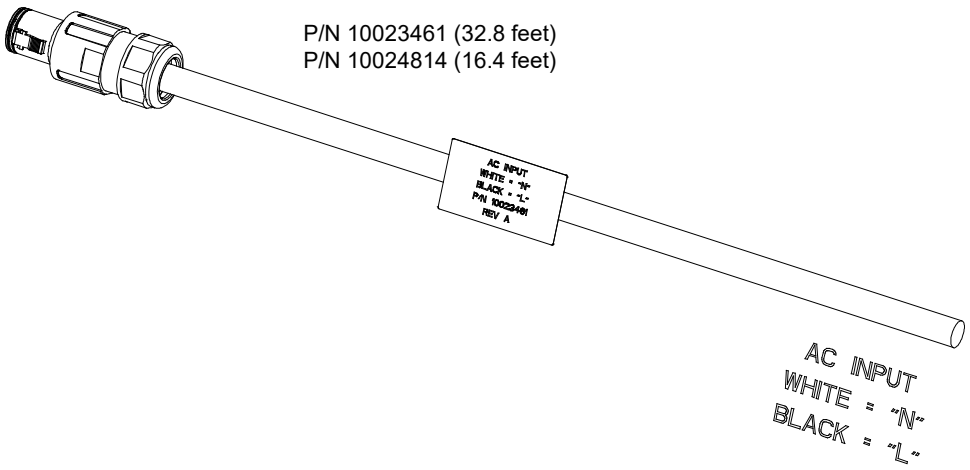
The rectifier is equipped with a plug-in AC input power connector located on the bottom of the enclosure. See Figure 4.1 for location. A separately ordered AC input power cable assembly with a mating plug is required (refer to Figure 4.4). See also “Pre-Assembled Cables” on page 2.

- This rectifier requires an external AC input branch circuit protective device rated for 15 A.
  - Assuming 208 VAC or 240 VAC Nominal Input: 15 A, 2-pole.
  - Assuming 120 VAC Nominal Input: 15 A, 1-pole (120 VAC results in reduced power output).

Procedure

1. Connect the separately ordered AC input power cable assembly to the AC input power source as shown in Figure 4.4. Connect the green lead to Ground. Connect the white lead to Neutral (or Line 2 if bi-phase). Connect the black lead to Line (or Line 1 if bi-phase).

Figure 4.4 Mating AC Input Power Cable Assembly P/N 10023461 and P/N 10024814 (AC Input Power Connector)



4.5 -48 VDC Output Load Connections

4.5.1 General

WARNING! Check for correct polarity before making connections.

ALERT! AC power must be turned off before connecting or disconnecting any DC load plug-in connector.

ALERT! 1kW and 2kW load cable connections are polarized. Only use 1kW cable into 1kW load ports. Only use 2kW cable into 2kW load port. Connector has polarizing hole (rectifier connector has mating male dimple), but connector may be damaged if forced into non-matching incorrect port.

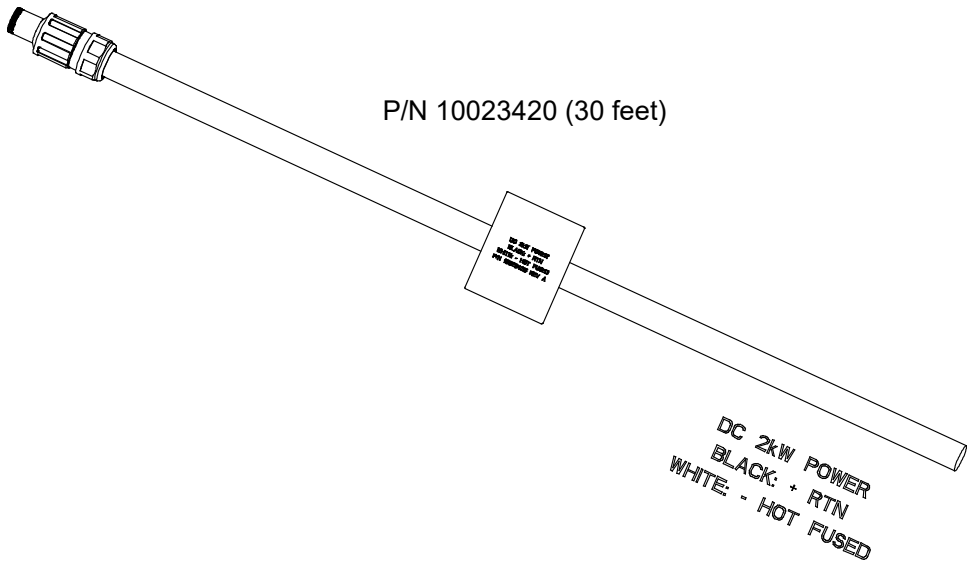
4.5.2 -48 VDC Output Load 1 and Output 4 Connections (2kW)

The rectifier is equipped with plug-in DC output Load 1 and Output 4 "bulkhead" type connectors located on the bottom of the enclosure. See Figure 4.1 for location. A separately ordered DC output cable assembly with a mating plug is required (refer to Figure 4.5). See also "Pre-Assembled Cables" on page 2.

Procedure

1. Connect the separately ordered DC output load cable to Load 1 or Output 4 (2kW) as shown in Figure 4.5. Connect the black lead to Load Return. Connect the white lead to -48 VDC Load.

Figure 4.5 Mating Load 1 / Output 4 Cable Assembly P/N 10023420 (DC Output Load1 Connector)



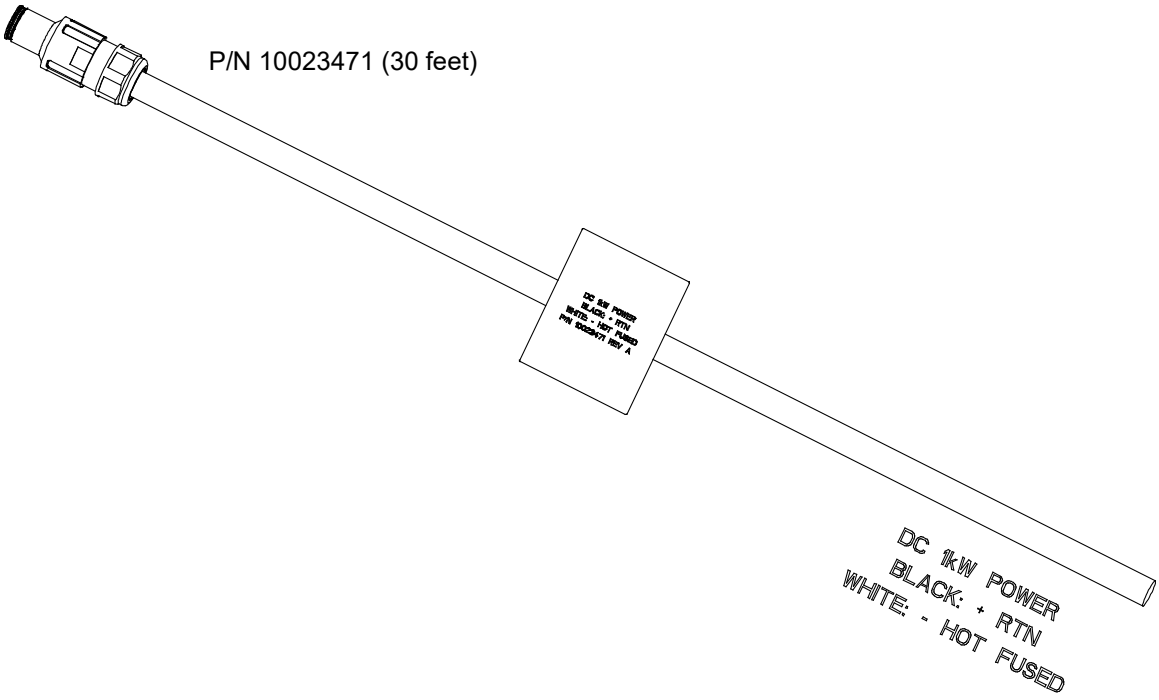
4.5.3 -48 VDC Output Load 2 and Load 3 Connections (1kW)

The rectifier is equipped with plug-in DC output Load 2 and Load 3 “bulkhead” type connectors located on the bottom of the enclosure. See Figure 4.1 for location. Separately ordered DC output cable assemblies with mating plugs are required (refer to Figure 4.6). See also “Pre-Assembled Cables” on page 2.

Procedure

1. Connect the separately ordered DC output Load 2 / Load 3 cable assemblies to Load 2 (1kW) and Load 3 (1kW) as shown in Figure 4.6. Connect the black lead to Load Return. Connect the white lead to -48 VDC Load.

Figure 4.6 Mating Load 2 / Load 3 Cable Assembly P/N 10023471 (DC Output Load 2 and Load 3 Connector)



4.6 External Alarm Connection (DB15)

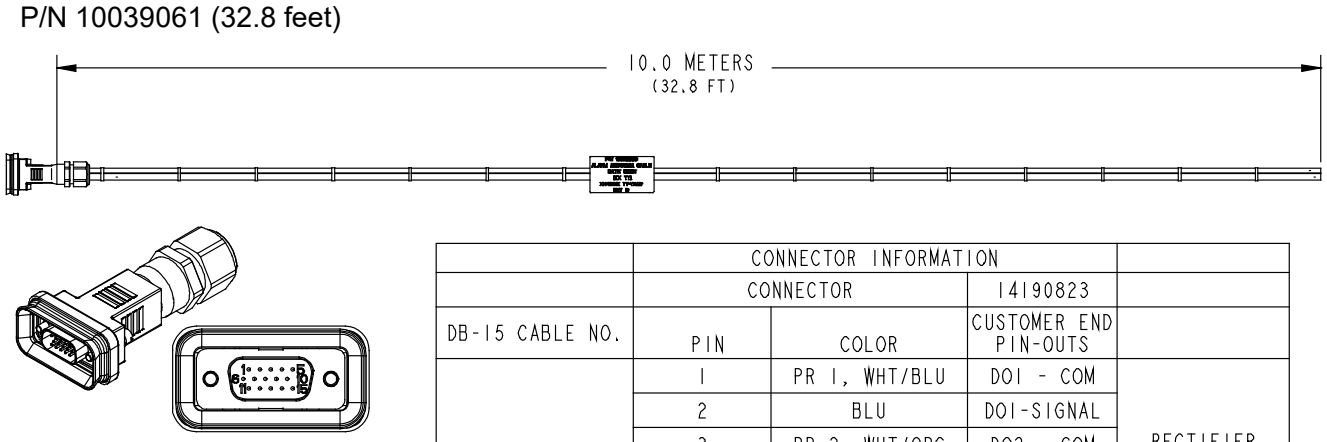
4.6.1 General

The rectifier is equipped with a plug-in external alarm connector located on the bottom of the enclosure. See Figure 4.1 for location. A separately ordered external alarm cable assembly with a mating plug is required (refer to Figure 4.7). See also “Pre-Assembled Cables” on page 2.

Procedure

1. Connect the separately ordered external alarm cable assembly to external alarm circuits as shown in Figure 4.7. See also Table 4.1 for connector pin-outs. Refer to the remainder of this section for further information.

Figure 4.7 Mating External Alarm Cable Assembly P/N 10039061 (DB15 Connector)



	CONNECTOR INFORMATION			
	CONNECTOR		14190823	
DB-15 CABLE NO.	PIN	COLOR	CUSTOMER END PIN-OUTS	
4 PAIR, DO's, UNSHIELDED	1	PR 1, WHT/BLU	DO1 - COM	RECTIFIER ALARM OUTPUTS: 1: FUSE FAIL 2: SPD FAIL 3: AC FAIL 4: RECTIF FAIL
	2	BLU	DO1-SIGNAL	
	3	PR 2, WHT/ORG	DO2 - COM	
	4	ORG	DO2-SIGNAL	
	5	PR 3, WHT/GRN	DO3 - COM	
	10	GRN	DO3-SIGNAL	
	8	PR 4, WHT/BRN	DO4 - COM	
	9	BRN	DO4-SIGNAL	

Table 4.1 DB15 Pin Definition

Pin	Signal Name	Description
1	Digital Output1+	Alarm Output
2	Digital Output 1-	
3	Digital Output 2+	
4	Digital Output 2-	
5	Digital Output 3+	
8	Digital Output 4+	
9	Digital Output 4-	
10	Digital Output 3-	

4.6.2 Rectifier Digital Output (DO) Dry Relay Contacts

Function and Operation State

Refer to Table 4.2 for rectifier digital output (DO) dry relay contacts function and operation state.

NOTE! *The contact operation can be changed by moving the jumpers for each of the connectors to the alternate location, as described in "Changing the Alarm Relay Configuration for the Digital Output (DO) Relay Functions" on page 32.*

Table 4.2 Digital Output (DO) Dry Relay Contacts

Dry Contact	Function	Jumper Connection	Dry Contact State when Alarm is Active
DO1	Fuse / Breaker Fail	JP4, short pin 1 and 2	Open
		JP4, short pin 2 and 3	Closed
DO2	SPD Alarm Fail	JP3, short pin 1 and 2	Open
		JP3, short pin 2 and 3	Closed
DO3	AC OV or AC UV	JP2, short pin 1 and 2	Open
		JP2, short pin 2 and 3	Closed
DO4	Rectifier Fail	JP1, short pin 1 and 2	Open
		JP1, short pin 2 and 3	Closed

Digital Output (DO) Relay Ratings

a) 30 VDC: 1 A resistive.

b) 125 VAC: 0.5 A resistive.

Changing the Alarm Relay Configuration for the Digital Output (DO) Relay Functions

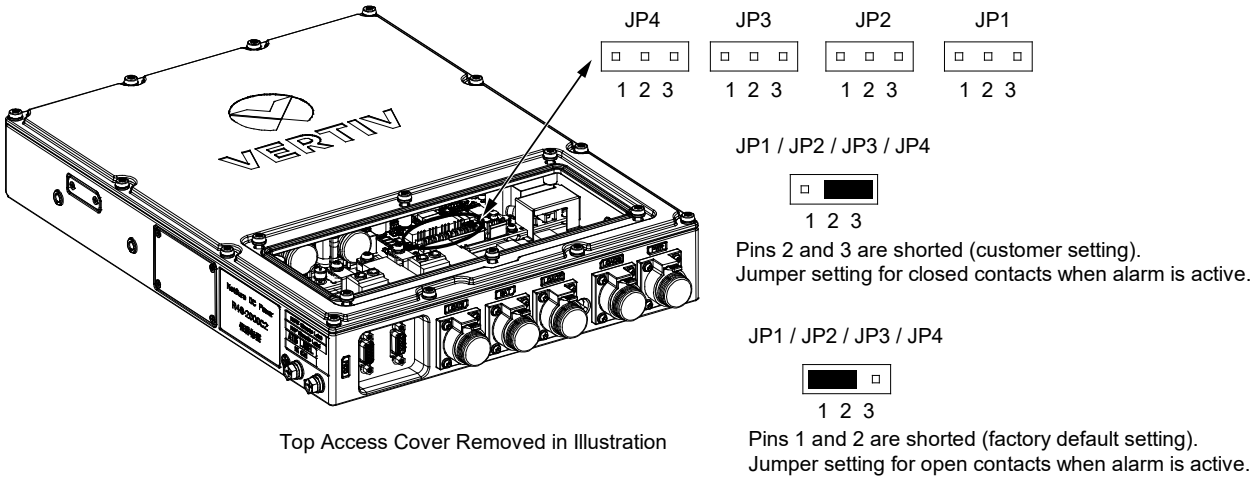
The alarm relay contact configurations can be changed. Refer to the following procedure.

Procedure

DANGER! Turn off AC input to unit before performing the following procedure.

1. Refer to “Opening / Closing the Front Access Panel” on page 37, and open the rectifier enclosure front access panel.
2. Locate jumpers JP1, JP2, JP3, and JP4. Set the jumpers per site requirements. See Table 4.2 and Figure 4.8.
3. Refer to “Opening / Closing the Front Access Panel” on page 37, and close the rectifier enclosure front access panel.

Figure 4.8: Changing Alarm Relay Configuration for Digital Output (DO) Relay Functions



4.7 Lashing of Cords and Cables

NOTE! *A strain relief plate is furnished and attached to the rectifier as outlined in the previous procedures.*

Follow all local laws and practices for installation requirements and clearances from power facilities. Installation must meet all applicable laws, ordinances, rules, and codes.

All flexible power and signal cords attached to rectifier and DC distribution boxes (if any), shall be lashed within 12-inches of the cord connection, so as not to transfer tension or pull on the physical connector termination or joint.

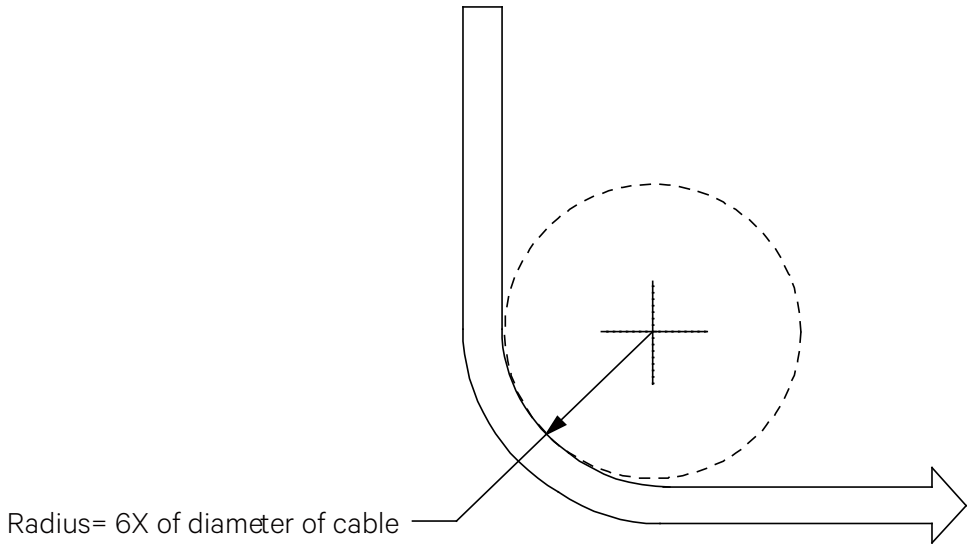
Connectors are IP65 rated when not accommodating installation cord or cable tension or pull.

At installation, use only approved outdoor rated devices and fittings, to protect all cords and cables from physical damage. Installer to use appropriate cable strain relief fittings/brackets as locally approved for pole and/or wall mounting.

Cords and cables shall be lashed and supported at intervals not exceeding 6-feet.

Vertiv recommends a minimum cable bend radius of 6X of the cable diameter. Example: 0.8-inches cable outer diameter, shall be installed using a 6 x 0.8-inches or 4.8-inches inside bend radius, minimum.

Figure 4.9 Cable Bend Radius



4.8 Final Step

If any of the connectors located on the bottom of the unit are left unused, attach the provided connector dust cover onto the unused connector.

5 Starting, Configuring, and Checking Rectifier Operation

5.1 Rectifier Start-up

Procedure

1. Make any internal rectifier jumper settings inside the rectifier as required before powering up the rectifier. This includes Bluetooth, DO alarms, and +RTN bonding.

   - Refer to “Bluetooth Jumper Setup” on page 13.
   - Refer to “Changing the Alarm Relay Configuration for the Digital Output (DO) Relay Functions” on page 32.
   - Refer to “Rectifier Ground Connection” on page 24.

2. Verify all customer side DC load output connections are properly terminated, carefully paying attention to +/- DC polarity at the output. Customer must verify DC polarity output to load before energizing rectifier.

3. Apply AC input power to the rectifier by closing the external AC input power disconnect or protective device. The rectifier starts automatically.

5.2 Checking Rectifier Status

Procedure

1. Observe the status of the local indicators (visible from the outside through a window located on the left side of the rectifier). If operating normally, the status of these is as shown in Table 5.1. See Figure 6.1 for location.

Table 5.1 Status and Alarm Indicators

Indicator	Normal State
Status (Green)	On
Observation Alarm (Yellow)	Off
Critical or Major (Red)	Off

5.3 Setting Up via Bluetooth

Refer to “Accessing the Rectifier Controller via Bluetooth” on page 39 for rectifier Bluetooth access.

5.4 Configuring the Rectifier

Required controller settings are provided in Table 5.2.

IMPORTANT NOTE! *The changes below are required to be made via Bluetooth APP settings page (shown in third column of table below).*

Table 5.2 Rectifier Controller Settings

Controller Setting	Default Settings	Required Changes in Settings	Notes
UV 1 alarm	47.5 V	49.0 V	Recommended - not required
BCL	Enable	Disable	Must be set to “Disabled” or Output 4 port will be current limited.

6 Operation

6.1 Rectifier Local Indicators

There are three (3) indicators located inside the rectifier enclosure (visible from the outside through a window located on the left side of the rectifier). See Figure 6.1 for location and Table 6.1 for indicator functions.

NOTE! *AC voltage must be present at the rectifier input terminals for indicators to be functional.*

Figure 6.1 Local Indicator Locations

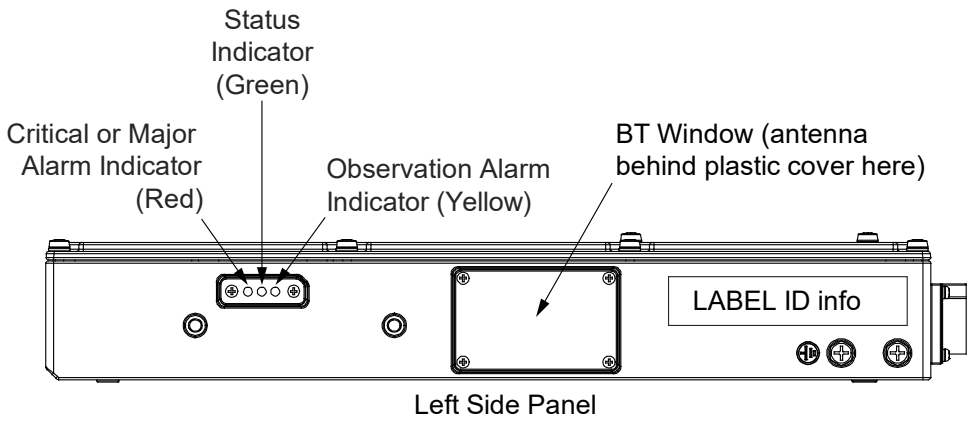


Table 6.1 Local Indicators

Indicator	Color	Normal State	Fault State	Fault Cause
Status	Green	On	Off	Non-operational power supply.
Observation Alarm	Yellow	Off	On	There is an observation alarm.
Critical or Major Alarm	Red	Off	On	There is a major or critical alarm.

NOTE! *Load sharing is not in scope in the single rectifier system.*

NOTE! *Rectifier controller software version V1.00.16 and earlier may show an Observation Alarm (OA) (yellow LED alarm indicator illuminated, see above) if powered at 120 VAC input. This alarm can be masked in later software versions by setting the AC Voltage setting (in the Setting tab of the Bluetooth App) to the 120V selection.*

6.2 Rectifier High Voltage Shutdown and Lockout Restart

Procedure

1. Remove AC input power to the rectifier. Wait 30 seconds or more (until the LEDs on the rectifier extinguish). Re-apply AC input power to the rectifier.

6.3 Opening / Closing the Front Access Panel

DANGER! Hazardous voltages are exposed when the cover is opened, and power is applied to the unit. Make sure AC power inputs are de-powered before opening the small access cover. The small panel is for customer access, but the main front cover with perimeter tamper-proof screws is NEVER INTENDED TO BE OPENED.

Refer to the following procedure to open and close the rectifier enclosure front access panel.

Procedure

1. To open, refer to the procedure in Figure 6.2. Tighten the hardware circled in the bottom view of Figure 6.2 to secure the access cover in the open position.
2. To close, refer to the procedure in Figure 6.3. Ensure the access panel is securely closed and the screws are torqued to 22 in-lbs.

Figure 6.2 Opening the Rectifier Enclosure Front Access Cover

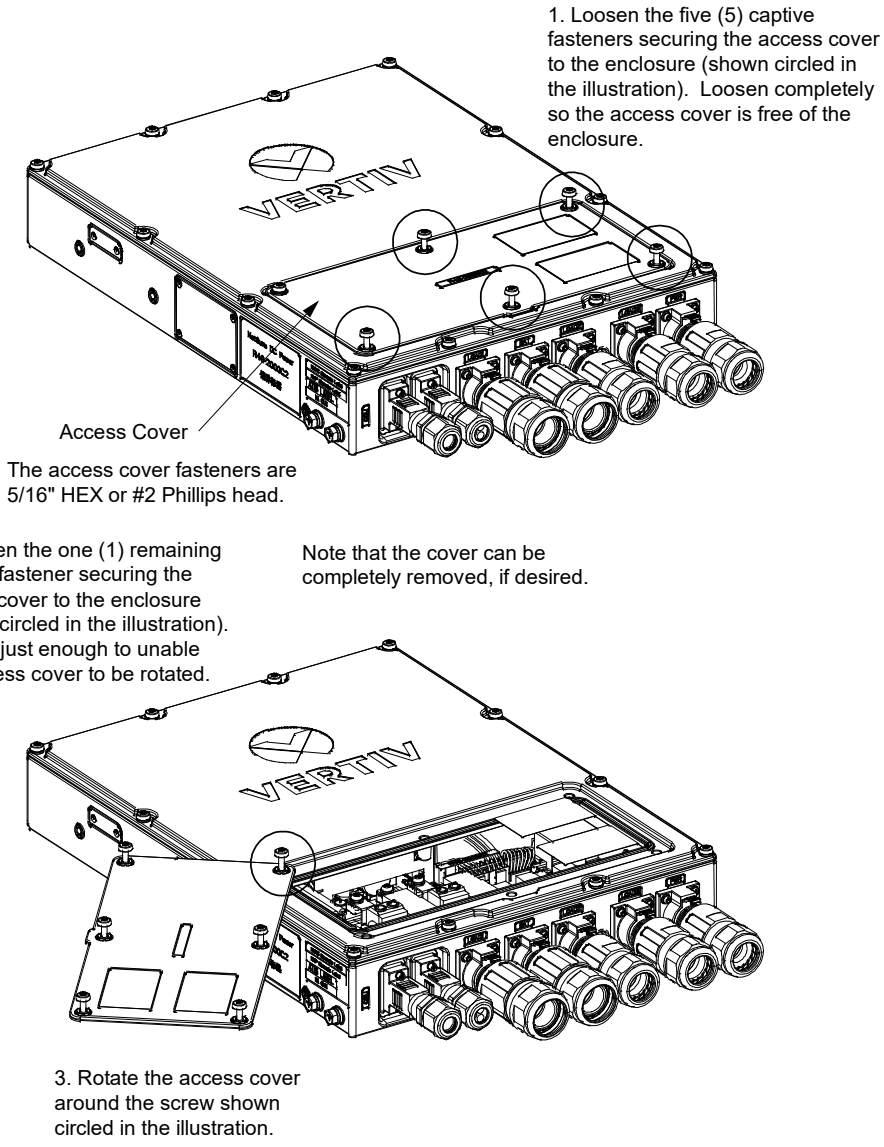
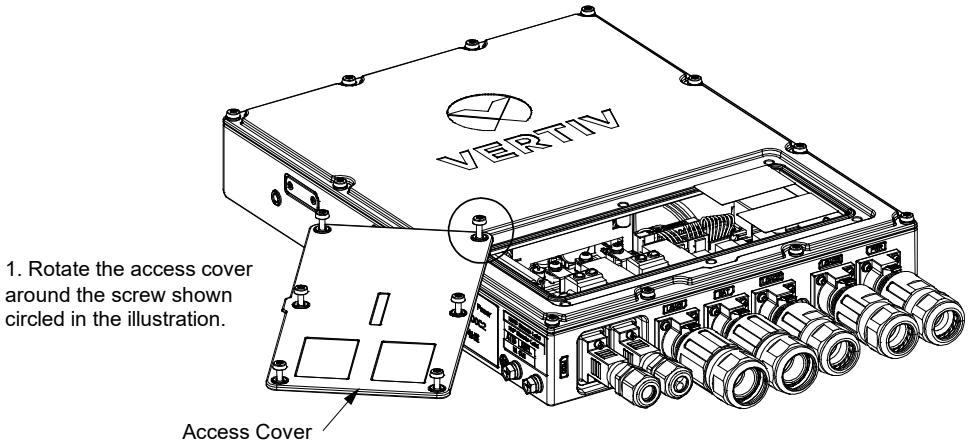
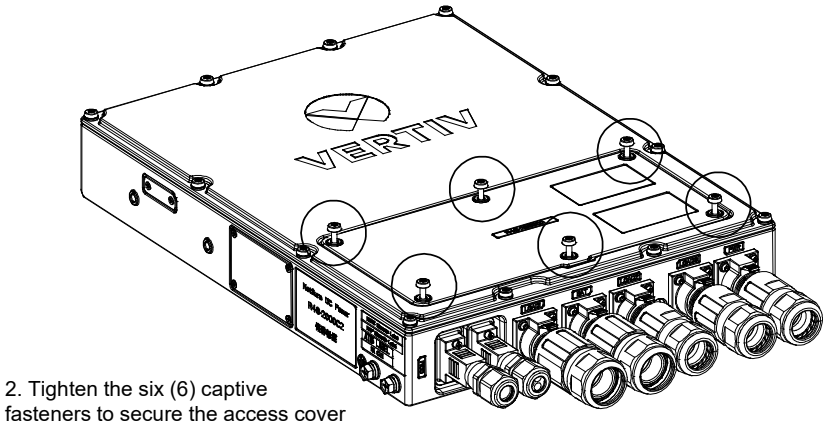


Figure 6.3 Closing the Rectifier Enclosure Front Access Cover





7 Controller and Controller Interface

7.1 General

Integrated inside the rectifier enclosure is a controller.

7.2 Controller Overview

7.2.1 General

The controller performs the following functions:

- Rectifier Control and Monitoring (via internal CAN communication)
- Alarms Generation
- User Access via a Smartphone using a Bluetooth APP

7.2.2 Rectifier Control and Monitoring

The controller controls the rectifier automatically via configured parameters. The controller monitors rectifier operation and performance. The controller board has one (1) CAN bus port, which is used to communicate with the rectifier board.

- The controller acquires, analyses, and processes rectifier information to monitor, manage, and report rectifier operation in real time.

7.2.3 Alarms Generation

General

The controller monitors the rectifier for alarm conditions. The controller generates alarms if a fault condition occurs.

Controller Relay Outputs (DO)

Specific alarms are mapped to the controller's relay outputs (DO). The controller's relay outputs (DO) can then be wired to external alarm circuits. See "Rectifier Digital Output (DO) Dry Relay Contacts" on page 31.

7.2.4 User Access via a Smartphone App using Bluetooth Connection

The controller supports on site access via a smartphone APP through Bluetooth. The communication distance is up to 32-feet (dependent on interference sources at the installation site). See "Accessing the Rectifier Controller via Bluetooth" on page 39. See also "Bluetooth Jumper Setup" on page 13.

7.3 Accessing the Rectifier Controller via Bluetooth

7.3.1 Mobile Device and Mobile Device Operating System Version Requirements

The Bluetooth APP supports iOS and Android devices, when the following requirements are met:

- iOS Model
  - iOS Version: iOS 8.0 and above.
  - iOS Phone: Screen size of 4.7" or larger.
- Android Model
  - Android Version: Android 5.1 and above.
  - Android Phone: Screen size of 4.7" or larger.

7.3.2 Bluetooth APP

General

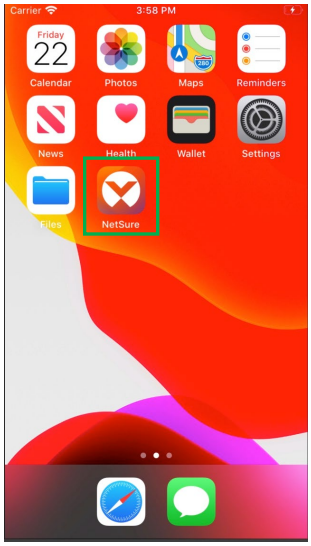
The controller provides a mobile wireless communication connection. Refer to the next sections to use the Bluetooth APP.

7.3.3 Setting Up the Bluetooth Connection

Procedure

1. Set the Bluetooth jumper. See “Bluetooth Jumper Setup” on page 13.
2. Acquire the Vertiv™ NetSure™ app and install the App on the mobile device.
   - iOS APP: Acquire the Vertiv™ NetSure™ app from Apple App Store.
   - Android APP: Acquire the Vertiv NetSure app from Vertiv product Website / Google Play Store.
3. Power up the rectifier before trying to connect to it with the mobile device.
4. Ensure mobile device, such as Cellphone, has Bluetooth Communications ON and ready to pair to other devices. In addition, for an Android cellphone, location must be ON.
   - The app supports one-to-one Bluetooth connection only.
5. With rectifier turned "on", the controller will broadcast a unique Bluetooth address. Connect to the appropriate unit ID.
6. Bluetooth Pairing – password is required in app for controls.
   - Read Only Account: Username: browser; Password: 123456
   - Admin Account: Username: admin; Password: 640275

Figure 7.1 APP Running on an iOS Device



7.3.4 Using the Bluetooth Application

The following sections introduce the mobile APP Screen, Homepage Screen, Alarm Icon, Setting Icon, Swap Controller Icon, and About Page Icon.

NOTE! *The screens presented below are examples. The real content may be different according to the configuration, system mode, and system status.*

Bluetooth Login Screen

Supported Application Language: English and Chinese

There are two account types: Read Only and Read-Write (Admin).

- Read Only Account: Username: browser; Password: 123456
- Read-Write Account (Admin): Username: admin; Password: 640275

NOTE! *It is a best practice to change the password using a combination of upper-case letters, lower-case letters, and numbers.*

NOTE! *Each controller has a unique identifier when connected via Bluetooth. If a site has multiple rectifiers installed, each rectifier has a unique identifier, such as "Vertiv 2000C2 C2F609" for example.*

Enter the following for Bluetooth read-write access to change controller settings:

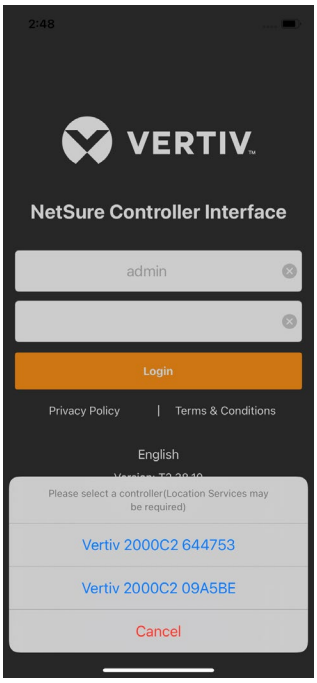
- Username: admin
- Password: 640275

Bluetooth Connection

Procedure

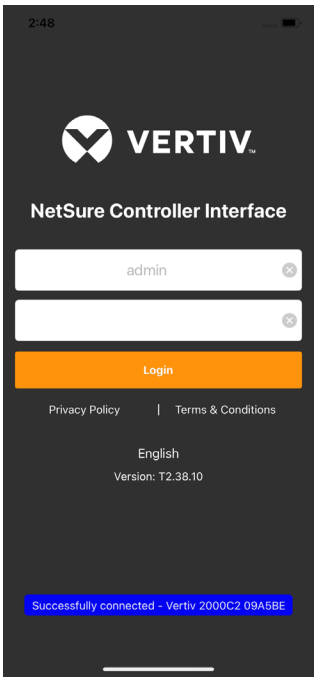
1. Open the Vertiv™ NetSure™ app on the mobile device. A list of supported controllers found in the Bluetooth connection appears. Select a controller from the list to connect (see Figure 7.2).

Figure 7.2 Bluetooth Connection



2. A connected successful screen appears (see Figure 7.3).

Figure 7.3 Connected Successfully

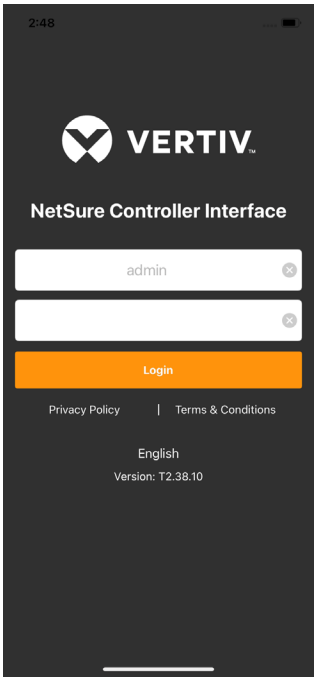


Login Screen

Procedure

1. After successfully connecting to a controller, the following login screen appears (see Figure 7.4).

Figure 7.4 Login Screen



2. Enter a valid Username and Password, then select “Login”.

NOTE! *When you first login to the Vertiv™ NetSure™ app, you must read and agree to the Privacy Policy (Figure 7.5) and Terms & Conditions (Figure 7.6).*

3. After logging into the App, the Homepage screen appears (see Figure 7.7).

Figure 7.5 Privacy Policy Page

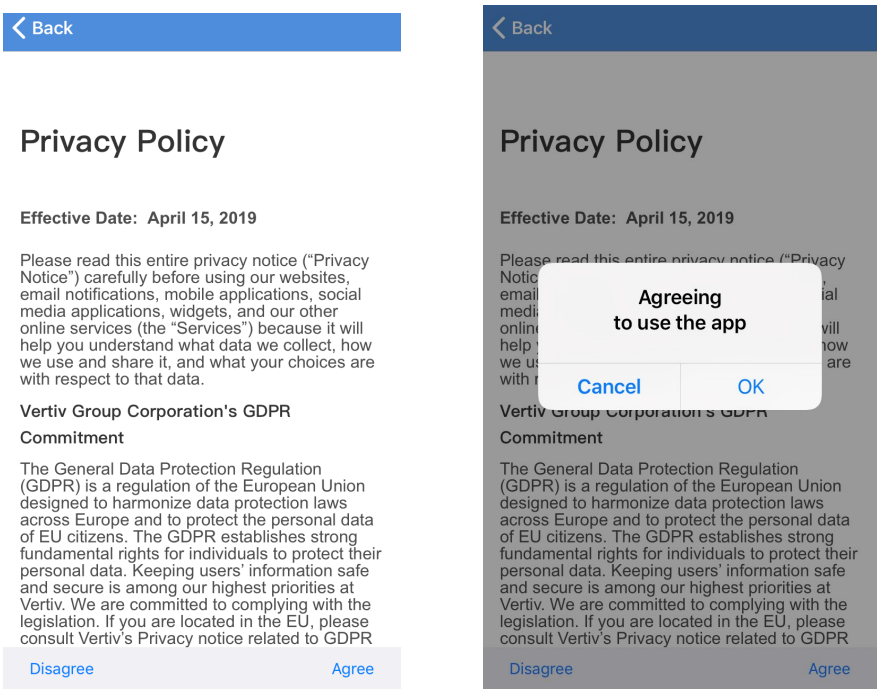
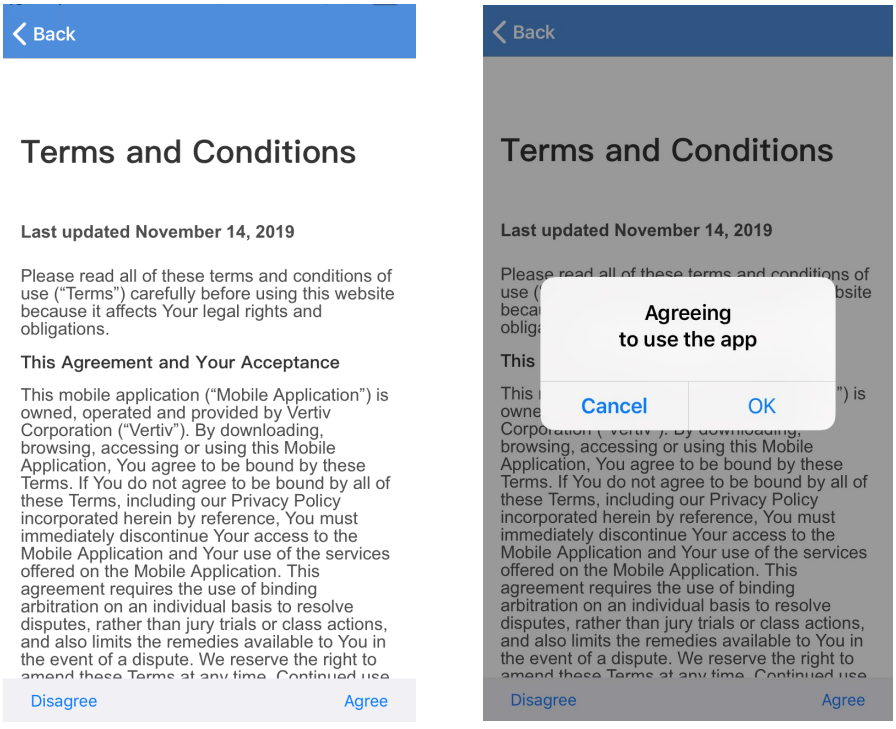


Figure 7.6 Terms & Conditions Page

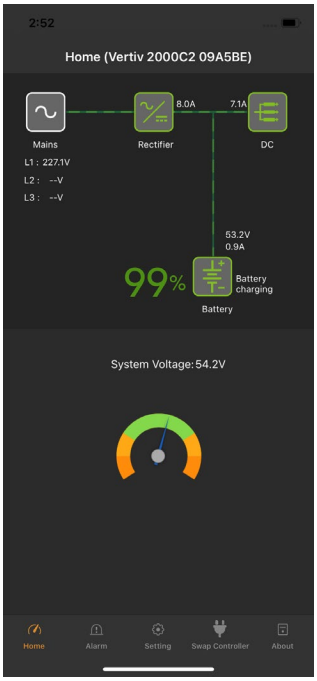


Homepage Screen

The Homepage screen includes a system status information area and a menu navigation area (see Figure 7.7).

- From the system status information area, you can obtain information on the rectifier by touching the “Rectifier” icon, as described in the following procedures.
- From the menu navigation area, you can navigate to the other screens, as described in the following procedures.

Figure 7.7 Homepage Screen



System Status Information Area

NOTE: Battery icon is not functional.

Menu Navigation Area
(Home, Alarm, Setting, Swap Controller, About

Menu Navigation Area

The menu navigation area contains the following menu Icons: Home, Alarm, Setting, Swap Controller, and About. The menu navigation area always appears in each screen.

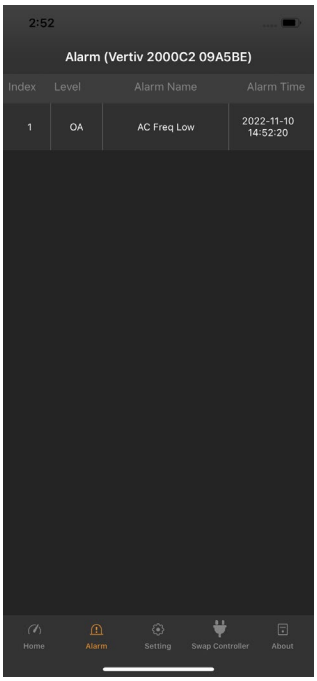
Home Icon

When in other screens, click on the Home Icon to go to the Homepage screen.

Alarm Icon and Alarm Screen

In the menu navigation area, click on the Alarm Icon to go to the Alarm screen. The Alarm screen displays active alarms. See Figure 7.8.

Figure 7.8 Alarm Screen

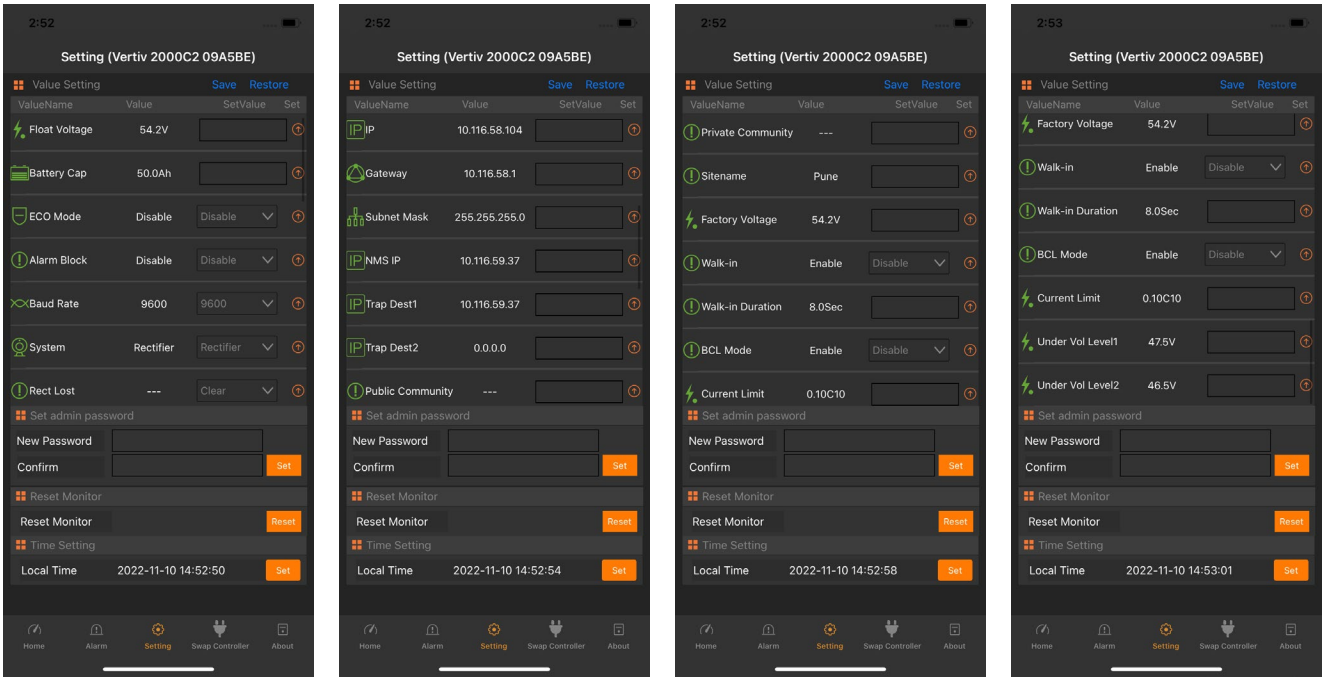


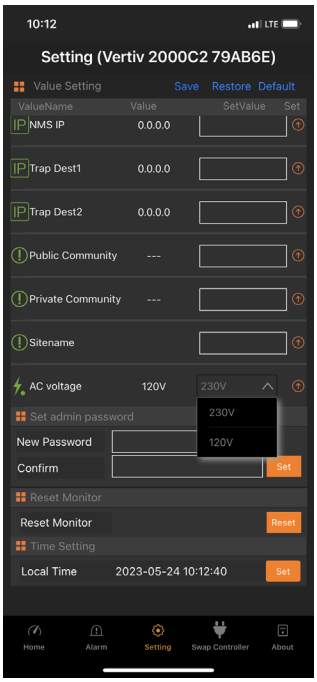
Setting Icon and Setting Screen

In the menu navigation area, click on the Setting Icon to go to the Setting screen (see Figure 7.9).

The settings are divided into Value Setting, Set Admin Password, Reset Monitor, and Time Setting. The Value Setting supports save and restore function.

Figure 7.9 Setting Screen





V1.00.18 and Later Versions (such as V1.10.03) Showing 120V or 230V AC Input Voltage Selection, Default at 230V, Selectable to 120V

Procedure

1. To change a setting, go to the “Set Value” column when in the Setting Tab, enter or select a value, and then click “Set” to save the value. If the value is none, ‘—' displays.

System Settings Programmable Parameter Default Values and Value Ranges

Refer to Table 7.1 for the default values and value ranges of the system settings programmable parameters.

Table 7.1 System Settings Programmable Parameter Default Values and Value Ranges

Parameter Name	Default Value	Value Range
Float Voltage	54.2 VDC	42 VDC to 58 VDC
Battery Cap	50.0 Ah	Not Used
ECO Mode	Disable	Disable, Enable
Alarm Block	Disable	Disable, Enable
Baud Rate	9600	Not Used
System	Rectifier	Rectifier
Rect Lost	--	Clear-App Side
IP	192.168.1.2	Not Used
Gateway	192.168.1.1	
Subnet Mask	255.255.255.0	
NMS IP	0.0.0.0	
Trap Destination1	0.0.0.0	
Trap Destination2	0.0.0.0	
Public Community	public	
Private Community	strpri	
Sitename	--	Two (2) to Sixteen (16) Characters (Alphanumeric)
Factory Voltage	54.2 VDC	40 VDC to 60 VDC
Walk-in	Enable	Disable, Enable
Walk-in Duration	8 Seconds	8 Seconds to 128 Seconds
BCL Mode	Enable	Disable, Enable
Current Limit	0.1C10	0.04C10 to 1.0C10
Under Vol Level1	47.5 VDC	40 VDC TO 60 VDC
Under Vol Level2	46.5 VDC	40 VDC to 60 VDC
V1.00.18 and Later		
AC Input Voltage	230V	230V or 120V

System Settings Programmable Parameter Descriptions

- Float Voltage: Leave at 54.2 V.
- Battery Cap: Not used in this application (leave at 50 Ah)..
- ECO Mode: Not used in this application.
- Alarm Block: When the outgoing alarms are blocked, the alarms shall not trigger relay outputs. The active alarms are continued to be displayed in the mobile app. Select ‘Enable' to block alarms from being transmitted or 'Disable' to allow alarm notifications. Click Set.

- Baud Rate: Not used in this application.
- System: The only system is rectifier.
- Rect Lost: Clears the Rectifier Lost Alarm (i.e., when rectifier is removed and replaced). Select Clear and click set.
- IP: Not used in this application.
- Gateway: Not used in this application.
- Subnet Mask: Not used in this application.
- NMS IP: Not used in this application.
- Trap Destination1: Not used in this application.
- Trap Destination2: Not used in this application.
- Public Community: Not used in this application.
- Private Community: Not used in this application.
- Site Name: Enter the site name. Click Set.
- Factory Voltage: Enter the desired voltage. Click Set.
- Walk-in: Enables or disables the rectifier's start-up walk-in feature. Select Enabled or Disabled and Click Set.
- Walk-in Duration: Sets the rectifier start-up walk-in time (in seconds) when the "Walk-In" setting above is set to enabled. Enter desired seconds and click Set.
- BCL Mode: MUST be set to 'Disable' or Output 4 port will be current limited. Select 'Disable' and Click Set.
- Current Limit: Not used when BCL Mode set to 'Disable' (see above).
- Under Vol Level1: Enter the Under Voltage Level1 alarm point. Click Set.
- Under Vol Level2: Enter the Under Voltage Level2 alarm point. Click Set.
- Set admin Password: Enter a password in the "New Password" field. Sixteen (16) characters maximum; the valid characters are alphanumeric values (i.e., 0-9, a-z, A-Z). Special characters are not allowed. Passwords must be at least six (6) characters long. Re-enter the password in the "Confirm Password" field. Click Set.
- Reset Monitor: Resets the monitor.
- Time Setting: Sets the time and date.

NOTE! *It is recommended to set the correct time and date immediately after turn-up (to track history of events).*

V1.00.18 and Later

- AC Input Voltage Setting: Select the AC input voltage connected to the rectifier (120V or 230V).

NOTE! *Rectifier software version V1.00.16 and earlier will generate an Observational Alarm (OA) and the yellow LED will illuminate if 120 VAC nominal input voltage is utilized. This is an "AC-A Volt Low" alarm. If the situation outlined above exists, this alarm should be ignored. For version V1.00.18 and later, the "AC Input Voltage Setting" corrects this situation when set to 120V. Default voltage setting is 230VAC input, and must be changed to 120V (if desired) via the AC voltage setting in the Settings Tab.*

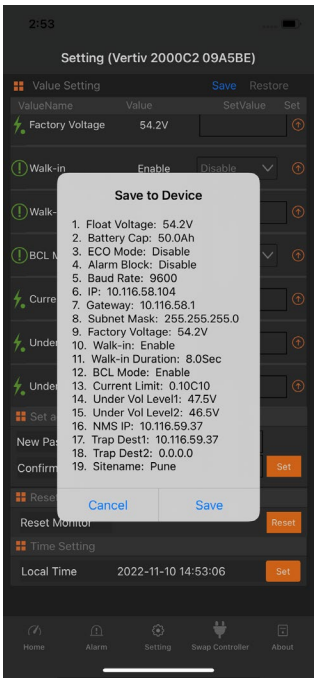
Save Data Function

The Save Data function saves the controller's settings to your device (see Figure 7.10).

Procedure

1. To save the controller's settings to your device, click "Save" in Value Setting. The Save to Device screen appears. Click "Save".

Figure 7.10 Save Data Screen



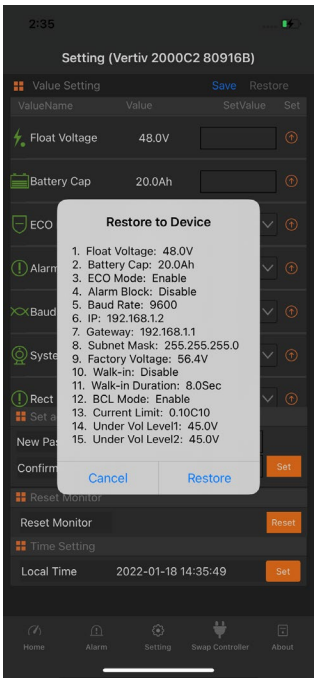
Restore Data Function

The Restore Data function restores the controller's settings previously saved to your device into the controller (see Figure 7.11).

Procedure

1. To restore the controller's settings from your device to the controller, click "Restore" in Value Setting. The Restore to Device screen appears. Click "Restore".

Figure 7.11 Restore Data Screen

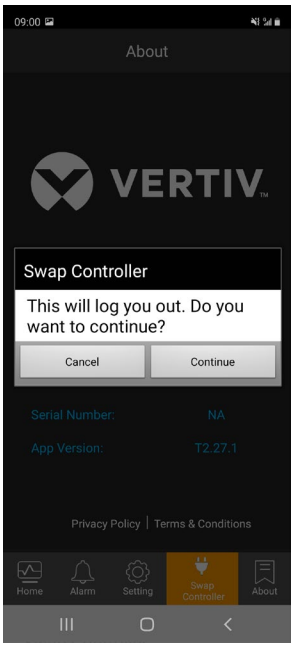


Swap Controller Icon and Swap Controller Screen

In the menu navigation area, click on the Swap Controller Icon to go to the Swap Controller screen (see Figure 7.12). Click Continue. This will log you out of the connected controller and allow you do connect to a different controller.

NOTE! *Swap Controller is also the method used to LOGOUT of the controller.*

Figure 7.12 Swap Controller Screen



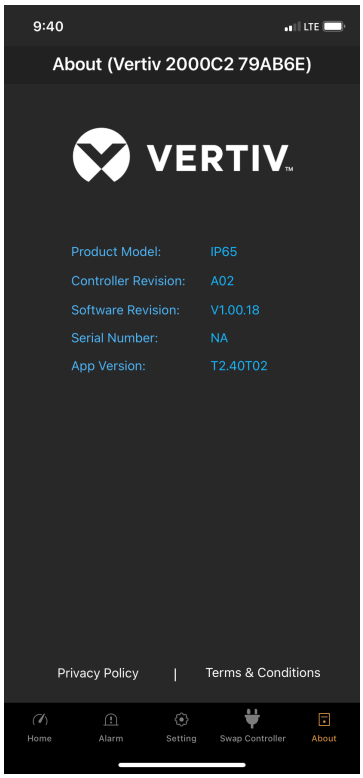
About Icon and About Screen

In the menu navigation area, click on the About Icon to go to the About screen (see Figure 7.13).

The About screen displays the Product Model, Controller Revision, Software Revision, Serial Number, and App Version.

TIP: The Software Revision and APP Version are key details if troubleshooting.

Figure 7.13 About Screen

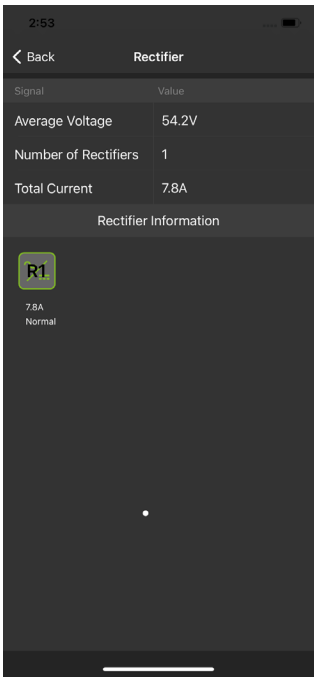


System Status Information Area

Rectifier Icon

In the Homepage screen (see Figure 7.7 on page 45), click on the Rectifier Icon ( ) to go to the Rectifier screen (see Figure 7.14).

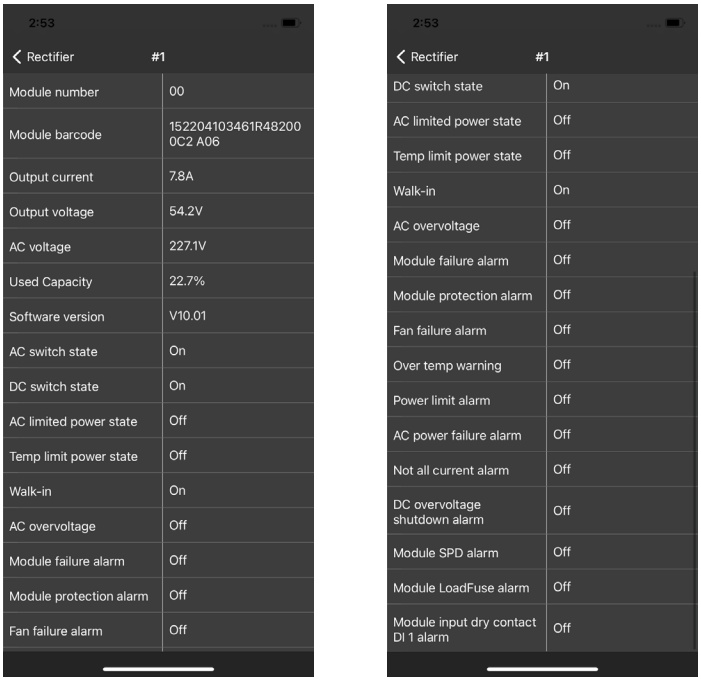
Figure 7.14 Rectifier Screen



Rectifier Information Screen

In the Rectifier screen, click on the particular Rectifier icon to go to the Rectifier Information screen (see Figure 7.15).

Figure 7.15 Rectifier Information Screen



Battery Icon

Not functional

8 Troubleshooting and Repair

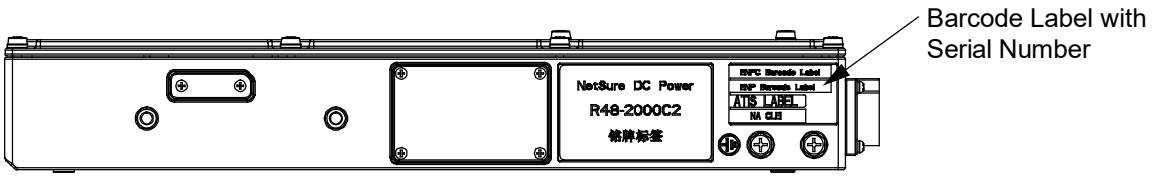
8.1 Contact Information

Refer to Section 4154 (provided with your customer documentation) for support contact information.

8.2 General

This system is designed for ease in troubleshooting and repair. The controller contains an active alarm list and an alarm log. Also, the rectifier contains various indicators as described below and in “Rectifier Local Indicators” on page 36. These are designed to isolate a failure to a specific fault. Once a failure fault has been identified, refer to “Replacement Information” on page 55 and “Replacement Procedures” on page 56. The serial number of the rectifier can be accessed remotely via either Bluetooth App or LAN. On the rectifier readings screen there is a field labeled “Barcode”, which displays the barcode number that is on the physical label of the rectifier. The first 11 digits of this number is the serial number for the device. The remaining digits are composed of the rectifier model and revision (NOTE: this model number does not contain the suffix identifying the regional model, -6 in North America). EXAMPLE: If the “barcode” field reads 0321100019 91R482000C2A05, the serial number is 03211000199. The barcode also appears on a label affixed to the side of the rectifier (see Figure 8.1).

Figure 8.1 Barcode Label with Serial Number



8.3 Replacement Information

8.3.1 General

When a trouble symptom is localized to a faulty rectifier (other than a fuse), the rectifier should be replaced in its entirety. No attempt should be made to troubleshoot or repair individual components inside the rectifier enclosure (except fuse replacement).

Opening the outer perimeter front panel screws shall void the VERTIV warranty. Screws are tamperproof and not intended for customer access.

8.3.2 Rectifier Fuses

Replace rectifier fuses with the same type and rating. Refer to Table 8.2 for fuse part numbers.

Table 8.1 Fuse Part Numbers

Fuse	Rating	Part Number
Load (1) 2 kW	70 A	10026786
Load (2) 1 kW	30 A	10026784
Load (3) 1 kW	30 A	10026784
Output (4) 2 kW	70 A	10026786

8.4 Replacement Procedures

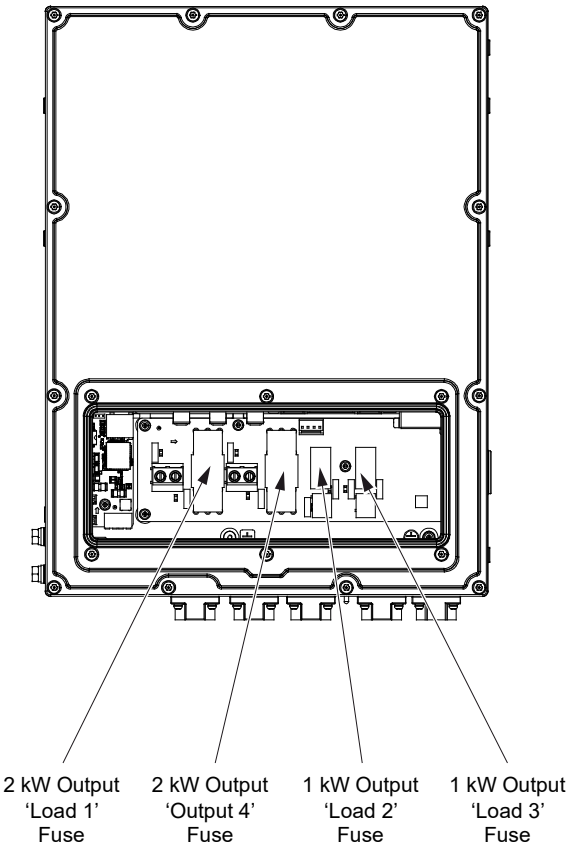
DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

8.4.1 Replacing a DC Load Fuse

Procedure

1. Identify and clear the fault which caused the fuse to open.
2. Remove AC input from the rectifier.
3. Refer to “Opening / Closing the Front Access Panel” on page 37, and open the rectifier enclosure front access panel.
4. Refer to Figure 8.2 and replace the appropriate fuse.
   - The 1 kw output load fuses snap into fuse clips.
   - The 2 kW output load fuses are secured with two bolts. Torque these to 40 in-lbs after replacing a fuse.
5. Refer to “Opening / Closing the Front Access Panel” on page 37, and close the rectifier enclosure front access panel.
6. Apply AC input power to the rectifier by closing the external AC disconnect or protective device. The rectifier starts automatically.

Figure 8.2 Replacing Fuses



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