eSure™ Inverter Module

User Manual

Specification Number: 1I1201000

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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/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 iv.

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.

Voltages

AC Input Voltages

DANGER! This system operates from AC input voltage capable of producing fatal electrical shock.

AC Output Voltages

DANGER! This system produces AC output voltage capable of producing fatal electrical shock.
AC output voltage is present even if only the DC input is connected!

DANGER! Follow local lockout/tagout procedures to ensure AC branch circuit protection devices remain de-energized during installation at loads, as required.

DC Input Voltages

DANGER! This system operates from DC input voltage. Although the DC voltage is not hazardously high, the DC input power can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact a DC input terminal or exposed wire connected to a DC input terminal. NEVER allow a metal object, such as a tool, to contact more than one DC input terminal at a time, or to simultaneously contact a DC input terminal and a grounded object. Even a momentary short circuit can cause sparking, explosion, and injury.

Personal Protective Equipment (PPE)

DANGER! 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 "hazard/risk" 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. The inverter system is not supplied with internal input voltage disconnect devices. It is a dual input power supply. Even if the main AC power to the inverter system has been disconnected, potential harm still exists from the inverters taking power from the DC input power source.

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 vii.

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.
6. If necessary to repair equipment containing static sensitive components, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.

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1 Introduction

1.1 Overview

The Vertiv™ eSure™ 1I120-1000 is a compact inverter module which offers efficient power conversion. It operates from a nominal 120 VAC or 48 VDC source (as a default power input) to provide nominal 120 VAC load power.

When installed in the inverter system it can be set to operate in one of two input power modes, AC Input Power Mode or DC Input Power Mode.

- In the AC Input Power Mode, each inverter module operates with the commercial AC input to supply 120 VAC power to the loads. In the event commercial AC power fails or becomes abnormal, the inverter modules immediately transfer operation to 48 VDC input to power the inverters.
- In the DC Input Power Mode, each inverter module operates with the 48 VDC input to supply 120 VAC power to the loads. In the event DC power fails or becomes abnormal or an inverter module fails, the inverter module immediately transfers operation to commercial 120 VAC input to power the inverters.

1.2 Specifications

1.2.1 AC Output Ratings

- Output Voltage: 120 VAC. Selectable 50 Hz or 60 Hz from inverter, with up to maximum 0.25% deviation. The default value is 120 VAC and 60 Hz.
- Output Power: 1000 W resistance load at 120 VAC output.
- Overload Ability:

  a) Range for normal operation:
  AC Input: 96 VAC to 140 VAC.
  DC Input: 48 VDC to 58 VDC.
  125% power for 15 seconds.
  Maximum current is 3x In with 120 ms.

  b) Overload ability in 42 VDC to 48 VDC range:
  As the input voltage increases from 42 VDC to 48 VDC, the overload value increases linearly from 110% to 125%.
  Maintain overload value for 15 seconds.

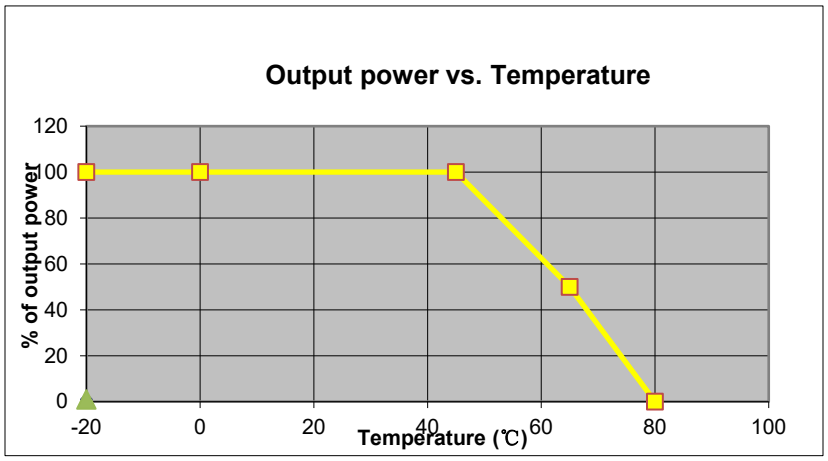
  c) Short Circuit Protection: The inverter will shut-down the output voltage immediately if a short circuit is detected. Should the short circuit last for 5 seconds or more the inverter will shut down entirely. The inverter can only be re-started after the short-circuit has been cleared and the AC and DC inputs have been cycled off and on again.

- Transfer Time: No disturbances or deviations on the AC output during the transfer between the input power sources, the transfer time is 0 seconds.
- Start Up Time: Upon module insertion - maximum 60 seconds.
- Load Power Factor: The power factor is between -0.65 to 1 and +0.9 to 1.
- Power Derating Based on Temperature: The inverter delivers full power when operating in an ambient temperature of +45 °C (+113 °F) or below. Each inverter 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 +45 °C (+113 °F), the inverter will not shut down. Rather, the inverter limits its maximum output power to maintain the temperature of the power conversion circuit within design parameters. Operation between +45 °C (+113 °F) and +80 °C (+176 °F) will result in output

power being decreased. The inverter delivers 50% load at an ambient temperature of +65 °C (+149 °F) with linear derating to 50% from 45 °C to 65 °C. The inverter delivers 0% load at an ambient temperature of +80 °C with linear derating to 0% from 65 °C to 80 °C. Full power capability is restored when the temperature decreases to below approximately +45 °C (+113 °F). Refer to Figure 1.1 to view the relationship between the output power and the ambient temperature.

WARNING! The inverter is rated for continuous operation at full output power up to +45 °C (+113 °F). Operation between +45 °C (+113 °F) and +80 °C (+176 °F) will result in output power decrease. Operation above +80 °C (+176 °F) is considered abnormal. When ambient temperature increases above +80 °C (+176 °F), the inverter shuts down. When the inverter temperature decreases to 78 °C (+172 °F), it will start to deliver power again.

Figure 1.1 Power Derating Based on Temperature



- Dynamic Regulation: In accordance with IEC 62040-3 specifies recovery time.
- THDu: <3% at resistive load, compliant with IEC 62040-3.
- Crest Factor at Nominal Power: 3:1.
- Output Protection Alarm: An alarm is sent to the controller when 80% load is reached. A critical load alarm is sent to the controller when 100% load is reached.

- Typical Efficiency Curves: Refer to Figure 1.2 for an AC-AC efficiency curve . Refer to Figure 1.3 for a DC-AC efficiency curve.

Figure 1.2 Typical AC-AC Efficiency Curve (60Hz)

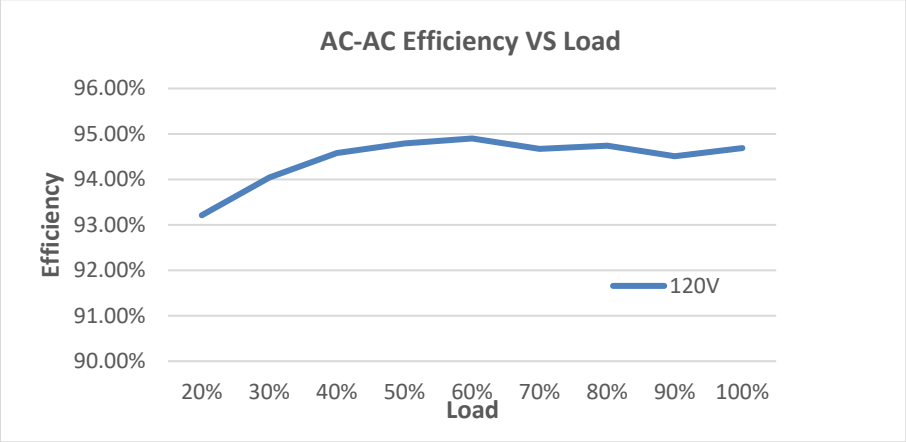
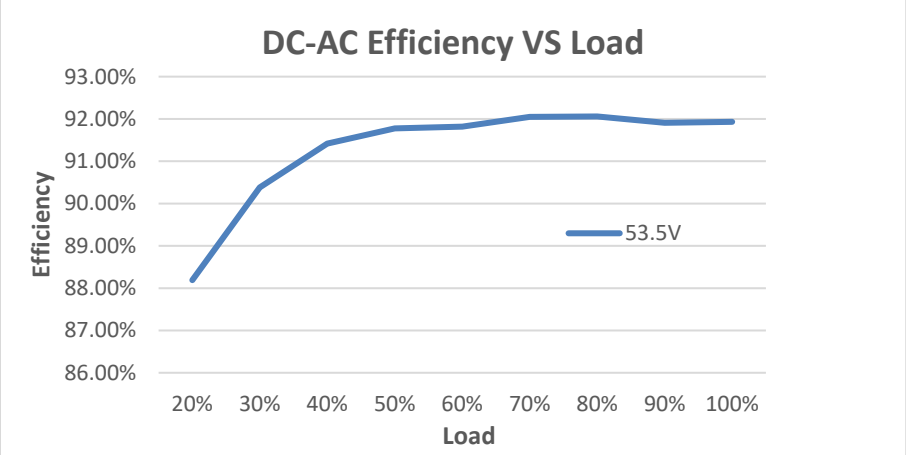


Figure 1.3 Typical DC-AC Efficiency Curve (53.5 VDC)



1.2.2 DC Input Ratings

- Voltage: Nominal 48 VDC. 42 VDC to 58 VDC, off at 42 VDC and 58 VDC.

NOTE! *High voltage limit of DC input: 60 VDC without damage.*

- Typical Input Data: When equipped with one inverter.

  a) See Table 1.1.

  b) Maximum Current: Input current is 26.45 A at 42.0 VDC input and 1000 W peak power.

Table 1.1 Typical Input Data

Input Voltage	Percent of Full Load	Input Current (Amps)	Input Watts	Efficiency (%)	Typical Heat Dissipation (BTU/Hr)
42 VDC	10	2.976	127.3	77.68	96.88
	20	5.462	232.8	86.00	111.17
	30	7.739	328.8	88.84	125.15
	40	9.935	421.1	89.71	147.65
	50	13.790	581.0	90.97	179.03
	60	15.683	659.1	90.57	212.10
	70	19.111	799.6	90.42	261.21
	80	20.052	838.2	90.64	267.69
	90	22.980	957.7	90.47	311.33
	100	26.442	1097.2	90.08	371.01
48 VDC	10	2.597	124.2	79.48	86.89
	20	4.805	229.0	87.03	101.31
	30	6.841	325.2	89.35	118.09
	40	8.802	417.4	90.37	137.08
	50	12.189	575.5	91.10	174.59
	60	13.789	649.8	91.24	194.03
	70	16.811	789.3	91.19	236.99
	80	17.648	827.8	91.31	245.18
	90	20.211	945.2	91.09	287.12
	100	23.283	1084.6	90.65	345.77
53.5 VDC	10	2.301	122.7	80.39	82.04
	20	5.267	230.0	86.64	104.76
	30	6.076	322.6	90.13	108.54
	40	7.821	414.2	91.21	124.12
	50	10.830	571.3	91.77	160.27
	60	12.273	646.4	91.96	177.32
	70	14.905	782.5	91.97	214.15
	80	15.683	822.9	91.81	229.83
	90	17.916	937.8	91.79	262.57
	100	19.227	1078.5	91.16	324.97
58 VDC	10	2.061	119.2	82.86	69.67
	20	3.940	227.4	87.72	95.24
	30	5.606	323.12	89.94	110.89
	40	7.238	416.5	90.64	132.99
	50	10.045	576.1	91.06	175.62
	60	11.355	650.5	91.21	195.05
	70	13.847	790.9	90.96	243.82
	80	14.559	830.4	90.82	259.84
	90	16.757	952.5	90.54	307.24
	100	19.313	1093.5	89.93	375.44

NOTE! *The output voltage of the inverter is initially adjusted to 120 VAC at 50% load and 53.5 VDC input.*

1.2.3 AC Input Ratings

- Voltage: Nominal 120 VAC. Operating range 96 VAC to 140 VAC with full load. Selectable by the inverter configuration file: 50 Hz (range 47 Hz to 53 Hz) and 60 Hz (range 57 Hz to 63 Hz). The output will trace the input frequency. If the frequency is out of scope, the inverter will transfer to DC or shut down by configuration.
- Power Factor: >0.99 with full resistance load at rated AC input voltage.
- THDi: The THDi will be less than or equal to 5% with full resistance load.
- Typical Input Data (50/60 Hz):
  a) Refer to Table 1.2.
  b) Maximum Input Current: Refer to Table 1.3.

Table 1.2 Typical Input Data (50/60 Hz)

Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input Watts	Power Factor	Efficiency %	Heat Dissipation BTU/Hr
96	25	2.686	256.08	0.9799	92.90	61.99
	50	5.812	561.80	0.9955	93.89	116.96
	75	8.040	777.70	0.9976	93.61	169.48
	100	11.023	1064.90	0.9982	92.96	255.75
120	25	2.188	254.62	0.9719	93.71	54.59
	50	4.690	557.70	0.9944	94.91	96.84
	75	6.471	771.20	0.9974	94.83	136.06
	100	8.822	1051.40	0.9985	94.43	199.83
140	25	1.924	253.60	0.9562	94.01	51.83
	50	4.066	555.30	0.9917	95.25	90.02
	75	5.603	768.00	0.9957	95.22	125.15
	100	7.639	1048.10	0.9977	94.94	180.73

NOTE! *At 100% of full load with output at 120 VAC as measured at the output terminals.*

Table 1.3 Maximum Input Current (50/60 Hz)

Input Voltage	Input Current (Amperes)
96 VAC	11.023 A

NOTE! *At 100% of full load with output at 120 VAC as measured at the output terminals.*

1.2.4 Environmental Ratings

- Operating Ambient Temperature Range:

  a) -20 °C (-4 °F) to +45 °C (+113 °F) with full power performance.

  b) +45 °C (+113 °F) to +65 °C (+149 °F) linear derating to 50% load.

  c) +65 °C (+149 °F) to +80 °C (+176 °F) linear derating to 0% load.

  d) Maximum Operating: +80 °C (+176 °F).

- Storage Ambient Temperature Range: -40 °C (-40 °F) to +70 °C (+158 °F).
- Relative Humidity: This inverter is capable of operating in an ambient relative humidity range of 0% to 95%.
- Altitude: Used in locations where highest altitude is 3000 meters (9842 ft), 2000 m (6560 ft) at full power.

NOTE! *As per Telcordia GR-63. Operating: -200 feet (-61 meters) to 10,000 feet (3048 meters). No de-rating below 2000 meters (6562 feet). Above this level (6562 feet) the de-rating can be up to 3 °C per 1000 feet. As a CE product, GR-63 is a reference standard.*

- Surge Protection: Compliance with IEC60664-1, Category IV. Capable of withstanding 1.2/50uS+8/20us wave, higher than 6kV/3kA.
- Ventilation Requirements: The inverters are fan cooled and utilize front to back forced ventilation. An inverter must be mounted so ventilating openings are not blocked and temperature of the air entering the inverter does not exceed the "Operating Ambient Temperature Range" stated above.
- Single Inverter Audible Noise: At 25 °C ≤50dB(A) with fan.
- Power Distribution System: TN/TT/IT.

NOTE! *The* inverter *is recommended to be used in an environment with Pollution of Degree 2 or less. Pollution Degree 2 applies where there is only non-conductive pollution that might temporarily become conductive due to occasional condensation (such as the office environment).*

- EMI Requirements:

  a) Conducted Emission: FCC Part 15 (CFR 47), Class A; GR-1089, Class A.

  b) Radiated Emission: FCC Part 15 (CFR 47), Class B; GR-1089, Class B.

- EMS Requirements:

  a) Immunity to Electrostatic Discharge: IEC/EN 61000-4-2.

  b) Immunity to Surges: ANSI C62.41; GR-1089.

1.2.5 Compliance Information

- Safety:
  - UL: UL1778.
  - CUL: CSA C22.2 NO.107.3.
- REACH: Material Composition Declaration.
- ROHS: R10.

1.2.6 Standard Features

- Type of Power Conversion Circuit: High frequency.
- AC Input Power Mode: Each inverter module operates with the commercial AC input to supply 120 VAC power to the loads. In the event commercial AC power fails or becomes abnormal, the inverter modules immediately transfer operation to 48 VDC input to supply the inverters. The transfer time is 0s. This is the default mode.
- DC Input Power Mode: Each inverter module operates with the 48 VDC input to supply 120 VAC power to the loads. In the event DC power fails or becomes abnormal or an inverter module fails, the inverter module immediately transfers operation to commercial 120 VAC input to supply the inverters. The transfer time is 0s.
- DC Input Only Power Mode: Each inverter module operates with the 48 VDC input to supply 120 VAC power to the loads. In the event DC power fails or becomes abnormal or an inverter module fails, the inverter module shuts off.
- Input Protection:

ALERT! The inverter module will become inoperable and require service if the DC input polarity is reversed.

  a) DC - Low/High Input Voltage Protection:

    1. When the DC input voltage is less than 42 VDC, the inverter will shut down or transfer to AC input (if available).
    2. When the DC input voltage is higher than 58 VDC, the inverter will shut down or transfer to AC input (if available). The maximum DC input voltage must not exceed 60 VDC.

  b) AC - Low/High Input Voltage Protection:

    1. When the AC input voltage is less than 96 VAC, the inverter will shut down or transfer to DC input.
    2. When the AC input voltage is higher than 140 VAC, the inverter will shut down or transfer to DC input. The maximum AC input voltage must not exceed 140 VAC.

- Over-Temperature Protection: The inverter provides high temperature protection by derating output power and recovers automatically.
- ESTOP: Emergency STOP can be applied via a software signal by CAN line from the controller to the inverter, automatically or manually triggered by controller.
- Remote ON/OFF Control/REPO: Closing the REPO connection on the inverter's backboard will disable the inverter, the inverter will automatically restart after opening the REPO via hardware circuit.
- Hot Swappable: The inverter is designed to be plug-and-play. The inverter can be inserted or removed from a live power system with no damage. When the inverter is plugged into the system, the system output voltage will not be affected.
- Cooling: Each inverter contains a fan for front-to-back force air-cooling.

  a) Fan Fault Protection: The inverter shuts down and its alarm indicator (red) flashes if the fan fails. After the fault is cleared, the inverter recovers automatically, and then the indicator turns off. Fan failure is detected and reported to controller. The fan is field replaceable.

  b) Fan Control: Fan speed is continuously variable. When input voltage is within normal range, the built-in processor adjusts fan speed according to the inverter's internal temperature and output power. For example, a higher temperature or output power increases the fan speed. This feature can be disabled via the controller, allowing the fan to run at full speed regardless of temperature.

- Paralleling: Up to twenty-four (24) inverters can be connected in parallel. Parallel operation means all inverters are installed in one system and connected to the same phase input.
- Communication Failure: The inverter's protection indicator (yellow) will flash should it experience a communication failure. The failure information will be reported to the controller and the controller will process the failure accordingly.
- Monitoring Function: The inverter has a built-in advanced DSP that monitors and controls the operation of the inverter. The DSP also communicates with the controller in real time through the CAN bus.
- Table 1.4 lists the different commands and information exchanged between the inverter and the controller.

1.2.7 Mechanical Specifications

- Dimensions:
  a) Millimeters: 40 (Height) X 84.5 (Width) X 252.5 (Depth)
  b) Inches: 1.57 (Height) X 3.3 (Width) X 9.9 (Depth)
- Weight: 1.15 kg (2.54 lbs)
- Indicators:
  a) Power (Green)
  b) Protection (Yellow)
  c) Alarm (Red)

Table 1.4 Exchange of Information between Inverter and Controller

Commands / Signals that can be Received by the Inverter Module from the Controller	Information Gathered by the Controller from the Inverter Module
• Remote On/Off • ESTOP • Operating Mode • Output Voltage Level • Frequency • Phase • DC Over/Under Voltage Setting and Return Point Voltage • Fan Speed Control • Clear Fault	• Output Voltage • Output Current • AC Input Voltage • AC Input Current • AC Input Frequency • AC Input Active Power • DC Input Voltage • DC Input Current • DC Input Power • Output Power Factor • Output Frequency • Output Load Rate (VA) CAP (%) • Output Active Power • Output Apparent Power • AC Input Electric Energy • DC Input Electric Energy • Output Electric Energy • Ambient Temperature • On/Off Status • Fault Alarms, includes: - Fan Fault - Inverter Fault - AC Input Abnormal - DC Input Abnormal - PFC Fault - DC Bus Fault - DC/DC Fault - Output Short - Output is About to Overload Alarm - Output Overload - Only DC Power - ESTOP - REPO - Repeat CAN ID - Parallel Flow Anomaly - System Parallel Parameters are Out of SYNC - Parallel CAN Communication Failure - Phase Anomaly • Protection Alarms, includes: - Input Voltage Protection - High Temperature Protection - Low Output Voltage • Address • Code • Running Time • Software Version • Hardware Version

2 Operation

2.1 Local Indicators

Location and Identification: Refer to Figure 2.1.

Description: There are three (3) indicators located on the inverter's front panel. The functions of these indicators are as shown in Table 2.1.

NOTE! *DC voltage must be present at the inverter input terminals.*

Figure 2.1 Local Indicator Locations

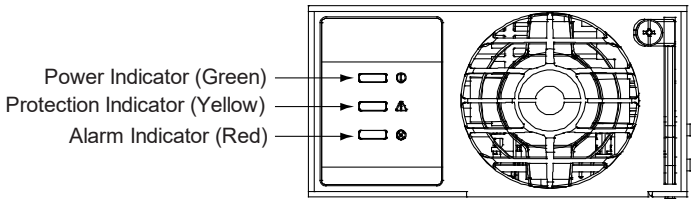


Table 2.1 Inverter Module Indicators

Indicator		Normal State	Alarm State	Alarm Cause
	Power (Green)	On	Off	No output voltage.
			Flashing	The inverter is being identified by the controller. Online Upgrade
	Protection (Yellow)	Off	On	AC Input Abnormal DC Input Abnormal Overload Inverter Over-Temperature Protection ESTOP Alarm Emergency Shutdown Alarm (REPO Alarm) Parallel Current Sharing Abnormal (Current Sharing Alarm)
			Flashing	Loss of communication with the controller. The inverter can provide power (slow flashing 1s). No output voltage. The inverter cannot provide power (fast flashing 0.5s). Parallel Communication Failure (Voltage, Frequency, Address Conflict)
	Alarm (Red)	Off	On	High Voltage Bus Fault (Abnormal High and Low Voltage of Bus) Inverter Failure Output Short Circuit
			Flashing	Fan not operating (inverter module shuts down).

2.2 Installing Inverter Modules

Inverters can be inserted or removed with power applied (hot swappable).

NOTE! *Each inverter locks into a module mounting shelf by means of a latch located on the bottom of the module. The latch and inverter handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract. See Figure 2.2.*

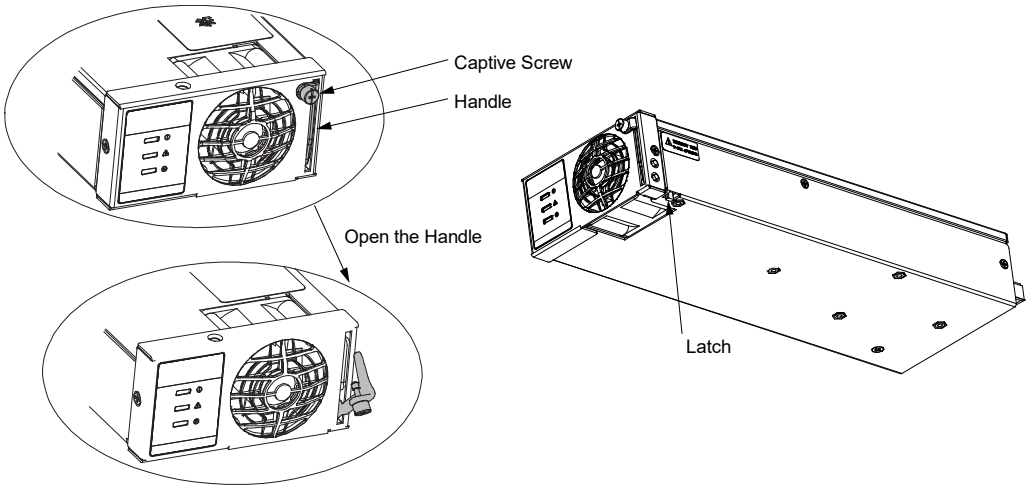
WARNING! To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing an inverter. NEVER hold the handle in the closed position when installing an inverter into a shelf.

Procedure

NOTE! *Refer to Figure 2.2 as this procedure is performed.*

1. Unpack the inverter.
2. Place the inverter into an unoccupied mounting slot without sliding it in completely.
3. Loosen the captive screw on the inverter's handle. Pull the handle down out from the inverter's front panel (this will also retract the latch mechanism). See Figure 2.2.
4. Push the inverter completely into the shelf.
5. Push the handle up into the inverter's front panel. This will lock the inverter securely to the shelf. Tighten the captive screw on the handle.
6. Repeat the above steps for each inverter being installed in the system.
7. After the inverters are physically installed in the mounting shelf(s), they are ready for operation within 60 seconds after power is supplied to them.
8. Certain functions (i.e. inverter addressing) may require adjustment when adding or replacing an inverter. Refer to the system documentation for instructions.

Figure 2.2 Installing Inverter Module



3 Troubleshooting and Repair

3.1 Troubleshooting

3.1.1 Inverter Current Sharing Imbalance

When multiple inverters are operating in parallel and the load is greater than 20%, if the current sharing imbalance among them is greater than ±5% of maximum current from 10% to 90% load, check if the inverter is properly seated in the shelf.

If the current sharing imbalance still persists following the verification suggested above, replace the inverter exhibiting the current imbalance.

3.1.2 Inverter Module Fault Symptoms and Troubleshooting

The fault indicators that can be displayed by the inverter are as follows.
Refer to Table 3.1 for a list of possible causes and corrective actions.

- Power Indicator (Green) OFF
- Protection Indicator (Yellow) ON
- Protection Indicator (Yellow) Flashing
- Alarm Indicator (Red) ON
- Alarm Indicator (Red) Flashing

Table 3.1 Inverter Module Troubleshooting

Symptom		Possible Cause(s)	Suggested Action(s)
	Power Indicator (Green) Off	No output voltage.	Make sure there is input voltage.
	Protection Indicator (Yellow) On	AC input abnormal.	Correct the AC input voltage to within the acceptable range.
		DC input abnormal.	Correct the DC input voltage to within the acceptable range.
		Overload	Remove overload.
		Inverter over-temperature protection.	Fan rotor blocked: Remove any object that may be blocking the fan. Ventilation blocked (inlet or outlet): Remove any object that may be blocking the inlet or outlet. Ambient temperature too high or inverter inlet too close to a heat source: Lower the ambient temperature or relocate the heat source.
		ESTOP alarm.	--
		Emergency shutdown alarm (REPO alarm).	--
		Parallel current sharing abnormal (current sharing alarm).	See “Inverter Current Sharing Imbalance” on page 12.
	Protection Indicator (Yellow) Flashing	Loss of communication with the controller (the inverter can provide power) (slow flashing 1s).	Check the communication cables. Remove and properly insert the inverter.
		No output voltage (the inverter cannot provide power) (fast flashing 0.5s).	Wait for the module output voltage to be normal. Check whether there is an alarm in the controller.
		Parallel communication failure (voltage, frequency, address conflict).	Check the communication cables. Remove and properly insert the inverter.
	Alarm Indicator (Red) On	High voltage bus fault (abnormal high and low voltage of bus).	Insert the module again. If the alarm still persists, replace the inverter.
		Inverter failure.	Replace the inverter.
		Output short circuit.	Check output wiring and load for short circuit.
	Alarm Indicator (Red) Flashing	Fan not operating (inverter shuts down).	Replace the fan.

NOTE! *If the yellow light keeps flashing rapidly after the new module is inserted into the shelf (flashing frequency is about 300ms), and then the module cannot startup after 1 minute (the green light is not on), please confirm whether the module is fully inserted into the shelf.*

3.2 Replacement Procedures

3.2.1 Inverter Module Replacement

Inverters can be inserted or removed with power applied (hot swappable).

NOTE! *Each inverter locks into a module mounting shelf by means of a latch located on the bottom of the module. The latch and inverter handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract. See Figure 2.2.*

DANGER! Take care when removing an inverter that was in operation, as inverter surfaces could be very hot.

WARNING! To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing an inverter. NEVER hold the handle in the closed position when installing an inverter into a shelf.

Procedure

NOTE! *Refer to Figure 2.2 as this procedure is performed.*

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any alarms associated with this system while this procedure is performed.
2. On the inverter to be removed, loosen the captive screw on the inverter's handle. Pull the handle down out from the inverter's front panel (this will also retract the latch mechanism). See Figure 2.2.
3. Grasp the handle and pull firmly to remove the inverter from the shelf.
4. Place the replacement inverter into the mounting position without sliding it in completely.
5. Loosen the captive screw on the inverter's handle. Pull the handle down out from the inverter's front panel (this will also retract the latch mechanism). See Figure 2.2.
6. Push the inverter completely into the shelf.
7. Push the handle up into the inverter's front panel. This will lock the inverter securely to the shelf. Tighten the captive screw on the handle.
8. Certain functions (i.e., inverter addressing) may require adjustment when adding or replacing an inverter. Refer to the system documentation for instructions.
9. After the inverters are physically installed in the module mounting shelf(s), they are ready for operation within 60 seconds after power is supplied to them. Verify that the inverters are operating normally.
10. Enable the external alarms or notify appropriate personnel that this procedure is finished.
11. Ensure that there are no local or remote alarms active on the system.

3.2.2 Inverter Fan Replacement

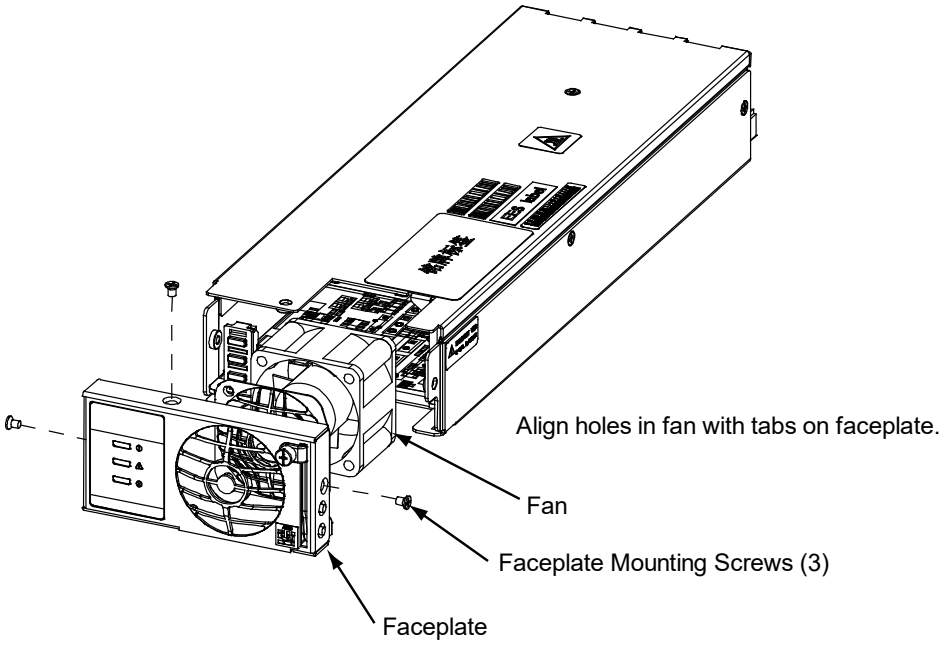
Each inverter uses a fan (P/N 32010474) for cooling. If fan replacement should become necessary, perform the following procedure.

Procedure

NOTE! *Refer to Figure 3.1 as this procedure is performed.*

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any alarms associated with this system while this procedure is performed.
2. Remove the inverter from the shelf. Refer to a previous procedure for step-by-step instructions.
3. Place the inverter on a static-safe work surface. Connect an approved grounding strap to your wrist for the remainder of this procedure.
4. On this inverter; remove the front panel by removing the three (3) screws securing the front panel to the chassis.
5. For proper orientation of the new fan, observe the location of the fan wires and the fan rotation and air flow arrows on the old fan.
6. Carefully remove the fan from the inverter chassis and unplug the fan power cable from the printed circuit card.
7. Plug the power cable of the replacement fan into the connector on the printed circuit card. Carefully slide the replacement fan into the inverter chassis (ensure the fan wires and fan rotation and air flow arrows match the orientation of the old fan).
8. Note that the fan has four holes in the front corners and that the faceplate has three tabs. Carefully slide the faceplate into position, aligning the fan holes with the faceplate tabs. Secure the faceplate to the inverter chassis with the three (3) screws previously removed.
9. Replace the inverter into the shelf. Refer to the previous procedure for step-by-step instructions.
10. When the fan starts, check to ensure that it is providing front-to-back airflow. If air direction is wrong, immediately remove the inverter from the shelf. Repeat previous steps to check fan orientation and correct as necessary. Reinstall the inverter and again check for proper airflow.
11. Enable the external alarms or notify appropriate personnel that this procedure is finished.
12. Ensure that there are no local or remote alarms active on the system.

Figure 3.1 Fan Replacement



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