The Power of Reliability

Hybrid Ultra
Instruction Manual
855-350-050

SAFETY GUIDELINES

Principles of Safe Operation and Maintenance

Safety must always be the top priority of all personnel involved in the installation, operation, and maintenance of this unit as it operates at high voltages that could be potentially lethal. Technicians must adhere to the appropriate standards and manufacturer's recommendations to minimize hazards.

Do not attempt to perform the tasks described in this manual if you are not a qualified professional.

It is essential that all safety devices and emergency response systems be fully operational and within their certification periods before starting any service.

Visual Communication

This manual uses extensive visual aids and tries to adhere to ANSI and ISO safety symbol standards. These symbols describe the following situations:

WARNING indicates a hazardous situation that, if not avoided, may result in death or severe injury or damage to equipment and property.

CAUTION indicates a hazardous situation that, if not avoided, may result in minor or moderate injury or damage to equipment and property.

NOTICE indicates practices not related to physical injury but may result in equipment damage, environmental hazards, loss of data, and other undesirable consequences.

General Alerts

Risk of serious personal injury or damage to equipment and property. Always observe the following:

- Install and operate unit in a restricted access location. A restricted access location is an area to which access can be gained only by service personnel using a special tool, lock and key, or other means of security and which is controlled by the authority responsible for the location.
- Install the unit in locations where children are likely not to be present.
- Install chassis ground to the unit before connecting AC input.
- Installation, operation, and service must be done by qualified technicians, with all wiring and connections done in accordance with the local electrical codes.
- Input voltages can range up to 240 volts AC. All upstream AC, load and battery breakers must be shut OFF prior to installation. The system must be completely de-powered.
- All AC connections must conform to local codes and regulations.

- Use caution when handling unit under load as surfaces may be hot.

Always observe the following for applications requiring a backup battery:

- Use a battery with rating and capacity appropriate for the model of power supply in use.
- Use an appropriate DC overcurrent protection device in-line with the backup battery connection.
- Use wire and connectors rated for the maximum load current.
- Ensure battery polarity is correct before connecting.
- Do not attempt to charge a frozen battery.
- Handle batteries with care. Never short-circuit battery terminals.
- Always install batteries in well-ventilated areas.
- Always consult with and observe all battery manufacturer recommendations.

CAUTION

Risk of personal injury or damage to equipment and property. Always observe the following:

- Install in a protected environment and keep sources of moisture away from unit.
- Ensure the total power consumption of the load does not exceed the continuous rated capacity of the power supply output.
- Provide adequate support for the rear of the unit without obstructing the air inlet or outlet openings.
- Remove all metallic jewelry before working with the unit.
- Wear appropriate eye protection and always use appropriate tools during installation.
- DC-AC inverters should not be connected to any of the load connection points without a battery connected to the system. DC-AC inverters create significant inrush current and may damage the circuitry or interfere with the operation of power supplies when there is no battery connected. Connecting a DC-AC inverter in this way may void the product warranty. Do not connect DC-AC inverters to the outputs of the Load Distribution Module of the ICT units.

NOTICE

Risk of damage to equipment, environmental hazards, loss of data and other undesirable consequences. Always observe the following:

- The unit must be properly handled, mounted, and installed.
- Do not block air inlet or outlet openings.
- Due to environmental factors which are common at outdoor communications sites, power surges from lightning strikes, electrostatic discharge, and utility power feeds can occur. These surges can damage connected equipment.
- This product is compliant and certified to IEC61000-4-5 Surge Immunity, however, additional surge suppression methods must be followed to better protect this device.
- Third-party surge suppression devices must be utilized to protect AC input power feeds, every exposed DC power conductor and exposed data cables. These protection devices must be installed at both ends of the exposed conductor, in close proximity to installed equipment. Periodically inspect these surge protection devices for proper function.
- Consult with manufacturers of surge suppression devices to select appropriately rated protection device(s) and proper installation methods.
- ICT's product warranty does not cover damage caused by power surges and electrostatic discharge events including lightning.

NOTE: Due to the breaker-detection circuitry internal to the unit, it may be possible to measure a voltage on the terminal(s) with no load connected, even if that terminal's breaker is open circuit. This is normal operation. The breaker-detection circuitry is a high-impedance circuit, and while a voltage may be present on the output terminal, it is a signal voltage and does not support loading. A load device connected to the output will immediately pull this voltage to zero volts.

Product Alerts

WARNING

Risk of serious personal injury or damage to equipment and property. Always observe the following:

- Operate the supply from a grounded 3-wire 120-volt AC or 230/240-volt AC source (50 or 60 Hz) with a branch circuit breaker rated 40 amps or less.
- The DC-DC Converter Module is NOT hot pluggable. Do not open the unit. Module may only be serviced by qualified personnel due to hazardous voltage inside.
- If a lithium-ion battery is used, it must have an integrated battery management system (BMS) to protect the battery cells from inappropriate voltage or current levels.

CAUTION

The DC-DC Converter Module draws up to 700 watts from the Power Modules and should be counted as a load device. Ensure the power consumption of the load does not exceed the continuous rated capacity of the DC-DC Converter Module.

GENERAL INFORMATION

Document Number: 855-350-050

Models:

ICT-2U4-DC12	ICT-2U4P-DC12
ICT-2U4-DC24	ICT-2U4P-DC24
ICT-2U5-DC12	ICT-2U5P-DC12
ICT-2U5-DC24	ICT-2U5P-DC24

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Disclaimer

ICT shall not be held liable for any damage or injury involving this product if it has been subjected to misuse and exposure to environmental conditions not conforming to the product's limits of operation, improper installation, or maintenance.

The illustrations in this manual are for illustrative purposes only. Review the drawings before proceeding. If there are questions and concerns regarding the product, refer to the FAQs section or contact ICT.

Contact Information

- North America toll-free: +1 877.930.0717 ext. 810
- International: +1 604.856.6303 ext. 810
- E-mail: techsupport@ictcorporate.com

ICT LIMITED WARRANTY

The warranty period on ICT products is two (2) years from date of purchase from an authorized ICT reseller or OEM with valid proof of purchase, or from date of shipment from the ICT manufacturing facility. The warranty period for a repaired product or part is ninety (90) days or the remainder of the unexpired term of the new product warranty period, whichever is greater. Repair or replacement of a defective product or part does not extend the original warranty coverage period.

The ICT Limited Warranty is only intended for the benefit of the original purchaser and user of this product. This Warranty is not transferable or assignable without the prior written permission of ICT. ICT's sole obligation and liability under this warranty is limited to either repairing or replacing defective products at the sole discretion of ICT. When repairing or replacing the products, ICT may use products or parts that are new, equivalent to new or re-conditioned. Parts repaired or replaced during the warranty period will be under warranty for the remainder of the warranty period.

No claim will be accepted unless written notice of the claim is received by ICT in accordance with ICT's Return Material Authorization (RMA) procedure, as soon as reasonably possible after the defect is discovered. A valid product serial number must be provided with the RMA claim to prove eligibility. The RMA procedure is available on the ICT website at www.ict-power.com/support/warranty-repair/.

The Purchaser shall at their own risk and cost return the defective product to ICT's factory or designated repair center once an RMA is issued by ICT. Return of the products to the customer after repair is completed shall be prepaid by ICT unless otherwise mutually agreed between the parties. Products shipped to ICT which have incurred freight damage will not be covered by this Warranty and any repairs or replacement parts, components or products needed will be invoiced in the full current price amount and returned freight collect to the Purchaser. It is the Purchaser's responsibility to check the product upon receipt for any damage during shipping and to contact the carrier or shipper regarding such damage. Product that is returned as defective, which is determined to operate within published specifications will be returned to the Purchaser freight collect.

ICT assigns to the Purchaser any warranties which are made by manufacturers and suppliers of components of, or accessories for, the ICT product and which are assignable. ICT makes no representations as to the effectiveness or extent of such warranties, assumes no responsibility for any matters which may be warranted by such manufacturers or suppliers and extends no additional coverage under this Warranty to such components or accessories.

In no event shall ICT be liable for any special, indirect, or consequential damages such as, but not limited to, loss of use, business or goodwill, loss of revenue, or loss of profits, which may result, either directly or indirectly, from defects in products provided by ICT.

This Warranty will be void if the product has been subjected to misuse, neglect, accident, exposure to environmental conditions not conforming to the products' limits of operation, improper installation or maintenance, improper use of an electrical source, defects caused by sharp items or by impact pressure, a force majeure event, has been modified or repaired by anyone other than ICT or its authorized representative, has been subjected to unreasonable physical, thermal or electrical stress, improper maintenance, or causes external to the unit including but not limited to general environmental conditions such as rust, corrosive atmospheres, sustained temperatures outside the specified operating range of the equipment, exposure to power surges and/or electrical surges, improper grounding, mold or dust, animal or insect damage, water damage or immersion in liquid of any kind, or if the serial number has been altered, defaced, or removed.

ICT does not control the installation and use of any ICT product. Accordingly, it is understood this does not constitute a warranty of performance or a warranty of fitness for a particular purpose. This Warranty represents the entire agreement between ICT and Purchaser with respect to the subject matter herein and supersedes all prior verbal or written communications, representations, understandings, or agreements relating to this subject.

Return Material Authorization Procedure

1. Request RMA number from ICT through telephone, e-mail, or website from Monday to Friday between 8:00am and 4:30pm Pacific Time.

    - North America toll-free: +1 877.930.0717 ext. 810
    - International: +1 604.856.6303 ext. 810
    - E-mail: techsupport@ictcorporate.com
    - ICT website: https://ict-power.com/support/warranty-repair

2. Provide the following information when requesting an RMA:

    - ICT model number
    - Serial number
    - The return ship-to address
    - The preferred shipping courier and account number, if applicable
    - An estimate of what the possible failure cause might be

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1.0 INTRODUCTION

The Hybrid Ultra is a flexible, N+1 redundant DC power system with intelligent networked control, advanced battery management, managed load distribution options, and a 12- or 24-volt integrated DC-DC Converter Module in a pre-configured 2RU rack mount chassis. The power chassis features a factory-installed Intelligent Control Module (ICM) with front graphic display and up to five parallel-connected hot-swappable 700-, 1,000-, or 1,500-watt, 24- or 48-volt Power Modules, for a combined 7,500 watts or 270 amps continuous output rating.

Table 1. Power Module Ratings

Module	Output Voltage adjustment range (V)	Default Output Voltage (V)	Output Current Limit adjustment range (A)	Default Current Limit (A) (+5%, −0%)
24 V 25 A ICT700-24PM	23–31	27.6	5–25	25
48 V 12 A ICT700-48PM	46–62	55.2	2.5–12.5	12.5
48 V 18 A ICT1000-48PM	46–60	55.2	3–20	18
24 V 54 A ICT1500-24PM	23–31	27.6	5–54	54
48 V 27 A ICT1500-48PM	46–62	55.2	3–27	27

1.1 System Components and Features

A typical configuration is illustrated in Figure 1. This unit consists of a power chassis with an ICM, four 700-, 1,000-, or 1,500-watt Power Modules, a dual input Battery Management Module (BMMD), an integrated DC-DC Converter Module, and two Load Distribution Modules (LDM) with output breakers. This 2RU system provides a remotely managed 2,800 watts, 4,000 watts, or 6,000 watts of hot-swappable DC power with built-in battery breakers, Low Voltage Disconnect (LVD), advanced battery management, a DC-DC Converter Module providing up to 700 watts of 12- or 24-volt DC output, and eight channels of intelligent, remotely controlled DC power distribution.

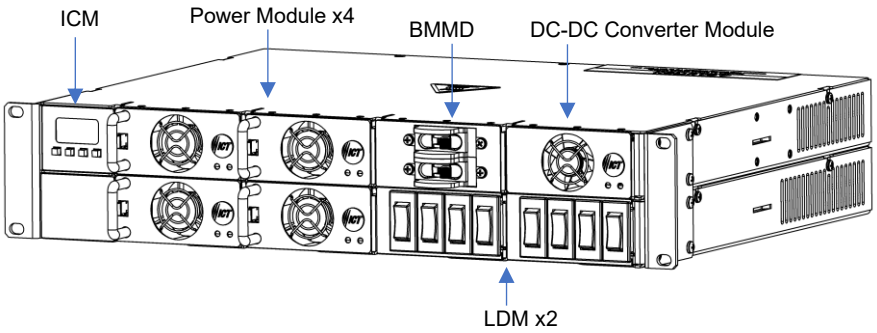


Figure 1. A Typical Hybrid Ultra Configuration

1.1.1 Intelligent Control Module (ICM)

- OLED display with intelligent front panel controls fully integrated into power chassis
- TCP/IP Ethernet communications port
- Embedded web server with easy-to-use graphical user interface (GUI)
- Intelligent monitoring, reporting and control of system and all installed modules
- HTTPS, SMTP, SNMP (v1, v2c, v3) protocols supported
- Alarm notifications via GUI, e-mail, or text
- Four digital site monitoring sensor inputs with alarm reporting
- Data logging
- Password protection

1.1.2 Power Module

- 100–300 VAC input with power factor correction
- 700-, 1,000-, or 1,500-watt hot-swappable Power Modules
- 24- or 48-volt nominal DC output (floating ground)
- Up to 95% efficiency
- −30 to +60°C operating temperature range

1.1.3 Battery Management Module (BMMD)

- Dual 100-amp battery disconnect circuit breakers
- Integrated 150-amp low voltage disconnect
- Advanced battery management features (with ICM installed) including:
  - temperature compensated charging (lead-acid batteries only)
  - display of battery voltage
  - status
  - battery current

  - state of charge
  - run time remaining
  - adjustable LVD settings
  - configurable advanced battery management features such as boost charge parameters, maximum charge current, battery capacity, battery test timer, and battery discharge test cutoff voltage
- Support for lead-acid and lithium-ion battery types (features differ depending on battery type)

1.1.4 DC-DC Converter Module

- 700-watt, 12- or 24-volt DC integrated isolated DC-DC Converter Module
- Powered from the system DC bus
- Monitoring and alarm reporting

1.1.5 Load Distribution Module (LDM)

- TCP/IP remote management and power control of individual outputs (with ICM installed)
- Four fully managed 25-amp (peak) load outputs with individual power cycling for each output
- Adjustable alarm and load-shed settings for each output
- Monitoring and alarm reporting of each output

1.1.6 Power Chassis

- Up to 7,500 watts of power with redundancy
- Flexible configurations allow the DC power system to be matched to the requirement

2.0 INSTALLATION

The following is the recommended sequence for the installation process.

2.1 Unpacking and Inspection

Perform a physical check of the unit as it is being taken out of the box to ensure it has not been damaged during shipping. Check that the system configuration matches the version ordered, and that the accessories under the package contents section were shipped with the unit.

NOTE: In case of shipping damage, your freight carrier should be notified immediately.

2.2 Package Contents

- Quick Start Guide
- Power chassis (hot-swappable Power Modules must be ordered separately)
- Two rack-mounting ears (installed)
- One ground strap (installed)
- Two T-shaped output strap (installed)
- Output bus bar safety cover (in packaging slot)
- Bag containing the following:
  - Instruction manual (USB drive)
  - Two 3-pin AC input wire clamp connectors
  - One 7-pin alarm and temperature sensor wire clamp connector
  - Two 3-pin form-C alarm relay connectors
  - Four 6-32 x 1/4-inch screws for installing the safety cover
  - Six 1/4- inch bolt/washer/nut sets for the output bus bar connection
  - Remote battery temperature sensor (ICT-TMP)
  - Clamp adhesive for mounting the ICT-TMP
  - RJ11 control cable jumper (ICT-JMP)
  - Circuit Breaker Installation Guide

2.2.1 Tools and Parts Needed

- Two 7/16-inch wrenches
- Wire stripper and crimper
- Four screws to install the unit into the equipment rack
- #1 Phillips screwdriver for the connections of rack ears, output bus bar cover, and AC input connectors
- 3/32-inch flathead screwdriver for the connections of the AC input wires, and alarm and sensor wires

2.3 Quick Install Guide

- Unpack and check that the unit and all materials have been delivered.
- Obtain the recommended tools.
- Check and verify the configuration.
- Mount the unit into a 19-inch rack.
- Connect the chassis ground according to the site design, and in accordance with local electrical code standards.
- Connect the sensors and alarms.
- Connect the battery.
- Insert the breakers and Power Modules.
- Connect the network cable using third-party surge protection.

- Connect and energize the AC power source, using third-party surge protection.
- Configure the software settings.
- De-energize the unit and connect the load devices using third-party surge protection on all DC conductors which may be exposed to environmental factors such as lightning.
- Verify the system wiring.
- Energize the loads and battery connections.

2.4 System Configuration

CAUTION

Risk of personal injury or damage to equipment and property. Always observe the following:

- Ensure the unit has the correct polarity for the application (see Table 2).
- Do not combine 1,500-watt with 1,000-watt or 700-watt Power Modules within the same unit.
- Do not combine 12-volt, 24-volt, and 48-volt Power Modules within the same unit.
- Ensure that there are enough matching Power Modules available to support the load requirement.

NOTE: Power Modules and accessories must be ordered separately.

Table 2. Power Chassis Models (cont'd on next page)

Description	Model No. (negative V output)	Model No. (positive V output)
Intelligent Power Chassis with integrated Control Module and Ethernet communications, includes dual 100 A battery disconnect breakers and 150 A Low Voltage Disconnect, a 700 W 12 V integrated DC-DC Converter Module, 8 x 25 A (max.) outputs, accepts up to four Power Modules	ICT-2U4-DC12	ICT-2U4P-DC12
Intelligent Power Chassis with integrated Control Module and Ethernet communications, includes dual 100 A battery disconnect breakers and 150 A Low Voltage Disconnect, a 700 W 24 V integrated DC-DC Converter Module, 8 x 25 A (max.) outputs, accepts up to four Power Modules	ICT-2U4-DC24	ICT-2U4P-DC24

Description	Model No. (negative V output)	Model No. (positive V output)
Intelligent Power Chassis with integrated Control Module and Ethernet communications, includes dual 100 A battery disconnect breakers and 150 A Low Voltage Disconnect, a 700 W 12 V integrated DC-DC Converter Module, 4 x 25 A (max.) outputs, accepts up to five Power Modules	ICT-2U5-DC12	ICT-2U5P-DC12
Intelligent Power Chassis with integrated Control Module and Ethernet communications, includes dual 100 A battery disconnect breakers and 150 A Low Voltage Disconnect, a 700 W 24 V integrated DC-DC Converter Module, 4 x 25 A (max.) outputs, accepts up to five Power Modules	ICT-2U5-DC24	ICT-2U5P-DC24

Table 3. Power Module Models

Description	Model No.
24 V, 700 W Power Module (27.6 V, 25 A)	ICT700-24PM
48 V, 700 W Power Module (55.2 V, 12.5 A)	ICT700-48PM
48 V, 1,000 W Power Module (55.2 V, 18 A)	ICT1000-48PM
24 V, 1,500 W Power Module (27.6 V, 54 A @ 230 VAC)	ICT1500-24PM
48 V, 1,500 W Power Module (55.2 V, 27 A @ 230 VAC)	ICT1500-48PM

Table 4. Available Accessories

Description	Model No.
5 A circuit breaker for LDM	ICT-CB5
10 A circuit breaker for LDM	ICT-CB10
15 A circuit breaker for LDM	ICT-CB15
25 A circuit breaker for LDM	ICT-CB25
Blanking plate for unused power module positions (snap-in)	ICT-BPM
Battery temperature sensor (1 pc included with Power System/BMM)	ICT-TMP
Secondary power shelf output bus bar jumper strap (for parallelling two power shelves) (included)	ICT-PAR
Secondary power shelf parallel RJ11 control cable jumper (4”) (included)	ICT-JMP

2.5 Rack Mounting

CAUTION

Provide adequate support for the rear of the unit without obstructing the air vents.

Mount the unit in an enclosed, standard 19-inch equipment rack or other restricted access location, using rack mounting screws (not supplied). Support the rear of the unit with rack chassis support or back rail if required.

2.6 Ground Connection

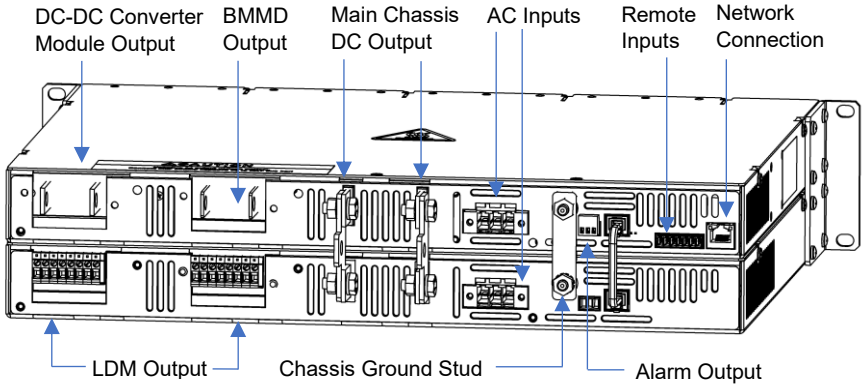


Figure 2. Typical Rear View

WARNING

De-energize the system before making any change to the wiring and connections.

NOTICE

All DC outputs of ICT's DC power systems are isolated from chassis ground (floating). DC output returns can remain isolated from ground (DC-I) or can be grounded (DC-C), as per site grounding requirements and/or local or national electrical codes. Ensure that all relevant electrical code standards are followed.

Connect a ground bonding wire from the chassis ground stud to a nearby common grounding point. Use a ground bonding wire that is sized in accordance with NEC Table 250.122 (see Table 5). Ensure that the selected ground bonding wire is rated to handle the maximum current rating of the power system.

Table 5. Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment

Maximum Circuit Breaker Size (Amps)	Conductor Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum
15	14	12
20	12	10
30	10	8
40	10	8
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1

This is sourced from "National Electrical Code 2005 Edition", p. 70-112.

2.7 Surge Protection Device(s) Installation

Third-party surge suppression devices must be utilized to protect AC input power feeds, every exposed DC power conductor and exposed data cables. These protection devices must be installed at both ends of the exposed conductor, in close proximity to installed equipment. Periodically inspect these surge protection devices for proper function.

NOTE: Consult with manufacturers of surge suppression devices to select appropriately rated protection device(s) and proper installation methods.

2.8 Sensor and Alarm Connections

The ALARM and AUX connectors allow the Hybrid Ultra to monitor external devices and batteries, and to report faults to an external monitoring device through a form-C contact.

NOTE: The Form-C relay provides a voltage-free (dry) contact and does not supply power. It is intended to switch external circuits energized by an external voltage source.

1. Connect the RJ11 ports of the primary unit and the secondary unit using the control cable jumper (ICT-JMP) provided.

2. If needed, connect form-C contact monitoring wiring to the ALARM connector as shown in Table 6. Use 22–26 AWG wire. Refer to Tables 16–20 for which conditions will trigger a form-C alarm.

NOTE: The alarm trigger signals for the top and bottom chassis are connected via the parallel RJ11 control cable jumper (ICT-JMP). If the ICT-JMP is connected, both top chassis contacts and bottom chassis contacts are flagged for all system alarms. If the ICT-JMP is not connected, the top chassis contacts are flagged for all system alarms while the bottom chassis contacts indicate the bottom power module faults only. Ensure that the ICT-JMP is connected.

Table 6. Alarm Output Connector

Pin Number	Name	Function
1	NC	Alarm NC (alarm state)
2	NO	Alarm NO (alarm state)
3	Common	Alarm output common

3. If needed, connect up to four devices to the AUX connector as shown in Table 7. Use 22–26 AWG wire.

4. Connect the external Battery Temperature Sensor (ICT-TMP) to the AUX connector as shown in Table 7 (use for lead-acid batteries only). This will allow the Hybrid Ultra to compensate the battery charge voltage according to the battery temperature. Use 22–26 AWG wire.

Table 7. Remote Input Connector

Pin Number	Name	Function
1	Alarm 1	Alarm 1 input
2	Alarm 2	Alarm 2 input
3	Alarm 3	Alarm 3 input
4	Alarm 4	Alarm 4 input
5	Alarm Return	Common alarm return
6	Bat Temp	Battery temperature sensor
7	Bat Temp	Battery temperature sensor return

Mount the sensor to the mid-level side of the middle battery in a battery bank using the adhesive-backed clip. The rate of voltage compensation can be adjusted through the ICM front display panel interface, or the Graphical User Interface (GUI) in the Battery Backup Settings section. The default compensation is 0 mV/C per cell (no compensation). Adjust this according to the battery manufacturer's recommendation to enable charge voltage temperature compensation.

NOTE: Battery temperature is assumed to be 25°C if no sensor is installed.

5. Install wiring to monitor up to four external devices such as smoke, door or water sensors through the digital alarm inputs. Each alarm input can be connected to a form-C/dry contact on the external device. If the alarm state changes on the device being monitored, the GUI will report the alarm. The GUI allows each of the four alarm inputs to be labelled with a unique name (see Section 4.7.2).

6. Enable the alarm inputs and set the contact logic (normally open or normally closed) in the GUI, Alarms Settings & Control tab (see Section 4.7.2).

2.9 Battery Connections

Risk of serious personal injury or damage to equipment and property. Observe the following:

- Use a battery with rating and capacity appropriate for the model of power supply in use.
- Use an appropriate DC overcurrent protection device in line with the backup battery connection.
- Use wire and connectors rated for the maximum load current.
- Ensure battery polarity is correct before connecting.
- Do not attempt to charge a frozen battery.
- Always install batteries in well-ventilated areas.
- Handle batteries with care. Never short-circuit battery terminals.
- Always consult with and observe all battery manufacturer recommendations.
- When connecting a battery, ensure the nominal battery voltage is correct, and that the battery positive is connected to a positive terminal and the battery negative is connected to a negative terminal.
- Note that the BAT terminal on the BMMD is internally tied to either the (+) or (−) system output through the LVD contactor, depending on the polarity of the power system used.
- Check system model polarity before connecting a battery to the BMMD.
- Only use the Equalize Charge setting for flooded lead-acid batteries in a well-ventilated location. **Do not use Equalize Charge on sealed or lithium-ion batteries.** Always consult with and observe all battery manufacturer recommendations.
- Do not tie either of the unit main outputs to the BAT terminal on the BMMD, as this may short-circuit the battery or bypass the internal LVD circuitry in the BMMD.

WARNING

- Use wire and connectors appropriately rated for the highest possible system current when making connections to the battery, BMMD, and main DC output.
- If a lithium-ion battery is used, it must utilize an integrated battery management system (BMS) to protect the battery cells from inappropriate voltage or current levels.

CAUTION

Leave BMMD breaker turned off until the software has been configured (see Section 3.2.2 or Section 4.5.2).

The BMMD dual breaker module provides a convenient and safe way to connect an external lead-acid or lithium-ion backup battery to the Hybrid Ultra. A 100-amp hydraulic-magnetic circuit breaker provides overcurrent protection, while an internal 150-amp LVD contactor will disconnect the battery should it discharge below the voltage level which is set in the Battery Backup section of the GUI. Internal battery current monitoring provides a full suite of remote battery charge monitoring features.

1. Check that the default system output voltage and current limit match the requirements of the battery and the loads to be connected. Adjust the system Output Voltage and Current Limit (see Section 3.2.1 or Section 4.2.2) to match the combined battery and system load requirements before making final connections, if required.

Table 8. Default System Output Settings

Output Settings	ICT700-24PM	ICT700-48PM	ICT1000-48PM	ICT1500-24PM	ICT1500-48PM
Output Voltage	27.6 V	55.2 V	55.2 V	27.6 V	55.2 V
Current Limit	464 A	232 A	232 A	464 A	232 A

NOTE: Use only identically rated battery strings for the dual battery BMM option to ensure equal charging of each battery set.

2. Verify the polarity of the BMMD installed in the unit by noting the label under the rear BMMD BAT bus bar input. The "BAT +" indicates a positive battery voltage system with the LVD contactor and battery breaker internally connecting this terminal to the system "+" output, while the "BAT –" indicates a negative battery voltage system, with the LVD contactor and battery breaker internally connecting this terminal to the system "−" output (see Figure 3 and Figure 4).

Figure 3. The BMMD Output Bus Bars

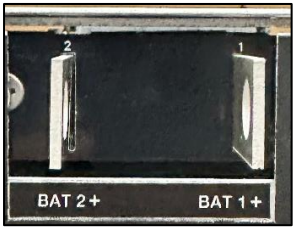


Figure 4. The BMMDP Output Bus Bars

NOTE: Use wire and connectors appropriately rated for the highest possible system current when making connections to the battery, BMM, and power chassis.

3. Connect the battery hot lead (see comment on polarity above) to the BMMD BAT bus bar, and the battery return lead to the main chassis output bus bar of the corresponding polarity (i.e., a positive voltage system will have the battery (+) tied to the BMMD terminal, with the battery (−) tied to the main NEG output busbar; a negative voltage system will have the battery (−) tied to the BMMD terminal, with the battery (+) tied to the main POS output busbar). Install an appropriate in-line DC overcurrent protection device, such as a fuse or circuit breaker, on the battery hot lead. Leave battery breaker open until the software has been configured.

Table 9. Available BMMD Models

−V BAT	+V BAT	Description	Connections
BMMD	BMMDP	Dual 100 A battery breakers to connect two identical battery strings through an LVD and current sensor with advanced battery management capability for the combined battery	BAT 1 and BAT 2 input bus bars (both either + or − polarity)

2.10 Installation of the Breakers

Install breakers in the four front locations of the LDM by inserting into the four breaker openings ("On" or "I" facing up, "Off" or "0" facing down), ensuring the breaker connector tabs securely seat in the LDM breaker sockets. Leave the breakers turned off until the software has been configured (see Section 3.2.4 or Section 4.6.2).

CAUTION

If the breakers are not fully installed or are not installed “square” they may cause intermittent power loss or unexpected behavior for the load devices.

When installing load breakers, apply even pressure to the top and bottom of the breaker to ensure proper engagement of the breaker with the rear contacts (see Figure 5).

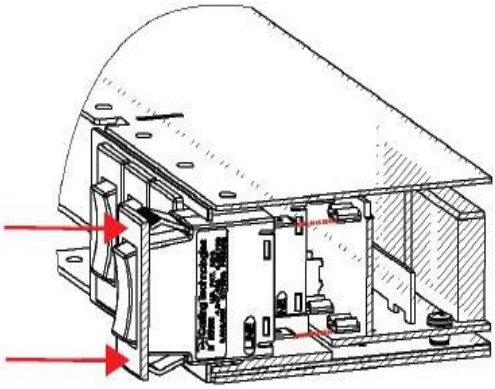


Figure 5. Installing breaker with even pressure

Applying pressure unevenly may result in misalignment of the contacts (see Figure 6).

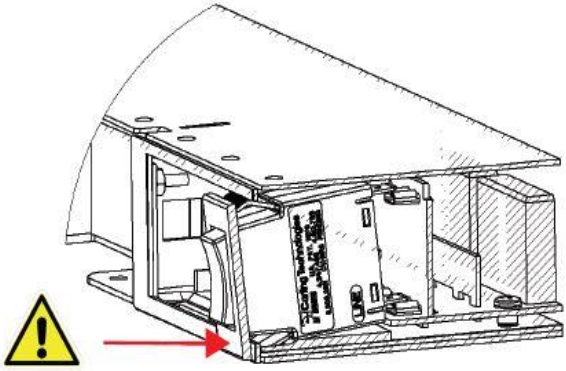


Figure 6. Installing breaker with uneven pressure

2.11 Installation of the Power Modules

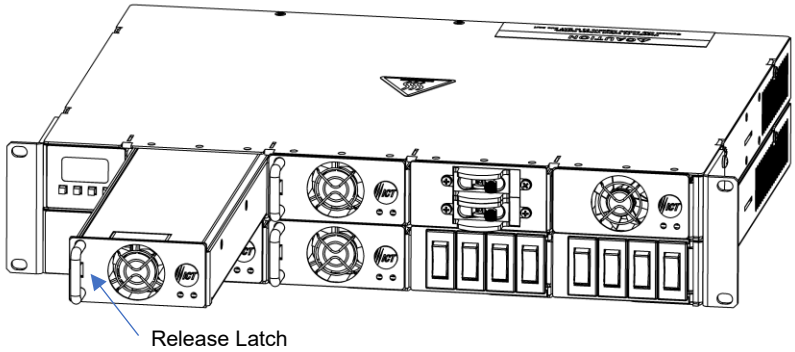


Figure 7. Installing Power Module in a Hybrid Ultra

CAUTION

Risk of personal injury or damage to equipment and property. Always observe the following:

- Ensure the unit has the correct polarity for the application (see Table 2).
- Do not combine 1,500-watt with 1,000-watt or 700-watt Power Modules within the same unit.
- Do not combine 24-volt and 48-volt Power Modules within the same unit.
- Ensure that there are enough matching Power Modules available to support the load requirement.
- Ensure that the orientation of the power module is correct when inserting into the desired slot — the handle and latch should be on the left side facing the Power Module.

1. Install one to five matching hot-swappable Power Modules — with the same voltage rating — in any remaining open chassis positions. The Power Modules will share the total output load, automatically disconnecting from the internal power bus in the event of an internal failure and may be "hot-swapped" (can be inserted or removed while the system is powered). If "N+1" redundancy is needed, ensure the combined power rating of the installed Power Modules exceeds the total requirement of the planned load by at least 700 watts (1,000 watts or 1,500 watts if using ICT 1000- or 1500-watt Power Modules).

NOTE: N+1 operation requires excess Power Module capacity to ensure that the load can be fully powered, even if one Power Module should fail or be removed.

2. Carefully align each Power Module with the internal chassis guides.

3. Firmly push into the system back plane until the module latch clicks, and the module is flush with the unit's front panel.

NOTE: The Power Modules can be easily removed by pressing the release latch to the right while firmly pulling the module from the unit (the system may be powered while swapping modules). The latch is located under the module handle (see Figure 7).

4. Install an optional blanking plate (ICT-BPM) into any unused Power Module positions to prevent accidental access to the internal circuitry of the system.

2.12 Network Cable Connection

Connect a 10/100 Base-T Ethernet cable, using third-party surge protection, to the RJ45 LAN port on the rear panel to allow for remote monitoring and control of the unit.

NOTE: See the Network Monitoring and Control section for information on configuring and using the built in GUI, e-mail, or SNMP functions (Section 4.8.2).

2.13 AC Power Source Connections

AC input wiring to the Hybrid Ultra unit must be protected using an outlet with a branch rated circuit breaker of 40 amps or less.

Install appropriately rated surge suppression systems on AC, DC, and data connections.

The ICT Hybrid Ultra provides flexible, managed DC power from single-phase AC power between 100 and 300 volts AC.

1. The two AC-input connectors on the ICT Hybrid Ultra are both required for normal operations. Create an AC power cable for each input using a 3-conductor cord rated for the maximum input current of the unit (up to 33 amps) by stripping and terminating the three wires in the Line, Neutral, and Ground terminals of the removable AC input connector provided with the unit (AC line labeled "L", neutral labeled "N" and safety ground labeled "⏚").

Table 10. AC Source Wiring Connections

AC Voltage	3-Conductor Cord	Connection to ICT Unit
120/240 VAC (Single-Phase)	Line Neutral Ground	Line to Line Neutral to Neutral Ground to Ground
240 VAC (Split-Phase/Two-Phase)	Line1 Line 2 Ground	Line 1 to Line Line 2 to Neutral Ground to Ground

2. De-energize the AC source by switching off its circuit breaker.

3. Plug the AC connectors into both AC inputs on the unit rear panel and tighten the captive retaining screws.

4. Connect the source end of the cord to the de-energized AC source equipped with a third-party surge protection and a branch rated circuit breaker as shown in Table 11.

5. Energize the AC feed.

Table 11. Recommended Breaker Rating

Total System Power Module Capacity	Recommended Breaker Rating
4 Power Modules	30 A per AC input
5 Power Modules	40 A per AC input

2.14 Software Configuration

Configure the software (see Section 3 or Section 4).

2.15 Load Connections

Risk of personal injury or damage to equipment and property. Always observe the following:

- DC-AC inverters should not be connected to any of the load connection points without a battery connected to the system. DC-AC inverters create significant inrush current and may damage the circuitry or interfere with the operation of power supplies when there is no battery connected. Connecting a DC-AC inverter in this way may void the product warranty.
- Do not connect DC-AC inverters to the outputs of the Load Distribution Module of the ICT units.
- Install appropriately rated surge suppression systems on AC, DC, and data connections.

WARNING

Damage to the unit, load, and/or personal injury may occur if the battery current through the BAT terminal exceeds 150 amps.

1. De-energize the unit before making or changing any connections.

2. Make connections to the load using wire and connectors appropriately rated for the maximum load current. The load may be powered in three different ways.

Table 12. Load Connection Points

Load Connection Points	Features
Directly from main system DC output bus bars	Full current rating of the system and combined Power Modules is available to operate the load
One of up to eight LDM output channel connector ports	Channel overcurrent protection with LDM front circuit breaker (1 to 8), individual remote channel on/off control and current monitoring
Integrated DC-DC Converter Module output bus bars	Fully isolated 12 V or 24 V, 700 W maximum

If using the DC output bus bars, connect the load "Return" to either the "POS" bus bar for a negative voltage system or "NEG" bus bar for a positive voltage system (see Figure 8). Connect the load output to the other bus bar. Ensure that the software has been configured (see Section 3.2.1 or Section 4.2.2) before connecting the loads to the DC output bus bars.

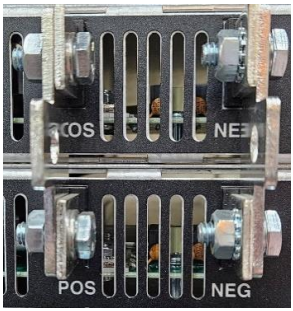


Figure 8. The DC Output Bus Bars

If using the LDM outputs, an "Output" (labelled + or − depending on polarity) and "Return" (labelled RTN) connection are provided for each channel (see Figure 9 and Figure 10).

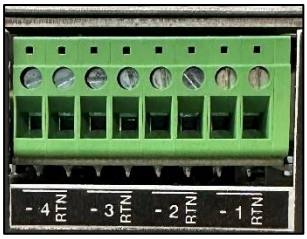


Figure 9. The LDM Output

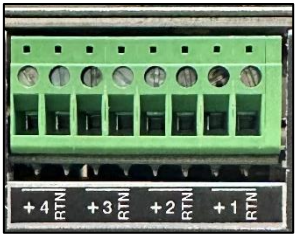


Figure 10. The LDMP Output

The LDM provides four remotely controlled and monitored outputs, with front panel overcurrent protection provided by hydraulic-magnetic circuit breakers (see Section 2.10 for the installation instructions for the breakers). The LDM maximum current rating is 80 amps. Each output can accept 25 amps maximum, 20 amps continuous.

Table 13. LDM Output Capacity

System Voltage	LDM Output Capacity
24, or 48 V	Up to 4 x 25 A peak output (20 A cont.)

NOTE: Due to the breaker-detection circuitry internal to the unit, it may be possible to measure a voltage on the terminal(s) with no load connected, even if that terminal's breaker is open circuit. This is normal operation. The breaker-detection circuitry is a high-impedance circuit, and while a voltage may be present on the output terminal, it is a signal voltage and does not support loading. A load device connected to the output will immediately pull this voltage to zero volts.

CAUTION

Risk of personal injury or damage to equipment and property. Always observe the following:

- Ensure that the combined current draw on all four LDM outputs does not exceed the output capacity of the Power Modules, or 80 amps, whichever is less.
- Leave breakers turned off until the software has been configured (see Section 3.2.4 or Section 4.6.2).
- Do not connect DC-AC inverters to the outputs of the Load Distribution Module of the ICT units.

1. Ensure that the unit is de-energized before making or changing any connections.

2. Locate the four controlled outputs on the LDM rear panel connector block.

NOTE: The internal channel relay, current sensor and circuit breaker are in the "hot" or output line, with voltage polarity depending on the configuration of the unit (each output = NEG V, for −48 V configured systems, each output = POS V, for +24, or +48 V configured systems).

3. Verify the polarity of the Hybrid Ultra.

4. Connect up to four external loads using appropriately rated wire inserted and secured into the four cage-clamp outputs on the LDM module rear panel. The LDM will accept wires from 12–22 AWG.

The integrated isolated DC-DC Converter Module output has "POS" and "NEG" terminals. Ensure polarity is correct when connecting the load. Ensure that the software has been configured (see Section 3.2.3 or Section 4.4.2) before connecting the loads to the DC-DC Converter Module output bus bars.

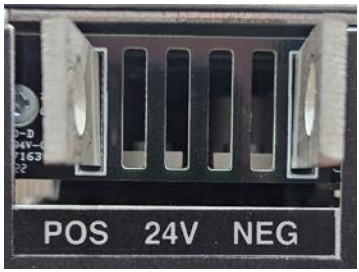


Figure 11. The 24-volt DC-DC Converter Module Output Bus Bars

CAUTION

- Ensure that the current draw on the DC-DC Converter Module output does not exceed the output capacity.
- Incorrect wiring may damage both the converter, and any equipment attached.

The DC-DC Converter Module provides up to 700 watts output power which is drawn from the Hybrid Ultra's primary voltage bus. The max current rating is shown in Table 14.

Table 14. DC-DC Converter Module Output Capacity

Converter Voltage	Converter Output Capacity
12 V	50 A
24 V	25 A

2.16 System Wiring Final Verification

1. Check that all connections to the power supply are correct and properly tightened.

2. Install the protective bus bar cover(s) using the screws provided.

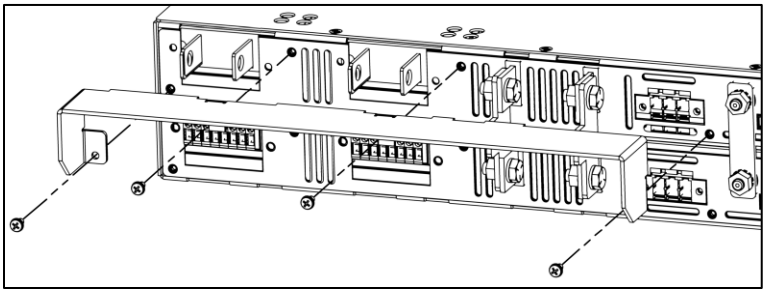


Figure 12. Installation of the Bus Bar Cover

2.17 Energize Loads and Battery Connections

1. Re-energize the AC source to energize the loads.

2. Switch on the BMMD battery breaker 1, and battery breaker 2 (if using) to connect the backup battery string(s) to the system.

3. Switch on the LDM output breakers 1 up to 8 to energize any loads connected to the Load Distribution Module outputs.

3.0 OPERATION: FRONT DISPLAY PANEL

Switch on the external AC power source circuit breaker; check that the green POWER LED is lit on each Power Module; and that the Intelligent Control Module (ICM) front graphic display is lit.

The Hybrid Ultra will start up and operate at the factory default settings when AC power is connected, generally requiring no other set up or adjustment for basic operation.

3.1 Graphic Display

Use the front display panel and four interface buttons on the ICM to monitor the supply operation and to make changes to settings such as output voltage, current limit, and battery low voltage disconnect points.

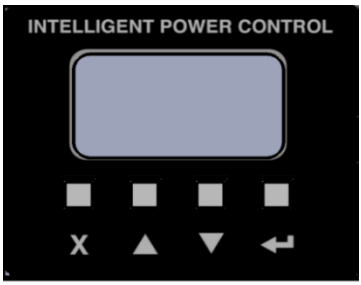


Figure 13. ICM Front Control Interface

NOTE: The display will turn off after approximately 60 minutes of no use and can be reactivated by momentarily pressing any button.

Up/Down ▲▼ Buttons: Use to scroll through display screens, and to adjust selected settings.

Enter ↵ Button: Use to select a screen for adjustment; to save a change and return to the previous screen.

Back X Button: Use to return to previous screen without saving changes.

3.2 Menu Structure

See the complete menu structure in the following diagram. Navigate through the various screens using the four interface buttons.

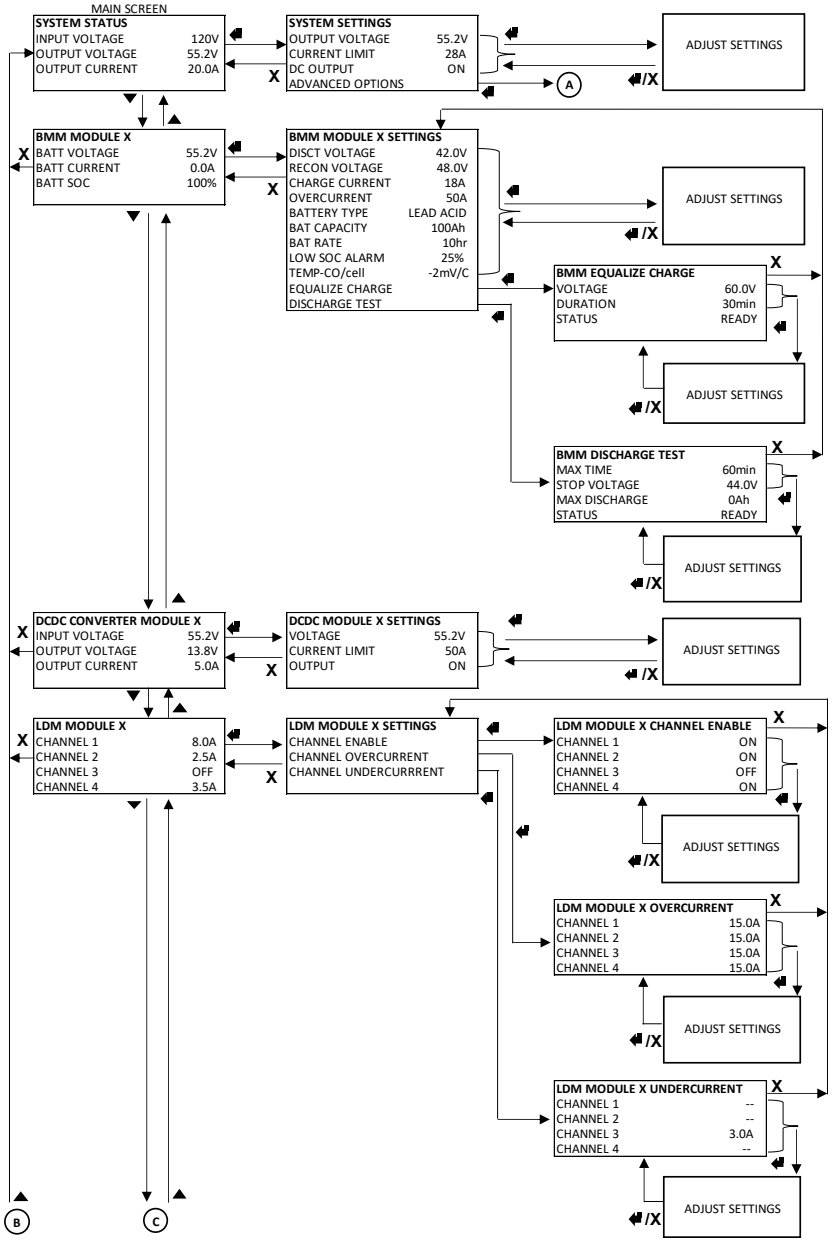


Figure 14. ICM Menu Structure (cont'd on next page)

NOTE: Connectors (A), (B) and (C) show continuation of the structure from one page to another.

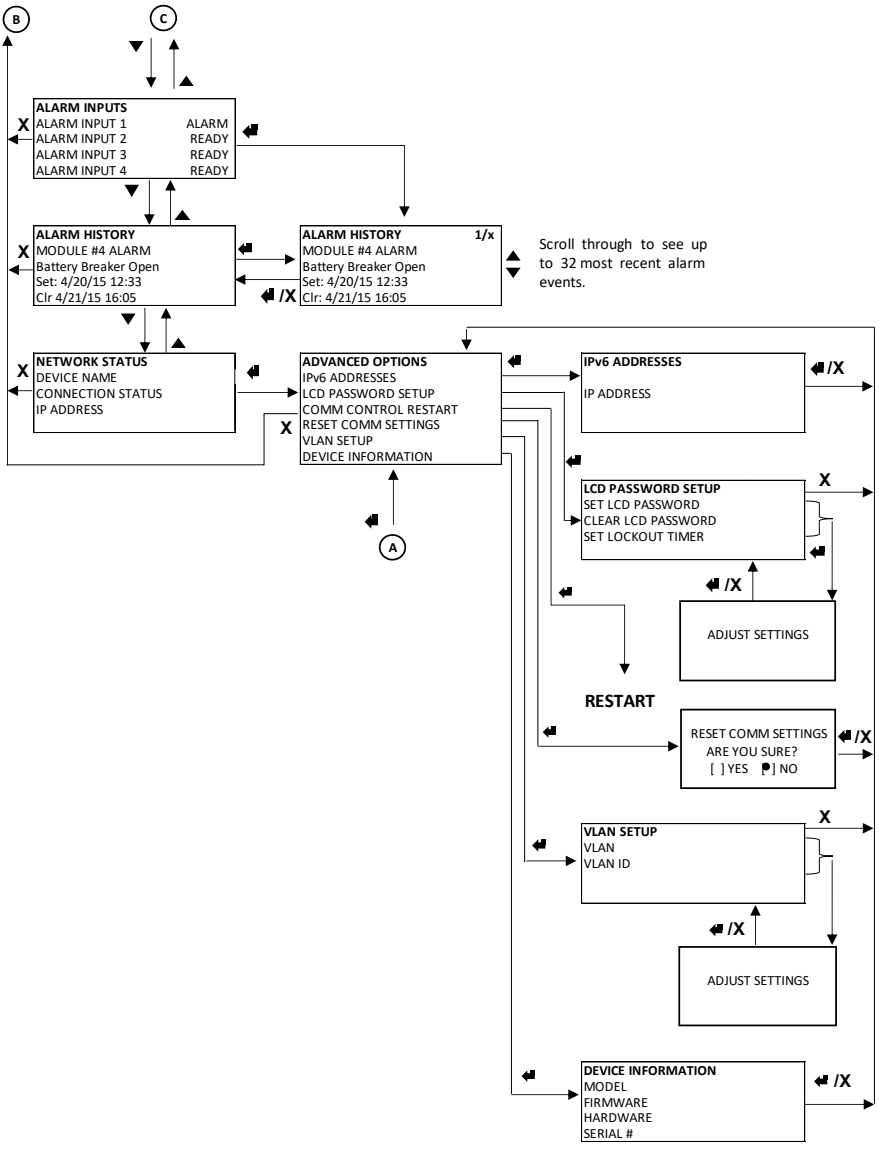
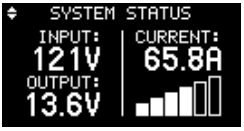


Figure 15. ICM Menu Structure (cont'd from previous page)

NOTE: Connectors (A), (B) and (C) show continuation of the structure from one page to another.

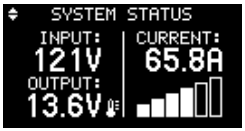
3.2.1 System Status

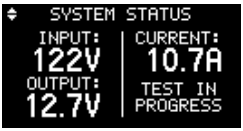
The main system status screen will show the most current operating conditions for the unit, primarily the Input Voltage (VAC), the Output Voltage (VDC), the total Output Current (A), and a bar graph indicating relative output current.



Other information will be shown depending on the operating state of the unit:

- A small thermometer symbol to indicate that the remote temperature sensor is installed and may be compensating the battery charge voltage
- Indication that the output has been disabled (off)
- Indication that a battery discharge test is in process
- The Input Voltage or Output Voltage will be flashing during an AC voltage or output voltage failure
- The Output Current will be flashing if the unit is operating at the set Current Limit.





↵ Press Enter to move to the System Settings.

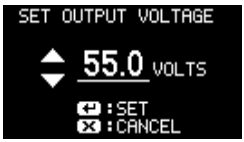
System Settings

The Output Voltage and Output Current Limit settings come with factory default values that should be adjusted to match the actual system and battery float voltage requirements, as shown below:

▲▼ Scroll to highlight the parameter to change.

- System Voltage
- Max total Output Current Limit
- Output Enable ON/OFF (default = ON)
- Advanced Options (see Section 3.2.7)

↵ Press Enter to select.

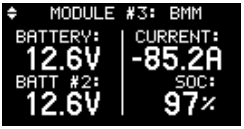


▲▼ Use the Up/Down buttons to adjust setting (Output Voltage shown), press Enter ↵ to set value and return to previous screen. Press Back ✖ to return to System Settings screen without saving changes.

NOTE: The output voltage and current limit settings apply to the combined output of all installed Power Modules. The ICM treats the combined modules as a single high-power supply. Adjust the system Output Voltage and Current Limit (see System Settings section) to match the battery type and system load requirements if required.

3.2.2 Battery Management Module

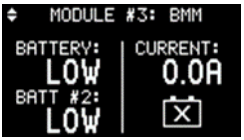
The BMMD Status Screen indicates the Battery 1 Voltage (VDC), the Battery 2 Voltage (VDC), the combined Battery Current, and the approximate battery State of Charge (%).



The SOC% is estimated by counting the ampere-hours (Ah) flowing into and out of the battery while knowing the nominal rated capacity of the battery. The system resets the SOC to 100% whenever it detects that the battery is at the rated Float Voltage with minimal charge current for at least 24 hours (Units with factory-installed firmware V2.10, or newer, will reset when at Float Voltage for 8 hours with lead-acid, or 1 hour with lithium batteries). The SOC is only displayed when the unit is running on battery power.

Other information will be shown depending on the operating state of the unit:

- Battery current will be zero when not charging, "+" while charging and "−" while discharging
- LOW indicates a battery is disconnected or over discharged
- A battery graphic marked with X indicates the battery is disconnected



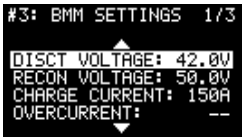
↵ Press Enter to move to the BMM Settings.

BMM Settings (All Battery Types)

The module comes with factory default settings that should be reconfigured to match the actual battery used in the system.

WARNING

Always consult battery manufacturer's specifications when selecting battery type. Incorrect battery type setting may damage the battery. If Lithium-Ion type battery is selected, it must utilize an integrated battery management system (BMS) to protect the battery cells from inappropriate voltage or current levels.

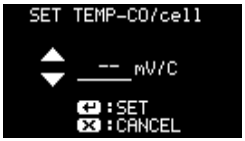


▲▼

Scroll to highlight the parameter or sub-menu to change.

- LVD Disconnect V
- LVD Reconnect V
- Charge Current Limit
- Overcurrent Alarm level
- Battery Type
- Battery Capacity (Ah) rating
- Battery discharge rate (hrs.) used for capacity spec. (typically either 10 or 20 hrs.)
- Low SOC Alarm
- V Temp-co/cell (default = 0, typically = −4 mV/°C)
- Equalize Charge
- Discharge Test

↵ Press Enter to select.



▲▼ Use the Up/Down buttons to adjust settings (SET TEMP-CO/sell shown), press Enter ↵ to set value and return to previous screen. Press Back ✕ to return to BMM Settings screen without saving changes.

DISCT VOLTAGE: Set the battery Low Voltage "Disconnect Voltage" threshold to a level that will protect the battery from excessive discharge. The LVD contactor will open when the battery discharges to this level for at least 3 seconds.

RECON VOLTAGE: Set the "Reconnect Voltage" higher than the disconnect voltage (see Table 26) to prevent the LVD contactor repeatedly cycling on and off. This setting will be used when charging

the battery from an external DC source (such as a solar system), otherwise once AC power returns, the LVD contactor will automatically close so that the Power Modules can charge the battery directly.

NOTE: For lead-acid battery, the LVD contactor will not close if the battery is less than 40 volts on a 48-volt system (see Table 23). The unit believes the battery is deeply discharged, and possibly damaged. A deeply discharged battery will not be reconnected as a safety measure. The battery will need to be manually checked for proper function and then manually charged to at least 40 volts (on a 48-volt system) before the LVD will close. Refer to the battery manufacturer's recommendations on how to proceed with a deeply discharged battery. This does not apply to the system when the Lithium setting has been chosen.

CHARGE CURRENT: Set the "Battery Charge Current Limit" to limit the maximum battery charge current provided, while still allowing the full rated current to be drawn from the main output.

OVERCURRENT: Set the "Battery Overcurrent" to receive an alarm notification when the battery discharge or charge current exceeds the set over-current level.

NOTE: Set the threshold to 0 A to disable this alarm (default setting).

BATT TYPE: Configure the "Battery Type" of the battery used in the system (Lead Acid, Lithium Ion (Narada), Lithium Ion (PWRSS) and Lithium Ion (Other)).

NOTE: PWRSS is an abbreviation for Power Storage Solutions.

If Lithium-Ion type battery is selected, the following battery parameters and settings will be unavailable. These should be available from the integrated BMS.

- Voltage Temperature Coefficient / cell
- Equalize Charge

BATT CAPACITY: Enter the combined battery capacity in Ah so the system can estimate the total battery SOC%.

BATT RATE: Set the battery rate (hrs.). This represents the discharge rate specified by the battery manufacturer to determine the battery capacity (usually will be 20 hr. or 10 hr. rate).

NOTE: Connecting batteries in parallel will increase the total Ah capacity, while connecting batteries in series will increase the voltage with no change to the Ah capacity.

LOW SOC ALARM: Set the "Low SOC Alarm" (%) if desired, to raise an alarm when the battery is nearly discharged.

TEMP-CO/cell (only available for lead-acid batteries): Ensure the Battery Temperature Sensor (ICT-TMP) is installed and connected to the battery case (see Section 2.8) for optimal lead-acid battery charging and best battery life. Set the "Temperature Compensation/°C" level per battery cell to match the recommendation of the battery manufacturer (−4 mV/°C per cell is typical). The numbers are absolute values.

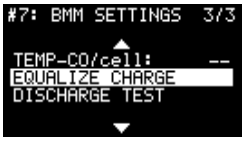
EQUALIZE CHARGE (only available for lead-acid batteries):

WARNING

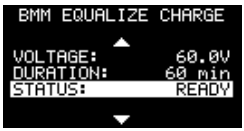
Risk of serious personal injury or damage to equipment and property! Always observe the following:

- Equalize charging is intended for flooded lead-acid batteries only and may produce higher than normal levels of hydrogen gas.
- Consult with the battery manufacturer when using SLA batteries.
- **Do not use equalization charging with lithium-ion batteries**.
- Ensure the battery compartment is well ventilated to avoid any risk of explosion.
- Always consult with and observe all battery manufacturer recommendations.

Configure the “Battery Equalize Charge” voltage, duration, and automatic repeat interval if desired when using flooded lead-acid type batteries only. The system will step up the output voltage to the Equalize Voltage for the Equalize Duration time whenever the Equalize Status is set to Enable. The unit’s data log (see Section 4.8.1) will record the completion of the equalization charge while a pop-up window will appear on the front display screen (see Section 3.2.8).



↵ Press Enter to select.



Scroll to highlight parameter in selected sub-menu.

- Voltage
- Duration
- Status

Press Enter to set to START EQUALIZE CHARGE screen.

Use the Up/Down buttons to select setting, press Enter ↵ to set selected setting and return to previous screen. Press Back ✕ to return to previous screen without saving changes.

Status will show IN PROGRESS when equalize charge is occuring. Press Back ✕ to return to the BMM Settings screen.

Press Enter to set to STOP EQUALIZE CHARGE screen.

Use the Up/Down buttons to select setting, press Enter ↵ to set selected setting and return to previous screen. Press Back ✕ to return to previous screen without saving changes.

Status will show COMPLETE when equalize charge is completed. Press Back ✕ to return to the BMM Settings screen. Press Enter ↵ to set status to READY.

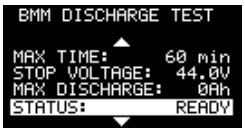
NOTE: System will state that Manual Equalize Charge is Not Ready if battery is not fully charged (a fully charged battery will have charge current close to zero amps).

DISCHARGE TEST: Configure the "Battery Discharge Test" to check on the battery's ability to power the system for a set duration. Set Max Discharge Time, minimum Stop Voltage, Max Discharge Limit, and the automatic repeat interval if desired. Each time the test is run the output

voltage from the Power Modules will be reduced so that the external battery will power the system load until the MAX TIME limit, STOP VOLTAGE, or MAX DISCHARGE limit is reached.

A Discharge Test Complete notification (on the front display and with an e-mail if messaging is configured via the GUI) will indicate a Test Failure if the Stop Voltage is reached before the Max Time limit, as the battery was not able to power the load for the desired duration. The unit's data log (see Section 4.8.1) will record the completion of the discharge test while a pop-up window will appear on the front display screen (see Section 3.2.8).

↵ Press Enter to select.



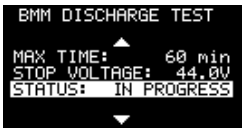
▲▼ Scroll to highlight parameter in selected sub-menu.

- Max Time
- Stop Voltage
- Max Discharge
- Status

↵ Press Enter to set to START DISCHARGE TEST screen.

▲▼ Use the Up/Down buttons to select setting, press Enter↵ to set selected setting and return to previous screen. Press Back ✕ to return to previous screen without saving changes.

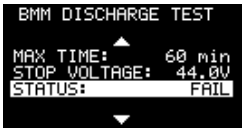
↵ Press Enter to start discharge test.



Status will show IN PROGRESS when discharge test is occuring. Press ✕ to return to the BMM Settings screen.

↵ Press Enter to set to STOP DISCHARGE TEST screen.

Use the Up/Down buttons to select setting, press Enter ↵ to set selected setting and return to previous screen. Press Back ✕ to return to previous screen without saving changes.

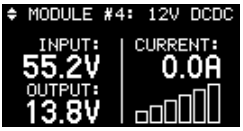


Status will show FAIL when discharge test is not completed. Press Back ✕ to return to the BMM Settings screen. Press Enter ↵ to set status to READY.

NOTE: A discharge test can only be initiated when the battery is fully charged (a fully charged battery will have charge current close to zero amps).

3.2.3 Integrated DC-DC Converter Module

The Integrated DC-DC Converter Module Status screen shows the input and output voltage of the integrated DC-DC Converter Module, the output current, and indicates if the output has been switched OFF.



↵ Press Enter to move to the Integrated DC-DC Converter Module Settings.

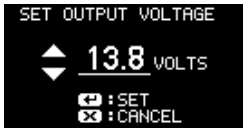
Integrated DC-DC Converter Module Settings

Changes can be made to the Output Voltage, Current Limit, and Output Enable (ON/OFF) settings of the integrated DC-DC Converter Module.

Scroll to highlight the parameter to change.

- Voltage
- Current Limit
- Output

↵ Press Enter to select parameter to adjust.



Use the Up/Down buttons to adjust setting, press Enter ↵ to set value and return to previous screen. Press Back ✕ to return to previous screen without saving changes.

Table 15. The Default Output Voltage and Current

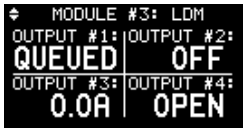
	12 V DC-DC Converter Module	24 V DC-DC Converter Module
Default Output Voltage	13.8 V	27.6 V
Default Output Current	50 A	25 A

3.2.4 Load Distribution Module

The LDM Status screen shows the output current for each of the four outputs. Use the Up/Down buttons to scroll through multiple LDM screens.

Other information will be shown depending on the operating state of the unit:

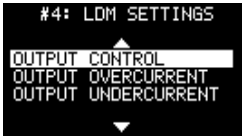
- QUEUED will be displayed if the output is in the power cycling state
- OFF will be displayed if the output has been disabled
- OPEN will be displayed if the circuit breaker is open or not installed



↵ Press Enter to move to the LDM Settings.

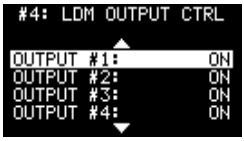
LDM Settings

The load current level alarm can be set by adjusting the Output Overcurrent, or Output Undercurrent threshold.



Scroll to highlight the sub-menu to change.
- Output Control
- Output Overcurrent
- Output Undercurrent

↵ Press Enter to select.



Scroll to choose Output to be changed (On/Off control shown).

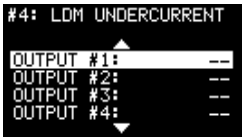
Press Enter to select.

Use the Up/Down buttons to adjust setting, press Enter to set value and return to previous screen. Press Back X to return to previous screen without saving changes.

Press Back X to return to LDM Settings screen.

Scroll to highlight the sub-menu to change (Output Undercurrent).

Press Enter to select.



Scroll to highlight Output to be adjusted.

Press Enter to select.

Use the Up/Down buttons to adjust setting, press Enter to set value and return to previous screen. Press Back X to return to previous screen without saving changes.

3.2.5 Alarm Inputs

The Alarm Inputs Status screen displays the status of the four alarm inputs provided on a unit equipped with the ICM. Use these inputs to monitor voltage free external contact closures such as door sensors, smoke alarm outputs or a water sensor.

Other information will be shown depending on the operating state of the unit:

- Alarm Inputs screen will not be displayed with disabled alarms
- OK will be displayed when there is no change on the state of the contacts
- ALARM will be displayed when a contact activates

Configure the logic of the external contact type selecting Normally Open (NO) or Normally Closed (NC) to activate the alarm inputs using the GUI Alarms Settings & Control tab (see Section 4.7.2). The factory default setting has the alarm inputs disabled.

Press Enter to see the Alarm History log (see below section for the Alarm History log).

3.2.6 Alarm History

The Alarm History screen displays a log of the 32 most recent alarm events. These alarms may have been raised by any module experiencing an alarm, or by one of the four external Alarm Inputs being triggered.

Other information will be shown depending on the operating state of the unit:

- If there is no alarm history, the screen will display "No Alarms in History" and the Alarm History log screen will not be displayed.

Alarm History screen if no alarms in history

Alarm History screen with alarms in history

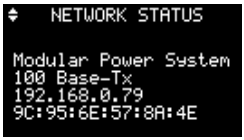
Press Enter to see Alarm History log.

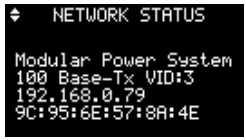
Scroll through the history screens to see the 32 most recent Alarm events. Shows the module that raised the alarm, date, and time when set, and cleared.

NOTE: The system date and time are normally set by the network. These may be manually set, see GUI, Communications Basic Setup tab (see Section 4.8.1).

3.2.7 Network Status and Advanced Options

The Network Status screen displays the network connectivity, IP address of the system, assigned VID # (if unit has VLAN enabled), and the assigned MAC address.





↵ Press Enter to move to the Advanced Options screen.

Advanced Options

Use the Advanced Options screen to view the IPv6 addresses, set or clear the LCD Password, Comm Control Restart, Reset Comm Settings, enable or disable VLAN tagging, and view the Device Information.

▲▼ Scroll to choose parameter or sub-menu.

- IPv6 Addresses
- LCD Password Setup
- Comm Control Restart
- Reset Comm Settings
- VLAN Setup
- Device Information

↵ Press Enter button to select the sub-menu.

Press Back ✘ button or Enter ↵ to return to the previous screen.

IPv6 ADRESSES: Displays the IPv6 addresses assigned to the system. If multiple IPv6 addresses are assigned, use the Up/Down buttons to scroll through the addresses.

LCD PASSWORD SETUP: Set or clear a 4-digit LCD password to lock out the ICM Display adjustments after the LOCKOUT TIMER has expired. Set the display Lockout Timer duration from 0 to 60 minutes. Once the password has been set, it will be required to access all front display settings screens.

NOTE: To reset forgotten passwords, refer to Section 3.3.1.

↵ Press Enter button.

▲▼ Scroll to choose.

↵ Press Enter button to select the sub-menu.

▲▼ Use the Up/Down buttons to adjust setting, press Enter ↵ to set value and return to previous screen. Press Back ✕ to return to previous screen without saving changes.

COMM CONTROL RESTART: Press "Comm Control Restart" to immediately restart the controller without affecting any of the unit settings and without interrupting DC power to the output terminals.

↵ Press Enter button to restart.

RESET COMM SETTINGS: Reset the admin password, port settings, and IP address to the factory defaults by pressing the "YES" button in the Reset Comm Settings. This does not affect the LCD password nor user accounts in the GUI (see Section 3.3).

↵ Press Enter button.

▲▼ Scroll to choose. Press Enter ↵ or Back ✕ to exit with no change.

▲▼ Scroll to choose. Press Enter ↵ to reset.

VLAN SETUP: Enable or disable VLAN tagging. Enter the VLAN ID number. After making any changes to the VLAN configuration, restart the controller to have the changes take effect. The controller can be restarted by selecting the "Comm Control Restart" option on the menu.

↵ Press Enter button.

▲▼ Scroll to choose (default: DISABLED).

↵ Press Enter button to select the sub-menu.

▲▼ Use the Up/Down buttons to adjust setting, press Enter ↵ to set value and return to previous screen. Press Back ✖ to return to previous screen without saving changes.

NOTE: VLAN should only be enabled if the unit is connected to a network that is configured to support VLAN tagging. If VLAN is enabled, ensure the network is configured to accept the VLAN ID assigned to the unit.

↵ Press Enter button to choose (default: 1).

Use the Up/Down buttons to adjust setting, press Enter ↵ to set value and return to previous screen. Press Back ✕ to return to previous screen without saving changes.

DEVICE INFORMATION: The Device Information screen displays the part family, installed firmware version, hardware version, and the serial number of the unit.

↵ Press Enter button.

Press Back ✕ button or Enter ↵ to return to the previous screen.

3.2.8 Notification Screens

Alarm Notification

When the unit triggers an alarm, the front display panel will be over-written by the Alarms Active screen. Press Back ✕ to return to the previous screen, press Enter ↵ to jump to the Alarm History screen.

Alarms will be shown as they occur, press Back ✕ button to return to the previous screen, press Enter ↵ for Alarm History info.

Equalization Charge Notification

When an Equalization Charge is completed, the front display panel will be overwritten with the Equalization Charge results screen.

Press Enter ↵ or Back ✕ buttons to jump to the System Status screen.

Discharge Test Notification
When a Discharge Test is completed, the front display panel will be overwritten with the Discharge Test results screen.

A notification will automatically appear indicating the results of a Discharge Test at the completion of the test. Press Enter ↵ or Back ✘ buttons to jump to the System Status screen.

A notification will automatically appear indicating a test failure. Press Enter ↵ or Back ✘ buttons to jump to the System Status screen.

3.3 Password Reset

3.3.1 LCD Password Reset

NOTE: Always record the LCD password when set, as it must be entered to change any supply settings using the front display panel.

Do the following to clear the LCD password in cases where it is lost:

1. Switch off the AC power to the unit.
2. Simultaneously press the ENTER ↵ and BACK ✘ buttons for more than 15 seconds while restoring the AC power.
3. Enter a new password (see Section 3.2.7) if password protection is required.

3.3.2 GUI Password Reset

Reset the GUI password back to the factory default (user: admin, no password) by selecting "RESET COMM SETTINGS" in the Network Status front display panel menu shown above (see Section 3.2.7).

NOTE: The browser cache may need to be cleared for the password reset to be recognized.

3.3.3 User Password Reset

Reset user passwords by following Section 4.8.4.

3.4 Status Indicators and Alarms

The status of the Hybrid Ultra is indicated on the front display panel module or via the network GUI (see Section 4) on remotely monitored units. It is also available through SNMP (see Section 4.8.2). Green "POWER" and red "FAULT" LEDs on the Power Modules, along with the form-C alarm contacts on the rear panel indicate the core status of the unit.

There is an option on the Setup & Control tab in the GUI for most alarms to send an e-mail to designated addresses for remote notification (see Section 4.8.3). No email will be sent if power is disconnected from the unit, due to loss of network control.

All alarms and warnings will be displayed on the front display screen on Hybrid Ultra systems and entered in the Alarm History log (most recent 32 alarms listed) (see Section 3.2.6).

Most alarms reset automatically when the trigger condition is removed. Major alarms such as a Module DC Output Failure or Module Configuration Error require that the module be temporarily removed to cycle input power and clear the fault.

Table 16. Power Module Alarms (cont'd on next page)

Alarm Condition	Trigger Condition	Module Output[1]	Red LED	Green LED	Alarm Relay	Send E-mail
Module Operating	Normal operation	Enabled	Off	On	No	No
Power Failure	Loss of AC power to module	Disabled	Off	Off	Active	Yes[2]
Configuration Error	Different voltage modules installed	Enabled	Off	On	No	Yes[2]
Current Limit (Warning only, display will flash)	Output current approaches within 1 A of the max current limit setting	Enabled	Off	On	No	No
Fan Failure (700 W)	Fan is not operating to spec	Enabled	Off	On	No	Yes[2]
Fan Failure (1,000 W)	Fan is not operating to spec or stops spinning	Enabled	Off	On	No	Yes[2]
Low Fan RPM (1,500 W)	Fan is not operating to spec	Enabled	Off	On	No	Yes[2]
Fan Failure (1,500 W)	Fan stops spinning	Disabled	On	Off	Yes	Yes[2]
Manual Disable	Output switched off by ICM or GUI	Disabled	Blink	Off	No	No

Alarm Condition	Trigger Condition	Module Output[1]	Red LED	Green LED	Alarm Relay	Send E-mail
Module Removal	Module system connections open	Disabled	On	Off	No	No
PFC Shutdown	Internal bus voltage out of range	Disabled	On	Off	No	No
Module Fault	Internal aux voltages out of range	Disabled	On	Off	Active	Yes[2]
Over Temp Shutdown	Internal temp too high	Disabled	On	Off	Active	Yes[2]
DC Output Failure	Output above set point (Manually re-enable DC output to reset)	Disabled	On	Off	Active	Yes[2]

[1] Other Power Modules are not affected when one module has its output disabled.
[2] E-mail notifications only sent if enabled in the unit's web-GUI E-mail Setup page, and either AC or DC power is available for the system to be operational.

Table 17. Battery Management Module (BMM) Alarms

Alarm Condition	Trigger Condition	LVD Contactor	ICM Required	Alarm Relay	Send E-mail
No Alarms	Normal Operation	Closed	No	No	No
Module Power Failure	Loss of AC, and battery disconnected	Open	No	No	Yes[2]
Battery Low SOC	SOC drops below Low SOC setting	Closed	Yes	Active[2]	Yes[3]
Battery Overcurrent	Battery current rises above overcurrent setting for 10 s	Closed	Yes	Active[2]	Yes[3]
Circuit Breaker Open	Circuit breaker trips or manually opened	Open	Yes	Active[2]	Yes[3]
Battery Over Temperature	Optional TMP probe temp >50°C for 5 s (Lead-acid battery only)	Open	Yes	Active[2]	Yes[3]
LVD	Battery V at LVD or Overvoltage setting	Open	No	Active	Yes[3]
Configuration Error	BMM in wrong slot or mixed polarity with LDM	Open	No	Active	Yes[3]

[1] Contact active only if alarm enabled in the web-GUI BMM Setup page.
[2] E-mail notifications only sent if enabled in the unit's web-GUI E-mail Setup page, and either AC or DC power is available for the system to be operational.
[3] E-mail notifications only sent if enabled in the unit's web-GUI BMM Setup page, and either AC or DC power is available for the system to be operational.

Table 18. DC-DC Converter Module Alarms

Alarm Condition	Trigger Condition	Module Output[1]	Red LED	Green LED	Alarm Relay	Send E-mail
Module Operating	Normal Operation	Enabled	Off	On	No	No
Module Power Failure	Loss of AC and DC bus connection	Disabled	Off	Off	Active	Yes[2]
Current Limit (warning only, display will flash)	Output current approaches within 1 A of the max current limit setting	Enabled	Off	On	No	No
Fan Failure	Fan is not operating to spec	Enabled	Off	On	No	Yes[3]
Output Under-voltage	Low output voltage	Enabled	Off	On	No	Yes[3]
Manual Disable	Output switched off by ICM or GUI	Disabled	Blink	Off	No	No
Input Voltage Failure	DC input voltage out of range	Disabled	On	Off	Active	Yes[3]
Module Fault	Internal aux voltages out of range	Disabled	On	Off	Active	Yes[3]
Over Temp Shutdown	Internal temp too high	Disabled	On	Off	Active	Yes[3]
Output Over-voltage	Output above set point (manually re-enable DC output to reset)	Disabled	On	Off	Active	Yes[3]

[1] DC-DC Output of other Modules is not affected when a Module Alarm occurs.
[2] E-mail notifications only sent if enabled in the unit's web-GUI E-mail Setup page, and either AC or DC power is available for the system to be operational.
[3] E-mail notifications only sent if enabled in the unit's web-GUI DC Converter Setup page, and either AC or DC power is available for the system to be operational.

Table 19. Load Distribution Module (LDM) Alarms (cont'd on next page)

Alarm Condition	Trigger Condition	Output Relays	ICM Required	Alarm Relay	Send E-mail
No Alarms	Normal Operation, outputs enabled	Closed	No	No	No
Module Power Failure	Loss of AC and DC bus connection	Open	No	No	Yes[2]
Circuit Breaker Open	Circuit breaker opened or tripped	Closed	Yes	Active[1]	Yes[3]

Alarm Condition	Trigger Condition	Output Relays	ICM Required	Alarm Relay	Send E-mail
Output Undercurrent	Output current drops below setting for 5 s	Closed	Yes	Active[1]	Yes[3]
Output Overcurrent	Output current rises above setting for 5 s	Closed	Yes	Active[1]	Yes[3]
Configuration Error	LDM in wrong slot or mixed polarity with BMM	No change	Yes	Active[1]	Yes[3]
Load Shedding	V drops below Load Shed setting for 30 s	Open	Yes	Active[1]	Yes[3]
Output Manually Disabled	Output manually disabled via ICM or GUI page	Open	Yes	No	No

[1] Contact active only if alarm enabled in the web-GUI LDM Setup page.
[2] E-mail notifications only sent if enabled in the unit's web-GUI E-mail Setup page, and either AC or DC power is available for the system to be operational.
[3] E-mail notifications only sent if enabled in the unit's web-GUI LDM Setup page, and either AC or DC power is available for the system to be operational.

Table 20. Intelligent Control Module (ICM) Alarms

Alarm Condition	Trigger Condition	Alarm Relay	Send E-mail
Alarm Input	Contact open or close on any Alarm input 1 to 4	Active (if set up on Alarm Input page)	Yes[2]
AC Input Failure	AC input falls below 90 VAC	Active[1]	Yes[3]
System Overcurrent	Total output current on system is >300 A for 20 s	Active[1]	Yes[3]
System Current Limit	ALL Power Modules in system at their current or power limit for 15 s	Active[1]	Yes[3]
Communication Bus Error	Internal communication bus error condition	Active[1]	No

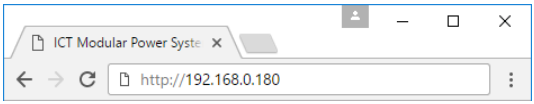
[1] Contact active only if alarm enabled in the web-GUI module Setup page .
[2] E-mail notifications only sent if enabled in the unit's web-GUI Alarms Setup page, and either AC or DC power is available for the system to be operational.
[3] E-mail notifications only sent if enabled in the unit's web-GUI E-mail Setup page, and either AC or DC power is available for the system to be operational.

4.0 OPERATION: GRAPHICAL USER INTERFACE

Connect to the intelligent Hybrid Ultra via Ethernet for full, secure access to all system settings, status, and alarm conditions. The unit is equipped with a built-in web server that can be accessed via any standard web browser on a network connected computer or phone. No additional software is required on the unit.

4.1 Log In/Log Out

1. Connect to the Hybrid Ultra by entering the IP address of the unit in the location/address field of the browser as shown:



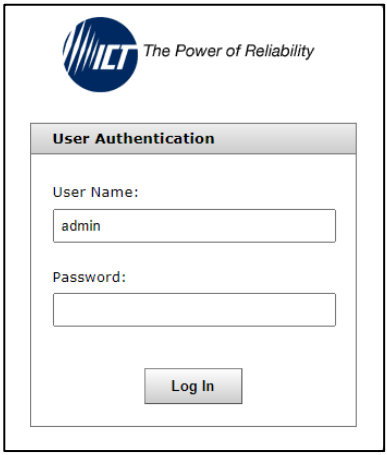
   The default IP address of the unit is "192.168.0.180", but any unit connected to a network with a DHCP server will be assigned a different IP address automatically. To find the assigned address use the front display screen on the unit and navigate to the Network Status screen (see Section 3.2.7).

NOTE: Take note of the assigned IP address displayed and use this in the browser address field to access the unit remotely.

NOTE: If connecting directly from a computer to the Hybrid Ultra, the computer must be configured with an IP address on the same network subnet as the unit. This is not required for a network connection (See Section 4.8.2).

   The IP address of any ICT unit on a local network can be found by running the ICT "IP Address Discovery tool", after installing it on a Windows computer connected to the same network (tool available for download from ICT http://www.ict-power.com/resources/tools-utilities/). This tool does not support macOS.

2. Log into the unit's built-in server when prompted with the username and password. The default username is "admin", and no password is required as the factory default.



To log out of the ICT Hybrid Ultra Graphical User Interface (GUI), click the Logout link on the header. The system will also automatically log off the user after 20 minutes of inactivity.

4.2 System

Once successfully logged in, the Status page of the System tab will be shown in the browser. All tabs have the same header that displays the name, model number, IP address, and firmware version number of the unit. Click the ICT logo to visit the ICT website.

4.2.1 STATUS

This tab provides the operating status of the unit.

DC Output

Output Status: Shows status of the DC output. Will show Enabled if providing DC output or Disabled if not.

Output Voltage: Shows output DC voltage. This is an absolute value and does not specify polarity.

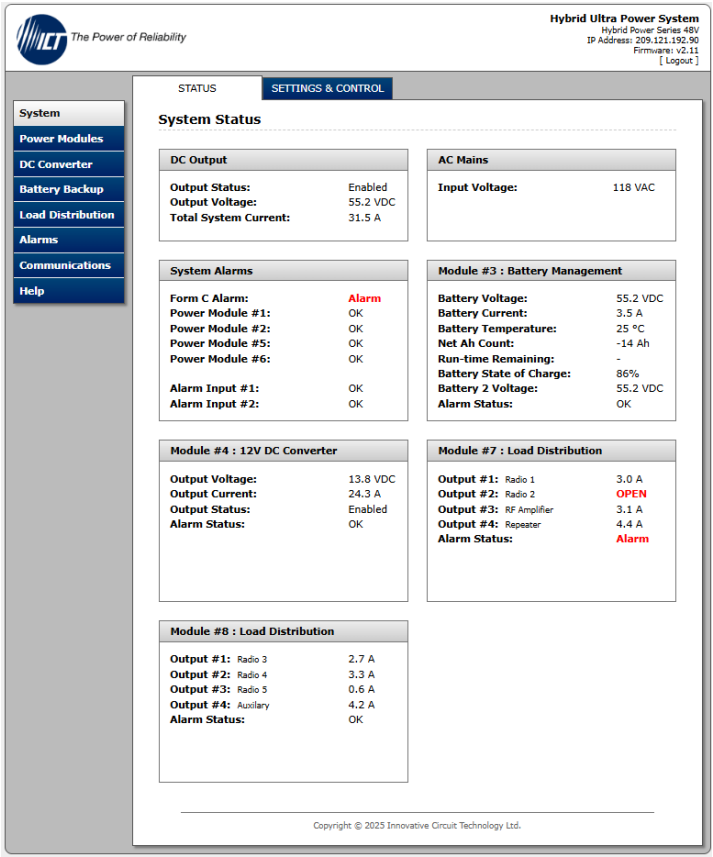
Total System Current: Shows total amps being supplied by the unit. This includes loads and battery charging.

AC Mains

Input Voltage: Shows the input AC voltage.

System Alarms

Form C Alarm: Shows whether the unit is broadcasting a form-C alarm. (Alarm or OK).



Power Module #x: Shows status of the installed Power Modules (Alarm or OK).

Alarm Input #x: Shows status of the monitored form-C contacts (Alarm or OK).

Module #x: Battery Management

This section will show the status of the connected batteries. The section will be labelled with the module number.

Battery Voltage: Shows voltage of battery #1. This number does not specify polarity.

Battery Current: Shows the current that is passing from, or to the batteries. This number is negative if the battery is discharging; positive if

the battery is being charged; and shows 0A if the battery is fully charged. This number represents both batteries for a dual BMM (BMMD).

Battery Temperature: Shows the temperature measured on the optional ICT Battery Temperature Probe (ICT-TMP).

Net Ah Count: Shows the Ah that have been consumed from the battery. Will display 0 Ah if the batteries are fully charged.

Run-time Remaining: Shows the estimated time in hours and minutes before the battery is discharged. This is blank if the batteries are charging.

NOTE: The Run-time Remaining and Battery State of Charge values shown are estimated values.

Battery State of Charge: Shows the estimated state of charge in %. The system resets the SOC to 100% whenever it detects that the battery is at the rated Float Voltage with minimal charge current for at least 24 hours (Units with factory-installed firmware V2.10, or newer, will reset when at Float Voltage for 8 hours with lead-acid, or 1 hour with lithium batteries).

Battery 2 Voltage: Shows the voltage of battery #2.

Alarm Status: Shows status of the batteries (Alarm or OK).

Module #x: 12/24V DC Converter

This section will show the status of the Integrated DC-DC Converter Module. This section will be labelled with the module number and output voltage of the DC-DC Converter Module.

Output Voltage: Shows the output voltage of the Integrated DC-DC Converter Module.

Output Current: Shows the output current of the Integrated DC-DC Converter Module.

Output Status: Shows the status of the output of the Integrated DC-DC Converter Module. Will show Enabled if providing output or Disabled if not.

Alarm Status: Shows status of the DC-DC Converter Module (Alarm or OK).

Module #x: Load Distribution

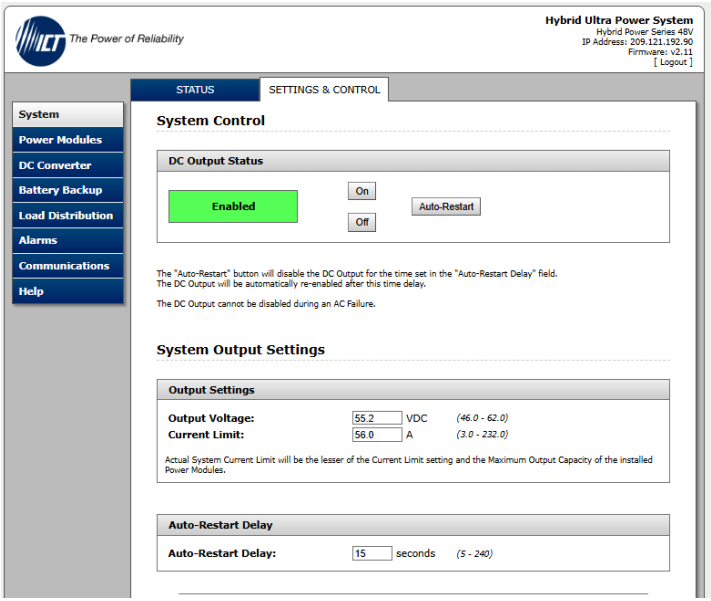
This section will show the status of the four LDM outputs; the section will be labelled with the module number.

Output #x: Shows name and status of the output. Will show amps of current being drawn. Will show OFF if the output is disabled. Will show OPEN if the breaker is turned off or has tripped due to an overcurrent event, or not installed. Will show QUEUED if the output is in the power cycling state.

Alarm Status: Shows status of the LDM (Current, Alarm or OK).

4.2.2 SETTINGS & CONTOL

This tab is used to adjust the System Output Settings.



DC Output Status

On/Off Buttons: Use these to remotely disable the system output by shutting off all Power Modules. The default setting is Enabled.

Auto-Restart Button: Use this button to momentarily shut off the main output, and then restart automatically after a time delay (set in the "Auto-Restart Delay" field). This feature can be used to remotely force connected equipment to re-boot.

Output Settings

Output Voltage: Set the system "Output Voltage" to match the float voltage requirement for the external battery. The default setting varies based on the Power Modules installed (see Table 8).

Current Limit: Set the system output "Current Limit", to limit the total current that can be drawn by all the external loads and charging the battery. The default setting varies based on the Power Modules installed (see Table 8).

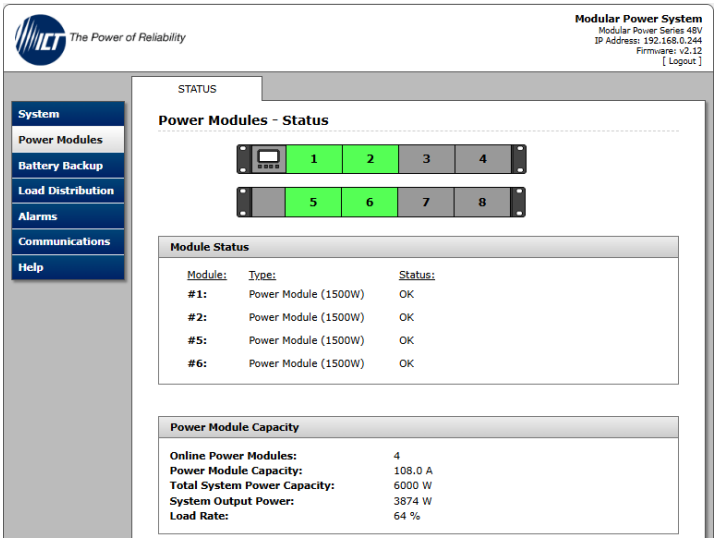
Auto-Restart Delay

Auto-Restart Delay: Set the delay time (5 to 240 s) that the output will remain off when output is remotely disabled using the "Auto-Restart" button. The unit will automatically restart after the Auto-Restart Delay period. The default setting is 15 seconds.

NOTE: The output voltage and current limit settings apply to the combined output of all installed Power Modules. The ICM treats the combined modules as a single high-power supply. Adjust the system Output Voltage and Current Limit (see Section 4.2.2) to match the battery type and system load requirements if required.

4.3 Power Modules

Use this tab to see the status of all installed Power Modules in the unit.



The graphic will display green for an installed Power Module that is working as expected; a red display for an installed Power Module that has an active alarm; and will be grey when a Power Module is not installed in that slot.

Module Status

Shows the slot that the Power Module is installed in; the rating of the Power Module; and the status (Alarm or OK).

Power Module Capacity

Online Power Modules: Shows the number of active Power Modules installed in the system.

Power Module Capacity: Shows the combined maximum output capacity (in amps) for all active Power Modules.

Total System Power Capacity: Shows the combined maximum output power capacity (in watts) for all active Power Modules.

System Output Power: Shows the total power (in watts) being supplied by the system. This includes all loads and battery charging.

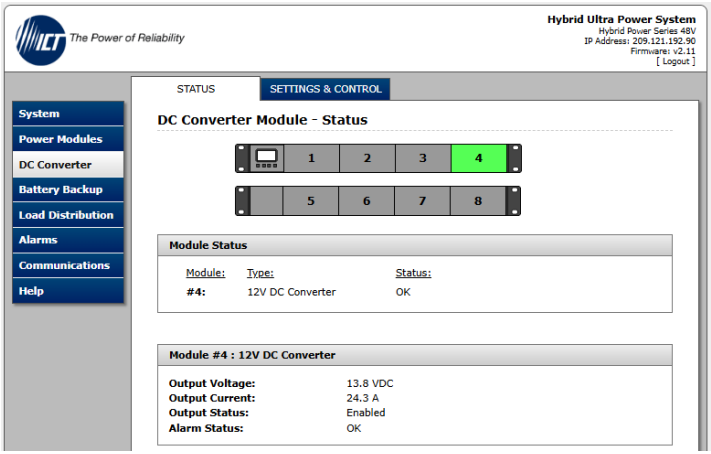
Load Rate: Shows the load utilization rate of the system.

4.4 DC Converter

Use this tab to see the status of integrated DC-DC Converter Module.

4.4.1 STATUS

This tab shows the alarm status, output voltage, and output current of the integrated DC-DC Converter Module.



The graphic will display green for an installed module that is working as expected; and a red display for an installed module that has an active alarm.

Module Status
Shows the slot that the DC-DC Converter Module is installed in and the status (Alarm or OK).

Module #x: 12/24V DC Converter

Output Voltage: Shows the output voltage of the Integrated DC-DC Converter Module.

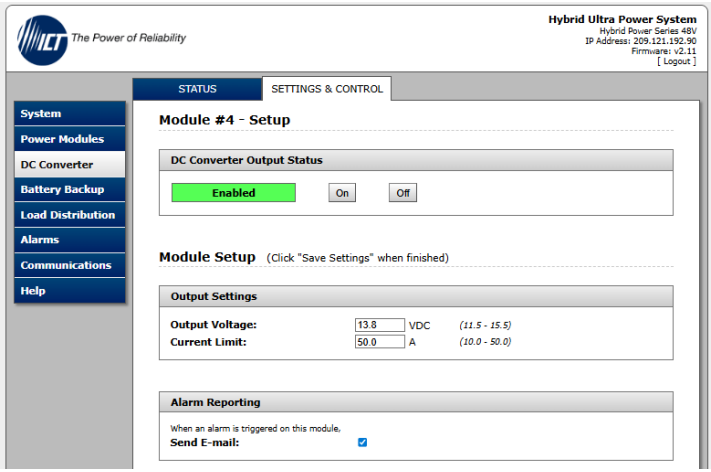
Output Current: Shows the output current of the Integrated DC-DC Converter Module.

Output Status: Shows the status of the output of the Integrated DC-DC Converter Module. Will show Enabled if providing output or Disabled if not.

Alarm Status: Shows status of the DC-DC Converter Module (Alarm or OK).

4.4.2 SETTINGS & CONTROL

This tab is used to configure the settings for the DC-DC Converter Module.



DC Converter Output Status

On/Off Buttons: Use these to remotely disable the DC-DC Converter Module. The default setting is On.

Output Settings

Output Voltage: Set the integrated DC-DC Converter Module "Output Voltage" to the voltage required for the application. The default setting varies based on the DC-DC Converter Module installed (see Table 21).

Table 21. The Default Output Voltage and Current

	12 V DC-DC Converter Module	24 V DC-DC Converter Module
Default Output Voltage	13.8 V	27.6 V
Default Output Current	50 A	25 A

Current Limit: Set the integrated DC-DC Converter Module "Current Limit" to limit the total current that can be drawn by the external loads connected to the DC-DC Converter Module. The default setting varies based on the DC-DC Converter Module installed (see Table 21).

Alarm Reporting

Send E-mail: Select the check box to have an e-mail sent to the e-mail addresses set up on the communications page whenever an alarm is triggered on the integrated DC-DC Converter Module (see Section 4.8.3). The default setting is Disabled.

NOTE: Save Settings before leaving this tab.

4.5 Battery Backup

Use this tab to see the status of the connected batteries and to control their settings.

The graphic will display green for an installed BMMD that is working as expected; a red display for an installed module that has an active alarm; and will be grey when a module is not installed in that slot.

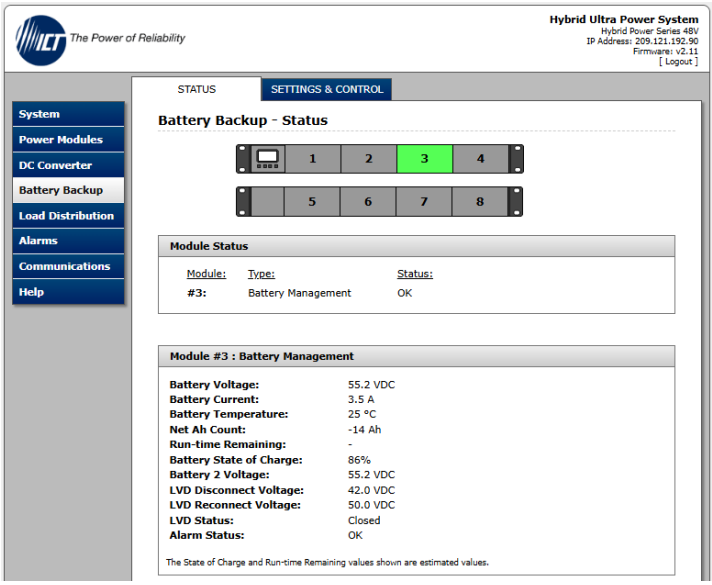
Leave BMMD breaker turned off until the software has been configured (see Section 3.2.2 or Section 4.5.2).

4.5.1 STATUS

This tab shows the operating status of the connected batteries.

Module Status

Shows the slot that the BMMD is installed in and the status (Alarm or OK).



Module #x: Battery Management

Battery Voltage: Shows voltage of battery #1. This number does not specify polarity.

Battery Current: Shows the current that is passing from, or to the batteries. This number is negative if the battery is discharging; positive if the battery is being charged; and shows 0A if the battery is fully charged. This number represents both batteries for a dual BMM (BMMD).

Battery Temperature: Shows the temperature measured on the optional ICT Battery Temperature Probe (ICT-TMP). If no probe is installed, the unit will default to 25°C.

Net Ah Count: Shows the Ah that has been consumed from the battery. Will display 0 Ah if the batteries are fully charged. The batteries must be fully charged for 24 hours before this field populates.

Run-time Remaining: Shows the estimated time in hours and minutes before the battery is discharged. This is blank if the batteries are charging. The batteries must be fully charged for 24 hours before this field populates.

NOTE: The Run-time Remaining and Battery State of Charge values shown are estimated values.

Battery State of Charge: Shows the estimated state of charge in %. The system resets the SOC to 100% whenever it detects that the battery is at the rated Float Voltage with minimal charge current for at least 24 hours (Units with factory-installed firmware V2.10, or newer, will reset when at Float Voltage for 8 hours with lead-acid, or 1 hour with lithium batteries).

Battery 2 Voltage: Shows the voltage of battery #2. This field only displays when a BMMD is installed.

LVD Disconnect Voltage: Shows the battery voltage when the LVD will disconnect the battery.

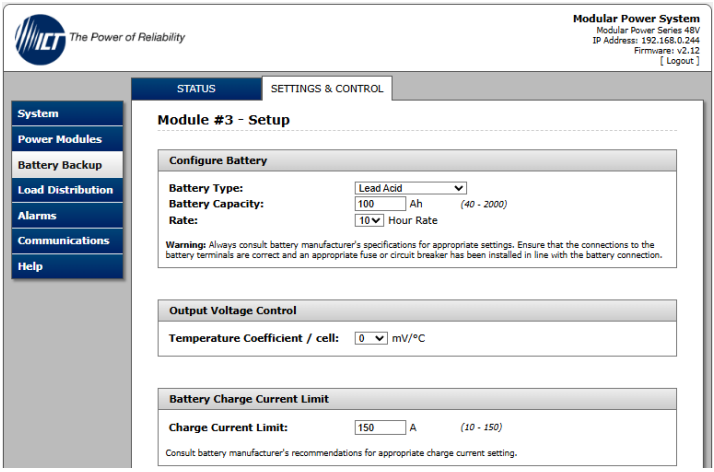
LVD Reconnect Voltage: Shows the battery voltage when the LVD will reconnect the battery.

LVD Status: Shows the status of the LVD (Open or Closed).

Alarm Status: Shows status of the batteries (Alarm or OK).

4.5.2 SETTINGS & CONTOL

This tab is used to adjust the settings of the BMMD.



WARNING

Always consult battery manufacturer's specifications when selecting battery type. Incorrect battery type setting may damage the battery. If Lithium Ion type battery is selected, an integrated battery management system (BMS) must be used to protect the battery cells from inappropriate voltage or current levels.

Configure Battery

Battery Type: Configure the Battery Type of the battery used in the system (Lead Acid, Lithium Ion (Narada), Lithium Ion (PWRSS) and Lithium Ion (Other)).

NOTE: PWRSS is an abbreviation for Power Storage Solutions.

Battery Capacity: Set the "Battery Capacity" in Ah (40 to 2000 Ah) of the total battery pack connected to the unit. This value is used by the unit when estimated Run-time Remaining. The default setting is 100 Ah.

Rate: Set the discharge "RATE" (in hours) as specified by the battery manufacturer to determine the battery capacity. Normally the 10- or 20-hr rate is used. The system will use this information to help estimate the Battery State of Charge, and remaining battery capacity when in use. The default setting is 10 hr.

NOTE: Connecting batteries in parallel will increase the total Ah capacity, while connecting batteries in series will increase the voltage with no change to the Ah capacity.

Output Voltage Control (only available on lead-acid batteries)

Temperature Coefficients / Cell: Set the battery voltage Temperature Coefficient / Cell to optimize the automatic control of the lead-acid battery charging voltage, to keep the battery in a good state of health. This setting is only available if the system is configured for use with a lead-acid type battery.

Adjust this setting to match the battery manufacturer's recommended compensation value in mV/°C per cell. This value will typically be −4 mV/°C for a flooded lead-acid battery (i.e., will compensate output voltage −24 mV/°C for a 6 cell 12 V battery) to help ensure the battery is fully charged in cold locations, and is not overcharged when warm. The numbers in the drop-down field are absolute values. The default setting is 0 mV/°C.

NOTE: The system must have the battery temperature sensor (ICT-TMP) installed on the battery for this setting to have an effect (default setting is 0 mV/°C, assumes 25°C operation).

Battery Charge Current Limit

Charge Current Limit: Set the maximum current that the unit may provide while still allowing the full rated current to be drawn from the main

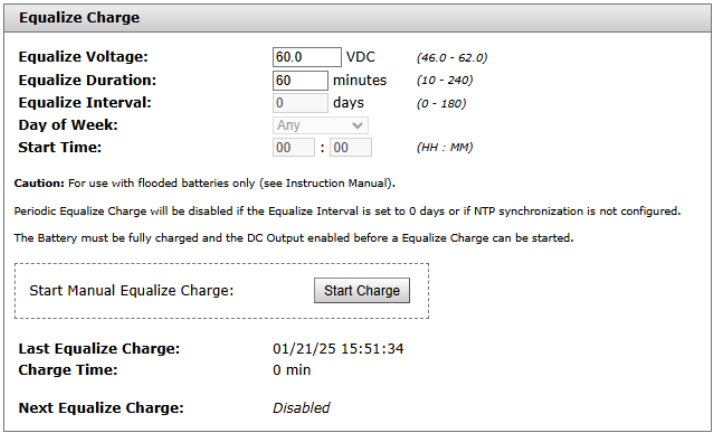
output. This setting should be set to the value recommended by the battery manufacturer. The default setting is 150 amps.

Equalize Charge (only available on Lead-acid Batteries)

WARNING

Risk of serious personal injury or damage to equipment and property! Always observe the following:

- Equalize charging is intended for flooded lead-acid batteries only and may produce higher than normal levels of hydrogen gas.
- Consult with the battery manufacturer when using SLA batteries.
- **Do not use equalization charging with lithium-ion batteries**.
- Ensure the battery compartment is well ventilated to avoid any risk of explosion.
- Always consult with and observe all battery manufacturer recommendations.



Set up manual or automatic equalize charge cycles for flooded lead-acid batteries. This setting is only available if the system is configured for use with a lead-acid type battery.

The connected load devices should continue to run normally while the equalization charge is running.

The unit's data log (see Section 4.8.1) will record the completion of the equalization charge.

Equalize Voltage: Set this to the battery manufacturer's recommended value for an equalize (or boost) charge (for flooded lead-acid batteries only). A regular high-voltage equalization charge will help prevent stratification of the electrolyte in the battery and can help extend its life. The default setting varies based on the Power Modules installed.

Table 22. Default Equalize Voltage Settings

Module	ICT700-24PM ICT1500-24PM	ICT700-48PM ICT1000-48PM ICT1500-48PM
Voltage	30 VDC	60 VDC

Equalize Duration: Set the time in minutes (10–240 minutes) for the equalize charge voltage to be applied (as recommended by the battery manufacturer). The default setting is 60 minutes.

Equalize Interval: Set the time in days (0–180 days) between automatic equalize charges. Set this time to 0 to disable the automatic equalize charge. The default setting is 0 (Disabled).

Day of Week: Set the day of the week that the automatically recurring equalize charge should take place or select "Any" to allow an equalize charge to take place on any day of the week. Day of Week takes precedence over Equalize Interval. The default setting is Any.

Start Time: Set the time of day for automatically recurring equalize charges to start. The time must be entered using 24-hour time format. The default setting is 00:00.

NOTE: NTP Time Synchronization must be enabled on the Communications Basic Setup page to enable automatically recurring equalize charges.

An Equalize Charge can only be initiated when the battery is fully charged (a fully charged battery will have charge current close to zero amps). If the system is unable to start an equalize charge at the selected Start Time, it will attempt again at the same time next day, or next week if a specific Day of Week is selected.

An Equalization Charge will immediately be terminated if AC power fails.

Manual Equalize Charge: Press this button to manually initiate an equalize charge for the set duration time once the battery is fully charged.

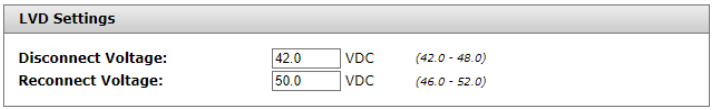
NOTE: System will state that Manual Equalize Charge is Not Ready if battery is not yet fully charged.

Last Equalize Charge: Shows the date and time that the last equalization charge was performed.

Charge Time: Shows the duration of the last equalization charge.

Next Equalize Charge: Shows the scheduled date and time of the next automatic equalize charge, if an Equalize Interval has been set. This information is to help track where the system is within the automatic charge cycle.

LVD Settings



The low voltage disconnect (LVD) protects the battery from excessive discharge by disconnecting the battery when the battery reaches a preset voltage. The battery is reconnected when AC power is restored or after recharging to a preset threshold.

The reconnect voltage setting will be used when charging the battery from an external DC source (such as a solar system), otherwise once AC power returns the LVD contactor will automatically close so that the Power Modules can charge the battery directly.

NOTE: For lead-acid battery, the LVD contactor will not close if the lead-acid battery is less than 40 volts on a 48-volt system (see Table 23). The unit believes the battery is deeply discharged, and possibly damaged. A deeply discharged battery will not be reconnected as a safety measure. The battery will need to be manually checked for proper function and then manually charged to at least 40 volts (on a 48-volt system) before the LVD will close. Refer to the battery manufacturer's recommendations on how to proceed with a deeply discharged battery. This does not apply to the system when the Lithium setting has been chosen.

Table 23. Deeply discharged battery values (typical)

24 VDC Units	48 VDC Units
20 VDC	40 VDC

Disconnect Voltage: Set the threshold to a level that will protect the battery from excessive discharge (as recommended by the battery manufacturer). The LVD contactor will open when the battery discharges to this level for at least 3 seconds. The default setting varies based on the Power Modules installed.

Table 24. Default Disconnect Voltage Settings

Module	ICT700-24PM ICT1500-24PM	ICT700-48PM ICT1000-48PM ICT1500-48PM
Threshold Voltage	21.0 VDC	42.0 VDC

Reconnect Voltage: Set the level where the unit will reconnect to the battery after it has recharged (as recommended by the battery manufacturer). The "Reconnect Voltage" must be higher than the Disconnect Voltage to prevent the LVD contactor repeatedly cycling on and off. The default setting varies based on the Power Modules installed.

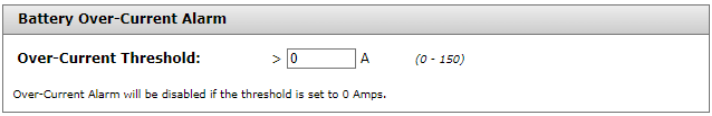
Table 25. Default Reconnect Voltage Settings

Module	ICT700-24PM ICT1500-24PM	ICT700-48PM ICT1000-48PM ICT1500-48PM
Threshold Voltage	25.0 VDC	50.0 VDC

Table 26. The minimum difference between Disconnect and Reconnect voltages

24 VDC Units	48 VDC Units
2 V	4 V

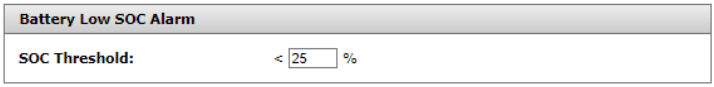
Battery Over-Current Alarm



Damage to the unit, load, and/or personal injury may occur if the battery current through the BAT terminal exceeds 150 amps.

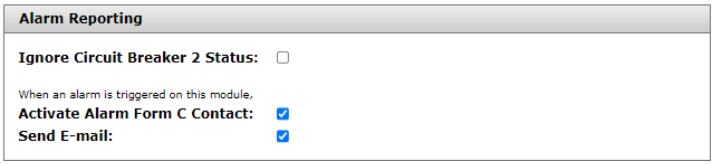
Over-Current Threshold: Set the threshold to receive an alarm notification when the battery discharge or charge current exceeds a set overcurrent level. Set the threshold to 0 amps to disable this alarm. The default setting is 0 (Disabled).

Battery Low SOC Alarm



SOC Threshold: Set this to receive an alarm notification when the battery state of charge falls below the specified level. Set the threshold to 0 amps to disable this alarm. The default setting is 0 (Disabled).

Alarm Reporting



Ignore Circuit Breaker 2 Status: Select this checkbox to prevent alarm e-mails being sent when a single battery is connected to a BMMD. The default setting is Disabled.

Activate Alarm Form C Contact: Select this checkbox to have the rear panel alarm contacts change state for an alarm condition. The default setting is Enabled.

Send E-mail: Select this checkbox to have an e-mail sent to the e-mail addresses set up on the communications page for an alarm condition (see Section 4.8.3). The default setting is Disabled.

Battery Discharge Test

NOTICE

This test must only be done when AC power is present during the test and for an adequate time after the test to allow for a full recharging of the battery. Otherwise, the battery may not have sufficient remaining capacity to power the load during an AC power outage.

Configure the Battery Discharge Test settings in this section to either manually or automatically perform a partial discharge test to gauge the

relative capacity of the external lead-acid battery. Limit the depth of discharge to no more than 50% of the nominal battery capacity to avoid stressing the battery due to a deep discharge.

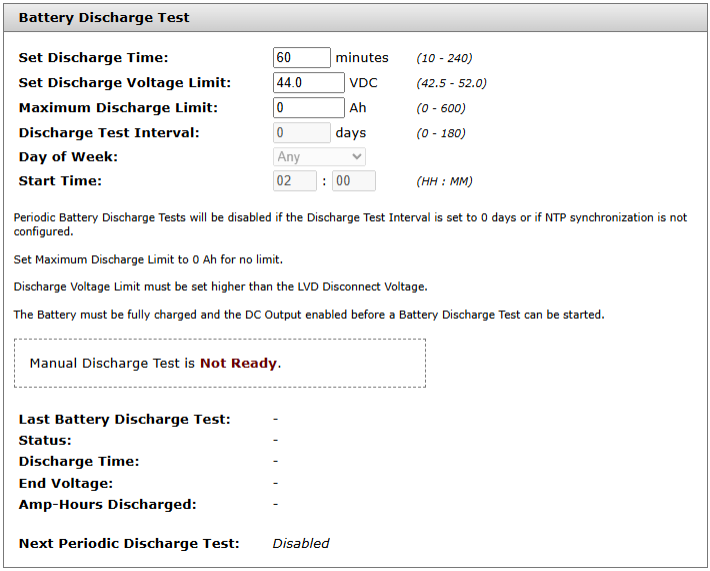
When the test is run, the output voltage from the Power Modules will be reduced so that the external battery will power the system load until the "Set Discharge Time" limit, the "Set Discharge Voltage Limit" or the "Maximum Discharge Limit" is reached.

A "Discharge Test Complete" notification indicates the battery can power the connected load for the set test duration while maintaining its voltage above the Discharge Voltage Limit. This notification is displayed on the front display panel and is delivered via e-mail if messaging is configured via the GUI (see Section 4.8.3).

The unit's data log (see Section 4.8.1) will record the completion of the discharge test.

A "Discharge Test Failure" notification indicates the battery is unable to power to load for the set duration.

The connected load devices should continue to run normally while the discharge test is running.



Set Discharge Time: Set the maximum time for the test in minutes (10–240 minutes) that the test will run. The default setting is 60 minutes.

Set Discharge Voltage Limit: Set the minimum battery voltage which will terminate the test. The default setting varies based on the Power Modules installed.

Table 27. Default Discharge Voltage Limit Settings

Module	ICT700-24PM ICT1500-24PM	ICT700-48PM ICT1000-48PM ICT1500-48PM
Threshold Voltage	22 VDC	44 VDC

Maximum Discharge Limit: Set the maximum battery capacity in amp-hours that can be discharged before the test will be terminated. Set this to 0 Ah for no limit. The default setting is 0 (no limit).

Discharge Test Interval: Set the time in days (0–180 days) between automatic discharge tests. Set this time to 0 to disable automatic discharge tests. The default setting is 0 (Disabled).

Day of Week: Set the day of the week that the automatically recurring discharge test should take place or select "Any" to allow a discharge test to take place on any day of the week. Day of Week takes precedence over Discharge Time Interval. The default setting is Any.

Start Time: Set the time of day for an automatically recurring discharge test to start. The time of time must be entered using 24-hour time format. The default setting is 00:00.

NOTE: NTP Time Synchronization must be enabled on the Communications Basic Setup page to enable automatic Discharge Tests.

A discharge test can only be initiated when the battery is fully charged (a fully charged battery will have charge current close to zero amps). If the system is unable to start a Discharge Test at the selected Start Time, it will attempt again at the same time next day, or next week if a specific Day of Week is selected.

A discharge test will immediately fail if the unit loses AC power. The log will show that the test failed.

Manual Discharge Test: Press this button to manually initiate a Battery Discharge Test of a fully charged battery.

NOTE: System will state that the discharge test is Not Ready if the battery is not fully charged (a fully charged battery will have charge current close to zero amps).

Last Battery Discharge Test: Shows the date and time that the last discharge test was performed.

Status: Displays the end status of the last discharge test (Complete or Fail).

Discharge Time: Shows the time in minutes that the test lasted.

End Voltage: Shows the battery voltage when the test ended.

Amp-Hours Discharged: Shows the amp-hours discharged during the test.

Next Periodic Discharge Test: Shows the scheduled date and time of the next automatic discharge test if a Discharge Test Interval has been set. This information is to help track where the system is within the automatic charge cycle.

NOTE: Save Settings before leaving this tab.

4.6 Load Distribution

Use this tab to see the status of the installed circuit breakers and to control their settings.

The graphic will display green for an installed LDM that is working as expected; a red display for an installed module that has an active alarm; and will be grey when a module is not installed in that slot.

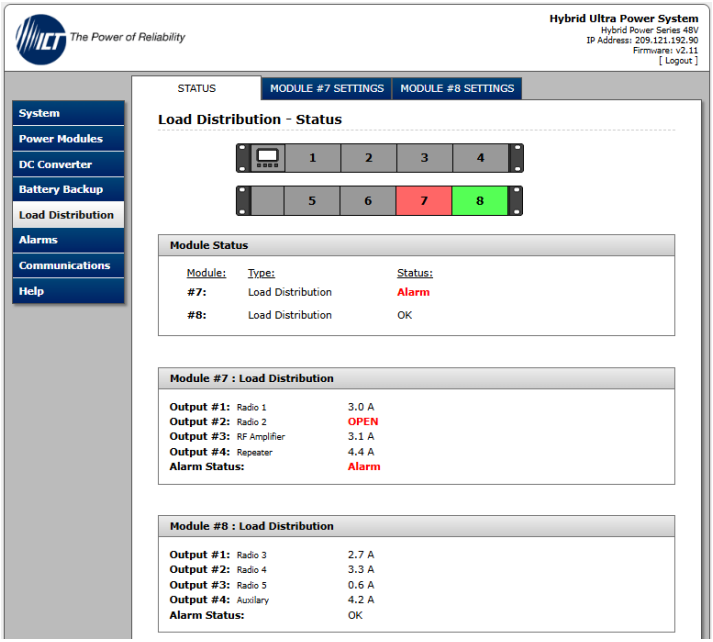
4.6.1 STATUS

This tab shows the operating status and current loads of the circuit-breaker controlled outputs on the LDM module.

If there is more than one LDM installed, they will show individually.

Module Status

Shows the slot that the LDM is installed in and the status (Alarm or OK).



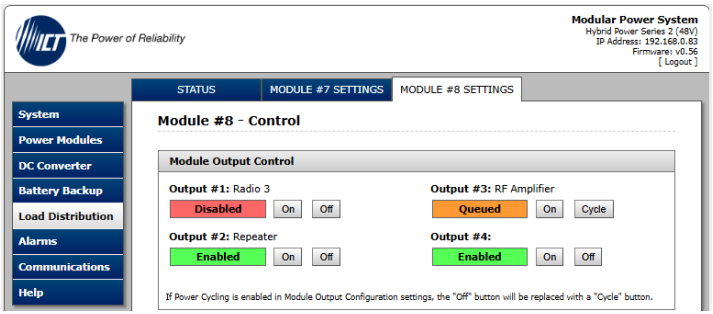
Module #x: Load Distribution

Output #x: Shows name and status of the output. Will show amps of current being drawn. Will show OFF if the output is disabled. Will show OPEN if the breaker is turned off or has tripped due to an overcurrent event, or not installed. Will show QUEUED if the output is in the power-cycling state.

Alarm Status: Shows status of the LDM (Alarm or OK).

4.6.2 SETTINGS & CONTOL

This tab is used to adjust the setting on the LDM. There will be a separate tab for each LDM that is installed in the unit.



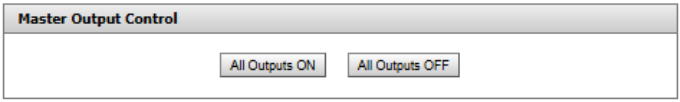
Module Output Control

Each output on the LDM will be displayed with name and status (Enabled, Disabled, Queued). A green Enabled indicates the electronic relay is closed or turned on. A red Disabled indicates that the electronic relay is open or turned off. An orange Queued indicates that the output is in the power cycling state.

Select the "On" or "Off" buttons to turn the output on or off. This will not affect the mechanical circuit breaker. The default setting is Enabled.

NOTE: The "Off" button will be replaced with a "Cycle" button if the Power Cycling is enabled in Module Output Configuration settings.

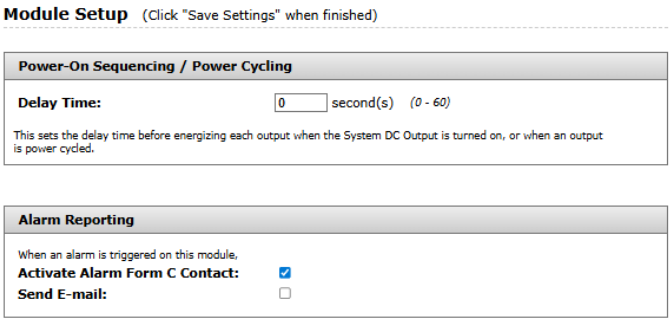
Master Output Control



Select "All Outputs On" or "All Outputs Off" to enable or disable all four output channels simultaneously.

NOTE: Outputs with Power Cycling enabled will cycle their output off, and then on if "All Outputs Off" is selected.

Module Setup



Power-On Sequencing / Power Cycling

Delay Time: Set the time in seconds (0–60 seconds) that will be used as the delay between energizing outputs. Will affect all outputs. Set to 0 to disable. Use this feature to allow a delay between energizing specified loads to reduce inrush current. The default setting is 0 (Disabled).

Alarm Reporting

Activate Alarm Form C Contact: Select this checkbox to have the rear panel alarm contacts change state for an alarm condition. The default setting is Enabled.

Send E-mail: Select this checkbox to have an e-mail sent to the e-mail addresses set up on the communications page for an alarm condition (see Section 4.8.3). The default setting is Disabled.

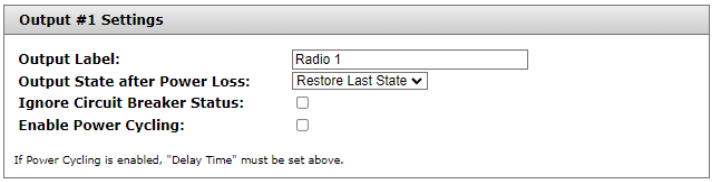
Module Output Configuration

NOTE: Each output on the LDM has an individual screen. Any changes made below will only affect the selected output. Save Setting before changing the selected output.

Select an Output to edit

Select the output to be edited in this section. Make any required changes, and then click on the Save Settings button at the bottom of the page to save any edits.

Output Settings



Output Label: Enter a descriptive label for the selected output channel. The default setting is blank.

Output State after Power Loss: Sets the state for the output after the LDM loses all input power, then recovers. The default setting is Restore Last State. Select one of the following:

- **Restore Last State:** This will return the output relay to the state prior to the reset event (default).

- **Enable Output:** This will turn the output on, regardless of its previous state.
- **Disable Output:** This will turn the output off, regardless of its previous state.

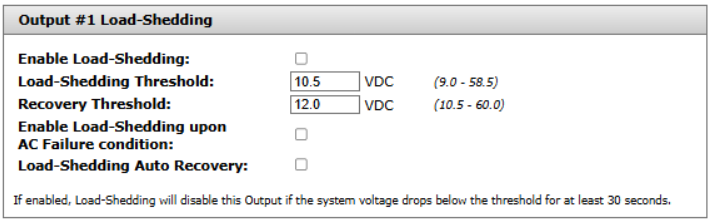
Ignore Circuit Breaker Status: Select to disable alarms from this output. Will prevent false alarms on an unused channel. The default setting is Disabled.

Enable Power Cycling: Select this box to enable output power cycling for this output. Enabled outputs will automatically be re-enabled after the "Power Cycle Delay Time" whenever the output is disabled using the Output Off button on the "SETTINGS & CONTROL" tab, or when the "Network Watchdog" is triggered. This feature is useful for remotely resetting power to a router or other hardware required for the network connectivity of the unit. The default setting is Disabled.

NOTE: The Power Cycle Delay time must be set with duration long enough for the connected network hardware to fully reset for this function to be effective. Multiple outputs that are disabled using Power Cycling will be reenabled in sequence from output #1 to output #4.

Output Load-Shedding

Load shedding will disable specified outputs when the system DC voltage reaches a preset threshold for at least 30 seconds. This will save battery capacity for mission-critical load devices by turning off non-critical load devices. Loads will be reconnected if "Load-Shedding Auto Recovery" is enabled, and the DC voltage exceeds the "Recovery Threshold" for 60 seconds.



Enable Load-Shedding: Select this box to enable load-shedding on this output. The default setting is Disabled.

Load-Shedding Threshold: Set the DC voltage (9.0–58.5 VDC) at which the selected output will be disabled. Default setting is 10.5 VDC.

Recovery Threshold: Set the DC voltage (10.5–60.0 VDC) at which the selected output will automatically be reconnected. This value must be at least 1.5 V above the "Load-Shedding Threshold" voltage. The default setting is 12.0 VDC.

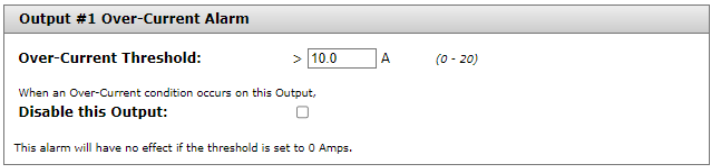
Enable Load-Shedding upon AC Failure condition: Select this box to disable the output when an AC failure condition regardless of DC voltage levels. If this option is selected, the Load-Shedding DC bus voltage thresholds are not used and will be greyed out. The default setting is Disabled.

Load-Shedding Auto Recovery: Select this box to allow the output to be automatically reconnected when the bus voltage is above the "Recovery Threshold".

If the “Enable Load-Shedding upon AC Failure condition” option is selected, the output will instead be reconnected when AC input power is restored.

The output must be manually re-enabled using the "Output ON" button if the "Load-Shedding Auto Recovery" function is not enabled. The default setting is Disabled.

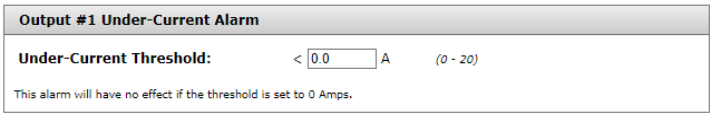
Output Over-Current Alarm



Over-Current Threshold: Set the current that will trigger an overcurrent alarm on this output. Output current above this level for at least 5 seconds will trigger the Over-Current Alarm. Disable this alarm by setting the threshold to 0 amps. The default setting is 0 (Disabled).

Disable this Output: Select this checkbox to disable the output if an over current alarm occurs. The default setting is Unselected.

Output Under-Current Alarm



Under-Current Threshold: Set the current that will trigger an undercurrent alarm on this output. Output current below this level for at least 5 seconds will trigger the Under-Current Alarm. Disable this alarm by setting the threshold to 0 amps. The default setting is 0 (Disabled).

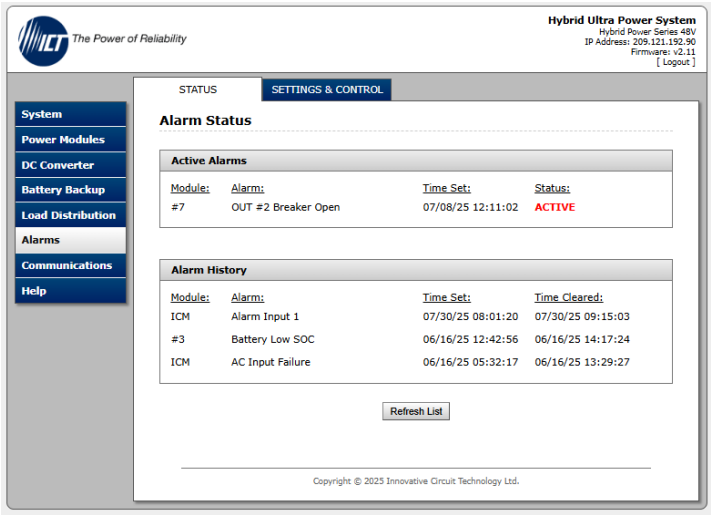
NOTE: Save Settings for each channel, and then repeat the setup process for all four output channels to be used.

4.7 Alarms

Use this tab to see the alarms on this unit and to control their settings.

4.7.1 STATUS

This tab shows all active alarms and up to 32 historic alarms. The history will be cleared after the ICM is rebooted.



Active Alarms

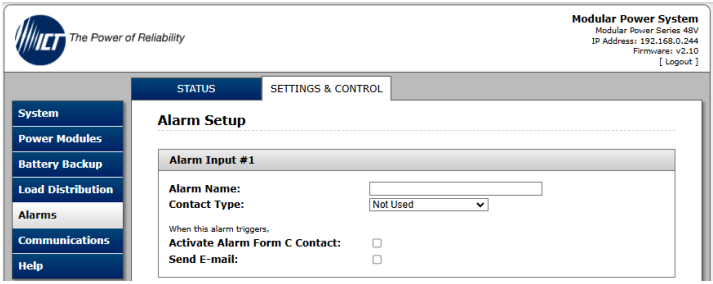
Shows the module that the alarm is on; the name of the alarm; the time that the alarm started and the status of the alarm (ACTIVE).

Alarm History

Shows the module that the alarm is on; the name of the alarm; the time that the alarm started; and the time that the alarm cleared.

4.7.2 SETTINGS & CONTOL

Use this tab to set up the four remote form-c alarm monitoring inputs and the system current limit alarm.



Alarm Input #

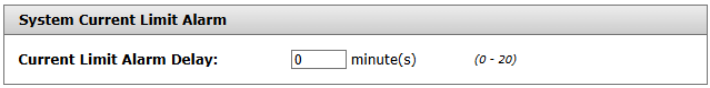
Alarm Name: Set a meaningful name to suit the installation (these will be used for e-mailed alarm messages).

Contact Type: Set the form-C behavior for each device to be monitored. (Not Used, Normally Open, Normally Closed) Select Not Used for all unused alarm input channels. The default setting is Not Used.

Activate Alarm Form C Contact: Select this checkbox to have the unit send a form-C alarm for an alarm condition. The default setting is Disabled.

Send E-mail: Select this checkbox to have an e-mail sent to the e-mail addresses set up on the communications page for an alarm condition (see Section 4.8.3).

System Current Limit Alarm



Current Limit Alarm Delay: Set the delay time (0–20 minutes) that the system current limit alarm will be triggered when the system current hits the current limit. The default setting is 0.

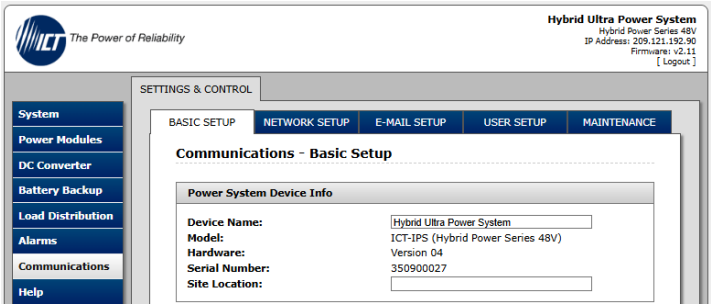
NOTE: Save Settings before selecting a different tab.

4.8 Communications

Use this tab to configure the basic system parameters, network settings, e-mail settings, user setup, and maintenance functions.

4.8.1 BASIC SETUP

Use this tab to configure the unit's name, set the date and time and enable the watchdog timer and data logging features.



Power System Device Info

Device Name: Enter a descriptive name for the system. This name will be used in all e-mail messages.

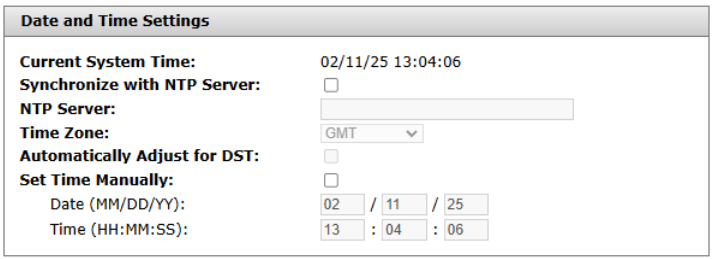
Model: Shows the model number, series name, and voltage configuration.

Hardware: Shows the hardware version.

Serial Number: Shows the serial number.

Site Location: Enter site location details. This information is optional.

Date and Time Settings



Current System Time: Shows the current system date and time.

Synchronize with NTP Server: Select this checkbox to synchronize with NTP Server. The default is Disabled.

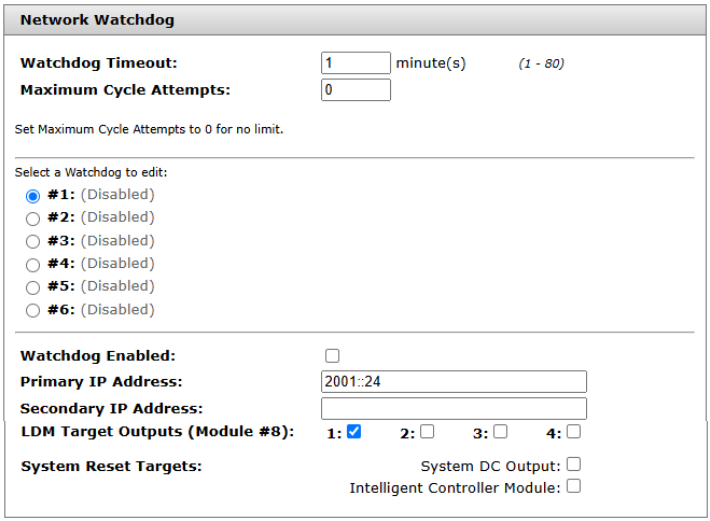
NTP Server: Set an NTP server address here (i.e., time.nist.gov) to automatically load network time.

Time Zone: Set the time zone this unit will be using.

Automatically Adjust for DST: Select this checkbox to automatically adjust the time for Daylight Savings Time when synchronizing the clock with a NTP Server. The default is Disabled.

Set Time Manually: Select this checkbox to enable manually setting the time and date. The default is Disabled.

Network Watchdog



Watchdog Timeout: Set a time in minutes (1–80 minutes) for the unit to wait with no ping response from either IP address before initiating a reset. The default is 10 minutes.

Maximum Cycle Attempts: This setting will limit the maximum number of times the unit can attempt to cycle power to the output(s). If network connectivity is restored the attempts counter is reset. Rebooting the unit will also reset the counter. Set Maximum Cycle Attempts to zero for no limit.

Select a Watchdog to Edit: Select one of the six independent watchdogs to configure. Each watchdog, if enabled, will cause the unit to periodically ping up to two remote IP addresses to verify network connection status. If there is no response from either address, the unit will cycle power on all target outputs that are configured below. This feature is useful for rebooting a router or other network device that is

powered by one of the LDM outputs, to help recover the network IP connection when one of these devices becomes unresponsive.

Watchdog Enabled: Select this checkbox to enable the selected network watchdog. The default is Disabled.

Primary IP Address: Set a primary IP address for the selected watchdog to monitor. If left blank the unit will monitor the Gateway IP address listed in the Network Setup page.

Secondary IP Address: Set a secondary IP address for the unit to monitor to verify network status (optional).

NOTE: The Network Watchdog will only trigger if both the Primary and Secondary IP addresses fail to respond.

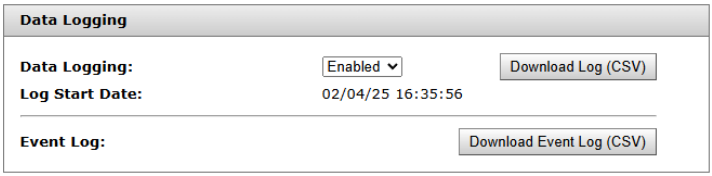
LDM Target Outputs (Module #): Set which LDM output(s) to power cycle when the watchdog detects a communications failure. The power will be restored after a delay determined by Power Cycling Delay Time (see Section 4.6.2). This setting is only available if the optional Load Distribution Module is installed.

System Reset Targets: Set system reset targets (either the main System DC Output, or the Intelligent Controller Module) to be cycled when the watchdog detects a communications failure.

If System DC Output is selected, the watchdog will cycle all output power. The power will be restored after a delay determined by Auto-Restart Delay (see Section 4.2.2). LDM Target Outputs cannot be selected if System DC Output is selected.

If Intelligent Controller Module is selected, the watchdog will reboot the ICM and Ethernet controller. This does not affect power to the outputs.

Data Logging



Data Logging: Set to "Enabled" to enable data logging. This will keep a running record of all the key system parameters and alarms, recorded once per minute for the last 30 days. The default is Enabled.

Log Start Date: Shows date and time that the data log started.

Download Log (CSV): Click on the Download Log (CSV) button to store the CSV format log file on the computer for further analysis.

Download Event Log (CSV): Click on this button to download the Event Log in CSV format. This log keeps a record of alarm events, device logins, configuration changes and other events.

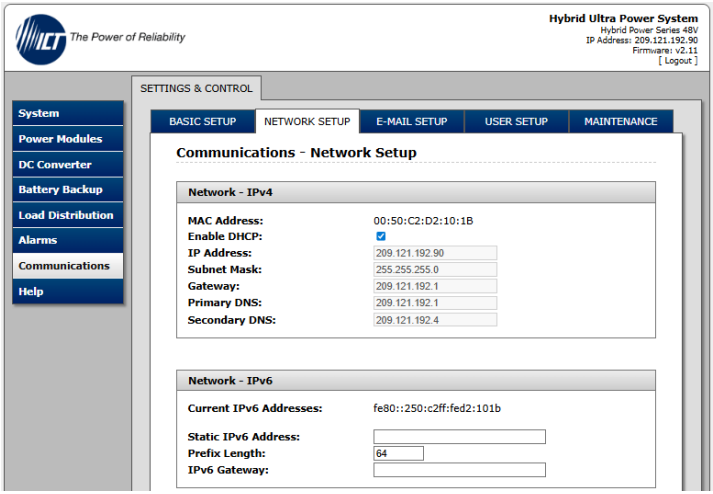
NOTICE

Updating the firmware will delete the current data log files. Download the logs before updating the firmware.

NOTE: Save Settings to enable any changes made.

4.8.2 NETWORK SETUP

Use this tab to configure the unit's network settings.



NOTICE

Saving any changes to the network settings will cause the ICM to re-start, causing momentary loss of communications.

Network – IPv4

MAC Address: Shows the MAC address assigned to the unit. It is also shown on the LCD Network Status screen.

Enable DHCP: Select this checkbox if the network uses a DHCP server to automatically assign IP addresses. The default is Enabled.

To manually assign a static IP address to the unit uncheck this box, then set the following parameters.

IP Address: Set a unique IP address for the unit.

Subnet Mask: Set the mask for the subnet the unit is located on.

Gateway: Set the IP address of the default router (Gateway) used for connecting attached devices to different networks.

Primary DNS: Set the IP address of the Primary DNS Server for the network.

Secondary DNS: Set the IP address of the Secondary DNS Server for the network.

Network – IPv6

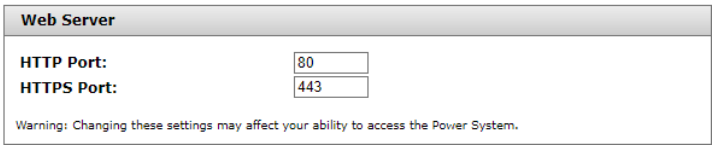
Current IPv6 Addresses: Displays the IPv6 addresses assigned to the unit. An IPv6 Link-Local address will be configured automatically. Addresses can also be configured by the router through Router Advertisements.

Static IPv6 Address: Set a unique static IPv6 address for the unit. Configuring a static IPv6 address is optional.

Prefix Length: Set the IPv6 prefix length for the network. The default value is 64.

IPv6 Gateway: Set the gateway IPv6 address for the network (optional).

Web Server



NOTICE

Changing the web server port numbers may cause loss of communication with the unit.

The following ports may be changed within a range of 1 to 65,565, if required.

HTTP Port: Set the port used for HTTP traffic between the unit and the browser. The default HTTP port is "80", and if this is changed, the new HTTP port number must be appended to the URL used to access the unit (e.g., use URL "http://192.168.0.180:8000" for IP address "192.168.0.180", port "8000").

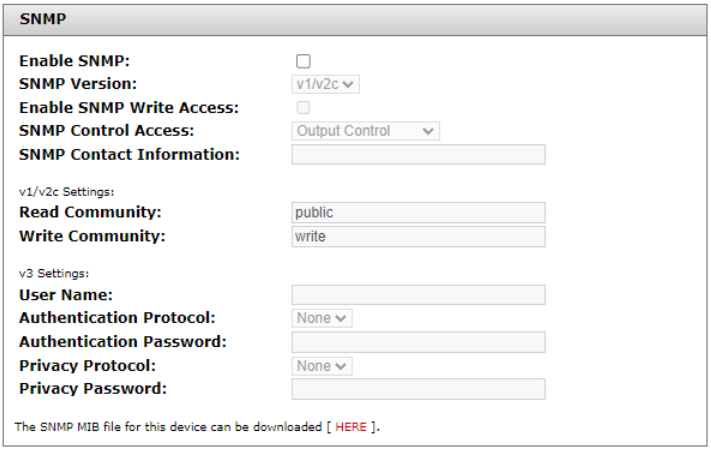
Setting the HTTP Port to zero will disable HTTP access to the unit.

HTTPS Port: Set the power used for HTTPS traffic between the unit and the browser. The HTTPS (HTTP Secure) protocol uses encrypted data transfer between web browsers and servers for higher security. The default HTTPS port is "443". Append any changed HTTPS port to the end of the URL for the unit.

To access the unit through a secure HTTPS connection, use "https://" at the start of the unit's URL (e.g., "https://192.168.0.180:8888" for IP address "192.168.0.180", HTTPS port "8888").

Setting the HTTPS Port to zero will disable HTTPS access to the unit.

SNMP



SNMP (Simple Network Management Protocol) is an industry standard protocol for network management software. Enabling the SNMP function on the unit will allow standard SNMP management software to connect to the SNMP agent running on the unit and read real-time system information such

as bus voltage, and channel currents. The unit can send SNMP traps to the external management software when an alarm or fault occurs.

The information available from the SNMP agent is described in a MIB (Management Information Base) file, which can be downloaded from the ICT website: https://ict-power.com/resources/tools-utilities/.

The MIB file can also be downloaded from within the GUI. There are links in the SNMP section of the Communications Network Setup tab and on the Help tab.

The unique unit MIB file must then be imported into the external SNMP management software.

Enable SNMP: Select this checkbox to enable the SNMP agent. The default setting is Disabled.

SNMP Version: Set the SNMP version (v1/v2c, v3, or All) supported by the SNMP agent. If "All" is selected, all SNMP versions will be supported simultaneously. The appropriate settings for the selected SNMP version will need to be configured.

Enable SNMP Write Access: Select this checkbox to enable remote SNMP control of the system output and individual LDM output channels. If this box is unchecked, all information available from the SNMP agent will be read-only.

SNMP Control Access: Set the level of unit control that is allowed through SNMP. This setting is only available if Enable SNMP Write Access is enabled.

- **Output Control:** Allows remote SNMP control of the system output and LDM channel outputs only.
- **Full Device Control**: Allows SNMP client to set all unit settings through SNMP. This setting requires a different MIB file which can be downloaded from the ICT Website: https://www.ict-power.com/resources/tools-utilities/.

SNMP Contact Information: Set contact information, such as an operator name and phone number for the unit, which can be read via SNMP queries (this information is optional).

v1/v2c Settings

Read Community: Enter the community string/password here for read-only SNMP access. The default read community string is "public".

Write Community: Enter the community string/password here for read/write SNMP access. The default write community string is "write".

NOTE: The community strings should be changed to unique passwords before enabling SNMP, as the defaults are well known.

v3 Settings

User Name: Set the username for SNMPv3 access.

Authentication Protocol: Set the SNMPv3 authentication protocol (None, MD5, or SHA).

Authentication Password: If an authentication protocol is selected, set the authentication password.

Privacy Protocol: Set the SNMPv3 privacy protocol (None, or AES).

Privacy Password: If a privacy protocol is selected, set the privacy password.

SNMP Traps

Trap Version: Set the SNMP version (v1 or v3) for SNMP traps sent from the system. The appropriate settings for the selected SNMP version will need to be configured.

Trap Community: Set the community string/password that will be sent with all SNMPv1 traps. Some trap receivers can filter based on Trap Community. This field is only used for v1 traps.

Trap User Name: Set the username for SNMPv3 traps. This field is only used for v3 traps.

Authentication Protocol: Set the authentication protocol for SNMPv3 traps (None, MD5, or SHA).

Authentication Password: If an authentication protocol is selected, set the authentication password for SNMPv3 traps.

Privacy Protocol: Set the privacy protocol for SNMPv3 traps (None, or AES).

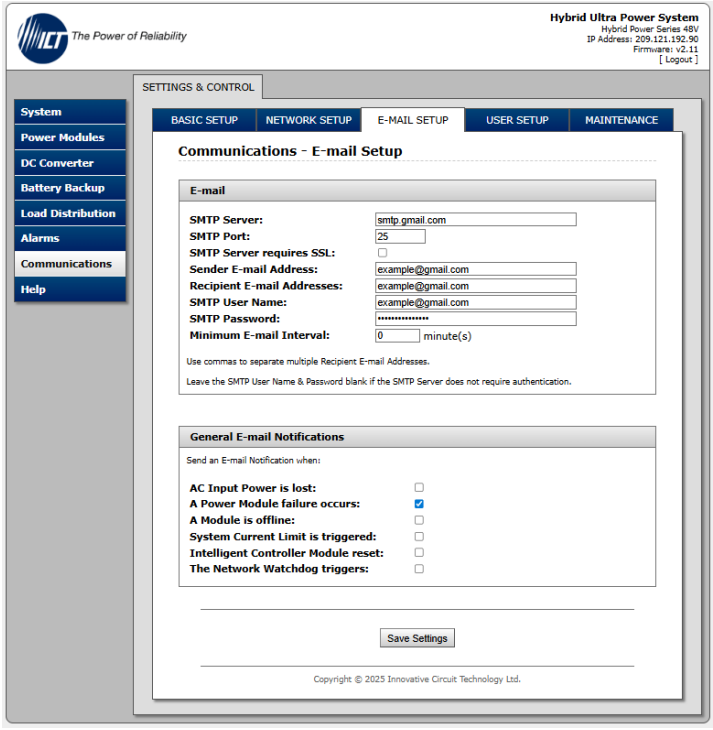
Privacy Password: If a privacy protocol is selected, set the privacy password for SNMPv3 traps.

Trap IP Addresses: Set the IP addresses for up to two devices that will receive SNMP traps from the unit.

NOTE: Save Settings before selecting a different tab.

4.8.3 E-MAIL SETUP

Use this tab to configure all e-mail settings to enable automatic e-mail notifications directly from the unit. The information required for this is available from the Network Administrator, or Internet Service Provider (ISP).



E-mail

SMTP Server: Set the name or the IP address of the SMTP server used for sending outgoing e-mail (e.g., “smtp.gmail.com”).

SMTP Port: Set the port used by the SMTP server. The default setting is 25.

SMTP Server requires SSL: Select this checkbox if the SMTP server requires an encrypted SSL connection. This box should normally be checked if the SMTP port used by the SMTP server is 465. If the SMTP server uses STARTTLS (normally port 587), this box should be unchecked.

Sender E-mail Address: Set an e-mail address that will appear as the sender for all e-mail notifications sent from the unit.

Recipient E-mail Addresses: Set one or more e-mail addresses that are to receive all e-mail notifications from the unit. Use commas to separate multiple addresses.

NOTE: This field can also be used to send text message notifications to a phone (see Section 7.8).

SMTP User Name: Set an SMTP user name here, if required by the SMTP server. Leave this field blank if the server does not require authentication.

SMTP Password: Set an SMTP password here, if required by the SMTP server. Leave this field blank if the server does not require authentication.

Minimum E-mail Interval: Set a minimum interval in minutes (0–60 minutes) between e-mail notifications. This time interval is used to prevent an un-intended flood of e-mail alarm notifications that could occur when an alarm limit is incorrectly configured, for example. The default setting is 0.

General E-mail Notifications

Set these options to receive an e-mail when one or more of these events occurs:

AC Input Power is lost: Select this checkbox to receive an e-mail notification when the AC input drops below a functional level.

A Power Module failure occurs: Select this checkbox to receive an e-mail notification when any of the installed Power Modules stop functioning.

A Module is offline: Select this checkbox to receive an e-mail notification when a module loses communication with the ICM.

System Current Limit is triggered: Select this checkbox to receive an e-mail notification when the "Total System Current" hits the "Current Limit".

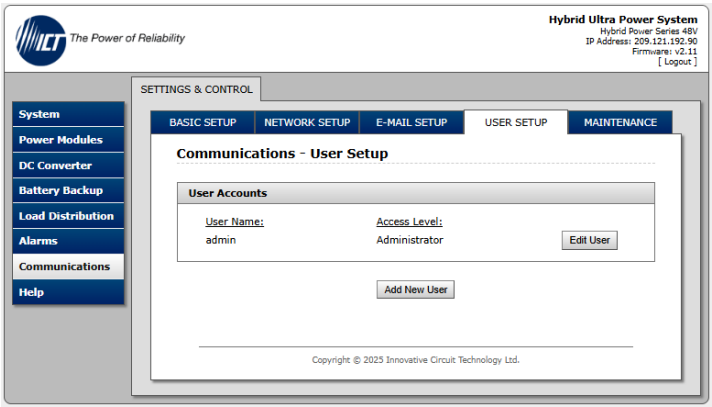
Intelligent Controller Module reset: Select this checkbox to receive an e-mail notification of an ICM reset for any reason.

The Network Watchdog triggers: Select this checkbox to receive an e-mail notification when the "Network Watchdog" triggers due to a loss of the network connection.

NOTE: Save Settings before selecting a different tab.

4.8.4 USER SETUP

Use this tab to set up and configure the usernames and passwords for up to 10 users. Set the level of access to the unit settings allowed for each user. Click on the Save Settings button at the bottom of the page to save any password changes.



The unit has no password assigned by default, so an Administrator password should be assigned to the unit for improved security.

NOTICE

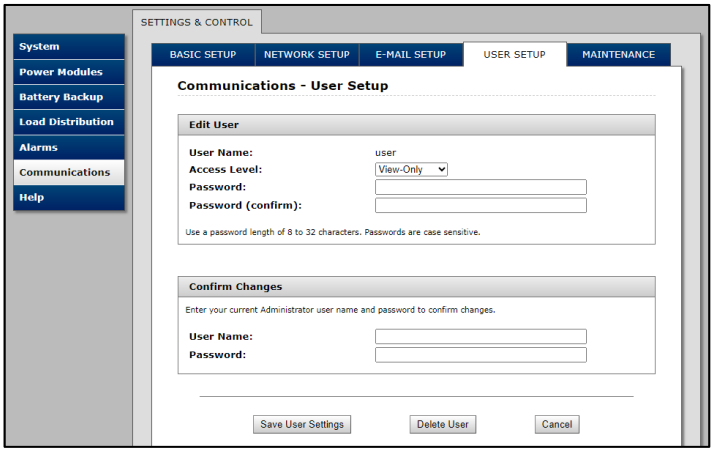
Record the new password(s) for future access. If the Administrator password is lost the unit must be reset to return the password to the blank default setting, causing loss of all other user settings (see Section 3.3).

User Accounts

Shows the User Name and Access Level.

Edit User

Select to edit an existing user account. Set the access level for each user.



Access Level: Set the access level:

- **Administrator:** This level has full access to the unit settings and can set up users and change passwords (“admin” is the default user).
- **Control:** User has read-only access to the unit, but can enable or disable the outputs, and change some of the basic settings.
- **View-Only**: User can only view status, cannot change any settings.

Password: Enter the new password for the chosen user.

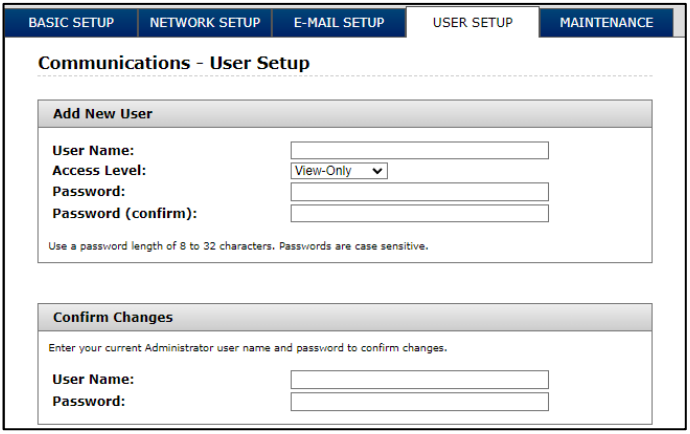
Password (confirm): Re-enter the new password to confirm the entry.

Confirm Changes

User Name: Enter admin user name to confirm these changes are valid.

Password: Enter the admin password to confirm the changes are valid.

Add New User



User Name: Set user name.

Access Level: Set access level.

Password: Set password.

Password (confirm): Confirm password.

Confirm Changes

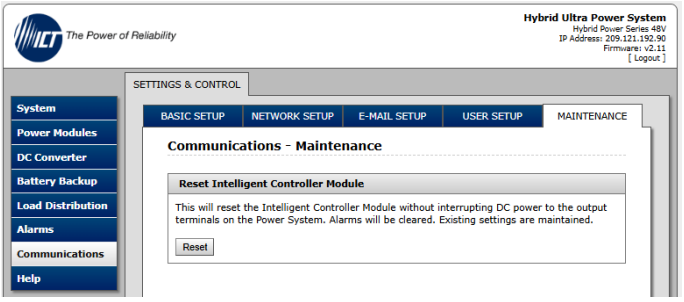
User Name: Enter admin user name to confirm these changes are valid.

Password: Enter the admin password to confirm the changes are valid.

Add User to save and return to the previous screen.

4.8.5 MAINTENANCE

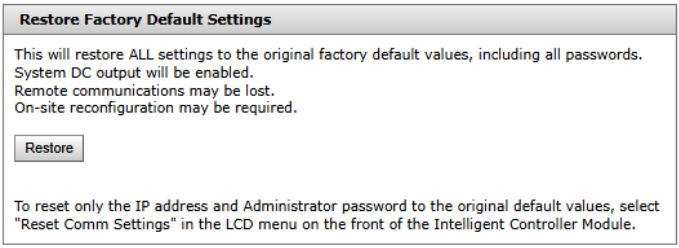
Use this tab to reset the unit (soft reset), restore the factory default settings, or send a test e-mail to verify e-mail functionality.



Reset Intelligent Controller Module

Select the "Reset" button to restart the ICM. The LDM channel output states will be restored according to the "Output State after Power Loss" setting for each output on the "Output Setup" page. All other settings are maintained during the reset.

Restore Factory Default Settings



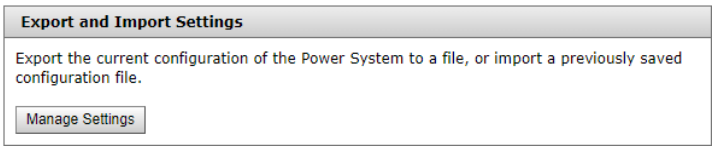
Select the "Restore" button to restore all settings to the original factory default values, including the user passwords. To restore the network settings and passwords only, see the Password Reset section (this feature is only available to the system Administrator) (see Section 3.2.7).

NOTICE

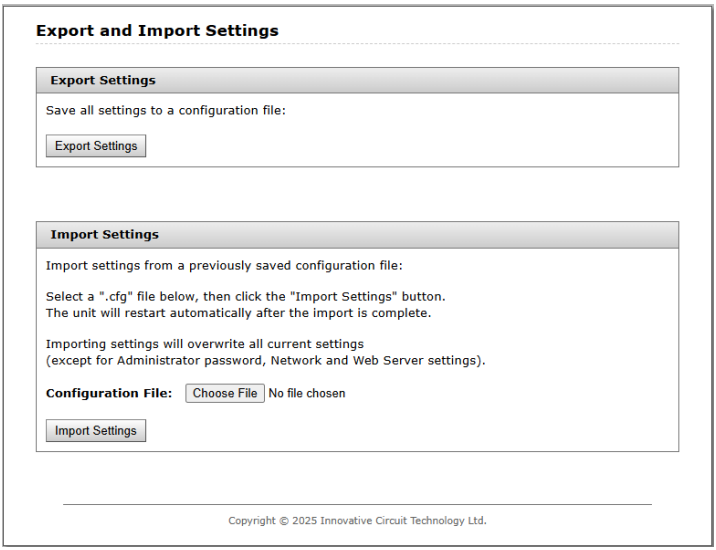
Restoring the unit to Factory Default settings may cause loss of network communications due to loss of custom changes to any network settings.

To reset only the IP address and Administrator password to the original default values, select "Reset Comm Settings" (see Section 3.2.6) in the front display panel menu.

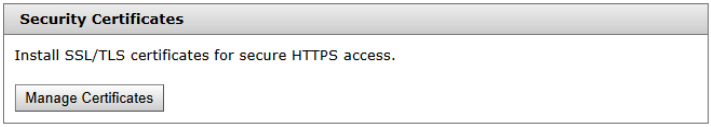
Export and Import Settings



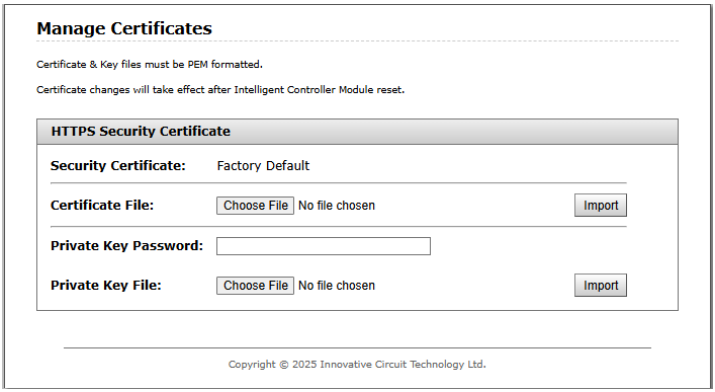
Select the "Manage Settings" button to access the Export and Import Settings page shown below. Use this page to export all system settings to an encrypted .cfg file which may be imported into other units to speed configuration. The export does not include Administrator password, Network nor Web Server settings. Use the Import Settings section on other systems to locate this file and then import it to any other Hybrid Ultra.



Security Certificates



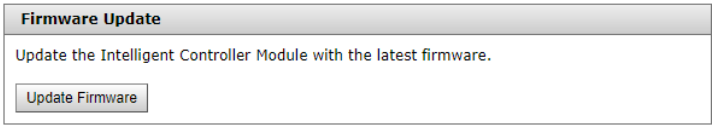
Select the "Manage Certificates" button to access the Manage Certificates page shown below. Use this page to import a new HTTPS Security Certificate to replace the default certificate. Both the Certificate File and Private Key File must be imported individually in PEM format. An optional Private Key Password can be entered if the Private Key is password protected.



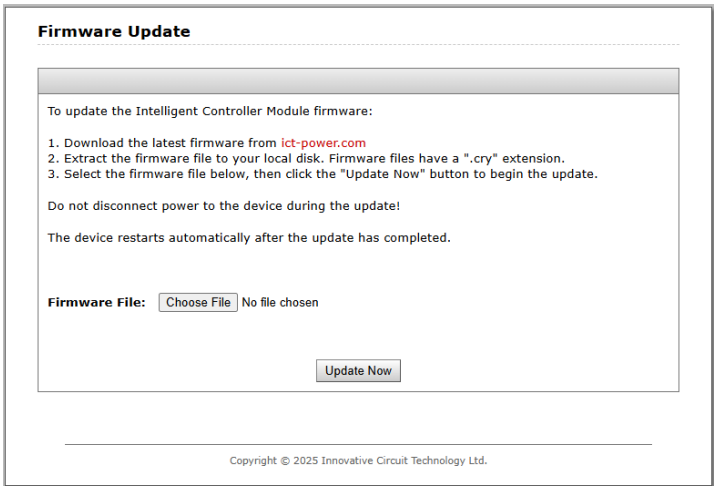
After a certificate has been successfully imported, a “Delete” button will be available which will erase the imported certificate.

The Intelligent Controller Module must be restarted before any certificate changes will take effect.

Firmware Update



Download the latest Hybrid Ultra firmware file from the ICT website (ict-power.com) to a local computer. Select the "Update Firmware" button to access the Firmware Update page shown below. Use this page to update the firmware on the power system control module by clicking the "Choose File" button to link the downloaded firmware then click the "Update Now" button. Note that the system settings will not be changed. Do not remove AC power during the update process.

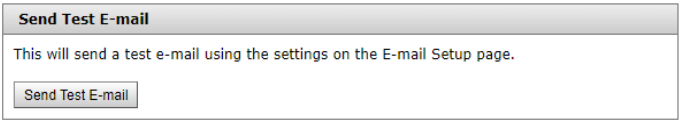


NOTICE

Updating the firmware will delete the current data log files. Download the logs before updating the firmware.

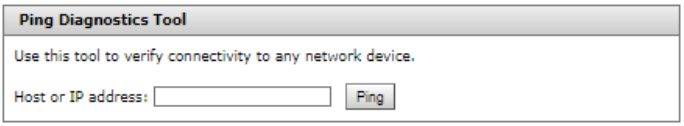
Send Test E-mail

Select the "Send Test E-mail" button to send a test e-mail to the e-mail recipients listed on the E-mail Setup page (see Section 4.8.3).



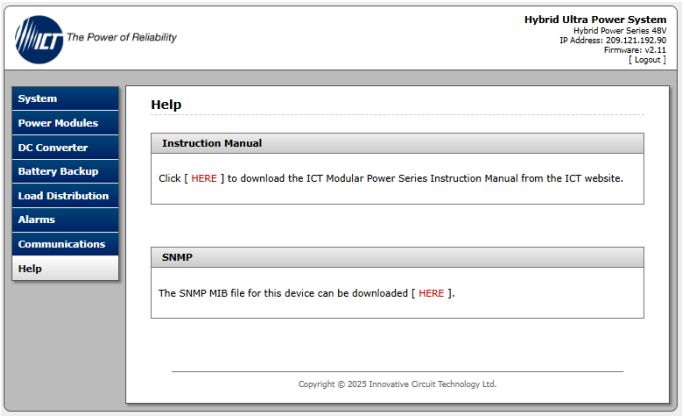
Ping Diagnostics Tool

Use this feature to verify connectivity of any network connected unit. Enter the hostname or IP address of the target device, and then click the "Ping" button to check if the device is active.



4.9 Help

This tab has helpful links to ICT's website.



Instruction Manual

Click the "HERE" button to download the ICT Hybrid Ultra Instruction Manual from the ICT's website.

SNMP

Click the "HERE" button to download the SNMP MIB file.

5.0 OPERATION: PARALLEL (Not applicable)

6.0 OPERATION: STANDARD POWER SYSTEM (Not applicable)

7.0 FAQs

7.1 Is the DC Converter's power in addition to the system power?

The integrated DC-DC Converter Module draws its power from the Power Modules. If there are 1400 watts of Power Modules, the DC-DC Converter Module will take up to 700 watts leaving 700 watts for other load devices.

7.2 How do I configure a router?

To set up the power system with remote internet access when it is located behind a router, Port Forwarding will need to be enabled on the router to forward incoming HTTP or HTTPS traffic to the local IP address of the unit. Refer to the router's user manual for instructions on how to configure Port Forwarding.

7.3 What information do I need to set up my battery?

Review the battery manual for the correct settings to enter into the GUI to ensure that the battery is correctly configured and to avoid future issues.

7.4 How do I connect the temperature sensor to the battery?

- Mount the sensor to the mid-level side of the middle battery in a set using the adhesive backed clip.
- See step # 3 of Section 2.8 for more information.

7.5 Why are Net Ah count, Run Time Remaining and SOC blank?

- The unit requires the battery to be running at full charge for 24 hours for the battery net Ah and Run Time Remaining to be displayed.
- See Section 4.5.1 in the user manual.

NOTE: Disconnecting and reconnecting the battery will require the same process as connecting a new battery to the unit.

7.6 How do I reset my password?

See Section 3.3.

7.7 How do I access the web-based configuration utility?

- Check the correct IP address for the system by downloading and running the ICT IP Address Discovery tool from http://www.ict-power.com/tools-utilities/.
- Check the network cable connections to the unit and the network.
- Ensure the network card settings on the computer are configured for accessing the IP address of the Hybrid Ultra. To access a unit with the default IP address of 192.168.0.180 the typical network settings for the computer are:

    - IP Address: 192.168.0.100
    - Subnet Mask: 255.255.255.0
    - Gateway: 192.168.0.1

- If the HTTP port of the unit has been changed, append the new port number to the URL used to access the unit (see Section 4.8.2). See the Password Reset Section (see Section 4.8.5) for details on how to reset the port number to the factory default value.
- If the network switch allows the user to manually configure port speed and duplex settings, turn-on “Auto Negotiation” for the switch port that the unit is connected to.
- If VLAN is enabled, check that the VLAN ID configured on the unit matches the VLAN ID set on the user’s network. After any changes to the VLAN configuration, make sure to restart the controller to have the changes take effect.

7.8 How do I receive text message alarm notifications?

The unit can send alarm notifications to a cell phone by configuring the alarm e-mails to be sent to the mobile phone service provider.

To use this feature, check with the user’s mobile phone service provider to confirm whether email-to-text messaging is supported and to obtain the correct address format. Alternatively, third-party email-to-SMS services may be used to deliver text message notifications.

7.9 How do I receive e-mails from the unit?

- See Section 4.8.3 E-MAIL SETUP.
- Verify that the "Send E-mail" checkboxes are selected for any alarm conditions for which the user wishes to receive e-mail notifications.
- Verify the e-mail settings by going to the "Communications/Maintenance" tab on the unit’s GUI and clicking on the "Send Test E-mail" button, to send a test message to the

designated recipient addresses. The Send Test E-mail box will show an error message if the system is unable to send the e-mail.

- Check on the "Communications/E-mail Setup" tab and ensure that the "SMTP Server" field is the correct address for the e-mail provider, and that the "SMTP Port" is correct (Port should be 25 for most servers).
- If the SMTP server requires SSL encryption, ensure that the "SMTP Server requires SSL" checkbox is ticked. Otherwise leave it blank.
- If the SMTP server requires authentication, ensure that the "SMTP User Name" and "SMTP Password" fields are correctly entered.

7.10 How do I upgrade the firmware?

On the ICT website, click on Resources > Product Firmware and select the product. Download the latest firmware. In the ZIP file will be a README document with step-by-step instructions or see section "Firmware Update" in Section 4.8.5.

NOTICE

Updating the firmware will delete the current data log files. Download the logs before updating the firmware.

7.11 How do I log out of the GUI?

To log out of the ICT Hybrid Ultra GUI, click on the Logout link on the top right of the browser window. The system will also automatically log off the user after 20 minutes of inactivity.

7.12 I cannot see the bottom shelf in GUI

- Ensure share cable is installed.
- Ensure both shelves have AC power.

8.0 PRODUCT SPECIFICATIONS

8.1 Electrical Specifications

Table 28. Overall Electrical Specifications

Parameters	Rating
AC Input Nominal Rating	120 / 240 VAC; 50 / 60 Hz
AC Input Operating Range	108 to 264 VAC
AC Input Maximum Range	90 to 300 VAC
Input Power Factor (typical)	0.99 (120 VAC input)
Efficiency	Up to 95%
Output V Line Regulation	+/− 0.1%
Network Communication	RJ45 10/100-T port (IPv4, IPv6, VLAN, HTTP, HTTPS, SMTP, DNS, TCP, UDP, ICMP, DHCP, ARP, SNMP v1/v2c/v3, SNTP Protocols)
Network Security	Password protection, SSL encryption for HTTPS and SMTP (TLS 1.3)

Table 29. Power Module Specifications (cont'd on next page)

Parameters	Power System	ICT 700-24PM	ICT 700-48PM	ICT 1000-48PM	ICT 1500-24PM	ICT 1500-48PM
AC Input Current (A_{rms} at 230 VAC)	24 A max	3.5 A max.	3.5 A max.	5.5 A max	8.0 A max.	8.0 A max.
AC Input Current (A_{rms} at 115 VAC)	33 A max	7.0 A max.	7.0 A max.	11 A max	8.0 A max.	8.0 A max.
Output Voltage[1] (Nominal Battery float Voltage) (+/− 0.5%)	-	27.6 VDC	55.2 VDC	55.2 VDC	27.6 VDC	55.2 VDC
Output Voltage Range (adjustable)	-	23–31 VDC	46–62 VDC	46–60 VDC	23–31 VDC	46–62 VDC
Output Power (max) (230 VAC) @ N+1	6,000 W	700 W	700 W	1,000 W	1,500 W	1,500 W
Output Power (max) (115 VAC) @ N+1	4,000 W	700 W	700 W	1,000 W	900 W	900 W
Output Current (continuous) (230 VAC)	270 A	25 A	12.5 A	18 A	54 A	27 A

Parameters	Power System	ICT 700-24PM	ICT 700-48PM	ICT 1000-48PM	ICT 1500-24PM	ICT 1500-48PM
Output Current (continuous) (115 VAC)	135 A	25 A	12.5 A	18 A	32 A	16 A
Output Derating	2% / °C (above 50°C)					
Efficiency (peak)	-	91%	93%	91%	94%	95%
Output Noise (max mV_{rms})	-	30 mV_{rms}	60 mV_{rms}	60 mV_{rms}	40 mV_{rms}	60 mV_{rms}
Output V Load Regulation	-	1.7%	1.2%	1.2%	1.7%	1.2%

[1] Actual operating point may be lower due to battery charge requirement.

Table 30. Battery Management Module Specifications

Parameters	Power System	ICT 700-24PM	ICT 700-48PM	ICT 1000-48PM	ICT 1500-24PM	ICT 1500-48PM
BMM Max Battery Current (per input)	100 A	-	-	-	-	-
BMM Max total Battery Current through LVD	150 A	-	-	-	-	-
BMM LVD Threshold V (Default)	-	21 V	42 V	42 V	21 V	42 V
BMM LVD Reconnect V (Default setting)	-	25 V	50 V	50 V	25 V	50 V
BMM idle DC Power Draw[1]	<1 W	-	-	-	-	-
Meter Accuracy (Voltage)	BMM voltage readings +/−3%					
Meter Accuracy (Current)	BMM current readings +/−5%, or +/−1 A if current reading is less than 20 A					

[1] AC mains power off; backup battery connected; LVD open.

Table 31. Load Distribution Module Specifications

Parameters	Rating
Outputs per LDM	4 (normally open)
Max Output Rating (12, 24, or 48 V)	25 A peak (20 A continuous)
Voltage Range	10–65 VDC
Channel Current Monitoring	+/−5% accuracy

Table 32. Integrated DC-DC Converter Module Specifications

Parameters	12 V	24 V
Default Output Voltage (VDC)	13.8 VDC	27.6 VDC
Output Voltage Adjustment Range (VDC)	11.5–15.5 VDC	23.0–31.0 VDC
Input Voltage	20–60 VDC	20–60 VDC
Power Output	700 W	700 W
Default Current Limit (A)	50 A	25 A
Output Current Limit Adjustment Range (A)	10–50 A	5–25 A
V-output Line Regulation	+/− 0.2%	
V-output Load Regulation	+/− 0.5%	
Efficiency (peak)	92% (Typical)	
Power Factor	0.99 (Typical)	0.99 (Typical)
Output ripple (rms)	20 mV_{rms}	30 mV_{rms}
Operating Temperature	−30°C to 50°C	
Output Grounding	DC-DC Converter Module is floating, may be connected with Positive or Negative ground	
Safety	Designed to meet EN60950-1	

8.2 Physical Specifications

Table 33. Physical Specifications

Parameters	Configuration
Output Grounding	Power Modules are floating, may be connected with Positive or Negative ground[1]
Alarm Output	Form-C dry contact, 0.5 A 60 VDC max (voltage-free contact)
DC Connectors: (Output, Battery, DC-DC Converter Module)	Bus Bar, 5/16-inch bolt hole
Load Distribution Module (LDM) Connectors	8-terminal cage clamp style, 12–22 AWG, 0.51 Nm max torque
Alarm Output Connector	3-pin removable plug, cage clamp type 16–24 AWG
Alarm Input, Bat temp sense Connector	7-pin removable plug, cage clamp type 16–24 AWG
AC Input Connector	3-pin removable plug, cage clamp type 8–22 AWG
Operating Temperature Range	−30 to +60°C[2]
Storage Temperature Range	−45 to +85°C
Humidity	(Operating) 10–90% (non-condensing) (Storage) 5–95% (non-condensing)
Cooling	Load controlled fan on Power Modules

[1] BMMD and LDM modules are available in positive (-48 volts) or negative (+12/24 volts) ground configuration. Specify at time of ordering.

[2] Ambient Temperature. De-rate output 2% per °C above 50°C.

Table 34. Heat Dissipation

Module	Rating
IPS	10 BTU/hr
ICT700-24PM	237 BTU/hr
ICT700-48PM	180 BTU/hr
ICT1000-48PM	338 BTU/hr
ICT1500-24PM	327 BTU/hr
ICT1500-48PM	270 BTU/hr
BMMD	10 BTU/hr (idle) 287 BTU/hr (150 A; Battery Voltage: 54 VDC)
LDM	10 BTU/hr (idle) 160 BTU/hr (20 A/channel; System Voltage: 55.2 VDC)
DC-DC Converter Module	208 BTU/hr

8.3 Regulatory Specifications

Table 35. Regulatory Compliance

Category	Certification
Safety, EMC-Emissions, EMC-Immunity, RoHS (700 W)	UL/CSA60950-1, UL/CSA 62368-1, ICES-003, FCC Part 15/B, EN 61000-6-2, EN 61000-6-3, EIC 61000-4-5, CE, RCM and RoHS
Safety, EMC-Emissions, EMC-Immunity, RoHS (1,000 W)	UL/CSA60950-1, UL/CSA 62368-1, ICES-003, FCC Part 15/B, EN 61000-6-1, EN 61000-6-3, EIC 61000-3-2, EIC 61000-3-3, CE, RCM and RoHS
Safety, EMC-Emissions, EMC-Immunity, RoHS (1,500 W)	UL/CSA60950-1, UL/CSA 62368-1, ICES-003, EN55032, EN 61000-3-2, EN 61000-3-3, IEC 61000-4-5, CE, RCM and RoHS

8.4 Mechanical Specifications

Table 36. Dimension and Weight

Physical Property	Value
Dimension - L x W x H	15.7 x 19.0 x 3.5 in. (398 x 483 x 89 mm)
Weight	32 lbs. (14.5 kg)[1] maximum

[1] Weight of unit as shipped with BMMD, LDM and DC-DC Converter Module. No Power Modules.

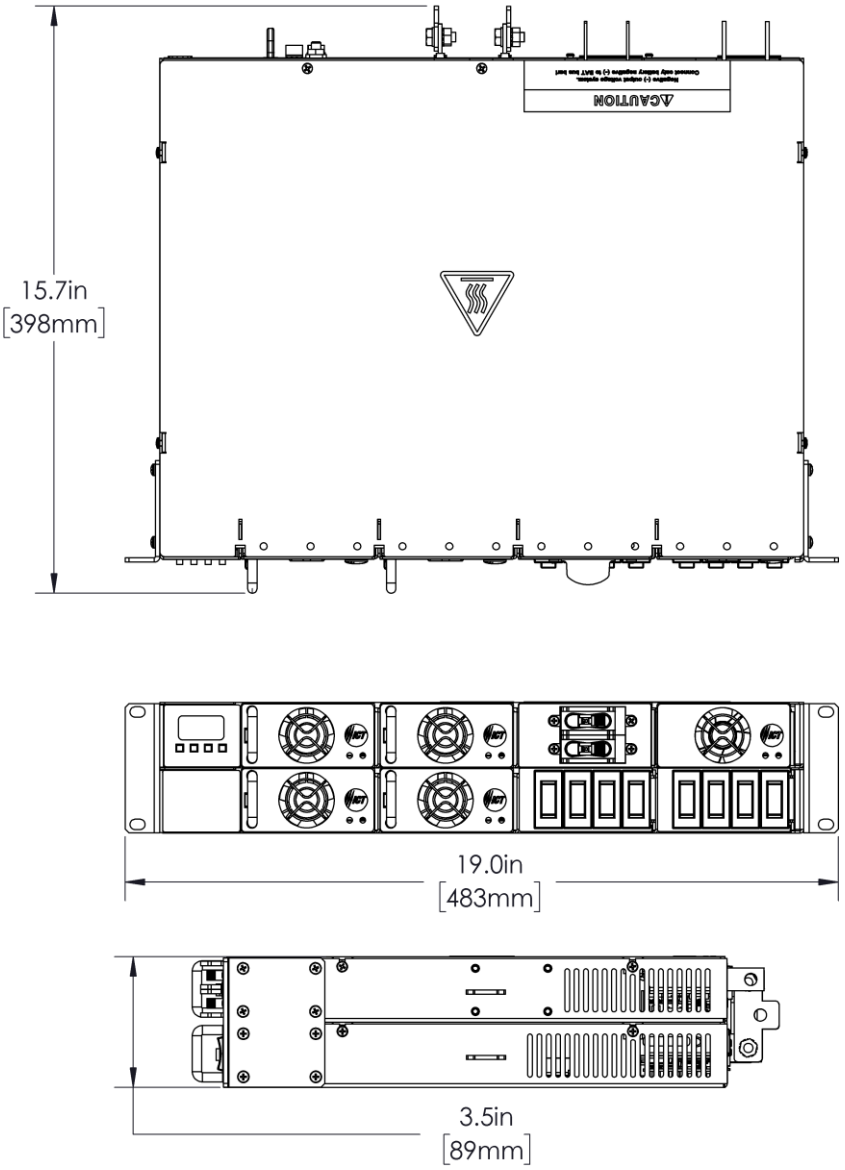


Figure 16. Dimensions

9.0 GLOSSARY

- 2RU — Two Rack Unit; 3.5-inch (89 mm) of rack height
- A, amps — Amperes
- A_{rms} — Amperes (Root Mean Square)
- AES — Advanced Encryption Standard
- Ah — Ampere-Hours
- ANSI — American National Standards Institute
- ARP — Address Resolution Protocol
- AWG — American Wire Gauge
- BMM — Battery Management Module
- BMMD — Dual Battery Management Module
- BMS — Battery Management System
- BTU — British Thermal Unit
- CSV — Comma-Separated Values
- DHCP — Dynamic Host Configuration Protocol
- DNS — Domain Name System
- FCC — Federal Communications Commission
- GUI — Graphical User Interface
- HTTPS — Hypertext Transfer Protocol Secure
- Hr — Hour
- Hz — Hertz
- ICES — Interference-Causing Equipment Standard
- ICM — Intelligent Control Module
- ICMP — Internet Control Message Protocol
- ISO — International Organization for Standardization
- ISP — Internet Service Provider
- LDM — Load Distribution Module
- LVD — Low Voltage Disconnect
- MAC — Media Access Control
- MIB — Management Information Base
- NEC — National Electrical Code
- OEM — Original Equipment Manufacturer
- OLED — Organic Light-Emitting Diode
- PEM — Privacy Enhanced Mail
- RMA — Return Material Authorization
- RoHS — Restriction of Hazardous Substances
- SHA — Secure Hash Algorithms
- SLA — Sealed Lead-acid
- SMTP — Simple Mail Transfer Protocol
- SNMP — Simple Network Management Protocol
- SOC — State of Charge
- TCP — Transmission Control Protocol
- TCP/IP — Transmission Control Protocol/Internet Protocol
- TLS — Transport Layer Security
- UDP — User Datagram Protocol
- V — Volts
- VAC — Volts, Alternating Current
- VDC — Volts, Direct Current
- VLAN — Virtual Local Area Network
- V_{rms} — Volts (Root Mean Square)
- W — Watts

Find the latest version of this manual here:

https://ict-power.com/product/hybrid-ultra

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