UPS25210 Series

PC/104 Hold-up Module

User's Manual

BDM-610020134 Rev. G

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AS9100 and ISO 9001 Certified

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Revision History

Rev A	01/22/2016	Initial Release
Rev B	02/29/2016	Added information from the UPS35110 and the CAP10100 manuals
Rev C	07/17/2016	Added information about LEDs and JP3. Changed serial protocol information. Added more information from the CAP10100HR and the UPSxx110HR manuals. Added IDAN® information.
Rev D	08/23/2016	Renamed document to the UPS25110 Series
Rev E	09/27/2016	Added reverse voltage rating to UPSxx110HR Electrical Characteristics
Rev F	03/20/2018	Throughout: Update photos Throughout: Correct IDAN ordering part numbers Throughout: Add IDAN ordering part numbers, pinouts, and drawings for IDAN-UPSxx216HR Chapter 6: IDAN Connections: Restructured section Chapter 6: IDAN Connections: Added height and weight Chapter 6: IDAN Connections: Add model numbers for IDAN connectors and mating connectors Chapter 6: IDAN Connections: Corrected the IDAN serial port pinout Chapter 6: IDAN Connections: Add contents for each IDAN ordering option and list ordering numbers for cables which must be purchased separately
Rev G	08/19/2019	Changed Output voltage specification to 33V and maximum battery charge voltage to 31V.

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1 Introduction

1.1 Product Overview

The UPS25210HR was designed to act as a compact, robust, reliable, short-term backup for power loss events. The quick power delivery, superior thermal range, and very high cycle life make this product the best fit for a multitude of demanding applications. This system is composed of the UPS25110HR and the CAP10100HR. The UPS will charge the capacitors and provide main power to a load, and switch over to the capacitor bank automatically in the event of a power loss. The system provides status through the USB connection on the PCIe bus, or externally through the serial port and USB 2.0 connector.

Note: In this manual, multiple model numbers are referenced using the letter x in the model number. i.e. “UPSxx110HR” is the same as “UPS10110HR / UPS25110HR / UPS35110HR”

1.2 System Features

- USB 2.0 and RS232 Interfaces to CPU
- -40 to +85C operation
- Various power off modes
- Thermistor input
- Status LEDs
- 8V to 33V input range
- 8V to 31V charging voltage
- 13.8V output voltage to system
- 4 Amps of super capacitor charging current
- Up to 136 Watts available power split between charging or system power
- 2250 Watt Seconds of backup
- Remote ON/OFF control
- Input protection for overvoltage and over current.

1.3 Ordering Information

The UPSxx210HR is available with the following options:

Table 1: UPSxx210HR Ordering Options

Part Number	Description
UPS35210HR	PCIe/104 UPS with Supercapacitor Backup
UPS25210HR	PCI/104-Express UPS with Supercapacitor Backup
UPS10210HR	UPS with Supercapacitor Backup (without stackable busses)
IDAN-UPS35210HR	PCIe/104 UPS with Supercapacitors in modular IDAN® frame - 2-pin input power receptacle - 2-pin output power receptacle - 9-pin DSUB for USB
IDAN-UPS25210HR	PCI/104-Express UPS with Supercapacitors in modular IDAN® frame - 2-pin input power receptacle - 2-pin output power receptacle - 9-pin DSUB for USB
IDAN-UPS10210HR	UPS with Supercapacitors in modular IDAN® frame (without stackable busses) - 2-pin input power receptacle - 2-pin output power receptacle - 9-pin DSUB for USB
IDAN-UPS35216HR	PCIe/104 UPS with Supercapacitors in modular IDAN® frame - 6-pin input power receptacle (for IDAN-ATX3510HR-190W) - 4-pin output power receptacle (for IDAN-ATX3510HR-190W) - 9-pin DSUB for USB
IDAN-UPS25216HR	PCI/104-Express UPS with Supercapacitors in modular IDAN® frame - 6-pin input power receptacle (for IDAN-ATX3510HR-190W) - 4-pin output power receptacle (for IDAN-ATX3510HR-190W) - 9-pin DSUB for USB
IDAN-UPS10216HR	UPS with Supercapacitors in modular IDAN® frame (without stackable busses) - 6-pin input power receptacle (for IDAN-ATX3510HR-190W) - 4-pin output power receptacle (for IDAN-ATX3510HR-190W) - 9-pin DSUB for USB

The Intelligent Data Acquisition Node (IDAN®) building block can be used in just about any combination with other IDAN® building blocks to create a simple but rugged 104® stack. This module can also be incorporated in a custom-built RTD HiDAN® or HiDANplus® High Reliability Intelligent Data Acquisition Node. Contact RTD sales for more information on our high reliability systems.

1.4 Contact Information

1.4.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.4.2 Technical Support

If you are having problems with your system, please try the steps in the Troubleshooting section of this manual.
For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 2: System Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
$V_{in(UPS)}$	UPS Supply Voltage		8	36	V
V_{out}	Main Voltage		8	33	V
Vout	Backup Voltage		8	13.8	V
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-40	+85	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, Ground benign, controlled	TBD		Hours

2.2 CAP10100HR Electrical Characteristics

Table 3: CAP10100HR Electrical Characteristics

Parameter	Test Condition	Max	Unit	Tolerance
Power Dissipation at full charge	25°C	0.4	Watts	5%
Input Overcurrent Trip Level	25°C	14.28	Amps	5%
Input Overvoltage Trip Level	25°C	14.09	Volts	5%
Output Overcurrent Trip Level	25°C	14.28	Amps	5%
Discharge Joules of energy	25°C	2250	Joules	-10% to +20%
Total Joules of energy	25°C	3332.7	Joules	-10% to +20%
Discharge Under Voltage Lock Out	25°C	7.22	Volts	5%
Maximum Recommended Charge Current	25°C	4.00	Amps	N/A

2.3 UPSxx110HR Electrical Characteristics

Table 4: UPSxx110HR Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typical	Max	Unit
Pin	Power Consumption	V_{in} = 20V*	0.658	4.44		W
I_{in}	Main Input Supply Current	Active Vin = 20V	0.033	0.222		A
Eff-C	Charge Efficiency	20Vin with 13.8V charge at 4.0 Amp		89.39		%
Eff-B	33V output efficiency	20Vin with 136 Watt load		95.62		%
Vr	Reverse Voltage	-33Vin		-33		V
		RS232 Receiver				
	V_{IN}		-15		+15	
	V_{IL}		0.6	1.2		V
	V_{IH}			1.5	2.0	V
	Input Resistance	-15V ≤ VIN ≤ +15V	3	5	7	KΩ
		RS232 Transmitter				
	V_O Output voltage Swing	3KΩ load to GND	±5.0	±5.5		V
	Receiver V_{IL}	No Load			±7.0	V
	Short circuit Current				±60	mA
	R_{OFF} Power Off Impedance	V_O=±2V	300	10M		Ω
		Data Rate				
	Baud Rate			115200		baud

*minimum power occurs with the charger and the onboard 33V disabled.

2.4 System Backup Time

Below is a graph of the expected backup time given a specific load.

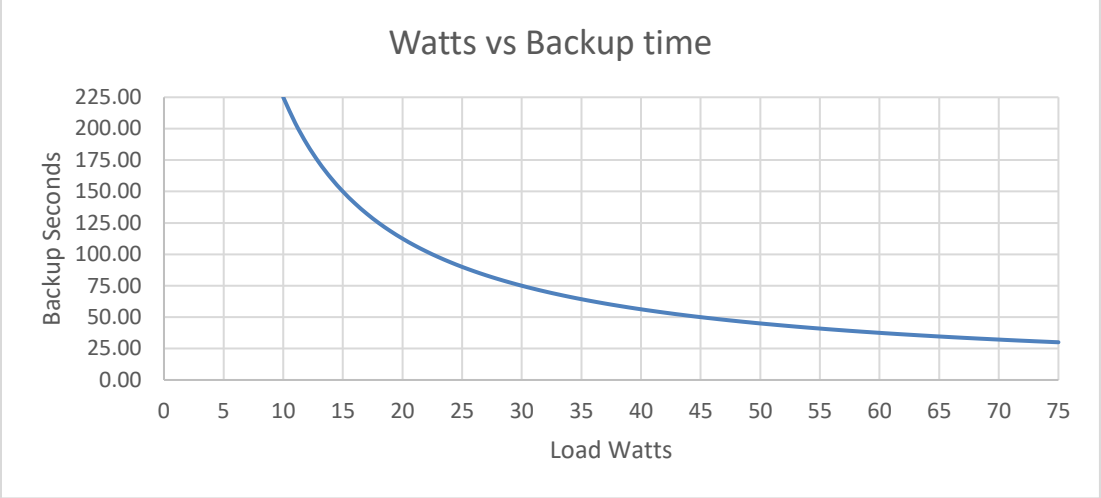


Figure 1: Backup Time vs. Load

2.4.1 Constant Current Charge Profile

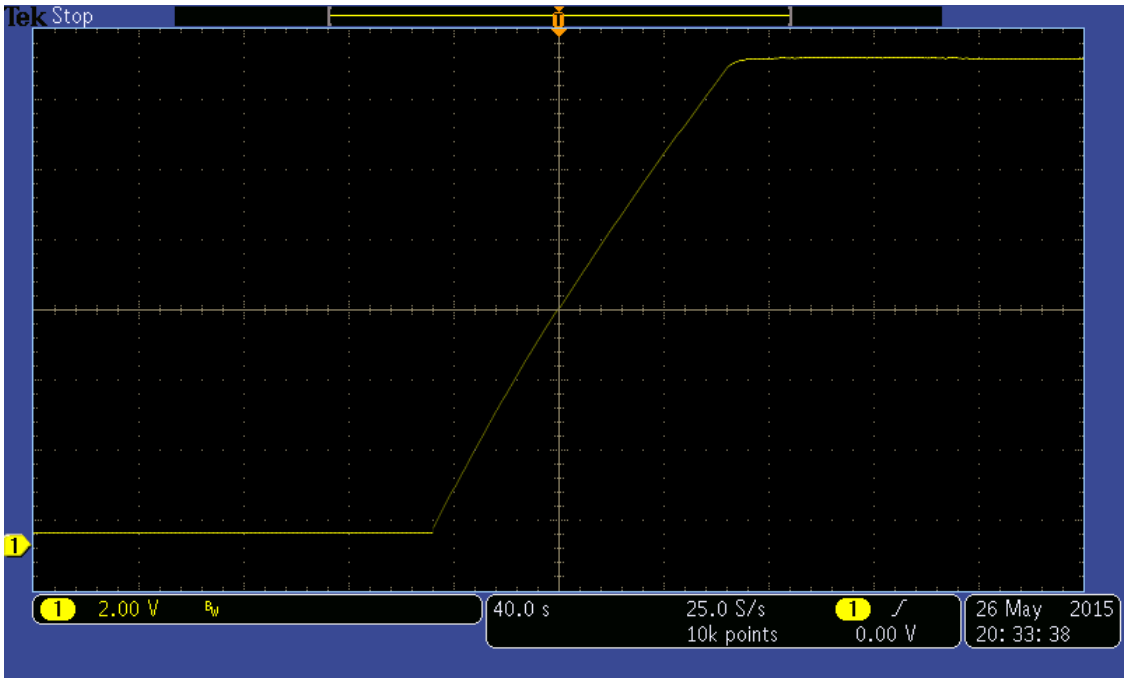


Figure 2: Charging from 0.0V to 13.76V at the programmed 4.0 Amps in 119.2 seconds (3280.4 Joules)

2.4.2 CONSTANT POWER DISCHARGE PROFILES

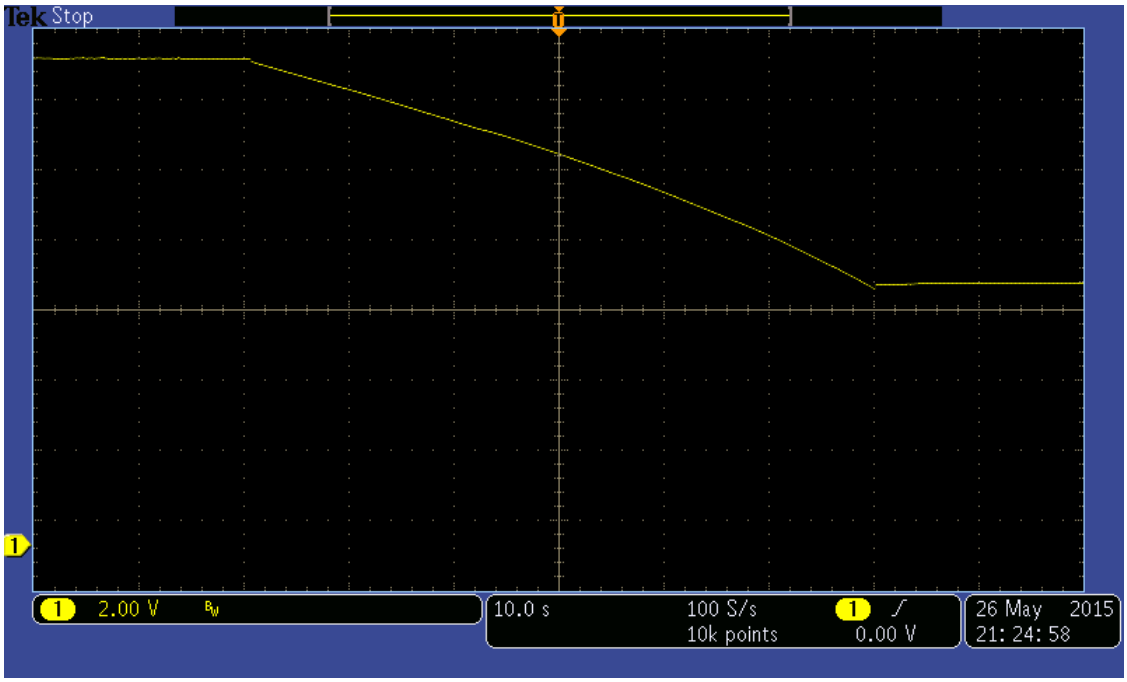


Figure 3: Discharging 40.0 Watts profile from 13.76V down to 7.45V (UVLO) in 59.3 seconds for 2372 Joules

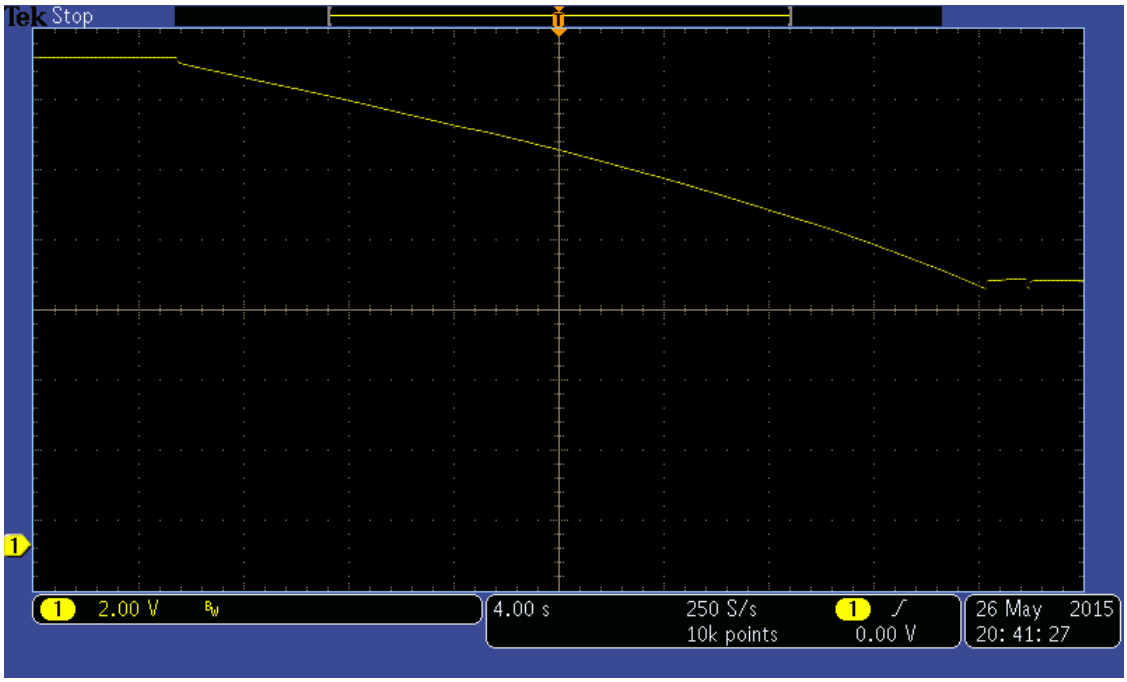


Figure 4: Discharging 75 Watts profile from 13.76V down to 7.45V (UVLO) in 30.8 seconds for 2310 Joules

2.4.1 CONSTANT CURRENT DISCHARGE PROFILES

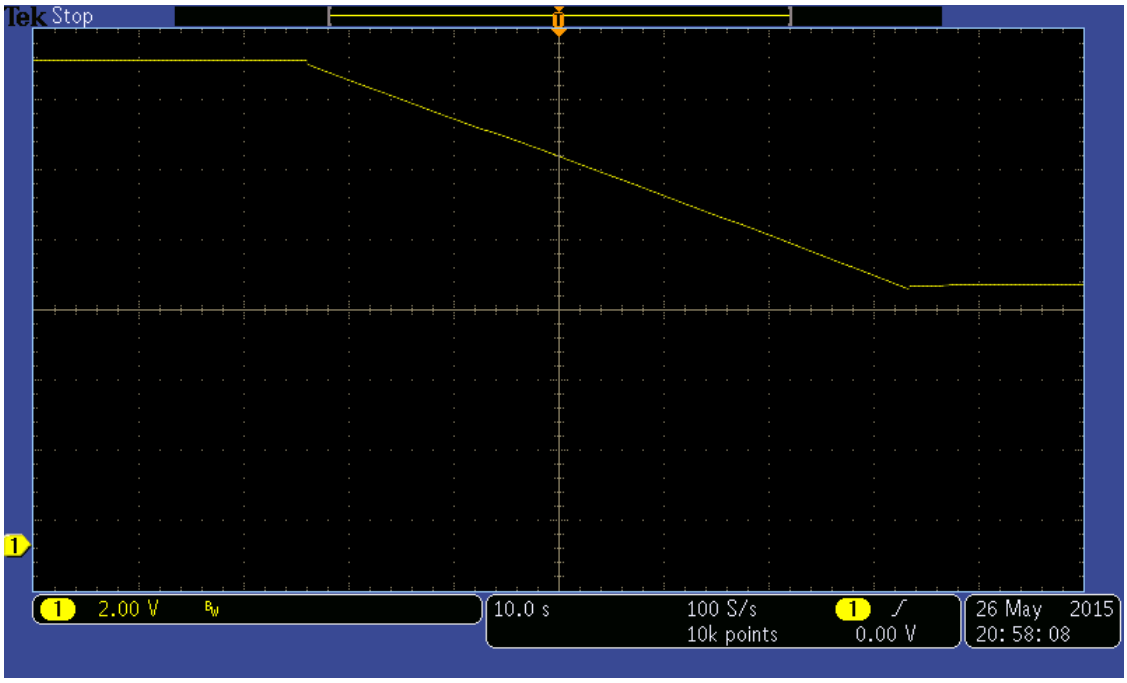


Figure 5: Discharge profile at 4.0 Amps from 13.76V down to 7.45V (UVLO) in 57.6 seconds for 2443 .4 Joules

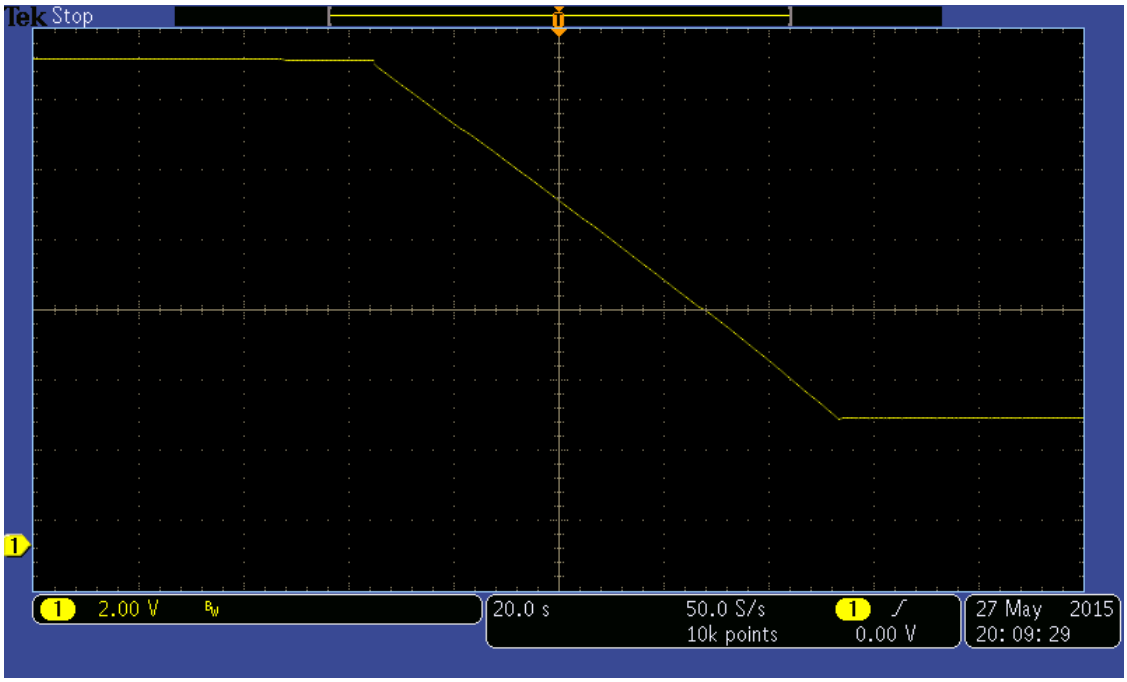


Figure 6: Discharge profile 4.0 Amps (BYPASS jumper removed) from 13.76V down to 3.5V at in 88.8 seconds for 3065.4 Joules

Only remove the BYPASS jumper to assist with a controlled 4.0 Amp discharge through the Vin connector. For normal operation, it must be installed.

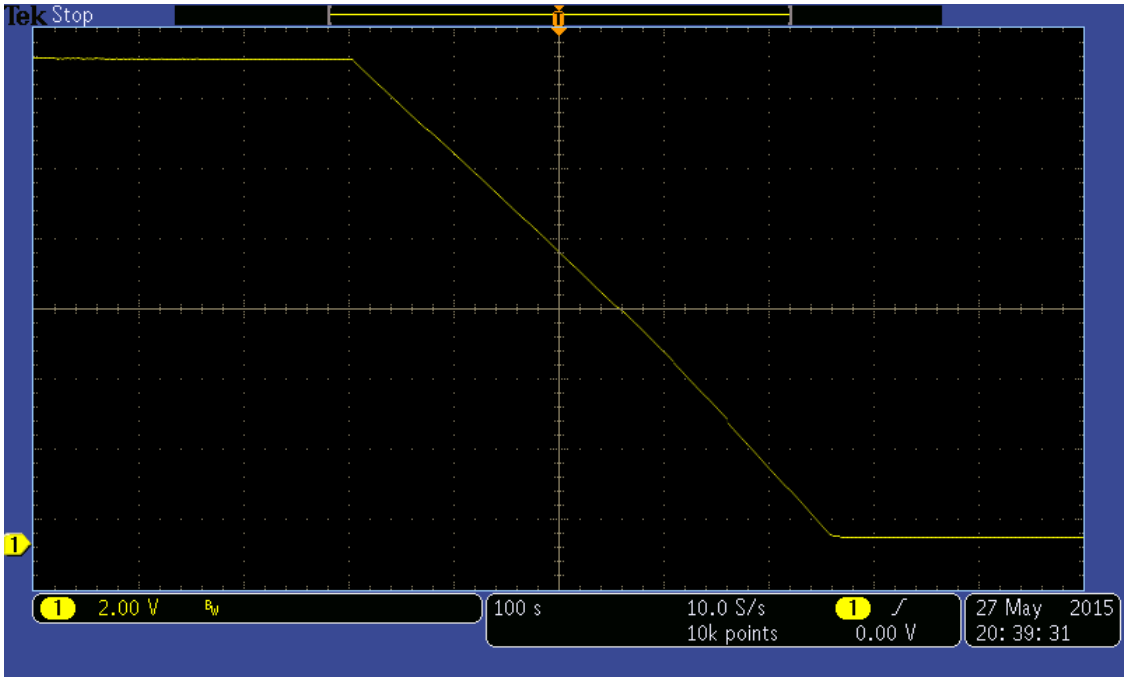


Figure 7: Discharge profile at 1.0 Amps (Safety discharge through CN1) from 13.76V down to 0V in 456 seconds for 3137.3 Joules.

CN1 is only rated to 1.0 Amp.

3 System Boards

3.1 CAP10100HR

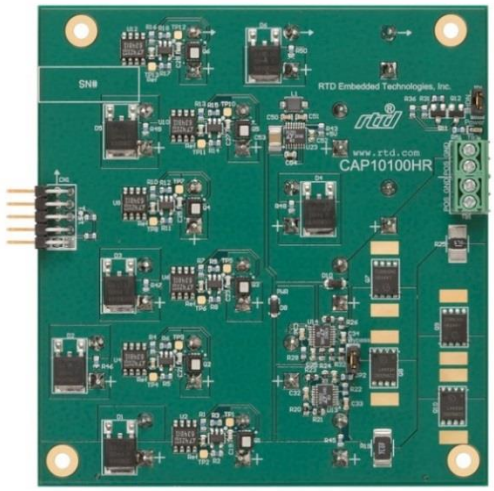


Figure 8: CAP10100HR top view

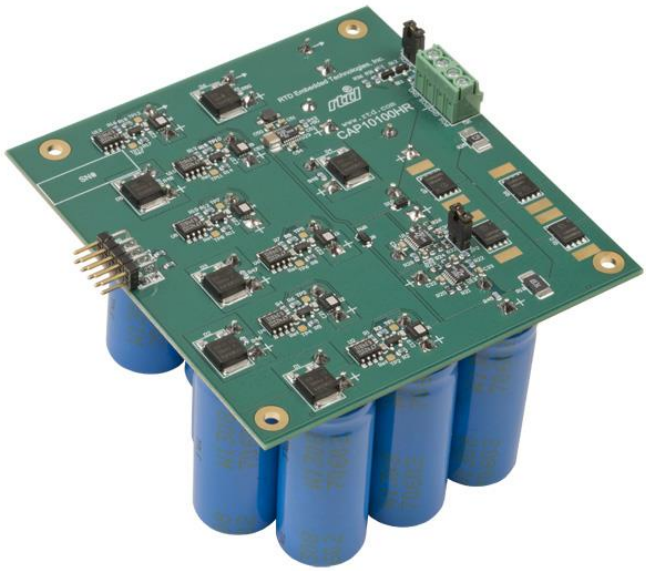


Figure 9: CAP10100HR side view

3.2 CAP10100HR Product Overview

The CAP10100HR was designed to act as a compact, robust, reliable, short-term backup for power loss events. The quick power delivery, superior thermal range, combined with very high cycle life make this product the best fit for a multitude of demanding applications.

3.3 CAP10100HR Block Diagram

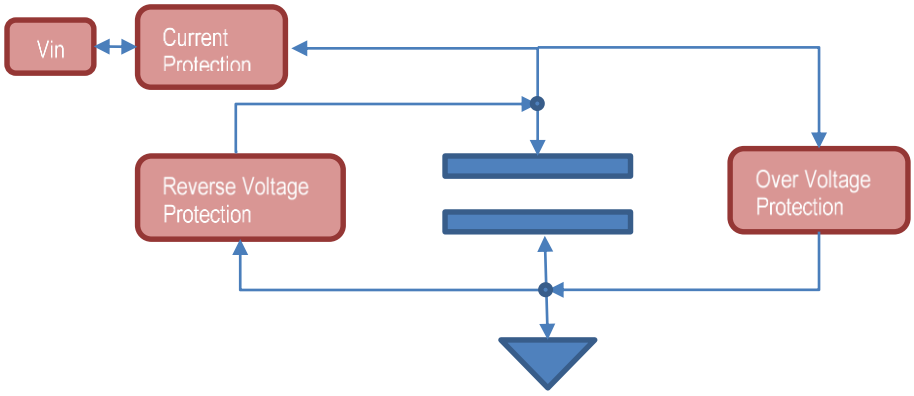


Figure 10: CAP10100HR Block Diagram

3.4 CAP10100HR Board Features

- Up to a 13.8V DC voltage input range
- Up to 14.28 Amps of backup Current
- 2250 Joules of energy available
- Remote ON/OFF control
- Accepts up to 4 Amps of charge current
- Input over voltage protection
- Input over current protection (input and output)

3.5 CAP10100HR Physical Characteristics

- Weight: Approximately 342g (0.754 lbs.)
- Board Dimensions: 90.17 mm L x 95.89 mm W (3.55 in L x 3.775 in W)

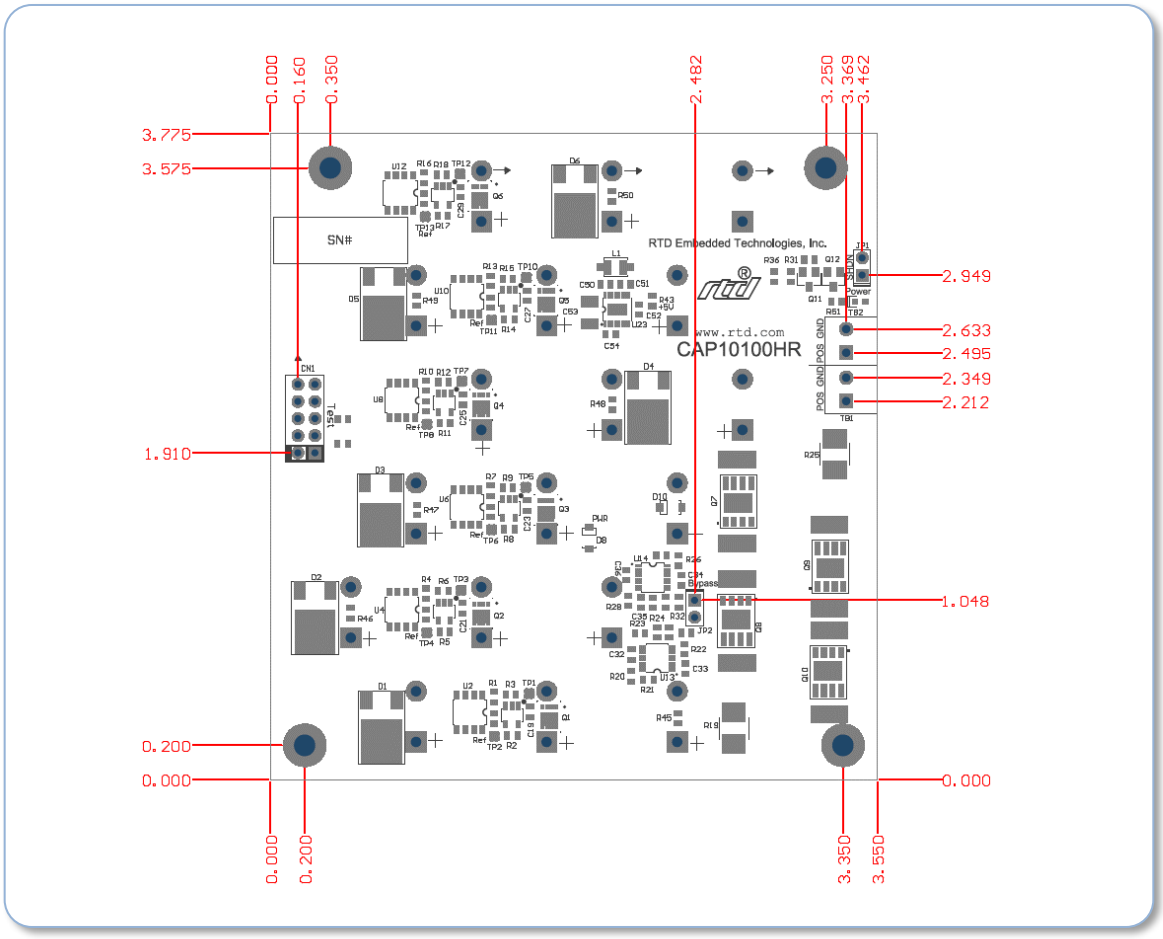


Figure 11: CAP10100HR Board Dimensions

3.6 CAP10110HR Connectors, Jumpers, and LEDs

All I/O connectors have Pin 1 designated by a thick white silkscreen line, and/or a square pad on the PCB.

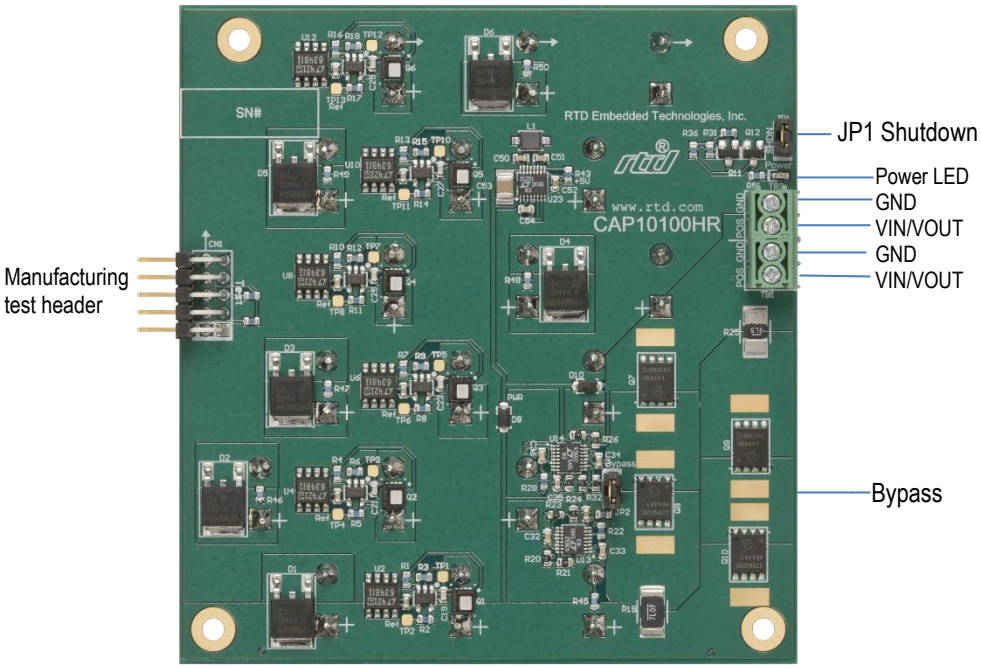
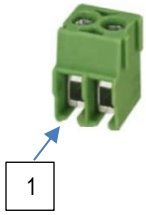


Figure 12: CAP10100HR Board Connections, Jumpers, LEDs

3.6.1 CAP10110HR Power Connectors

TB1 and TB2 are both 3.5 mm (0.138”), two pin input power connectors (Pheonix Contact 1984617). Each pin is labeled on the PCB. There is no mating connector (www.Pheonixcontact.com). This connector is intended to have 20 AWG wires directly connected to it.



Facing the connector, from left to right, the pin out is:

Table 5: TB1 and TB2 VIN / VOUT Connector

TB1 Pin	Pin Name	Function	IDAN®
1	POS	13.8V input	Connected Internally
2	NEG	Input Negative	Connected Internally

3.6.2 CAP10100HR SHDN JUMPER JP1

The 0.1" JP1 jumper functions as a power disconnect switch. If this jumper is open, the Super Capacitors will be disconnected from the Vin connector, TB1. The purpose of this connector is to allow the user to hot plug the CAP10100HR to a load safely. Only connect the CAP10100HR with JP1 open and install JP1 when the connection is safely completed.

Table 6: JP1 Board SHDN Jumper (Default Installed)

JP1 State	Function	IDAN®
Short	(default) normal operation	N/C
Open	Disconnect Caps from Vin	N/C

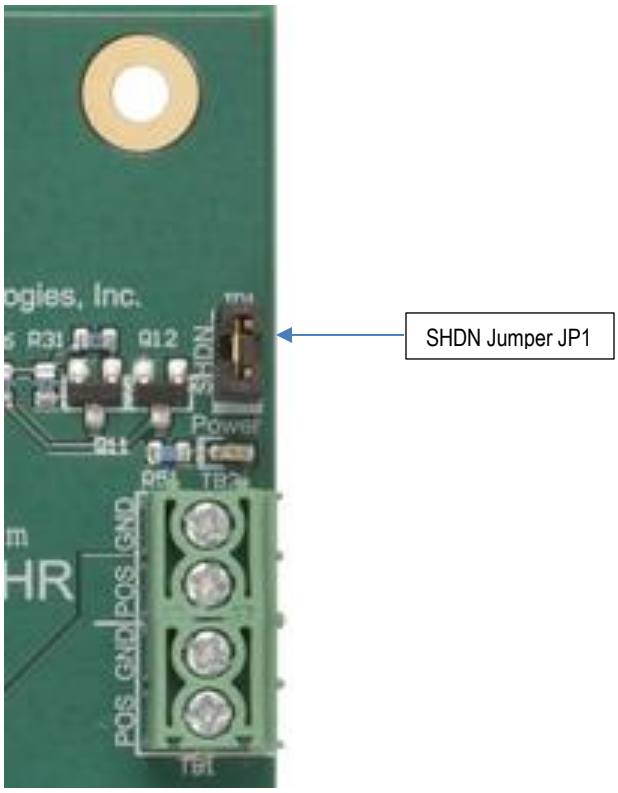


Figure 13: CAP10100HR JP1 Location

3.6.3 CAP10100HR UNDER VOLTAGE LOCKOUT BYPASS JUMPER JP2

The 0.1" JP2 jumper is for bypassing the under voltage discharge termination circuitry. The reason for this feature is to allow the Super Capacitors to be fully discharged down to zero Volts for safe disconnect and storage. This jumper must remain installed during normal operation. The default condition is JP2 shorted.

Table 7: CAP10100HR JP2 BYPASS Jumper (Default Installed)

JP2 Pin	Signal	Function	IDAN®
Short	Normal Operation (Default)	Discharge Under Voltage Lockout	N/C
Open	BYPASS	For completely discharging caps	N/C

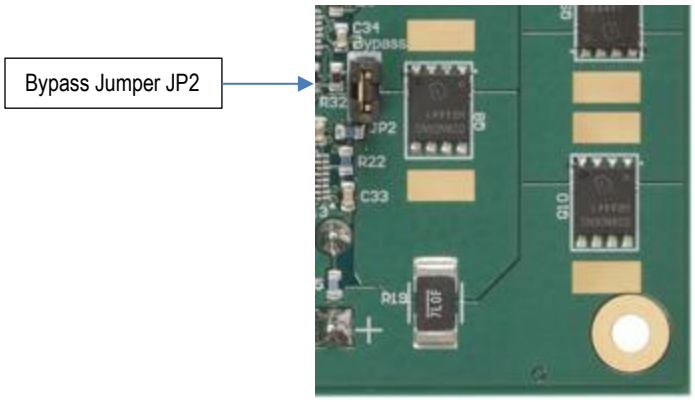


Figure 14: CAP10100HR JP2 Location

3.6.4 CAP10100HR TEST HEADER CN1

The CN1 connector is a 0.1", 10 pin DIL connector used by manufacturing to test the CAP10100HR. The customer may only use pins 2 and 10. All other pins are not for customer use. Pins 2 and ten are only intended for a safe discharge (see the section "Safe Discharge of Capacitors" for more information).

Table 8: CN1 TEST Connector

CN1 Pin	Signal	Function	IDAN®
1	V_Cb	Manufacture Test Point	N/C
2	Vcaps	Manufacture Test Point	N/C
3	V_Cc	Manufacture Test Point	N/C
4	FLT_CHRG	Manufacture Test Point	N/C
5	FLT_DIS	Manufacture Test Point	N/C
6	V_Cd	Manufacture Test Point	N/C
7	V_Ce	Manufacture Test Point	N/C
8	V5	Manufacture Test Point	N/C
9	V_Cf	Manufacture Test Point	N/C
10	GND	Manufacture Test Point	N/C

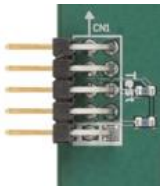


Figure 15: CAP10100HR Test Header CN1

3.6.5 CAP10100HR SOLDER JUMPERS B3, B4, B5, AND B6

B3, B4, B5, and B6 are for connecting CAP10100HR GND to frame GND. These solder jumpers are located on the bottom of the board near the mounting holes. This feature is used when required by the customer. Default condition of all solder jumpers is open. Any one solder jumper, when shorted, will connect the frame to GND.

3.6.6 CAP10100HR POWER INDICATOR LED

The Power LED is located on top of the CAP10100HR near theTB2 Vin connector. The power LED is set to have full illumination when the capacitors are charged to 13.8V and will dim as the capacitors are discharged. The purpose of this LED is to alert the user that there is energy on the capacitors. When the Power LED is dark there can still be about 40 Joules of energy remaining on the capacitors. The LED goes dark at about 1.5V of capacitor charge.

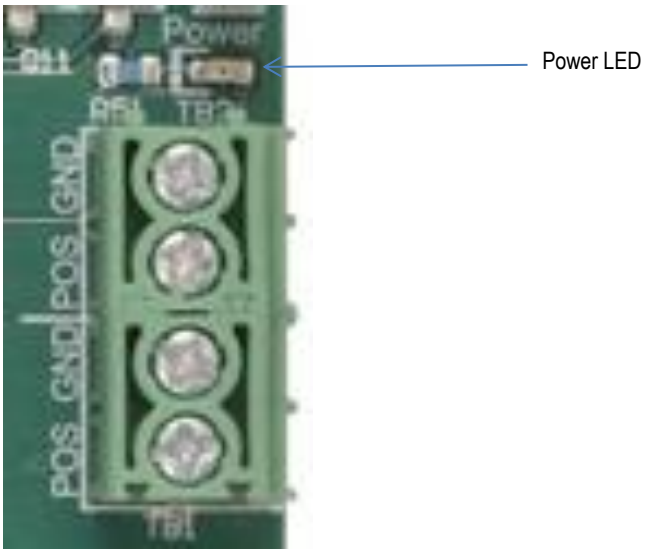


Figure 16: CAP10100HR Power LED Location

3.7 UPSxx110HR

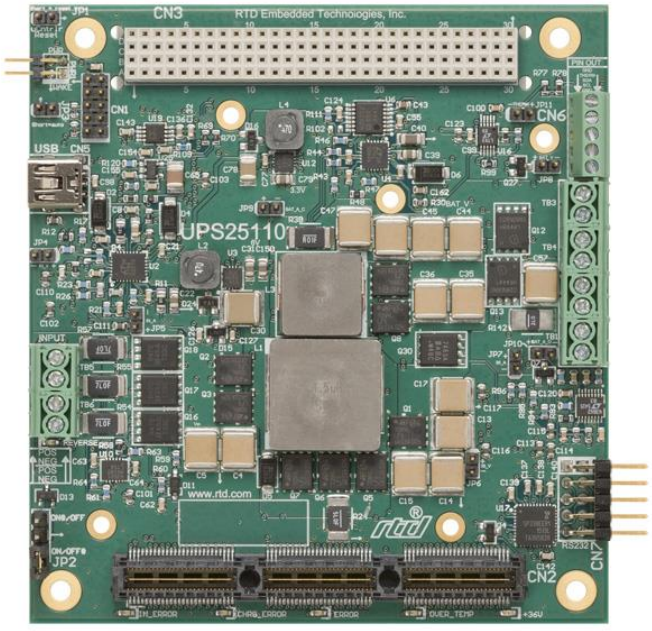


Figure 17: UPSxx110HR top view (UPS25110HR shown)

3.8 UPSxx110HR Product Overview

The UPS10110HR / UPS25110HR / UPS35110HR is designed to provide control for charging energy storage media and backing up a target unit.

3.9 UPSxx110HR Block Diagram

The Figure below shows the functional block diagram of the UPS25110HR / UPS35110HR. The various parts of the block diagram are discussed in the following sections.

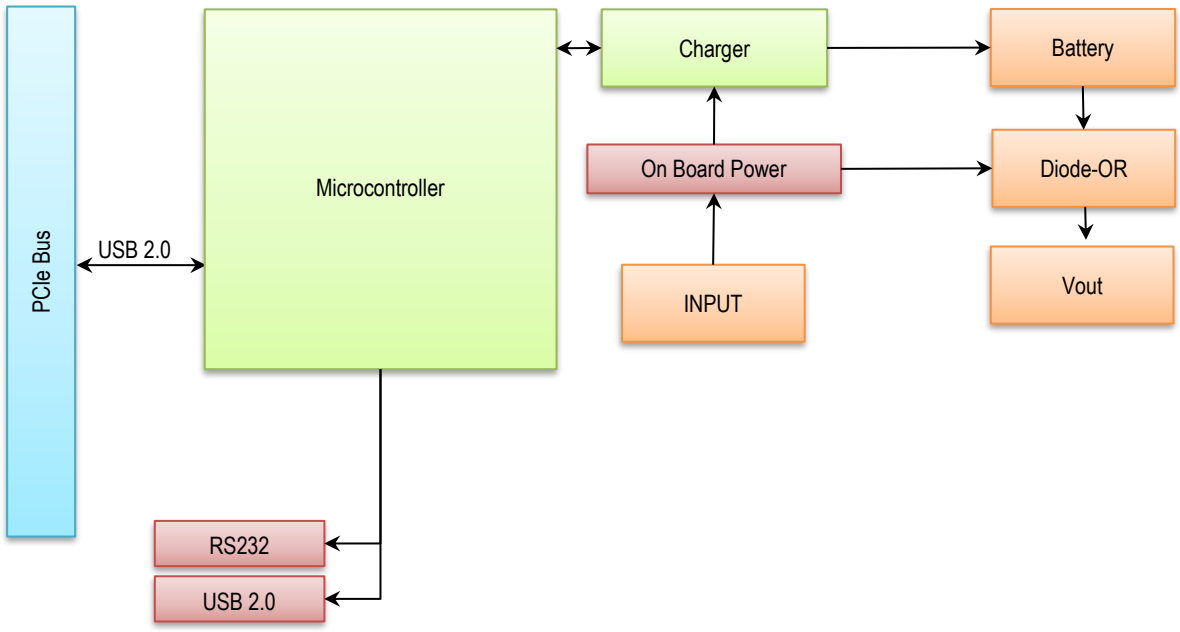


Figure 18: UPS25110HR / UPS35110HR Block Diagram

Note: The UPS10110HR has no PCIe bus connector.

3.10 UPSxx110HR Board Features

- USB 2.0 and RS232 Interfaces
- -40 to 85C operation
- Various power off modes
- Thermistor input
- Status LEDs
- 8V to 33V input range
- 8V to 31V charging voltage
- 8V to 33V output voltage to system
- Up to 4 Amps of charging current
- Up to 136 Watts available power for charging or system power

3.11 UPSxx110HR Physical Characteristics

A STEP model is available upon request; contact RTD Tech Support for more information.

- Weight: Approximately 0.14 Kg (0.30 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (4.570 in L x 3.775 in W)

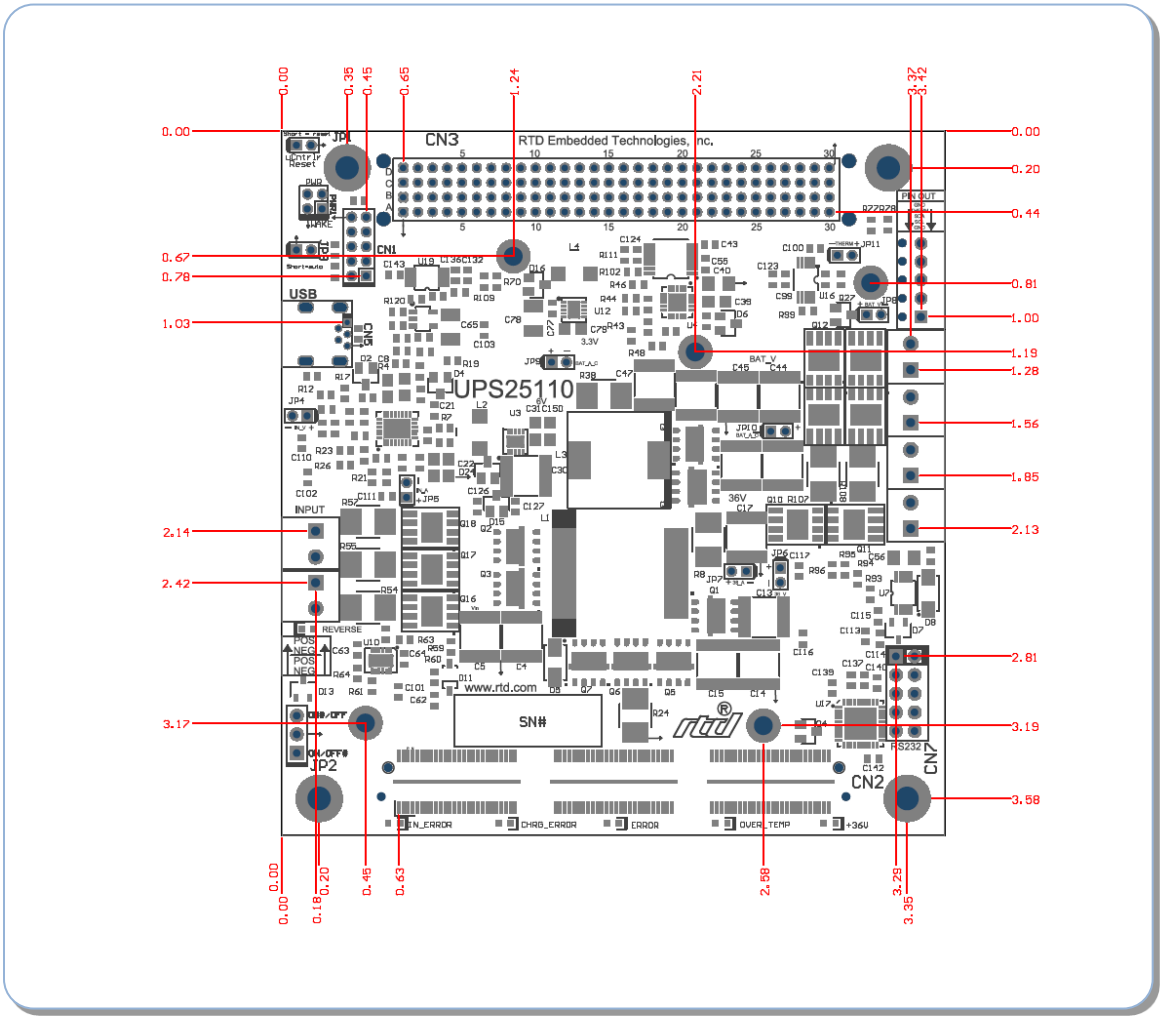


Figure 19: UPSxx110HR Board Dimensions in Inches

3.12 UPSxx110HR Connections and Jumpers

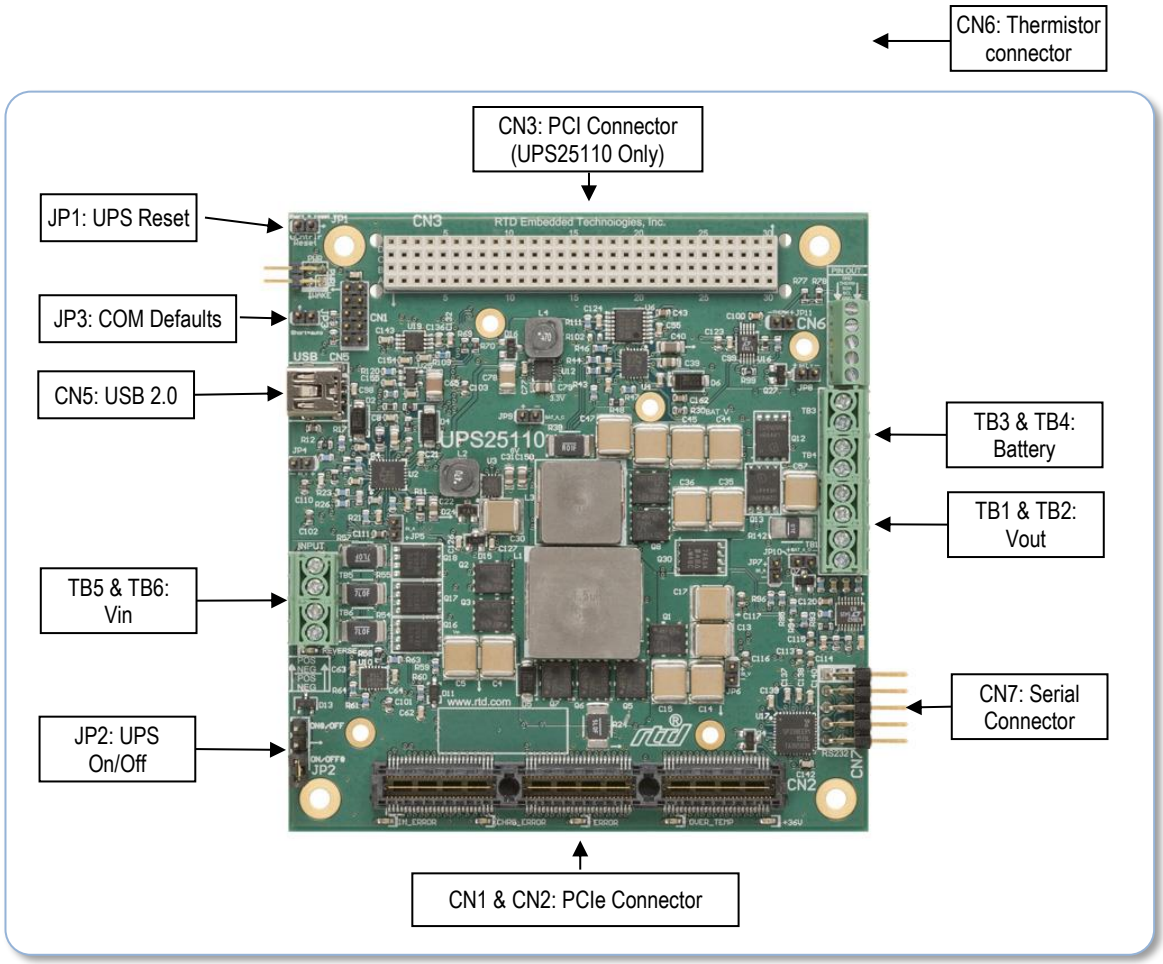


Figure 20: UPSxx110HR Board Connections and Jumpers (UPS25110HR shown)

3.12.1 UPSxx110HR Bus Connectors

CN2 (Top) & CN4 (Bottom): PCIe Connector

The PCIe connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications Version 3.0). This product runs off the USB port in the connector. There is no PCIe link.

The UPSx5110HR is a "Universal" board, and can connect to either a Type 1 or Type 2 PCIe/104 connector.

CN3: PCI Connector

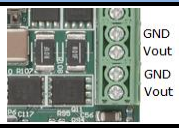
The PCI connector is the connection to PCI peripheral modules. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications in Section 6). On this board, this connector is pass-through only.

3.12.2 UPSXX110HR EXTERNAL CONNECTORS

TB1 and TB2: Output Power Terminal Block (Vout)

TB1 and TB2 are the Vout connectors. These connectors are intended to connect to a power supply such as the ATX3510HR-190W. Each pin can handle 17.5 amps, so if one requires less current, one connection is sufficient. This connector is a Phoenix Contact 1984617. Both grounds are connected and both Vout pins are connected. The pin names are labeled on the bottom of the board for ease of use.

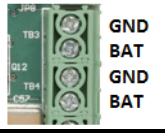
Table 9: TB1 and TB2 UPS Output Connector

Connector	Pin #	Pin Name	
TB1	2	GND	
TB1	1	Vout	
TB2	2	GND	
TB2	1	Vout	

TB3 and TB4: Backup Power Terminal Block (Battery)

TB3 and TB4 are the Battery Connectors. These connectors are intended to connect to an external energy storage media. Each pin can handle 17.5 amps, so if one requires less current, one connection is sufficient. This connector is a Phoenix Contact 1984617. Both grounds are connected and both Battery pins are connected. This connector is not intended to charge two separate batteries (i.e. one at 12V with 1Amp and another at 16V with 3 amps). One could place Supercapacitors on one and a battery on the other as long as both are used within specification. Only one current and voltage will be present. The pin names are labeled on the bottom of the board for ease of use.

Table 10: TB3 and TB4 UPS Battery Connector

Connector	Pin #	Pin Name	
TB3	2	GND	
TB3	1	BAT	
TB4	2	GND	
TB4	1	BAT	

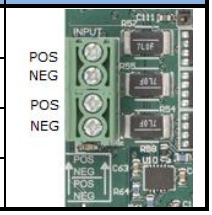
TB5 and TB6: Input Power Terminal Block (Vin)

Make the connection from here to supply power to the stack from an external power source.

Each pin of the input connector can handle 17.5 amps. The connector model is a Phoenix Contact 1984617.

Both NEG pins are connected and both POS pins are connected. The pin names are labeled on the bottom of the board for ease of use. The NEG pins do not share a common ground with the rest of the board.

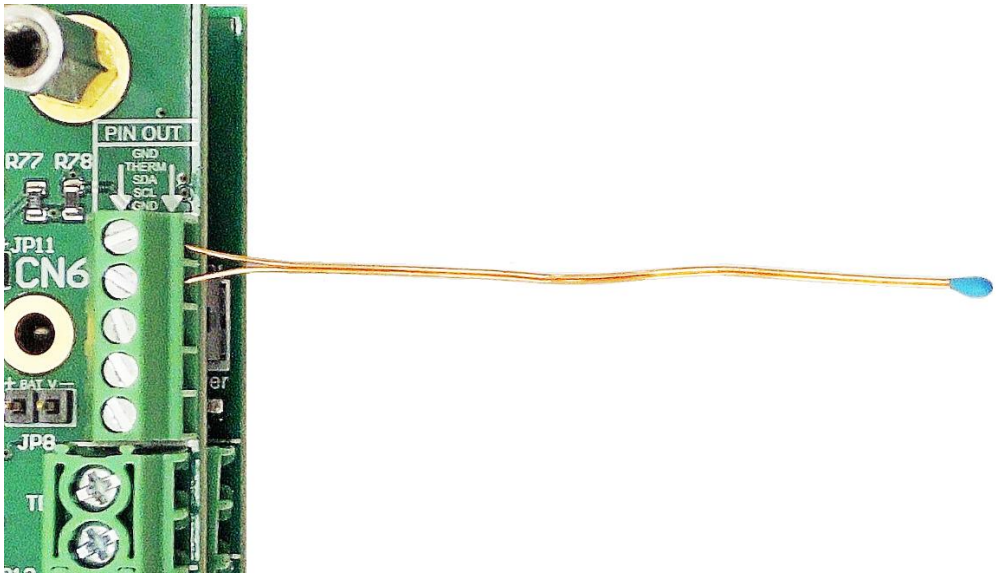
Table 11: TB5 and TB6 UPS Input Connector

Connector	Pin #	Pin Name	
TB5	1	POS	
TB5	2	NEG	
TB6	1	POS	
TB6	2	NEG	

UPSxx110HR CN5: USB 2.0 Connector

CN5 is the external USB connector. This connector is a type B, right angle, mini USB connector. The communication through this port is USB 2.0 Full speed, running at 12 Mbit/sec. Connecting to this port overrides the USB connection available through the PCI Express connector.

Figure 21: UPSxx110HR CN5 USB 2.0 Connector



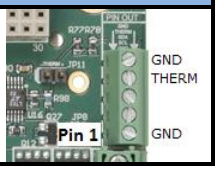
UPSxx110HR CN6: Thermistor Connector

The UPS provides temperature readings from built-in sensors on the top and bottom of the UPS board. CN6 allows the optional use of a thermistor to monitor temperatures elsewhere in the UPS system.

The supported thermistor is the Murata NTC, part number NXFT15WF104.

Temperature information from the thermistor is available over the serial port only.

Table 12: UPSxx110HR CN6 Battery Communication Pinout

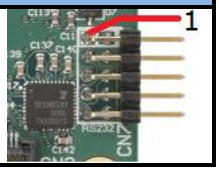
Pin #	Pin Name	
5	GND	
4	THERM	
3	Reserved	
2	Reserved	
1	GND	

UPSxx110HR CN7: Serial I/O Connector

CN7 provides an RS-232 serial interface for communicating with the UPS for status information and feature control. For more information, see Section 4 Serial Communication.

Figure 22: UPSxx110HR Thermistor Connection at CN6

Table 13: UPSxx110HR CN7 Serial Port Connector Pinout

Pin Name	Pin #	Pin #	Pin Name	
NC	1	2	NC	
TxD	3	4	CTS	
RxD	5	6	RTS	
NC	7	8	NC	
GND	9	10	GND	

3.12.3 UPSxx110HR JUMPERS

UPSxx110HR JP1: UPS Reset Jumper

Figure 23: UPSxx110HR JP1 reset jumper

This jumper allows for resetting the UPS through momentary contact. While JP1 is shorted, the UPS will be held in reset. The output power at Vout will be cutoff and the backup power source will not be charging. When JP1 is opened, the UPS will boot up and begin normal operation.

The user should not normally need to reset the UPS. The most common use of this feature is in conjunction with the serial command to change serial COM port settings.

UPSxx110HR JP2: UPS On/Off Jumper

The JP2 jumper can be used to turn the UPS on or off remotely. The jumper can be connected to an externally wired switch or a remote voltage source to control this function.

Table 14: UPSxx110HR JP2 On/Off Settings

Connector	Pin #	Low (<1.5V)	High (1.5V to 5V)
JP2	1 - 2	UPS Off	UPS On
	2 - 3	UPS On	UPS Off
	Pin #	**Short**	**Open**
	1 - 2	UPS Off	UPS On
	2 - 3	UPS On	UPS On

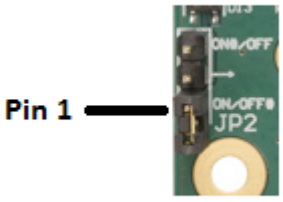


Figure 24: UPSxx110HR JP2 On/Off Jumper Location

UPSxx110HR JP3: Serial Port Default Settings Jumper

If JP3 is shorted when the UPS is reset, then it will use the factory default COM port settings of:

Baud: 115200
Data Size: 8
Parity: None
Stop Bits: 1

This allows the user to recover communication with the UPS if the baud rate or port settings are changed through the UCP serial command.

Note that the use of JP3 does not change the stored COM port settings. When JP3 is removed, the UPS will again use the COM port settings stored in its memory upon next reset. If the settings have become invalid, the user will need to change them with the UPC serial command prior to removing JP3.

Figure 25: UPSxx110HR JP3 COM Defaults Jumper

UPSxx110HR JP4 through JP11: Factory Use Only

Do not use or short any of these jumpers because damage could occur to the board.

NOTE: A Board failure caused by using these jumpers is not covered by the warranty.

UPSxx110HR B1 through B4: Ground Connection Solder Jumpers

The solder jumpers are for connecting system GND to frame GND. These solder jumpers are located on the bottom of the boards near the mounting holes. This feature is used when required by the customer. The default condition of all solder jumpers is open. Any one solder jumper, when shorted, will connect the frame to system GND.

3.12.4 UPSXX110HR LED INDICATIONS

Figure 26: UPSxx110HR LED Locations

The board has 5 LEDs that can be used for status information.

LED0: Factory Use Only

LED1: Charging LED (red).

This LED will be on when the UPS is providing power to charge the backup supply.

LED2: Discharging LED (red).

This LED will flash at a 1Hz rate when the UPS is providing backup power through Vout.

The duty cycle of the flashing corresponds to the percent remaining backup charge. In other words, if the LED remains lit through most of the 1 second time, then most of the charge in the backup source remains. If the LED spends the same time on as it does off, then the backup source is at approximately 50% remaining charge.

LED3: Heartbeat LED (red). This LED will flash continuously at a .5 Hz rate to indicate that the UPS is turned on and operating normally.

LED4: Input Power Present (green).

This LED will be on when input power is detected and is being used to provide load power and charging to the backup power supply.

When the UPS starts up, LED1 - LED3 will light up for 2 seconds to confirm operation.

4 System Connection

4.1 System Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment and use a grounded workbench for testing and handling of your hardware.

4.2 Physical Characteristics

A STEP model is available upon request; contact RTD Tech Support for more information.

- Weight: Approximately 552g (1.214 lbs.)
- System Dimensions: 90.17 mm L x 95.89 mm W x 75 mm H (3.55 in L x 3.775 in W x 2.953 in H)
    - Dimensions include both UPSxx110 and CAP10100 boards.

4.3 Safety Concerns (Important)

WARNING

CAUTION

The UPS35210HR contains significant energy and has the potential to injure the user if not handled properly. The capacitors should be in a discharged state and the system power disconnected during installation. The UPS35210HR is shipped discharged.

WARNING

DANGER

Never touch any metal on the UPS35210HR without insulating gloves. High current flow can cause burns. Use caution with metal tools and the UPS35210HR. Take care when removing screws from any frame near the UPS35210HR. The capacitors should be fully discharged before manipulating the board. See the "Safe Discharge of Capacitors" section for proper discharge.

4.3.1 Safe Discharge of Capacitors

The UPS35210 / UPS25210 / UPS10210 is designed to operate as a single unit, despite being two separate boards. Once stacked and connected via wire, it is not recommended that you separate the boards. If the capacitor module must be disconnected from the UPS board, it is mandatory that the module first be fully discharged to guarantee safety.

- **Do not** operate the UPS35210 / UPS25210 / UPS10210 outside the rated voltage.
- **Do not** operate the UPS35210 / UPS25210 / UPS10210 outside the rated temperature range.
- **Do not** touch the terminals with conductors while charged. Serious burns, shock, or arching may occur.

- Protect surrounding electrical components from accidental contact.
- Always physically disconnect UPS INPUT from input power.

WARNING

DANGER

A discharged CAP10100HR's voltage may rise after some time. ***NEVER*** assume the capacitors are fully discharged before handling.

Attach a resistor between GND (pin 10) and VCAPS (pin 2) of the CN1 connector of the CAP10100 board. This resistor should be able to deal with at least 20 Watts. A good example would be a Vishay RH05014R20FC02, 14.2 Ohms, and 50 Watts (not included). This load will discharge a fully charged CAP10100HR at 13.8V down to 0V in about 1 hour. Select a resistance value to produce a current no greater than 1.0 Amps.

Caution: the resistor will get very hot (about 13 Watts of dissipation at first).

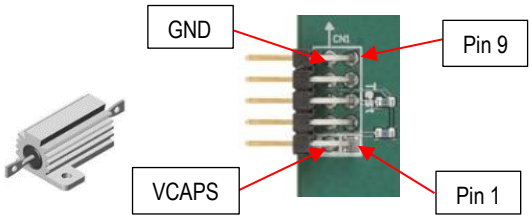


Figure 27: CAP10100HR CN1 Monitor connector and discharge resistor (not included)

Table 15: CAP10100HR CN1 Pin out

CN1 Pin	Signal	Function
1	V_Cb	Manufacture Test Point
2	Vcaps	1 Amp Discharge Pin
3	V_Cc	Manufacture Test Point
4	FLT_CHRG	Manufacture Test Point
5	FLT_DIS	Manufacture Test Point
6	V_Cd	Manufacture Test Point
7	V_Ce	Manufacture Test Point
8	V5	Manufacture Test Point
9	V_Cf	Manufacture Test Point
10	GND	1 Amp Discharge Pin

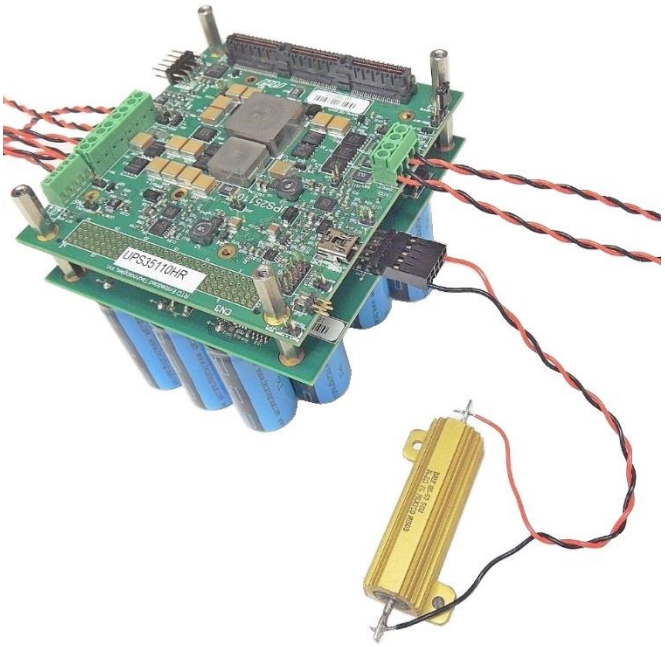


Figure 28: System with discharge resistor Attached

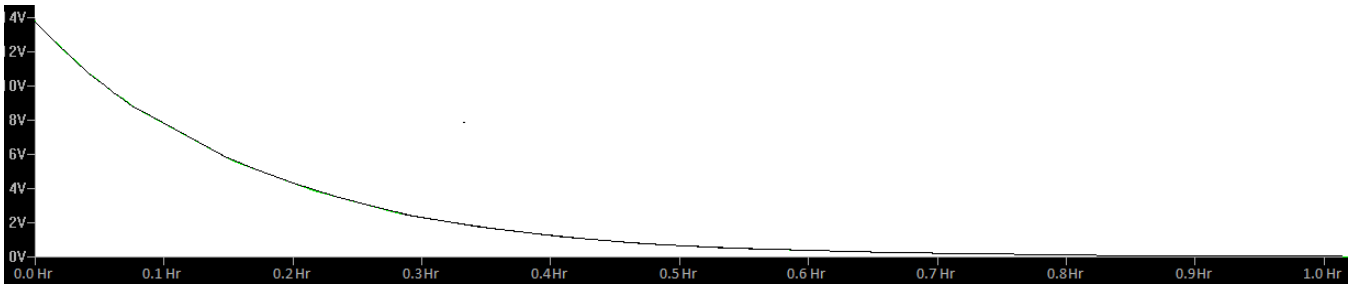


Figure 29: Discharge profile with 14.2 Ohm resistor from 13.8V to Zero V in 1 hour

You may use an electronic load, set to 1.0 Amps, to do the same job in about 8 minutes. CN1 pins are rated at 1.0 Amps. Do not exceed 1.0 Amps

Before disconnecting the wire to the CAP10100HR Vin connector, verify that the LED Energy indicator LED is dark.

Caution: The LED goes dark when the capacitors are about 1.5V

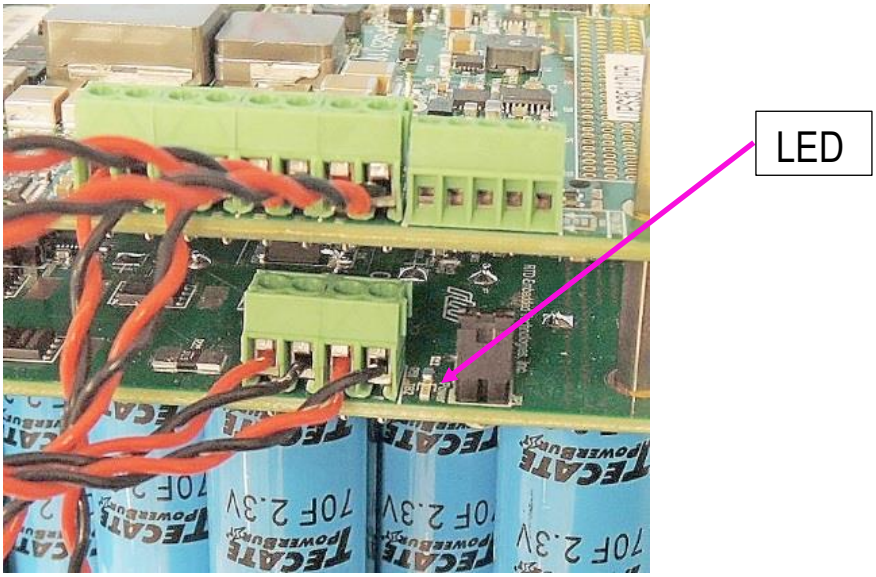


Figure 30: Energy indicator LED

WARNING

DANGER

A discharged UPS35210HR's voltage may rise after some time. ***NEVER*** assume the capacitors are fully discharged before handling.

4.3.2 Bus Connectors

See the section for the UPSxx110HR Bus Connectors

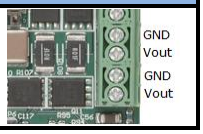
4.4 External Connectors

4.4.1 TB1 and TB2: Output Power Terminal Block (VOUT)

This is the connection from the UPS to the load being provided uninterrupted power. In most cases, this connection will be made to the input power connection of a PC/104 power supply board.

Be sure to use wire of sufficient size to handle the expected current.

Table 16: TB1 and TB2 UPS Output Connector

Connector	Pin #	Pin Name	
TB1	2	GND	
TB1	1	Vout	
TB2	2	GND	
TB2	1	Vout	

4.4.2 TB3 AND TB4: BACKUP POWER TERMINAL BLOCK (BATTERY)

Make the connection from here to the corresponding connections on the Supercapacitor board. When stacked as shown below, the connections will align vertically.

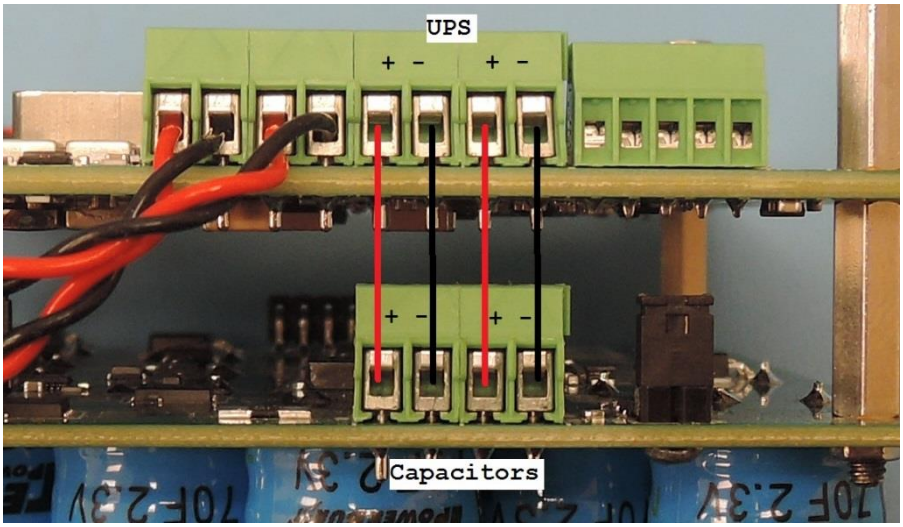
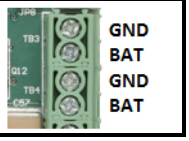


Figure 31: Capacitor connection locations Relative to the UPS battery output.

Table 17: TB3 and TB4 UPS Battery Connector

Connector	Pin #	Pin Name	
TB3	2	GND	
TB3	1	BAT	
TB4	2	GND	
TB4	1	BAT	

Proper capacitor connection connects wires from the UPSxx110HR BAT pin to the CAP10100HR POS pin. The ground is connected from the UPSxx110HR GND pin to the CAP10100HR NEG pin. The wires pictured are separate, but they should be twisted and kept as short as possible to reduce wire inductance and wire resistance.

Because there is no bus connection between the capacitor board and the UPS board, they do not have to be on top of each other. They can be placed side by side or in separate locations. Ensure that the wire connecting the UPS board to the CAP board is sufficiently sized if there is significant distance between them.

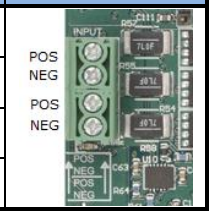
4.4.3 TB5 AND TB6: INPUT POWER TERMINAL BLOCK (VIN)

Make the connection from here to supply power to the stack from an external power source.

Each pin of the input connector can handle 17.5 amps. The connector model is a Phoenix Contact 1984617.

Both NEG pins are connected together and both POS pins are connected together. The double connectors are to allow more current to flow. The pin names are labeled on the bottom of the board for ease of use. The NEG pins do not share a common ground with the rest of the board.

Table 18: TB5 and TB6 UPS Input Connector

Connector	Pin #	Pin Name	
TB5	1	POS	
TB5	2	NEG	
TB6	1	POS	
TB6	2	NEG	

4.4.4 CN5: USB 2.0 CONNECTOR

CN5 is the external USB connector. This connector is a type B, right angle, mini USB connector. The communication through this port is USB 2.0 Full speed, running at 12 Mbit/sec. Connecting to this port overrides the USB connection available through the PCI Express connector.

Figure 32: CN5 USB 2.0 Connector

4.4.5 CN6: THERMISTOR CONNECTOR

The UPS provides temperature readings from built-in sensors on the top and bottom of the UPS board. CN6 allows the optional use of a thermistor to monitor temperatures elsewhere in the UPS system.

The supported thermistor is the Murata NTC, part number NXFT15WF104.

Temperature information from the thermistor is available over the serial port only.

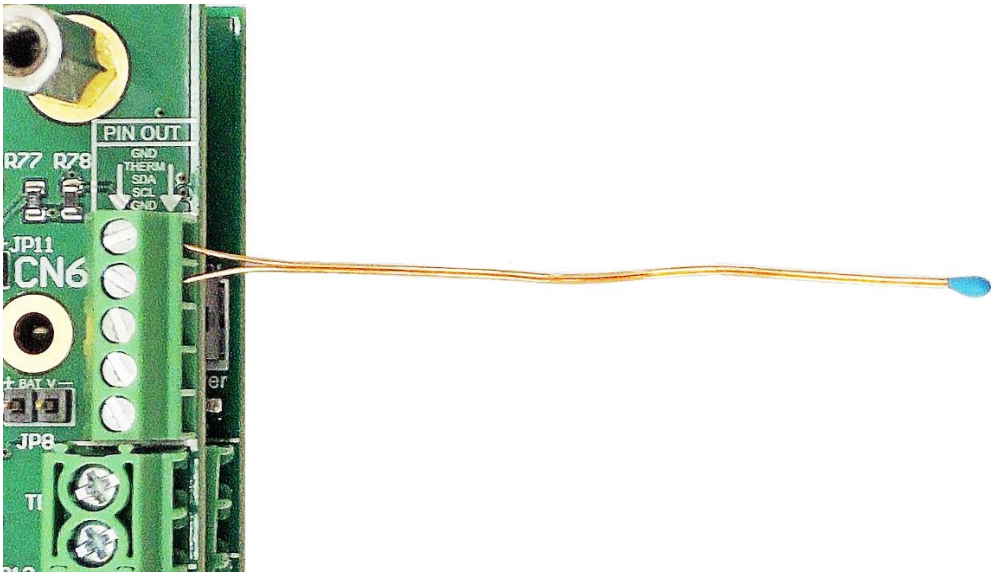
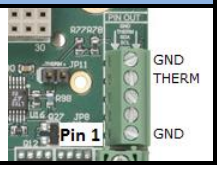


Figure 33: Thermistor Connection at CN6

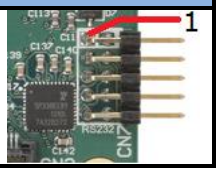
Table 19: CN6 UPS Battery Communication Pinout

Pin #	Pin Name	
5	GND	
4	THERM	
3	Reserved	
2	Reserved	
1	GND	

4.4.6 CN7: SERIAL I/O CONNECTOR

CN7 provides an RS-232 serial interface for communicating with the UPS for status information and feature control. For more information, see Section 5 Serial Communication.

Table 20: CN7 Serial Port Connector Pinout

Pin Name	Pin #	Pin #	Pin Name	
NC	1	2	NC	
TxD	3	4	CTS	
RxD	5	6	RTS	
NC	7	8	NC	
GND	9	10	GND	

4.5 Jumpers

JP1: UPS Reset Jumper

Figure 34: JP1 UPS reset jumper

This jumper allows for resetting the UPS. While JP1 is shorted, the UPS will be held in reset. The output power at Vout will be cutoff and the backup power source will not be charging. When JP1 is opened, the UPS will boot up and begin normal operation.

The user should not normally need to reset the UPS. The most common use of this feature is in conjunction with the serial command to change serial COM port settings.

4.5.1 JP2: UPS ON/OFF JUMPER

The JP2 jumper can be used to turn the UPS on or off remotely. The jumper can be connected to an externally wired switch or a remote voltage source to control this function.

Table 21: JP2 UPS On/Off Settings

Connector	Pin #	Low (<1.5V)	High (1.5V to 5V)
JP2	1 - 2	UPS Off	UPS On
	2 - 3	UPS On	UPS Off
	Pin #	**Short**	**Open**
	1 - 2	UPS Off	UPS On
	2 - 3	UPS On	UPS On

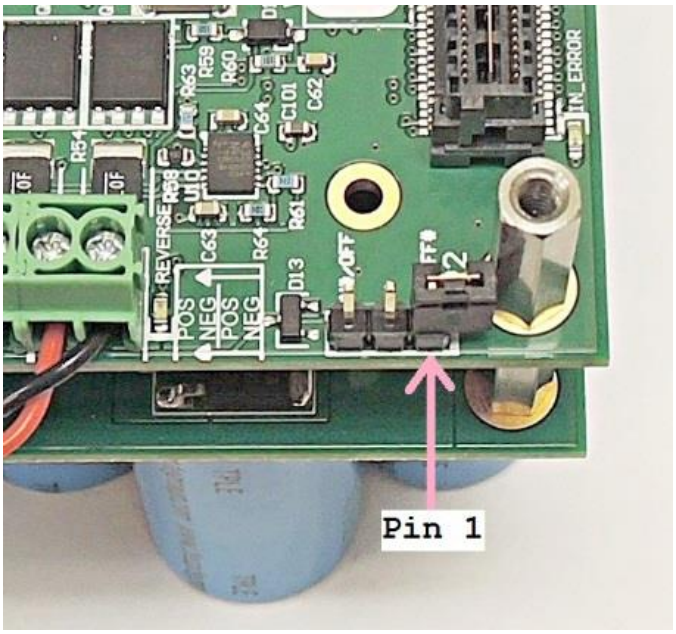


Figure 35: JP2 UPS On/Off Jumper Location

4.5.2 JP3: Serial Port Default Settings Jumper

If JP3 is shorted when the UPS is reset, then it will use the factory default COM port settings of:

Baud: 115200
Data Size: 8
Parity: None
Stop Bits: 1

This allows the user to recover communication with the UPS if the baud rate or port settings are changed through the UCP serial command.

Note that the use of JP3 does not change the stored COM port settings. When JP3 is removed, the UPS will again use the COM port settings stored in its memory upon next reset. If the settings have become invalid, the user will need to change them with the UPC serial command prior to removing JP3.

4.5.3 JP4 through JP11: Factory Use Only

Do not use or short any of these jumpers because damage could occur to the board.

NOTE: A Board failure caused by using these jumpers is not covered by the warranty.

4.5.4 B1 through B4: Ground Connection Solder Jumpers

The solder jumpers are for connecting system GND to frame GND. These solder jumpers are located on the bottom of the boards near the mounting holes. This feature is used when required by the customer. The default condition of all solder jumpers is open. Any one solder jumper, when shorted, will connect the frame to system GND.

The CAP10100 board contains similar jumpers at B3 through B6.

4.6 LED Indications

Figure 36: LED Locations

The board has 5 LEDs that can be used for status information.

LED0: Factory Use Only

LED1: Charging LED (red).

This LED will be on when the UPS is providing power to charge the backup supply.

LED2: Discharging LED (red).

This LED will flash at a 1Hz rate when the UPS is providing backup power through Vout.

The duty cycle of the flashing corresponds to the percent remaining backup charge. In other words, if the LED remains lit through most of the 1 second time, then most of the charge in the backup source remains. If the LED spends the same time on as it does off, then the backup source is at approximately 50% remaining charge.

LED3: Heartbeat LED (red). This LED will flash continuously at a .5 Hz rate to indicate that the UPS is operating normally.

LED4: Input Power Present (green).

This LED will be on when input power is detected and is being used to provide load power and backup charging.

When the UPS starts up, LED1 - LED3 will light up for 2 seconds to confirm operation.

4.7 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Verify that there is a shunt in the Vin connector TB1
6. Verify the Power LED on the CAP10100 is dark to indicate no energy is present
7. Any wires into or out of the board should be twisted to reduce inductance.
8. Wires are to be kept as short as possible to reduce unnecessary voltage drops.
9. Remove the shunt from TB1 Vin connector
10. Connect the UPSxx210HR to its charger.
11. Verify that the polarity of the connection is correct. Failure to do so may result in damage to the UPSxx210HR
12. Power wires should be able to carry at least 15 Amps of current.
13. If any boards are to be stacked above this module, install them.
14. Attach any necessary cables to the PC/104 stack.
15. Re-connect the power cord and apply power to the stack.

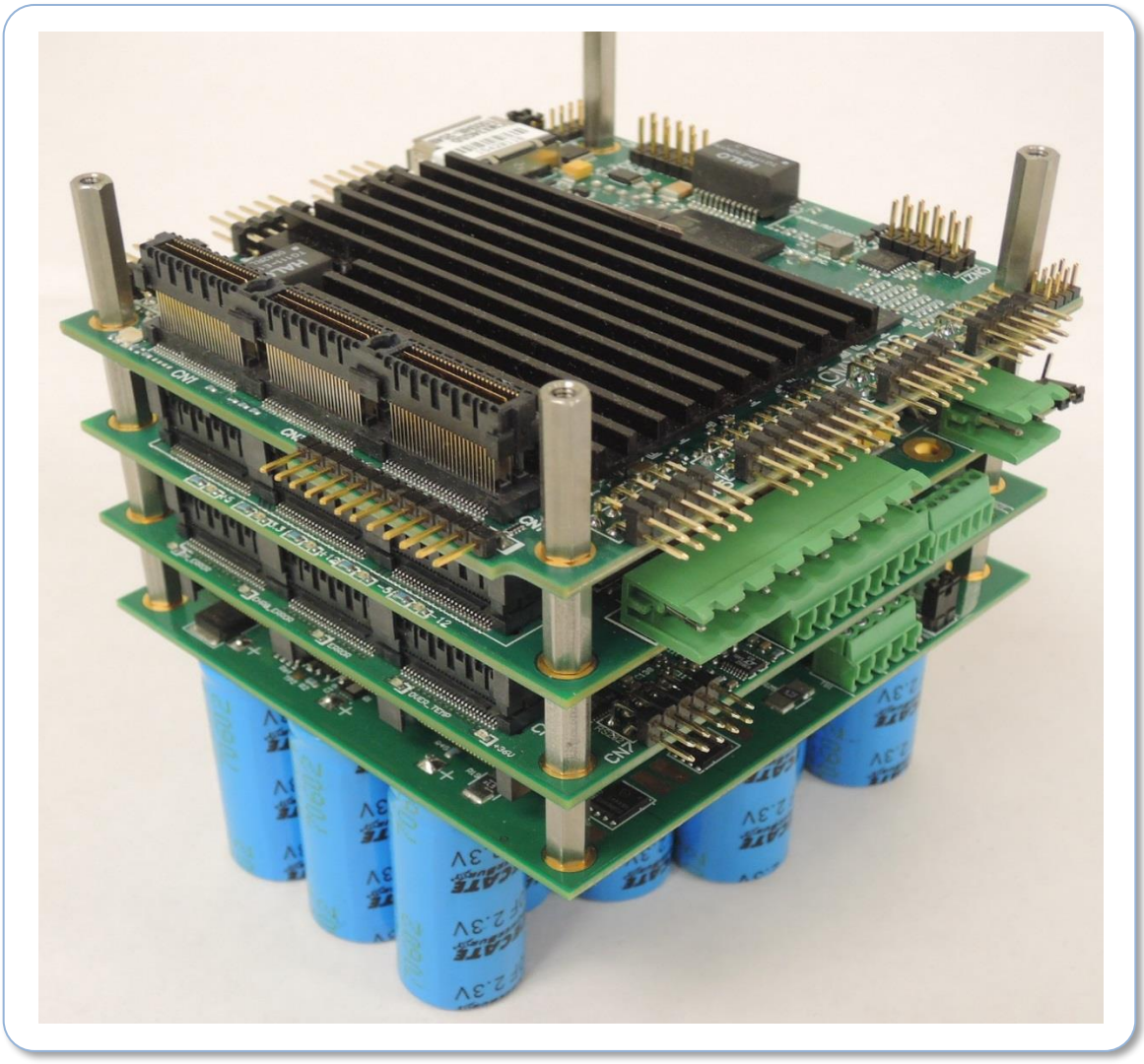


Figure 37: Example 104™ Stack With CAP10100HR and UPS25110HR

5 Serial Communication

A user can monitor and control the UPS through the serial connection at CN7, using any standard serial terminal program.

5.1 COM Port Settings

Communication with the UPS through the RS232 connection at CN7 is setup as follows:

Baud Rate: 115200
Data Size: 8
Parity: None
Stop Bits: 1
Flow Control: None

5.2 Serial Protocol

All serial commands have the following syntax: **!@CMD**[input]**?**

The command consists of one or more characters, followed by an input value (if required). Capitalization is not important.

Example: To display the backup voltage, enter the command: !@BV?
Example: To shut off the UPS load after 30 seconds: !@UXF30?

As a shortcut, you may enter just a '**?**' and the last successful command will be repeated. If no command has been successfully executed yet, then a NAK will result.

If a command results in a response with data, the output will include the original command and the response, separated by a colon:

CMD:RESPONSE

This allows the user to parse system responses independent of the last command sent.

All commands that have executed successfully will be followed by **OK**. Unknown or malformed commands respond with the unknown command and then **NAK**.

Note: Additional serial commands are available that provide more control of UPS features. Please contact RTD Tech Support if you feel the protocol listed below does not meet your requirements.

Command	Description
Help Commands	
H	Show help text. Includes description of all available serial commands.
Backup Information Commands	
BCH	Get backup charge, in percentage.
BCL	Get backup charge - Low, in percentage, at which the status of the UPS will change to Low Battery.
BCW	Get backup charge - Warning, in percentage, at which the status of the UPS will change to Shutdown Imminent.
BR	Get backup runtime estimate. This is the time, in seconds, that backup power can continue to be provided. This value can fluctuate greatly because it is based on the current load being powered. As such, it is not recommended to use this value when trying to determine a shutdown time.
BV	Get backup voltage, in volts.
Input Power Commands	
IC	Get input current, in amps.
IV	Get input voltage, in volts.
IXF[secs]	Disconnect UPS input power after specified time elapses, in seconds. The system will transition to providing backup power, assuming backup is available.
IXFX	Cancel scheduled disconnect of input power.
IXO[secs]	Connect UPS input power after specified time elapses, in seconds.
IXOX	Cancel scheduled connection of input power.
Output Power (Load) Commands	
OC	Get output current, in amps.

OV	Get output voltage, in volts.
OXF[secs]	Disconnect UPS output power after specified time elapses, in seconds. The system will no longer be supplying power to the load connected at Vout.
OXFX	Cancel scheduled disconnect of output power.
OXO[secs]	Connect UPS output power after specified time elapses, in seconds.
OXOX	Cancel scheduled connection of output power.
UPS Information and Control Commands	
UL	Get UPS load, as a percentage of rated design load.
UI	Get UPS information. This includes device name, manufacturer name, serial number, firmware version, etc.
UTT	Get the temperature on the top of the UPS board, in degrees Celsius.
UTB	Get the temperature on the bottom of the UPS board, in degrees Celsius.
UTH	Get the temperature from the optional thermistor attached at CN6, in degrees Celsius.
US	Get the UPS status. The status may consist of multiple codes, separated by spaces: OL = Online OB = On Backup LB = Low Backup level SI = Shutdown Imminent
UR	UPS Reset. Execute this command twice within 5 seconds to reboot the UPS. WARNING: This command will cause the UPS output (load) to be shut off immediately and remain off until UPS reboot is complete.
UCP	Get UPS COM port settings. The response will be in the form: BAUD,DATA_SIZE,PARITY,STOP_BITS Example: UCP:115200,8,N,1
UCP[baud,D,P,S]	Set UPS COM port settings. New settings will take effect on the next reset of the UPS. Valid settings are: **baud**: Any valid baud rate from 300 to 115200 **data size**: 8 or 9 **parity**: E, O, or N **stop bits**: 1 or 2 Example: UCP9600,8,O,1 Note: Some of the line-control options are mutually exclusive. When changing from the default values of 8,N,1, you may change data size or parity, but not both. COM port settings persist through resets. If communication is lost with the UPS because of incorrect or forgotten settings, communication can be recovered through use of the JP3 jumper.
UCEO	Enable local serial echo.
UCEF	Disable local serial echo.
UCVO	Enable more verbose output. Some commands will provide more information. Also, some information from the UPS will be sent asynchronously. For example, when on battery, the backup remaining (BR) data will be sent from the UPS over serial without being requested.
UCVF	Disable more verbose output. Commands will only respond with the requested data (if applicable) and "OK"

6 IDAN® Configurations

This section applies to the IDAN-UPS35210HR, IDAN-UPS35210HR, and IDAN-UPS35210HR.

6.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

6.2 Physical Characteristics

- Weight: Approximately 3.02 lbs. (1.37 Kg)

- Dimensions:
  - Length: 5.98 inches (152 mm)
  - Width: 5.12 inches (130 mm)
  - Height: 2.88 inches (73 mm)

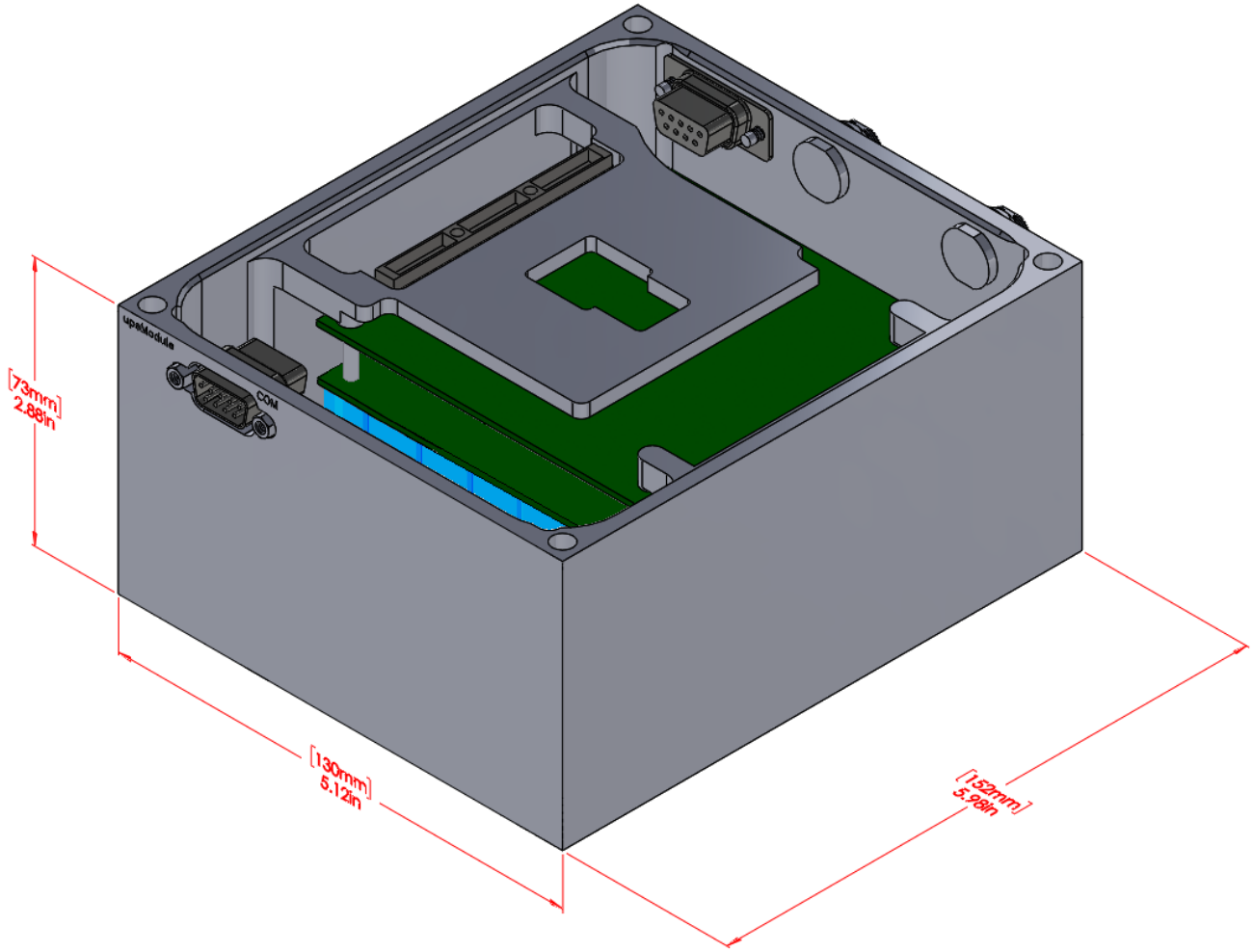


Figure 38: IDAN-UPSxx210HR Dimensions

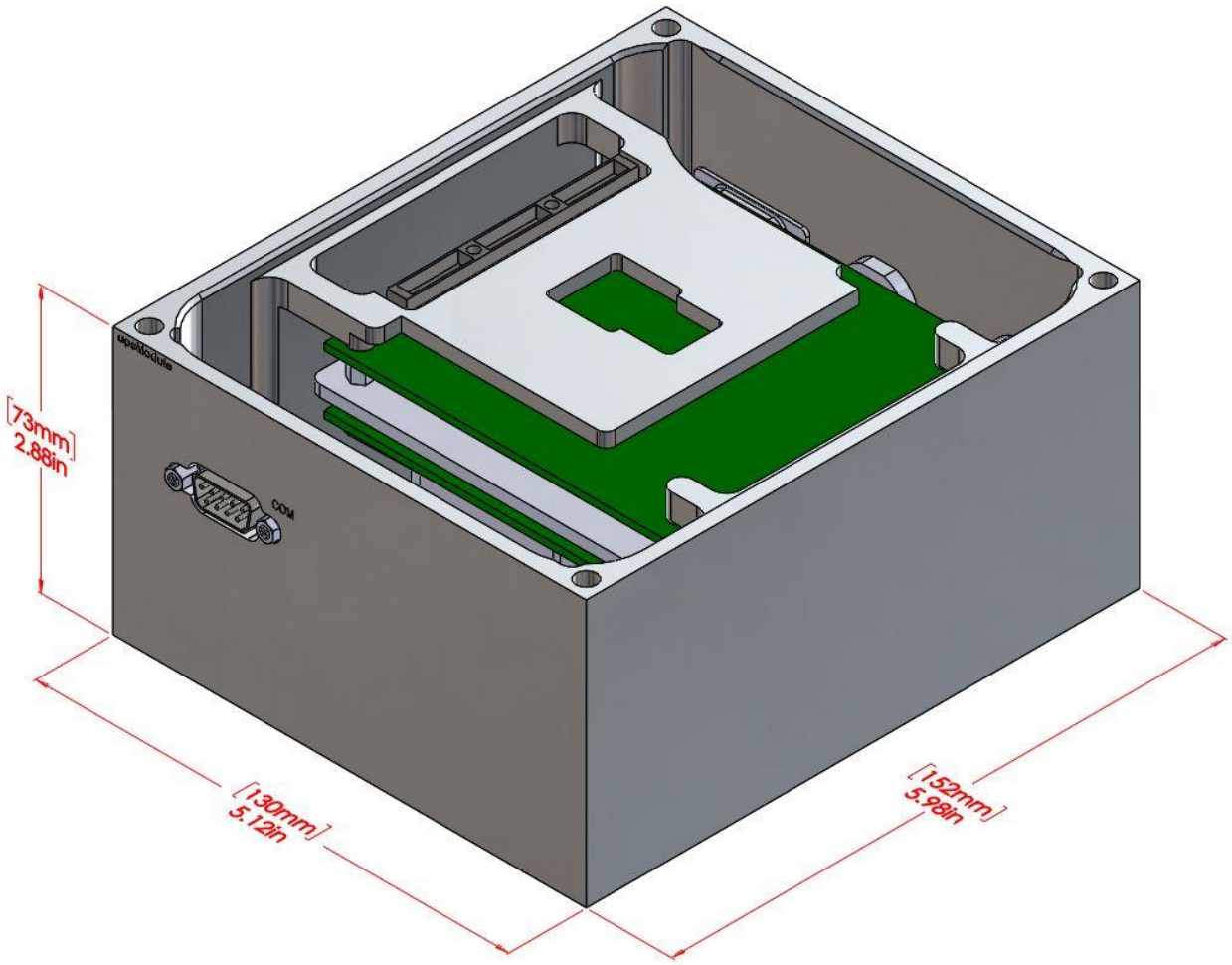


Figure 39: IDAN-UPSxx216HR Dimensions

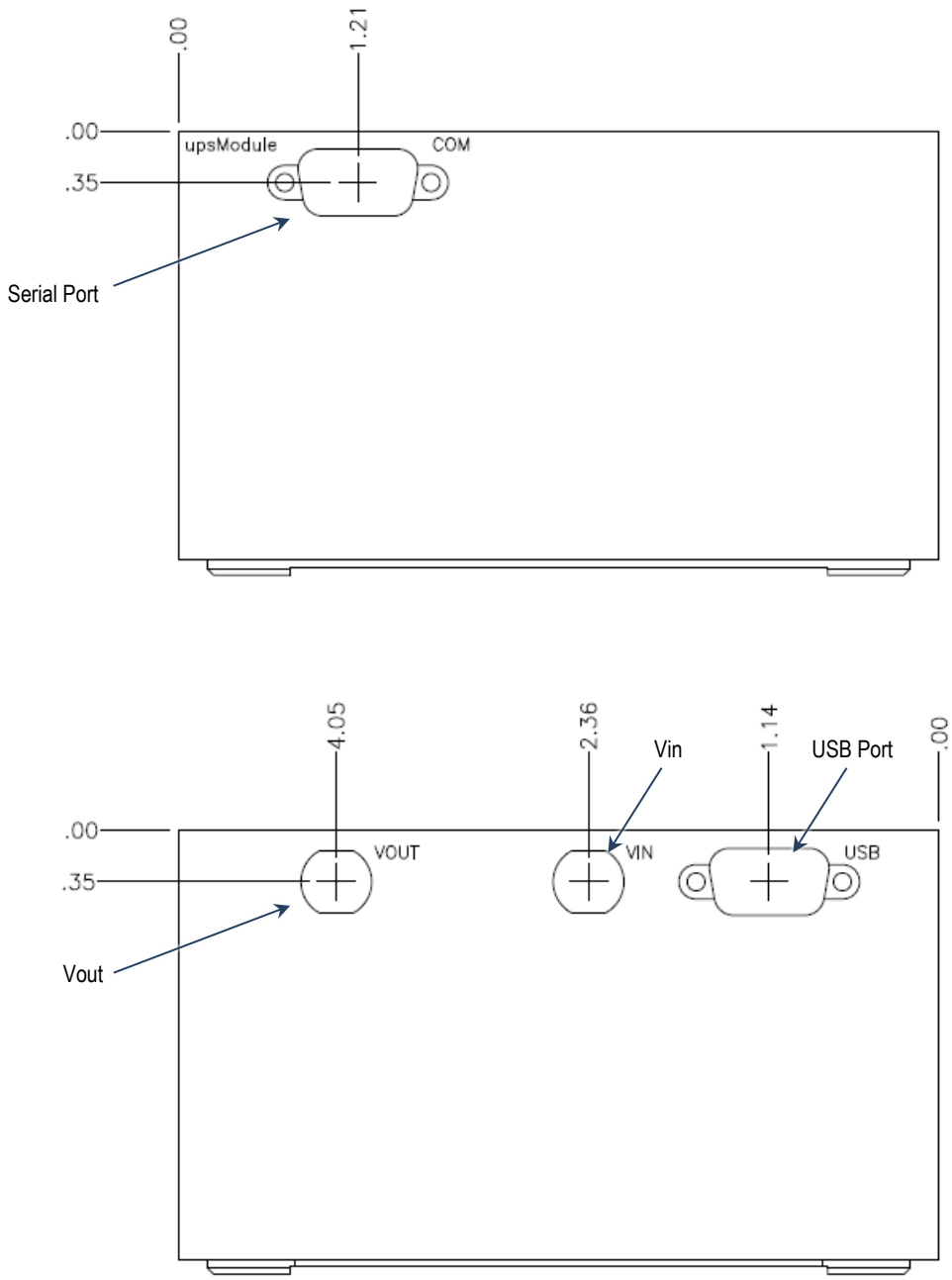


Figure 40: IDAN-UPSxx210HR Connector Locations (Front and Rear)

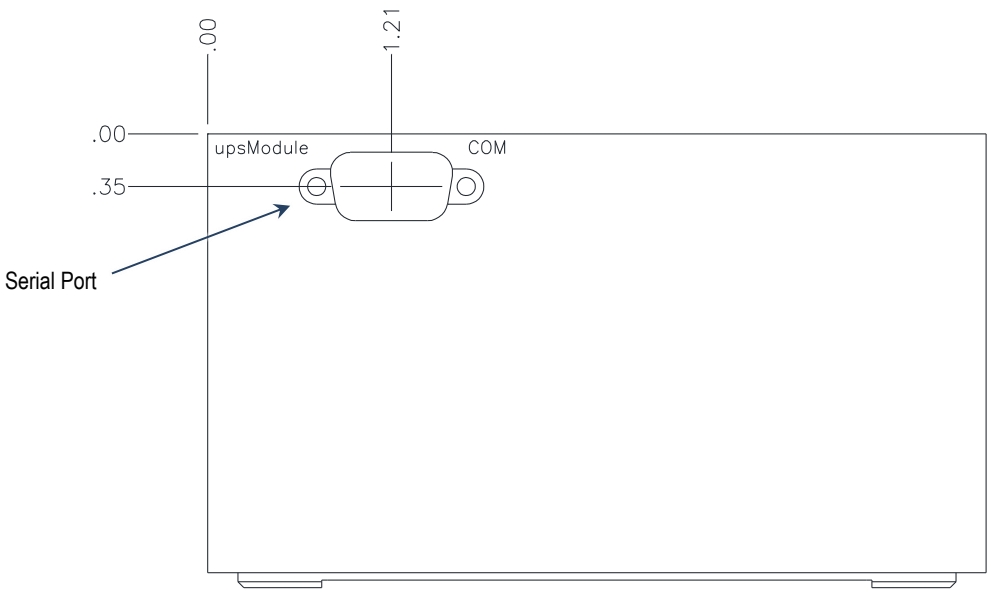


Figure 41: IDAN-UPSxx216HR Connector Locations (Front)

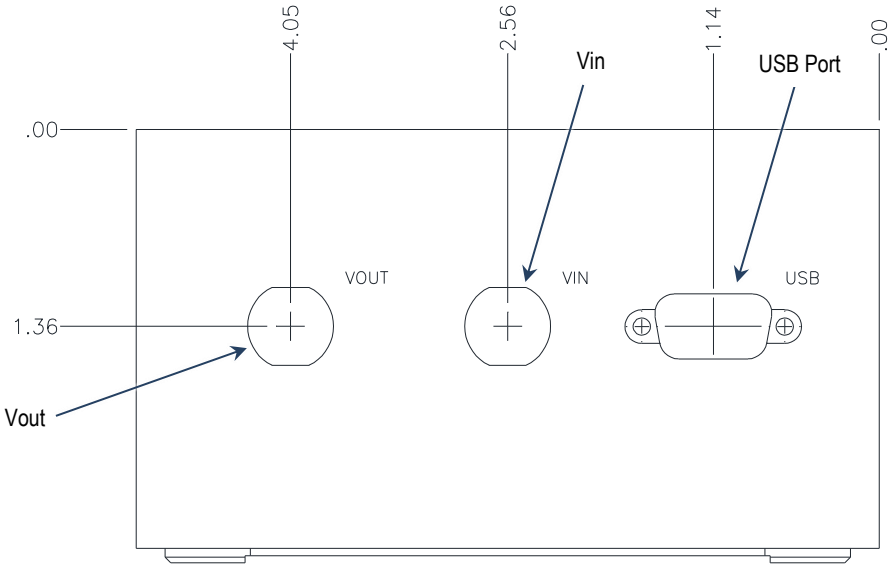


Figure 42: IDAN-UPSxx216HR Connector Locations (Rear)

6.3 Connectors

The table below shows the model numbers for the connectors on the IDAN-UPSxx210HR and IDAN-UPSxx216HR as well as corresponding mating connectors.

Table 22: IDAN Connectors and Mating Connectors

IDAN-UPSxx210HR	UPS25110 Connection	Panel Location	Connector	Mating Connector
Vin (2-pin)	TB5 & TB6	Rear	Souriau Connectors M/N: JBXEP1G02FSSDS	Souriau Connectors M/N: JBXFD1G02MSSDSMR
Vout (2-pin)	TB1 & TB2	Rear	Souriau Connectors M/N: JBXEA1J02FSSDS	Souriau Connectors M/N: JBXFD1J02MSSDSMR
Serial Port	CN7	Front	Valcon M/N: DF-9P-CN	Amphenol M/N: 1658610-4
USB Port	CN5	Rear	Norcomp M/N: 171-009-103L-021	Amphenol M/N: 1658610-4
IDAN-UPSxx210HR	**UPS25110 Connection**	**Panel Location**	**Connector**	**Mating Connector**
Vin (6-pin)	TB5 & TB6	Rear	Souriau Connectors M/N: JBXEP2G06FSSDS	Souriau Connectors M/N: JBXFD2G06MSSDSMR
Vout (4-pin)	TB1 & TB2	Rear	Souriau Connectors M/N: JBXEP2G04FSSDS	Souriau Connectors M/N: JBXFD1J02MSSDSMR
Serial Port	CN7	Front	Valcon M/N: DF-9P-CN	Amphenol M/N: 1658610-4
USB Port	CN5	Front	Norcomp M/N: 171-009-103L-021	Amphenol M/N: 1658610-4

6.3.1 External I/O Connectors

The serial port and USB port connectors on the IDAN-UPSxx210HR and IDAN-UPSxx216HR are DB9 male connectors, with pins.

Table 23: IDAN-UPSxx21xHR Serial Port Pinout

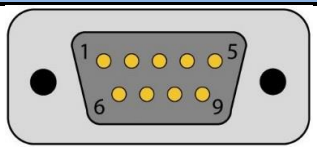
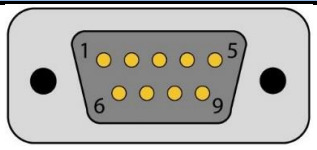
IDAN-UPSxx21xHR DB9 Male Serial Port					
					
Pin #	1	2	3	4	5
Pin Name	NC	TXD	RXD	NC	GND
Pin #	6	7	8	9	
Pin Name	NC	CTS	RTS	NC	

Table 24: IDAN-UPSxx21xHR USB Pinout

IDAN-UPSxx21xHR DB9 Male USB Port					
					
Pin #	1	2	3	4	5
Pin Name	VCC	USB+	USB-	GND	SHIELD
Pin #	6	7	8	9	
Pin Name	NC	NC	NC	NC	

The Vin and Vout connectors for the IDAN-UPSxx210HR are circular, two pin connectors. The Vin and Vout connectors are keyed differently, so there is no risk of incorrect connections.

Table 25: IDAN-UPSxx210HR Vin Pinout

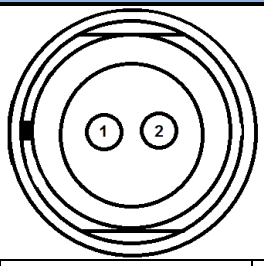
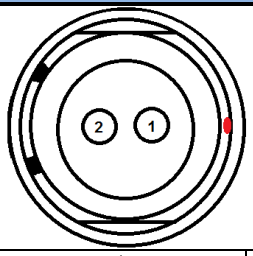
IDAN-UPSxx210HR Vin		
		
Pin #	1	2
Pin Name	POS	NEG

Table 26: IDAN-UPSxx210HR Vout Pinout

IDAN-UPSxx210HR Vout		
		
Pin #	1	2
Pin Name	POS	NEG

For the IDAN-UPSxx216HR, the Vin connection is a circular 6-pin connector and the Vout connection is a circular 4-pin connector.

Table 27: IDAN-UPSxx216HR Vin Pinout

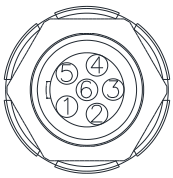
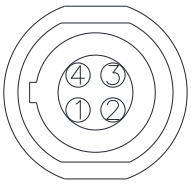
IDAN-UPSxx216HR Vin						
						
Pin #	1	2	3	4	5	6
Pin Name	POS	POS	POS	NEG	NEG	NEG

Table 28: IDAN-UPSxx216HR Vout Pinout

IDAN-UPSxx216HR Vout				
				
Pin #	1	2	3	4
Pin Name	POS	POS	NEG	NEG

6.3.1 BUS CONNECTORS

CN1: Top-side PCIe Connector

The top-side PCIe connector is the connection to the system CPU and peripheral PCIe/104 components in the system. The position and pin assignments are compliant with the *PCI/104-Express Specification*.

6.4 IDAN-UPSxx210HR Contents and Cables

The IDAN-UPSxx210HR is shipped with the following items:

- 1x RS-232 cable
- 1x IDAN-XKCM121 power output cable

Power input cables are not shipped with the IDAN-UPSxx210HR, and may be ordered separately:

Table 29: IDAN-UPSxx210HR Cable Kits

Part Number	Description
IDAN-XKCM18[1]	Input power cable with 2-pin quick-release connector and two 20 AWG wires for supplying power to the IDAN-UPSxx210HR
IDAN AC/DC PS	AC to DC power converter with 2-pin quick-release connector for supplying power to the IDAN-UPSxx210HR

6.5 IDAN-UPSxx216HR Contents and Cables

The IDAN-UPSxx216HR is shipped with the following items:

- 1x RS-232 cable
- 1x IDAN-XKCM55 power output cable

Power input cables are not shipped with the IDAN-UPSxx216HR, and may be ordered separately:

Table 30: IDAN-UPSxx216HR Cable Kits

Part Number	Description
IDAN-XKCM44[2]	Input power cable with 6-pin quick-release connector and six 20 AWG wires for supplying power to the IDAN-UPSxx216HR
IDAN-AC/DC PS-190	AC to DC power converter with 6-pin quick-release connector for supplying power to the IDAN-UPSxx216HR

[1] Included with RTD IDAN power supplies with a 2-pin Vin connector
[2] Included with RTD IDAN power supplies with a 2-pin Vin connector

7 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform your troubleshooting with the least number of modules in the system possible.

- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

8 Additional Information

8.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

8.2 PCI and PCI Express Specification

A copy of the latest PCI and PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

9 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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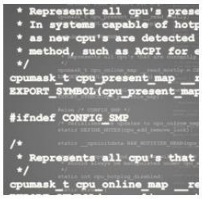

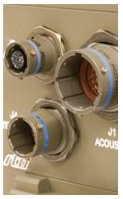
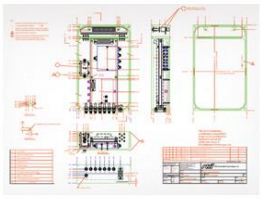

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