Solar inverters

Quick installation guide
Rapid shutdown device (RSD) for 600Vdc

EN

RSD - Single Channel Version

RSD - Dual Channel Version

1. Label and warnings

IMPORTANT SAFETY INSTRUCTIONS – This QIG contains important safety instructions that must be followed during installation and maintenance of the RSD system.

SAVE THESE INSTRUCTIONS – Keep this document in a safe place near the photovoltaic (PV) system inverter for easy access during installation and maintenance.

NOTE – This RSD has been tested and certified for use only with ABB single-phase inverters. If used with other inverters, the RSD may not meet the rapid shutdown requirements of the NEC or perform as specified. Furthermore, use of the RSD with any other inverters voids the RSD product warranty.

ELECTRICAL WARNINGS –

- An ABB RSD system is designed to comply with the 2014 NFPA 70 National Electric Code, section 690.12 and is tested according to international safety requirements (UL1741); however, certain safety precautions must be observed when installing and operating this product. Personal protective equipment (PPE) must be worn at all times when servicing this equipment.
- Wiring methods used must be in accordance with the National Electric Code, ANSI/NFPA 70 and/or any prevailing local codes and regulations.
- For suitable wire sizes (AWG), refer to National Electrical Code, Table 310.15(B)(16) for U.S. applications. Use only copper (Cu) wire rated for 90°C, solid or with type B or type C stranding (19 strands minimum).
- This RSD operates only when properly connected to the power supply and PV strings.
- These connections must be made only by qualified technical personnel.
- The DC operating current and voltage MUST NOT exceed the absolute maximum limits (25A and 600Vdc).
- The RSD system is compatible with 208V and 240V grid connections; it is not compatible with 277V connections.
- The **RSD must be tested before the system is commissioned**.

Safety and Hazard Symbols

	Risk of electrical shock. Hazardous voltage will cause severe injury or death. No user-serviceable parts inside. Only trained service personnel are allowed access.		Verify the correct connection of the strings to the input terminals. Polarity reversal may cause serious damage. Refer to the appropriate product instruction manuals for more details.
	Risk of electrical shock. Multiple voltage sources may be terminated inside this equipment. Each circuit must be disconnected before servicing.		When the photovoltaic array is exposed to light, it supplies DC voltage to this equipment.

Table 1

2. List of components and spare parts

Qty	Description	Part Number	Included with standalone device or kit*
1	RSD2.0-1PN6-MC4 - single channel RSD2.0-2PN6-MC4 - dual channel	3P029970000C - single 3P029950000C - dual	Standalone device and kit
1	24Vdc power supply	YPA.00238	Kit only
1	Mounting bracket - standard	XER.P0500.0	Standalone device and kit
4	Mounting screws	816200010FA-G	Standalone device and kit
2	Three-position terminal blocks	ZEB.00273	Kit only
1	Inverter power supply AC conductors (Terminal 1, Terminal 2, GND)	ZLH.P0504.0	Kit only
1	Cover for three-position terminal block	ZEB.00275	Kit only
1	Quick installation guide	BCM.00372.3DG_AA	Standalone device and kit

Table 2 *kit version required for PVI-3.0/3.6/3.8/4.2/5000/6000 and UNO-7.6/8.6 inverters

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3. RSD installation location

a. Install the RSD on the roof, within ten feet of the PV array.

b. Note that the RSD may be installed at any angle from horizontal to vertical.

c. Note the temperature (-40°C to 75°C) and enclosure ratings (Type 4X) listed on product label attached to the RSD.

d. Choose a location where the maximum ambient air temperature will be less than the 75°C specifed maximum temperature. While exposure to direct sunlight is permitted; installation under a module is preferred.

e. Ensure there is sufficient working area around the RSD to allow easy access for maintenance and/or service of the PV system. If installing the RSD under a PV module, place it under the first or last module in a row for access. Never install the RSD in a location that would require the removal of multiple PV modules in order to gain access.

f. Note that the RSD power supply may already be inside the photovoltaic inverter wiring box.

4. Mounting the RSD

a. The mounting bracket (**A)** will come attached to the RSD device. The bracket has four screw holes (**B**). The RSD box may be raised or lowered to match four bracket screw holes as needed for clearance from modules or roof. If needed, adjust the bracket, reattach the bracket to the RSD box with the four screws provided with the device, and torque to 3.5 N·m (2.6 ft-lb).

b. When mounting the RSD device to the PV module frame, use the components supplied with the racking to secure the mounting bracket (**A)** to the PV module frame in the area marked (**C)**.

Label	Description of RSD device components
A	Mounting bracket
B	Bracket mounting holes
C	RSD mounting bracket attachment points
D	Input conductor leads (coming from PV panels)
E	Output conductor leads (going to the inverter)
F	24V supply cable

Table 3

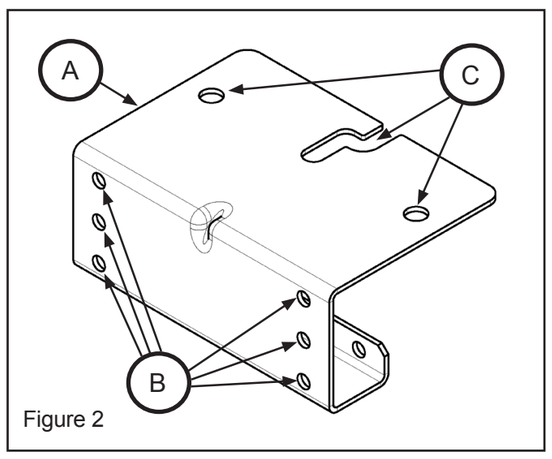

Figure 2

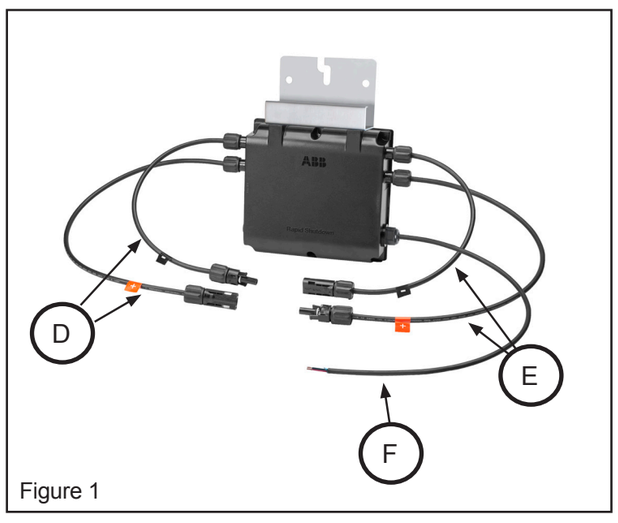

Figure 1

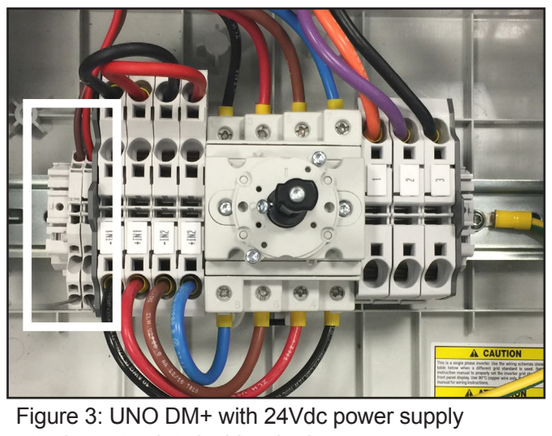

Figure 3: UNO DM+ with 24Vdc power supply attachment points inside wire box.

5. Wiring the RSD input (from PV array) and output (to inverter)

a. Ensure the inverter's external AC disconnect and its integrated DC disconnect are turned OFF (open). Use appropriate PPE, and use insulated tools when working with this equipment.

b. Ensure the EGC from the array is indeed connected in the inverter: The equipment grounding conductor (EGC) must connect the inverter and array in order for the inverter's ground fault protection to operate as required. (The RSD enclosure itself is polycarbonate and does not require bonding.)

c. Refer to local codes for appropriate wire size on all conductors.

d. Locate the input wires (D) on the side of the RSD device marked "Input". This marking is present near the edge of the RSD device on the front and back side. Connect the RSD input wires (D) to the PV array. The positive end of the PV array must be connected to the RSD input wire labeled (+). The negative end of the PV array must be connected to the RSD input wire labeled (-). (Note that there will be voltage on the PV array at this point.)

e. Locate the output wires (E) on the side of the RSD device marked "Output". This marking is present near the edge of the RSD device on the front and back side. Connect the RSD output wires (D) to the inverter inputs. The RSD output wire labeled Inverter (+) must be connected to the positive DC input terminal of the inverter. The RSD output wire labeled Inverter (-) must be connected to the negative DC input terminal of the inverter.

WARNING: Swapping the input and output connections of the RSD device may make the system non-compliant and/or create a hazardous situation. Therefore extra care must be taken to ensure proper connections of the input and output wiring of the RSD device.

6. Prepare to install the 24Vdc power supply

a. Confirm the inverter output (grid connection) is three-wire 240V line-to-line or two-wire 208V line-to-line inverter output.

The RSD unit is NOT compatible with a 277V grid connection. It must only be used with a 208V or 240V grid connection.

b. Confirm all items in the RSD kit are accounted for; two 3-position terminal blocks and one terminal block cover (Figure 4), 24Vdc power supply and three short conductors to connect the power supply to the inverter AC terminals and to ground. The 24Vdc power supply, terminal blocks, terminal cover and AC conductor cable will be be installed inside the ABB string inverter's wiring box.

c. Before installing the 24Vdc power supply, open (turn OFF) the PV system AC disconnect switch AND the PV breaker to ensure the inverter is disconnected from the grid and from the PV modules.

d. Follow the instructions starting in section 7 to install the 24Vdc power supply. Note that the power supply pigtail coming out of the RSD box (FIgure 5) will house both the 24V and return wires.

e. The new UNO-DM+ inverter will already have a 24Vdc power supply inside the inverter wiring box and you can skip sections 7 & 8. Only the older PVI-3.0/3.6/ 3.8/4.2/5000/6000-TL inverters and the UNO 7.6/8.6 inverters will require you to add the 24Vdc power supply as described in sections 7 & 8.

Note that an uncovered terminal blocks' interior metal will carry the AC voltage. Therefore, the terminal block cover is required to ensure there is no exposed AC voltage.

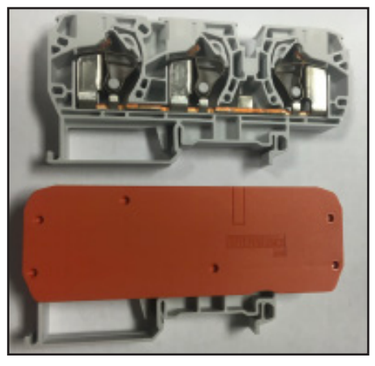

Figure 4

7a. Installing the power supply

Step 1: Open the inverter wiring box. Disconnect the inverter output conductors from top-side of terminals 1 and 2 by inserting a ¼" flat screwdriver into the square holes. (The square holes are indicated in Figures 6 and 7.) Lightly press the screwdriver toward the wire slot until the clamp opens.

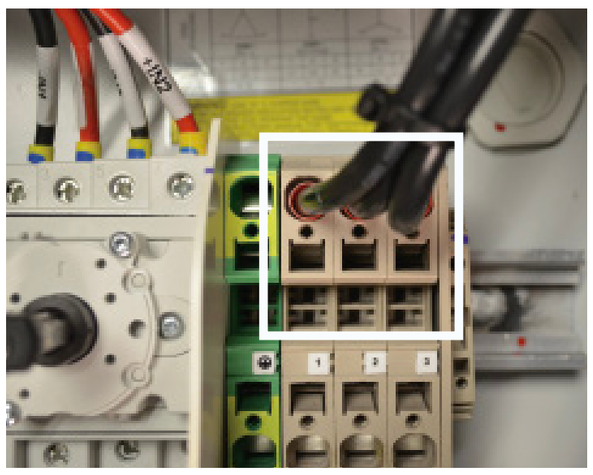

Figure 6
Wiring box for PVI-3.0/3.6/3.8/4.2 and PVI-5000/6000

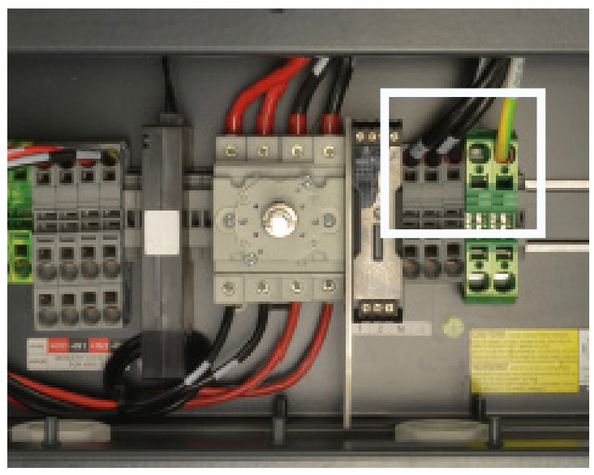

Figure 7
Wiring box for UNO-7.6/8.6

7b. Installing the power supply

Step 2: Push the end caps on the DIN rail to the right. Pop the terminal block 1, 2 and GND off the DIN rail by pulling upwards from the bottom. Install the 24V power supply on the DIN rail, by using a small screwdriver to pull down on the tab on the bottom of the power supply. See Figures 8a-8d and 9.

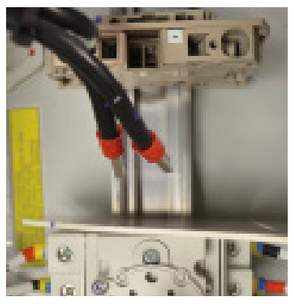

Figure 8a

Figure 8b

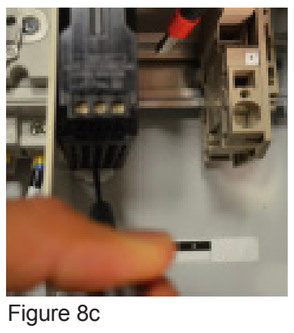

Figure 8c

Figure 8d

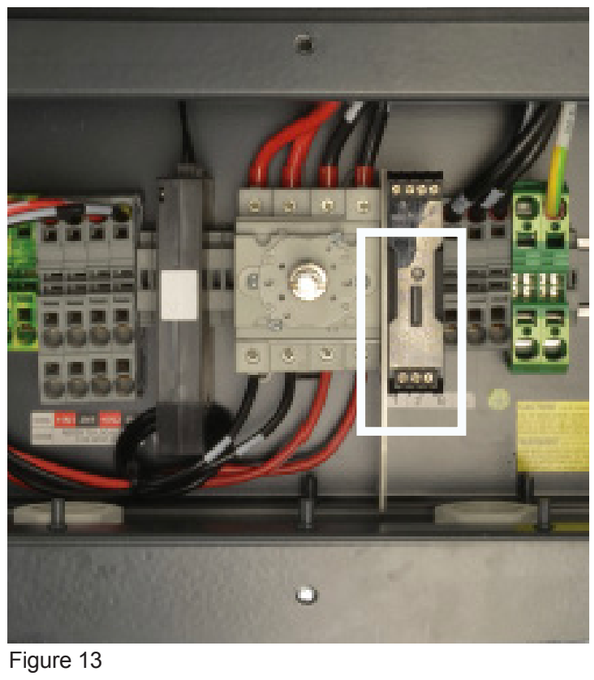

Figure 13

Note: Once the Grid Connections are done to the power supply, measure the output voltage of the power supply to be 24V. If not, adjust the screw off the power supply until it reads 24V.

7c. Installing the power supply

Step 3: Snap the orange cover on one terminal block from the kit, prior to mounting it on the DIN rail. Install both terminal blocks from the kit on the DIN rail to the right of the power supply. The terminal cover must be on the right-side end. Push the two new terminal blocks, the terminal cover, terminal block 3 and end caps to the left, up against the 24V power supply. Figures 10 and 11 show the two new terminal blocks in place.

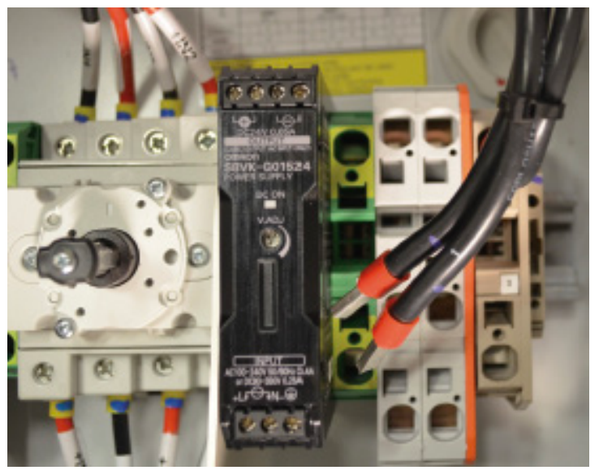

Figure 10
Wiring box for PVI-3.0/3.6/3.8/4.2 and PVI-5000/6000

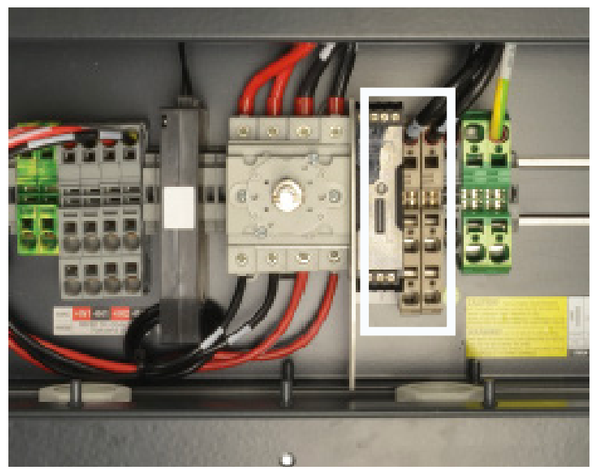

Figure 11
Wiring box for UNO-7.6/8.6

7d. Installing the power supply

Step 4: Replace the inverter AC conductors in the top positions of the two, new left-hand terminal blocks by inserting a ¼" flat screwdriver into the square holes. Insert the wire labeled '1' into terminal 1 and wire labeled '2' into terminal 2. The wires are shown in Figures 12 and 13. Be sure the wires are completely seated. Give each wire a pull test to confirm the wire is snugly held in place.

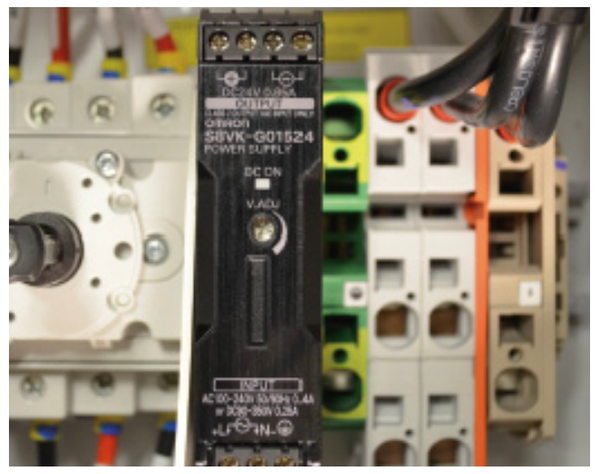

Figure 12

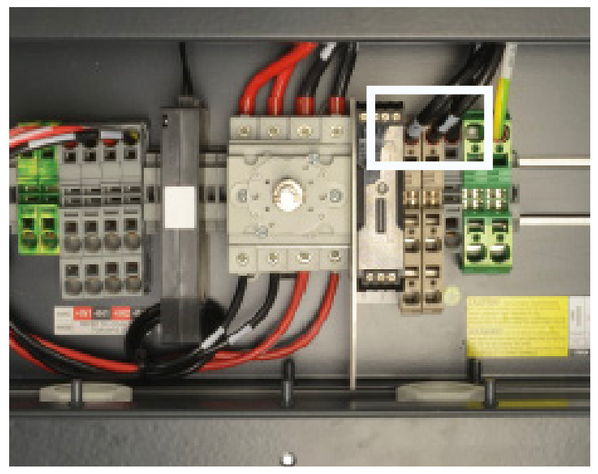

Figure 13

11. Operation of the RSD

Note: To comply with NEC 690.12 rapid shutdown requirements, within the ten-foot perimeter of the PV array, DC voltage must be reduced to no more than 30Vdc, and power to <240VA, within 30 seconds. The RSD system is activated through a loss of AC voltage to the inverter. When the loss of AC occurs, the RSD power supply shuts off. This results in opening the relay contacts of the RSD device and de-energize the system per NEC 690.12 requirements.

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8. Wiring the Power Supply inputs from the Grid

PVI-3.0/3.6/3.8/4.2/5000/6000-TL	UNO-7.6/8.6

Step 5: Connect the ground (green) wire from the kit to the ground terminal of the power supply and to the green terminal block. Connect one black wire between the center position of the first terminal block and terminal "L" on the power supply. Connect the 2nd black wire between the center position of the 2nd DIN rail terminal block and terminal "N" on the power supply. Confirm all wires are completely seated. Torque all power supply screws to 4.43 in-lb (0.5 N.m) - 5.31 in-lb (0.6 N.m). Figures 14 and 15 show the two terminal blocks in place and correctly wired. Give all wires a pull test to confirm the connections are solid.

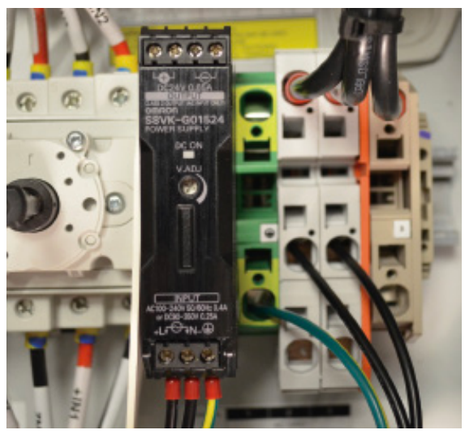


Figure 14

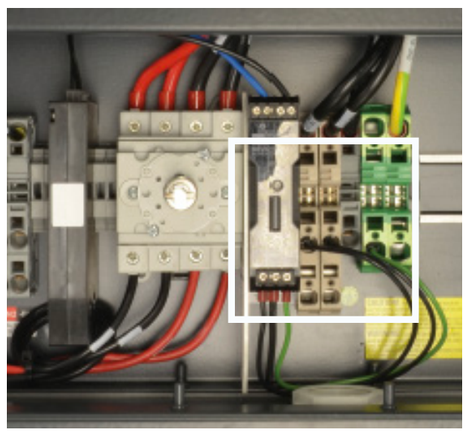


Figure15

9. Connecting the control wires between RSD(s) and power supply

Step 6: The installer may connect the 24Vdc supply cable (F) to a UL approved "I" or "T" splice connector depending on the number of SRD boxes or into a UL approved junction box on the roof. Installer is allowed to clip off connectors in order to use the junction box.

Run the 24Vdc wire pair from the splice connector or junction box to the inverter and attach to the 24Vdc power supply. (Note the power supply terminals accept wire sizes 18 AWG to 16 AWG). Connect the conductors as follows:

Strip 0.3" of insulation from the ends of the wires.

Use a small Philips screwdriver to attach wires to the (+) and (-) outputs of the power supply. Torque all power supply terminal screws between 4.43 lb.-in (0.5 N•m) and 5.31 lb.-in (0.6 N•m).

The 24Vdc power supply conductors may be routed through the DC conduits to the location where the RSD device is installed near the PV array or the installer may run these conductors through a separate DC conduit.

Note: 1. The power supply installed in the inverter wiring box is a Class 2 power source. Class 2 circuits are permitted to be reclassified as Class 1 circuits per NEC 725.130 (A) exception 2. By reclassifying this circuit at Class 1, the 24Vdc conductors may be installed in the same raceway as the PV conductors as specified in section 725.48(B) (1) of the NEC. Be sure to follow all Class 1 wiring methods as stated in section 725.49 to ensure compliance. The installer should mark out any reference to 'Class 2.'

2. Placing the 24Vdc power supply conductors in the same EMT conduit as the PV conductors will require use of 18 AWG 600Vdc wire.

10. Multiple-RSD installation

Each 24Vdc power supply has terminals for connecting four RS1-1PN6-MC4 devices or two RS2-2PN6-MC4 devices. Repeat the wiring directions above to connect a second RSD control circuit to the second output positions on the power supply.

However, each 24Vdc power supply in the kit can power up to six single-output RSDs (ABB P/N: RS1-1PN6-MC4) or three dual-input RSDs (ABB P/N: RS2-2PN6-MC4). For more than two RSDs, you must use an UL approved "I" or "T" splice or a UL approved junction box, or equivalent.

Without the approved splices an additional power supply would be required to power more than two RSDs in a single-inverter system. UNO-7.6/8.6 inverters have sufficient space for additional power supplies. If using PVI-series ABB in-verter, there may be space for only one power supply on the inverter DIN rail.

12. System testing - required before system commissioning

Testing Rapid Shutdown within the PV system:
Once the PV system has been installed, test the RSD system. The intention of the test is to confirm inverter DC input drops to less than 30 Vdc in less than 30 seconds after AC is removed. A multimeter will be required to measure the DC voltage. PPE must be used in all steps while working with this equipment.

1. Before connecting the inverter to the grid, measure the output resistance of the RSD at the inverter input terminals (see Table 4 for correct values.)

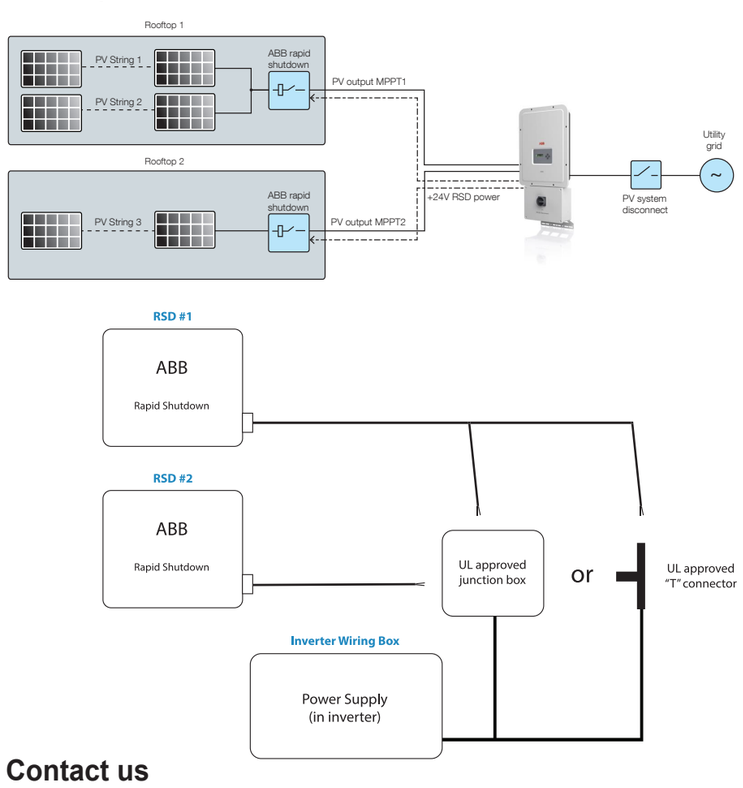
Do NOT energize the system until proper resistance values are measured.

2. Connect a voltmeter to the inverter DC input voltage at a convenient location.
3. Reinstall the inverter switchbox cover.
4. Connect the system to the grid by closing a circuit breaker or circuit disconnect.
5. Begin monitoring the DC input voltage at the input terminals. Ensure that the proper input voltage is present based on the PV plant design documentation.
6. Once the inverter is connected to the grid and producing power, remove the grid voltage from the inverter by opening AC circuit breaker or circuit disconnect and monitor the inverter DC input voltage.
7. Confirm the inverter DC input voltage is below 30Vdc within 30 seconds of grid disconnect by measuring the voltage across the DC input terminals inside the wiring box.

Table 4: Expected resistance measurements

Number of RSD channels in parallel	Expected resistance value
1	36kΩ ±5%
2	18kΩ ±5%
3	12kΩ ±5%
4	9kΩ ±5%

Testing the PV System only, without Rapidshutdown or to Perform Anti-Islanding Test:
If it is necessary to test the PV system without the rapid shutdown being operational, bypass the rooftop RSD by directly connecting the PV strings to the corresponding PV array output conductors.
Prior to commissioning the PV system, the PV strings and PV output circuits must be properly reconnected through the RSD, and the system must be tested as described above.



The inputs of both rapid shutdown boxes are rated for 25A which allows for single or paralleled string to be connected to one input. On a 2 rooftop system either version of the Rapid Shutdown box, or both, may be used.

A system with two or more RSD boxes will require either a UL approved "T" connector (available from ABB) or a UL approved junction box.

Contact us

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BCM.00372.3DG Rev AA