



COMBINER INSTALLATION MANUAL

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Revision History

Rev. No.	Date	By	Description
1.0	9 Nov 2009	AS	Preliminary Release
1.1	3 Oct 2011	CS	250/400A
1.2	14 March 2014	WC	Torque Values
1.3	22 Dec 2020	AY	Conduit entry, Maintenance
1.4	24 March 2021	ST	Certification
1.5	11 July 2022	CS	Terrasmart

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for Terrasmart combiner box products that must be followed during installation and use.

The combiner boxes are designed and tested according to international safety requirements, but as with all electrical and electronic equipment, certain precautions must be observed. To reduce the risk of personal injury and to ensure safe installation and operation, you must carefully read and follow all instructions and warnings in this

Installation Guide.

1. Symbols

Safety and Hazard Symbols



This symbol appears beside instructions and warnings that deal with dangerous voltages that can cause injury.

Warnings





WARNING: A warning describes a hazard to equipment or personnel. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the SolarBOS equipment and/or other equipment connected to the SolarBOS equipment or personal injury.

Warnings may also be accompanied by one or more of the safety and hazard symbols described above to indicate the type of hazard described therein.






Other Symbols

In addition to the safety and hazard symbols described previously, the following symbol is also used in the **Installation Guide**:

	This symbol accompanies notes that call attention to supplementary information that you should know to ensure optimal operation of the system.
	This GROUND symbol marks areas in the combiner box for connecting equipment grounds only.

2. Warranty

Terrasmart combiner boxes sold in the USA carry a five-year warranty. For warranty coverage, or if you have questions about the warranty, contact Terrasmart at the address, telephone number, or website listed on the cover of this manual (to e-mail, see the contact section of the website).

	WARNING: All electrical installation must be done in accordance with the National Electrical Code ANSI/NFPA 70, local building codes, and the requirements of the authority having jurisdiction.
	WARNING: To prevent electrical shock or injury, all wiring and commissioning procedures must be performed by qualified personnel.
	WARNING: Before installing or using the combiner box, read all of the instructions and warnings on the combiner box and in this Installation Guide.
	WARNING: PV arrays produce electrical energy when exposed to light and thus create an electrical shock hazard.
	WARNING: Terrasmart combiners use an integrated disconnect switch(es), yet both the line and load side of the switch may be energized in the OFF position. Always test both sides of the disconnect before servicing the combiner.

3. Introduction

Terrasmart has introduced a new line of combiner boxes designed for use with all module and inverter combinations.

Combiner box features include:

- Listed to UL 1741
- Simplified input and output wiring
- Compact, low-cost, and flexible design
- Available in NEMA 3, 3R, 4 powder-coated steel, and NEMA 4X stainless steel or fiberglass enclosures (others available on request)
- Integrated load-break disconnect switch

4. Unpacking and Inspection

All Terrasmart combiner boxes are thoroughly checked before they are packaged and shipped. Although they are shipped in sturdy packaging, damage can still occur during shipping and delivery. It is important to carefully inspect the shipping container and contents prior to installation. If you detect any external damage after unpacking, report the damage immediately to Terrasmart and the shipping company that delivered the unit. Items not rejected within 10 days of delivery are considered accepted without recourse. If it becomes necessary to return the combiner, please use the original packing material.

If you need assistance with a damaged unit, contact Terrasmart at **925-456-7744** or through the Contact section of the Terrasmart website **www.terrasmart.com**

5. Installation

Refer to Figure 1 and Table 1 for enclosure dimensions. Use appropriate hardware for the mounting surface. The approximate weight of the unit is shown in Table 1.

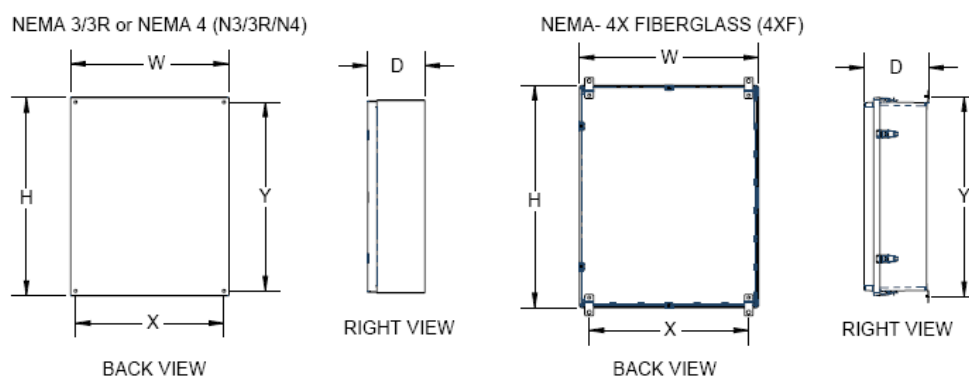


Figure 1 Combiner Enclosure Dimensions

Table 1 Disconnect Combiner Dimensions

Enclosure Type	Max. Output	# Input Circuits	H (inches)	W (inches)	D (inches)	X (inches)	Y (inches)	Weight (lbs)
N3/3R/N4	100	6-8	20	20	6	18.5	18.5	60
N3/3R/N4	200	6-8	20	20	6	18.5	18.5	62
N3/3R/N4	200	10-20	24	24	8	22.5	22.5	80
N3/3R/N4	250	12-24	24	24	8	22.5	22.5	82
N3/3R/N4	275	8-18	24	24	8	22.5	22.5	84
N3/3R/N4	275	19-20	30	24	8	28.5	22.5	100
N3/3R/N4	320	10-18	24	24	8	22.5	22.5	64
N3/3R/N4	320	19-24	30	24	6	28.5	22.5	105
N3/3R/N4	320	25-34	30	30	8	28.5	28.5	115
N3/3R/N4	400	12-18	30	24	8	28.5	22.5	64
N3/3R/N4	400	19-24	30	24	8	28.5	22.5	105
N3/3R/N4	400	25-28	30	30	8	28.5	28.5	115
N3/3R/N4	400	29-36	36	30	8	34.5	28.5	150
4XF	200	6-20	26	26	11.7	22	26.25	80
4XF	275	8-18	26	26	11.7	22	26.25	84
4XF	275	19-20	32.2	26.2	12.25	20.5	32	95
4XF	320	10-18	26	26	11.7	22	26.25	82
4XF	320	19-24	32.2	26.2	12.25	20.5	32	98
4XF	320	25-36	37.25	32.5	10	24	38	150
4XF	400	10-18	26	26	11.7	22	26.25	84
4XF	400	19-24	32.2	26.2	12.25	20.5	32	98
4XF	400	25-36	37.25	32.5	10	24	38	150

6. Combiner Orientation

NEMA-3R enclosures may only be installed in the vertical orientation. This applies to combiners with the “3R” designation.

NEMA-3/4/4X enclosures may be installed in either the vertical or the horizontal orientation. This applies to combiners with the “N3” “N4” “4XF” “4XP” and “4XSS” designation.

When mounting enclosure in horizontal orientation, mounting the enclosure at a minimum of 10 degrees off level plane is recommended to mitigate water from pooling on the flat surface of the enclosure door.

The disconnect handle carries a NEMA-4X rating.

7. Disconnect Switch

The disconnect combiner contains an integrated disconnect that includes a handle installed on the enclosure door with marked ON and OFF positions.

The disconnect handle allows padlocking in the OFF position with the door open or closed, and can be used for Lock Out/Tag Out procedures.

8. Disconnect Door Interlock

The door interlock prevents opening the door while the disconnect handle is in the “ON” position. In some instances, it may be helpful to temporarily defeat the door interlock.

With the switch ON, the door interlock may be defeated with a slender tool to allow the door to open (see item 1 on figure 2). The door interlock reactivates automatically when the enclosure door is closed.

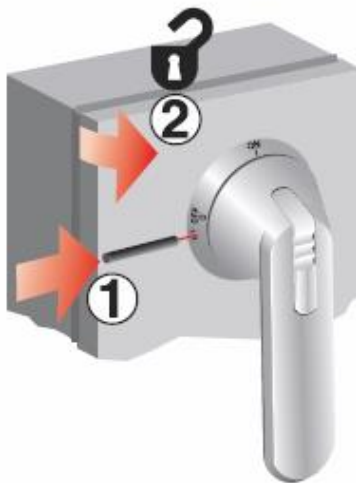


Figure 2 Defeating the Switch Handle



WARNING: Only qualified personnel should defeat the door interlock.

9. Wiring



NOTE: Unless requested, combiner products are shipped without entry holes. A knock-out is required for the appropriate conduit size. SolarBOS recommends wire entry be made according to Figure 3.



NOTE: Raintight or wet location hubs that comply with the Standard UL514B must be used for NEMA 3/3R outdoor applications. NEMA 4 or 4X applications must use watertight hubs that comply with the Standard UL514B. Use Myers type, water-tight conduit fittings such as Thomas & Betts H200TB (for 2" conduit) or H300TB (for 3" conduit) or equivalent from others. Install fittings per manufacturer's recommendations.

10. Input Wiring

Refer to Figure 3 for the input wiring locations of the combiner box. PV positive and negative conductors are wired to the corresponding marked locations within the combiner. Ground conductors are wired into the ground bus located at the bottom of the combiner box.

11. Output Wiring

Refer to Figure 3 for output wiring locations. Many combiner products have high current ratings. When temperature and voltage drop adjustments are considered, the output conductor sizes can become quite large (500 MCM or greater) and difficult to manage. NEC Article 310.4 allows paralleling of conductors greater than AWG 1/0 to achieve higher ampacities. Some combiner products provide output terminals for paralleling two conductors.



NOTE: On units with provisions for crimp lugs, use only UL listed crimp lugs. Be sure to use the appropriate crimp lug for the intended wire gauge. Please request a submittal drawing to confirm the barrel/tang size, mount hole size and spacing of the crimp lugs are compatible with provisions provided by Terrasmart.

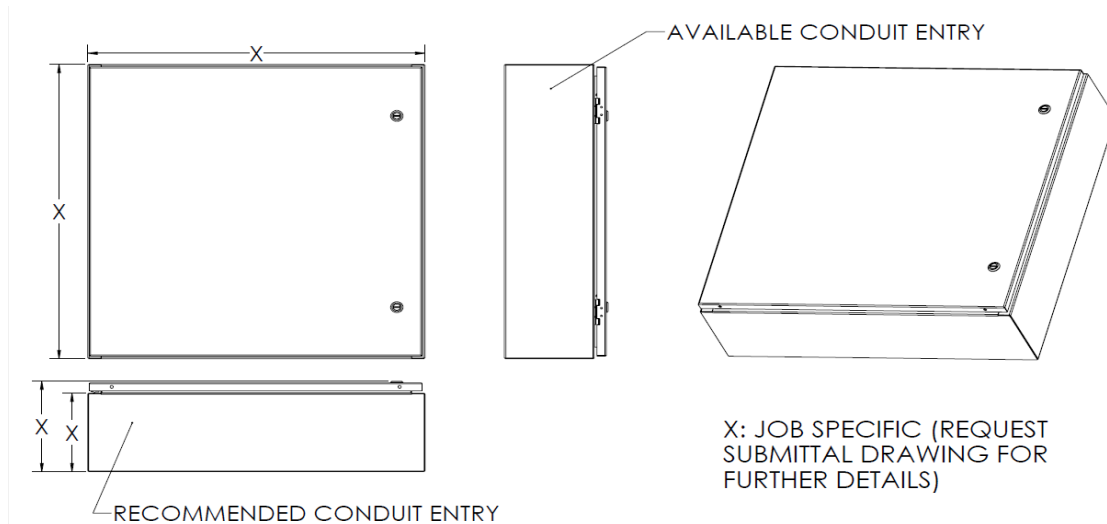


Figure 3 Combiner Wire Entry Locations

These locations are recommendations only. Care should always be taken to assure there is enough wire bend space for the desired output wire gauge when choosing a conduit entry location. Dimensions are project specific. Please request a submittal drawing for further details.



WARNING: Never open a fuse holder while it is under load. Electrical arcing and damage to the fuse holder will occur if a fuse holder is opened under load.

12. PV String Fuses

Terrasmart combiner boxes ship with fuses installed according to the user's predetermined requirements. Fuses and connection points are electrically tested prior to shipment. Terrasmart maintains stock of common fuse sizes if replacements are necessary or spares desired.

13. Combiner Box Torque Values

COMBINER TORQUE VALUES

MECHANICAL LUGS		SMALL CONDUCTORS	
CONDUCTOR SIZE	TORQUE	ITEM	TORQUE
1/0 - 2/0	180 in-lbs	DINRAIL TERMINAL	11 in-lbs
3/0 - 4/0	250 in-lbs	FUSEHOLDER	18 in-lbs
250 - 350	325 in-lbs	SURGE (TVSS)	22 in-lbs
400 - 600	375 in-lbs	DISTRIBUTION BLOCK INPUT	25 in-lbs
700 - 800	500 in-lbs	SMALL GROUND SCREW	25 in-lbs
900 - 1000	600 in-lbs	LARGE GROUND SCREW	50 in-lbs
*For Contactor Terminals		THREADED FASTENERS AND COMP LUGS	
		THREAD	TORQUE
		1/4"	120 in-lbs
		M8*	110 in-lbs
		M8	220 in-lbs
		M10*	275 in-lbs
		M10	550 in-lbs
		M12	600 in-lbs

Figure 4 Combiner Torque Values



NOTE: Terrasmart products are factory assembled under ideal conditions using calibrated torque tools. When field terminations are made during installation or repair, it is recommended to use a good quality torque tools with a current calibration. Checking torque at 80% of spec allows confirmation of appropriate torque without moving the fastener and disturbing the torque mark.



NOTE: It is recommended to thermal image combiners to ensure proper installation and function. Combiners should operate under load for at least 3 hours prior to a thermal scan. Thermal images should be performed during initial startup (<30 days) and again within the first year.

14. Recommended Annual Maintenance



WARNING: To prevent electrical shock or injury, all wiring and commissioning procedures must be performed by qualified personnel.



WARNING: Before opening the combiner box, read all of the instructions and warnings on the combiner box and in the Installation Guide.





WARNING: PV arrays produce electrical energy when exposed to light and thus create an electrical shock hazard.



WARNING: Terrasmart combiners use an integrated disconnect switch(es), yet both the line and load side of the switch may be energized in the OFF position. Always test both sides of the disconnect before servicing the combiner.

With the system de-energized:

1	Check for hazards before beginning inspection.
2	Visually check the exterior of the enclosure to ensure it is structurally sound without any damage from environmental factors.
3	Inspect door gasket for damage. Check inside of enclosure for moisture or condensation. Moisture can enter through conduit, if present, determine source of moisture.
4	Look for discoloration of fuses, lugs, disconnect tabs or other current carrying components. Thermal imaging is a valuable tool to assess combiner condition. This is best done around solar noon and at the time the system is shut down or still operating. If any connections are found abnormally hotter than others, it may be an indication of a bad connection.
5	Check for signs of animals or rodents which can nest or chew away material.
6	Check condition of conductors including insulation particularly around entry locations.
7	Check all connections: Grounds, positive/negative input and outputs, control, and monitoring wiring if equipped. Small conductor connections may be checked by gently pulling on conductors.
8	<p>Check torques. A list of torque specs can be found on the label inside the door of the combiner box (see figure 4). Use a quality calibrated torque tool with current calibration. Checking torque at 80% of spec allows confirmation of appropriate torque without moving the fastener and disturbing the torque mark.</p> <div>  <p>WARNING:</p> <p>Never open a fuse holder while it is under load. Electrical arcing and damage to the fuse holder will occur if a fuse holder is opened under load.</p> </div> <div>  <p>NOTE:</p> <p>System voltage is present at the string input (and fuseholder) unless the input string is disconnected. System voltage is present at the bus bar (and fuseholders) if any fuseholders are closed or the disconnect is in the ON position</p> </div>
9	<p>Optional: Check fuses. Caution: fuses may be hot. Remove fuses and check for continuity. Also check fuses for proper rating. Fuse rating can be found on product label on inside of enclosure door. The fuseholder screw terminals may be used to avoid fuse removal.</p> <p>Caution: System voltage may be present at fuseholder screw terminals.</p> <p>NOTE: When system is operating each string input conductor can be checked for expected current with a clamp on meter.</p>
10	Check Transient surge suppressor (if equipped). The windows in the TVSS modules should be green.

If any problems are found, take action to correct the problem and/or reach out to Terrasmart for assistance.