2022 Product Catalog

MSRP Effective July 1, 2022

SnapNrack®

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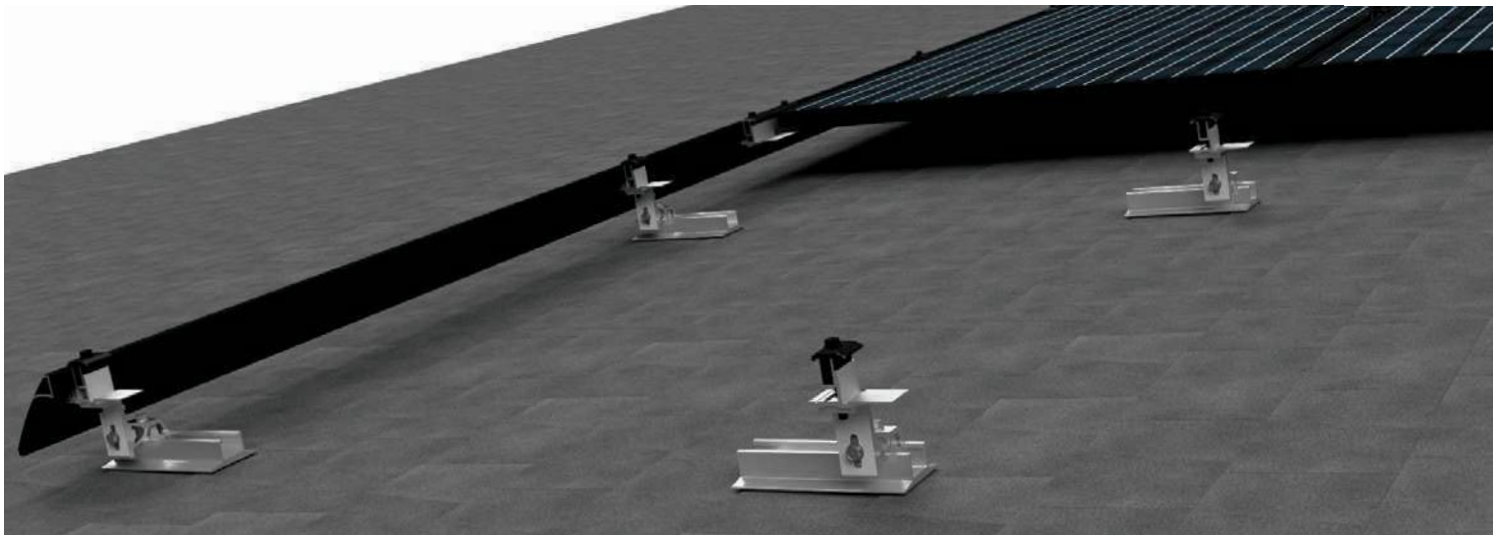
Ultra Rail Roof Mount System | *Rail-based Mounting*

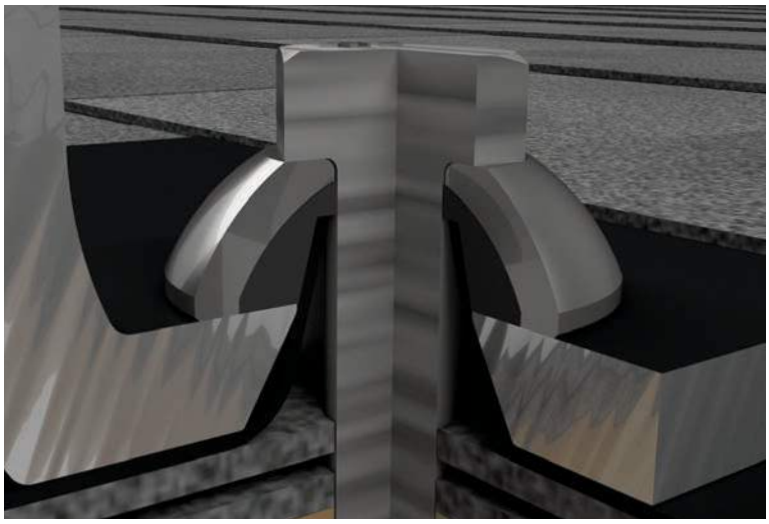
The SnapNrack **Ultra Rail Roof Mount** portfolio satisfies virtually all residential roof types featuring labor saving components like the snap-in mounts and splices along with the open rail channel and accessories to create the industry's leading Wire Management Solutions.



RL Universal Roof Mount System | *Railless Mounting*

SnapNrack's **RL Universal System (RL-U)** for composition shingle roofs provides the greatest labor efficiency with an installer focused process allowing the system to be installed by a single person, saving time on the roof. This railless system was designed with an installer-focused approach, featuring Universal Mounts and nothing larger than a module.

Flashing Based | *Roof Attachment Technology*



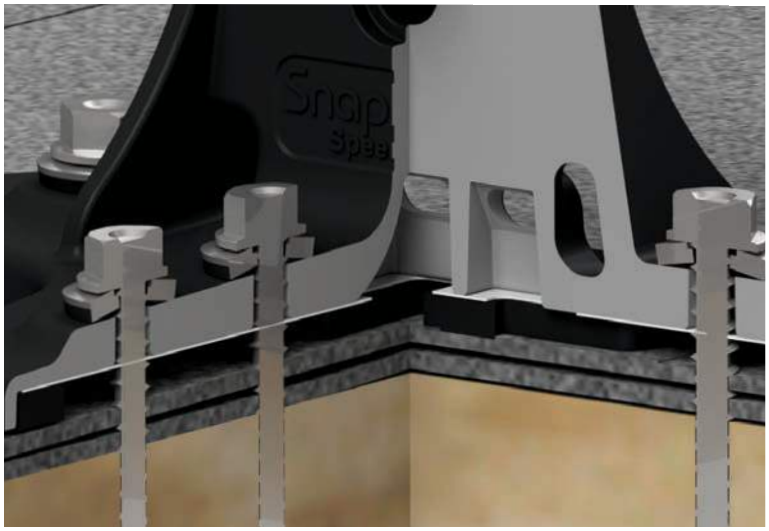
The SnapNrack **Umbrella Seal Technology** is an innovative flashing that uses a fully formed raised cone to prevent any water leakage. When paired with a single lag bolt & our Umbrella Washer, the Ultra Rail L Foot Mount is secured to the roof with the Umbrella Flashing in one step creating a multi-layer waterproof seal.

Integrated Flashing | *Roof Attachment Technology*

SnapNrack's new **SpeedSeal™ Technology** features an innovative design that incorporates flashing reliability into a single roof attachment by using a patent pending Lag Driven Sealant Technology. The SpeedSeal™ Foot or Track has a sealant cavity with compressible barrier secures sealant in place & fills voids.

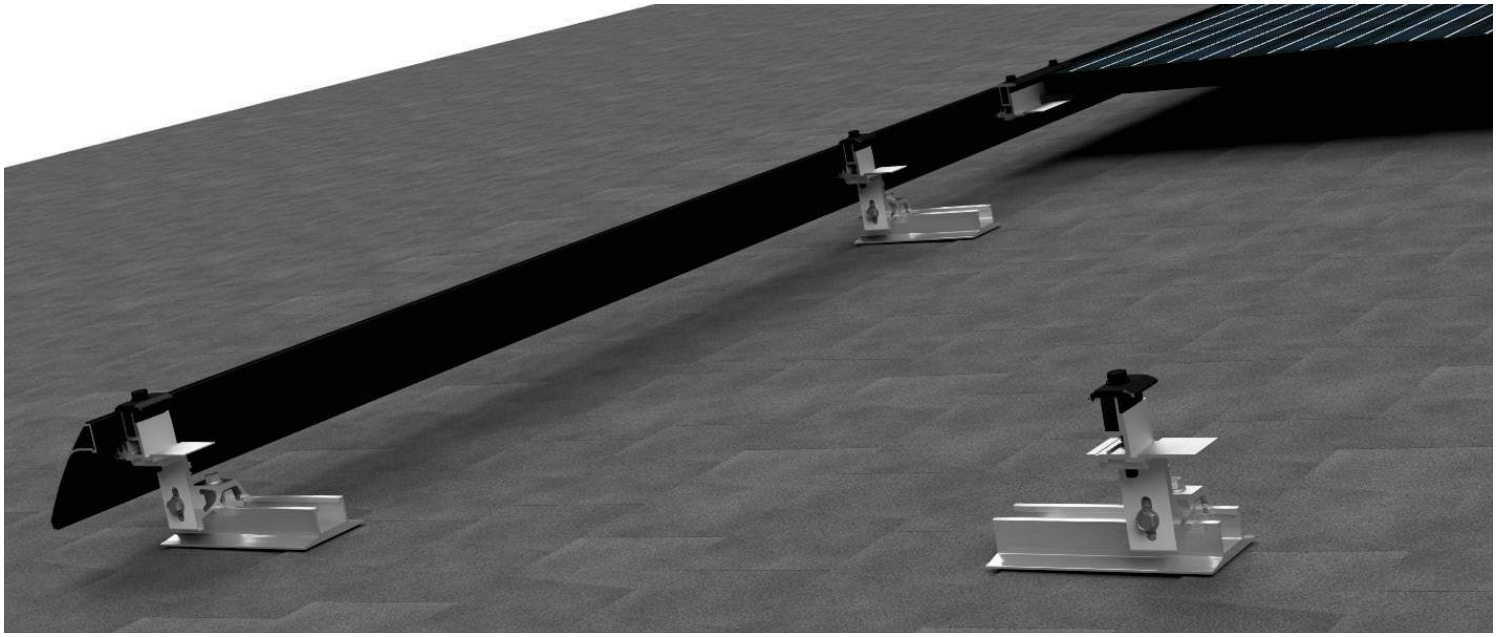
Miami-Dade NOA NO: 20-1104.01

Direct to Deck | *Roof Attachment Technology*



Now **SpeedSeal™ Technology** applies to roof attachments that mount directly to the deck with the **SpeedSeal™ DeckFoot & DeckTrack.** These rafter independent attachments allow for layout adjustability on the roof without the need to locate & attach to rafters. More importantly, installers have the ability to mount on specialty roof structures without standard rafters.

RL Universal | *Railless Mounting*



SnapNrack RL Universal
The Fastest Mounting System. Period

SnapNrack RL Universal Mounting System is designed to provide the fastest, most intuitive install experience on the roof. The direct mount system features four basic components for easy material management. Features incredible flexibility with a single Universal Mount that fits module heights from 30 - 40 mm and the highest spans of any current rail less system. The installer focused process allows the system to be installed by a single person.

- The RL Universal Skirt ensures a strong structure for leveling and alignment of first row of modules.
- Both SpeedSeal™ Technology or Umbrella Seal Technology roof attachments are designed for maximum versatility with 6” of North-South adjustability for all Mounts.
- A single Umbrella Lag screw secures flashing & Flash Track to roof in one complete action
- A single Mount is used at all locations on array and eliminates Mount/Link interference, bypassing the need for hybrid mounts found in competitive systems.
- The Links clamp onto the top of modules securing them in place while providing row-to-row bonding.

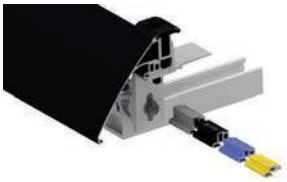
More Info
RL Universal Product Page

RL Universal Configuration Tool
Design a system & download a BOM to quote with the online Configuration Tool

Visit Resource Library
Download Structural Engineering, Installation Manuals & System Drawings

RL-U Components

RL-U Flash Track with Flashing & Mount
(All Sold Separately)



RL-U Skirt with Mount, Flash Track & Spacers
(All Sold Separately)

RL-U SpeedSeal™ Track with Mount
(All Sold Separately)

RL-U SpeedSeal™ DeckTrack
(Bottom view)

RL Universal Link

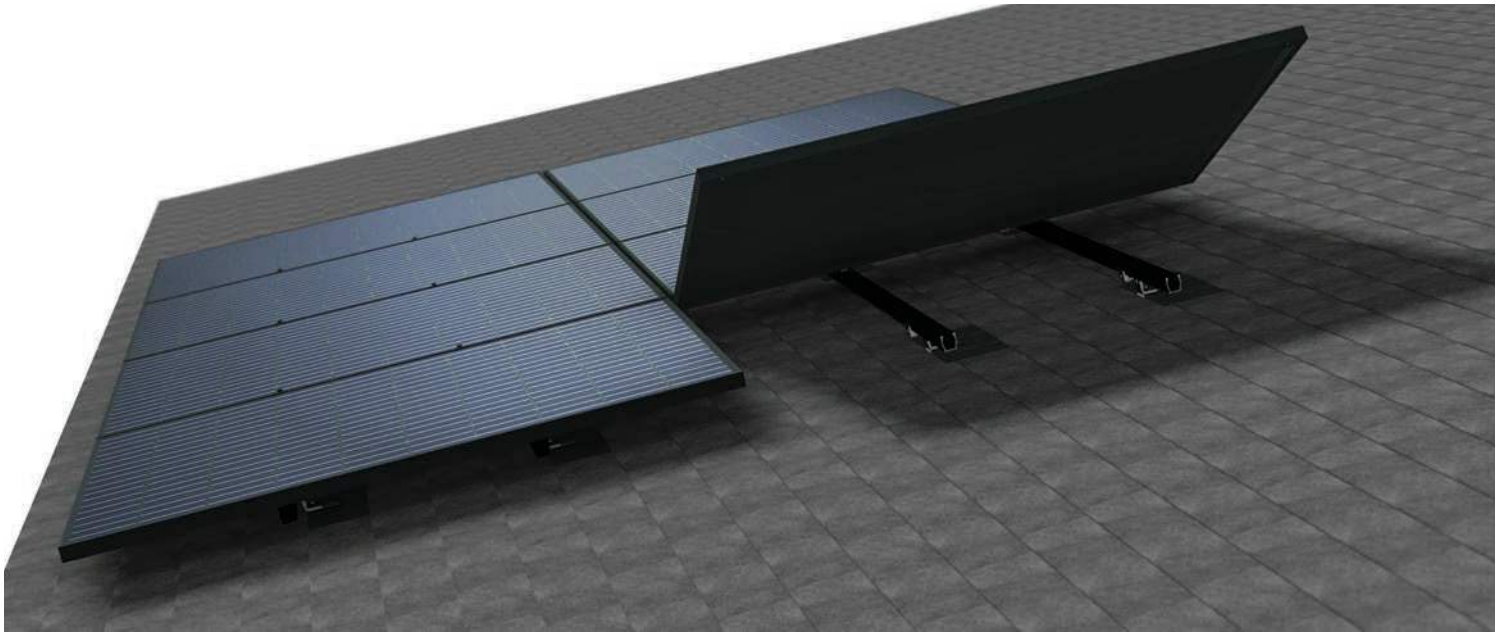
Smart Clip XL

RL-U Skirt Components			
Description	**SKU**	**MSRP**	**QTY***
RL Universal Landscape Skirt, 70”, Black (Bundle of 72, priced as each)	232-02492	$45.97	72 EA
RL Universal Landscape Skirt, 70”, Black (Box of 6)	015-11791	$282.90	1 Box
RL Universal Double Portrait Skirt, 83”, Black, (Bundle of 72, priced as each)	232-02493	$52.67	72 EA
RL Universal Double Portrait Skirt, 83”, Black, (Box of 6)	015-11792	$338.80	1 Box
RL Universal Skirt Spacer, 30mm	232-02532	$0.75	20 EA
RL Universal Skirt Spacer, 32mm	232-02494	$0.75	20 EA
RL Universal Skirt Spacer, 35mm	232-02495	$0.75	20 EA
RL Universal Skirt Spacer, 38mm	232-02496	$0.75	20 EA
RL Universal Skirt Spacer, 40mm	232-02497	$0.75	20 EA

RL-U Mount Components			
Description	**SKU**	**MSRP**	**QTY***
RL Universal Flash Track	232-01371	5.00	20 EA
Comp Flashing, 9” x 12”, Black Alum (requires Umbrella Lag)	232-01375	$6.06	20 EA
Comp Flashing, 9” x 12”, Silver Alum (requires Umbrella Lag)	232-01376	$5.03	20 EA
Comp Flashing, 9″ X 12″, Black Galvalume (requires Umbrella Lag)	232-01377	$5.20	20 EA
Umbrella Lag, 4”	242-92266	$1.55	20 EA
RL Universal SpeedSeal™ Track	232-01464	$8.75	20 EA
Sealing Washer Lag, 4 1/2”, SS	242-02168	$1.25	20 EA
RL Universal SpeedSeal™ DeckTrack	242-02171	$11.00	20 EA
Sealing Washer Wood Screw, #14 X 2¾”, SS	242-02175	$1.00	40 EA
RL Universal Mount	242-02155	$11.75	20 EA
RL Universal Link	242-02156	$12.86	20 EA

RL-U Wire Management & Accessories			
Description	**SKU**	**MSRP**	**QTY***
Smart Clip II	232-01173	$0.44	100 EA
Smart Clip XL	232-01176	$0.61	100 EA
Wire Saver	242-92262	$2.82	20 EA
Junction Box XL with Comp Kit	242-92121	$49.95	1 Kit
Universal Wire Clamp for J Box	242-09025	$4.27	1 EA
MLPE Frame Attachment Kit	242-02151	$4.68	20 EA
Flash Track Universal Wire Clamp	242-92641	$6.44	20 EA
RL Flash Track Leveling Spacer	242-92254	$8.98	20 EA

Ultra Rail | *Rail-based Mounting*



SnapNrack Ultra Rail
The Ultimate Value in Rooftop Solar

Ultra Rail is the ultimate rail solution for mounting solar modules on the roof. The entire system is a snap to install utilizing new pre-assembled Ultra Rail Mounts that include snap-in brackets for attaching rail. Snap-in module clamps provide an intuitive install experience installers know and love.

- Industry-leading aesthetics with Universal End Clamps and snap-in End Caps that make the mounting system invisible underneath the array
- Unparalleled wire management solutions with accessories such as Junction Boxes, Universal Wire Clamps, MLPE Attachment Kits, and Conduit Clamps
- Low profile rail maintains the open channel with room for running wires resulting in a top quality finished install
- UR-40 has the largest span capabilities of any light rail solution
- UR-60 is a heavy duty profile for higher loading conditions

More Info
Ultra Rail Product Page

Ultra Rail Configuration Tool
Design a system & download a BOM to quote with the online Configuration Tool

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UR-40/60 Rail & Accessories

UR-40 Rail, Black

UR-40 Splice

UR-40 End Cap

UR-60 Rail, Black

UR-60 Splice

UR-60 End Cap

UR-40 Rail			
Description	**SKU**	**MSRP**	**QTY***
UR-40 Rail, 172", Black (Bundle of 144, priced as each)	232-02538	$60.91	144 EA
UR-40 Rail, 172", Silver (Bundle of 144, priced as each)	232-02537	$59.79	144 EA
UR-40 Rail, 172", Mill (Bundle of 144, priced as each)	232-02536	$55.75	144 EA
UR-40 Rail, 172", Black (Box of 4)	015-10207	$271.19	1 Box
UR-40 Rail, 172", Silver (Box of 4)	015-10208	$266.67	1 Box
UR-40 Rail, 172", Mill (Box of 4)	015-10209	$255.22	1 Box

UR-60 Rail			
Description	**SKU**	**MSRP**	**QTY***
UR-60 Rail 172", Black (Bundle of 120, priced as each)	232-02541	$79.81	120 EA
UR-60 Rail 172", Silver (Bundle of 120, priced as each)	232-02540	$78.96	120 EA
UR-60 Rail 172", Mill (Bundle of 120, priced as each)	232-02539	$72.50	120 EA
UR-60 Rail Set, 172", Black (Box of 4)	015-10210	$373.78	1 Box
UR-60 Rail Set, 172", Silver (Box of 4)	015-10211	$369.79	1 Box
UR-60 Rail Set, 172", Mill (Box of 4)	015-10212	$346.72	1 Box

UR-40 Rail Accessories			
Description	**SKU**	**MSRP**	**QTY***
UR-40 Splice, Silver	242-01213	$8.70	20 EA
UR-40 Splice, Black	242-01214	$9.24	20 EA
UR-40 End Cap	232-02452	$0.70	20 EA

UR-60 Rail Accessories			
Description	**SKU**	**MSRP**	**QTY***
UR-60 Splice, Silver	242-01270	$9.99	20 EA
UR-60 Splice, Black	242-01271	$10.29	20 EA
UR-60 End Cap	232-02484	$0.70	20 EA

*** QTY (Quantity) listed is the standard package and minimum order quantity. SnapNrack products are sold through distribution and may be available as individual units.**

Flashing & L Foot Attachments

Ultra Rail Umbrella L Foot with Comp Flashing *(Sold Separately)*

UR SpeedSeal™ Foot, Black

UR SpeedSeal™ DeckFoot, Black

Ultra Rail Leveling Spacer

Composition Shingle Attachments			
Description	**SKU**	**MSRP**	**QTY***
Ultra Rail Umbrella L Foot, Silver	242-01219	$6.30	20 EA
Ultra Rail Umbrella L Foot, Black	242-01220	$7.04	20 EA
Comp Flashing, 9” x 12”, Black Alum (requires Umbrella Lag)	232-01375	$5.51	20 EA
Comp Flashing, 9” x 12”, Silver Alum (requires Umbrella Lag)	232-01376	$4.57	20 EA
Comp Flashing, 9" X 12", Black Galvalume (requires Umbrella Lag)	232-01377	$4.73	20 EA
Umbrella Lag, 4”	242-92266	$1.55	20 EA
UR SpeedSeal™ Foot, Silver	242-02163	$9.50	20 EA
UR SpeedSeal™ Foot, Black	242-02167	$10.50	20 EA
Sealing Washer Lag, 4 1/2”, SS	242-02168	$1.25	20 EA
UR SpeedSeal™ DeckFoot, Silver	242-02173	$13.50	20 EA
UR SpeedSeal™ DeckFoot, Black	242-02174	$14.75	20 EA
Sealing Washer Wood Screw, #14 x 2¾”, SS	242-02175	$1.00	40 EA

Ultra Rail Attachment Components			
Description	**SKU**	**MSRP**	**QTY***
Ultra Rail Leveling Spacer, Black	242-05161	$2.87	20 EA
Ultra Rail Mounting Hardware, Black	242-01230	$3.85	20 EA
Ultra Rail Mounting Hardware, Silver	242-01229	$3.55	20 EA
Ultra Rail All Purpose L Foot (90°), Black	242-01239	$7.04	20 EA
Ultra Rail All Purpose L Foot (90°), Silver	242-01223	$7.01	20 EA

Note that the fasteners are sold separately from the Composition Shingle Roof Attachments listed above. Required fasteners are as follows:

One (1) Umbrella Lag, 242-92266, is required for each Ultra Rail Umbrella L Foot & Comp Flashing attachment.

One (1) Sealing Washer Lag, 242-02168, is required for each Ultra Rail SpeedSeal™ Foot attachment.

Four (4) Sealing Washer Wood Screws, 242-02175, are required for each Ultra Rail SpeedSeal™ DeckFoot attachment.

SnapNrack Module Attachments - Ultra Rail - S200

Module Clamps are available for all PV module frame sizes (30-46 mm). **Universal End Clamps** are a unique one-size-fits-all that slips inside the module frame – completely out of sight. The rails are cut flush with the modules and finished with SnapNrack End Caps to create a system with a flush, clean line. All Module Clamps work with Ultra Rail and Series 200 Ground Mount. Module Clamps ship pre-assembled, ready to install.

Ultra Rail Mid Clamp, Black

Universal End Clamp

Ultra Rail End Clamp, Black

Mid Clamps			
Description	**SKU**	**MSRP**	**QTY***
Ultra Rail Mid Clamp, Silver	242-02070	$4.22	20 EA
Ultra Rail Mid Clamp, Black	242-02071	$4.43	20 EA
End Clamps			
Description	**SKU**	**MSRP**	**QTY***
Universal End Clamp	242-02215	$6.28	20 EA
Ultra Rail End Clamp, Silver	242-02072	$5.77	20 EA
Ultra Rail End Clamp, Black	242-02073	$6.06	20 EA

*** QTY (Quantity) listed is the standard package and minimum order quantity. SnapNrack products are sold through distribution and may be available as individual units.**

Tile Roof Solutions

Ultra Rail Tile Roof Hook F

Ultra Rail Adjustable Tile Hook

Tile Hook Replacement Flashing, S

Tile Hook Replacement Flashing, W

Tile Roof Hooks			
Description	**SKU**	**MSRP**	**QTY***
Ultra Rail Tile Roof Hook F	242-01247	$10.86	20 EA
Ultra Rail Tile Roof Hook WS	242-01248	$14.20	20 EA
Ultra Rail Adjustable Tile Hook	242-02729	$14.89	10 EA

Ultra Rail Adjustable Tile is the one Tile Hook for all tile roofs with install compatibility on S/W and Flat tile profiles.

Ultra Rail Tile Roof Hook F is for application on flat tile roofs only. Ultra Rail Tile Roof Hook WS is for application on both W & S Shaped tile roofs.

Ultra Rail Tile Hooks ship pre-assembled with the Ultra Rail Mount.

Tile Hook Replacement Flashing			
Description	**SKU**	**MSRP**	**QTY***
Tile Hook Replacement Flashing, Flat	232-60055	$15.93	20 EA
Tile Hook Replacement Flashing, S	232-60056	$15.93	20 EA
Tile Hook Replacement Flashing, W	232-60057	$15.93	20 EA

Ultra Rail Tile Hook Replacement Flashings are for Tile Hook installations when necessary to replace broken tiles.

Deck Level Flashing for Tile			
Description	**SKU**	**MSRP**	**QTY***
PS45 Deck Level Flashing Set, (1) 9x9 & (1) 4X13	242-02723	$7.98	20 Sets
PS45 Deck Level Flashing Set, (1) 5X13 & (1) 4X17	242-02728	$8.98	20 Sets
Protecto-Tak Spray Adhesive	131-01347	$32.99	20 EA

SnapNrack Wire Management - Ultra Rail - S200

SnapNrack offers the largest set of mounting accessories to enhance the install process. SnapNrack **Wire Management Solutions** comprise a set of dedicated components to reliably and cost-effectively secure PV module and microinverter leads. All components are made of materials which have been selected for their ability to handle high UV exposure and extreme rooftop temperatures common under solar arrays.

Junction Box XL

Universal Wire Clamp

Wire Retention Clip

Smart Clip II

Ground Lug R, 6-12 AWG

Wire & Electronics Management			
Description	**SKU**	**MSRP**	**QTY***
Junction Box R for Rail	242-01104	$35.11	1 EA
Junction Box XL for Rail	242-92120	$47.20	1 EA
Junction Box XL with Comp Kit	242-92121	$54.95	1 Kit
Terminal Block Kit, 4 Circuit + RSD	242-02725	$35.00	1 EA
Universal Wire Clamp for Rail	242-02150	$3.92	20 EA
Universal Wire Clamp for J Box	242-09025	$4.27	1 EA
Snap-in Wire Retention Clip	232-01106	$0.47	20 EA
Smart Clip II	232-01173	$0.44	100 EA
Smart Clip XL	232-01176	$0.61	100 EA
MLPE Rail Attachment Kit	242-92093	$2.67	20 Kits
MLPE Frame Attachment Kit	242-02151	$4.68	20 EA

MLPE Rail Attachment Kit includes over-sized Fender Washer, Channel Nut and serrated Flange Bolt.

Grounding Solutions			
Description	**SKU**	**MSRP**	**QTY***
Ground Lug R, 6-12 AWG	242-02101	$6.01	20 EA

Conduit Supports			
Description	**SKU**	**MSRP**	**QTY***
Conduit Support Assembly, 3/4" EMT	242-02730	$5.70	20 EA
Conduit Support Assembly, 1" EMT	242-02731	$6.21	20 EA
Conduit Support Assembly, 3/4" PVC	242-02732	$5.70	20 EA
Conduit Support Assembly, 1" PVC	242-02733	$6.21	20 EA
Conduit Support for Tile, 3/4" EMT	242-02104	$5.70	20 EA
Conduit Support for Tile, 1" EMT	242-02108	$6.21	20 EA

Conduit Support 3/4" PVC

Conduit Support 3/4" EMT

Conduit Support - Tile

Tilt System Roof Attachments

Roof Type		Description	SKU	MSRP	QTY*
Foam Roof	Select this SKU	Ultra Rail Tilt-Mount Kit, 10″	242-10020	$21.56	20 EA
	Plus **ONE** of these SKUs	Ultra Rail Tilt-Mount Kit, 14″	242-10021	$22.50	20 EA
		Ultra Rail Tilt-Mount Kit, 23″	242-10022	$27.05	10 EA
Metal Roof	Select this SKU	Ultra Rail Variable Tilt Hardware Kit for Metal Roof Attachments	242-92116	$31.67	20 EA
	Plus **ONE** of these SKUs	Metal Roof Base	242-02036	$6.27	20 EA
		Standard Base Seam Clamp	242-05000	$7.57	20 EA
		Wide Base Seam Clamp	242-05001	$8.61	20 EA
		Corrugated Straddle Block	232-02421	$3.92	20 EA
Flat Roof	Select this SKU	Ultra Rail Tilt-Mount Kit, 5 1/2”	242-10019	$18.77	20 EA
	Plus **ONE** of these SKUs	Ultra Rail Tilt-Mount Kit, 10″	242-10020	$21.56	20 EA
		Ultra Rail Tilt-Mount Kit, 14″	242-10021	$22.50	20 EA
		Ultra Rail Tilt-Mount Kit, 23″	242-10022	$27.05	10 EA
	Ultra Rail Simple Tilt Front Leg 10° (no base)		242-03217	$8.00	20 EA
	Ultra Rail Simple Tilt Back Leg 10° Portrait (no base)		242-03215	$12.00	20 EA
	Ultra Rail Simple Tilt Back Leg 10° Landscape (no base)		242-03216	$10.00	20 EA

Ultra Rail Tilt-Mount Kits include include the new **OmniBase**, a Standoff Shaft and Ultra Rail Tilt Clamp (Standoff Clamp, L Foot, and Ultra Rail Mounting Hardware).
Please refer to Ultra Rail Tilt Angle Table (Nominal).

For Foam Roofs, order **Ultra Rail Tilt-Mount Kit, 1 0”** for front leg and **Ultra Rail Tilt-Mount Kit, 14”** for rear leg to obtain a desired **low fixed tilt (5° - 14°).** Order **Ultra Rail Tilt-Mount Kit, 1 0”** for front leg and **Ultra Rail Tilt-Mount Kit, 23”** for rear leg to obtain a desired **high fixed tilt (15° - 28°).**

Ultra Rail Variable Tilt Hardware Kit for Metal Roof Attachments includes L Feet, Ultra Rail Mounting Hardware, and miscellaneous hardware to complete kit for front and rear legs. Metal roof attachments (without L Foot) and section of Ultra Rail for rear leg are to be ordered separately.

Please refer to Ultra Rail Tilt Angle Table (Nominal) to obtain desired tilt angles for 5° - 30° Fixed Tilt Kit Standoffs with Ultra Rail Tilt Clamps.

Variable Tilt hardware and Simple Tilt hardware *can be* installed with Standoffs and such, they are <u>not approved</u> in SnapNrack Structural Engineering Reports.

Simple Tilt requires 4ft spacing for portrait modules and 2ft spacing for landscape modules between mounts front to rear, and is only available as a direct mount to roof structure.

Ideal for use with E-Curb (pourable penetration sealant), Simple Tilt Attachments are for application on flat roofs only.

Note that Simple Tilt SKUs are referred to in Structural Documentation as Tilt Leg Plus.

NEW

Ultra Rail Tilt-Mount with OmniBase

NEW

Ultra Rail OmniBase
(SOLD IN KITS)

Ultra Rail Variable Tilt Hardware Kit for Metal Roof Attachments

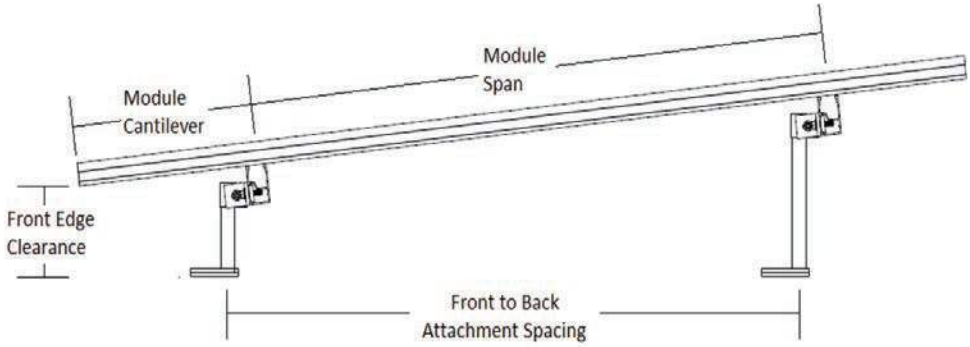
Ultra Rail Tilt Angle Table (Nominal)

5° - 30° Fixed Tilt Kits - Standoffs with Ultra Rail Tilt Clamps

Front to back attachment spacing	Landscape			Portrait		
	5 ½" & 10" Standoffs	5 ½" & 14" Standoffs	5 ½" & 23" Standoffs	5 ½" & 10" Standoffs	5 ½" & 14" Standoffs	5 ½" & 23" Standoffs
16"	16°	28°	N/A	N/A	N/A	N/A
24"	10°	20°	N/A	N/A	N/A	N/A
32"	8°	15°	28°	8°	15°	28°
48"	N/A	N/A	N/A	5°	10°	20°

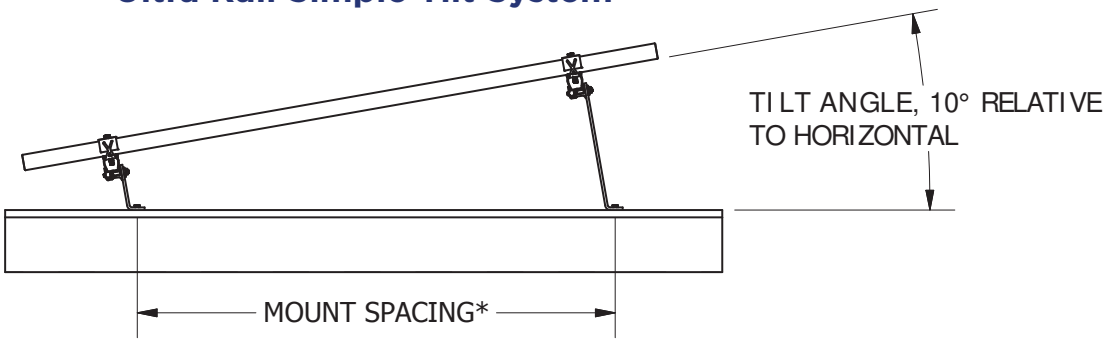
Notes:

1. Table is based on 60 cell modules
2. Table assumes mounting zone on portrait modules not exceeding 25% of module length
3. Maximum tilt angle allowed = 30° relative to horizontal
4. All tilt ups must have 5-1/2" Standoff in front



Ultra Rail Simple Tilt System

Ultra Rail Simple Tilt Portrait



*4'-0" PORTRAIT
2'-0" LANDSCAPE

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Ultra Rail Metal Roof Base w/ L Foot

Ultra Rail Standard Base Seam Clamp w/ L Foot & Lock

Ultra Rail Flush-Mount Kit, 5 ½"
Includes new OmniBase

Ultra Rail OmniBase
(SOLD IN KITS)

Rubber Rain Collar

Metal Roof Attachments

Description	SKU	MSRP	QTY*
Ultra Rail Metal Roof Base w/ L Foot	242-02158	$13.89	20 EA
Ultra Rail Standard Base Seam Clamp w/ L Foot & Lock	242-05158	$13.57	20 EA
Ultra Rail Wide Base Seam Clamp w/ L Foot & Lock	242-05159	$14.61	20 EA
Ultra Rail All Purpose L Foot (90°), Silver	242-01223	$6.68	20 EA
Ultra Rail Hanger Bolt Clamp	242-01128	$6.53	20 EA
Corrugated Straddle Block	232-02421	$3.92	20 EA
Metal Roof Base	242-02036	$7.21	20 EA
Standard Base Seam Clamp	242-05000	$7.57	20 EA
Wide Base Seam Clamp	242-05001	$8.61	20 EA

Standoff Mount Roof Attachments

Description	SKU	MSRP	QTY*
Ultra Rail Flush-Mount Kit, 5 ½"	242-10016	$16.10	20 EA
Ultra Rail Flush-Mount Kit, 7"	242-10017	$16.30	20 EA
Ultra Rail Flush-Mount Kit, 8 ½"	242-10018	$17.53	20 EA
Standoff Spacer, 1"	242-92081	$1.66	20 EA

Standoff Mount Roof Attachments are sold in kits which include the new **OmniBase** roof attachment base.

Standoff Mount Roof Accessories

Description	SKU	MSRP	QTY*
Chem Link E-Curb, 4.5" x 3.5", Gray, Pourable (Pack of 4)	131-01357	$246.84	1 Pack
Rubber Rain Collar	232-01000	$1.18	20 EA
Standoff Flashing, Straight Cone for HD Base, 18" X 18" X 4", Galv	131-01213	$18.04	12 EA
Standoff Flashing, Verde 1.0STF, Skinny Cone for Tile, 20" x 20" x 3", Dead Soft Alum	175-05001	$22.48	25 EA
Standoff Flashing, Offset Cone for 1-Hole Base, 18 ¾" x 15" x 4", Galv	131-01216	$23.20	20 EA
Standoff Flashing, Oatey 11830, No Caulk Rubber Cone, 9" x 12½", Galv	015-00162	$12.10	12 EA
Standoff Flashing, Verde 1.0SSO, Deck Level for 1-Hole Base, 10" x 12" x 1", Galv	175-05005	$9.11	25 EA

Skirt, 162”

Array Skirt			
Description	**SKU**	**MSRP**	**QTY***
Skirt Set, 162″ (Box of 6)	015-11787	$735.23	1 Box
Skirt, 162″ (Bundle of 60, priced as each)	232-01259	$108.30	60 EA
Skirt Frame Mount	242-92211	$5.23	20 EA
Skirt Splice	232-01251	$6.26	20 EA
Skirt End Cap Pair	232-01250	$2.57	20 EA

Skirt Frame Mount

Array Edge Screen			
Description	**SKU**	**MSRP**	**QTY***
Array Edge Screen, 4” Black (100’)	232-03998	$66.80	1 EA
Array Edge Screen, 6” Black (100’)	232-04077	$102.33	1 EA
Array Edge Screen, 8” Black (100’)	232-04076	$137.85	1 EA
Array Edge Screen Fastener	242-04105	$2.82	100 EA

Array Edge Screen Fastener

Misc.			
Description	**SKU**	**MSRP**	**QTY***
Original Channel Nut	232-02005	$1.13	20 EA
UEC Rail Cutting Tool	232-02284	$14.25	20 EA
Rail Cover, 48”	232-01033	$10.07	20 EA

*** QTY (Quantity) listed is the standard package and minimum order quantity. SnapNrack products are sold through distribution and may be available as individual units.**

Series 200 | *Ground Mount*

SnapNrack Series 200
The Adaptable High Quality Solution for Ground Mount Installations

The Series 200 Ground Mount System is designed to attach easily to a standard 1 ½" galvanized pipe structure using structural pipe fittings. Using a standard three to four-module high assembly, the system is efficient and flexible while optimizing materials and minimizing system footprint. Industry leading installation times are achieved with unique snap-in fasteners.

- Assembles easily using snap-in bonding pipe clamps that connect the rails
- Fully compatible with all SnapNrack module clamps and accessories
- Ground rail channel keeps wires neatly organized providing a clean finished look to every install
- Industry's largest offering of Wire Management accessories include snap-in Junction Boxes, Universal Wire Clamps, as well as ground rail channel to keep wires neatly organized
- Maximum versatility with the ability to configure easily to desired tilt between 0 and 45 degrees
- Using pipe structural fittings, labor hours to install the system are typically less than required for a more complicated racking system not using standardized components

More Info
Series 200 Ground Mount Product Page

Configuration Tool
Design a system & download a BOM to quote with the online Configuration Tool

Visit Resource Library
Download Structural Engineering, Installation Manuals & System Drawings

Series 200 Components

Ground Rail

Series 200 Rail			
Description	**SKU**	**MSRP**	**QTY***
Ground Rail Set, 172”, Silver (Box of 4)	015-09857	$536.82	1 Box
Ground Rail, 172”, Silver (Bundle of 112)	232-02542	$122.29	112 EA
Ground Rail End Cap	232-01043	$2.87	20 EA
Ground Rail Splice	242-04009	$16.88	20 EA

Bonding Pipe Clamp

Double Adjustable Socket Tee, Hollaender

Series 200 Structural Fittings			
Description	**SKU**	**MSRP⬩**	**QTY***
Bonding Pipe Clamp for 1 ½” Pipe	242-09004	$7.48	20 EA
Single Socket Tee, Hollaender (5EXT-8), 1 ½”, AL-MG	172-05818	$33.37	1 EA
Single Adjustable Socket Tee, Hollaender (17-8), 1 ½”, AL-MG	172-05803	$30.87	1 EA
Double Adjustable Socket Tee, Hollaender (19E-8), 1 ½”, AL-MG	172-05804	$39.93	1 EA
Rectangular Base Flange, Hollaender (46-8), 1 ½”, AL-MG	172-05807	$28.70	1 EA
Plug End, Hollaender (62-8), 1 ½” Sched 40, AL	172-05808	$7.85	1 EA
Adjustable Reducing Elbow/Tee, Hollaender (17-98) 2” x 1 ½", AL-MG	172-05819	$47.50	25 EA
Adjustable Reduce Cross Assembly, Hollaender (19-98) 2” x 1 ½”, AL-MG	172-05820	$69.47	25 EA
Reducing Tee, Hollaender (5-89) 1 ½” x 2", AL-MG	172-05821	$38.11	25 EA

⬩ MSRP from third party manufacturers like Hollaender are subject to change without 30 day notice.

*** QTY (Quantity) listed is the standard package and minimum order quantity. SnapNrack products are sold through distribution and may be available as individual units.**

Place Your Order

Contact your SnapNrack distributor, which can be found at **www.SnapNrack.com/where-to-buy**, contact us directly at **contact@snapnrack.com,** or call us **Toll Free at (877) 732-2860** for technical support.

SnapNrack distributors have trained knowledgeable staff that can provide product design and ordering assistance.

MSRP

Prices published in this document are Manufacturer Suggested Retail Prices (MSRP) and should be used for reference only. Prices are subject to change without notice. The quantity (QTY) shown is based on the standard package and is the recommended order quantity.

Warranty

All SnapNrack products are covered by a **25-year limited warranty**. For complete details please view the online SnapNrack's Manufacturers Limited Product Warranty.

SnapNrack®

IMO

Pushbuttons

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Ø22.0mm Product Range

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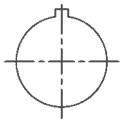
Mounting Hole
Ø 22.5mm

With Key Way



Without Key Way

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Wrench for Actuators
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Pushbuttons

(IP67), cULus Type 12

Push Buttons *(Actuator Caps Markable)*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	N/A	B3DRED	BS3DRED	BC3DRED	10	0.014
Red	0	B3DRED-0	BS3DRED-0	BC3DRED-0	10	0.014
Green	N/A	B3DGREEN	BS3DGREEN	BC3DGREEN	10	0.014
Green	I	B3DGREEN-I	BS3DGREEN-I	BC3DGREEN-I	10	0.014
Green	II	B3DGREEN-II	BS3DGREEN-II	BC3DGREEN-II	10	0.014
Green	→	B3DGREEN-PF	BS3DGREEN-PF	BC3DGREEN-PF	10	0.014
Yellow	N/A	B3DYELLOW	BS3DYELLOW	BC3DYELLOW	10	0.014
Blue	N/A	B3DBLUE	BS3DBLUE	BC3DBLUE	10	0.014
White	N/A	B3DWHITE	BS3DWHITE	BC3DWHITE	10	0.014
Black	N/A	B3DBLACK	BS3DBLACK	BC3DBLACK	10	0.014
Black	→	B3DBLACK-PF	BS3DBLACK-PF	BC3DBLACK-PF	10	0.014

Push Buttons Maintained *(Actuator Caps Markable)*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc
Red	N/A	B3DRRED	BS3DRRED	BC3DRRED	10	0.014
Green	N/A	B3DRGREEN	BS3DRGREEN	BC3DRGREEN	10	0.014
Yellow	N/A	B3DRWHITE	BS3DRYELLOW	BC3DRYELLOW	10	0.014
Blue	N/A	B3DR-BLUE	BS3DRBLUE	BC3DRBLUE	10	0.014
White	N/A	B3DR-WHITE	BS3DRWHITE	BC3DRWHITE	10	0.014
Black	N/A	B3DR-BLACK	BS3DRBLACK	BC3DRBLACK	10	0.014

Mushroom Head *Ø28mm*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	N/A	B3P1RED	BS3P1RED	BC3P1RED	10	0.017
Red	0	B3P1RED-0	BS3P1RED-0	BC3P1RED-0	10	0.017
Green	N/A	B3P1GREEN	BS3P1GREEN	BC3P1GREEN	10	0.017
Yellow	N/A	B3P1YELLOW	BS3P1YELLOW	BC3P1YELLOW	10	0.017
Blue	N/A	B3P1BLUE	BS3P1BLUE	BC3P1BLUE	10	0.017

Mushroom Head *Ø40mm*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	0	B3P14RED-0	BS3P14RED-0	BC3P14RED-0	10	0.020

Mushroom Head *Ø40mm*

Colour	Symbol	Part Number	Pack Pcs.	Weight kg/pc
Red	N/A	BS3P44TRED	10	0.028

Foot and Palm Switch *Ø70mm*

Colour	Symbol	Part Number	Pack Pcs.	Weight kg/pc
Red	N/A	BS3P14PRED	1	0.062
Grey	N/A	BS3P14PGREY	1	0.062

Emergency Stop Pushbuttons

(IP67), c UL us Type 12

EMERGENCY STOP Push Buttons *According to EN ISO 13850, push to trip, pull to release, Ø40mm*

Colour	Marking	Part Number	Pack Pcs.	Weight kg/pc.
Red	30mm	BS3P44RED	10	0.028
Red	38mm	BS3P45RED	10	0.028

EMERGENCY STOP Push Buttons *According to EN ISO 13850, release by key, Ø40mm*

Colour	Symbol/High	Part Number	Pack Pcs.	Weight kg/pc.
Red	38mm	BS3P44S3	1	0.050
Lock Ronis R455	N/A	B4-R455	N/A	N/A

EMERGENCY STOP Push Buttons *Release by turning, Ø28mm*

Colour	Marking	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	N/A	B3P3RED	BS3P3RED	BC3P3RED	10	0.017
Red	0	B3P3RED-0	BS3P3RED-0	BC3P3RED-0	10	0.017

EMERGENCY STOP Push Buttons *Release by turning, Ø40mm*

Colour	Marking	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	0	B3P34RED-0	BS3P34RED-0	BC3P34RED-0	10	0.020
Red	→	B3P34RED-PF	BS3P34RED-PF	BC3P34RED-PF	10	0.020
Red (Illuminated)	N/A	B3P34LRED	BS3P34LRED	BC3P34LRED	10	0.020

EMERGENCY STOP Push Buttons *Release by turning, Ø70mm*

Colour	Part Number	Pack Pcs.	Weight kg/pc.
Red	BS3P34PRED	1	0.062

Yellow Disk *Thickness 1mm, Ø70mm*

Description	Part Number	Pack Pcs.	Weight kg/pc.
Neutral	B3-7603	1	0.004
With marking EMERGENCY STOP	B3-7603-2	1	0.004
2-side markings: NOT-AUS / EMERGENCY STOP	B3-7603-12	1	0.004
2-side markings: ARRET D`URGENCE / NØDSTOP	B3-7603-34	1	0.004
2-side markings: ARRET D`URGENCE / NOODSTOP	B3-7603-35	1	0.004

Protection Cover Against Unintentional Manupulation *Thickness 1mm*

Description	Part Number	Pack Pcs.	Weight kg/pc.
For Push Buttons Ø28mm and Ø40mm Yellow	B3-SK-YELLOW	1	0.04

Rotary & Toggle Knobs

c UL us *Type 12*

Rotary Knobs and Swing Knobs *IP65, Black*

Diagram	Type	Knob	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
	Maintained 60°	Rotary	B3KN2	BS3KN2	BC3KN2	10	0.020
		Swing	B3KRN2	BS3KRN2	BC3KRN2	10	0.020
	Spring Return 60°	Rotary	B3KN8	BS3KN8	BC3KN8	10	0.020
		Swing	B3KRN8	BS3KRN8	BC3KRN8	10	0.020
	Spring Return 60°	Rotary	B3KN1	BS3KN1	BC3KN1	10	0.020
		Swing	B3KRN1	BS3KRN1	BC3KRN1	10	0.020
	Maintained 60°	Rotary	B3KN3	BS3KN3	BC3KN3	10	0.020
		Swing	B3KRN3	BS3KRN3	BC3KRN3	10	0.020
	Maintained/Spring Return 60°	Rotary	B3KN6	BS3KN6	BC3KN6	10	0.020
	Maintained/Spring Return 60°	Rotary	B3KN7	BS3KN7	BC3KN7	10	0.020
	Maintained 120°	Rotary	B3KN9	BS3KN9	BC3KN9	10	0.020
	Maintained 90°	Rotary	B3KN10	BS3KN10	BC3KN10	10	0.020

Illuminated Rotary Knobs and Swing Knobs *Clear IP67, Lamp Max. 1.2W Black*

Diagram	Type	Knob	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
	Maintained 90°	Rotary	B3KL2	BS3KL2	BC3KL2	10	0.016
	Sring Return 60°	Rotary	B3KL1	BS3KL1	BC3KL1	10	0.016
		Swing	B3KRL1	BS3KRL1	BC3KRL1	10	0.016
	Maintained 60°	Rotary	B3KL3	BS3KL3	BC3KL3	10	0.016
		Swing	B3KRL3	BS3KRL3	BC3KRL3	10	0.016
	Maintained/Spring Return 60°	Rotary	B3KL6	BS3KL6	BC3KL6	10	0.016

Toggle *IP65*

Diagram	Type	Knob	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
O - I	N/A	N/A	B3E	BS3E	BC3E	10	0.017

Key Operated Rotary Switch With lock Ronis

Diagram	Type	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
	Maintained 60°	B3SAR0	BS3SAR0	BC3SAR0	1	0.044
	Maintained 60°	B3SAR1	BS3SAR1	BC3SAR1	1	0.044
	Maintained 60°	B3SAR01	BS3SAR01	BC3SAR01	1	0.044
	Spring Return 60°	B3SAT0	BS3SAT0	BC3SAT0	1	0.044
	Maintained 60°	B3SARR0	BS3SARR0	BC3SARR0	1	0.044
	Maintained 60°	B3SARR102	BS3SARR102	BC3SARR102	1	0.044
	Spring Return/Maintained 60°	B3SATR02	BS3SATR02	BC3SATR02	1	0.044
	Spring Return 60°	B3SATT0	BS3SATT0	BC3SATT0	1	0.044
N/A	Spare key lock Ronis R455	N/A	N/A	B4-R455	1	0.007

Illuminated Pushbuttons & Lens Caps

c UL us *Type 12*

Illuminated Push Buttons IP67, lamp max. 1.9W

Colour	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	B3DLRED	BS3DLRED	BC3DLRED	10	0.014
Green	B3DLGREEN	BS3DLGREEN	BC3DLGREEN	10	0.014
Yellow	B3DLYELLOW	BS3DLYELLOW	BC3DLYELLOW	10	0.014
Blue	B3DLBUE	BS3DLBLUE	BC3DLBLUE	10	0.014
White	B3DLWHITE	BS3DLWHITE	BC3DLWHITE	10	0.014

Illuminated Push Buttons Maintained IP67, lamp max. 1.9W

Colour	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	B3DLRRED	BS3DLRRED	BC3DLRRED	10	0.014
Green	B3DLRGREEN	BS3DLRGREEN	BC3DLRGREEN	10	0.014
Yellow	B3DLRYELLOW	BS3DLRYELLOW	BC3DLRYELLOW	10	0.014
Blue	B3DLRBLUE	BS3DLRBLUE	BC3DLRBLUE	10	0.014
White	B3DLRWHITE	BS3DLRWHITE	BC3DLRWHITE	10	0.014

Double Push Buttons With Indicator Lamp in white, lamp max. 1.9W, With non-standard marking upon request

Colour	Marking	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Green & Red	N/A	B3DT-GRE/RED[1)]	BS3DT-GRE/RED	BC3DT-GRE/RED	10	0.016
White & Black	N/A	B3DT-WHITE/BLACK[1)]	BS3DT-WHITE/BLACK	BC3DT-WHITE/BLACK	10	0.016
Green & Red	I & 0	B3DT-GRE-I/RED-O[1)]	BS3DT-GRE-1/RED-O	BC3DT-GRE-1/RED-O	10	0.016
White & Black	I & 0	B3DT-WHITE-I/BLACK-O[1)]	BS3DT-WHITE-1/BLACK-O	BC3D-WHITE-1/BLACK-O	10	0.016

Lens Caps IP67, with fresnel lens, lamp max. 1.9W, laser marking on request

Colour	Part Number	Pack Pcs.	Weight kg/pc.
Red	B3RRED	10	0.009
Green	B3RGREEN	10	0.009
Yellow	B3RYELLOW	10	0.009
Blue	B3RBUE	10	0.009
Clear	B3RVCLEAR	10	0.009
White	B3RWHITE	10	0.009

Suitable for Alu, Black and Chrome

Lens Caps Low, IP67, with fresnel lens, lamp max. 1.9W, laser marking on request

Colour	Part Number	Pack Pcs.	Weight kg/pc.
Red	B3RNRED	10	0.008
Green	B3RNGREEN	10	0.008
Yellow	B3RNYELLOW	10	0.008
Blue	B3RNBLUE	10	0.008
White	B3RNWHITE	10	0.008

Suitable for Alu, Black and Chrome

[1)] Plastic Ring in Alu design

Pushbutton Sets

With Contact Block and Connector

Push Buttons *IP67*

Actuator Colour	Symbol	Add On	Part Number	Pack Pcs.	Weight kg/pc.
Black	N/A	+connector +1NO	BS3DBLACK/10	1	0.037
Green	N/A	+connector +1NO	BS3DGREEN10	1	0.037
Yellow	N/A	+connector +1NO	BS3DYELLOW/10	1	0.037
Blue	N/A	+connector +1NO	BS3DBLUE/10	1	0.037
Red	N/A	+connector +1NC	BS3DRED/01	1	0.037
Green	I	+connector +1NO	BS3DGREEN-I/10	1	0.037
Red	O	+connector +1NC	BS3DRED-0/01	1	0.037

Double Push Buttons *IP65*

Actuator Colour	Add On	Part Number	Pack Pcs.	Weight kg/pc.
Green/Red	+connector +1NO +1NC	BS3DT-GRE/RED11	1	0.049

EMERGENCY STOP Push Buttons *IP67, Ø40mm*

Description	Add On	Part Number	Pack Pcs.	Weight kg/pc.
Pull to release acc. EN ISO 13850	+connector +1NO +1NC	BS3P44RED/11	1	0.061
Key release acc. EN ISO 13850	+connector +1NO +1NC	BS3P44S3RED/11	1	0.083
Twist release	+connector +1NO +1NC	BS3P34RED-0/11	1	0.053

Rotary Knobs *IP65*

Diagram	Add On	Part Number	Pack Pcs.	Weight kg/pc
	+connector +1NO	BS3KN2/10	1	0.043
	+connector +1NO +1NC	BS3KN2/11	1	0.053
	+connector +2NO	BS3KN3/20	1	0.053
	+connector +2NO	BS3KN1/20	1	0.053

Key Operated Rotary Switch *With Lock Ronis 455, IP65*

Key: *Key removeable in*

Diagram	Add On	Part Number	Pack Pcs.	Weight kg/pc
	+connector +1NO	BS3SAR 0/10	1	0.057
	+connector +1NO	BS3SAR 01/10	1	0.057
	+connector +1NO	BS3SAT 0/10	1	0.057
	+connector +2NO	BS3SARR 102/20	1	0.067
	+connector +2NO	BS3SARR 0/20	1	0.067

Connectors

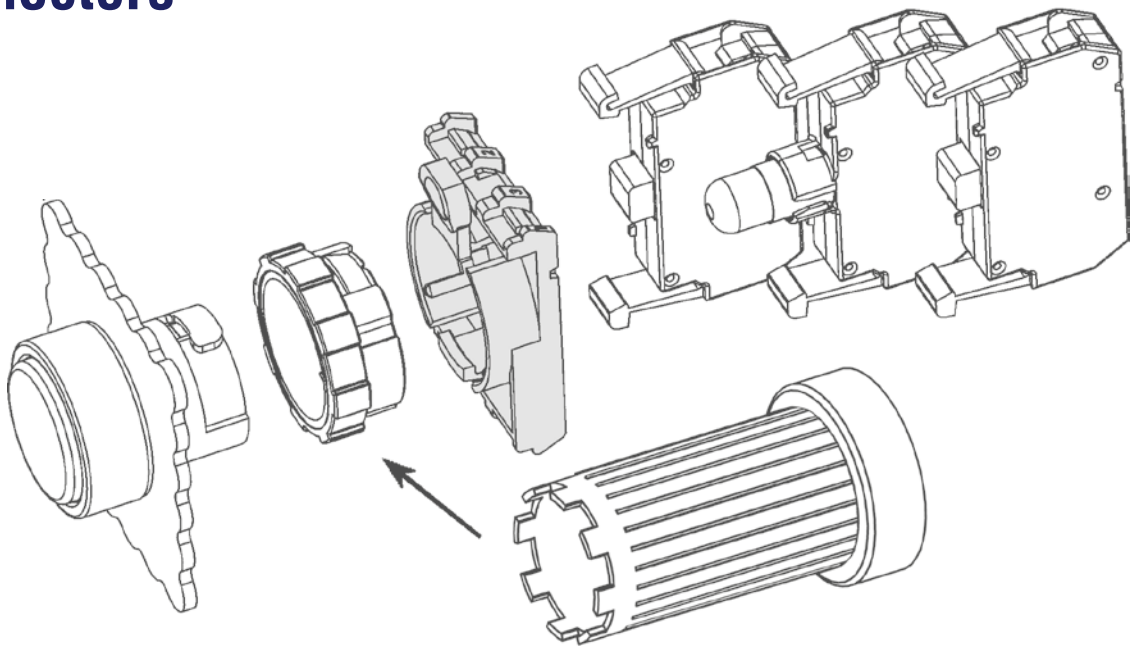
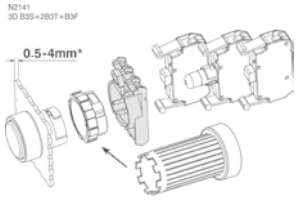
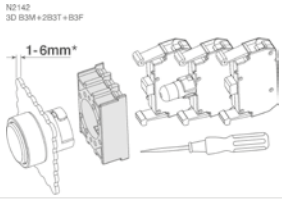


Diagram	Part Number	Pack Pcs.	Weight kg/pc.
	B35	10	0.013
	B3M	10	0.013

Includes thickness from label holder and yellow disk.

Accessories

Accessory	Description	Part Number	Pack Pcs.	Weight kg/pc.
Wrench	For mounting of Actuators and Lens Caps B(S)3	J7049	1	0.018
Marking Plate	For marking of Contact Blocks B3T and Lamp Holders B3F	P672-1	10	0.001
Lamp Installer	Used to install or replace lamps BA9s	B4-7408	1	0.010
Spare Key	For B(S)3SA.. and BS3P44S3, Ronis R455	B4-R455	1	0.007
Spare Key	For B(S)3SB.. , Ronis R786	B4-R786	1	0.007
Hole Plug Black	Black - For fixing holes Ø22.5mm	B3-DU-BLACK	10	0.007
Hole Plug Grey	Grey - For fixing holes Ø22.5mm	B3-DU-GREY	10	0.007
Sealing Cover	Ambient temperature 0° - +50°C	P279-1	1	0.003
Sealing Cover	Petrol resistant, not for B3D..R.. (maintained), ambient temperature -25° - +55°C	P279-3	1	0.003
Sealing Cover	For Double Push Buttons, petrol resistant, ambient temperature -25° +55°C	P279-DT	1	0.003
Protection Cover Yellow	Yellow - Thickness 1mm	BS-SK-YELLOW	1	0.04
Protection Cover Grey	Grey - Thickness 1mm	BS-SK-GREY	1	0.04
Protection Ring with Thread Black	Black	P921-1	1	0.012
Protection Ring with Thread Chrome	Chrome	P921-2	1	0.012
Protection Ring with Thread Alu	Alu	P921-3	1	0.012


Wrench


Lamp Installer


Hole Plug


Protection Cover

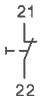
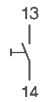

Protection Ring

Contact Blocks and Lamp Holders

For Panel Mounting

Contact Blocks *Screw Terminals, Contact Blocks with gold contacts (B3T..G) on request, suitable for 17V= /1mA and for difficult ambient conditions*

Key: ⊖ *NC Contact has a positive opening according to IEC/EN 60947-5-1*

Diagram	Voltage	Description	Part Number	Pack Pcs.	Weight kg/pc.
	Max. 690V AC	1 NC ⊖	B3T01[2)]	10	0.010
	Max. 690V AC	1 NO	B3T10[2)]	10	0.010

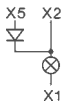
Contact Blocks *RAST 5 Terminal (Note Coding)*

Diagram	Voltage	Description	Part Number	Pack Pcs.	Weight kg/pc.
N/A	Actuator Insert	To actuate the center contact block	P642	10	0.001

Lamp Holders *Socket BA9s*

Diagram	Voltage	Description	Part Number	Pack Pcs.	Weight kg/pc.
	Max. 440V AC	Direct connection, for lamps max. 1.9W (Take care for active power consumption)	B3F	10	0.012

Lamp Holders For Lamp Test Circuits *Socket BA9s*

Diagram	Voltage	Description	Part Number	Pack Pcs.	Weight kg/pc.
	Max. 440V AC	Direct connection. For lamps Max 1.7W (Active power consumption)	B3FT	10	0.020

Lamps

Glow-discharge Lamps

Socket BA9s Lamp Voltage	Power Consumption	Part Number	Pack Pcs.	Weight kg/pc.
220-250V AC	0.3W for clear, red, yellow lens caps	NEON220-250	100	0.005

LED Lamps[2] *10 Years Lifetime*

Socket BA9s Lamp Voltage	Power Consumption	Part Number	Pack Pcs.	Weight kg/pc.
20-30V AC/DC	17mA / 0.4W for Red Lens Caps	B3-L24A-RED	10	0.005
20-30V AC/DC	17mA / 0.4W for Green Lens Caps	B3-L24A-GREEN	10	0.005
20-30V AC/DC	17mA / 0.4W for Green Lens Caps	B3-L24A-YELLOW	10	0.005
20-30V AC/DC	17mA / 0.4W for Blue Lens Caps	B3-L24A-BLUE	10	0.005
20-30V AC/DC	17mA / 0.4W for White Lens Caps	B3-L2A-WHITE	10	0.005
90-120V AC/DC	7mA / 0.8W for Red Lens Caps	B3-L110-RED	10	0.005
90-120V AC/DC	7mA / 0.8W for Green Lens Caps	B3-L110-GREEN	10	0.005
90-120V AC/DC	7mA / 0.8W for Yellow Lens Caps	B3-L110-YELLOW	10	0.005
90-120V AC/DC	7mA / 0.8W for Blue Lens Caps	B3-L110-BLUE	10	0.005
90-120V AC/DC	7mA / 0.8W for White Lens Caps	B3-L110-WHITE	10	0.005
200-250V AC/DC	4mA / 0.9W for Red Lens Caps	B3-L230-RED	10	0.005
200-250V AC/DC	4mA / 0.9W for Green Lens Caps	B3-L230-GREEN	10	0.005
200-250V AC/DC	4mA / 0.9W for Yellow Lens Caps	B3-L230-YELLOW	10	0.005
200-250V AC/DC	4mA / 0.9W for Blue Lens Caps	B3-L230-BLUE	10	0.005
200-250V AC/DC	4mA / 0.9W for White Lens Caps	B3-L230-WHITE	10	0.005

Filament Lamps

Socket BA9s Lamp Voltage	Power Consumption	Part Number	Pack Pcs.	Weight kg/pc.
12V	1.2W for all Lens Caps	Lamp 12V	50	N/A
24V	1.2W for all Lens Caps	Lamp 24V	50	0.005
42V	1.2W for all Lens Caps	Lamp 42V	50	0.005
48V	1.2W for all Lens Caps	Lamp 48V	50	0.005
60V	1.2W for all Lens Caps	Lamp 60V	50	0.005
110/120V[1]	1.5/1.8W for all Lens Caps	Lamp 110V	50	0.005

[1] Voltage marking 130V/2W max. rated voltage 120V/1.8W
[2] Suitable for B3FT lamp test holders

Label Holders and Legend Plates

Label Holder *Marking 1 or 2 Lines*

Description/Marking	Part Number	Pack Pcs.	Weight kg/pc.
For Legend Plate BK4 black, Thickness 0.8mm	P751	100	0.0002
Label holder for legend plate BK4, yellow, Thickness 0.8mm	P751-3	10	0.0002

Legend Plate Alu For Label Holder P751 *Marking 1 or 2 Lines*

Part Number	Marking	Part Number	Marking	Pack Pcs.	Weight kg/pc.
BK4-9736	Blank	N/A	N/A	10	0.0002
BK4-I	I	BK4-II	II	10	0.0002
BK4-III	III	BK4-IV	IV	10	0.0002
BK4-V	V	N/A	N/A	10	0.0002
BK4--->	←	BK4-<--	←	10	0.0002
BK4-0-I	0 I	BK4-H 0 A	H 0 A	10	0.0002
BK4-0___I	0 I	BK4-1 0 2	1 0 2	10	0.0002
BK4-START	START	BK4-STOP	STOP	10	0.0002
BK4-ON	ON	BK4-OFF	OFF	10	0.0002
BK4-ON/OFF	ON/OFF	BK4-OFF	OFF	10	0.0002
BK4-POWERON	POWER ON	N/A	N/A	N/A	N/A
BK4-PLC-HEALTHY	PLC HEALTHY	N/A	N/A	N/A	N/A
BK4-CONTROL-ON	CONTROL ON	N/A	N/A	N/A	N/A
BK4-FORWARD	FORWARD	BK4-FAULT	FAULT	10	0.0002
BK4-REVERSE	REVERSE	BK4-TRIPPED	TRIPPED	10	0.0002
BK4-MAN-AUTO	MAN-AUTO	BK4-RUNNING	RUNNING	10	0.0002

Legend Plate With Non-standard Marking *Marking 1 or 2 Lines*

Description/Marking	Part Number	Pack Pcs.	Weight kg/pc.
Text 1 line, max 11 letters, letter height 3mm	BK4-...	1	0.0002
Text 2 lines, max 2 X 11 letters, letter height 3mm	BK4-...-...	1	0.0002

Legend Plate Yellow For Label Holder P751-3 *Marking 1 or 2 Lines*

Description/Marking	Part Number	Pack Pcs.	Weight kg/pc.
Legend Plate yellow without marking	BK4-10827	10	0.0002
Legend Plate yellow with marking NOT-AUS	BK4-10827-1	10	0.0002
Legend Plate yellow with marking EMERGENCY STOP	BK4-10827-2	10	0.0002
Legend Plate yellow with marking ARRET D`URGENCE	N/A	N/A	0.0002

Label Holder *Marking 3 or 4 Lines*

Description/Marking	Part Number	Pack Pcs.	Weight kg/pc.
Label Holder for Legend Plate BK8, black, Thickness 0.8mm	P761	10	0.002
Label Holder for Legend Plate BK8, yellow, Thickness 0.8mm	P761-3	10	0.002
Label Holder for BK8, for Double Push Buttons only	P761-DT	10	0.002

Label Holders and Legend Plates

Legend Plate BK8 For Label Holder P761 Marking 3 or 4 Lines

Description/Marking	Part Number	Pack Pcs.	Weight kg/pc.
Legend Plate without marking	BK8-9736	10	0.0004
Text 3 lines, max. 3 x 11 letters, letter height 3mm	BK8-...-...-...	10	0.0004
Text 4 lines, max. 4 x 11 letters, letter height 3mm	BK8-...-...-...	10	0.0004

Actuator Caps with Text

The Part Number must be completed with the code for colours (see table)

Part Number	Suffix for Marking	Marking	Part Number	- Suffix for Marking	Marking	Pack Pcs.	Weight kg/pc.
DK-BLACK	...-TEST	TEST	DK(L)	..-EMERGENCY STOP	EMERGENCY STOP	10	0.001
DK(L)	...-START	START	DK(L)	...-STOP	STOP	10	0.001
DK(L)	...-ON	ON	DK(L)	...-OUT	OUT	10	0.001
DK-RED	...-STOP	STOP	DK-BLUE	...-RESET	RESET	10	0.001

Actuator Caps with Symbols

The Part Number must be completed with the code for colours (see table)

Part Number	Suffix for Marking	Marking	Part Number	- Suffix for Marking	Marking	Pack Pcs.	Weight kg/pc.
DK(L)	..-100		DK(L)	..-101		10	0.001
DK(L)	..-102		DK(L)	..-103		10	0.001
DK(L)	..-200		DK(L)	..-201		10	0.001
DK(L)	..-202		DK(L)	..-203		10	0.001
DK(L)	..-204		DK(L)	..-205		10	0.001
DK(L)	..-300		DK(L)	..-301		10	0.001
DK(L)	..-302		DK(L)	..-303		10	0.001
DK(L)	..-304		DK(L)	..-305		10	0.001
DK(L)	..-306		DK(L)	..-307		10	0.001
DK(L)	..-400		DK(L)	..-401		10	0.001
DK(L)	..-402		DK(L)	..-403		10	0.001
DK(L)	..-404		DK(L)	..-405		10	0.001
DK(L)	..-406		DK(L)	..-407		10	0.001
DK(L)	..-408		DK(L)	..-409		10	0.001
DK(L)	..-410		DK(L)	..-411		10	0.001
DK(L)	..-412		DK(L)	..-413		10	0.001

Code for Colours

Colour	For Buttons*	For Illuminated Buttons*
Red	DK-RED-..	DKL-RED-..
Green	DK-GREEN-..	DKL-GREEN-..
Yellow	DK-YELLOW-..	DKL-YELLOW-..
Blue	DK-BLUE-..	DKL-BLUE-..
White	DK-WHITE-..	DKL-WHITE-..
Black	DK-BLACK-..	DKL-BLACK-..

*Must specify print

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Ø30.0mm Product Range

IP67 (IP65)

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Ø 30.5mm

Connectors
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EMERGENCY STOP Buttons

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LED
24-230V

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6-130V

Glow-discharge

230V

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Wrench
J7049

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Pushbuttons Ø30mm

IP67

Push Buttons *Actuator Caps Markable*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	N/A	B5DRED	BS5DRED	BC5DRED	10	0.029
Red	0	B5DRED-0	BS5DRED-0	BC5DRED-0	10	0.029
Green	N/A	B5DGREEN	BS5DGREEN	BC5DGREEN	10	0.029
Green	I	B5DGREEN-I	BS5DGREEN-I	BC5DGREEN-I	10	0.029
Green	II	B5DGREEN-II	BS5DGREEN-II	BC5DGREEN-II	10	0.029
Green	→	B5DGREEN-PF	BS5DGREEN-PF	BC5DGREEN-PF	10	0.029
Yellow	N/A	B5DYELLOW	BS5DYELLOW	BC5DYELLOW	10	0.029
Blue	N/A	B5DBLUE	BS5DBLUE	BC5DBLUE	10	0.029
White	N/A	B5DWHITE	BS5DWHITE	BC5DWHITE	10	0.029
Black	N/A	B5DBLACK	BS5DBLACK	BC5DBLACK	10	0.029
Black	→	B5DBLACK-PF	BS5DBLACK-PF	BC5DBLACK-PF	10	0.029

Push Buttons Maintained *Actuator Caps Markable*

Colour	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	B5DRRED	BS5DRRED	BC5DRRED	10	0.029
Green	B5DRGREEN	BS5DRGREEN	BC5DRGREEN	10	0.029
Yellow	B5DRYELLOW	BS5DRYELLOW	BC5DRYELLOW	10	0.029
Blue	B5DRBLUE	BS5DRBLUE	BC5DRBLUE	10	0.029
White	B5DRWHITE	BS5DRWHITE	BC5DRWHITE	10	0.029
Black	B5DRBLACK	BS5DRBLACK	BC5DRBLACK	10	0.029

Mushroom Head *Ø28mm*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	N/A	B5P1RED	BS5P1RED	BC5P1RED	10	0.032
Red	0	B5P1RED-0	BS5P1RED-0	BC5P1RED-0	10	0.032
Green	N/A	B5P1GREEN	BS5P1GREEN	BC5P1GREEN	10	0.032
Yellow	N/A	B5P1YELLOW	BS5P1YELLOW	BC5P1YELLOW	10	0.032
Blue	N/A	B5P1BLUE	BS5P1BLUE	BC5P1BLUE	10	0.032
Black	N/A	B5P1BLACK	BS5P1BLACK	BC5P1BLACK	10	0.032

Mushroom Head *Ø40mm*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	0	B5P14RED-0	BS5P14RED-0	BC5P14RED-0	10	0.035

Emergency Stop Push Buttons *Ø28mm, release by turning, with Yellow Ring*

Colour	Symbol	Alu	Pack Pcs.	Weight kg/pc.
Red	N/A	B5P3RED-RGE	10	0.032
Red	0	B5P3RED-0-RGE	10	0.032

Emergency Stop Push Buttons *Ø40mm, release by turning*

Colour	Symbol	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	0	B5P34RED-0	BS5P34RED-0	BC5P34RED-0	10	0.035

Rotary Knobs & Illuminated Pushbuttons Ø30mm

IP67

Yellow Disk for Emergency Stop Push Buttons, Ø40mm, release by turning

Colour	Alu	Pack Pcs.	Weight kg/pc.
Neutral	B5-7603	1	0.004
With marking EMERGENCY STOP	B5-7603-1	1	0.004
With marking EMERGENCY STOP	B5-7603-2	1	0.004

Rotary Knobs and Swing Knobs IP65, Black

Diagram	Type	Knob	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
	Maintained 60°	Rotary	B5KN2	BS5KN2	BC5KN2	10	0.035
		Swing	B5KRN2	BS5KRN2	BC5KRN2	10	0.035
	Spring Return 60°	Rotary	B5KN8	BS5KN8	BC5KN8	10	0.035
		Swing	B5KRN8	BS5KRN8	BC5KRN8	10	0.035
	Spring Return 60°	Rotary	B5KN1	BS5KN1	BC5KN1	10	0.035
		Swing	B5KRN1	BS5KRN1	BC5KRN1	10	0.035
	Maintained 60°	Rotary	B5KN3	BS5KN3	BC5KN3	10	0.035
		Swing	B5KRN3	BS5KRN3	BC5KRN3	10	0.035
	Maintained/Spring Return 60°	Rotary	B5KN6	BS5KN6	BC5KN6	10	0.035
	Maintained/Spring Return 60°	Rotary	B5KN7	BS5KN7	BC5KN7	10	0.035
	Maintained 120°	Rotary	B5KN9	BS5KN9	BC5KN9	10	0.035
	Maintained 90°	Rotary	B5KN10	BS5KN10	BC5KN10	10	0.035

Illuminated Rotary Knobs and Swing Knobs IP67, Clear, Lamp Max. 1.2W

Diagram	Type	Knob	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
	Maintained 90°	Rotary	B5KL2	BS5KL2	BC5KL2	10	0.031
	Sring Return 60°	Rotary	B5KL1	BS5KL1	BC5KL1	10	0.031
		Swing	B5KRL1	BS5KRL1	BC5KRL1	10	0.031
	Maintained 60°	Rotary	B5KL3	BS5KL3	BC5KL3	10	0.031
		Swing	B5KRL3	BS5KRL3	BC5KRL3	10	0.031
	Maintained/Spring Return 60°	Rotary	B5KL6	BS5KL6	BC5KL6	10	0.031

Toggle IP65

Diagram	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
O - I	B5E	BS5E	BC5E	10	0.032

Key Operated Rotary Switch *With Lock Ronis*

Key: *Key removeable in*

Diagram	Type	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
	Maintained 60°	B5SAR0	BS5SAR0	BC5SAR0	1	0.059
	Maintained 60°	B5SAR1	BS5SAR1	BC5SAR1	1	0.059
	Maintained 60°	B5SAR01	BS5SAR01	BC5SAR01	1	0.059
	Spring Return 60°	B5SAT0	BS5SAT0	BC5SAT0	1	0.059
	Maintained 60°	B5SARR0	BS5SARR0	BC5SARR0	1	0.059
	Maintained 60°	B5SARR102	BS5SARR102	BC5SARR102	1	0.059
	Spring Return/Main-tained 60°	B5SATR02	BS5SATR02	BC5SATR02	1	0.059
	Spring Return 60°	B5SATT0	BS5SATT0	BC5SATT0	1	0.059
N/A	Spare key lock Ronis R455	N/A	N/A	B4-R455	1	0.059

Illuminated Push Buttons *IP67, Lamp Max. 1.9W*

Colour	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	B5DLRED	BS5DLRED	BC5DLRED	10	0.029
Green	B5 DLGREEN	BS5DLGREEN	BC5DLGREEN	10	0.029
Yellow	B5 DLYELLOW	BS5DLYELLOW	BC5DLYELLOW	10	0.029
Blue	B5DLBUE	BS5DLBLUE	BC5DLBLUE	10	0.029
White	B5DLWHITE	BS5DLWHITE	BC5DLWHITE	10	0.029

Illuminated Push Buttons *IP67, Maintained, Lamp Max. 1.9W*

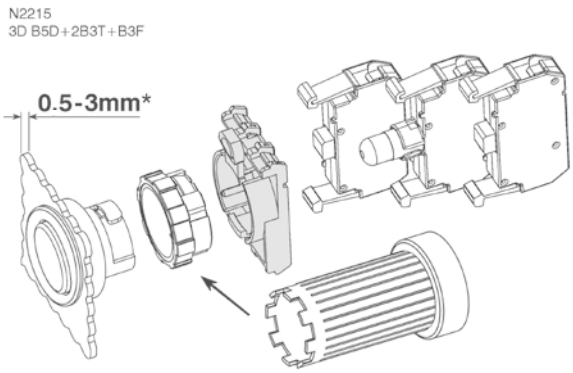
Colour	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	B5DLRRED	BS5DLRRED	BC5DLRRED	10	0.029
Green	B5DLRGREEN	BS5DLRGREEN	BC5DLRGREEN	10	0.029
Yellow	B5DLRYELLOW	BS5DLRYELLOW	BC5DLRYELLOW	10	0.029
Blue	B5DLRBLUE	BS5DLRBLUE	BC5DLRBLUE	10	0.029
White	B5DLRWHITE	BS5DLRWHITE	BC5DLRWHITE	10	0.029

Lens Caps *IP67, With fresnel lens, Lamp max. 1.9W*

Colour	Alu	Black	Chrome	Pack Pcs.	Weight kg/pc.
Red	B5RRED	BS5RRED	BC5RRED	10	0.029
Green	B5RGREEN	BS5RGREEN	BC5RGREEN	10	0.029
Yellow	B5RYELLOW	BS5RYELLOW	BC5RYELLOW	10	0.029
Blue	B5RBLUE	BS5RBLUE	BC5RBLUE	10	0.029
Clear	B5RCLEAR	BS5RCLEAR	BC5RCLEAR	10	0.029
White	B5RWHITE	BS5RWHITE	BC5RWHITE	10	0.029

Connectors

Connector B3S

Diagram	Part Number	Pack Pcs.	Weight kg/pc.
	B35	10	0.013

Includes thickness from Label Holder and Yellow Disk.

Contact Blocks and Lamp Holders

For Panel Mounting

Contact Blocks

Contact Blocks with gold contacts (B3T..G) on request, suitable for 17V = /1mA and for difficult ambient conditons.

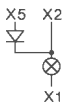
Key: ⊖ *= NC Contact has a positive opening according to IEC/EN 60947-5-1*

Diagram	Voltage	Description	Part Number	Pack Pcs.	Weight kg/pc.
	Max. 690V AC	1 NC ⊖	B3T01 [2)]	10	0.010
	Max. 690V AC	1 NO	B3T10 [2)]	10	0.010
N/A	Actuator Insert	To actuate the center Contact Block	P642	10	0.001

Lamp Holders, Socket BA9s

Diagram	Voltage	Description	Part Number	Pack Pcs.	Weight kg/pc.
	Max. 440V AC	Direct connection, for lamps max. 1.9W (Take care for active power consumption)	B3F	10	0.012

Lamp Holders for Lamp Test Circuits, Socket BA9s

Diagram	Voltage	Description	Part Number	Pack Pcs.	Weight kg/pc.
	Max. 440V AC	Direct connection. For lamps ax 1.7W (Active power consumption)	B3FT	10	0.020

Lamps

Glow-discharge Lamps

Socket BA9s Lamp Voltage	Power Consumption	Part Number	Pack Pcs.	Weight kg/pc.
220-250V AC	0.3W for clear, red, yellow Lens Caps	NEON220-250	100	0.005

LED Lamps[2] 10 Years Lifetime

Socket BA9s Lamp Voltage	Power Consumption	Part Number	Pack Pcs.	Weight kg/pc.
20-30V AC/DC	17mA / 0.4W for Red Lens Caps	B3-L24A-RED	10	0.005
20-30V AC/DC	17mA / 0.4W for Green Lens Caps	B3-L24A-GREEN	10	0.005
20-30V AC/DC	17mA / 0.4W for Green Lens Caps	B3-L24A-YELLOW	10	0.005
20-30V AC/DC	17mA / 0.4W for Blue Lens Caps	B3-L24A-BLUE	10	0.005
20-30V AC/DC	17mA / 0.4W for White Lens Caps	B3-L2A-WHITE	10	0.005
90-120V AC/DC	7mA / 0.8W for Red Lens Caps	B3-L110-RED	10	0.005
90-120V AC/DC	7mA / 0.8W for Green Lens Caps	B3-L110-GREEN	10	0.005
90-120V AC/DC	7mA / 0.8W for Yellow Lens Caps	B3-L110-YELLOW	10	0.005
90-120V AC/DC	7mA / 0.8W for Blue Lens Caps	B3-L110-BLUE	10	0.005
90-120V AC/DC	7mA / 0.8W for White Lens Caps	B3-L110-WHITE	10	0.005
200-250V AC/DC	4mA / 0.9W for Red Lens Caps	B3-L230-RED	10	0.005
200-250V AC/DC	4mA / 0.9W for Green Lens Caps	B3-L230-GREEN	10	0.005
200-250V AC/DC	4mA / 0.9W for Yellow Lens Caps	B3-L230-YELLOW	10	0.005
200-250V AC/DC	4mA / 0.9W for Blue Lens Caps	B3-L230-BLUE	10	0.005
200-250V AC/DC	4mA / 0.9W for White Lens Caps	B3-L230-WHITE	10	0.005

Filament Lamps

Socket BA9s Lamp Voltage	Power Consumption	Type	Pack Pcs.	Weight kg/pc.
12V	1.2W for all Lens Caps	Lamp 12V	50	N/A
24V	1.2W for all Lens Caps	Lamp 24V	50	0.005
42V	1.2W for all Lens Caps	Lamp 42V	50	0.005
48V	1.2W for all Lens Caps	Lamp 48V	50	0.005
60V	1.2W for all Lens Caps	Lamp 60V	50	0.005
110/120V[1]	1.5/1.8W for all Lens Caps	Lamp 110V	50	0.005

[1] Voltage marking 130V/2W, max rated voltage 120V/1.8W
[2] Suitable for B3FT lamp test lamp holders

Accessories

Accessory	Description	Part Number	Pack Pcs.	Weight kg/pc.
Wrench	For mounting of Actuators and Lens Caps B(S)3	J7049	1	0.018
Marking Plate	For marking of Contact Blocks B3T and Lamp Holders B3F	P672-1	10	0.001
Lamp Installer	Used to install or replace lamps BA9s	B4-7408	1	0.010
Spare Key	For B(S)3SA.. and BS3P44S3, Ronis R455	B4-R455	1	0.007
Spare Key	For B(S)3SB.. , Ronis R786	B4-R786	1	0.007
Protective Sealable Cover	For protection against unintentional manipulation of buttons B5, (not for Mushroom Heads, Rotary and Swing Knobs)	B5-SAP	1	0.008
Label Holder	For Legend Plate BK5, black	P942-1	10	0.002
Legend Plate	Alu without marking, text 1 or 2 lines, max 4x13 letters, letter height 3mm	BK5-11374	10	0.002
Adapter to convert Actuators 22mm to 30mm	Alu	B5	10	0.017
	Black	BS5	10	0.017
	Chrome	BC5	10	0.017

Marking Plate

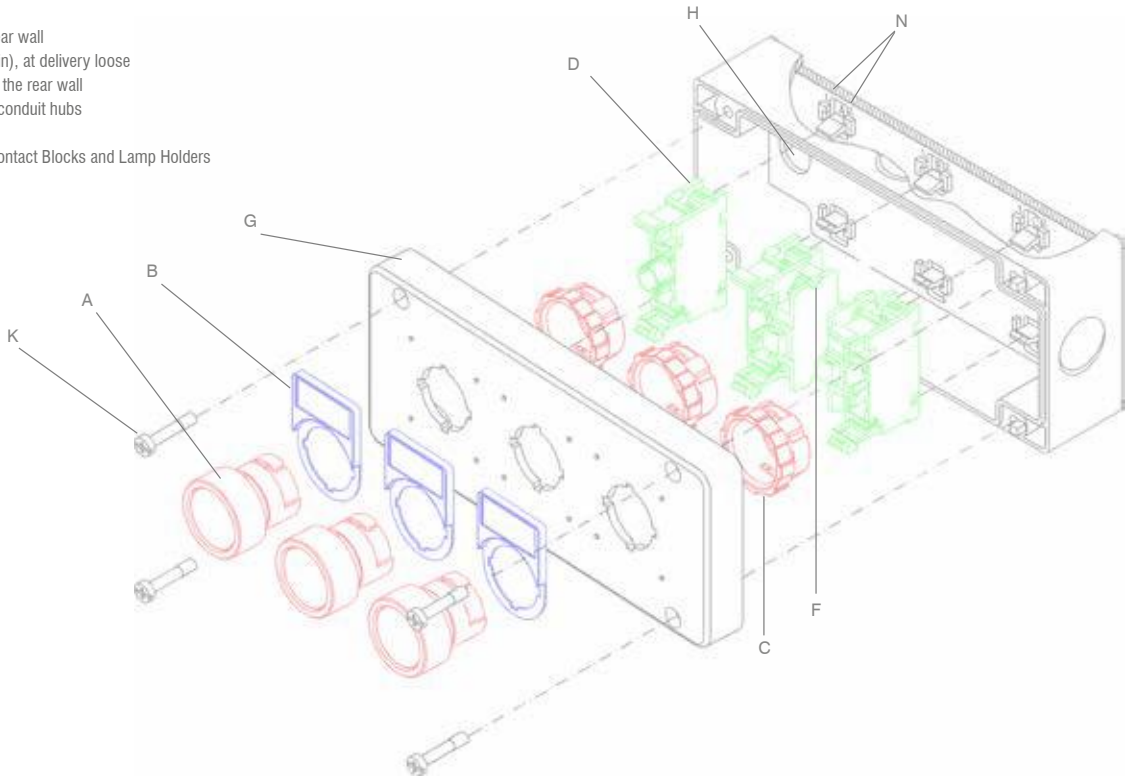
Protective Sealable Cover

Adapter to convert Actuators 22mm to 30mm (Alu)

Assembled Pushbutton Stations

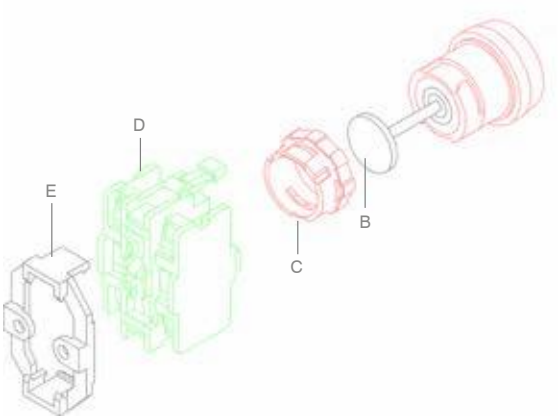
IP65 c UL us Type 12

A. Actuators or Lens caps
B. Legend plates with Label Holder
C. Ring and Nut (included with Actuator or Lens Cap)
D. Contact Blocks and Lamp Holders
E. Rear Shroud
F. Function number
G. Cover
H. Pre-moulded Knockouts in rear wall
K. Captive screws (after screw in), at delivery loose
L. Sign of units at the ground of the rear wall
M. Pre-moulded Knockouts for conduit hubs
N. Sequence number
O. Spring-catches for snap in Contact Blocks and Lamp Holders



Buttons for Base Mounting

A. Actuator Ø 22mm
B. Extension B4V...
C. Ring and Nut (included with actuator or lens cap)
D. Contact Block B4...
E. Base B4U for base and DIN-rail mounting of Contact Blocks



Mounting Plate

Decscription	*Part Number*	*Pack Pcs.*	*Weight kg/pc.*
For base and DIN-rail mounting of Contact Blocks and Lamp Holders B4.U...	B4U	10	0.010

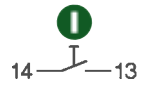
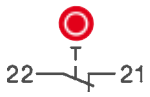
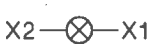
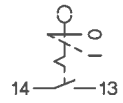
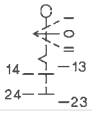
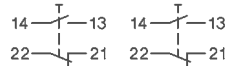
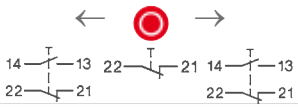
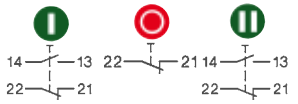
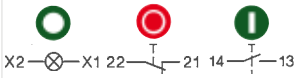
Ring and Nut

Decscription	*Part Number*	*Pack Pcs.*	*Weight kg/pc.*
For mounting forer Actuators and Lens Caps B4...	B3UP	N/A	0.004

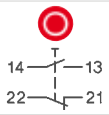
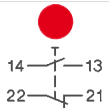
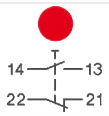
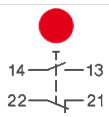
Assembled Pushbutton Stations

IP67(IP65) cULus Type 12

Plastic Enclosed Buttons and Pilot Lights

Diagram	Description	Part Number	Pack Pcs.	Weight kg/pc.
	On Push Button Green	BG10GREEN	1	0.135
	OFF Push Button Red	BG10RED	1	0.135
	Pilot Light Green	BG01GREEN	1	0.135
	Pilot Light Red	BG01RED	1	0.135
	Key operated 0 - I[1], Lock Ronis, 60° maintained	BG10SAR-0	1	0.165
	Key operated 0 - II[1] Lock Ronis, 60° maintained	BG10SARR-0	1	0.172
	2 Push Buttons 0 - I	BG20	1	0.200
	2 Push Buttons ← →	BG20PF	1	0.200
	3 Push Buttons ← 0 →	BG30PF	1	0.283
	3 Push Buttons I - 0 - II	BG30	1	0.283
	2 Push Buttons 0 - I with pilot light green	BG21GREEN	1	0.270

Plastic Enclosed Emergency Stop Buttons

Diagram	Description	Part Number	Pack Pcs.	Weight kg/pc.
	Emergency Stop Button, head Ø40mm, unlock by turning	BG10P34-11	1	0.145
	Emergency Stop Mushroom Button Ø40mm, according to EN418, unlock by pulling	BG10P44-11	1	0.145
	Emergency Stop Key, Ø40mm, according to EN418, unlock with key	BG10P44S3-11	1	0.178
	Emergency Stop Mushroom Button, Ø70mm, unlock by turning	BG10P34P-11	1	0.187

Components for Pushbutton Stations

IP67 cULus Type 12

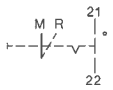
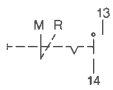
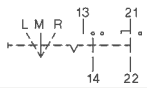
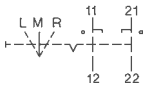
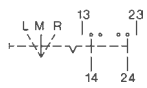
Knockouts

Description	Number Of Units	Type	Pack Pcs.	Weight kg/pc.
3 Knockouts Ø20.5mm (M20 or PG13.5)	1	BG1	1	0.108
3 Knockouts Ø20.5mm (M20 or PG13.5)	2	BG2	1	0.145
3 Knockouts Ø20.5mm (M20 or PG13.5)	3	BG3	1	0.188

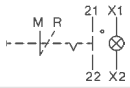
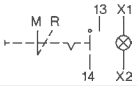
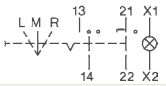
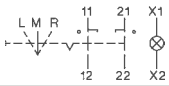
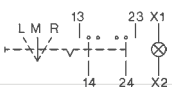
3 Knockouts

Contact Blocks for Enclosures BG...

Key: 1) → NC Contact has a positive opening according to IEC/EN 60947-5-1

Contacts	Wiring Diagram	Actuators With 2 or 3 Switch Positions	Part Number	Pack Pcs.	Weight kg/pc.
1NC1) →			B4TU01	10	0.015
1NO			B4TU10	10	0.015
1NO+1NC1)			B4TU11	10	0.022
2NC1) →			B4TU02	10	0.022
2NO			B4TU20	10	0.022

Contact Blocks with Lamp Holder *Socket BA9s for LED or lamps, for enclosures BG...*

Contacts	Wiring Diagram	Actuators With 2 or 3 Switch Positions	Part Number	Type	Pack Pcs.	Weight kg/pc.
1NC			Max. 440V AC/DC	B4TU01F	10	0.020
1NO			Max. 440V AC/DC	B4TU10F	10	0.020
1NO+1NC1)			Max. 440V AC/DC	B4TU11F	10	0.027
2NC			Max. 440V AC/DC	B4TU02F	10	0.027
2NO			Max. 440V AC/DC	B4TU20F	10	0.027

Lamp Holder *Socket BA9s for LED or lamps*

Description	Actuators With 2 or 3 Switch Positions	Lamp Voltage	Type	Pack Pcs.	Weight kg/pc.
Direct Connecton, for lamps max. 1.9W (Take care for active power consumption)		Max. 440V AC/DC	B4FU	10	0.013

Pushbuttons for Enclosures

Pushbuttons Grey RAL7035

Description	Colour	Symbol	Length mm	Type	Pack Pcs.	Weight kg/pc.
Reset Push Button	Blue	R	8-22	B2GRB-22	10	0.005
Reset Push Button	Blue	R	22-60	B2GRB-60	10	0.016
Reset Push Button with stop function	Red	0/R	8-22	B2GR-22	10	0.005
Reset Push Button with stop function	Red	0/R	22-60	B2GR-60	10	0.016
Start Push Button	Green	I	8-22	B2GI-22	10	0.005
Start Push Button	Green	I	22-60	B2GI-60	10	0.016
Stop Push Button	Red	0	8-22	B2G0-22	10	0.005
Stop Push Button	Red	0	22-60	B2G0-60	10	0.016
Mushroom Head lockable Ø28mm	Red	0	8-22	B2GP-22	10	0.005
Mushroom Head lockable Ø28mm	Red	0	22-60	B2GP-60	10	0.016

Pushbuttons with Metal Ring

Specification	Colour	Symbol	Length mm	Type	Pack Pcs.	Weight kg/pc.
Reset Push Button	Blue	R	19.5-38.5	B3GRB-31.5	10	0.023
Reset Push Button	Blue	R	38.5-60	B3GRB-60	10	0.026
Reset Push Button with stop function	Red	0/R	19.5-38.5	B3GR-31.5	10	0.023
Reset Push Button with stop function	Red	0/R	38.5-60	B3GR-60	10	0.026
Start Push Button	Green	I	19.5-38.5	B3GI-31.5	10	0.023
Start Push Button	Green	I	38.5-60	B3GI-60	10	0.026
Stop Push Button	Red	0	19.5-38.5	B3G0-31.5	10	0.023
Stop Push Button	Red	0	38.5-60	B3G0-60	10	0.026
Mushroom Head lockable Ø28mm	Red	N/A	19.5-38.5	B3GP-31.5	10	0.023
Mushroom Head lockable Ø28mm	Red	N/A	38.5-60	B3GP-60	10	0.026

Extensions for Pushbuttons

Specification	Diameter Ø mm	Length mm	Type	Pack Pcs.	Weight kg/pc.
Self Adjusting Pin, for B(S,C) 3D... and B(2,C)3P..	15	19.5-38.5	B4V31.5	10	0.001
Self Adjusting pin, for B(S,C) 3D... and B(2,C)3P..	18.5	38.5-60	B4V60	10	0.004

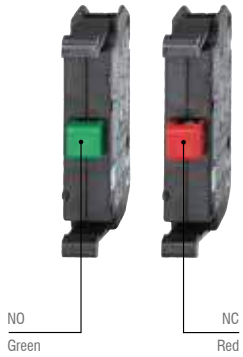
Accessories

Description	Type	Pack Pcs.	Weight kg/pc.
Wrench - For mounting of Actuators and Lens Caps B(S)3...	J7049	1	0.018
Couple Part - To couple enclosures BKLG or assembled stations BG...	B4-8852	1	0.018
Suspension Eye - For Hanging Stations	B4-9929	1	0.188
Handle and Cable Inlet - To change encosures BG... or assembled stations BG... into a hanging station	B4-9149	1	0.064

Wrench

Technical Data

Terminal Markings for Control Units *According to DIN EN 50013*

Distinc. Number	Contact Elements	Distinc. Number	Contact Elements	Distinc. Number	Contact Elements	Distinc. Number	Contact Elements	Distinc. Number	Contact Elements	Colour Code
10	13 14							01	21 22	
20	13 23 14 24	11	13 21 14 22					02	11 21 12 22	
30	13 23 33 14 24 34	21	13 21 33 14 22 34	12	13 21 31 14 22 32			03	12 22 32 12 22 32	
40	13 23 33 43 14 24 34 44	31	13 21 33 43 14 22 34 44	22	13 21 31 43 14 22 32 44	13	13 21 31 41 14 22 32 42	04	11 21 31 41 12 22 32 42	

Data According to IEC 947-5-1, VDE 0660, EN 60947-5-1

Type			*B3T*	*B4T*
Rated insulation voltage U_i	V AC		690[1)]	500
Utilization category AC12 Control of resistive loads and solid stateloads with isolation by opto couplers **Rated current I_e**	220-240V 380-415V 500V 690V	A A A A	10 10 10 10	10 10 10 -
Utilization category AC15 Control of electromagnetic load (>72VA) **Rated current I_e**	220-240V 380-415V 500V 690V	A A A A	6 5 3 2	6 5 3 -
Utilization category DC12 L/R = 1ms Control of resistive loads and solid stateloads with isolation by opto couplers **Rated current I_e**	24V 60V 110V 220V	A A A A	10 6 2.5 0.8	10 6 2.5 0.8
Utilization category DC14 L/R = 15ms Control of electromagnetic loads having economy resistors in circuit **Rated current I_e**	24V 60V 110V 220V	A A A A	8 1 2 0.5	8 1 2 0.5
Utilization category DC13 L/R = 300ms Control of electromagnets **Rated current I_e**	24V 60V 110V 220V	A A A A	2 5 0.5 0.2	2 5 0.5 0.2
Making capacity **Breaking capacity** cosj = 0.7-1	40-60Hz	A A	60 50	60 50
Mechanical life		Millions of operations	10	10
Contact life (AC15) 100VA 300VA 800VA 1200VA		 Millions of operations Millions of operations Millions of operations Millions of operations	 10 3 1 0.5	 10 3 1 0.5
Maximum frequency of operations		Ops. per hour	600	600
Short circuit protection	Slow	A	25	25

Type	B3F	B4F
Rated inslation voltage U_i	440[2)]	440[2)]
Lamp base	BA9s	

Type		B3, B4
Protection degree (according to IEC 947-1) In assembled state, from the front from rear		IP65 IP00
Ambient temperature LED Lamps (B3-Lxx)	°C °C	-40 to +60[3)] -40 to +40
Cable cross-section Cables per clamp	Solid, mm^2 Flexible, mm^2 Flexible with Multicore Cable End, mm^2 Number	 0.5 - 2.5 0.5 - 2.5 0.5 - 1.5 2
Mounting Hole (according to IEC 947-1)		Optional
Terminal Screws		Pozidriv No. 2 Screws M3,5

Data according to cULus

Type	B3	B4
Contact Block for NO and NC General use Heavy pilot duty	 600V AC max. 10A A600	 600V AC max. 10A A600
Lamp Holder with socket BA9s	240V 2.6W max.	240V 2.6W max.
Wire (Contact and Lamp Holder) Torque	14 - 18AWG 9lb/in.	14 - 18AWG 9lb/in.

Approvals

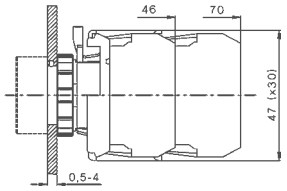
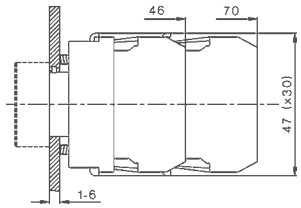
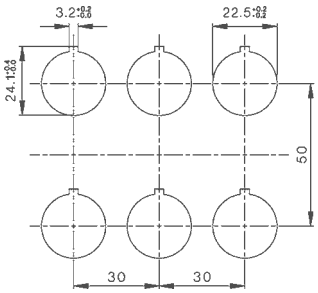
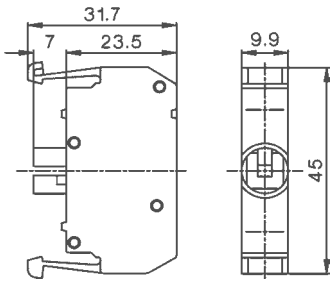
Key: o = In standard version approved
- = Not provided for test till now

Country Type	USA Canada UL	Europe	Register of Shipping Great Britain LRS	CENELEC CB- Certificates
B3T.. B3F..	o o	o o	- -	o o
B4TU.. B4T..UF B4FU..	o o o	o o o	o o o	o o o
B3-MB..	o	o	-	-

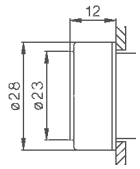
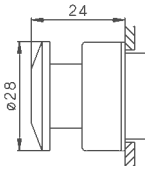
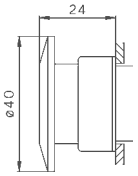
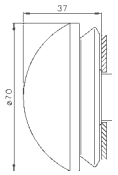
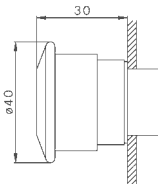
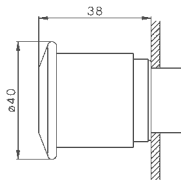
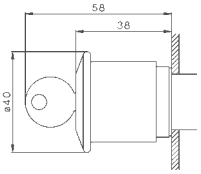
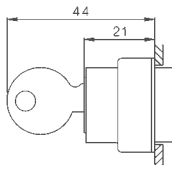
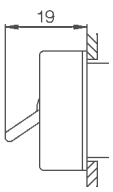
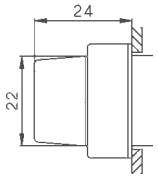
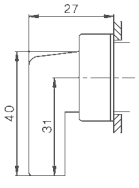
[1)] Suitable for: Earthed-neutral systems, overvoltage category I to IV, pollution degree 3 (standard industry) U_{imp} = 6kV.
Data for other conditions available upon request.
[2)] Suitable for: Earthed-neutral systems, overvoltage category I to III, pollution degree 3 (standard industry) U_{imp} = 4kV.
[3)] Except sealing cover.

Dimensions

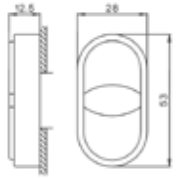
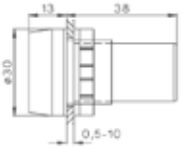
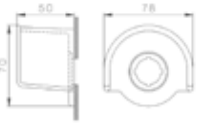
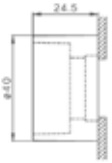
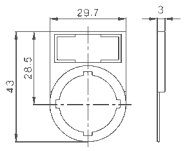
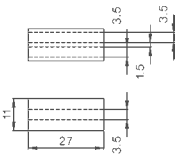
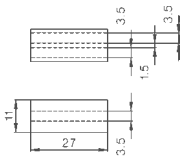
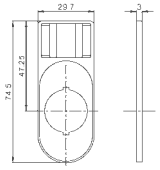
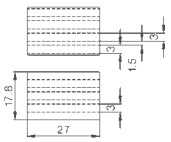
Ø22.0mm Pushbutton Mounting Dimensions (mm)

Panel mounting	Mounting Holes	Contact blocks and Lamp Holder B3...
B3S  B3M  	 Dimensions of minimum space requirements according to IEC. Take to consideration the field of traverse of swing knobs (27mm) and the diameter of mushroom heads.	

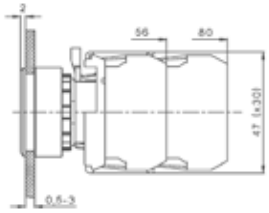
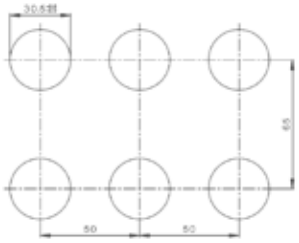
Ø22.0mm Pushbutton Dimensions (mm)

Flush Head Illuminated Flush Head	Mushroom Head Ø28mm Emergency Stop Ø28mm	Mushroom Head Ø40mm Emergency Stop Ø40mm	Mushroom Head Ø70mm Emergency Stop Ø70mm
 	 	 	
B3D(R), B3DL(R) BS3D(R), BS3DL(R) BC3D(R), BC3DL(R)	B3P1 bis B3P3 BS3P1 bis BS3P3 BC3P1 bis BC3P3	B3P14, B3P34 BS3P14, BS3P34 BC3P14, BC3P34	BS3P14P BS3P34P
Push and pull button Ø40mm	**Push and pull button Ø40mm**	**Push and pull button Ø40mm with key**	**Lockable push button**
 	 	 	
BS3P44	BS3P45	BS3P44S3	B3SAR., B3SAT. BS3SAR., BS3SAT. BC3SAR., BC3SAT.
Toggle	**Rotary Knob**	**Swing Knob**	**Lens Cap**
 	 	 	
B3E BS3E BC3E	B3KN, B3KL BS3KN, BS3KL BC3KN, BC3KL	B3KRL, B3KRN BS3KRL, BS3KRN BC3KRL, BC3KRN	B3R(F)

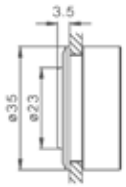
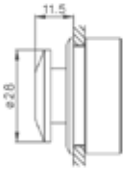
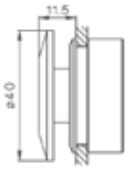
Illuminated Pushbutton Dimensions (mm)

Double Push button	Monoblock Multi-LED	Protection Cover	Protection Ring w. Thread	
				
B3DT	B3-MB...	B3-SK...	P921-.	
Label Holder	**Legend Plate**	**Label Holder**	**Label Holder**	**Legend Plate**
				
P751	BK4-...	P761	P761-DT	BK8-...

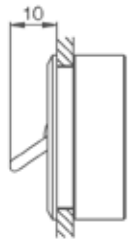
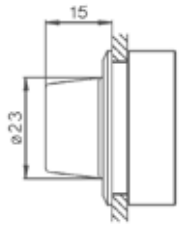
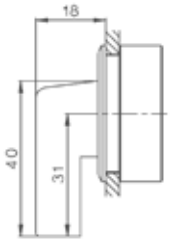
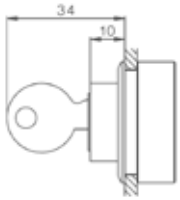
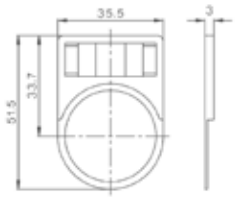
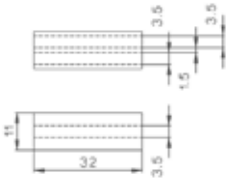
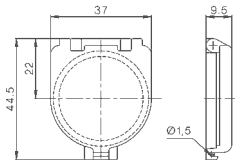
Ø30.0mm Pushbutton Mounting Dimensions (mm)

Panel mounting B3S	Mounting Holes
	

Ø30.0mm Pushbutton Dimensions (mm)

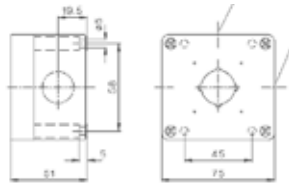
Flush Head Illuminated Flush Head	Mushroom Head Ø28mm Emergency Stop Ø28mm	Mushroom Head Ø40mm Emergency Stop Ø40mm	Lens Cap
			
B5D(R), B5DL(R) BS5D(R), BS5DL(R)	B5P1 to B5P3 BS5P1 to BS5P3	B5P14, B5P34 BS5P14, BS5P34	B5RF

Handle & Legend Plate Dimensions (mm)

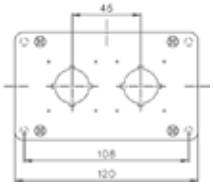
Toggle	Rotary Knob	Swing Knob	Lockable Push Button
			
B5E	B5KN, B5KL	B5KRL, B5KRN	B5SAR, B5SAT
BS5E	BS5KN, BS5KL	BS5KRL, BS5KRN	BS5SAR, BS5SAT
Lable Holder	**Legend Plate**	**Protective Cover**	
			
P761	BK5-...	B5-SAP	

Pushbutton Enclosure Dimensions (mm)

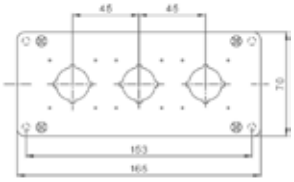
Three conduit entries (Knockouts), each on top, left and right side, Ø20.5mm (M20 or PG13.5)



BG1

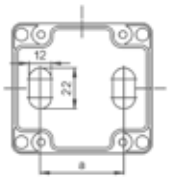


BG2



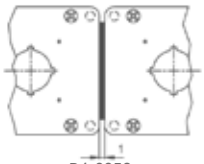
BG3

Conduit Entries in the Bottom (Knockouts)



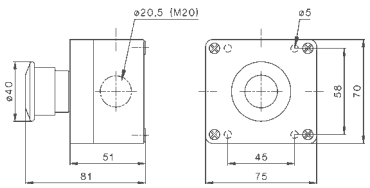
Units	A
1	45
2	90
3	135

Couple Enclosures



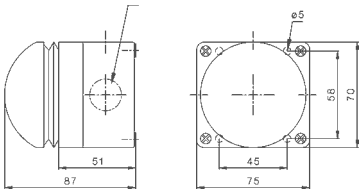
B4-8852

EMERGENCY STOP Push Button Ø40mm

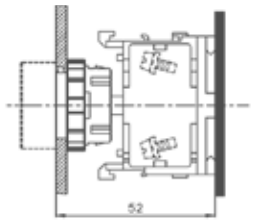
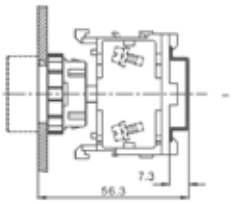
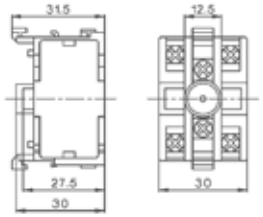
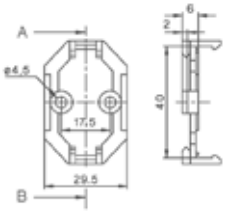


EMERGENCY STOP Push Button Ø70mm, Foot switch

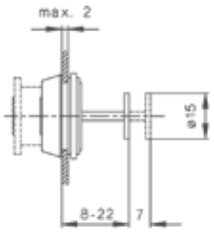
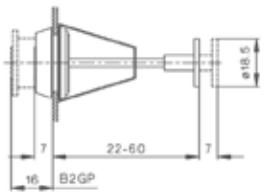
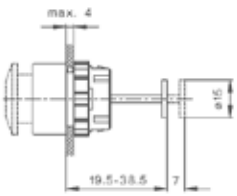
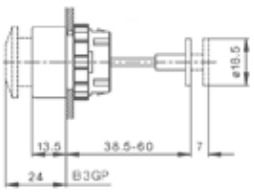
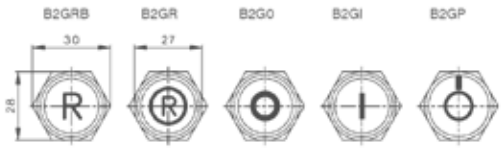
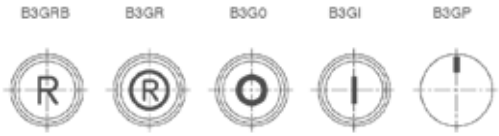
Ø20.5mm (M20 or PG13,5) Knockout on top, left and right side



Mounting Dimensions (mm)

Base Mounting	DIN-rail Mounting	Contact block and Lamp Holders B4.U	Base B4U
			

Push Buttons for Enclosures Dimensions (mm)

B2G..-22	B2G..-60	B3G..-31.5	B3G..-60
			
			

LED Pilot Lights

(IP65), cULus Ø22.5mm Single Hole Fixing

Introducing the LMB mono-block, multi-chip LED pilot light. The LMB range of LED pilot lights can be used in new installations, or a retrofit of an existing panel as they fit into a standard Ø22.5mm (7/8") hole. Besides having a bulb that outlasts a standard incandescent bulb type, LEDs are not affected by vibration or heat, making them suitable for almost every application.

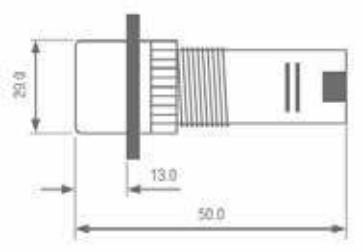
- *Multi-chip LED integrated onto light surface*
- *IP65 rated protection*
- *Single hole fixing Ø22.5mm*
- *Bright & colour intensive light distribution*
- *Temperature range: -25°C to +55°C*
- *cURus & CE approved*
- *MTBF > 30,000 hours*

LMB Series

Pilot Light Colour	Supply Voltage	Part Number
RED	12V AC/DC	LMB-12-RED
	24V AC/DC	LMB-24-RED
	110V AC	LMB-110-RED
	230V AC	LMB-230-RED
GREEN	12V AC/DC	LMB-12-GREEN
	24V AC/DC	LMB-24-GREEN
	110V AC	LMB-110-GREEN
	230V AC	LMB-230-GREEN
YELLOW	12V AC/DC	LMB-12-YELLOW
	24V AC/DC	LMB-24-YELLOW
	110V AC	LMB-110-YELLOW
	230V AC	LMB-230-YELLOW
WHITE	12V AC/DC	LMB-12-WHITE
	24V AC/DC	LMB-24-WHITE
	110V AC	LMB-110-WHITE
	230V AC	LMB-230-WHITE
BLUE	12V AC/DC	LMB-12-BLUE
	24V AC/DC	LMB-24-BLUE
	110V AC	LMB-110-BLUE
	230V AC	LMB-230-BLUE

LMB Series Dimensions (mm)

Ø22.5mm Fixing Hole

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Australia

Tel: 1300 34 21 31

Email: sales@imopacific.com.au
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CAT-PUSHBUTTONS-1020v8

Tigo® Flex MLPE

TS4-A-2F

Module-level PV Rapid Shutdown for Two Modules

The TS4-A-2F (Fire Safety) is the advanced add-on rapid shutdown solution that brings smart module functionality to standard PV modules for higher reliability. Ensure safety by upgrading existing PV systems or by adding safety features to new installations.

The TS4-A-2F complies with NEC 2017 & 2020 690.12 Rapid Shutdown specifications when installed with the Tigo RSS Transmitter or an inverter with built-in Tigo certified transmitter.

Included Features

Fire Safety

Enhanced **safety** for NEC 690.12 rapid shutdown compliance

Easy Installation

Snap to standard module frame or remove clips for rack mounting

PLC Signaling

Control rapid shutdown with the Tigo RSS Transmitter

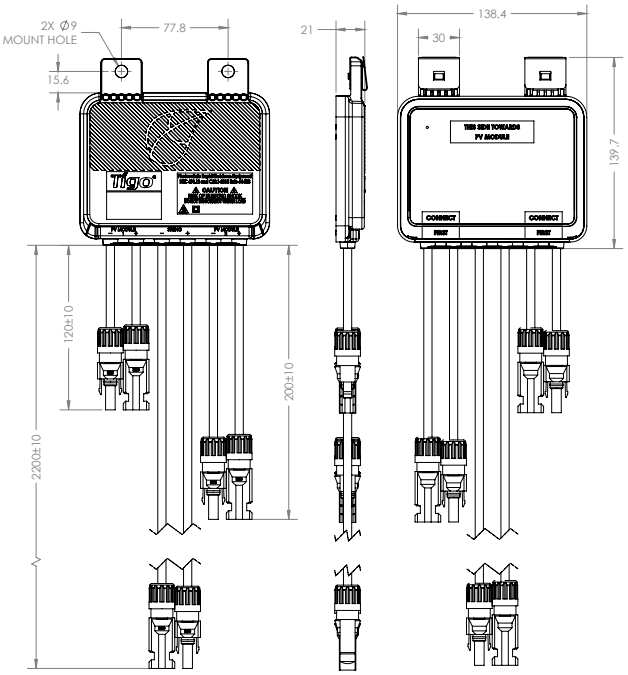
Automatic Shutdown

PV array enters rapid shutdown in event of AC grid loss

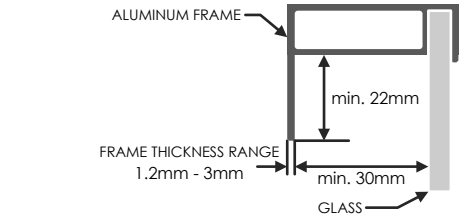
TS4-A-2F SPECIFICATIONS

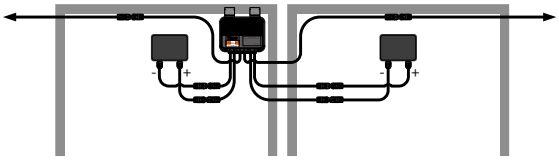
Environmental	
Operating Temperature Range	-30°C to +70°C (-22°F to +158°F)
Outdoor Rating	IP68, NEMA 3R
Mechanical	
Dimensions	138.4mm x 139.7mm x 22.9mm
Weight	590g
Electrical	
Max Input Voltage (V_{OC} @ Lowest Temperature)	80V
Input Voltage Range (per input)	16 - 80V
Maximum Output Voltage	160V (80V per input)
Maximum Current (per input)	15A
Maximum Power (total)	1000W
Cable Lengths (in/out)	0.12 and 0.2m/2.2m (standard) 1.2 and 1.3m/ 2.4m (optional)
Connectors	MC4 (standard), EVO2 (optional)
Communication Type	PLC
Rapid Shutdown UL Listed (NEC 2017 & 2020 690.12)	Yes
Rapid Shutdown Time Limit	30 secs or less**
Conductor AWG Range	10-12AWG
PVRSE Controlled Conductors	≤30 Vdc, ≤240VA, ≤8A**

Rapid shutdown activation of TS4-A-2F requires RSS Transmitter.
*Maximum output voltage of the TS4 is dependent on the PV module voltage. Refer to PV modules nameplate.
**Limits are based on NEC 690.12 rapid shutdown requirements.



Module frame specifications for mounting TS4-A





Installation example: Serial connection of two PV modules to a TS4-A-2F

ORDERING INFORMATION

Standard	
484-00252-22	15A, 1000W, 1500VUL/1000VIEC, 2.2m Cable, MC4
Optional	
484-00252-24	15A, 1000W, 1500VUL/1000VIEC, 1.2/1.3/2.4M Cable, MC4
484-00261-22	15A, 1000W, 1500VUL/IEC, 2.2M Cable, EVO2
484-00261-24	15A, 1000W, 1500VUL/IEC, 1.2/1.3/2.4M Cable, EVO2

Photovoltaic Rapid Shutdown System Equipment, QIJW
LISTED E469960

For sales info:
sales@tigoenergy.com or 1.408.402.0802

For product info:
Visit tigoenergy.com/products

For technical info:
Visit support.tigoenergy.com

For additional info and product selection assistance, use Tigo's online design tool at tigoenergy.com/design

Tigo TS4-A-2F

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Tigo® Flex MLPE

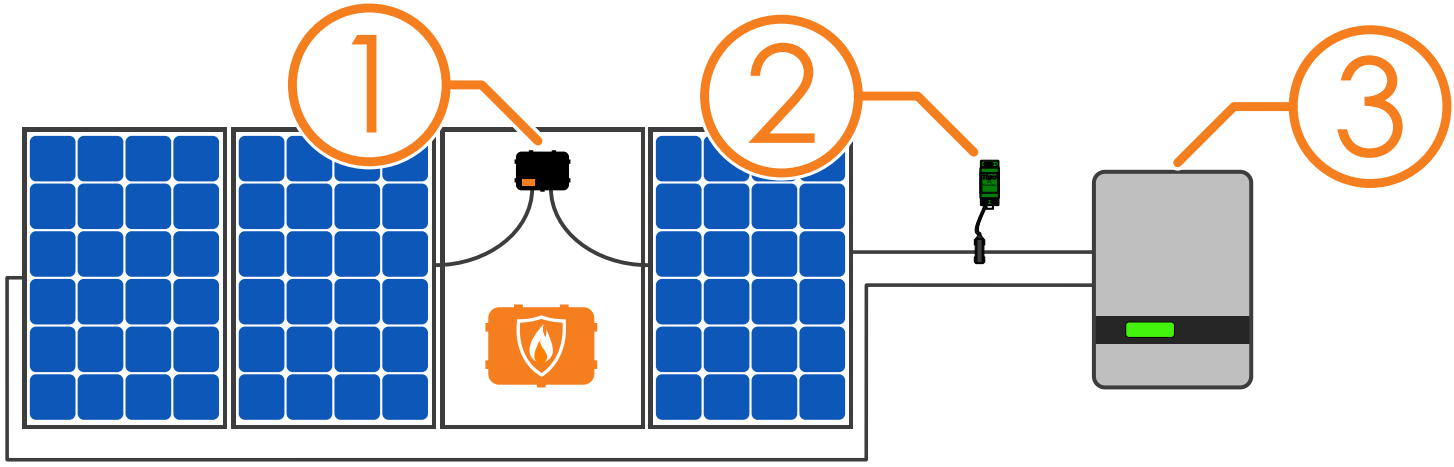
RSS TRANSMITTER

PV Shutdown Activator for TS4-F

The Tigo RSS Transmitter is part of a module-level shutdown solution when paired with Tigo TS4-F. While powered on, the RSS Transmitter sends a power line communication (PLC) signal to the TS4-F units to keep their PV modules connected and supplying energy.

TS4-F units automatically enter shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter.

The RSS Transmitter includes one or two RSS Cores, and a 120/240V_{AC} power supply is available separately.



1. Modules equipped with Tigo TS4-F
2. Tigo RSS Transmitter and RSS Core
3. Inverter

RSS TRANSMITTER

Meets NEC 690.12 requirements

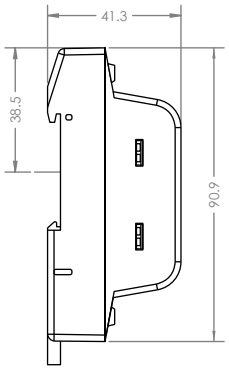
Module-level deactivation with TS4-F

Automatic or manual shutdown

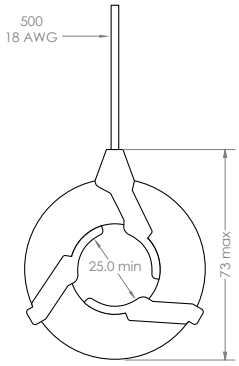
Includes one or two RSS Cores

Optional 120/240V_{AC} power supply

RSS Transmitter - Front View



RSS Transmitter - Side View



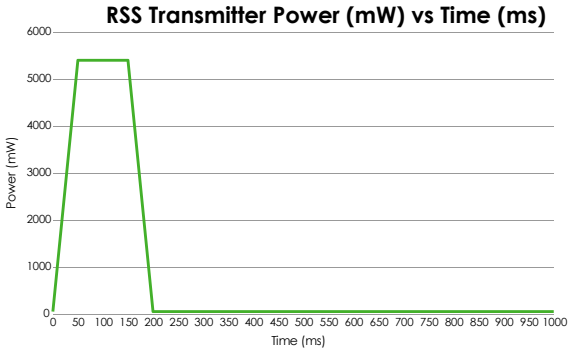
RSS Core - Side View

All dimensions in mm.

Input
Transmitter Input Voltage: 12V_{DC} (+/- 2%)
Transmitter Input Current: 1A
RSS Core
Max Current: 150A per RSS Core (Single Core: 150A, Dual Core: 300A)
Max String Voltage: 1500V_{DC}
Max Number of Strings per Core: 10
Max Supported PV Modules per String: 30
Environmental
Operating Temperature Range: -40°C to 85°C (PCBA)

For Tigo RSS Transmitter integration inside an inverter, be able to provide the following power profile:

- Voltage: 12V_{DC} (+/- 2%)
- Power Average: 0.85W
- Power Standby: 0.06W
- Duty Cycle: 15%
- Max Power: 5.5W



ORDERING OPTIONS

490-00000-10	Single Core (150A) RSS DIN Rail Transmitter (no power supply)
490-00000-20	Dual Core (300A) RSS DIN Rail Transmitter (no power supply)
983-01512-00	DIN Rail Power Supply, 12V_{DC}, 1.25A

For sales info:
sales@tigoenergy.com or 1.408.402.0802

For technical information:
http://support.tigoenergy.com

For product info:
Visit www.tigoenergy.com/products

For technical info:
http://support.tigoenergy.com

For additional info and product selection assistance, use Tigo's online design tool at www.tigoenergy.com/design

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RSS Transmitter with Pure Signal technology

Rapid Shutdown Activator

The Tigo Rapid Shutdown System (RSS) Transmitter is a part of Module Level rapid shutdown solution when paired with Tigo Module Level Power Electronics (MLPE). The RSS Transmitter can link multiple RSS transmitters together, this enables Tigo's Pure Signal Technology, providing one coordinated keep-alive signal to the array.

Features

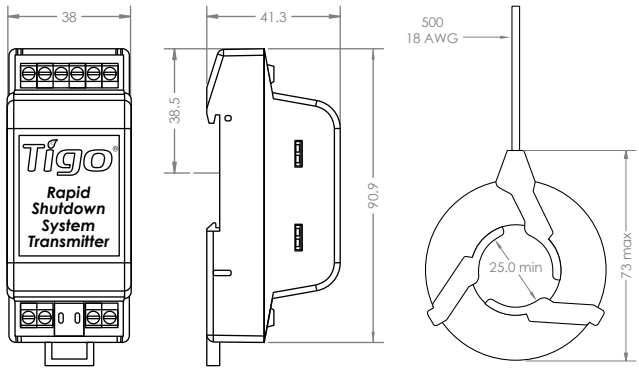
- PLC Communication
- Scalable from residential to large utility projects
- Patented Pure Signal Technology for multiple transmitters
- Configurable with one or two RSS Cores
- Bi-colored core ensures accurate signal directionality

Benefits

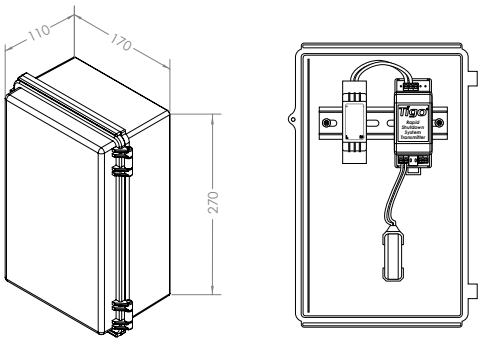
- Meets NEC 690.12 2014, 2017, and 2020 requirements
- Automatic or manual shutdown
- Reduce balance of system cost
- Easy and fast to install
- Compatible with majority of the inverters in the market

Dimensions

Dimensions (W x D x H)	38 x 41.3 x 90.9 mm (1.5 x 1.63 x 3.58in)



Outdoor Enclosure (optional)	
Dimensions (W x D x H)	170 x 110 x 270 mm (6.69 x 4.33 x 10.63in)



Input

Transmitter Input Voltage	$12V_{DC}$ (+/- 2%)
Transmitter Input Current	1A
Power consumption (Max/ Average)	5.5W/0.85W

RSS Core

Max Current	150A per RSS Core (Single Core: 150A, Dual Core: 300A)
Max String Voltage	$1500V_{DC}$
Max Number of Strings per Core	10
Max Supported PV Modules per String	30

Environmental

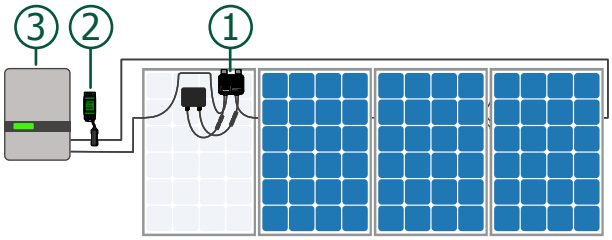
Operating Temperature Range	-40°C to +85°C (-40°F to +185°F)
Outdoor Enclosure Temperature Range (optional)	-20°C to +50°C (-4°F to +122°F)
Enclosure Rating (optional)	IP68, NEMA 4

Ordering Options

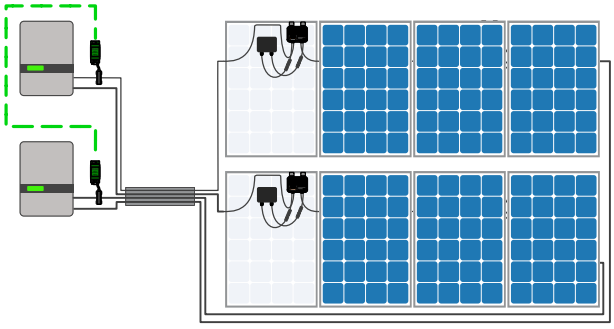
Item #	Description
490-00000-51	Single Core (150A) RSS Din Rail Transmitter (no PS or enclosure)
490-00000-52	Dual Core (300A) RSS Din Rail Transmitter (no PS or enclosure)
492-00000-51	Single Core RSS Din Rail Transmitter, 120/240VAC PS, Outdoor Enclosure kit
492-00000-52	Dual Core RSS Din Rail Transmitter Kit, 120/240VAC PS, Outdoor Enclosure kit
493-00000-52	Commercial Dual Core RSS Din Rail Transmitter, 480/277VAC PS (no enclosure)

System Components:

1. Modules equipped with Tigo MLPE
2. Tigo RSS Transmitter and RSS Core
3. Inverter



Typical Multi-Inverter Application



Photovoltaic Rapid Shutdown System Equipment, QIJW

Additional resources

Tigo RSS

Community

Support

Tigo®

tigoenergy.com

PN: 002-00096-00 | Rev. 2022.6.28

UL-listed with PV Modules

AE SOLAR · ASTRONERGY · CanadianSolar · DAH Solar · DMEGC · ET Solar · GCL · GW Green Wing Solar Technology · Hansol · JA SOLAR · JinKO Solar · 中来股份 JOLYWOOD · LONGi Solar · NSP NEO SOLAR POWER · PERLIGHT · Phono Solar · Q CELLS · risen solar technology · SERAPHIM SOLAR USA MANUFACTURING · Solartec Energía Renovable · SUNPOWER · SUNPREME · SUNTECH · TALESUN · Trinasolar · YINGLI SOLAR · VSUN Innovative & Smart · ZNSHINESOLAR

UL-listed with PV Inverters

ABB · CanadianSolar (Tigo) · CPS (Tigo) · DELTA · solis (Tigo) · Growatt · Hanwha · HUAWEI · Ingeteam · KACO new energy · LG Life's Good · SMA · Sol-Ark LIMITLESS POWER · SOLAX POWER · SUNGROW Clean power for all · YASKAWA SOLECTRIA SOLAR (Tigo)

Tigo Enhanced inverters are plug and play with Tigo's MLPE

- When you see the logo, you know it works with Tigo's rapid shutdown devices
- See the logo on partner inverter specification sheets, marketing materials, inverter front panels, and more
- Integrated RSS transmitters enable a simple, reliable, plug and play rapid shutdown solution

Tigo®

TS4 Flex MLPE System: Optimization, Monitoring, And Rapid Shutdown

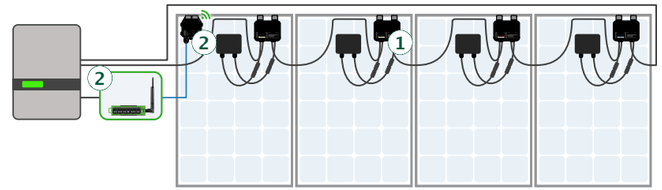
The Only UL-Certified Multivendor Rapid Shutdown MLPE Solution

With Tigo, only pay for what you need to maximize the benefit of your PV installation.

	O	S	M	F
FEATURES	Rapid Shutdown Monitoring Optimization	Rapid Shutdown Monitoring	Monitoring	Rapid Shutdown
REQUIRED SEE SCHEMATIC BELOW	CCA & TAP	CCA & TAP	CCA & TAP	RSS Transmitter
OPTIONS	May be selectively deployed	May be selectively deployed	May be selectively deployed	TS4-A-2F serves 2 PV modules with 1 device
UP TO 700W PER CHANNEL	✓	✓	✓	✓

SCHEMATIC | O,S,M

Monitoring enabled smart devices



1. TS4: O, S, M

Tigo TS4 units are connected to each module. Customers can selectively deploy any combination of the TS4-A-O, -S, or -M products to maximize returns for their particular site.

2. CCA & TAP

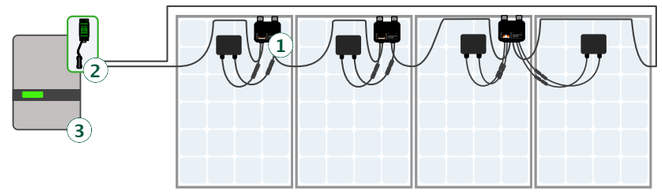
Tigo's Cloud Connect Advanced (CCA) is the data hub for TS4s and other devices (inverter, battery, etc.). It connects with an RS485 cable to the TAP which wirelessly communicates with TS4s.

3. Tigo Energy Intelligence

All of the module-level data, and any third party data connected to Tigo's CCA can be viewed in Tigo's Energy Intelligence monitoring system.

SCHEMATIC | F, 2F

Dedicated, reliable rapid shutdown devices



1. TS4: F or 2F

Tigo's Fire Safety line of TS4 are completely dedicated to the rapid shutdown function and communication via PLC with the RSS Transmitter.

2. Required: RSS Transmitter

The Tigo Rapid Shutdown System (RSS) Transmitter* enables UL PVRSS certified rapid shutdown with TS4-A-F and -2F units to meet required safety codes.

*RSS Transmitter may be inside the inverter, see Tigo Enhanced Inverters.

3. Monitoring: Inverter

Tigo's TS4-A-F and -2F are dedicated rapid shutdown devices. Inverter monitoring may provide DC data at the string, MPPT or array level.

Tigo Energy, Inc. | www.tigoenergy.com | Phone: (408) 402-0802 | sales@tigoenergy.com

Rapid Shutdown with Power Line Communication

TS4-A Advanced Add-on			SKU
TS4-A-F	500W, 1500V UL / 1000V IEC, 1.2M Cable, MC4		458-00252-32
TS4-A-F	700W, 1500V UL / 1000V IEC, 1.2M Cable, MC4		459-00252-32
TS4-A-2F	1000W, 1500V UL / 1000V IEC, 2.2M Cable, MC4		484-00252-22

Rapid Shutdown with Module-Level Monitoring & Optimization

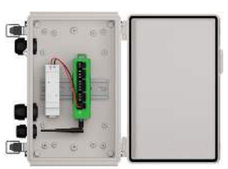
TS4-A Advanced Add-on			SKU
TS4-A-O	500W, 1500V UL / 1000V IEC, 1.2M Cable, MC4		451-00252-32
TS4-A-O	700W, 1500V UL / 1000V IEC, 1.2m Cable, MC4		461-00252-32
TS4-A-S	500W, 1500V UL / 1000V IEC, 1.2M Cable, MC4		456-00252-32
TS4-A-S	700W, 1500V UL / 1000V IEC, 0.12/1.2m Cable, MC4		466-00252-32
TS4-A-M	500W, 1500V UL / 1000V IEC, 0.12/1.2m Cable, MC4		455-00252-32

*Consult factory for other/special connector options

RSS Transmitter and Accessories

Power Line Communication			SKU
Single Core RSS	150A DIN Rail Transmitter (no power supply or enclosure)		490-00000-10
Dual Core RSS	300A DIN Rail Transmitter (no power supply or enclosure)		490-00000-20
Single Core RSS Kit	100A DIN Rail Transmitter Kit, 120/240VAC power supply, Enclosure		492-00000-10
Dual Core RSS Kit	200A DIN Rail Transmitter Kit, 120/240VAC power supply, Enclosure		492-00000-20
Commercial Dual Core RSS	DIN Rail Transmitter, 480/277VAC power supply (no enclosure)		493-00000-20
RSS Signal Detector	(includes 4 x AA batteries)		400-00900-00

Communication Accessories for Module-Level Monitoring



Wireless Communication			SKU
Cloud Connect Advanced (CCA)	Standalone, data logger, communication hub		346-00000-00
Tigo Access Point (TAP)	Collect data from up to 300 TS4 units		158-00000-02
Outdoor Enclosure (CCA)	Standalone, data logger, communication hub. CCA, TAP, DIN rail power supply		348-00000-52

Embrace Solar Freedom

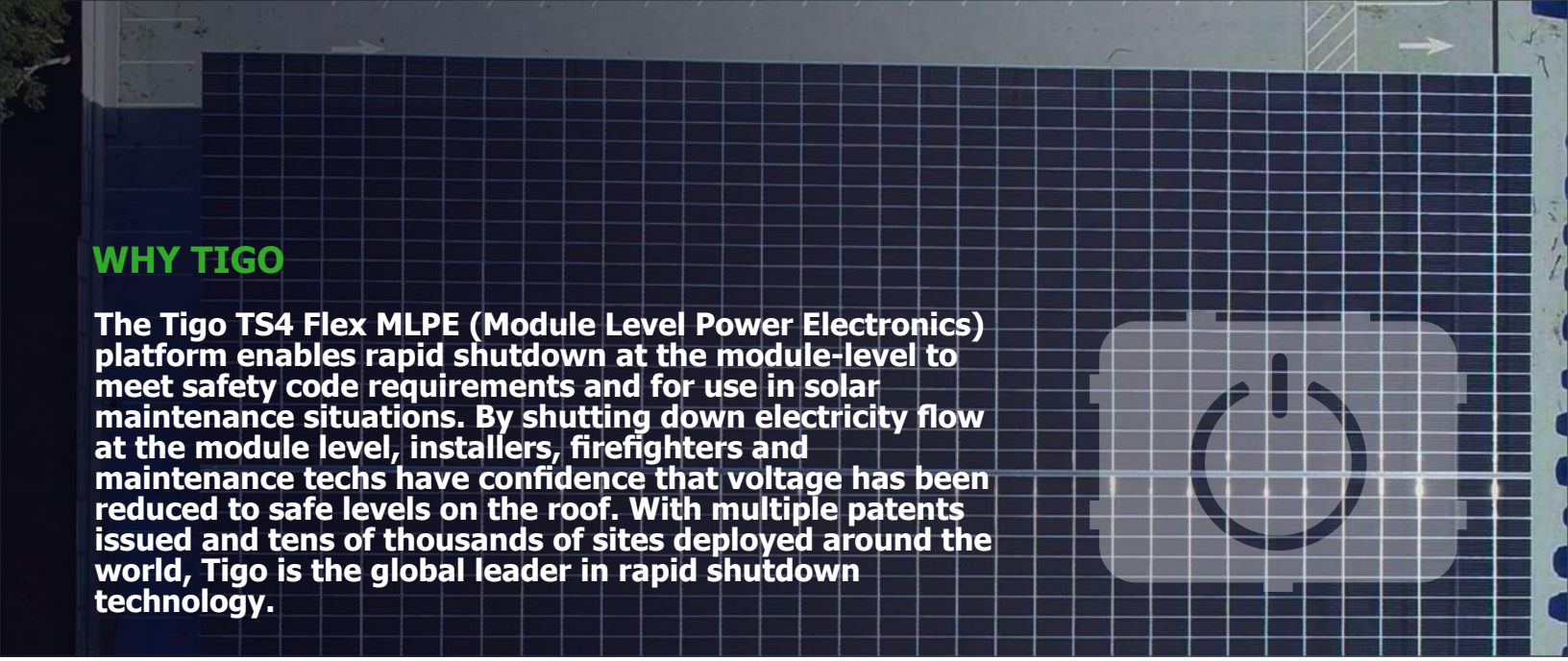
Flexible.
Simple.
Trusted.

1/18/2022

Tigo Energy

Rapid Shutdown Solutions

Meet safety requirements. Improve project ROI. Get multi-vendor flexibility from the leader in rapid shutdown technology.



WHY TIGO

The Tigo TS4 Flex MLPE (Module Level Power Electronics) platform enables rapid shutdown at the module-level to meet safety code requirements and for use in solar maintenance situations. By shutting down electricity flow at the module level, installers, firefighters and maintenance techs have confidence that voltage has been reduced to safe levels on the roof. With multiple patents issued and tens of thousands of sites deployed around the world, Tigo is the global leader in rapid shutdown technology.

HUNDREDS OF INVERTERS TO PAIR WITH

Tigo MLPE are certified with the largest inverter network

- Dozens of brands and hundreds of inverters are certified with Tigo MLPE
- Tigo Enhanced Partner inverters enable plug and play rapid shutdown
- For the complete list of inverters, visit: www.tigoenergy.com/ul-pvrss

THREE MLPE FEATURES TO CHOOSE FROM

Choose the features that maximize the ROI for your site

- **Rapid Shutdown** - enhance safety and meet code requirements.
- **Monitoring** - lower operational costs by gaining visibility into the performance of each module with Tigo Energy Intelligence (EI)
- **Optimization** - increase output, increase the capacity of the site by fitting more modules on a roof, and minimize the effects of mismatch.

MORE THAN A DECADE OF RELIABLE RESULTS

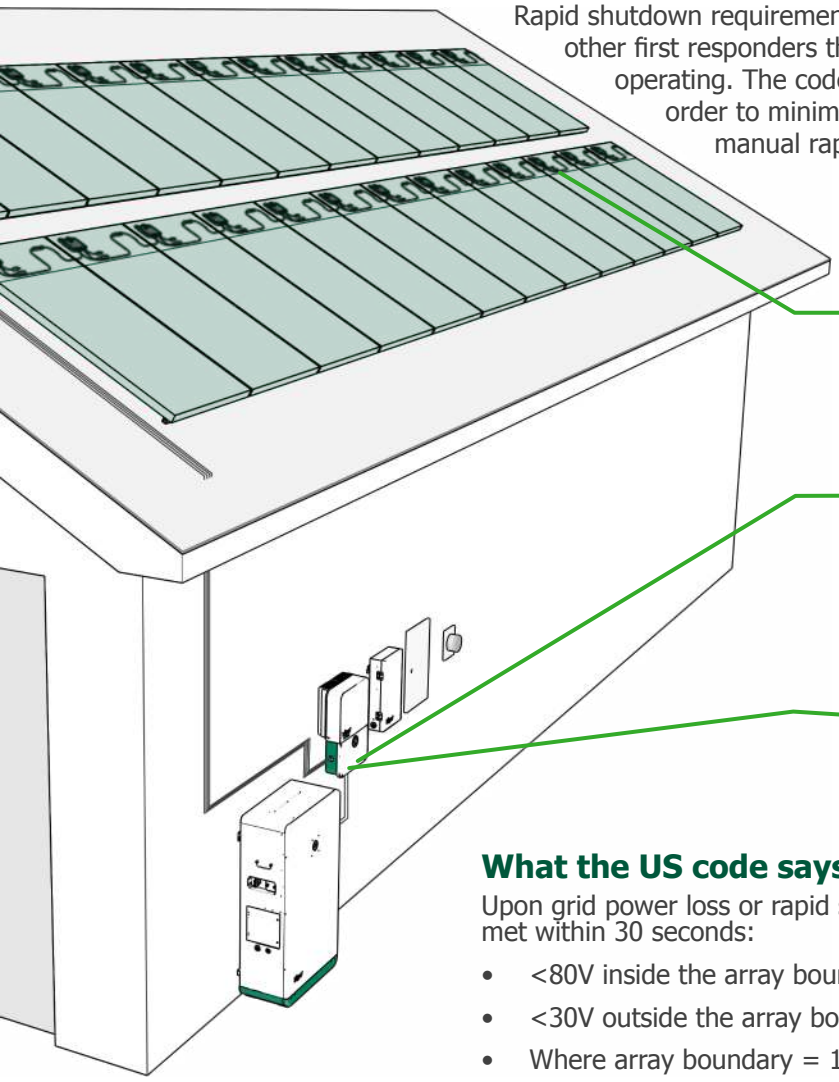
Tigo has industry-leading warranties and support

- Sales Engineers help you design the optimal site
- Tigo support picks up the phone
- Proven technology operating globally from residential to utility scale

Contact us
https://www.tigoenergy.com/contacts

Tigo®

Rapid shutdown requirements, simplified



Rapid shutdown requirements have been enacted for the safety of firefighters and other first responders that access the roof where live solar modules may be operating. The code is specific about reducing the voltage of the array in order to minimize risk for these groups in the event of grid power loss or manual rapid shutdown so the roof can be accessed safely.

Components required

Rapid Shutdown Device (RSD)

Stops the voltage at the module level. May communicate over PLC (Powerline Communication) or wirelessly with initiator.

Rapid Shutdown Initiator

Initiates the rapid shutdown process when the keep-alive signal it transmits is no longer detected by the RSD

Certified inverter

Inverter must be certified with the Rapid Shutdown Device and Initiator. The Initiator is often located inside the inverter wirebox.

What the US code says

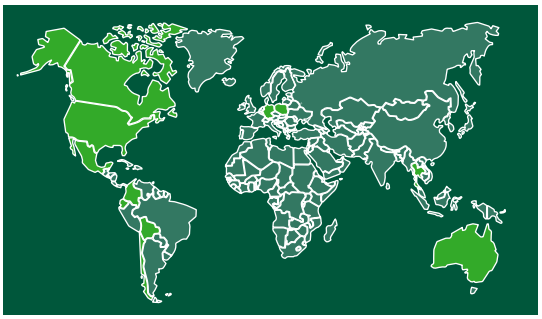
Upon grid power loss or rapid shutdown initiation, the following requirements must be met within 30 seconds:

- <80V inside the array boundary
- <30V outside the array boundary
- Where array boundary = 1ft on all sides of the modules

In addition, the code requires rapid shutdown equipment (PVRSE) and systems (PVRSS) be UL Listed by a Nationally Recognized Testing Laboratory for rapid shutdown.

- PVRSE: Equipment intended to initiate, disconnect, isolate or attenuate the controlled conductors of a PV system
- PVRSS: System consisting of PVRSE including Rapid Shutdown Device, Initiation Device, and Inverter

Rapid Shutdown requirements are spreading around the world



The Rapid shutdown requirements enacted by the US National Fire Protection Agency as part of the National Electrical Code are being replicated and enacted in countries throughout the world including Canada, Mexico, Philippines, Thailand, Poland, and more.

To watch a Tigo a webinar on rapid shutdown requirements around the world, visit: https://www.tigoenergy.com/webinars

Contact us
https://www.tigoenergy.com/contacts

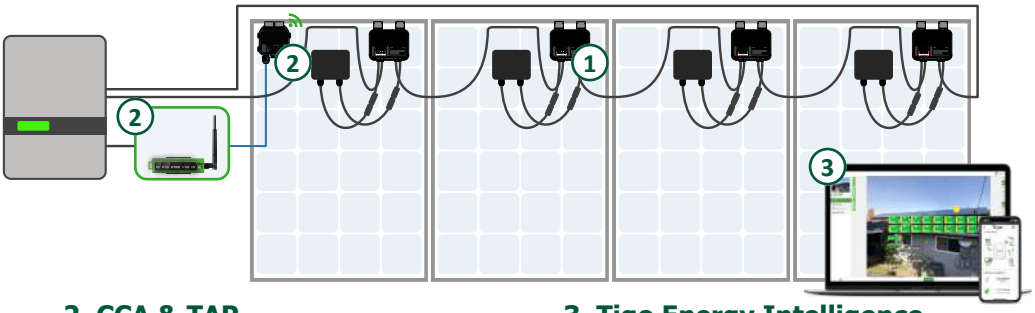
Rapid shutdown with Tigo TS4 Flex MLPE

Select the features you want with rapid shutdown, enabled by Tigo TS4 Flex MLPE

	 O	 S	 F	 2F
FEATURES	Rapid Shutdown Monitoring Optimization	Rapid Shutdown Monitoring	Rapid Shutdown	Rapid Shutdown
REQUIRED SEE SCHEMATIC BELOW	CCA & TAP (Wireless)	CCA & TAP (Wireless)	RSS Transmitter (PLC)	RSS Transmitter (PLC)
MODULES SERVED	1	1	1	2
OPTIONS	May selectively deploy with TS4-A-S	May selectively deploy with TS4-A-O	Works with TS4-A-2F on same strings	Works with TS4-A-F on same strings

SCHEMATIC: TS4-A-O, S

Monitoring enabled smart devices



1. TS4: O, S

Tigo TS4 units are connected to each module. Customers can selectively deploy any combination of the TS4-A-O, or S products to maximize returns for their particular site.

2. CCA & TAP

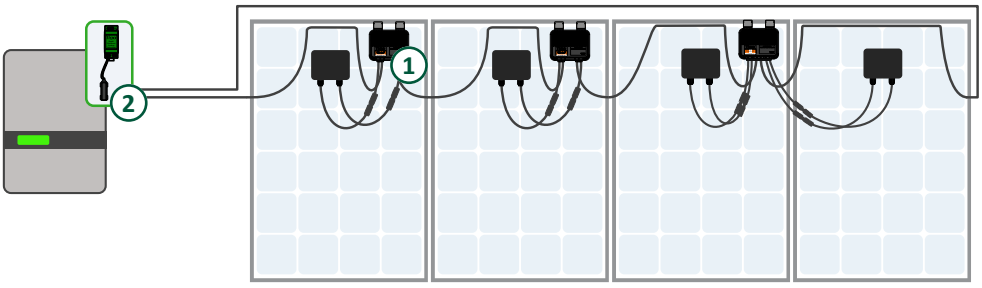
Tigo's Cloud Connect Advanced (CCA) is the data hub for TS4s and other devices (inverter, battery, etc.). It connects with an RS485 cable to the TAP which wirelessly communicates with TS4s.

3. Tigo Energy Intelligence

All of the module-level data, and any third party data connected to Tigo's CCA can be viewed in Tigo's Energy Intelligence monitoring system.

SCHEMATIC: TS4-A-F, 2F

Dedicated, reliable rapid shutdown devices



1. TS4: F or 2F

Tigo's Fire Safety line of TS4 are completely dedicated to the rapid shutdown function and communication via PLC with the RSS Transmitter.

2. Required: RSS Transmitter

The Tigo Rapid Shutdown System (RSS) Transmitter enables UL PVRSS certified rapid shutdown with TS4-A-F and 2F units to meet required safety codes.

3. Monitoring: Inverter

Tigo's TS4-A-F and -2F are dedicated rapid shutdown devices. Inverter monitoring may provide DC data at the string, MPPT or array level.

Contact us
https://www.tigoenergy.com/contacts

Tigo®

Embrace solar freedom with Tigo Rapid Shutdown

Examples of customers using Tigo MLPE to meet code and maximize benefits

Rapid Shutdown + Monitoring + Optimization to maximize output

531 kW Commercial Rooftop | California, USA

TIGO EQUIPMENT USED

Tigo TS4-A-O (Optimization) | TAP | CCA

Rapid Shutdown + Monitoring to enhance safety & visibility

10 MW Floating Solar Array | Israel

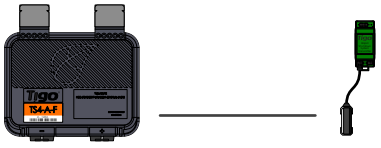
TIGO EQUIPMENT USED

Tigo TS4-A-S (Safety) | TAP | CCA

Rapid Shutdown to meet code requirements

75 kW Airport / Commercial Building | Oregon, USA

TIGO EQUIPMENT USED



Tigo TS4-A-F (Fire Safety) | RSS Transmitter

Contact us
https://www.tigoenergy.com/contacts

Additional Tigo product information

TS4-A-O (optimization)

Rapid shutdown, module level monitoring and optimization for modules up to 700W.

tigoenergy.com/product/ts4-a-o

TS4-A-F (fire safety)

Rapid shutdown dedicated device for modules up to 700W.

tigoenergy.com/product/ts4-a-f

TS4-A-S (safety)

Rapid shutdown and module level monitoring for modules up to 700W.

tigoenergy.com/product/ts4-a-s

TS4-A-2F (fire safety for 2 modules)

Rapid shutdown dedicated device for 2 modules, each up to 500W.

tigoenergy.com/product/ts4-a-2f

Cloud Connect Advanced (CCA)

Universal data-logger that connects to Tigo TS4-A-O and S via the Tigo Access Point (TAP).

tigoenergy.com/product/cloud-connect-advanced

RSS Transmitter

It completes the rapid shutdown system architecture when paired with Tigo's TS4 F/2F.

tigoenergy.com/product/rss-transmitter

Tigo Access Point (TAP)

The TAP wirelessly connects to Tigo TS4-A-O and S to enable monitoring and rapid shutdown.

tigoenergy.com/product/tigo-access-point

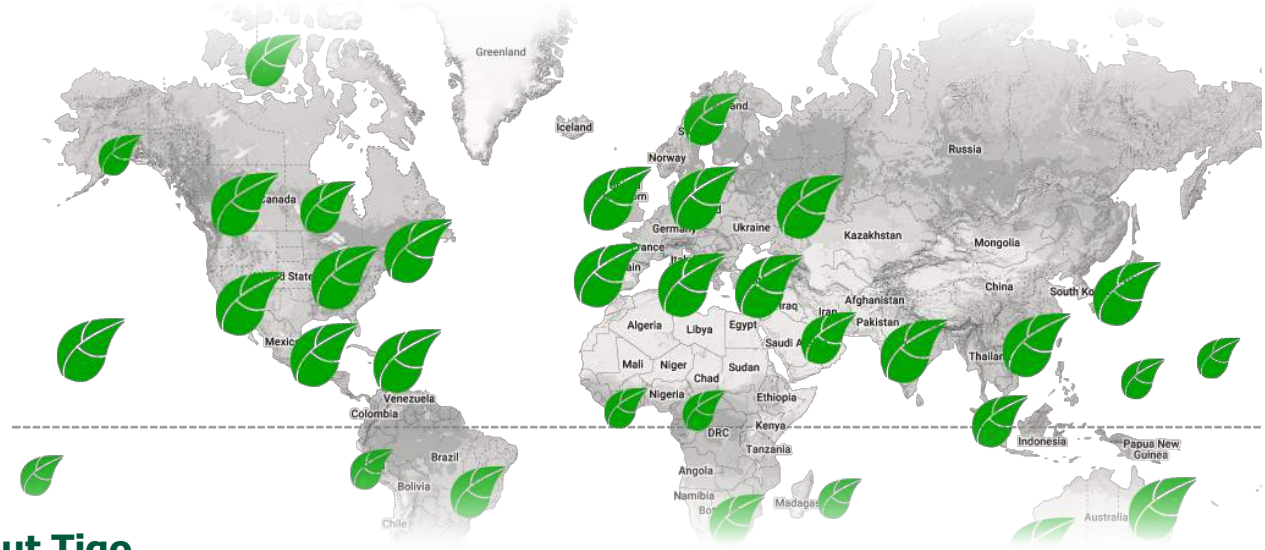
UL PVRSS Certified inverter list

View the hundreds of inverters that have been UL PVRSS certified with Tigo TS4 Flex MLPE.

tigoenergy.com/ul-pvrss

TRUSTED AROUND THE WORLD

Tigo monitors >1GWh of daily solar production on 7 continents



About Tigo

Tigo Energy, the worldwide leader in Flex MLPE (Module Level Power Electronics), designs innovative solar power conversion and storage products that provide customers more choice and flexibility. The Tigo TS4 platform increases solar production, decreases operating costs, and enhances safety. When combined with the Tigo Energy Intelligence (EI) platform, it delivers module, system, and fleet-level insights to maximize solar performance and minimize operating costs. Tigo was founded in Silicon Valley in 2007 to accelerate the adoption of solar energy, and its global team supports customers whose systems reliably produce gigawatt hours of safe solar energy on seven continents.

Contact Sales

Contact us
https://www.tigoenergy.com/contacts

TIGO ENERGY PV-OFF™

Improving PV Safety with PV-OFF™ for Rapid Shutdown

Tigo Energy Inc.
655 Campbell Technology Pkwy, Ste 150
Campbell, CA 95008

01/24/20

Introduction

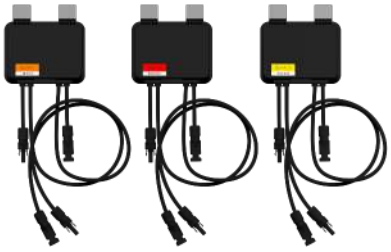
Safety requirements and hazard controls are on the rise for PV systems across the globe. From design regulations to installation best practices, installers are being held to a higher standard for safety as the solar market progresses. Solar equipment - including module-level power electronics (MLPE) - is helping to mitigate the known risks of these arrays.

PV modules are charged with high voltage when exposed to the sun, which is the primary safety concern for installers and other personnel working near the array. In a standard array this is true even after the DC disconnect is activated because PV modules still carry open circuit voltage and are connected in series. Due to the serial connectivity of the string, each module and cable can be carrying a charge of 600V, 1000V, or even 1500V, depending on the maximum system voltage allowed. Systems today are not fully equipped to detect PV safety hazards without specialized hardware.

Although the USA currently has the strictest solar electric codes, other countries are quickly following with similar requirements to protect solar assets and system owners. Tigo is the only UL-certified multivendor module-level rapid shutdown solution that meets the latest requirements.

Tigo PV-Off™ provides enhanced safety through on-site manual or automatic module-level disconnect. In PV-Off mode, each module output drops to 0W and 0V (or 0.6V per unit for TS4-F.) This revolutionary disconnect provides installers, firefighters, and maintenance personnel absolute certainty that no high voltage is present.

Module-Level Hardware with PV-Off



TS4-A-F, TS4-A-S, & TS4-A-O

TS4-F, TS4-S, TS4-O, & TS4-L

PV-Off can be manually activated on-site, or automatically triggered by certain conditions like AC grid loss.

The Tigo power electronics can be integrated in smart modules or installed as an add-on with standard modules and enter PV-Off mode by disconnecting the PV module from the interconnecting cabling. PV-Off shuts off the array at the module level and limits voltage exposure to the open circuit voltage of an individual module.

PV-Off can be activated in case of emergency, maintenance, or any other reason requiring personnel to walk through the array. Whenever it activates, an alert is generated and sent to the system manager and whomever else the user designates. These alerts can be sent via email or text message.

TS4-A-F, TS4-A-S, TS4-A-O, TS4-F, TS4-S, TS4-O, TS4-L, TS4-R-F, TS4-R-S, TS4-R-O, and TS4-A-2F are UL-certified as a rapid shutdown solution when installed as directed and are compliant with NEC 2014 and 2017 690.12 rapid shutdown requirements.

AC Breaker Deactivation

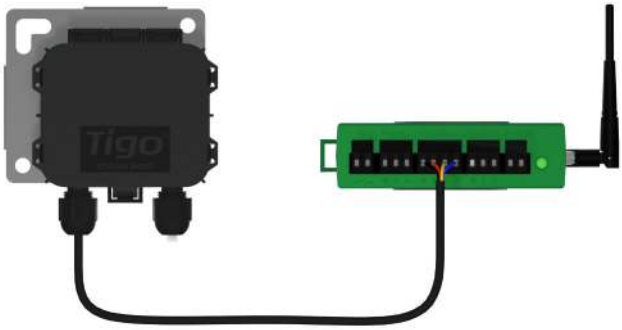
In the case of an emergency such as a fire, first responders routinely shut down the building's AC mains supply and/or breaker to the facility upon arriving on-site, and before attempting to contend with the fire or hazard.

For PV systems equipped with TS4 smart modules incorporating PV-Off, no other action is required in order to make sure DC string voltage drops to $0V_{DC}$ (or $0.6V_{DC}$ for each TS4-F unit). Note that in the event of an AC grid outage, the system will automatically default into PV-Off mode. This important operation is designed to reduce the amount of time needed for firefighters to shut down DC system power for the array. Instead of searching for additional DC ground-mounted or roof-mounted isolators, emergency personnel can rest assured with Tigo TS4 PV-Off operation that once the building's AC is disconnected the PV array's DC voltage is off as well.

By connecting Tigo's Cloud Connect Advanced (CCA) or RSS Transmitter to the same AC main service as the inverter, you can ensure that the entire system will be de-energized when the breaker is turned off. The system will automatically enter PV-Off mode when the CCA or RSS Transmitter is switched off.

While the AC breaker is off, PV-Off will keep the modules off throughout the entire installation, including strings and home runs. When the AC breaker is switched on again the units will receive the keep-alive signal from the RSS Transmitter or CCA & TAP and the system will reactivate. The TS4 modules with PV-Off will wake up and resume normal power production without the need for any direct user interface.

PV-Off Activating Hardware



TAP and CCA
for Flex MLPE

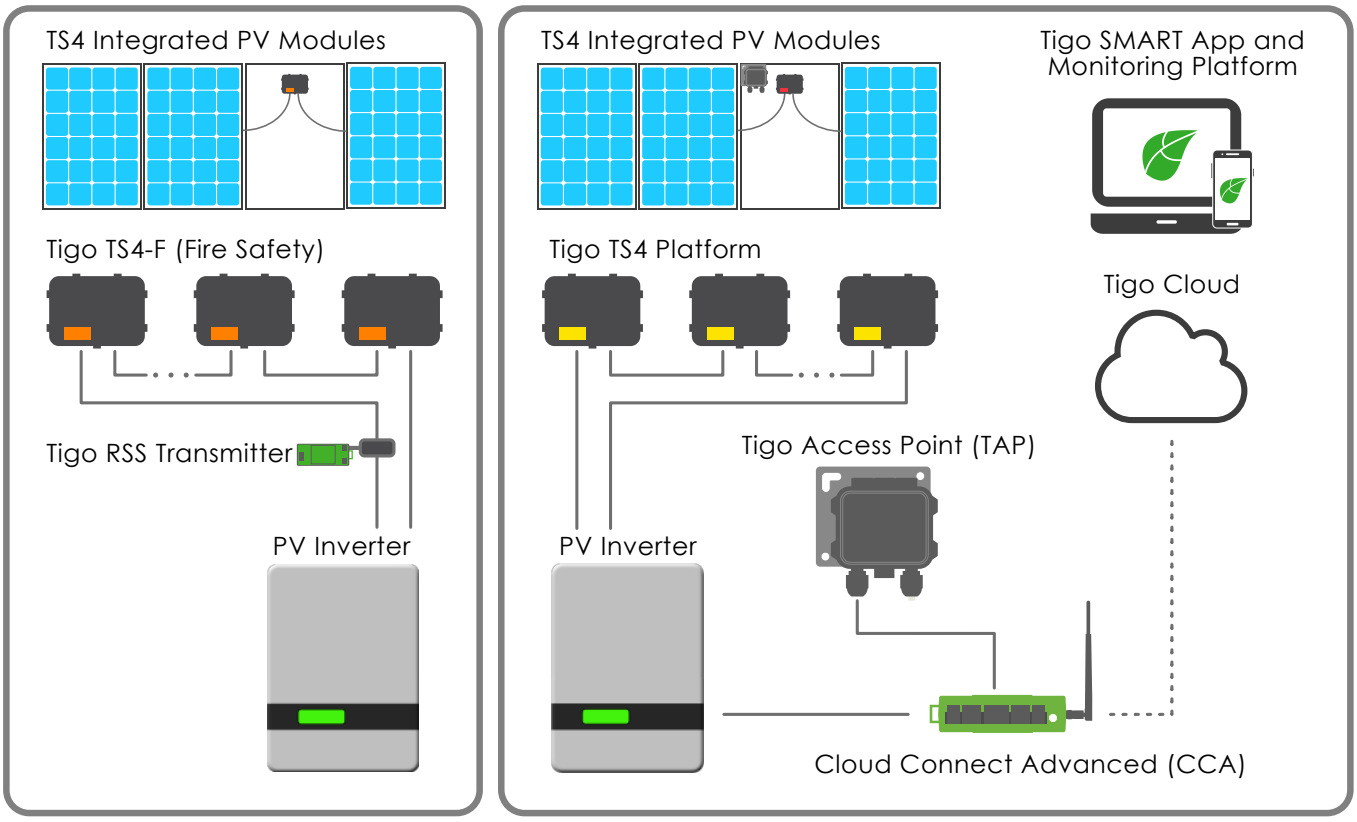
RSS Transmitter
for TS4-F

The CCA and TAP supply the keep-alive signal for the TS4-S, TS4-O, TS4-L (integrated), TS4-A-S, and TS4-A-O (add-on) units. The CCA also enables module-level monitoring via the Tigo SMART website and app.

The RSS Transmitter supplies the keep-alive signal for the TS4-F (integrated), TS4-A-F (add-on), and TS4-A-2F (add-on for two modules.)

Refer to the installation manuals for complete instructions.

Sample System Installation



TS4-F and RSS Transmitter

Flex MLPE, TAP, and CCA

Module-Level Hazard Detection

TS4 units with wireless communication are constantly measuring module-level voltage and current. If a safety hazard such as overvoltage or overcurrent is detected, the TS4 unit will switch off at the module level and communicate the potential hazard to the TAP and CCA. Tigo's Ultra High Definition monitoring provides quick and accurate detection of potential hazards while ensuring maximum performance for the array.

Conclusion

PV systems should be designed, installed, and monitored with safety in mind. However, due to evolving equipment, changing regulations, and unforeseen risks, additional safety technology is always a good idea. Tigo's PV-Off™ enhanced safety through on-site manual and automatic module-level disconnect protects your assets throughout your PV system's lifetime. Strings and modules are easily disconnected, voltages are controlled, safety hazards are detected, and dangerous situations are avoided. Tigo provides this revolutionary disconnect and helps keep systems safe so you can focus on the PV benefits and return on investments.

Learn more at www.tigoenergy.com.

Tigo Energy, Inc.

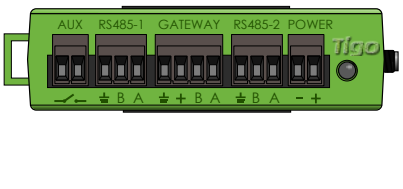
Tigo® is a Silicon Valley company founded in 2007 by a team of experienced technologists. Combining a unique systems-level approach with expertise in semiconductors, power electronics, and solar energy, the Tigo team developed the first-generation Smart Module Optimizer technology for the solar industry. Tigo's vision is to leverage integrated and retrofitted Flex MLPE (module-level power electronics) and communications technology to drive the cost of solar electricity down. By partnering with tier 1 module and inverter manufacturers in the industry, Tigo is able to focus on its key innovation with the smartest TS4 modular platform and leverage the broader ecosystem. Tigo has operations in the USA, across Europe, Japan, China, Australia and the Middle East.

Annex: National Electrical Code 690.12
Rapid Shutdown of PV Systems

To activate Rapid Shutdown:

1. Switch off AC disconnect (with CCA or RSS Transmitter installed on same AC main panel as inverter.)

2. LED on CCA or RSS Transmitter will be unlit until AC power is restored. Module output can be tested with a voltmeter.



When PV-Off is initiated (Rapid Shutdown):
String voltage across the PV array and conductors will drop lower than 30V within 10 seconds.

To re-energize a system after Rapid Shutdown:

Switch on AC disconnect to restore power to CCA or RSS Transmitter and inverter. System will resume operation.

Tigo®

Installation Manual

TS4-F, TS4-A-F, TS4-A-2F
and RSS Transmitter

IMPORTANT SAFETY INSTRUCTIONS

LETHAL VOLTAGE MAY BE PRESENT IN ANY PV INSTALLATION

SAVE THESE INSTRUCTIONS

WARNING - THIS PHOTOVOLTAIC RAPID SHUTDOWN EQUIPMENT (PVRSE) DOES NOT PERFORM ALL OF THE FUNCTIONS OF A COMPLETE PHOTOVOLTAIC RAPID SHUTDOWN SYSTEM (PVRSS). THIS PVRSE MUST BE INSTALLED WITH OTHER EQUIPMENT TO FORM A COMPLETE PVRSS THAT MEETS THE REQUIREMENTS OF NEC (NFPA 70) SECTION 690.12 FOR CONTROLLED CONDUCTORS OUTSIDE THE ARRAY. OTHER EQUIPMENT INSTALLED IN OR ON THIS PV SYSTEM MAY ADVERSELY AFFECT THE OPERATION OF THE PVRSS. IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE COMPLETED PV SYSTEM MEETS THE RAPID SHUTDOWN FUNCTIONAL REQUIREMENTS. THIS EQUIPMENT MUST BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

- This manual contains important instructions for installation and maintenance of the Tigo product models TS4-F, TS4-A-F, TS4-A-2F, and the RSS Transmitter.
- Risk of electric shock, do not remove cover, disassemble, or repair, no user serviceable parts inside. Refer servicing to qualified service personnel.
- Before installing or using the Tigo System, please read all instructions and warning markings on the Tigo products, appropriate sections of your inverter manual, photovoltaic (PV) module installation manual, and other available safety guides.
- All equipment shall be installed and operated in an environment within the ratings and limitations of the equipment as published in the installation manual.
- To reduce risk of fire and shock hazard, install this device with strict adherence to National Electric Code (NEC) ANSI/NFPA 70 and/or local electrical codes. When the photovoltaic array is exposed to light, it supplies a DC voltage to the Tigo TS4 units and the output voltage may be as high as the PV module open circuit voltage (V_{OC}) when connected to the module. The installer should use the same caution when handling electrical cables from a PV module with or without the TS4 units attached.
    - TS4-F, TS4-A-F, and TS4-A-2F are shipped in the OFF position and will measure 0.6V at the output when the keep-alive signal is not present.
- Installation must be performed by trained professionals only. Tigo does not assume liability for loss or damage resulting from improper handling, installation, or misuse of products.
- Remove all metallic jewelry prior to installing the Tigo TS4 units to reduce the risk of contacting live circuitry. Do not attempt to install in inclement weather.
- Do not operate the Tigo TS4 units if they have been physically damaged. Check existing cables and connectors, ensuring they are in good condition and appropriate in rating. Do not operate Tigo TS4 units with damaged or substandard wiring or connectors. Tigo TS4 units must be mounted on the high end of the PV module backsheet or racking system, and in any case above ground.
- Do not connect or disconnect under load. Turning off the inverter and/or the Tigo products may not reduce this risk. Internal capacitors within the inverter can remain charged for several minutes after disconnecting all power sources. Verify capacitors have discharged by measuring voltage across inverter terminals prior to disconnecting wiring if service is required. Wait 30 seconds after rapid shutdown activation before disconnecting DC cables or turning off DC disconnect.
- Mating connectors from different manufacturers cannot be mated with each other.

The transmitter control power supply MUST be on the same AC branch circuit as the inverter to meet rapid shutdown requirements.

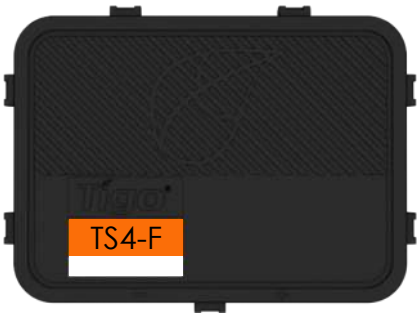
TABLE OF CONTENTS

TS4-F RAPID SHUTDOWN SYSTEM

Tigo's TS4-F (or TS4-A-F, TS4-A-2F) and RSS Transmitter are a UL-certified PVRSS (Photovoltaic Rapid Shutdown System) when installed together. The RSS Transmitter supplies a keep-alive signal along one of the DC homeruns of the string and the TS4-F units on each module will shut down when the Transmitter is switched off.

The TS4-F, TS4-A-F and TS4-A-2F can be used interchangeably in the same system.

Module-Level Power Electronics:



TS4-F

- NEC 2017 and 2020 690.12 rapid shutdown compliant
- Module-level deactivation
- PLC communication
- Plug & play, no configuration required

Transmitter:

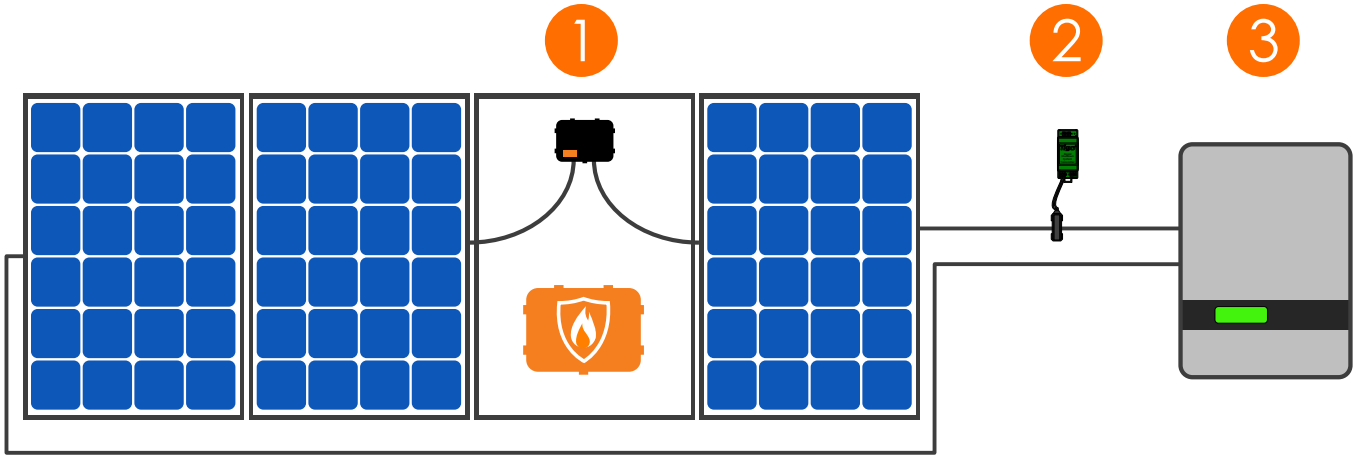
RSS Transmitter

- Rapid Shutdown System Transmitter for rapid shutdown activation of TS4-F, TS4-A-F, or TS4-A-2F units
- The external device that provides a keep-alive signal to the TS4-F via Power Line Communication

SYSTEM OVERVIEW: TS4-F

TS4-F

- Module electronics are contained in the junction box, installed at the PV module factory.
- Connected in series like regular modules
- No additional wiring connections to make



1. Modules with integrated TS4-F
2. RSS Transmitter and RSS Core
3. UL PVRSS Listed Inverter

The TS4-F requires a Tigo RSS Transmitter or inverter with built-in transmitter for operation. The Tigo RSS Transmitter is installed in line with a solar PV inverter, as shown, and can be installed inside the inverter or external to it.

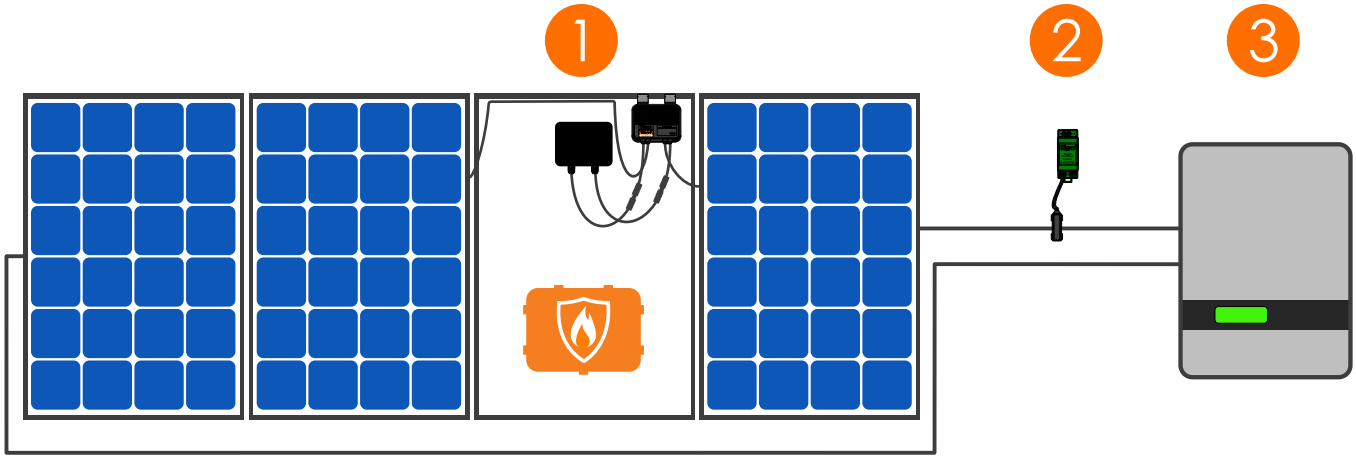
Method of Operation
All TS4-F units start in the OFF position and measure 0.6V at the output. When power is supplied to the RSS Transmitter, the TS4-F units turn ON and allow full PV module voltage.

The units constantly receive a "keep-alive" signal from the transmitter over PLC. When power to the transmitter is cut, this keep-alive signal ceases, sending every TS4-F into shutdown mode with output reduced to 0.6V.

SYSTEM OVERVIEW: TS4-A-F

TS4-A-F

- Bracket clips to module frame without tools
- TS4-A outputs are connected in series to form a string
- No additional grounding required



1. Modules with TS4-A-F add-on
2. RSS Transmitter and RSS Core
3. UL PVRSS Listed Inverter

Note: connect modules to TS4-A inputs before connecting outputs

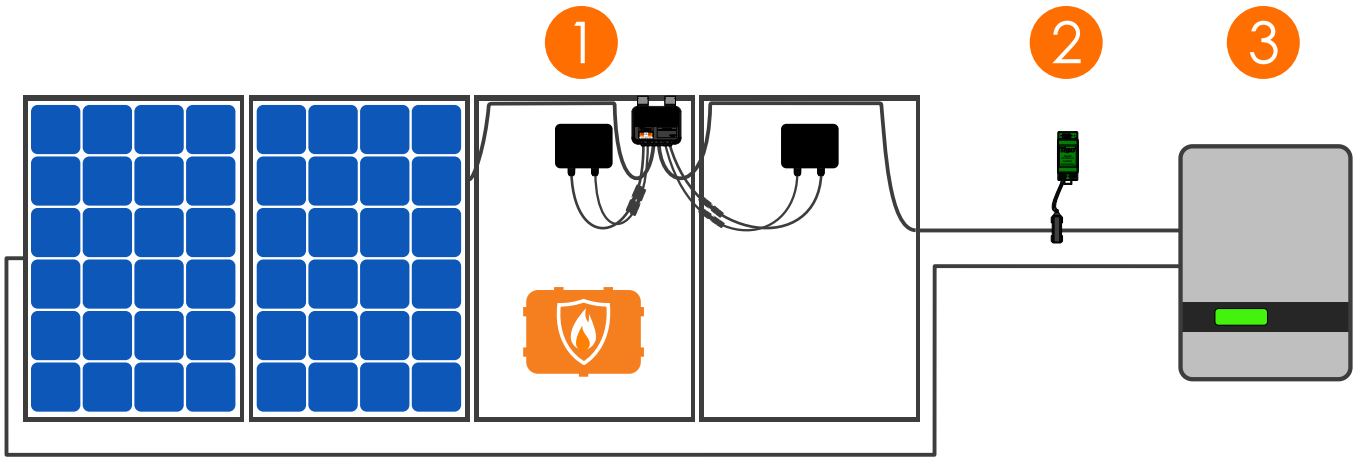
The TS4-A-F requires a Tigo RSS Transmitter or inverter with built-in transmitter for operation.

- TS4-A-F mounting is recommended on the upper right as shown, but can be placed elsewhere on the frame or bolted to the racking if needed.
- TS4-A-F cable glands must not be facing up.
- Allow clearance between PV module and mounting surface for air circulation around TS4-A-F.
- For installation on frameless modules, remove metal clips and bolt TS4-A to rail. Do not drill additional mounting holes in the frame or metal bracket.

SYSTEM OVERVIEW: TS4-A-2F

TS4-A-2F

- Bracket clips to module frame without tools
- TS4-A outputs are connected in series to form a string
- No additional grounding required
- Two individual module inputs



1. Modules with TS4-A-2F add-on
2. RSS Transmitter and RSS Core
3. UL PVRSS Listed Inverter

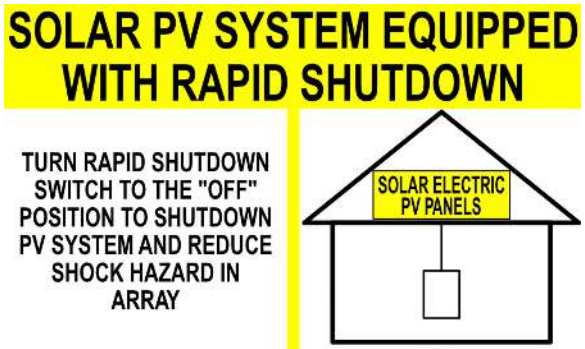
Note: connect modules to TS4-A inputs before connecting outputs

The TS4-A-2F requires a Tigo RSS Transmitter or inverter with built-in transmitter for operation.

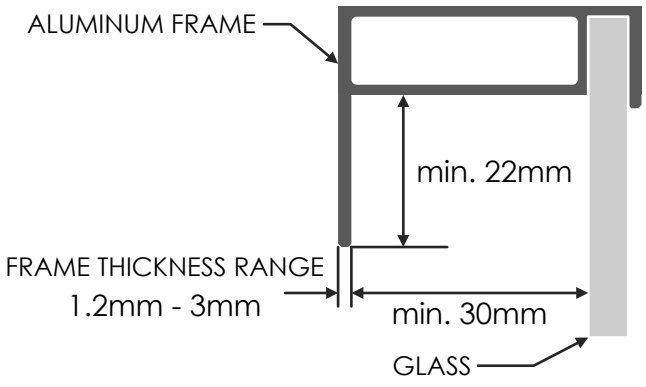
- TS4-A-2F mounting is recommended on the upper right as shown, but can be placed elsewhere on the frame or bolted to the racking if needed.
- TS4-A-2F cable glands must not be facing up.
- Allow clearance between PV module and mounting surface for air circulation around TS4-A-2F.
- For installation on frameless modules, remove metal clips and bolt TS4-A to rail. Do not drill additional mounting holes in the frame or metal bracket.

INSTALLATION NOTES

- TS4-F, TS4-A-F, and TS4-A-2F are shipped in the OFF position and will measure **0.6V** at the output when the keep-alive signal is not present.
- Failing to follow the sequence of installation steps may result in TS4 damage not covered under warranty.
- Connect all TS4-A-F or TS4-A-2F units to their respective modules **before** connecting their outputs in series.
- Install all TS4-F, TS4-A-F, or TS4-A-2F units **before** powering on the RSS Transmitter.
- Never modify or extend wires between RSS Transmitter and RSS Core.
- Never apply an external voltage source to a module or string equipped with TS4-F, TS4-A-F, or TS4-A-2F units.
  - If parallel string connections are needed, first connect the TS4-F, TS4-A-F, or TS4-A-2F to the PV modules, then connect all TS4-F, TS4-A-F, or TS4-A-2F outputs in series, and finally pass one side (+ **or** -) of the homeruns through the PLC transmitter to turn the system ON.
- If connecting TS4-A-2F to a single PV module:
  - Connect PV module to **Input 1**, connect **Input 2** cables together
- Place rapid shutdown system label no more than 1m (3ft) from initiator (AC disconnect) or service panel containing means of disconnection if not at same location.



Place safety labels in proper location

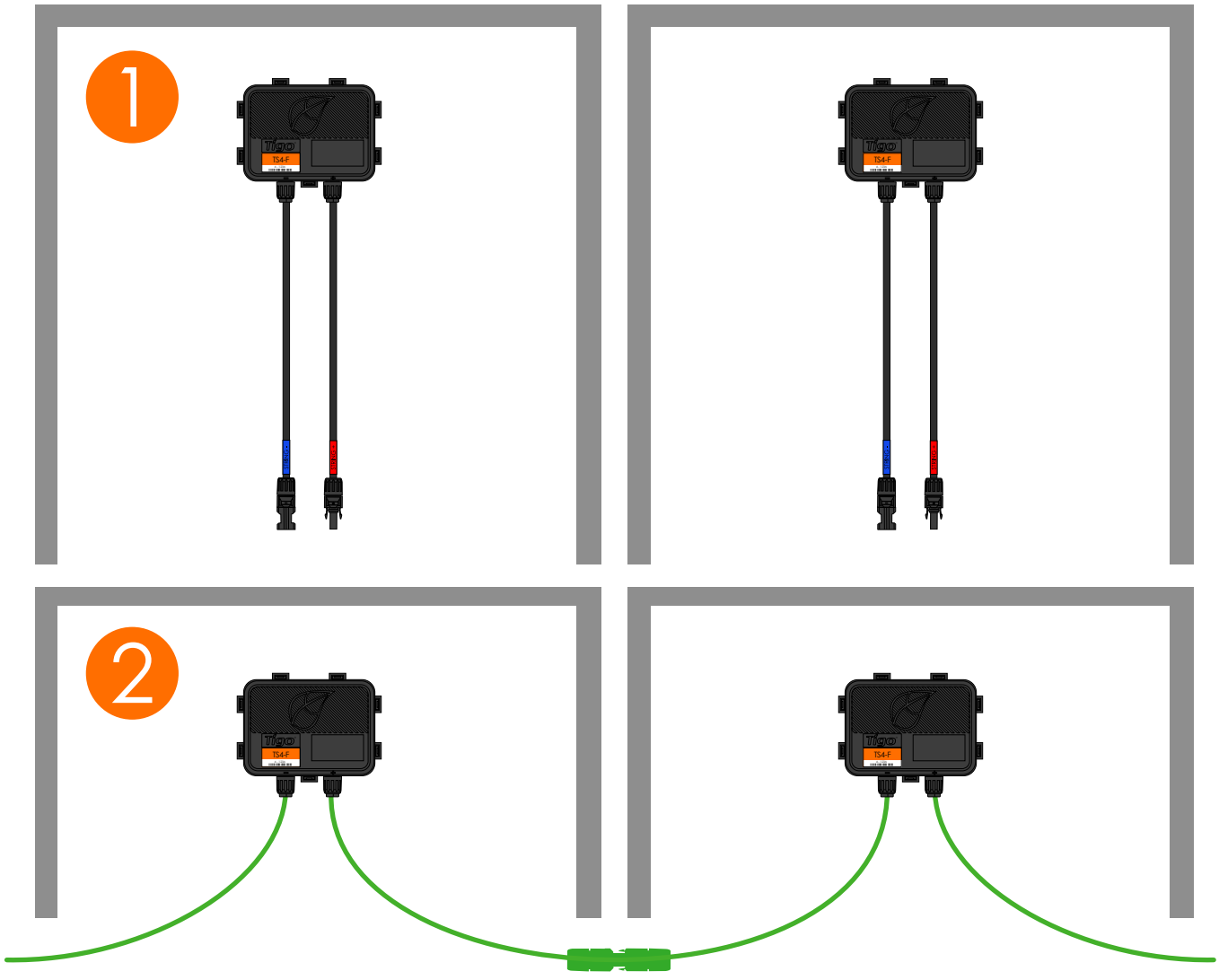


Module frame specifications for mounting TS4-A

TS4-F INSTALLATION

Smart modules with an integrated TS4 Junction box are installed and connected in series just like standard PV modules.

Connect modules with TS4-F in series before powering on the RSS Transmitter.



RSS Transmitter must be powered OFF during TS4-F installation.

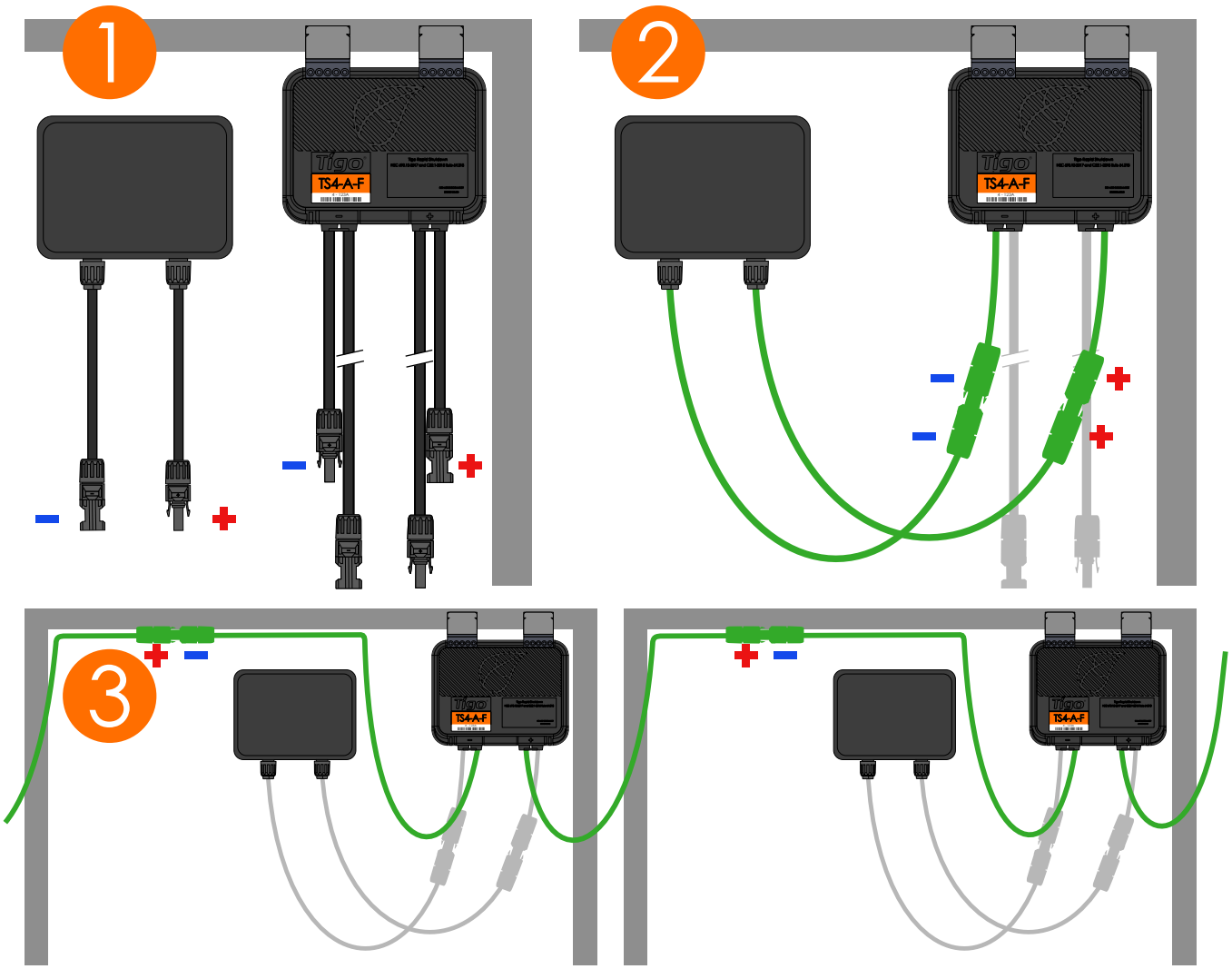
TS4-A-F INSTALLATION

Standard modules can be equipped with TS4-A-F add-on units as shown below.

Always connect modules to TS4-A inputs before connecting outputs.

Each TS4-A-F must have a PV module connected to its input before connecting the outputs of TS4-A-F units in series.

To disconnect TS4-A-F from a module, disconnect the TS4-A-F outputs from the string before disconnecting the TS4-A-F inputs from the module junction box.



RSS Transmitter must be powered OFF during TS4-A-F installation.

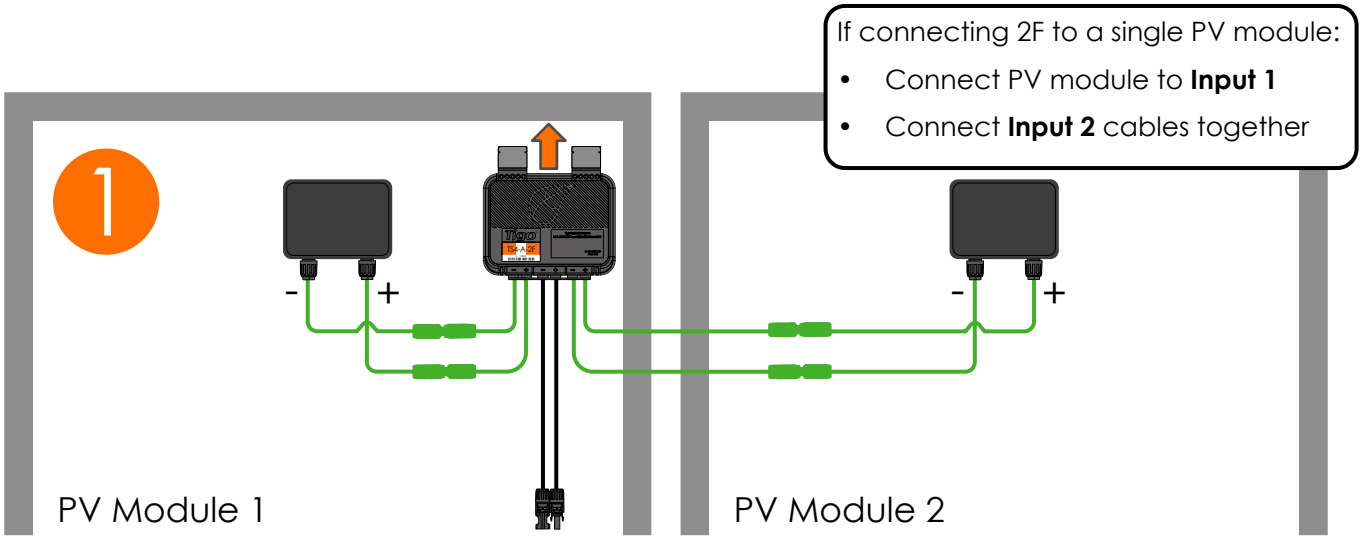
TS4-A-2F INSTALLATION

Standard modules can be equipped with TS4-A-2F add-on units as shown below.

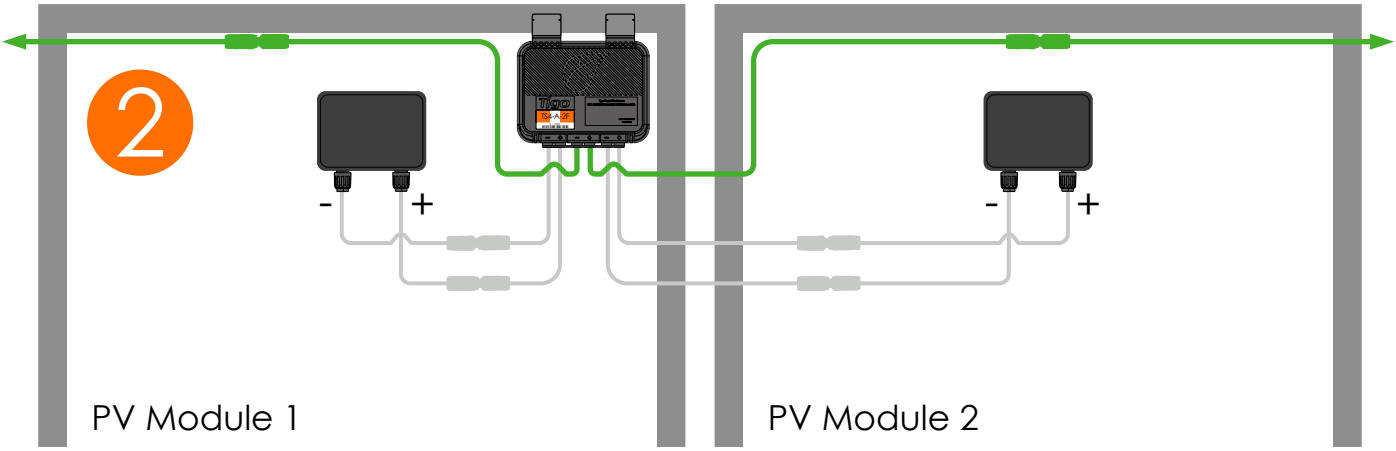
Always connect modules to TS4-A inputs before connecting outputs.

Each TS4-A-2F must have a PV module connected to its inputs before connecting the outputs of TS4-A-2F units in series.

To disconnect TS4-A-2F from a module, disconnect the TS4-A-2F outputs from the string before disconnecting the TS4-A-2F inputs from the module junction box.



1. Connect PV modules to TS4-A-2F inputs



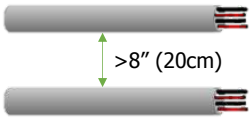
2. Connect TS4-A-2F outputs in series

RSS Transmitter must be powered OFF during TS4-A-2F installation.

PV CONDUCTOR INSTALLATION - MULTI-TRANSMITTER SYSTEMS - REQUIRED PRACTICES

When installing a system with 2 or more transmitters it is mandatory to use the following best installation practices of PLC circuits to ensure a trouble-free installation.

Run +/- string conductors from the same transmitter together in the same conduit.



Run +/- string conductors from the same string together through array and conduit.

Twist the +/- of the string.

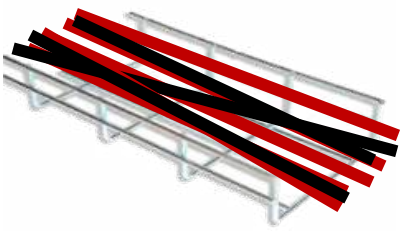
If cable trays must be used, only lay conductors from the same transmitter in the cable tray and twist pairs.

The closer the conduit or cable tray the greater potential for crosstalk to occur.

Never separate the + and – of the same string.

Never separate the + and – of the same string.

Open cable trays provide no additional protection from crosstalk. Never place conductors from different transmitters in the same Cable tray.

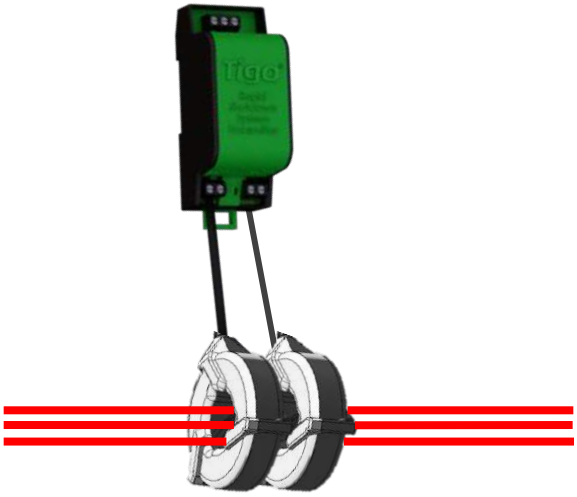


MAINTAIN SIGNAL INTEGRITY

The following practices will help maintain signal integrity for all PLC rapid shutdown systems.

Do not cross other power conductors, communications cables, or current carrying conductors in general over any PV conductor in the PVRSS system.

In order to maintain signal integrity, the RSS Transmitter has a specified maximum round-trip distance from positive to negative of 300m (985ft). If the longest string in a system exceeds 300m, but is less than 500m, two cores may be used in series on the string to amplify the signal.

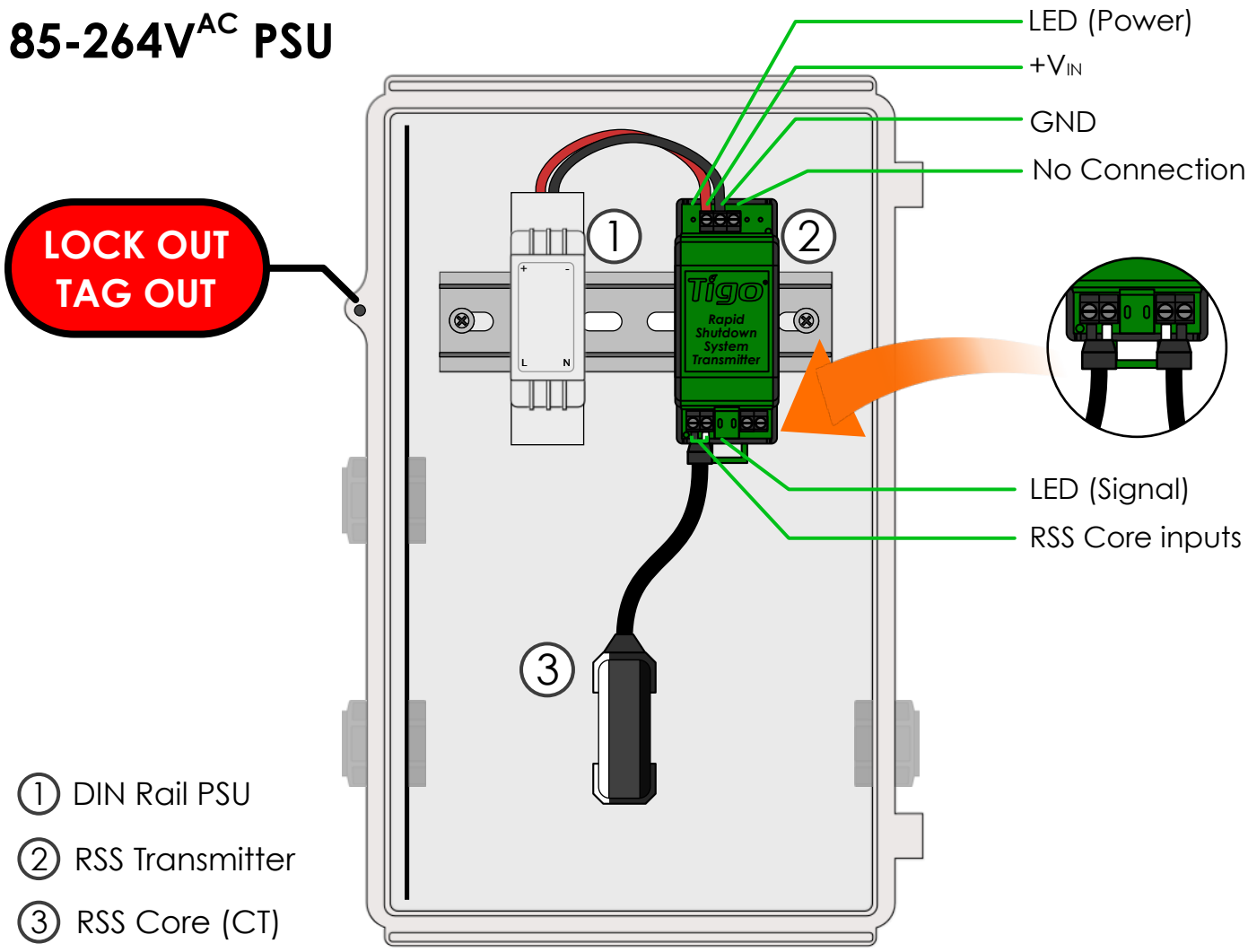


Contact Tigo Sales Engineers for more information and assistance in these applications.

Never face cores in opposite directions. The signal is directional. Directing the signals of two transmitters toward each other could cancel the signal.

RSS TRANSMITTER INSTALLATION – SINGLE RSS CORE

85-264V^{AC} PSU



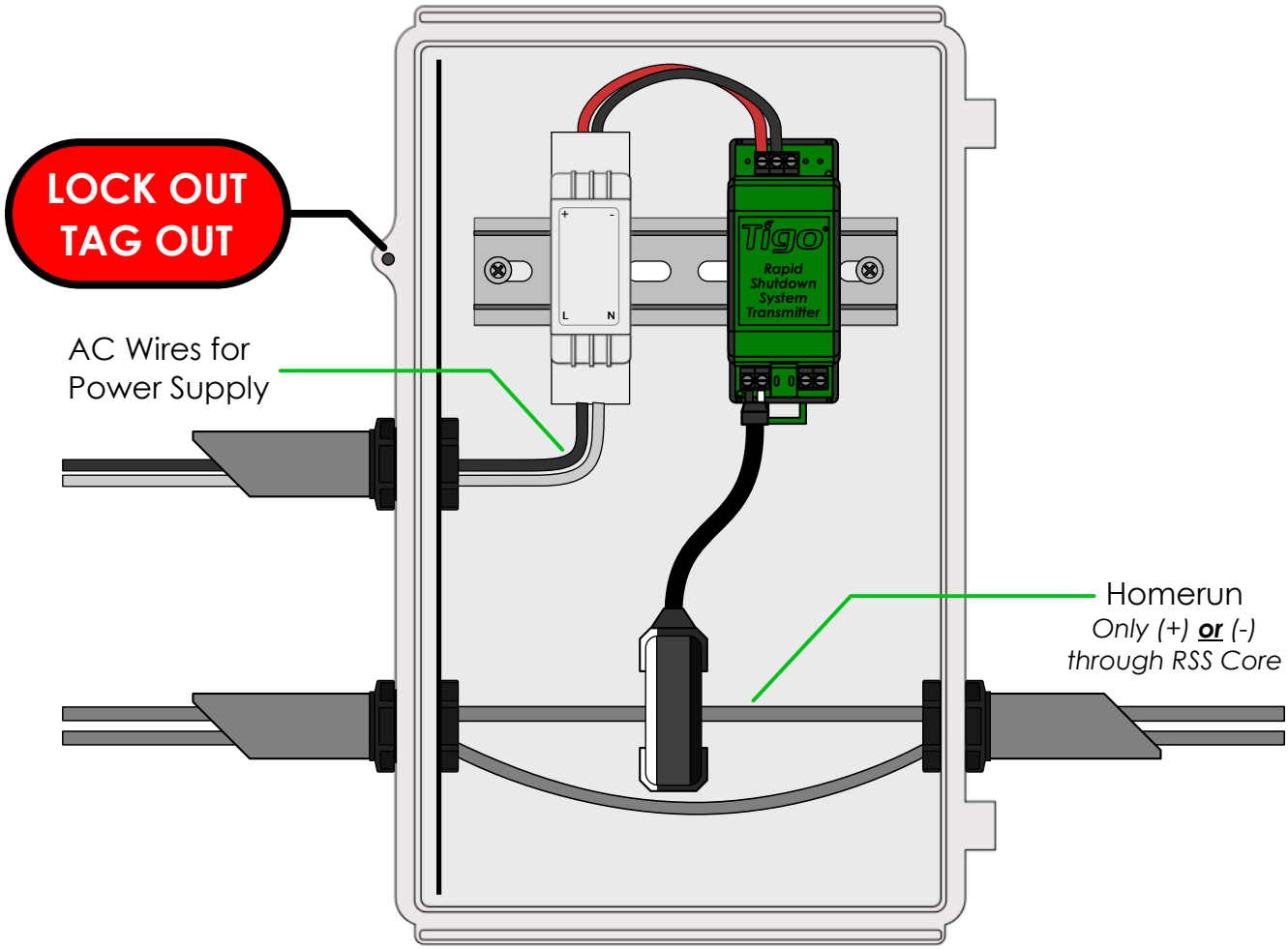
Transmitter power supply must be on same AC branch circuit as inverter to meet rapid shutdown requirements.

Note: Install TS4-F before powering on RSS Transmitter

- Drill holes in enclosure for conduit (see drilling guide for placement)
- Mount RSS Transmitter and power supply on DIN rail
- Connect DC leads from power supply (1) to transmitter (2)
- Connect RSS Core (3) to transmitter

Place rapid shutdown system label no more than 1m (3ft) from RSS Transmitter or AC disconnect if not at same location.

RSS TRANSMITTER WIRING – SINGLE RSS CORE

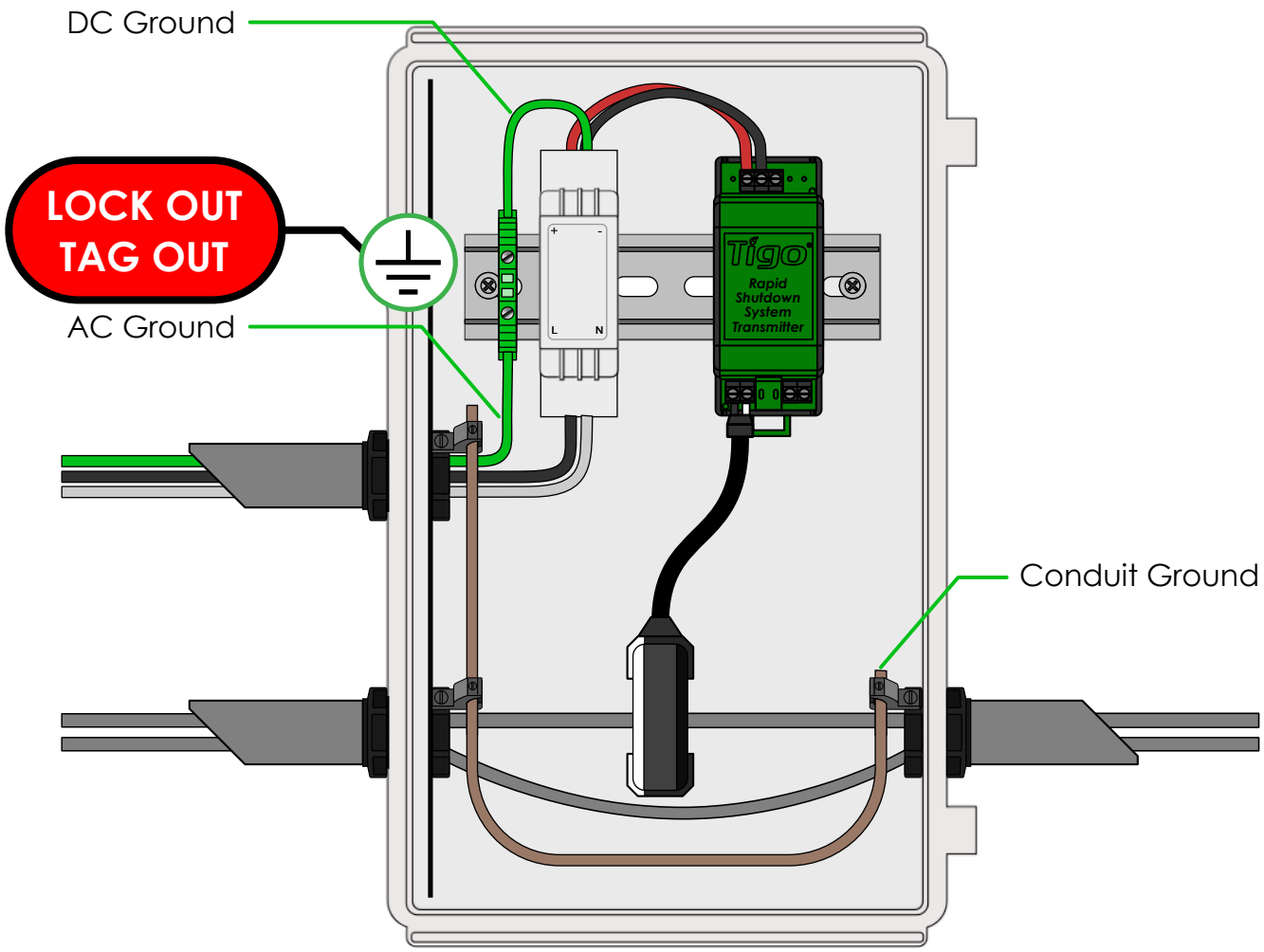


Note: Install TS4-F before powering on RSS Transmitter

- Pass either positive **or** negative homerun through RSS Core
- Connect wires to AC side of power supply

Max number of strings per RSS Core: **10**
Max string length: **30 modules**
Max current per RSS Core: **100A**
Max cable length from inverter (+) to inverter (-): **1000ft (300m)**
For longer distances please contact Tigo

RSS TRANSMITTER GROUNDING – SINGLE RSS CORE

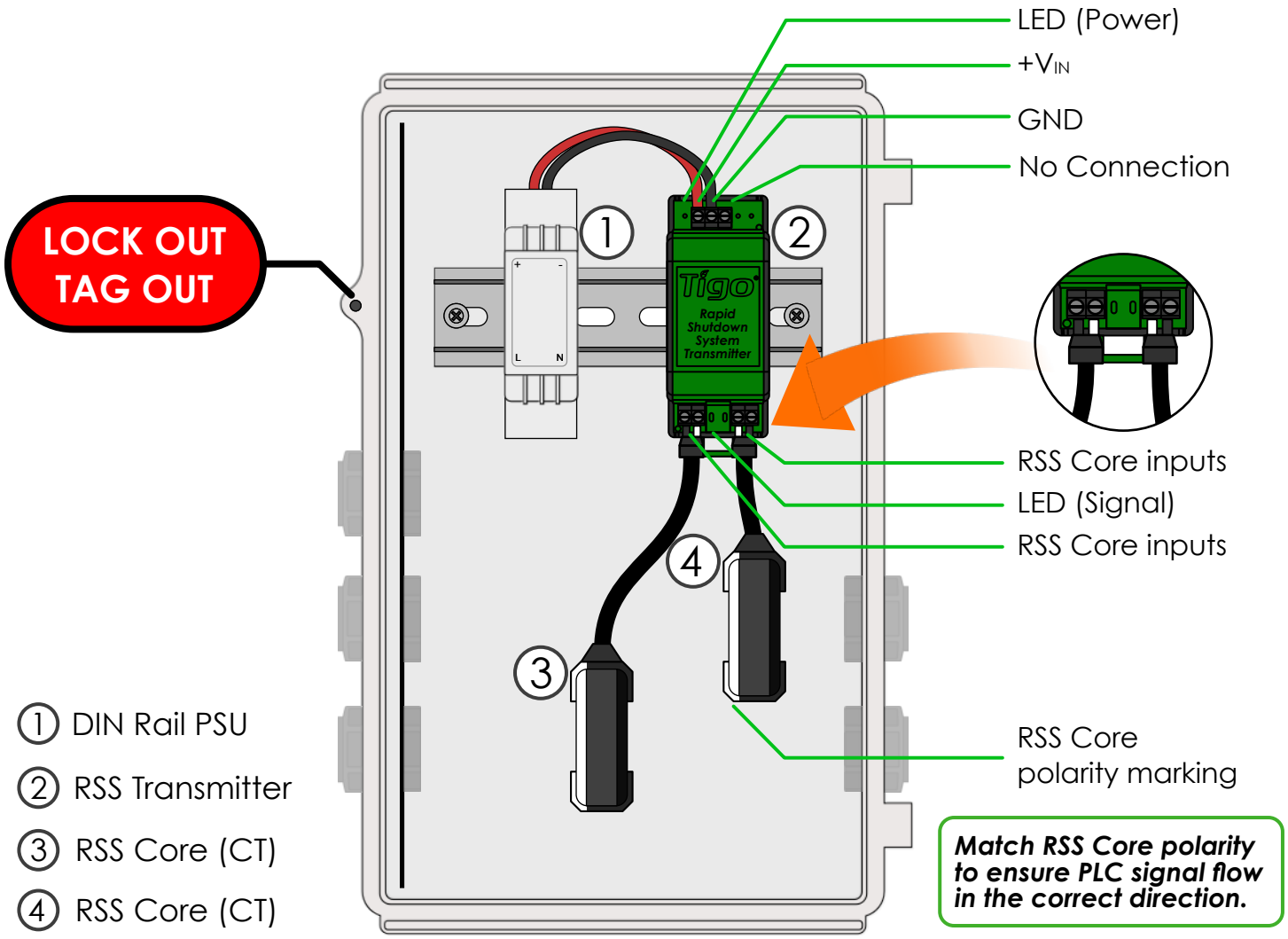


Note: Install TS4-F before powering on RSS Transmitter

- Connect AC and DC ground wires to DIN rail
- Ground all conduit connections
- Turn on AC power to Transmitter power supply to activate keep-alive signal and energize PV array

Warning: nonmetallic enclosure does not provide bonding between conduit connections. Use grounding type bushings and jumper wires.

RSS TRANSMITTER INSTALLATION – DUAL RSS CORE



① DIN Rail PSU

② RSS Transmitter

③ RSS Core (CT)

④ RSS Core (CT)

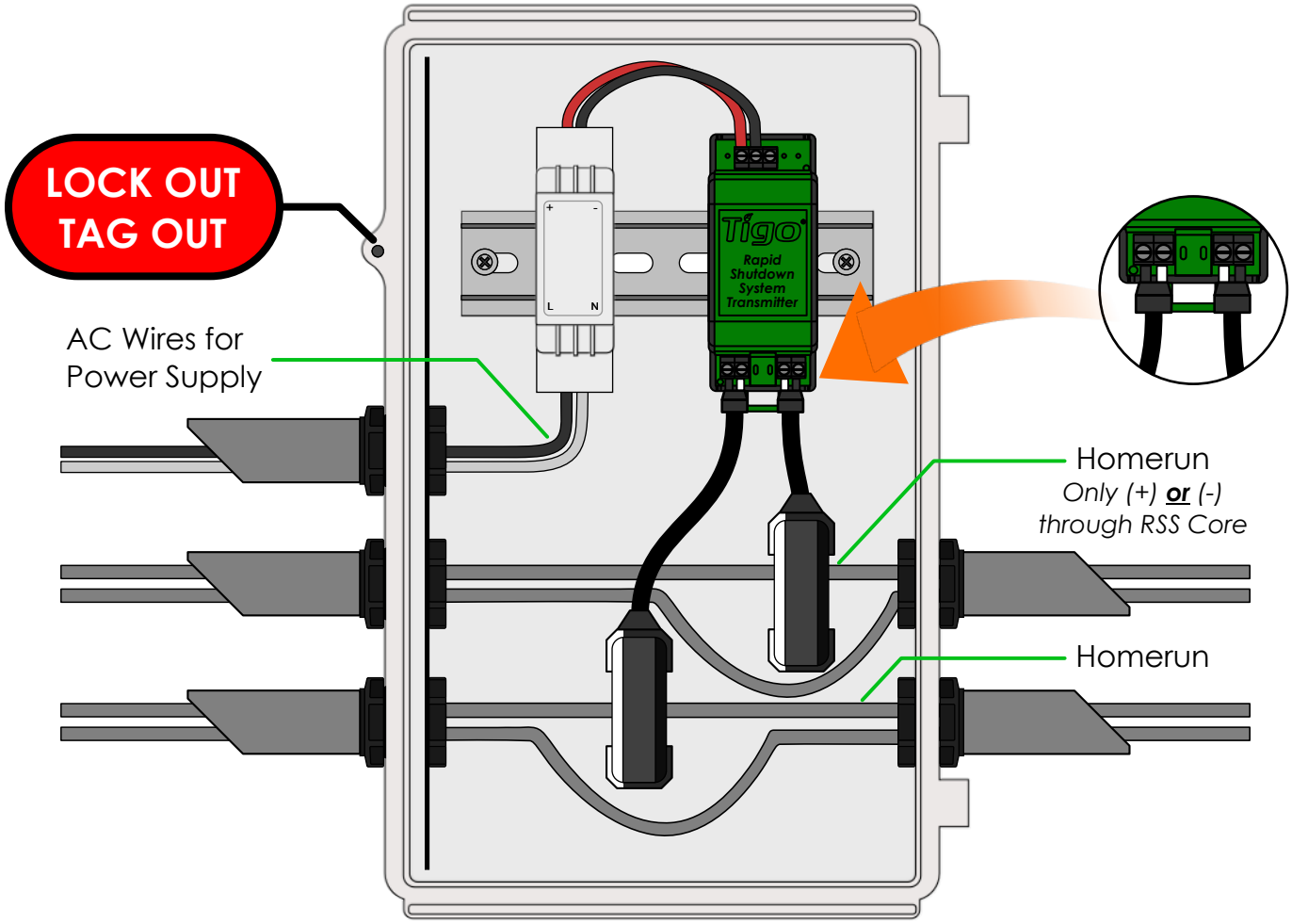
Transmitter power supply must be on same AC branch circuit as inverter to meet rapid shutdown requirements.

Note: Install TS4-F before powering on RSS Transmitter

- Drill holes in enclosure for conduit (see drilling guide for placement)
- Mount RSS Transmitter and power supply on DIN rail
- Connect DC leads from power supply ① to transmitter ②
- Connect RSS Core ③ and ④ to transmitter

Place rapid shutdown system label no more than 1m (3ft) from RSS Transmitter or AC disconnect if not at same location.

RSS TRANSMITTER WIRING – DUAL RSS CORE



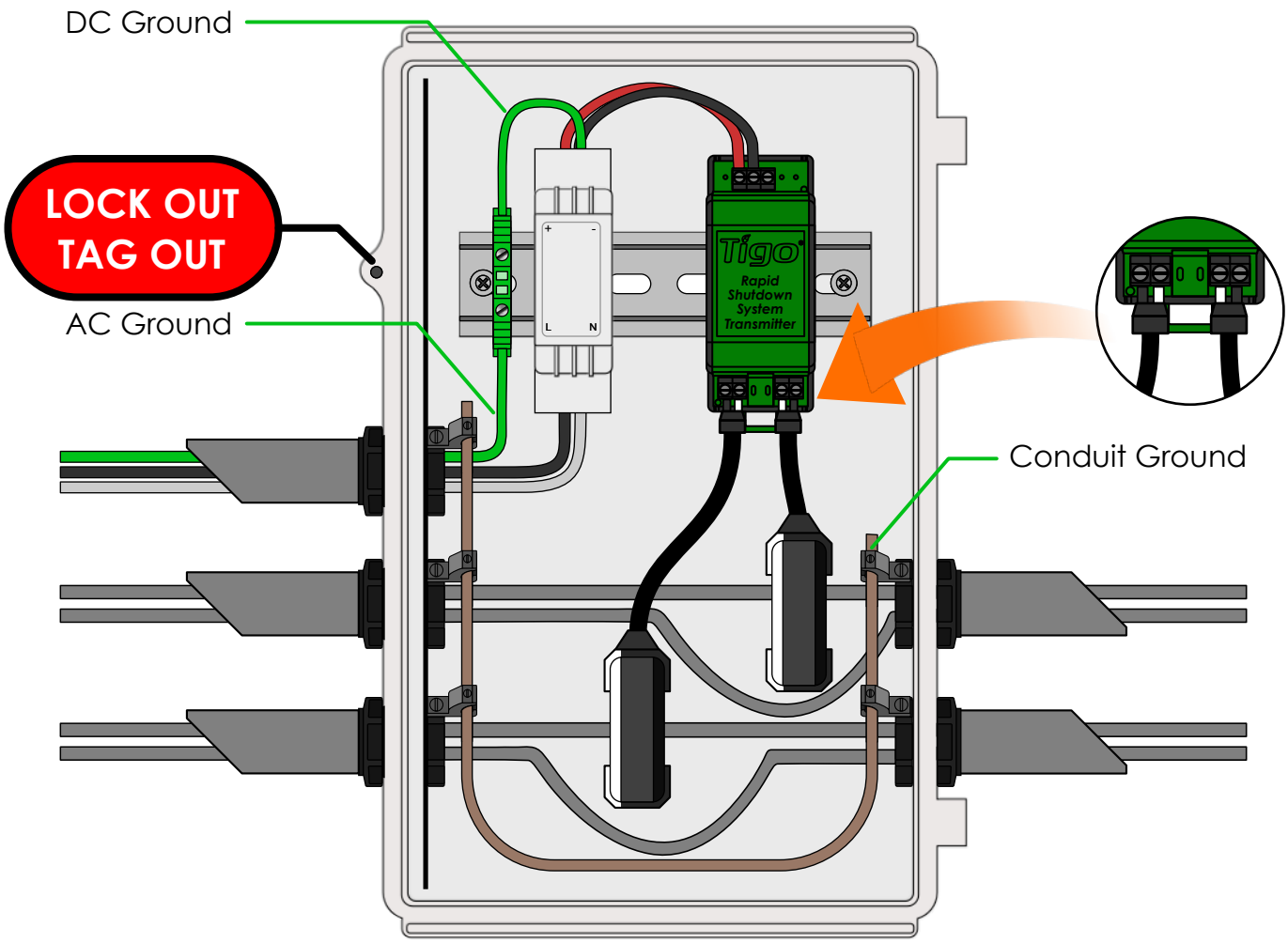
Keep same polarity for all homeruns and RSS Cores throughout the installation

Note: Install TS4-F before powering on RSS Transmitter

- Pass either positive **or** negative homerun through RSS Cores
- Connect wires to AC side of power supply

Max number of strings per RSS Core: **10**
Max string length: **30 modules**
Max current per RSS Core: **100A**
Max cable length from inverter (+) to inverter (-): **1000ft (300m)**
For longer distances please contact Tigo

RSS TRANSMITTER GROUNDING – DUAL RSS CORE



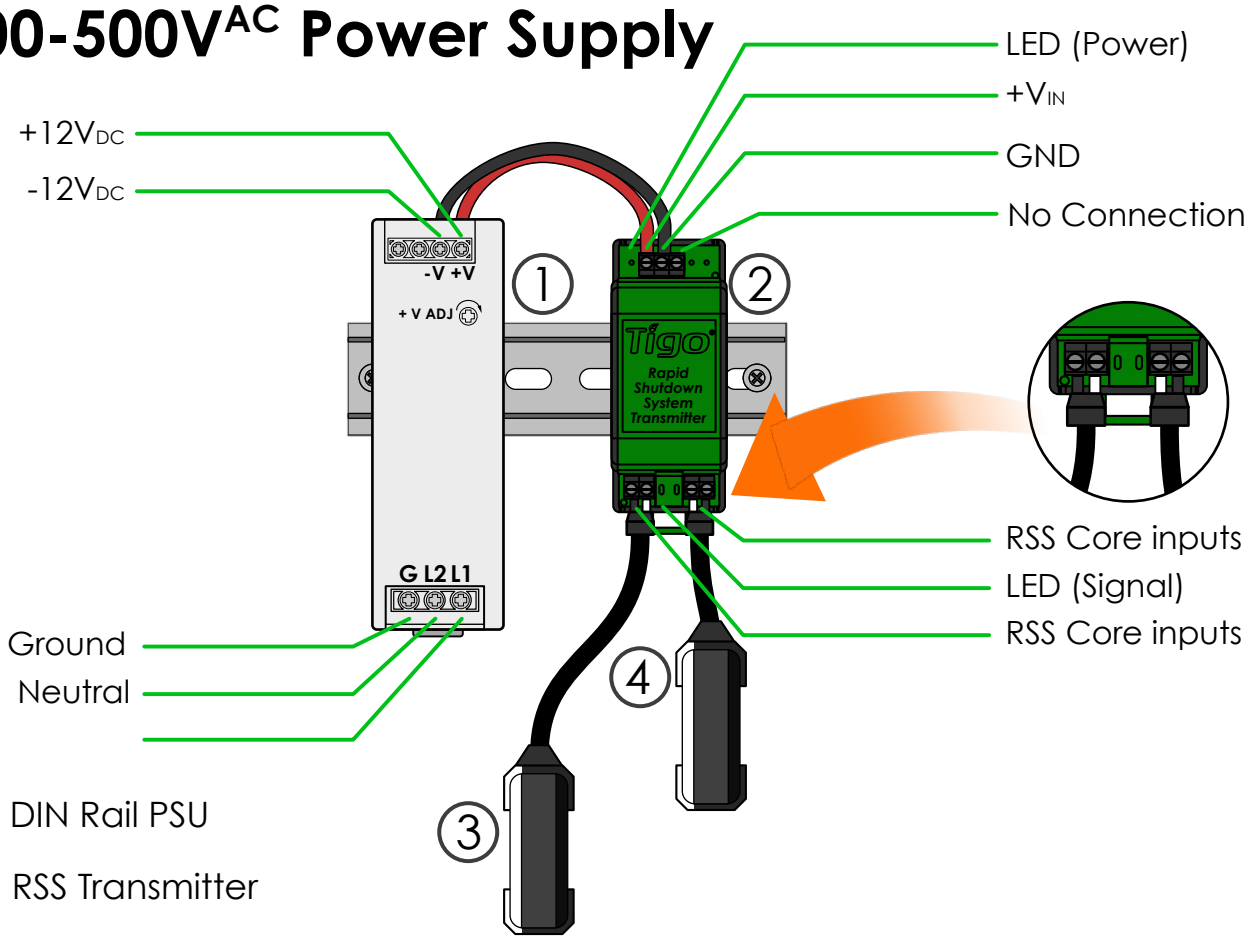
Note: Install TS4-F before powering on RSS Transmitter

- Connect AC and DC ground wires to DIN rail
- Ground all conduit connections
- Turn on AC power to Transmitter power supply to activate keep-alive signal

Warning: nonmetallic enclosure does not provide bonding between conduit connections. Use grounding type bushings and jumper wires.

RSS TRANSMITTER COMMERCIAL INSTALLATION

200-500V^{AC} Power Supply



① DIN Rail PSU

② RSS Transmitter

③ RSS Core (CT)

④ RSS Core (CT)

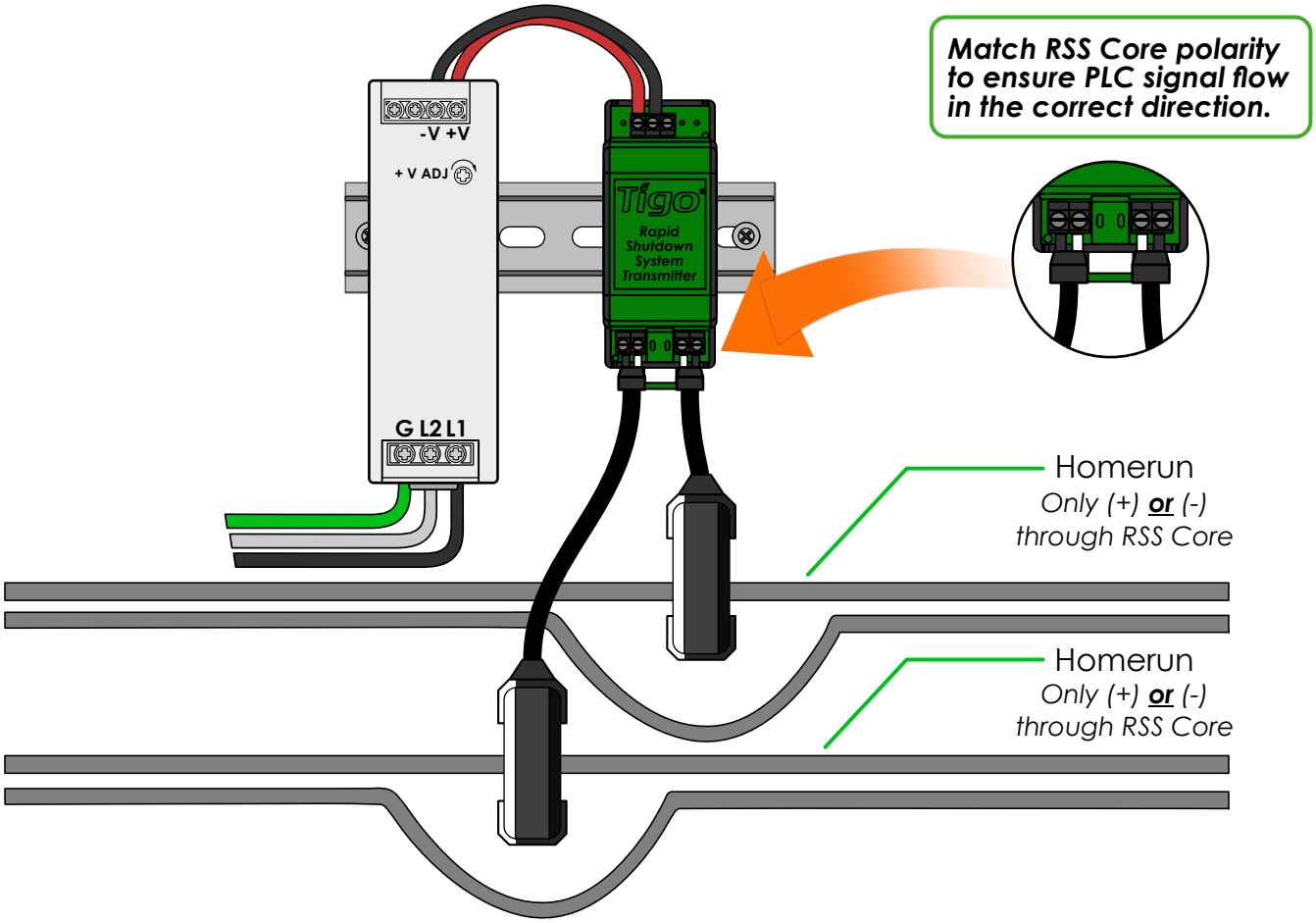
Transmitter power supply must be on same AC branch circuit as inverter to meet rapid shutdown requirements.

Note: Install TS4-F before powering on RSS Transmitter

- Mount RSS Transmitter and power supply on DIN rail
- Connect DC leads from power supply ① to transmitter ②
- Connect RSS Core ③ and ④ to transmitter

Place rapid shutdown system label no more than 1m (3ft) from RSS Transmitter or AC disconnect if not at same location.

RSS TRANSMITTER COMMERCIAL WIRING



Keep same polarity for all homeruns and RSS Cores throughout the installation

Note: Install TS4-F before powering on RSS Transmitter

- Pass either positive **or** negative homerun through RSS Cores
- Connect wires to AC side of power supply
- Turn on AC power to Transmitter power supply to activate keep-alive signal

Max number of strings per RSS Core: **10**
Max string length: **30 modules**
Max current per RSS Core: **150A**
Max cable length from inverter (+) to inverter (-): **1000ft (300m)**
For longer distances please contact Tigo

Tigo®

Appendix

TS4-F, TS4-A-F, TS4-A-2F, RSS Transmitter

TECHNICAL SPECIFICATIONS – TS4-F

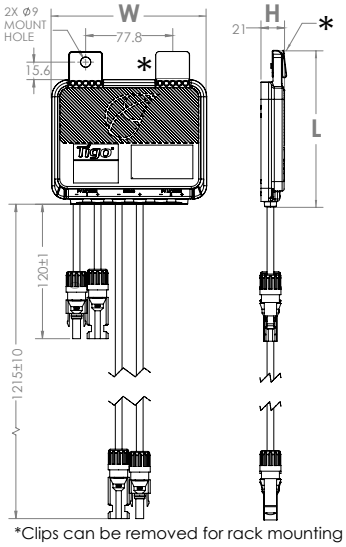
Electrical Ratings	TS4-F Fire Safety
Input	
Rated DC Input Power	475W
Input Voltage	16 - 90V
Max Continuous Input Current (I_{MAX})	12.5A
Output	
Output Power Range	0 - 475W
Output Voltage Range	0 – V_{OC}
Communication Type	Power Line Communication (PLC)
Rapid Shutdown UL Listed (NEC 2017 & 2020 690.12)	Yes
Impedance Matching Capability	No
Output Voltage Limit	No
Maximum System Voltage	1500V
Mechanical	
Operating Temperature Range:	-40°C to +70°C (-40°F to +158°F), RH < 85%
Storage Temperature Range:	-40°C to +70°C (-40°F to +158°F), RH < 60%
Cooling Method	Natural Convection
Dimensions (with cover)	178.5mm x 134mm x 25.5mm
Weight (base and cover)	670g
Outdoor Rating	IP68, NEMA 3R
Cabling	
Type	H1Z2Z2-K
Output Length	1.2m standard, other lengths available
Cable Options	1000V rated, 1500V rated
Cable Cross-Section	6.3 ± 0.3mm
Connectors	MC4, MC4 comparable
UV Resistance	500hr with UV light between 300-400nm @65C

Specify system voltage when ordering (1000V / 1500V) for appropriate cables & connectors.

Rapid shutdown activation requires RSS Transmitter.

TECHNICAL SPECIFICATIONS – TS4-A-F (500W)

Specifications	TS4-A-F Fire Safety
Environmental	
Operating Temperature Range	-30°C to +70°C (-22°F to +158°F)
Outdoor Rating	IP68, NEMA 3R
Mechanical	
Dimensions	W= 138.4mm, L= 139.7mm, H= 22.9mm
Weight	490g
Electrical	
Input Voltage	16 - 80V
Maximum Continuous Input Current (I_{MAX})	15A
Maximum Power	500W
Output Cable Length	1.2m (standard), other lengths available
Connectors	MC4 (standard)
Communication Type	PLC
Maximum System Voltage	1000/1500V
Rapid Shutdown UL Listed (NEC 2017 & 2020 690.12)	Yes



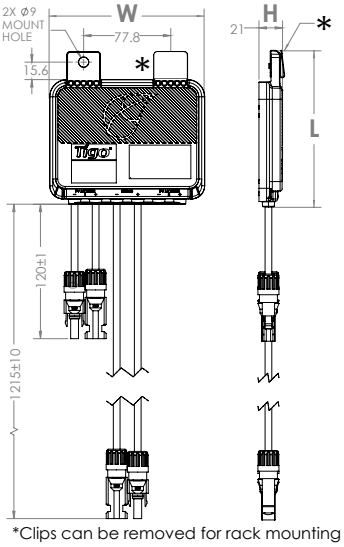
*Clips can be removed for rack mounting

Specify system voltage when ordering (1000V / 1500V) for appropriate cables & connectors.

Rapid shutdown activation requires RSS Transmitter.

TECHNICAL SPECIFICATIONS – TS4-A-F (700W)

Specifications	TS4-A-F Fire Safety
Environmental	
Operating Temperature Range	UL: -30°C to +70°C (-22°F to +158°F) IEC: -30°C to +70°C (-22°F to +158°F)
Outdoor Rating	IP68, NEMA 3R
Mechanical	
Dimensions	W= 138.4mm, L= 139.7mm, H= 22.9mm
Weight	490g
Electrical	
Input Voltage	16 - 80V
Maximum Continuous Input Current (I_{MAX})	15A
Maximum Power	700W
Output Cable Length	1.2m (standard), other lengths available
Connectors	MC4 (standard)
Communication Type	PLC
Maximum System Voltage	1000/1500V
Rapid Shutdown UL Listed (NEC 2017 & 2020 690.12)	Yes



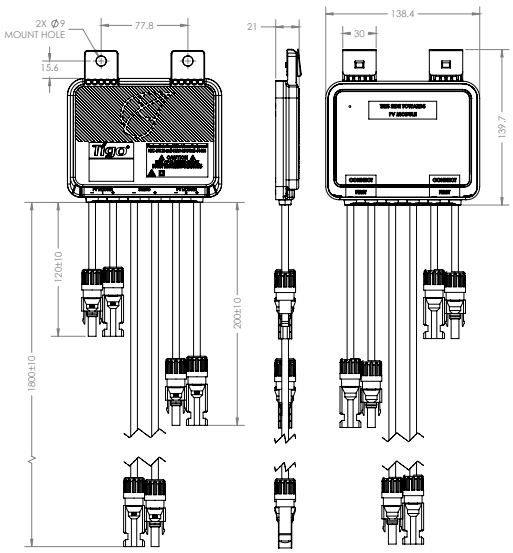
*Clips can be removed for rack mounting

Specify system voltage when ordering (1000V / 1500V) for appropriate cables & connectors.

Rapid shutdown activation requires RSS Transmitter.

TECHNICAL SPECIFICATIONS – TS4-A-2F

Specifications	TS4-A-2F Fire Safety
Environmental	
Operating Temperature Range	-30°C to +70°C (-22°F to +158°F)
Outdoor Rating	IP68, NEMA 3R
Mechanical	
Dimensions	138.4mm x 139.7mm x 22.9mm
Weight	590g
Electrical	
Voltage Range (per input)[1]	16 - 80V
Maximum Current (per input)	15A
Maximum Power (total)	1000W
Output Cable Length	1.2m (portrait) or 2.2m (landscape)
Connectors	MC4 (standard)
Communication Type	PLC
Maximum System Voltage	1000/1500V
Rapid Shutdown UL Listed (NEC 2017 & 2020 690.12)	Yes



Specify system voltage when ordering (1000V / 1500V) for appropriate cables & connectors.

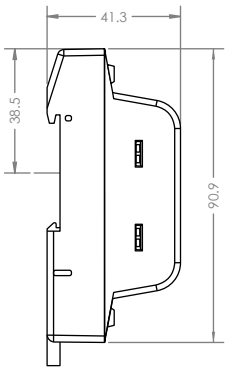
Rapid shutdown activation requires RSS Transmitter.

TECHNICAL SPECIFICATIONS – RSS TRANSMITTER

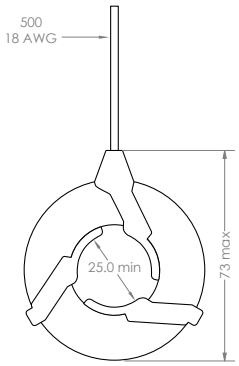
Electrical Ratings	RSS Transmitter
Input	
Input Voltage	$12V_{DC}$ (+/- 2%)
Input Current	1A
Average Supply Power	0.85W
Dimensions(Transmitter only)	90.2mm x 36.3mm x 57.7mm
RSS Core	
Maximum Current	150A per Core (Single Core: 150A, Dual Core: 300A)
Maximum MPPT String Voltage	$1500V_{DC}$
Internal Opening for Wires	~25mm
Outside Dimensions	59mm
Maximum Number of Strings per Core	10
Maximum String Length	30 modules
Environmental	
Temperature	-40°C to 85°C

Recommended max. torque 0.4 N/m for wiring (3.5 Lb/in),
Wire range: 14-22 AWG

RSS Transmitter - Front View



RSS Transmitter - Side View



RSS Core - Side View

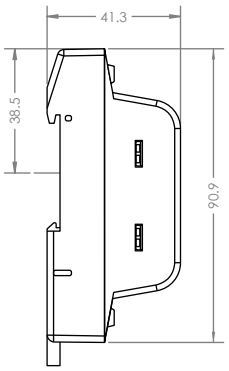
All dimensions in mm.

TECHNICAL SPECIFICATIONS – RSS TRANSMITTER COMMERCIAL KIT

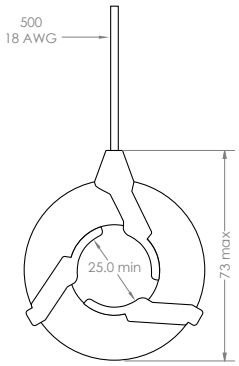
Electrical Ratings	RSS Transmitter
Input	
Input Voltage	$12V_{DC}$ (+/- 2%)
Input Current	1A
Average Supply Power	0.85W
Included Power Supply Rating	$480/277V_{AC}$ input, $12V_{DC}$ output
Dimensions(Transmitter only)	90.2mm x 36.3mm x 57.7mm
RSS Core	
Maximum Current	150A per Core (includes 2 Cores for 300A)
Maximum MPPT String Voltage	$1500V_{DC}$
Internal Opening for Wires	~25mm
Outside Dimensions	59mm
Maximum Number of Strings per Core	10
Maximum String Length	30 modules
Environmental	
Temperature	-40°C to 85°C

Recommended max. torque 0.4 N/m for wiring (3.5 Lb/in),
Wire range: 14-22 AWG

RSS Transmitter - Front View



RSS Transmitter - Side View



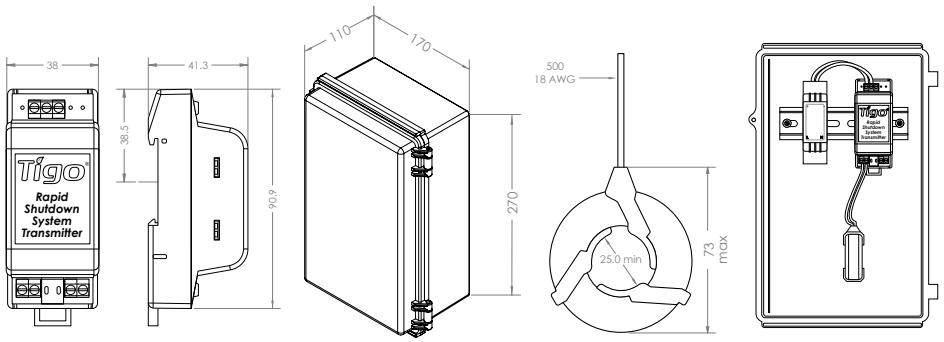
RSS Core - Side View

All dimensions in mm.

TECHNICAL SPECIFICATIONS – RSS TRANSMITTER OUTDOOR KIT

Electrical Ratings	RSS Transmitter
Input	
Input Voltage	$12V_{DC}$ (+/- 2%)
Input Current	1A
Average Supply Power	0.85W
Dimensions(Transmitter only)	90.2mm x 36.3mm x 57.7mm
RSS Core	
Maximum Current	100A per Core (Single Core: 100A, Dual Core: 200A)[1]
Maximum MPPT String Voltage	$1500V_{DC}$
Internal Opening for Wires	~25mm
Outside Dimensions	59mm
Maximum Number of Strings per Core	10
Maximum String Length	30 modules
Environmental	
Temperature	-40°C to 85°C

Recommended max. torque 0.4 N/m for wiring (3.5 Lb/in),
Wire range: 14-22 AWG



RSS Transmitter | Outdoor Enclosure | RSS Core | Installation Example

[1] Rating of outdoor enclosure

All dimensions in mm.

TESTING RAPID SHUTDOWN

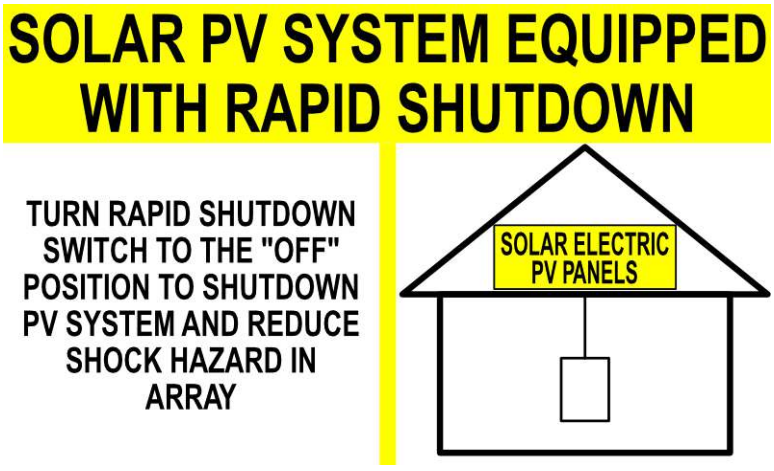
TS4-F (or TS4-A-F, TS4-A-2F) and an RSS Transmitter are a solution to meet NEC 2017 & 2020 690.12 Rapid Shutdown requirements.

TS4-F, TS4-A-F, and TS4-A-2F units automatically enter rapid shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter.

Wait 30 seconds after rapid shutdown activation before disconnecting DC cables or turning off DC disconnect.

Test your rapid shutdown system by switching off the AC power to the RSS Transmitter or inverter with built-in transmitter.

TS4-F, TS4-A-F, and TS4-A-2F units will reduce their output to 0.6V when the Transmitter is powered off.



Place safety labels in proper location

The RSS Transmitter control power supply MUST be on the same AC branch circuit as the inverter to meet rapid shutdown requirements.

Click here for more info about Rapid Shutdown

TROUBLESHOOTING

TS4-F/TS4-A-F/TS4-A-2F:

- Output voltage without active transmitter signal is **0.6V**
- Output voltage with active transmitter signal will be normal module V_{MP} or V_{OC}
- If output is 0V contact Tigo support

Check that the system conforms to the design rules for TS4-F:

- Up to 10 strings per RSS Core (CT)
- Up to 30 modules per string
- String length up to 1000ft (**total** cable length from **+** to **-**)
    - *For longer distances please contact Tigo*
- Homeruns through RSS Core must be the same polarity (all positive **or** all negative)
- Match RSS Core polarity markings to ensure PLC signal flow in the correct direction

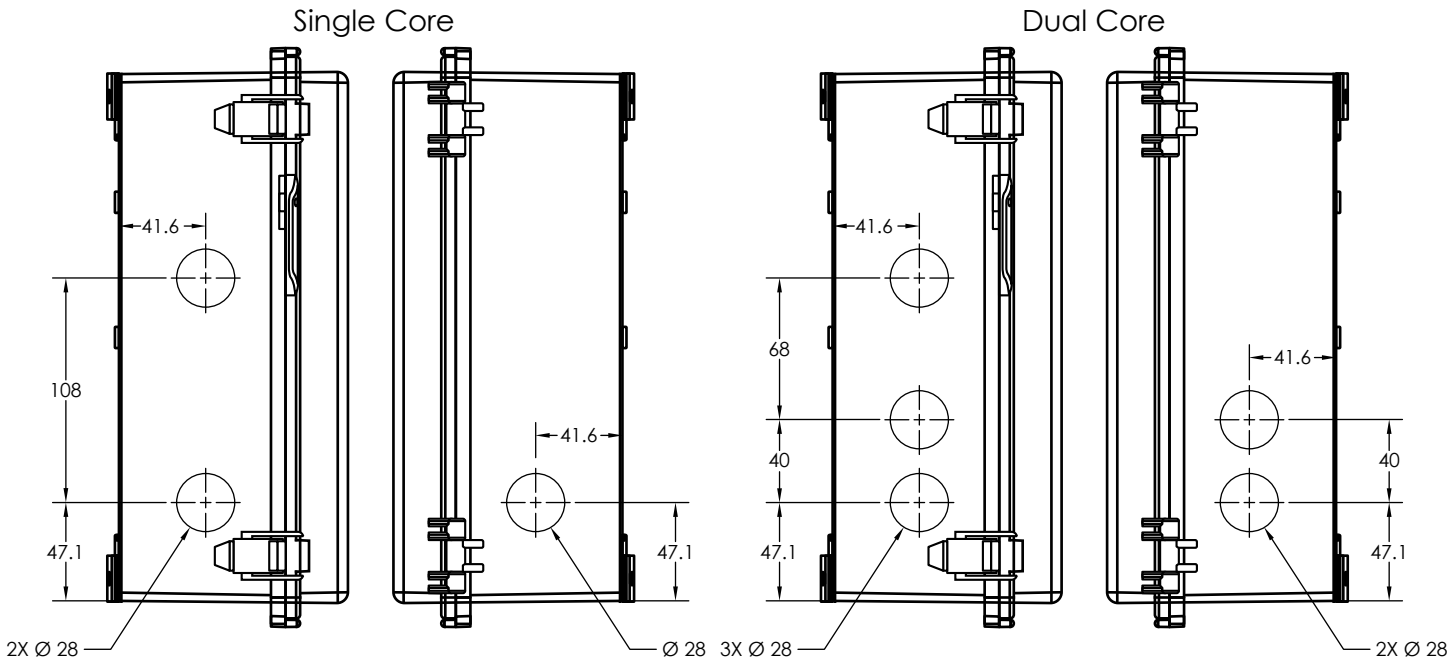
RSS Transmitter:

- Power LED should be lit and Signal LED should be blinking during operation
- Verify that RSS Core wiring and polarity are correct
- Power cycle RSS Transmitter if Signal LED is unlit
- While RSS Transmitter is powered off, string voltage should be
    - TS4-F/TS4-A-F: 0.6V * number of modules
    - TS4-A-2F: 0.6V * number of TS4s
- While RSS Transmitter is powered on, full string voltage should be present

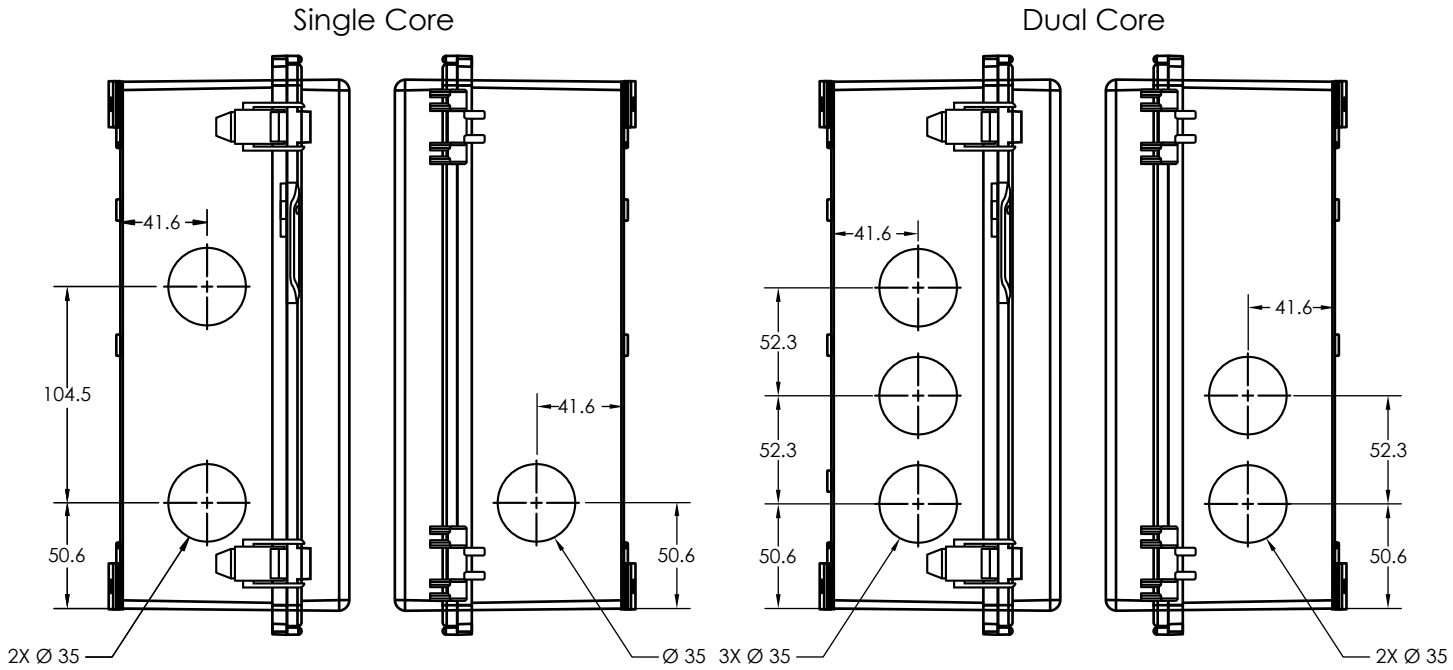
Test individual strings with active RSS Transmitter one at a time in case of unexpected voltage.

CONDUIT DRILLING GUIDE

Enclosure Drilling Guide for .75" Conduit



Enclosure Drilling Guide for 1" Conduit



*all dimensions in mm

MISCELLANEOUS

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

INSTALLATION COMPLETE

Problems?

TS4-F Troubleshooting Guide

For more details on designing and installing solutions powered by Tigo, please visit:

Tigo Academy
Resource Center

Or contact us at:

training@tigoenergy.com

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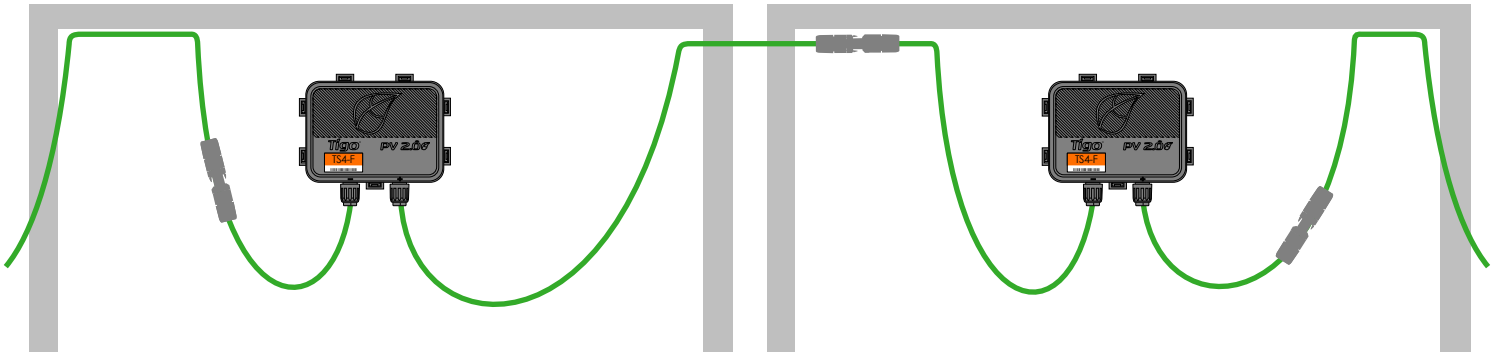
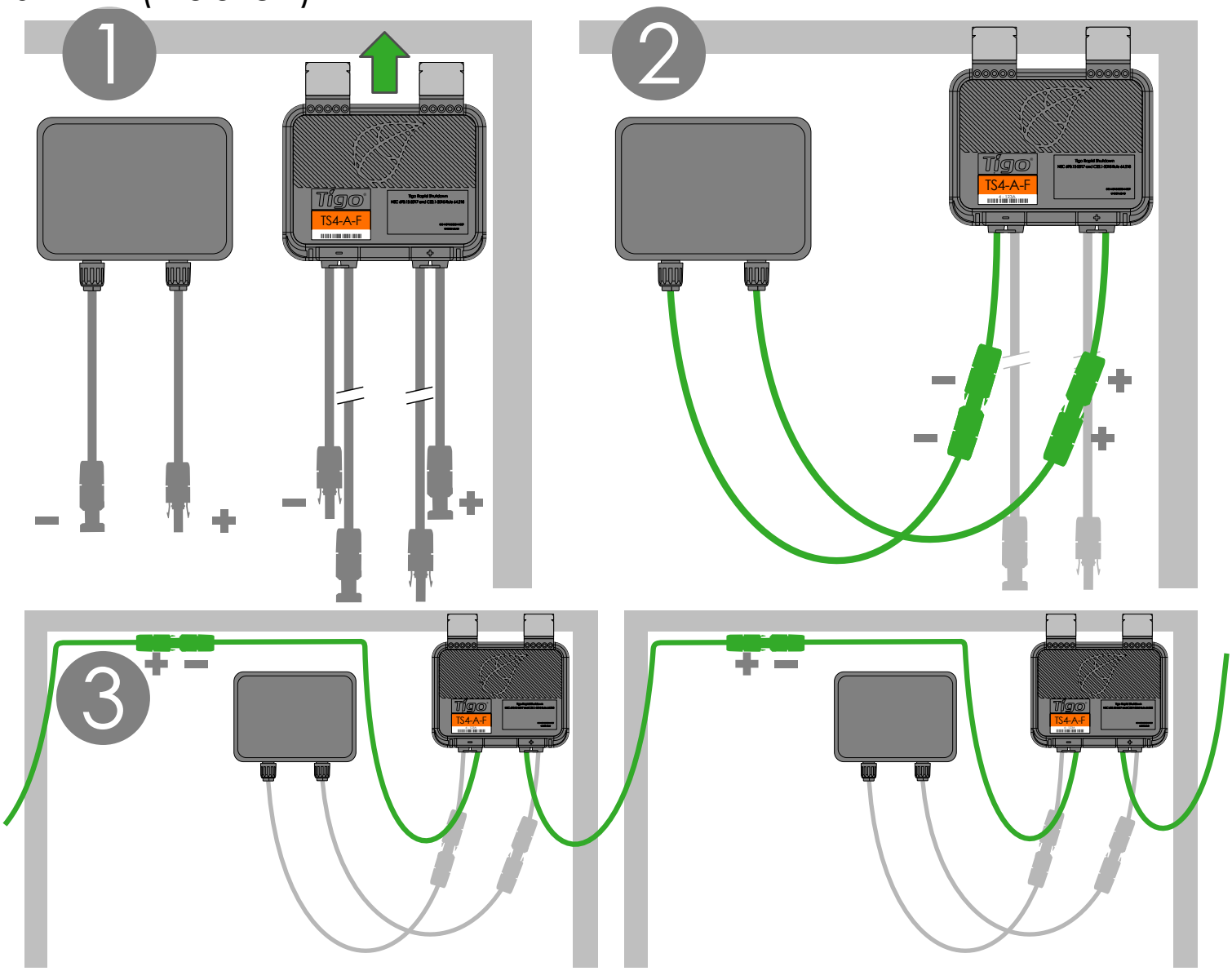
PVRSS Installation Quick Start Guide

TS4-F (Integrated)



TS4-A-F (Add-on)



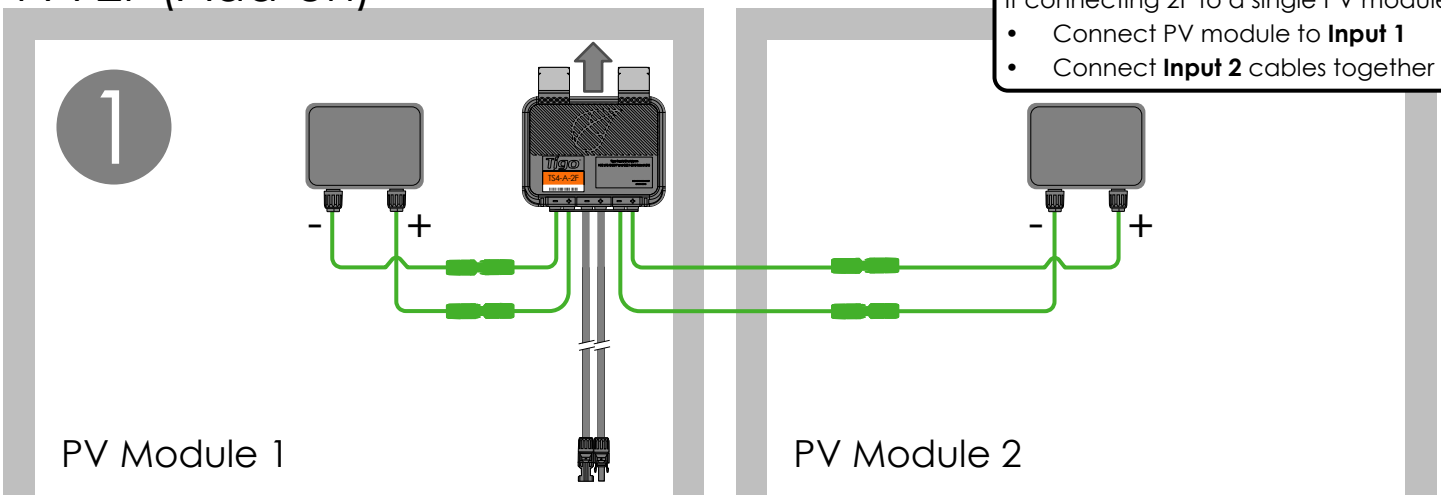
Note: When installing TS4-A-F, connect the input cables to the PV module before connecting the TS4-A-F output cables in series.

If disconnecting TS4-A-F, disconnect the TS4-A-F output cables from the string before disconnecting the input cables from the PV module.

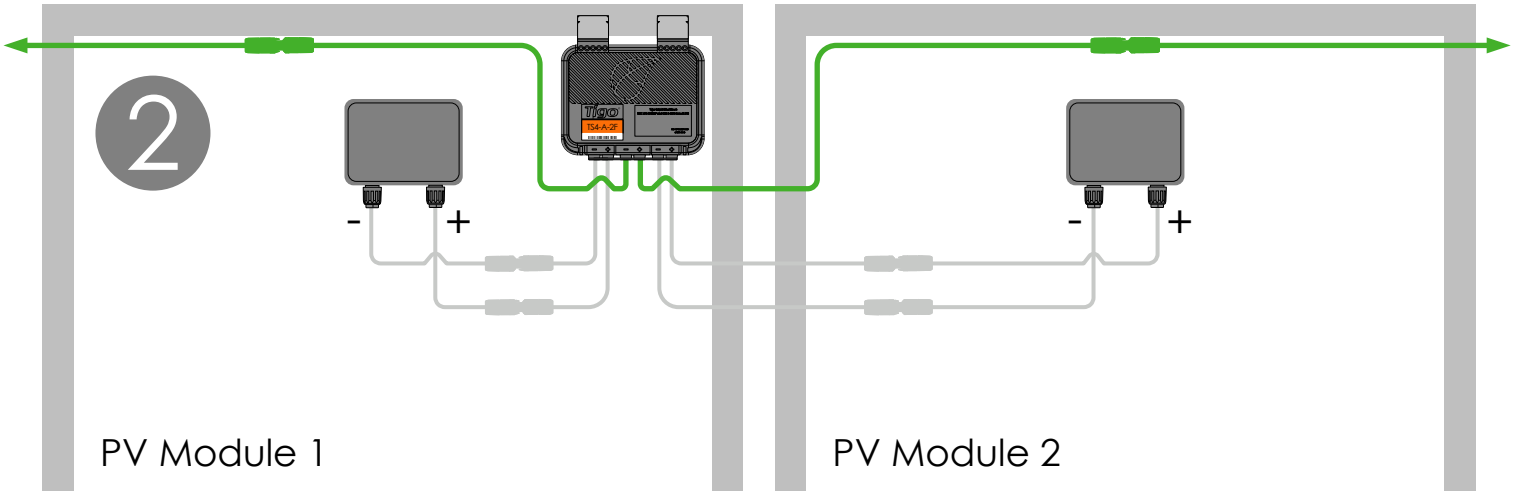
RSS Transmitter must be powered <u>off</u> during TS4-A-F installation.

TS4-A-2F (Add-on)

If connecting 2F to a single PV module:
- Connect PV module to **Input 1**
- Connect **Input 2** cables together



1. Connect PV modules to TS4-A-2F inputs

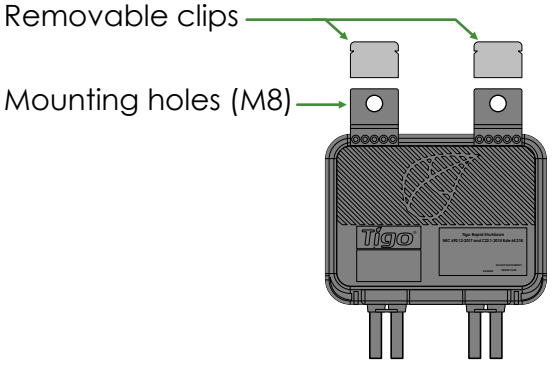


2. Connect TS4-A-2F outputs in series

Note: When installing TS4-A-2F, always connect the input cables to the PV modules before connecting the TS4-A output cables in series.

If disconnecting TS4-A-2F, always disconnect the TS4-A-2F output cables from the string before disconnecting the input cables from the PV modules.

RSS Transmitter must be powered OFF during TS4-A-2F installation.



For installation with frameless modules, remove metal clips and bolt TS4-A to rail.

support.tigoenergy.com

Manuals

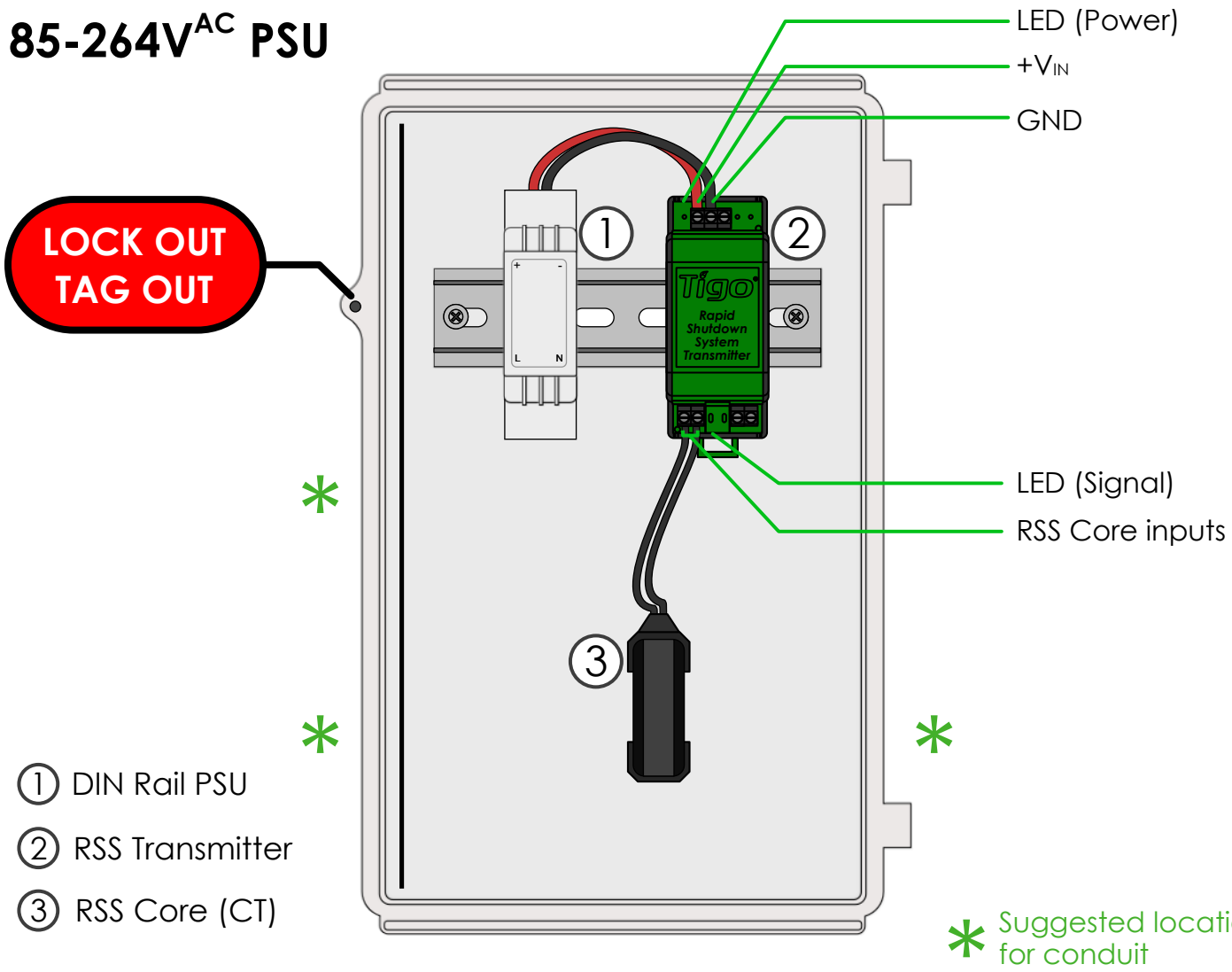
support@tigoenergy.com

International: 00800.2255.8446

Americas: +1.408.402.0802

RSS TRANSMITTER INSTALLATION – SINGLE RSS CORE

85-264V^{AC} PSU



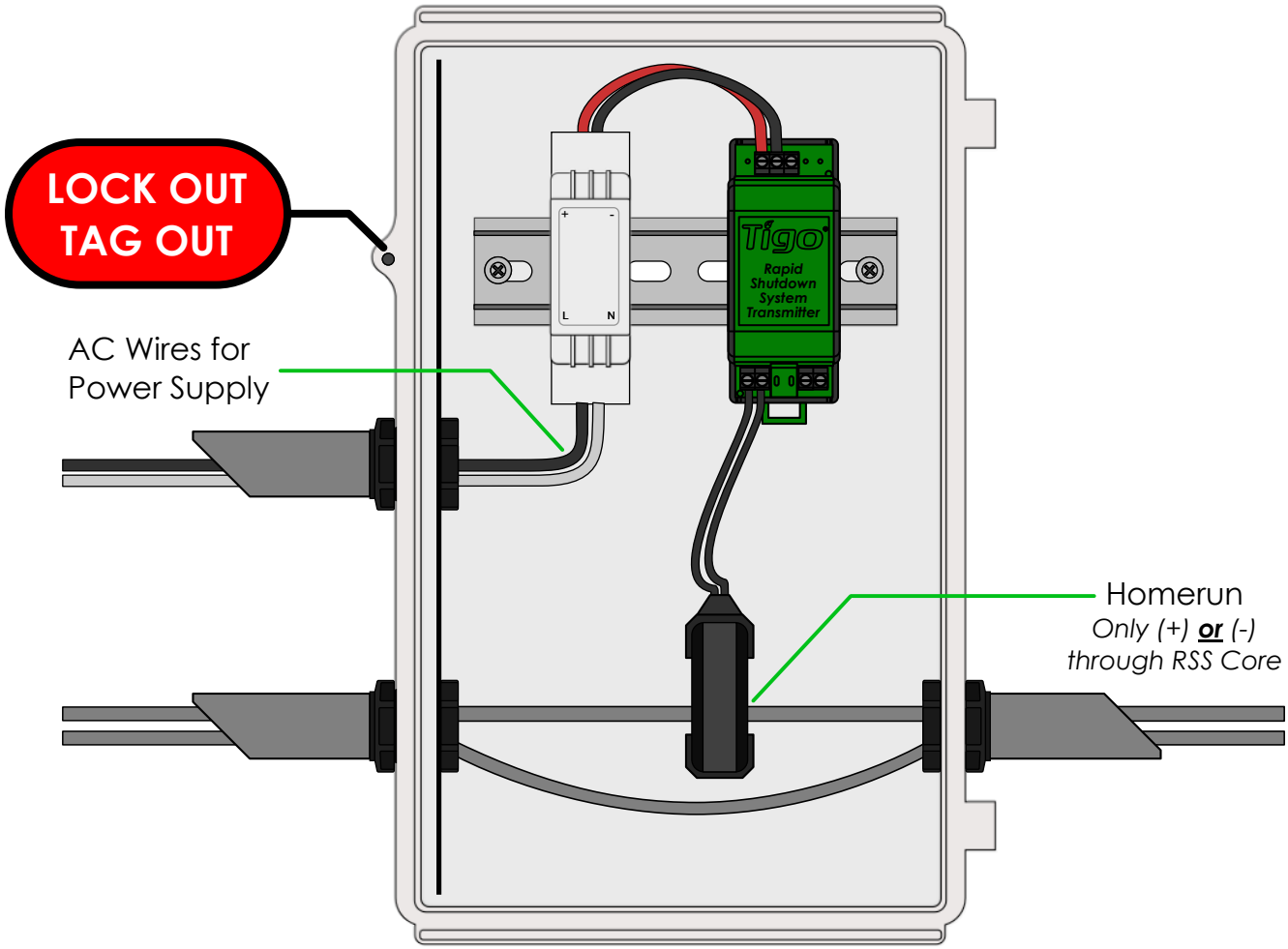
Transmitter power supply must be on same AC branch circuit as inverter to meet rapid shutdown requirements.

Note: Install TS4-F before powering on RSS Transmitter

- Drill holes in enclosure for conduit (see drilling guide for placement)
- Mount RSS Transmitter and power supply on DIN rail
- Connect DC leads from power supply (1) to transmitter (2)
- Connect RSS Core (3) to transmitter

Place rapid shutdown system label no more than 1m (3ft) from RSS Transmitter or AC disconnect if not at same location.

RSS TRANSMITTER WIRING – SINGLE RSS CORE

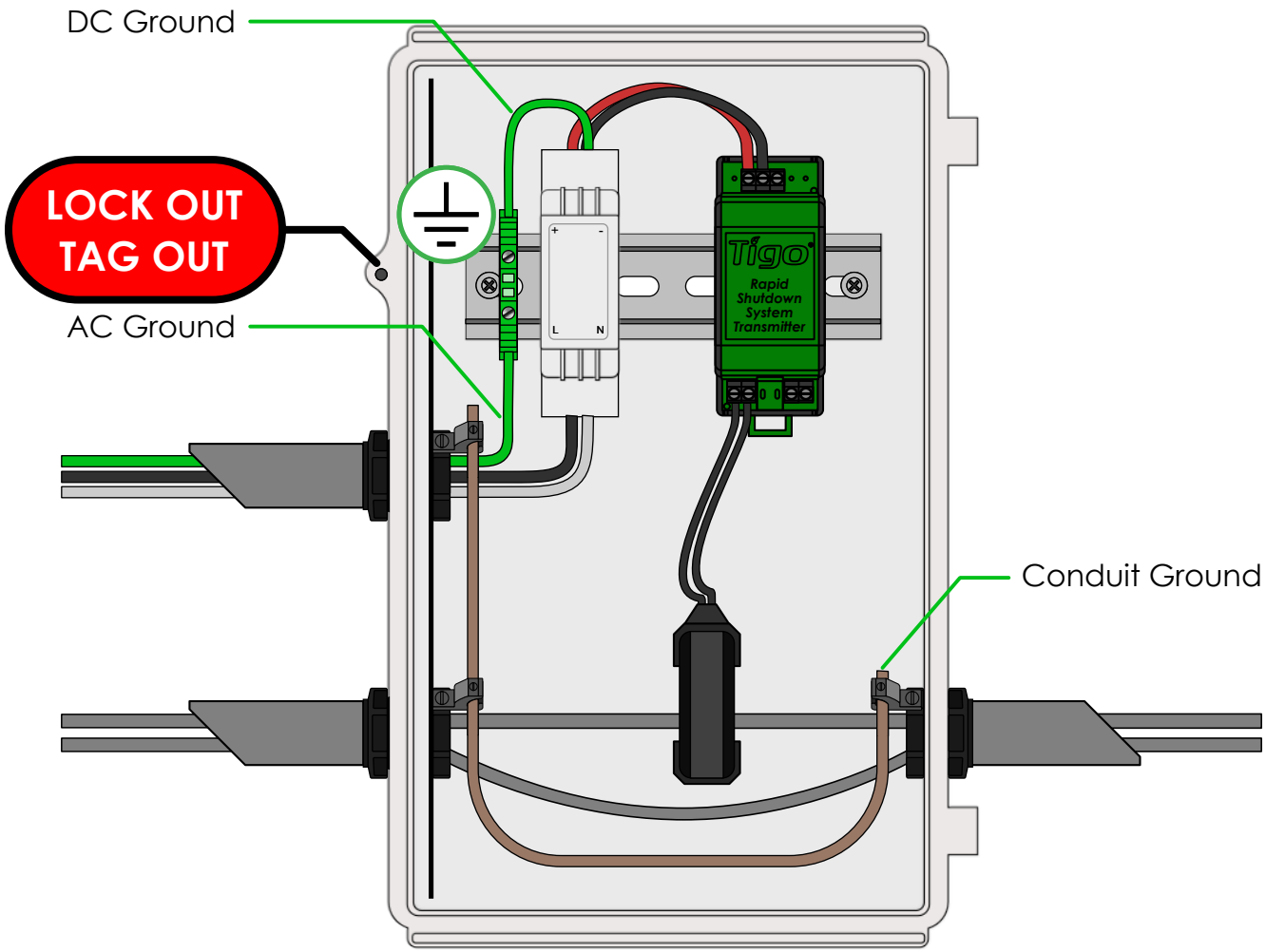


Note: Install TS4-F before powering on RSS Transmitter

- Pass either positive **or** negative homerun through RSS Core
- Connect wires to AC side of power supply

Max number of strings per RSS Core: **10**
Max string length: **30 modules**
Max current per RSS Core: **100A**
Max cable length from inverter (+) to inverter (-): **1000ft (300m)**

RSS TRANSMITTER GROUNDING – SINGLE RSS CORE

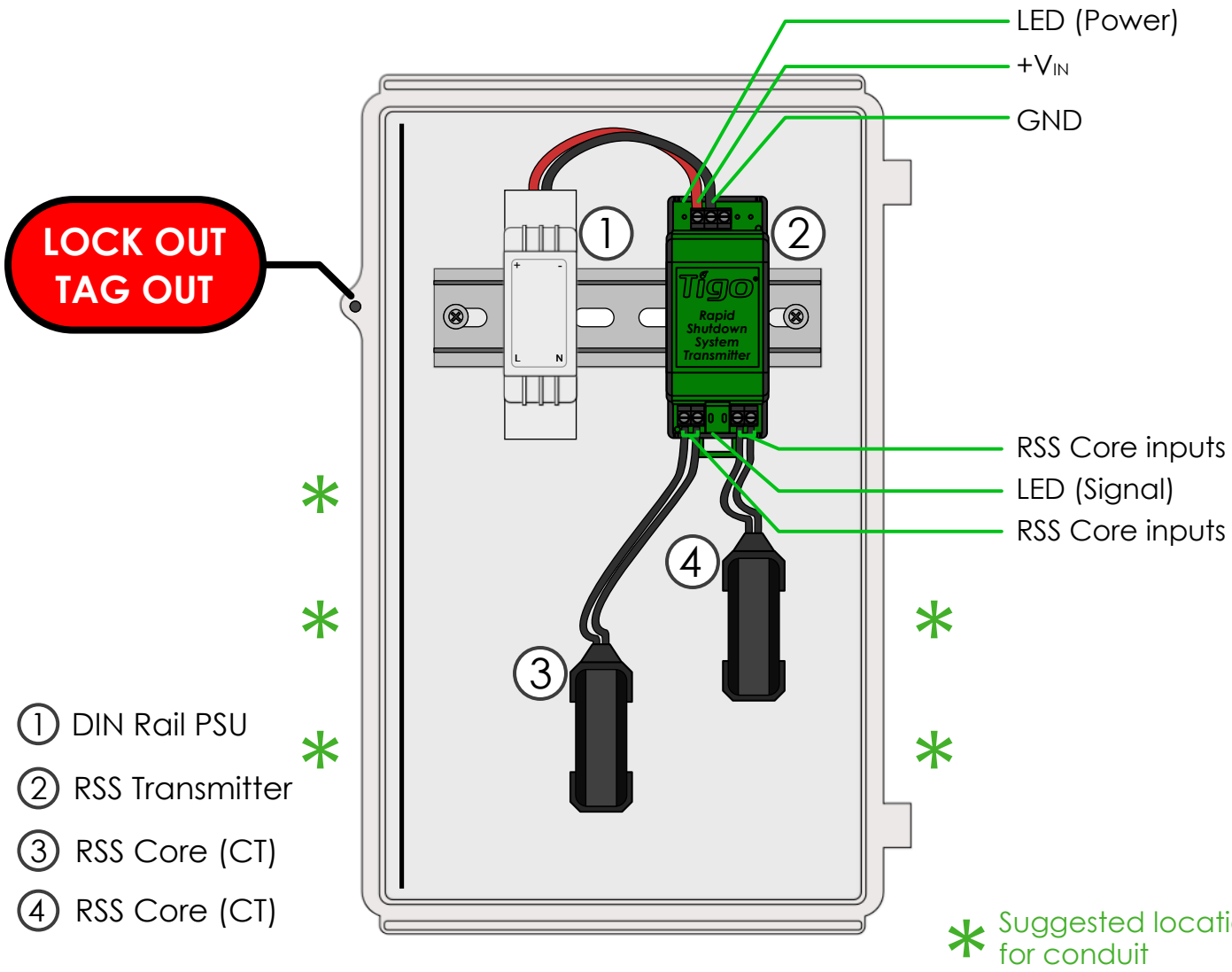


Note: Install TS4-F before powering on RSS Transmitter

- Connect AC and DC ground wires to DIN rail
- Ground all conduit connections
- Turn on AC power to Transmitter power supply to activate keep-alive signal and energize PV array

Warning: nonmetallic enclosure does not provide bonding between conduit connections. Use grounding type bushings and jumper wires.

RSS TRANSMITTER INSTALLATION – DUAL RSS CORE



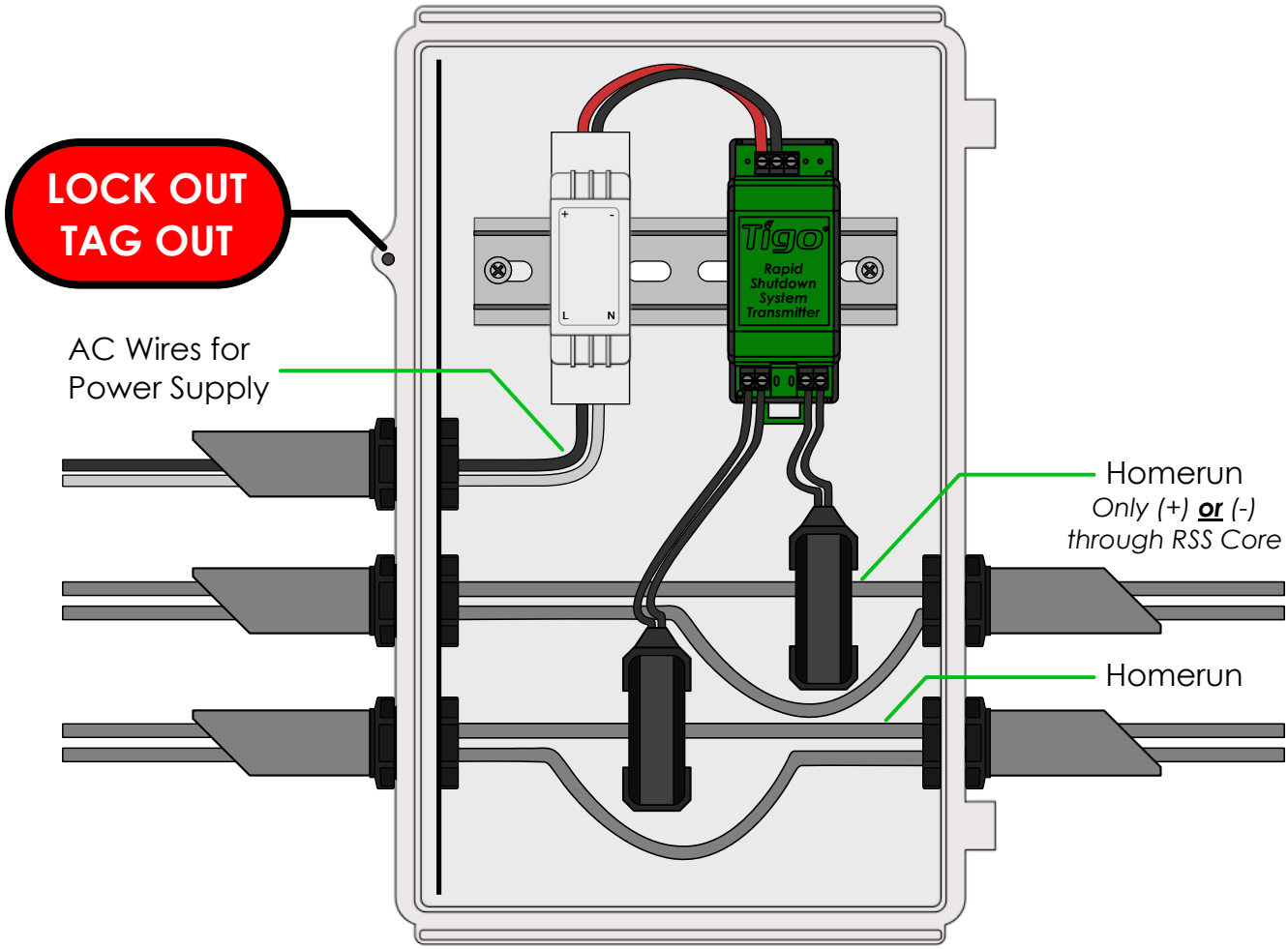
Transmitter power supply must be on same AC branch circuit as inverter to meet rapid shutdown requirements.

Note: Install TS4-F before powering on RSS Transmitter

- Drill holes in enclosure for conduit (see drilling guide for placement)
- Mount RSS Transmitter and power supply on DIN rail
- Connect DC leads from power supply (1) to transmitter (2)
- Connect RSS Core (3) and (4) to transmitter

Place rapid shutdown system label no more than 1m (3ft) from RSS Transmitter or AC disconnect if not at same location.

RSS TRANSMITTER WIRING – DUAL RSS CORE



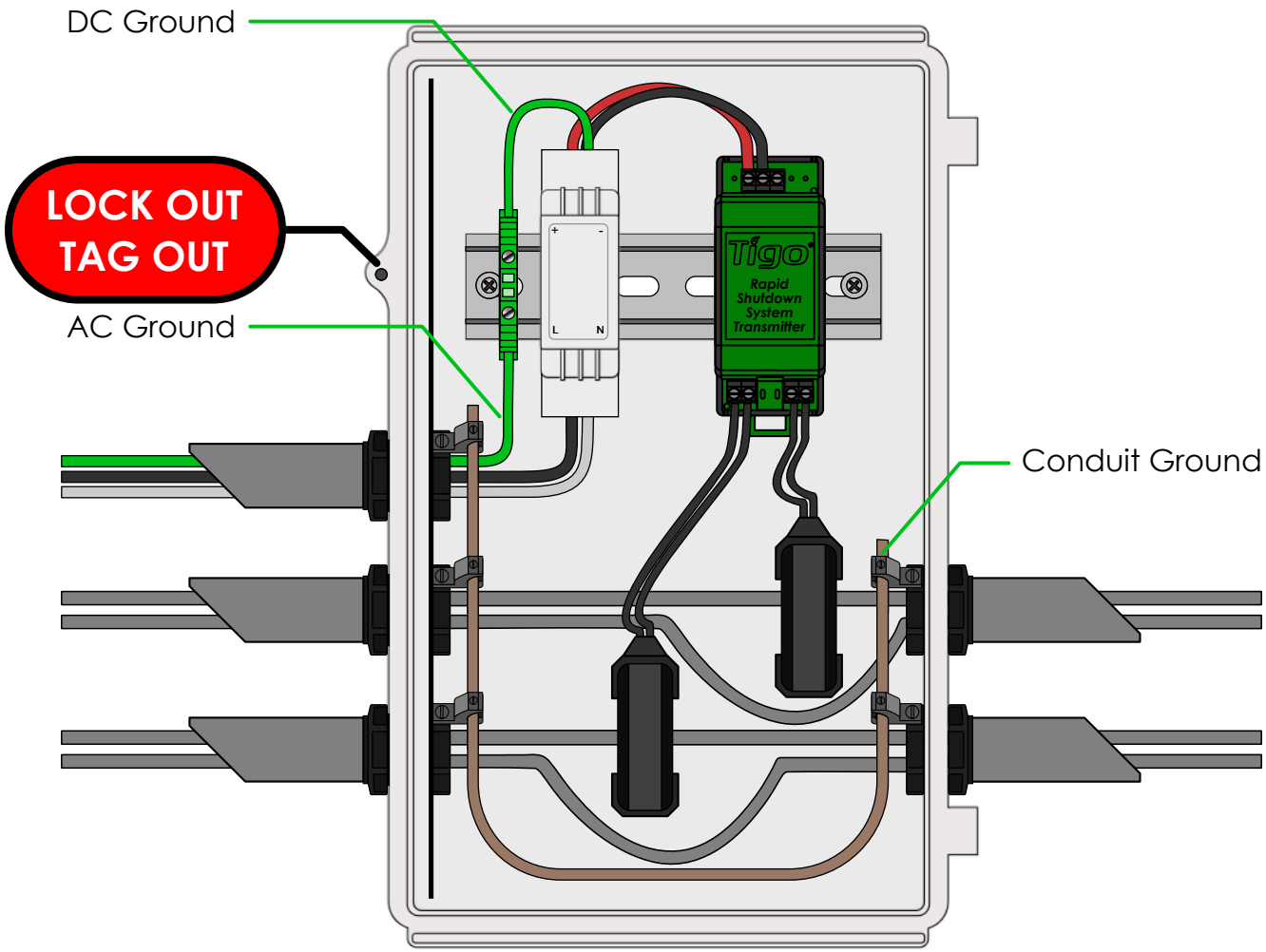
Keep same polarity for all homeruns and RSS Cores throughout the installation

Note: Install TS4-F before powering on RSS Transmitter

- Pass either positive **or** negative homerun through RSS Cores
- Connect wires to AC side of power supply

Max number of strings per RSS Core: **10**
Max string length: **30 modules**
Max current per RSS Core: **100A**
Max cable length from inverter (+) to inverter (-): **1000ft (300m)**

RSS TRANSMITTER GROUNDING – DUAL RSS CORE



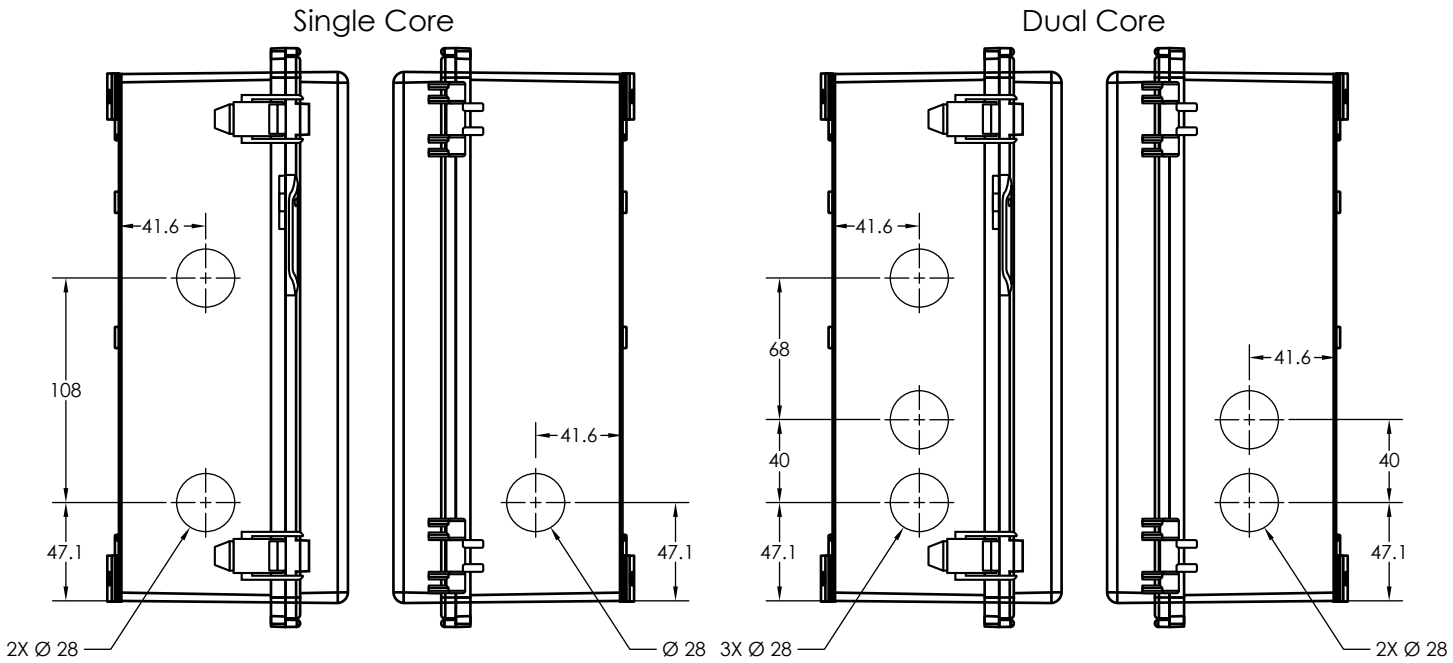
Note: Install TS4-F before powering on RSS Transmitter

- Connect AC and DC ground wires to DIN rail
- Ground all conduit connections
- Turn on AC power to Transmitter power supply to activate keep-alive signal

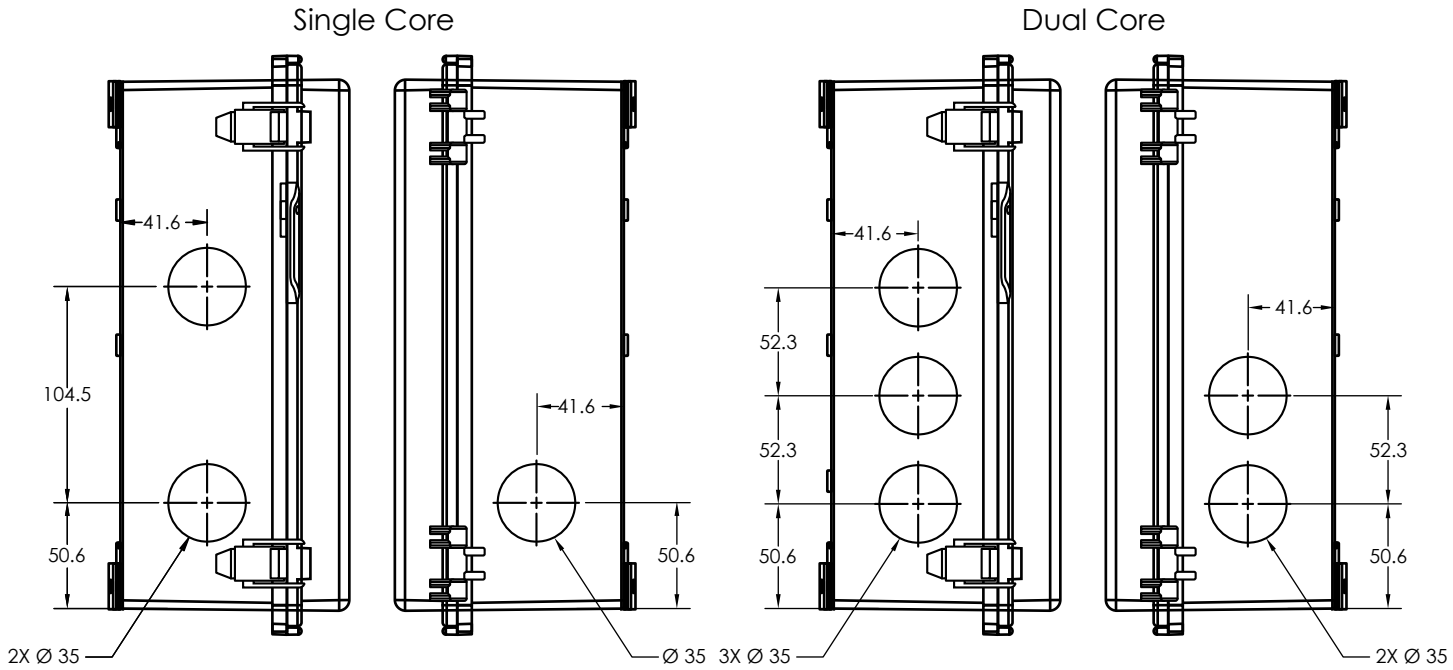
Warning: nonmetallic enclosure does not provide bonding between conduit connections. Use grounding type bushings and jumper wires.

CONDUIT DRILLING GUIDE

Enclosure Drilling Guide for .75" Conduit



Enclosure Drilling Guide for 1" Conduit



*all dimensions in mm

TESTING RAPID SHUTDOWN

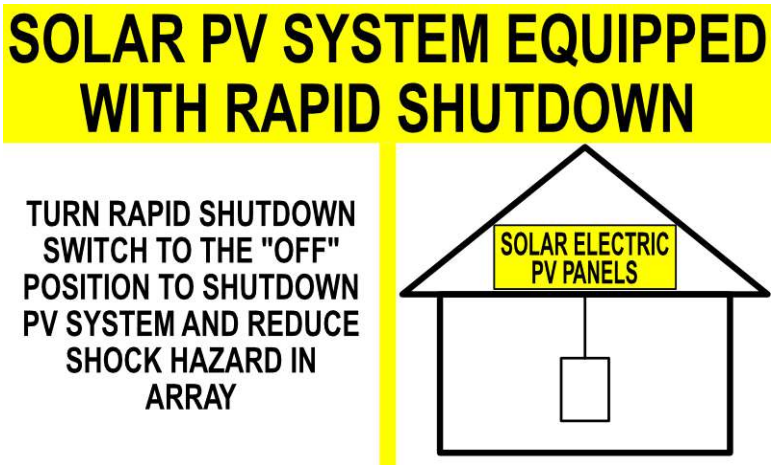
TS4-F (or TS4-A-F, TS4-A-2F) and an RSS Transmitter are a solution to meet NEC 2017 & 2020 690.12 Rapid Shutdown requirements.

TS4-F, TS4-A-F, and TS4-A-2F units automatically enter rapid shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter.

Wait 30 seconds after rapid shutdown activation before disconnecting DC cables or turning off DC disconnect.

Test your rapid shutdown system by switching off the AC power to the RSS Transmitter or inverter with built-in transmitter.

TS4-F, TS4-A-F, and TS4-A-2F units will reduce their output to 0.6V when the RSS Transmitter is powered off.



Place safety labels in proper location

The RSS Transmitter control power supply MUST be on the same AC branch circuit as the inverter to meet rapid shutdown requirements.

Click here for more info about Rapid Shutdown

Troubleshooting TS4-F and RSS Transmitter

TS4-F/TS4-A-F/TS4-A-2F:

- Output voltage without active transmitter signal is **0.6V**
- Output voltage with active transmitter signal will be normal module V_{MP} or V_{OC}
- If output is 0V contact Tigo support

Check that the system conforms to the design rules for TS4-F:

- Up to 10 strings per RSS Core (CT)
- Up to 30 modules per string
- String length up to 1000ft (**total** cable length from **+** to **-**)
- Homeruns through RSS Core must be the same polarity (all positive **or** all negative)

RSS Transmitter:

- Power LED should be lit and Signal LED should be blinking during operation
- Verify that RSS Core wiring is correct
- Power cycle RSS Transmitter if Signal LED is unlit
- While RSS Transmitter is powered off, string voltage should be (0.6V * number of modules)
- While RSS Transmitter is powered on, full string voltage should be present

Test individual strings with active RSS Transmitter one at a time in case of unexpected voltage.

1. General Information - Specifications

⚠ ATTENTION - READ THIS FIRST

1. This document is for quick guidance only. For details, please refer to the RSS Transmitter Installation and Operations Manual.
2. **WARNING: Do not energize the RSS Transmitter until all TS4's have been installed and all RSS Transmitter Cores connections and communications have been established. Failing to adhere to the Installation Manual and Quick Start Guide instructions will void the warranty and can cause irreparable damage to the device.**
3. TS4-A-F, TS4-A-2F and an RSS Transmitter are a solution to meet NEC 2017 & 2020 690.12 Rapid Shutdown requirements. TS4-A-F and TS4-A-2F units automatically enter rapid shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter. Wait 30 seconds after rapid shutdown activation before disconnecting DC cables, or turning off DC disconnect, or powering the RSS transmitter back ON.

1.1 Package Contents

490-00100-52 RSS Transmitter

Item	Quantity
RSS Transmitter w/ PST	1
RSS Core	2
Quick Start Guide	1
Rapid shutdown label	1

492-00000-52 RSS Transmitter Outdoor kit

Item	Quantity
NEMA 4 Enclosure	1
RSS Transmitter w/ PST	1
RSS Core	2
Din Rail Ground Terminal	1
Power conductor	3
120/240Vac Power supply	1
Quick Start Guide	1
Rapid shutdown label	1

493-00000-52 Commercial RSS Transmitter kit

Item	Quantity
RSS Transmitter w/ PST	1
RSS Cores	2
480/277Vac Power supply	1
35mm Din Rail	1
Quick Start Guide	1
Rapid shutdown label	1

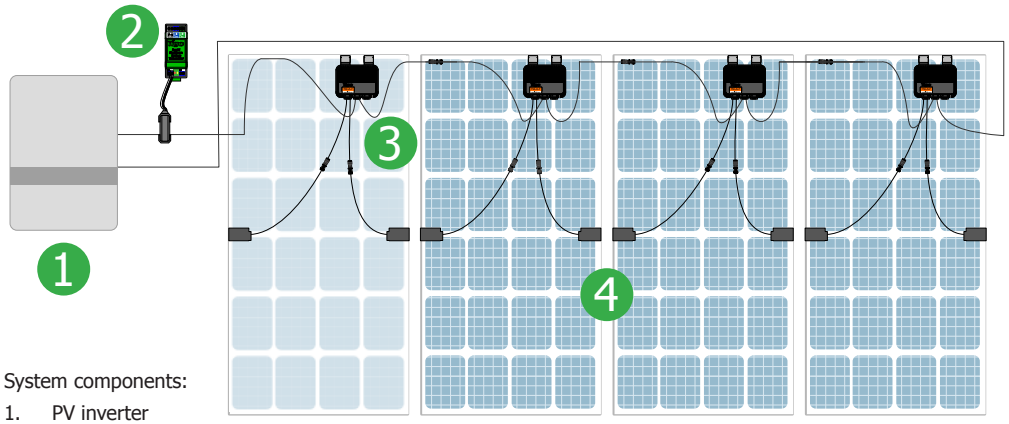
Tigo **TS4-A-F, TS4-A-2F** are required for the proper operation of this rapid shutdown system. For more information, scan the QR code here.

Tigo TS4-A-F

Tigo TS4-A-2F

1.2 System Wiring Diagram

Many leading inverters integrate the Tigo RSS Transmitter. Look for the Tigo Enhanced label or check for Tigo integration partners at https://www.tigoenergy.com/ul-pvrss

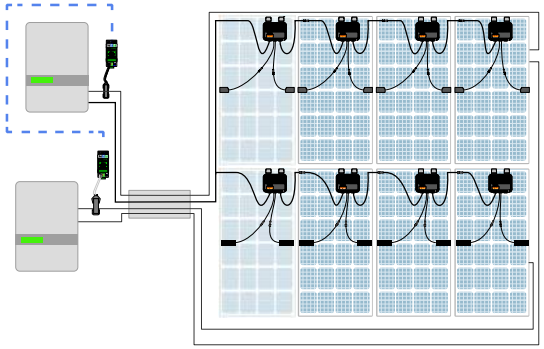


System components:

1. PV inverter
2. Tigo PV RSS Transmitter (RRSx)
3. Tigo TS4-A-Fs
4. PV modules

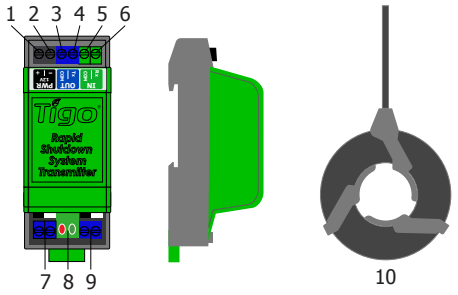
A single Core can accommodate up to 10 conductors. If your project exceeds the limit, refer to Installation and Operations Manual.

The RSS Transmitter with PST can link multiple RSS transmitters together. This enables Tigo's Pure Signal Technology to provide one coordinated keep-alive signal to the array.



1.3 RSS Transmitter with Pure Signal Technology Overview

1. $12V_{DC}$ Power (+)
2. $12V_{DC}$ Power (-)
3. Com ground (COM)
4. Transmit Signal (Tx)
5. Com ground (COM)
6. Receive Signal (Rx)
7. Core 1 input (RSS Core1)
8. LEDS
9. Core 2 input (RSS Core2)
10. Bi-colored RSS Core



2. Installation

Install the TS4-A-F and/or TS4-A-2F BEFORE powering on the RSS transmitter.

Always use appropriate PPE.

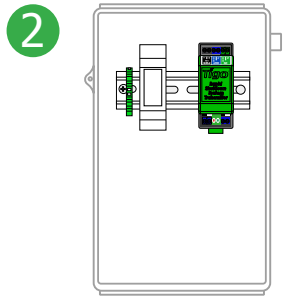
Always abide by prevailing codes/requirements to determine the number of PV conductors that can fit inside the 25.4mm (I.D.) core. Wire gauges and suppliers vary.

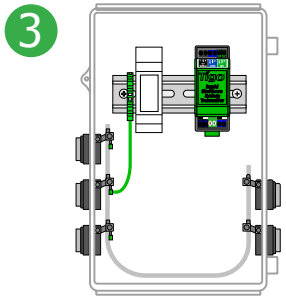
2.1 Installing the RSS Transmitter Kit

The RSS Transmitter Kits include a DIN Rail power supply, RSS Transmitter with PST and a grounding terminal. If not using a Tigo enclosure, confirm a 35mm DIN Rail can be installed and maintain the environmental ratings of the equipment installed.

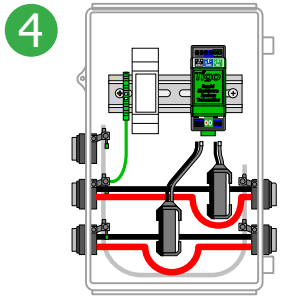
Prior to mounting, drill out all applicable conduit openings.

1. Mount enclosure with appropriate mounting hardware for the surface.
2. Securely install the Ground terminal, power supply and RSS Transmitter with PST onto the 35mm Din Rail.
3. Route conduit to the enclosure. Use appropriate weather-tight fittings and bond conduit, as necessary. Connect to ground terminal.





4. Route the PV array homeruns into the enclosure. Pass only the **negative** homeruns through the RSS Transmitter Core, with the **black side** of the Core facing towards the PV array (polarity matters). Continue the homeruns to the PV inverter. Each Core can accommodate up to 10 homeruns. Use additional Cores as necessary.
5. Pull conductors through the enclosure to the next termination point (inverter).



At this time, the TS4-A-F/2F should be installed. No power is applied to the RSS Transmitter.

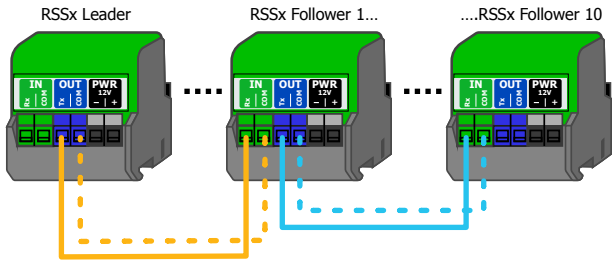
2.2 Wiring multiple RSS Transmitters

POWER MUST BE DISCONNECTED THROUGHOUT THIS STEP.

If multiple RSS Transmitters exist in the system, the most effective way to mitigate crosstalk is to synchronize the signal between the transmitters in a Leader-Follower method.

If only one transmitter is required, skip this step.

- Connect up to 10 RSS Transmitters with PST.
- The total length of daisy-chain signal wiring must not exceed 100ft (30m).
- Use 22-14 AWG twisted pair wire (shielded recommended).
- Wire as shown
- Torque to 0.4Nm (3.5LB-in)

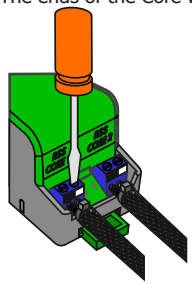


2.3 Connecting the RSS Cores

The RSS Cores are colored black and white to indicate signal directionality. The ends of the Core wires are colored to match the RSSx and terminals.

The RSS cores connect to the lower terminals of the RSS Transmitter.

1. Insert the wire with the white ferrule into the white terminal of the Core 1 input (left side). Torque to 0.5 Nm max.
2. Insert the wire with the black ferrule into the black terminal. Torque to 0.5 Nm max.
3. Repeat at Core 2 input **(9)** for two-core applications.



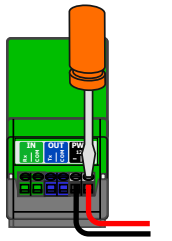
Bottom view of RSS Tx

2.4 Powering the RSS Transmitter

The RSS Transmitter MUST be on the same AC branch circuit as the inverter to meet NEC 690.12 Rapid Shutdown requirements.
You must complete Section 2.2 before powering on the RSS Transmitters.

Each RSS Transmitter with PST requires 12V_{DC} (+/-2%) and 1A from a DC power supply. The optional RSS Transmitter Kits include a power supply. If sourcing a third party power supply, ensure the specification meet the requirements found in the installation manual.

1. Using a red 22-14 AWG conductor, connect the 12V output of the power supply to the + **(1)** and torque to 0.4Nm (3.5lb-in).
2. Using an 22-14 AWG black conductor, connect the 12V_{dc}- of the power supply to the - terminal of the transmitter **(2)** and torque to 0.4Nm (3.5lb-in).
3. Using an 22-14 AWG grounding conductor, connect the AC and DC ground wires of the Power Supply to DIN rail.



Top view of RSS Tx with Pure Signal Technology

3. Pre-Power Checklist

✔	Check Item	Acceptance Criteria
	TS4 Installation	All PV modules are connected to a TS4-A-F/TS4-A-2F.
	Core directionality	All Cores are facing the correct position (Black side towards the PV array).
	Conductor signaling	Only the negative conductors are run through the RSS cores and no more than 10 conductors per Core.
	Distance	The total round-trip distance of the PV conductors is <300m or <500m if Cores are installed in series on the same strings for long distance applications.
	Series transmitter wiring	The transmitters are wired correctly and connections are secure.
	Power supply	Power supply is wired correctly, and connections are secure.
	Conduit connections	All conduit attachments are sealed and bonded, where necessary.
	Workmanship	Cable ties are secured evenly, have no sharp edges, the enclosure and installation area are left clean and accessible.
	Voltage check	Check string voltage prior to powering up the system. Without the keep alive signal the string voltage should equal 0.6V x # of PV modules in the string.

4. Commissioning

⚠ **CAUTION – For personal safety always wear and use appropriate PPE.**

1. Follow the normal commissioning steps of the inverter(s) installed. Note - the RSS Transmitter must be connected to the same AC branch circuit as the inverter to meet NEC 690.12 Rapid Shutdown requirements. By connecting the inverter(s) to the grid, power is supplied to the RSS transmitter, turning it on.

2. The RSS Transmitter should now be powered and signaling the array to pass energy. Each string should now have full voltage to the inverter.

5. LED Status

LED Status	Description	Action
Red ON, Green Flashing	Leader (transmitter 1)	None; normal operation
Red OFF, Green flashing	Follower (transmitters 2-10)	None, normal operation
Red ON, Green OFF	Error, not transmitting signal	Remove power from all transmitters. Verify all wiring is correct. Verify torque.

6. Troubleshooting

⚠ **CAUTION – For personal safety always wear and use appropriate PPE.**

Issue	Check
Low string voltage	The TS4-A-F produces 0.6V per unit when the RSS Signal is not present. If the string Voc is abnormally low (<100 volts), verify each RSSx has power and that the IN and OUT connections are correct (if using multiple RSSx), and that the Cores are properly installed.
Lower voltage than expected	One or more TS4s may not be connected properly. Use the **RSS Signal Detector** (not included) to verify the TS4 is receiving the keep alive signal.
No output voltage at the string	Verify all TS4s are connected to the modules and that all TS4s are connected to each other.

7. Your Customer Service Contact

United States (HQ):

Tigo Energy, Inc.
655 Campbell Technology Pkwy
Campbell, CA 95008

EMEA Office:

Tigo Energy Italy
Srl Via Calamandrei 36 52025
Montevarchi Tuscany, Italy

Americas: +1 408 402 0802
International: 00800 2255 8446

https://support.tigoenergy.com/

Tigo RSS

Tigo TS4-A-F

Community

Support

c UL us LISTED E469960 Photovoltaic Rapid Shutdown System Equipment, QIJW

Type Approved

Class II double insulation

DANGER High Voltage

Ver. 1 July 14, 2022
PN: 002-00100-00 REV 1.0

Tigo® Flex MLPE

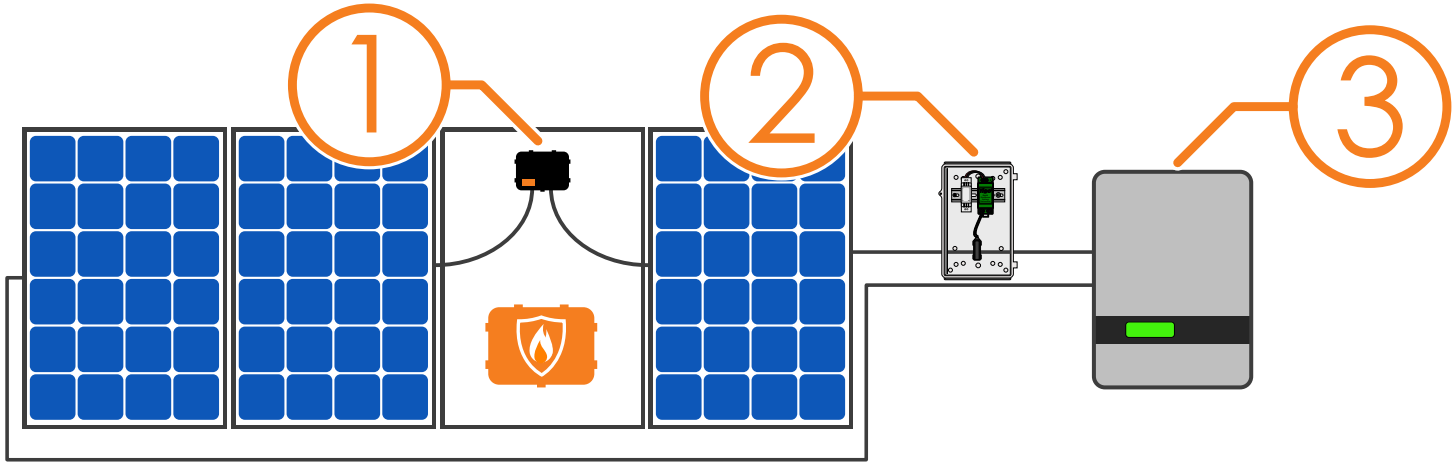
RSS TRANSMITTER - OUTDOOR KIT

Rapid Shutdown Activator for TS4-F

The Tigo Rapid Shutdown System (RSS) Transmitter is part of a rapid shutdown solution when paired with Tigo TS4-F (Fire Safety), a PV module rapid shutdown unit. While powered on, the RSS Transmitter sends a signal to the TS4-F units to keep their PV modules connected and supplying energy.

TS4-F units automatically enter rapid shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter. This solution complies with NEC 690.12 specifications for 2014, 2017, and 2020 and uses PLC signaling for rapid shutdown.

The RSS Transmitter Outdoor Kit includes an RSS Transmitter, outdoor enclosure, 120/240V_{AC} power supply, and one or two RSS Cores.



1. Modules equipped with Tigo TS4-F (Fire Safety)
2. Tigo RSS Transmitter with Outdoor Kit
3. Inverter

RSS TRANSMITTER - OUTDOOR KIT

Meets NEC 690.12 requirements

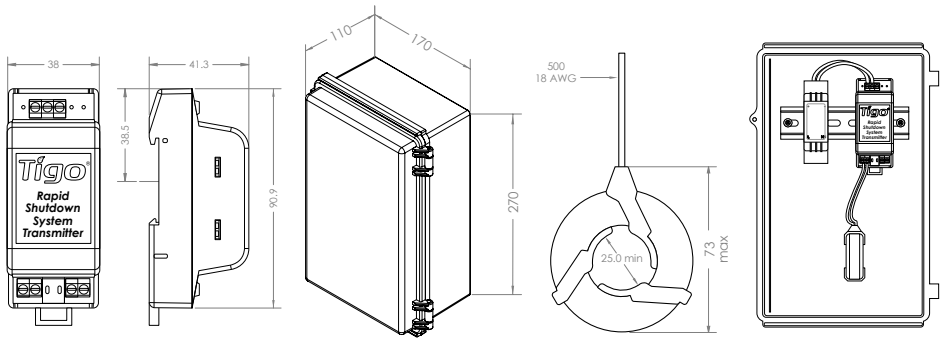
Module-level deactivation with TS4-F

Automatic or manual shutdown

Weatherproof outdoor enclosure

Includes one or two RSS Cores

Includes 120/240V_{AC} power supply



RSS Transmitter | Outdoor Enclosure | RSS Core | Installation Example

All dimensions in mm.

Input
Transmitter Input Voltage: 12V_{DC} (+/- 2%)
Transmitter Input Current: 1A
RSS Core
Max Current (in Outdoor Kit): 100A per RSS Core (Single Core: 100A, Dual Core: 200A)
Max String Voltage: 1500V_{DC}
Max Number of Strings per Core: 10
Max Supported PV Modules per String: 30
Environmental
Operating Temperature Range: -20°C to 50°C (in Outdoor Enclosure)
Enclosure: IP68, NEMA 4

ORDERING OPTIONS

492-00000-10	Single Core RSS DIN Rail Transmitter Kit, 120/240V_{AC} Power Supply, Outdoor Enclosure
492-00000-20	Dual Core RSS DIN Rail Transmitter Kit, 120/240V_{AC} Power Supply, Outdoor Enclosure

For sales info:
sales@tigoenergy.com or 1.408.402.0802

For technical information:
http://support.tigoenergy.com

For product info:
Visit www.tigoenergy.com/products

For technical info:
http://support.tigoenergy.com

For additional info and product selection assistance, use Tigo's online design tool at www.tigoenergy.com/design

FC c UL us LISTED Photovoltaic Rapid Shutdown System Equipment, QIJW

Tigo®

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Phono® Solar
SHARE THE SUN, POWER THE FUTURE!

Phono Solar Technology Co., Ltd.

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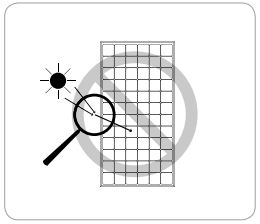
PHONO SOLAR TECHNOLOGY CO., LTD.

Photovoltaic Module Installation Manual (UL)

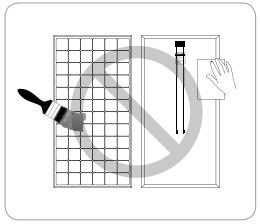
Version: EN-IM-UL-20191011

Phono® Solar
SHARE THE SUN, POWER THE FUTURE!

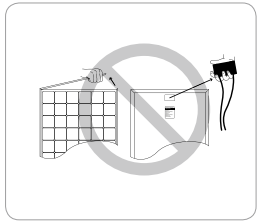
CONTENTS



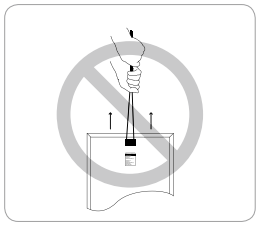
DO NOT use mirrors or magnifiers to concentrate sunlight onto the module.



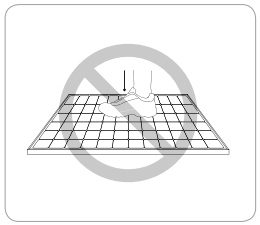
DO NOT paint the module or attach anything on to the back of the module.



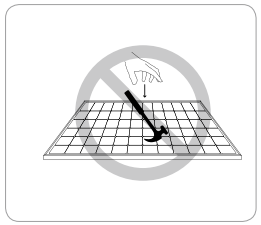
DO NOT attempt to disassemble the modules, and do not remove any attached nameplates or components from the module.



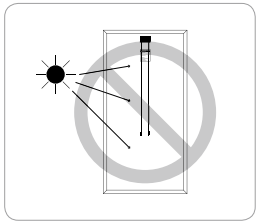
DO NOT lift or move the module by holding the junction box or cable.



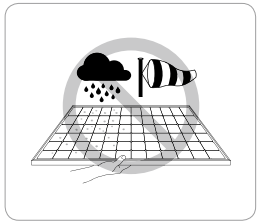
DO NOT place anything on the module or press on the module surface.



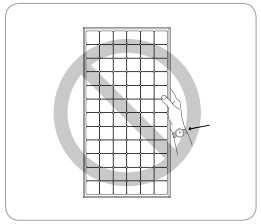
DO NOT drop the module or allow objects to fall on the module.



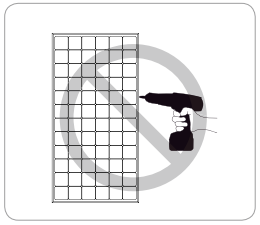
DO NOT expose the back of the module to direct sunlight.



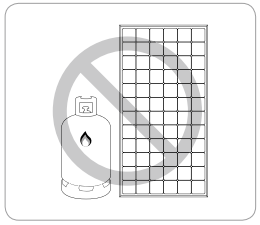
DO NOT install or handle module in wet or strong windy conditions.



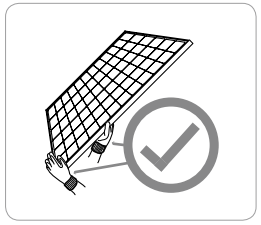
DO NOT wear metal ornaments while handling the module or during the installation.



DO NOT drill holes in the frame.



DO NOT use module near equipment or in places where flammable gases may be generated or collected.



Insulated gloves must be worn while handling the module and during the installation.

❶ IMPORTANT SAFETY GUIDE

This manual contains information regarding product identification and the safe installation and maintenance of photovoltaic modules (hereafter referred to as “module”) supplied by PHONO SOLAR TECHNOLOGY CO., LTD. (hereafter referred to as “PHONO SOLAR”). The term “module” can be interpreted as a single module or multiple modules depending on the context.

Installers must already be familiar with the mechanical and electrical requirements for a photovoltaic system. Installers must also read this manual carefully prior to installation. We recommend that you keep this manual in a safe place for future reference and in case of future sale or disposal of the module.

1.1 General Safety

- The installation of a photovoltaic system requires specialized skills and knowledge and must only be carried out by licensed/qualified persons.
- Installers should assume all risks of injury and do everything to avoid potential damages and risks that might occur during installation, including but not limited to, the risks of electric shock.
- PHONO SOLAR modules do not need special cables for connection. All of the modules have permanent junction boxes, cables and connectors.
- Do not use mirrors or magnifiers to concentrate sunlight onto the modules.
- The modules generate DC electrical energy from sunlight. They are designed for outdoor use and can be mounted onto frames on rooftops or in the ground etc.
- Do not paint the module or attach anything on to the back of the module.
- Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.

1.2 Handling safety

- When handling the module insulated gloves must be worn.
- Inappropriate transportation and installation may break the module.
- Do not lift or move the module by holding the junction box or cable.
- Do not place anything on the module or press on the module surface.
- Do not drop the module or allow objects to fall on the module.
- Do not expose the back of the module to direct sunlight.

- Do not wear metal ornaments while handling the module.
- Do not install or handle modules in wet or strong windy conditions.

1.3 Installation safety

- Local, regional and state laws and regulations must be adhered to while installing a photovoltaic system. For example, any necessary licenses must be obtained prior to the installation commencing. Regulations around vehicles and ships must also be observed during the installation.
- Observe all safety rules for the other system components, including the cables, connectors, charging controllers, inverter and storage battery etc.
- Do not place the modules near a location where flammable gases are either generated or collected.
- Insulated gloves must be worn during the installation.
- Do not wear metal ornaments during the installation.
- Do not drill holes in the frame.
- Under normal conditions, a module is likely to produce more current and/or voltage than reported under Standard Test Conditions (STC). Accordingly, the values of I_{SC} and V_{OC} marked on the module nameplate should be multiplied by a factor when determining the component voltage ratings, conductor current ratings, fuse sizes, and the size of controllers connected to the photovoltaic system. The exact factor value should be suggested by a licensed/qualified person.
- The live connector may cause fire. spark or lethal shocks even when the modules are not connected.
- Electricity can be generated when the modules are exposed to sunlight, even if they are not connected. It is dangerous to touch 30V DC or higher, so never open the electrical connectors or unplug the electrical connectors while the circuit is under load, and do not touch the live connectors during the installation when the modules are exposed to sunlight.
- Children should be kept away from the photovoltaic system.
- In order to prevent current and voltage generation during installation an opaque board can be used to cover the modules.
- Only use licensed/qualified insulated tools.
- The frame of the modules may be grounded according to local, regional and state safety and electrical standards.

- Only Balance of System (BOS) components that conform with local, regional and state safety electricity standards should be used to avoid affecting module performance and/or module damage.

1.4 Fire Safety

- Consult your local authority for guidelines and requirements for building or structural fire safety.
- Roof constructions and installations may affect the fire safety of a building; an improper installation may create a hazard in the event of a fire.
- Use components such as ground fault circuit breakers and fuses as required by the local authorities.
- Do not use the modules near a location where flammable gases are either generated or collected.
- The modules have been rated Fire Class C complying with ULC/ORD-C1703-01, and Type 1 complying with UL1703. So the system fire class of module with appropriate mounting system in combination with a rated roof covering can achieve Class A.

2 PRODUCT IDENTIFICATION

On the back of each module there are 2 labels that provide the following information:

Nameplate: Describes the product type, rated power, rated current, rated voltage, open circuit voltage, short circuit current, all as measured under STC; weight, dimensions etc.; the maximum system voltage of 1000V/1500V DC.

Warning: The value of Voc times the number of modules in series should not be bigger than the maximum system voltage marked in the nameplate.

Barcode: This is used to identify each module. Each module has a unique and traceable serial number in the form of barcode. The barcode of each PHONO SOLAR module has 15 letter/digits.

Warning: Do not remove the nameplate or barcode. The PHONO SOLAR product warranty will be void if either the module nameplate or barcode is removed.

❸ MECHANICAL INSTALLATION

(Note: All instructions hereafter are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.)

3.1 Select suitable locations for installation

- Select a suitable location for installing the modules.
- PHONO SOLAR recommends that to achieve the best performance the modules should face south in northern latitudes and north in southern latitudes. The exact tilt angle and orientation of mounted modules should be recommended by a licensed/qualified installer.
- The modules should be completely free of shade at all times.
- Do not place the modules near a location where flammable gases are either generated or collected.

Note1: Saline environments can accelerate the processes of electrical insulation losses and galvanic corrosion, especially when different metals with high electrochemical potential come into contact each other.

In saline environments, based on the distance to seashore, Phono Solar generally classifies coastal PV installation into three different levels:

- From 0 up to 50 meters, Phono Solar does not recommend any installation due to concerns for salt-mist corrosion.
- From 50 to 500 meters, Phono Solar regards this as "Near-Coast" installation requiring adherence to salt-mist corrosion prevention.
- From 500 meters and onwards, Phono Solar estimates the risk of salt mist corrosion is minor and only requires annual preventive maintenance.

In "Near-Coast" installation, Phono Solar PV modules must be installed under the following conditions:

- During the installation, do not scratch or break the corrosion-resistant coating (e.g. electroplated layer, oxidized coating, etc.) on the modules and mounting systems.
- The modules shall be mounted with a minimum tilt angle of 10°in respect to the horizon.
- Use corrosion-resistant materials (e.g. stainless steel SUS 316) for components (nut, bolt, gasket, etc.) to fixing the modules and mounting systems.
- To avoid possible galvanic corrosion between the aluminum frame and the support structure, mica lamination, or other silicone, or fluoride made gasket shall be interposed between the two metals
- When grounding the module frames, stainless steel hardware must also be used. To prevent salt corrosion to grounding block, fluorocarbon varnish could be sprayed on the grounding block thoroughly to form an anti-corrosion coating (at least 40um thick) or a pad of butyl plaster covering could be placed on the grounding block completely.

To ensure optimum module performance for near- coast installation, a system maintenance service of every three months is generally recommended and additionally the following maintenance measures shall be taken:

- Check the frame, mounting system, grounding block and other junction areas for potential signs of corrosion.
- Clean the frame, mounting system, grounding block and other junction areas from salt and dust accumulation.
- To repair the rusty areas, apply butyl plaster or fluorocarbon varnish spray to cover the area thoroughly after clean the salt and other dust accumulations around the rusty areas.

Note2: In environments where ammonia is present, Phono Solar PV modules must be installed under the following conditions:

- When fixing the modules using the 8 mounting slots, all the hardware (washers, screws and nuts) shall be made of stainless steel;
- To avoid possible galvanic corrosion between the aluminum frame and the support structure, PVC washers or neoprene tape shall be interposed between the two metals;
- When grounding the module frames, stainless steel hardware must also be used.

Note3: If you are planning to use the PV modules where the water damage (Humidity: > 85RH%) may be possible, please consult with Phono Solar technical support first to determine an appropriate installation method and module type , or to determine whether the installation is possible.

3.2 Select suitable mounting rails

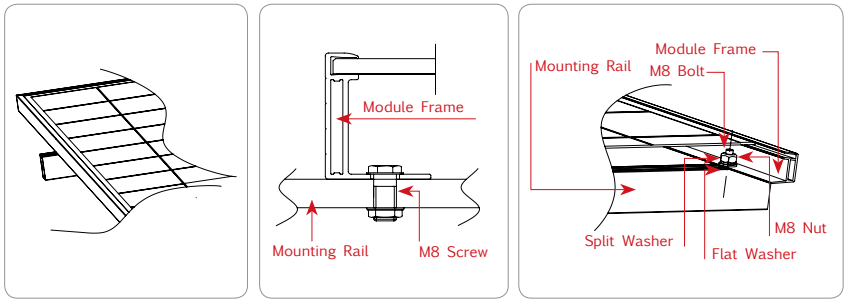
- Please observe the safety regulations and installation instructions included with the mounting rail. If necessary please contact the supplier directly for further information.
- The modules must be safely set onto the mounting rail. The whole rail supporting the photovoltaic system must be strong enough to resist potential mechanical pressures caused either by wind or snow, in accordance with local, regional and state safety (and other associated) standards.

- Make sure that the mounting rail will not deform or affect the modules when it expands as a result of thermal expansion.
- The mounting rail must be made of durable, anti-corrosive and UV-resistant materials.

3.3 Select suitable mounting methods

PHONO SOLAR modules can be mounted using two methods:

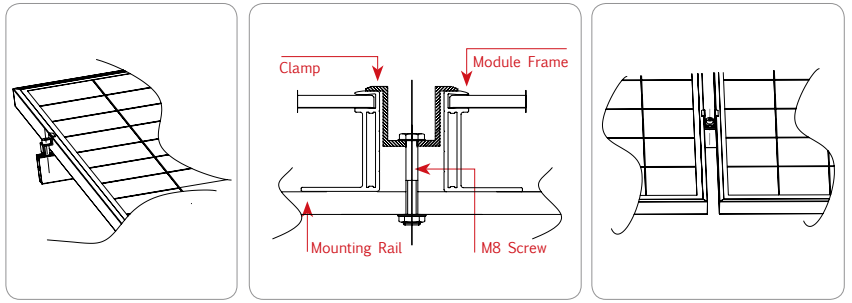
Screw Fitting: Use corrosion-proof screws in the existing installing holes in the module frame. Each module has 8 mounting holes for securing the module on the mounting rail. The module frame must be attached to a mounting rail using M8 corrosion-proof screws together with spring washers and flat washers in symmetrical locations on the module. The applied torque should be approximately 16~20Nm. Please find detailed mounting information in the below illustration:



Module installed using Screw Fitting method

Clamp fitting: Using suitable module clamps on the LONG side of the module frame to mount the modules is “portrait orientation” mode, while on the SHORT side of the module frame is “landscape orientation” mode.

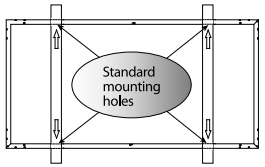
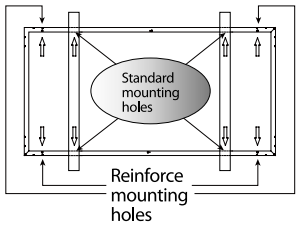
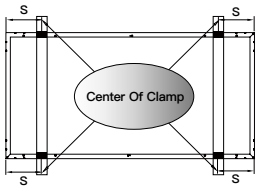
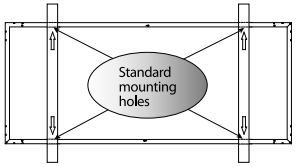
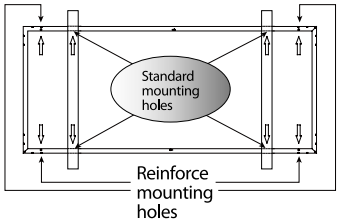
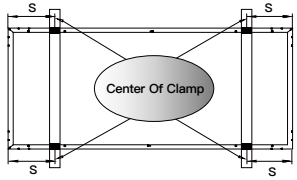
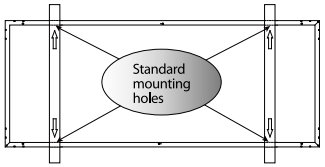
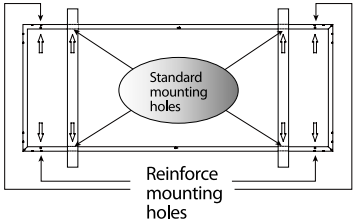
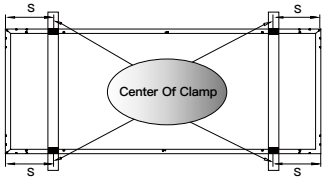
The module clamps should not come into contact with the front glass and must not deform the module frame. Avoid any shadowing effects from the module clamps. The module frame can not be modified under any circumstances. Regardless of the orientation chosen, at least 4 clamps must be used on each module. For portrait orientation, 2 clamps should be attached to the long sides of the module and for landscape orientation 2 clamps should be attached to the short sides of the module. Depending on the local wind and snow loads, additional clamps may be required. The applied torque should be about 16~20Nm. Please find detailed mounting information in the below illustration:



Module installed using Clamp Fitting method (The minimum recommended length for each clamp is 50 mm)

Select the appropriate installation method depending on the load (see below for more detailed information).

F Type	1580mm × 808mm × 35mm
U Type	1640mm × 992mm × 35/40/45mm 1675mm × 992mm × 35/40/45mm 1664mm × 998mm × 20/30mm 1684mm × 998mm × 30mm 1666mm × 1000mm × 35/40mm 1686mm × 1000mm × 35/40mm
T Type	1956mm × 992mm × 40/45/50mm 2000mm × 992mm × 40/45/50mm 2006mm × 998mm × 30 mm 1980mm × 1000mm × 40/45mm 2010mm × 1000mm ×40/45mm

Installation	Mounting system		Clamping system
	Maximum Load: Uplift load ≤ 2400 Pa Downforce load ≤ 2400 Pa	Maximum Load: Uplift load ≤ 2400 Pa Downforce load ≤ 5400 Pa	Maximum Load: Uplift load ≤ 2400 Pa Downforce load ≤ 5400 Pa
F Type module	Use standard mounting holes  The guide rail should be installed perpendicular to the long side of the frame.	Use standard mounting holes and reinforce mounting holes  The guide rail should be installed perpendicular to the long side of the frame.	Use four clamps 125mm＜S＜375mm Pemissible Clamp Range  The guide rail should be installed perpendicular to the long side of the frame.
U Type module	Use standard mounting holes  The guide rail should be installed perpendicular to the long side of the frame.	Use standard mounting holes and reinforce mounting holes  The guide rail should be installed perpendicular to the long side of the frame.	Use four clamps 205mm＜S＜455mm Pemissible Clamp Range  The guide rail should be installed perpendicular to the long side of the frame.
T Type module	Use standard mounting holes  The guide rail should be installed perpendicular to the long side of the frame.	Use standard mounting holes and reinforce mounting holes  The guide rail should be installed perpendicular to the long side of the frame.	Use four clamps 300mm＜S＜350mm Pemissible Clamp Range  The guide rail should be installed perpendicular to the long side of the frame.

Warning: Do not attempt to drill holes in the module frame or in the glass surface of the module. Any such modifications will void the PHONO SOLAR product warranty.

3.4 When installing a module on a pole ensure that the pole and mounting rail can withstand anticipated local winds. The pole must be installed on a hard base.

3.5 Ensure that the installation height is such that the lowest modules will not be covered by accumulated snow or shaded by the surroundings.

3.6 Ensure that there is adequate ventilation under the modules, conforming to local, regional and state standards and regulations.

3.7 A minimum distance of 10cm, between the roof plane and the frame of the module is generally recommended.

3.8 Observe the linear thermal expansion of the module frames. A minimum distance of 1cm between two modules is generally recommended.

4 ELECTRICAL INSTALLATION

(Note: All instructions hereafter are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.)

4.1 Any hardware used must be compatible with the mounting material to avoid galvanic corrosion.

4.2 Only use connectors that are designed for photovoltaic systems and that match PHONO SOLAR modules.

4.3 When working with the connectors only use tools as recommended by the connector manufacturer.

4.4 PHONO SOLAR recommends that the same type of modules are connected together in order to avoid any system power loss.

4.5 The maximum number of series connected modules depends on system design, the type of inverter used and environmental conditions.

4.6 Select insulated cables that are able to resist to ultraviolet radiation and extreme weather conditions.

4.7 The rated voltage of the cable chosen must be appropriate to the overall maximum voltage of the system.

4.8 The module frame may be grounded according to local, regional and state safety and electrical standards. Ensure that a recommended connector or equivalent is used for the grounding cable. The grounding cable must be properly fastened to the module frame.

4.9 In order to reduce the risk of potential induced degradation (PID), Phono Solar strongly recommends to use anti-PID solar modules in wet regions (i.e. shores, wetlands), or to use the system negative grounding where the negative polarity of the PV modules array (i.e. negative grounding at the DC bus bar level) is connected to the ground. Failure to comply with this recommendation may reduce the module performance and will invalidate the limited power warranty of the module.

5 GROUDING

5.1 For grounding and bonding requirements, please refer to regional and national safety and electricity standards. If grounding is required, use a recommended connector type for the grounding wire.

5.2 For grounding, this guide refers to module frame grounding. If grounding is required, make sure module frames (metal exposed to touch) are always grounded.

5.3 System grounding is not mandatory for Phono Solar modules, however negative system grounding may be required by local authorities and can therefore be recommended.

5.4 Phono Solar recommends the Grounding Clip (Cat. No. 1954381 (Supplier: TE)) when grounding.

5.5 The grounding lug must be a tin-coated copper lug, silver in color. Do NOT use a bare copper lug, which is brown.

Please refer to relevant connector specifications for instructions.

For grounding clip, using a cross-recessed screwdriver, thread the screw into the hole until the head is flush with the base and the base is flush with the frame, then tighten the screw with another 1/4 to 1/2 turn. Insert the wire into the wire slot. Press down on both ends of the wire (the wire slot will cause the wire to form a slight curve). Manually, or using channel lock pliers, push the slider over the base until it covers the base. This will terminate the wire.

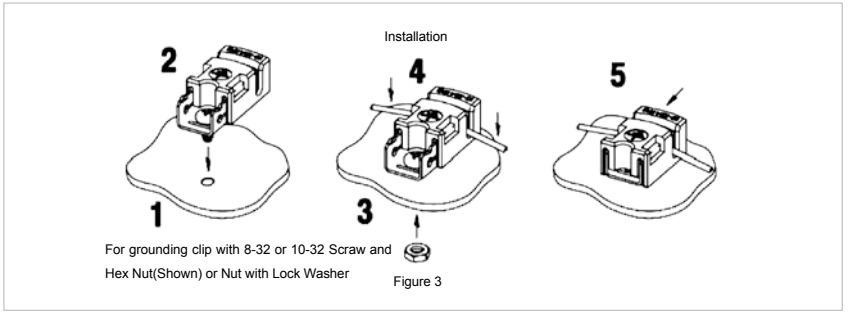


Figure 3

⑥ MAINTENANCE

6.1 The amount of electricity generated by a solar module is proportionally correlated with the light absorbed by the module with a factor equivalent to module conversion efficiency. Cells shaded by leaves and dust accumulated on the surface will reduce the light absorption and power generation, and therefore it is important to keep modules unshaded and clean. To ensure the optimum module performance, PHONO SOLAR recommends the following:

- PV modules can be cleaned only if the solar irradiance is below 200W/m2; Cleaning water or solution with a large temperature difference from the modules shall not be used for cleaning the modules;
- It is forbidden to clean PV modules under the weather conditions of heavy rain, heavy snow or wind grade higher than 4;
- If pressurized water is employed in cleaning, the water pressure applied on the glass surface of the module shall not exceed 4MPa (40bar); the module is prohibited to bear the extra force;
- When cleaning PV modules, do NOT step on the modules; do NOT spay water on the backside of the module or the cables; keep the connectors clean and dry; prevent fire and electrical shock from occurring; do NOT use a steam cleaner;
- When cleaning the modules, use soft cloth and clean water together with a mild detergent. The temperature of the water applied shall be close to that of the module being cleaned.
- Use dry or wet soft clean cloth to clean the PV modules; Corrosive solvents hard objects are strictly prohibited;
- If there are greasy dirt and other substances on the surface of the PV module
- which are difficult to clean, conventional household glass cleaning agents can be used; Do NOT use the alkaline and strong acid solvents.
- Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not "self-clean" as effectively as modules mounted at a 10° tilt or greater.
- The back surface of the module normally does not need to be cleaned, but in the event this is deemed necessary, avoid the use of any sharp objects that might damage or penetrate the substrate material.
- Check the electrical and mechanical connections routinely and make sure they are clean, safe, complete and secure.
- In the event of a problem, please consult with a licensed/qualified person.

6.2 Requirements for Water Quality

- PH: 5 ~7;
- Chloride and Salinity: 0 - 3,000 mg/L
- Turbidity: 0-30 NTU
- Conductivity: 1500~3000 μs/cm
- Total dissolved solids (TDS): ≤1000 mg/L
- Water Hardness—calcium and magnesium ions: 0-40 mg/L
- Non-alkaline water must be used; demineralized water shall be used if the condition permits.

6.3 Safety Warning

- Cleaning work might impose the risk of damaging the a component or a series of components, and might also increase the risk of electric shock.
- Broken or damaged components may present a risk of electric shock due to current leakage, and this risk may be exacerbated by the moisture in the components. Before cleaning, ensure to check all wiring for possible rodent damage, weathering and that all connections are tight and corrosion free.
- During the day, the voltage and current present in the array are sufficient to cause a fatal electric shock. Before cleaning, make sure the array is disconnected from live parts (such as inverters, etc.).
- Wear protective equipment (clothes, insulated gloves, etc.) while cleaning
- Do not immerse components partially or completely in water or any kind of liquid.

⑦ DISCLAIMER OF LIABILITY

Since it is impossible for PHONO SOLAR to control installation, operation, application and maintenance of the photovoltaic system according to this instruction, PHONO SOLAR does not accept responsibility and expressly disclaims liability for any loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

PHONO SOLAR will not take any responsibilities for any possible violation of patent rights and third party rights that are related to application of the solar energy system. No permission of patents is given through implication.

The information of this instruction is from knowledge and experience of PHONO SOLAR, and so it is reliable. However, the instructions and suggestions of this instruction do not make an external or internal of guarantee. PHONO SOLAR reserves the right to revise this instruction, products and all the information about products without prior notification to customers.

Failure of the customer to follow the requirements outlined in this Manual during the installation of the module will result in the invalidity of the PHONO SOLAR product warranty.

Phono® Solar

TWINPLUS MODULE SERIES

HIGH EFFICIENCY MONO-PERC M4-9B-R

435-455W

OUTSTANDING PRODUCT PERFORMANCE

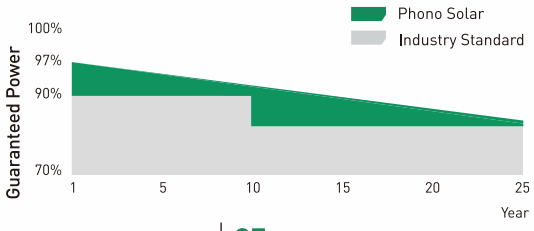
- Competitive high-temperature performance with ameliorated temperature coefficient
- Minimized power loss in cell connection
- Better performance under shading effect
- Decreased nominal operating cell temperature to 43 ± 2°C
- Higher power generation with multi-busbar and half-cut technology

TRUSTWORTHY QUALITY AND RELIABILITY

- Guaranteed 0~+5W positive tolerance secures reliable power output
- 5400Pa maximum snow load, 2400Pa maximum wind load
- Optimized electrical design lowers hot spot risk and operating current

PID RESISTANT

- Industry-leading cell processing technology and electrical design ensure solid PID resistance



12-year Product Warranty | **25-year** Linear Performance Warranty

MANAGEMENT SYSTEM CERTIFICATES

IEC 61215, IEC 61730
ISO 9001:2015 / Quality management system
ISO 14001:2015 / Standards for environmental management system
OHSAS 18001:2007 / International standards for occupational health & safety
IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules-guidelines for increased confidence in PV module design qualification and type approval

Bloomberg NEW ENERGY FINANCE Tier1

2019 TOP PERFORMER
PVEL | DNV·GL
PV MODULE RELIABILITY SCORECARD

www.phonosolar.com info@phonosolar.com

ELECTRICAL TYPICAL VALUES

Model	PS435M4-24/TH PS435M4H-24/TH		PS440M4-24/TH PS440M4H-24/TH		PS445M4-24/TH PS445M4H-24/TH		PS450M4-24/TH PS450M4H-24/TH		PS455M4-24/TH PS455M4H-24/TH	
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Rated Power (Pmpp)	435	322	440	325	445	329	450	333	455	336
Rated Current (Impp)	10.66	8.61	10.73	8.67	10.80	8.73	10.87	8.78	10.94	8.84
Rated Voltage (Vmpp)	40.81	37.33	41.01	37.51	41.21	37.70	41.40	37.87	41.60	38.05
Short Circuit Current (Isc)	11.13	8.99	11.21	9.06	11.29	9.12	11.38	9.20	11.47	9.27
Open Circuit Voltage (Voc)	48.85	44.69	48.98	44.81	49.11	44.93	49.24	45.04	49.37	45.16
Module Efficency (%)	19.89		20.12		20.35		20.58		20.80	

STC(Standard Testing Conditions):Irradiance 1000W/m², AM 1.5, Cell Temperature 25'C

NOCT (Nominal Operation Cell Temperature): Irradiance 800W/m², Ambient Temperature 20'C, Spectra at AM1.5, Wind at 1m/S

MECHANICAL CHARACTERISTICS

Cell Type	Monocrystalline 166mm x 83mm
Dimension (L× W × H)	Length: 2103mm (82.79 inch) Width: 1040mm (40.94 inch) Height: 35mm (1.38 inch)
Weight	25.0kg (55.12 lbs)
Front Glass	3.2mm Toughened Glass
Frame	Anodized Aluminium Alloy
Cable	4mm² (IEC), Length:350mm (vertical) 1250mm (horizontal) or Customized Length
Junction Box	IP 68 Rated

TEMPERATURE RATINGS

Voltage Temperature Coefficient	-0.30%/'C
Current Temperature Coefficient	+0.05%/'C
Power Temperature Coefficient	-0.38%/'C
Tolerance	0~+5w
NOCT	43±2'C

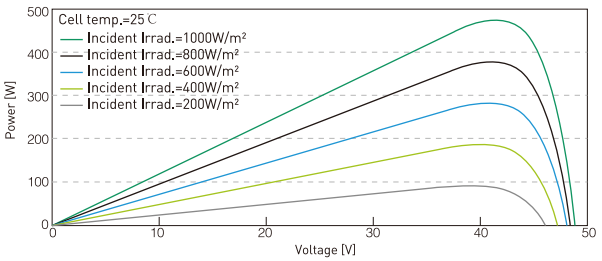
ABSOLUTE MAXIMUM RATING

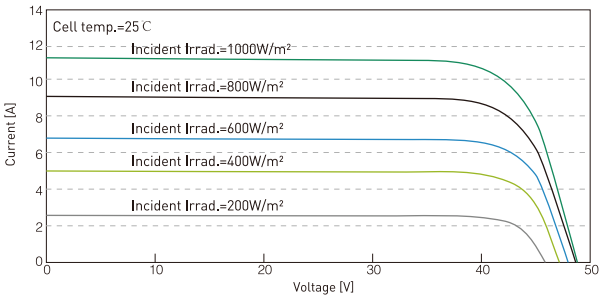
Operating Temperature	From -40 to +85'C
Hail Diameter @ 80km/h	Up to 25mm
Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Maximum Series Fuse Rating	20A
PV Module Classification	II
Fire Rating (IEC 61730)	C
Module Fire Performance(UL 61730)	Type 4
Maximum System Voltage	DC 1500V/1000V

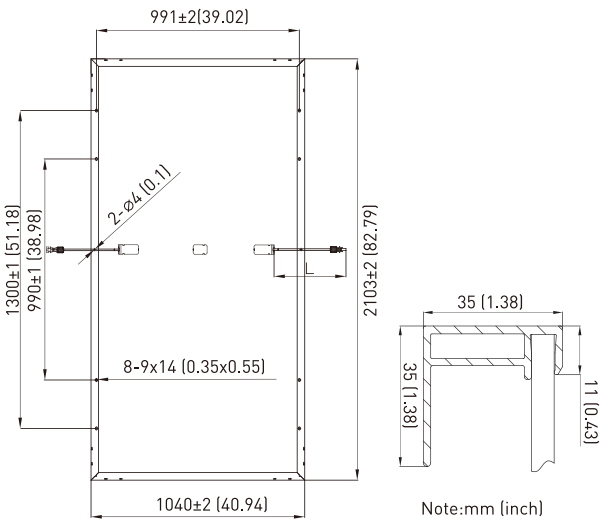
PACKING CONFIGURATION

Container	20' GP	40' HQ
Pieces/Container	255	682

ELECTRICAL CHARACTERISTICS







Phono® Solar

PHONO SOLAR TECHNOLOGY CO.,LTD reserves the right to make necessary adjustments to the information described herein at any time without further notice. The specifications and certificates contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. Please be sure to use the most recent version of data.

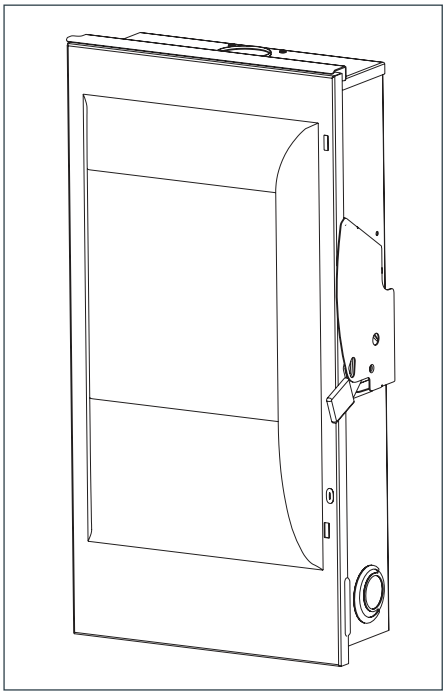
SIEMENS

Data Sheet

VBII General Duty Safety Switch

200A, 240V, Type 3R

usa.siemens.com/switches



Standards and Ratings

- UL Listed under file #E4776
- Meets UL98 for switches and UL 50 for enclosures
- Meets NEMA Standard KS-1 for enclosed switches
- Meets NEC wire bending space requirements
- Rated 10,000 AIC with Class H fuses or 100,000 AIC with Class R or T fuses
- Suitable for use as service entrance equipment
- Meets 2020 NEC 230.62 with addition of line side barrier kit (listed as accessory below)

Features

- Quick-make and break switching action
- Double break visible blade design
- Highly visible ON/OFF indication
- Rugged installer friendly enclosure design
- Modular design allows quick and easy replacement of parts
- Single cover interlock

Product Specifications

General Duty 200A, 240V, Type 3R

General Information

Catalog Number	Description	Shipping Weight (lbs.)
GF224NR [1]	2 Pole, 3 Wire Fusible	48
GF324NR	3 Pole, 4 Wire, Fusible	50
GNF324R	3 Pole, 3 Wire, Non-Fusible	47

Horsepower Ratings [2]

Catalog Number	1 Phase, 3 Wire 240V AC		3 Phase, 3 Wire, 240V AC		250V DC
	Std	Max	Std	Max	
GF224NR	15	—	25	60	40
GF324NR	15	—	25	60	40
GNF324R	—	15	—	60	40

Mechanical Lug Wire Range (60/75°C, Cu/Al)

Description	Wire Range
Line, Load, Neutral	#6 AWG - 300 Kcmil
Neutral Ground	#14-1/0 AWG
Ground Lug Kit	#14-4 AWG

Accessories

Catalog Number	Description
HG61234	Equipment Ground Lug Kit
HN64	Neutral Kit
HR64	Class R Fuse Clip Kit (3 fuse clips per kit) (GF224NR, GF324NR)
HT24	Class T Fuse Clip Kit (1-Pole per kit) (GF224NR, GF324NR)
HSK24B [3]	Line Side Barrier Kit
H150	1.50" Type "HS" Outdoor Hub
H200	2.00" Type "HS" Outdoor Hub
H250	2.50" Type "HS" Outdoor Hub
HSK24B	Line Side Barrier Kit [4]

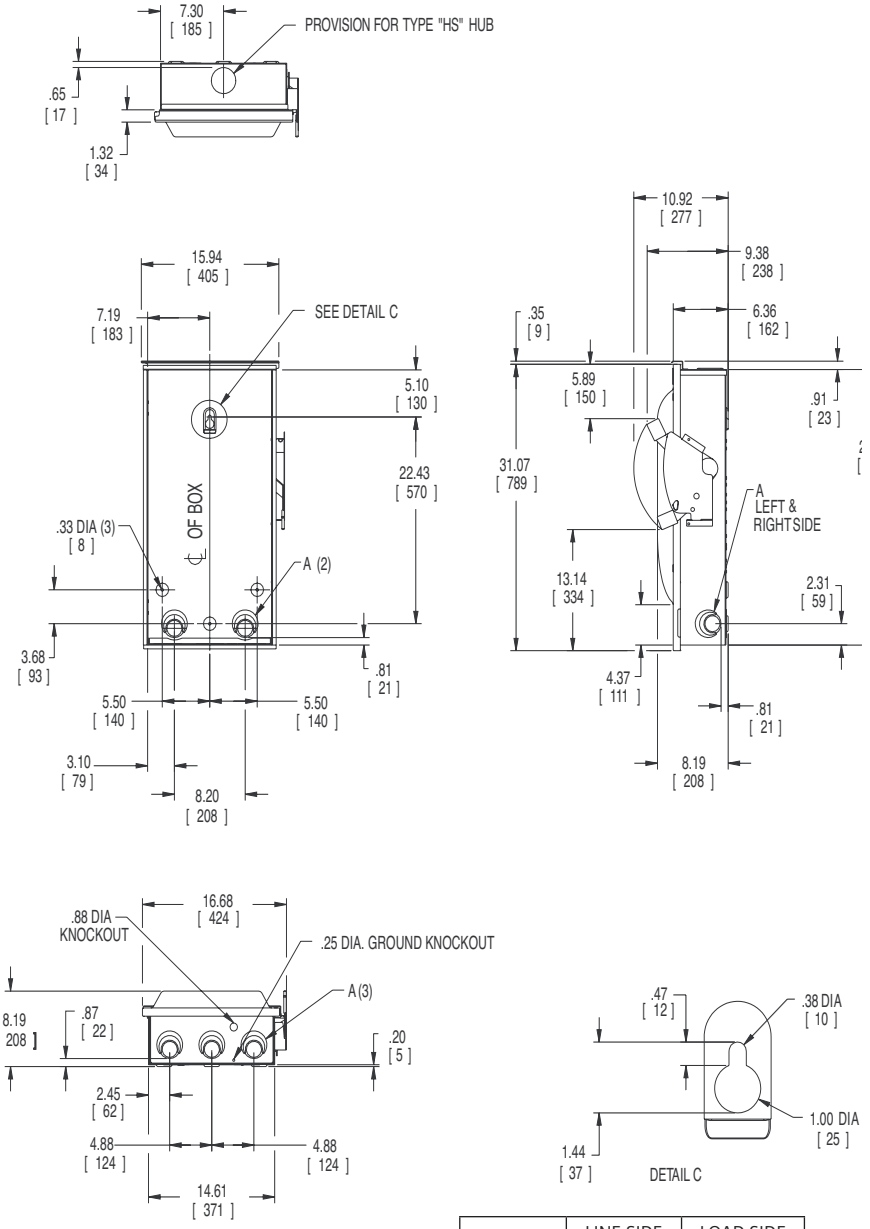
Replacement Parts

Catalog Number	Description
HFB64	Fusible Line Side Replacement Base (GF224NR, GF324NR)
HBB64	Fusible Load Side Replacement Base (GF224NR, GF324NR)
HNB64	Non-Fusible Replacement Base (GNF324R)
GH24	Replacement Handle/Handle Guard
HM64	Replacement Mechanism
HL64	Replacement Lugs (3 lugs per kit)

1 These switches are UL Listed for application on grounded B phase systems.
2 Dual horsepower ratings: Std - applies when non-time delay fuses are installed.
Max - applies when time-delay fuses are installed
3 Internal shield which meets 2020 NEC 230.62 line side barrier requirements for service entrance equipment.

Dimension Drawings

General Duty 200A, 240V, Type 3R



Dimensions shown in inches and millimeters ( ).
Dimension shown accurate to ± ⅛ inch.

KNOCKOUT CODE	CONDUIT SIZE			
A (Tangential)	1.25	1.50	2.00	2.50

	LINE SIDE WIRE BEND	LOAD SIDE WIRE BEND
Fused	7.87 (200)	10.34 (263)
Non-Fused	7.87 (200)	15.84 (402)

Enclosure: Galvanized Steel
.054 Thick (17 Gauge)
Finish: ANSI Grey #61 Paint

Published by
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Siemens Industry, Inc.
3617 Parkway Ln
Peachtree Corners, GA 30092

For more information, please contact
our Customer Support Center.
Phone: 1-800-241-4453
E-mail: info.us@siemens.com

usa.siemens.com/switches

Order No.: SSFL-GF23R-0521
Printed in U.S.A.

OUTDOOR SOL-ARK 15K INSTALL GUIDE & OWNER'S MANUAL

Disclaimer

UNLESS SPECIFICALLY AGREED TO IN WRITING, SOL-ARK:

(a) MAKES NO WARRANTY REGARDING THE ACCURACY, SUFFICIENCY, OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.

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Sol-Ark cannot be responsible for system failure, damages, or injury resulting from improper installation of their products.

The information included in this manual is subject to change without notice.

This version is for OUTDOOR MODEL ONLY.

Contact Us:

PHONE	1-972-575-8875 x2
EMAIL	SUPPORT@SOL-ARK.COM
WEBSITE	WWW.SOL-ARK.COM

Warning Symbols

	**This symbol indicates information that, if ignored, could result in minor injury or damage to the equipment.**
	**This symbol indicates information that, if ignored, could result in serious injury, damage to the equipment, or death.**
	**This symbol indicates information that is important but not hazard-related.**

Warnings

Read this entire document before installing or using the Sol-Ark 15K inverter. Failure to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, or death. Damage to the 15K inverter is also possible, potentially rendering it inoperable.

High Life Risk Due to Fire or Electrocution – ONLY qualified persons should install the Sol-Ark 15K inverter.

The system must have Ground connections and Neutral connections. Ground MUST be bonded to Neutral ONLY ONCE in the circuit.

Solar PV+/PV- are UNGROUNDED. Note, you may ground PV Racking/Mounts, but doing so directly to the Sol-Ark will likely result in damage in the case of a direct lightning strike to the PV array.

DO NOT connect the grid to the Load Output Terminal Block.

DO NOT reverse the polarity of batteries. Damage WILL occur.

DO NOT exceed 500Voc on any MPPT on the Sol-Ark.

DO NOT use impact drivers to tighten any fasteners on the Sol-Ark.

MUST use Strain Reliefs ON ALL wires entering/exiting the Sol-Ark 15K user area.

MUST use conduit (or double insulated wire) for AC Wires entering/exiting Sol-Ark 15K user area.

ALL terminals/breakers, including battery, MPPT, and AC Terminal Block inputs, should only have one conductor connecting to them.

Inspect Shipment

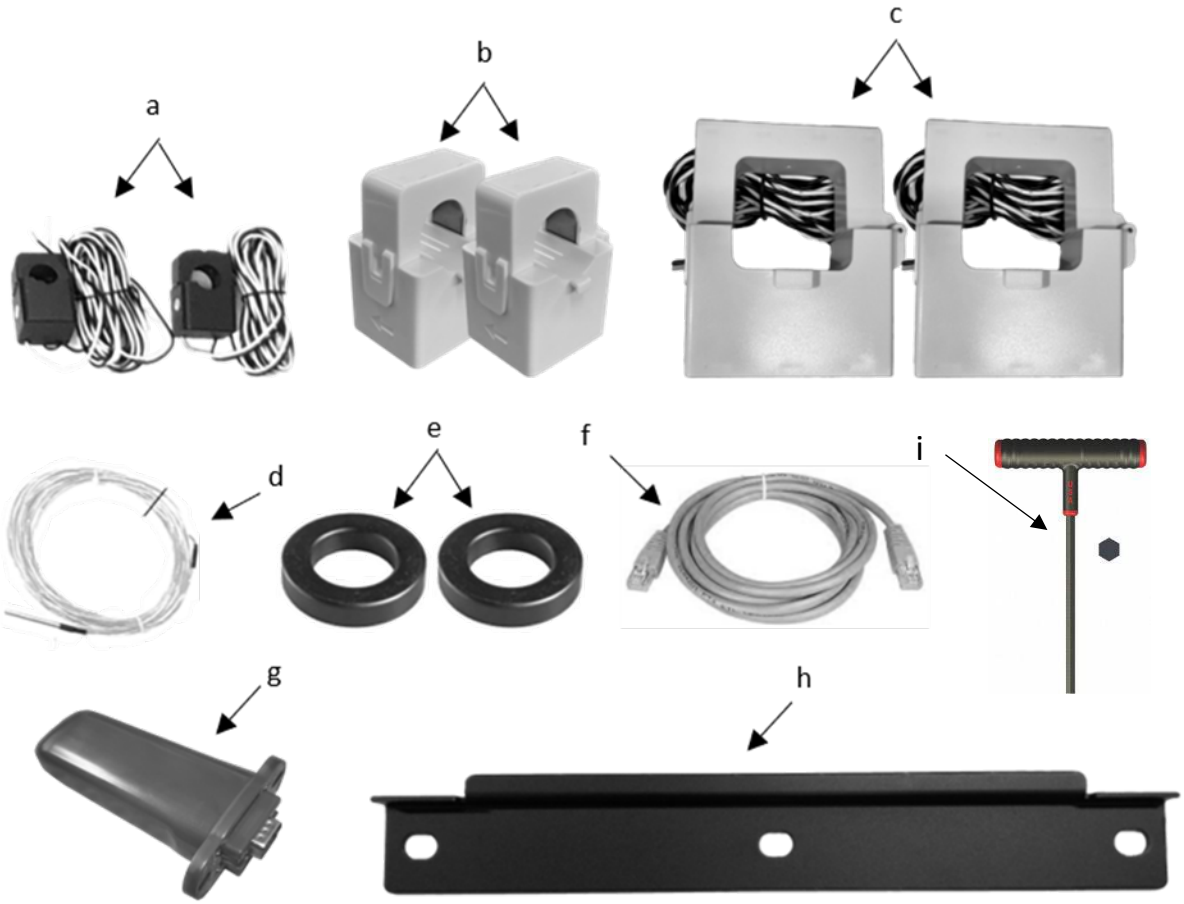
A. Compare the package condition to the condition of the package in the photo we sent you before it left our facility.

You must note any damage due to shipping with delivery driver before accepting the package otherwise the shipping company will deny any claim.

B. If damaged, contact us immediately at 972-575-8875 Ext. 3

Component Guide

A. Limiter Sensors included: 5/8" CT sensors x2 (**Included**)
B. Limiter Sensors, if purchased: 15/16" CT sensors x2 (**Available upon request**)
C. Limiter Sensors, if purchased: 2" CT sensors x2 (**Available upon request**)
D. Battery Temperature Sensor: for voltage adjustment
E. Battery Cable Toroid x2
F. CAT 5 cable for parallel communications
G. WIFI Dongle: For software updates and remote monitoring (use M4x10 screws to hold in)
H. French Cleat: For wall mounting the Sol-Ark 15K
I. Allen Key: For tightening the AC connections



LIMITLESS 15K-LV Spec Sheet

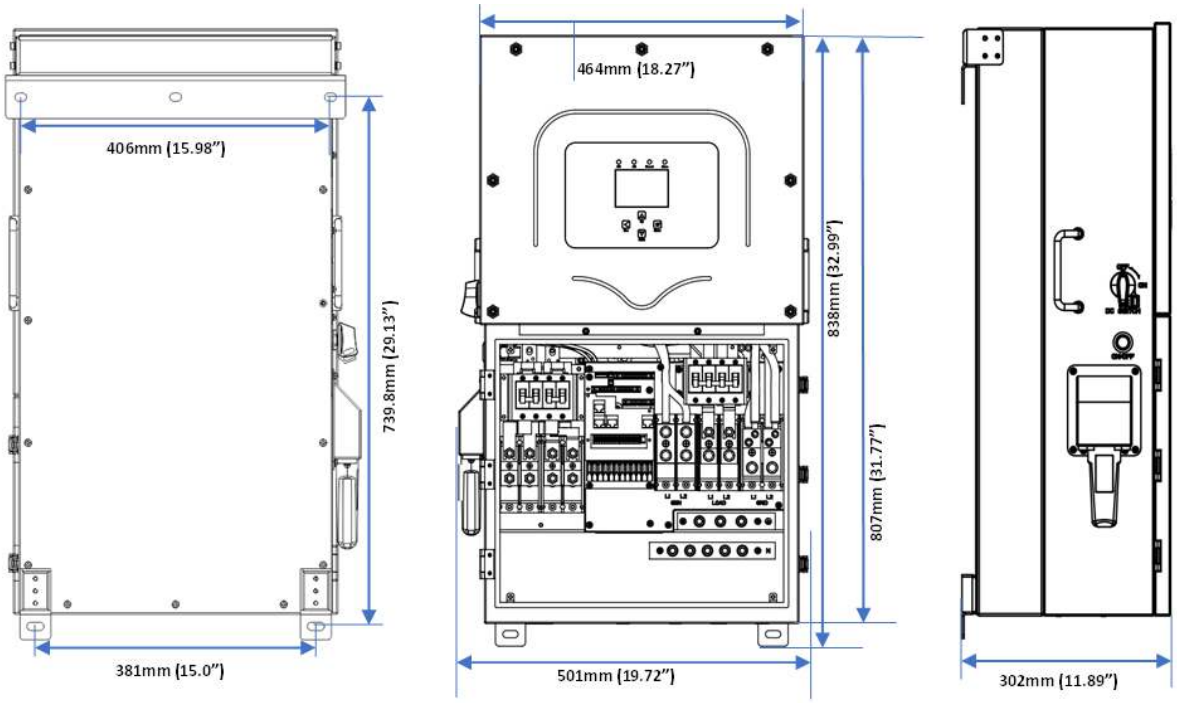
Solar	Input Power 17000W
Max Allowed PV Power	17000W
Max PV Power Delivered to Battery & AC Outputs	15000W
Max DC Voltage (Voc)	500V @ 26A
MPPT Voltage Range	150-425V
Starting Voltage	125V
Number of MPPT	3
Max Solar Strings Per MPPT	2
Max DC Current per MPPT (Self Limiting)	26A
Max AC Coupled Input (Micro/String Inverters)	19200W

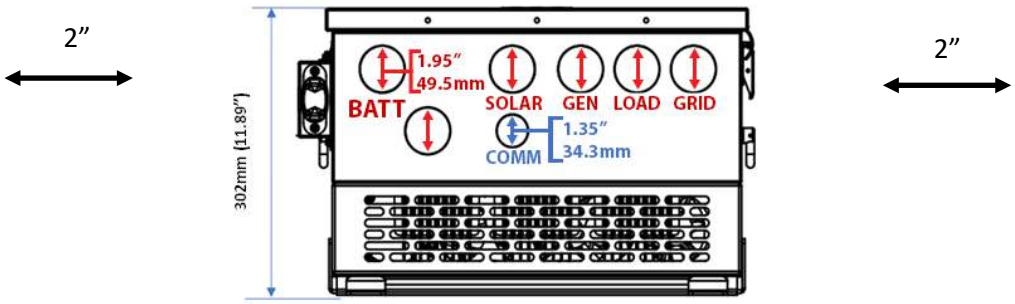
AC	Output Power 15kW On-Grid & Off-Grid
Connections	120/240/208V Split Phase
Continuous AC Power with PV	15000W 62.5A-L (240V)
Continuous AC Power from Batteries	12000W 50A-L (240V)
Surge AC Power 10sec Surge AC Power 100ms	24,000VA L-L (240V) 30,000VA L-L (240V)
Parallel Stacking	Yes - Up to 12
Frequency	60/50Hz
Continuous AC Power with Grid or Generator	48000W 200A L-L (240V) 24000W 200A L-N (120V)
CEC Efficiency	96.5% (Peak 97.5%)
Idle Consumption Typical—No Load	90W
Sell Back Power Modes	Limited to Household/Fully Grid-Tied
Design (DC to AC)	Transformerless DC
Response Time (Grid-Tied to Off-Grid)	5ms
Power Factor	+/- 0.9 - 1.0

Battery (optional)	Output Power 12000W
Type	Lead-Acid or Li-Ion
Nominal DC Input	48V
Capacity	50 — 9900Ah
Voltage Range	43.0 — 63.0V
Continuous Battery Charging Output	275A
Charging Curve	3-Stage w/ Equalization
Grid to Batt Charging Efficiency	96.0%
External Temperature Sensor	Included
Current Shunt for Accurate % SOC	Integrated
External Gen Start Based on Voltage or %SOC	Integrated
Communication to Lithium Battery	CanBus & RS485

General	
Dimensions (H x W x D)	31.8" x 18.3" x 10.9"
Weight	135 lbs
Enclosure	IP65 / NEMA 3R
Ambient Temperature	-40~60°C, >45°C Derating
Installation Style	Wall-Mounted
Wi-Fi & LAN Communication	Included
Standard Warranty (verified by HALT Testing)	10 Years

Protections & Certifications	
Electronics Certified Safety by SGS Labs to NEC & UL Specs - NEC 690.4B & NEC 705.4/6	Yes
Grid Sell Back — UL1741-2010/2018, IEE-E1547a-2003/2014, FCC 15 Class B, UL1741SA, CA Rule 21, HECO Rule 14H	Yes
PV DC Disconnect Switch — NEC 240.15	Integrated
Ground Fault Detection — NEC 690.5	Integrated
PV Rapid Shutdown Control — NEC 690.12	Integrated
PV Arc Fault Detection — NEC 690.11	Integrated
PV Input Lightning Protection	Integrated
PV String Input Reverse Polarity Protection	Integrated
AC Output Breakers - 200A	Integrated
2 x 200A Battery Breaker / Disconnect	Integrated
Surge Protection	DC Type II / AC Type II





2" Minimum Clearance

Temperature Derating
DC: 90C-100C Shutdown @ 100C
AC: 75C-82C Shutdown @ 82C

Sol-Ark 15K Torque Values Application Note

Load Terminal Block	62 IN Lbs	7 NM
Grid Terminal Block	62 IN Lbs	7 NM
Gen Terminal Block	62 IN Lbs	7 NM
Neutral / Ground Busbars	26.5 IN Lbs	3 NM
Cover Screws	26.5 IN Lbs	3 NM
Battery Connection	90.0 IN Lbs	10 NM

Do Not Use Impact Drivers to Tighten Any Fasteners on the Sol-Ark.

PV input: 12-10AWG

AC Inputs/Outputs: 1/0AWG-4/0 AWG

All Sensors: 20-24AWG

CT Sensors: 10' Wire Included

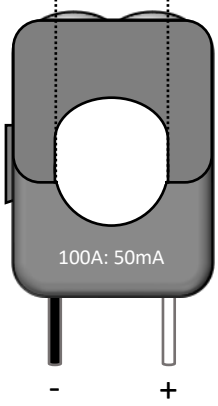
Batt Temp Sensor: 6' Wire Included

RJ45 Cable: 7' Included (Extendable up to 20')

Battery input: 2/0-4/0AWG (3/8" Lugs)

15.875mm (5/8in)

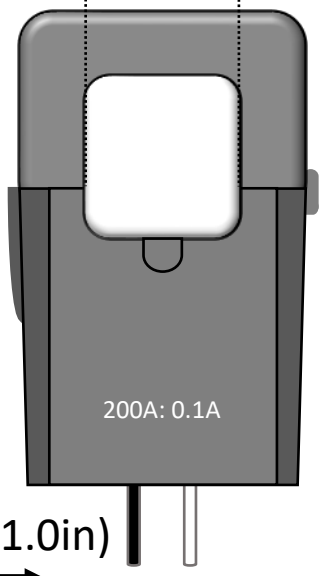
2/0 AWG Max



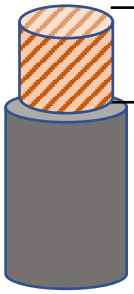
Small Limiter Sensor

23.813mm (15/16in)

4/0 AWG Max



Large Limiter Sensor



15.875mm (5/8in)

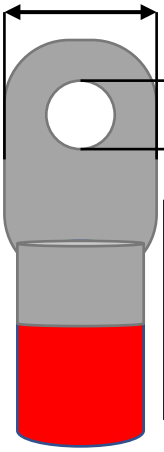
10 AWG Max

PV Panel Inputs

0' – 100': 12 AWG

100' – 300': 10 AWG

25.4mm (1.0in)



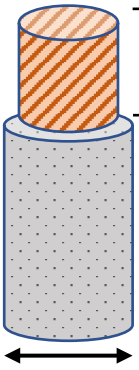
10mm

DC Battery Input

0' – 12': 2/0 AWG

12' – 20': 4/0 AWG

4/0 AWG Max



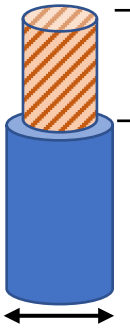
25.4mm (1in)

Grid + Load L1/L2, Ground, & Neutral: 2/0 AWG

Gen L1/L2, Ground, Neutral: 1/0 AWG

Distance Limits Will Vary Per User ⚠

4/0 AWG Max



6.35mm (1/4in)

20 AWG Max

All Sensor Inputs

0' – 100': 24 AWG

100' – 400': 23 AWG CAT 6

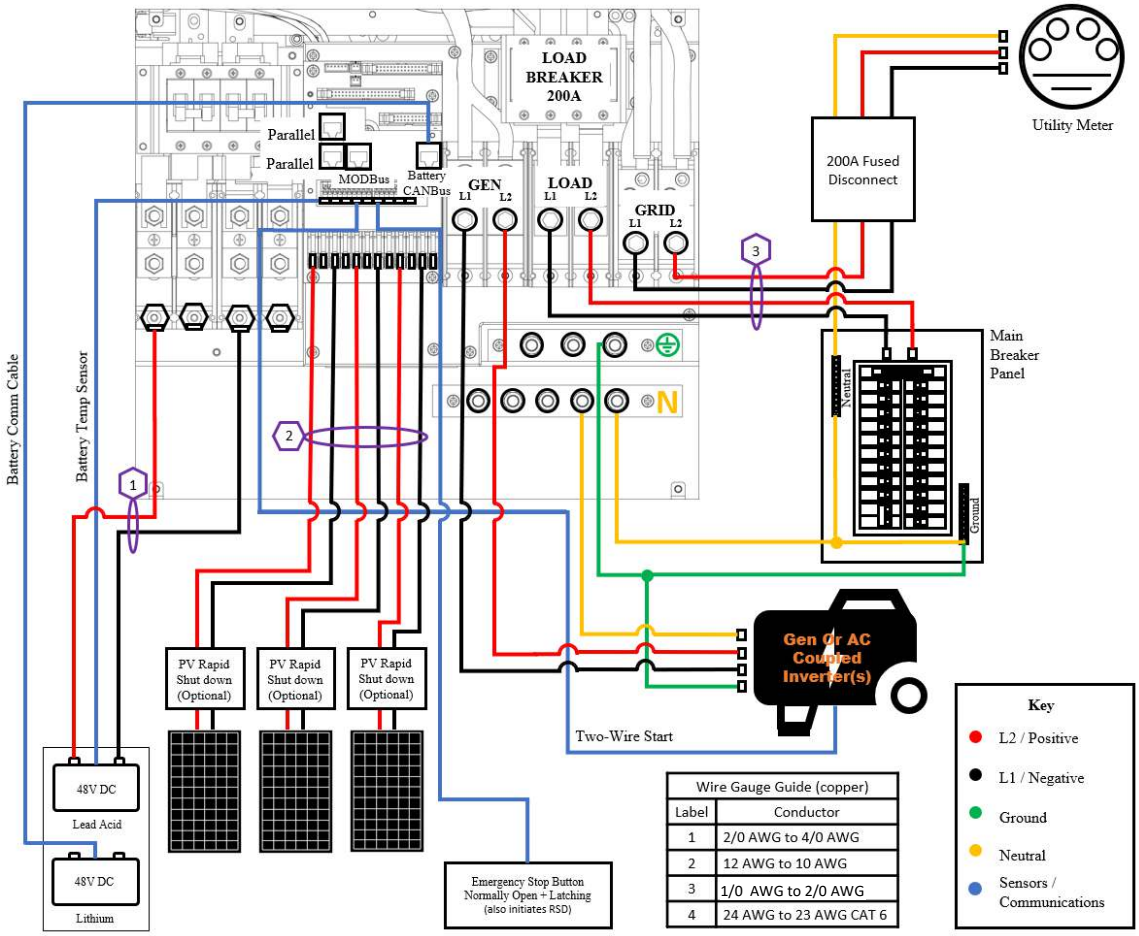
CT Wires Can Be Extended -Extensions for Limiter Sensors must be twisted pair (**See pg. 39**)

(Shielded CAT6 Recommended)

These Wiring Diagrams are examples of common use-cases for Sol-Ark inverters.

Sol-Ark does not provide custom diagrams; however, you may contact support@sol-ark.com for any questions about existing Wiring Diagrams.

Sol-Ark 15K Standard Wire Diagram 120V/240V



Wire Gauge Guide (copper)	
Label	Conductor
1	2/0 AWG to 4/0 AWG
2	12 AWG to 10 AWG
3	1/0 AWG to 2/0 AWG
4	24 AWG to 23 AWG CAT 6

Diagram 1

CT Sensors are optional but necessary to enable Peak Shaving.

See pg. 21 and pg.39 for additional info.

Diagram 2

Sol-Ark 15K Off-Grid Standard Wire Diagram 120V/240V

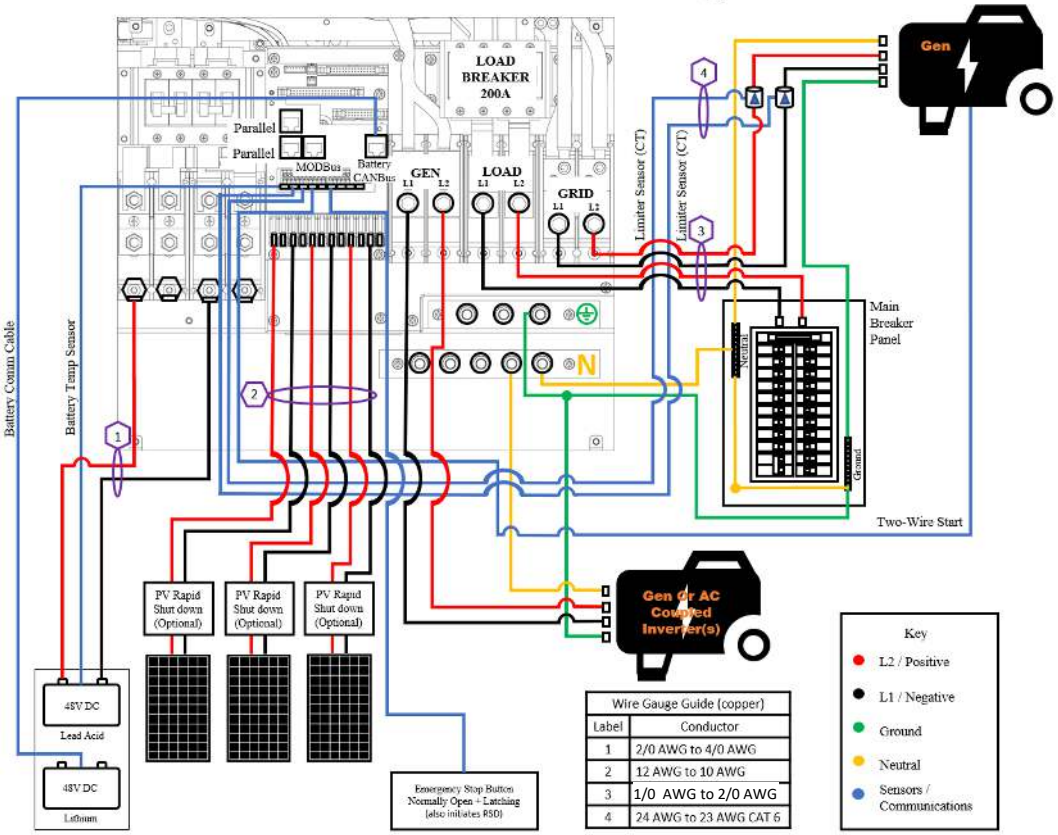
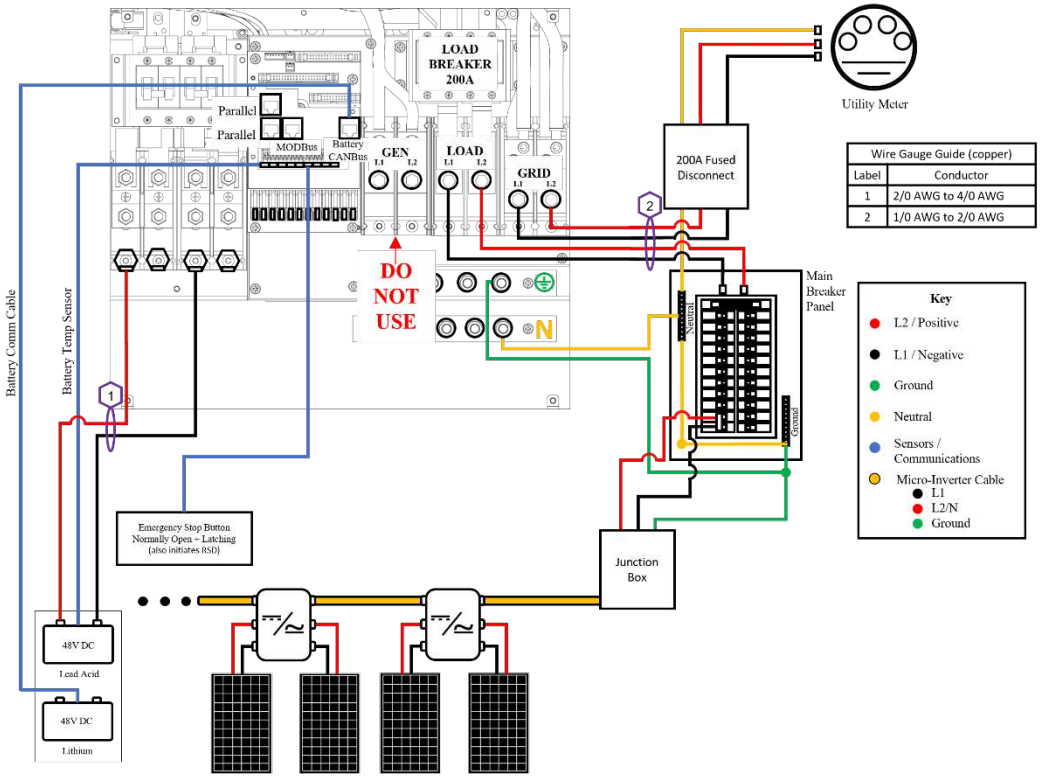


Diagram 3

Sol-Ark 15K Load Side AC Coupling W/ Micro Inverters Wire Diagram 120V/240V



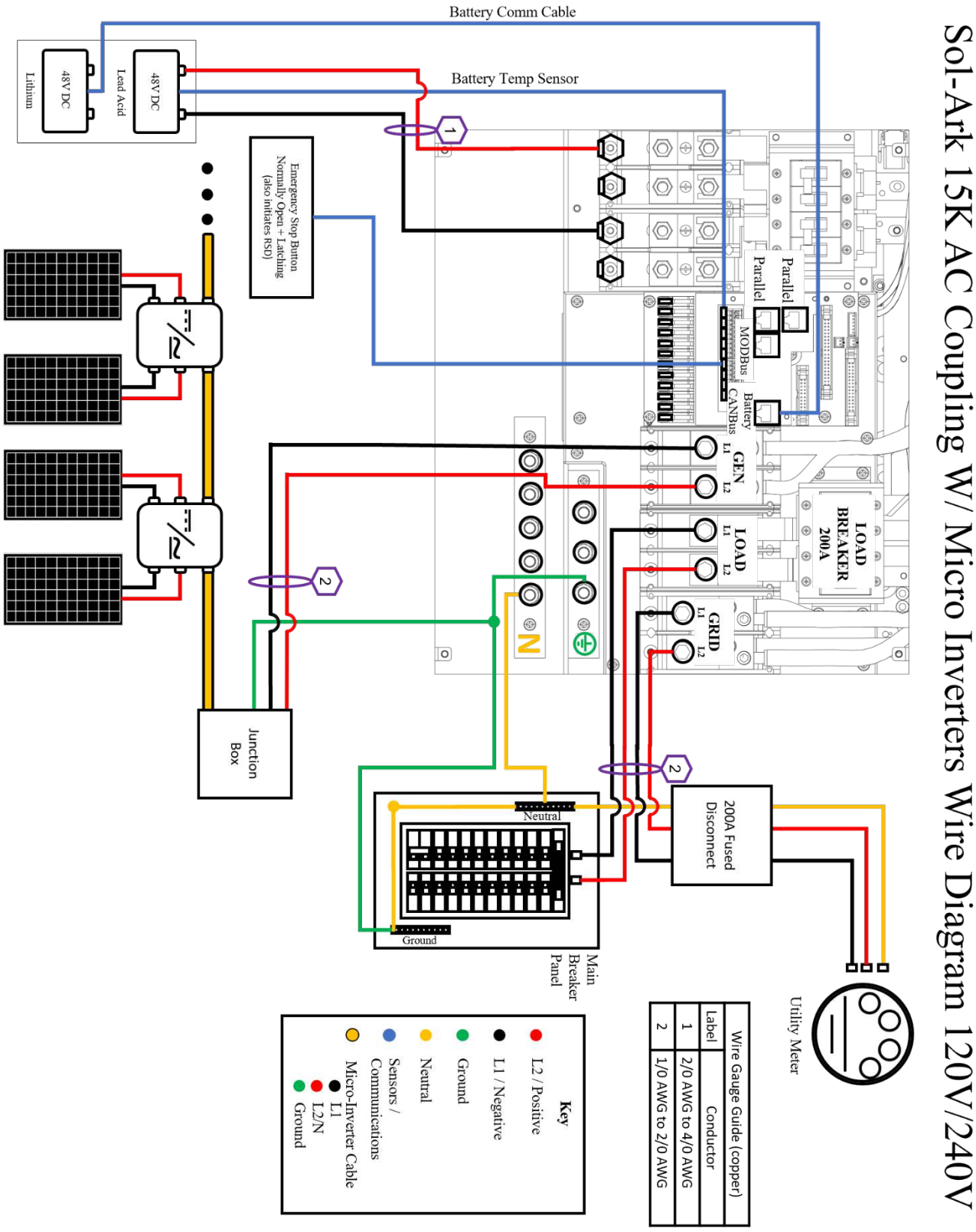

Sol-Ark 15K AC Coupling W/ Micro Inverters Wire Diagram 120V/240V
Battery Comm Cable
Battery Temp Sensor
48V DC
Lead Acid
48V DC
Lithium
Emergency Stop Button
Normally Open + Latching
(also initiates RSD)
Parallel
Parallel
MODBus
CANBus
Battery
GEN
L1
L2
LOAD
L1
L2
LOAD BREAKER 200A
GRID
L1
L2
N
1
2
2
Junction Box
Neutral
Ground
Main Breaker Panel
200A Fused Disconnect
Utility Meter
Wire Gauge Guide (copper)
Label
Conductor
1
2/0 AWG to 4/0 AWG
2
1/0 AWG to 2/0 AWG
Key
L2 / Positive
L1 / Negative
Ground
Neutral
Sensors / Communications
Micro-Inverter Cable
L1
L2/N
Ground

Diagram 4

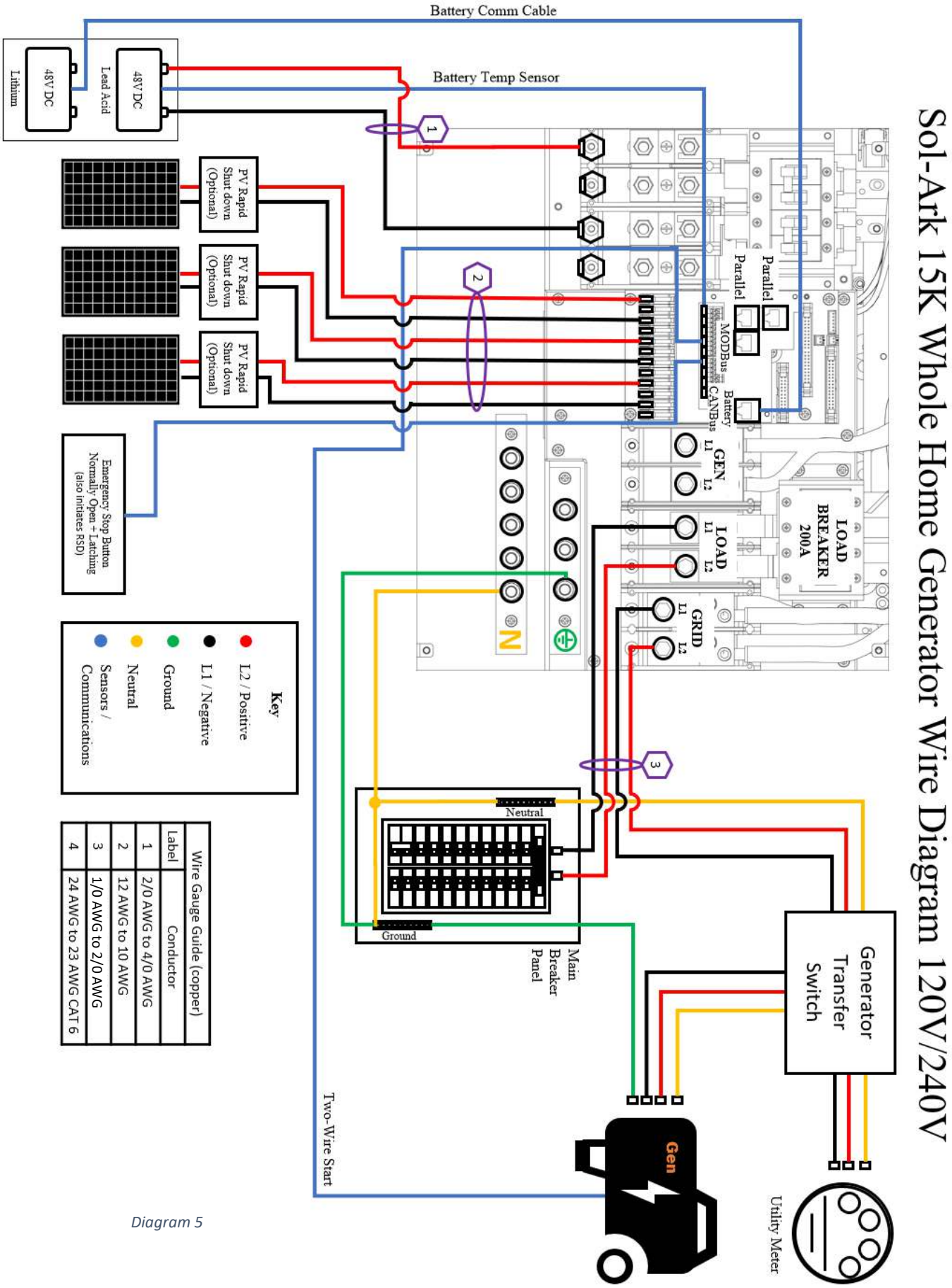

Sol-Ark 15K Whole Home Generator Wire Diagram 120V/240V
Battery Comm Cable
Battery Temp Sensor
48V DC
Lead Acid
48V DC
Lithium
PV Rapid Shut down (Optional)
PV Rapid Shut down (Optional)
PV Rapid Shut down (Optional)
Emergency Stop Button
Normally Open + Latching
(also initiates RSD)
Parallel
Parallel
MODBus
CANBus
Battery
GEN
L1
L2
LOAD
BREAKER
200A
LOAD
L1
L2
GRID
L1
L2
N
Key
L2 / Positive
L1 / Negative
Ground
Neutral
Sensors / Communications
Neutral
Ground
Main Breaker Panel
Generator Transfer Switch
Gen
Utility Meter
Two-Wire Start
Wire Gauge Guide (copper)
Label
Conductor
1
2/0 AWG to 4/0 AWG
2
12 AWG to 10 AWG
3
1/0 AWG to 2/0 AWG
4
24 AWG to 23 AWG CAT 6

Diagram 5

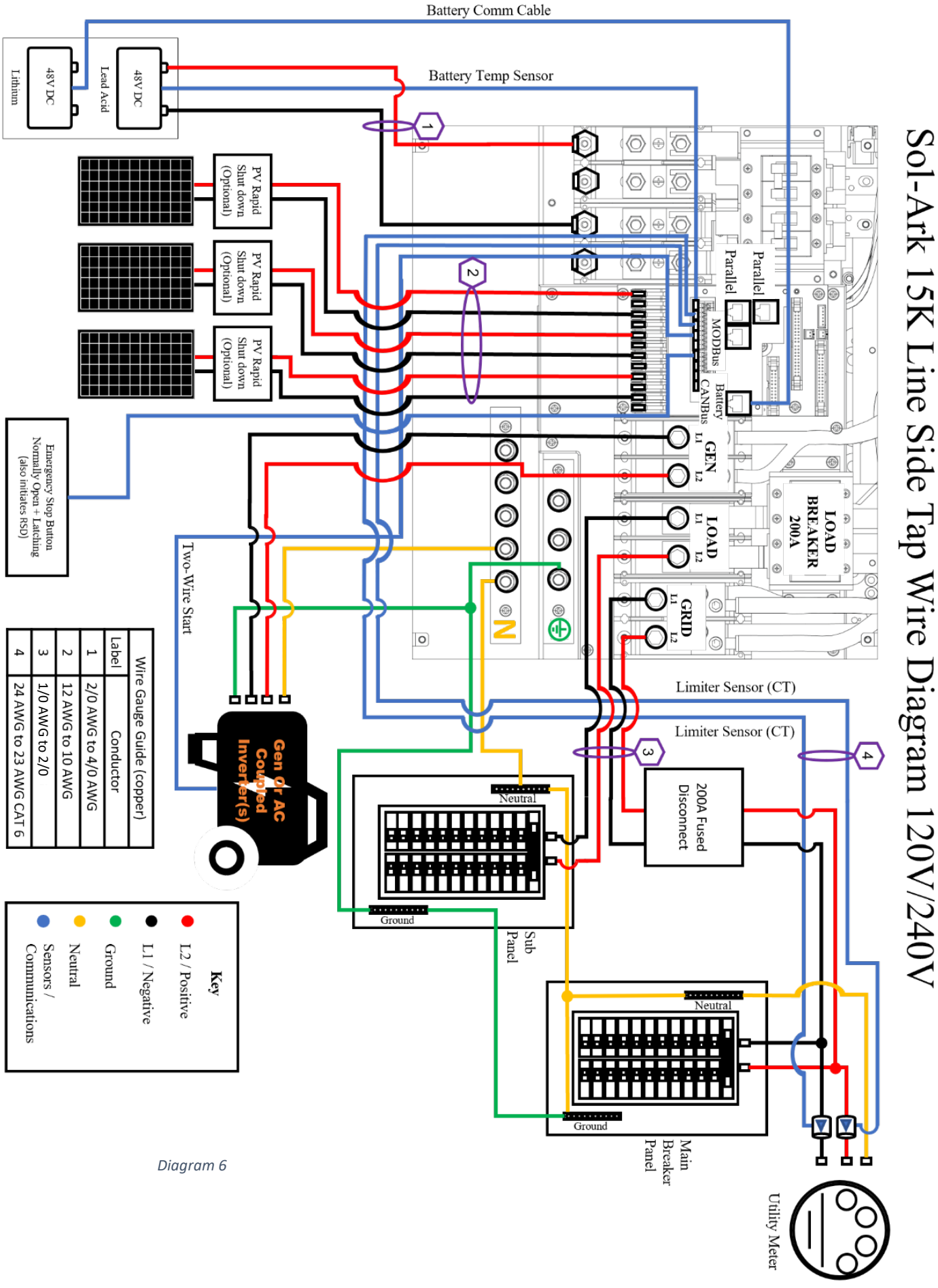

Sol-Ark 15K Line Side Tap Wire Diagram 120V/240V
Battery Comm Cable
Battery Temp Sensor
Lithium
48V DC
Lead Acid
48V DC
PV Rapid Shut down (Optional)
PV Rapid Shut down (Optional)
PV Rapid Shut down (Optional)
Emergency Stop Button Normally Open + Latching (also initiates RSD)
Two-Wire Start
Parallel
Parallel
MODBus
CANBus
Battery
GEN
L1
L2
LOAD
L1
L2
LOAD BREAKER 200A
GRID
L1
L2
N
Limiter Sensor (CT)
Limiter Sensor (CT)
Gen or AC Coupled Inverter(s)
200A Fused Disconnect
Neutral
Ground
Sub Panel
Neutral
Ground
Main Breaker Panel
Utility Meter
1
2
3
4
Wire Gauge Guide (copper)
Label
Conductor
1
2/0 AWG to 4/0 AWG
2
12 AWG to 10 AWG
3
1/0 AWG to 2/0
4
24 AWG to 23 AWG CAT 6
Key
L2 / Positive
L1 / Negative
Ground
Neutral
Sensors / Communications

Diagram 6

Note: Before powering up Parallel System installs, please see Parallel System app note

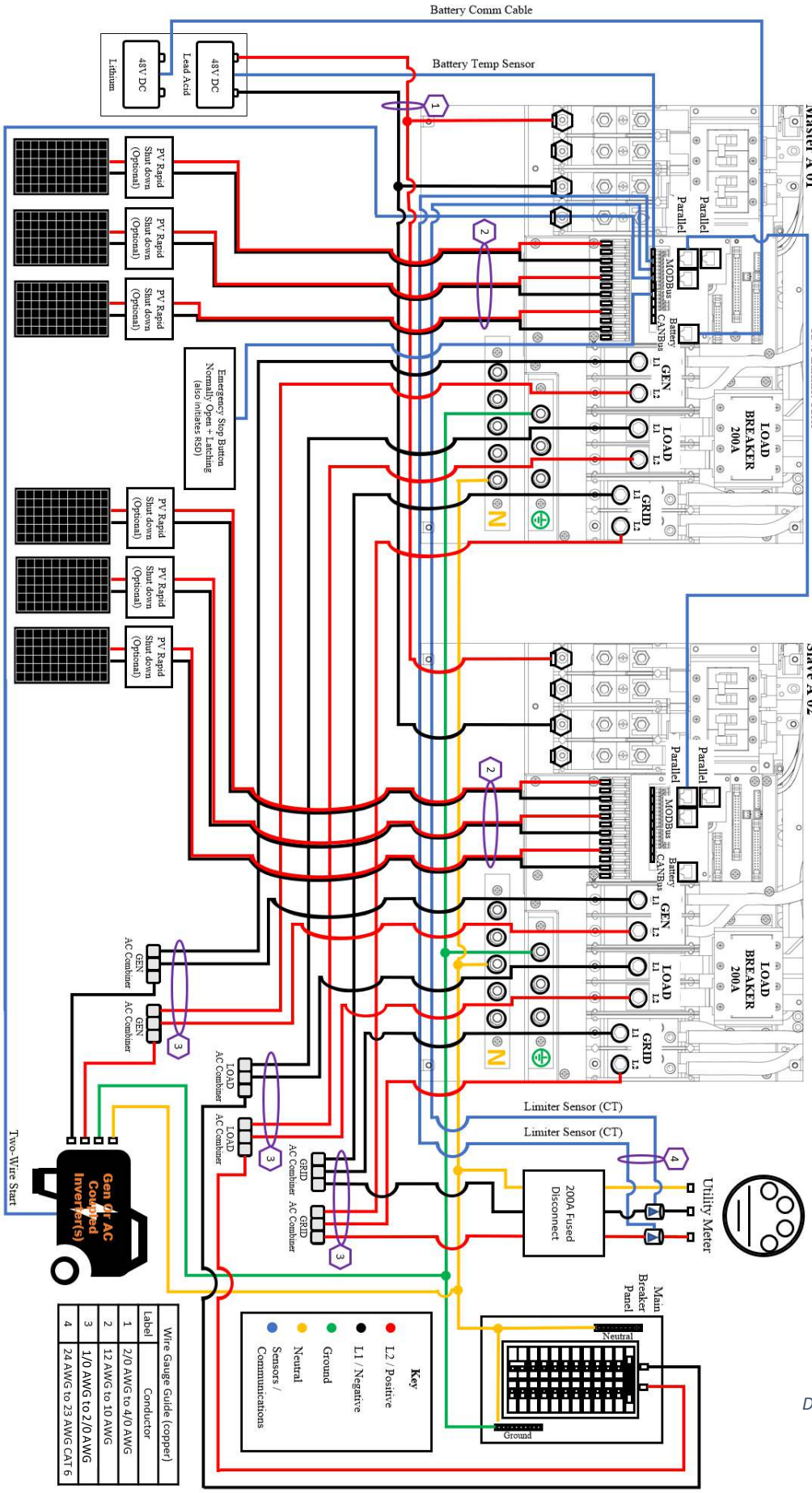


Diagram 7

Note: Before powering up Parallel System installs, please see Parallel System app note

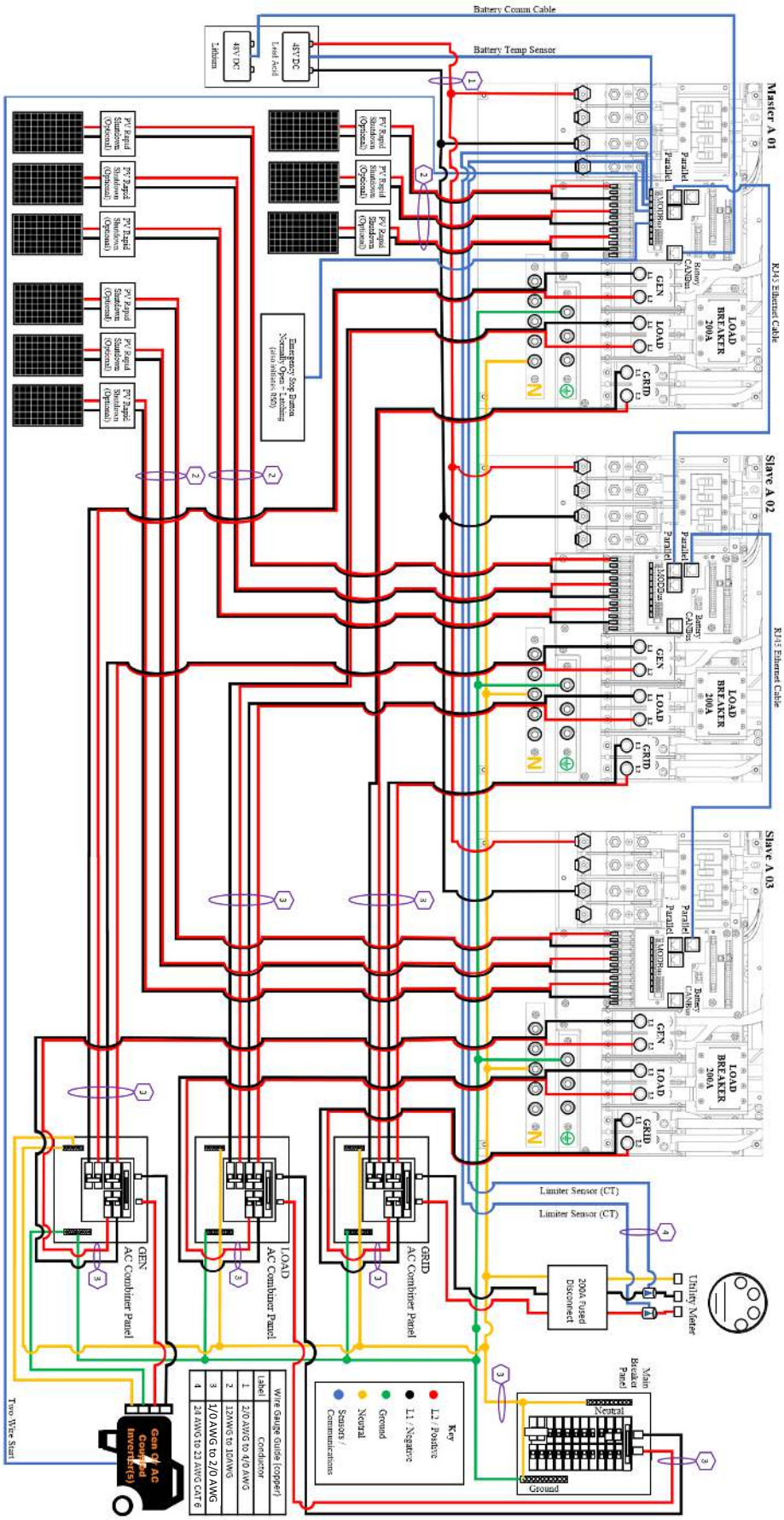


Diagram 8

Note: Before powering up Parallel System installs, please see Parallel System app note

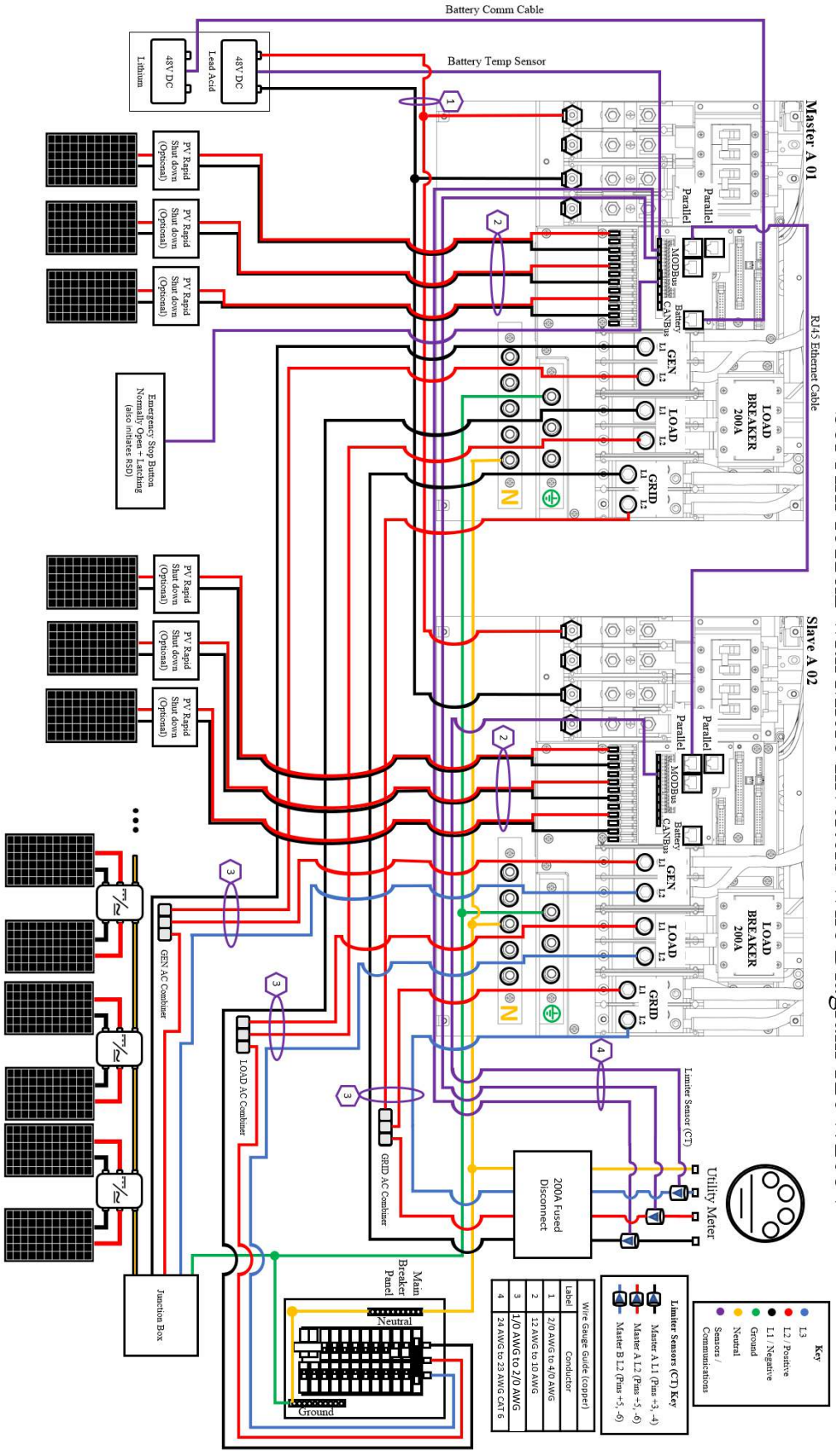


Diagram 9

Note: Before powering up Parallel System installs, please see Parallel System app note

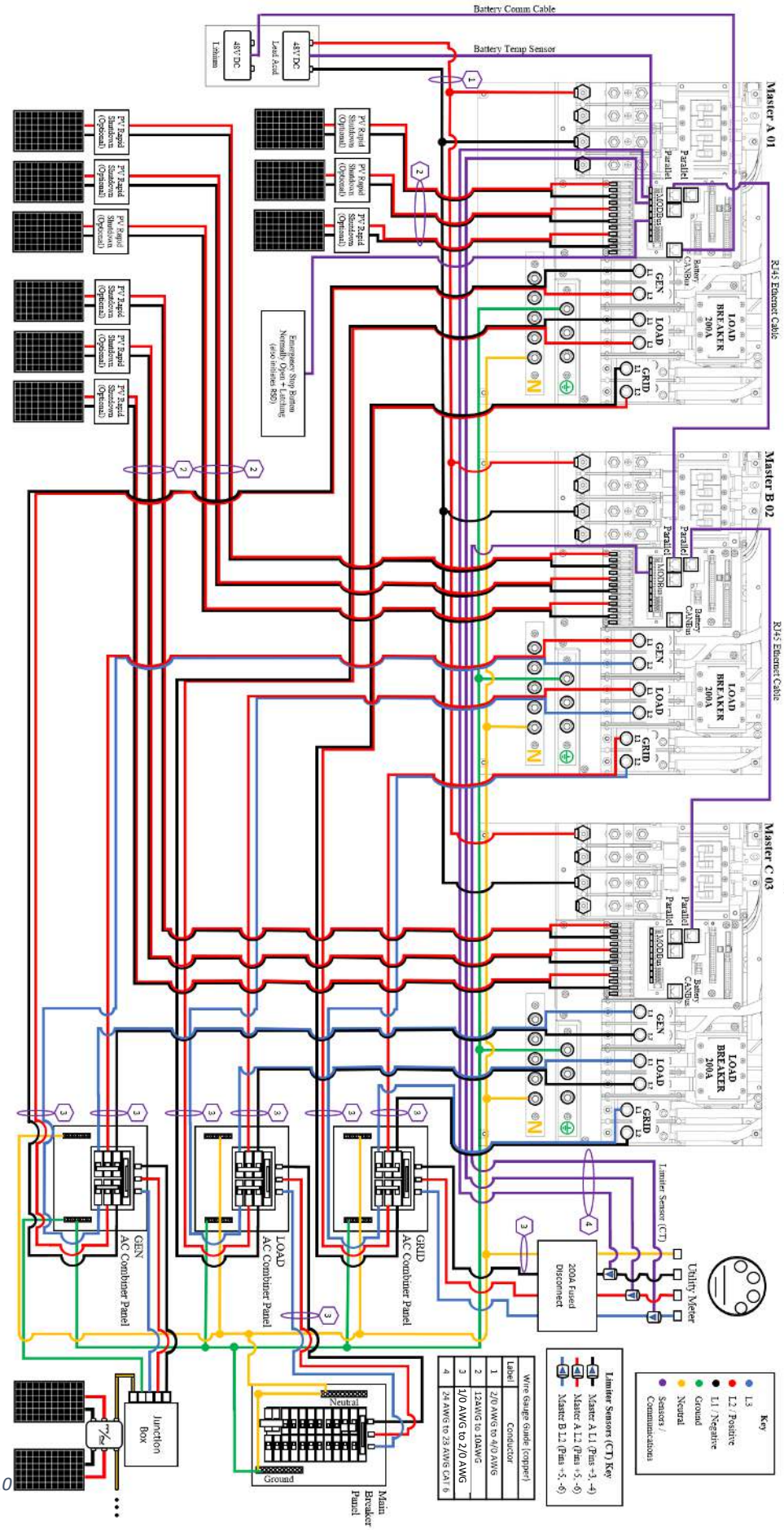
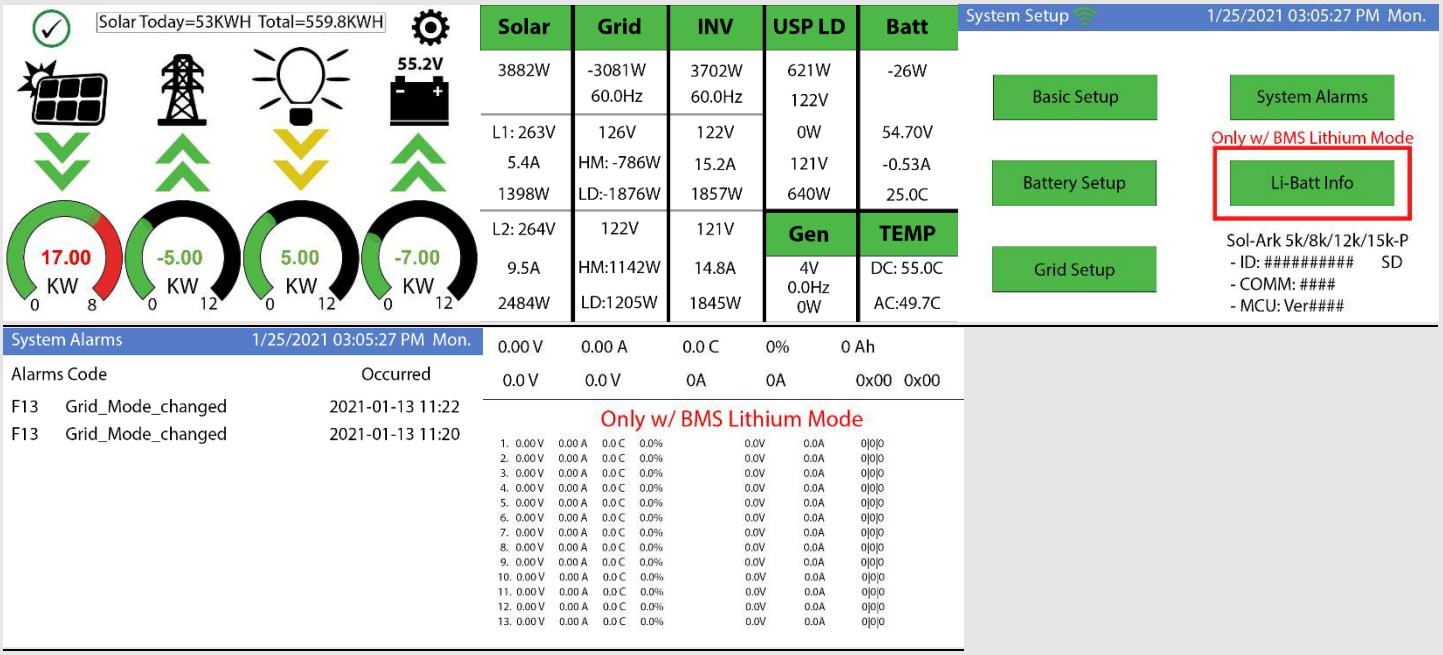
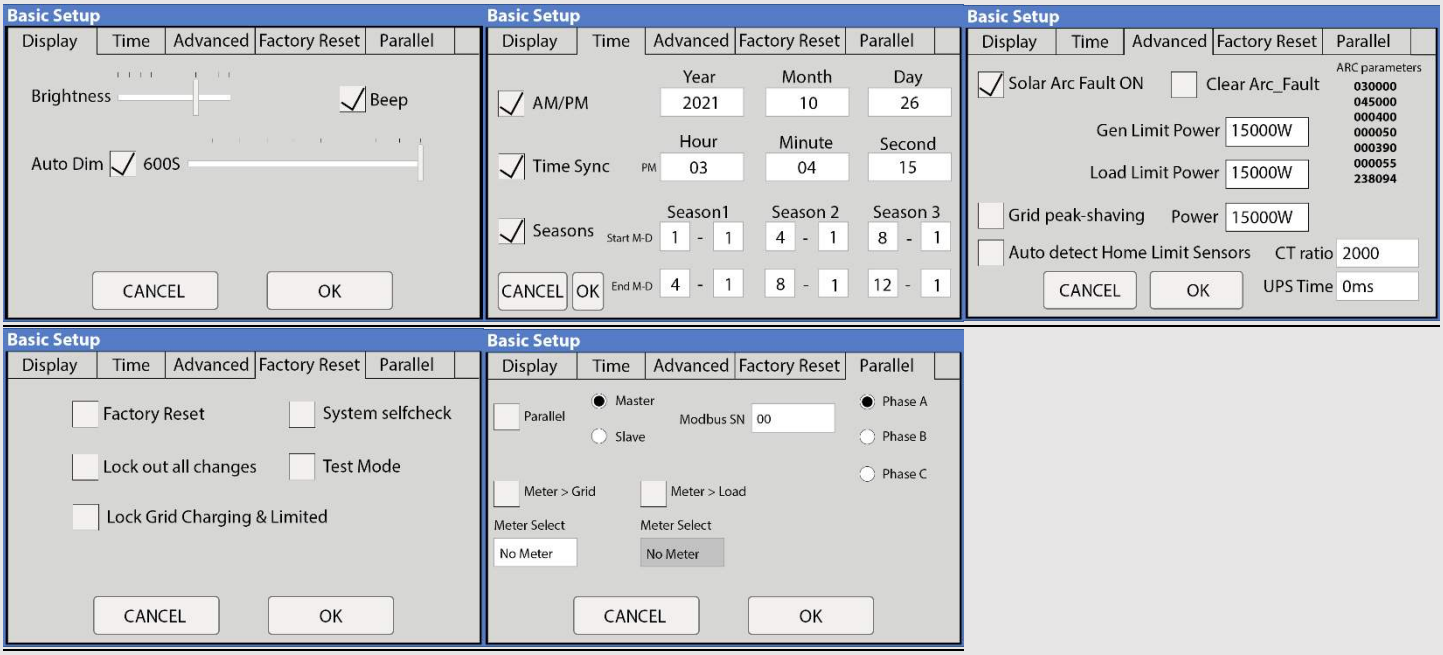


Diagram 10

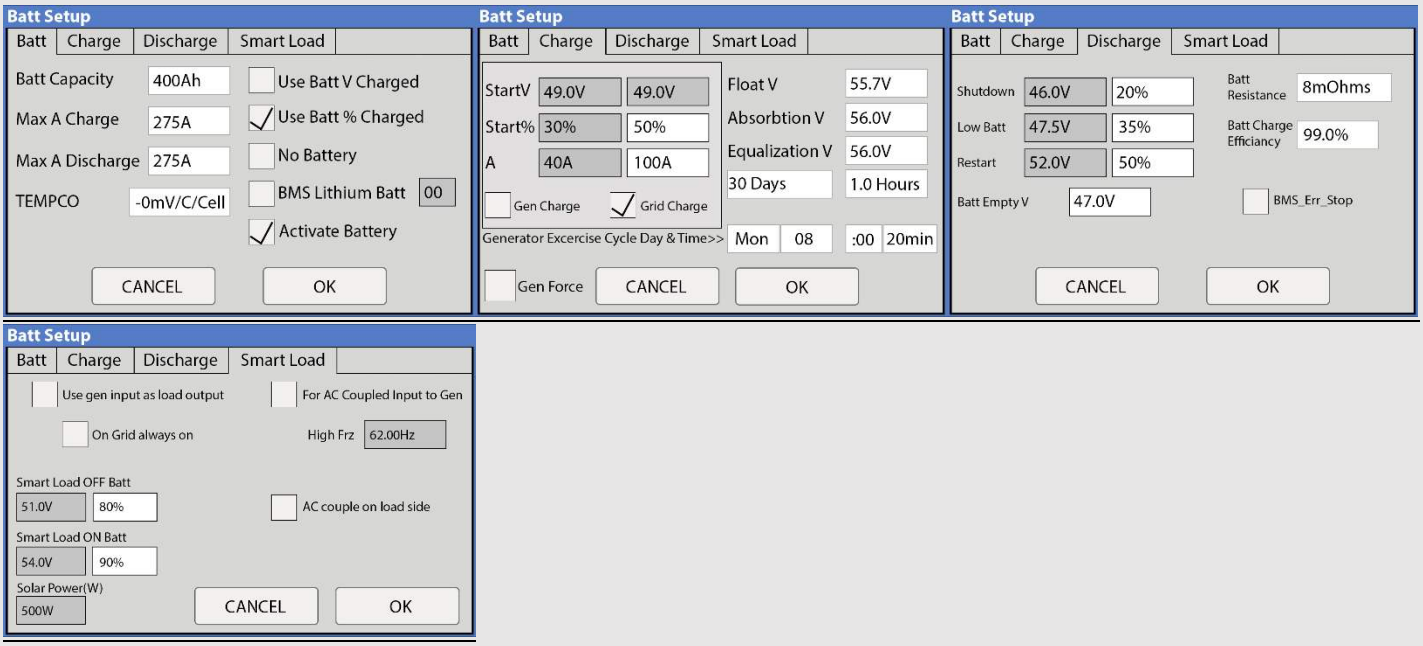
Main Menus



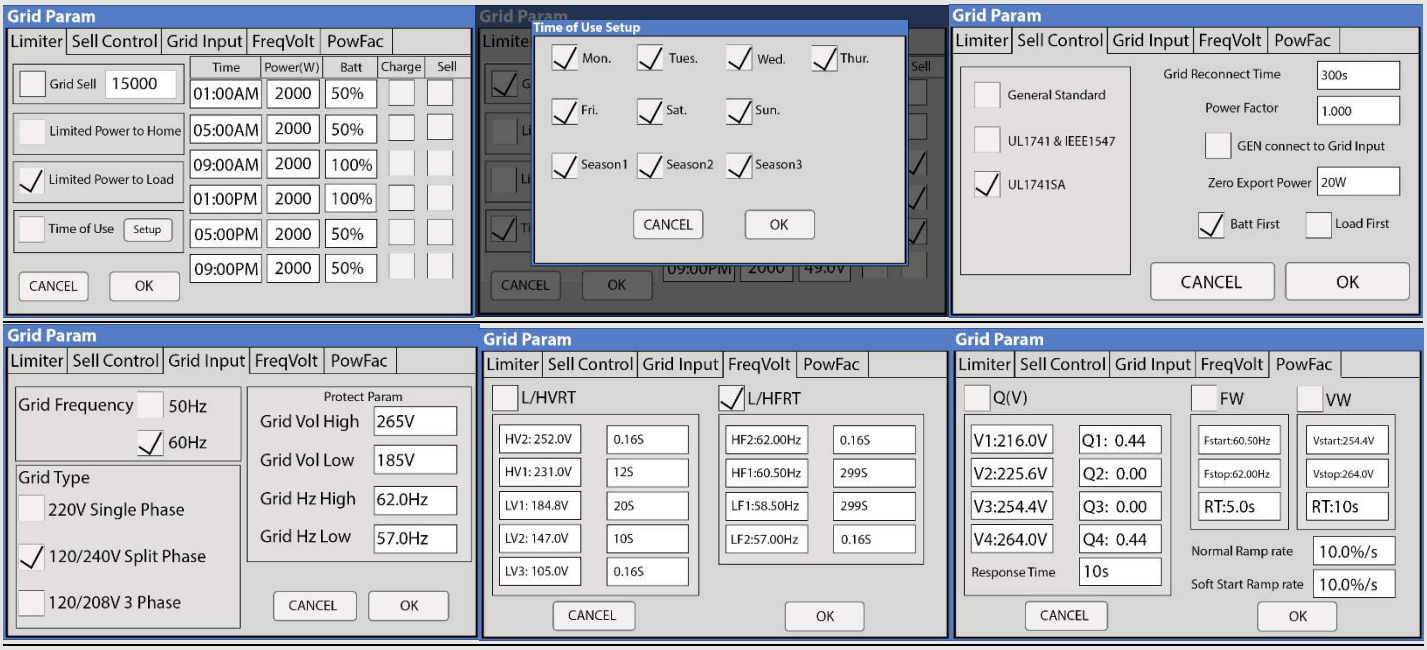
Basic Setup



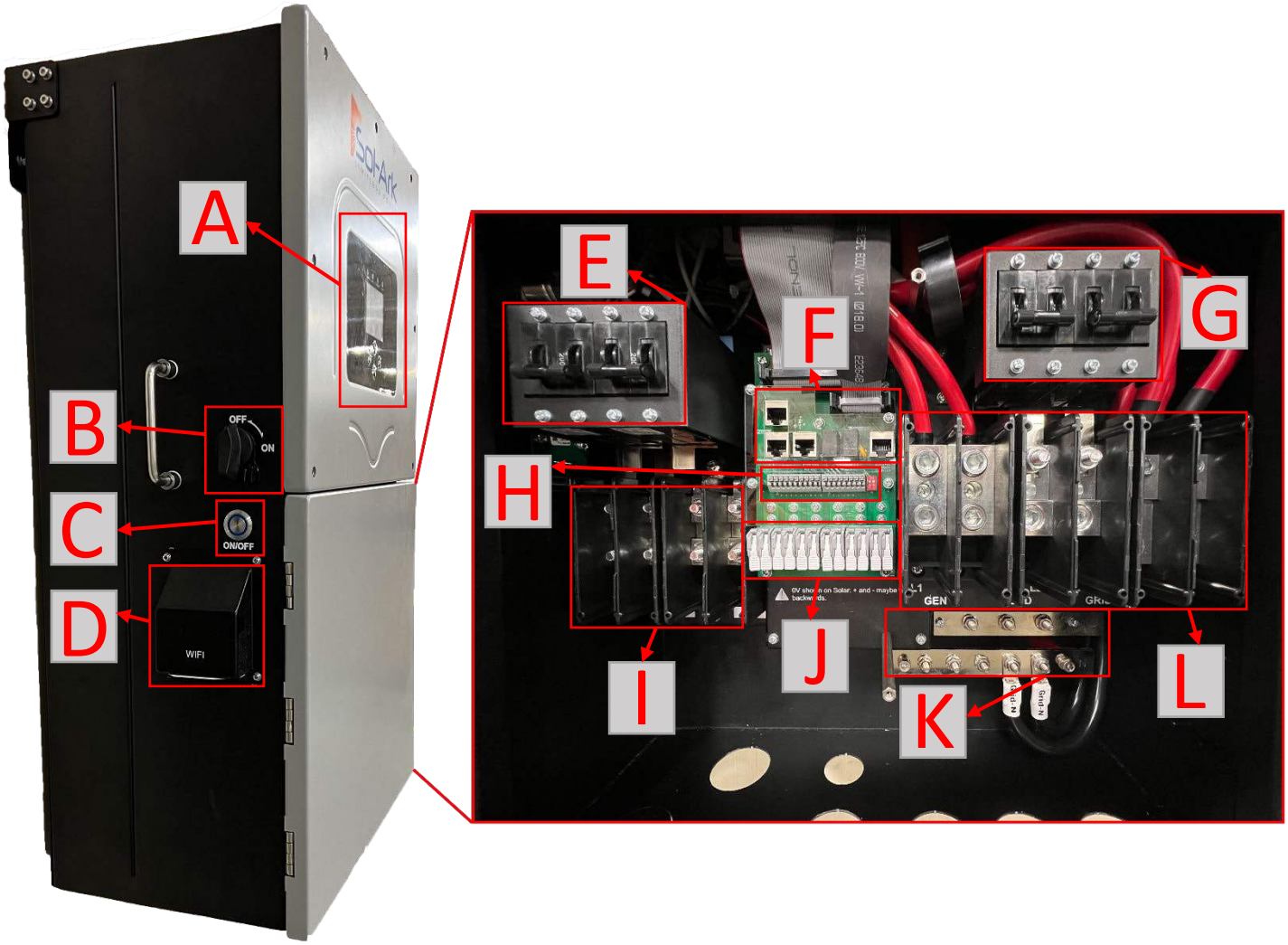
Battery Setup



Grid Setup



Inverter Components



A. **LCD Touch Screen**
B. **PV Disconnect Switch**
C. **ON/OFF Button**
D. **WI-FI Dongle Input**
E. **250A Battery Breaker**
F. **Communication Ports**
G. **200A Load Breaker**
H. **Sensor Input Board**
I. **Battery Terminal Blocks (+ + || - -)**
J. **MPPT Inputs**
K. **Neutral/Ground Bus Bar**
L. **Terminal Blocks (GEN/ Load/ Grid)**

Deciding Backup Circuits

A. We recommend subpanels and require them if you have Arc-Fault / GFI breakers
B. Ensure you keep the inverter within its amperage limits
   - ON-Grid = 200A Continuous (pass-through)
   - OFF-Grid = 12kW = 50A Continuous (62.5A w/ solar) | 24kW = 100A Peak (10s) | 30kW = 125A Peak (100ms)
C. Verify each load circuit by measuring typical and max Amps with a clip-on Amp meter. Amps x 120V = Watts
D. Install a subpanel for backup loads if you have Arc-Fault / GFI breakers, NOT a multi-circuit transfer switch

Single System Installs (Whole-Home Backup)

A. Use the output from 200A Fused Disconnect (from the grid) for the Grid input connection to the Sol-Ark
B. Connect the Load output from the Sol-Ark directly to the Main Service Panel (at least 2/0 AWG)
C. Connect a Generator (100A) or AC-Coupled system to the GEN terminal block

Mounting the Sol-Ark

A. Keeping in mind Sol-Ark's dimensions, find a suitable location for the system(s)
B. NEMA 3R rating for Outdoor installations
C. **PROTECT the LCD screen from excessive UV exposure**
D. System weight = 135lbs (61.24kg). Securely attach to the wall. Affix a mounting board to studs using 6-8 screws
E. Use 2-3 screws + washers (choose screw length and surface type) to mount the French Cleat to the board/wall
F. Mount Sol-Ark on the installed French Cleat / Ensure Sol-Ark is level and sits properly
G. Add two screws for the bottom mount

Integrating Batteries (Sol-Ark POWERED "OFF")

A. Connect batteries to Sol-Ark as shown in **Fig. B** below
B. Install included toroids (Part e. on pg. 4) on battery input cables, as shown in **Fig. A** to the right
C. Ensure the built-in battery disconnect is OFF while connecting batteries, or arcing may occur

Fig. A

Multi-System Installs

a. ALL paralleled systems MUST connect to the same large battery bank, each with its own cables attached
b. **Do NOT use separate battery banks for parallel systems**

Fig. B

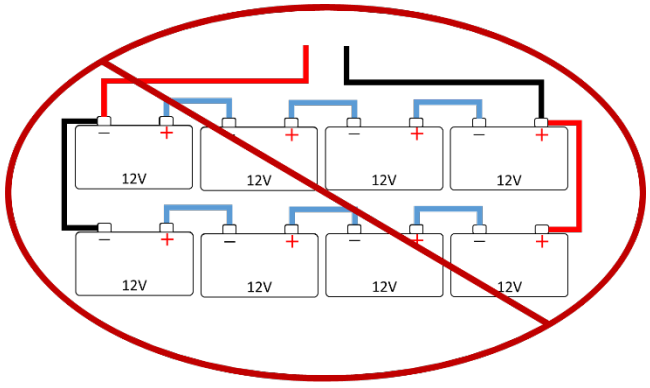
PCC batts are stackable

Do NOT stack more than 2 banks high

Sol-Ark 15K is a **48V** system. Do NOT wire the battery bank to any other nominal voltage.

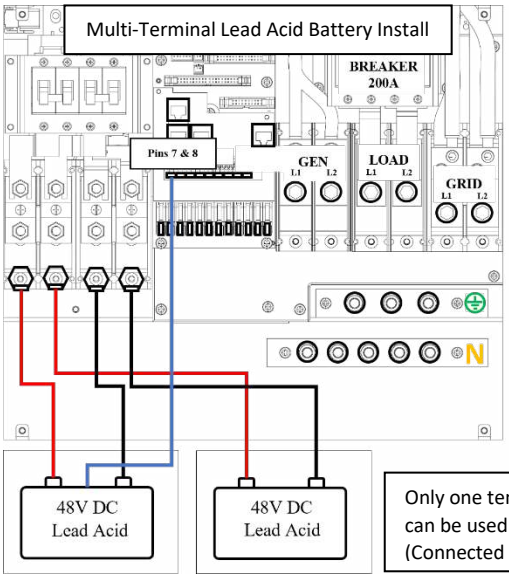
When using 12V batteries do not exceed FOUR (4) batteries in series.

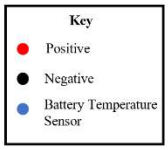
When using other battery chemistries, stay within the voltage range: MIN 43V-MAX 63V



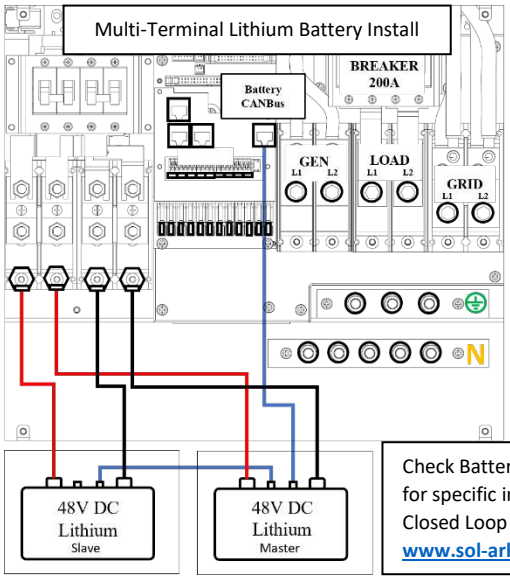
Do NOT reverse polarity of batteries!
Damage will occur!

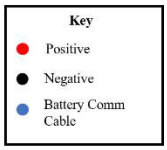
Optional Battery Installation Method: Multi-Terminal Installation (Only applicable with 1 or 2 batteries)
The battery terminals parallel batteries to ensure a common connection. You do not need to use both terminals to connect the batteries; If using 3 or more batteries, you **must** use a bus bar for (+) and (–) battery connections.
Only connect batteries of the same brand, model, and chemistry (if Lead Acid, approx. age as well) to both terminals.





Only one temperature sensor can be used per install (Connected to Master Inverter)





Check Battery Integration Guide for specific instructions on Closed Loop Comm Integration: www.sol-ark.com/support/

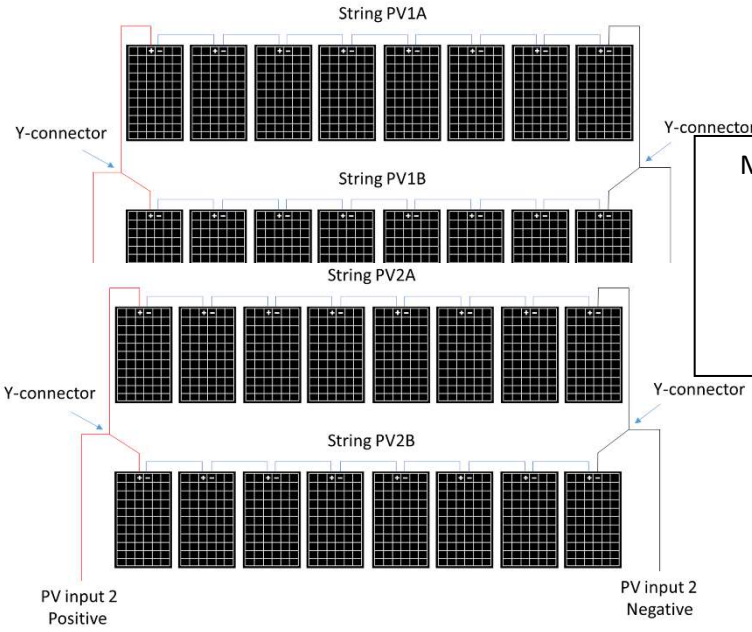
Connecting Solar Panels

A. Sol-Ark has TRIPLE MPPTs for three separate PV input pairs
B. MAX PV input = 17kW (± 5%) / system | 5.67kW / MPPT | MAX 500V_{OC} PV | MAX I_{SC} /MPPT 26A (limiting to 26A)

Damage will occur if PV V_{OC} > 550V

C. **Parallel strings per MPPT must be the same Voltage**
   i. PV1 A/B must be the same voltage if using both strings
   ii. Panels on the same MPPT CAN face different directions
D. Ground the panel MOUNTS/FRAMES to any ground in the Home via 12AWG wire
E. **IF using Y-Connectors: Running two strings in parallel, totaling 26A (self-limiting)**
F. Connect the solar panel strings as indicated by the following diagram:

Each string **can** use separate wires
String minimum is usually 5 panels or 125V



Maximum combined input (AC+DC) =
34.2kW
19.2kW AC + 15kW DC

Integrating a Generator

Generators < 10kW (GEN Breaker)— See Diagram 1-2

A. ONLY supports 240V / 208V generators | 100A Terminal Block
B. Connect the generator output to the "GEN" input terminal block in the Sol-Ark 15K user area
C. THD of less than 15% is preferred but not required

Standby Generators > 10kW (GRID Breaker)— See Diagram 2 (OFF-GRID)

A. Supports 220V / 240V / 208V generators | Depends on "Grid Type" selection | 200A Terminal Block
B. Off-Grid / Whole-home Generator on ATS installations requires selecting "GEN Connected to Grid Input"
   Home Screen → Gear Icon → Grid Setup → Sell Control → GEN Connected to Grid Input
C. Off-Grid = turn "Grid Sell" off | Only need CTs (on Gen lines) if using Grid Peak Shaving (see below)

Increase Gen/Sol-Ark Efficiency

1. Select "Limited to Load" 2. Select "General Standard"
3. Increase Grid frequency range: 55-65H

Weekly Gen Exercise

If the Sol-Ark is up to date with MCU version xx73 or newer, and your generator has two-wire start compatibility, you will experience weekly generator tests.

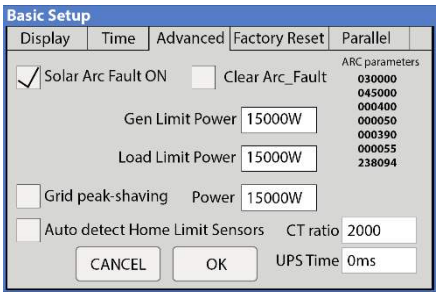
These tests occur at 8AM (local time) every Monday by default.

The test takes approximately 20 minutes to complete. During that time, the generator will auto-start and auto-stop.

The generator will not provide power during this test. The generator may charge the batteries if the batteries reach designated generator start point, however.

Grid Peak Shaving Mode (For Gen Connected to Grid Breaker)

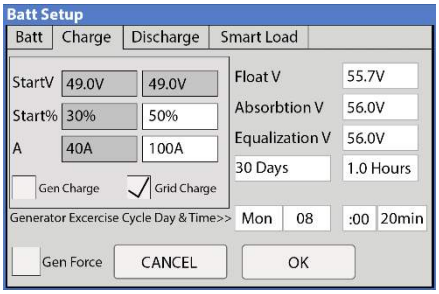
A. It prevents the Sol-Ark from overloading generators
B. Must place the CT sensors so that they measure L1 and L2 of the generator's output, pointing arrows on the CTs towards the generator
C. Sol-Ark contributes power above the "Power" value threshold to prevent overloading the generator
D. This mode will auto-adjust the Grid Charge Amperage to avoid overloads



Gen Start V or % (Grid Start if Gen on Grid Breaker)

Value batts need to reach **BEFORE** automatically starting a generator connected to the GEN breaker to charge the battery bank.

Sol-Ark will NOT charge batteries from a generator until the batteries reach this value.



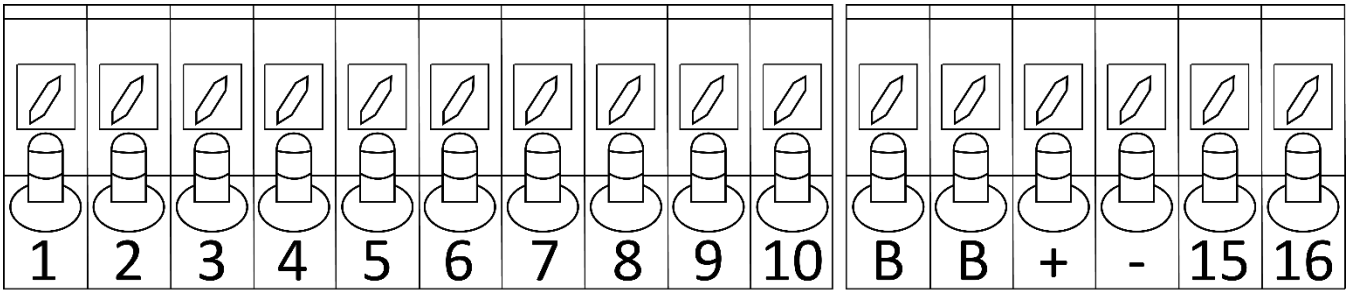
Gen Start A (Grid Start if Gen on Grid Breaker)

This is how many amps **(DC)** you can push specifically from the generator to charge the batts. To ensure you do not overload a small Generator, you will want to adjust the GEN or GRID Start A value. ***Multiply value by # of Sol-Arks for actual current value into batteries.***

Suppose PV production = 0W | Disabled TOU | Enabled Grid/Gen Charge: the batteries will be charged to "full" using the Grid or a Generator (if available) until the battery bank accepts only 5% of its rated capacity in Amperes. This value correlates to roughly 90-93% full for most batteries and is the generator's default "OFF" signal. If producing PV, the system will use PV to charge the batteries to 100% full instead.

Integrating Sensors and Accessory Placement

Sensor Pin Out (Located in Sol-Ark user area)



(1,2) Batt Temp: Batt Temp Sensor has no polarity; used for voltage correction when using lead acid batteries

(+3, -4) CT1 & (+5, -6) CT2: Current transformers used for limited to home mode and peak shaving; **Polarity matters**

(7,8) Gen Start Relay: Two wire start for generators, simple open or closed relay

(9,10) Gen On Relay: Not currently in use

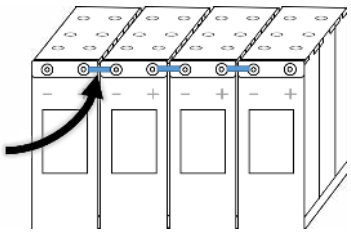
(11 B, 12 B) Emergency Stop: Short these pins to initiate emergency stop. This will shut down AC output from the inverter and initiate rapid shutdown of the PV.

(+, -) Optional 12V input signal for RSD; Not Currently in use

(+15, -16) 12V power supply for RSD transmitters: such as TIGO; Rated for a **maximum of 1.2W (100mA @12V)**

Battery Temperature Sensor

Fig. C



- Place between batteries with tape (See Fig. C).
- This sensor has no polarity and helps perform voltage charging adjustments and capacity calculations.

Note: Lithium Batteries do NOT require a Temperature sensor.

Limiter Sensors (CT Sensors)

- Install sensors on incoming electrical service wires on L1 and L2 (see Diagrams Section)
- Limited To Home Mode (meter zero) and Peak Shaving Modes require CT sensors
- To ensure the sensors will fit, please check the wire size before ordering
- See pg. 39 for additional CT sensor information.

GEN Start Signal (Two-Wire)

- The signal comes from a normally open relay that closes when the Gen Start state is active

CANbus & RS485

- To connect batteries to the Sol-Ark 15K via RJ45, you need to splice the end connecting to the Sol-Ark 15K
- Use the middle two conductors
- RS485 is SunSpec draft 4 (will not work with draft 3)

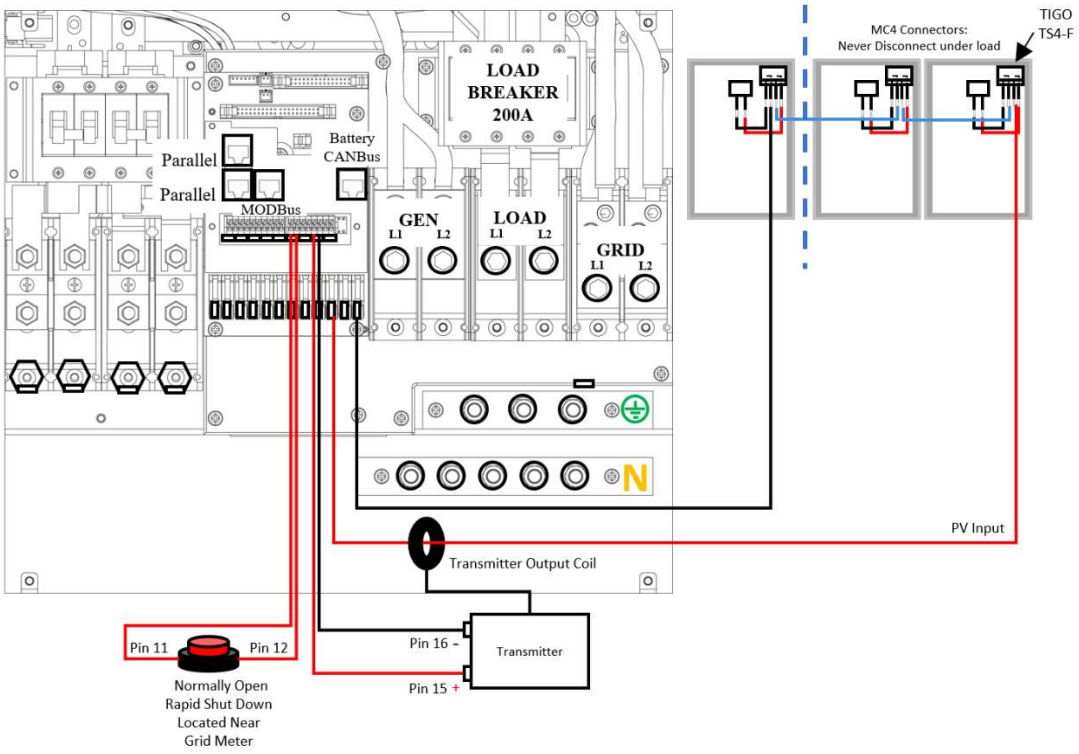
Wi-Fi Antenna (Dongles)

Remote monitoring and software updates require an internet connection through the Wi-Fi dongle

Emergency Stop Signal & PV Rapid Shutdown Signal

Pins 11(B) and 12 (B) use an ordinarily open & latching switch to connect the two emergency stop pins that cut off the RSD power supply when triggered, thus stopping the inverter AC output.

Pins 15 and 16 provide the 12V / 100mA signal power lost when the Sol-Ark shuts down using the front button.



Rapid Shutdown: TIGO TS4-A-O | TIGO TS4-A-F | TIGO TS4-O | TIGO TS4-O-DUO | APsmart RSD S-PLC / RSD-D

PARALLEL SYSTEMS: Emergency Stop should be connected to the Master with address 01 and will initiate emergency stop for all paralleled systems from the one button

- The Built-in 12V power supply in the user area of the Sol-Ark (Pins 15 and 16) is rated for 100mA (1.2W)
- Transmitter fits inside the user area of the Sol-Ark 15K but can cause interference (sometimes requires placing it outside of the user area)
- TIGO Optimizers are compatible with the Sol-Ark 15K (Do not use the built in 12V Power supply in the Sol-Ark user area to Power the Tigo Optimizer TX transmitter)

If you are unsure whether or not the transmitter power supply is compatible with pins 15 & 16 of the inverter, contact the RSD manfucaturer

Misc. Hardware Recommendations

Disconnect / Transfer Switches: 200A Fused Disconnect: Square D D224NRB Safety Switch Fusible 200A 2P NEMA-3R 240V, Single Throw | Siemens 200 Amp 2-Pole Fusible General-duty Safety Switch Disconnect

PV Fuses: 15A PV MC4 in-line fuse holder (ZOOKOTO or DPJ)

Electrical Panel: Any appropriately rated panel for your loads (Check local hardware stores for recommendations)

Battery Combiners (Parallel Systems Only): Any appropriately rated pair of Bus Bars with 3/8" battery connection terminals

Powering-Up and Testing the Sol-Ark 15K

Check the voltage on each PV input circuit

A. It should be no higher than 500Voc Temp. corrected
B. **DO NOT connect PV+ OR PV- to GND**
C. Verify polarity (backward polarity shows 0V)

Check Grid Input Voltage

A. Measure L1 to Neutral and L2 to Neutral. Ensure 120Vac
B. Measure L1 and L2. Ensure 240 V_{AC}
C. Check Neutral and Ground are ~0 V_{AC}
D. Verify L1 voltage on AC in/out is 0 V_{AC} with the main L1 connection in the panel. Same for L2

Check Battery Voltage

A. Turn on the battery switch (if using a Lithium battery)
B. Turn on the built-in battery disconnect in the user area
C. The voltage should be 45V_{DC}-60V_{DC}

Provide Power to Sol-Ark

A. Turn on Grid Breaker and Load Breaker
B. Turn PV disconnect switch to the "ON" position
C. Press the ON/OFF Button on the front, and the blue light should turn on

Indicator LED's

DC

A. Green = DC Solar Panels are producing
B. Off = Solar Panels are not producing

AC

A. Green = Grid (or Gen or AC Coupled) is Connected
B. Off = grid is not Connected

Normal

A. Green = Sol-Ark 15K is working properly
B. Off = Sol-Ark 15K is not working properly

Alarm

A. Red = Alarm, check the alarms menu
B. Off = No alarms

Turn ON with one of three sources of power:
1) PV 2) Grid 3) ON/OFF Battery

Power Cycle Sequence

1. Turn on the Built-In battery disconnect

2. Make sure that Sol-Ark 15K is properly connected to the batteries, panels, grid, etc. (see system wiring diagram).

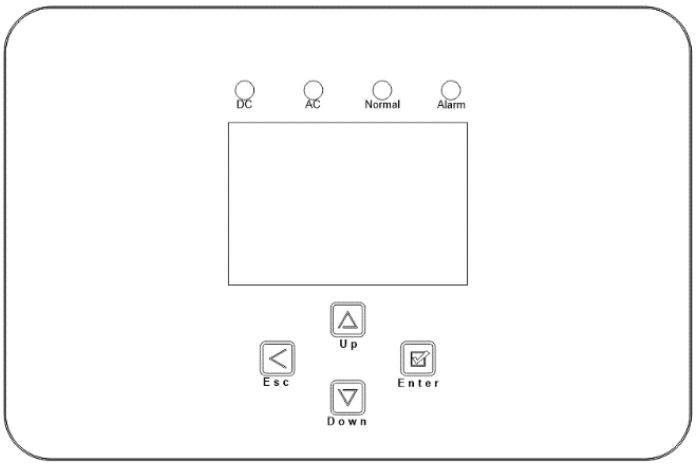
3. Turn on grid power from 200A disconnect.

4. Press the power button on the left SIDE of the unit.

5. Make sure Solar panel inputs are not connected to Ground, then Turn on DC disconnect switch.

6. Turn on load breakers.

7. Reverse the steps to turn off



Remote Monitoring Setup

Ethernet Dongle

A. Open the dongle enclosure and thread the ethernet cable through the hole, and plug it into the RJ45 port
B. Reassemble the dongle housing and plug dongle into Sol-Ark, and secure it with screws
   If all is well, you will see solid red and green lights
C. Register the dongle via the app or www.mysol-ark.com

Wi-Fi (Via Cell Phone or computer)

A. Plug Wi-Fi dongle into Sol-Ark
B. Using your device, look for an "EAP" network containing the last five digits of the dongle S/N
C. Password: 12345678
D. Follow the instructions in the upcoming pages

You can access PowerView on a computer with the following link:
http://www.mysol-ark.com

Download PV Pro App

iPhone: (Will only show up as PV Pro)
https://apps.apple.com/lk/app/powerview-pro/id1247121391

Android
https://play.google.com/store/apps/details?id=com.elinter.app.powerview&hl=en_US&gl=US

Attention Installers

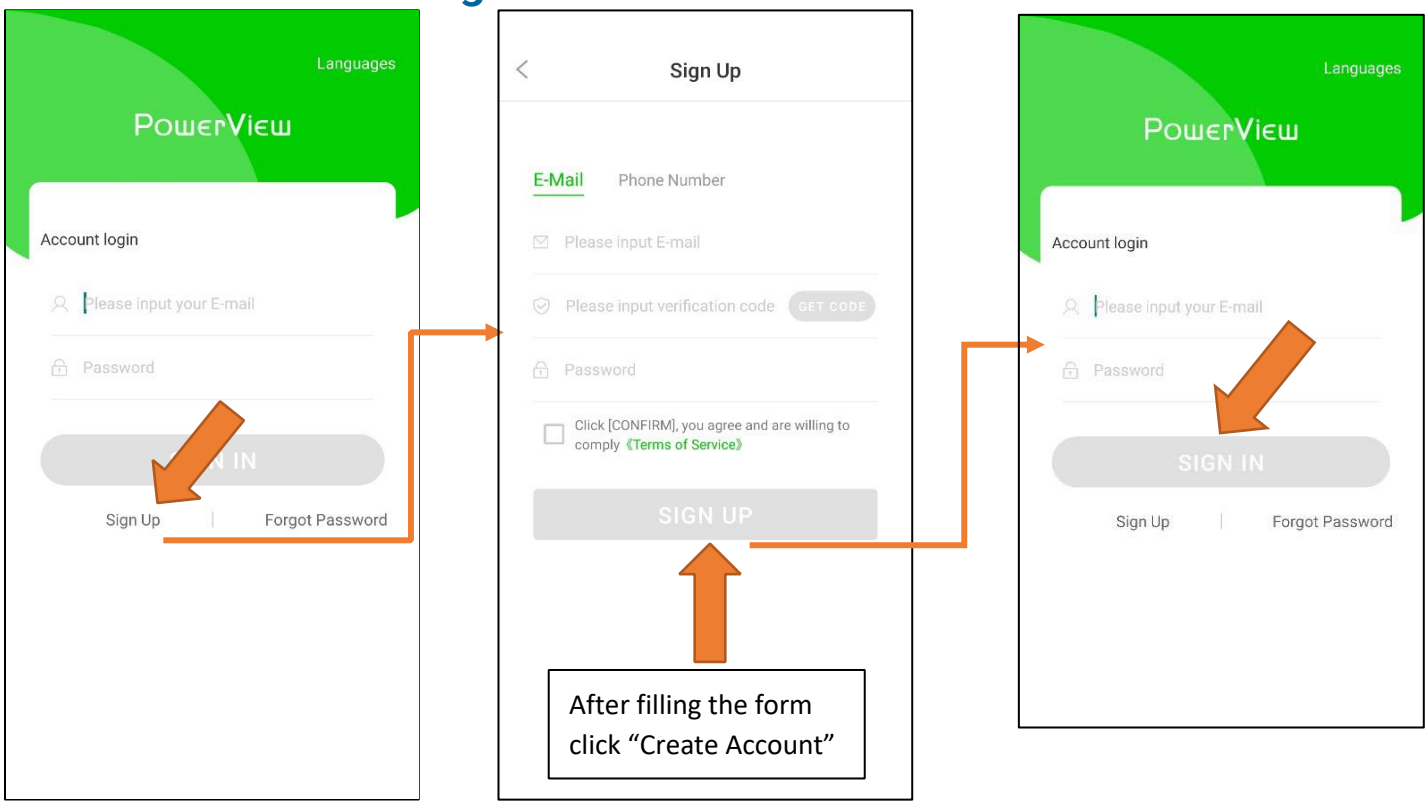
If you plan to add an install to your installer account for monitoring multiple installs, you must first make the plant under the **customer's** account.

Once created, the customer can share the plant, with **Manager permissions**, to the installer via the app ("…"under My Plants) or webpage (press the "…" next to the plant name in Power View).

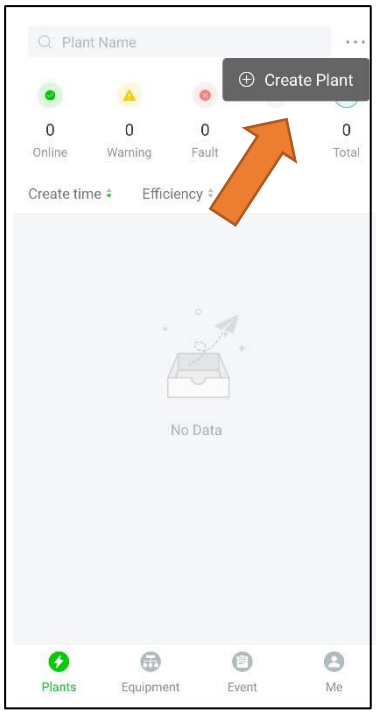
PV Pro App Tutorial Video

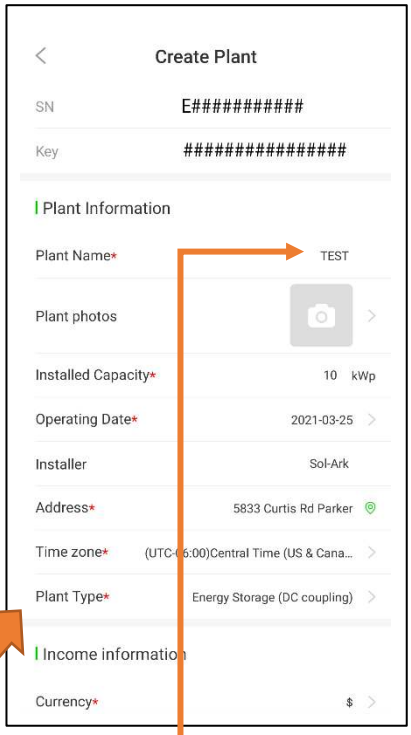
PV Pro Website Tutorial Video

Create an Account and Sign In



Add a Plant



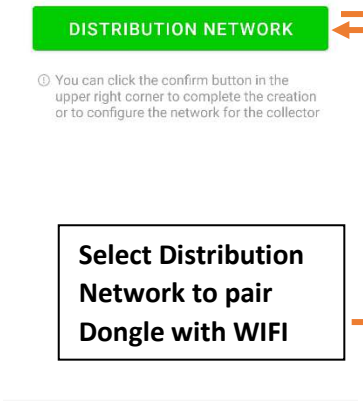


On Plant Type, **ALWAYS** select Energy Storage (DC coupling).

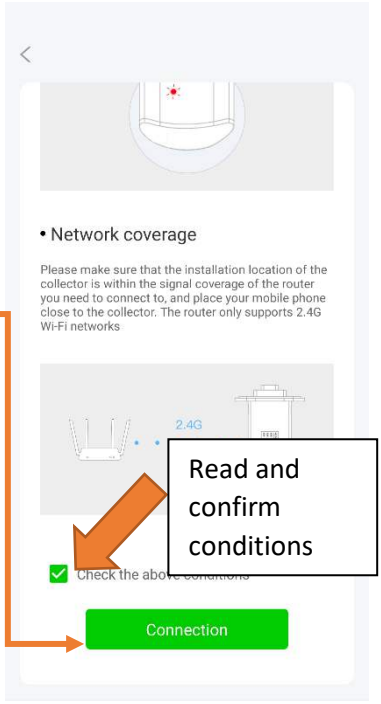
Make sure to pick a unique plant name. (I.E.“Last Name, First four of Address”)

Connect the System to the Internet

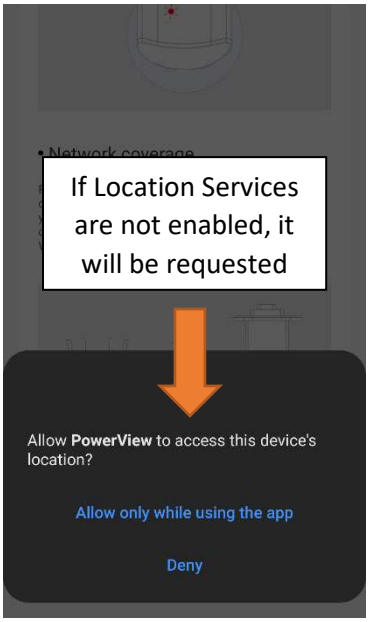
If Wi-Fi paired with 10.10.10.1, select Done



Select Distribution Network to pair Dongle with WIFI



Read and confirm conditions



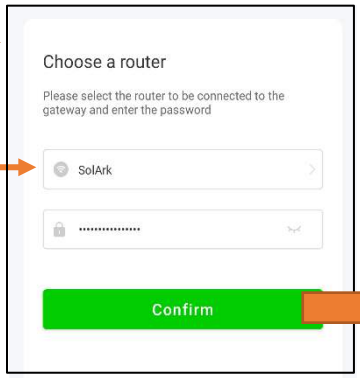
If Location Services are not enabled, it will be requested

Once you see this screen, go to your **DEVICE'S** Wi-Fi settings and connect to the Wi-Fi network that starts with:

EAP-#####

Password: "12345678"

Return to app once connected



Select the local Wi-Fi network that will be providing the internet connection to the system

Do NOT select the dongle's Wi-Fi network

The app will buffer for a few seconds

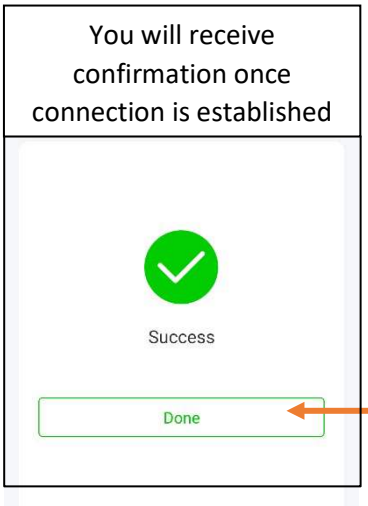
It takes about 60sec for the lights to turn on after setup

Red LED: Connected to Sol-Ark and has power

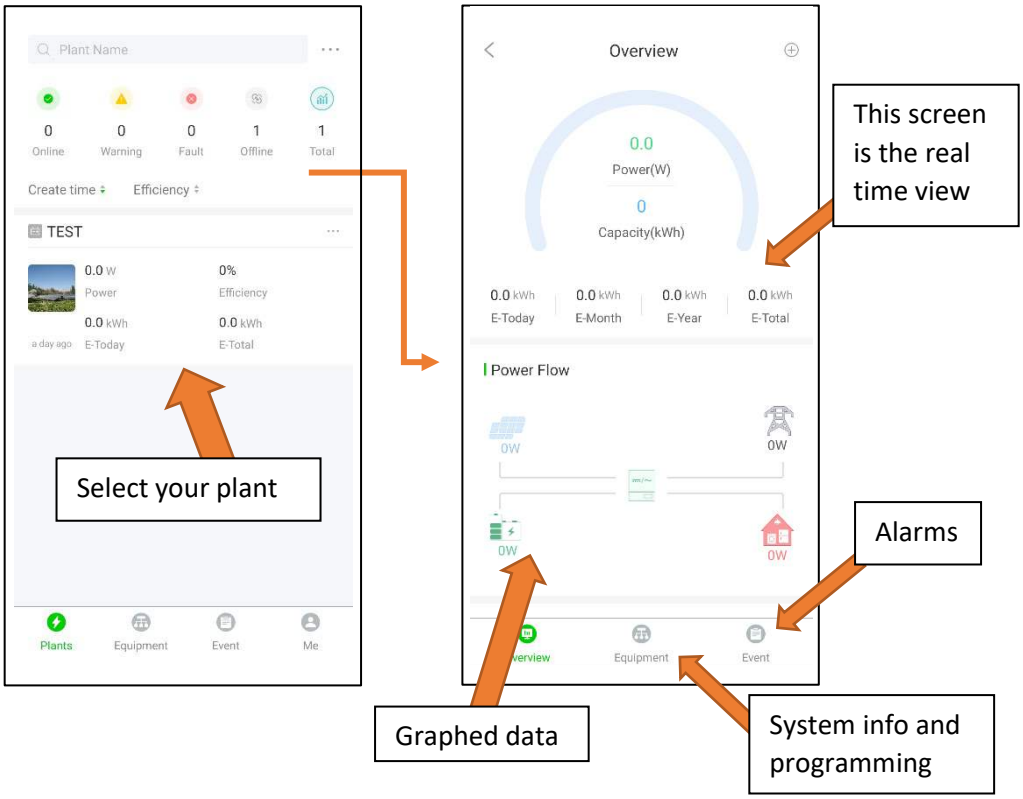
Green LED: Connected to Internet and Server

Flashing Green LED: Connected to router but not server (usually a VPN or firewall issue)

You will receive confirmation once connection is established



Start Monitoring The Data



Attention

If you are installing **parallel** systems, **DO NOT** create a plant for each inverter.

Create one plant for the **Master** unit and then use the browser version of PowerView (mysol-ark.com).

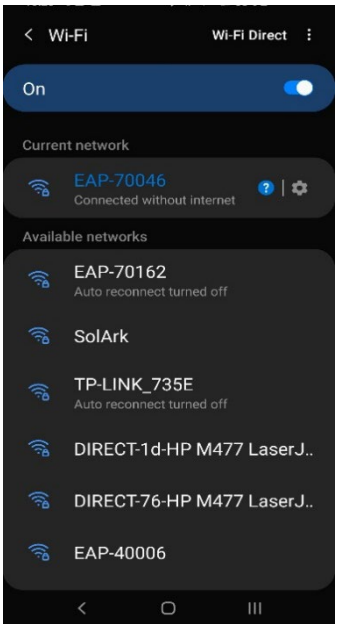
Click on the "…" for the **MASTER's** plant and hit "Add Gateway" then put the S/N and Key of the **SLAVE's** dongle.

IP Address Setup Instructions (PC or SmartPhone)

Please note that this method only achieves internet connectivity. For registration and account management, please use the app and/or www.mysol-ark.com

Connect to the Dongle Network

A. Settings → Wi-Fi → Select the Network with EAP- ##### (The last 5 digits of your SN number)

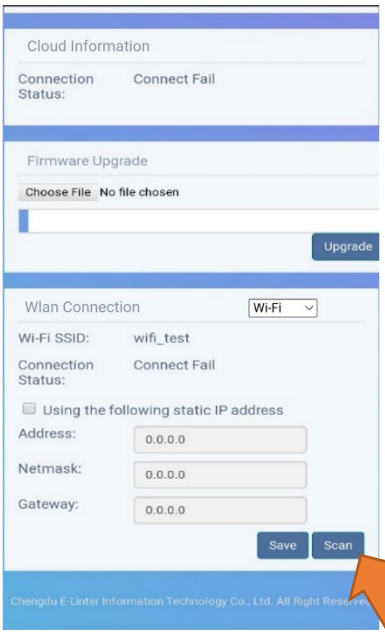


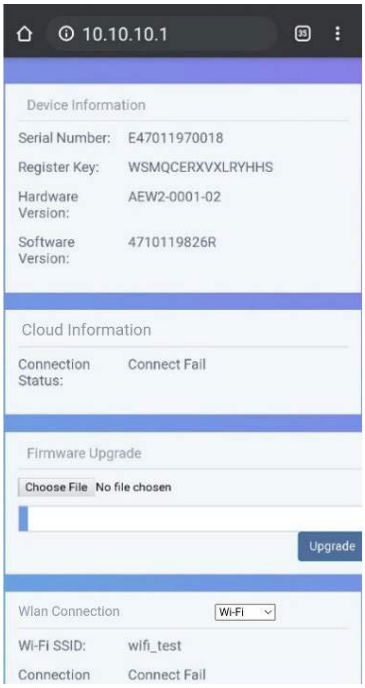
Password: 12345678

***Disclaimer*:** The Wi-Fi dongle does not have internet; You still need to be connected to the dongle for this process.

Login to Web Portal using ANY Search Browser

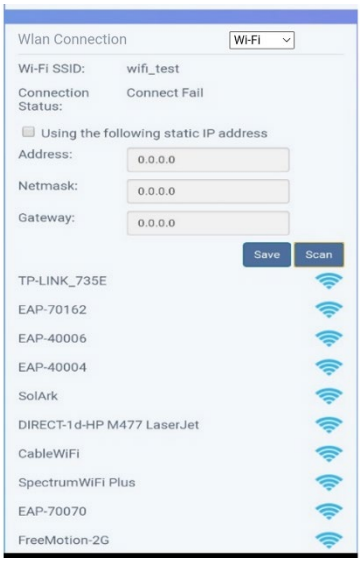
A. Open Google or Safari → type in the search bar: 10.10.10.1
B. Scroll Down to "Wi-Fi Connection"
C. Press "Scan" to search local networks





Select Your HOME Network

A. Find the home network
B. Enter personal Wi-Fi Password
C. DO NOT SELECT DONGLE NETWORK
D. Select "Connect"

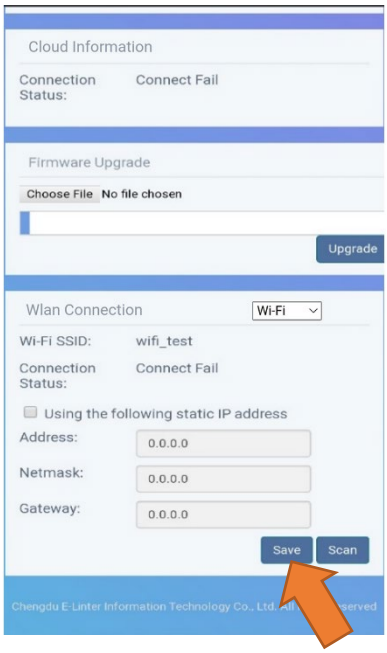


Disclaimer

Connecting the dongle via the IP address only connects the dongle to the internet

YOU MUST STILL CREATE AN ACCOUNT VIA THE POWER VIEW APP

Save Your Information



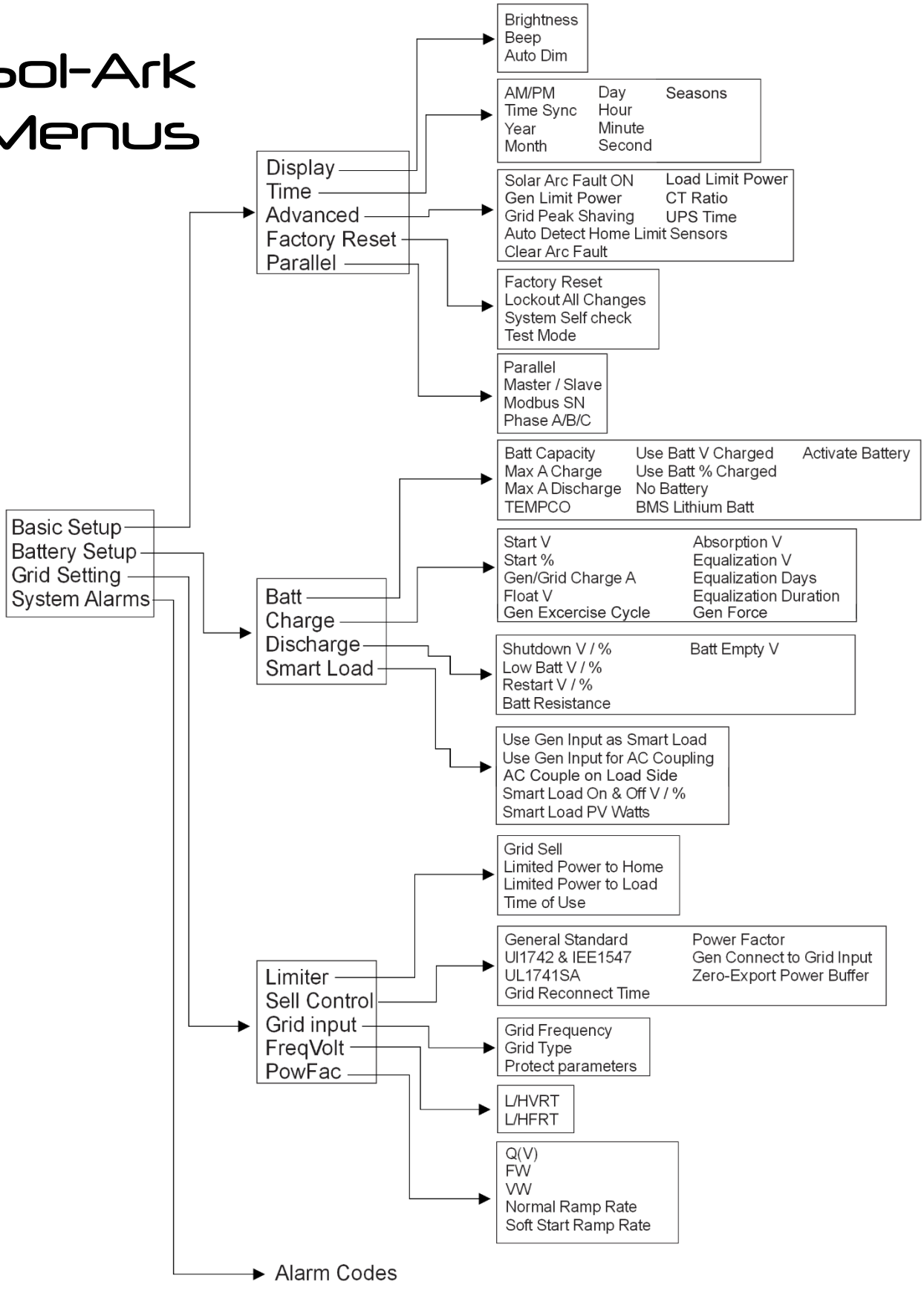
If successful, you should see a Red and Green Light on the Dongle showing a successful connection.

Red LED: Connected to Sol-Ark and has power.

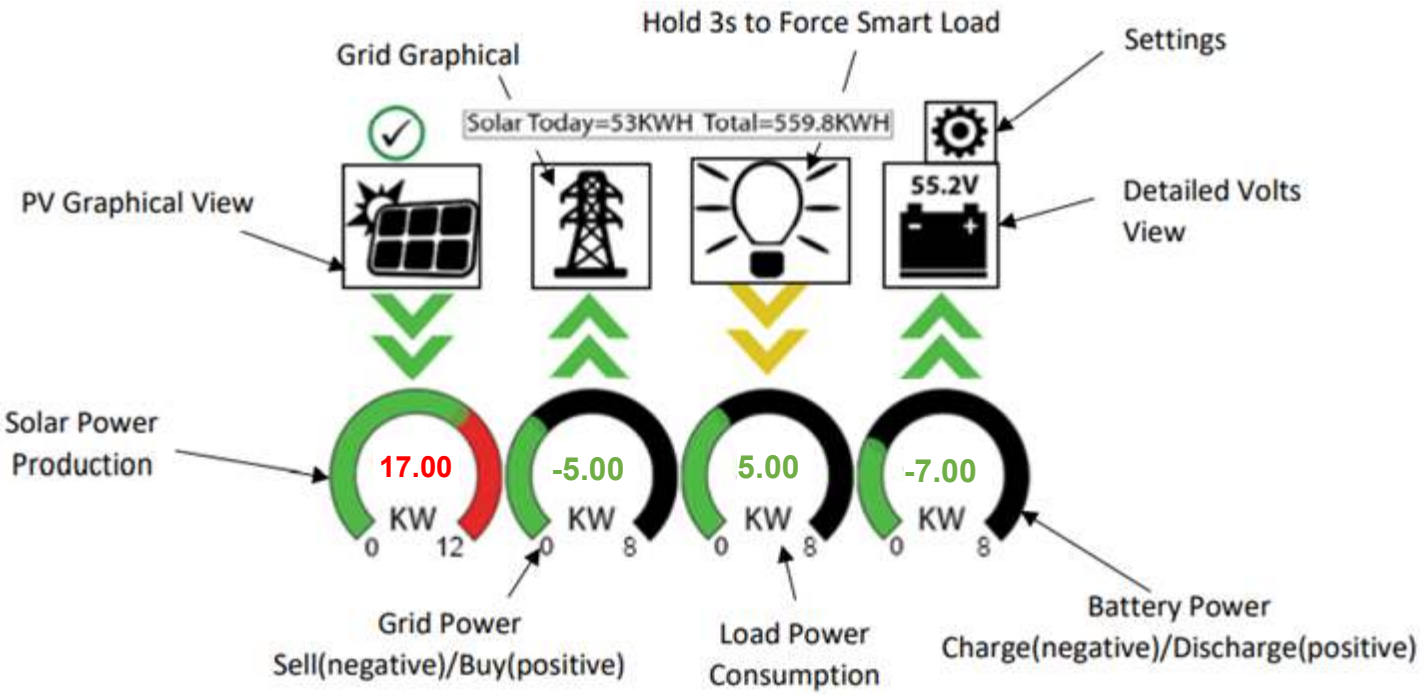
Green LED: Connected to Internet and Server

Flashing Green LED: Connected to router but not server (usually a VPN or firewall issue)

Sol-Ark Menus



Main Screens (Touchscreen)



Detailed Volts View

- Top row = Total power for column
- Middle Row = Line 1/PV1 voltage, Amps, and Watts
  (note: PV Voltage not to exceed 500V)
- Bottom Row = Line 2/PV2 voltage, Amps, and Watts
  (note: PV Voltage not to exceed 500V)
- Batt Temperature will show -20°C if the temperature sensor is not connected. Batt SOC % = % batteries are charged
- DC Temp = Temperature of DC conversion electronics
  - Batt → AC
  - PV → Batt
  - AC → Batt
- AC Temp = Temperature of AC conversion electronics
  - Batt → AC
  - PV → AC
- Grid Column
  - If selling to the Grid, Grid Watts = negative
  - If buying from the Grid, Grid Watts = positive
  - HM = power detected by the external current sensors on the entire home L1 & L2
  - LD = power detected using internal sensors on AC grid in/out breaker

Solar	Grid	INV	USP LD	Batt
3882W	-3081W 60.0Hz	3702W 60.0Hz	621W 122V	-26W
L1: 263V 5.4A 1398W	126V HM: -786W LD:-1876W	122V 15.2A 1857W	0W 121V 640W	54.70V -0.53A 25.0C
L2: 264V 9.5A 2484W	122V HM:1142W LD:1205W	121V 14.8A 1845W	**Gen** 4V 0.0Hz 0W	**TEMP** DC: 55.0C AC:49.7C

Note: Reversed Grid Watt values may indicate incorrectly installed current sensors (reversed polarity). See Page 38.

PV Graphical View

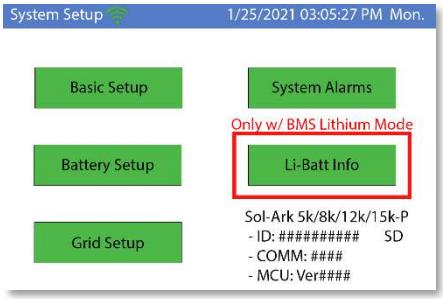
A. Displays power production over time for the PV array
B. Use up/down buttons to navigate between days
C. Month view, Year view, and Total view

Grid Graphical View

A. Displays power drawn from and sold to the grid over time
B. Bars above the line indicate power bought from the grid
C. Bars below the line indicate power sold back to the grid

This view can help determine when the peak power is used in the Home and for Time of Use programing

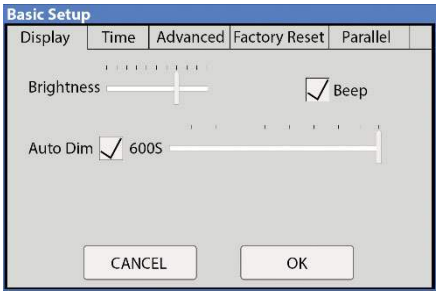
System Setup Menu



A. ID = LCD serial #. Sol-Ark Technical Support uses the Wi-Fi serial #.
B. COMM = LCD software version
C. MCU = Inverter software version

Basic Setup

Display

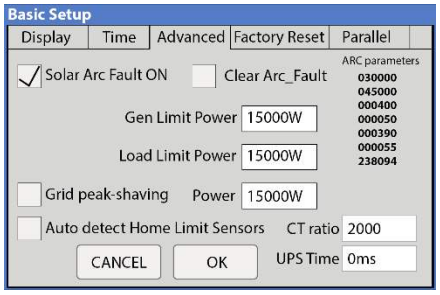


A. Brightness adjustment
B. Auto dim (must be enabled for the warranty to cover LCD screen)
C. Enable/disable BEEP

Time

A. Set date and time for the system
B. Set up to three (3) seasons for Time of Use to follow

Load Limit Power



Set the total AC Output of the Sol-Ark; curtails excess power. The default value is always the Maximum output of the inverter.

Grid Peak Shaving

Set the Sol-Ark's threshold to begin contributing power to keep the power drawn from the grid below the threshold.

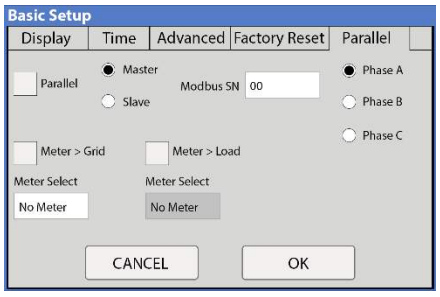
CT Ratio

Set the CT ratio; the Default value is 2000/1. Please **DO NOT** change this value unless you speak with support; 3rd party CT sensors require our permission not to void the warranty**.**

UPS Time

Set the UPS transfer time to the chosen value; any value below 4ms will default to a 4ms transfer time.

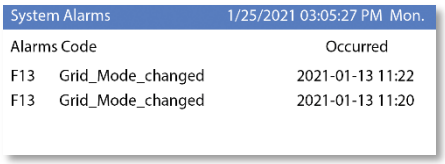
Parallel (connecting multiple systems)



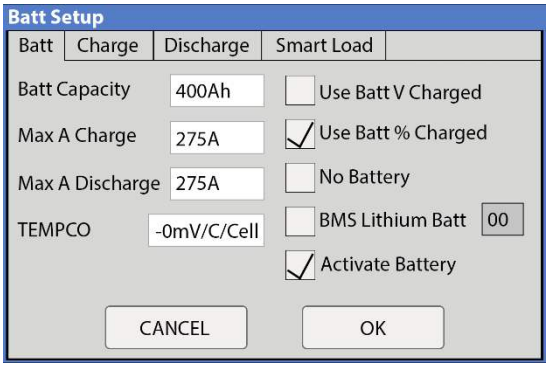
A. Select parallel mode when using more than one system
B. Set the Master/Slave status of each system
    i. Label only one system as the "Master"
C. Set the MODBUS address of each system starting at 01
D. When using multiple Systems in 120/208V mode, select which phase each system is responsible for (A, B, C)

System Alarms

A. Lists all recorded System alarms in chronological order



Battery Setup



Batt

Batt Capacity: Enter the battery bank's size connected to the system.
Series = add Voltage | Parallel = add Amp-Hours

Max A Charge: set the max charge rate for the batteries (This also sets the PV → Battery charge rate)

Suggest 20%-30% of battery capacity for lead-acid

Max A discharge: set max discharge for battery bank (In off-grid mode, the battery bank will discharge 120% of this value for 10 seconds before the inverter shuts down to prevent battery damage)

TEMPCO: Temperature coefficient used in conjunction with the batt temp sensor to adjust optimal voltages for lead-acid batteries

Use Batt V Charged: displays battery charge in terms of voltage

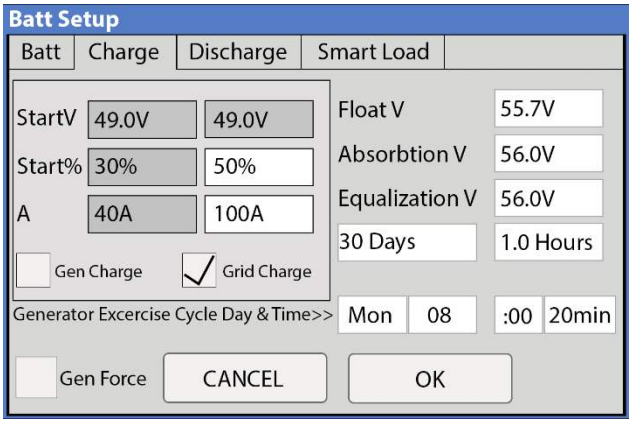
Use Batt % Charged: Battery voltage can be misleading for determining the % Charged. So, we use algorithms measuring power in and out to measure a true value for % Charged. It compensates for aging batteries also.

Charge

Float V: Set value appropriate for the batteries connected to the system

Absorption V: Set value suitable for the batteries connected to the system

- Absorption will stop at 2% of the capacity of the battery bank and drop to float
- Ex: 400Ah battery would be 8A



Equalization V: Set value appropriate for the batteries in use.

Days: the period between equalization cycles

Hours: period taken to equalize batteries

Note if Hours = 0 system will not equalize the batteries

Gen Charge: uses the gen input of the system to charge the battery bank from an attached generator.
Start V: voltage at which system will AutoStart a connected generator to charge the battery bank

Start percentage: Percent S.O.C at which system will AutoStart a corresponding generator to charge the battery bank

A: Charge rate from the attached Generator in Amps (DC)

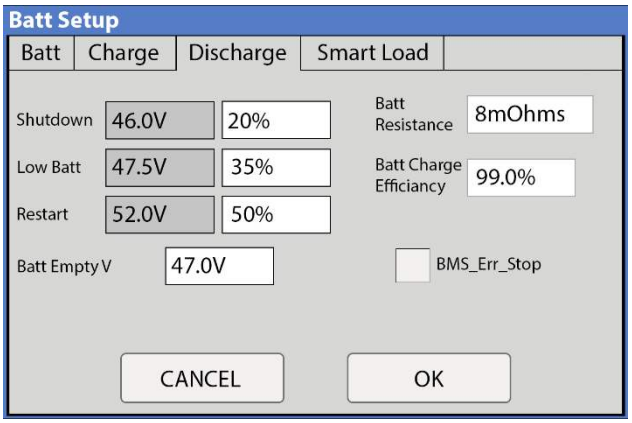
Size this value according to the generator size

Grid Charge: uses Grid input to charge batteries from the grid or generator

Gen Exercise Cycle (Day & Time): Set a weekly Gen exercise schedule. (Day of the week/Time/Duration Length)

Gen must have two-wire start connected to Sol-Ark. To disable the exercise, set the duration length to 0 min.

Discharge



Shutdown V: battery voltage at which the inverter will shut down (battery symbol on the home screen will turn red)

Low Batt: Low battery voltage (battery symbol on the home screen will turn yellow)

Restart: battery voltage at which AC output will resume

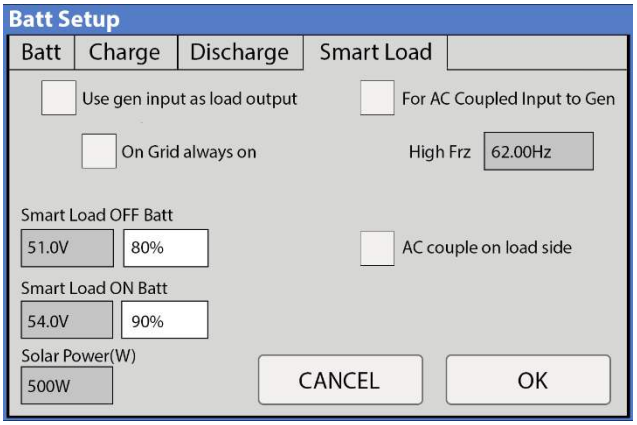
Batt Resistance: used in % SOC batt calculations

Batt Charge Efficiency: used in % SOC batt calculations

Batt Empty V: sets reserve capacity and improves % SOC calculations. It is not Batt_I adjusted

(Recommendations: 45V for AGMs, 48V for Lithium Iron Phosphate)

Smart Load (Gen Breaker)



A. This mode utilizes the Gen input connection as an output that only receives power when the battery exceeds a user-programmable threshold.
B. Enable "Use gen input as load output" to power high power loads such as a water heater, irrigation pump, AC unit, pool pump, etc.

Smart Load OFF Batt

Battery voltage at which the Gen Load will stop receiving power

Smart Load ON Batt

Battery voltage at which the Gen Load will start receiving power

Using Gen load for a water heater, we recommend that only one leg (120V) be connected to the bottom element. This significantly reduces the power consumption of the water heater while retaining core functionality (it will heat water, only slower).

Gen Load is limited to 100A at 240V (Do not exceed!)

Solar Watts is for on Grid

A. The system waits to turn on smart load until enough PV power is produced (when on grid)

AC Coupling Settings (" For AC Coupled Input")

A. To use the Gen input breaker as an AC coupled input, check the "For AC Coupled Input" box (this feature will also work with "Grid-Tied" Inverters)
B. The meaning of Smart Load OFF Batt and Smart Load ON Batt change in this mode

Smart Load OFF Batt: The SOC at which the AC coupled inverter(s) are shut down when in off-grid mode

90% recommended

Smart Load ON Batt: The SOC at which the AC coupled inverter(s) are turned on when in off-grid mode 60%-80% recommended

Maximum combined input (AC+DC) = 34.2kW

19.2kW AC +

15kW DC

When On-Grid, the AC-coupled inverter will always be on, and it will sell any extra power back to the grid.
AC Coupled PV Arrays will not work WITHOUT grid sell enabled (while the grid is available).

To use the LOAD breaker for AC coupling grid-tied inverter(s)

i. You must select "For Micro Inverter Input"
ii. The Gen Breaker is not used (even though the GEN breaker is not physically being used for this mode, AC coupling on the LOAD breaker prevents the use of the GEN breaker)
iii. Wire as shown in the preceding example diagram labeled "Load side AC coupling example"

Some load-side AC coupling installs will require a line side tap instead of the 50A breaker shown in the example diagram

Grid Setup

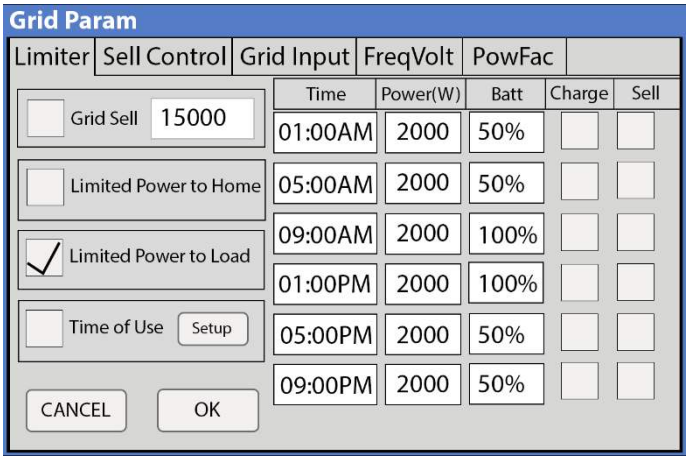
Limiter

Grid Sell: maximum watts sold to grid

Limited To Home: Limits power produced by the system to match the demand of the Home

Limited To Load: Limits power produced by the system to match the demand of connected loads

Time Of Use:



Time: When the System will sell batt/PV power to the Grid or Home

Power(W): Max watts called from the battery only at each time

Batt: The battery voltage or % at which the system will limit selling to the Grid or Home from the battery. The system will drain the battery until reaching that percent/voltage.

Charge: Enables grid/gen charging up to the voltage or percentage specified on the line during a selected period. PV will always charge 100%. If using a generator, select the charge box for the times that may need the generator, and the Gen will charge the battery to the voltage of percentage specified in the "Batt" column.

Sell: The sell check box allows us to discharge the battery for grid sell-back for that time slot.

Note: This Mode requires grid sell / limited to home / peak shaving be enabled.

Note: If you need the batteries to never charge from the grid, **uncheck** the "Grid Charge" box under the charge tab of the battery menu.

Sell Control

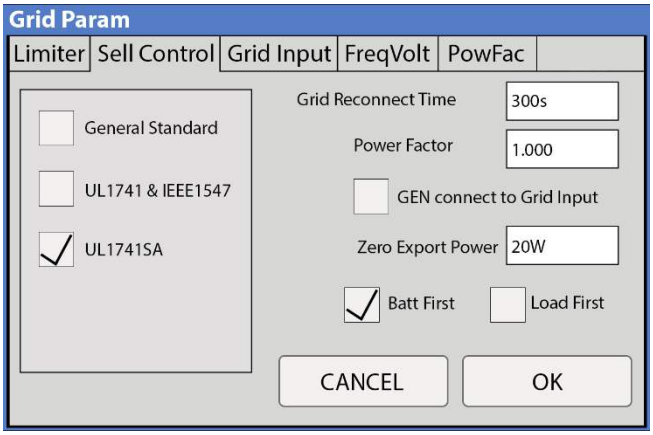
General Standard: uses Protect Parameters in table

UL 1741 & IEEE1547: Enables sell compliant functionality

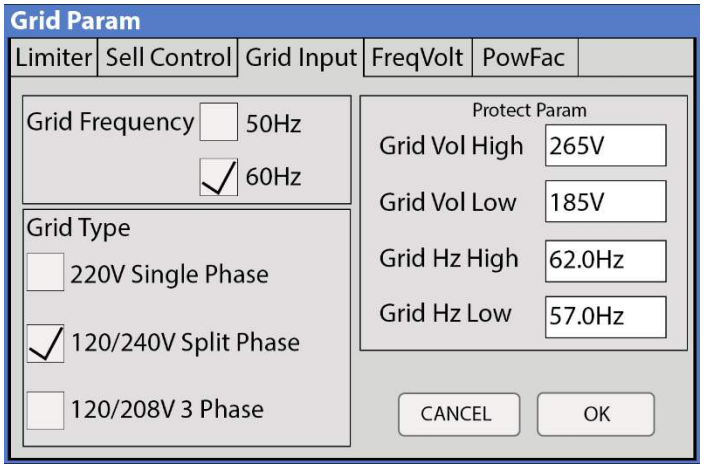
UL1741SA: Enables wider Freq, Voltage, and Power Factor

GEN connect to Grid Input: Enable if Generator connects to the AC Grid breaker

Zero Export Power: Power drawn from the grid at all times



Grid Input



Grid Frequency: Select the Grid Frequency connection

Grid Type:

- **220V Single Phase (Call us before using)**
- **120/240V Split Phase (North America)**
- **120/208V Three (3) Phase**

Protect Parameters: (when Settings when the system will connect/disconnect from the grid. UL 1741 & IEEE1547 do not use these parameters.

We recommend widening the frequency range when connecting a generator to the grid breaker (55-65Hz)

If 120/208V, the L1 and L2 are phase specific. So, you may have to swap Grid L1 L2 for 208V applications.

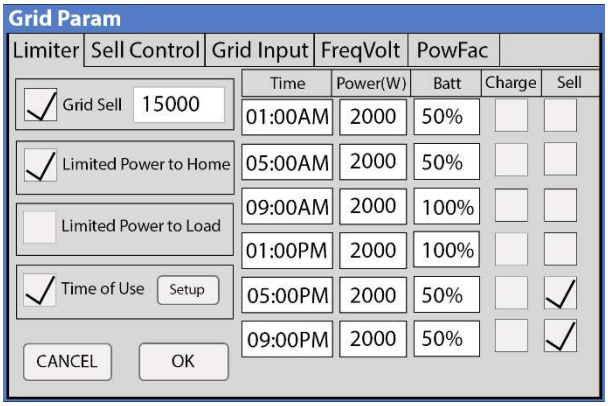
Each time the input/output voltage changes, the Inverter(s) require a power cycle.

Selecting Power Mode

Sol-Ark 15K will simultaneously use various power sources available to meet loads demand. The following power modes allow the user to determine the power sources available to the Sol-Ark 15K.

Limited Load / Self Consumption

A. Sol-Ark will only power loads connected to it.
B. It will not produce more power than the connected loads require.
C. This mode will neither sell back to the Home nor Grid.



Limited To Home (Zero-Metering)

Main Menu → System Settings → Grid Setup → Limiter → Limited to Home

A. Pushes power to the whole Home without selling back any excess to the grid (no net metering agreement required)
B. This mode requires the use of the limiter sensors
C. Power source priority is the same as Grid Sell Back

Simultaneously select Grid Sell and Limited to Home

Load (light bulb) icon on the home screen now includes both the load breaker power and the home's consumption.

Grid Sell

Main Menu → System Settings → Grid Setup → Limiter → Grid Sell

A. This mode allows Sol-Ark 15K to sell back any excess power produced by the solar panels to the grid.

Power source priority:

1. Solar Panels | 2. Grid | 3. Generator (Manual) | 4. Batteries (until reaching programmable % discharge)

Time Of Use (using batteries during peak power times)

Main Menu → System Settings → Grid Setup → Limiter → Time Of Use

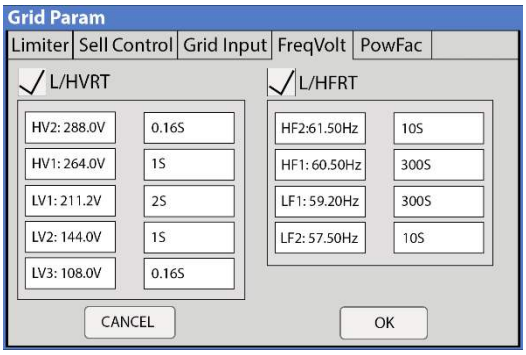
A. Use the batteries to reduce power consumption from the grid during a user programable peak pricing time.

Power source priority:

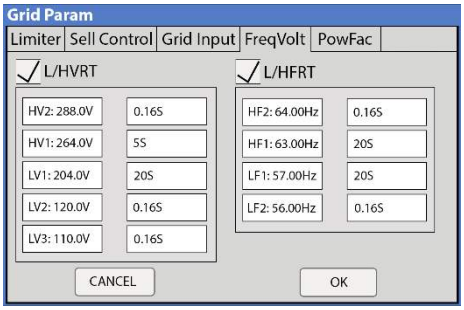
1. Solar Panels | 2. Batteries (programmable % discharge) | 3. Grid (control when Grid charges) | 4. Generator

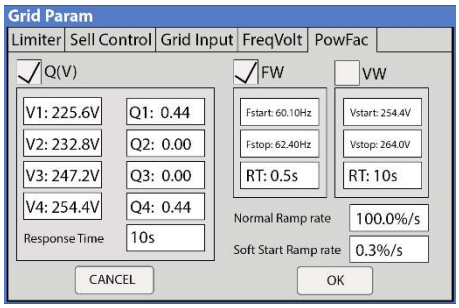
FreqVolt (UL 1741SA must be enabled in "Sell Control" tab)

Puerto Rico Grid Compliance Settings:

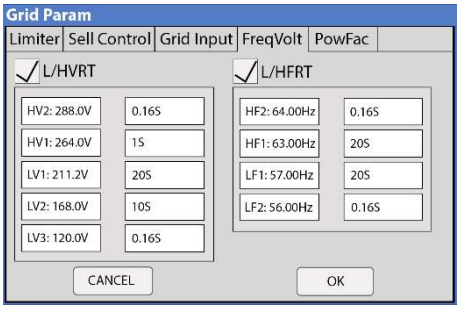


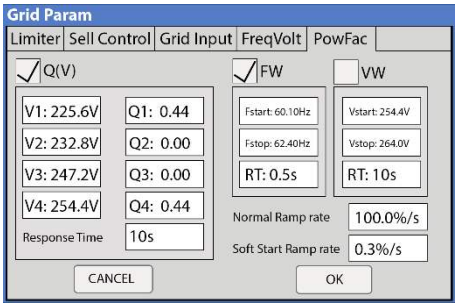
Kauai Grid Compliance Settings:



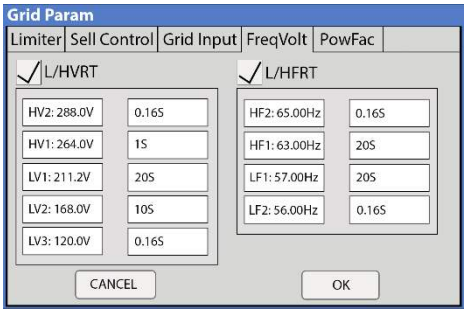


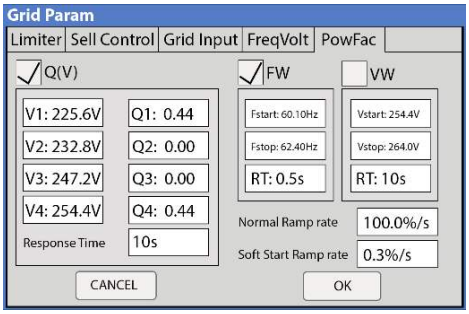
HECO Grid Compliance Settings for O'ahu, Maui, Hawai'i:





HECO Grid Compliance Settings for Lana'I and Moloka'i:





PowFac

Power Factor is programmable from 0.8 – 1.0

CT Sensors enable Limited to Home mode (meter zero) and Peak Shaving mode. CT sensors also allow the system to calculate loads powered upstream of the Grid Breaker in the home. If using multiple inverters or using a critical loads panel, CT installation is **recommended.**

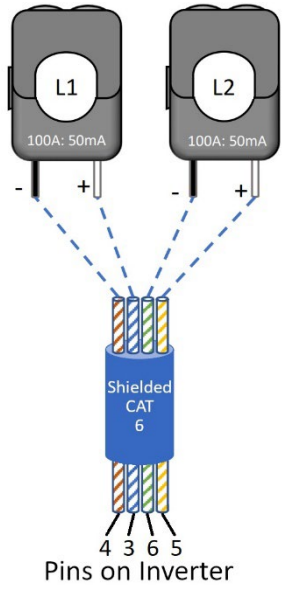
CT Sensor Install Location

- CT sensors should be installed on L1 and L2 (also L3 for parallel 3 phase) upstream of everything in the home except for a Generator Transfer Switch, Knife Blade Disconnect or Bypass Transfer Switch (upstream of Main Service Panel and Line-Side Tap – see Diagrams Section Pgs. 8-16).

CT Sensor Size

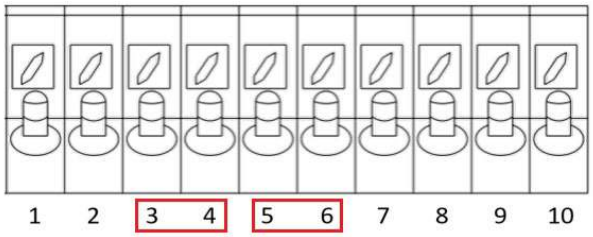
- Each inverter includes a pair of 5/8" CT sensors (fits up to 2/0 AWG service wires).
- We have 15/16" (up to 4/0 AWG) and 2" sensors available for purchase if needed.
- Dimensions refer only to CT sensor hole size; contact Sales at (972) 575-8875 Ext 1 to purchase larger sensors.

CT Sensor Extension Example



CT Sensor Wiring

- Wire CT sensor on L1 to pins 3 (white) and 4 (black).
- Wire CT sensor on L2 to pins 5 (white) and 6 (black).
- Twist the black and white wires for each sensor along the length of the run.
- If needed, you may extend the range using Shielded Cat 6 (use both twisted pair wires).



CT Sensor Direction

- There is an arrow embossed on the CT sensor housing to determine direction.
- Install pointing upstream to the service meter, **EXCEPT** in 3 phase installs where this should be reversed.

Peak Shaving Mode

- Grid Peak Shaving is available with the CT sensors in the location described above and applicable direction.

CT Ratio

Set the CT ratio; the default value is 2000/1. **DO NOT** change this value unless you speak with technical support; 3rd Party CT sensors require our permission not to void the warranty.

Parallel 120V/240V Split Phase Note

- Each inverter will come with a pair of CT sensors.
- Only install one pair and wire to the master inverter.
- Set the system to Limited to Home mode after CT installation for BEST operation.

Parallel 120V/208V 3 Phase Note

- Each inverter will come with a pair of CT sensors.
- Install only one sensor per phase, wire sensor for L1 and L2 to Phase A Master.
- Install the third sensor on L3 and wire to Phase B master pins 5 (+ white) and 6 (- Black).
- Point the arrow on the CT sensor downstream to the inverters (3 phase only).

Limiter Sensor Automatic Setup

Requires Batteries, AC coupled panels must be off while detecting, and does NOT work for 208V installs.
If you do not have batteries or are in 208V mode: verify CT sensor placement manually.

A. Install limiter sensors as previously described (shown in all diagrams as well). Battery and grid connections also required before starting auto-setup.
B. Navigate to the "Advanced" Tab of the Basic Setup screen (follow the directions below to get there)
   A. Touch the gear icon → Touch the Basic Setup button → Select the Advanced tab (see Fig. C)
C. Select "Auto detect Home Limit Sensors" and press “OK”
D. Wait for the Sol-Ark to finish its learning process (Sol-Ark will alternate sell back between legs and magnitude automatically determining the correct settings for the sensors)
E. Verify sensors were correctly configured (see Fig. D) if they are not correct, repeat the learn function

Fig. C

Fig. D

In Limited To Home Mode HM values will be close to zero. HM values should never be negative. If negative, the Limiter Sensors are not installed properly.

Solar	Grid	INV	USP LD	Batt
3882W	-3081W 60.0Hz	3702W 60.0Hz	621W 122V	-26W
L1: 263V	126V	122V	0W	54.70V
5.4A	HM: -786W	122V	121V	-0.53A
1398W	LD:-1876W	1857W	640W	25.0C
L2: 264V	122V	121V	**Gen**	**TEMP**
9.5A	HM:1142W	14.8A	4V 0.0Hz	DC: 55.0C
2484W	LD:1205W	1845W	0W	AC:49.7C

Possible Limiter Sensor issues:

Sensors are facing wrong direction

Sensors are on the wrong wire(s)

Sensors are not fully closed on wire(s)

Sensor Polarity is wrong (White = + BLK = -)

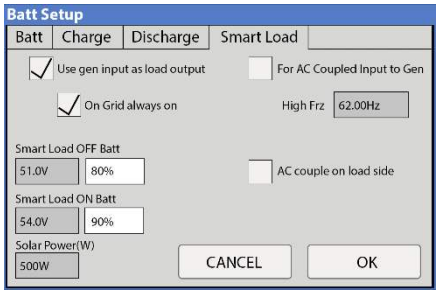
Verifying proper sensor direction:

- Any loads in the home will show a positive HM (+) value in Watts
- Turning on solar panels and enabling Grid Sell should show a negative HM (-) in Watts if you are producing more power than the loads are consuming
- If you turn on limited power to Home mode, then HM: ~0 Watts to zero the meter (system matches the loads to within 99%)

If you installed limiter sensors (CTs) for Limited To Home selling mode, verifying the proper sensor placement and direction is critical. Remove one sensor from the main L1 connection, and the power should drop to 0W.

Off-Grid Install Tips

Sol-Ark 15K will automatically operate in Off-Grid Mode without the grid (under the same power priority as TOU).



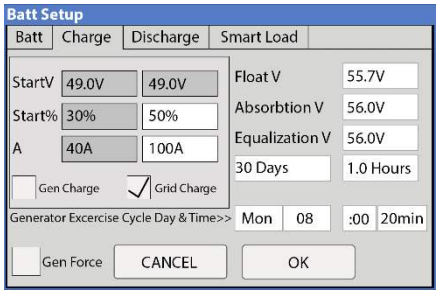
A. Limiter Sensors are not required for completely Off-Grid installs unless using Grid Peak Shaving with a Gen connected to Grid input breaker.

B. The Grid input Terminal Block on the Sol-Ark should be used as the Generator input (4-30kW generators) so that you may maintain Smart Load output capability when off-grid. Therefore, you will use Grid Charge (default) in the Battery Setup/Charge menu to enable the generator's ability to charge the batteries.

C. When off-grid, there is no need for a transfer switch: connect the load output of the Sol-Ark to the whole home.

D. Do not use Grid Sell or Limited To Home Modes Off-Grid. Only Limited power to load (default).

E. The Auto Generator start functions as a 2-wire switch (closes the circuit when needing charging)



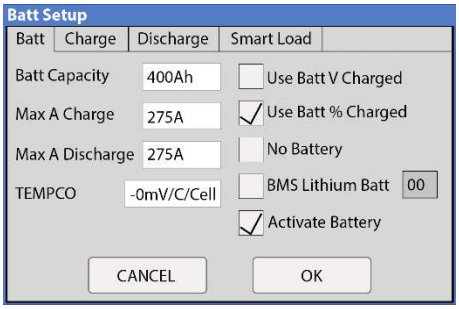
i. Auto Gen-start will be triggered when the battery voltage or percent reaches the level programmed in the battery setup menu. Then, the generator will continue to charge the batteries until they are about 95% full (this percentage is not programmable) before turning the generator off.

ii. When using the Sol-Ark to control a generator, an exercise function will turn on the generator once a week on Monday mornings at 8 AM

F. We recommend changing the "Grid Reconnect Time" under the Sell control tab of the grid setup menu to 30 seconds; otherwise, the Sol-Ark will not charge from the generator until it has been on for at least 5 minutes per the default value of 300 seconds.

G. Under setup for Grid/Sell Control, select General Standard and "GEN connect to Grid Input." Then go to Grid input to widen the input frequency range to 55-65Hz to work with any frequency generator.

H. If you would like to use a wind turbine in conjunction with the Sol-Ark 15K, the turbine must have a 48V charge controller with a dump load to prevent overcharging the batteries. Connect the charge controller on the turbine to the battery bank the Sol-Ark is using, and the turbine will help charge the batteries.



I. Don't forget to set the Battery capacity and reasonable charge rates.

Grid-Tie / No Battery Install Tips

A. Under Battery setup, select no Battery & disable Activate Battery (or the system will beep).

B. Note: a whole system power cycle is required when changing the battery to no battery settings.

C. Under Grid Setup, select Grid Sell.

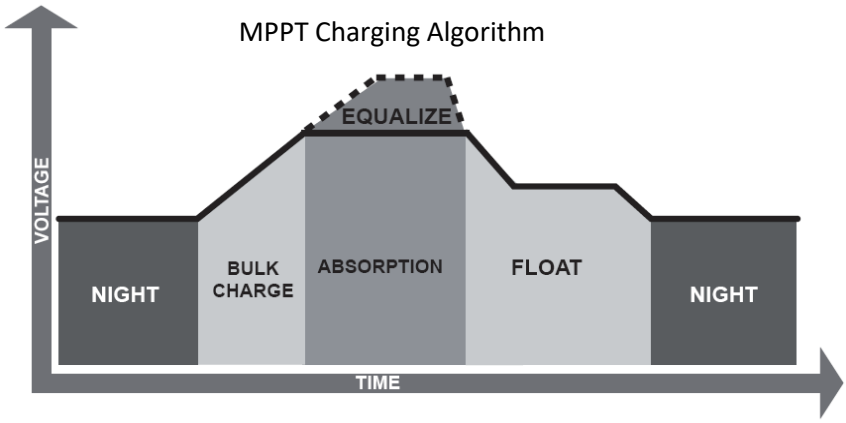
D. Touch Battery Icon to see the Detailed Volts View to verify your inputs & outputs.

Solar	Grid	INV	USP LD	Batt
3882W	-3081W 60.0Hz	3702W 60.0Hz	621W 122V	-26W
L1: 263V 5.4A 1398W	126V HM: -786W LD:-1876W	122V 15.2A 1857W	0W 121V 640W	54.70V -0.53A 25.0C
L2: 264V 9.5A 2484W	122V HM:1142W LD:1205W	121V 14.8A 1845W	**Gen** 4V 0.0Hz 0W	**TEMP** DC: 55.0C AC:49.7C

Battery Charging Information

4-Stage Charging

The MPPT has a 4-stage battery charging algorithm for rapid, efficient, and safe battery charging. The figure below shows the stage sequence.



Bulk Charge Stage

In the Bulk Charge stage, the battery is not at a 100% state of charge and has not yet reached the Absorption voltage setpoint. The controller will deliver 100% of available solar power to recharge the battery.

Absorption Stage

When the battery has reached the absorption voltage setpoint, we use constant-voltage regulation to maintain battery voltage at the absorption setpoint, preventing heating and excessive battery gassing. The battery is allowed to come to a full state of charge at the absorption voltage setpoint. Absorption lasts until batteries charge at 2% of the programmed Ah size.

Float Stage

After the Absorption stage charges the battery fully, the MPPT reduces the battery voltage to the float voltage setpoint. If batts have 100% charge, there can be no more chemical reactions, and all the charging current turns into heat and gassing. The float stage provides a meager rate of maintenance charging while reducing the heating and gassing of a fully charged battery. The purpose of float is to protect the battery from long-term overcharge.

Battery Charging Setpoint Examples (48V)

Battery Type	Absorption Stage	Float Stage	Equalize Stage (every 30 days 3hr)	
AGM / PCC	14.4v (**57.6v**)	13.5v (**53.6v**)	14.4v (**57.6v**)	Default
Gel	14.1v (**56.4v**)	13.5v (**54.0v**)		
Wet	14.7v **(59.0v)**	13.7v **(55.0V)**	14.7v **(59.0v)**	
Lithium	14.1v (**54.6v**)	13.2v (**54.3v**)	14.1v (**54.6v**)	

- **Batteries in series: ADD VOLTAGES**
- **Batteries in parallel: ADD AMP-HOURS**

Calculating Battery Bank's Amp-Hours (PCC 230)

Battery Count	Voltage / Battery	Amp Hours / Battery	Total Amp Hours @48V	Max Charge/ Discharge Amp
4	12V	230Ah	230Ah	100A
8	12V	230Ah	460Ah	200A
12	12V	230Ah	690Ah	275A
16	12V	230Ah	920Ah	275A

Sol-Ark PCC-230 Battery

Batt Capacity: 230Ah x #Parallel_Batteries
(1 parallel = 4 Batt in series, 2 = 8 Batt, 3 = 12 Batt, 4 =16 Batt)
Max A Charge: 100A x #Parallel_Batteries
Max A Discharge: 100A x #Parallel_Batteries
Max A Grid Charge: 50A x #Parallel_Batteries
TEMPCO: -5mV/C/Cell
Float V: 53.6V
Absorption V: 57.6V
Equalization V: 57.6V
Equalization Days: 30
Equalization Duration: 3 Hours
Recommended Shutdown V / Percentage: 47.0V & 20%
Recommended Low Batt V / Percentage: 47.5V & 35%
Recommended Restart V / Percentage: 52.0V & 50%
Battery Resistance: 35mOhms (8 Batt) or 25mOhms (16 Batt)
Battery Charge Efficiency: 99%
Battery Empty Voltage: 45V

Time	Watts	SOC	GridCharge
1:00AM	1500*Par_Batts	70%	
5:00AM	1500*Par_Batts	70%	
9:00AM	1500*Par_Batts	70%	
1:00PM	1500*Par_Batts	100%	
4:00PM	1500*Par_Batts	70%	
9:00PM	1500*Par_Batts	70%	

These settings will charge the batteries off solar only. Discharge the batteries down to a maximum of 70% full.

Limited To Home mode will not sell to the grid from the batteries (only the home will use battery power). The 100% time slot is to ensure that the batteries are properly cycled each day.

Generation 2 Fortress Battery-eVault18.5

Batt Capacity: 360Ah x #Parallel_Batteries
Max A Charge: 150A (100A for life) x #Parallel_Batteries
Max A Discharge: 160A x #Parallel_Batteries
Max A Grid Charge: 100A x #Parallel_Batteries
TEMPCO: 0mV/C/Cell
BMS Lithium Batt: 04
Float V: 54.2V
Absorption V: 54.4V
Equalization V: 55.5V
Equalization Days: 30
Equalization Duration: 1 Hours (tops off battery)
Recommended Shutdown V / Percentage: 51.3V & 20%
Recommended Low Batt V / Percentage: 51.7V & 30%
Recommended Restart V / Percentage: 51.9V & 40%
Battery Resistance: 5mOhms
Battery Charge Efficiency: 99%
Battery Empty Voltage: 46V

Time	Watts	SOC	GridCharge
1:00AM	6000*Par_Batts	40%	
5:00AM	6000*Par_Batts	40%	
9:00AM	6000*Par_Batts	40%	
1:00PM	6000*Par_Batts	40%	
5:00PM	6000*Par_Batts	40%	
9:00PM	6000*Par_Batts	40%	

These settings will charge the batteries off solar only. Discharge the batteries down to a maximum of 40% full.

Limited To Home mode will not sell to the grid from the batteries (only the home will use battery power).

Simpliphi Power: PHI 3.8 Battery 48V

Batt Capacity: 75Ah x # Batt
Max A Charge: 37.5A x # Batt (20A for better lifespan)
Max A Discharge: 37.5A x # Batt (34A for better lifespan)
Max A Grid Charge: 20A x # Batt
TEMPCO: 0mV/C/Cell
BMS Lithium Batt: Not Selected
Float V: 55.6V
Absorption V: 56V
Equalization V: 56V
Equalization Days: 30
Equalization Duration: 2 Hours (tops off battery)
Recommended Shutdown V / Percentage: 50.2V & 20%
Recommended Low Batt V / Percentage: 50.6V & 30%
Recommended Restart V / Percentage: 51.0V & 40%
Battery Resistance: 24mOhms ÷ (battery Count)
Battery Charge Efficiency: 99%
Battery Empty Voltage: 46V

Time	Watts	SOC	GridCharge
1:00AM	1000*Batts	40%	
5:00AM	1000*Batts	40%	
9:00AM	1000*Batts	40%	
1:00PM	1000*Batts	40%	
5:00PM	1000*Batts	40%	
9:00PM	1000*Batts	40%	

These settings will charge the batteries off solar only. Discharge the batteries down to a maximum of 40% full.

Limited To Home mode will not sell to the grid from the batteries (only the home will use battery power).

MODBUS/RJ45 Application Note

BMS Lithium Batt Modes (Subject to Change):

00: CANBus Battery mode – Inverter also acts a ModBus slave with slave ID set by "ModBus SN Setting" (Pg. 32)

01: Storz ModBus Protocol

02: Pylontech ModBus Protocol

03: Old Blue Ion + eGauge / Polarium ModBus Protocol

04: Fortress Power ModBus Protocol

05: Kilovault HAB ModBus Protocol

06: Battery or Battery Controller is ModBus master and writes battery data to inverter's BMS registers (not currently in use).

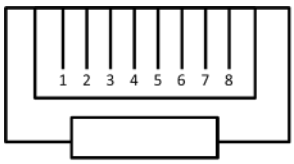
Find our full list of currently supported battery communications
www.sol-ark.com/battery-partners

Our Battery Communications Integration Guide can also be found here
www.sol-ark.com/support

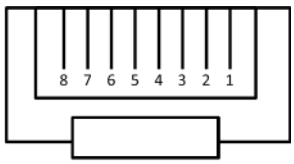
Use the information below at your own risk; the warranty will not cover any damage caused by the improper use of the communications protocols. Read-Only Modbus Map available upon request at support@sol-ark.com

Combined RS-485 and CANBus
Pin 1 or 8 is RS-485 B- (Data -)
Pin 2 or 7 is RS-485 A+ (Data +)
Pin 4 CAN High
Pin 5 CAN Low
Pin 6 is GND

Baud 9600
8bits data
One stop bit, no parity
Does not require termination



End View



Looking Into Connector

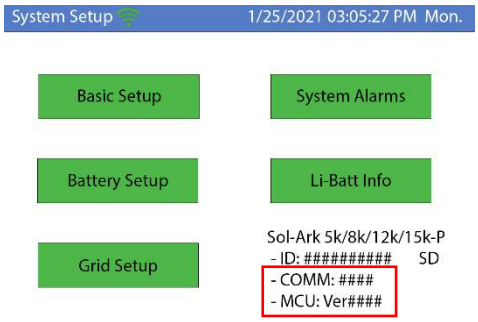
Incorporating 3rd Party ModBus Devices:

If your device utilizes BMS Lithium Batt 00, you need to set the inverter Modbus SN to 01. The default ModBus SN is 00.

If you have more than one inverter, then follow pg. 45 to ensure proper programming.

Before Enabling Parallel Operation

A. Make sure all units in parallel have the same software version.
B. Check the following screen to verify your firmware versions.
C. Go to https://www.sol-ark.com/software-update/ to schedule an update or call/email Tech Support for assistance.
D. Parallel systems **REQUIRE** a joint battery bank. If you do not have a battery, you can keep all Sol-Ark's out of parallel and set every System to Grid Sell Mode.



Stacking Sol-Ark 15K @ 120V/240V Outputs

Parallel 15Ks	Continuous With PV (kW)	Continuous With No PV (kW)	Grid Input Pass Through (kW)	Peak 10sec (VA)
1	15	12	200	30
2	30	24	400	60
3	45	36	600	90
4	60	48	800	120
5	75	60	1000	150
6	90	72	1200	180
7	105	84	1400	210
8	120	96	1600	240
9	135	108	1800	270
10	150	120	2000	300
11	165	132	2200	330
12	180	144	2400	360

Stacking Sol-Ark 15K @ 120V/208V Outputs (3-phase)

Parallel 15Ks	Continuous With PV (kW)	Continuous With No PV (kW)	Grid Input Pass Through (kW)	Peak 10sec (VA)
1*	15	12	200	30
2**	30	24	400	60
3	45	36	600	90
6	90	72	1200	180
9	135	108	1800	270
12	180	144	2400	360

*Two phases only **Three phases but unbalanced (7.5kW, 15kW, 7.5kW)

MUST wire load outputs in parallel for systems to work correctly!

- Communication lines must be connected between parallel units, as shown in the wire diagrams section
    - Preferred shielded CAT 6 cable for this purpose
- Program all units to "Parallel" in the "Basic Setup" screen under the "Parallel" tab
    - Set one system to "Master" | Modbus SN: 1
    - Set all others to "Slave" | Modbus SN: 2,3,4…
    - Phases B/C for 120V/208V installations only
    - Power up slaves first, then Master
        - You will get an F29 or F41 error until both slaves and Master are on

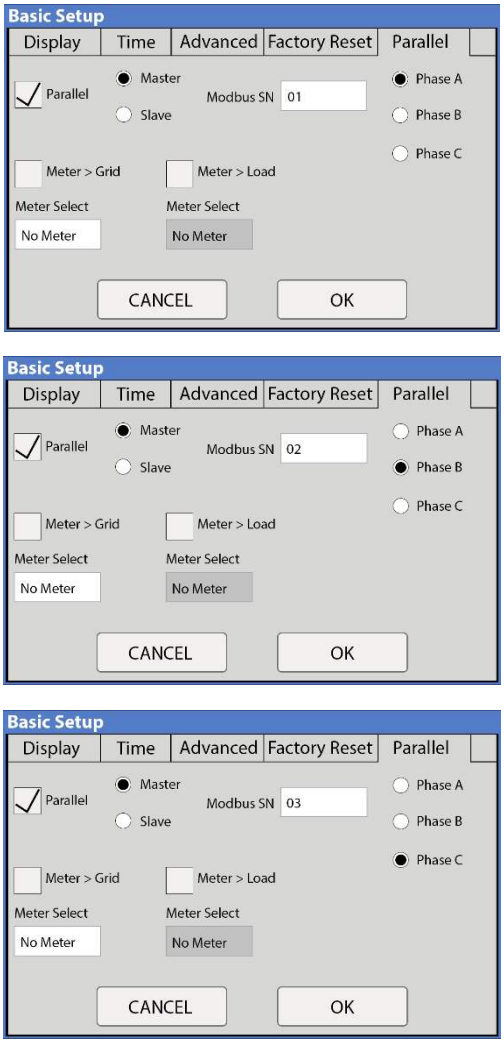
Note: You must always fully power cycle all inverters after enabling or disabling parallel settings. Check Pg. 24 for more info on Power cycling.

- All parallel systems must connect to the **same battery bank** through their battery breakers
    - Generators must connect to all systems in parallel as well

Note: The values shown on the home screen of each system represent each system's contribution, not the total of the array.

- If an error or fault occurs on any unit, all units will shut down. They will automatically attempt to restart up to 5 times before requiring a manual restart. If a manual restart is necessary, first resolve the issue that caused the shutdown. For this reason, we recommend using a bypass switch for large installs (as shown in the diagrams section Pg. 12-15).
    - A manual restart requires powering down the system (See Pg. 24).
- Systems = 1 @ 208V
    - Master Ph A Modbus=1: Inv_L1 = **Grid_L1**|| Inv_L2 = **Grid_L2**
- Systems = 2 @ 208V
    - Master Ph A Modbus=1: Inv_L1 = **Grid_L1**|| Inv_L2 = **Grid_L2**
    - Master Ph B Modbus=2: Inv_L1 = **Grid_L2** || Inv_L2 = **Grid_L3**
- Systems = 3 @ 208V
    - Master Ph A Modbus=1: Inv_L1 = **Grid_L1** || Inv_L2 = **Grid_L2**
    - Master Ph B Modbus=2: Inv_L1 = **Grid_L2** || Inv_L2 = **Grid_L3**
    - Master Ph C Modbus=3: Inv_L1 = **Grid_L3** || Inv_L2 = **Grid_L1**

3 System Install: Master Ph A (Top), Master Ph B (Middle), and Master Ph C (Bottom)



6 Systems @ 208V

Master Ph A Modbus=1	|	Slave	Ph A Modbus=2
Master Ph B Modbus=3	|	Slave	Ph B Modbus=4
Master Ph C Modbus=5	|	Slave	Ph C Modbus=6

9 Systems @ 208V

Master Ph A Modbus=1	|	Master	Ph B Modbus=4
Slave Ph A Modbus=2	|	Slave	Ph B Modbus=5
Slave Ph A Modbus=3	|	Slave	Ph B Modbus=6
Master Ph C Modbus=7	|	Slave	Ph C Modbus=8
Slave Ph C Modbus=9			

12 Systems @ 208V

Master Ph A Modbus=1	|	Master	Ph B Modbus=5
Slave Ph A Modbus=2	|	Slave	Ph B Modbus=6
Slave Ph A Modbus=3	|	Slave	Ph B Modbus=7
Slave Ph A Modbus=4	|	Slave	Ph B Modbus=8
Master Ph C Modbus=9	|	Slave	Ph C Modbus=10
Slave Ph C Modbus=11	|	Slave	Ph C Modbus=12

LCD is not powering on

- Check all connections- at least one of the following power sources is required: PV/Grid/Battery
- Try pressing the power button, touchscreen, or navigation buttons

Panels are connected, but DC Light is not on

- PV voltage must be 150V-425V | It's night

Panels are not producing

- Check for proper wiring on all solar panel connections
- Turn PV disconnect "ON"
- Check that the PV input voltage is not greater than 500V
- If the system says PV = 0V, check PV polarity

Panels are not producing much power

- PV Wire Strip Length: 5/8". Your batteries are charged; you can test Grid Sell to verify.

The system does not keep batteries charged

- Check the charge setting in the Charge Menu

Auto Gen-Start is not working

- Check to make sure your generator is compatible with Auto Start
- Make sure that the Auto Gen Start wire is adequately connected to the Sol-Ark 15K and the generator

Normal LED isn't on

- Sol-Ark 15K is in pass-through-only mode, only a Grid connection.
- Sol-Ark 15K is not working correctly (Call us)

The alarm light is on

- Check the system alarms menu to identify the alarm

Grid HM value is negative when it should be positive (only applies in limited home mode)

- Limiter Sensors are backward, L1/L2 sensors are swapped, or incorrectly wired L1/L2 sensors. Try Auto Learn.

AC Overload Fault or Bus Unbalance Fault

- Check Transfer Switch/Subpanel wiring
- Check for large loads that consume more than the inverter rating (EX: AC units over 3 tons)

The system connects to grid and quickly disconnects

- With a DMM, verify your Neutral wire connection (should be 0 Vac referenced to GND)
- Check your Freq is set to 60Hz, and the 15K measures 120V on L1 / L2 vs. N.
- If overloading: verify 120/240V grid input and load output wires are not swapped.
- If 120/208V, the L1 and L2 are phase-specific. So, you may have to swap Grid L1 / L2 for 208V applications.

DC Overload Fault

- Check PV voltage
- Make sure you have not wired more than two (2) solar strings in parallel

System is beeping

- Check the system alarms menu to see which alarm has been triggered. Most alarms will self-reset.
- There is no battery connected. If not using a battery, select no battery and disable activate batt in Batt menu.
    - Turn off the center button, remove AC Grid and PV Power for the 30s (screen is dead), and then power up to fully reset the system.

Battery cable sparks when connected

- Put the built-in battery breaker in the off position before connecting or disconnecting batteries.

Battery symbol on the home screen is red

- The battery is under-Voltage or over-Voltage

Battery symbol on the home screen is yellow

- The battery is low, or the charge/discharge current is close to the programmed limit (which is ok)

Grid symbol on the home screen is yellow

- Grid parameters are out of specified range or grid is down

System has restarted

- It happens if the system is overloaded, battery voltage is greater than 63V, or Software update

Batteries were connected backward

- The battery breaker will trip. It can cause damage!

Why is the LCD screen still on when the power button is off?

- If PV or Grid power, LCD stays on, but the inverter and loads are off.

The Batt % meter is not reaching 100%

- The system needs to go through a small discharge/charge cycle first to calibrate the battery

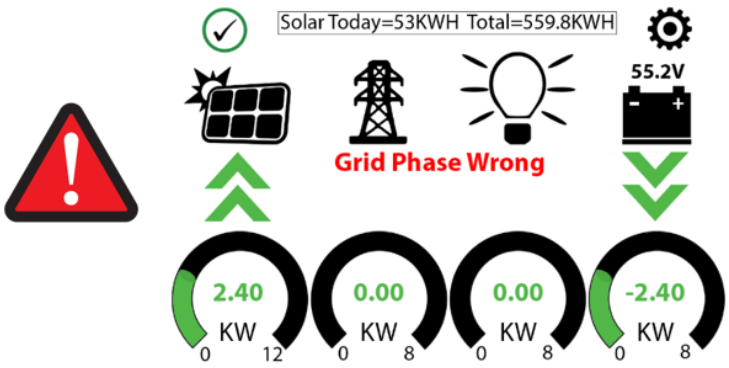
Generator setup is reading 0Hz

- Select "General Standard" instead of UL1741. Then widen the frequency range to 55Hz-65Hz.

Color Touchscreen is Frozen

- Press and hold the escape button [←] for 7-10 seconds

Troubleshooting Phasing Issues



If the Sol-Ark screen shows **Grid Phase Wrong,** there is a phasing issue with your wiring, and it may cause overload faults (F18, F26, F34) even with the Load breaker **off** and **WILL CAUSE DAMAGE if left unchecked**.

Single Sol-Ark: To locate the improperly wired phases, measure **L1** to **L1 (Top Screws)** between the **Grid** and **Load** breaker; you should see 0V AC. Repeat for **L2** to **L2** between the **Grid** and **Load** breaker. Attempt to correct the wiring until you are only reading 0V AC between **L1** to **L1** & **L2** to **L2**.

Parallel inverters: measure L1 of the **Grid** breaker to L1 of another unit's **Grid** breaker; you should see 0V AC. If in 208V parallel, measure the lines of the same wire color between sol-arks to see if you read 0V AC.

Make sure to correct both the Grid and Load wiring; they both need to be correct.

If the error persists, you will need to check your AC wiring beyond the inverter and may also need to verify that the phases are properly labeled coming from your meter.

Sol-Ark 15K Error Codes

Fault	Instruction	Common Cause/Remedy
F1	DC Inversed Failure	If you have parallel systems and turn one system off, you with get this notification. **NOT** a fault.
F8	GFDI_Relay_Failure	Current Leakage from inverter AC output to Ground, check Ground and neutral are connected at the main panel
F13	Grid_Mode_change	It can happen when not using batteries or if Grid Input settings are changed. This is a notification, **NOT** a fault. If you switch from No Batt to Battery mode, power the system down completely to restart.
F15	AC_OverCurr_Failure	It is usually caused by Loads too large for the inverter. If off-grid, the battery discharge amps are programmed too low. Overloads can result in F15, F18, F20, or F26.
F16	GFCI_Failure	Ground fault. Check PV+ or PV- wiring (which must be ungrounded). Exposed PV conductors + rain can also cause. Check that the neutral line and Ground are not double-bonded (common with portable generators).
F18	Tz_Ac_OverCurr_Fault	Overloaded the Load Output (reduce loads) or overloaded a generator (reduce Gen Start A see pg. 33). Wiring Short on the AC Side can also cause this error. Overloads can result in F15, F18, F20, or F26.
F20	Tz_Dc_OverCurr_Fault	It is typically caused by DC current from the battery that is too large (ex: 4 Ton AC Unit) or too much PV current (3 or more strings in parallel). Overloads can result in F15, F18, F20, or F26.
F22	Tz_EmergStop_Fault	Initiated Emergency Stop; see sensor pinout table.
F23	Tz_GFCI_OC_Fault	PV Ground fault. Check PV+ or PV- wiring (which must be ungrounded or damage can occur). Typically caused by pinched PV wire grounding the PV+ or PV-. Grounded PV wire can cause F20, F23, or F26.
F24	DC_Insulation_Fault	An exposed PV conductor combined with moisture is faulting (can cause F16, F24, F26).
F25	AC_Active_Batt_Fault	No battery connection to the Inverter and Activate Battery is enabled. Disable Activate Battery in settings while no battery is connected.
F26	BusUnbalance_Fault	Too much load on one leg (L1 or L2) Vs. the other leg or DC loads on the AC output when off-grid. Grounded PV +/- wire can cause F20, F23, or F26.
F29	Parallel_CANBus_Fault	Usually, a communication error for parallel systems, check cables and MODBUS addresses (pg. 44)
F30	AC_MainContactor_Fault	Contact Sol-Ark.com
F31	Soft_Start_Failed	Soft Start of large motor failed
F34	AC Overload Fault	AC Overload or load shorted. Reduce heavy loads.
F35	AC_NoUtility_Fault	Grid connection lost
F37	DCLLC_Soft_Over_Cur	Software DC overcurrent
F39	DCLLC_Over_Current	Hardware DC overcurrent
F40	Batt_Over_Current	Batteries exceeded their current discharge limit
F41	Parallel_System_Stop	If one system faults in parallel, this normal fault will register on the other units as they disconnect from grid
F45	AC_UV_OverVolt_Fault	Grid under-voltage causes a disconnect. This will self-reset when the grid stabilizes.
F46	Parallel_Aux_Fault	Cannot communicate with other parallel systems. Check Master = 1, Slaves are 2-9, ethernet cables are connected.
F47	AC_OverFreq_Fault	Grid over Frequency (common in power outages) causes a disconnect. Will self-reset when grid stabilizes.
F48	AC_UnderFreq_Fault	Grid under Frequency (common in power outages) causes a disconnect. Will self-reset when grid stabilizes.
F55	DC_VoltHigh_Fault	PV may be higher than 500V. Battery voltage should not be above 59V or 63V (depending on the model).
F56	DC_VoltLow_Fault	Batteries are overly-discharged, inverter is off grid and exceeded programmed batt discharge current by 20%, or Lithium BMS has shut down. If battery settings are incorrect, this can also happen.
F58	BMS communication fault	Sol-Ark is programmed to BMS Lithium Battery Mode but cannot communicate with a BMS
F60	Gen_Volt_or_Fre_Fault	Generator Voltage or Frequency went outside the allowable range
F61	Button_Manual_OFF	The parallel Slave system turned off without turning off Master
F63	ARC_Fault	It can be a poor PV connector/connection. And sometimes a false alarm due to powerful lightning storms.
F64	Heatsink_HighTemp_Fault	Check the built-in fans are running; ambient temp may be too high. Ensure proper clearance (pg. 6).

Install Verification Checklist

<u>For installer to complete AFTER the system is operational. The purpose is to protect the installer, homeowner, and inverter.</u>

1. Is the 15K installed where the **<u>LCD is protected from direct sunlight</u>** and has 2" clearance left and right for cooling? **Y/N**
2. Are all the battery lugs tightened? **Y/N**
3. 15K should connect to the grid, 15K load breaker ON, Grid disconnect ON, batteries connected, PV input ON and ON button ON. With the inverter running the Backup load's panel and Grid-connected:
   A. Did any breakers trip? **Y/N**
   B. Did inverter overload? **Y/N**
4. If you have problems, please take pictures of these and email to: support@ Sol-Ark.com
   A. Battery icon screen, showing detailed voltages (the screen shown below)
   B. Sol-Ark 15K with batteries and of user wiring area
5. Load and solar test
   A. Press the battery icon for the detailed voltages screen.
   B. Is batt temp sensor working? **Y/N**
   C. Turn on many loads for the Backup circuits. Are solar panels producing enough power to match the load (provided there is enough sun)? **Y/N**
   D. Program Full Grid Sell Mode. If there are enough panels and sun or light loads in the entire house, the Grid HM measurements will be negative on both L1/L2. Are they negative (solar selling back to the grid)? **Y/N**
   E. Program limited power to home mode. The Grid HM sensors will be near zero or slightly positive. Are they both near zero and canceling out the whole home power? **Y/N**
   F. You have verified the limit sensors are correctly installed. An auto-learn function corrects any mistakes in CT limiter wiring (provided you have batteries and in 120/240V). Program in the correct Grid mode the customer will use.
6. Did you program the correct Ah for the battery bank and max Amps charge/discharge? **Y/N**
7. Did you program the correct battery charge voltages for your battery type? **Y/N**
8. **<u>Turn off the AC breaker, so 15K operates in an off-grid mode for several minutes.</u>** Are appliances still powered? **Y/N**
9. **<u>Turn off PV input, running only on batteries for several minutes.</u>** Are appliances still powered? **Y/N**
10. Turn on PV input and AC Grid inputs.
11. Did you set up the Wi-Fi plug to the customer's internet? **Y/N**
12. Absolutely important for software updates. Did you help the customer register system on Monitoring App? **Y/N**
13. Does the customer have a standby generator or a small portable Generator? **Y/N**
    A. Did you turn off UL1741/IEEE1547 (use General Standard) and reprogram grid freq. range to 55-65Hz? **Y/N**
    B. Did you enable Gen charging and adequately set the charge current if using a small gas generator on Gen inputs? **Y/N**
14. If EMP protected, did you install EMP Suppressors on essential appliance cords? **Y/N**

This checklist must be filled out and submitted to register your warranty. Please visit:

https://www.sol-ark.com/register-your-sol-ark/

_____	_____	_____
Installer Name	Installer Signature	Date

_____	_____	_____
Customer Name	Customer Signature	Date

Sol-Ark 15K Limited Warranty

10-Year Limited Warranty for SOL-ARK (Portable Solar LLC) Products. Sol-Ark provides a Ten-year (10) limited Warranty ("Warranty") against defects in materials and workmanship for its Sol-Ark products ("Product"). The term of this warranty begins on the Product(s) initial purchase date, or the date of receipt of the Product(s) by the end user, whichever is later. This must be indicated on the invoice, bill of sale from your installer. This warranty applies to the original Sol-Ark Product purchaser and is transferable only if the Product remains installed in the original use location. Please call Sol-Ark to let us know if you are selling your Home and give us name and contact of the new owner.

The warranty does not apply to any Product or Product part that has been modified or damaged by the following:

- Installation or Removal (examples: wrong voltage batteries, connecting batteries backward, damage due to water/rain to electronics, preventable damage to solar wires.)
- Alteration or Disassembly
- Normal Wear and Tear
- Accident or Abuse
- Unauthorized Firmware updates/software updates or alterations to the software code
- Corrosion
- Lightning: unless using EMP hardened system, then Portable Solar will repair the product
- Repair or service provided by an unauthorized repair facility
- Operation or installation contrary to manufacturer product instructions
- Fire, Floods, or Acts of Nature
- Shipping or Transportation
- Incidental or consequential damage caused by other components of the power system
- Any product whose serial number has been altered, defaced, or removed
- Any other event not foreseeable by Portable Solar, LLC

Contact Us: 1-972-575-8875

For Info/Purchasing:

sales@sol-ark.com **| ext.1**

For Tech Support/Warranty Claim:

support@sol-ark.com **| ext.2**

For Administrative Help:

ext.3

Sol-Ark (Portable Solar LLC) liability for any defective Product, or any Product part, shall be limited to the repair or replacement of the Product, at Portable Solar LLC discretion. Sol-Ark does not warrant or guarantee workmanship performed by any person or firm installing its Products. This warranty does not cover the costs of installation, removal, shipping (except as described below), or reinstallation of Products or parts of Products. LCD screen and fans are covered for 5 years from date of purchase.

THIS LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY APPLICABLE TO SOL-ARK (PORTABLE SOLAR LLC) PRODUCTS. SOL-ARK EXPRESSLY DISCLAIMS ANY OTHER EXPRESS OR IMPLIED WARRANTIES OF ITS PRODUCTS. SOL-ARK ALSO EXPRESSLY LIMITS ITS LIABILITY IN THE EVENT OF A PRODUCT DEFECT TO REPAIR OR REPLACEMENT IN ACCORDANCE WITH THE TERMS OF THIS LIMITED WARRANTY AND EXCLUDES ALL LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION ANY LIABILITY FOR PRODUCTS NOT BEING AVAILABLE FOR USE OR LOST REVENUES OR PROFITS, EVEN IF IT IS MADE AWARE OF SUCH POTENTIAL DAMAGES.

Return Policy - **No returns will be accepted without prior authorization** and must include the Return Material Authorization (RMA) number. Please call and talk to one of our engineers to obtain this number at 972-575-8875.

Return Material Authorization (RMA) A request for an RMA number requires all of the following information: 1. Product model and serial number; 2. Proof-of-purchase in the form of a copy of the original Product purchase invoice or receipt confirming the Product model number and serial number; 3. Description of the problem; 4. Validation of problem by Technical Support, and 5. Shipping address for the repaired or replacement equipment. Upon receiving this information, the Sol-Ark representative can issue an RMA number.

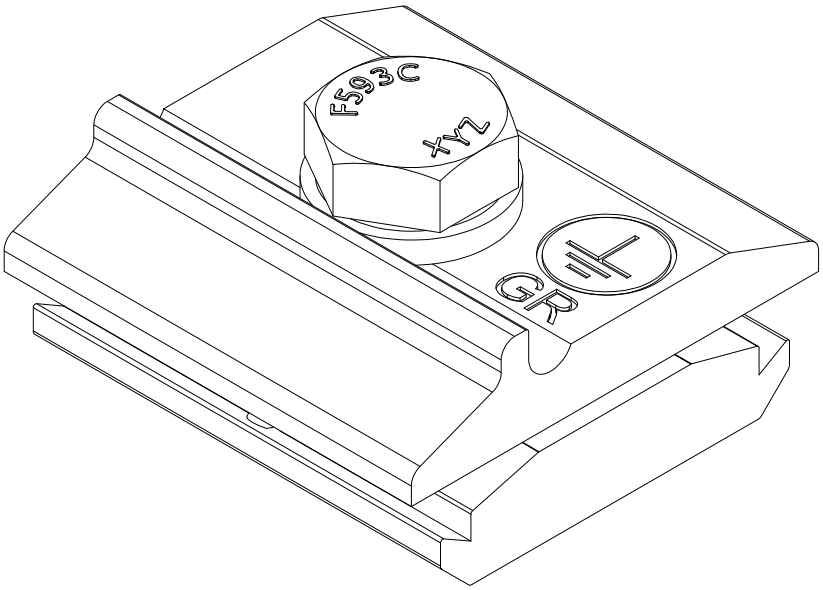
Any product that is returned must be brand new, in excellent condition and packaged in the original manufacturer's carton with all corresponding hardware and documentation. Returns must be shipped with prepaid freight and insured via the carrier of your choice to arrive back at Portable Solar within 30 days of your initial delivery or pick-up. **Shipping charges will not be refunded**.

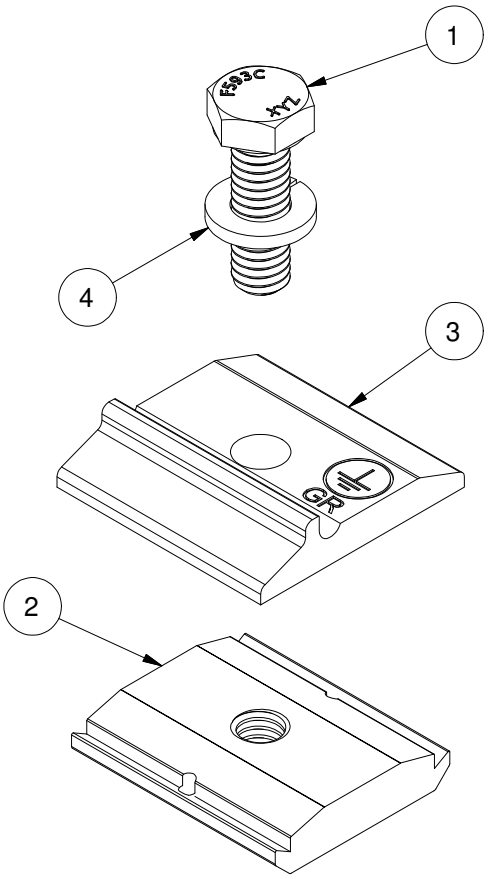
All returns are subject to a 35% restocking fee. **No returns will be accepted beyond 30 days of original delivery.** The value and cost of replacing any items missing (e.g. parts, manuals, etc.) will be deducted from the refund. If you have any questions regarding our return policy, please email us at sales@sol-ark.com or call us at the number above during regular (M-F) business hours.

Sol-Ark 15K Install Operational Verification Checklist Questionnaire must be filled out, signed, and dated to secure full warranty coverage.

DESCRIPTION:	DRAWN BY:	SnapNrack™ Solar Mounting Solutions
SNAPNRACK, GROUND LUG	D.Ryan	
PART NUMBER(S):	REVISION:	
242-02101	A	

595 MARKET STREET, 29TH FLOOR • SAN FRANCISCO, CA 94105 USA
PHONE (415) 580-6900 • FAX (415) 580-6902





PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	BOLT, HEX CAP, 5/16IN-18 X 1IN, SS
2	1	SNAPNRACK, BONDING CHANNEL NUT
3	1	SNAPNRACK, GROUND LUG R PRC
4	1	5/16IN SS SPLIT LOCK WASHER

MATERIALS:	TIN-PLATED ALUMINUM, STAINLESS STEEL	OPTIONS:
DESIGN LOAD (LBS):	N/A	
ULTIMATE LOAD (LBS):	N/A	
TORQUE SPECIFICATION:	16 LB-FT	
CERTIFICATION:	UL 467 & UL 2703, FILE E359313	
WEIGHT (LBS):	0.13	

DESCRIPTION:

SNAPNRACK, GROUND LUG

PART NUMBER(S):

242-02101

DRAWN BY:

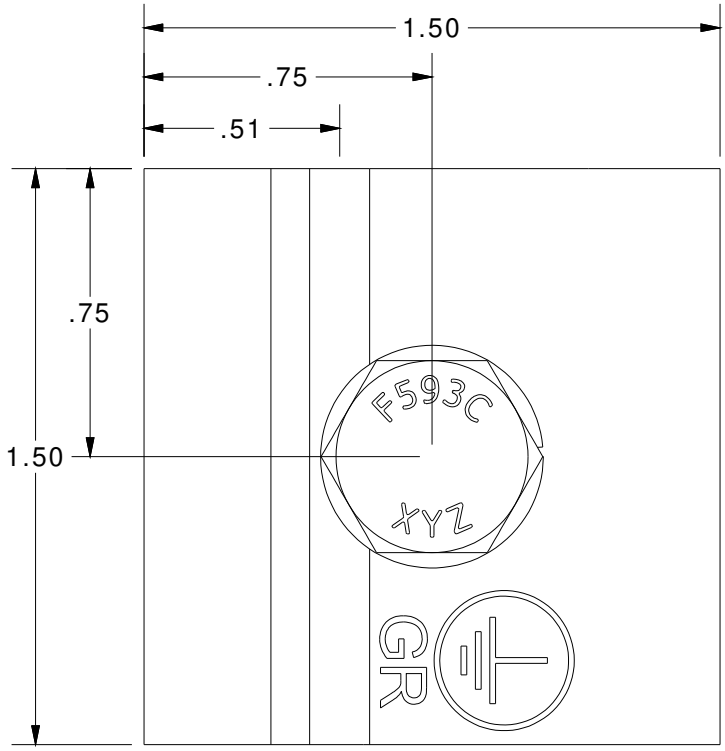
D.Ryan

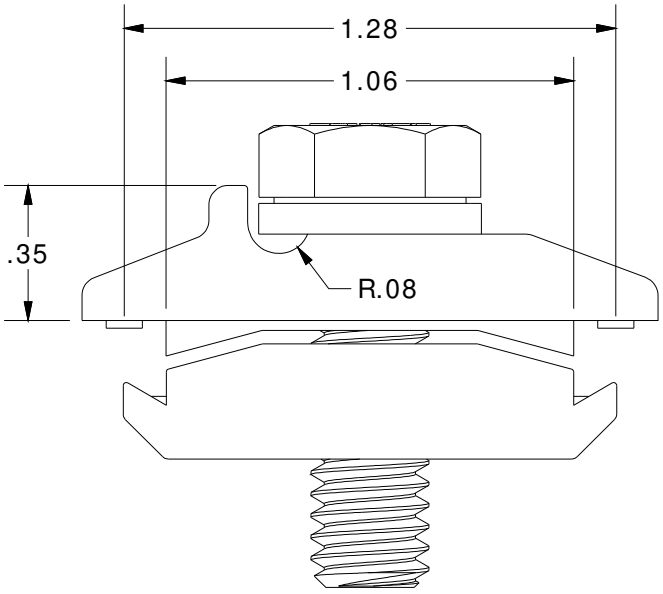
REVISION:

A

SnapNrack™
Solar Mounting Solutions

595 MARKET STREET, 29TH FLOOR • SAN FRANCISCO, CA 94105 USA
PHONE (415) 580-6900 • FAX (415) 580-6902



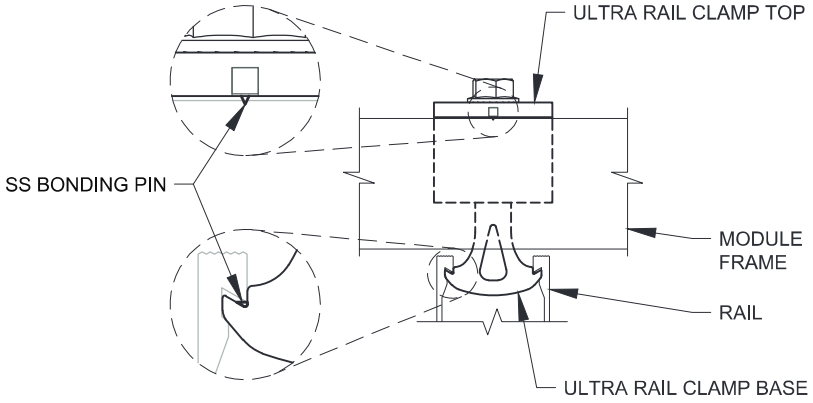


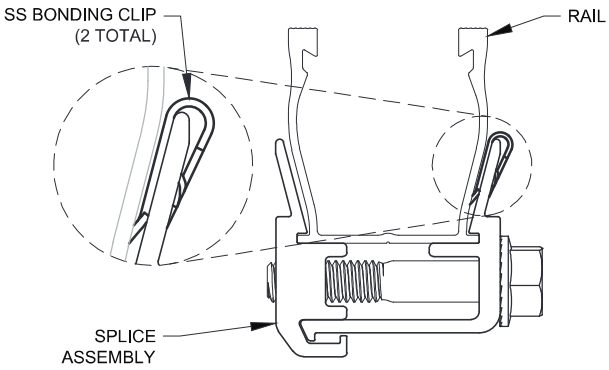
ALL DIMENSIONS IN INCHES

Grounding Specifications

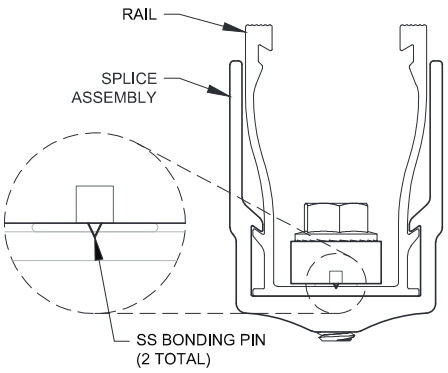
System Bonding Methods

1. SnapNrack Ultra Rail Mid Clamp
2. SnapNrack Ultra Rail End Clamp
3. SnapNrack Mid Clamp
4. SnapNrack Adjustable End Clamp
5. SnapNrack UR-40 Rail Splice
6. SnapNrack UR-60 Rail Splice



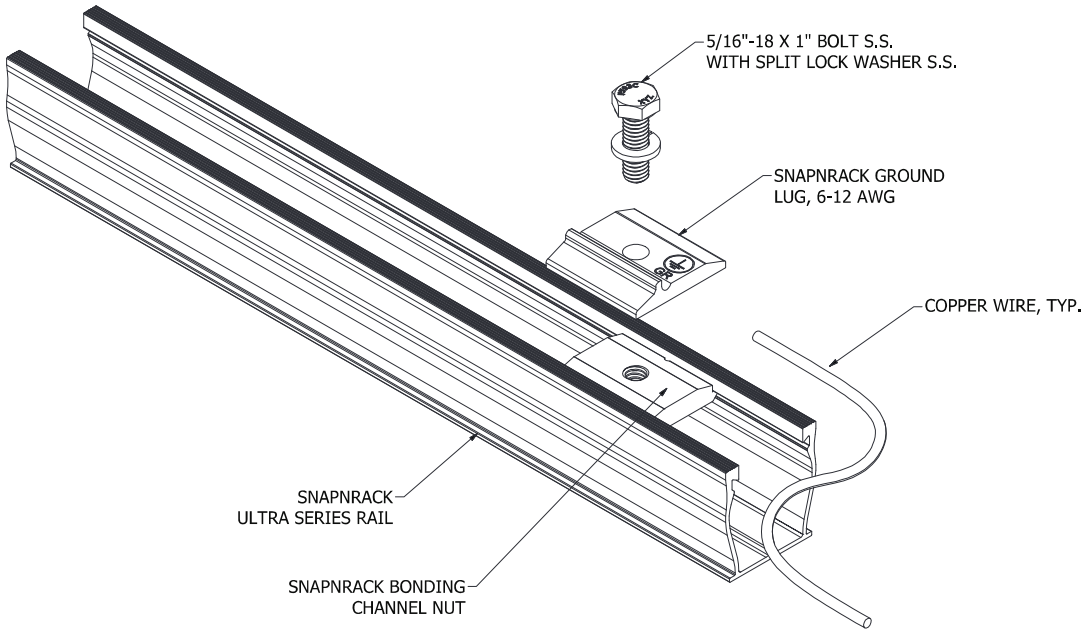


Note:
SnapNrack Ultra Rail Splices contain integral bonding clips in assembly to properly bond the system.



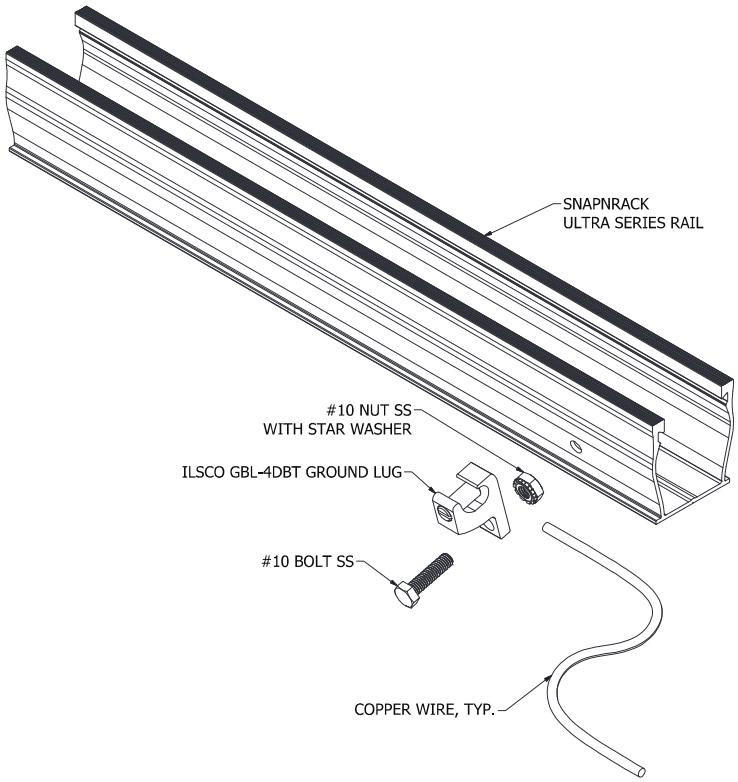
Note:
SnapNrack module clamps contain a SnapNrack Channel Nut with integral bonding clips or pins in assembly to properly bond the system (except Universal End Clamps).

SnapNrack Ground Lug Assembly

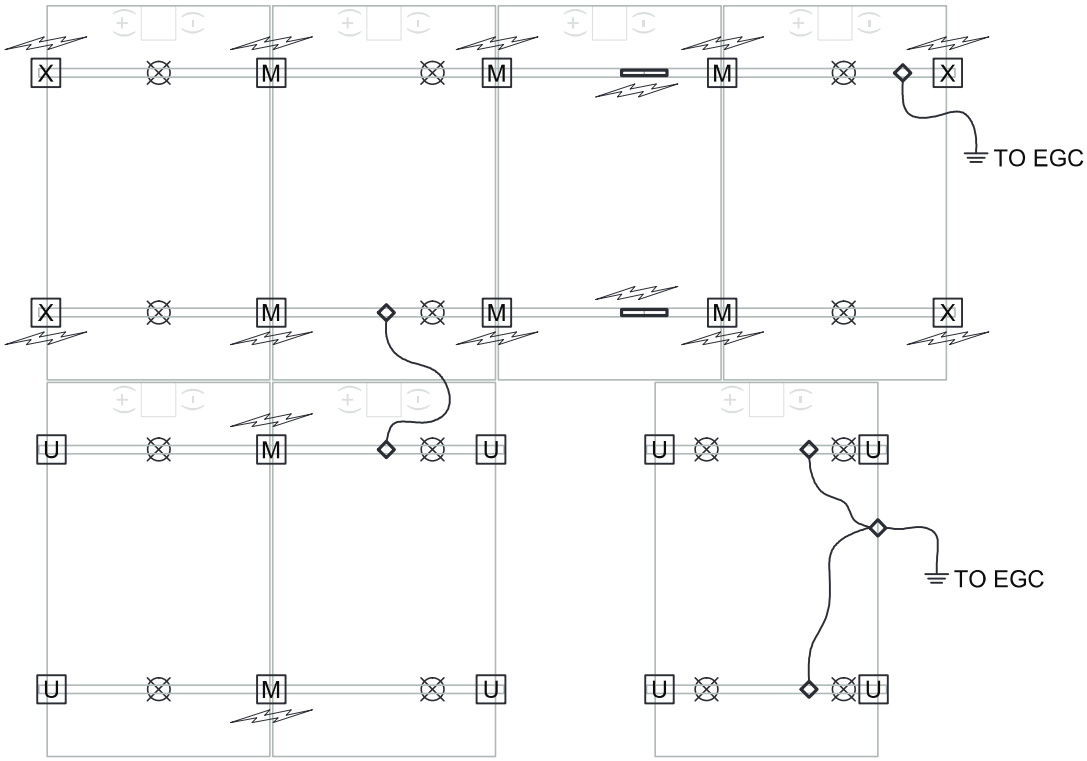


Grounding Specifications

Ilsco Lay-in Lug Assembly



Ground Path Details

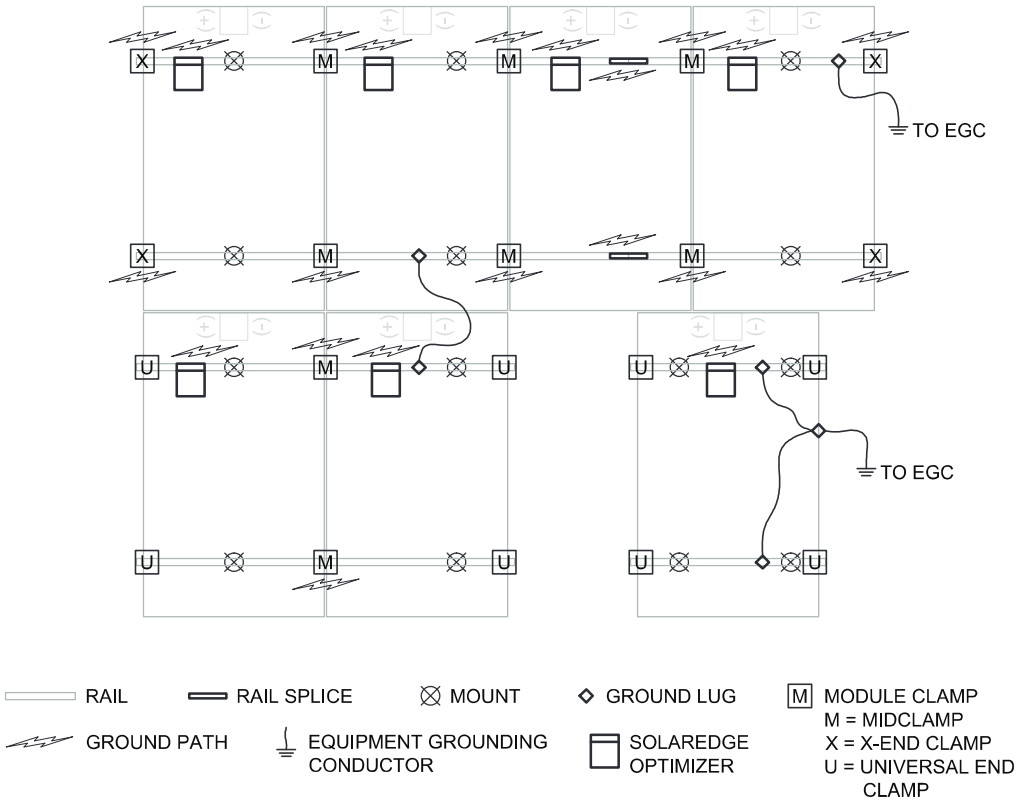


RAIL — RAIL SPLICE — MOUNT — GROUND LUG — M MODULE CLAMP

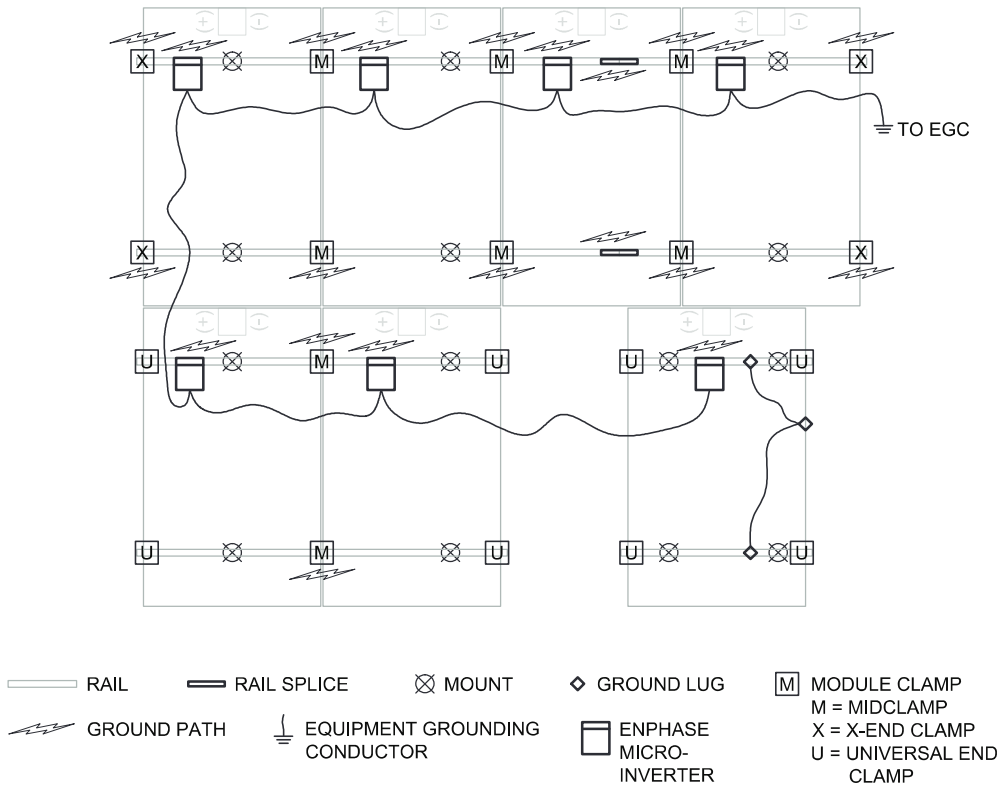
GROUND PATH — EQUIPMENT GROUNDING CONDUCTOR

M = MIDCLAMP
X = X-END CLAMP
U = UNIVERSAL END CLAMP

Ground Path Details - SolarEdge



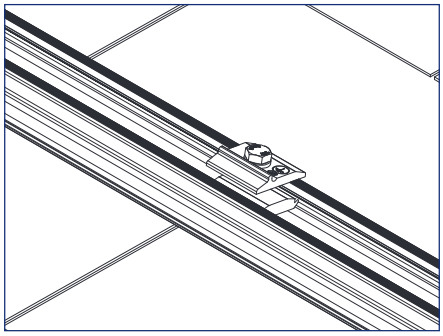
Ground Path Details - Enphase



Grounding Specifications

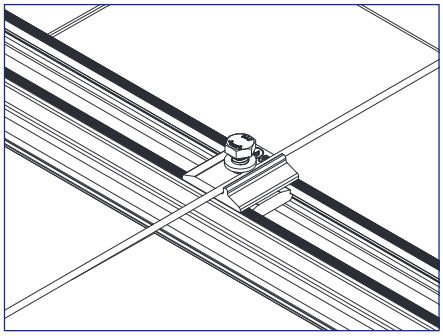
snapnrack.com

INSTALLATION INSTRUCTIONS - SNAPNRACK GROUND LUG



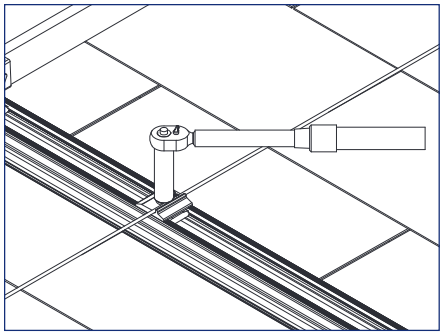
1) Snap the SnapNrack Ground Lug into the rail channel on **one rail per module row.**

Install Note:
SnapNrack Ground Lug may be used in side or top channel, and may be rotated 90 degrees relative to slot to facilitate running copper across top of rails.



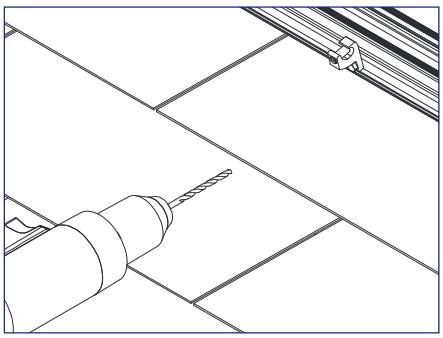
2) Place grounding conductor into slot underneath split ring washer.

Install Note:
SnapNrack Ground Lug only Listed for use with 6-12 AWG solid copper conductor.



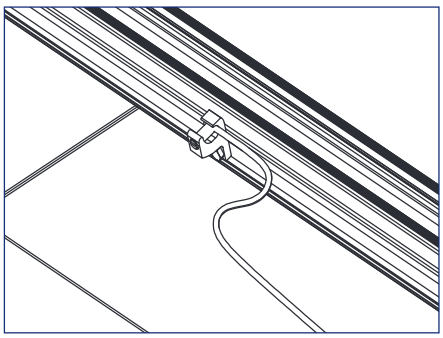
3) Tighten hardware to 16 ft-lbs.

INSTALLATION INSTRUCTIONS - ILSCO LAY-IN LUG

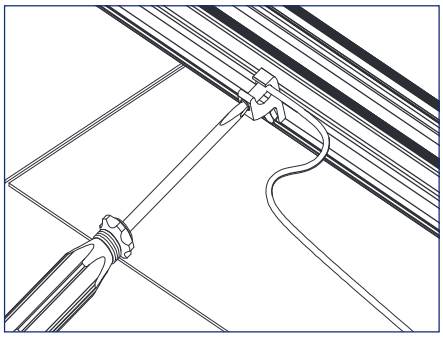


1) Drill and deburr a 1/4" hole in the back side of the rail for the Ilsco lug to attach to, place the bolt through the hole, and attach the lug assembly on **one rail per module row.**

Install Note:
Torque rail connection to 35 in-lbs.



2) Place grounding conductor into slot.



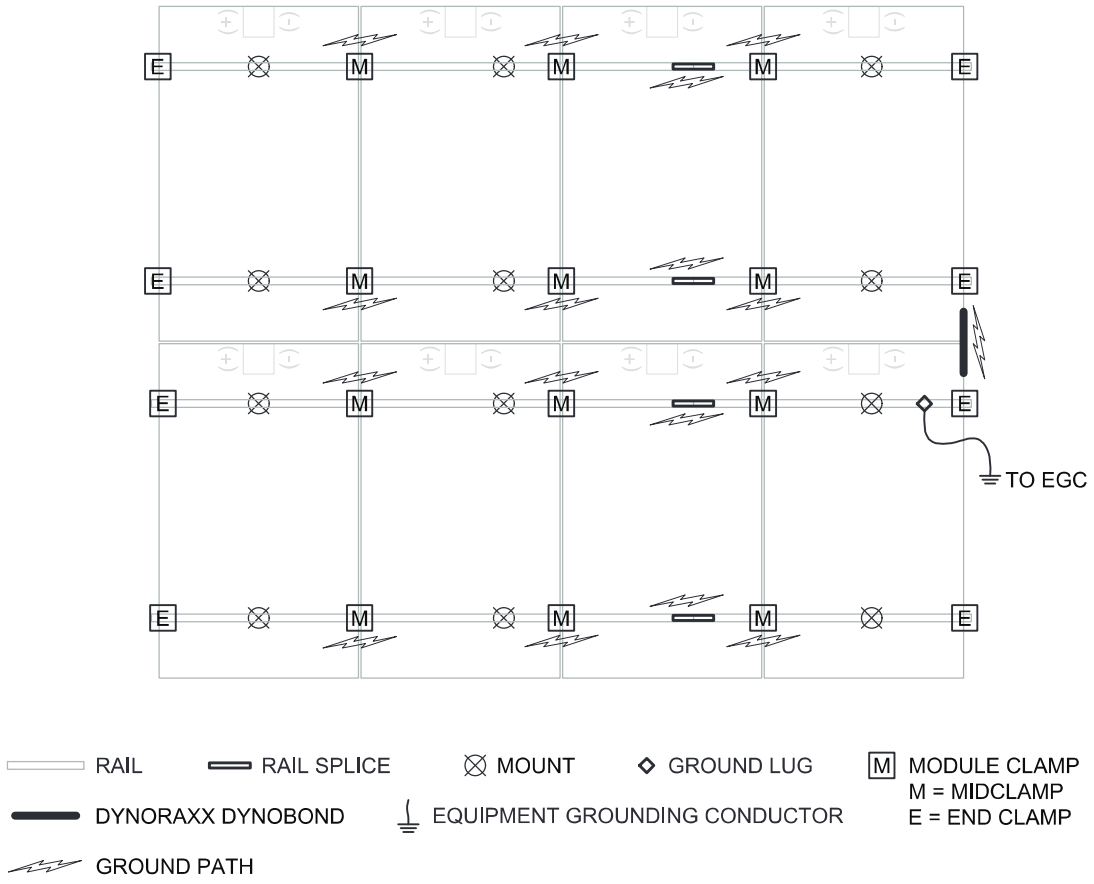
3) Tighten set screw per Ilsco's recommendation (see below).

Install Note:
Torque set screw to 20 in-lbs for #10-#14 solid and stranded copper, 25 in-lbs for #8 stranded copper, and 35 in-lbs for #4-#6 stranded copper.

Note:

- System has been evaluated to a maximum overcurrent device (OCD) protection level of 20 Amps.
- Universal End Clamp (UEC) does not bond module to rail. Be sure to separately ground any modules that are only secured by UECs, especially during servicing.
- SnapNrack recommends that bare copper never come into contact with aluminum.
- SnapNrack Ground Lug: torque bolt to 16 ft-lbs. The Ground Lug may be used in side or top channel. It may be rotated 90 degrees relative to slot to facilitate running copper across top of rails.
- Grounding with a standard Ilsco GBL-4DBT Lug is a listed alternate and requires drilling of a hole in the rail.
- Ilsco hardware connection to rail: 5 ft-lbs. Torque for lug set screw: #10-#14 solid and stranded copper- 20 in-lbs, #8 stranded copper- 25 in-lbs, #4-#6 stranded copper- 35 in-lbs.

Ground Path Details - DynoBond



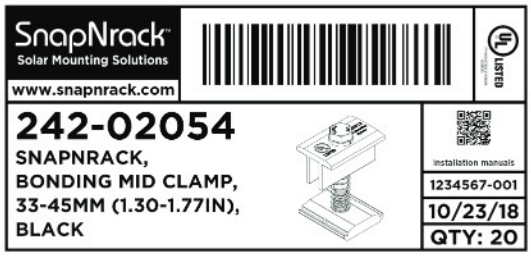
R/C (QIMS2), DynoRaxx (E357716) photovoltaic bonding jumper cat. no. DynoBond is an optional component that may be used with this system. The DynoBond jumper has been evaluated to provide module to module bonding. The DynoBond device attaches to the frame flange of adjacent modules.

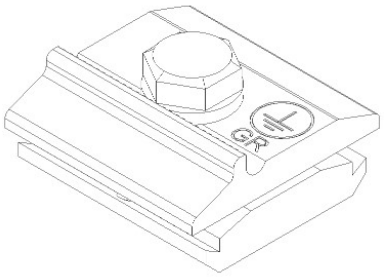
Grounding Specifications

GROUNDING MARKING DETAILS

All components included in the Ultra Rail UL 2703 Listing for grounding/bonding are packaged and marked with the UL logo, SnapNrack File E359313, and "PV Mounting System"

The SnapNrack Ground Lug is marked with the ground symbol
Ilsco Ground Lugs have green colored set screws or bolts to indicate connection to the grounding electrode conductor





INSTRUCTION FOR MAINTAINING THE GROUNDING BONDING WHEN REMOVING A MODULE FOR SERVICING

CAUTION: Module removal may disrupt the bonding path and could introduce the risk of electric shock. Additional steps may be required to maintain the bonding path. Modules should only be removed by qualified persons in compliance with the instructions in this manual.

Module removal is not presented as a frequently expected occurrence and will not be required as part of routine maintenance.

Scenarios that could result in a disruption of the bonding path are, for example irregularly-shaped arrays, arrays consisting of individual rows, and any other scenario where module removal could disrupt the bonding path.

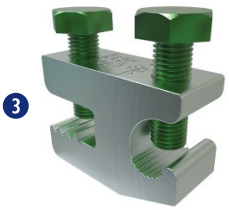
In most cases, the removal of a module for servicing will not disturb or break grounding continuity because SnapNrack Ultra Rail systems are bonded through the rail. If a module is to be removed that will break continuity, these are the steps that must be taken to maintain a continuously bonded SnapNrack Ultra Rail system.

Required Tools

- Socket Wrench
- Torque Wrench
- 1/2" Socket
- 7/16" Socket

Required Materials

1. #10 Or Larger Bare Copper Conductor
2. SnapNrack SKU 242-02101
3. Ilsco Part No. SGB-4
4. DnoRaxx Dynobond™

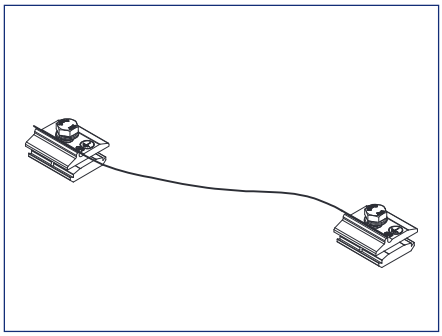


Maintaining the Grounding Bonding When Removing a Module

JUMPER ASSEMBLY INSTRUCTION & INSTALLATION

CAUTION: Do Not Remove the Module until the Jumper is installed

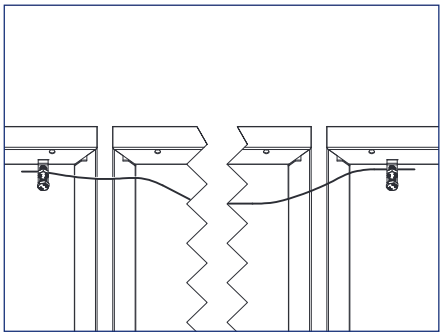
1) Identify the existing ground path at the location of module removal and choose an appropriate length of #10 bare copper to bridge the soon to be broken ground path.



Example of assembled bonding jumper using (2) SnapNrack Ground Lugs

2) Attach one ground lug to each end of #10 bare copper wire. See recommended options below:

1. (2) SnapNrack SKU: 242-02101
2. (2) Ilsco part no. SGB-4
3. (1) SnapNrack part no. 242-02101 & (1) Ilsco part no. SGB-4
4. (1) DroRaxx DynoBond™



3) Before the module is removed, attach the assembled bonding jumper. Depending on where the module will be removed and choice of ground lug, jumper attachment locations will vary.

- Ilsco SGB-4 lugs can be attached to SnapNrack Ultra Rail, or module frames
- SnapNrack Ground Lug can only be attached to SnapNrack Ulra Rail
- DynoRaxx DynoBond™ is approved and appropriate when a short bonding jumper is needed from module to module, or module to rail

4) Service the array. With the bonding jumper installed, it is now safe to remove the module for service or maintenance.

5) After Servicing the array reinstall the module and original ground path. Only then remove the bonding jumper.

Caution: Do not remove the bonding jumper until original ground path is established.

Grounding Specifications

Ultra Rail has been tested with the following UL Listed modules:

The Ultra Rail System employs top-down clamps which have been evaluated for frame-to-system bonding, at specific mounting torques and with the specific modules listed below.

Ultra Rail has been tested with the following UL Listed module series: The Ultra Rail System employs top-down clamps which have been evaluated for frame-to-system bonding, at specific mounting torques and with the specific module series listed below. All wattage values are covered.

Manufacturer	Model	
Aptos Solar	DNA-120-MF23-XXX	DNA-120-MF26-XXXW
	DNA-120-BF23-XXX	DNA-144-MF26-XXXW
	DNA-144-MF23-XXX	DNA-120-BF26-XXXW
	DNA-144-BF23-XXX	DNA-144-BF26-XXXW
Boviet Solar	BVM6610P-XXX	BVM6612P-XXX
	BVM6610M-XXX	BVM6612M-XXX
Canadian Solar	CS6K-XXX-M	CS3K-XXX-P
	CS6K-XXX-M-SD	CS3K-XXX-MS
	CS6K-XXX-P	CS3U-XXX-MS
	CS6K-XXX-P-SD	CS3U-XXX-P
	CS6K-XXX-MS	CS1K-XXX-MS
	CS6P-XXX-M	CS1H-XXX-MS
	CS6P-XXX-P	CS1H-XXX-MS-AB
	CS6P-XXX-P-SD	CS3W-XXX-P
	CS6V-XXX-M	CS3N-XXX-MS
	CS6V-XXX-P	CS1Y-XXX-MS
	CS6X-XXX-P	
CertainTeed	CTXXXHC11-06	
Chint Solar	CHSM6612M-XXX	CHSM72M-HC-XXX* (Astro 4)
	CHSM6612M(BL)-XXX	CHSM72M-HC-XXX* (Astro 5)
	CHSM6612M/HV-XXX	
Dehui Solar	DH-M760B-XXXW	DH-M760F-XXXW*
	DH-M760W-XXXW	DH-M772F-XXXW*
	DH-M772W-XXXW	
ET Solar	ET-P660XXXBB	P660XXXWB/WW
	ET-P660XXXWB	P660XXXWWG
	ET-P660XXXWW	M660XXXBB
	ET-P660XXXWWG	M660XXXWW
Hanwha Q Cells	Q.PEAK BLK-G3.1-XXX	Q.PEAK BLK-G4.1-XXX
	Q.PEAK G3.1-XXX	Q.PEAK BLK-G4.1/TAA-XXX
	Q.PLUS BFR-G3.1-XXX	Q.PEAK G4-XXX
	B.LINE PLUS BFR-G4.1-XXX	Q.PEAK G4.1-XXX
	B.LINE PRO BFR-G4.1-XXX	Q.PEAK G4.1/MAX-XXX
	Q.BASE GY-XXX	Q.PEAK G4.1/TAA-XXX
	Q.PEAK BFR-G4-XXX	Q.PLUS BFR-G4-XXX
	Q.PEAK BFR-G4.1-XXX	Q.PLUS BFR-G4.1-XXX

Grounding Specifications

Manufacturer	Model	
Hanwha Q Cells	Q.PLUS BFR-G4.1/TAA-XXX	Q.PEAK DUO-L-G7.3-XXX
	Q.PLUS G4-XXX	Q.PEAK DUO-L-G6-XXX
	Q.PLUS GY-XXX	Q.PEAK DUO-L-G6.2-XXX
	Q.PLUS BFR-GY-XXX	Q.PEAK DUO-L-G6.3-XXX
	Q.PRO BFR-G4-XXX	Q.PEAK DUO-L-G8-XXX
	Q.PRO BFR-G4.1-XXX	Q.PEAK DUO-L-G8.1-XXX
	Q.PRO BFR-G4.3-XXX	Q.PEAK DUO-L-G8.2-XXX
	Q.PRO BFR-GY-XXX	Q.PEAK DUO-L-G8.3-XXX
	Q.PRO BLK-GY-XXX	Q.PEAK DUO-G5/SC-XXX
	Q.PRO G4-XXX	Q.PEAK DUO-BLK-G5/SC-XXX
	Q.PRO GY-XXX	Q.PEAK DUO-G6+/SC-XXX
	Q.PRO GY/SC-XXX	Q.PEAK DUO-BLK-G6+/SC-XXX
	Q.PEAK DUO-G5-XXX	Q.PEAK DUO BLK-G6+/AC-XXX
	Q.PEAK DUO-BLK-G5-XXX	Q.PEAK DUO-ML-G9-XXX
	Q.PLUS DUO-G5-XXX	Q.PEAK DUO-BLK-ML-G9-XXX
	Q.PEAK DUO-G7-XXX	Q.PEAK DUO-G5/TS-XXX
	Q.PEAK DUO-BLK-G7-XXX	Q.PEAK DUO BLK-G5/TS-XXX
	Q.PEAK DUO-G7.2-XXX	Q.PEAK DUO-G6/TS-XXX
	Q.PEAK DUO-G6+-XXX	Q.PEAK DUO BLK-G6/TS-XXX
	Q.PEAK DUO-BLK-G6+-XXX	Q.PEAK DUO-G6+/TS-XXX
	Q.PEAK DUO-G6-XXX	Q.PEAK DUO BLK-G6+/TS-XXX
	Q.PEAK DUO-BLK-G6-XXX	Q.PEAK DUO XL-G9.2-XXX
	Q.PEAK DUO-G8+-XXX	Q.PEAK DUO XL-G9.3-XXX
	Q.PEAK DUO-BLK-G8+-XXX	Q.PEAK DUO XL-G9.3/BFG-XXX*
	Q.PEAK DUO-G8-XXX	Q.PEAK DUO XL-G10.2-XXX
	Q.PEAK DUO-BLK-G8-XXX	Q.PEAK DUO XL-G10.3/BFG-XXX*
	Q.PLUS L-G4-XXX	Q.PEAK DUO XL-G10.3-XXX
	Q.PLUS L-G4.1-XXX	Q.PEAK DUO XL-G10.c-XXX
	Q.PLUS L-G4.2-XXX	Q.PEAK DUO XL-G10.d-XXX
	Q.PEAK L-G4.1-XXX	Q.PEAK DUO L-G8.3/BFG-XXX*
	Q.PEAK L-G4.2-XXX	Q.PEAK DUO L-G8.3/BGT-XXX*
	Q.PLUS DUO-L-G5-XXX	Q.PEAK DUO ML-G10-XXX
	Q.PLUS DUO-L-G5.1-XXX	Q.PEAK DUO BLK ML-G10+-XXX
	Q.PLUS DUO-L-G5.2-XXX	Q.PEAK DUO ML-G10+-XXX
	Q.PLUS DUO-L-G5.3-XXX	Q.PEAK DUO BLK ML-G10-XXX
	Q.PEAK DUO-L-G5.2-XXX	Q.PEAK DUO ML-G10.a+-XXX
	Q.PEAK DUO-L-G5.3-XXX	Q.PEAK DUO BLK ML-G10.a+-XXX
	Q.PEAK DUO-L-G7-XXX	Q.PEAK DUO ML-G10.a-XXX
	Q.PEAK DUO-L-G7.1-XXX	Q.PEAK DUO BLK ML-G10.a-XXX
	Q.PEAK DUO-L-G7.2-XXX	
Hanwha SolarOne	HSL60P6-PB-2-XXXQ	HSL60P6-PB-4-XXXQ
Heliene	60M-XXX	72M-XXX
	60P-XXX	72P-XXX

Grounding Specifications

Manufacturer	Model	
Hyundai	HiS-MXXXRG	HiD-SXXXRG
	HiS-SXXXRG	HiA-SXXXMS
	HiS-SXXXRW	HiS-SXXXXY
	HiS-MXXXMG	HiS-SXXXYI
	HiS-SXXXMG	
JA Solar	JAM6-60-XXX/SI	JAM72S09-XXX/PR
	JAP6-60-XXX/3BB	JAM72S10-XXX/MR
	JAM60S09-XXX/PR	JAM72S10-XXX/PR
	JAM60S10-XXX/MR	JAM72S12-XXX/PR
	JAM60S10-XXX/PR	JAP6(k)-72-XXX/4BB
	JAM60S12-XXX/PR	JAM60S17-XXX/MR
	JAP72S01-XXX/SC	
Jinko Solar	JKMXXXM-60	JKMXXXP-72
	JKMXXXM-60L	JKMXXXP-72-V
	JKMXXXM-60HL	JKMXXXPP-72
	JKMXXXM-60HBL	JKMXXXPP-72-V
	JKMXXXP-60	JKMSXXXP-72
	JKMXXXP-60-J4	JKMXXXM-72HL-V
	JKMXXXP-60-V	JKMXXXM-72HL-TV
	JKMXXXP-60B-J4	JKMXXXM-72HBL
	JKMXXXPP-60	JKMXXXM-6TL3-B
	JKMXXXPP-60-V	JKMXXXM-6RL3-B
	JKMXXXM-72	JKMXXXM-7RL3-V
	JKMXXXM-72L-V	JKMXXXM-7RL3-TV
Kyocera	KUXXX-6YYY	KUXXX-8YYY
LG	LGXXXN1C-A5	LGXXXA1C-V5
	LGXXXN1K-A5	LGXXXM1C-L5
	LGXXXQ1C-A5	LGXXXM1K-L5
	LGXXXQ1K-A5	LGXXXN1C-N5
	LGXXXS1C-A5	LGXXXN1K-L5
	LGXXXN2C-B3	LGXXXN1K-A6
	LGXXXN2W-B3	LGXXXN1C-A6
	LGXXXN1C-G4	LGXXXN1W-A6
	LGXXXN1K-G4	LGXXXQ1C-A6
	LGXXXS1C-G4	LGXXXQ1K-A6
	LGXXXN2C-G4	LGXXXM1K-A6
	LGXXXN2K-G4	LGXXXM1C-A6
	LGXXXN2W-G4	LGXXXA1C-A6
	LGXXXS2C-G4	LGXXXQAC-A6
	LGXXXS2W-G4	LGXXXQAK-A6

Grounding Specifications

Manufacturer	Model	
LG	LGXXXN1C-V5	LGXXXN1K-B6
	LGXXXN1W-V5	LGXXXN2W-E6
	LGXXXN2T-V5	LGXXXN2T-E6
	LGXXXN2T-J5	LGXXXN1K-E6
	LGXXXN1T-V5	
Longi	LR6-60-XXXM	LR4-60HPB-XXXM
	LR6-60BK-XXXM	LR4-60HIB-XXXM
	LR6-60HV-XXXM	LR4-60HPH-XXXM
	LR6-60PB-XXXM	LR4-60HIH-XXXM
	LR6-60PE-XXXM	LR6-60HIH-XXXM
	LR6-60PH-XXXM	LR6-60HIB-XXXM
	LR6-60HPB-XXXM	LR4-72HPH-XXXM
	LR6-60HPH-XXXM	
Mission Solar	MSEXXXSO5T	MSEXXXSQ4S
	MSEXXXSO5K	MSEXXXSR8K
	MSEXXXSQ5T	MSEXXXSR8T
	MSEXXXSQ5K	MSEXXXSR9S
	MSEXXXMM4J	MSE60AXXX
	MSEXXXMM6J	MSEXXXTS60
	MSEXXXSO6W	MSEXXXSX5K
	MSEXXXSO4J	MSEXXXSX5T
	MSEXXXSO6J	MSEXXXSX6S
	MSEXXXSQ6S	MSEXXXSX6W
Next Energy Alliance	USNEA-XXXM3-60	USNEA-XXXM3-72
	USNEA-XXXM3B-60	USNEA-XXXM3B-72
Panasonic	VBHNXXXKA01	VBHNXXXSA18
	VBHNXXXKA02	VBHN325SA17E
	VBHNXXXSA16	VBHXXXRA18N
	VBHNXXXKA03	VBHXXXRA03K
	VBHNXXXKA04	EVPVXXX(K)
	VBHNXXXSA17	
Phono Solar	PSXXXM-20/U	PSXXXMH-20/U
REC	RECXXXPE	RECXXXPE72XV
	RECXXXPE-BLK	RECXXXTP2M 72
	RECXXXTP	RECXXXTP2M 72 BLK
	RECXXXTP-BLK	RECXXXTP2M 72 BLK2
	RECXXXTP IQ	RECXXXTP2SM 72
	RECXXXTP2	RECXXXTP2SM 72 BLK
	RECXXXTP2-BLK	RECXXXTP2SM 72 BLK2
	RECXXXNP	RECXXXAA
	RECXXXTP2M	RECXXXTP3M
	RECXXXTP72	RECXXXNP2
	RECXXXPE72	

Grounding Specifications

Manufacturer	Model	
Renesola	JCXXXM-24/Bb	JCXXXM-24/BBh
Silfab	SLAXXX-M	SSGXXX-M
	SLAXXX-P	SSGXXX-P
	SSAXXX-M	SILXXXNT
	SSAXXX-P	SILXXXHL
	SILXXXBL	SILXXXBK
	SILXXXML	SILXXXHC
	SILXXXNL	SILXXXNU
	SLGXXX-M	SILXXXNX
	SLGXXX-P	
Solaria	Solaria PowerXT-XXXR-PX	Solaria PowerXT-XXXR-PM
	Solaria PowerXT-XXXR-BX	Solaria PowerXT-XXXR-PM-AC
	Solaria PowerXT-XXXR-AC	
SolarWorld	SWXXX-Mono	SWXXX-Mono XL
Suniva	MVX-XXX-60-5-701	OPT-XXX-60-4-1B0
	MVX-XXX-60-5-7B1	OPT-XXX-60-4-800
	OPT-XXX-60-4-100	OPT-XXX-60-4-8B0
Sunpower	SPR-EYY-XXX	SPR-XYY-XXX
	SPR-XYY-XXX	SPR-P17-XXX-COM
	SPR-EYY-XXX	SPR-P19-XXX-COM
SunSpark	SST-XXXM3-60	SST-XXXM3-72
	SST-XXXM3B-60	SST-XXXM3B-72
Talesun	TP660M-XXX	TP672M-XXX
	TP660P-XXX	TP672P-XXX
Tesla	TXXXS	TXXXH
Trina	TSM-XXXDD05(II)	TSM-XXXPD05.05S
	TSM-XXXDD05A.05(II)	TSM-XXXPD05.08
	TSM-XXXDD05A.08(II)	TSM-XXXPD05.082
	TSM-XXXDD05A.082(II)	TSM-XXXPD05.08D
	TSM-XXXPA05	TSM-XXXPD05.08S
	TSM-XXXPA05.05	TSM-XXXDD06M.05(II)
	TSM-XXXPA05.08	TSM-XXXDE15H(II)
	TSM-XXXPD05	TSM-XXXDE15M(II)
	TSM-XXXPD05.002	TSMXXXDD05H.05(II)
	TSM-XXXPD05.05	TSMXXXDE06X.05(II)
Yingli	YLXXXA-29b	YLXXXP-29b
ZNShine	ZM6-60-XXX/M	ZXM6-NH144-XXXM
	ZXM6-NH120-XXXM	

Grounding Specifications

Ultra Rail has been tested with the following Module Level Power Electronic (MLPE) devices:

The UR-40 and UR-60 mounting systems have been tested with the following UL/NRTL Listed Module Level Power Electronic (MLPE) Devices. The back plates of the MLPEs have been evaluated for bonding to UR-40 and UR-60 rail through the MLPE Attachment Kit.

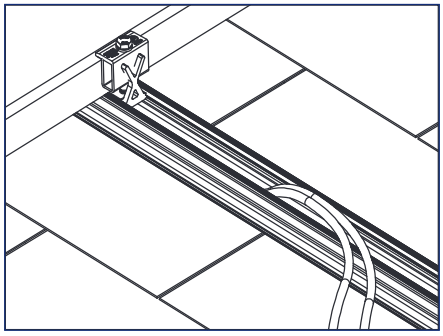
AP Smart	RSD-S-PLC	
Celestica International	DG-006-F001201x	DG-006-F001401x
Delta Electronics	GPI00010105	
Enphase	C250	IQ7-60-2-US
	M215	IQ7-60-B-US
	M250	IQ7PLUS-72-2-US
	IQ6-60-2-US	IQ7PLUS-72-B-US
	IQ6PLUS-72-2-US	
Ginlong Technologies	Solis-RSD-1G	Solis-MLRSD-R2-1G
	Solis-MLRSD-R1-1G	
SolarEdge	P300-5NC4ARS	P405
	P320-5NC4ARS	P485
	P370-5NC4AFS	P505
	P400-5NC4AFS	P730
	P320	P800p
	P340	P850
	P370	P860
	P400	P950
	P401	
SMA	RSB-2S-US-10	
Tigo	TS4-R-F	TS4-R-S-DUO
	TS4-R-M	TS4-A-F
	TS4-R-O	TS4-A-2F
	TS4-R-S	TS4-A-O
	TS4-R-M-DUO	TS4-A-S
	TS4-R-O-DUO	
Vikram	SOMERA VSMHBB.60.XXX.05	

Notes:

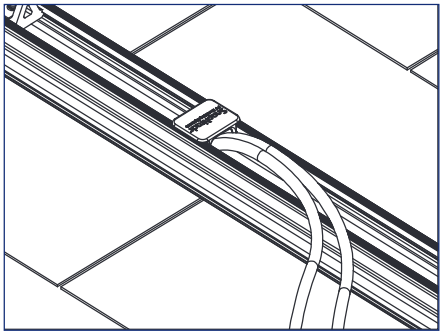
AP Smart RSD-S-PLC, Ginlong Solis-MLRSD-R1-1G and Solis-MLRSD-R2-1G, and all Tigo models have not been investigated for bonding since the enclosures are constructed entirely of polymeric materials.
The SolarEdge P320 and P370 models are both frame mount and rail mount. All other PXXX series models are rail mount.

INSTALLATION INSTRUCTIONS

SnapNrack Wire Retention Clip

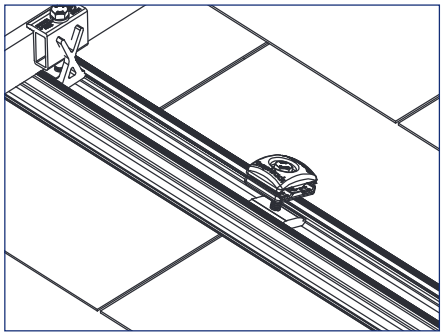


1) Place all electrical conductors in the bottom of the rail channel.

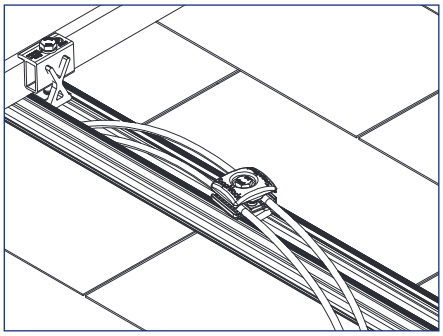


2) Install the Wire Retention Clip by snapping it into place on the rail.

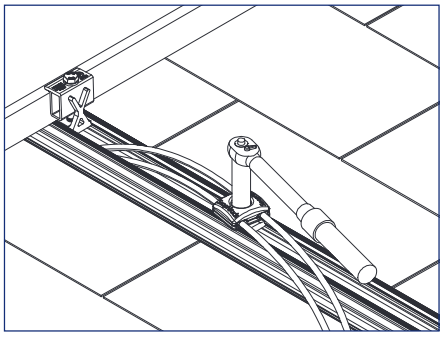
SnapNrack 4-Wire, Trunk Cable, or Universal Wire Clamp



1) Snap Wire Clamp into top or side rail channel.

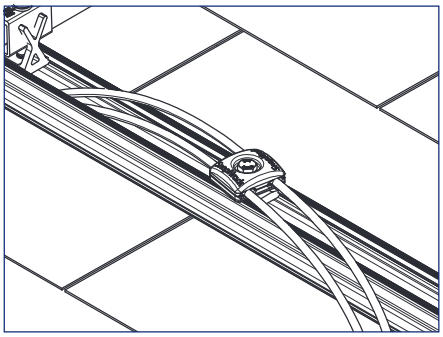


2) With Wire Clamp loose, place conductors or cables in slots.



3) Tighten Wire Clamp with 1/2" socket, ensure cables and conductors are aligned in the clamp slots.

Install Note:
Wire Clamps can be rotated and oriented in any direction.



4) 4-Wire Clamp intended for PV Wire conductors, Trunk Cable Clamp intended for trunk cables, Universal Wire Clamp intended for both PV Wire conductors and AC trunk cables.

Install Note:
Conductors of different types should be placed under separate Universal Wire Clamps.

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Solar Mounting Solutions

Ultra Rail

Wire & Conduit Management Solutions

The Best Wire & Conduit Management of any Mounting System

All products ship from the factory with nuts and bolts preassembled for ease of install

The industry's most complete product offering for wire and conduit management solutions

Products keep wires neatly organized providing a clean finished look to every install

Can be installed at any time allowing easy retrofit of existing systems

Keep your wires & conduit organized with SnapNrack solutions today

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DESIGN	snapnrack.com/configurator
WHERE TO BUY	snapnrack.com/where-to-buy

SnapNrack Wire and Conduit Management Solutions

comprise a set of dedicated products to reliably and cost effectively secure PV module and microinverter leads. These solutions will not only provide a high quality wire and conduit management solution for the life of the system, but will provide a faster and easier installation.

Junction Box

- Quick and easy installation utilizing snap-in features
- NEMA 4x rating to conceal and protect electrical connections
- Now two junction boxes available in different sizes for multiple wire management situations

Standard Rail Channel & Wire Retention Clips

- The ONLY rail channel in the industry with space for running wires and cables
- Wire Retention Clip snaps into place securing PV conductor and AC trunk lines within channel

Wire Clamp Offering

- Universal Wire Clamp can hold Enphase IQ Cables as well as 4 PV Wires
- Easily attaches to Ultra Rail using channel nut and single bolt with 1/2” socket

Conduit Clamp

- Flashed composition support attaches to roof with single lag bolt
- Tile support requires no tools to attach to tiles
- Secure conduit in clamp using single 1/2” socket
- Works with all 3/4” standard EMT conduit

Quality. Innovative. Superior.

SnapNrack Solar Mounting Solutions are engineered to optimize material use and labor resources and improve overall installation quality and safety.

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