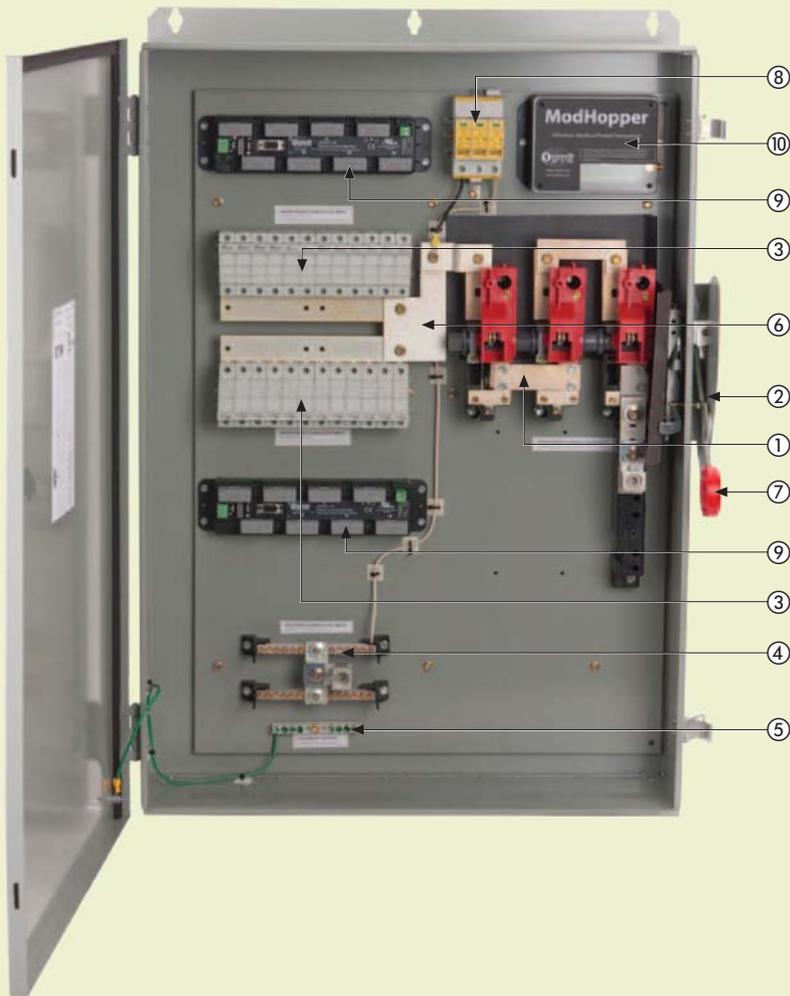


# Solar energy:

Our products are warming up to each other



## Key features

- Marked as suitable for NEC® 690 PV applications up to 600 Vdc
- UL® 1741 listed device
- NEMA® 3R, 4, 4X stainless steel and 4X non-metallic enclosures
- Ample wiring space
- Meets all NEC, UL 1741 and UL 98 wire bending requirements
- Flexible input/output conduit options
- Clear deadfront shield covering all potentially live parts

- ① Heavy-duty K-switch design main disconnect
  - Provides visible blade indication
  - Fusible or non-fusible options
- ② Familiar safety switch style disconnect with robust side operating handle
- ③ Touch-safe input fuse holders
  - Numerous circuit configurations
- ④ Isolated return block for grounded conductors
- ⑤ Equipment ground bar
- ⑥ Hard bussed connection from input fuse holders to main disconnect
- ⑦ Traditional red handle—preferred by first responders

## Optional features

- ⑧ Surge protective device
    - With or without remote signaling
  - ⑨ String current monitoring
  - ⑩ Wireless communication
- Flex Center modifications available, such as viewing windows, pilot lights and more

**Note:** For additional product details, see Technical Data TD00801006E.

**The Eaton switched combiner (ESC) is a solar combiner box and integrated heavy-duty 600 Vdc safety switch.**

**Eaton Corporation has rolled out yet another new product for the emerging solar photovoltaic marketplace—the Eaton switched combiner (ESC). The introduction of this product unites Eaton’s 600 Vdc solar disconnect and source-combiner box in one convenient enclosure.**

The ESC, a UL 1741 listed device, provides a single point to combine incoming PV strings and disconnect DC power close to the PV modules. It is a safer alternative that saves installation time and cost.

Due to the integration of a side-operated UL 98 design, quick-make, quick-break heavy-duty safety switch, operators benefit by having a visible means of disconnect when the switch is in the OFF position. Blade disengagement from the stationary contact can be seen when viewing the switch base (**Figure 1**).

**The product**

The NEC® 2011 code release brought a variety of requirements related to solar photovoltaic systems. One of the most important is NEC 690.16(B), which relates to disconnecting means and fuse servicing. This update states, “Disconnecting means shall be installed on PV output circuits where overcurrent devices (fuses) must be serviced that cannot be isolated from energized circuits. The disconnecting means shall be within sight of, and accessible to, the location of the fuse or integral with fuse holder...” Input fuse holders in combiner boxes are not load break rated and should only be opened/closed after the output of the combiner box has been disconnected. Thus, the Eaton switched combiner is the perfect solution to meet the intent of this code addition.

Consistent with Eaton’s full line of solar disconnect switches, the ESC is available with either a non-fusible or fusible integral disconnect. Fusible versions have one set of fuse clips mounted on the center pole, allowing complete isolation of the fuse when the switch is in the OFF position. This also helps reduce cost by requiring only one fuse per main disconnect switch.

The ESC standard offering includes input fuse holders, a return block, a ground bar and integral disconnect in a variety of NEMA enclosure ratings. Eaton also offers an array of other options, such as surge protection, current monitoring and wireless communication. For the ultimate in flexibility and customer solutions, further modifications are available through the Switching Device Flex Center, such as viewing window(s), special paint and special lugs, among others.

The layout of all ESC products includes a hard bussed connection from the input fuse holders to the integral disconnect. Careful consideration has also been given to enclosure size, which provides ample space to allow for easier wiring of the main disconnect, input fuse holders and current monitoring. Enclosures were designed to allow mounting in either vertical or horizontal orientations, and all products are rated for service/operation conditions of -30°C (-22°F) to +50°C (+122°F).

Eaton’s line of switched combiners demonstrates our further expansion into the solar marketplace and commitment to provide another quality product designed with the installer in mind—just what you expect from a market leader.



**Figure 1. Visible Blade**

**Surge protection**

Integrated surge protection is an option throughout the entire range of ESC products. These UL listed surge protective devices are designed for 600 Vdc maximum systems and are rated for 40 kA. Surge protective devices with remote signaling capabilities are also available.

**Monitoring**

The solar market continues to shine, and customers are increasingly interested in knowing and understanding the performance of their installations and return on investment. To provide a solution to meet that need, current monitoring is available as an option in the ESC product 100A–400A. The UL listed monitors (**Figure 2**) measure DC current per channel as well as total and average DC current. Each monitor uses Modbus® communication protocol through RS485 or RS232 and has 8 channels (Hall effect sensors). Each channel can typically accept between 1 and 3 strings, depending on the wire size and amount of current (50A maximum), and is +/- 1% accurate. Monitors arrive factory installed and ready to wire if monitoring options are selected.

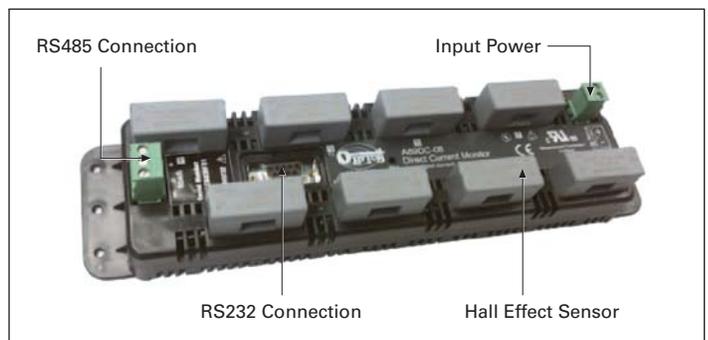
Wireless communication of collected data is also an option. Incorporation of the Obvius ModHopper® allows data from up to 32 “daisy-chained” monitors to be wirelessly transmitted to a PC or data-acquisition unit (an additional ModHopper unit—not included—is required on the receiving end between the transmitting unit and PC/data-acquisition unit).

Monitors and ModHopper require separate power supply, not included. The power requirements for these units are as follows:

- Monitor—24 Vdc, 382 mA power input
- ModHopper—9–30 Vdc, 200 mA power input

**Figure 3** displays a simplified example of the current monitors with wired and wireless communication applications.

For more specific information on monitoring specifications, consult Technical Data TD00801006E.

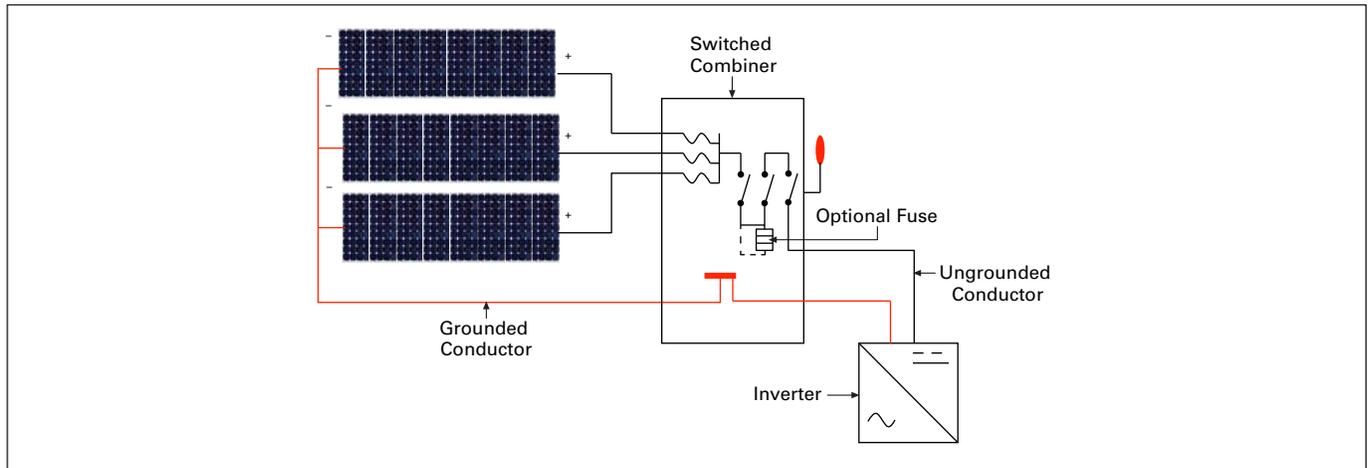


**Figure 2.**



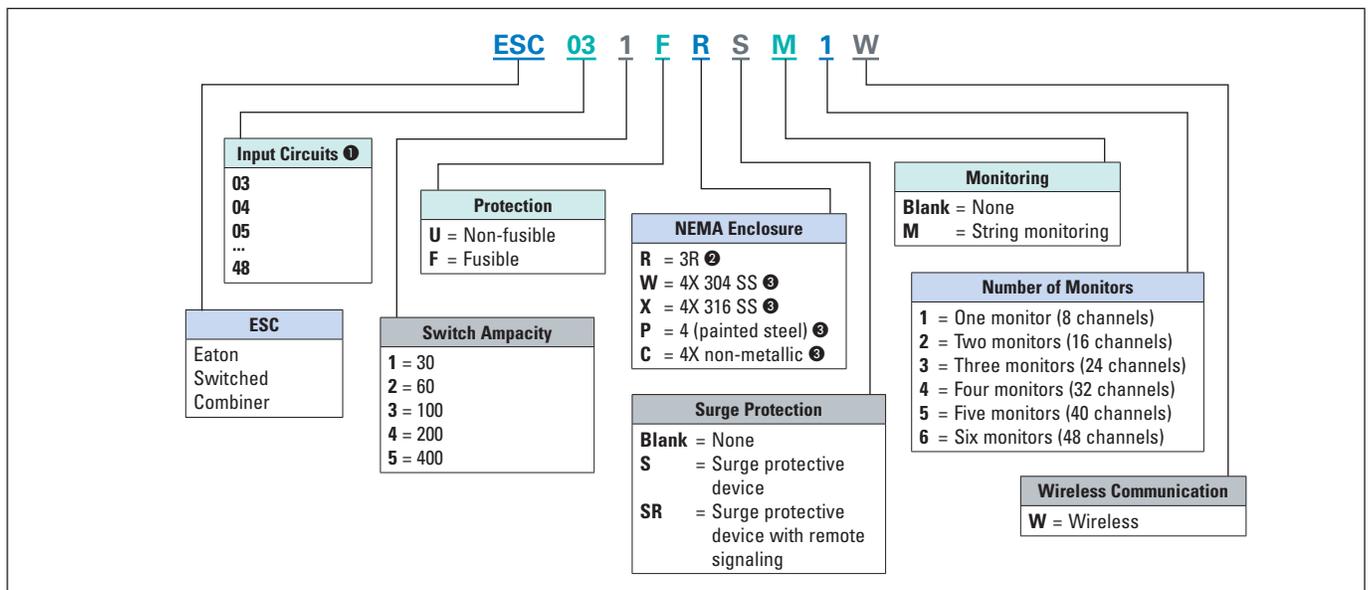
**ESC with Integrated Fusible Disconnect**

## Basic wiring diagram



**Note:** The ESC is not polarity sensitive—it may be used on both negative and positive grounded systems.

## Catalog numbering system



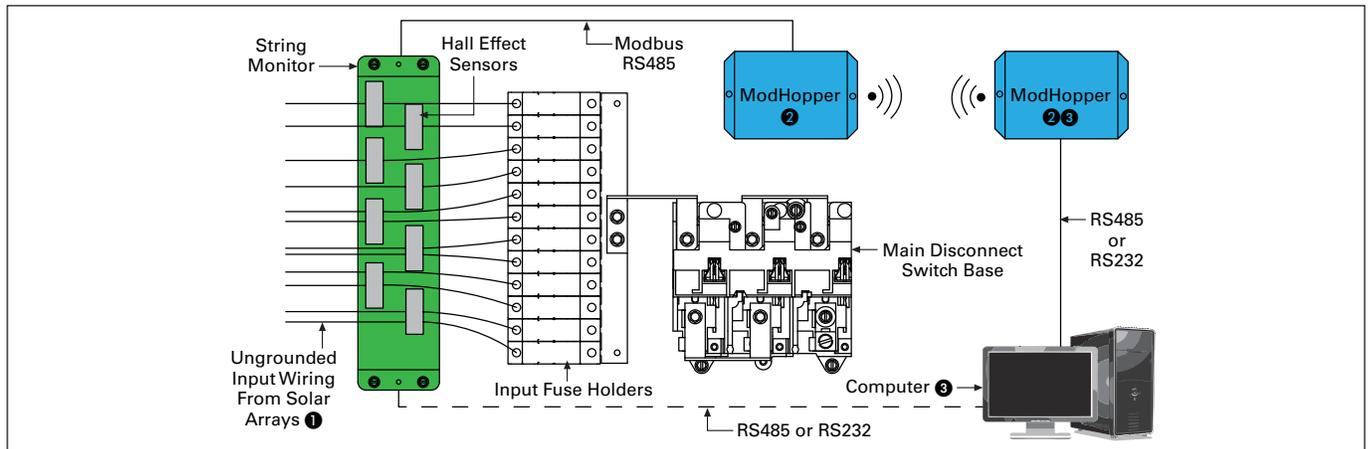
① Standard input circuit quantities shown in table at bottom of page 5.

② NEMA 3R vertical mount only.

③ NEMA 4, 4X stainless and 4X non-metallic are suitable for mounting in both vertical and horizontal orientations.

## Sample communication diagram

**Note:** One would use either hard-wired or wireless communication.

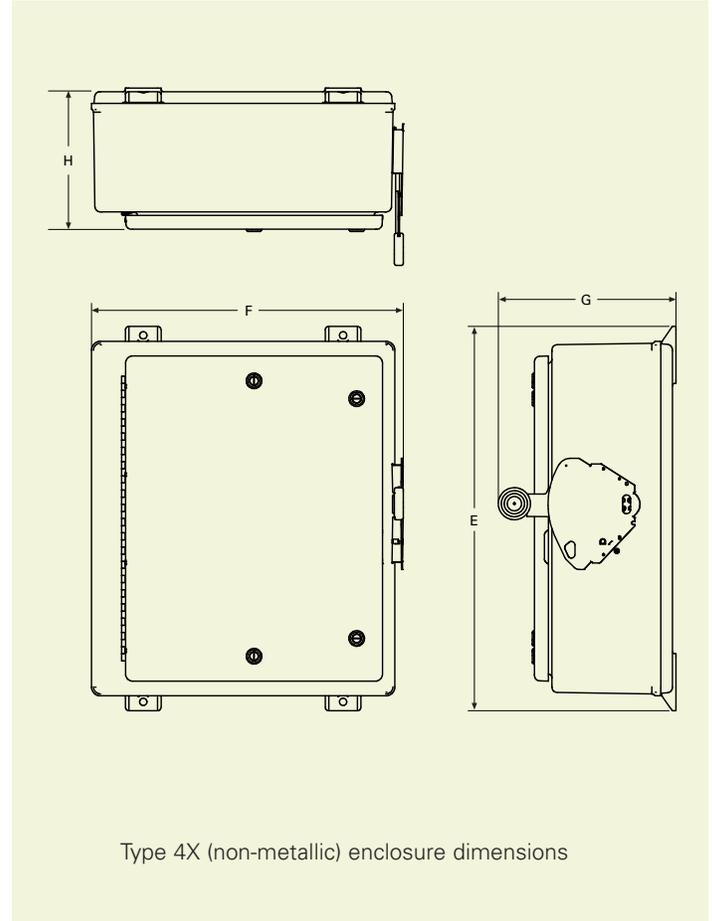
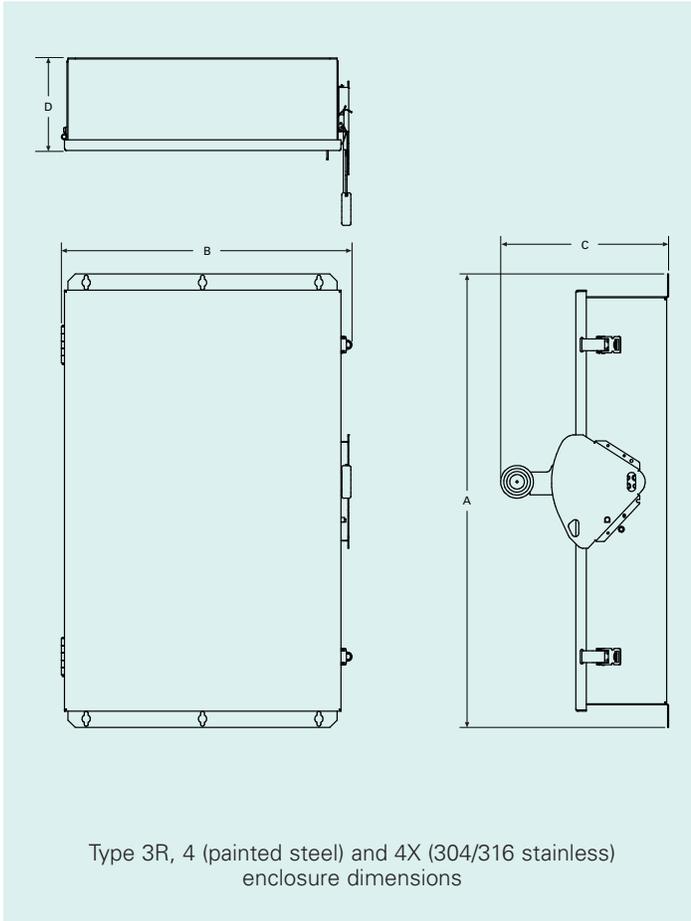


**Figure 3.**

① Ability to run one to three wires per sensor (50 kA maximum).

② ModHoppers are optional, wireless devices.

③ Computer and additional ModHopper unit not included with the ESC.



### Switched Combiner Dimensions in inches (mm)

Amperes	NEMA Types 3R, 4, 4X Stainless ②				NEMA Type 4X Non-Metallic ②			
	A	B	C	D	E	F	G	H
30	19.27 (489.5)	14.33 (364.0)	11.54 (293.1)	6.37 (161.8)	22.75 (577.9)	17.46 (443.5)	12.26 (311.4)	9.94 (252.5)
60	19.27 (489.5)	14.33 (364.0)	11.54 (293.1)	6.37 (161.8)	22.75 (577.9)	17.46 (443.5)	12.26 (311.4)	9.94 (252.5)
100	23.27 (591.1)	16.33 (414.8)	11.54 (293.1)	6.37 (161.8)	22.75 (577.9)	17.46 (443.5)	12.26 (311.4)	9.94 (252.5)
100 ①	27.27 (692.7)	20.44 (519.2)	11.54 (293.1)	6.37 (161.8)	27.00 (685.8)	21.84 (554.7)	12.44 (316.0)	9.94 (252.5)
200	31.27 (794.3)	19.97 (507.2)	11.54 (293.1)	6.37 (161.8)	32.84 (834.1)	21.59 (548.4)	12.26 (311.4)	9.94 (252.5)
200 ①	36.27 (921.3)	24.97 (634.2)	11.54 (293.1)	6.37 (161.8)	33.41 (848.6)	26.50 (673.1)	11.31 (287.3)	8.93 (226.8)
400	50.08 (1272.0)	38.53 (978.7)	12.35 (313.7)	7.23 (183.6)	51.28 (1302.5)	37.65 (956.3)	16.46 (418.1)	14.08 (357.6)

① With monitoring option.

② NEMA 4, 4X stainless and 4X non-metallic are suitable for mounting in both vertical and horizontal orientations. NEMA 3R can be mounted vertical only.

ESC Nameplate Rating ②	Number of Input Circuits ③④	Lug/Terminal Capacity ①						Total Input Short-Circuit Current (ISC)
		Wire Size—Ungrounded Conductor		Wire Size—Grounded Conductor		Wire Size—Equipment Ground		
		Input ⑤⑥	Output	Input ⑥	Output	Input	Output	
30A	3, 4	18–8 AWG	14–2 AWG	14–4 AWG	14–4 AWG	14–4 AWG	14–4 AWG	19.2A
60A	4, 6	18–8 AWG	14–2 AWG	14–4 AWG	6–2/0 AWG	14–4 AWG	14–4 AWG	38.4A
100A	6, 8, 10, 12	18–8 AWG	14–1/0 AWG	14–4 AWG	6–2/0 AWG	14–4 AWG	14–4 AWG	64.0A
200A	12, 16, 18, 20, 24	18–8 AWG	6 AWG–300 kcmil	14–4 AWG	6 AWG–300 kcmil	14–4 AWG	14–4 AWG	128.0A
400A	24, 30, 36, 40, 48	18–8 AWG	(1) 1/0–750 kcmil or (2) 1/0–350 kcmil	14–4 AWG	(1) 750 kcmil–1/0 or (2) 350 kcmil–1/0	14–4 AWG	14–1/0 AWG	256.0A

① For additional lug options, please consult factory.

② Full nameplate ampere rating shall be used when the input/source circuits are sized per NEC 690.8 (156% of PV source short-circuit current).

③ Standard number of input circuits shown. Optional circuits are available for any number within the listed range: 30A (3–4), 60A (3–6), 100A (6–12), 200A (12–24), 400A (24–48).

④ Maximum fuse size for input fuse holders = 30A. For recommended fuse sizes, please consult Technical Data TD00801006E.

⑤ Refer to Technical Data TD00801006E for specific solid/stranded wire options.

⑥ 90°C rated wire required—ampacity based on the 75°C ratings shown in NEC 2011 table 310.15(B)(16). 10 AWG minimum for +40°C or higher ambient.