MORNINGSTAR
PROFESSIONAL SERIES
World's Leading Solar Controllers & Inverters

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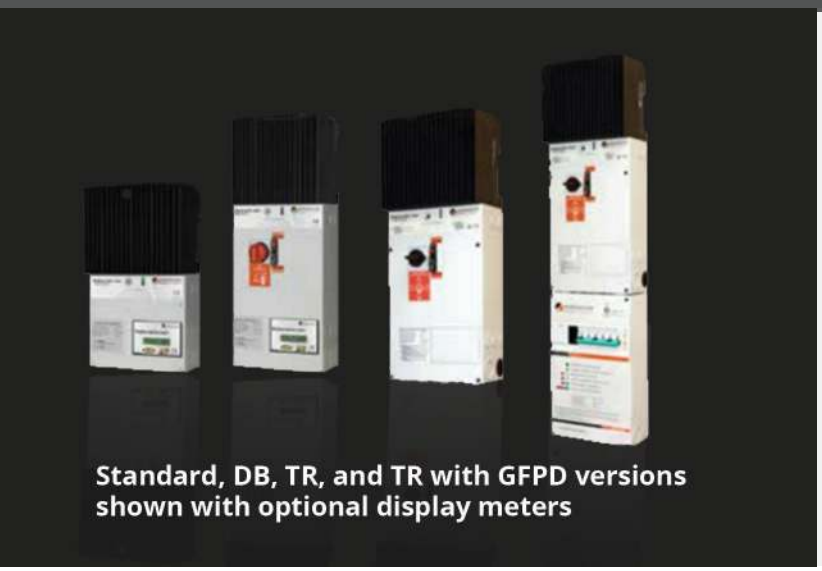

TRISTAR MPPT™ 600V

HIGH VOLTAGE CHARGE CONTROLLER

- High Voltage Capacity
- Extremely High Reliability
- Very High Efficiency
- Maximizes Energy Harvest
- Communications Capabilities

The **"breakthrough in charge controller design"**, TriStar MPPT 600V is the high-voltage controller solar system designers and installers have been looking for. Because it enables them to build systems with longer and fewer individual strings, wiring, cable and breaker costs are reduced, and installations go faster and easier.

Morningstar is able to deliver this performance with no cooling fans required— a remarkable technical achievement in a high-voltage controller. The secret is more agile control software combined with over-spec'd components, optimized through advanced thermal and electronic engineering. Fanless design improves service life, increases reliability, and raises efficiency. The TriStar 600V controller (TS-MPPT-600V) accepts PV array input up to 600 Voc with 97.9% peak efficiency. In addition to solar charge controlling, the TriStar 600V with DC transfer switch is uniquely suited for retrofitting existing grid-tied solar installations with energy storage for back-up power in a DC-coupled configuration connected to batteries.

KEY FEATURES AND BENEFITS

High Voltage Capacity

- Maximum input voltage of 600V
- Operates with PV array Voc voltages up to 525 Voc
- Wind, hydro operating voltages up to 500 Vdc*
- Pre-set for 48 Vdc battery systems
- Programmable for 24V, 36V and 60V battery systems
- Allows long wire runs from the array to the controller
- Higher voltage reduces voltage drop and wire costs
- No combiner boxes required for single or two string systems
- Better enables grid-tie PV systems with battery back-up
- Enables easier PV array expansion than lower voltage systems and accommodates increasing loads

Extremely High Reliability

- Robust thermal design and no cooling fans
- No moving parts
- Superior lightning protection from nearby lightning-induced voltage/current spikes
- Extensive electronic protections
- Epoxy encapsulated inductors and conformally coated printed circuit boards

Very High Efficiency

- 97.9% peak efficiency
- Proprietary tracking algorithm minimizes power losses
- Low self-consumption easy mounting by a single person
- Continuous operation at full power to 45°C ambient temperatures without need to de-rate
- Electronic devices with higher ratings to minimize losses from heating

Maximizes Energy Harvest

Our TrakStar™ MPPT Technology features:

- Better peak power point tracking than other MPPT charge controllers
- Very fast sweeping of the entire PV array
- Recognition of multiple power points during shading or mixed PV arrays
- Low input voltage operation
- Excellent performance at sunrise and low solar insolation levels

Communications Capabilities

- Enables system monitoring, data logging and adjustability. Uses open standard MODBUS™ protocol and Morningstar's MS View software
- Meterbus: Communications between compatible Morningstar products
- Serial RS-232 and EIA-485 serial connectivity
- Ethernet: fully web-enabled interface to a local network or internet; view from a web browser or send email

Other Features

- High-Low voltage barrier improves safety
- Available with optional Disconnect Box: 600V PV disconnect switch, battery breaker and prewired input/output bus bars
- Available with DC Transfer Switch option for switching from a GT string inverter to battery backup charging during a utility outage. Multiple controllers and GFPDs may be added later, on an as-needed basis

*To avoid product/system failure, please contact Morningstar for latest wind/hydro information.

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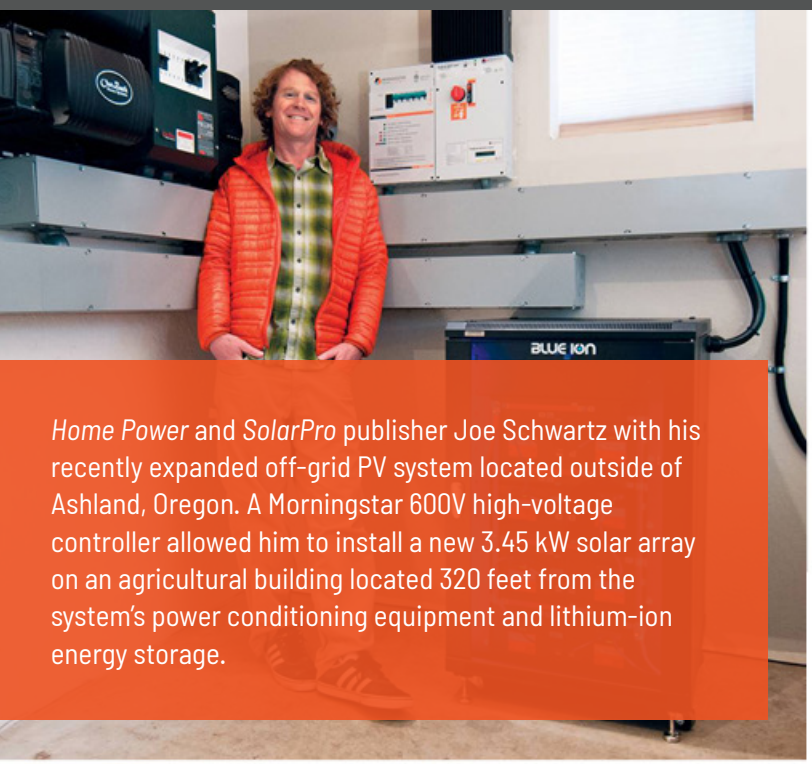
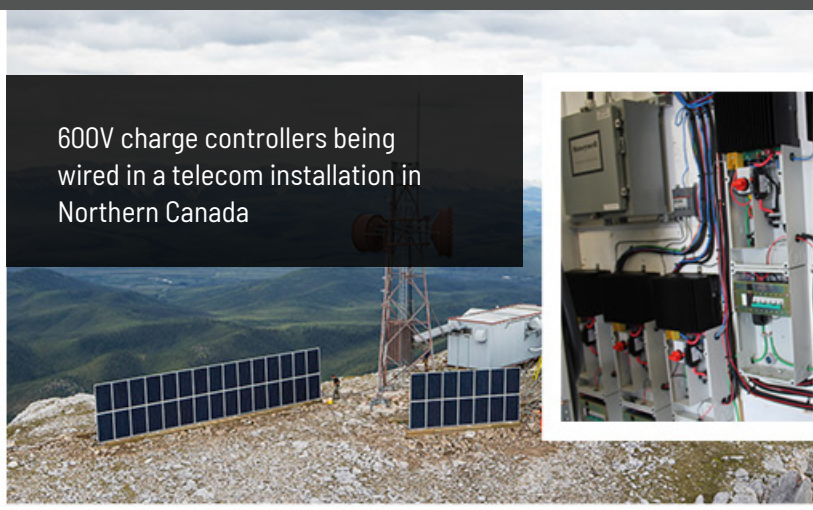
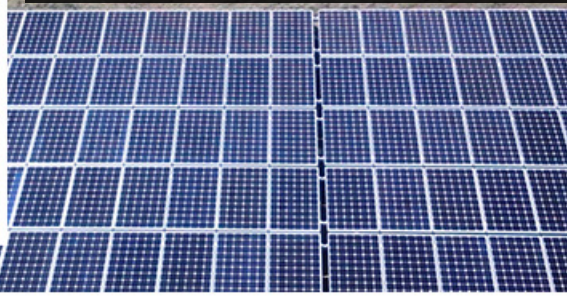


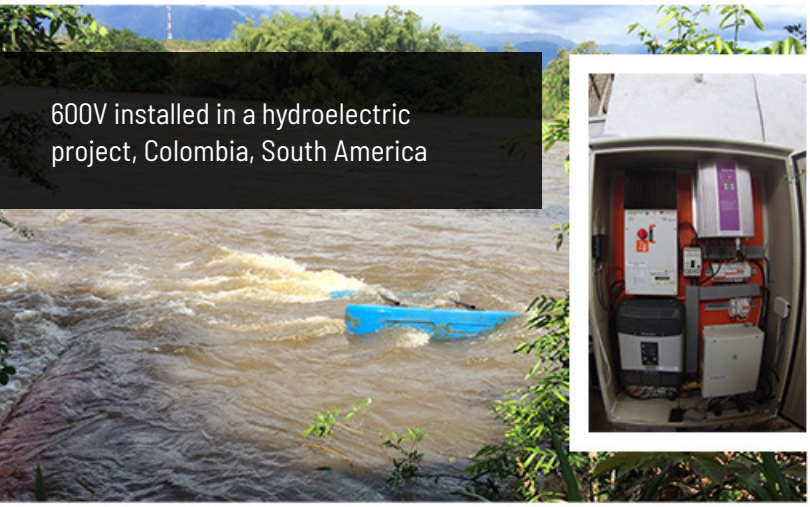
Home Power and *SolarPro* publisher Joe Schwartz with his recently expanded off-grid PV system located outside of Ashland, Oregon. A Morningstar 600V high-voltage controller allowed him to install a new 3.45 kW solar array on an agricultural building located 320 feet from the system's power conditioning equipment and lithium-ion energy storage.



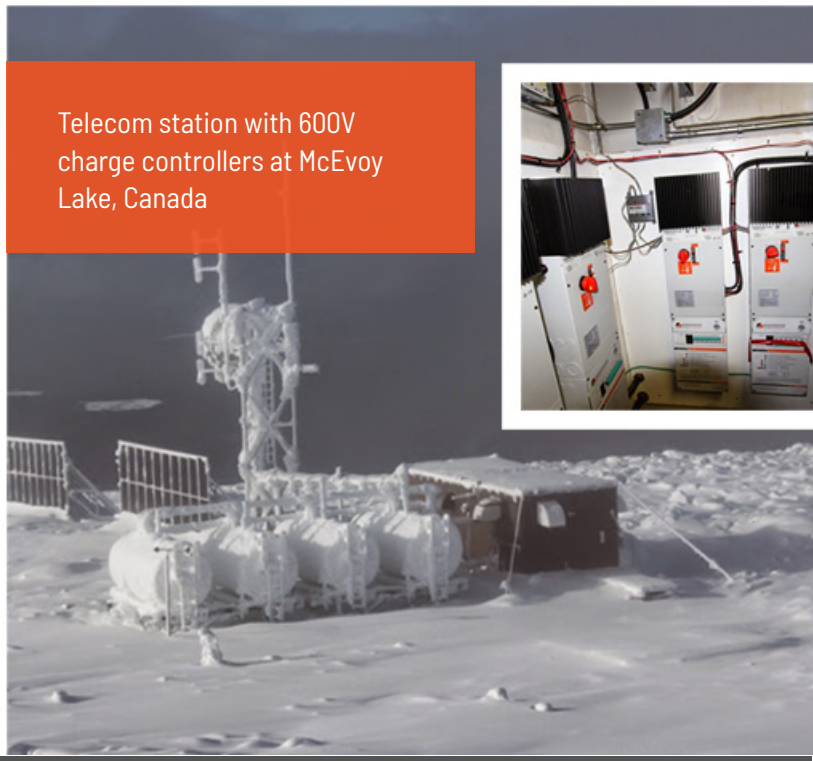
600V charge controllers being wired in a telecom installation in Northern Canada

12 TriStar 600V system with a 52kW array in Williston, North Dakota USA





600V installed in a hydroelectric project, Colombia, South America



Telecom station with 600V charge controllers at McEvoy Lake, Canada

Morningstar 600V TriStar installed in the Gourma Rharous radio station renovation project, Mali, Africa

8 Pheasant Run, Newtown, PA 18940 USA

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Available in four versions:

- TS-MPPT-60-600V-48: Standard
- TS-MPPT-60-600V-48-DB: with Disconnect Box
- TS-MPPT-60-600V-48-DB-TR: with DC Transfer Switch
- TS-MPPT-60-600V-48-DB-TR-GFPD: Pre-wired with Ground Fault Protection Device

Noteworthy features:

- Accommodates PV systems > 150 Voc with long wire runs from the array to the controller
- Uses Morningstar's patented 4-stage charging algorithm to optimize battery health
- Features extensive system networking, monitoring and communications
- Optimized for harsh environments and equipped with electronic protections
- Enables battery back-up for grid-tied systems using more efficient DC-coupling system topology (as opposed to AC-coupling typical from other brands)

Technical Specifications

Electrical	
Peak Efficiency	97.9%
Maximum Battery Current	60A
Maximum Input Operating Current	15A (self limiting)
Maximum Solar Open Circuit Voltage	600V
Nominal Maximum Operating Power ****	3200Wp, 48 Volt
Nominal System Voltage	48 Vdc custom programmable to 24V, 36V and 60V
Battery Operating Voltage Range	16-72Vdc
PV Input Operating Voltage Range	100V to Voc = 525V
Wind/Hydro Input Operating Voltage Range	Battery Voltage to 500V
Self-Consumption	1.75 - 2.50W
Transient Surge Protection	4500 Watts/port

Electrical Protections	
Input	Overload, high voltage
Battery	High voltage, battery sense disconnected, remote temperature sense disconnected
General Operation	High temperature, reverse current at night, lightning and transient surges

Mechanical	
Dimensions	Standard Version: 39.2 x 22.1 x 14.9 cm / 15.4 x 8.7 x 5.9 in DB & TR Version: 54.2 x 22.1 x 14.9 cm / 21.4 x 8.7 x 5.9 in
Unit Weight	Standard Version: 9.0 kg / 19.8 lbs DB & TR Version: 12.8 kg / 28.1 lbs
Maximum Wire Size	Power Terminals: 2.5 mm^2 - 35 mm^2 / 14 AWG - 2 AWG RT/Sense Terminals: 0.25 mm^2 - 1.0 mm^2 / 24 AWG - 16 AWG
Conduit Knockouts	M20; 0.50, 1.00, 1.25 inches
Enclosure Rating	Type 1 (indoor and vented), IP20

Environmental	
Ambient Temperature	-40 °C to +45 °C
Storage Temperature	-55 °C to +85 °C
Humidity	100% non-condensing
Tropicalization	Epoxy encapsulation, conformal coating, marine-rated terminals

Battery Charging	
Charging Stages	MPPT, absorption, float, equalize
Temperature Compensation	Coefficient: 5mV/°C/cell (25° ref) Range: 30 °C to +80 °C / -22 °F to +176 °F Set points: Absorption, Float, Equalize, HVD
Note: Remote Temperature Sensor is included.	

Communication	
Ports	Ethernet, EIA-485, RS-232, MeterBus
Supported Protocols	MeterBus, MODBUS RTU, MODBUS TCP/IP, HTTP, SNMP v2, SMTP

Options:

- TriStar 600V Meter (TS-M-2-600V)
- TriStar Remote Meter (TS-RM-2)
- Meter Hub (HUB-1)
- Relay Driver (RD-1)
- 600V Ground Fault Protection Device (GPD-600V)

Certifications:

- CE, RoHS, NEC Compliant
- ETL Listed: UL-1741 and Canadian CSA C22.2 No. 107.1.01
- FCC Class B Part 15 Compliant

Warranty: 5 year warranty period. Contact Morningstar or your authorized distributor for complete terms.

* Can be used as a 2-pole version of the Disconnect Box. ** See GFPD-600V datasheet for additional specifications. *** Can be replaced with 2-pole battery breaker. **** Input power can exceed Nominal Maximum Operating Power, but controller will limit and provide its rated continuous maximum output current into batteries. This will not harm the controller.

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TriStar TS-MPPT-600V

Maybe on a COLD day here, the other charge controllers will catch up.

But for now, there's only one high-voltage charge controller that doesn't need fans to keep its cool: the Morningstar TriStar TS-MPPT-600V.

Solar designers and installers have long sought the benefits provided by a high-voltage charge controller. By allowing longer and fewer strings, they reduce wire, cable and breaker costs, and make installations go faster and easier.

But higher voltages come with the penalty of higher operating temperatures. The short-cut other brands take, of using fans to deal with extreme heat, can shorten the operational life of the controller by sucking in dirt and debris and adding moving parts that can fail in the field. Worse, powered fans are a parasitic load that reduces efficiency in solar harvesting. For these reasons, even achieving medium voltage is a struggle for conventional designs. Morningstar's high-voltage 600V is a true technical breakthrough.

Advanced digital processing responds much more quickly and accurately on both input and output sides, avoiding the transient "swings" of ordinary controllers. The internal architecture is laid out for maximum performance and thermal management rather than economy, with critical parts located where they make the most engineering sense. And finally, the controller is built with high quality, "over spec" components used throughout.

This may go way beyond the standard industry approach, but it's business as usual at our employee-owned brand. With 25 years of experience and well over three million products made, installers know they can bet their reputation on ours.

When it's time to push the design envelope on your next system, our revolutionary 600V TriStar is ready when you are.
Contact your Morningstar distributor for complete information or visit us at www.morningstarcorp.com