

# TriStar MPPT™ 600V Charge Controller

## World-Class Performance

Morningstar is pleased to announce the introduction of the TriStar MPPT 600V (TS-MPPT-600V) charge controller. Our TriStar MPPT controller family commenced production in 2009 and has since become the world's leading photovoltaic (PV) MPPT controller, operating in a myriad of off-grid industrial and residential installations around the globe.

The TS-MPPT-600V leverages our TrakStar MPPT technology and Morningstar's 20 years of power electronics engineering excellence to deliver a PV controller with the widest PV input operating voltage range in the solar industry.

## Quality and Reliability

Morningstar's products are ***built from the inside out*** to deliver more than twice the industry average operating life. The TS-MPPT-600V delivers high reliability and excellent performance and features:

- The industry's best-in-class power efficiency
- Morningstar's advanced 4-stage charging algorithm to optimize battery health
- Robust thermal, mechanical and electrical design
  - Environmentally optimized design with extensive electronic protections
  - No moving parts
  - Epoxy encapsulated components
  - Conformally coated printed circuit boards
- Industry standard open communication protocols and interfaces for system networking, monitoring and communications
- Superior lightning protection from nearby lightning-induced voltage/current spikes



Products shown include optional meter.

## Features

- Wide array input operating voltage range (5-525 V)
- Maximum 60A continuous battery current
- Supports nominal 48 Vdc batteries
- Facilitates simple and cost-effective design (including savings on wiring and labor costs)
- Enables use of existing high voltage PV or small wind turbines for battery charging
- Passively cooled for high reliability
- Compact form factor
- Ethernet standard



## TrakStar Technology

The TS-MPPT-600V features Morningstar's advanced TrakStar MPPT technology to harvest the maximum energy from the solar array or wind turbine. The high-speed sweeping algorithm minimizes power loss and provides full visibility of the entire power curve from open circuit to battery voltage; ensuring the maximum power point is chosen under all ambient conditions.



## Communications

Morningstar's TriStar MPPT 600V charge controller is the only 600-volt PV controller to offer open communication protocols and true Ethernet-enabled functionality.

The TS-MPPT-600V uses reliable, pre-established industry standard open communication protocols and interfaces to help reduce operational costs and to increase integration efficiencies. As a result, there are neither proprietary network hardware nor software compatibility issues to resolve nor requirements for external gateways. This enables developers to use proven and readily available code to speed development time and to decrease costs.

- Protocols: Supports Morningstar MeterBus™, MODBUS™ RTU and MODBUS TCP/IP™, HTTP, SNMP v2 (for system networking and monitoring) and SMTP
- Communication Ports / Interfaces: Ethernet, EIA-485, RS-232 and MeterBus (for flexible communications)
- Data Logging

## Parallel Operation\*

The TS-MPPT-600V was engineered to support parallel operation. Up to four TS-MPPT-600V controllers may be used in parallel to manage charging from a single solar or wind input. This enables the use of up to 15kWp\*\* of high voltage PV or wind for back-up power during a grid outage.

## Optimized Battery Health

Morningstar designed the TS-MPPT-600V's battery charging process to deliver long battery life and excellent system performance.

## Simplified Installation and Use

The TS-MPPT-600V is built for easy installation, setup and use. Self-diagnostics and electronic error protections make installation easier and minimize the chances of installation errors and system faults. It is also equipped with 8 adjustable switches to make system setup and configuration simple. The TS-MPPT-600V's simplified installation and usability benefits include:

- Easy series installation
- No combiners required
- Wire cost savings
  - Supports the use of small wire diameter
  - Supports long wire runs

\* Coming Soon

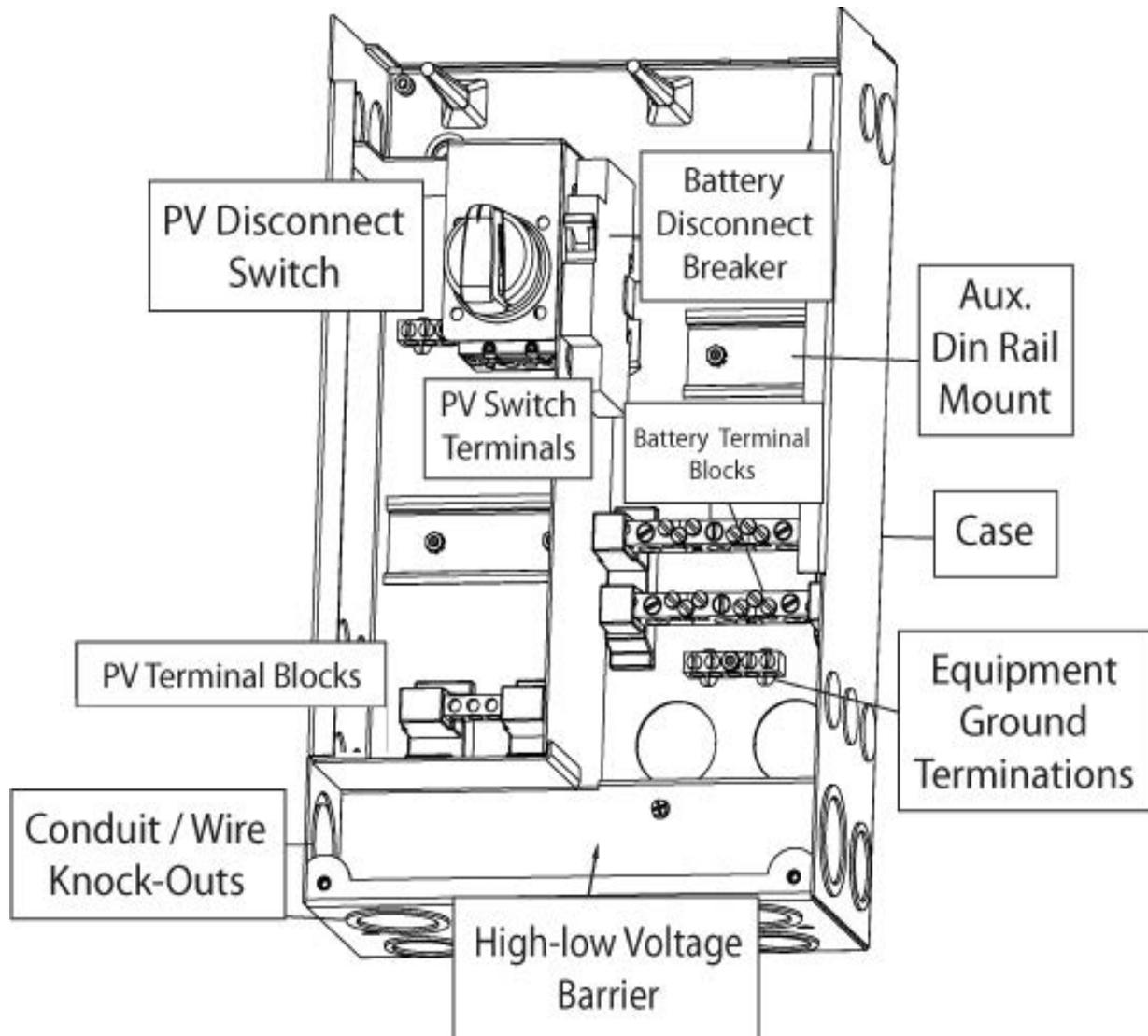
\*\* Based on System Load Size





Morningstar's TriStar MPPT 600V charge controller is available with and without a DC Disconnect Box. Model TS-MPPT-60-600V-48-DB includes a compact on-board DC Disconnect Box, which helps to save on installation time and cost. The DC Disconnect Box enables the TriStar MPPT 600V charge controller to be used in either positively-grounded or negatively-grounded PV systems. The DC Disconnect Box includes the following features:

- PV Disconnect Switch
- Battery Disconnect Breaker (Positive pole battery breaker)
- Four (4) Bus Bars (One for each: PV +/-, Battery +/-)
- Two (2) Standard 35mm DIN Rails
- High-Low Voltage Barrier (Internal barriers between the high voltage PV and low voltage battery wiring)

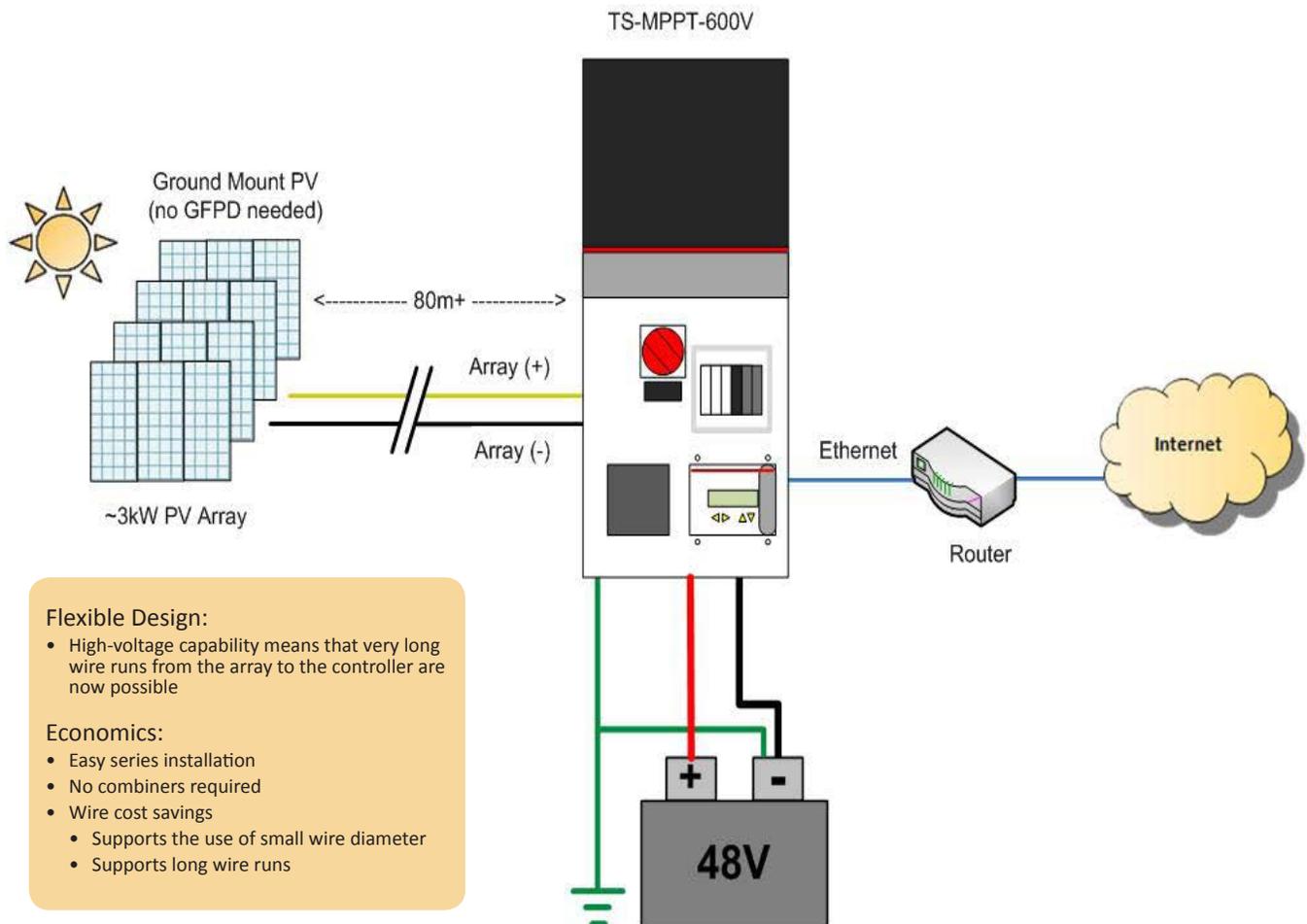


## Innovation

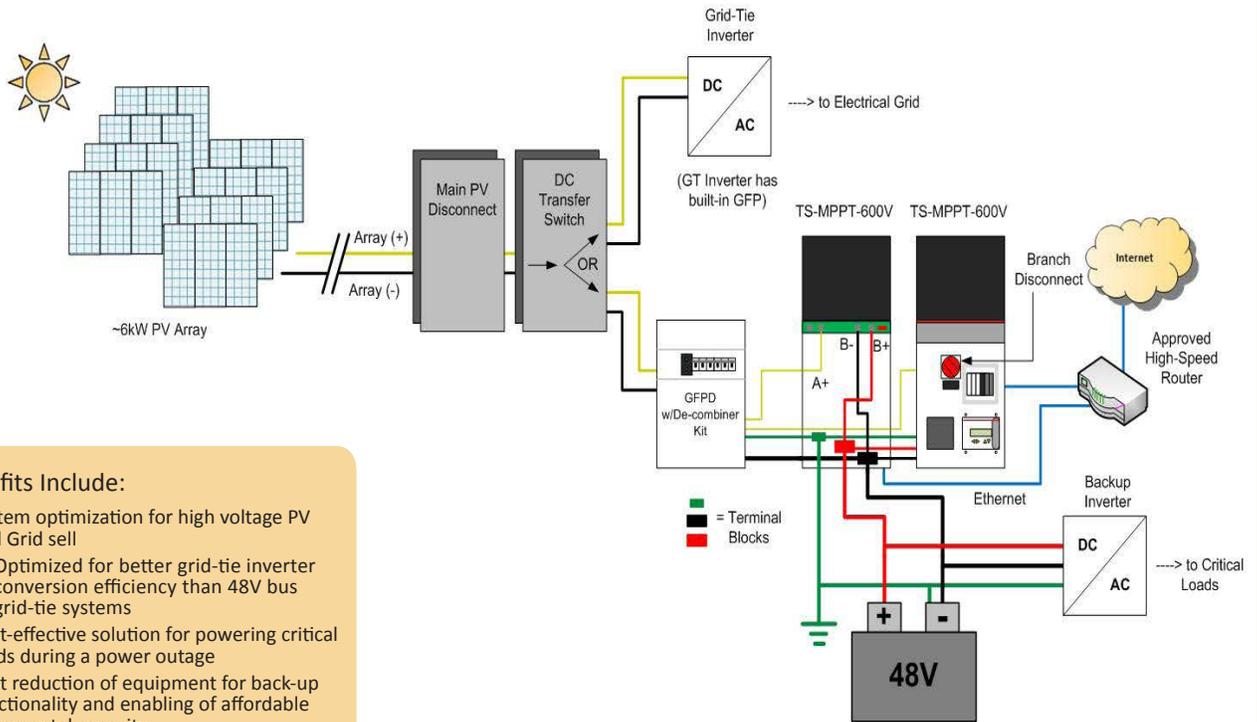
Morningstar's TriStar MPPT 600V charge controller is the ideal choice for residential, industrial and small commercial installations. It offers a highly efficient power path for charging batteries with high-voltage strings, thin film and other grid-tie PV modules. The TS-MPPT-600V uses advanced power electronics to efficiently match up to 600 Voc PV to 48 Vdc battery systems. TS-MPPT-600V controller's high voltage capability and flexible design enable several application scenarios including:

- Off-grid PV systems greater than 150 Voc with long wire runs from the array to the controller
- New installation grid-tie PV systems with battery back-up
- Retrofitting string PV inverter systems to later add battery back-up without changing the PV array configuration
- Battery-based Wind systems

## Off-grid PV systems greater than 150 Voc with long wire runs



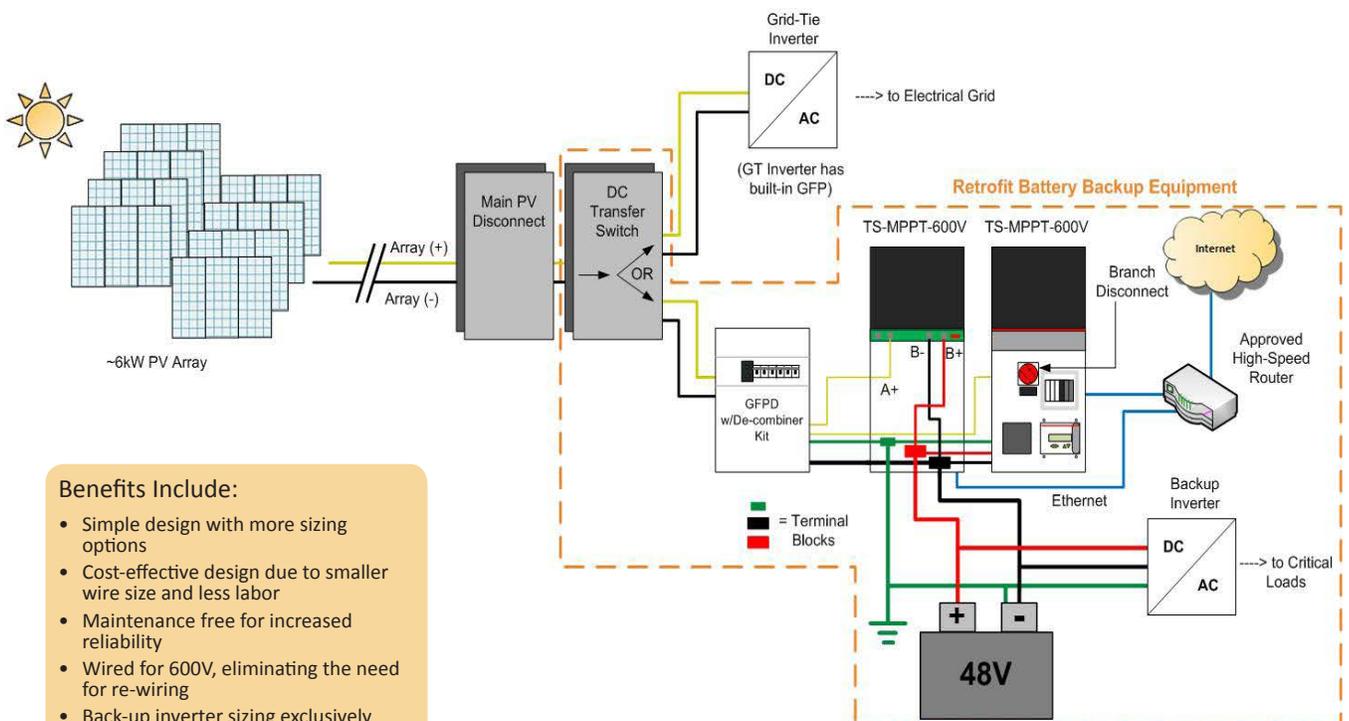
## New installation grid-tie PV systems with battery back-up



### Benefits Include:

- System optimization for high voltage PV and Grid sell
- Optimized for better grid-tie inverter conversion efficiency than 48V bus grid-tie systems
- Cost-effective solution for powering critical loads during a power outage
- Cost reduction of equipment for back-up functionality and enabling of affordable incremental capacity
- Back-up inverter sizing exclusively targeted to critical load

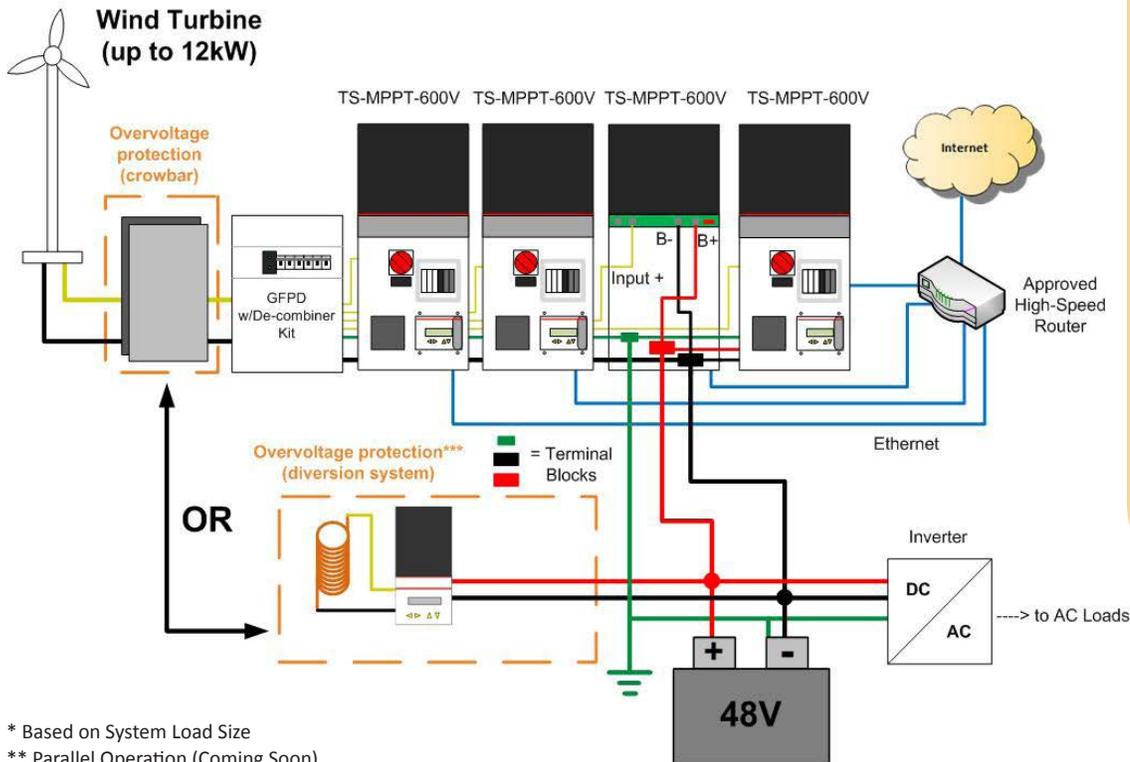
## Retrofitting string inverter PV systems to later add battery back-up without changing the PV array configuration



### Benefits Include:

- Simple design with more sizing options
- Cost-effective design due to smaller wire size and less labor
- Maintenance free for increased reliability
- Wired for 600V, eliminating the need for re-wiring
- Back-up inverter sizing exclusively targeted to critical load

## Battery-Based Wind Systems\*\*



\* Based on System Load Size

\*\* Parallel Operation (Coming Soon)

\*\*\* Input (crowbar) overvoltage protection may be required to protect the wind turbine in the event of a controller fault

### Cost-Effective Solution:

- Until now there has not been a way to use larger size wind turbines in off-grid installations.
  - The TS-MPPT-600V enables the use of larger off-grid wind turbines.
- The TS-MPPT-600V was designed to be used in parallel\*\* to manage charging from a single wind input.
  - Up to four controllers in parallel\*\* for a 12-15kW\* wind system.
  - Wind may output native voltages up to 600 Voc.

### Efficiency:

- The TS-MPPT-600V enables more efficient wind turbine operation via power curve tracking MPPT technology.

### Morningstar's TriStar MPPT 600V Charge Controller:

- Features an innovative digital signal processor and utilizes Morningstar's advanced TrakStar MPPT technology to harvest the maximum available energy from the solar array's or wind turbine's peak power point within the controller's operating range—ensuring the maximum power point is chosen under all ambient conditions
- Utilizes high-speed processing and control methodology—sweeps from array or wind Voc to battery voltage in less than one tenth of a second, faster than all similar controllers
- Uses Morningstar's advanced 4-stage charging algorithm to optimize battery health
- Features extensive system networking, monitoring and communications
- Offers superior lightning protection from nearby voltage and current spikes
- Features extensive electronic protections and environmentally tolerant construction
- Provides the highest reliability and excellent performance—engineered with a robust thermal, mechanical and electrical design



**TS-MPPT-60-600V-48****TS-MPPT-60-600V-48-DB****ELECTRICAL**

Peak Efficiency	97.5%	97.5%
Maximum Battery Current	60A	60A
Maximum Input Current	15A	15A
Maximum Open Circuit Voltage	600V	600V
Nominal Solar Input	3200Wp	3200Wp
Nominal System Voltage	48 Vdc	48 Vdc
Battery Operating Voltage Range	16-72 Vdc	16-72 Vdc
Input Operating Voltage Range	5-525 V	5-525 V
Voltage Accuracy	<= 0.1% +/- 100 mV	<= 0.1% +/- 100 mV
Self-Consumption	1.75 - 2.5 W	1.75 - 2.5 W
Transient Surge Protection	4500 W / port	4500 W / port

**MECHANICAL**

Dimensions	39.2 x 22.1 x 14.9 cm 15.4 x 8.7 x 5.9 in	54.2 x 22.1 x 14.9 cm 21.4 x 8.7 x 5.9 in
Maximum Wire Size		
Power Terminals	2.5 mm <sup>2</sup> - 35 mm <sup>2</sup> 14 AWG - 2 AWG	2.5 mm <sup>2</sup> - 35 mm <sup>2</sup> 14 AWG - 2 AWG
RTS/Sense Terminals	0.25 mm <sup>2</sup> - 1.0 mm <sup>2</sup> 24 AWG - 16 AWG	0.25 mm <sup>2</sup> - 1.0 mm <sup>2</sup> 24 AWG - 16 AWG
Conduit Knockouts	M20; 1/2, 1, 1-1/4 inch (trade size)	M20; 1/2, 1, 1-1/4 inch (trade size)
Mounting	Vertical Surface	Vertical Surface
Enclosure Rating	Type 1 (indoor and vented)	Type 1 (indoor and vented)
Ingress Protection	IP20	IP20
Unit Weight	9.0 kg / 19.8 lbs.	12.8 kg / 28.1 lbs.

**ENVIRONMENTAL**

Ambient Operating Temperature	-40 °C to +45 °C -40 °F to +113 °F	-40 °C to +45 °C -40 °F to +113 °F
Storage Temperature	-55 °C to +85 °C -67 °F to +185 °F	-55 °C to +85 °C -67 °F to +185 °F
Humidity	100% non-condensing	100% non-condensing
Tropicalization	Epoxy Encapsulation, Conformal Coating, Marine-Rated Terminals	Epoxy Encapsulation, Conformal Coating, Marine-Rated Terminals

**ELECTRONIC 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

**COMMUNICATION**

Ports	Ethernet, EIA-485, RS-232, MeterBus
Supported Protocols	MeterBus, MODBUS RTU, MODBUS TCP/IP, HTTP, SNMP v2, SMTP
Information Display	MSView™ Software, Webpage Server, Email/Text Alerts, LCD Display (optional)

**TS-MPPT-60-600V-48**

**TS-MPPT-60-600V-48-DB**

**ACCESSORIES / OPTIONS**

Ethernet	STANDARD	STANDARD
DC Disconnect Box	NO	STANDARD
Ground Fault Protection Device (GFPD-600V)	YES	YES
MeterHub™ (HUB-1)	YES	YES
Relay Driver (RD-1)	YES	YES
Meters (On-Board or Remote)		
TriStar™ Meter-2-600V (TS-M-2-600V)	YES	YES
TriStar Remote Meter-2 (TS-RM-2)	YES	YES
Remote Temperature Sensor (RTS)*	STANDARD	STANDARD

**BATTERY CHARGING**

MPPT Algorithm	TrakStar Maximum Power Point Tracking Technology	
Charging Algorithm	4-Stage	
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	

**CERTIFICATIONS**

- CE, RoHS and REACH Compliant
- ETL Listed [UL-1741 and Canadian CSA C22.2 No. 107.1.01]
- EMC Compliance
  - Immunity: EN61000-6-2:2005
  - Emission: EN55022:2007
- Safety: EN60335-1:2002 and EN60335-2-29:2005
- FCC Class B Part 15 Compliant
- U.S. National Electrical Code (NEC) Compliant
- Manufactured in a Certified ISO 9001 Facility

\* The RTS is shipped standard with the TS-MPPT-600V.

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World's Leading Solar Controllers & Inverters

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