Morningstar’s TriStar MPPT™ solar controller with TrakStar Technology™ is an advanced maximum power point tracking (MPPT) battery charger for off-grid photovoltaic (PV) systems with PV array max power (Pmp) up to 4.2 kW. The controller provides the industry’s highest peak efficiency of 99% and significantly less power loss compared to other MPPT controllers. Detailed battery programming options allow for advanced battery support for the latest Lithium, Nickel Cadmium, and Lead Acid battery types.

The TriStar MPPT features a smart tracking algorithm that maximizes the energy harvest from the PV by rapidly finding the solar array peak power point with extremely fast sweeping of the entire I-V curve. This product is the first PV controller to include on-board Ethernet for a fully web-enabled interface and includes up to 200 days of data logging.

**KEY FEATURES AND BENEFITS**

**Maximizes Energy Harvest**
Our TrakStar MPPT Technology features:
- Better peak power point tracking than other MPPT controllers
- Very fast sweeping of the entire I-V curve
- Recognition of multiple power points during shading or mixed PV arrays
- Excellent performance at sunrise and low solar insolation levels

**Extremely High Reliability**
- Robust thermal design and no cooling fans
- Parallel circuit design provides less stress and longer life for electronic components
- No mechanical relays
- Extensive electronic protections including PV short circuit protection
- Epoxy encapsulated inductors and conformally coated printed circuit boards

**Very High Efficiency**
- Peak efficiency of 99%
- Proprietary tracking algorithm minimizes power losses
- Low self-consumption
- Continuous operation at full power to 45°C without need to de-rate
- Selected electronic devices with higher ratings to minimize losses from heating

**Extensive Networking and 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: connection to a personal computer
- EIA-485: communications between multiple devices on a bus
- Ethernet: fully web-enabled interface to a local network or internet; view from a web browser or send email/text messages
- EMC-1: IP based network and internet connectivity (including SNMP)

**Metering and Data Logging**
- TriStar meter and remote meter provides detailed operating data, alarms and faults
- Three LEDs display system status
- Up to 200 days of data logging via meters or communications ports

<table>
<thead>
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<th>System Status</th>
<th>53.60V</th>
<th>28°C</th>
<th>54.2A</th>
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<th>Data: Day-1</th>
<th>Today</th>
<th>Data: Day-1</th>
<th>Today</th>
<th>Data: Day-1</th>
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### Technical Specifications

#### Versions

<table>
<thead>
<tr>
<th>Versions</th>
<th>TS-MPPT-30</th>
<th>TS-MPPT-45</th>
<th>TS-MPPT-60</th>
<th>TS-MPPT-60M</th>
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<tr>
<td>TS-RM2</td>
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</table>

#### Electrical

- **Max Battery Current**: 30 amps (TS-MPPT-30), 45 amps (TS-MPPT-45), 60 amps (TS-MPPT-60)
- **Nominal Maximum Output Power***: 400 Watts (12 Volt), 800 Watts (24 Volt), 1600 Watts (48 Volt)
- **Max Recommended Solar PV Input***: ~130% of Nominal Max Output Power
- **Peak Efficiency**: 99%
- **Nominal System Voltage**: 12, 24, 48 volts DC
- **Maximum PV Open Circuit Voltage**: 150 volts DC (without damage to unit)
- **Battery Operating Voltage Range**: 8-72 volts DC
- **Maximum Self-consumption**: 2.7 Watts
- **Transient Surge Protection**: 4500 Watts/port

#### Battery Charging

- **Charging Algorithm**: 4-stage
- **Charging Stages**: Bulk, Absorption, Float, Equalize
- **Temperature Compensation**: ~5mV/°C/cell (25° ref)
  - Absorption: -30°C to +80°C
  - Float, Equalize, HVD: Absorption, Float, Equalize, HVD
- **Remote Temperature Sensor (RTS)**: Included

#### Communication Ports

<table>
<thead>
<tr>
<th>Communication Ports</th>
<th>TS-MPPT-30</th>
<th>TS-MPPT-45</th>
<th>TS-MPPT-60</th>
<th>TS-MPPT-60M</th>
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<td>MeterBus</td>
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<tr>
<td>EMC-1</td>
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</tr>
</tbody>
</table>

#### Electronic Protections

- **Solar**: Overload, Short Circuit, High Voltage
- **Battery**: High Voltage
- **High Temperature**
- **Lightning & Transient Surges**
- **Reverse Current at Night**

#### Environmental

- **Ambient Operating Temperature Range**: -40°C to 60°C
- **May derate above the following temperature*****:
  - TS-MPPT-60 = 45°C
  - TS-MPPT-45 = 50°C
  - TS-MPPT-30 = 55°C
- **Storage Temperature**: -55°C to +85°C
- **Humidity**: 100% non-condensing
- **Tropicalization**: Epoxy encapsulation, Conformal coating, Marine rated terminals

#### Mechanical

- **Dimensions**: 29.1 x 13.0 x 14.2 cm, 11.4 x 5.1 x 5.5 in
- **Weight**: 4.2 kg / 9.2 lbs
- **Maximum Wire Size**: 35 mm² / 2 AWG
- **Conduit Knockouts**: M20, 1/2, 1, 1 ¼ in
- **Enclosure**: Type 1 (indoor and vented) IP 20

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*The PV array power rating may exceed the controller’s Max Nominal Output Power specification. The controller will limit battery current and prevent damage. Array oversizing should be considered on a case by case basis. See our array string tool and related tech documentation. [https://www.morningstarcorp.com/array-oversizing](https://www.morningstarcorp.com/array-oversizing)*

**PV Voltage must be greater than Vbattery + 1 Volt to start charging**

*** Assumes 75Vmp, unvented enclosure. See operating manual for further performance characteristic data.

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**Five year warranty period. Contact Morningstar or your authorized distributor for complete terms.**

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**Certifications:**
- CE and RoHS Compliant
- ETL Listed (UL1741)
- cETL (CSA C22.2 No. 107.1-01)
- FCC Class B Part 15 Compliant
- Manufactured in a certified ISO 9001 facility
- IEC 62109-1 (UL/CSA/IEC requires ambient temperature limited to 45°C)

**Options:**
- TriStar Meter-2 (TS-M-2)
- TriStar Remote Meter-2 (TS-RM-2)
- Meter Hub (HUB-1)
- Relay Driver (RD-1)
- EMC-1

**Notes:**

* Due to Morningstar’s policy of continuous improvement, product availability, features and specifications are subject to change without notice.