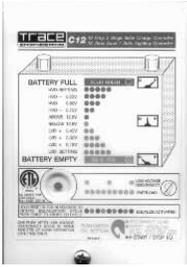


# CHARGE CONTROLS

Charge controllers, or voltage regulators, protect batteries from becoming overcharged or discharged which can severely shorten battery life. Charge controls which operate with Pulse Width Modulation (PWM) technology are built with 100% solid state circuitry. This makes them much more efficient and long-lasting than those using simple on-off charge switching, but they cost more. Electronic circuitry in a regulator measures battery voltage, which rises as the battery state of charge increases. At a determined voltage, which will differ from one battery type to another, and at different battery cell temperatures, the regulator will begin to reduce the charge into the battery. When charging stops, the battery voltage will begin to fall. At a preset lower voltage, the regulator will allow charging to resume. Regulators for photovoltaic, wind and water power systems perform the same function as voltage regulators in automobiles, but they do it in different ways. Automobile regulators will not work at all as a battery charge controller in renewable energy power systems.

## Xantrex Charge Controllers



**C12**



**C35**



**C40 / C60**

Xantrex charge controls are very versatile and can work as load controllers, or as diversion controls for solar, wind and small hydro electric power systems, or as three-stage charge controllers for solar electric systems. Regardless of the charging source, Xantrex makes the right control to suit virtually any application. A range of optional features make these charge controls even more versatile and user friendly. Xantrex charge controls and multifunction charge-load diversion controls are all covered by two year warranties.

### C12

The Xantrex C12 Charge/Lighting/Load controller is unique in that no other controller offers three-stage charging, user definable voltage parameters, and automatic battery equalization. Standard in the load control circuitry of the C12 are field adjustable low voltage disconnect and reconnect points, along with a five minute low battery disconnect warning. The C12 also functions as a lighting controller. Run time of the lights is adjustable from 2 to 8 hours or they may be set to run from dusk to dawn.

### C35, C40, & C60

The C Series has long been the mainstay of Xantrex's charge controller line-up. It is field configurable for 12, 24 or 48 volt DC operation, and can be used as a charge or diversion or load controller. In addition to the standard multi-color charge status LED, the C40 offers an optional cumulative amp hour meter. This meter can either be installed on the face of the controller (DVM) or remotely up to 50 feet (15 m) away with the DVM. An optional battery temperature sensor (BTS) for these controllers ensures precise battery charging regardless of outside temperature fluctuations. The C Series is designed for use with solar electric, hydro electric, wind generator, PV/wind hybrid, and telecommunications power systems. Features include: silent, Pulse Width Modulated (PWM) microprocessor control (maximizes battery life), field-adjustable voltage and battery type set points, electronic protection against short-circuit overload, over temperature, and reverse polarity conditions.

20-105	Xantrex C12, 12 Amp Charge/Load Control 12 Volt	\$158
20-111	Xantrex C35, 35 Amp Charge Control 12/24 Volt	\$169
20-106	Xantrex C40, 40 Amp Charge Control 12/24/48 Volt	\$226
20-116	Xantrex C60, 60 Amp Charge Control 12/24 Volt	\$284
20-107	Xantrex DVM Digital Display For C40 & C60	\$ n/a
20-108	Xantrex C40-C60 Remote DVM Display 50 Ft.	\$155
20-109	Xantrex C40-C60 Remote DVM Display 100 Ft.	\$175
20-115	Battery Temperature Sensor for C12, C40	\$ 39



# CHARGE CONTROLS



This sophisticated line of charge controls for PV systems incorporate micro-processor control for constant voltage pulse-width modulation to make maximum use of valuable PV power. They have automatic equalization, temperature compensation and are very efficient. All of the ProStar controllers can be used with 12 volt and 24 volt systems with sealed, gel-electrolyte or wet-cell lead acid batteries. Optional front panel LCD indicates when the batteries are being charged and relative battery state-of-charge. Automatic low voltage disconnect (LVD) for the batteries is current-compensated to prevent false disconnect when the battery is heavily loaded.

## Morningstar Tristar

Morningstar's Tristar Controller is a three function controller that provides reliable solar battery charging, load control or diversion regulation. The controller operates in one of these modes at a time and two or more controllers may be used to provide multiple functions.

20-820	Tristar 45 amp, 12/24/48 Volt	\$228
20-821	Tristar 60 amp, 12/24/48 Volt	\$315
20-822	Digital Meter	\$149
20-823	RTS	\$ 49

## Tristar & ProStar Product Features:

- Pulse Width Modulation (PWM)
- 3 stage charging & equalizing
- Short Circuit and reverse polarity protection
- High Voltage and high temperature disconnects
- Lightning and surge protection
- Low Voltage Disconnect (LVD)
- manual disconnect
- automatic recovery



## Morningstar ProStar Charge Controls

There are models for 15 and 30 amps of PV arrays outputs @12 or 24V and 15 Amps @ 48V. All of the ProStar controls are available with optional LCD display of battery voltage and PV array charging current and a manual PV disconnect. 5 Year Warranty.

20-810	ProStar 15 Amp Control	\$138
20-830	ProStar 30 Amp Control	\$179
20-811	ProStar 15 A w/LCD meter	\$209
20-831	ProStar 30 A w/LCD meter	\$262
20-832	RTS	\$ 49



## Morningstar SunSaver Charge Controls

This is another line of quality charge controls from Morningstar. SunSaver's battery charging design closely copies the Prostar's advanced charging algorithm and offers many of the advantages of the Prostar for smaller 12 volt, 1 to 3 module systems, at reduced costs. Low voltage disconnect (LVD) models available with 10 & 20 amp ratings.

Constant voltage PWM charging is a proven advancement compared to the common on/off PV regulators. SunSavers are field-selectable for sealed or flooded batteries. A rugged anodized aluminum case and epoxy-encapsulated electronics ensure durability and longevity. Two year warranty. A temperature compensation sensor in the charge control varies full charge voltage with temperature. They have LED charging and LVD indicators. Available in 24 volt models, add approximately \$12.00.



20-840	SunSaver 6 Amp Control	\$ 74
20-841	SunSaver 10 Amp Control	\$ 99
20-842	SunSaver 10 Amp w/LVD	\$112
20-843	SunSaver 20 Amp w/LVD	\$158

## Morningstar SunSaver SunLight Charge/Lighting Control

SunLight has all the features of the SunSaver 10 amp control. It has a rotary switch that allows it to turn on the loads after dusk for 2, 4, 6, 8 or 10 hours periods. It also has the option to turn loads on at dusk, off and on again before dawn, and you can choose the following settings (in hours): 3/off/1, 4/off/2, 6/off/2. On from dusk to dawn is also available. A test button turns lights on for 5 minutes. Maximum load current is 10 amps. Available in 24 volt, add approximately \$15.00

20-848	SunLight 10 Amp/12V	\$179
20-849	SunLight 20 Amp/12V	\$224



# MPPT CHARGE CONTROLS

Maximum Power Point Tracking (MPPT) technology increases charge current up to 30% or More! MPPT controllers increase charge current by operating in a manner that allows the PV module to produce all the power of which it is capable. The controller continually calculates the module's maximum power voltage, and then operates the module at its maximum power voltage to extract maximum power. The higher power extracted from the module is then provided to the battery in the form of an increased charge current. MPPT charge controls are rated by their output, therefore your arrays amperage must be 25%-30% lower than the controllers output to achieve the increased charge current. MPPT controllers allow you to use a higher output voltage PV array with lower voltage battery such as charging a 24 VDC battery with a 48 VDC PV array. This reduces wire size requirements and power loss from the array to the battery location. A doubling of PV input voltage allows a given wire size to run four times as far.

## Blue Sky Energy

### Solar Boost MPPT Charge Controllers

The Blue Sky Solar Boost features reverse-polarity protection, MPP tracking and selectable charge voltage for flooded and gel lead-acid batteries. An equalize function periodically conditions liquid electrolyte lead-acid batteries. An optional user-friendly digital display is available to monitor PV charge performance. The display shows battery voltage, solar current, charge current and charge mode, either in the controller, as a remote panel installed up to 300 feet away, or both. Optional temperature compensation of charge voltage is also available to further improve charge controller and battery performance. Solar Boost controllers available with or without digital display and optional remote display. 3-year limited warranty

#### Solar Boost 50

This charge controller can be used on 12- and 24-volt systems. It can also be used to charge a 12-volt battery from a 24 volt array. Maximum open-circuit PV array voltage is 57 VDC.

#### Solar Boost 2000E

This 25-amp solar charge controller is for 12-volt systems. It mounts in a 5-11/16" x 3-15/16" cut-out and is wired from the rear. This controller is very popular in RV installations. Optional box allows surface mounting

20-950	Blue Sky Solar Boost 50L 12/24V(w/o LCD display)	\$574
20-951	Blue Sky Solar Boost 50DL 12/24V(LCD display)	\$679
20-952	Blue Sky Solar Boost 2000E, 20 Amp, 12V only	\$319
20-957	Blue Sky Solar Boost Battery Temperature Sensor, 20'	\$ 49
20-958	Blue Sky Boost Remote LCD Display, 25'	\$149



### Blue Sky IPN Controllers

Solar Boost 3024i and 2512iX charge controllers include load control outputs. These controllers can also serve as lighting controllers with complete flexibility over post-dusk and pre-dawn ON time settings. An IPN-ProRemote is required to enable and configure dusk-to-dawn lighting control. The IPN-ProRemote does not need to remain with the system and can be used as a setup tool only.

#### Solar Boost 3024iL

SB3024iL is designed to charge 12- and 24-volt battery systems from a 24-volt array (maximum open circuit voltage is 57). Maximum charge current is 40 amps output at 12 and 30 amps at 24 VDC. The new IPN network interface coordinates multiple controllers and shares temperature sensors and display.

#### Solar Boost 2512i and 2512iX

The low-cost Solar Boost 2512i provides a fully automatic 3-stage charge controller system. A partial IPN network interface is also included to allow use of the IPN-Remote or IPN-ProRemote displays.

Additional features provided in the Solar Boost 2512iX include automatic or manual equalization, battery temperature sensor input, full IPN network compatibility, lighting control and an auxiliary output. The user-configurable auxiliary output can serve as either a 25-amp load controller or a 2-amp auxiliary battery charger. The auxiliary battery charge feature is ideal for charging a separate battery such as the engine battery in an RV.



#### Controllers w/Integrated Power Net capabilities:

20-970	Solar Boost SB3024iL 40A/12V - 30A/24V (w/o display)	\$524
20-971	Solar Boost SB3024iL w/display	\$574
20-972	Solar Boost SB2512i 25A/12V	\$249
20-973	Solar Boost SB2512iX 25A/12V w/load control	\$289
20-974	Solar Boost SB1524iX 15A/24V w/load control	\$294
20-975	Solar Boost SB2512i-HV 25A/12V for higher voltage modules	\$295
20-976	Solar Boost SB2512iX-HV 25A/12V for higher voltage modules	\$339
20-977	Solar Boost SB3000i, 30A, 12V, flush mount w/digital display	\$429



# MPPT CHARGE CONTROLS

## OutBack: FM60/80

Rated for up to 60 amps of DC output current, the OutBack FM60 can be used with battery systems from 12 to 60 VDC with PV open-circuit voltage as high as 140 VDC. The FM60 setpoints are fully adjustable to allow use with virtually any battery type, chemistry and charging profile. The OutBack FM60 allows you to use a higher output voltage PV array with a lower voltage battery – such as charging a 12- or 24-VDC battery with a 48-VDC PV array. This reduces wire size and power loss from the PV array to the battery/inverter location and can maximize the performance of your PV system. Array size can be up to 750 watts when charging a 12-volt battery, 1,500 watts when charging at 24 volts and 3,000 watts when charging at 48 volts.

The FLEXmax80 (FM80) is the latest innovation in Maximum Power Point Tracking (MPPT) charge controllers from OutBack Power Systems. Its innovative MPPT algorithm is both continuous and active, increasing your renewable energy yield up to 30%. Thanks to enhanced cooling, the FM80 can operate at its full 80-amp maximum current rating in ambient temperatures as high as 104°F (40°C). Array size can be up to 1,000 watts when charging a 12-volt battery; 2,000 watts when charging at 24 volts; and 4,000 watts when charging at 48 volts.

Both controllers come standard with an easy-to-use-and-understand display of PV system performance. The 4-line, 80-character backlit LCD display is also used for programming and monitoring of the system's operation. They come with standard 5-year warranty with a 5-year extension available.



FM60

20-960	OutBack FM60, 12/24/48 VDC, 60 Amp	\$ 849
20-961	OutBack Remote Temperature Sensor	\$ 49
20-962	OutBack FM80, 12/24/48 VDC, 80 Amp	\$ 979

## Xantrex: XW-MPPT60-150

The Xantrex XW Solar Charge Controller incorporates a dynamic MPPT algorithm designed to maximize energy harvest from the PV array. Features: Integrated PV ground-fault protection; communicates settings and activity to other Xanbus-enabled devices, such as the XW Hybrid Inverter/Charger, the XW Systems Control Panel, XW Autogenstart and other XW Solar Charge Controllers; ultra-reliable, convection cooled design does not require a cooling fan. Large, aluminum, diecast heat-sink allows full output current up to 45 C without thermal derating, indoor enclosure; 5-year warranty.

20-965	XW-MPPT-60-150	\$ 895
20-966	XW-MPPT-80-600	\$2,035



## Morningstar: SunSaver MPPT

Morningstar's SunSaver MPPT (15 Amps at 12/24 volts) solar controller with TrakStar Technology is a maximum power point tracking battery charger for off-grid photovoltaic (PV) systems. It is designed for 12V and 24V battery charging from PV modules with a maximum open circuit voltage of 75W. It can be used with 200W of PV when charging 12V and up to 400W when charging a 24V battery. The controller features a smart tracking algorithm that maximizes the energy from the PV and also provides load control to prevent over discharge of the battery. The SunSaver MPPT is well suited for both professional and consumer PV applications. Its charging process has been optimized for long battery life and improved system performance. 5-year warranty.

- |   |   |
|---|---|
| Features include:   | - Converts 36V or 24V to 12V                      |
| - Temperature compensation                                      | - Epoxy encapsulated                              |
| - Compatible with high voltage PV modules and all battery types | - User adjustable settings                        |
| - Records 30 days of PV system data logging                     | - Efficient MPPT tracking and four stage charging |
| - Operating temperature range: -40°C, +60°C                     | - System status LEDs                              |



20-851	SunSaver MPPT-15L	\$349
20-852	RM-1 Remote meter w/30' cord (for MPTT and SureSine)	\$164

# MPPT CHARGE CONTROLS

## New: Morningstar TriStar MPPT 45/60

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 up to 3kW. The controller provides the industry's highest peak efficiency of 99% and significantly less power loss compared to other MPPT controllers.



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.

	TS-MPPT-45	TS-MPPT-60
• Maximum Battery Current	45 amps	60 amps
• Nominal Maximum Solar Input	12 Volt 600 Watts	800 Watts
	24 Volt 1200 Watts	1600 Watts
	48 Volt 2400 Watts	3200 Watts

20-824	TriStar TS-MPPT-45, incl. Remote Temp. Sensor	\$ 649
20-825	TriStar TS-MPPT-60, incl. Remote Temp. Sensor	\$ 819
20-826	TS-M-2 Digital Meter for TS-MPPT	\$ 149
20-827	TS-RM-2 Digital Remote Meter for MPPT	\$ 178
20-828	TriStar TS-MPPT-30, incl. Remote Temp. Sensor	\$ 519
20-855	Meter Hub Hub-1	\$ 189
20-856	EIA-485/RS-232 Communications Adaptor RSC-1	\$ 83
20-871	TriStar TS-MPPT-60-600V-48 w/RTS	\$2,245
20-872	TriStar TS-MPPT-60-600V-48 w/RTS & Disconnect	\$2,580

## APOLLO T80HV - HIGH VOLTAGE INPUT, 80 AMP MPPT BATTERY CHARGE MANAGEMENT SYSTEM

### 200 Volt maximum PV open circuit voltage

The T80HV is the only MPPT charge controller that works with the newer higher voltage PV modules. Specifically, the Sanyo HIT 200 modules have Vmp of 51.75v at 50oC which will not charge a 48 volt battery, but they generate up to 79.88 volts open circuit at -40oC. Two of these modules in a series string will generate 103 volts at Vmp, but the Voc is almost 160 volts which will destroy all the 140/150 volt charge controllers. The T80HV is designed to operate up to 200 Voc and 160 Vmp and works with the Sanyo HITs.



### FREE Energy Monitor Built In

The T80HV includes a built-in Energy Monitor using TriMetric™ Technology from Bogart Engineering. The monitor tracks power production and consumption to calculate the energy remaining in the battery. State-of-Charge (SOC) is displayed in Percent Full, Amp-hours, Watt-Hours, and Bar-Graph format. In addition, 90 days of energy-harvest history is stored in the T80HV.

### Power and Control in a Single Device

The T80HV *TurboCharger*™ integrates Maximum Power Point Tracking, battery charge management, state-of-charge information, and communications into a single device.

### Integral Performance-and-Update Communications

The slot for optional add-in cards provides data communication to Wireless Remote Displays, PCs and the Internet. System performance can be monitored remotely and the T80HV accepts software upgrades using a PC and the Remote Display SD Card.

### Optimum MPPT/Charging Efficiency Cuts Costs

The T80HV captures up to 35% more power from the photovoltaic (PV) array with patent-pending MPPT

technology. The Apollo MPPT algorithm starts early and locks onto the peak power during rapidly changing insolation

and temperature. The T80HV dramatically cuts the cost of a PV system by reducing the number of PV panels required, eliminating the need for heavy gauge wiring, and increasing the life of the storage batteries.

20-941	T80HV TurboCharger MPPT Charge Controller, 80 amp, 200V	\$ 998
20-942	RD Wired Remote Display	\$ 199
20-943	RD-100 Wireless Remote Display	\$ 419
20-944	RTS Remote Battery Temperature Sensor	\$ 45

# MULTI-FUNCTION ENERGY SYSTEM METERS-MONITORS

We strongly recommend using a quality multi-function Energy Meter, such as the Tri-Metric meter, to eliminate the guess work about what is taking place in nearly every area of your *Renewable Energy Power System*. A multi-function digital energy/battery meter is a great way to monitor conditions in your power system. These keep track of battery state-of-charge, total amp hours produced by the charging source(s), number of amp hours being used. When the battery is full, and the meter is first installed, it is set to zero. As you use power, the meter counts amp hours backwards showing progressive minus numbers on the read-out. When the battery is fully charged again, the meter will read zero again. If you equalize the battery, it counts how many extra amp hours you used during the equalizing cycle, then when you stop charging, it resets itself to zero. Battery voltage can be called up on the display at any time. Amp hour meters are a must for nickel cadmium and nickel iron batteries, where it is nearly impossible to tell state-of-charge from voltage, or specific gravity. They are also a must for UPS (Uninterrupted Power Supply) where generator charging ability can vary greatly depending on loads being applied to it. An amp hour meter can also be used to keep track of power consumption of inverters or other large loads. You will quickly observe how much power it takes to pump water, wash a load of laundry, make toast or saw boards with your table saw.



## Xantrex TM-500A Energy Meter

The TM-500A will monitor 12 or 24 volt power systems, and with the addition of part No. 28-052 it will monitor 48 volt systems. After all the negative leads from DC charging/load circuits are connected to the current shunt, connecting the shunt to the meter is simplified with a snap in phone jack lead. Using the six conductor phone cord included, plug the shunt and meter together and all the connections are made. Comes with a 50 foot six conductor phone cord with jacks and a special 500A/50mV shunt. Measures volts, amps, amp hours, and state of charge.

28-051	<b>Xantrex TM-500A Meter</b>	n/a
28-052	<b>Xantrex TM-48 48V Adapter</b>	n/a



## Blue Sky Energy IPN-ProRemote

The IPN-ProRemote is a full featured IPN compatible charge controller and battery system monitor which provides parameter setup and monitoring capability for up to 8 controllers. It provides a variety of battery and controller data capture functions and computes remaining battery amp-hours displayed as a fuel gauge type indicator. Only one IPN-ProRemote may reside on a single IPN network. A 500A/50mV battery shunt is required. 2-year limited warranty.

Features include:

- Backlit multi-line LCD display
- Accesses advanced controller parameters
- Monitors up to 8 controllers
- Complete battery system monitor
- Coordinates and displays charge control and battery monitor activities



28-109	<b>IPN Pro Remote w/o shunt</b>	<b>\$315</b>
28-500	<b>500 Amp shunt</b>	<b>\$ 55</b>

# MULTI-FUNCTION ENERGY SYSTEM METERS-MONITORS

## Tri-Metric 2020 Battery/Energy Monitor



This battery monitor for 12 or 24 volt (and 48 volt with adapter) battery systems reads amp-hours, amps and volts on an LED display. Amp hours can be displayed in actual amp-hour numbers, or as "percent of full". An LED lights when the battery is charging and flashes when the battery has reached full charge. A "Battery Reminder" LED flashes when batteries should be recharged or equalized or when battery voltage drops too low. It uses only .03 amps with the display on and .016 amps with display off. It also records minimum and maximum battery voltage, days since batteries were last fully charged, days since equalized and total lifetime amp-hours withdrawn from the batteries.

Total amp-hours can be measured to  $\pm 100,000$  amp-hours at an accuracy of  $\pm 1\%$ . Amp-hour reading resets to "0" when the charged criterion is met. This set-point is fully adjustable by the user, depending upon battery type or charging system. Amp-hours can also be reset to "0" manually by the front panel reset control. The Tri-Metric can be located hundreds of feet away from the batteries using 4 conductor meter wire.

A shunt is required for operation.

28-106	Tri-Metric Digital 7 Function Meter 12/24V	\$279 w/gang box
28-107	Tri-Metric 2030-A Digital battery monitor 12/24/48V	\$305 w/gang box
28-300	100 Amp 100A 100mV Shunt	\$ 45
28-500	500 Amp 500A/50mV Shunt	\$ 55

## PentaMetric Battery Monitor

The PentaMetric monitor measures 1 or 2 battery systems with a common negative. With one battery system, battery current plus two charging sources/loads can be measured.

The new PentaMetric battery monitor system offers a lot more capability than the Tri-Metric monitor. The complete system consists of 3 parts: input unit (near batteries), display unit (shown here) and computer interface unit. It can monitor up to 3 shunts: For example; measure total solar input and wind input independently in addition to monitoring battery "state of charge". You can access the data with display unit (shown here) with LCD display and buttons up to 1000 feet from batteries. An optional computer interface with Windows software allows you to control and read out all data from the computer. It has a relay output to control a generator or external alarm and it has audible and visual alarms for high and low battery conditions. 2-year warranty

### Basic measurements:

- 2 voltage channels: 8-100 volts. (For example you can monitor volts from two-battery systems).
- 3 amperage channels  $\pm 0.1$ -200 amps (with 100A/100mV shunt).  $\pm 0.1$ -1000 amps (with 500A/50mV or 1000A/10mV shunt). Each of these requires a separate shunt.
- Temperature -20 to +65 degrees C.

### Secondary measurements:

- Amp-hour (3 channels): to  $\pm 83,000$  amp-hours
- Cumulative (negative) battery amp-hours (2 channels)
- Watts (2 channels)  $\pm 0.1$ - 20,000 watts
- Watt-hours (2 channels)  $\pm 21,000$  kilowatt hours
- Battery % full (2 channels) 0-100%
- Days since batteries charged (2 channels) .01-250 days
- Days since batteries equalized (2 channels) .01-250 days

### Data logging functions

There are 3 types of data logging functions. With the computer interface all 3 types can be output to spreadsheet file.

- Periodically logged data can record any or all of the following at regular intervals: once per day to up to once per minute, amp-hours (3 channels), watt hours (2 channels), Temperature max/min (1 channel), volts (1 channel), amps (1 channel)
- Battery discharge voltage profile data logs volts and amps every time charge level changes by 5% (or 10%) for 1 or 2 battery systems.
- Battery cycle efficiency data documents system efficiency for up to 2 battery systems.



28-115	Pentametric Input Unit	\$339
28-116	Pentametric Display Unit	\$259
28-117	Computer Interface RS232	\$159
28-118	Computer Interface Ethernet	\$254
28-119	Computer Interface USB	\$189