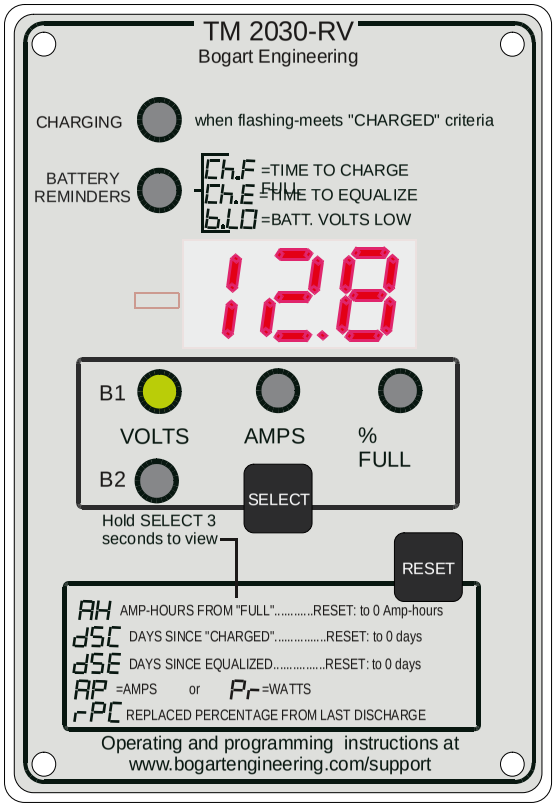
TM-2030

TriMetric Battery Monitor

Installation and User Guide



Warranty: All items have a 3 year limited warranty covering any item that does not perform according to specifications stated or implied in our instructions, provided it does not show obvious signs of abuse or misapplication. We will replace or repair any such item at our option. A return authorization is required for all merchandise returned to Bogart Engineering.

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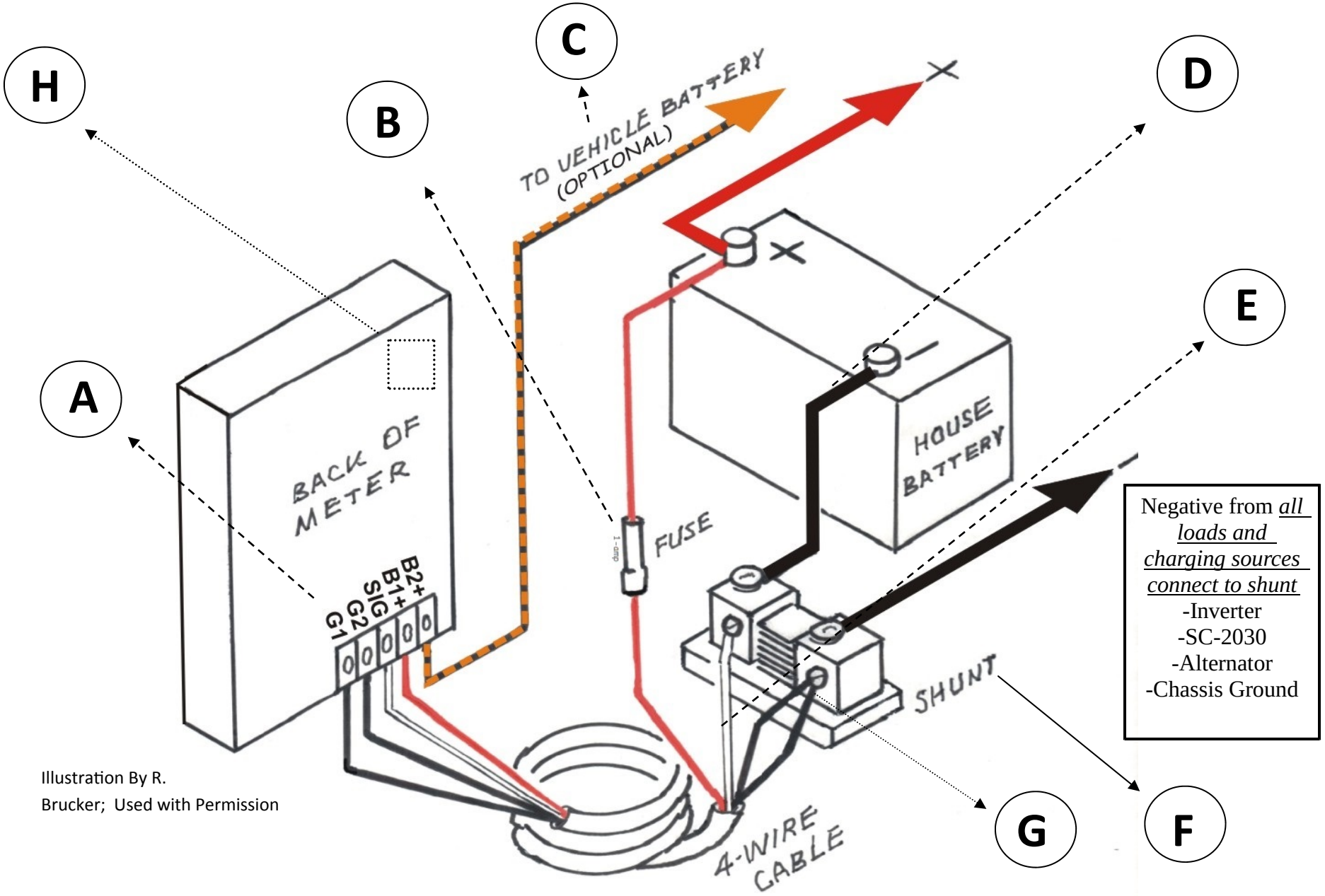
TriMetric Installation



Negative from *all loads and charging sources connect to shunt*
-Inverter
-SC-2030
-Alternator
-Chassis Ground

Illustration By R. Brucker; Used with Permission

REQUIRED: 4-Wire Cable and Electrical Shunt

Wire Length (feet)	**45**	**70**	**110**	**150**	**300**	**Over 300**
Wire Gauge	# 26	# 24	# 22	# 20	# 18	CAT5

Refer to http://www.nfpa.org for electrical wiring standards and information

Shunt Type	**500 Amp-50 mV** (default) "H" under P11	**100 Amp-100mV** Set to "L" under P11	**1000 Amp-100mV** (rarely used) "H" under P11
Maximum Charging Amps	**400**	**75**	**650**

TRIMETRIC INSTALLATION:

Turn off main breaker to battery before attempting installation. Remove all connections from battery negative post.

A. **4-Wire cable.** Most multi-conductor cable is suitable for this application. Cable jacket (outer casing) should be removed to avoid contact with battery, shunt connections or other heat sources.

If installed near high current carrying wires for 10 feet or more: Use twisted pair. "G2" and "SIG" should be run with one twisted pair, and if another pair is used, "G1" and "+B1" may be paired. **CAT5 may be used for long runs up to 350 ft. Visit our support page at www.bogartengineering.com for more information.**

B. **B1 wire** 1-amp fast-blow glass fuse required. Do not insert the fuse into the fuse-holder until installation is complete

C. **Optional B2 wire** connects to vehicle (starting) battery or 2nd battery bank to measure voltage only.

D. **Battery Cable.** Length from 6 inches to several feet as necessary. Battery cable must be large enough to accommodate maximum amps going to and from battery. This is the *only* connection to the battery negative post unless a temperature sensor is used.

E. **SIG wire (white).** Must connect to the small kelvin terminal on the "battery side" of the shunt.

F. **Load side of Shunt.** Negative WIRES from ALL charging sources and loads CONNECT HERE TO MEASURE CURRENT including SOLAR PANELS, CHARGE CONTROLLER, ALTERNATOR, INVERTER, AND CHASSIS GROUND (IF APPLICABLE). Okay to use bus bar as long as connection is ultimately to the shunt. Note: The shunt measures all current to be displayed by the meter.

G. **G1 and G2 wires (black)** connect together at small kelvin terminal on "load side" of shunt.

H. **Phone connector for crossover type modular cable** to connect meter to SC-2030 Solar Charge Controller (if used). May also be used for serial data connection.

Primary System Information

IMPORTANT! After installation, the voltage set-point and amps set-point (P1 and P3) must be programmed in order to display **% Full**. Once programmed, a full charge must occur (parameters must be met) once before the % Full display will show a value.

To Program the TriMetric:

Press and hold **Select** until **P1** appears, then press **Select** to toggle through the different programmable data (**P1-P22)**. To change the data, **briefly press Select and Reset at the same time and let go**. The green lights will flash to indicate that you are in **Change Mode**. Press the **Reset** button **to change the value**, then press **Select** to get out of change mode.

Basic Programmable Parameters required to properly use the TriMetric

P1: Charged voltage set point: The battery is signaled as "charged" when volts exceeds the P1 value, and charging amps is less than as described in P2 (below). P1 is also the "absorb voltage" set point for the SC-2030 charger when used. The **default and recommended value for a 12 volt system is "14.3"**

P2: Charged amps set point: The charged set-point amps (mentioned in P1 above) is a percentage of the value set in P3. If P2 is set to 2.0, and P3 is 220, then the set-point amps value = 4.4. It also signals the SC-2030 to go into "finish charge" mode. The **default and recommended value is "2.0"%**

P3: Battery system capacity (20 Hr. rate) in Amp-Hours (10 to 9990 A-hr). **Default "220". Above 1000 amp hours will display with a decimal value Example 1.2 = 1200.**

Note: Review shunt type information under P11.

Volts: The voltage of your main battery (if the B1 lamp is on) or the voltage of the secondary battery (if the B2 lamp is on). Use volts to:

Check whether the batteries are nearing a low state of charge. This would be (for 12V system) when volts are somewhat less than 12.0 volts. Between 12.0 and 14.0 volts the display is a poor indicator of state of charge in a working system. Use % full instead.

Amps (or watts): Positive when the battery is being **charged** or **negative** when the battery is being **discharged**. This display mode can be reconfigured (using program **P4**) to show power (in Watts) instead of showing current (in Amps).

% Full: This display shows the state of charge (how much energy is left) based on voltage and amps. Use this display to:

Minimize generator run time when charging batteries by running it when "**% FULL**" is low and thus charging amps are higher. When **% FULL** is high, finish charging with solar at lower amps and longer charge times.

Other Programmable Parameters

The **RESET** button will reset any of the following:
"Batt% full" (to 100%)
Amp Hours from full (to 0 Ahr)
Days since charged (to 0 days)
Days since equalized (to 0 days)
To RESET any of these:
(1) Use SELECT to view it on display.
(2) Push and hold RESET for 5 seconds.
Except when viewing rPC: hold down **RESET** to **view** "previous discharge minimum Amp-hours".

P4: Choose either amps ("A") or power (watts) ("Pr") to appear in the primary display. **Default "A"**

P5: Days since charged alarm set point (off, 0.0 to 250 days). **Default "Off"**

P6: Days since equalized alarm set point (off, 0.0 to 250 days). **Default "Off"**

P7: User "complexity" level. L1, L2 ,L3, or L4. Note: L3 or L4 is required to access P8-P22 program parameters. **Default L1**

Secondary display data

The first five items in this category are listed in the lower box on the front panel of the TM-2030. Please see SC-2030 User Manual for additional displays.

The following displays will repeat as long as SELECT is held down. Release SELECT when you arrive to the desired display. Push SELECT to move through options.

AH: Amp-hours from full. This is another way to indicate percentage full. When the battery is full, this value is zero. When the battery is less than full, the value is a negative number, which shows how many amp-hours should be returned to the battery to fully charge it. Automatically resets to 0.00 A-hr and %= "100%" when batteries are charged. May be (though not usually necessary) manually reset to 0.00 A-hr (and %= 100%) by holding the reset key down for at least five seconds while showing this display.

dSC: Days since charged. This value shows the number of days since the battery was last fully charged. If batteries are discharged below 90% every day it is important to not leave the battery at a low charge level for long periods of time. This is only important when batteries are regularly being discharged, not when sitting unused for days. It is reset to 0 automatically when the "charged criteria" are met, however it can be manually reset by holding the reset key down for at least five seconds while in that display mode.

dSE: Days since equalized. Provides a reminder to perform a manual equalization. Shows how many days have elapsed since the last time the battery was equalized. This number is not automatically reset; **it must be reset by holding the reset key down for at least five seconds** while in that display mode. **With SC-2030 charger** also accesses manual equalization: See SC-2030 User's Manual.

Pr or AP: Power ("**Pr**" on display indicating **watts**) or current ("**AP"** on display indicating "**amps"**) depending on whether the amps primary display was set (using program P4) for **amps** or **power**, respectively. This allows both Watts and Amps information to be available in all cases; as one is available as primary information, the other is available as secondary information.

rPC: Percent returned from last discharge period. Because of batteries' inherent inefficiency, it is necessary to recharge batteries with more energy than was last taken out. Flooded batteries require 10-20% more charge than was removed. AGM batteries need about 5-10% more. During battery **discharge**, the value shown is usually zero. While the battery is being **charged**, shows the percentage of charge added compared to amount of charge previously removed: anywhere from 0% to 120%--or much more if your last discharge was small. This display does not indicate current state of charge. **Push RESET while showing this display to see lowest amp hours of the previous discharge**—upon which **rPC** is based. If the base number is small because the discharge was light, a large value of **rPC** isn't problematic.

Advanced Programmable Parameters

Programming Instructions for the TM-2030: **http://www.bogartengineering.com/wp-content/uploads/docs/EnterP1Data.pdf**

Refer to SC-2030 instructions for programmable parameters when using the SC-2030 Solar Charger (P8-P14-P15-P16-P20-P21-P22)

P8-P22 are accessible only when Program **P7** is set to L3 or L4. Default values shown below are automatically installed when switching from L4 or L3 into L2 or L1.

P9: Lo-battery audible alarm: based on % full and battery voltage. Set "low % full" alarm point with **P9 (OFF, 1-100%)**. **Default "OFF"**.

P10: Efficiency factor (60-100%): This parameter affects how the "% full" is evaluated. Discharging amp-hours always evaluated at 100%. Charging amp-hours evaluate at an amps rate determined by this setting. This compensates for battery charging inefficiency. **The default and recommended value is 94%**

P11: Shunt type: Set to "H" for 500A/50mV. Set to "L" for 100A/100mV. **Default H.** Also use "H" when using a 1000 A-100 mV shunt (rarely used)

P12: Auto Reset **ON-OFF**: When OFF percent full and amp hours are not automatically reset. **Default ON**

P13: Low battery voltage alarm setting: "low threshold volts" (10.0-65.0 V) **Default: 10.0** Audible alarm also controlled by **P9 .**

P17: Shows how many hours after "now" that daily history data **H7, H8** ,**H9** will be recorded: (0-24). **Default 12**

P18: Battery calibration voltage adj. Not recommended unless advised by Bogart Engineering. See TM-2030 User's Instructions, Section 6.4.

P19: Resets TriMetric to factory default settings.

History data–displays only when program P7 is set to L3 or L4.

H1: Cumulative lifetime Amp-hours drawn from the battery. Acts like an odometer for batteries. Press and hold Reset for 5 seconds to reset to 0.00

History data: for each of the last **five charge-discharge cycles: P7 must be set to L3 or L4. Press and hold Select until H1.1 appears.** Use SELECT button go down the table rows. For each row, push RESET to step back in time up to five earlier charge cycle periods. **History data**: retained in memory when power turned off

	History Number	X.1 Most Recent	X.2	X.3	X.4	X.5 Least Recent
	H1.1 Cumulative A-hr	H1.1				
5 Charge-Discharge cycle info	H2:Hours since cycle ended	H2.1	H2.2	H2.3	H2.4	H2.5
	H3: Length of Cycle-hours	H3.1	H3.2	H3.3	H3.4	H3.5
	H4: Amp-hour efficiency %	H4.1	H4.2	H4.3	H4.4	H4.5
	H5: Cycle Low % Full	H5.1	H5.2	H5.3	H5.4	H5.5
	H6: Cycle Min. volts	H6.1	H6.2	H6.3	H6.4	H6.5
5 day Log Info	H7: Day's Maximum Volts	H7.1	H7.2	H7.3	H7.4	H7.5
	H8: Day's Minimum Amps	H8.1	H8.2	H8.3	H8.4	H8.5
	H9: Day's percent amp-hr charge	H9.1	H9.2	H9.3	H9.4	H9.5

Technical Information

Permissible battery voltage: 8-65 Volts

Designed for a maximum nominal 48 volt system (not to exceed 65 volts)

Meter Power Requirement: Power from main battery B1: 9-65V, 32mA with display lighted. 16 mA with display off.

Battery capacity settable 10 to 10,000 Amp-hrs.

Dimensions:

TM-2030-RV: 4-1/4 high x 3 x 1-3/8 inch depth with 1/2 in. flanges
TM-2030-A: 4-1/2 x 4-3/4 panel with circuit board 1-1/8 (max)

Important: All charging sources and loads must connect to the "load" side of the shunt. Amps display will not reflect amps correctly if G2 and SIG are not wired properly and/or current sources aren't connected. Additionally, **P1 and P3 must be programmed** and criteria must be met once before % Full will show a value. Please review this information before contacting us.

Serial Data: 5V output stream with all TriMetric real time data ASCII coded.

Charge criteria defined by: Filtered voltage above Voltage set-point. Filtered amps less than amps set-point. Time greater than Time set, all three adjustable. (Filtered time constant: 140 seconds). See website for detailed description.

Visit www.bogartengineering/support for more information.

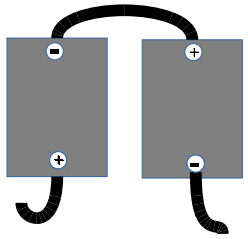
System Information

Battery Type and Connection (example: AGM, Series, 12V)	
Total AH Capacity (20 Hr. rate)	
Shunt Type (500 A-50 mV, 100 A-100mV, etc.)	
Solar Panel Configuration (12, 24, or 48V)	

Series

Example:
Two 6 volt batteries @ 230 AH capacity:
12V 230 AH

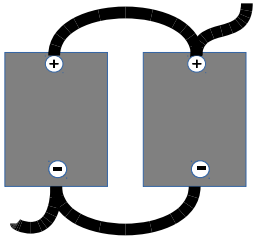
-Increases Voltage
-Does not increase Amps



Parallel

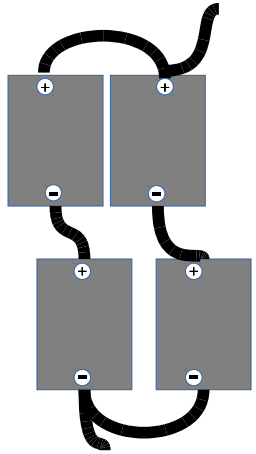
Example:
Two 6 volt batteries @ 230 AH capacity: 6V 460 AH

-Increases Amps
-Does not increase Voltage



Series/Parallel

Example:
Two 6 volt batteries @ 230 AH capacity:
12V 460 AH
-Increases Amps
-Increases Voltage



Notes

Basic P7 set to L1 Default value	**Notes**	**Advanced** P7 set to L3 or L4 Default value	**Notes**	**SC-2030 Only** P7 set to L3 or L4 Default value	**Notes**
P1: 14.3		P9: OFF		P8: 65	
P2: 2 (%)		P10: 94%		P14: --	
P3: 220		P11: H		P15: --	
P4: A		P12: ON		P16: --	
P5: OFF		P13: 10		P20: --	
P6: OFF		P17: --		P21: --	
P7: L1		P18: --		P22: --	