User Manual and Operating Instructions

TRUE BLUE POWER

TT28-2

TRUE BLUE CHARGER Mx

Manual Number
LI-282-101

Revision 1.4 • Date June 21, 2022

NOTICE:

This Operator Manual applies to the
TT28-2 True Blue Charger MX.
These units are manufactured by Lamar Technologies LLC
for True Blue Power.

For similar Activator 282 chargers, contact Lamar Technologies
for the appropriate manual.

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TABLE OF CONTENTS

WARNINGS

DANGER

The TT28-2 enclosure does not have electrical interlocks. Contact with the primary power input lines can be lethal. Only qualified electronics technicians should open the enclosure. There are no user-serviceable parts inside.

1. Introduction

The TT28-2 is a compact aircraft battery maintenance charger, intended to be connected to an aircraft battery and left unattended for an extended time. It is lightweight and compact and connects directly to the aircraft battery terminals. It uses an IEC 60320 C13/C14 power inlet and can operate from any global line/mains AC power source. The TT28-2 comes in two versions; the 282-101 has an integral MS3509-compatible connector, the 282-102 uses adapter cables to connect to the battery. No other tools or equipment are required to use the TT28-2.

The unit will charge a 24 Volt lithium-ion or lead-acid aircraft battery using the standard MS3509-compatible connector on the 282-101 version, or with the supplied adapter cables on the 282-102 version. Do not use it on any other battery voltage or chemistry, such as nickel-cadmium. The TT28-2 displays the battery voltage and any fault codes on its Liquid Crystal Display (LCD) and shows its status with three lights on the front panel. The unit charges at about 2 to 3 Amperes maximum current and regulates the battery voltage to prevent overcharge. After the battery is fully charged, a short “topping” charge is applied. Then the unit shuts off all charging and monitors the battery open-circuit voltage. As the battery self-discharges to a low charge level, the TT28-2 starts another charge cycle. All operation is completely automatic and requires no user interaction.

The TT28-2 is intended for sheltered use (no water into the enclosure) at temperatures from -20°C to +50°C.

Items furnished	Note
TT28-2	282-102 includes adapter cable
Line cord for North America	Line cords available for other countries – see “Replacement Parts Listing” for details
Operator Manual	

The TT28-2 is warranted against defects in materials and workmanship for one (1) year after shipment.

2. Preparation for use

Inspect the shipping carton for obvious signs of damage or dampness.

Open the shipping carton and remove the contents. Check the contents against the shipping list and be sure all items are included.

When not in use, store the TT28-2 safe from shock, vibration, moisture, and excessive heat.

3. Principles of operation

The TT28-2 plugs into any global power outlet of 100 ~ 240 VAC, 50 ~ 60 Hz. It uses a switching power supply to efficiently convert the line/mains voltage to 24 ~ 32 Volts DC, regulated by its microcontroller.

Voltage limits stated in this section are for a Lithium-Ion battery. See the table in the section “TT28-2 Charging Cycles” for Lead-Acid voltage levels.

When AC line power is applied, the display will light up with a white backlight and all three indicator lights will illuminate for several seconds. The TT28-2 will display the firmware revision, followed by the battery voltage for approximately five seconds if one is present, otherwise it will show a low voltage coming from its own power supply. If a battery is connected and the voltage is above 20.5V, the unit will begin charging the battery. If no battery is connected or the voltage is below 20.5V, the unit will display “Er1” and a red FAULT light. The power must be turned off to clear the error message “Er1”.

During charging, a yellow “CHARGE” light is on.

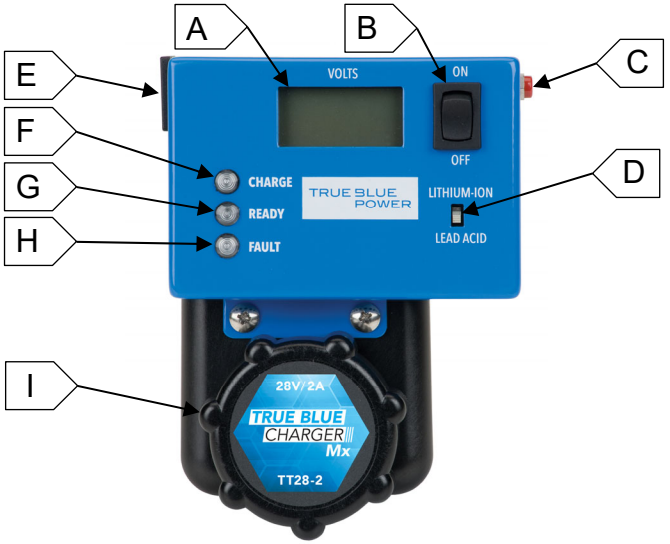
When the battery voltage reaches full charge the TT28-2 illuminates the “READY” light and continues with a “topping” charge for a short time. Voltage is regulated by the microcontroller to prevent over-charging. Counting from when full charged is reached, the topping charge is about 30minutes.

After the topping charge is complete or when the battery reaches its maximum voltage, the TT28-2 turns off the charge current and just monitors the open-circuit battery voltage. The “CHARGE” light is off and only the green “READY” light is on. The TT28-2 draws its operating power from the AC and draws only 125 micro-amps (0.000125 Amps) from the battery while monitoring the self-discharge of the battery. As the battery self-discharges below 26.0 Volts the TT28-2 will automatically begin another charge cycle, lighting the yellow “CHARGE” light. This cycle will repeat as long as the charger is powered on.

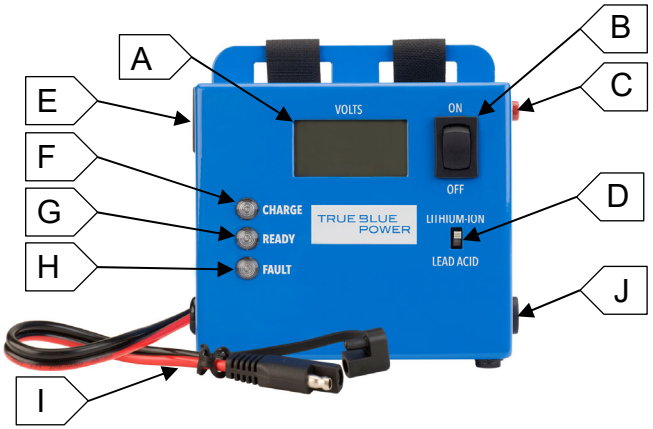
The TT28-2 has an internal timer set for 26 hours. If a battery fails to reach a full charge within 26 hours, the TT28-2 will show a flashing red “FAULT” light and the error message “Er2”. Charging will be suspended. Cycling AC power on the TT28-2 will reset the timer and restart the charge cycle.

The TT28-2 (282-101 version) monitors the temperature at the battery connector. At about 50°C (122°F), the TT28-2 will show a red “FAULT” light flashing about once per second, display the voltage detected and the message “Er3” on the LCD, and will suspend charging. The TT28-2 will resume charging only after the terminals have cooled by approximately 5°C and the AC power is cycled “OFF”, then back “ON”.

Operating Instructions



282-101 Version



282-102 Version

A – Voltmeter B – Power Switch C – Test Points
D – Battery Type Switch E – AC Input Port F – Charge Light
G – Ready Light H – Fault Light I – Connector Knob/Cable
J – Battery Fuse

Operating Instructions

Refer to the preceding figure.

Callout	Description
A	Voltmeter • Displays battery voltage when connected to a battery or • “Er1” when powered on but not connected • “Er2” if battery has not completed a charge in 26 hours • “Er3” if the battery terminals reach 50ºC (122ºF)
B	Power switch. Turns the AC power on or off.
C	Calibration test points (see section 5).
D	Battery Type Switch. Set this recessed switch for the type of 24 Volt aircraft battery to be charged. This switch affects the battery charging voltages.
E	AC power input port. IEC 60320 C14
F	CHARGE light. Shows yellow when charging is taking place.
G	READY light. Shows green when the battery has reached full charge. NOTE: The yellow “CHARGE” light remains on during topping charge and turns off during the idle period while the battery self discharges.
H	FAULT light. Flashes red to indicate an error has been detected, see voltmeter display for error codes.
I	Connector knob (282-101). Insert into the battery connector and turn the knob clockwise to secure the TT28-2 to the battery. Turn counter-clockwise to remove the TT28-2 from the battery. Connector cable (282-102). Connect the appropriate adapter cable and hook up to battery, observing correct polarity.

4.1 Charging a Battery

CAUTION

Connect the TT28-2 to the battery before applying AC power, to prevent a spark when connecting to the battery.

Always observe the proper polarity when connecting the TT28-2 using adapter cables. Red wires connect to battery+, black wires connect to battery->

Disconnect any battery connections. Connect the TT28-2 directly to the aircraft battery terminals with the integral connector on the 282-101 version, or with the supplied adapter cable on the 282-102 version. When using the MS3509 adapter twisting the connecting knob clockwise to secure the adapter to the battery. When using the ring terminal adapter cable be sure and observe proper polarity. Reversing the connection will blow the fuse on the side of the 282-102.

Connect a power cord to the TT28-2 and to a suitable power outlet.

A suitable power outlet will stay continuously powered for the time that the TT28-2 is in use. It will not be turned off periodically, such as a lighting circuit or a circuit that is shut down every weekend.

Observe that the voltmeter backlight comes on with all the lights ON and the battery voltage is displayed on the screen, then the yellow “CHARGE” light comes on. The display shows only battery voltage.

A full charge of a healthy but deeply discharged battery may take up to 24 hours. Of course, partially charged batteries will finish charging more quickly. When the battery has reached full charge, the TT28-2 will provide a topping charge for a few more minutes, then automatically stop charging and just monitor battery voltage. At this time the green “READY” light will be on and the yellow “CHARGE” light will go off.

4.2 TT28-2 Charging Cycles

The TT28-2 charges a battery to full charge, then disconnects completely to let the battery alone until the battery self-discharges to the preset value. The TT28-2 then wakes up and recharges the battery. The cycles and voltage setpoints are shown in the following table.

Note that this sequence restarts every time power is applied or reapplied to the TT28-2. For example, if the TT28-2 is plugged in to a circuit that gets turned off every night (or every weekend), then when power is re-applied the TT28-2 will start over with a full charge of the battery. This is not the desired protocol; it is better to avoid regularly recharging the battery until it has self-discharged to the preset value.

Mode	Indication	Lithium-Ion	Lead Acid
Charge	Yellow “CHARGE”	Charge to 28.7 Volts, then switch to topping charge.	Charge to 28.3 Volts, then switch to topping charge.
Topping Charge	Yellow “CHARGE” and Green “READY”	Hold voltage near 28.7 and allow current to taper for 30 minutes or until voltage reaches 29.0. Then shut down and monitor.	Hold voltage near 28.3 and allow current to taper for 30 minutes or until voltage reaches 28.6. Then shut down and monitor.
Monitor	Green “READY”	Watch battery self-discharge until it drops below 26.0 Volts.	Watch battery self-discharge until it drops below 25.3 Volts.

4.3 Unexpected Loss of Power

If the AC power is removed unexpectedly, the TT28-2 draws no current from the battery.

When AC power is re-applied, the TT28-2 will automatically restart the charge cycle and will reset its internal 26 hour maximum charge timer.

4.4 Disconnecting from a Battery

Turn off the TT28-2. Remove the power cord from the power outlet.

Remove the TT28-2 from the battery by twisting its knob counter-clockwise, or by removing the adapter cables.

4.5 Emergency Shutdown

Remove AC power either from the power outlet or from the TT28-2.

4.6 Lead-Acid Battery Considerations

The TT28-2 may be used with Lead Acid batteries by selecting “Lead-Acid” on the Battery Type switch. Operation is the same as for Lithium-Ion except for voltage levels as noted in section 4.

In the event that the lead-acid battery is sulfated or has some other problem, it may heat up even at the modest 2 to 3 ampere charging rate. The TT28-2 will detect high temperatures (above 50°C) and shut down when necessary.

This heating is very unusual with a good battery unless the environment is close to 50°C (122°F). If the flashing red light and error code “Er3” are observed in a cool environment, it is suggested the battery condition be independently tested.

5. Maintenance and servicing (preventive and corrective)

5.1 Verifying Charge Voltage

Equipment	Example
Calibrated high-impedance digital voltmeter for 30 Volts DC.	Fluke 179, many other meters with 4-1/2 digits or more resolution.

This test is to be done with a battery and AC power connected. This verification procedure is recommended once per year.

Set the meter to read a DC voltage near 30 Volts. Connect the meter leads to the red (positive) and black (negative) test points on the TT28-2.

Apply power to the TT28-2.

Note the voltmeter reading and note the display reading. The display may bounce up and down by a few digits, but the average reading must agree with the voltmeter reading within ±0.20 Volts.

The voltage reading that the TT28-2 uses to regulate the battery charge is the same as the displayed voltage. If the voltmeter reading is more than ±0.20 Volts different from the display, it may be necessary to calibrate or repair the TT28-2. This is best done by the factory.

5.2 Verifying Fan Operation

It is recommended this be performed each time the unit is switched on. It does not matter if the TT28-2 is connected to a battery. Connect AC power and check for air movement through the top fan vent holes. Use a flashlight or strong room light to verify that the fan is rotating. Listen for any ticking or grinding sounds that indicate a bad fan bearing.
The fan is very small, and the airflow is not strong. That is normal.

A bad fan can be replaced by the factory.

6. Preparation for shipment

Place the TT28-2 and power cord into a padded case, if available.

Place into a plastic bag and seal it to prevent moisture from getting into the TT28-2.

Place the bagged TT28-2 into a cardboard carton with at least 1” of resilient padding on all sides.

7. Storage

Store the TT28-2 sheltered from moisture and from severe shock and vibration, at a temperature of -28°C (-18°F) to +70°C (+158°F). The TT28-2 must be cooled below 45°C (113°F) before use.

8. Replacement Parts Listing

8.1 Power Cord

The only user-replaceable part is the power cord. This is a standard cord with IEC 60320 type C13 connector on one end and the appropriate country power plug on the other end. The smallest gauge power wire available is adequate, as the TT28-2 draws less than 1 Ampere under all conditions and all AC voltages.

9. Troubleshooting

Symptom	Possible Cause	Action
No backlight or front panel lights when plugged in.	Power cord not fully plugged in.	Check both ends of the power cord to be sure they are securely plugged in.
	Power outlet not energized.	Test outlet with another device.
	Internal power supply fuse blown.	This is not a replaceable fuse. Its failure indicates a serious internal power failure. Contact distributor or factory for repair.
Displayed voltage is different from an external voltmeter reading.	Tolerance.	Allow a difference of ±0.2 Volts in voltage comparisons before taking corrective action.
	External voltmeter accuracy	Be sure the voltmeter is calibrated.
	Out of calibration	This should not happen. Return unit to distributor or factory for checking and re-calibration.

Symptom	Possible Cause	Action
Red “Fault” light illuminated and message “Er1” is displayed	Battery not connected properly.	Check for proper connection.
	Battery fuse blown	The adapter cable leads may have been shorted or connected improperly. Replace fuse with the specified fast-acting fuse.
Red “Fault” light flashes about once per second and message "Er2" is displayed.	Charging time exceeded 26 Hours (first time)	Battery capacity is larger than 42 Ampere-Hours. Cycle power on the TT28-2 and continue charging.
	Charging time exceeded 26 Hours (second time)	Battery may be defective. Test battery.
Red “Fault” light flashes about once per second and message "Er3" is displayed.	Battery terminals have exceeded 50°C/122°F.	Allow battery to cool. Remove and re-apply power to the TT28-2. This may be a sign of a sulfated or defective battery. If the problem persists, test the battery.

10. Specifications

Input voltage:	90 ~ 264 VAC, 50 ~ 60 Hz, 1 A max.
Input connector:	IEC 60320 C14
Battery charge voltage:	28.8 Volts maximum (Lithium-Ion) 28.6 Volts maximum (Lead-Acid)
Operating temperature:	-20°C to +50°C (-4°F to +122°F)
Storage range:	-28°C to +70°C (-18°F to +158°F)
Timing accuracy:	±5% of nominal time
Display accuracy:	±0.2V
Weight:	TT28-2 and power cord, 2.0 pounds/0.9 kilograms
Size:	Approx. 110mm x 150mm x 95mm (4.33” x 5.9” x 3.8”)
Battery Connector:	282-101 version mates with MS3509 standard aircraft battery connector. 282-102 version includes ring terminal adapter cable.
Battery Fuse:	(282-102 only) 5 Amp, 2AG Fast-Acting, Littelfuse 0225005MXP or equivalent (Lamar p/n 4510-6002)

11. Certificate of Calibration

Lamar Technologies LLC
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CERTIFICATION OF FACTORY CALIBRATION
BATTERY CHARGER ● MODEL TT28-2 ●
Lamar P/N: 282-101 or 282-102

SPECIFICATIONS: Refer to Operating Manual for Complete Specifications

NOTES:	All Standards Used are Traceable to NIST
UNIT:	24 VOLT BATTERY CHARGER
MODEL:	TT28-2
DATE MANUFACTURED:	_____
SERIAL #:	_____
DATE CALIBRATED:	_____
CALIBRATED BY:	_____

Lamar Technologies LLC. certifies that the above listed instrument meets or exceeds all published specifications. It has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology.

Field Calibration Log

Date	Calibrated By	Pass/Fail	Notes

12. Warranty

1 YEAR WARRANTY

Lamar Technologies LLC. warrants its products to be free from defects in workmanship and material for a one-year period from the date of shipment to the distributor, original equipment manufacturer (OEM), or original end user. If any product shall prove to be defective during the warranty period, Lamar Technologies LLC. will repair or replace such part.

There are no warranties, which extend beyond the description on the face hereof. This warranty is in lieu of all other warranties, express or implied. Lamar Technologies LLC. excludes liability for incidental and consequential damages.

An action for breach of this warranty must be commenced within one year after the breach is or should have been discovered. Lamar Technologies LLC. specifically disclaims all other representations to the first user/purchaser, and all other obligations or liabilities. No person is authorized to give any other warranties or to assume any liabilities on Lamar Technologies LLC. behalf.

Power Products by Lamar® Technologies LLC

13. Revisions

Revision	Date	Description
1.0	October 21, 2020	Original Issue
1.1	November 23, 2020	Updated Cover Art and specifications.
1.2	April 19, 2021	Updated text to include 282-102
1.3	June 3, 2021	Updated cover and page 8 to show pictures of 282-102
1.4	June 21, 2022	Updated for Firmware revision b1.1