TELEDYNE
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TDMC+

Teledyne Dual Mode

12 and 24 VDC, Lead-Acid Battery Charger

Product Name: TDMC+

Part Number: TDMC-01

Document:

Revision: A

Revision Date: 10 September 2021

Teledyne Battery Products recommends you read the entire user manual before assembling and using the battery charger. For any questions or concerns please email support: support@teledynebattery.com or call 1 (800) 456 0070 / 1 (909) 793 3131.

Contents

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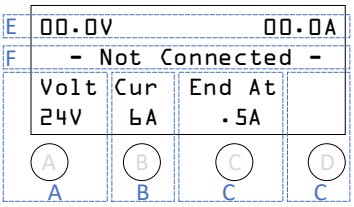
Quick Reference

- Connect (or Disconnect) a battery only when the charger is either unplugged from AC (off) or when the display indicates "-not charging-".
- For proper polarity connect the Positive (Red / +) charging cable to the Positive terminal on the battery. Connect the Negative (Black / -) charging cable to the Negative terminal on the battery. Reversing these connections will result in the charger displaying a "Reverse Polarity" error.



Idle Screen

- When not charging, the charger screen looks similar to the illustration shown on the right. The screen is organized in 6 sections as denoted by letters A-F:
  - Battery Voltage and Battery Current shown in Screen Section E: this information is shown in all modes and updates continuously.
    - Indicated Voltage will be 00.0V when a battery is not connected; or will reflect the voltage of a connected battery.
    - Indicated Amperage will be 00.0A
  - Charger Operational Status shown in Screen Section F: indicates whether the charger is "not charging" and idle, or if a charge cycle is in process.
  - Charger Voltage mode: **User selects** charger voltage for 12V or 24V operation as appropriate for the battery to be charged by pressing the button in Screen Section A.
    - Caution: If a 12V battery is charged with a 24V charge curve the battery may be overcharged causing potentially serious damage.
    - Caution: if a 24V battery is charged with a 12V charge curve the battery may be undercharged, potentially damaging the battery. Please refer to the LT batteries CMM, Section 5.1.2, 5.1.3, and section 5.1.4 page 11.
  - Charger Current mode: **User selects** for 6A to 1A as appropriate for the battery to be charged by pressing the button in Screen Section B.
    - Caution: Always follow battery Component Maintenance Manual (CMM) guidance.
  - Charge Cycle End Condition: **User selects** amperage or time limited charge by pressing the button in Screen Section C.
    - Amperage (.5A) – the charger will follow a three-stage charge mode recommended for use with all normally discharged lead-acid batteries.
      The final stage of the three-stage mode is a constant float maintenance charge. The battery may be left on constant float and will maintain charge until use.
    - Time-Limited (65 hours to 10 hours) – the charger will follow a two-stage charge mode recommended for use with deeply discharged or sulphated lead-acid batteries. Follow CMM and see guidance (section 6) for calculating the recommended time limit.
  - Go! Button: **User initiated** charge cycle
    - After confirming charger configuration, press the button in Screen Section D to start the charge cycle.

- Quick Start
  - Plug in charger, ensure charger shows “not Charging” in Idle Screen Section F.
  - Connect battery, verify voltage in Section E has changed.
  - Select Charge Voltage (Press button in Screen Section A), Charge Current (Screen Section B) and Charge Cycle End Condition (Press button in Screen Section C).
  - Press Go! (Press button in Screen Section D)
  - Screen Section F will show “Charge Complete” when the charge cycle ends successfully.

Product Description

The Teledyne Battery Products TDMC+ is a battery charger for 12V and 24V lead-acid batteries. It offers two microprocessor-controlled precision charging method: a three-stage charging method for normally discharged batteries, and a two-stage charging Method for recovering sulphated or overly discharged batteries.

The charger offers an internationally recognized AC input connector, wide input voltage range operation, wide operating temperature operation, a sealed chassis with external convection-cooled heat fins, reverse polarity detection, temperature and voltage protection and integrated voltage and current monitor. The TDMC includes a battery connection cable with crocodile clips for a wide variety of battery terminals.

TDMC-01 Unit

Power Cord

Universal Battery Charge Cable

Precautions and Warnings

Batteries

- Use caution when handling or charging batteries
- Use caution when charging at high current; monitor the battery regularly for overheating during high current charging. Stop charging if the battery temperature exceeds 120F (50C).
  Allow battery to cool to room temperature before restarting. Any battery that overheats has an internal fault and should be rejected and recycled.
- Wear eye protection when handling, cleaning, working around, or charging batteries
- Verify that the battery rating corresponds to the charger output voltage setting, i.e. 12V to 12V, 24V to 24V
- Ensure the charger is “not charging” or off when making or breaking a battery connection.
- Never charge a battery that is, or appears to be: cracked, damaged, swollen, frozen, emitting a strange odor, or leaking.
- Clean battery terminals. When cleaning, be careful to prevent corrosion from coming in contact with eyes.
- Never short the terminals of a battery.

Location

- Use charger in a well-ventilated area: Lead-Acid batteries under charge may emit hydrogen gas.
- Remove battery from airplane before connecting charger.
- Place charger and battery on a smooth, even, uncluttered surface.
- Allow adequate airflow around the unit during charging to prevent overheating.
  - Maintain minimum 3” (7cm) distance to wall
  - Do not use the charger on a soft, carpeted, upholstered, or varnished surface
- Do not mount charger directly over, or directly under a charging battery.
- Use charger indoors only: the unit is closed to external airflow but not sealed, do not expose the battery charger to water, snow, ice, moisture, fuel, oils, pressurized gasses, combustible or inflammable substances.
- Only use in an area where all charger electrical cords will avoid hot surfaces, such as exhaust pipes, and moving parts, such as fan wheels.
- Place the battery in a location where items will not be dropped on it.
- This charger can be used with Lead-Acid batteries only. Avoid charging batteries of differing chemistries in the same work area in order to prevent accidental connection of charger to any chemistry other than Lead-Acid.

Grounding and AC Power Cord

- Never use a cable that is worn, frayed or damaged.
- The battery charger must be grounded to reduce risk of electric shock. The charger must use an electrical cord with a grounding plug. The outlet must be properly installed and grounded in accordance with applicable codes and ordinances.
- Never connect the AC plug into an electrical outlet if you are wet or barefoot.
- DANGER – Never alter the AC cord or plug- if it will not fit in the outlet, have a proper outlet installed by a qualified electrician.

- Be sure that any AC adaptors or extension cords provide all three connections (power, return and ground), and are of suitable rating for the charger product.

DC Output Connection

- DC connections must be made before starting the charge cycle.
- Never use a cable that is worn, frayed, nicked or damaged or is in any other condition than will make a reliable connection to the battery.
- An intermittent cable connection will interfere with the proper operation of the charger.
- Do not disconnect the charger from the battery while the charge cycle is in operation.
- Be careful not to short the terminals of a battery together when connecting or disconnecting the DC connection.
- Make sure that the cable's terminals are free of any corrosion.

Charger

- Never operate a charger that has been damaged in any way including impact, shock, or excessive exposure to moisture, plague, pestilence or locusts.
- Do not disassemble the charger. No user serviceable parts inside. Return the product to Teledyne Battery Products for service: call or email for return instructions.

Personal Precautions

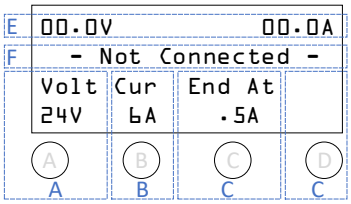
- Have plenty of fresh water and soap nearby in case battery electrolyte contacts skin, clothing or eyes. Wear complete eye and skin protection when connecting, disconnecting, handling and charging batteries. In the event of an accident, immediately flood the affected area with water and get medical attention.
- Someone should be within the range of your voice, aware of your activity, and be able to come to your aid when you are working with or near a battery.
- Never smoke, or allow a spark or flame, in the vicinity of a battery or engine.
- Remove jewelry
- Wear eye protection

Charger Operation

The Teledyne Battery Products TDMC+-~~01~~ offers two distinctive battery charging methods that are recommended for all lead-acid batteries. The choice of method is guided by user selections that the user makes based upon the condition of the battery. Once a charge cycle is initiated the charger will operate automatically and stop. The LCD text display and the LED color lights display inform the user of proper connection, charger operation and status of an operational charge cycle.

Organization of the Screen and Options

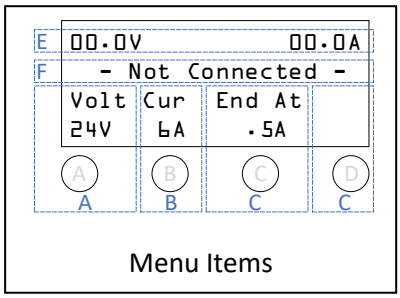
- When not charging, the charger screen looks similar to the illustration shown on the right. The screen is organized in 6 sections as denoted by letters A-F:
  - Battery Voltage, Battery Current and Charger Temperature: this information is shown in all modes and updates continuously.
    - Indicated Voltage will be 00.0V when a battery is not connected; or will reflect the voltage of a connected battery.
    - Indicated Amperage will be 00.0A



Idle Screen

- Charger Operational Status:
  - indicates whether the charger is “not charging” and idle, or if a charge cycle is in process.
  - Other possible indications include:
    - Error: Rev Polarity – indicates an error that the charger senses that a battery has been connected in reverse polarity.
      For proper polarity connect the Positive (Red / +) charging cable to the Positive terminal on the battery. Connect the Negative (Black / -) charging cable to the Negative terminal on the battery. Reversing these connections results in the charger displaying a “Reverse Polarity” error. In the event “Rev Polarity” is displayed, disconnect the battery and check connections. This error does not require a power reset to clear the error.
    - Error: Not Connected – indicates an error that the charger senses a connection problem or under-voltage condition during a charge. Disconnect the battery. Inspect the power cabling for worn, frayed, corroded, or broken wiring. Verify the battery shows a nominal voltage for its rating, and that the charger is properly configured. Reset the charger by disconnecting and reconnecting power.
    - Error: Over-Voltage – indicates an error that the charger reaches an over voltage condition during the charge. There may be a problem with the connected battery or an opening in the output cabling. Disconnect the battery. Inspect the power cabling for worn, frayed, corroded, or broken wiring. Verify no other circuits are connected to the battery. Reset the charger by disconnecting and reconnecting power.
    - Error: Over-Current – indicates that the charger reaches an over current condition during the charge. There may be a problem with the connected battery or a short in the output cabling. Disconnect the battery. Inspect the power cabling for worn, frayed, corroded, or broken wiring. Verify no other circuits are connected to the battery. Reset the charger by disconnecting and reconnecting power.

- Error: Over-Temp – indicates the internal temperature of the charger is outside specified operational limits. Disconnect the battery. Disconnect power from the charger and allow it to cool. Ensure there is adequate airflow around the charger and that other environmental factors are not contributing to overheating.
- Error: Under-Volt – an error occurred during charging where battery voltage did not rise during constant-current mode. This error may indicate that the battery design voltage did not match the 12V/24V voltage selector, or it may indicate a problem with one or more cells in the battery.
  Reset the charger by disconnecting and reconnecting power. Ensure that the 12V/24V voltage selector is correct for the battery and the battery shows a reasonable resting voltage before restarting the charge cycle.
- Error: Timeout – an error occurred during charging where the charger stage failed to complete in the allotted time. See charging Method details for allotted times.
- Note: in most Error conditions, Selection Items A, B, C and D will vanish and the charger will not allow further operation until power has been turned off and on, and the error condition is remedied.



Menu Items

- Charger States
  The charger can be in one of four operational states
  - Not Charging – the charger is idle and supplying no energy to the battery. In this state, the user may make selections to configure the charger and to start the charge cycle.
  - Charging – the charger is charging according to the selections made by the user. In this state the user may select to pause the charge.
  - Charging Paused – The charger has paused the charge Method and allows the battery to rest. The user may select “Go!” to resume the charge cycle or “End” to cancel the charge cycle (Not Charging).
  - Charge Completed – the charger has completed the selected charge cycle and is waiting for the user to confirm this message by pressing “End”.
- Button Operation
  - Each press of a Voltage, Current or Charge-Cycle-End button advances the selection above that button one step. The order of sections is as shown on the right.

LED Indicators

Four Red/Green indicators provide an easy way to monitor the operation of the charger from a distance.

 Status	• Status
	  • Off – Not Charging / Charger is idle
	  • Red – Stopped on Error
	  • Red/Green – Charging
	  • Green – Charge Complete

 Connection	• Connection
	  • Red – Battery is reverse polarity
	  • Red/Green – Battery not detected
	  • Green – Battery is connected correctly

 Stage	• Charge Stage
	  • Off – Not Charging / Charger is idle
	  • Red – Constant Current
	  • Red/Green – Constant Voltage
	  • Green – Float

 Fault	• Fault
	  • Red – Fault detected, unit requires service
	  • Red/Green – Over temperature, allow unit to cool before use
	  • Green – No faults detected

Charging Methods

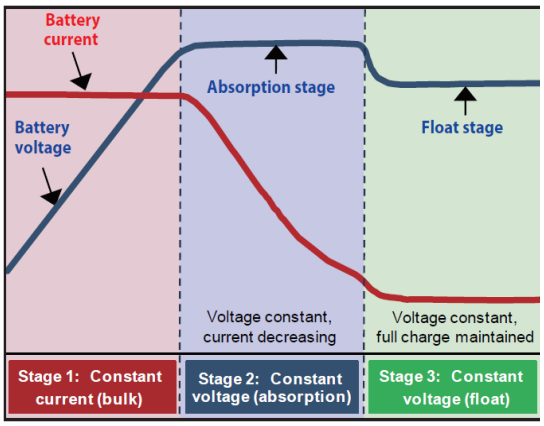
This section provides details for the two charging methods and how to use them.

Normally Discharged Lead-Acid Battery Three Stage Charge Method

For any normally discharged lead-acid battery, configure the charger for the three-stage charge mode as follows:

- Connect (or Disconnect) a battery only when the charger is either unplugged from AC (off) or when the display indicates "-not charging- ".
  - Charger Voltage mode: **Select** charger voltage for 12V or 24V operation as appropriate for the battery to be charged by pressing the button in Screen Section C.
    Caution: *If a 12V battery is charged with a 24V charge curve the battery may be overcharged causing potentially serious damage.*
- Charger Current mode: **Select** for 6A to 1A as appropriate for the battery to be charged by pressing the button in Screen Section D.
  Caution*: Teledyne Battery Products does not recommend using a charge current (Amps) that is greater than the battery capacity in Amp hours. Always follow battery Component Maintenance Manual (CMM) guidance. CMM are available at www.TeledyneBattery.com.*
  - Charge Cycle End Condition: There is only one .5A current set point ending condition For Normally Discharged Lead-Acid Battery Charge Method. **select "End at .5A"** in Screen Section E. With this selection, the charger will follow the three-stage charge mode recommended for use with all normally discharged lead-acid batteries.
  - Go! Button: **User initiated** charge cycle
    - After confirming charger configuration, press the button in Screen Section F to start the charge cycle.

Details of Three Stage Charge Method



Three Stage Charge Algorithm

1. Stage 1: Constant Current – Bulk Charge
   With the battery in a discharged state, charging initiates in constant current mode. Current is maintained at user specified current as the battery voltage increases. The charger automatically progresses to Stage 2 based upon the battery voltage. This stage is allowed a maximum of 6 hours.
2. Stage 2: Constant Voltage – Absorption
   When the battery voltage has reached the 12 or 24V set-point, charging continues in constant voltage mode. Voltage is maintained as the charging current decreases. The charger automatically progresses to Stage 3 based upon the battery current. This stage is allowed a maximum of 6 hours.
3. Stage 3: Constant Float – Finishing Charge
   When the charge current has dropped off to the .5A setpoint, the charge is complete. The charger continues in float voltage mode. Voltage is maintained at float voltage level to keep the battery charged without boiling out electrolyte or overcharging the battery. The battery may be left connected to the charger and in constant float until use.

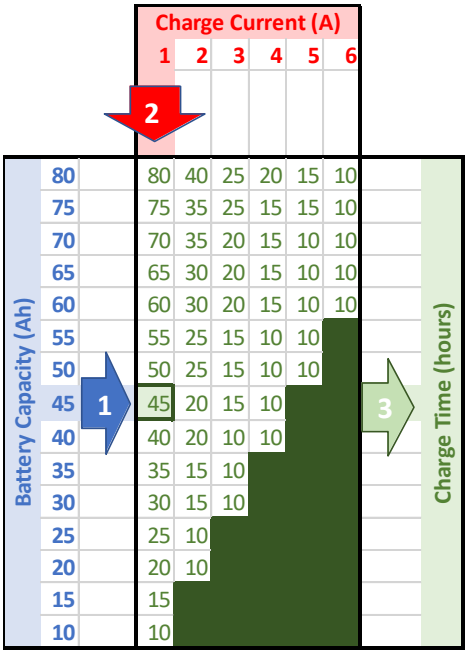
Deeply Discharged or Sulphated Lead-Acid Battery Two Stage Charge Method

For any deeply discharged lead-acid battery, configure the charger for the two-stage charge mode as follows:

- Connect (or Disconnect) a battery only when the charger is either unplugged from AC (off) or when the display indicates "-not charging- ".
  - Charger Voltage mode: **Select** charger voltage for 12V or 24V operation as appropriate for the battery to be charged by pressing the button in Screen Section C.
    Caution: *If a 12V battery is charged with a 24V charge curve, the battery may be overcharged causing potentially serious damage.*
- Charger Current mode: **Select** for 6A to 1A as appropriate for the battery to be charged by pressing the button in Screen Section D.
  Caution*: On deeply discharged batteries, Teledyne Battery Products recommends a 1A charge curve and recommends not using a charge current (Amps) that is greater than 1/10 of the battery capacity in Amp hours. Always follow battery Component Maintenance Manual (CMM) guidance, consult the battery documentation, service bulletin or battery manufacturer for guidance or use the lowest 1A setting.*
  - Charge Cycle End Condition: The Deeply Discharged or Sulphated Lead-Acid Battery Charge Method ending condition is based on time. The time should be based upon the battery capacity in amp hours, and the desired charging current. **select an ending condition in hours** in Screen Section E.
    - Observe the Battery Capacity in Amp Hours (Ah) as recommended by the battery CMM section on Deep Discharge Recovery. Round this number to the nearest 5 Amp-hours.
    - Observe the selected charge current (1A).
    - Calculate the charge time using the equation or the table provided.
    - Calculation method:

$$\frac{Battery\ Capacity\ (Ah)}{Charge\ Current\ (A)} = Charge\ Time\ (hours)$$

      Round the result down to the nearest 5 hours. If the result returns less than 10 hours, the selected charge current is too high, select a lower charge current.
    - Table Method
      - Select the row (1) that corresponds to the Battery Capacity (Ah).
      - Select the column (2) that corresponds to the desired charge Current (A).
      - Identify the Charge Time at the intersection of the chosen row and column.
    - Example 1: The Teledyne 7638-44 battery is a 24V, 44 Ah battery, 1A charge:
      - The battery capacity is 44Ah, round to 45.
        - Divide 45/1 = 45
        - 45 is already evenly divided by 5
      - This column, row and result are marked in the table



Battery Charge Timetable

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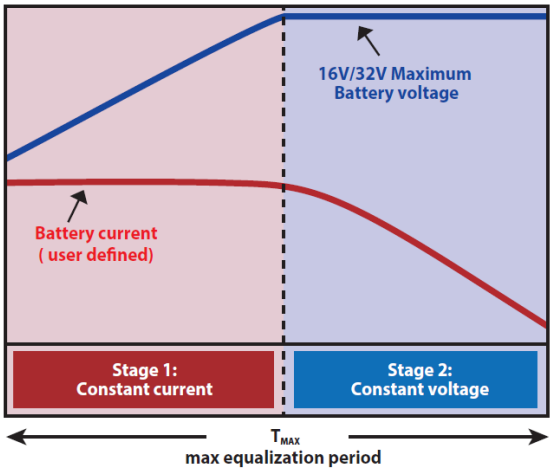
  - Example 2: The Teledyne 7638-44 battery is a 24V, 44 Ah battery, 2A charge:
    - The battery capacity is 44Ah, round to 45.
      - Divide 45/2 = 22.5
      - 22.5 is not evenly divisible by 5, round 22.5 down to 20.
    - On the table, select the same row as in (1), select the next column to the right, observe the answer 20 is to the right of 45.
- Go! Button: **User initiated** charge cycle
  - After confirming charger configuration, press the button in Screen Section F to start the charge cycle.

Details of the Two Stage Charge Mode

1. Stage 1: Constant Current – Bulk Charge
   With the battery in a discharged state, charging initiates in constant current mode. Current is maintained at user specified current as the battery voltage increases. The charger automatically progresses to Stage 2 based upon the battery voltage. This stage is allowed a maximum of 6 hours.
2. Stage 2: Constant Voltage – Absorption
   When the battery voltage has reached the 16 or 32V set-point, charging continues in constant voltage mode for the selected duration. Voltage is maintained as the charging current decreases.
3. Charge Complete – The charge cycle is complete



Two Stage Charge Algorithm

Charging Specifications

General Parameters	**12V Specification**	**24V Specification**
Maximum Charging Current	6A +/- .5A	
Standby battery Drain	<100 uA with AC disconnected	
Voltage Regulation	+/- .5%	
Output noise and ripple	<150mV, 100MHz BW	
Efficiency	Minimum 85% under worst line/load conditions	
3 Stage Parameters	**12V Specification**	**24V Specification**
Max Absorption Voltage	14.4V +/- 100mV	28.8V +/- 100mV
Absorption to Float Current	500mA +/1 100mA	500mA +/1 100mA
Float Voltage	13.15V +/- 100mV	26.30V +/- 100mV
Overvoltage Protection	15.2V +/- 200mV	30.4 +/- 200mV
2 Stage Parameters	**12V Specification**	**24V Specification**
Duration of Stage 1 + 2	10 – 80 hours, selectable	
Max Absorption Voltage	15.0V +/- 100mV	30.0V +/- 100mV

Unit Specifications

Electrical Input	Voltage	85 VAC – 270 VAC, 50/60 Hz
	Max Power	250 Watts
	Configuration	Line, neutral, chassis ground
	Connector	IEC 60320 C14 power inlet (C13 cord plug)
	Supplied Cable	18AWG grounded cord with NEMA 5-15 grounded Type B wall connector
Electrical Output	Voltage	32 VDC maximum
	Current	6A maximum
	Configuration	Positive, Negative
	Connector	Two pin circular
	Supplied Cable	14 AWG battery cord with crocodile style battery clips
Environment	Orientation	May be used horizontally or vertically
	Location	For indoor use only.
	Operation	-22F to 140F (-30C to 60C)
	Storage	-40F to 176F (-40C to 90C)
Certification	UL (U.S)	Under Evaluation
	CUL (Canada)	Under Evaluation
	CE	Under Evaluation
	FCC	Compliant to Part 15 of FCC Rules
Mechanical Dimensions (unit only)	Height	11.5” (290mm)
	Depth	5” (130mm)
	Width	6” (150mm)
	Weight	6 lbs (2.7 Kg)

FCC STATEMENT This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. NOTE: This equipment has been tested and found to comply with time limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio interference energy and, if not installed and used in accordance with the instructions, may case harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: A. Re-orient or relocate the receiving antenna. B. Increase the separation between the equipment and the receiver. C. Connect the equipment into an outlet or on a circuit different from that to which the receiver is connected. D. Consult the dealer or an experienced radio/TV technician for help.

Charger Settings

- The charger automatically retains the settings selected at the start of a charge cycle and returns to them at the end of a charge cycle and at the next power on.

Software Version

The TDMC only has one software configuration. Software cannot be updated by the user and does not need to be updated. Software may change due to production variation or component differences. A charger's software version can be determined in the field by following these steps:

1. Power unit off.
2. Press and hold any of the four buttons A-D
3. Power unit on while continuing to hold the button

Field Test / Calibration Check

This unit does not require periodic calibration. Validate proper operation of the unit and internal sensor calibration by following this field test procedure.

Required Items:

1. Charger
2. 12V or 24V Lead Acid Battery or at least 10A capacity (preferably 50% - 80% charged)
3. Calibrated DC Multimeter with 30V and 10A ranges
4. Time reference (watch, clock, etc. with elapsed seconds)
5. Power Cord
6. Appropriate Battery connection cord for the selected battery

Approximate Duration of Test: Ten minutes, plus setup time.

Field Test Procedure:

1. Power on Charger with battery disconnected
2. **Verify** screen shows 00.0V and 00.0A
3. Connect 12V or 24V battery (as available) and configure charger:
    a. Select 12V or 24V (as appropriate),
    b. Select 6A,
    c. Select End At .5A; press Go!
4. Set DMM to voltage mode, connect DMM in parallel with battery.
5. **Verify** DMM matches voltage on screen (+/- .5V)
6. Press Pause.
7. **Verify** DMM matches voltage on screen (+/- .2V)
8. Set DMM to current mode, connect DMM in series with battery (10A mode)
9. Resume charge (press Go!)
10. **Verify** DMM matches current on screen (+/- .15A)
11. Cancel charge: Select Pause, then select End.
12. Leave DMM in circuit in current mode (10A mode), and configure charger:
    a. Verify selection on screen is still 12V or 24V (as appropriate),
    b. Select 1A, End At 65h (or any time limit – charge will be interrupted) press Go!
13. **Verify** DMM matches current on screen (+/- .15A)
14. Observe countdown timer over period of 30 seconds as measured by time reference
15. **Verify** that 30 seconds elapsed on time reference and unit simultaneously (+/- 2 seconds)
16. Cancel charge: Select Pause, then select End.
17. Remove DMM from circuit and reconnect battery to charger
18. Set DMM to voltage mode, connect DMM in parallel with battery.
19. **Verify** DMM matches voltage on screen (+/- .2V)
20. Disconnect battery and reconnect battery in *reverse polarity.*
21. **Verify** screen indicates reverse polarity
22. **Verify** reverse polarity LED
23. If the unit fails Verification steps, discontinue use and contact Teledyne for support.