

# **TSM2500 Series High Efficiency Intelligent Charger**

**ThunderStruck User Manual Version 1.09 July 2023**



# **Table Of Contents**

I. Product Overview

II. Safety

III. Preventing Short Circuits and Fire

1. Correct use of Breakers, Sockets and Cables

2. Correct Input Connections

3. Charging Environment Requirements

4. Lithium Cell Safety

IV. Regular Maintenance

V. Technical Specifications

VI. Parts List

VII. LED Charge Light Information

VIII. Input and Output Interface

IX. Appearance and Installation Dimensions

X. Connections and Wiring

XI. Faults & Solutions

## I. Product Overview

The TSM2500 series high efficiency intelligent charger is designed to charge traction batteries of electric vehicles. This series of products adopt the most advanced technologies such as LLC resonant, active power factor correction, microcomputer measurement and control, digital adjusting, and extremely water resistant technology. Its features include: wide input voltage range, high input power factor that significantly reduces the input current as well as heat generated from the input cable, and low harmonic current that reduces interference to other electric equipment. Full range soft switching is used to achieve high conversion efficiency and very little electromagnetic interference. The charger is designed according to IP66 protection grade and is highly water resistant. It is also small in size, lightweight, quiet, beautiful, simple to install and of course easy operation and maintenance.

The charger uses microcomputer measurements and control technology, the embedded CPU can accurately detect battery voltage and charge current.

The charger has temperature compensation functions, as well as automatic shut down after being fully charged. Reverse battery connection protection as well as output short circuit protection, AC input under voltage protection, and overheating protection. These functions help to ensure safe and reliable use.

These are canbus controlled chargers, which require a charge controller to initiate a charge, such as the ThunderStruck MCU and EVCC. Canbus information is available if needed for custom applications.

Charging will automatically stop under the following conditions:

1. Lost canbus communication
2. Charge controller fault determination (power source, BMS, or communication fault)
3. Charger internal fault

Note: The non-canbus 48v charger model is designed for lead acid batteries, and provides a pre-programmed charge profile without canbus control.

## II. Safety

1. Please do not disassemble the charger; this may cause electric shock or other injuries.
2. If the charger needs to be connected to an AC power supply with extension cables, please make sure that the extension cable can withstand the maximum input current (2.5 mm<sup>2</sup> or larger flexible copper wire is recommended), and limit the extension cable length within 10m.
3. Don't place the charger where it can get wet, this may cause damage to the charger as well as electric shock to the operator.
4. The charger's DC output plug should be connected reliably to the socket, if connections are damaged or loose, please replace them immediately, otherwise it will cause overheating and possibly fire.
5. If the charger produces any abnormal sound or smell while on, please unplug the power immediately and contact the manufacturer. Do not attempt to open the charger case.
6. Make sure that the fan and cooling fins are unobstructed to prevent charger overheating. Do not place the charger near a heat source; the charger should be left with enough space to ensure proper ventilation.
7. Please disconnect the charger's AC input power if you need to remove it.
8. Make sure that AC power supply voltage matches chargers' input voltage. For inquiries, please contact your supplier or utility company.
9. Battery voltage and the nominal voltage of the charger must be matched or it could damage both the charger and the batteries.
10. To avoid damage to the charger's cables, do not pull, twist or shake the cables or the connection terminals. If the cable is worn, please replace it immediately.

## **III. Preventing Short Circuits and Fire**

### **1. Correct use of Breakers, Sockets and Cables**

- a) Use stranded copper cables with flame-retardant jackets. 2.5 mm<sup>2</sup> or larger flexible copper wire is recommended for the AC power input.
- b) The power input connector pins should be crimped and soldered for best operation.
- c) Protect plugs and sockets from contact with water.

**Note:** According to statistics, 80% of electric car fires occur during charging. The main reasons for this include insufficient cable size, poor quality plugs and sockets, poor contact of plugs and sockets, poor flame-retardant sheath or shells of breakers, plugs and sockets, and uncontrolled charge cycles.

### **2. Correct Input Connections**

Make sure that the charge plug and connectors are clean, undamaged and free of dirt before charging.

### **3. Charging Environment Requirements**

Avoid the use of flammable materials. Charger should be mounted in a well-ventilated space.

Avoid mounting/placing the charging plugs, charging cables or the charger itself on flammable objects.

### **4. Lithium Cell Safety**

A lithium battery pack should have a battery management system to ensure safe charging. A battery pack with no BMS can be very dangerous. We are not responsible for damage to batteries due to using a charger with no BMS.

Most prismatic lithium batteries should be contained in a manner that prevents them from swelling during charging and discharging. Consult your battery manufacturer's recommendations for the best way to package your cells.

## **IV. Regular Maintenance**

1. Check all connectors and J1772 Socket regularly for corrosion, discoloration or other conduction inhibitors. Poor contact may result in overheating and burning inside connectors, which could cause a fire.
2. All input power circuits should have functioning circuit protection (breaker or fuse).
3. Regularly check the charger's case and cooling fan, and remove all debris and dirt. Contact the manufacturer if the fan is inoperative.

## **V. Technical Specifications**

Rated input voltage: 220VAC 50/60Hz

Input voltage range: 85~265VAC (Note: When the Input voltage is lower than 185VAC, the output power will be limited to 1.5KW)

Power Factor:  $\geq 0.99$  @ 220VAC input, full power output;

Total Harmonic Current:  $\leq 5\%$  @ 220VAC input, full power output;

Nominal output voltage: 144V

Maxim output voltage: 180V

Rated output current: 15A

Voltage regulation accuracy:  $\leq 0.5\%$

Current regulation accuracy:  $\leq 2\%$

Conversion efficiency:  $\geq 95\%$  @ 220VAC input, full power output

Moisture Ingress Rating: IP66

Audible Noise:  $\leq 40$ dB

Seismic rating: Designed according to IEC60335-2-29-2004-Part.21

Working temperature:  $-25\sim 55^{\circ}\text{C}$

Storage temperature:  $-40\sim 80^{\circ}\text{C}$

Recognition certificates: CE SGS will ensure 2KW output at  $60^{\circ}\text{C}$ .

Internal electrical isolation: Greater than 2 Megohms between input and output power terminals

Power input ground is connected to the charger case

## VI. Parts List

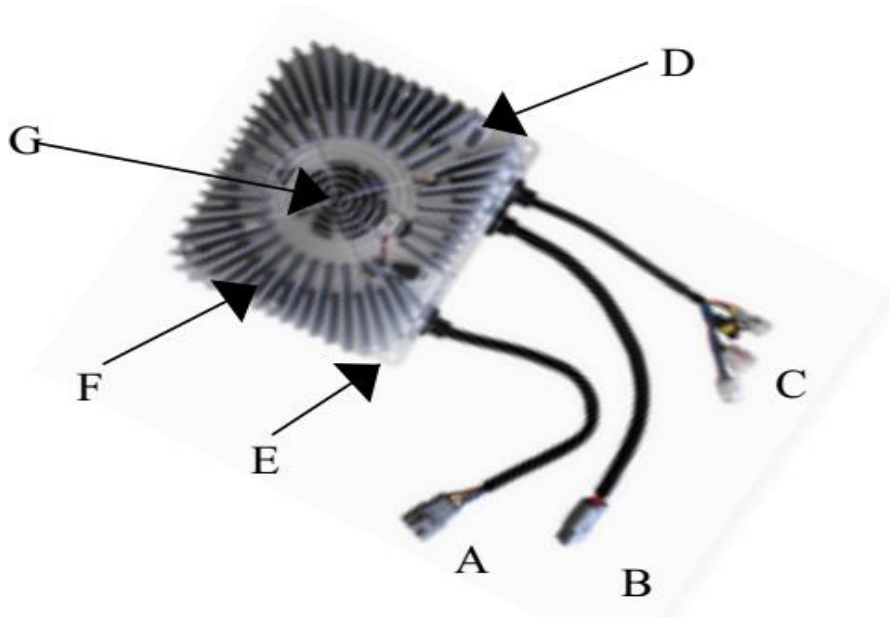
A - AC Input Cables

B - DC Output Cables

C - Signal Cables

D - Charging Indicator E Mounting plate F Shell

G - Cooling Fan and Fan Cover

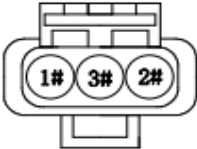
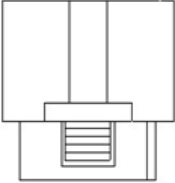
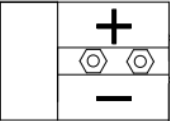


## VII. LED Charge Light Information

When...	Then...
Red Light Flashing	The pack is approximately < 80% Charged
Yellow Light Flashing	The pack is approximately > 80% Charged
Green Light Flashing	The pack is approximately 100% Charged
Flashing Yellow, Red and Green in Various Orders	Charging has recently stopped or has a Fault with Charger or Batteries.
Repeated flashing sequence like Red, Green, Yellow, Yellow, Yellow	Suggests a connection issue is detected (canbus or high voltage output). Check all connections.



## VIII. Input and output interface

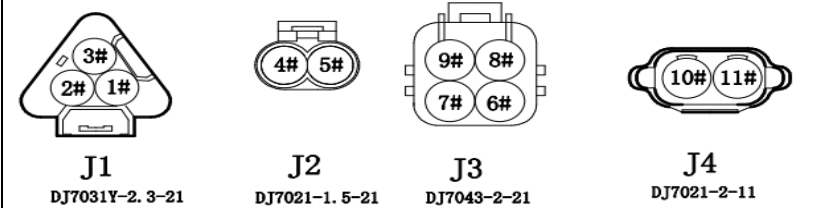
Input Cables				
<b>Terminal Model</b>		DJ7031-4.8-11	 <p>Direction of view: form the cables to terminal.</p>	
<b>Terminal Model for matching</b>		DJ7031-4.8-21		
Needle No.	Wire Color	Wire core diameter	Description	
1#	brown	2.5 mm <sup>2</sup>	L——Live wire	
2#	blue	2.5 mm <sup>2</sup>	N——Neutral wire	
3#	Yellow and green	2.5 mm <sup>2</sup>	PE——Protective grounding wire	
Output Cables				
<b>Terminal Model</b>		SB50		
Needle No.	Wire Color	Wire core diameter	Description	
+	red	6 mm <sup>2</sup>	Output positive pole	
-	black	6 mm <sup>2</sup>	Output negative pole	
Signal Cables				
Needle No.	Wire Color	Wire core diameter	Description	Needle No.
1#	brown	DJ7031Y-2.3-21	external LED indicator interface	DJ7031Y-2.3-11
2#	Blue			
3#	yellow			
4#	purple	DJ7021-1.5-21	Battery Temperature sensor interface	DJ7021-1.5-11
5#	white			
6#	pink	DJ7043-2-21	Serial communication interface	DJ7043-2-11
7#	Yellow and green			
8#	Blue and white			
9#	Green and white			

10#	orange	DJ7021-2-11	Driveaway Protection (normally closed)	DJ7021-2-21
11#	grey			

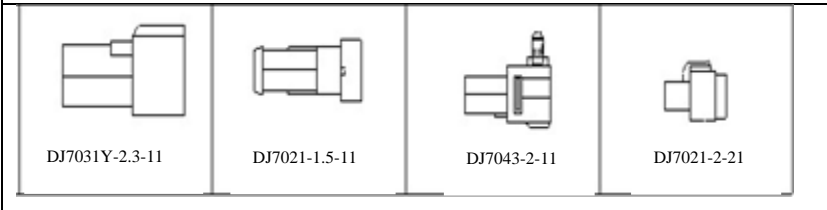
Wire core diameter	0.5 mm2 for all Signal wires
--------------------	------------------------------

--

**Signal Cables Terminal Diagram (prior to 2020)**

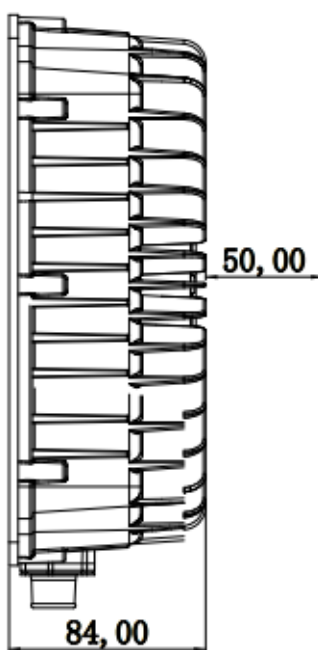
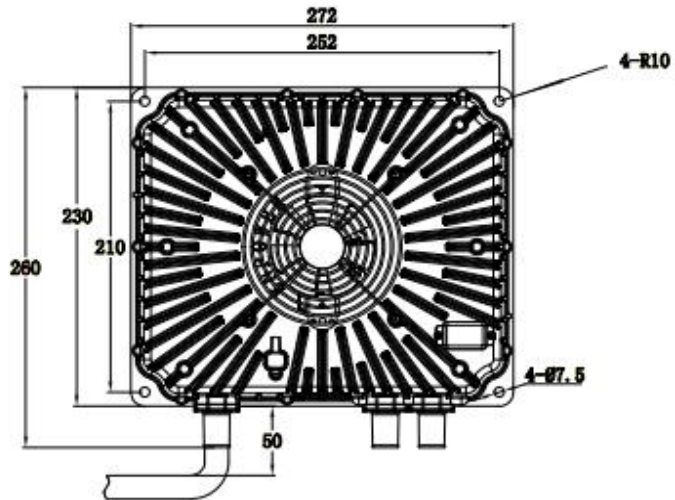


Direction of view: form the cables to terminal.



## IX. Appearance and Installation Dimensions

Do not bend wires close to the charger. Bends should start at least 50mm from where they enter the shell of the charger (see below).

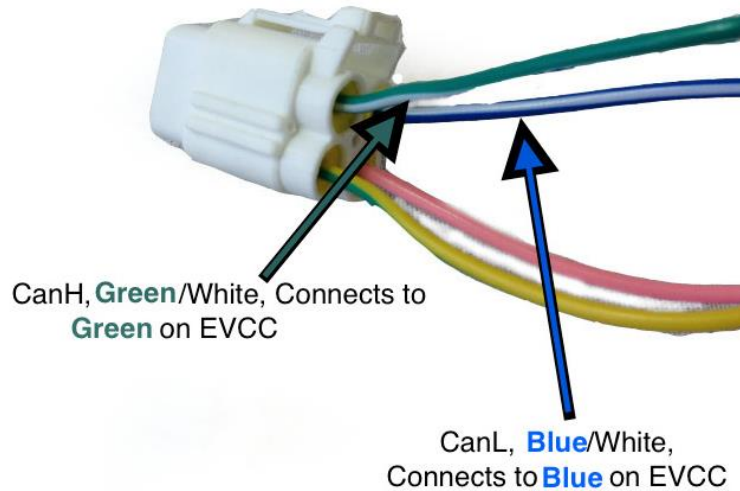


Ensure that there is a 50mm gap above the charger to allow for proper ventilation. Enclosed spaces should have forced air ventilation.

## X. Connections and Wiring

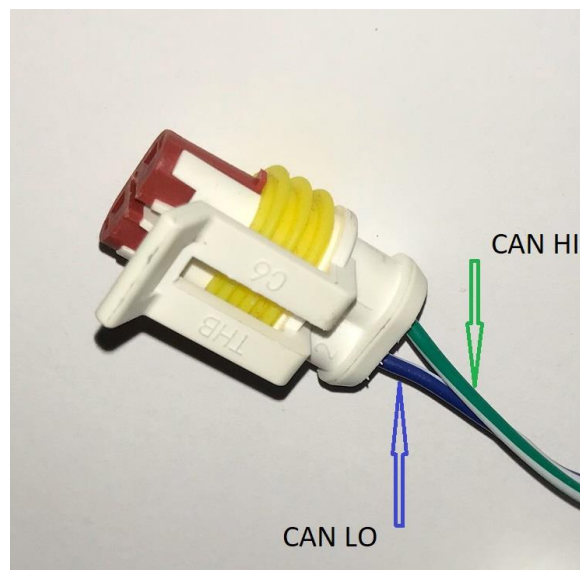
### Input Cables

#### Canbus Connection – prior to 2020



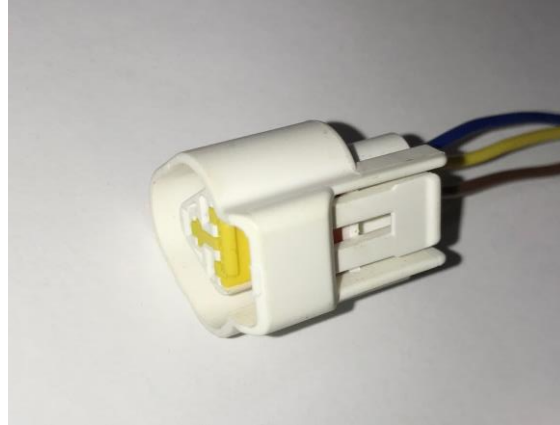
**Note:** The Yellow and Pink wires are not used  
Refer to the EVCC Manual for more details on EVCC wiring.

#### Canbus Connection – 2020 and later



**Note:** If wire colors do not match, then compare connector orientation.

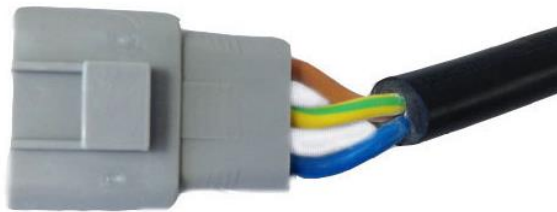
## Remote Charge Indicator Connector



**Note:** Remote light provided with charger

## AC Input Connection Options

**For 110V**

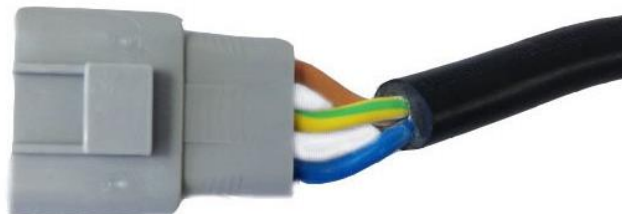


**Yellow/Green** - Ground Wire

**Blue** - Neutral Wire

**Brown** - Live Wire

**For 220V**



**Yellow/Green** - Ground Wire

**Blue** - Live Wire

**Brown** - Live Wire

## Output Cables

### HV DC Output Connector

**Red** - Positive DC Out  
**Black** - Negative DC Out



SB50 Connector

### 12v DC Output Connector – 2020 and Later



**Note:** During charge only, provides up to 2 amps at 12v DC

### Driveaway Protection Switch Output



**Note:** EVCC can also provide driveaway protection. The above connects to a normally closed (NC) internal switch. The switch is closed when the charger is NOT plugged into AC power. This can be used to activate a 12v low current (200 ma) external relay which enables drive components only when the charger is unplugged.

## XI. Faults and Solutions

Please refer to this table to help resolve common charger issues. Also see our website:

[www.thunderstruck-ev.com/images/companies/1/ChargeTroubleshooting.pdf](http://www.thunderstruck-ev.com/images/companies/1/ChargeTroubleshooting.pdf)

Please email ThunderStruck Motors if troubleshooting is unsuccessful. Please include all test results and measurement details.

<b>Fault</b>	<b>Analysis</b>	<b>Solutions</b>
No Fan or Light	Poor connection on charger AC input. AC supply circuit breaker is open or supply is off. Charger fault	Check connectors and breaker for heat damage or open circuit. Minimum supply wiring 2.4mm <sup>2</sup> or larger. Check J1772 Proximity connections.
Charging timeout	Battery circuit open or high resistance	Check DC connections at charger and entire battery circuit
High temperature indication with cool charger	Charger error	Please contact us
Charger reports incorrect voltage	Poor output connection, charger fault	Check output connections, pack connections. Contact us if fault.
Reaches max voltage after short charge	Poor contact between charger and battery, battery fully charged, low battery capacity	Check if the battery is damaged, battery connections are tight, the battery is fully charged
Low battery capacity after full charge	Wrong charge voltage, battery is aging, power circuit cable fault	Check voltage settings, replace the battery, repair cable fault
Low current during charge	Cables are too long or too thin Between the charger and battery, wrong current setting	Use proper cable size for length used, check charge current settings
Charger fan off or intermittent but light flashes	Poor input connection, dirty fan, fan faulty	Repair connections, clean fan, contact us if fan faulty
Arching when connecting to battery	Minor arcing is normal. Significant arcing means wrong polarity or bad charger	Check and connect the battery correctly, contact us
Over-Temperature Fault	Charging environment temperature is too high; cooling fan is fault; air vents are obstructed	Keep charger case away from surfaces for cooling. Ventilate charger space. Verify fan is operating.
Battery Overheating	Battery overcharging, wrong charger voltage, damaged or aging battery	Check charge settings, Test and replace battery