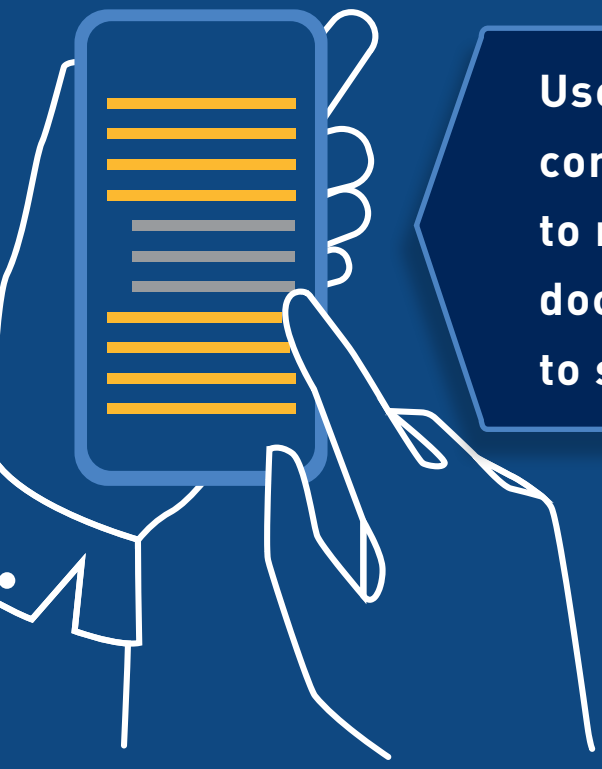
delta-q TECHNOLOGIES

IC SERIES

INSTALLATION & TROUBLESHOOTING GUIDE

NOTE TO THE READER



Use table of contents links to make the document easier to search.

Use the link in the bottom left corner to return to the table.

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GETTING STARTED

Before installing your Delta-Q Technologies battery, please review and follow these safety guidelines.

HIGH VOLTAGE SAFETY

WARNING: This product can contain potentially lethal levels of voltage. Exercise extreme care when working with the equipment.

WARNING: DO NOT open the case of the charger. No serviceable parts are contained inside the unit.

ELECTRICAL SAFETY INFORMATION

DANGER: Risk of electric shock. Connect charger power cord to an AC outlet that has been properly installed and grounded in accordance with all local codes and ordinances. A grounded AC outlet is required to reduce the risk of electric shock. **Do not use ground adapters or modify the plug**. Do not touch uninsulated portions of the output connector or uninsulated battery terminals. Disconnect the AC supply before making or breaking the connections to the battery. Do not open or disassemble the charger. Do not operate this charger if the AC supply cord or DC output cord is damaged or if the charger has received a sharp blow, been dropped, or is damaged in any way. Refer all repair work to the manufacturer or qualified personnel. This charger is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge on electrical systems and battery charging, unless they have been given supervision or instruction concerning use of the charger by a person responsible for their safety. Children should be supervised to ensure they do not play with the charger.

BATTERY SAFETY INFORMATION

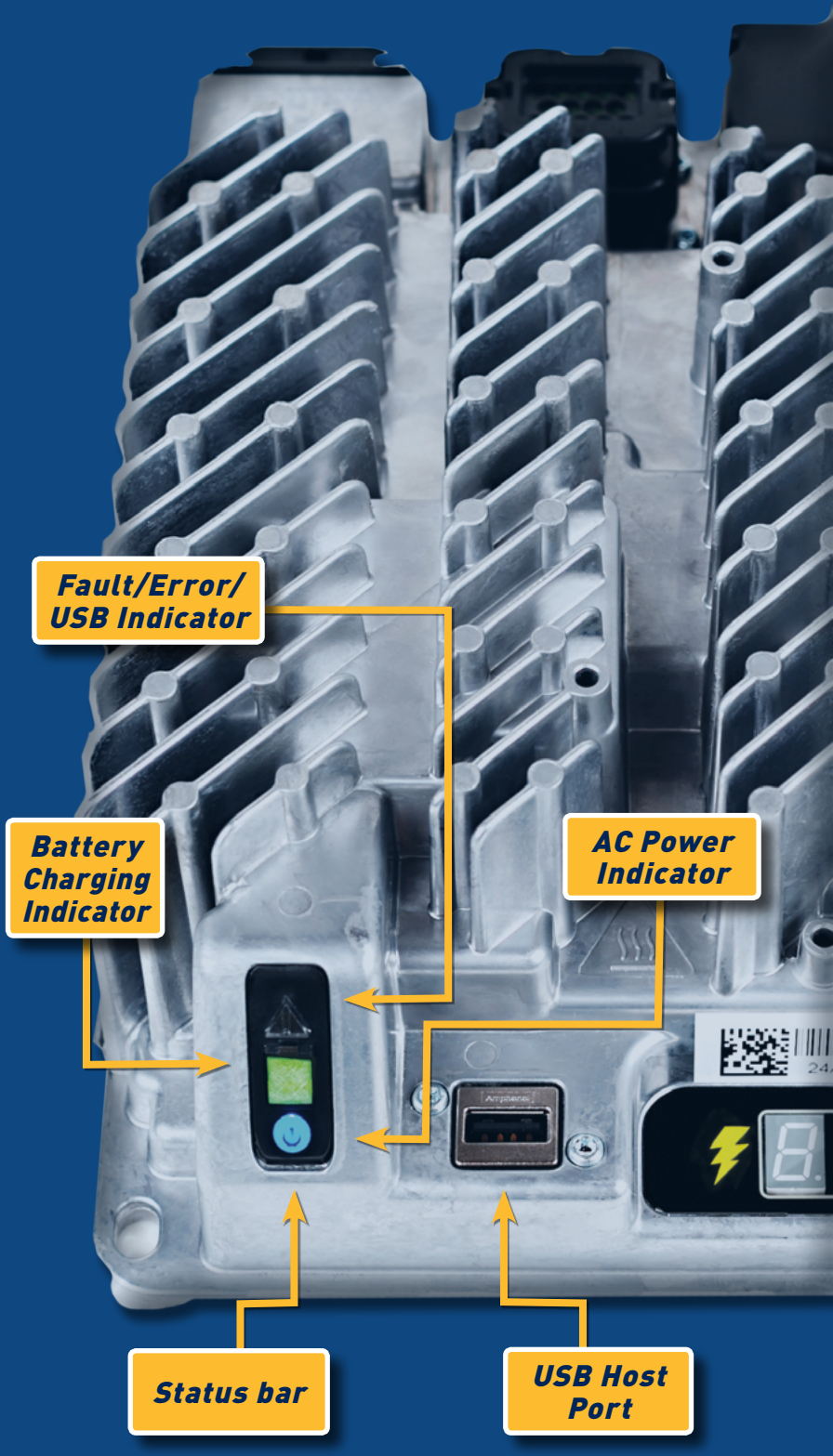
WARNING: Use the charger only with an algorithm that is appropriate to the specific battery type and capacity. Other usage may cause personal injury and damage. Lead acid batteries may generate explosive hydrogen gas during normal charging. Keep sparks, flames, and smoking materials away from batteries. If this charger is used with lithium-ion type batteries, an integrated battery management system (BMS) must be used. The BMS must ensure that, in all operating modes, the battery cells are protected from inappropriate levels of voltage, current, temperature, and state of charge. Do not operate the charger in a closed-in area or restrict its ventilation. Never charge a frozen or non-rechargeable battery. Observe all battery manufacturers' precautions (e.g., maximum charge rates and if cell caps should be removed while charging).

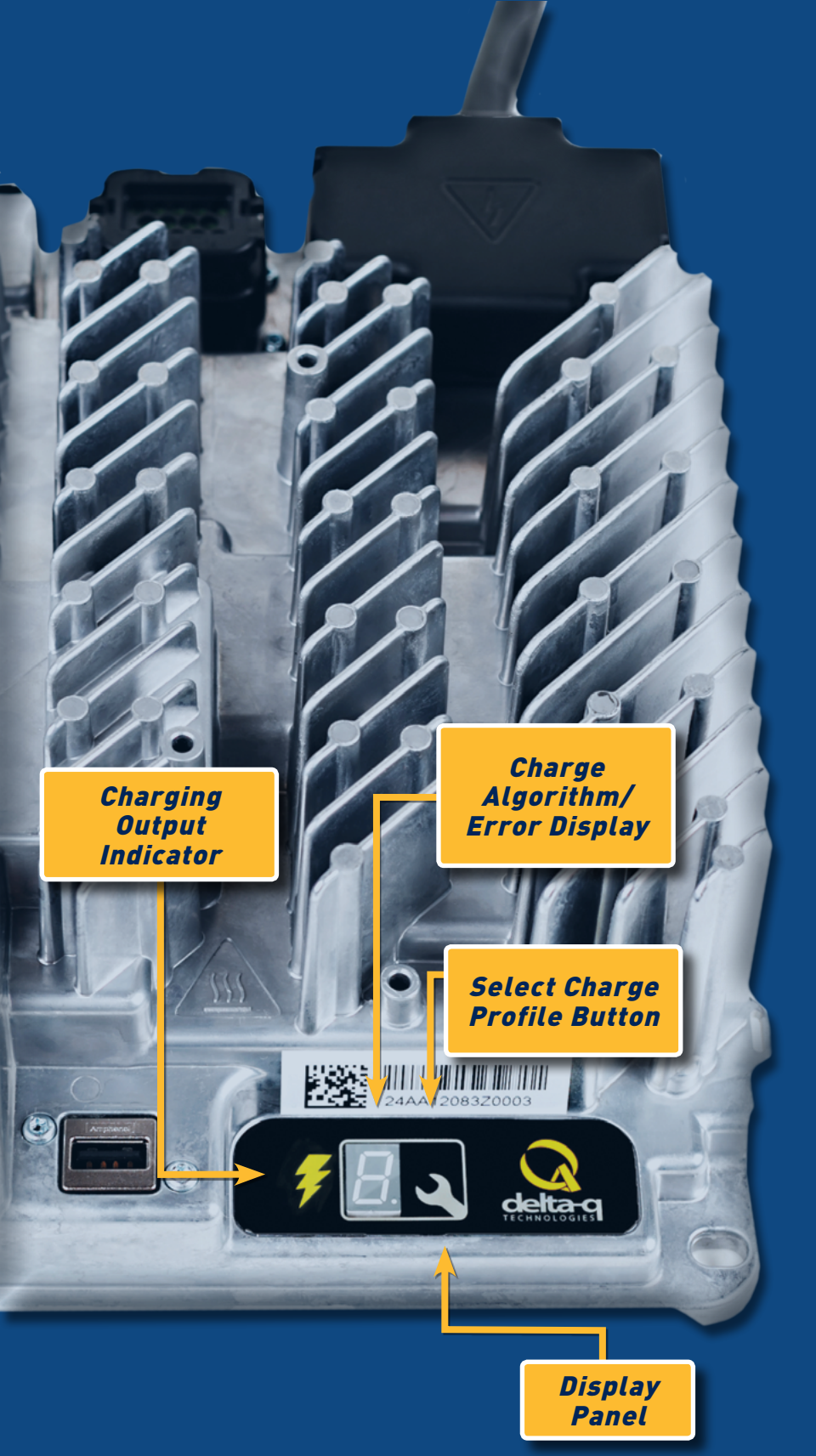
PRECAUTIONS

HOT SURFACES: During charging, the surface of the charger may become hot to the touch, especially in higher ambient temperatures. This is normal. Avoid touching the surface of the charger.

EXTENSION CORD RATING: Extension cords used with the charger must have appropriate safety approvals for the country in which it is used (e.g., Nationally Recognized Testing Laboratories (NRTL) approval in the United States). Wire gauge must be appropriate for the input current of the charger.

IC SERIES CHARGER INTERFACE


Fault/Error/
USB Indicator
Battery
Charging
Indicator
AC Power
Indicator
Status bar
USB Host
Port


Charging Output Indicator
Charge Algorithm/ Error Display
Select Charge Profile Button
Display Panel
delta-q
TECHNOLOGIES

LEGEND

	**Solid blue -** AC power available
	**Flashing amber -** External error condition - caution see display panel details
	**Solid red -** Charge fault see display panel details
	**Flashing green -** USB port active **Solid green -** Safe to remove USB flash drive
	**Flashing green -** Low state of charge **Solid green -** High state of charge
	**Flashing green -** High state of charge **Solid green -** Charge complete

NOTES

The Charging Output Indicator is solid yellow when the charger output is active. Take appropriate actions while handling the charger, as there is a risk of electric shock.

The USB Host Port provides read and write USB functionality. Using a standard USB flash drive, a user can download charge tracking data, and update the charger's software and charging profiles.

The Charge Profile/Error Display shows one of four possible codes to indicate different conditions:

F CODES

mean an internal fault condition has caused charging to stop.

P CODES

indicate the charge profile number.

E CODES

mean an external error condition that may cause the charging to stop.

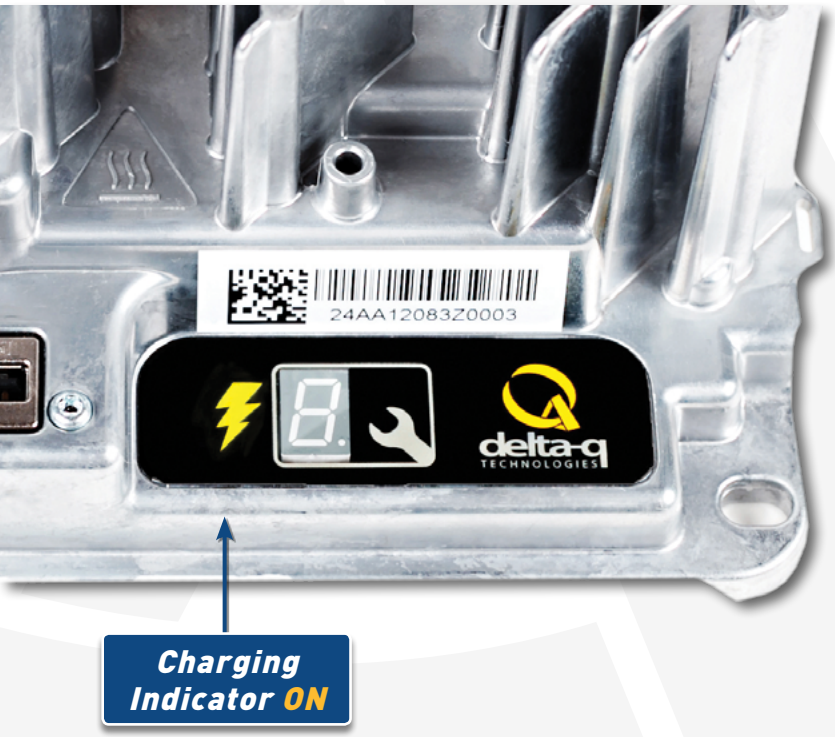
USB CODE

meaning the USB interface is active, and the USB flash drive should not be removed.

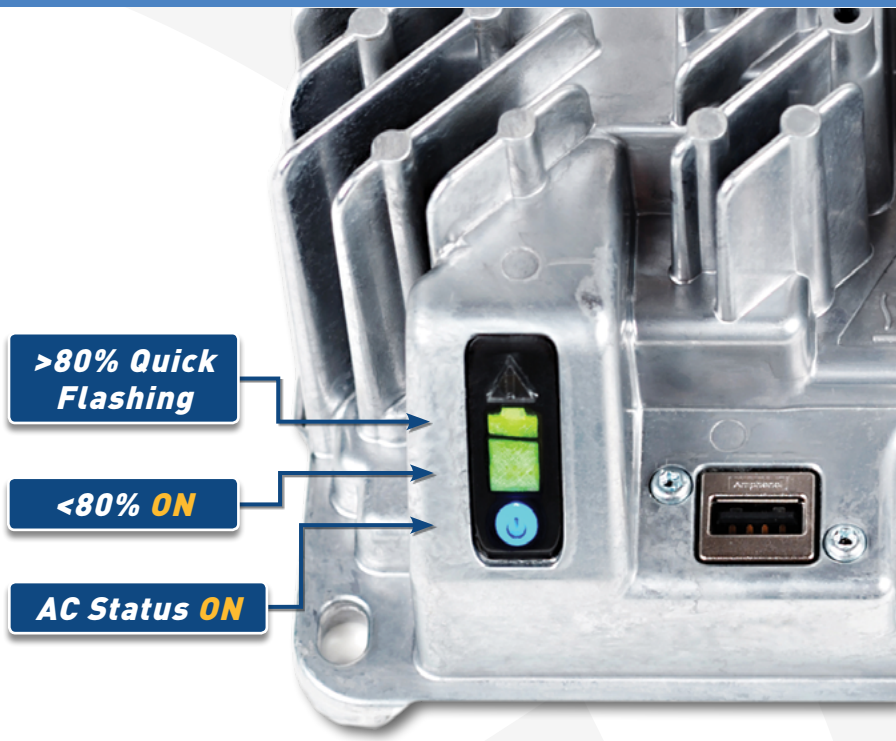
The E and F codes are followed by three numbers and a period to indicate different conditions (e.g., E-0-0-4.). See Charger Fault Codes or Charger Error Codes for details on these conditions and their solutions.

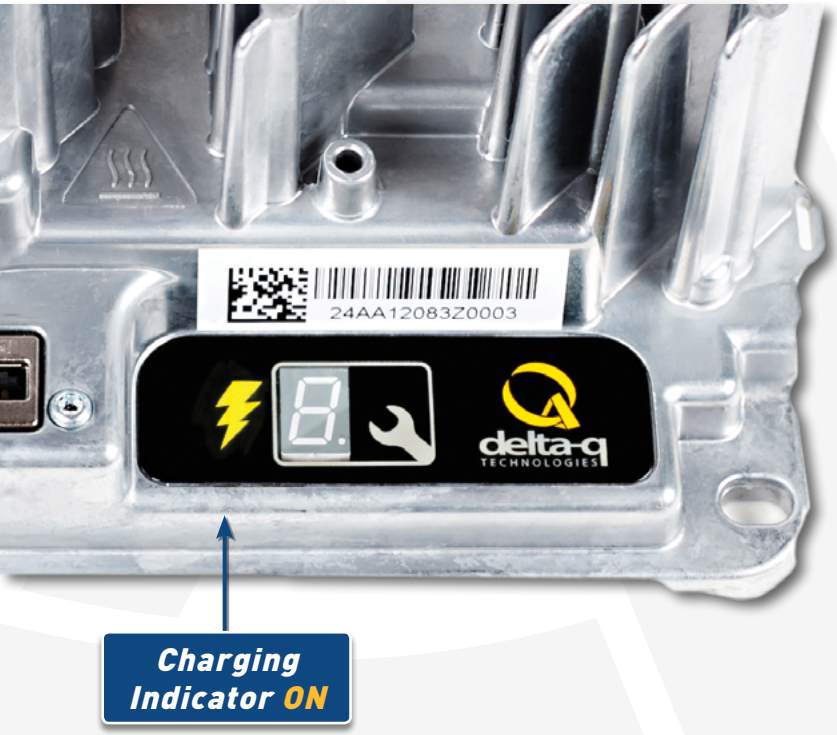
NORMAL OPERATION

BULK CHARGING, <80% COMPLETE

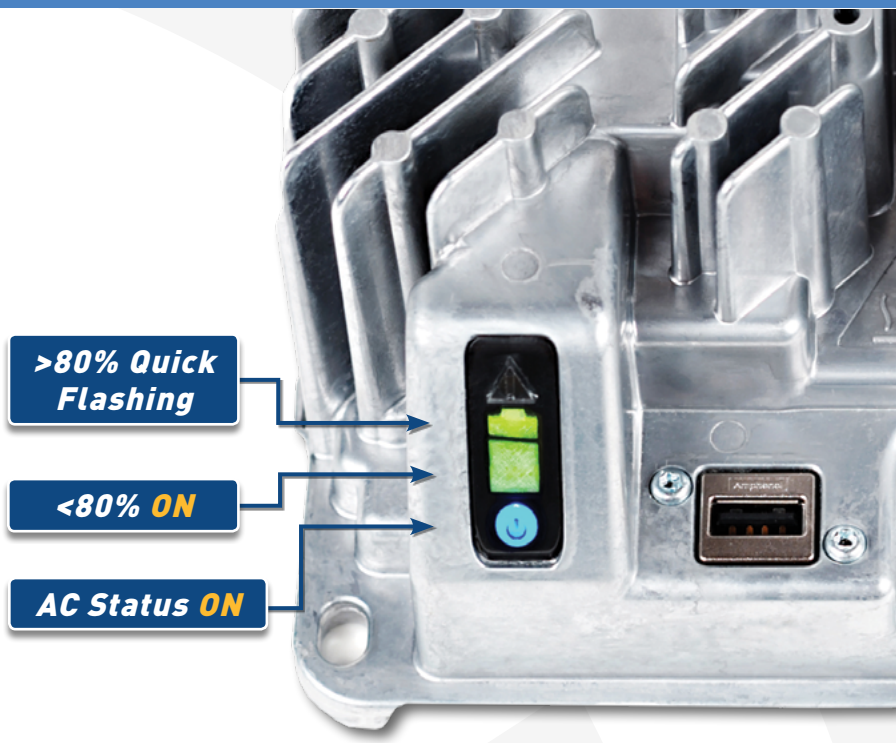


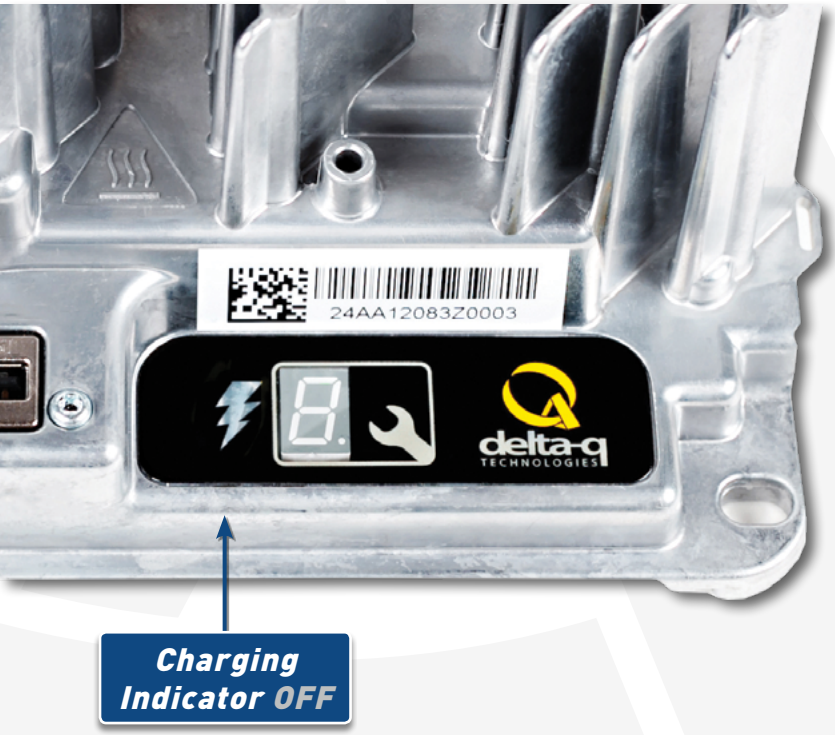
ABSORPTION/FINISH PHASE, >80% COMPLETE





CHARGING COMPLETE





CONFIGURING THE IC650 CHARGER USING A USB FLASH DRIVE

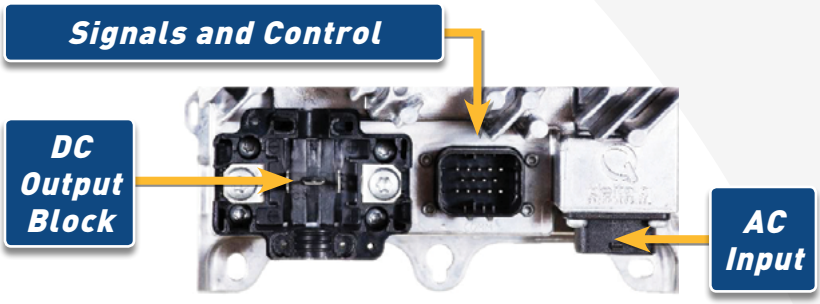
Using the Delta-Q software, USB storage drives can be pre-programmed to certain charger configurations. To use the USB port, follow these steps:

1. Insert the USB flash drive at any time, but preferably not during a charge cycle. Stop the charge cycle by removing AC power or the DC connection to the batteries. The charger can power the USB port from the AC connection (DC disconnected) or from the DC connection (AC disconnected).
2. If there is enough disk space (about 2 MB), the charger will write charge tracking data to the drive. The Fault/Error/USB Indicator will flash green during reading and writing.
3. If the drive contains compatible configuration files, the charger will load them.
4. The charger will briefly reset.
5. Remove the drive when the Fault/Error/USB indicator is solid green. Add note:

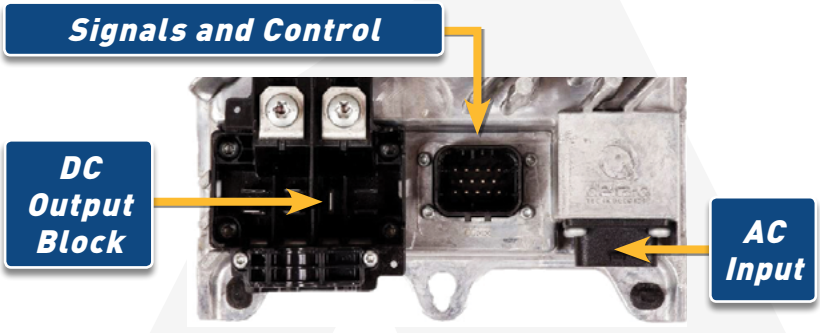
The green triangle may turn off for a few seconds during programming as the charger reboots, DO NOT remove the USB during this time or the update might fail.

ELECTRICAL INSTALATION

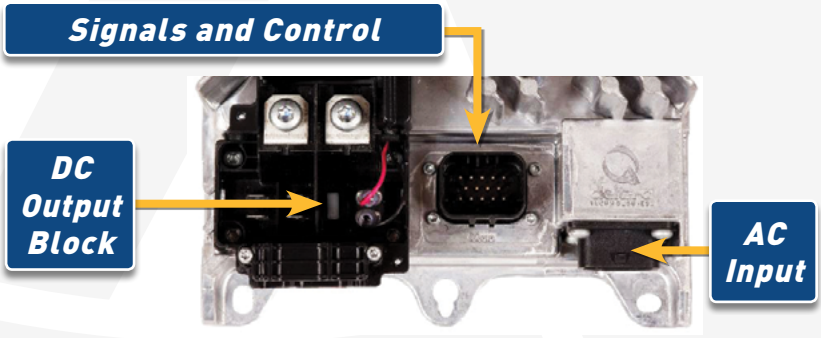
The charger has either two or three connectors on the rear panel depending on the model. The COMM model with all connectors is shown below. The BASE model does not have a Signals & Control Connector.



IC650 COMM Model Rear Panel



IC900 COMM Model Rear Panel



IC1200 COMM Model Rear Panel

GENERAL CONSIDERATIONS FOR MACHINE WIRING

To reduce electromagnetic interference (EMI) issues, avoid routing power and communications cables together. If they must cross, it should be at right angles, to minimize EMI coupling. If these cables must be run together, keep the cable lengths as short as possible. Also, the greater the distance between the data and power cables, the less EMI coupling there will be between them.

- Ideally, communications cables should use twisted-pair wiring so any AC or DC noise coupled to the data cable will be balanced on each wire and will be cancelled out in the receiving circuit.
- For battery cables, see the tables in the following sections for minimum recommended cable sizes. Wire lengths should be kept as short as is practical. For best performance, the positive and negative cables should run alongside each other. Avoid cable loops.
- Battery overcurrent protection is highly recommended, even if it is not required by the specific safety regulations for

the vehicle or equipment. Fuses and disconnects should be sized to protect the wiring in the system. Install the overcurrent protection as close to the battery as possible, to provide adequate protection. IC Series chargers have built-in overcurrent protection on both the AC input and the DC output.

CABLE DRESSING

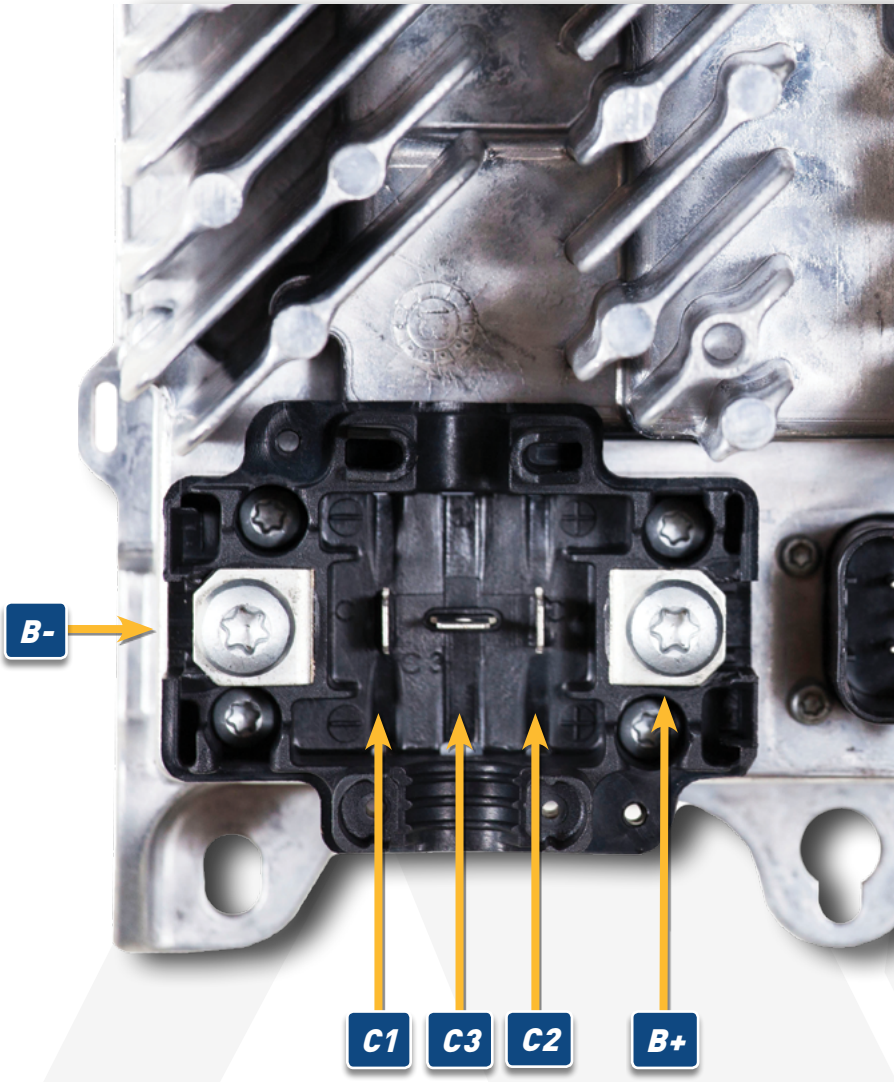
It is recommended that AC, DC, and signal cables be secured, especially in applications where there are high vibration and shock loads. Cables and cords used to secure cables should be rated to at least 105°C (221°F). Delta-Q Technologies offers cable clamps and sealed, locking AC cables to provide improved system robustness.

The IC650 charger provides a channel between the heat sink fins to thread the DC Cabling through the front side of the charger and clamp the cable in place.

Example of Cable Routing on the IC650 Charger

IC650 DC OUTPUT

Warning: Be careful not to allow battery voltage to be applied to the blade terminals (C1, C2, C3), as it will result in permanent damage to the charger.



PIN	RECOMMENDED WIRE SIZE (AWG/MM2)	DESCRIPTION
B-	12/4.0	Battery negative
B+	12/4.0	Battery positive
C1	20/0.5	Battery temperature sense negative
C2	20/0.5	Battery temperature sense positive
C3	20/0.5	Interlock Signal

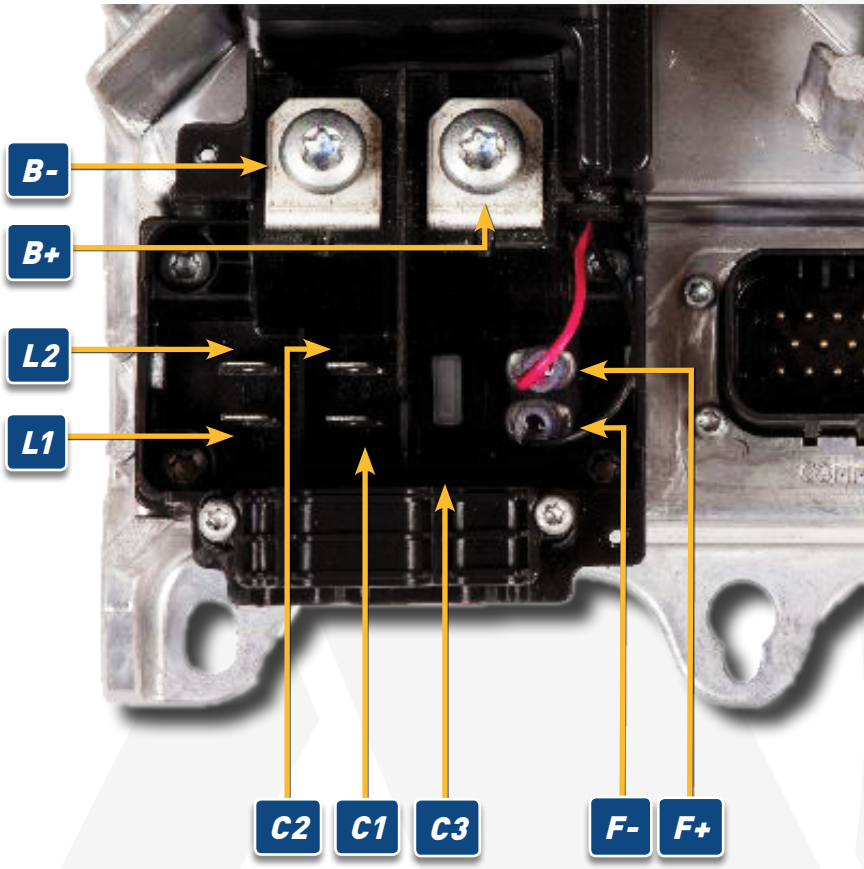
Table 1-1

PIN	NOTES
B-	Each accepts a 1/4" or larger ring terminal Fastener: Torx T30 screw, M6 nut. Recommended Torque: 4.5Nm +/-5%
B+	
C1	Each is a 1/4" quick-connect terminal.
C2	
C3	1/4" quick-connect terminal; normally closed to battery positive. Open when the charger output is active. 1.5A max.

Table 1-2

IC900/1200 DC OUTPUT

Warning: Be careful not to allow battery voltage to be applied to the blade terminals (L1, L2, C1, C2, C3, F+, F-), as it will result in permanent damage to the charger.



PIN	RECOMMENDED WIRE SIZE (AWG/MM2)	DESC.
B-	12 /4.0 (IC900) 10 /6.0 (IC1200-24V) 12 /2.5 (IC1200-36V, 48V	Battery Negative
B+		Battery Positive
L1	22/0.5 (2-conductor cable)	Remote LED red anode/ green cathode
L2		Remote LED green anode/ red cathode
C1	18/1.0 (2-conductor cable)	Battery temperature sense negative
C2		Battery temperature sense positive
C3	12/4.0	Interlock Signal
F+	N/A	Fan power/control; 0-12 VDC (IC1200 only)
F-		Fan power/control return; 0-12 VDC (IC1200 only)

Table 2-1

PIN	NOTES
B-	Each accepts a 1/4” or larger ring terminal Fastener: Torx T30 screw, M6 nut. Recommended Torque: 4.5Nm +/-5%
B+	
L1	Each is a 1/4” quick-connect terminal.
L2	
C1	Each is a 1/4” quick-connect terminal.
C2	
C3	1/4” quick-connect terminal; normally closed to battery positive. Open when the charger output is active. 1.5A max.
F+	1/4” quick-connect terminals
F-	

Table 2-2

IC650 DC WIRING INSTRUCTIONS

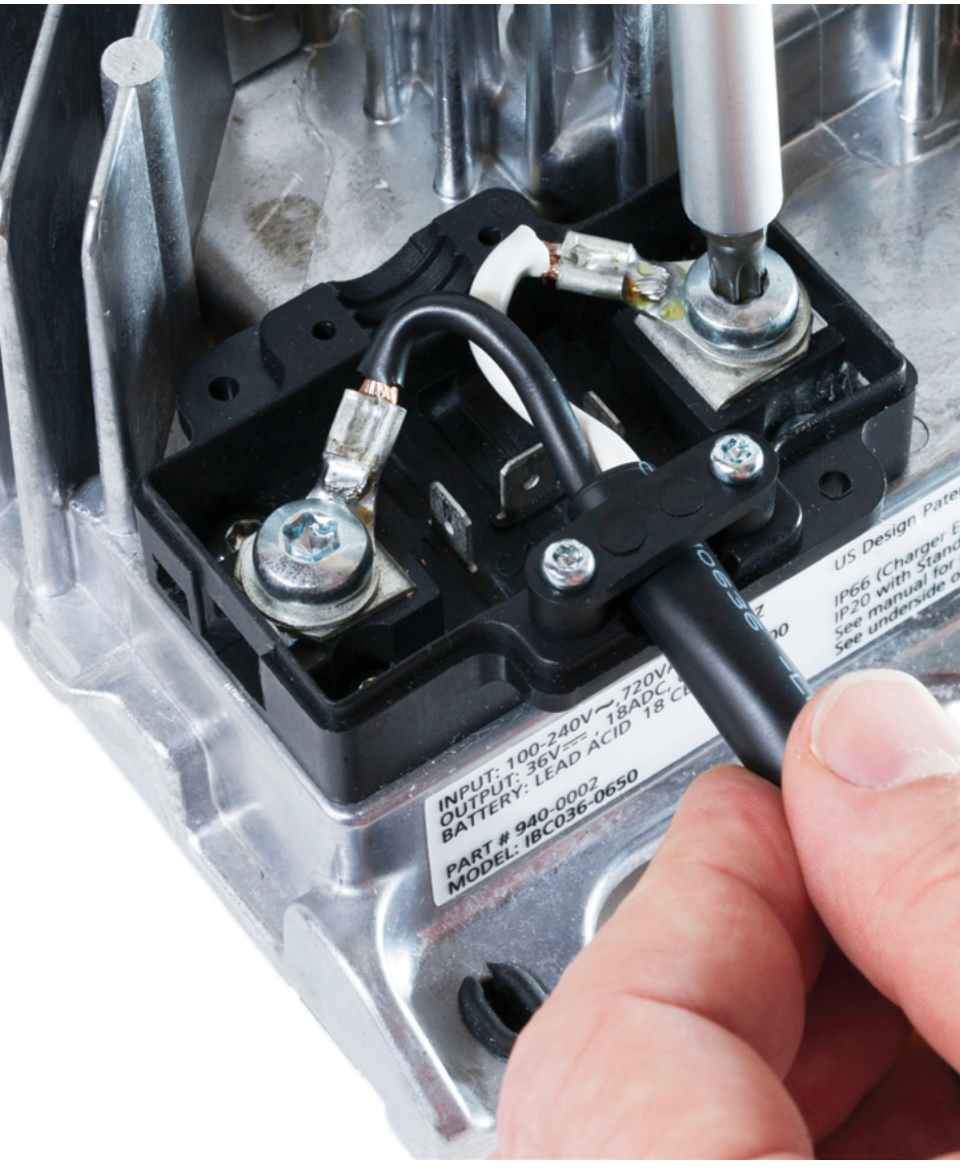
To attach DC cabling to the IC650 Charger, you will need the following items:

- **1** Torx T30 screwdriver
- **1** Torx T10 screwdriver
- **2** Torx T30/M6 screws (provided)
- **2** longer Torx T10 screws (provided)
- **1** shorter Torx T10 screw (provided)
- **1** DC cable with ring terminals for attachment into the DC block
- **1** DC block cover (provided)
- **1** DC cable clamp (provided)

1. Remove the DC terminal block cover by inserting the head of the Torx T30 screwdriver into the gap on the lower left side of the DC block fixture. Pull up on the same side of the cover.

2. Insert the head of the Torx T30 screwdriver into the gap on the lower right side of the DC terminal block cover and push the screwdriver in while pulling up on the cover to release the right side of the cover.
3. Lift the cover and remove the bag of parts.

4. Remove the positive and negative battery fasteners (M6 screws).
5. Fix the DC cable in place using the supplied cable clamp.
6. Fasten with the two longer Torx T10 screws (supplied) to a recommended torque of 0.6Nm +/-6%.



7. Attach the positive and negative leads to the positive and negative terminals using the Torx T30 screwdriver and Torx T30/ M6 screws, with a recommended torque of 4.5Nm +/-5%.
8. Replace the DC terminal block cover and use the third, shorter T10 screw (supplied) to secure the cover with a recommended torque of 0.6Nm +/-6%.

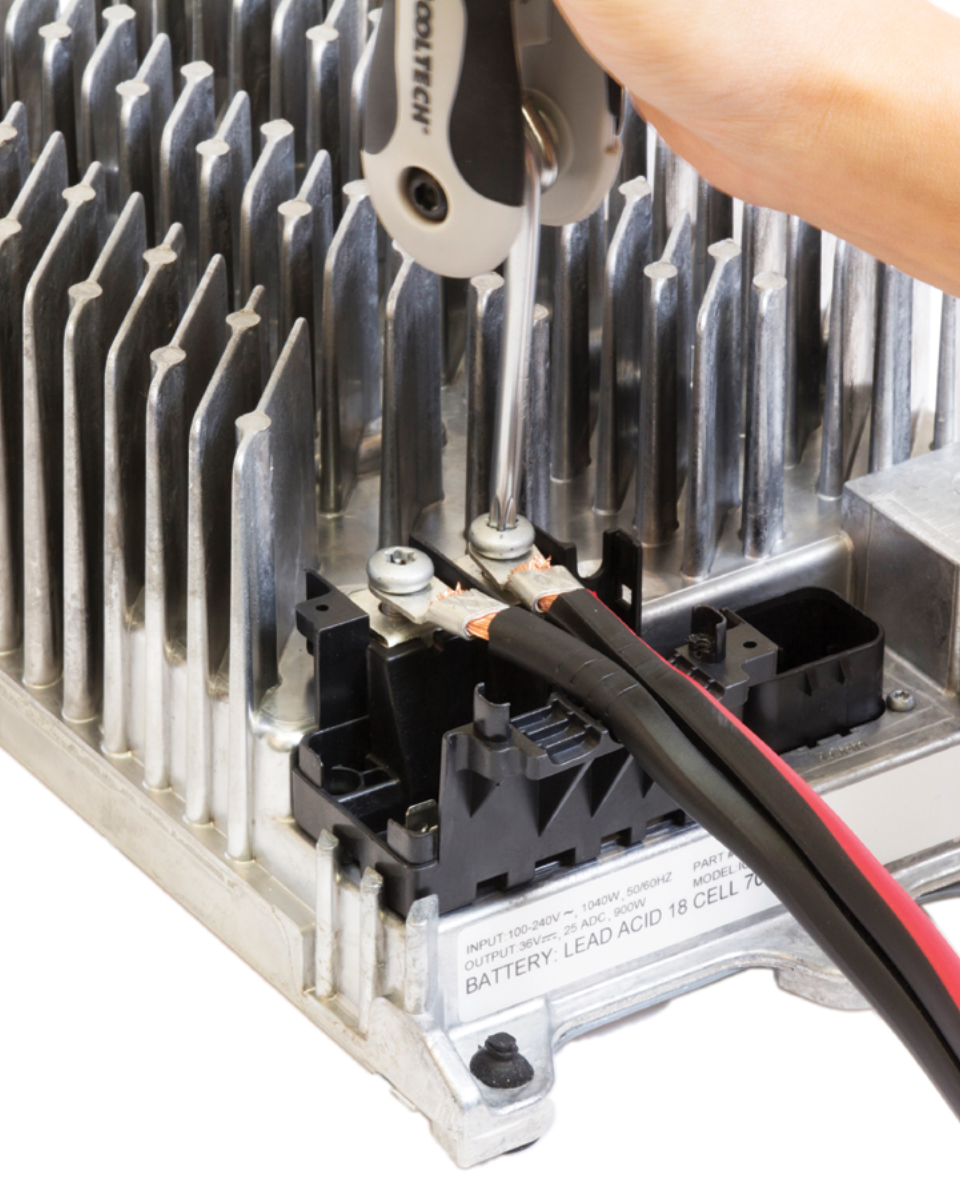
IC900 & IC1200 DC WIRING INSTRUCTIONS

To attach DC cabling to the IC900 and IC1200 chargers, you need the following items:

- **1** Torx T30 screwdriver
- **1** Torx T10 screwdriver
- **2** Torx T30/M6 screws (provided)
- **2** longer Torx T10 screws (provided)
- **1** shorter Torx T10 screw (provided)
- **1** DC cable with ring terminals for attachment into the DC block
- **1** DC block cover (provided)
- **1** DC cable clamp (provided)

1. Remove the DC terminal block cover by lifting it vertically off the charger. Remove the bag of parts that contains the cable clamp, 2 longer Torx T10 screws, and 2 shorter Torx T10 screws.

2. Remove the positive and negative battery fasteners (M6 screws). Attach the ring terminals of the wires to the terminals of the charger and secure with the T30/ M6 screws to a recommended torque of 4.5Nm +/-5%.
3. Secure the DC wire(s) in place using the supplied cable clamp. Fasten with the two longer Torx T10 screws to a recommended torque of 0.6Nm +/-6%.



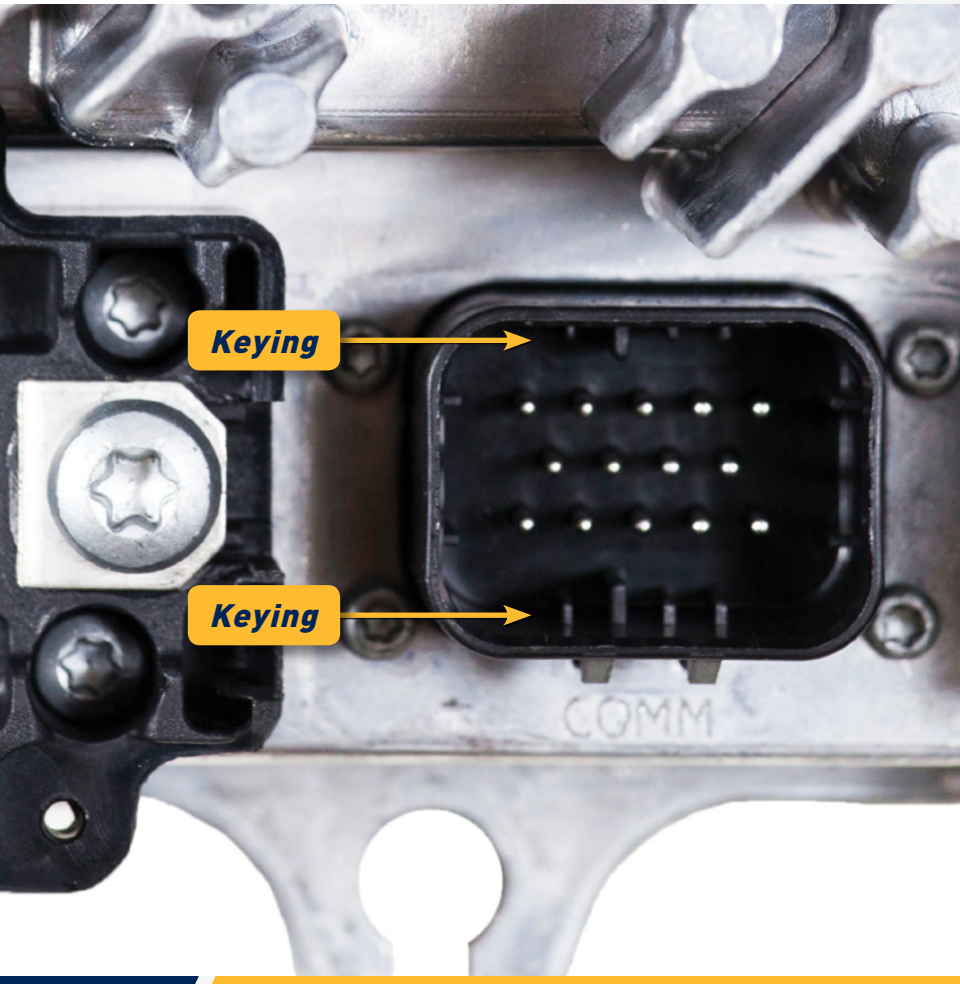
4. Replace the DC terminal block cover and use the 2 shorter T10 screws to secure the cover in place.

SIGNALS & CONTROL CONNECTOR

Recommended Mating Connector PN:
TE AMPSeal 776273-1

Sockets:
TE 770854-1

Note: Pin numbers 1, 5, 6, 9, 10, and 14 are labeled on the connector's inside face, next to the pins. On the mating plug, the same pin numbers are embossed on the top of the body. The recommended wire for all pins is 16-20 AWG (1.0-0.50 mm2), 300V rated (UL3266 or equivalent). Wire colours listed are suggestions only.



WIRE COLOR	PIN	DESC.
WHITE / BLACK	1	CAN GND
BLUE	2	Interlock-NC
PURPLE	3	Interlock-Common
PINK	4	Interlock-NO
WHITE / RED	5	Battery temperature sense +ve
ORANGE	6	CAN High
BLACK	7	Signal Ground
BROWN	8	Not used
YELLOW	9	IC650: unused IC900/IC1200: APO
WHITE / ORANGE	10	CAN Low
GREY	11	Not used
GREEN	12	Remote LED Green +ve
RED	13	Remote LED Red +ve
WHITE	14	Battery temperature sense -ve

Table 3-1

WIRE COLOR	DETAILS
WHITE / BLACK	Isolated reference ground for CAN signals.
BLUE	Dry Contact Interlock relay: Normally closed contact.
PURPLE	Dry Contact Interlock relay: Common contact.
PINK	Dry Contact Interlock relay: Normally open contact.
WHITE / RED	
ORANGE	Isolated CAN high signal.
BLACK	Do not connect to Battery Negative. Can be used with Pin 9.
BROWN	
YELLOW	IC650: Pin is unused IC900/IC1200: Accessory Power Output (+5VDC, 250 mA max)
WHITE / ORANGE	Isolated CAN Low.
GREY	
GREEN	For Remote LED. Pin 12 goes high with respect to Pin 13 to light the Remote LED green, and vice versa to light the Remote LED red.
RED	
WHITE	

Table 3-2

TROUBLESHOOTING

The IC Series charger is continuously monitoring itself and its environment for unusual conditions. There are a few indications that may require attention.

SYMPTOM	RECOMMENDED ACTION
No indicator lights	Check AC voltage and connection to wall power
Only blue AC light on	Charger is connected to AC and is waiting for a battery to be connected, or for CAN remote control commands. Battery voltage must rise over 0.1V/cell before charging will begin. Some charging algorithms require a higher battery voltage to begin.
Solid red Fault/ Error/USB Indicator	Read fault code (e.g., F-0-0-1) number on the Charge Algorithm/ Error Display and refer to the fault code table.
Flashing amber Fault/Error/USB Indicator	Read error code (e.g., E-0-0-1) number on the Charge Algorithm/ Error Display and refer to the error code table.

Table 4-1

FAULT CODE	TROUBLESHOOTING / CUSTOMER ACTIONS
If a unit is not functioning and an Error is not indicated or logged, and this condition persists after cycling both AC and DC, it should be sent back to manufacturer of your vehicle/ machine or the distributor of the charger for servicing.	
F-0-0-1	Internal charger fault. Remove AC and battery for minimum 30 seconds and retry charger. If the fault persists, contact the manufacturer of your vehicle/ machine or the distributor of the charger for servicing
F-0-0-2	
F-0-0-3	
F-0-0-4	
F-0-0-5	
F-0-0-6	

Table 4-2

FAULT CODES - INTERNAL CONDITION PREVENTING CHARGING

ERROR CODES - EXTERNAL CONDITIONS

Very Quick Amber Flashing

ERROR CODE "E" "1" "3" "6."

10 MOST COMMON ERROR CODES

ERROR CODE	DESC.	TROUBLESHOOTING / CUSTOMER ACTIONS
E-0-0-1 E-0-2-1	High Battery Voltage Error	Battery Voltage is too high to charge. Check the battery voltage and cable connections. Check battery size and condition (could be too full to charge). This error automatically clears once the condition has been corrected.
E-0-0-2 E-0-2-2	Low Battery Voltage	Battery Voltage is too low to charge. Check the battery voltage and cable connections. Check battery size and condition. This error automatically clears once the condition has been corrected.
E-0-0-3	Charge Timeout	Charge Timeout caused by battery pack not reaching required voltage within safe time limit. Charger output reduced due to high temperatures. Possible causes include poor battery health, very deeply discharged battery, poorly connected battery, or extra loads. Possible solutions include replacing the battery pack, checking the DC connections, disconnecting parasitic loads, and operating at lower ambient temperatures. This error automatically clears once the charger is reset by cycling DC.

Table 5-1

ERROR CODE	DESC.	TROUBLESHOOTING / CUSTOMER ACTIONS
E-0-1-2	Reverse Polarity	Battery is connected the wrong way around. Check the battery connections. This error automatically clears once the condition has been corrected.
E-0-1-3	Battery does not take current	Battery voltage is detected but the charger is unable to charge the battery. This can be due to an electrical device connected between the charger and the battery, which passes through voltage but not current. Verify correct set up with OEM.

Table 5-2

SOFTWARE / ALGORITHM ERRORS

Quote error code to manufacturer of your vehicle/machine or the distributor of the charger.

ERROR CODE	DESC.	TROUBLESHOOTING/ CUSTOMER ACTIONS
E-0-11, E-0-29, E-0-30, E-0-32	Charger is disabled by external command (e.g., CAN bus)	Charger has been disabled by an external controller over the CAN bus network contact contact the manufacturer of your vehicle/machine or the distributor of the charger for assistant.
E-0-16, E-0-18, E-0-19, E-0-26	Software error	The software update failed. Ensure the USB Flash Drive is properly formatted (FAT 32 recommended) and retry the update by reinserting the USB Flash Drive into the charger. If software updates continue to fail, try a different USB Flash Drive or contact the manufacturer of your vehicle/ machine or the distributor of the charger for servicing.
E-0-20, E-0-28	Algorithm Error	The selected charging profile is incompatible with the charger software. Update charger software or select a different charging profile. Ensure default algorithm is selected.

Table 6

for complete list, please check our website at

https://support.delta-q.com

CONFIGURATION ERRORS

Quote error code to manufacturer of your vehicle/machine or the distributor of the charger.

ERROR CODE	DESC.	TROUBLESHOOTING/ CUSTOMER ACTIONS
E-0-14, E-0-15, E-0-24, E-0-31, E-0-33, E-0-34, E-0-35, E-0-36 E-0-37	Configuration Error	There is an error with the charger's internal configuration. Contact the manufacturer of your vehicle/machine or the distributor of the charger for assistance. USB drive update may be provided to clear the error.
E-0-38	Fan has a locked rotor or open circuit	(Fan-equipped models only) Check fan connections. Check to ensure the fan turns freely and is not obstructed. This error automatically clears once the condition has been corrected.

Table 7

for complete list, please check our website at

https://support.delta-q.com

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(PN: 710-0009 Rev 7 Date: 28/10/2019

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