



# IC SERIES BATTERY CHARGERS USER MANUAL



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## ORIGINAL SAFETY AND OPERATING INSTRUCTIONS

This manual is for the Delta-Q Technologies IC Series Industrial Battery Chargers. Read and comprehend this document fully before handling or working with any IC Series battery chargers. Important safety, operating, and installation instructions are included. As well, this manual includes a link to a list of fault codes and error codes that help engineers take steps quickly to resolve issues.

**Read this information in its entirety before using your Delta-Q Technologies charger. Save these instructions.**

For technical support, contact the manufacturer or distributor of your vehicle or machine, as their version of this charger may require unique operating instructions. For additional product documentation, see [www.delta-q.com/resources](http://www.delta-q.com/resources).



### Warning

Use the charger only with a charging 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 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).



### 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.

## Attention



Utiliser le chargeur seulement avec un algorithme approprié au type et capacité spécifique de batterie. D'autres types de batteries pourraient éclater et causer des blessures ou dommages. Les batteries au plomb peuvent produire des gaz explosifs en service normal. Ne jamais fumer près de la batterie et éviter toute étincelle ou flamme nue à proximité des batteries. Si ce chargeur est utilisé avec des batteries au lithium-ion, un système de gestion des batteries intégrés doit être utilisé. Le système de gestion des batteries doit assurer que dans tous les modes de fonctionnement, les cellules de la batterie sont protégées contre les niveaux inappropriés de tension, de courant, de température et d'état de charge. Fournissez une ventilation adéquate du chargement. Ne jamais charger une batterie gelée. Prendre connaissance des mesures de précaution spécifiées par le fabricant de la batterie, p. ex., vérifier s'il faut enlever les bouchons des cellules lors du chargement, et les taux de chargement.



## Danger

Risque de décharge électrique. Ne pas toucher les parties non isolées du connecteur de sortie ou les bornes non isolées de la batterie. Toujours connecter le chargeur à une prise de courant mise à la terre. Déconnectez la source CA avant de faire ou défaire les connexions à la batterie en chargement. Ne pas utiliser le chargeur si le cordon d'alimentation CA est endommagé ou si le chargeur est abîmé suite à une chute ou autre incident. Ne pas ouvrir ni désassembler le chargeur – référer toute réparation aux personnes qualifiées. Cet appareil n'est pas destiné à un usage par des personnes (dont les enfants) avec des facultés motrices, sensorielles ou mentales réduites, ou ayant une expérience et des connaissances insuffisantes, à moins qu'elles sont sous la supervision ou reçoivent les instructions sur l'utilisation de l'appareil d'un répondant garant de leur sécurité. Les enfants devraient être surveillés afin qu'il ne jouent en aucun temps avec l'appareil.

## SAFE OPERATING INSTRUCTIONS

- The charger contains up to 25 selectable charging algorithms stored in its internal memory to charge batteries. These algorithms are specific to each manufacturer and model of battery. Your equipment supplier or charger distributor is responsible for ensuring the active charge algorithm matches the battery pack charging requirements. Contact them with any questions about which algorithm to select for each batterypack.
- The charger may become hot during charging. Use hand protection to safely handle the charger when charging.
- To maintain safe operations, the unit automatically reduces its output power if the temperature rises above set thresholds, or if the AC input voltage is too low.
- If power is interrupted, and then returns, the charger restarts and continues to operate without hazard to the user, or damage to the batteries.
- Unplug the charger from both AC and DC sources when cleaning, moving, or conducting any maintenance or repair on the charger. No user serviceable parts are inside. Do not remove the cover due to the risk of electrical shock.
- Do not expose the charger to oil, dirt, mud, or direct heavy water spray when cleaning the vehicle or machine.
- If the detachable AC input power cord set or DC output cord is damaged, do not use the charger until they are replaced with cord sets appropriate to your region and application.
- When mated with a Delta-Q Technologies sealed AC cord, the charger meets IP66 specifications, making it dust-tight and protected against powerful water jets. If a cord set with an unsealed connector is used, the plug and connector must be periodically inspected to ensure the contacts are clean and dry.
  - If this charger is provided with an AC cord set and the power plug does not match the power outlet, contact the equipment manufacturer, distributor, or Delta-Q Technologies for the correct AC cord set terminating with a 3-prong plug suitable for your region's grounded power outlet.
  - In North America (and other 120V AC regions), the AC cord must be a 3-conductor UL Listed/ CSA approved detachable cord set at least 1.8m in length ( $\geq 6$  feet), minimum 16 AWG and rated SJT; rated 105°C min, and terminated with 125V, 13A, or greater connector.
  - In Japan, the AC cord must be a 3-conductor PSE approved detachable AC cord set, rated 105°C, and terminated with 100V, 15A, or greater connector.
  - In 220-240VAC regions, the AC cord must be a 3-conductor safety-approved cord set, with 1.5mm<sup>2</sup> conductors (min.), rated appropriately for industrial use. The cord must be terminated on one end with a grounding type input plug appropriate for use in the country of destination; both plug and connector should be rated 250V, 10A, or greater.
- Extension cords must be 3-wire cords no longer than 30m (100') at 10 AWG or 7.5m (25') at 16 AWG, per UL guidelines.



## EMC DECLARATION

The IC Series 650, 900, and 1200 models have been tested and found to comply with the limits for a **Class A** digital device, pursuant to part 15 of the FCC Rules for the United States and the ICES Regulations for Canada. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

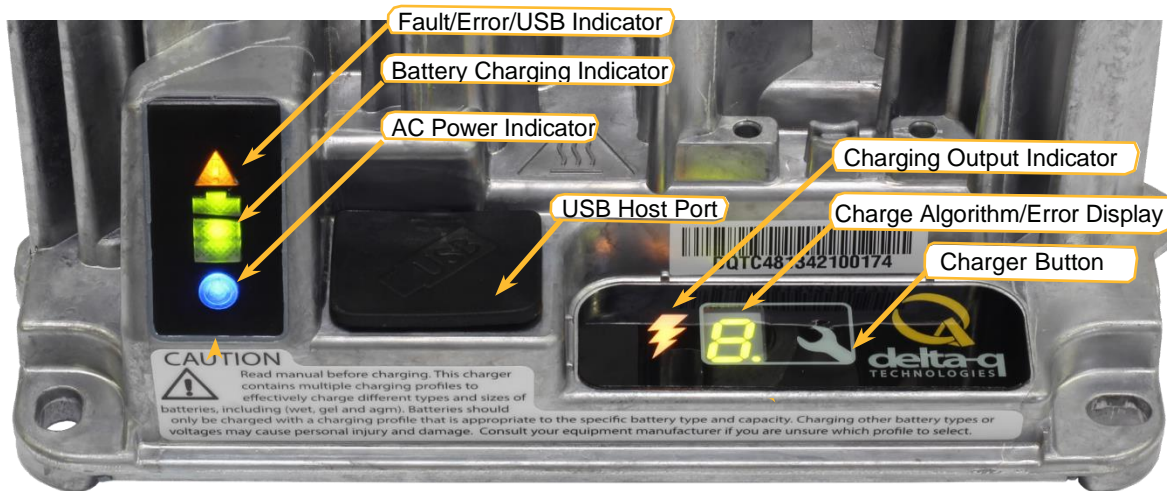
Some IC650 models have been tested and found to comply with the limits for a **Class B** digital device, pursuant to part 15 of the FCC Rules for the United States and the ICES Regulations for Canada. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause 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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.


As well, some IC650 models have been tested and comply with the limits for a **UNECE R10** for vehicular use.

## CHARGER INTERFACE

All IC Series chargers share the same user interface to improve usability.







1. When you plug into AC power, the **AC Power Indicator** illuminates solid blue to indicate AC power is present.






Solid Blue = AC power available

2. The **Battery Charging Indicator** has four states:

	Breathing Green = Low state of charge
	Solid Green = High state of charge
	Breathing Green = High state of charge
	Solid Green = Charge completed

3. The **Fault/Error/USB Indicator** indicates faults, errors, and USB activity.

	Solid Red = Charger fault; see display panel for details
	Flashing Amber = External error condition – Caution See display panel for details
	Flashing Green = USB Port Active Solid Green = Safe to remove USB flash drive

4. The **Charging Output Indicator** means the charger output is active and there is a potential risk of electric shock.
5. The **Charge Algorithm/Error Display** displays the following:

Code	Description
F-#-#-#	Fault Code – an internal fault condition that has caused charging to stop. Remove AC power and the battery for a minimum of 30 seconds and retry the charger. If it fails again, contact Delta-Q Technologies Support.
E-#-#-#	Error Code - an external error condition has caused charging to stop. Reinsert AC power to reset the charger to clear the error.
P-#-#-#	Indicates the active algorithm.
U-S-B	Indicates the USB host port is active. Do not remove the USB flash drive.
C-#-#-#-# or S-#-#-#	Checksum and Software – Contact Delta-Q Technologies for details.

Visit the Delta-Q Technologies support website at <https://support.delta-q.com> and search for *fault and error codes* to review recommended actions.

6. The **Charger** button has multiple functions:
  - o Short Press (less than 4 seconds) shows the currently active algorithm.
  - o It is also used to select a new algorithm from those loaded on the charger. Up to 25 algorithms can be stored. See *Selecting a Charging Algorithm* for instructions.

From charger software version 4.3.3 and later, the button has additional features:

- o Long Press (5 seconds): Shows software version, checksum, algorithm, and algorithm version as follows:

```
S 4 . 3 . 3 C a b 1 2 P 0 1 1 r 1 . 3 2
```

Where:

```
SW: v4.3.3
Checksum: ab12
Algorithm: 11 v1.32
```

- o Very Long Press (10 seconds): Off mode. This turns off all charger functions, while not charging, to save energy while connected only to batteries. This is only applicable for off-board applications when connected to DC only. If AC power is present the charger turns back on again.
7. The **USB Host Port** allows data to be transferred to and from the charger using a standard USB flash drive, including the downloading of charge tracking data and updating of the charger’s software and/or charge algorithms. **NOTE:** Only applicable to models with a USB port.



## CHARGING ALGORITHMS

Almost every model of battery has different charging requirements and each application may add to those requirements. Delta-Q Technologies has established over 200 charge algorithms for the most common motive deep cycle batteries. These algorithms are designed to get the longest battery life and meet a variety of application environments.

The algorithms are specific to each manufacturer and model of battery. Your equipment supplier or charger distributor is responsible for ensuring the active charge algorithm matches the battery pack charging requirements. Contact them with questions regarding the default algorithm, the other algorithms on the charger, and which algorithm to select for each battery pack.

### Selecting a Charging Algorithm

1. Disconnect AC input from the charger or from the wall outlet. Wait 30 seconds.

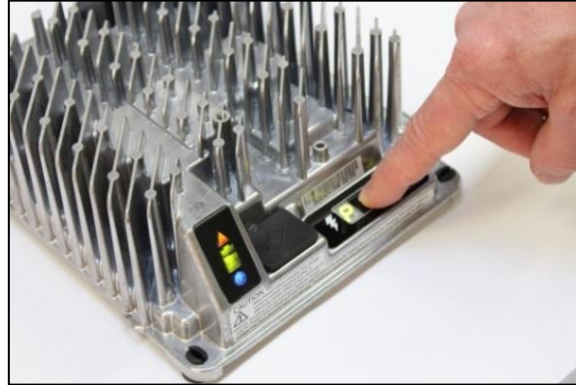


2. Reconnect the AC input while continuing to press and hold the **Charger** button.



3. Continue to hold the **Charger** button until the **Error Display** illuminates amber and the **Battery Charging Indicator** is flashing green (wait maximum 22 seconds). Release the **Charger** button.

4. Press and release the **Charger** button to advance through the charge algorithms. The selected charging algorithm will be displayed up to three times (e.g., P-0-1-1 for Algorithm 11).



5. Once the desired charging algorithm is displayed, press and hold the **Charger** button for 10 seconds to confirm selection and exit Selection Mode. When the charge algorithm is confirmed, the **Error Display and Battery Charging Indicator** lights turn off, while the blue **AC Power Indicator** remains lit. At this time, the button can be released.
6. Press the **Charger** button to check the desired algorithm has been selected.

In some circumstances, the charging algorithm output will be altered to maintain safe operations. The unit automatically reduces its output power if the temperature rises above set thresholds, or if the AC input voltage is too low. If power is interrupted, and then returns, the charger will start and continue to operate without hazard to the user or damage to the batteries.

## FAULT AND ERROR CODES

Visit the Delta-Q Technologies support website at <https://support.delta-q.com> and search for *fault and error codes* to review recommended actions.

## IDENTIFYING THE CHARGER SERIAL NUMBER

The serial number is printed on the front of the charger. Use this number when requesting technical support.



## ACRONYMS

The following table provides acronym definitions used within this guide.

Term	Definition
AC	Alternating Current
AWG	American Wire Gauge
BMS	Battery Management System
CFM	Cubic Feet Per Minute
DC	Direct Current
EMC	Electromagnetic Compliance
FCC	Federal Communications Commission
HV	High Voltage
HW	Hardware
ICES	Interference-Causing Equipment Standard
ID	Identification
kW	Kilowatt
LED	Light Emitting Diode
LIN	Local Interconnect Network
LV	Low Voltage
MB	Megabyte
MCU	Microcontroller - also abbreviated uC or $\mu$ C
NMT	Network Management
SJTW	Hard Service Cord
SW	Software
TBD	To Be Determined
UL	Underwriters Laboratories
USB	Universal Serial Bus
V	Volt
VAC	Volts Alternating Current



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