

# **Deka**<sup>®</sup>

## **POWERFORCE**

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### **OWNER MANUAL – MOTIVE POWER CHARGER**



**IMPORTANT:** Read these instructions before installing, operating, or servicing this system.

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## INTRODUCTION

### How To Use This Manual

**IMPORTANT:** It is especially important that all charger internal components be kept clean and dry, and all electrical connections tightened. Replace any precautionary or instruction label that cannot be easily read.

To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.

Throughout this manual, the words **WARNING**, **CAUTION**, and **NOTE** may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

**WARNING** gives information regarding possible personal injury.

**CAUTION** refers to possible equipment damage.

**NOTE** offers helpful information concerning certain operating procedures.

### Equipment Identification

The unit's identification number (specification, model, serial number) appears on a nameplate attached to the front panel.

### Receipt Of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to the company shown on the cover of this manual. Include all equipment identification numbers and group part numbers (if any) as described above, along with a full description of the parts in error.

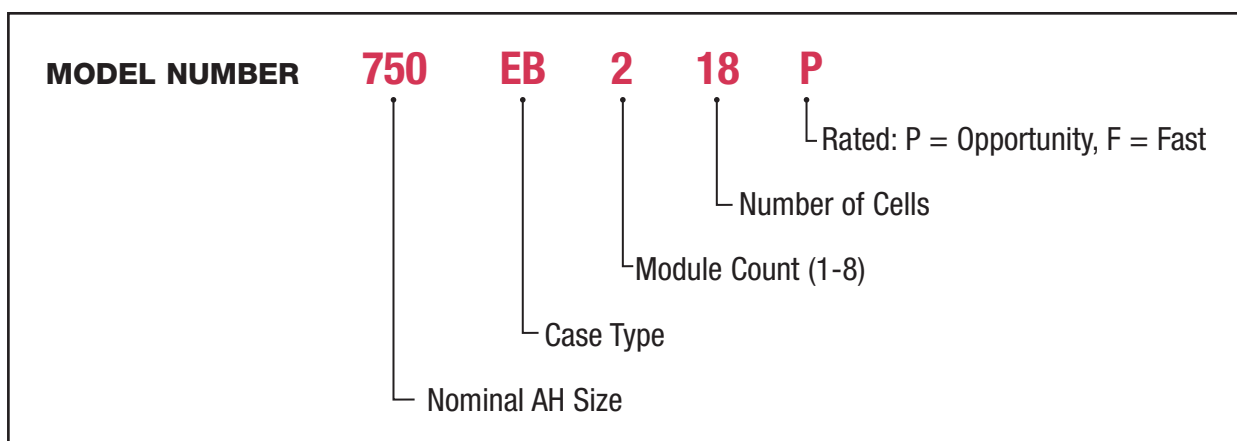
Move the equipment to the site of installation before uncrating. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.

Additional copies of this manual are available on the company website [www.eastpenmanufacturing.com](http://www.eastpenmanufacturing.com).

**NOTE:** Information regarding obtaining additional copies of this manual is located in the Introduction chapter of this manual.

A battery charger is identified by model number. Incorporated into the model number is the ampere-hour capacity, module count, and number of cells in battery for which charger is intended. The following example explains the basic model numbering arrangement.

**NOTE:** This information is required for ordering certain replacement/service parts.



## SAFETY INSTRUCTIONS AND WARNINGS

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### FOR OPERATION OF BATTERY CHARGING EQUIPMENT

**IMPORTANT** – READ AND UNDERSTAND THESE INSTRUCTIONS. DO NOT LOSE THEM. ALSO READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING, OR SERVICING THIS EQUIPMENT.

#### A. General

Battery charging products can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from experience in the use of charging equipment. These practices must be learned through study and training before using this equipment. Anyone not having extensive training in battery charging practices should be taught by trained and experienced operators.

Only qualified personnel should install, use, or service this equipment.

#### B. Shock Prevention

Bare conductors, or terminals in the output circuit, or ungrounded, electrically live equipment can fatally shock a person. To protect against shock, have a certified electrician verify that the equipment is adequately grounded and learn what terminals and parts are electrically energized.

The body's electrical resistance is decreased when wet, permitting dangerous current to flow through the body. Do not work in damp area without being extremely careful. Stand on dry rubber mat or dry wood and use insulating gloves when dampness or sweat cannot be avoided. Keep clothing dry.

1. Installation and Grounding of Electrically Powered Equipment – Electrical equipment must be installed and maintained in accordance with the National Electrical Code, NFPA 70, and local codes. A power disconnect switch must be located at the equipment. Check nameplate for voltage and phase requirements. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. **DO NOT CONNECT** the equipment grounding conductor (lead) to the third live wire of the 3-phase line as this makes the equipment frame electrically energized, which can cause a fatal shock.

If a grounding lead (conductor) is part of the power supply cable, be sure to connect it to a properly grounded switch box or building ground. If not part of the supply cable, use a separate grounding lead (conductor). Do not remove a ground prong from any plug. Use correct mating receptacles. Check ground for electrical continuity before using equipment.

The grounding conductor must be of a size equal to or larger than the size recommended by Code or in this manual.

2. Charging Leads – Inspect leads often for damage to the insulation. Replace or repair cracked or worn leads immediately. Use leads having sufficient capacity to carry the operating current for long periods of time without overheating.

3. Battery Terminals – Do not touch battery terminals while equipment is operating.
4. Service and Maintenance – Shut OFF all power at the disconnect switch or line breaker before inspecting, adjusting, or servicing the equipment. Lock switch OPEN (or remove line fuses) so that the power cannot be turned ON accidentally. Disconnect power to equipment if it is to be left unattended or out of service.

Disconnect battery from charger.

**A 5 minute delay is required after AC power removal for full discharge.**

Keep inside parts clean and dry. Dirt and/or moisture can cause insulation failure. This failure can result in high voltage at the charger output.

#### C. Burn and Bodily Injury Prevention

The battery produces very high currents when short circuited, and will burn the skin severely if in contact with any metal conductor that is carrying this current. Do not permit rings, watches, or jewelry to come in contact with battery terminals or the cell connectors on top of the battery.

Battery acid is very corrosive. Always wear correct eye and body protection when near batteries.

#### D. Fire and Explosion Prevention

Batteries give off explosive flammable gases which easily ignite when coming in contact with an open flame or spark. Do not smoke, cause sparking, or use open flame near batteries. Charge batteries only in locations which are clean, dry, and well ventilated.

Do not lay tools or anything that is metallic on top of any battery. All repairs to a battery must be made only by experienced and qualified personnel.

#### E. Arcing and Burning of Connector

**CAUTION:** To prevent arcing and burning of the connector contacts, be sure the charger is OFF before connecting or disconnecting the battery (If the charger is equipped with an ammeter, the ammeter should not indicate current flow).

#### F. Medical and First Aid Treatment

First aid facilities and a qualified first aid person should be available for each shift for immediate treatment of electrical shock victims.

**EMERGENCY FIRST AID:** Call physician and ambulance immediately. Use First Aid techniques recommended by the American Red Cross.

**DANGER:** ELECTRICAL SHOCK CAN BE FATAL. If person is unconscious and electric shock is suspected, do not touch the person if he or she is in contact with charging leads, charging equipment, or other live electrical parts. Disconnect (open) power at wall switch and then use First Aid. Dry wood, wooden broom, and other insulating material can be used to move cables, if necessary, away from person. IF BREATHING IS DIFFICULT, give oxygen. IF NOT BREATHING, BEGIN ARTIFICIAL BREATHING, such as mouth-to-mouth. IF PULSE IS ABSENT, BEGIN ARTIFICIAL CIRCULATION, such as external heart massage.

IN CASE OF ACID IN THE EYES OR ON THE BODY, flush with clean water and obtain professional medical attention immediately.



### **G. Equipment Warning Labels**

Inspect all precautionary labels on the equipment. Order and replace all labels that cannot be easily read.

## **DESCRIPTION OF EQUIPMENT**

The basic charging circuit is the IGBT inverter high frequency-type with isolating transformer (s). This design regulates charging current by allowing the battery to determine its own charge cycle rate in accordance with its state of discharge. It provides a constant current-constant voltage-constant current (IEI) charge that eliminates the possibility of overcharging, even with line voltage variations of  $\pm 10\%$  and allows the battery to finish at the proper current regardless of battery age or gravity type.

The PowerForce provides battery charging over a wide range of environmental conditions. The charger will precisely charge your battery based on battery temperature, type, and size; by automatically adjusting its own output charge characteristic within the power limits of the charger's power circuit.

When applied with the PowerForce optional Battery Identification Module (BID), the PowerForce Charger identifies the battery selected for charging at the time of connection and adjusts its output for that specific battery. During the charge cycle, or duration of connection, the PowerForce continuously monitors the battery's temperature via the BID and adjusts its output to match the battery temperature as it changes throughout the charge cycle.

Upon connection of the battery, the PowerForce control reads the information programmed into the BID and identifies the battery's AH rating, cell size, type of construction, electrolyte temperature, and programmed method of charge and adjusts its output curve based on this information.

The PowerForce is internally protected against overload and short circuits by both input and output fusing, plus PowerForce's unique curve monitoring circuit measures the output curve to ensure that the voltage and current are within the limits set at the factory.

### **Operating Modes**

The PowerForce reads the information that was programmed into the BID Module during installation and charges the battery based on an opportunity charging profile or a profile designed to recharge a fully discharged battery in 8 hrs. Valve regulated batteries of several types can also be recharged at the 8 hour rates when equipped with a properly programmed BID Module.

The PowerForce always reads the BID module first when an installed BID Module is detected and enabled in charger settings. The charger automatically adjusts its output to match the battery information programmed into the module.

The BID module allows users with various cell size batteries to charge any battery on any charger without the fear of mismatching batteries and chargers.

### **Conventional Charging**

In applications utilizing conventional charging, the output of the PowerForce returns recharges a battery over a long break period. PowerForce conventional models are for rates up to 16.3% and are not rated for lithium battery charging.

### **Opportunity Charging**

In applications utilizing opportunity charging, the high current output of the PowerForce returns significant capacity to the battery during short periods such as breaks, lunch and shift changes. In many applications battery changing can be eliminated completely. PowerForce opportunity models are for rates up to 25% charging or lithium battery charging with or without CAN bus communications.

### **Fast Charging**

In applications utilizing fast charging, the high current output of the PowerForce returns significant capacity to the battery during short periods such as breaks, lunch and shift changes. In many applications battery changing can be eliminated completely. PowerForce Fast models are for rates up to 50% charging or lithium battery charging with or without CAN bus communications.

### **POWERFORCE Control**

The PowerForce control is the standard charge control for the PowerForce Charger. It utilizes either a voltage/time (VT) charge termination or a patented delta voltage / delta time (dV/dT) charge termination technique which eliminates excessive gassing returning approximately 107% of the amp hours removed from the lead battery.

Features of the PowerForce Control include auto start/stop, manual equalize, manual stop, back-up timer protection, two charge termination methods, manual or automatic (with optional BID module) battery temperature compensation, AC power fail recovery, selectable output profiles, and charge cycle data archiving.

The backlit touch screen display indicates the status of a normal charge cycle. The screen will display "80% Charged" when the battery current is reduced to approximately 8.2 amps per 100 AH of battery rating. The battery voltage at the 80% charged point will vary with charge profile setting and/or manual or automatic temperature settings. "Charge Complete" will display only if the battery has completed the charge cycle and is ready for use.

**WARNING:** Do not connect a battery to this charger if the screen is not on and charger indicator light is not illuminated. Do not disconnect a battery from this charger while a charge is in progress. Otherwise, damage to charger, arcing and burning of connector parts or a battery explosion may result. Batteries produce explosive gases. Keep sparks, flame, and cigarettes away. Ventilate when charging in an enclosed area. Always shield eyes when working near batteries.

## INSTALLATION

### Location

For best operating characteristics and longest unit life, take care in selecting an installation site. Avoid locations exposed to high humidity, dust, high ambient temperature, or corrosive fumes. Moisture can condense on electrical components, causing corrosion or shorting of circuits, especially when dirt is also present.

Adequate air circulation is needed at all times in order to assure proper operation. Provide a minimum of 12 inches of free air space at the side and front of the unit. Make sure that ventilation openings are not obstructed.

Always remove the charger shipping skid from the unit before installation. The charger must be installed over a noncombustible surface such as concrete or metal. Keep the charging area clear of all combustible material such as wood, paper, and cloth. When moving the charger after the packing skid and box have been removed, make sure that lifting forks do not damage the charger panels or cables.

**WARNING:** SPARKS OR MOLTEN METAL falling through open bottom can cause fire or explosion.

- Install over noncombustible material such as concrete or metal.
- Keep charging area clear of combustible material.

### Stacking

Units with a single door can be stacked up to two units vertically. Applications that require more than two units vertically stacked will require shelf or rack systems not offered by E.P.M. Units with two doors are not designed to be stacked. See options list for stacking kits.

<i><b>Environmental Characteristics</b></i>	
Operating Characteristics	-20°C to 45°C (-4°F to 113°F)
Operating Altitude	To 2000 Meters (6562 Feet)
Operating Humidity	80% up to 31°C, decreasing to 50% at 45°C, non-condensing 80% up to 88°F decreasing to 50% at 113°F, non-condensing

### Grounding

The frame of the power source must be grounded for personnel safety. Where grounding is mandatory under state or local codes, it is the responsibility of the user to comply with all applicable rules and regulations. Where no state or local codes exist, it is recommended that the National Electrical Code be followed.

In addition to the usual function of protecting personnel against the hazard of electrical shock due to fault in the equipment, grounding serves to discharge the static electrical charges which tend to build up on the surfaces of equipment. These static charges can cause painful shock to personnel, and can lead to the erroneous conclusion that an electrical fault exists in the equipment.

If a charger is to be connected to the AC power supply with a flexible jacketed cable, one having a separate grounding conductor should be used. When included in cable assembly, grounding conductor will be green, green with a yellow stripe, or bare. When connecting input power to charger (as instructed in Line Connection to Battery Charger section of this manual), connect grounding conductor to equipment grounding terminal, taking care to make a good electrical connection. Connect other end of grounding conductor to the system ground.

If, for any reason, an input cable which does not include a grounding conductor is used, the equipment must be grounded with separate conductor. Minimum size and color coding requirements must be in accordance with any applicable state or local code, or the National Electrical Code.

If metallic armored cable or conduit is used, the metal sheathing or conduit must be effectively grounded as required by state or local code, or the National Electrical Code.

**WARNING:** ELECTRIC SHOCK HAZARD- Under no circumstance should you use a grounding conductor with a current carrying capacity less than the ampere rating shown in Table 4-1.

If a system ground is not available, the charger frame must be connected to a driven ground rod (at least 8 ft [2438 mm] long), or to a water pipe that enters the ground not more than 10 ft (3048 mm) from the charger. A grounding conductor must be connected to the rod or pipe in a manner that will assure a permanent and effective ground. The conductor must be sized in accordance with any applicable state or local code, or by the National Electrical Code. If in doubt, use the same size conductor as is used for the conductors supplying power to the charger.

LINE AMPS	DISCONNECT SWITCH *	BRANCH FUSE SIZE (AMPERES)	COPPER CABLE SIZE AWG**	
			POWER	GROUND
0-2.5	30A	5	No. 14	No. 14
2.6-4.5	30A	7	No. 14	No. 14
4.6-7.5	30A	10	No. 14	No. 14
7.6-12	30A	15	No. 14	No. 14
12.1-16	30A	20	No. 12	No. 12
16.1-18	30A	25	No. 10	No. 10
18.1-22	30A	30	No. 10	No. 10
22.1-24.5	60A	35	No. 8	No. 10
24.6-32.5	60A	40	No. 8	No. 10
32.6-40	60A	50	No. 8	No. 10
40.1-45	60A	60	No. 6	No. 10
45.1-57.5	100A	80	No. 4	No. 8
57.6-78	100A	100	No. 2	No. 8
78.1-102.5	200A	125	No. 2	No. 6
102.6-135	200A	150	No. 1/0	No. 6

**Table 4-1 Recommended AC Input and Branch Fusing**

The above table (Table 4-1) is based on 75°C (167°F) rated conductors and 40°C (104°F) ambient temperatures. Refer to National Electrical Code (2008) Tables 310-16 corrected to 40°C (104°F).

\* For 115, 208, and 230-volt lines, use 250-volt disconnect switch. For 440-480, 575-volt lines, use 600-volt disconnect switch.

\*\* Two conductors and ground conductor required for single phase. Three conductors and ground conductor required for three phase.

Recommended minimum size of grounding conductors (based on National Electrical Code 2008 – Table 250-95).

### Line Connections to Battery Charger

Follow local code requirements if different than instructions in this manual.

1. Turn charger OFF.
2. Be sure charger is connected correctly for available line voltage as instructed above.
3. On charger nameplate, note the AC input amperes corresponding to the line voltage to which charger is to be connected. Use that ampere value to select the proper disconnect switch, fuse, and power cable sizes from Table 4-1.
4. Route AC power input cable in through knockout provided in side panel of charger cabinet. Securely fasten cable wires to a power input terminal inside charger. Refer to Grounding section of this manual for proper connection of grounding conductor.
5. With disconnect switch (on AC input power line) in "OPEN" or "OFF" position, connect power cable coming from charger, to the switch. Install fuses in switch.

**Warning:** At all times, safety must be considered an important factor in the installation, servicing and operation of the product and skilled, qualified technical assistance should be utilized.

### AC Supply Input Conditions:

Supply voltage should not exceed +/-10% of rated input voltage value. Consistent power should be provided with fluctuations not to exceed 1200VAC (850Vrms) for a duration longer than 25 Microseconds.

### Mounting Pattern

This is an excerpt from the 199740 and 199752 outline drawings. Please request if you need further mechanical information (utilize a 3/8" or 9.5 mm drill bit) The fasteners are M8 -1.25 with a maximum thread depth of 7.5mm. Please consider your rack or shelf thickness as well as your washer thickness when selecting an appropriate length

*Note: remember to maintain 12" of free airspace between and in front of each charger*

*Mounting pattern should be 4.53" (115 mm) square.*

### **Special Considerations**

#### **Generators and Backup Power Systems**

On site power generation and backup power systems create special considerations both because of the power quality itself and the way the load is transferred between mains and backup (and reversion to mains).

If this installation will incorporate either on – site generation or some other form of backup power, please consult E.P.M Engineering for a review of the planned system prior to implementation.

#### **Charging Cable Connectors**

If connectors are already attached to charging cables, make sure that they are attached so that positive charger polarity will connect to positive battery terminal.

If connectors must be attached to charging cables, follow instructions supplied with connectors.

**CAUTION:** Make sure connector contacts are securely attached to cables (good solder joint or crimps, whichever is applicable). Be certain that positive charger cable will connect to positive battery terminal. If necessary, trace cables into charger to determine polarity. The use of a DC voltmeter may show polarity. Improper connections will “blow” output fuse and may cause other damage.

#### **Pre-operation Checks**

1. Inspect charger thoroughly for damage; loose screws, nuts, or electrical connections

**WARNING:** ELECTRICAL SHOCK HAZARD – Before inspecting or cleaning inside cabinet, turn OFF and remove fuses of disconnect switch (supplying AC power to charger) and disconnect battery.

2. Remove all special tags that are tied to charger. Keep tags with this manual for future reference. Leave all precautionary and instruction labels in place on charger. Carefully read and follow instructions on all tags and labels. Make sure all labels remain visible to anyone operating charger.
3. Make sure all charger cabinet panels are fastened in place, to assure proper flow of ventilating air through cabinet.

#### **Pre-Operation Changes To The Factory Control Settings**

Typically few changes are required to be made if the amp hour rating is sized to the battery and the voltage rating is equal to or greater than the battery. However, in some applications, some changes to the programmable control settings may be desirable. The most common changes are listed below:

##### **TIME**

Factory Setting for Time can be set to the desired time zone

*NOTE: It is advisable to check the day of the week, date, month, and year for accuracy*

##### **VOLTAGE SETTING**

Factory Setting for Maximum Rating of charger

##### **CAPACITY SETTING**

Factory Setting for Maximum Rating of charger

##### **CURVE SETTING**

Factory Setting for Conventional is “FLD”, Factory Setting for opportunity is “MAX”, Factory Setting for FAST is “MAX”

##### **NO GASSING HOURS**

Factory Setting is 2 hours

##### **MAX BATTERY TEMPERATURE**

Factory Setting is 150° F

##### **AUTO EQUALIZE**

Factory setting is ON

##### **AUTO EQUALIZE TYPE**

Factory setting is by Cycle

##### **AUTO EQUALIZE COUNT**

Factory setting is 05

##### **START MODE**

Factory Setting is automatic start

##### **BID COMMUNICATIONS ENABLE**

Factory setting is ON

##### **REFRESH**

Factory setting is on with 96 hour setting

Other functions are available for programming the PowerForce Control to meet your specific charging needs. Programming these functions is described in the Programming the PowerForce Control chapter of this manual.

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## **MAINTENANCE**

**WARNING:** ELECTRICAL SHOCK HAZARD — Before inspecting or cleaning inside cabinet, turn OFF and remove fuses of disconnect switch (supplying AC power to charger) and disconnect battery.

#### **Inspection And Cleaning**

For uninterrupted, satisfactory service from this charger, it's necessary to keep unit clean, dry, and well ventilated. ***At least every three months, or more often as necessary, wipe and blow out all dirt from unit's interior components, with clean, dry air of not over 25 psi (172 kPa) pressure.*** Use a hand bellows if compressed air isn't available.

A certified technician can remove modules and clean the heat sink with compressed air or a wire brush, if necessary.

Check and tighten all electrical connections as necessary to eliminate unnecessary losses and to avoid subsequent trouble from overheating or open circuits. Check for broken wiring or damaged Insulation on wiring.

**WARNING:** ELECTRICAL SHOCK HAZARD — Failure to keep internal parts clean and dry may allow transformer(s) to short out, causing secondary circuits to carry dangerously high voltage.

Be sure to close all charger cabinet panels after any servicing, to assure proper flow of cooling air through unit and to protect internal components.

**WARNING:** ELECTRICAL SHOCK HAZARD — All cabinet panels must be closed to protect personnel from contact with hazardous voltages.

#### **Lubrication**

None required.



## Fuse Replacement

The input and output of the PowerForce modules are protected by 'fast clearing' fuses. Three AC fuses on the input and a DC fuse on the output.

**CAUTION:** The use of any other type fuse besides the "fast-clearing" type may cause damage to silicon diodes.

## OPERATION

The operating procedure given here explains the operation of a PowerForce Charger equipped with the PowerForce Control.

**NOTE:** If this charger is equipped with certain optional features, the operating procedure may be modified.

### Preliminary

1. Make sure that charger is installed and grounded as instructed in this manual.
2. Turn on main fused disconnect switch that supplies AC power to charger.
3. Maintain electrolyte level in batteries to be charged, as instructed by battery manufacturer. The volume of electrolyte will expand during the charge. Therefore, to avoid overfilling, do not add water until the battery has received a full charge.

### Normal or Daily Charge

(For batteries with ampere-hour capacity within the range shown on charger nameplate)

1. Verify that battery size matches the charger and/or charger setting. (Number of cells is equal to or less than the charger nameplate rating and ampere-hour capacity is within charger nameplate rating.)
2. Securely engage the battery and charger connectors. The charger will go to the Dashboard view.
3. The charger will display "Detecting BID Device" as it looks for a BID module.
4. After a short delay, the charger will turn on, the fans will run and the charge indicator of LEDs will blink green. The touch screen display will indicate the cell size and amp hour settings for the charge cycle.
5. The charge indicator will blink green slowly and become faster when the battery reaches 80%.
6. When the charge termination point is reached, the charger will turn off and the blinking green light will become solid. If an equalize charge has been selected, the lights will blink fast green/white during the Equalize portion of the charge cycle.

**NOTE:** To disconnect battery from charger before charge is complete, press the "Stop" button on the charger front panel.

**NOTE:** While not normally required, the charging rate may be adjusted to compensate for unusual ambient temperature, age of battery, etc.

**NOTE:** Start up delays can occur with multi voltage modes enabled, power fail recovery, and start mode settings.

**WARNING:** EXPLOSION HAZARD - Do not connect or disconnect a battery unless the charge indicator is a solid Green: otherwise, damage to charger, arcing and burning of connector parts or a battery explosion may result (batteries produce explosive gases). Keep sparks, flame, and cigarettes away. Ventilate when charging in an enclosed area. Always shield eyes when working near batteries. Disconnect battery if charger is to be turned off for prolonged periods of time.

### Equalize or Weekend Charge

Batteries need equalizing every 5 to 7 cycles to correct for inequalities between cells that result from daily or frequent cycling. An equalizing charge should be given if any of the following conditions exist:

1. The specific gravity of any cell at the end of charge is 20 points less than the average.
2. The on-charge voltage of any cell at the end of charge is 30 mV less than the average.
3. The battery has been stored for 30 days.
4. A large volume of water has been added.

When the equalize mode is desired, follow the operation outlined for a normal charge but switch the Equalize toggle to the on position.

**NOTE:** The PowerForce Control is shipped from the factory set to the Auto Equalize by Cycle mode, and will automatically provide an equalize charge every 5 complete cycles. Auto Equalize prevents manual equalizing.

### Manual Stop

To stop any charge cycle before charge complete, press the "Stop" key.

**WARNING:** Do not connect a battery to this charger if any error is displayed. Do not disconnect a battery from this charger while a charge is in progress. Otherwise, damage to charger, arcing and burning of connector parts or a battery explosion may result. Batteries produce explosive gases. Keep sparks, flame, and cigarettes away. Ventilate when charging in an enclosed area. Always shield eyes when working near batteries.

### AC Power Fail

The PowerForce Control will resume the charge where it left off when the AC power failure occurred, virtually unaffected charge time.

As power is returned, if a charge cycle was in progress, the display will show "delayed start due to power failure" and will restart based on cycle run times. This will prevent multiple chargers from restarting all at once, minimizing peak restart power.

**NOTE:** If a battery is disconnected from the charger during an AC power failure and discharged, reconnecting it or any other battery may result in an incomplete charge cycle.

**WARNING:** ELECTRICAL SHOCK HAZARD – Before checking electrical components, turn off and remove fuses of disconnect switch (supplying AC power to charger) and disconnect battery.



### Abnormal Shutdowns:

**High Battery Reject-** Initial battery voltage higher than expected per the charger's capabilities or cell count setting. The charge indicator will turn red and screen will display "High Battery voltage detected unable to Charge"

**Battery Overtemperature-** Battery has exceeded the max temperature setting and is cooling down. The charge indicator will show solid Red and screen will display "Battery Over Temperature Detected Cooling Down". Once the battery cools down, charging will continue.

**Low Voltage Shutdown-** This shutdown will occur if cell voltage does not rise above the following levels in the indicated time frame: On screen message: "Charge Curve Error Minimum Charge Slope Not Met"

Voltage	Charge Time (Minutes)
> 1.7VPC	30
>1.8VPC	60
>1.9VPC	90

**Charge Curve Voltage Error-** On screen message text: "Charge Curve Error Unable to Reach Tar-get CV". This is to indicate to the user that the charger cannot charge the battery properly due to battery problems, charger problems or mis-matched equipment.

**Low Current Shutdown-** Predetermined level is below 2 amps for greater than 30 seconds. On screen message: "Charge Curve Error Low Current"

**High Current Shutdown-** Charger output current is higher than expected. This error is triggered when output is 5 amps above the desired out-put for longer than 30 seconds and the charge controller is unable to compensate for it. The charge indicator is solid red. On screen message: "Charge Curve Error Over Current".

**Manual Stop-** On screen message: "Manual Stop". This should only be present if the Manual Stop button has been pressed while the charger is running.

**Backup Timer-** Charger recognizes that the battery is not charging properly due to a lack of increased voltage as the charge occurs. On screen message: "Charge Session Timeout".

**Over Max AH Returned-** Without a BID this will trip at 125% of total battery amp hour. 150% with a BID. For an equalize charge, it is 150% without a bid and 175% with a BID. On screen message: "Charge Error Over AH Returned"

**Charger Overtemperature Shutdown-** Charger cabinet temperature high, charging stopped. The charge indicator is solid red, on-screen message: "Charger Over Temperature Error"

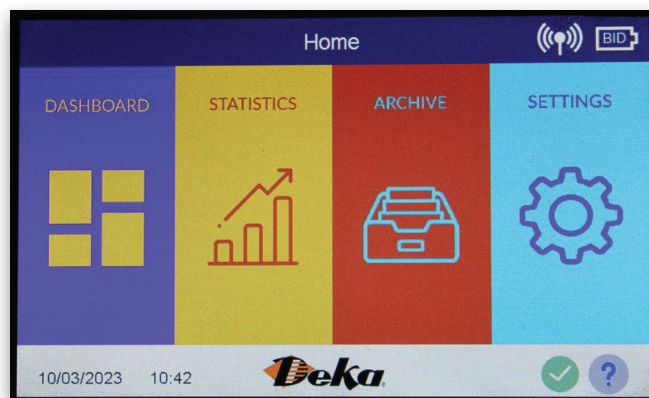
**Charge Curve Error DiDt-** Indicates an increase in current over time. Current should decrease when it hits gassing voltage. On screen message "Charge Curve Error DI/DT"

**Charge Engine Error-** All power modules are offline, unable to charge. The charge indicator is solid red, on screen message: "Charge Engine Error"

**BID Battery Reject-** Battery type described by BID/ WBID device is not compatible with this charger. The charge indicator is solid red, on screen message reads: "BID Battery Reject"

**Arcless Subsystem Error-** A problem was detected in the arcless detection circuit that prevents the unit from charging. Charge indicator: Solid Red. On screen message: "Arcless Subsystem Error"

## POWERFORCE CONTROL FEATURES



### Main Features

1. Up to 50 A/100AH high rate fast charging output.
2. Multi-Voltage Charging Capability
3. Multi-Ampere-Hour Charging Capability
4. Automatic or Manual Battery Temperature Compensation
5. 15 Minute Minimum DV/DT Charge Termination and VT Termination
6. Touch Screen Display
7. Manual Stop Capability
8. Review of Current Charge Cycle Statistics Information during charge cycle or after charge complete
  - Amp hours returned during charge cycle
  - Total time on charge
  - 80% point to end of charge timer
  - Battery open circuit voltage
  - Start current
  - Start voltage (volts/cell)
  - Finish current
  - Finish voltage (volts/cell)
  - Charge termination code
  - Battery and Charger Module Temperature
  - Time/Date of Charge Cycle
  - Charger curve type

9. Review of Archived Charge Cycle Data for the Last 1000 Charge cycles.
  - Battery ID
  - Amp hours returned during charge cycle
  - Total time on charge
  - 80% point to end of charge time
  - Battery open circuit voltage
  - Start current
  - Start voltage (volts/cell)
  - Finish current
  - Finish voltage (volts/cell)
  - Charge termination code
  - Equalize time
  - Start time
  - End time
  - Battery I.D.
  - Battery I.D. start temperature
  - Battery I.D. end temperature
  - Cycle battery voltage
  - Curve Type
  - Month
  - Date
10. Automatic start operation
11. Manual or Automatic Equalize Operation
12. Refresh Charge
13. Back-up Timer Shutdowns
14. Failure Mode Diagnostics
  - High Battery Reject
  - Low Battery Reject
  - Module Temperature Warnings (IGBT / DIODE)
  - Battery Over-temperature
  - Low Voltage Shut Down
  - Charge Curve Error
  - Low Current Shut Down
  - Backup Timer
  - Manual Stop
  - Over Maximum Amp Hour Returned Shut Down
  - Charger Overtemperature Shutdown
  - DIDT Shut Down
  - Phase warning
  - Arcless Subsystem fault
  - Warning/Error Count
15. Programmed Features and Archive Data maintained for a minimum of 10 Years
16. Charge Cycle Data and Time-of-Day/Date maintained for a minimum of 10 Years

17. 5 Programmable Start Modes
  - Automatic Start
  - Delayed Start
  - Time-of-Day Start
  - Time-of-Day Blockout
  - Timer Mode
18. Programmable Manual Override of Start Modes
19. Password Protection
20. Automatic Equalize by Number of Charges or BID Cycles, Day of Week
21. Programmable Cool Down Time
22. Staggered Start on A/C Fail Recovery

### **Description of Features**

**Multi-Voltage Charging** — The PowerForce provides the capability to charge batteries of different voltage sizes. With the Multi-volt Mode ON, the charger automatically selects the proper charge curve based on battery voltage. A 48V PowerForce will safely charge 48V, 36V, and 24V cell batteries. An 36V PowerForce will safely charge 36V and 24V batteries.

Fixed mode operation can be selected by programming Multi-volt mode to OFF. In this mode the charger will charge only batteries of the volt setting programmed into the Fixed-volt setting.

If the battery is equipped with BID Module, the Multi-volt ON or OFF function will be overridden and the charger will charge the battery if it is within the charger output rating.

**Temperature Compensation** — The PowerForce Control is capable of modifying the output voltage to compensate for ranges of battery electrolyte temperatures from 32 to 150 degrees F. Because the 80% percent point is based on reaching a point on the charge curve rather than a single voltage, it is automatically adjusted with the output voltage.

**CAUTION:** Consult your batteries manufacturer for the recommended maximum battery temperature for your battery.

When the battery is equipped with a PowerForce BID module, the charger automatically reads the battery temperature throughout the charge cycle and adjusts the output voltage to match the battery temperature.

Manual adjustment of the charger output voltage to match the temperature of the battery is performed by programming the proper battery electrolyte temperature into the Fixed Battery Temperature function (BID readings automatically override the Fixed Battery Temperature setting).

**Max Battery Temperature**—The PowerForce Control monitors the battery temperature throughout the charge cycle. Programming the MAX BATT TEMP setting of the control to the desired maximum battery temperature will cause the charger to shut down if the battery on charge is equipped with a BID and the temperature exceeds the set point. It will wait until the battery temperature has decreased to 5 degrees F below the set point before restarting the charge cycle.

**Charge Termination** — The PowerForce control utilizes two types of termination. VT, Voltage Time termination, will go to charge complete after a timer. The other way to terminate a charge cycle is to use DV/DT. DV/DT is a patented proportional time DV/DT technique in order to determine the charge termination point. This technique returns approximately 107% of the amp hours removed from a battery (regardless of the state of discharge) and prevents variations in the incoming AC line voltage from affecting the amount of energy returned to the battery. The minimum time required for a DV/DT charge termination on the PowerForce control is fifteen minutes. The control can be programmed to utilize a voltage-time charge termination technique. If the DV/DT charge termination is disabled, the control will terminate the charge cycle four hours after the battery reaches the “80% Charged” point.

**Touch Screen Display** — A backlit touch screen display is standard on the PowerForce control. Plain English and easy to understand abbreviations are used to indicate charge status, output current, voltage and other functions including; archive information, review information, programming information, fault information, and operating status.

**Review of Charge Cycle** — When the charge cycle is in progress or has been terminated, either by the control or the operator, the charge cycle history can be automatically read out by Statistics App.

**Automatic or Push-to-Start Operation** — In the automatic start mode, the charger will start a short time after the battery is connected. The display will display “Reading BID Device Data” and then display upcoming cycle information. In delayed, blockout, or time-of-day start mode, the charger will not start the charge cycle until “Start Mode Override” is toggled ON.

**Manual or Automatic Equalize** — An equalize charge is a prolonged charge cycle (by 3 hours) used to correct any inequalities of voltage and specific gravity which may have developed between the cells during service. PowerForce controls are shipped from the factory with the automatic equalize feature enabled. There are three modes of automatic equalize. See the Equalize section of chapter 9 of this manual for further details. When the automatic equalize feature is active, the “Equalize” switch on the touch screen display is disabled. When automatic equalize is disabled, an equalize charge is requested by switching the “Equalize” toggle on the touch screen display before or after the charge cycle has started. If this toggle switch is turned off during the charge cycle, the equalize request will be canceled if the equalize period has not begun.

**Refresh Charge Feature** — A refresh charge of a storage battery is a charge given to charged, wet type batteries, which are in storage or inactive for long periods to replace losses due to limited action and to be certain that every cell is brought periodically to a full state of charge. The PowerForce control has an adjustable 0 to 99 hour refresh charge timer (programmed through the “Refresh” icon in the settings app) which starts with a normal charge complete, either DV/DT or voltage time. If a battery is left connected to the charger for the programmed number of hours after a charge complete, the control will automatically begin a refresh charge cycle. The control will start automatically even if programmed for time-of-day start, delayed start or push-to-start operation. The PowerForce will not start the charge cycle during a time-of-day blockout period. It will automatically request an equalize cycle if it is programmed to equalize on that day. Charge cycle data is not

affected by a refresh charge. The charge termination technique for a refresh charge will be DV/DT regardless of how the control is user programmed, and the 0-80% back-up timer will be four hours and fifteen minutes during a refresh charge. This feature will insure that any battery left connected to the charger for extended periods of time will not be damaged due to self-discharge, and will be kept in a fully charged state.

**80% Charged Point** — A PowerForce control will blink the LEDs a faster green and enable the charge termination routine when the battery voltage reaches the gassing voltage and the charging has decreased below 8.2 amps/100AH. The gassing voltage is nominally 2.40 volts/cell and is adjusted automatically when the charger output voltage is modified to charge batteries of different temperatures.

**Time-of-Day Start** — The PowerForce Control can be programmed to delay the start of a charge cycle until a specific time of day. Any time of day, in one minute increments, can be used for the time-of-day start time.

When a control is programmed for time-of-day start, and a battery is connected to the charger, the programmed start time will be displayed. This feature can be used to save on energy costs, provide a battery cool down or warm up period, or to prevent opportunity charging.

**Delayed Start** — The PowerForce control can be programmed to delay the start of a charge cycle for a specific period of time. Any time period from 1 minute to 23 hours and 59 minutes, in one minute increments, can be used for the delayed start period.

When an PowerForce is programmed for delayed start, and a battery is connected to the charger, the programmed delay time will be displayed.

The time displayed will be decremented once per minute so that the time displayed is always the amount of time remaining before the start of charge. This feature can be used to save on energy costs, provide a battery cool down or warm up period, or to prevent opportunity charging.

**Time-of-Day Blockout** — The PowerForce control can be programmed to disable the charger during a specific time of day. The charger will turn off at the beginning of the block-out period, and resume the charge cycle at the end of the block-out period. Any period of time of day, in one minute increments, can be used for the time-of-day block-out period. When a PowerForce is programmed for time-of-day block-out, and a battery is being charged when the block-out period occurs, the programmed end of block-out time will be displayed. This feature can be used to save on energy costs, provide a battery cool down period, or to prevent charging at certain times in the day.

**Manual Override of Programmed Start Modes** — A PowerForce control, when programmed for time-of-day start, delayed start, or time-of-day block-out, can be manually overridden by toggling the override switch on the display while the start of the charge cycle is being automatically delayed by the control. This manual override feature can be disabled through the “Start Override” programming function. The manual override feature allows the operator to start a charge cycle immediately if a battery is needed sooner than the programmed start time would allow.



**Automatic Equalize** — The PowerForce control can be programmed for 3 different types of automatic equalize. Controls are shipped from the factory programmed to automatically provide an equalize charge to every fifth complete charger cycle. The number of cycles between equalize requests can be varied from 0 to 30. If the PowerForce control is programmed to automatically provide an equalize cycle every five cycles, then an equalize charge cannot be requested manually. The second type of automatic equalize mode is when an equalize charge is desired on a particular day of the week. When programmed for automatic equalize by day of week, the PowerForce will provide an equalize charge to any battery which is connected to the charger on the programmed equalize day. Additionally, any battery which is connected to the charger previous to the day of week equalize day will be given an equalize charge provided that it is at a charge complete status when the PowerForce's clock calendar switches to the equalize day. The automatic equalize features allow for the consistent application of equalize charges without constant attention by the operators. The third type of equalize is by BID count. When programmed for this mode, the current complete cycle count is read from the BID at connect and compared to that of the equalize cycle counter. An equalize will be requested when the BID count equals the equalize cycle count programmed into the control.

For further information on programming and reviewing the PowerForce control features, refer to the Programming Settings chapter.

**Programmable Cool Down Time** — A programmable cool down feature allows the battery to cool down for 0 to 8 hours before the charger signals charge complete. During the cool down period the display reads "Cool Down". This feature allows the battery to cool down before being returned to use and can be used to minimize the battery maximum temperature during operation.

**No Gassing Time**— A programmable time that effects how long from the start of a charge cycle before the gassing portion can begin. If the battery on charge reaches the finish portion of the curve and the gassing time has not elapsed, the charger will shut-off and display "No Gassing". This minimizes any battery gassing that may occur during an opportunity charge cycle. Once the start gassing time has passed, the charger will restart at the standard finish current and complete the charge cycle.

**WARNING:** Enabling the Finish Cell forming feature will cause the charger to continue to run for a period of time if the battery has been disconnected before Charge Complete or pressing the Manual Stop button. This condition will continue until the programmed number of cycles have been completed. The should never be disconnected while charge is in progress.

**Maximum Battery Temperature** — The PowerForce Control can be programmed to interrupt the charge cycle if the battery temperature exceeds the limit programmed into function. The temperature may be programmed from 80°F to 150°F. Once the battery cools down past the trip temperature the charge cycle will be resumed. The display will show "Battery Cooling" if the charge has been interrupted and the cooling period is taking place. A BID must be in use to utilize this function.

**Password** — The user can turn on a 4 number password for use in keeping programming functions protected. Any time the user tries to access the settings, they will be prevented from doing so until the password is entered. The user will have to enter the password on the dashboard screen to enable settings modifications.

## NAVIGATING THE POWERFORCE CONTROL



### HOME SCREEN

The PowerForce control **Home** screen is the default screen. From this interface, the user can select four different applications in the control.

To return to the **Home** screen at any time, press the **Home** icon in the top left of each screen. This can be done while the charger is idle or while charging a battery.

### Dashboard

The **Dashboard** app screen is active during a charge cycle. This screen displays real time information to the user. This and the **Home** screen are the most commonly used in normal operation.

### Statistics

This app gives the user access to the charge data from the current charge cycle. To use this during a charge cycle, click the **Home** button on the top left of the **Dashboard**, and click **Statistics**.

These records are the same as the archive records, but they are updating in real time

### Archive

The **Archive** app is where the control saves the charging records. It tracks many parameters in the charger and the connected battery.

If BID or WBID modules are on the batteries, the records will save those battery ID's with the corresponding charge cycle.

Archive data can be aggregated into the IntelliFleet software to get a detailed view of an entire facilities fleet of batteries and chargers.

### Settings

The Settings app is used for customizing the charger output to fit the needs of a specific battery or fleet of batteries.

*Each of these Apps will be explained in further detail in this chapter.*



## POWERFORCE DASHBOARD

1. **Home Icon:** Touching icon will automatically return the unit to the Home screen from any other screen.
2. **Clock Icon:** Indicates the charger has stopped the charge cycle temporarily for one or more of the following functions:  
Start Mode Delay  
No Gassing Delay  
Battery Cool Down  
Multi-Cell mode new battery delay
3. **Battery Icon:** Indicates the battery connection state.
  - Battery with no text in the center means that a battery is connected with no BID installed.
  - Battery with the word BID in the center indicates the charger has detected a BID on the connected battery.
  - Battery with the word BID flashing indicates the charger is attempting communication with the BID device.
4. **Battery Info Icon:** Indicates battery AH size, cell size, start rate, and AH returned.
5. **Charge Time Icon:** Indicates the charge time, idle time, & time since Charge Complete.

*NOTE: the wireless icon is shown on the top bar toward the left if connected.*

6. **Battery State of Charge Icon:** Indicates battery state at a glance.  
Each bar indicates the State of Charge (SOC) in 20% increments, along with colors.  
-Red – Start of Charge at battery connect  
-Orange – SOC < 80%  
-Yellow - > 80%  
-Green – Finish to Charge Complete, Bars will flash during equalize.  
SOC text will indicate current status as follows:  
-SOC will be displayed while charging is in progress  
-CC is displayed when the it is Charge Complete  
-EQ is displayed when battery has completed the initial charge & is now Equalizing.
7. **Battery Temperature Icon:** Touching this icon will cycle display between Celsius and Fahrenheit.
8. **Help Icon:** Pressing this icon twice while on the home screen will show a table of system firmware revision
9. **Status Icon:** Indicates the status of the charger and charge cycle at a glance. Touching this icon will recall any active warnings/errors for review.
10. **Charge VPC:** Indicates On Charge volts per cell
11. **Charge Amps:** Indicates On Charge DC Amps
12. **Date & Time:** Indicates current date & time
13. **Wireless Icon:** Indicates connected



## POWERFORCE CHARGE ARCHIVE

The archive data can be selected on the main screen. After the range of charge cycles is chosen, the archive will display on the screen.

### AMP HOURS RETURNED

The total ampere-hours returned during the charge cycle. This number includes ampere-hours delivered to the battery during the Verify, 0-80%, 80% to End, and Equalize portions of the charge cycle.



### CHARGE TIME

The total charging time of the charge cycle. This number includes the time of the Verify, 0-80% 80% to End, and Equalize portions of the charge cycle.

### 80% TO END

The time the battery was charged from the 80% charged point until DV/DT or VT (depending on the control setting) charge termination. This time does not include any equalize charging time that may have been automatically or manually selected.

### BATTERY OCV

The open circuit voltage in volts per cell of the battery immediately before the beginning of the charge cycle.

### START AMPS

The value of the current delivered to the battery at the start of the charge cycle.

### START VOLTS

The value of the battery voltage (in volts/cell) of the battery at the start of the charge cycle.

### FINISH AMPS

The value of the charge current delivered to the battery at the end of the charge cycle.

### FINISH VOLTS

The value of the battery voltage in volts per cell at the end of the

charge cycle.

### EQUALIZE TIME

The time of the equalize portion of the charge cycle. Equalize can be automatically or manually selected.

### START TIME

The time at the start of the charge cycle.

### END TIME

The time at the end of the charge cycle. Includes the equalize time if it was automatically or manually selected format.

### BATTERY I.D.

The Battery I.D. number of the battery that was charged in the charge cycle. Requires PowerForce Battery Identification Module (BID).

### BID START TEMP

The temperature of the battery sensed by the PowerForce Battery Identification Module at the start of the charge cycle.

### BID END TEMP

The temperature of the battery sensed by the PowerForce Battery Identification Module at the end of the charge cycle.

### CYC. AMP HOURS

The Ampere-hour setting of the charger during the charge cycle. This value cannot exceed the maximum charger output rating.

### CYCLE CELLS

The Cell Size setting of the charger during the charge cycle. This value cannot exceed the maximum charger output rating.

### BATTERY TYPE

The Battery Type setting of the charger during the charge cycle. This value cannot exceed the maximum charger output rating.

### PRESENT MONTH

The month that the charge cycle occurred.

### PRESENT DATE

The day of the month that the charge cycle occurred.

### MODULE OUTPUT AND TEMPERATURE

Each module will display its maximum current and temperature as

well as any warnings or engine faults.

## CHARGE STATUS

Statistics will have a real-time status. Archive records will have the termination code.

**Session Start** – Charge Session started

**Start Current** – Charger is providing Start Current

**Gassing** – Charger is regulating voltage to the Battery

**80 Percent** – Charge session has passed the 80% complete point.

**Finish Current** – Charger is providing finishing current.

**Lid** – Charger is modulating LID voltage (maximum charge voltage).

**Charge Complete** – Charge Session Complete

**High Battery** – High Battery Volts Reject Error.

**Batt Over Temp** – Battery Overtemperature Error

**Low Volt Shut** – Low Voltage Shutdown Error

**Charge Curve Err** – Charge Curve Error

**Low Curr Shut** – Low Current Shutdown

**High Curr Shut** – High Current Shutdown

**Backup Timer** – Session timeout due to backup timer.

**Over Max AH** – Over Max AH returned.

**Over Temp Err** – Charger overtemp error

**DIDT Shutdown** – DiDt Shutdown error

**Engine Error** – Charge Engine Error

**Over Temp Warn** – Charger Cabinet is overheating, (charging power may be reduced in this state)

**Output Limited** – The charger is unable to meet the required output

**Low Batt Reject** – Low Battery Volts Reject Warning

**SM Inhibit** – Charging temporarily halted due to Start Mode

**Batt Cycle Delay** – Multi-Cell charging delay active. This delay occurs to avoid issues with the user disconnecting and reconnecting a battery quickly when the charger is set for Multi-Cell Mode

**No Gas Inhibit** – Charging is delayed due to No Gassing being active

**Equalize** – Charger is currently equalizing

**Refresh Started** – Charger is in a 60 second countdown to begin a refresh.

**Battery Watering** – Charger is running the battery watering routine.

**Addition Charge** – Charger is running additional Finish Current charge as specified by the customer.

**BID Comm Failed** – Communication with the BID device has ended and failed.

**BID Detect** – Charger is attempting to detect if the connected battery contains a BID/WBID

**BID Init** – Charger has established communication with the BID/WBID and is reading ALL of the available data.

**BID Refresh** – Charger is reading the latest Battery Temperature, Battery VPC, and Accumulated Charge/Discharge data from the battery.

**Mod X Over Temp** – Module #X is reporting that it is overheating. In this scenario, the system will attempt to cool down the module by reducing power.

**Mod X IGBT Err** – Module #X is reporting a problem with its IGBT drive

**Mod X Short** – Module #X is reporting a Short Circuit condition on its output.

**Mod X Phase Loss** – Module #X is reporting a Phase Loss

**Mod X Over Curr** – Module #X is reporting an overcurrent issue

**Mod X Offline** – Module #X is offline and not providing power.

**Hot Disconnect** – Charge cycle aborted due to disconnecting the battery while charging.

**Manual Stop** – User requested to stop the charge cycle by pressing the red button on the front door.

**Cell Validate** – The charger is determining the correct cell count for the battery when in Multi-Cell mode.

**Writing BID** – The charger is writing information to the BID.

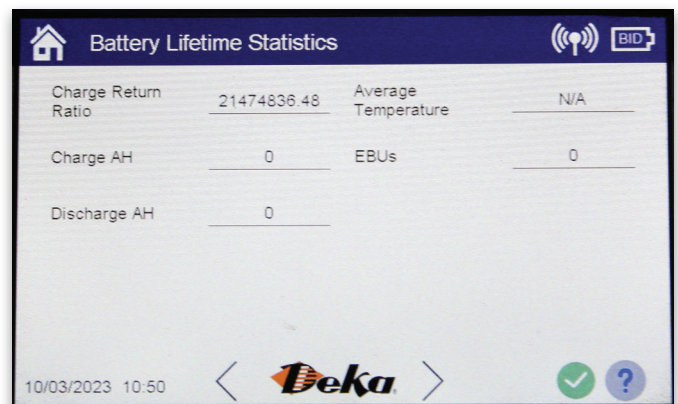
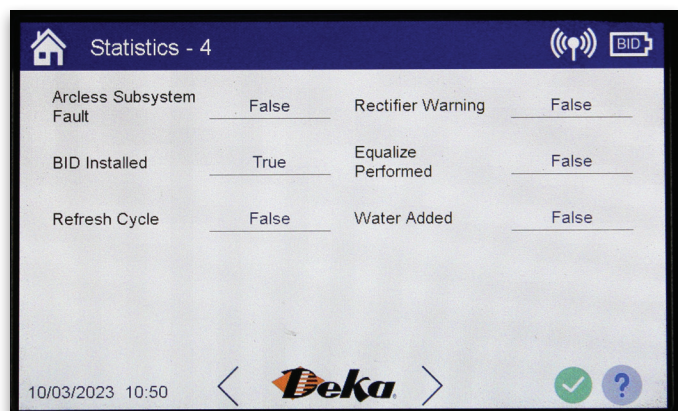
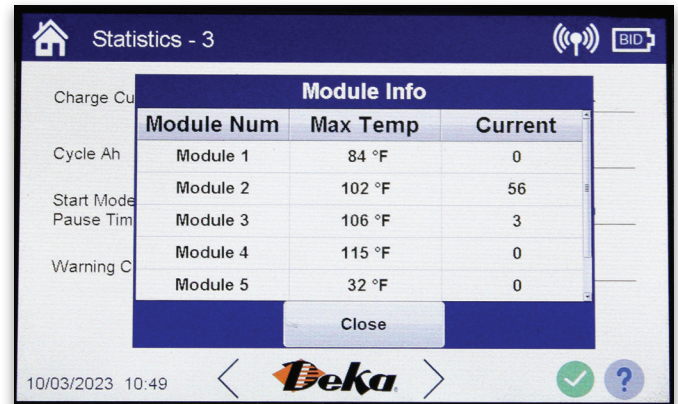
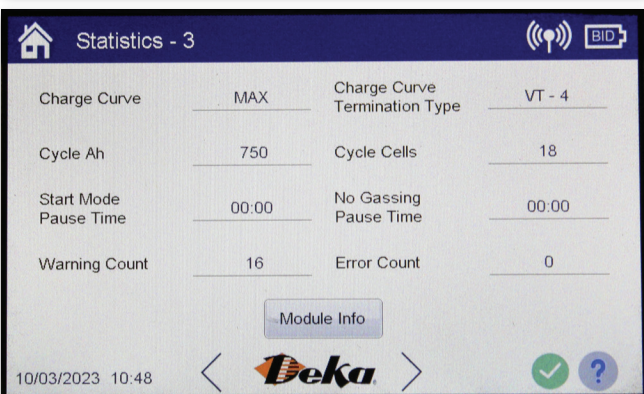
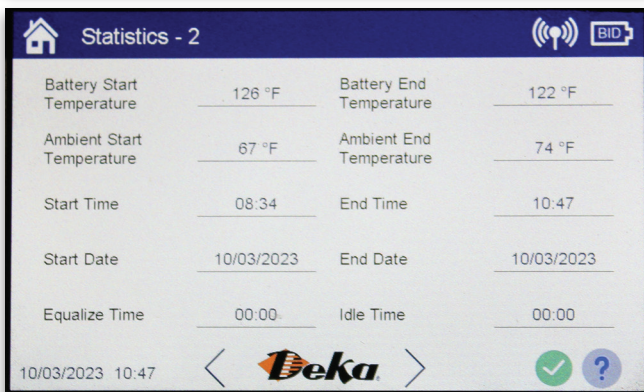
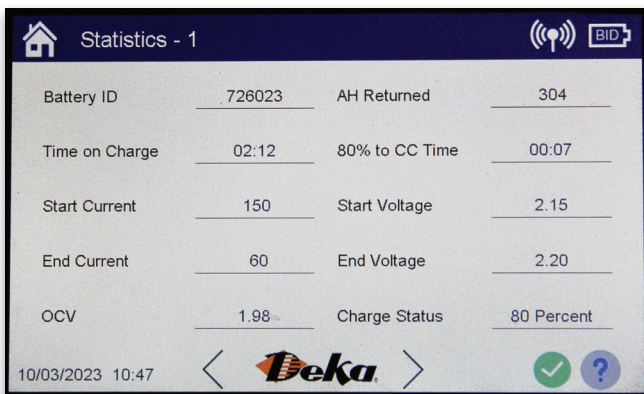
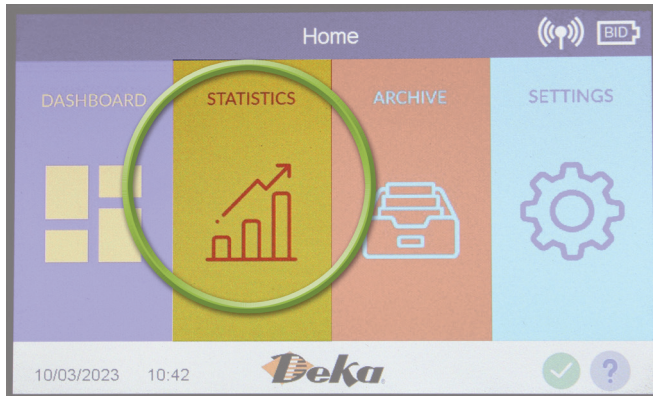
**Mod X Temp Err** – Module #X has overheated and is shutdown.



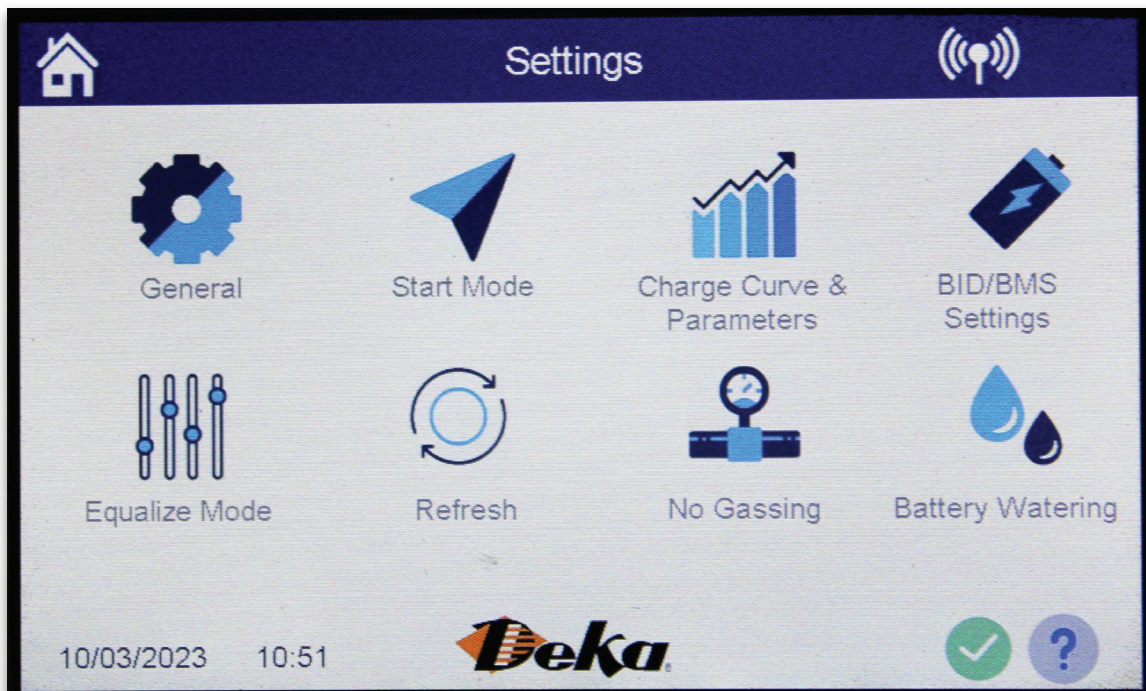
**Batt Cool Down** – Battery is cooling down.

**Arcless Error** – Arcless subsystem fault, charging disabled.

### PowerForce Statistics App







The Statistics App can be accessed during or after a charge cycle. The same information that is available in the archive records is available here, but it is updating in real time.

## NAVIGATING THE POWERFORCE CONTROL

### SETTINGS

The **Settings** app opens the settings menu. There are eight icons that can be accessed from this page. The next chapter will have details about each icon.

*NOTE: If the Password is turned on, there will be a red lock in the bottom right corner. Press this icon to enter the password to access the settings.*

#### General

This is the location where the default settings can be changed to match a specific battery. Time and date are also entered in this menu.

#### Start Mode

The default start mode is automatic. If the start mode needs to be changed to time-of-day start, time-of-day blockout or delayed start. There is also a timer mode that will prompt the user to input the amount of time a charger will charge.

#### Charge Curve and Parameters

This is where the battery type and charge curve parameters are chosen. If set to custom curve, the start rate, finish rate, gassing voltage, and lid voltage can be changed to meet the needs of the application.

#### BID / BMS (Opportunity or Fast) Settings

Is the page where BID settings can be set for a connected battery. BID or BMS communication can be configured.

*NOTE: To program a BID module with a charger, the battery must be plugged into the charger and the charger must be in manual stop.*

#### Equalize Mode

This is where the equalize type and frequency is set. Batteries can be equalized by cycle, BID cycle or by day-of-the-week.

#### Refresh

Refresh charge cycles can be set in this screen. It can be turned on or off, and be set by hours or voltage per cell.

#### No Gassing

No Gassing time is set on this screen. It can be set to a total of connected hours or by a daily schedule.

## Battery Watering

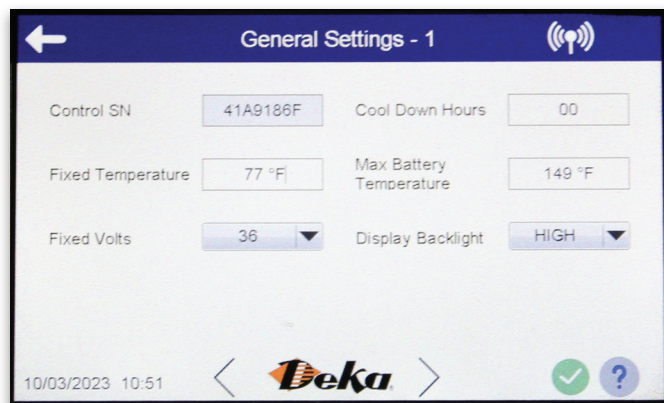
This setting is used to indicate to the user when to water the batteries.

## Programming Settings

### SETTINGS APP

The **Settings** app has eight icons that grant the user access to different programming parameters. Each icon is selected using the touch screen and each will open a series of screens that settings can be inputted.

#### General



The first screen in the **General Settings** menu contains the following parameters. The interface uses the touchscreen to navigate and input boxes, dropdown menus, and toggle switches are used to program parameters.

**Fixed Temperature** – This is the setting for the average battery temperature. If no BID's or WBID's are present, this is the value the charger will use to compensate gassing voltage. This setting does not affect BID's.

**Max Battery Temperature** – The maximum battery temperature for the battery while charging is in progress. If BID or WBID modules reach this temperature, the charger will wait for the battery to cool 5 degrees Fahrenheit below this threshold to continue charging.

**Fixed Volts** – This is the programmed voltage size for the charger. Multi-volt mode and BID/WBID modules will override this setting.

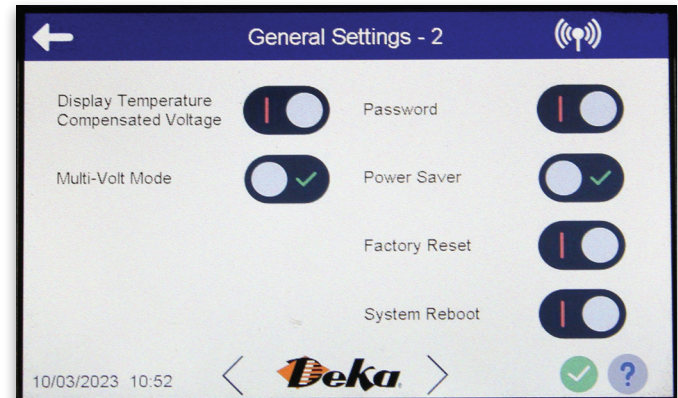
*NOTE: A charger will not be able to output a higher voltage or current than what it is rated. It will electronically protect itself from overheating by pulling the output back or ending the charge cycle.*

**Display Backlight** – The backlight of the control board can be set to three levels of light intensity. Low, medium, and high.

**Control SN** – The Control SN is the number designation for the charger. This is how the charger will be identified on IntelliFleet or the Insight Cloud.

**Cool Down Hours** – The charger can be set to display cool down hours after a charge cycle. This indicates to the user that the battery needs to cool before use. It can be set from 0 hours to 24. The default is 0.

**Display Temperature Compensated Voltage** - Select to display voltages after temperature compensation. Values reported on the Dashboard will show actual voltage of the battery when you adjust for it's temperature.



**Password** – Select to enable password protection. A lock icon will be shown in the bottom right corner. If it is red, click the icon to input the password in order to modify control settings. If it is green, it is not locked.

**Multi-Volt Mode** - Select to enable the automatic cell selection mode of operation for the charger. When multi-cell mode is selected, the charger cannot automatically recognize the difference between 72 and 80 volt sizes. Therefore, in **Multi-Volt Mode**, the charger must be programmed to 72 or 80 volts. Regardless of this setting 72 or 80 volt batteries with properly programmed PowerForce BID modules will be charged correctly.

**Power Saver** – Display will go blank after 3 minutes in order to save power. Touch the display to wake the control.



### NETWORK SETTINGS

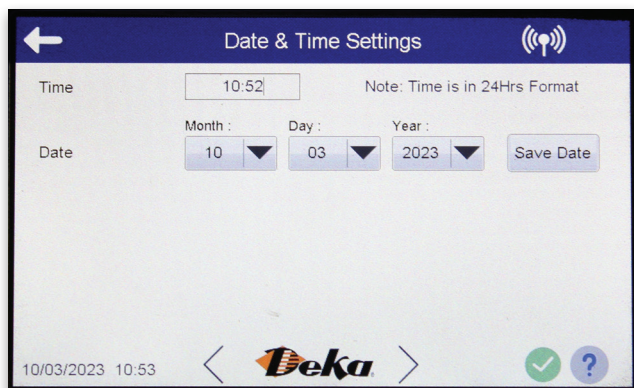
**EPID** – Extended PAN ID. This is the network ID utilized in IntelliFleet downloads and Insight Cloud communications. The default is network 00.

**Wireless Access** – Enable or disable wireless connectivity

### TIME/DATE



**Time/Date**– This is the screen that the controls time and date is



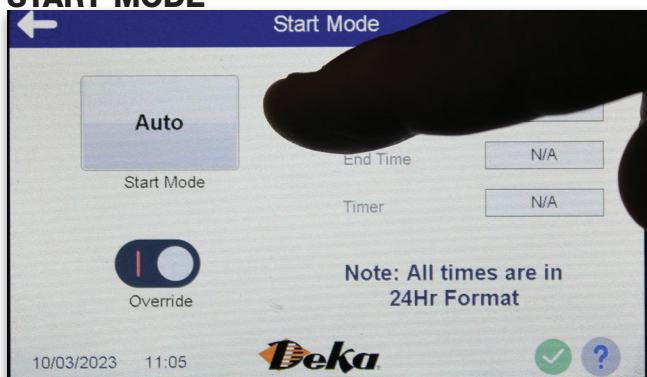
programmed. The clock is a 24 hour clock.  
Press the Save Date button to save these settings.

### Screen Calibration



**Screen Calibration**– Calibrate the touch screen display by pressing the screen where the little + symbols appear.

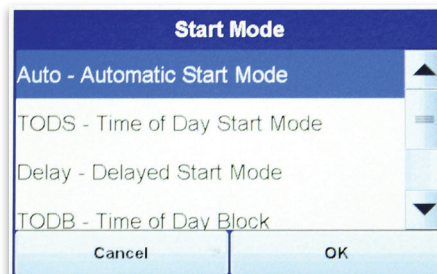
### START MODE



The start mode can be set to:

1. **Auto**– Charge cycles begins when battery is detected
2. **TODS**– Time of Day Start can start the charge cycle at a desired time every day.
3. **Delay**– Delays the start of a charge cycle for the programmed hours.
4. **TODB**– Time of Day Blockout can prevent charging during a specified time period.

5. **Timer Mode**– The charger will prompt the user to input the desired charge time.

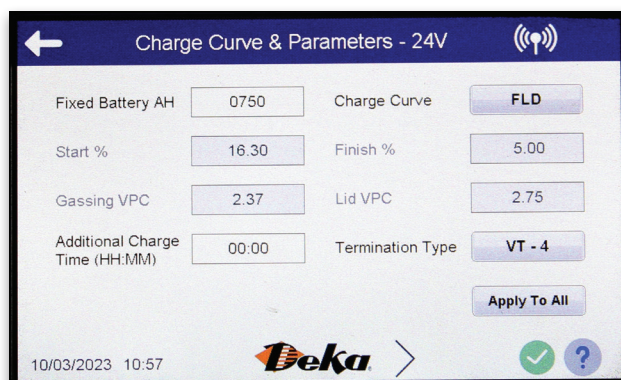


**Override**– This toggle switch can enable a manual override if the start mode is set to anything but Auto.

## CHARGE CURVE AND PARAMETERS

### Battery Voltage Selection

The bottom arrows allow selection of the battery voltage supported by the charger. The user should select the proper voltage and modify the charge curve and other settings as needed.



### Charge Curve

The curve setting is the battery type the charger uses to select proper output voltage & current characteristics, if the charger does not detect a PowerForce BID.

The values on the right are the rates for the chosen charge curve. The custom curve allows the user to modify these values.

### Termination Type

**VT-4** – The charger will continue to charge for 4 hours after the 80% SOC point is reached.

**VT-6** – The charger will charge for 6 hours after 80% SOC point is reached

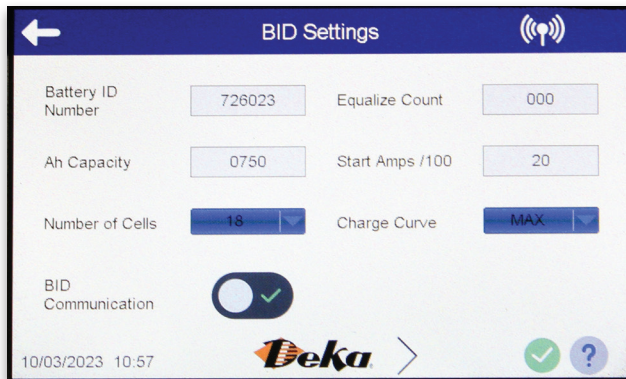
**For VT-4 and VT-6** If 80% SOC in less than 5 minutes the charger will automatically select DvDt to limit extra time at finish current. If FLD or MAX curve is selected the charger will automatically select DvDt upon reaching 2.65VPC (temperature corrected) to limit extra time at finish current. For DSG the DvDt changeover is at 2.45 (temperature corrected).

**DVDT** – When the charger reaches 80% SOC, battery voltage is monitored and the charge stopped when the voltage rise slows to a point to indicate a fully charged battery.

**FIXED BATTERY AH** - configures the battery capacity

**Additional Charge Time** -Extra run time, starts at the Charge Complete point (00:00 to 02:00 hours) default 00.

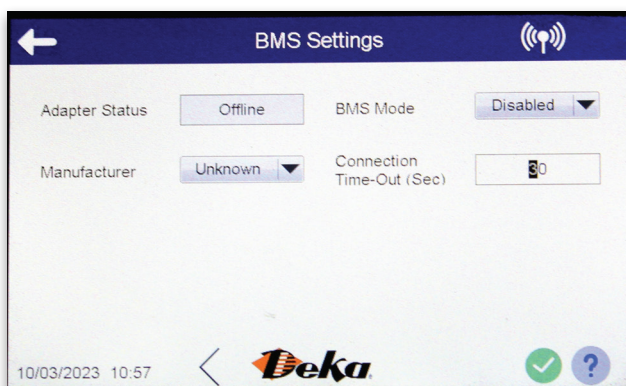
## BID SETTINGS



1. **Battery ID Number** Programs the battery identification number into the BID (000000 to 999999).
2. **Equalize Count** Displays cycle count since last equalize.
3. **AH Capacity** Programs the battery ampere hour rating into the BID. Once programmed, the charger will recognize the battery upon connection and charge the battery at the proper charge rates or the max charger output, whichever is greater (0000 to 3000).
4. **Start Amps/100** Programs the charger start rate at the programmed BID AH rating to the selected amps/100AH (20 to 50).
5. **Number of Cells** Programs the Cell quantity into the BID. Once programmed, the charger will recognize the battery upon connection, bypass the battery cell size verify function, and charge to the programmed BID cell size.
6. **Charge Curve** Programs the battery curve type into the BID. The charger will recognize the battery type upon connection.
7. **BID Communication** Must be enabled to allow communication between the BID & the charger.

*NOTE: When data is being written to the BID, a popup box will appear that says "Refresh BID"*

## BMS SETTINGS



### BMS Mode

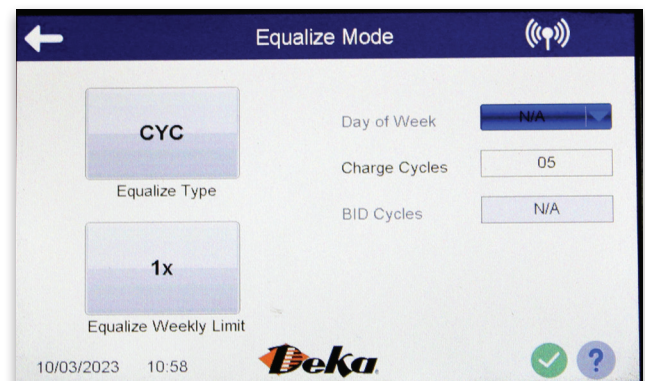
Disabled = no CAN communication

Optional = First try Lithium then reverts to BID or fixed settings after connection timeout delay.

Required = charger only responds to BMS equipped batteries

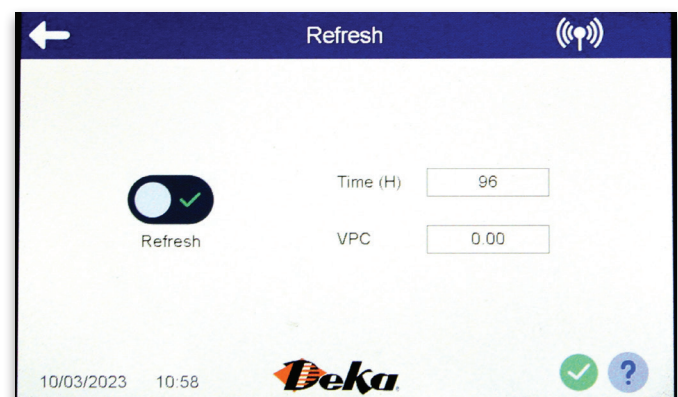
**Manufacturer** - select supported manufacturer

## EQUALIZE MODE



- Off – No Equalize cycles
- Cycle – Equalize will occur after the charger completes the programmed number of cycles in the "Charge Cycles" box.
- Day of Week – Equalize will occur on a specific day of the week. That day is programmed in the Day of Week box.
- BID Cycles – Equalize will occur when a specific battery has completed a programmed number of charge cycles in the "BID Cycles" box.
- Manual – Equalize will only occur when the equalize toggle is switched on during a charge cycle.
- Weekly Limit – This is the programmed value for total equalize cycles a charger will do in one weeks' time. Default is off.

## REFRESH



- Refresh - Select to enable a refresh charge. Default Off.
- Time - The number of hours before the charger starts a refresh charge, provided the battery has not been disconnected (00 to 99 hours).
- VPC - The volt per cell level before the charger automatically starts a refresh charge, provided the battery has not been disconnected (1.50 to 2.20).

There is a 5 hour minimum time between refresh charge cycles.

*Note: Refresh will occur when one of the two parameters are met.*



### NO GASSING

In order to properly opportunity or fast charge a battery, it must be prevented from charging above 80% battery capacity more than once per day.

We do this by adding timers that will prevent gassing for a programmed amount of hours, No Gassing Time.

It can be set to a timer with the Time (HH:MM) box.

It can be set to block out a period of time by entering the start and end of that period in the Start and End Time boxes.

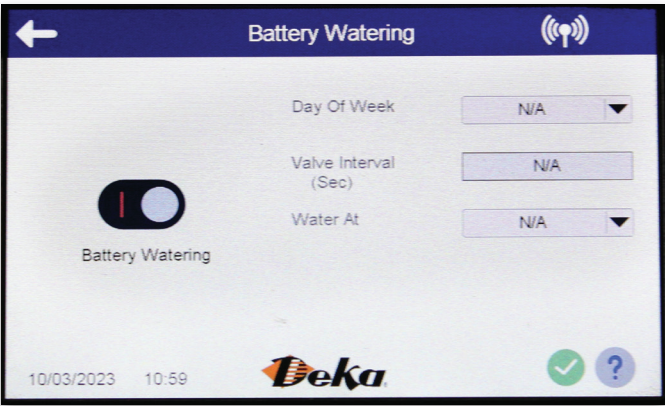
### 1x/day Full Charge

This feature will prevent more than one full charge a day regardless of how the charger is programmed.



### BATTERY WATERING

This feature is to enable a battery watering indicator. It can be set to let the user know when it is to be watered.



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**Deka PowerForce.  
Industrial Battery Chargers**

## **WARRANTY**

Ametek/Prestolite Power (hereinafter called "Prestolite") warrants that each new and unused Industrial Battery Charger manufactured and supplied by it is of good workmanship and is free from any inherent mechanical defects, provided that (1) the product is installed and operated in accordance with generally accepted industrial standards and in accordance with the printed instructions of Prestolite outlined in the product Owner's Manual, (2) the product is used under normal conditions for which designed, (3) the product is not subjected to misuse, negligence or accident, and (4) the product receives proper care, protection and maintenance under supervision of competent personnel. This warranty is subject to the following provisions:

### **AC SUPPLY INPUT CONDITIONS:**

- Supply voltage should not exceed +/-10% of rated input voltage value.
- Consistent power should be provided with fluctuations not to exceed 1200VAC (850Vrms) for a duration longer than 25 microseconds.

1. **PRODUCT AND PARTS WARRANTED.** Subject to the exceptions listed below each Industrial Battery Charger is warranted for a specific period of time commencing from the date of its shipment by Prestolite, provided the charger is used in accordance with Prestolite's published performance rating for the unit involved. The exceptions to this warranty are as follows:

a) Terms and conditions for warranty coverage:

<b>FULL COVERAGE - LABOR, TRAVEL, MILEAGE &amp; PART REPLACEMENT</b>	<b>5-years</b>
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b) Warranty Expense Limitation: The maximum warranty expense Prestolite will incur for any Battery Charger will be limited to the original purchase price of the Battery Charger.

c) Primary switch contacts, fuses, bulbs and filters are not warranted unless found to be defective prior to use.

2. **COMMENCEMENT OF WARRANTY TIME PERIODS.** The warranty periods indicated in the Warranty Schedule shall commence on the date of shipment by Prestolite.
3. **PERSONS COVERED BY WARRANTY.** Prestolite extends this warranty only to the purchaser of new equipment from Prestolite or one of its authorized distributors. The products purchased under this agreement shall be used exclusively by the buyer and its employees and by no other persons; and therefore, there shall be no third-party beneficiary to this warranty.
4. **LIMITATION OF REMEDY.** The existence of claimed defects in any product covered by this warranty is subject to Prestolite's factory inspection and judgement. Prestolite's liability is limited to repair of any defects found by Prestolite to exist or, at Prestolite's option, the replacement of the defective product F.O.B. factory after the defective product has been returned by the purchaser at its expense to Prestolite's shipping place. Replacement and exchange parts will be warranted for the remainder of the original Industrial Battery Charger Warranty or for a period of ninety (90) days, whichever is greater. Modifications or repairs performed by anyone other than Prestolite or an Authorized Service Provider will VOID all warranty.
5. **USE OF DEFECTIVE PRODUCT.** Continued use of an Industrial Battery Charger after discovery of a defect VOIDS ALL WARRANTIES.
6. **ALTERED EQUIPMENT.** Except as authorized in writing, the warranty specified does not cover any equipment that has been altered by any party other than Prestolite.

THIS WARRANTY IS GIVEN AND ACCEPTED IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN AS EXPRESSLY SET FORTH HEREIN. IN NO EVENT SHALL PRESTOLITE BE LIABLE FOR ANY ANTICIPATED OR LOST PROFITS, SPECIAL, DIRECT, INDIRECT OR INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, TIME CHARGES OR OTHER COMMERCIAL EXPENSES OR LOSSES, AND BUYER ASSUMES ALL RISK AND LIABILITY RESULTING FROM USE OF THE GOODS. PRESTOLITE DOES NOT AUTHORIZE ANY REPRESENTATIVE OR OTHER PERSON TO ASSUME ON BEHALF OF PRESTOLITE ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OR USE OF THE GOODS SOLD, AND THERE ARE NO ORAL AGREEMENTS OR WARRANTIES COLLATERAL TO OR AFFECTING THIS WRITTEN WARRANTY.

### **WARNING**

At all times, safety must be considered an important factor in the installation, servicing and operation of the product and skilled, qualified technical assistance should be utilized.

**AMETEK/PRESTOLITE POWER - TROY, OHIO USA**

**AMETEK®**  
**PRESTOLITE POWER**

WORLD HEADQUARTERS  
66 Industry Court  
Suite F  
Troy, OH 45373  
Toll Free: +1-800-367-2002  
Fax: +1-800-654-4024

WEBSITE  
[www.prestolitepower.com](http://www.prestolitepower.com)

EMAIL  
[prestolite.sales@ametek.com](mailto:prestolite.sales@ametek.com)



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**PRESTOLITE POWER**

E.P.M. Form No. 2709 01/24

WORLD HEADQUARTERS  
66 Industry Court  
Suite F  
Troy, OH 45373  
Toll Free: +1-800-367-2002  
Fax: +1-800-654-4024

WEBSITE  
[www.prestolitepower.com](http://www.prestolitepower.com)

EMAIL  
[prestolite.sales@ametek.com](mailto:prestolite.sales@ametek.com)

