

# **DISCHARGER**

## **BDX**



# **USER'S MANUAL**

Software Revision ver 100

Sept 2013

---

# 1. SAFETY INSTRUCTIONS AND WARNINGS

## GENERAL

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

Safe practices must be learned through study and training before using this equipment.

Only qualified personnel should install, use, or service this battery discharger.

## SHOCK PREVENTION

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

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.

**INSTALLATION AND GROUNDING** – Electrical equipment must be installed and maintained in accordance with all the applicable national and local codes.

A power disconnect switch must be located at the equipment. Check the data label 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 to the third live wire of the 3-phase line as this makes the equipment frame electrically HOT, which can cause a fatal shock.

If a grounding 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 conductor. Don't 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 this manual.

**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 without overheating.

**BATTERY TERMINALS** – Do not touch battery terminals while equipment is operating.

**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 discharger.

Measure voltage on capacitors and, if there is any voltage reading, wait 5 minutes before to proceed.

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

## **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 on fingers 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.

## **FIRE AND EXPLOSION PREVENTION**

When batteries are being recharged, they generate hydrogen gas that is explosive in certain concentrations in air (the flammability or explosive limits are 4.1% to 72% hydrogen in air). The spark-retarding vents help slow the rate of release of hydrogen, but the escaping hydrogen may form an explosive atmosphere around the battery if ventilation is poor.

The ventilation system should be designed to provide an adequate amount of fresh air for the number of batteries being charged. This is essential to prevent an explosion.

Always keep sparks, flames, burning cigarettes, and other sources of ignition away from the battery recharging area. Do not break "live" circuits at the terminals of batteries. Do not lay tools or anything that is metallic on top of any battery.

To prevent arcing and burning of the connector contacts, be sure the discharger is OFF before connecting or disconnecting the battery. The digital display must be completely OFF.

## **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 and 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 person if he or she is in contact with charging equipment, battery, charging leads, or other live electrical parts. Disconnect 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, flush very well with clean water and obtain professional medical attention immediately.

## **EQUIPMENT WARNING LABELS**

Inspect all precautionary labels on the equipment.

*Order and replace all labels that cannot be easily read.*

## **2. DESCRIPTION**



The *BDX* battery discharger/analyzers have been designed to test the efficiency of batteries of any type, voltage and capacity.

These instruments perform a controlled discharge of the battery, while the current is kept constant by a high frequency DC/DC converter, based on MOSFET technology for smaller units and IGBT technology for bigger units.

The operation of the BDX is completely automatic: it's sufficient to connect the battery, to set the stop voltage, the maximum time and the discharge current.

All the test is made automatically, while the digital display shows the partial results.

**RECOMMENDED DISCHARGE CURRENT**

<b>BATTERY CAPACITY</b>	<b>DISCHARGE CURRENT</b>
<b>C5 (Ah)</b>	<b>AMPS (A)</b>
50	10
60	12
80	16
100	20
120	24
180	36
200	40
240	48
300	60
360	72
380	76
400	80
420	84
480	96
500	100
540	108
600	120
700	140
750	150
800	160
900	180
1000	200

**RECOMMENDED STOP VOLTAGE**

<b>NOMINAL VOLTAGE</b>	<b>STOP VOLTAGE</b>
<b>V</b>	<b>V</b>
6	5,1
12	10,2
24	20,4
36	30,6
48	40,8
72	61,2
80	68,0
96	81,6

## **TEST VALUE**

While the test is in progress, it's always possible to visualize on the display all the partial results of the test, by pressing the button "SET":

<i>PARAMETER</i>	<i>UNITS</i>
CURRENT	(AMPS)
CAPACITY DISCHARGED	(AMPS*HOURS)
TIME	(HOURS.MINUTE DECADES)
BATTERY VOLTAGE	(VOLTS)

## 3. INSTALLATION OF DISCHARGER

**Conditions of use:**

- **Operating /Storage temperature:** 5°C to 45°C
- **Relative humidity:** less than 75%

**WARNING !**

The discharger can be installed by qualified personnel only!  
To avoid the risk of injuries, the user is not allowed to open the cabinet.  
Always refer to qualified electricians for installation and service operations.

**WARNING !**

To prevent fire or shock hazard, do not expose the discharger to rain or moisture.  
Do not use the e discharger in presence of flammable gas, because it can generate sparks!  
Do not install the discharger near flammable materials.

**WARNING !**

To reduce the risk of fire, the discharger must be installed on a  
floor of non-combustible material.  
If this is not possible, a floor plate of at least 1,6mm steel extended  
at least 150mm beyond the discharger on all sides must be installed.

**CAUTION !**

**Before to install the discharger:**  
Check that the discharger input voltage (V) is identical to your AC power supply voltage.  
Check that the discharger max input power (KVA) is available from your AC power supply.

## GROUNDING AND LINE CONNECTION

### **WARNING !**

The cabinet of the battery discharger must be properly grounded to protect personnel against hazard of electrical shock in case of fault on the discharger!  
The grounding conductor must have a current carrying capacity equal or higher than the current carrying capacity of the AC-input wires.

### **CAUTION !**

Allow adequate air circulation to prevent internal heat buildup.  
Do not place the unit near materials that may block the ventilation slots.  
Do not install the unit near heat sources such as radiators or air ducts, or in a place subject to direct sunlight, excessive dust, mechanical vibration or shock.

If the discharger is to be connected to the AC power supply with a flexible jacketed cable, one having a separate grounding conductor should be used.  
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 national or local code.

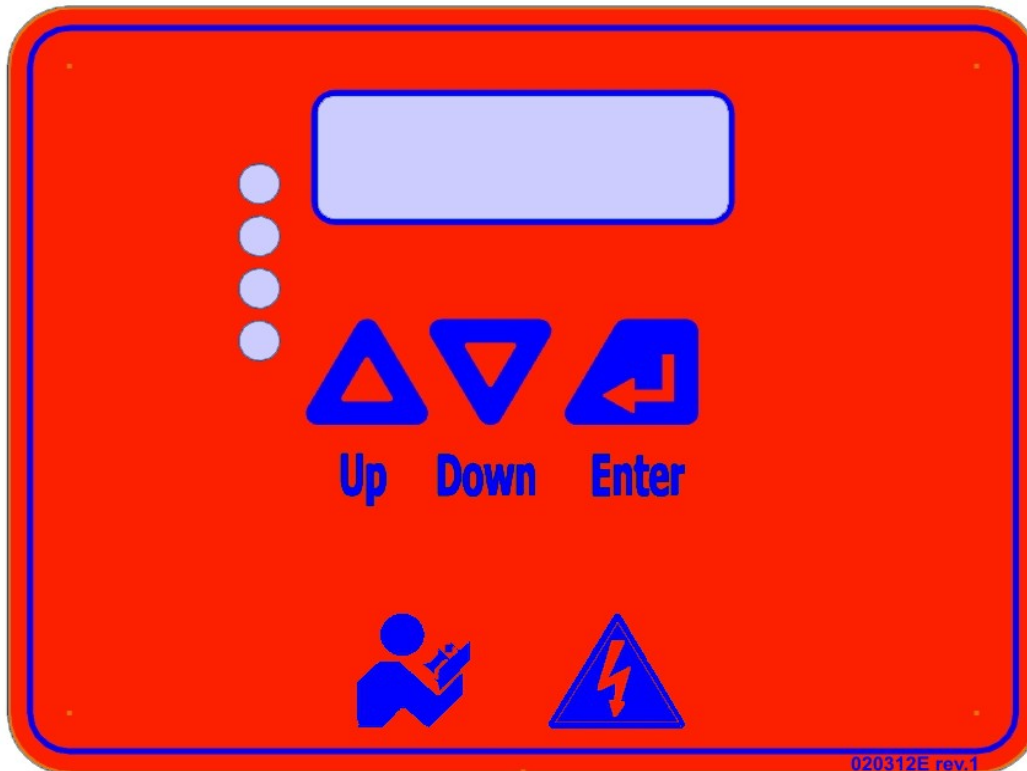


**LOCATION - Choose your installation location to:**

- Avoid temperature and humidity extremes.
- Minimize moisture and dust.
- Provide adequate air circulation to prevent the buildup of fumes.
- Install on a cement pad minimum 7" above surrounding curbing or walkways for water flood control,
- Maintain a minimum of 32" (80 cm) of clearance on the sides of the unit for proper ventilation.
- Maintain 18" (45 cm) minimum clearance on Front and Back for servicing as required by local codes.
- Do not install unit where it will be exposed to direct sunlight.



## 4. HOW TO USE THE DISCHARGER



### PRELIMINARY CHECKS

- Inspect the discharger completely for loose screws, electrical connections or other damages;
- Check that all the ventilation slots are not obstructed to assure proper air flow;
- Make sure that the discharger is installed as instructed in this manual and in accordance with any applicable national or local Code.

### PROGRAMMATION

Turn on the discharger by moving the main switch to position “1”.

The discharger will perform an automatic test of the control circuits, and will wait for a random delay on start.

The display will visualize the following messages.

```
BASSI - BATTERY  
BDX   - DISCHARGER
```

SYSTEM CHECK  
PLEASE WAIT . . .

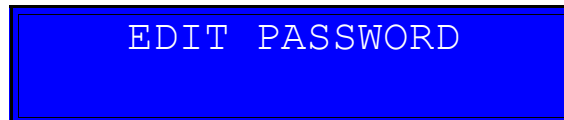
BDX DISCHARGER  
MAX xxx V - xxx A

SYSTEM READY  
DATE                      TIME

## **USER PROGRAMMING MODE**

### **HOW TO ACTIVATE USER PROGRAMMING MODE**

- Press the button **DOWN** and keep it pressed for 3 seconds  
The display will show the message:



- Enter the Programming Password.  
The display will show the message:



### **HOW TO MODIFY A VALUE**

- Scroll between the programmable values using the **UP/DOWN** buttons.
- In order to modify a value, press **ENTER** and keep it pressed for 2 seconds, until the cursor will start blinking over the value that can be modified.
- Modify the value using the **UP/DOWN** buttons.
- Confirm the modified value by pressing **ENTER** for 2 seconds, until the cursor will disappear. At this point the new value will be saved.

### **HOW TO RETURN TO NORMAL MODE**

- Press the buttons **UP** and **DOWN** simultaneously.

**PARAMETER 1: DATE and TIME**

**Programmable values:** Month/Day/Year, Hour/Minutes  
**Default value:** Eastern Time (GMT-5)

**NOTES:**

It's fundamental to keep the Real Time Clock set to the correct date and time, in order to use all the time base functions. The Discharger calculates the Day of the Week automatically, however **it's necessary to adjust the Clock manually in Daylight saving time periods.**

**PARAMETER 2: START TIME WINDOW**

**Programmable values:** From 00.00 to 23:59  
**Default value:** From 00.00 to 23:59



```
START BEG<->END
00:00 23.59
```

**NOTES:**

This parameter sets a time window during the day in which the discharger is allowed to start a new discharge cycle. If a battery is connected outside of this time window, the discharger will remain in stand-by mode until the programmed Start time will be reached. Once the discharge cycle has begun, this time window is not considered anymore.

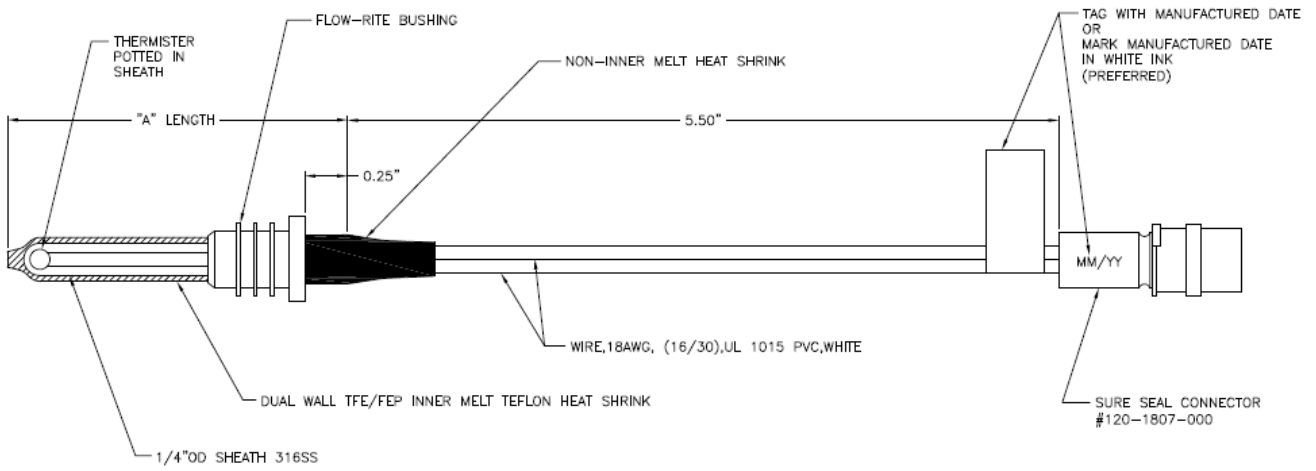
**PARAMETER 3: MAX TEMPERATURE**

**Programmable values:** from (45 to 70 °C) 115 to 160 °F, or DISABLED  
**Default value:** (60 °C) 140 °F

**NOTES:** This parameter sets a maximum limit for the battery temperature. If this limit is reached, the charge is terminated and a specific error message is given. This functionality requires the connection of an optional temperature probe.

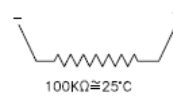


```
TEMPERATURE
TOO HIGH
```



**SPECIFICATIONS:**

NOMINAL RESISTANCE: 100KΩ @ 25° TWO-WIRE, SINGLE ELEMENT;  
 NTC THERMISTOR VISHAY P/N 2381-640-63104  
 TEMPERATURE RANGE: -50°~ 90°C



**(SPECIAL PARAMETERS FOR REGENERATIVE SYSTEM  
CHARGER + DISCHARGER)**

**PARAMETER 4: CONSECUTIVE CYCLE**

**Programmable values:** from 1 to 20 , or DISABLED

**Default value:** DISABLED

**NOTES:**

The discharger can apply a recursive number of discharging cycle at the same battery,  
This function is very useful in case of regenerative test charger (MVD) and discharger (BDX)

**PARAMETER 5: TIME WAIT CHARGE**

**Programmable values:** from 1 to 99 Hour or DISABLED

**Default value:** DISABLED

**NOTES:**

In case of regeneration mode (Charger MVD + discharger BDX), this parameter define the maximum time of charging, during this time, the discharger will check voltage, but it cannot restart in automatic mode.

In standard application normally the user will consider the maximum time of charging and he will add 2 hours in order to wait a cooling of the battery, before to launch a new discharging cycle

## 5. OPERATION

### CONNECTION OF THE BATTERY AND AUTOMATIC RECOGNITION

Connect the Battery to the discharger, using a connector of adequate size.

When the battery is correctly connected, the discharger visualizes the following message:



BATTERY  
CONNECTED

The display will show:



AMPERE DISCHARG.  
100 A

The discharger shows the value used in the previous discharging cycle.

The user need to set the value of current (Amps) in according with the capacity/time/size of the battery to test.

(change this setting with button ENTER 3 'secs' and press button UP/DW to set the value, confirm the change with button ENTER 3 secs)

----Press Button DW to scroll next parameter



DISCHARGING VOLT  
22.6 V → 19.4 V

In left side the user reads a real voltage of the battery, in right side the user reads the target final voltage. This final voltage will define the END of the Discharging cycle.

The user need to set the value of final voltage (V) in according with the capacity/time/size of the battery to test.

(change this setting with button ENTER 3 'secs' and press button UP/DW to set the value, confirm the change with button ENTER 3 secs)

----Press Button DW to scroll next parameter



AMPEREHOUR DISCH  
200Ah

The discharger shows the value used in the previous discharging cycle.  
The user need to set the value of capacity to return OFF (AmperHour) in according with the capacity/time/size of the battery to test.  
This capacity returned will define the END of the Discharging cycle.  
(change this setting with button ENTER 3 'secs' and press button UP/DW to set the value, confirm the change with button ENTER 3 secs)

-----Press Button DW to scroll next parameter

DISCHARGING TIME  
4 HH

The discharger shows the value used in the previous discharging cycle.  
The user need to set the value of maximum discharging time to return OFF (HOUR) in according with the capacity/time/size of the battery to test.  
This maximum time will define the END of the Discharging cycle.  
(change this setting with button ENTER 3 'secs' and press button UP/DW to set the value, confirm the change with button ENTER 3 secs)

-----Press Button together UP+DW at the same time for launch a discharging cycle

**Once the discharger has been properly set, the display visualizes the message:**

PREPARING TO  
DISCHARGE

## **ERROR SETTING**

In case that the user inserted a bad values, not compatible in terms of Ampere, AmpereHour, Time, Final Volt



ERROR  
PARAMETER

If this message appears, it's recommended to verify launch new discharging test, and check all parameters inserted.

## **BATTERY VOLTAGE TOO LOW**

If the battery voltage is lower than a minimum threshold, the discharge cycle will not start and the display visualizes the message:



BATTERY VOLTAGE  
TOO LOW !!!

If this message appears, it's recommended to verify that the nominal battery voltage.

## **BATTERY VOLTAGE TOO HIGH**

If the battery voltage is higher than a maximum threshold, the discharge cycle will not start and the display visualizes the message:



BATTERY VOLTAGE  
TOO HIGH !!!

If this message appears, it's recommended to verify that the nominal battery voltage.

### **BATTERY TEMPERATURE TOO HIGH**

If the battery temperature is higher than a maximum threshold, the discharge cycle will stop and the display visualizes the message:



BATTERY TEMPERATURE  
TOO HIGH !!!

If this message appears, it's recommended to verify the temperature of the battery, and even redefine the Amps settings, because the battery seems sthermal tressed

### **OUTPUT CURRENT NOT CORRECT**

If the discharger have a difficult to manage konstant current fase, the display will show



EMERGENCY STOP  
CURRENT

If this message appears, it's recommended to verify that the voltage of the battery is too low, and at the same time the current in discharging is too high

### **FUSE ERROR OR POWER STAGE ERROR**

If the discharger is not able to manage output current



EMERGENCY STOP  
SEE MANUAL

If this message appears, it's recommended to wait 30 minutes, in order to reduce the internal temperature of the discharger, after this time it is possibile launch a new discharging cycle.

## DISCHARGE CYCLE

When the preliminary controls are complete, the discharge starts and the display visualizes the following information:

- Battery Voltage [Volt]
- Discharging Current [Amps]
- Time of Charge [hours.minutes]
- Capacity Returned [Ah]



```
xx.x V      xxx A
xxx Ah     x.x t
```

The Discharger performs an konstant current discharging profile.

While the discharge is in progress, it's always possible to scroll between different menu pages, using the buttons UP/DOWN:

- **DISCHARGE STATE**
  - Identifies the position in the charge curve, with reference to the picture blow.
- **TEMPERATURE**
  - Visualizes the temperature of the battery, if the optional probe is connected.
- **HISTORY LOG**
  - Visualizes the history log of the previous charge cycles. Refer to Paragraph 6 “History Log”

## AC INPUT BLACK OUT

If there is a black-out of the AC input, while the discharge is in progress, the discharger will shut down,

When the AC input will be recovered, the discharger will wait that the user launch a new discharging cycle.



```
RESTART AFTER
POWER SUPPLY OFF
```

## **REVERSE POLARITY PROTECTION**

The dischargers are equipped with an active protection against the connection of batteries with Reverse Polarity.

**If a battery with reverse polarity is connected, the discharger remains in a safe Stand-By mode.**

## DISCONNECTION OF THE BATTERY DURING THE DISCHARGE

### **WARNING !**

**DON'T disconnect the battery from the discharger while it is being discharged.  
ARCING AND BURNING OF CONNECTORS OR BATTERY EXPLOSION MAY RESULT!**

**If it's necessary to disconnect the battery while it's being discharged,  
press the button UP for five seconds, in order to stop the discharger  
manually.**

The discharger will suspend the charge and the display will show the message:



At this time it's possible to disconnect the battery.

Eventually, the discharge can be restarted, by pressing the button UP for 5 seconds.

### **ANTI ARCING PROTECTION (optional)**

The discharger is equipped with a built-in Anti-Arcing protection.

In order to activate this function, it's necessary to add an optional wire loop, using a battery connector equipped with Auxiliary Pins.

Contact your local dealer for more information.

## 6. HISTORY LOG

The internal memory of the discharger contains a log of the last 150 charge cycles.

The most significant parameters can be visualized on the display of the discharger.

The history log can be accessed at any moment, even while a discharge cycle is in progress. It's sufficient to scroll the menu using the UP-DOWN buttons, until the display will visualize the first page of the most recent history log, that will have a format of this type:

```
01    24.0V    31.3V
2009/06/01  10:30
```

At this point, press ENTER for 3 seconds, until the cursor will start blinking over the number 01 on the top left of the display.

The results of each charge cycle are represented on two or three pages.  
Use the UP-DOWN buttons to scroll between each record.

### PAGE A

```
No    VSTART    VSTOP
Start Date and Time
```

Where:

No =	Number of cycle (1 is the most recent)
Vstart =	Battery Voltage at the connection
Vstop =	Battery Voltage at the end of the discharge
Start Date and Time =	Date and Time of the BEGINNING of the discharge

**PAGE B**

```
T=01:00    V=23.0
Ah=125Ah   I=100A
```

Where:

t = Discharging cycle time [REQUESTED in SETTING]

V = final Voltage of the battery [REQUESTED in SETTING]

AH= Ampere Hour returned from the discharging cycle [REQUESTED in SETTING]

I=Constant current set in the discharging cycle [REQUESTED in SETTING]

**PAGE C**

```
End Date and Time
TT  HH.MM  AHRET
```

Where:

End Date and Time = Date and Time of the TERMINATION of the discharge

TT = Charge Termination Code (see next paragraph)

HH.MM= Total charge time

AHRET= Total capacity Returned to the battery



---

## 7. CHARGE TERMINATION CODES

### ***CHARGE TERMINATION CODES***

#### ***GROUP 1: CHARGE COMPLETED***

01-07

Discharge completed successfully.

13

Discharge completed successfully.

Termination by maximum time

#### ***GROUP 2: MANUAL STOP***

11-20

Discharge stopped manually, during a generic cooling state

#### ***GROUP 3: BATTERY DISCONNECTED***

30

The battery has been disconnected before the begin of the discharge, while the discharger was waiting for the programmed Start.

31

The battery has been disconnected during the first part of the discharge

41

Battery disconnected during the preparation of the cycle. Discharge never started.

42

Battery disconnected during the calculation of the cycle. Discharge never started.

43

Battery disconnected during the initial identification sequence. Discharge never started

***GROUP 4: EMERGENCY STOP***

60  
Emergency Stop!  
Maximum voltage limit exceeded

64  
Discharge never started.  
Battery voltage was too LOW

65  
Discharge never started.  
Battery voltage was too HIGH

66  
Emergency Stop!  
Maximum Current Limit Exceeded.

68  
Emergency Stop!  
Maximum temperature exceeded

69  
Emergency Stop!  
Maximum temperature exceeded during the finishing charge.

75  
Emergency Stop!  
Wrong/Unknown Battery.

**GROUP 5: WARNING MESSAGES**

82

The battery has been disconnected while the discharge was in progress, in a generic state.

83

Output fuse blown.

85-95

Parameter Error

86

Battery temperature probe malfunction

96-97-98

Battery voltage anonymous at the connection.  
After 1 hour scale voltage to minus battery.

99

Black out of the AC input.

K2 -

Communication Error – Serial Port/BlueTooth/Connectivity Pack

This termination code happened in 2 different cases:

a) The operator interrupt the charger with general interruptor 0-1, normally it is better interrupt the charger with button STOP. But we know that many operators use interruptor 0-1, this is not a problem.

b) external Black out.

Normally it is not a problem, but if we know that the battery was not well charged, this means that the operator unplugged the battery too early. or really there was a black out. (in this case also others chargers had the same termination code at the same time)

- End of Manual -