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All specifications are subject to change without notice.

® ANALYZER X3 & X6

User's Manual



**3 MINUTE
BATTERY
ANALYZER !**

MADE IN
USA BY: **W & W Manufacturing Co.**

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OVERVIEW

The W&W Analyzer X3& X6 is a programmable battery tester and battery cycler capable of testing a variety of battery chemistries such as; Lithium Ion, Lithium Polymer, Nickel Cadmium and Nickel Metal Hydride. Most mechanical shapes can be accommodated with a specially designed battery cup. See battery Cup description for more information.

FEATURES

- Analyzes, condition and charges Nickel Cadmium and Nickel Metal Hydride batteries.
- Analyzes and charge lithium Ion and lithium polymer batteries.
- Features a single button capable of multifunction and an easy to read display for a user interface.
- Auto condition cycle for nickel batteries and life cycle mode for all batteries.
- Quick Test (QT), determines the state of a battery, as well as one of two states Batt>60% and Batt<60%
- Prime mode, allows one to enable a Li-ion battery to be unlocked at the upper and lower end of the Li-ion protective circuits range. Enabling Nickel based battery to acquire a charge to enable the battery to be evaluated by the various modes of the X3 & X6.
- Optional thermal printer for status and result printing.
- PC program available for more advance user interfacing and graph generation.
- Embedded OEM parameters or user defined profiles in "Learn Mode".

Universal cup

The Universal cup will allow one to evaluate batteries with different chemistries and cell counts within defined specifications. The Universal cup has one memory location that can be programmed the same as the Learn Memory location in a standard cup.

During entry into the "Learn Mode" of the Universal cup, Battery Chemistry, Capacity, and the number of Cells Are prompted for data entry. Follow the Directions below to enter data for the Learn Mode.

Data Range
 Chemistry (Lithium Ion, Nickel Cadmium, and Nickel Metal Hydride)
 Capacity 100 - 4000 mAh
 # Of Cells 1-12 NiCd and 1-4 Li-Ion

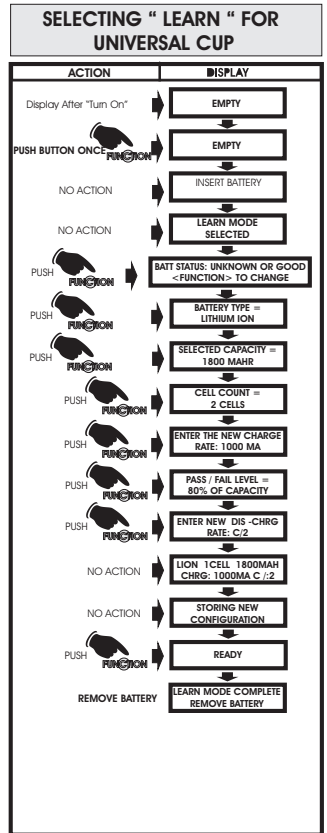
* **Important:** It is important that when testing an **UNKNOWN BATTERY** in the **learn mode** that you select the **UNKNOWN** state as opposed to **GOOD**. You can not perform a valid Quick test or an impedance test with the Universal cup. **One must observe the proper polarity when connecting the battery to the Universal cup. Should you connect the battery incorrectly, you will hear a buzzing sound, reverse the leads.**

At this point you may perform all the standard operations that can be performed in stations; 2, 3, 5 and 6 of the X3 and X6.

To change the cup settings for a different battery or for different parameters for the same battery, just repeat the Learn mod process again.



Universal cup.



Learn Mode

This mode when selected will allow a battery's parameters to be created for new battery models. A battery "Adapter Cup" holds a total of 5 battery profiles for parameter storage; four are preprogrammed with OEM information for a particular battery series. The fifth profile can be modified by the "Learn Mode". During entry into the "Learn Mode", Battery Chemistry, Capacity, and the number of Cells are prompted for data entry. Follow the Directions below to enter data for the Learn Mode.

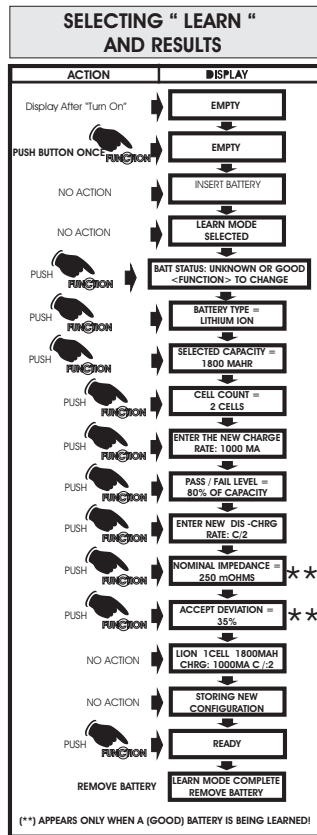
Data Range

Chemistry (Lithium Ion, Nickel Cadmium, and Nickel Metal Hydride)
Capacity 100 - 4000 mAh
Of Cells 1-12 NiCd and 1-4 Li-ion

* **Important:** It is important that when testing an **UNKNOWN BATTERY** in the **learn mode** that you select the **UNKNOWN** state as opposed to the **GOOD** state until the battery has been certified to be equal to or greater than 95% of it's rated capacity, then perform an Impedance test and record the results, repeat the learn mode with: **BATT STATUS:** as **GOOD**. Once a good battery is learned, you will be able to perform a **QUICK TEST** in station (1) of the X3 and on stations (1) and (4) of the X6.

Learn Mode Precautions

A good battery must be used to calibrate a battery's profile. OEM batteries have unique profiles that should not be used when testing non-OEM batteries. For each new non-OEM battery, create a new profile. The factory settings can not be modified in the field, however by utilizing the **LEARN MODE** function one can learn a non-OEM battery. It is very important that the battery you are using the LEARN MODE function for must be at least 95% of the stated capacity and a **Impedance test** should be performed on the battery in question and entered when requested in the LEARN MODE. It is a good idea to set the acceptable deviation to 35% to begin with. The learning of a good non-OEM battery will enable you to perform a **QUICK TEST (QT)** in station #1 of the X3 and stations #1 and #4 of the X6.



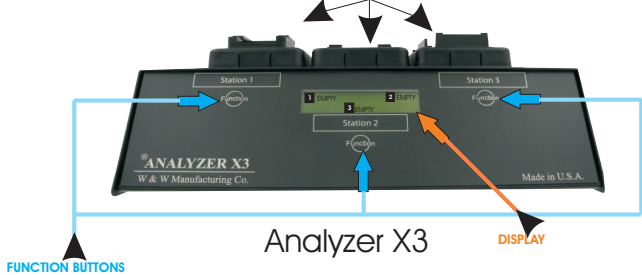
X3 & X6 Specifications

	Station	Std Power Supply	Hi Power Supply
Number of stations	X3 3	X6 6	
Quick Test:	Stations #1	#1 & 4	
Takes approximately 3min. Checks impedance Checks voltage min/max Checks discharge at different rates Utilizes an algorithm to determine capacity range.			
Standard Tests:	Stations		
Charge only	3	6	
Discharge only	3	6	
Cycle : 1, 2, 3	3	6	
Auto	3	6	
Condition	3	6	
Impedance	1	1 & 4	
Battery Voltage :	1.2 to 15V	Max. Number of cells: Nickel based : 12 cells, Li-ion: 4 cells	
Charge/Discharge current:	50mA to 4A in 50mA steps		
Maximum charge power :	X3	55W/station, 60W total	58W/station, 100W total
	X6	55W/station, 120W total	58W/station, 200W total
Maximum Discharge power:	X3	25W/station, 75W total	25W/station, 75W total
	X6	25W/station, 150W total	25W/station, 150W total
Power Management	The X3 & X6 automatically regulates which station will receive max. Power during high pwr demands.		
Chemistries:	Lion, NiCD and NiMH		
Charge and End of Charge Detection Protocols:	Li-ion, Constant current - Constant voltage Detection is achieved at C/11. Where (C) = capacity of Batt. Nickel based battery: Constant current, with negative delta V Detection.		
Display:	20x2 Backlit LCD		
Battery Adapters:	Quick Connect Adapter Cups for ease of changing Adapters (No tools required) Five Memory locations, each can be programmed for Li-ion, NiCD or NiMH Fifth memory location is field programmable, for all parameters		
Data Ports:	RS-232 Interface to P.C. And Serial Printer		
Line Voltage:	100 TO 240 VAC 50 to 60 Hz		
Input Current:	2 A		
Output:	X3	24V@2.5 A	X6 24V@4.16A
Dimensions and Weight:	X3		X6
Length	4.5"(110.25mm)		4.5"(110.25mm)
Width	13"(318.5mm)		24.5"(622.3mm)
Depth	9"(220.5mm)		9"(220.5mm)
Weight	6.5lb(2.96kg)		11.3lb(5.2kg)
Options Available:	P.C. Software, Serial Printer, Universal Adapter and Power Supply (24V@4.16A)		

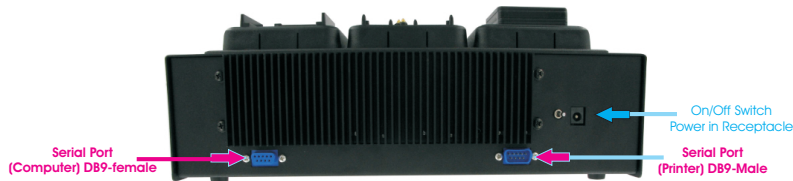
Parts Overview



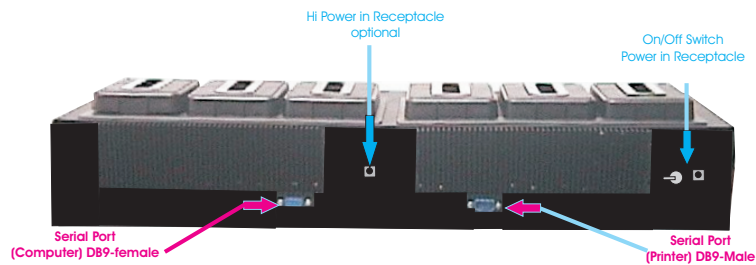
Adapter cups



Analyzer X3



Rear view of Analyzer X3



Rear view of Analyzer X6

Impedance Test

Impedance of a battery can be a good indicator of degradation of a battery's performance. In general, the lower the impedance number the better the battery performance during discharge. As a battery ages the impedance starts to rise indicating possible problems with the electrolyte, separator, contact corrosion, or metal interfaces, all impact the impedance.

The initial impedance of a new battery should be recorded and compared through the life of a battery and a determination can be made to remove the battery from service when the impedance rises out of range.

The Analyzer X3 and X6 produce impedance results within a 15 seconds of testing and displays the impedance in Ohms on the display or on a printout when an optional printer is used.

Follow the directions below for Impedance testing.

This test is only performed in Pocket #1 for the X3 and pockets #1 and #4 for the X6.

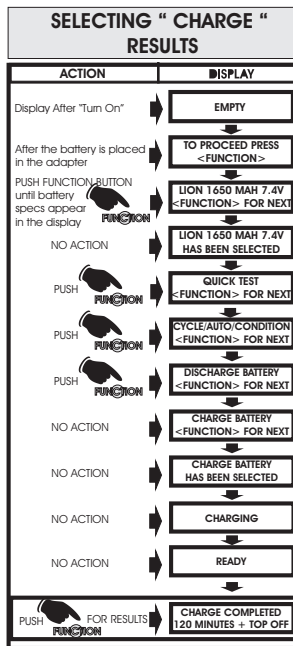
SELECTING "IMPEDANCE" AND RESULTS

ACTION	DISPLAY
Display After "Turn On"	EMPTY
After the battery is placed in the adapter	TO PROCEED PRESS <FUNCTION>
PUSH FUNCTION BUTTON until battery specs appear in the display	NICD 700 MAH 7.2V <FUNCTION> FOR NEXT
NO ACTION	NICD 700 MAH 7.2V HAS BEEN SELECTED
PUSH FUNCTION	QUICK TEST <FUNCTION> FOR NEXT
PUSH FUNCTION	CYCLE/AUTO CONDITION <FUNCTION> FOR NEXT
PUSH FUNCTION	DIS-CHRG BATTERY <FUNCTION> FOR NEXT
PUSH FUNCTION	CHARGE BATTERY <FUNCTION> FOR NEXT
NO ACTION	IMPEDANCE TEST <FUNCTION> FOR NEXT
NO ACTION	IMPEDANCE TEST HAS BEEN SELECTED
NO ACTION	TESTING
FOR RESULTS PUSH FUNCTION	READY
PUSH FUNCTION	BATTERY IMPEDANCE .233 ohms

Charge Mode

The Analyzer X3 and X6 applies two types of charge algorithms for the two types of chemistries. For Nickel based battery chemistries, a constant current of 1C (changeable with software option) is applied until the battery voltage peaks and descends negative. A top off current or 0.2C is then applied for 30 minutes to bring the total charge to 100%. Lithium batteries are charged with a different algorithm. The Analyzer X3 and X6 applies a constant current of 1C until the battery pack voltage equals between 4.1 and 4.2 Volts (the exact voltage depends on the pack manufacturer's specification). Upon reaching the predetermined voltage, the voltage is then held constant allowing the current to decrease to C/11. The rate at which the battery is charging is called a C rate. The (C) rate is the charging current divided by the Capacity of the battery. For example: the capacity of a battery is 1200mAh and the charge current is 1200 mA, then (C) rate is 1(C). If the charge current is reduced to 120 mA, then the C rate is 0.1C.

To select the Analyzer X3's and X6's **Charge Mode**, follow the directions below:

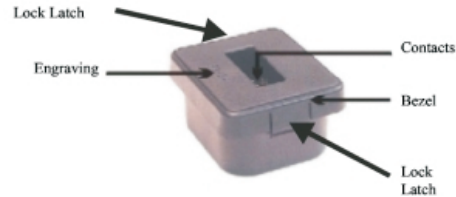


Understanding the Analyzer X3's and X6's Adapter CUP

The "Adapter Cup" allow different batteries to be serviced by the Analyzer X3 and X6. Each "Adapter Cup" is made for a specific battery model. There are 5 memory locations (data profile locations) within each "Adapter Cup". The first four profiles store pre-stored battery information and can only be altered using an optional software interface. The type of data stored for example is chemistry (NiCD, NiMH, Lithium Ion and Lithium Polymer), capacity, impedance, charge current, and discharge current. The fifth profile location is used for a user defined battery type or the same OEM model. To invoke this location and store data, use the "Learn Mode". See the Section on "Learn Mode" in order to enter data.

Highlighted Features

- Physically accommodates battery pack in the analyzer
- Holds five different Multi -chemistry parameter profiles.
- **Learn Mode** profile location for user defined parameters of a unique battery.
- Locking Latch system allows cups to be changed without tools.
- UP to 4 OEM battery pack's profiles programmed at factory
- **Prime mode**, allows the unlocking of a Li-ion Battery protection circuits, both at the upper and lower limits. The Prime mode will also put a charge on a nickle based battery that has been allowed to self discharge to a level that the X3 or the X6 or a battery charger could not recognize it when the battery is placed in a charger or the X3 or X6.

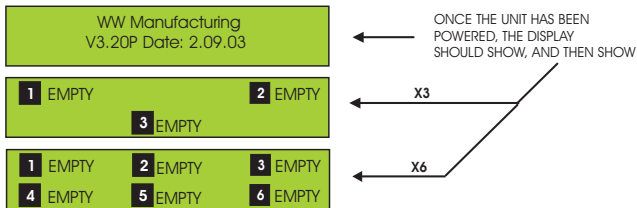


Adapter cup

Getting Started

Power Up

- Connect the unit to the proper AC voltage and Turn-on power using the switch located on the Back of the unit.



You are now ready to service a battery. Placing the appropriate "adapter cup" in the analyzer will allow you to service an OEM battery. The cup contains pre-stored data e.g. chemistry type, capacity, impedance, charge rate and discharge rate for 4 battery types. There is a fifth data position in the "cup" reserved for user defined information during the Learn Mode. See "Learn Mode" for more information.

1. Place a battery into the "adapter cup". The display "Press Function to Proceed" should be displayed.

The analyzer should detect your battery and give chemistry and capacity options as the function button is pushed. See note below, should the aforementioned not occur. *

*Note: If you do not see your chemistry during this process, remove the battery and reinsert it after pressing the function button momentarily. This operation will place you in the "Learn Mode". See "Learn Mode" on how to proceed.

2. Scroll through the menu until your battery appears (using the Function Button). When your battery appears, stop pressing the Function Button and wait until the display stop blinking. An acknowledgement beep will be heard and the display will also acknowledge your selection.

3. The display will now show a menu of "Test options" as you press the function button e.g. **QUICK TEST**, **CYCLE/AUTO/CONDITION**, **Dis-charge**, **Charge** and **Impedance** Test. This sequence only occurs for Station (1). For Stations (2) and (3) you will see the following sequence: **CYCLE/AUTO/CONDITION**, **DIS-CHRG BATTERY** and **CHARGE BATTERY**

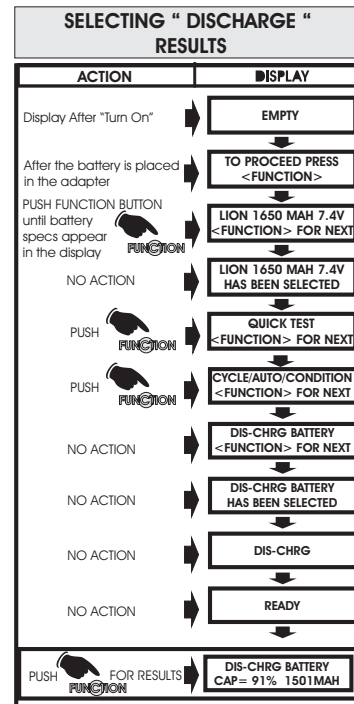
As you press the Function button the display should scroll through the menu of "Tests". When the test you have select appears in the display, just simply stop pressing the function button and wait until the display stop blinking. Once the display stops blinking, an acknowledgement beep will be heard along with a visual of the test you Selected in the display.

4. The test you selected will now start. Results will be displayed upon completion and if you have the optional printer attached a print out will also be printed upon test completion.

Discharge Mode

The Analyzer X3 and X6 is capable of a single discharge cycle by selecting Discharge Mode. In the normal discharge mode a constant pre-stored load current (C/5) is applied to the battery until 1 volt per cell has been reached. The result of the measurement is displayed as a percent of capacity. The capacity of a battery is defined as the amount of current over time. So the discharge result shown by the Analyzer X3 and the X6 is also given in mAh, the amount of current discharged over time. The rate at which the battery is discharge is called the (C) rate. 1C is the discharge current amount of the battery divided by battery capacity. For example: the capacity of a battery is 1200mAh and the discharge current is 1200 mA, 1C. If the discharge current is reduced to 120 mA, then the C rate is 0.1C.

Use the following procedure to select the **Discharge mode**:

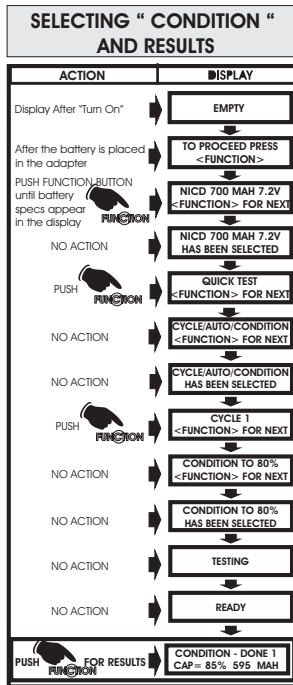


Condition Mode

The **CONDITION CYCLE** serves basically two needs of Nickel based batteries, one is to reform the Cells of a battery that hasn't been used for an extended period of time, say for 3 or more Months. Secondly this mode will eliminate **MEMORY EFFECT** better known as **VOLTAGE DEPRESSION**. Usually deep discharging the battery will restore the battery back to normal capacity such as the discharging and charging cycle used in the Analyzer X3 and X6.

Lithium Ion batteries do not suffer from voltage depression, but they will not be harmed if the Conditioning cycle is applied to them. To select the condition cycle follow the instructions below.

With the X3 and X6, the percentage of the rated capacity of the battery being **CONDITIONED** is set at 80%, the 80% is set of the factory and can be modified with the use of optional software.

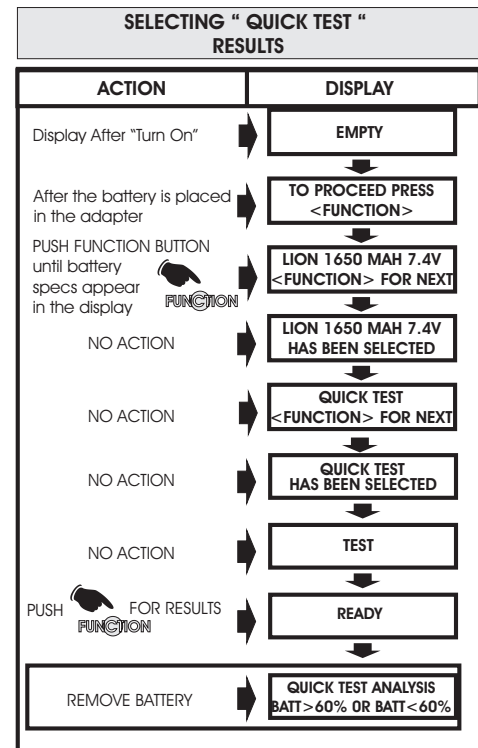


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QUICK TEST ANALYSIS

This is an advanced proprietary algorithm capable of determining the health of a battery. Specially stored parameters allowing the Analyzer X3 or X6 to identify a battery's range of capacity and display: Batt > 60% or Batt < 60% of rated capacity. Batteries that have a low state of charge when placed in the X3 for the QT May require a charge of up to 10 minutes before performing the QT. Up to 3 attempts to charge the battery will be tried before a message is displayed "Discard the Battery".

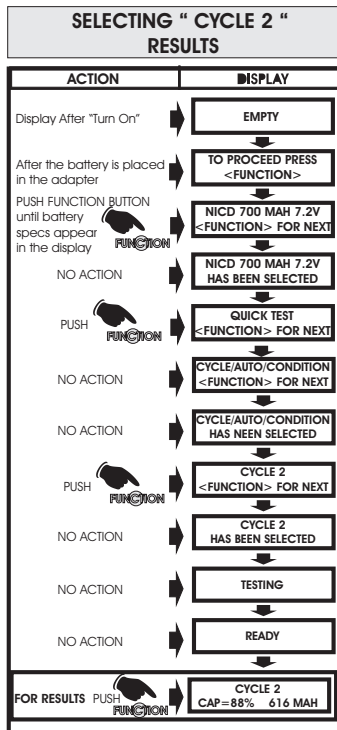
Even batteries that do not have pre-stored parameters can have a QT on, but will first be required to go through the "Learn Mode". Note, first a good battery must be learned before QT can be performed. A impedance test must be performed prior to the "Learn Mode", and incorporated into the LEARN MODE.



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Cycle Mode

The Cycle mode will cycle a battery through a charge and discharge cycle, known as Cycle (1). One could select Cycle 1, 2 or 3. By selecting cycle 1,2 or 3 all one would be doing is repeating the Charge/discharge number to reflect the chosen Cycle count. Cycle 2 and 3 are often used for incoming quality control of new batteries. The X3 will display the capacity (in percentage of rated capacity and mAh). It should be noted that after the completion of the Cycle function the battery is left in a fully charged state.



Auto Mode

Life cycle testing can be accomplished by choosing the Auto test. Battery performance for multiple cycles can be evaluated as long as the battery is not removed. Charge and discharge cycles are performed with 10-minute rest in between charge and discharge.

An example of how this test can be used is the following: A manufacturer states that a NIMH battery will Achieve a % of the stated capacity through the 300 cycles through its life (life can be defined as 300 cycles). The 300 cycles can be verified provided that the discharge rate is adjusted per the manufacturer's specifications.

