

IQ^{five} logo FPO

USER'S GUIDE

An Operation Manual

Copyright © 1998

Intelligent Technologies Company, San Diego, California, USA

*IQ, IQ^{five} and iTECH are registered trademarks of
iTECH - Intelligent Technologies Company, San Diego, California, USA
800-233-6868, 619-458-1500, fax: 619-458-1798
Internet Address: www.itecheng.com*

What's New

The IQ^{five} is the newest member of Intelligent Technologies' successful System 90 and IQ[®] family of battery services products.

Cycle Test Mode

The IQ^{five} now offers a CYCLE TEST mode which allows for battery “service life” testing and efficient battery “forming.” CYCLE TEST reports battery capacity while continuously charging and discharging the battery with appropriate rest periods between.

Optional Printer

Another option with the IQ^{five} is a report printer. Now you may print records of your battery test results—***without the added cost of a computer!*** The report printer utilizes the IQ^{five} real-time clock to date and time stamp reports. You can analyze reports later, compare “service histories” of your batteries, or give your customers a “receipt” of their battery's performance.

Real-Time Clock

The IQ^{five} comes equipped with a real-time clock that provides a date/time stamp for your test reports, as noted above.

Three-Year Warranty

At Intelligent Technologies, we know reliability is important to you. The IQ^{five} comes with a ***3-year warranty—the longest in the business!*** If the product becomes defective under normal usage conditions* anytime within the first three years, we will repair or replace it at no charge. (*See your IQ^{five} warranty for complete information.*)

**excludes damage from obvious abuse or spills*

Contents

OPERATING INFORMATION

UNPACKING	1
FEATURES, CONTROLS AND DISPLAYS	1
SPECIFICATIONS	4
PRECAUTIONS	5
BATTERY ADAPTER INSTALLATION	7
POWER ON	9
STARTING THE OPERATION	9
ENTERING THE CHARGE MODE	11
ENDING THE CHARGE MODE	12
ENTERING THE ANALYZE MODE	13
ENDING THE ANALYZE MODE	15
ENTERING THE CONDITION MODE	16
ENDING THE CONDITION MODE	17
ENTERING THE DISCHARGE MODE	18
ENDING THE DISCHARGE MODE	19
ENTERING THE CYCLE TEST MODE	20
ENDING THE CYCLE TEST MODE	21
THE REPORT PRINTER	22
Setting the Real-Time Clock	22
Connecting the Report Printer	23
Sample Print-Outs	24
Glossary of Printer Abbreviations	25

TROUBLESHOOTING INFORMATION

NO DIAGNOSTIC DISPLAY	26
BATTERY DOES NOT FIT INTO ADAPTER.	26
NO STATION DIAGNOSTIC DISPLAY	26
NO DISPLAY WITH BATTERY INSTALLED	27
LCD DISPLAY PROBLEMS	28
NO “H” APPEARS ON THE DISPLAY	29
BATTERY FAULT (BAT.FAULT) MESSAGE	29
Message “E01”	29
Message “E02”	30
Message “E03”	30
BATTERY VOLTS MESSAGE GIVES HIGH READINGS	31
BATTERY OVERHEATS	31
CHARGING A FULLY-CHARGED BATTERY	31
REMOVING A BATTERY BEFORE FINISHING A PROCESS	32
“VOLTS” AND “mAh” MESSAGES	32
REAL-TIME CLOCK LOSES DATE/TIME SETTING AFTER BEING POWERED DOWN	33
PRINTER DOES NOT GENERATE REPORTS	33

APPENDICES

APPENDIX A- INTERNATIONAL CAUTION STATEMENTS 34
APPENDIX B - REPLACEMENT OF REAL-TIME CLOCK
BATTERY 35

THANK YOU FOR SELECTING OUR PRODUCT

Thank you for selecting one of our nickel cadmium (NiCd) and nickel metal hydride (NiMH) charger and analyzer/conditioner products. Your IQ^{five} represents the latest in fast charging and battery maintenance technology. The product uses a microprocessor and digital signal processing to charge, analyze and maintain your NiCd and NiMH batteries. The proprietary and patented signal processing system uses a distinctive voltage-sensing algorithm to assure accurate and consistent product performance and extend the life of your batteries. A fail-safe temperature circuit also insures that your NiMH batteries will not be overheated and further damaged - no matter what their condition may be at the time of charge.

The following sections offer guidelines for the unpacking and preparation of your IQ^{five}, and some safety-related advice.

UNPACKING

Your product has been carefully packed. Please remove the product from its protective foam and bag. Keep this material and use it should you decide to ship or mail your IQ^{five}.

FEATURES, CONTROLS & DISPLAYS

Now is the time to examine your product and note its features.

Battery Adapters

Battery adapters are separately packed or come installed and are connected to J1 through J6 respectively. *If your adapters are separately packed, please refer to "Battery Adapter Installation" for instructions on page 7.*

NOTE!

**A NiCd & NiMH
Battery Charging
and Maintenance
Program**

Features, Controls and Displays

Each IQ^{five} has:

- a rear-mounted Power Switch
- a rear-mounted Fuse Holder (115V) or Circuit Breaker (230V)
- a rear-mounted AC Receptacle
- a rear-mounted Serial Printer Port
- six Battery Station(s)

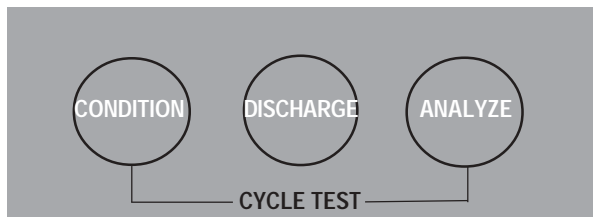
A battery station consists of an associated adapter, display and mode switches.

Each Battery Station has a:

- Battery Adapter
- custom LCD Information Center
- Fast Charge Mode (Default Activated)

Three front panel dome switches to activate four additional modes:

CONDITION
DISCHARGE
ANALYZE
CYCLE TEST



Each LCD Information Center has a:

CHARGE, DISCHARGE, ANALYZE &
CONDITION Message

Cycle # Message

Volts/Cycle Message

mAh (capacity) Message

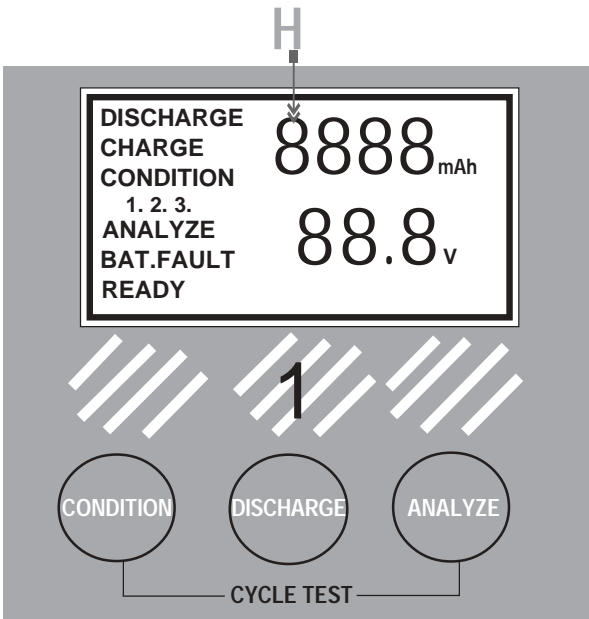
READY Message

BATTERY FAULT Message

E01,2,3 Message

H (NiMH) Message

LCD Information Center



DISCLAIMER:

Specifications are subject to change without notice.

SPECIFICATIONS

Mechanical

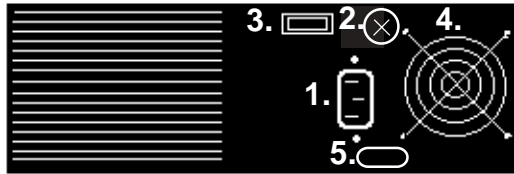
Front Panel Features

Six Battery Stations

Three Dome Switches per Battery Station

One Custom Liquid Crystal Display per Battery Station

Rear Panel



Rear Panel Features

1. AC Cable Receptacle
2. Fuse Holder (115V) or Circuit Breaker (230V)
3. Power Switch
4. Cooling Fan
5. Serial Printer Port

(Case Material Cold Rolled Steel)

Weight

9.5 lbs (4.3 kg)

Size

3.7"H x 16.2"W x 7.7"D (94 x 412 x 196 mm)

Electrical

Input Voltage (*depends on model*):
100 - 130 or 205 - 250 VAC 50/60Hz

Maximum mAh Battery: 7000 mAh

Operating Temperature: 0° C - 50° C

Battery Cells (NiCd/NiMH 1.2Vdc): 3-12

Battery Voltage: 3.6 - 14.4Vdc

Charge Rate: 600mAh +/-5%

Discharge Rate: 590mAh +/-3%

PRECAUTIONS

Before you plug in and operate the IQ^{five}, please read and understand this section. In the interest of safety and reliability, please read and accept the following advice:

Battery Types — **WARNING!**

Your IQ^{five} must only be used to charge, analyze and condition NiCd or NiMH batteries. Any attempt to charge other types of batteries may cause an explosive reaction, fire or chemical burns. Please do not assume that the physical form of another battery qualifies it for use in the IQ^{five}. *It does not!!*

Hot or Cold Batteries — **NOTE!**

NiMH batteries may be permanently damaged by over-temperature or under-temperature charging. Therefore you should bring all NiMH batteries to room temperature before charging or maintaining that battery. The IQ^{five} temperature circuits will prevent the charge process if you install a battery that is too hot or cold and an error message will appear (E01, etc.).

WARNING!!

NiCd & NiMH
Only!!
No Other
Batteries!!

Other battery
types may cause
an explosion, fire
or chemical
burns that could
result in
property
damage, bodily
harm or even
death.

WARNING!

Please read this page carefully to assure your safety! Failure to follow these precautions may result in property damage, bodily harm or death!

Battery Handling — **WARNING!**

Never dispose of a battery in a fire. This may cause an explosion. Do not replace individual cells in a battery. The imbalance in the battery pack will result in poor performance.

Electrolyte Burns — **WARNING!**

Be careful when handling NiCd or NiMH batteries. **If a battery is broken or shows signs of leakage do not attempt to charge it. Dispose of it!!** Nickel-based cells contain a chemical solution which burns skin, eyes, etc. Leakage from cells is the only possible way for such exposure to occur. In this event, rinse the affected area thoroughly with water. If the solution contacts the eyes, get immediate medical attention.

Electrical Burns — **WARNING!**

NiCd and NiMH batteries are capable of delivering high currents when accidentally shorted. Accidental shorting can occur when contact is made with jewelry, metal surfaces, conductive tools, etc., making the objects very hot. **Never place a charged battery in a pocket or case with keys, coins, or other metal objects.**

Lithium Ion Batteries — **WARNING!**

Lithium Ion Batteries are potentially hazardous by virtue of their chemical construction. Therefore, they are equipped with protective circuits that are designed to render them safe under all foreseeable charging conditions.

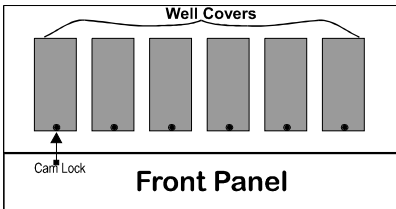
However, **do not place Lithium Ion Batteries in the NiMH or NiCd adapters. Lithium Ion batteries may be permanently damaged, or explode and combust if the battery's protective circuits fail when charged in this product using NiCd or NiMH adapters.**

Radio Interference — **WARNING!**

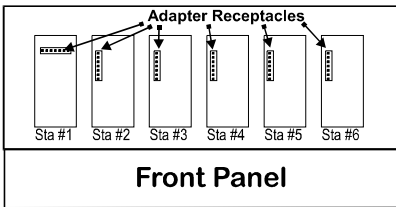
This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

BATTERY ADAPTER INSTALLATION

Your IQ^{five} may arrive with battery adapters packaged separately. To install these adapters first remove the blank panels from the six adapter wells. Rotate the Cam Lock on each panel to the "UNLOCK" position - lift up and remove.



CAUTION: Use battery adapters or blank panels to cover all adapter wells when the IQ^{five} is powered on. Ventilation will be altered if adapter wells remain uncovered when the IQ^{five} is powered on, which may cause certain internal circuits to overheat and fail. **This will void your warranty. Please keep adapter wells covered at all times!**

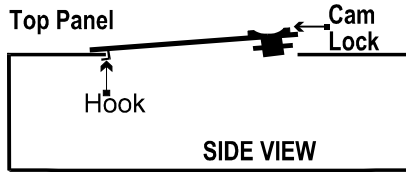


Install battery adapters by connecting the battery adapter multi-pin plug to an appropriate adapter receptacle. The receptacles are located under each adapter entry port on the main circuit board assembly. The plug is keyed, so take care to align the key and maintain polarity.

Place the battery adapter down into the adapter well with the tooled hook sliding to the rear, installing the adapter in the obvious manner. Apply slight rearward and downward pressure to the rear of the adapter. This will drive the tooled hook under the top panel and fully engage the rear section of the adapter.

CAUTION!

Damage to the unit due to overheating may occur if you operate your IQ^{five} without well covers or battery adapters installed in all stations !



Next, using a standard screwdriver, rotate the Cam Lock to the "UNLOCK" position. Now apply downward pressure on the front of the adapter to set it in place. Then rotate the Cam Lock to the "LOCK" position. The Cam Lock will rotate 360° so be sure to stop at the indentation, which indicates the locked position.

NOTE!

Some topside adapters require the cam lock to be positioned to the rear of the unit — simply reverse the adapter orientation.

The Battery Adapter Installation is now complete.

When you remove an adapter you need to rotate the Cam Lock to the "UNLOCK" position and reverse the installation process.

NOTE: Some topside adapters require the cam lock to be positioned to the rear in order to avoid overhanging the front of the product. Simply reverse the adapter orientation for these adapters.

POWER ON

At this time, you should do the following:

Confirm that your IQ^{five} power switch is off.

To power unit "Off", the black side panel of the rocker switch is exposed.

For "On," the raised side of the switch will be red.

Connect the AC line cable from the rear of the IQ plus to a convenient and appropriate (115VAC or 230/240)VAC outlet. (230/240 VAC = ONLY "QW" models).

STARTING THE OPERATION

With the Battery Adapters Empty or with Batteries Installed - Use the Rear Panel Power Switch to Turn the IQ^{five} to "On."

When the power is turned "On," the LCD Information Centers at all stations will come on and stay active for 5 seconds. For approximately 2 seconds, the "Volts" fields will display the software revision (9.2v, for example, as shown below) that is installed in the charger.

Diagnostic Display with Software Rev. Number

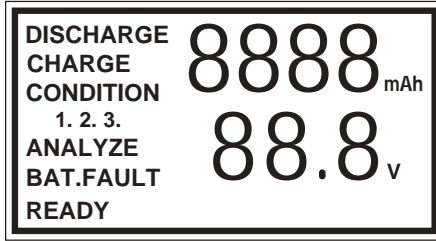


After the initial 2 seconds, the "Volts" field will change to display "88.8" for the remaining 3 seconds.

NOTE!

Diagnostic
Display =
Software
Revision for 2
seconds and
"88.8v" for 3
seconds.

Diagnostic Display



NOTE!

After the 5-second diagnostic display, battery-occupied stations will default to the CHARGE mode.

After the five second diagnostic cycle, the display on the empty battery stations will be blank and the **IQ^{five}** will be in “Standby,” ready for use. *The battery-occupied stations will enter the default Charge mode.*

Installing a Battery - Insert the Appropriate Battery into its Respective Battery Adapter. Be Certain the Polarity is Correct, and that the Battery Contacts Align with the Adapter Contacts.

A Secondary Diagnostic Cycle Will Begin.

At the end of another 5 second diagnostic cycle, the LCD Information Center for that battery station will remain active presenting a CHARGE and Volts message. If you installed a NiMH battery, an "H" appears to the upper right. This indicates the battery's thermistor is communicating with the processor.

NOTE!

After you install a battery - wait 10 Seconds for the battery to stabilize. Then you have one minute to select the mode of operation.

Battery Installed; Initial Display



You Now Have One Minute To Select the Mode of Operation (Charge, Discharge, Analyze or Condition).

After the “Entry Time Period” is over (from one to two minutes) or once you select a mode of operation, you will be unable to change the mode of operation.

Due to variations in the signal processing clock cycle, it may be possible to change modes for as long as two minutes. However, this tolerance is a variable after the first minute. Therefore, select the desired mode of operation within the first minute to insure your success. Once you have selected a mode of operation, you are locked out from changing the mode. To change modes, you will need to remove the battery for more than two seconds to reset the station, reinstall it and then select your alternate mode.

If you were unable to set the desired mode of operation during the “Entry Time Period,” simply remove the battery from the adapter for more than two seconds and reinstall it. The station will be reset and a new mode can be selected.

ENTERING THE CHARGE MODE

Install a Battery in the Adapter — Touch Nothing — After Two Minutes, the Charge Mode Begins.

A fast charge will be applied to the battery, under the supervision and control of the microprocessor. The IQ^{five} station will continue to charge the battery and measure the battery voltage.

You Install a Functional Battery and it Charges Properly

If the battery is not under or over temperature, shorted or open, and passes the fifteen minute voltage test, the fast charge cycle continues under the supervision and control of the microprocessor. The IQ^{five} continues to charge the battery and measure the battery voltage.

NOTE!

You will be unable to change modes of operation after the “Entry Time Period” or after selecting a mode. To change modes, remove the battery for more than 2 seconds to reset the station, reinstall it, and then select your alternate mode.

NOTE!

Refer to page 32 regarding “Volts Message.”

NOTE!

Refer to page 29 regarding “BAT.FAULT” and pages 29 - 30 regarding Error (“E01,2,3”) Messages.

CHARGE Mode; Beginning Charge



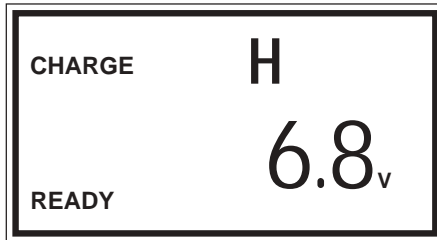
Measured and displayed voltages will be based on the battery specifications. For example: the battery voltage display may begin as low as 3 - 4 volts and go to more than 14 volts while under charge.

ENDING THE CHARGE MODE

The Battery Reaches Full Charge

The IQ^{five} microprocessor judges the battery to be fully charged when the battery exhibits certain voltage transitions and simultaneously meets certain other criteria (patented time and voltage algorithm). The battery is now fully charged and the display indicates the READY mode.

CHARGE Mode; Fully Charged Battery



The station will now continuously charge the battery at a low 20-25mA rate. This maintenance charge holds the battery's full charge state until the operator removes that battery from the battery adapter.

ENTERING THE ANALYZE MODE

The NiCd or NiMH battery's ability to power a product or portable device over time is called a battery's capacity, stated in mAh or Ah. Analyzing a battery measures that capacity and provides data.

In the ANALYZE mode, the battery station will initially charge your battery to a fully-charged state.

The station will then automatically discharge the battery, while tracking the energy it deducts during this process. ***A mAh message continuously displays the discharged capacity.***

When the microprocessor senses that the battery has been fully discharged, the mAh message (*measured discharged capacity*) is frozen and the battery is again fully charged. This final charge prepares your battery for use at the end of the analysis cycle.

You can compare the frozen mAh message with your battery's specification and judge its ability to power your product over time (battery cycle time).

If you analyze a battery and decide that it has unsatisfactory capacity, you should then condition that battery using the CONDITION mode (page 16).

If You Wish to Analyze A Battery - Install the Battery in an Adapter and Press the Analyze Dome Switch.

The ANALYZE mode will initially apply a fast charge to your battery, as described on pages 11 and 12, under the supervision and control of the microprocessor.

NOTE!

Charge then Discharge - The only way to accurately and efficiently measure the capacity of a battery!

NOTE!

Refer to page 32 regarding "mAh Message"

NOTE!

A battery's cycle time refers to how long it will power your product before needing to be charged; service life refers to the number of discharge cycles available over that battery's useful lifetime.

NOTE!

IQ^{five} discharges the battery to cell manufacturers' recommended 1 volt per cell.

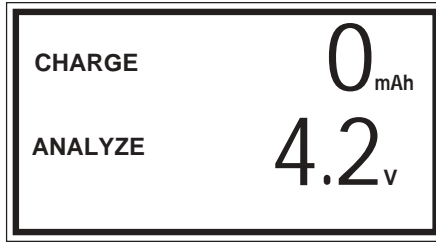
NOTE!

When analyzing the battery, the mAh message is frozen after each discharge cycle - in all test and maintenance modes - displaying the measured capacity for the prior cycle.

NOTE!

All IQ^{five} products finish with a final charge cycle in all test and maintenance modes - preparing the battery for use.

ANALYZE Mode; Charge Cycle



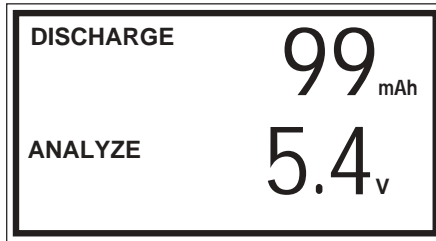
The Battery Reaches Full Charge

The IQ^{five} microprocessor judges the battery to be fully charged as described on page 12. Then the discharge cycle begins.

The Battery Discharges

During the ANALYZE mode, the IQ^{five} station will discharge the battery and measure the capacity stored during the first charge cycle.

ANALYZE Mode; Discharge Cycle



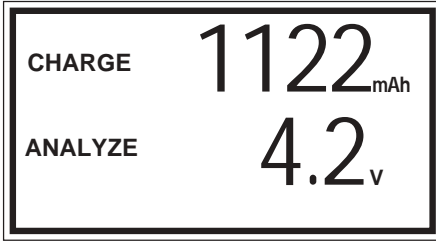
The Battery is Fully Discharged and the Final Charge Begins.

The IQ^{five} assumes that all batteries (that are processed without error messages) should be prepared for use at the end of a mode. Therefore, the IQ^{five} finishes the Analyze mode with a charge cycle.

When the discharging battery voltage reaches 1 volt per cell, the battery is fully discharged and the final CHARGE cycle begins.

At the end of any discharge cycle, the mAh display will freeze and continuously display the last measured capacity of the battery.

ANALYZE Mode; Final Charge Cycle



ENDING THE ANALYZE MODE

The Battery Reaches Full Charge

The ANALYZE mode’s final CHARGE cycle is identical to the CHARGE cycle described in the CHARGE mode section on page 12.

Once the battery reaches the READY state, the station will then continuously offer a maintenance charge to the battery.

ANALYZE Mode; Fully Analyzed and Charged Battery



NOTE!

Compare your final “mAh” display with your battery specifications to determine the condition of your battery.

NOTE!

CONDITION mode is essentially 3 sequential ANALYZE cycles, i.e. three successive charge/discharge cycles followed by a final charge cycle.

NOTE!

Some stubborn batteries, especially those that have sat unattended for months, may require as many as two successive Condition treatments to clear their "memory" or voltage depression problems.

NOTE!

When conditioning the battery, the mAh message is frozen after each discharge cycle - in all test and maintenance modes - displaying the measured capacity for the prior cycle.

ENTERING THE CONDITION MODE

At times you will use the IQ^{five} to restore a deficient battery to its optimum or highest potential capacity. This is known as "conditioning the battery."

In order to fully condition a battery, industry practice recommends the battery be fully charged and fully discharged three successive times. The IQ^{five} CONDITION mode automatically cycles a battery through this process, monitoring the battery status and capacity during the procedure. The CONDITION mode then charges the battery, and maintains the full-charge state (READY) until the operator removes that battery from the battery adapter.

The LCD Information Center will track and display the capacity of the battery during each of the discharge cycles. The displayed battery capacity will be frozen during the following charge cycle. Therefore, if you check the display during the process, at each of the charge intervals, you will see the incremental improvement in capacity.

During the final charge cycle and when the process is finished (READY), the LCD will display your battery's fully charged capacity. You can compare this reading with your battery's specification and judge its ability to power your product over a period of time (battery service time).

If You Wish to Condition a Battery - Install the Battery in an Adapter and Press the "CONDITION" Dome Switch.

The battery will undergo three successive CHARGE/DISCHARGE cycles, and conclude with a final CHARGE sequence, preparing the battery for use.

CONDITION Mode; Cycle #1

Charge

Discharge

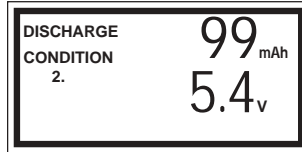


The CONDITION Mode continues through two more cycles with the following display attributes:

CONDITION Mode; Cycle #2

Charge

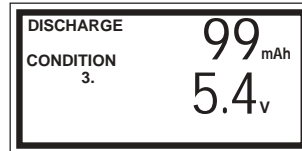
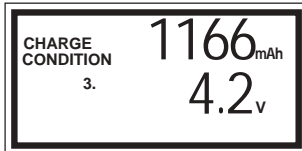
Discharge



CONDITION Mode; Cycle #3

Charge

Discharge

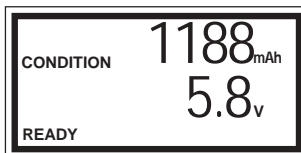


ENDING THE CONDITION MODE

The Battery Reaches Full Charge

The mAh display will freeze at the end of the final discharge sequence and remain frozen through the READY state. This will *indicate* the capacity that was depleted during the last discharge cycle - *the measured capacity of the battery* .

CONDITION Mode; Fully Conditioned and Charged Battery



NOTE!

Compare your final "mAh" display with your battery specifications to determine the condition of your battery.

NOTE!

Use this mode to check another charger's ability to produce capacity.

NOTE!

If batteries analyze fine - then give short operating life - "Stand Loss" may be the problem - defined here!

NOTE!

IQ^{five} discharges the battery to all manufacturers' recommended 1 volt per cell.

ENTERING THE DISCHARGE MODE

You may use the IQ^{five} to verify the performance of another battery charger. If you take a known good battery and charge it on another charger, the IQ^{five} DISCHARGE mode will deplete and measure the capacity produced by the other charger. Therefore, the DISCHARGE mode indicates the other charger's ability to produce capacity.

Also, you can check for excessive "stand loss" in a battery with the DISCHARGE mode. To understand "stand loss," please consider the following explanation. Some defective batteries will self-discharge at abnormally high rates. These batteries will analyze and report satisfactory capacity. Then, when placed in a brief-case or on a shelf for a few days, at reasonable temperatures, *the defective batteries will lose as much as 20-30% of their capacity each day.*

This unacceptable self-discharge activity is known as excessive "stand loss." The DISCHARGE mode can check for unacceptable "stand loss." Simply ANALYZE the battery and note its capacity. Stand the battery in a room temperature location for three days. After that period of time has passed, put the battery through the DISCHARGE mode.

The DISCHARGE mode will discharge the battery (without a preliminary charge) and measure its capacity - as it exists after the time on the shelf. If the difference is *more* than 1-5% of the capacity per day (depending on the type, age and condition of the battery) - you have a problem with excessive "stand loss" in that battery. This abnormal self-discharge activity may or may not be corrected with the CONDITION process.

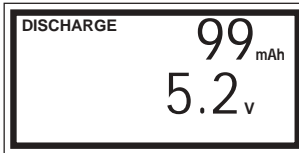
If You Wish to Discharge a Battery - Install the Battery in an Adapter and Press the DISCHARGE Dome Switch.

In this mode, the mode message may not be obvious. The absence of the ANALYZE or CONDITION message will indicate that you are in the DISCHARGE mode, not in the

DISCHARGE cycle of an ANALYZE or CONDITION mode.

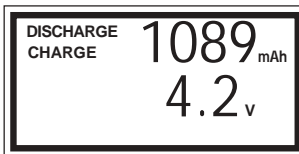
The battery will immediately begin to discharge and the capacity message will appear, tracking the capacity discharged from that battery.

DISCHARGE Mode; Discharge Cycle



When the discharging battery voltage attains a processor-calculated value (1 volt per cell), the battery is judged to be fully discharged and the final CHARGE cycle begins.

DISCHARGE Mode; Charge Cycle



NOTE!

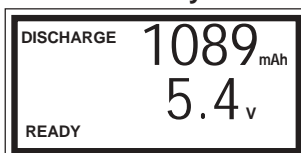
During the Charge Cycle of DISCHARGE mode, both "Charge" and "Discharge" will show on the display.

ENDING THE DISCHARGE MODE

The Battery Reaches Full Charge

The mAh display will freeze at the end of the final discharge cycle and remain through the READY state. This will indicate the capacity that was discharged during the last discharge cycle—the *measured capacity of the battery after that battery was charged on another charger or standing (when checking for stand loss)*.

DISCHARGE Mode; Discharged and Fully Charged Battery



NOTE!

Many new products and batteries instruct you to charge and use the battery a number of times before you can expect proper capacity. This overcomes the problem and is known as “forming” the battery.

NOTE!

CYCLE TEST is initiated by pressing the **CONDITION** and **ANALYZE** dome switches at the same time.

NOTE!

CYCLE TEST will continuously run Charge/ Discharge cycles until you stop the process by removing the battery.

ENTERING THE CYCLE TEST MODE

Cycle Test solves problems that appear when you first put new batteries into use.

New batteries may have been in stock or dormant for a sustained period of time. This will create a voltage depression and low capacity (acts like a memory effect). (*You may notice that many new products and batteries come with instructions directing you to charge and use the battery a number of times before you can expect proper capacity. This overcomes the problem and is known as “forming” the battery.*)

The IQ^{five} “Cycle Test” continuously charges and discharges new batteries while reporting capacity. This “forms” the battery.

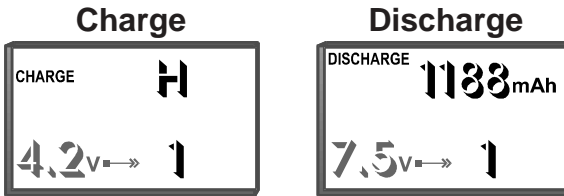
“Cycle Test” can also check the “*service life*” (how many cycles a battery will typically power your product before needing replacement) of a battery type for quality acceptance purposes. In this test you note the number of cycles that have passed when the capacity reaches a level that you deem unacceptable. This count is the approximate (+/- 10%) number of cycles the battery will last in controlled usage.

If You Wish to CYCLE TEST a Battery—Install Your Battery into the Adapter then Press the CONDITION and ANALYZE Dome Switches at the same time. When successfully started, Cycle # “1” will alternate with the volts. (Cycle Test runs continuous charge and discharge cycles until you either remove the battery or power the unit down.)

The initial charge cycle (Cycle #1) prepares the battery for the first capacity measurement (displayed during subsequent discharge). The cycle type, cycle #, battery volts and NiMH message (if appropriate) are displayed. The volts display alternates with the cycle number (*ref. display on page 21*).

The Cycle counter runs from 1 - 99, then rolls back over to 1 for the next 100 cycles.

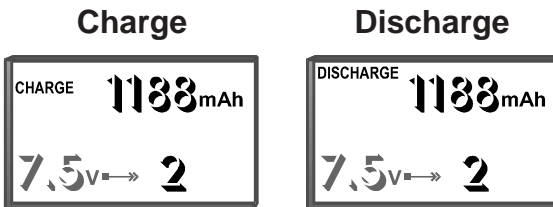
CYCLE TEST Mode; Cycle (#1)



When the battery discharges to a processor-calculated value (1 volt per cell), the battery is judged to be fully discharged and the next cycle begins.

The battery capacity remains frozen during the following charge cycle and indicates the latest actual capacity of your battery.

CYCLE TEST Mode; Cycle (#2)



ENDING THE CYCLE TEST MODE

Cycle Test will continue until you remove the battery from the station, or power down the unit. Therefore, to end Cycle Test, remove the battery from the adapter.

The battery will be partially charged if you do not take care to remove the battery immediately after the completion of a charge cycle (however, this is difficult to time). Therefore, if you are putting the battery into use, you should return the battery to the battery adapter and place it in the CHARGE MODE. This will fully charge the battery for use.

NOTE!

CHARGE your battery to bring it to full capacity before returning the battery to use after running CYCLE TEST.

THE REPORT PRINTER

The report printer utilizes the IQ^{five} real-time clock to date stamp all test reports.

NOTE!

The clock is set at Battery Station 1. All batteries must be removed from all stations when setting or viewing the clock.

Setting the Real-time Clock

Your IQ^{five} comes equipped with a real-time clock that will date and time stamp all printed records. Before you begin using your IQ^{five} printer, please follow the steps below to set the date and time.

NOTE: All batteries must be removed from all stations when setting or viewing the clock.

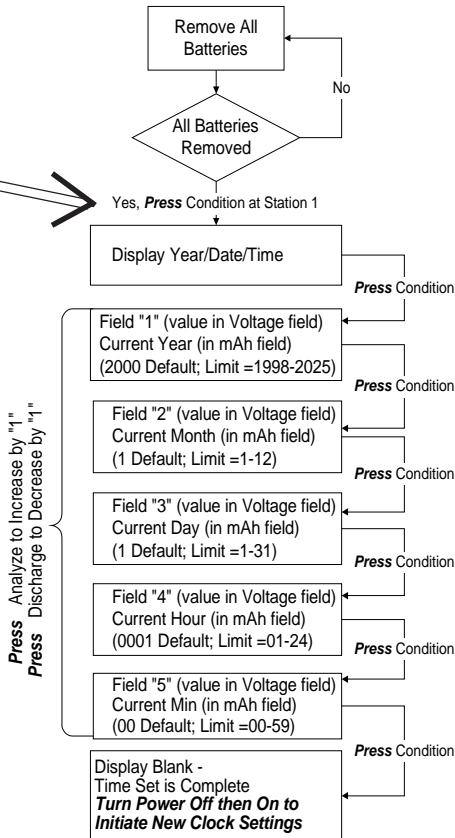
NOTE!

Press
CONDITION
dome switch to:
1) access clock settings;
2) advance to next field;
3) accept current clock settings.

Press
ANALYZE
dome switch to increase field value by 1.

Press
DISCHARGE
dome switch to decrease field value by 1.

Turn power off, then on to initiate new clock settings and clear safety lock-out.



NOTE: All steps are performed at Battery Station 1.

Your clock is now set to the current date and time. Now you need to power down the IQ^{five} to accept the new clock settings and clear the safety lock-out.

NOTE: The IQ^{five} real-time clock runs on a separate Lithium button cell located under Battery Station 4. To ensure accurate time, you will need to periodically replace it (see Appendix B for instructions). See page 35 for battery failure indicators.

Connecting the Report Printer-

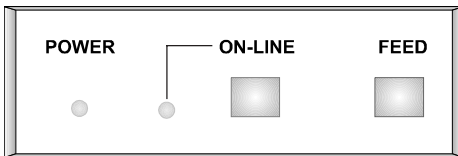
You connect the printer to the IQ^{five} via a serial printer port on the back panel. A serial female 9-pin to male 25-pin printer cable is used. Connect the power to cord to an appropriate outlet and power it on using the on/off switch located on the back panel. Test results can now be printed.

A diagnostic report for the IQ^{five} is available. *If you desire to print this report, you must have your printer connected to the IQ^{five} and powered on before powering on your IQ^{five}.* The only time the diagnostic report is generated is when the IQ^{five} is first powered on. The diagnostic report reads:



Features

Please note the two LEDs and two dome switches on the top panel of the printer:



You may press the Feed dome switch at any time to advance the paper; hold down the Feed dome switch for multiple line advances.

NOTE!

The clock runs on a separate Lithium button cell that you will need to periodically replace (ref. Appendix B).

NOTE!

Refer to Glossary of Abbreviations on Print Outs, page 25.

NOTE!

The printer will print whether it is on- or off-line because the IQ^{five} communicates only one way with the printer.

NOTE!

For all modes except Cycle Test, test results are printed at the end of each mode of operation when the READY state is reached.

The report printer prints out test results at the end of each mode of operation (when the READY state is reached).

Sample CHARGE Report

5		01/02/98	08:20:02	
1	12			
/		#		
-		1 . .	14.4	

Sample ANALYZE Report

5		01/02/98	09:10:08	
2	7			
/		#		
-		3 1185	7.2	

NOTE!

Refer to Glossary of Abbreviations on Print Outs, page 25.

Sample CONDITION Report

5		01/06/98	16:40:45	
3	5			
/		#		
-		7 1235	6.0	

NOTE!

You will lose reports if you do not have the printer powered on or run out of paper during a test since neither the IQ^{five} nor the report printer has internal memory for data storage.

Sample DISCHARGE Report

5		01/16/98	12:04:57	
4	6			
/		#		
-		2 1235	6.0	

For CYCLE TEST, however, a report is printed at the end of each charge and discharge cycle.

Sample CYCLE TEST Reports

5		02/24/98	15:23:27
5	6		
/		#	
-		17 . .	6.0

5		02/24/98	15:23:27
5	6		
/		#	
-		17 1215	6.0

NOTE!

For Cycle Test, test results are printed at the end of each charge and discharge cycle.

NOTE!

The Charge Cycle printout of CYCLE TEST mode will show "NA" in the CAPMAH field since capacity is measured only during the discharge cycle.

GLOSSARY OF ABBREVIATIONS ON PRINT OUTS

- STA Battery Station
- NiCd Nickel Cadmium Battery
- NiMH Nickel Metal Hydride Battery
- CY# Cycle Number Running or Completed in Cycle Test Mode
- CAPMAH Capacity in milliAmp hours
- V Volts
- ERR Error Code
- E01 NiMH Temperature out of range
- E02 Battery didn't reach required volts per cell after 15 minutes of Fast Charge
- E03 Shorted battery
- FAULT Battery Fault

IQ^{five} TROUBLESHOOTING GUIDE

NO DIAGNOSTIC DISPLAY

No Diagnostic Display

Is Fan Running?

No -

Check power switch, power cord and fuse. If fuse is blown, replace it with 5A 250V MDL-5. If fuse blows again, contact your customer service representative.

Yes, but Still No Diagnostic Display on “Power On”

If the LCD diagnostic display does not appear and the fan is still running - contact your customer service representative.

The Battery Does Not Fit Into The Adapter

THE BATTERY DOES NOT FIT INTO THE ADAPTER

Please remove the battery adapter and compare the adapter number (label on the side of the adapter) to the adapter guide to be certain you have the correct adapter. Also verify that the battery has been installed with the radio-to-battery contacts connecting to the battery adapter contacts.

No Station Diagnostic Display

NO STATION DIAGNOSTIC DISPLAY

The battery is installed. The “Power On” diagnostic display was OK. But the station diagnostic display did not appear when you installed the battery.

NOTE!

Some batteries have an “On/Off” switch—check to be certain that it is in the “On” position, as the adapter uses the radio contacts.

Remove the battery and check the battery adapter interface with the battery contacts. The IQ^{five} connects to the battery via the radio-to-battery contacts, not the external charging contacts. Please check to see that you are placing the radio-to-battery contacts into the battery adapter.

If The Battery Is Not Making Contact With The Battery Adapter Contacts -

Remove the adapter and reference the adapter number (numbered label on the side of the adapter) to the battery make and model that is called out in the battery adapter guide. Confirm that the appropriate adapter has been selected for your make and model of battery. If the guide indicates that you have not selected the appropriate adapter - please install the correct adapter.

If The Guide Indicates That You Have Installed The Correct Battery Adapter And The Contacts Appear To Be Mis-Aligned -

Try rotating the battery 180°. If the rotation of the battery fails to align the contacts, please call your customer service representative.

Also - the battery adapters are designed to the original equipment manufacturer's mechanical specifications. Aftermarket batteries may vary with regard to these specifications. High-quality aftermarket batteries are typically identical to the OEM version's mechanical specifications, but some secondary battery products may vary. Please contact your customer service representative if these conditions exist and you have an aftermarket battery that does not physically match the OEM version. However, the representative may or may not be able to assist you. The IQ^{five} adapters are only guaranteed to conform to the OEM's mechanical specifications.

NO DISPLAY WITH THE BATTERY INSTALLED

Check Your Battery With A Voltmeter -

You should read approximately 1 volt per cell. If the battery reads some voltage less than 1 volt per cell you should trickle charge that battery on a different charger for at least 24 hours and again try to service the battery with the IQ^{five}. If the battery reads "0" volts - you have a defective battery.

If The Battery Is Not Making Contact With The Battery Adapter Contacts -

Installed The Correct Battery Adapter And The Contacts Appear To Be Mis-Aligned -

No Display With The Battery Installed

No Display With
The Battery
Installed

If The Battery Reads Approximately “1” Volt Per Cell Or More -

Remove the battery adapter from the IQ^{five} top panel and inspect the adapter connector. (Your IQ^{five} may remain powered-on during this process.)

Verify that the connector is inserted into the appropriate receptacle and is properly aligned with the receptacle on the PC board. Inspect the wires running from the adapter to the connector for breaks or damage. Then press down on the connector, applying gentle pressure to insure pin contact.

Reinstall the adapter into the top panel, replace the battery in the adapter and check for a display. If your display remains blank - contact your customer service representative.

LCD Display
Problems

LCD DISPLAY PROBLEMS

The LCD Displays Messages (after the "Power On" diagnostic) with no Battery Installed in the Related Battery Adapter.

Remove the battery from the adapter and check the adapter well for foreign conducting matter (keys, screws, etc.). If the well and adapter contacts are free of conductive debris - the display should be totally blank. If this is not the case, please contact your customer service representative.

The LCD Displays Partial Numbers or Garbled Messages, with or without the Battery installed

Check and secure the display-board-cable connector. If this does not help, contact your customer service representative.

A NiMH BATTERY IS INSTALLED AND ENTERS THE CHARGE MODE - NO "H" APPEARS ON THE DISPLAY

When a NiMH battery is installed in the adapter, the processor senses its thermistor through the adapter connector. The processor then sends the "H" message to the display for that station - **only when you select no other mode and the station enters the default "Charge" mode.** If the "H" is not present in the charge mode, check the battery thermistor contact and make sure it is clean and clear of debris.

BATTERY FAULT (BAT.FAULT) MESSAGES

Battery Fault (BAT.FAULT) conditions generate Error Codes (E01,02, 03) to help you diagnose the possible problem with your battery.

A NiMH Battery Is Installed and the Message E01 Appears

This error indicates that the battery temperature is out of range (too hot or too cold for charging) or that there has been a loss of contact with the thermistor after the battery has been identified as NiMH.

Allow the battery to stand for at least 20 minutes to return to room temperature, then reinstall in the adapter and run your test again.

No "H" Display
With CHARGE
Mode & NiMH
Battery Installed

Battery Fault
(BAT.FAULT)
Messages

"E01" Display
With NiMH
Battery
Installed

**"E02" Display
With Battery
Installed**

A Battery Is Installed and Processing and Message E02 Appears

The battery has not reached a voltage of at least 1V/cell after 15 minutes of charging.

This battery may be removed and the process restarted, but this message may indicate that the battery has a weak cell, or that the battery needs to be formed (*refer to CYCLE TEST mode on page 20*).

A Battery Is Installed and Processing and Message E03 Appears

The battery voltage measures less than 0.7V/cell.

Check to see if debris or some foreign matter has created a short in the battery receptacle or plug interface.

This may indicate that the battery is defective - or the battery may need to be formed (*refer to CYCLE TEST mode on page 20*).

**"E03" Display
With Battery
Installed**

BATTERY VOLTS MESSAGE SEEMS TO GIVE HIGH READINGS

The IQ^{five} battery voltage reading is essentially a voltmeter which measures across the battery terminals. When the battery is undergoing a charge, the IQ^{five} applies a considerable voltage to those battery terminals. Therefore, the reading will be high (IQ^{five} applied-voltage) during the charge process.

However, the voltage reading and the associated display will be nominal or normal when the battery is in the READY state, and will accurately reflect the decreasing battery voltage during the DISCHARGE state.

If the battery is not warm to the touch during the charge process, you can be sure that your high-voltage reading is not harming your battery.

BATTERY OVERHEATS

The IQ^{five} offers the most complete and gentle charging algorithm in the market which should not overheat the battery under normal circumstances. If the IQ^{five} heats, or melts a battery or its external surface, please contact your customer service representative. (*Refer to “Trying to Charge a Fully-Charged Battery, page 32.”*)

TRYING TO CHARGE A FULLY-CHARGED BATTERY

If you try to charge a fully charged battery, the IQ^{five} microprocessor will sense the voltage conditions that indicate the full charge status.

However, the IQ^{five} will monitor the battery voltage for approximately five minutes before confirming the full charge state and entering the READY mode. The delay permits the processor to detect and ignore the false “full charge” signals which may come from some batteries.

Battery Volts High? --May not be a problem.

Battery Overheats?

WARNING!

Trying to Charge a Fully-Charged Battery? Do NOT do it! May cause battery to overheat or an Error E01 Battery Fault.

Removing a Battery Before Finishing a Process?

NOTE!

Do not remove your battery from the adapter unless it is in a BAT. FAULT or READY state - you will have to start the process over and you will lose time!

The "VOLTS" & "mAh" Messages

REMOVING A BATTERY BEFORE FINISHING A PROCESS

The IQ^{five} will remain in your selected mode of operation when there is a momentary loss of battery contact (less than 2 seconds). This prevents the station from resetting in the event that vibration or inadvertent battery movement creates a momentary loss of electrical contact.

However, if a battery is removed from its adapter or the IQ^{five} is powered down during a "Mode" of operation, the "Mode" of operation will reset. The Diagnostic mode will start again when the battery is reinstalled or power is restored.

Therefore, after you have selected a "Mode" of operation and are processing your battery, be certain to check your battery's status before removing it from the station. If it is not in a battery FAULT condition, or READY, do not remove it from its adapter. You will lose valuable time if you do!

THE "VOLTS" AND "mAh" MESSAGES

The "V" or volts message will continuously display the measured battery voltage. This measurement should increase through the charging cycles (until the peak charge point is reached) and decrease during the discharge cycles.

The "mAh" display will continuously track the discharged capacity of the battery. The message will display the capacity in real-time increments during the discharge cycles.

THE REAL-TIME CLOCK WON'T KEEP DATE/TIME AFTER THE UNIT HAS BEEN POWERED DOWN

Upon powering up, the clock gives incorrect or erratic dates and times on print outs.

This usually indicates the need to replace the battery that maintains your time/date settings when the IQ^{five} is powered down. Please refer Appendix B - REAL-TIME CLOCK BATTERY REPLACEMENT INSTRUCTIONS on page 35.

THE REPORT PRINTER WON'T PRINT REPORTS

The printer is powered on, but no reports are printed.

Please check the following to assure proper operation of the report printer:

Is the cable between the IQ^{five} and the printer connected at both ends?

Is there paper in the printer?

Is the IQ^{five} powered on?

If all of the above check out, please call your Customer Support representative.

**The Real-Time
Clock Won't
Keep Date/Time
After The Unit
Has Been
Powered Down**

**The Report
Printer Won't
Print Reports**

APPENDIX A — CAUTION STATEMENTS

CAUTION

Danger of Explosion if Battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the Manufacturer. Discard used batteries according to the Manufacturer's instructions.

ATTENTION

Il y a danger d'explosion s'il y a remplacement incorrect de la batterie, remplacer uniquement avec une batterie du même type ou d'un type recommandé par le Constructeur. Mettre au rebut les batteries usagées conformément aux instructions du Fabricant.

ADVARSEL!

Lithiumbatteri — Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

ADVARSEL

Eksplosjonsfare ved feilaktig skifte av batteri. Benytt samme batteritype eller en tilsvarende type anbefalt av apparatfabrikanten. Brukte batterier kasseres i henhold til fabrikantens instruksjoner.

VARNING

Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

VAROITUS

Paristo voi räjähtää, jos se on viheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

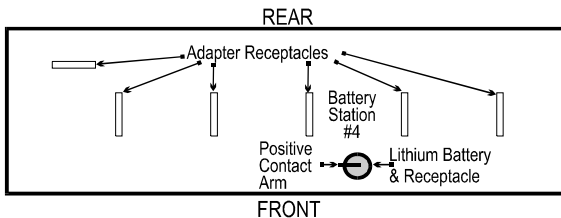
APPENDIX B — REPLACEMENT OF REAL-TIME CLOCK BATTERY

If the battery for the real-time clock is dead or removed, the IQ^{five} will generate test reports that show erratic dates and times. When you see unpredictable dates and times, then it is time to replace the battery. However, you will still be able to use the IQ^{five} to test and maintain your batteries.

Lithium Battery Replacement Instructions

NOTE: Replace with a Panasonic BR2032 battery or equivalent.

- 1. WARNING!:** To avoid electrical shock and bodily harm, first power down your IQ^{five} and disconnect the power cord from the A/C receptacle at the rear of unit.
2. Remove all adapters or well covers from all Battery Stations.
- 3. Remove the top cover.**
 - 3.1 Turn your IQ^{five} upside down.
 - 3.2 Using a small Phillips screwdriver, remove the four feet by unscrewing the connecting screws.
 - 3.3 Turn your IQ^{five} right-side up, the rear panel facing you.
 - 3.4 Remove the top cover by sliding towards the back of the unit.



4. Locate the Lithium battery on the logic board (*refer to drawing above*).

NOTE!

The battery for the real-time clock does not affect the operations of your IQ^{five} - so you don't lose valuable processing time!

NOTE!

Use Panasonic BR2032 or equivalent battery to power your IQ^{five}'s real-time clock.

WARNING!

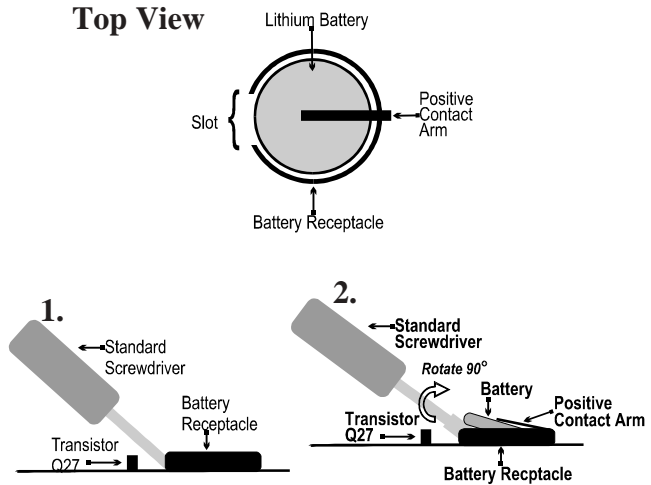
To avoid electrical shock and bodily harm, first power down and unplug your IQ^{five} from A/C power. Only then proceed with replacing the battery for the real-time clock.

CAUTION!

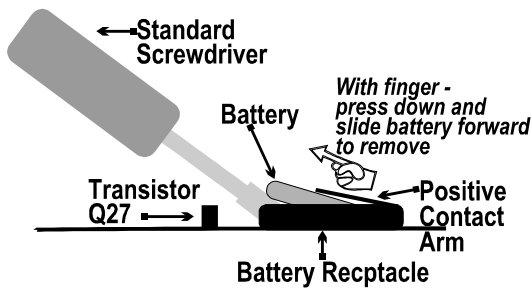
Damage to components on the logic board may occur if proper care with tools is not used! Do not allow tools to touch any components and insert tool into battery receptacle just enough to be able to lift the battery above the lip of the receptacle.

CAUTION: YOU MAY DAMAGE COMPONENTS ON THE LOGIC BOARD IF YOU DO NOT USE CARE IN USING TOOLS TO REMOVE THE BATTERY FROM ITS RECEPTACLE!

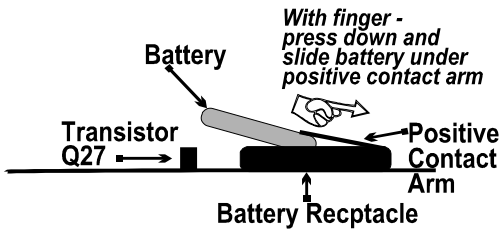
Transistor Q27 is especially close to the battery receptacle—*keep your tools from touching it to avoid bending or breaking it*. Also, there is a hole in the bottom center of the battery receptacle that could allow your tool to scratch the logic board and traces—*insert the tool just enough to be able to lift the battery above the lip of the receptacle*.



5. Insert a standard screwdriver blade into the slot (located on the left side, unit facing away from you) of the battery receptacle and rotate the blade 90° to lift the left edge of the battery.



6. With a finger of your right hand or other tool, push down and forward on the edge of the battery opposite the slot. The battery will slide out of the receptacle and you may then remove the battery.



7. To Insert a New Battery:

CAUTION: *Do not touch Transistor Q27 with the battery as any pressure may bend or break the transistor.*

- 7.1 Slide the edge of the battery through the slot on the battery receptacle and under the positive contact arm.
- 7.2 Press the battery into place. When it is properly inserted, you will hear a loud snap.

8. Follow the instructions for **Setting The Real-Time Clock** on page 22.

CAUTION!

Do not touch Transistor Q27 with the battery as any pressure may bend or break the transistor.