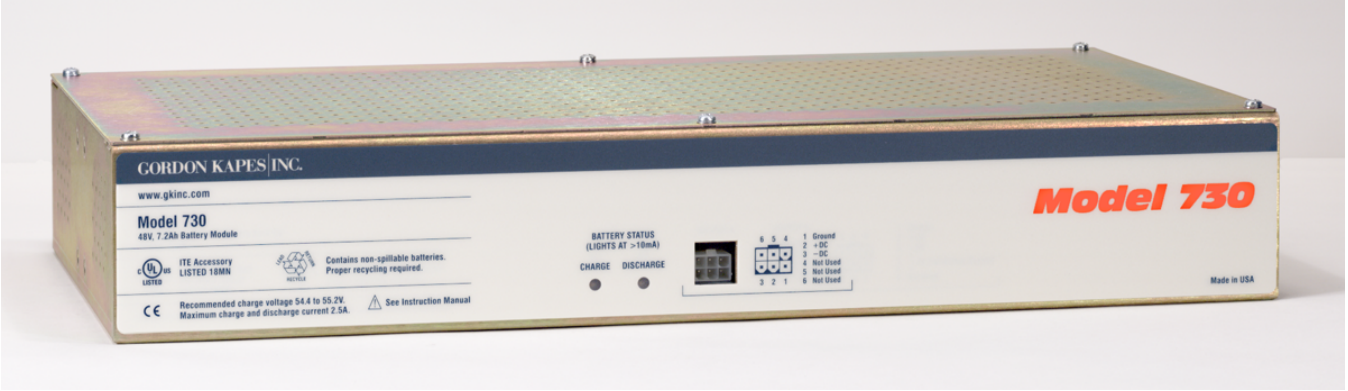
Technical Practice

Issue Preliminary 3, June 2004

Model 730 Battery Module



1. General Description

1.1 Product Overview

The Model 730 is a 48 V, 7.2 Ah Battery Module with current overload protection and visual CHARGE and DISCHARGE LED status indicators. Rechargeable batteries contained within the Model 730 provide output battery backup capability in the event of an AC input voltage interruption to the external charging power supply. The Model 730 will continue to supply a 2 A DC output for up to nominally three hours. For output loads of less than 2 A the battery operating time will substantially increase. The unit is completely self-contained in a compact enclosure. Mounting kits, available separately, allow the unit to be wall or rack mounted. The Model 730 is Underwriters Laboratories, Inc. Listed under their UL-60950 category.

1.2 Features

Model 730 features include CHARGE and DISCHARGE LED status indicators, battery output short-circuit protection, one output connector, and simple installation. The LED status indicators are provided to serve as installation, operation, and maintenance aids. The DC battery output is expressly designed to support a wide range of telecommunications and data applications.

The Model 730 can support a 0.6 A output load for up to ten hours. The internal batteries are short-circuit and over-current protected. The Model 730 is intended for wall- or rack-mounted applications. Mounting kits, available from Gordon Kapes, Inc., are purchased separately. Various wall-mounting kits are available, including specialized ones that allow co-mounting of equipment from other manufacturers. Kits are also available to allow the Model 730 to be mounted in 19- and 23-inch rack enclosures. Contact the factory for details, or access www.gkinc.com. One 6-position detachable connector is accessible on the Model 730's front panel. This connector provides access to the ground and the DC battery output connections.

1.3 Physical Description

The Model 730 consists of a steel enclosure that houses a precision-fabricated circuit board, four 12 V, 7.2 Ah sealed lead-acid batteries, and related interconnection wiring. The overall dimensions are 2.9 inches (7.4 cm) high, 17.0 inches (43.2 cm) wide, 9.1 inches (23.1 cm) deep. The unit weighs a hefty 32.7 pounds (14.9 kg).

2. Applications

2.1 Primary Application

The Model 730 (48 Vdc, 7.2 Ah) Battery Module is intended to provide battery backup support for telecommunications and data applications.

2.2 Floating Output

The Model 730's DC battery output is isolated (floating) from ground, making it suitable to provide a positive or negative ground-referenced DC voltage. The DC battery output can float up to ±150 V away from ground, allowing it to be connected in series with other telecommunications power supplies, e.g., ring voltage generators.

2.3 Safety Compliance

The Model 730 has been tested and approved by Underwriters Laboratories, Inc. as a CUL (Canada-United States) Listed device under their UL-60950 category. A Listed product is one that has passed the requirements of a complete, independent unit. This helps to ensure that the Model 730 will perform in a safe manner, as well as complying with most local electrical codes.

3. Installation

3.1 Words of Caution

As with any product, installing the Model 730 requires a safety-first approach. Read the entire installation section of this practice before starting the installation process.

Warning: Handle the Model 730 with great caution! It is very heavy relative to its physical dimensions. If dropped, it can be hazardous to people or property.

3.2 Checking for Damage

The Model 730 should be inspected for damage immediately upon receipt. A claim should be filed with the shipper if damage is found. A replacement should be ordered if necessary.

3.3 Installation Kits are Required

In all cases, a separate mounting kit is required to install a Model 730. In most cases, no mounting kit will be included in the Model 730's shipping carton. Mounting kits, purchased separately, allow the unit to be wall or rack mounted. By offering a variety of mounting options, installations can be configured to meet the exact needs of a facility. Ensure that the desired mounting kit is specified and procured before attempting to install a Model 730.

3.4 Output Connector

One 6-position connector provides access to the ground and DC battery output signals.

3.5 Interconnection Cable Required

Depending on the requirements of the application, a interconnecting cable is necessary to interface the Model 730 with the external charging power supply. In most cases, no interconnecting cables will be included in the Model 730's shipping carton. Interconnecting cables can be purchased from Gordon Kapes, Inc. They are offered with various length and termination options. In all cases, one end of an interconnecting cable will have a 6-position plug to mate with the Model 730's connector. The other end will have either unterminated leads or be provided with a connector specifically selected to interface with the connected equipment. If unterminated leads are provided, refer to Figure 1 for the wire color code.

Pin Number	Function	Wire Color
1	Ground	Green
2	+DC	Red
3	– DC	Black
4	Not Used	
5	Not Used	
6	Not Used	

Figure 1 Output interconnecting cable wire color chart

Alternately, a technician can fabricate a custom cable assembly. This requires both parts and a special crimp tool. These are available from Gordon Kapes, Inc., or other electronic parts suppliers.

Ensure that the desired interconnecting cable is specified and procured (or fabricated) before attempting to install a Model 730.

3.6 Selecting a Mounting Location

Whether wall or rack mounting is going to be performed, when selecting the "perfect" mounting location: keep the battery pack away from excessive heat. Excessive heat will decrease the battery life, the life expectancy of the batteries is three to five years when used at room temperature 68 degrees F (20 degrees C).

3.7 Wall Mounting

Several wall-mounting kits, purchased separately, are available from Gordon Kapes, Inc. Included in each kit are two mounting brackets and a set of fasteners. The mounting brackets are symmetrical, allowing each bracket to be mounted on either the left or right side of the Model 730's enclosure. Each bracket is attached to the enclosure by means of four 10-32 x ½-inch pan-head machine screws. For safety it's important to use the fasteners provided in the wall-mounting kit as they are the correct length and include an integral lock washer. Also included in the mounting kit are four #10 x ¾-inch self-tapping screws. These are used to secure the brackets to the recommended mounting surface.

Begin the mounting process by securing the two mounting brackets to the left and right sides of the Model 730's enclosure. Ensure that four screws are installed per bracket. Refer to Figure 2 for details. When using the wall-mounting kit, the Model 730 is intended for use only with a wood backboard surface (minimum thickness ¾-inch). The unit is designed for mounting in a vertical orientation, with the front panel facing left or right. Refer to Figure 3 for details. Refer to Section 5.2 of this practice for temperature-issue details.

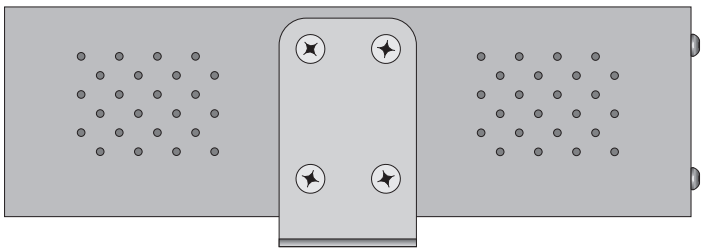


Figure 2 Right side view of Model 730 with wall-mount bracket attached

The actual mounting process is best done as a two-person procedure. One person should carefully hold the Model 730 into the desired mounting position. The second person should mark the locations of the four mounting screws: two on the top bracket and two on the bottom. Be certain that the correct two screw locations on each bracket are marked. The narrow part of the "keyhole" mounting slots should be on the top. Pilot holes can then be drilled at the marked locations. The #10 x ¾-inch screws provided in the mounting kit, as previously mentioned, are appropriate for use only on a minimum ¾-inch wood surface.

3.8 Rack Mounting

Several rack-mounting kits, purchased separately, are available from Gordon Kapes, Inc. Separate kits are available to allow a Model 730 to be mounted in either a 19- or 23-inch rack enclosure. Some kits allow the Model 730 to be mounted flush with the rack rails, others are designed for center mounting, providing superior weight balance. Included in each kit are a left and a right bracket, along with a set of fasteners. Each bracket is attached to the Model 730 using four 10-32 x ½-inch pan-head machine screws. For a secure attachment, these screws include an integral lock washer. Screws are not provided to secure the Model 730 with attached brackets to the rack enclosure. The installer must provide four screws; two per rack mounting "ear."

Begin the installation by selecting an appropriate mounting location. While the unit can be installed in any two "spaces" (3½ vertical inches) of a standard rack, selecting a location that allows proper cooling is critical. Adequate battery life depends on maintaining the Model 730's ambient temperature as close to 68 degrees F (20 degrees C) as possible. Refer to Section 5.2 of this practice for details. Attach the mounting brackets using four screws per bracket. Refer to Figure 4 for details. Then mount the completed assembly to the rack rails.

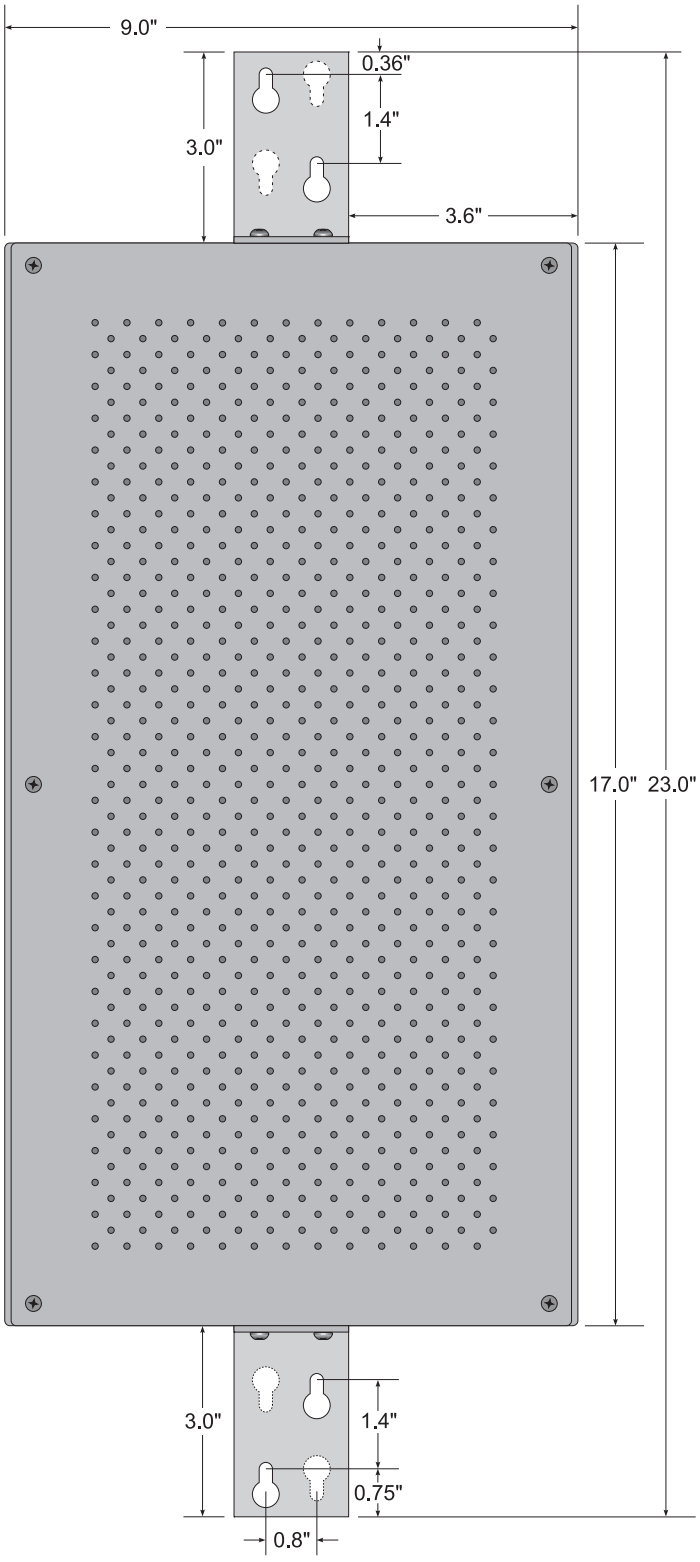


Figure 3 Recommended Model 730 wall-mount configuration

It's important to note that the Model 730's enclosure is 2.9-inches high, substantially less than the 3.5 inches taken by two full rack spaces. But with the brackets installed the completed assembly does use two full rack spaces. A gap is present between the top of the Model 730 and the bottom of the next piece of equipment. This gap is useful as it provides all-important cooling space around the Model 730. Refer to Figure 5 for details.

3.9 Safety Ground Connection

A separate safety ground connection must be made directly to the Model 730's enclosure. A ground connection screw has been specifically provided on the back panel of the Model 730's enclosure. Using a #12 AWG wire, connect safety ground to this green-colored screw. The other end of the wire must be connected to a known-good safety ground location. Should there be any questions, a competent electrician is best able to identify an adequate safety ground connection point.

3.10 Safety First

Before making any output connections to the Model 730, ensure that a separate safety ground connection has been made.

3.11 Ground and DC Battery Output

One 6-position connector, accessible on the front panel, allows access to the ground and the DC battery output. Refer to Figure 6 for details. Pin 1 of the output connector is connected, via the Model 730's internal circuitry, to ground. This ground is the same as supplied by the separate safety ground connection. This ground on pin 1 allows a safety ground connection to be provided to the connected equipment. Note that this ground connection must not be used as the primary safety ground connection for the connected equipment! This ground is provided strictly as a secondary path. Pin 2 of the output connector provides the +DC connection of the 48 Vdc output. Pin 3 provides the –DC connection of the 48 Vdc output.

3.12 Selecting the Desired DC Battery Output Scheme

As mentioned previously, the DC battery output is isolated (floating) with respect to ground. The DC battery output can be connected directly to the equipment to be powered in this manner, or it

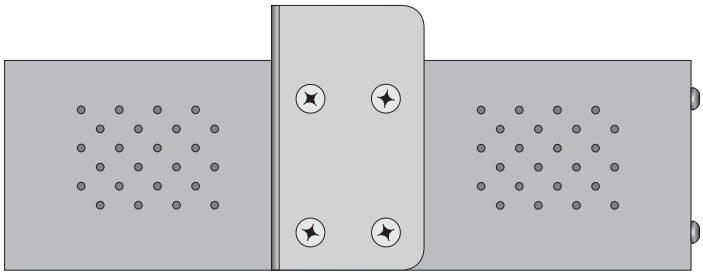


Figure 4 Right side view of Model 730 with center rack-mount bracket attached

can be referenced to ground. In telecommunications applications it is typical to utilize a positive ground scheme, with the output configured to be –48 Vdc with respect to safety (earth) ground. This is easily accomplished by connecting pin 1 (ground) to pin 2 (+DC) and using this combination as the ground connection for the load. Pin 3 (–DC) would provide the –48 Vdc connection for the load.

3.13 Connecting the Battery Module

Before the Model 730's DC battery output is plugged into the external charging power supply, ensure that a separate safety ground connection has been made and that the connecting equipment is turned off. Utilizing the 6-position DC battery output connector and the required cable assembly interconnect the Model 730 Battery Module to the connected equipment. The 6-position plug should be firmly mated with the output connector located on the Model 730's front panel and the other cable end to the connected equipment. Upon completion of the DC interconnects, power can be restored to the external charging power supply. The green CHARGE LED indicator should be visible on the front panel.

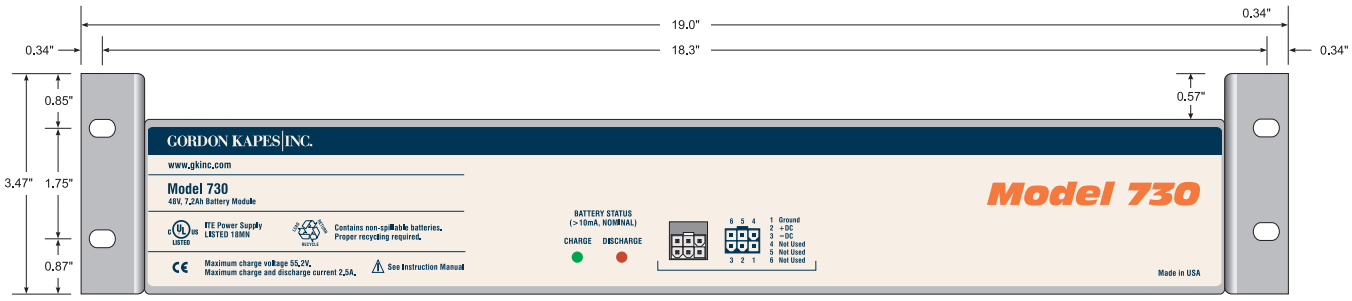


Figure 5 Front view of Model 730 with 19-inch rack-mount brackets attached

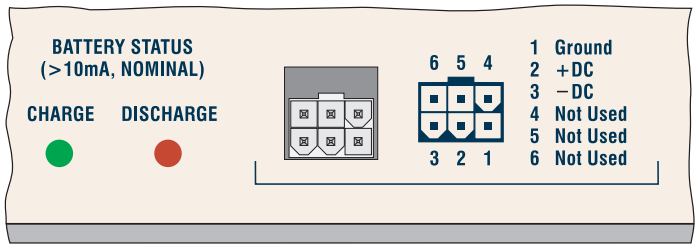


Figure 6 Front panel detail showing output connector and pinout chart

4. Testing and Operation

4.1 Installation Review

By this point, the desired connections should have been made between the Model 730 and the external charging power supply. A safety ground connection should have been made to the ground screw located on the back panel of the Model 730. At this time the green CHARGE LED indicator should be lit steadily. If the CHARGE LED does not light a wiring error may exist; most likely a short or over-current condition is present. Check the installation and refer to Section 7 of this practice for troubleshooting assistance.

4.2 Status LEDS

The Model 730 contains two status LED indicators which are visible on the front panel of the unit. The CHARGE LED lights steadily whenever the battery module is charging >10 mA, the DISCHARGE LED lights steadily whenever a discharge >10 mA occurs.

4.3 Testing the External Charging Power Supply

To confirm that proper charging voltage is being produced, check the connected equipment output that is charging the Model 730 Battery Module. If possible, use a digital voltmeter to check the connected equipment's DC battery output for a nominal 54 Vdc; a reading of 53 to 55 V would be considered normal when AC power is present to the connected equipment and the batteries are fully, or nearly fully, charged. The green CHARGE status LED should be lit.

4.4 Testing Battery Operation

Warning: The testing method described in this section makes the assumption that a safety ground connection has been made to the ground screw located on the back panel of the Model 730's enclosure. This dedicated ground ensures that a safety ground connection will be maintained even if the AC power plug from the external charging power supply is disconnected from the outlet. If you are uncertain whether this safety ground connection has been made, review Section 3.9 of this practice.

The Model 730 does not include a direct means of placing the unit under battery operation. To test the Model 730's backup capability simply unplug the external charging power supply's AC plug from the AC outlet. The Model 730's green CHARGE LED should extinguish and the red DISCHARGE LED should light on the Model 730's front panel. After observing correct battery operation and indication, reinsert the external charging power supply's plug into the AC outlet. The Model 730's green CHARGE LED should again light.

4.5 Placing the Model 730 in Service

The unit should now be ready for a long, uneventful life. Normal operation should find the green CHARGE LED lit steadily.

5. Technical Notes

5.1 Battery Charging Time

The Model 730's recharging time depends upon the external charging power supply's DC battery output current. The recharge time for the Model 730 is typically related to the output load. The greater the output load the longer the battery recharge time will be. This is because most battery charging and DC battery output functions share the same DC energy generated by the circuitry. When the DC battery output is loaded to its 2 A maximum rated value, the recharge time for fully discharged batteries is on the order of 24 hours. As the output load decreases, more energy is available to charge the batteries. An output load of 1 A will reduce the recharge time to something less than six hours. With no load on the DC battery output, the recharge time will be in the range of just three hours.

Note that in most real-world cases the batteries will supply energy for only a limited period of time before being recharged. This is because most AC failures are of a relatively short duration. A recharge process would generally start with batteries that are not in their full-discharged state. In this fairly typical scenario the recharge time would be considerably less than the 24-hour worst-case figure.

5.2 Ambient Temperature

As previously mentioned, four 12 V, 7.2 Ah sealed lead-acid batteries are contained in the Model 730. A large book could be written on how various factors impact the long-term performance of such batteries. But instead of boring you with a book, we'll simply review a few of the issues. The battery charging voltage, charging rate, discharge rate, and discharge depth all greatly impact the length of time a battery will provide adequate performance. (This "adequate" performance would be measured in months or years.)

What is entirely installation dependent is ambient temperature. A simple rule of thumb is to strive to locate the Model 730 in an environment that is maintained at a 68-degree Fahrenheit (20-degree Celsius) ambient temperature. This is an excellent temperature as it promotes both optimum battery life and good battery performance. Note that an elevated ambient temperature serves as a very effective destroyer of battery life. For example, changing the ambient temperature to 104 degrees F (40 degrees C), compared to the recommended 68 degrees F (20 degrees C), will reduce the battery life by well over 50%!

5.3 Battery

The Model 730 contains batteries that are optimized for general-purpose use. The batteries are recommended for applications that have repeated charge/discharge cycles. In the Model 730 they should provide a minimum three-year operating life with proper charging techniques.

6. Incorrect Operation

6.1 Review Practice

Should problems arise in the opera-tion of the Model 730, please review Section 3–Installation and Section 4–Testing and Operation in this practice.

6.2 AC Outlet

If the CHARGE LED does not light, reconfirm that the AC outlet is functioning by plugging another piece of equipment into the outlet. Verify that the external charging power supply is turned on. To confirm that proper charging voltage is being produced, check the external power supply output that is charging the Model 730 Battery Module. If possible, use a digital voltmeter to check the connected equipment's DC battery output for a nominal 54 Vdc; a reading of 53 to 55 V would be considered normal when AC power is present to the connected equipment and the batteries are fully, or nearly fully, charged. If the AC outlet is okay, and the measured DC voltage is 53 V to 55 V but the green CHARGE LED doesn't light, the Model 730 needs to be returned to the factory for repair.

6.3 Output Overload or Short Condition

Finding the red DISCHARGE status LED lit with AC present to the external charging power supply would typically indicate that an overload condition is being placed on the Model 730's DC battery output. This will occur whether the output is being fully shorted, or has a load that is attempting to draw more than approximately 3.5 A. Carefully recheck the wiring and equipment being powered. "Shed" all of the load to ensure that an overload is not present. Note that it may take several minutes for the protection components to cool sufficiently to again allow normal operation.

6.4 Application Limitations

The Model 730 was designed to operate correctly in many applications. However, Gordon Kapes, Inc. does not guarantee the Model 730 to be compatible with every specific application. All functions of the installed Model 730 should be thoroughly tested before the unit is placed into service.

6.5 Save Time

You are encouraged to email or call Gordon Kapes, Inc. for technical support. Please email support@gkinc.com or refer to the web site, www.gkinc.com, for the applicable telephone number. We do not mind "walking" you through an installation, or performing a verbal review prior to your actually getting started. Please have these items with you: a copy of this technical practice, system configuration documentation, and adequate tools, including a digital volt-ohm meter (VOM).

7. Maintenance

7.1 Maintenance

The Model 730 requires no normal maintenance. It is recommended that the unit be examined not less than every six months to confirm proper CHARGE LED status indication.

7.2 Battery Replacement

The Model 730's internal batteries should provide reliable service for a minimum of three years, with six or more years possible. Refer to Section 5.3 of this technical practice for details. Variables that can effect battery life include the number of charge/discharge cycles and ambient temperature. A label, attached to the back of the enclosure, indicates when the batteries were installed at the factory. This can be used to "guess" when the batteries will require replacement. However, the only true test of battery quality is to place a known load across the Model 730's DC battery output, disconnect the AC input power to the external charging power supply, placing the unit under battery operation, and then measuring the time until the unit automatically "shuts down." If the measured time deviates significantly from the published specification, the batteries need replacement.

8. Repair and Replacement

8.1 Not So Fast

Statistically, most equipment returned to Gordon Kapes, Inc. for repair actually has nothing wrong with it. An email or telephone call to Gordon Kapes, Inc. technical support can often help get the equipment operating correctly. We don't mind spending time with our customers getting a site up and running.

8.2 Send it Back

If you determine that the Model 730 is defective, return it for repair or replacement according to the Gordon Kapes, Inc. Warranty/Repair and Return policy. We request that you obtain a return authorization number prior to returning any equipment.

8.3 Only We Fix It

In the event repairs are ever needed on your Model 730, they should only be performed by Gordon Kapes, Inc. Do not remove the cover as it will expose you to hazardous voltages.

9. Specifications

DC Input Voltage:

54.5 Vdc to 55.2 Vdc Trickle Charge Method
58.0 Vdc to 59.6 Vdc Cycle Charge Method

Max Input Current:

1.08 A, maximum with Trickle Charge Method
2.80 A, maximum with Cycle Charge Method

Output Voltage: 48 Vdc, nominal, battery operation

Output Current: 2.0 A continuous, maximum

Output Protection:

Type: solid-state, automatic reset
Current required for automatic output shutoff: 3.5 A, nominal

Batteries: 4

Type: 12 V, 7.2 Ah, sealed lead-acid
Transportation: classed as "Non-Spillable"

Battery Operating Time (Nominal):

3 hours, 2.00 A output load
5 hours, 1.20 A output load
10 hours, 0.60 A output load
20 hours, 0.30 A output load

Battery Charge Time (Nominal):

24 hours, 0.65 A
6 hours, 1.30 A
3 hours, 2.60 A
Figures reflect charging process beginning with batteries in fully discharged state

Automatic Battery Disconnect: to prevent deep discharge to the batteries the connected equipment must provide a nominal 41 V low voltage cut out

Output Connectors: 1

Functions Supported: ground and DC battery output
Type: Molex® Mini-Fit, Jr.™ 6-position dual-row header
Mating Connector: Molex Mini-Fit, Jr. 6-position dual-row receptacle, suggested Molex part number 39-01-2060; suggested crimp-on female terminals Molex part number 39-00-0039.

Interconnecting Cables: One interconnecting cable required for every installation; purchased separately, not included with Model 730. Various lengths and configurations available from Gordon Kapes, Inc.

Battery Status LED Indicators: 2
Functions: CHARGE, DISCHARGE

Safety Compliance: Underwriters Laboratories, Inc. UL-60950 Listed

Radiated Noise Compliance: complies with FCC Part 15, subpart J, class A for radiated and conducted emission

Operating Environment: 68 degrees F (20 degrees C), nominal. Intended for operation in commercial environment where air conditioning is present. Operation at temperatures greater than recommended will significantly reduce battery life.

Dimensions (Overall):
2.9 inches high (7.4 cm)
17.0 inches wide (43.2 cm)
9.1 inches deep (23.1 cm)
Figures reflect no mounting brackets attached

Mounting: wall, 19-inch rack, or 23-inch rack mounting kits available, purchased separately. A mounting kit is required for every installation; not included with Model 730.

Weight:
32.7 pounds (14.9 kg)
35.2 pounds (16.0 kg), shipping weight
Figures reflect no mounting brackets attached

Specifications and information contained in this technical practice subject to change without notice.