

## Technical Note

Freedom Inverter/Charger  
512-0080-01-01 Rev 1

# Controlling Charging Current on Deeply Discharged Gel Batteries

## Overview

This technical note discusses charging deeply discharged gel electrolyte batteries using the Xantrex Freedom Inverter/Charger and the Freedom Remote Panel or the Link 2000.

## Problem—Overheating batteries during charging

The gelled electrolyte battery chemistry and construction may present a charging problem when some gelled batteries are discharged below 80% of their capacity. The problem occurs when deeply discharged batteries recharge inefficiently and most of the charge current produces heat rather than a chemical reaction necessary for recharging. This charging inefficiency can cause the batteries to overheat and go into a thermal runaway condition that can destroy the battery.

A gelled battery is at 80% discharge level when the open circuit terminal voltage measures 11.80 VDC to 12.00 VDC depending on the manufacturer. The open circuit terminal voltage is measured after the batteries have been at rest for 1 to 3 hours with no load or charge source present.

## Solution—Limiting the charge

You can use your Xantrex Freedom inverter/chargers to prevent an overheating condition during recharge by limiting the charge current once it has been determined the batteries have been discharged below 80%. The goal is to limit the charge current to a percentage of battery capacity. Depending upon the chemistry of the battery, the current should be limited between 4% and 25% of capacity. If you have a 400 amp-hour bank the charge current will be limited to 100 amps or less.

The methods for current limiting require positioning the dip switches on the Freedom standard remote panel or selecting the proper battery type in the setup mode of the Link 2000.

## Using the Freedom Remote

There are two steps to limit the charge current using the Freedom Remote: setting an appropriate voltage for the charge then setting the charging current.

**Setting the charging voltage**

There is an 8-position DIP-switch on the back of the Freedom remote. You will need to position dip switches 2 and 3 on the Freedom remote for setting the charge voltage for gel batteries depending upon the ambient temperature of the batteries. The voltages are 14.4 VDC for cool climate (lower than 80 F) and 14.1 VDC for warm climate (higher than 80 F). Select the appropriate setting.

Switch Position	Charge Voltage	Float Voltage	Equalize Voltage
2 off, 3 on	14.4 VDC	13.8 VDC	14.4 VDC
2 on, 3 on	14.1 VDC	13.8 VDC	14.1 VDC

**Limiting the current**

Once the voltages are set up the current can be limited in two ways: by using the equalize charge or using power sharing. If the serial number of the unit is at or above the number listed below you can set the unit for equalize charge and accomplish an 8 hour timed, current-limited charge at the equalize voltage. Note: When the battery type is set for gel batteries the equalize voltage is equal to the acceptance voltage.

Model	Serial Number	Current Limit	Serial Number	Current Limit
Freedom 10	112809	6 amps DC	122603	8 amps DC
Freedom 20	111965	6 amps DC	127058	16 amps DC
Freedom 25	111118	6 amps DC	121252	24 amps DC

**Equalize charge**

To limit the current using the "equalize feature" , turn DIP switch number 1 to the "on" position and immediately back to the "off " position. Using a Link 2000 requires that equalize mode be activated through the setup button, the Link owners manual covers this procedure in detail. When this method is used the unit will return to the normal charge mode following the 8 hour equalize charge without any more user intervention.

**Power sharing**

The second method of charger current limiting can be set by DIP switches 7 and 8 which set power sharing. This method limits the amount of AC current available for the charger to use. The limits are the same for the Freedom 10 and Freedom 20 and differ slightly with the Freedom 25. Power sharing on a Link 2000 is changed through the setup button, please refer to the Link owners manual.

Model	Switch setting	Power share	Charge current
Freedom 10,20,25	7 on, 8 on	5 Amps	25 amps DC
Freedom 10 any other 15,20 &30 Amps			50 amps DC
Freedom 20	7 off, 8 on	15 Amps	75 amps DC
Freedom 20	7 on, 8 off	20 Amps	90 amps DC

Model	Switch setting	Power share	Charge current
Freedom 20	7 off, 8 off	30 Amps	100 amps DC
Freedom 25	7 off, 8 on	20 Amps	90 amps DC
Freedom 25	7 on, 8 off	30 Amps	130 amps DC
Freedom 25	7 off, 8 off	unlimited	130 amps DC

If there is any AC load operating on the output of the inverter, the currents in the table will be further reduced.

### **Multiple inverter/chargers**

In an application that employs two or more inverter/chargers the battery banks are usually large enough that one of the chargers can be turned off and the remaining charger allowed to charge at full current. The default mode of charger operation is for the charger to come "on" automatically without regard to the position of the on/off switch either on the unit or on the Freedom remote. Chargers being controlled by a Link 2000 require that the charger be turned on using the "Charge" button on the Link. To change the mode of charger operation to respond to the Freedom remote on/off switch simply turn DIP switch number 4 to the "on" position.

## **Using Link 2000**

Voltage setting, equalize charge, and power sharing are all set from the setup menus. Refer to the *Link 2000 Owner's Manual* for complete instructions.

## **Conclusion**

While the current limiting of the charger will increase the time it takes to recharge the batteries from a deep discharge condition, it will prevent overheating and therefore battery damage. The current limiting method that is used is based on the size of the battery bank and the recommendations of the battery manufacturer. The most trouble-free current limit setup is the equalize mode. The charger will automatically reset to normal operation following the equalize cycle. The drawback of this mode is that the charge current is very low. Knowing the battery bank size, in amp hours, and the recommended charge current limit set by the manufacturer is critical in recharging deeply discharged gel electrolyte batteries.

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