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## MX921 Option T46

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### INTRODUCTION

The MX921 has been design around low power consumption, to maximize operation time when used in conjunction with battery(s) powered sites. To insure maximum efficiency of the radio and to insure maximum efficiency from your Battery system, we have developed option T46, Low Loss Solar Regulator and intelligent Battery Manager.

Typical other types of battery managers have high volt drop due to there design or the necessity of a diode on the solar panel. With the T46 option we have removed all the unnecessary volt drop caused by diodes and employing an efficient Switching mode regulator system to achieves 99% charging efficiency. This technique is virtually lossless and disconnects the Solar Panel from the Battery when the end float voltage has been reached. It has the added advantage of not generating any electrical noise.

The intelligent Battery Manager automatically stops the solar panels, wind generator or other power source from charging the battery when the battery is fully charged.

### Special features

- Plug and Play installation with MX921.
- MX921 Front panel power on/off control.
- LED readout to show the status of the solar charging system and batteries.
- User Adjustable Control Settings for different types of batteries systems.
- Very low voltage loss. Using extremely low resistance FETs, the voltage drop across the controller from the Solar Panel to Battery and from Battery to MX921 is much lower than other third party controllers
- Over Volts protection.
- Over Charge protection.
- Deep discharge protection
- Reverse Polarity protection

### Operation information

To maintain a long battery life, it is desirable to use only a small part of the total battery(s) capacity before recharging. Each time the batteries are run down and charged up, the batteries undergo a charge/discharge cycle. If more than half the battery's stored energy is discharged before it is recharged, this is called 'deep cycling'. Solar systems normally do one shallow cycle per day, but during 'low sun' periods may undergo much deeper discharges (system dependent). For maintaining a long battery life, the shallow cycle should be less than 20 per cent of battery capacity and the deep cycle less than 80 per cent. So when choosing your battery(s) insure you take this into account.

It is possible to damage batteries by overcharging them. Some solar panels have an output voltage which is claimed to be low enough to stop charging above 15 volts and to be 'self regulating'. However, because their open circuit voltage is still +18 volts or so, they will actually continue to charge with a much reduced current. Most conventional panels will deliver full power up to about 18 volts and therefore an external Low Loss Solar Regulator and intelligent Battery Manager (option T46) is required.

The Loss Solar Regulator and intelligent Battery Manager continuously monitors the battery voltage and will disconnect the load if the voltage is higher than 15V in the factory default position. This is Over Volts protection. Like wise when the voltage reaches higher than 13.8V in the factory default position the solar panel is disconnected. This provides over charging protection.

When the battery is below 11V in the factory default position the battery manager will hold the battery system disconnected for a period of 2:30min. This is done to prevent oscillations in the circuit due to battery(s) voltage recovery.

When the Battery's voltage is below the set voltage point, the Solar Panel is connected to the Battery via the low loss switching FETs. During the charge process the terminal voltage will slowly rise until the voltage rises above the switch point, at which time the Solar Panel is disconnected.

In normal operation, the Batteries terminal voltage will hence cycle between the hysteresis points of the controller. The default setting is to stop charging when the Battery terminal voltage reaches 13.8 Volts and charge below 13.3 Volts.

This method has the advantage not requiring any lossy voltage conversion and transfers the maximum power from the Solar Panels during the charge process.

## Charge limitations and precautions

For correct operation, the Solar Panels output current capability should not exceed the charge current rating of the battery. This is because the charge current is not monitored or controlled. If the Battery used is too small or the available Solar Panel current is too big, the Battery's terminal voltage will be forced to rise to fast resulting in early disconnection. A continual cycling may result when the Battery has not actually finished charging.

As a guide, if a 100Ahr Battery is used, the optimum charge current is one tenth that of the Amp Hour rating. ie. 10Amps. Use a Solar Panel with less than 10Amps output. Generally a standard Polycrystalline 180 Watt Panel array outputs 18Volts at 10 Amps. Some Batteries may have a higher or lower charge current capability, so please check your Battery manufactures specifications. The correct system operation is the responsibility of the person setting up and installing the system.

## LED Indicators

LED indicators have been fitted to the T46, Low Loss Solar Regulator and intelligent Battery Manager to provide indication of the current status of battery and solar panel. Please see Table 1 below.

Led Colour	Function
Blue (LED8)	Lights when Load is connected to Battery
Blue (LED3)	Lights when power source is connected
Aqua (LED2)	Lights when Solar panel volts connected
RED (LED1)	Lights when a Solar panel is connected reverse polarity
RED (LED7)	Lights when the power source is connected reverse polarity.
Green (LED4)	Lights when Battery charging
Yellow (LED5)	Lights when battery volts is Over Volts
Amber (LED6)	Lights when battery flat

Table 1

## Intelligent Battery Manager Setup

The T46 comes from the factory preset. The preset settings are set via Jumpers.

JMP	Function	Connect	Disconnect
2	Battery Flat Volts	12V	11V
3	Over Volts	15V	16V
4	Charge Volts	13.3V	13.8V

Table 2

The battery manager has the facility provides the ability to set user define protection levels. This is done by removing the factory preset jumpers and adjusting the corresponding potentiometer. See Table 3 Below.

Note the potentiometers will only set the function Voltage connects points only. The voltage difference between connect and disconnect will remain the same ratio as seen in Table 2.

Potentiometer	Function
RV1	Battery Flat Volts
RV2	Over Volts
RV3	Charge Volts

Table 3

## Installation

The option board provides ease of installation within the MX921 Radio. Follow the following simply steps.

1. Remove the top cover from the MX921.
2. Locate in the front right hand corner four mounting standoff.
3. Now overlay PCB and fasten 4X M3 screws.
4. Remove Power supply cable from PA and chassis Power Socket.

5. Remove the PA Connector plug from power wiring and connect the wiring to the T46 PCB connector marked Input . (Make note of polarity before removing as reconnection is required in next step)
6. Connect the figure8 cable supplied to PA connector plug and also the thinner radio supply wires. Attach the other end to T46 PCB connector marked TO PA. Insure correct polarity.
7. Connect the smaller length of figure8 cable. Connect (+Ve) RED & (-Ve) Red with black strip to T45 PCB connector marked Solar and the other end to CN5 pin1 (+Ve), CN5 pin2 (-Ve). See section below on CN5 DC Power Input)
8. Refit power socket to radio chassis.
9. Solar Panel Ground maybe connected to -ve of battery or pin 2 of supply Plug.
10. Fit SKH jumper cable between radio and option board. This provides front panel switch ON/OFF function.

## CN5 DC Power Input

DC power is connected to the transceiver through this connector. The transceiver is fitted with a 3-pin male connector. For 50W transceivers pins 2 and 3 are used for the 12V DC pin 1 is unused. Connect Solar panel (+) positive wire to this unused pin. The power lead to the transceiver should be made from a gauge of wire suitable to ensure less than 0.5V drop at 10A for the required length of the lead.

PIN No	Function
1	Unused \Solar Panel input used in conjunction with T46 Option
2	Ground
3	+ 13.8VDC

Table 4 CN5 DC Power Input Connections



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Revision 1.0 Thursday, 16 March 2006

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