2. Installation and Operation

2.1 Installation

MX800 series radios are securely packed for transport with special end packers within a pasteboard container. Before unpacking the MX800 radio, please inspect the packaging for signs of damage and report any damage to your MX800 distributor.

Upon unpacking of the MX800 radio, please ensure that all items shipped were received, report any missing items to your MX800 distributor.

All ports on the rear of the radio should be carefully examined to ensure that packaging has not become wedged inside them. It is very important to examine the fan as operation of the radio will be affected if any packaging or shipping damage causes the fan to stop working.

If you intend to install the radio in an equipment rack consult the suppliers instructions for your system. Spectra Engineering recommends that the radio be secured into the rack system using four screws through the mounting holes in the front panel near the handles. If the radio is to be used in a stand-alone configuration, ensure that it is in a secure, dry location with sufficient air space around it to allow for adequate ventilation. It is recommended that the chassis is earthed to the equipment rack.

Equipment connection details are located in Appendix 7.1. The MX800 will draw approximately 10A (band dependent) on transmit and the gauge of the DC cable fitted to the 12V supply connector should be adequate to ensure less than 0.5V volt drop at this current.

2.2 Operation

The MX800 can operate in local control mode via the front panel controls, stand alone repeater mode, or may be remotely controlled through the line port. Setting up the MX800 to operate in the wanted mode is straightforward and involves four main steps.

1. Using the MX800 programming utility 'MXTOOLS' to set the software configurable parameters.
2. Setting the hardware jumpers on the Micro Controller for the required options.
3. Adjusting the levels where necessary.
4. Making the necessary electrical connections to the radio and your system.

Note that generally if the requirements have been fully specified at time of purchase steps 1 to 3 will already have been done at the factory. In the following sections the hardware aspects of the set up procedure are described.

If the set up requires a software setting a cross reference to the MXTOOLS User Manual is quoted.

2.2.1 MXTOOLS Utility

MXTOOLS is a programming utility used to program channel data, configure and perform remote diagnostics on the MX800. It runs on a PC compatible computer and use of the program is covered by the MXTOOLS User Handbook. This technical manual should be used in conjunction with the MXTOOLS User Handbook.

2.2.1.1 MX800 Networking

At sites where more than one MX800 is located it is possible to "bus" the RS232 lines to allow up to 16 MX800s at one site to be addressed on a single RS232 port. Hardware facilities provided on the MX800 Micro controller card provide isolation between transmit ports. When MX800s are bussed in this way JMP24 in each radio must be set so that

1.   At least one radio and no more than four are set as masters.

2.   All other radios are set as slaves.

Refer to Table 2-1, section 2.2.2.1 for details.

In addition to this, each radio must be assigned a unique address. This address is assigned as a binary code through CN3. Four address lines are available on input port A where bit 4 is the LSB and bit 7 is the MSB. These lines should be pulled high or low depending upon the setting of JMP19. Default is active low so that GND = Logic 1, Refer section 5.1.3.

The RS232 cable should be made up such that all MX800 transmit ports (TXD) are commoned and connected to the PC receive port (RXD) and all MX800 receive ports (RXD) are commoned and connected to the PC transmit port (TXD).

MXTOOLS automatically polls the bussed radios to determine which addresses are active when the "Use Network" button is selected in the initial connect screen (MXTOOLS version 2.8.1 or later).

2.2.2 Setting to Work

The following sections describe the steps necessary to set the MX800 to operate as required.

2.2.2.1   Set Micro Controller Jumpers

The micro controller layout is contained in the drawings section and the position of the jumpers and DIP switches (highlighted) are shown below. The jumpers and switches are used for setting the general configuration of the audio processing for both the TX and RX paths as well as various miscellaneous functions.

Table 2-1 below summarises the functions of the jumpers.

JMP	Function / Description	Default Selection	Default Position
JMP 1	Selects either default RUN or EMULATE mode for the micro processor.	Run	2-3
JMP 2	Enables the WATCHDOG auto reset function in the microprocessor.	Enabled	1-2
JMP 3	Enables or disables the PRE-EMPHASIS for the TX audio.	Enabled	1-2
JMP 4	Enables or disables the COMPRESSOR for the TX audio.	Enabled	1-2
JMP 5	Enables or disables the HIGH PASS FILTER for the RX audio.	Enabled	2-3
JMP 6	Enables or disables the LOW PASS FILTER for the RX audio.	Enabled	2-3
JMP 7	Enables or disables the DE-EMPHASIS processing for the RX audio.	Enabled	2-3
JMP 8	Enables a direct connection to the TX modulator. Select either Wide Band or Wide Band filtered and limited or nil.	DC-FM	1-2
JMP 9	TX VF loopback control. Trunking LIFUISEN function. The function polarity or nil can be selected.	Active low	1-2
JMP 10	Controls the direction of the RS-232 TX and RX data.	Swap	2-3

JMP 11	Controls the direction of the RS-232 TX and RX data.	Swap	2-3
JMP 12	Trunking RX Talk function. Disables RX VF to line and TTR VF. The function polarity or nil can be selected.	Active low	1-2
JMP 13	Enables or disables the HIGH PASS FILTER for the TX audio.	Enabled	1-2
JMP 14	Repeater enable. Trunking LIFULOCEN function. The function polarity or nil can be selected. Note that this control is in parallel with DIP S/W 2/3	Active low	1-2
JMP15	Selects the connection for the common pin on the digital I/O connector to either ETH or + 5 volts.	ETH	2-3
JMP16	Enables or disables the Low frequency HPF used for the Repeater VF routing.	Enabled	1-2
JMP17	Selects the Mute / Squelch output polarity to either normally high or low.	Active low	1-2
JMP 18	Trunking TX Talk function. Disables TX VF to line and TTR VF. The function polarity or nil can be selected.	Active low	1-2
JMP 19	Selects either internal pull up to 5V or internal pull down to ETH for digital input on D25 connector	Pull up	2-3
JMP 20 JMP 21	Selects modem discriminator audio source. *Optional PCB fitted* Modem audio via opt PCB: JMP20 fitted JMP21 not fitted Modem audio bypass opt PCB: JMP20 not fitted JMP21 fitted *Optional PCB not fitted* Modem audio bypass opt PCB: JMP20 fitted JMP21 not fitted Note in this case a link is fitted between SKK1 and SKK2	Modem audio disconnected	Both links not fitted

JMP 22	Microphone gain. Fit this jumper to increase mic gain 33dB	Low gain	Not fitted
JMP 23	Enable tone to speaker. Fit this jumper to enable tone	Disabled	Not fitted
JMP 24	RS232 port termination. This jumper allows an internal termination to be selected or not for bussed RS232 connections. Up to 16 units may be bussed. Normal: Non-bussed mode. No resistor fitted. D10 out of circuit. Master: Bussed mode. 4K7 resistor across D10. Configure at least one and no more than four MX800 in this mode when multiple units connected. Slave: Bussed mode. D10 fitted, no resistor. Configure balance of bussed units in this mode.	Normal	1-2
JMP 25	Mute defeat enable. Mute defeat cannot be used if RX TALK line is required. To use mute defeat remove JMP12 and fit JMP 25. The control signal polarity can be inverted by changing the position of JMP25. Active low control: JMP25 2-3 Active high control: JMP25 1-2	Disabled	Not fitted

Table 2-1 Micro Controller Jumpers

When the MX800 option card is not fitted there is no connection made to SKK (Aux 2 connector) on the micro controller. Links should be placed across SKK1-2 (Discriminator audio), SKK11-12 (TX supply) and SKK13-14 (RX supply). These links are normally fitted in production.

2.2.2.2   Select Operating Mode

The MX800 can operate in a number of different modes. The primary alternatives are full duplex, which is the default mode, repeater and simplex. Using MXTOOLS the operating mode is programmed for each channel. When a channel is selected in operation the MX800 adopts the mode programmed for that channel.

The operating mode programmed in the software can be modified by the settings of DIP switch 2. The functions of this switch are detailed in Table 2-2 below.

SW 2	Function	Description	Def Select
1	PTT Delay	Enables 50mS delay of PTT for use with simplex function.	OFF
2	Simplex Enable	Enables simplex function*	OFF
3	TX Timer	Sets programmable TX time out timer on	ON
4	Repeater Enable	Enables repeater function*	OFF
5	TX VCO on continuously	Switches TX VCO on continuously	ON
6	Scan on	Selects the receiver to enable the scanning of programmed scan channels	OFF

Table 2-2 DIP Switch 2 Settings

Note The Repeater Enable functions as follows:

If the switch is ON and the channel is programmed as a repeater channel (using MXTOOLS) the MX800 will act as a repeater. If the switch is OFF the MX800 will remain in full duplex mode even if the channel is programmed as a repeater. The Simplex Enable operates in a similar way.

In the case of the Repeater Enable function, the Repeater Enable on Pin 8 of the DB15 Line connector is effectively in parallel with SW2/4. If SW2/4 is OFF the function may be controlled through this external line. JMP 14 selects the control polarity in that case.

2.2.2.3   Select Operating Channel

The MX800 has a channel capacity of 255. The RF and CTCSS frequencies for each channel are programmed using MXTOOLS Channel Information screen. There are four ways of selecting the operating channel.

1. *DIP Switch 8-way.* DIP switch SW1 provides a binary channel selection facility. When a switch is ON it is read as a logical 1. When all switches are off the software channel select mode is enabled.

2. *Rear channel select port.* Digital input port B provides an 8 way Binary or BCD channel select input. Binary or BCD coding is selected using MXTOOLS. If Binary is selected 255 channels are accessible. If BCD is selected 99 channels are accessible.

3. *Software channel select.* If DIP switch SW1is set to 0 then it is possible to send a software command to the radio to select the channel.

4. *Front panel Push-wheel switches.* If this option is fitted the rear channel select port is internally wired to the Push-wheel switches however the rear channel select function is still in parallel with the Push-wheel. The rear select method should not be used in this case. The 99 channels are selectable on the front panel. The same rules apply to this channel select method as apply to the rear port described below.

The following rules apply.

♦   DIP switch SW1 has priority. If DIP switch SW1 is not set to 0 the rear inputs and the software command will be ignored.

♦   If DIP switch SW1 is set to 0 then both the software commands and the rear input port will select the channel. In this case the most recent event will take priority. For example, if the rear input port is set to CH10 and a software command arrives to send it to CH15, the radio will go to CH15. If the rear input port is now changed to CH11 the radio will switch to CH11.

♦   If DIP switch SW1 is set to 0 and the radio is powered up the channel selected on the rear port will be adopted.

♦   If DIP switch SW1 and the rear port are both set to 0, on power up, the radio will adopt the last software channel selected. This may be the software channel set at the factory if the user has not used the software channel select feature.

2.2.2.4   Configure Alarms/M Lead

The MX800 has 3 open collector outputs. Two of these are assigned as alarm outputs and one (output 1) may be configured as either an alarm output or an M Lead output. If the output one is configured as an M Lead, this line is active when mute is open and CTCSS/DCS is decoded. These outputs are assigned in the Configuration screen of MXTOOLS.

2.2.2.5   Configure Digital I/O

The MX800 has 16 digital inputs and 8 general-purpose outputs. The inputs are +5V CMOS logic compatible and are buffered by a 10K resistor in series with each input. JMP19 on the Micro-Controller selects whether these inputs are internally pulled up or internally pulled low. The active state of the input is set up through MXTOOLS. Of the 16 inputs the 8 input port B inputs are allocated to the Channel Select function. Two of the input port A inputs (bit 0 and bit 1) are allocated to a power control function (see Table 2-3 below), two (bit 2 RX and bit 3 TX) are allocated to CTCSS control and the other 4 are allocated as address bits for the MX800 network mode (software V2.8.1 and higher).

Bit 1	Bit 0	RF O/P Power
0	0	100%
0	1	50%
1	0	20%
1	1	10%

Table 2-3 Power Control Function Settings

An auxiliary voltage (either +5V or GND dependant upon the setting of JMP15) is available on CN3 pin one for wiring convenience.

The 8 general-purpose outputs are +5V CMOS logic compatible and are buffered by a series 1K resistor.

2.2.3 Adjustments

There are two categories of adjustable parameters in the MX800. Those that are controlled by conventional potentiometers, which may be manually adjusted, and those controlled by digital potentiometers which are under the control of the Micro Controller. The latter category of items comprises TX power, TX VCO deviation, TX reference oscillator deviation and TX reference oscillator frequency. All of these are adjusted with the aid of MXTOOLS and all except TX power should only be adjusted as a part of a full TX VF path alignment procedure.

Following adjustment of a digipot controlled parameter the value must then be saved to the radio to make the change permanent.

Refer to section 5 'Alignment and Testing' for details.