MX800 / MX800LC Serial Network Capabilities

INTRODUCTION

The MX800 and MX800LC radio base stations have the ability to operate in a network mode using multi-drop serial communication methods. The serial network allows an addressed base station to have its radio configuration and channel information queried and updated as well as its diagnostic information read while it is connected in a rack. The serial network mode is a diagnostic tool used to verify the operation of multiple radios in the network.

Using the serial communications network, diagnostic information can be sequentially downloaded from a rack of radio base stations and displayed on multiple diagnostic screens. The update rate of this diagnostic information will depend on the serial network changeover time from base station to base station.

THE SERIAL NETWORK

The serial communications network operates on a token passing scheme. There can be only one base station actively performing serial communications when the system is operating in the network mode. The reason for this is signal degradation due to slightly differing clock frequencies, latency in command processing and differing response instances.

Sending a serial network command, usually to address a particular base station over the network starts the serial network. The initial reply from every base station will be garbled as explained earlier. Once a network command has been decoded, all base stations will actively listen on the serial network but will reply only if it is addressed. The usual response to any serial command is either "MX" for the MX800 or "LX" for the MX800LC, but this changes to "SN" when a network command is sent. This also ensures that the radio base station is backward compatible to earlier versions of MXTOOLS.

A base station will remain in network mode until one of the following conditions occur:

- the base station is reset
- the base station is re-powered (ie powered-down and powered-up again)
- the base station receives a network stop command ("NETWS")

Other base stations can be addressed on the serial network by sending a different address. Once a base station has been addressed in the network mode it will behave as if it is the only base station on that multi-drop serial line.

STARTING THE NETWORK

Attempting to address a base station with a network command will initiate the network mode. A typical method is to address a base station and ignore the initial reply; the address used need not be a valid address. This sets all base stations into network mode. Another attempt to address a base station is then performed, this time using a valid address. This should result in the correct response being received, unless there is an incompatible base station on the serial network.

A consequence of the way the serial network starts is that a list of available base stations should be maintained. Polling the network for a correct response will indicate that a radio base station exists at the addressed being polled. This method will work on base stations with hardware IDs and is used by MXTOOLS in its network mode.

STOPPING THE NETWORK

The best way to stop the system from operating in network mode is to send a network stop command, "NETWS". All available base stations will then exit from network mode and begin operating in their default mode. As all available base stations will also try to reply to the command, so the resulting received reply should be discarded.

NETWORK BEHAVIOUR

The addressed radio base station behaves as if it is the only base station on the serial cable when operating in the network mode. All other base stations listen on the serial cable but they do not respond unless addressed. This is similar to a token passing scheme where only one unit is allowed to transmit at any time.

Once a base station is addressed, it will respond to the MXTOOLS serial commands as per normal.

HARDWARE REQUIREMENTS

The following details the hardware provisions and requirements to operate the serial communications network.

MX800 RADIO BASE STATION

The newer versions of the MX800 radio base station have a jumper (JMP 24) on the motherboard to facilitate the multi-drop serial communications. Older versions of the motherboard require that diode D10 be removed. In either case the MX800 radio base station can electrically support up to 16 simultaneous connections on its serial port.

The MX800 radio base station can also use a multi-drop serial communications box, in which case, no changes are required on the motherboard.

MX800LC RADIO BASE STATION

The MX800LC radio base station requires a multi-drop serial communications box in order to operate in a serial communications network. This is because the MX800LC has not on-board provisions for multi-drop serial communications.

IDENTIFICATION METHODS

The radio base stations in a serial network can be identified using three distinct methods:

1. Hardware ID
2. Software ID using a string ID
3. Software ID using a numeric ID

The MX800LC has only the software ID as it does not have any identification provision on its rear connector. The MX800 radio base station has a DB-25 female rear connector on which 4 pins have been dedicated to identification purposes.

HARDWARE ID

The hardware ID ability exists only on the MX800 radio base station. The identification of each base station is done through the wiring of bits 4 through 7 of Port A, on the DB-25 female connector. The serial network using the hardware ID allows the simultaneous

connection of up to 16 radio base stations using a multi-drop serial connection. This is also the electrical limit for the serial line without signal degradation.

The pin designation are given in the table below:

Port A	DB-25 Pin
Bit 4	23
Bit 5	10
Bit 6	22
Bit 7	9

These pins can be connected to pin 13 of the DB-25 connector which can be either HIGH or LOW depending on the position of JMP 19 on the radio motherboard. For example, if pins 9 and 10 are connected to pin 13 on the connector, the resulting hardware ID is then 1010b (0xA) or 10. The default ID number with nothing connected is 1111b (0xF) or 15. The hardware ID overrides the numeric software ID setting changing it to the hardware ID number when the hardware ID is other than 15 (default).

SOFTWARE ID

The software ID ability exists for both the MX800 and MX800LC radio base stations. The software ID is stored in the serial EEPROM memory of the microcontroller boards. The software ID can be configured using the MXTOOLS Base Station Programming Utility. The software ID adds flexibility to the network identification scheme allowing for combinations of the IDs when addressing radio base stations.

String ID

The string ID is a 16-character alphanumeric identification string that can be used to identify a site or radio base station. The string ID can be less than 16 characters; the unused locations are filled with the space character from the right.

Numeric ID

The numeric ID is a 6-character alphanumeric identification string that can be used to identify a radio base station. The numeric ID can be less than 6 characters; the unused locations are zero filled from the left. The hardware ID

number overrides the numeric ID, copying the hardware ID number to the numeric ID when the hardware ID is other than the default value.

NETWORK ADDRESSING METHODS

There are a number of methods to address a base station on the serial network. These methods are listed below and are arranged by their serial network commands. Any base station on the serial network will enter the network mode once the command is decoded.

NETWA Use only the hardware ID number. This is valid only for the MX800 radio base stations, which have a provision for hardware ID.

NETWB Use both the numeric and hardware ID. This should not be used as the hardware ID overrides the numeric ID.

NETWC Use only the string software ID. This will work for both the MX800 and MX800LC radio base stations.

NETWD Use both the string software ID and the hardware ID. Once again this is valid for only the MX800 radio base stations.

NETWL Use the complete software ID (both the string and numeric IDs). This will work for both the MX800 and MX800LC radio base stations.

NETWN Use only the numeric software ID. This will work for both the MX800 and MX800LC radio base stations.

A list of base station IDs will need to be maintained in order to facilitate addressing the base stations on a serial network.

THE MXTOOLS SERIAL NETWORK

MXTOOLS has a serial communications network mode that operates on a token passing scheme. This feature is available on MX800 radio base stations having firmware version v2.8.2 or later. The serial network is a multi-drop network where all base stations have their serial communication lines tied in parallel.

Once a base station receives the token, it responds as if it is the only base station on that serial network. Only the addressed base station will respond to commands from MXTOOLS, the remaining base stations will parse the commands but will not reply. All functions of MXTOOLS operate as per normal. This continues until another base station is addressed on the serial network.

The MXTOOLS serial network currently only works with the MX800 radio base stations. Support for the MX800LC radio base stations will be provided in future releases of MXTOOLS.

CONNECTING TO THE SERIAL NETWORK WITH MXTOOLS

Connection to the serial network begins by polling the network for a list of available base stations on the multi-drop serial communication line. This is done via the "Poll Network" button on the "Serial Network Connect" screen in MXTOOLS. Once a list of available radio base stations has been obtained, a base station can be selected using the radio button on the "Serial Network Connect" screen and clicking the "Select" button. The serial network is started once a base station is selected. The radio configuration information is then automatically downloaded to MXTOOLS. It should be noted that the channel information is however **NOT** downloaded. It is important to remember this especially when changing the RF settings in the radio configuration screen. It is recommended that the serial network be used for retrieving diagnostic information rather than remotely configuring radio base stations.

As previously stated, once the network mode is entered, the base stations remain in that mode unless a network stop command is sent or all the base stations are reset. Selecting the appropriate radio button and clicking on the "Select" button in the "Serial Network Connect" screen does the selection of another base station in the network.