MOTOROLA

INPUT/OUTPUT SPECIFICATIONS FOR EXTERNAL CONTROLLERS

For *Quantar* and *Quantro* Stations

1 OVERVIEW

The *Quantar* and *Quantro* stations can be connected to external third-party controllers to accommodate various system applications. Connections between the station and the external controller equipment typically involve the following primary interface signals (available on the station backplane System Connector #17):

- Line 1 + and Line 1 —
- Aux TX Audio (or Aux PL Audio)
- Aux RX Audio
- Carrier Indication + and Carrier Indication —
- PTT + and PTT —

To facilitate making connections between the station and external controller, this section provides electrical characteristics, frequency response curves, and other interface details for the primary interface signals.

Note *When the WildCard option is purchased (required to configure inputs/outputs for connection to an external controllers) and is then enabled (via the RSS), the pre-defined functionality of the signals on System Connector J17 as shown in the Backplane section of this manual (e.g., J17-Pin 22 is Ext PTT +, J17-Pin 11 is Ext Failsoft, etc.) is lost.*
In order to restore the pre-defined signals, you must press ***F4*** *(SET TO DEFAULT) on any of the WildCard RSS screens. Doing so automatically creates a set of WildCard Tables that now determine J17's signal functionality. The* ***Editing WildCard Tables*** *section (page 8) may now be used to change the signal functionality, as desired.*

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68P81096E86–O
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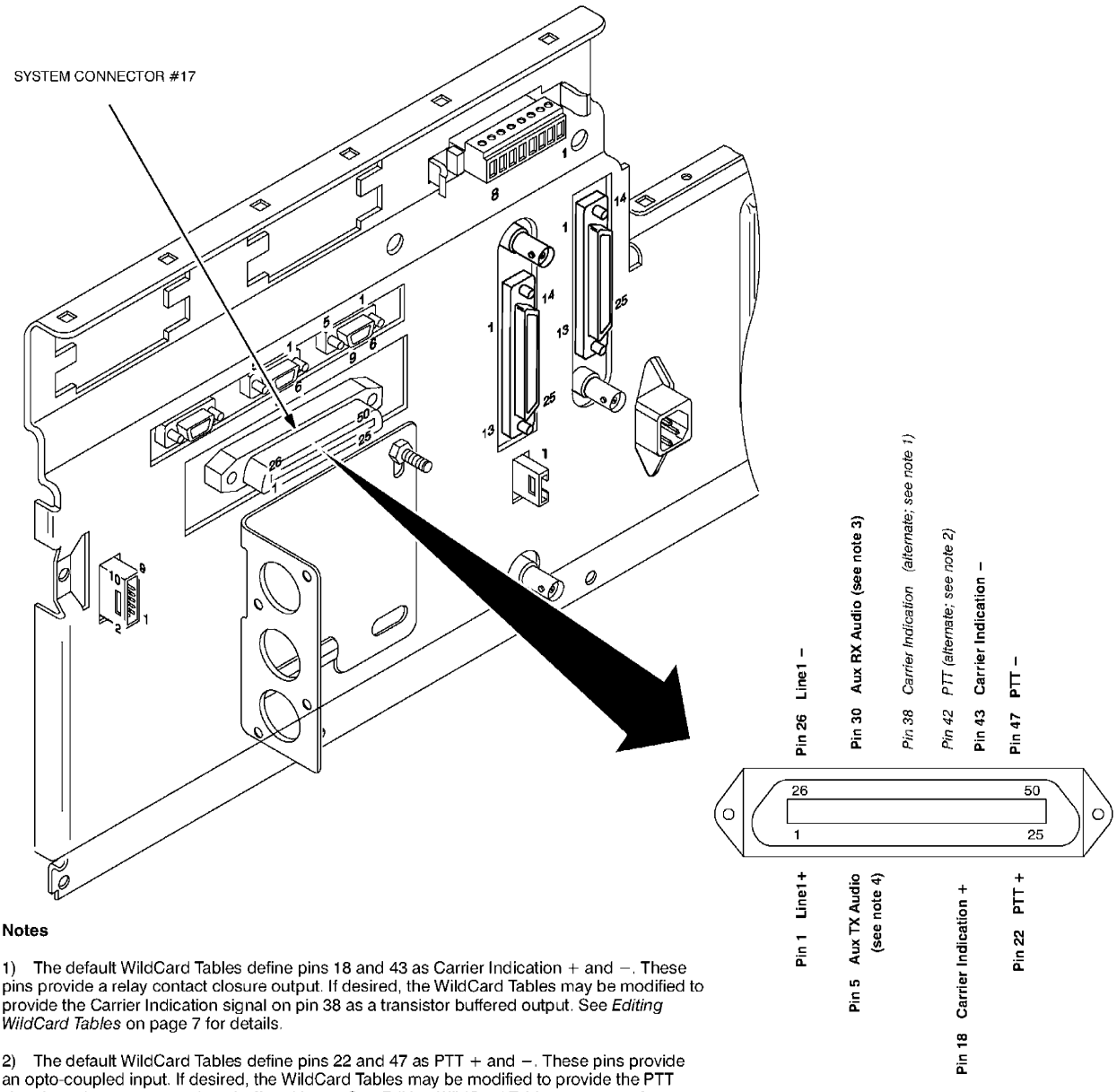
2 ELECTRICAL CONNECTIONS

Figure 1 shows the pin-out locations of the primary interface signals available on System Connector #17.



Notes

1) The default WildCard Tables define pins 18 and 43 as Carrier Indication + and –. These pins provide a relay contact closure output. If desired, the WildCard Tables may be modified to provide the Carrier Indication signal on pin 38 as a transistor buffered output. See *Editing WildCard Tables* on page 7 for details.

2) The default WildCard Tables define pins 22 and 47 as PTT + and –. These pins provide an opto-coupled input. If desired, the WildCard Tables may be modified to provide the PTT signal on pin 42 as a transistor buffered input. See *Editing WildCard Tables* on page 7 for details.

3) Stations shipped from the factory are programmed with no signal at pin 30. In order to program this pin for Aux RX Audio, refer to *Editing WildCard Tables* on page 7.

4) Stations shipped from the factory are programmed with no signal at pin 5. Depending on the application, this pin may be programmed for AUXPL Audio or Aux TX Audio In order to program this pin for AUXPL Audio or Aux TX Audio, refer to *Editing WildCard Tables* on page 7.

Figure 1. Signal Locations on System Connector #17

3 ELECTRICAL CHARACTERISTICS

This section provides the electrical characteristics, frequency response curves, and other interface details for the primary interface signals.

Line 1 + and Line 1 — (J17–Pins 1 and 26)

General Characteristics

Line 1 + and Line 1 – provide a balanced phone line input for incoming audio signals to the station. The input impedance is set by jumpers located on the Wireline Interface Board. The jumpers are set at the factory for 600Ω impedance. You may change the impedance (if desired) by changing the jumpers as described in the appropriate (4-wire or 8-wire) Wireline Interface Board section in this manual.

Phone Line Specifications

Most telephone companies recognize either "3002" or "Type 5" as designations to define phone line types and associated electrical specifications. Telephone lines meeting the specifications for either of these types are acceptable for use with the *Quantar* station. The following table shows the specifications for "3002" and "Type 5" phone line types.

Type 5 and "3002" Phone Line Specifications

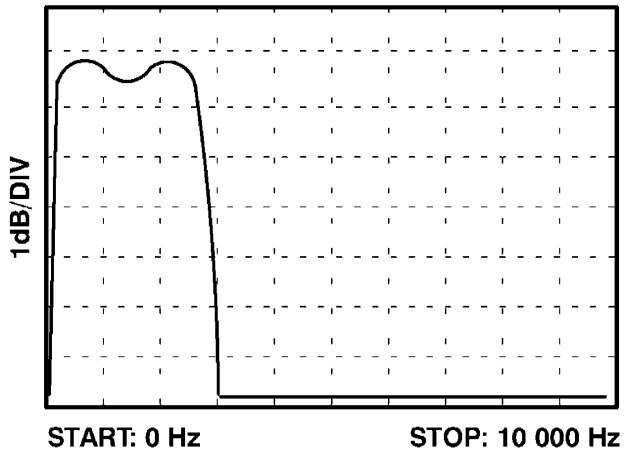
Parameter	Type 5 Specification	3002 Specification
Loss Deviation	±4.0 dB	±4.0 dB
C–Notched Noise	51 dBrnCO	51 dBrnCO
Attenuation Distortion: 504 to 2504 Hz 404 to 2804 Hz 304 to 3004 Hz	 –2.0 to +8.0 dB –2.0 to +10.0 dB –3.0 to +12.0 dB	 –2.0 to +8.0 dB spec not available –3.0 to +12.0 dB
Signal to C–Notched Noise Ratio	≥ 24 dB	≥ 24 dB
Envelope Delay Distortion: 804 to 2604 Hz	1750 µsec	1750 µsec
Impulse Noise Threshold	71 dBrnCO	
Intermodulation Distortion: R2 R3	 ≥ 27 dB ≥ 32 dB	 ≥ 25 dB ≥ 30
Phase Jitter: 20–300 Hz 4–300 Hz	 ≥ 10 Degrees ≥ 15 Degrees	 ≥ 25 Degrees ≥ 30 Degrees
Frequency Shift	± 3 Hz	± 5 Hz

Aux TX Audio (J17 – Pin 5)

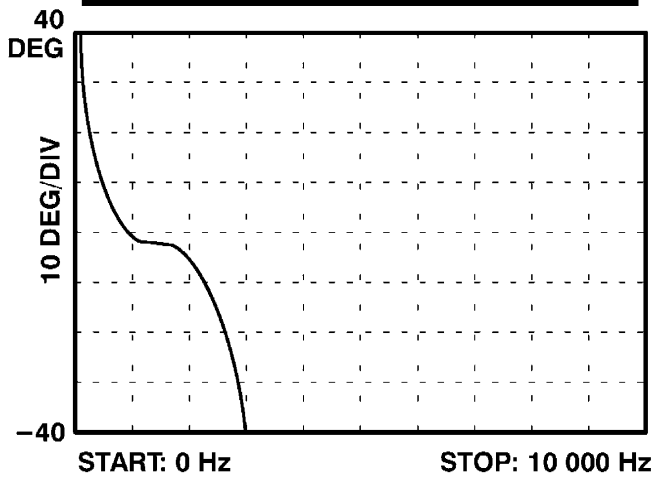
***Note** In order for J17-Pin 5 to support the Aux TX Audio signal, you must edit the Wildcard Table as shown on page 11.*

The **Aux TX Audio** signal is an unbalanced, 470Ω impedance input to the station. The input voltage range is −4.1 V to +4.1 V at 250 Hz to 3 kHz. The response curves for this signal are shown below.

Aux Tx Audio Magnitude Response



Aux Tx Audio Phase Response

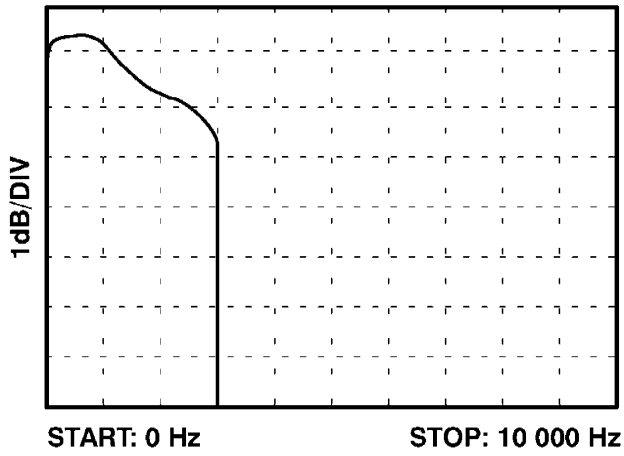


Aux PL Audio (J17 – Pin 5)

***Note** In order for J17-Pin 5 to support the Aux PL Audio signal, you must edit the Wildcard Table as shown on page 12.*

The **Aux PL Audio** signal is an unbalanced, 470Ω impedance input to the station. The input voltage range is −4.1 V to +4.1 V at 5 Hz to 3 kHz. The response curves for this signal are shown below.

Aux PL Audio Magnitude Response

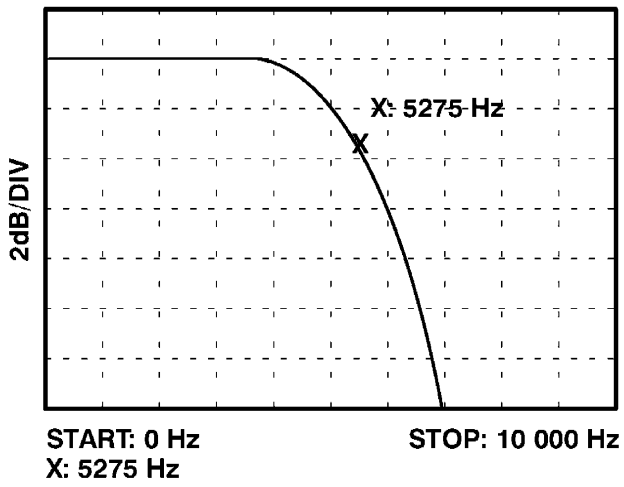


Aux PL Audio Phase Response

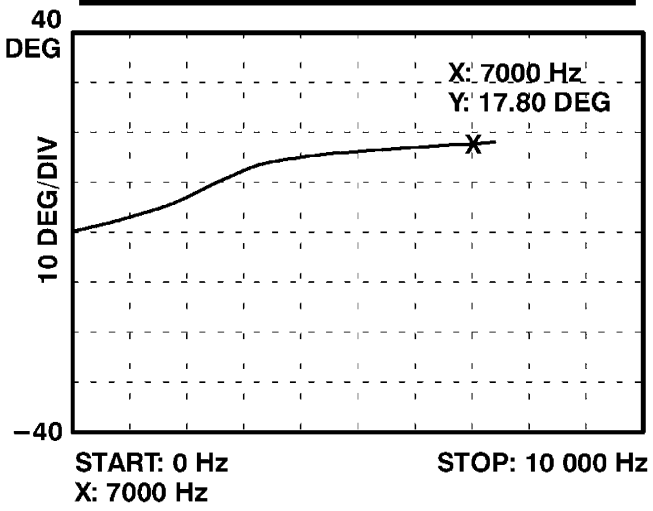
Aux RX Audio (J17 – Pin 30)

The Aux RX Audio signal is an unbalanced output from an operational amplifier with an output impedance of less than 5Ω. The output voltage range is 0 to 6.6V P-P at 0 to 6 kHz. The response curves for this signal are shown below.

Aux RX Audio Amplitude Response

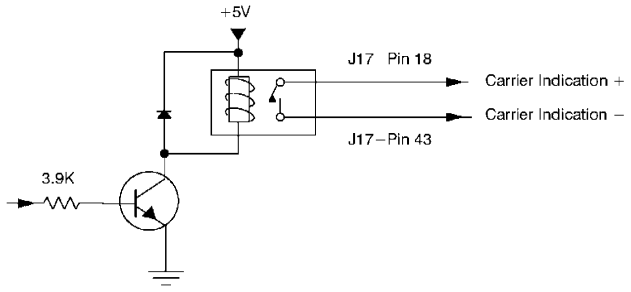


Aux RX Audio Phase Response



Carrier Indication +/– (J17–Pins 18 and 43)

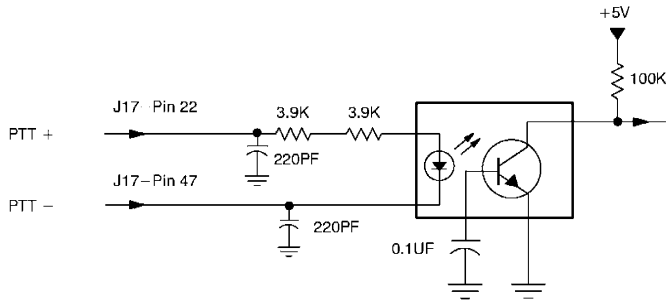
The Carrier Indication + and Carrier Indication – signal provides a relay closure output, as shown below. (If desired, the WildCard Tables may be edited to provide the Carrier Indication signal on J17–Pin 38 as a transistor-buffered output. Refer to *Editing WildCard Tables* on page 7 for details.)



Typical Relay Closure Output Circuit

PTT +/– (J17–Pins 22 and 47)

The PTT + and PTT – signal provides an opto-isolated input, as shown below. (If desired, the WildCard Tables may be edited to provide the PTT signal on J17–Pin 42 as a transistor-buffered input. Refer to *Editing WildCard Tables* on page 7 for details.)



Typical Opto–Coupled Input Circuit

4 EDITING WILDCARD TABLES

You must edit certain WildCard Tables in order to cause certain signals to appear on specific pins on the System Connector J17. Instructions for modifying these WildCard Tables are provided in this section.

The WildCard Tables are programmed in the factory to provide:

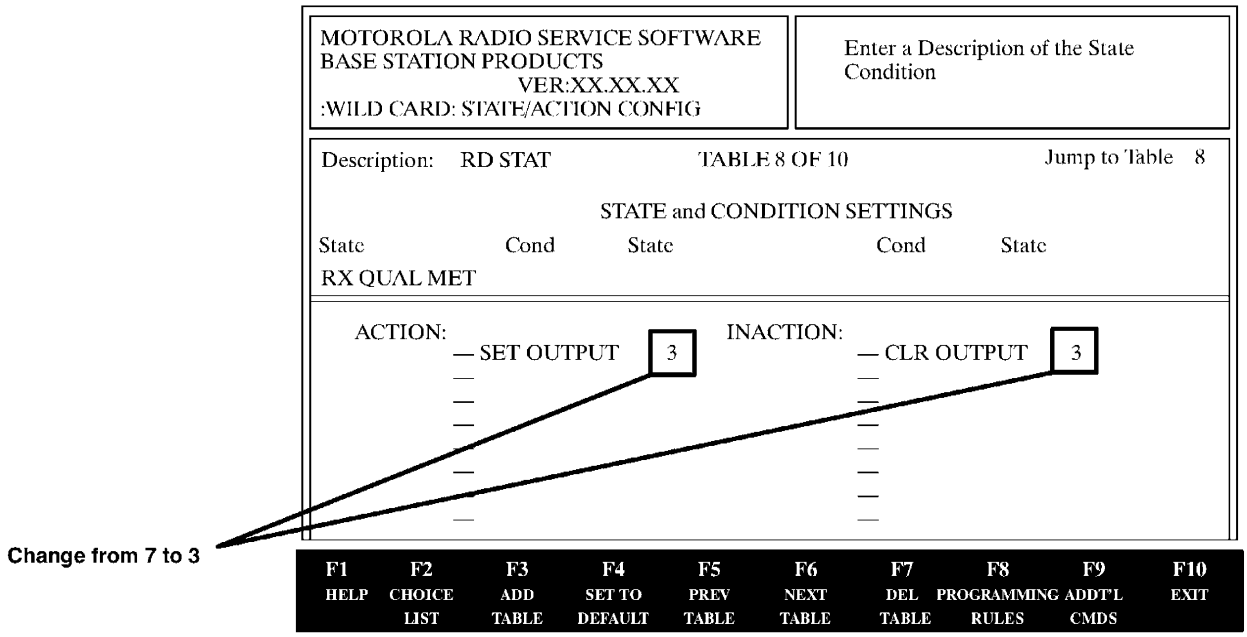
- Carrier Indication + and − on J17−Pins 18 and 43 as a relay contact closure output
- PTT + and − on J17−Pins 22 and 47 as an opto-isolated input

If desired, the WildCard Tables may be modified to change the connector pin number and signal interface as follows:

- Carrier Indication on J17−Pin 38 as a transistor buffered output
- PTT on J17−Pin 42 as a transistor buffered input

Changing Carrier Indication Signal to J17−Pin 38

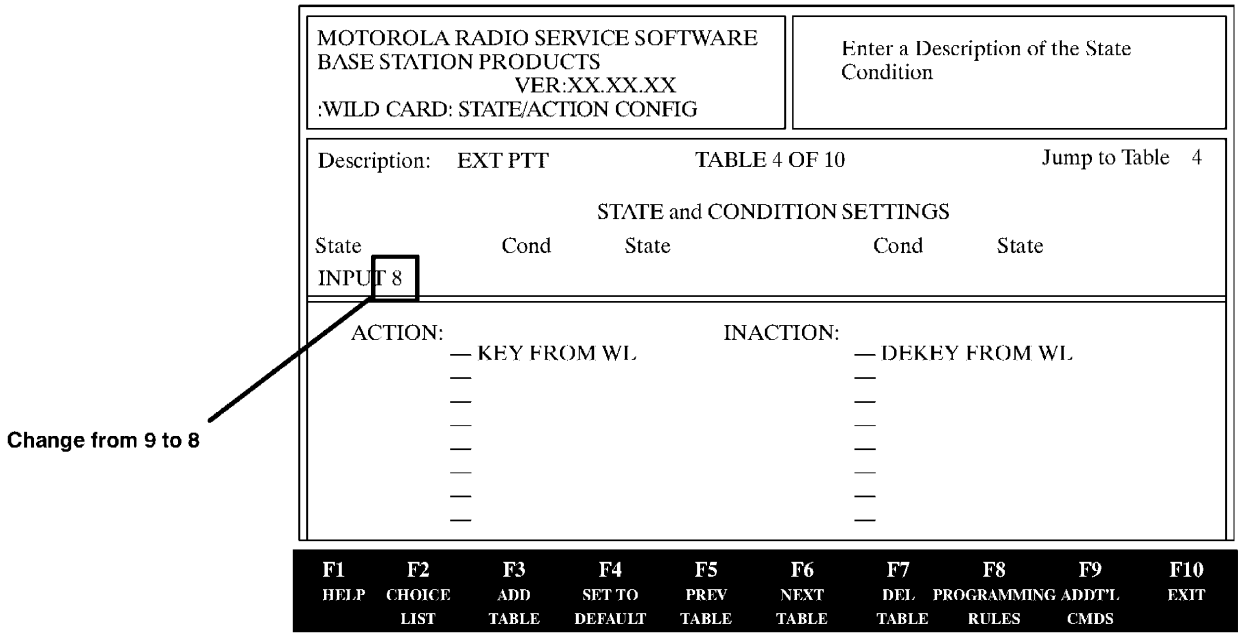
The WildCard Tables are programmed in the factory to provide Carrier Indication + and − on J17−Pins 18 and 43 as a relay contact closure output. Modify WildCard Table 8 as shown below to move the Carrier Indication signal to J17-Pin 38 as a transistor buffered output.



Change from 7 to 3

Changing PTT to J17–Pin 42

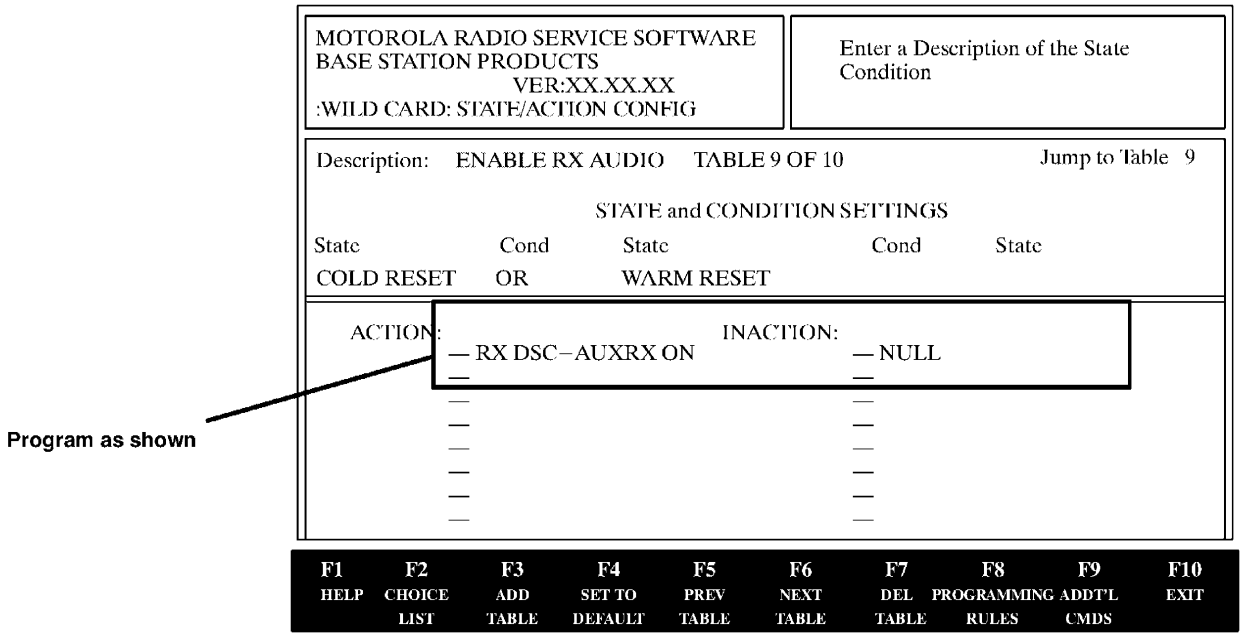
The WildCard Tables are programmed in the factory to provide PTT + and – on J17–Pins 22 and 47 as an opto-isolated input. Modify WildCard Table 4 as shown below to move PTT to J17–Pin 42 as a transistor buffered input. When PTT is asserted, the station will gate audio from Line 1 to the transmitter. Follow the alignment instructions for the Wireline to set proper deviation level.



Change from 9 to 8

Routing Aux RX Audio to J17-Pin 30

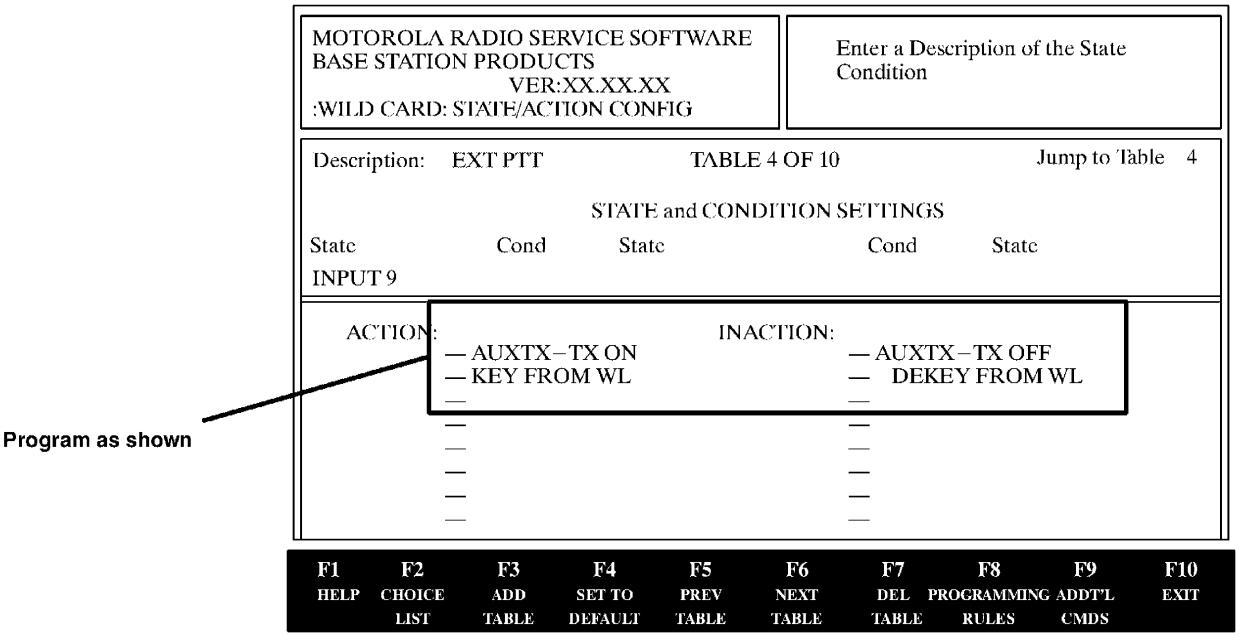
Edit (or add) WildCard Table 9 in order to route the Aux RX Audio signal to J17-Pin 30.



Program as shown

Routing Aux TX Audio to J17-Pin 5

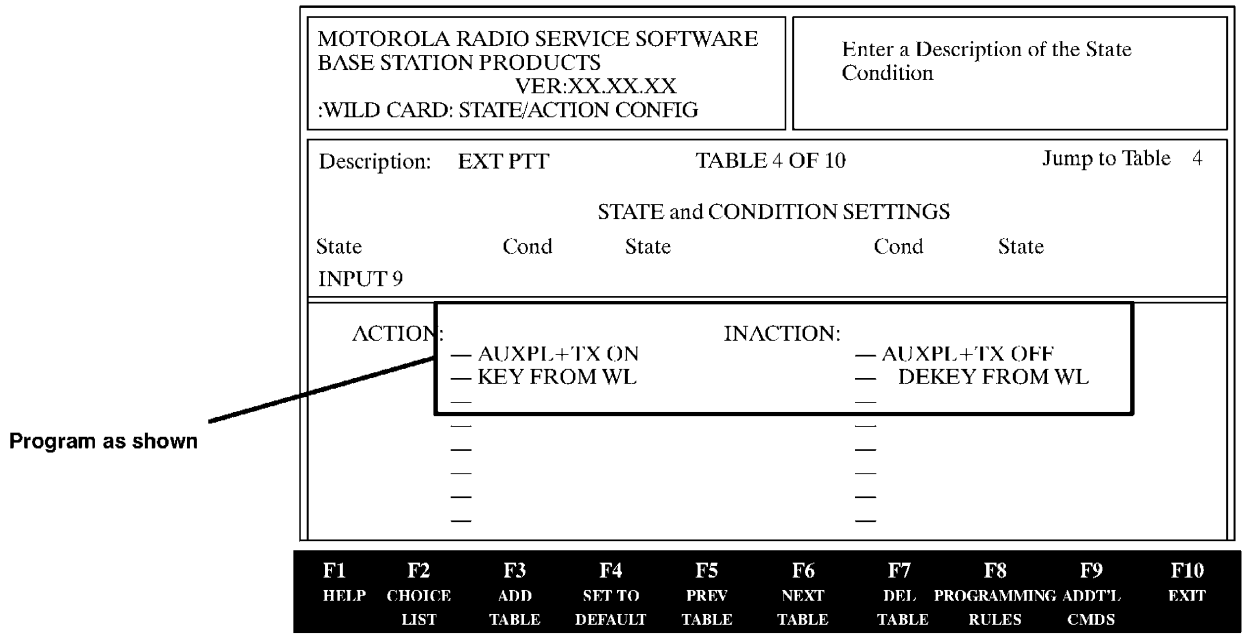
Edit WildCard Table 4 in order to route the Aux TX Audio signal from J17-Pin 5 to the transmitter. Alignment is fixed so that a 1 kHz tone at −10 dBm at the input provides 60% deviation. (For example, on a 25 kHz channel with 5 kHz maximum deviation, a −10 dBm input results in 3 kHz deviation.)



Program as shown

Routing Aux PL Audio to J17-Pin 5

Edit WildCard Table 4 as shown below in order to sum the signal at Aux TX Audio with the audio signal at Line 1. The signal input to the Aux TX Port can be either a PL signal, a DPL signal, or some other low speed digital signal. The port is scaled so that an amplitude of −10 dBm provides a 20% deviation of the transmitted rf signal. (For example, on a 25 kHz channel with 5 kHz maximum deviation, the low speed signal input at − 10 dBm results in 1 kHz deviation.) Note that the audio input at Line 1 must be aligned following the wireline alignment procedure located in the Radio Service Software (RSS) User's Guide.



Program as shown

MOTOROLA

SERIAL INTERFACE SPECIFICATIONS

For *Quantar* and *Quantro* Stations and *ASTRO-TAC* Receivers

(For Interface Protocol Version 01.01.01)

1 OVERVIEW

This section describes how to make a serial connection from a PC (or other external device) to the *Quantar*/*Quantro* station or receiver, enter a special servicing mode (i.e., "RSS Mode"), and issue commands to reset the station or retrieve various station status information.

Important! These serial interface specifications ***do not apply*** to stations running ASTRO® 25 Trunking Software.

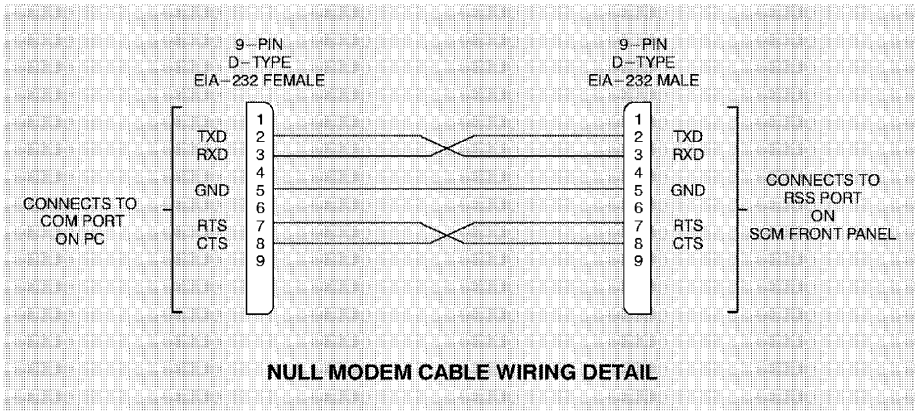
2 MAKING SERIAL CONNECTION TO STATION

Equipment Required

The following hardware is required to connect serially to one of the two RSS ports (one located on the SCM front panel, the other located on the station backplane):

- Personal Computer or other external control device
- 9-pin female to 9-pin male EIA-232 cable wired for null modem connections; cable is available (Motorola Part No. 30–80369E31) from Motorola Aftermarket and Accessories Division (AAD, formerly Motorola National Parts), or can be made by wiring the connectors as shown below.

  Note *A null modem adapter (9–pin male to 9–pin female) may also be used to convert a standard EIA–232 cable for connection to the RSS port. Adapters are available at most electronic supply retailers.*



NULL MODEM CABLE WIRING DETAIL

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Connecting to the Station RSS Port

Figure 1 shows a typical scenario in which a PC is connected to the RSS port on the station (SCM front panel RSS port in this illustration). The PC could be used as a simple terminal (running *Windows HyperTerminal* or similar terminal software) to allow commands to be issued manually, or it could be running third party software designed to perform automated retrieval of station operating information.

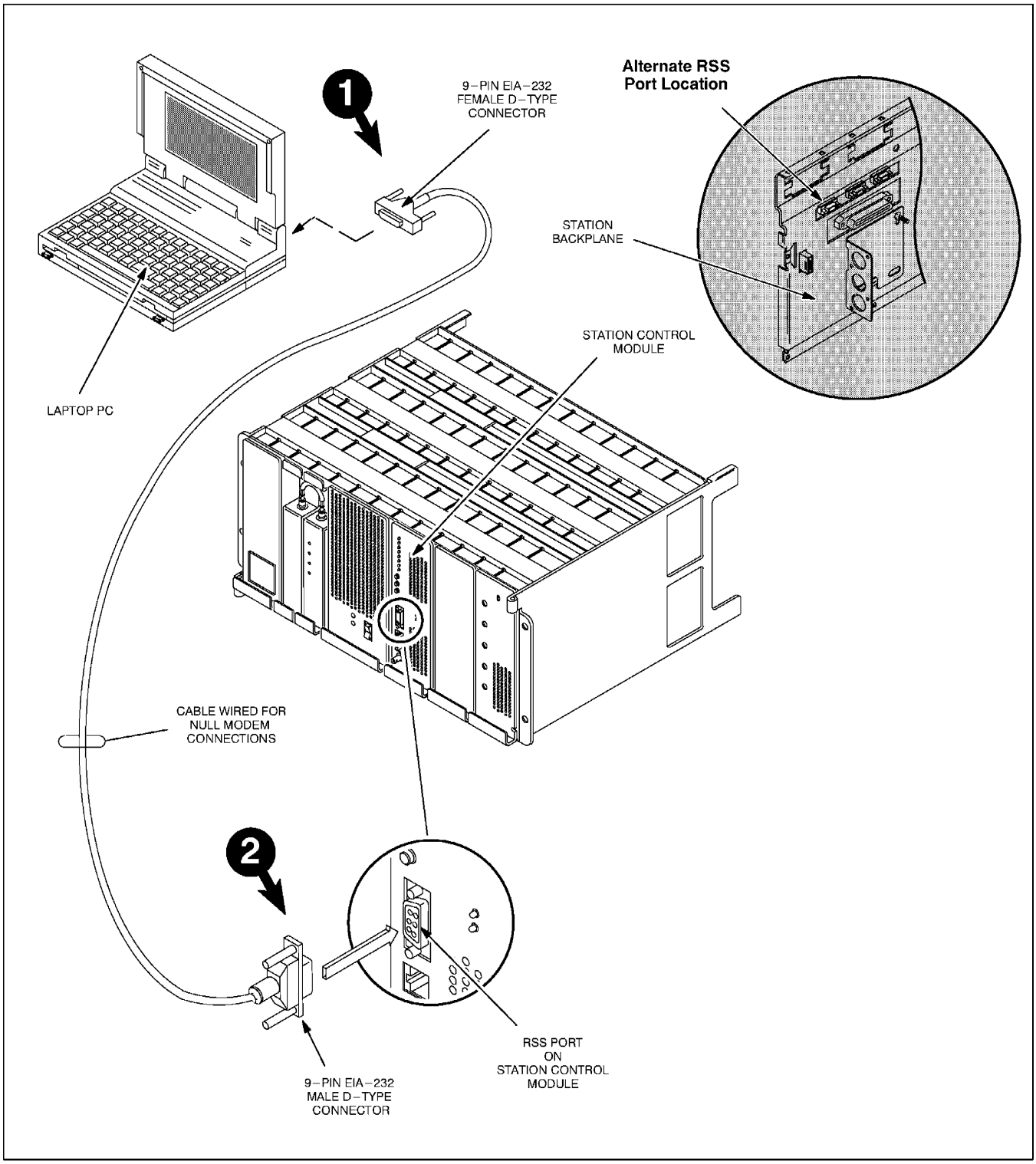


Figure 1. Connecting PC to RSS Port (Typical Scenario)

3 ENTERING "RSS MODE"

Overview

In order to issue commands to the station, the station must be placed into a special operating mode called "RSS Mode." Once in RSS Mode, you may enter commands as detailed on page 4.

Note *The station remains fully operational while in RSS Mode.*

Configuring Terminal Settings

Before communicating serially with the station, you must launch and configure a terminal application running on the PC (or other external device). The primary settings are as follows:

- 9600 Baud
- No Parity
- 8 data bits
- 1 stop bit
- Flow Control set to None
- Set to appropriate Com port (typically Com1)

Entering RSS Mode

Step 1. Press **<ret>** to obtain the station normal operating mode prompt (**]–O**).

Note Local Echo mode is on by default (following any station reset).
To **disable** local echo, type **PCTL –ECHO OFF** <cr>
To **enable** local echo, type **PCTL –ECHO ON** <cr>

Step 2. At the **]–O** prompt, type: **dorss** <cr>. The station will enter RSS Mode, as indicated by the **RSS:** prompt.

Step 3. The station is now ready to receive commands as described on page 4.

4 SUPPORTED COMMANDS

Introduction

Once in RSS Mode, the station is ready to accept the following commands:

- RESET
- GET RSS_PROTOCOL
- GET STATION_STATUS (ALL, or 1 thru 8)
- EXIT

Each of these commands is described below, including how to interpret the results of the "GET" commands.

Note *Be sure to read Important Things To Know on page 12. This section provides caveats, restrictions, and other information that affect how the commands may be used.*

RESET Command

Issuing the **RESET** command initiates a hardware reset of the station. After several seconds, the station will enter normal operating mode. This may be verified by a return of the **]–O** prompt.

GET RSS_PROTOCOL Command

Overview

The station software includes a serial interface kernel that determines which commands are supported and how the station responds to those commands. The serial interface kernel has a version number associated with it, which may be retrieved using the GET RSS_PROTOCOL command.

Note that the GET RSS_PROTOCOL command will always be accepted regardless of the particular protocol version (e.g., a third party external device designed for use with protocol version 01.01.01 will still be able to successfully issue the GET RSS_PROTOCOL command for a station containing protocol version 02.03.02).

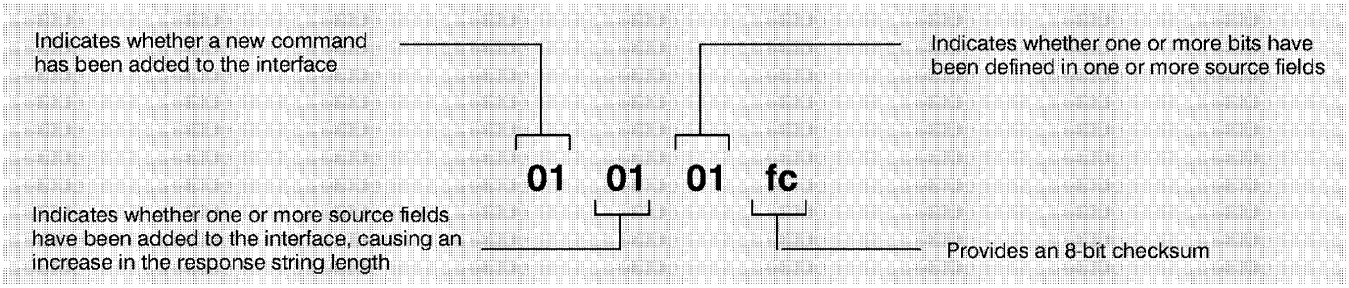
Issuing the GET RSS_PROTOCOL Command

Entering GET RSS_PROTOCOL causes the station to report its Serial Interface Protocol Version Number. For example:

```
RSS: GET RSS_PROTOCOL
RSS: 010101fc
```

Interpreting the Serial Interface Protocol Version Number

The protocol version number is displayed in hexadecimal format, including a checksum. The initial protocol version number is $010101fc_{HEX}$. The following illustration shows how to interpret the protocol version number following retrieval from the station.



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GET STATION_STATUS Command

Overview

Issuing the GET STATION_STATUS command results in a Status Response String being returned from the station. The bits in this string may be interpreted to determine various operating characteristics about the particular station.

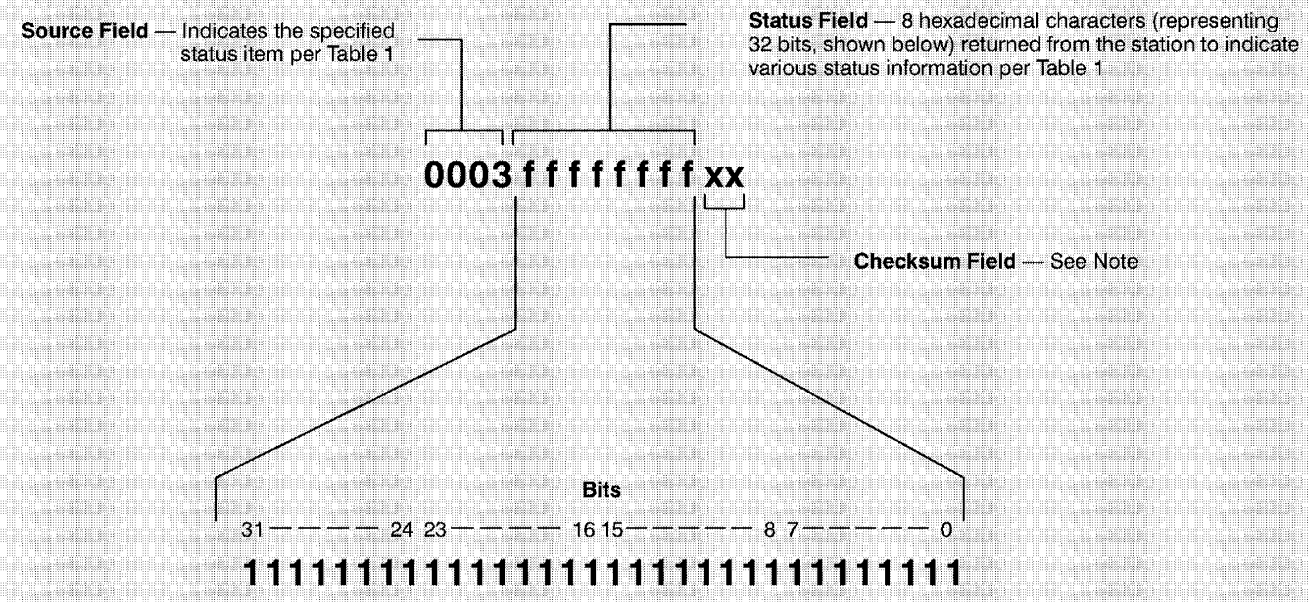
Command Usage

There are two uses of the GET STATION_STATUS command:

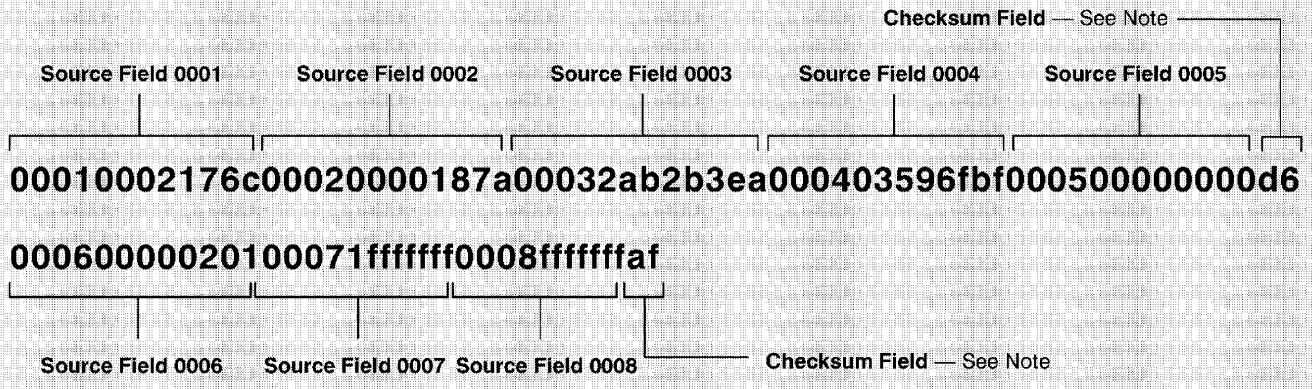
- **GET STATION_STATUS 1 thru 8** — Allows you to specify a particular status item to retrieve from the station (according to Table 1)
- **GET STATION_STATUS ALL** — Returns status information for all eight (8) status items from the station; as shown, each Source Field (1 thru 8) along with its status field is returned in a concatenated format, with each line ending in an 8-bit checksum

The two examples shown below illustrate the structure of the Status Response Strings returned from the station for each usage type. (GET STATION_STATUS 3 and GET STATION_STATUS ALL are shown in this example.)

GET STATION_STATUS 3



GET STATION_STATUS ALL



Note *Checksums are provided at the end of each line in the Status Response String. The checksum value is generated such that adding each pair of hex digits (starting from the left and including the checksum value) results in a hex number that ends in FF. If so, the data returned from the station is considered valid.*

Interpreting the Status Response Strings

After issuing the desired command (GET STATION_STATUS 1 thru 8 or GET STATION_STATUS ALL), you may interpret the Status Response String returned from the station by using the information in Table 1.

Table 1. Interpreting Bits in Status Response String

Source Field	Status Item	Bit Descriptions		
		Bit Numbers	Parameter	Values
0000_{HEX}	Reserved	Reserved		
0001_{HEX}	Date *(Following station reset, date is reset to 1/1/1900)*	31 thru 22	Not Used	
		21 thru 17	Month	00001 (Jan) thru 01100 (Dec)
		16 thru 12	Day	00001 (1st) thru 11111 (31st)
		11 thru 0	Year	12-bit binary converted to decimal (e.g., 011101101100 = 1900)
0002_{HEX}	Time *(24-Hour format)*	31 thru 17	Not Used	
		16 thru 12	Hour	00000 (midnight) thru 10111 (23)
		11 thru 6	Minutes	000000 (0) thru 111010 (59)
		5 thru 0	Seconds	000000 (0) thru 111010 (59)
0003_{HEX}	Hardware States #1	31 – 30	External Ref (UHSO or External)	00= N/A 11 = Failure 10 = Operational
		29 – 28	Power Suppy Fan	
		27 – 26	PA Fan	
		25 – 24	Receiver Module	
		23 – 22	Exciter Module	
		21 – 20	Power Supply Module	
		19 – 18	Overvoltage Alarm	00= N/A 11 = Alarm 10 = No Alarm
		17 – 16	AC State	00= N/A 11 = Failure 10 = Operational
		15 – 14	Wireline Module Failure	00= N/A 11 = Failure 10 = Operational
		13 – 12	Wireline Module Status	00= N/A 11 = On 10 = Off

continued on next page

Source Field	Status Item	Bit Descriptions		
		Bit Numbers	Parameter	Values
0003_{HEX}	Hardware States #1	11 – 10	Receiver Module #2 Lock	00= N/A 11 = Locked 10 = Out of Lock
		9 – 8	Receiver Module #1 Lock	00= N/A 11 = Locked 10 = Out of Lock
		7 – 6	Exciter Module Lock	00= N/A 11 = Locked 10 = Out of Lock
		5 – 4	PA Keyed and at Expected Output Power (As set via RSS)	00= N/A 11 = Keyed and Expected Output 10 = Not Keyed or Keyed and not at Expected Output
		3 – 2	PA Output Less than Expected (As set via RSS)	00= N/A 11 = PA Keyed and Less than Expected Output 10 = PA Not Keyed or PA Keyed and at Expected Output
		1 – 0	PA Output Status	00= N/A 11 = Keyed and No Output 10 = PA Output at Expected Level
0004_{HEX}	Software States #1	31 – 27	Not Used	
		26	Secure (12 Kilobits) Station Type	0 = Not Secure 1 = Secure
		25	ASTRO Station Type	0 = Not ASTRO 1 = ASTRO
		24	Analog Station Type	0 = Not Analog 1 = Analog
		23	Trunked System Type	0 = Not Trunked 1 = Trunked (IR or 6809)
		22 – 21	Analog Wireline Link Status	00 = N/A 10 = Failure 11 = Operational
		20 – 19	Digital Wireline Link Status	00= N/A 10 = Failure 11 = Operational
		18 – 17	Rx Activity	00 = None 01 = Analog 10 = ASTRO 11 = SECURENET

continued on next page

Source Field	Status Item	Bit Descriptions		
		Bit Numbers	Parameter	Values
0004_{HEX}	Software States #1	16 – 15	Tx Inhibit	00= N/A 10 = Tx Enabled 11 = Tx Inhibited
		14 – 13	Intercom	00 = N/A 10 = Enabled 11 = Inhibited
		12	Access Disable Status	0 = Station Enabled 1 = Access Disabled
		11 – 10	Selective Alarms	00 = N/A 11 = Enabled 10 = Disabled
		9 – 8	Station Alarms	00= N/A 11 = Enabled 10 = Disabled
		7 – 6	Station Disable	00 = N/A 11 = Disabled 10 = Operational
		5 – 4	Tx PL On/Off	00 = N/A 11 = On 10 = Off
		3 – 2	Rx PL On/Off	00 = N/A 11 = On 10 = Off
		1 – 0	Repeater State	00= N/A 11 = Set Up 10 = Knocked Down
0005_{HEX}	Trunking States #1	31 – 8	Not Used	
		7 – 6	ISW Detect (*IntelliRepeater* only)	00 = N/A 11 = Active 10 = Inactive
		5 – 4	Active Master (*IntelliRepeater* only)	00 = N/A 11 = Active 10 = Inactive
		3 – 2	Control or Voice Channel	00 = N/A 11 = Control 10 = Voice
		1 – 0	Failsoft Mode	00= N/A 01 – Off 10 = Site Failsoft 11 = Normal

Source Field	Status Item	Bit Descriptions		
		Bit Numbers	Parameter	Values
0006_{HEX}	Channel Information	31 – 16	Not Used	
		15 – 8	Total Channels Configured (See note)	00000001 (1) thru 11111111 (255)
		7 – 0	Current Station Channel (See note)	00000001 (1) thru 11111111 (255)
		Note *The station currently supports 16 maximum (Conventional) and 28 channels maximum (**IntelliRepeater**).*		
0007_{HEX}	Current Measured Power	31 – 29	Not Used	
		28	Configuration	0 = Receiver only configuration 1 = Receiver/Transmitter configuration
		27 – 20	VSWR	00000001 (1) thru 11111111 (255) Divide decimal value by 10 to obtain VSWR (e.g., 00001011 reported = decimal 11; 11 ÷ 10 = VSWR of 1.1:1)
		19 – 10	Reverse Power	0000000000 (0) thru 1111111111 (1023) Multiply decimal value by .01961 to obtain value in Watts (e.g., 0000100101 reported = 37 decimal; 37 x .01961 = .725 Watts
		9 – 0	Forward Power	0000000000 (0) thru 1111111111 (1023) Multiply decimal value by .01961 to obtain value in Watts (e.g., 1101000101 reported = 937 decimal; 937 x .01961 = 18.37 Watts
0008_{HEX}	Stored Measured Power	Same as *Current Measured Power* (above) except values apply to last previous transmitter keyup. **Note** *Upon station reset, values for Reverse Power and Forward Power will default to maximum values, indicating that the station has not been keyed up since the last reset.*		

5 IMPORTANT THINGS TO KNOW

- Each time the station is keyed for a minimum of 400 msec, Forward Power, Reverse Power, and VSWR are measured and stored.
- When issuing commands to a Quantar Receiver, maximum values are returned for all transmit power measurements, indicating that the measurement values are not applicable (since no transmitter is present in a receiver). Additionally, the *Configuration* bit (part of *Current Measured Power* and *Stored Measured Power* fields, as described on page 11) is set to **0**, indicating that the values are not applicable.
- All messages between an external device (e.g., PC) and the station must be transmitted as ASCII strings at 9600 bps.
- A command is defined as an ASCII string terminated by a carriage return.
- The station allows a maximum rate of one command per second in order to minimize the usage of the CPU.
- The station processes only one command at a time.
- Stations/Receivers must be running software release R10.05 or higher in order to support the serial communications protocol described in this manual.
- If station is in *Configuration Mode* (a failure mode in which the codplug is typically corrupted), the normal prompt (**]–O**) will appear and the **Fail** LED on the station will be lit. Reset and Exit commands continue to work normally, but issuing any other command (e.g., GET STATION_STATUS ALL) results in a return of data that may or may not be valid.
- No future enhancements or additional functions are currently planned for this serial protocol.
- Motorola will not be held liable for any damage caused by 3rd party external devices used to communicate with the station using the serial interface protocol.

END OF PART 15 AND DOCUMENT

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7/31/01