MOTOROLA INC.
Communications
Sector

SPECTRA TAC™ ENCODER

OPTION C269

Item	Description	Alteration
TRN6085B	*Spectra TAC* Encoder Module	Added
TRN6552A	4-Wire Line Driver Module	Replaces TLN4669B
TRN6689A	Squelch Gate Module	Replaces TLN4662A
TRN6103A	Modification Kit	Added

1. APPLICATION

The *Spectra TAC* Encoder option is available for Motorola remotely controlled Micor™ base and repeater radios. The addition of this option permits the station receiver to operate as a receiver-encoder in a *Spectra TAC* total area coverage system.

The Motorola *Spectra TAC* Total Area Coverage System electronically compares and selects the receiver with the best signal of multiple receivers operating on the same rf frequency over a wide coverage area. The *Spectra TAC* system consists of multiple receiver- encoder units distributed throughout a coverage area and a comparator which determines which receiver has the best signal on the same rf frequency. With the use of multiple receiver-encoders, the *Spectra TAC* system can extend the talk-back range of personal portable and mobile radio units.

By selecting only one receiver-encoder unit, the high noise and phase distortion, which would result if several receiver audio lines were connected in parallel at the monitoring point, are eliminated.

One receiver-encoder unit is required at each given satellite site. The receiver monitors one rf frequency and amplifies the received audio for transmission to the comparator. An encoder generates a status tone for transmission to the comparator when there is no received signal.

The comparator receives the audio and tone signals from multiple receiver-encoder units, which are operating on the same rf frequency. It compares the signals and selects the receiver-encoder unit with the best audio signal (the generated tone is not used for voting). The audio of the receiver-encoder unit with the best signal is then sent to the dispatcher.

2. DESCRIPTION

The *Spectra TAC* encoder option includes a TRN6085B *Spectra TAC* Encoder Module, which is added in position 11; a TRN6552A 4-Wire Line Driver Module, which replaces the standard TLN4669A/B 2-Wire Line Driver Module; a TRN6689A Squelch Gate Module, which replaces the standard TLN4662A Squelch Gate Module in repeater systems; and adds a TRN6103A Modification Kit. The modification kit contains two spark gaps (part no. 80-83029H01) and two guide rails (part no. 45-83914G01). These spark gaps are installed on the remote control chassis interconnect board from the LINE 2 (+) and (−) terminals to the GND terminal. The guide rails are installed in position 11 to guide the added *Spectra TAC* encoder module.

3. FUNCTION

3.1 GENERAL

3.1.1 When this option is added to a base station, the receiver becomes a voting receiver in the *Spectra TAC* system. In this application, the receiver audio is routed to the comparator. The comparator selects (votes) the receiver with the best quality signal and routes its audio to the dispatcher console.

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3.1.2 When this option is added to a repeater station, the voted audio from the comparator is applied to the station transmitter where it is retransmitted. The station automatically reverts to in-cabinet repeat (RT) operation when the comparator or the comparator wire line fails. The transmitter is normally keyed by a line PTT from the comparator. When a line PTT is not received from the comparator within approximately 200 msec after the receiver is unsquelched, the squelch gate module automatically keys the transmitter and the receiver audio is applied to the transmitter for retransmission.

3.2 TRN6085B *SPECTRA TAC* ENCODER MODULE

The *Spectra TAC* encoder module provides a status tone when the receiver is squelched. This tone is used at the comparator location to disable voting, for line checking, and for in-path loss factoring. Status tone is turned off when the receiver is unsquelched. The module also provides 400 Hz and 2500 Hz test tones for use in equalizing audio response over the telephone line (or other path). An equalizer circuit in the 4-wire line driver module can be set (via jumpers) to add gain at either or both of the test frequencies.

3.3 TRN6552A 4-WIRE LINE DRIVER MODULE

The 4-wire line driver module accepts audio from the receiver, amplifies it, and routes it via the LINE 2 terminals to the *Spectra TAC* comparator and to the local speaker. Two transformers are used; one is used for accepting the transmit audio and control signals, and the other is used to provide audio to the comparator. The module also contains a line equalization circuit to compensate for rolloff in the frequency response of the output line.

For further details on the *Spectra TAC* encoder and 4-wire line driver, refer to sections 68P81026E28 and 68P81029E04 attached to this section.

3.4 TRN6689A SQUELCH GATE MODULE

Keying of the transmitter by the squelch gate on *Spectra TAC* repeaters is only desired if a wire line failure occurs. A 200 msec delay in the squelch gate allows time for the normal line transmit command before the repeater will initiate in-cabinet repeat operation.

4. INSTALLATION

The *Spectra TAC* option is factory installed. The encoder module plugs into the remote control chassis in the single tone decoder slot. The 4-wire line driver module provides for "4-wire; 1 receiver; receiver audio on line 2" operation.

Install the station in the same manner as described for stations without this option, with the following exceptions:

-- Connect the transmitter audio lines from the *Spectra TAC* comparator output to the station's LINE 1 terminals.

-- Connect the receiver audio lines from the station's LINE 2 terminals to one of the inputs of the comparator.

-- After all other station levels are adjusted, as described in the station instruction manual, perform the line level, status tone level, and line equalization adjustments as described in paragraph 5.

5. ADJUSTMENTS

Three adjustments, in addition to the standard station adjustments, are required for *Spectra TAC* operation: line level adjustment, status tone level adjustment, and line equalization adjustment. These adjustments are to be made after the standard station adjustments and must be made in the sequence given below.

5.1 LINE LEVEL ADJUSTMENT

There are two basic reasons for observing correct line level settings; (1) to avoid exceeding maximum levels allowed by the phone company, and (2) to assure correct operation of the *Spectra TAC* equipment. The phone company will specify a maximum audio level on the phone line and the customer must specify the signal level required at the opposite end which determines the maximum line loss. In addition, for voice quality lines, the phone company may specify the maximum allowable power level. This is done to minimize crosstalk and equipment overloading. The maximum power level is determined by averaging the audio signal level over a 3-second period. Due to the pauses between speech syllables and words, the 3-second average will be in most cases, a power level 13 dB below the peak level of voice. The allowable peak level of voice is specified by the phone company as the Transmission Level Point (TLP). A 1000 Hz tone at full system deviation (±5 kHz) is recommended for setting the line level.

Step 1. Connect an ac voltmeter to the LINE 2 (+) and (−) screw terminals on the remote control chassis interconnect board. If LINE 2 terminals are not connected to the comparator, the meter must be bridged by a 600-ohm load.

Step 2. Turn the SQUELCH control fully counterclockwise and disable the PL module (if used).

Step 3. Inject an on-frequency carrier signal into the receiver antenna input.

Step 4. Modulate the receiver input with a 1000 Hz tone at ±5 kHz deviation. Determine the maximum allowable level permitted on the line and set the LINE LEVEL control on the audio control module for this level. If the specified maximum is the maximum allowable *power* (3 second average), then set the LINE LEVEL control for 13 dB above this level. Do not exceed +11 dBm.

5.2 STATUS TONE LEVEL ADJUSTMENT

5.2.1 General

5.2.1.1 Status tone level settings must be done correctly to assure correct receiver voting at the comparator. The AGC circuitry on the signal quality module provides compensation for phone line losses and permits correct receiver voting. The AGC circuitry is "set" relative to the status tone generated by the receiver encoder module. The encoder module must be installed in a TLN8799A Extender Card for TONE LEVEL adjustment access.

5.2.1.2 Two methods of status tone level adjustment are employed in the *Spectra TAC* receivers depending upon the type of signal quality modules utilized in the *Spectra TAC* comparator. It is recommended that the status tone level be adjusted only after the line level has been adjusted, because both the LINE LEVEL and TONE LEVEL controls affect the level of the status tone on the line.

5.2.2 0 dB System

In a 0 dB system, the TRN6091A Signal Quality Module is required, or a TRN6091B Signal Quality Module may be jumpered to operate as a TRN6091A by installing JU4. These signal quality modules are located in the comparator chassis. The status tone level must be adjusted equal to receiver peak audio at full system deviation (±5 kHz). The status tone must not exceed maximum power and peak audio levels specified by the phone company. The following conditions must be met for proper operation of a 0 dB system:

Module	Jumper	Status
TRN6085A	JU3	IN
TRN6085B	JU3, JU5	IN
TRN6552A	JU1	OUT

Step 1. Connect an ac voltmeter across the LINE 2 (+) and (−) terminals which must be terminated by a 600-ohm load. Disconnect any rf input to the receiver. Turn the SQUELCH control fully clockwise until the receiver is fully squelched.

Step 2. Adjust the TONE LEVEL control on the encoder module until the line level, as measured by the ac voltmeter, is the same as the 1000 Hz test tone level set in Step 4 of paragraph 5.1.

Step 3. Remove the extender card and re-install the encoder module in the card cage.

5.2.3 −13 dB System

In a −13 dB system, the TRN6091B Signal Quality Module is utilized; JU4 is removed. The status tone level must be adjusted 13 dB below receiver peak audio at full system deviation (±5 kHz). The following conditions must be met for proper operation of a −13 dB system:

Module	Jumper	Status
TRN6085A	JU3	OUT
TRN6085B	JU3, JU5	OUT
TRN6552A	JU1	IN

Step 1. Connect an ac voltmeter across the LINE 2 (+) and (−) terminals which must be terminated by a 600-ohm load. Disconnect any rf input to the receiver so that the receiver is squelched.

Step 2. Adjust the TONE LEVEL control on the TRN6085B Encoder Module until the line level, as measured by the ac voltmeter, is 13 dB below the 1000 Hz test tone level set by the LINE LEVEL control.

Step 3. Remove the extender card and re-install the encoder module in the card cage.

5.3 LINE EQUALIZATION ADJUSTMENT

5.3.1 General

The purpose of the line equalization procedure is to ensure sufficient audio gain to the comparator site to compensate for line losses. Two men are required to perform the line equalization procedure; one man at the receiver site and one man at the comparator site. The man at the receiver site measures the line level at the output of the receiver while the man at the comparator site measures the line level at the input to the comparator. Line equalization is performed by setting the 1 kHz test tone (used in the line level adjustment procedure) level equal to the LOW and HIGH test tone levels generated by the encoder module.

NOTE

The LOW and HIGH TONE switches are not available on the TLN1460A Voting Module. The 400 Hz, 1000 Hz, and 2500 Hz test tones must be generated using an audio oscillator at the LINE (+) and (−) terminals on the receiver interconnect board.

The line driver must be installed in an extender card for equalization adjustment access.

5.3.2 Procedure

Step 1. Establish communications between both sites. The TMN6067A Handset may be used for transmission and monitoring purposes at the station and comparator sites. Plug the handset into J1 on the line driver module. Refer to the Maintenance section of the comparator manual (68P81026E40) for further instructions regarding operation of the handset at the comparator site.

Step 2. At the receiver site, be sure the 400 Hz, 2500 Hz, and 1 kHz test tones are at equal levels.

Step 3. Send the 1 kHz test tone, making sure the man at the comparator site measures and records the received level.

NOTE

Maximum equipment output level is +11 dBm. Be sure not to exceed this limit at any time.

Step 4. At the receiver site, send the 2500 Hz high tone by setting and holding the momentary HIGH TONE switch on the encoder module. At the comparator site, measure and compare this level with the 1 kHz level previously recorded. Inform the man at the receiver site of the difference.

Step 5. At the receiver site, install the 2500 Hz equalization jumper (on the line driver) in the position necessary to obtain the level equivalent to the 1 kHz level.

Step 6. Repeat Steps 4 and 5 using the 400 Hz low tone switch and equalization jumper.

Step 7. Repeat the entire procedure to ensure correct equalization adjustment.

Step 8. Remove the extender card and re-install the line driver in the card cage.

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