

T70/T150 - Operation and Maintenance

Alignment Procedure

The following procedures may be used to align the transmitter for optimum performance. Normally, full alignment will only be required after repairing, replacing or re-adjusting components.

Reference oscillator calibration may be required periodically due to crystal aging. The aging should be less than 1 ppm/year.

Standard Test Conditions

AF Signal Generator
600 Ohms output impedance
Frequency range, 50 to 3000 Hz
Level, 387 mV rms to the line input

Power Supply
13.8 Vdc
5 A max.

Load
50 Ohms
25 Watts

Jumpers
Standard Ex-Factory Configuration
except where indicated

Alignment Frequency

| <u>Model</u> | <u>Range</u> | <u>Align F</u> |
|--------------|--------------|----------------|
| T70 | (66-78) | 74 MHz |
| T70 | (70-85) | 78 MHz |
| T70 | (73-88) | 81 MHz |
| T150A | (136-156) | 146 MHz |
| T150A | (140-160) | 150 MHz |
| T150B | (148-168) | 158 MHz |
| T150B | (154-174) | 164 MHz |

VCO Alignment

| <u>Step</u> | <u>Input</u> | <u>Measure</u> | <u>Adjust</u> |
|-------------|---|---|---|
| 1 | Select alignment frequency channel Key the transmitter | dc Volts on test socket pin 9 to pin 1 | L15 to read 5.0 Vdc Alarm LED must be off. Tx LED must be ON. |

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Reference Oscillator Calibration

| <u>Step</u> | <u>Input</u> | <u>Measure</u> | <u>Adjust</u> |
|-------------|--|--|--|
| 2 | Key the transmitter on center frequency channel. Audio input OFF. | Frequency at the rear coax connector(25W) or J1 (10mW) | CV1 to read the correct channel frequency +/- 50 Hz |

Modulation Balance

| <u>Step</u> | <u>Input</u> | <u>Measure</u> | <u>Adjust</u> |
|-------------|---|----------------|-----------------------------|
| 3 | Set RV3 fully CCW. Set RV1 fully CW. Set RV2 mid way. Set JP4 for Hi-Z input Set JP7 for flat response. | FM deviation | |
| 4 | 100 Hz 387 mV to the Hi-Z input. Key the transmitter. | FM deviation | RV4 (line input) for 5 kHz |
| 5 | 1000 Hz 387 mV to the Hi-Z input Key the transmitter. | FM deviation | RV2 (Mod.Bal.) for 5 kHz |
| 6 | | | Repeat 3 & 4 until balanced |
| 7 | Return JP7 to pre-emphasis. Return JP4 to line input. Proceed to setting tone deviation, deviation, and line level. | | |

Tone Deviation

| <u>Step</u> | <u>Input</u> | <u>Measure</u> | <u>Adjust</u> |
|-------------|--|----------------|--|
| 8 | No audio input. Key the transmitter | FM deviation | RV3 for the desired deviation (0 - 1 kHz) CCW if tone not used on any ch. |

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Deviation

| <u>Step</u> | <u>Input</u> | <u>Measure</u> | <u>Adjust</u> |
|-------------|--|----------------|--|
| 9 | 1 kHz 387 mV to the line input Set RV4 fully CW. Key the transmitter. | FM deviation | RV1 for maximum system deviation. (2.5 or 5 kHz) |

Line Input Level

| <u>Step</u> | <u>Input</u> | <u>Measure</u> | <u>Adjust</u> |
|-------------|---|---|---|
| 10a | 1 kHz 387 mV or test signal from line to the line input Key the transmitter. | FM deviation | RV4 for 60% rated system deviation. (1.5 or 3 kHz) Or use alternate method 10b below. |
| 10b | 1 kHz 387 mV or test signal from line to the line input | Audio Voltage Test pin 6 to pin 1 | RV4 for 234 mV rms. |

Output Power

| <u>Step</u> | <u>Input</u> | <u>Measure</u> | <u>Adjust</u> |
|-------------|------------------|-------------------------------|--|
| 11 | None required | RF power at coax connector | RV1 on power amplifier for the power desired. (5 - 25 Watts) Do not set above 25 Watts. |

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1. Specifications

1.1 Description

The transmitter is a 5-25 watt output, frequency synthesized, narrow band FM unit which is normally used to drive a high power amplifier. It can also be used alone in lower power applications. The output power is nominally 25 Watts but can be preset between 5 and 25 watts. All necessary control and 600 ohm line interface circuitry is included.

1.1.1 Channel Capacity

Although most applications are single channel, it can be programmed for up to 100 channels numbered 0-99. This is to provide the capability of programming all channels into all of the transmitters used at a given site.

1.1.2 CTCSS

The CTCSS tone or no tone can also be programmed for each channel. So that each channel number can represent a unique RF and tone frequency combination.

1.1.3 Channel Programming

The channelling information is stored in a non-volatile memory chip and can be programmed via the front panel test connector using a PC and RF Technology TechHelp software.

1.1.4 Channel Selection

Channel selection is by eight channel select lines. These are available through the rear panel connector.

A BCD active high code applied to the lines selects the required channel. This can be supplied by pre-wiring the rack connector so that each rack position is dedicated to a fixed channel.

1.1.5 Microprocessor

A microprocessor is used to control the synthesizer, tone squelch, PTT function and facilitate channel frequency programming. With the standard software it also can provide some rudimentary fault monitoring and reporting.

1.3 Physical configuration

The transmitter is designed to fit in a 19 inch rack mounted frame. The installed height is 4 RU (178 mm) and the depth is 350 mm. The transmitter is 63.5 mm or two Eclipse modules wide.

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2. Front Panel Controls, Indicators and Test Points

2.1 Controls

Transmitter Key - Momentary Contact Push Button

Line Input Level - screwdriver adjust multi-turn pot

2.2 Indicators

Power ON - Green LED

Tx Indicator - Yellow LED

Fault Indicator - Flashing Red LED

External ALC - Green LED

External Reference - Green LED

2.3 Test Points

Line Input - 1 + Gnd.

Forward Power - 1 + Gnd.

Reverse Power - 1 + Gnd.

Tuning Voltage - 1+ Gnd.

Serial Data (RS-232) - 2 + gnd

3.0 Electrical Specifications

3.1 Power Requirements

Operating Voltage - 10.5 to 16 Vdc with output power
reduced below 12 Vdc

Current Drain - 5.0A Transmit
0.2A Standby

Polarity - Negative Ground

3.2 Frequency Range and Channel Spacing

| <u>Frequency</u> | <u>25 KHz</u> | <u>12.5 KHz *</u> |
|------------------|---------------|-------------------|
| 66 - 88 MHz | T70 | T70N |
| 136 - 160 MHz | T150A | T150AN |
| 148 - 174 MHz | T150B | T150BN |

* The 25 and 12.5 KHz versions are identical
different model numbers are required by some
licensing authorities.

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3.3 Frequency Synthesizer Step Size

- 5.0 KHz or 6.25 KHz

3.4 Frequency Stability

+/- 5 ppm over -10 to +60 C, Standard

3.5 Number of Channels

100 channels numbered 00 - 99

3.6 Nominal Antenna Impedance

50 Ohms

3.7 Output power

5 - 25 Watts

3.7 Transmit Duty Cycle

100% to 40 deg. C.

3.8 Spurious and Harmonics

Less than 0.25 uW

3.9 Carrier and Modulation Attack Time

Less than 20 mSec.

3.10 Modulation

3.10.1 Type

Two point direct FM with optional pre-emphasis

3.10.2 Frequency Response

Within +1/-1 dB of the selected response characteristic from 300 to 3000 Hz.

3.10.3 Maximum Deviation

The maximum deviation may be preset to 2.5 or 5 KHz as required

3.10.4 Distortion

The modulation distortion is less than 3% at 1 KHz and 60% of rated system deviation

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3.10.4 Residual Modulation and Noise

The residual modulation and noise in the range 300 to 3000 Hz is typically less than - 50 dB referenced to rated system deviation.

3.11 600 Ohm Line Audio Input Level

Adjustable from -30 to +10 dBm

3.12 HI-Z Input

3.12.1 Impedance

10 K Ohms Nominal, balanced input

3.12.3 Input Level

25 mV to 1V rms

3.13 Test Microphone Input

200 Ohm dynamic with PTT

3.14 External Tone Input

Compatible with R150 tone output

3.15 External ALC Input

The external ALC input can be connected to the power control circuit in the PA150 series external power amplifiers.

3.16 Antenna Change Over Switch Driver

An open collector transistor output is provided to operate an antenna change over relay or solid state switch. The transistor can sink up to 250 mA.

3.17 Channel Select Input/Output

3.17.1 Coding

8 lines BCD coded 00-99

3.17.2 Logic Input Levels

0 = < 1.5 Volts

1 = > 3.5 Volts

Internal 10K pull down resistors selects Ch. 00 when all inputs are O/C.

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3.18 DC Remote Keying

An opto-coupler input is provided to enable dc loop keying over balanced lines or local connections. The circuit can be connected to operate through the 600 Ohm line or through a separate isolated pair.

3.19 CTCSS

CTCSS tones can be provided by an internal encoder or by an external source connected to the external tone input.

The internal CTCSS encoding is provided by a hybrid module. This provides programmable encoding of all EIA tones.

3.19.1

TONE SQUELCH FREQUENCIES

| Tone Freq. | EIA# | Tone Freq. | EIA# | Tone Freq. | EIA# |
|------------|------|------------|------|------------|------|
| No Tone | | 114.8 | A6 | 179.9 | B12 |
| 67.0 | A1 | 118.8 | B6 | 183.5 | |
| 69.4 | | 123.0 | A7 | 186.2 | A13 |
| 71.9 | B1 | 127.3 | B7 | 189.9 | |
| 74.4 | C1 | 131.8 | A8 | 192.8 | B13 |
| 77.0 | A2 | 136.5 | B8 | 196.6 | |
| 79.7 | C2 | 141.3 | A9 | 199.5 | |
| 82.5 | B2 | 146.2 | B9 | 203.5 | A14 |
| 85.4 | C3 | 151.4 | A10 | 206.5 | |
| 88.5 | A3 | 156.7 | B10 | 210.7 | B14 |
| 91.5 | C4 | 159.8 | | 218.1 | A15 |
| 94.8 | B3 | 162.2 | A11 | 225.7 | B15 |
| 97.4 | | 165.5 | | 229.1 | |
| 100.0 | A4 | 167.9 | B11 | 233.6 | A16 |
| 103.5 | B4 | 171.3 | | 241.8 | B16 |
| 107.2 | A5 | 173.8 | A12 | 250.3 | A17 |
| 110.9 | B5 | 177.3 | | 254.1 | |

3.19.2 Programmable No-Tone Period

A No-Tone period can be appended to the end of each transmission to aid in eliminating squelch tail noise which may be heard in mobiles with slow turn off decoders. The No-Tone period can be set from 0-5 seconds in 0.1 second increments.

The No Tone period is in addition to the reverse phase burst at the end of each transmission. The reverse phase burst is usually sufficient to eliminate squelch tail noise.

3.20 Firmware Timers

The controller firmware includes some programmable timer functions.

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3.20.1 Repeater Hang Time

A short delay or "Hang Time" can be programmed to be added to the end of transmissions. This is usually used in talk through repeater applications to prevent the repeater from dropping out between mobile transmissions. The Hang Time can be individually set on each channel for 0-15 seconds.

3.20.2 Time Out Timer

A Time Out or transmission time limit can be programmed to automatically turn the transmitter off. The time limit can be set from 0-254 minutes in increments of one minute. The timer is automatically reset when the PTT input is released.

4.0 Connectors

4.1 Antenna Connector

Type N Female Mounted on the module rear panel

4.2 Power & I/O Connector

25 pin "D" Male Mounted on the rear panel

4.3 Test Connector

9 pin "D" Female mounted on the front panel

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