
SUMMARY OF CONTROLS AND ADJUSTMENTS

ADJUSTMENTS

- R4 = Input audio level adjustment
- R7 = Squelch adjustment
- R20 = Repeat audio deviation adjustment
- R55 = Transmitter hold on time adjustment
- R61 = CTCSS Encode deviation adjustment

SWITCHES

- S1 = Memory write switch
 - S2 = 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7 ON = Program mode
 - 8 ON = CTCSS Encode audio loopback to decoders
 - 9
 - 10
- } Encode tone frequency data programming switches
- } Transmitter - On Time Limit

TEST POINTS

- TP-1 = Input audio level test point

JUMPERS

- JU1-JU8 = Decode tone frequency data
- JU9 A = Phase modulation
- B = Direct FM

SETUP

8. Press S1 once. This will place the ST-180 in the carrier squelch mode. (The transmitter should again key.)
9. Add a 1KHz tone modulated at $\pm 3.0\text{KHz}$ to the carrier provided by the service monitor.
10. Adjust R20 for $\pm 3.0\text{KHz}$ modulation at the output of the transmitter under test.

NOTE

If necessary, clip R58 to reduce maximum repeat audio and make R20 adjustment near center of range.

11. Turn off the 1KHz tone modulation from the service monitor but retain the RF carrier.
12. Press S1 once. This will return the ST-180 to tone squelch operation. (The transmitter should un-key.)
13. Add CTCSS modulation (on a previously programmed frequency) at $\pm 0.75\text{KHz}$ deviation to the carrier being provided by the service monitor. (The transmitter should key.) Turn off the carrier from the service monitor and note the duration of transmit time from loss of signal until the transmitter un-keys. Adjust R55 and repeat the above test until an acceptable duration of hang time after loss of signal is achieved.

14. Set S2 positions 9 and 10 for the desired maximum transmit time according to TABLE 2.

TIME-OUT TIMER SETTINGS

| MAXIMUM TRANSMIT TIME | S2 SECTIONS | |
|-----------------------|-------------|-----|
| | 9 | 9 |
| 1.5 Minutes | ON | ON |
| 2.0 Minutes | ON | ON |
| 2.5 Minutes | OFF | OFF |
| 5.0 Minutes | OFF | OFF |

TABLE #2

NOTE

Because decode control is derived as a memory address, it is possible to have CARRIER SQUELCH as a valid user. This may occur as a programming problem if the jumpered decode tone frequency does not match the S2 tone frequency code setting when S1 is pressed. You will have to push S1 while receiving a carrier with no tone to get out of this condition.

LEVEL ADJUSTMENTS DESCRIPTION

The ST-180 has several level adjustment pots. Each of these pots set levels that are critical to proper operation of the finished repeater. A properly calibrated Communications Service Monitor or the equivalent number of separate instruments will be required to properly set these adjustments. The first adjustment is R4, the input level adjustment pot. The operational performance specifications of the repeater panel are based on the proper setting of this pot. R7 is the squelch adjust pot. The setting of this pot is also critical since misadjustment can cause unintentional key-up problems and/or poor

sensitivity. R20 is the repeat audio level adjustment and is used to set the proper repeat audio modulation level. Misadjustment can cause either low repeat audio level or possible adjacent channel interference. Repeated sub-audible tone modulation is set with R61. Misadjustment can cause poor CTCSS decode performance of the units using the repeater. Finally, R55 is used to set the transmitter hold on time. This pot is set according to user preference for how long the repeater should stay keyed after loss of input signal and is not critical to performance.

SETUP

PROGRAMMING SETUP

1. Disconnect the antenna from the receiver.
2. Set R61 to its midrange (or above) position.
3. If you are adding tone channels install all the IC's now.

NOTE

The Programming Chart is used for both decode and encode frequencies. Reference to S2 sections in the Chart applies also to the decode jumpers (i.e., S2 section 1 = JU1-1 through S2 section 6 = JU1-6).

PROGRAMMING (or adding) A SINGLE CTCSS TONE USER

NOTE

A single tone position may be programmed at any time. If multiple tone channels are already in use it is not necessary to reprogram all the installed positions to add or change a tone channel.

1. Perform the steps shown in PROGRAMMING SETUP.
2. Set the tone decode jumpers to the desired tone frequency according to TABLE 1. (Refer to the component locator to find the location of position one in the jumper field.)
3. Turn on power to the ST-180.
4. Set S2 positions 7 and 8 to ON.

5. Set S2 positions 1 through 6 to the same tone frequency as was set by the decode tone jumpers in step 2.

IMPORTANT! Verify that both the decode jumpers and the encode programming switch are set to identical tone frequencies.

6. Press S1.
7. Set S2 positions 1 through 8 OFF.
8. Reset R61 (if necessary) as outlined in LEVEL ADJUSTMENTS.

FREQUENCY PROGRAMMING

Frequency Programming is done by setting DIP switch positions according to the following Programming Chart.

S2: (0 = SWITCH ON; 1 = SWITCH OFF)
JUMPERS: (0 = IN; 1 = OUT)

| PROGRAMMING CHART | | | | | | | | | | | | | |
|-------------------|----------------|---|---|---|---|---|-------|----------------|---|---|---|---|---|
| FREQ | JUMPER SECTION | | | | | | FREQ | JUMPER SECTION | | | | | |
| IN Hz | 1 | 2 | 3 | 4 | 5 | 6 | IN Hz | 1 | 2 | 3 | 4 | 5 | 6 |
| 67.0 | 1 | 1 | 1 | 1 | 1 | 1 | 131.8 | 0 | 0 | 1 | 0 | 0 | 1 |
| 71.9 | 0 | 1 | 1 | 1 | 1 | 1 | 136.5 | 0 | 1 | 1 | 0 | 0 | 0 |
| 74.4 | 1 | 1 | 1 | 1 | 1 | 0 | 141.3 | 0 | 0 | 1 | 0 | 0 | 0 |
| 77.0 | 0 | 0 | 1 | 1 | 1 | 1 | 146.2 | 0 | 1 | 0 | 1 | 1 | 1 |
| 79.7 | 1 | 1 | 1 | 1 | 0 | 1 | 151.4 | 0 | 0 | 0 | 1 | 1 | 1 |
| 82.5 | 0 | 1 | 1 | 1 | 1 | 0 | 156.7 | 0 | 1 | 0 | 1 | 1 | 0 |
| 85.4 | 1 | 1 | 1 | 1 | 0 | 0 | 162.2 | 0 | 0 | 0 | 1 | 1 | 0 |
| 88.5 | 0 | 0 | 1 | 1 | 1 | 0 | 167.9 | 0 | 1 | 0 | 1 | 0 | 1 |
| 91.5 | 1 | 1 | 1 | 0 | 1 | 1 | 173.8 | 0 | 0 | 0 | 1 | 0 | 1 |
| 94.8 | 0 | 1 | 1 | 1 | 0 | 1 | 179.9 | 0 | 1 | 0 | 1 | 0 | 0 |
| 97.4 | 1 | 1 | 1 | 0 | 1 | 0 | 186.2 | 0 | 0 | 0 | 1 | 0 | 0 |
| 100.0 | 0 | 0 | 1 | 1 | 0 | 1 | 192.8 | 0 | 1 | 0 | 0 | 1 | 1 |
| 103.5 | 0 | 1 | 1 | 1 | 0 | 0 | 203.5 | 0 | 0 | 0 | 0 | 1 | 1 |
| 107.2 | 0 | 0 | 1 | 1 | 0 | 0 | 210.7 | 0 | 1 | 0 | 0 | 1 | 0 |
| 110.9 | 0 | 1 | 1 | 0 | 1 | 1 | 218.1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 114.8 | 0 | 0 | 1 | 0 | 1 | 1 | 225.7 | 0 | 1 | 0 | 0 | 0 | 1 |
| 118.8 | 0 | 1 | 1 | 0 | 1 | 0 | 233.6 | 0 | 0 | 0 | 0 | 0 | 1 |
| 123.0 | 0 | 0 | 1 | 0 | 1 | 0 | 241.8 | 0 | 1 | 0 | 0 | 0 | 0 |
| 127.3 | 0 | 1 | 1 | 0 | 0 | 1 | 250.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | OFF | 1 | 1 | 0 | 0 | 0 | 0 |

TABLE #1

INSTALLATION

MOUNTING

The ST-180 is designed for mounting in a standard 19" equipment rack. It requires one module (1-3/4") of rack space. External connections are made at the rear of the chassis by an 8-conductor cable. The front panel is removable with the two fractional-turn fasteners for easy access to the circuit board. Other than setup, there are no operating controls or visual indicators on the unit; therefore, operator access is not required.

INTERFACE:

The 8-conductor cable assembly is unterminated at the radio end. It must be wired into a full-duplex radio for repeater operation. The following instructions reference the color of the leads in the cable and the P1 pin numbers on the connector. P1 mates with J1 on the repeater panel. J1 is located at the rear of the chassis.

Positive (+) Supply (RED) P1-10:

Connect to the positive side of a 13.6Vdc \pm 20% source. For proper operation, the supply must remain well filtered (less than 5mVrms ripple at full transmit load).

Negative (-) Supply (BLK) P1-1:

Connect to the negative side of the supply voltage, normally system ground.

Signal Input (GRN) P1-3:

Connect direct to the FM detector output from the repeater receiver.

Speech Output (GRY) P1-8:

Connect to the speech (microphone) input to the repeater transmitter.

Tone Output (WHT/BRN) P1-5:

Connect to the CTCSS tone input for the transmitter. This point should go direct to the modulator and bypass the speech circuitry.

PTT (WHT/YEL and WHT/BLK) P1-6 & P1-7:

A dry relay closure is provided between these pins to key the repeater transmitter. Connect between PTT and negative (-) supply for PTT(-) keying, or to positive (+) supply for PTT(+) keying.

SPECIFICATIONS

| | |
|------------------------|---|
| Operating Voltage: | + 13.6Vdc \pm 20% |
| Operating Current: | Less than 80mA (TX not keyed); less than 120mA (TX keyed) |
| User Capacity: | Up to 8 user tones with tone translation |
| Frequency Capability: | Any EIA RS-220A tone plus 97.4 Hz |
| Frequency Accuracy: | Within \pm 0.3% |
| Frequency Stability: | Over Temperature Range: \pm 0.3%, -20°C to 80°C Over Long Term: \pm 0.3% |
| Input Impedance: | Greater than 100K |
| Output Impedance: | Repeat Audio: Less than 2K (keyed); open circuit (un-keyed) CTCSS Encode: Less than 3K |
| Decoder Response Time: | Attack: \leq 270 msec. Release: \leq 270 msec. |
| Decoder Bandwidth: | \geq 0.5% and \leq 3% |
| Encoder Rise Time: | \leq 20 msec. for $f_0 \geq$ 100 Hz \leq 50 msec. for $f_0 \geq$ 100 Hz |
| Transmitter Keying: | Dry relay contact closure |
| Transmit Hold-On Time: | 100 msec. to 3 seconds, adjustable |
| Transmit Limit Time: | 1.5, 2.0, 2.5 and 5.0 minutes, switch selectable |
| Squelch: | Standard feature, 6 to 20dB quieting, adjustable |
| Output Level: | Speech Output: 0 to 1V _{rms} , adjustable (100K load) CTCSS Encode: 0 to 2V _{rms} , adjustable (100K load) |
| Output Distortion: | Speech Output: Less than 5% THD greater than input CTCSS Encode: Less than 5% THD |
| Hi-Pass Filter: | Typically 0dB attenuation @ 1 KHz \geq 36dB attenuation below 250 Hz |
| Dimensions: | 19" L x 1.75" W x 1" D |
| Mounting: | One 19" rack unit |
| Interface: | 36" cable with P1 mating connector to J1 on the ST-180 (0.1" center, 10-pin) |

OPTIONS

| | |
|--|---|
| Owner Shut-Down of User: | ST-800RPT Remote Control Module. A 4-character DTMF code received simultaneously with CTCSS toggles user tone to opposite condition (ON or OFF) |
| Decode Circuit for Each Additional User Tone | ST-180K1 Kit. Monolithic IC and six programming jumpers |