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Model TP-154

Shared Repeater Tone Panel

USER'S INSTRUCTION MANUAL

S/W rev. 3.01
Manual upgraded January 1997

Made in U.S.A.

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IMPORTANT NOTICE

Your TP-154 is equipped with **CTCSS Trak...** , a revolutionary software decoding algorithm that gives the TP-154 unbeatable tone sensitivity and talk down resistance.

This TP-154 is supplied with the ability to decode either the standard 38 EIA CTCSS or 50 CTCSS tones and 104 DCS codes. To select the number of tones, use JP-7. With JP-7 installed, you decode 38 tones. With JP-7 removed, you decode 50 tones.

Consider carefully before you jump into the 50 tone version. Dividing up the subtone spectrum into 50 slots rather than 38 slots gives each standard tone less operating room. The 38 tone version makes the TP-154 more tolerant of mobile and portable radios which have poor CTCSS frequency tolerance. We recommend only using the 38 tone version because in general you will experience far better system performance. The TP-154 also supports 104 DCS codes. Please see Table 2 for a listing of standard and non standard tones and codes.

Our recommendation to avoid problems:

DO NOT USE THE 12 NON STANDARD TONES UNLESS ABSOLUTELY NECESSARY!

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THE CONNECTIONS

Two connections must be made to the receiver and three to the transmitter. Use shielded wires with the shields at each end connected to chassis ground. (The rear panel barrier strip terminals labeled "GND" are chassis ground). We recommend using spade type crimp-on connectors for ease and reliability. Connect the center wires as follows:

RX AUDIO: The audio input terminal should be connected directly to the receivers discriminator (de-modulator) output.

RX COS: Connect to a point that has good voltage swing when the squelch is opened/closed. The best point to connect is to the collector of the transistor that controls the busy light (if the receiver has one). Otherwise, you may connect to the squelch gate control voltage. Your last choice would be to connect to output of the noise rectifier.

If the point selected goes more positive (voltage increases) when a signal is received, strap JP-10 center to the + side. If the point goes to a lower voltage, strap JP-10 from center to the - side.

When the COS threshold control P4 has been properly adjusted (see page 5), and JP-10 properly strapped (see page 6), the front panel RECEIVE LED will illuminate only when a signal is received. This condition must be achieved for proper operation of the interconnect.

NOTE: The squelch control in the receiver must be set for quiet (squelched) receive. Set the squelch as you would any squelch, but remember if you set it too tight receive sensitivity may suffer.

TX AUDIO: Connect to the transmitter audio input or Mic high line.

PTT: Connect to the transmitter PTT line.

SUBTONE The SUBTONE output is used to inject DCS and CTCSS into the transmitter. The injection point must be after the IDC clipper circuit, and preferably directly to the modulator.

NOTE: For CTCSS operation you may use either a phase modulated or true FM (frequency modulation) transmitter. However for DCS operation only a true FM transmitter may be used.

VALID: This is an open collector NPN transistor output that is used to let a companion Model 8200 Full Duplex Interconnect know when DCS or CTCSS is valid. The transistor is normally on, but is turned off during the interval that a DCS or CTCSS code is valid. This output is only used when using the TP-154 in conjunction with a CSI Model 8200.

+12 VDC: Connect to a source of 12-14 VDC. The TP-154 is reverse polarity protected, so a polarity mistake will not damage your TP-154. Connect the return lead (-) to GND.

WARNING

The TP-154 contains a power supply sensing circuit that continuously monitors the input supply voltage. An instantaneous drop below 10 VDC will cause a microcomputer reset. If the power supply has poor regulation, erratic operation may result.

The purpose of the input voltage sensor is to protect the non-volatile EE memory during power up and power down.

If erratic operation is observed be suspicious of poor regulation from the power supply.

#####

IMPORTANT NOTE

The TP-154 is factory programmed with all 154 tones/codes turned on. As far as programming is concerned the panel is ready to operate as soon as it is connected to the receiver and transmitter and appropriate level adjustments have been made.

Do not attempt any reprogramming until you have the TP-154 up and running as a repeater. Or you run the risk of a programming error causing a problem you do not understand. The TP-154 can be returned to full factory default programming at any time by simply installing jumper JP-6 and turning the power off and back on again. You will see || || || || in the display during the re-initializing process. When the display shows ---- the process is complete. Remove JP-6 and your TP-154 is ready to use programmed to factory default values.

Should you forget your programming mode access code you will have to return all programming to the factory default values so that you can start over again.

ADJUSTMENTS

P1 PREAMP: The **PREAMP** control is used to match the audio level from your receiver to the TP-154. To adjust, a signal containing 100 HZ CTCSS with about 600 HZ deviation must be applied to the receiver. Adjust the PREAMP control until a level of 3V P-P is observed at TP-1 using an oscilloscope. If an oscilloscope is not available TP-1 should read 1V RMS using a VOM.

This completes the adjustment of the PREAMP control. Future adjustment should only be required if the TP-154 is connected to a different receiver.

P2 ID LEVEL: Courtesy beeps & CW ID level: Adjust for desired modulation level of the courtesy beep and CW ID.

P3 RPT AUDIO: The **REPEAT AUDIO** control sets the level of the voice audio. Set so that 3 khz. input deviation causes 3 khz. output deviation. This will cause a linear input/output relationship.

NOTE: The RPT AUDIO control should only be adjusted after the PREAMP control has been properly adjusted.

P4 COS: The **COS** control sets the COS input threshold level. Measure the voltage at TP-2 with no signal. Then measure the voltage again with a signal applied. Adjust the **COS** control until the voltage reading at TP-3 is approximately midway between the two readings previously obtained at TP-2.

For example: If TP-2 read 2 volts with no signal, and 4 volts with a signal applied to the receiver, TP-3 would be set to read 3 volts.

IMPORTANT: If the COS polarity select strap JP-10 is set correct and the **COS** control is properly adjusted the RECEIVE LED will illuminate when there's a signal, and will go out when the signal is removed.

P5 DCS: The **DCS** control sets the modulation level of digital DCS.

P6 CTCSS: The **CTCSS** control sets the modulation level of analog CTCSS.

P7 DTMF: The **DTMF** control adjusts the deviation of the outgoing DTMF transpond and regenerated DTMF. Set for about 2.5 KHz. deviation.

JUMPER STRAP OPTIONS

- JP-1 De-emphasis strap.** If you have connected to the discriminator output, JP-1 should be installed. If you have connected to a source of flat (already de-emphasized) audio such as the high end of the volume control JP-1 must be removed. If JP-1 is improperly strapped the audio will not sound proper and DTMF will not decode properly.
- JP-2 Output level strap.** The audio output is selectable in two ranges. With the strap installed, the audio out is 0-1 volt. With the strap removed, the output range is 0-5 volts. The strap should be installed in most installations.
- JP-3 DCS/CTCSS Level strap.** The DCS/CTCSS output level is selectable in two ranges. With the strap installed, the level is 0-1 volt. With the strap removed, the output range is 0-5 volts. The strap should be installed in most installations.
- JP-4 PTT Polarity.** This strap gives you a choice of pull to ground, or pull to +12 VDC for transmitter keying.
- JP-5 LED Power.** Removal disables all front panel LEDs (except PTT) and is used to save power in low power applications such as solar powered installations.
- JP-6 Reset Factory Settings.** If you wish to return the programming back to factory settings simply install this strap and turn the power on. When the initialization begins, the display will show "11 11 11 11". When the procedure is complete, the display will show "----". At this point remove the jumper. The display will blank and the TP-154 is ready to use just like it came from the factory.
- JP-7 50 or 38 tones.** Install this jumper to operate in 38 tone mode. Remove this jumper to operate in 50 tone mode. see the IMPORTANT NOTICE at the beginning of the manual for more information.
- JP-8 8200 compatible.** Install this strap only if the TP-154 is going to operate in conjunction with a CSI Model 8200 Full Duplex Interconnect. Installation modifies TP-154 operation for compatibility.
- JP-9 Not Used.** There is no JP-9
- JP-10 COS Polarity Select.** This strap must be installed. Select the polarity that causes the REC led to illuminate when a signal is received, and go out when there's no signal. Note that the COS threshold adjustment P4 must first be adjusted.

PROGRAMMING THE TP-154

The TP-154 can be programmed with DTMF from a radio or service monitor, or by plugging any DTMF telephone set into the rear panel RJ-11 modular jack and using the telephone DTMF keypad.

There are three programming modes:

- 1. PER USER PROGRAMMING:** This allows you to make programming selections on a per user basis. See **TABLE 2** for User Number vs Tone/Code
- 2. GANG PROGRAMMING:** This allows you to quickly program all 154 user slots to the same setting. For example you could enable or disable the courtesy tone for all users with a single command. Use the gang programming feature to quickly set all users to the condition you wish for the majority and then afterward use the Per User Programming to modify individual users as required. For Example: If you only want five users enabled, you would disable all users with gang programming and then selectively enable the five desired users with per user programming.
- 3. GLOBAL PROGRAMMING:** This allows you to program selections that affect all users at once. For example, DCS polarity or Hog Penalty time etc. (Global Programmed items are not individually programmable on a per user basis).

To Enter and Exit Programming Mode: To enter programming mode you must first enter the programming mode access code. The access code consists of six digits plus a leading * and a trailing #. The syntax is *mmmmmm#. The factory default programming access code is 123456 (note that this code is always six digits in length). Therefore the code required to get into programming mode is *123456#. This code will be valid unless you change the Programming Mode Access Code in the GLOBAL programming area.

When programming is completed send #### to exit the programming mode. (If you forget, the TP-154 is designed to self exit three minutes after the last DTMF command).

Remote and Local Programming Modes: When the TP-154 receives the program mode access code it checks to see if the code came from a radio or from a local telephone keypad. If the code is received from the radio the TP-154 goes into Remote Programming mode. If the code does not come from the radio the TP-154 knows that you are local and using a DTMF telephone as a keypad.

In Remote Programming mode the transmitter remains keyed and a beep will be heard about every five seconds to remind you that the TP-154 is still in Program Mode. The front panel PROGRAM LED will flash on and off. A DTMF sequence is transponded back after each command sequence for programming validation on your CD-2 Decoder Unit.

In Local Programming Mode the front panel PROGRAM LED is steady on (non-flashing) and the transmitter remains off. Each time you make a programming entry the results are displayed on the front panel display (rather than a DTMF transpond) for validation.

Command Syntax: When programming, you will enter programming sequences such as *nnn#09#mm#. (This particular command programs a users first character of CW ID). Or, *nnn#01#J#. (This command enables or disables a users courtesy beep).

In each case nnn defines the user number (001-154). See **TABLE 2** to determine user Number vs Tone/Code, mm is a choice which you may supply and J is always 1 for enable or 0 for disable.

De-limiters (separators) are used to segregate data fields. Every command you program begins with * and then the delimiters that follow are the # symbol.

Leading zeros: Data fields such as nnn, mm, mmmmmm etc. require that you enter the number of digits specified. Numbers which have fewer digits than the field calls for will require leading zeros. Example: An nnn (User Number) field requires three digits. You would enter user number 6 as 006 or user number 84 as 084.

Local Display: The front panel display is active during local or remote programming. The * and # delimiters are displayed as - and || because the display cannot show the * and #. Each time you enter a delimiter the previous information is blanked and the delimiter plus data that follows is displayed. For example: The command *013#09#20# would appear as: -013, ||09, ||20.

Remote Data Downloading: The TP-154 will transpond a DTMF validation code each time you send a programming command from your radio and each time you send a specific request for data. These codes will appear on your CD-2 Communications Decoder Unit exactly as they appear on the TP-154 front panel display and give you positive feedback about data entry and how your TP-154 is programmed. The command syntax for data feedback is shown in the programming lists. Also see "Interpretation of CD-2 Display Data on page 15. The left two digits give you the parameter number and the right two digits show the programmed data.

WE HIGHLY RECOMMEND THAT YOU PURCHASE A COMPANION CD-2 AS A PROGRAMMING AID FOR YOUR TP-154'S!!

Understanding the programming format: Following is a typical line excerpted from the GLOBAL PROGRAMMING COMMANDS:

```
-----  
                                TO PROGRAM          TO  
DISPLAY  
  
STUCK MIKE ACTIVITY TIMER          *000#22#mm#          *000#22*  
mm 01-99 0 to disable (10-990 Secs - 10 sec/step) [mm=3=30 Secs]  
-----
```


The top bold line identifies the item you may wish to program and the syntax to use for programming followed by the syntax to use to read this parameter back to either the front panel display if programming locally or to your CD-2 if programming from a remote site.

The subline tells you everything you need to know to program this particular parameter. The first information lets you know the allowable range for mm and that if you can enter zero to disable this parameter altogether. In parenthesis the actual range of adjustment is indicated. If you multiply the value you enter (mm) by the step size you will have the resultant time. The information in brackets [mm = 3 = 30 Secs] is how the TP-154 is programmed when shipped from the factory.

Example: You wish to set the Stuck Mic. Activity Timer to 60 seconds for all users on the system. First determine the value for mm. This would be 6 (6 times the step value of 10 seconds equals 60 seconds. The desired value). To make this modification, enter the following sequence on your local or remote DTMF keypad: *000#22#06#. (Note the leading zero which must be used)

To read this parameter back on the local display or on your CD-2 simply send: *000#22*.

Resetting your position: If you are distracted or have a lapse and forget where you are in the middle of a command sequence simply send * three times (***) and start the command sequence over again. Example: You have just entered *000#22#0 and suddenly you forget where you are. Simply send *** and begin inputting the command over again.

Be organized. We recommend thinking through what you want to program and then writing down the entire sequence of codes you must send including programming mode access code at the beginning and exit code (####) at the end. You may send a request to display any data you wish to see on the local display or CD-2 at any time while in programming mode.

TABLE 1 CW ID CHARACTER CODES						
A = 0	G = 6	M = 12	S = 18	Y = 24	5 = 30	WORD
B = 1	H = 7	N = 13	T = 19	Z = 25	6 = 31	SPACE= 36
C = 2	I = 8	O = 14	U = 20	1 = 26	7 = 32	
D = 3	J = 9	P = 15	V = 21	2 = 27	8 = 33	SLANT
E = 4	K = 10	Q = 16	W = 22	3 = 28	9 = 34	BAR = 37
F = 5	L = 11	R = 17	X = 23	4 = 29	0 = 35	
						MESSAGE
						END = 38
e.g. CW ID message desired is 'CSI' Enter 2, 18, 8, 38						

USER	CODE	USER	CODE	USER	CODE	USER	CODE
001	67.0	040	199.5 *	079	156	118	423
002	69.4 *	041	203.5	080	162	119	431
003	71.9	042	206.5 *	081	165	120	432
004	74.4	043	210.7	082	172	121	445
005	77.0	044	218.1	083	174	122	446
006	79.7	045	225.7	084	205	123	452
007	82.5	046	229.1 *	085	212	124	454
008	85.4	047	233.6	086	223	125	455
009	88.5	048	241.8	087	225	126	462
010	91.5	049	250.3	088	226	127	464
011	94.8	050	254.1 *	089	243	128	465
012	97.4	051	023	090	244	129	466
013	100.0	052	025	091	245	130	503
014	103.5	053	026	092	246	131	506
015	107.2	054	031	093	251	132	516
016	110.9	055	032	094	252	133	523
017	114.8	056	036	095	255	134	526
018	118.8	057	043	096	261	135	532
019	123.0	058	047	097	263	136	546
020	127.3	059	051	098	265	137	565
021	131.8	060	053	099	266	138	606
022	136.5	061	054	100	271	139	612
023	141.3	062	065	101	274	140	624
024	146.2	063	071	102	306	141	627
025	151.4	064	072	103	311	142	631
026	156.7	065	073	104	315	143	632
027	159.8 *	066	074	105	325	144	654
028	162.2	067	114	106	331	145	662
029	165.5 *	068	115	107	332	146	664
030	167.9	069	116	108	343	147	703
031	171.3 *	070	122	109	346	148	712
032	173.8	071	125	110	351	149	723
033	177.3 *	072	131	111	356	150	731
034	179.9	073	132	112	364	151	732
035	183.5 *	074	134	113	365	152	734
036	186.2	075	143	114	371	153	743
037	189.9 *	076	145	115	411	154	754
038	192.8	077	152	116	412		
039	196.6 *	078	155	117	413		

TABLE 2

User Number vs Tone/Code

Users 001-050 are CTCSS.
051-154 are DCS.

NOTE: The twelve tones with an * are non standard and are available when JP-7 is removed. When JP-7 is installed, they are not available. See page 2 and page 6 for details.

Normal	Invert	Normal	Invert	Normal	Invert
023	047	223	134	445	043
025	244	225	122	446	255
026	464	226	411	452	053
031	627	243	351	454	266
032	051	244	025	455	332
036	172	245	072	462	252
043	445	246	523	464	026
047	023	251	165	465	331
051	032	252	462	466	662
053	452	255	446	503	162
054	413	261	732	506	073
065	271	263	205	516	432
071	306	265	156	523	246
072	245	266	454	526	325
073	506	271	065	532	343
074	174	274	145	546	132
114	712	306	071	565	703
115	152	311	664	606	631
116	754	315	423	612	346
122	225	325	526	624	632
125	365	331	465	627	031
131	364	332	455	631	606
132	546	343	532	632	624
134	223	346	612	654	743
143	412	351	243	662	466
145	274	356	212	664	311
152	115	364	131	703	565
155	731	365	125	712	114
156	265	371	734	723	431
162	503	411	226	731	155
165	251	412	143	732	261
172	036	413	054	734	371
174	074	423	315	743	654
205	263	431	723	754	116
212	356	432	516		

TABLE 3
Normal / Inverted DCS Codes

It is important to have the DCS decode and DCS encode polarities programmed correctly. The default values are set to normal for incoming and outgoing DCS. The radios you use may need to have incoming and/or outgoing DCS set for inverted polarity.

Example: An incoming 023 code reads as 047. Inverting the DCS Polarity Decode parameter will correct the code. An outgoing code of 212 appears as 356 on your service monitor or CD-2. Simply invert the DCS Encode Polarity to correct.

DCS Polarity Decode and Encode parameters are found in the Global Programming section.

PER USER PROGRAMMING COMMANDS ----- (Programs one user at a time)	TO PROGRAM V	TO DISPLAY V
LIST ALL PER USER PROGRAMMING ON DISPLAY OR CD-2		*nnn#00*
Downloads entire user file to CD-2 or front panel display.		
COURTESY BEEP	*nnn#01#J#	*nnn#01*
J = 1 = Enabled, J = 0 = Disabled		[J = 1 = Enabled]
CTCSS/DCS DURING HANG TIME	*nnn#02#J#	*nnn#02*
J = 1 = Enabled, J = 0 = Disabled		[J = 1 = Enabled]
BARGE IN CONTROL	*nnn#03#J#	*nnn#03*
J = 1 = Enabled, J = 0 = Disabled		[J = 1 = Enabled]
If enabled, the subscriber you are currently programming can be barged in on by subscribers with a different tone/code. If disabled, the subscriber you are currently programming can not be barged in on by subscribers with a different tone/code until hangtime expires.		
SUBSCRIBER ENABLE/DISABLE	*nnn#04#J#	*nnn#04*
J = 1 = Enabled, J = 0 = Disabled		[J = 1 = Enabled]
Allows enabling or disabling specific tones or codes.		
RESERVE TONE	*nnn#05#J#	*nnn#05*
J = 1 = Enabled, J = 0 = Disabled		[J = 0 = Disabled]
If a subscriber tone/code is turned off and reserve tone is enabled, the repeater will come up, but no audio will pass. Beeps indicate reserve tone is active.		
HOG PENALTY	*nnn#06#J#	*nnn#06*
J = 1 = Enabled, J = 0 = Disabled		[J = 0 = Disabled]
See DEFINITION OF TERMS for information about Hog Penalties.		
SUBSCRIBER HANG TIME	*nnn#07#mm#	*nnn#07*
mm 10-99 (1.0-9.9 Sec's - .1 sec/step)		[mm = 30 = 3 Sec's]
CROSS TONE	*nnn#08#mmm#	*nnn#08*
Can cross any DCS/CTCSS code nnn to any DCS/CTCSS code mmm		[nnn=mmm]
See Table 2.		
CWID SEQUENCE CHARACTER 1	*nnn#09#mm#	*nnn#09*
CWID SEQUENCE CHARACTER 2	*nnn#10#mm#	*nnn#10*
CWID SEQUENCE CHARACTER 3	*nnn#11#mm#	*nnn#11*
CWID SEQUENCE CHARACTER 4	*nnn#12#mm#	*nnn#12*
CWID SEQUENCE CHARACTER 5	*nnn#13#mm#	*nnn#13*
CWID SEQUENCE CHARACTER 6	*nnn#14#mm#	*nnn#14*
CWID SEQUENCE CHARACTER 7	*nnn#15#mm#	*nnn#15*
CWID SEQUENCE CHARACTER 8	*nnn#16#mm#	*nnn#16*
CWID SEQUENCE CHARACTER 9	*nnn#17#mm#	*nnn#17*
CWID SEQUENCE CHARACTER 10	*nnn#18#mm#	*nnn#18*
See Table 1.		[CHAR 1 - CHAR 10 are defaulted to 38]

CW ID characters and corresponding mm values may be obtained from Table 1. The entry immediately following your message must be 38 which means "end of message".

Example: To program KYZ 2584 the following mm sequence is required in character positions 1-8: 10 24 25 27 30 33 29 38

GANG PROGRAMMING

(Programs all 154
user slots at once)

TO PROGRAM

|
V

COURTESY TONE	*999#01#J#
CTCSS DURING HANG TIME	*999#02#J#
BARGE IN CONTROL	*999#03#J#
USER ENABLE/DISABLE	*999#04#J#
RESERVE TONE	*999#05#J#
HOG PENALTY ENABLE	*999#06#J#

| In position J for all of the above |
enter 1 for enable, 0 for disable.

SUBSCRIBERS HANG TIME	*999#07#mm#	
mm 5-99 (.5-9.9 Seconds - .1 sec/step)		[mm = 30 = 3 Sec's]

Note: There are no display codes for Global programming because the programming affects 154 locations. You must view subscriber programming on an individual basis.

GLOBAL PROGRAMMING COMMANDS

(These parameters affect all users)

TO PROGRAM

|
V

TO DISPLAY

|
V

LIST ALL GLOBALS ON DISPLAY OR CD-2	*000#00*
Downloads all global parameters to CD-2 or front panel display.	

ANTI-KERCHUNKING TIME	*000#19#mm#	*000#19*
mm = 01-99, 0 to disable (.1 sec/step)		[mm = 0 = Disable]
If enabled, repeater will not hang unless user keys down at least as long as the time set. Does not affect pick up speed.		

SQUELCH TAIL LENGTH *000#20#mm# *000#20*
mm 00-99 (0-99 Ms - 1 Ms/step) [mm = 0 = 0 Milliseconds]
Set to 0 for minimum tail. Only used if the receiver has a poor
squelch and can stop word clipping by adding squelch delay. If
there is a tail noise when set to 0, it is caused by slow
squelch response in the receiver. The TP-154 does not add any
more tail than is inherent to the receivers squelch if set to 0.

CTCSS/DCS HOLD DELAY *000#21#mm# *000#21*
mm 3-99 (.3-9.9 Sec's - .1 sec/step) [mm = 30 = 3 Sec's]
Use the lowest setting possible without introducing talk off.
Fills the missing gap when CTCSS/DCS decoding momentarily
falters due to overmodulation, momentary weak signal etc.

STUCK MIKE ACTIVITY TIMER *000#22#mm# *000#22*
mm 01-99, 0=disable (10 sec/step) [mm = 18 = 180 Sec's]

DCS ENCODE POLARITY *000#23#J# *000#23*
0 = NORMAL, 1 = Inverted [mm = 0 = Normal]
Corrects transmitted DCS Polarity.

DCS DECODE POLARTIY *000#24#J# *000#24*
0 = NORMAL, 1 = Inverted [mm = 0 = Normal]
Corrects received DCS polarity.

HOG PENALTY TIME *000#25#mm# *000#25*
mm 06-99 (60-990 Sec's - 10 sec/step) [mm = 18 = 180 Sec's]

HOG IDLE TIMER *000#26#mm# *000#26*
mm 02-99 (20-990 Sec's - 10 sec/step) [mm = 06 = 60 Sec's]

HOG TIMER *000#27#mm# *000#27*
mm 06-99 (60-990 Sec's - 10 sec/step) [mm = 18 = 180 Sec's]

See DEFINITION OF TERMS for information about Hog Penalties.

COR OR DCS/CTCSS OPERATE *000#28#J# *000#28*
J = 0 = DCS/CTCSS, 1 = COR [J = 0 = DCS/CTCSS]
NOTE: The operating parameters for carrier operation are
programmed in the user No. 001 file.

RESPONSE DELAY TO CD-2 *000#29#mm# *000#29*
mm 00-99 (0-9.9 Sec's - .1 sec/step) [mm = 10 = 1 Sec.]
Delays CD-2 data transpond to give your base time to return to
receive after entering a command.

PROGRAMMING MODE ACCESS CODE *000#30#mmmmmm# *000#30*
(Code must be precisely six digits) [mmmmmm = 123456]
This code must be used to enter programming mode locally or over
the air.

INTERPRETATION OF CD-2 DISPLAY DATA

When the *nnn#00* command is sent from the remote programming location, the TP-154 responds with a lengthy string of DTMF data to load the CD-2 memory with all data relative to user nnn. Upon completion of the string the CD-2 begins displaying all of the user programming for the user (nnn) which has been requested. The left two digits identify which data is displayed and the right two digits show the actual data. If the data exceeds two digit positions as in line 7 below, the data is shown on the next line.

PER USER DATA ON CD-2: (Command syntax = *nnn#00*)

-NNN	USER NUMBER	VALUE 001 -154
01-J	COURTESY TONE	VALUE 0 - 1
02-J	CTCSS/DCS DURING HANG	VALUE 0 - 1
03-J	BARGE IN CONTROL	VALUE 0 - 1
04-J	DEADBEAT CONTROL	VALUE 0 - 1
05-J	RESERVE TONE	VALUE 0 - 1
06-J	HOG PENALTY	VALUE 0 - 1
07MM	USER HANG TIME	VALUE 05 - 99
08--	CROSS TONE	N/A
NNN-	CROSS TONE	VALUE 001 - 154
09MM	CWID CHARACTER 1	VALUE 00 - 38
10MM	CWID CHARACTER 2	VALUE 00 - 38
11MM	CWID CHARACTER 3	VALUE 00 - 38
12MM	CWID CHARACTER 4	VALUE 00 - 38
13MM	CWID CHARACTER 5	VALUE 00 - 38
14MM	CWID CHARACTER 6	VALUE 00 - 38
15MM	CWID CHARACTER 7	VALUE 00 - 38
16MM	CWID CHARACTER 8	VALUE 00 - 38
17MM	CWID CHARACTER 9	VALUE 00 - 38
18MM	CWID CHARACTER 10	VALUE 00 - 38
----	END OF SEQUENCE	N/A

GLOBAL DATA ON CD-2: (Command syntax = *000#00*)

19MM	ANTI KERCHUNKING TIME	VALUE 00 - 99
20MM	SQUELCH TAIL LENGTH	VALUE 00 - 99
21MM	CTCSS/DCS HOLD DELAY	VALUE 00 - 99
22MM	STUCK MIKE TIMER	VALUE 00 - 99
23-J	DCS POLARITY ENCODE	VALUE 0 - 1
24-J	DCS POLARITY DECODE	VALUE 0 - 1
25MM	HOG PENALTY TIME	VALUE 00 - 99
26MM	HOG IDLE TIME	VALUE 00 - 99
27MM	HOG MONITOR	VALUE 00 - 99
28-J	DCS/COR OPERATED	VALUE 0 - 1
29MM	RESPONSE DELAY TO CD-2	VALUE 00 - 99
30MM	PROGRAM ACCESS CODE	VALUE 00 - 99
NNNN	PROGRAM ACCESS CODE	VALUE 0000 - 9999
31MM	COURTESY TONE DELAY	VALUE 00 - 99
32MM	SYSTEM CW INTERVAL	VALUE 00 - 99
33MM	USER CW INTERVAL	VALUE 00 - 99

34MM	MORSE SPEED	VALUE 00 - 99
35MM	CWID CHARACTER 1	VALUE 00 - 38
36MM	CWID CHARACTER 2	VALUE 00 - 38
37MM	CWID CHARACTER 3	VALUE 00 - 38
38MM	CWID CHARACTER 4	VALUE 00 - 38
39MM	CWID CHARACTER 5	VALUE 00 - 38
40MM	CWID CHARACTER 6	VALUE 00 - 38
41MM	CWID CHARACTER 7	VALUE 00 - 38
42MM	CWID CHARACTER 8	VALUE 00 - 38
43MM	CWID CHARACTER 9	VALUE 00 - 38
44MM	CWID CHARACTER 10	VALUE 00 - 38
----	END OF SEQUENCE	N/A

DISPLAY AND REMOTE BOOTING INFORMATION

DTMF DISPLAY: The display will indicate all DTMF codes that are received on the repeater input when in operate mode. However The digital displays used in the TP-154 are not capable of directly displaying the *, #, A, B, C or D. The * and # are displayed using - and ||. A, B, C and D are displayed using the numbers 1. 2. 3. and 4. Note that these are distinguishable from 1 2 3 and 4 because the decimal points accompany the digits. The Table below shows all the DTMF digits and how they appear on the front panel display:

1 = 1	5 = 5	9 = 9	A = 1.
2 = 2	6 = 6	0 = 0	B = 2.
3 = 3	7 = 7	* = -	C = 3.
4 = 4	8 = 8	# =	D = 4.

RE-BOOTING: A variety of conditions can occur (e.g. lightning) that will occasionally lock up a microprocessor. The only solution is to restart the processor. In a Personal Computer you may be familiar with the term "warm boot" (this is done using the Cont + alt + Del keys) or "hard boot" which is accomplished by either pressing the reset button or by turning the power off and back on again.

Your TP-154 has been provided with the ability to do both warm boot and hard boot remotely using DTMF. If a malfunction occurs first try a warm boot. This is accomplished by pressing the # five times (#####). This will normally restart the processor and correct the difficulty. If a warm boot does not restore operation try a hard boot (full reset) by pressing any DTMF digit for ten or more seconds. (Re-booting will have no effect on user programming).

SPECIAL TEST MODES

1. **Test Transmission with any DCS or CTCSS:** Occasionally it may be handy to have the repeater send a carrier with any DCS code or CTCSS tone you wish for various test purposes. First enter the program mode as previously discussed. Then enter this sequence:

***nnn#99#**

Where nnn is the user number that corresponds to the tone or code you want the TP-154 to transmit. See Table 2. The test transmission will last as long as you remain in program mode or until you enter a * or a new command. Don't forget that the TP-154 will automatically exit program mode three minutes after the last command. You can occasionally hit any digit except * or # to extend the test mode time if desired. Enter #### when you wish to exit program mode.

2. **DCS/CTCSS display:** While at the site you may wish to have the front panel display indicate the DCS and CTCSS codes of all signals heard on the repeater input. Simply enter the following code while in operate mode:

nnnnnn

Where nnnnnn is the same user programmable code sequence used to enter the programming mode. The difference is that the program mode access code ends with # while the display mode sequence ends with *. If the factory programmed access code has not been changed simply enter *123456* to activate the DCS/CTCSS display mode.

The display mode is disabled in any of the following ways:

1. By entering #### from your DTMF keypad.
2. By entering programming mode.
3. A built in software timer will automatically turn off the display mode 30 minutes after it has been enabled.

Note: The TP-154 does not normally display DCS or CTCSS in operate mode to realize a significant reduction in average power consumption which is important in solar powered installations. In some applications a slight buzz in the repeat audio may be noticeable while in display mode. However this will go away as soon as display mode is disabled.

3. **Display all CTCSS/DCS codes enabled for repeater usage:** To view a list of all CTCSS/DCS codes enabled for repeater use simply enter the following sequence while in program mode..

***888#**

DEFINITION OF TERMS

Courtesy beep: A brief tone at the end of a users transmission that lets the party you are speaking with know that it is their turn to reply.

Barge in: An attempt to cut in by a user who does not have the DCS/CTCSS code of the user currently using the system.

Reserve tone: A tone in reserve tone status will bring up the repeater but audio will not pass.

Cross tone: Converts a users input DCS or CTCSS to another DCS or CTCSS as desired.

CW ID: Automatic identification of call sign in Morse Code.

Hangtime: The amount of time the repeater transmitter remains on the air after a user stops transmitting.

Kerchinking: A kerchunker is a user that briefly hits his PTT switch to see if he can raise the repeater. Many find this practice annoying. The Anti-Kerchinking feature in the TP-154 is designed to stop users who like to kerchunk. The Anti-Kerchinking filter does not affect pick-up time or repeat capability, however if a transmission is shorter than the Anti-Kerchunk time there will be no hangtime when the user unkeys.

CTCSS/DCS hold delay: A software timer that fills in momentary DCS or CTCSS loss when a signal is weak. When the hold delay is set to at least two seconds the effective receiver sensitivity is precisely the same as the receivers' squelch sensitivity.

Stuck Mic. activity timer: Sets the maximum continuous (uninterrupted) talk time. If a user talks past the activity timer time, the repeater merely stops transmitting until the input drops and is picked up anew.

DCS polarity: Characteristics of receivers and transmitters can invert DCS. The TP-154 has independently programmable receive and transmit invert to accommodate your radios.

Response delay to CD-2: The amount of time from a download request until the TP-154 begins outputting a DTMF download to your CD-2 Communications Decoder Unit. This time is required if you are programming from a half duplex radio.

User Enable/Disable: Ability to turn a subscriber off for non payment and back on in response to payment. Sometimes it may be desirable to put a subscriber into reserve tone status rather than use the deadbeat disable. That way he will realize that he is picking up the repeater but can't talk. This may give the user a clue that they need to write a check.

Hog: A user or user group that monopolizes airtime.

Hog Penalty: This feature is designed to give the system manager some control over airtime hogs which may drive other customers away.

In order to use the Hog Penalty feature it is necessary to understand how it works. There are three timers which can be individually set in the global programming. These are ...

HOG MONITOR: This timer sets the maximum talk time a subscriber may use without incurring a no talk penalty. Warning beeps during the final thirty seconds indicate that a penalty is forthcoming if use is not quickly terminated. If the subscriber ignores the warning beeps for the full thirty seconds he is penalized by not being able to use the system for the "penalty time" duration.

IDLE TIMER: The "hog monitor" timer is reset if the user does not use the system for the "idle time" this gives the user a clean slate. It must be noted that the "hog monitor" timer time is cumulative, if the idle time criteria is not met.

PENALTY TIME: If the subscriber exceeds the cumulative "hog monitor" timer time he receives a hog penalty time.

The TP-154 can only track the most recent five users for hog penalty. If the system operator (or any other user) enters "###", all hog timers will be cleared, allowing the penalized Hog(s) to use the system before the penalty time has expired

CIRCUIT DESCRIPTION

The incoming audio is buffered, de-emphasized and amplified to the amount set by the PREAMP control by input op amps U1. The audio then proceeds to a six pole low pass filter and a six pole high pass filter. The low pass filter U2 removes voice audio and extracts the DCS/CTCSS signal for detection at the adaptive differential comparator. The comparator output is fed to the microcomputer U12 pin 12 for software DCS/CTCSS detection. The six pole high pass filter (U3) removes CTCSS and DCS from the incoming audio to avoid retransmission. The audio from the high pass filter continues through the squelch switch U18 and on to the audio output amplifier.

The COS input is buffered and compared to a reference voltage which is set by the COS threshold pot. The output then proceeds to the polarity select strap JP-10 and then to the microcomputer U12 pin 6.

DTMF is decoded and regenerated by U11 with some assistance from the microcomputer U12.

DCS is generated directly by the microcomputer U12. CTCSS is generated by waveform generator U16. The microcomputer U12 controls the U16 waveform generator via pins 34,35 and 36. DCS and CTCSS have separate level controls the output of each is fed to summation amplifier and four pole low pass filter U4. The output of U4 feeds the transmitter modulator with SUBTONE.

The PTT circuit consists of Q6, Q14 and Q20. This circuit is controlled by the microcomputer U12 via pin 7. A polarity select strap gives the choice of ground keying or plus keying.

A power on reset circuit consisting of Q21 and associated components monitors the input voltage and quickly halts the microcomputer if the applied input voltage is too low. The power on reset circuit provides proper computer start up after power is applied and protects the EE memory U13 on power down.

Counters U22 and U23 divide the 448 KHz clock from U11 and allow remote re-booting of the microprocessor when any incoming DTMF digit exceeds 9 seconds in duration. At the end of nine seconds U22 pin 15 turns on transistor Q9 which in turn enables the power on reset circuit.

The front panel digital display U6-U9 are controlled by the display driver U5. The microcomputer U12 talks to U5 via pins 37,38 and 39.

Incoming power is fed through reverse polarity protect diode D8 and then fuse F1. From there the +V voltage feeds a +5 volt regulator U20 used by the digital components. Another smaller +5 volt regulator U21 is used to supply bias and reference voltage to the analog op-amps etc.

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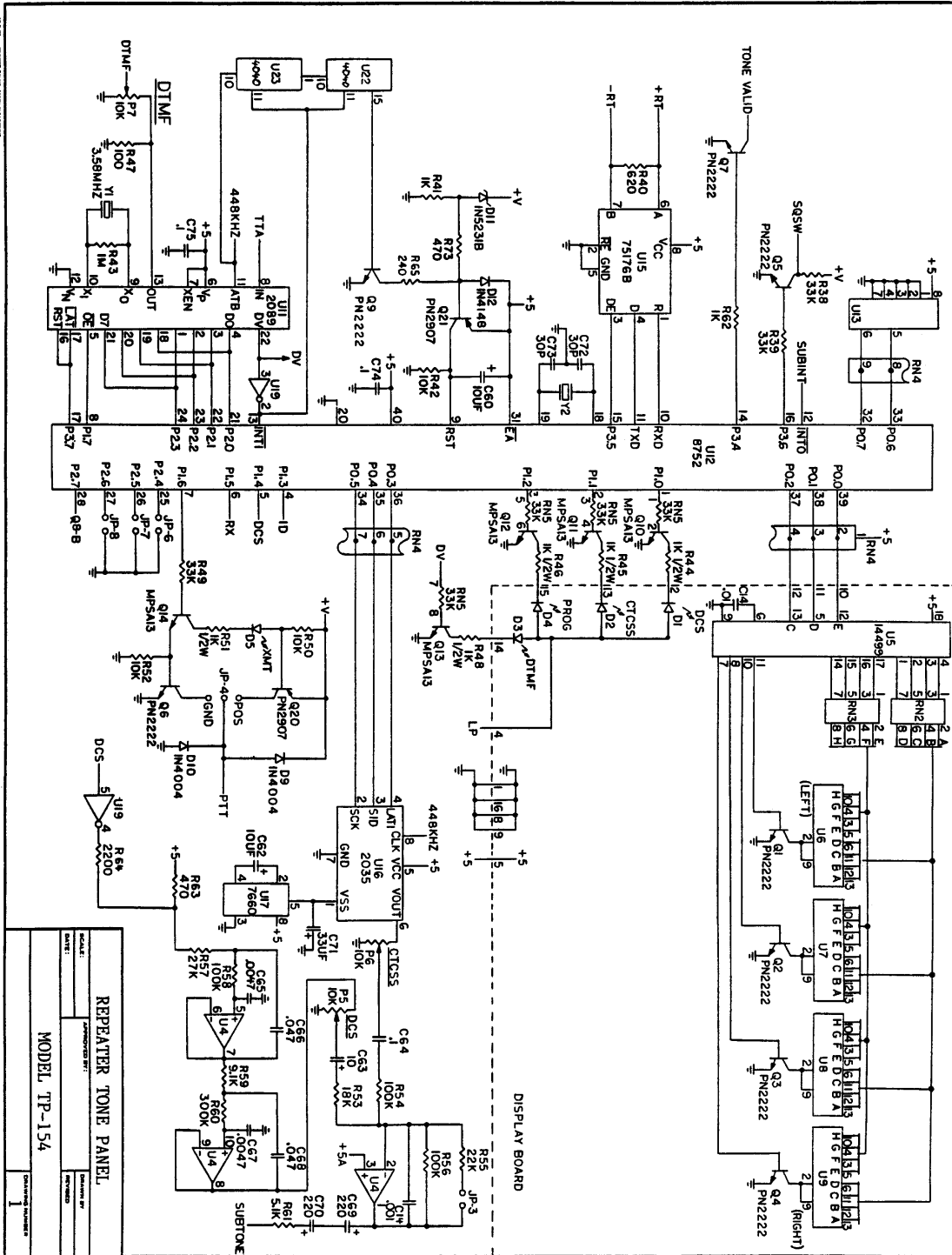
What is not covered by this limited warranty:

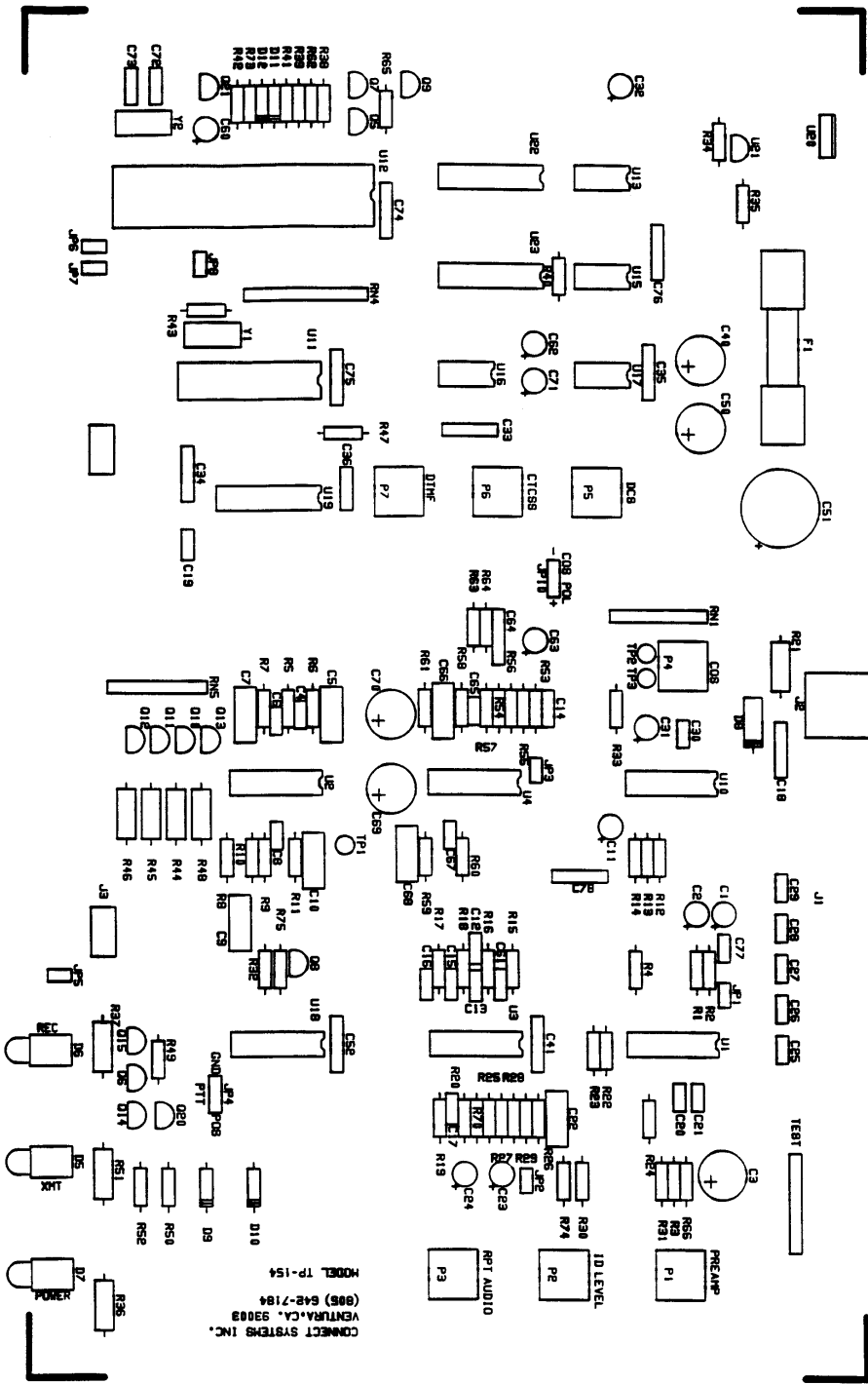
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