MODEL TP-3200 SHARED REPEATER TONE PANEL

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SECTION IV

GENERAL DESCRIPTION

The Communications Specialists Model TP-3200 is a compact 19” rack mount Shared Repeater Tone Panel for use on shared repeater stations that utilize CTCSS signaling tones and/or Digital Coded Squelch (DCS) codes for access and control. It is the complete repeater control interface between the repeater transmitter and receiver. The microprocessor based design uses the latest state of the art nonvolatile memory chips for data retention, and uses a proprietary digital algorithm for CTCSS tone detection. This eliminates adjacent tone falsing, provides for superior tone decoding response time and permits up to 157 subscriber capacity.

Since the TP-3200 Shared Repeater Tone Panel is field programmable, this allows the technician to program the individual repeater subscribers from a laptop computer, or by DTMF signaling from any base station. A five digit security code insures that only authorized personnel may re-program the unit. The TP-3200 has built-in time and hit accumulators which record the activity of all CTCSS tones and DCS codes on the repeater channel. This data is stored in the nonvolatile memory chips and can be recalled for observation at any time by a laptop computer or DTMF signaling using the Communications Specialists Model DI-16 DATA INTERROGATOR.

The TP-3200 operates from 12.6 VDC obtained from the repeater power supply, and its low power consumption is ideal for solar site applications. An optional wall transformer allows the TP-3200 to operate from 120 VAC. All RF connections are made through the DB-9 connector on the rear side of the unit. The TP-3200 is enclosed in an RF tight metal enclosure, and is protected against static and lightning discharges that are common to mountain top sites.

SECTION V

OPERATION

The TP-3200 has two modes of operation. The primary mode of operation is the Normal Repeater Mode. The secondary mode of operation is the Programming Mode. The Normal Repeater Mode allows the TP-3200 to operate as a conventional shared repeater station. The TP-3200 will encode and decode 157 different CTCSS tones and DCS codes. If a repeater user is enabled, then the TP-3200 will key the transmitter, pass the repeat audio, and regenerate a new CTCSS tone for transmission. If a user is not enabled, the TP-3200 will still decode the user, however, the transmitter will not key.

Front Panel Indicators

Five front panel LEDs show the current operating status of the TP-3200. The five LEDs operate as follows:

POWER LED- Indicates that power is supplied to the unit.

XMIT LED- This RED LED indicates when the TP-3200 is keying the repeater transmitter.

ENCode LED- This LED indicates when the TP-3200 is regenerating a CTCSS encode tone or DCS code.

CARrier LED- This LED indicates when the TP-3200 is receiving a carrier signal from the repeater receiver.

DECode LED- This LED will illuminate when the TP-3200 decodes a CTCSS tone, DCS code, or DTMF digit.

Power up

Upon application of the proper DC voltage to the TP-3200, the POWER LED will illuminate, and the ENCode LED will flash indicating proper operation. Upon power up, the TP-3200 goes through an automatic test of various parts of the circuit. If the TP-3200 finds any problems in the system, the ENCode LED will stay lit for an extended period of time. After the automatic test, the TP-3200 will operate in the normal repeater mode.

When the TP-3200 is first received from the factory, the nonvolatile memories are initialized to a predetermined state. The memory contents can be modified to suit the particular requirements of the system by following the instructions in the Computer Programming and DTMF Programming section of this manual.

Remote Reset

The TP-3200 is well protected against static and lightning damage that could upset the operation of the CPU. However, in the unlikely case that the CPU has crashed, as a safeguard, the TP-3200 can be remotely reset by transmitting the DTMF digit '#' on the repeater input channel for at least 10 seconds. This will return the TP-3200 back to normal repeater operation.

SECTION VI

INSTALLATION

Installation of the Communications Specialists Model TP-3200 Shared Repeater Tone Panel should be done by qualified service personnel. If the TP-3200 is retrofitted to an existing repeater, remove or disable all repeat audio cards, timeout timers, and any other repeater control cards, since these will no longer be needed.

Jumper Options

The first step in the installation procedure is to configure the internal jumpers for your application. All modifications should be made with the POWER OFF to the TP-3200.
The TP-3200 contains five internal jumpers on the circuit board which provide flexibility for various installation requirements. The jumpers are installed at the factory for the most common application. Therefore, altering the jumper options will probably not be necessary for your installation. Please read over the jumper options to verify that they are correctly installed.
To access the internal jumpers, first remove the four screws on the bottom of the TP-3200 enclosure, then remove the rear panel, and slide the circuit board out.

JP1- REPEAT AUDIO PROCESSING default- IN

The audio signal from the repeater receiver discriminator is normally pre-emphasized. JP1 will de-emphasize the discriminator signal resulting in a flat audio response. This audio is then properly processed to be injected into a repeater transmitter. If for some reason the transmitted repeat audio contains too many low frequencies, or sounds bassy, then remove JP1 to increase the high frequency response of the circuit.

JP2- TRANSMIT AUDIO GAIN default- IN

If the input to the repeater transmitter is high impedance, then JP2 should be removed. For a low impedance transmitter, JP2 should be installed. If you cannot get enough repeat audio transmit deviation, install JP2.

JP3- CTCSS/DCS OUTPUT RESPONSE default- IN

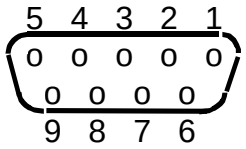
If the repeater transmitter uses a phase modulator, then JP3 should be installed. If the repeater transmitter uses a direct FM modulator, then remove JP3. This can be tested by generating different CTCSS tones and checking to see if there is any significant output deviation variation as measured on a service monitor tuned to the repeater transmitter channel. If a significant variation exists, then remove JP3. Please note that DCS codes WILL NOT operate with a phase modulated transmitter!

JP4/JP5- PTT OUTPUT POLARITY default- JP5 IN / JP4 OUT

This jumper controls the PTT voltage. If a ground is required to transmit, install JP5 and remove JP4. If +V is required for PTT then remove JP5 and install JP4. DO NOT install both jumpers at the same time.

RF Interface Connections

All TX and RX connections are made to the DB-9 RF Interface connector on the rear panel. All audio lines should use coaxial type shielded wires to reduce any RF interference. Shields should be terminated at both ends. The TP-3200 should be mounted as close as possible to the repeater transmitter-receiver. All audio lines should be kept as short as practical for the installation. See the Typical Installation diagram for wiring. The pin numbers on the rear panel RF Interface connector, J1, are arranged as follows:



J1-1 DC POWER INPUT- Power input to the TP-3200 should be 12.6 VDC +/-20% regulated or unregulated obtained from the repeater power supply. If the AC wall transformer is used, connect the wire with the white stripe (+12VDC) to J1-1. Connect the other wire (ground) to J1-6.

J1-2 TRANSMITTER PTT OUTPUT- This pin will provide PTT keying for the repeater transmitter by an internal relay.

J1-3 RECEIVER DISCRIMINATOR- Connect the repeater receiver discriminator to this pin. Please note that this connection should be made in the receiver before any de-emphasis circuit so that the TP-3200 can process unfiltered audio.

J1-4 COS INPUT- This pin is used to control the length of the squelch tail that is heard when the mobile stops transmitting. Connect this pin to the receiver COS output. If this is not provided, connect this pin to the collector of the squelch switch transistor in the repeater receiver. The collector voltage should change from less than .4 volts, to at least 2.0 volts when squelched and unsquelched. The polarity is not important since it is programmable in the TP-3200.

J1-5 TRANSMIT REPEAT AUDIO OUTPUT- This pin can be connected to the microphone input or repeat audio input on the repeater transmitter.

J1-6 GROUND- Use this pin as the main power supply ground.

J1-7,8 GROUND- Connect the shield of all audio lines to these pins.

J1-9 CTCSS OUTPUT- This pin outputs the regenerated CTCSS tone or DCS code for transmission, and should be wired to the subaudible tone input on the repeater transmitter. This connection is usually near the modulator circuit, and is after any voice processing circuits in the repeater transmitter.

LEVEL ADJUSTMENTS

Four level adjustments are located on the rear panel of the TP-3200. Adjustments are done by computer control by using the Level Adjustments Menu and the On-Line Help. Please refer to the next section on Computer Programming.

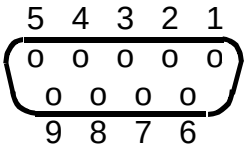
SECTION VII

COMPUTER PROGRAMMING

Computer programming can be done by any computer or terminal with communications software and an RS-232 compatible serial port. Communications software such as PROCOMM is very common and popular. Communication parameters are 9600 baud, 8 data bits, 1 stop bit and no parity. Computer programming must be used to access all of the programmable features of the TP-3200. The front panel serial Programming Port is used for this purpose. **The TP-3200 can also be programmed remotely from the Programming Port by using an external 9600 baud modem**. Minimal instructions for programming are contained in this manual since 'On-Line Help' is provided in the TP-3200 programming software, and explains all of the unique and advanced features. Please note that if the TP-3200 is left in the Programming Mode with no activity for 5 minutes, the TP-3200 will automatically revert back to normal repeater operation.

To program the TP-3200 by a computer, connect an RS-232 cable from your computer's serial port to the DB-9 connector, J3, on the front panel of the TP-3200. After the connection is made, power up the TP-3200 and your computer, and activate your computer's communications software. **To access the TP-3200 computer programming mode, press the carriage return key**. The TP-3200 will respond with a request for password. Please note that the **DEFAULT PASSWORD = 12345**. Enter the five digit password and press carriage return. The Main Menu will then appear. Complete programming instructions and assistance for programming the TP-3200 are provided in the 'On-Line Help' selections in each menu.

The pin numbers on the front panel Programming Port connector, J3, are arranged as follows:



If you cannot communicate with the TP-3200 using your computer, check to make sure that the serial cable is wired properly. Make sure the cable you are using is a 'straight thru' cable. That is, pin 1 connects to pin 1, pin 2 connects to pin 2, and so on. Your computers serial port should be configured as a standard DTE device. The TP-3200 is configured as a standard DCE device. If you are still having trouble, try using a 'null modem cable adapter'.

If for any reason you wish to reprogram the TP-3200 back to the factory default values, use the Global User Menu to initialize all user memory data, and then the System Parameters 2 Menu to load all default system parameters.

SECTION X

DTMF PROGRAMMING

Programming the TP-3200 by DTMF is accomplished by a control station on the repeater channel equipped with a 12 or 16 button DTMF encoder, or the Communications Specialists Model DI-16 DATA INTERROGATOR. A standard DTMF encoder will allow the radio shop to control many programmable features in the TP-3200 that must be altered from time to time from a remote location. In order to recall data from the TP-3200, the DI-16 DATA INTERROGATOR or a DTMF display decoder must also be used.

The first step in programming the TP-3200 is to enter the Programming Access Code by DTMF signaling on the repeater input channel. To enter the programming mode, transmit the five digit programming access code followed by the '#' key on the repeater channel. Please note that the DEFAULT PROGRAMMING ACCESS CODE = 12345. As soon as the proper code is received, the TP-3200 will key up and transmit a double beep. Signals received by the TP-3200 will not be repeated while in the programming mode.

When you have finished programming, revert the TP-3200 back to normal repeater operation by pressing the "#" key, and hold it down for at least 10 seconds. This will reset the TP-3200, and it will revert to normal repeater operation. If the TP-3200 is left in the Programming Mode with no activity for 5 minutes, the TP-3200 will automatically revert back to normal repeater operation.

The following table summarizes the DTMF programming commands:

PROGRAMMING

CODE	FUNCTION	DEFAULT
10#	User Enable-Disable Status	OFF
11#	User Enable-Disable Reserve Tone	OFF
12#	User Enable-Disable Busy Channel Lockout	ON
13#	User Enable-Disable Hold TX Encode Tone	ON
14#	User Enable-Disable Courtesy Tone	OFF
15#	User Enable-Disable Hog Penalty	OFF
16#	User Enable-Disable Prepay Airtime	OFF
17#	User TX Carrier Delay Time	3.0 sec
18#	User Cross Tone Encode	NONE
19#	User Station ID	NONE
20#	Recall User Time Accumulator	
21#	Recall User Hit Accumulator	
22#	Recall the Total TX time	
23#	Load User Prepay Airtime	
24#	Reset and Clear Time and Hit Accumulators	
25#	High Speed Time and Hit Counter Recall	

After a parameter is programmed, the TP-3200 will key up and transmit a high frequency double beep. If an error is detected while programming the TP-3200 will key up and transmit three low frequency beeps.

Program codes 10 thru 16 use the following format:

```
AA#       BBBB#       C#

 |        |           |
 |        |           |____ 1 = ENABLE  0 = DISABLE
 |        |
 |        |____ USER CTCSS TONE OR DCS CODE
 |
 |____ DTMF PROGRAMMING CODE
```

These programming codes are derived from the computer programming User Menu. A two digit DTMF programming code is used to select the parameter to program. A user can be any CTCSS tone or DCS code. When entering a user tone frequency, such as 100.0 hz., use the '*' key as the decimal point followed by the '#' key (100*0#). When entering a user DCS code, simply use the three digit DCS code number followed by the '#' key (023#). The parameter selected is then enabled or disabled. Enter a '1#' to enable or a '0#' to disable the feature. When the last key is pressed, the TP-3200 will key up and transmit two beep tones to acknowledge the programming sequence.

EXAMPLE: A new user using 203.5 Hz is placed on the repeater. This subscriber can use the repeater by having the CTCSS tone, 203.5 Hz enabled using the programming code '10#'. To enable this user, transmit the following DTMF tones:

10# 203*5# 1#

EXAMPLE: To disable a DCS user 023, transmit the following DTMF tones:

10# 023# 0#

PROGRAMMING CODE 17# USER TRANSMIT CARRIER-DELAY TIME

This programming code sets a users TX carrier-delay timer in 0.1 second steps, ranging from 0.0 seconds to 9.9 seconds. This delay is the amount of time that the repeater transmitter will stay on the air after the input carrier disappears. A users TX carrier-delay time is programmed by entering the programming code '17#', followed by the users CTCSS tone or DCS code followed by the '#' key, and then the time, in .1 second steps, for the TX carrier delay. Terminate the time with the "#" key.

EXAMPLE: To set the TX carrier delay for user 67.0 hz to 2.5 seconds, transmit the following DTMF tones: 17# 67*0# 2*5#

PROGRAMMING CODE 18# USER CROSS TONE ENCODE

This parameter tells the TP-3200 to regenerate a different CTCSS tone or DCS code than the one currently being received on the input channel of the repeater. A users cross tone is programmed by entering the programming code '18#', followed by the users CTCSS tone or DCS code followed by the '#' key, and then the cross CTCSS tone or DCS code to encode. Terminate with the "#" key.

EXAMPLE: To set user 203.5 hz for a cross tone of 100.0 hz, transmit the following DTMF tones: 18# 203*5# 100*0#

EXAMPLE: To cancel a cross tone for user 203.5, transmit the following DTMF tones: 18# 203*5# #

PROGRAMMING CODE 19# USER STATION ID

This programming code programs in the Morse code station call sign for a user. A maximum of eight characters may be programmed. The call sign is sent at 25 words per minute after the end of a users first transmission, and again at the users station ID programmed interval. To program a users station call sign, dial the programming code, "19#", followed by the users CTCSS tone or DCS code followed by the '#' key, and then dial the two digit number to the right of the letters or numbers that you wish to program for that user. Continue to program additional characters in the same manner. Follow each number code with the "#" key. At the completion of the call sign entry, fill up the remaining locations with '00#' until all eight characters have been entered.

N/L	#	N/L	#	N/L	#
0	48	C	67	O	79
1	49	D	68	P	80
2	50	E	69	Q	81
3	51	F	70	R	82
4	52	G	71	S	83
5	53	H	72	T	84
6	54	I	73	U	85
7	55	J	74	V	86
8	56	K	75	W	87
9	57	L	76	X	88
A	65	M	77	Y	89
B	66	N	78	Z	90

EXAMPLE: To program in the station call sign of 'KMG365' for user 250.3 hz, dial the following number sequence:

19# 250*3# 75# 77# 71# 51# 54# 53# 00# 00#

Notice that all eight characters must be programmed. When the TP-3200 sends the identification, the following sequence will be transmitted: 'KMG365' To clear out a call sign for user 250.3 hz, enter the following sequence:

19# 250*3# 00# 00# 00# 00# 00# 00# 00# 00#'

PROGRAMMING CODE 20# RECALLING USER TIME ACCUMULATOR DATA

This programming code will recall the time accumulator data for any CTCSS or DCS user. To recall time data for a user, enter in the programming code '20#', followed by the users CTCSS tone or DCS code that you want to recall, followed by the '#' key.

EXAMPLE: To recall data for DCS user 114, transmit the following

DTMF tones: 20# 114#

The TP-3200 will transmit the total accumulated time for the user in minutes using DTMF. This data will then be displayed and printed on the DI-16 DATA INTERROGATOR, or a DTMF display decoder.

PROGRAMMING CODE 21# RECALLING USER HIT ACCUMULATOR DATA

This programming code will recall the hit accumulator data for any CTCSS or DCS user. To recall hit data for a user, enter in the programming code '21#', followed by the users CTCSS tone or DCS code that you want to recall, followed by the '#' key. The TP-3200 will transmit the total accumulated hits for the user using DTMF. This data will then be displayed and printed on the DI-16 DATA INTERROGATOR, or a DTMF display decoder.

PROGRAMMING CODE 22# RECALLING THE TOTAL TX TIME

This programming code will display the total accumulated time for the repeater transmitter. Please note that the time accumulated for all users will not add up to the same number as the time for the repeater transmitter since the individual time counters do not include the carrier delay time duration. This data is useful for doing loading studies on different repeaters, and calculating the duty cycle of different repeaters. This data can be recalled by entering in the programming code "22#", The TP-3200 will transmit the total accumulated time using DTMF. This data will then be displayed and printed on the DI-16 DATA INTERROGATOR, or a DTMF display decoder.

PROGRAMMING CODE 23# LOAD USERS PREPAY AIRTIME

This programming code will program a users prepay airtime. To program a users prepay airtime, enter the programming code '23#', followed by the users CTCSS tone or DCS code you wish to program, followed by the '#' key, and then the amount of prepay airtime, in minutes, to program for the user. Maximum time is 9999 minutes. Follow this by the '#' key. Also, make sure the users prepay airtime feature is enabled with programming code '16#'.

EXAMPLE: To program the user 123.0 hz for 1200 minutes of airtime

(20 hours), transmit the following DTMF tones: 23# 123*0# 1200#

PROGRAMMING CODE 24# CLEAR TIME AND HIT ACCUMULATORS

This programming code will clear and reset to zero, all time and hit accumulators. All previous data in the counters will be erased.

PROGRAMMING CODE 25# HIGH SPEED TIME AND HIT RECALL

This programming code is used for high speed recall of time and hit accumulation counter data for all users. This can be used with the DI-16 DATA INTERROGATOR for printing out all counter data on the Printer Option. When the programming code, '25#' is entered, the TP-3200 will begin to transmit the time and hit counter data for all users.

SECTION XI

DATA INTERROGATION

The TP-3200 has the capability to transpond data to and from a control station on the repeater channel using DTMF signaling. Instructions can be sent to the TP-3200, via the input channel of the repeater, in order to recall data which is stored in the nonvolatile memory chips. This data comes back to the control station, by DTMF, on the output channel of the repeater station. By using the DI-16, data can be recalled from the TP-3200 regarding time and hit accumulator data. This data is very useful for locating new CTCSS tones for new repeater subscribers, since the TP-3200 records all the activity on the channel. This data can also be used for subscriber time billing.

In order to receive the data from the TP-3200, the Communications Specialists Model DI-16 DATA INTERROGATOR can be used. The DI-16 is a microprocessor controlled DTMF encoder and DTMF decoder in a desk top unit. Optionally, any DTMF display decoder could be used in conjunction with a 12 or 16 button DTMF encoder. The DI-16 has a serial printer output which allows the recalled data to be listed out on the DI-16 Printer Option.

Data is recalled from the TP-3200 by first entering in the 5 digit Security Code from a control station on the repeater channel that is equipped with a DTMF encoder. Now enter in the proper programming code from the Programming Section of this manual for recalling data. Within a few seconds after the last keystroke is entered, the TP-3200 will start sending the DTMF data down the repeater output channel. This information will be shown in the LED display of the DTMF display decoder. Please refer to the Programming Section of the DI-16 instructions for more detailed information on recalling data from the TP-3200. To terminate the programming session, and to return to normal repeater operation, press the "#" key, and hold it for at least 10 seconds.

The TP-3200 uses a monolithic decoder for receiving DTMF signaling. This chip is designed to be used on RF channels, and therefore has good sensitivity to noise, and twist. However, care must be observed when sending DTMF signals to the TP-3200. If the DTMF decoding seems unreliable, then try changing the deviation level of the DTMF tones either up, or down. The TP-3200 should also be receiving a signal which is as full quieting as possible.