

INTRODUCTION:

The 1P is a basic repeater controller. The controller uses low power devices and stores all commands and system status in non-volatile EE prom. The commands and call-sign are easily programmed using a basic "dumb" data terminal.

The 1P features:

- Low power design
- Small size
- EE prom memory for system status and ID
- User programming of ID and command codes
- Transmits acknowledgment of DTMF commanding
- 32 commands

The 1P board has four LED indicators and two adjustment potentiometers. The TX indicator (left most LED - viewing the board from the LED side) lights when the key-line (PTT) is logic low. The CTCSS on/off LED (located between the TX indicator and the crystal) lights when the CTCSS control line is logic low. The DTMF decode LED (between crystal and potentiometer) lights when a valid D.T.M.F. is being decoded. The right most (next to 9 pin "D" connector) LED is the power indicator.

On the side opposite the LEDs, is the input and output connections. At the left is a group of pins. These are shorted as required to provide gain or de-emphasis (see figure 2 at end of this book) The primary input and output pads are right of the shorting pins. At the right side of the board, is the 12 volt power input pads.

The 1P requires:

12 volt power capable of supplying 100 ma.

The connections to the 1P:

receiver audio (ideally, adjusted to 100 mv RMS or -16 dbm)

receiver activity indicator - COS (switches to common ground when RX is active)

common ground

keying output for transmitter - PTT (switches to common ground - 100ma MAX)

audio for transmitter (designed to drive 1000 ohms or more)

control line for CTCSS decoder. (switches to common ground - 100ma MAX)

receiver CTCSS indicator (switch to common ground when CTCSS is active)

INTRODUCTION continued :

The 1P is shipped setup for use with a receiver that has a 6 DB per octave de-emphasis circuit. If the receiver does not have a de-emphasis circuit, move the “berg” shorting block as required – see figure 1.

If CTCSS* is turned on (default *107), the controller will require a low on the CTCSS line for repeat operation. If a low (0 volts) appears on the COS pad, a low must also be present on the CTCSS input pad for the transmitter to key. If the repeater station has internal processing for CTCSS operation, then connect the CTCSS line to the COS line. This extra input was developed back when many amateur portables were not sub audible equipped. This allows a station to send the CTCSS off command code without encoding CTCSS Thus allowing the CTCSS to be shut off by a station operating without CTCSS. CTCSS off is the only command that can be performed without CTCSS when CTCSS operation is turned on.

The potentiometer located on the edge (near center) of the circuit board adjusts the level of the tones generated by the controller. Typically, tones would be set to deviate the transmitter 1 to 2 kc.

The potentiometer located near the green power LED adjusts the receiver level to the controller. It is best set to accept 100mv RMS of receiver audio when the receiver is modulated to 3kc by a 1000 c.p.s. tone. The controller's range is -25dbm (about 25mv RMS) to -10dbm (about 150mv RMS). Attempting to operate outside these limits may result in distorted audio or intermittent DTMF decoding. The controller will drive a transmitter input impedance above about 1000 ohms. If the transmitter input impedance is lower, change the LM 324 to a TL084. If the repeater transmitter has a mic bias resistor, removing the bias resistor will raise the mic hi input impedance.

If the transmitter has no level adjustment, a 50K potentiometer should be installed. This will become the repeat audio input. This input should be setup to deviate the transmitter 3kc when a 1000 c.p.s. tone (set to 100mv RMS) is applied to the repeat audio input.

SIMPLE REPEATER SETUP: without access to a communications service monitor. A sensitive ac voltmeter or scope may be used if available. The most basic (check-out setup) would have the receiver and transmitter connected to the 1P's pads. Initially the CTCSS input should be tied to the COS input. Using a hand held radio or signal generator if available, key the handheld on the receiver input frequency or generate a strong signal using a signal generator. The 1P's TX LED should light and the transmitter should key up. If the TX LED fails to light, make sure the COS line is near ground when the receiver is receiving a signal.

If TX is keying up ok, (while watching the DTMF decode LED), hit the 1, star, pound, and 3 digits on the DTMF pad – the LED should light during each tone.

If the LED fails to light, try turning the input potentiometer through its range while sending DTMF. If the DTMF LED still fails to light, try different setting of the “berg” shorting jumpers. (see Figure 2) If the D.T.M.F. decode LED lights when the four digits are sent, set the input potentiometer about $\frac{1}{4}$ of a turn clockwise beyond the point where any one of the four digits fails to decode. (LED lighting)

Monitor TX – audio should be passing through the 1P. Adjust the repeat audio level by adjusting the “repeat audio level” potentiometer on the transmitter. Adjust the TX level for a 1 to 1 audio relationship between input and output. In most cases, this very simple approach will yield a simple reliable repeater.

If a communications service monitor is available, follow the same basic procedure. The transmitter repeat level should be set up to deviate 3kc with 100 mv or -16 dbm applied. Use this as the reference level for the input during test and setup and the 1P should operate satisfactorily.

Once the 1P is repeating, the CTCSS on/off control line should be connected to the CTCSS control output pad and – if available and/or desired - the CTCSS input pad may be connected to the CTCSS decoder output.

NOTE: the CTCSS input pad must not be tied permanently to ground. If not used, tie to COS.

REMEMBER: the transmitter deviation control is not a repeat audio level. It should be set to limit the maximum frequency deviation to 5 kc in a typical narrow band F.M. radio system. The repeat input level is the amount of audio applied to the transmitter audio input.

This space is intentionally blank

*(CTCSS Continuous Tone Coded Squelch System) (P.L. C.G. etc)

PROGRAMMING:

A "dumb" terminal or PC loaded with a terminal emulator is needed to program the controller call-sign and change function commands. The programming device will be set up for 1200 baud, 8 bits, 1 stop bit, no parity. Connect the terminal (programming computer) to the 9 pin "D" connector. When hitting the return (enter), the controller should respond with the "\$" prompt. This is the programming mode and normal repeater operations are suspended during this mode. If the prompt does not respond when hitting the return key, install a null modem adapter. The following is a list of the controller's commands. The controller's software is case sensitive and all programming must be in lower case. The programming mode will automatically time out after about 30 seconds.

(enter command character and hit return (enter))

- l responds with the call sign.
- c responds with the command list
- x exit

To change a command:

Enter Cxx=yyyy

xx is the number of the command (example 00 01 02 etc)

yyyy is the new command (example *123 a90a d911 etc)

y is the standard D.T.M.F. (0 - 9 and a, b, c, d)

To change the call-sign:

Enter l=aaaaaaaa

a is any alpha character (a - z), or the forward slash (/)

The call-sign can be 1 to 8 characters long.

To clear call-sign, enter 8 periods (.).

- s will set command codes to the default settings (warning resets all codes)
the s command will not change call-sign

For diagnostic use only:

- r responds with the system status bytes
- z writes ascii "." into command memory
- f writes binary 0 into command memory

COMMAND SUMMARY – software version 4.0 (mfg defaults):

Command number	default	description of function
-----	-----	-----
c00	*100	access on
c01	*101	access off
c02	*102	test tone
c03	*103	DTMF muting on
c04	*104	DTMF muting off
c05	*105	long carrier tail (set by *124, 5 ,6)
c06	*106	very short carrier tail
c07	*107	CTCSS on (control line low – LED on)
c08	*108	CTCSS off (control line high – LED off)
c09	*109	immediate TX call-sign
c10	*110	ID transmits automatically at 30 minute intervals
c11	*111	ID automatic off
c12	*112	repeater operation on
c13	*113	repeater operation off
c14	*114	function acknowledgment on
c15	*115	function acknowledgment off
c16	*116	courtesy beep (time-out reset) on
c17	*117	courtesy beep (time-out reset) off
c18	*118	AUX1 output LOW
c19	*119	AUX1 output HIGH
c20	*120	CTCSS encode gate output - follows RX activity
c21	*121	CTCSS encode gate output – follows TX activity
c22	*122	time-out timer on
c23	*123	time-out timer off
c24	*124	carrier tail approx. = 1 second
c25	*125	carrier tail approx. = 2 seconds
c26	*126	carrier tail approx. = 3 seconds
c27	*127	ID at 30 min intervals – Commercial Two - Way
c28	*128	ID at 10 min intervals – Amateur Radio
c29	*129	disable auto shut off after 60 minutes of no activity (special version of 1P software)
c30	*130	not used
c31	*131	not used

COMMANDING CONTROLLER and MISC. NOTES:

The 1P is setup for four digit commands. The commands can be composed of any of the standard digits generated by a 16 button DTMF pad. When a user sends a valid command to the controller, the controller responds with 2 short beeps (function complete).

The access command controls the ability to "run" the other 30 functional commands. Disabling access does not shut off the repeater, it only prevents changes to the system. **The code for this command should not be left in the default setting.**

The test tone command is for diagnostics. For about 30 seconds, this command will key the transmitter and generate a 1000 c.p.s. tone to the transmitter audio line. This command could be used to set transmit level to your desired repeat level (typically 3kc). Caution: this audio is a smoothed square wave and should be used accordingly.

The muting command is used to disable DTMF muting. Normally, all DTMF tones are muted.

The short carrier delay (sometimes inappropriately called a squelch tail) is very close to zero transmit time after the receiver signal disappears. To the user, the repeater may appear off. During this mode, the telemetry beep (time out reset) will not be heard. This mode may be used when one user is talking through the repeater and the other is direct (talk-around).

Function 9 will respond in Morse, the text stored in call-sign location 1.

Function 10 activates automatic continuous transmissions of the text stored in call-sign location 1.

The function complete (command received acknowledgement) is the beep beep heard when a D.T.M.F. command is received and understood by the controller. Disabling function 14 will inhibit the function complete beeps. The controller will continue to respond to D.T.M.F. commands. Disabling the beeps may help discourage unauthorized persons attempting to breach command code security.

If the courtesy beep is disabled using function 17, the time-out timer will continue to function normally - unless disabled by function 23.

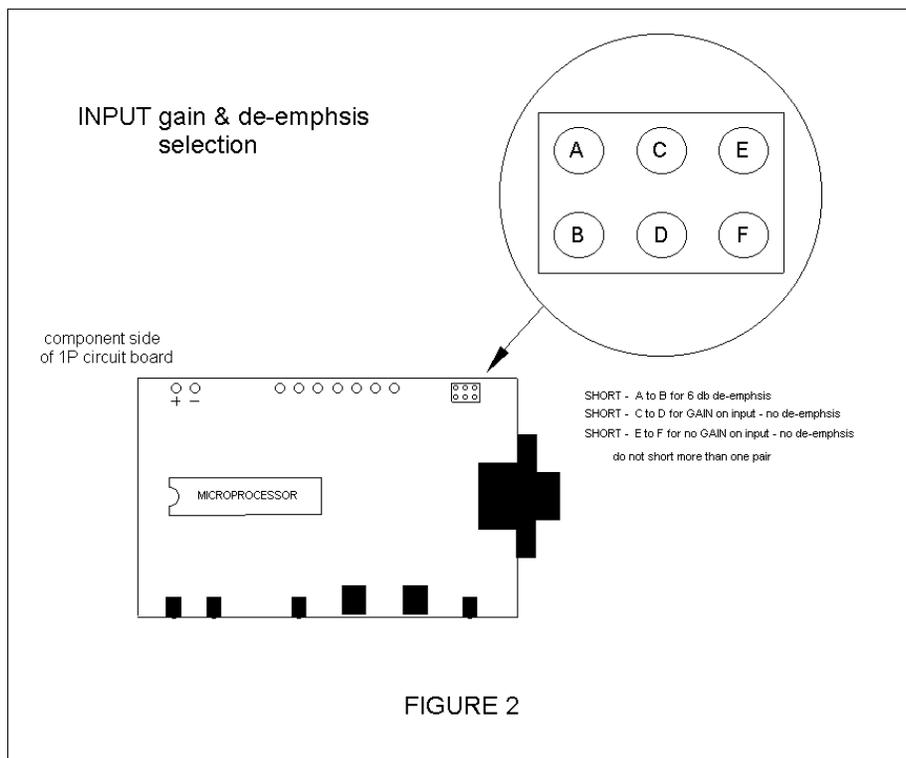
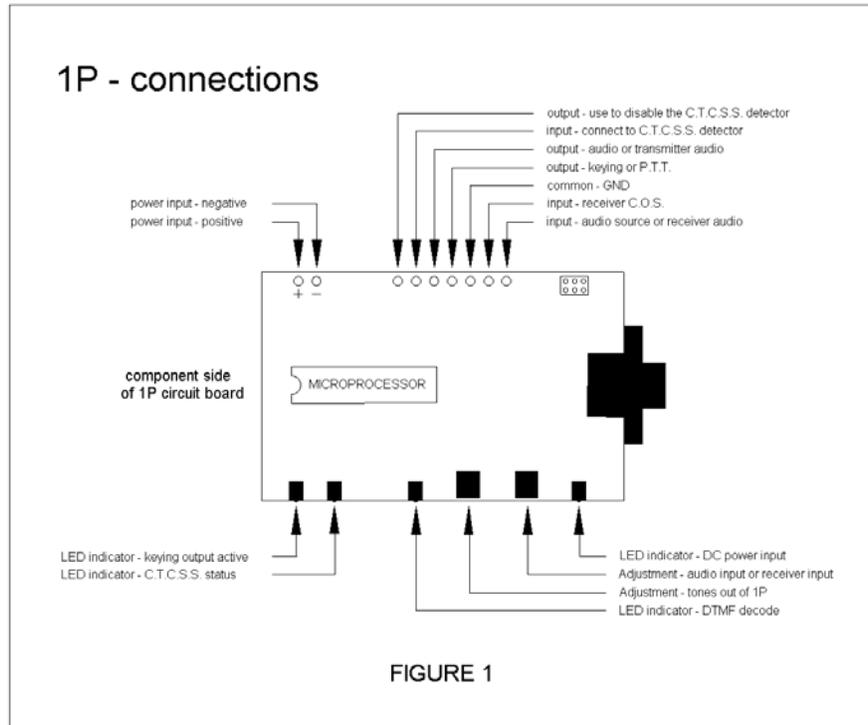
The time out timer limits transmitter time to about 3 minutes. When time out has occurred, the transmitter will shut off. If the signal remains on receiver (stuck mic, etc), the controller will transmit "TO" in Morse at 10 minute intervals until the received signal disappears. Function 23 disables the time out timer.

Functions 24, 25, and 26 adjust to transmit carrier delay after the receiver signal disappears. At the one second setting, there will be no courtesy beep due to the short delay. Courtesy beep will be heard when carrier delay is set to 2 and 3 seconds. IMPORTANT NOTE - the short delay function 6 overrides all settings of functions 24, 25, or 26.

TROUBLE SHOOTING:

1. Verify receiver operation: Deactivate the receiver's CTCSS decoder if present. Using a signal generator, input a fully quieted (more than 100 microvolts) RF signal into the receiver. Check receiver activity indicator line. It should be low (less than 1 volt). Modulate signal generator with 1000 c.p.s., adjust signal generator FM deviation to 3 kc. Inject this signal into receiver ant jack. The audio output of receiver (connected to RX pad on controller) should be more than 25 mv R.M.S. If the receiver audio is measured with a meter calibrated in dbm, the receiver audio output should be more than - 25 dbm. Receiver audio should be connected to the RX input pad. (see figure 1)
2. Verify DTMF decode. Connect receiver to controller. Using signal generator or transceiver, input a signal to receiver modulated with any DTMF, the DTMF LED should light. If the DTMF LED fails to light, check the receiver audio for distortion. The DTMF tones should not be clipped, they should be between 25 mv and 150 mv and not have any distortions.
3. D.T.M.F. decode and receiver activity ok, but no transmit:
Ensured the CTCSS is decoding or the CTCSS pad (if not used) is tied to the COS. Send the access enable code (code 00) following by the repeat enable (code 12) and CTCSS disable. If no transmit, check keying line (PTT). The line should go low (less than 1 volt) when receiver is active. Note: the switching transistor for the keying line is capable of sinking 100ma. The transmit audio leaves the controller on pad 5. The keying line is pad 4.

For additional assistance, call B & D Enterprises at (408) 246-6231. 8:00 to 3:00 PST.



Addendum to 1P manual March 2003

During March 2003, the firmware used in the 1P (one port) controller was changed. The revision changed the function of the AUX 2 output. In version 4.0, the AUX 2 is changed to an output to be used as a gate output to control a CTCSS encoder. This output is an open collector and will switch low when activated. The CTCSS gate output can be configured to track the receiver activity. It will switch low when the COS input is low and return high when the COS goes high. In the alternate mode, the action of the gate output will follow the transmitter keying line. In this mode, there is a short delay to help eliminate system user squelch tails. The CTCSS gate will return high about 300 ms before the PTT keying line switches high.

In addition, there was a minor correction to the version 3.0 firmware used in all controllers prior to this date. At power up in version 3.0 (initial application of 12 volts to controller board) the CTCSS control line would default high, but the firmware assumed it defaulted low. This anomaly would be corrected with the first use of the CTCSS *on* or *off* DTMF command. This minor deficiency was corrected in version 4.0. This was the only know firmware issue with version 3.0.

