CONNECT SYSTEMS INCORPORATED

1802 Eastman Ave., Suite 116
Ventura, Ca. 93003

Phone (805) 642-7184
Fax (805) 642-7271

Model CD-2, CD2-2-CAR and CD-2P

Communications Decoder
And
Application Software

User's Instruction Manual

Revision 1.10

INTRODUCTION

Congratulations on your purchase of the CD-2 communications decoder. You will find enclosed with your new CD-2 a DB-9S RS-232 adapter and a 6 wire modular cord. They are especially wired for the CD-2. The CD-2 is intended for the communications professional or hobbyist who needs the finest test equipment in order to properly monitor systems and service land mobile equipment.

This manual contains instructions for installation and operation of the CD-2, CD-2-CAR, and the optional CD-2P application program. At the end is a brief trouble shooting guide. As of version 1.04 of the CD-2 processor, the CD-2-CAR personality may be owner selected by adding/cutting a jumper on the main PC board. This jumper is located next to JP2 but is not labeled on the silk screen. On the schematic, it is called JP5. If JP5 is installed, the CD-2 will behave like a CD-2-CAR.

CD-2-CAR Operation

The CD-2-CAR decodes only DTMF. It's purpose is to display ANI codes. When a DTMF character is received, it blanks the display and displays the character at the right side. As more characters are received within a 1-2 second timeout, they are scrolled from right to left. As long as not more characters are received, the display remains illuminated with the decoded digits. The display will extinguish after 25 seconds unless JP2 is installed. If JP2 is installed the display will remain on indefinitely until a new DTMF character is detected. In all other respects, the CD-2-CAR is exactly like the CD-2.

INSTALLING, ADJUSTING AND OPERATING YOUR CD-2

INSTALLATION

The CD-2 must be connected to a source of clean 10-15 VDC power and to the receiver. For best results, please use shielded wire for power and receiver connections.

GND:	Power supply return (-) lead.
+12V:	Positive side of the 10-15 VDC supply. If receiver is powered with 12 VDC, share with CD-2.
GND:	Shield of cable to receiver chassis ground.
INPUT:	From receiver (see AUDIO TAKEOFF POINT below)

AUDIO TAKEOFF POINT

The CD-2 can be connected to a variety of places in the receiver depending upon what you wish to decode.

To decode CTCSS, DCS and DTMF, the CD-2 must be connected directly to the detector output (before de-emphasis). The De-Mod output on service monitors is suitable. In many receivers connecting to the Center Meter test point or to a TNC Packet output port may work satisfactorily.

If you only wish to decode CTCSS and DTMF, a connection to the high side of the volume control may work. (CTCSS may not decode at this point depending upon how the receiver is configured).

If you only care about decoding DTMF or you have a CD-2-CAR, a connection to the speaker leads will probably suffice (amateur receivers and scanners may even decode CTCSS at this point).

If in doubt about where your detector output is, simply contact a technical representative at the company who produced your radio. Alternatively, send us a schematic diagram, and we will attempt to assist you, however bear in mind the manufacturer of your radio knows more specific details about your radio than we do.

ADJUSTMENTS

DTMF will not reliably decode unless the audio is properly de-emphasized. Strap JP-1 must be left installed if you have connected directly to the detector. If you have taken audio past the receiver's built-in de-emphasis, remove the JP-1 shorting clip.

While receiving a transmission containing a CTCSS or DCS code (preferably about 600 Hz. deviation) adjust the GAIN potentiometer P1 for 1.4 volts peak-peak measured at TP-1 using an oscilloscope. (TP-1 is located between the large fuse and the RS-232 jack). If an oscilloscope is not available, turn P1 fully CCW and increase CW until LED D7 just begins to light. (D7 is adjacent to the P1 GAIN potentiometer). Be sure to make this adjustment only when a CTCSS or DCS encoded signal is being received. Be sure a signal with CTCSS or DCS is present, because the LED may also light on receiver noise when no signal is present resulting in an incorrect P1 setting.

NOTE: TP-2 is not used.

If you wish to decode DCS, you must select the correct polarity. Each DCS code has an incorrect inverse code if the polarity is inverted. Remove or install the DCS polarity select strap JP-2 until the display indicates the correct code while receiving a known DCS code.

OPERATION

The CD-2 is fully automatic. When a tone or code is decoded it appears in the digital display and one of the front panel LED's illuminates to indicate which type of tone or code is being decoded.

The displays used in the CD-2 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 decimals accompany the digits. The Table below shows all the DTMF digits and how they appear on your CD-2.

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.

If a DTMF code occurs, the CD-2 temporarily stops displaying CTCSS or DCS and displays the DTMF activity. When the DTMF concludes, the CD-2 replays the entire sequence (up to 128 digits) slowly so that you can observe ANI and speed-dialer codes that would be otherwise too fast to comprehend. Afterward, the CD-2 resumes decoding CTCSS or DCS automatically.

ABOUT the RS-232 SERIAL PORT

IBM Compatible Personal Computers use either DB-9 or DB-25 serial COM ports. The DB-9 is more commonly used in recent years, therefore we have provided a DB-9 to RJ-11 adapter along with a seven foot, six wire phone cord. If your computer uses a DB-25 connector, you must obtain a DB-9 male to DB-25 female adapter from your favorite computer store.

NOTE: Only a six wire phone cord with locking tabs on same side of cord may be used. A six wire cord is supplied.

The RJ-11 to DB-9 adapter is wired as follows (with the locking tab up and the modular phone jack facing you, pin 1 is on the right. This wiring is for a "standard" 6 wire phone cable with the locking tab on the same side on both ends. (This reverses pins 1-6 through the cable). If you wish to wire a DB-25, then it is shown here also:

RJ-11 pin		DB-9S pin	DB-25S pin	Description
1	to	8	5	CTS
2	to	3	2	TX Data
3	to	5	1	Gnd
4	to	n/c	7	Gnd
5	to	2	3	RX Data
6	to	7	4	RTS
		4	6	DTR --|
		6	20	DSR --|(Must be shorted)

In addition, DB-9S pins 4 and 6 are shorted. (DTR to DSR). The equivalent pins are 6 and 20 on the DB-25S. Although you see a lot of RJ-11 to DB-9/25 adapters, there is no standard for their connection. The adapters are available commonly in many electronic stores. If you are connecting to a modem, you will need a null modem adapter to reverse pins 2 and 3 of DB-9S or to reverse pins 7 and 8 of the DB-9S.

CD-2P APPLICATION PROGRAM

INSTALLATION

If you purchased the CD-2P Program, you received a single 3.5 inch PC DOS compatible disk containing the CD2P.EXE application and an install program. The easiest way to install is as follows: (The symbol <CR> refers to the keyboard "ENTER" key.)

1) Place the new disk into your 3.5 inch drive.
2) Make this drive the current drive. If it is drive A:, type A:<CR>. If it is drive B: type B:<CR>.
3) Type install<CR>

Install will ask you on which hard drive you wish to install the program and in which directory. It will modify autoexec.bat on drive C: if required. This will allow you to run CD2P in any directory on your PC.

4) When installation is complete, remove the disk from your PC and reboot. Reboot either by pressing CTRL+ALT+DEL or by pressing RESET or by cycling power to the computer. (If it is not convenient to reboot now, then you will need to run CD2P in the installation directory until you do reboot.)

5) Attach the CD-2 to either COM1 or COM2 serial port on this PC. See the instructions above about making the connections to the DB-9 or adapting to a DB-25 on your PC.

INTRODUCTION to the CD-2P APPLICATION

After installation of the CD-2P application on your computer, installation of the CD-2 on your receiver or service monitor, and after connecting the CD-2 serial cable to the PC, you are ready to explore the power of the CD-2P application. This is a summary of the features and screens available to you with this program.

Main (Run) screen (**F1** or **R**)

Displays a scrolling log of all received data from the CD-2 and a continuous log of the 22 most recently decoded

Initialization Screen (**F4** or **I**)

Allows setup of the COM port and selection of the codes to be monitored.

Tone Detection (Used Tone) Screen (**F8** or **U**)

Displays the complete list of 163 CTCSS/DCS codes and indicates whether codes that were detected during the monitoring time.

Time of Day Screen (**F2** or **D**)

Displays accumulated code duration's and sum of all usage as a percentage of available time each hour of the day.

Hit Screen (**F3** or **H**)

Displays Hits per code (A Hit is a detected code lasting 2 seconds or longer).

Total Time Screen (**F7** or **T**)

Displays the total accumulated time for each code enabled by the initialization screen.

Observe Programming Screen (**F5** or **O**)

Displays programming data in readable English for CSI TP-154 and/or TP-154PLUS repeater tone panels when any such data has been received during connection of the CD-2P program.

Help Screens (**F1** or **?**)

These are context sensitive help which shows details about the options available to you at any given stage.

RUNNING THE CD-2P APPLICATION

To run the program type CD2P at the command prompt. There are two switches available, but normally they will not be used.

1. /S[IM] Runs CD2P in a simulate mode. This reads a file named CD2P.SIM in your local directory (if it exists) and updates the display with a new line every 1 second. This can be used to demonstrate the capability of the program.

2. /U[PDATE] Reads the file CD2P.LOG which contains information from previous sessions into the program. This allows data to be combined with current data to observe the information previously collected.

For example, to use the update option, type CD2P/UPDATE or CD2P/U at the command line prompt.

When the program starts, you will first see the Connect Systems, Inc. welcome and copyright notice. After pressing any key, you will see the Main Run Screen with just the headings and the "F1 or ? for help" prompt. Figure 1 shows the Main Run Screen.

As valid data is received, it is added to the CD-2 Log at the left of the screen. (Data is filtered by the program so that invalid data is not recorded.) If a line is too long to display on the half screen available, then the line is "wrapped" with a back slash "\" at the end of the line. (This back slash will not be in the data received from the CD-2.)

At the same time the accumulation table on the right is updated every second. This table is sorted in order of CSI user number, which has CTCSS codes first and DCS codes last. If more than 22 codes have been recorded then only the most recently recorded 22 are shown on the screen.

The Total column shows the total time in HR:MIN:SEC format. This is the total time which was accumulated under that code during the time the program was running plus the accumulated time from the CD2P.ACC file, if it was previously saved. In addition, the time from the log (CD2P.LOG) if /UPDATE was used is included.

The Hits column shows the total number of hits or conversations recorded. A hit is any continuous activity with gaps of no more than 2 seconds.

The Dials column counts the number of DTMF dialing lines which were recorded from the CD-2.

The Since column shows the number of HRS:MIN:SEC since the last recorded time for that code. If the time exceeds 999 hours, the time field is replaced with a days display.

MAIN (RUN) SCREEN

This is an example of the main screen.

```
CD-2 Log                                    Tone      Total   Hits Dials  Since
67.0  (001) C 21                            67.0       0:21      1    0   0:00:06
466   (129) C 6                             110.9      0:17      1    0   0:00:01
462   (126) T 233987498798739874932187 94\  074        0:10      1    0   0:00:00
3879873498732987498798732947923874979980\  462        0:23      1    0   0:00:02
098423098                                   466        0:06      1    0   0:00:05
462   (126) C 23
110.9 (016) C 17
074   (066) C 10
```

```
F1:?, F2:D, F3:H, F4:I, F5:O, F6:R, F7:T, F8:U,
```

Figure 1. Example of the RUN screen of the CD2P program.

Access to any other screen is obtained by pressing a keyboard key corresponding to the screen desired. The letter for the desired screen is indicated above in the list of screens in parentheses. The list is also available by pressing the F1 function key or the ? key at any time.

INITIALIZATION SCREEN

To see the Initialization screen, press the letter I. Figure 2 is an example of the initialization screen.

```
CD-2 Setup                                  Setup
PORT COM1  PRINTER PRN
67.0   *  141.3  *  225.7  *  114    *  243    *  356    *  523    *  63.0   *
69.4   *  146.2  *  229.1  *  115    *  244    *  364    *  526    *  006    *
71.9   *  151.4  *  233.6  *  116    *  245    *  365    *  532    *  007    *
74.4   *  156.7  *  241.8  *  122    *  246    *  371    *  546    *  015    *
77.0   *  159.8  *  250.3  *  125    *  251    *  411    *  565    *  017    *
79.7   *  162.2  *  254.1  *  131    *  252    *  412    *  606    *  021    *
82.5   *  165.5  *  023    *  132    *  255    *  413    *  612    *  050    *
85.4   *  167.9  *  025    *  134    *  261    *  423    *  624    *  141    *
88.5   *  171.3  *  026    *  143    *  263    *  431    *  627    *  214    *
91.5   *  173.8  *  031    *  145    *  265    *  432    *  631    *
94.8   *  177.3  *  032    *  152    *  266    *  445    *  632    *
97.4   *  179.9  *  036    *  155    *  271    *  446    *  654    *
100.0  *  183.5  *  043    *  156    *  274    *  452    *  662    *
103.5  *  186.2  *  047    *  162    *  306    *  454    *  664    *
107.2  *  189.9  *  051    *  165    *  311    *  455    *  703    *
110.9  *  192.8  *  053    *  172    *  315    *  462    *  712    *
114.8  *  196.6  *  054    *  174    *  325    *  464    *  723    *
118.8  *  199.5  *  065    *  205    *  331    *  465    *  731    *
123.0  *  203.5  *  071    *  212    *  332    *  466    *  732    *
127.3  *  206.5  *  072    *  223    *  343    *  503    *  734    *
131.8  *  210.7  *  073    *  225    *  346    *  506    *  743    *
136.5  *  218.1  *  074    *  226    *  351    *  516    *  754    *
F1:?, F2:D, F3:H, F4:I, F5:O, F6:R, F7:T, F8:U, ^P, S, Arrows, *, -, (sp)
```

Figure 2. Initialization screen

In the initialization screen, you may change the COM port, change the printer, add codes to monitor, or delete codes to monitor.

To change the COM port, move the cursor (with the arrow keys) to the PORT line. By pressing the space bar, you may toggle the COM port from 1 to 2 and back. Pressing the letter S will save any settings from this screen to a file named CD2P.INI.

The enabled codes are followed by an asterisk (*). The disabled codes are followed by a minus (-).

To change the selection of a code, move the cursor to the * or - next to the code to change. For example, you wish to disable 74.4, place the cursor under the * following 74.4 and press the space bar. The * will change to a -. To disable display of all codes, press the '-' key (usually to the right of the zero key). All codes will change to disabled. To enable all codes press the asterisk key (usually shift 8). The easiest way to enable a limited number of codes is to press the - key then use the cursor to move to the codes you wish to enable and use the space bar to enable the selected code(s).

The codes selected or deselected remain in effect for the session in which they were changed unless you save them. Save with the S key while in the Initialization screen.

TONE DETECTION (USED TONE) SCREEN

Access the Used Tone Screen with the U key. Figure 3 shows the appearance of the Used Tone Screen.

```
                Tone List, * = Detected, - = Not Detected
 67.0  *  141.3  *  225.7  *  114   -  243   *  356   -  523   -  63.0  *
 69.4  -  146.2  -  229.1  *  115   *  244   *  364   *  526   *  006   *
 71.9  -  151.4  *  233.6  *  116   -  245   -  365   -  532   *  007   *
 74.4  *  156.7  *  241.8  -  122   -  246   *  371   -  546   -  015   *
 77.0  *  159.8  -  250.3  -  125   -  251   *  411   -  565   *  021   *
 79.7  *  162.2  *  254.1  *  131   *  252   *  412   -  606   -  017   *
 82.5  -  165.5  *  023    *  132   *  255   -  413   -  612   -  050   *
 85.4  *  167.9  *  025    *  134   *  261   *  423   -  624   -  141   *
 88.5  -  171.3  -  026    *  143   *  263   -  431   *  627   -  214   *
 91.5  -  173.8  -  031    -  145   -  265   -  432   *  631   -
 94.8  -  177.3  -  032    *  152   -  266   -  445   -  632   *
 97.4  -  179.9  -  036    -  155   -  271   *  446   *  654   *
100.0  -  183.5  -  043    *  156   -  274   -  452   *  662   *
103.5  *  186.2  *  047    -  162   *  306   *  454   *  664   *
107.2  -  189.9  -  051    -  165   *  311   -  455   -  703   *
110.9  *  192.8  *  053    *  172   *  315   -  462   *  712   -
114.8  *  196.6  -  054    *  174   -  325   -  464   -  723   *
118.8  -  199.5  *  065    *  205   *  331   -  465   -  731   *
123.0  *  203.5  *  071    -  212   *  332   *  466   *  732   *
127.3  -  206.5  *  072    -  223   *  343   -  503   *  734   *
131.8  -  210.7  *  073    -  225   -  346   -  506   -  743   *
136.5  *  218.1  -  074    *  226   *  351   -  516   *  754   *
             F1:?, F2:D, F3:H, F4:I, F5:O, F6:R, F7:T, F8:U, ^P
```

Figure 3. Tone Detection (Used Tone) Screen

The Tone Detection Screen simply shows a list of all 163 CTCSS/DCS codes. To the right of each code is an asterisk or a minus sign. The asterisk (*) indicates at least one hit on that tone or code. A minus sign indicates no hits on that tone or code.

TIME OF DAY SCREEN

The Time of Day Screen depicts the utilization vs. time of day. This allows you to see where the peak utilization's are for each of the enabled codes. Figure 4 shows an example of the Time of Day Screen.

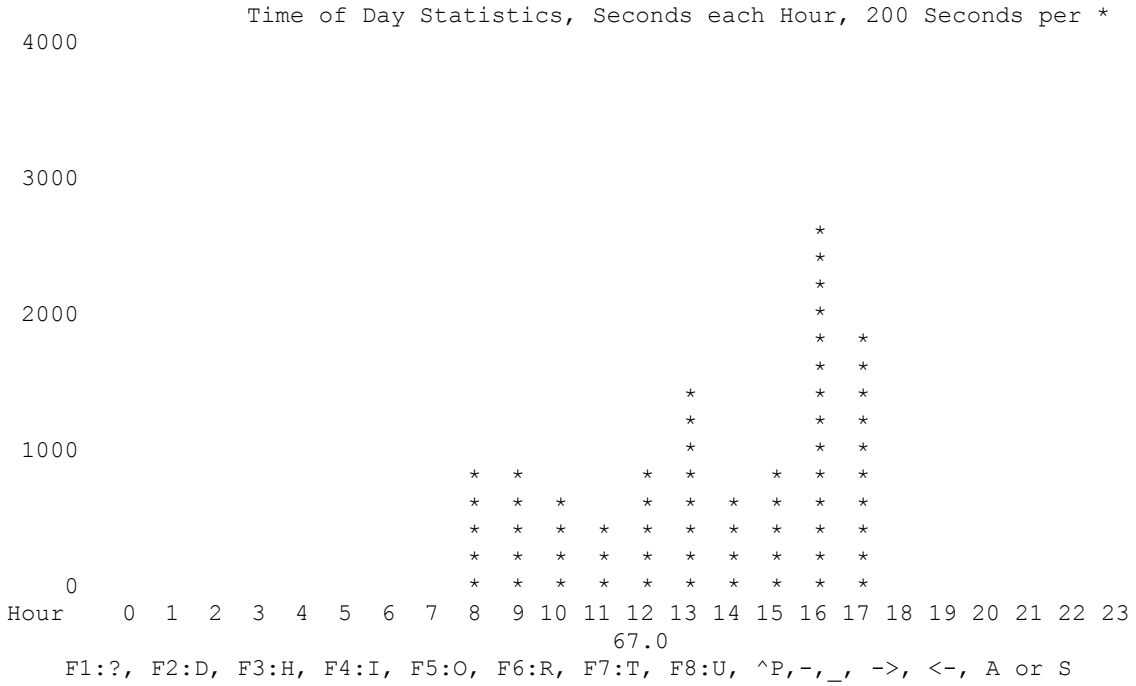

Figure 4. Time of Day Screen

While reading the Time of Day Screen, you may review any code by using the left and right arrow keys to select a code to view. In addition, use of the A or S key will toggle to a display of the total utilization for all codes combined. Note that the total utilization may exceed one hour because of accumulation of data over many days. You need to take into account the number of days of monitoring to determine accurately the percentage utilization.

You may also see the time used as a fraction of one hour by pressing the % key. The percent key is a toggle, so you may return to the time display by pressing the % key again.

Using the UP and DOWN arrow keys, you may adjust the vertical scale factor to have better ability to see detail in times of lower utilization.

HITS SCREEN

The Hits Screen displays the number of hits (or conversations) recorded during the monitoring interval. A hit is defined as a continuous code detection with no more than a 2 second gap at any one time. Figure 5 is an example of a Hits Screen.

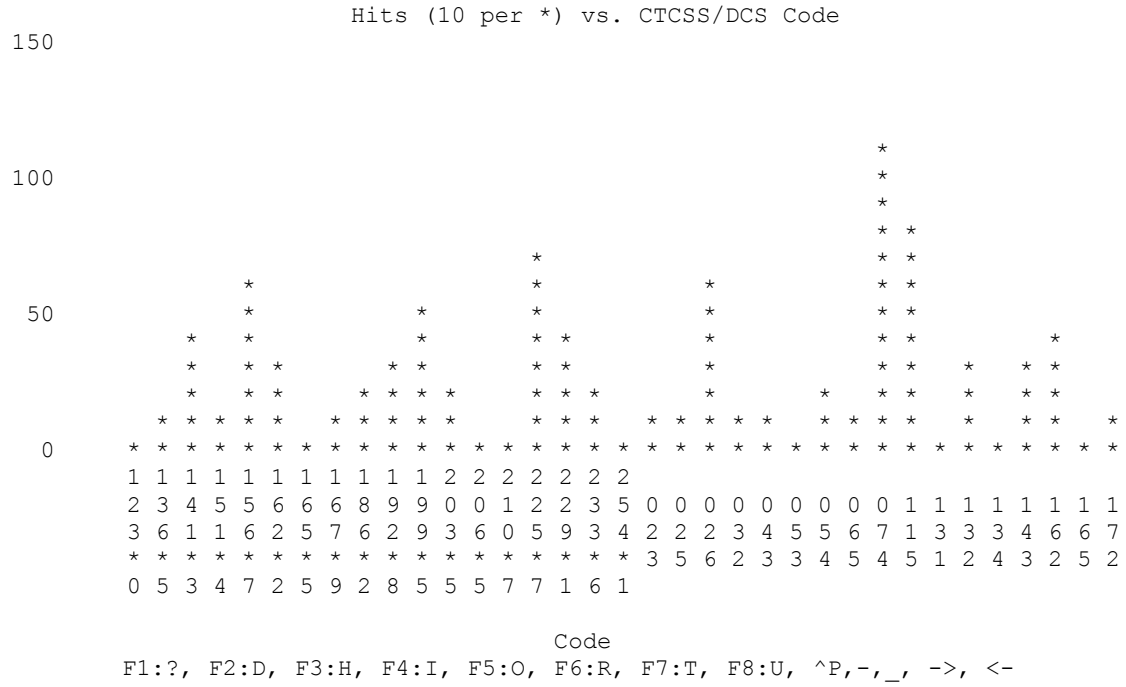

Figure 5. Hits Screen

The Hit Screen displays only those codes with at least one hit during the monitoring time. If more than 35 codes have at least one hit, then you may scroll left and right using the LEFT and RIGHT arrow keys.

Using the UP and DOWN arrow keys, you may adjust the vertical scale factor to have better ability to see detail in codes of lower utilization.

TIME SCREEN

The Time Screen displays the total time per code during the monitored time interval. Codes with no detected time greater than 2 seconds are not displayed. Figure 6 is an example of a Time Screen.

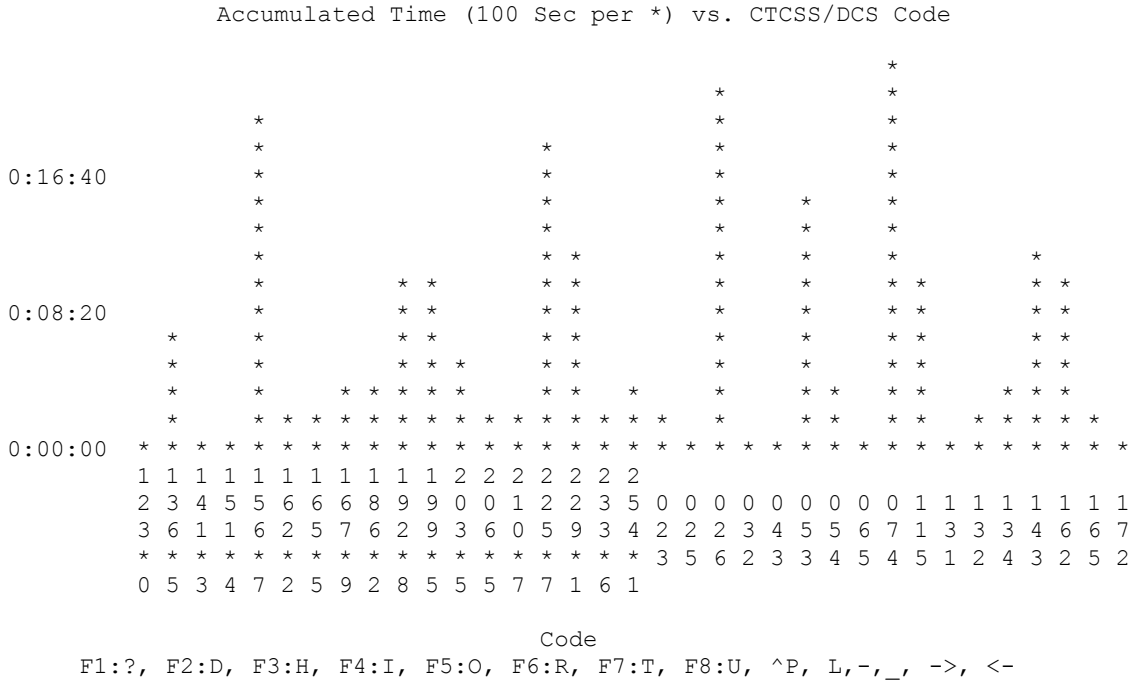

Figure 6. Time Screen

Using the LEFT and RIGHT arrow keys, you may scroll the Time Screen in the same manner as the Hit Screen above. Using the UP and DOWN arrow keys, you may adjust the vertical scale factor to have better ability to see detail in times of lower utilization.

OBSERVE PROGRAMMING SCREENS and DOWNLOADING DATA

This set of screens is a powerful adjunct to the TP-154 and TP-154PLUS tone panels manufactured by CSI. These screens allow you to capture and read, in plain English the programming information as down loaded from the panel.

In order to make use of these screens, you will need to download the information to the CD-2 while the CD-2P program is running. It is suggested that the TP-154 or the TP-154PLUS be placed into programming mode by transmitting the access code without CTCSS or DCS encoding. This prevents retransmission of the access code during this step. The CD-2P program will automatically recognize any of the full download commands. This includes *000#00* and *nnn#00* for the TP-154 and TP-154PLUS. It also includes the accounting data for the TP-154PLUS accessed with *nnn#mmm#k#. Remember, the TP-154 and TP-154PLUS send data in 124 character bursts in order to accommodate the slow display of the CD-1, which has no serial port. When the data exceeds 124 characters, you will have to wait approximately 2 minutes between bursts before the data is complete.

When the accounting data is downloaded, a file named CD2P.DWN is created or appended with that data. The file is available immediately for your observation. Figure 7 is an example of the CD2P.DWN file format.

```
Enabled Repeater Airtime (Minutes) (K=3)
Tue Jan 24 15:50:14 1995
67.0     22
69.4     30
71.9    330
74.4    220
77.0    350
79.7     20
82.5     35
85.4     27
88.5      4
91.5      7
94.8      8
97.4      0
100.0     1
103.5     0
107.2     0
Enabled Hits (K=1)
Tue Jan 24 15:53:10 1995
67.0     22
69.4     10
71.9    100
74.4     50
77.0    360
79.7     40
82.5    100
85.4     35
88.5      7
91.5      7
94.8      5
97.4      0
100.0     1
103.5     0
107.2     0
```

Figure 7. Example of CD2P.DWN download file

After downloading accounting data, be sure to clear the data using K=7, 8, or 9 per the TP-154PLUS manual, page 37, "DOWNLOADING TIME AND HITS."

When the CD-2P program detects programming data, it maintains that data in an internal buffer. You may observe the contents of that buffer with the Observe Programming Screen, examples of which are shown in Figures 8 and 9.

```
                                Unit Programming TP-154                    Globals
19 Anti-Kerchunk Time           Dis     42 CWID Sequence Char  8        38(EOM)
20 Squelch Tail Length          0       43 CWID Sequence Char  9        38(EOM)
21 CTCSS/DCS Hold Delay         30      44 CWID Sequence Char 10        38(EOM)
22 Stuck Mike Activity Timer    18      45 Carrier Drop Delay           ???
23 DCS Encode Polarity          0
24 DCS Decode Polarity          0
25 HOG Penalty Time             18
26 HOG Idle Time                6
27 HOG Timer                    18
28 Carrier Operate              0
29 Response delay to CD-1       10
30 Programming Access Code      123456
31 Courtesy Tone Delay          10
32 System CWID Interval         Dis
33 User CWID Interval           Dis
34 CWID ID Speed                5
35 CWID Sequence Char  1        38(EOM)
36 CWID Sequence Char  2        38(EOM)
37 CWID Sequence Char  3        38(EOM)
38 CWID Sequence Char  4        38(EOM)
39 CWID Sequence Char  5        38(EOM)
40 CWID Sequence Char  6        38(EOM)
41 CWID Sequence Char  7        38(EOM)
        F1:?, F2:D, F3:H, F4:I, F5:O, F6:R, F7:T, F8:U, ^P, +, 1, A, M
```

Figure 8. Example of Global Programming TP-154 Screen

NOTE: Due to the late addition of line 45, it is not automatically downloaded and is not available to the CD-2P.

```
                              Unit Programming TP-154PLUS                User 001
 1 Courtesy Tone                1       24 Disconnect Code              0
 2 CTCSS/DCS During Hang Time   1       26 Mob to Mob Signalling        1
 3 Barge In                     1       27 Access Code                  ------
 4 Subscriber Enable            1       28 Call Limit Timer Reset       0
 5 Reserve Tone                 0       29 Line Port Selection          Dis
 6 Hog Penalty                  0
 7 Users Hang Time              30
 8 Cross Tone                   1
 9 CWID Sequence Char  1        38(EOM)
10 CWID Sequence Char  2        38(EOM)
11 CWID Sequence Char  3        38(EOM)
12 CWID Sequence Char  4        38(EOM)
13 CWID Sequence Char  5        38(EOM)
14 CWID Sequence Char  6        38(EOM)
15 CWID Sequence Char  7        38(EOM)
16 CWID Sequence Char  8        38(EOM)
17 CWID Sequence Char  9        38(EOM)
18 CWID Sequence Char 10        38(EOM)
19 Interconnect Enable          1
20 Apply Toll Restricts         0
21 Apply Toll Overrides         0
22 Full Duplex                  1
23 Semi-Duplex Privacy          0
        F1:?, F2:D, F3:H, F4:I, F5:O, F6:R, F7:T, F8:U, ^P, +, 1, A, M
```

Figure 9. Example of User Programming of a TP-154PLUS

PRINTING of SCREENS

Any of the screens, except the help screens, may be printed at any time by pressing Control-P. The screen is sent to the printer as normal text and should print properly on almost any printer. The printer supported is PRN, which is normally LPT1 unless changed by you. See your DOS manual if you wish to print to another printer.

IN CASE OF DIFFICULTY

My CD-2 decodes DTMF and some CTCSS codes but does not decode DCS.

You probably have not connected the CD-2 to the actual detector of the receiver. Connections to the speaker leads or to the volume control do not have enough low frequency bandwidth to work. Also, be sure the pre-amp level in the CD-2 is adjusted properly using TP-1 (as described in the manual pages 3 and 4) or using the internal LED sensor.

My CD-2 decodes CTCSS and DCS but not all DTMF digits.

The most likely problem is that the de-emphasis jumper is incorrect. Since DCS works properly, you probably need the jumper (JP-1) installed.

My CD-2 decodes everything correctly except the DCS codes seem wrong.

You need to change the polarity jumper JP-2. All DCS codes have a positive and a negative polarity interpretation. If you have the wrong polarity, the reading will show a valid code, but it will not be what you expect. The inverse codes are just the binary complement of the direct codes.

My CD-2 decodes everything on the display but I see nothing on my computer terminal.

Be sure the port is properly selected. If you are not using CD-2P, make sure the baud rate is correct. If you are using a terminal (not a computer) make sure you are using a null modem adapter to reverse the TXD and RXD data.

I am using Windows and sometimes when I use the CD2P program, it gives me a message about which MS-DOS Prompt I want to use.

Windows does not allow the use of the serial ports by more than one window at a time. Either you are using that serial port in another application, or you used CD-2P in another window before trying it in this window. If no other program is using the port, simply tell windows you want to use the other port, and it will work fine.

I am using Windows, and I lose data whenever I use another window.

Set up the MS-DOS prompt window (Using Settings...) to allow background running. If your computer is a 386 or better, it should be fast enough to keep up with the serial data from the CD-2P even with 30% background operation.

I accidentally quit CD2P but now I need that data back!

Run CD2P/U. This reads a log file (CD2P.LOG) which allows CD2P to start from where it left off. Obviously, any data sent while the program was not running will be lost. Much or all of the data may be lost if the computer crashes or you turn off power while CD2P is running.

I try to print a screen using the PRINT SCREEN button, but nothing happens.

CD2P can only print the screen with CTRL+P or CTRL+PRINTSCREEN. This is a side effect of the method used to interpret the keyboard and is not easily changed.

I try to print a screen using CTRL+P but nothing is on my printer.

The Initialization screen allows you to select your printer or to place the print results into a file named CD2P.PRN. You may have the printer selection incorrect. Also, please be sure your printer is actually connected and turned on and works with other applications.

DESCRIPTION OF CD-2 RS-232 OUTPUT

This section is for those who choose to read the RS-232 output directly or otherwise have interest in its format. It is not required to understand this format if using the CD-2P application.

The output of the CD-2 is a very simple, easy to read format, which may be observed by any terminal emulator program or by making a proper connection to an ordinary terminal. The serial data rate is 1200 baud and cannot be adjusted. Set the COM port on an IBM compatible as follows:

MODE COM1:1200,N,8,1,P

Replace COM1 with COM2 if the secondary serial port is used. (While you may use any serial port compatible with your terminal emulator, the CD-2P program available from Connect Systems, will only operate with COM1 or COM2.) The MODE setting is not required when using the CD-2P.

The data is formatted for readability but significant processing is left to the CD-2P program described in its section in this manual. The format is line oriented. Each line contains first the CTCSS or DCS code. CTCSS are sent as the tone frequency of the nominal CTCSS frequency. DCS codes are sent in the standard octal format. The next character after the code is either a 'C' or a 'T'. A 'C' indicates the line is a CTCSS/DCS line. A 'T' indicates the line is a DTMF code.

A CTCSS/DCS line ends with the time in seconds representing the time duration of the CTCSS or DCS code.

A DTMF line ends with the string of DTMF digits received. If the string exceeds a line length, the line ends with a back-slash (\) and the DTMF codes continue on the next line. In this manner, DTMF sequences of any length are recorded. A gap of approximately 3 seconds after any DTMF character terminates the DTMF line. A DTMF line occurring with no CTCSS nor DCS begins with blanks in lieu of the CTCSS/DCS code.

An example of an output is shown here:

```
67.0  C 0021
754   C 0010
462   T 18056427184
462   C 0047
      T 18056427271
```

This shows a tone of 67.0 Hz CTCSS of duration 21 seconds. Later, a DCS code of 754 was heard with a duration of 10 seconds. Later, during a DCS code of 462, a DTMF sequence of 18056427184 was heard. The duration of the 462 code was 47 seconds. Finally, a DTMF sequence with no CTCSS nor DCS was received. Dead times are not recorded, real time is maintained by the CD-2P program, if connected.

LIMITED WARRANTY on CD-2 and CD-2-CAR

Connect Systems Inc. (CSI) hereby warrants our products to be free from defective workmanship for a period of one year and defective parts for a period of five years from date of sale to the initial end user. This warranty applies only to the original consumer / end user purchaser of each CSI product. During the first year of warranty, CSI will repair any of its products at no charge providing the defective unit is returned prepaid to Connect Systems Inc. During the years 2-5, there shall be no charge for replacement parts providing that the defective unit is shipped prepaid and service is performed by CSI. Conventional prevailing labor and shipping charges will apply following the end of the first year. CSI, at its sole discretion, will replace defective parts on an exchange basis for the first five years of ownership by the original purchaser. All shipping costs are the responsibility of the customer.

What is not covered by this limited warranty:

This warranty shall not apply if, in our judgment the defects are caused by misuse, lightning strikes, customer modification, water damage, negligent use, improper installation, overloads caused by external voltage fluctuations, use of unregulated power supply, damage caused in transit or handling or any abusive treatment not in accordance with ordinary product use or the product serial number has been removed, altered or defaced. Warranty on CD-2P software is printed on the next page.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, STATEMENTS OR REPRESENTATIONS, AND UNLESS STATED HEREIN, ALL SUCH WARRANTIES, STATEMENTS OR REPRESENTATIONS MADE BY ANY OTHER PERSON OR FIRM ARE VOID. ALL IMPLIED WARRANTIES IN CONNECTION WITH THE SALE OF THIS EQUIPMENT, INCLUDING THE WARRANTY OF MERCHANTABILITY, SHALL BE OF THE SAME DURATION AS THE WARRANTY PERIOD STATED ABOVE. SOME STATES DO NOT ALLOW LIMITATIONS OF HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. IN THE EVENT OF PRODUCT FAILURE WHICH PROVES TO BE CAUSED BY A DEFECT IN WORKMANSHIP OR MATERIALS, YOUR SOLE REMEDY SHALL BE THE REPAIR OF THE DEFECT BY CSI OR ITS APPOINTED REPAIR STATION AS STATED IN THIS WARRANTY, AND UNDER NO CIRCUMSTANCES SHALL CSI BE LIABLE FOR ANY LOSS OR DAMAGE, DIRECT, INCIDENTAL, OR CONSEQUENTIAL, ARISING OUT OF THE USE, OR INABILITY TO USE, THIS CSI PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

If your new CSI product should ever fail, contact Connect Systems Inc. Customer Service Dept. for repair and warranty information at (805) 642-7184.

Note: Connect Systems Inc. reserves the right to render a modest service charge when returned units are found to be free of parts or workmanship defect(s) (i.e. operating to factory specifications) within the first year of the warranty. Such units will be returned freight collect to the sender, including the appropriate service charge.

LIMITED WARRANTY on CD-2P

Connect Systems, Inc., guarantees that there are no defects in the media furnished with the CD-2P program. If you find the disk unreadable for any reason, you may return the disk for a replacement within 60 days of initial purchase to the address above.

Connect Systems, Inc. disclaims all implied warranties on the software and manuals, including, without limitation, warranties of merchantability, performance, and fitness for a particular purpose. Connect Systems, Inc., will not be liable for any bug, error, omission, defect, deficiency, or nonconformity in any software. As a result, the software is sold "as is," and the purchaser assumes the entire risk as to its quality and performance.

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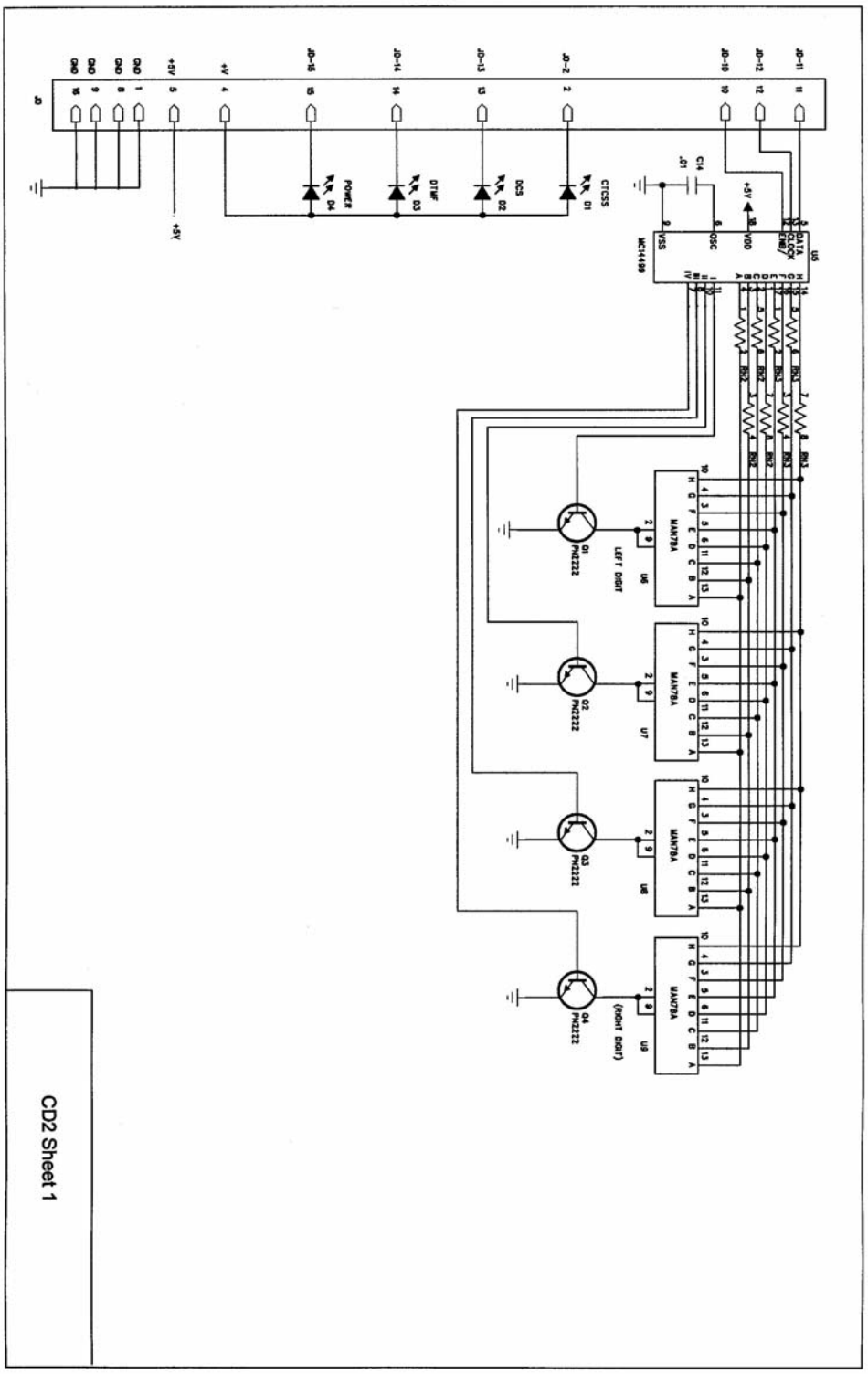
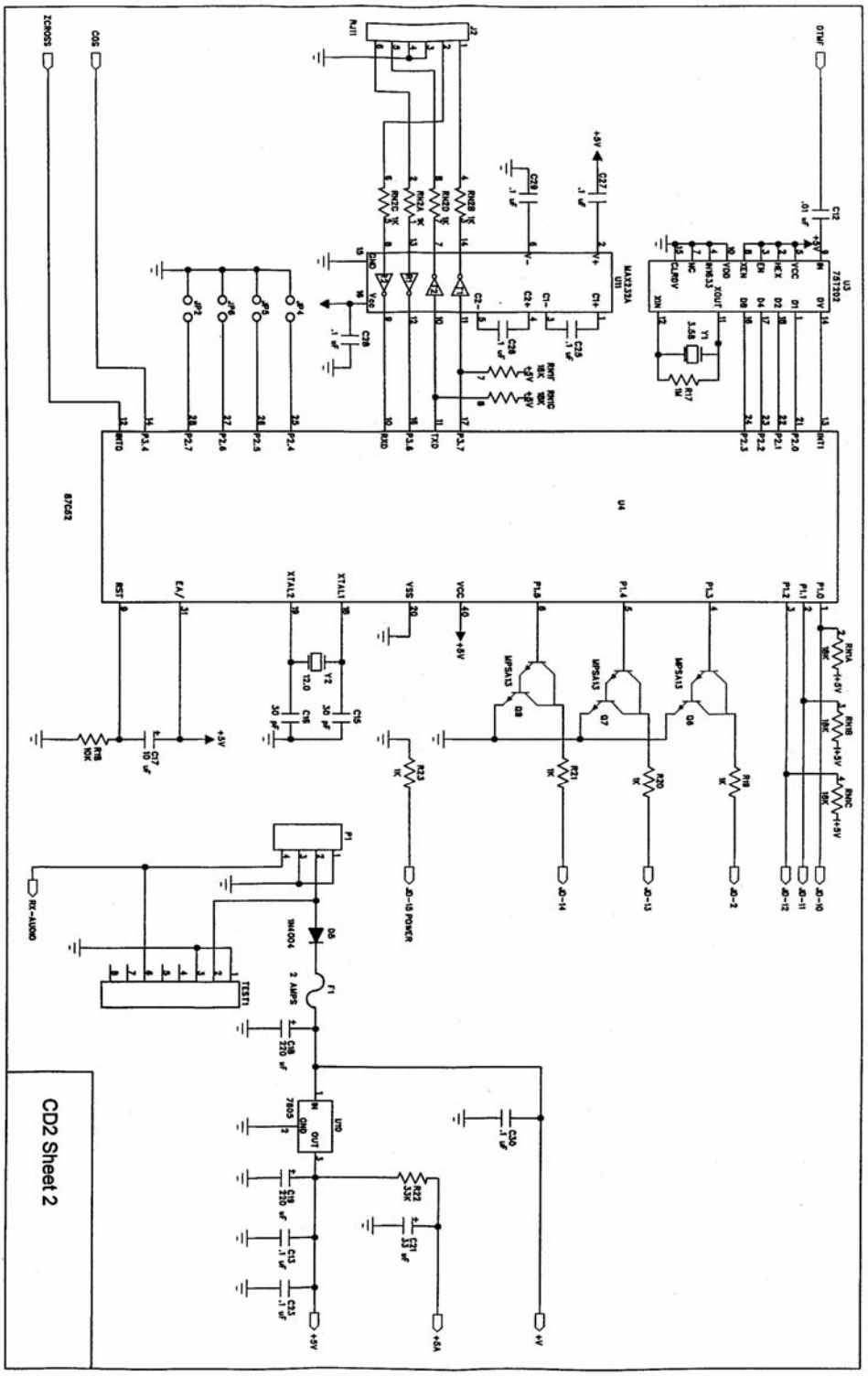
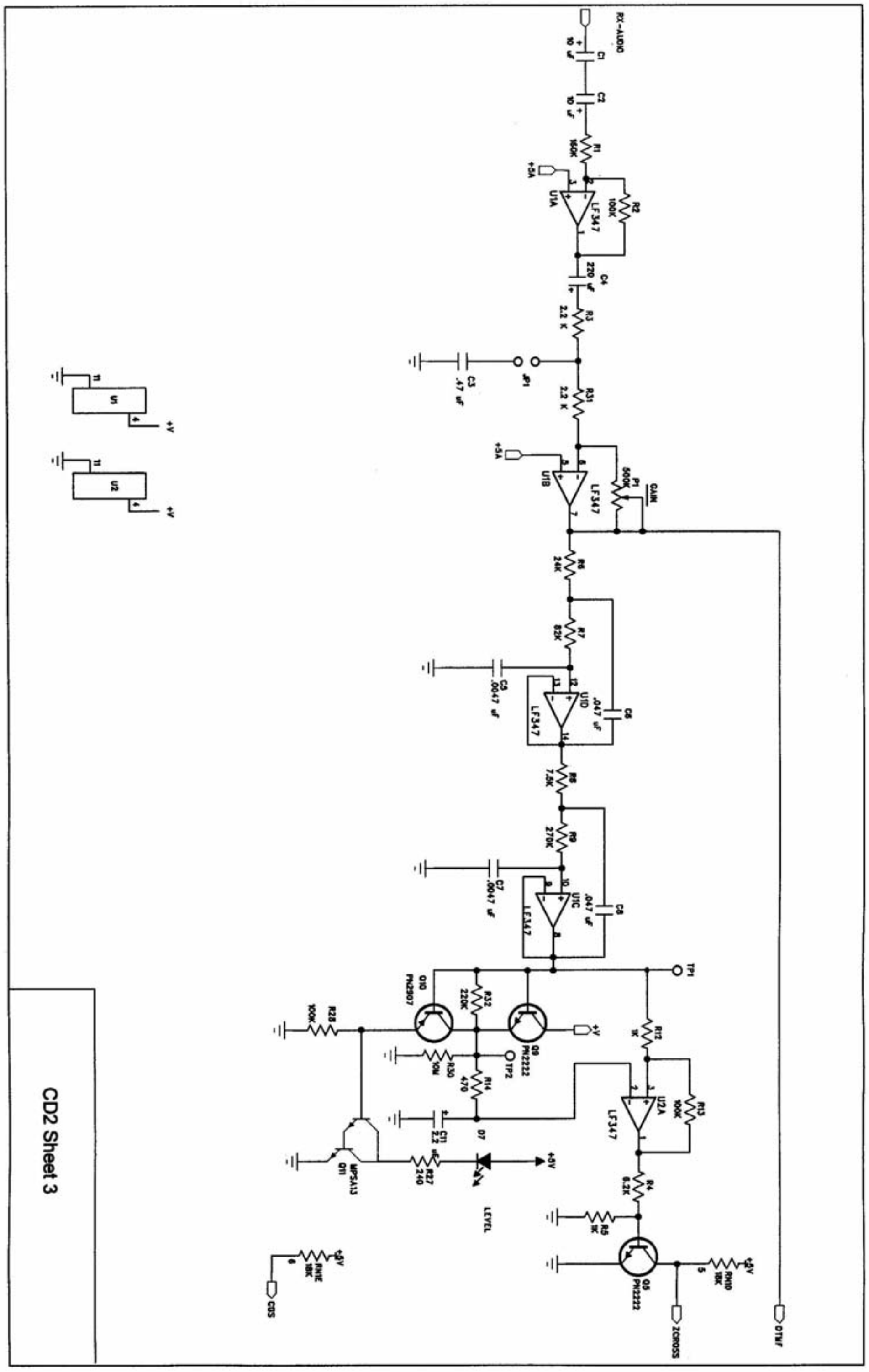

CD2 Sheet 1
J0
GND
GND
GND
GND
GND
+5V
+V
J0-15
J0-14
J0-13
J0-2
J0-10
J0-12
J0-11
+5V
POWER
DTMF
DCS
CTCSS
D4
D3
D2
D1
C14
.01
MC14489
VSS
OSC
VDD
DATA
CLOCK
ENB/
U5
RN1
RN2
RN3
Q1
Q2
Q3
Q4
PN2222
MAN78A
U6
U7
U8
U9
LEFT DIGIT
(RIGHT DIGIT)


CD2 Sheet 2


CD2 Sheet 3
RX-AUDIO
LF347
GAIN
TP1
TP2
LEVEL
DTMF
ZCROSS
CDS