CAT-500
Repeater Controller

Computer Automation Technology, Inc.

4631 N.W. 31st Avenue, Suite 142
Fort Lauderdale, Florida 33309
Phone: (954) 978-6171 Fax: (561) 488-2894
Internet: http://www.catauto.com

Table of Contents

Revision V3.0
(August 22, l992)

Chapter 1 - Introduction and Specifications

Congratulations on the purchase of the CAT-500 "Automatic Repeater Controller." You are about to experience a new freedom in day to day repeater operation.

In addition to the pre-programmed command feature, you also get a digital voice clock, three user functions. and eight user programmable voice messages. A vocabulary base of 425 words carefully selected for amateur repeater operation are available for ID's, squelch tail and transmitter drop messages. Two hardware activated messages provide information about equipment at your repeater site.

Configure the CAT-500 to suite your particular needs. It is as simple as setting a dip-switch. The CAT-500 will control two repeaters, a repeater and control receiver, a repeater and link transceiver or a repeater with autopatch when connected to the Telephone Interface Card. The CAT-500 will accept frequency commands and serially tune your transceiver. The choice is yours.

Three power FET switches are included. They can be used to control equipment at the repeater site. These switches are under full clock control. They can be programmed to turn OFF, ON or MOMENTARY ON any time you choose.

The CAT-500 synthesized voice will ID your repeater, announce the time and interact with you during control and programming operations. The Grandfather Clock will announce the time and ID on the hour.

The command scheduler with its 60 positions, will store the time and the command to be sent. This includes hours, minutes, day of week, or day of month and month of year. Space is also provided for the zone, channel number and command.

Select between a dual or single courtesy beep and change the beep frequency with an external input from other equipment at your repeater site.

A total of nineteen timers control repeater operation. Each timer is user programmable to afford maximum flexibility to suite your special requirements.

A DTMF key-pad test just like the more expensive controllers will read back the numbers decoded in a synthesized voice.

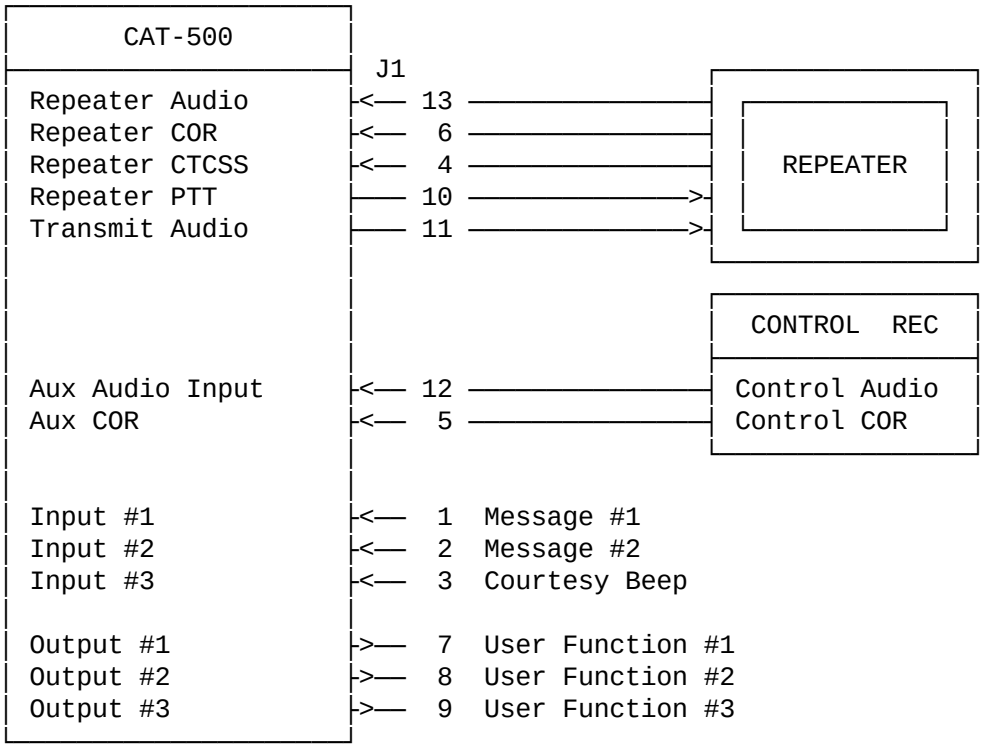
Specifications

Microprocessor	80C85
Memory	EPROM 512K RAM 64K, (non volatile)
Clock Accuracy	±1 minute per month at +25 degrees C. In the absence of power, data and time will be maintained for five years.
Voice Synthesizer	Texas Instruments TSP53C30 Linear Predictive Coded
Voice Vocabulary	425 Words
DTMF Receiver	Mitel MT8870
Operating Temperature	-15 to +55 degrees C
Call Letter ID	Buffer size Voice (31) CW (12)
Control Codes	Buffer size (7)
Schedular	Serial Command (60)
Speed Dials	User (60) Emergency (10)
Phone Number Lockout	(60) Positions
Macros	(8) Memory Saves (5) With Enhanced Autopatch Software
Audio Input Audio Output	Receiver 0.2 - 2VAC adjustable 10K ohms Transmitter 2VAC adjustable 600 ohms
Logic Inputs	Low 0 to .8 volts High 2.4 to 15 volts
Logic Outputs	Open Drain Power FET 60 volts at 200 ma.
Power	9 to 15VDC at 80 mA
Size	6.0" X 5.5"

Chapter 2 - Configuration

Control Receiver Mode

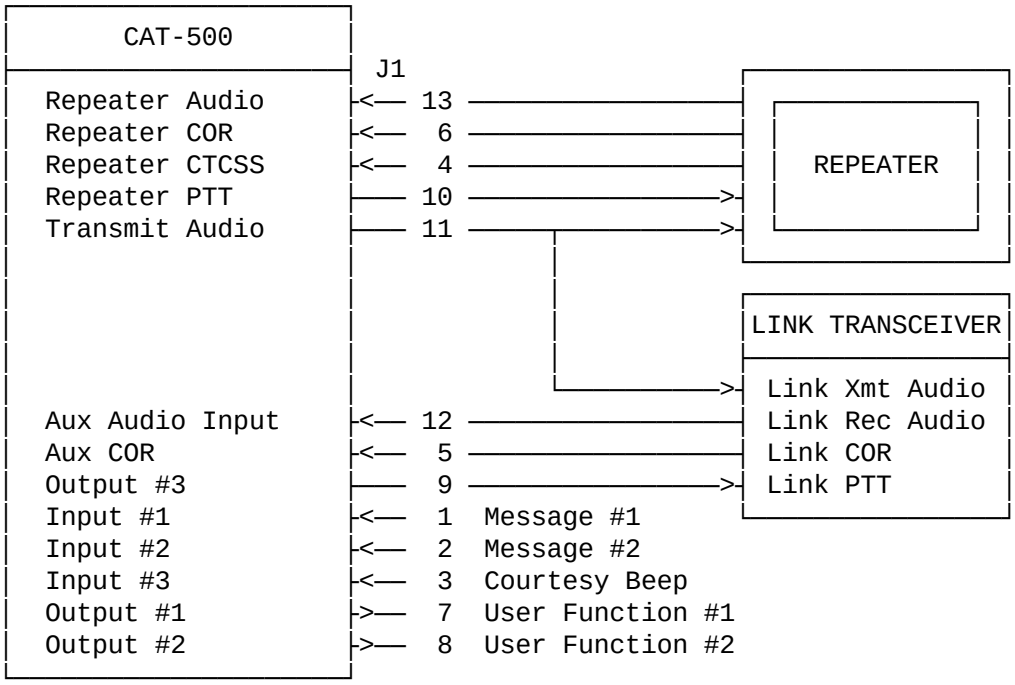
In this configuration the CAT-500 supports a repeater interface with a CTCSS input and a control receiver. The control receiver audio is connected to the Aux Audio Input J1-12. Control receiver COR is connected to the Aux COR Input J1-5. Input #1 and #2 become Message Request #1 and #2. Input #3 changes the frequency of the courtesy beep. Outputs #1, #2, and #3 become User Functions and can be used to control equipment at the repeater site. These three outputs can be placed under the scheduler for automatic control.



Repeater With Control Receiver
Figure 2-1

Link Mode

In this configuration the CAT-500 supports a repeater interface with a CTCSS input and a link transceiver. The link receiver audio is connected to the Aux Audio Input J1-12. Link receiver COR is connected to the Aux COR Input J1-5. Inputs #1 and #2 become Message Request #1 and #2. Input #3 changes the frequency of the courtesy beep. Outputs #1 and #2 become User Functions and can be used to control equipment at the repeater site. These two outputs can be placed under the scheduler for automatic control. Output #3 becomes a PTT to control the link transmitter. Some of the repeater transmit audio is diverted to the link transmitter.



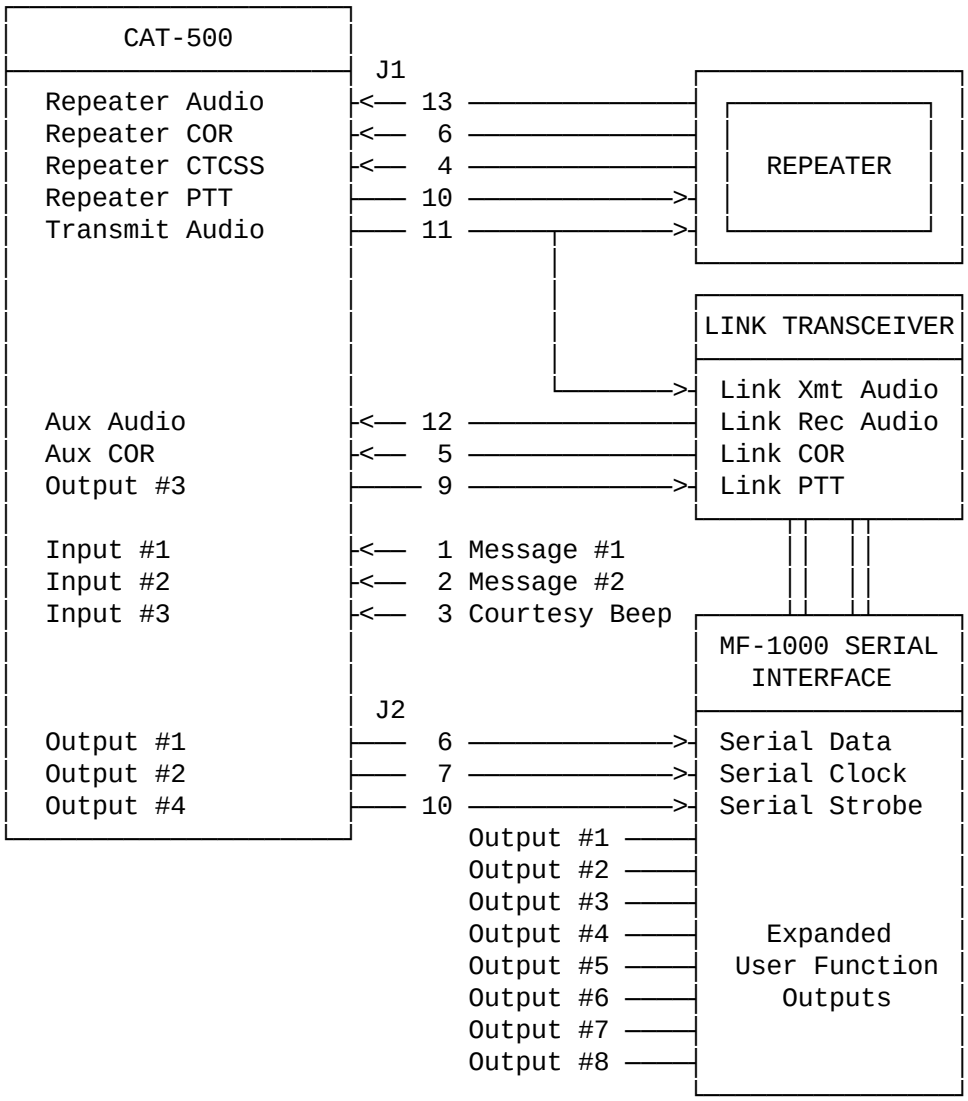
Repeater With Link Transceiver
Figure 2-2

Repeater Mode

The Link Transceiver may be replaced with a second repeater. The only change required is to turn ON Link Repeater Enable Zone 7 Channel 3.

Link Mode (Serial Tune)

In this configuration the CAT-500 supports a repeater interface with a CTCSS input and a serial tuned link transceiver. The link receiver audio is connected to the Aux Audio Input J1-12. Link receiver COR is connected to the Aux COR Input J1-5. Inputs #1 and #2 become Message Request #1 and #2. Input #3 changes the frequency of the courtesy beep. Output #1, #2 and #4 become the Serial Tuning Clock, Data and Strobe. Output #3 becomes a PTT to control the link transmitter. Some of the repeater transmit audio is diverted to the link transmitter.

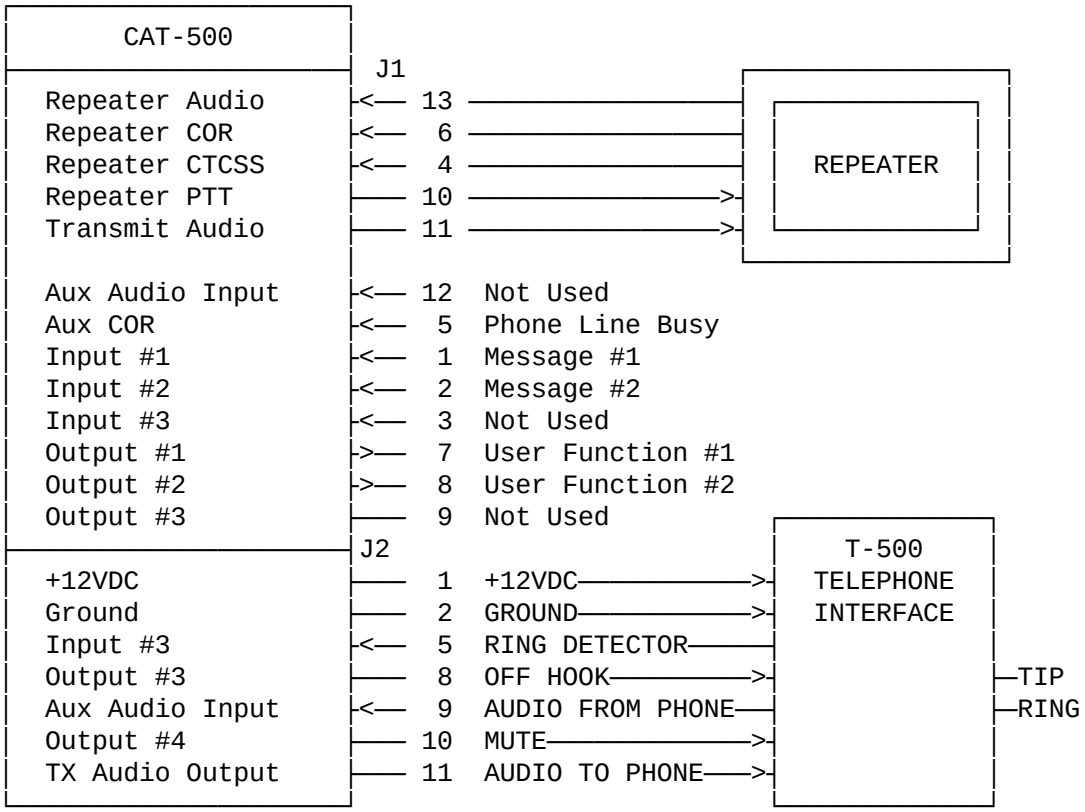


Repeater With Link Transceiver (Serial Tuned)

Autopatch

In this configuration the CAT-500 supports a repeater autopatch when an optional Telephone Interface Card is connected to the accessory connector J2. Audio from the phone line is connected to Aux Audio Input J2-9. Input #3 at J2-5 becomes the ring detector input. Output #3 at J2-8 becomes the OFF HOOK relay driver. Some of the repeater transmit audio at J2-11 is diverted to provide audio to the phone line. Output #4 at J2-10 mutes the phone line audio input when the mobile is transmitting. If the CAT-500 shares a phone line with another controller the AUX COR at J1-5 acts as a BUSY input to disable autopatch activity. The Telephone Interface Card contains a modular jack for easy connection to the telephone line.

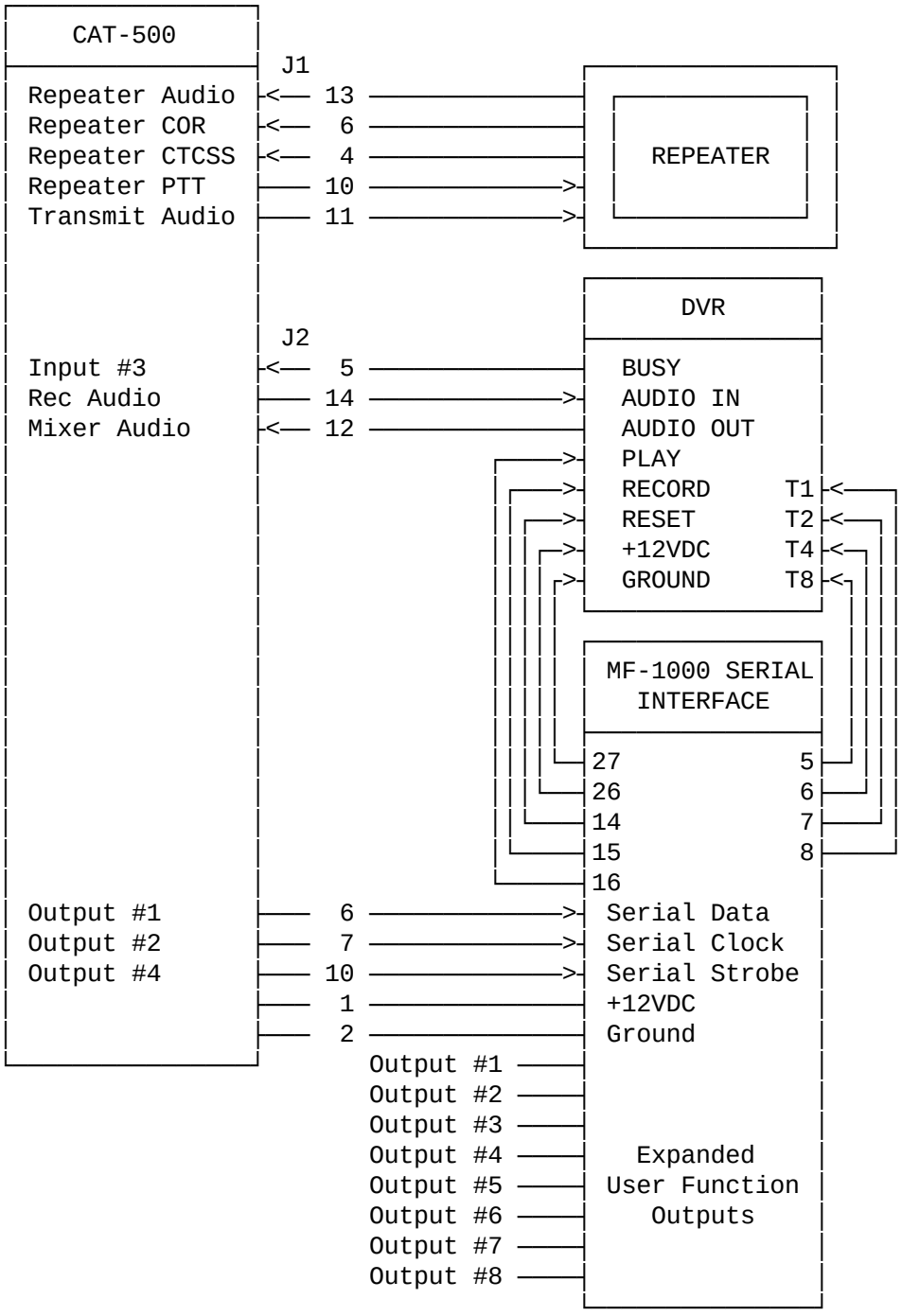
NOTE: The Telephone Interface Card has <u>not</u> received FCC Part 68 certification. You may require an approved external coupling device.



Autopatch
Figure 2-4

Digital Voice Recorder

In this configuration the CAT-500 with the expanded outputs of the MF-1000 Serial Interface Card supports a Digital Voice Recorder.



Repeater With Digital Voice Recorder
Figure 2-5

Dip Switch Settings

An eight position dip switch is used to configure the CAT-500.

Switch 1 determines Repeater COR input logic. This switch should be ON if the repeater receiver's COR is an active low and OFF if COR is active high.

Switch 2 determines Auxiliary COR input logic. This switch should be ON if the auxiliary receiver's COR is an active low and OFF if COR is active high.

Switch 3 configures the CAT-500 auxiliary input to accept one of the following

Switch 4 inputs:

Auxiliary Input	**Switch #3**	**Switch #4**
Control Receiver	OFF	OFF
Link Receiver	ON	OFF
Autopatch	OFF	ON
Digital Voice Recorder	ON	ON

Switch 5 determine the type of serial tuning when switch 3 and 4
Switch 6 are set for Link Receiver configuration.

Link Serial Tuning	**Switch #5**	**Switch #6**
NO Serial Tuning	OFF	OFF
BCD	ON	OFF
Push Button	OFF	ON
Reserved	ON	ON

Switch 5 determines the Pulse-Per-Second dialing rate.

Switch 6 dials "9" first for operation on a business phone line.

Autopatch	**Switch #5**	**Switch #6**
Dial (10 P.P.S.)	OFF	---
Dial (20 P.P.S.)	ON	---
Redial (normal)	---	OFF
Redial (9 first)	---	ON

Switch 7 This switch should be OFF. To initialize the CAT-500, set this switch to ON. Cycle the power OFF and back ON. During power-up the default values will be loaded into the CAT-500 memory. Set switch 7 to OFF.

Switch 8 This switch should be OFF. To program a new unlock number, set switch 8 to ON. After the seven digit unlock number is entered, switch 8 should be set to OFF.

Input - Output Definitions

Configuration

Depending on how the CAT-500 is configured the three inputs and four outputs are assigned different functions.

Control Receiver

Input #1	Message Request #1	Output #1 User Function #1
Input #2	Message Request #2	Output #2 User Function #2
Input #3	1/2 Beep Frequency	Output #3 User Function #3
		Output #4 Not Used

Link Transceiver (No Serial Tuning)

Input #1	Message Request #1	Output #1 User Function #1
Input #2	Message Request #2	Output #2 User Function #2
Input #3	Not Used	Output #3 Link Transmitter PTT
		Output #4 Not Used

Link Transceiver (BCD)

Input #1	Message Request #1	Output #1 Serial Clock
Input #2	Message Request #2	Output #2 Serial Data
Input #3	Not Used	Output #3 Link Transmitter PTT
		Output #4 Serial Strobe

Link Transceiver (Push Button)

Input #1	Message Request #1	Output #1 Serial Clock
Input #2	Message Request #2	Output #2 Serial Data
Input #3	Not Used	Output #3 Link Transmitter PTT
		Output #4 Serial Strobe

Link Transceiver (Reserved)

Input #1	Message Request #1	Output #1 Serial Clock
Input #2	Message Request #2	Output #2 Serial Data
Input #3	Not Used	Output #3 Link Transmitter PTT
		Output #4 Serial Strobe

Autopatch

Input #1	Message Request #1	Output #1 User Function #1
Input #2	Message Request #2	Output #2 User Function #2
Input #3	Ring Detector	Output #3 Off Hook Relay Driver
		Output #4 Phone Line Audio Mute

Digital Voice Recorder

Input #1	Message Request #1	Output #1 Serial Clock
Input #2	Message Request #2	Output #2 Serial Data
Input #3	Voice Recorder Busy	Output #3 User Function #3
		Output #4 Serial Strobe

Chapter 3 - Repeater Control

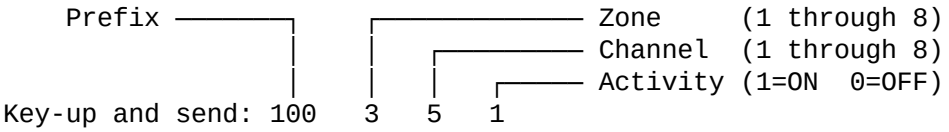
The CAT-500 has a maximum capacity of 64 remote control channels. These channels are divided up in groups of 8. The channels are segregated into zones according to their function. In addition to being controlled by the scheduler, these channels can be manually controlled by the control operator over the repeater, control or link receivers.

Interrogation of Repeater Control Status

Key-up and send the control operator prefix number followed by the zone number and a zero. Un-key and the voice synthesizer will read back the channels that are turned on in that zone. Example: "ONE TWO FIVE ON." If all the channels are turned off, the voice synthesizer will say: "ALL CLEAR."

Changing Repeater Control Status

To change the status of a channel, key-up and send the control operator prefix number followed by the zone number, channel number and a [1] to turn the channel ON or a [0] to turn the channel OFF. Un-key and the voice synthesizer will read back the zone, channel number and control activity. The voice synthesizer will say: "ONE-ONE ON." or "THREE-FIVE-OFF." EXAMPLE: With control operator prefix 100, turn Zone 3 Channel 5 ON.



Un-key and the voice synthesizer will say: "3-5-ON."

Zone 1

1. Repeater Transmitter	Enable
2. Repeater CTCSS	Enable
3. Turn on Delay	Enable
4. DTMF Access	Enable
5. DTMF Window Active	Enable
6. Squelch Tail	Disable
7. DTMF Muting	Enable
8. DTMF Pad Test	Enable

Zone 2

1. Repeater Timer	Disable
2. Repeater Alternate Timer	Enable
3. Clock Control	Disable
4. Time of Day Request	Enable
5. Grandfather Clock	Enable
6. Grandfather Clock Sleep	Enable
7. Courtesy Beep	Disable
8. Dual Courtesy Beep	Enable

Zone 3

1. Repeater ID #1	Enable
2. Repeater ID #2	Enable
3. Squelch Tail Message #1	Enable
4. Squelch Tail Message #2	Enable
5. Dropout Message #1	Enable
6. Dropout Message #2	Enable
7. Message Request #1	Enable
8. Message Request #2	Enable

Zone 4

1. Macro #1 Load	Enable
2. Macro #2 Load	Enable
3. Macro #3 Load	Enable
4. Macro #4 Load	Enable
5. Macro #5 Load	Enable
6. Macro #6 Load	Enable
7. Macro #7 Load	Enable
8. Macro #8 Load	Enable

Zone 5		Zone 6	
1. Autopatch	Enable	1. Expanded Output #1	Enable
2. Autopatch Timer	Disable	2. Expanded Output #2	Enable
3. Long Distance	Enable	3. Expanded Output #3	Enable
4. Emergency 911	Enable	4. Expanded Output #4	Enable
5. Speed Dial	Enable *	5. Expanded Output #5	Enable
6. Phone Number Read Back	Enable	6. Expanded Output #6	Enable
7. Reverse Autopatch	Enable *	7. Expanded Output #7	Enable
8. Ring Detector	Disable	8. Expanded Output #8	Enable

Zone 7		Zone 8	
1. Link Receiver	Enable	1. Link Frequency #1	Enable
2. Link Transmitter	Enable	2. Link Frequency #2	Enable
3. Link Repeater	Enable	3. Link Frequency #3	Enable
4. Link ID	Disable	4. Link Frequency #4	Enable
5. Link Auto Disconnect	Enable	5. Link Frequency #5	Enable
6. Output #1	Enable	6. Link Frequency #6	Enable
7. Output #2	Enable	7. Link Frequency #7	Enable
8. Output #3	Enable	8. Link Frequency #8	Enable

NOTE: * Requires Enhanced Autopatch Software

Control Command Description

Zone 1 Repeater Control

1. Repeater Transmitter Enable

This is the master repeater switch. This channel must be enabled for normal repeater operation. The CAT-500 will continue to respond to control operator commands even when the repeater's transmitter is disabled. This channel will automatically be enabled after an initialization reset.

2. Repeater CTCSS Enable

When this channel is enabled, a positive logic input from a CTCSS decoder at J1-4 must be present before the repeater will activate. A COR input will have no affect. NOTE: To prevent loss of control, DO NOT ENABLE THIS CHANNEL unless a CTCSS decoder is connected to J1-4.

3. Turn on Delay Enable

When this channel is enabled, a deliberate and sustained input must be present before the controller will activate the repeater. A time delay of 0.1 to 9.9 seconds can be selected with the [*604*] programming command. When the CAT-500 is initialize, this timer defaults to 1.0 seconds. This channel is useful during periods when noise bursts are present on the repeater input.

4. DTMF Access Enable

When this channel is enabled, a DTMF Access number must be entered to activate the repeater. Once this number is entered and the user un-keys, the voice will say: "OK". A COR input will activate the repeater until it returns to rest. A rest period of up to 29 minutes can be selected with the [*603*] programming command. When the CAT-500 is initialize this timer defaults to 60 seconds.

5. DTMF Window Active Enable

When this channel is enabled the controller will only accept DTMF entries when the window is open. The Pre-window timer programming command [*605*] sets the time the window opens after the presents of COR. The length of time the window remains open is set by the window timer programming command [*606*]. When the CAT-500 is initialize the pre-window timer defaults to 2 seconds and the window timer defaults to 8 seconds. Therefore the CAT-500 will accept DTMF entries from 2 to 10 seconds after initial COR.

6. Squelch Tail Disable

When this channel is enabled, the instant COR drops; the repeater's transmitter turns off. This feature is useful during linking or band openings.

7. DTMF Muting Enable

When this channel is enabled, anytime a DTMF tone is received the audio will be turned off to the repeater's transmitter. The transmit audio will remain muted until a pre-determined time after the last DTMF tone is received. This time is set by the [*609*] timer programming command. During the mute period, cover beeps are transmitted each second to indicate repeater activity. This feature is useful in preventing control commands from being repeated. It provides an extra measure of security. There may be times when it is desirable to pass the DTMF tones through the repeater. To temporarily disable DTMF muting, precede the DTMF string with a pound (#).

8. DTMF Pad Test Enable

When this channel is enabled, a repeater user is able to perform a test of their radio's 12 or 16-button keypad. As the numbers are being decoded, they are stored in memory. When the repeater user stops transmitting the controller will read back all the numbers that were decoded.

Zone 2 Repeater Control

1. Repeater Timer Disable

Repeater timeout is user programmable with the [*601*] timer programming command. When the CAT-500 is initialize this timer defaults to 3 minutes. When this channel is enabled, the repeater will not time-out.

2. Repeater Alternate Timer Enable

When this channel is enabled, the repeater time-out will change. Set the time with the [*602*] programming command. When initialized, this timer defaults to 60 seconds. This feature is useful during high traffic periods to reduce long-winded QSO.

3. Clock Control Disable
When this channel is enabled, all action by the scheduler will be suspended. There may be times, during emergency net operations, when it is not desirable to have channels change automatically.

4. Time of Day Request Enable
When this channel is enabled, repeater users can request a time of day announcement by entering the time of day request number. The voice synthesizer will say: "THE TIME IS 7:15 PM."

5. Grandfather Clock Enable
When this channel is enabled, the CAT-500 will announce the time of day with repeater ID every hour on the hour.

6. Grandfather Clock Sleep Enable
To suspend grandfather clock operation during the early morning hours, enable this channel. The last announcement will occur at 11:00 PM. The Grandfather Clock will resume time announcements at 8:00 AM the next morning.

7. Courtesy Beep Disable
When this channel is enabled, the courtesy beep will be suspended. The timeout timer will continue to function.

8. Courtesy Beep Dual Tone Enable
When this channel is enabled, the courtesy beep will consist of a dual tone.

Zone 3 Voice Synthesizer Control

1. Repeater ID #1 Enable
When this channel is enabled, the Repeater ID Message #1 will repeat subject to the setting of the ID timer. This ID will consist of up to 31 words selected from the voice vocabulary table and programmed with the [*311] command.

2. Repeater ID #2 Enable
When this channel is enabled, the Repeater ID Message #2 will repeat subject to the setting of the ID timer. This ID will consist of up to 31 words selected from the voice synthesizer vocabulary and programmed with the [*312] command. NOTE: When Repeater ID #1 and #2 are enabled, the ID messages will alternate.

3. Squelch Tail Message #1 Enable
When this channel is enabled, voice squelch tail message #1 will occur when a repeater user un-keys and repeats subject to the setting of the squelch tail message timer. This message may consist of up to 31 words selected from the voice vocabulary table and programmed with the [*313] command.

4. Squelch Tail Message #2 Enable

When this channel is enabled, voice squelch tail message #2 will occur when a repeater user un-keys and repeats subject to the setting of the squelch tail message timer. This message may consist of up to 31 words selected from the voice vocabulary table and programmed with the [*314] command. When Squelch Tail Message #1 and #2 are enabled, they will alternate.

5. Dropout Message #1 Enable

When this channel is enabled, voice drop out message #1 will occur just before the repeater transmitter turns off and repeats subject to the setting of the drop out message timer. This message may consist of up to 31 words selected from the voice vocabulary table and programmed with the [*315] command.

6. Dropout Message #2 Enable

When this channel is enabled, voice drop out message #2 will occur just before the repeater transmitter turns off and repeats subject to the setting of the drop out message timer. This message may consist of up to 31 words selected from the voice vocabulary table and programmed with the [*316] command. When Dropout Message #1 and #2 are enabled, they will alternate.

7. Message Request #1 Enable

The CAT-500 voice synthesizer will make a message announcement when requested by an external hardware interrupt. When this channel is enabled, a voice message will occur when a momentary logic 1 is placed on Input #1 at J1-1. This message will consist of up to 31 words selected from the voice vocabulary table and programmed with the [*317] command.

8. Message Request #2 Enable

The CAT-500 voice synthesizer will make a message announcement when requested by an external hardware interrupt. When this channel is enabled, a voice message will occur when a momentary logic 1 is placed on Input #2 at J1-2. This message will consist of up to 31 words selected from the voice vocabulary table and programmed with the [*318] command.

Zone 4 Macro Control

1. Macro #1 Enable

When this channel is enabled the CAT-500 will copy to active memory the macro stored in position one. This includes control channel settings, timer values, codes and the eight voice messages. After the macro is copied, the channel is reset to the OFF position. If Zone 4 is interrogated, the voice will always say: "ALL CLEAR." Using Enhanced Autopatch Software limits the macros to five.

2. Macro #2 Enable
3. Macro #3 Enable
4. Macro #4 Enable
5. Macro #5 Enable
6. Macro #6 Enable
7. Macro #7 Enable
8. Macro #8 Enable

Zone 5 Autopatch

1. Autopatch Enable

This is the master autopatch switch. This channel must be enabled for the controller to process autopatch requests. The CAT-500 must also be configured for autopatch operation with dipswitch 3 OFF and dipswitch 4 ON.

2. Autopatch Timer Disable

Autopatch timeout is user programmable with the [*616*] and [*617*] timer programming commands. When the CAT-500 is initialized the autopatch timer defaults to 3 minutes and the autopatch activity timer defaults to 30 seconds. When this channel is enabled, the autopatch will not time-out.

3. Long Distance Enable

During the dialing transmission, the CAT-500 checks for a first digit of 0 and counts the total number of entries. Phone numbers in excess of eight digits will be considered a long distance call or an error in dialing. The controller will immediately terminate the autopatch. When this channel is enabled, phone numbers with 0 or more than eight digits will be accepted.

4. Emergency 911 Enable

This channel must be enabled for the controller to process Emergency 911 requests. The autopatch access code must precede 911.

5. Speed Dial Enable

This channel must be enabled for the controller to process Speed Dial requests. A user can access any speed dial location. The voice will say: "SPEED CALL TO W4XYZ," delay two seconds and then dial the phone number stored at that location. Space is provided for sixty user phone numbers with call letter identifications.

A user can access any emergency speed dial location. The voice will say: "CALL TO POLICE DEPARTMENT," delay two seconds and then dial the phone number stored at that speed dial location. Space is provided for ten public service phone numbers with identifications.

6. Phone Number Read Back Enable

This channel must be enabled for the controller to read-back the phone number prior to dialing. After the repeater user enters the number, the CAT-500 will read-back the number for verification. If the number was entered correctly, after a two second delay, the CAT-500 will redial the number. If the number is incorrect, key-up and enter the autopatch disconnect code during the two-second period. The call will be terminated.

7. Reverse Autopatch Enable

This channel must be enabled for the controller to process a reverse autopatch. Call the repeater by phone; enter the reverse autopatch control number followed by the speed dial table position.
The controller will generate a ringing type tone and the voice will say: "CALL

FOR W4XYZ." The radio user need only enter the reverse autopatch number to complete the autopatch.

8. Ring Detector Disable

During control operator call-in, upon receipt of a ring detector input, the CAT-500 will simulate an off-hook condition. The delay in answering the phone is user programmable with the [*618*]. When the CAT-500 is initialized the ring detector timer defaults to 2 seconds. When this channel is enabled, the controller will not answer the phone.

Zone 6 Expanded Outputs

1. Expanded Output #1 Enable

When this channel is enabled the CAT-500 will turn ON the expanded user function output J1 pin 24 of the MF-500 Serial Interface Card. In addition to being manually controlled, this output can also be scheduled. Expanded Outputs #2 through #8 are assigned to J1 pins 23 through J1-17 respectively.

2. Expanded Output #2 Enable
3. Expanded Output #3 Enable
4. Expanded Output #4 Enable
5. Expanded Output #5 Enable
6. Expanded Output #6 Enable
7. Expanded Output #7 Enable
8. Expanded Output #8 Enable

Zone 7 Link Control

1. Link Receiver Enable

When this channel is enabled, the repeater's transmitter will repeat any signal received by the link transceiver. This feature permits monitoring of the link receiver without transmitting on the link frequency.

2. Link Transmitter Enable

When this channel is enabled, the link transmitter will repeat any signal received by the repeater's receiver. The link PTT output will follow the repeater's COR input.

3. Link Repeater Enable

When this channel is enabled, the link interface is converted to a second repeater interface. The link PTT output will no longer follow the repeater's COR input but will remain active during the squelch tail period. Link PTT will also be present when Link COR is active. This provides full duplex operation. The CAT-500 will support two repeater systems. NOTE: A duplexer is required to protect the link receiver from the link transmitter when this channel is enabled.

4. Link ID Disable

When this channel is enabled, link transmitter PTT will be inhibited when the controller sends an ID, squelch tail or transmitter drop message.

5. Link Auto Disconnect Enable

When this channel is enabled, the Link Receive Enable and Link Transmitter Enable (Zone 7 Channels 1 and 2) and the Repeater Timer Disable Zone 2 Channel 1 will automatically turn OFF after a predetermined period of repeater inactivity. A COR input will keep the Link activate until the repeater returns to rest. A rest period of up to 29 minutes can be selected with the [*603*] programming command. When the CAT-500 is initialize this timer defaults to 60 seconds.

6. Output #1 Enable

This is a generic user function output. It serves various functions depending on how the CAT-500 is configured. In the control receiver or link mode, this output is a conventional user function that can be manually controlled or scheduled. When the CAT-500 is configured for serial tuning, this output becomes the serial DATA line used to tune the link transceiver or control the DVR. Control or scheduler commands will have no effect.

7. Output #2 Enable

This is a generic user function output. It serves various functions depending on how the CAT-500 is configured. In the control receiver or link mode, this output is a conventional user function that can be manually controlled or scheduled. When the CAT-500 is configured for serial tuning, this output becomes the serial CLOCK line used to tune the link transceiver or control the DVR. Control or scheduler commands will have no effect.

8. Output #3 Enable

This is a generic user function output. It serves various functions depending on how the CAT-500 is configured. In the control receiver mode, and DVR mode this output is a conventional user function that can be manually controller or scheduled. When the CAT-500 is configured in the Link mode, (dip-switch 3 ON), this output becomes the link transmitter PTT. When the CAT-500 is configured in the Autopatch mode, (dip-switch 4 ON), this output becomes the off-hook relay driver. Control or scheduler commands will have no affect.

Zone 8 Link Control

1. Link Frequency #1 Enable

When this channel is enabled the CAT-500 will send a preset frequency load command to the link transceiver. This includes the frequency, offset and transmitter power setting. After the frequency command has been sent, the channel is reset to the OFF position. If Zone 8 is interrogated, the voice will always say: "ALL CLEAR."

2. Link Frequency #2 Enable
3. Link Frequency #3 Enable
4. Link Frequency #4 Enable

5. Link Frequency #5 Enable
6. Link Frequency #6 Enable
7. Link Frequency #7 Enable
8. Link Frequency #8 Enable

If the repeater is in use and the scheduler is programmed to send a link frequency command, the controller will wait until the transmitter drops. This will insure the link frequency does not change in the middle of a QSO.

The CAT-500 will retain the last link frequency command in memory. In case of a power failure, the CAT-500 will re-send the command. This will insure the link serial interface resets the transceiver to the desired frequency.

Macro Memory

Memory space is provided for eight macros. Each macro includes: control channel settings, timer values, codes, eight voice messages and Link Frequency settings. When the CAT-500 is initialized all macro locations are filled with the default values. The macro prefix number will permit the user to copy a macro into active memory. To store a macro, it is necessary to unlock the CAT-500 and use the programming commands [*91] through [*98]. Note: Enhanced Autopatch software limits the Macros to five.

Read Macro In Active Memory

To read the current macro stored in active memory, key-up and enter the macro prefix number followed by a 0. Un-key and the voice synthesizer will read back the macro number. Example: With macro prefix number of 150, and current macro 5.

```
Key-up and enter:  1 5 0 0
                   └─┼─┘ └──── Macro Read Back
                     └──────── Macro Prefix Number.
```

The voice will say: "MACRO ID IS FIVE". If changes were made to the active memory and it no longer agrees with the macro in storage, the voice will say: "MACRO FIVE DATA MODIFIED."

Copy Macro To Active Memory

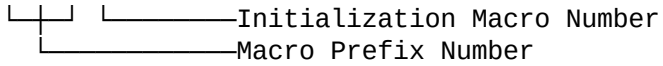
To copy a macro into active memory, key-up and enter the macro prefix number followed by the number of the macro you wish to move. Example: With macro prefix of 150, copy macro 3 to active memory.

```
Key-up and enter:  1 5 0 3
                   └─┼─┘ └──────── Macro Number
                     └──────────── Macro Prefix Number
```

Initialize Active Memory

To initialize the active memory with the default values, key-up and enter the macro prefix number followed by the number [9]. Example: With a macro prefix number of 150, initialize active memory with default values.

Key-up and enter: 1 5 0 9



Initialization consists of the following operations:

1. Zone 1 Channel 1 Repeater Enable and Zone 3 Channel 1 Repeater ID #1 Enable, are turned ON. All other channels are turned OFF.

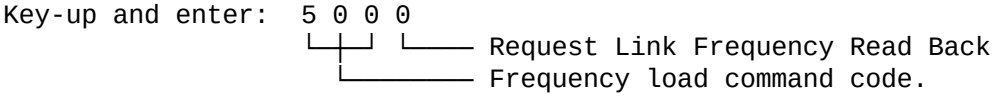
2. Prefix numbers are loaded with the default values described in Figure 4-4.

3. Timers are loaded with the default values described in Figure 4-5.

4. ID Message #1 is loaded with "CAT-500 AUTOMATIC REPEATER CONTROL." All other message locations are loaded with the message number as a test.

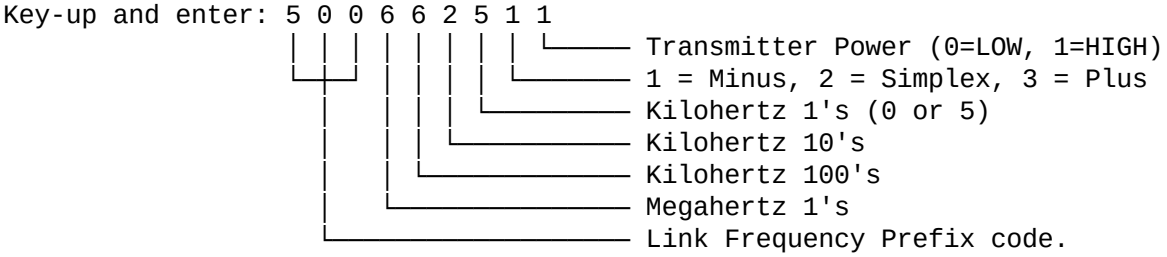
Read Link Frequency

To read the link frequency, key-up and enter the link frequency prefix, followed by a 0. Un-key and the voice synthesizer will read back the current link frequency including the offset and the setting of the user function. Example: With link prefix number of 500, read frequency.



Load Link Frequency

To load a link frequency, key-up and enter the link frequency prefix, frequency, offset and setting of transmitter power. The CAT-500 automatically enables the link receiver and disables the repeater's timer. Example: With a link prefix of 500, load 146.625 MHz, minus offset, and transmitter power to HIGH.



NOTE: To READ or LOAD a link frequency, dipswitch 3 and dipswitch 5 or 6 must be turned ON.

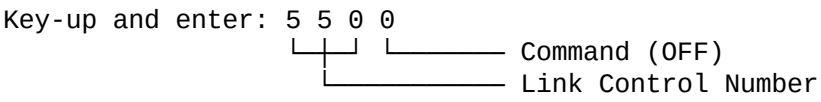
Link Control By Repeater Input

This feature permits repeater users to control link operation with a simple DTMF entry. It is not necessary to divulge the control operator prefix number or instruct the user in how to control the zone and channel number required to control link operation.

Link Disconnect

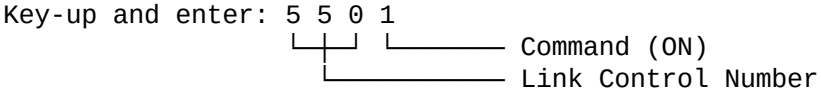
To disconnect the Link, Key-up on the repeater's input and enter the link control number followed by a 0. The CAT-500 will turn OFF Zone 7-1, Zone 7-2,

and Zone 2-1. The voice synthesizer will say the message stored at the #7 location. Example: With a link control number of 550, turn OFF the link.



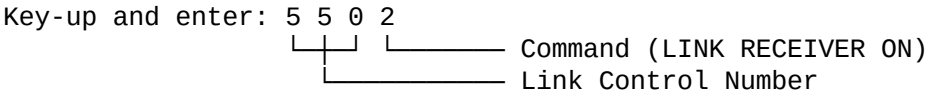
Link Connect

To connect the Link, Key-up on the repeater's input and enter the link control number followed by a 1. The CAT-500 will turn ON Zone 7-1, Zone 7-2, and Zone 2-1. The voice synthesizer will announce the message stored at the #8 location. Example: With a link control number of 550, turn ON the link.



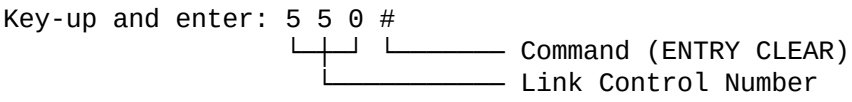
Link Receiver Connect

To connect just the Link receiver, Key-up on the repeater's input and enter the link control number followed by a 2. The CAT-500 will turn ON Zone 7-1 and Zone 2-1. There will be no voice announcement. Example: With a link control number of 550, turn ON link receiver.



Link Entry Clear (Push Button Only)

This command will clear a key-board entry by pulsing (Pin 15) on the Serial Interface Card.



Autopatch Access

To initiate an autopatch, Zone 5 Channel 1 must be turned ON. Key-up, enter the autopatch access code followed by the number. Un-key, and the CAT-500 will redial the number. During dialing a courtesy beep will be generated between each digit of the phone number. The autopatch code can be any number from one to seven digits and is user selectable with the *507* programming command. During initialization the autopatch access code defaults to [*].

Autopatch Access With Phone Number Verification

Key-up, and enter the autopatch access code followed by the number. Un-key, and the voice will read back the number, wait two seconds and then dial the number.

If the number is incorrect, enter the autopatch disconnect number during the two second period. This will terminate the autopatch and prevent a wrong number. Zone 5 Channel 6 must be turned ON.

Autopatch Speed Dial Access

To initiate a speed dial, Zone 5 Channel 5 must be turned ON. Key-up, and enter the speed dial number. Un-key, and the voice will read back the call letters assigned to that speed dial location, wait two seconds and then dial the number. The speed dial code can be any number from one to seven digits and is user selectable with the *509* programming command. During initialization the speed dial code defaults to [800]. The speed dial number consists of the speed dial code followed by the two-digit table position 00 through 59.

Autopatch Emergency Speed Dial Access

Key-up, and enter the emergency speed dial number. Un-key, and the voice will read back the identification assigned to that emergency speed dial location, wait two seconds and then dial the number. The emergency speed dial code can be any number from one to seven digits and is user selectable with the *510* programming command. During initialization the speed dial code defaults to [800]. The emergency speed dial number consists of the emergency speed dial code followed by the single digit table position 0 through 9.

Autopatch 911 Access

To initiate a 911 call, Zone 5 Channel 4 must be turned ON. Key-up, and enter the autopatch access code followed by 911. Un-key, and the voice will say: "AUTOPATCH 911" waits two seconds and then dial the number.

Autopatch Termination

To terminate the autopatch, key-up and enter the autopatch termination code. Un-key, the autopatch will terminate and the voice will log the time. Example: "AUTOPATCH COMPLETED AT 7:30PM." The autopatch disconnect code can be any number from one to seven digits and is user selectable with the *508* programming command. During initialization the autopatch termination code defaults to [#].

Reverse Autopatch

To initiate a reverse autopatch, Zone 5 Channel 7 must be turned ON. Call the repeater by telephone. When the CAT-500 answers the phone a beep will be heard. Enter the reverse autopatch code followed by the desired speed dial table number. You must terminate the entry with a (#) pound. The CAT-500 will turn on the repeater's transmitter, generate a ringing tone and say: "CALL FOR W4XYZ." To connect the reverse autopatch the radio operator must enter the reverse autopatch code.

Autopatch Timer Extend

When there is one minute left on the autopatch, the CAT-500 will generate a warning beep each time the mobile un-keys. If additional time is required, key-up and sent the [*]. This will reset the autopatch timer. You will no longer hear the warning beep.

Control By Telephone

To control the CAT-500, call the repeater by telephone. When the CAT-500

answers the phone a beep will be heard. Enter the control operator prefix code followed by a (#) pound. The voice will say: "CONTROL READY." You need only enter the Zone number, Channel number and a (1) to turn the channel ON or a (0) to turn the channel OFF followed by the (#) pound. It is not necessary to enter the control operator prefix number before each command when controlling by phone. To terminate control by phone send [*0#].

Phone Line Busy

If the phone line busy input J1-5 is active high, the CAT-500 will not process an autopatch request. The voice will say: "TELEPHONE LINE IN SERVICE" and the autopatch will be rejected.

Telephone Number Lockout

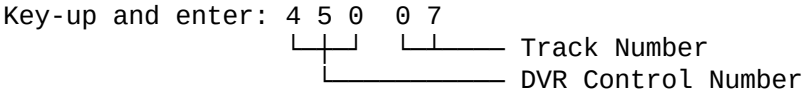
If a repeater user dials a number stored in the Number Lockout table, the autopatch attempt will be rejected and the voice will say: "NUMBER LOCKOUT".

Programming By Telephone

To program the CAT-500, call the repeater by telephone. When the CAT-500 answers the phone a beep will be heard. Enter the seven digit unlock number followed by a (#) pound. The voice will say: "CAT-500 CONTROL." Programming by phone is identical to programming by radio except you must end each entry with a (#) pound. To terminate programming by phone send [*0#].

DVR Track Selection

To play one of the sixteen DVR tracks, key-up and enter the DVR control number followed by the track number. The CAT-500 will key the transmitter and play the message pre-recorded at that track. Example: With a DVR control number of 450, play track seven.



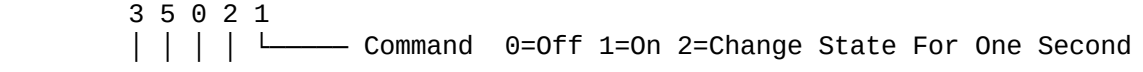
Forced DTMF Command Entry

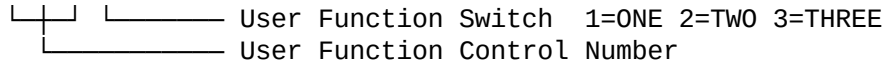
During normal operation a DTMF command is entered at the drop of receiver COR. It is possible to force a DTMF entry while COR is present. The CAT-500 will accept the [D] key as an entry command.

User Function Control By Repeater Input

This feature permits repeater users to control the three user function switches with a simple DTMF entry. To control one of the user function switches, Key-up and enter the user function control number followed by the switch number to be controlled and a [0] to turn the switch OFF, a [1] to turn the switch ON or a [2] to momentary change the switch for one second. There will be no voice announcement. The CAT-500 will change the switch immediately. Example: With a user function control number of 350, turn ON switch two.

Key-up and enter:

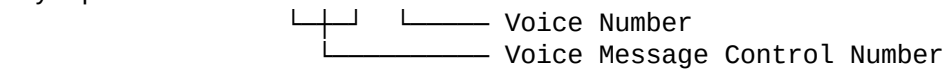




NOTE: If the CAT-500 is configured for Autopatch or Link, User Function #3 is not available. If a MF-1000 Serial Interface card is use, User Function #1 and #2 are not available.

Voice Message Demonstration

To play one of the eight voice messages, key-up and enter the VOICE MESSAGE control number followed by the voice message number. The CAT-500 will key the transmitter and play the voice message. Example: With a VOICE MESSAGE control number of 225, play voice message six.



Chapter 4 - Repeater Programming

This chapter describes how the CAT-500 control board is programmed by the repeater owner using a DTMF key-pad. The various types of program commands are described in detail and examples are given in the following text.

Initialization

To initialize the CAT-500, set dip-switch #7 to ON. Cycle the power OFF and back ON. During power-up, the voice will say: "RESET DATA LOAD COMPLETED."

Initialization consists of the following operations:

1. All memory locations are cleared.

2. Zone 1 Channel 1 Repeater Enable and Zone 3 Channel 1 Repeater ID #1 Enable, are turned ON.

3. The unlock number is loaded with the default value [1234567].

4. Control numbers are loaded with default values described in Figure 4-4.

5. Timers are loaded with default values described in Figure 4-5.

6. ID Message #1 is loaded with "CAT-500 AUTOMATIC REPEATER CONTROL." Messages 2 through 8 are loaded with the message number.

Programming the Unlock Control Number

To program the UNLOCK code, set dip-switch #8 to the ON position. The voice will say: "ENTER CONTROL." Key-up and enter a seven digit number. Un-key, if the number is accepted, the voice will say: "CONTROL OK." If the number is rejected, the voice will say: "CONTROL ERROR" followed by "ENTER CONTROL." Key-up and enter the seven digit number. Set dip-switch #8 to the OFF position.

When the CAT-500 is powered up with dip-switch #7 set to ON, the unlock number defaults to: [1-2-3-4-5-6-7]. The unlock number cannot be reprogrammed using the instant Start-up Kit.

Unlocking the Controller

To unlock the controller, key-up and enter the seven digit unlock control number. The voice will say: "CAT-500 CONTROL."

Locking the Controller

Key-up and send [*0]. Un-key, the controller will lockup and the voice will say: "MANUAL EXIT." The CAT-500 will lockup automatically when the programming timer expires. The voice synthesizer will say: "TIMER EXIT." The programming time limit can be set with the [*610*] programming command. The controller must be unlocked to perform the following procedures:

Scheduler Command Memory

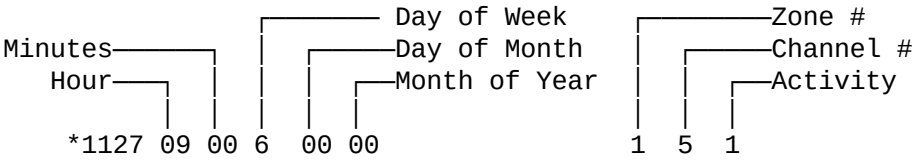
This memory area is reserved for storage of scheduler activity. This includes the time the command is to be executed, the zone and channel number to be changed and the action to be taken.

Read Scheduler Locations (01-60)

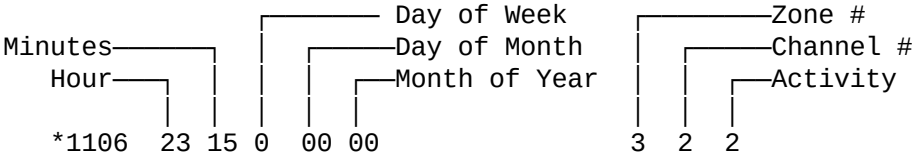
Key-up and send [*10XX]. Un-key and the voice synthesizer will read back the status of the memory location. If there is no command stored at that memory location, the voice will say: "POSITION XX IS CLEAR." If a command is stored at that memory location, the voice will read back the time, day, zone, channel number and command.

Program Scheduler Locations (01-60)

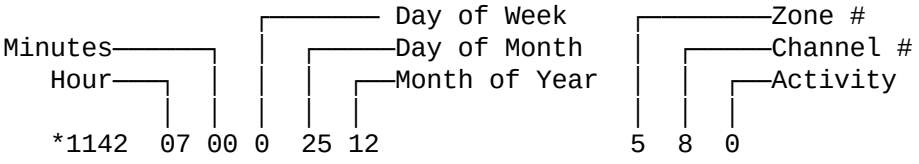
Key-up and send [*11XX] followed by the hours, minutes, day of week, or day of month and month of year, zone number, channel number and activity. Un-key and the voice will say: "CONTROL OK." Example: Zone 1 Channel 5 (ON) 9:00 AM every Friday, stored at table location 27.



Example: Zone 3 Channel 2 (momentary) 11:15 PM everyday stored at location 6



Example: Zone 5 Channel 8 Off 7:00 AM December 25th stored at location 42



DAY OF WEEK		ACTIVITY
0=DAILY	5=THURSDAY	0=CHANNEL OFF
1=SUNDAY	6=FRIDAY	1=CHANNEL ON
2=MONDAY	7=SATURDAY	2=MOMENTARY (1 SECOND)
3=TUESDAY	8=WEEKDAYS	
4=WEDNESDAY	9=WEEKENDS	

(Scheduler Programming Table)
Figure 4-1

Erase Scheduler Locations (01-60)

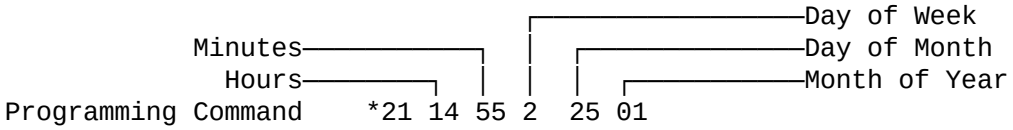
Key-up and send [*12XX]. Un-key and the voice synthesizer will say: "CANCEL CLOCK CONTROL POSITION XX."

Read the Time of Day

Key-up and send [*20]. Un-key and the voice synthesizer will read the time of day. Example: "THE TIME IS TWELVE FIFTEEN PM."

Setting the Clock

Key-up and send [*21] followed by the hours, minutes, day of week, day of month, and month of year. See Figure 4-2 for the number that represents the day of week. Un-key and the voice will say: "CLOCK SET OK." Example: 2:55 PM Monday January 25th. Hours are entered in 24 hour time. All entries must be double digit, except the day of week.



hour	0-23	Sun=1
minute	0-59	Mon=2 Fri=6
day of week	1-7	Tue=3 Sat=7
day of month	1-31	Wed=4
month of year	1-12	Thr=5

(Clock Programming Table)
Figure 4-2

Voice Synthesizer Memory Storage

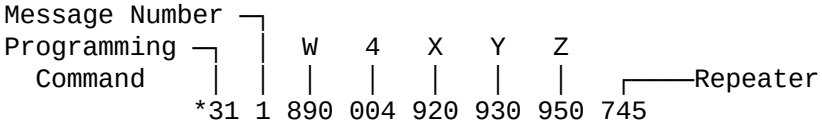
Space is provided for eight user programmable messages of up to 31 words each. Repeater ID #1 and ID #2 can be turned on at the same time. In this case the repeater ID will alternate between the two ID messages. This is also true for the Squelch Tail and Drop Out messages. Message Request #1 and #2 are activated by an external hardware device. When a positive voltage is applied to CAT-500 Input #1 or Input #2 the voice synthesizer will announce the message stored at the respective memory locations.

Read Synthesized Voice Message

Key-up and send [*30X]. Un-key and the voice synthesizer will read the message stored at memory location "X".

Program Synthesized Voice Message

Key-up and send [*31X] followed by the three digit numbers that represents the words required to construct the message. Memory space is provided for thirty-one entries. Refer to Chapter 7 Voice Vocabulary Word List. Example: Load Repeater ID #1 with "W4XYZ REPEATER."



1	REPEATER ID #1	5	DROP OUT #1
2	REPEATER ID #2	6	DROP OUT #2
3	SQUELCH TAIL #1	7	MESSAGE REQUEST #1
4	SQUELCH TAIL #2	8	MESSAGE REQUEST #2

Message Number Table
Figure 4-3

Program Synthesized Voice Message With Time

To insert the time-of-day into one of the voice messages load the number [100]. Example: Load Repeater ID #1 with "THE TIME IS [ACTUAL TIME] AND THIS IS THE W4XYZ REPEATER."

```
      [Actual Time] ──┐
                      │
   *31 1 816 824 480 100 229 820 816 890 004 920 930 950 745
```

User Function Control by Voice Message.

The voice message buffers can be used to control the User Function outputs. If during the execution of a voice message, a User Function command (101 through 110) is encountered, the CAT-500 will set the output and then continue with the remainder of the voice message.

USER FUNCTION VOICE CONTROL COMMANDS		
101 UF #1 ON	104 UF #1 OFF	107 UF #1 MOMENTARY ON
102 UF #2 ON	105 UF #2 OFF	108 UF #2 MOMENTARY ON
103 UF #3 ON	106 UF #3 OFF	109 UF #3 MOMENTARY ON
		110 500 mSEC DELAY

DVR Track Selection by Voice Message.

The voice message buffers can be used to select one of the sixteen DVR voice tracks. If during the execution of a voice message, a DVR track command (120 through 135) is encountered, the CAT-1000 will play the recorded message stored in that track. The MF-500 Serial Interface Card is required to operate the DVR.

DVR TRACK CONTROL COMMANDS			
120 TRACK #0	124 TRACK #4	128 TRACK #8	132 TRACK #12
121 TRACK #1	125 TRACK #5	129 TRACK #9	133 TRACK 313
122 TRACK #2	126 TRACK #6	130 TRACK #10	134 TRACK #14
123 TRACK #3	127 TRACK #7	131 TRACK #11	135 TRACK #15

Erase Synthesized Voice Message

Key-up and send [*32X]. Un-key and the voice will say: "CONTROL OK." The

synthesized voice message will be erased at location [X].

CW ID Memory Storage

Memory space is provided for a CW identification of up to twelve characters. If a repeater user talks over a voice ID in progress, the CAT-500 will switch to the CW ID. If both voice ID messages are disabled, (Zone 3 Channel 1 and Zone 3 Channel 2 turned OFF), the controller will ID in CW only. The CW ID memory buffer is loaded with "CAT500" during initialization.

Read Repeater CW ID

Key-up and send [*33]. Un-key and the CAT-500 will send the CW ID.

Program Repeater CW ID

Key-up and send [*34] followed by the two digit numbers that represents the numbers and letters required to construct the ID. Memory space is provided for twelve entries. Refer to the CW ID programming table. Example: Load CW ID memory buffer with DE W4XYZ/R

Programming Command	D	E	SPACE	W	4	X	Y	Z	/	R
*34	13	14	38	32	04	33	34	35	36	27

CW ID PROGRAMMING TABLE

00=ZERO	05=FIVE	10=A	15=F	20=K	25=P	30=U	35=Z
01=ONE	06=SIX	11=B	16=G	21=L	26=Q	31=V	36=/
02=TWO	07=SEVEN	12=C	17=H	22=M	27=R	32=W	37=AR
03=THREE	08=EIGHT	13=D	18=I	23=N	28=S	33=X	38=SPACE
04=FOUR	09=NINE	14=E	19=J	24=O	29=T	34=Y	

Erase Repeater CW ID

Key-up and send [*35]. Un-key and the voice will say: "CONTROL OK." If the CW ID buffer is empty and a repeater user keys-up during a voice ID, the voice ID will continue.

Digital Voice Recorder

The CAT-500 will support a Digital Voice Recorder with up to sixteen tracks. The optional MF-500 Serial Interface Card is required to provide the necessary control functions. Follow the interconnect diagram figure 2-5. Configure the CAT-500 for DVR operation by setting dip-switches 3 an 4 to ON.

Play Digital Voice Recorder

Key-up and send [*36XX]. Un-key and the CAT-500 will play the prerecorded message stored at track "XX"

Record Digital Voice Recorder

Key-up and send [*37XX]. Un-key and the voice will say: "START MESSAGE". Key-up and enter the message to be stored at track "XX".

Link Control Memory

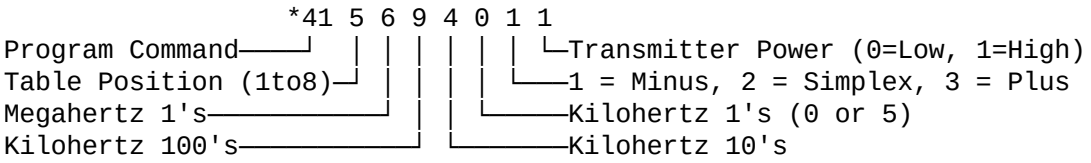
This memory area is reserved for storage of eight preset link frequencies that can be loaded automatically by the scheduler.

Read Link Frequency Locations (1-8)

Key-up and send [*40X]. Un-key and the voice synthesizer will announce the frequency, offset, and transmitter power setting at memory location [X]. If the memory location is empty, the voice will say: "NO FREQUENCY."

Program Link Frequency Locations (1-8)

Key-up and send [*41X] followed by the frequency (4 digits), offset, and the transmitter power setting. Un-key and the voice synthesizer will read back the frequency, offset and setting of transmitter power. Example: At table position 5, load frequency of 146.940 MHz, minus offset, with transmitter power HIGH.



Erase Link Frequency Location (1-8)

Key-up and send [*42X]. Un-key and the voice will say: "CONTROL OK."

Control Number Memory

This memory area is reserved for storage of control and prefix numbers. These numbers can be from one to seven digits and will change to a default value when the CAT-500 is powered up with dip-switch #7 set to the ON position. See the Control Number Table Figure 4-4 for default values.

Control Operator Prefix Number [*501*]

This number must precede the command used to change the settings of the repeater control channels in zones 1 through 8. Example: To program a Control Operator Prefix Number of 345, key-up and send [*501*345], Un-key and the voice will say: "CONTROL OK." Access to this number should be limited to control operators.

Macro Prefix Number [*502*]

This number must precede the command used to copy a macro into active memory. Example: To program a Macro Prefix Number of 275, key-up and send [*502*275], Un-key and the voice will say: "CONTROL OK." Access to this number should be limited to repeater control operators.

DTMF Access Number [*503*]

When the repeater is in the DTMF Access Mode it will not respond to a COR input. The repeater user must enter a DTMF access number to activate the repeater. When the repeater returns to rest for a period determined by the sleep timer, the number must be re-entered to activate the repeater. Example: To program a DTMF Access Number of 675, key-up and send [*503*675]. Un-key and the voice will say: "CONTROL OK."

DTMF Pad Test Number [*504*]

This number must be entered to initiate a DTMF key-pad test. Example: To program a DTMF Pad Test Number of 590, key-up and send [*504*590]. Un-key and the voice will say: "CONTROL OK."

Time Request Number [*505*]

This number must be entered to request the time of day announcement. Example: To program a Time Request Number of 825, key-up and send [*505*825]. Un-key and the voice will say: "CONTROL OK."

Link Frequency Load Number [*506*]

This number must precede the command used to change the frequency of the serial tuned link transceiver. Example: To program a Link Frequency Load Number of 999, key-up and send [*506*999]. Un-key and the voice will say: "CONTROL OK."

Autopatch Access Number [*507*]

This number must be entered to access the autopatch. Example: To program an autopatch access number of 234, key-up and send [*507*234]. Un-key and the voice will say: "CONTROL OK."

Autopatch Disconnect Number [*508*]

This number must be entered to terminate the autopatch. Example: To program an autopatch termination number of #, key-up and send [*508*#]. Un-key and the voice will say: "CONTROL OK."

User Speed Dial Prefix Number [*509*]

This number must be entered to access a user speed dial location. Example: To program the speed dial prefix 3, key-up and send [*509*3]. Un-key and the voice will say: "CONTROL OK." This number must precede the speed dial location number. With the prefix 3, the speed dial numbers will be 300 through 399.

Emergency Speed Dial Prefix Number [*510*]

This number must be entered to access an emergency speed dial location. Example: To program the speed dial prefix 55, key-up and send [*510*55]. Un-key and the voice will say: "CONTROL OK." This number must precede the speed dial location number. With the prefix 55, the speed dial numbers will be 550 through 559.

Reverse Autopatch Access Number [*511*]

This number must be entered to access a reverse autopatch. Example: To program the reverse autopatch number 678, key-up and send [*511*678]. Un-key and the voice will say: "CONTROL OK." This number must precede the speed dial number.

Link Control Number [*512*]

This number must precede the command used to activate or deactivate the link transceiver. Example: To program a Link Control Number of 432, key-up and send [*512*432]. Un-key and the voice will say: "CONTROL OK."

DVR Control Number [*513*]

This number must be entered to PLAY one of the DVR tracks. This number must precede the track number. Example: To program a DVR Control Number of 456, key-up and send [*513*456]. Un-key and the voice will say: "CONTROL OK."

User Function Switch Control Number [*514*]

This number must precede the command used to control one of the three user function switches. Example: To program a User Function Control Number of 24, key-up and send [*514*24]. Un-key and the voice will say: "CONTROL OK."

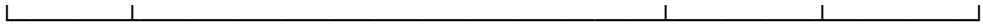
Voice Message Demonstration Control Number [*515*]

This number must be entered to have the voice synthesizer say one of the eight voice messages. This number must precede the message number. Example: To program a Voice Demonstration Control Number of 456, key-up and send [*515*456]. Un-key and the voice will say: "CONTROL OK."

Read Control Number [*501 - *515]

Key-up and send [*501]. Un-key and the voice will read back the Control Operator Prefix Code. The voice will say: "PRESET NUMBER 501 IS ONE HUNDRED."

	CONTROL NUMBER DESCRIPTION	DEFAULT	
501	CONTROL OPERATOR PREFIX CODE	100	
502	MACRO PREFIX CODE	150	
503	DTMF ACCESS CODE	200	
504	DTMF PAD TEST CODE	300	
505	TIME OF DAY REQUEST CODE	400	
506	LINK FREQUENCY LOAD PREFIX CODE	500	
507	AUTOPATCH ACCESS CODE	*	
508	AUTOPATCH DISCONNECT CODE	#	
509	USER SPEED DIAL PREFIX	800	
510	EMERGENCY SPEED DIAL PREFIX	900	
511	REVERSE AUTOPATCH CODE	650	
512	LINK CONTROL PREFIX	550	
513	DVR CONTROL PREFIX	450	
514	USER FUNCTION PREFIX	350	
515	VOICE DEMONSTRATION PREFIX	425	



Control Number Table
Figure 4-4

Timer Memory

This memory area is reserved for storage of nineteen timers. These timers are user programmable. If the CAT-500 is initialize by applying power with dip-switch #7 in the ON position, the timers will be automatically loaded with default times. See Figure 4-5.

Repeater Time-out Long [*601*]

The maximum length of a transmission is limited by the repeater time-out timer. This timer is programmable between 1.0 and 1799 seconds. Example: To program this timer to 2 minutes, key-up and enter [*601*120]. Un-key and the voice will say: "CONTROL OK." When initialize, this timer will default to 180 seconds.

Repeater Alternate Time-out [*602*]

When Zone 2 Channel 2 is enabled the repeater time-out changes to the different timer setting. This timer is programmable between 1.0 and 1799 seconds. When initialize, this timer will default to 60 seconds.

Repeater Sleep Timer [*603*]

This timer determines the time required for the repeater to be at rest before the DTMF access code is required to activate the repeater. This timer is programmable between 1.0 and 1799 seconds. When initialize, this timer will default to 60 seconds.

Repeater Turn on Delay Timer [*604*]

When the repeater is at rest, this timer determines the time COR must be present before the repeater will activate. This timer is programmable between 0.1 and 9.9 seconds. Example: To program this timer to 1.5 seconds, key-up and enter [*604*15]. Un-key and the voice will say: "CONTROL OK." When initialize, this timer will default to 1.0 seconds.

DTMF Pre-window Timer [*605*]

This timer determines the time between the presence of COR and the point where the DTMF window opens to accept DTMF entries. This timer is programmable between 0.1 and 9.9 seconds. When initialize, this timer will default to 2 seconds.

DTMF Window Timer [*606*]

This timer sets the length of time the window will be open to accept DTMF entry. This timer is programmable between 0.1 and 9.9 seconds. When initialize, this timer will default to 8 seconds.

COR Drop to Courtesy Beep Timer [*607*]

This timer determines the time between loss of COR and the generation of the courtesy beep. This timer is programmable between 0.1 and 9.9 seconds. When

initialize, this timer will default to 1 second.

Courtesy Beep to PTT Drop Timer [*608*]

This timer determines the time between the courtesy beep and the time the repeater transmitter turns off. This timer is programmable between 0.1 and 9.9 seconds. When initialize, this timer defaults to 4 seconds.

DTMF Mute Delay Timer [*609*]

This timer determines the time the transmit audio will continue to be muted after the entry of the last DTMF tone. This timer is programmable between 0.1 and 9.9 seconds. When initialize, this timer will default to 1 second.

Repeater Programming Timer [*610*]

This timer sets the maximum time the controller remains unlocked. Programmable from 1 to 1799 seconds, when initialize, it will default to 300 second.

Repeater ID Timer [*611*]

This timer sets the time between transmissions of the repeater ID. The ID occurs when a repeater user stops transmitting. This timer is programmable between 1.0 and 1799 seconds. When initialize, the timer defaults to 600 seconds.

Squelch Tail Message Timer [*612*]

This timer sets the time between transmissions of the squelch tail message. The message occurs when a repeater user stops transmitting. Programmable from 1.0 to 1799 seconds, when initialize, it will default to 1799 seconds.

Drop Out Message Timer [*613*]

This timer sets the time between transmissions of the drop out message. The message occurs when a repeater stops transmitting. Programmable from 1.0 to 1799 seconds, when initialize, it will default to 1799 seconds.

Voice Delay Timer [*614*]

The CAT-500 generates a PTT output and after a short delay the voice speaks. This delay is field programmable. This feature is useful in repeater systems using CTCSS tone squelch or multiple linking where the system is slow to come up. The voice delay timer can be programmed between 0.1 and 9.9 seconds. When initialize, the timer defaults to 1.0 seconds.

Audio Test Tone Timer [*615*]

The courtesy beep tone generator will produce a continuous tone to adjust audio levels to the transmitter. This timer is programmable between 0.1 and 9.9 seconds. When initialize, this timer will default to 5.0 seconds.

Autopatch Timer [*616*]

This timer sets the maximum length of an autopatch. Programmable from 1.0 to 1799 seconds, when initialize, this timer will default to 180 seconds.

Autopatch Activity Timer [*617*]

The repeater user must periodically key-up to maintain the autopatch. Five

seconds before the autopatch activity timer is to expire, the controller will generate a warning beep. The user must key-up or the autopatch will disconnect. This timer is programmable between 1.0 and 1799 seconds. When initialize, this timer will default to 30 seconds.

Ring Detector Timer [*618*]

This timer sets the delay between detection of the first ring and when the controller takes the telephone off-hook to answer a control operator call in. This timer is programmable between 1.0 and 1799 seconds. When initialize, this timer will default to 2.0 seconds.

Courtesy Beep Length Timer [*619*]

This timer determines the length of the courtesy beep. This timer is programmable between .01 and .99 seconds. When initialize, this timer will default to .10 seconds.

Read Timer Setting [*601 - *619]

Key-up and send [*601]. Un-key and the voice synthesizer will read back the setting of the repeater's time-out timer. The voice will say: "TIMER 601 IS THREE MINUTES." NOTE: Timer read back of *615 and *619 is not available.

	TIMER MEMORY	RANGE	DEFAULT	
601	REPEATER TIME-OUT	1.0 - 1799	180	
602	REPEATER ALTERNATE TIME-OUT	1.0 - 1799	60	
603	REPEATER SLEEP TIME	1.0 - 1799	60	
604	REPEATER TURN ON DELAY TIME	0.1 - 9.9	1.0	
605	REPEATER PRE-WINDOW TIME	0.1 - 9.9	2.0	
606	REPEATER WINDOW TIMER	0.1 - 9.9	8.0	
607	COR DROP TO COURTESY BEEP TIME	0.1 - 9.9	1.0	
608	COURTESY BEEP TO PTT DROP TIME	0.1 - 9.9	4.0	
609	DTMF MUTE DELAY TIME	0.1 - 9.9	1.0	
610	PROGRAMMING MAX LENGTH TIME	1.0 - 1799	300	

611	REPEATER ID TIME	1.0 - 1799	600	
612	SQUELCH TAIL MESSAGE TIME	1.0 - 1799	1799	
613	DROP OUT MESSAGE TIME	1.0 - 1799	1799	
614	VOICE DELAY TIMER	0.1 - 9.9	1.0	
615	AUDIO TEST TONE LENGTH	0.1 - 9.9	5.0	
616	AUTOPATCH LENGTH TIME	1.0 - 1799	180	
617	AUTOPATCH ACTIVITY TIME	1.0 - 1799	30	
618	RING DETECTOR TIME	1.0 - 1799	2.0	
619	COURTESY BEEP LENGTH TIME	.01 - .99	.10	

Timer Table (Seconds)
Figure 4-5

User Speed Dial Memory

This memory area is reserved for storage of sixty phone numbers with call letter identification. Space is provided for a seven digit phone number with an ID of eight number, letters or word from the Voice Vocabulary Word List.

Read User Speed Dial Locations (00-59)

Key-up and send [*70XX]. Un-key and the voice synthesizer will read back the status of the memory location. If there is no command stored at that memory location, the voice will say: "POSITION XX IS CLEAR." If a User Speed Dial is stored at that memory location, the voice will read the phone number and ID.

Program User Speed Dial Locations (00-59)

Key-up and send [*71XX] followed by a seven digit phone number, a [*] separator and up to eight words from the voice synthesizer vocabulary list. Un-key and the voice will say: "CONTROL OK." Example: 978-6171 W4XYZ at table location 15.

```
Phone Number ──────┐       W    4    X    Y    Z
                   │       │    │    │    │    │
          *7115 9786171 * 890  004  920  930  950
```

Erase User Speed Dial Locations (00-59)

Key-up and send [*72XX]. Un-key and the voice synthesizer will say: "CONTROL OK"

Emergency Speed Dial Memory

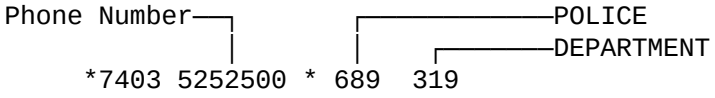
This memory area is reserved for storage of ten, seven digit phone numbers with an identification of eight number, letters or word from the voice word list.

Read Emergency Speed Dial Locations (00-09)

Key-up and send [*73XX]. Un-key and the voice synthesizer will read back the status of the memory location. If there is no command stored at that memory location, the voice will say: "POSITION XX IS CLEAR." If an Emergency Speed Dial is stored at that memory location, the voice will read the phone number and identification.

Program Emergency Speed Dial Locations (00-09)

Key-up and send [*74XX] followed by a seven digit phone number, a [*] separator and up to eight words from the voice synthesizer vocabulary list. Un-key and the voice will say: "CONTROL OK." Example: 525-2500 POLICE DEPARTMENT at table location 3.



Erase Emergency Speed Dial Locations (00-09)

Key-up and send [*75XX]. Un-key and the voice synthesizer will say: "CONTROL OK"

Telephone Lock-Out Memory

This memory area is reserved for storage of sixty phone numbers or phone number prefixes. Space is provided for an eleven digit number.

Read Lock-Out Number Locations (00-59)

Key-up and send [*76XX]. Un-key and the voice synthesizer will read back the phone number stored at that memory location. If there is no number stored at that memory location, the voice will say: "TELEPHONE CANCEL NUMBER POSITION XX.

Program Lock-Out Number Locations (00-59)

Key-up and send [*77XX] followed by the seven digit phone number. Un-key and the voice will say: "CONTROL OK." Example: Lock-out number 555-1212. stored at memory location 3.

Example: Lock-out all numbers with the 976 Prefix stored at table location 17.

Erase Lock-Out Number Locations (00-59)

Key-up and send [*78XX]. Un-key and the voice synthesizer will say: "CONTROL OK"

Program Pre Dial Number

When the CAT-500 is connected to a business phone line, it is often necessary to pre dial a number to access an outside line. When initialized, this number defaults to 9. You can change this pre dial number with the [*79X] programming command. Example: to change the pre dial number to 5, key-up and enter *795. Un-key and the voice will say: "CONTROL OK". Note: dip-switch 6 must be ON for pre dial operation.

Memory space is provided for four digits. On a non-business line, this feature can be used to suppress the new caller ID service provided by the telephone company. Example: to suppress caller ID, key-up and enter *791176. Un-key and the voice will say: "CONTROL OK".

Audio Test Tone [*90]

The CAT-500 will generate a 1000Hz test tone. This tone is use as a reference when setting audio levels. To activate the tone key-up and enter [*90]. The frequency of the tone is fixed. The length of the tone is determined by the setting of the Audio Test Tone Timer [*615*].

Macro Memory Storage [*91 through *98]

Space is provided for eight user programmable macros. Configure the CAT-500 active memory to suite your special requirements. Use the [*91] programming command to save the current settings of the channels, codes, timers and voice messages as Macro #1. Example: Save active memory as Macro #5.

Key-up and sent [*95]. Un-key and the voice will say: "MACRO FIVE SET OK"

Initialize Active Memory [*99]

Key-up and send [*99]. Un-key and active memory will be loaded with the default values. The voice will say: "PRESET MACRO SET OK." This programming command is similar to the CAT-500 initialization. However, it is not necessary to go to the repeater site, set dip-switch #7 ON and power up the CAT-500.

Exit Programming Mode [*0]

To exit the programming mode and return to normal repeater operation, key-up and send [*0]. Un-key and the voice will say: "MANUAL EXIT."

If you fail to exit the programming mode, when the programming timer expires, the CAT-500 will automatically return to normal repeater operation. The voice will say: "TIMER EXIT."

DTMF Programming Table

ENTRY	DESCRIPTION
*10XX	READ PROGRAM SCHEDULER COMMAND
*11XX	PROGRAM SCHEDULER COMMAND
*12XX	ERASE SCHEDULER COMMAND
*20	READ TIME OF DAY
*21	PROGRAM TIME OF DAY
*30X	READ VOICE SYNTHESIZER
*31X	PROGRAM VOICE SYNTHESIZER
*32X	ERASE VOICE SYNTHESIZER
*33	READ CW ID
*34	PROGRAM CW ID
*35	ERASE CW ID
*36XX	PLAY DIGITAL VOICE RECORDER
*37XX	RECORD DIGITAL VOICE RECORDER
*40X	READ LINK FREQUENCY
*41X	PROGRAM LINK FREQUENCY
*42X	ERASE LINK FREQUENCY
501	PROGRAM CONTROL OPERATOR PREFIX CODE
502	PROGRAM MACRO PREFIX CODE
503	PROGRAM DTMF ACCESS CODE
504	PROGRAM DTMF PAD TEST CODE
505	PROGRAM TIME OF DAY REQUEST CODE
506	PROGRAM LINK FREQUENCY LOAD PREFIX CODE
507	PROGRAM AUTOPATCH ACCESS CODE
508	PROGRAM AUTOPATCH DISCONNECT CODE
509	PROGRAM USER SPEED DIAL PREFIX CODE
510	PROGRAM EMERGENCY SPEED DIAL PREFIX CODE
511	PROGRAM REVERSE AUTOPATCH CODE
512	PROGRAM LINK CONTROL PREFIX CODE
513	PROGRAM DVR CONTROL PREFIX CODE
514	PROGRAM USER FUNCTION SWITCH PREFIX CODE
515	PROGRAM VOICE MESSAGE DEMONSTRATION PREFIX

DTMF Programming Table

ENTRY	DESCRIPTION
601	PROGRAM REPEATER TIME-OUT
602	PROGRAM REPEATER ALTERNATE TIME-OUT
603	PROGRAM REPEATER SLEEP TIME
604	PROGRAM REPEATER TURN ON DELAY TIME
605	PROGRAM REPEATER PRE-WINDOW TIME
606	PROGRAM REPEATER WINDOW TIMER
607	PROGRAM COR DROP TO COURTESY BEEP TIME
608	PROGRAM COURTESY BEEP TO PTT DROP TIME
609	PROGRAM DTMF MUTE DELAY TIME
610	PROGRAM PROGRAMMING MAX LENGTH TIME
611	PROGRAM REPEATER ID TIME
612	PROGRAM SQUELCH TAIL MESSAGE TIME
613	PROGRAM DROP OUT MESSAGE TIME
614	PROGRAM VOICE DELAY TIMER
615	PROGRAM AUDIO TEST TONE LENGTH
616	PROGRAM AUTOPATCH TIME
617	PROGRAM AUTOPATCH ACTIVITY TIME
618	PROGRAM RING DETECTOR TIME
619	PROGRAM COURTESY BEEP LENGTH TIME
*70XX	READ USER SPEED DIAL *
*71XX	PROGRAM USER SPEED DIAL *
*72XX	ERASE USER SPEED DIAL *
*73XX	READ EMERGENCY SPEED DIAL *
*74XX	PROGRAM EMERGENCY SPEED DIAL *
*75XX	ERASE EMERGENCY SPEED DIAL *
*76XX	READ LOCKED OUT PHONE NUMBER *
*77XX	PROGRAM LOCKED OUT PHONE NUMBER *
*78XX	ERASE LOCKED OUT PHONE NUMBER *
*79X	PROGRAM PRE-DIAL NUMBER
*90	GENERATE 1000Hz TEST TONE
*91	PROGRAM MACRO #1
*92	PROGRAM MACRO #2
*93	PROGRAM MACRO #3
*94	PROGRAM MACRO #4
*95	PROGRAM MACRO #5
*96	PROGRAM MACRO #6
*97	PROGRAM MACRO #7
*98	PROGRAM MACRO #8
*99	INITIALIZE ACTIVE MEMORY
*0	MANUAL EXIT

NOTE: * Requires Enhanced Autopatch Software.

Chapter 5 - Interfacing to Other Equipment

Interfacing the CAT-500 to your repeater system is a simple matter. A minimum of two inputs and two outputs are required for the CAT-500 to control a repeater. They are:

1. A COR signal from the repeater receiver to indicate when a signal is being received.

2. A receive audio signal containing DTMF tone to be processed for control.

3. A Push-To-Talk signal to tell the repeaters transmitter to turn ON.

4. A transmit audio signal containing a combination of receive audio, synthesized voice, and courtesy tone.

Additional inputs are required and outputs are produced to realize the full features of the CAT-500.

Determining COR Logic

Locate your repeater receiver's COR output. This line has a DC voltage that changes state when a signal is being received. If the COR line is 0 volts and goes to some positive voltage when a signal is received it is said to be (positive logic) or active HIGH. If the COR line is a positive voltage, and goes to 0 volts when a signal is received it is said to be (negative logic) or active LOW. Set dipswitch #1 on the CAT-500 to ON for (negative logic) and OFF for (positive logic). NOTE: 0 volts is any voltage less than 0.8VDC. A positive voltage is any voltage greater than 3.0VDC.

Connection to Receiver

Connect the repeater receiver audio output to J1-13 and the COR to J1-6 of the CAT-500. Measure the COR level when the receiver is active. Verify this line changes from less than 0.8VDC to greater than 3.0 VDC. If the COR line will not meet these limits it may be necessary to add an external pull-up resistor to the COR line. This may also be true for the AUX COR and CTCSS inputs.

Connection to Transmitter

Locate your repeater's Push-To-Talk input. When grounded, this line will make the repeater transmit. Connect the CAT-500 TX audio output (J1-10) to this line.

Locate your repeater's TX audio input. This is the line were the audio signal used to modulate the transmitter is applied. Connect the TX AUDIO OUT (J1-11) to this line.

Connection to Auxiliary Input

Connect the control receiver or link transceiver audio output to J1-12 and the COR to J1-5 of the CAT-500.

Connection to CTCSS Decoder

If your repeater receiver has a CTCSS decoder output, connect it to J1-4. The CAT-500 requires a positive logic input to represent a CTCSS input.

Connection to Inputs 1, 2, and 3

The three user inputs J1-1, J1-2, and J1-3 require a positive logic input. Any input voltage between 3 and 15 VDC represents a positive input logic

Connection to Outputs 1, 2, and 3

The CAT-500 User Function output switches are assigned to J1-7, J1-8, and J1-9. These switches may be connected to any equipment at the repeater site. They are ideally suited as relay drivers and can sink 200 milliamps of current with supply voltages of 60 volts. When switching inductive loads, such as relays, install diodes across the relay coils with the cathode to the power supply side.

Interface Review

1. Are dipswitches #1 through #8 in their proper positions?

2. Is the RPT TX output at J1-10 connected to the transmitter PTT input?

3. Is the TX AUDIO OUT at J1-11 connected to the transmitter audio input?

4. Is the RPT COR at J1-6 connected to the receiver COR output of the repeater's receiver?

5. Is dipswitch #1 in the ON position for active low COR or in the OFF position for active high COR from the repeater's receiver?

6. Is the COR level from the repeater's receiver changing from less than 0.8 VDC to greater than 3.0 VDC?

7. Is the CAT-500 RPT AUDIO INPUT at J1-13 connected to the repeater's receiver audio output?

8. Is dipswitch #2 in the ON position for active low COR or in the OFF position for active high COR from the control or link receiver? Set dipswitch #2 OFF if there is no receiver connected to the AUX COR input.

9. Is the repeater receiver audio input level (100mV minimum at U11 pin 4) sufficient for the DTMF decoder?

Power Supply

The CAT-500 is powered by an external 12VDC power supply. Connect the positive lead of the supply to the center pin of the coaxial power plug P1 and the negative lead to the outer conductor. Install a 0.25A fuse in the DC power line to protect the power distribution tracks on the printed circuit board.

Audio Level Adjustment (Radio)

The audio mixing-switching circuits of the CAT-500 are optimized around an input and output of -10dbM (250mV RMS). For best results the receiver audio input should be 250mV when a DTMF tone is being received.

Unlock the CAT-500 and enter the [*90] programming command to produce the 1000Hz test tone. Adjust the TX AUDIO (R4) for a transmit audio output level of -16dbM (130mV RMS) at J1-11. (R4) has a range of adjustment from -10dbM (250mV RMS) to -26dbM (40mV RMS). Lock the CAT-500 with the [*0] command.

To increase the 1000Hz test tone at J1-11, decrease the value of R12. Changing any other component will disrupt the action of the active audio filter U5B.

While providing a DTMF audio input at J1-13 of -10dbM (250mV RMS), adjust the RPT AUDIO (R8) for a transmit audio output level at J1-11 of -10dbM (250mV RMS).

While providing a DTMF audio input at J1-12 of -10dbM (250mV RMS), adjust the AUX AUDIO (R17) for a transmit audio output level at J1-11 of -10dbM (250mV RMS).

With the RPT AUDIO, AUX AUDIO, and TEST AUDIO balanced, adjust the TX AUDIO (R4) for the desired level of modulation while monitoring the transmitter output. Compare the receive and synthesized voice audio and adjust the VOICE LEVEL (R10) as desired.

If your repeater's transmit audio input is very sensitive and you find that TX AUDIO (R4) is set to minimum, it is strongly recommended that an external voltage divider be installed at the input of the transmitter. This will insure an acceptable transmit audio signal to noise ratio.

Audio Level Adjustment (Autopatch)

Connect the Telephone Interface Card to the CAT-500 accessory connector J2. Set dip-switchs 3 to OFF and 4 to ON. Access the autopatch. While providing a DTMF audio input at J1-13 of -10dbM (250mV RMS), adjust (R8) on the Telephone Interface Card for a level at the modular phone jack TIP and Ring of 0dbM (770mV RMS). Adjust the AUX AUDIO (R17) for the desired level of phone audio at the transmitter audio output J1-11.

Repeater Interface (J1)

Connector J1 provides the interface to the repeater, and the control receiver, or link transceiver.

1 - Input #1	2 - Input #2
3 - Input #3	4 - RPT CTCSS
5 - AUX COR	6 - RPT COR
7 - User Output #1	8 - User Output #2
9 - User Output #3	10 - RPT TX (PTT)
11 - TX Audio Output	12 - AUX Audio Input
13 - RPT audio Input	14 - Ground

NOTE: Connector pins J1-14 through J1-25 are PC board grounds.

Accessory Interface (J2)

Connector J2 is provided as an interface for the Telephone Interface Card.

1 - +12 Volts	2 - Ground
3 - Input #1	4 - Input #2
5 - Input #3	6 - User Output #1
7 - User Output #2	8 - User Output #3
9 - AUX Audio Input	10 - Phone Line Mute
11 - TX Audio Output (LO-Z)	12 - Audio Mixer Input
13 - AUX Audio Output (LO-Z)	14 - RPT Audio Output (LO-Z)

Front Panel Interface (J3)

This interface is used to provide outputs to drive LED indicators for the controller's front panel.

1 - +12 Volts	2 - Ground
3 - User Output #3	4 - User Output #2
5 - User Output #1	6 - Repeater PTT
7 - DTMF Decoder Strobe	8 - Phone Audio Mute

Display Definitions

Seven LED'S indicate the operational condition of the CAT-500. They are:

POWER indicates when primary power (+12VDC) is applied to the CAT-500.

STROBE indicates when a DTMF tone is being decoded.

MUTE indicates when RPT COR is present during an Autopatch.

PTT indicates when the CAT-500 is producing a push-to-talk output for the repeater's transmitter.

OUT-1 indicates when user function #1 switch is turned ON.

OUT-2 indicates when user function #2 switch is turned ON.

OUT-3 indicates when user function #3 switch is turned ON. When the CAT-500 is configured for Link operation, OUT-3 displays Link push-to-talk activity. In the autopatch configuration OUT-3 displays OFFHOOK activity.

The display LED'S for PTT, OUT-1, OUT-2, and OUT-3 outputs should be connected to +12V through a 560-ohm current limiting resistor. If any of these outputs are used to switch an external TTL (0-5VDC) input, an isolation diode must be installed between the CAT-500 and the TTL device being switched. Connect the diode's cathode towards the CAT-500. When switching inductive load such as a relay, install a diode across the relay coil with the cathode to the power supply side.

The MUTE and STROBE outputs are active high TTL levels and require an external inverter transistor to drive the LED.

Audio Delay Interface (J4)

This interface is used to connect an audio delay board. The CAT-500 is shipped from the factory with a jumper installed across J4 pins 1 and 2. This

completes the audio path between RPT AUDIO INPUT and the transmit audio mixer.

An audio delay board connected to J4 will eliminate the receiver squelch noise crash and the chirp of the first DTMF tone when the DTMF mute is enabled. Several Audio Delay Modules are available from other manufacturers.

1 - Repeater Audio Input	3 - Ground
2 - Delayed Audio Output	4 - +12 Volts

Serial Tuning (BCD)

The CAT-500 will accept a DTMF command from a repeater user and produce a serial command to channel a link transceiver. Output #1 and Output #2 produce a serial clock and a 24-bit serial data word in response to the input command. This word contains the frequency and offset in a TTL level serial BCD code.

When the repeater user enters a link frequency the voice will read back the frequency. Immediately following the read back, the CAT-500 will send the twenty-four-bit word. Once received by the MF-1000 Serial Interface Card, this serial word is converted to twenty-four latched parallel outputs. Refer to the MF-1000 Serial Interface Card in Chapter 13 of this manual.

Serial Tuning (Push Button)

When the repeater user enters a link frequency the voice will read back the frequency. Immediately following the read back, the CAT-500 will pulse the various outputs to simulate a frequency entry as if it was entered by the front panel keypad on the transceiver. Push Button serial tuning is designed to work with the Kenwood 7800, 7900 and 2500 series of transceivers. A user fabricated relay interface board is required to provide isolation. Refer to the MF-1000 Serial Interface Card schematic on page 9-4 for the output pin assignments.

Telephone Line Busy

When the CAT-500 is configured for autopatch, (dip-switch 4 ON), the AUX COR J1-5 becomes a telephone line busy input. A user supplied circuit that detects when a shared telephone line is off-hook and produces a positive DC voltage from 3 to 12 volts is required. If a repeater user attempts an autopatch when the busy input is active the voice will say: "TELEPHONE LINE IN SERVICE." The autopatch will be rejected.

Chapter 6 - Theory of Operation

Control Channel Scheduler

Memory is provided for sixty table positions. Each position provides space to store the time the command is to be executed. This includes hours, minutes, day of week, or day of month and month of year if required. Additional space is provided to store the zone, channel number and action.

Input Port Definition

The CAT-500 has two input ports with eight discrete inputs.

Port 1 Input 1

VOICE BUSY is reserved for the voice synthesizer and is used to tell the microprocessor not to issue any more instructions until the voice is through speaking. This port is internal to the CAT-500.

Port 1 Input 2

AUX COR is used to tell the microprocessor the link receiver is receiving a signal. If Zone 7 Channel 1 is enabled, the controller will key-up the repeater's transmitter. If dipswitch #2 is turned ON, a logic LOW input is required for activation. If dipswitch #2 is turned OFF, logic HIGH input is required for activation. In the autopatch mode, this input becomes a telephone line busy input to prevent an autopatch if the phone line is off-hook.

Port 1 Input 3

INPUT #3 tells the microprocessor to half the frequency of the courtesy beep tone. A logic HIGH input is required for activation.

Port 1 Input 4

INPUT #1 tells the microprocessor to announce the pre-programmed voice message stored with the [*317] programming command. Zone 3 Channel 7 must be enabled. A logic HIGH input is required for activation.

Port 1 Input 5

INPUT #2 tells the microprocessor to announce the pre-programmed voice message stored with the [*318] programming command. Zone 3 Channel 8 must be enabled. A logic HIGH input is required for activation.

Port 1 Input 6

RPT CTCSS tells the microprocessor the signal being received by the repeater's receiver contains a sub-audible tone. If Zone 1 Channel 2 is enabled, the controller will key-up the transmitter. A logic HIGH input is required for activation.

Port 1 Input 7

RPT COR tells the microprocessor the repeater’s receiver is receiving a signal. If Zone 1 Channel 1 is enabled, the controller will key-up the repeater's transmitter. If dipswitch #1 is turned ON, a logic LOW input is required for

activation. If dipswitch #1 is turned OFF, a logic HIGH input is required for activation.

Port 1 Input 8

STROBE tells the microprocessor that a DTMF tone is being decoded. This port is internal to the CAT-500.

Input Port 2

This input port is connected to an eight-position dipswitch. The switch is used to configure the CAT-500 for various modes of operation. See pages 2-6 and 2-7 for definitions.

Output Port Definition

Output 1 (RPT TX)

This output keys the repeater's transmitter. This output is under the control of Zone 1 Channel 1.

Output 2 (User Output #1)

This output is User Function #1 and is under the control of Zone 7 Channel 6. If dipswitches 5 and 6 are configured for link serial tuning, this output generates the clock signal to serial tune the link transceiver.

Output 3 (User Output #2)

This output is User Function #2 and is under the control of Zone 7 Channel 7. If dipswitches 5 and 6 are configured for link serial tuning, this output generates the data signal to serial tune the link transceiver.

Output 4 (User Output #3)

This output is User Function #3 and is under the control of Zone 7 Channel 8. If dipswitch 3 is ON, this output generates the link transmitter PTT. If dipswitch 4 is ON, this output provided the off-hook relay drive.

Output 5 (Phone Mute)

This output mutes the phone audio input. During an autopatch when ever a COR signal is present on the input, the CAT-500 will generate a MUTE signal. This output is a positive going logic and is used to control the muting relay on the telephone interface card connected to accessory connector J2.

Output 6 (Audio Switch-A)

This output controls the audio switch that directs RPT Audio or AUX Audio to the DTMF decoder.

Output 7 (Audio Switch-B)

This output controls the audio switch that limits RPT Audio to the input of the TX Audio Mixer.

Output 8 (Audio Switch-C)

This output controls the audio switch that limits AUX Audio to the input of the TX Audio Mixer.

INPUT PORT #2	INPUT PORT #1	OUTPUT PORT #1
1. (COR LOGIC)	1. INPUT #1	1. RPT TX
2. (AUX LOGIC)	2. INPUT #2	2. USER OUT #1
3. (CONFIGURE)	3. INPUT #3	3. USER OUT #2
4. (CONFIGURE)	4. RPT CTCSS	4. USER OUT #3
5. (CONFIGURE)	5. AUX COR	5. PHONE MUTE
6. (CONFIGURE)	6. RPT COR	6. AUDIO SW (A)
7. (INITIALIZE)	7. VOICE BUSY	7. AUDIO SW (B)
8. (UNLOCK)	8. DTMF STROBE	8. AUDIO SW (C)

Port Assignments
Figure 6-1

Microprocessor

The 80C85 microprocessor is the heart of the CAT-500. The 80C85 receives instructions from the control operator or repeater user through the DTMF receiver, monitors the time from the on-board digital clock, and produces responses in accordance to the software program stored in the PROM.

PROM

The 27512 is a UV erasable 512K PROM. In addition to the program, this PROM contains data used by the voice synthesizer for word construction.

RAM Real Time Clock

The DS1243Y is a static nonvolatile 8K RAM with a built-in clock. This memory and real time clock has a self-contained lithium energy source and control circuitry that constantly monitors the power supply for an out-of-tolerance condition. When such a condition occurs, the lithium energy source is automatically switched on and write protection is enabled to prevent loss of data and time. In the absence of power, the energy cell will maintain the data and time for five years. Clock accuracy is $\pm$ one minute per month at an ambient temperature of +25 degrees centigrade.

DTMF Receiver

The MT-8870 is a complete Dual Tone Multi-Frequency (DTMF) receiver that can decode all 16 DTMF tones. The receiver outputs to the microprocessor bus, a 4-bit hexadecimal code. The receiver exhibits excellent speech immunity. A 3.58 MHz color burst crystal frequency source determines tone detection accuracy.

Watchdog

The DS1232 monitors the performance of the microprocessor. If for any reason the microprocessor stops executing the program, the DS1232 will generate an automatic reset.

Timer

The MM5369 timer divides the microprocessor clock to produce a 30Hz output used to interrupt the microprocessor. This decrements internal software timers.

Negative Voltage Generator

The ICL7660 negative voltage generator is used to produce a negative 5 volts to supply the audio switch U11 and the OP-AMP U5.

Audio Switch

The MC4053 is a three section audio switch. Switch U11A controls repeater receive audio into the transmit mixer. Switch U11B connects repeater receive audio or auxiliary audio to the input of the DTMF decoder. Switch U11C controls auxiliary audio into the transmit mixer.

Audio Amplifier

The LM348 is a four-section low distortion audio amplifier. U5A is the transmit audio mixer. RPT audio, AUX audio and a combination of voice and tone audio are mixed to produce the transmitter audio. U5B with its input resistor capacitor network forms a low pass filter to reduce harmonic content in the tone and voice inputs. U5C and U5D are buffer amplifiers for the RPT and AUX audio inputs.

Voice Synthesizer

The TSP53C30 operates as a slave to the system microprocessor. It includes a 10 pole linear predictive filter, an 8K ROM and an 8-bit microprocessor. Speech data is stored in the external 512K PROM and transferred to the TSP53C30 via the data bus.

Link Frequency Control

Refer to the Serial Interface Card schematic on page 9-4 of this manual. The serial data word enters U1 at pin 14. As the serial clock pulses enter U1, U3, and U5 at pin 11 the data word is clocked through U1, U3 and U5 until all three shift registers are filled with eight bits each. A strobe pulse is sent to pin 12 of each register to latch the data to the parallel outputs. U2, U4 and U6 are output buffers with increased current sinking ability.

Chapter 7 - Voice Vocabulary

CAT-500 Word Listing

U

V

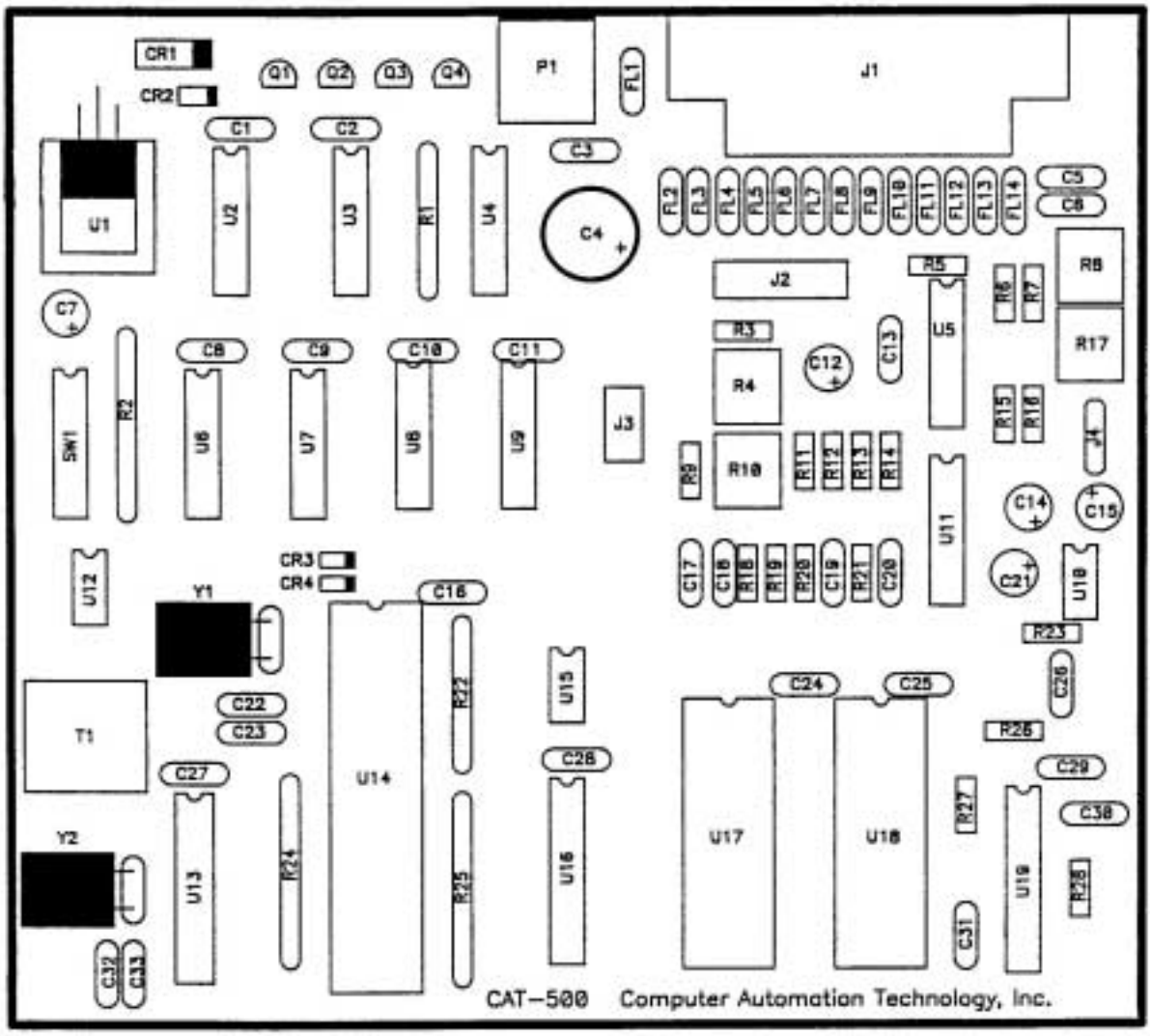
W

X

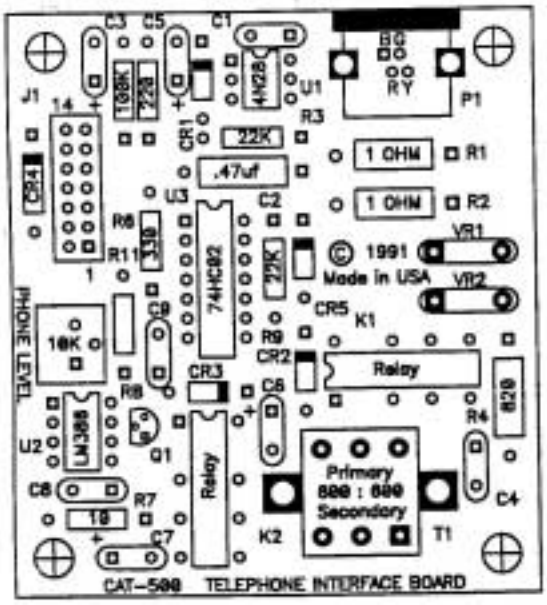
Y

Z

Chapter 8 - Diagrams

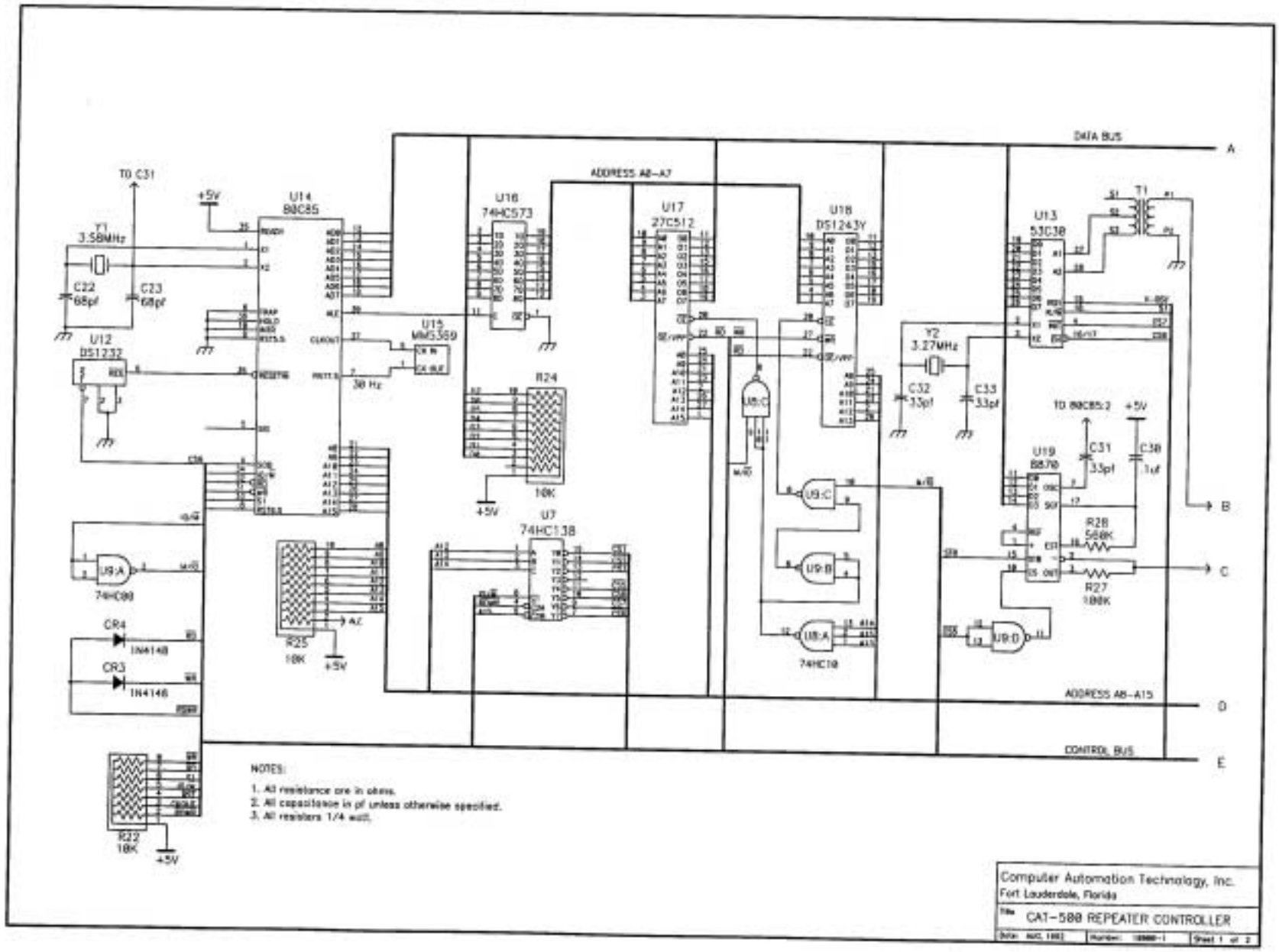


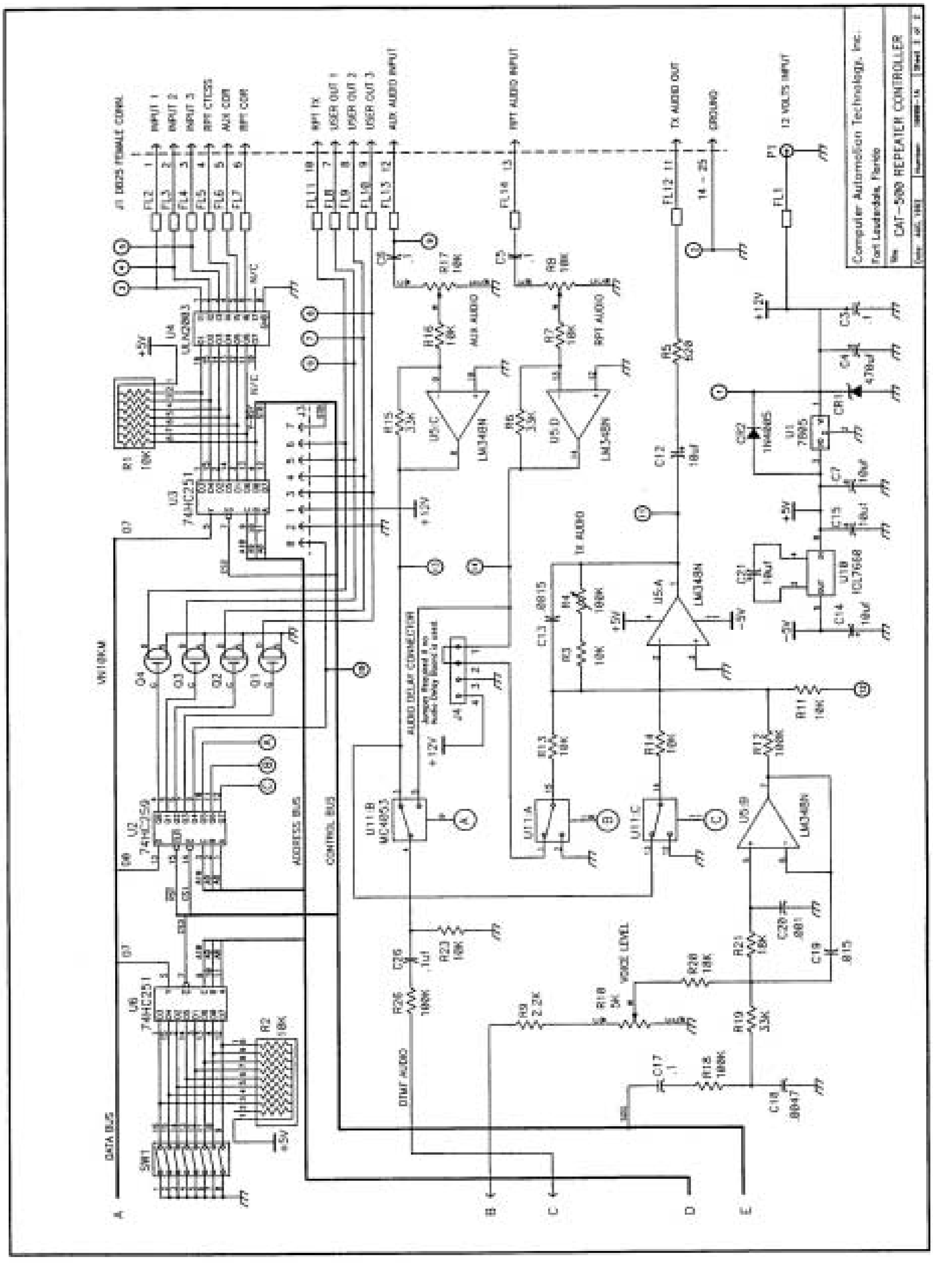
CAT-500 Control Board
Figure 8-1

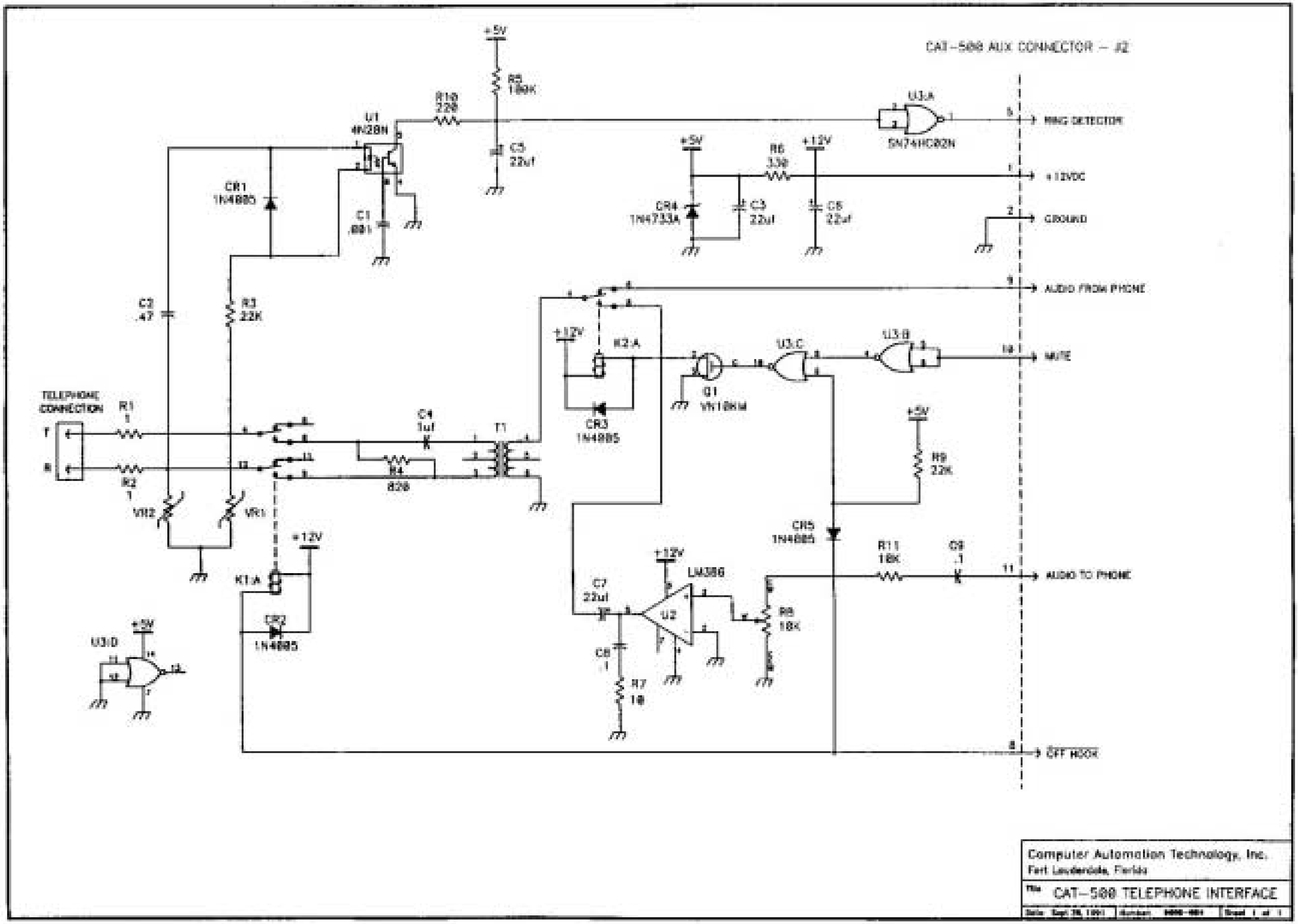


Telephone Interface
Figure 8-2

Chapter 9 - Schematics


DATA BUS
A
ADDRESS A8–A7
TO C31
+5V
U14
80C85
U16
74HC573
U17
27C512
U18
DS1243Y
U13
53C38
T1
Y1
3.58MHz
C22
68pf
C23
68pf
U12
DS1232
U15
MM5369
30 Hz
R24
10K
U7
74HC138
U9:A
74HC08
U9:C
U9:B
U9:D
U8:A
74HC10
Y2
3.27MHz
C32
33pf
C33
33pf
TO 80C85:2
U19
88.70
C31
33pf
C38
1uf
R28
568K
R27
100K
B
C
CR4
IN4148
CR3
IN4148
R25
10K
R22
10K
ADDRESS A8–A15
D
CONTROL BUS
E
NOTES:
1. All resistance are in ohms.
2. All capacitance in pf unless otherwise specified.
3. All resistors 1/4 watt.
Computer Automation Technology, Inc.
Fort Lauderdale, Florida
CAT-588 REPEATER CONTROLLER


Computer Automation Technology, Inc.
Fort Lauderdale, Florida
CAT-500 REPEATER CONTROLLER


CAT-500 AUX CONNECTOR - J2
RING DETECTOR
+12VDC
GROUND
AUDIO FROM PHONE
MUTE
AUDIO TO PHONE
OFF HOOK
TELEPHONE CONNECTION
T
R
R1 1
R2 1
C2 .47
R3 22K
CR1 1N4005
U1 4N28N
C1 .001
R10 220
+5V
R5 100K
C5 22uf
U3:A
SN74HC02N
+5V
R6 330
+12V
CR4 1N4733A
C3 22uf
C6 22uf
VR2
VR1
C4 1uf
R4 820
T1
+12V
K2:A
CR3 1N4005
Q1 VN10KM
U3:C
U3:B
+5V
R9 22K
CR5 1N4005
+12V
K1:A
CR2 1N4005
R11 10K
C9 .1
+12V
LM386
C7 22uf
U2
R8 10K
C8 .1
R7 10
U3:D
+5V
Computer Automation Technology, Inc.
Fort Lauderdale, Florida
CAT-500 TELEPHONE INTERFACE

Chapter 10 - Part List

Control Board

1	Resistor	620 5% 1/4W	R5
1	Resister	2.2K 5% 1/4W	R9
7	Resistor	10K 5% 1/4W	R3,R7,R11,R13,R14,R16,R23
5	Resistor	33K 5% 1/4W	R6,R15,R19,R20,R21
1	Resistor	330K 5% 1/4W	R28
4	Resistor	100K 5% 1/4W	R12,R18,R26,R27
1	Resistor	5K Variable	R10
2	Resistor	10K Variable	R8,R17
1	Resistor	100K Variable	R4
3	Resistor	10K 10pin	R2,R24,R25
2	Resistor	10K 8pin	R1,R22
18	Capacitor	0.1uF 50V	C1,C2,C3,C5,C6,C8,C9,C10,C11, C16,C17,C24,C25,C26,C27,C28,C29,C30
1	Capacitor	.015uF 50V	C19
1	Capacitor	.0047uF 50V	C18
1	Capacitor	.001uF 50V	C20
1	Capacitor	.0015uF 50V	C13
3	Capacitor	33pF 50V	C31,C32,C33
2	Capacitor	12pF 50V	C22,C23
5	Capacitor	10uF 15V	C7,C12,C14,C15,C21
1	Capacitor	470uF 25V	C4
14	EMI Filter		FL1 thur FL14
1	Diode 15V	Transorb	CR1
2	Diode	1N4005	CR2
2	Diode	1N4148	CR3,CR4
4	Transistor	VN10KM	Q1,Q2,Q3,Q4
1	I.C.	80C85	U14
1	I.C.	27C512	U17
1	I.C	74HC573	U16
2	I.C.	74HC251	U3,U6
1	I.C.	74HC259	U2
1	I.C.	74HC138	U7
1	I.C.	74HC00	U9
1	I.C.	74HC10	U8
1	I.C.	CD4053	U11
1	I.C.	8870	U19
1	I.C.	DS1243Y	U18
1	I.C.	DS1232	U12
1	I.C.	MM5369	U15
1	I.C.	ICL7660	U10
1	I.C.	LM348	U5
1	I.C.	ULN2003	U4
1	I.C.	TSP53C30	U13
1	Regulator	LM340-5	U1
1	Crystal	3.58MHz	Y1

1	Crystal	3.27MHz	Y2
1	Transformer	600 ohm	T1
1	Switch	8 position Dip	SW1
1	Connector	DC Power	P1
1	Connector	25D (F)	J1
1	Header	2x7	J2
1	Header	2x4	J3
1	Header	1x4	J4
1	Heat sink		
1	Jumper Plug		

Telephone Interface Card

2	Resistor	1 ohm 1/2W	R1,R2
1	Resistor	820 5% 1/4W	R4
2	Resistor	22K 5% 1/4W	R3,R9
1	Resistor	330 5% 1/4W	R6
1	Resistor	10 5% 1/4W	R7
1	Resistor	100K 5% 1/4W	R5
1	Resistor	220 5% 1/4W	R10
1	Resistor	10K 5% 1/4W	R11
1	Resistor	10K Var.	R8
2	Varistor	130VAC	VR1,VR2
2	Capacitor	0.1uF 50V	C8,C9
1	Capacitor	.001uF 50V	C1
4	Capacitor	20uF 15V	C3,C5,C6,C7
1	Capacitor	1uF 50V	C4
1	Capacitor	.47uF 200V	C2
4	Diode	1N4005	CR1,CR2,CR3,CR5
1	Diode	1N4733A	CR4
1	Transistor	VN10KM	Q1
1	I.C.	4N28A	U1
1	I.C.	LM386	U2
1	I.C.	74HC02	U3
1	Transformer	600 ohm	T1
2	Relay	DPDT	K1,K2
1	Connector	Mod. Jack	J1
1	Header	2x7	J2
1	Cable Ribbon	2X7	

Serial Interface Card MP-1000

2	Resistor	100 5% 1/4W	R1.R2
3	Resistor	4.7K 10 pin	R3,R4,R5
1	Resistor	33K 5% 1/4W	R6
2	Capacitor	10uF 15V	C1,C2
1	Capacitor	0.1uF 50V	C4
3	I.C.	74HC595	U1,U3,U5
3	I.C.	ULN2803A	U2.U4,U6
1	I.C.	7805	U7
1	Header	2X17	J1
1	Header	2x7	J2
1	Header	2X3	JP1
1	Header	1X3	JP2
2	Jumper		
1	Cable	Ribbon 2X7	
1	Cable	Ribbon 2X17	

Instant Start-up Kit K-500

1	Resistor	330 5% 1/4W	R25
3	Resistor	560 5% 1/4W	R20,R21,R22
2	Resistor	1K 5% 1/4W	R24,R26
2	Capacitor	47uF 16V	C22,C23
3	Display	LED (Yellow)	DS1,DS2,DS3
1	Switch	Push Button	S1
1	Connector	Mod. Jack	J1
1	Header	2x7	J11
1	Cable	Ribbon 2X7	