

# **CAT-400 Repeater Controller**

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REVISED: 02/07/09 V1.05

# Chapter 1 - Introduction and Specifications

Congratulations on your purchase of the CAT-400 Repeater Controller. The CAT-400 is a four-port controller and will support a repeater on port #1 and any combination of repeaters or transceivers on port #2, #3 and #4. The CAT-400 is designed to be a drop-in for the very popular (CAT-250 - RLS-1000) combination.

Programming the CAT-400 is a snap, with its carefully structured uniform programming commands. The manual is easy to follow and the voice synthesizer interacts with you during control and programming operation. An optional WINDOW EDITOR is available to program the CAT-400 controller.

## Voice Synthesizer

A vocabulary base of 290 words is available to ID your repeater and make voice announcements.

## DTMF Control

Four DTMF decoders one dedicated to each port afford complete control over the CAT-400 controller.

## CW ID

The controller will switch to CW when a repeater user talks over the voice ID, or ID in CW only, depending on how you configure the CAT-400.

## Courtesy Tone

Separate courtesy tones denote port activity. Create up to eight custom courtesy tones. You can assign a different courtesy tone to each of the four ports. Courtesy tones can be changed on the fly by using event macros 15 through 18.

## Port Configuration

The CAT-400 is a four-port controller. Port #1 is a repeater port. Ports #2, #3 and #4 can be configured as simplex or duplex ports in any combination. Port configuration can be changed by DTMF command.

## User Function Output Switches

Four open DRAIN user function output switches control equipment at your repeater site. These switches are located on the J1, J2, J3 and J4 connectors and are controlled manually by DTMF commands or from within a macro. They can be made to turn OFF, ON or momentarily change state.

## User Function Inputs

Four inputs activated by a voltage change from other equipment at the repeater site, causes the CAT-400 to execute event macros. Two event macros are assigned to each logic input. Different macros are called when the input goes high and then low.

## DTMF Keypad Test

A DTMF keypad test will read back the numbers decoded in a synthesized voice. This feature is available on all four ports.

## User Macros

The CAT-400 supports forty User Macros each containing sixteen commands. A user macro is a series of commands, defined by the repeater owner. Macros permit the owner to customize certain aspects of repeater operation. Once the CAT-400 decodes the macro number, the commands will execute in the order they were stored within the macro.

## Event Triggered Macros

An event macro is a series of commands, defined by the repeater owner. Event Macros are positioned throughout the program to execute during certain prescribed operations. The CAT-400 supports fifty event macros each containing sixteen commands.

## Specifications

Microprocessor	P89C668
Memory	AT25256
Voice Synthesizer	Texas Instruments MSP53C391NI2D
Voice Vocabulary	290 Words
DTMF Receivers	(4) MT887D Decoders
Operating Temperature	15 to +55 degrees C
Call Letter ID	(4) Buffer Size VOICE (15) - CW (16)
Logic Inputs	(4) 10K ohm input impedance
	Low (0 to 0.8VDC) High (2.4 to 15VDC)
User Function Outputs	Open Drain Relay Driver (28VDC at 50mA)
Audio Input	Receiver 0.2 - 2VAC adjustable 10K ohms
Audio Output	Transmitter 2VAC adjustable 600 ohms
Power	+9 to +15VDC at 120mA
Size	5" X 7"
Warranty	Limited one-year, parts and labor.

## FCC Part 15 RF Interference

When installed in the RME-2000 rack mount enclosure, the CAT-400 has been tested and found to meet the standards for a Class A digital device, as specified in Part 15 of the FCC Rules. These specifications are designed to provide reasonable protection against such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation.

# Chapter 2 - System Configuration

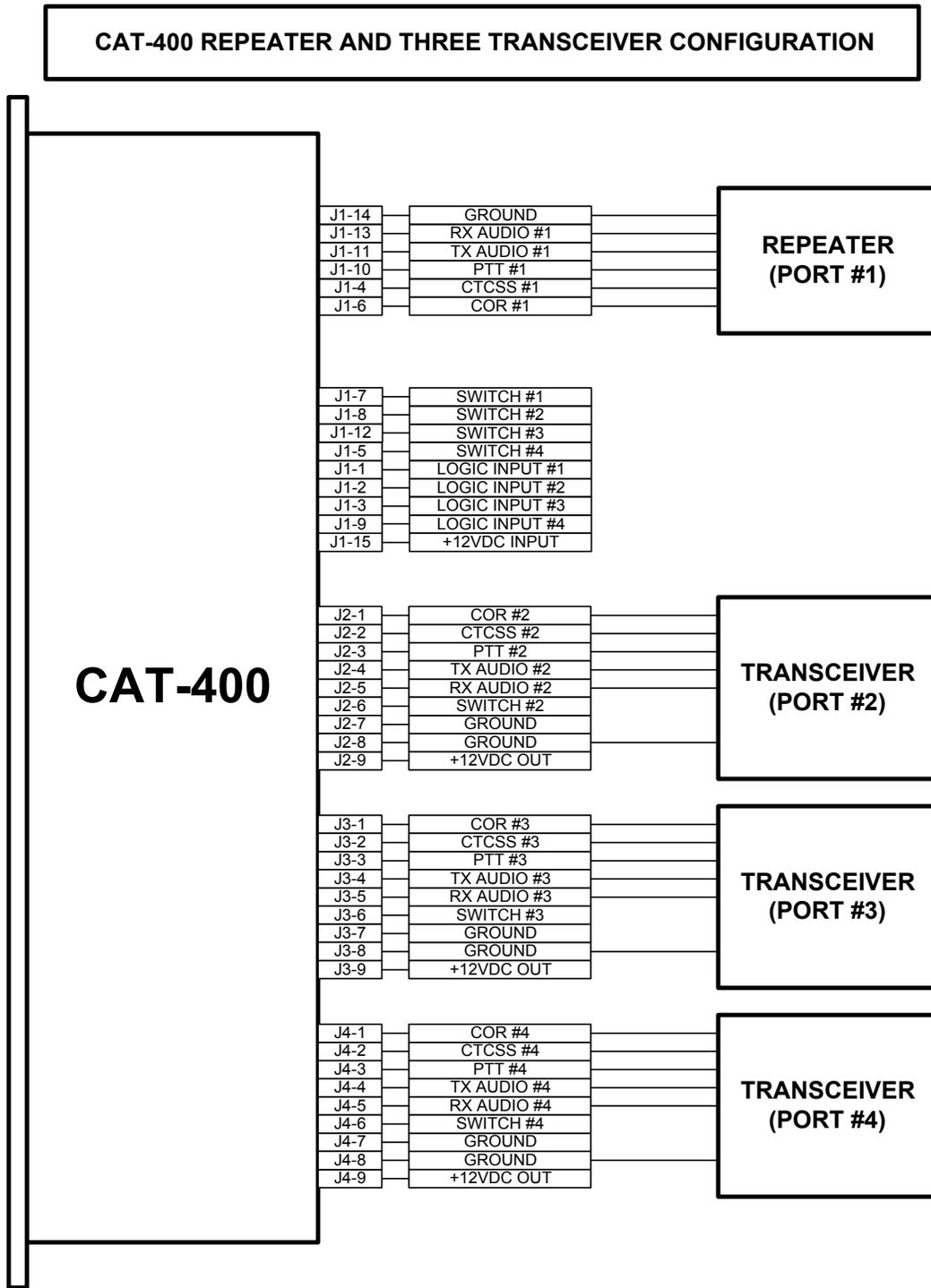


Figure 2-1

## Dipswitch Settings

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

**Switch 2** This switch determines Port #1 CTCSS input logic. Switch #2 should be ON if the Port #1 CTCSS logic input is an active low and OFF if CTCSS is active high.

**Switch 3** This switch determines Port #2 COR input logic. Switch #3 should be ON if the Port #2 receiver's COR is an active low and OFF if COR is active high.

**Switch 4** This switch determines Port #3 COR input logic. Switch #4 should be ON if the Port #3 receiver's COR is an active low and OFF if COR is active high.

**Switch 5** This switch determines Port #4 COR input logic. Switch #5 should be ON if the Port #4 COR logic input is an active low and OFF if COR is active high.

**Switch 6** This switch determines whether Port #1 is in duplex or simplex mode. Switch #6 should be OFF for duplex and ON for simplex mode. In the simplex mode the CAT-400 will act as a sophisticated remote link switch.

**Switch 7** This switch is used to initialize the CAT-400. Set this switch to ON. Cycle DC power. During power-up, the memory will be flushed and reloaded with default values. The voice will say: "RESET SYSTEM OK." Set dipswitch #7 to the OFF position.

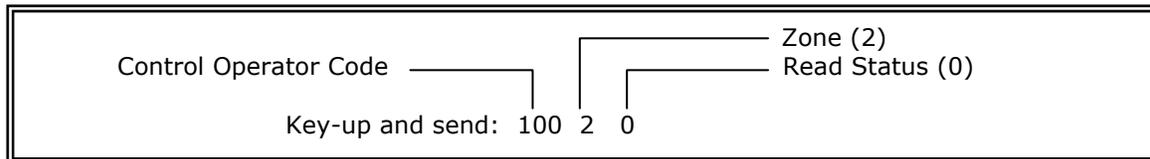
**Switch 8** This switch is used to program a new MASTER un-lock number. Set switch #8 to ON. The voice will say: "ENTER CONTROL." After the seven-digit master unlock number is entered, set switch #8 to OFF. This switch is also used to activate the RS-232 port. Turn the power off set dipswitch #8 to ON and apply power to the CAT-400.

## Chapter 3 - Repeater Control

The CAT-400 has eight control zones. These zones can be manually controlled by DTMF commands; USER and EVENT macros and LOGIC input action. The first four Zones are repeated for each of the four ports. Zones 5 through Zone 8 are global zones common to each of the four ports.

### Interrogation of Repeater Control Status

Key-up and send the control operator code [100] followed by the zone number and a zero. Un-key and the voice will read back the channels that are turned on in that zone. Example: Read Zone 2 control status. If all the channels are turned off, the voice will say: "CLEAR."

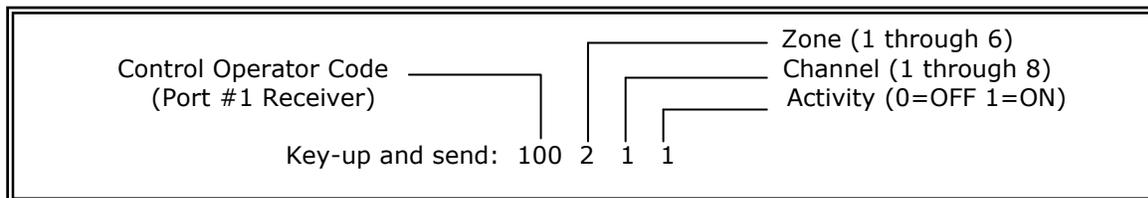


Un-key and the voice will say: "ONE- FIVE- EIGHT"

### Changing Repeater Control Status

To change the status of a control function, key-up and send the control operator code followed by the zone number, function number and a [1] to turn the function ON or a [0] to turn the function OFF. Un-key and the voice will read back the zone, function number and control activity.

Example: Turn Zone 2 Channel 1 ON through the Port #1 receiver.



Un-key and the voice will say: "TWO ONE ON."

Control of the CAT-400 is also available through the Port #2, Port #3 and Port #4 receivers. The procedure is the same as above however the default control operator code for Port #2 is [200], Port #3 is [300] and Port #4 is [400].

# CAT-400 Repeater Control Channels

## Zone 1

1	PORT #1 TRANSMIT	ENABLE*
2	PORT #1 COR AND CTCSS	ENABLE
3	PORT #1 COR OR CTCSS	ENABLE
4	PORT #1 TURN ON DELAY	ENABLE
5	PORT #1 DTMF PAD TEST	ENABLE*
6	PORT #1 INACTIVITY MACRO	ENABLE
7	PORT #1 DTMF MUTING	ENABLE
8	PORT #1 TIMEOUT	ENABLE*

## Zone 2

1	PORT #2 TRANSMIT	ENABLE*
2	PORT #2 COR AND CTCSS	ENABLE
3	PORT #2 COR OR CTCSS	ENABLE
4	PORT #2 TURN ON DELAY	ENABLE
5	PORT #2 DTMF PAD TEST	ENABLE
6	PORT #2 INACTIVITY MACRO	ENABLE
7	PORT #2 DTMF MUTING	ENABLE
8	PORT #2 TIMEOUT	ENABLE*

## Zone 3

1	PORT #3 TRANSMIT	ENABLE*
2	PORT #3 COR AND CTCSS	ENABLE
3	PORT #3 COR OR CTCSS	ENABLE
4	PORT #3 TURN ON DELAY	ENABLE
5	PORT #3 DTMF PAD TEST	ENABLE
6	PORT #3 INACTIVITY MACRO	ENABLE
7	PORT #3 DTMF MUTING	ENABLE
8	PORT #3 TIMEOUT	ENABLE*

## Zone 4

1	PORT #4 TRANSMIT	ENABLE*
2	PORT #4 COR AND CTCSS	ENABLE
3	PORT #4 COR OR CTCSS	ENABLE
4	PORT #4 TURN ON DELAY	ENABLE
5	PORT #4 DTMF PAD TEST	ENABLE
6	PORT #4 INACTIVITY MACRO	ENABLE
7	PORT #4 DTMF MUTING	ENABLE
8	PORT #4 TIMEOUT	ENABLE*

### Zone 5

1	REPEATER ID #1 (At Rest)	ENABLE*
2	REPEATER ID #2 (Active)	ENABLE*
3	SQUELCH TAIL MESSAGE	ENABLE
4	TRANSMITTER DROP MESSAGE	ENABLE
5	TIMED MESSAGE #1	ENABLE
6	TIMED MESSAGE #2	ENABLE
7	TIMED MESSAGE #3	ENABLE
8	TIMED MESSAGE #4	ENABLE

### Zone 6

1	PORT #2 CONTROL OPERATOR	ENABLE*
2	PORT #2 MACRO CONTROL	ENABLE*
3	PORT #3 CONTROL OPERATOR	ENABLE*
4	PORT #3 MACRO CONTROL	ENABLE*
5	PORT #4 CONTROL OPERATOR	ENABLE*
6	PORT #4 MACRO CONTROL	ENABLE*
7	PORT #1 DTMF ACCESS	ENABLE
8	FORCED DTMF ENTRY (ALL PORTS)	ENABLE*

### Zone 7

1	PORT #2 DUPLEX	ENABLE
2	PORT #3 DUPLEX	ENABLE
3	PORT #4 DUPLEX	ENABLE
4	REPEATER COURTESY TONE	ENABLE*
5	REPEATER TRANSMITTER HANG TIME	ENABLE*
6	RESERVED	ENABLE
7	RESERVED	ENABLE
8	RESERVED	ENABLE

### Zone 8

1	USER LOGIC INPUT #1	ENABLE*
2	USER LOGIC INPUT #2	ENABLE*
3	USER LOGIC INPUT #3	ENABLE*
4	USER LOGIC INPUT #4	ENABLE*
5	USER OUTPUT SWITCH #1	ENABLE
6	USER OUTPUT SWITCH #2	ENABLE
7	USER OUTPUT SWITCH #3	ENABLE
8	USER OUTPUT SWITCH #4	ENABLE

\* During initialization these control channels are set to the enable position.

## Zone 1 Control Functions

### 1. Repeater Transmitter Enable

When this control function is enabled the repeater's PTT will be active. This control function must be enabled for normal operation. The CAT-400 will continue to respond to control operator commands even when this control function is disabled. This control function will automatically be enabled after a dipswitch #7 initialization reset.

### 2. Repeater COR and CTCSS Enable

When this control function is enabled, in addition to a COR input, an input from a CTCSS decoder at J1-4 must also be present before the repeater's PTT will activate. A COR input by itself will have no affect. To prevent loss of control, DO NOT ENABLE THIS CONTROL FUNCTION unless a CTCSS decoder is connected to J1-4.

### 3. Repeater COR or CTCSS Enable

When this control function is enabled, the COR and CTCSS inputs will function as a (OR) logic input. This means activity on either the COR or the CTCSS input will cause the repeater's PTT to activate.

### 4. Repeater Turn on Delay Enable

When this control function is enabled, a deliberate and sustained input on the repeater's input must be present before the CAT-400 will respond. A time delay of 0.1 to 9.9 seconds can be selected with the [\*624\*] programming command. When the CAT-400 is initialized, this timer defaults to 1.0 seconds. This control function is useful during periods when noise bursts are present on the repeater input.

### 5. Repeater DTMF Pad Test Enable

When this control function is enabled, a repeater user is able to perform a test of their radio's 12 or 16-button keypad through the repeater's receiver. As the numbers are being decoded, they are stored in memory. When the user stops transmitting the controller will read back all the numbers that were decoded. The Forced DTMF Entry key is defaulted to the [D] key. It must be entered last and it will not read back during the pad test.

### 6. Repeater Inactivity Macro Enable

When this control function is enabled and after a period of inactivity determined by the setting of the [\*605\*] Inactivity Timer has occurred the CAT-400 will execute event Macro [35].

### 7. Repeater DTMF Muting Enable

When this control function is enabled, anytime a DTMF tone is received, the audio will be turned off to the transmitter. The transmit audio will remain muted until a pre-determined time after the last DTMF tone is received. During the mute period, cover beeps are transmitted each second to indicate repeater activity. This feature prevents 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 (#). This key can be changed with the [\*29X] programming command.

### 8. Repeater Timeout Enable

When this control function is enabled, a continuous signal on the repeater's input will cause the repeater to turn off. The time-out period is user programmable with the [\*601\*] timer command. When the CAT-400 is initialized, this timer defaults to 3 minutes. When this control function is turned off, the repeater will not timeout.

## Zone 2 Control Functions

### 1. Port #2 Transmitter Enable

When this control function is enabled Port #2 PTT will be active. When this control function is disabled the Port #2 transmitter will be disabled. However the CAT-400 will continue to respond to control operator and macro commands if Zone 6 control functions 1 and 2 are enabled.

### 2. Port #2 COR and CTCSS Enable

When this control function is enabled, in addition to a COR input at J2-1, an input from a CTCSS decoder at J2-2 must also be present before the repeater will activate. A COR input by itself will have no affect. To prevent loss of control through this port, DO NOT ENABLE THIS CONTROL FUNCTION unless a CTCSS decoder is connected to J2-2.

### 3. Port #2 COR or CTCSS Enable

When this control function is enabled, the COR and CTCSS inputs will function as a (OR) logic input. This means activity on either the COR or CTCSS inputs will cause the CAT-400 to activate the repeater.

### 4. Port #2 Turn on Delay Enable

When this control function is enabled, a deliberate and sustained input on Port #2 must be present before the controller will respond. A time delay of 0.1 to 9.9 seconds can be selected with the [\*624\*] programming command. When the CAT-400 is initialized, this timer defaults to 1.0 seconds. This control function is useful during periods when noise bursts are present on the repeater input.

### 5. Port #2 DTMF Pad Test Enable

When this control function is enabled, a user is able to perform a test of their radio's 12 or 16-button keypad through the Port #2 receiver. As the numbers are being decoded, they are stored in memory. When the user stops transmitting the controller will read back all the numbers that were decoded.

### 6. Port #2 Inactivity Macro Enable

When this control function is enabled, after a period of Port #2 inactivity determined by the setting of the [\*606\*] Inactivity Timer has occurred, the CAT-400 will execute event Macro [36].

### 7. Port #2 DTMF Muting Enable

When this control function is enabled, DTMF tones present on the Port #2 receiver's input will mute the audio to the repeater's transmitter. The audio will remain muted until a pre-determined time after the last DTMF tone is received. During the mute period, cover beeps are transmitted each second to indicate repeater activity.

### 8. Port #2 Timeout Enable

When this control function is enabled, a continuous signal on the Port #2 receiver's input will cause the repeater to turn off. This time-out period is user programmable with the [\*602\*] timer command. When the CAT-400 is initialized, this timer defaults to 3 minutes. When this control function is turned off, the repeater will not timeout.

## Zone 3 Control Functions

### 1. Port #3 Transmitter Enable

When this control function is enabled Port #3 PTT will be active. When this control function is disabled the Port #3 transmitter will be disabled. However the CAT-400 will continue to respond to control operator and macro commands if Zone 6 control functions 3 and 4 are enabled.

### 2. Port #3 COR and CTCSS Enable

When this control function is enabled, in addition to a COR input at J3-1, an input from a CTCSS decoder at J3-2 must also be present before the repeater will activate. A COR input by itself will have no affect. To prevent loss of control through this port, DO NOT ENABLE THIS CONTROL FUNCTION unless a CTCSS decoder is connected to J3-2.

### 3. Port #3 COR or CTCSS Enable

When this control function is enabled, the COR and CTCSS inputs will function as a (OR) logic input. This means activity on either the COR or CTCSS inputs will cause the CAT-400 to activate the repeater.

### 4. Port #3 Turn on Delay Enable

When this control function is enabled, a deliberate and sustained input on Port #3 must be present before the controller will respond. A time delay of 0.1 to 9.9 seconds can be selected with the [\*624\*] programming command. When the CAT-400 is initialized, this timer defaults to 1.0 seconds. This control function is useful during periods when noise bursts are present on the repeater input.

### 5. Port #3 DTMF Pad Test Enable

When this control function is enabled, a user is able to perform a test of their radio's 12 or 16-button keypad through the Port #3 receiver. As the numbers are being decoded, they are stored in memory. When the user stops transmitting the controller will read back all the numbers that were decoded.

### 6. Port #3 Inactivity Macro Enable

When this control function is enabled, after a period of Port #3 inactivity determined by the setting of the [\*607\*] Inactivity Timer has occurred, the CAT-400 will execute event Macro [37].

### 7. Port #3 DTMF Muting Enable

When this control function is enabled, DTMF tones present on the Port #3 receiver's input will mute the audio to the repeater's transmitter. The audio will remain muted until a pre-determined time after the last DTMF tone is received. During the mute period, cover beeps are transmitted each second to indicate repeater activity.

### 8. Port #3 Timeout Enable

When this control function is enabled, a continuous signal on the Port #3 receiver's input will cause the repeater to turn off. This time-out period is user programmable with the [\*603\*] timer command. When the CAT-400 is initialized, this timer defaults to 3 minutes. When this control function is turned off, the repeater will not timeout.

## Zone 4 Control Function

### 1. Port #4 Transmitter Enable

When this control function is enabled Port #4 PTT will be active. When this control function is disabled the Port #4 transmitter will be disabled. However the CAT-400 will continue to respond to control operator and macro commands if Zone 6 control functions 5 and 6 are enabled.

### 2. Port #4 COR and CTCSS Enable

When this control function is enabled, in addition to a COR input at J4-1, an input from a CTCSS decoder at J4-2 must also be present before the repeater will activate. A COR input by itself will have no affect. To prevent loss of control through this port, DO NOT ENABLE THIS CONTROL FUNCTION unless a CTCSS decoder is connected to J4-2.

### 3. Port #4 COR or CTCSS Enable

When this control function is enabled, the COR and CTCSS inputs will function as a (OR) logic input. This means activity on either the COR or CTCSS inputs will cause the CAT-400 to activate the repeater.

### 4. Port #4 Turn on Delay Enable

When this control function is enabled, a deliberate and sustained input on Port #4 must be present before the controller will respond. A time delay of 0.1 to 9.9 seconds can be selected with the [\*624\*] programming command. When the CAT-400 is initialized, this timer defaults to 1.0 seconds. This control function is useful during periods when noise bursts are present on the repeater input.

### 5. Port #4 DTMF Pad Test Enable

When this control function is enabled, a user is able to perform a test of their radio's 12 or 16-button keypad through the Port #4 receiver. As the numbers are being decoded, they are stored in memory. When the user stops transmitting the controller will read back all the numbers that were decoded.

### 6. Port #4 Inactivity Macro Enable

When this control function is enabled, after a period of Port #4 inactivity determined by the setting of the [\*608\*] Inactivity Timer has occurred, the CAT-400 will execute event Macro [38].

### 7. Port #4 DTMF Muting Enable

When this control function is enabled, DTMF tones present on the Port #4 receiver's input will mute the audio to the repeater's transmitter. The audio will remain muted until a pre-determined time after the last DTMF tone is received. During the mute period, cover beeps are transmitted each second to indicate repeater activity.

### 8. Port #4 Timeout Enable

When this control function is enabled, a continuous signal on the Port #4 receiver's input will cause the repeater to turn off. This time-out period is user programmable with the [\*604\*] timer command. When the CAT-400 is initialized, this timer defaults to 3 minutes. When this control function is turned off, the repeater will not timeout.

## Zone 5 Control Functions

### 1. Repeater ID #1 (At Rest) Enable

When this control function is enabled, repeater ID message #1 will repeat subject to the setting of the ID timer. This ID will consist of up to 15 words selected from the voice vocabulary table and is programmed with the [\*3101\*] command.

### 2. Repeater ID #2 (Active) Enable

When this control function is enabled, the Repeater ID Message #2 will repeat subject to the setting of the ID timer. This ID will consist of up to 15 words selected from the voice vocabulary table and is programmed with the [\*3102\*] command. When Repeater ID #1 and #2 are enabled, ID messages selection will be determined by whether the repeater is at rest or a QSO is in progress.

### 3. Squelch Tail Message Enable

When this control function is enabled, the squelch tail message occurs when a repeater user un-keys their transmitter. This message will repeat subject to the setting of the [\*617\*] squelch tail message timer. This message will consist of up to 15 words selected from the vocabulary table and programmed with the [\*3103\*] command.

### 4. Transmitter Drop Out Message Enable

When this control function is enabled, the voice drop out message will occur just before the repeater transmitter turns off. This message will repeat subject to the setting of the [\*618\*] drop out message timer. This message will consist of up to 15 words selected from the voice vocabulary table and is programmed with the [\*3104] command.

### 5. Timed Message #1 Enabled

When this control function is enabled, timed voice message #1 will occur on a regular schedule subject to the setting of the [\*609\*] timed message #1 timer and event macro #29. This message will consist of up to 15 words selected from the voice vocabulary table and is programmed with the [\*3105\*] command.

### 6. Timed Message #2 Enabled

When this control function is enabled, timed voice message #2 will occur on a regular schedule subject to the setting of the [\*610\*] timed message #2 timer and event macro #30. This message will consist of up to 15 words selected from the voice vocabulary table and is programmed with the [\*3106\*] command.

### 7. Timed Message #3 Enabled

When this control function is enabled, timed voice message #3 will occur on a regular schedule subject to the setting of the [\*611\*] timed message #3 timer and event macro #31. This message will consist of up to 15 words selected from the voice vocabulary table and is programmed with the [\*3107\*] command.

### 8. Timed Message #4 Enabled

When this control function is enabled, timed voice message #4 will occur on a regular schedule subject to the setting of the [\*612\*] timed message #4 timer and event macro #32. This message will consist of up to 15 words selected from the voice vocabulary table and is programmed with the [\*3108\*] command.

## Zone 6 Control Functions

### 1. Port #2 Control Operator Enable

When this control function is enabled, the CAT-400 will accept control operator commands to change the settings of the zone channels through the Port #2 receiver. The default code is [200]. This code can be changed with the [\*502\*] programming command.

### 2. Port #2 Macro Control Enable

When this control function is enabled, the CAT-400 will accept user macro commands through the Port #2 receiver.

### 3. Port #3 Control Operator Enable

When this control function is enabled, the CAT-400 will accept control operator commands to change the settings of the zone channels through the Port #3 receiver. The default code is [300]. This code can be changed with the [\*503\*] programming command.

### 4. Port #3 Macro Control Enable

When this control function is enabled, the CAT-400 will accept user macro commands through the Port #3 receiver.

### 5. Port #4 Control Operator Enable

When this control function is enabled, the CAT-400 will accept control operator commands to change the settings of the zone channels through the Port #4 receiver. The default code is [400]. This code can be changed with the [\*504\*] programming command.

### 6. Port #4 Macro Control Enable

When this control function is enabled, the CAT-400 will accept user macro commands through the Port #4 receiver.

### 7. DTMF Access Enable

When this control function is enabled, a DTMF Access number [325] selected by programming command [\*505\*] must be entered to activate the repeater. The repeater will continue to operate until a period of inactivity occurs determined by the [\*616\*] sleep timer. Once the timer expires the next repeater user must re-enter the DTMF Access number.

### 8. Forced DTMF Entry D Key

When this control function is enabled it is possible to force a DTMF command even while the port is active. To force a DTMF command, end the command with a [D]. This key can be changed with the [\*29X] programming command.

## **Zone 7 Control Functions**

### **1. Port #2 Duplex Enable**

When this control function is enabled, Port #2 will operate in the duplex mode. When a signal is present on the Port #2 receiver, the CAT-400 will activate the Port #2 transmitter in addition to the repeater transmitter. A duplex radio must be connected to this port when this control function is enabled.

### **2. Port #3 Duplex Enable**

When this control function is enabled, Port #3 will operate in the duplex mode. When a signal is present on the Port #3 receiver, the CAT-400 will activate the Port #3 transmitter in addition to the repeater transmitter. A duplex radio must be connected to this port when this control function is enabled.

### **3. Port #4 Duplex Enable**

When this control function is enabled, Port #4 will operate in the duplex mode. When a signal is present on the Port #4 receiver, the CAT-400 will activate the Port #4 transmitter in addition to the repeater transmitter. A duplex radio must be connected to this port when this control function is enabled.

### **4. Repeater Courtesy Tone Enable**

When this control function is enabled, a courtesy tone will occur when the COR signal is lost. To eliminate the courtesy tone, turn this channel OFF. The timeout timer will continue to be reset.

### **5. Repeater Transmitter Hang Time Enable**

When this control function is enabled, the Port #1 transmitter will have a hang-time subject to the settings of the COR Drop to Courtesy Beep Timer [\*621\*] and the Courtesy Beep to PTT Drop Timer [\*622\*]

### **6. Reserved Enable**

This control function is reserved for a future assignment.

### **7. Reserved Enable**

This control function is reserved for a future assignment.

### **8. Reserved Enable**

This control function is reserved for a future assignment.

## Zone 8 Control Functions

### 1. User Logic Input #1 Enable

When this control function is enabled, an active high logic input on connector J1-1 will execute event macro #03 while an active low logic input will execute event macro #04.

### 2. User Logic Input #2 Enable

When this control function is enabled, an active high logic input on connector J1-2 will execute event macro #05 while an active low logic input will execute event macro #06.

### 3. User Logic Input #3 Enable

When this control function is enabled, an active high logic input on connector J1-3 will execute event macro #07 while an active low logic input will execute event macro #08.

### 4. User Logic Input #4 Enable

When this control function is enabled, an active high logic input on connector J1-9 will execute event macro #09 while an active low logic input will execute event macro #10.

### 5. USER Output Switch #1 Enable

When this control function is enabled, switch #1 is turned on. Connector J1-7 or J2-6 will sink 50 MA to ground.

### 6. USER Output Switch #2 Enable

When this control function is enabled, switch #2 is turned on. Connector J1-8 or J3-6 will sink 50 MA to ground.

### 7. USER Output Switch #3 Enable

When this control function is enabled, switch #3 is turned on. Connector J1-12 or J4-6 will sink 50 MA to ground.

### 8. USER Output Switch #4 Enable

When this control function is enabled, switch #4 is turned on. Connector J1-5 will sink 50 MA to ground.

## Chapter 4 - Repeater Operation

### DTMF Keypad Test

Key-up, and enter [375], the DTMF keypad access code followed by the keypad numbers and letters to be tested. The entries can be in any order. Un-key, and the voice will read-back all numbers and letters that were decoded including the "STAR" and "POUND". The Forced DTMF Entry key is defaulted to the [D] key. It must be entered last and it will not read back during the pad test.

### DTMF Access

When the CAT-400 is in the DTMF Access mode, you must enter the DTMF Access code to activate the repeater. The voice will say: "OK UP" and the repeater will respond to a COR and or CTCSS input. When the repeater returns to rest, for a time determined by the sleep timer, the DTMF Access code must be re-entered to activate the repeater. You can bypass the rest period and return the repeater to DTMF access mode by re-entering [325], the DTMF access code. The voice will say: "OK DOWN".

### Forced DTMF Command Entry

During normal operation a DTMF command is entered when the input goes inactive. It is possible to force a DTMF command entry even while the input is active. The CAT-400 will accept the [D] key as an entry command. This key can be changed with the [\*29X] programming command.

### DTMF Muting Override

With DTMF muting enabled, there may be times when it is desirable to pass the DTMF tones to the repeater or link transmitters. To temporarily disable DTMF muting, precede the DTMF string with a pound [#]. Use the DTMF muting programming command [\*28X] to change [#] to a different number or character.

### Repeater ID #1 (At Rest)

If the repeater has been at rest for a period in excess of the ID timer setting, when a signal is received the CAT-400 will send the Voice message #1. This ID should be longer than the Pending ID and include additional information about the repeater or sponsoring organization. Example: "WITH ONE HUNDRED WATTS OF POWER THIS IS THE W4XYZ REPEATER SYSTEM". If someone talks over the voice ID the CAT-400 will switch to the CW ID and permit the receive audio to pass on to the transmitter.

### Repeater ID #2 (Active)

If the repeater is in use and it is time to ID the CAT-400 will send Voice message #2. This ID should be short as to not interfere with a QSO in progress. Example: "W4XYZ REPEATER". If someone talks over this ID the CAT-400 will switch to CW. This ID is also used as the final ID.

### User Macro

A user macro is a series of commands, defined by the repeater owner. User macros permit the owner to customize certain aspects of repeater operation. Once the CAT-400 decodes the macro number, the commands will execute in the order they were stored within the macro string. The CAT-400 supports forty user macros.

### Event Macro

An event macro is a series of commands, defined by the repeater owner. Event macros permit the owner to customize certain aspects of repeater operation. Event macros are assigned to various locations through the CAT-400 program. Examples of event macros are: logic inputs, port activity and timed messages. The commands will execute in the order they were stored within the macro string. The CAT-400 supports fifty event macros.

## Chapter 5 - Repeater Programming By DTMF Tone

This section describes how the repeater owner using a DTMF keypad programs the CAT-400 controller. The various types of program commands are described in detail and examples are given in the following text.

### Initialization

To initialize the CAT-400, set dipswitch #7 to on and cycle DC power. During power-up, the voice will say: "RESET SYSTEM OK." Set dipswitch #7 to off. Initialization consists of the following operations:

### Dipswitch #7 Initialization

1. All memory locations are cleared.
2. The control functions marked with a [\*] are enabled.
3. The master unlock number is loaded with the default value [1234567].
4. The unlock number is loaded with the default value [7654321].
5. The Port #1 control operator prefix code is loaded with [100].
6. The Port #2 control operator prefix code is loaded with [200].
7. The Port #3 control operator prefix code is loaded with [300].
8. The Port #4 control operator prefix code is loaded with [400].
9. All codes are loaded with default values.
10. All timers are loaded with default values.
11. The voice Ids are loaded with "CAT-400 REPEATER".
12. All messages are loaded with default messages.
13. Event and User macros are loaded with defaults.

### Programming the Master Unlock Number

To program the Master UNLOCK number, set dipswitch #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: "ENTER CONTROL." Key-up and enter the seven-digit number. Set dipswitch #8 to the off position.

### Unlocking the Controller By Radio From [7654321]

To unlock the controller, key-up and enter the unlock number. The voice will say: "CAT-400 CONTROL."

Note: The CAT-400 can be unlocked and placed in the programming mode with either the unlock or the master unlock number. The master unlock number must be changed by using dipswitch #8. The unlock number can be changed remotely without having to go to the site. For security reasons use the unlock number because it can easily be changed. Use the master unlock number only when conditions are thought to be secure.

### Locking the Controller By Radio [\*0]

Key-up and send [\*0]. Un-key, the controller will lockup and the voice will say: "CONTROL EXIT." The controller will lock automatically when the programming timer expires. The voice will say: "TIMER EXIT." The programming time limit is set by the [\*615\*] programming timer. The default time is ten minutes.

NOTE: The CAT-400 must be unlocked to perform the following programming functions.

## CAT-400 Internal Command Assignments

	COMMAND	CHANNEL	ACTION
CONTROL REPEATER ZONE 1	11	1-8	0=OFF 1=ON
CONTROL REPEATER ZONE 2	12	1-8	0=OFF 1=ON
CONTROL REPEATER ZONE 3	13	1-8	0=OFF 1=ON
CONTROL REPEATER ZONE 4	14	1-8	0=OFF 1=ON
CONTROL REPEATER ZONE 5	15	1-8	0=OFF 1=ON
CONTROL REPEATER ZONE 6	16	1-8	0=OFF 1=ON
CONTROL REPEATER ZONE 7	17	1-8	0=OFF 1=ON
CONTROL REPEATER ZONE 8	18	1-8	0=OFF 1=ON
		<b>COMMAND</b>	<b>COMMENTS</b>
PLAY VOICE MESSAGE (No Interruption with COR)		30XX	01-20
PLAY VOICE MESSAGE (Interruption with COR)		31XX	01-20
PLAY VOICE MESSAGE (Interruption with COR, Switch to CW)		32XX	01-20
PLAY CW BUFFER		3300	
PLAY CW CHARACTER		34XX	01-46
LOAD COURTESY TONE PORT #1		401X	1-8
LOAD COURTESY TONE PORT #2		402X	1-8
LOAD COURTESY TONE PORT #3		403X	1-8
LOAD COURTESY TONE PORT #4		404X	1-8
PLAY COURTESY TONE PORT #1		4110	
PLAY COURTESY TONE PORT #2		4120	
PLAY COURTESY TONE PORT #3		4130	
PLAY COURTESY TONE PORT #4		4140	
AUDIO SWITCH CONTROL [VOICE TO TX1]		501X	0=OFF 1=ON
AUDIO SWITCH CONTROL [VOICE TO TX2]		502X	0=OFF 1=ON
AUDIO SWITCH CONTROL [VOICE TO TX3]		503X	0=OFF 1=ON
AUDIO SWITCH CONTROL [VOICE TO TX4]		504X	0=OFF 1=ON
AUDIO SWITCH CONTROL [VOICE TO TX1 AND TX2]		505X	0=OFF 1=ON
AUDIO SWITCH CONTROL [VOICE TO TX3 AND TX4]		506X	0=OFF 1=ON
AUDIO SWITCH CONTROL [TONE TO TX1]		511X	0=OFF 1=ON
AUDIO SWITCH CONTROL [TONE TO TX2]		512X	0=OFF 1=ON
AUDIO SWITCH CONTROL [TONE TO TX3]		513X	0=OFF 1=ON
AUDIO SWITCH CONTROL [TONE TO TX4]		514X	0=OFF 1=ON
AUDIO SWITCH CONTROL [TONE TO TX1 AND TX2]		515X	0=OFF 1=ON
AUDIO SWITCH CONTROL [TONE TO TX3 AND TX4]		516X	0=OFF 1=ON
PORT #1 VOICE DELAY		5191	
PORT #2 VOICE DELAY		5192	
PORT #3 VOICE DELAY		5193	
PORT #4 VOICE DELAY		5194	
LOAD TIME DELAY (SECONDS)		60XX	01 - 99
		<b>COMMAND</b>	<b>COMMENTS</b>
PTT #1 CONTROL		611X	0=OFF 1=ON
PTT #2 CONTROL		612X	0=OFF 1=ON
PTT #3 CONTROL		613X	0=OFF 1=ON
PTT #4 CONTROL		614X	0=OFF 1=ON
PTT #1 AND PTT #2 CONTROL		615X	0=OFF 1=ON
PTT #3 AND PTT #4 CONTROL		616X	0=OFF 1=ON
PPT#1 AND PTT#2 AND PTT#3 AND PTT#4 CONTROL		617X	0=OFF 1=ON
PTT #1 AND AUDIO CONTROL [VOICE TO TX1]		621X	0=OFF 1=ON
PTT #2 AND AUDIO CONTROL [VOICE TO TX2]		622X	0=OFF 1=ON

PTT #3 AND AUDIO CONTROL [VOICE TO TX3]	623X	0=OFF 1=ON
PTT #4 AND AUDIO CONTROL [VOICE TO TX4]	624X	0=OFF 1=ON
PTT #1, PTT #2 AND AUDIO CONTROL [VOICE TO TX1-TX2]	625X	0=OFF 1=ON
PTT #3, PTT #4 AND AUDIO CONTROL [VOICE TO TX3-TX4]	626X	0=OFF 1=ON
PTT #1, PTT #2, PTT #3, PTT #4 AND AUDIO CONTROL [VOICE TO TX1-TX2-TX3-TX4]	627X	0=OFF 1=ON
PTT #1 AND AUDIO CONTROL [TONE TO TX1]	631X	0=OFF 1=ON
PTT #2 AND AUDIO CONTROL [TONE TO TX2]	632X	0=OFF 1=ON
PTT #3 AND AUDIO CONTROL [TONE TO TX3]	633X	0=OFF 1=ON
PTT #4 AND AUDIO CONTROL [TONE TO TX4]	634X	0=OFF 1=ON
PTT #1, PTT #2 AND AUDIO CONTROL [TONE TO TX1-TX2]	635X	0=OFF 1=ON
PTT #3, PTT #4 AND AUDIO CONTROL [TONE TO TX3-TX4]	636X	0=OFF 1=ON
PTT AND VOICE AUDIO CONTROL FROM ACTIVE PORT	641X	0=OFF 1=ON
PTT AND TONE AUDIO CONTROL FROM ACTIVE PORT	642X	0=OFF 1=ON
USER FUNCTION SWITCH #1 OUTPUT	691X	0=OFF 1=ON 2 = PULSE
USER FUNCTION SWITCH #2 OUTPUT	692X	0=OFF 1=ON 2 = PULSE
USER FUNCTION SWITCH #3 OUTPUT	693X	0=OFF 1=ON 2 = PULSE
USER FUNCTION SWITCH #4 OUTPUT	694X	0=OFF 1=ON 2 = PULSE
PORT #2 OFF	7010	
PORT #2 ON	7011	
PORT #3 OFF	7020	
PORT #3 ON	7021	
PORT #4 OFF	7030	
PORT #4 ON	7031	
PORT #2 & PORT #3 OFF	7040	
PORT #2 & PORT #3 ON	7041	
PORT #3 & PORT #4 OFF	7050	
PORT #3 & PORT #4 ON	7051	
PORT #2 & PORT #3 & PORT #4 OFF	7060	
PORT #2 & PORT #3 & PORT #4 ON	7061	
READ PORT SETTINGS (USE WITH 641X COMMAND)	7003	
DTMF ACCESS OFF	7100	
DTMF ACCESS ON	7101	
EVENT MACRO DISABLE	80XX	01-50
EVENT MACRO ENABLE	81XX	01-50
USER MACRO DISABLE	82XX	01-40
USER MACRO ENABLE	83XX	01-40
VOICE WORDS	9XXX	000-999

## User Macro Command Memory

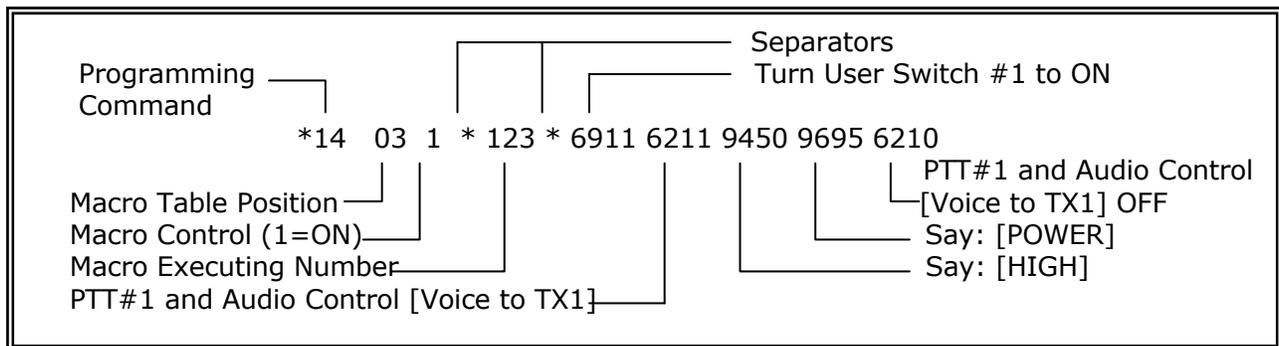
Macros are used to store custom commands of up to sixteen operations that will execute with a single DTMF entry.

### Read User Macro Locations (01-40)

Key-up and send [\*13XX]. Un-key and voice will read back the macro control number followed by the enable control byte followed by the macro data commands stored at that memory location. If the location is empty, the voice will say: "MACRO NUMBER XX NO CODE NO DATA."

### Program User Macro Locations (01-40)

Key-up and send [\*14XX] followed by the macro control number and the string of internal commands to be executed. See Figure 5-1. Un-key and the voice will say: "CONTROL OK." Example: Program macro #3 with a control number of [123] to Turn ON User Function Switch #1 and say: "HI POWER". The Macro Control number [123] is the number entered by a repeater user to execute the macro.



### Program User Macro Locations Enable – Disable (01-40)

Key-up and send [\*14XX] followed by a [1] to enable the macro or a [0] to disable the macro. This feature permits the macro to be turned off without having to erasing it. Un-key and voice will say: "CONTROL OK."

### Erase User Macro Locations (01-40)

Key-up and send [\*15XX]. Un-key, the voice will say: "CONTROL OK."

## CAT-400 User Macro Default Data (Port Control)

USER MACRO	DTMF COMMAND	MACRO ACTION
01	A2	CONNECT PORT #2 TO PORT #1 6411-9746-9561-9002-9656-6410-7011
02	B2	DISCONNECT PORT #2 FROM PORT #1 6110-6411-9746-9561-9002-9654-6410-7010
03	A3	CONNECT PORT #3 TO PORT #1 6411-9746-9561-9003-9656-6410-7021
04	B3	DISCONNECT PORT #3 FROM PORT #1 6110-6411-9746-9561-9003-9654-6410-7020
05	A4	CONNECT PORT #4 TO PORT #1 6411-9746-9561-9004-9656-6410-7031
06	B4	DISCONNECT PORT #4 FROM PORT #1 6110-6411-9746-9561-9004-9654-6410-7030
07	A23	CONNECT PORT #2 AND PORT #3 TO PORT #1 6411-9746-9561-9002-9003-9656-6410-7041
08	B23	DISCONNECT PORT #2 AND PORT #3 FROM PORT #1 6110-6411-9746-9561-9002-9003-9654-6410-7040
09	A234	CONNECT PORT #2 AND PORT #3 AND PORT #4 TO PORT #1 6411-9746-9561-9002-9003-9004-9656-6410-7041-7051
10	B234	DISCONNECT PORT #2 AND PORT #3 AND PORT #4 FROM PORT #1 6110-6411-9746-9561-9002-9003-9004-9654-6410-7040-7050

### Event Macro Command Memory

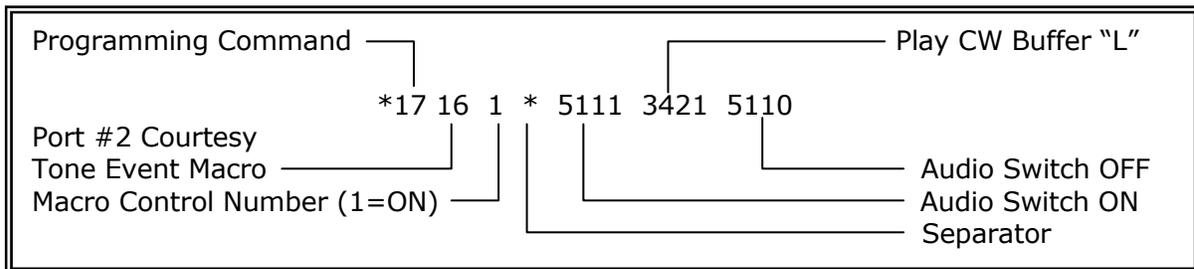
Event Macros are used to perform custom operations at pre determined times during repeater operation.

### Read Event Macro Locations (01-50)

Key-up and send [\*16XX]. Un-key and voice will read back the macro control number followed by the macro data commands stored at that memory location. If the location is empty, the voice will say: "NO MACRO."

### Program Event Macro Locations (01-50)

Key-up and send [\*17XX] followed by the macro control number and the string of internal commands to be executed. Un-key and the voice will say: "CONTROL OK." Example: Program the Port #2 courtesy tone to be the letter "L".



### CAT-400 Event Macro Default Data

01	PORT #1 INPUT ACTIVE								
02	PORT #1 INPUT INACTIVE								
03	LOGIC INPUT #1 ACTIVE HIGH	6911							
04	LOGIC INPUT #1 ACTIVE LOW	6910							
05	LOGIC INPUT #2 ACTIVE HIGH	6921							
06	LOGIC INPUT #2 ACTIVE LOW	6920							
07	LOGIC INPUT #3 ACTIVE HIGH	6931							
08	LOGIC INPUT #3 ACTIVE LOW	6930							
09	LOGIC INPUT #4 ACTIVE HIGH	6941							
10	LOGIC INPUT #4 ACTIVE LOW	6940							
11	ID MESSAGE INITIAL	5011	3201	5010					
12	ID MESSAGE PENDING	6120	5011	3202	5010				
13	ID MESSAGE FORCED	5111	3300	5110					
14	ID MESSAGE FINIAL	6211	3002	6210					
15	COURTESY TONE PORT #1 INPUT	5111	4110	5110					
16	COURTESY TONE PORT #2 INPUT	5111	3414	5110					
17	COURTESY TONE PORT #3 INPUT	5111	3418	5110					
18	COURTESY TONE PORT #4 INPUT	5111	3428	5110					
19	SQUELCH TAIL MESSAGE	6211	3003	6210					
20	TRANSMITTER DROP MESSAGE	6211	3004	6210					
21	RECEIVER PORT #1 TIME OUT	6211	6001	9561	9001	9838	9664	6210	6170
22	RECEIVER PORT #1 TIME OUT EXIT	6211	6001	9561	9001	9656	6210		
23	RECEIVER PORT #2 TIME OUT	6211	6001	9561	9002	9838	9664	6210	6170
24	RECEIVER PORT #2 TIME OUT EXIT	6211	6001	9561	9002	9656	6210		
25	RECEIVER PORT #3 TIME OUT	6211	6001	9561	9003	9838	9664	6210	6170
26	RECEIVER PORT #3 TIME OUT EXIT	6211	6001	9561	9003	9656	6210		
27	RECEIVER PORT #4 TIME OUT	6211	6001	9561	9004	9838	9664	6210	6170
28	RECEIVER PORT #4 TIME OUT EXIT	6211	6001	9561	9004	9656	6210		
29	TIMED MESSAGE #1	6211	6001	3005	6210				
30	TIMED MESSAGE #2	6221	6001	3006	6220				
31	TIMED MESSAGE #3	6231	6001	3007	6230				
32	TIMED MESSAGE #4	6241	6001	3008	6240				
33	DTMF ACCESS UP	6411	9650	9530	9875	6410			
34	DTMF ACCESS DOWN	6411	9650	9530	9324	6410			
35	PORT #1 INACTIVITY TIMER								
36	PORT #2 INACTIVITY TIMER	6211	6001	9561	9002	9738	9324	6210	7010
37	PORT #3 INACTIVITY TIMER	6211	6001	9561	9003	9738	9324	6210	7020
38	PORT #4 INACTIVITY TIMER	6211	6001	9561	9004	9738	9324	6210	7030
39									
40									
41									

42									
43									
44									
45									
46									
47									
48									
49									
50	POWER UP	6211	6001	9275	9004	9456	9999	6001	6210

## Erase Event Macro Locations (01-50)

Key-up and send [\*18XX]. Un-key, the voice will say: "CONTROL OK."

## Event Macro Default Definitions

### Event Macro 3 User Function #1 UP

[6911 - User SW #1 On]

### Event Macro 4 User Function #1 DN

[6910 - User SW #1 Off]

### Event Macro 5 User Function #2 UP

[6921 - User SW #2 On]

### Event Macro 6 User Function #2 DN

[6920 - User SW #2 Off]

### Event Macro 7 User Function #3 UP

[6931 - User SW #3 On]

### Event Macro 8 User Function #3 DN

[6930 - User SW #3 Off]

### Event Macro 9 User Function #4 UP

[6941 - User SW #4 On]

### Event Macro 10 User Function #4 DN

[6940 - User SW #4 Off]

### Event Macro 11, Initial ID

[5011 - Voice Audio's to TX1] [3201 - Message #1] [5010 - Voice Audio OFF]

### Event Macro 12, Pending ID

[6120 - Drop PTT#2] [5011 - Voice Audio's to TX1] [3202 - Message #2]  
[5010 - Voice Audio OFF]

### Event Macro 13, Forced ID

[5111 - Beep Audio's to TX1 on] [3300 - Play CW Buffer] [5110 - Beep Audio's to TX1 off]

### Event Macro 14, Final ID

[6211 - Port #1 PTT, Audio's & Delay] [3002 - Message #2] [6210 - Drop PTT's]

**Event Macro 15 Play Courtesy Tone for Port #1 Input**

[5111 - Beep Audio to TX1 ON] [4110 - Play courtesy tone for Port #1]  
[5110 - Beep Audio to TX1 OFF]

**Event Macro 16 Play Courtesy Tone for Port #2 Input**

[5111 - Beep Audio to TX1 ON] [3414 - Play courtesy tone for Port #2]  
[5110 - Beep Audio to TX1 OFF]

**Event Macro 17 Play Courtesy Tone for Port #3 Input**

[5111 - Beep Audio to TX1 ON] [3418 - Play courtesy tone for Port #3]  
[5110 - Beep Audio to TX1 OFF]

**Event Macro 18 Play Courtesy Tone for Port #4 Input**

[5111 - Beep Audio to TX1 ON] [3428 - Play courtesy tone for Port #4]  
[5110 - Beep Audio to TX1 OFF]

**Event Macro 33, DTMF Access UP**

[6411 - Port PTT, Audio's & Delay] [9650 - "O"] [9530 - "K"] [9875 - "UP"]  
[6410 - All PTT's Off]

**Event Macro 34, DTMF Access DN**

[6411 - Port PTT, Audio's & Delay] [9650 - "O"] [9530 - "K"] [9324 - "Down"]  
[6410 - All PTT's Off]

**Event Macro 36, Port #2 Auto Disconnect**

[6211 - PTT #1 and Audio Control VOICE to TX1 ON] [6001 - Time Delay 1 SECOND]  
[9561 - "Link"] [9002 - "2"] [9738 - "Receive"] [9324 - "Down"]  
[6210 - PTT #1 and Audio Control VOICE to TX1 OFF]

**Event Macro 37, Port #3 Auto Disconnect**

[6211 - PTT #1 and Audio Control VOICE to TX1 ON] [6001 - Time Delay 1 SECOND]  
[9561 - "Link"] [9003 - "3"] [9738 - "Receive"] [9324 - "Down"]  
[6210 - PTT #1 and Audio Control VOICE to TX1 OFF]

**Event Macro 38, Port #4 Auto Disconnect**

[6211 - PTT #1 and Audio Control VOICE to TX1 ON] [6001 - Time Delay 1 SECOND]  
[9561 - "Link"] [9004 - "4"] [9738 - "Receive"] [9324 - "Down"]  
[6210 - PTT #1 and Audio Control VOICE to TX1 OFF]

**Event Macro 50, Power On**

[6211 - PTT Up, Audio SW #1 On] [6001 - 1 Sec Delay] [9275 - CAT] [9004 - 4]  
[9456 - Hundred] [9999 - Version] [6001 - 1 Sec Delay] [6210 - Drop PTT and Audio SW Off]

**Program DTMF Muting Override Command [\*28X]**

With DTMF muting enabled, there may be times when it is desirable to pass the DTMF tones to the transmitter. To temporarily disable DTMF muting, precede the DTMF string with a pound [#]. This key can be changed with the [\*28X] programming command. To change this key to [A], key-up and send [\*28A]. Un-key, the voice will say: "CONTROL OK." Select [\*, [#], [A], [B], [C], or [D]. To read the command, key-up and send [\*28].

**Program Forced Entry Command [\*29]**

DTMF commands are entered when the port goes inactive. To force a DTMF command when the port is active, end the command with a [D]. This key can be changed with the [\*29X] programming command. To change this key to [#], key-up and send [\*29#]. Un-key, the voice will say: "CONTROL OK." Select [\*, [#], [A], [B], [C], or [D]. To read the command, key-up and send [\*29].

**Send Voice Message [\*3001]-[\*3020]**

Key-up and send [\*3001]. Un-key and the voice synthesizer will say the ID.



## CW ID Memory Storage

Memory space is provided for a CW identification. This buffer will accept 15 characters. During initialization, the CW buffer is loaded with "CAT400/R."

## Send CW Identification [\*33]

Key-up and send [\*33]. Un-key and the CAT-400 will send the CW ID stored in the CW buffer.

## Program CW Identification [\*34]

To program the CW buffer send [\*34], followed by the two digit numbers that represents the call letter identification. Memory space is provided for (15) entries. Example: Load CW ID memory buffer with DE W4XYZ/R.

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

00=0	07=7	14=E	21=L	28=S	35=Z	42=[?]
01=1	08=8	15=F	22=M	29=T	36=/	43=[-]
02=2	09=9	16=G	23=N	30=U	37=AR	44=(
03=3	10=A	17=H	24=O	31=V	38=SPACE	45=SK
04=4	11=B	18=I	25=P	32=W	39=[.]	
05=5	12=C	19=J	26=Q	33=X	40=[;]	
06=6	13=D	20=K	27=R	34=Y	41=[:]	

## Erase CW Identification [\*35]

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

## Program Muting Tone Frequency [\*38XX]

This programming command selects the muting cover tone frequency used when DTMF tones are entered and the DTMF Muting control function is enabled.

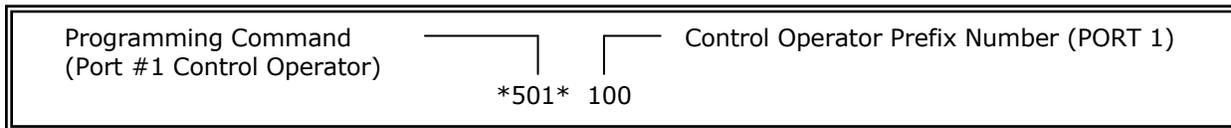
MUTING TONE FREQUENCY TABLE						
01=207Hz	06=277Hz	11=370Hz	16=493Hz	21=660Hz	26=880Hz	31=1174Hz
02=220Hz	07=293Hz	12=392Hz	17=523Hz	22=698Hz	27=932Hz	32=1244Hz
03=233Hz	08=311Hz	13=415Hz	18=554Hz	23=740Hz	28=987Hz	00=NO TONE
04=246Hz	09=330Hz	14=440Hz	19=587Hz	24=784Hz	29=1046Hz	
05=261Hz	10=349Hz	15=466Hz	20=622Hz	25=830Hz	30=1108Hz	

## Control Code And Prefix 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-400 is powered up with dip-switch #7 set to the on position.

## Control Operator Prefix Number Port #1 [\*501\*]

This programming command selects the control operator number for Port #1. This number must precede the command to change the zone control functions. Example: To program a Control Operator Prefix of [100] for Port #1, key-up and send:



Un-key, the voice will say: "CONTROL OK." The default number for Port #1 is [100].

## Control Operator Number Port #2 [\*502\*]

This programming command selects the control operator number for Port #2. The default control operator code for Port #2 is [200].

## Control Operator Number Port #3 [\*503\*]

This programming command selects the control operator number for Port #3. The default control operator code for Port #3 is [300].

## Control Operator Number Port #4 [\*504\*]

This programming command selects the control operator number for Port #4. The default control operator code for Port #4 is [400].

## DTMF Access Code [\*505\*]

This programming command selects the DTMF access prefix number. When the repeater is in the DTMF Access Mode it will not respond to a COR input. The repeater user must enter the DTMF access number to activate the repeater. When the repeater returns to rest for a period determined by the sleep timer, this number must be re-entered to activate the repeater. The default number is [325].

## DTMF Pad Test Number [\*506\*]

This programming command selects the DTMF pad test prefix number. This number must be entered to initiate a DTMF keypad test. Example: To program a DTMF Pad Test Number of 375, key-up and send [\*506\*375]. Un-key and the voice will say: "CONTROL OK."

## Voice Demonstration Control Number [\*507\*]

This number must be entered to PLAY one of the voice messages. This number must precede the voice message number. Example: To program a Voice Demonstration Control Number of 700, key-up and send [\*507\*700]. Un-key and the voice will say: "CONTROL OK."

## Unlock Number [\*508\*]

This programming command selects the unlock number used to place the CAT-400 in the programming mode. This number is not restricted to a seven-digit number. The default number is [7654321].

## Read Control And Prefix Numbers [\*501 - \*508]

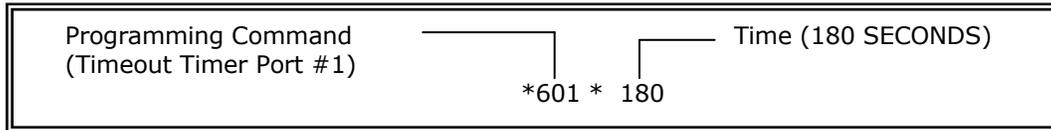
Use this programming command to read the Port #1 control operator code. Example: Key-up and enter [\*501], un-key and the voice will say: "CODE FIVE ZERO ONE IS ONE ZERO ZERO."

## Timer Memory

This memory area is reserved for storage of [23] timers. These timers are user programmable. When the CAT-400 is initialized, these timers are automatically loaded with default values.

### **Port #1 Timeout Timer [\*601\*]**

This timer limits the time a signal can appear on the Port #1 receiver input. If this time limit is exceeded the controller will turn off the transmitter. This timer is programmable between 60 and 1799 seconds. Example: To program the Port #1 timer for 3 minutes, key-up and enter [\*601\*180]. Un-key and the voice will say: "CONTROL OK." When the CAT-400 is initialized this timer defaults to 180 seconds.



### **Port #2 Timeout Timer [\*602\*]**

This timer limits the time a signal can appear on the Port #2 receiver input. If this time limit is exceeded the controller will turn off the transmitter. When the CAT-400 is initialized this timer defaults to 180 seconds.

### **Port #3 Timeout Timer [\*603\*]**

This timer limits the time a signal can appear on the Port #3 receiver input. If this time limit is exceeded the controller will turn off the transmitter. When the CAT-400 is initialized this timer defaults to 180 seconds.

### **Port #4 Timeout Timer [\*604\*]**

This timer limits the time a signal can appear on the Port #4 receiver input. If this time limit is exceeded the controller will turn off the transmitter. When the CAT-400 is initialized this timer defaults to 180 seconds.

### **Timed Message #1 Timer [\*609\*]**

This timer sets the timed message repeat period. This timer is programmable between 1.0 and 1799 seconds. The timer default is 300 seconds.

### **Timed Message #2 Timer [\*610\*]**

This timer sets the timed message repeat period. This timer is programmable between 1.0 and 1799 seconds. The timer default is 600 seconds.

### **Timed Message #3 Timer [\*611\*]**

This timer sets the timed message repeat period. This timer is programmable between 1.0 and 1799 seconds. The timer default is 900 seconds.

### **Timed Message #4 Timer [\*612\*]**

This timer sets the timed message repeat period. This timer is programmable between 1.0 and 1799 seconds. The timer default is 1200 seconds.

### **System ID Timer [\*613\*]**

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 60 and 1799 seconds. The timer default is 480 seconds.

### **System Pending ID Timer [\*614\*]**

The CAT-400 waits until the input is clear before generating a voice ID. If the System ID Timer expires and the input is still not clear, the CAT-400 will wait an additional period of time before a forced ID is sent. This timer sets the length of this period. This timer is programmable between 60 and 1799 seconds. The timer default is 120 seconds.

### **Programming Length & CRT Timeout Timer [\*615\*]**

During the programming mode, this timer determines the maximum time the controller remains unlocked. This timer is programmable between 60 and 1799 seconds. When initialize, this timer will default to 600 second.

### **DTMF Access Sleep Timer [\*616\*]**

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 60 and 1799 seconds. The timer default is 60 seconds.

### **Squelch Tail Message Timer [\*617\*]**

This timer sets the time between transmissions of the squelch tail message. The message occurs when a repeater user stops transmitting. This timer is programmable between 1.0 and 1799 seconds. The timer default is 1799 seconds.

### **Drop Out Message Timer [\*618\*]**

This timer sets the time between transmissions of the drop out message. The message occurs when a repeater stops transmitting. This timer is programmable between 1.0 and 1799 seconds. The timer default is 1799 seconds.

### **COR Drop to Courtesy Beep Timer [\*621\*]**

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 defaults to 1 second. Example: To program the timer for 2.5 seconds, key-up and enter [\*621\*25].

### **Courtesy Beep to PTT Drop Timer [\*622\*]**

This timer determines the time between the generation of the courtesy beep and the time the repeater transmitter turns off. This timer is programmable between 0.1 and 9.9 seconds. The timer default is 4 seconds.

### **Pre-Voice Delay Timer [\*623\*]**

This timer determines the time after PTT goes active and the voice synthesizer begins to speak. This timer is programmable between 0.1 and 9.9 seconds. The timer default is 0.5 seconds.

### **Turn on Delay Timer [\*624\*]**

When the repeater is at rest, this timer sets 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 [\*624\*15]. Un-key and the voice will say: "CONTROL OK." When initialize this timer will default to 1.0 seconds. This timer also sets the turn on delay time for the Port #2 input.

### **DTMF Muting Timer [\*625\*]**

This timer determines the time the transmit audio will continue to be muted after the entry of the last DTMF tone. When initialize, this timer defaults to 1 second.

### **Read Timer Settings [\*601-\*625]**

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."

### **Audio Test Tone [\*901 \*902 \*903 \*904]**

The CAT-400 will generate a 1000Hz test tone. Use this tone as a reference when setting the transmit audio levels. To activate the tone, as TX1 audio, key-up and enter [\*901]. To activate the tone, as TX2 audio, key-up and enter [\*902]. To activate the tone, as TX3 audio, key-up and enter [\*903]. To activate the tone, as TX4 audio, key-up and enter [\*904].

### **Courtesy Tone**

Memory space is provided for [8] custom courtesy tones. Each tone can consist of up to three different tone frequencies of various lengths and separations.

### **Send Courtesy Tone (1-8)**

Key-up and send [\*91X]. Un-key and the CAT-400 will transmit the courtesy tone. "X" represents the courtesy tone table location.



## CAT-400 DTMF Programming Commands

ENTRY	DESCRIPTION	DEFAULT
*13XX	READ USER MACRO COMMAND (01-40)	
*14XX	PROGRAM USER MACRO COMMAND (01-40)	
*15XX	ERASE USER MACRO COMMAND (01-40)	
*16XX	READ EVENT MACRO COMMAND (01-50)	
*17XX	PROGRAM EVENT MACRO COMMAND (01-50)	
*18XX	ERASE EVENT MACRO COMMAND (01-50)	
*28	READ DTMF MUTING OVERRIDE ENTRY KEY	
*28X	PROGRAM DTMF MUTING OVERRIDE ENTRY KEY	#
*29	READ FORCED ENTRY KEY	
*29X	PROGRAM FORCED ENTRY KEY	D
*30XX	PLAY VOICE MESSAGE (01-20)	
*31XX	PROGRAM VOICE MESSAGE (01-20)	
*32XX	ERASE VOICE MESSAGE (01-20)	
*33	SEND CW IDENTIFICATION	
*34	PROGRAM CW IDENTIFICATION	
*35	ERASE CW IDENTIFICATION	
*36XX	SET CW TONE FREQUENCY (01-32)	25
*37X	SET CW SPEED (1-5) (1=10 2=15 3=20 4=25 5=30WPM)	3
*38XX	PROGRAM MUTING TONE FREQUENCY (00 - 32)	20
*501*	PROGRAM CONTROL OPERATOR NUMBER PORT #1 (REPEATER)	100
*502*	PROGRAM CONTROL OPERATOR NUMBER PORT #2	200
*503*	PROGRAM CONTROL OPERATOR NUMBER PORT #3	300
*504*	PROGRAM CONTROL OPERATOR NUMBER PORT #4	400
*505*	PROGRAM DTMF ACCESS NUMBER	325
*506*	PROGRAM DTMF PAD TEST NUMBER	375
*507*	PLAY VOICE MESSAGE DEMO NUMBER	700
*508*	UNLOCK NUMBER #2 (NOT RESTRICTED TO A 7 DIGIT CODE LENGTH)	7654321

ENTRY	DESCRIPTION	DEFAULT
*601*	PORT #1 TIME-OUT TIMER (60 - 1799 SECONDS)	180
*602*	PORT #2 TIME-OUT TIMER (60 - 1799 SECONDS)	180
*603*	PORT #3 TIME-OUT TIMER (60 - 1799 SECONDS)	180
*604*	PORT #4 TIME-OUT TIMER (60 - 1799 SECONDS)	180
*605*	PORT #1 PROGRAM INACTIVITY TIMER (60 - 1799 SECONDS)	600
*606*	PORT #2 PROGRAM INACTIVITY TIMER (60 - 1799 SECONDS)	600
*607*	PORT #3 PROGRAM INACTIVITY TIMER (60 - 1799 SECONDS)	600
*608*	PORT #4 PROGRAM INACTIVITY TIMER (60 - 1799 SECONDS)	600
*609*	TIMED MESSAGE #1 TIMER (60 - 1799 SECONDS)	300
*610*	TIMED MESSAGE #2 TIMER (60 - 1799 SECONDS)	600
*611*	TIMED MESSAGE #3 TIMER (60 - 1799 SECONDS)	900
*612*	TIMED MESSAGE #4 TIMER (60 - 1799 SECONDS)	1200
*613*	SYSTEM ID TIMER (60 - 1799 SECONDS)	480
*614*	SYSTEM PENDING ID TIMER (60 - 1799 SECONDS)	120
*615*	PROGRAMMING LENGTH TIMER & CRT TIMEOUT (60 - 1799 SECONDS)	600
*616*	PROGRAM DTMF ACCESS SLEEP TIMER (60 - 1799 SECONDS)	60
*617*	SQUELCH TAIL MESSAGE TIMER (60 - 1799 SECONDS)	1799
*618*	PTT DROP OUT MESSAGE TIMER (60 - 1799 SECONDS)	1799
*621*	COR DROP TO COURTESY BEEP TIMER (0.1 - 9.9 SECONDS)	1.0
*622*	COURTESY BEEP TO PTT DROP TIMER (0.1 - 9.9 SECONDS)	4.0
*623*	PRE-VOICE DELAY TIMER (0.1 - 9.9 SECONDS)	0.5
*624*	TURN-ON DELAY TIMER (0.1 - 9.9 SECONDS)	1.0
*625*	DTMF MUTING TIMER (0.1 - 9.9 SECONDS)	1.0
*901	TRANSMIT AUDIO TEST TONE PORT #1 (REPEATER)	
*902	TRANSMIT AUDIO TEST TONE PORT #2	
*903	TRANSMIT AUDIO TEST TONE PORT #3	
*904	TRANSMIT AUDIO TEST TONE PORT #4	
*91X	READ COURTESY TONE (1-8)	
*92X	PROGRAM COURTESY TONE (1-8)	
*93X	ERASE COURTESY TONE (1-8)	
*0	MANUAL EXIT OF PROGRAMMING MODE	

## Chapter 6 – Interfacing to Other Equipment

Interfacing the CAT-400 to your repeater system is a simple matter. A minimum of two inputs and two outputs are required for the CAT-400 to control a repeater. They are:

1. A COR signal to indicate when a signal is being received.
2. A receive audio signal containing DTMF tones to be processed for control.
3. A Push-To-Talk signal to tell the repeater transmitter to turn ON.
4. A transmit audio signal containing a combination of receive audio, synthesized voice, and courtesy tone.

Additional connections are required to realize all features of the CAT-400.

### 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 a 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. Note: 0 volts is any voltage less than 0.8VDC. A positive voltage is any voltage greater than 3.0VDC. Set dipswitch #1 on the CAT-400 to ON for (negative logic) and OFF for (positive logic).

### Connection to Receiver

Connect the repeater receiver audio output to J1-13 and the COR to J1-6 of the CAT-400. 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 a pull-up resistor to the COR #1 line. This may also be true for the COR #2, COR #3 and COR #4 inputs. Space is provided on the CAT-400 board to add pull-up resistors.

### Connection to Transmitter

Locate your repeater's Push-To-Talk input. When grounded, this line will make the repeater transmit. Connect the CAT-400 PTT #1 output (J1-10) to this line. Locate your repeater's TX audio input. This is the line where the audio signal used to modulate the transmitter is applied. Connect the TX1 AUDIO (J1-11) to this line.

### Connection to CTCSS Decoder

If your repeater receiver has a CTCSS decoder output, connect it to J1-4. If the decoder output is active high dipswitch #2 should be OFF. If the output is active LOW set dipswitch #2 to ON.

### Interface Review

1. Are dipswitches #1 through #8 in their proper positions?
2. Is the PTT-1 output at J1-10 connected to the transmitter PTT input?
3. Is the TX1 Audio at J1-11 connected to the transmitter audio input?
4. Is the COR-1 at J1-6 connected to the repeater receiver COR output?
5. Is dipswitch #1 ON for active low COR or OFF for active high COR?
6. Is the COR level changing from less than 0.8 VDC to greater than 3.0 VDC?
7. Is the RX1 AUDIO at J1-13 connected to the receiver audio output?
8. Is the audio input level sufficient for the DTMF decoder?

## Connector Kit

Included with the controller is a connector kit containing a 25 pin "D" connector to mate with J1, three 9 pin "D" connectors to mate with J2, J3 and J4, a 2.5mm power plug to mate with J5 (center pin is [+]). Four 2200 ohm resistors are provided to pull-up the COR inputs if the inputs are active LOW. If the receiver's COR circuit is not capable of pulling down a 2200 ohm resistor, you may increase the value up to 10K ohms. Also included are four 0.0047uF capacitors to be installed on the board if the receiver audio inputs are supplied with discriminator audio.

## Power Supply

The CAT-400 is powered by an external 12VDC power supply. Connect the positive lead of the supply to the center pin of the coaxial power connector J5 and the negative lead to the outer conductor.



## Audio De-Emphasis

If the controller is supplied with discriminator audio it is necessary to de-emphasize the audio. Install the 0.0047uF capacitors on the board at the appropriate positions. When connected across the feedback resistors of the receiver audio amplifiers these capacitors will lower the gain at the higher frequencies and produce the necessary de-emphasis. C17 is for Port #1, C18 is for Port #2, C27 is for Port #3 and C28 is for Port #4. If de-emphasize audio is supplied to the controller these capacitors are not required.



## Audio Level Adjustment

The audio mixing-switching circuits of the CAT-400 are optimized around an input and output of -10dBm (220mV).



Connect a signal generator to the repeater's receiver input. Adjust the signal generator's output for a standard test signal of 1000 Hz at 3 KHz deviation. If a signal generator is not available, select a handi-talkie that you suspect has the DTMF tone pad adjusted for approximately 3 KHz deviation.

Key-up on the repeater input and send a DTMF tone. Adjust the RX1 control R44 for 220mVAC at TP1. If a link transceiver is connected to Port #2, key-up on the link input and adjust RX2 control R45 for 220mVAC at TP2. If a link transceiver is connected to Port #3, key-up on the link input and adjust RX3 control R46 for 220mVAC at TP3. If a link transceiver is connected to Port #4, key-up on the link input and adjust RX4 control R47 for 220mVAC at TP4.

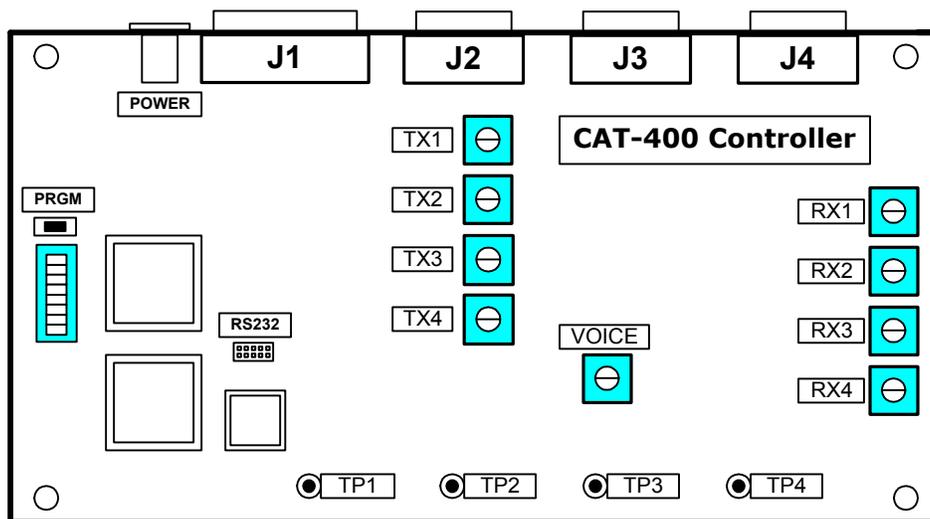


Figure 6-1

Once the receive audios are adjusted, key-up on the repeater input and send a DTMF tone. Monitor the repeater's transmitter. Adjust the TX1 Audio level control (R12) as required to set the repeater's transmitter deviation to 3 KHz or as desired. If the repeater transmit audio input is very sensitive and you find the TX1 Audio level control near minimum, it is strongly recommended that an external resistor voltage divider be installed at the audio input of the repeater's transmitter.

If a link transceiver is connected to Port #2, key-up on the repeater input and send a DTMF tone. Monitor the Link transmitter. Adjust the TX2 Audio level control (R13) as required to set the link transmitter deviation to 3 KHz or as desired.

If a link transceiver is connected to Port #3, key-up on the repeater input and send a DTMF tone. Monitor the Link transmitter. Adjust the TX3 Audio level control (R14) as required to set the link transmitter deviation to 3 KHz or as desired.

If a link transceiver is connected to Port #4, key-up on the repeater input and send a DTMF tone. Monitor the Link transmitter. Adjust the TX4 Audio level control (R15) as required to set the link transmitter deviation to 3 KHz or as desired.

NOTE: Port #2, Port #3 and Port #4 must be linked to the repeater Port #1 to adjust the transmitter audio levels.

Compare the receive and synthesized voice audio and adjust the voice Level (R27) as desired. The synthesized voice should be slightly lower than the receive audio.

Unlock the CAT-400 by keying-up on the repeater input and entering: [1234567]. Key-up and enter the [\*901] test tone programming command. Verify that the test tone provides approximately 1.5 KHz transmitter deviation. Key-up and enter [\*0] to exit the programming mode.

### Port #1 Repeater Interface (J1)

1	LOGIC INPUT #1	6	COR #1	11	TX AUDIO #1
2	LOGIC INPUT #2	7	SWITCH #1	12	SWITCH #3
3	LOGIC INPUT #3	8	SWITCH #2	13	RX AUDIO #1
4	CTCSS #1	9	LOGIC INPUT #4	14	GROUND
5	SWITCH #4	10	PTT #1	15	+12VDC INPUT

Figure 6-2

### Port #2 Interface (J2)

1	COR #2	6	SWITCH #1
2	CTCSS #2	7	GROUND
3	PTT #2	8	GROUND
4	TX AUDIO #2	9	+12VDC OUTPUT
5	RX AUDIO #2		

Figure 6-3

### Port #3 Interface (J3)

1	COR #3	6	SWITCH #2
2	CTCSS #3	7	GROUND
3	PTT #3	8	GROUND
4	TX AUDIO #3	9	+12VDC OUTPUT
5	RX AUDIO #3		

Figure 6-4

## Port #4 Interface (J4)

1	COR #4	6	SWITCH #3
2	CTCSS #4	7	GROUND #4
3	PTT #4	8	GROUND
4	TX AUDIO #4	9	+12VDC OUTPUT
5	RX AUDIO #4		

Figure 6-5

### CTCSS Decoder

Connect the TS-64 CTCSS Encoder/Decoder assembly to the CAT-400 as described in Figure 6-6. The decoder must be connected to discriminator audio. Speaker or volume control audio will have insufficient low frequency CTCSS tone content.

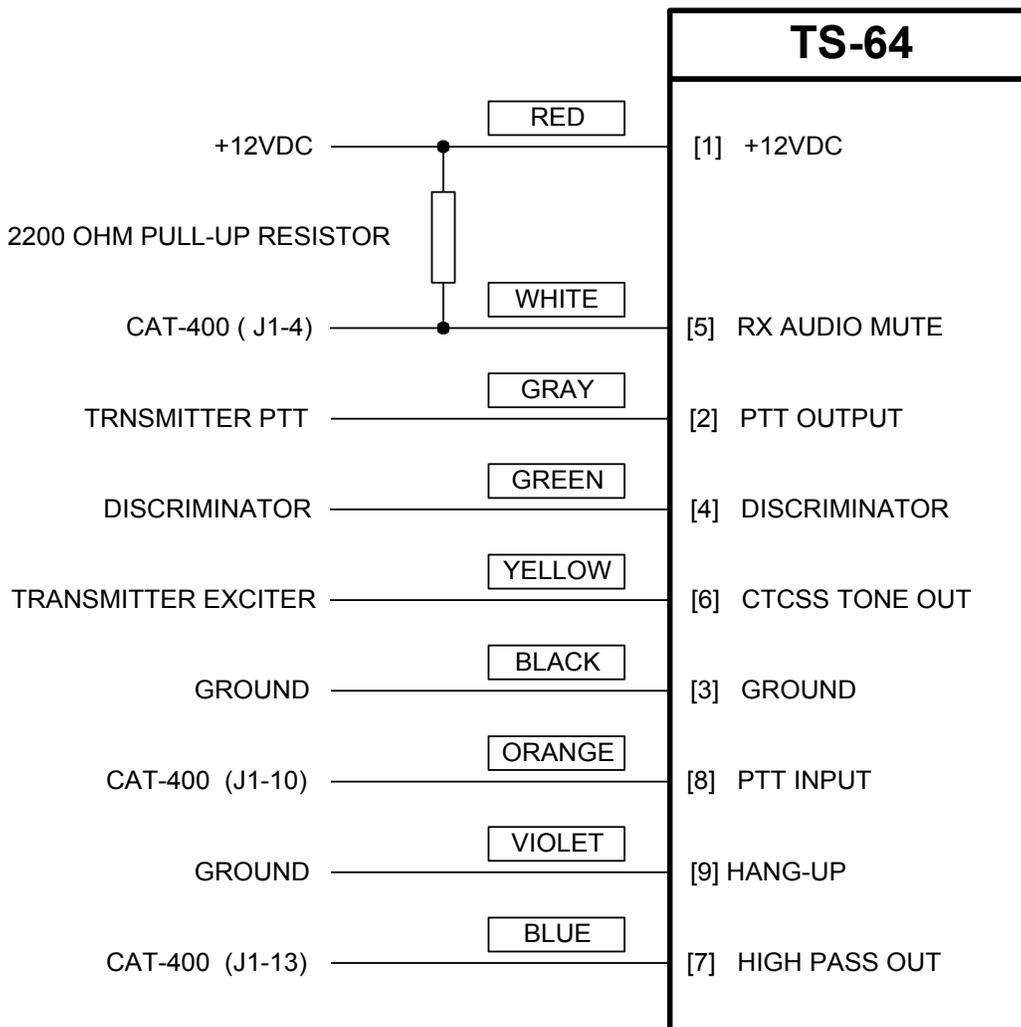


Figure 6-6

## Chapter 7 - RS-232 Interface

Connect your computer's COMM port to the CAT-400 at J6 as described in Figure 7-1.

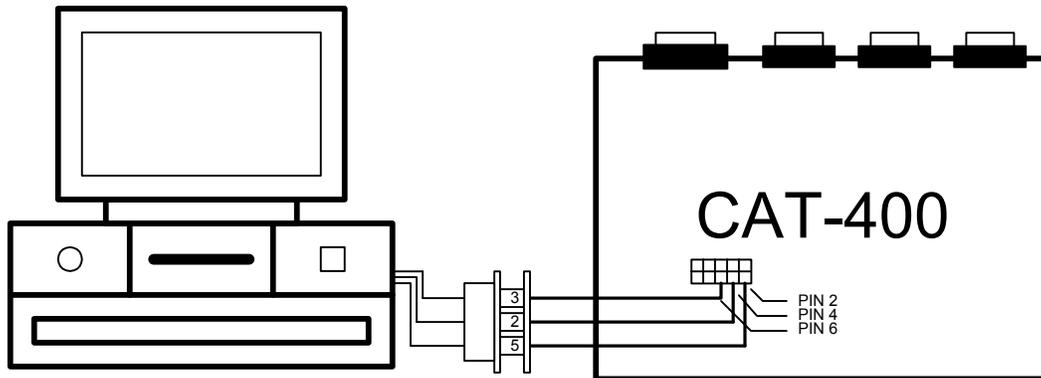
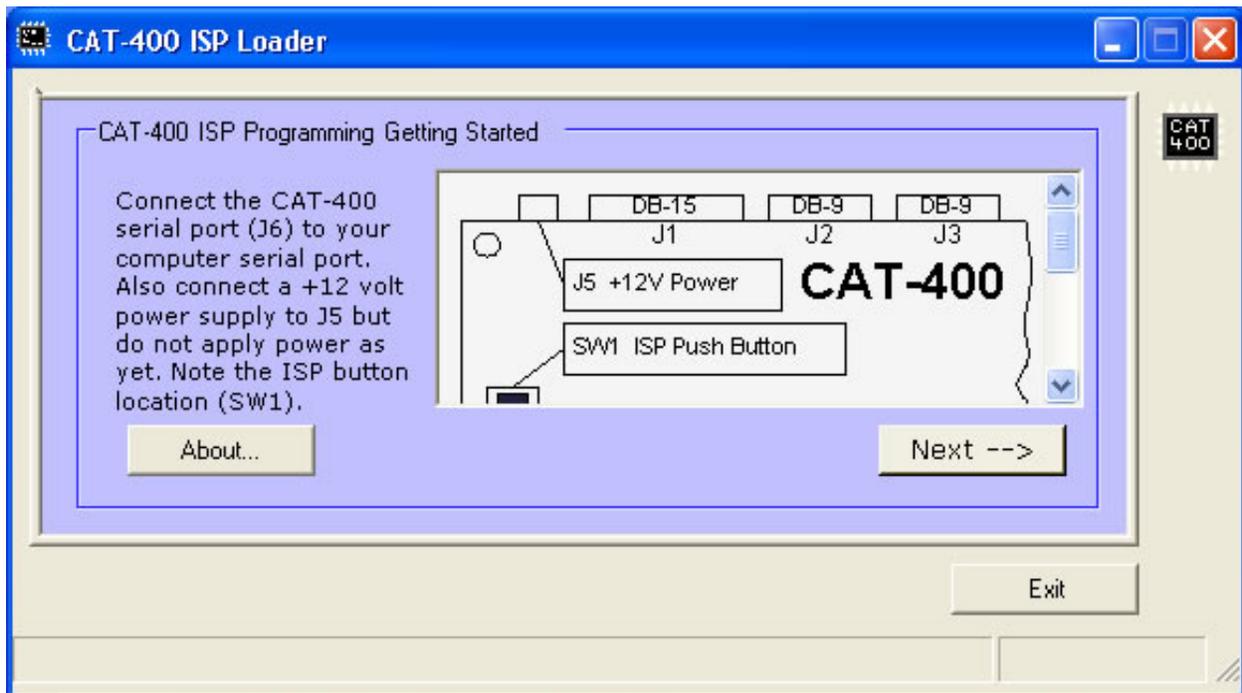


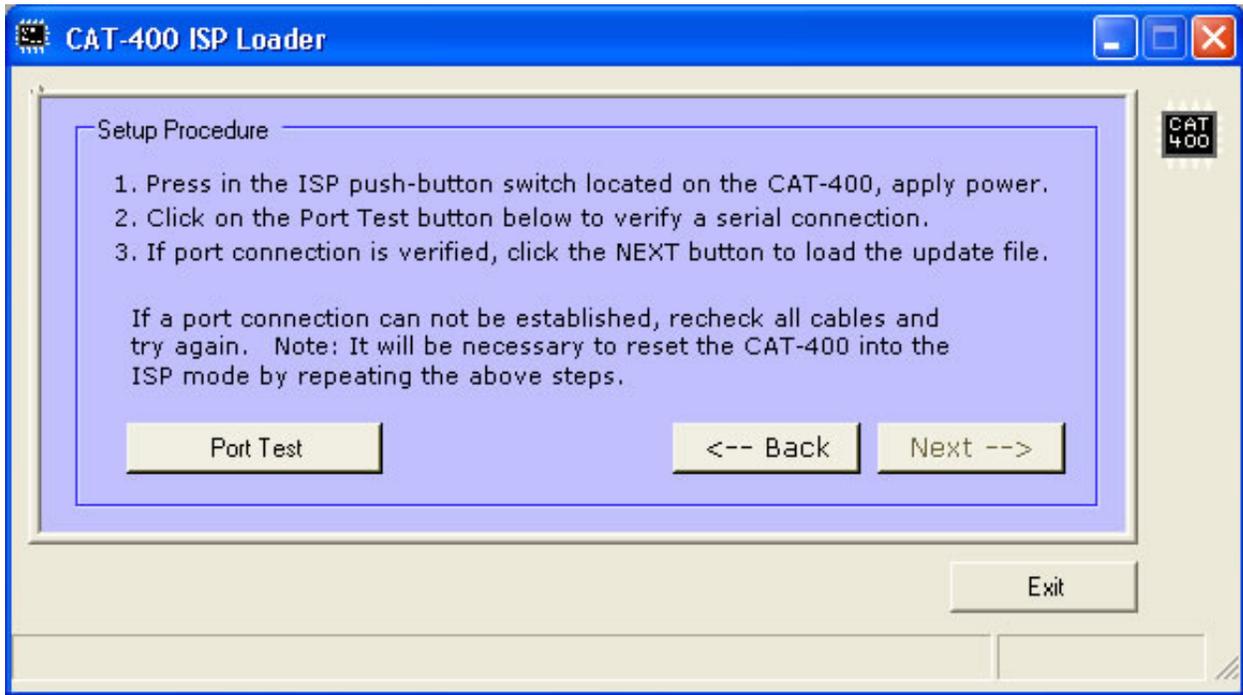
Figure 7-1

### ISP Loader For CAT-400

Use the ISP Loader to upload the latest firmware version of the CAT-400 controller available at the <http://www.catauto.com/ISPLoader.html> web site. Under **RESOURCES**, select **FIRMWARE UPDATES** and then **CAT-400** and the latest version. Follow the procedure described in the "CAT-400 Firmware Download Instructions".

Start the ISP Loader program to display the "**ISP Loader For CAT-400**" window. Follow the directions described in the window.





Turn on dipswitch #7 and cycle power or there will not be any PTT.

### ED-400 Windows Editor

Start the windows editor program to display the "CAT-400 Repeater Controller Editor" window.

### Activation Of The RS-232 Port With Dipswitch #8

To activate the RS-232 port, set the DC power to OFF. Set dipswitch #8 to ON. Turn the DC power to ON.

### Activation Of The RS-232 Port By Radio

To activate the RS-232 port, key-up on any port and enter the control operator prefix code for that port. Enter [100], [200], [300] or [400] followed by [97]. The voice synthesizer will say: "CONNECT" and the transmitter will drop.

### RS-232 Interface Cable

The CAT-400 controller's RS-232 port is available at header J6. Included in the connector kit is a three-wire cable terminated with a header plug on one end. Solder a 9 pin "D" connector as shown in Figure 7-2.

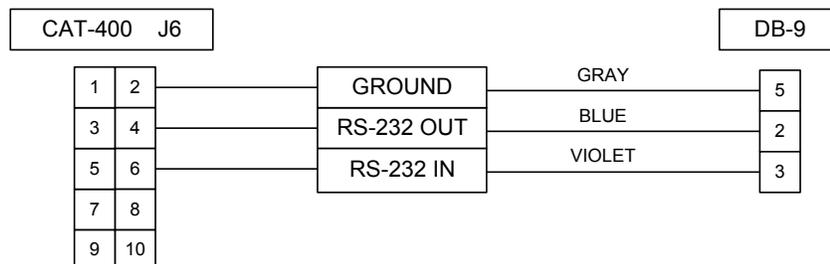
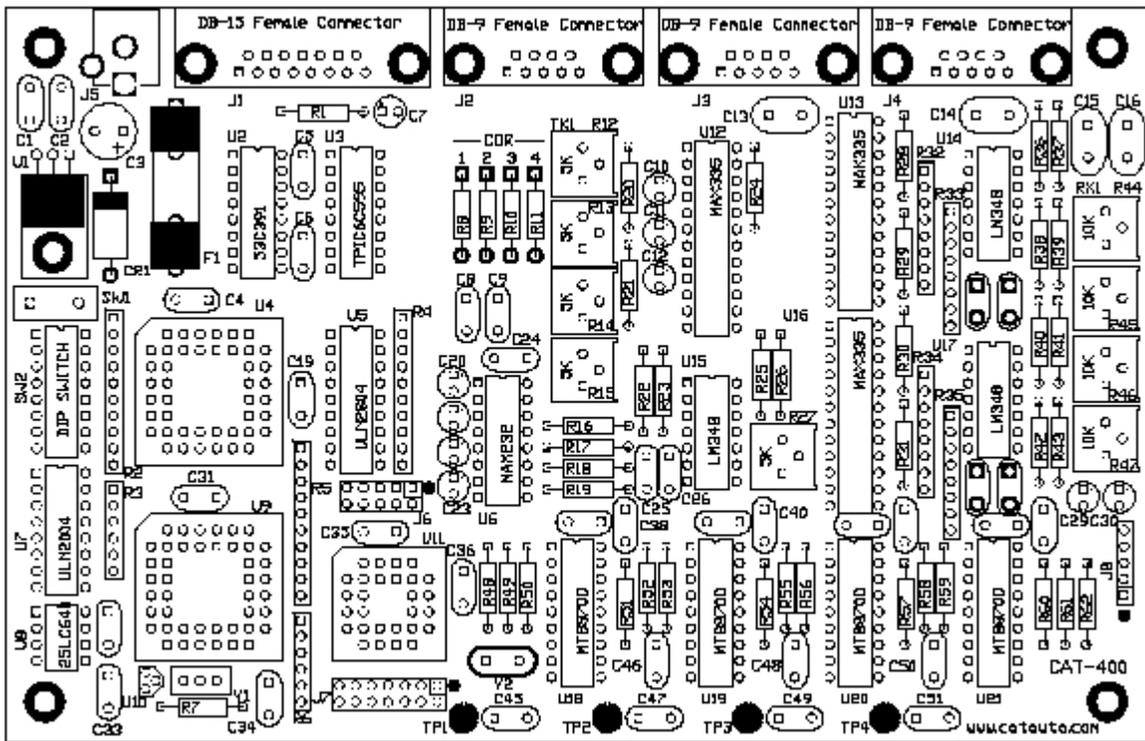


Figure 7-2

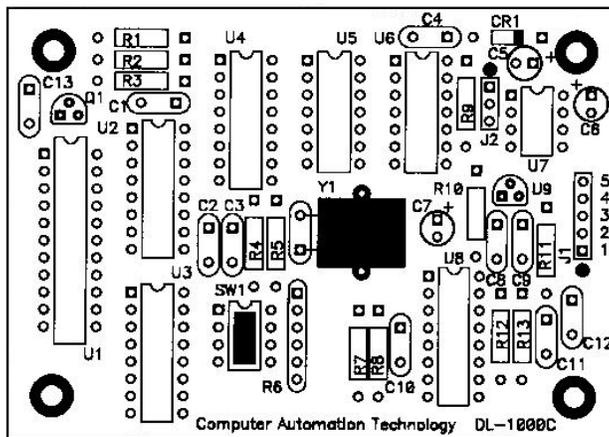
## Chapter 8 - Voice Vocabulary

Zero	000	Connect	294	Link	561		
One	001	Contact	295	Low	568	T	820
Two	002	Control	296			Temperature	824
Three	003			M	580	Thank-You	828
Four	004	D	310	Machine	581	The (short E)	830
Five	005	Danger	311	Macro	582	The (long E)	831
Six	006	Date	313	Manual	585	This-is	834
Seven	007	Day	314	Meeting	593	Thunderstorms	836
Eight	008	Direction	322	Mega	594	Thursday	837
Nine	009	Down	324	Message	595	Time	838
Ten	010			Meter	596	Timer	839
Eleven	011	E	340	Minus	603	Today	840
Twelve	012	Echo	342	Minutes	605	Tomorrow	841
Thirteen	013	Ed(suffix)	343	Monday	608	Tone	854
Fourteen	014	Emergency	344			Tonight	842
Fifteen	015	End	345	N	620	Tornado	843
Sixteen	016	Enter	346	Net	623	Traffic	845
Seventeen	017	Error	348	Night	626	Transceiver	853
Eighteen	018	Exit	350	No	627	Transmit	846
Nineteen	019			Not	630	Tuesday	849
Twenty	020	F	370	November	631	Turn	850
Thirty	030	Failure	372	Now	632		
Forty	040	Feet	376	Number	633	U	870
Fifty	050	For	004			Until	874
Sixty	060	Frequency	388	O	650	Up	875
Seventy	070	Friday	389	Of	653	Use(noun)	876
Eighty	080	From	390	Off	654	Use(verb)	877
Ninety	090	Full	392	On	656		
				Operator	659	V	880
A	210	G	410	Out	664		
Above	214	Get	412	Over	665	W	890
Alert	223	Go	413			Wait	891
All	224	Good	415	P	680	Warning	892
Alpha	225			Please	689	Watch	893
Amateur	228	H	440	Plus	690	Watts	894
An	230	Ham	443	Point	691	Weather	896
And	231	Hamfest	444	Power	695	Wednesday	897
At	239	Hertz	449			Welcome	900
Attention	241	High	450	Q	720	What	903
		Hour	454			Whiskey	904
		Hundred	456	R	730	Will	905
B	250			Radio	731	With	908
Band	252			Ready	737		
Base	253	I	470	Receive	738	X	920
Below	255	Identify	473	Receiver	739	X-Ray	921
By	260	Information	478	Remote	743		
		Ing (suffix)	478	Repeater	746	Y	930
C	270	Inputs	480			Yes	934
Call	272	Intruder	481	S	770	Your	937
Cancel	274	Is	482	Saturday	772		
Cat	275	It	483	Seconds	774	Z	950
Caution	276			Set	782	Zone	953
Change	279	J	500	Severe	783	Zulu	954
Check	281			Star	795	<b>Pause</b>	
Clear	283	K	530	Start	796	Pause 1	960
Club	286	Keypad	532	Stop	797	Pause 2	961
Code	287			Sunday	799	Pause 3	962
Come	288	L	550	System	801	Pause 4	963
Complete	289	Last	552	S (plural)	802		
Condition	292	Let	556				

# Chapter 9 CAT-400 Drawings



## DL-1000C Digital Audio Delay



## Chapter 10 - Schematic

Controller Board (CAT-400)

Sheet 1 of 3

Controller Board (CAT-400)

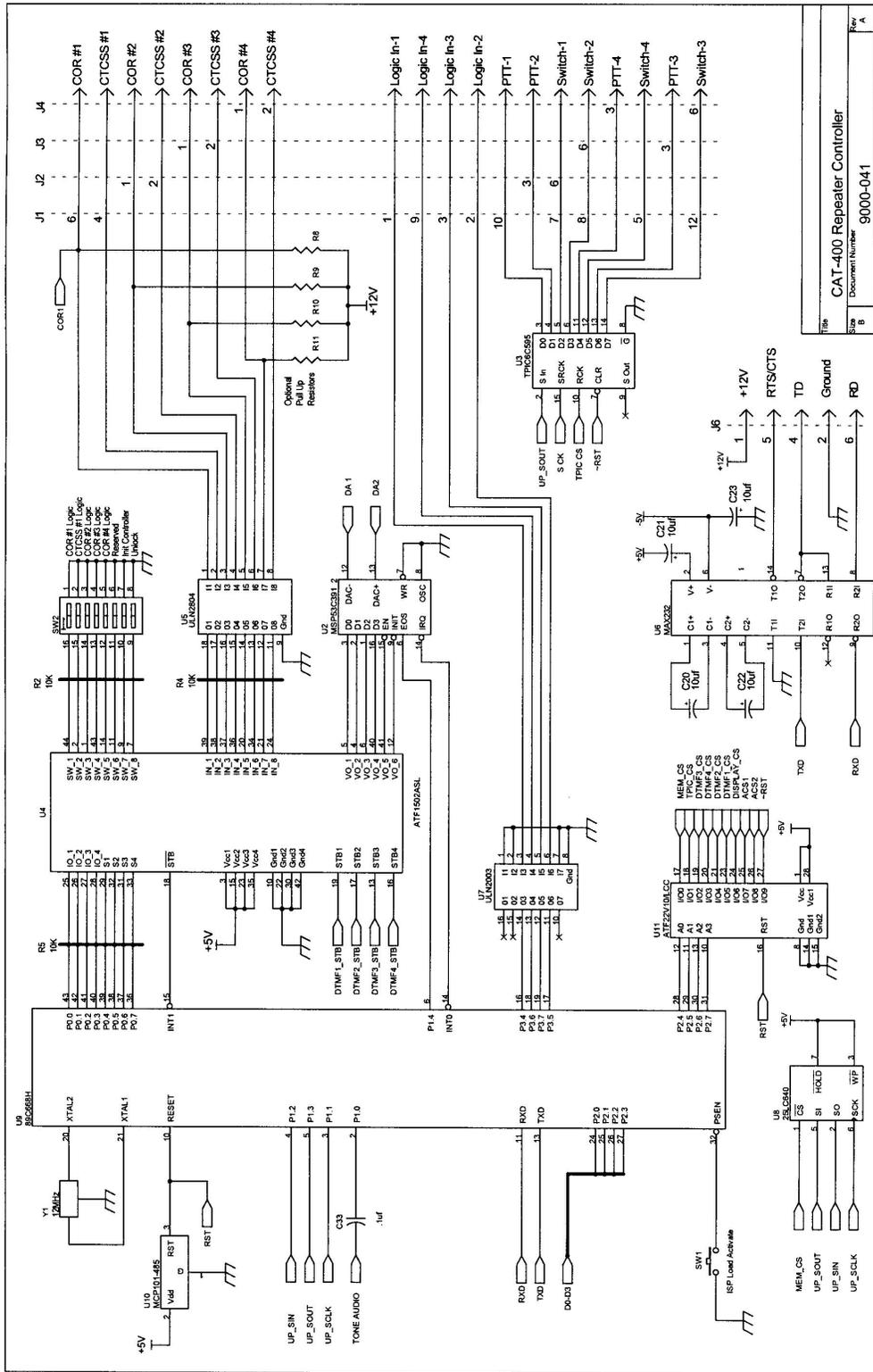
Sheet 2 of 3

Controller Board (CAT-400)

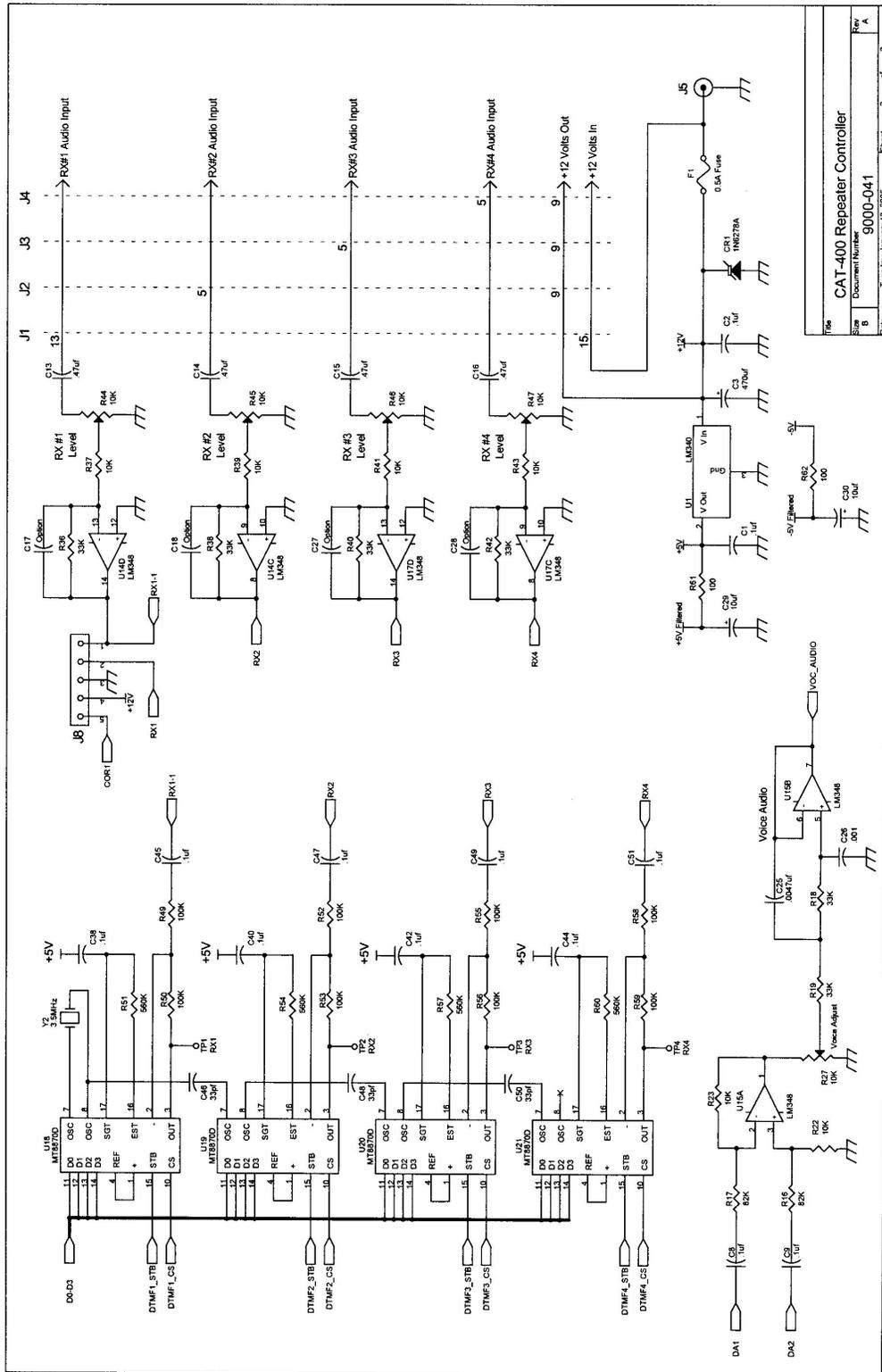
Sheet 3 of 3

Audio Delay Board (DL-1000C)

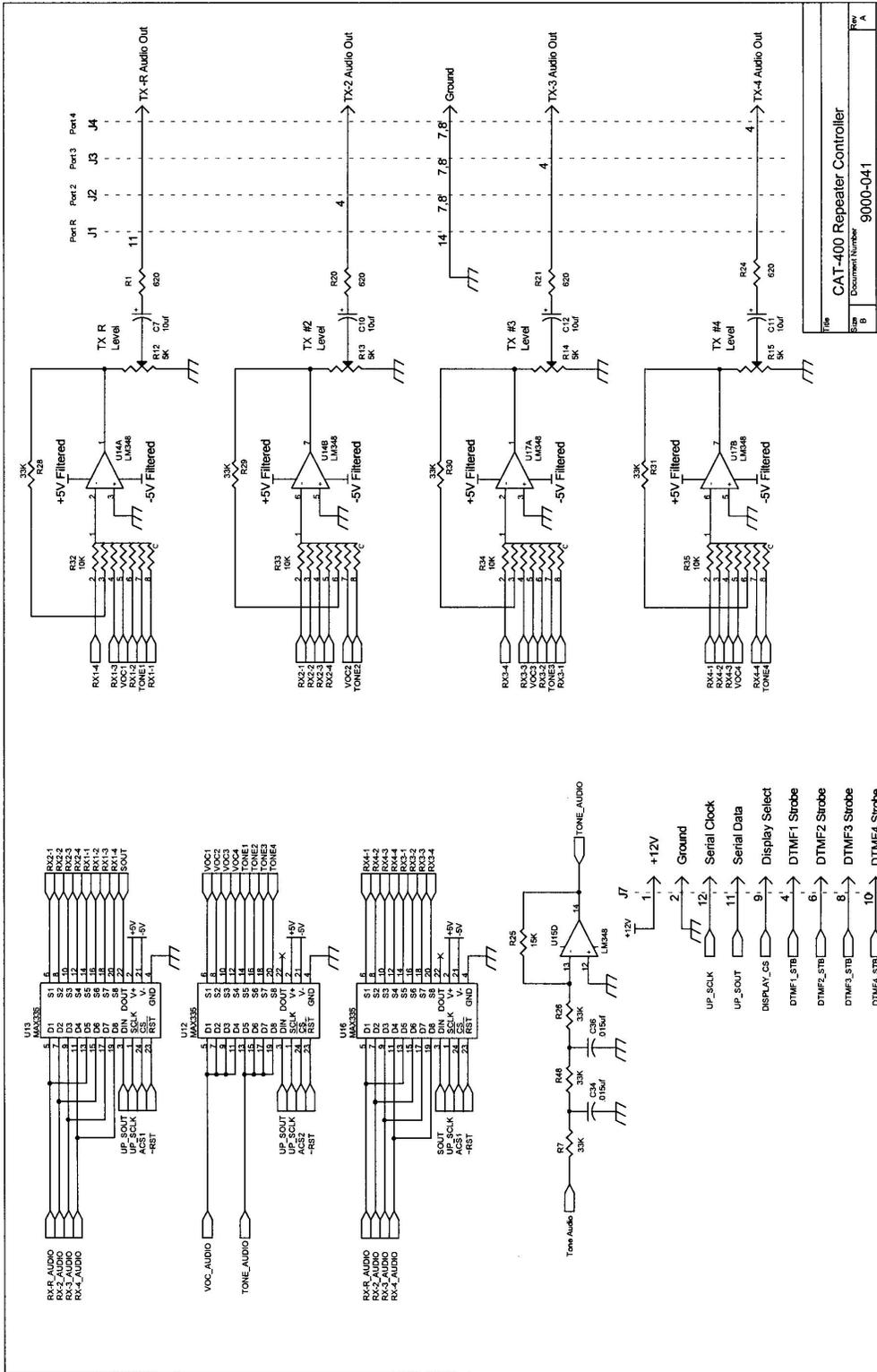
Sheet 1 of 1



File	CAT-400 Repeater Controller
Doc Number	9000-041
Rev	A



File	CAT-400 Repeater Controller		
Size	B	Document Number	9000-041
Rev	A	Date	10/25/99, January 18, 2005
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Title		CAT-400 Repeater Controller	
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## Chapter 11 - Part List

### CAT-400 Repeater Controller Parts List

Quantity	Type	Value	Designation
3	Capacitor	33pf 50V	C46,C48,C50
1	Capacitor	.001uf 50V	C26
1	Capacitor	.0047uf 50V	C25
2	Capacitor	.015uf 50V	C34,C36
25	Capacitor	.1uf 50V	C1,C2,C4,C5,C6,C8,C9,C19,C24,C31 C32,C33,C35,C37,C38,C39,C40,C41 C42,C43,C44,C45,C47,C49,C51
4	Capacitor	.47uf 50V	C13,C14,C15,C16
4	Capacitor	User Option Capacitor	C17,C18,C27,C28
10	Capacitor	10uf 16V	C7,C10,C11,C12,C20,C21,C22,C23 C29,C30
1	Capacitor	470uf 25V	C3
1	Connector	DC Power	J5
3	Connector	DB9 Female	J2,J3,J4
1	Connector	DB15 Female	J1
1	Connector	Header 1X5	J8
1	Connector	Header 2X5	J6
1	Connector	Header 2X7	J7
1	Crystal	12MHz Resonator	Y1
1	Crystal	3.58MHz	Y2
1	Diode	1N6278A	CR1
1	Fuse	0.5 Amp	F1
1	I.C.	MAX232	U6
3	I.C.	LM348	U14,U15,U17
3	I.C.	MAX335	U12,U13,U16
1	I.C.	P89C668H	U9
1	I.C.	ATF1502ASL	U4
1	I.C.	MSP53C391	U2
1	I.C.	TPIC6C595	U3
1	I.C.	ULN2804	U5
4	I.C.	MT8870D	U18,U19,U20,U21
1	I.C.	25LC640	U8
1	I.C.	ATF22V10CQ	U11
1	I.C.	ULN2004	U7
1	I.C.	LM340-5.0	U1
1	I.C.	MCP101	U10
2	Resistor	100 Ohm	R61,R62
4	Resistor	620 Ohm	R1,R20,R21,R24
5	Resistor	5K Variable	R12,R13,R14,R15,R27
7	Resistor	10K	R22,R23,R25,R37,R39,R41,R43
4	Resistor	10K Variable	R44,R45,R46,R47
1	Resistor	10K 6 Pin SIP	R6
4	Resistor	10K 8 Pin SIP	R32,R33,R34,R35
3	Resistor	10K 10 Pin SIP	R2,R4,R5
13	Resistor	33K	R7,R18,R19,R26,R28,R29,R30 R31,R36,R38,R40,R42,R48
2	Resistor	82K	R16,R17
8	Resistor	100K	R49,R50,R52,R53,R55,R56,R58,R59
4	Resistor	560K	R51,R54,R57,R60
4	Resistor	User Option	R8,R9,R10,R11
1	Switch	ISP Load	SW1
1	Switch	DIP Switch 8 Position	SW2
4		Test Points	TP1,TP2,TP3,TP4

## DL-1000C Audio Delay Board

Quantity	Type	Value	Designation
7	Capacitor	0.1uF 50V	C1,C4,C8,C9,C10,C11,C12
3	Capacitor	10uF 16V	C5,C6,C7
2	Capacitor	18pF 50V	C2,C3
1	Capacitor	.001uF 50V	C13
1	Crystal	2.048Mhz	Y1
1	Diode	1N4148	CR1
1	Header	1X3	J2
1	Header	1X5	J1
1	I.C.	74HC73	U5
1	I.C.	74HC02	U6
2	I.C.	74HC4520	U2,U3
1	I.C.	CY7C187	U1
1	I.C.	MC7805AC	U9
1	I.C.	74HC4060	U4
1	I.C.	TP3054	U8
1	I.C.	7660CPA	U7
3	Resistor	10K 5% 1/4W	R1,R3,R11
1	Resistor	4.7K 5% 1/4W	R9
1	Resistor	22K 5% 1/4W	R13
1	Resistor	100 5% 1/4W	R10
2	Resistor	47K 5% 1/4W	R2,R12
3	Resistor	330 5% 1/4W	R4,R7,R8
1	Resistor	10MEG 5% 1/4W	R5
1	Resistor	10K 6pin Network	R6
1	Switch	Dip 4 Pole	SW1
1	Transistor	2N7000	Q1
7	Capacitor	0.1uF 50V	C1,C4,C8,C9,C10,C11,C12
3	Capacitor	10uF 16V	C5,C6,C7
2	Capacitor	18pF 50V	C2,C3
1	Capacitor	.001uF 50V	C13
1	Crystal	2.048Mhz	Y1
1	Diode	1N4148	CR1
1	Header	1X3	J2
1	Header	1X5	J1
1	I.C.	74HC73	U5
1	I.C.	74HC02	U6
2	I.C.	74HC4520	U2,U3
1	I.C.	CY7C187	U1
1	I.C.	MC7805AC	U9
1	I.C.	74HC4060	U4
1	I.C.	TP3054	U8
1	I.C.	7660CPA	U7
3	Resistor	10K 5% 1/4W	R1,R3,R11
1	Resistor	4.7K 5% 1/4W	R9
1	Resistor	22K 5% 1/4W	R13
1	Resistor	100 5% 1/4W	R10
2	Resistor	47K 5% 1/4W	R2,R12
3	Resistor	330 5% 1/4W	R4,R7,R8
1	Resistor	10MEG 5% 1/4W	R5
1	Resistor	10K 6pin Network	R6
1	Switch	Dip 4 Pole	SW1
1	Transistor	2N7000	Q1

## Chapter 12 - DL-1000C Audio Delay Board

When placed in the receive audio path, the DL-1000C will eliminate the first chirp of DTMF tone during muting and the squelch crash noise present on many repeater systems. A dipswitch selects delays of 50, 100, 200 or 400 milliseconds. With an audio sampling rate 60 KHz, the delayed audio is faithfully reproduced.

Remove the jumper plug from the CAT-400 at J8. Connect the cable from the DL-1000C to header connector J8 to delay Port #1 audio.

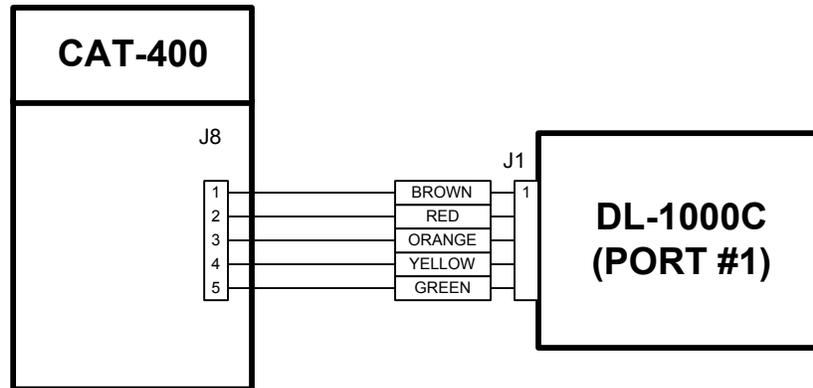


Figure 12-1

### Select Delay

The amount of delay is determined by the setting of the dipswitch. The typical repeater receiver has a squelch crash noise of 40 milliseconds. The 50mSEC setting should be sufficient to eliminate the noise. If not increase the delay to the next setting. See Figure 13-2.

MILLISECONDS	SW1	SW2	SW3	SW4
0.0	OFF	OFF	OFF	OFF
50	ON	OFF	OFF	OFF
100	ON	ON	OFF	OFF
200	ON	ON	ON	OFF
400	ON	ON	ON	ON

Figure 12-2

The DL-1000C is inserted in the receive audio path, before the controller's audio switch. This audio switch is controlled by the COR logic signal. Loss of COR will cause the audio switch to open, preventing the receive audio from reaching the transmitter. The DL-1000C provides time for the switch to open before the squelch crash noise reaches the switch's input.

During DTMF muting, 40 milliseconds of the first tone will sneak through before the DTMF decoder can tell the microprocessor to open the audio switch. The DL-1000C provides the necessary delay to overcome this problem.

### Discriminator Switch

The DL-1000C can be used with discriminator audio. A FET switch Q1 is included on the board. If the repeater's COR logic is connected to the J1 header, the white noise hiss will be eliminated during key-up. If the COR logic is active high set the J2 jumper between pins 1 and 2. If the COR is active low set the J2 jumper between pins 2 and 3.