MODEL 5700

DUAL-TONE MULTI-FREQUENCY PROGRAMMABLE ENCODER WITH LIQUID CRYSTAL DISPLAY

INSTRUCTION & MAINTENANCE MANUAL

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Model 5700

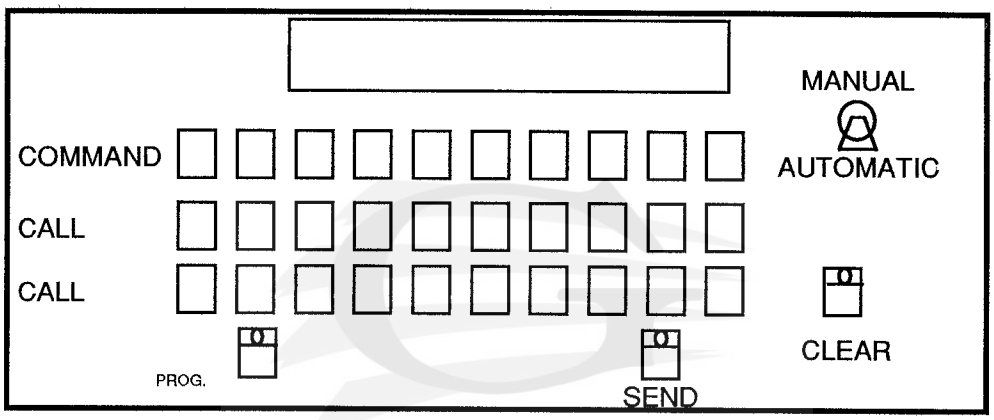
Programmable DTMF Encoder

The Model 5700 DTMF encoder allows you to establish flexible, error free DTMF codes, that may be transmitted without the operator having to know all of the detailed information about each code. This translates to less operator errors, faster code transmit time, and greater overall efficiency in the activation process.

USING THE 5700

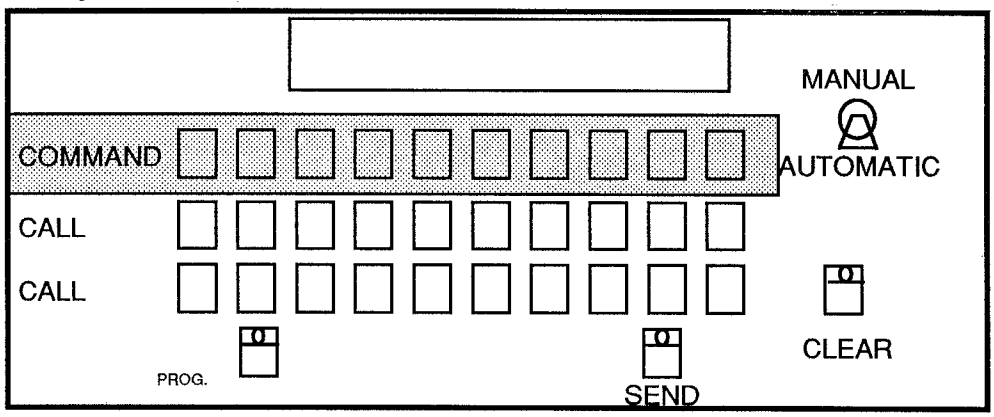
Automatic Mode

Place the MODE switch which is to the right of the display screen, into the AUTOMATIC Mode. Note the color of the words AUTOMATIC. Any information printed on the front panel and the keytops with the same color is used only when the switch is in this position.



Whenever you want the Encoder to Stop what it is doing and return you back to the Ready _ display, just like it does when you apply power, Press the CLEAR key. If the unit was transmitting the codes it will stop and unkey the transmitter, if a COMMAND key or some CALL keys had been pressed and were ready to send, they will be cleared from the screen so you will have a fresh start the next time you press any of them. Pressing the CLEAR key will not wipe out any of the code information stored in memory, it only CLEARS the display and starts you out at the beginning display.

The top row of keys are the COMMAND keys, these will slip a special number into the DTMF code(s) that are selected by the bottom two rows of keys called the CALL keys. The special number inserted by the COMMAND key is instructing the unit that you are calling to do something unique. Example, you might use the COMMAND key "4" to turn the unit ON, then COMMAND key "2" to turn it OFF, and COMMAND key "7" might be used to tell the unit to go into a Standby mode.



After you press any key in the COMMAND row of keys, the display screen will change from the READY _ indication. It will now display CALL COMMAND ?. The KEYS is for the second line of the display to show which of the CALL keys are going to be sent. The COMMAND ? will show which COMMAND key you pressed to be sent. If you pressed COMMAND key 2 the display will show COMMAND 2.

If by chance your finger slipped and you pressed COMMAND 2, when you really wanted COMMAND 3, just press the COMMAND 3 key, and verify the change by looking at the display and noting that the display now shows the words COMMAND 3.

(It must be noted that some Encoders will display different wording other than COMMAND ? for each key, these are Encoders that are designed and programmed by our factory with specific applications in mind by the user. Key #0 for example might say CODE 1, or MOTOR ON or TORNADO or any other word programmed for a special use. If your encoder is equipped like this, then plug in your wording in your mind for the COMMAND ? function as we go through the operation of the Encoder.)

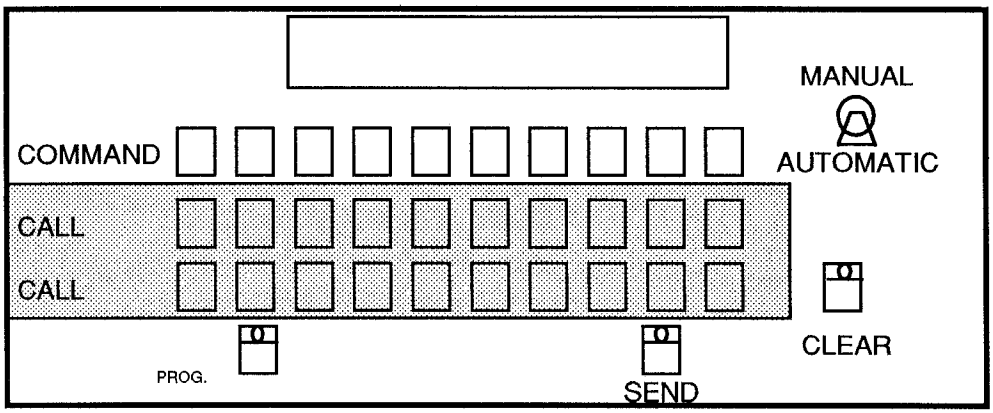
To get back to the READY _ display just press the CLEAR key.

The above is only an example, the command keys on your Encoder will have different meanings that will be programmed into them and shown on the top of each key with a label.

It is important to remember however, that a command key alone will not do anything. Along with the COMMAND key you must press at least one CALL key.

CALL keys

The two rows of CALL keys are the ones you use to actually call up the units that you want to act on the COMMAND key.



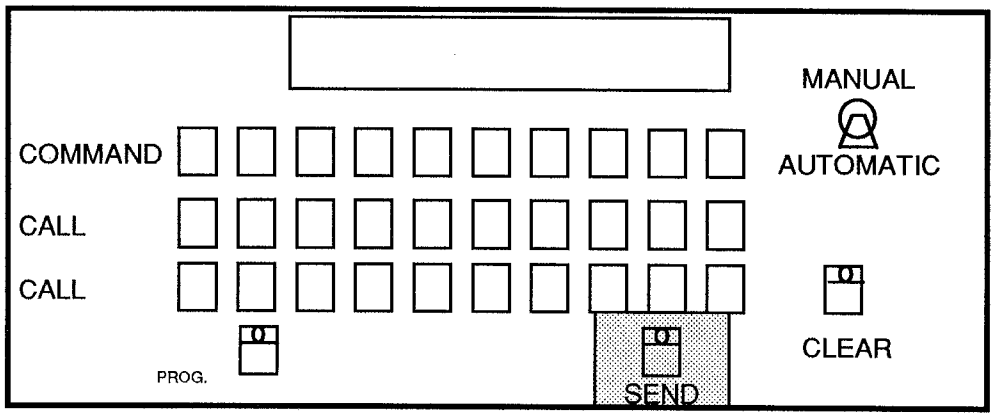
Example, if CALL key "A" called unit 1, CALL key "B" called unit 2, and so forth. To activate unit 2 you would press the CALL key labeled "B". The letter "B" would show on the second line of the display indicating that that CALL code would be sent when you press the SEND key.

You may press as many of the CALL keys as you need to call the units before you press the SEND key. If you pressed a CALL key then decided that you did not want to send it, then press the same CALL key again. As you do it note the displays second line. Each time you press the same CALL key it 'Toggles' the letter of the key in the display, which means if it was off and you press the CALL key it will turn on, and if you press the same CALL key again it will turn the letter off in the display so it will not be transmitted when you press the SEND key.

If you do have several CALL keys to SEND, the Encoder will SEND them as it reads them from the display going left to right. It makes no difference what order you entered them in or how many times you have Toggled them on and off. They are all processed left to right.

SEND key

You use the SEND key to actually Send out the COMMAND and CALL information that you have selected and is showing in the display. Any COMMAND and CALL information that is showing in the display will be transmitted by the type of device that your encoder is hooked up to, it might be Radio, Phone Lines, Microwaves or any other type of transmitter.



Once you press the SEND key the Encoder hooks itself up to your transmitter and starts sending the COMMAND and CALL information that you selected.

You will know it is connected by looking at the little light that is molded in the SEND key, this light glows red when the Encoder is actually hooked into the transmitter and sending.

If you selected more than one CALL key, the encoder will read them from left to right, sending them one at a time. After it is finished with each CALL key it will erase its letter and go to the next one showing on the screen.

When all of the selected CALL keys are sent, the red light goes out on the SEND key, and the screen changes back to READY _ display to wait for your next CALL & COMMAND.

It must be noted that there are certain times when only a CALL key is needed to send the entire code, your programmer has the option of actually working the COMMAND code into a CALL key. This enables one key to do double duty, but it also limits the flexibility of the CALL key since it can no longer access any of the COMMAND key information, even though this information might be present on the screen. If the programmer has programmed a key like this, it will ignore the COMMAND information and SEND its own preprogrammed Command line.

If you use one of these Double Duty CALL keys without selecting a COMMAND key, it simply does not matter. The Encoder will SEND the information contained in the Double Duty (D/D) CALL key, and since this was programmed special to already contain the Command, the information is transmitted as it normally would be.

To do this the Encoder will look at each CALL key before it SENDs it, if it already contains the Command information the code is sent right out. If the Encoder sees that it is a standard CALL key it then looks up at the top line of the screen for the COMMAND that is supposed to be sent with it, and inserts the COMMAND code that you have selected into the CALL keys.

If a CALL key requires a COMMAND key, and one was not selected before the SEND key was pressed, then the Encoder will look at the CALL key as it comes to it (reading left to right) and see that the CALL key requires a COMMAND but one was not selected. It will then stop SENDing, turn the red SEND light off, and instruct you on the screen to ...

```
 ----------------------
|PLEASE SELECT COMMAND|
|                      |
 ----------------------
```

You then may select the desired COMMAND from the COMMAND line, and you will be returned to the Select screen where the COMMAND you just selected will now be displayed as well as all of the remaining CALL's that still have to be sent; to continue SENDing press the SEND key.

The Encoder starts SENDing from the CALL key that it found needed a command, and will continue until it is done with all of the CALL keys or is interrupted early by pressing the CLEAR key.

At the PLEASE SELECT COMMAND key you also have the option of using the CLEAR key to Clear out everything and start fresh from the READY _ screen. No part of the CALL key that was found needing a COMMAND was sent out, so you do not need to worry that a partial code was sent and might need to be completed.

EMERGENCY STOP SENDING

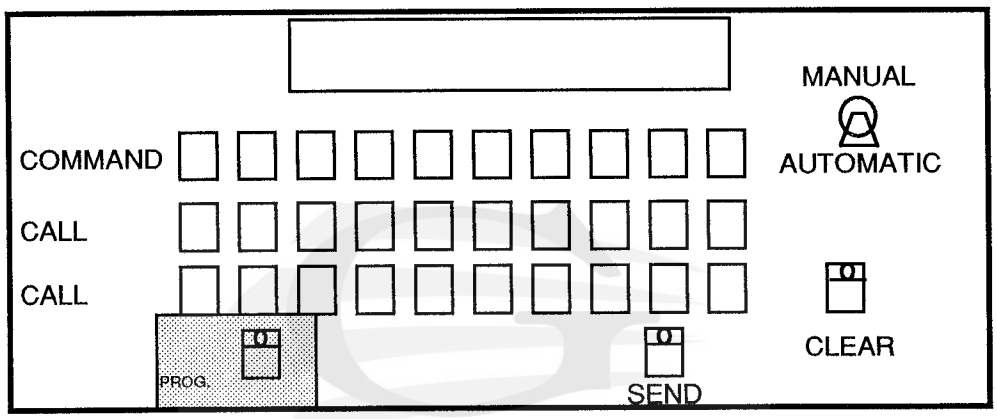
To Stop SENDing CALL & COMMAND information before all of the selected CALL keys have been sent, PRESS THE CLEAR KEY.

This will not recall any of the codes that have already been sent but will keep the rest of the codes from going out.

The Encoder will Stop SENDing and return you to the READY screen where it will wait for your next CALL & COMMAND.

Prog. key

This key is only for initial Programming of the Encoder's memory and has no other function in any operating mode of the Encoder.

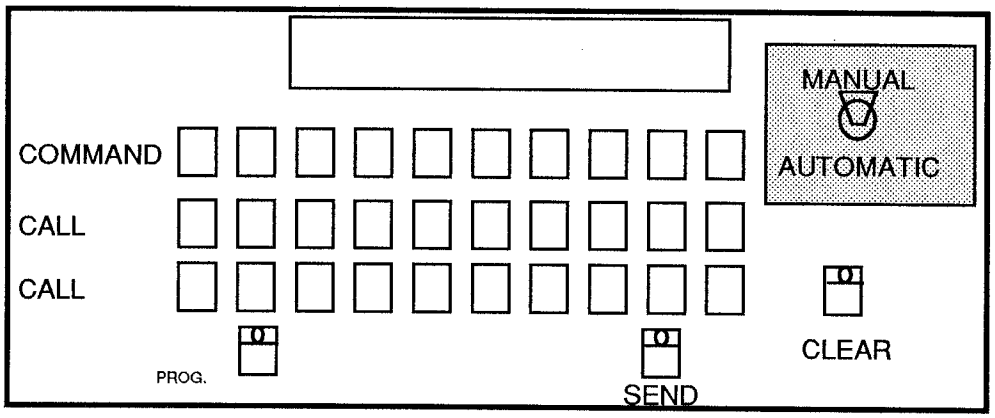


Audio Outputs

Along with all of the standard DTMF tones that can be programmed into the Encoder, the Encoder can also contain Pauses to keep the encoder in the SENDing mode but not actually transmitting codes. Your programmer also has the ability to make the Encoder "Beep" on command. They may use this to provide an audible 'Prompt', to indicate to you when you should do something special, (eg. throw a switch, key your microphone, etc.) without having to keep a close eye on the Encoder. Your programmer will provide you with more information on where and why these special prompts are used.

Manual Mode

Place the MODE switch, which is to the right of the display screen, into the MANUAL Mode. Note the color of the words MANUAL. Any information printed on the front panel with the same color is used only when the switch is in this position.



Whenever you want the Encoder to Stop what it is doing and Clear the MANUAL Mode screen, or to just Clear the screen, press the key labeled CLEAR.

To send a MANUAL code, use the COMMAND & CALL keys with the information printed in blue above them on the panel. The Manual keys on the COMMAND line are the numbers 0 to 9.

On the first CALL line are the DTMF digits A,B,C,D,#, and *. These two lines comprise the extended DTMF 16 digit code. In addition to these if you look to the right of the * code you will see the letter P. This stands for PAUSE.

Each time you enter the PAUSE key a letter P will be added to the screen and when transmitted it will suspend SENDing the code for 1/2 second each time it comes to one. During this pause the transmitter will remain SENDing, but no information will be going out.

The PAUSE feature is used when you want to wait a few moments before continuing SENDing code, (eg. you want to give the equipment in the field a chance to come on line before continuing, or allow someone time to perform a function before sending them more information). It may also be used to delay the first code from going out for a few moments to allow a transmitter to come up to power. Each code is already delayed for a 1/2 second just for this purpose but you might want to extend it even longer.

The reason for the four dark boxes on the first line of the screen is that the encoder has a 16 digit maximum length in the MANUAL Mode. The screen itself can display 20 characters. So the last four positions are blanked off as unusable so you can easily see how many digits you have to go. Any keys pressed after reaching the dark boxes are ignored. The encoder will only send what you can see on the screen.

Entering a Code

Using the keys that we outlined above, you enter your DTMF code. When the code in the display is what you want to transmit then press the SEND key.

The red SEND light will glow while the code is being sent, and will go out after all of the codes have been sent.

After SENDing the code, that code will remain visible in the display.

You may now...

* Send the Code again by pressing the SEND key.
* Add more Codes to the line (up to 16 total) and SEND the whole code (what you see, is what goes out).
* Press the CLEAR key to clear out the code from the display.
* Switch to AUTOMATIC Mode which CLEARS the Manual Codes from temporary memory, and gives you the READY _ screen.
* Leave the unit as it is; this will allow the Code that is in the display to be sent at any time by simply pressing the SEND key.

FUNCTION SETTINGS

1. Press & Hold the Prog. key while you toggle the CLEAR key.
2. Press the Prog. key 5 times.
3. Enter the Mark time.
4. Enter the Space time.
5. Enter the Interkey time.
6. Verify entries on line 1 of screen. They read Mark, Space, Interkey.
7. Press Prog. to return to the Ready screen.

DETAILED FUNCTION ENTRY PROCEDURES

When you send a DTMF code, you are sending audible tones. Each of the sixteen DTMF characters (0-9, A, B, C, D, #, & *) has its own special tone.

For the receiver that you are calling to be able to correctly understand and decode the tones, we must have a Space between each of the tones.

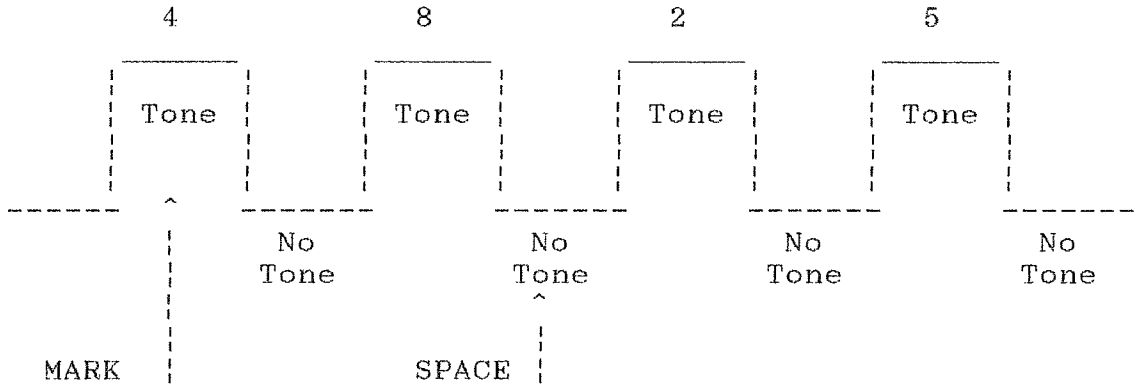
This is where we come up with the phrase Mark and Space.

A Mark is the length of time that each DTMF tone is actually transmitted.

A Space is the length of time between each Mark in the Code.

As an example let's send the code 4825

The receiver would see the Code as...



Each tone MUST have a duration long enough to allow the receiver time enough to decode it, plus there must be enough Space between the tones so that the decoder can understand that one code is ending and another is begining.

The Mark & Space timing also determine the speed that the code is sent out. If the Mark is 50 Milli-seconds (msec), and the Space is also 50 msecs, then it takes 100 msec for one digit to be completely sent. This is because a complete DTMF digit consists of the Mark tone plus the Space.

If we are sending 1 digit every 100 msec (1/10 of a second), this means that our speed is 10 digits per second. This is a standard way to refer to the speed, and 10 digits per second (dps) is one of the more common speeds.

The formula for computing the speed is ...

$$dps = \frac{1000}{(Mark + Space)}$$

If our Mark speed is 40 msec, and our Space is 30 msec ...

dps = 1000 / (40 + 30)

dps = 1000 / 70

dps = 14.2857

dps = 14.2

You might have noticed that the Mark and the Space timing were different.

Mark = 40 msec

Space = 30 msec

Each manufacturer's DTMF decoders are different in their timing requirements, and unless a Space time is given in their specifications, you will probably want to make the Space the same duration as the Mark.

To figure the timing needed, the formula is ...

$$\text{Timing} = \frac{1000 \,/\, \text{dps}}{2}$$

As an example, if the DTMF decoder was specified as having a 16 dps decode rate, we would figure our timing as follows ...

Timing = (1000 / 16) / 2

Timing = 62.5 / 2

Timing = 31.25

This means that our Mark & our Space timing would each be 31 msec. The Encoder can be programmed in 10 msec increments from 10 msec to 90 msec, so unless actual tests indicate a faster speed can be handled by the decoder, you will want to go to the next higher rate, which in this case would be 40 msec Mark and 40 msec Space.

(In instances where even a 90 msec Mark & a 90 msec Space are too fast for the decoder, the DTMF characters A, B, C, D, #, & * may be used in the Mark & Space timing. Their speeds are as follows ...

A = 100 msec B = 110 msec C = 120 msec D = 130 msec

= 140 msec * = 150 msec)

INTERKEY TIMING

When we send several CALL Codes at one time in the Automatic Mode, we have the option of instructing the Encoder to wait for a set period of time between each of the codes.

Example, if the decoders we are using need 2 seconds after receiving a code, to give them time to reset themselves for another code. We can have the encoder wait 2 seconds after each of the selected codes are sent, before it sends the next.

Let's assume that the Interkey is set at 2 seconds.

If we select CALL keys A, D, & G, along with COMMAND 1, and SEND them the encoder will perform like this ...

1. Key transmitter for 1/2 second (standard key up time).
2. Send CALL & COMMAND for key A.
3. Wait 2 seconds.
4. Send CALL & COMMAND for key D.
5. Wait 2 seconds.
6. Send CALL & COMMAND for key G.
7. Wait 2 seconds.
8. Unkey transmitter, return you to Ready screen.

The Interkey timing can be set from .5 seconds to 7.5 seconds. The timing is .5 times the key that you enter, so if you press 6 for the Interkey, the timing will be 3 seconds (6 x .5).

The other characters A, B, C, D, #,& * may also be used with the following results.

A = 5 sec B = 5.5 sec C = 6 sec D = 6.5 sec

= 7 sec * = 7.5 sec

PUTTING IT ALL TOGETHER

Let's enter a Mark, Space & Interkey timing right now.

We will use a ...

50 msec Mark

40 msec Space

3 second Interkey

The screen should look like figure 1.

Fig. 1

Now Press & Hold the Prog. key while you toggle the CLEAR key.

The screen should now look like figure 2.

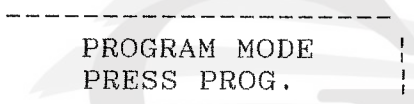


Fig. 2

Press the Prog. key, and the screen should look like figure 3.

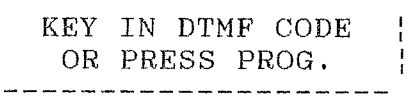


Fig. 3

Press the Prog. key and the screen should look like figure 4.

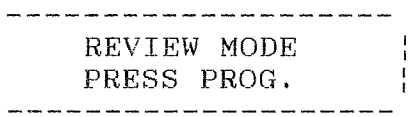


Fig. 4

Press the Prog. key and the screen should look like figure 5.

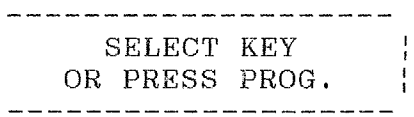


Fig. 5

Press the Prog. key and the screen should look like figure 6.

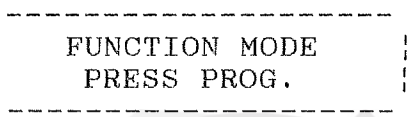


Fig. 6

Press the Prog. key and the screen should look like figure 7.

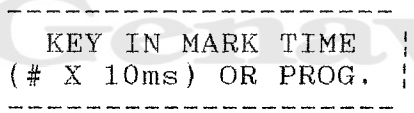


Fig. 7

We now enter our Mark time of 40 msec. The encoder will multiply the number we enter times 10 msec.

Press the number 4.

This enters 40 as our Mark timing and gives us figure 8.

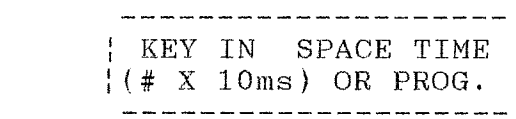


Fig. 8

We now enter our Space time of 30 msec. The Encoder will multiply the number that we enter times 10 msec.

Press the number 3.

This enters 30 msec as our space timing, and gives us figure 9.

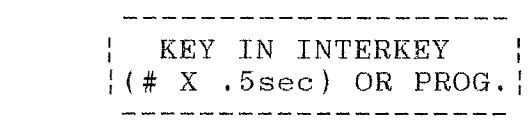


Fig. 9

We now enter our Interkey timing of 3 seconds. The encoder will multiply the number that we enter by .5 seconds.

As we want to have a 3 second Interkey timing, we will enter a 6 into the Encoder.

Press the number 6.

The screen should now change to figure 10.

Fig. 10

This displays the information that we have just entered.

On line one, the 4 is the number that we entered for our Mark timing of 40 msec.

The 3 is the number that we entered for our Space timing of 30 msec.

And the 6 is the number that we entered to get our 3 second Interkey timing (6 x .5 second).

Now press the Prog. key and we will be back to our Ready screen as shown in figure 11.

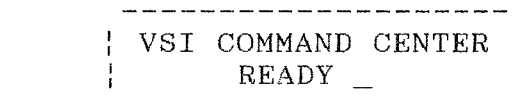


Fig. 10

We have now reprogrammed the Function Settings of the Encoder.

You may go back & change them at any time. When you enter new values the old ones are erased from the memory. Even without power, the values are remembered.

In figures 7, 8, & 9 you will notice that you may PRESS PROG. to by-pass the entry.

This means that if you do not want to change what is in the memory for the Mark, Space or Interkey, press the Prog. key instead of entering a number.

The Encoder will not change the value of the item, and will instead skip to the next screen.

By using the Prog. key in this manner, you may go back & review the values of the Mark, Space & Interkey at any time, without having to change the values.

To do this, follow the above directions to get to the screen in figure 12.

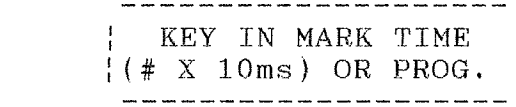


Fig. 12

Now press Prog. instead of entering a number.

You will get a screen like figure 13.

```
 --------------------
| KEY IN  SPACE TIME |
|(# X 10ms) OR PROG. |
 --------------------
```

Fig. 13

Again, press Prog. instead of a number. You will have Figure 14.

```
 --------------------
|  KEY IN INTERKEY   |
|(# X .5sec) OR PROG.|
 --------------------
```

Fig. 14

Press Prog. once again and you will have the Screen as in figure 15.

```
 --------------------
|436                 |
| PLEASE PRESS PROG. |
 --------------------
```

Fig. 15

You can now review the information the Encoder has in it's memory.

Press the Prog. key once again to take you back to the Ready screen, and you are ready to send codes.

To recap ...

1. Press & Hold the Prog. key while you toggle the CLEAR key.
2. Press the Prog. key 5 times.
3. Enter the Mark time.
4. Enter the Space time.
5. Enter the Interkey time.
6. Verify entries on line 1 of screen. They read Mark, Space, Interkey.
7. Press Prog. to return to the Ready screen.

PROGRAMMING THE MODEL 5700
DTMF ENCODER

Before you can program the 5700 Encoder you must make sure that the programming jumper is in place on the back of the printed circuit board of the keyboard. This is a shorting jumper that can be removed after programming to prevent inadvertent reprogramming of the Memory Chip.

A few things to remember...

Each one of the CALL & COMMAND keys can store up to 16 characters in it's memory.

A character is any number 0 to 9, DTMF codes A,B,C,D,#,*, the P for pause, i (small i) for Insert Command, and b (small b) for Beep.

If you have troubles while programming, pressing the CLEAR key will return you to the "READY _" or "MANUAL MODE" display, depending on which one you started from.

To Enter Codes

1. Press & hold Prog. while you toggle the CLEAR key.
2. Enter the DTMF Code.
3. Press Prog.
4. Press the key where you want the DTMF code stored to.
5. Verify retrieved Code on the screen.
6. Press Prog.
7. Continue entering codes; press CLEAR or Prog. when done.

DETAILED CODE ENTRY PROCEDURES

To get into the Program Mode, press and hold the Prog. key while you press and release the CLEAR key, then release the Prog. key. The display should now look like figure 1.

```
┌──────────────────────┐
│    PROGRAM MODE      │
│    PRESS  PROG.      │
└──────────────────────┘
```

Fig 1

Now press the Prog. key. The screen will now look like figure 2.

```
 ----------------------
|  KEY IN DTMF CODE    |
|   OR PRESS PROG.     |
 ----------------------
```

Fig. 2

If we were going to proceed past the Code Enter part of the program we would press the Prog. key.

But we want to enter a DTMF code and store it to a certain key. To do this, just start to "KEY IN" your DTMF code. As an example let's use the code 342874.

As soon as you press the first character 3, you will see the screen change to figure 3.

```
 ----------------------
|3_                    |
|CODE>PROG.>LOCATION   |
 ----------------------
```

Fig. 3

The first line shows you the characters you have thus far entered (the number 3).

The second line shows the sequence for entering a DTMF code into memory.

* You will enter the CODE, up to 16 characters long.

* Press the PROG. key.

* Then press the key that you want to store this code into, it may be either a CALL or a COMMAND key.

Let's continue on and enter the rest of our CODE; press the keys 42874. After you press each key the number will show up on the screen and the cursor will move over one place.

The screen should now look like figure 4.

```
 ----------------------
|342874_               |
|CODE>PROG.>LOCATION   |
 ----------------------
```

Fig. 4

We verify the number that you entered and then press the Prog. key. The display will not change it's appearance.

We now store the code to a particular key; let's use key E as the Code LOCATION. Press the CALL key labeled E.

The Encoder will now store the code 342874 into a memory location that can be retrieved by the CALL key E. After it is stored to this location, the Encoder goes back to this memory location and retrieves the number just like it does when you send the code out, but instead of transmitting it, the code is displayed on the screen as in figure 5.

```
----------------------
|E=342874_       _____|
| PLEASE PRESS PROG.  |
----------------------
```

Fig. 5

You must examine this display and verify the Code, as this is the code that the Encoder will send when you press the coresponding CALL or COMMAND key.

Now press the Prog. key and we will be back to the beginning of the Code Enter section, ready to enter another code. The screen should look like figure 6.

```
----------------------
|  KEY IN DTMF CODE   |
|   OR PRESS PROG.    |
----------------------
```

Fig. 6

Let's take the level of programming a little higher. We will first enter some codes into the COMMAND keys.

* Press the number 1

* Press the Prog. key.

* Press the COMMAND key 1

We have just entered the DTMF Code 1 into COMMAND key #1. The display should look like figure 7.

```
----------------------
|1=1_                 |
| PLEASE PRESS PROG.  |
----------------------
```

Fig. 7

Press the Prog. key and you will be ready to enter some more codes.

Enter the following codes into their listed locations.

CODE	LOCATION	
2	2	
1752650	3	
9PPPPPP	7	(use the CALL key G to
9bPPPPP	8	get the P Code).

After you enter each code, verify it as it comes back on the screen from memory, as in figure 5.

If you make a mistake, use the CLEAR key to leave this program, then reenter the Program mode and start from the point where the mistake was made.

We now have a variety of codes in the COMMAND keys, but we do not yet have any CALL keys that are instructed to look at the COMMAND line and Insert the COMMAND Code.

To allow a CALL key to use the information in the selected COMMAND key, we add the character i (small i) in the CALL code; this instructs the Encoder to stop sending the CALL code, then jump up and send the COMMAND code. Upon reaching the end of the command code it jumps back down and continues sending the CALL code from where it left off.

Let's enter one right now.

* Enter the code 7325i39 (use the CALL key H to get the i Code labeled above).
* Press the Prog. key
* Press the CALL key B

The screen should look like figure 8.

```
 --------------------
|B=7325i39_          |
| PLEASE PRESS PROG. |
 --------------------
```

Fig. 8

We have instructed the Encoder that when CALL key B is sent, it is to send the characters 7325, then send the code from the selected COMMAND key, then to come back and send the final characters of 39.

If we select COMMAND key 2 along with CALL key B when we SEND a code, the resulting code would be 7325239.

Or if COMMAND key 3 had been selected instead, the code that was sent would have been 73251752650.

As you can see, using the Insert Command (i) function, we can make one CALL key represent up to 10 different codes.

Using the CALL keys with the different COMMAND keys allows us up to 200 different codes to be sent using only 30 keys.

And as a CALL key can contain nothing but Insert Command functions, we can send up to 256 characters using only two keys.

And just for the fun of working numbers, taking this 256 characters times the 20 CALL keys, we could send 5120 characters at one SEND! But enough fun and games, back to work now.

Let's go to the run mode and see what we have accomplished.

Press the CLEAR key, this will get us out of the Program Mode.

Make sure that the Mode Switch is in the AUTOMATIC Mode.

Make sure that the Encoder is not hooked up to any transmitting equipment, as we will be using the unit the exact same way as the operator would to transmit codes.

To recap, we have programmed the Encoder in the following manner.

LOCATION	CODE
1	1
2	2
3	1752650
7	9PPPPPP
8	9bPPPPP
B	7325i39
E	342874

Press the CALL key E, and SEND.

Note as the Code in CALL key E did not contain the Insert Command character i, we did not need to give the encoder a COMMAND key.

Now press the CALL key B, and SEND

As you can see, the Code for CALL key B was scanned and found to have an Insert Command character imbedded in it, so before it started sending the code the Encoder looked for the selected COMMAND code, but there was none selected, so the encoder halted operation and gave us figure 9.

Fig. 9

This is exactly what would happen to the operator if they forgot to enter a COMMAND, when one is needed.

To continue, select COMMAND 1, then press SEND. Now that you gave it a COMMAND to Insert into the CALL code, the Encoder sent the entire code without difficulty.

Now let's send another code.

SEND CALL B and COMMAND 7.

Note that the SEND light stays on for an extended time.

This is because COMMAND code 7 is 9PPPPPP. Each P instructs the Encoder to wait 1/2 second before sending the next character. With 6 of these Pauses in sequence, the Encoder will Pause 3 seconds (6 x .5sec) before continuing.

SEND CALL B and COMMAND 8

Note that just before the Pauses, the Encoder gave us three quick "Beeps". You may use these in either a CALL or a COMMAND key code, to inform the operator that some action is going on or to prompt the operator to perform some function on their own (eg. key a microphone and give a message, switch channels, etc.).

If you do take advantage of this feature, make sure that you instruct all operators of the Encoder exactly what the Beep means, and what to do.

You can now go back in and reprogram the keys that we have just worked with, but using your own CALL & COMMAND Codes.

A Few Suggestions ...

* Work out your Codes on paper before Programming any.

  You get a better view and can often streamline and enhance the codes as you work them out.

* If you have an incorrect code in the display before you enter it into a LOCATION. You can ...

  Press CLEAR, then reenter the Program Mode.

  Enter it into LOCATION that you were going to, then come right back and reenter a correct code into the same LOCATION.

* If you see the Code Incorrect after you have entered it into a location. Just reenter a corrected code into the same Location.

* The Memory Chip can be 'written' to tens of thousands of times, and can be read from millions of times from each separate location.

  * It will retain the information, even without power, for 100 years.

* You can not enter the Insert Command (i) character into a COMMAND key.

  If you were able to do this a COMMAND key would keep calling itself, and would stay in a continuous loop.

  If you do try to store the Insert Command Code to a COMMAND key the Encoder will show you figure 10.

```
 --------------------
|  CAN NOT ENTER AN  |
|"I/C" INTO KEYS 0-9 |
 --------------------
```

Fig. 10

You then press the Prog. key and reenter the correct Code.

To Enter Codes

1. Press & Hold Prog. while you toggle the CLEAR key.
2. Enter the DTMF Code.
3. Press Prog.
4. Press the key where you want the DTMF code stored to.
5. Verify retrieved Code on the screen.
6. Press Prog.
7. Continue entering codes, Press CLEAR or Prog. when done.

REVIEWING WHAT'S STORED IN MEMORY

1. Press & Hold the Prog. key while you Toggle the CLEAR key.

2. Press the Prog. key again.

3. Press the Prog. key again.

4. Select & press the CALL or COMMAND key you want to review.

5. After you verify the code, press the Prog. key.

6. You may now review another key, or Press CLEAR to exit,
   or press the Prog. key to continue to the next section.

If you want to change an existing code in either a COMMAND or CALL key, note the key that you want to enter it into and the new code.

After you are through Reviewing, press the CLEAR key. This will get you back to the Ready screen.

At this point you may reenter the program mode and enter your new DTMF code over the existing code for any of the keys.

It does not matter if your new code is shorter in length than the one that you are over-writing. The Model 5700 Encoder automatically erases all of the old code before it enters your new code into the key.

After you are through reviewing you may press the CLEAR key to get back to the Ready screen, or press Prog. to continue on to the Function section.

Again, to Review ...

1. Press & Hold the Prog. key while you Toggle the CLEAR key.

2. Press the Prog. key again.

3. Press the Prog. key again.

4. Select & press the CALL or COMMAND key you want to review.

5. After you verify the code, press the Prog. key.

6. You may now review another key, or Press CLEAR to exit,
   or press the Prog. key to continue to the next section.

Keyboard

The 5700 Encoder keyboard consists of 31 pushbutton momentary keys that are scanned by IC U1 which is a 16 key keyboard scanner that outputs the decoded key onto data lines D0 to D3. IC U2 in association with CR1,CR2,CR3, & CR4 doubles the size of U1 to 32 keys by giving an output on the D4 data line when a key with a value higher than 15 is depressed.

Capacitor C1 on U1 establishes the keyboard scan rate, while capacitor C2 provides a timing period to prevent multiple outputs from key contact bounce.

When a key is depressed the DA line goes high, and the decoded data is placed on the data lines. Both these conditions are present until the key is released. During the active period the computer section receives the DA output and latches it into its internal memory.

Switch SW32 is not matrixed through U1, this is the CLEAR switch that provides a Hard Reset to the computer. Upon depressing SW32 a ground is established to JP1-6, and to the cathode of D2 which is intergal to SW32. This ground potential gives the computer the Reset signal and also turns on the LED which is housed in SW32.

D1 is another intergal LED housed in SW31. SW31 is used as the SEND key. D1 illuminates whenever the K1 relay on the Computer Board is enabled to indicate that the Encoder is "On Line" with the transmitter.

JP2 is the Mode Select jumper; when JP2 is shorted the 5700 Encoder goes into the Manual (Store & Forward) mode. While in the open state the 5700 is in the Automatic Mode. JP2 is normally hooked up to a SPDT toggle switch that allows the user to select the operating mode. However, in some situations this switch may be removed and a jumper installed, or left open to prevent the operator from accessing the alternate mode.

JP3 is a removable shorting jumper. With the jumper in place switch SW30 (Prog.) is scanned by U1 as with the other keys. This allows the user to access the Program mode to Review, Add or Change information contained in memory. When the shorting jumper is removed, SW30 can no longer be scanned for operation by U1, which effectively disables the Program mode from operation until the shorting jumper is replaced.

SW30 is ONLY used for Programming operations, the key is not used for any Automatic or Manual Mode functions, so removing the jumper after programming will not affect any other functions besides eliminating the programming option.

Voltage Regulation

Voltage is applied to terminals 1 & 2 of the backpanel terminal strip TS1, by either a wall transformer power pack or user supplied voltage not to exceed 12v dc. The positive terminal is #1 which passes through fuse F1 for circuit protection. Voltage surge protector VR1 is immediately after F1, and is designed to act to clamp transient voltages with a response time of 50nsec. Bridge rectifier CR1 prevents damage to the computer due to inadvertent power hookup, and also acts as another impedance to any voltage transients or surges. C13 & C9 provide pre-filtering of the power for U5 while C10 & C11 provide filtering for the +5 vdc appearing at the output of U5 which provides all of the power for the entire 5700 Encoder.

U1 is a micro-computer on a single chip. It is equipped with seven individual I/O ports, Programmable Read Only Memory (PROM), and on board timers.

U2 is an Electrically Eraseable Programmable Read Only Memory that holds all of the User Programmable information. It communicates with U1 in a serial manner on data lines on Port 2.

U3 is a Dual Tone Multiple Frequency single chip encoder, with binary input. It operates from a 3.58 MHz crystal, and receives its operating instructions from U1 over data lines on Port 7.

U4 is a low voltage audio amplifier that boosts the audio from the DTMF IC U3. This audio then passes through R14 for level control and T1 for further level control and isolation.

LCD1 is a 2 line by 20 character LCD display that is controlled by U1 via Ports 1 & 4. It provides feedback and prompts to the user to indicate status of the 5700.

BZ1 is a piezo electric buzzer that may be programmed to operate while the 5700 is in the Automatic Mode. It is usually used to give the operator an indication that a code has been transmitted and that they should now perform another task (eg change channels, enter another code, give voice message, etc.).

Detailed

On power up or a CLEAR the 5700 micro-computer U1 goes through a group of housekeeping functions to initialize ports and the LCD1. It presents the Ready Message on line 2 of LCD1 and an optional message on line 1 of LCD2. The line 1 message is factory programmable to customer specifications.

During housekeeping, U1 checks the status of SW30 on the keyboard. If SW30 is depressed the 5700 goes into the Program Mode. If SW30 is open, the 5700 continues with houeskeeping and then proceeds to a wait state where it looks for a positive edge at Port 50, the high level signal comes from the keyboard and signals that Data is Available for processing. This signal also provides a forward bias condition through D1 & R3 which causes D1 to 'light' when DA is high. D1 is used as a troubleshooting aid to indicate the operating status of the keyboard & computer boards. Pressing each key SW0 - SW31 should give an indication on D1 as they are pressed. Note, JP3 on the Keyboard must be installed to allow SW30 to give an indication.

Upon receipt of a valid key, U1 latches the information into memory and changes the display to show the user which key has been pressed.

Keys 0-9 (Command Keys) are shown on line 1 of LCD1, these keys are software interlocked so only the last key pressed is displayed and acted upon. Each key 0-9 has a standard wording of "COMMAND X" associated with it. The "X" is filled in with the key number that was pressed. The COMMAND wording is accessed when the shorting jumper JP4 is removed.

When JP4 is installed, Keys 0-9 will have access to a completely different set of words. These words are 10 characters maximum, and are programmed at the factory to the user specifications for an extra charge.

Keys 10-29 are labeled A - T, and as a key is pressed a corresponding character is turned on on line 2 of LCD1, to show that the information contained in the keys memory will be used when the SEND key is pressed.

The CALL keys of 10 - 29 are individual, and will toggle on and off as they are pressed.

After you have selected CALL & COMMAND keys, the SEND key is pressed. U1 now shuts down further keyboard inputs until it is through transmitting all of the codes, or until an input error is found.

U1 pulls in relay K1 which also acts as a buffer/driver, for .5 seconds. At the end of this pre-transmit delay, it scans its memory for the first code that the user wants to send (eg. user pressed Call Key C). It then checks the code for the key, if the code has an Insert Command code imbedded in it, it then checks to make sure that a Command key has also been pressed. If the user failed to press a Command key when one was needed, the 5700 stops and prompts the user to enter a Command before the code can be sent. The user must then enter a Command key and press SEND to continue the process.

The 5700 continues down sending all of the Call keys pressed, checking each one for inbedded Insert Command codes, and verifying a Command Code is available if required, before sending the code.

Each key code is separated by a programmable time interval from 0 seconds to 7.5 seconds. During this time the 5700 still is maintaining control of the transmitter which it holds in the keyed mode by keeping K1 closed. See the Programming Manual for more information on the Interval timing.

Each DTMF character tone is transmitted for a set period with with a quiet time period after each tone. This is the Mark & Space timing that are both user programmable. See the Programming Manual for more information on the Mark & Space.

U1 transmits a DTMF character by placing the information on Port 7 that connects to U3, and then taking P74 high for the duration of the Mark timing.

While P74 is high, U3 places the DTMF tones on Pin 16. These are sent to U4 which amplifies them and acts as buffer for the U3 IC. R12 & C3 are used to set the amplifier gain, as well as provide feedback for frequency equalization. After they are amplified by U4, the tones go to deviation control R14 which is across the primary of T1.

T1 acts as an isolation transformer, and when JP5 is connected to the LOW position, also acts as a step-down transformer to reduce the primary input voltage by 1/2. This allows for a finer adjustment of R14 for eaiser deviation adjustments.

T1 secondary connects to TS1-10 and to the N.O. side of pole 1 of K1. The Common pole connects to TS1-9, while the N.C. pole connects to TS1-8. The user may use TS1-8 & TS1-9 as a microphone feed-through, this allows normal microphone operation until the SEND key on the 5700 is pressed, this would then open the audio path for the user microphone during the SEND time, so as to not allow any backround audio to corrupt the DTMF signals.

Pole 2 of K1 provides dry contacts for transmitter keying or other purposes with TS1-4 Common, TS1-5 N.C., and TS1-6 N.O.

CR3 across the coil of K1 clips reverse voltages produced by the collapsing magnetic field when K1 is released.

R6 is a trimmer resistor that controls the intensity of the LCD1 display.

When the CLEAR key is pressed and released, U1-6 is pulled to ground and C8 is discharged. C8 then begins charging through RP1-4. C8 & RP1-4 act as an RC timer to allow U1 to proceed with several machine timing cycles before U1-6 reaches a logic 1 level. This process allows for U1 to initialize itself in a logical and complete manner before receiving any program instructions.

MANUAL MODE

Manual Mode is selected by pulling U1-25 low (usually through a front panel toggle switch). This initializes a jump to the Manual Mode program.

Manual Mode is indicated by line 2 of the LCD1 displaying "MANUAL MODE". The user now may use the 5700 as a Store & Forward DTMF encoder.

Keys 0-9 and A-D will output the corresponding individual DTMF characters associated with them. Call key E will output an # character, Call key F outputs a * character, and Call key G now provides a .5 second interword Pause each time it is pressed and the P character appears on line 1 of LCD1.

All other Call keys H - T do not have any function in the Manual Mode and are ignored by U1. The SEND and CANCEL keys have the same function as in the Automatic Mode.

The user enters the desired code using the keys outlined above, and presses the SEND key after verifying the DTMF code present in LCD1.

The DTMF code is now transmitted after the .5 second pre-transmit delay. All Mark & Space timing uses the same user programmable values that are in memory and that are used in the Automatic Mode.

After transmitting, the 5700 retains the code in memory and in the display. This may now be retransmitted as it is shown, increased in length and retransmitted in its entirety, cleared out by pressing the CLEAR key, or left alone to be retransmitted at a later time.

Lifting U1-25 from ground, will switch the program back to the Automatic Mode. With this change the registers in U1 are altered so that upon returning to the Manual Mode, the previous data will be cleared out and you will start with a clear display.

The 5700 is divided into three separate modules to facilitate repair. There are the Keyboard, the Computer board and the Liquid Crystal Display modules. Each is connected via a ribbon cable and attached to its mounting surface with nuts and/or screws.

IMPORTANT NOTE

ALL THREE OF THE MODULES CONTAIN COMPLEMENTARY METAL OXIDE SEMICONDUCTORS (CMOS) COMPONENTS.

CMOS COMPONENTS ARE VERY FAST, AND CONSUME VERY LOW POWER.

* * * BUT * * *

CMOS IC'S ARE ALSO STATIC SENSITIVE

This is not a problem when the IC's are soldered into the circuit board, as the circuits have been designed with this side effect in mind.

However, when the chip is not soldered into a circuit, or not in a conductive foam pad that keeps all of the pins at the same potential, some bad things can happen in the way of damaged components, unless you take some precautions.

If at all possible use a conductive work pad with a conductive wrist strap; the pad puts you near the same potential as the board and parts. Small field pad kits can be purchased for less than $100.00 and can save many times that amount in reducing static damaged equipment. Other precautions may include static dissipating soldering and desoldering equipment, anti-static carpet spray, and even simple things such as an air humidifier to reduce static build-up, or requesting that others not touch you or the parts when you are working on the equipment.

We are not trying to discourage you from working on the equipment, on the contary, we are just giving a little advice so you can make any necessary repairs in a faster, and more confident manner.

KEYBOARD

PROBLEM - Possible key bad.

SERVICE - Check the Ribbon cable between the keyboard and the computer board to make sure that there is a good solid connection. If that checks out ok, then press the key while observing the LED D1 on the computer board. If LED lights and stays lit while you hold the key (except for SW32) then the key is being scanned & decoded.

If D1 does not light, disconnect power from the 5700 and test the key with an Ohm Meter. It should show 0 ohms when the key is depressed, while in the non-depressed state the meter should indicate infinity.

If D1 lights but the display still does not register the information for that key in the display, you will have to check the data lines for correct information. Below you will find a table for the data and its associated key.

KEY	D0	D1	D2	D3	D4	KEY	D0	D1	D2	D3	D4
0	0	0	0	0	0	1	1	0	0	0	0
2	0	1	0	0	0	3	1	1	0	0	0
4	0	0	1	0	0	5	1	0	1	0	0
6	0	1	1	0	0	7	1	1	1	0	0
8	0	0	0	1	0	9	1	0	0	1	0
10	0	1	0	1	0	11	1	1	0	1	0
12	0	0	1	1	0	13	1	0	1	1	0
14	0	1	1	1	0	15	1	1	1	1	0
16	0	0	0	0	1	17	1	0	0	0	1
18	0	1	0	0	1	19	1	1	0	0	1
20	0	0	1	0	1	21	1	0	1	0	1
22	0	1	1	0	1	23	1	1	1	0	1
24	0	0	0	1	1	25	1	0	0	1	1
26	0	1	0	1	1	27	1	1	0	1	1
28	0	0	1	1	1	29	1	0	1	1	1
30	0	1	1	1	1	31	1	1	1	1	1

0 = 0 volts 1 = 5 volts

If the data is incorrect on data lines 0-3 then the problem is most likely with U1.

If the data is incorrect on D4 then the problem is with U2, or with its pull-up resistor pack of RP1 or the diodes of CR1-CR4.

If data lines D0 - D4 all contain the correct information, but the key still doesn't register, then the problem is located on the computer board.

DISPLAY

The display module is a self contained, self refreshing LCD module. If the display is on but not showing complete characters, reset the computer by pressing the CLEAR key. As you do this observe the display; if the display shows complete characters during the initial housekeeping, then the problem is most likely located on the computer board.

If the display is either blank, or has only small parts of the display showing, and does not clear itself after a reset, the problem is most likely in the display itself, which does not contain any field or factory replaceable components. The display must be replaced as a whole unit.

COMPUTER BOARD

Check all connections from the ribbon cables, checking for tight connections and correct orientation with the marked #1 cable in the correct #1 socket.

Also make sure that the ribbon cable for the keyboard is not going to the socket for the display and display cable to the keyboard socket.

If F1 is blown and the unit continues to blow fuses when replaced, check the Surge Absorber VR1 and the Bridge Rectifier CR1. These two components take the brunt of power surges and may short to ground and stay there in case of a hard hit, like a lightening strike close by.

Make sure that JP3 is in place; JP3 is installed when the Key Switch option is not installed. This allows for convenient switch hook-up in the field at a later date, or to interface to other equipment supplied by the user.

If the encoder works fine in the Manual Mode but not in the Automatic Mode, and the display shows that you are indeed switching between the two modes, then the problem is most likely with either the micro-computer U1 or with the memory chip of U2.

If the screen returns immediately to the Ready or Manual display when you are trying to send a command, or it returns to the Ready display after you try to enter a value into memory, this means that the computer chip U1 is unable to communicate with the memory chip U2. If this occurs, and the rest of the displays look normal and it switches between the operating modes without difficulty, then the problem is most likely with U2.

Audio problems can be readily traced with a high impedance audio amplifier, or more preferable, an oscilliscope.

First go into the program mode and go all the way to the end, there mark down the Mark, Space and Interdigit timing that is shown in the display, (this is so you can reprogram the unit to its original specifications after you have repaired it).

Next reprogram the Mark timing for *, the Space for 0 and just press enter for the Interdigit. We now have the encoder set up to give us longer tones without spaces.

Switch the encoder to Manual and enter a full 16 digits of all the same character. Now all we have to do is to press the SEND key each time to get 3 seconds of tone.

(If you need longer tones you can reprogram one of the CALL keys with all i's, and one of the COMMAND keys with 16 characters all the same; when you send this combination at the speeds that we entered above you will get 50 seconds of tone. Remember to write down the codes of the keys that you are going to use, so you can reenter the original numbers after you are through).

Send the codes you have programmed while checking pin 16 of U3. If you dont get any tones there, but you can hear the relay K1 pulling in, then check Pin 15 of U3 with a scope or voltage meter as you send the codes out. Pin 15 should rise to +5 vdc during the time that the tones are being sent, then go back down to 0 vdc.

If Pin 15 functions normally, then check X1 (note - you can only do this with a high impedance oscilloscope , an RF probe for your volt meter, or a frequency counter); it should be oscillating at all times. If all the above check out OK then its probably U3 that is bad, and should be replaced.

Audio goes out from U3-16, through an RC network for frequency compensation and biasing of U3's output, to U4.

U4 is a low voltage LM386N-1; keep this in mind in case you replace it with other than a factory supplied part. Most supply houses will send you the higher voltage version unless you specify otherwise, and the higher voltage part will not work in the encoder.

U4 amplifies the tones, and the gain is set by C3 & R12. These two also provide for frequency compensation. If you want to change the frequency compensation to make up for excessive telephone line roll-off, transmitter pre-emphasis out of normal range, etc., then you would want to change the values of C3 & R12. Change C3 first, this will usually get enough of a change to satisfy most requirements. If you need even more, then change R12, but watch the output pin U4-5 for distortion or clipping as you do so, because you are also changing the Gain of the amplifier.

If the tones are at pin 3 as you SEND them, and the voltage on pin 1 is at +5 vdc, then the tones should be present on Pin 5. If they are not there, replace U4.

The amplified tones go to the high side of R14, then through the wiper to pin 3 of audio transformer T1. Turn the deviation control all the way clock-wise to make sure that you are sending all the audio out that you can.

If the audio is not present at the high side of R14 then check to make sure that C5 is not open. If the audio is at R14 check the wiper side for audio to see that the wiper is making good connection with the body of R14.

T1 should have a DC resistance of about 62 ohms on the Primary side between pins 1 & 3, and about 52 ohms between the secondary side on pins 4 & 6. Make sure that power is disconnected before making these readings.

Check the shorting jumper on JP5 to make sure that it is in place and making good connection. If you have audio in the Low position but not in the High position, then one section of the Center Tapped transformer secondary is open, and you will have to replace T1.

Check the audio output from the relay by hooking up the ground side of your probe to pin 10 of the rear terminal strip, and then probing the N.O. and Comm. pins of the relay as you send the tones. Tones on the N.O. pin but not on the Comm at any time means the relay is out.

The relay coil DC resistance should be about 400 ohms, and there should be +5 vdc on both coil leads when its NOT transmitting.

When it transmits, U1 puts out a +5 vdc steady signal on pin 31 for the duration of the transmit time. This +5 vdc causes Q1 to forward bias, the current flows through Q1 and the coil of K1 causing K1 to pull in. When the U1 signal drops, Q1 stops conducting, K1 drops out and CR3 clamps the reverse voltage from the coil of K1.

If you suspect the peizo buzzer BZ1 is bad, pull it out of the circuit and using +5 vdc from the computer board power supply, apply voltage and ground to the bottom pins of BZ1 (they are labeled on the bottom of the buzzer, you will see them after you remove it from the board. Do not try to apply power to it while its in the circuit board, you will be forcing the voltage back on U1 which could be damaged by this). If it still doesn't produce sound then it must be replaced. If it produces sound then the problem could be in U1, or it could be with the user programming of the keys; you will want to verify that it was programmed correctly before you replace U1.

After you have repaired the encoder...

* Make sure that you go back and replace any codes that you might have changed, back to their original codes.

* Remove the Prog. jumper if you installed it during repair.

* Place all other jumpers to their original state.

* Check deviation when you place it back into service. (as a reminder, you usually do not use as high of deviation levels for DTMF as you would for Two Tone sequential. Most of the time 2.5 KHz will do just fine. Check the specs. on the receiver if in doubt.)