Assembly Instructions and Tips

The circuit board is designed to fit in place of the front panel of a Radio Shack enclosure, part number 270-1801.

If the Radio Shack enclosure is used, the pushbutton switches may be mounted on the back side of the board. This is the solder side, opposite of where the other components are mounted. This allows the board to be mounted in the box with the components down and the buttons facing up. If this is done, the LED power indicator (LED1), if used, may also be mounted on the solder side as a power indicator.

If the buttons are mounted on the back side, the SP version of the PIC firmware must be programmed. This SP version reverses the switches left to right, but is otherwise functionally identical to the regular firmware. The web page has both versions available.

THERE IS A SMALL ERROR IN THE SILK-SCREENING ON THE BOARD. C1 IS SHOWN AS A .01 MF CAPACITOR. THE VALUE SHOULD BE .33 MF. THE SCHEMATIC AND PARTS LIST SHOW THE CORRECT VALUE.

The 1 megohm resistor (R17) near the resonator is normally not required. Only use it if you experience erratic operation of the device.

The recommended speaker for use with the device is a 150 ohm earpiece from an old "500" type telephone handset. These are the standard handsets used by Western Electric, ITT and other phone manufacturers for decades. See the parts list for sources. Just unscrew the earpiece from an old phone, loosen the two screws, and remove the earpiece. BE SURE TO CLIP OUT THE VARISTOR (A SMALL COMPONENT SOLDERED BETWEEN THE SCREW CONTACTS) OR YOUR TONES WILL BE DISTORTED AND THE BOX WILL NOT WORK RELIABLY!

The box may work with other impedance speakers/earphone elements, with varying volume and hiss. Lower impedances will reduce the effectiveness of the PWM low-pass filter in the circuit, increasing hiss. Speakers vary widely in their efficiency (volume for a given power input), so you may need to experiment. The output power is low to keep the circuit simple.

The box may be connected to an external amplifier for volume control, or to a computer sound card input. If this is done, the output should be connected through a small .33 mf capacitor to block the DC component present when tones are being played.

The box draws 15-20 mA of current when generating tones. Battery life is very good if the unit is always switched off between uses.

If a 6 volt battery is used (a 4LR44/476A/L1325 designed for dog collars works well, as well as 2 CR2032 lithium coin cells wired in series), be sure to populate the diode (D1) on the board and omit the 78L05 (IC2), C1, and C2. The 4LR44 fits into an "N" battery holder, available at Radio Shack, if a small nut is used as a spacer on the negative side.

If a 9 volt rectangular battery is used, populate the 78L05 (IC2), C1, C2 and omit the diode (D1).

Note that you cannot install both D1 and IC2; install one or the other!

If the optional LED power indicator is installed (LED1 and R20), current consumption will increase by an additional 15 milliamps. This will reduce the battery life significantly. This is particularly important if using the 6 volt battery option, as the battery is of lower capacity. You can try a larger resistor for R20 (try 1000 ohms) to reduce LED brightness and current consumption. I like to use a blue or purple UV LED. It's higher voltage drop (3.6 V) reduces the current to around 5 mA when used with the specified 330 ohm series resistor.

Using the Project MF Blue Box

The Project MF Blue Box is a sophisticated little device!

Both MF and DTMF are supported. When initially programmed, the chip defaults to MF mode on powerup. The powerup mode is stored in FLASH memory. This may be temporarily toggled to the opposite mode by holding down the 2600 key while powering up. The next powerup reverts to the default tone mode. The default tone mode may be persistently toggled by holding down the "*" while powering up. This will toggle the tone mode, but also write the new setting to eeprom so subsequent powerups will default to the opposite tone mode. Two tones confirm the write to FLASH memory.

Two tone durations/spacings are supported, 75 ms. (default) and 120 ms. The tone duration/spacing is stored in FLASH memory. The duration/spacing may be permanently toggled by holding down the "#" key at power up. This will toggle the duration/spacing and write the new value to FLASH for subsequent powerups. A tone confirms the write to FLASH. The duration/spacing value is used in manual mode and also in memory playback mode. The KP tone is always 120 ms.duration, regardless of this setting. The 2600 tone duration is always 1.5 seconds.

There are two operating modes, normal and playback. The chip always powers up in normal mode. Operating modes are toggled by holding down the 2600 key for 1 second. Tones confirm the mode change. In normal mode, dialing is manual using the current tone mode and duration settings. In playback mode, each keypad key will play back any stored dialing sequences.

There are 12-32 digit dialing memories, one for each keypad key. On power-up, a playback to normal mode change, or a dialing memory write the chip stores the next 32 key presses in a RAM buffer. At any point, this buffer may be saved to one of the 12 dialing memories by pressing and holding the corresponding key for 2 seconds. (The digit played when initiating a write to the memory will not be saved.) A tone confirms the eeprom write. Memories are cleared by storing to memory immediately after a power-up, mode change from playback to normal, or after a previous dialing memory save. The MF/DTMF tone mode is saved in memory, so the dialing memories may contain a mix of MF and DTMF sequences. If a 2600 tone is saved, a 1.5 second fixed delay will be added after the tone to allow for a wink ack from the trunk. Then, any additional tones will play.

Memory locations may be cleared by pressing and holding the corresponding key in normal mode immediately after the buffer has been cleared at power-up, after a mode change back to normal mode, or after storing a digit sequence.

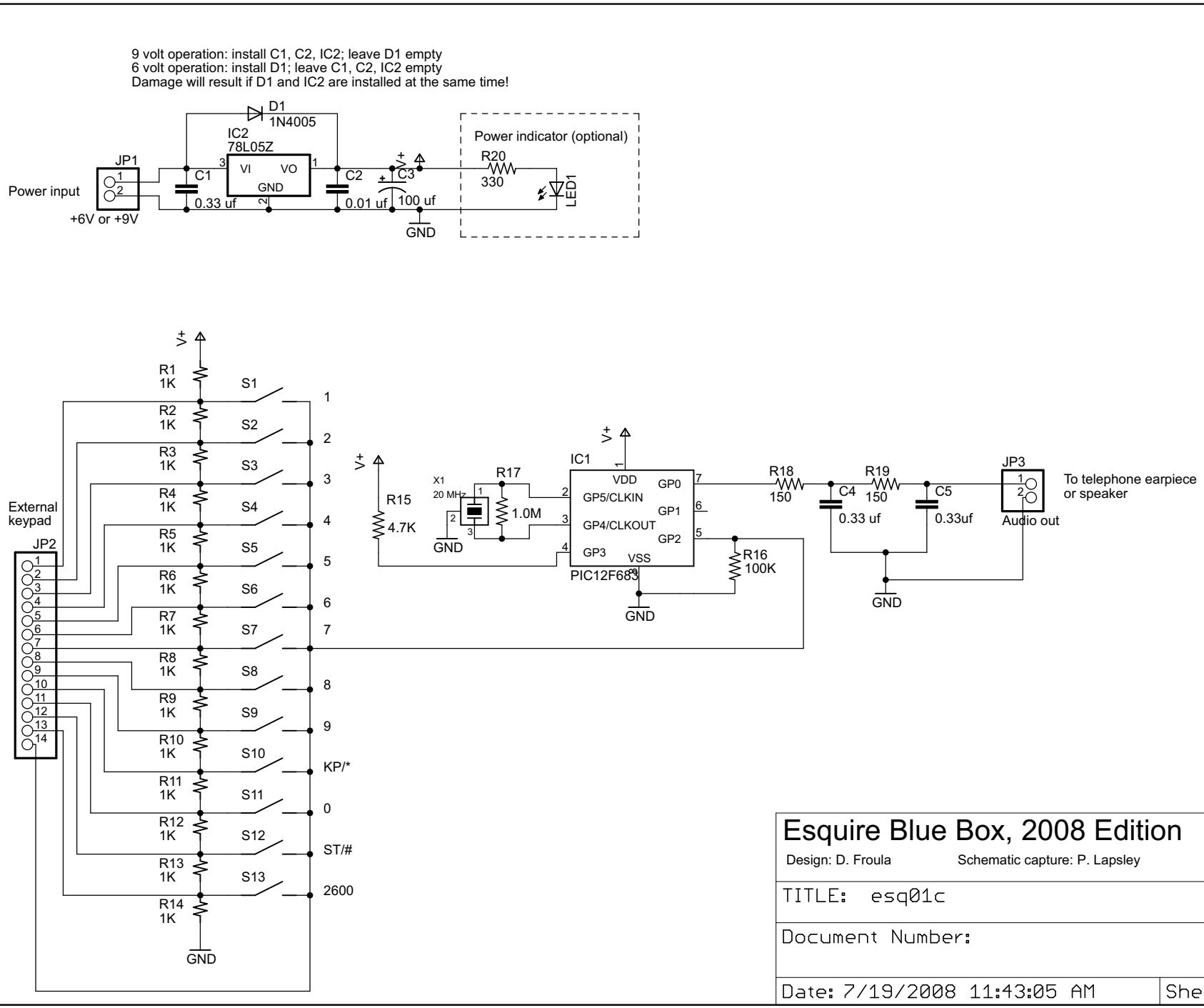
Short instructions:

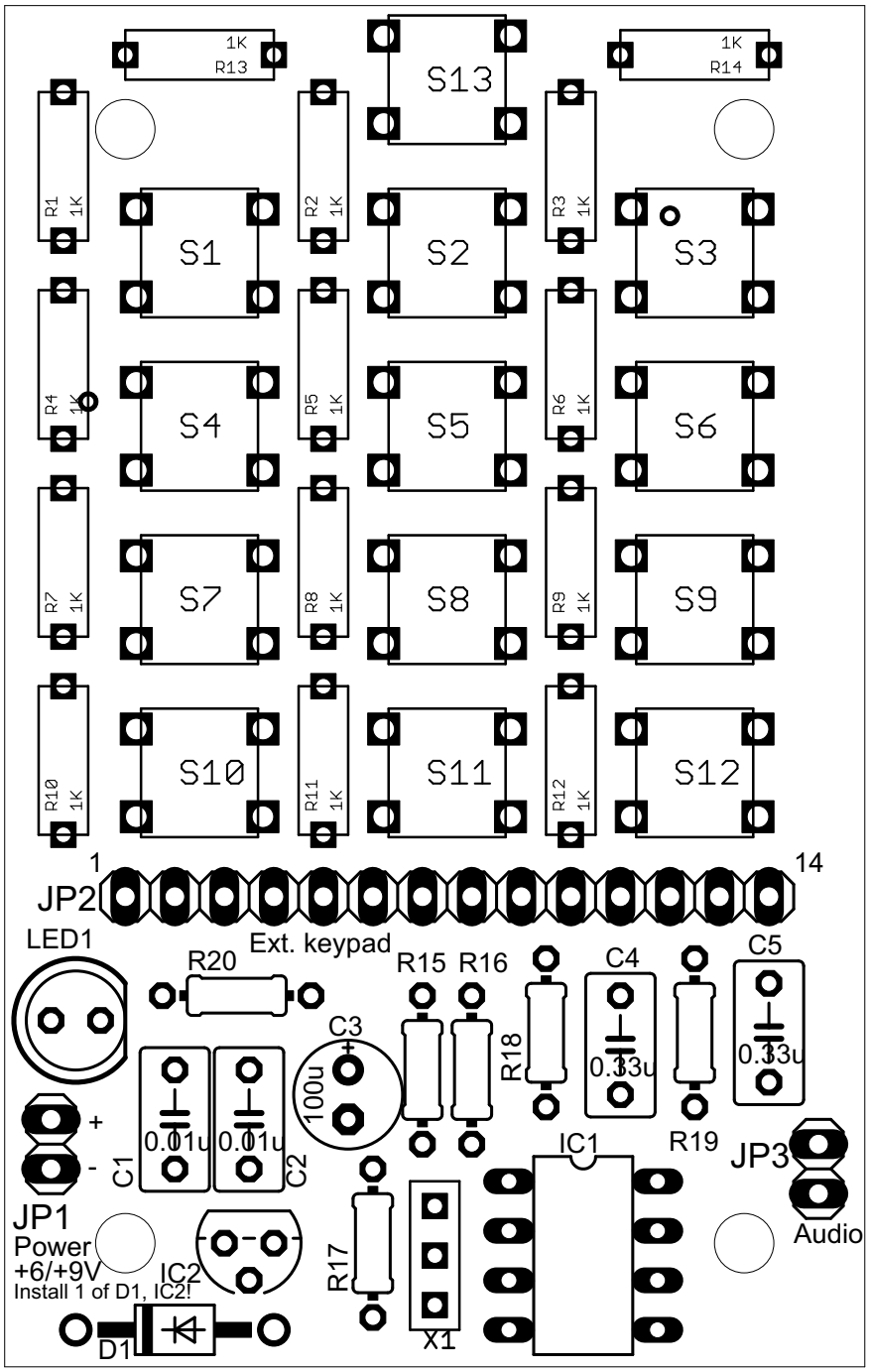
Operating functions:

- Toggle beteen manual and playback modes: Hold 2600 button for two seconds
- Clear keypress memory buffer: power off then on (also cleared after previous store or mode change)
- Store keypress memory buffer: Hold down any keypad key for two seconds

Configuration functions:

- Temporarily switch between MF/DTMF modes: Hold down 2600 while powering up
- Permanently switch default power-up mode between MF/DTMF: Hold * while powering up
- Permanently toggle between short (75 ms.) and long (120 ms.) tone duration: Hold # while powering up


9 volt operation: install C1, C2, IC2; leave D1 empty
6 volt operation: install D1; leave C1, C2, IC2 empty
Damage will result if D1 and IC2 are installed at the same time!
D1
1N4005
IC2
78L05Z
VI
VO
GND
JP1
Power input
+6V or +9V
C1
0.33 uf
C2
0.01 uf
C3
100 uf
Power indicator (optional)
R20
330
LED1
V+
External keypad
JP2
R1 1K
R2 1K
R3 1K
R4 1K
R5 1K
R6 1K
R7 1K
R8 1K
R9 1K
R10 1K
R11 1K
R12 1K
R13 1K
R14 1K
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
1
2
3
4
5
6
7
8
9
KP/*
0
ST/#
2600
R15
4.7K
X1
20 MHz
R17
1.0M
IC1
VDD
GP0
GP5/CLKIN
GP1
GP4/CLKOUT
GP2
GP3
VSS
PIC12F683
R16
100K
R18
150
R19
150
C4
0.33 uf
C5
0.33uf
JP3
Audio out
To telephone earpiece or speaker
Esquire Blue Box, 2008 Edition
Design: D. Froula
Schematic capture: P. Lapsley
TITLE: esq01c
Document Number:
REV:
Date: 7/19/2008 11:43:05 AM
Sheet: 1/1



7/10/2008 2:34 pm PT
Board 1.74" x 2.75"
Holes 1.25 x 2.25 apart

Designator	Type	Quantity	Source	Part Number
R1-R14	1K Ohm, 1/6 watt, 5% Carbon Film Resistor	14	DigiKey	P1.0KEBK-ND
C1,C4,C5	.33 mf Capacitor	3	DigiKey	BC1630-ND
C2	.01 mf Capacitor	1	DigiKey	P4582-ND
C3	100 mf Capacitor	1	DigiKey	P1370-ND
R20	330 Ohm, 1/6 watt, 5% Carbon Film Resistor (optior	1	DigiKey	330EBK-ND
LED1	Green LED (optional)	1	DigiKey	160-1142-ND
IC2	78L05Z 5 Volt Voltage Regulator	1	DigiKey	LM78L05ACZFS-ND
D1	1N4005 Diode	1	DigiKey	1N4005GOS-ND
S1-S13	SPST Pushbutton Switch	13	DigiKey	SW419-ND
Rr15	4.7K Ohm, 1/6 watt, 5% Carbon Film Resistor	1	DigiKey	4.7KEBK-ND
X1	20 MHz Ceramic Resonator, Integral Capacitors	1	DigiKey	X909-ND
R16	100K Ohm, 1/6 watt, 5% Carbon Film Resistor	1	DigiKey	100KEBK-ND
R18, R19	150 Ohm, 1/6 watt, 5% Carbon Film Resistor	2	DigiKey	150EBK-ND
IC1	12F683 DIP PIC Microcontroller	1	DigiKey	PIC12F683-I/P-ND
	8-pin DIP Socket	1	DigiKey	ED60000-ND
	Miscellaneous Components			
	Power Switch	1		
	Telephone Earpiece, 150 ohms	1	http://www.porticus.org/bell/images/we_handset1.jpg	
	1/8" Mono Earphone Jack	1		
	1/8" Mono Earphone Plug and Cable for Earpiece	1		
	Battery clip/holder	?		
	Enclosure, 270-1801	1	Radio Shack	
	Note: For 9 volt operation install IC2, C1, and C2, but do not install D1. For 6 volt operation install D1, but do not install IC2, C1, and C2.			
	Do not install both IC2 and D1 at the same time!			

Accessing My ProjectMF Server

My ProjectMF server can be accessed via the PSTN on **630-485-2995**. The switch will play back recorded instructions when you dial in.

Access is also available via:

- CNET (telephone switch collectors network): 1-762-2600/2601 (see www.ckts.info for gateway numbers)
- Asterisk direct connection: exten => 2600,1,Dial(IAX2/cnetguest@projectmf.homelinux.com/17622600)
- SIP phone direct connection: 17622600@projectmf.homelinux.com

During the ringing of the line (or after it stops), play a short burst of 2600, wait for the wink acknowledgment (the "Ker-Cheep"), followed by the MF digits from the list below. The 2600 Hz tone must be played at a somewhat higher level than the MF digits. Additional calls can be placed by playing 2600 again, waiting for the wink, and re-routing the call with new MF digits.

If you do not begin dialing within 5 seconds after playing 2600 and getting the wink, you will hear a "reorder" tone (fast busy). You must then re-seize the line with another burst of 2600.

The system will read back the digits it hears if you dial anything the switch does not understand. Play around with volume levels, especially if just holding the PC speaker up to the phone. The MF tones do not need to be excessively loud. It is important to do this in a fairly quiet environment. Do not talk while dialing. The switch will try to interpret loud sounds as MF digits.

You can divert a call through the box. Just dial 2600, KP, a 10-digit phone number (no leading "1"), and ST. Experiment on the test numbers to get the levels right first.

The Dialing Plan

Here are some numbers to try after you have seized a trunk with 2600 Hz. (Any three-digit code will also work with an area code prefixed.)

For all recordings, DTMF “0” to exit, “*” and “#” to skip backward and forward.

Dialing sequence	Gets you ...
KP + 101 + ST	"Weasels" recording
KP + 102 + ST	"Monkeys" recording
KP + 103 + ST	"Moo 1" recording
KP + 104 + ST	"Moron" recording
KP + 105 + ST	"Moo 2" recording
KP + 106 + ST	"Something wrong" recording

KP + 107 + ST	"Made it up" recording
KP + 108 + ST	"I'm bored" recording
KP + 109 + ST	"Don't understand" recording
KP + 110 + ST	"Step in stream" recording
KP + 111 + ST	"ProjectMF" presentation recording (exit with DTMF "0")
KP + 112 + ST	"Classic Tandem Stacking" recording - Evan Doorbell (exit with DTMF "0")
KP + 113 + ST	"Evan Doorbell juices off N1 and phreaks around. Part 1 (exit with DTMF "0")
KP + 114 + ST	"Evan Doorbell juices off N1 and phreaks around. Part 2 (exit with DTMF "0")
KP + 115 + ST	"Evan Doorbell investigates 1xx and 0xx codes (exit with DTMF "0")
KP + 116 through 120 and 122 + ST	"How Evan Doorbell Became a Phone Phreak, parts 1-6"
KP + 600 + ST	Asterisk echo test
KP + 121 + ST	"Operator" - Leave message if no answer
KP + 123 + ST	Joybubbles (Joe Engressia) 1991 Off the Hook Interview, Part 1
KP + 124 + ST	Joybubbles (Joe Engressia) 1991 Off the Hook Interview, Part 2
KP + 125 + ST	Haxor Joybubbles tech interview, part 1
KP + 126 + ST	Haxor Joybubbles tech interview, part 2
KP + 127 + ST	Haxor Joybubbles tech interview, part 3
KP + 128 + ST	Sounds of Long Distance, part 1
KP + 129 + ST	Sounds of Long Distance, part 2
KP + 130 + ST	Sounds of Long Distance, part 3
KP + 131 + ST	Goog411 Directory Assistance
KP + 132 + ST	Sounds of Long Distance, part 4
KP + 133 + ST	Sounds of Long Distance, part 5
KP + 134 + ST	Sounds of Long Distance, part 6
KP + 135 + ST	Sounds of Long Distance, part 7
KP + 136 + ST	Sounds of Long Distance, part 8
KP + 137 + ST	Sounds of Long Distance, part 9
KP + 138 + ST	Sounds of Long Distance, part 10
KP + 139 + ST	Sounds of Long Distance, part 11
KP + 140 + ST	Sounds of Long Distance, part 12
KP + 141 + ST	Sounds of Long Distance, part 13
KP + 142 + ST	Sounds of Long Distance, part 14
KP + 143 + ST	Sounds of Long Distance, part 15
KP + 144 + ST	Sounds of Long Distance, part 16
KP + 145 + ST	Dialing the 1XX Codes from Greenville NC Coin Phones, Part 1
KP + 146 + ST	Dialing the 1XX Codes from Greenville NC Coin Phones, Part 2

KP+147+ST	Local Coin Control in the 1970s
KP + 161 + ST	Record a comment
KP + 171 + ST	Playback comments. 0 to exit, * and # to skip backward and forward
KP + 199 + ST	2600 Hz supervision test
KP + xxx-xxx-xxxx + ST	Outdial to phone network
KP + 011 + country code + number + ST	Collectors Net Access (www.ckts.info)
KP + 2111 + ST	Conference bridge. Please hang up with "#" when done.
KP + 777 + ST	Direct access to Telephreak
KP + 2602 + ST	DISA dialtone. Can use DTMF to dial. Stack with repeated 2602