

## DESCRIPTION

The ST-809B is a miniature universal DTMF Decoder designed for operation over any voice grade circuit such as radio, microwave or telephone lines. Compatible with the widely used DTMF (Touch-Tone) signaling format, the ST-809B is typically used for mobile radio paging, selective calling or remote control applications.

Due to its small size, the ST-809B is ideally suited for installation in portable and mobile two-way radios. The ST-809B responds to an address sequence of 1 to 7 digits in length, using any of the 16 DTMF characters. Because there are no restrictions in the use of repeated digits, this provides more than 250 million unique address sequences.

Application Notes with detailed installation instructions for a wide variety of mobile and hand-held radios are available free of charge from the Selectone web site. For further applications assistance, contact our Selectone Technical Support Department at (510)887-1950, ext. 3, or by E-mail at [techsupport@selectone.com](mailto:techsupport@selectone.com).

## OPERATION

In a typical mobile radio selective calling application, the ST-809B mutes the radio to block out unwanted channel traffic while awaiting a call. When the correct DTMF address is received, the ST-809B provides a latched output to unmute the radio, a momentary output to activate a buzzer or vehicle horn and an additional latched output to activate a "call lamp" or LED. In addition, the ST-809B provides an alert tone output for alerting the operator of an incoming call and a transpond acknowledgement to confirm receipt of the call to the calling party.

The ST-809B supports individual, group and "All Call" addresses for maximum selective calling flexibility. A "Radio Kill" function is also provided to remotely disable a lost or stolen radio. The status of Radio Kill is stored in non-volatile EEPROM and the radio may be re-enabled over the air by the servicing dealer or fleet manager. For remote control applications, the ST-809B provides three separate open-collector outputs which may be toggled on or off individually or interlocked in two different modes. Whenever the ST-809B receives a valid sequence, it generates a series of transpond tones to report the state of all output.

## CONFIGURATION

Before installation in the radio, the ST-809B must be configured to meet the requirements of the radio and to provide the features that will be used in the system. Configuration is performed using a PC running ST-809PM Product Manager software. A programming kit or adapter to connect the ST-809B to a COM port of the computer is required.

## PROGRAMMING KIT

The ST-954 Programming Kit consists of three items: a 6' DB-9 to DB-9 serial cable assembly, a DB-9 to DB-25 adapter plug and an ST-954B Programming Adapter. The ST-954 may be ordered from SmartTrunk Systems.

For customers who already have a serial cable, the ST-954B may be purchased separately or constructed from a circuit schematic that may be downloaded from the Selectone web site at [www.selectone.com](http://www.selectone.com) (a DB-9 female connector and an ST-809B cable will be required).

## OPERATING SPECIFICATIONS

Parameter	Min	Typ	Max	Unit
Power supply voltage	5.5		25	V DC
Power supply current			7	mA DC
Open collector output (sink current)			80	mA DC
Call Lamp output current (sink or source)			80	mA DC
Temperature range	-30		+60	°C
DTMF input (HI range)	30		850	mV RMS
DTMF input (LO range)	10		280	mV RMS
Signal to noise ratio	12			dB SINAD
DTMF twist			±10	dB
Digit recognition time	20			mS
Interdigit time	50		5000	mS
Decode time	0		1	Interdigit time <sup>1</sup>
Decode Momentary time	0.050		9999	Sec.
Transpond/Alert tone level			5	V p-p, no load
Transpond duration		2.34		Sec
Transpond Tone Freq.		874		Hz
Alert Tone Freq.		528		Hz
Call Lamp Flash Rate (50% duty Cycle)	100	500	999	mS
Interconnect type	13 pin miniature low profile connector.			
Size	1.34"L x 0.85"W x 0.21"H (34.0mm x 21.6mm x 5.33mm)			

<sup>1</sup> Measured from the end of the last DTMF character in the sequence.

*Specifications are subject to change without notice.*

## PRODUCT MANAGER SOFTWARE

The ST-809PM Product Manager software includes both Windows and DOS versions. It may be purchased at a nominal charge from SmartTrunk Systems or it may be downloaded at no charge from the Selectone web site at [www.selectone.com](http://www.selectone.com).

The Windows-based Product Manager installs using normal Windows installation procedures. The DOS-based version may be copied to the hard disk or run directly from the supplied disk.

Many popular Windows programs access serial communications and prevent the use of the COM ports by other programs. If the ST-809PM software cannot access a serial port, perform the following steps:

Shut down the computer and reboot in DOS mode. To do this, press <F8> immediately after the report "Starting Windows 95", then select "Command Prompt Only". Then run the 809DOS program (file name 809DOS.EXE), using the appropriate path.

## PRODUCT MANAGER/DTMF PROGRAMMING

In some cases, it may be advantageous to configure a number of ST-809B's and not assign the address sequences until the unit is installed in a radio. To accommodate this, address sequences may be programmed using either the Product Manager software or DTMF signaling. All other parameters can only be programmed with the Product Manager software.

### ADDRESS PROGRAMMING VIA DTMF

To enter the configuration mode for DTMF programming, alternately connect and release the Brown wire (J1-7) to (-) Supply or, if the unit is installed in the radio, press and release the monitor switch (or toggle the hookswitch) at least five times within five seconds of applying power (the first transition must be within one second). The ST-809B verifies entry into the configuration mode by generating an alert tone and blinking the Call Lamp output for about six seconds.

The Call Lamp output remains energized while in the configuration mode. Once in configuration mode, programming can be accomplished via a DTMF encoder connected to the DTMF Signal input (referenced to (-) supply) or over the air via a service monitor or DTMF-equipped transmitter.

1. Select which address sequence is to be programmed by sending one of the following control digits for at least two seconds.
  - 1 Primary Address sequence
  - 2 Secondary Address sequence
  - 3 Radio Kill sequence
  - 4 Primary Reset sequence
  - 5 Secondary Reset sequence
  - 6 Radio Kill Reset (Restore) sequence
2. Enter the desired sequence at normal manual dialing speeds (at least an 80 ms tone ON time). When the complete sequence has been entered, send the "\*" character for at least two seconds. The Call Lamp will flash OFF and the alert tone will beep twice to indicate that the sequence has been written to the EEPROM. The control digit for the next sequence may then be entered.

If only a single digit is entered as any of the reset sequences, it is used as a suffix to the corresponding address sequence. For example, if the Primary Address sequence is "123" and "\*" is entered as the Primary Reset sequence, sending "123\*" energizes the outputs and sending "123##" resets the outputs. The factory default for the three reset sequences is the "\*" suffix.

To disable a sequence, send the appropriate control digit for two seconds then, without sending any other digits, send the "\*" character for two seconds. If an error is made while entering a sequence, send "\*" for at least two seconds to cancel the entry. It is necessary to re-send the control digit for two seconds to select the desired sequence again.

### CONFIGURATION VIA PRODUCT MANAGER

In addition to the address sequences, the Product Manager software also allows setting the following parameters:

#### DTMF INPUT SENSITIVITY

To accommodate the wide range of audio levels that may be available in different models of receivers, two sensitivity ranges are provided. If the audio level in the receiver is 280mVrms or less, set for HIGH sensitivity. If greater than 280mVrms, set for LOW sensitivity.

#### DIGIT RECOGNITION TIME

This is the minimum time a digit must be present to be accepted by the ST-809B. When used with automatic encoders, this time should be set to slightly less than the digit ON time of the encoders. When used with manual keypad encoders, this time should normally be set to 70 to 80 milliseconds.

#### INTERDIGIT TIME

This is the maximum time allowed between digits of the sequence. If the time between digits is greater than this, the ST-809B resets to await a new sequence. When used with automatic encoders, this time should be set to approximately 1 1/2 times the digit OFF time of the encoders. When used with manual keypad encoders, this time should be 1 1/2 to 2 seconds.

#### MONITOR/RESET (HOOKSWITCH) POLARITY

This parameter sets which polarity of the Mon/Res input causes the ST-809B to mute the receiver.

#### OVERLENGTH SEQUENCE ACCEPT/REJECT

In most cases, the ST-809B should be set to reject overlength sequences and this is the factory default. This setting results in a one interdigit time delay between receipt of the last digit of the sequence and activation of the outputs. This delay may be undesirable in some remote control applications. In this case, setting the unit to accept overlength sequences will eliminate the delay and cause the output to energize immediately upon termination of the last digit of the sequence.

#### DECODER LATCHED OUTPUT

This output is normally connected to the muting point in the receiver to mute/enable the receive audio. The requirements for each model of radio must be determined prior to setting the two parameters described below:

**ACTIVE STATE** This parameter sets whether the Decode Latched output is on to mute or on to enable the receiver audio. In most receivers, the Decode Latched output is turned on to mute the receive audio. However, there are some receivers that require that it turn on to enable the audio.

**SOURCE/SINK** The Decode Latched output must sink current to control the muting circuit in most radios. There are some radios that require that this output source current.

#### ALL CALL

If All Call is enabled, the ST-809B energizes its outputs in response to receipt of five seconds of the "\*" character and receipt of five seconds of the "#" character resets all units. If All Call is not used in the system, this feature should be disabled.

#### MOMENTARY OUTPUT TIME

This parameter sets the period that the Momentary output is active upon receipt of a call.

#### CALL LAMP FLASH RATE

This parameter sets the rate at which the lamp flashes (at a 50% duty cycle). Enter 0 to defeat flashing and cause the lamp to light steadily.

#### PTT CONFIGURATION

If Radio Kill is not used, the keying circuit of the radio is not modified and the PTT input and PTT output are connected to the same point. In this case, PTT COMMON must be selected. If Radio Kill is used, the PTT switch of the radio must be disconnected from the keying circuit. Then PTT input is connected to the PTT switch and PTT output is connected to the keying circuit of the radio. When this is done, PTT SEPARATE must be selected.

#### TRANSPOND ENABLE/DISABLE

If Radio Kill is not used, transpond can be disabled by simply not connecting the PTT output. If Radio Kill is used and transpond is not desired, this parameter should be set to disabled.

**NOTE:** This setting only affects the Primary sequence and remote control modes. Transpond is not activated by the Secondary sequence or All Call. The Radio Kill sequence always generates a double transpond, regardless of this setting.

## REMOTE CONTROL MODES

The ST-809B has four operational modes. As shipped from the factory, it is configured for selective calling applications (mode 1). Modes 2, 3 and 4 provide three open-collector outputs for remote control applications. These modes are described below:

### MODE 2

The three outputs are independent. The Primary Address sequence turns on the Call Lamp output and the Primary Reset sequence turns it off. The Secondary Address sequence turns on the Decode Momentary output and the Secondary Reset sequence turns it off. The Radio Kill sequence turns on the Decode Latched output and the Radio Kill Restore sequence turns it off.

**MODE 3** The Call Lamp and Decode Momentary outputs are interlocked and the Decode Latched output is independent. The Primary Address sequence turns on the Call Lamp output and turns off the Decode Momentary output. The Secondary Address sequence turns on the Decode Momentary output and turns off the Call Lamp output. The Decode Latched output is controlled as in Mode 2.

**NOTE:** *The Primary and Secondary Reset sequences are not used.*

### MODE 4

All three outputs are interlocked. The Primary Address sequence turns on the Call Lamp output and turns off the Decode Momentary and Decode Latched outputs. The Secondary Address sequence turns on the Decode Momentary output and turns off the Call Lamp and Decode Latched outputs. The Radio Kill sequence turns on the Decode Latched output and turns off the Call Lamp and Decode Momentary outputs.

**NOTE:** *The Primary and Secondary Reset and the Radio Kill Restore sequences are not used.*

## INSTALLATION

### MOUNTING

Use of a double-sided adhesive pad or an insulating shrink tube eliminates hardware requirements. When using the adhesive pad, mount the ST-809B on a clean dry surface, oriented to allow easy routing of the wiring to the radio. Press firmly after mounting to ensure good adhesive contact. Do not touch the adhesive surface or attempt to re-position after mounting.

### WARRANTY POLICY

All Selectone products are guaranteed to meet or exceed published performance specifications and are warranted against defects in material and workmanship for a period of two (2) years from date of purchase. Third party equipment such as radios, power supplies, antennas, etc., carry the factory warranty of their respective manufacturers.

All warranty repairs must be performed at the SmarTrunk factory in Hayward, California, or other factory authorized repair depot. Any unauthorized repair attempted by the customer, alteration or modification of the equipment, damage by external sources, or removal or alteration of the serial number label or date code, will void the warranty. Specifically excluded from this warranty are batteries, fuses, lamps, and damage caused by lightning, power surges, or mechanical abuse.

Equipment for repair may be returned to the factory without prior written authorization; however, a note must be sent with the packing list briefly describing the nature of the defect. Repairs must be shipped freight prepaid and will be returned freight prepaid. Shipments should be directed to:

SmarTrunk Systems, Inc.  
Attn: Repair Department  
23278 Bernhardt Street  
Hayward CA 94545, U.S.A.

## ELECTRICAL INTERFACE

The following section describes all wires on the interface cable for the ST-809B. The connector pin numbers are shown in brackets [] and the wire colors are shown in parentheses ().

**[9] (BLK) Negative (-) Supply:** Connect to system (-) Supply (GND).

**[3] (RED) Positive (+) Supply:** Connect to system (+) Supply (5.5 to 25Vdc).

**[12] (GRN) DTMF Signal Input:** Connect to the signaling audio source, e.g., discriminator output, volume control high, etc. Connection to the speaker output is not recommended due to the extremely wide dynamic range across the speaker.

**Note:** *This point must not mute while awaiting signaling tones.*

**[8] (BLK/BRN) Call Lamp #1:** Open-collector output to drive a call lamp or other alerting device. This output remains active until a hookswitch transition or receipt of a remote reset command. If this output is used, the Call Lamp #2 output MUST be connected to Negative (-) Supply.

**[11] (BLU) Call Lamp #2:** Open-emitter output to drive a call lamp or other alerting device. This output remains active until a hookswitch transition or receipt of a remote reset command. If this output is used, the Call Lamp #1 output MUST be connected to Positive (+) Supply.

**Note:** *If either of the above outputs is used to drive an LED, the output must be connected to it through a current limiting resistor.*

**[5] (ORG/BLK) Decode Momentary:** Open-collector output saturates to (-) Supply (GND) for the programmed momentary time upon receipt of each Primary or Secondary Address sequence.

**[7] (BRN) Monitor/Reset:** Connect to the hookswitch, monitor switch, hang-up button or box. This input places the Decode Latched output in the unmute condition when off-hook and resets all outputs upon any transition of this lead.

**[1] (WHT/BLU) Alert Tone:** This output provides a 528Hz tone pulsed 250ms ON – 250ms OFF for local user alerting. This output remains active until a hookswitch transition or receipt of a remote reset command.

**[6] (YEL) PTT Input:** Connect to the PTT switch of the radio. This input acts as a "set" function to unmute the receiver if PTT is activated on a muted radio to eliminate multiple "blind" transmissions. If the Radio Kill feature is used, refer to the instructions following the PTT Output description.

**[10] (BLK/YEL) PTT Output:** Open-collector output used to key the radio transmitter. If neither transpond or Radio Kill is used, this wire can be removed from the connector. If transpond is used but Radio Kill is not, connect this line to the same point as the PTT input lead. See the following paragraph if Radio Kill is used.

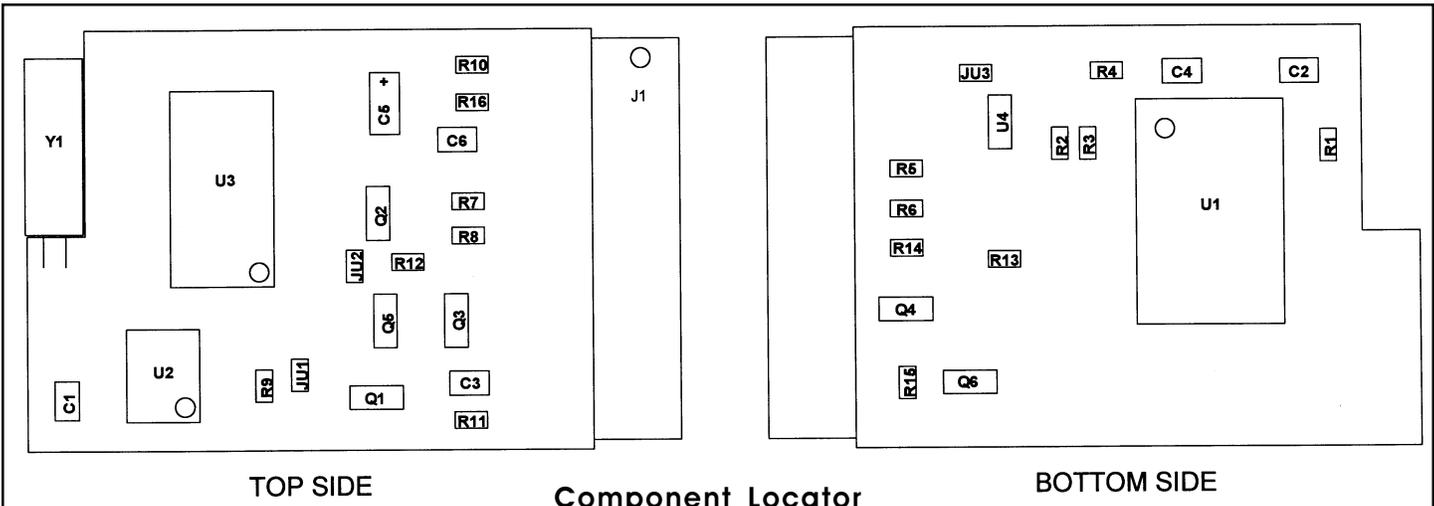
**IF RADIO KILL IS USED:** To allow disabling the radio, the existing connection between the PTT switch and the keying circuit of the transmitter must be broken. Connect the PTT Input lead to the PTT switch and connect the PTT Output lead to the keying circuit of the transmitter.

**Caution:** *If the PTT Input and PTT Output are connected to the same point and the ST-809B is configured for SEPARATE PTT, the ST-809B will "hang up" with the transmitter keyed. If the keying circuit is modified to allow Radio Kill operation and the ST-809B is configured for COMMON PTT, the operator will not be able to key the transmitter.*

**[13] (WHT/GRN) Transpond Tone:** This output provides an 874Hz tone which is active only during transpond. Connect this output to the microphone audio circuit of the transmitter. If transpond is not used, this wire may be removed from the connector.

**[4] (WHT/ORG) Decode Latched Output:** Connect to the muting point in the radio. This output is controlled by the Monitor/Reset input and it goes to the UNMUTE condition upon receipt of a correct sequence. It may be reset to the MUTE condition by placing the Monitor/Reset input to the "off-hook" condition, then then returning it to the "on-hook" condition. It is also reset by receipt of the Primary or Secondary Reset sequences or the All Call reset command (if enabled).

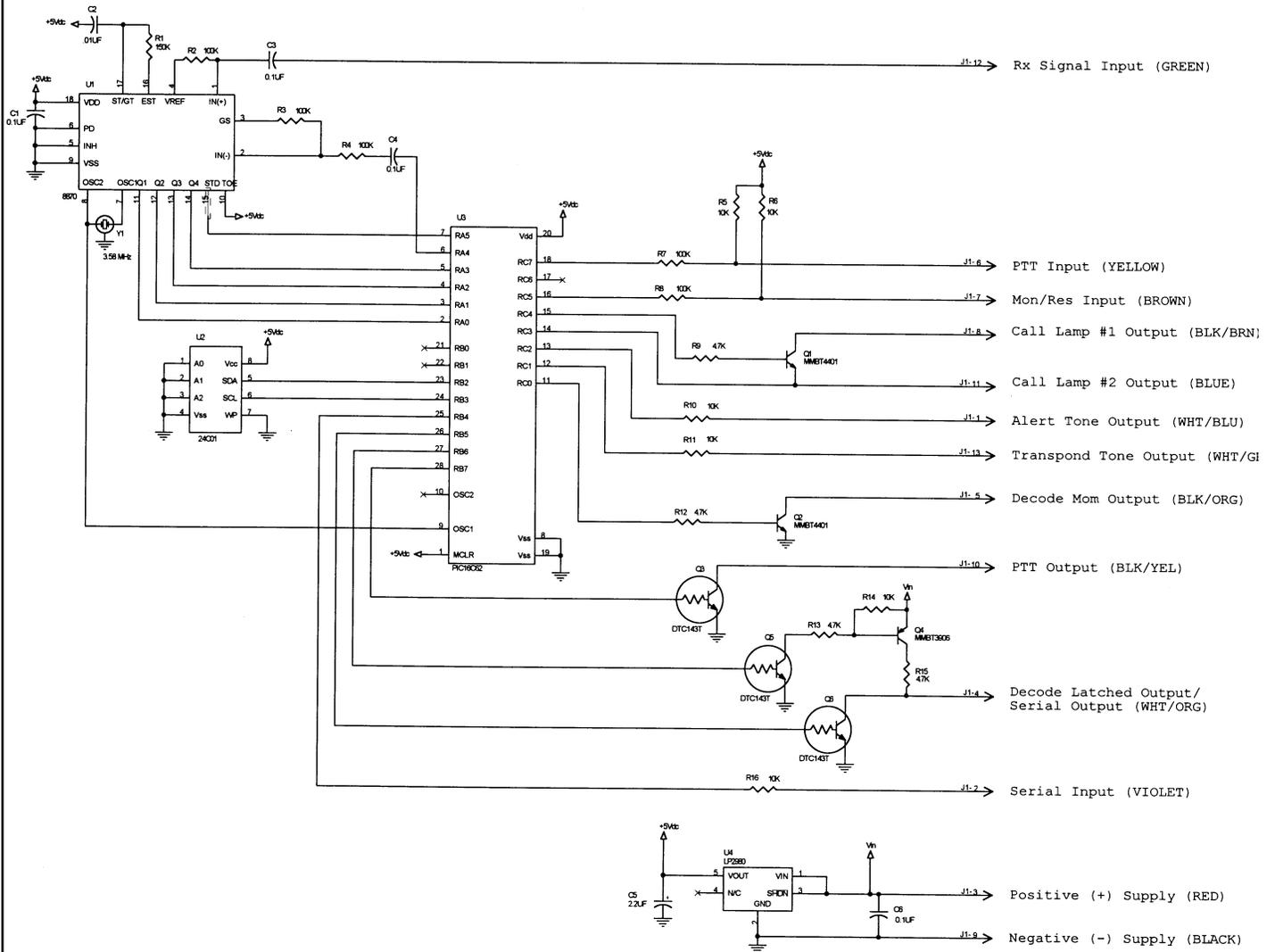
**[2] (VIO) RS-232 Input:** The violet wire should be removed from the connector. This input is only used during configuration of the unit.



TOP SIDE

Component Locator

BOTTOM SIDE



Schematic Diagram

SmarTrunk Systems, Inc.

23278 Bernhardt Street • Hayward, CA 94545-1621 USA

Phone: +1-510-887-1950 - Fax: +1-510-887-4011

Email: salesinfo@smartrunk.com • Web Address: http://www.smartrunk.com

