

GENERAL

The ST-809 is a sub-miniature DTMF Address Decoder designed for Selective Calling and Remote Control applications via radio or wire line. Due to the small size the ST-809 is especially applicable for installation in hand-held and mobile radios. The ST-809 uses surface mount and uP technologies to produce a small sized product aimed at the limited available space in modern two-way radios. The ST-809 will respond to an address of 1 to 7 digits in length using any of the 16 DTMF characters. There are no restrictions on the use of repeated digits in the address. This provides greater than 250,000,000 unique addresses. Digit position and address length recognition virtually eliminate the possibility of response to incorrect addresses. Group/All call, Radio Kill, Call Alert Tone, Transpond Acknowledgement and Remote Reset are additional features.

Application information is available or can be developed for most radio models. Many of our application notes are available for instant access on our web site <http://www.selectone.com>. If you would like application details for a specific radio, please call us TOLL FREE at (800)227-0376 or request assistance via fax at (510)781-5454 or E-Mail at techsupport@selectone.com.

OPERATION

The ST-809 is generally set up to monitor DTMF signalling on a radio or wire line circuit. For radio applications, ST-809 outputs are used to mute receiver audio, blocking out unwanted channel traffic. When the correct PRIMARY, SECONDARY, or ALL CALL DTMF address is received, the decoder latches its DECODE LATCHED OUTPUT to un-mute the host radio. On decode the DECODE MOMENTARY, CALL LAMP and ALERT TONE outputs can be used to activate a multitude of audible or visual alerting devices. Decode of the PRIMARY ADDRESS CODE activates the PTT and TRANSPOND TONE outputs permitting contact acknowledgement to the calling radio operator. When the radio operator responds to the call, all outputs are reset on the ON-HOOK to OFF-HOOK transition. Use of PRIMARY, SECONDARY, or ALL RESET permits remote reset of all functions. The ST-809 provides a special RADIO KILL function. When RADIO KILL is decoded the ST-809 will open the PTT circuit and mute the receiver. The condition of this function is stored in EEPROM making it immune to reset by radio power down. Radios that have been "KILLED" may be restored to operation when the ST-809 receives a RESTORE address.

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)			200	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		2300	mS
Decode time	0		1	Interdigit time
Decode Momentary time	0.050		590	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 (50% duty Cycle)	100	500	900	mS
Interconnect type	13 pin miniature low profile connector.			
Size	1.5"L x 0.85"W x 0.25"H (38.1mm x 21.6mm x 6mm)			

¹ Measured from the end of the last DTMF character in the sequence.

Specifications are Subject to change without notice.

INSTALLATION

MOUNTING:

Use of a double-sided adhesive pad or an insulating piece of Mylar® eliminates hardware requirements. When using the adhesive pad, mount the ST-809 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 or attempt to re-position the unit after mounting.

WIRE INTERFACE:

Connector pin numbers are shown in brackets [#]. Wire colors represent the assignment on the mating connector

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

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

[12] DTMF Signal Input (GRN): Connect to signalling audio source, e.g., discriminator output, volume high, etc. This input will accept levels between 10 and 850 mVrms in two ranges. Factory default input range is 10 mVrms to 280 mVrms. If the input level is > 280 mVrms and less than 850 mVrms, the HI input level range may be selected in custom configuration. Connection to the speaker output is not recommended due to the extremely wide dynamic range across a speaker.

NOTE: This point must not mute while awaiting signalling tones.

[2] Call Lamp #1 (VIOLET): Open collector output, to provide a flashing or steady “ON” CALL LAMP. This output remains active until an ON-HOOK to OFF-HOOK transition or receipt of a remote reset command.

NOTE: CALL LAMP #2 must be tied to NEGATIVE (-) SUPPLY when using CALL LAMP #1 as an output.

[11] Call Lamp #2 (BLUE): Open emitter output, to provide a flashing or steady “ON” CALL LAMP. This output remains active until an ON-HOOK to OFF-HOOK transition or receipt of a remote reset command.

NOTE: CALL LAMP #1 must be tied to POSITIVE (+) SUPPLY when using CALL LAMP #2 as an output.

Did You Know...?

Most Call Lamps are LED's which require a series current limiting resistor.

[6] PTT Input (YELLOW): Used with the RADIO KILL feature. The PTT path between the mic and radio is broken and the ST-809 placed in series. This lead goes to the mic side of PTT. Additionally this line acts as a “set” function to force the radio to un-mute if PTT is activated on a muted radio (eliminates multiple blind transmissions)

[10] PTT Output (BLK/YEL): Open collector output, saturates to (-) Supply (GND) following the PTT input unless RADIO KILL is activated. Additionally this input is used to key the transmitter after each Primary or Remote Control sequence to permit transpond. This lead goes to the radio side of PTT.

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

[7] Monitor/Reset (BROWN): Connect to the microphone hook switch, hang-up button or box. This lead places the DECODE LATCH output in UNMUTE condition when off-hook and resets all other outputs on the transition from “ON-HOOK” to “OFF-HOOK”. Refer to custom programming to customise the MONITOR/RESET line for your application.

[1] Alert Tone (WHT/BLU): 528Hz tone pulsed 250mS “ON” then 250mS “OFF” for local user alerting applications. This tone remains active until reset.

[13] Transpond Tone (WHT/GRN): 874 Hz tone active only while PTT OUTPUT is active for transpond.

[4] Decode Latched (WHT/ORG): Connect to the muting point in the radio. This output goes to the UNMUTE condition upon decode, if the MONITOR/RESET Line is “ON-HOOK”. It may be reset to the MUTE condition by a “OFF-HOOK” then back “ON-HOOK” transition of the MONITOR/RESET line. If the MONITOR/RESET line is “ON-HOOK” this output may be reset remotely with the PRIMARY or SECONDARY RESET address code. This output can be customized with the sink/source and the state programming parameter. See the programming section for customising details.

[8] Unused.

FUNCTIONAL DESCRIPTION

The microprocessor circuit of the ST-809 utilises an advanced decoding algorithm which allows all possible combinations of the sixteen standard DTMF tone pairs in codes of one to seven digits in length. The decoder ignores codes of incorrect length, even though they may contain the correct code within them. It is allowable, for example, to install decoders programmed with codes “1”, “12,” “123,” “1234” and “12345” in the same system without improper activation of any of the units. ST-809 factory default application parameters accommodate most applications. For unique configurations, the ST-809 permits the installer to customise most outputs and timing to accommodate the specifics of the application.

CUSTOM CONFIGURATION

Before use, all ST-809's must be configured to accommodate the specifics of the application where it is being used, and to its own address codes. Most applications only require customisation of the address codes.

To enter the configuration mode, press and release the monitor switch (or manipulate the hook switch at least five times in the first five seconds following power turn-on. The ST-809 verifies entry to the configuration mode by generating an alert tone and toggling the call lamp outputs for about 6 seconds. The call lamp will remain ON while in the configuration mode. Once in the configuration mode, configuration can be accomplished via a DTMF encoder connected to the Rx signal input [(-) Supply as common], or Over the Air via a Service Monitor or DTMF equipped transmitter.

- ⇒ To exit the configuration mode remove power from the ST-809.
- ⇒ If an error occurs while keying in a configuration sequence, Press * to Clear the Current Entry. Once cleared, additional entries may proceed as required.
- ⇒ To return the unit Factory DEFAULT (known starting point) Press 99. Additional entries may proceed as required.

Custom Configuration can be grouped into 4 sets of related sequences.

#1 = Six (6) decoder address sequences.

#2 = Three (3) timing parameters.

#3 = Seven (7) application specific parameters.

#4 = Four (4) operational modes.

In most applications ONLY the primary and secondary address codes need to be programmed. The other programmable parameters can usually be left at the factory default. The programmability is only available to accommodate unique and creative application requirements that occur world wide..

Table 1-1 indicates the entry sequences required to customise all ST-809 parameters.

- The entries must be made from the configuration mode.
- Each prefix and suffix digit **MUST** have a tone duration of at least 1 second (button down). Other digits may be entered at normal dialing speed (greater than 50 mS and less than 500 mS).
- While in the configuration mode, there is no interdigit timing.
- Address entries may have 1 to 7 digits (X's on the chart). Each digit may be any DTMF character.
- Time entries must be three digits. X X being any numeric character. M being the multiplier power of 10.
- When entries are saved to EEPROM (release of the long #) the call lamp will flash OFF twice and the alert tone will beep twice.
- If a mistake is made during entry, press and hold the * for longer than 1 second to erase the current entry sequence.

TABLE 1-1: CUSTOM CONFIGURATION

Group	Function	Condition	Prefix	Keystrokes	Suffix	Factory Default
	Clear Current Entry	BAD ENTRY			*	
	Return to Factory	DEFAULT	9 9		NONE	
1	Primary Address	UN-MUTE RADIO	1 1	XXXXXXX	#	1 5 9 D * 8 6
1	Secondary Address	UN-MUTE RADIO	1 2	XXXXXXX	#	DISABLED
1	Radio Kill	KILL RADIO OPERATION	1 3	XXXXXXX	#	DISABLED
1	Primary Reset	MUTE RADIO	2 1	(X)XXXXXX	#	PRIMARY + #
1	Secondary Reset	MUTE RADIO	2 2	(X)XXXXXX	#	SECONDARY + #
1	Restore from Kill	RESTORE RADIO OPERATION	2 3	(X)XXXXXX	#	KILL + #
2	Interdigit Time	MAX. TIME BETWEEN DIGITS	3 1	XX M	#	20 x 10 ² mS = 2000 mS
2	Call Lamp Flash	ON / OFF TIME 50/50 DUTY CYCLE	3 2	XX M	#	50 x 10 ¹ mS = 500 mS
2	Call Lamp Steady	NO FLASH	3 2	00 0	#	
2	Decode Momentary	ON TIME	3 3	XX M	#	20 X 10 ² mS = 2000 mS
3	Rx Input Sensitivity	HIGH (30 - 850 mV)	4 1	2 0	#	
3	Rx Input Sensitivity	LOW (10 - 280 mV)	4 1	2 1	#	HIGH
3	Mon/Reset Polarity	GND TO MONITOR	4 1	3 0	#	
3	Mon/Reset Polarity	OPEN TO MONITOR	4 1	3 1	#	OPEN TO MONITOR
3	Decode Latched	ON = SINK	4 1	4 0	#	ON = SINK
3	Decode Latched	ON = SOURCE	4 1	4 1	#	
3	Decode Latched	OFF = MUTE	4 1	5 0	#	
3	Decode Latched	ON = MUTE	4 1	5 1	#	ON = MUTE
3	All Call	DISABLED	4 1	6 0	#	
3	All Call	ENABLED	4 1	6 1	#	ENABLED
3	Transpond	DISABLED	4 1	8 0	#	
3	Transpond	ENABLED	4 1	8 1	#	ENABLED
3	Sequence Length	OVER LENGTH OK	4 1	7 0	#	
3	Sequence Length	OVER LENGTH REJECT	4 1	7 1	#	OVER LENGTH REJECT
4	Remote Control: MODE #1	SELECTIVE CALL OPERATION	4 2	1	#	ENABLED
4	Remote Control: MODE #2	F1, F2, F3	4 2	2	#	DISABLED

4	Remote Control: MODE #3	(F1, F2 INTERLOCKED), F3	4 2	3	#	DISABLED
4	Remote Control: MODE #4	F1, F2, F3 ALL INTERLOCKED	4 2	4	#	DISABLED

DEFINITIONS & KEYSTROKES:

PRIMARY ADDRESS CODE:

One to seven digit sequence, user-definable. Reception of this code activates all outputs including the PTT and TRANSPOND TONE outputs, which are generally used to key the radio transmitter momentarily and send an acknowledgement tone. The PRIMARY ADDRESS CODE may be recalled any number of times, setting off the momentary outputs each time, without resetting the decoder. The decoder may be reset locally by the "ON-HOOK" to "OFF-HOOK" transition of the MONITOR/RESET line. Remote reset occurs on receipt of the PRIMARY or SECONDARY RESET addresses. Receipt of the ALL RESET code ([#] for 5 seconds) also produces reset.

SECONDARY ADDRESS CODE:

Identical to PRIMARY with the exception that TRANSPOND TONE and PTT do not occur. This address is often used for group call. In Group applications, stations transponding simultaneously would produce radio interference with each other.

RADIO KILL:

This is used to remotely disable selected radios. PTT and TRANSPOND output activate to acknowledge receipt of these signals.

NOTE: Radio Kill status is stored in EEPROM to insure retention during loss of power.

NOTE: The transpond tone is a double beep for RADIO KILL.

RESET and RESTORE:

The reset addresses factory default to equal the address code plus a # suffix. When a reset function is programmed as one digit it is inferred to be a suffix to the address code. When reset and restore are programmed to more than one digit, the programmed sequence becomes the reset or restore address.

INTERDIGIT TIME:

This is the time permitted between DTMF button presses by a calling party. The Factory default of 2000 mS is intended for normal manual dialing. If an automatic dialer is used, a shorter interdigit time reduces probability of false decodes. Shorter interdigit time reduced the delay before activation at the end of a sequence. The range is: 50 to 2300 mS.

Example: [3] [1] [1] [0] [2] [#] sets interdigit time to 1000 mS or 1.0 seconds.

CALL LAMP FLASH RATE :

The CALL LAMP OUTPUT flashes the lamp ON and OFF. This parameter sets the ON and OFF time. The range is: 100 to 900 mS with a 50/50 duty cycle.

NOTE: [3] [2] [0] [0] [0] [#] sets the CALL LAMP FLASH RATE to steady state ON. No flashing.

DECODER MOMENTARY OUTPUT:

Following reception of a valid Primary or Secondary address sequence, this output conducts to (-) Supply (GND) for this time period. The range is 50 mS to 590 Sec. (9.83 min.)

Example: [3] [3] [5] [0] [2] [#] sets DECODER MOMENTARY time to 5000 mS or 5 seconds.

Rx INPUT SENSITIVITY:

To accommodate the wide range of possible input levels, two sensitivity ranges are available. HIGH (10 - 280 mVrms) and LOW (30 - 850mVrms).

MONITOR/RESET POLARITY:

The Monitor/Reset lead is normally connected to a radio monitor button or hook switch. This parameter sets the sense polarity.

DECODE LATCHED OUTPUT

SINK/SOURCE: The Decode Latched Output normally connects to the muting point in the radio. SINK refers to transistor Q6 being turned on presenting a low impedance between its collector (J1 pin 4) and (-) Supply.

SOURCE refers to transistor Q5 being turned on presenting a low impedance between its collector and (+) Supply (J1 pin 4) (R17 limits the current output capability). In either mode, when OFF, J1 pin 4 is high impedance (open circuit).

DECODE LATCHED OUTPUT:

ACTIVE STATE: The Decode Latched Output normally connects to the muting point in the radio. Active state is the condition this output (J1- pin 4) provides to the host radio to produce Rx Audio Mute. Though SINK is the most common, SINK, SOURCE, and OPEN CIRCUIT are application possibilities. ON refers to the condition of J1 pin 4 as presented to the host radio when J1 pin 4 will SINK or SOURCE to MUTE the radio. OFF refers to the condition of J1 pin 4 as presented to the host radio when J1 pin 4 will SINK or SOURCE to UN-MUTE the radio.

ALL CALL:

ENABLE/DISABLE: Application parameter that permits the ALL CALL and ALL RESET functions (reception of > 6 Sec. of * or #) to be disabled.

TRANSPOND:

ENABLE/DISABLE: Application parameter that permits the TRANSPOND function to be disabled. This function is needed if TRANSPOND is not desired or legal, but RADIO KILL is required (PTT OUTPUT has to be hooked up).

NOTE: Transpond applies to Primary, Primary Reset and all Remote control functions.

SEQUENCE LENGTH REJECT:

ENABLE/DISABLE: The ST-809 verifies the length of an incoming DTMF sequence. To insure the sequence length is correct the ST-809 must look for additional digits before and following a valid sequence. This is why the ST-809 does not decode immediately on the release of the final digit in a valid sequence. This application parameter Disables the Sequence Length checking following the final digit in a valid sequence. When disabled the ST-809 will decode immediately on release of the final digit.

REMOTE CONTROL:

The ST-809 has four operational modes. As shipped from the factory, the ST-809 is configured for selective calling applications (MODE #1). By selecting one of three other operational modes 2, 3, or 4, the ST-809 may be used for Remote Control applications. When a Remote Control mode is selected the hook switch is disabled. Three of the outputs are redefined as open collector control outputs. The output

associated to the function may be turned ON or OFF individually or interlocked as described in the configuration chart.

CALL LAMP = Function #1 (F1) = Pri. Address and Reset

DECODE MOM = Function #2 (F2) = Sec. Address and Reset

DECODE LATCHED = Function #3 (F3) = Kill and Restore

NOTE: Interlocked functions do not have individual reset addresses. Activation of interlocked functions resets the associated function(s).

NOTE: Remote control output states are stored in EEPROM to insure retention during loss of power.

Example: In MODE 3, reception of the Primary Address sets F1 to ON and resets F2 to OFF. Reception of the Secondary Address sets F2 to ON, and resets the F1 to OFF. F3 is independent.

Example: In MODE 4, reception of any function resets the other two functions.

When any Remote Control function is set or reset, Transpond occurs. Transpond for remote control always consists of three beeps. A high frequency beep indicates ON a low frequency beep indicates OFF. Beeps 1 - 3 represent F1 - F3.

WARRANTY POLICY

All standard Selectone products are guaranteed to meet or exceed published performance specifications and are warranted against defects in material and workmanship for a period of five years from the date of purchase. Special configurations and non-standard systems are warranted for a period of one year.

If any standard Selectone product fails to operate within the first 90 days from the date of purchase, Selectone will immediately send a replacement unit post-paid via airmail or UPS Orange Label (air), and will issue full credit, including freight, upon the return of the defective unit(s). Prepay/C.O.D. customers must return the defective equipment prior to exchange or will receive the replacement C.O.D. with credit issued only on the return of the defective equipment.

After 90 days, this warranty is specifically limited to correction of the defects by factory or replacement of faulty equipment or parts.

All warranty repairs must be performed at the Selectone factory in Hayward, California. **No credit will be given for unauthorized repair work attempted by the customer.** Any unauthorized alterations 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.

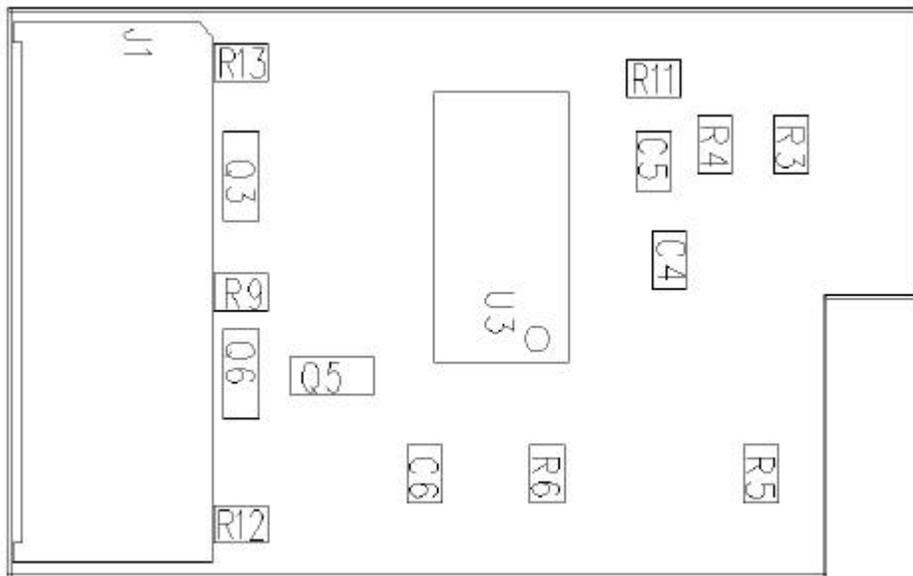
Equipment for repair must be returned with a **Returned Materials Authorization (RMA)** number visible on the shipping package. The RMA number may be obtained via Phone, Fax, or E-Mail. Additionally, returned equipment should be sent with a note briefly describing the nature of the defect. Equipment returned without an RMA number will receive no attention until Selectone Customer Service has been able to contact the shipper to obtain the necessary RMA information.

For warranty service, contact Selectone Customer Service Department at (800) 227-0376, fax (510) 781-5454 or E-Mail at techsupport@selectone.com.

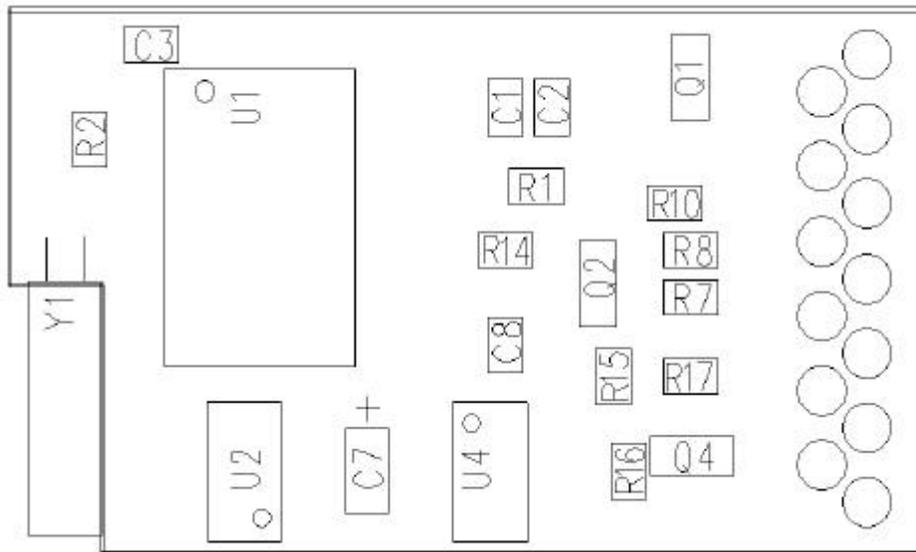
**Send all repairs and returns with the associated RMA
number visible on the shipping package to:
Selectone, Inc.**

**3501 Breakwater Ave.
Hayward, Ca. 94545-3610
ATTN: Warranty Repair**

ST-809 Component Locator



Top View



Bottom View

ST-809 Schematic Diagram

