Model 600L
DTMF Microphone

Master OEM Manual

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Limited Warranty

CES Wireless Technologies (**C*ES***) warrants it's products to be free of defects in material and workmanship and extends this warranty under intended use and normal service conditions to the original owner for a period of one year from the date of purchase.

This warranty does not apply to any product that has been subjected to repairs or alteration not authorized by *CES*, or for any product that has been damaged due to accident, abuse, neglect, vandalism, loss, unreasonable use, improper installations, lightning, fire, or water damage.

The obligations of *CES* are limited to repairing or replacing, at the option of *CES*, any product or component that is returned to the factory all transportation charges prepaid, accompanied by proof of purchase and which examination reveals to have been defective within the warranty period stated above. *CES* does not assume, nor is any person authorized to assume for it, any obligation other than that stated herein.

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CES takes pride in the products and after the sale support that we offer our many customers.

 Due to continual product improvements, descriptions and specifications are subject to change without notice.

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Model 600L Universal Microphone Manual

GENERAL DESCRIPTION

The CES Model 600L DTMF Encoder Microphone is engineered specifically for use with a wide variety of mobile radio applications. Whether used on SMR trunked systems, conventional telephone interconnected shared mobile radio systems, or in dedicated single-user radio systems, your new 600L microphone will enhance the utility of your mobile communications. Standard features in the Model 600L microphone include:

- **Automatic push-to-talk transmitter keying**
- **Direct compatability with many models of mobile radio products**
- **Installed mating connector available for many popular model radios**
- **Durable backlighted silicone rubber keypad**
- **Precise crystal controlled tone generation**
- **Automatic microphone muting**
- **Audible DTMF sidetone to ensure proper dialing**
- **Rugged urethane extreme temperature coil cord**
- **Optional fixed length DTMF digit dialing (150 milliseconds)**

INSTALLATION

Your CES Model 600L DTMF Encoder microphone may be easily configured for the particular application. Power is supplied to the microphone through the radio's microphone connector for all functions, including: audible sidetone and keypad illumination.

If the Model 600L microphone was ordered for a specific application, a mating connector is installed; or, an appropriate connector may be installed using the information supplied below:

Cable Wire Color	**Function**
BLUE	+12 VDC Input
RED	Push-To-Talk (logic low)
WHITE	TX Audio Output
BLACK	CTCSS Hang Up (logic low)
SHIELD	Audio/Logic Ground
YELLOW	Logic and Power Ground

CTCSS Hang Up (Monitor) is a logical function that will normally (as shipped) provide an off-hook (open-circuit) to the radio for CTCSS or DCS squelch "monitor" , or other decoder functions, and a logic low when placed on-hook. A grounded microphone hang-up clip is required.

A CTCSS Inverter is available as a factory option that provides reversed logic from the method described above. That is: the CTCSS Hang Up logic is an open-circuit when on-hook, and a closed circuit (logic low) when taken off hook.

LEVEL SETTING AND INTERFACE ADJUSTMENTS

To accomplish level setting and any changes in (jumper) options, remove the four screws and the microphone back cover.

Jumper JP1 - Audio Gain Select Jumper
This jumper is used to set the range of microphone and DTMF audio output from the 600L microphone. When JP1 is installed (factory default, as shipped), it will accommodate requirements where the microphone audio is in the range of 40 mV or less. For higher voice and DTMF tone input levels, remove JP1.

DTMF Tone Output Level (RV1)
For reliable DTMF signaling: The DTMF tone deviation should be approximately 2/3 of the maximum deviation (for example: if the modulation limiting is set to 5.0 kHz, then the DTMF level should be 3.3 kHz). In any event, the DTMF Tone transmitted by the 600L microphone should not be clipped or distorted. If your service monitor does not have a CRT display to observe the transmitted waveform, use an oscilloscope connected to the "demod" output from the service monitor to visually verify the quality of this signal. Set RV1 for the proper DTMF Tone level (3.3 kHz). *For applications where a 2.5 kHz deviation limit is used, set the DTMF level to approximately 1.7 kHz with no CTCSS tone, or 2.2 kHz with CTCSS tone.* If the output is insufficient for proper modulation deviation, then remove JP1.

Voice Level Adjustment (RV2)
This adjustment sets the microphone level for voice modulation only. While monitoring the transmitter frequency on a service monitor, press the microphone PTT switch and set RV2 on the 600L microphone so that the voice deviation peaks just before limiting (clipping) occurs while speaking in an average voice level. Remove JP1 if the proper modulation level cannot be reached.

Tone Burst Mode
The 600L microphone is shipped for the continuous DTMF tone mode. This mode provides a DTMF tone for the duration that the user presses a key. For the Burst Mode option, where a fixed length DTMF tone burst of 150 milliseconds is desired, install jumper JP4 (shown on figure "A").

Automatic Push-To-Talk (PTT)
The 600L microphone is shipped with Automatic Push-To-Talk enabled, where PTT occurs upon depressing any keypad digit. Should the application require that the user press the PTT switch in order to encode DTMF dialing, then remove resistor R2 (10K) to invoke this operation, and disabling the Automatic PTT feature. See Figure "A" for the location of R2. If R2 is removed, sidetone audio will not be heard from the microphone during DTMF dialing.

LEVEL SETTING AND INTERFACE ADJUSTMENTS - continued

Adjusting DTMF Twist

The DTMF microphone generates two tones when any keypad button is pressed. The following table illustrates the row tones and column tones generated by activating a keypad button:

Row Tones (Hz)	Column Tones (Hz) 1209	1336	1477
697	1	2	3
770	4	5	6
852	7	8	9
941	*	0	#

The term "DTMF Twist" is the ratio between the level of the column tone and the row tone generated by any keypad button. In application, the higher frequency (column) tones are more readily attenuated than the lower frequency (row) tones, the high frequency tones of any DTMF are generated by the microphone at a slightly higher level.

The 600L microphone is shipped with the proper DTMF twist required for most applications, and this procedure should not be necessary.

Should a particular application require the DTMF twist to be tested or changed, the following may be accomplished: (the temporary modification allows two keypad digits to be pressed within a column or row - resulting in the generation of a single tone applicable to that column or row):

(1) Cut the plating run on the bottom of the 600L printed circuit board at JP6.
(2) If installed, remove 600L microphone jumper JP4 (disables Burst Mode operation).
(3) Press two keys within a column (for high tones) or two keys within a row (for low tones) while monitoring the transmitted tone level on a service monitor.

LEVEL SETTING AND INTERFACE ADJUSTMENTS - continued

(4) The ratio of high to low tones may be modified by changing the value of C9 (470 pf):

Increase the value to reduce the DTMF twist ratio
Decrease the value to increase the DTMF twist ratio

Table of Single-Tone Encoding - Service Mode

Keypad Location	Reference Tone (Hz)	Actual Tone Output (Hz)	Percent Deviation
Row Tone 1	**697**	699.1	+0.30
Row Tone 2	**770**	766.2	-0.49
Row Tone 3	**852**	847.4	-0.54
Row Tone 4	**941**	948.0	+0.74
Column Tone 1	**1209**	1331.7	+0.57
Column Tone 2	**1336**	1331.7	-0.32
Column Tone 3	**1477**	1471.9	-0.35

(5) Reinstall JP6 with a wire jumper, returning the microphone to normal operation.

Isolating Analog, Logic, and Power Grounds
If your application requires that the microphone audio, push-to-talk logic, and -12 VDC grounds be separate: Cut the jumper JP2 on the printed circuit board as shown in Figure "A".

PTT Logic associated with Microphone Audio
If your application requires that the push-to-talk logical low signal be on the microphone audio line: Then install a wire jumper or resistor, as required by the application, at JP3.

CTCSS Monitor (Standard Communications GX series)
For the Standard Communications GX series mobile radios: Install a 10K ohm 1/8 watt resistor at R6. *If you ordered the 600L microphone for this application, this (GXC) option has already been installed.*

CTCSS Monitor (Inverted Logic)

For applications where the CTCSS monitor hookswitch circuit is open-circuit when the microphone is on-hook, and closed-circuit when off hook (Ericsson-GE and others):

Remove R11
Install R20 (27K ohm)
Install R22 (27K ohm)
Install C17 (.001 uf)
Install Q3 (MPS2222)

If you ordered the 600L with this specification, this option has already been installed.

If an operating voltage (+8 to +12 VDC) not already available at microphone connector, locate a spare or unused pin on the radio microphone connector. Some radio microphone connectors may not have any obvious "spare" pins, but an existing function such as speaker or handset receive audio may be disconnected to free up the pin. Make a wire connection from this pin to a switched voltage within the radio (+8 to 12 VDC), and one that is filtered and/or regulated. Connect the microphone cable Blue wire to this source voltage connector pin on the microphone connector plug.

If the radio application has no provision for providing the necessary operating voltage for the microphone and the radio microphone audio circuit incorporates a bias voltage of approximately 7 volts or more, a special version of the 600L is available from CES to interface with this requirement. Contact your CES Sales Representative for more information.

THEORY OF OPERATION

Power to the microphone is provided via the radio microphone connector. This +12 VDC source voltage is filtered by C3 and regulated to 5.0 volts by VR1.

Each time a key is pressed on the keypad, the normally low output of U2 pin 8 goes high, forward biasing CR2 and causing C2 to charge. The rise in voltage on inputs of U1C pins 8 and 9 causes the output pin 10 to go low. A low on either U1A pin 1 or U1B pin 6 results in the output of U1A-3 and U1B-4 to latch to a high state. The high input on the gate of Q1 in the drain output going to a low state and asserting a push-to-talk output to the radio. The charge on C1 will keep PTT low for approximately 1.5 seconds after each key is pressed. This delay allows for an adequate period of time for another user-initiated key to be subsequently pressed before transmitter push-to-talk is allowed to return to the unkeyed mode.

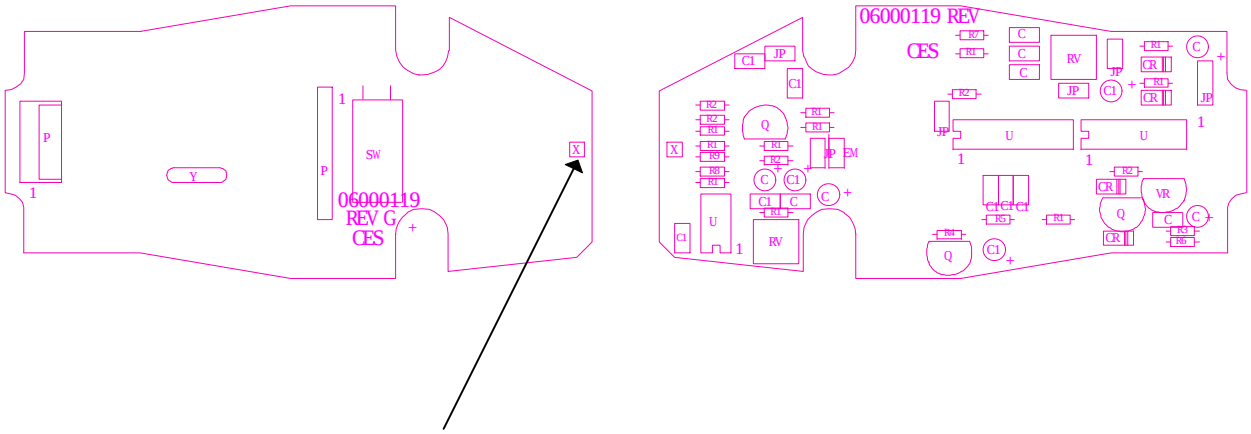
With jumper JP4 in-place, the DTMF tone generated will be a tone burst of approximately 150 ms per digit, irregardless of how long the key is pressed. As received from the factory, the jumper is removed and each DTMF tone is generated for the entire duration of a pressed key.

If the Burst Mode is enabled (JP4 installed), the length of the DTMF tone burst may be changed to accommodate a particular system requirement: Change R18 (270K) to a higher value to increase, or to a lower value to decrease the time period for each DTMF tone.

If the automatic push-to-talk feature is disabled by removal of resistor R2, the microphone will have to be manually keyed (PTT depressed) to send the DTMF tones. In this mode, when the PTT switch is depressed, an active high is placed on the gate of Q1 causing the PTT output to go low enabling the transmitter and permitting the DTMF tones to be transmitted.

The DTMF tone output is generated at U2 pin 16, and the DTMF output level is set with RV1. The microphone element voice output is amplified by U3A, where the gain and voice level is set by RV2 and then combined with the previously set DTMF audio level. Both voice and DTMF tones are further amplified by U3B (the actual gain determined by jumper JP1 setting: JP1 installed = low output, JP1 out = high output). The combined DTMF tones and voice audio are coupled through a non-polarized capacitor C11 to the microphone high input to the radio.

The DTMF tones are connected to the microphone element EM1 when the PTT button is not depressed to provide audible sidetone of dialed digits. Sidetone is disabled if resistor R2 is removed for the Manual PTT option.



CES will insert appropriate pointers after manual revision by OEM

Model 600L Universal Microphone Parts List

Symbol Number	Description	CES Part Number
C1,8,19	.1 uf 35V Capacitor	CM.1
C2,6,16	10 uf 16V Tant. Capacitor	CT10
C3	10 uf 25V Tant. Capacitor	CT106
C4	1500 pf Capacitor	CM1501
C5	.01 uf Capacitor	CM.01
C7,12,18	1 uf Capacitor	CT1
C9	470 pf Capacitor	CM471
C10	22 pf Capacitor	CC22P
C11	2.2 uf 16V NP Capacitor	CT2.2NP
C13,14,15	220 pf Capacitor	CM221
CR1,3	1N5248 Zener Diode	D5248
CR2,4	1N914 Diode	D914
EM1	Microphone Element	MIC01-K
Q1	N CH Mosfet VN10KM	QVN10
Q2	NPN Transistor MPSA06	QA06
Q3	MPS2222 Transistor	Q2222A
R1	200K 1/8W Resistor	RC204
R2,6	10K 1/8W Resistor	RC10K
R3	100 1/8W Resistor	RC101
R4	1K 1/8W Resistor	RC103
R5,13	4.7K 1/8W Resistor	RC472
R7,14,23	150K 1/8W Resistor	RC154
R8,9	82K 1/8W Resistor	RC823
R10	680 1/8W Resistor	RC681
R11,19,21	0 1/8W Resistor	RC-JUMPER
R12	8.2K 1/8W Resistor	RC8.2K
R15	470 1/8W Resistor	RC471
R16,17	100K 1/8W Resistor	RC104
R18	270K 1/8W Resistor	RC274
R20,22	27K 1/8W Resistor	RC273
RV1	100K Potentiometer	RV100K
RV2	10K Potentiometer	RV103

Symbol Number	Description	CES Part Number
P1	Connector, 6 Pole	CON54
P2	Flex Strip, 9-circuit	FLEX1
SW1	PTT Switch DPDT	MIC01-M
U1	IC CMOS CD4011	U4011
U2	IC DTMF Encoder	U2559
U3	IC TL062	U062
VR1	IC Regulator 78L05	U78L05
Y1	3.579 Mhz Crystal	XTAL3
NON-REF ITEMS	Front Case Half (includes DTMF keypad)	MIC01-A
	Rear Case Half	MIC01-B
	Hang-up Button	MIC01-C
	Ground wire w/terminal	MIC01-D
	Felt Screen	MIC01-E
	Metal Screen	MIC01-F
	PTT Lever, Plastic	MIC01-G
	Rubber Ring	MIC01-H
	Neoprene Pad	PAD03
	Case Screw #4 x 5/16"	SCREW40
	Microphone Cord	CRDCES-1
	Strain Relief	STRNREL04
	Rubber Boot	BOOT1
	Complete Case Assembly	600LMF
	Rear Label: 600LUniv	LABEL002