

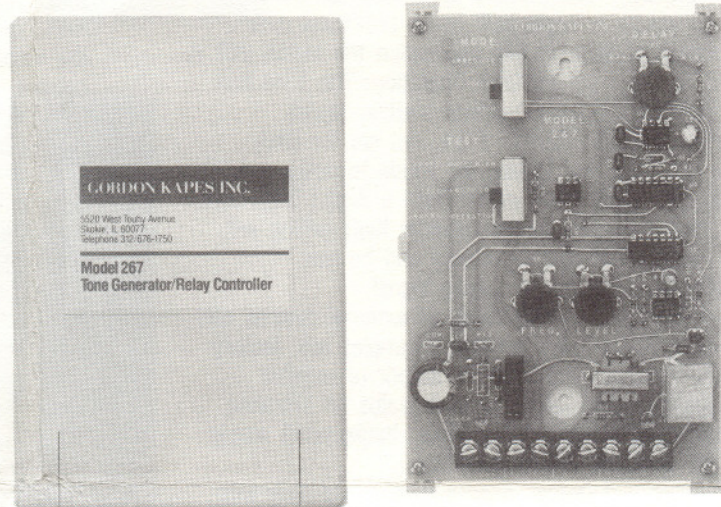
## GORDON KAPES INC.

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### MODEL 267 TONE GENERATOR/RELAY CONTROLLER

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## 1. General Description

**1.1 PRACTICE** The information contained in this technical practice uses terminology and specifications current as of September 16, 1986. Gordon Kapes, Inc. will update this practice as new information is available.

**1.2 PRODUCT OVERVIEW** The Model 267 contains a tone generator, logic circuit, and relay that are controlled by an external input signal. The Model 267 is designed expressly for use with the Redwood® digital telephone system manufactured by ROLM Corporation. Redwood provides two general purpose signals, called TTL1 and TTL2 (hereafter referred collectively as TTL1/2), for use in Universal Night Answer (UNA) ringing indication and/or customer selected control applications. The Model 267 allows TTL1/2 to control operation of the tone generator and relay contact, facilitating connection of a wide variety of external devices.

**1.3 FEATURES** The tone generator produces a "warble tone," which is similar in character to the ringing signal produced by most electronic telephones. The tone signal is designed to connect to a line level input channel of an audio amplifier associated with a public address system. Controls are provided to adjust the frequency and level. The relay contact is a Form C type, providing both a normally closed and normally open contact. The Model 267 also contains two (2) indicator lights and one (1) test switch to assist in installation and trouble-shooting.

**1.4 OPERATING MODES** Three modes of operation allow great flexibility in controlling external devices. In all modes the tone generator and the relay operate in tandem, (i.e. when the tone generator is active the relay is energized). In the direct mode, tone signal and relay operation follow TTL1/2. In the delay mode, activation by TTL1/2 causes the tone and the relay to operate for a preset time period, then stop. A control on the Model 267 allows adjustment of this delay time. In the latch mode, activation by TTL1/2 causes the tone and the relay to operate continuously (i.e. latch on). The next activation by TTL1/2 unlatches the tone and the relay.

**1.5 TTL1/2 DESCRIPTION** TTL1 and TTL2 are logic signals that change state due to user initiated commands or system UNA commands. Electrically TTL1/2 are 5V TTL compatible logic outputs in series with 1K ohm resistors. TTL1/2 operate in a negative logic mode. In the idle, not active state, TTL1/2 remain in the logic high state, (i.e. nominally 5Vdc can be measured at the TTL1/2 connection point). TTL1, when configured for UNA operation, produces a logic signal in cadence with a standard 2 second ring, 4 second silent ring cycle. TTL1 goes logic low during the 2 second part of the ring cycle. TTL1, when not configured for UNA operation, and TTL2 respond to user initiated commands. After receiving a system dial



tone, dialing “#” then “8” on the digital telephone causes TTL1 to go to the logic low state for approximately 250 milliseconds. Dialing “#” then “9” on the digital telephone causes TTL2 to go to the logic low state for approximately 250 milliseconds.

**1.6 POWER REQUIREMENTS** The Model 267 requires an external source of 24Vac for operation.

**1.7 PHYSICAL DESCRIPTION** The Model 267 consists of a precision fabricated printed circuit board mounted in a plastic enclosure. The Model 267 measures 7.5” long, 4.5” wide, 2.0” deep, and weighs less than one (1) pound. The Model 267 is wall mounted with two (2) screws.

## 2. Applications and Limitations

**2.1 TONE SIGNAL** The primary application for the tone signal is to act as a “night bell” to be broadcast over a public address system. In this application the Model 267 is connected to TTL1 set for UNA operation. The tone can also be used as a general purpose alerting signal.

Connecting the Model 267 to TTL1, not set for UNA operation, or TTL2 and setting the mode to delay or latch, users can control the tone signal from a digital telephone. Adjusting the frequency to the extreme high setting will create a much more piercing sound and be less recognizable as a telephone ringing signal.

**2.2 RELAY CONTACT** A multitude of external devices can be controlled by the relay contact. Examples are: factory alert horns, lighting contactors for indoor or outdoor lighting, garage doors, electric strike plates on entrance doors, lava lamp in the bosses office, background music for night or weekend use in an office.

**2.3 LIMITATIONS** External devices must be chosen with the limitations of the Model 267 in mind. The external device(s) must be specified taking into account what could happen if power to the Model 267 and/or the associated Redwood is momentarily removed. A reset circuit is utilized to insure that upon power up, the outputs of the Model 267 switch to a defined state. But if the Model 267 and the associated Redwood power up at the same time, as in the case of the power interruption, there is a chance that a momentary logic low may be present on the TTL input terminals. Depending on the length of the logic low and the mode the Model 267 is set in, a momentary or latched audio signal and relay closure may occur. An external device such as a fire alarm is best not connected, as a momentary power failure could accidentally activate it. The external devices connected to the Model 267 should be such that an erroneous signal from the Model 267 will not cause major problems for the end user.

**2.4 SAFETY** Although the relay contact is capable of handling ac line voltages, safety dictates that low voltage devices be connected to minimize the chance of shock hazard. The Model 267 terminal strip has exposed screw terminals that would pose a shock hazard to both installers and exploring end users. If ac line voltages are to be controlled, it is best to let the Model 267 relay contact switch a low voltage signal that will activate an ac power relay, or lighting contactor. The ac power relay, or lighting contactor should be installed to meet recognized safety codes.

## 3. Installation

**3.1 CHECKING FOR DAMAGE** The Model 267 should be inspected for damage immediately upon receipt. If damage is found, a claim should be filed with the shipper. A replacement Model 267 should be ordered if necessary.

**3.2 MOUNTING** Each Model 267 is wall mounted using two (2) #6 pan head screws of the type appropriate for the wall material. The cover must be removed to allow access to the mounting holes.

**3.3 INTERCONNECTIONS** All interconnections are made via a nine (9) position terminal strip, accessible with the plastic cover on or off. Figure 1, at the end of this practice, gives detailed connection information.

**3.4 POWER CONNECTION** Connect 24Vac to the terminals labeled “24VAC.”

**3.5 TTL CONNECTION** Observing lead polarity connect Redwood TTL1 or TTL2 to the terminals labeled “TTL” on the Model 267. TTL1 terminates on Redwood master cabinet connector J50, Violet/Slate wire for positive and Slate/Violet for ground. TTL2 terminates on Redwood master cabinet connector J51, Violet/Slate wire for positive and Slate/Violet for ground.

**3.6 TONE CONNECTION** Connect the audio equipment to the terminals labeled “AUDIO” on the Model 267. The tone is designed to interface with virtually all public address equipment. The circuit utilizes a transformer to provide a balanced line level output with a nominal impedance of 600 ohms. The tone can be connected to all types of audio amplifier line level input channels: low or high impedance, balanced or unbalanced.

**3.7 TONE ADJUSTMENTS** The tone level is adjustable from 0 to approximately 0.5 Vac RMS. The control marked “LEVEL” is adjusted to the desired level. The center frequency of the tone is adjustable over a range of approximately 250 to 1500Hz. The control marked “FREQ.” is adjusted to produce the desired output frequency. Lower output frequencies are more pleasant to the ear, but less attention getting than those in the higher frequencies.

**3.8 MODE SWITCH** The three (3) position mode switch at the top of the Model 267 circuit board must be set to the desired position.

**IMMEDIATE:** In the immediate mode (top switch position) the tone and the relay directly follow the state of TTL1/2. Whenever TTL1/2 is in the logic low state, the tone is produced and the relay is energized. The immediate mode is intended for use with TTL1 when TTL1 is set for UNA operation. The tone signal can be connected to an audio amplifier associated with a public address system. The normally open relay contact can be used to activate a night bell, or other indicating device. The 24Vac powering the Model 267 can be routed through the relay contact to trigger a chime, bell, horn, or other indicating device.

**DELAY:** In the delay mode (middle switch position) TTL1/2 momentarily going into the logic low state makes the tone active, and the relay energize until the end of a preselected time period. The control marked “DELAY” should be adjusted for the desired time. The range is approximately 1 second in the “MIN.” position, to approximately 10 seconds in the “MAX.” position. The delay mode is not intended for use with TTL1 when TTL1 is set for UNA operation.



**LATCH:** In the latch mode (bottom switch position) TTL1/2 momentarily going into the logic low state makes the tone active, and the relay energize. The tone remains active, and the relay remains energized until the next momentary TTL1/2 transition to the logic low state. The state of the tone and the relay reverses each time TTL1/2 momentarily goes into the logic low state. The latch position is not intended for use with TTL1 when TTL1 is set for UNA operation.

**3.9 INDICATOR LIGHTS** Two LED indicator lights are visible with the plastic cover on or off. The power LED, located on the left, indicates the presence of 24Vac. The relay LED, located on the right, indicates the status of the relay and the tone generator. When the relay LED is lit, the relay is energized and the tone is on.

**3.10 TEST SWITCH** The three (3) position test switch is used to test the operation of the Model 267 during both installation and trouble-shooting.

**TEST-LOGIC HIGH:** In the top position 4mA of current is fed into the opto-coupler that isolates the TTL input from the remainder of the Model 267 circuitry. This simulates TTL1/2 being in the idle, logic high state.

**TEST-LOGIC LOW:** In the middle position no current is fed to the opto-coupler, simulating TTL1/2 being in the logic low state.

**NORMAL OPERATION:** In the bottom position the TTL1/2 signal connected to terminal strip pins 3 and 4 is connected to the opto-coupler. For operation with Redwood the test switch must be left in the down position.

**3.11 TESTING** After connecting the external device(s) to the tone output and/or the relay contact, and selecting the desired mode of operation, the test switch and the LED's can be used to check the operation of the Model 267. To simulate TTL1/2 being in the idle state, set the test switch to the test-logic high position. It is important to remember that Redwood puts out a logic high state, approximately 5Vdc, in the idle state. Only when there is activity on TTL1/2 will the logic low state, approximately 0.5Vdc, occur on TTL1/2. To simulate a user pressing "#" "8" or "#" "9" on one of the digital telephones, move the test switch from the test-logic high position to the test-logic low position, and then quickly back to the test-logic high position. To simulate TTL1 set for UNA operation, move the test switch from the test-logic high position to the test-logic low position, wait for about two (2) seconds, then return to the test-logic high position. After testing, be sure to place the test switch in the normal operation position to connect the TTL input to Redwood.

## 4. Circuit Description

**4.1 GENERAL** The circuit description is intended to familiarize you with the Model 267 for engineering and applications use.

**4.2 INPUT ISOLATION** To achieve isolation between the input signal (Redwood TTL1/2) and the Model 267 circuitry, an opto-coupler is utilized. A 200 ohm resistor is in series with the opto-coupler input diode as protection from accidental connection of logic signals or other voltage sources that have not been current limited.

**4.3 TEST SWITCH** For testing, a three (3) position switch selects which source is connected to the input diode of the opto-coupler: TTL input from the terminal strip for normal operation, nothing to simulate logic low, or 4mA of current from the internal power supply to simulate logic high.

**4.4 LOGIC CIRCUITRY** The output of the opto-coupler is debounced and fed through CMOS type inverting gates prior to connecting to the delay and the latch sections. The delay section uses a low power version of the 555 type timer acting as a one-shot. A potentiometer is used to allow the duration of the one-shot to be adjusted over a nominally one (1) to ten (10) second range. The latch section utilizes a CMOS type D flip flop.

**4.5 MODE SWITCH** A three (3) position switch selects which signal (the debounced output of the opto-coupler, the output of the one-shot, or the output of the D flip flop) is sent to a transistor acting as a current sink. The transistor controls power going to the tone generator integrated circuit and the relay coil.

**4.6 TONE GENERATOR** The warble tone signal is produced by an integrated circuit. The output frequency and level are adjusted by potentiometers. An audio coupling transformer is utilized to provide electrical isolation between the Model 267's circuitry and the outside world.

**4.7 POWER UP** A circuit is used to insure that upon power up the logic circuitry will end up in a defined state. When not interfered with by an input signal, the tone generator and relay will power up to the off state.



## 5. Specifications

### POWER REQUIREMENT

24 ± 4Vac, 70mA maximum

### FUSING:

One (1) 1 amp fuse. Fuse is equivalent to Buss GMT and Littlefuse 401 Series and is field replaceable.

### TTL INPUT:

Opto-coupler in series with 200 ohm current limiting resistor designed for connection to Redwood TTL1 or TTL2. TTL1 and TTL2 are nominally +5Vdc for logic high state and 0.5Vdc for logic low state. TTL1 and TTL2 are current limited to 4mA maximum via 1K ohm series resistors in Redwood circuitry.

### TONE:

Type: Two alternating tones, commonly known as "warble tone"  
Level: Variable from 0-0.5 Vac RMS (approximate)  
Impedance: 600 ohms (nominal)  
Center Frequency: Variable from 250-1500Hz (approximate)

### RELAY CONTACT SPECIFICATIONS:

Type: Form C, Break Before Make  
Max. switching power (resistive load): 150W, 600VA  
Max. switching voltage (resistive load): 250Vac, 30Vdc  
Max. switching current (resistive load): 5A  
Min. voltage and current: 5Vdc, 0.1A

### CONNECTIONS:

Nine (9) position screw terminal strip

### DIMENSIONS:

7.5" high (19.05cm)  
4.5" wide (11.43cm)  
2.0" deep (5.08cm)

### WEIGHT:

Less than one (1) pound (.453Kg)

### MOUNTING:

Wall mounted with two (2) #6 pan head screws

## 6. Incorrect Operation

**6.1 DIFFICULTIES** Should problems arise in the operation of the Model 267, review Section 3 — INSTALLATION. Insure that all connections and switch settings have been made properly. If another Model 267 is available, substitute and retest.

**6.2 REPLACEABLE PART** Fuse F1 is the only field replaceable part on the Model 267. It is a one (1) amp alarm indicator type equivalent to Buss GMT/Littlefuse 401 Series — also known as "GRASSHOPPER" or alarm fuses.

**6.3 DEFECTIVE UNIT** If it is determined that the Model 267 is defective, return for repair or replacement according to the Gordon Kapes, Inc. Warranty/Repair and Return Policy.

### TERMINAL STRIP CONNECTION DIAGRAM MODEL 267 TONE GENERATOR/RELAY CONTROLLER

TERMINAL STRIP		
NUMBER	LEGEND ID	CONNECTION
1	24Vac	24Vac
2		24Vac
3	+ TTL	TTL1/2 Positive
4		TTL 1/2 Ground
5	Audio	Tone Output
6		Tone Output
7	N.C.	Normally Closed Relay Contact
8	COM.	Common Relay Contact
9	N.O.	Normally Open Relay Contact

### NOTES

Connection to ROLM Redwood® System:

TTL1:	Master Cabinet J50	VIOLET/SLATE: Positive
		SLATE/VIOLET: Ground
TTL2:	Master Cabinet J51	VIOLET/SLATE: Positive
		SLATE/VIOLET: Ground

Figure 1