

TELLABS 6072
SINGLE DIGIT DTMF/DIAL DECODER

1. GENERAL

1.01 This Section describes the 6072 Single Digit Dual Tone Multi Frequency (DTMF) or Rotary Dial Decoder manufactured by TELLABS Inc. which is approved for installation by Southwestern Bell Telephone Co.

1.02 This Section is issued to provide guidelines for the installation and maintenance of TELLABS 6072 Single Digit DTMF/Dial Decoder.

2. GENERAL DESCRIPTION

2.01 The TELLABS 6072 Single Digit DTMF/Dial Decoder module provides single-digit selective signaling from either a dual tone multifrequency (TOUCH-TONE*) or rotary dial source. Upon receipt of a single digit input, the 6072 activates a separate signaling output lead dedicated to that dialed digit. When used in TELLABS 291 Conference/Alert System, the activated signal lead can be used to operate a community siren or to selectively signal separate groups of conference stations. These output leads, one for each of the 12 standard DTMF keys, provide an active ground potential for external loads referenced to any negative voltage between -22 and -56Vdc.

2.02 The 6072 module is factory-equipped with a TELLABS 9971 DTMF Receiver subassembly. This plug-on subassembly receives DTMF tones or rotary dial pulses and outputs a digital signal required by the 6072 for digit recognition. The 9971 also supplies a trigger pulse that is used to gate the digital data to the 6072.

2.03 As stated above, each of the 12 signaling leads (0 through 9, # and *) provides a ground for external loads referenced to any voltage between -22 and -56Vdc. (Typical units will operate with negative voltages as low as -5Vdc.) Each ground output is capable of sourcing up to 100mA of continuous current.

2.04 Each output lead may be independently switch optioned for either momentary or latched operation. In the momentary mode, the output lead is activated (after dialing is completed) for approximately 100ms. In the latched mode, the output lead is activated after dialing is completed and remains active until a ground potential is placed on the reset lead associated with the activated output.

2.05 Master reset and control functions may be implemented via wiring options. The 6072 provides separate master set and reset leads that provide group activation and deactivation of all output leads optioned for latched operation. Two additional non-optionable output leads are provided to furnish control signals for external equipment.

2.06 An internal voltage regulator permits the 6072 to operate on filtered -21 to -56Vdc input. Maximum current requirement is 120mA. The 6072 incorporates power-on reset circuitry to ensure that all outputs are deactivated for 500ms after power is initially applied to the unit. Power input to the 9971 DTMF Receiver is derived from the mainboard.

*Trademark of the American Telephone and Telegraph Co.

2.07 As a Type 10 module, the 6072 Single Digit Decoder mounts in one position of a TELLABS type 10 mounting shelf, versions of which are available for relay rack or KTU apparatus case installation. In relay rack applications, up to 12 modules may be mounted across a 19-inch rack, while up to 14 modules may be mounted across a 23-inch rack. In either case, 6 inches of vertical rack space is used.

3. APPLICATION

3.01 The 6072 Single Digit DTMF/Dial Decoder is typically used in applications requiring selective signaling or control functions from a single input digit. When used in TELLABS' 291 Conference/Alerting System, for example, the 6072 provides the means for any conference subscriber to activate a community siren by depressing the (*) pushbutton of the conference telephone set. The 6072 can also provide the dispatcher with the means to selectively signal up to 12 separate groups of conference stations, thus permitting the dispatcher to call only those crewmen required for a particular emergency. Figure 1 shows a typical circuit arrangement. In this example, the 6072 is used on a local party line circuit to provide selective signaling for up to 12 stations. The 6072 permits any station on the party line to access any other station by dialing a single digit. Since all the stations are in close proximity to each other, the required signaling and reset leads are metallic loops connected directly from the 6072. Because of its inherent flexibility, the 6072 is also suitable for remote telemetry applications.

3.02 A switch option conditions the 6072 module to operate with either a DTMF or rotary dial digit source. When optioned for rotary dial operation, a mixed TOUCH-TONE

and rotary dial input arrangement can be accommodated via a wiring option. In this mixed mode, the 6072 responds to both TOUCH-TONE and rotary dial inputs.

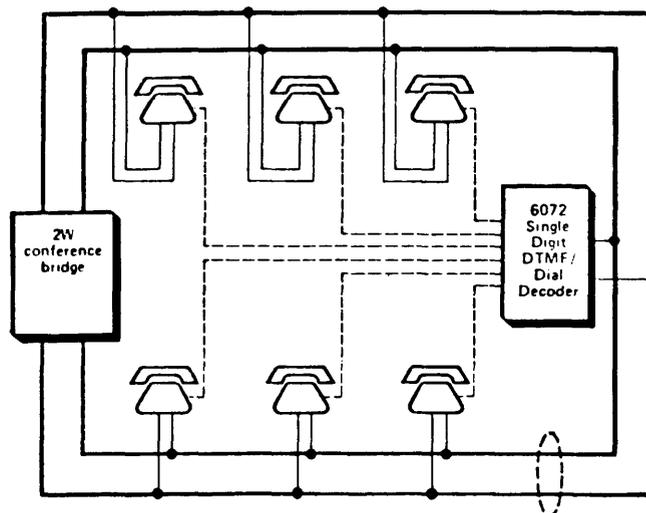


FIGURE 1

3.03 Each of the module's 12 signaling output leads can be individually switch optioned for either a momentary or latched mode of operation. In the momentary mode, a decoded rotary digit's output lead is active (i.e., a ground potential is present on the digit's output lead) for approximately 100ms, beginning 200ms after dialing is completed. A decoded DTMF digit's output lead is active for as long as the DTMF key is held depressed or for a minimum of 100ms, beginning 35ms after the key is depressed. In the latched mode, a decoded rotary digit's output lead is activated approximately 200ms after dialing is completed and remains active until ground is temporarily placed on the digit's reset (RST) lead. A decoded DTMF digit's output lead is activated approximately 35ms after the DTMF key is depressed and, again, remains active until ground is placed on the digit's RST lead.

3.04 Master activation and deactivation of both DTMF and rotary dial output leads optioned for latched operation can be effected via the module's master activate (SET) and master reset (MRST) leads. Applying a temporary ground to the SET lead activates all idle latched output leads, while a temporary ground applied to the MRST lead deactivates all active latched output leads.

3.05 The SET and MRST leads can also be used in conjunction with a digit output lead optioned for momentary operation to provide master activation and deactivation of all latched output leads via a single input digit. If a momentary digit's output lead is strapped to the SET lead, all idle latched outputs will be deactivated when the momentary digit is dialed. If a momentary digit's output lead is strapped to the MRST lead, all active latched outputs will be deactivated when the momentary digit is dialed.

Note: These modes of activation and deactivation can be used concurrently with the modes of operation described in the preceding paragraphs. Bear in mind, however, that the SET and MRST leads activate and deactivate all latched output leads simultaneously. Table A summarizes these basic modes of operation.

3.06 Master control of the 6072 can be effected via the module's LOCKED lead. When this lead is held at ground potential, all decoding by the module is inhibited. Wiring the output lead of a digit optioned for latched operation to the module's LOCKED lead provides the means to control operation of the 6072 from a single digit input. In this mode, once the latched digit's output lead is activated, no further decoding will take place until the latched digit's output lead is deactivated via either

the latched digit's RST lead (see paragraph 3.03) or the module's MRST lead.

3.07 A dial-up/dial-down mode of operation can be implemented by wiring a digit output lead, optioned for momentary operation, to the RST lead of a second digit optioned for latched operation. With this arrangement, the output of the second digit is activated in the normal manner, latched active, and then deactivated when the momentary digit is dialed.

3.08 The 6072 may also be used for multiple digit decoding. If the module's output leads are optioned for latched operation and used to drive external relays whose contacts are series wired, a multiple digit decoder is derived.

3.09 Two additional output leads, TONE ACTIVE and LATCHED STATUS, are provided for external control and status indication functions. The TONE ACTIVE output lead is functional only when the 6072 module is switch optioned for DTMF operation; this lead is active for as long as any DTMF key is held depressed. The LATCHED STATUS output lead functions with either DTMF or rotary dial inputs and is active for as long as any latched digit's output lead is active. If all of the 6072's digit output leads are optioned for momentary operation, the LATCHED STATUS output lead will be activated for approximately 100ms, beginning approximately 200ms after rotary dialing is completed or 35ms after a DTMF key is depressed.

4. INSTALLATION

A INSPECTION

4.01 The 6072 Single Digit Dial Decoder module should be visually inspected upon arrival in order to find possible damage incurred during shipment. If damage is

noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

B MOUNTING

4.02 The 6072 module mounts in one position of the TELLABS type 10 mounting shelf, which is available in configurations for both relay rack and apparatus case installation. The module plugs physically and electrically into a 56-pin connector at the rear of the type 10 shelf.

C INSTALLER CONNECTIONS

4.03 Before making any connections to the mounting shelf, make sure that power is off and modules are removed. Modules should be put into place only after they are properly optioned and after wiring is completed.

4.04 Exhibit 1 lists external connections to the 6072 module. All connections are made via wire wrap at the 56-pin connector at the rear of each module's mounting shelf position. Pin numbers are found on the body of the connector.

D. OPTION SELECTION

4.05 Thirteen option switches must be set before the 6072 is plugged into place or power is applied to the unit. These switches and their functions are described in paragraphs 4.06 and 4.07. The location of each switch on the module's printed circuit board is shown in Figure 2.

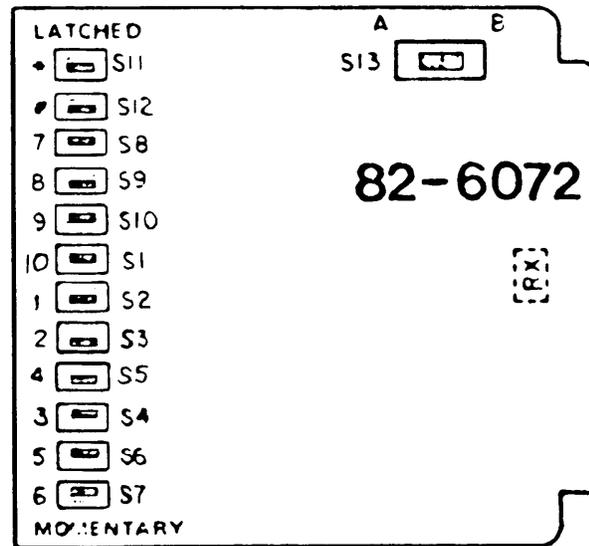


FIGURE 2

4.06 Switch S13 options the 6072 for use with rotary-dial or DTMF digit sources. To condition the module to detect loop current dial pulsing, set S13 to B and connect the series loop current lead (pin 32) and the loop current return lead (pin 33) in series with either the station tip or station ring leads. As an option, resistor RX may be customer-installed on the 6072's printed circuit board to limit loop current to 60mA. If this is the case, pin 33 should be left unterminated and the series loop current return (current limited by RX) lead (pin 34) used instead. To condition the 6072 to detect dial pulsing in the open-and-ground mode, (E-lead signaling) set S13 to A and connect the dial pulse detection lead (pin 55) directly to the E lead. If the 6072 is to be used solely with DTMF inputs, set S13 to A; in this mode pins 32, 33, 34 and 55 may be left unterminated. If the module is to be used with DTMF and rotary dial inputs, set S13 to B; in this mode the station tip or ring leads

must be connected in series to pins 32 and 33 (if loop current dial pulsing is used) or pin 55 must be open during the time at which DTMF signaling is decoded.

4.07 Switches S1 through S12 are used to select momentary or latched operation for each of the 6072's twelve signaling leads. Switch numbers, the digit whose signaling lead each switch controls, and switch positions are indicated on the printed circuit board adjacent to these switches. Switches S1 through S10 program digits 0 through 9, respectively, switch S11 controls the (*) output and switch S12 controls the (#) output. Set each switch to LATCHED to condition the corresponding signaling lead for latched operation, or to MOMENTARY to condition the corresponding signaling lead for momentary operation.

5. CIRCUIT DESCRIPTION

5.01 This circuit description is intended to familiarize you with the 6072 Single Digit Dial Decoder for engineering and application purposes only. Attempts to test or troubleshoot the 6072 in the field are not recommended, and may void your warranty. Procedures for recommended testing and troubleshooting in the field are limited to those prescribed in Part 7 of this Section. Refer to the 6072 Functional Schematic, (Exhibit 2), as an aid in following this circuit description.

5.02 The 6072 Single Digit DTMF/Dial decoder provides 12 identical digit logic circuits each with separate signaling and reset leads. The module is factory equipped with a TELLABS 9971 DTMF Receiver subassembly.

5.03 The 9971 DTMF Receiver subassembly accepts both DTMF and rotary dial input digits and outputs a decoded signal to the corresponding digit logic circuit. Detection

of both DTMF and rotary dial digits may be initiated by placing ground to the locked lead (pin 5). The 9971 also derives a tone active output (TAO) lead on pin 56 for external status indications.

5.04 The loop current detector is a dual optoisolator that provides a nonpolarized input via pins 32 and 33. Since input current must be limited to 60mA, the customer may install limiting resistor RX and use pins 32 and 34 as inputs. Switch S13 couples the output of the loop current detector to the dial pulsing input of the 9971.

5.05 When a digit is decoded, the 9971 subassembly outputs a digital signal to the appropriate digit logic circuit. Each digit logic circuit consists of several complementary metal oxide semiconductor (CMOS) gates that provide the various modes of latched and momentary operation. The individual reset leads for each digit logic circuit, as well as the master set and master reset leads, are gated "on" or "off" via the same switches (S1 through S12) that option the signaling leads. The output of each digit logic circuit is outputted via an open collector transistor.

5.06 When the 6072 receives and decodes an input digit, the 9971 outputs a signal to the 100ms timer. The timer then outputs a 100ms pulse to the digit logic circuits. This input to the digit logic circuits is gated "on" or "off" by each digit logic circuit's mode selection switch (S1 through S12). When gated "on", the 100ms pulse ensures that the digit logic circuit's output is present for 100ms (minimum), thereby providing the momentary mode of operation.

5.07 The 6072 provides a latched status output lead (pin 7) that is derived by ORing the outputs of each of the digit logic circuits via the latched status gate.

The output of this gate is outputted via an open collector transistor driver.

5.08 An on-board voltage regulator allows the 6072 to operate on filtered input potentials from -21 to -56Vdc. The power reset circuitry is used to apply a 200ms pulse that resets all digit logic circuits to the inactive state approximately 500ms after power is applied to the unit.

6. SPECIFICATIONS

A (TOUCH-TONE) INPUT

- INPUT IMPEDANCE
150 kilohm
- SIGNAL LEVEL (EACH FREQUENCY)
-23 to +6dBm (0.055 to 1.55Vrms)
- SIGNAL DURATION
40ms minimum
- SIGNAL INTERDIGIT TIME
40ms minimum
- TONE ACCEPT BANDWIDTH
 $\pm 1.5\%$ $\pm 2\text{Hz}$
- TONE REJECT BANDWIDTH
 $\pm 3.0\%$
- PRECISE DIAL TONE TOLERANCE
-12dBm (0.195Vrms) per tone
- NOISE TOLERANCE
-22dB (C-weighted)

B ROTARY DIAL INPUT

- INPUT IMPEDANCE (DIAL PULSING)
4.7 kilohm

- INPUT CURRENT (LOOP CURRENT DETECTOR)
60mA maximum

- ON-HOOK RECOGNITION
300ms $\pm 10\text{ms}$

- OFF-HOOK RECOGNITION
100ms $\pm 10\text{ms}$

- OFF-HOOK BLANKING
300ms $\pm 10\text{ms}$

- DIAL-PULSE-BREAK RECOGNITION
27ms $\pm 2.5\text{ms}$

- END-OF-DIGIT RECOGNITION
100ms $\pm 3\text{ms}$

- INTERDIGIT BLANKING
200ms $\pm 5\text{ms}$

C COMMON SPECIFICATIONS

- LOCKED INPUT IMPEDANCE
20 kilohm

- OUTPUT INTERFACE
open collector transistor

- OUTPUT LOADING
100mA maximum @ -22 to -56Vdc

- INPUT POWER REQUIREMENT
-21 to -56Vdc

- CURRENT REQUIREMENT
120mA maximum

- OPERATING ENVIRONMENT
32° to 149°F (0° to 65°C), humidity to 85% (no condensation)

● DIMENSIONS

5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.90 inches (15.14cm) deep

● WEIGHT

9 ounces (252 grams)

● MOUNTING

relay rack or apparatus case via one position of TELLABS Type 10 Mounting Shelf

7. TESTING AND TROUBLESHOOTING

7.01 The Testing Guide Checklist (Exhibit 3) may be used to assist in the installation, testing or troubleshooting of the 6072 Single Digit Dial Decoder. The Testing Guide Checklist is intended as an aid in the localization of trouble to a specific module. If a module is suspected of being defective, a new module should be substituted and the test conducted again. If the substitute module operates correctly, the original module should be considered defective and returned to TELLABS for repair or replacement. It is strongly recommended that no internal (component level) testing or repairs be attempted on the 6072 module. Unauthorized testing or repairs may void the 6072's warranty.

7.02 If a 6072 is diagnosed as defective, the situation may be remedied by either replacement or repair and return. Because it is the more expedient method, the replacement procedure should be followed whenever time is a critical factor (e.g., service outages, etc.)

A REPLACEMENT

7.03 If a defective module is encountered on central office installed equipment, Network Maintenance will arrange for a replacement by notifying TELLABS via telephone on 312-969-8800, letter (See Below), or TWX on 910-695-3530. Notification should include all relevant information, including the 8X6072 part number (from which TELLABS can determine the issue of the module in question). Upon notification, TELLABS will ship a replacement module to the site or other designated address. If the warranty period of the defective module has not elapsed, the replacement module will be shipped at no charge. Package the defective module in the replacement module's carton; sign the packing list included with the replacement module and enclose it with the defective module (this is your return authorization); affix the preaddressed label provided with the replacement module to the carton being returned; and ship the equipment prepaid to TELLABS.

7.04 For defective customer premise installed units, Business I/M will return the defective module to their Supplies Attendent or Material Management coordinate for Repair and Return handling as covered in paragraph 7.05.

B REPAIR AND RETURN

7.05 Return the defective 6072 module, shipment prepaid, to:
TELLABS Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532
Attn: Repair and Return Dept.

7.06 Enclose an explanation of the module's malfunction. TELLABS will repair the module and ship it back to you. If the module is in warranty, no invoice will be issued.

TABLE A

6072 BASIC MODES OF OPERATION

INPUT SOURCE	MODE OF OPERATION			
	LATCHED		MOMENTARY	
	ACTIVATION	DEACTIVATION	ACTIVATION	DEACTIVATION
Rotary dial	200ms after dialing is completed or in response to SET-lead* ground	momentary ground to digit's RST lead or MRST lead*	200ms after dialing is completed	automatic release after 100ms timeout
Touch-Tone dial	35ms after key is depressed or in response to SET-lead* ground	momentary ground to digit's RST lead or MRST lead. (See Note.)	35ms after key is depressed and released or for as long as the key is held depressed	automatic release after 100ms timeout (minimum) or when depressed key is released

NOTE: Application of ground to SET and MRST leads activates and deactivates all outputs optioned for latched operation. This type of operation may also be initiated by dialing a momentary digit whose output lead is strapped to the SET or MRST lead.

EXHIBIT 1

6072 EXTERNAL CONNECTIONS

CONNECT:	TO PIN:
T (DTMF tip lead)	25
R (DTMF ring lead).	27
SLC (series loop current)	32
LCR (series loop current)	33
LSCR (series loop current return, limited by optional resistor RX)	34
LC (dial pulse detection lead, open/ground)	55
MRST (master reset lead).	49
SET (master activate lead).	23
TAO (tone active output lead)	56
LK (locked input lead).	5
LSO (latched status output lead).	7
0 OUT (digit zero output lead).	21
0 RST (digit zero reset lead)	37
1 OUT (digit 1 output lead)	13
1 RST (digit 1 reset lead).	29
2 OUT (digit 2 output lead)	15
2 RST (digit 2 reset lead).	9
3 OUT (digit 3 output lead)	8
3 RST (digit 2 reset lead).	10
4 OUT (digit 4 output lead)	6
4 RST (digit 4 reset lead).	11
5 OUT (digit 5 output lead)	4
5 RST (digit 5 reset lead).	1
6 OUT (digit 6 output lead)	3
6 RST (digit 6 reset lead).	2
7 OUT (digit 7 output lead)	45
7 RST (digit 7 reset lead).	51
8 OUT (digit 8 output lead)	43
8 RST (digit 8 reset lead).	39
9 OUT (digit 9 output lead)	19
9 RST (digit 9 reset lead).	31
* OUT (* output lead).	47
* RST (* reset lead)	53
# OUT (# output lead).	50
# RST (# reset lead)	41
-V (filtered -21 to -56Vdc input)	35
GND (ground).	17

Note: Do not terminate unused connector pins.

EXHIBIT 2

6072 FUNCTIONAL SCHEMATIC

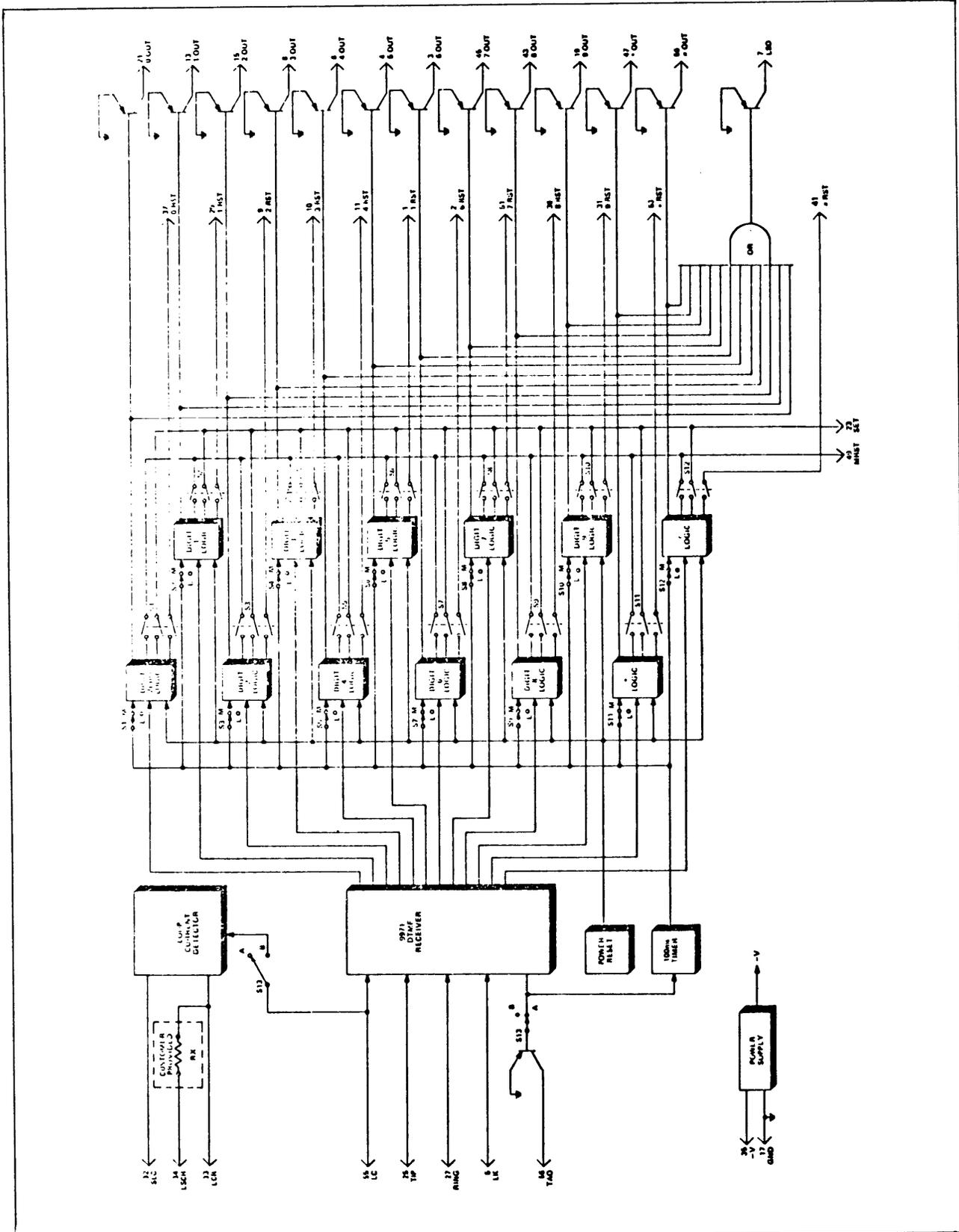


EXHIBIT 3
6072 TESTING GUIDE CHECKLIST

TEST	TEST PROCEDURE	NORMAL CONDITION	IF NORMAL CONDITIONS ARE NOT MET, VERIFY:
Rotary dial decoding (momentary mode)	Set S13 to A and S1 through S10 to MOMENTARY. Dial each digit consecutively.	Outputs 0 through 9 are activated for approx. 100ms, beginning 200ms after corresponding digit is dialed. Latched status output is activated (for 100ms) with first output.	LOCKED or RST leads are not at ground potential. Option switches properly set. Power. Wiring. Replace 6072 and retest.
Rotary dial decoding (latched mode)	Set S13 to B and S1 through S10 to LATCHED. Dial each digit consecutively.	Outputs 0 through 9 are activated and held activated, beginning 200ms after corresponding digit is dialed. Latched status output is activated and held activated with first output.	Same as above.
Individual output reset	Momentarily place ground on each RST lead.	Outputs 0 through 9 are deactivated as ground is placed on corresponding RST lead. Latched status output is deactivated with last output.	SET lead is not at ground potential. Option switches properly set. Power. Wiring. Replace 6072 and retest.
Master output activation	Momentarily place ground on SET lead.	Outputs 0 through 9 and latched status output are simultaneously activated.	MRST, SET, LOCKED, or RST leads should not be at ground. Option switches properly set. Power. Wiring. Replace 6072 and retest.

EXHIBIT 3 (Con't)
6072 TESTING GUIDE CHECKLIST

TEST	TEST PROCEDURE	NORMAL CONDITION	IF NORMAL CONDITIONS ARE NOT MET, VERIFY:
Master output deactivation	Momentarily place ground on MRST lead.	All outputs are simultaneously deactivated.	SET and LOCKED lead should not be at ground. Option switches properly set. Power. Wiring. Replace 6072 and retest.
DTMF decoding (momentary mode)	Set S13 to B and S1 S12 to MOMENTARY.	Outputs 0 through # are activated for approx. 100ms, as each corresponding digit is keyed.	LOCKED or RST leads are not at ground potential. Option switches properly set. Power. Wiring. Replace 6072 and retest.
DTMF decoding (latched mode)	Set S13 to A and S1 through S12 to LATCHED. Key each digit consecutively.	Outputs 0 through # are activated and held activated, as each corresponding digit is keyed. Latched status output is activated and held with first output.	Same as above.
Individual output reset	Momentarily place ground on each RST lead.	Outputs 0 through # are deactivated as ground is placed on corresponding RST lead. Latched status output is deactivated with last output.	SET lead is not at ground potential. Option switches properly set. Power. Wiring. Replace 6072 and retest.
Master output activation	Momentarily place ground on SET lead.	Outputs 0 through # and latched status output are simultaneously activated.	MRST, SET, LOCKED, or RST leads should not be at ground. Option switches properly set. Power. Wiring. Replace 6072 and retest.
Master output deactivation	Momentarily place ground on MRST lead.	All outputs are simultaneously deactivated.	SET and LOCKED lead should not be at ground. Option switches properly set. Power 6072 and retest.