

7370 Dial Long Line Repeater Circuit

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1. GENERAL

1.01 This Section provides circuit description, installation, and basic testing information for the Wescom 7370 Dial Long Line (DLL) Repeater Circuit. The reverse side of the attached schematic diagram provides a history of previous schematic revisions.

1.02 The 7370 DLL Repeater (Figure 1) is a plug-in, printed-circuit module used to increase the effective signaling, supervisory, and dial pulsing range on either an individual two-wire line or PBX trunk. The 7370 detects an off-hook condition at the subscriber location and provides dial-pulse repetition from the subscriber location to the central office, thus allowing signaling extension of an individual line by a maximum of 3000 ohms, d-c loop resistance (6000 ohms with 96Vdc operation). On an incoming call, the 7370 repeats ringing toward the subscriber or bypasses office ringing when the bypass ringing strapping is provided and trips ringing when the subscriber answers.

1.03 Features provided by the 7370 are electronic ring detection and ring trip, low

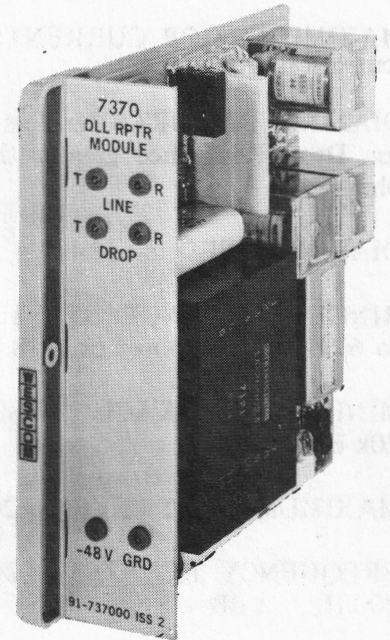


Figure 1. 7370 Dial Long Line (DLL) Repeater Module

pulse distortion, low current drain, line and drop current limiting, and idle line termination. The 7370 is also provided with additional relay contacts to disable a negative impedance repeater during idle (when required), and a high current protection circuit.

1.04 The 7370 is constructed as a plug-in module designed to mount in one position of the Wescom Type 400 Mounting Assembly. Type 400 Mounting Assemblies are available in capacities of from 1 to 13 modules and allow for either KTU apparatus-case or relay-rack mounting.

1.05 The 7370 makes electrical connection to the system through one of the 56-pin, wire-wrap connectors provided as part of the mounting assembly. Each connector is mechanically keyed to prevent the module from being inserted into any position other than the proper mounting assembly position.

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- (d) Line and drop current limiting.
- (e) Idle line termination.
- (f) Repeater enable relay contacts.

1.04 The Issue 4 version of the 7370-00 also provides these features not found on the Issue 3 version:

- (a) Strap selectable isolated ring detector inputs; compatible with HORIZON* Key System ring detection requirements.
- (b) Integral pulse corrector equipped with user-selected enable/disable option.
- (c) Ring-stretch option can be arranged to either follow or bridge short ringing intervals.
- (d) Automatic current limiting on the drop side over a wide range of loop lengths.
- (e) High-impedance ringing detector to minimize line loading.
- (f) Ringing supplied either from SWG (switchgear) or from local ringing generator.
- (g) Local ringing generator (if used) may supply grounded or negative-superimposed ringing.
- (h) Can be equipped with optional 7377-50 Battery Boost Subassembly.

2. APPLICATION GUIDELINES

2.01 The 7370-00 can be used alone, as shown in Figure 2, or it can be combined with a separate transmission unit such as the

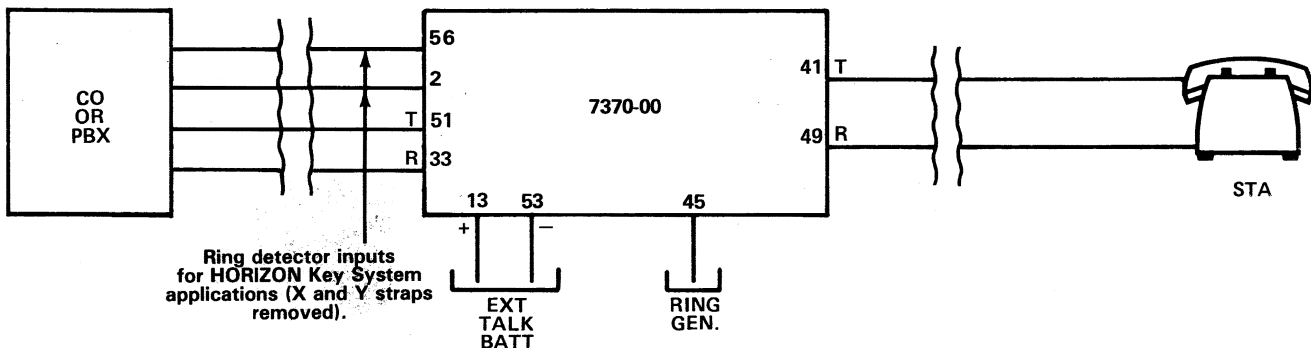


Figure 2. 7370-00 2W Application

401-00 in a 4W/4W application. This configuration is shown in Figure 3.

3. CIRCUIT DESCRIPTION

3.01 The 7370-00 is used to increase the signaling, dial pulsing, and ringing range of an individual 2W line or PBX trunk. Refer to Figure 5, the 7370-00 (Issue 4) Block Diagram, while reading the following circuit description.

3.02 The 7370-00 operates in the loop-start mode only and may be used in either the signaling or the transmission path, i.e., with or without the integral repeat coil. The voice path is transformer coupled and may be switched out of the circuit so that the A&B leads can be used with an external repeater.

Call Initiated From SWG Side

3.03 When a call is initiated from the SWG side, ringing voltage from the SWG is applied to the T/A and R/B leads (pins 51 and 33, respectively). The ringing is sensed by the RING DETECTOR after passing through the line impedance option switch, S1, and the SWG side of T1. The output signal from the RING DETECTOR is applied to the RING DETECTOR TIMER, which recognizes a valid ring signal after a nominal delay of 70 milliseconds and releases within a nominal 70 milliseconds after the signal is no longer present. This release delay can be extended to a nominal 900 milliseconds for special applications

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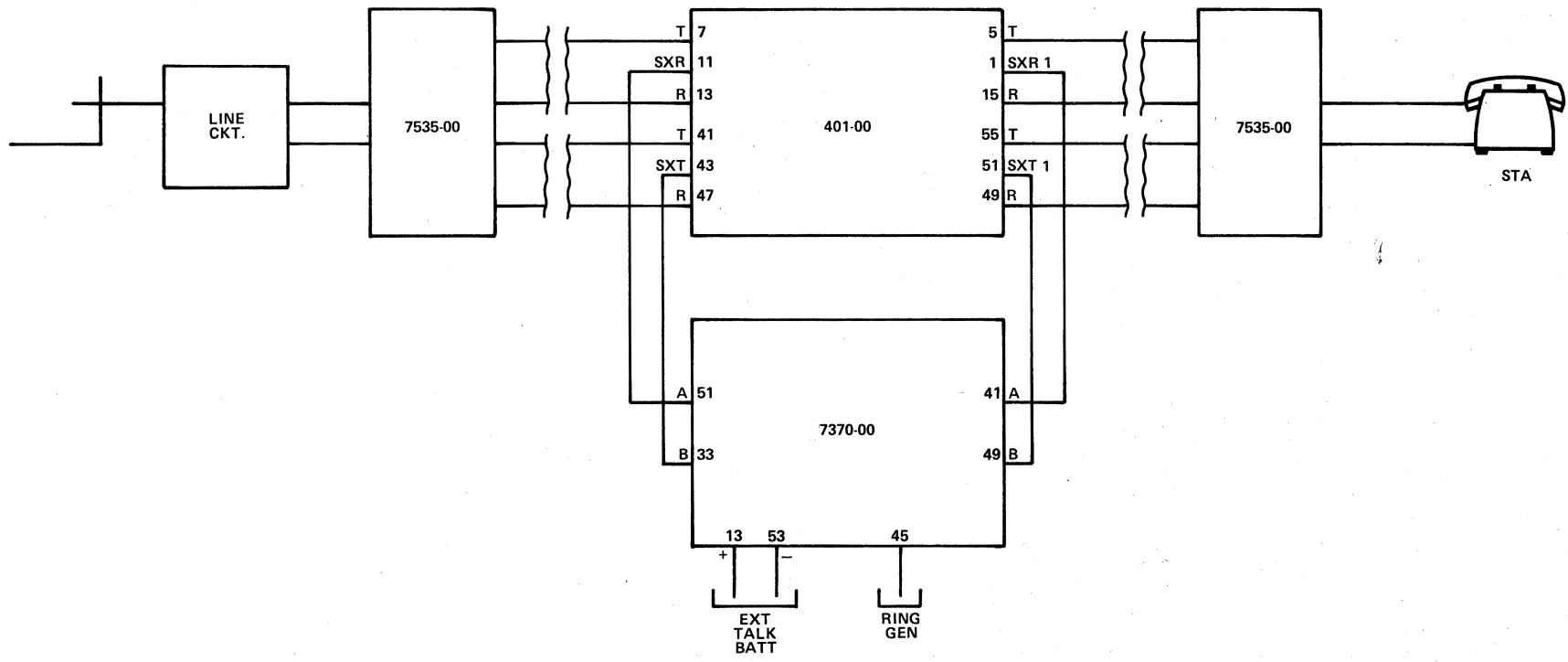


Figure 3. 7370-00/401-00 4W/4W application

through the use of the RS option. The output signal of the RING DETECTOR TIMER operates the RING RELAY through the RING DISABLE NAND gate and the RING RELAY DRIVER. The operated RING RELAY contact closure applies ringing (either locally-generated or from the SWG, depending on the position of S4) to the station side on the tip and ring leads (pins 41 and 49, respectively) through the RING TRIP DET circuit. This applied ringing follows the ringing/silent pattern of the SWG ringing through the action of the RING RELAY and its associated timing circuitry.

3.04 When the called station goes off-hook in response to the ringing, the loop closure provides answer supervision in either one of two ways. If the off-hook occurs during ringing, the RING TRIP DET circuitry's output signal is applied to the LOOP TRANSIENT BLANKING circuitry through the closed R relay contact. If the off-hook occurs during the silent interval, the loop current flow is sensed by the LOOP CURRENT DETECTOR through switches S2 and S3, screw options A and B, and the ACTIVE CURRENT LIMITER circuitry. The output signal from the LOOP CURRENT DETECTOR is applied to the LOOP TRANSIENT BLANKING circuitry through the alternate position of the same R relay contact. The LOOP TRANSIENT BLANKING signal is applied to the CURRENT DETECTOR TIMER and, after a nominal 15-millisecond delay, to the PULSE CORRECTOR if the push-on jumper is in the PCI position, or directly to the RING DISABLE NAND gate if the jumper is in the PCO position. This signal at the RING DISABLE NAND gate releases the RING RELAY, stopping the ringing. The signal from the CURRENT DETECTOR TIMER also enters the REPEATER ENABLE LOGIC and this circuit provides a ground on the RPTR ENBL lead (pin 29) for the duration of the off-hook. The signal applied to the RING DISABLE NAND gate is also applied to the LOOP PULSE RELAY DRIVER, and its output signal illuminates the BUSY LED and operates the LOOP PULSE A RELAY. The A relay contact closure across the SWG loop is detected by the SWG, which then removes the ringing.

Call Initiated From Station Side

3.05 When the station equipment associated with the 7370-00 goes off-hook, it closes the loop across the tip and ring leads

(pins 41 and 49, respectively). The resultant current flow is sensed by the LOOP CURRENT DETECTOR through the ACTIVE CURRENT LIMITER circuitry, the A and B screw options, the 2W position of S3, the station side of transformer T1, and the station impedance switch, S2. When S3 is in the A&B position, the current path is the same except that T1 is bypassed. The output signal from the LOOP CURRENT DETECTOR operates the LOOP PULSE A RELAY through the LOOP TRANSIENT BLANKING, CURRENT DETECTOR TIMER, PULSE CORRECTOR, LOOP PULSE RELAY DRIVER, and the BUSY LED.

3.06 When the LOOP PULSE A RELAY operates, it closes the loop toward the SWG. The SWG interprets this loop closure as a request for service and returns dial tone to the 7370-00, which enters the card on pins 51 and 33. Dial tone is sent to the station equipment on pins 41 and 49. Dial pulsing from the station equipment is adjusted to a 58 ± 5 percent break ratio by the PULSE CORRECTOR and applied to the LOOP PULSE A RELAY, which pulses the loop toward the SWG. At the same time, the signal from the PULSE CORRECTOR is also applied to the RING DISABLE NAND gate to prevent the dial pulses from ringing the station equipment when the station gear is off-hook. DTMF tones from the station equipment (if equipped for DTMF) pass from pins 41 and 49 to pins 51 and 33 where they are sent toward the SWG. After the address signaling is complete, ringback tone is supplied from the SWG. When the called party goes off-hook in response to the ringing, the SWG removes the ringing to the called party and ringback tone to the station equipment: talk paths are now complete in both directions.

Disconnect

3.07 As the mode of operation is loop-start, disconnect can only be initiated by the station side. When the station equipment goes on-hook, the lack of current flow in the station loop is detected by the LOOP CURRENT DETECTOR, which then causes the release of the LOOP PULSE A RELAY through the circuitry described in Paragraph 3.05. The release of the A relay results in the opening of the loop toward the SWG, which then releases the connection. The 7370-00 is now in an idle condition.

4. INSPECTION

4.01 Inspect the equipment thoroughly as soon as possible after delivery. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company.

4.02 Wescom equipment is identified by a model and issue number imprinted on the front panel or located elsewhere on the equipment. Each time a major engineering design change is made on the equipment, the issue number is advanced by one number on any following models that are manufactured. Therefore, be sure to include the issue number along with the model number when making inquiries about the equipment.

5. MOUNTING

5.01 The 7370-00 is designed to be mounted in one module position of a standard Wescom (or other) Type 400 Shelf. Wescom Type 400 Shelves are available in capacities of from 1 to 13 modules and are designed to be mounted in 19- or 23-inch relay racks. Full-width shelves (11 positions in a 19-inch rack, or 13 positions in a 23-inch rack) require 6 inches of vertical space, while those shelves of less than full capacity require 7 inches of vertical space due to the addition of mounting bars above and below the shelf. Refer to Section 040-001-002 and Section 440-211-202 for complete information.

6. INSTALLER CONNECTIONS

6.01 The 7370-00 makes electrical connection to the associated equipment through a 56-pin, wire-wrapped, card-edge connector provided as part of the mounting assembly. Make all connections to the module in accordance with the information contained in Table 1.

CAUTION

Do not make any connections when power is

applied to the equipment or when modules are installed in the mounting assembly.

CAUTION

This unit contains a mercury-wetted-contact relay. During shipment, surplus mercury may collect on the relay contacts, causing a short. To correct this condition, hold the unit upright, tap it gently on a hard surface, and install.

6.02 Insert the module into its mounting position after making all installer connections and after properly conditioning the module for the required service. Do not force a module into position. If excessive resistance is encountered while inserting a module, remove and reinsert the module and check the card guide and connector for improper alignment and/or the presence of foreign material.

7. OPTIONS

7.01 The 7370-00 is equipped with switch, push-on, screw, and hardwire strap options which allow the module to be arranged for various features and modes of service. The locations of these options are shown in Figure 4 and their usage is explained in the paragraphs which follow.

NOTE

When opening a screw option, rotate the screw counterclockwise two full turns to insure that the connection is open. When closing a screw option, rotate the screw clockwise until it seats.

Impedance Options (S1 And S2)

7.02 Switch S1 sets the line impedance of the 7370-00 at either 600 or 900 ohms and S2 performs the same function for the station side of the unit. Place S1 and S2 in the positions appropriate to the installation.

2W Repeat Coil/A&B Leads Option (S3)

7.03 When switch S3 is in the 2W position, it places the integral repeat coil in the circuit path to accommodate voice transmission. When S3 is in the A&B position, this coil is bypassed, allowing the 7370-00 to be used in conjunction with an external repeater.

Table 1. 7370-00 Installer Connections

LEAD DESIGNATION		PIN
SWG T/A*	Line connections	51
SWG R/B*		33
T/A	Drop connections	41
R/B		49
	Ringing connections for special applications	56
		2
+	External talk battery connections	13
-		53
RING GEN	External ring generator	45, 46
MS	Machine start	37
RPTR ENBL	Repeater enable	29
-48V	Office battery	35
GRD	Ground	17

*SWG connections are polarity sensitive, verify connection of incoming tip to T/A and incoming ring to R/B.

plied to pins 56 and 2 when S4 is in the BYP position and the X and Y straps are removed.)

Grounded/Superimposed Ringing Option (S5)

7.05 The 7370-00 can be used with either grounded or negative superimposed ringing generators. If the module is used with a grounded ringing generator, place switch S5 in the GRG position: this supplies negative battery bias from the module on the tip lead only during the ringing interval to activate the ring trip circuit. If used with a negative superimposed ringing generator, place S5 in the SRG position.

Pulse Corrector Option (PCI/PCO)

7.06 The integral pulse corrector in the 7370-00 can be enabled and disabled by the PCI/PCO push-on option. To enable the pulse corrector, place the push-on jumper in the PCI position. To disable the pulse corrector, place the jumper in the PCO position.

Talk Battery Option (+EXT TB/+INT TB And -EXT TB/-INT TB)

7.07 The 7370-00 can extend the signaling and supervisory range of a 1500-ohm CO or PBX to a maximum of 5400 ohms (96Vdc operation). The module can be arranged to use the internal ground and battery (-48Vdc) when the talk battery options are in the +INT TB and -INT TB positions. External talk battery potentials of -48, -72, or -96Vdc for -EXT TB and ground, +24V, or +48Vdc for +EXT TB may be used in any combination to a maximum of 96Vdc (total). In general, use a 48Vdc talk battery supply when the subscriber loop is 1500 ohms or less, a 72Vdc supply when the loop is between 1500 and 3000 ohms, and a 96Vdc supply when the subscriber loop is between 3000 and 5400 ohms.

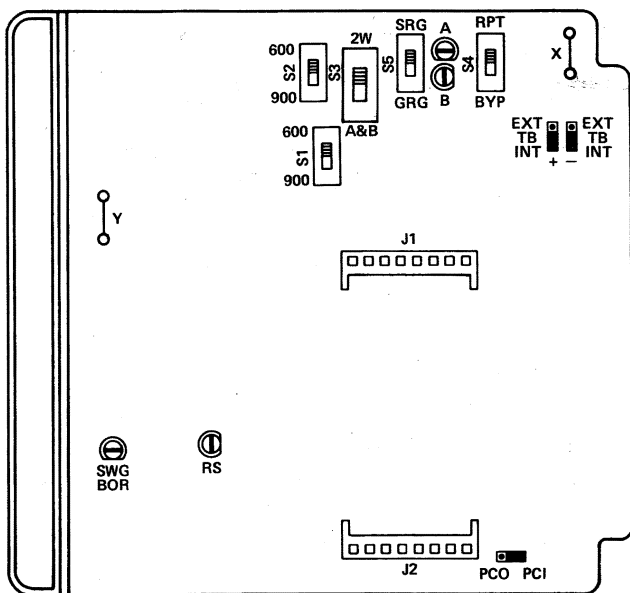


Figure 4. 7370-00 Option Locations

Repeated/Bypassed Ringing Option (S4)

7.04 The RPT position of switch S4 places locally-generated ringing (which follows the ringing/silent pattern of the SWG ringing) on the 2W station side of the module. When S4 is in the BYP position, ringing is supplied from the SWG, eliminating the need for an external ringing source. (The SWG ringing is ap-

NOTE

Although the 7370-00 can operate with station loop currents as low as 16mA, loop currents of less than 23mA may affect DTMF signaling and transmission performance. For this reason, it may be necessary to use talk battery voltages higher than those recommended for a given loop length (not to exceed 96Vdc, total). In calculating the current in the station loop, use 410 ohms as the source impedance of the 7370-00.

Ring Stretch Option (RS)

7.08 The RS screw option controls the release delay of the ringing detector circuit. When the RS option is closed, it provides a symmetrical 70 millisecond operate/release delay. When RS is open, the release time is increased to stretch short ringing intervals. If the 7370-00 is to follow standard 2/4 second ringing, or certain distinctive ringing patterns, close RS. Open the RS option to stretch short ringing intervals or to mask the silent intervals.

Build-Out Resistance Option (SWG BOR)

7.09 The SWG BOR screw option provides current-limiting on short SWG loops and minimizes the internal SWG side resistance on long SWG loops. Close the SWG BOR option for SWG loops over 500 ohms, and open it for loops of 500 ohms or less. Place the SWG BOR screw option in the closed position for switch hook flashing.

7377-50 Battery Boost Subassembly Options (A and B)

7.10 When the 7377-50 Battery Boost Subassembly is not used, close both the A and B screw options. When this subassembly is installed, open both of these options.

X And Y Strap Option (Ring Detector)

7.11 When using the 7370-00 in conjunction with a HORIZON Key System, snip or unsolder the X and Y straps. This disconnects the ring detector circuit from pins 51 and 33 and connects it to pins 56 and 2.

CAUTION

When soldering to replace or remove these straps, use insulated strap wire and no larger than a 60W soldering iron.

NOTE

If you remove the X and Y straps, peel the sticky label (OPTIONED FOR HORIZON INTERFACE) from page 1 of this Section and place it on the front panel of the 7370-00.

8. TESTING

8.01 It is recommended that an end-to-end test be made to verify the performance of the 7370-00 after conditioning the options and installing the module. The test procedure is given in Table 2. If technical assistance is required, contact the Wescom Technical Services Department by calling:

Table 2. 7370-00 Test Procedure

STEP	ACTION	VERIFICATION
1	Place the station equipment associated with the 7370-00 off-hook.	The BUSY LED on the 7370-00 illuminates and the SWG returns dial tone.
2	Place a test call to the SWG.	The BUSY LED flashes during dial pulsing and ringback tone is audible.
3	The SWG goes off-hook in response to the ringing.	Ringing and ringback tone stop. The talk path is complete.
4	Request that a test call be placed from the SWG to the local station equipment, and place the station equipment on-hook.	The BUSY LED is extinguished, then the local station equipment is rung.
5	Place the station equipment off-hook.	Ringing and ringback tone stop, the BUSY LED illuminates, and the talk path is complete.

NOTE: Key system side current flow must occur to enable VF transmission.

(312) 985-9000,
 TWX 910-695-4735,
 DATA-PHONE® (312) 985-1700, or
 TELEX 253-656

Canadian Customers:
 (416) 877-0191,
 TWX 610-492-2646, or
 TELEX 06-97777

Canadian Customers:
 Rockwell International of Canada Ltd.
 Wescom Canada Division
 45 Sinclair Ave.
 Georgetown, Ontario
 L7G 4X4

Repair Or Exchange Services

9.04 In addition to the standard Wescom Warranty Service, Wescom offers a repair or exchange service for those items out of warranty. Under this arrangement, faulty units may be shipped to Wescom and either completely repaired and quality tested or exchanged for a replacement unit. To obtain details of this service and a schedule of prices, contact your local Wescom Sales Representative.

9. WARRANTY

9.01 **STANDARD WARRANTY:** Wescom products are warranted to be free from defects in material, workmanship, and design, given proper installation and regular maintenance. Wescom's obligations under this warranty are limited to correction and replacement, at Wescom's production facility, of any defective items received by Wescom, transportation prepaid, for a period of 60 months from the date of original shipment. Warranty and remedies on products not manufactured by Wescom are in accordance with the warranty of the respective manufacturer. WESCOM MAKES NO OTHER WARRANTY OF ANY KIND WHATEVER, EXPRESSED OR IMPLIED; AND ALL IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEEDS THE AFORESAID OBLIGATIONS IS HEREBY DISCLAIMED BY WESCOM.

9.02 Field repairs involving the replacement of components within a unit are not recommended. If an item is found to be defective, contact Wescom, Inc., by telephone or TWX, for instructions regarding replacement or repair.

9.03 If a replacement unit is required, it will be shipped in the fastest manner consistent with the urgency of the situation. Upon receipt of a replacement unit, return the defective unit in the carton in which the replacement was shipped, using the shipping label provided, to:

Wescom, Inc.
 8245 Lemont Road
 Downers Grove, Illinois 60515

10. SPECIFICATIONS

10.01 The electrical and physical characteristics of the 7370-00 (Issue 4) are as follows:

(a) **POWER REQUIREMENTS AND LIMITS:**

Voltage	Maximum Current*	
	Idle	Busy
-44V	15mA	34mA
-48V	15mA	37mA
-56V	18mA	42mA

*Does not include loop current.

- (b) **RETURN LOSS:** 20dB ERL.
- (c) **MAXIMUM INSERTION LOSS:** 1.0dB at 1000Hz.
- (d) **FREQUENCY RESPONSE:** -0.6dB, +0.5dB at 600 to 4000Hz; -1.25dB, +0.5dB at 400 to 600Hz; -2.6dB, +0.5dB at 250 to 400Hz (all levels referenced to 1000Hz).
- (e) **LONGITUDINAL BALANCE:** 60dB (minimum) at 250 to 4000Hz.

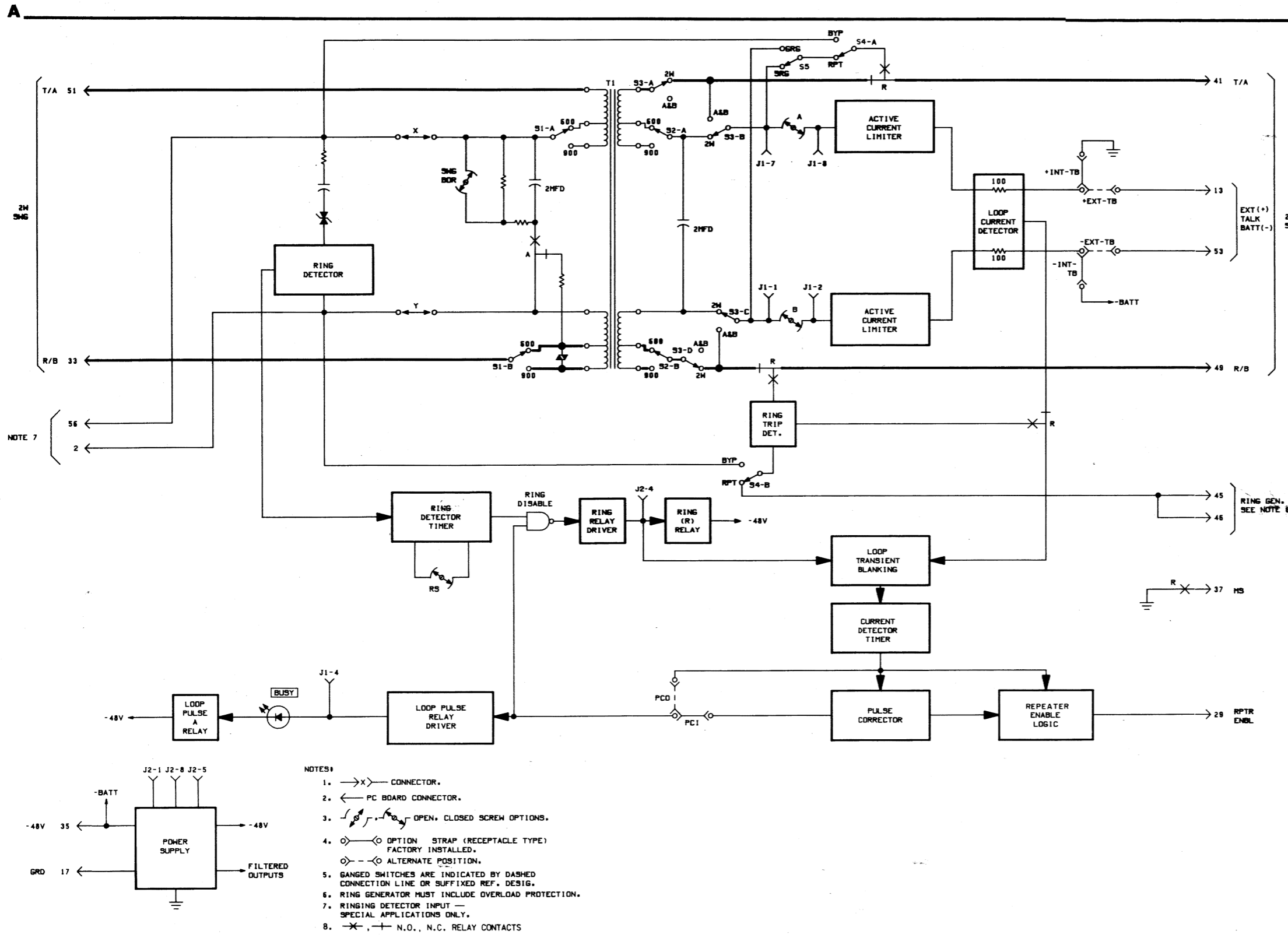
- (f) MAXIMUM ENVELOPE DELAY DISTORTION: 200usec, 600 to 3000Hz; 300usec, 400 to 3200Hz; 700usec, 250 to 4000Hz.
- (g) CROSSTALK IMMUNITY: 80dB (minimum).
- (h) STATION SIDE LOOP LENGTH:

Loop Current	Voltage		
	-48V	-72V	-96V
16mA	2450 ohms	3900 ohms	5400 ohms
23mA	1550 ohms	2550 ohms	3600 ohms

- (i) DIALING SPEED: 8 to 12.5pps.
- (j) PULSE CORRECTION:

PPS Input	Percent Break In	Percent Break Out
8	25 - 80	58 ±5
10	30 - 80	58 ±5
12.5	40 - 75	58 ±5

- (k) SWITCHGEAR SIDE RING SENSITIVITY: 50Vrms, 16 to 40Hz.
- (l) LOCAL RINGING SUPPLY CHARACTERISTICS: 85 to 130Vrms, 16 to 67Hz, negative superimposed or grounded generator.
- (m) MAXIMUM STATION SIDE LOOP CURRENT (2W): 48V, 50mA; 72V, 52mA; 96V, 55mA.
- (n) OPERATING ENVIRONMENT: Temperature, 32° to 120°F (0° to 49°C).
- (o) WEIGHT: 19 oz (540g).
- (p) DIMENSIONS: Height, 5.6 in. (14.2cm); width, 1.5 in. (3.8cm); depth, 6.0 in. (15.2cm).
- (q) MOUNTING: One position in a Wescom Type 400 Shelf.



MODE	OPTION DESIG.	OPTION POSITION	NOTES
LONG SWG LOOPS	SWG BOR	CLOSED	CLOSED FOR SWG LOOPS OVER 500 OHMS.
SHORT SWG LOOPS		OPEN	OPEN FOR SWG LOOPS UNDER 500 Ω.
REPEAT SHORT SWG RINGING INTERVALS	RS	CLOSED	CLOSED FOR NORMAL SWG RINGING REPEAT RESPONSE TIME UNIT WILL PASS 90MS RINGING INTERVALS
BRIDGE SHORT SWG RINGING INTERVALS		OPEN	OPEN TO BRIDGE SHORT SWG RINGING INTERVALS
INTERNAL TALK BATTERY	-INT TB	EXT TB INT	STATION TALK BATTERY SUPPLIED INTERNALLY, GRD AND -48V RESPECTIVELY
		INT	
EXTERNAL TALK BATTERY	+EXT TB	EXT TB INT	STATION TALK BATTERY SUPPLIED EXTERNALLY. PERMISSIBLE POTENTIAL TO PIN 13 (EXT + TB) ARE GRD, +24V, +48V PERMISSIBLE POTENTIALS TO PIN 53 (EXT-TB) ARE -48V, -72V, -96V. TOTAL STATION BATTERY VOLTAGE MUST NOT EXCEED 96V.
		INT	
NO SUBASSEMBLY	A AND B	CLOSED	WHEN NO SUBASSEMBLY IS USED
SUBASSEMBLY		OPEN	WHEN USING 7377-50 SUBASSEMBLY
PULSE CORRECTION	PC1	PC0 PC1	DIAL PULSE CORRECTION
		PC0	NO DIAL PULSE CORRECTION

OPTION OR SW	POSITION	FUNCTION
S1	600	SELECT 600 OHM SWG. IMPEDANCE
	900	SELECT 900 OHM SWG. IMPEDANCE
S2	600	SELECT 600 OHM STA. IMPEDANCE
	900	SELECT 900 OHM STA. IMPEDANCE
S3	2H	USES ON BOARD REPEAT COIL
	A & B	FOR USE WITH EXTERNAL TRMSN UNIT REMOVES ON BOARD REPEAT COIL
S4	RPT	SUPPLIES LOCAL RG CONNECTED TO PIN 45, TO STATION
	BYP	PASSES RG FROM SWG TO STATION
S5	SRG	WHEN RG CONNECTED TO PIN 45 IS NEG. SUPERIMPOSED
	GRG	WHEN RG CONNECTED TO PIN 45 IS GRD
X AND Y STRAPS		REMOVE X AND Y STRAPS FOR SPECIAL APPLICATIONS ONLY.

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Figure 5. 7370-00 2-Wire Loop Signaling Repeater, Loop Start Only (Issue 4) Block Diagram