

Addendum To 7370 Dial Long Line Repeater Circuit

1. GENERAL

1.01 This addendum is issued to revise Section 7370-101/3 and to serve notification that the attached schematic diagrams 191-737000, Issue 2, and 191-737001, Issue 1, have been updated to revision level E.

1.02 Make the changes indicated in Part 2 of this addendum in ink or red pencil. Add this information in the margin adjacent to the affected copy or insert a note referring to this addendum.

2. CHANGES

2.01 On page 6, change the ending of the first sentence of paragraph 6.09 from "lamps DS-1 through DS-4 and associated circuitry." to "resistance lamps RT1 through RT4 and associated circuitry."

2.02 On page 6, change the middle of the last sentence of paragraph 6.09 from "lamps DS1 through DS-4" to "resistance lamps RT1 through RT4."

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

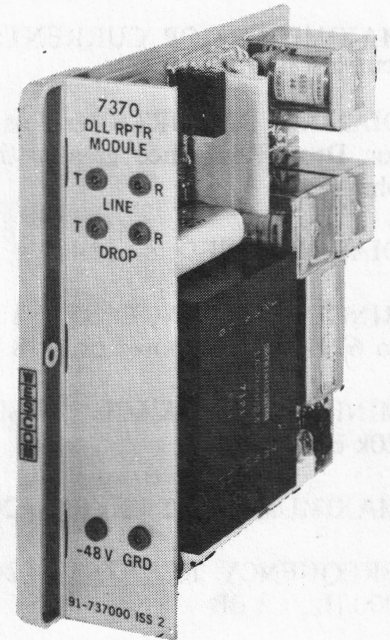


Figure 1. 7370 Dial Long Line (DLL) Repeater Module

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.

2. SPECIFICATIONS

2.01 Specifications describing the electrical and physical and characteristics of the 7370 are as follows:

- (a) **MAXIMUM DROP LOOP SIGNALING LIMITS:** 3000ohms, -48Vdc operation; 6000ohms, -96Vdc operation.
- (b) **MAXIMUM LOOP CURRENT:** 50mA. (current limited)
- (c) **DIALING DISTORTION:** less than 4% for Drop Resistance greater than 1,000 ohms.
- (d) **DIALING SPEED:** 8 to 14 pps
- (e) **RINGING VOLTAGE:** 85 to 130 Vac, 16 to 67 Hz superimposed on -48 Vdc.
- (f) **MINIMUM LEAKAGE RESISTANCE:** 20k ohms
- (g) **MAXIMUM INPUT LEVEL:** +20 dBm
- (h) **FREQUENCY RESPONSE:** 200 to 10,000 Hz, ± 1 dB
- (i) **INSERTION LOSS:** 0.4 dB max.
- (j) **PROTECTION CIRCUIT ENERGIZING CURRENT:** Either HC relay winding, 87mA (approx.); Total, both windings, 44mA (approx.).
- (k) **POWER REQUIREMENTS:** 10 mA (idle), 60mA plus loop current (busy) at -48Vdc.
- (l) **OPERATING ENVIRONMENT:** temperature, 35° to 120° F; Humidity to 95% (no condensation).
- (m) **WEIGHT:** 1 lb. and 8 oz.
- (n) **DIMENSIONS:** Height, 5-19/32 inches; Width, 1-1/2 inches; Depth, 6 inches.
- (o) **MOUNTING:** Module occupies one position in a Type 400 Mounting Assembly which provides for either KTU apparatus case or relay rack mounting. Refer to Part 5 for mounting information.

3. INSPECTION

3.01 Inspect the equipment thoroughly, as soon as possible after delivery. If the equipment has been damaged in transit, report the extent of damage to the transportation company immediately. If the equipment is to be stored, make an operational check to determine that the equipment is in proper working order as received from the factory. After an indication of satisfactory performance has been obtained, the equipment may be stored for future installation. If the System is to be installed at once, make an operational check after the installation is completed.

3.02 Wescom equipment is specifically identified by the model number and final-assembly number silk screened on the front panel of the plug-in module. At the start of production, the final-assembly number is assigned an issue number of 1 which becomes an integral part of the final-assembly number. After the start of production, this issue number is advanced each time a major engineering change occurs. Therefore, be sure to use the model number and final-assembly number when making inquiries about the equipment. The issue number of the instruction manual and schematic diagram attached should be the same as the issue number assigned to the equipment. If a one-to-one correspondence does not exist between these items request from Wescom the instruction manual required for your equipment.

4. MOUNTING

4.01 The 7370 DLL Repeater is designed in a Type 400-1 (1-module) Mounting Assembly. Type 400 Mounting Assemblies are available in capacities of from 1 to 13 modules and may be factory-wired and equipped with any combination of modules from the Wescom product line.

KTU apparatus case mounting

4.02 Type 400-1 (one-module) through 400-5 (five-module) Mounting Assemblies may be installed in a 15A (equivalent to W.E.Co. 31B) KTU apparatus case. Type 400-1 through 400-13 Mounting Assemblies may be installed in a 16C (equivalent to W.E.Co. 16C) KTU apparatus case.

relay rack mounting

4.03 Type 400-1 through 400-9 Mounting Assemblies require the use of mounting bars, when mounted on either a 19- or 23-inch relay rack. 400-10 and 400-11 Mounting Assemblies are provided with mounting brackets for mounting directly across 19-inch relay racks. Type 400-12 and 400-13 Mounting Assemblies are also provided with mounting brackets for 23-inch relay rack mounting.

4.04 Because Type 400-1 through 400-9 Mounting Assemblies must be installed on mounting bars, 7 inches of vertical space (four-mounting spaces) are required for relay-rack mounting. Type 400-10 through 400-13 Mounting Assemblies, however, are provided with mounting extensions located on the sides of the mounting assemblies and require only 6 inches of vertical rack space. Install the mounting assembly in a KTU apparatus case or on a relay rack (as described above) with mounting hardware provided.

universal shelf mounting

4.05 When a high degree of flexibility is required to provide for new circuit arrangements as well as circuit rearrangements, the 7370 may be mounted in a Wescom Universal Shelf. The Universal Shelf permits all intermodule wiring and installer connections to be made at the front of the mounting assembly and provides maximum accessibility to these connections when changes are required. The Type 400UA-11 and 400UB-11 Universal Shelves provide mounting positions for up to 11 modules and are designed for mounting in a 19-inch relay rack. Type 400UA-13 and 400UB-13 Universal Shelves provide mounting positions for up to 13 modules and are designed for mounting in a 23-inch relay rack.

5. INSTALLER CONNECTIONS

5.01 The 7370 module makes electrical connection to the associated equipment through a 56-pin, wire-wrap card connector provided as part of the mounting assembly; all installer connections are made to this connector. Make the connections in accordance with Table 1.

Table 1. 7370 Installer Connections

| INSTRUCTION | 56-PIN CONNECTOR ASSIGNMENT |
|---|-----------------------------|
| CONNECT: | TO: |
| CO or PBX 2W LINE (T) | 51 |
| CO or PBX 2W LINE (R) | 33 |
| Station EQPT or PBX TRK (T1) | 41 |
| Station EQPT or PBX TRK (R1) | 49 |
| E6 repeater ground enable (when required) | 29 |
| ring generator start (MACH START) | 37 |
| ± RING GEN. (-48Vdc Bias) | 45 & 46 |
| RING GEN. GRD. | 11 & 12 |
| -48 Vdc battery in | 35 |
| +48 Vdc battery in (96 Vdc loop only) | 13 |
| positive ground in (GND) | 17 |
| *LINE CURRENT SENSE | 2 & 4 |
| *DROP CURRENT SENSE | 6 |

*NOTE: These pins are used with the 7371 Dial Long Line Ground Start Module when required.

CAUTION: Do not make any connections with power applied to the equipment or modules installed in the mounting assembly.

strapping

5.02 The 7370 is provided with strapping options that provide for matching either 600 or 900 ohm impedance on the line or drop; 48 or 96 Vdc operation, by-pass ringing, and pulsing contact protection. Perform these strapping procedures in accordance with the following and Figure 2.

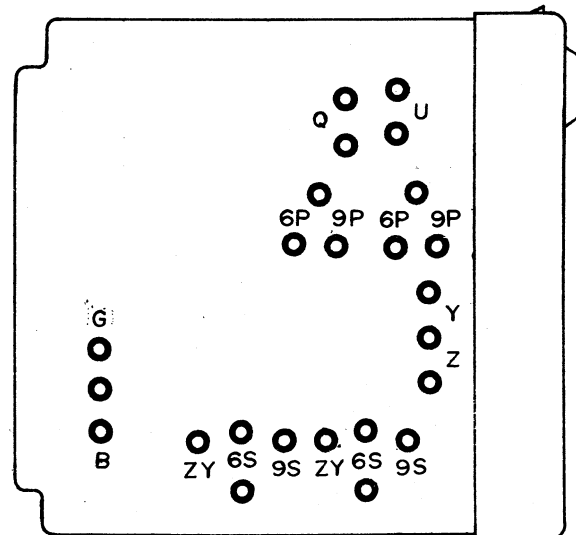


Figure 2. 7370 Strapping Post Location

CAUTION: When soldering straps, use insulated wire and not larger than a 30-watt iron.

600/900 option

5.03 The repeat coil used in the 7370 may be strapped for either 600- or 900-ohm operation (factory strapped for 900-ohm operation). The strapping posts for this option are located on the solder side of 7370 module. If the impedance of the central-office line (primary side) is 900 ohms, make certain that each of the two straps on the primary side of the repeat coil are soldered across the common strapping post and the post designated "9P". If however, the required impedance is 600-ohms on the primary side, unsolder any existing strap connected to each of the "9P" strapping posts and move them to the "6P" strapping posts.

5.04 If the impedance of the subscriber lines (secondary side) is 900 ohms, make certain that each of the two straps on the secondary side of the repeat coil are soldered across the common strapping post and the post designated "9S". If, however, the required impedance on the secondary side is 600 ohms, unsolder any existing strap connected to each of "9S" strapping posts and move them to the "6S" strapping post.

simplex signaling

5.05 To provide four-wire simplex signaling, remove any existing strips on the secondary side of T1, and connect the ZY strapping to the common strapping posts.

48/96 Vdc option

5.06 The 7370 permits the use of either 48 or 96 Vdc operation. Station-side loop currents less than 23mA may affect transmission performance. Calculate transmission range using 390-ohms as the source resistance of the DLL battery-feed circuit. Use only 48 Vdc operation when the subscriber drop is less than 1500-ohms. Use 96Vdc operation when the subscriber drop is between 3000- and 6000-ohms, or when required to maintain adequate drop current. When using 96Vdc, remove straps across Z and Q options and place strap option Y.

bypass ringing

5.07 Bypass ringing may be provided when the proper or adequate local ringing generator is not available to provide for repeated ringing. Bypass ringing must not be used adjacent to drop side equipment such as two-wire repeaters that provide a capacitance bridge greater than 2mfds on the drop side of the 7370. When bypass ringing is required, place an insulated wire strap across pins 51 and 11 and also across pins 33 and 45 on the 7370 connector. Strapping Option B should be provided and option G removed when using bypassed ringing. Only superimposed or battery connected ringing generator may be used with the 7370.

pulsing contact protection

5.08 The pulsing contacts of the 7370 are provided with a strappable transient suppression network. The strapping posts for this option are located on the solder side of the 7370 module and are designated "U". The "U" strap is required for loops less than 200ohms and is factory-strapped. If, on longer loops, excessive pulse distortion is experienced, unsolder and remove the "U" strap.

inserting modules

5.09 When all installer connections and strapping have been completed, insert the 7370 module into the mounting assembly. An identification label designated 7370 is also provided on the front lower lip of the mounting assembly if the 7370 is factory mounted.

CAUTION: The 7370 contains a mercury-wetted relay. During shipment, excess mercury may collect on the contacts of this relay causing it to be "shorted". Consequently the 7370 should be gently tapped on a hard surface while being held in an upright position before inserting the module.

CAUTION: Do not force any module into place. If a module encounters excessive resistance while being installed, remove the module and check the card guides and connector for alignment and/or foreign particles.

6. CIRCUIT DESCRIPTION

6.01 The 7370 DLL Repeater is used to extend the signaling and supervisory range of either an individual line or PBX trunk by a maximum of 3000 ohms (48 Vdc operation) or 6000 ohms (96 Vdc operation). Refer to the attached 7370 schematic diagram during the following discussion.

subscriber originated call

6.02 When the subscriber goes off-hook, loop current flows through the drop side of the Dial Long Line Unit, producing voltage drops across resistors R3 and R7. These voltage drops cause transistors Q1 and Q2 to turn on operating relays B and A. Relay A energizes immediately while B is delayed, to prevent the effect of false off-hook pulses, resulting from ring transients. This 30 to 50 ms delay is caused by C7 and R8. The energized B removes the ring detection circuit CR9 and associated circuitry. B also applies a ground signal to pin 29 to enable an E6 repeater. When both B and A are energized, loop seizure at the central office is accomplished. This arrangement of Q1 and Q2 and relays B and A protect the module from the effects of high longitudinal voltages which may exist on the 2-wire drop. Diodes CR5 and CR7 provide transient protection on the drop side of the repeat coil T1.

outgoing dialing

6.03 As the number is dialed, relay A follows the opening and closing of the subscriber's dialing contacts thereby repeating the dial pulses to the central office. During the break portion of the contacts, relay B remains energized for 100 ms. This is due to the shunt capacitance of C7 across the relay windings.

distant terminals answers

6.04 Before the called party answers, all processing such as switching and busy check is accomplished by the central office. When the called party answers, the talk path is established to the calling subscriber.

subscriber release

6.05 When the subscriber goes on-hook, the circuitry of the 7370 reverts back to its quiescent state; all relays are deenergized and loop current ceases to flow, terminating the call.

central office originated call

6.06 When a call is originated from the central office ringing voltage appears at the line tip and ring terminals of the 7370. This ring voltage appears across diode bridge CR4 via closed contacts of relay B (deenergized). The rectified ring voltage operates RU after a delay of about 100 ms. provided by resistor R16 and capacitor C4. This delay is provided to prevent transient induced bell-tap. Relay RU, operated, connects a local superimposed (-48 Vdc bias) ring generator through a normally closed contact on the RT relay toward the distant station. This energized relay also connects a ground lead to the E6 repeater. When repeated ringing is used, local ringing voltage is applied to the two-wire drop whenever the RU relay is operated.

ring trip during silent interval

6.07 Ring trip during the silent interval is accomplished through release of the central office ring relay. When the subscriber answers, during the silent interval, relays B and A operate, providing termination toward the central office, which trips the central office ring relay and establishes the talking path.

ring trip during the ring interval

6.08 Ring trip during the ring interval is accomplished through a sequential tripping of the local ring trip relay and the central office ring relay. The local generator release is accomplished through operation of Relay RT as follows:

The local ring generator must be superimposed on -48 volt battery. When ringing is applied through operation of Relay RU, the capacitor associated with the distant ringer or ringers inhibits flow of direct current, maintaining capacitor C8 in the 7370 in an uncharged condition. AC ring voltages, however, flow through Capacitor C8 and Diode CR11 with very little attenuation. When the subscriber station goes off-hook during the ring interval, a negative potential is applied to the tip side of the two-wire drop through the station set as a result of the negative bias on the ring generator. Diode CR11 is reverse biased, and Capacitor C8 begins to charge negatively. When the voltage across C8 reaches approximately -5 volts, Transistor Q4 and Regenerator Q3 begin to conduct, quickly operating Relay RT. Relay RT, operated, removes the local ring generator from the ring side of the

loop and momentarily inserts a 1000-ohm resistance termination across the secondary of T1, causing Q1 and Q2 to conduct to operate Relays B and A. Relays B and A, operated, provide a DC current path through the line side of the dial long line unit, enabling ring trip toward the CO. The charge on Capacitor C8 maintains Relay RT operated sufficiently long to insure establishment of the loop toward the central office and tripping of the CO ring relay. When repeat ringing is used, strapping option G should be provided.

high current protector circuit

6.09 The high current protector circuit for the 7370 consists of relay HC, lamps DS-1 through DS-4 and associated circuitry. This protector circuit is bypassed by the contacts of relay HC unless loop current is such that one or both windings of HC are energized, HC's contacts open. In this condition, resistors R1 and R2 and lamps DS-1 through DS-4 will carry the excess current and Zener diodes CR1 and CR2 will regulate the voltage across each lamp pair.

7. TESTING

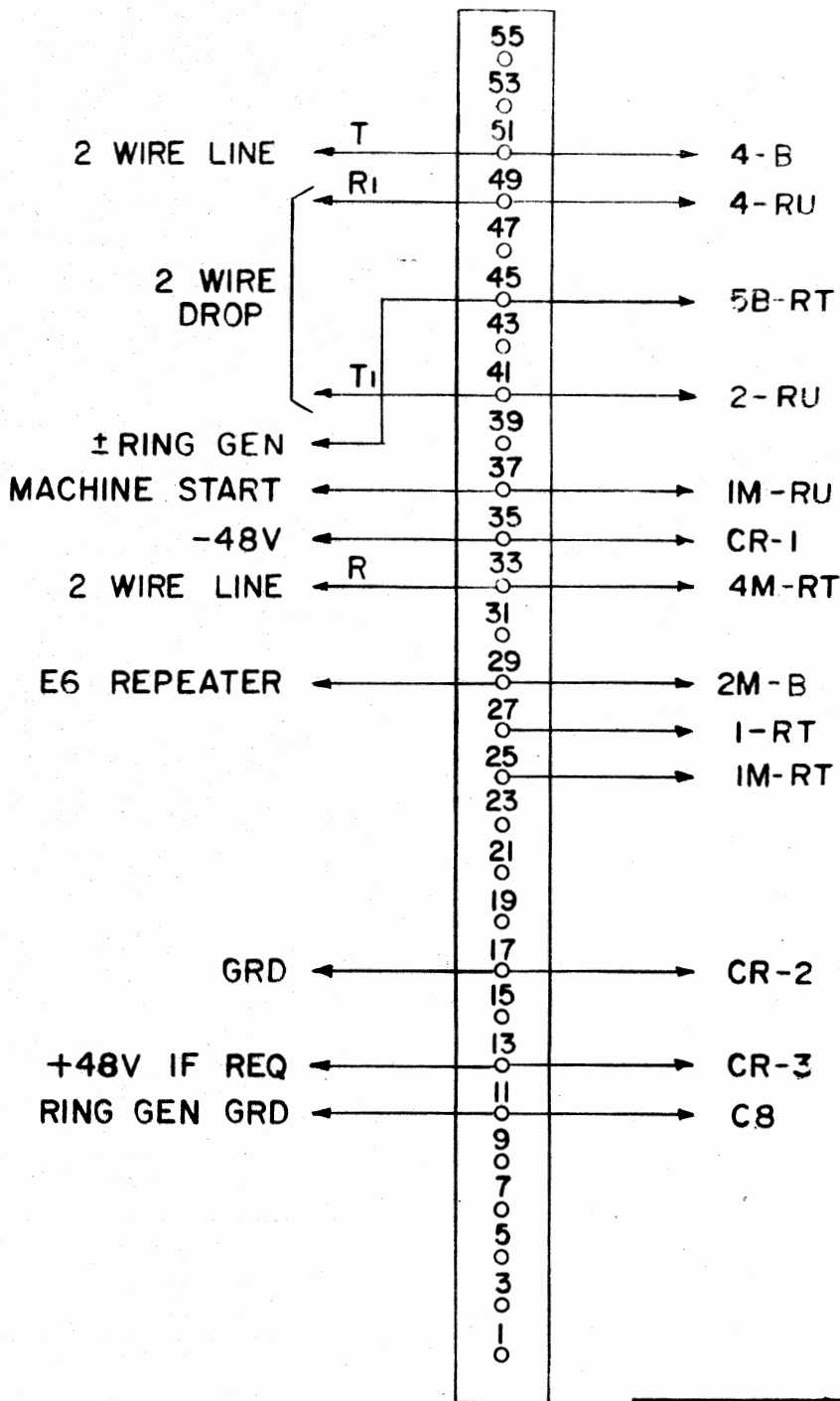
7.01 If trouble is encountered with the operation of the 7370 DLL, verify that all

installer connections have been properly made in accordance with Table 1. Make certain that the 7370 module is making good connection with the mounting-assembly card connector; snap the module out and in several times. Verify that power is applied to the 7370. If the trouble persists, change out and retest. If technical assistance is required, contact Wescom Customer Service Department by calling 312-971-2010 or TWX 910-695-4735.

Canadian Customers: 416-742-0236 or TWX 610-492-4367.

7.02 Field repairs involving the replacement of components within a module are not recommended. If a module is found to be defective, contact Wescom, Inc., by telephone or TWX, for instructions regarding replacement or repair. If a replacement module is required, it will be shipped the fastest way, or as specified by the customer. Upon receipt of a replacement module, return the defective module, using the shipping label provided, to Wescom, Inc., 501 Rogers Street, Downers Grove, Illinois 60515.

Canadian Customers: Wescom Canada, Ltd., 87 Brydon Drive, Rexdale, Ontario, Canada.



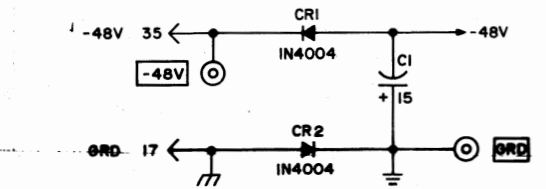
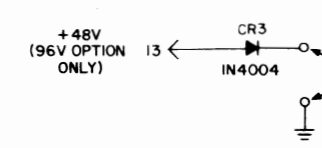
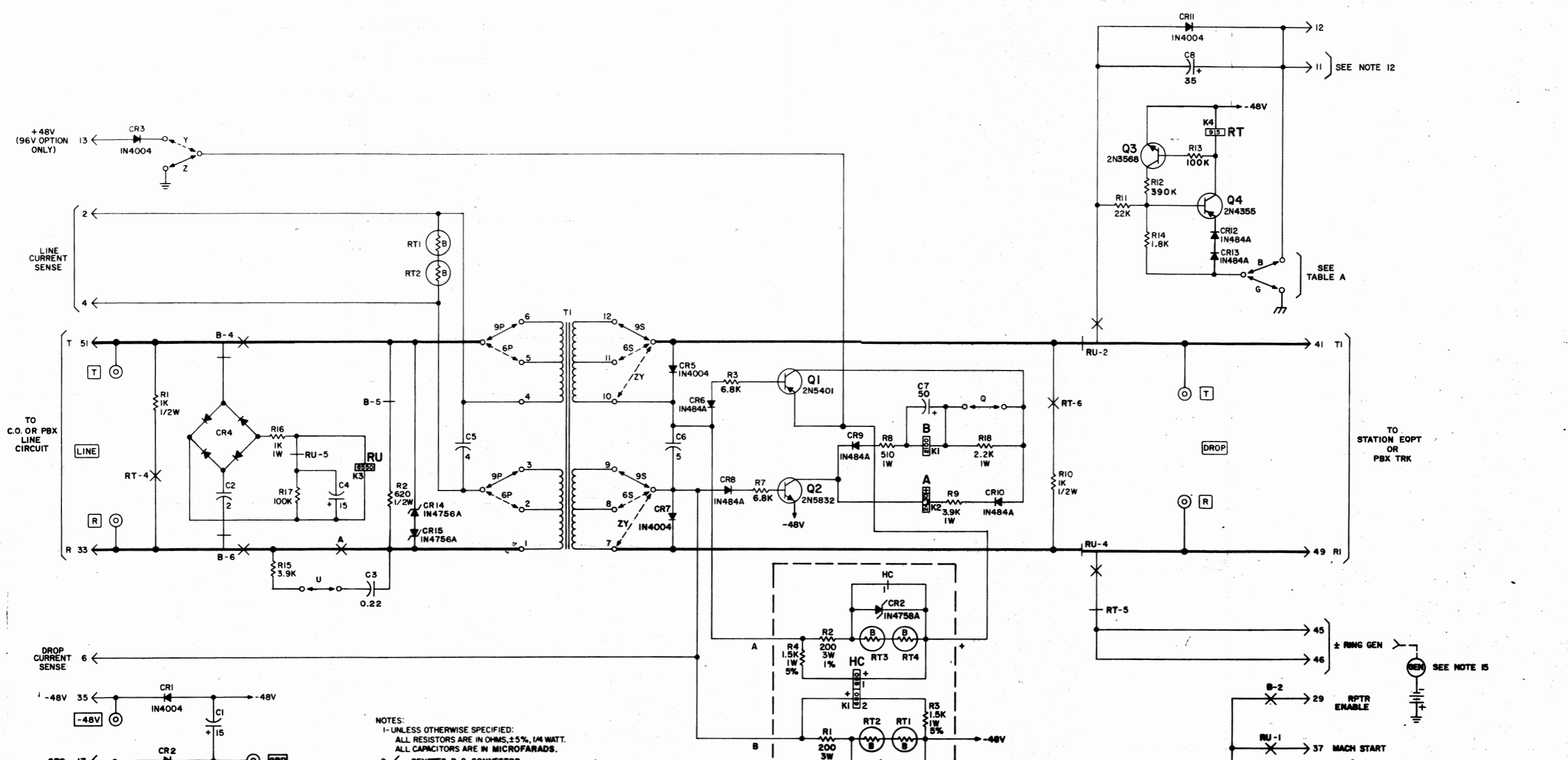
CAD DRAWING FOR THE 7370
DIAL LONG LINE REPEATER

| | | | |
|---|------------|------------------|---------------|
| IB | 8/23/72 | UP DATED TO 7370 | C.M |
| IA | 12/15/71 | UPDATED TO 7370 | RAR |
| REV NO. | DATE | E.C.O. NO. | BY |
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| DRAWN | RP | CHKD | APVD |
| MODEL | | | SCALE NONE |
| DATE | 5-26-70 | | SIZE A |
| DRW NO. | 393 000032 | | |

| | |
|-------------------------------|--------|
| TOLERANCES UNLESS NOTED | MAT'L |
| .X ± .020 P.C.C./MECH. ± .010 | |
| .XX ± .010 FRACTIONAL ± 1/32 | FINISH |
| .XXX ± .005 ANGULAR ± 0°-30' | |

WESCOM INC.

501 ROGERS
DOWNERS GROVE
ILL. 60515



| FUNCTION | OPTION | | NOTE |
|----------------------------|----------------|-------------------------|---|
| | IN | OUT | |
| SWITCHING-SIDE IMPEDANCE | 9P 6P | 6P 9P | 900 OHM PRIMARY 600 OHM PRIMARY |
| STATION-SIDE IMPEDANCE | 9S 6S ZY | 6S,ZY 9S,ZY 9S,6S | 900 OHM SECONDARY 600 OHM SECONDARY SIMPLEX SIGNALING |
| PULSING CONTACT PROTECTION | U | | SWITCHING-SIDE LOOP RESISTANCE LESS THAN 200 OHMS |
| STATION-SIDE RINGING MODE | B,G B,G | G | BY-PASS (SEE NOTE 12) |
| STATION-SIDE SIGNALING | Z,Q Y | Y Z,Q | 48 VDC OPERATION 96 VDC OPERATION |

- NOTES:
- UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE IN OHMS, ±5%, 1/4 WATT.
ALL CAPACITORS ARE IN MICROFARADS.
 - ← DENOTES P. C. CONNECTOR.
 - ⊙ DENOTES FRONT PANEL TEST POINTS.
 - XXX DENOTES FRONT PANEL DESIGNATIONS.
 - DENOTES FACTORY STRAPPING OPTION.
 - DENOTES INSTALLER STRAPPING OPTION.
 - DENOTES NORMALLY OPEN RELAY CONTACT.
 - DENOTES NORMALLY CLOSED RELAY CONTACT.
 - DENOTES PRIMARY TRANSMISSION PATH.
 - 10- THE INTERNAL SWITCHING-SIDE RESISTANCE VARIES ACCORDING TO LOOP LENGTH. THE RT1 AND RT2 LAMPS HOLD APPROX. 40 ms ON SHORT LOOPS AND ALLOW 22 ms ON A 1200 OHM LOOP.
 - 11- ALL RELAYS SHOWN DEENERGIZED.
 - 12- FOR BY-PASS RINGING APPLICATION, STRAP CONNECTOR PINS 51 AND 11 TOGETHER AND CONNECTOR PINS 33 AND 45 TOGETHER AND REMOVE OPTION G. SWITCHING EQUIPMENT MUST PROVIDE GROUND ON TIP DURING RINGING.
 - 13- FOR 96V OPERATION, PROVIDE +48VDC AT CONNECTOR PIN 13.
 - 14- STATION-SIDE LOOP CURRENTS LESS THAN 25 MA MAY AFFECT TRANSMISSION PERFORMANCE; CALCULATE TRANSMISSION RANGE USING 390 OHMS AS THE SOURCE RESISTANCE OF THE DLL BATTERY FEED CIRCUIT.
 - 15- USE SUPERIMPOSED (-48VDC BIAS) RING GENERATOR ONLY.

| FUNCTIONAL DESIG. | FUNCTION |
|-------------------|--------------|
| B | SLOW RELEASE |
| A | LINE RELAY |
| RU | RING UP |
| RT | RING TRIP |
| HC | HIGH CURRENT |

SCHEMATIC DIAGRAM
MODEL 7370
DIAL LONG LINE REPEATER

WESCOM INC. 801 ROGERS
DOWNS GROVE ILL. 60008

| REV. NO. | DATE | ECO. NO. | BY |
|----------|---------|--|------|
| E | 4-4-73 | ECO 2360 | RMS. |
| D | 1/22/73 | ECO 2280 & ST. CB WRS 25, RELAY TRUGS 6550 WRS 6650. | CMW |
| C | 10-6-72 | ECO 2182/21 ASY CHG | AJM |
| B | 9-1-72 | ECO NO. 2146 ADDED TABLE A REVISED NOTES 10 THRU 15 DELETED R4, 10K, DELETED NOTE 6, 7. | IDW |
| A | 7/16/71 | ECO # 203 | EW |

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WPA
7370 ISS: 2
12-15-71
SIZE D

191-737000

191-737001 SCHEMATIC HISTORY

| ISS/REV | ECO NO. | DATE | CHANGE | REASON | ADDENDUM |
|---------|---------|-------|---|---|---------------|
| 1/A | | 11/71 | Released to production. | | Not required. |
| 1/B | 1955 | 12/71 | Schematic designation (and symbols) of DS1, 2, 3, & 4 were changed to RT1, 2, 3, & 4. | These indicator lamps are electrically used as ballast lamps. | Not required. |
| 1/C | 2077 | 5/72 | Records change. | | Not required. |
| 1/D | 2193 | 10/72 | Mechanical. | | Not required. |
| 1/E | 2360 | 4/73 | Changed rating of resistance lamps RT 1 through RT4. | To improve loop current range. | A |

191-737000 SCHEMATIC HISTORY

| ISS/REV | ECO NO. | DATE | CHANGE | REASON | ADDENDUM |
|---------|-----------------|-------|--|--|---------------|
| 2/A | | 12/71 | Released to production. | | Not required. |
| 2/B | 2146 | 9/72 | Removed resistor R4. | To ensure high reliability on a 3,000-ohm loop. | Not required. |
| 2/C | 2182 2182-S1 | 10/72 | Mechanical. | | Not required. |
| 2/D | 2280 2280-S1 | 1/73 | Changed value of capacitor C8 from 25uF to 35uF and changed RU relay type. | To prevent false pre-trip of 7370 module and improve RU relay sensitivity. | Not required. |
| 2/E | 2360 | 4/73 | Changed rating of resistance lamps RT1 and RT2. | To improve loop current range. | A |