

TECHNICAL INFORMATION

FOR

EMS-1

CONNECTOR MODULE

800030

Approved: *Albrecht*

Issue 1 11/30/79

Issue 2 2/20/80

Issue 3 5/15/80

Issue 4 5/5/82

Issue 4 of I-2130 Connector Module Technical Information applies to equipment with the following or later KS issues.

500163	Backplane	KS 4	600100	Matrix	KS 14
500185	Revertive Call	KS 10	600130	Connector	KS 23
500186	FM/Code Ring	KS 5	600139	Connector Test	KS 11
500187	Superimposed Ring	KS 3	600138	PBX	KS 7
500188	Last Party Control	KS 1			
500189	NU Tone/Metering	KS 1			
500092	Timing	KS 10			

KS issues can advance without reissue of this instruction when basic data is not affected. The KS issue number often changes for reasons that do not affect the circuit or its operation.

Issue 2 of I-2130 applies to Connector issues KS 1 through KS 9.

Issue 3 of I-2130 applies to Connector issues KS 10 thru KS 19.

EMS-1 CONNECTOR MODULE

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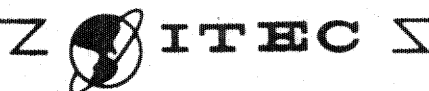
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EMS-1

CONNECTOR MODULE

1.0 DESCRIPTION

The EMS-1 Connector may be used for Individual or Trunk Hunting applications in existing Step-by-Step and XY Systems. This module can be added individually to your present system or in combination with other EMS-1 Modules. It may also be used with EMS-1 Lines and Selectors as a complete Switching System.

Major components of the Connector Equipment consist of the basic Connector Card, Optional Features, Test Connector, and the Matrix Cards.

The Circuit may be added to either 3-Wire or 4-Wire Systems. The Connectors with the associated Matrix Card(s) provide up to 96 Terminals per Connector Module.

1.1 FEATURES

STANDARD FEATURES include but are not limited to: • Terminal per Station operation • Single Frequency Ringing for one and two party operation • Strappable Battery or Ground Connected Generator • 1900 ohm Loop capability with 23ma transmitter current at 51.6 volts • compatible with Common Mode Line Treatment equipment • Called Party Hold by strap option to allow Nuisance Call Trapping • Peg Count Meter Output • LED Status Display on faceplate. A Test Connector is provided with each Module. The Test Connector provides test and verification distributor access and aids in call tracing. A digital display on the faceplate indicates the terminal the Connector has accessed.

Connectorized Module for ease of installation.

1.2 OPTIONAL FEATURES AVAILABLE

PBX HUNTING — is provided by simply equipping the Connector Module with the optional PBX Control Card. The PBX Control Card Faceplate has controls for programming group and number assignments. PBX Rotary Hunting is assignable up to 48 PBX Groups per Module, and a group can be any size up to 96 Terminals. Rotary alternate numbers (Terminals) can be assigned at random which permits non-consecutive assignment of numbers. This feature allows growth of PBX groups without reserving consecutive numbers as any vacant number can be used. For large PBX groups, Connector Modules may be added together to provide additional traffic capacity.

REVERTIVE CALL — Provides Revertive Call By Directory Number.

AUTOMATIC INTERCEPT — Connects unassigned connector terminals to intercept equipment. Access is via output pins on the connector module backplane.

REVERTIVE CALL/AUTOMATIC INTERCEPT — Provides the functions of both the Revertive Call and Automatic Intercept features.

TROUBLE TIMING — Release Connector after one, two, or four minutes (selectable) if not answered and provides Post Supervision Disconnect Timing of 23 seconds.

SELECTIVE RINGING — Frequency Mark, Superimposed or Coded Ringing. NOTE: This method requires 4-Wire Matrix.

FUSE FAILURE BUSY — Buses out Connector with blown fuse, used in Absence of Ground Searching Systems. Use with complete EMS-1 Exchange.

LAST PARTY RELEASE — Allows revertive calls to hold connector after revert call switch releases.

NU TONE/+BATTERY METERING — Provides tone to calling party for unassigned numbers. Provides +48V pulse on sleeve for call metering.

1.3 SPECIFICATIONS - CONNECTOR MODULE

GENERAL

Supply Voltage --	44-56 VDC	Temp. Range -----	+10 to 120 F (Room Ambient)
Supply Current	<u>IDLE</u> <u>BUSY</u>		
PBX	30ma 100ma	Humidity Maximum ----	20 to 90%
TEST	20ma 80ma	(non condensing)	
CONNECTOR	22ma *200ma		
Sub Loop -----	1900 ohm	Surge Protection ----	1500V
Line Leak -	15,000 ohms minimum resistance between conductors or to ground.		

TRANSMISSION

Insertion Loss ---	.45dB max. (300-3400 HZ)	Echo Return Loss ----	25dB min.
Crosstalk Loss ---	96dB min.	Sing Return Loss ----	15dB min.
Long Balance -----	65dB min. (1 KZ at 0dB)		

NOTE: All transmission specifications are for talking mode.

MECHANICAL

Connector Wt. -----	3.2 lbs. (with options)	Matrix Card Wt. -----	11 lbs.
PBX Card -----	1.5 lbs.	Module Wt. -----	16 lbs. (2 Cages & Cables)
Test Card Wt. -----	1.5 lbs.	Module Depth -----	12.8 in.
Module Height			
3 Matrix Cards	17.50 in.		
4 Matrix Cards	19.25 in.		

NOTE: Specifications subject to change without notice.

* Resistance of subscriber loop affects current requirements.

Value shown is for 500 ohm originating & terminating loops.

1.4 WARRANTY

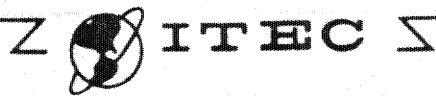
ITEC, Inc. warrants these units to be free of defects in material or workmanship for five years from date of shipment. Any units found defective during the first year will be repaired or replaced at no charge when returned prepaid to our Huntsville facility. During the remaining four years of the warranty, a handling fee will be charged for this service. Any abuse or improper installation will void this warranty.

A Return Material Authorization Number (RMA) must be obtained from the Customer Service Department (205-881-5759) prior to shipment:
The following information should be included with the shipment:

Ship via UPS or Parcel Post to:

ITEC, Inc.
P.O. Box 4147
520 Green Cove Road
Huntsville, Alabama 35802

Adherence to this procedure will facilitate the prompt repair and return of your material.



EMS-1

CONNECTORS

1.5 ORDERING INFORMATION			
#1 Connector and Matrix Card Module 800030			
#2 Connectors	#3 Options	#4 Matrix Cages	
- 1, 1 ea. 600130 Conn. - 2, 2 ea. 600130 Conn. - 3, 3 ea. 600130 Conn. - 4, 4 ea. 600130 Conn. - 5, 5 ea. 600130 Conn. - 6, 6 ea. 600130 Conn. - 7, 7 ea. 600130 Conn. - 8, 8 ea. 600130 Conn. - 9, 9 ea. 600130 Conn. - 10, 10 ea. 600130 Conn.	-11, 500185, Revt. Call by Dir. # -12, 500097, Fuse Failure Busy -13, 500188, Last Party Rls. -14, 500092, Trouble Timing -15, 500186, Freq. Mark/Coded Ring -16, 500187, Superimposed Ring -17, 500185-1, Automatic Intercept -18, 500185-2, Revt. Call/Auto Intercept -19, 500189, Nu-Tone/Metering -20, 600138, PBX Control	-23, 500045-3 Holds 3 Cards -24, 500045-4 Holds 4 Cards	
		#5 Matrix Cards	3W TERM 4W
		-31, 1 ea. 600100	32 24
		-32, 2 ea. 600100	64 48
		-33, 3 ea. 600100	96 72
		-34, 4 ea. 600100	— 96

NOTES

- #1 BASIC MODULE — The Connector and Matrix Card Module #800030, consist of one Connector Cage with Back Plane #500044-42, one Test Connector #600139, and one Matrix Card Cage #500045.

The Basic Module will accommodate 10 Connectors, the Test Connector, a PBX Control Circuit, and three or four Matrix Cards (see #4). The dash numbers as shown in the example below, denote how the Module can be equipped.

- #2 QUANTITY OF CONNECTORS — Order by dash number the quantity of Connectors required.
- #3 OPTIONS (GENERAL) — Order dash number as required. EXAMPLE: -11 (Revertive Call), -14 (Trouble Timing).

RINGING OPTIONS — Single Frequency (or Freq. per shelf) Battery Connected - No option required.

Single Frequency (or Freq. per shelf) Ground Connected -15, 500186 required.

Frequency Marking, (Multi-Freq.) -15, 500186 and 4W (extra matrix card) required.

Coded (Single Freq.) -15, 500186 and 4W (extra matrix card) required.

Superimposed (Single Freq.) -16, 500187 and 4W (extra matrix card) required.

- #4 MATRIX CAGE — Order dash number 23 if accommodations for three Matrix Cards is required. Order dash 24 for four Matrix Cards.

- #5 MATRIX CARDS — Order Matrix Cards as required for 3-Wire or 4-Wire Systems per number of Terminals needed (4th Wire is required for Selective Ringing only).

NOTE: Order Terminal Blocks and Connectorized Cable as required. See page 30 for listings.

EXAMPLE

Note Number	#1	#2	#3	#5	#6
Basic Module and Dash Number	800030	-10	-11 -14	-23	-33

CABLES

CONNECTOR, OGT, MDF

ORDERING INFORMATION	
Female Connector One End (Tinned)	Female Connector Both Ends
651025, 1 ea. 25 Feet, 25 Pair	652025, 1 ea. 25 Feet, 25 Pair
651050, 1 ea. 50 Feet, 25 Pair	652050, 1 ea. 50 Feet, 25 Pair
651075, 1 ea. 75 Feet, 25 Pair	652075, 1 ea. 75 Feet, 25 Pair
651100, 1 ea. 100 Feet, 25 Pair	652100, 1 ea. 100 Feet, 25 Pair
651125, 1 ea. 125 Feet, 25 Pair	652125, 1 ea. 125 Feet, 25 Pair
651150, 1 ea. 150 Feet, 25 Pair	652150, 1 ea. 150 Feet, 25 Pair
651200, 1 ea. 200 Feet, 25 Pair	652200, 1 ea. 200 Feet, 25 Pair

NOTES

OGT — Order one Cable per #800030 Connector Module to Selector OGT Block as required (T,R,S for 3-Wire, or T,R,S,4W for 4-Wire).

MDF — Order two Cables per Matrix Card (32 Terminals) to MDF as required (T,R,S,4W).

GENERAL — Where multiple shelves are used to meet high traffic requirements. order MDF Cables as specified above for the primary Module only. Order one #652004 and one #652005 Cables for each Matrix Card in the secondary Module(s).

TERMINAL BLOCKS CONNECTOR, MDF

ORDERING INFORMATION	
#1 Connector Terminal Single Frequency	#2 Connector Terminal Frequency Mark
100245, 1 ea. 6 × 26 Wire Wrap	100247, 1 ea. 8 × 26 Wire Wrap
100244, 1 ea. 6 × 48 Connectorized	100246, 1 ea. 8 × 48 Connectorized
#3 Bay Supervisory Block	
500038, Supervisory Block Assembly	

NOTES

- #1 CONNECTOR TERMINALS, SINGLE FREQUENCY — Order four each 100245 (6 × 26 Wire Wrap Blocks) or two each 100244 (6 × 48 Connectorized Blocks) for each Module (96 Terminals T, R, S per Connector Terminal, T, R, S for Intercept access and separate plug for ANI sleeves).
- #2 CONNECTOR TERMINALS, FREQUENCY MARK — Order four each 100247 (8 × 26 Wire Wrap Blocks) or two each 100246 (8 × 48 Connectorized Blocks) for each Module (96 Terminals T, R, S, 4W per Connector Terminal, T, R, S for Intercept access and FM and separate plug for ANI sleeves).
- #3 Order 1 per bay when required for miscellaneous lead multiple.
- #4 Terminal Blocks specified above are adjustable for 7, 7.5, or 8 inch mounting.

2.0 ENGINEERING & INSTALLATION NOTES

2.1 APPLICATIONS OF EMS-1 CONNECTOR EQUIPMENT

EMS-1 Connector equipment can be added to SxS or XY equipment or be used in new installations.

EMS-1 Connector equipment is TPS. It is engineered to be compatible with all common ringing systems and provides PBX hunting, revertive call by directory number and other features.

2.1.A Special 100 Number Groups

When replacing existing equipment it is often necessary to have all 100 numbers equipped to avoid subscriber number changes. EMS-1 Connector Modules can be arranged for a full 100 numbers by equipping the Matrix with numbers 97, 98, 99 & 00 by adding a partial Matrix Card.

PBX operation for the added numbers requires a small modification to the PBX control card (600138). This change does however disable the group overflow meter feature. See Paragraph 3.6 for additional information on PBX operation.

Single Frequency Ringing (3 Wire Matrix)

Use a 500045-4 Matrix Card Cage (4 position) and add special 600101 Matrix Card in position 4 for terminal numbers 97, 98, 99 & 00. Cable the front plug on this card to the MDF. In the Connector, omit straps "99" and "matrix size."

Multi-frequency or Code Ringing (4 Wire Matrix)

Use a 500045-5 Matrix Card Cage (5 position) and add special 600102 Matrix Card in Position 5 for terminal numbers 97, 98, 99 & 00. Cable the front plug on this card to the MDF. In the Connector, omit straps "99" and "matrix size."

Note: Connectors issue KS 22, or earlier, require a factory modification to control the 5th Matrix Card. Later issues have the feature incorporated.

Contact the factory for ordering information and pricing.

2.2 MOUNTING

All EMS-1 equipment is mounted in 23 inch relay racks. A complete connector module requires 17.5 inches of rack space for single frequency ringing and 19.25 inches for frequency mark, code, superimposed ringing.

Relay racks use cable duct or standoffs to support installers cable.

See page 2-3 of this instruction booklet for typical shelf mounting arrangements.

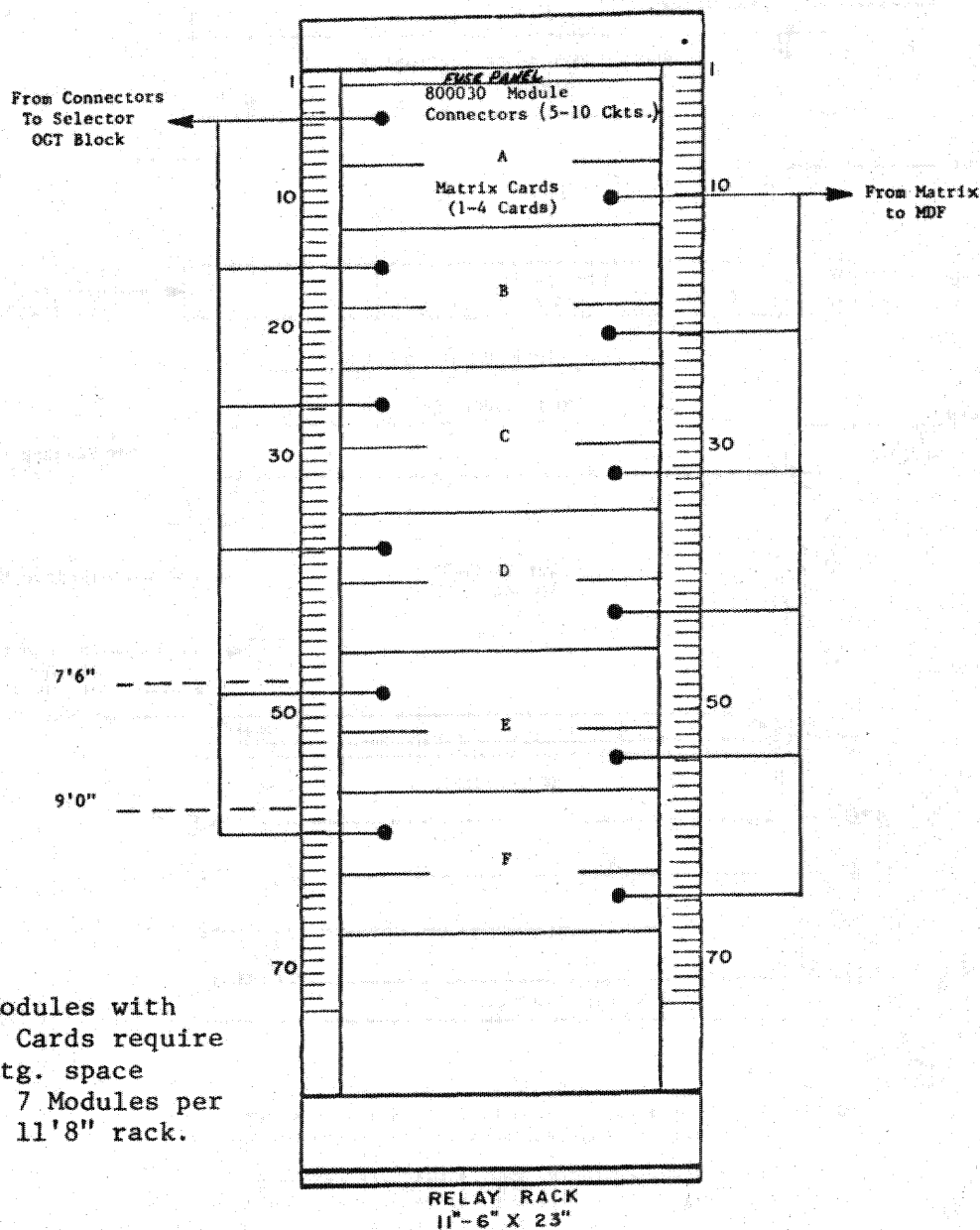
Refer to ordering information for additional information.

Figure 1.

PBX C O N T R O L	C O N N E C T O R S										T E S T C O N N
	1	2	3	4	5	6	7	8	9	10	
Matrix Card 1						1-24 (FM) Terms 1-32 (SF)					
" " 2						25-48 (FM) Terms 33-64 (SF)					
" " 3						49-64 (FM) Terms 65-96 (SF)					
" " 4						65-96 (FM) Terms 97-00 (SF) (600101)					
" " 5						Terms 97-00 (FM) (600102)					

(FM) Frequency Marking
(SM) Single Frequency

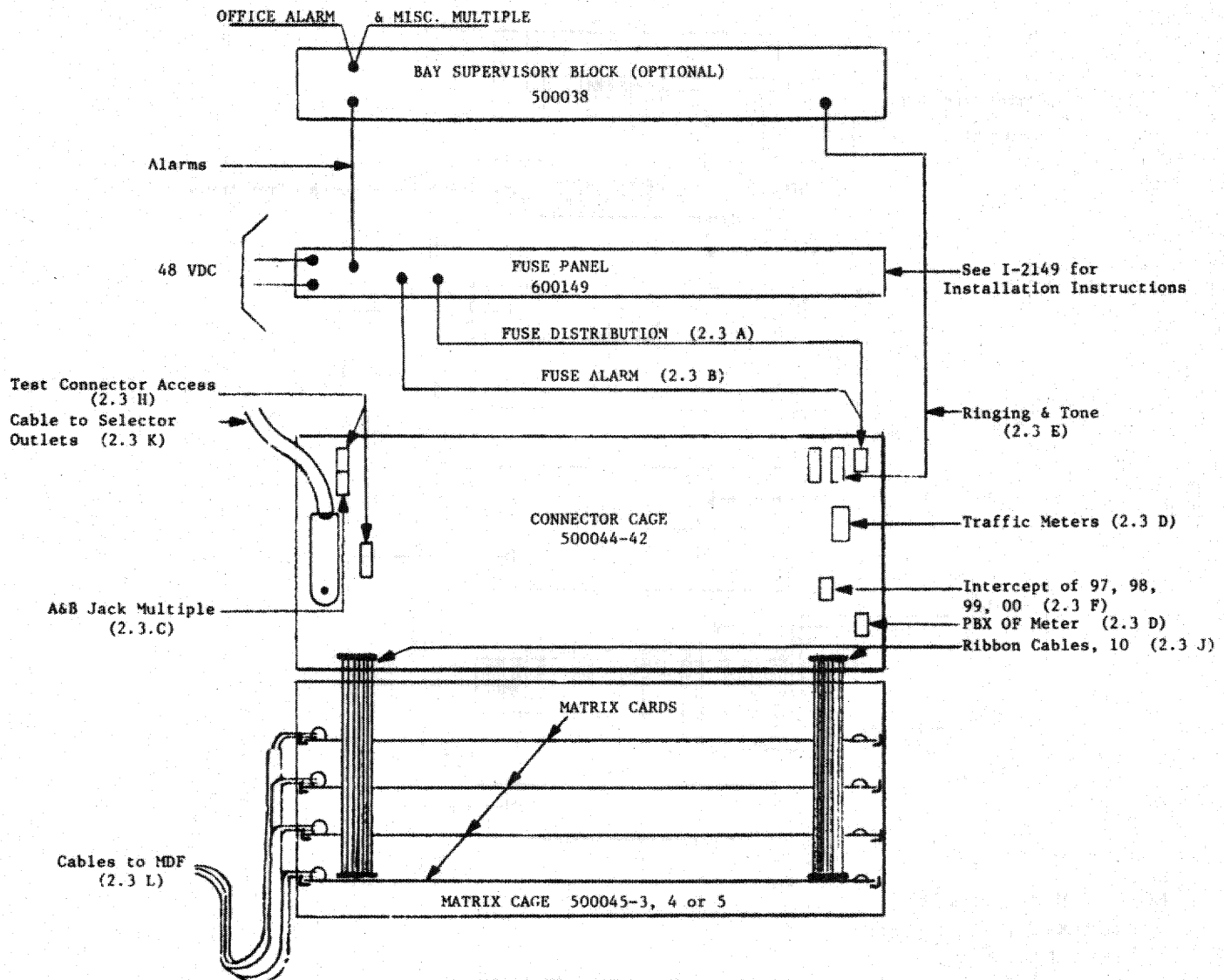
Figure 2. Typical Connector Bay



NOTE: Modules with 3 Matrix Cards require 1 less mtg. space allowing 7 Modules per 11'6" or 11'8" rack.

Figure 3. Installers Cabling

(See Figure 5 for Connecting Information)



- NOTES:
1. The number in parenthesis indicates the text paragraph that explains the associate wiring.
 2. All wiring to the Fuse Panel must be formed from the left side of the relay rack to allow the Fuse Panel to swing to one side for access from the Front of the bay.

2.3 CABLING & WIRING - Refer to Figure 5 for additional information.

2.3.A Power Wiring & Fusing

Each connector cage must be fused by a single 5 amp fuse on a bay fuse panel. Each circuit has individual fuse(s) on the unit.

The Installer shall use 20 gauge wire (paired if available) for battery and ground from the bay fuse panel to each backplane. If the proper wire wrap bit is not available, the power connections must be soldered.

It is recommended that EMS-1 equipment be powered with filtered battery when it is installed as an addition. One row filter of the appropriate size can be used if all EMS-1 can be powered from the same feeder cable, otherwise, bay filters should be provided. A filtered fuse panel is available from ITEC. Order 600149 for connector bay.

2.3.B Fuse Alarms

Fuse Alarms must be wired to the bay fuse alarm in a manner that will cause the bay lamp to light and to activate the office alarm system major alarm.

A blown fuse on a circuit card will provide a 500 ohm battery on the FA pin located on the connector backplane. If the 500 ohm resistance is not required, strap across the resistor on the backplane.

ITEC Fuse Panel 600149 is recommended. Refer to I-2149 for additional information.

2.3.C A & B Test Jacks

The A & B Test Jacks can be wired through the office as required. In new installations it is recommended that both A & B be multiplied throughout the office. These jacks are for the convenience of maintenance personnel.

2.3.D Meter Leads

The Meter outputs provided are:

Peg Count - A ground pulse (50 or 150 ms as strapped) appears each time a call is attempted.

PBX Group Busy-97, 98 & 99 - A ground pulse of 150ms for up to three PBX groups to be observed. Program 97, 98 or 99 to the group to be observed as an alternate number and the appropriate meter will operate. Valid only with 96 number installations.

Note: 1. The Installer shall cable with 24 gauge bulk cable to the IDF for cross connecting, or direct to the meters per job requirements.

2. Meters must have a 1N4005 or equivalent diode wired across the coil terminals for suppression. Wire with "band" away from battery terminal.

2.3.E Ringing, Tone & Misc. Leads

The Installer shall wire the following misc. leads per office requirements. See Figure 4 for optional bay supervisory block layout. Use 20 gauge wire to Bay and 22 gauge within bay.

PIN DESIG

FUNCTION

Gen ±	Ringing generator from power board.
1,2,3,4	Leads 1-4 are wired into the connector ringing option card. They are used for special applications. For TPS operation they are used to terminate superimposed ringing marks so that positive marks will operate the positive ring relay in the 500187 option card to maintain correct DC polarity of the ring trip circuit. Wire 1 to + Ring, 1 Ring or SUP M (ITT) Wire 2 to - Ring, 1 Ring Wire 3 to + Ring, 2 Rings Wire 4 to - Ring, 2 Rings or Revertive Ring-splash mark for code ringing.
Trip +	Wire only when office has separate Positive Ring Trip voltage supply.
Trip -	Wire only when office has separate Negative Ring Trip voltage supply.
RCT 1	Revertive Call Tone 1
RCT 1R	Revertive Call Tone 1 Return These terminals are wired to a recorded announcer or to a distinctive tone source that notifies the caller he has called a party on his own line and to hang up to allow the phone to ring. (Only if -11 option is equipped.) Also see RC ST1.
RC ST1	Start lead - wire to announcer start or MACH ST if revertive call option is equipped.
RCT 2	Revertive Call Tone 2

RCT 2R Revertive Call Tone 2 Return

These terminals are wired to a distinctive tone source that notifies a person answering a revertive call that he has answered a revertive call and to wait for the calling party to pick up again. Also see RC ST2.

RC ST2 Start lead - wire to MACH ST if revertive call option is equipped.

BT 60 IPM Busy Tone

BTR Busy Tone Return - Ground if office does not have balanced tone distribution.

RBT Ring Back Tone

RBT R Ring Back Tone Return - Ground if office does not have balanced tone distribution.

Note: 1. A strap is required for the above leads to connect to the Backplane multiple. This allows trouble isolation without disturbing multiple wiring.

2. Tone distribution in telephone exchanges may be balanced or unbalanced. In a "balanced" office, the powerboard will provide a tone ground return for each tone. We assign the 1st wire of a twisted pair to a tone and utilize the 2nd wire of the pair for the grounded return. When the office is balanced, the return lead is to be connected at both ends of the cable run or jumper. (EMS-1 is Balanced) This lead also acts as a shield for the tone lead.

In an unbalanced office the tone lead shields will be grounded at the powerboard. tone shield lead is to be grounded at the "source end only of all tone lead cabling and jumpering. It is multiplied through any distribution blocks utilized. This procedure is to prevent creating "ground loops" between equipment. Most older systems are unbalanced. See Figures 4 and 4A.

Mach ST Ground output when Connector is siezed to start interrupter and ringing generators. If required multiple through all modules and to power board.

NOTE: Ground is removed when Connector is in talking mode.

Pick Up Ringing Pick Up lead from interrupter. Wire as required by office for the following operations.

A. Used to enable ringing at the start of a ring code - Frequency Mark, Code & Superimposed ringing normally use this method.

- B. Used to operate the ringing relay on option card to interrupt continuous generator - Can be a code 1 or code 2 ground.
- C. If office interrupter does not provide a pick up lead, this pin must be connected to ground.

Figure 4.

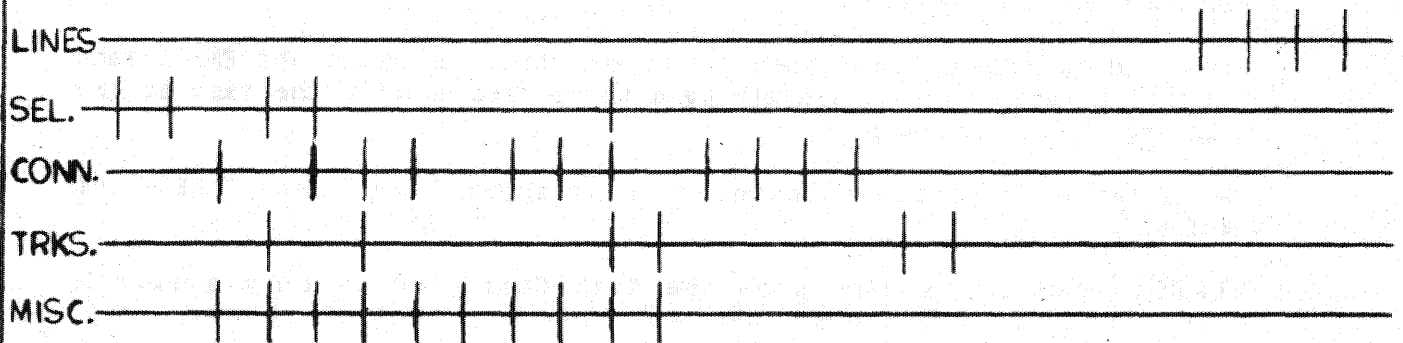
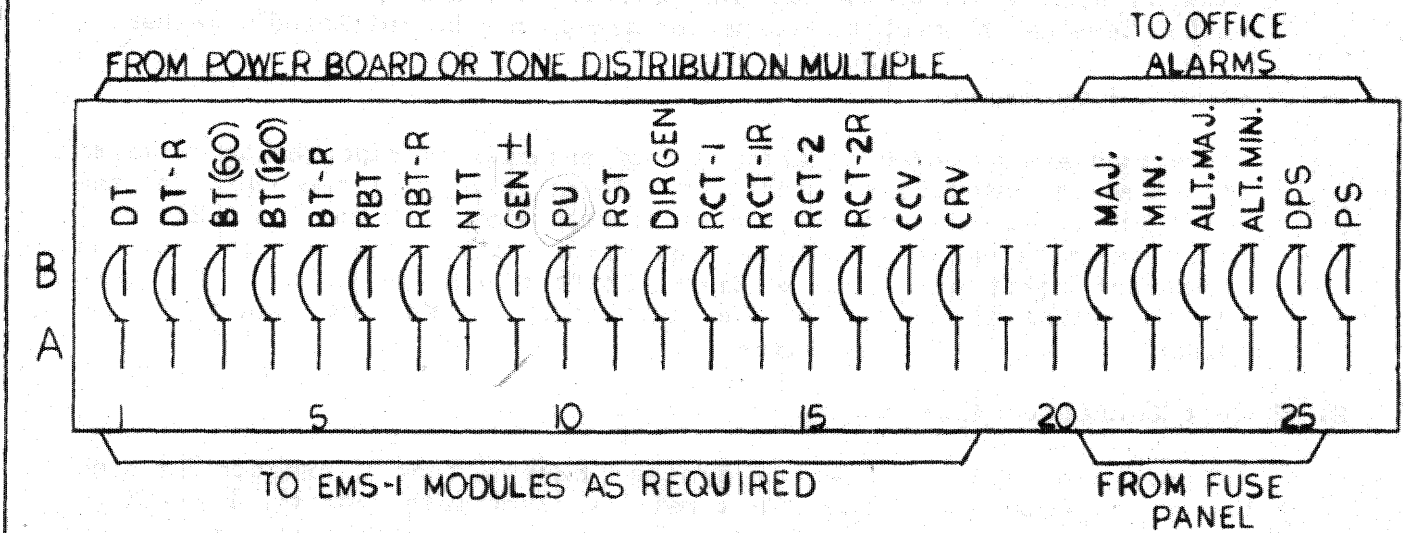
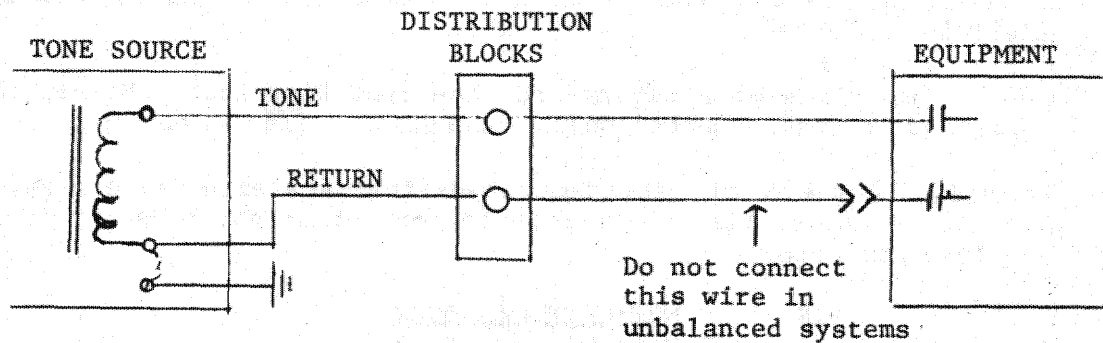


Figure 4A.



SUPERVISORY BLOCK LAYOUT

ISSUE	DATE	ENGR	PAGE
1	1-21-82	CEM	1 OF 2

500038

2.3.F Intercept of #s 97, 98, 99 & 00

Wire T, R, S & 4th to the MDF and connect to Intercept multiple on connector terminal blocks. All connector groups may be multiplied together.

2.3.G Common Mode Access

Connectors are arranged to allow a loop extender/VF repeater to be wired into them for common mode operation. To do this it is necessary for the Installer to cut the artwork straps between A15 & A16 and B15 & B16 edge connector pins on the backplane, and cable T & R in and out to the line treatment equipment. Use an Exacto Knife to cut the tracks. Use care in connecting the wiring to the backplane. Use no more than a 60 watt soldering iron. Reference Figure 5.

2.3.H Test Connector Access

All stage-by-stage switching systems have a Test Connector in each Connector group to establish a metallic test path from the Wire Chief Test Panel or Operator Verification Trunk to a subscriber line. The Test Connector is accessed via a Test & Verification Selector or Test & Verification Distributor.

When adding EMS-1 Connectors to an existing exchange, the EMS-1 Test Connector must be wired and strapped to operate exactly the same as the existing Test Connectors.

Two types of control (selectable by strapping) are used, DIRECT and INDIRECT.

DIRECT control is used when the Test Connector is only a switch mechanism and, therefore, does not have any control relays. The mechanism is controlled by the Test Distributor. Direct control is used by ITEC EMS-1, ITT (USA), Plessey, AEI, GEC, some models of Stromberg Carlson and others.

INDIRECT control is used when the Test Connector has A, B & D relays to allow normal loop pulsing control of the mechanism. Indirect control is used by AE, WECO, some models of Stromberg Carlson, ITT Standard Electric and others.

EMS-1 Test Connector wiring from the Test Distributor Matrix (Bank) is connected to the Connector Module Backplane. (see Figure 5).

Pins 1, 2, 3 & 4 are the test leads that are extended directly to the line to be tested via the Test Connector and do not have any function in the Test Connector.

<u>PIN</u>		<u>NORMAL DESIGNATION</u>
1	-	Test Tip or + Test
2	-	Test Ring or - Test
3	-	Test Sleeve or EC or P1
4	-	4th Wire, SP (Rarely Used)
5	-	Not used

Pins 6, 7, 8 & 9 are the control leads that operate the Test Connector.

<u>PIN</u>	<u>INDIRECT DESIG</u>	<u>DIRECT DESIG</u>
6	Tip, + Oper or + Line	V or X-M
7	Ring, -Oper or - Line	R or X-ON or LD
8	Sleeve, C, SL or P	Z or S
9	NPC (Rarely Used)	Y-ON
10	Not Used	Not Used

In addition, the Installer must strap the SG or SB post on the backplane as follows:

Strap S to SG if Test Distributor selects an idle Test Connector by detecting absence of ground on the sleeve. Normally used with indirect systems. Provides ground on sleeve when Test Connector is removed.

Strap S to SB if the Test Distributor selects an idle Test Connector by detecting battery on the sleeve or through the release magnet (Z lead) on a direct system.

2.3.J Ribbon Cables - Connector to Matrix Cards

Each Connector circuit must be connected to all matrix cards equipped in the module. Use the 26 conductor ribbon cables supplied with the matrix cage. Care must be used to insure the ribbon cable connectors are mated properly when plugging them onto the backplane and matrix card connectors. Install all ribbon cables, even if all connector positions are not equipped.

2.3.K Tip, Ring, Sleeve and 4th Wire Leads from Selector DTA

All leads are contained in the 25 pair connector on the backplane. Use a 25 pair connectorized cable to extend these leads to the selector outgoing trunk block (OGT) or grading block.

The OGT terminal block pin assignments and lead colors are presented below in TABLE 1.

2.3.L Matrix Card Outlet Cables to MDF

The Matrix Card Outlet Cables are connectorized 25 pair cables. Two cables are required for each matrix card. In 3 wire installations each cable carries 16 terminals. In 4 wire installations, each cable carries 12 terminals. The cable near the front of the matrix card is for terminals 1-16 (3W) or 1-12 (4W), the cable near the rear of card is 17-32 or 13-24. See TABLES 2 and 3 for color codes.

On connectorized terminal blocks, all sleeves (48) are brought out on the last Connector equipped. Cable these sleeves to ANI matrix.

NOTE: Be sure matrix cards are strapped for their installed position prior to installation.

Matrix cables can be ordered connectorized on both ends or just the matrix card end. The charts below give pin assignments and color code information for terminating the non connectorized end.

Pins 25 & 50 with Slate-Violet pair are not used.

Enough slack should be left in the matrix cables to allow a card to be pulled out the front of the cage to unplug the cables, if necessary for maintenance.

Cables plugged into matrix cards must have plastic covers on Connectors.

Check all relay covers to insure they are seated prior to installing matrix cards or Connectors.

Connector terminals number 01 to 96 or 01 to 00 when 100 numbers are equipped.

TABLE 1. PIN & COLOR ASSIGNMENTS

(25 Pair Cable from Connector to OGT Block)

CONN	LEAD									
	TIP		RING		SLEEVE		4TH		NOT USED	
	COLOR	PIN	COLOR	PIN	COLOR	PIN	COLOR	PIN	COLOR	PIN
1	WH-BL	26	BL-WH	1	WH-OR	27	ORN-WH	2	V-BL	46
2	WH-GR	28	GR-WH	3	WH-BR	29	BR-WH	4	BL-V	21
3	WH-SL	30	SL-WH	5	R-BL	31	BL-R	6	V-OR	47
4	R-OR	32	OR-R	7	R-GR	33	GR-R	8	OR-V	22
5	R-BR	34	BR-R	9	R-SL	35	SL-R	10	V-GR	48
6	BK-BL	36	BL-BK	11	BK-OR	37	OR-BK	12	GR-V	23
7	BK-GR	38	GR-BK	13	BK-BR	39	BR-BK	14	V-BR	49
8	BK-SL	40	SL-BK	15	Y-BL	41	BL-Y	16	BR-V	24
9	Y-OR	42	OR-Y	17	Y-GR	43	GR-Y	18	V-SL	50
10	Y-BR	44	BR-Y	19	Y-SL	45	SL-Y	20	SL-V	25

TABLE 2. 3 WIRE MATRIX OUTLET CABLE COLOR CODE

LEAD DES 3-WIRE	WIRE COLOR	PIN NO.
T1	WHT-BLU	26
R1	BLU-WHT	1
S1	WHT-ORN	27
S2	ORN-WHT	2
T2	WHT-GRN	28
R2	GRN-WHT	3
T3	WHT-BRN	29
R3	BRN-WHT	4
S3	WHT-SL	30
S4	SL-WHT	5
T4	RED-BLU	31
R4	BLU-RED	6
T5	RED-ORN	32
R5	ORN-RED	7
S5	RED-GRN	33
S6	GRN-RED	8
T6	RED-BRN	34
R6	BRN-RED	9
T7	RED-SL	35
R7	SL-RED	10
S7	BLK-BLU	36
S8	BLU-BLK	11
T8	BLK-ORN	37
R8	ORN-BLK	12

LEAD DES 3-WIRE	WIRE COLOR	PIN NO.
T9	BLK-GRN	38
R9	GRN-BLK	13
S9	BLK-BRN	39
S10	BRN-BLK	14
T10	BLK-SL	40
R10	SL-BLK	15
T11	YEL-BLU	41
R11	BLU-YEL	16
S11	YEL-ORN	42
S12	ORN-YEL	17
T12	YEL-GRN	43
R12	GRN-YEL	18
T13	YEL-BRN	44
R13	BRN-YEL	19
S13	YEL-SL	45
S14	SL-YEL	20
T14	VIO-BLU	46
R14	BLU-VIO	21
T15	VIO-ORN	47
R15	ORN-VIO	22
S15	VIO-GRN	48
S16	GRN-VIO	23
T16	VIO-BRN	49
R16	BRN-VIO	24

TABLE 3. 4 WIRE MATRIX OUTLET CABLE COLOR CODE

LEAD DES 4-WIRE	WIRE COLOR	PIN NO.
T1	WHT-BLU	26
R1	BLU-WHT	1
S1	WHT-ORN	27
4W1	ORN-WHT	2
T2	WHT-GRN	28
R2	GRN-WHT	3
S2	WHT-BRN	29
4W2	BRN-WHT	4
T3	WHT-SL	30
R3	SL-WHT	5
S3	RED-BLU	31
4W3	BLU-RED	6
T4	RED-ORN	32
R4	ORN-RED	7
S4	RED-GRN	33
4W4	GRN-RED	8
T5	RED-BRN	34 •
R5	BRN-RED	9
S5	RED-SL	35
4W5	SL-RED	10
T6	BLK-BLU	36
R6	BLU-BLK	11
S6	BLK-ORN	37
4W6	ORN-BLK	12

LEAD DES 4-WIRE	WIRE COLOR	PIN NO.
T7	BLK-GRN	38
R7	GRN-BLK	13
S7	BLK-BRN	39
4W7	BRN-BLK	14
T8	BLK-SL	40
R8	SL-BLK	15
S8	YEL-BLU	41
4W8	BLU-YEL	16
T9	YEL-ORN	42
R9	ORN-YEL	17
S9	YEL-GRN	43
4W9	GRN-YEL	18
T10	YEL-BRN	44
R10	BRN-YEL	19
S10	YEL-SL	45
4W10	SL-YEL	20
T11	VIO-BLU	46
R11	BLU-VIO	21
S11	VIO-ORN	47
4W11	ORN-VIO	22
T12	VIO-GRN	48
R12	GRN-VIO	23
S12	VIO-BRN	49
4W12	BRN-VIO	24

2.4 TRAFFIC

EMS-1 has traffic characteristics that are nearly identical to those of existing SxS switching systems. Use standard SxS traffic tables or refer to ITEC Traffic Calculations Instruction I-2000 for more complete information.

Connector shelves can be multiplied together if more than 10 connectors are required for high traffic groups such as PBX groups. When PBX groups are multiplied each module must have a PBX control card.

3.0 STRAPPING AND OPTION INSTRUCTIONS (Also see Figure 7)

3.1 GENERAL

EMS-1 equipment is very flexible in application and therefore must be programmed to function as desired in each installation by use of strapping. This section explains the configuration of the equipment and how to strap for each function.

Strapping can be done with wire wrap or using strapping clips ITEC PN 270087-000000 for adjacent pins. Strapping put on by wire wrap should be done with a hand gun to prevent static damage to the logic. Use care in handling to prevent static damage.

3.2 MATRIX CONFIGURATION

The matrix consists of 1, 2, 3, or 4 matrix cards. Each card can have either 24 terminals of T, R, S, & 4th wire selective ringing control (4th wire is not required for PBX hunting), or 32 terminals of T, R & S for single frequency Connectors. See 2.1.A for full 100 number configuration. Each matrix card must be strapped, as explained below, for its position number in the shelf. Battery and ground for the matrix card is supplied by the associated Connector.

3.3 MATRIX STRAPPING

Each matrix card has ten independent groups of eight relays; each group is associated with a Connector. From one to five matrix cards may be associated with a cage of connectors. Each matrix card must be strapped to respond to signals from the control cards (Connectors) as matrix card number 1, 2, 3 4 or 5. Thus, there are ten groups of strapping posts; each associated with a group of relays. All groups of posts on any one matrix card must be strapped the same so that the entire matrix card with its common outlets will be addressed in the same fashion by each of the Connectors.

Thus, for a three matrix card system, Strap C (common) to 1 (ten places) on the top card, C to 2 (ten places) on the next card down, and C to 3 (ten places) on the third card down. Do not skip numbers (i.e. 1, 3, will not work.)

C posts - 10 places - Strap to 1, 2, 3, 4 or 5 to indicate which matrix card this is. On matrix cards with 6 sets of posts, the #6 set is never used for Connectors.

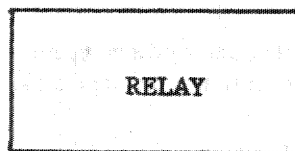


Figure 6.

C —●—●—●—●—● C

● ● ● ● ●
1 2 3 4 5

RIBBON CABLE

3.4 CONNECTOR STRAPPING

3.4.A 3W

Required when only the T, R & S are cabled to the MDF for single frequency ringing.

4W

Required when T, R, S & 4th are cabled to the MDF for selective ringing; Frequency per Terminal or coded ringing.

3W or 4W straps must be installed for the Connector to function.

3.4.B Matrix Size

Strap Pin C to pins 1, 2, 3 or 4 that corresponds to the number of matrix cards equipped in the module; i.e. for 3 matrix cards equipped strap C to 3. Do not strap for full 100 number configurations.

3.4.C 4th Wire Supervision to Selector

Strap only when 4th wire supervision is required. To return supervision on the 4th wire (EC, HS, B etc.) strap as follows:

<u>Strap</u>	<u>Provides</u>
C4 to C5	Ground on answer.
C3 to C5	800 ohm Ground on answer.
C6 to C5	800 Battery on answer.
C1 to C2	Ground when idle or unanswered.
C3 to C2	800 ohm Ground when idle or unanswered.
C6 to C2	800 ohm Battery when idle or unanswered.

3.4.D Idle Sleeve Battery

The condition of the connector sleeve in the idle state is normally 800 ohm battery. Absence of ground seeking equipment will recognize this battery as an absence of ground. In the event an idle sleeve must be open, remove diode D3 by cutting the leads and removing from the PCB.

Where 500 ohm battery is required the "500" (S1 to S2) strap must be installed. Install 500 ohm strap for complete exchanges of EMS-1 equipment. When 350 ohm battery is required on the sleeve for battery testing systems strap S1 to S2 to S3.

For idle sleeve battery values other than 350, 500 or 800 ohms, contact ITEC customer service department for special instructions.

3.4.E Term 99 Test Number

Strap "99" posts to cause the dialed test number 99 to terminate on terminal 96 instead of going to intercept. Allows 99 to be retained as a test number when adding EMS-1 to existing equipment. Wire test equipment to terminal 96. Do not strap in full 100 number configurations.

3.4.F "K" Strap (Special)

Install the "K" strap when EMS-1 Connectors are added to systems that have line circuits with less than 1200 ohms cutoff relay coil resistance. Normally required only if revertive call by directory number is used (-11 option on Connector) in ITT SxS systems. This strap is otherwise applied in special situations requiring idle test sensitivity to be adjusted.

3.4.G Peg Count Timing

When strap "50" is installed the ground pulse to operate the peg count meter is reduced from 150 ms to 50 ms duration. Use 50 ms when peg counts are monitored by a traffic scanner.

3.4.H Ringing Treatment

See section 3.5.A for instructions on ringing options and strapping.

If ringing option card 500186 or 500187 is not equipped, strap plug-on posts A1 to A2, A3 to A4 and D1 to D2.

3.4.J No Supervision Option - (Factory Option)

The No Supervision Option is installed by the factory on special order only. It prevents reverse battery on selected tens groups for no charge calls.

Strap the selected tens group such as 3 to NR and none of the ten numbers in that group will return reverse battery supervision upon answer.

3.4.K No Revertive Call, Last Party Release or NU TONE/Meter Options

When option card 500185, 500188 or 500189 is not equipped, the plug on posts for that option must have the following straps installed.

A1 to A2, B1 to B2, D1 to D2 & A4 to A5.

See section 3.5D.

3.5 CONNECTOR PLUG ON OPTIONS & ASSOCIATED STRAPPING

3.5.A Ringing Options

The EMS-1 Connector can be arranged for all common methods of ringing by equipping the Connector with the appropriate option card and/or strapping for the ringing method employed for a given installation.

Following is a description of ringing methods and how the Connector and option cards are arranged for each method.

3.5.A1. Single Frequency & Frequency per Shelf

With single frequency ringing, all telephones assigned to a connector group are rung with the same ringing frequency (usually 20 Hz). Different connector groups in the same office can have different frequencies, however, allowing multi-party lines by assigning numbers to the same party line from various connector groups. If the entire exchange is being rung with the same frequency, no more than two parties on the same line can be rung selectively.

Single frequency exchanges normally have a high percentage of one party lines. Single Party ringers are connected bridged across the line. When two party lines are utilized the ringers are connected to ground, one on tip and one on ring, with the connector terminal jumper being reversed on the MDF for the tip party (divided ringing).

If interrupted generator is available, no ringing option card (-15, 500186) is required. If only continuous ringing generator is available, the 500186 ringing option card must be equipped to control ringing from an interrupted ground pulse via the PU pin. Strapping methods are as follows:

- a. **Interrupted Battery Connected Generator.** To arrange the EMS-1 Connector for battery connected single frequency ringing, it is only necessary to install three straps on the Connector mother board where the ring option card would plug on for other ringing methods. Strap pins A1 to A2, A3 to A4 and D1 to D2.
- b. **Interrupted Ground Connected Generator.** A 3 watt, 400 ohm (+ or - 50 ohms) resistor is required to supply trip battery. Strap the Connector PCB;

A4 to A2
D1 to A7 with the resistor
A3 to A1

- c. **Continuous Battery Connected Generator.** Plug on 500186 ring option card (see Fig. 7). Strap option card;

1 to 2
3 to 4
7 to 8
10 to 11
14 to 15

Wire interrupted ground for ring control to PU pin on backplane.

- d. **Continuous Ground Connected Generator.** Plug on 500186 ring option card (see Fig. 7). Strap option card;

1 to 4
2 to 3
7 to 8
9 to 10
13 to 14

Wire interrupted ground for ring control to PU pin on backplane.

- e. **Adding Single Frequency Shelves to Frequency Marking Offices.** Use "c" above except wire the mark lead for the frequency desired to the PU pin on the backplane.

3.5.A2. **Frequency Marking (-15) - Decimonic, Harmonic and Synchronomic**

Frequency marking (frequency per terminal) requires option card 500186. Frequency marking is a method of selecting the ringing frequency to be applied to the telephone dialed, allowing full selective ringing of up to ten parties on a line when using divided ringing. (Only one party's phones ring.) It is necessary to reverse the Connector tip & ring, by using a bunching block, to ring parties 6 thru 10 on the tip side of the line.

Marking is accomplished by the interrupter alternately applying each ringing frequency (up to five) to the generator lead. Synchronized with each frequency, a ground is applied to its respective mark lead. Mark lead one for frequency one and so on. The mark leads are cabled to the MDF connector terminal blocks. When a connector terminal is assigned, it is determined which frequency ringer it will have and the appropriate mark lead is strapped to the 4th wire. In the Connector, the ground on the 4th wire (from the mark lead) will operate a relay that will connect the generator lead to the ring of the called number during the time the associated ringing frequency is present.

The 500186 ringing option card must be strapped as follows:

Battery Connected Generator - strap pins 1 to 2, 3 to 4, 6 to 7, 10 to 11 and 14 to 15.

Ground Connected Generator - strap pins 1 to 4, 2 to 3, 6 to 7, 9 to 10 and 13 to 14.

The last row of terminals are strapped together on MDF terminal blocks for mark leads. Cut straps or jumper blocks together to assign mark lead appearances as desired.

3.5.A3. Code Ringing -15

Code ringing requires option card 500186. Code ringing selects the party on a multi-party line by ringing the telephones 1 long ring, 2 short rings, 1 long & 1 short ring, etc. and only one ringing generator frequency is used.

If the telephones are bridged on the line, as many phones can be rung as there are codes available. By connecting the ringers to ground from tip or ring (divided ringing) each code can be used twice. With divided ringing the terminals are jumpered to a bunching block which reverses the tip and ring for the tip parties.

For revertive call, calling party ring-splash wire ring-splash lead from interrupter to pin 4 on the backplane.

The ringing codes generated by the interrupter are cabled to the MDF connector terminal blocks. When a number is assigned, the selected code is strapped to the 4th wire. In the Connector, the ringing codes (grounds) operate the ringing relay to connect generator to the ring of the called line.

The 500186 ringing option card must be strapped as follows:

Battery Connected Generator - strap pins 1 to 2, 3 to 4, 6 to 7, 10 to 11 and 14 to 15.

Ground Connected Generator - strap pins 1 to 4, 2 to 3, 6 to 7, 9 to 10 and 13 to 14.

Special Strapping for Synchronized Code Ring Tone

Strap option plug-on as above (Standard Strapping). In addition:

1. Cut tracks on backplane on pin A8 (RBT) to remove multiple.
2. Cut tracks on backplane on pin A4 (Trip +) to remove multiple.
3. Disconnect any RBT connected to module.
4. Strap A4 to A8.
5. Add .047 capacitor from strapping pin 2 to strapping pin 12 on 500186 ringing option card. Ring tone should now follow ringing.

3.5.A4. Superimposed Ringing -16

Selective superimposed ringing requires option card 500187 which is arranged to allow it to be adapted to all SxS methods of superimposed ringing. Polarity per shelf does not require the option card.

A general explanation of superimposed ringing applies to all systems. However, details vary between systems of different manufactures.

The Connector provides single party and party-line service on a terminal-per-station basis. The associated ringing generator (one frequency only) and interrupter are arranged for superimposed ringing, a scheme which provides semi-selective ringing on 8-party lines. Each station on a party line has a code of one or two rings. The code and polarity applied to the line is determined by the interrupter lead connected to the 4th wire. Each interrupter lead corresponds both to a code (one or two rings) and to a polarity of 35-40 volts DC superimposed on (connected in series with) the generator lead (+ GEN or - GEN).

Only one generator lead is wired to the Connector. The return side of the ringing generator is grounded permanently. The other side is connected for half the ringing cycle to the positive terminal of a 35-40 volt battery and for the other half-cycle to the negative terminal of another 35-40 volt battery. The opposite terminals of the 35-40 volt batteries are connected to the single generator lead. Thus 35-40 volts DC are superimposed on 90 volts ringing current.

Ground is applied via an interrupter mark lead to the Connector at the same time that the polarity of superimposed DC battery, associated with that lead, is connected in series with the AC ringing voltage. This synchronization between interrupter and generator leads makes possible code ringing from a single generator lead. It provides a method for connecting the generator lead to the line, only, when the superimposed DC is poled correctly to operate the biased ringer of the called station. By reversal of the tip and ring, either side of the line may be rung to ground.

The following strapping is for common ITT, SC and AE selective superimposed ringing arrangements. The 500187 ringing option card can be strapped for other arrangements if required. Review the circuit schematic for additional information.

ITT SxS - Strap 500187 option pins E to D and #1 posts. Wire "Sup M" lead from interrupter to installers wiring pin #1 on the backplane.

AE SxS - Strap 500187 option pins E to D and numbers 1 & 3 posts. Wire all ring codes to pins 1 to 4 on backplane, pin 1 (+ Ring 1), pin 2 (- Ring 1), pin 2 (+ Ring 2), pin 4 (- Ring 2).

SC XY - Same as AE above.

Polarity per shelf operation

The 500187 ringing option card is not required if the ringing is interrupted.

For Pos. polarity strap:

A4 to A2
D1 to A7 using a 250 ohm 3 watt resistor
A3 to A1

For Neg. polarity strap:

A1 to A2
A3 to A4
D1 to D2

3.5.A5. Terminal per Line (TPL)

Ringing control for TPL is done by dialing a third digit into the Connector that selects the ringing frequency and line polarity of the telephone to be rung. The EMS-1 connector is not arranged for TPL operation.

3.5.B Timing Option -14

The 500092 timing option card is equipped to provide two timing functions: 1. **Trouble disconnect** that will release the circuit in 1, 2 or 4 minutes after seizure or after the last dial pulse if the circuit is not answered. 2. **Post supervision disconnect** that will release the circuit within 23 seconds after the called party goes on hook, if the calling party does not go on hook.

Units prior to KS issue 9 had soldered straps to set times. Starting with KS issue 9, a 10 position DIP switch is used. Set times desired in accordance with the table below. Post supervision times of 6, 10 and 17 seconds are not available on the newer units with switches.

TABLE 4

FUNCTION	TIME	SWITCH	STRAPS
<u>Trouble Disconnect</u> (Timing starts when trunk is seized or at last dial pulse when unanswered)	1 Min	8	Z-1M
	2 Min	9	Z-2M
	4 Min	10	Z-4M
<u>Post Supervision Disconnect</u> (after called party goes on hook)	2 Sec	4	Y-2S
	4 Sec	5	Y-4S
	6 Sec	NA	Y-4S & X-2S
	8 Sec	6	Y-8S
	10 Sec	NA	Y-8S & X-2S
	12 Sec	1 & 6	Y-8S & X-4S
	15 Sec	7	Y-15S
	17 Sec	NA	Y-15S & X-2S
	19 Sec	1 & 7	Y-15S & X-4S
	23 Sec	2 & 7	Y-15S & X-8S

3.5.C Fuse Failure Busy Option Card -12

This option provides a method of making the Connector busy (by ground on the sleeve), in absence of ground searching systems when the fuse on the Connector PCB blows.

3.5.D Revertive Call Option -11

The 500185 revertive call option provides directory number revertive call without access digits or adapters.

The following strapping options are provided.

NLO - Strapped when office does not have balanced lockout line circuits. Without this strap the Connector is freed upon answer and the parties receive talk battery from the line circuit.

With the NLO strap installed, the connector is held during the conversation and battery feed is from the terminating side of the Connector. The originating switchtrain is released.

S-S3 Strap only when necessary to increase sensitivity of sleeve test
or - for revertive call. Normally no strap is required, however, if
S-S2 the connector does not test a revertive call sleeve as a revertive call, strap S3 and retest, if not yet sensitive enough strap S2. Also do not strap S1.

LTR - (Low Test Resistance) Adjusts resistance value inserted into sleeve for revertive call test. With the strap not installed the test value is 120 ohms, which is used by most AE systems. With the strap installed the value is approximately 50 ohms which is used by ITT and SC systems. When adding EMS-1 to existing systems strap the value used in the present Connectors. Do not strap for EMS-1 systems.

SW - Shortens length of switchtrain winkoff, normally strapped. Remove if switchtrain does not have sufficient time to release on revertive call.

NWB - Non wink back - to prevent release of switchtrain during winkoff.

NWF - Non wink forward - to prevent release of switchtrain during winkoff.

NOR - No open Ring - special use straps.

NOT - No open Tip - special use straps.

Straps normally installed are as follows:

Non Lockout office - (Hold Connector) NLO, LTR, SW

Lockout office - (Drop Connector) LTR, SW, NWB

3.5.E Last Party Release -13

The last party release option is used with AE and SC systems that have revertive call by directory number using a special switch that is accessed by a 1 or 2 digit code. This option allows the Connector to drop the accessing switchtrain, including the revertive call switch, but hold the Connector via the answer relay to provide talk battery during the conversation. The SW strap is normally installed, remove if winkoff time of sleeve is too short to drop off originating switchtrain.

3.5.F Automatic Intercept -17

Plugs onto Connector to provide routing to intercept via backplane when a number is dialed that does not have battery or ground on the terminal sleeve. No straps are required.

3.5.G Revertive Call/Automatic Intercept -18

This plug-on option is a combination of -11 and -17 options. Refer to paragraphs 3.5.D and 3.5.F for strapping.

3.5.H NU-Tone/Metering -19

This plug-on option provides number unassigned (NU) tone when a number is dialed that does not have battery or ground on its sleeve. Also, it provides a +48VDC pulse (150 ms) on the accessing sleeve on answer for operating a subscriber billing meter. No straps are required.

3.6 PBX CONTROL 600138 (-20) (ROTARY HUNTING)

3.6.A General

The EMS-1 PBX control option is plugged into position 1 of the connector module to enable the standard connectors in that module to PBX hunt. The EMS-1 PBX operation provides greater flexibility of number assignment than standard step-by-step rotary or level hunting connectors. The following features are equipped in the 600138 PBX control:

a. Up to 48 groups can be assigned

A group can be a pilot (start) number and 1 alternate, allowing 48 groups in a 96 terminal module.

or

A group can consist of 1 pilot number with 95 alternate numbers, or any combination within the 96 numbers available.

b. Non-consecutive number assignment

Any PBX group can have any available terminal in the 96 number module assigned to it. For example: if 5330 has alternates 5331, 5332 and an additional terminal is needed, 5310 could be assigned.

c. Pilot number is active

The pilot (or start) number for a PBX group is active as in normal SxS practice.

d. Multiple pilot numbers

In the event a large PBX group requires a primary pilot number for all terminals equipped and a secondary pilot number to search only the last portion of the group it can be programmed by assigning only the alternate numbers to the secondary pilot number that it is to control. The NB strap must be installed which prevents reaching alternate numbers lower than the pilot number. The secondary pilot number can also be an alternate for the primary pilot number.

e. Night Service

1. Cut off hunting from a remote location: a relay located in the central office and controlled from the customers premises can apply a ground to the PBX control circuit to disable the hunt feature for that group (groups 90, 91, 92, or 93). All calls to the pilot number(s) will reach only the number dialed. If it is busy, the caller will receive a busy signal as usual. See Figure 5 for connecting points.
2. Dial an alternate number. The call will go to that terminal and will not hunt.

f. Group Overflow Metering

Up to 3 groups can be programmed to peg overflows for traffic information. This is done by simply programming 97, 98 or 99 as an alternate number to the group. If that group overflows, a ground pulse will be applied to the meter connected to the respective pin 97, 98 or 99 on backplane.

g. Programming from Front Panel

All PBX assignment activities are performed on the face plate of the PBX control card with buttons and switches. No wiring is required. Refer to 3.6.B for programming instructions.

h. Power Fail Guard

The PBX control card has backup power that protects the memory for several hours if the power is interrupted or the card is unplugged.

j. High Traffic Groups

Connector modules can be multiplied together as required for high traffic groups. A PBX control card is required for each module and all must be programmed the same.

k. Test of PBX Assignments

By operating switches in the face plate, all PBX assignments can be verified by digital readouts on the Connector Test Card. Refer to 3.6.C for test instructions.

3.6.B Programming

a. Group number -

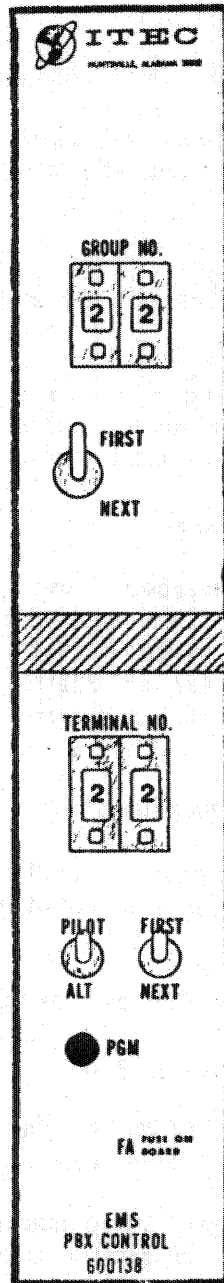
Each PBX group must have a different group number. Groups requiring night service rotary cutoff must be 90, 91, 92, or 93.

The group number is set on the digital switches at the top of the face plate. All programming activity with other switches will relate to the group number displayed.

b. Pilot Number -

1. Set terminal number switches to listed PBX directory number.
2. Set toggle switch to pilot.
3. Push recessed PGM button to store pilot number.

PBX CONTROL SWITCH LOCATIONS



c. Alternate Numbers -

1. Set terminal number switch to the terminal number for 1st alternate.
2. Set toggle switch to ALT.
3. Push PGM button.
4. Repeat for each alternate number assigned.
5. If a number is to be both a pilot and an alternate, set the toggle switch to each in turn and push PGM button each time.

d. Group Overflow Metering -

Meter outputs are designed as 97, 98 & 99 on the backplane; each is wired to a separate meter.

To assign one of the meters to a group simply program 97, 98 or 99 as an alternate number. When all numbers are busy the meter will receive a ground pulse. (Not valid for 100 number operation).

e. Deletion of Groups or Numbers

To delete a group, or one number from a group, set the group number switches to 00. Then in turn set the terminal number(s) to be deleted on the terminal number switches and operate the PGM button twice, once with the toggle set on PILOT and once with the toggle set on ALT. To delete a group, all numbers in the group must be deleted individually.

3.6.C Test & Verification of PBX Assignments

All assignments in the PBX memory can be verified by operation of switches on the PBX card face plate and monitoring the digital display on the Connector Test Card.

- a. Set Connector Test display on "P" by operating STEP switch.
- b. To verify terminals assigned to a group;
 1. Set group number to be verified on the group number switches at the top of the PBX card face plate.
 2. Operate toggle switch below group number switches to FIRST. The lowest (generally the primary) pilot number will display on the test card.

3. Operate toggle switch to NEXT. Subsequent pilot numbers, if any, will display. Each subsequent operation of the toggle to NEXT will display pilot numbers assigned in the group under test until all pilot numbers are displayed, then OF will be displayed. Continue operating the NEXT switch and all alternate numbers will be displayed in turn then OF when no more alternate numbers are available. The ALT LED will light on the test card to indicate a PBX ALT number.
- c. To verify alternate numbers assigned to a pilot number, simulating action of a Connector;
1. Setting of Group Number Switches is unnecessary.
 2. Set pilot number to be tested with directory number switches.
 3. Operate the toggle switch located below the directory number switches to FIRST; the 1st alternate number will display on the test card. Operate the toggle switch to NEXT and the next alternate in line will display.

Continue to operate the NEXT switch to display all remaining alternate numbers in turn. The ALT LED will light on the test card. Note that searching for alternate numbers always starts at number 01 and progresses to 96 no matter what the pilot number is.

3.6.D Strapping

1. Strap NB on the card can be installed to cause the alternate search to start at the pilot number and not search numbers lower than the pilot number. The strap is located on a four post strip near the edge connector. Strap the two bottom pins together. The top two pins are test points and must not have wires or straps attached.
2. Strap 50 located near the top edge of the PCB shortens the overflow meter ground pulse to 50 ms from 150 ms.
3. Erase is not a permanent strap, but is shorted momentarily to erase all numbers stored in memory. Short the two pins for 10 seconds to discharge the capacitors that provide backup power for the memory. (Circuit removed). Erase posts are located just below "50" straps.

3.6.E Operation with 100 Numbers

The PBX Card must be modified to disable the group overflow peg counts to allow 97, 98, 99 & 00 to function as PBX numbers. Number 00 can only be a pilot, never an alternate. Number 00 will not display when testing the numbers assigned, but will function during call processing.

This arrangement can also be used when only 96 numbers are equipped to redirect number 97, 98, 99 & 00 to a working number. Assign the listed number as a pilot with a working number as an alternate. This is useful to prevent number changes if a 96 number group replaces a group with the last four numbers assigned. Do not connect intercept to the backplane.

3.6.F Intercept Operation Using PBX Control

In Modules equipped with PBX control, intercept of unassigned numbers can be done as follows.

1. Jumper one unassigned number to intercept.
2. Program all unassigned numbers to one PBX group as pilot numbers.
3. Program the number jumped to intercept as the alternate number to that group.

Any unassigned number will appear busy and rotary to the alternate which is connected to intercept.

When a number is assigned, simply remove it from memory as stated in Paragraph 3.6.B.e.

3.7 TEST CONNECTOR 600139

The Test Connector card has two distinct functions and circuits. One is the test display and monitor for the Connector Shelf, the other is the Test Connector for test and verification functions.

3.7.A Connector Test Function

Displays the terminal number a Connector is terminated to, when that Connector position number is displayed. The Connector to be monitored is selected by operating the STEP switch up or down to assign the display to the desired Connector. When the PBX control circuit is being tested, a P will show in the CONN window. If the connector terminal selected is a PBX alternate choice, the PBX ALT LED will light. See section on PBX hunting for additional information on testing PBX assignments.

3.7.B Test Connector Function

Accessed by a test and verification Distributor or Selector and provides access to a selected terminal for line or equipment test by the Wire Chief or busy verification by the toll Operator. A BY LED on the face plate indicates busy when the Test Connector is in use. A CT LED indicates cut through after dialing. Note: No LEDs will light on direct operation until the tens digit is dialed.

The Test Connector is designed to work with AE, SC, ITT, AEI, GEC, Standard Electric, Plessey, Northern Telecom and WECO Test Selectors as well as the EMS-1 Test Distributor. It is necessary to strap the card to enable it to function in the correct mode for the type Test Selector or Test Distributor it is being accessed by. (See paragraph 2.3.H)

Two methods of controlling the Test Connector are used, direct and indirect. The direct method is where the Test Connector is only a mechanical and the V & R or X & Y is pulsed from the Test Selector. EMS-1, ITT, some SC, Northern Telecom, WECO, Plessey use direct control. Indirect control is where the Test Connector has a dialing relay and hold function and receives loop pulsing from the Test Selector via the T & R. Refer to TABLE 5 for representative strapping.

The Engineer or Installer must verify the operation method of existing Test Connectors and strap the EMS-1 Test Connector to function in the same manner.

The following straps, as applicable, must be installed. Refer to Fig. 8 for location of straps on PCB.

Direct (6 places)	required for direct control operation.
Indirect (6 places)	required for indirect control operation.
3W (4 places)	required where only T, R & S leads are wired to the MDF from connector terminals.
4W (5 places)	required where T, R, S & 4th (or Mark) leads are wired to the MDF from connector terminals.
6L, 7L, 8L	required only with direct control systems. (Some direct control systems will function properly without these straps but most require them). Not required with EMS-1 Test Distributor 600152.
TG	required only with indirect control systems that require a solid ground on tip.
MS	Matrix size, strap MS to 1, 2, 3 or 4 determined by the number of matrix cards equipped in the module. Example: 3 cards strap MS to 3.
B9	strap with AE systems requiring NPC (Normal Post Control) ground. (Rarely Used).
M9	strap with XY systems requiring Y-ON ground.
XY	special straps for XY systems when X or Y off normal are required.
XY-XON	strap for off normal after 1st digit.
XY-YON	strap for off normal after 2nd digit.

- M** special straps for certain uncommon applications.
- M-ON** strap if SC off normal is required.
M-1D strap to operate M relay after 1st digit.
M-2D strap to operate M relay after 2nd digit.
- M6 & M7** normally required for all systems, removed when special treatment of T & R is required under control of M relay.
- M8** used only with SC exchanges originally equipped with S30248 test connector.
- LM** Level Mark - allows tens digit to be marked for one digit operation. This is a factory option equipped on special order.

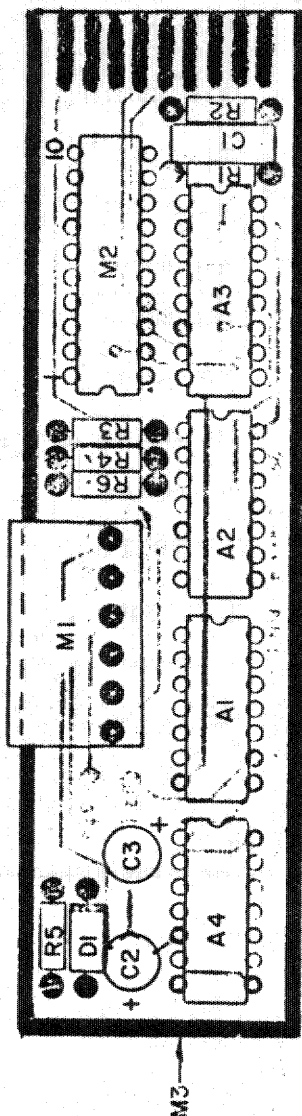
Fuse Failure Busy Option is available as a plug on to busy the Test Connector if its fuse blows. Used only in indirect systems.

TABLE 5.

<u>Test Connector</u>	<u>Straps required</u>
1. ITEC EMS-1 complete exchange	Direct, 3 or 4 wire, Matrix Size, M6, M7
2. ITT Federal or Kellogg 11156 replacement	Direct, 3 or 4 wire, Matrix size, 6L, 7L, 8L, M6, M7
3. Stromberg Carlson 30248 replacement	Direct, 3 or 4 wire, Matrix size, 6L, 7L, 8L, M-ON, Y-ON, M6, M8, M9.
4. Stromberg Carlson 30161 replacement	Indirect, 3 or 4 wire, Matrix size, M-1D, TG, M7
5. Automatic Electric 58466 replacement	Indirect, 3 or 4 wire, Matrix size, M6, M7
6. Western Electric	Indirect, 3 or 4 wire, Matrix size, M6, M7
7. Northern Telcom	Indirect, 3 or 4 wire, Matrix size, M6, M7
8. Standard Electric (ITT)	Indirect, 3 or 4 wire, Matrix size, M6, M7
9. GEC	Direct, 3 or 4 wire, Matrix size, 6L, 7L, 8L, M6, M7
10. Plessey	Direct, 3 or 4 wire, Matrix size, 6L, 7L, 8L, M6, M7
11. AEI	Direct, 3 or 4 wire, Matrix size, 6L, 7L, 8L, M6, M7

Note: See Fig. 8 next page for location of strapping points.

ISSUE	E. C. O. NO.	DATE	APPROVAL
1	RELEASED	9-22-77	1712
2	1165	12-16-77	1712
3	1861	3-9-81	1712
4	1942	5-26-81	1712



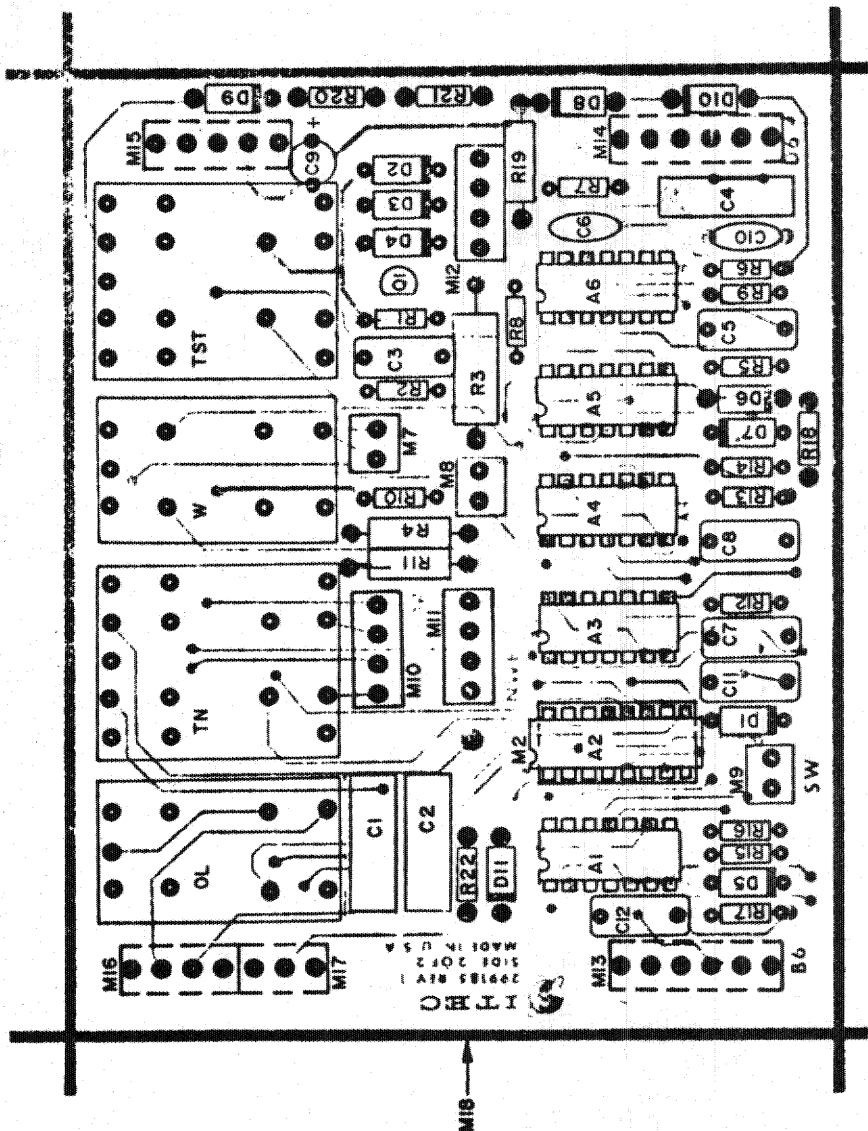
NOTE:

1. FOR TIME-OUT TO MONITOR ANSWER ONLY, CUT BETWEEN PADS 1 & 2 AND SOLDER WIRE FROM 2 TO 3.

TITLE		SIGNATURE & DATE		TIMING OPTION	
TCR		<i>Donald R. Reed</i>			
DR					
CHK					
ENGR					
ENGR					
APPR					
MFG					
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DWG. SCALE		REF.		DWG. BASE NO.	

REDPAWN 3-9-81

ISSUE	E.C.O. NO	DATE	APPROVAL
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3	1600	1-24-60	
4	1809	1-25-60	
5	1829	1-28-61	
6	1810	1-23-61	
7	1848	2-12-61	
8	1849	2-12-61	



TITLE	SIGNATURE & DATE
DES	
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CHK	
ECGR	
ENGR	
APPR	
OFF	

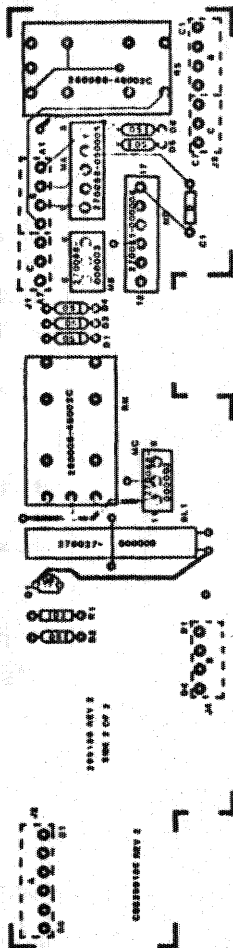


REVERTIVE CALL
OPTION

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A500185

1	ECO NO.	CA 1 11-11-11
2	RELEASED	11-3-84
3	1-46	9-2-84
4	2135	1-4-84

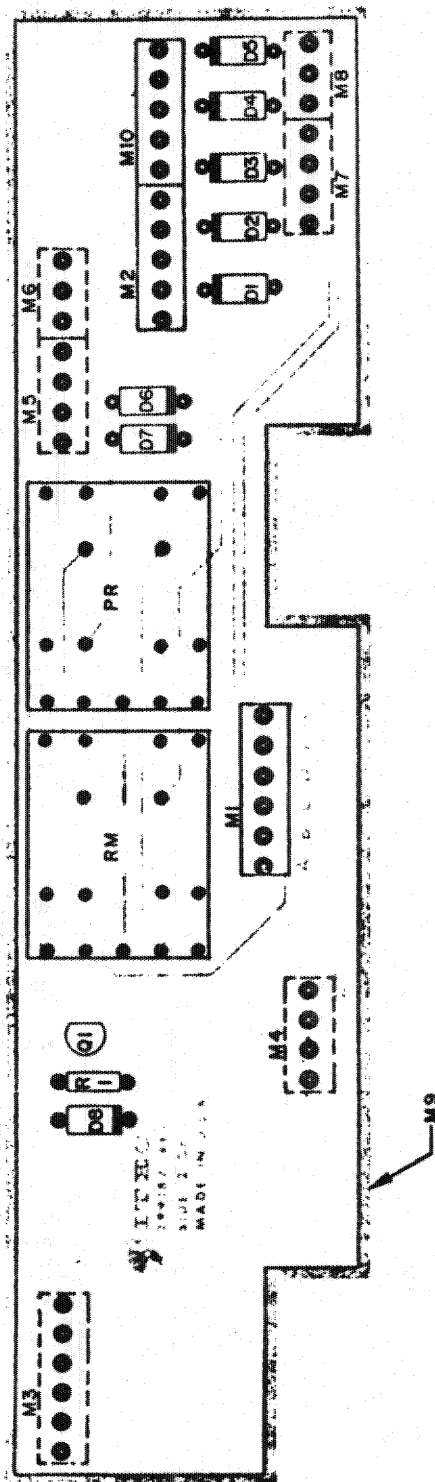


NOTES:
 A. 270038-000006
 B. 270039-000003
 C. 270040-000003
 D. 270041-000003
 E. 270042-000003
 F. 270043-000003
 G. 270044-000003
 H. 270045-000003
 I. 270046-000003
 J. 270047-000003
 K. 270048-000003
 L. 270049-000003
 M. 270050-000003
 N. 270051-000003
 O. 270052-000003
 P. 270053-000003
 Q. 270054-000003
 R. 270055-000003
 S. 270056-000003
 T. 270057-000003
 U. 270058-000003
 V. 270059-000003
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 X. 270061-000003
 Y. 270062-000003
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 BH. 270097-000003
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 BJ. 270099-000003
 BK. 270100-000003

THIS DRAWING WILL SERVE AS BOTH
 AN "A" AND "M.A."

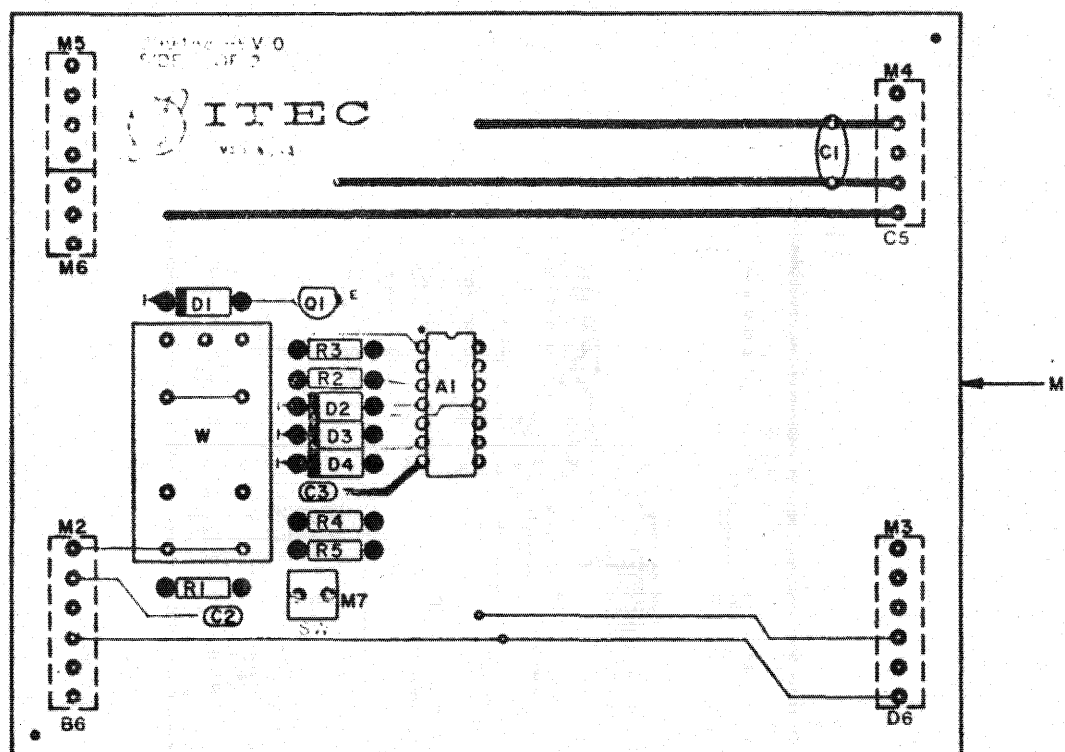
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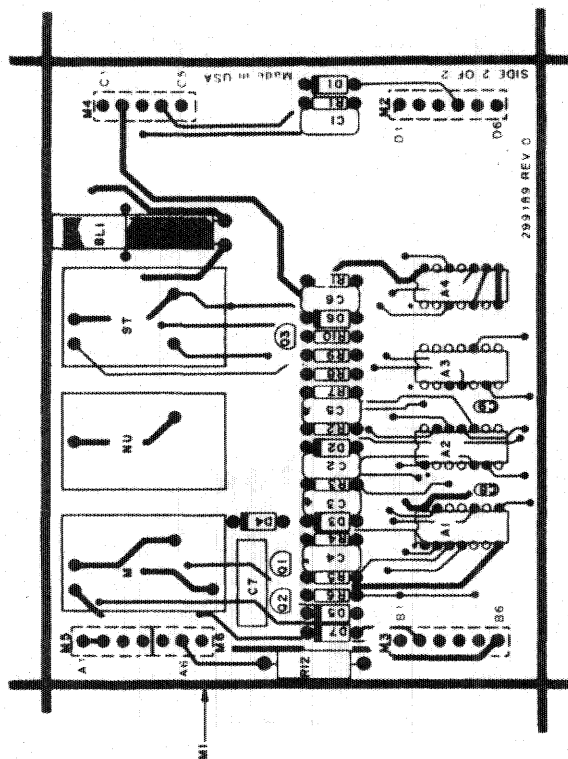



ITHC MONTVILLE, ALABAMA 3602		SUPERIMPOSED RINGING OPTION	
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C		SCALE 1:1	
TITLE		SIGNATURE & DATE	
P.C.		M. J. P. 10/1/79	
D.R.		M. J. P. 10/1/79	
C.R.		M. J. P. 10/1/79	
E.N.G.		M. J. P. 10/1/79	
E.N.G.		M. J. P. 10/1/79	
A.P.P.		M. J. P. 10/1/79	
R.F.O.		M. J. P. 10/1/79	

ISSUE	E. C. O. NO.	DATE	APPROVAL
1	RELEASED	9-11-81	<i>[Signature]</i>



TYPE	SIGNATURE & DATE	 ITEC HUNTSVILLE, ALABAMA 35802	LAST PARTY CONTROL OPTION
TCR			
DR	MONA PERREAU		
CHK			
ENGR			
APPRO	<i>[Signature]</i>	THIS DRAWING OR SPECIFICATION IS THE PROPERTY OF ITEC. COPIES ARE LOANED BY FIRST COMPARISON AND SHALL NOT BE REPRODUCED OR USED AS THE BASIS FOR THE MANUFACTURE OF ANY APPARATUS WITHOUT PERMISSION.	A500188 DWG. BASE NO.
WFO		DWG. SCALE SIZE	DEF



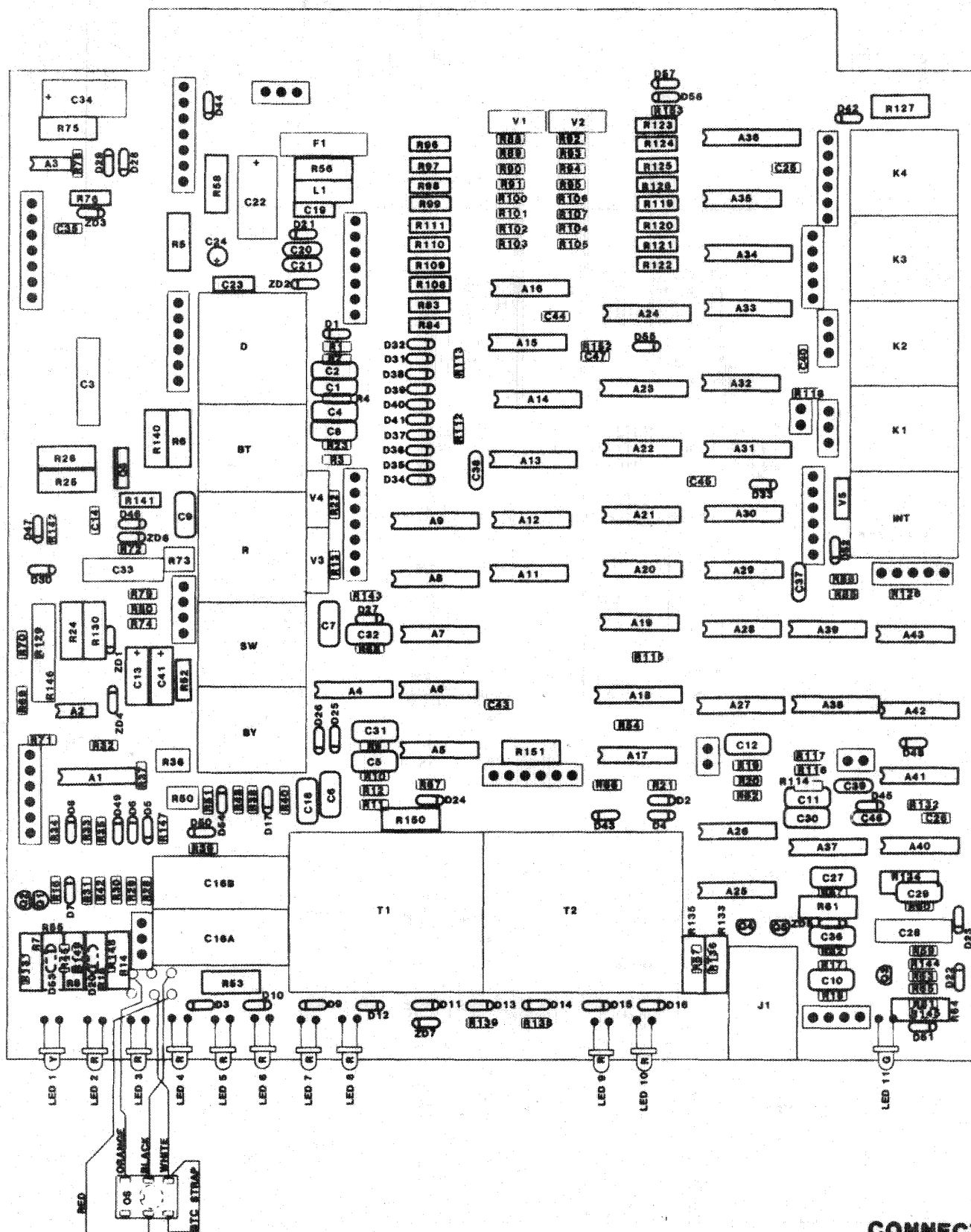
 ITEC INTERNATIONAL ELECTRONIC TECHNOLOGY CORPORATION ALABAMA 36601		VACANT TERMINAL NO TONE / METERING CIRCUIT OPTION
DATE DESIGNED BY CHECKED BY APPROVED BY	D A500189	A500189



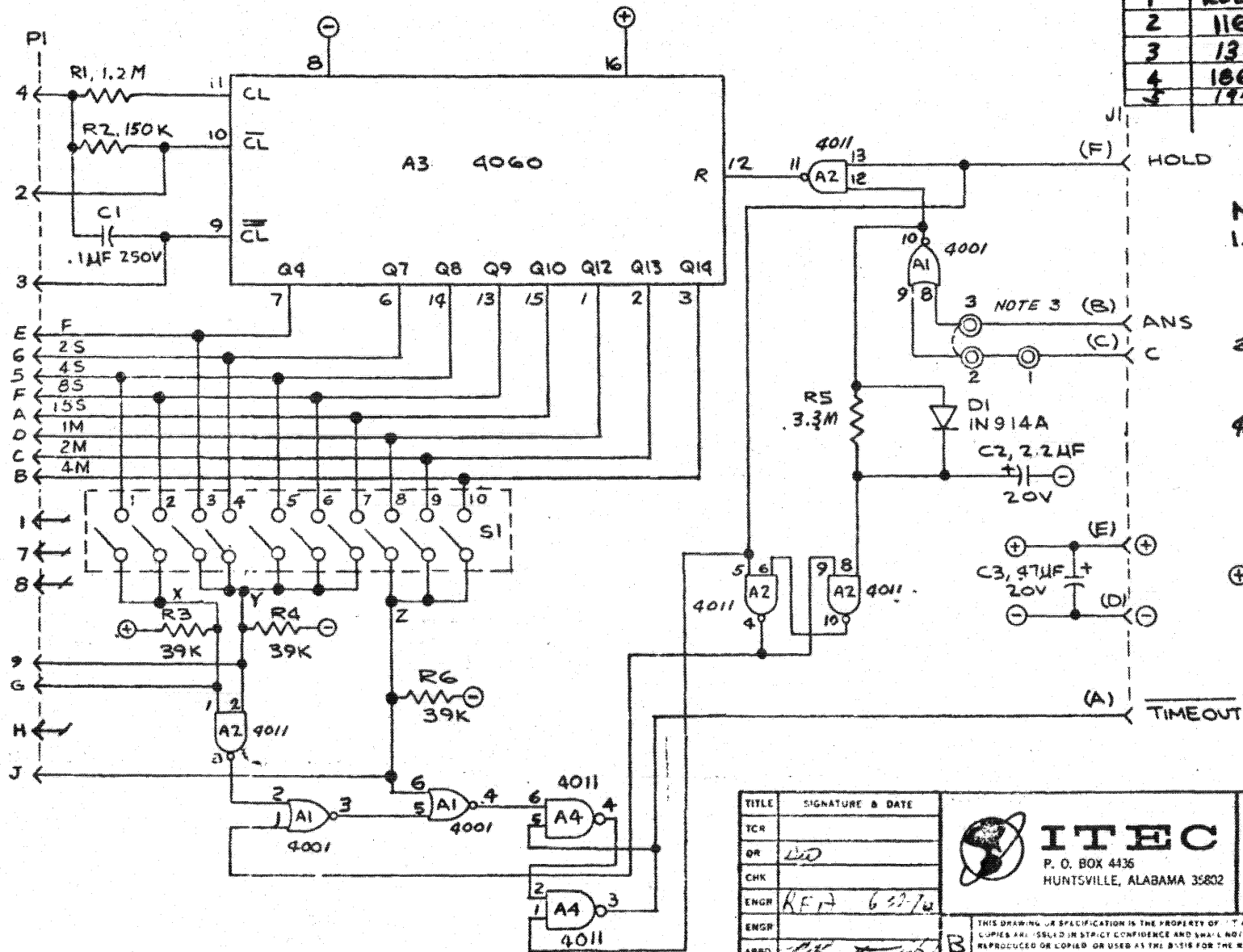
SECTION 10 - - - - SECTION 1

[illegible]

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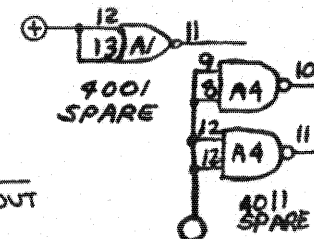
CONNECTOR
A600130



ISSUE	E.C.O. NO	DATE	APPROVAL
1	RELEASE	6-30-76	
2	1165	12-16-77	RLL
3	1363	4-5-79	RAC
4	1861	3-5-81	WJR
5	1942	5-26-81	WJR

NOTES:

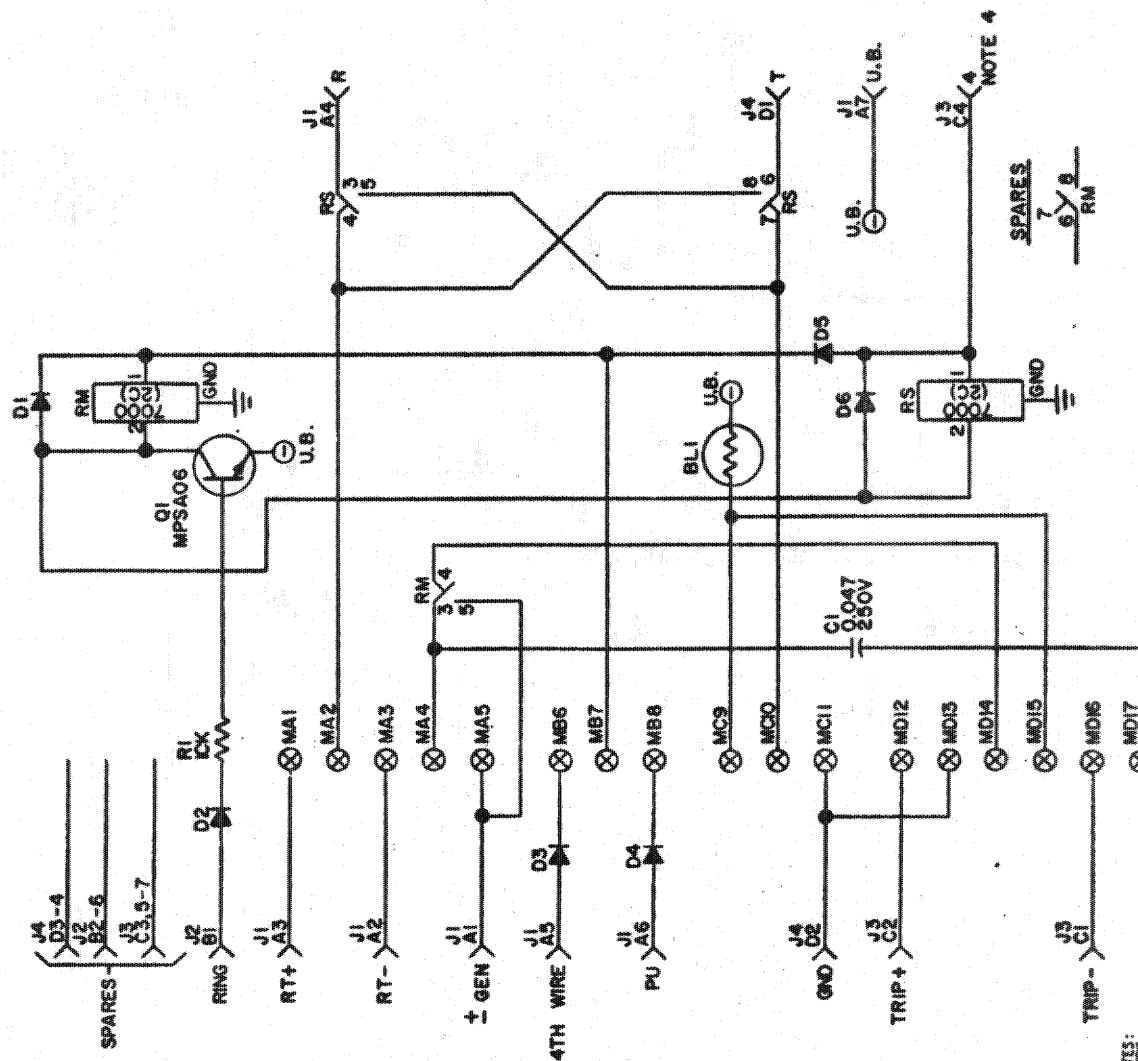
- LETTERS IN () INDICATE PINS ON BOARD CONNECTOR.
- FOR TIME-OUT TO MONITOR ANSWER ONLY, CUT BETWEEN PADS 1 & 2 AND SOLDER WIRE FROM 2 TO 3.
- PJ USED FOR FACTORY TEST ONLY.



TITLE	SIGNATURE & DATE	<p>ITEC P. O. BOX 4436 HUNTSVILLE, ALABAMA 35802</p>	<p>TIMING OPTION</p>
TCR			
DR	LDO		
CHK			
ENGR	REF 6-30-76		
ENGR			
APPR		<p>THIS DRAWING OR SPECIFICATION IS THE PROPERTY OF ITEC. COPIES ARE ISSUED IN STRICT CONFIDENCE AND SHALL NOT BE REPRODUCED OR COPIED, OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT PERMISSION.</p>	<p>C500092</p>
DATE		<p>DATE</p>	<p>DATE</p>

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ISSUE	CHANGES	APPROVED
ISSUE 1	RELEASED 11-3-79	JDR
ISSUE 2	ECO-1746: PRESENT RM RELAY FROM OPERATING UNTIL RING RELAY OPERATES IN CONNECTOR.	JDR
ISSUE 3	ECO-1746: PRESENT RM RELAY FROM OPERATING UNTIL RING RELAY OPERATES IN CONNECTOR.	JDR
ISSUE 4	ECO-1746: PRESENT RM RELAY FROM OPERATING UNTIL RING RELAY OPERATES IN CONNECTOR.	JDR
ISSUE 5	ECO-1746: PRESENT RM RELAY FROM OPERATING UNTIL RING RELAY OPERATES IN CONNECTOR.	JDR



NOTES:

- THIS CIRCUIT CAN ALSO BE USED FOR PICK-UP CONTROL OF CONTINUOUS GENERATOR (BATTERY OR GROUND CONNECTED).
- FOR PICK-UP CONTROL OF CONTINUOUS SINGLE FREQUENCY GROUND CONNECTED GENERATOR, STRAP: 1 & 4, 7 & 8, 9 & 10, 13 & 14, FOR BATTERY CONNECTED GENERATOR STRAP: 1 & 2, 3 & 4, 7 & 8, 10 & 11, 14 & 15.
- FOR INTERRUPTED SINGLE FREQUENCY GROUND CONNECTED GENERATOR, STRAP THE FOLLOWING: 1 & 5, 2 & 3, 9 & 10.
- THIS LEAD TERMINATES ON THE BACKPLANE.
- UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE 1/4 WATT
ALL RESISTOR VALUES IN OHMS
ALL DIODES ARE 1N4005 OR EQUIVALENT
ALL CAP. VALUES

ON INSTALLER WIRING PIN DESIGNATED 4 VIA CONNECTOR EDGE CONNECTOR PIN A3.

WIRE INTERRUPTER GROUND MARK FOR REVERSIVE CALL RING SPLASH TO WIRE MARK PIN DESIGNATED 5 ON BACKPLANE.

		FREQUENCY MARK OR CODE RINGING OPTION
ITEC HUNTSVILLE, ALABAMA 35892		IC500186
WIRING DATE: 11-3-79 BY: JDR	CHECKED DATE: 11-3-79 BY: JDR	APPROVED DATE: 11-3-79 BY: JDR



5.0 INSTALLATION TEST GUIDE

5.0.A General

This Test Guide for ITEC EMS-1 equipment is intended to be a general guide for testing to be performed during installation. It can also be used as a check list of the tests that have been performed for equipment acceptance records. Each applicable item in this guide should be initialled by the Installer in charge, attesting that the equipment item covered has been fully tested as specified.

EMS-1 equipment can be tested using the same procedures commonly used to test any SxS type switching equipment. The Technician has a distinct advantage, however, of having many Light Emitting Diodes (LED's) and digital displays to show the progress of the call being processed.

This guide includes all basic items in a complete new EMS-1 exchange, however, it can also be used for equipment additions as applicable. It is organized in the sequence in which testing should be performed. It is desirable to test the equipment in reverse sequence to normal call progress so that tests are always being conducted into equipment that has been tested.

5.0.B Testing Procedures for Connector Module 800030

1. Refer to preceeding sections of I-2130 for drawings and equipment details. Verify power wiring to be correct and free of foreign ground or EMF potential and verify fuse alarm operation, prior to fusing the module.
2. Dial each connector with and without loop resistance to verify ability to register pulsing. Observe the connector test card for proper number display.
3. Make up a movable test plug to allow connector numbers to be terminated to a telephone connected through 750 ohms resistance in each side of the line and 3 MF capacitor and 20,000 ohms across the line. Terminate 2 calls from each connector, verify proper LED indications, answer and talk. Observe ring trip function (CONN LED) for fast trip action during silent and ringing periods.

Connector LED functions are:

OS	Out of Service - Indicates OS switch is operated.
SZ	Seize - Same as dialing or A relay. Follows dial pulses.
BY	Busy - Same as hold or B relay.
CT	Cut through - Indicates matrix relays are operated.
RING	Ringing - Indicates ringing is enabled.
ANS	ANSWER - Follows supervision of called party.

CONN Connect - Same as ring trip relay operation.

BT Busy Tone - Indicates call went to busy.

RC Revertive Call - Indicates call went to revertive call (only used when revertive call by directory number option is equipped). Not used outside North America.

When -19 500189 NU/Meter option is equipped this LED indicates +48V meter pulse on sleeve.

PBX PBX Hunt - Indicates that the connector terminated to a subscriber number other than the one dialed due to the PBX rotary hunt function operating.

FA Fuse Alarm - Indicates a fuse on the circuit card is blown.

4. Dial a number from each Connector to a vacant terminal. Busy tone should be returned. Note that when a working number is called, the line LED on the associated line card will illuminate. Note: 1200 ohm battery is required on sleeve for Connector to cut-through.
5. Operate all OS switches, observe that OS LED illuminates and check sleeves on DTA or OGT block for presence of ground.
6. Dial all numbers from each Connector, answer and talk.
7. In all PBX number groups, program a PBX group into the 600138 control card. Test, using the connector test circuit, and ring all phones (use minimum of 3). Check each Connector for PBX operation. See 3.6 for detailed instructions.
8. Access the Test Connector via the Test Distributor and/or operator verification access and ensure that it cuts the +, -, p test leads through the proper terminal and makes Connector #10 busy. (The Test Connector shares the #10 Connector Matrix).
9. Go to the Selector DTA (assuming all grading and outlet jumpers are in place) and short the T & R to each Connector, test that ground appears on the sleeve. This test will verify jumpers and cabling from the DTA to the Connectors.
10. Traffic Meter operation must be verified.

The Meter outputs provided are:

Peg Count - A ground pulse (50 or 150 ms as strapped) appears each time a call is attempted.

A traffic scanner can be connected to the connector sleeve at DTA OGT block.

PBX Group Busy - 97, 98 & 99 - A ground pulse of 150 ms for up to three PBX groups to be observed. Program 97, 98, or 99 to the group to be observed as an alternate. See PBX instruction Section 3.6 for greater detail.

NOTE: This function cannot be used when PBX groups have 97, 98, & 99 used as working numbers.

11. All grading cards completed with information about access from selectors and the associated line circuit.

The Installer in charge should sign and submit this form to the Installation Manager attesting to having performed all tests listed.

I certify that all applicable tests herein have been performed and all deficiencies corrected.

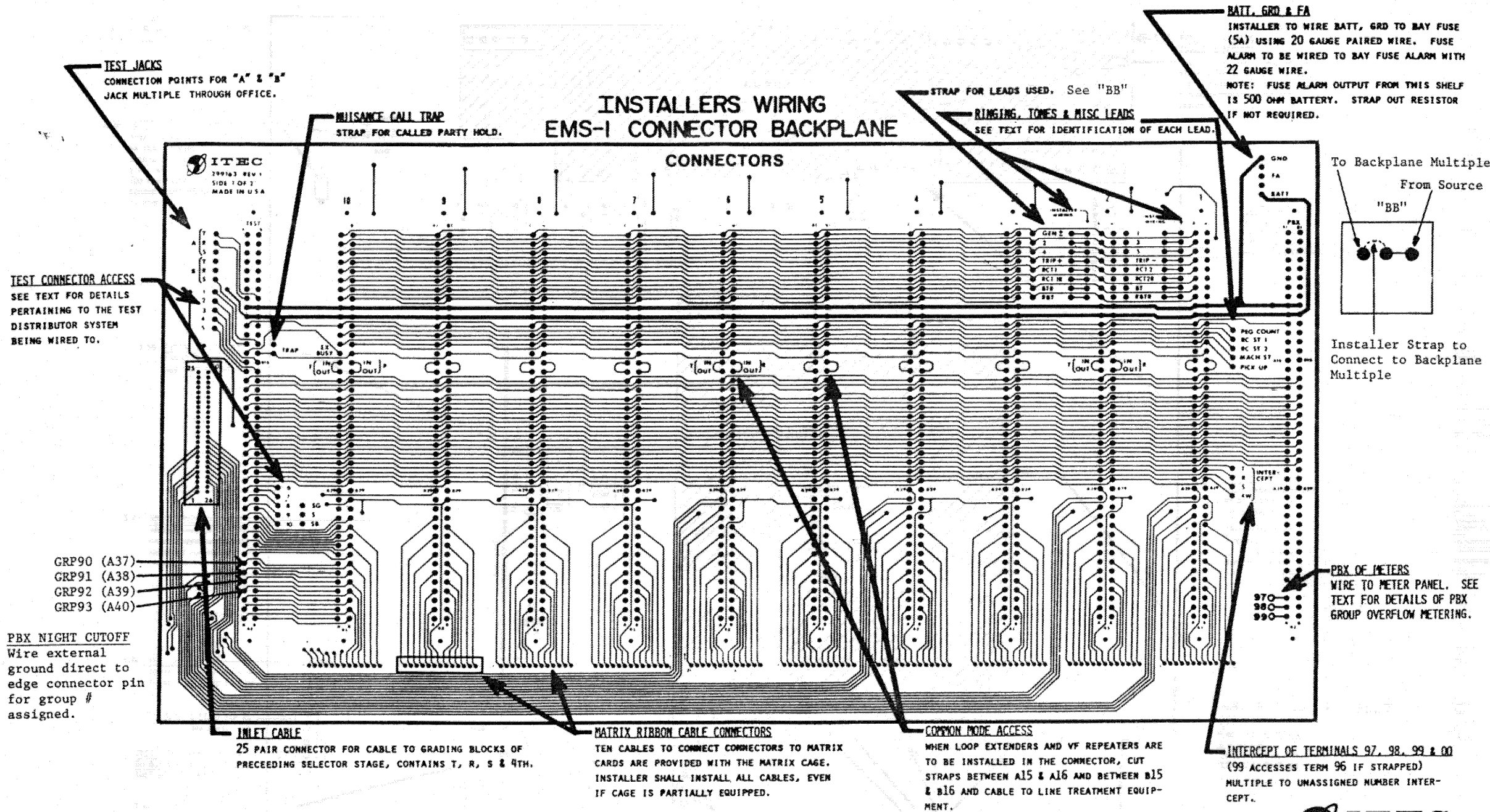
Installer in Charge

DATE

I verify that all tests herein have been performed by the Installer in charge.

Acceptance Test Engineer

DATE



IT&C

Figure 5.

ISSUE:1 11-19-79
1-2130

NOTE: NUMBERS IN FRONT OF ITEMS ARE TEXT PARAGRAPH NUMBERS.

3.40 SLEEVE BATTERY - 500 OHMS
STRAP A1 TO A2 WHEN 500 OHM BATTERY IS REQUIRED ON IDLE SLEEVE TO INDICATE NOT BUSY. STRAP A1 TO A2 TO A3 WHEN 350 OHM BATTERY IS REQUIRED. REMOVE DIODE D3 IF OPEN SLEEVE IS REQUIRED.

3.58 TIMING OPTION CARD (500092)
SEE TEXT FOR STRAPPING.

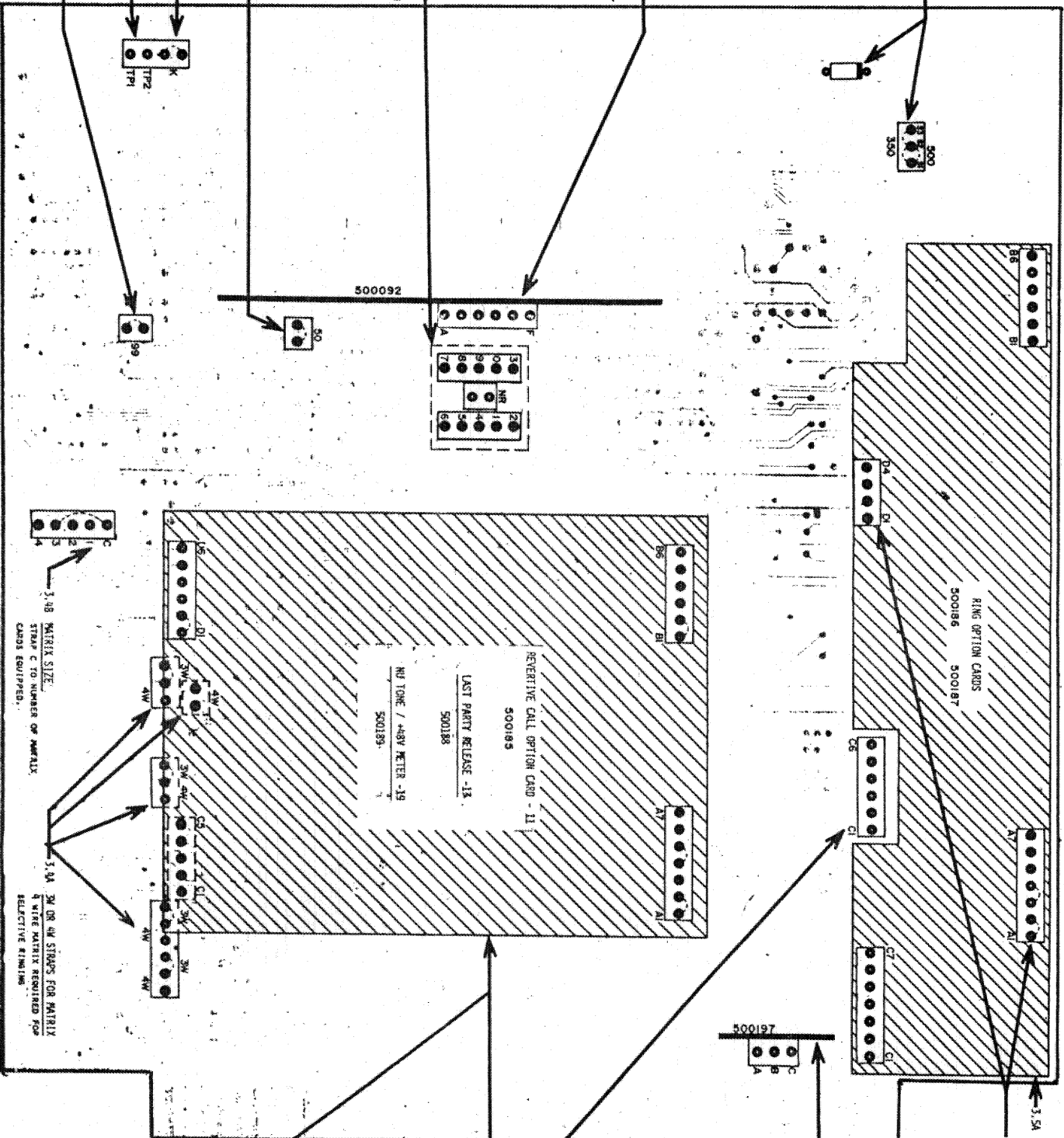
3.41 NO SUPERVISION OPTION
SPECIAL FACTORY OPTION TO PREVENT REVERSE BATTERY ON SELECTED NUMBERS FOR NO CHANGE CALLS.

3.46 PEG COUNT TIMING
STRAP TO CHANGE PEG COUNT PHASE FROM 150MS TO 50MS.

3.46 K STRAP FOR RC
SEE TEXT.

TEST POINTS
DO NOT WIRE TO TP1 OR TP2, THEY ARE FACTORY TEST POINTS.

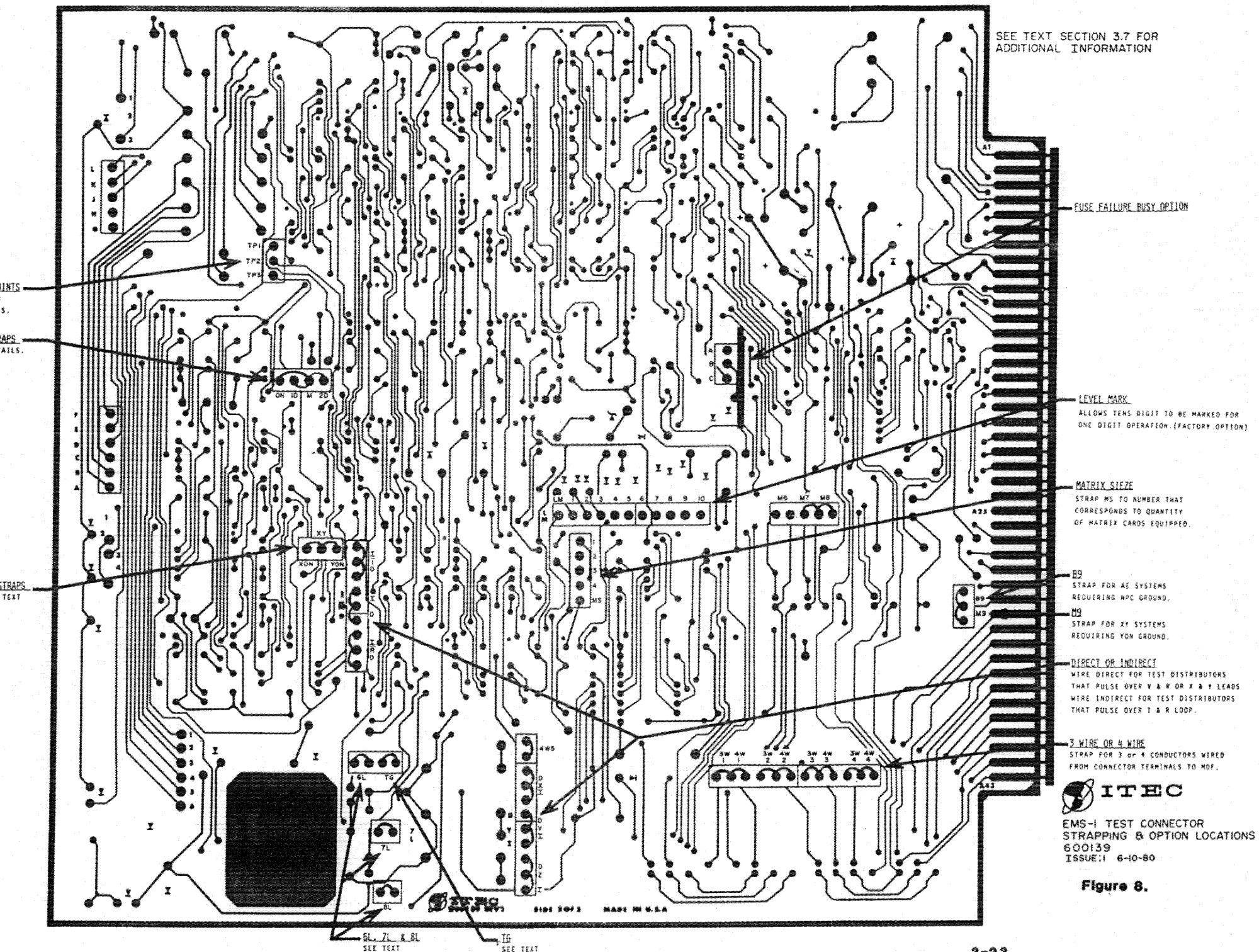
3.46 TEST 99
STRAP TO ALLOW 99 TO BE USED AS A TEST NUMBER.

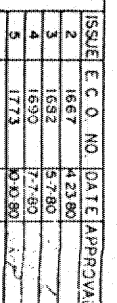


STRAPPING & OPTION LOCATIONS

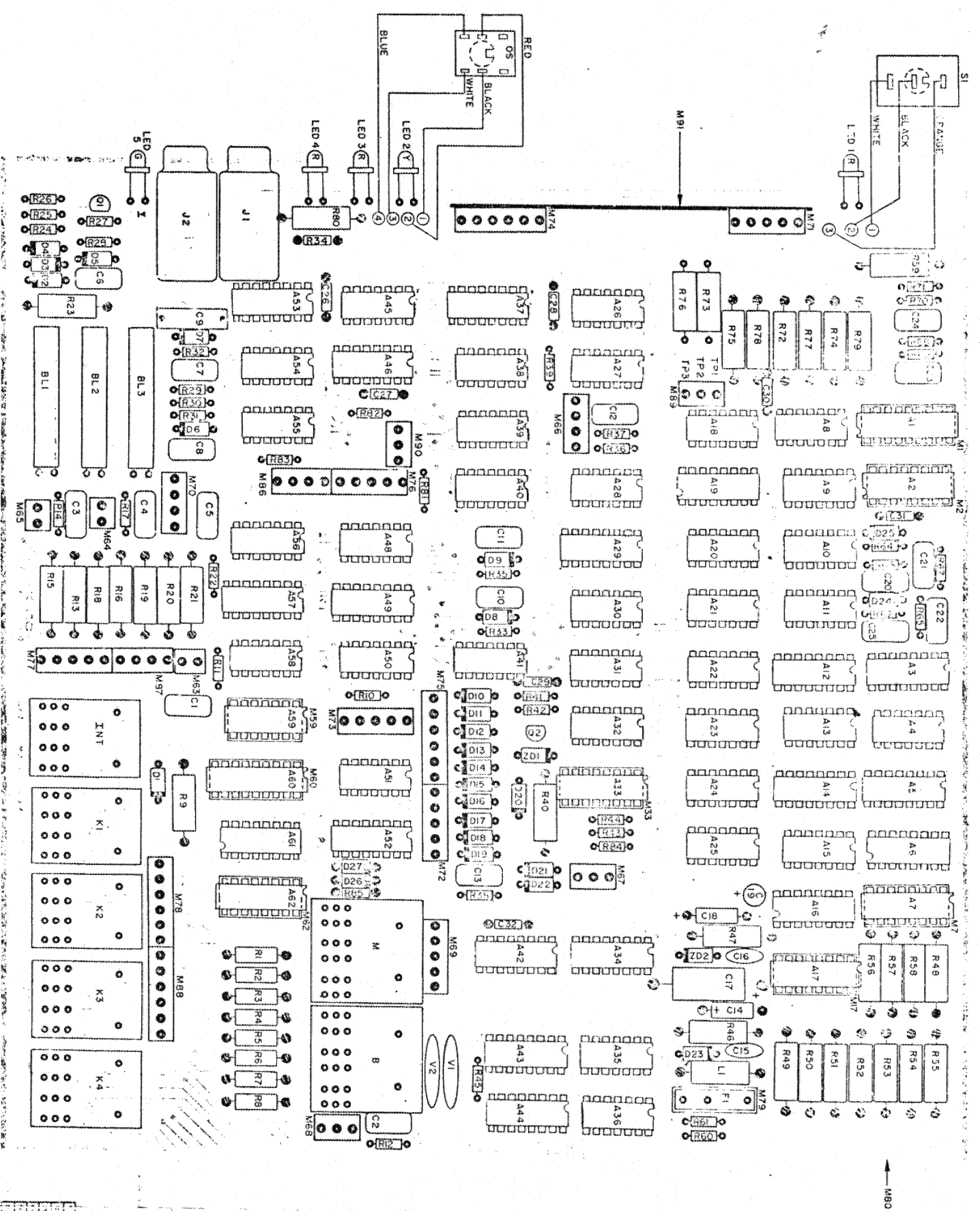
NOTE: COMPONENT SIDE SHOWN

ITHC
FIG. 7
EIMS-1 CONNECTOR
600130
ISSUE: 12-5-79
ISSUE: 2-7-82

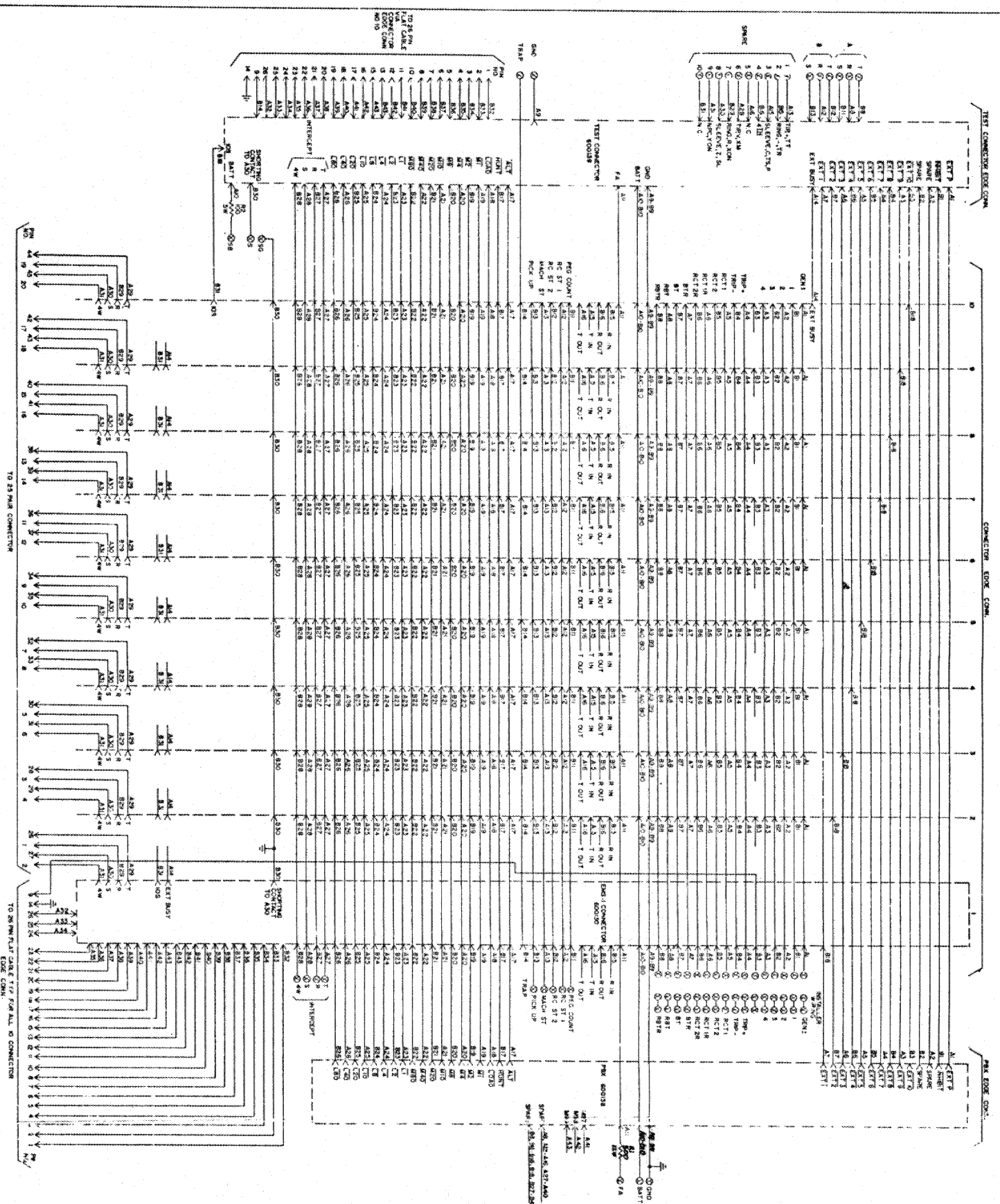




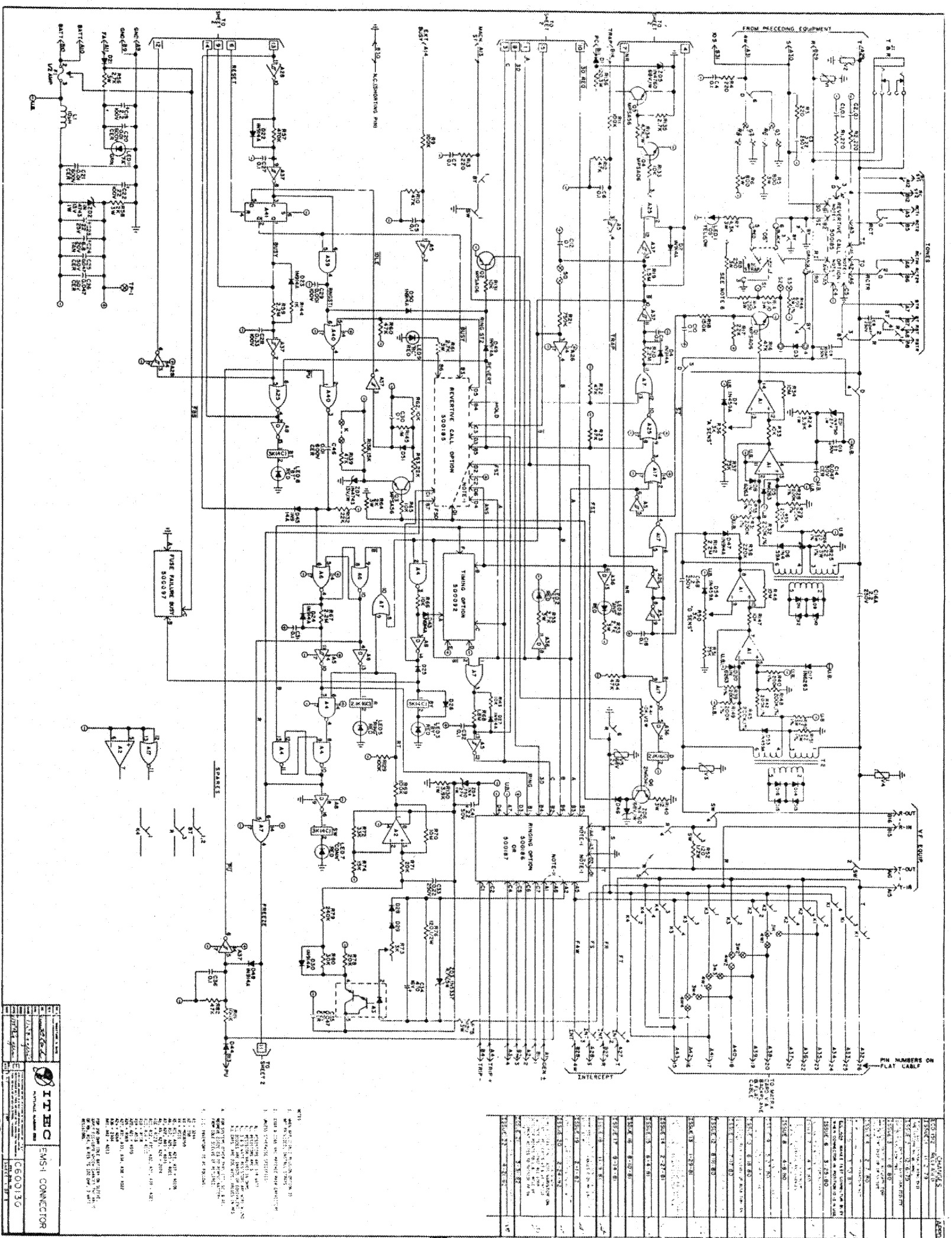
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2	1/572	1-11-80	
4	1702	5-11-80	
5	1732	7-11-80	
6	1844	3-11-81	
7	2232	4-2-82	



		EMC-1 TEST CONNECTOR	
ITHC INTERNATIONAL TELEPHONE HUB COMPANY 10000 WILSON AVENUE VAN NUYS, CALIF. 91411		A600139	



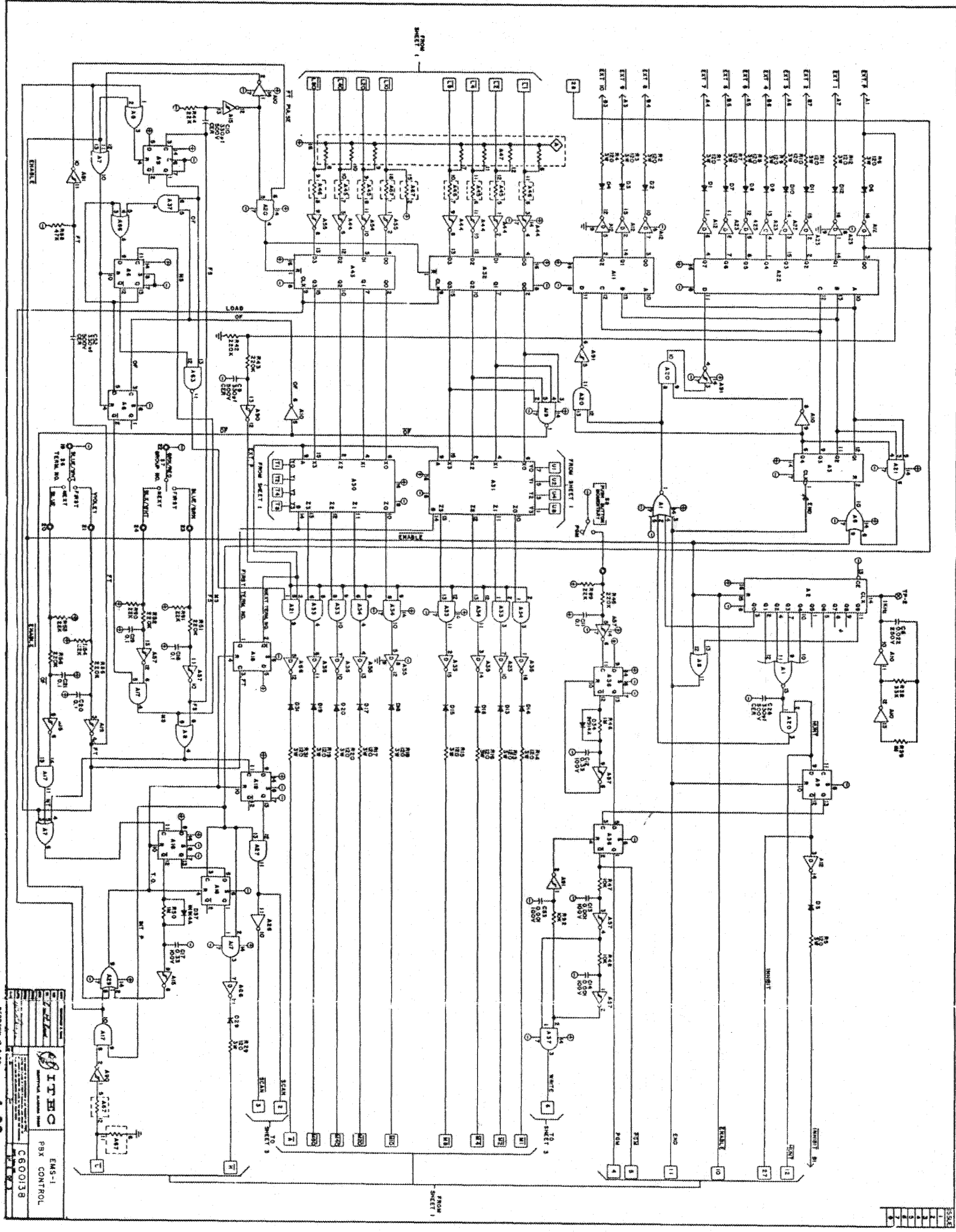
7-1	NAME OF AGENCY	
7-2	ADDRESS	
7-3	CITY	
7-4	STATE	
7-5	ZIP	
7-6	DATE	
7-7	TIME	
7-8	BY	
7-9	FOR	
7-10	REMARKS	
7-11	REMARKS	
7-12	REMARKS	
7-13	REMARKS	
7-14	REMARKS	
7-15	REMARKS	
7-16	REMARKS	
7-17	REMARKS	
7-18	REMARKS	
7-19	REMARKS	
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7-100	REMARKS	



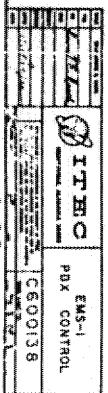
ITHC
EN5-1 CONNECTOR
C600130

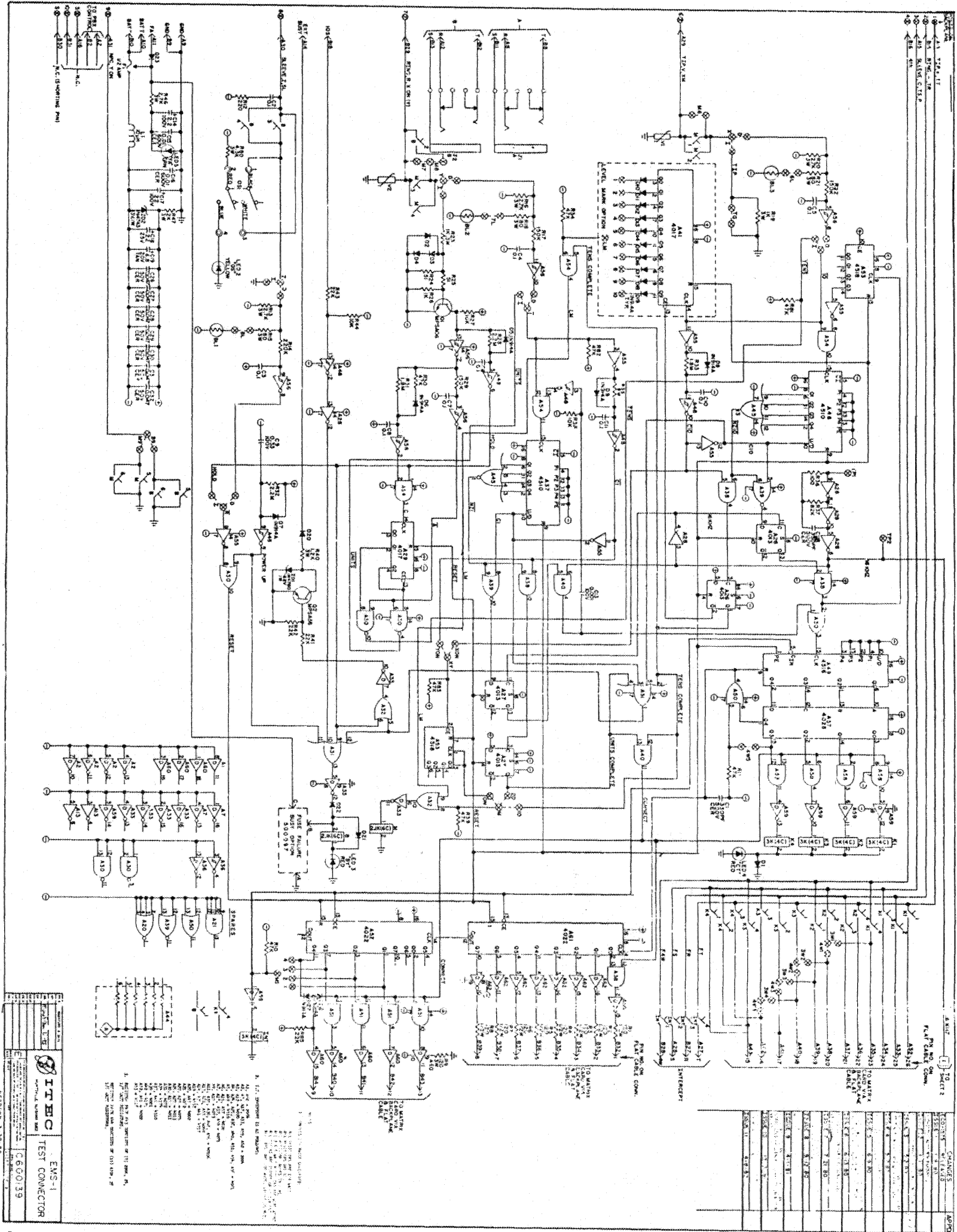
RESERVED 2-24-80 A-10





EMS-1
 PBX CONTROL
 6600138
 REVISION 2-3-70
 4-22

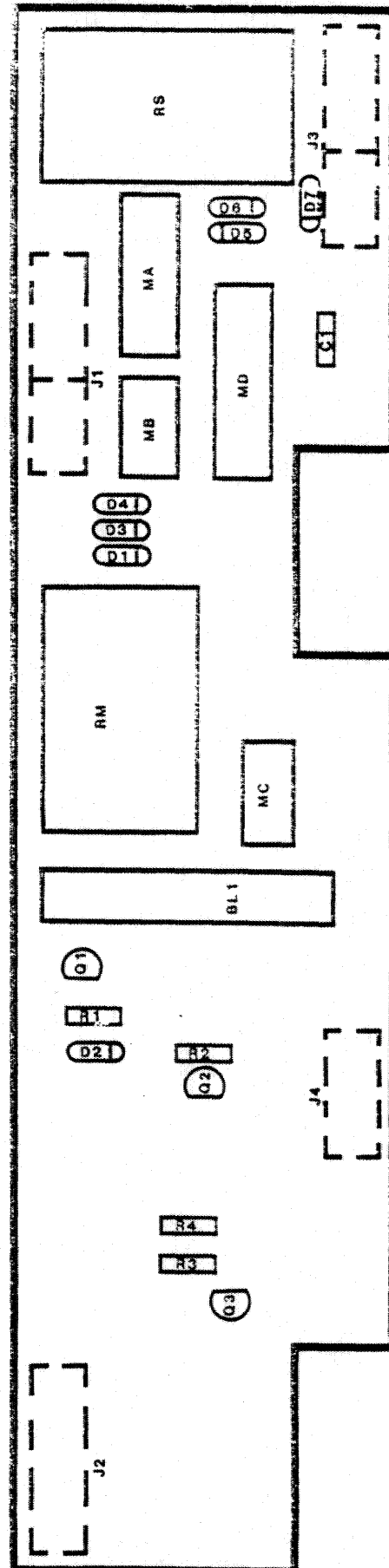




REV	DATE	BY	CHKD	APP'D
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2	10/1/73	W. J. B.		
3	10/1/73	W. J. B.		
4	10/1/73	W. J. B.		
5	10/1/73	W. J. B.		
6	10/1/73	W. J. B.		
7	10/1/73	W. J. B.		
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9	10/1/73	W. J. B.		
10	10/1/73	W. J. B.		

4-24

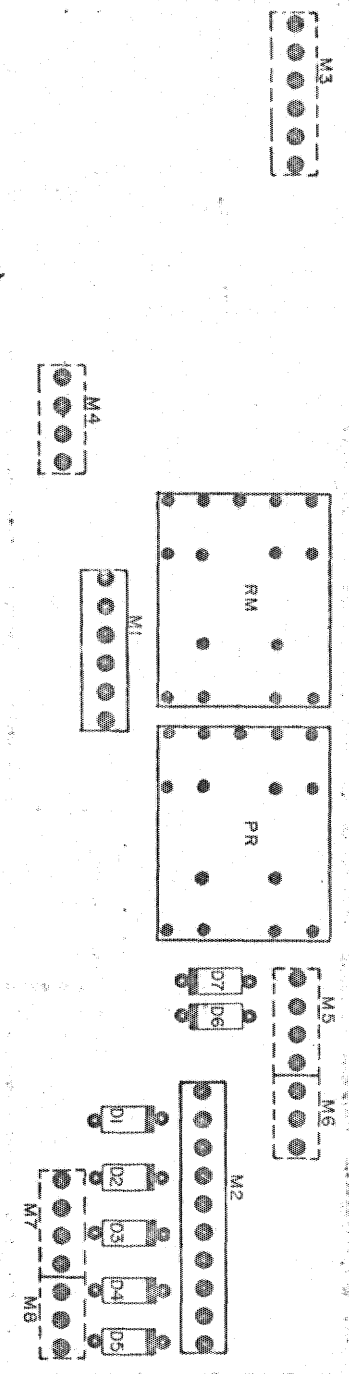




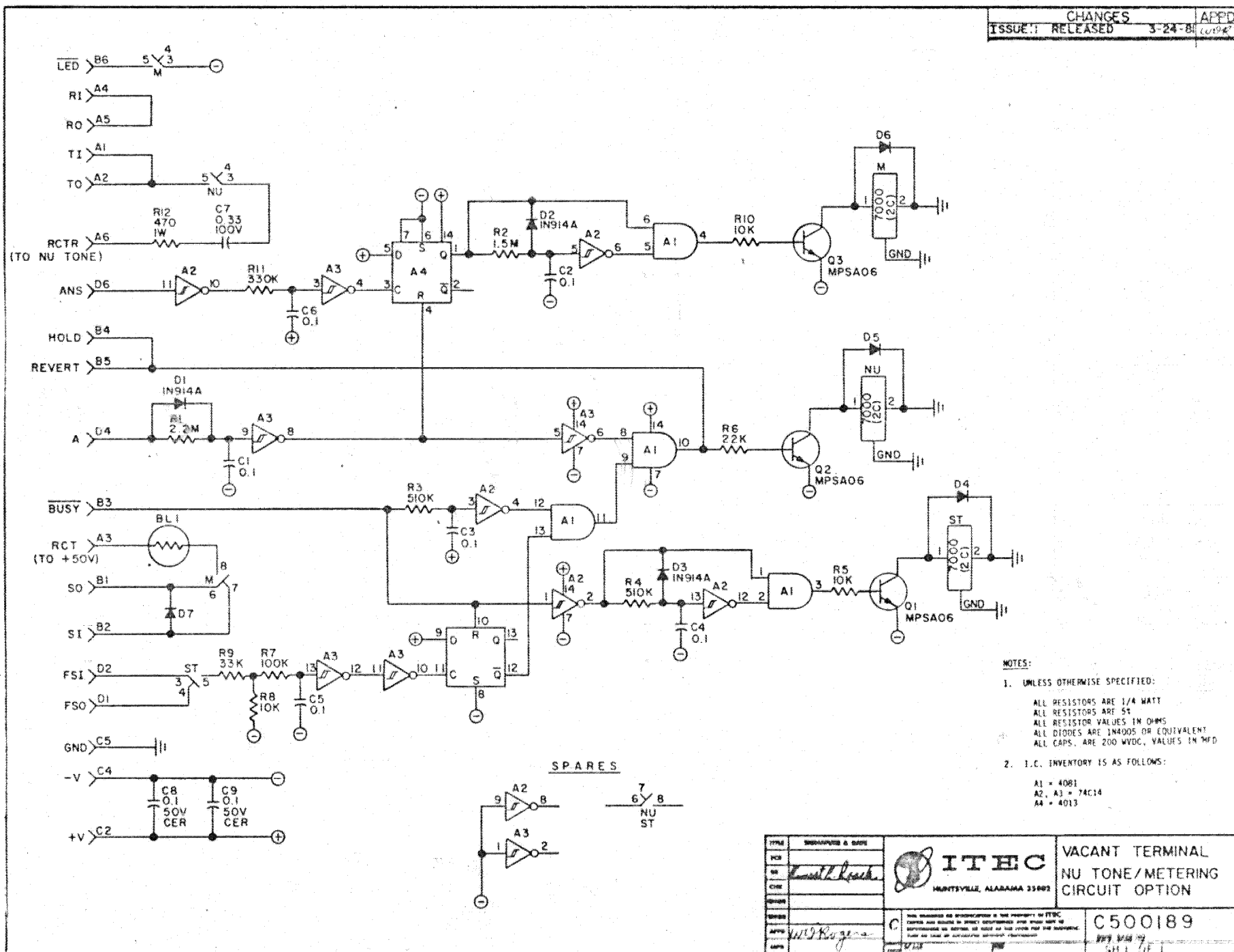
FREQUENCY MARK OR CODE RINGING

A500186

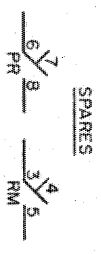
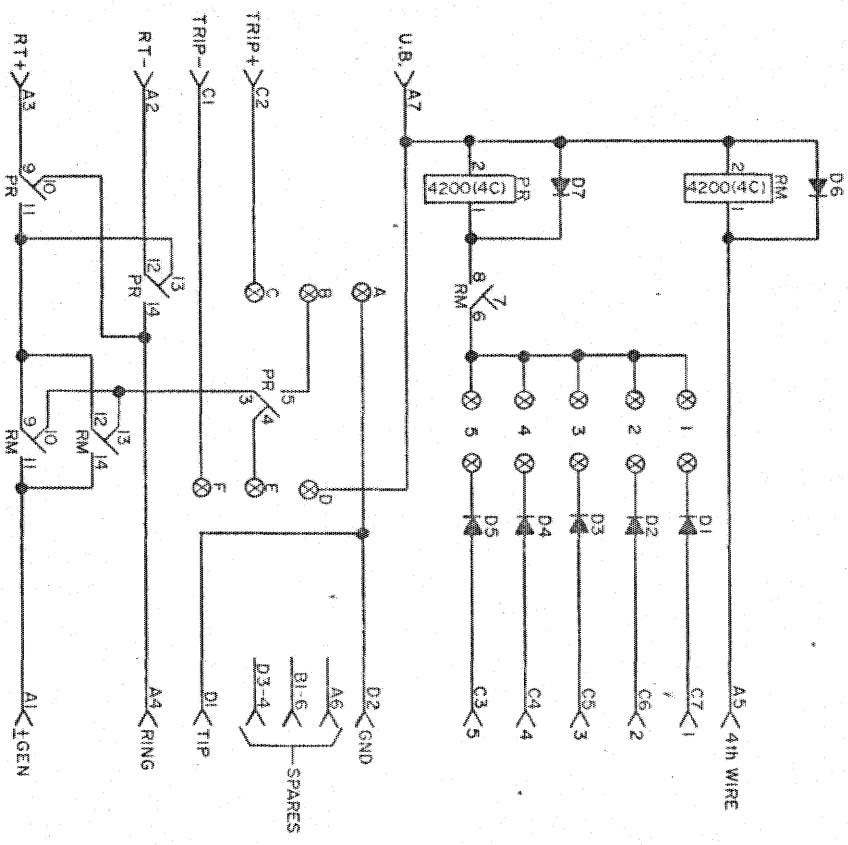
ISSUE	E.C. NO	DATE	APPROVAL
1	RELEASED	12-6-79	1092



TITLE		SIGNATURE & DATE	
DES	DES		
DR	DR		
CHK	CHK		
ENGR	ENGR		
APP	APP		
REC	REC		
HUNTSMILL, ALABAMA 35892		SUPERIMPOSED RINGING OPTION	
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SCALE	SCALE	DWG. LIST NO.	



ISSUE	E.C. NO	DATE	APPROVAL
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1. ALL DIODES ARE 1N4005 OR EQUIVALENT.
 2. FOR IIT S X S SYSTEMS, STRAP THE FOLLOWING: D TO E, #1, #3.
- FOR AE S X S SYSTEMS AND SC-X SYSTEMS, STRAP THE FOLLOWING: D TO E, #1, #3.

TOTAL: SIGNATURE & DATE		ITT SUPERIMPOSED RINGING OPTION P.O. BOX 4136 HUNTSVILLE, ALABAMA 35892
ICP	<i>Wm. B. Ball</i>	
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