CONTINUITY-ELECTRONIC LEAD VERIFICATION

SYSTEM - NO. 4 CROSSBAR

CONTENTS

1. GENERAL

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1. GENERAL

1.1 This section provides information and methods to be employed for verifying the continuity of switchboard cable leads associated with the Telephone Central Office bulk wiring operations on the No. 4 type Toll Switching System. The verification procedures covered herein are applicable to both new and additions to No. 4 Crossbar Offices.

1.11 The methods of this section cover the applications of the "Electronic Lead Verification System" as a vehicle for performing lead verification operations.

1.2 Precautions Against Personal Injury, Equipment Damage and Service Interruptions

1.21 General precautions to be taken against personal injury, equipment damage and service interruptions are covered in Handbook 0 and are to be observed at all times as they apply to the operations being performed.

1.3 Refer to G.I.C.-1.01 and Handbook 9, Section 910 for the method of operation of the test sets used in this section.

2. TEST EQUIPMENT

2.1 Equipment

Amt	ITE	Description
1	2260	Call, Wire Tel. Jack
1	* 4137 4137A	Continuity Test Set A.C.
1	5420	Test Accessory Set
1	5421	Analyzer Test Set
1	5422	Encoder, Master
1	5424	1000 Circuit Encoder
1	9600	Operator's Telephone Set

* Cords and accessories are furnished with test set.

2.11 Cords and Accessories

Amt	ITE	Description
2	9215	Multi-Contact Relay Cord
2	9216	Multi-Contact Terminal Strip Cord
2	9217	Multiple Terminal Strip Test Cord
2	9218	Cross Point Terminal Cord
5	9220	Distributing Frame Cord (150-5 x 20)
1	9214A	Interconnect Cable (30 ft.)
1	9214B	Interconnect Cable (60 ft.)
1	9214C	Interconnect Cable (100 ft.)
(As Req'd)	KS-20406 -L1	Cleaner

3. APPLICATION

3.1 The electronic lead verification system is designed to provide wire identification, wire search, short circuit and open circuit verification of installer wiring. The system is used for continuity verification and circuit analysis in Telephone Central Office bulk wiring operations. In general there are three major components required for the No. 4 Crossbar system as follows:

3.11 The Analyzer and Master Test Encoder provides readout and control functions respectively. These units are located near the frame under test.

For identification purposes, this location will be considered as "End A" or the point of origin.

3.12 The 1000 circuit encoder provides test access at the far end of the wiring being tested and for identification purposes this end will be considered as "End B" or the point of destination.

3.13 Test cords are designed to follow assigned numbering when feasible. When it becomes impractical to have an exact match between the apparatus terminal number and the Analyzer display image, a compromise is used which has a pattern that can be readily recognized during Manual operation with a test probe.

3.14 Example - Figure 7 shows the display Image numbers associated with each of the 5 terminal strips located at the distributing frame as shown in Figures 1 and 4. The Hundred digit defines the Level being probed (in this example there is an exact match between the apparatus terminal and the display image), the Tens digit is used to define the lead designations and the Units digit defines the Switch number. Leaving "N" represent any number from 0 to 9, the following patterns occur:

Location	Image
Tip	N3N
Ring	N4N
Sleeve	N2N
T1	NON
R1	N1N
Level 0	ONN
Level 1	1NN
Level 9	9NN
SW 0	NNO
SW 1	NN2
SW 2	NN4
SW 3	NN6
SW 4	NN8
SW 5	NN1
SW 6	NN3
SW 7	NN5
SW 8	NN7
SW 9	NN9

3.15 The performance of subsequent operational test methods per No. 4, A4A and 4A Crossbar Test Handbook 67 is based on the assumption that the continuity of all switchboard cable conductors, with the exception of those items referred to in the lead tests shown and covered in the respective assignment and operational test sections of Handbook 67.

3.16 Conductor colors should not be employed during verification operations. Continuity verification must be performed as a terminal-to-terminal check disregarding the associated lead color information listed on CCED's or running sheets. Terminal-to-terminal checking not only provides for continuity checking of the leads, but verifies the integrity of functional lead assignments within a circuit. This type of checking thereby eliminates the chance of missing slipped terminals that can readily occur when checking by color code.

3.17 Continuity verification as described above is performed with the ITE-4137 or ITE-4137A AC Continuity Set. Cables listed in Table "A" may be verified using an "Electronic Lead Verification System".

3.18 A.C. Continuity Set ITE-4137 or ITE-4137A (see Handbook 67, Vol. 1, Sect. 0.2, Par. 5.03)

3.19 Plug the ITE-4137 or ITE-4137A into a 105-125V AC outlet and prepare the set using a suitable test set-up from illustrations shown in Handbook 67, Section 0.2, Paragraph 5.04, Figures 2A, 2B and 2C. A typical illustration is also shown within (Figure 8).

3.2 Continuity and Lead Verification Tests (See Table "A" for Test Cords Used)

3.21 Testing Cables from Crossbar Switches to the Distributing Frame - TRUNKS

3.22 Test set up of equipment arranged as shown in Figure 1 or 4. At "End B" plug the five test cords (ITE-9220) onto the 150-type terminal strips (on the cross connect side) so as to contact the rows designated "T, R, T1, R1 and S". Insert the other end of the five test cords (ITE-9220) into the connectors designated L1 and L3 on ITE-5424. Interconnect the 1000 circuit encoder (ITE-5424) to the Master Test Encoder (ITE-5422) or the analyzer (ITE-5421) in accordance

with the methods outlined in Handbook 9, Section 910. Test procedure consists of scanning the crossbar switch terminals of two levels on each switch at the equipment frame per test scan. Test Cords ITE-9218 are associated with switch levels 0 and 1 on each of the 10 switches in the equipment frame for the first test scan. Readout for the distributing termination for first scan will be from 000 to 149. Upon completion of tests for switch levels 0 and 1 the ITE-9218 Cord Shoes (P0 to P4 of Figure 1) should be moved to levels 2 and 3 on each switch and the test scan repeated. A total of five test scans are required to test all the levels of each switch (Zones 1 to 5). Typical readouts using cords ITE-9218 and ITE-9220 are shown in Figures 1.1 and 1.2.

3.3 Testing Terminal Strip Multiple Cables Between Equipment Frames

3.31 Test setup of equipment to be arranged as shown in Figure 2 or Figure 5. Test cords are arranged to plug onto terminal strips from the front of the bays being tested. If a cord must be plugged onto the rear of a terminal strip due to operating conditions, the reversal program plug is to be used on the ITE-5421 Test Set to provide the correct readout information.

3.32 The procedure consists of scanning the terminal of two terminal strips per test scan. Where the multiple under test uses more than two terminal strips (i.e., the home and mate terminal strips at ITI and TCI frames), a second test scan will be required. For the second test scan, the test cords at both the originating and terminating frames are moved to the second set of multiple terminal strips. The zone switch of ITE-5422 is set at Zone 1 for each scan and the test cords plugged into the L1 and R2 Connectors on ITE-5422 and ITE-5424 Test Sets for both scans. Readouts will be from 000 to 059 with punching assignments shown in Figures 2.1 and 2.2. When testing multiple cabling between a new frame and working frame, the test set is to be used as indicated in TMO-5420 for testing active circuits and standard procedures for working equipment shall be observed.

3.4 Testing Multi-Contact Relay Multiple Cables Between Equipment Frames

3.41 Test setup of equipment to be arranged as shown in Figure 3 or Figure 6. The multi-contact relay test cards are inserted between the fixed and make contacts of the 286- or 287-type relays with the etched side of the card contacting the make side of relay. Where 287-type relays are tested, two multi-contact relay test cards will be required. The contact surface of the multi-contact relay test cards must be cleaned using KS-20406-L1 Wash (Trichlorotribluorethane) prior to each usage.

3.42 The procedure consists of scanning two 286-type relays or one 287-type relay per test scan. Where the multiple under test uses more than two 286-type relays or one 287-type relay, additional test scans will be required. For each test scan the zone switch of the ITE-5422 Test Set is set at Zone 1 and the test cords plugged into the L1 and R2 connectors. Readouts will be from 000 to 059 with punching assignments shown in Figure 3.1. When testing multiple cabling between a new frame and a working frame, the test sets should be used in manual mode. (Refer to Handbook 9, Section 910 and standard procedures for working equipment.)

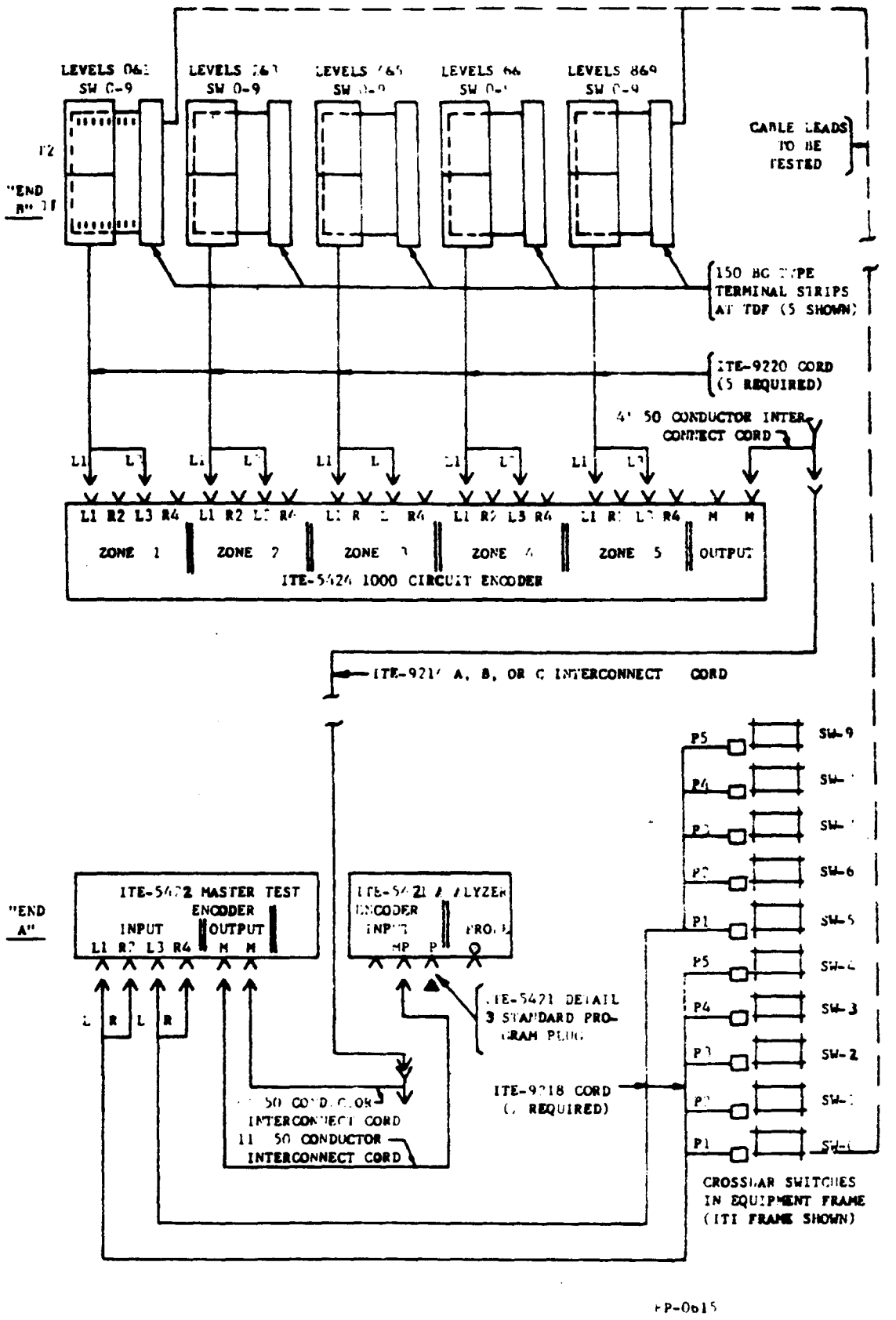
3.5 Miscellaneous Testing

3.51 Various combinations of test cords other than those specified in Paragraphs 3.2 through 3.4 are possible. For these situations the test setup will follow the segments of Paragraphs 3.2 through 3.4 which apply to the particular cords. An example might be the testing of tie cables from 150-type terminal strips on one distributing frame to 150-type terminal strips on another distributing frame using two ITE-9220 Test Cords for "End A" and two ITE-9220 Test Cords for "End B".

3.52 For testing circuits where "End A" does not have a terminal array which fits any of the available test cords, the ITE-5422 Test Set can be used in a manual mode with a test probe. An example might be the testing of trunk circuits from the TUA, TUB or TUC Frames to the Distributing Frame.

TABLE A

CONTINUITY TEST APPLICATION - NO. 4 CROSSBAR						
"END A" ORIG FRAME	MASTER TEST ENCODER TEST CORD QUANTITY	CODE	"END B" TERM FRAME	ENCODER TEST CORD QUANTITY	CODE	TYPICAL CABLES TO BE TESTED
CBA	1	Probe	ADF, IDF, TDF	5	ITE-9220	H6, H7, H8, H9, H31
DC	1	ITE-9217	DC	1	ITE-9217	K1 to K5, K21 to K26
ITI, TCI	2	ITE-9218	TDF	5	ITE-9220	G1-8 G1-23
ITI, TCI	1	ITE-9217	ITI, TCI	1	ITE-9217	G1-9, R6
ITI, TCI	1	ITE-9215	ITI, TCI	1	ITE-9215	G1-4A, G1-10
ITO, TCO	2	ITE-9218	ADF, TDF	5	ITE-9220	D8, D21, D22
ITO, TCO	1	ITE-9217	ITO, TCO	1	ITE-9217	D12
ITO, TCO	1	ITE-9215	ITO, TCO	1	ITE-9215	D6A, D7
ITO, TCO	1	ITE-9218	ITO, TCO	1	ITE-9218	D35
MC	1	ITE-9216	MC	1	ITE-9216	MA
MFSL, ORSL	2	ITE-9218	TDF	5	ITE-9220	D8
MFSL, ORSL	1	ITE-9216	LCC	1	ITE-9216	LCB
MFSL, ORSL	1	ITE-9215	MFSL, ORSL	1	ITE-9215	MS
Misc RR	1	Probe	TDF	5	ITE-9220	Trunk Cable
MIT, MTC	1	ITE-9216	MIT, MTC	1	ITE-9216	MB, MC, MD, ME
SDC	1	ITE-9217	SDC	1	ITE-9217	K101
SDC	1	ITE-9217	DC	1	ITE-9217	K104 to K112
TCB, ITB	1	ITE-9217	TCB, ITB	1	ITE-9217	MA, MB
TUA	1	Probe	ADF, IDF, TDG	5	ITE-9220	B55, B63 to B65, B67, B371, B373
TUB	1	Probe	ADF, IDF, TDF	5	ITE-9220	B256, B260, B261, B226 to B268, B286, B271
TUC	1	Probe	ADF, IDF, TDF	5	ITE-9220	AG21, AG25, AG33 to AG35



FP-0615

FIG. 1 EQUIPMENT LAYOUT FOR TESTING CONTINUITY BETWEEN X-BAR SWITCHES AND DISTRIBUTING FRAME TERMINAL STRIPS. (PAR. 3.22)

T1	R1	S	T	R	
109	119	129	139	149	159
108	118	128	138	148	
107	117	127	137	147	
106	116	126	136	146	
105	115	125	135	145	
104	114	124	134	144	
103	113	123	133	143	
102	112	122	132	142	
101	111	121	131	141	
100	110	120	130	140	150
009	019	029	039	049	059
008	018	028	038	048	
007	017	027	037	047	
006	016	026	036	046	
005	015	025	035	045	
004	014	024	034	044	
003	013	023	033	043	
002	012	022	032	042	
001	011	021	031	041	
000	010	020	030	040	050

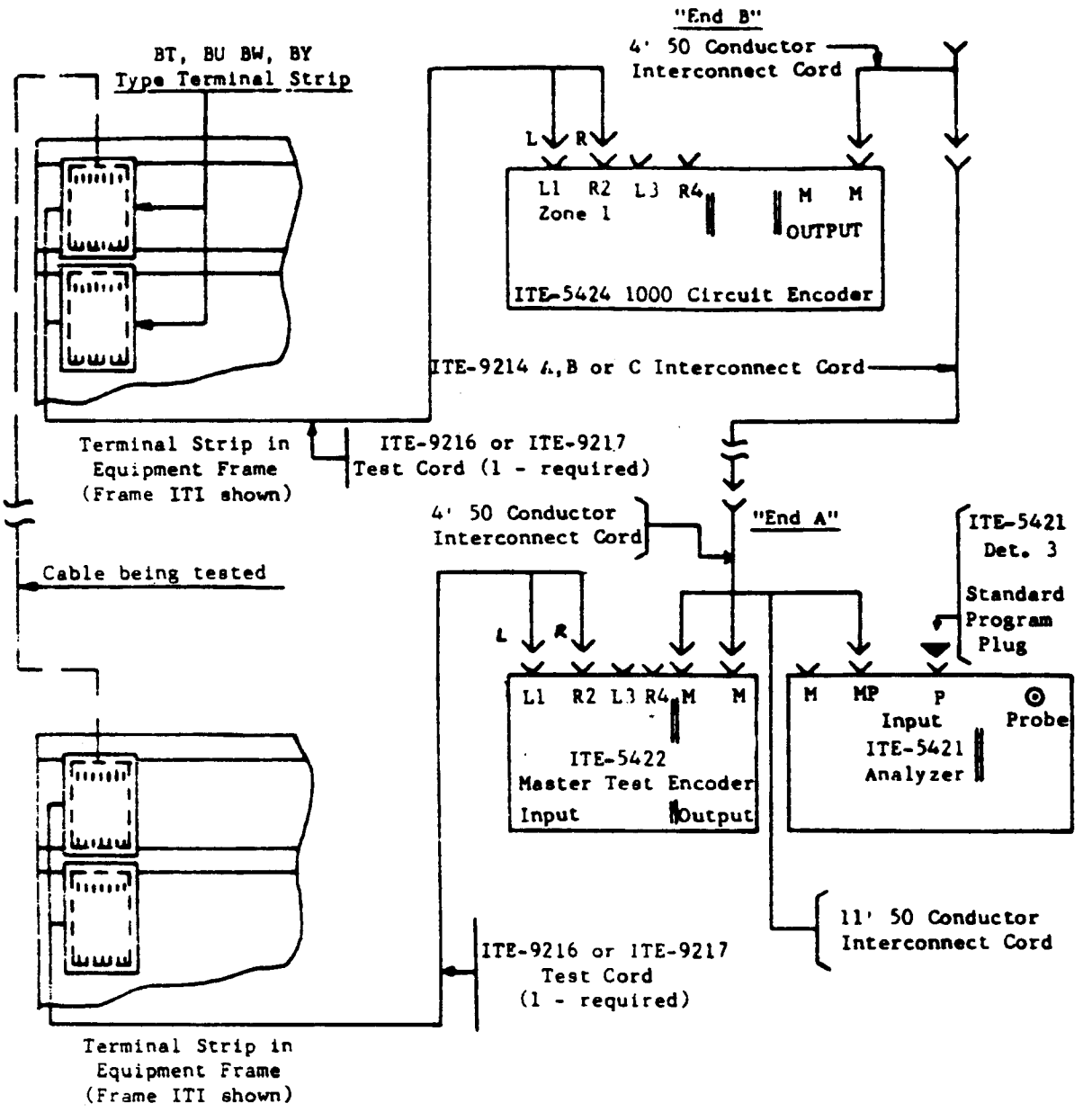
T1	R1	S	T	R	
909	919	929	939	949	959
908	918	928	938	948	
907	917	927	937	947	
906	916	926	936	946	
905	915	925	935	945	
904	914	924	934	944	
903	913	923	933	943	
902	912	922	932	942	
901	911	921	931	941	
900	910	920	930	940	950
809	819	829	839	849	859
808	818	828	838	848	
807	817	827	837	847	
806	816	826	836	846	
805	815	825	835	845	
804	814	824	834	844	
803	813	823	833	843	
802	812	822	832	842	
801	811	821	831	841	
800	810	820	830	840	850

----------Zone 1---------- Thru ----------Zone 5----------

FIG. 1.1 READOUT DISPLAY ASSOCIATED WITH TTE-9218 CORD (ZONES 1 THRU 5) (PAR. 3.22)

T	R	Tl	Rl	S																T	R	Tl	Rl	S
139	149	109	119	129	339	349	309	319	329	539	549	509	519	529	739	749	709	719	729	939	949	909	919	929
137	147	107	117	127	337	347	307	317	327	537	547	507	517	527	737	747	707	717	727	937	947	907	917	927
135	145	105	115	125	335	345	305	315	325	535	545	505	515	525	735	745	705	715	725	935	945	905	915	925
133	143	103	113	123	333	343	303	313	323	533	543	503	513	523	733	743	703	713	723	933	943	903	913	923
131	141	101	111	121	331	341	301	311	321	531	541	501	511	521	731	741	701	711	721	931	941	901	911	921
039	049	009	019	029	239	249	209	219	229	439	449	409	419	429	639	649	609	619	629	839	849	809	819	829
037	047	007	017	027	237	247	207	217	227	437	447	407	417	427	637	647	607	617	627	837	847	807	817	827
035	045	005	015	025	235	245	205	215	225	435	445	405	415	425	635	645	605	615	625	835	845	805	815	825
033	043	003	013	023	233	243	203	213	223	433	443	403	413	423	633	643	603	613	623	833	843	803	813	823
031	041	001	011	021	231	241	201	211	221	431	441	401	411	421	631	641	601	611	621	831	841	801	811	821
138	148	108	118	128	338	348	308	318	328	538	548	508	518	528	738	748	708	718	728	938	948	908	918	928
136	146	106	116	126	336	346	306	316	326	536	546	506	516	526	736	746	706	716	726	936	946	906	916	926
134	144	104	114	124	334	344	304	314	324	534	544	504	514	524	734	744	704	714	724	934	944	904	914	924
132	142	102	112	122	332	342	302	312	322	532	542	502	512	522	732	742	702	712	722	932	942	902	912	922
130	140	100	110	120	330	340	300	310	320	530	540	500	510	520	730	740	700	710	720	930	940	900	910	920
038	048	008	018	028	238	248	208	218	228	438	448	408	418	428	638	648	608	618	628	838	848	808	818	828
036	046	006	016	026	236	246	206	216	226	436	446	406	416	426	636	646	606	616	626	836	846	806	816	826
034	044	004	014	024	234	244	204	214	224	434	444	404	414	424	634	644	604	614	624	834	844	804	814	824
032	042	002	012	022	232	242	202	212	222	432	442	402	412	422	632	642	602	612	622	832	842	802	812	822
030	040	000	010	020	230	240	200	210	220	430	440	400	410	420	630	640	600	610	620	830	840	800	810	820
-Zone 1-					-Zone 2-					-Zone 3-					-Zone 4-					-Zone 5-				

FIG. 1.2 READOUT DISPLAY ASSOCIATED WITH ITE-9220 CORD - 150-5 x 20
(PAR. 3.22)



RP-0472

FIG. 2 EQUIPMENT LAYOUT FOR TESTING CONTINUITY BETWEEN MULTIPLE TERMINAL STRIPS ON EQUIPMENT FRAMES (PAR. 3.31)

059	049	039	029	019	009
058	048	038	028	018	008
057	047	037	027	017	007
056	046	036	026	016	006
055	045	035	025	015	005

054	044	034	024	014	004
053	043	033	023	013	003
052	042	032	022	012	002
051	041	031	021	011	001
050	040	030	020	010	000

FIG. 2.1 READOUT DISPLAY ASSOCIATED WITH ITE-9216 CORD (PAR. 3.32)

059	049	039	029	019	009
058	048	038	028	018	008
057	047	037	027	017	007
056	046	036	026	016	006
055	045	035	025	015	005

054	044	034	024	014	004
053	043	033	023	013	003
052	042	032	022	012	002
051	041	031	021	011	001
050	040	030	020	010	000

FIG. 2.2 READOUT DISPLAY ASSOCIATED WITH ITE-9217 CORD (PAR. 3.32)

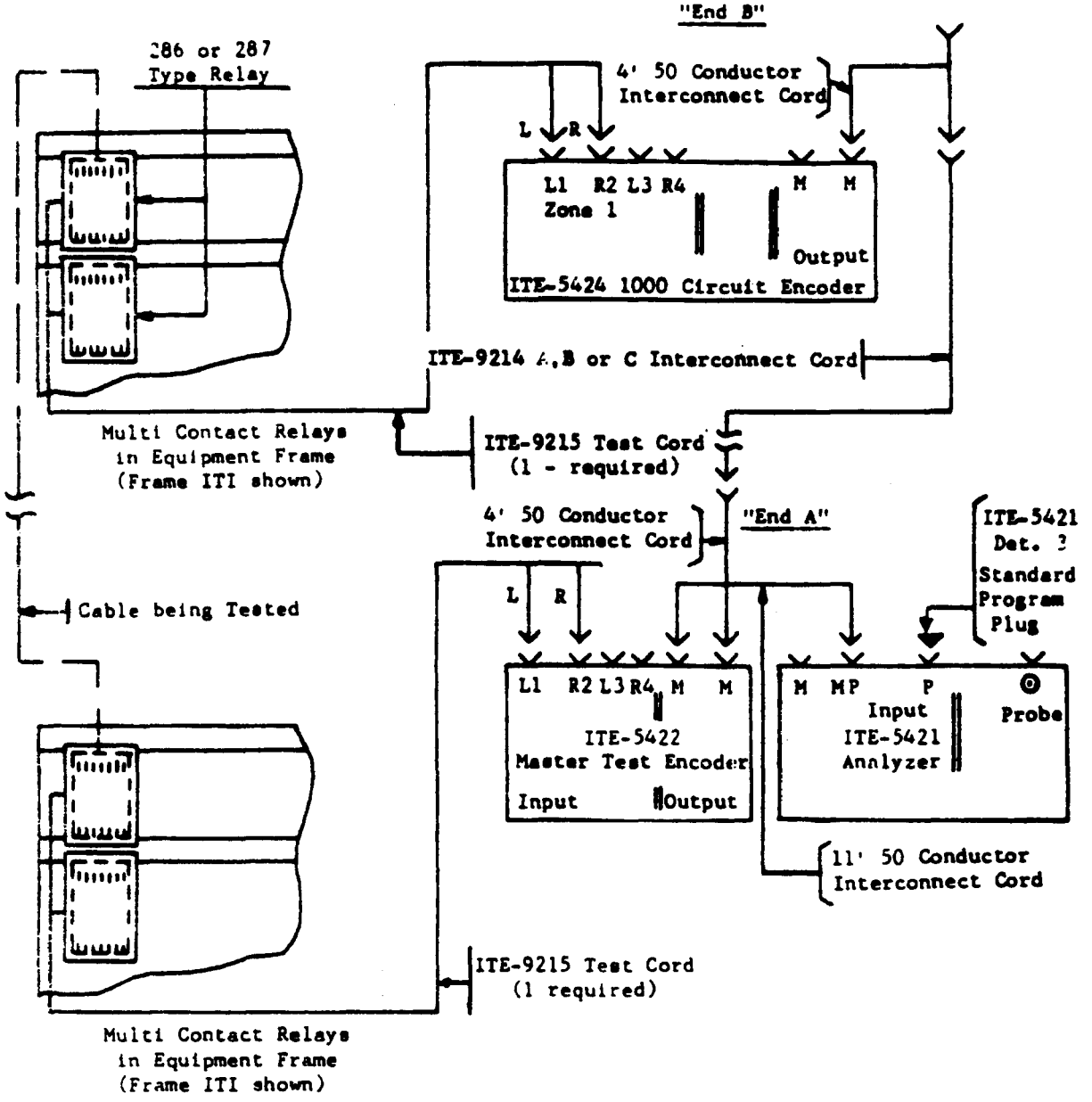


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FIG. 3 EQUIPMENT LAYOUT FOR TESTING CONTINUITY BETWEEN MULTI-CONTACT RELAYS ON EQUIPMENT FRAMES (PAR. 3.41)

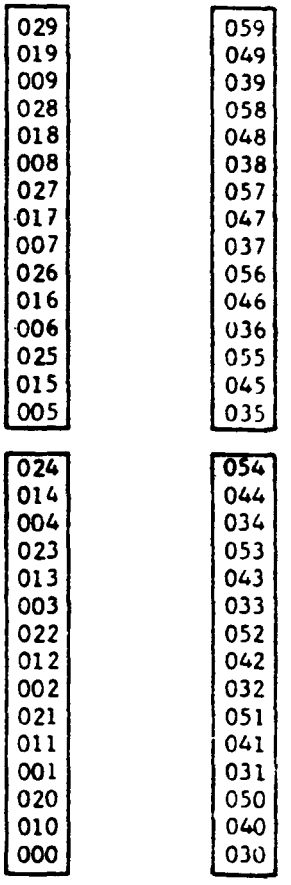


FIG. 3.1 READOUT DISPLAY ASSOCIATED WITH ITE-9215 (PAR. 3.42)

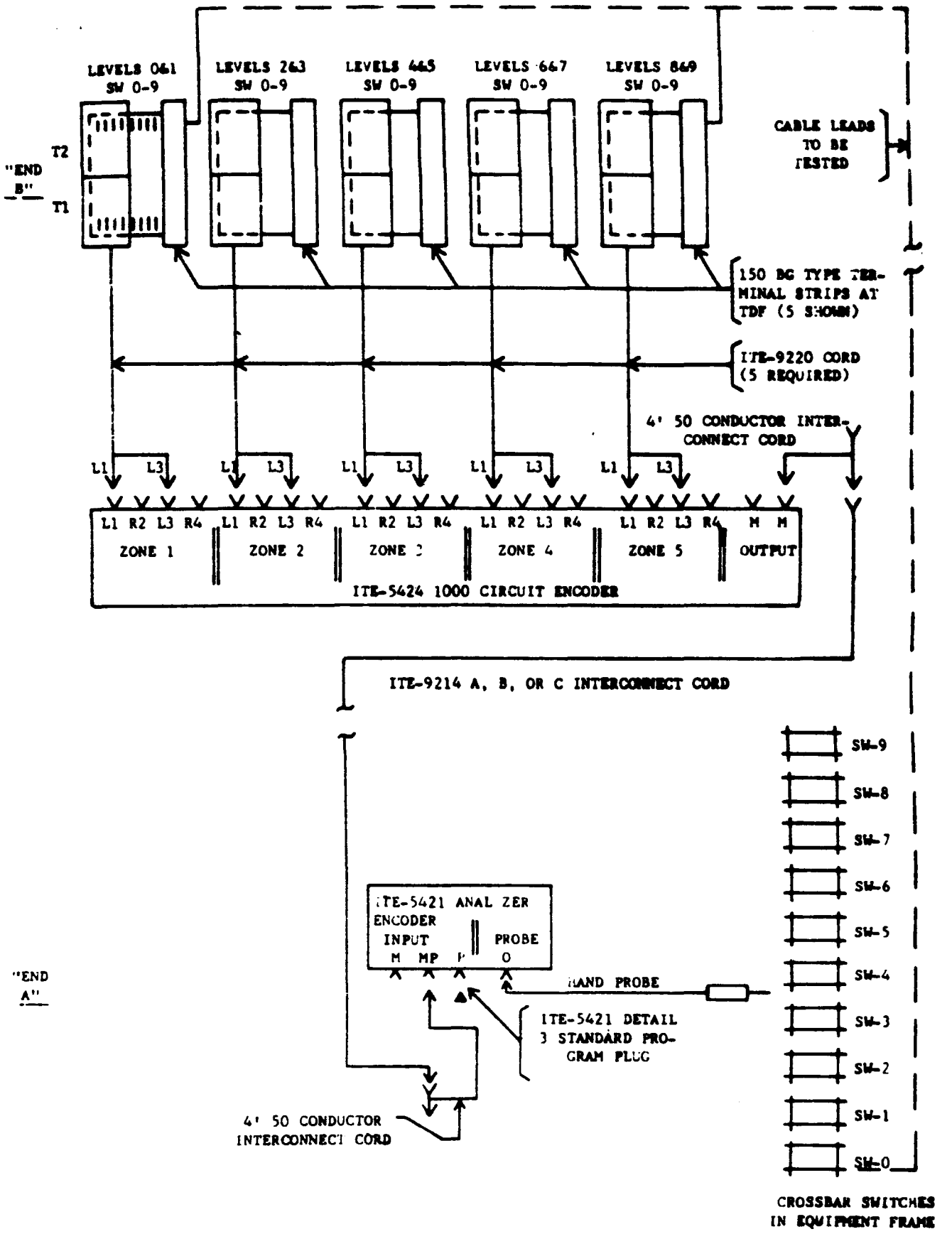
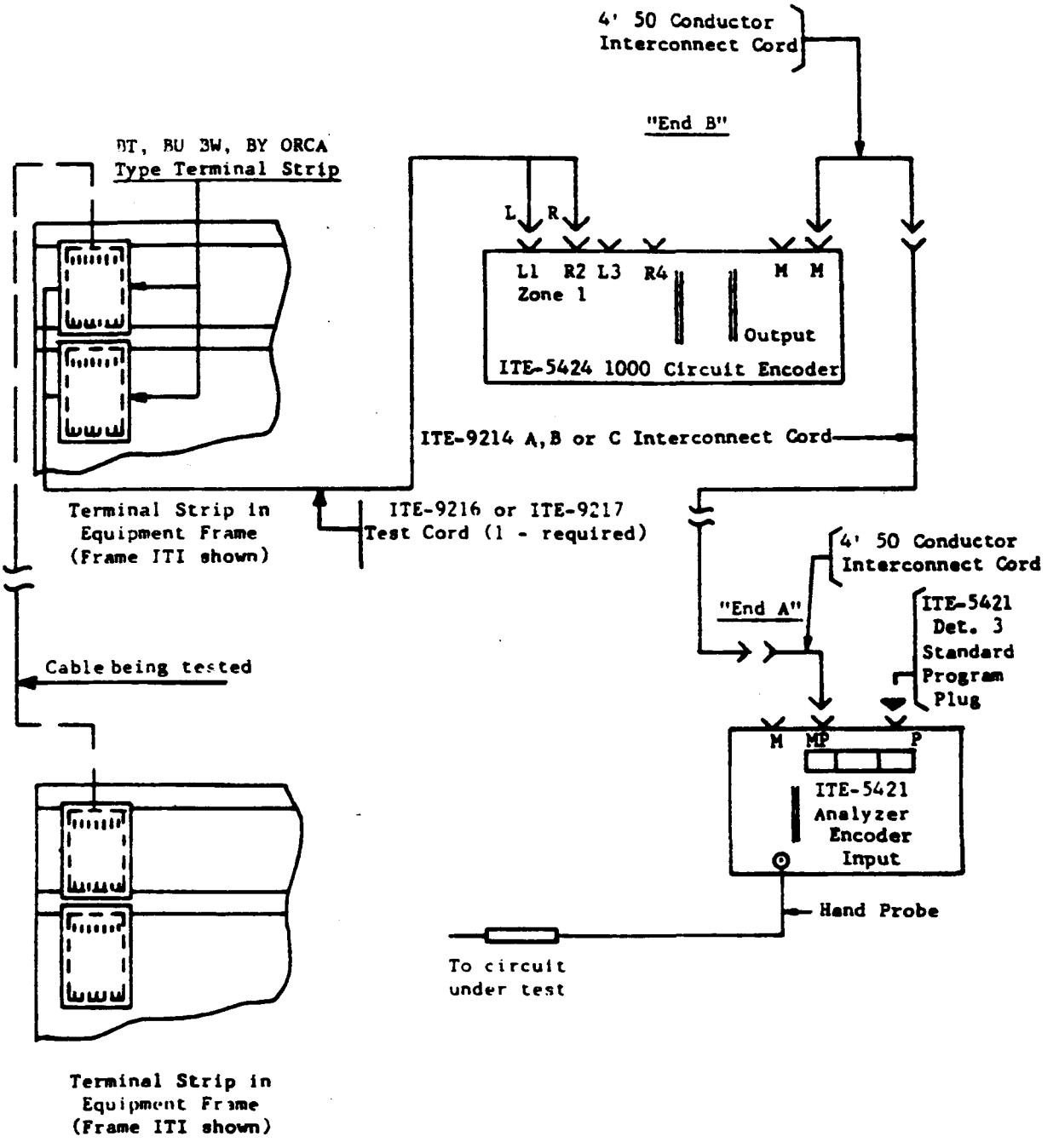
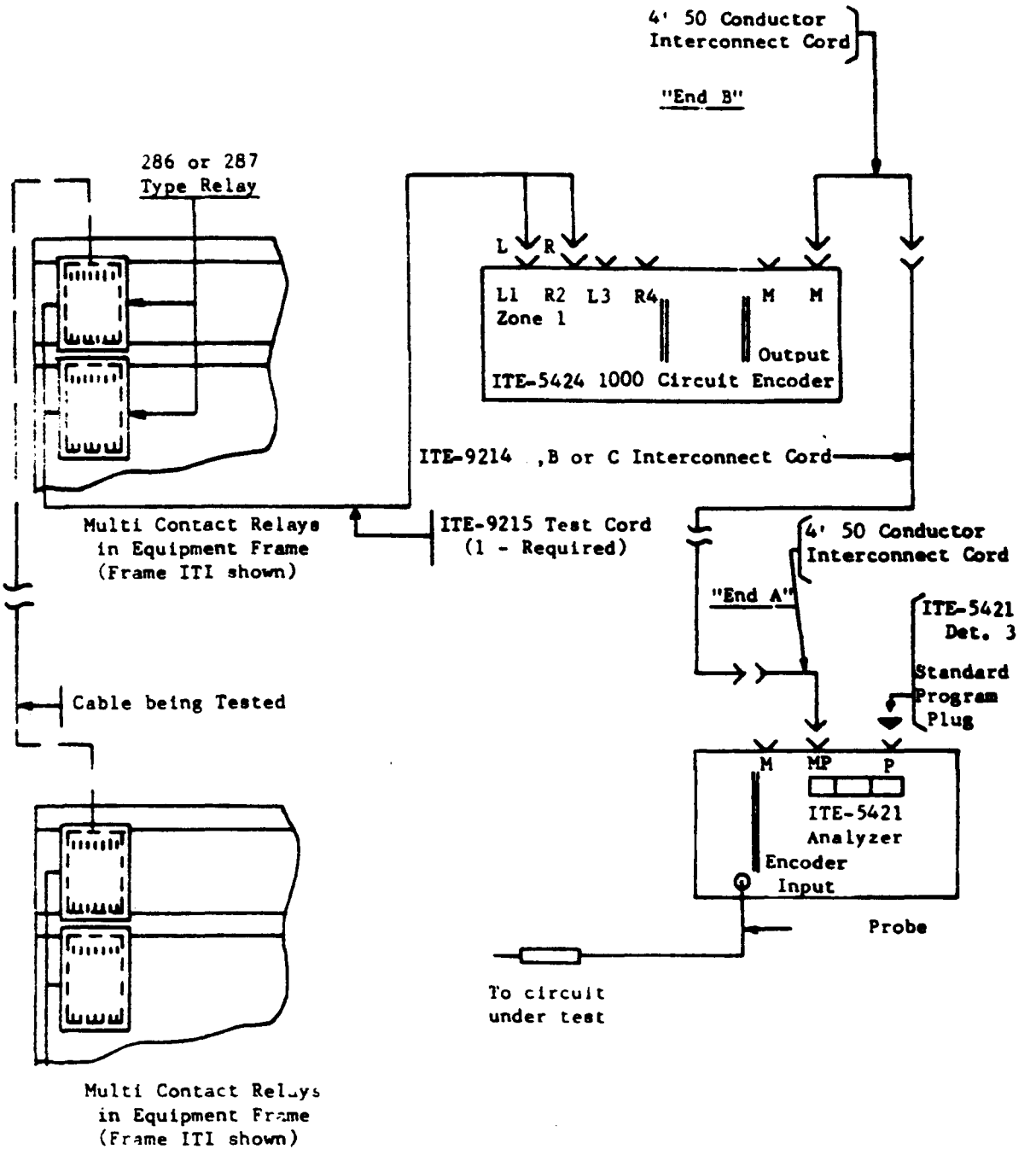


FIG. 4 EQUIPMENT LAYOUT FOR TESTING CONTINUITY BETWEEN X-BAR AF 0617
SWITCHES AND DISTRIBUTING FRAME TERMINAL STRIPS
(PAR. 3.22)



RP-0510

FIG. 5 EQUIPMENT LAYOUT FOR TESTING CONTINUITY BETWEEN MULTIPLE TERMINAL STRIPS ON EQUIPMENT FRAMES (PAR. 3.31)



RP-0511

FIG. 6 EQUIPMENT LAYOUT FOR TESTING CONTINUITY BETWEEN MULTI-CONTACT RELAYS ON EQUIPMENT FRAMES (PAR. 3.41)

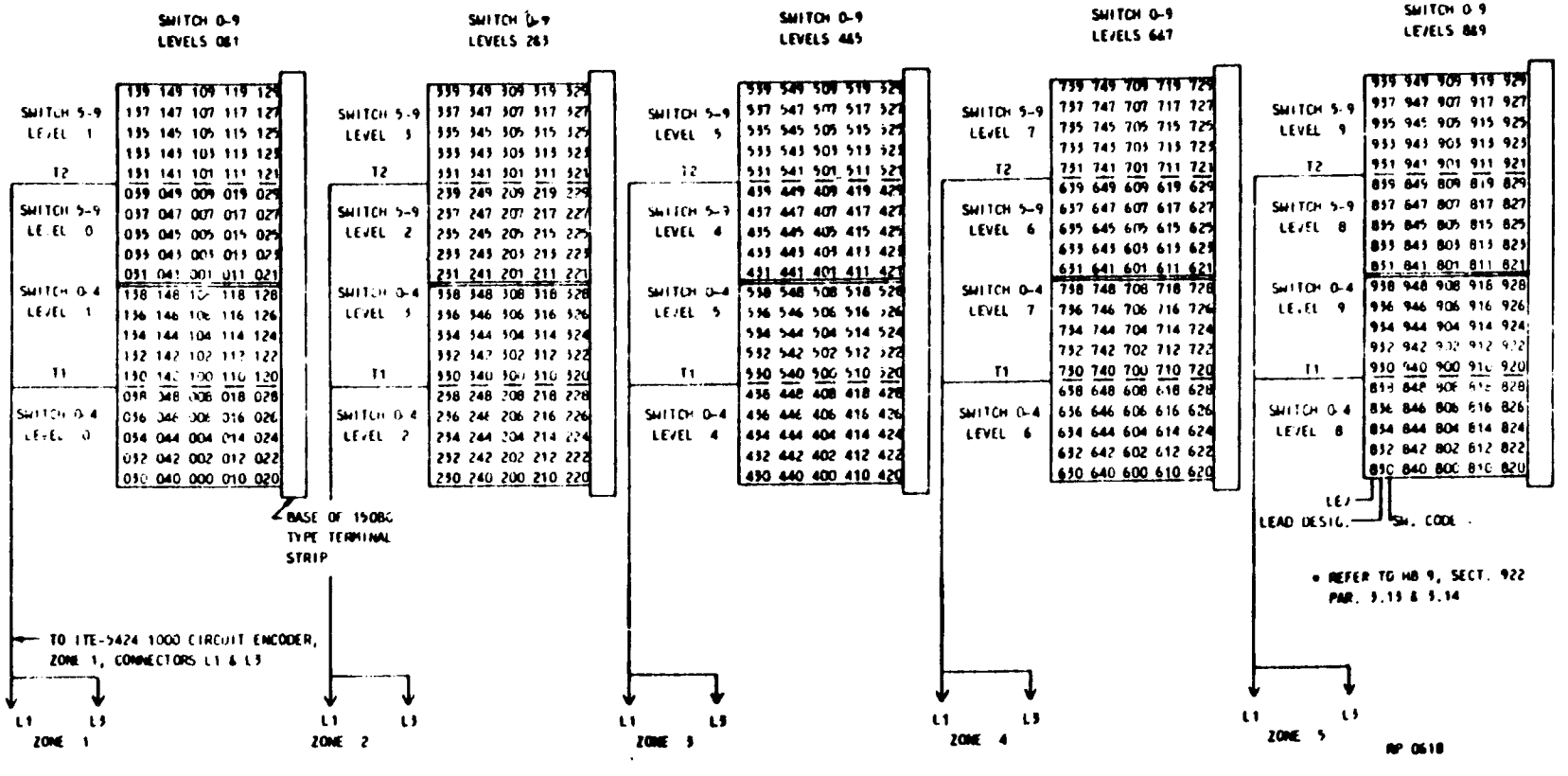


FIG. 7 DISPLAY IMAGES ASSOCIATED WITH ITE-9220 CORD (PAR. 3.14)

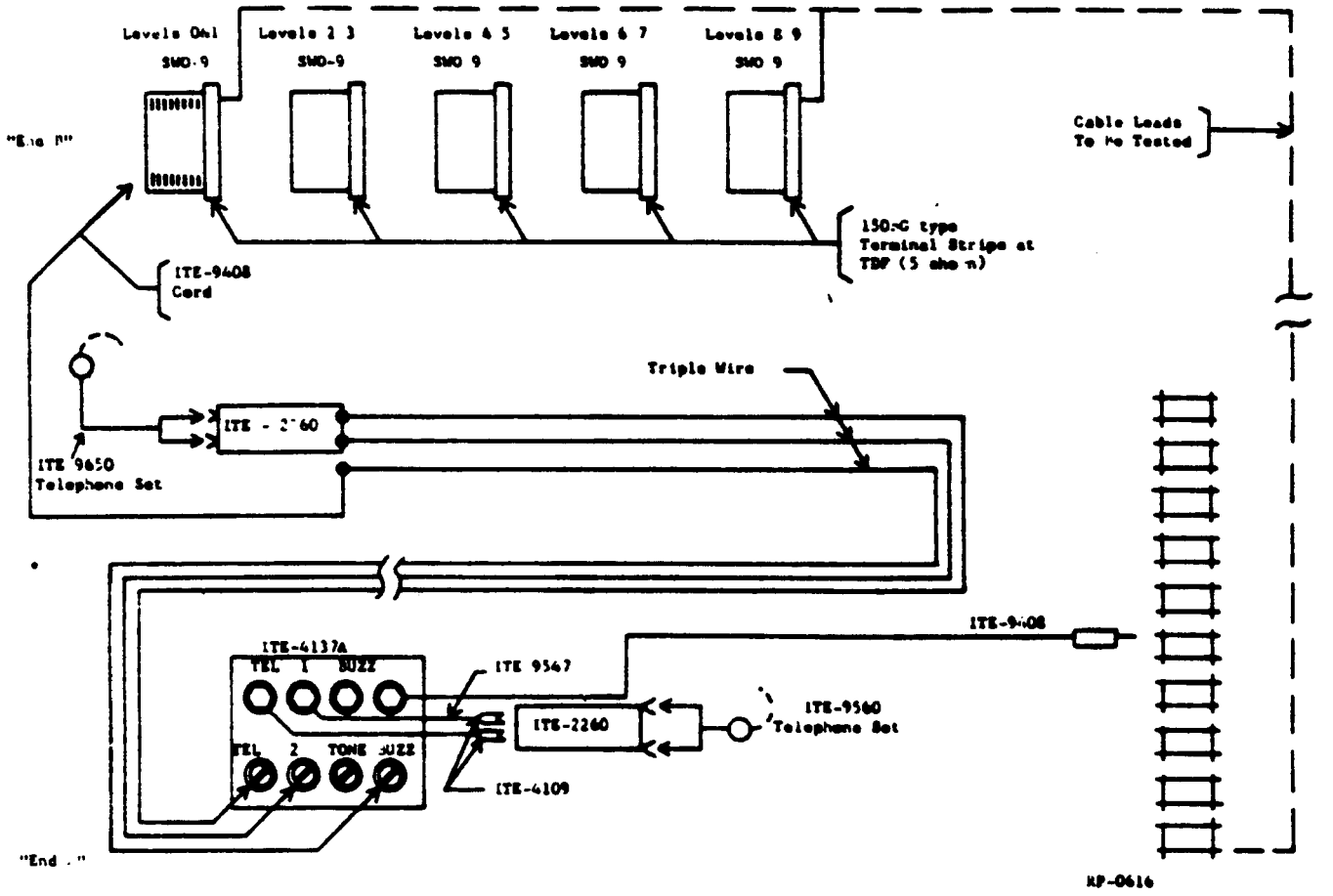


FIG. 8 BUZZING - ITE-4137A AC CONTINUITY TEST SET
(PAR. 3.19)

Engineering Planning Manager
Common Installation Engineering