

SWITCHING SYSTEMS MANAGEMENT
STEP-BY-STEP OFFICES
WITH COMMON CONTROL
GENERAL DESCRIPTION

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1. INTRODUCTION

1.01 This section describes in general terms TOUCH-TONE calling and common control equipment for use in step-by-step No. 1, 350A, and 355A offices. (See Fig. 1.)

1.02 When this section is reissued, this paragraph will contain the reason for reissue.

1.03 Since TOUCH-TONE calling and common control outpulsing employ the same general organization of circuitry when applied to step-by-step switching systems, they can conveniently be incorporated into a single package of equipment.

1.04 Common control outpulsing for step-by-step offices provides an economical means of achieving uniform dialing procedures for direct distance dialing and extended area service; trunk economy through translation, code conversion, and alterate routing; multifrequency signaling to other switching offices; and improved maintenance facilities.

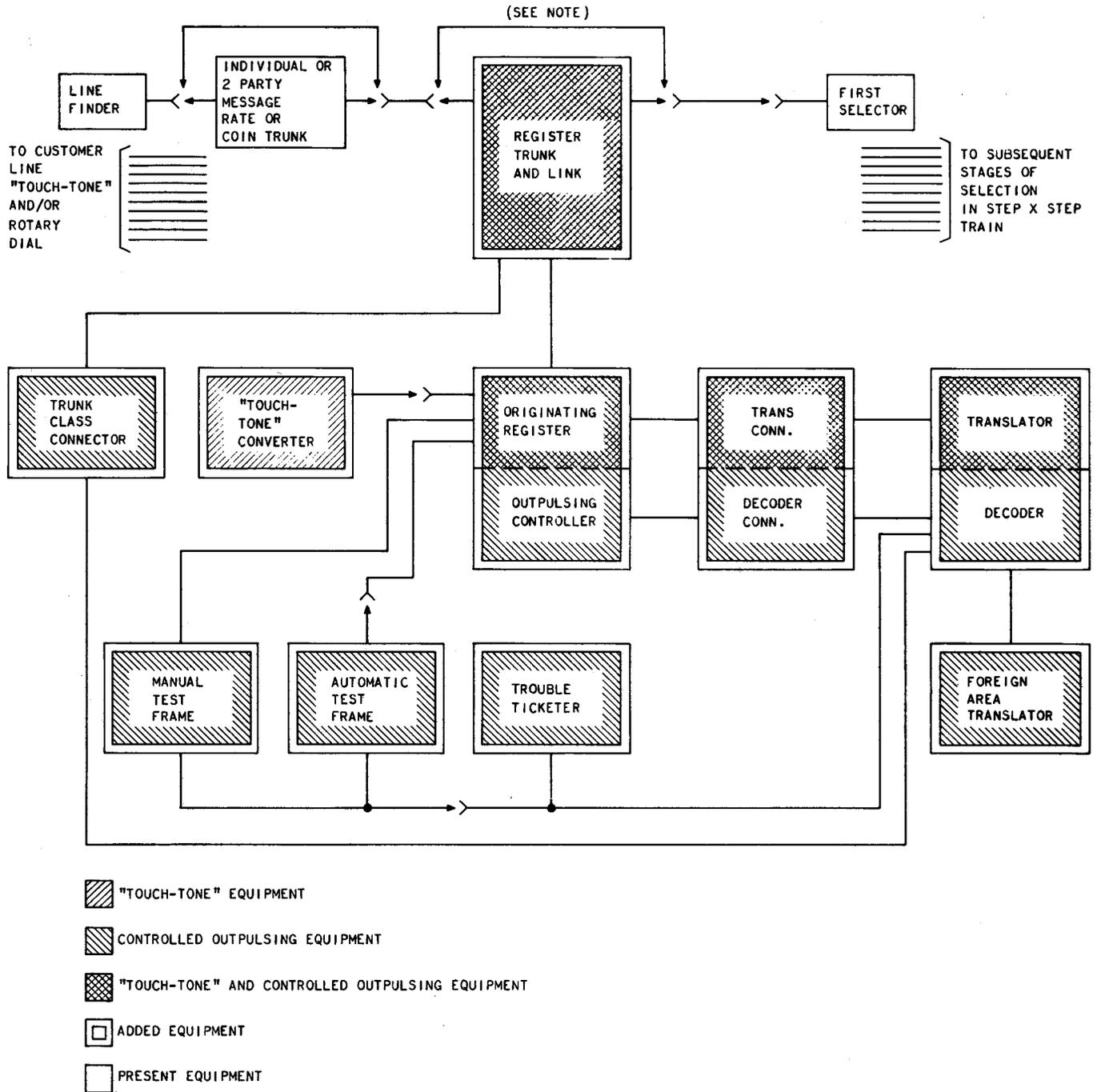
1.05 The need for uniform dialing procedures is a result of the introduction of a new numbering plan to be used in nationwide direct distance dialing. This numbering plan was derived so that a maximum of 11 digits would be required for a customer to reach any desired number. Common control also allows the step-by-step system equipment to deal with 0 or 1 access digits as a prefix to direct distance dialing calls and to handle interchangeable office and area codes.

1.06 TOUCH-TONE calling and common control outpulsing equipment will be made available for step-by-step offices in three basic configurations. One configuration will provide equipment for an office to serve TOUCH-TONE customers as well as rotary dial customers but will not include controlled outpulsing. This configuration will be referred to in this section as TOUCH-TONE calling equipment. The other two configurations will provide an office with controlled outpulsing features and may or may not include equipment for serving TOUCH-TONE customers. These two configurations will be referred to in this section as controlled outpulsing with TOUCH-TONE calling or controlled outpulsing without TOUCH-TONE calling.

1.07 The equipment to be added to step-by-step offices to provide for TOUCH-TONE calling is as follows:

- (a) Register trunk and link
- (b) TOUCH-TONE converters
- (c) Originating registers
- (d) Translator connectors
- (e) Translators
- (f) Manual test set or automatic test frame
- (g) Jack, key, and lamp circuit
- (h) TOUCH-TONE dial tone supply
- (i) TOUCH-TONE service observing

In addition to the equipment required for TOUCH-TONE calling, the following equipment will be added for controlled outpulsing.



NOTE:
 LINE FINDERS SERVING ROTARY DIAL ONLY CUSTOMERS, FOR "TOUCH-TONE" CALLING WITHOUT CONTROLLED OUTPULSING, BY PASS REGISTER TRUNK AND LINK, AND ARE CONNECTED DIRECTLY TO FIRST SELECTORS

Fig. 1—TOUCH-TONE and Controlled Outpulsing Equipment for Step-by-Step

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- (a) Outpulsing controllers (combined with originating registers)
- (b) Decoder connectors (combined with translator connectors)
- (c) Decoder (combined with translators)
- (d) Foreign area translators (optional)
- (e) Trunk class connectors
- (f) Trouble ticketer
- (g) Manual test set, automatic test set, or automatic test frame.

For controlled outpulsing without TOUCH-TONE, the TOUCH-TONE converter, TOUCH-TONE dial tone supply, and TOUCH-TONE service observing equipment listed above is not required.

2. EQUIPMENT UNITS AND FRAMES

2.01 The equipment units and frames for both TOUCH-TONE calling and controlled outpulsing will be described in this part. Included within each description will be an explanation of the application of each unit or frame for TOUCH-TONE calling or controlled outpulsing with or without TOUCH-TONE calling.

A. Register Trunk and Link Circuit Frames (Fig. 2 and 3)

2.02 The register trunk and link is used for TOUCH-TONE calling and/or controlled outpulsing and is introduced in step-by-step offices between line finders and first selectors. It provides access from line finders to common control system equipment and from common control system equipment to first selectors. During the talking portion of a call, the register trunk and link bypasses common control system equipment and provides talking paths between line finders and selectors. Line finders may be segregated into groups: those serving TOUCH-TONE customers and those serving rotary dial only customers. These groups can be arranged so that the register trunk and link will provide access to originating registers with associated TOUCH-TONE converters for line finders serving TOUCH-TONE customers. For TOUCH-TONE calling, rotary dial only customers are served by line finders which bypass the register

trunk and link and are connected directly to first selectors. If a link group serves TOUCH-TONE and dial pulse calls, then all the originating registers must have associated TOUCH-TONE converters.

2.03 The register trunk and link provides 1000 line finders (maximum) and their associated first selector switches access to 50 (maximum) originating register and outpulsing controller circuits on a selection basis. The line finders appear on the verticals of crossbar switches in the primary register trunk and link frame; originating register and outpulsing controllers appear on the horizontals of crossbar switches in the secondary register trunk and link frame. There may be as many as ten primary frames associated with one secondary frame. The frames are cabled together with primary frame switch horizontals connected to secondary frame switch verticals. When more than one primary frame is used, the additional frame(s) horizontals are multiplied with the first primary frame.

2.04 When fully equipped, each 11-foot 6-inch register trunk and link frame (Fig. 2) contains ten 200-point crossbar switches (ten switches in each primary frame and ten switches in the secondary frame), associated control circuits, and cross-connection fields. Each fully equipped primary frame added provides 10 additional 200-point crossbar switches for the appearance of 100 additional line finders until as many as 10 primary frames are added, and 1000 line finders can be served. For fully equipped offices using 9-foot 0-inch frames (Fig. 3), a supplementary secondary frame is required.

B. Originating Registers

2.05 In offices equipped for TOUCH-TONE calling but not requiring controlled outpulsing for a TOUCH-TONE call, a TOUCH-TONE converter will convert the TOUCH-TONE signals and an originating register will generate corresponding dial pulses to operate the step-by-step switches. The register receives all of the customer's dial information and remains attached until it has outpulsed the required number of digits, determined by a translator (11 maximum under new numbering plan). For a rotary dial call, after completion of dialing a single digit, the originating register will pulse repeat this digit and release, leaving the switch train under control of the originating customer.

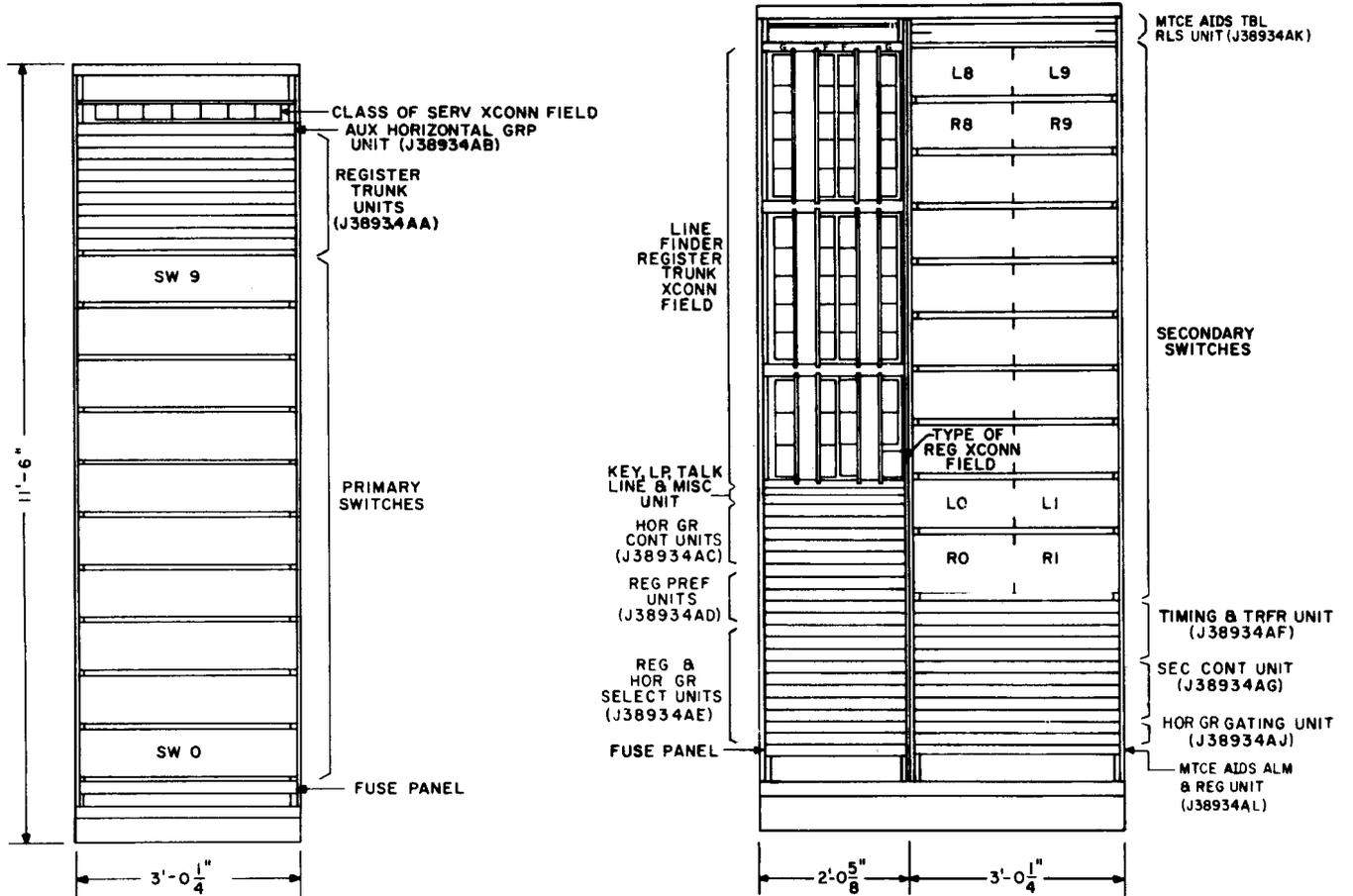


Fig. 2—Register Trunk and Link, Primary, and Secondary Frames (11 Feet 6 Inches)

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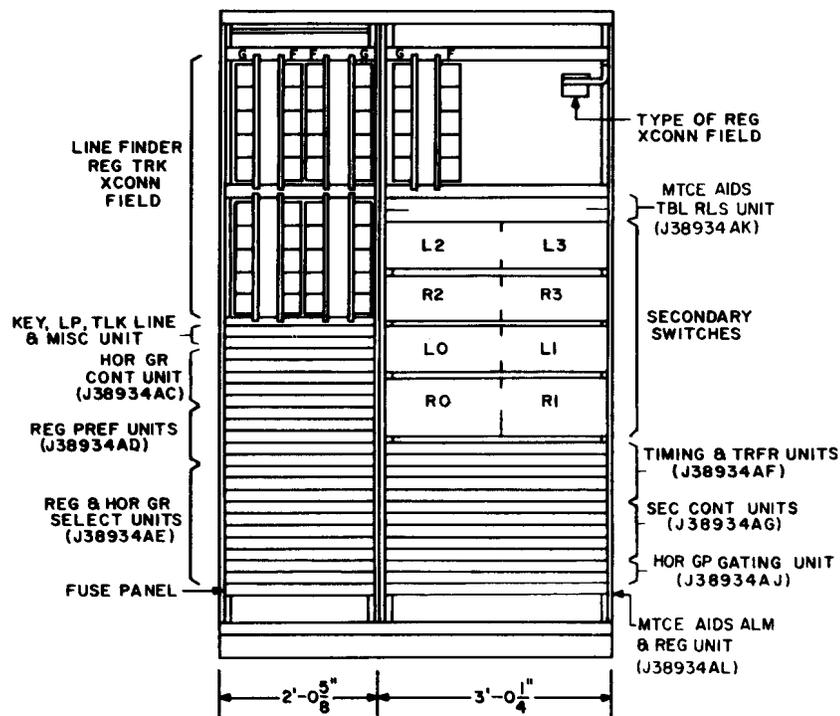
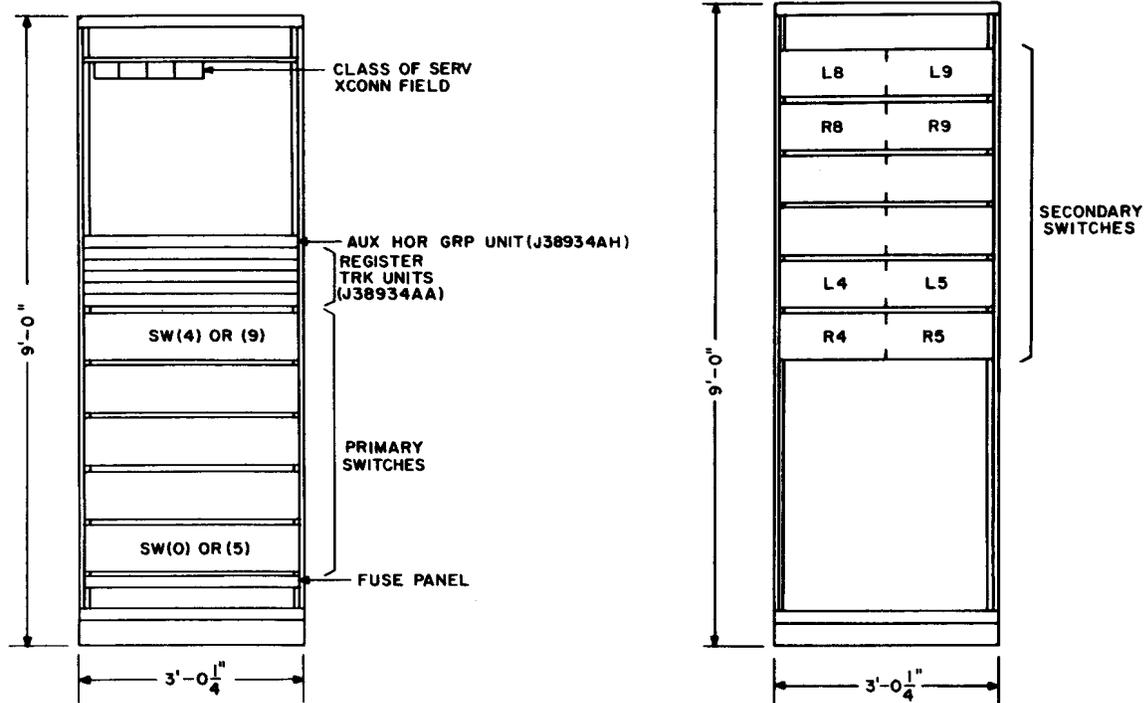


Fig. 3—Register Trunk and Link, Primary, Secondary, and Supplementary Secondary Frames (9 Feet 0 Inches)

2.06 In offices equipped for controlled outpulsing, originating registers will be combined with outpulsing controllers described in 2.09 and 2.10. When outpulsing controllers are supplied, an originating register will be capable of recording dial information for a rotary dial customer as well as a TOUCH-TONE customer. The originating register outpulsing controller will usually wait for three digits (four with 0 or 1 prefix) to be received before calling for a translator decoder to determine if controlled outpulsing is required. The register may have the option of sampling the initial digit (0 through 9) and determining two courses of action:

- (a) Controlled outpulsing is never required, or
- (b) Controlled outpulsing is always required.

2.07 Originating registers are normally arranged in subgroups of ten (maximum) registers so that five (maximum) subgroups serve up to 1000 line finders.

2.08 Originating registers and outpulsing controllers are mounted three to an 11-foot 6-inch frame (Fig. 4) or two to a 9-foot 0-inch frame.

C. Outpulsing Controllers

2.09 The outpulsing controller is a common control outpulsing circuit which directs outpulsing the indicated arbitrary digits followed by the required number of digits to complete a call. The outpulsing controller can provide outpulsing in the form of dial pulses or multifrequency pulsing and is advised by the decoder the type of outpulsing required and furnished with the arbitrary digits to gain access to the appropriate route as determined by the decoder. It can also recall the translator and decoder for alternate routing in case of a busy on the original route.

2.10 Outpulsing controllers are directly associated with originating registers in an office equipped for controlled outpulsing and, as mentioned in 2.08, are mounted in the same frame.

D. TOUCH-TONE Converters

2.11 The TOUCH-TONE converter is used to convert TOUCH-TONE signals from a customer's station set into information in a form which can be registered in an originating register. The TOUCH-TONE converter employs a TOUCH-TONE

receiver circuit that functions as a frequency selective detector; the TOUCH-TONE converter converts the 4-by-3 ac TOUCH-TONE signals into a 2-out-of-5 dc code.

2.12 TOUCH-TONE converters are directly associated with originating registers that serve TOUCH-TONE link group and are not required for a link group serving rotary dial calls only.

2.13 TOUCH-TONE converters (Fig. 5) are mounted with as many as 20 to an 11-foot 6-inch frame or 14 to a 9-foot 0-inch frame.

E. Translator Connector Frames (Fig. 6)

2.14 Translator connectors connect one originating register at a time to one translator on a preference basis. Translator connectors are used for TOUCH-TONE calling and/or controlled outpulsing. One translator connector connects a maximum of 20 originating registers to a maximum of 9 translators.

2.15 When fully equipped, each 11-foot 6-inch translator connector frame will mount five translator connectors, and each 9-foot 0-inch frame will mount three translator connectors.

F. Decoder Connector Frames (Fig. 7)

2.16 Decoder connectors connect one originating register outpulsing controller to one decoder at a time. The decoder connector functions with an associated translator connector as each translator is associated with a unique decoder for controlled outpulsing operation. One decoder connector connects a maximum of 20 originating register outpulsing controllers to a maximum of 9 decoders.

2.17 When fully equipped, each 11-foot 6-inch frame will accommodate 14 decoder connectors and each 9-foot 0-inch frame will accommodate 10 decoder connectors.

G. Translator and Decoder, Route Relay, and Supplementary Decoder Frames (Fig. 8, 9, and 10)

2.18 Translators are used for TOUCH-TONE calling. Translators, decoders, and route relays are used when controlled outpulsing may be required by TOUCH-TONE and rotary dial customers.

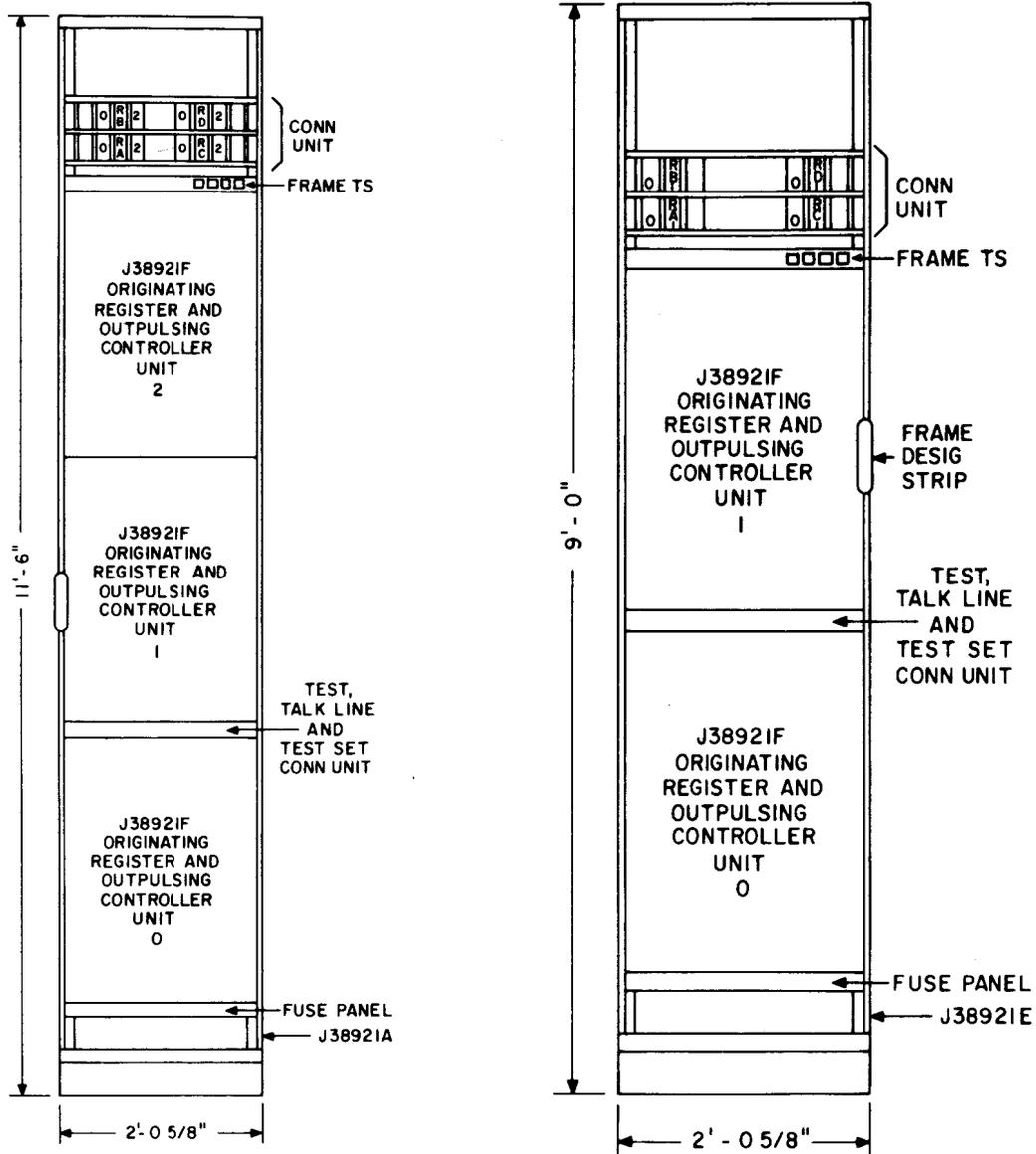


Fig. 4—Originating Register and Outpulsing Controller Frames

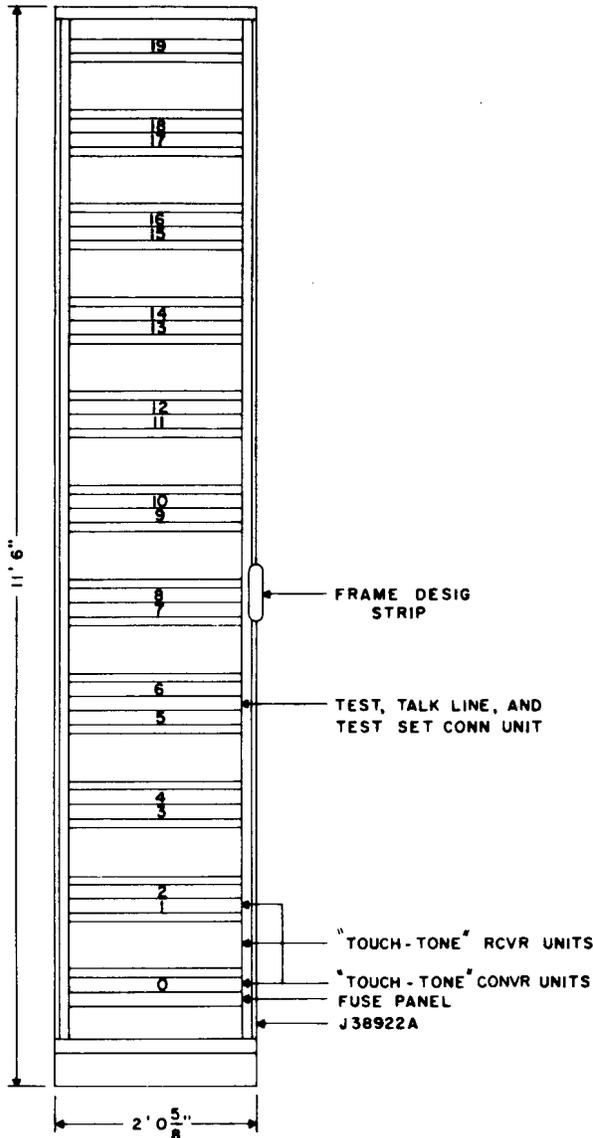


Fig. 5—TOUCH-TONE Converter Frames

2.19 The purpose of a translator in TOUCH-TONE calling is to translate the first three digits (exclusive of prefix digit) of any called number to determine the expected number of digits in that number. With the new numbering plan, these digits may represent an area, office, or service code. A translator may also advise the originating register that the first three digits are an interchangeable code; that is, a number structure which is not uniquely an area or office code, and therefore the originating register will have to determine by timing when the complete number has been received.

2.20 The purpose of a translator in controlled outpulsing with or without TOUCH-TONE calling is to provide 3-digit code translation to its associated decoder. If codes in an adjacent foreign area are to be translated and decoded, a translator also provides the means of registering and forwarding the office code information to foreign area translators associated with the decoder.

2.21 The purpose of a decoder and associated route relays is to convert the 3-digit information supplied by the translator into routing instructions for the originating register and outpulsing controller.

2.22 Translators, decoders, and route relays are mounted in the same frame when 11-foot 6-inch frames are used (Fig. 8). The frame can mount one translator, one decoder, and associated route relays. When the 9-foot 0-inch frame is used (Fig. 9), an additional frame is required to mount the route relays. The translator decoder frame mounts only the translator and decoder.

2.23 The supplementary decoder frame expands the decoder circuit's capacity in route relays, route supplementary relays, and class-of-service screening points (Fig. 10). One supplementary frame can serve two decoder frames.

2.24 The supplementary decoder frame is 11 feet 6 inches. There have been no provisions for a 9-foot 0-inch frame.

H. Foreign Area Translator Frames (Fig. 11)

2.25 A foreign area translator is used with a translator and decoder as optional equipment for controlled outpulsing with or without TOUCH-TONE calling. This unit will provide an additional 3-digit translation so that a total of six digits may be translated for a direct distance dialing call. It will perform the office code translation in a foreign area. The foreign area translator also makes office code validity checks on 10- or 11-digit calls.

2.26 When fully equipped, each 11-foot 6-inch frame will mount four foreign area translators and each 9-foot 0-inch frame will mount three.

I. Manual Test and Trouble Ticketer Frames (Fig. 12)

2.27 A manual test and trouble ticketer frame is intended to be used in offices where an automatic test frame is not required. When the

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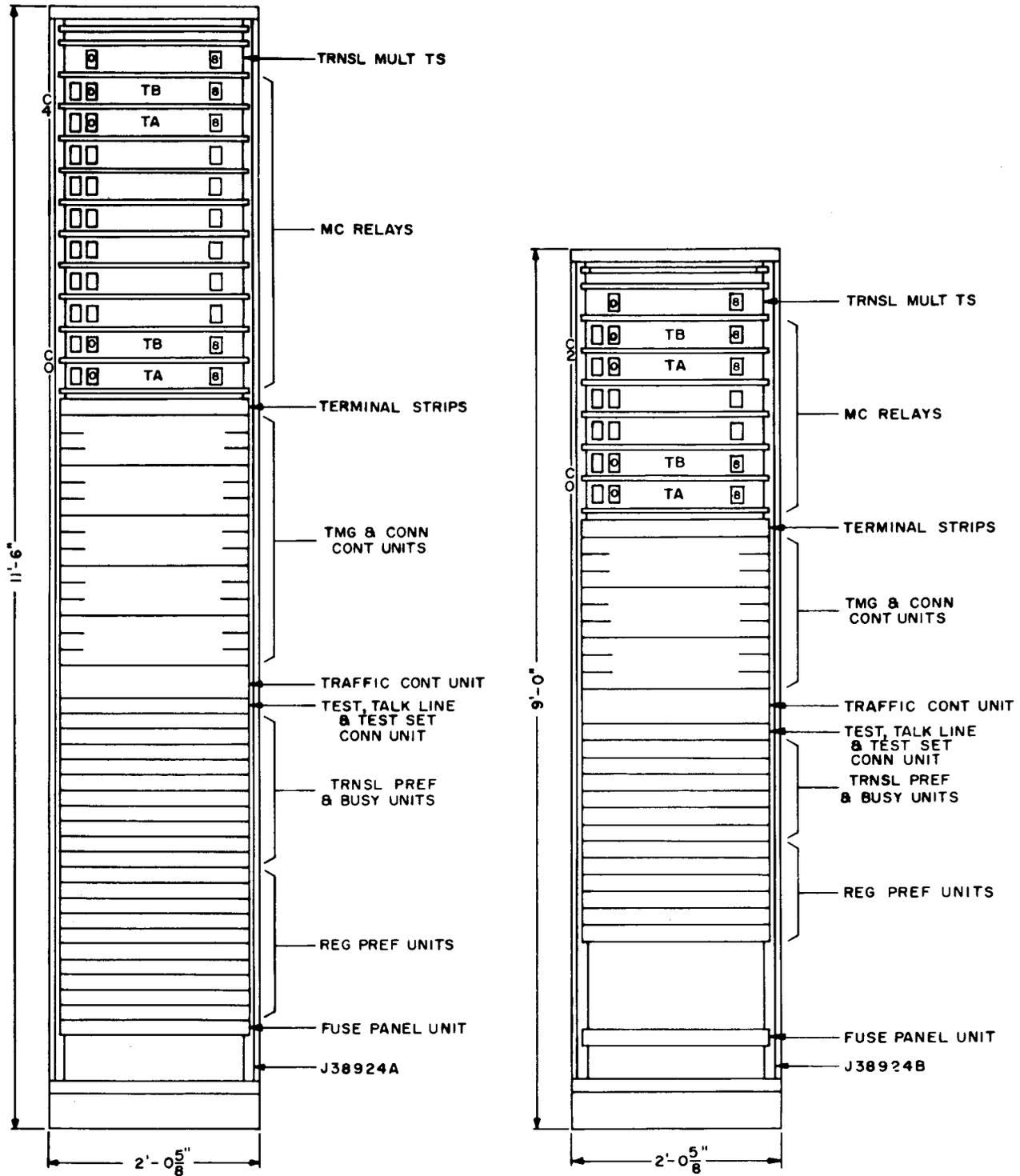


Fig. 6—Translator Connector Frames

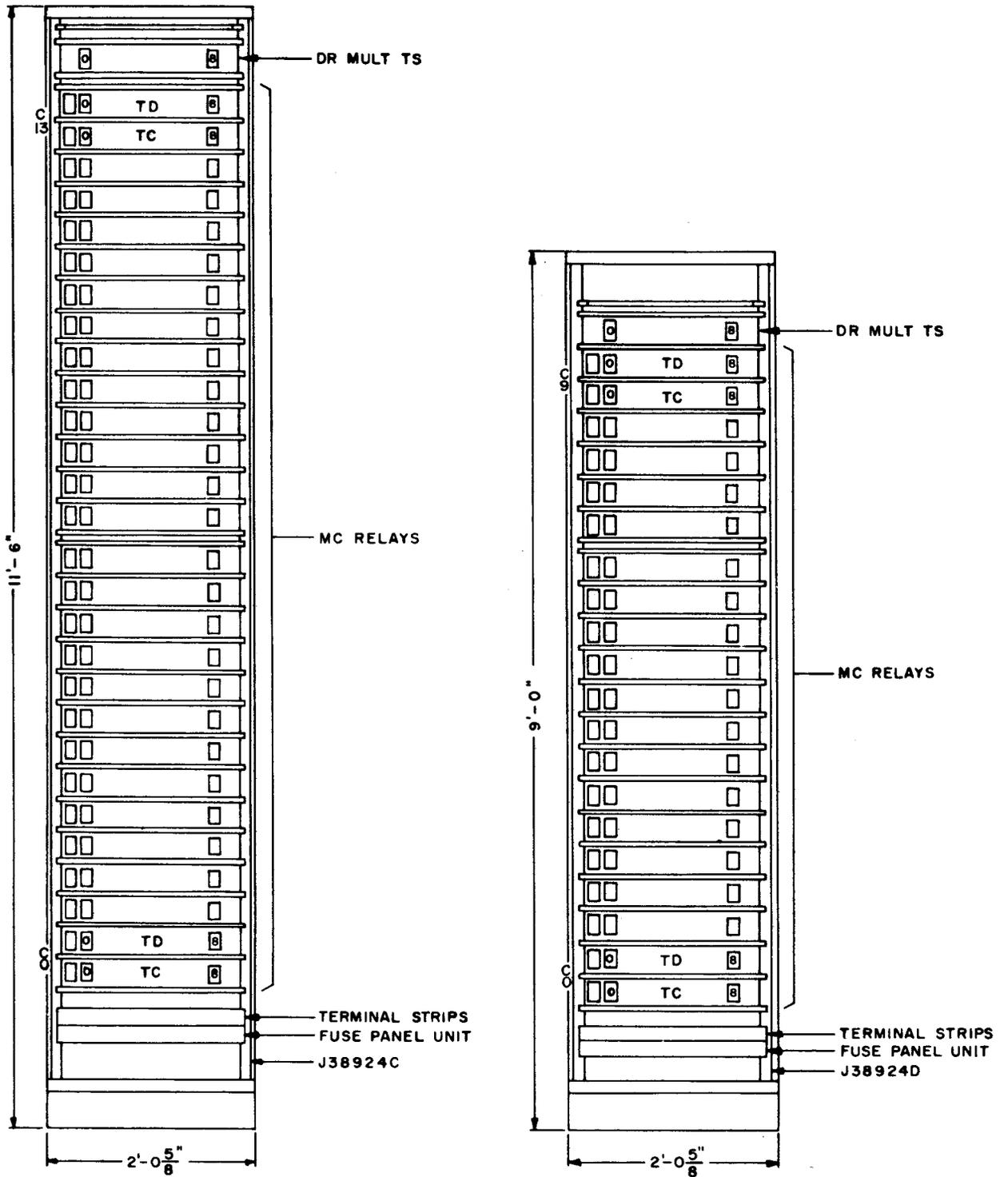


Fig. 7—Decoder Connector Frames

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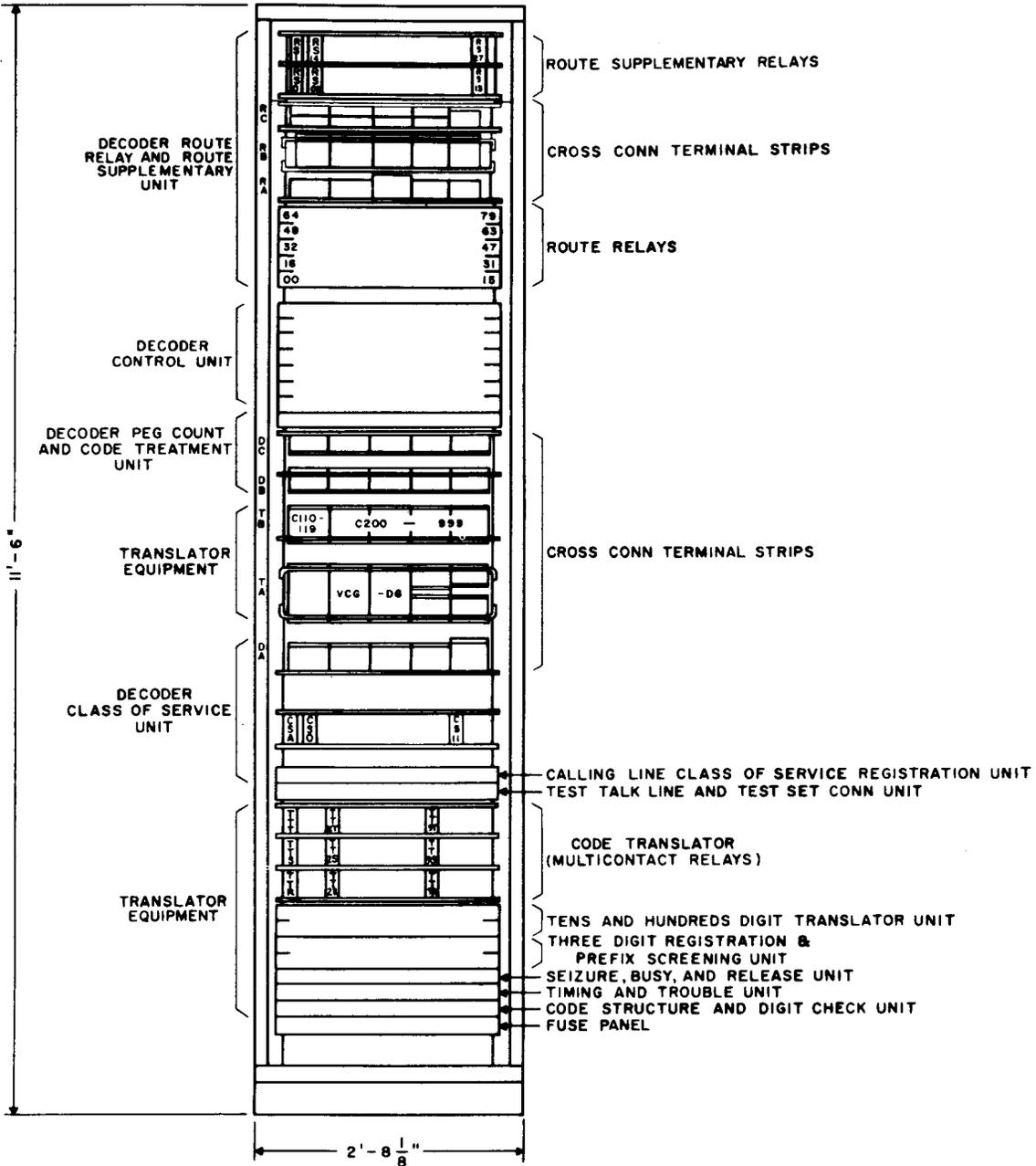


Fig. 8—Translater and Decoder Frame (11 Feet 6 Inches)

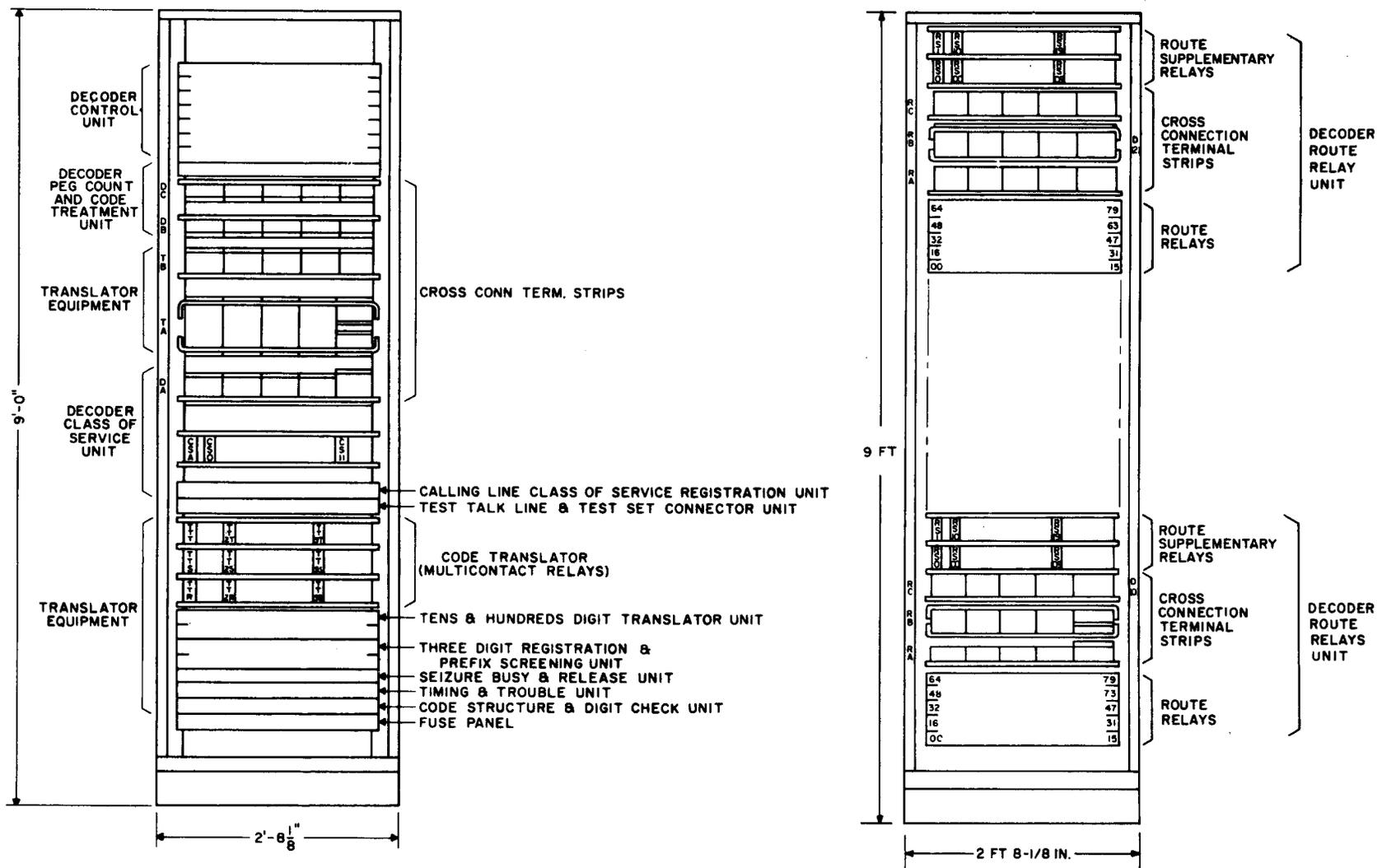


Fig. 9—Translator and Decoder and Route Relay Frame (9 Feet 0 Inches)

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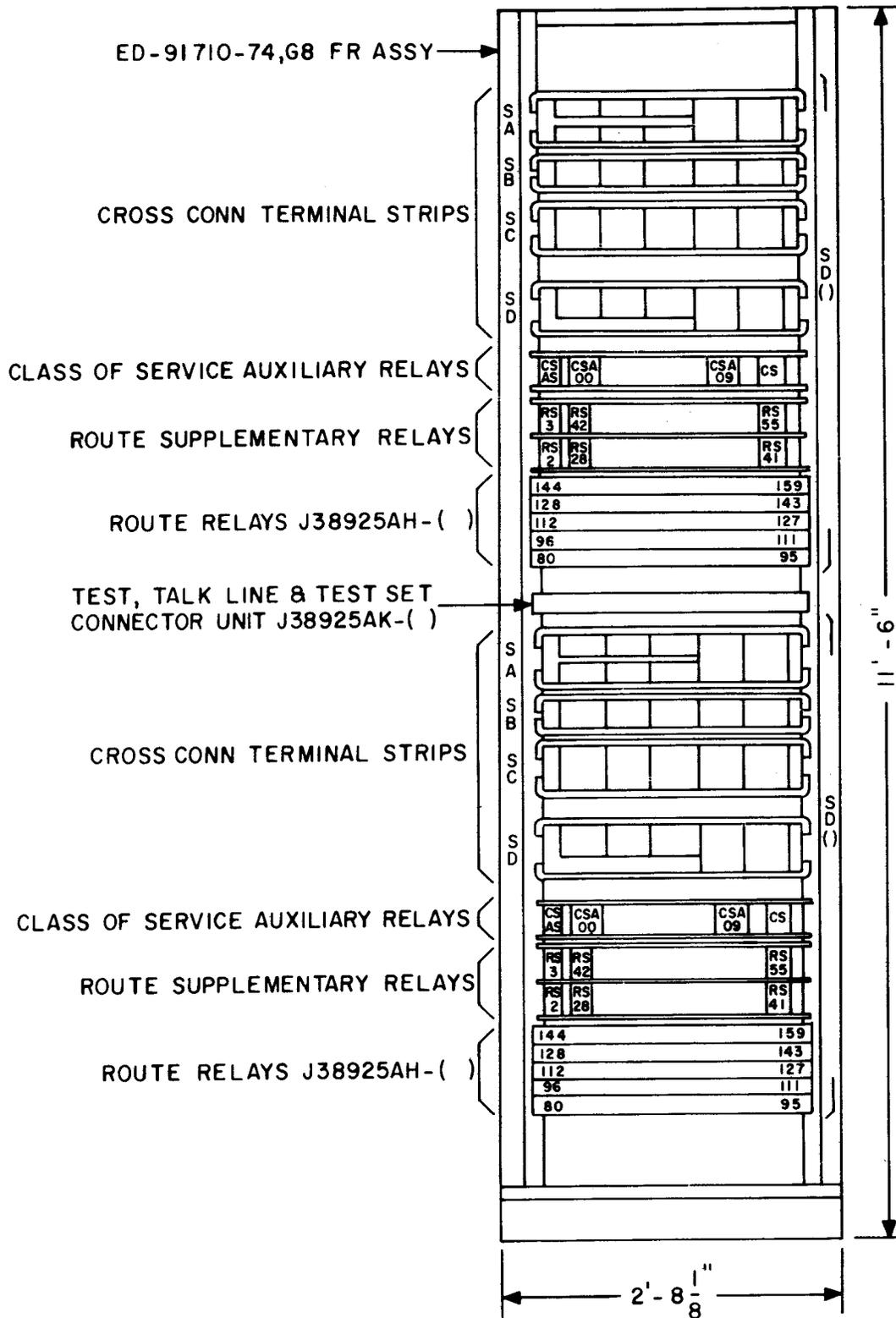


Fig. 10—Supplementary Decoder Frame

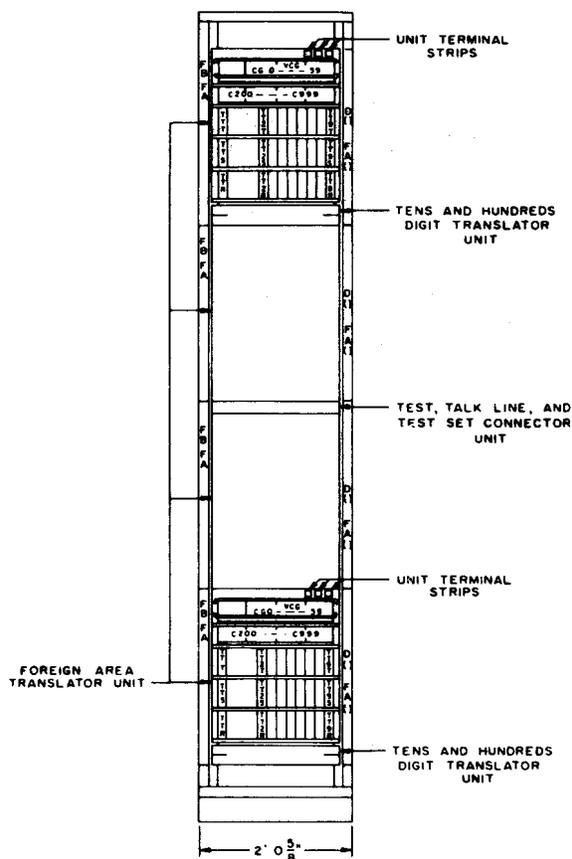


Fig. 11—Foreign Area Translator Frames

automatic test frame is used, the manual test and trouble ticketer frame is supplied without the manual test circuit. Manual test and trouble ticketer frames are available in two sizes: 11 feet 6 inches and 9 feet 0 inches. The 9-foot 0-inch frame is a double-bay frame to mount the same equipment contained in the 11-foot 6-inch single bay frame.

2.28 A manual test and trouble ticketer frame contains the following circuits.

- (a) **Manual Test Circuit:** This circuit is used in conjunction with its portable test set to test TOUCH-TONE calling and controlled outpulsing circuits. This circuit is required for both TOUCH-TONE calling and for controlled outpulsing with or without TOUCH-TONE.
- (b) **Multifrequency Receiver Circuit:** This circuit is used in conjunction with the manual test circuit as well as the automatic test circuit. It converts the multifrequency outpulsing from

the originating register into dc signals which can be verified through the test circuit. This circuit is not required for TOUCH-TONE calling, but is required for controlled outpulsing with or without TOUCH-TONE.

- (c) **Trouble Ticketer Circuit:** This circuit prints trouble and maintenance tickets for decoders and is required for controller outpulsing with or without TOUCH-TONE, but not for TOUCH-TONE calling.

- (d) **Jack, Key, and Lamp Circuit:** This circuit acknowledges and identifies trouble ticketer alarm requests from decoders. In addition, it provides identification, busy, alarm, and guard lamps along with test and make-busy jacks. It also provides keys for removing equipment from service and for testing purposes.

- (e) **Miscellaneous Circuit:** This circuit provides a multiple appearance of the switchman talk line circuit (SP) jack and (RC) jack.

2.29 The test, talk line, and test set connector unit is furnished on the translator, translator connector, TOUCH-TONE converter, originating register and outpulsing controller, decoder, supplementary decoder, and foreign area translator frames. The test set connectors are repeated on frames as necessary to allow testing from any frame location with the 12-foot long cords furnished with the test set.

J. Automatic Test Frame (Fig. 13 and 14)

2.30 The automatic test frame accommodates all equipment for one automatic test circuit. It can be used in offices with controlled outpulsing with or without TOUCH-TONE or in offices with TOUCH-TONE calling only. When an automatic test frame is used, the manual test frame is supplied without the manual test circuit. The automatic test frame will have associated with it a multifrequency receiver; trouble ticketer; jack, key, and lamp circuit; and miscellaneous circuits.

2.31 The automatic test frame is available in an 11-foot 6-inch single-bay frame or a 9-foot 0-inch double-bay frame.

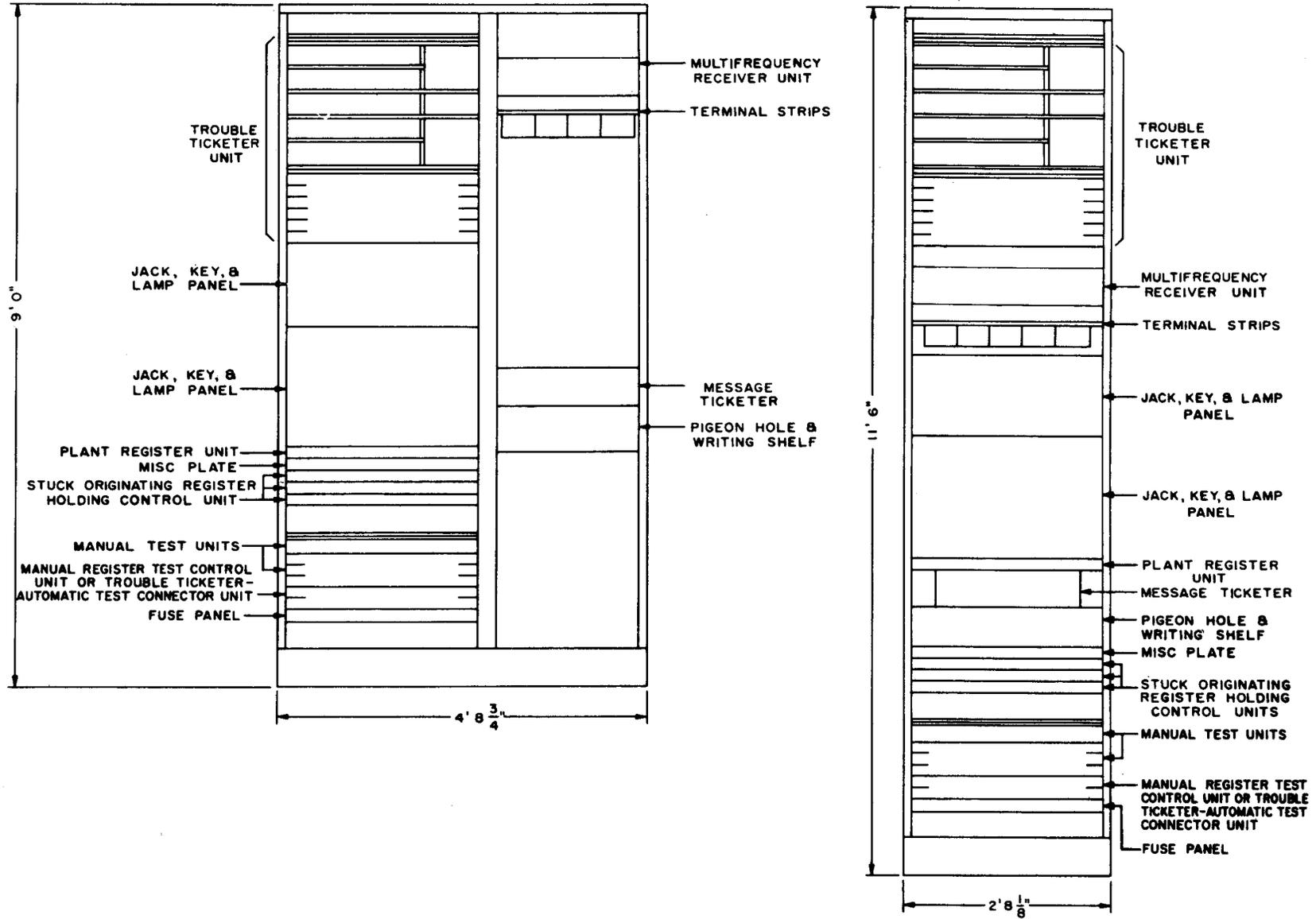


Fig. 12—Manual Test and Trouble Ticketer Frames

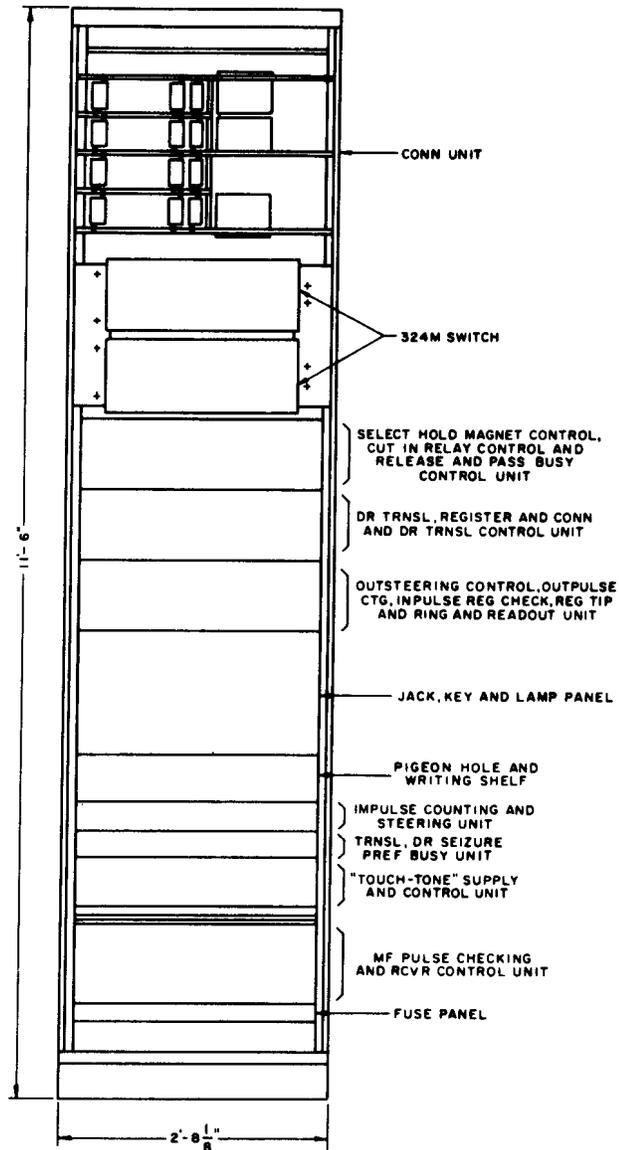


Fig. 13—Automatic Test Frame (11 Feet 6 Inches)

K. Miscellaneous Equipment

2.32 There are two units of equipment used in common control system installation which have no specific frame mounting location. The two units are as follows.

(a) **Party Test Unit:** Consists of two party test circuits to function with two originating register circuits. The party test unit is required

in automatic message accounting or automatic number identification offices with 2-party flat rate lines.

(b) **Trunk Class Connector:** This unit functions to give the decoder access to register trunk and link for obtaining trunk class information. There is a maximum of ten trunk class marks available.

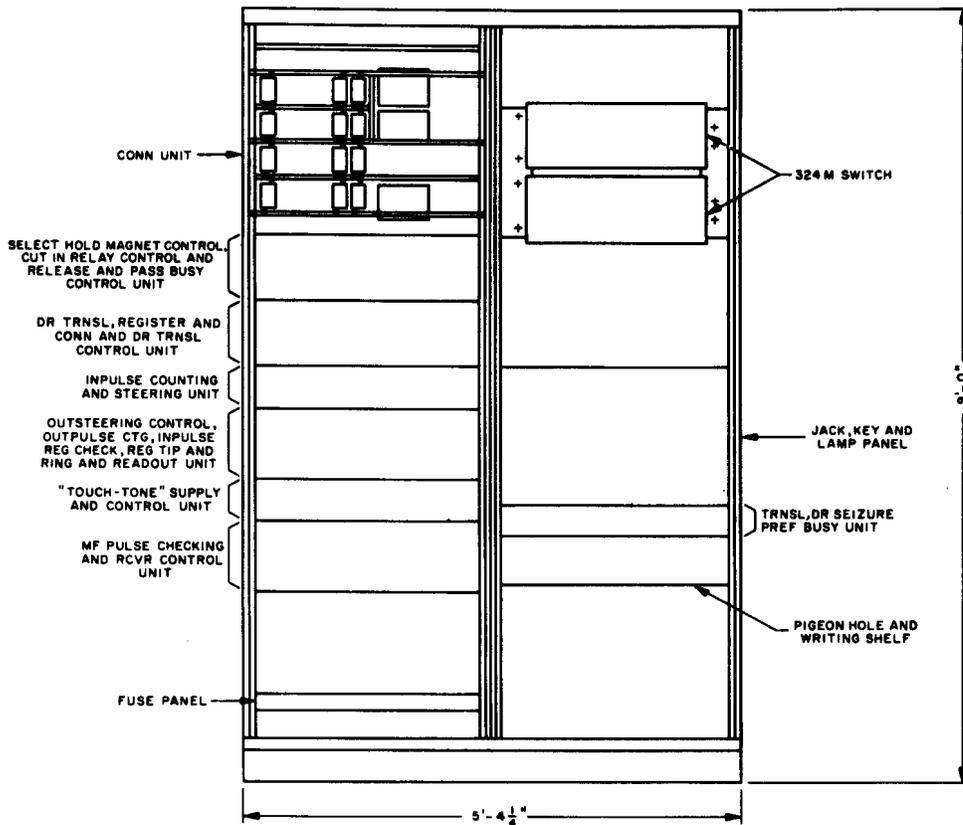


Fig. 14—Automatic Test Frame (9 Feet 0 Inches)

L. Trunks

2.33 Equipment layouts for new trunks arranged for common control system operation will be provided as follows:

- (1) Outgoing automatic number identification, dial pulse and multifrequency pulsing, E and M signaling, loop signaling, person-to-person, or station-to-station
- (2) Permanent signal holding trunks.

M. Dial Tone Supply

2.34 A new dial tone supply is required to supply a standard dial tone in all offices which offer TOUCH-TONE calling since the existing dial tone supply will block the reception of the initial TOUCH-TONE digit. The new dial tone, a

combination of two frequencies, 350 and 440 Hz, will serve the entire office for both TOUCH-TONE and rotary dial customers. For TOUCH-TONE calling without controlled outpulsing, the dial tone will be supplied to originating registers for TOUCH-TONE groups and to first selectors for non TOUCH-TONE groups. For controlled outpulsing with TOUCH-TONE, the dial tone will be supplied to originating registers.

3. METHOD OF OPERATION

3.01 The equipment elements used in TOUCH-TONE calling with controlled outpulsing are shown in Figure 1. The method of operation will be discussed for an office equipped for TOUCH-TONE calling only and an office equipped for controlled outpulsing, with or without TOUCH-TONE calling. As necessary throughout the method of operation, the new numbering plan will be discussed.

**A. Description of TOUCH-TONE or Rotary Dial Call
(Office Equipped for TOUCH-TONE Calling Without
Controlled Outpulsing)**

3.02 A customer originates a call. This customer may be a rotary dial customer or a TOUCH-TONE customer. If the customer is associated with a group of line finders serving rotary dial only, a line finder locates the calling line and connects it to the first selector and the call is served as in any other step-by-step office. If the customer is associated with a group of line finders serving TOUCH-TONE and rotary dial customers, a line finder finds the calling line and connects it to a first selector via the register trunk and link.

3.03 The register trunk and link splits tip and ring leads between the line finder and first selector and connects these leads to an idle originating register. The register makes a party test when required and then transmits dial tone to the calling customer.

3.04 When the calling customer is a rotary dial customer, the originating register recognizes dial pulsing, repeats the first digit to the switch train, and then releases. The call is served as any other step-by-step call. When the calling customer is a TOUCH-TONE customer, the TOUCH-TONE converter responds to signals keyed by the TOUCH-TONE customer. The TOUCH-TONE converter converts the 4-by-3 ac code to a 2-out-of-5 dc code and passes it to the originating register. The originating register is capable of recording from 1 to 11 digits, since under the new numbering plan there may be a maximum of 11 digits in a direct distance dialing call. The originating register records the converted digits in its digit register. Outpulsing is started immediately after receiving the first digit. Outpulsing is accomplished by reading out the stored digits in the form of dial pulses. These dial pulses operate the switch train in the same manner that customer dial pulses operate the train in present step-by-step offices.

3.05 The originating register requires the services of a translator to advise how many digits to expect. After three (no prefix) or four (0 or 1 prefix) digits have been registered, the register seizes an idle translator via the translator connector. The translator can, on the basis of the first three digits (exclusive of prefix), advise the register how many digits to expect. Under the new numbering

plan, these digits may be an office code, area code, or service code. The translator will give the register one of the following translations: 3-digit, 4-digit, 5-digit, 7-digit, 10-digit code, vacant code, or interchangeable code. In the case of an interchangeable code translation, the translator cannot advise the register how many digits to expect since the new numbering plan will allow office codes and area codes to be of the same number structure. Under these conditions, the translator will give an interchangeable code translation and the register will be required to time after the eighth digit to determine when the complete number has been registered.

3.06 If the first digit keyed is a 0, the register will outpulse the 0 digit and time for approximately 3.5 seconds. If no more digits are received within this time, the register will release without calling for a translator. The register optionally can release immediately after outpulsing the 0 digit.

3.07 After the translator passes information to the register about the expected number of digits, the translator sends a release signal to the register, which in turn releases the connection through the translator connector, allowing the translator to be released to serve another call. At the end of outpulsing, the register releases to serve other calls and the connection is cut through via trunk relays in the register trunk and link.

**B. Description of TOUCH-TONE or Rotary Dial Call
(Office Equipped for Controlled Outpulsing)**

3.08 A customer originates a call; a line finder in the line finder group with which the customer line is associated locates the calling line and connects it to the first selector via register trunk and link. The register trunk and link splits tip and ring leads between the line finder and first selector and connects these leads to an idle originating register. All the originating registers in a link group used for controlled outpulsing are arranged to provide service for TOUCH-TONE and rotary dial customers or rotary dial customers only. Registers with associated TOUCH-TONE converters can serve TOUCH-TONE as well as rotary dial calls while registers without TOUCH-TONE converters can serve rotary dial calls only.

3.09 The majority of originating calls will not require the use of the outpulsing controller.

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That is, the majority of calls will use the switch train in the normal manner, under control of a rotary dial customer, or use only the originating register and TOUCH-TONE converter to convert TOUCH-TONE signals to dc pulses to operate the switch train if the call is from a TOUCH-TONE customer. The decision to use or not to use the outpulsing controller is based on the code dialed and class-of-service of the customer. The originating register outpulsing controller will usually wait until three digits (four with 0 or 1 prefix) have been received before calling for a translator decoder to decide whether controlled outpulsing is required. Normally during registration of the three or four digits, they are being outpulsed to the switch train. When the translator decoder has determined that controlled outpulsing is required, the originating register outpulsing controller opens the loop to the switch train, releasing the selectors which have been set up. If, on the other hand, the translator decoder determines from examination of the three or four digits registered that controlled outpulsing is not required, then the originating register will release during the next interdigital interval. The register trunk and link will be cut through, and all subsequent rotary dialed digits will be handled by the step-by-step switch train in the usual manner.

3.10 In addition, the originating register may determine that controlled outpulsing is or is not required. The originating register looks at the initial digit (0 through 9) and from this translation provides two courses of action.

(a) ***Controlled outpulsing is never required.***

1. On rotary dial calls, the originating register outpulsing controller will cut through the path from the line finder to the first selector during the first interdigital interval and will release. The dial pulses from the customer dial directly control subsequent stages of selection. All calls to a particular initial digit (including 0 and 1) must be handled in an identical manner.
2. On TOUCH-TONE calls, the originating register accepts dc digit signals from the converter and outpulses the equivalent digits to the switch train at the rate of 10 pps. When three digits (four with 0 or 1 prefix) have been registered, the originating register calls for a translator decoder to determine how many digits to expect. After

outpulsing the last digit, the register outpulsing controller signals the register trunk and link circuit to cut through and release.

- (b) ***Controlled outpulsing will always be required.*** On rotary dial calls, the initial digit will be pulse repeated to the switch train and registered in the originating register. On TOUCH-TONE calls, the initial digit will be registered but not outpulsed. When the originating register translates the initial digit as requiring controlled outpulsing, it opens the loop toward the switch train, releasing the first selector and withholding further outpulsing. After receiving three digits (four with 0 or 1 prefix), the originating register calls for a translator decoder for routing information and completes the call according to the routing instructions received from the operated route relay in the decoder.

3.11 The decoder furnishes the outpulsing controller with the following information for properly routing the call:

- (a) Number of digits to be detected, if any
- (b) Arbitrary routing digits to be prefixed in order to reach the desired trunk group, either directly from the local switch train in its own office or through the local switch train and a step-by-step tandem beyond
- (c) The type of outpulsing required (dial pulse or multifrequency) following the dial pulse exit digits
- (d) Whether or not an alternate route is available so that if a busy condition is encountered before trunk selection, the outpulsing controller can recall the decoder for alternate routing instructions.

When a number has been dialed which contains 10 digits exclusive of the prefix and this number requires additional translation, the decoder has the capability of calling in a foreign area translator. The foreign area translator will look at the fourth, fifth, and sixth digits exclusive of prefix and advise the decoder about routing the call. Based on the 6-digit translation, the decoder operates an appropriate route relay. In addition to routing information, the foreign area translator can make office code validity checks. For example, if the fourth digit

exclusive of prefix in a 10-digit call is a 0 or 1, the call is blocked since this is the first digit of the office code and under the new numbering plan, no office codes will have a 0 or 1 first digit. An option is also provided for areas which do not have conflicting office and area codes to check the fifth digit exclusive of prefix for a 0 or 1. If there is a 0 or 1 present, the call will be blocked since no office codes under the present numbering plan have a 0 or 1 second digit. If new codes are added to an area, so that office codes conflict with area codes, this option is deleted.

3.12 After transmitting routing information to the outpulsing controller, the decoder releases. The outpulsing controller outpulses the required number of digits in the proper form (dial pulse and/or multifrequency) to complete the call. After outpulsing the last digit, the originating register releases to serve other calls, and the connection is cut through via trunk relays in the register trunk and link.

4. MAINTENANCE FEATURES

4.01 The basic provisions for maintenance consist of testing equipment for the various circuits of the common control equipment, arrangements for facilitating location of trouble occurring during service, and means of readily removing equipment from service without serious interruption. Most of the equipment used for these purposes is mounted on specific test frames (see Fig. 12, 13, 14.)

A. Maintenance Aids Circuit

4.02 The register trunk and link frames contain a maintenance aids circuit which provides a maintenance aids lamp panel. The maintenance aids lamp panel will provide a visual display of the path through the register trunk and link circuit which failed to connect to an originating register. The visual display identifies the horizontal group, primary frame, link, register subgroup, originating register, and controller (regular or emergency).

B. Manual Test Circuit

4.03 The function of the manual test circuit is to manually test TOUCH-TONE and common control system circuits. The manual test circuit is to be used in offices where automatic test equipment is not required.

4.04 The manual test circuit is used in conjunction with a portable test box. The tests may be performed at the test frame or at the frame of equipment under test. This is accomplished by patching the test box into any one of the appearances of belt line jacks and plugs. All circuits are provided with manual test facilities through an originating register. The manual test circuit is arranged to test the following circuits: originating registers, outpulsing controllers, trunk class connectors, TOUCH-TONE calling signal converters, translators, translator connectors, decoders, and decoder connectors. The manual test circuit can perform TOUCH-TONE tests and can also check the operation of the originating register and its associated equipment on party testing, rotary dial calls, translator, timing, reverting and service code calls, permanent signals, and partial dials.

C. Automatic Test Circuit

4.05 An automatic test circuit may be provided in offices with controlled outpulsing with or without TOUCH-TONE, or in offices with TOUCH-TONE calling only. The automatic test circuit has the capability of testing up to a maximum of 300 originating registers, 9-translator-decoder combinations, and their associated foreign area translators. Automatic progression from one originating register to the next is provided. Repeat tests of originating registers may be made. The automatic test circuit is also provided with a feature to allow direct access to translator decoders rather than gaining access to them through originating registers. These direct tests would be controlled on a manual basis. In automatic progress tests, the circuit will cause progression until end of test is reached or until trouble is encountered. If trouble is encountered, the test circuit will block and seize the trouble ticketer circuit, causing a record of the failure to be made and advance to the next originating register. If the trouble ticketer is made busy to the test circuit and trouble is encountered, the test circuit will remain blocked on the particular register in trouble and actuate on alarms. The automatic test circuit can test originating registers and associated equipment for the same functions described in 4.03 for the manual test circuit and, in addition, can perform routing information tests and perform tests directly on translator decoders and foreign area translators independent of associated originating registers.

SECTION 2b(2)

D. Trouble Ticketer

4.06 The function of the trouble ticketer is to automatically print out a record of trouble encountered by TOUCH-TONE calling and controlled outpulsing equipment during service or test calls. The trouble ticketer will be used in conjunction with the manual test circuit or the automatic test circuit. The trouble ticketer is called into operation by a decoder on a preference basis and records trouble indications originated in decoders, decoder connectors, translators, and translator connectors. If a circuit fails to complete its function in the allowed time or if it detects a fault by other means, a trouble ticket will be printed. In addition, a trouble ticket can be forced on test calls. The trouble ticketer lists circuit, regular or emergency call, progress of call, timeout conditions, identification of connecting circuits, crosses, grounds or other trouble conditions, and the time at which failure occurred.

4.07 When the trouble ticketer is seized, an alarm is sounded. This may be a major or minor alarm depending upon which circuit requested the ticket or whether trouble occurred on first or second trial by a decoder. The alarm can be retired by operation of a key.

4.08 A preference chain is provided in the trouble ticketer to permit connection to only one decoder at a time. In case of simultaneous seizures, the highest preferred circuit in the chain will be served; the others will be released and a display lost lamp lighted.

4.09 If a circuit tries to seize the trouble ticketer when it is busy, it will withdraw the request, light a display lost lamp, sound an alarm, and then return to normal and be free to serve other calls.

4.10 During regular operation when a trouble ticket is printed, the previous ticket is cut off and dropped into a bin. To permit a ticket to be examined immediately after it is printed, a ticket eject feature is provided. The operation of a key will cause another ticket to be printed (all dashes) and the desired ticket is cut off.

4.11 Jacks are provided on the associated jack, key, and lamp panel to permit the trouble ticketer to be made busy to all decoders or to a selected decoder.

E. Jack, Key, and Lamp Circuit

4.12 A jack, key, and lamp circuit provides visual and audible alarm indications, in-use lamps, test jacks, portable test set connector jacks, and make-busy jacks for the various circuits for TOUCH-TONE and common control operation.

F. Multifrequency Receiver Circuit

4.13 The multifrequency receiver circuit is used in conjunction with the manual or automatic test circuit to convert multifrequency outpulsing from an originating register into dc signals which can be verified by means of the test circuit.