RECORDED ANNOUNCEMENT FRAMES

SD-97725-01, SD-97725-02, SD-97725-03, SD-97725-04

DESCRIPTION

COMMON SYSTEMS

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Tables

1. GENERAL

1.01 This section describes the common systems recorded announcement frame (CSRAF), which can be arranged to provide four basic types of recorded announcements:

- Variable message length (VML) announcement
- Modular message (MM) announcement
- Phased message (PM) announcement
- Message synthesis service (MSS).

The CSRAF is adaptable to most announcement applications, providing heavy-duty recorded announcement services from the central office.

1.02 This section is reissued to:

- Include information on KS-20952, L7 and L8 magnetic drums, in paragraph 4.38

- Add new Table E and redesignate old Tables E through H to Tables F through I, respectively
- Reference KS-20951, L31 audio monitor circuit, in paragraph 7.26
- Add new paragraph 8.02 to include information on modular message channel module
- Add Part 13, ABBREVIATIONS AND ACRONYMS
- Change title of section to conform with standards

Revision arrows are used to emphasize significant changes.

1.03 This section also includes descriptive information for the record (where applicable) and playback (R/P) modes of the basic recorded announcements, new capabilities and options, interfacing information, alarm features, and equipment information. Detailed functional descriptions of the frame operations are also contained within, including functional and layout schematics.

1.04 Figures 1, 2, 3, and 4 illustrate typical frame arrangement for the four basic types of recorded announcements. Three of the basic types of announcements (VML, MM, and PM) or any combination thereof can be contained on any one frame to meet the service objectives for recorded announcements. The multiple recording service(MRS) type uses only the VML and MM announcements. The remaining type (MSS) cannot be combined with the other types because of timing differences, drum rotation speed, and frame layout as will be explained later in this document.

1.05 The CSRAF fulfills the need for improved heavy-duty recorded announcement facilities. The improvements, that the CSRAF has made, lie in the following general areas:

- Greater channel (message) capacity
- Substantially more versatility to provide for new and varying applications
- Improved reliability
- Improved quality so that the fidelity of an announcement does not deteriorate during the life of the announcement
- Modular design
- Substantially reduced maintenance
- Remote recording capabilities through No. 1 Electronic Switching System (ESS).

USE

1.06 The initial use of the CSRAF equipped with PM service is in the No. 4 ESS. A version equipped with MM and VML services is used in the No. 5 crossbar equipped for automatic call distribution (ACD). A version equipped with MSS is intended for use in the Automatic Intercept System (AIS). A version equipped with MMs and VMLs announcements is used with the No. 1 ESS equipped for ACD. The design improvements offered by the CSRAF make it adaptable for common systems use.

CAPACITY

1.07 The number of channels available on the CSRAF is limited by the physical mounting capacity of the frame and the storage capacity of the KS-20951 drum storage unit (DSU).

1.08 The KS-20951 DSU (the magnetic storage medium for audio announcements) has a capacity for 200 separate tracks of recorded information. When the frame is equipped with VML-, MM-, PM- and/or MRS-type announcement service, each of the tracks provides 4 seconds of recorded information, and the tracks can be electronically pieced together to provide longer announcements in 4-second increments. When the frame is equipped for MSS, each of the tracks provides 3 seconds of recorded information. This 3-second track is electronically divided into two alike announcements of 1.5 seconds duration, or into six alike announcements of 0.5 second duration. When the frame is equipped with a KS-20952, L6, the drum will provide six timing signals 2/3 second apart.

1.09 The channels on the CSRAF are arranged in channel modules, one for each of the basic types of recorded announcements. When provided with VML, MM, PM, or MRS service, a maximum of nine of these channel modules can be mounted on the frame. When provided with MSS, due to duplication on the same frame and system requirements, the need for additional channel modules is unnecessary. The VML channel module contains a maximum of

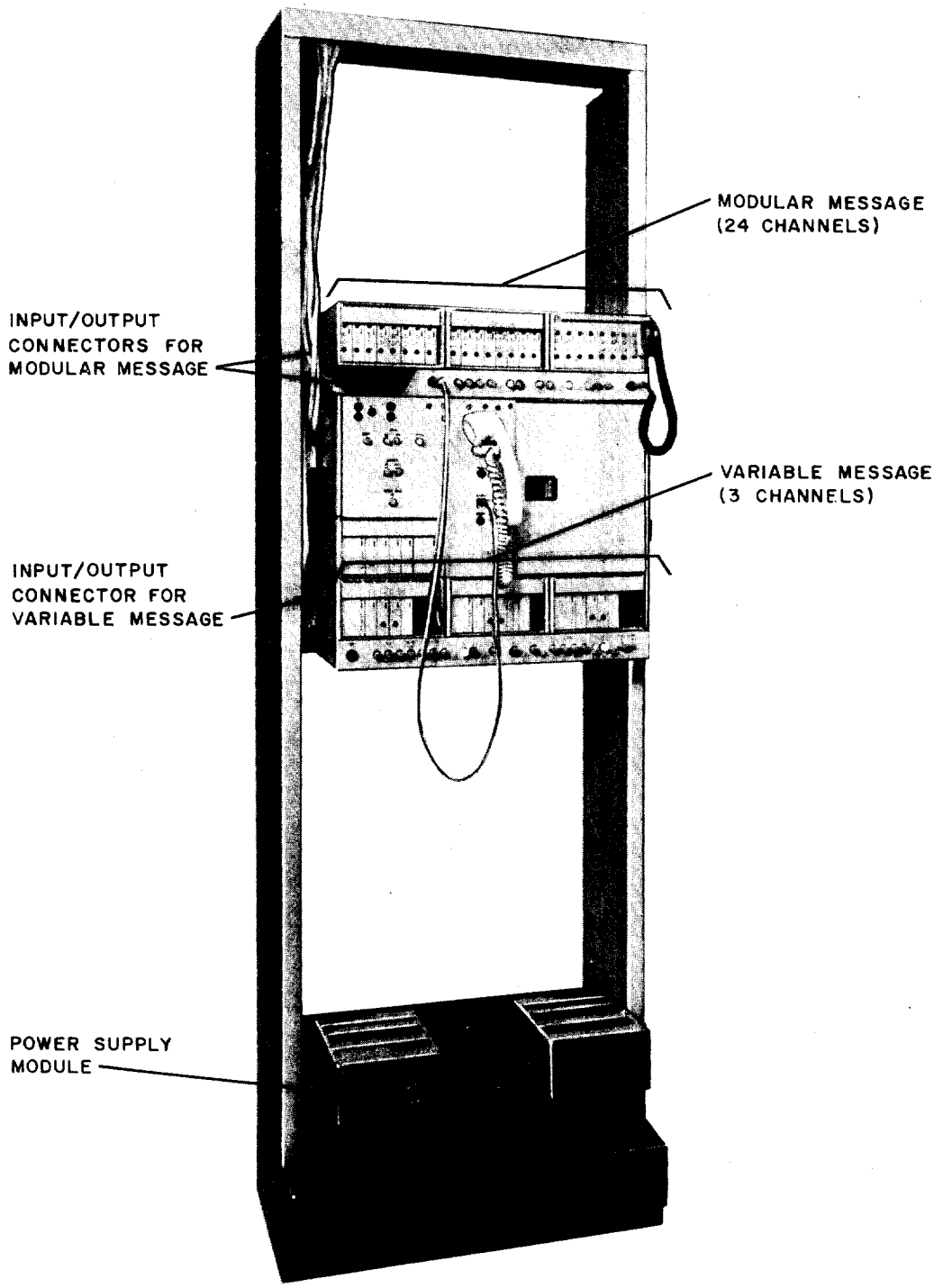


Fig. 1—Typical Frame Arrangement for MM and VML Announcement

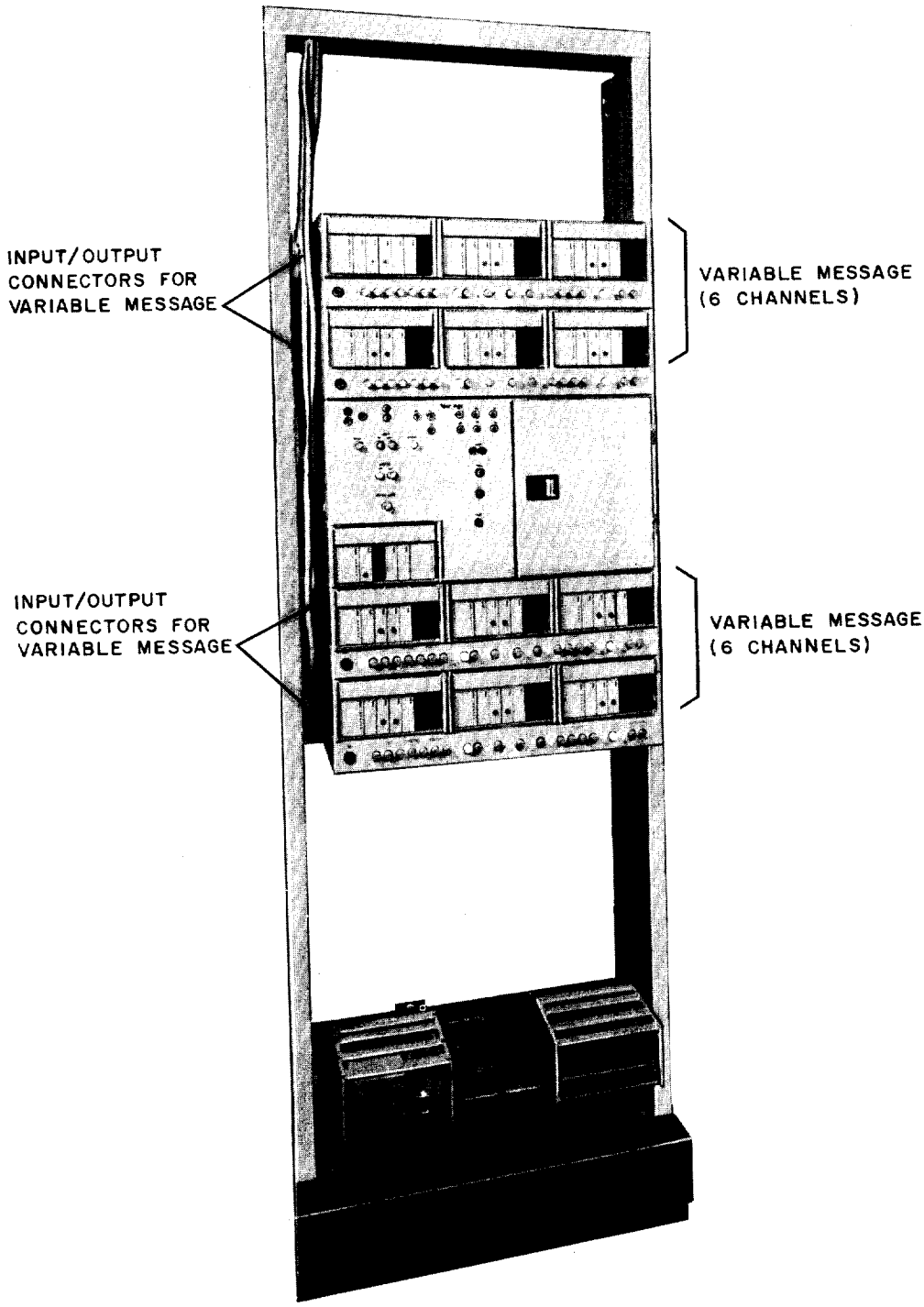


Fig. 2—Typical Frame Arrangement for the VML Announcement (12 Channels Shown)

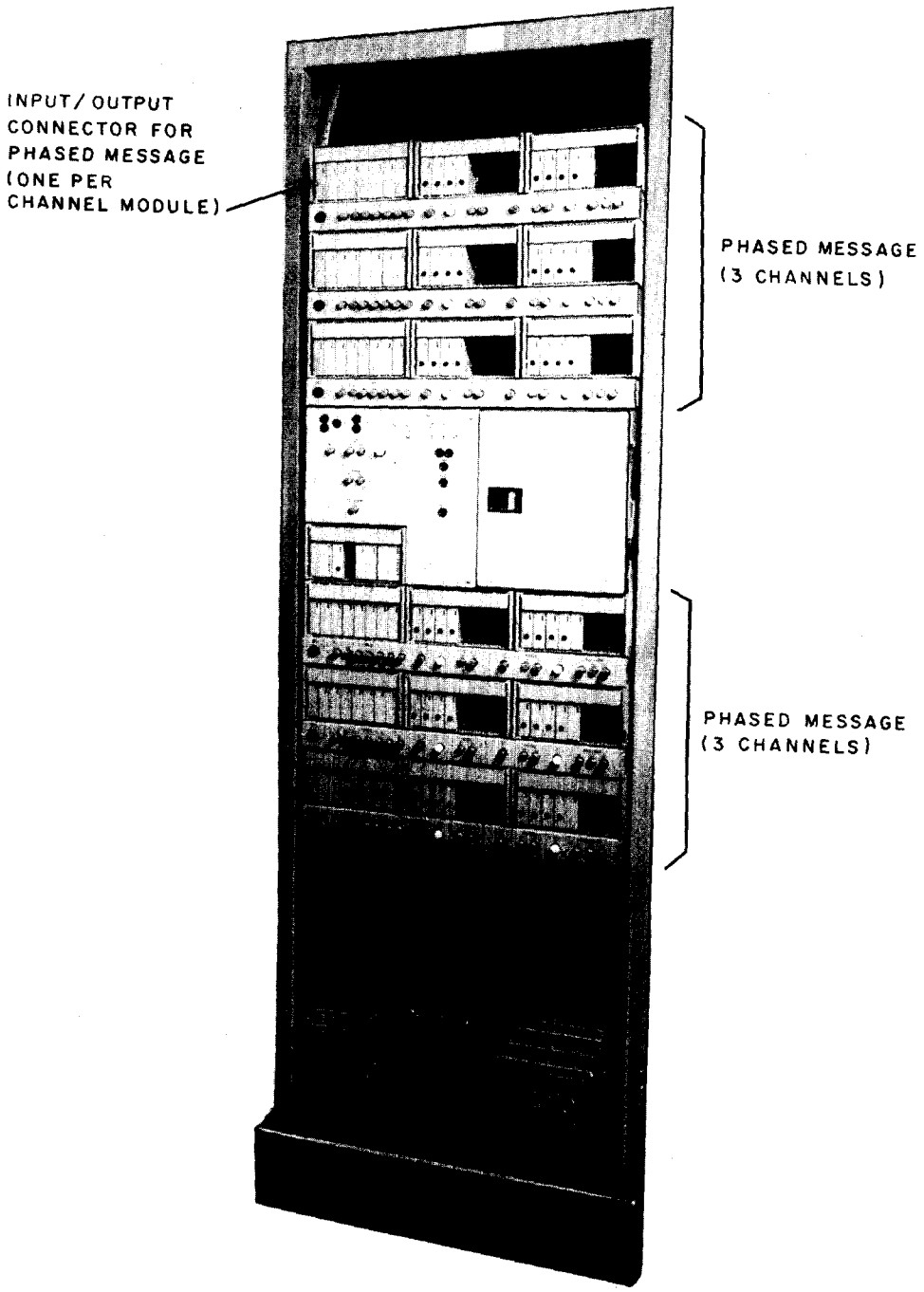


Fig. 3—Typical Frame Arrangement for PM Announcement (6 Channels Shown)

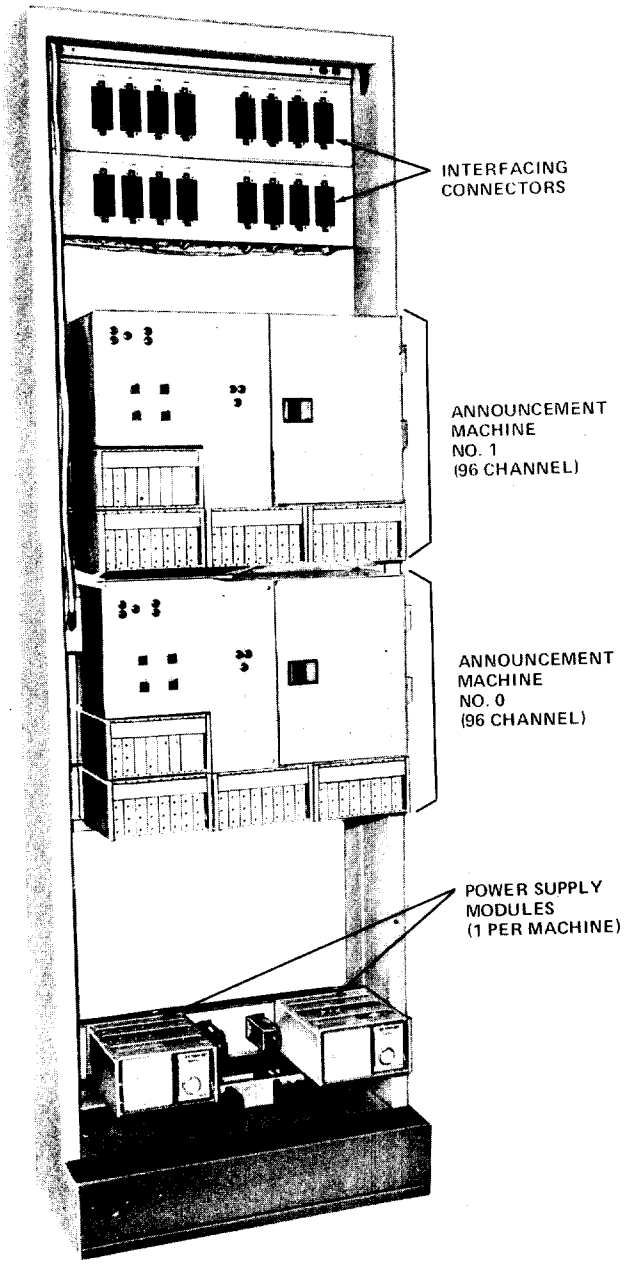


Fig. 4—Typical Frame Arrangement for MSS Announcement (Duplicated Machines Per Frame)

three channels; the MM channel module contains a maximum of 24 channels; the PM channel module contains one channel; and the MSS channel module contains a maximum of 96 channels. Table A illustrates the channel capacity of a frame when it is equipped with only one type of channel. A mixture of channels, however (VML, MM, and PM), will alter the channel capacity of the frame.

Note: Message synthesis service cannot be mixed on the same frame with other versions due to timing differences.

MODES OF OPERATION

1.10 The modes of operation of the CSRAF are as follows:

(a) Recorder/reproducer (VML, MM, PM, or MRS)

- Record live
- Dub from tape
- Reproduce.

(b) Reproducer only (MSS)

- Reproduce from prerecorded drum.

2. DESIGN

2.01 The CSRAF design is based upon a modular building block concept which results in a unit with substantial versatility and, consequently, the capability to provide many types of announcement services. The CSRAF is largely electronic in nature and all circuits are mounted on plug-in circuit packs having the envelope configuration of No. 1 ESS circuit packs. The overall design is thus based upon making maximum use of available apparatus and design technology developed for No. 1 ESS. As a result, the entire frame resembles the appearance of No. 1 ESS equipment. Also, the units on the frame are limited to only those that are required for proper operation of the frame. These units may vary depending on the service provided, but in general, the units required are for the recording, playback, control, maintenance, and test of the audio signal. These units are:

- Drum storage unit
- R/P electronics
- Control and maintenance circuits
- Alarm circuits
- Power and fuse circuits.

With the exception of MSS, which provides interfacing connectors at the upper portion of the frame for

TABLE A

MAXIMUM NO. CHANNELS VS CHANNEL VERSION

CHANNEL VERSION	MAXIMUM MESSAGE LENGTH FOR EACH CHANNEL	NUMBER OF CHANNELS	DRUM STORAGE UNIT LIMITED	FRAME LIMITED
Modular Message	4 seconds	200	X	—
Variable Message Length	16 seconds	27	—	X
	32 seconds	25	X	—
	48 seconds	16	X	—
Phased* Message	12 seconds	9	—	X
Message Synthesis Service	.5 seconds or 1.5 seconds	96	Limited only by specification for present requirements of 96 channels	

* The addition of the J1C012E auxiliary frame will provide a total of twenty phased message channels.

both machines (Fig. 4), all interfacing circuits, generally distribution and trunk circuits, are located on separate interfacing frames which are part of the switching system providing the recorded announcement service.

2.02 Flat cable is used extensively in the DSU (Fig. 5) to permit a more compact design. Also, for VML, MM, PM, and MRS type announcements, flexible printed wiring [(FPW) (Fig. 6)] is used on the backplane of the frame (channel modules) to interconnect circuit packs. The use of FPW eliminates conventional point-to-point wiring from unit to unit.

> ***Note:*** For MSS type announcements, FPW is not used on the backplane of the frame (channel modules) to interconnect circuit packs because of the small amount of point-to-point wiring that is required. See Fig. 7.

2.03 The associated electronics contribute to the versatility of the CSRAF. A family of circuit packs provides a group of basic building blocks from which the proper circuits can be assembled for the particular announcement application.

2.04 The mechanical design of the DSU results chiefly in improved reliability, quality, and reduced maintenance. With the exception of the rotating magnetic drum, all moving parts have been eliminated. There are no traversing heads or other mechanisms, and the drum is driven directly from a very low-speed dc servomotor, thereby eliminating the need for speed reducing gears, belts, and pulleys. The use of this motor also eliminates the need for 110 Vac power; therefore, no alternating current is required on the frame.

2.05 The flexible design of the magnetic heads, head bar assemblies, and the channel module and control units are such that, as the need for increased or varying service arises, the capabilities and features of the frame can be increased. If increased service is needed, a head bar assembly equipped with 20 heads can be added, thus providing an additional 80 seconds of storage capacity for VML, MM, PM or MRS service, or 60 seconds of storage capacity for MSS. Various configurations of channel modules and control units for VML, MM, or PM service can be added to meet new requirements.

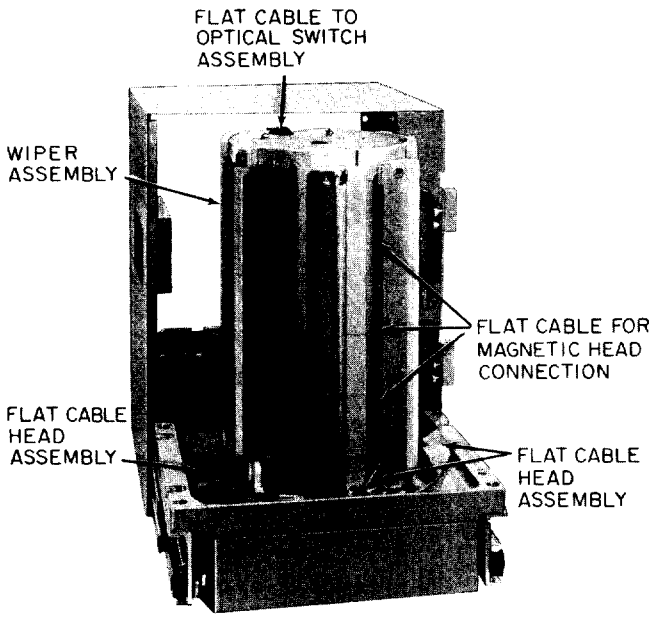


Fig. 5—Flat Cable of DSU

Note: Because of specification limitations for present requirements of 96 channels for MSS, no provisions have been made for adding additional channel modules to meet new requirements.

3. BASIC ANNOUNCEMENTS

VARIABLE MESSAGE LENGTH, MM, and PM

3.01 A diagrammatic representation of the CSRAF is shown in Fig. 8. This figure shows the physical location and arrangement of the various circuits. The 200-track DSU (recorder-reproducer) is located approximately 5 feet above floor level on the right side of the frame. The section containing the DSU (recorder-reproducer) is called the storage module. The left portion of the storage module contains controls and maintenance elements common to the entire frame. The audio channel electronics consist of various types of printed circuit boards, as shown in the inserts in Fig. 8.

3.02 The modular and variable message channels are arranged in horizontal rows within the channel module, 24 channels for modular or three channels for variable to a channel module. The PM channel requires an entire channel module for each announcement. Each channel contains the circuit packs required for independent operation of the channel. The channel modules are stacked vertically on the frame in numerical order with a maximum of nine modules per frame regardless of the type of announcement.

3.03 The DSU tracks can be pieced together to provide multichannel VML service or used individually to provide a maximum of two hundred 4-second tracks for short, message-type (4 seconds or less) service. The tracks may also be arranged to provide fixed length, PM announcement service.

3.04 The MM announcement can provide either a repetitive 1.33-second announcement, achieved by dividing a 4-second recording track into three equal parts, or a repetitive 2/3-second announcement by dividing a 4-second recording track into six equal parts. The KS-20952, L6 magnetic drum is used to provide the 2/3-second announcement. No switching of heads is involved; therefore, the electronics for this type message channel are relatively simple. Only one circuit pack is required for this announcement. It consists of an R/P amplifier, the logic required to record the name of a city or area or other short messages three times on a 4-second track, and voice alarm circuitry to indicate loss of audio signal at the output.

3.05 With variable message announcement, each channel can be provided for maximum message lengths of 16, 32, or 48 seconds by equipping the channel with either 1-, 2-, or 3-head switching circuit packs and accessing the channel to either 4, 8, or 12 tracks on the DSU. The length of the message is established during recording (in 4-second increments up to the capacity of the channel) and causes the associated electronics to reset at the end of the message, thereby eliminating long silent periods.

3.06 With PM announcement, a 12-second message is required that is "phased" so that the beginning of the message is available every 4 seconds. During the recording process, the 12-second recorded announcement is automatically separated into three 4-second segments, with each segment being recorded by a stationary magnetic record head. During the playback mode, these three heads are switched in the proper sequence into the input of a playback amplifier. A 4-second silent period between repetitions of the announcement results in a 16-second cycle.

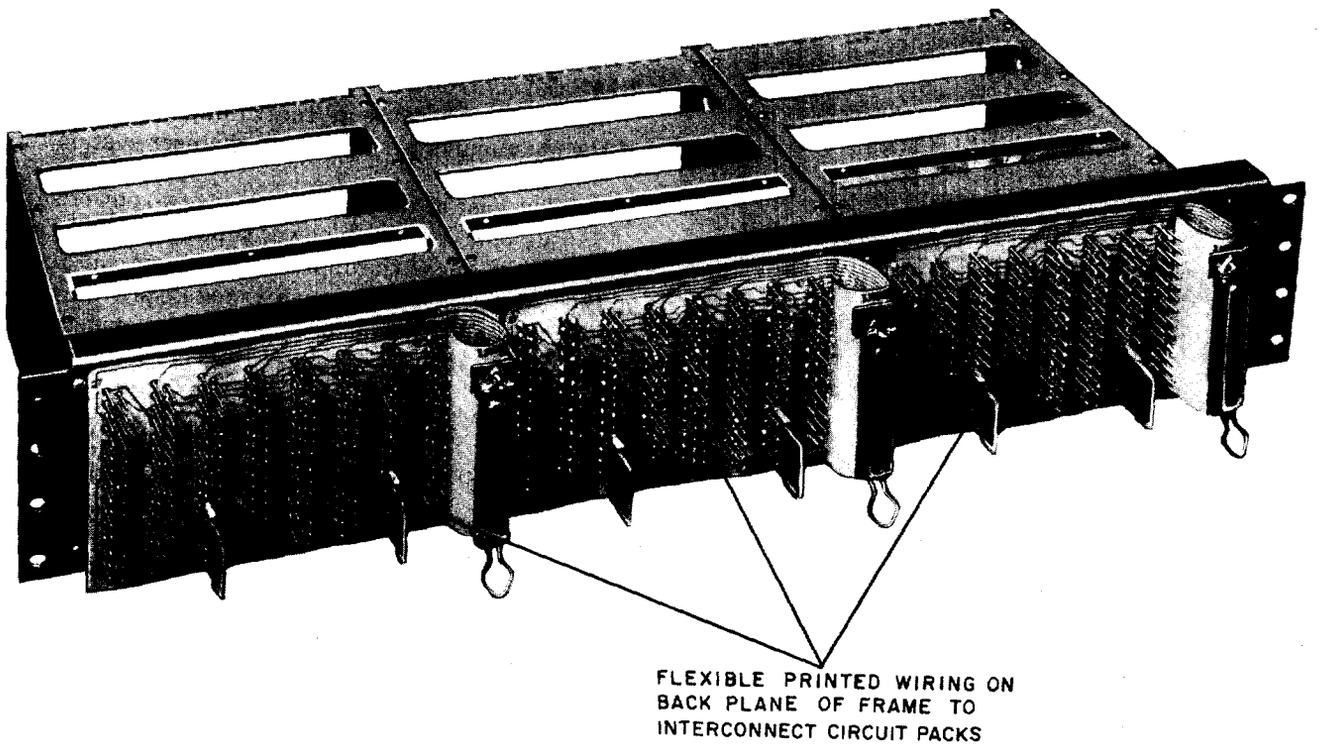


Fig. 6—Rear View of a Channel Module Showing Flexible Printed Wiring (VML, MM, PM, and MRS)

Four sets of amplifiers are used. Therefore, by properly switching the three magnetic heads to the four amplifiers, four phases of the message are possible, and the position of the silent period indicates the amplifier which will start the announcement within 4 seconds.

3.07 Immediately below each channel module is a control unit serving the channel(s) immediately above it, an arrangement which adds versatility to the CSRAF, in that, control units are added as channel modules are added. Control units are available in three configurations to provide for some differences in control that are required for the three channel modules.

3.08 The base of the frame contains a power supply module for providing the proper dc voltages and a fuse panel so that each channel can be separately fused.

Note: For MM announcement, the entire channel module (24 channels) is fused to one common fuse.

MESSAGE SYNTHESIS SERVICE

3.09 A diagrammatic representation of the CSRAF is shown in Fig. 9. This figure shows the physical location and arrangement of the various circuits. The basic prerecorded messages for the MSS version of the CSRAF is provided by fully duplicated systems. Since the announcement equipment and the prerecorded messages they provide are both duplicated, only the description of one unit will be described for the purpose of this section except where warranted. The 200-track DSUs are located on the right side of the frame. The section containing the drum storage unit (reproducer) is called the storage module. The left portion of the storage module contains controls and maintenance elements common to the associated machine. The audio channel electronics consist

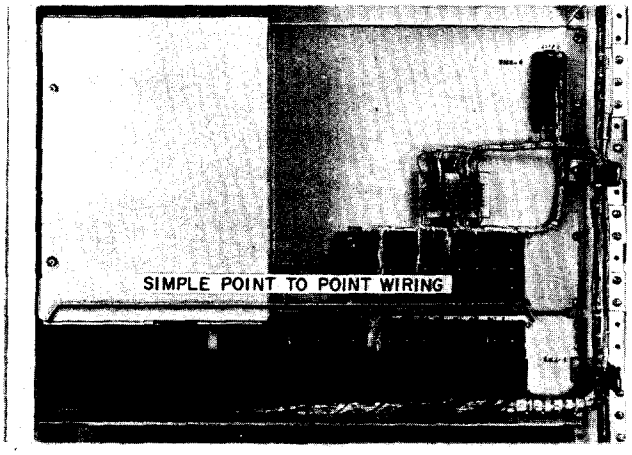


Fig. 7—Rear View of MSS Channel Module Showing Point-to-Point Wiring

of A1102 type printed circuit boards, as shown in the insert in Fig. 9.

3.10 The MSS channels are arranged vertically on the quad amplifier circuit pack, four amplifiers per circuit pack, with each amplifier serving one announcement track. The circuit packs are arranged in a horizontal row within the channel module, 24 circuit packs per module or a total of 96 channels.

3.11 The announcement tracks, after being reproduced from the DSU, are amplified by the associated amplifier on this frame. The announcements are then seized and pieced together electronically by the user system. No switching or connecting together of channels is performed on the MSS version of the CSRAF.

3.12 The MSS announcement provides message lengths of 0.5 second and 1.5 seconds. With the drum rotation at 20 rpm, the 1.5-second announcement is recorded twice on the circumference of the same drum channel and the 0.5-second announcement is recorded six times on the circumference of the same drum channel. Each drum channel is connected to only one head, therefore no switching of heads is involved. Also the electronics for this type message channel is relatively simple. Only one circuit pack is required per four channels. It consists of four amplifiers capable of amplifying each of the four channels that it serves on a one-to-one basis.

3.13 The user system through stored program control is capable of connecting to a channel, extracting a 1.5-seconds or a 0.5-second phrase, and piecing together in proper sequence several of these phrases to form an uninterrupted announcement.

3.14 No control units are provided for the channel modules because all controlling and accessing of the channels is performed by the user system.

3.15 The base of the frame contains two power supply modules. Each power supply module is associated with one of the duplicated systems contained on the frame. Each power supply module provides the proper dc voltages and a fuse panel provides the proper fusing for each machine.

4. EQUIPMENT ELEMENTS

4.01 The CSRAF equipment described in this section is designed to function in heavy-duty recorded announcement applications. This part provides a functional and physical description of each unit in the CSRAF.

STORAGE MODULE

A. Variable Message Length, MM, PM, and MRS

4.02 The storage module (Fig. 10) contains the drum storage unit on the right side, a common control panel on the left side, which consists of functions required for frame maintenance, and a 36A apparatus mounting frame for holding circuit packs. The packs provide the following:

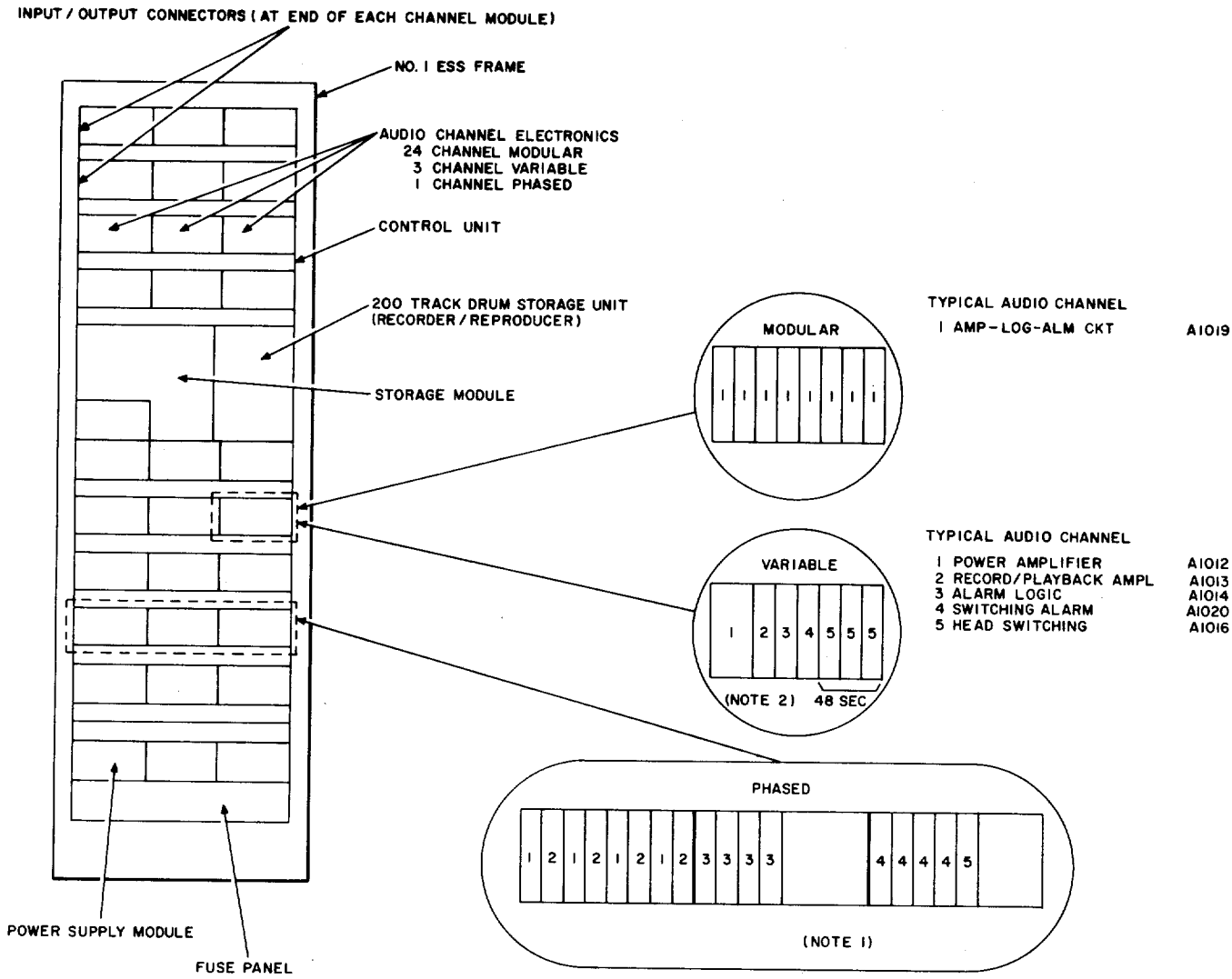
- Control of the dc servomotor located in the DSU
- Bias and erase signals
- Frame timing signals.

4.03 The storage module is designed to be the same for all frames, independent of the announcement service provided.

Note: When MM service is provided, an additional clock card (Fig. 11) is added to the storage module.

4.04 The keys, lamps, and jacks on the control panel (Fig. 10) provide the following features:

- On-off control of -48 Vdc power
- On-off normal indications of -48 Vdc power



NOTE:
1 FOR PHASED MESSAGE ANNOUNCEMENT AN ENTIRE CHANNEL MODULE MUST BE USED. THIS PROVIDES 4 PHASES OF THE ANNOUNCEMENT.
2 VARIABLE MESSAGE ANNOUNCEMENTS CAN BE INCREMENTALLY INCREASED IN 16-SECOND UNITS WITH THE ADDITION OF A HEAD SWITCHING CARD A1016 CONNECTING TO 4 AVAILABLE MAGNETIC HEADS.

Fig. 8—Common Systems Recorded Announcement Frame—Diagrammatic Representation (VML, MM, PM, and MRS)

- On-off control of motor power
- Frame line communication
- Spare jack
- Test jacks for +5, +15, -15, -48 Vdc, and ground
- Local recording
- Local monitoring
- Local test of voice alarm.

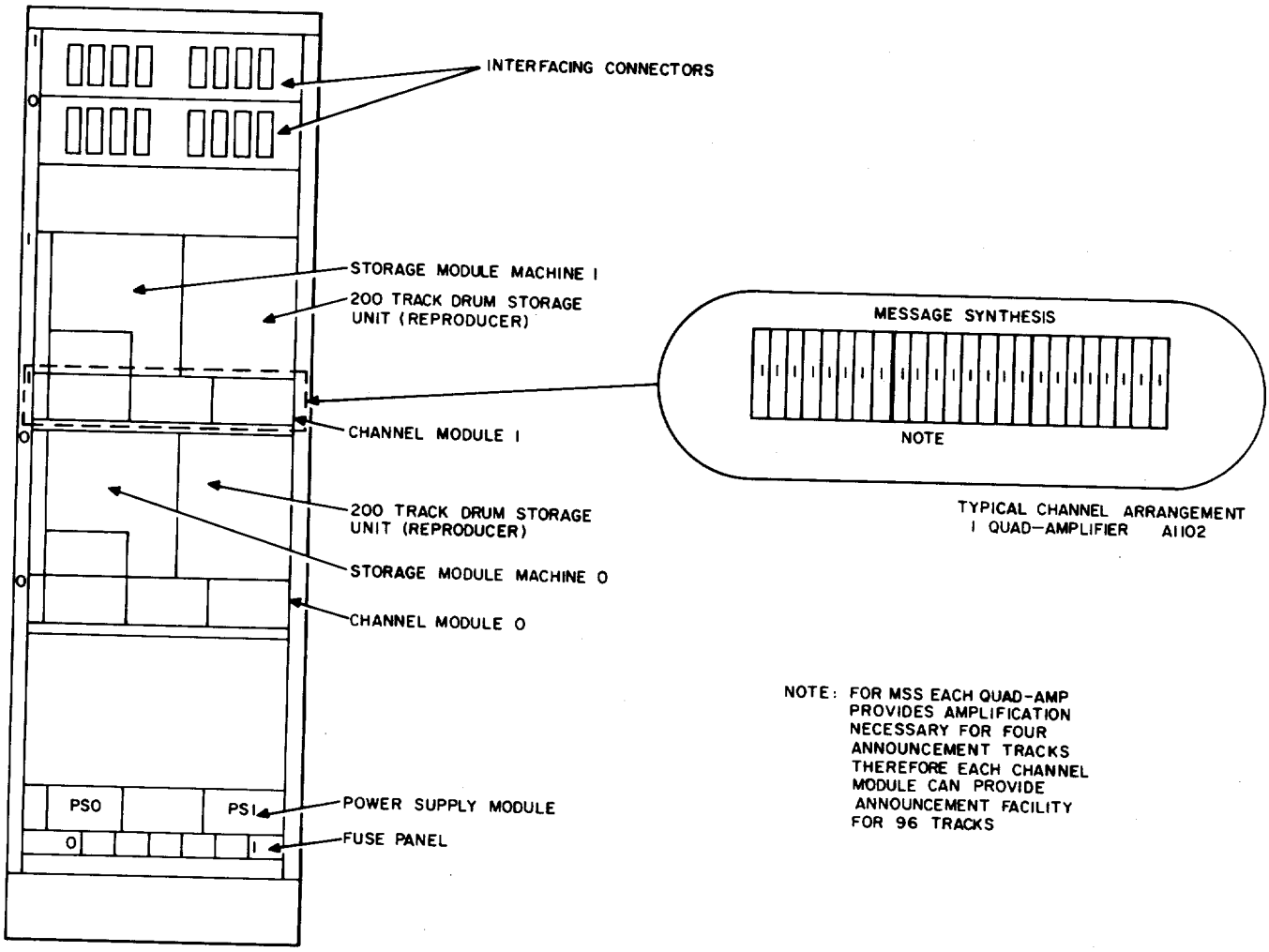


Fig. 9—Common Systems Recorded Announcement Frame—Diagrammatic Representation (MSS)

Note: The TTY jack on the left side of the storage module is used by the user system for communication from the frame to system interfacing units for maintenance and testing purposes.

B. Message Synthesis Service

4.05 The storage module (Fig. 12) contains the drum storage unit on the right side, a common control panel on the left side which consists of functions required for frame maintenance, and a 36A apparatus mounting frame for holding circuit packs. The packs provide the following:

- Two spare quad amplifiers
- Storage for test cables
- Ferrod driver
- Control of the dc servomotor located in the DSU.

Figure 13 illustrates storage module circuit pack locations for the MSS CSRAF.

Note: Shown in Fig. 13 are two spare A1102 quad amplifiers located in the apparatus mounting nest of the storage module. These spare packs can be employed for troubleshooting track amplifier problems on a direct substitution basis.

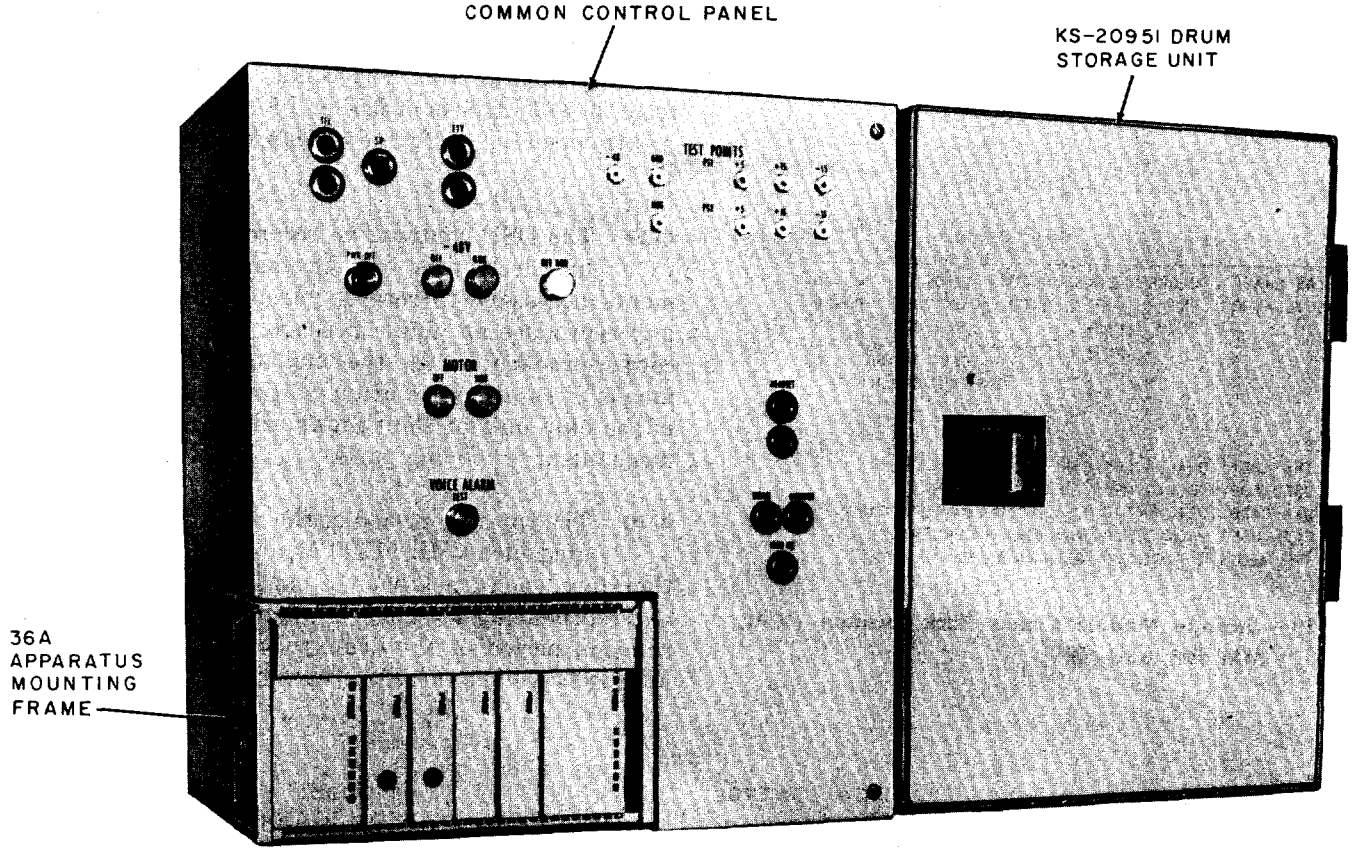


Fig. 10—Storage Module—(VML, MM, PM, and MRS)

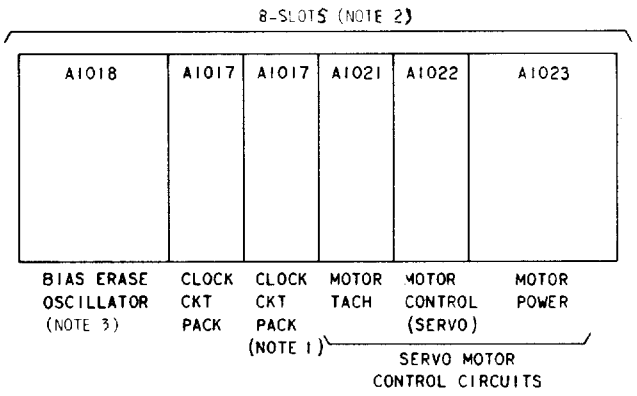
4.06 The keys, lamps, and jacks on the control panel (Fig. 12) provide the following features:

- On-off control of -48 Vdc power
- On-off normal indications of -48 Vdc power
- On-off control of motor power
- On-off indications of motor power
- On-off control of amplifier power
- On-off indications of amplifier power
- On-off control and indications of audible alarm
- Frame line communication
- Spare jack
- Test jacks for +5, +15, -48 Vdc, and ground
- Local monitoring.

Note: The TTY jack on the left side of the storage module is used by the user system for communication from the frame to system interfacing units for maintenance and testing purposes.

DRUM STORAGE UNIT KS-20951

4.07 The KS-20951 DSU (Fig. 14) is a magnetic drum-type storage unit having the capacity for 200 separate tracks (maximum) of recorded audio information. The unit consists of a direct drive dc motor which drives a KS-20952 magnetic drum. When associated with VML, MM, or PM, the drum has a storage capacity of 800 seconds of recorded information. When associated with MSS, the drum uses 96 tracks of recorded information. Mounting arrangements are provided in either case for a maximum of 200 heads arranged in 10 groups of 20 each.



NOTES:
1. THE ADDITIONAL CLOCK CIRCUIT PACK IS ONLY USED FOR MODULAR MESSAGE ANNOUNCEMENT.
2. SIX CARD TOTAL CAPACITY (2 DOUBLE WIDTH CARDS) FIVE USED WHEN OTHER THAN MM ANNOUNCEMENT.
3. THE A1018 IS REPLACED WITH AN A1232 FOR MRS.

Fig. 11—Storage Module Circuit Pack Location (VML, MM, PM, and MRS)

4.08 The modular magnetic head mountings make possible the assembly of a DSU with capacities incremental from 80 seconds to 800 seconds, or from 20 to 96 tracks of 0.5- or 1.5-second announcements depending on frame version, as shown in Table B.

4.09 The DSU contains no recording or reproducing electronics, only the basic magnetic elements necessary to record, when applicable, store and reproduce an audio message, the magnetic record-reproduce heads, the magnetic drum, and a means of rotating the drum continuously. The DSU is the only unit of the CSRAF which contains any mechanism or moving parts.

4.10 The rotation period of the drum when associated with VML, MM, PM, or MRS is 4 seconds; therefore, each track has the capacity for recording and reproducing 4 seconds of audio information. The rotation period of the drum when associated with MSS is 3 seconds; therefore, each drum track has the

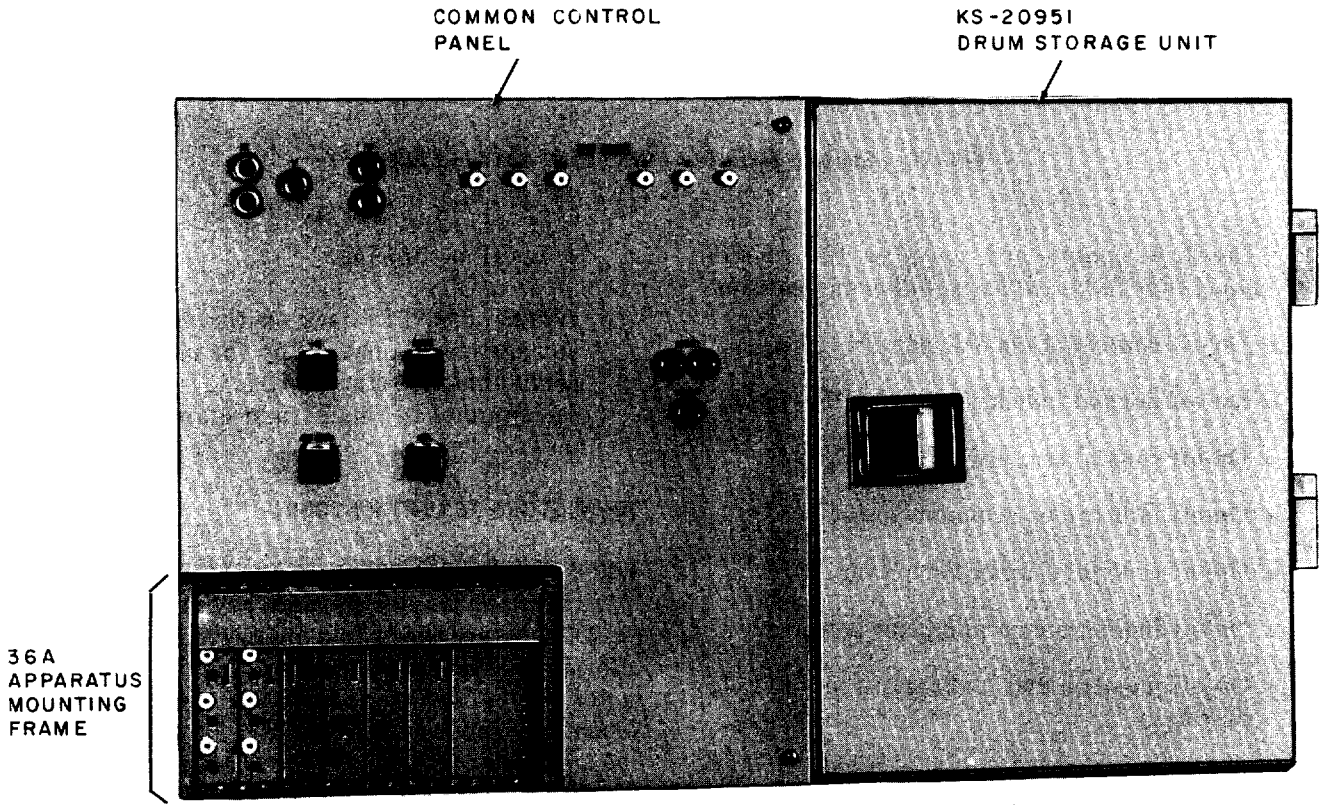


Fig. 12—Storage Module—(MSS)

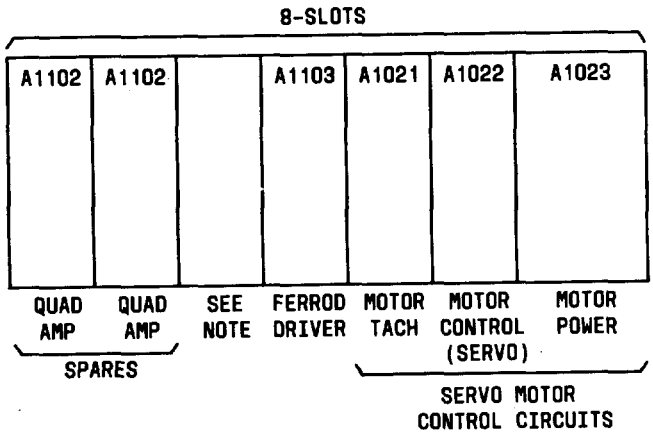


Fig. 13—Storage Module Circuit Pack Location for MSS

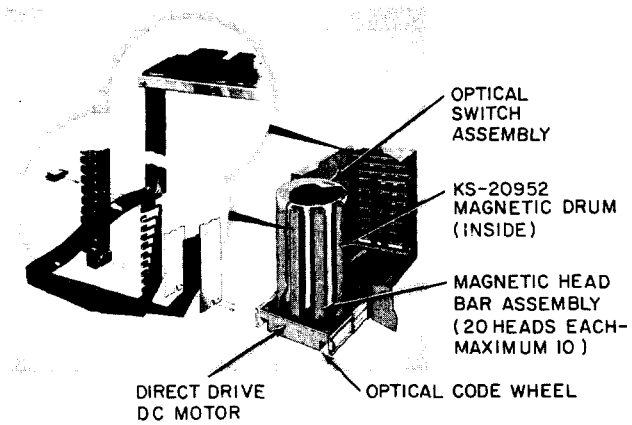


Fig. 14—KS-20951 Drum Storage Unit (Cutaway View)

capacity for reproducing 3 seconds of audio information.

4.11 For VML or PM, the design of the tracks of the drum storage unit are such that they can be electronically pieced together in 4-second increments to provide longer announcements. This design efficiently provides for handling two classes of messages:

- Very short messages of fixed length
- Longer messages of variable-increment length.

4.12 For MSS, the tracks of the DSU are pieced together by the user system. By proper selection of phrases recorded on the drum, announcements are made by placing these phrases in the proper sequence and reproducing them.

4.13 The DSU contains an optical code wheel (and its associated electronics located at the bottom of the DSU) to provide a reference signal used in a separately mounted speed control servocircuit (not part of the drum storage unit). The reference signal is described in detail subsequently in this section.

4.14 Also contained on the top of the DSU is an optical switch assembly which provides the necessary clock pulses for switching the channel electronics of the VML, MM, PM, or MRS, or in the case of MSS, provides timing pulses to the user system which makes use of it for proper timing of the connection to an announcement phrase. Four list numbers of the KS-20951 DSU are available. When a List 1 is provided, the optical switch assembly is equipped with one optical switch (for use with PM and variable message announcements). When a List 2 is provided, the optical switch assembly is equipped with either one (dual channel) or three single channel optical switches (for use with MM announcement or on any frame having combined versions of announcements, one of which is MM). When a List 3 is provided, the optical switch assembly is equipped with 1 (dual channel) optical switch (for use with MSS announcements). When a List 4 is provided with a KS-20952 magnetic drum, timing signals are provided 2/3 second apart. Table C illustrates the KS-20951 DSU list and serial number relationship to the optical switch assemblies.

4.15 Elements of the servosystem which are not part of the DSU are located in a 36A apparatus mounting in the storage module. Refer to Fig. 11 for location of servomotor control circuits (for VML, MM, PM, and MRS) or to Fig. 13 for location of servomotor control circuits (for MSS).

4.16 The DSU design reduces the number of moving parts to the absolute minimum. The only moving parts are the magnetic drum (KS-20952) and dc motor armature which are directly coupled and rotate together at 15 rpm (for VML, MM, PM, and MRS) or at 20 rpm (for MSS). Thus, no speed reducing elements, such as gears, pulleys, and belts, are required. Similarly, no mechanisms are required to translate magnetic heads, since the heads are fixed.

4.17 The servomotor, used to rotate the magnetic drum, consists of a permanent magnet stator,

TABLE B

RELATION OF HEAD BAR ASSEMBLIES TO STORAGE CAPACITY OF THE DRUM STORAGE UNIT

NO. OF HEAD BAR ASSEMBLIES	NO. OF HEADS	FOR VML, MM OR PM SERVICE	FOR MSS SERVICE
		STORAGE CAPACITY (SECONDS)	ACCESS CHAN. CAP (CHANNELS)
1	20	80	20
2	40	160	40
3	60	240	60
4	80	320	80
5	100	400	100
6	120	480	
7	140	560	
8	160	640	
9	180	720	
10	200	800	

TABLE C

DSU LIST AND SN. RELATIONSHIP TO OPTICAL SWITCH ASSEMBLY

	KS-20951, LIST 1		KS-20951, LIST 2		KS-20951, LIST 3	KS-20951, LIST 4
	SN.1→7	SN.8→UP	SN.1→8	SN.9→UP	SN.1→UP	SN.1→UP
Optical Switch Assembly	L-504316-1*	L-509855-1‡	L-504316-2†	L-509855-2§	L-509855-2§	L-509855-2§

* L-504316-1 — Optical switch assembly with one optical switch. Used in list 1 machines No. 1 through 7.

† L-504316-2 — Optical switch assembly with three optical switches. Used in list 2 machines No. 1 through 8.

‡ L-509855-1 — Optical switch assembly with one single channel optical switch. Used in list 1 machines No. 8 and up.

§ L-509855-2 — Optical switch assembly with a dual channel optical switch. Used in list 2 machines No. 9 and up and in ALL list 3 and list 4 machines.

a wound armature, and a brush assembly. The motor contains no bearings; therefore, motor lubrication is never necessary. Figure 14 shows the location of the direct drive dc servomotor. Figure 15 shows the DSU removed from the CSRAF, revealing the servomotor mounting on the bottom of the DSU.

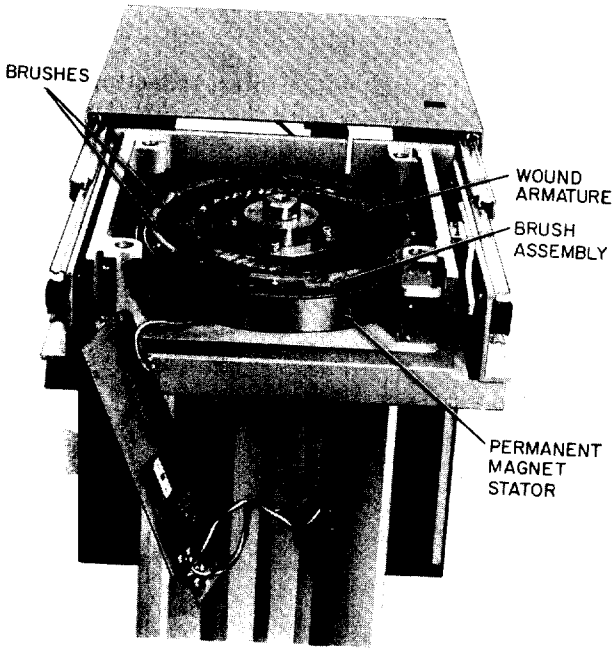


Fig. 15—Drum Storage Unit (Bottom View With Code Wheel Removed)

4.18 Electrical access to the DSU is provided by connectors mounted on the rear of the unit. The connectors are designed to mate with the KS-20955 and KS-20956 interconnecting units. Figure 16 shows the connectors on the rear of the drum storage unit.

4.19 The DSU is mounted on slides in a steel case with a hinged front door (Fig. 17).

4.20 To provide additional dust and environmental protection, a dust cover (Fig. 17) is placed over the drum and head bar assemblies, virtually sealing the unit from outside contaminating influences. Refer to Fig. 14 for information on location of magnetic drum and head bar assemblies.

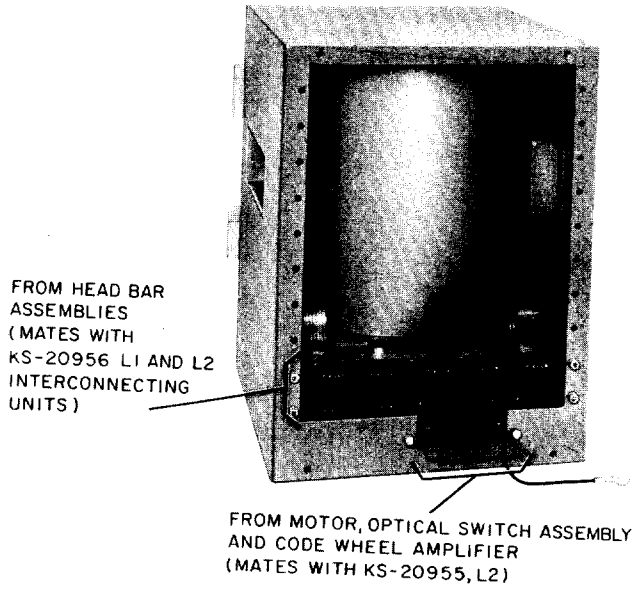


Fig. 16—Drum Storage Unit (Rear View)

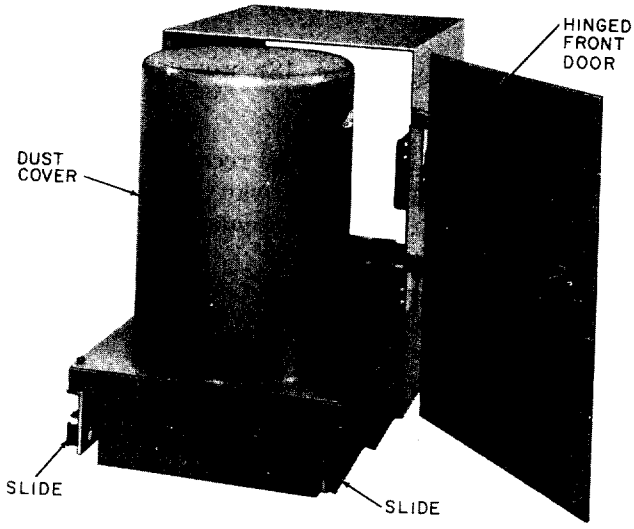


Fig. 17—Drum Storage Unit Slid Out of CSRAF on Its Slides

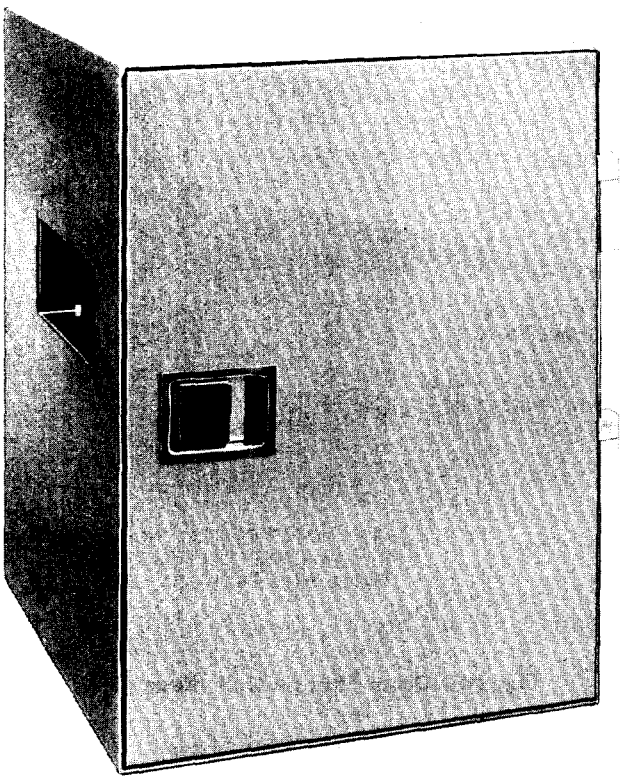


Fig. 18—Sealed Drum Assembly—DSU (Front View)

4.21 The DSU case (Fig. 18) provides three features:

- Sliding mounts for the recorder unit which allow it to be pulled forward from the CSRAF for inspection or maintenance
- A mounting surface for attachment of the DSU to the CSRAF
- Use of the rear of the enclosure for holding the printed circuit termination ends of the head cables (Fig. 16).

4.22 On the front of the enclosure is a door which can be opened to withdraw the recorder unit. In addition, the enclosure protects the DSU if it is removed from the CSRAF.

A. Head Bar Assemblies

4.23 To provide for flexibility, the magnetic heads are mounted on head bar assemblies (Fig. 19). Each head bar assembly contains 20 magnetic heads (in 5 groups of 4) and an interconnecting unit by which the heads are accessed. Head bar assemblies are mounted on a cylindrical housing (Fig. 20) which surrounds the magnetic drum. Head bar assemblies can be conveniently added to increase the storage capacity of the DSU. The DSU can be arranged with up to a maximum of ten head bar assemblies, which would provide a 200-track capability.

> ***Note:*** The KS-20954 interconnecting unit is used in conjunction with the KS-20953 magnetic head and will be described subsequently in this section.

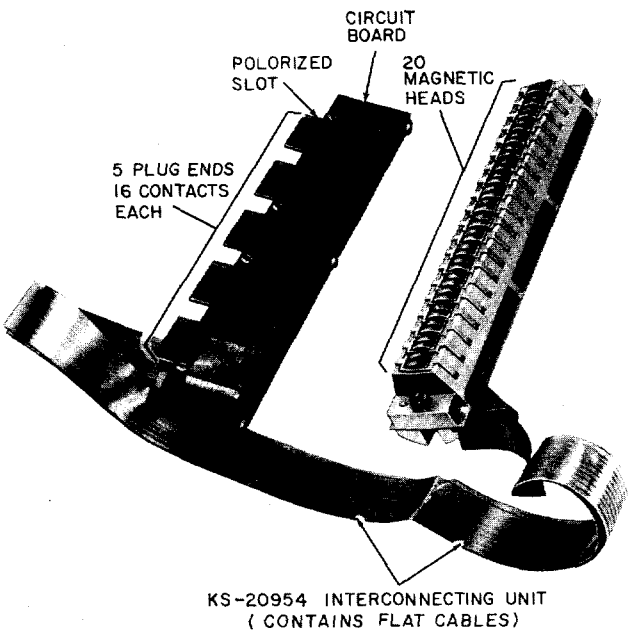
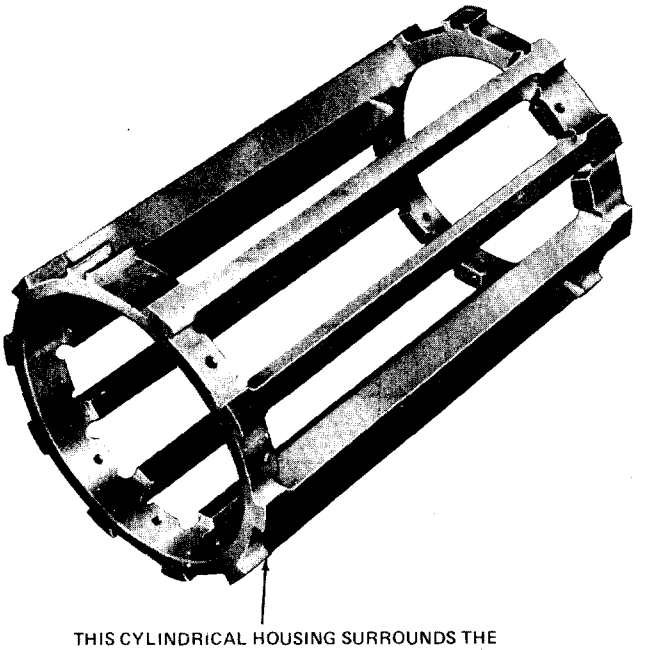


Fig. 19—Head Bar Assembly

4.24 Each head bar assembly is provided with preformed flat cable to connect to the 20 magnetic heads in the bar. The cable is preconnected to the individual magnetic heads through a connector at the head end and is terminated on a printed circuit board having edge connectors at the other end. The head bars are mounted onto the cylindrical housing, and the heads run in intimate contact with the magnetic drum.

4.25 Each L-504320 head bar assembly is assigned a dash number from 1 to 10.

4.26 Only one of each dash number will fit on the drum storage unit. The dash number is used to



THIS CYLINDRICAL HOUSING SURROUNDS THE MAGNETIC DRUM AND CAN BE ARRANGED TO PROVIDE FROM 1 TO 10 HEAD BAR ASSEMBLIES.

Fig. 20—Cylindrical Housing

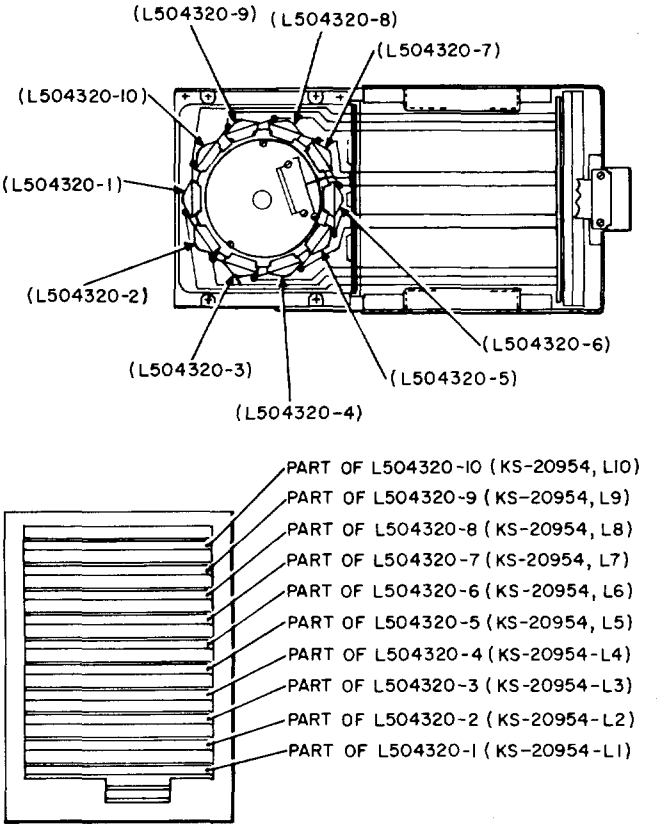


Fig. 21—Head Bar Assembly Location (From Drum Position to Rear of Storage Unit)

define the position of the head bar assembly on the DSU. Each head bar assembly has a specific location on the drum and a specific location for its termination on the rear of the DSU. Refer to Fig. 21 for termination locations. Table B shows the relationship between the number of head bar assemblies and the storage capacity of the drum unit (for VML, MM, or PM) or accessible channel capacity (for MSS).

B. Interconnecting Unit KS-20954 (Cabling)

4.27 The KS-20954 interconnecting unit is used to electrically interconnect the associated heads of the head bar assembly it serves to the rear of the DSU. This unit then mates at the rear of the DSU with one to five KS-20956 interconnecting units which connect to the channels served by those heads of the associated head bar assembly. This arrangement is shown in Fig. 22.

4.28 The KS-20954 interconnecting unit (Fig. 19) consists of two flat cables, each of which is 1-inch wide, contains 40 conductors, terminates in 20 female 4-terminal conductors at one end (the magnetic head end), and terminates on a printed circuit board at the other end. The printed circuit board provides five plug ends of 16 contacts each. The plug ends have a polarizing slot to accept a key, ensuring proper mating with their corresponding connectors on the KS-20956 interconnecting units.

4.29 Ten list numbers have been assigned to the KS-20954 interconnecting unit. Each number defines a different folding pattern and length for the flat cable used in this interconnecting unit. The list numbers are coordinated with the installation position on the KS-20951 DSU, as shown in Fig. 21.

C. Interconnecting Unit KS-20955

4.30 The KS-20955 interconnecting units exist in two distinct configurations, Lists 1 and 2. The L1 unit connects the circuitry of the optical switch assembly (located atop the drum storage unit) and the code wheel and motor (mounted on bottom of drum storage unit) to a connector on the rear of the drum storage unit. The L2 unit connects the control

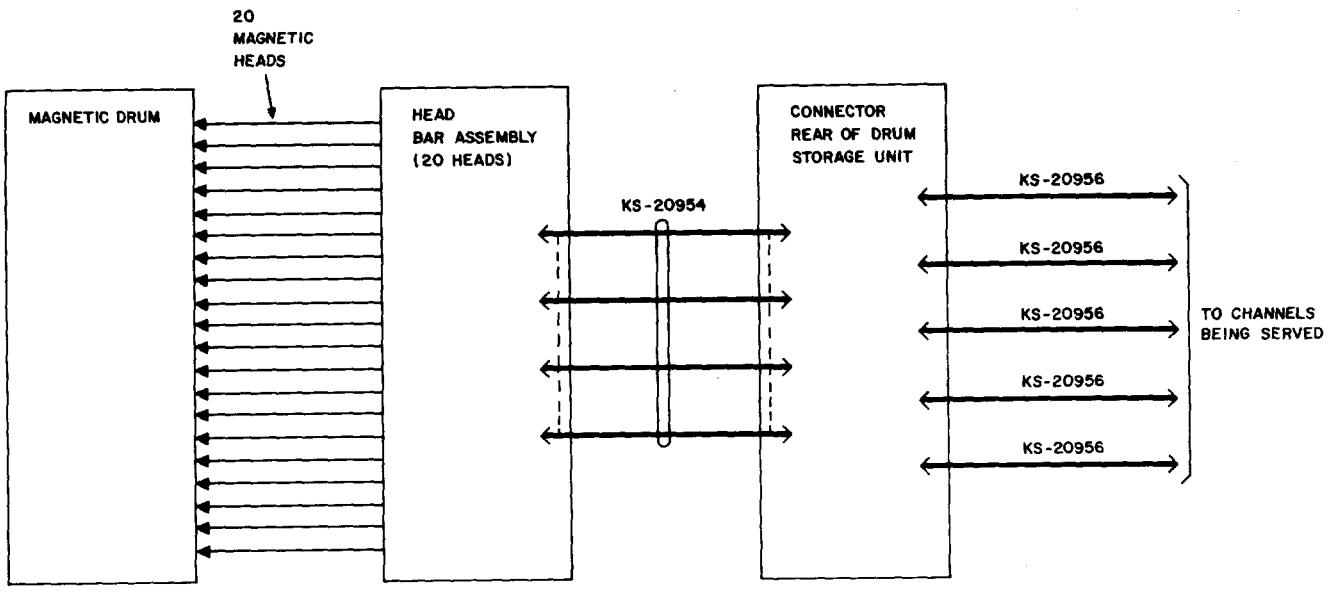


Fig. 22—Interconnecting Unit Arrangement

functions and circuit cards of the storage module to the DSU. Figure 23 shows the location of interconnecting units.

4.31 The L1 unit (Fig. 24) has two flat cables both terminated in the same male connector on one end and a female connector on each of the other ends. The L2 unit (Fig. 25) has two flat cables both terminated in one female connector on each end. The unused positions in the female connectors are filled to provide for polarization. Both units are shielded and folded to fit.

D. Interconnecting Unit KS-20956

4.32 The KS-20956 interconnecting unit consists of a flat cable (with 16 conductors) terminated in a female connector on each end. The connectors are keyed for polarization to mate with an edge of a printed circuit card. List numbers have been assigned to the KS-20956 interconnecting unit to identify the length.

- List 1 is 4 feet 4 inches in length.
- List 2 is 7 feet 0 inches in length.

4.33 The KS-20956 interconnecting unit is used to connect the magnetic heads in the DSU to the associated channel electronics. Figure 26 illustrates the typical arrangement of the KS-20956-type units on the rear of the CSRAF when used with VML, MM, PM, and MRS. Figure 27 illustrates the typical arrangement of the KS-20956-type units on the rear of the CSRAF when used with MSS.

E. Magnetic Head KS-20953

4.34 The KS-20953 magnetic head (Fig. 28) is used to record (when necessary) and reproduce audio signals on the KS-20952 magnetic drum in the KS-20951 DSU. The dual-gap magnetic head is designed to provide erase and R/P functions in the same core structure. An extended magnetic pole piece is held by a nonmagnetic supporting structure in a shielded case. Two bobbin-wound coils, erase and R/P, are fitted onto leg extensions of the core structure and wired so that the high-frequency bias for the recording section is obtained automatically by internal magnetic coupling.

F. Magnetic Drum KS-20952

4.35 The KS-20952 magnetic drum is 4 inches in diameter and 8-1/2 inches long and consists of a band of magnetic rubber mounted on an aluminum drum. The magnetic properties of the drum are derived from the 1/8-inch thick, specially compounded

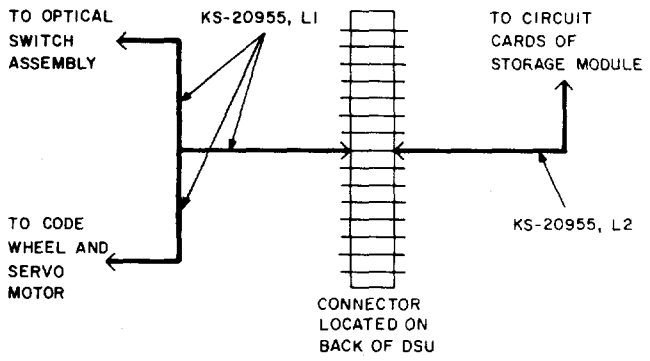


Fig. 23—Location of KS-20955, L1 and KS-20955, L2 Interconnecting Units

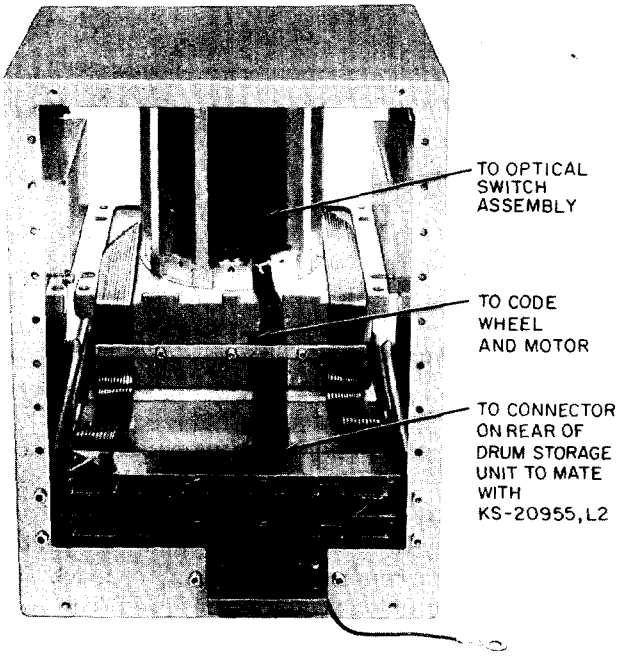


Fig. 24—KS-20955, L1 Interconnecting Unit (Rear View DSU Removed From CSRAF)

rubber which contains a uniform dispersion of magnetic iron oxide particles.

4.36 The KS-20952 magnetic drum is available in ▶eight◀ configurations. Figure 29 illustrates one of the ▶eight◀ available versions of the KS-20952, L1 magnetic drum. This drum is used with the KS-20951, L1, serial numbers 1 through 7, and KS-20951, L2, serial numbers 1 through 8 only. This drum is designed only to operate with the L1 or L2 drum storage unit when equipped with an L-504316-1 or L-504316-2 optical switch assembly, respectively. This drum is not furnished with prerecorded announcements.

4.37 The second available version of the KS-20952, L1 magnetic drum is shown in Fig. 30. This drum is intended for use with the KS-20951, L1, serial numbers 8 and up and with KS-20951, L2, serial numbers 9 and up only. This drum is designed only to operate with the L1 or L2 DSU when equipped with an L-509855-1 or L-509855-2 optical switch assembly, respectively. This drum is not furnished with prerecorded announcements.

4.38 The KS-20952, L3 magnetic drum shown in Fig. 31 is to be ordered with the prerecorded localities specified for the area to be served. The L3 magnetic drums are intended for use with all KS-20951, L3 DSUs only. The L3 drum is designed to operate with the L3 DSU when equipped with an L-509855-2 optical switch assembly. The KS-20952, L4 magnetic drum provides timing signals occurring at 1.5 seconds and .5 second. The KS-20952, L4 magnetic drum is unrecorded. The KS-20952, L2 magnetic drum is used in manufacturing testing. The KS-20952, L5 magnetic drum is an L3 drum with a special information tone (SIT) recorded on track 89. The SIT is used to distinguish recorded announcements from operator answered calls. The L5 magnetic drum is available for use with AIS program PG-1B203. The KS-20952, L6 magnetic drum is unrecorded and provides timing signals 2/3 second apart (see Fig. 32). ▶The KS-20952, L7 magnetic drum has 58 tracks of standard recordings, which include SITs, and 38 tracks of locality recordings. The L7 magnetic drum is available for use with AIS program PG-1B204. The silent period preceding each recording is 75 milliseconds to provide switching time for the system. The KS-20952, L8 magnetic drum has 58 tracks of standard recordings, which include revised SITs, and 38 tracks of locality recordings. The L8 magnetic drum is also available for use with AIS program PG-1B204 and has the same 75 milliseconds of silence preceding each recording available with the L7 magnetic drum.◀

4.39 The magnetic drum is capable of storing a maximum of 200 circumferential tracks of audio information which is recorded on and reproduced from the magnetic drum with KS-20953 magnetic heads.

4.40 The magnetic drum rotates about a vertical axis and is directly coupled to a very simple,

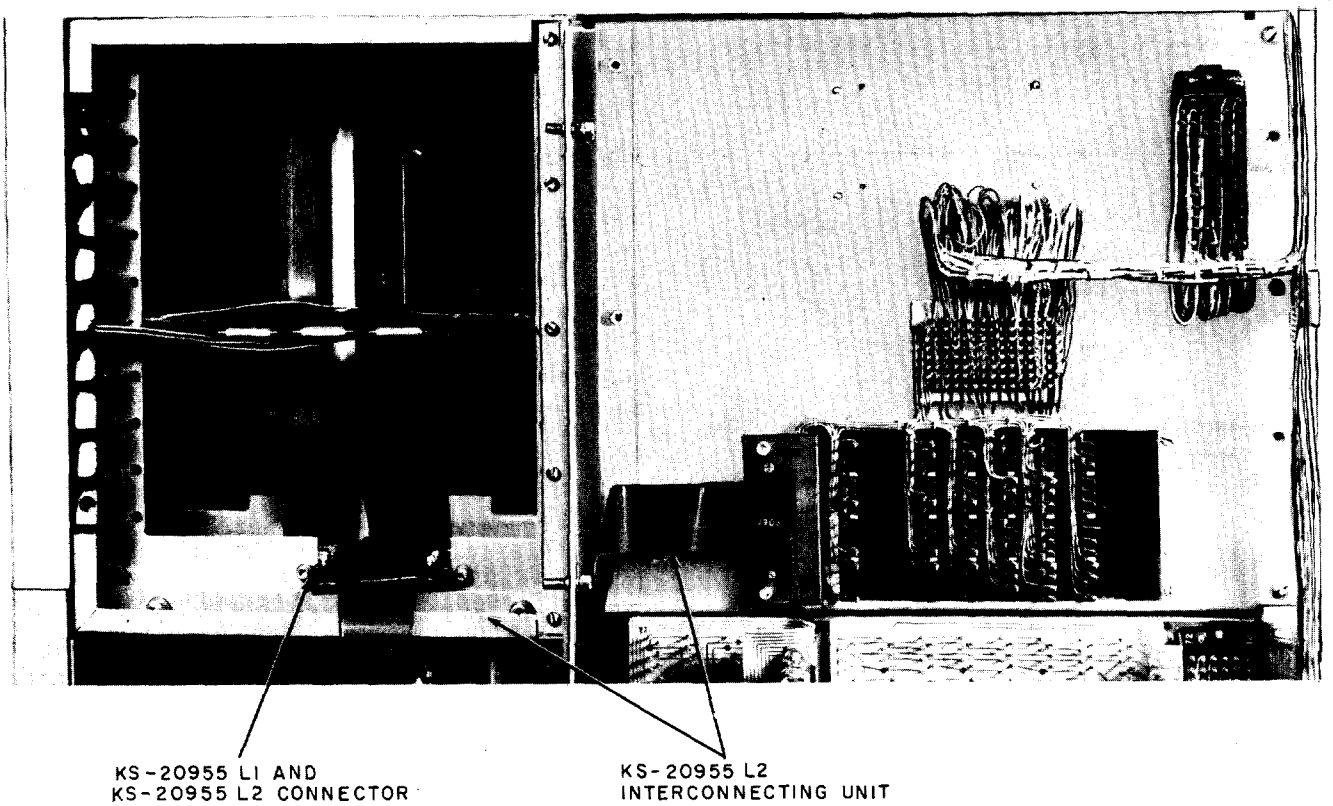


Fig. 25—KS-20955, L2 Interconnecting Unit (Rear View Storage Module Shown)

rugged dc servomotor located at the bottom of the drum. During operation, the magnetic drum is driven at a constant 15 or 20 rpm (depending on the version of the frame provided) by the dc servomotor.

4.41 The bearings used to suspend the drum rotational shaft are prelubricated and sealed and require no subsequent lubrication during the life of the unit.

G. Code Wheel and Amplifier

4.42 The optical code wheel (Fig. 33) is rigidly attached to the drum rotational shaft and provides a frequency feedback signal through a photocell and photocell amplifier (code wheel amplifier) to the servomotor control circuits to maintain a constant rotational velocity of the magnetic drum.

4.43 The optical code wheel is a glass plate with 12,600 alternating light and dark bands located around the circumference of the plate. The width of the lines is equal to the width of the spaces located between the lines. The pattern of the code wheel when rotating interrupts the light beam from a light emitting diode (LED) to a photo transistor. The rate of interruption produces a feedback frequency which is proportional to the speed. The feedback signal is then locally amplified by the code wheel amplifier[(Fig. 34) (located in the bottom of the drum storage unit)]whose output is connected to the servomotor control circuits in the storage module to maintain a constant rotational velocity of the magnetic drum. Figure 34 illustrates the code wheel and amplifier mounted in their normal operating positions.

H. Optical Switch Assembly

4.44 The optical switch assembly is located atop the drum storage unit. This assembly provides the necessary switching pulses for the channel electronics, or timing pulses for seizure by the user system. The pulses are produced by interrupting the

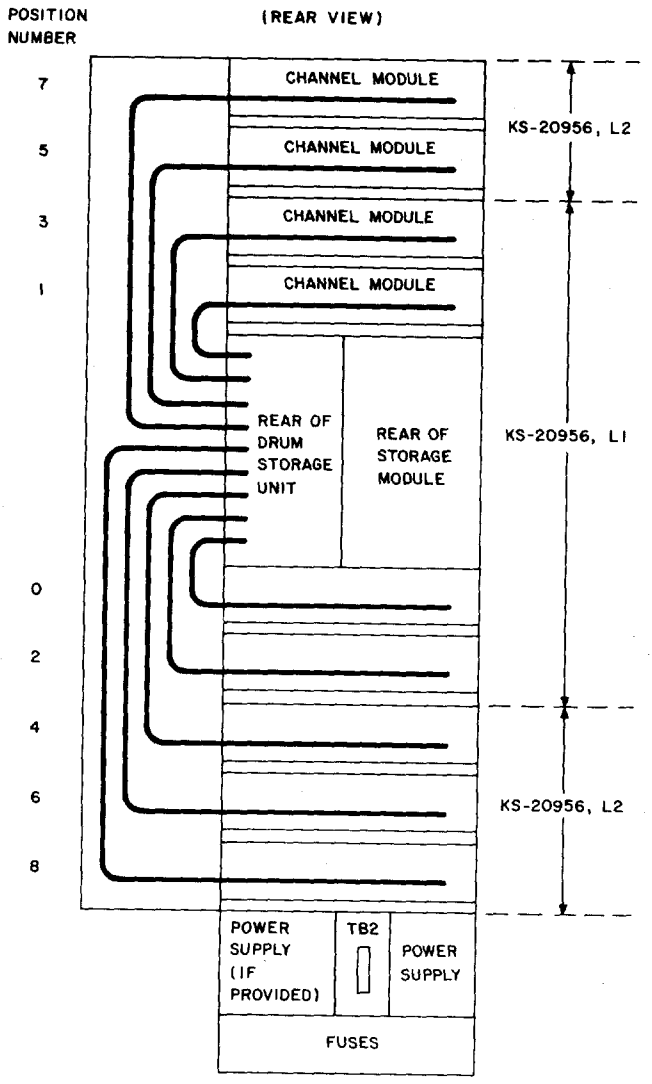


Fig. 26—Typical Arrangement of the KS-20956 Interconnecting Unit on Rear of CSRAF—(VML, MM, PM, and MRS)

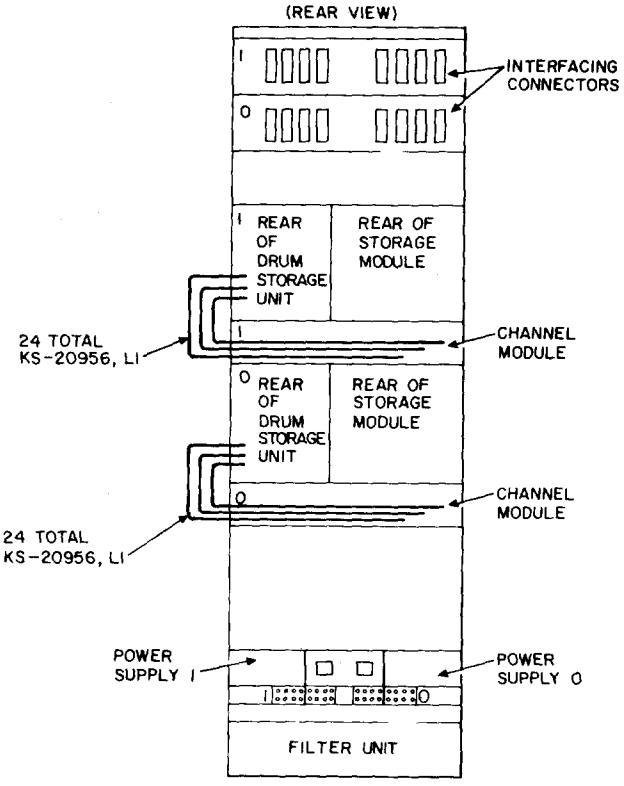


Fig. 27—Typical Arrangement of the KS—20956 Interconnecting Unit on Rear of CSRAF—(MSS)

light beam in the optical switch with a notched or cutaway surface on the magnetic drum.

4.45 The optical switch assembly, like that of the magnetic drum, is available in various physical configurations. Figure 35 illustrates a typical example of how the optical switch assembly appears when mounted in place with relation to the magnetic drum unit. Figure 36 illustrates the L-504316-1 optical switch assembly that is used in conjunction with the KS-20952, L1 magnetic drum in KS-20951, L1 DSUs serial numbers 1 through 7. This assembly consists of only one optical switch and is used when only one timing pulse per revolution is required.

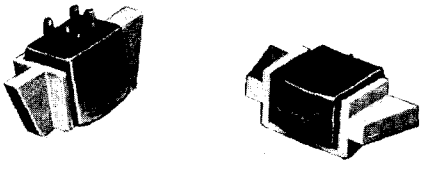


Fig. 28—KS-20953 Magnetic Head

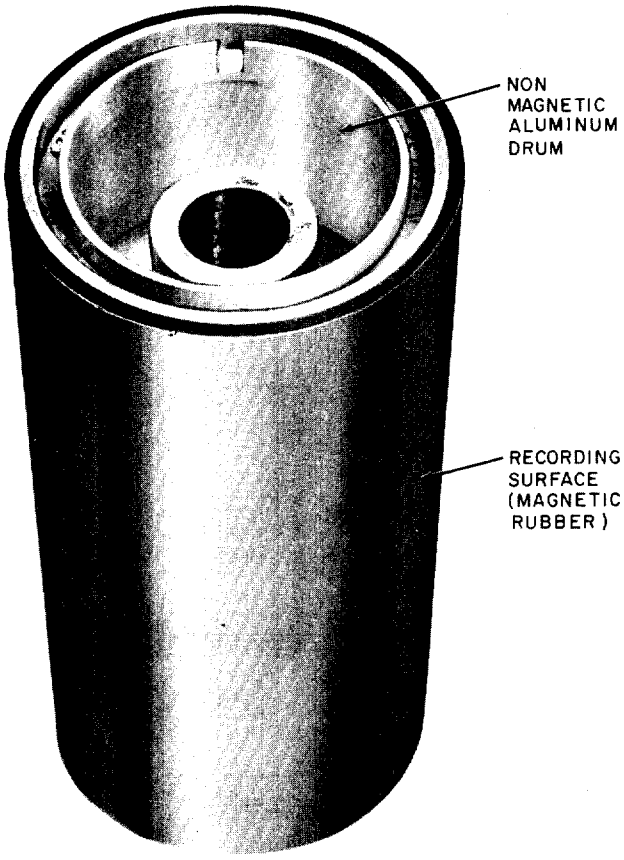


Fig. 29—KS-20952, L1—Magnetic Drum (L1 DSUs Serial No. 1 Through 7 and on DSUs Serial No. 1 Through 8)

4.46 Illustrated in Fig. 37 is the L-509855-1 optical switch assembly that is used with the KS-20952, L1 magnetic drum in KS-20951, L1 drum storage units serial numbers 8 and up. This assembly consists of only one single-channel optical switch and is used with the KS-20952, L1 magnetic drum having three cutaways, one of which is larger in depth than the other two. With the physical mounting arrangement of the drum cutaways and the single-channel switch, this arrangement can be used like that of the L-504316-1, previously discussed, when only one timing pulse per revolution is required. With this arrangement, the other two alike and smaller cutaways are not used.

4.47 Illustrated in Fig. 38 is the L-504316-2 optical switch that is used in conjunction with the

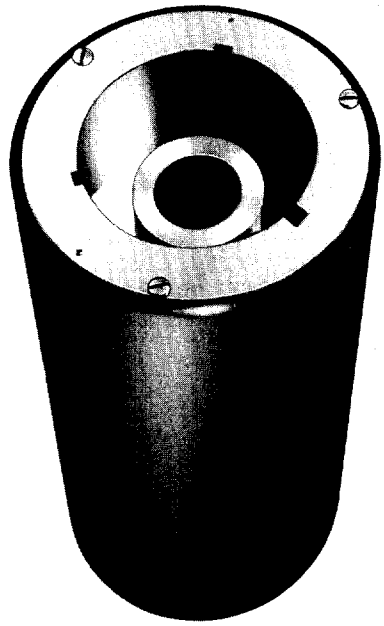


Fig. 30—KS-20952, L1 Magnetic Drum (Used on L1 DSUs Serial No. 8 and Up and L2 DSUs Serial No. 9 and Up)

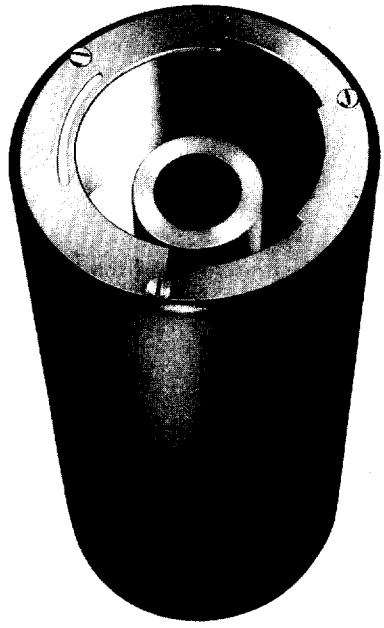


Fig. 31—KS-20952, L2 or L3 Magnetic Drum (Used With KS-20951, L3 DSUs)

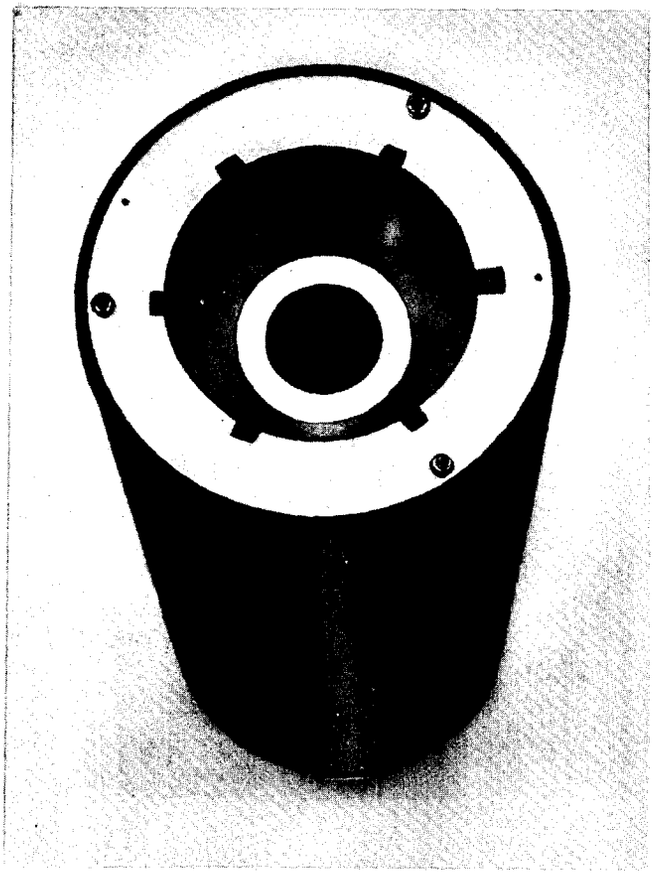


Fig. 32—KS-20952, L6 Magnetic Drum

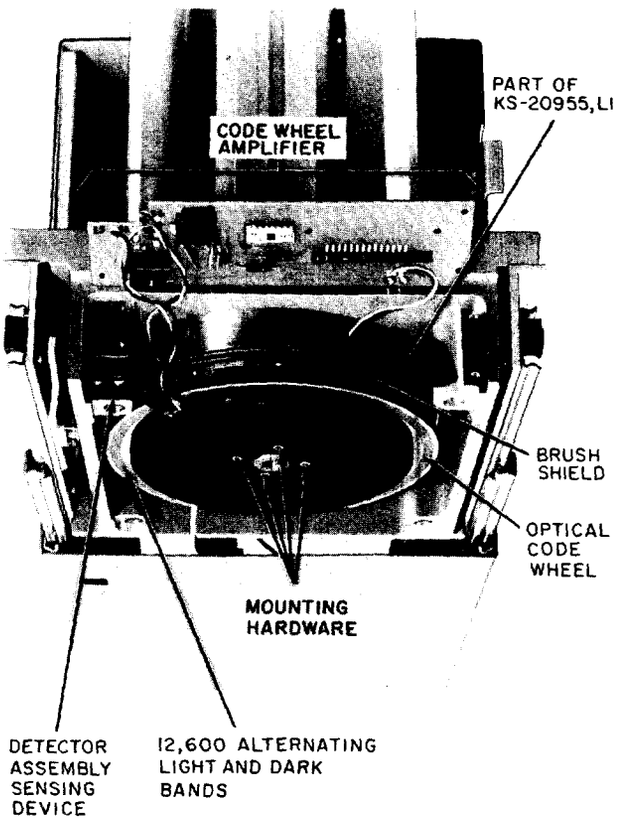


Fig. 33—Optical Code Wheel (Underside View of DSU)

KS-20952, L1 magnetic drum in KS-20951, L2 drum storage units serial numbers 1 through 8. This assembly consists of three optical switches and is used with the KS-20952, L1 magnetic drum having one notched slot when three timing pulses per drum revolution are required.

4.48 Illustrated in Fig. 39 is the L-509855-2 optical switch assembly that is used with the KS-20952, L1 magnetic drum in KS-20951, L2 drum storage units serial numbers 9 and up and with the KS-20952, L6 magnetic drum in KS-50951, L4 DSUs. This assembly consists of only one dual-channel optical switch and is used with the KS-20952, L1 magnetic drum having three cutaways, one of which is larger in depth than the other two or with the KS-20952, L6 magnetic drum having six cutaways, one of which is larger in depth than the other five. With the physical mounting arrangement of the drum cutaways and the dual-channel switch, this arrangement can be used like that of the L-504316-2 previously discussed, when three timing pulses per drum revolution are required. A timing pulse from one channel of the dual-channel switch will occur either at 3 or 6 times per drum revolution, while the other channel of the dual-channel switch will cause a timing pulse to occur only once per drum revolution.

4.49 Illustrated in Fig. 40 is the L-509855-2 optical switch assembly that is used with the KS-20952, L3 magnetic drum in all KS-20951, L3 and KS-20951, L4 DSUs. This assembly consists of only one dual-channel optical switch and is used with KS-20952, L3 and L5 magnetic drums having a semicircular cutaway for one channel of the dual-channel switch and three cutaways evenly spaced with three solid areas in the same circular plane. With the physical mounting arrangement of the drum cutaways and the dual-channel switch, this arrangement is capable of producing timing signals that change state twice per revolution of the drum on one channel and six times per revolution of the drum on the second

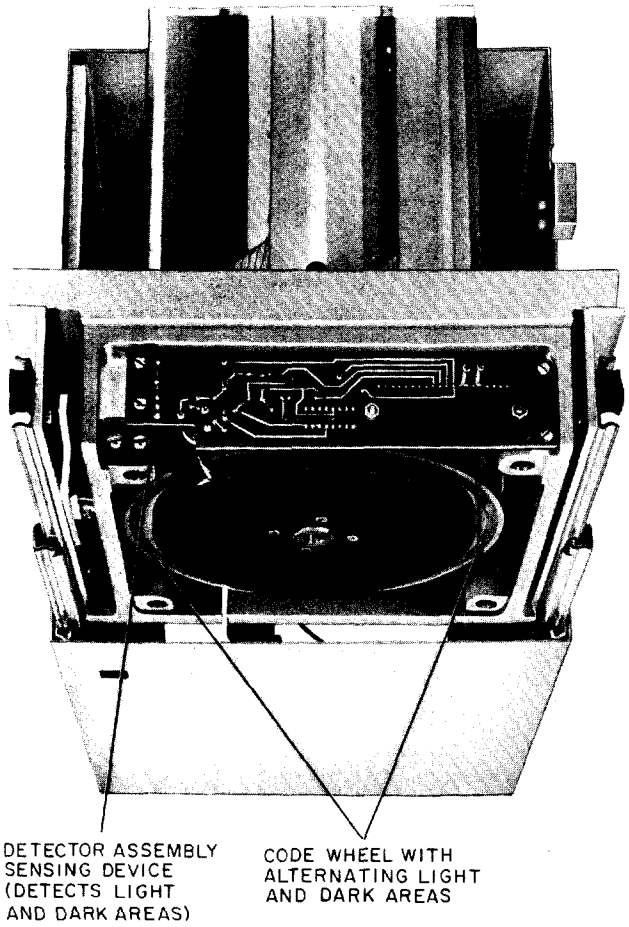


Fig. 34—Code Wheel and Code Wheel Amplifier Mounting in Relation to One Another (Underside View of DSU)

channel. The changes in state produce a square wave with a period of 3 seconds on one channel and a square wave with a period of 1 second on the other channel.

I. Wiper

4.50 Exceptionally long life is afforded the heads and the magnetic drum by a lubrication wiper (Fig. 41 and 5) which is mounted on the same cylindrical housing, which supports the magnetic head bar assemblies. The wiper runs in intimate contact with the drum, continually cleaning and lubricating by a wicking process as the drum rotates.

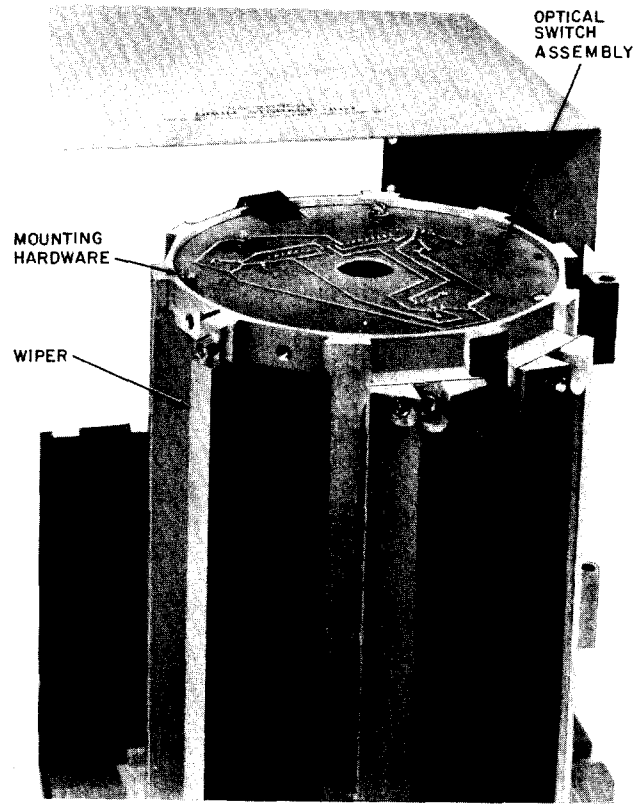


Fig. 35—Optical Switch Assembly—Mounted (Viewed With DSU Cover Removed)

J. Brush Shield

4.51 A saucer shaped brush shield (Fig. 42) is mounted on the shaft between the code wheel assembly and the motor brush ring. The shield collects the wear particles from the motor brushes to keep the code wheel clean.

CHANNEL ELECTRONICS

4.52 A family of circuit packs provides the electronics required for any channel version. In addition, a family of channel modules is provided to contain and interconnect the channel electronics. Each channel module is designed for a specific type of announcement service and a specific number of channels. Depending upon the service to be provided, the channel module can be selected and equipped with the proper types and quantities of circuit packs to provide the desired number of channels.

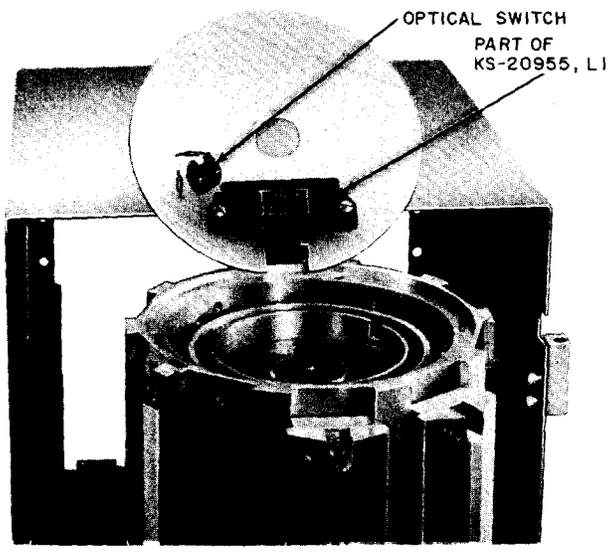


Fig. 36—L-504316-1 Optical Switch Assembly—(KS-20951, L1 DSUs Serial No. 1 Through 7)

4.53 The channel electronics are designed so that each channel operates independently of any other channel.

4.54 A channel for the fixed length short messages having a 4-second single track consists of only one circuit pack. A channel for the VML messages consists of a minimum of five to a maximum of seven circuit packs depending upon the maximum message length. The number of circuit packs varies in the VML channel because these circuit packs, in addition to their normal record-reproduce function, also provide for the electronic switching from track to track. The switching is accomplished by a switching circuit pack which is designed to handle the basic 16-second message length. Therefore, a 16-second channel would require one switching circuit pack; a 32-second channel would require two switching circuit packs; and a 48-second channel, the longest possible message, would require three switching circuit packs. A channel for the PM announcement is comprised of 17 circuit packs, consisting of four amplifiers and four switching circuit packs to handle the four phases of the announcement, an alarm logic circuit pack for each phase, a switching alarm circuit pack associated with each phase, and a demultiplexer (DMUX) audio amplifier per channel. A channel (phrase) for the MSS announcement consists of 1/4th of a circuit pack. Each circuit pack of the MSS announcement

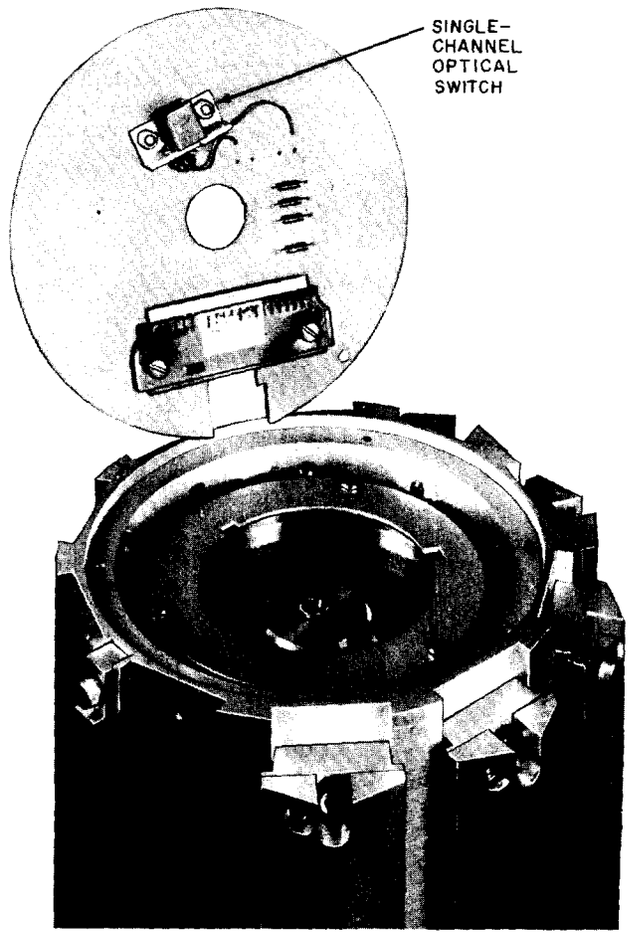


Fig. 37—L-509855-1 Optical Switch Assembly—Used With KS-20951, L1 DSUs Serial No. 8 and Up)

contains four amplifiers capable of handling four drum channels. Therefore, with the channel module containing 24 circuit packs the maximum of 96 (24× 4) channels can be handled.

4.55 All electronic circuits are mounted on printed circuit boards having the envelope size and connector end configuration of the present type A-coded circuit packs used in the No. 1 ESS. A family of 16 circuit packs is provided for use with the CSRAF. Eight of the circuit pack designs are for use in various channel modules to provide the electronics needed to operate the audio channels, and the remaining eight designs are for use in the storage module in partiality for providing servomotor controls, record bias and erase signals, and timing signals.

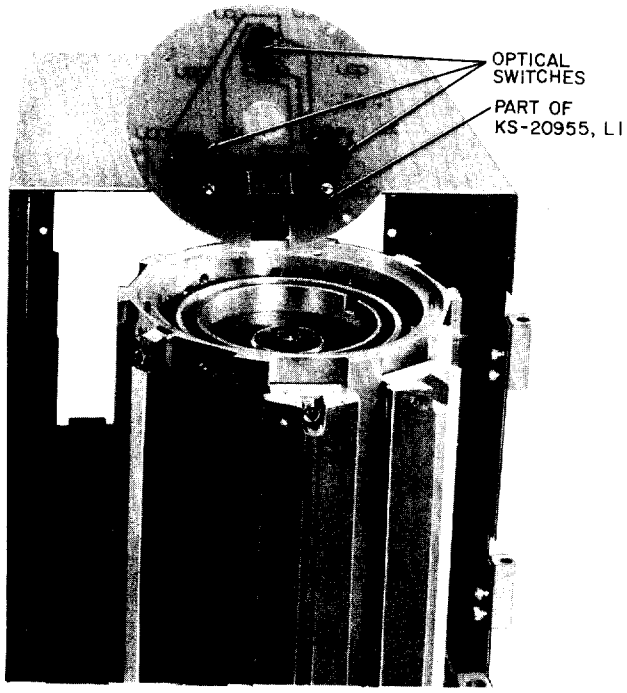


Fig. 38—L-504316-2 Optical Switch Assembly—(KS-20951, L2 DSUs Serial No. 1 Through 8)

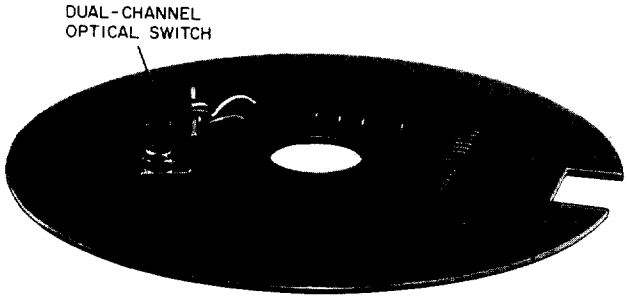


Fig. 39—L-509855-2 Optical Switch Assembly—Used With KS-20951, L2 DSUs Serial No. 9 and Up

CHANNEL MODULE

A. Variable Message Length, MM, PM, and MRS

4.56 The channel module (Fig. 43) consists of a 291A-type 4-inch mounting plate, three 36A apparatus mounting frames, a plurality of 905B circuit pack connectors interconnected with three FPW backplanes, channel input/output connectors, and a

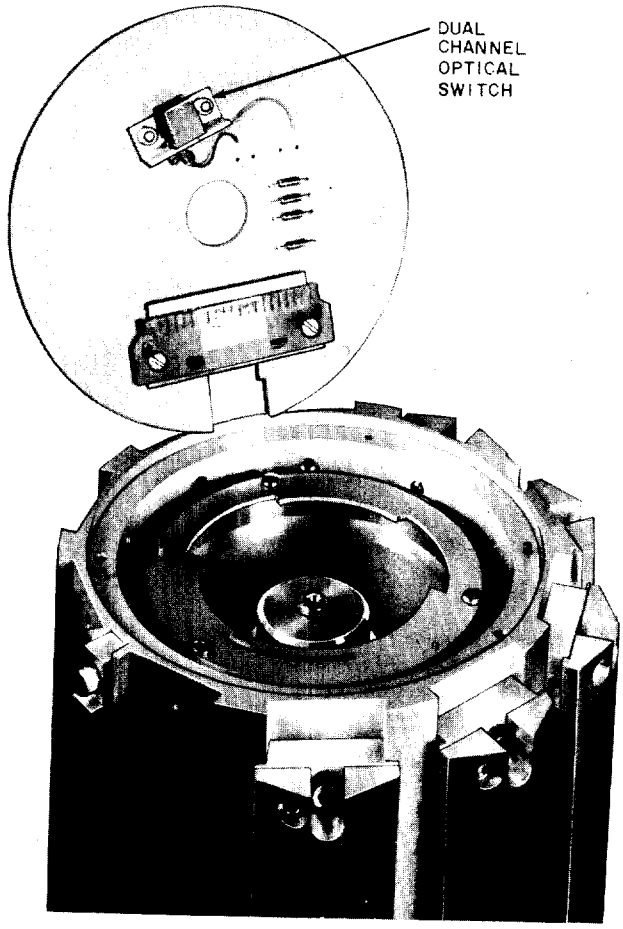


Fig. 40—L-509855-2 Optical Switch Assembly—Used With All KS-20951, L3 DSUs

channel module input/output connector. There are three channel module designs: one for the VML announcement service, one for the MM announcement service, and one for the PM announcement service. However, all channel modules are assembled from the same basic apparatus.

4.57 The basic differences between the channel modules lie in the type and number of circuit pack connectors they contain and the manner in which the circuit pack connectors are interconnected. Since the interconnection is accomplished by the FPW backplane, each of the different channel modules contains different FPW backplanes.

4.58 All connections to the channels are made through the channel connectors located on the

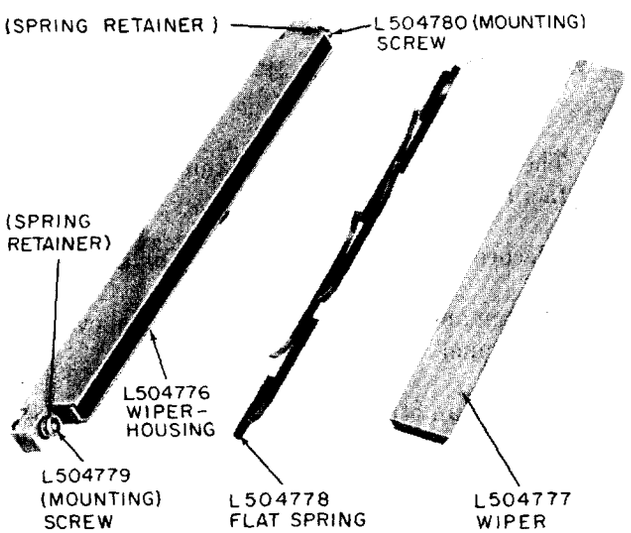


Fig. 41—Wiper Assembly

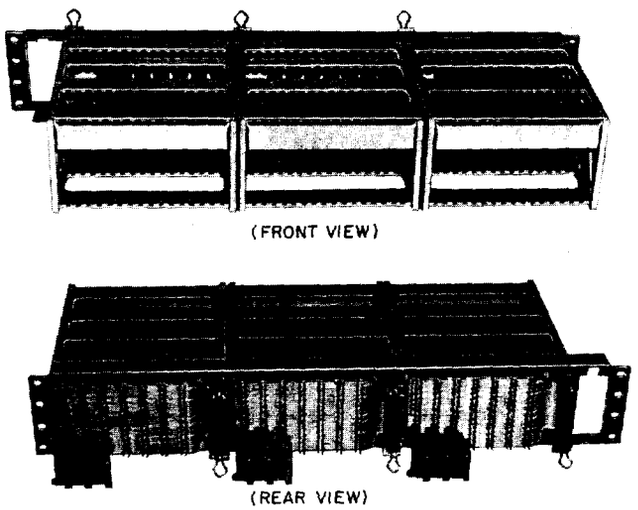


Fig. 43—Channel Module—Front and Rear Views (VML, MM, PM, or MRS)

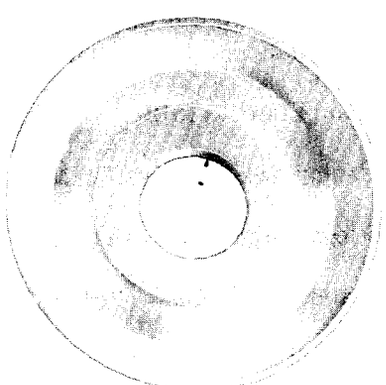


Fig. 42—Brush Shield

FPW backplane (Fig. 44). All central office connections to the channel modules are made via the channel module input/output connectors, one of which is located at the left end of each channel module for the PM and VML announcements (Fig. 2 and 3). For MM announcement, two input/output connectors are provided. One is at the left end of the channel module, and one is at the left end of the control unit (Fig. 1).

4.59 A total of nine channel modules can be mounted on one frame. The total or any part of the total may consist of any combination of the three channel module designs. These modules can in no way be combined with the module used with MSS.

B. Message Synthesis Service

4.60 The channel module consists of a 291A-type 4-inch mounting plate, three 36A apparatus mounting frames, a plurality of 905B circuit pack connectors interconnected by point-to-point wiring, and channel input/output connectors. All connections to the channels are made by point-to-point wiring at the rear of the module.

4.61 One channel module is used with each announcement machine. There are two announcement machines in each frame, therefore, only two channel modules are needed per frame. This channel module can in no way be combined with the

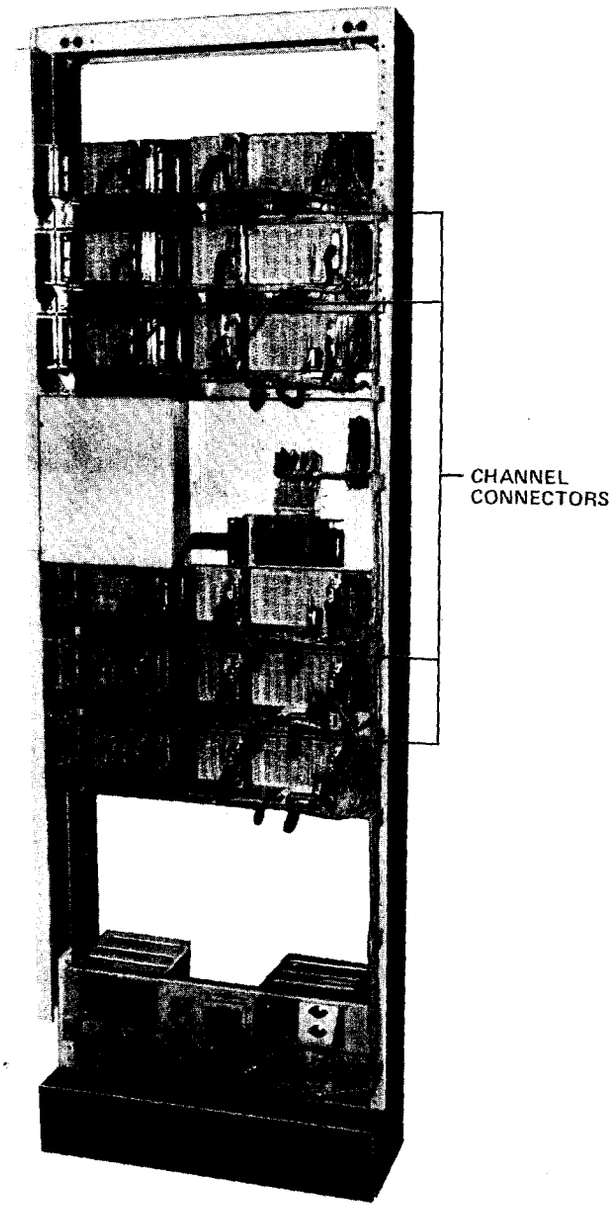


Fig. 44—Typical Rear View of CSRAF (VML, MM, PM, or MRS) Showing Channel Connectors FPW Backplane

modules used for VML, MM, and PM versions of the CSRAF.

CIRCUIT PACKS

A. Variable Message Length, MM, PM, and MRS

4.62 The circuit packs in each channel provide the facilities required to:

- Record and reproduce a message on a channel
- Adjust and monitor the transmission level on a channel
- Initiate an office alarm signal if a deterioration of the reproduced message occurs.

B. Message Synthesis Service

4.63 The circuit packs in each channel provide the facilities required to:

- Reproduce a message on a channel
- Adjust and monitor the transmission level of a channel.

4.64 There are a total of 16 circuit pack types used in the CSRAF. Eight of the sixteen types are used in the audio channels. These eight are:

- Power amplifier—A1012
- Record/playback amplifier—A1013
- Alarm logic circuit pack—A1014
- DMUX audio amplifier—A1015
- Head switching circuit—A1016
- Amp-log-alarm circuit—A1019
- Switching alarm circuit—A1020
- Quad amplifier—A1102.

4.65 The remaining eight types are common to the entire frame and are located in the storage module. Three of the remaining eight types are common to all frame versions. These three are:

- Motor tach—A1021
- Motor control—A1022
- Motor power—A1023.

Two of the remaining five types are common to VML, MM, and PM version frames. These two are:

- Clock circuit—A1017
- Bias erase oscillator—A1018.

One of the remaining three is common to MSS version of the frame. This circuit pack is ferrod driver—A1103. One of the remaining two is common to MRS version along with the A1017 clock circuit pack. The circuit pack is bias erase oscillator—A1232. The remaining type is used in the J1C012E auxiliary frame used with phased message announcement. The circuit pack is clock driver circuit—A1234.

4.66 The designations of the circuit packs and the units in which they are used are shown in Table D.

4.67 ▶A list of circuit packs in the CSRAF and a description of each is contained in Table E.◀

TABLE D

CIRCUIT PACK DESIGNATION AND USE

CIRCUIT PACK DESIGNATION	UNIT USED IN					
	MM	VML	PM	MSS	MRS	STORAGE MODULE
Power Amplifier A1012		*			*	
Record-Playback Amplifier A1013		*	*		*	
Alarm-Logic Circuit A1014		*	*		*	
DMUX Audio Amplifier A1015			*			
Head Switching Circuit A1016		*	*		*	
Clock Circuit A1017					*	*
Bias Erase Oscillator A1018						*
Amp-Log-Alarm A1019	*					*
Switching Alarm Circuit A1020		*	*		*	
Motor Tach A1021					*	*
Motor Control A1022					*	*
Motor Power A1023					*	*
Quad Amplifier A1102				*		
Ferrod Driver A1103						*
Bais Erase Oscillator A1232					*	
Clock Driver Circuit A1234			*†			

† Used in J1CO12E Auxiliary Frame

TABLE E

CIRCUIT PACKS USED IN THE CSRA FRAME

CIRCUIT PACK	DESCRIPTION
Power Amplifier A1012	This circuit pack is intended for use in the variable message length (VML) service as a constant gain power output stage and is capable of delivering 1 watt into 1 ohm.
Record-Playback Amplifier A1013	This circuit pack is intended for use in the VML and phased message channels to provide amplification in the record and playback (R/P) modes of the channels. The circuitry contains switching to operate in either mode and automatic gain control amplifiers to minimize the level differences at the input to the amplifiers. The playback amplifier acts as a variable gain preamplifier for VML service and as a final output stage for phased message service and is capable of delivering 0.1 watts into 100 ohms.
Alarm-Logic Circuit A1014	This circuit pack is intended for use in the VML and phased message channels to provide logic required to start announcements, provide timing information, and to control the channels in the R/P modes. This circuit pack also provides a cut-through relay closure and a voice alarm circuit which detects the output level of the announcement and breaks a loop to the system sensing circuitry, providing a central office alarm relay closure when the output transmission level falls below a preset level.
DMUX Audio Amplifier A1015	This circuit pack is intended for use in the VML and phased message channel to amplify the announcement returning from a dedicated subscriber connection to a level sufficient to operate the alarm circuitry on the A1014 circuit pack.
Head Switching Circuit A1016	This circuit pack is intended for use in the variable message channel and phased message channel to provide the logic, memory and relays required to electrically couple four magnetic heads consecutively to both the R/P electronics.
Clock Circuit A1017	This circuit is intended for use in the storage module to generate a fast rise-time clock pulse timing signal and a relay closure signal once-per-revolution of the magnetic drum. The clock pulse timing signal is used to initiate magnetic head switching.
Bias Erase Oscillator A1018	This circuit pack is intended for use in the storage module as a bias oscillator which provides a high-frequency (20 KHz) sine wave signal current for erasing previously recorded announcements and for ac biasing in the recording procedure.
Amp-Log-Alarm Circuit A1019	This circuit pack is intended for use in the modular message channel to record an announcement with the addition of external bias current and to play it back. A level detect circuit monitors the output level and provides a loop break whenever the level falls below a manually set level. The playback amplifier is capable of delivering 0.5 watts into 40 ohms.
Switching Alarm Circuit A1020	This circuit pack is used in the variable message and phased message channels to check for possible modes of message failures resulting from the use of head switching and to provide a central office alarm if the switching sequence is ever incorrect. This function is performed by comparing one message repetition to the next and detecting any sudden change in the message. Message repetitions are compared to each other by the use of two integrater and hold circuits which work on alternate message repetitions.

TABLE E (Contd)

CIRCUIT PACKS USED IN THE CSRA FRAME

CIRCUIT PACK	DESCRIPTION
Motor Tach A1021	This circuit pack is intended for use in the storage module to operate in association with the A1022 and A1023 circuit packs, and the code wheel, code wheel electronics, and servo motor of the KS-20951 drum storage unit. This circuit receives feedback control signals from the code wheel on the magnetic drum to provide a dc output proportional to the frequency of the input signal which, in turn, is proportional to the speed of the motor (15 RPM, 4 seconds per revoltuion).
Motor Control A1022	This circuit pack is intended for use in the storage module to operate in association with the A1021 and A1023 Circuit packs, the code wheel, code wheel electronics, and servo motor of the KS-20951 drum storage unit. This circuit contains the motor speed setting reference voltage and forward gain and compensation for the servo loop controlling the servo motor in the KS-20951 drum storage unit.
Motor Power A1023	This circuit pack is intended for use in the storage module to operate in association with the A1021 and A1022 circuit packs, the code wheel, code wheel electronics, and servo motor of the KS-20951 drum storage unit. This circuit provides the current capability and output impedance required.
Quad Amplifier A1102	This circuit pack is intended for use in the MSS channel module. This circuit contains four independent amplifiers for playing back audio signals from magnetic heads. Each amplifier is capable of delivering a maximum of 80 dB of gain into a 3300 ohm load. The output of each amplifier is made available at test points (TP1-TP4), which are located on the faceplate of each quad amplifier circuit pack. These test points are used for monitoring purposes. Each of the four individual amplifiers of the A1102 quad amp circuit pack is also equipped with a variable gain adjustment which can be accessed through the hole in the front panel of the circuit card. This control provides the means for obtaining the required transmission levels.
Ferrod Driver A1103	This circuit pack is intended for use in the storage module when the CSRA frame is equipped for MSS. This circuit provides 0.5 second and 1.5 second timing pulses which are used to drive independent but identical ferrods in the master scanner of the user system. The timing pulses are initially derived from a dual channel light detecting sensor located on the optical switch assembly within the DSU.
Bias Erase Oscillator A1232	This circuit pack is intended for use in the storage module as a bias oscillator with the additional capacity to drive six heads simultaneously.
Clock Driver Circuit A1234	This circuit pack is intended for use in the J1CO12E frame to boost the clock signal received for A1017 clock circuit

4.68 The physical arrangement of the circuit packs in the various units is described in Parts 7, 8, 9, and 10 for each announcement configuration.

CONTROL UNIT

A. Variable Message Length, MM, PM, and MRS

4.69 A control unit is associated with each channel module on a one-to-one basis. There are three control unit designs, a specific control unit design provided for each of the three channel module designs.

4.70 The control unit is mounted on the frame immediately below the channel module it serves. Each of the control units contains the frame-mounted jacks, keys, and lamps required to provide for the local control, test, and maintenance of the channel module. Each time a channel module is added to a frame, an associated control unit is also added.

4.71 Each control unit is connectorized in the rear, and connection between the control unit and its associated channel module is via a connectorized harness provided for each channel module-control unit combination. The harness plugs into the channel module connectors and the control unit connectors on the backplane of the frame. Refer to Fig. 45 for harness and connector location and identification.

4.72 The front panel of the control unit, which contains the keys, jacks, and lamps, can be completely removed from the frame for replacement of components.

4.73 In general, the keys, jacks, and lamps on the front panels of the control units provide for the following functions to be performed at the front of the frame:

- Monitoring channel message with headset
- Recording message with headset or 1000-Hz tone
- Dubbing message from tape recorder
- Turning channel power on and off
- Adjusting the voice alarm
- Measuring audio output level of a channel.

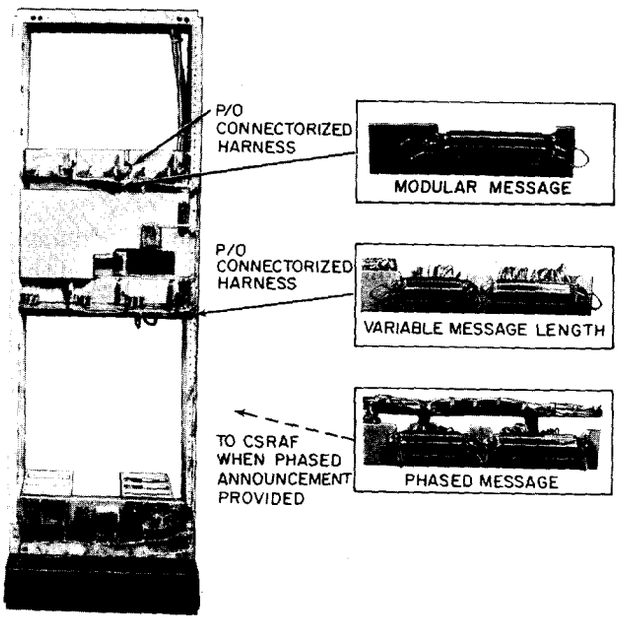


Fig. 45—Control Unit Connectors and Connectorized Harness—Typical CSRAF (VML, MM, PM, or MRS)

B. Message Synthesis Service

4.74 For MSS, no control units are necessary since no facilities are required due to the prerecorded drum. Facilities have been provided on the storage module for turning power on and off and thus no additional control unit is necessary. Also, with the test points (TP1-TP4) provided on each quad amplifier circuit card and associated amplifier level adjustments, the monitoring, measuring, and adjusting of the output level of each channel may be made.

POWER SUPPLY

4.75 All the circuit packs in the CSRAF operate from either +15, -15, or +5 Vdc. To provide for obtaining these voltages in any central office in which a CSRAF may be installed, a power supply (Fig. 1, 2, 3, and 4) is provided at the base of the frame to convert the -48 Vdc, which is universally available.

4.76 The power supply is composed of two units, a 70B power unit and a 71H power unit. The combined power output capacity from all three voltages in one power supply is 100 watts, sufficient to

power the storage module and four channel modules. If five or more channel modules are used in the same frame, two power supplies are mounted beside one another at a base. Refer to Fig. 3.

A. Variable Message Length, MM, PM, and MRS

4.77 One power supply is used to supply channel modules and control units 0 through 3 and the storage module. The second power supply is needed when any or all of channel modules and control units 4 through 8 are used. When using J1C012E with the J1C012A frame for additional PM announcements, the power supplies needed are one for channel modules 9 through 13 and one for channel modules 14 through 19.

B. Message Synthesis Service

4.78 Two power supplies are required for MSS. The MSS frame is equipped with duplicated announcement systems and therefore two power supplies (one per machine and channel module) are necessary.

4.79 Each power supply (70B and 71H) is designed to fit into one 36B apparatus mounting frame. Two of the 36B frames are mounted on one 291A type 4-inch mounting plate located at the base of the main frame immediately above the fuse panel. Normally only one power supply is provided with the frame. However, if additional power is required or if the frame is arranged for MSS, the mounting space is available for the second power supply. The power supply is designed to be self protecting under short circuit conditions.

FUSE PANEL

4.80 A fuse panel, shown in Fig. 1, 2, 3, and 4, is mounted at the base of the frame to protect channels on an individual or group basis. A separate fuse panel is used with each power supply.

FRAMES

4.81 With the use of the DSU, channel module, channel electronics, and control units (if provided), a frame can be arranged to provide a specific announcement service or a desired combination of announcement services. The principal physical differences between arrangements of the frame would be in the type and quantity of channel modules and control units (if provided).

4.82 The CSRAF equipment can be built up on either of two frameworks. When the equipment is mounted on a No. 1 ESS framework, the frame is coded J1C012A. When the equipment is mounted on an 11-foot 6-inch bulb angle framework, the frame is coded J1C012B. Neither of these two codes can be arranged for MSS. When the equipment is mounted on the same framework as the J1C012A and arranged for MSS, the frame is coded J1C012C. When the equipment is mounted on the same framework as the J1C012A and arranged for MRS, the frame is coded J1C012D. Also, when the addition of PM channels are needed, the auxiliary frame is coded J1C012E.

A. Variable Message Length, MM, PM, and MRS

4.83 A CALL DIRECTOR telephone (Fig. 46) is used as a dedicated phone for recording of audio information on the CSRAF from a quiet location. The CALL DIRECTOR telephone is a 637 EA13-type equipped with 18 key positions; two positions for the record function and 16 positions for selecting channels on the CSRAF, one position per channel. If the CSRAF is equipped with more than 16 channels, two additional 635 GC keys can be added to provide for 12 additional channels or a maximum of 28 channels. Also provided on the side of the CALL DIRECTOR telephone is a jack arrangement so that professionally prerecorded messages can be dubbed onto the recorded announcement frame.

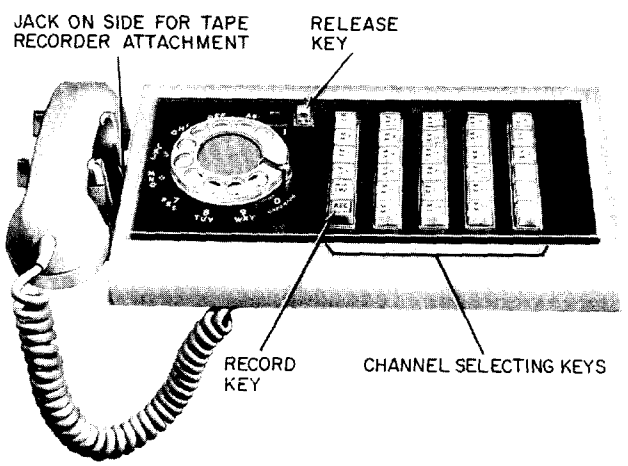


Fig. 46—The 637EA13—CALL DIRECTOR Telephone

4.84 One CALL DIRECTOR telephone is provided per frame. Two frames located in the same frame lineup require two CALL DIRECTOR telephones for access.

B. Message Synthesis Service

4.85 For MSS, the use of a dedicated phone is not necessary. Because of the use of the prerecorded magnetic drum, no recording facilities of any type are required.

5. RESTRICTIONS

VARIABLE MESSAGE LENGTH, MM, PM, AND MRS

5.01 Only three restrictions apply in the use of the CSRAF. Two are associated with the input/output connecting cables and one with channel capacity.

A. Cables

5.02 The output impedance of the playback amplifiers is designed to be very low to minimize transmission loss with simultaneous trunk connections and to maximize talk through loss between trunks connected to the same amplifier. The resistance of the cable connecting the amplifier output to the distributing networks, which connect to the trunks, adds to the output impedance of the amplifier. This cable resistance should, therefore, be kept as low as possible while still allowing some degree of freedom in locating the CSRAF in a frame lineup. Generally, the service to be provided and the transmission objectives will dictate the cable resistance tolerance; but if the loop resistance of the cable can be kept to approximately 0.5 ohms, transmission performance should be excellent in all cases. Also, the resistance of the cable connecting the CALL DIRECTOR telephone to the CSRAF must be kept within bounds. In this case, however, considerably more resistance is tolerable; if the cable loop resistance does not exceed 150 ohms, very satisfactory recordings should result. The 150-ohm limitation applies to remote recording from a CALL DIRECTOR telephone located in the same building which contains the CSRAF.

B. Channel Capacity

5.03 The channel capacity is limited to nine channel modules per frame, and the total recording time of all channels cannot exceed 800 seconds.

MESSAGE SYNTHESIS SERVICE

5.04 The only restriction in the use of the CSRAF arranged for MSS is that the total number of channels cannot exceed 96. The limit is set by the number of amplifiers provided.

> ***Note:*** Although not a requirement, it is suggested, in order to cause minimum interference to the audio signals, that the CSRAF should not be located adjacent to frames which produce extraordinary electrical activity (ie, ring and tone frame).

6. RECORDING

VARIABLE MESSAGE LENGTH, MM, PM, AND MRS

6.01 Recordings on the CSRAF can be made either locally at the frame by central office personnel or remotely in a quiet area by operators or other qualified personnel.

A. At the CSRAF

6.02 Recording at the frame can be accomplished in one of three ways:

- Live voice using a 52-type operator headset or a G3DR-61 type handset
- Using a 1000-Hz, 1-milliwatt tone
- Dubbing professionally prerecorded messages from a tape recorder.

Local recording at the frame would generally be done for test or maintenance functions. Means of accomplishing local recording are provided by keys, jacks, and lamps on the storage module and the control units. More detailed information about local recording procedures can be found in Sections 201-520-301 and 201-520-501.

B. Remote

6.03 Remote recording is accomplished from a CALL DIRECTOR telephone located in a quiet area. Two of the keys, REC (record) and MM LMP (modular message timing lamp), are used for recording, and the remaining buttons are used for channel selection. To make a recording, the receiver is lifted and the desired channel selection key is depressed.

The present message can be immediately monitored. Interfacing equipment can be arranged to light the lamp under the REC key when the channel is available for recording. The REC key is then depressed and held. Within 4 seconds, a lamp lights either under the depressed channel selection key for PMs and VMLs or under the MM LMP key for MMs, at which time the operator can start dictation. When the dictation has been completed, the REC key is released, after which the recorded message can be monitored. Remote recording is also possible using a tape recorder to dub professionally prerecorded messages onto the frame. A jack is provided on the CALL DIRECTOR telephone for this purpose.

MESSAGE SYNTHESIS SERVICE

6.04 Because of the use of the prerecorded magnetic drum, no recording facilities of any type either local or remote are necessary.

7. VARIABLE MESSAGE LENGTH ANNOUNCEMENT

GENERAL

7.01 The maximum capacity of the VML announcement is 48 seconds, variable in 4-second increments at the time of recording. The channel operation is synchronous with a 4-second period which corresponds to the drum rotation period. A clock pulse is produced by an optical switch assembly mounted on top of the drum unit.

7.02 If a message exceeds 4 seconds in length, it must be recorded on two or more tracks which are electronically pieced together in the R/P process. The number of messages or channels that can be handled by the DSU is dependent upon the lengths of the individual messages; the longer a message, the more tracks are required.

7.03 To handle this situation, the DSU is organized to arrange the tracks in groups of four. Since each track provides 4 seconds, the 4-track group provides a basic message length of 16 seconds. The 16-second modules may then be added together to provide for the maximum length of message expected. The established standard message lengths are 16, 32, and 48 seconds. The maximum message length selected for a channel is dictated by the maximum length message anticipated to be recorded on a channel. The actual message length can be from zero to maximum, since the message is built up in 4-second increments until maximum is reached.

7.04 In the playback mode, the message is announced on a repeating cycle which is determined by the actual message length, not the maximum length. This feature of the DSU, in conjunction with the associated electronics on the frame, provides a VML announcement service. When a particular maximum message length is chosen for a given channel, an associated number of tracks (maximum message length in seconds divided by four) are dedicated to that channel and cannot be used elsewhere. Therefore, to realize the greatest number of channels, the maximum message length of each channel must be realistically chosen.

CHANNEL MODULE

7.05 The VML channel module (Fig. 47) provides for a 3-channel operation with each channel having a maximum message length of 48 seconds. In this design, each 36A apparatus mounting frame is dedicated to a single channel, and the three 36A apparatus mounting frames together provide for three separate channels. The 48-second limitation on each channel results from the physical limitation of the number of circuit packs that can be placed in one 36A mounting frame. Each VML channel requires four circuit packs for the normal record, reproduce, and alarm functions. The channel also requires switching circuit packs. If the channel is equipped for only 16-second long messages, one switching circuit pack is required in addition to the previously described normal circuit packs. If the channel is equipped for 32-second messages, two switching circuit packs are required and for 48-second messages, three switching circuit packs are required. The third switching circuit pack fills the 36A apparatus mounting frame. Refer to Fig. 48 for location and identification of VML channel module circuit cards.

CONTROL UNIT

7.06 For local maintenance, a control unit is located under each channel module. This control unit is used to turn power on and off, record test signals on the tracks, monitor recorded announcements, adjust voice alarm levels, and indicate off-normal and power-off conditions.

7.07 Table F provides a complete listing of all keys, jacks, and lamps associated with the variable message control unit and a description of each.

ALARMS

7.08 The announcement frame is alarmed for the predominant modes of failure. To simplify the

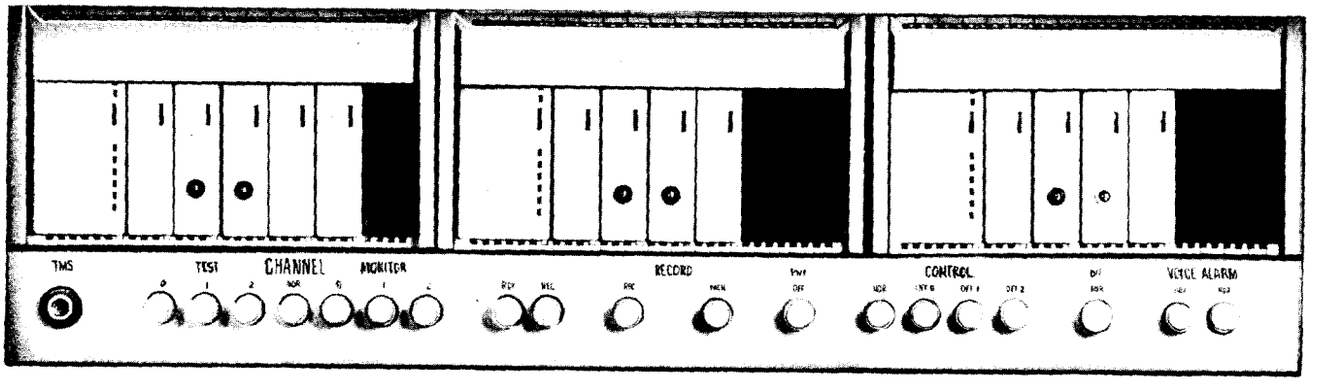


Fig. 47—Variable Message Length Channel Module and Control Unit

diagnosis of a machine fault, the alarm features are classified into three areas:

- Voice alarms
- Memory loss alarms
- Fuse alarms.

Alarms are given on the frame itself in the form of lights, and to the interfacing circuit in the form of relay contacts for loop closures.

A. Voice Alarms

7.09 To maintain a satisfactory audio level at the output of the announcement frame, a voice alarm circuit samples the audio at the output transformer through a 600-ohm coil. This alarm audio coil feeds a high input impedance circuit, which transforms the audio signal to obtain a dc level proportional to the signal strength so that at the nominal system audio output level, it is sufficient to operate an alarm relay. When the audio level drops below a preset level, the AL relay releases, breaking a loop for the interfacing circuit.

7.10 Provision for adjusting the sensitivity of the voice alarm level is available on the control unit. By depressing the VOICE ALARM ADJ key on the control unit, resistors are connected across the alarm audio coils of the three channels, decreasing the signal level by approximately 6 dB. The voice alarm circuit is adjusted in accordance with Section 201-520-701. A pair of contacts on the AL relay goes to the interfacing circuit for signaling. When the VOICE ALARM NOR key is depressed, the resistors are disconnected yielding a 6 dB threshold on the voice alarm.

7.11 It is not necessary to interfere with the output audio to test the voice alarm, either locally at the machine or remotely. The voice alarm is tested locally by depressing the VOICE ALARM TEST key on the storage module or remotely by supplying a loop closure from the interfacing circuit.

7.12 The audio level at which the voice alarm operates is adjustable to accommodate different system output requirements. The voice alarm not only detects a decrease in the audio level, but also any fault which would deteriorate or eliminate the signal, such as power loss, drum stoppage, malfunctioning magnetic head, faulty amplifier, etc.

B. Memory Loss Alarm

7.13 The memory feature of the VML announcement can be lost if power is removed from the associated channel module, or can be erroneously changed due to voltage transients and circuit malfunctions.

7.14 To make these errors observable, a switching alarm circuit is added to the channel circuitry. The switching alarm circuit will light an LED on the faceplate of the switching alarm card and will operate the voice alarm, lighting a second LED on the faceplate of the alarm-logic card and sending a voice alarm signal to the system. This malfunction is detected by observing the two lighted LEDs on the faceplates of the switching alarm card and the alarm-logic card.

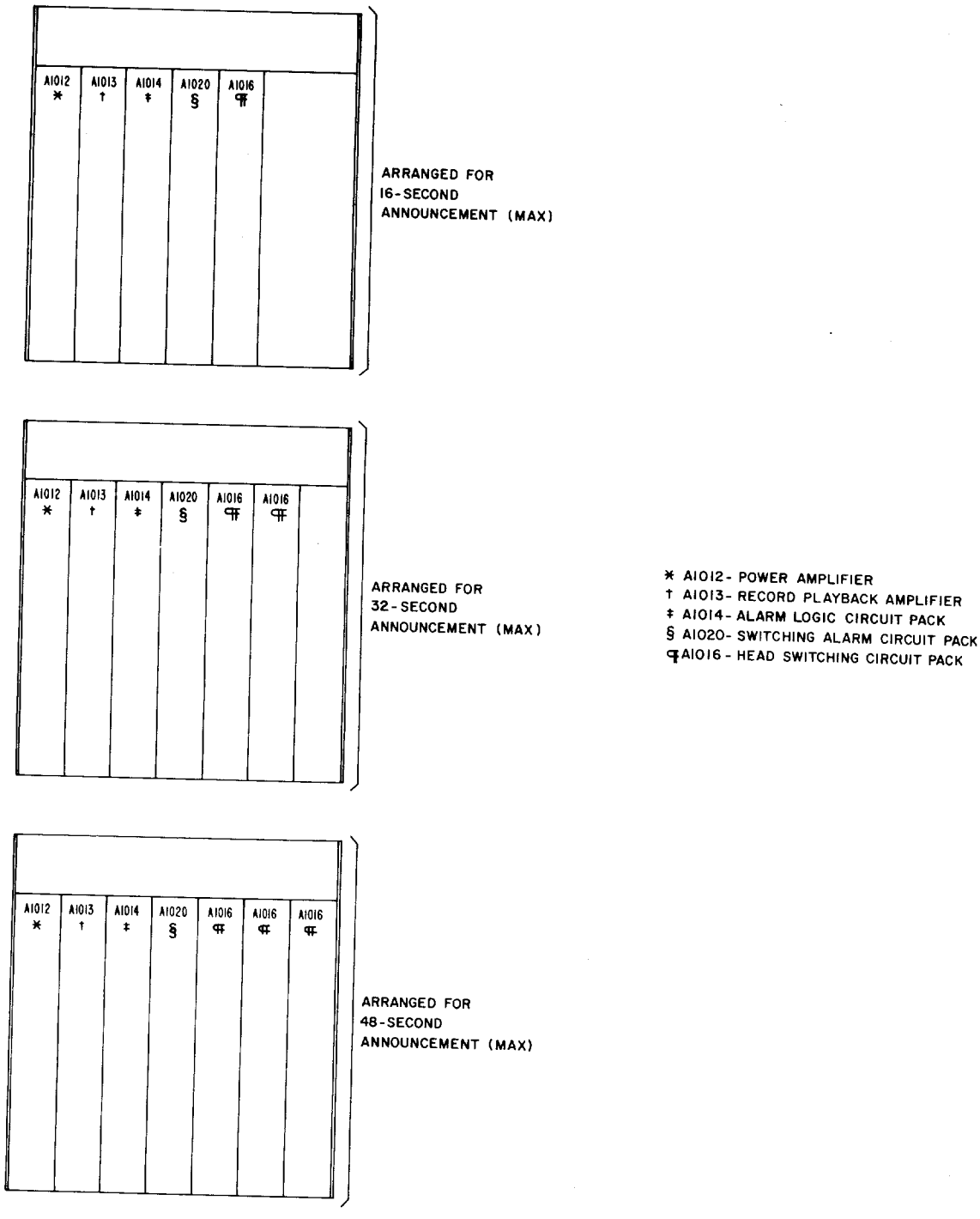


Fig. 48—Location and Identification of VML Channel Module Circuit Cards

TABLE F

VARIABLE MESSAGE LENGTH CONTROL UNIT

KEY, JACK, OR LAMP	DESCRIPTION
TMS	Transmission measuring set jack used for: • Measuring audio levels with transmission measuring set. • Recording from headset by inserting jumper rom storage module SIGNAL jack.
CHANNEL TEST (0-2)	Channel test keys—Contacts on CHANNEL TEST keys: • Connect corresponding channel preamplifier audio to TMS jack. • Supply power to CM relay. • Connect MEM key to corresponding channel. • Light OFF NOR lamp.
CHANNEL NOR	Channel normal key—Depressed when operating in normal mode.
CHANNEL MONITOR (0-2)	Channel monitor keys—Contacts on CHANNEL MONITOR key: • Remove circuit round from TMS jack. • Connect correspondng channel output to TMS jack. • Light OFF NOR lamp. Indication to interfacing circuit to remove channel from service is given when a CHANNEL TEST key is depressed but not when CHANNEL MONITOR key is depressed.
RDY	Ready lamp—Gives indication from interfacing circuit that the tested channel is out of service.
REC	Record lamp—Gives indication from alarm logic circuit that channel being tested is in the record mode.
REC	Record key—Places channel being tested into the record mode.
MEM	Memory reset key—Restores memory to channel being tested in case of memory loss.
PWR OFF	Power off lamp—Indicates: • At least one channel has power disconncted with its CONTROL key in OFF position. • A fuse has overloaded in one of the three connected channels.
CONTROL NOR	Control normal key—Depressed when in normal mode.
CONTROL OFF (0-2)	Channel control off keys—Contacts on CONTROL OFF key depressed: • Remove power from corresponding channel. • Break loop in office alarm circuit. • Light PWR OFF lamp. • Light OFF NOR lamp. • Provide closure to interfacing circuit.

TABLE F (Contd)

VARIABLE MESSAGE LENGTH CONTROL UNIT

KEY, JACK, OR LAMP	DESCRIPTION
OFF NOR	Off-normal lamp—Indicates that at least one CHANNEL CONTROL key or CHANNEL TEST key is depressed.
VOICE ALARM ADJ	Voice alarm adjust key—Contacts on ADJ key: • Connect resistors across alarm audio coil to decrease level by 6 dB, aiding in the voice alarm adjustment. • Light OFF NOR lamp.
VOICE ALARM NOR	Voice alarm normal key—Depressed when in normal mode of operation.

7.15 If the error was due to transients, the memory can be reset without erasing the message on that channel by listening to the channel with the headset and depressing the MEM (memory) key on the control unit. The MEM key will clear the memory registers and start the message from the beginning. When the end of the message is heard, releasing the MEM key restores the memory of the channel.

C. Fuse Alarms

7.16 The power supply levels used in the CSRAF are +15 and -15 Vdc for operating integrated circuit operational amplifiers and +5 Vdc for operating digital integrated circuits. These voltages are available at the base of the CSRAF from a power supply.

7.17 The three voltages are fused individually to each channel with 70-type indicating fuses. Should a fuse overload, its contact energizes a relay in the control unit serving that channel. Contacts on this relay light the PWR OFF lamp on the control unit and energize the fuse alarm (FA) relay located on the power supply module at the base of the announcement frame. Contacts on the FA relay complete a loop to the office major audible alarm. The -48 volt office supply is separately fused to supply the PWR OFF and the OFF NOR lamps.

RECORD PROCEDURES

A. Remote Recording

7.18 Recording on the announcement frame with a dedicated phone is initiated by lifting the receiver from the line switch (LS). When the LS makes contact, the control functions on the dedicated phone are enabled, and the dedicated phone receives a filtered talking current. By depressing a channel selection L key on the dedicated phone, the playback preamplifier output of that channel is connected to the dedicated phone, and the message recorded on that channel can be heard. Contacts on the channel selection L key also energize the channel maintenance(CM) relay for that channel. The CM relay contacts connect the channel to the record function and give a relay closure to the interfacing circuit indicating that the channel is being tested. The interfacing circuit can provide a closure to light the lamp under the REC key to indicate that the channel has been taken out of service.

7.19 To record a new message, the REC NL (record nonlocking) key is depressed clearing the registers on the head switching circuit and reversing the state of the relays on the R/P amplifier. These relays turn on the record amplifier and connect the bias-erase oscillator to the channel being tested.

> ***Note:*** With the use of cross-field magnetic heads, erasing of the previous announcement is accomplished simultaneously with the recording of a new announcement, thus eliminating the need for a separate erase cycle.

7.20 At the next clock pulse after the REC NL key was depressed (within 4 seconds), a record lamp lights under the depressed channel selection L key on the dedicated phone, indicating that the channel is in the record mode and the new message can

now be recorded by the operator. The record amplifier has automatic gain control, which sets a proper record level even though the voice level of the operator into the dedicated phone may not be at the optimum recording level.

7.21 At the completion of the message, the REC NL key is released. Within 4 seconds, the channel will automatically switch into the playback mode, and the lamp under the channel selection L key will extinguish. However, if the maximum capacity of the channel is exceeded while recording, the record lamp under the channel selection L key will extinguish and the message must be rerecorded.

7.22 After a recording has been made, the operator can listen to determine whether a satisfactory announcement has been recorded. If not, the message can be rerecorded by repeating the previous procedure. The channel is released to the subscribers by selecting another channel or by pushing the release (RLS) key on the dedicated phone and replacing the receiver on the line switch.

7.23 There is also provision at the CALL DIRECTOR telephone to enable the recording of messages from a tape recorder. Remote recording using a tape recorder is accomplished by connecting the tape recording equipment through 4 μF blocking capacitors into the jack provided on the side of the CALL DIRECTOR telephone. The procedure when prescribed for remote recording from a CALL DIRECTOR telephone is followed. The recorder can be unplugged after recording, and the message can be heard in the receiver of the CALL DIRECTOR telephone for verification.

B. Local Recording

7.24 It is possible to record new messages locally at the frame, either through a headset or by dubbing a prerecorded message from a tape recorder. The local recording feature provides a valuable maintenance facility for diagnosing recording problems as well as a means for recording professional prerecorded messages. Means for accomplishing local recording are provided by keys, jacks, and lamps on the storage module and the control units.

7.25 To record on one of the channels, the corresponding channel test key (TEST) is depressed. The test contacts connect the audio signal from the preamplifier output of that channel to the TMS (transmission measuring set) jack. By inserting a headset into the HEADSET jack in the storage module and connecting the SIGNAL jack in the storage module to the TMS jack in the control unit with a patch cord, the message recorded on the selected channel can be heard. The test contacts also energize the CM relay on the channel which couples the REC and MEM functions to that channel, and signals the system through a loop closure to a sensor that the channel is being tested. The interfacing circuit can provide a closure to light the record ready (RDY) lamp when no subscribers are connected to the channel (in some time interval) after the TEST key has been depressed.

7.26 To record from a tape recorder, the tape recorder output is connected into the HEADSET jack through 4 μF blocking capacitors, and a TMS is inserted into the MONITOR jack. An appropriate recording level is set by adjusting the volume control of the tape recorder and observing the level on the TMS. By pushing the REC key and turning on the tape recorder when the REC lamp lights, the message from the tape recorder will be recorded on the channel. When the message ends, the REC key is released; and when the REC lamp goes off, the channel has switched into the playback mode. By inserting a headset into the HEADSET jack, the newly recorded message can be monitored. If the message on the tape recorder is longer than the capacity of the channel, only part of the message will be recorded.

> ***Note 1:*** In preparing prerecorded tapes, the channel capacity and the reaction times in the prior procedure must be considered.
>
> ***Note 2:*** ▶The KS-20951 L31 audio monitor circuit may also be used for adjusting and monitoring the output of each track.◀

7.27 To record with a headset, it is necessary to power the microphone of the headset by inserting it into the HEADSET jack on the storage module. A patch cord is connected from the SIGNAL jack in the storage module to the TMS jack in the control unit. When the REC key is depressed, within 4 seconds, the REC lamp will light and the audio dictated into the headset will be recorded on the channel as long as the REC lamp is lighted. When the dictation stops, the REC key is released; and when the REC lamp goes off, the channel has switched into the playback mode.

7.28 After a message has been recorded, the level at the output of the frame can be measured. By

pushing the MONITOR key of the channel being tested, the output audio is connected to the TMS jack. Since no other function is accessed with the MONITOR button key, no indication is given to the interfacing circuit during the monitor mode. The output is measured by inserting the TMS into the TMS jack.

7.29 A 1000-Hz test tone is recorded on a channel by connecting the TMS jack to the 1000-Hz jack on the storage module using a patch cord and depressing the REC NL key. After the REC lamp extinguishes, the TMS jack can be connected to the SIGNAL jack, enabling the recorded tone to be monitored through the headset. Indication that a test tone is being recorded is given to the interfacing circuit through a closure of the 1000-Hz jack sleeve and the sleeve on the TMS jack.

PLAYBACK OPERATION

7.30 The most frequent mode of operation of the CSRAF is the playback mode, in which messages recorded on the drum are distributed to the subscribers. The message recorded on the drum is stored in 4-second tracks and is retrieved by switching heads in the same sequence in which the message was recorded. The operation of this system is synchronous, every action occurring at a clock pulse.

7.31 The timing pulse for the CSRAF is generated by the clock circuit pack (Fig. 11). Since all announcements are recorded on one drum, only one clock circuit pack per machine is necessary. The timing information to the clock circuit pack is supplied by an optical switch assembly located above the drum. A monostable multivibrator is incorporated to convert this once-per-revolution output into a fast, rise-time clock pulse. A relay (CL1), also on the clock circuit pack, provides a once-per-revolution closure for interface purposes.

7.32 The magnetic heads are consecutively switched to the preamplifier input through relay contacts. In determining which relay to switch and the number of relays necessary to handle the duration of the message, each head switching circuit pack contains four relays with all necessary logic and memory required to switch them. The logic and memory are composed of digital integrated circuit flip-flops in a shift register formation. To detect any possible failure in the switching logic and memory, a switching alarm circuit is included.

7.33 If a gate fails on the head switching card, a voice alarm indication will be given; and LEDs on the front panels of both the switching alarm and the alarm-logic circuit packs will light in that channel.

7.34 Additional logic is required to start announcements, to provide timing information, and to control the channel in the R/P modes. This channel logic, located on the alarm-logic circuit pack, samples the switching relay current. As long as at least one relay is operating in the channel, no action is taken. When the message ends, the memory on the head switching circuit pack inhibits the next relay from operating and the relay current drops to zero. The channel logic recognizes this condition and sets the first flip-flop on the switching register at the next clock pulse. Since this 4-second period of no relay current corresponds to a silent output condition, the channel logic also provides a 4-second CT relay closure to the interfacing circuit. Zero relay current condition could also occur if one of the gates in the switching circuitry were malfunctioning. The switching alarm circuit would detect this error. During the playback mode, the magnetic heads act as sources of audio signals which are switched consecutively by the relays to the input of a preamplifier.

7.35 The audio preamplifier contains equalization to improve the audio quality and automatic gain control (AGC) to decrease differences in head output due to variations from head to head. The amplified audio signal goes to the power amplifier, to the control unit, and to the dedicated phone.

7.36 The power amplifier is capable of delivering 0.3 watts into 0.5 ohms. A separate 600-ohm coil in the output transformer is used to monitor the level of the output audio. If the level drops 6 dB from a manually set audio output level, a voice alarm will be actuated and the LED on the front panel of the alarm logic circuit pack of the channel in question will light.

7.37 The audio signal from the preamplifier also goes to the dedicated phone and the control unit. The channel can be accessed for monitoring, and a new message can be recorded from both these locations. On the control unit, the audio signal level can be measured with a TMS to indicate that the proper audio output level is being transmitted to the interfacing circuit.

8. MODULAR MESSAGE ANNOUNCEMENT

GENERAL

8.01 The MM announcement provides for MMs, a repetitive 1.33 second announcement, with the announcement being recorded three times within the 4-second drum rotation period. The partition of the announcement is accomplished by dividing a 4-second track into three equal parts by means of the optical switch assembly. Since there is no switching of heads and the maximum load is relatively small, the circuits are very simple. For MM application, the amp-log-alarm circuit contains an R/P amplifier, the logic required to record the audio information (normally the identification of a city or area) three times on a 4-second track, and voice alarm circuitry to indicate loss of audio signal at the output.

8.02 ⧫The MM announcements can be recorded and monitored from a dedicated phone or at the frame. Only one MM channel module(24 channels) can be connected to each dedicated phone. Each channel is capable of providing an unbalanced output of 0.1 watts into a 10-ohm load.⧫

CHANNEL MODULE

8.03 The MM channel module (Fig. 49) provides for a maximum of 24 channels of MM announcement service. Each channel is associated with a single 4-second track, and the module is intended for service where the 4-second message would normally be divided into three repetitive 1.33-second messages, as used for area or city-of-origin announcements. All the electronics for one channel are contained on only one circuit pack. Each 36A apparatus mounting frame can house eight of these circuit cards. The three 36A apparatus mounting frames thus provide for a total channel module capacity of 24 channels.

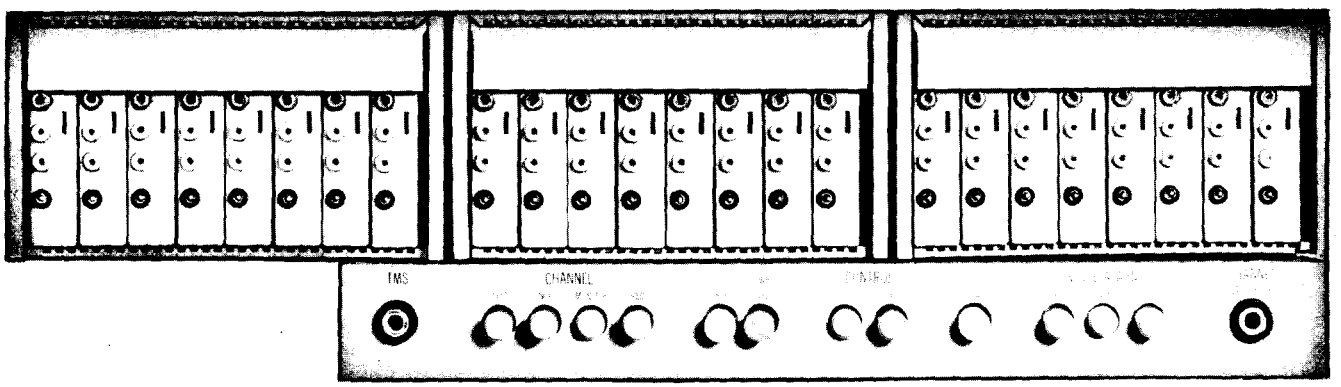


Fig. 49—Modular Message Channel Module and Control Unit

CONTROL UNIT

8.04 For local maintenance, a control unit (Fig. 49) is located under each channel module. This control unit is used to turn power on and off, record test signals on the tracks, adjust voice alarm levels, and indicate off-normal and power-off conditions. The method of channel selection for recording and testing is performed by using a patch cord, as shown in Fig. 50.

8.05 Table G provides a complete listing of all keys, jacks, and lamps associated with the modular message control unit and a description of each.

ALARMS

8.06 The announcement frame is alarmed for two modes:

- Voice alarms
- Fuse alarms.

Alarms are given on the frame itself and to the interfacing circuit through relay contacts for loop closures.

A. Voice Alarm

8.07 To maintain a satisfactory audio level at the output of the announcement frame, a voice alarm circuit samples the audio at the output. This voice alarm circuit transforms the audio signal to obtain a dc level proportional to the signal strength so that at the nominal system audio output level, it is sufficient to operate an alarm relay. When the audio level drops below a preset level, the alarm relay releases breaking a loop to the interfacing circuit.

8.08 Provision for adjusting the sensitivity of the voice alarm level is available on the control unit. By depressing the VOICE ALARM ADJ key on the control unit, resistance is added into the alarm circuit of the channel accessed, thereby decreasing the signal level by 6 dB.

8.09 The voice alarm circuit is adjusted in accordance with Section 201-520-701.

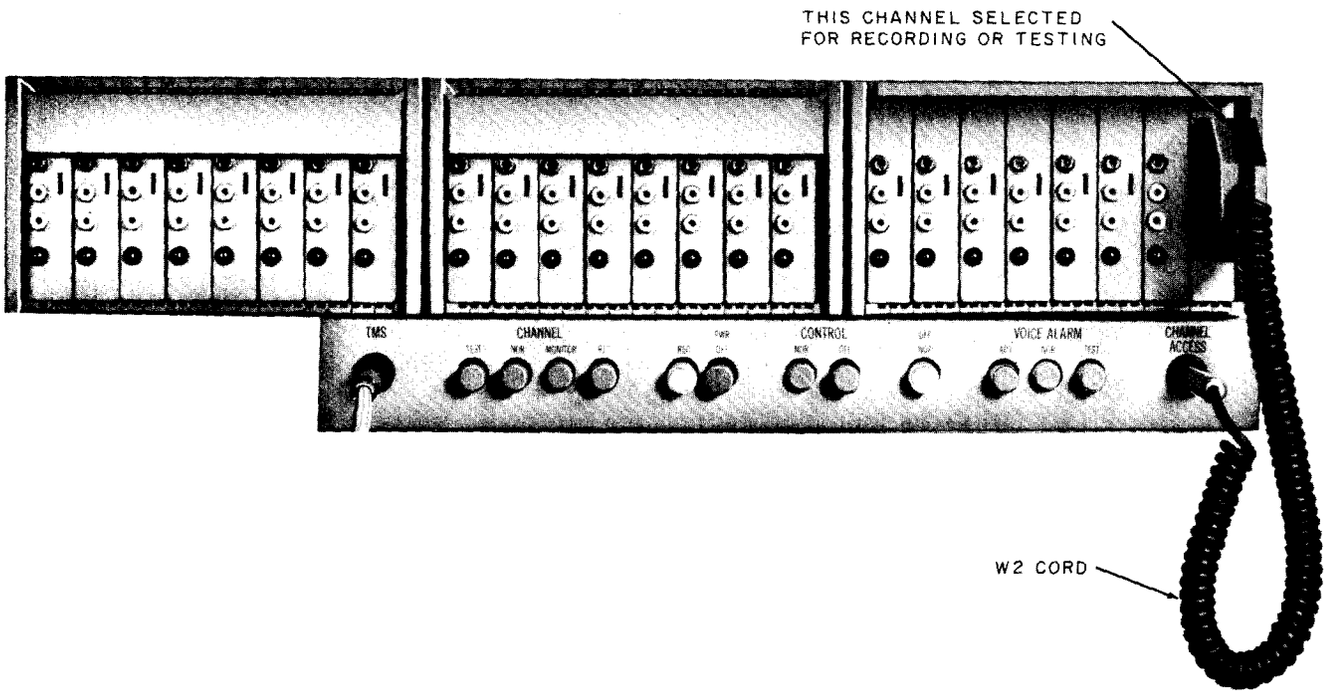


Fig. 50—Modular Message Channel Module and Control Unit and W2 Patch Cord—(Local Recording and Testing)

TABLE G

MODULAR MESSAGE CONTROL UNIT

KEY, JACK, OR LAMP	DESCRIPTION
TMS	Transmission measuring set jack used for: • Measuring audio levels with transmission measuring set. • Recording from headset by inserting patch cord from storage module SIGNAL jack.
CHANNEL TEST	Channel test key—Contacts on test key connect ACCESS jack to TMS jack and enable the record function.
CHANNEL NOR	Channel normal key—Depressed when operating in normal mode.
CHANNEL MONITOR	Channel monitor key—When depressed, connects output of a channel selected by a W2 cord to TMS jack.
CHANNEL REC	Channel record key—Used in conjunction with TEST key for recording purpose
REC	Record lamp—When in record mode, flashes once every 1.33 seconds for 100 ms when recording at the frame.
PWR OFF	Power off lamp—Lights when power is removed from frame or when a fuse overloads.
CONTROL NOR	Control normal key—Depressed when operating in normal mode.
CONTROL OFF	Control off key—Powers down all 24 associated channels.
OFF NOR	Off normal lamp—Lights when any key is in its off-normal position.
VOICE ALARM ADJ	Voice alarm adjust key—Decreases alarm level by approximately 6 dB for testing and adjusting purposes.
VOICE ALARM NOR	Voice alarm normal key—Depressed when operating in normal mode.
VOICE ALARM TEST	Voice alarm test key—Causes output level of selected channel to go to 0 causing a voice alarm.
CHANNEL ACCESS	Channel access jack—Used in conjunction with W2 patch cord for accessing channels for recording and monitoring purposes.

B. Fuse Alarms

8.10 The power supply levels used in the CSRAF are +15 and -15 Vdc for operating integrated circuit operational amplifiers, and +5 Vdc for operating digital integrated circuits. These voltages are available at the base of the CSRAF from a power supply.

8.11 The three voltages are fused individually to each channel module with 70-type indicating fuses. Should a fuse overload, its contact energizes a relay in the control unit serving that channel module.

Contacts on this relay light the PWR OFF lamp on the control unit and energize the FA relay located on the power supply module at the base of the announcement frame. Contacts on the FA relay complete a loop to the office major audible alarm. The -48 volt office supply is separately fused to supply the PWR OFF and the OFF NOR lamps.

RECORD PROCEDURES

A. Remote Recording

8.12 Recording on the announcement frame with a dedicated phone is initiated by lifting the receiver from the LS. When the LS makes contact, the control functions on the dedicated phone are enabled, and the dedicated phone receives a filtered talking current. By depressing a channel selection L (locking) key on the dedicated phone, the playback preamplifier output of that channel is connected to the dedicated phone. The output of the selected channel can now be heard in the receiver, usually the name of a city, area, or other short messages occurring every 1.33 seconds. If a new recording is to be made, a REC NL key is depressed during the entire record mode. The depressed REC key turns on the bias-erase oscillator, switches the amplifier into the record mode, and enables a record lamp to light. The optical switch assembly in the DSU produces a timing pulse every 1.33 seconds which flashes the MM LMP lamp on the CALL DIRECTOR telephone to indicate the placement of the recording. The operator can now record a new city name three consecutive times cuing on the lamp flashes. The cross-field design magnetic head used in the announcement frame performs the erase and record functions simultaneously, eliminating the delay required to erase. After recording is completed, the REC NL key is released. The operator can now listen to determine whether a satisfactory announcement has been recorded. If the announcement is satisfactory, the RLS key is depressed, and the receiver is replaced on the LS.

8.13 There is also provision at the CALL DIRECTOR telephone to enable the recording of messages from a tape recorder. Remote recording using a tape recorder is accomplished by connecting the tape recording equipment through 4 μF blocking capacitors into the jack provided on the side of the CALL DIRECTOR telephone. The procedure then prescribed for remote recording from a CALL DIRECTOR telephone is followed. The recorder can be unplugged after recording, and the message can be heard in the receiver of the CALL DIRECTOR telephone for verification.

B. Local Recording

8.14 It is possible to record new messages locally at the frame, either through a headset or by dubbing a prerecorded message from a tape recorder. The local recording feature provides a valuable maintenance facility for diagnosing recording problems as well as a means for recording professional prerecorded messages. Means for accomplishing local recording are provided by keys, jacks, and lamps on the storage module and control units.

8.15 To record on one of the channels, the channel is first accessed by means of a W2 cord (Fig. 51), and the W1 cord is connected from the SIGNAL jack on the storage module to the TMS jack of the associated control unit. Depressing the CHANNEL TEST key connects the audio signal from that channel preamplifier output to the jacks. After a headset is inserted into the HEADSET jack, the message recorded on the selected channel can be heard. The test contacts also energize the record function. When ready to record, the CHANNEL REC key is depressed and held while recording, causing the REC lamp to flash every 1.33 seconds. The announcement should be recorded between successive flashes three times, after which time the CHANNEL REC key should immediately be released.

8.16 When it is desired to record at the frame from a tape recorder, the tape recording equipment is connected into the HEADSET jack in place of the headset. The same procedure is followed as with local recording, but the recorder is activated when the lamp flashes and deactivated after the fourth consecutive flash.

8.17 A 1000-Hz test tone is recorded on a channel by connecting the TMS jack to the 1000-Hz jack on the storage module using a patch cord and depressing the REC NL key. After the REC lamp extinguishes, the TMS jack can be connected to the SIGNAL jack, enabling the recorded tone to be monitored through the headset. Indication that a test tone is being recorded is given to the interfacing circuit through a closure of the 1000-Hz jack sleeve and the sleeve on the TMS jack.

PLAYBACK OPERATION

8.18 The most frequent mode of operation of the CSRAF is the playback mode in which mes-

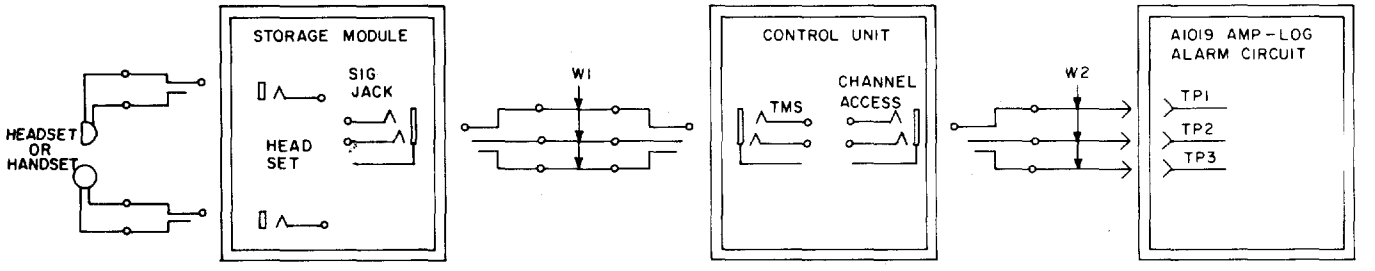


Fig. 51—Local Record Procedure for MM Announcement

sages recorded on the drum are distributed to the subscribers. The message recorded on the drum is stored in 1.33-second segments contained in a normal 4-second track on the drum. A timing closure is provided to the interface circuit to indicate cut-through (CL0B-CL1B), every 1.33 seconds. The playback amplifier is capable of delivering 100 milliwatts into 40 ohms.

8.19 On the control unit, the output audio signal level can be measured with a TMS to indicate that the proper level is being transmitted to the interfacing circuit.

9. PHASED MESSAGE ANNOUNCEMENT

GENERAL

9.01 The PM announcement provides a 12-second message that is "phased" so that the beginning of the message is available every 4 seconds. This feature results in an average waiting time of 2 seconds to hear a complete 12-second announcement.

> ***Note:*** The PM announcement is primarily intended for those services where the rate of connection for recorded announcement is high, barge-in is not desirable, and a 12-second message is satisfactory.

9.02 The PM announcement is 16 seconds long with 12 seconds of recorded announcement and a 4-second silent period. During the recording procedure, the 12-second recorded message is automatically separated into three 4-second tracks, each track being recorded by a separate stationary magnetic recording head.

9.03 The ability to provide this type of service is due to the versatility of the DSU. After the first track is used in the initial announcement, it is available to be used again to start the announcement from the beginning, while tracks two and three continue to complete the initial announcement. Providing the proper phased switching technique results in the prescribed PM announcement. The channel circuit packs in this channel module are similar to those used in the VML channel module.

9.04 When additional channels are required above the nine that are available on the J1C012A frame, eleven more are available by using the J1C012E auxiliary frame. These additional channels are interfaced to the storage module of the J1C012A, therefore, an additional storage module is not required. An additional circuit pack card, above those normally required (A1234), is positioned on the J1C012E auxiliary frame. Two power supplies are required; one for channels 9 through 14 and one for channels 15 through 19. Also located in the area of the power supplies is the fuse alarm relay. This relay operates the same as the fuse alarm relay on the J1C012A frame. In order to maintain the normal sequence of odd-numbered channel modules on the lower half and even-numbered channel modules on the upper half, the first channel module is installed above the auxiliary unit. Therefore, after ending with number eight on the top most position, number nine is positioned at the lowest position of the upper half of J1C012E auxiliary frame. The PM channel modules and control units are identical in both the J1C012A and J1C012E frames. Figure 52 shows a typical arrangement of the J1C012E frame in conjunction with the J1C012A frame.

CHANNEL MODULE

9.05 Each PM channel module (Fig. 53) provides for a single channel with the channel divided

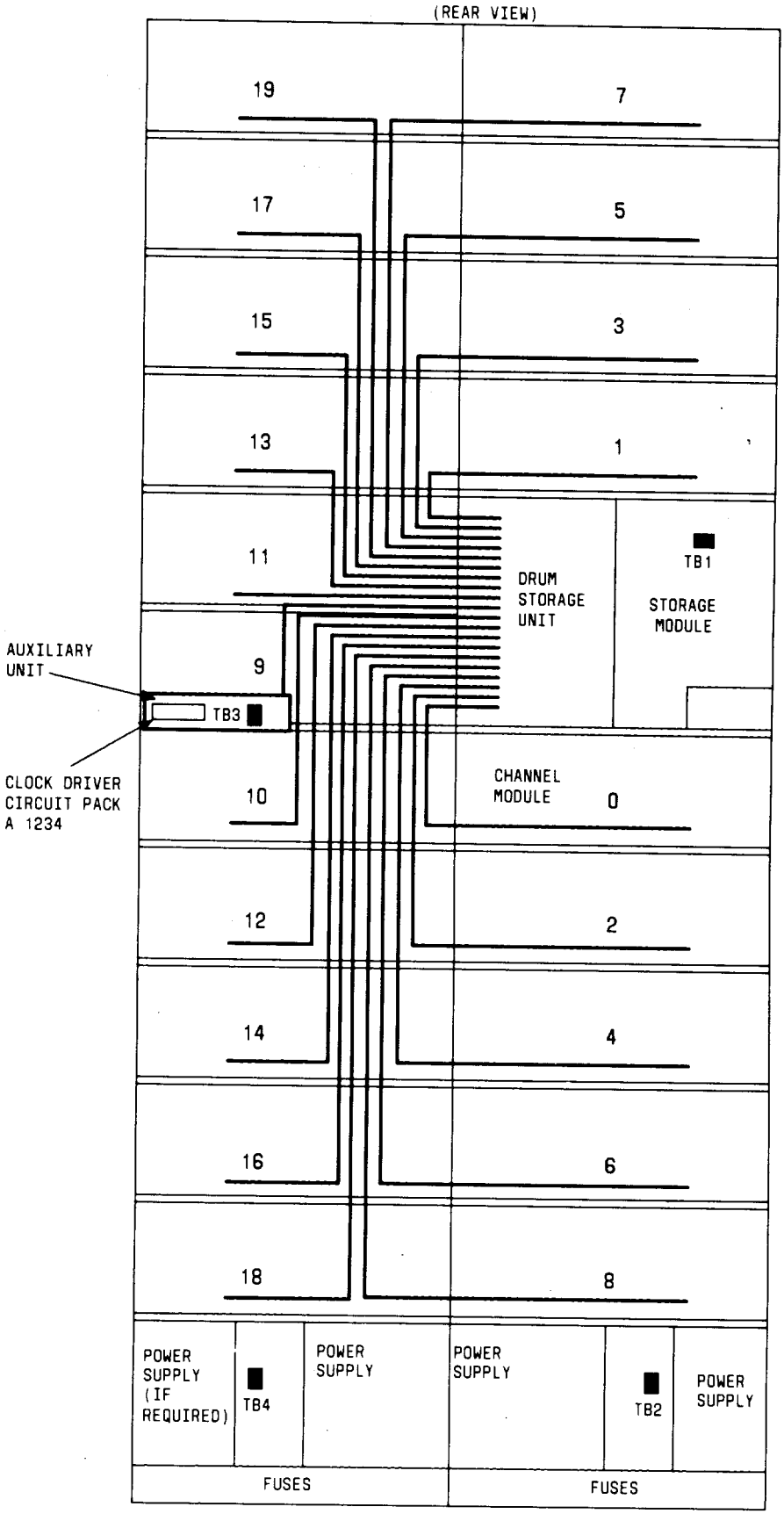


Fig. 52—Typical Arrangement of the J1C012E in Conjunction With J1C012A Frame

into four phases. The maximum message length of each phase is 12 seconds. The message length on all four phases is the same, but each phase is displaced 4 seconds from the preceding one. Each phase requires four circuit packs; three for record, reproduce, and alarm functions and one for switching. A DMUX audio amplifier circuit pack is also associated with each PM channel module to amplify the announcement coming back from the user system to a level sufficient to operate the alarm circuitry. All the circuit packs are arranged in three 36A apparatus mountings. Refer to Fig. 54 for location and identification of PM channel module circuit packs.

CONTROL UNIT

9.06 For local maintenance and control, a control unit (Fig. 53) is located under each channel module. This control unit is used to turn power on and off, record test signals on the tracks, adjust voice alarm levels, and indicate off-normal and power-off conditions.

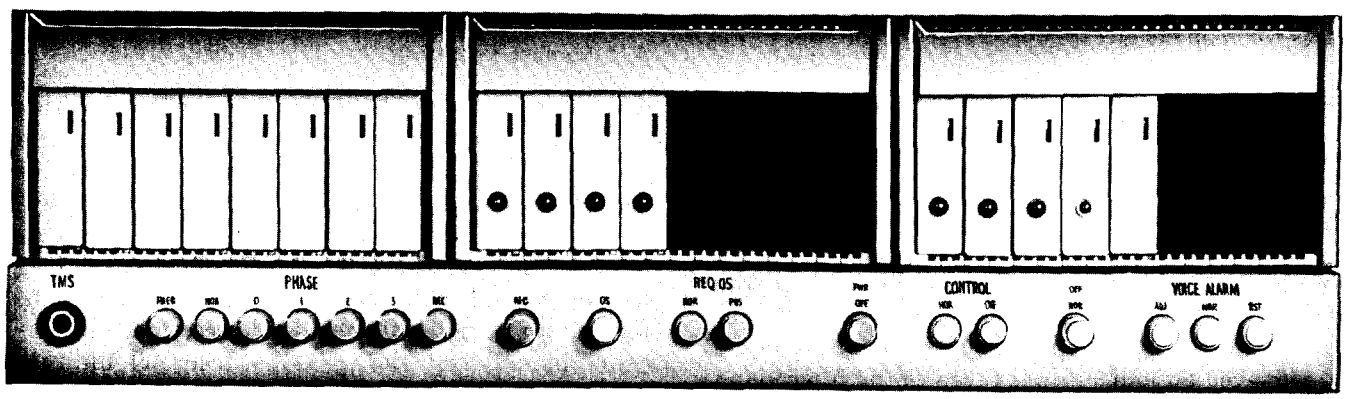
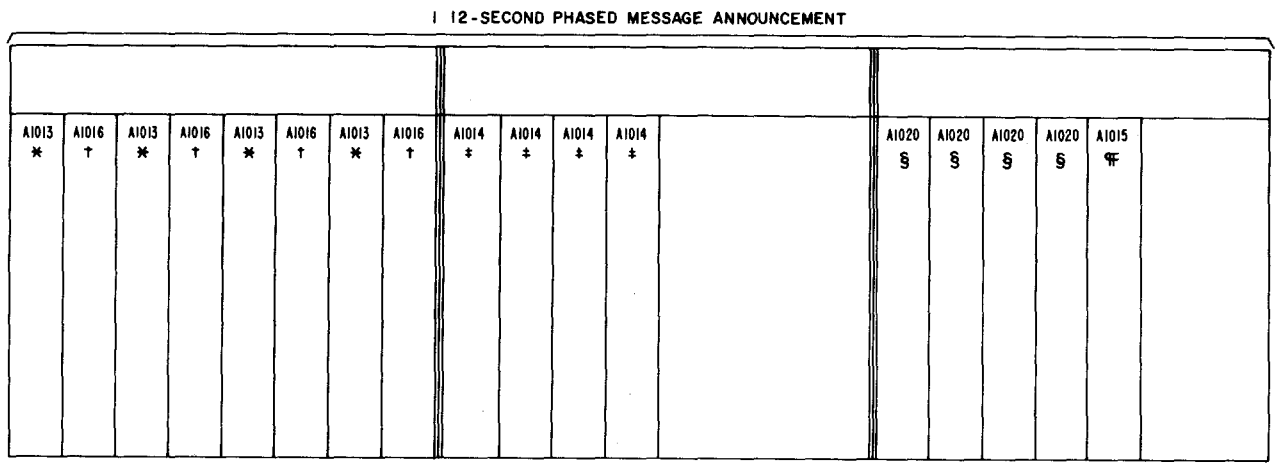


Fig. 53—Phased Message Channel Module and Control Unit



* A1013 - RECORD PLAYBACK AMPLIFIER
† A1016 - HEAD SWITCHING CIRCUIT PACK
‡ A1014 - ALARM LOGIC CIRCUIT PACK
§ A1020 - SWITCHING ALARM CIRCUIT PACK
¶ A1015 - DEMUX AUDIO AMPLIFIER

Fig. 54—Location and Identification of PM Channel Module Circuit Packs

9.07 Table H provides a complete listing of all keys, jacks, and lamps associated with the PM control unit and a description of each.

ALARMS

9.08 The announcement frame is alarmed for two modes:

- Voice alarms
- Fuse alarms.

Alarms are given on the frame in the form of lights, and to the interfacing circuit in the form of relay contacts for loop closures.

A. Voice Alarm

9.09 To maintain a satisfactory audio level, a voice alarm circuit samples the announcement from the point of distribution. This "feedback" audio output of each phase is amplified in the DMUX amplifier circuit and monitored for the correct level on the alarm logic circuit of the phase producing the announcement. If audio level drops below a predetermined level, an indication is given to the interfacing circuit for each phase. Since the level sense circuitry contains long-time constants, individual head dropouts are detected by the switching alarm circuit.

9.10 Provision for adjusting the sensitivity of the voice alarm is available on the control unit. By depressing the VOICE ALARM ADJ key on the control unit, resistors are added to decrease the feedback audio level of each phase by 6 dB. The voice alarm is adjusted in accordance with Section 201-520-701. A pair of contacts on the AL relay go to the interfacing circuit for signaling. The four phases can be adjusted simultaneously. When the VOICE ALARM NORMAL key is depressed, the resistors are disconnected yielding a 6 dB threshold on the voice alarm.

B. Fuse Alarms

9.11 The power supply levels used in the CSRAF are +15, -15, and -5 Vdc for operating integrated circuit operational amplifiers, and for operating digital integrated circuits. These voltages are available at the base of the CSRAF from a power supply.

9.12 The three voltages are fused individually to each channel with 70-type indicating fuses. Should a fuse overload, its contact energizes a relay in the control unit serving that channel module. Contacts on this relay light the PWR OFF lamp on the control unit and energize the FA relay located on the power supply module at the base of the announcement frame. Contacts on the FA relay complete a loop closure to the office major audible alarm. The -48 volt office supply is separately fused to supply the PWR OFF and the OFF NOR lamps.

RECORD PROCEDURES

9.13 A new announcement on a channel is recorded with the electronics of phase 0 only, and other phases are inhibited during the record procedure.

A. Remote Recording

9.14 Recording on the announcement frame with a dedicated phone is initiated by lifting the receiver from the LS. When the LS makes contact, the control functions on the dedicated phone are enabled, and the dedicated phone receives a filtered talking current. By depressing a channel selection locking key on the dedicated phone, the playback preamplifier output of that channel is connected to the dedicated phone, and the message recorded on that channel can be heard. When a channel selection key is depressed at the dedicated phone, a lamp on the clock circuit face plate lights, indicating that a recording is being made from the dedicated phone. Contacts on the channel selection L key also energize the CM relay for that channel. The CM contacts connect the channel to the record function and give a relay closure to the interfacing circuit indicating that the channel is being tested. The interfacing circuit can provide a closure to light the lamp (record ready) under the REC key to indicate that the channel has been taken out of service.

9.15 To record a new message, the REC NL key on the dedicated phone is depressed clearing the registers on the head switching circuit and reversing the state of the relays on the R/P amplifier. These relays turn on the record amplifier and connect the bias-erase oscillator to the channel being tested.

> ***Note:*** With the use of cross-field magnetic heads, erasing of the previous announcement is accomplished simultaneously with the recording of a new announcement, thus eliminating the need for a separate erase cycle.

9.16 At the next clock pulse after the REC NL key was depressed (within 4 seconds), a record

TABLE H

PHASED MESSAGE CONTROL UNIT

KEY, JACK, OR LAMP	DESCRIPTION
TMS	Transmission measuring set jack used for: • Measuring audio levels with transmission measuring set. • Recording from headset by inserting jumper from storage module SIGNAL jack.
PHASE RREC	Phase request record key (enabled when OS lamp is lighted)—When depressd: • Notifies system that a new message will be recorded on the respective channel. • Places a channel in state to respond to record command. • Connects DP audio from phase 0 to TMS jack.
PHASE NOR	Phase normal key—Depressed when channel is operating in normal mode.
PHASE (0-3)	Phase (0-3) keys (interlocked with RREC and NOR)—Connects respective phase output audio signal to TMS jack where output transmission levels can be monitored.
PHASE REC	Phase record key—When depressed, places channel in record mode when ROS and RREC keys are depressed and OS lamp is lighted.
REC	Record lamp—Lights for 12 seconds when channel is in record mode.
OS	Out-of-service lamp—Indicates that channel is out of service
REQ OS NOR	Request out-of-service normal key—Depressed when in normal mode.
REQ OS ROS	Request out-of-service key—When depressed requests that channel be disconnected from subscribers.
PWR OFF	Power off lamp—Indicates channel power is off.
CONTROL NOR	Control normal key—Depressed when in normal mode.
CONTROL OFF	Control off key—When depressed, removes power from channel.
OFF NOR	Off normal lamp—Indicates that at least one NOR key is not depressed.
VOICE ALARM ADJ	Voice alarm adjust key—When depressed: • Decreases alarm audio by 6 dB. • Voice alarm level can be adjusted.
VOICE ALARM NOR	Voice alarm normal key—Depressed when in normal mode.
VOICE ALARM RST	Voice alarm reset key—Depressed for greater than 32 seconds to reset switching alarm circuit.

lamp lights under the depressed channel selection locking key on the dedicated phone, indicating that the channel is in the record mode, and the new message can now be recorded by the operator. The record amplifier has AGC which sets a proper record level even though the voice level of the operator into the dedicated phone may not be at the optimum recording level.

9.17 At the completion of the message, the REC NL key is released. Within 4 seconds the channel will automatically switch into the playback mode, and the lamp under the channel selection locking key will extinguish. However, if the maximum capacity of the channel is exceeded while recording, the record lamp under the channel selection locking key will extinguish; and the message must be rerecorded.

> ***Note:*** After recording, complete message must be heard at least twice to initialize the voice alarms.

9.18 After a recording has been made, the operator can listen to determine whether a satisfactory announcement has been recorded. If not, the message can be rerecorded by repeating the previous procedure. The channel is released to the system by selecting another channel or by pushing the RLS key on the dedicated phone and replacing the receiver on the LS.

9.19 There is also provision at the CALL DIRECTOR telephone to enable the recording of messages from a tape recorder. Remote recording using a tape recorder is accomplished by connecting the tape recording equipment through 4 μF blocking capacitors into the jack provided on the side of the CALL DIRECTOR telephone. The procedure then prescribed for remote recording from a CALL DIRECTOR telephone is followed. The recorder can be unplugged after recording, and the message can be heard in the receiver of the CALL DIRECTOR telephone for verification.

B. Local Recording

9.20 It is possible to record new messages locally at the frame, either through a headset or by dubbing a prerecorded message from a tape recorder. The local recording feature provides a valuable maintenance facility for diagnosing recording problems as well as a means for recording professional prerecorded messages. Means for accomplishing local recording are provided by keys, jacks, and lamps on the storage module and the control units.

9.21 The recording procedure is initiated by depressing the request out-of-service (ROS) key. The interfacing circuit provides a closure lighting the OS lamp and enabling the record functions (R REC, REC keys). The request record (R REC) key is depressed connecting the audio signal from the preamplifier output of that channel to the TMS jacks and giving an indication to the interfacing circuit. This indication lights the lamp under the REC NL key on the CALL DIRECTOR telephone, indicating that recording is being done at the frame.

9.22 To record from a tape recorder, the tape recorder output is connected into the HEADSET jack through 4 μF blocking capacitors and a TMS is inserted into the monitor jack. An appropriate recording level is set by adjusting the volume control of the tape recorder and observing the level on the TMS. By pushing the REC NL key and turning on the tape recorder when the REC lamp lights, the message from the tape recorder will be recorded on the channel. After 12 seconds, the REC lamp will be extinguished and the REC NL key must be released within 4 seconds. By inserting a headset into the HEADSET jack, the newly recorded message can be monitored. If the message on the tape recorder is longer than the capacity of the channel, only part of the message will be recorded.

> ***Note:*** In preparing prerecorded tapes, the channel capacity and the reaction times in the above procedures must be considered.

9.23 To record with a headset, it is necessary to power the microphone of the headset by inserting it into the HEADSET jack on the storage module. A patch cord is connected from the SIGNAL jack in the storage module to the TMS jack in the control unit. When the REC NL key is depressed (within 4 seconds), the REC lamp will light. The audio dictated into the headset will be recorded on the channel as long as the REC lamp is lighted. After 12 seconds, the REC lamp will go off and the REC NL key must be released within 4 seconds, automatically switching the channel into the playback mode.

> ***Note:*** After recording, complete message must be heard at least twice to initialize the voice alarms.

9.24 After the message has been recorded, the level at the output of the frame can be measured. By depressing the phase keys, the output audio of each

phase is connected to the TMS jack. The output is measured by inserting the transmission measuring set into the TMS jack.

9.25 A 1000-Hz test tone is recorded on a channel by connecting the TMS jack to the 1000-Hz jack of the storage module using a patch cord and depressing the REC key. After the REC lamp extinguishes, the TMS jack can be connected to the SIGNAL jack, enabling the recorded tone to be monitored through the headset. Indication that a test tone is being recorded is given to the interfacing circuit through a closure of the 1000-Hz jack sleeve and the sleeve on the TMS jack.

PLAYBACK OPERATION

9.26 The most frequent mode of operation of the CSRAF is the playback mode in which messages recorded on the drum are distributed to the subscribers. The message recorded on the drum is stored in 4-second blocks and is retrieved by switching heads in the same sequence in which the message was recorded. The operation of this system is synchronous, every action occurring at a clock pulse.

9.27 The timing pulse for the CSRAF is generated by the clock circuit pack (Fig. 11). Since all announcements are recorded on one drum, only one clock circuit pack per machine is necessary. The timing information to the clock circuit pack is supplied by an optical switch assembly located above the drum. A monostable multivibrator is incorporated to convert this once-per-revolution output into a fast, rise-time clock pulse. A relay (CL1), also on the clock circuit pack, provides a once-per-revolution closure for interface purposes. When a J1C012E frame is used, a clock driver circuit pack located on the E frame is used to provide the clock signal for the additional channels.

> ***Note:*** Refer to Fig. 55 for a block diagram of a PM announcement.

9.28 A 4-second silent period between successive repetitions of the announcement results in a 16-second cycle. Four sets of amplifiers are used. Therefore, by properly switching the three magnetic heads (fourth head is connected but not used) to the four amplifiers, phases of the message are available, and the position of the silent period indicates the amplifier that will start the announcement within 4 seconds. This characteristic of the announcement cycle is used by the interfacing circuit to switch listeners into the silent period, and the announcement will begin within 4 seconds.

9.29 A cut-through (CT) indication in the form of a loop closure is given to the interfacing circuit when the 4-second silent period occurs in each phase. In the steady state operation, there is only one phase in the silent interval.

9.30 The R/P amplifier contains equalization to improve the audio quality and AGC to decrease differences in head output due to variations from head to head. The amplified audio signal goes to the interfacing circuit, the control unit, and the dedicated phone. The playback amplifier is capable of delivering 0.4 milliwatts into 600 ohms.

9.31 The channels can be accessed for monitoring, and a new message can be recorded from both these locations. On the control unit, the audio signal level can be measured with a transmission measuring set to indicate that the proper level is being transmitted to the interfacing circuit.

10. MESSAGE SYNTHESIS SERVICE

GENERAL

10.01 Each announcement machine of the CSRAF arranged for MSS has the capability of reproducing simultaneously a total of 96 tracks of prerecorded voice information. Each prerecorded track contains number, phrase, or locality messages. The maximum message interval for numbers is 0.5 second and for phrases and localities 1.5 seconds. With the magnetic drum rotation period of 3 seconds, the 1.5-second phrase is provided two times and the 0.5-second phrase is provided six times within the same rotation period. The partition of the announcement is accomplished by dividing a 3-second track into either two or six equal parts by means of the optical switch assembly. Under program control, a number of prerecorded phrase, locality, and number information of either 1.5 seconds, duration, 0.5 second duration, or both, are electronically "pieced" together (synthesized) in a logical programmed sequence by time division switching techniques.

10.02 Time division switching of phrase and number information onto and off of a common talking bus in a programmed sequential order forms complete announcements.

10.03 Each electronically synthesized announcement is arranged for responding to a specific

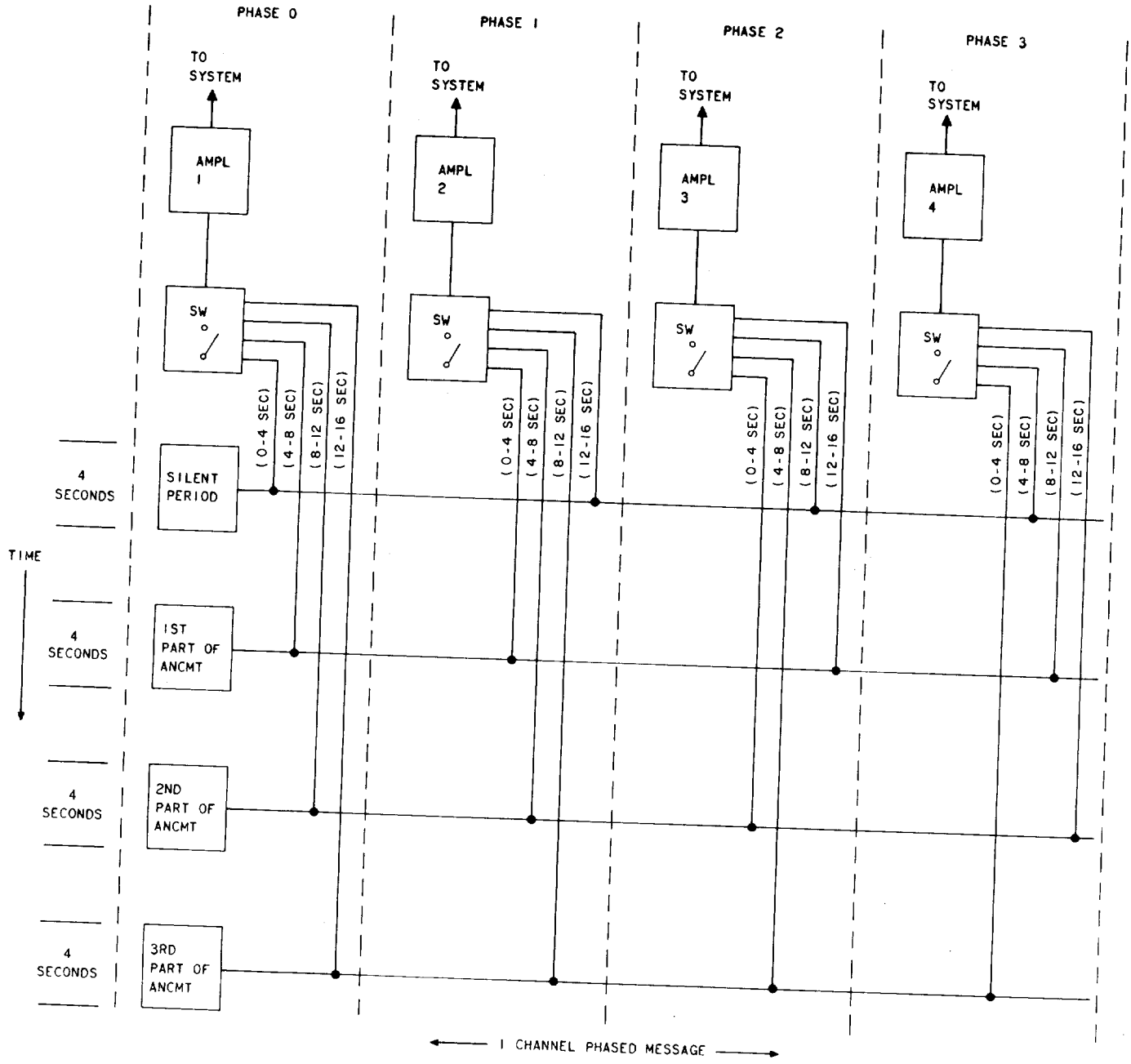


Fig. 55—Phased Message Announcement—Block Diagram

type of calling condition entering a user system for service.

10.04 Since there is no necessity for the switching of heads and the need for recording facilities is not required, the circuits for the MSS version of the CSRAF are relatively simple. The quad amplifier circuit, which is used entirely to make up the MSS channel module, contains four independent amplifiers for playing back audio signals from magnetic heads. Each independent amplifier of the quad amplifier is associated on a one-to-one basis to a magnetic head. When the user system requires a particular announcement, it will connect to the proper amplifiers in the proper sequence. With the prerecorded drum constantly rotating and the timing pulses being sent

to the system, the system can connect to the beginning of a phrase of either 1.5 or 0.5 seconds duration and disconnect at the next timing pulse which would be the end of the phrase. With this timing arrangement, no time is lost between phrases, and the user system is able to achieve a complete announcement with no noticeable gap or time lag. (Timing information defining the beginning and end of prerecorded message intervals is provided by a coded disk located atop the magnetic drum.) Complete announcements are then immediately transmitted to calling subscribers who have reached nonworking numbers. The arrangement of the various announcements and the head and amplifier associated with each is shown in Table I. This table is physically located at the CSRAF on the back side of the drum storage unit door. (See Fig. 56.)

CHANNEL MODULE

10.05 The MSS channel module (Fig. 57) provides for a maximum of 96 channels. The channel module is made up of 24 individual quad amplifiers, with each quad amplifier providing 4 individual amplifier circuits. Thus, each channel module contains 24 (quad amps) × 4 (amps each) for a total of 96 amplifiers per channel module. Therefore, the 96 amplifiers per channel module can serve the 96 channels on a one-to-one basis. Each amplifier is associated with a single 3-second track, and the module is intended for service where the 3-second message would normally be divided into two 1.5-second messages or six 0.5-second messages, for synthesizing a large inventory of intercept announcements. All the electronics for one channel is contained on one-fourth of a circuit pack. Each circuit pack, therefore, can handle four individual channels. Each 36A apparatus mounting frame can house eight of these circuit packs. The three 36A apparatus mounting frames thus provide for housing 24 circuit packs for a total channel module capacity of 96 channels. Refer to Fig. 58 for location and identification of circuit packs and channel (track) assignment for MSS.

RECORDING OF MESSAGES

10.06 For MSS, no record procedures are necessary due to the use of the prerecorded drum. All announcements are recorded on a KS-20952, L3 drum or KS-20952, L5, if the AIS is equipped with PG-1B203 or later, for actual operation. Also, no provision is made for recording new information on blank announcement tracks or for rerecording of existing information in the field. Announcement information can be changed, added, or renewed in the field only by replacement with new or refurbished drums on which the required information has been prerecorded by the manufacturer.

DRUM TRACK AND MESSAGE ASSOCIATION

10.07 Table I provides an organization breakdown and assignment for standard messages (announcement tracks 1 through 48) as they relate to magnetic head, amplifier, output, connector leads, and announcement track number.

PRERECORDED STANDARD MESSAGES

10.08 Out of the 96 available announcement tracks, 48 (tracks 1 through 48) are assigned specific standardized prerecorded messages consisting of numbers and phrases. The time duration allowed for phrases is 1.5 seconds maximum. The time duration allowed for numbers is .5 second. Phrases therefore are prerecorded two times around the circumference of each drum track, while numbers are prerecorded six times around the circumference of each drum track to be compatible with the 3-second period of revolution of the drum.

PRERECORDED LOCALITY MESSAGES

10.09 Prerecorded tracks 49 through 88 are reserved for locality names with tracks 89 to 96 reserved for standardized prerecorded messages, of which track 89 is the special information tone. The time duration allowed for locality names is 1.5 seconds. The locality names are specified for local area announcements to satisfy specific job requirements.

PLAYBACK OPERATION

10.10 The only mode of operation of the CSRAF arranged for MSS is the playback mode in which messages prerecorded on the drum are extracted by the user system and distributed to the subscribers. The messages recorded on the drum are stored in 1.5-second or 0.5-second segments contained in a normal 3-second track on the drum. The two timing signals, that are provided to the interface circuit, change state every 0.5 or 1.5 seconds to indicate the beginning of a letter, word, number, or phrase. A large inventory of announcements are generated from the 96 prerecorded phrase, number, and locality messages. These are automatically assembled to-

TABLE I

REPRODUCER ANNOUNCEMENT TRACK, HEAD AMPLIFIER, PLUG CONNECTIONS, TRUNK AND MESSAGE ASSIGNMENT

J27 PIN NO.	AMP AND HEAD	OCTAL NUMBER	MESSAGE
1,13	1	640	THE NUMBER YOU HAVE REACHED
2, 14	2	641	HAS BEEN CHANGED
3, 15	3	642	THE NEW NUMBER (PAUSE) IS
4, 16	4	643	TO A NONPUBLISHED NUMBER
5, 17	5	644	FOR INCOMING CALLS
6, 18	6	645	IN AREA CODE
7, 19	7	646	HAS BEEN DISCONNECTED
8, 20	8	647	TO A NON-LISTED NUMBER
9, 21	9	650	HAS BEEN TEMPORARILY
10, 22	10	651	AT THE CUSTOMER'S REQUEST
11, 23	11	652	IS BEING CHANGED
12, 24	12	653	THE NEW NUMBER
49, 61	13	654	MAY NOT YET BE CONNECTED
50, 62	14	655	
51, 63	15	656	CALLS ARE BEING TAKEN BY
52, 64	16	657	IS NOT IN SERVICE
53, 65	17	660	IS A WORKING NUMBER
54, 66	18	661	PLEASE CHECK THE NUMBER
55, 67	19	662	AND DIAL AGAIN
56, 68	20	663	IF YOU NEED ASSISTANCE
57, 69	21	664	PLEASE MAKE A NOTE OF IT
58, 70	22	665	YOU MAY STAY ON THE LINE
59, 71	23	666	AND AN OPERATOR WILL ANSWER
60, 72	24	667	THOUSAND

J28 PIN NO.	AMP AND HEAD	OCTAL NUMBER	MESSAGE
1,13	25	670	HUNDRED
2, 14	26	671	OH –
3, 15	27	672	ONE –
4, 16	28	673	TWO –
5, 17	29	674	THREE –
6, 18	30	675	FOUR –
7, 19	31	676	FIVE –
8, 20	32	677	SIX –
9, 21	33	700	SEVEN –
10, 22	34	701	EIGHT –
11, 23	35	702	NINE –
12, 24	36	703	OH
49, 61	37	704	ONE
50, 62	38	705	TWO
51, 63	39	706	THREE
52, 64	49	707	FOUR
53, 65	41	710	FIVE
54, 66	42	711	SIX
55, 67	43	712	SEVEN
56, 68	44	713	EIGHT
57, 69	45	714	NINE
58, 70	46	715	(REORDER TONE)
59, 71	47	716	AREA CODE
60, 72	48	717	WILL YOU DIAL IT AGAIN PLEASE

TABLE I (Contd)

REPRODUCER ANNOUNCEMENT TRACK, HEAD AMPLIFIER, PLUG CONNECTIONS, TRUNK AND MESSAGE ASSIGNMENT

J29 PIN NO.	AMP AND HEAD	OCTAL NUMBER	MESSAGE
1,13	49	720	LOCALITY OR NPA CODE PHRASES
2, 14	50	721	
3, 15	51	722	
4, 16	52	723	
5, 17	53	724	
6, 18	54	725	
7, 19	55	726	
8, 20	56	727	
9, 21	57	730	
10, 22	58	731	
11, 23	59	732	
12, 24	60	733	
49, 61	61	734	
50, 62	72	735	
51, 63	63	736	
52, 64	64	737	
53, 65	65	740	
54, 66	66	741	
55, 67	67	742	
56, 68	68	743	
57, 69	69	744	
58, 70	70	745	
59, 71	71	746	
60, 72	72	747	

J30 PIN NO.	AMP AND HEAD	OCTAL NUMBER	MESSAGE
1,13	73	750	LOCALITY OR NPA CODE PHRASES
2, 14	74	751	
3, 15	75	752	
4, 16	76	753	
5, 17	77	754	
6, 18	78	755	
7, 19	79	756	
8, 20	80	757	
9, 21	81	760	
10, 22	82	761	
11, 23	83	762	
12, 24	84	763	
49, 61	85	764	
50, 62	86	765	
51, 63	87	766	
52, 64	88	767	
53, 65	89	770	SIT-TONE
54, 66	90	771	AND IS NO LONGER TOLL FREE
55, 67	91	772	PLEASE TRY YOUR CALL AGAIN LATER
56, 68	92	773	IS BEING CHECKED FOR TROUBLE
57, 69	93	774	AND IS TOLL FREE
58, 70	94	775	DISCONNECTED AND
59, 71	95	776	DISCONNECTED
60, 72	96	777	REMOVED FROM SERVICE AND

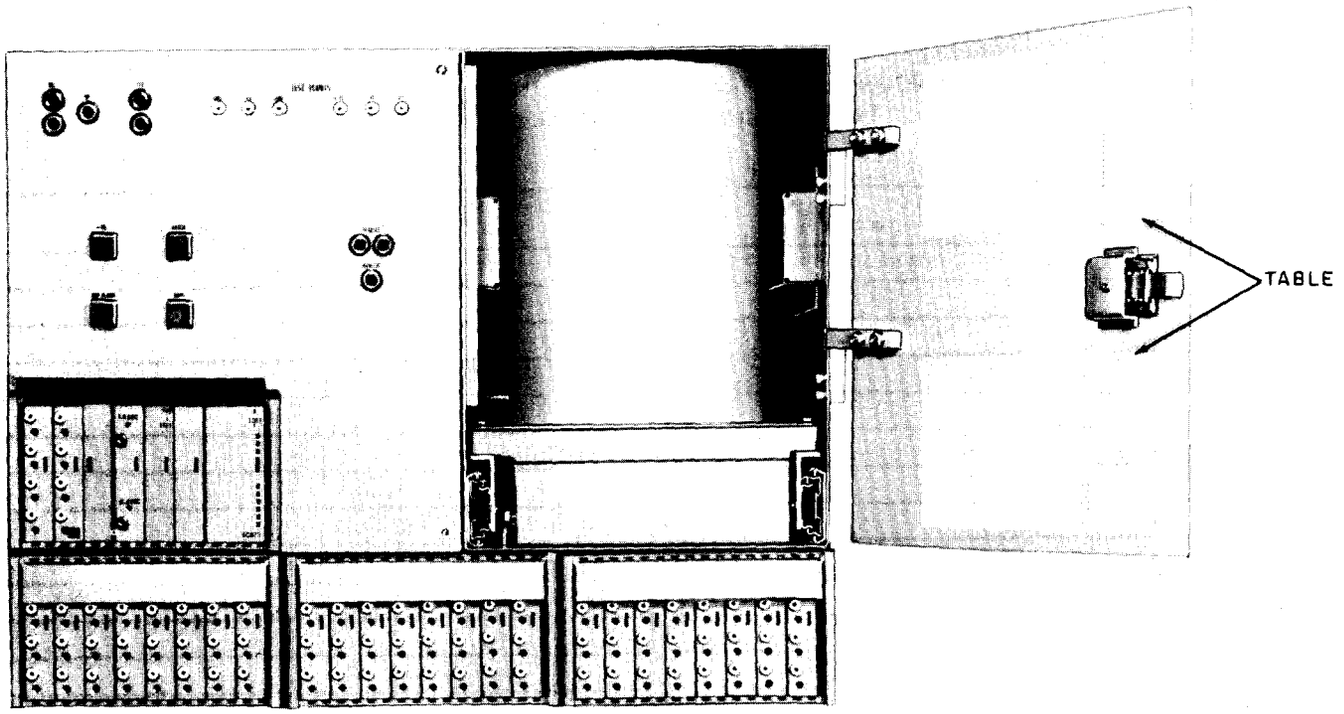


Fig. 56—Location of Table Showing Arrangement and Drum Track and Amplifier Associated With Each

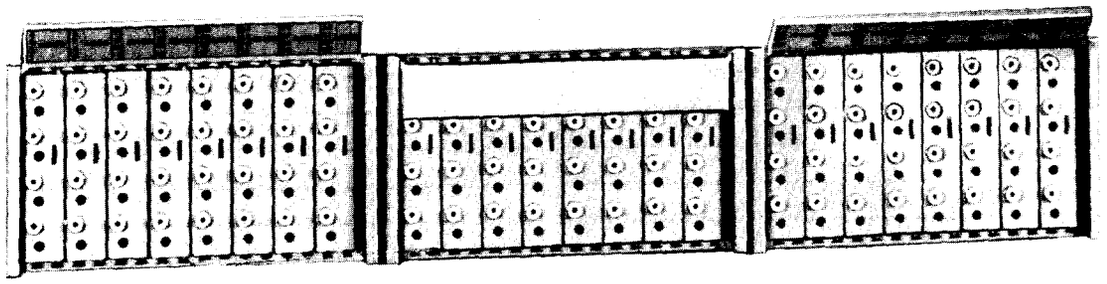


Fig. 57—Message Synthesis Service Channel Module

gether in a multitude of combinations by user system computer programs as required for the total inventory. Each track can be monitored from the test points on the faceplate of the circuit pack by using a handset and the patch cord provided with the frame.

TYPICAL MESSAGE ASSEMBLY

10.11 Figure 59 is an example of how a complete announcement is synthesized from a selected series of prerecorded messages as reproduced during the drum rotational period. The full announcement and time sequence is typical of the type of machine-produced announcements provided for nonworking number calls attached to the CSRAF arranged for MSS.

11. MULTIPLE RECORDING SERVICE

GENERAL

11.01 This version uses a combination of VML announcements and MM announcements. The CSRAF with MRS was designed to be used with an interfacing frame in the No. 1 ESS. Consequently, functions on the frame that can affect service are controlled by the ESS. Recording, adjusting the output level, and resetting the memory are functions that cannot be performed unless the circuit is en-

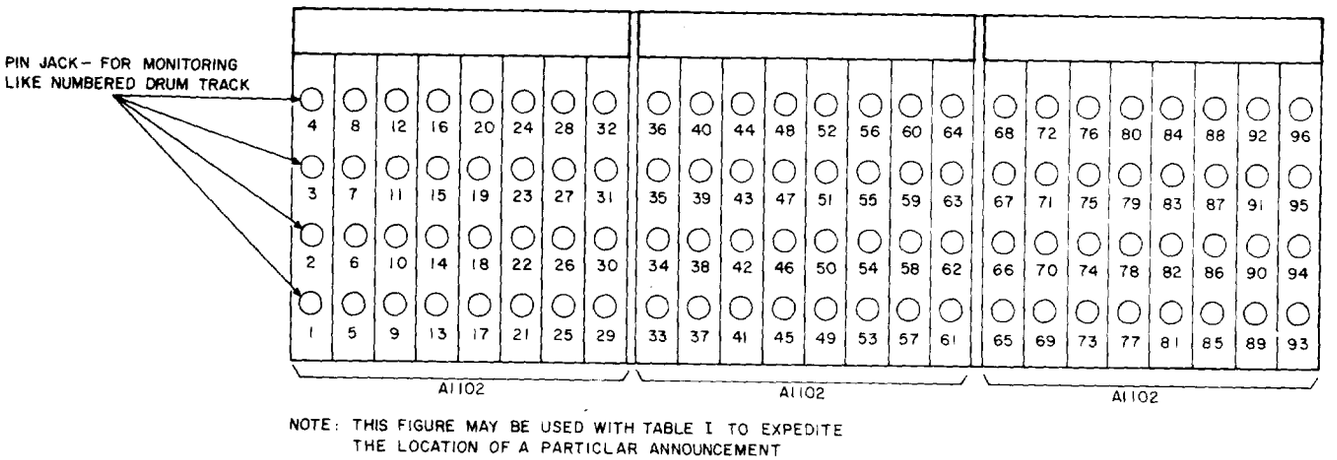


Fig. 58—Location and Identification of MSS Channel Module Circuit Cards and Channel (Track) Assignment

abled by the ESS. A typical arrangement for MRS version of the CSRAF is shown in Fig. 60.

11.02 Two different kinds of announcement channels are provided, the VML channel and the MM channel. The VML channel supplies an announcement that is variable in 4-second increments to a maximum of 48 seconds and the modular message channel supplies a 1.33-second message.

11.03 Three VML channels are grouped into one type of channel module, and 24 MM channels are grouped into the second type of channel module provided on the CSRAF. Each channel module has an associated control unit.

11.04 The modular construction of the CSRAF has the flexibility of holding a maximum of 27 VML channels or 200 MM channels or a proportional mixture of both.

11.05 Recording can be made locally at the frame or remotely, with a maximum of six simultaneous inputs.

11.06 Channel selection and lockout features are controlled by the No. 1 ESS.

CHANNEL MODULES

11.07 The VML channel module (Fig. 47) provides for a 3-channel operation with each channel having a maximum message length of 48 seconds. In this design, each 36A apparatus mounting frame is dedicated to a single channel, and the three 36A apparatus mounting frames together provide for three separate channels. The 48-second limitation on each channel results from the physical limitation of the number of circuit packs that can be placed in one 36A mounting frame. Each VML channel requires four circuit packs for normal record, reproduce, and alarm functions. The channel also requires switching circuit packs. If the channel is equipped for only 16-second long messages, one switching circuit pack is required in addition to the previously described normal circuit packs. If the channel is equipped for 32-second long messages, two switching circuit packs are required, and for 48-second messages, three switching circuit packs are required. The third switching circuit pack fills the 36A apparatus mounting frame. Refer to Fig. 48 for location and identification of the VML channel module circuit cards. The VML channel modules are identical in the J1C012A and J1C012D frames.

11.08 The MM channel module (Fig. 49) provides for a maximum of 24 channels of MM an-

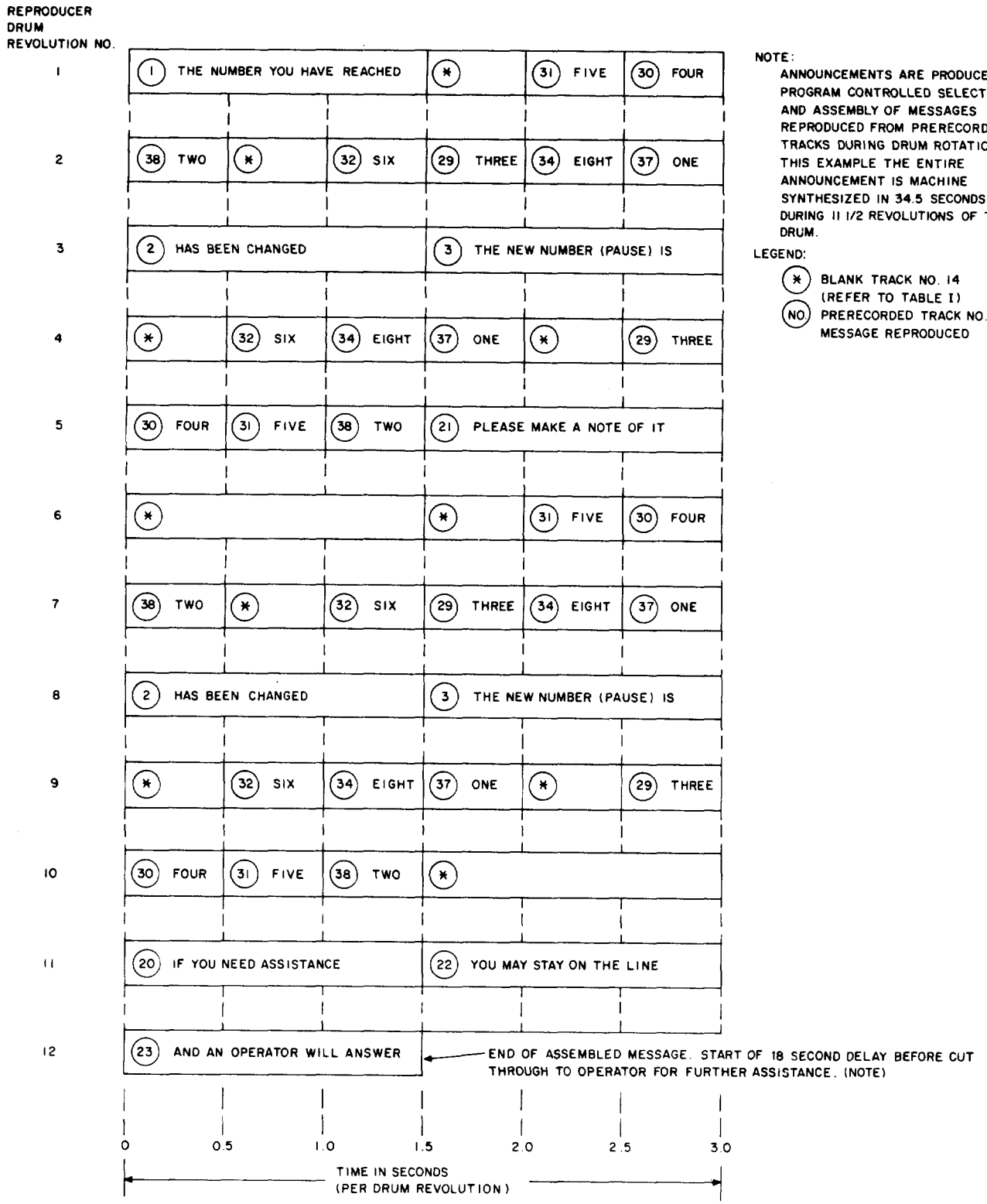


Fig. 59—Typical Message Assembly for MSS During Reproducer Drum Rotation

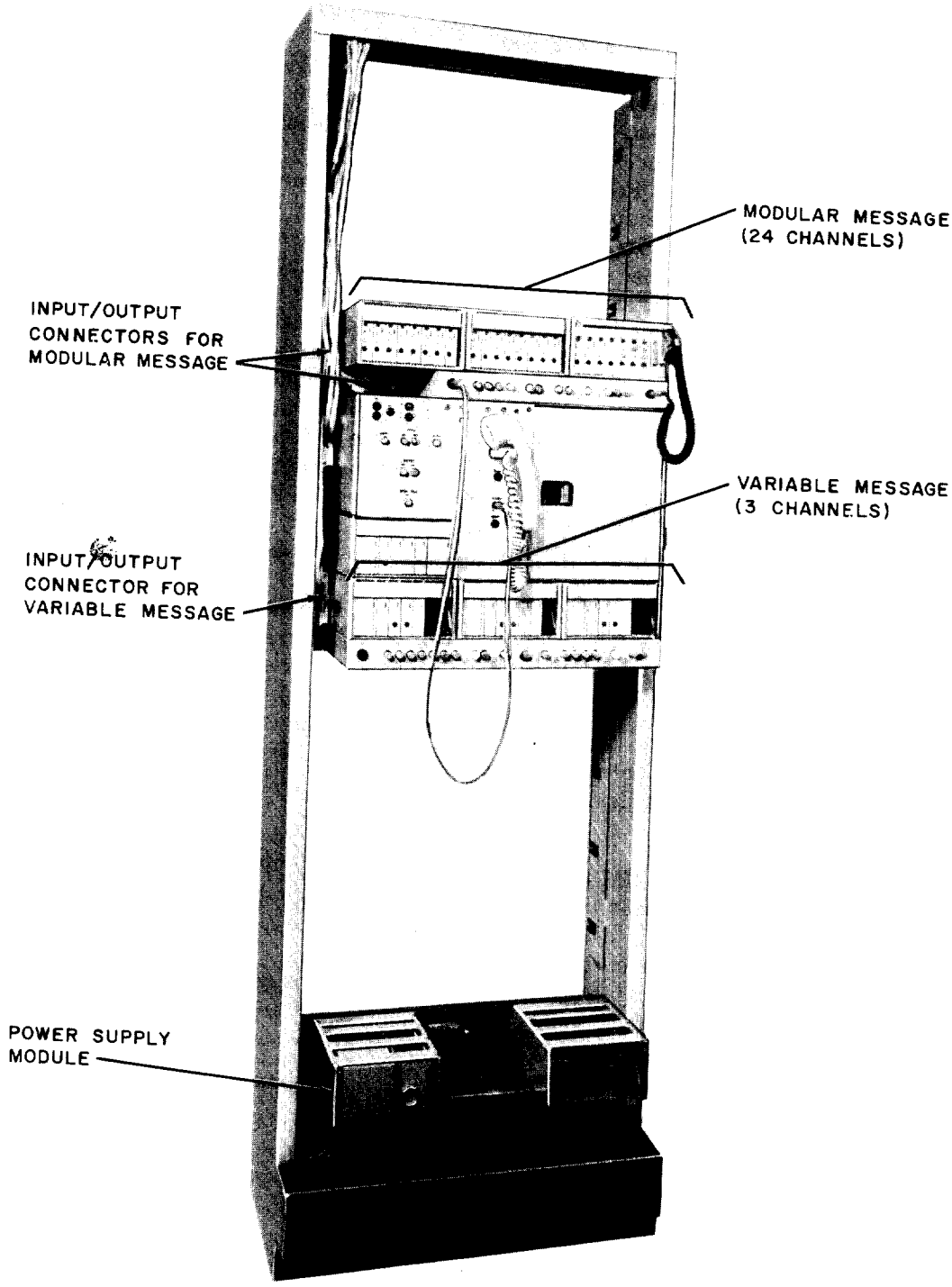


Fig. 60—Typical Frame Arrangement of the MRS Version

nouncement service. Each channel is associated with a single 4-second track, and the module is intended for service where the 4-second message would normally be divided into three repetitive 1.33-second messages, as used for area or city-of-origin announcements. All of the electronics for one channel are contained on only one circuit pack. Each 36A apparatus mounting frame can house eight of these circuit cards. The three 36A apparatus mounting frames thus provide for a total channel module capacity of 24 channels. The circuit pack arrangement is identical to the MM channel module used in the J1C012A frame but the backplane wiring is different.

CONTROL UNITS

11.09 The control units used in a frame for MRS appear to be the same as those in the J1C012A frame but they are not wired the same. For local maintenance of a VML channel, a control unit (Fig. 47) is located under each channel module. This control unit is used to turn power on and off, record test signals on the tracks, monitor recorded announcements, adjust voice alarm levels, and indicate off-normal and power-off conditions.

11.10 Table F provides a complete listing of all keys, jacks, and lamps associated with the variable message control unit and a description of each.

11.11 For local maintenance of a MM channel, a control unit (Fig. 49) is located under each channel module. This control unit is used to turn power on and off, record test signals on the tracks, adjust voice alarm levels, and indicate off-normal and power-off conditions. The method of channel selection for recording and testing is performed by using a patch cord as shown in Fig. 50.

11.12 Table G provides a complete listing of all keys, jacks, and lamps associated with the modular message control unit and a description of each.

ALARMS

11.13 The announcement frame is alarmed for the predominant modes of failure. To simplify the diagnosis of a machine fault, the alarm features are classified into three areas:

- Voice alarms
- Memory loss alarms
- Fuse alarms.

Alarms are given on the frame itself in the form of lights, and to the interfacing circuit in the form of relay contacts for loop closures.

A. Voice Alarms

11.14 To maintain a satisfactory audio level at the output of the announcement frame, a voice alarm circuit samples the audio at the output transformer through a 600-ohm coil. This alarm audio coil feeds a high input impedance circuit, which transforms the audio signal strength so that at the nominal system audio output level, it is sufficient to operate an alarm relay. When the audio level drops below a preset level, the alarm relay releases, breaking a loop to the interfacing circuit.

Variable Message Length

11.15 Provision for adjusting the sensitivity of the voice alarm level is available on the control unit. By depressing the VOICE ALARM ADJ key on the control unit, resistors are connected across the alarm audio coils of the three channels, decreasing the signal level by approximately 6 dB. The voice alarm circuit is adjusted in accordance with Section 201-520-701. A pair of contacts on the alarm (AL) relay goes to the interfacing circuit for signaling. When the VOICE ALARM NOR key is depressed, the resistors are disconnected yielding a 6 dB threshold on the voice alarm.

11.16 It is not necessary to interfere with the output audio to test the voice alarm, either locally at the machine or remotely. The voice alarm is tested locally by depressing the VOICE ALARM TEST key on the storage module or remotely by supplying a loop closure from the interfacing circuit.

11.17 The audio level at which the voice alarm operates is adjustable to accommodate different system output requirements. The voice alarm not only detects a decrease in the audio level, but also any fault which would deteriorate or eliminate the signal, such as power loss, drum stoppage, malfunctioning magnetic head, faulty amplifier, etc.

Modular Message

11.18 Provisions for adjusting the sensitivity of the voice alarm level is available on the con-

trol unit. By depressing the VOICE ALARM ADJ key on the control unit, resistance is added into the alarm circuit of the channel accessed, thereby decreasing the signal level by 6 dB. The voice alarm circuit is adjusted in accordance with Section 201-520-701.

B. Memory Loss Alarm

11.19 The memory feature of the VML announcement can be lost if power is removed from the associated channel module, or can be erroneously changed due to voltage transients and circuit malfunctions.

11.20 To make these errors observable, a switching alarm circuit is added to the channel circuitry. The switching alarm circuit will light a LED on the faceplate of the switching alarm card and will operate the voice alarm, lighting a second LED on the face plate of the alarm-logic card and sending a voice alarm signal to the system. This malfunction is detected by observing the two lighted LEDs on the faceplates of the switching alarm card and the alarm-logic card.

11.21 If the error is due to transients, the memory can be reset without erasing the message on that channel by listening to the channel accessed in the TEST mode with the headset and depressing the MEM key on the control unit after system acknowledgment by RDY lamps. The MEM key will clear the memory registers and the message from the beginning. When the end of the message is heard, releasing the MEM key restores the memory of the channel. The message must be heard a second time before restoring the system to normal.

C. Fuse Alarms

11.22 The power supply levels used in the CSRAF are +15 and -15 Vdc for operating integrated circuit operational amplifiers, and +5 Vdc for operating digital integrated circuits. These voltages are available at the base of the CSRAF from a power supply.

11.23 The three voltages are fused individually to each channel module with 70-type indicating fuses. Should a fuse overload, its contact energizes a relay in the control unit serving that channel module. Contacts on this relay light the PWR OFF lamp on the control unit and energize the FA relay located on the power supply module at the base of the announcement frame. Contacts of the FA relay complete a loop to the office major audible alarm. The -48 volt office supply is separately fused to supply the PWR OFF and the OFF NOR lamps.

RECORD PROCEDURES

A. Variable Message Length

11.24 The ESS has control over the record circuit, and no recording can be made without system acknowledgment.

11.25 The message can be recorded at the frame, from a dedicated phone, or from a customer through the No. 1 ESS and the interfacing frame.

11.26 Of the 27 VML channels that can be provided by the CSRAF, only a maximum of 20 channels can be accessed for recording from a remote facility through an interfacing frame.

11.27 Options allow connecting a channel to either the remote facility or the dedicated phone for recording. Six simultaneous recordings are allowed; five from the remote facility and one from either the dedicated phone or the local frame.

11.28 The maximum capacity of the VML announcement is 48 seconds, variable in 4-second increments, at the time of recording. The channel operation is synchronous with a 4-second period which corresponds to the drum rotation period. A clock pulse is produced by an optical switch assembly mounted on top of the drum unit.

11.29 If a message exceeds 4 seconds in length, it must be recorded on two or more tracks which are electronically pieced together in the R/P process. The number of messages or channels that can be handled by the DSU is dependent upon the lengths of the individual messages; the longer a message, the more tracks are required.

11.30 To handle this situation, the DSU is organized to arrange the tracks in groups of four. Since each track provides 4 seconds, the 4-track group provides a basic message length of 16 seconds. The 16-second modules may then be added together to provide for the maximum length of message expected. The established standard message lengths are 16, 32, and 48 seconds. The maximum message length selected for a channel is dictated by the maxi-

mum length message anticipated to be recorded on a channel. The actual message length can be from zero to the maximum since the message is built up in 4-second increments until maximum is reached.

11.31 In the playback mode, the message is announced on a repeating cycle which is determined by the actual message length, not the maximum length. This feature of the DSU, in conjunction with the associated electronics on the frame, provides a VML announcement service. When a particular maximum message length is chosen for a given channel, an associated number of tracks (maximum message length in seconds divided by four) are dedicated to that channel and cannot be used elsewhere. Therefore, to realize the greatest number of channels, the maximum message length of each channel must be realistically chosen.

At the CSRAF

11.32 It is possible to record new messages locally at the frame, either through a headset or by dubbing a prerecorded message from a tape recording. The local recording feature provides a valuable maintenance facility for diagnosing recording problems as well as a means for recording professional prerecorded messages. Means for accomplishing local recording are provided by keys, jacks, and lamps on the storage module and control units.

11.33 To record on one of the channels, the corresponding channel test key (TEST) is depressed. The test contacts connect the audio signal from the preamplifier output of that channel through relay contacts to the TMS jack. By inserting a headset into the HEADSET jack in the storage module and connecting the SIGNAL jack in the storage module to the TMS jack in the control unit with a patch cord, the message recorded on the selected channel can be heard after system acknowledgment provides the relay closures. The test contacts also energize the CM relay on the channel which couples the REC and MEM functions to that channel, and signals the system through a loop closure to a sensor that the channel is being tested. The interfacing circuit provides a closure to light the record RDY lamp when no subscribers are connected to the channel (in some time interval) after the TEST key has been depressed.

11.34 To record from a tape recorder, the tape recorder output is connected into the HEADSET jack through 4 μF blocking capacitors, and a TMS is inserted into the MONITOR jack. An appropriate recording level is set by adjusting the volume control of the tape recorder and observing the level on the TMS. By pushing the REC NL key and turning on the tape recorder when the REC lamp lights, the message from the tape recorder will be recorded on the channel. When the message ends, the REC NL key is released; when the REC lamp goes off, the channel has switched into the playback mode. By inserting a headset into the HEADSET jack, the newly recorded message can be monitored. If the message on the tape recorder is longer than the capacity of the channel, only part of the message will be recorded.

> ***Note:*** In preparing prerecorded tapes, the channel capacity and the reaction times in the prior procedure must be considered.

11.35 To record with a headset, it is necessary to power the microphone of the headset by inserting it into the HEADSET jack on the storage module. A patch cord is connected from the SIGNAL jack in the storage module to the TMS jack in the control unit. When the REC NL key is depressed, the REC lamp will light and the audio dictated into the headset will be recorded on the channel as long as the REC lamp is lighted. (The REC lamp will not light until system acknowledgment is provided as indicated by the RDY lamp.) When the dictation stops, the REC NL key is released; when the REC lamp goes off, the channel has switched into the playback mode.

11.36 After a message has been recorded, it should be heard through a handset or headset. The level at the output of the frame can be measured by pushing the MONITOR key of the channel being tested. The output audio is connected to the TMS jack. Since no other function is accessed with the MONITOR button key, no indication is given to the interfacing circuit during the monitor mode. The output is measured by inserting the transmission measuring set into the TMS jack.

11.37 A 1000-Hz test tone is recorded on a channel by connecting the TMS jack to the 1000-Hz jack on the storage module using a patch cord and depressing the REC NL key. After the REC lamp extinguishes, the TMS jack can be connected to the SIGNAL jack, enabling the recorded tone to be monitored through the headset. Indication that a test tone is being recorded is given to the interfacing circuit through a closure of the 1000-Hz jack sleeve and the sleeve on the TMS jack.

From the Dedicated Phone

11.38 Recording on the announcement frame with a dedicated phone is initiated by lifting the receiver from the LS. When the LS makes contact, the control functions on the dedicated phone are enabled, and the dedicated phone receives a filtered talking current. By depressing a channel selection L key on the dedicated phone, the playback preamplifier output of that channel is connected to the dedicated phone, and the message recorded on that channel can be heard. Contacts on the channel selection L key also energize the CM relay for that channel. The CM contacts connect the channel to the record function and give a relay closure to the interfacing circuit indicating that the channel is being tested. The interfacing circuit can provide a closure to light the lamp under the REC key to indicate that the channel has been taken out of service.

Note: The REC lamp will light when a channel is accessed in the TEST mode at the frame and a record signal from the dedicated phone will be blocked.

11.39 To record a new message, the REC NL key is depressed and held. Contacts on the RYR relay provide closure to the system indicating a request to record from the dedicated phone. System acknowledgment is provided by lighting the lamp under the channel selected key. When the light comes on, the channel is in the record mode clearing the registers on the head switching circuit and reversing the state of the relays on the R/P amplifier. These relays turn on the record amplifier and connect the bias-erase oscillator to the channel being recorded and the message can now be recorded by the operator.

Note: With the use of cross-field magnetic heads, erasing of the previous announcement is accomplished simultaneously with the recording of a new announcement, thus eliminating the need for a separate erase cycle.

11.40 The record amplifier has AGC, which sets a proper record level even though the voice level of the operator into the dedicated phone may not be at the optimum recording level.

11.41 At the completion of the message, the REC NL key is released. Within 4 seconds, the channel will automatically switch into the playback mode and the lamp under the channel selection L key will extinguish. However, if the maximum capacity of the channel is exceeded while recording, the record lamp under the channel selection L key will extinguish and the message must be rerecorded.

11.42 After a recording has been made, the operator can listen to determine whether a satisfactory announcement has been recorded. If not, the message can be rerecorded by repeating the previous procedure. The channel is released by pushing the RLS key on the dedicated phone and replacing the receiver on the LS.

11.43 There is also provision at the CALL DIRECTOR telephone to enable the recording of messages from a tape recorder. Remote recording using a tape recorder is accomplished by connecting the tape recording equipment through 4 μF blocking capacitors into the jack provided on the side of the CALL DIRECTOR telephone. The procedure then prescribed for remote recording from a CALL DIRECTOR telephone is followed. The recorder can be unplugged after recording, and the message can be heard in the receiver of the CALL DIRECTOR telephone for verification.

Remote Via ESS

11.44 A maximum of 20 VML channels can be provided for remote recording via ESS. The wiring option determines whether a channel will have access either from the dedicated phone or from a remote location via the ESS.

11.45 The description of the VML recording remotely via ESS is similar to that for VML recording remotely at the dedicated phone, paragraphs 11.38 through 11.43. The basic difference in the record operation is that a channel is held in the record mode for the maximum length of the channel and the message length is established by resetting the memory.

B. Modular Message

11.46 The ESS has control over the record circuit and no recording can be made without system acknowledgment.

At the CSRAF

11.47 It is possible to record new messages locally at the frame, either through a headset or by

dubbing a prerecorded message from a tape recorder. The local recording feature provides a valuable maintenance facility for diagnosing recording problems as well as a means for recording professional prerecorded messages. Means for accomplishing local recording are provided by keys, jacks, and lamps on the storage module and control units.

11.48 To record on one of the channels, the channel is first accessed by means of a W2 cord (Fig. 51), and the W1 cord is connected from the SIGNAL jack on the storage module to the TMS jack of the associated control unit. Depressing the CHANNEL TEST key connects the audio signal from the channel preamplifier output to the relay contacts in the control unit. After a headset is inserted into the HEADSET jack, the message recorded on the selected channel can be heard only after system acknowledgment provides the relay closures. The test contacts also energize the REC function. When ready to record, the CHANNEL REC NL key is depressed and held while recording, causing the REC lamp to flash every 1.33 seconds. (The REC lamp will not flash until system acknowledgment is provided.) The announcement should be recorded three times,between successive flashes, after which time the CHANNEL REC NL key should immediately be released.

11.49 When it is desired to record at the frame from a tape recorder, the tape recording equipment is connected into the HEADSET jack through 4 μF blocking capacitors in place of the headset. The same procedure is followed as with local recording, but the recorder is activated when the lamp flashes and deactivated after the fourth consecutive flash.

11.50 A 1000-Hz test tone is recorded on a channel by connecting the TMS jack to the 1000-Hz jack on the storage module using a patch cord and depressing the REC NL key. After the REC lamp extinguishes, the TMS jack can be connected to the SIGNAL jack, enabling the recorded tone to be monitored through the headset. Indication that a test tone is being recorded is given to the interfacing circuit through a closure of the 1000-Hz jack sleeve and the sleeve on the TMS jack.

From the Dedicated Phone

11.51 The dedicated phone can be equipped with a maximum of 28 keys. If required, a second dedicated phone can be connected to the frame. Both VML and MM channels can be connected to the same dedicated phone.

11.52 Recording on the announcement frame with a dedicated phone is initiated by lifting the receiver from the LS. When the LS makes contact, the control functions on the dedicated phone are enabled, and the dedicated phone receives a filtered talking current. By depressing a channel selection L key on the dedicated phone, the playback preamplifier output of that channel is connected to the dedicated phone. The output of the selected channel can now be heard in the receiver, usually the name of a city or area or other short messages occurring every 1.33 seconds. If a new recording is to be made, the REC NL key is depressed during the entire record mode. The depressed REC NL key, after system acknowledgment, turns on the bias-erase oscillator, switches the amplifier into the record mode, and enables an MM lamp to light.

> ***Note:*** The MM lamp will not light until system acknowledgment is provided.

11.53 The optical switch assembly in the DSU produces a timing pulse every 1.33 seconds which flashes the MM LMP lamp on the CALL DIRECTOR telephone to indicate the placement of the recording. The operator can now record a new city name three consecutive times cuing on the lamp flashes. The cross-field design magnetic head used in the announcement frame performs the erase and record functions simultaneously, eliminating the delay required to erase. After recording is completed, the REC NL key is released. The operator can now listen to determine whether a satisfactory announcement has been recorded. If the announcement is satisfactory, the RLS key is depressed, and the receiver is replaced on the LS.

11.54 There is also provision at the CALL DIRECTOR telephone to enable the recording of messages from a tape recorder. Remote recording using a tape recorder is accomplished by connecting the tape recording equipment through 4 μF blocking capacitors into the jack provided on the side of the CALL DIRECTOR telephone. The procedure then prescribed for remote recording from a CALL DIRECTOR telephone is followed. The recorder can be unplugged after recording, and the message can be heard in the receiver of the CALL DIRECTOR telephone for verification.

Remote Via ESS

11.55 No provisions have been made for recording MM announcements from a remote facility through ESS.

PLAYBACK PROCEDURES

A. Variable Message Length

11.56 The most frequent mode of operation of the CSRAF is the playback mode, in which messages recorded on the drum are distributed to the subscribers. The message recorded on the drum is stored in 4-second tracks and is retrieved by switching heads in the same sequence in which the message was recorded. The operation of this system is synchronous, every action occurring at a clock pulse.

11.57 The timing pulse for the CSRAF is generated by the clock circuit pack (Fig. 11). Since all announcements are recorded on one drum, only one clock circuit pack per machine is necessary. The timing information to the clock circuit pack is supplied by an optical switch assembly located above the drum. A monostable multivibrator is incorporated to convert this once-per-revolution output into a fast, rise-time clock pulse. A relay (CL1), also on the clock circuit pack, provides a once-per-revolution closure for interface purposes.

11.58 The magnetic heads are consecutively switched to the preamplifier input through relay contacts. In determining which relay to switch and the number of relays necessary to handle the duration of the message, each head switching circuit pack contains four relays with all necessary logic and memory required to switch them. The logic and memory are composed of digital integrated circuit flip-flops in a shift register formation. To detect any possible failure in the switching logic and memory, a switching alarm circuit is included.

11.59 If a gate fails on the head switching card, a voice alarm indication will be given, and LEDs on the front panels of both the switching alarm and the alarm logic circuit packs will light in that channel.

11.60 Additional logic is required to start announcements to provide timing information and to control the channel in the R/P modes. This channel logic, located on the alarm-logic circuit pack, samples the switching relay current. As long as at least one relay is operating in the channel, no action is taken. When the message ends, the memory on the head switching circuit pack inhibits the next relay from operating and the relay current drops to zero. The channel logic recognizes this condition and sets the first flip-flop on the switching register at the next clock pulse. Since this 4-second period of no-relay current corresponds to a silent output condition, the channel logic also provides a 4-second CT relay closure to the interfacing circuit. Zero-relay current condition could also occur if one of the gates in the switching circuitry were malfunctioning. The switching alarm circuit would detect this error. During the playback mode, the magnetic heads act as sources of audio signals which are switched consecutively by the relays to the input of a preamplifier.

11.61 The audio preamplifier contains equalization to improve the audio quality and AGC to decrease differences in head output due to variations from head to head. The amplified audio signal goes to the power amplifier, to the control unit, and to the dedicated phone.

11.62 The power amplifier is capable of delivering 0.3 watts into 0.5 ohms. A separate 600-ohm coil in the output transformer is used to monitor the level of the output audio. If the level drops 6 dB from a manually set audio output level, a voice alarm will be actuated and the LED on the front panel of the alarm logic circuit pack of the channel in question will light.

11.63 The audio signal from the preamplifier also goes to the dedicated phone and the control unit. The channel can be accessed for monitoring, and a new message can be recorded from both these locations. On the control unit, the audio signal level can be measured with a TMS to indicate that the proper audio output level is being transmitted to the interfacing circuit.

B. Modular Message

11.64 The most frequent mode of operation of the CSRAF is the playback mode in which messages recorded on the drum are distributed to the subscribers. The message recorded on the drum is stored in 1.33-second segments contained in a normal 4-second track on the drum. A timing closure is provided to the interface circuit to indicate cut-through (CL0B-CL1B), every 1.33 seconds. The playback am-

plifier is capable of delivering 100 milliwatts into 40 ohms.

11.65 On the control unit, the output-audio signal level can be measured with a TMS to indicate that the proper level is being transmitted to the interfacing circuit.

12. LIST OF REFERENCES

12.01 The following listing provides information and/or test requirements for the CSRAF:

SD	TITLE
SD-97723-01	Common Systems Drum Storage Unit Circuit KS-20951 for Recorded Announcement Frame
SD-97724-01	Common Systems Circuit Pack Schematics Recorded Announcement Frame
SD-97725-01	Common Systems Recorded Announcement Frame
SD-97725-02	Common Systems Recorded Announcement Frame Circuit for Message Synthesis Service
SD-97725-03	Common Systems Recorded Announcement Frame Circuit For Multiple Recording Service
SD-97725-04	Common Systems Auxiliary Frame (J1C012E)

KS	TITLE
KS-20951	Drum Storage Unit
KS-20952	Magnetic Drum
KS-20953	Magnetic Head
KS-20954	Interconnecting Unit
KS-20955	Interconnecting Unit
KS-20956	Interconnecting Unit

SECTION	TITLE
201-520-301	Common Systems Recorded Announcement Frame (CSRA) SD-97725-01, SD-97725-02, and SD-97725-03 Operating Procedures
201-520-501	Common Systems Recorded Announcement Frame (CSRA) SD-97725-01, SD-97725-02, and SD-97725-03 Tests and Trouble Analysis
201-520-701	Common Systems Recorded Announcement Frame (CSRA) SD-97725-01, SD-97725-02, and SD-97725-03 Requirements and Adjusting Procedures
201-520-801	Common Systems Recorded Announcement Frame (CSRA) SD-97725-01, SD-97725-02, and SD-97725-03 Piece-Part Data and Replacement Procedures
801-603-162	J1C012 Recorded Announcement Frame Equipment Design

13. ABBREVIATIONS AND ACRONYMS

13.01 The following is a list of abbreviations and acronyms used in this section.

ACD	Automatic call distribution
AGC	Automatic gain control
AIS	Automatic Intercept System
AL	Alarm
CM	Channel maintenance
CSRAF	Common systems recorded announcement frame
CT	Cut-through
DMUX	Demultiplexer
DSU	Drum storage unit
ESS	Electronic Switching System
FA	Fuse alarm
FPW	Flexible printed wiring
L	Locking

LED	Light emitting diode
LS	Line switch
MEM	Memory
MM	Modular message
MM	LMP Modular message timing lamp
MRS	Multiple recording service
MSS	Message synthesis service
PM	Phased message
R REC	Request record
RDY	Ready
REC	Record
REC	NL Record nonlocking
RLS	Release
ROS	Request out-of-service
R/P	Record/playback
SIT	Special information tones
TMS	Transmission measuring set
VML	Variable message length