

**COMMON SYSTEMS**  
**RECORDED ANNOUNCEMENT FRAME (CSRA)**  
**SD-97725-01, SD-97725-02, SD-97725-03, AND SD-97725-04**

CONTENTS	PAGE	CONTENTS	PAGE
1. INTRODUCTION . . . . .	4	B. Channel Capacity . . . . .	40
A. General . . . . .	4	6. RECORDING . . . . .	40
B. Field of Use . . . . .	5	A. At the Frame . . . . .	40
C. Capacity . . . . .	5	B. Remote . . . . .	41
D. Modes of Operation . . . . .	9	7. VML ANNOUNCEMENT . . . . .	41
2. DESIGN . . . . .	9	A. General . . . . .	41
3. GENERAL . . . . .	11	B. Channel Module . . . . .	41
4. EQUIPMENT ELEMENTS . . . . .	14	C. Control Unit . . . . .	42
A. Storage Module . . . . .	14	D. Alarms . . . . .	42
B. Drum Storage Unit KS-20951 . . . . .	17	E. Record Procedures . . . . .	45
C. Channel Electronics . . . . .	31	F. Playback Operation . . . . .	46
D. Channel Module . . . . .	32	8. MODULAR MESSAGE ANNOUNCEMENT . . . . .	47
E. Circuit Packs . . . . .	34	A. General . . . . .	47
F. Control Unit . . . . .	38	B. Channel Module . . . . .	47
G. Power Supply . . . . .	38	C. Control Unit . . . . .	48
H. Fuse Panel . . . . .	39	D. Alarms . . . . .	48
I. Frames . . . . .	39	E. Record Procedures . . . . .	49
J. CALL DIRECTOR® Telephone . . . . .	39	F. Playback Operation . . . . .	51
5. RESTRICTIONS . . . . .	40	9. PHASED MESSAGE ANNOUNCEMENT . . . . .	51
A. Cables . . . . .	40	A. General . . . . .	51

**NOTICE**  
Not for use or disclosure outside the  
Bell System except under written agreement

CONTENTS	PAGE	CONTENTS	PAGE
B. Channel Module . . . . .	52	Message Announcement and Variable Message Announcement . . . . .	6
C. Control Unit . . . . .	52	2. Typical Frame Arrangement for the Variable Message Announcement (12 Channels Shown) . . . . .	7
D. Alarms . . . . .	52	3. Typical Frame Arrangement for the Phased Message Announcement (6 Channels Shown) . . . . .	8
E. Record Procedures . . . . .	56	4. Typical Frame Arrangement for the Message Synthesis Service Announcement (Duplicated Machines Per Frame) . . . . .	9
F. Playback Operation . . . . .	57	5. Flat Cable of Drum Storage Unit . . . . .	11
10. MESSAGE SYNTHESIS SERVICE . . . . .	58	6. Rear View of a Channel Module Showing Flexible Printed Wiring (Used With VML, MM, PM and MRS Only) . . . . .	12
A. General . . . . .	58	7. Rear View of MSS Channel Module Showing Point-to-Point Wiring . . . . .	12
B. Channel Module . . . . .	59	8. Common Systems Recorded Announcement Frame—Diagrammatic Representation (VML, MM, PM, and MRS Only) . . . . .	13
C. Recording of Messages . . . . .	60	9. Common Systems Recorded Announcement Frame-Diagrammatic Representation (MSS Only) . . . . .	15
D. Drum Track and Message Association . . . . .	60	10. Storage Module (VML, MM, PM, and MRS Only) . . . . .	16
E. Prerecorded Standard Messages . . . . .	60	11. Storage Module Circuit Pack Location (VML, MM, PM, and MRS Only) . . . . .	16
F. Prerecorded Locality Messages . . . . .	62	12. Storage Module—(MSS Only) . . . . .	17
G. Playback Operation . . . . .	62	13. Storage Module Circuit Pack Location for MSS . . . . .	18
H. Typical Message Assembly . . . . .	63	14. KS-20951 Drum Storage Unit (Cutaway View) . . . . .	18
11. MULTIPLE RECORDING SERVICE . . . . .	63	15. Drum Storage Unit (Bottom View With Code Wheel Removed) . . . . .	20
A. General . . . . .	63	16. Drum Storage Unit (Rear View) . . . . .	20
B. Channel Modules . . . . .	63		
C. Control Units . . . . .	66		
D. Alarms . . . . .	66		
E. Record Procedures . . . . .	67		
F. Playback Procedures . . . . .	71		
12. LIST OF REFERENCES . . . . .	72		
 <b>FIGURES</b>			
1. Typical Frame Arrangement for the Modular			

CONTENTS	PAGE	CONTENTS	PAGE
17. Drum Storage Unit Slid Out of CSRA on Its Slides . . . . .	21	31. KS-20952, L6 Magnetic Drum (Used With the KS-20951, L4 DSUs) . . . . .	27
18. Sealed Drum Assembly—Drum Storage Unit (Front View) . . . . .	21	32. KS-20952, L2 or L3 Magnetic Drum (Used With KS-20951, L3 DSUs) . . . . .	28
19. Head Bar Assembly . . . . .	22	33. Optical Code Wheel (Viewed From Underside Drum Storage Unit) . . . . .	28
20. Cylindrical Housing . . . . .	22	34. Code Wheel and Code Wheel Amplifier Mounting in Relation to One Another (Viewed From Underside of Drum Storage Unit) . . . . .	29
21. Head Bar Assembly Location (From Drum Position to Rear of Storage Unit) . . . . .	23	35. Optical Switch Assembly—Mounted (Viewed With Drum Storage Unit Cover Removed) . . . . .	29
22. Interconnecting Unit Arrangement . . . . .	23	36. L-504316-1 Optical Switch Assembly—Used With KS-20951, L1 Drum Storage Units Serial No. 1 Through 7 . . . . .	29
23. Location of KS-20955, L1 and KS-20955, L2 Interconnecting Units . . . . .	24	37. L-509855-1 Optical Switch Assembly—Used With KS-20951, L1 Drum Storage Units Serial No. 8 and Up . . . . .	30
24. KS-20955, L1 Interconnecting Unit (Rear View Drum Storage Unit Removed From CSRA) . . . . .	24	38. L-504316-2 Optical Switch Assembly—Used With KS-20951, L2 Drum Storage Units Serial No. 1 Through 8 . . . . .	30
25. KS-20955, L2 Interconnecting Unit (Rear View Storage Module Shown) . . . . .	25	39. L-509855-2 Optical Switch Assembly—Used With KS-20951, L2 Drum Storage Units Serial No. 9 and Up . . . . .	30
26. Typical Arrangement of the KS-20956 Interconnecting Unit on Rear of CSRA (Intended for Use With VML, MM, PM, and MRS Only) . . . . .	26	40. L-509855-2 Optical Switch Assembly—Used With all KS-20951, L3 Drum Storage Units . . . . .	31
27. Typical Arrangement of the KS-20956 Interconnecting Unit on Rear of CSRA—Intended for Use With MSS Only . . . . .	26	41. Wiper Assembly . . . . .	31
28. KS-20953 Magnetic Head . . . . .	26	42. Brush Shield . . . . .	32
29. KS-20952, L1 Magnetic Drum (Used on List 1 DSUs Serial No. 1 Through 7, and List 2 DSUs Serial No. 1 Through 8) . . . . .	27	43. Channel Module—Front and Rear Views (VML, MM, PM, or MRS) . . . . .	32
30. KS-20952, L1 Magnetic Drum (Used on List 1 DSUs Serial No. 8 and Up and List 2 DSUs Serial No. 9 and Up) . . . . .	27		

CONTENTS	PAGE
44. Typical Rear View of CSRA (VML, MM, PM or MRS) Showing Channel Connectors on FPW Backplane . . . . .	33
45. Control Unit Connectors and Connectorized Harness—Typical CSRA (VML, MM, PM, or MRS) . . . . .	38
46. J637EA13 CALL DIRECTOR Telephone . . . . .	40
47. Variable Message Length Channel Module and Control Unit . . . . .	42
48. Location and Identification of Variable Message Length Channel Module Circuit Cards . . . . .	43
49. Modular Message Channel Module and Control Unit . . . . .	48
50. Modular Message Channel Module and Control Unit and W2 Patch Cord Used for Local Recording and Testing . . . . .	49
51. Local Record Procedure for Modular Message Announcement . . . . .	51
52. Typical Arrangement of the J1C012E Frame in Conjunction With the J1C012A Frame . . . . .	53
53. Phased Message Channel Module and Control Unit . . . . .	54
54. Location and Identification of Phased Message Channel Module Circuit Packs . . . . .	54
55. Phased Message Announcement—Block Diagram . . . . .	59
56. Location of Table Showing Arrangement of Announcement and Drum Track and Amplifier Associated With Each . . . . .	60
57. Message Synthesis Service Channel Module . . . . .	62
58. Location and Identification of Message Synthesis Service Channel Module Circuit Cards and Channel (Track) Assignment . . . . .	62

CONTENTS	PAGE
59. Typical Message Assembly for Message Synthesis Service During Reproducer Drum Rotation . . . . .	64
60. Typical Frame Arrangement of the Multiple Recording Service (MRS) Version . . . . .	65

**TABLES**

CONTENTS	PAGE
TABLE A—Maximum Number Channels vs Channel Version . . . . .	10
TABLE B—Relation of Head Bar Assemblies to Storage Capacity of the Drum Storage Unit . . . . .	19
TABLE C—DSU List and Serial Number Relationship to Optical Switch Assembly . . . . .	20
TABLE D—Circuit Pack Designation and Use . . . . .	35
TABLE E—Variable Message Length Control Unit . . . . .	44
TABLE F—Modular Message Control Unit . . . . .	50
TABLE G—Phased Message Control Unit . . . . .	55
TABLE H—Reproducer Announcement Track, Head Amplifier, Plug Connections, Trunk and Message Assignment . . . . .	61

**1. INTRODUCTION**

**A. General**

1.01 This section describes the common systems recorded announcement frame (CSRA), 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 CSRA is adaptable to most announcement applications, providing heavy-duty recorded announcement services from the central office.

**1.02** This section is reissued to include KS-20952, L5 and L6 magnetic drums. Revision arrows are used to denote the more significant changes. The specific reasons for reissue are listed below.

- (a) Add to paragraph 1.08, the reference to KS-20952, L6 magnetic drum.
- (b) Add to paragraph 4.14, the reference to KS-20952, L5 magnetic drum.
- (c) Update paragraph 4.38 to show new magnetic drum information.
- (d) Delete all references to 2L+ calling.
- (e) Add KS-20951, L4 to Table C.
- (f) Update Table H to show new and changed announcements.

**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.

**Note 1:** 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 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.

**Note 2:** Unless otherwise specified, all information in this section pertains to all versions of the CSRA. When any information pertains to a particular version it will be specified by using VML for variable message length, MM for modular message, PM for phased message, MSS for message synthesis service and MRS for multiple recording service.

**1.04** The CSRA fulfills the need for improved heavy-duty recorded announcement facilities. The improvements that the CSRA 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 ESS.

#### B. Field of Use

**1.05** The initial use of the CSRA equipped with phased message service is in the No. 4 Electronic Switching System (ESS). A version equipped with modular message and variable message length services is used in the No. 5 crossbar phase II automatic call distributor (ACD). A version equipped with message synthesis service is intended for use in the Automatic Intercept System (AIS). A version equipped with variable message and modular message length announcements is used with the No. 1 ESS phase II automatic call distributor. The design improvements offered by the CSRA make it adaptable for common systems use.

#### C. Capacity

**1.06** The number of channels available on the CSRA is limited by the physical mounting capacity of the frame and the storage capacity of the KS-20951 drum storage unit.

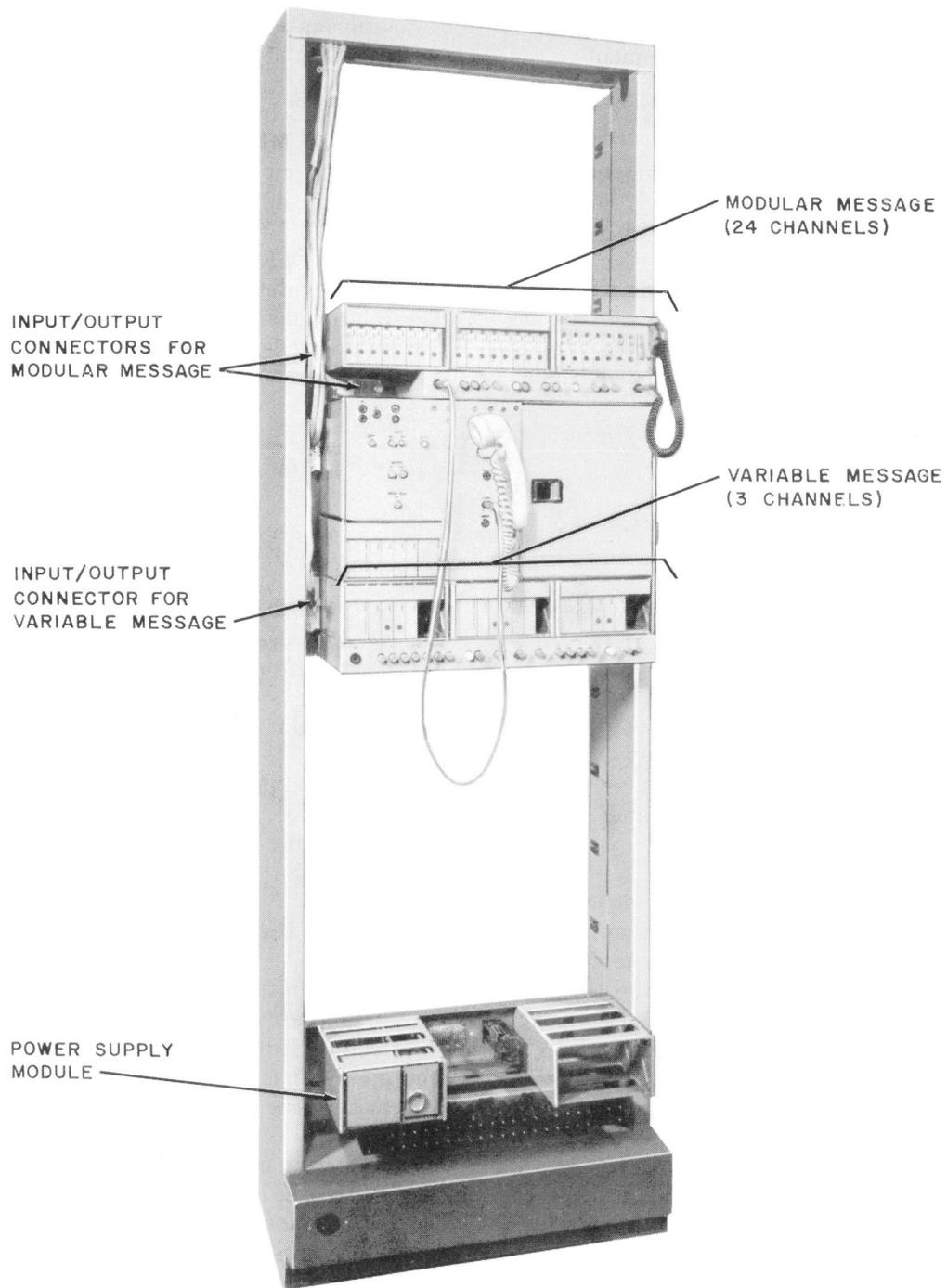


Fig. 1—Typical Frame Arrangement for the Modular Message Announcement and Variable Message Announcement

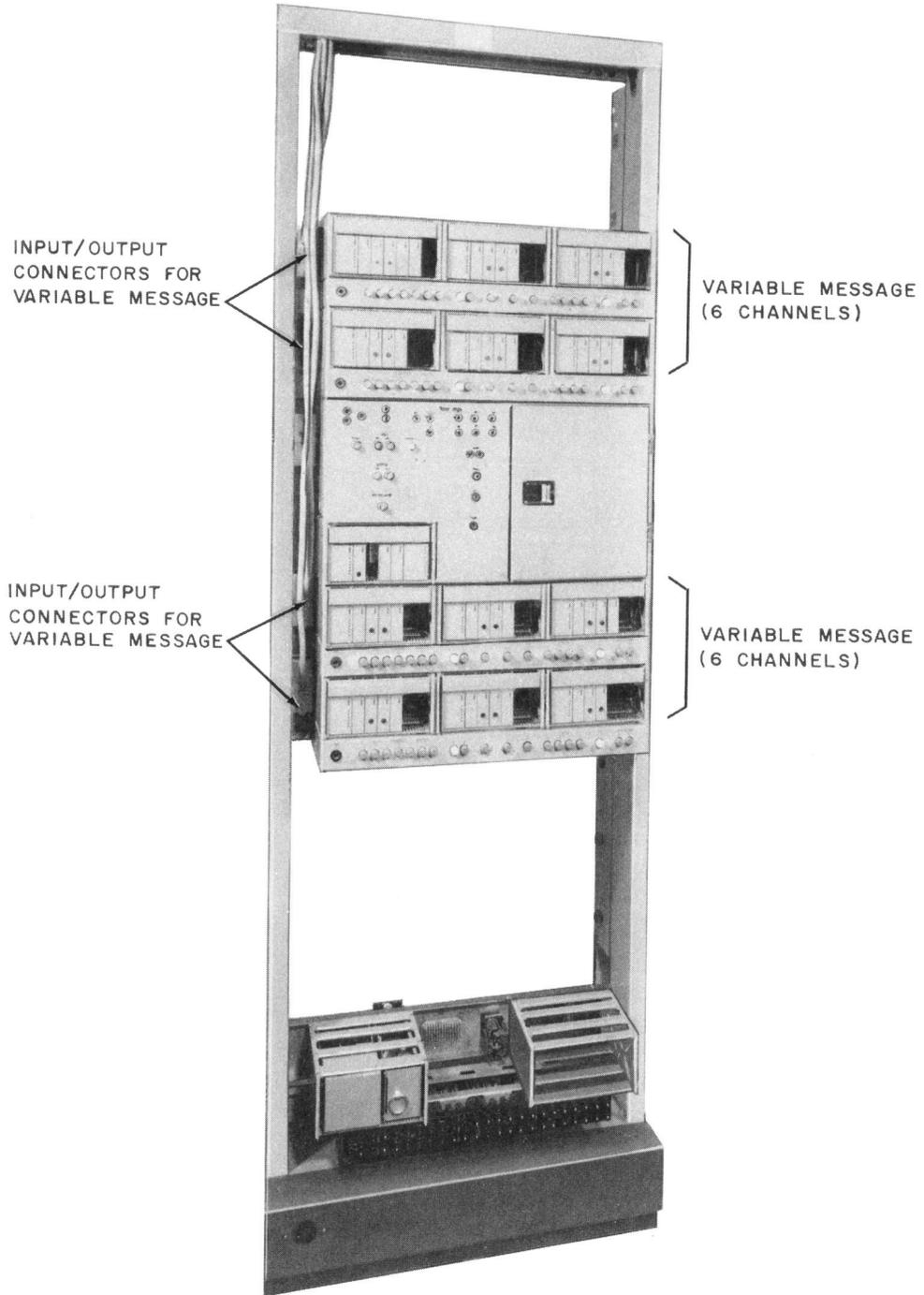


Fig. 2—Typical Frame Arrangement for the Variable Message Announcement (12 Channels Shown)

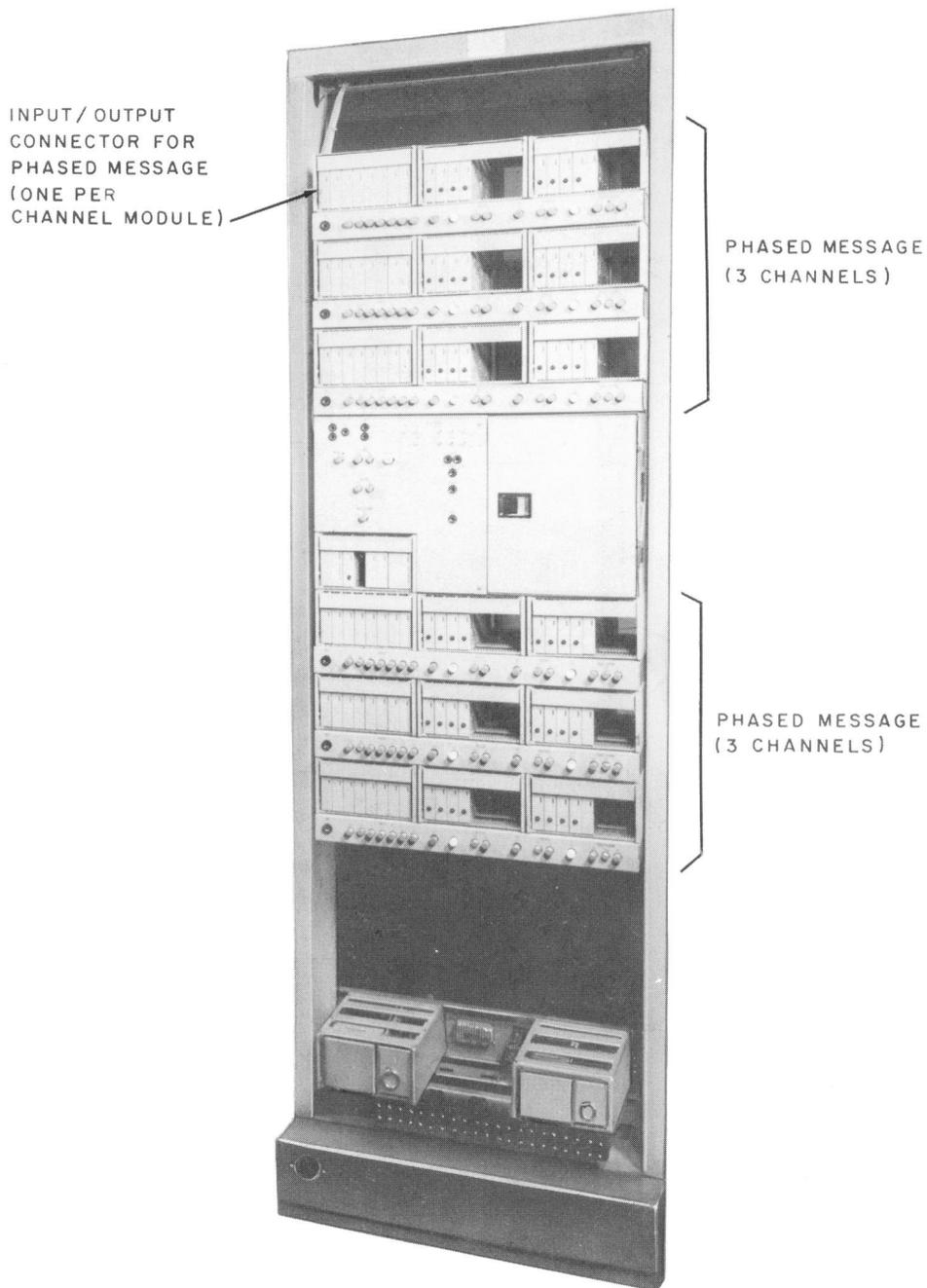
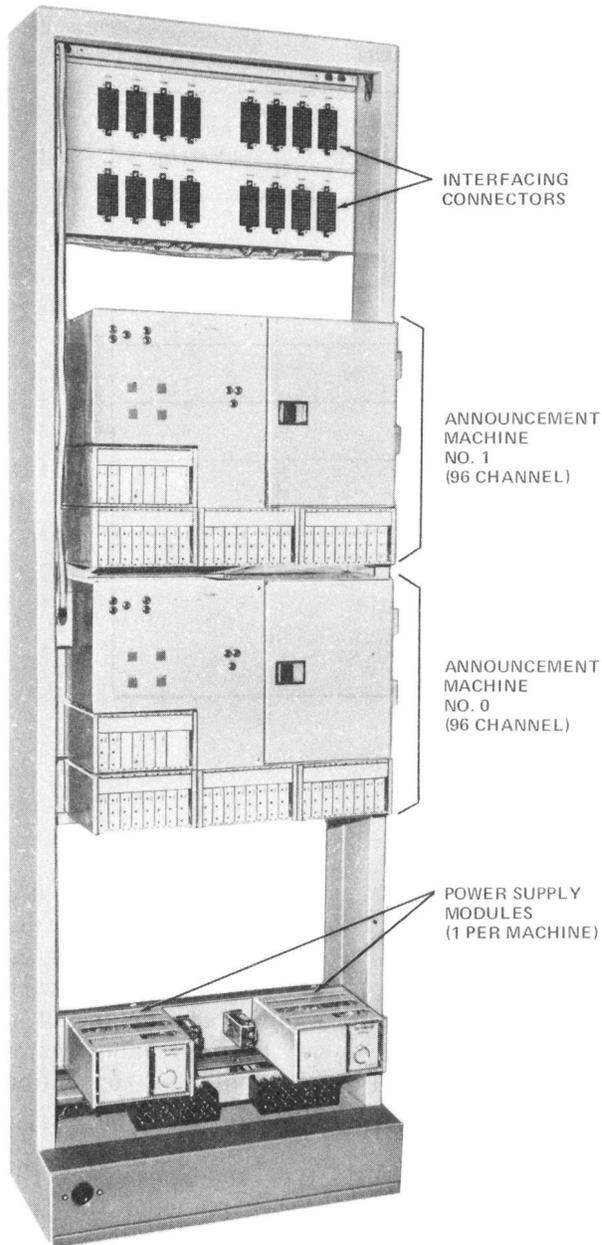


Fig. 3—Typical Frame Arrangement for the Phased Message Announcement (6 Channels Shown)

1.07 The KS-20951 drum storage unit (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 2 alike



**Fig. 4—Typical Frame Arrangement for the Message Synthesis Service Announcement (Duplicated Machines Per Frame)**

announcements of 1.5 seconds duration, or into 6 alike announcements of 0.5 second duration.

◆When the frame is equipped with a KS-20952, L6, the drum will provide 6 timing signals 2/3 second apart.◆

**1.08** The channels on the CSRA 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 3 channels; the MM channel module contains a maximum of 24 channels; the PM channel module contains 1 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:** MSS cannot be mixed on the same frame with other versions due to timing differences.

#### D. Modes of Operation

**1.09** The mode of operation of the CSRA is as follows:

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

- Record live
- Dub from tape
- Reproduce.

Reproducer only (MSS only)

- Reproduce from prerecorded drum.

## 2. DESIGN

**2.01** The CSRA 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 CSRA 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

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	

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

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:

- (a) Drum storage unit
- (b) R/P electronics
- (c) Control and maintenance circuits
- (d) Alarm circuits
- (e) Power and fuse circuits.

With the exception of MSS, which provides interfacing connectors at the upper portion of the frame for 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 drum storage unit (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 CSRA. 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 drum storage unit 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

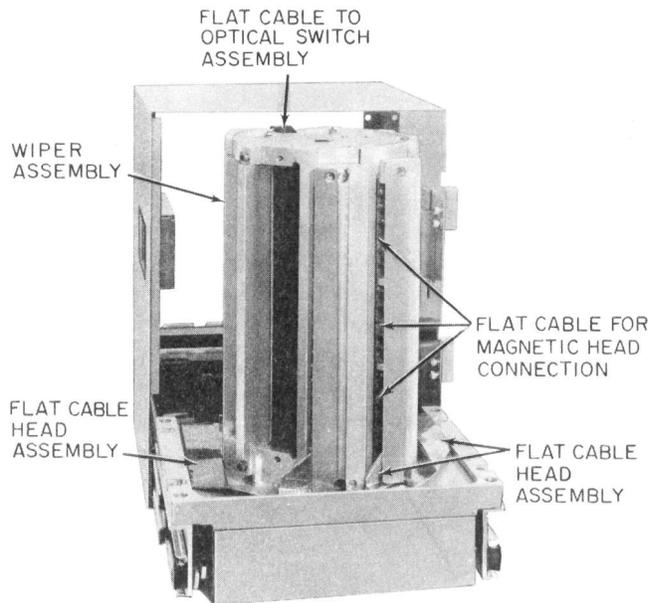


Fig. 5—Flat Cable of Drum Storage Unit

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.

**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. GENERAL

#### For VML, MM, PM, and MRS Only

**3.01** A diagrammatic representation of the CSRA is shown in Fig. 8. This figure shows the physical location and arrangement of the various circuits. The 200-track drum storage unit (recorder-reproducer) is located approximately 5 feet above floor level on the right side of the frame. The section containing the drum storage unit (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 3 channels for variable to a channel module. The phased message 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 drum storage unit 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, phased message announcement service.

**3.04** The modular message 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.

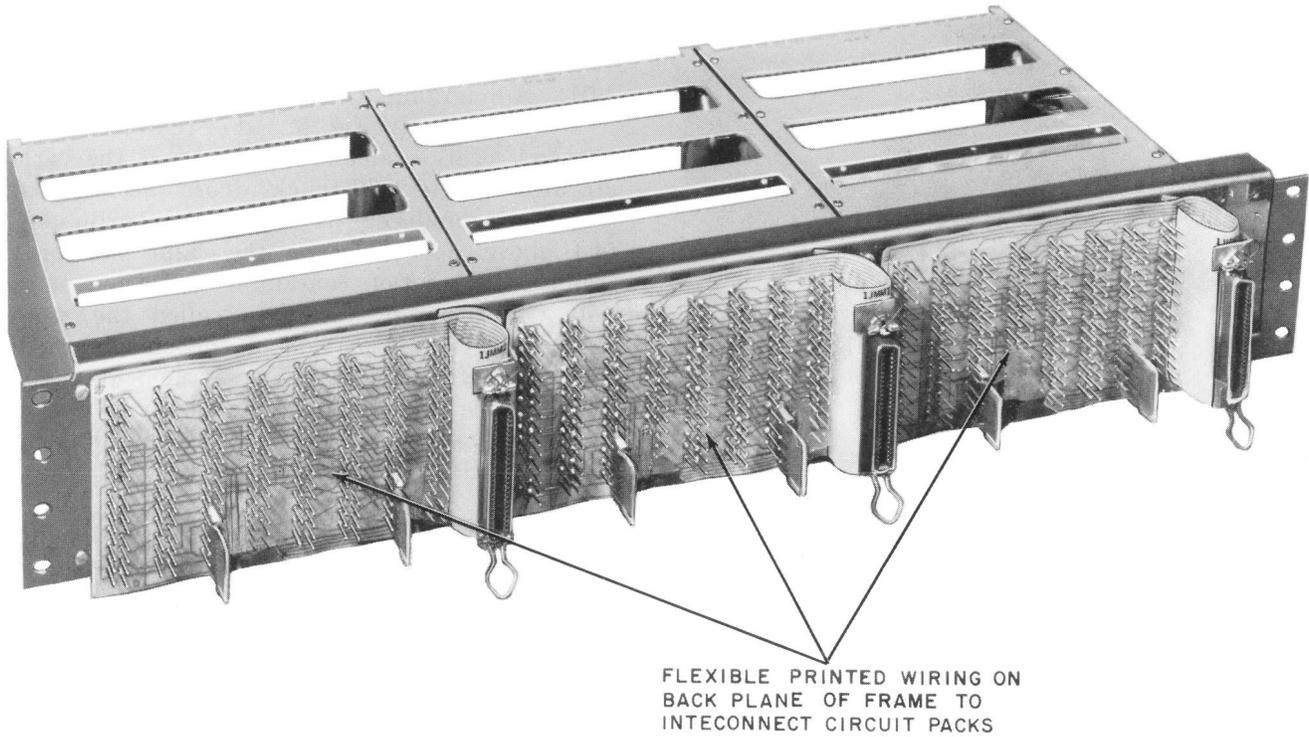


Fig. 6—Rear View of a Channel Module Showing Flexible Printed Wiring (Used With VML, MM, PM, and MRS Only)

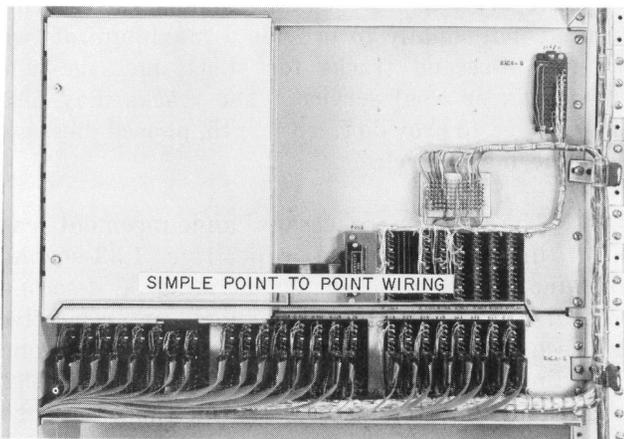
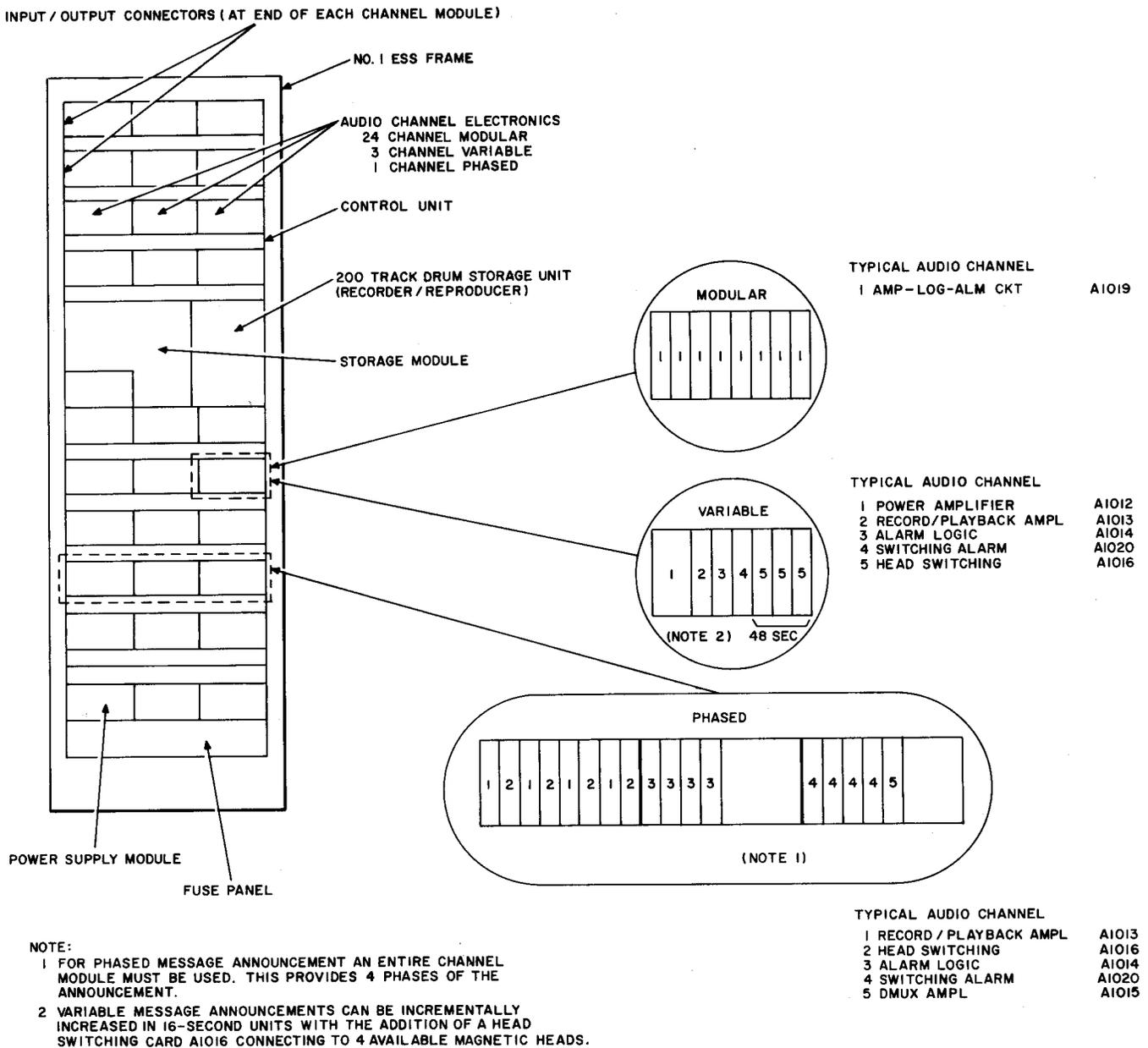


Fig. 7—Rear View of MSS Channel Module Showing Point-to-Point Wiring

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 drum storage unit. 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 phased message 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. Four sets of amplifiers are used. Therefore, by properly switching the three magnetic heads to the four amplifiers, four



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

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 CSRA 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

## SECTION 201-520-101

voltages and a fuse panel so that each channel can be separately fused.

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

### For MSS Only

**3.09** A diagrammatic representation of the CSRA is shown in Fig. 9. This figure shows the physical location and arrangement of the various circuits. The basic prerecorded messages for MSS version of the CSRA 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 drum storage units 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 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, 4 amplifiers per circuit pack, with each amplifier serving 1 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 drum storage unit, 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 CSRA.

**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-second 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 CSRA 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 CSRA.

### A. Storage Module

#### For VML, MM, PM, and MRS Only

**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 drum storage unit
- 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.

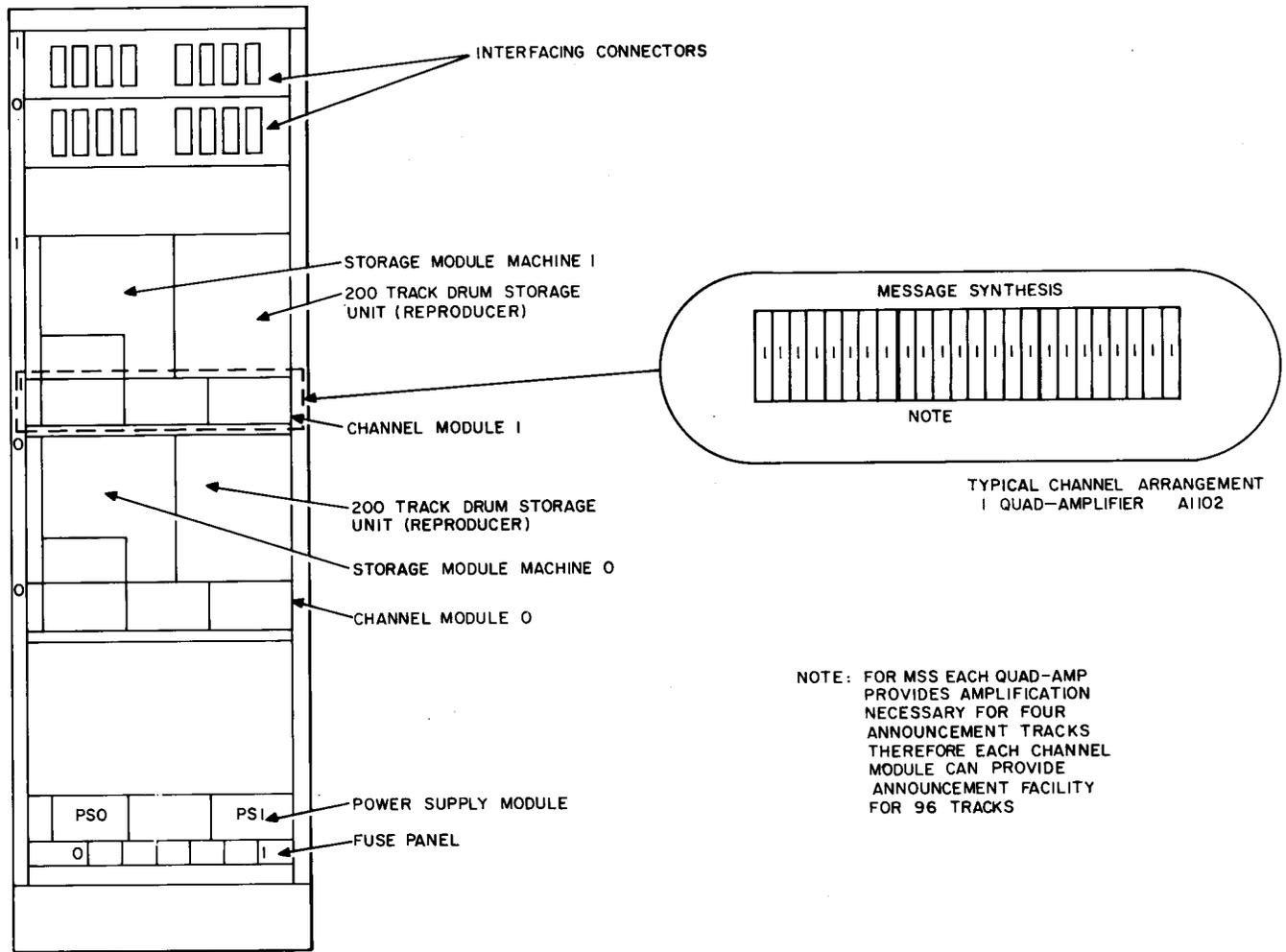


Fig. 9—Common Systems Recorded Announcement Frame—Diagrammatic Representation (MSS Only)

**Note:** When modular message 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:

- (a) On-off control of -48 Vdc power
- (b) On-off normal indications of -48 Vdc power
- (c) On-off control of motor power
- (d) Frame line communication
- (e) Spare jack
- (f) Test jacks for +5, +15, -15, -48 Vdc, and ground
- (g) Local recording
- (h) Local monitoring
- (i) Local test of voice alarm.

**Note:** The TTY jack on the left side of the storage module is used by Electronic Switching Systems (ESS) for communication from the frame to system interfacing units for maintenance and testing purposes.

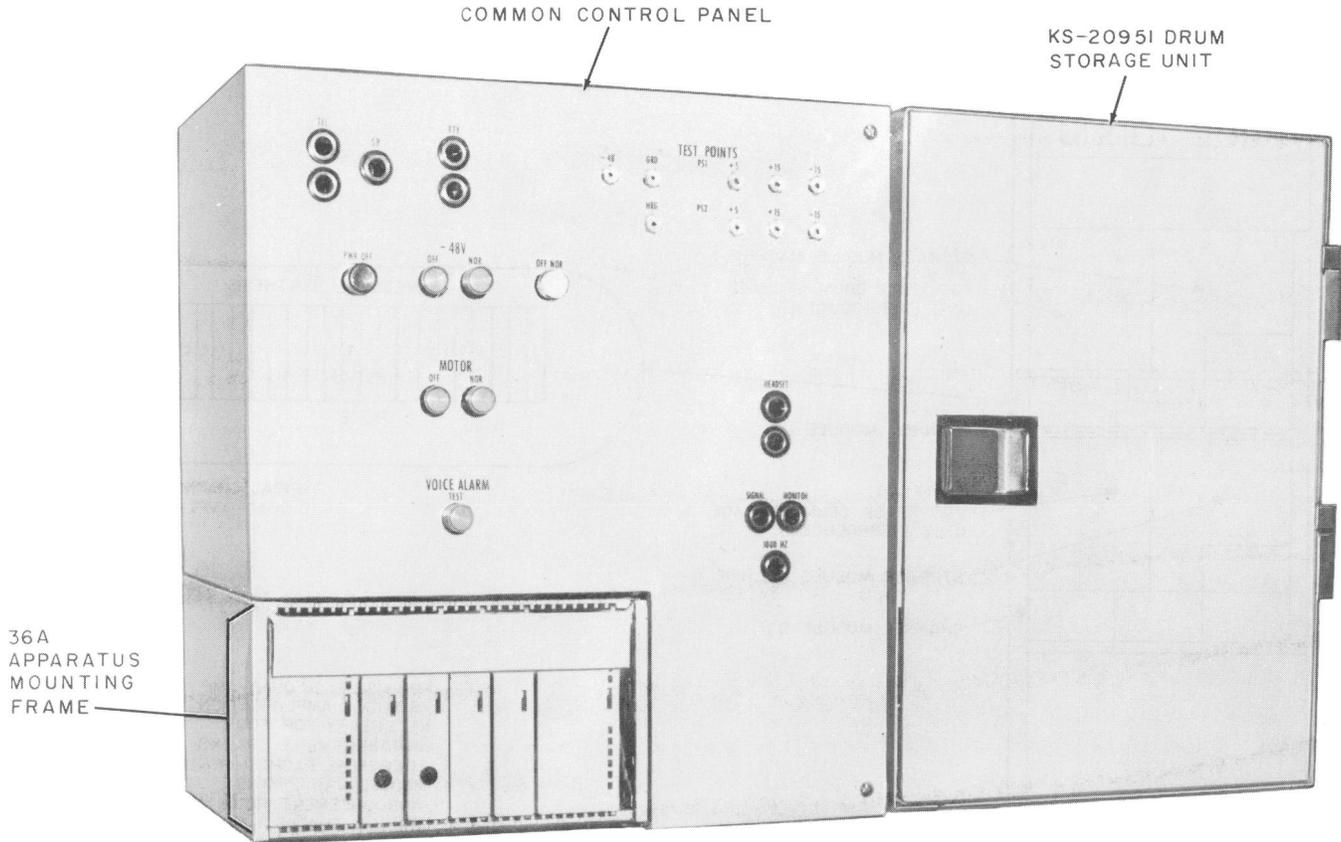
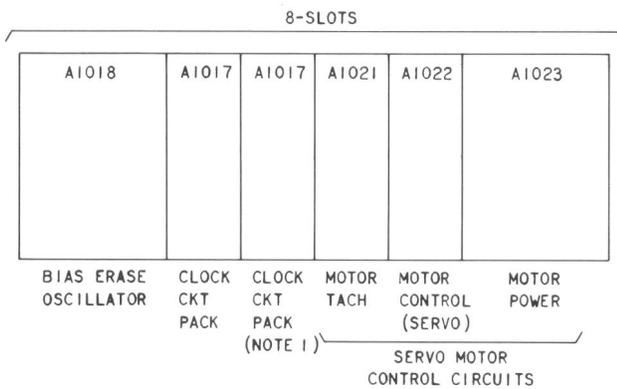


Fig. 10—Storage Module—(VML, MM, PM, and MRS Only)



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 Only)

For MSS Only

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 amps
- Storage for test cables
- Ferrod driver
- Control of the dc servomotor located in the drum storage unit.

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

**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.

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

- (a) On-off control of -48 Vdc power
- (b) On-off normal indications of -48 Vdc power
- (c) On-off control of motor power
- (d) On-off indications of motor power
- (e) On-off control of amplifier power
- (f) On-off indications of amplifier power

- (g) On-off control and indications of audible alarm
- (h) Frame line communication
- (i) Spare jack
- (j) Test jacks for +5, +15, -48 Vdc, and ground
- (k) 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.

#### B. Drum Storage Unit KS-20951

**4.07** The KS-20951 drum storage unit (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

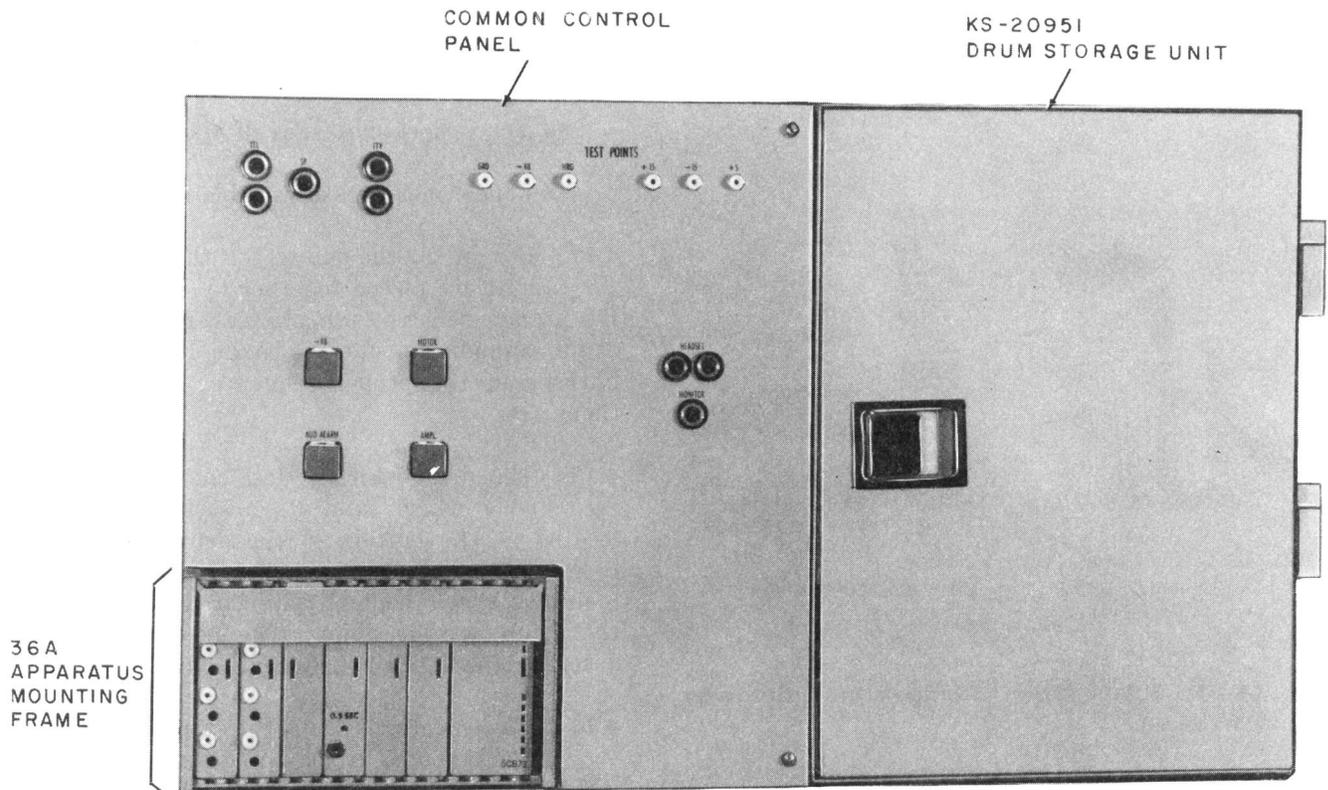


Fig. 12—Storage Module—(MSS Only)

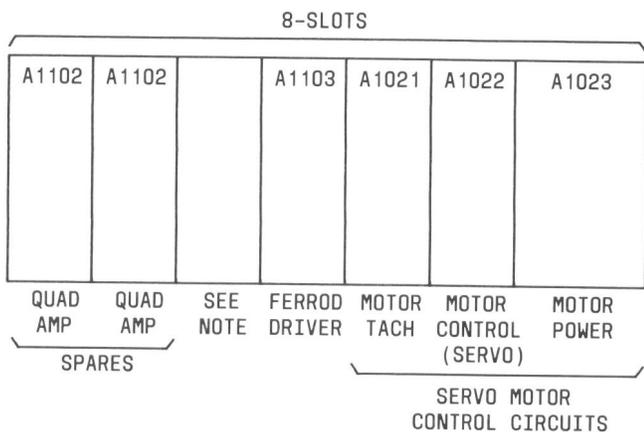


Fig. 13—Storage Module Circuit Pack Location for MSS

a direct drive dc motor which drives a KS-20952 magnetic drum. When associated with VML, MM, PM, 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.

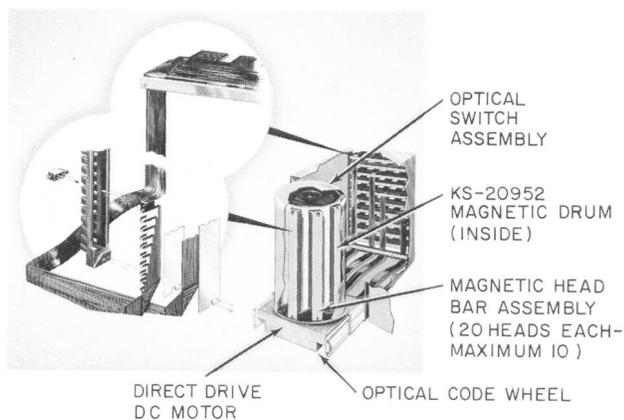


Fig. 14—KS-20951 Drum Storage Unit (Cutaway View)

4.08 The modular magnetic head mountings make possible the assembly of a drum storage unit 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 drum storage unit contains no recording or reproducing electronics, only the basic magnetic elements necessary to record (when applicable), store, and reproduce an audio message, magnetic record-reproduce heads, the magnetic drum, and a means of rotating the drum continuously. The drum storage unit is the only unit of the CSRA 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 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 drum storage unit 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 drum storage unit contains an optical code wheel (and its associated electronics located at the bottom of the drum storage unit) 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 drum storage unit is an optical switch assembly which provides the necessary clock pulses for switching the channel electronics of the VML, MM, PM, or MRS only, or in the case of MSS provides timing pulses to the user system which makes use

**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	

of it for proper timing of the connection to an announcement phrase.

◆Four◆ list numbers of the KS-20951 drum storage unit are available. When a list 1 is provided, the optical switch assembly is equipped with one optical switch (for use with variable and phased 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 modular message announcement or on any frame having combined versions of announcements, one of which is modular message). When a list 3 is provided, the optical switch assembly is equipped with 1 (dual channel) optical switch (for use with message synthesis service 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 drum storage unit list and serial number relationship to the optical switch assemblies.

**4.15** Elements of the servosystem which are not part of the drum storage unit 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 only) or to Fig. 13 for location of servomotor control circuits (for MSS only).

**4.16** The drum storage unit 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 only) or at 20 rpm (for MSS only). 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, a wound armature, and a brush assembly. The motor contains no bearings; therefore, motor lubrication is never necessary. Figure 14 shows

◆ 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 (Note 1)	L-509855-1 (Note 3)	L-504316-2 (Note 2)	L-509855-2 (Note 4)	L-509855-2 (Note 4)	L-509855-2 (Note 4)

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

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

**Note 3:** L-509855-1 — Optical switch assembly with one single channel optical switch. Used in list 1 machines No. 8 and up.

**Note 4:** 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.

the location of the direct drive dc servomotor. Figure 15 shows the drum storage unit removed from the CSRA, revealing the servomotor mounting on the bottom of the drum storage unit.

**4.18** Electrical access to the drum storage unit 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.

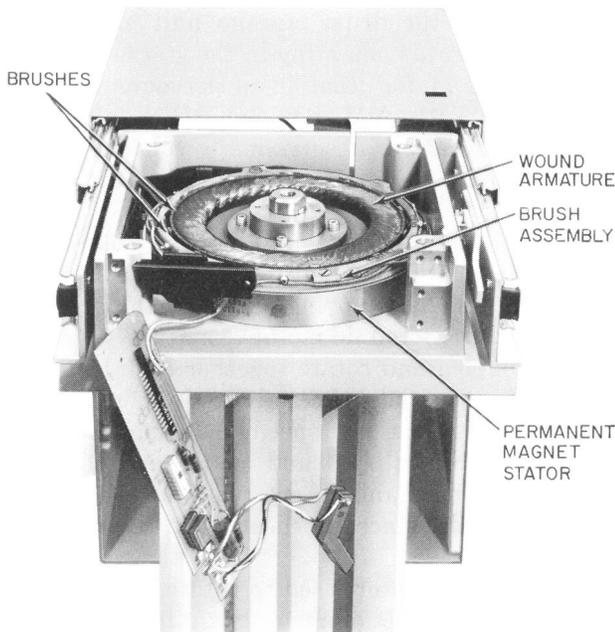


Fig. 15—Drum Storage Unit (Bottom View With Code Wheel Removed)

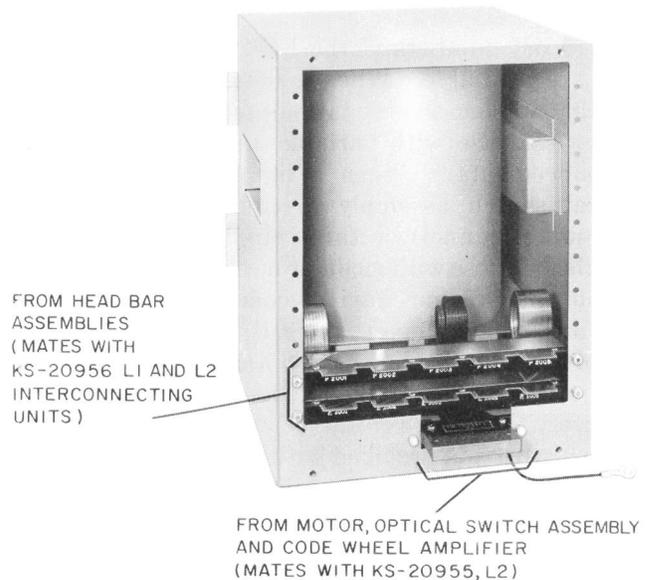


Fig. 16—Drum Storage Unit (Rear View)

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

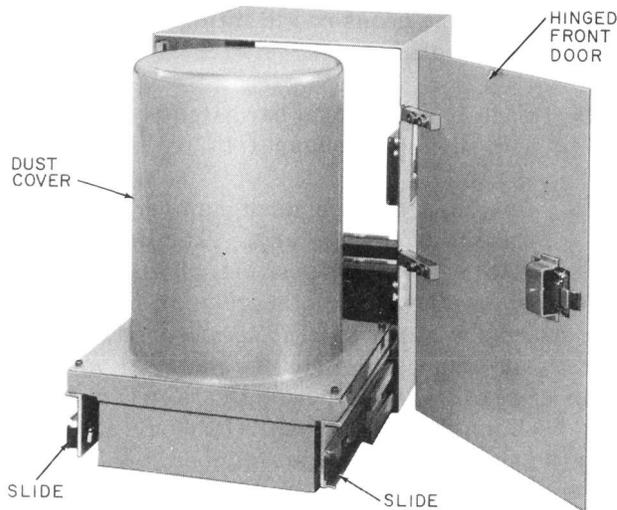


Fig. 17—Drum Storage Unit Slid Out of CSRA on Its Slides

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.

4.21 The drum storage unit case (Fig. 18) provides three features:

- Sliding mounts for the recorder unit which allow it to be pulled forward from the CSRA for inspection or maintenance
- A mounting surface for attachment of the drum storage unit to the CSRA
- 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 drum storage unit if it is removed from the CSRA.

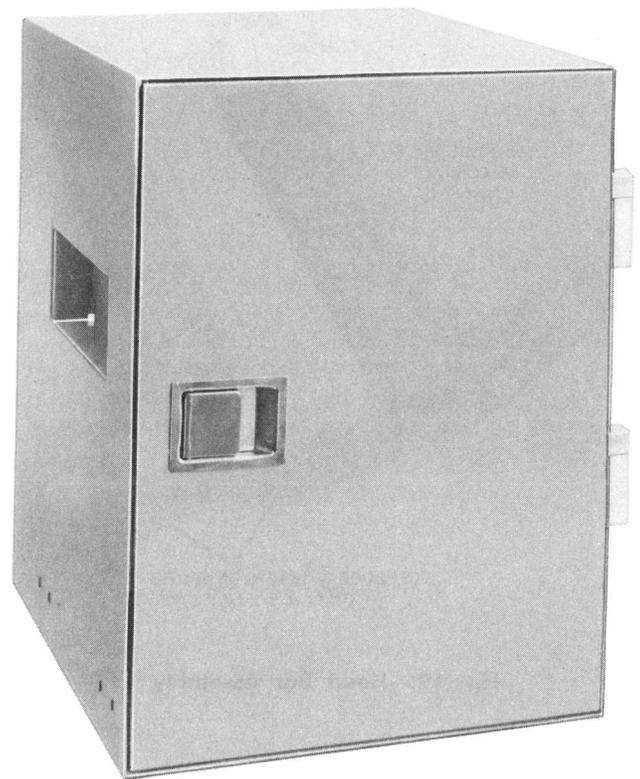


Fig. 18—Sealed Drum Assembly—Drum Storage Unit (Front View)

#### 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 drum storage unit. The drum storage unit 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.

4.24 Each head bar assembly is provided with preformed flat cable to connect to the 20

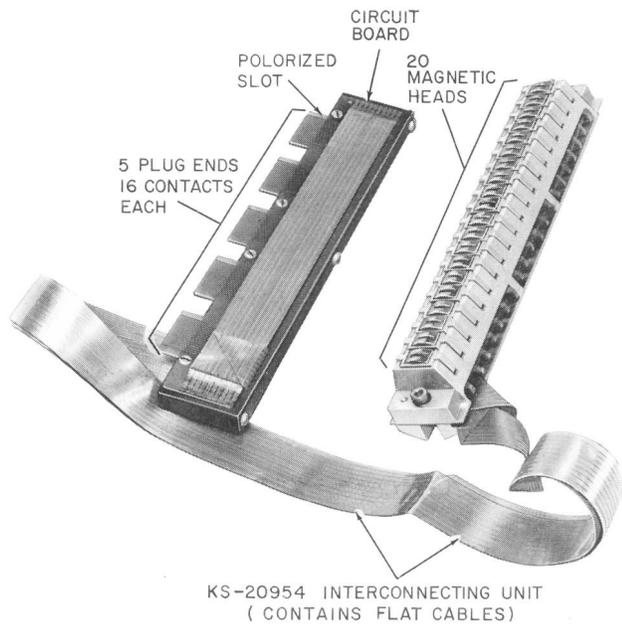


Fig. 19—Head Bar Assembly



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

Fig. 20—Cylindrical Housing

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.

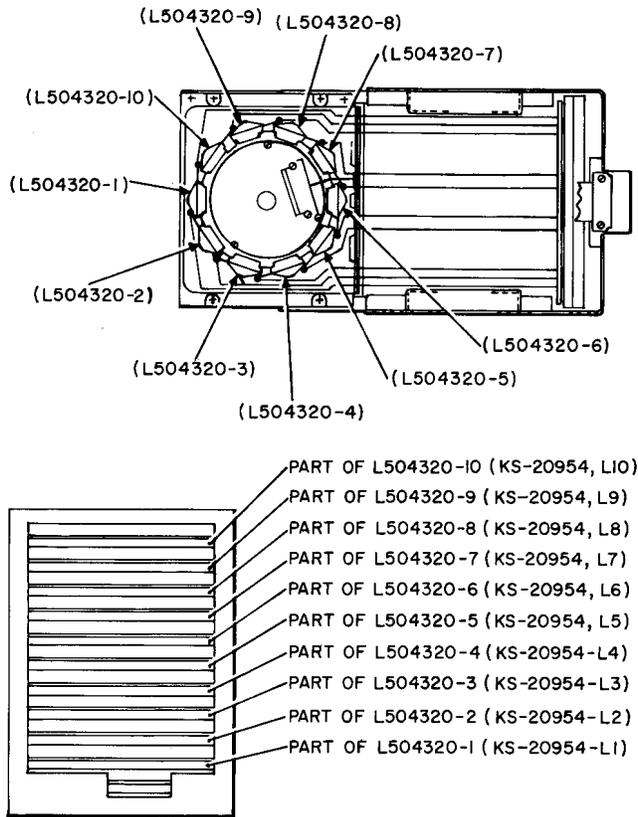
4.26 Only one of each dash number will fit on the drum storage unit. The dash number is used to define the position of the head bar assembly on the drum storage unit. Each head bar assembly has a specific location on the drum and a specific location for its termination on the rear of the drum storage unit. 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 only) or accessible channel capacity (for MSS only).

#### 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 drum storage unit. This unit then mates at the rear of the drum storage unit 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 5 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 drum storage unit, as shown in Fig. 21.



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

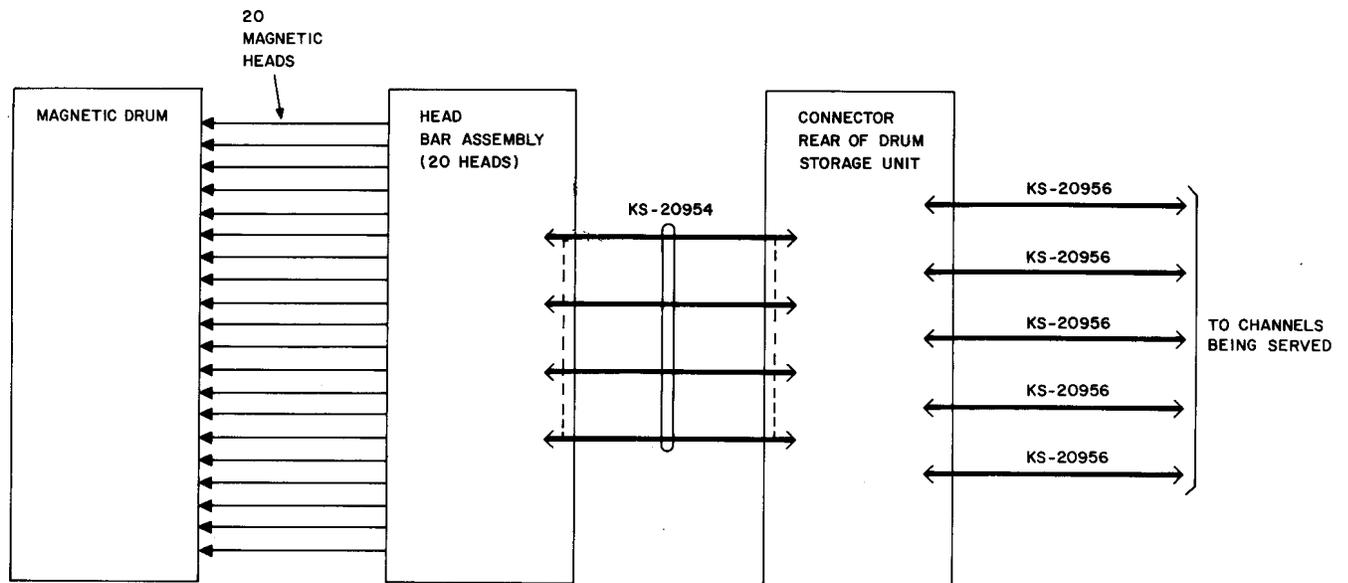
**Interconnecting Unit KS-20955**

**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 functions and circuit cards of the storage module to the drum storage unit. 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.

**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



**Fig. 22—Interconnecting Unit Arrangement**

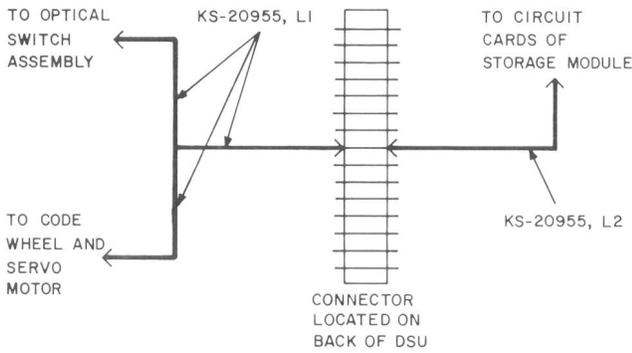


Fig. 23—Location of KS-20955, L1 and KS-20955, L2 Interconnecting Units

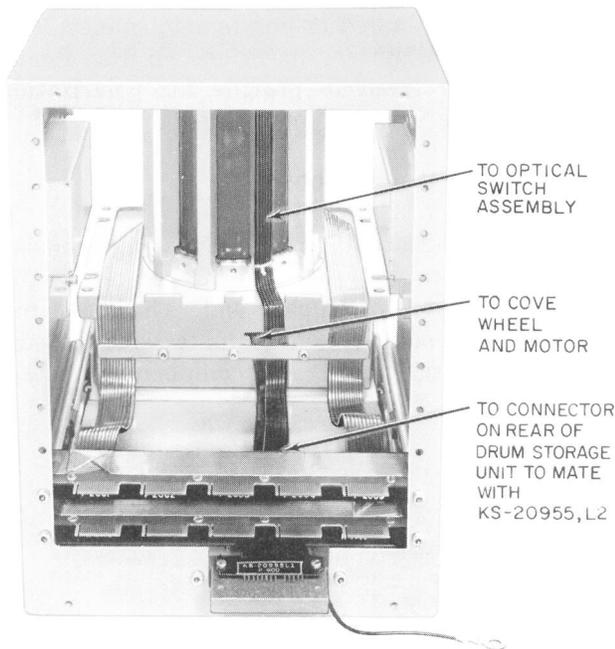


Fig. 24—KS-20955, L1 Interconnecting Unit (Rear View Drum Storage Unit Removed From CSRA)

assigned to the KS-20956 interconnecting unit to identify the length.

- List 1 is 4 feet 4 inches in length.

(VML, MM, PM, and MRS only—Used to connect to channel modules in frame positions 0 through 3.)

(MSS only—Used to connect to all amplifiers of channel module of each machine.)

- List 2 is 7 feet 0 inches in length.

(VML, MM, PM, and MRS only—Used to connect to channel modules in frame positions 4 through 8.)

(MSS only—Not used for MSS.)

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

**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 drum storage unit. 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.

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

4.36 The KS-20952 magnetic drum is available in six configurations. Figure 29 illustrates one of the six versions of the KS-20952, L1 magnetic drum available. 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

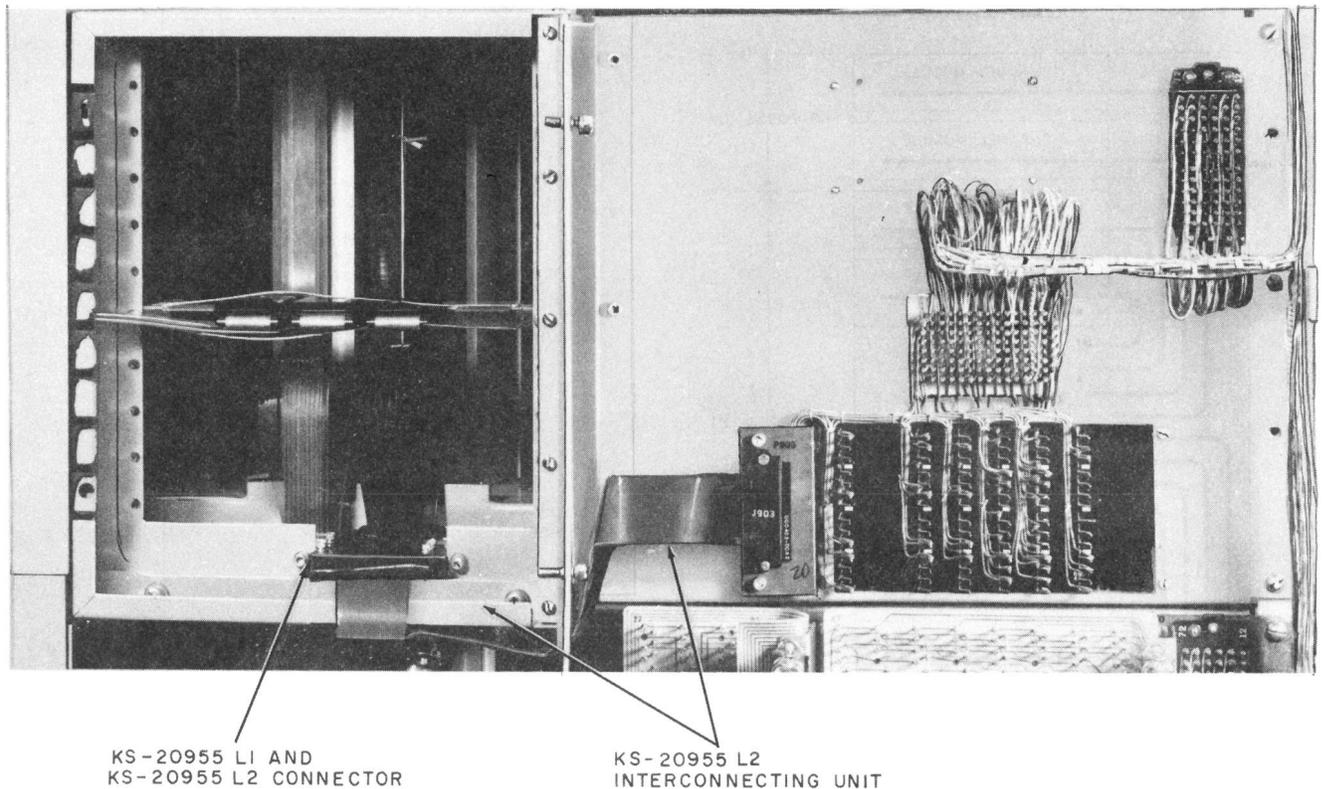


Fig. 25—KS-20955, L2 Interconnecting Unit (Rear View Storage Module Shown)

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 version of the KS-20952, L1 magnetic drum available 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 drum storage unit when equipped with an L-509855-1 or L-509855-2 optical switch assembly, respectively. This drum is not furnished with prerecorded announcements.

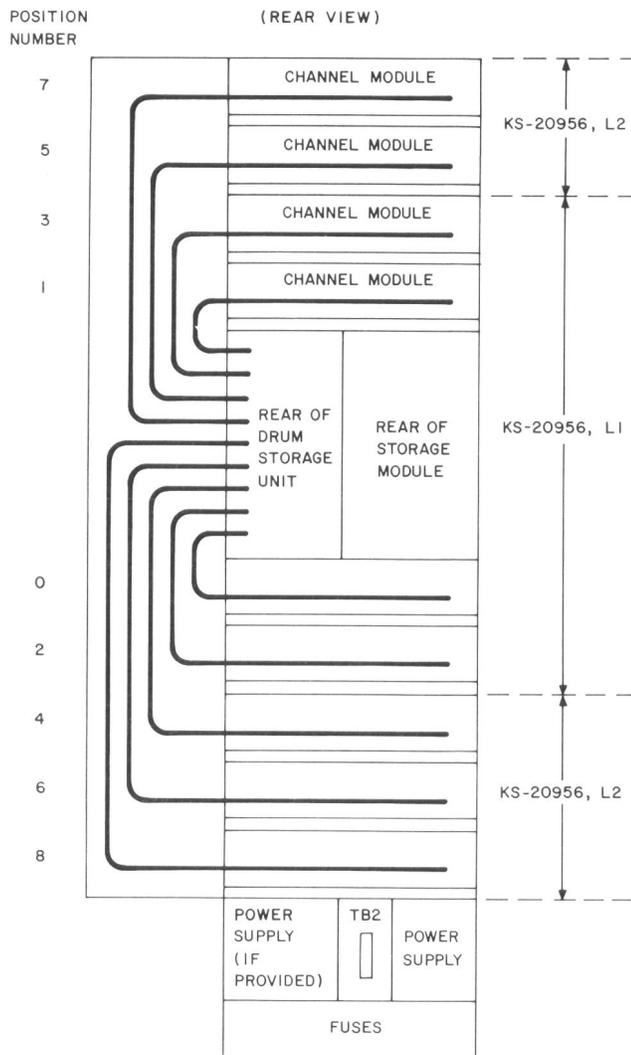
**4.38** The KS-20952, L3 magnetic drum shown in Fig. 31 is to be ordered with the prerecorded localities specified for the area to be served. The L3 magnetic drums are intended for use with all KS-20951, L3 drum storage units only. The L3 drum is designed to operate with the L3 drum storage unit when 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 a 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 Automatic Intercept System program PG-1B203. The KS-20952, L6 magnetic drum is unrecorded and provides timing signals 2/3 second apart (see Fig. 32).♦

**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.

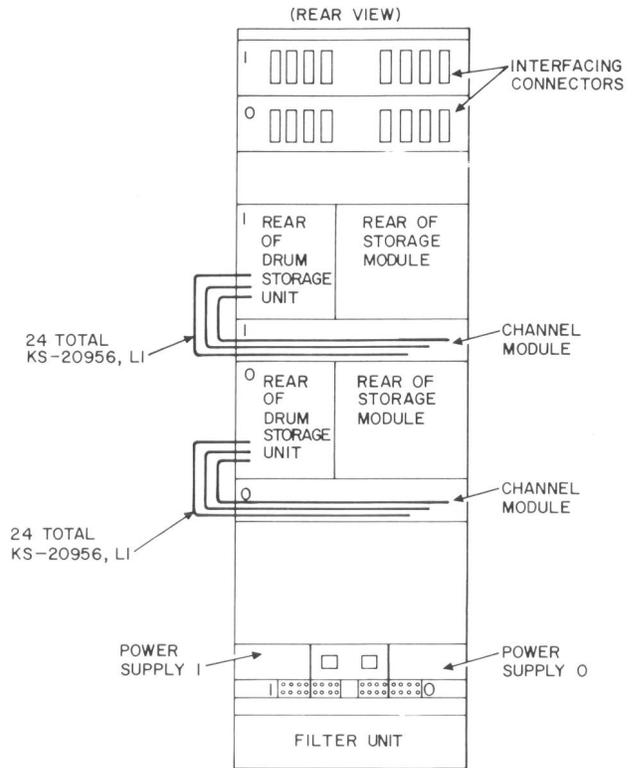
**4.40** The magnetic drum rotates about a vertical axis and is directly coupled to a very simple,



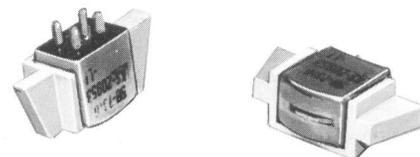
**Fig. 26—Typical Arrangement of the KS-20956 Interconnecting Unit on Rear of CSRA—(Intended for Use With VML, MM, PM, and MRS Only)**

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.



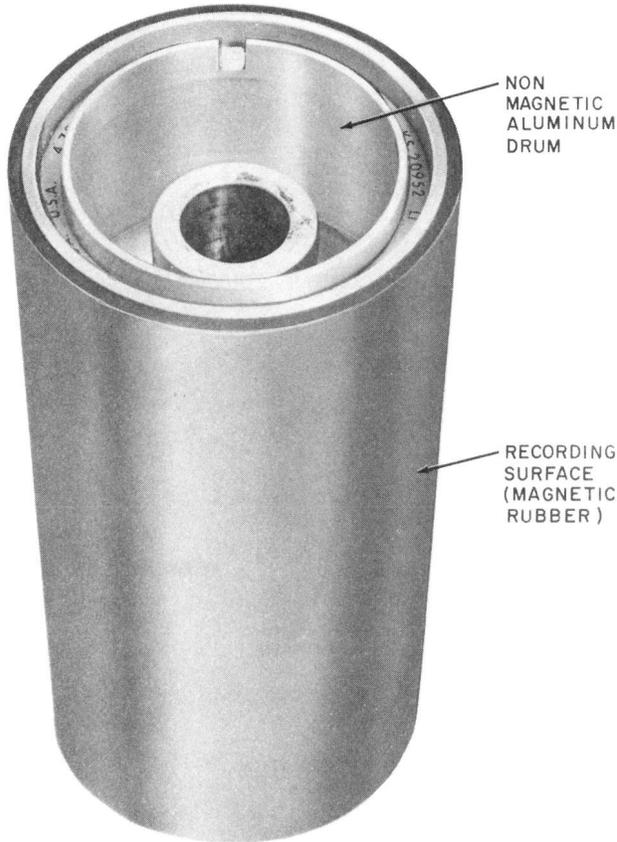
**Fig. 27—Typical Arrangement of the KS-20956 Interconnecting Unit on Rear of CSRA—Intended for Use With MSS Only**



**Fig. 28—KS-20953 Magnetic Head**

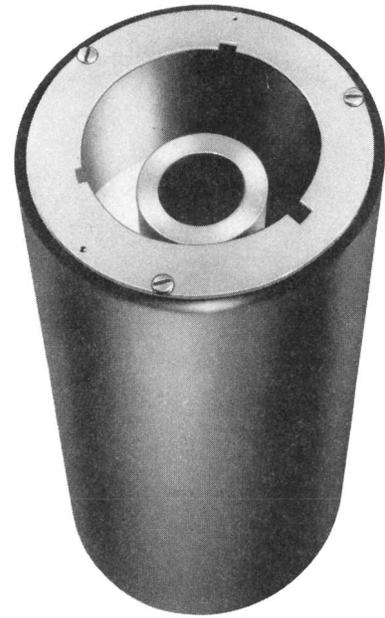
**Code Wheel and Amplifier**

**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.



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

**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.



**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 LSUs)**

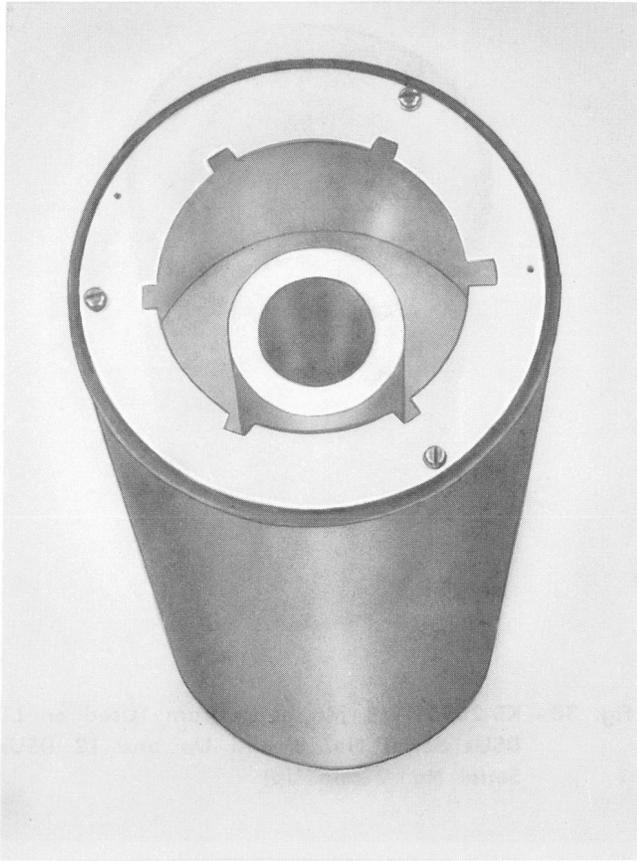


Fig. 32—KS-20952, L6 Magnetic Drum

#### 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 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 drum storage units serial numbers 1 through 7. This assembly consists of only one

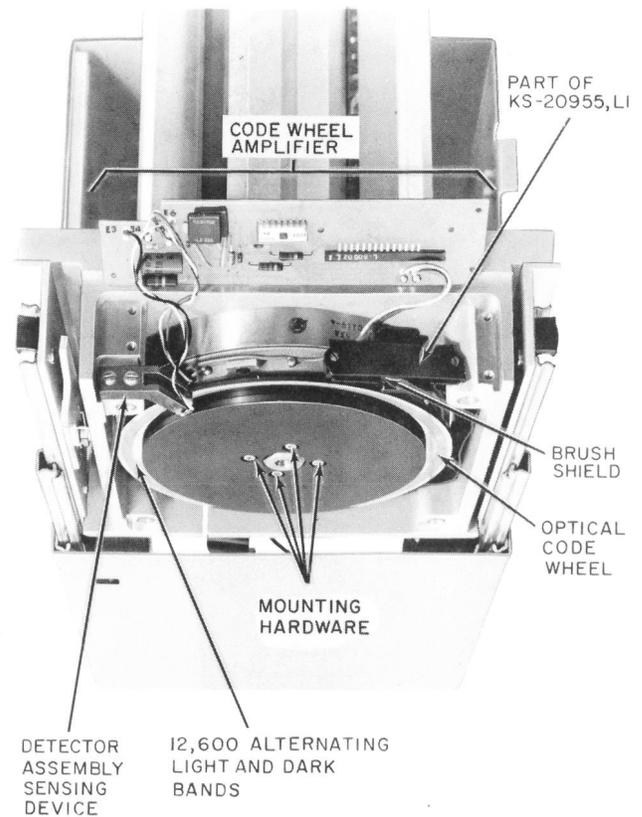
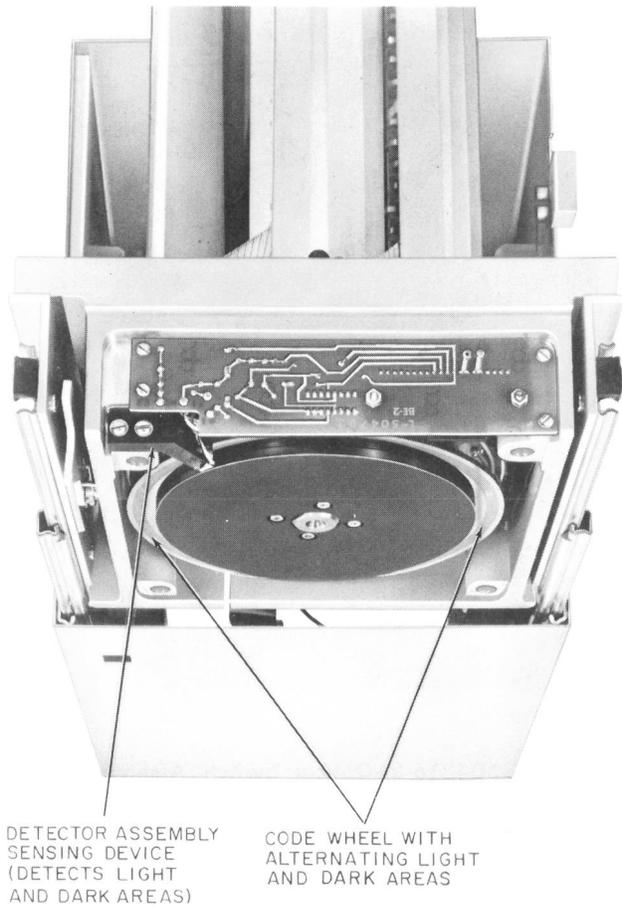


Fig. 33—Optical Code Wheel (Viewed From Underside Drum Storage Unit)

optical switch and is used when only one timing pulse per revolution is required. (See Fig. 36.)

**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. (See Fig. 37.) 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.

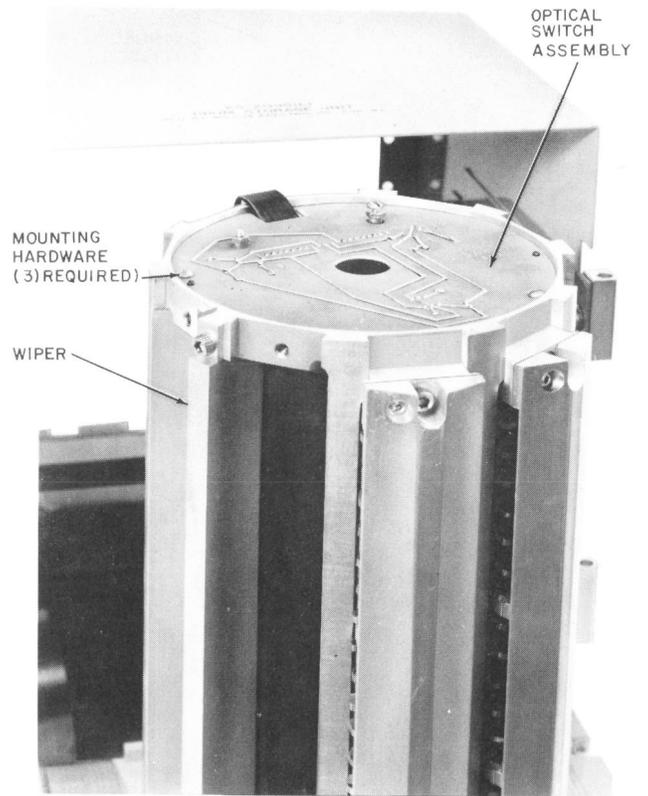
**4.47** Illustrated in Fig. 38 is the L-504316-2 optical switch that is used in conjunction with the



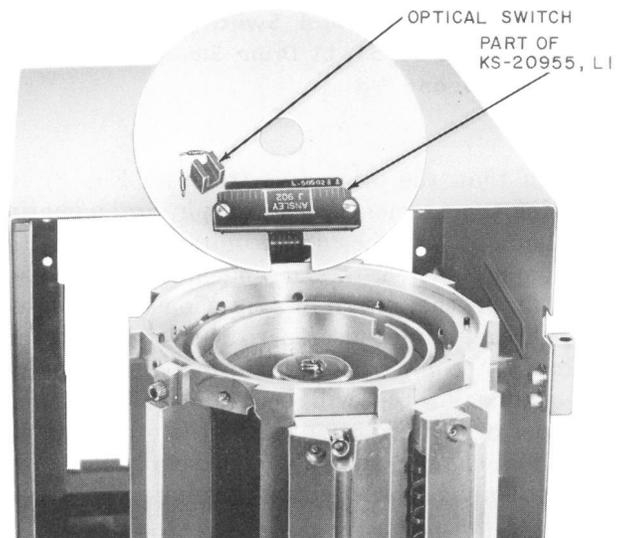
**Fig. 34—Code Wheel and Code Wheel Amplifier Mounting in Relation to One Another (Viewed From Underside of Drum Storage Unit)**

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.

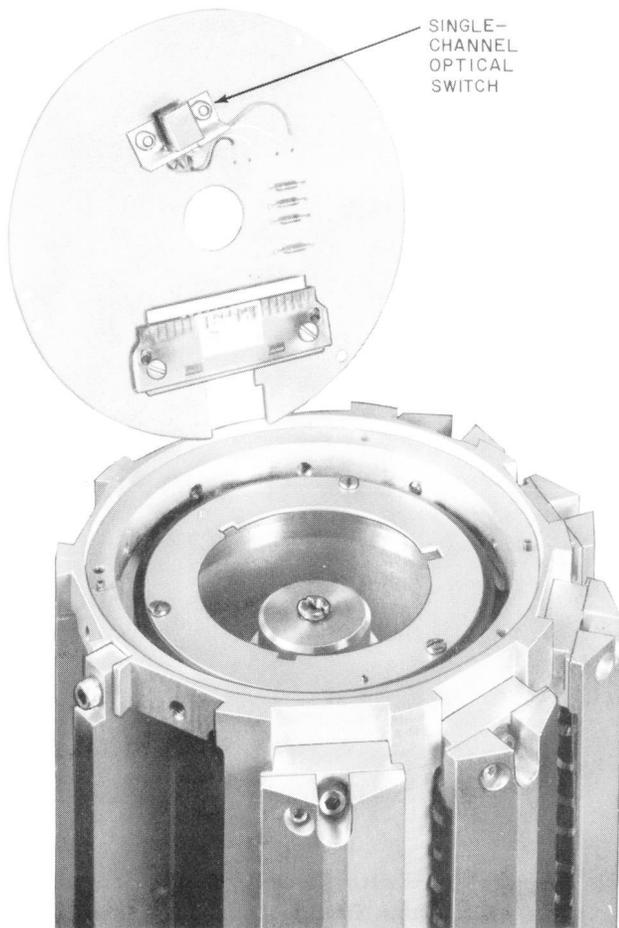
**4.48** Illustrated in Fig. 39 is the L-509855-2 optical switch assembly that is used with the KS-20952, L1 magnetic drum in KS-20951, L2 drum storage units serial numbers 9 and up and with the KS-20952, L6 magnetic drum in KS-50951, L4 drum storage units. This assembly consists of only one dual-channel 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



**Fig. 35—Optical Switch Assembly—Mounted (Viewed With Drum Storage Unit Cover Removed)**



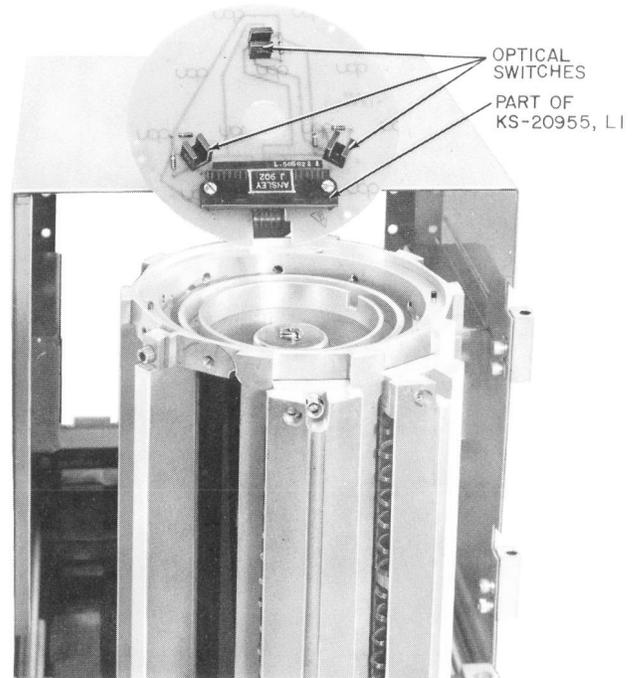
**Fig. 36—L-504316-1 Optical Switch Assembly—Used With KS-20951, L1 Drum Storage Units Serial No. 1 Through 7**



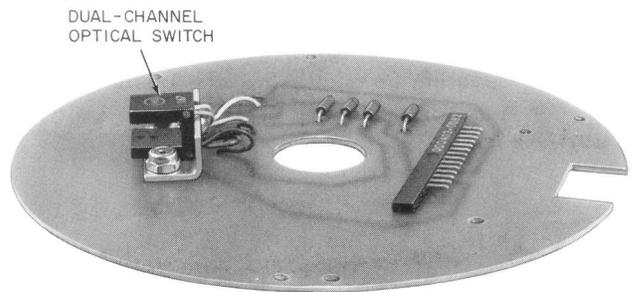
**Fig. 37—L-509855-1 Optical Switch Assembly—Used With KS-20951, L1 Drum Storage Units Serial No. 8 and Up**

in depth than the other five (refer to Fig. 37 for mounting arrangement). 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 drum storage units.



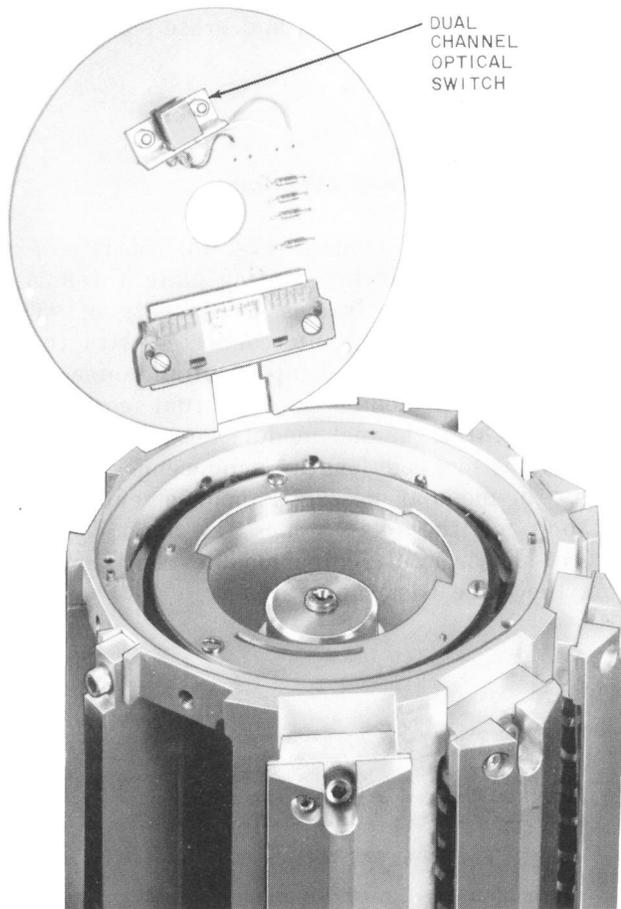
**Fig. 38—L-504316-2 Optical Switch Assembly—Used With KS-20951, L2 Drum Storage Units Serial No. 1 Through 8**



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

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. (See Fig. 40.) 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 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.

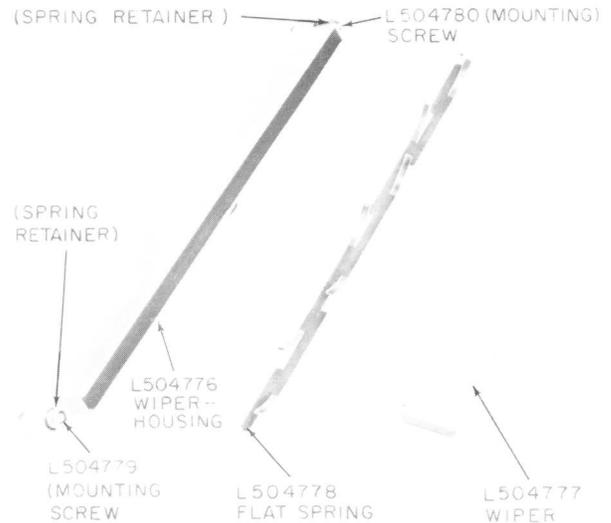


**Fig. 40—L-509855-2 Optical Switch Assembly—Used With All KS-20951, L3 Drum Storage Units**

#### 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. 41—Wiper Assembly**

#### 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 (Fig. 33). The shield collects the wear particles from the motor brushes to keep the code wheel clean.

#### C. 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.

**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

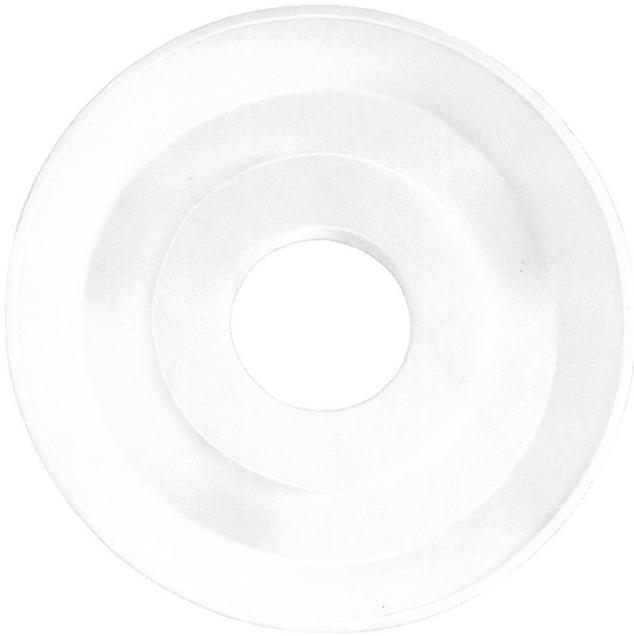


Fig. 42—Brush Shield

only one circuit pack. A channel for the variable length 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 variable message length 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 phased message 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 DMUX audio amplifier per channel. A channel (phrase) for the message synthesis service announcement consists of 1/4th of a circuit pack. Each circuit pack of the message synthesis announcement 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 CSRA. 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.

#### D. Channel Module

##### For VML, MM, PM, and MRS Only

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 channel module input/output connector. There are three channel module designs: one for the variable message length announcement service, one for the modular message announcement service, and one for the phased message announcement service. However, all channel modules are assembled from the same basic apparatus.

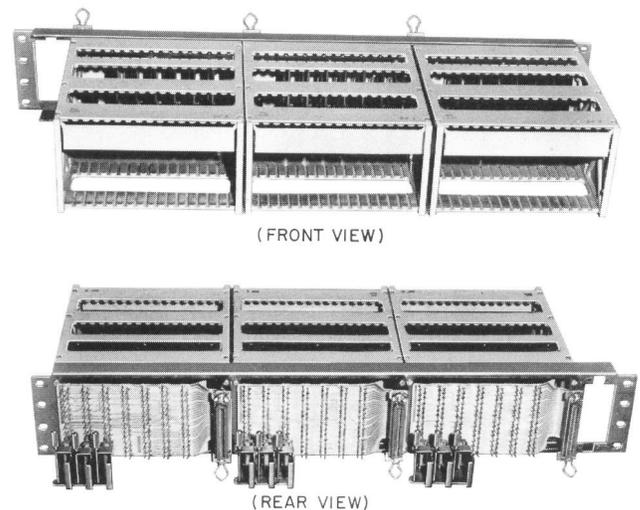


Fig. 43—Channel Module—Front and Rear Views (VML, MM, PM, or MRS)

**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.

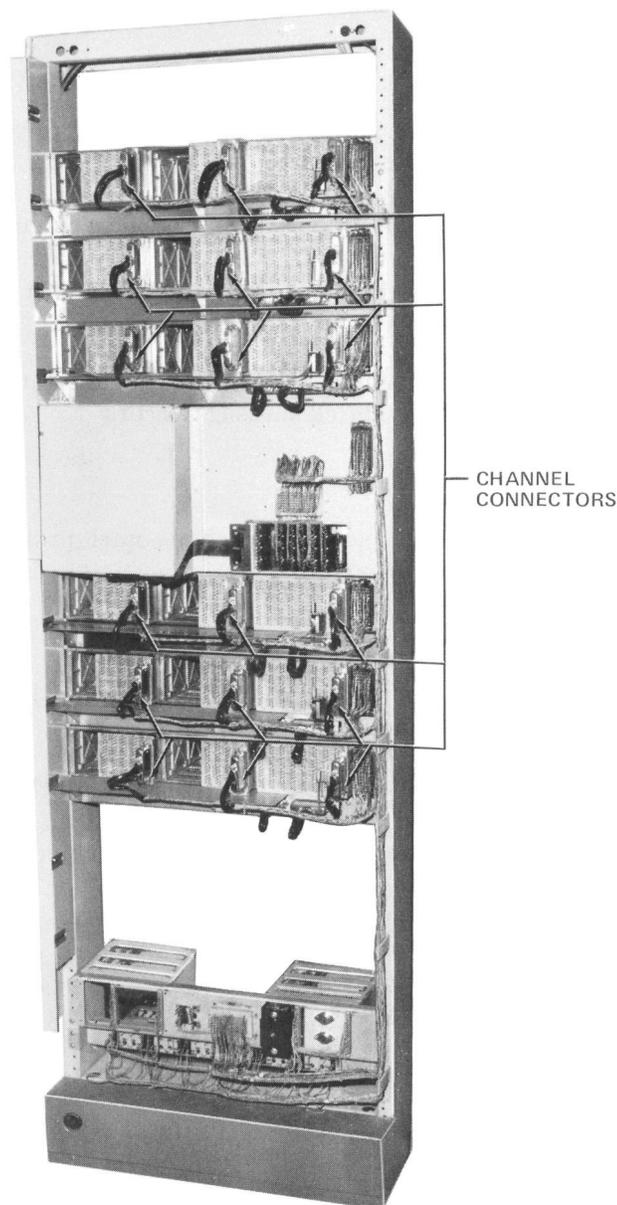
**4.58** All connections to the channels are made through the channel connectors located on the FPW backplane (Fig. 44). All central office connections to the channel modules are made via the channel module input/output connectors, one of which is located at the left end of each channel module for the variable and phased message announcements (Fig. 2 and 3). For modular message 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 message synthesis service.

#### For MSS Only

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



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

**SECTION 201-520-101**

**E. Circuit Packs**

**For VML, MM, PM, and MRS Only**

**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.

**For MSS Only**

**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 sixteen circuit pack types used in the CSRA. Eight of the sixteen types are used in the audio channels. These eight are:

- (a) Power amplifier—A1012
- (b) Record/playback amplifier—A1013
- (c) Alarm logic circuit pack—A1014
- (d) DMUX audio amplifier—A1015
- (e) Head switching circuit—A1016
- (f) Amp-log-alarm circuit—A1019
- (g) Switching alarm circuit—A1020

(h) 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:

- (a) Motor tach—A1021
- (b) Motor control—A1022
- (c) Motor power—A1023.

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

- (a) Clock circuit—A1017
- (b) Bias erase oscillator—A1018.

One of the remaining three is common to MSS version of the frame. This circuit pack is:

- (a) Ferrod driver—A1103.

One of the remaining two is common to MRS version along with the A1017 clock circuit pack. The circuit pack is:

- (a) Bias erase oscillator—A1232.

The remaining type is used in the J1C012E auxiliary frame used with phased message announcement. The circuit pack is:

- (a) 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. The following listing gives a brief description of each circuit pack in Table D.

**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						*
Bias Erase Oscillator A1232					*	
Clock Driver Circuit A1234			*†			

† Used in J1C012E Auxiliary Frame

**4.67 List of Circuit Packs Used in the CSRA and a Description of Each:**

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.	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.
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 the record or playback 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.	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.
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.	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.
DMUX Audio – Amplifier A1015	This circuit pack is intended for use in the 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.	Amp-Log-Alarm – Circuit A1019	This circuit pack is used 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.

Switching Alarm –  
Circuit A1020  
(Cont)

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.

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 80dB of gain into a 33 3300 ohm load. The output of each amplifier is made available at test points (TP1 – TP4), which are located on the face-plate 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.

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 revolution).

Ferrod Driver –  
A1103

This circuit pack is intended for use in the storage module when the CSRAF 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.

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.

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.

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.

Clock Driver –  
Circuit A1234

This circuit pack is intended for use in the J1C012E Frame to boost the clock signal received from 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.

**F. Control Unit**

**For VML, MM, PM, and MRS Only**

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.

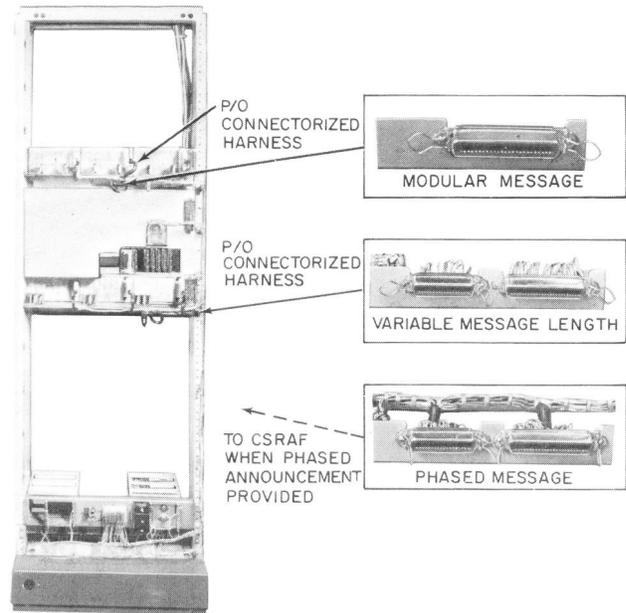
4.70 The control unit is mounted on the frame immediately below the channel module it serves. Each of the control units contains the frame-mounted jacks, keys, and lamps required to provide for the local control, test, and maintenance of the channel module. Each time a channel module is added to a frame,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



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

- Measuring audio output level of a channel.

**For MSS Only**

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.

**G. Power Supply**

4.75 All the circuit packs in the CSRA operate from either +15, -15, or +5 Vdc. To provide for obtaining these voltages in any central office in which a CSRA 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.

**For VML, MM, PM, and MRS Only**

**Note 1:** 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 phased message announcements, the power supplies needed are one for channel modules 9 through 13 and one for channel modules 14 through 19.

**For MSS Only**

**Note 2:** 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.

**4.77** 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.

**H. Fuse Panel**

**4.78** 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.

**I. Frames**

**4.79** With the use of the drum storage unit, 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).

**4.80** The CSRA 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 phased message channels are needed, the auxiliary frame is coded J1C012E.

**J. CALL DIRECTOR® Telephone**

**For VML, MM, PM, and MRS Only**

**4.81** A CALL DIRECTOR telephone (Fig. 46) is used as a dedicated phone for recording of audio information on the CSRA from a quiet location. The CALL DIRECTOR telephone is a 637 EA13-type equipped with 18 key positions; 2 positions for the record function and 16 positions for selecting channels on the CSRA, 1 position per channel. If the CSRA is equipped with more than 16 channels, 2 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.

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

**For MSS Only**

**4.83** For MSS the use of a dedicated phone is not necessary. Because of the use of the

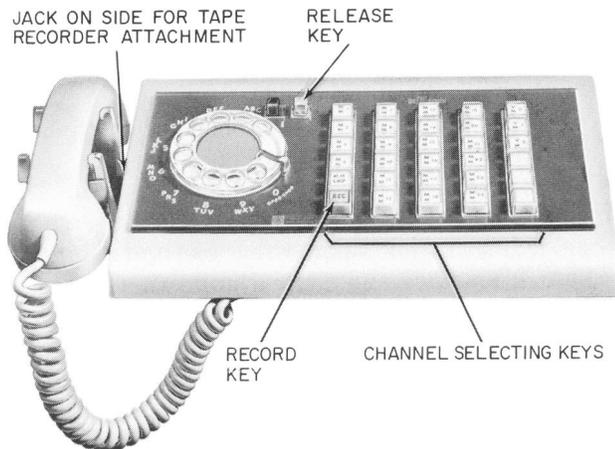


Fig. 46—637A13 CALL DIRECTOR Telephone

prerecorded magnetic drum, no recording facilities of any type are required.

## 5. RESTRICTIONS

### For VML, MM, PM, and MRS Only

5.01 Only three restrictions apply in the use of the CSRA. 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 CSRA 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 CSRA 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 CSRA.

#### 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.

#### For MSS Only

5.04 The only restriction in the use of the CSRA 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 CSRA should not be located adjacent to frames which produce extraordinary electrical activity (ie, ring and tone frame).

## 6. RECORDING

### For VML, MM, PM, and MRS Only

6.01 Recordings on the CSRA 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 Frame

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 headset
- 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 variable and phased messages or under the MM LMP key for modular messages, 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.

#### For MSS Only

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

### 7. VML ANNOUNCEMENT

#### A. 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 drum storage unit 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 drum storage unit 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 drum storage unit, 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.

#### B. 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.

**C. Control Unit**

**7.06** For local maintenance, 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.

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

**D. Alarms**

**7.08** 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.

**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

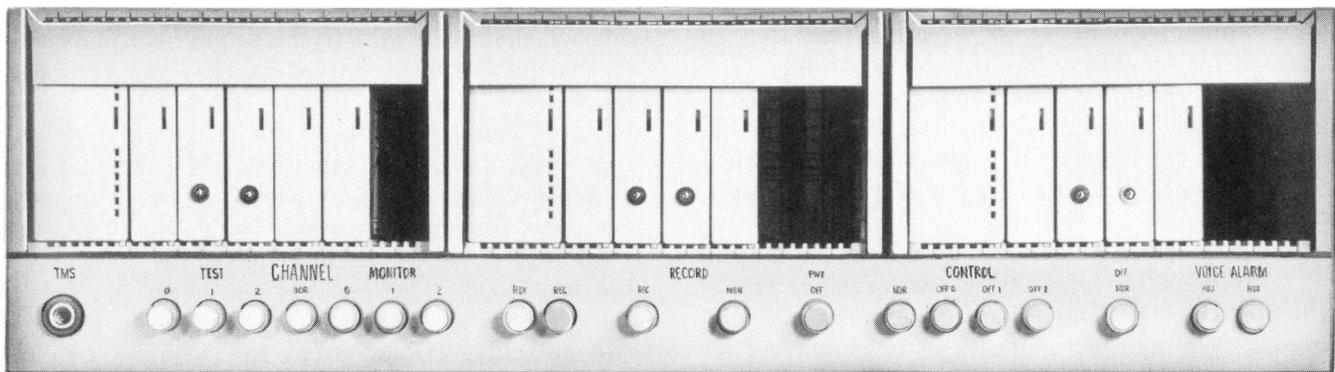
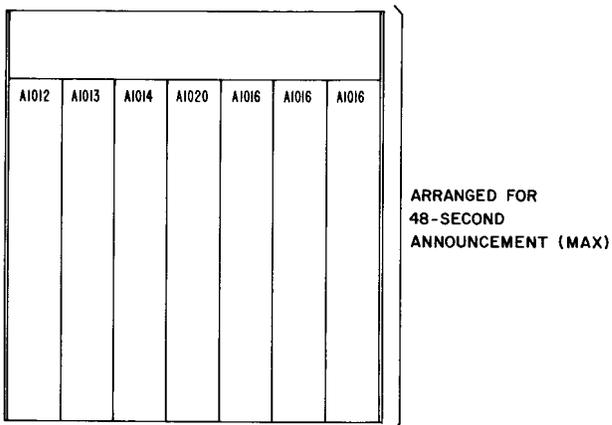
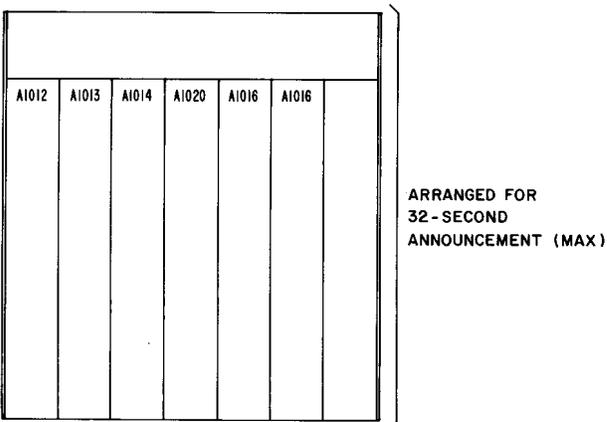
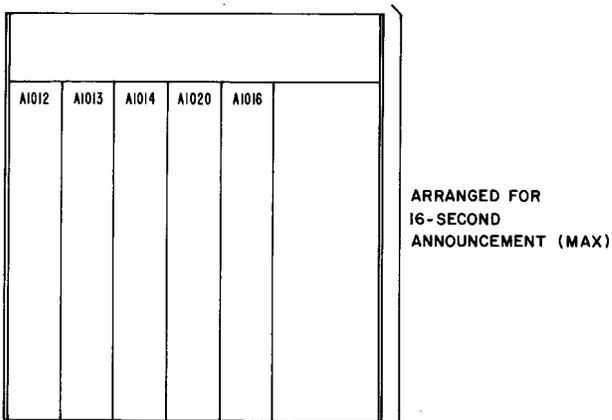


Fig. 47—Variable Message Length Channel Module and Control Unit



A1012- POWER AMPLIFIER  
A1013- RECORD PLAYBACK AMPLIFIER  
A1014- ALARM LOGIC CIRCUIT PACK  
A1020- SWITCHING ALARM CIRCUIT PACK  
A1016 - HEAD SWITCHING CIRCUIT PACK

**Fig. 48—Location and Identification of Variable Message Length Channel Module Circuit Cards**

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.

**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 a 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.

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.

**Fuse Alarms**

7.16 The power supply levels used in the CSRA 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 CSRA 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

TABLE E

## VARIABLE MESSAGE LENGTH CONTROL UNIT

KEY, JACK, OR LAMP	DESCRIPTION
TMS	Transmission measuring set jack used for: <ul style="list-style-type: none"> <li>● Measuring audio levels with transmission measuring set.</li> <li>● Recording from headset by inserting jumper from storage module SIGNAL jack.</li> </ul>
CHANNEL TEST (0-2)	Channel test keys—Contacts on CHANNEL TEST keys: <ul style="list-style-type: none"> <li>● Connect corresponding channel preamplifier audio to TMS jack.</li> <li>● Supply power to CM relay.</li> <li>● Connect MEM key to corresponding channel.</li> <li>● Light OFF NOR lamp.</li> </ul>
CHANNEL NOR	Channel normal key—Depressed when operating in normal mode.
CHANNEL MONITOR (0-2)	Channel monitor keys—Contacts on CHANNEL MONITOR key: <ul style="list-style-type: none"> <li>● Remove circuit ground from TMS jack.</li> <li>● Connect corresponding channel output to TMS jack.</li> <li>● Light OFF NOR lamp.</li> </ul> <p><i>Note:</i> 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.</p>
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: <ul style="list-style-type: none"> <li>● At least one channel has power disconnected with its CONTROL key in OFF position.</li> <li>● A fuse has overloaded in one of the three connected channels.</li> </ul>
CONTROL NOR	Control normal key—Depressed when in normal mode.
CONTROL OFF (0-2)	Channel control off keys—Contacts on CONTROL OFF key depressed: <ul style="list-style-type: none"> <li>● Remove power from corresponding channel.</li> <li>● Break loop in office alarm circuit.</li> <li>● Light PWR OFF lamp.</li> <li>● Light OFF NOR lamp.</li> <li>● Provide closure to interfacing circuit.</li> </ul>

TABLE E (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: <ul style="list-style-type: none"> <li>● Connect resistors across alarm audio coil to decrease level by 6 dB, aiding in the voice alarm adjustment.</li> <li>● Light OFF NOR lamp.</li> </ul>
VOICE ALARM NOR	Voice alarm normal key—Depressed when in normal mode of operation.

alarm. The -48 volt office supply is separately fused to supply the PWR OFF and the OFF NOR lamps.

#### E. Record Procedures

##### 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 relay (CM) 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.

**7.19** To record a new message, the REC NL 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  $\mu$ F 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.

#### 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 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  $\mu$ F blocking capacitors, and a transmission measuring set 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 transmission measuring set. 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:** In preparing prerecorded tapes, the channel capacity and the reaction times in the prior procedure must be considered.

**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 transmission measuring set 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.

#### F. Playback Operation

**7.30** The most frequent mode of operation of the CSRA 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 CSRA 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 transmission measuring set to indicate that the proper audio output level is being transmitted to the interfacing circuit.

## **8. MODULAR MESSAGE ANNOUNCEMENT**

### **A. General**

**8.01** The modular message announcement provides for modular messages, 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 modular message 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.

### **B. Channel Module**

**8.02** The modular message channel module (Fig. 49) provides for a maximum of 24 channels

of modular message 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.

**C. Control Unit**

**8.03** 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.

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

**D. Alarms**

**8.05** 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.

**Voice Alarm**

**8.06** 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.

**8.07** 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.

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

**Fuse Alarms**

**8.09** The power supply levels used in the CSRA 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 CSRA from a power supply.

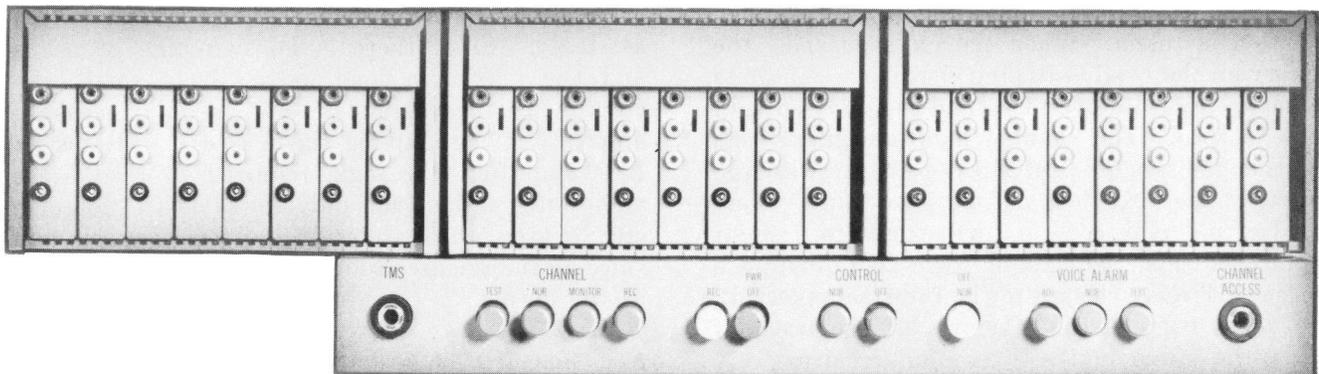


Fig. 49—Modular Message Channel Module and Control Unit

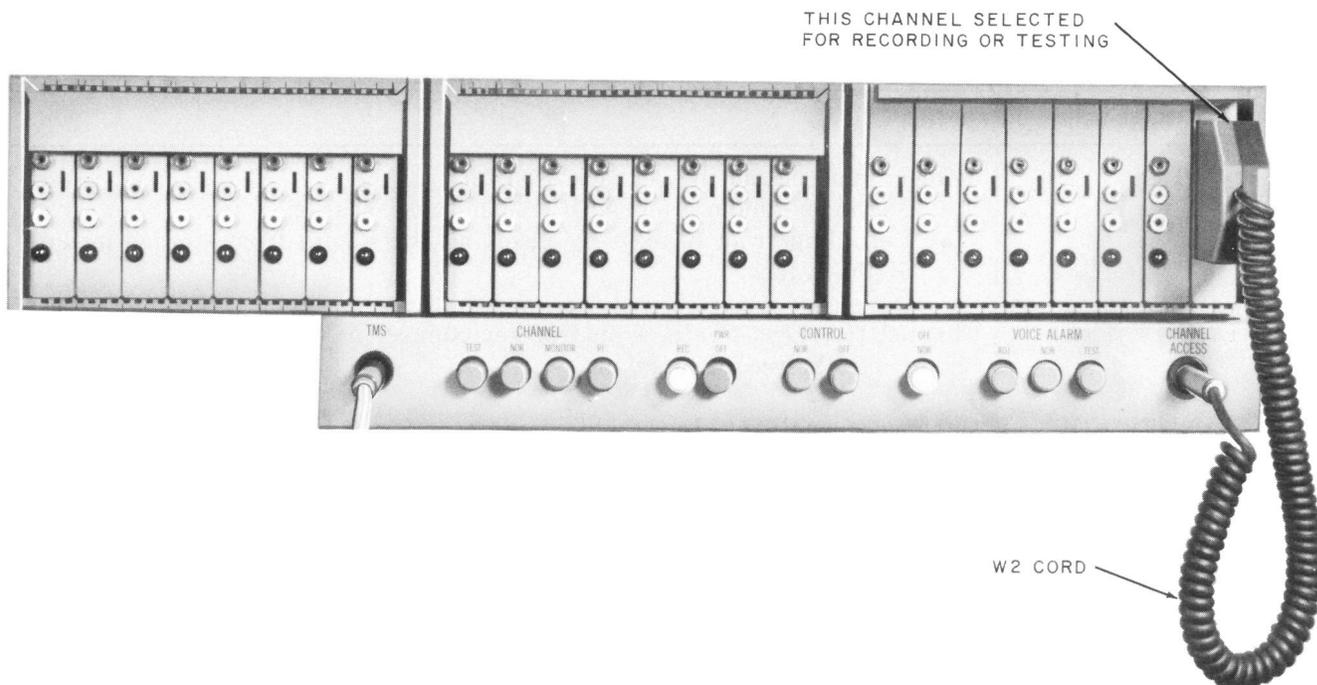


Fig. 50—Modular Message Channel Module and Control Unit and W2 Patch Cord Used for Local Recording and Testing

8.10 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 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.

#### E. Record Procedures

##### Remote Recording

8.11 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 (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 (nonlocking) 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 drum storage unit produces a timing pulse every 1.33 seconds which flashes the MM LMP lamp on the CALL DIRECTOR 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,

TABLE F

## MODULAR MESSAGE CONTROL UNIT

KEY, JACK, OR LAMP	DESCRIPTION
TMS	Transmission measuring set jack used for: <ul style="list-style-type: none"> <li>• Measuring audio levels with transmission measuring set.</li> <li>• Recording from headset by inserting patch cord from storage module SIGNAL jack.</li> </ul>
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 purposes
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.

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 (release) key is depressed, and the receiver is replaced on the LS.

**8.12** 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  $\mu$ F 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.

### Local Recording

**8.13** 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.

**8.14** 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 REC 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.

**8.15** 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.

**8.16** 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.

### F. Playback Operation

**8.17** The most frequent mode of operation of the CSRA 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 (CLOB-CL1B), every 1.33 seconds. The playback amplifier is capable of delivering 100 milliwatts into 40 ohms.

**8.18** On the control unit, the output audio signal level can be measured with a transmission measuring set to indicate that the proper level is being transmitted to the interfacing circuit.

## 9. PHASED MESSAGE ANNOUNCEMENT

### A. General

**9.01** The phased message 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.

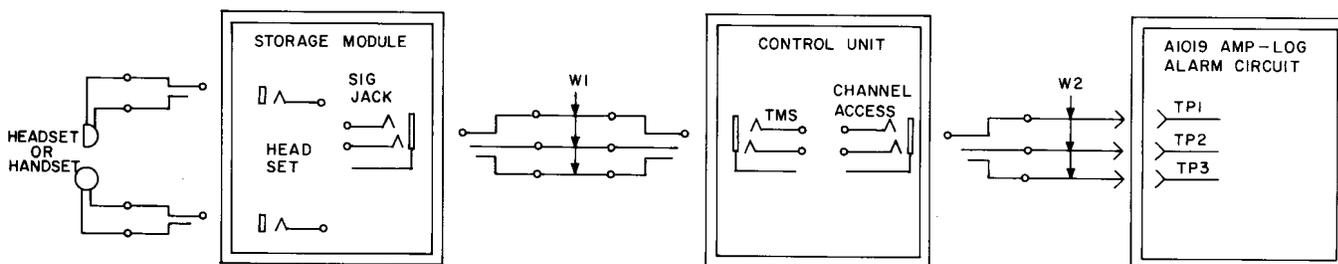


Fig. 51—Local Record Procedure for Modular Message Announcement

**Note:** The phased message 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 phased message 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 drum storage unit. 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 phased message 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 phased message 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.

## B. Channel Module

**9.05** Each phased message channel module (Fig. 53) provides for a single channel with the channel divided 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 phased message 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 phased message channel module circuit packs.

## C. 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.

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

## D. 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.

## 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

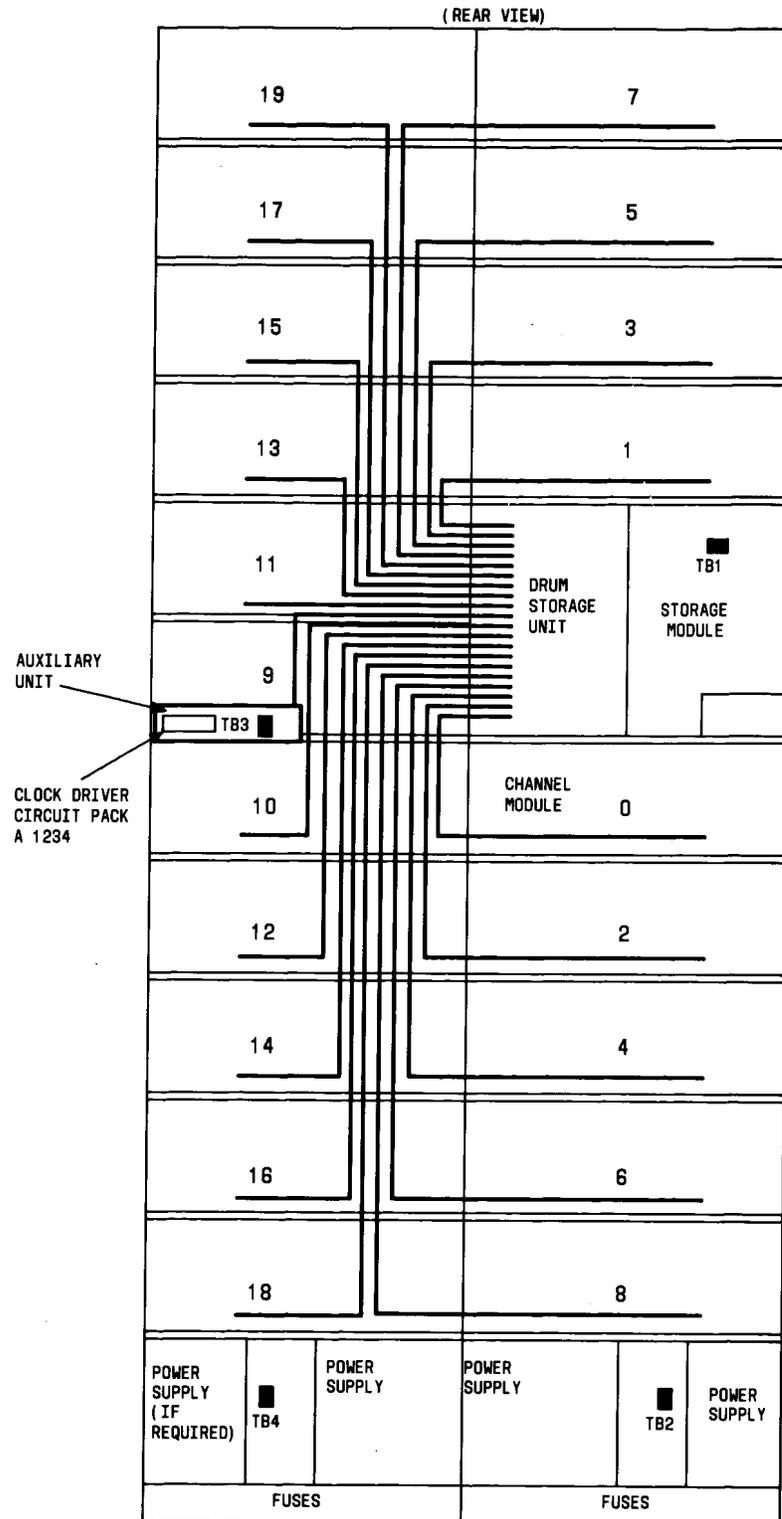


Fig. 52—Typical Arrangement of the J1C012E Frame in Conjunction With J1C012A Frame

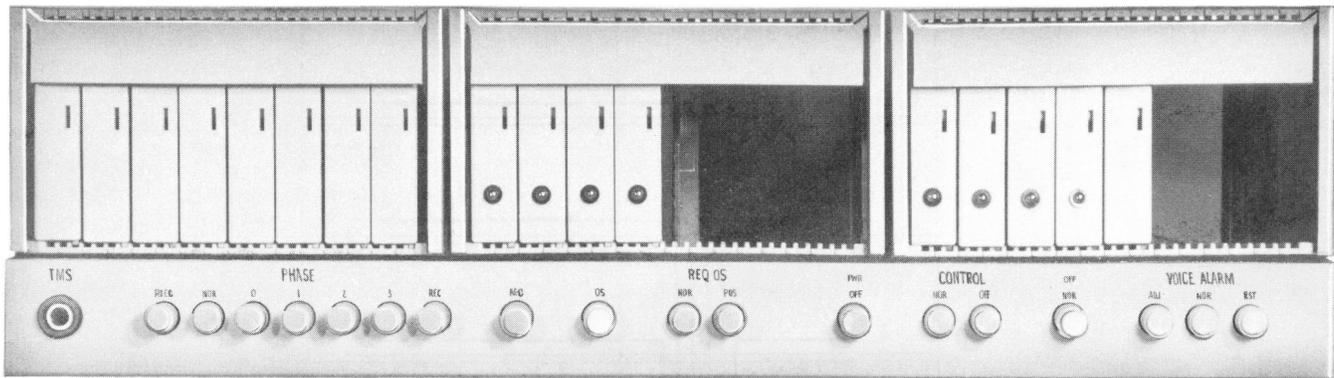
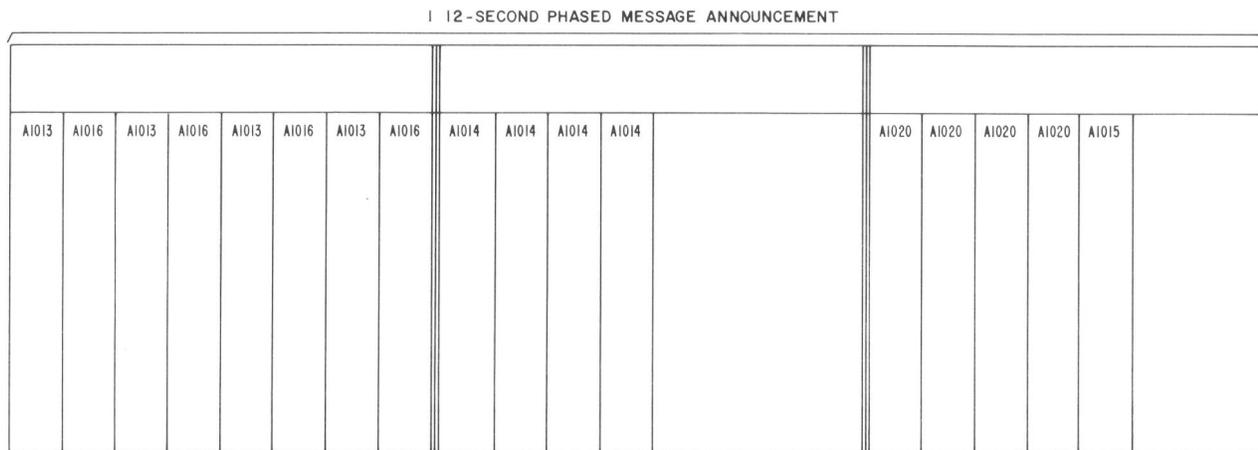


Fig. 53—Phased Message Channel Module and Control Unit



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 Phased Message Channel Module Circuit Packs

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.

**Fuse Alarms**

**9.11** The power supply levels used in the CSRA are +15, -15, and -5 Vdc for operating

TABLE G

## PHASED MESSAGE CONTROL UNIT

KEY, JACK, OR LAMP	DESCRIPTION
TMS	Transmission measuring set jack used for: <ul style="list-style-type: none"> <li>● Measuring audio levels with transmission measuring set.</li> <li>● Recording from headset by inserting jumper from storage module SIGNAL jack.</li> </ul>
PHASE RREC	Phase request record key (enabled when OS lamp is lighted)—When depressed: <ul style="list-style-type: none"> <li>● Notifies system that a new message will be recorded on the respective channel.</li> <li>● Places a channel in state to respond to record command.</li> <li>● Connects DP audio from phase 0 to TMS jack.</li> </ul>
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: <ul style="list-style-type: none"> <li>● Decreases alarm audio by 6 dB.</li> <li>● Voice alarm level can be adjusted.</li> </ul>
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.

## SECTION 201-520-101

integrated circuit operational amplifiers, and for operating digital integrated circuits. These voltages are available at the base of the CSRA 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 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 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.

### E. 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.

### Remote Recording

**9.14** 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 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 channel maintenance (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 non-locking key on the dedicated phone is depressed clearing the registers on the head switching circuit and reversing the state of the relays on the

record/playback 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 non-locking key was depressed (within 4 seconds), a record 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 non-locking 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 release (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  $\mu$ F 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.

#### 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  $\mu$ F blocking capacitors and a transmission measuring set 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 transmission measuring set. 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. After 12 seconds, the REC lamp will be extinguished and the REC 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 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 non-locking key will release 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.

#### F. Playback Operation

**9.26** The most frequent mode of operation of the CSRA 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 CSRA 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

## SECTION 201-520-101

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 phased message 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 record/playback amplifier 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 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

#### A. General

**10.01** Each announcement machine of the CSRA 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 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 CSRA 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 amp 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.

**Note:** Timing information defining the beginning and end of prerecorded message intervals is provided by a coded disk located atop the magnetic drum.

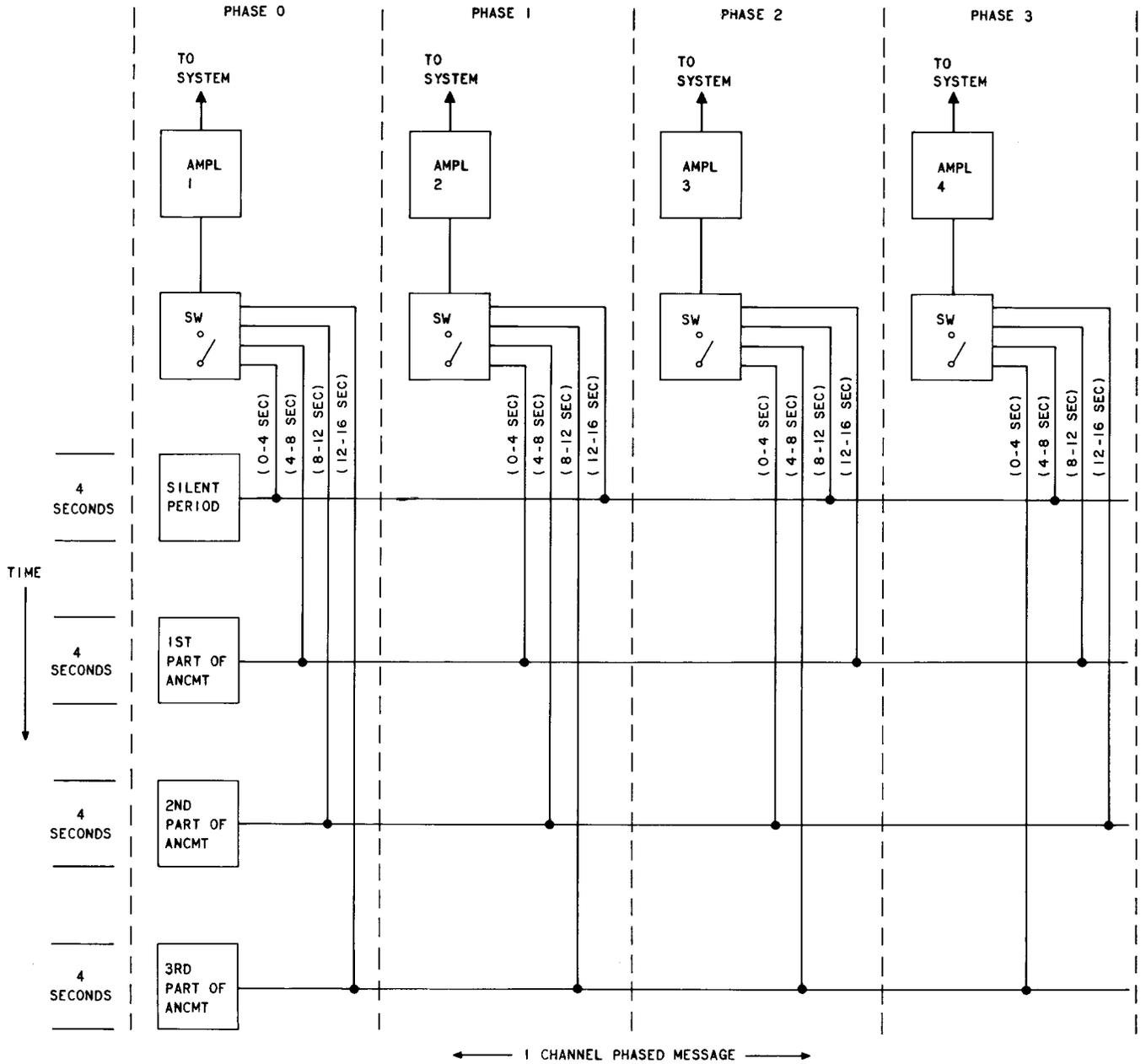
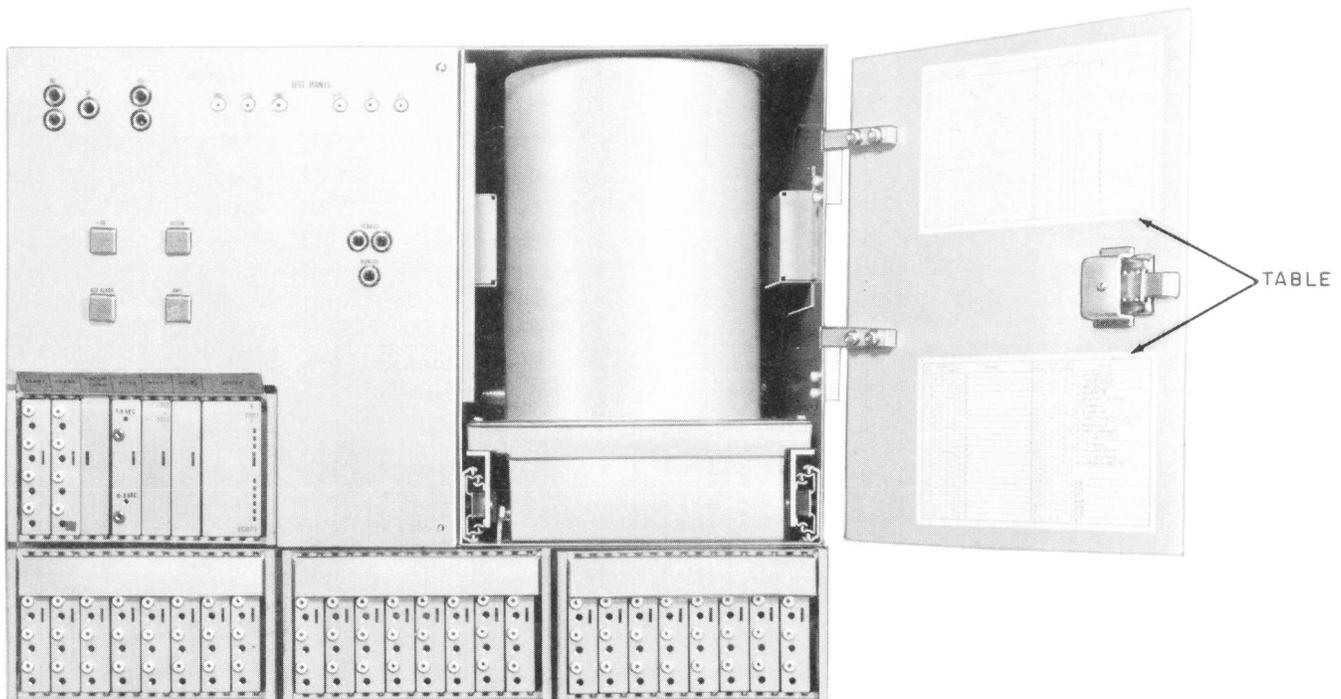


Fig. 55—Phased Message Announcement—Block Diagram

Complete announcements are then immediately transmitted to calling subscribers who have reached nonworking numbers. The arrangement of the various announcements and the lead and amplifier associated with each is shown in Table H. This table is physically located at the CSRA on the back side of the drum storage unit door. (See Fig. 56.)

**B. Channel Module**

**10.05** The message synthesis service 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.



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

Thus, each channel module contains 24 (quad amps)  $\times$  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.

#### C. 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.

#### D. Drum Track and Message Association

**10.07** Table H 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.

#### E. 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

**TABLE H**  
**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 NON-PUBLISHED 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	40	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

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	62	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

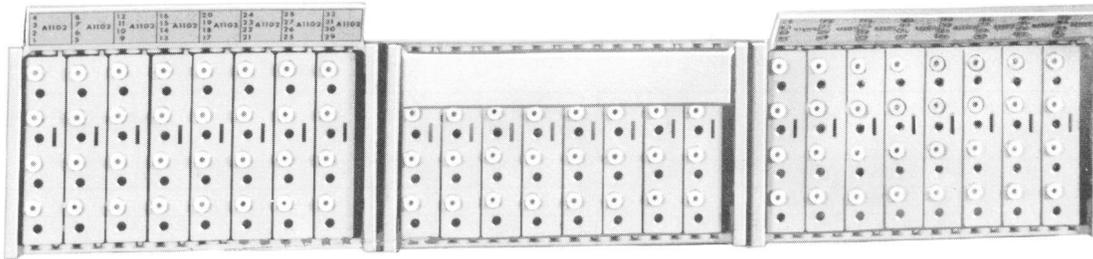


Fig. 57—Message Synthesis Service Channel Module

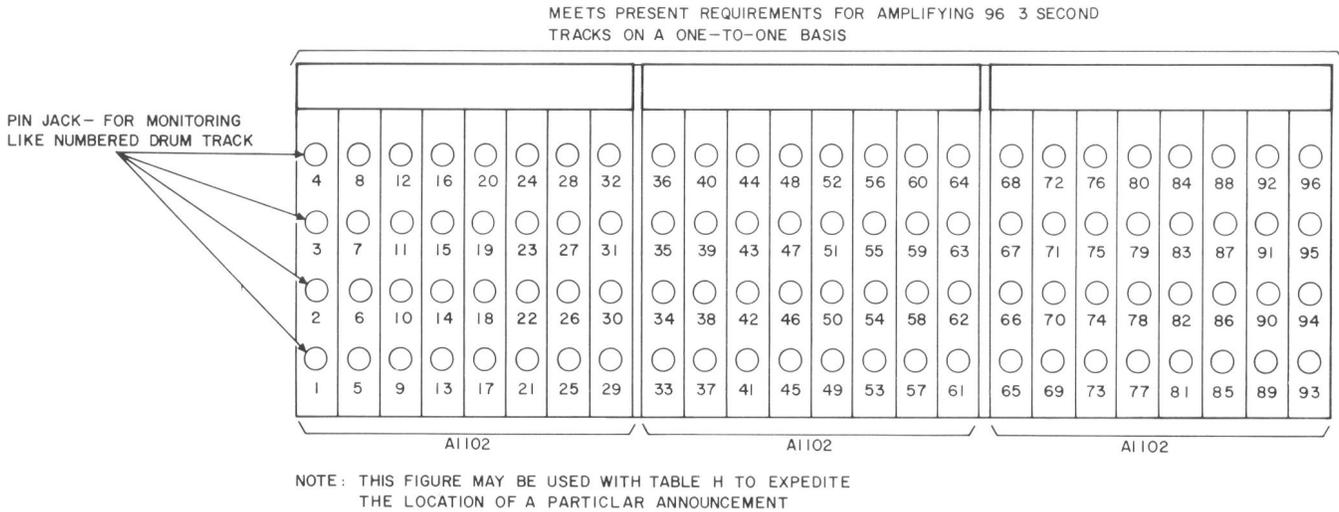


Fig. 58—Location and Identification of Message Synthesis Service Channel Module Circuit Cards and Channel (Track) Assignment

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.

**F. 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.

**G. Playback Operation**

**10.10** The only mode of operation of the CSRA 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 together 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.

#### H. 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 CSRA arranged for MSS.

### 11. MULTIPLE RECORDING SERVICE

#### A. General

**11.01** This version uses a combination of variable message length (VML) announcements and modular message (MM) announcements. The CSRA with multiple recording service 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 enabled by the ESS.

A typical arrangement for MRS version of the CSRA is shown in Figure 60.

**11.02** Two different kinds of announcement channels are provided, the VML channel and the MM channel. The variable message length 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 CSRA. Each channel module has an associated control unit.

**11.04** The modular construction of the CSRA 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.

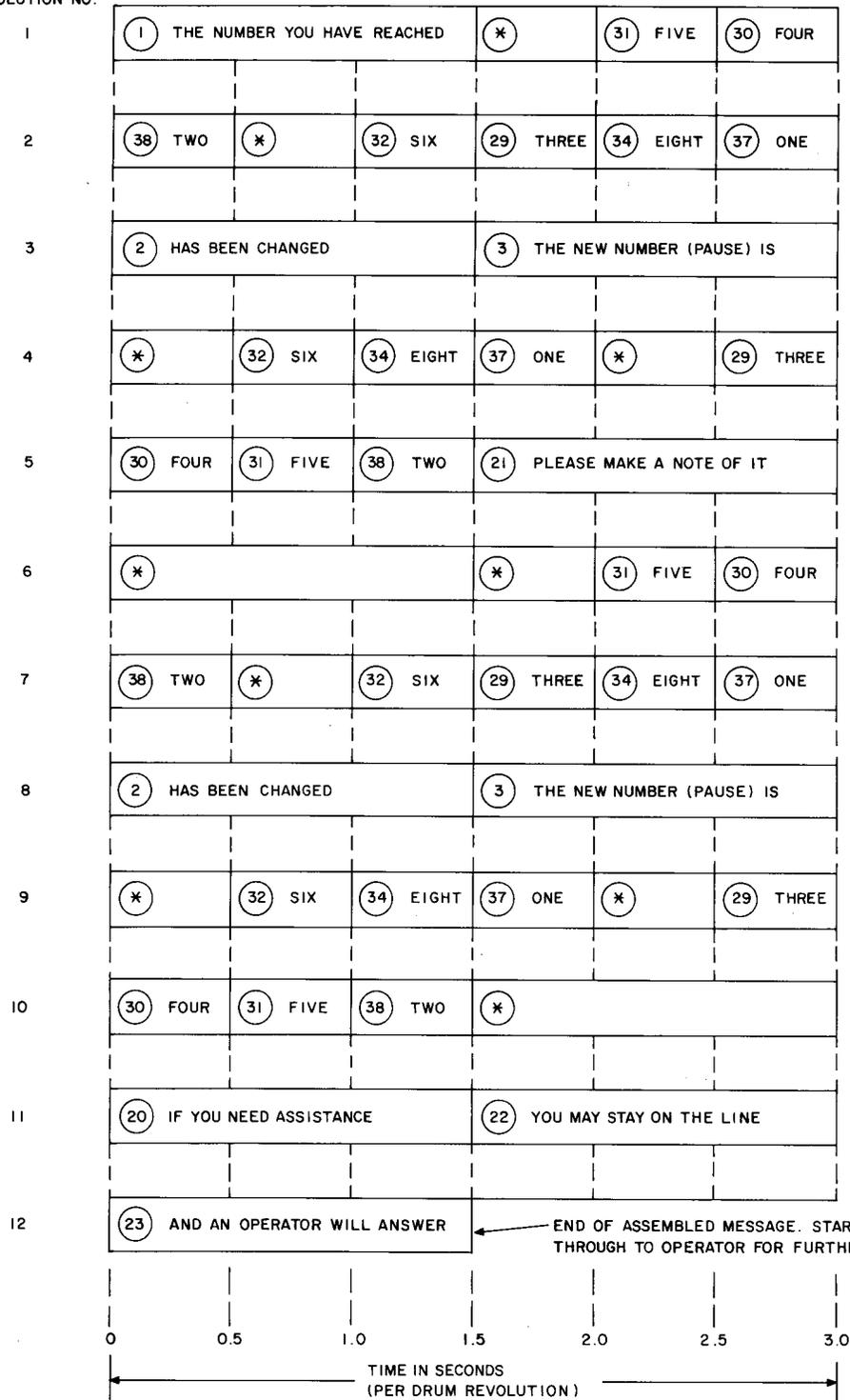
#### B. Channel Modules

**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 modular message 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 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.

SECTION 201-520-101

REPRODUCER  
DRUM  
REVOLUTION NO.



NOTE:  
ANNOUNCEMENTS ARE PRODUCED BY PROGRAM CONTROLLED SELECTION AND ASSEMBLY OF MESSAGES REPRODUCED FROM PRERECORDED TRACKS DURING DRUM ROTATION. IN THIS EXAMPLE THE ENTIRE ANNOUNCEMENT IS MACHINE SYNTHESIZED IN 34.5 SECONDS OR DURING 11 1/2 REVOLUTIONS OF THE DRUM.

- (\*) BLANK TRACK NO. 14 (REFER TO TABLE H)
- (NO.) PRERECORDED TRACK NO. AND MESSAGE REPRODUCED

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

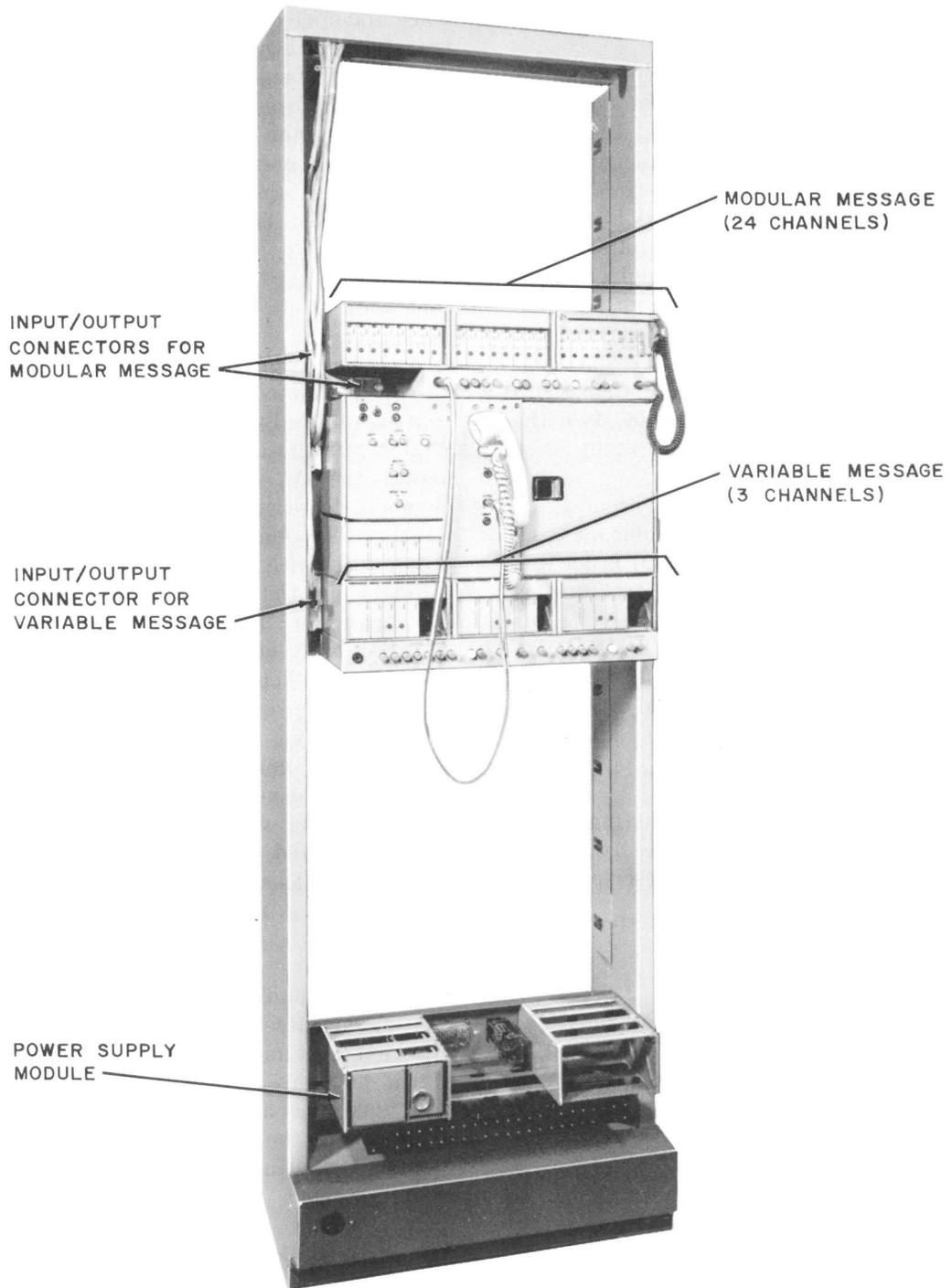


Fig. 60—Typical Frame Arrangement of the Multiple Recording Service (MRS) Version

**C. 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 variable message length 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 E 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 modular message 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. 49.

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

**D. 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 (VML only)
- 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.

**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.

**VML Only**

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 relay (AL) 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.

**Memory Loss Alarm**

11.18 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.

11.19 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.

**11.20** 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 (memory) 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.

#### **MM Only**

**11.21** Provisions 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. The voice alarm circuit is adjusted in accordance with Section 201-520-701.

#### **Fuse Alarms**

**11.22** The power supply levels used in the CSRA 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 CSRA 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 fuse alarm (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.

#### **E. Record Procedures**

##### **For VML Only**

**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 CSRA, 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 drum storage unit 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 drum storage unit 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 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 drum storage unit, 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 Frame**

**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 ready (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  $\mu$ F blocking capacitors, and a transmission measuring set 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 transmission measuring set. 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; 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 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.

**Note:** The REC lamp will not light until system acknowledgment is provided as indicated by the RDY lamp.

When the dictation stops, the REC 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 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 relay (CM) 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.

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.

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.

**11.39** 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.

**11.40** 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 release (RLS) key on the dedicated phone and replacing the receiver on the LS.

**11.41** 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  $\mu$ F 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

**11.42** 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.

**11.43** 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 11.41. 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.

#### For MM Only

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

**At the Frame**

**11.45** 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.

**11.46** 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 key is depressed and held while recording, causing the REC lamp to flash every 1.33 seconds.

**Note:** The REC lamp will not flash until system acknowledgment is provided.

The announcement should be recorded between successive flashes three times, after which time the CHANNEL REC key should immediately be released.

**11.47** 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  $\mu$ F 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.

**11.48** 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**

**11.49** 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.

**11.50** 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 (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 or area or other short messages occurring every 1.33 seconds. If a new recording is to be made, the REC NL (nonlocking) key is depressed during the entire record mode. The depressed REC 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.

The optical switch assembly in the drum storage unit 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 (release) key is depressed, and the receiver is replaced on the LS.

**11.51** 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  $\mu$ F 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

**11.52** No provisions have been made for recording modular message announcements from a remote facility through ESS.

#### F. Playback Procedures

##### For VML Only

**11.53** The most frequent mode of operation of the CSRA 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.

**11.54** The timing pulse for the CSRA 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.

**11.55** 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.

**11.56** 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.

**11.57** 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.

**11.58** 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.

**11.59** 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.

**11.60** 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 transmission measuring set to indicate that the proper audio output level is being transmitted to the interfacing circuit.

**SECTION 201-520-101**

**For MM Only**

**11.61** The most frequent mode of operation of the CSRA 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 (CLOB-CL1B), every 1.33 seconds. The playback amplifier is capable of delivering 100 milliwatts into 40 ohms.

**11.62** On the control unit, the output-audio signal level can be measured with a transmission measuring set 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 CSRA:

<b>SD NO.</b>	<b>TITLE</b>	<b>KS NO.</b>	<b>TITLE</b>
SD-97723-01	Common Systems Drum Storage Unit Circuit KS-20951 for Recorded Announcement Frame	KS-20951	Drum Storage Unit
SD-97724-01	Common Systems Circuit Pack Schematics Recorded Announcement Frame	KS-20952	Magnetic Drum
SD-97725-01	Common Systems Recorded Announcement Frame	KS-20953	Magnetic Head
SD-97725-02	Common Systems Recorded Announcement Frame Circuit for Message Synthesis Service	KS-20954	Interconnecting Unit
SD-97725-03	Common Systems Recorded Announcement Frame Circuit For Multiple Recording Service	KS-20955	Interconnecting Unit
SD-97725-04	Common Systems Auxiliary Frame (J1C012E)	KS-20956	Interconnecting Unit
		<b>SECTION</b>	<b>TITLE</b>
		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 Requirements for Common Systems