J99395 COMMON SYSTEMS

DESCRIPTION

TYPE G 2600-HZ SINGLE-FREQUENCY SIGNALING

CONTENTS PAGE

1. GENERAL

1.01 This section provides a general description of the Type G Single-Frequency (SF) Signaling System. Detailed information on the individual plug-in units can be found in Sections 179-405-100, 179-406-100, and 179-407-100 of the Bell System Practices.

1.02 Whenever this section is reissued, the reasons for reissue will be listed in this paragraph.

1.03 The Type G SF Signaling System consists mainly of a G signaling module, which contains 24 SF signaling units, 1 GYA unit (fuse and alarm, carrier group alarm, and tone supply SD-7C051-01), and 1 285A power unit (SD-82497-01). The module schematic and module wiring can be found in SD-7C052-01 and ED-7C197. The SF units are plug-in type units which contain the circuitry to provide an interface between a 4-wire carrier or metallic facility and office, station, or other signaling equipment. The SF unit that is to be used depends upon: (1) the particular function desired, (2) compatibility with SF unit at the distant end, (3) the office or station side interface. Individual SF units are described in Part 2.

1.04 The Type G SF Signaling System supersedes the Type E and F signaling systems in all applications except revertive pulsing, but will not directly replace E- and F-type SF units because of differences in physical design. However, the Type G signaling units are compatible with most of the E- and F-type units working at the distant end of a specified circuit. The circuitry of the Type G units has been substantially improved over the E and F. These improvements provide better signaling and transmission performance, better operating stability, better component reliability, and lower power dissipation.

1.05 The Type G signaling system provides a means of transmitting address and supervisory information for telephone switching systems over transmission facilities on an ac inband (within voice-frequency range) basis. Basically, the system converts dc and ac signals from connecting trunk or station equipment into a 2600-Hz tone that shares the transmission path with the speech. The Type G signaling units convert these signals, as required, to initiate and terminate telephone connections. These converted signals are for connect (seizure), stop dialing, start dialing, wink, start pulsing, dial pulsing, ringing, answer, and disconnect.

1.06 Optional circuit conditions can be selected and provided through the use of slide type switches which are located on the printed wiring board of the SF units. Most of the options, such as build-out resistance, build-out capacitance, carrier group alarm features, loop-start or ground-start features, etc, are cut in and out of the circuit with slide type switches. The SF units, including the common module equipment, can be placed into and removed from service with ease. For the SF unit, simply slide the unit forward until the latch locks when inserting the unit into the module and depress the latch on the faceplate of the unit before removing it from the module position. The latching mechanism of the power unit has an interlock which operates the power switch to the off position when the unit is removed.

1.07 A shorthand 3-letter coded system has been developed to identify the major system components of the Type G signaling system. The first letter identifies the component as being part of the Type "G" signaling system, the second letter identifies the component as being within a particular family group, and the third letter identifies the particular unit within the family group. The family groups can be found in Fig. 1 and can be identified as follows:

FAMILY	NOTE	TYPE OF UNIT	SD-NUMBER	CLEI CODE
GAA		2-Wire 900-Ohm E&M Signaling Unit	SD-7C061-01	SFEE900
GAB		2-Wire 600-Ohm E&M Signaling Unit	SD-7C062-01	SFEE600
GBA		4-Wire 600-Ohm E&M Signaling Unit	SD-7C063-01	SF60B00
GBM	1	4-Wire 600-Ohm E&M Signaling Unit With Pulse Link Repeater	SD-7C071-01	
GCA		Loop Reverse Battery (Originating) Signaling Unit	SD-7C064-01	SFD0G00
GDA		Loop Reverse Battery (Terminating) Signaling Unit	SD-7C065-01	SFDTG00
GEA	1	2-Wire Private Line Automatic Ringdown Signaling Unit (72U)	SD-7C075-01	
GEB	1	2-Wire 20-Hz Ringdown Signaling Unit	SD-7C066-01	
GFA	1	4-Wire Private Line Automatic Signaling Unit	SD-7C074-01	
GFB	1	4-Wire 20-Hz Ringdown Signaling Unit	SD-7C067-01	
GGA	1	2-Wire Duplex Signaling Unit	SD-7C068-01	
GGB	1	2-Wire Duplex Signaling Unit With Gain Transfer	SD-7C069-01	
GHA	1	4-Wire Duplex Signaling Unit	SD-7C070-01	
GLA		2-Wire LS/GS Special Access CO End Signaling Unit	SD-7C058-01	SFXTA20
GLB		2-Wire LS/GS Special Access CO End Signaling Unit With Gain Transfer	SD-7C060-01	SFXTV20
GMA	1	4-Wire Transmit-Only Bypass Unit	SD-7C076-01	
GMB		4-Wire Transmit-Only Bypass Unit	SD-7C079-01	SFCTG00
GMC	1	4-Wire Transmit-Only Bypass Unit With Equalization	SD-7C077-01	
GNA	1	2-Wire Transmit-Only Bypass Unit	SD-7C078-01	
GPA		4-Wire LS/GS Special Access CO End Signaling Unit	SD-7C059-01	SFXTA40
GPD	1	4-Wire LS/GS Special Access Tandem Signaling Unit (Toward CO)	SD-7C072-01	
GRA		4-Wire LS/GS Special Access Station End Signaling Unit	SD-7C055-01	SFXSA40
GRD	1	4-Wire LS/GS Special Access Tandem Signaling Unit (Toward Station)	SD-7C073-01	
GSA		2-Wire LS/GS Special Access Station End Signaling Unit	SD-7C054-01	SFXSA20
GSB		2-Wire LS/GS Special Access Station End With Gain Transfer	SD-7C056-01	SFXSV20
GSC	1	2-Wire LS/GS Special Access Station End With Gain Transfer (72U)	SD-7C057-01	
GTA		Test Extender	SD-7C080-01	SFTEGC0
GYA		Power Control and Alarm-Tone Supply	SD-7C051-01	SFGAG00

Note 1: These units are not available at present time but will be available first quarter of 1981.

2. EQUIPMENT

A. Module Arrangement

2.01 One G-signaling module has two shelves and contains 24 SF units, 1 power unit, and 1 GYA unit (see Fig. 2). On the top shelf of the module there are 12 SF units and the power unit and on the bottom shelf, there are 12 more SF units and the GYA unit. Each Type G SF unit is 1.5 inches wide, 7.3 inches high, and 10.3 inches long. One Type G SF unit contains all the interface functions for one circuit end. When the SF unit is inserted, the cutout in the bottom of the unit displays the shelf position assignment number (1 through 24) that is printed on the shelf. A designation card is provided on the framework to identify the circuit assigned to the shelf position and SF unit.

B. Frame Arrangements

2.02 In the Type G signaling system, there are four basic frame arrangements in which each arrangement is available in four different frame heights. The four frame arrangements are standalone, consolidated, unitized, and retrofit, which come in either 11-foot 6-inch, 10-foot 6-inch, 9-foot, or 7-foot heights.

2.03 For small installations, a self contained G module (J99395B) is available. This includes the framework, apparatus wiring, common module equipment (power unit and GYA unit), and mountings for 24 SF units. This combined package can be mounted in any framework which accepts standard 23-inch mounting plates or on customer premises using cabinet arrangements.

Standalone

2.04 The G-standalone frames use standard 23-inch relay racks in four heights. The standalone frame does not have an option for the Switched Maintenance Access System (SMAS), but an external connection to SMAS via the distributing frame is available. Figure 3 shows the different frame heights, maximum number of SF units, and J-codes. The standalone frame can be used with any 4-wire transmission facility via distributing frame cross-connection. Further information concerning the standalone frame is located in Section 801-644-150.

Consolidated

2.05 The G-consolidated frames use standard 23-inch relay racks in four heights. The consolidated frame has the option for SMAS and other maintenance features (Fig. 4). This type of frame reduces the amount of cabling and distributing frame cross-connects because the maintenance features are in the frame. The consolidated frame can be used in conjunction with all analog carrier systems or 4-wire facilities. Further information concerning the consolidated frame is located in Section 801-644-151.

Unitized

2.06 The G-unitized bay uses standard 23-inch relay racks in four heights. The unitized frame (see Fig. 5) has the option for maintenance features, SMAS, and analog carrier systems (A5, A6, A6B, N2, N3, and N4). This frame is more desirable because only the transmission paths go to the distributing frame, and the related transmission equipment is located in the same frame for easy access. Further information on unitized frame arrangements is located in the 801 division of the Bell System Practices.

Retrofit

2.07 Retrofit provides a means to remove existing E or F signaling mountings from the frame and to install G-signaling, reusing as much office cabling as possible. By retrofitting the E or F frame, the signaling capacity of the bay is doubled in the same floor space.

C. Common Module Equipment

2.08 The common equipment consists of two plug-in units which occupy the right side of the G-signaling module. The upper right unit is the power unit and the lower right is the GYA unit (J99395YA). Figure 6 is a block diagram of the power and GYA units illustrating the various alarm features. Section 179-401-100 describes the maintenance required when a trouble condition is indicated at the GYA unit.

Power Unit

2.09 The 285A power unit is a dc-to-dc converter. This unit (Fig. 7) filters and converts -48 volt dc office battery to ±12 and +5 volt dc.

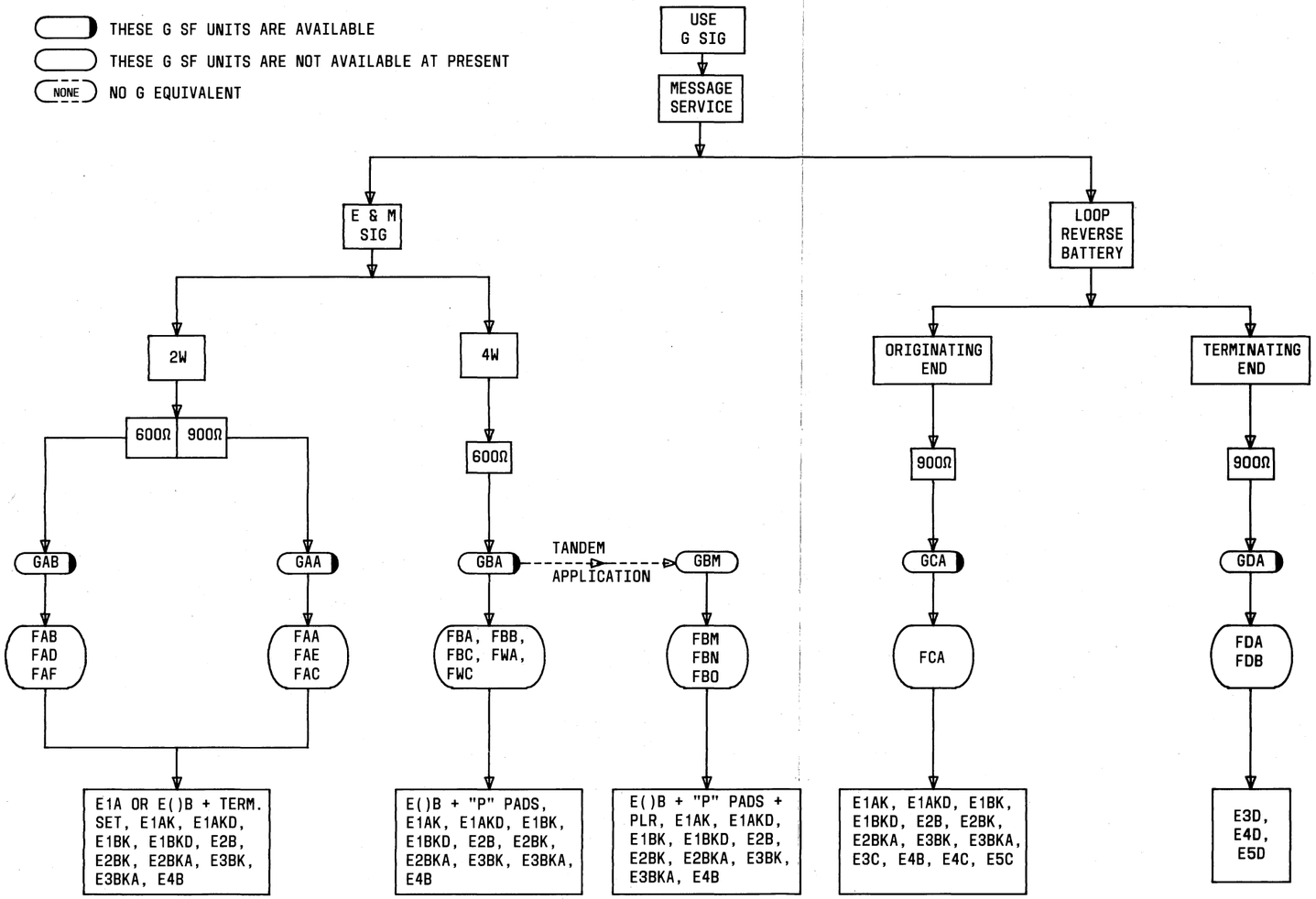

Fig. 1—Conversion Chart for G, F, and E Signaling Units (Sheet 1 of 2)

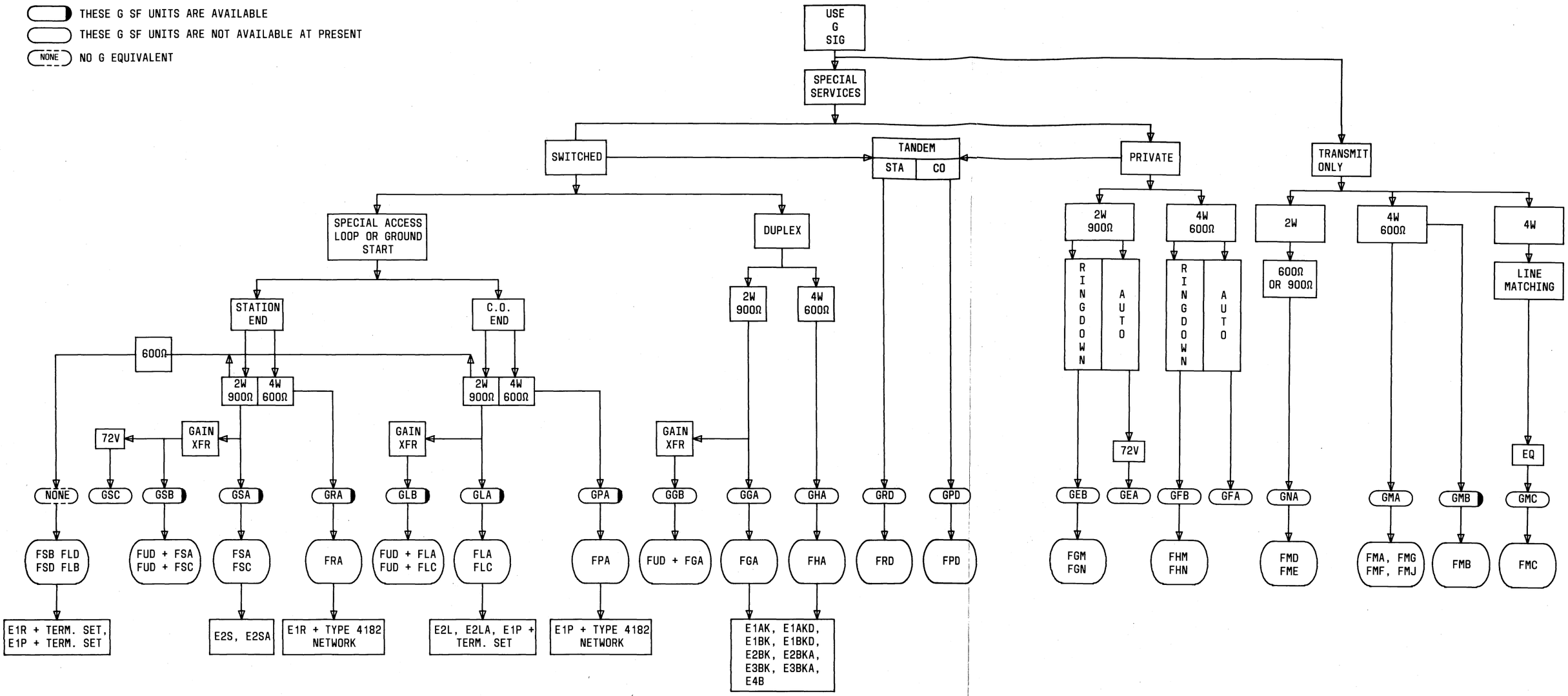

Fig. 1—Conversion Chart for G, F, and E Signaling Units (Sheet 2 of 2)

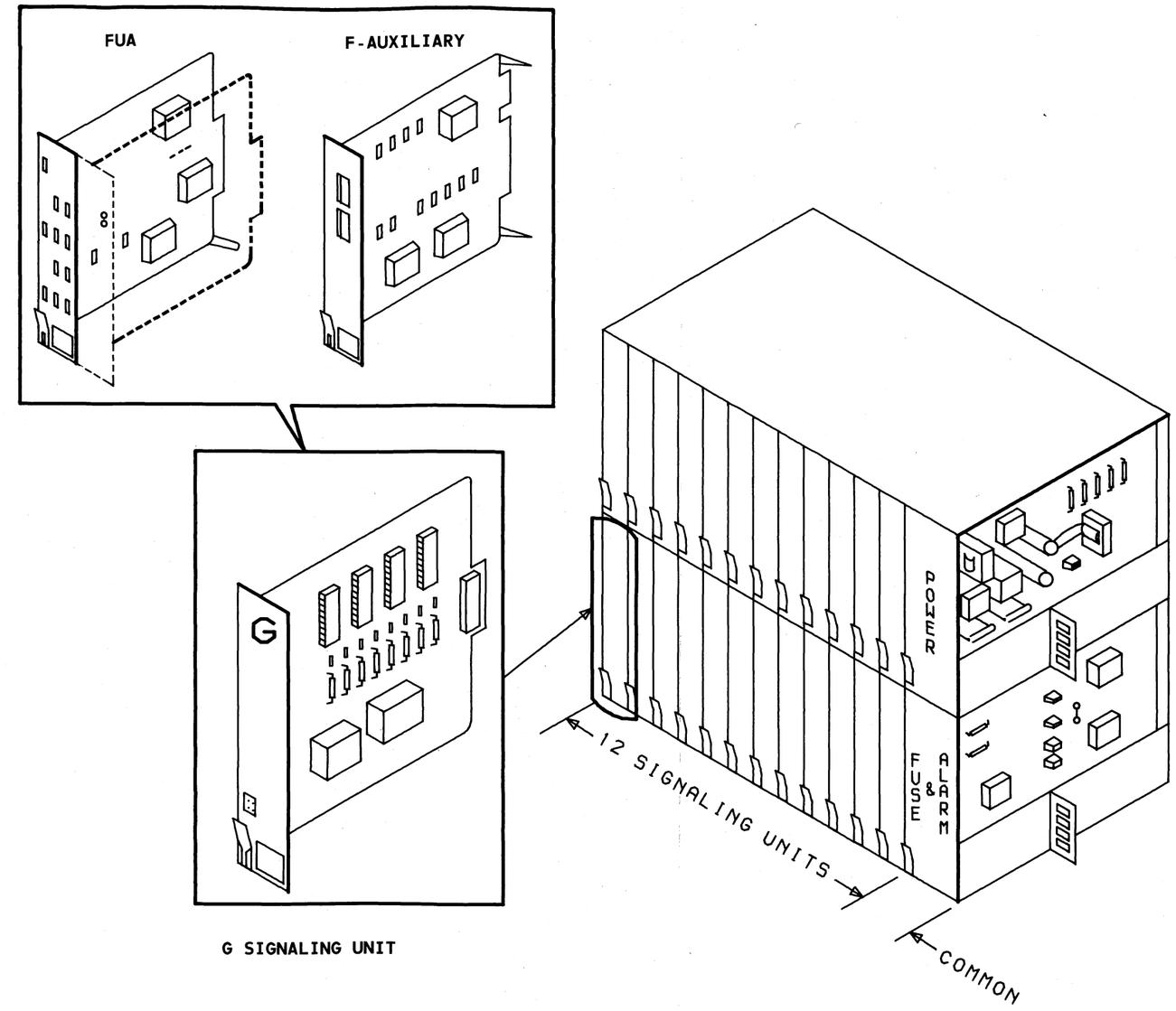

Fig. 2—G-Signaling 24-Unit Module

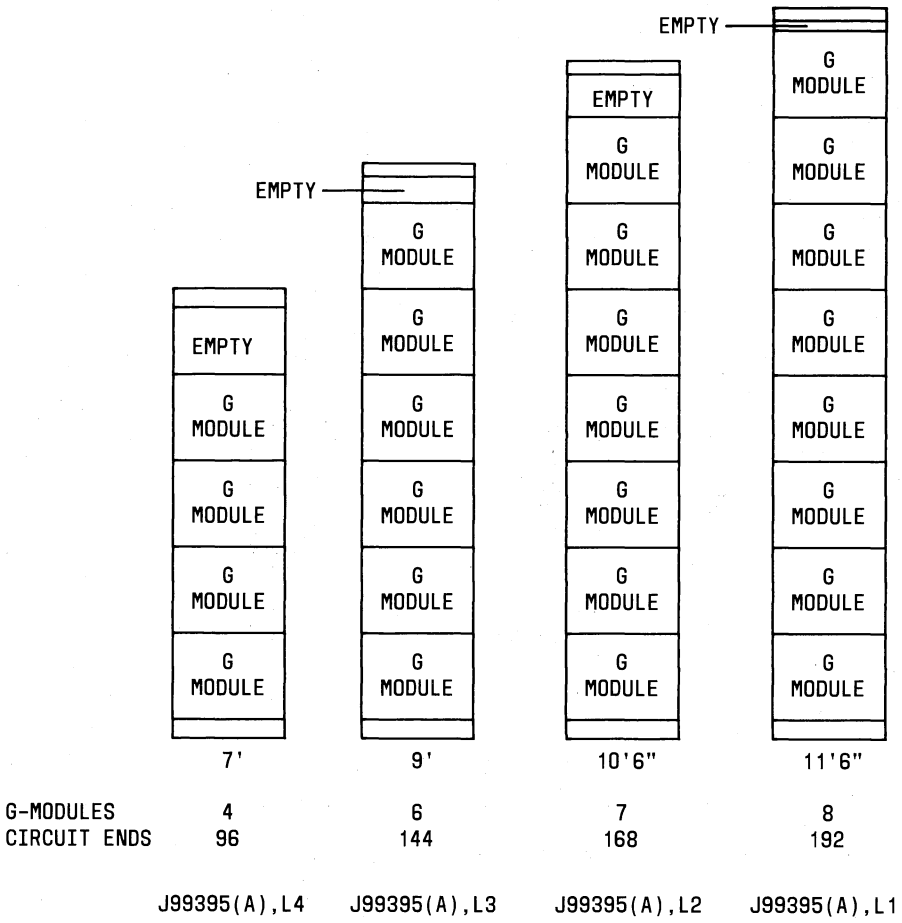

Fig. 3—G-Signaling Standalone Frame Configurations

These voltages are applied to the G signaling units and to the GYA unit in the module.

2.10 High voltage shutdown will light the red FAIL light emitting diode (LED) when the power unit +5 volt output is exceeded by more than 5.8 volts or the sum of the ±12 volt output is exceeded by more than 27 volts. When a shutdown occurs, the ON-OFF switch must be operated to the OFF position. After the high voltage condition has been cleared, normal operation is restored by placing the switch in the ON position.

2.11 Low voltage condition will light the red FAIL LED when the power unit +5 volt output decreases to 3.86 volts or the sum of the ±12 volt output decreases to 18 volts. The GYA unit will also indicate the loss of ±12 volts and +5 volts (see Section 179-401-100).

GYA Unit (J99395YA)

2.12 The GYA unit (Fig. 8) is a plug-in unit that consists of a circuit breaker, alarm circuit, carrier group alarm (CGA) circuit, and tone supply circuit. The faceplate of the GYA unit contains the LEDs which are used for trouble indications. The green LED when lighted indicates that -48V battery has been applied to the GYA unit and is available for application to the G module. The green LED will extinguish when there is a current overload condition in the G module or when the -48V battery is removed. Other trouble indications are classified into major alarm (red LED) and minor alarm (amber LED). The major alarm occurs when any of the following conditions exist: (1) loss of 2600-Hz tone, (2) when the power unit fails, or (3) when the circuit breaker is tripped. When these conditions occur, the individual red LEDs will light, indicating which condition has occurred. If there

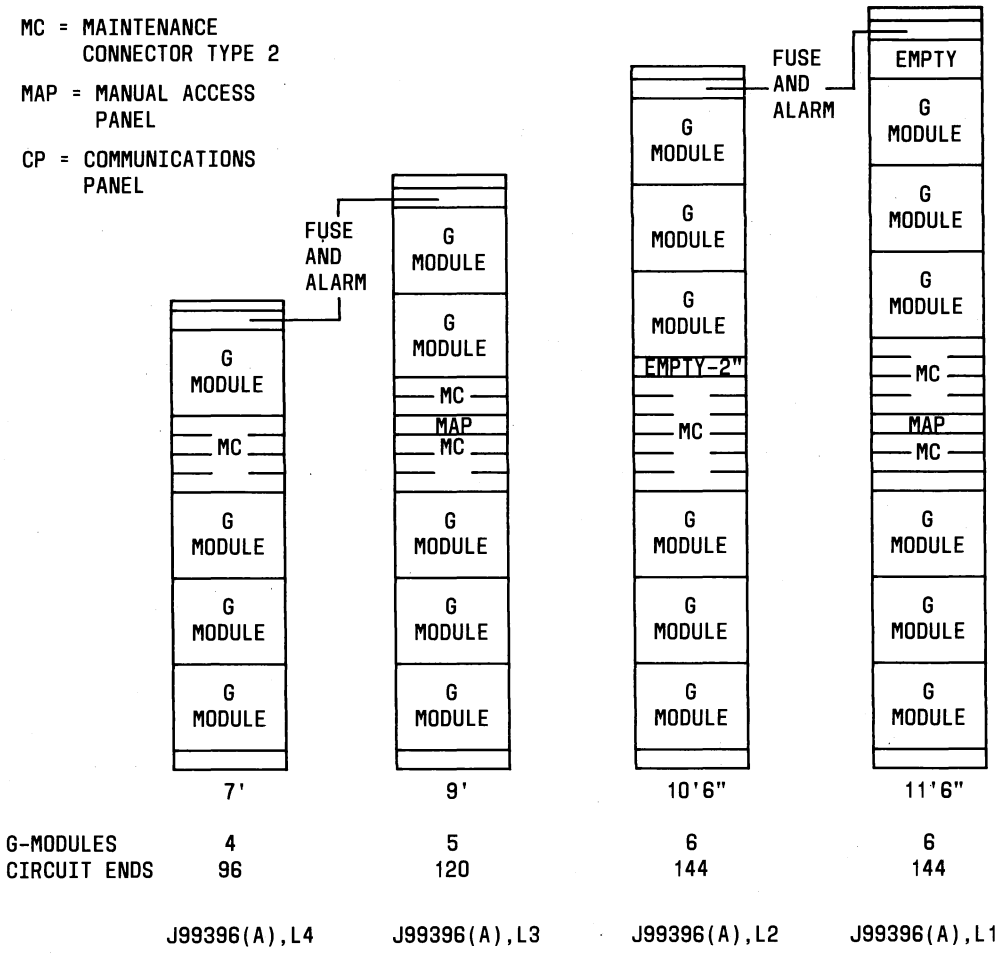

Fig. 4—G-Signaling Consolidated Frame Configurations With Maximum Number of G Modules

is a loss of the 20-Hz ringing supply, the minor alarm (amber LED) will light and the RING (red LED) will light.

2.13 The carrier group alarm (CGA) and trunk processing section has two CGA circuits. Each CGA circuit is dedicated to a shelf of 12 G-signaling units and provides the common CGA functions. When the carrier status is lost, the CGA trunk processing circuit and the signaling units provide the proper CGA responses, which include stopping the charges on a call and preventing further line or trunk seizures. When the carrier status returns to normal, the CGA circuit returns the line or trunk circuit to service. Trunk processing is done at the individual signaling unit as a function of the CGA option set on each unit. The trunk processing sequence will be discussed with the individual plug-in units. Trunk groups in ESS offices can be processed in groups of 12 trunks but selective assignments must be made to insure that master scanner assignments and trunk assignments are correct.

2.14 The tone supply circuit contains a crystal oscillator which provides 2600-Hz tone to the 24 G-signaling units in the module and is also used as the system clock.

D. SF Units

2.15 A number of SF signaling units have been designed to provide a variety of services. An SF unit is approximately 1.5 inches wide by

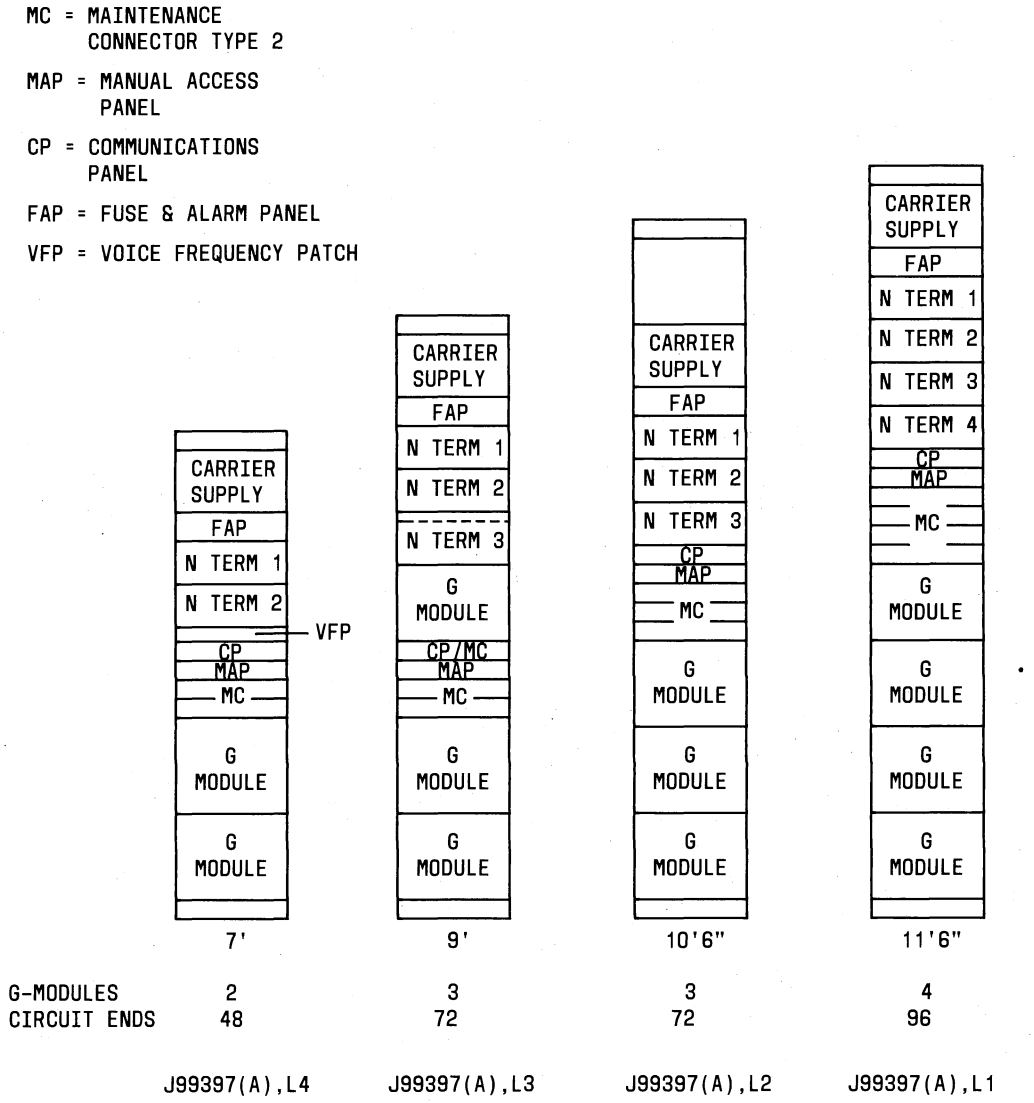

Fig. 5—G-Signaling Unitized—N4 Frame Configurations

7.3 inches high by 10.3 inches long. Most of the circuit components are mounted on a printed board. Table A provides a list of the SF units and corresponding features. The SF units listed in Table A are described briefly in 2.16 through 2.21. Figure 9 shows the faceplate of a GAA unit.

2.16 ***GA_ and GB_ Units:*** These units are 2- or 4-wire, 600- or 900-ohm, E- and M-lead SF signaling units (see Table A). These units can be used at either the originating or terminating end, or both, of a signaling link, or at an intermediate point with a GBM when more than one signaling link is used. The GA_ and GB_ units will operate with Type I, II, or III interface. When a unit is used at an intermediate point, Type II E&M interface can be directly connected without a pulse link repeater (see Section 179-100-100). These units can be used for DP (dial pulse) or MF (multifrequency) signaling applications. A complete description of the E and M units is given in Section 179-405-100.

2.17 ***GC_ and GD_ Units:*** These units are 2-wire, 900-ohm, loop reverse battery signaling SF units. The GCA unit is utilized at the originating end of one-way interoffice trunks, whereas the GDA unit is utilized at the terminating end. DP or MF signals can be used.

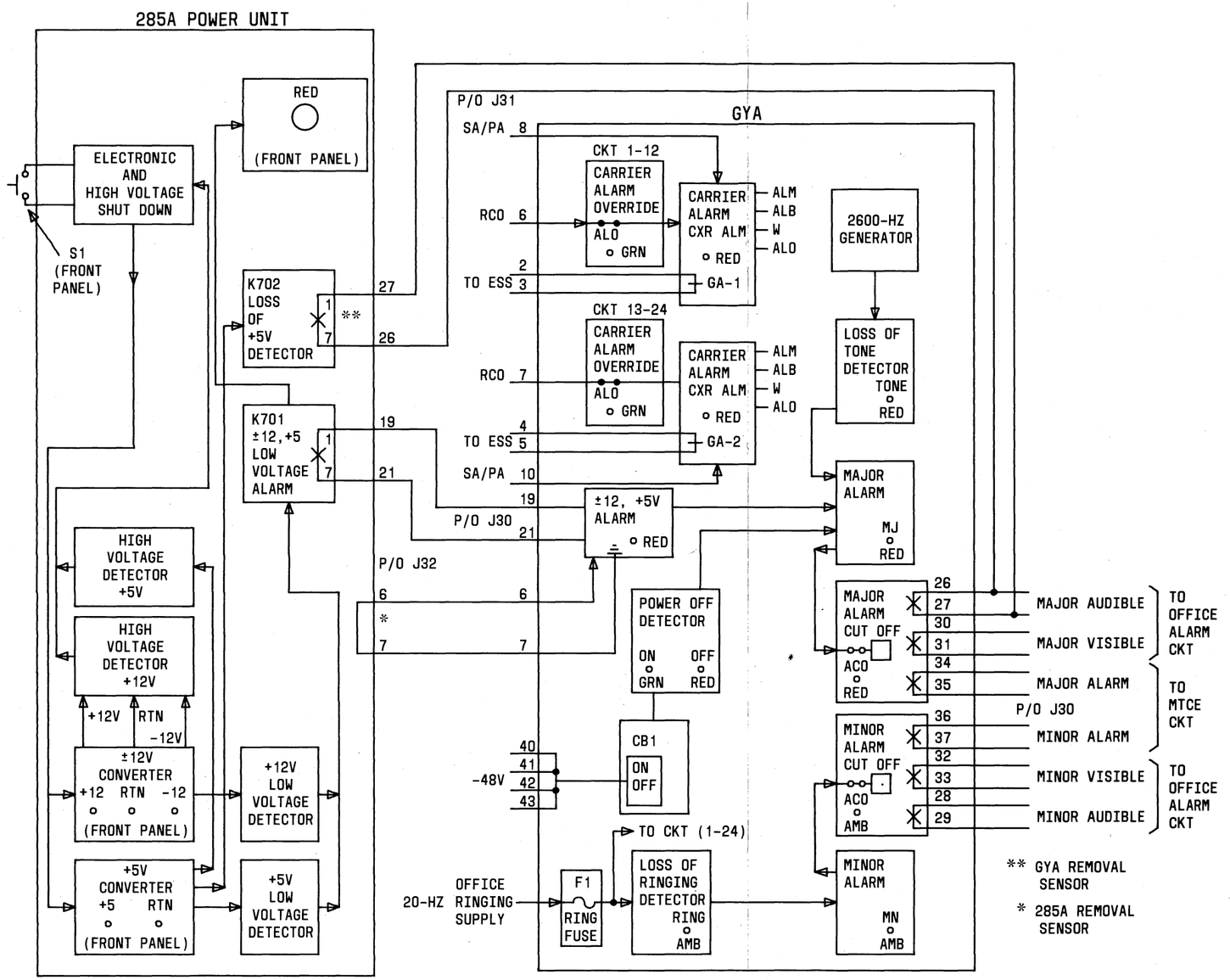

Fig. 6—Illustration of the Alarm Features of the Common Units

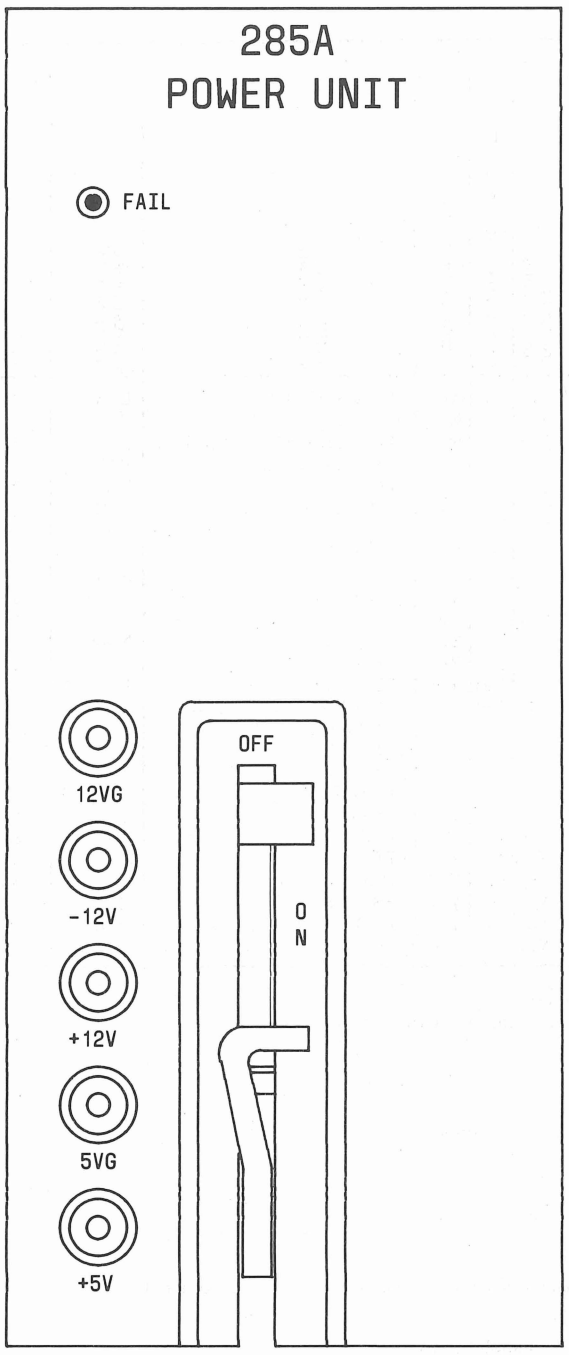

Fig. 7—G-Signaling Power Converter

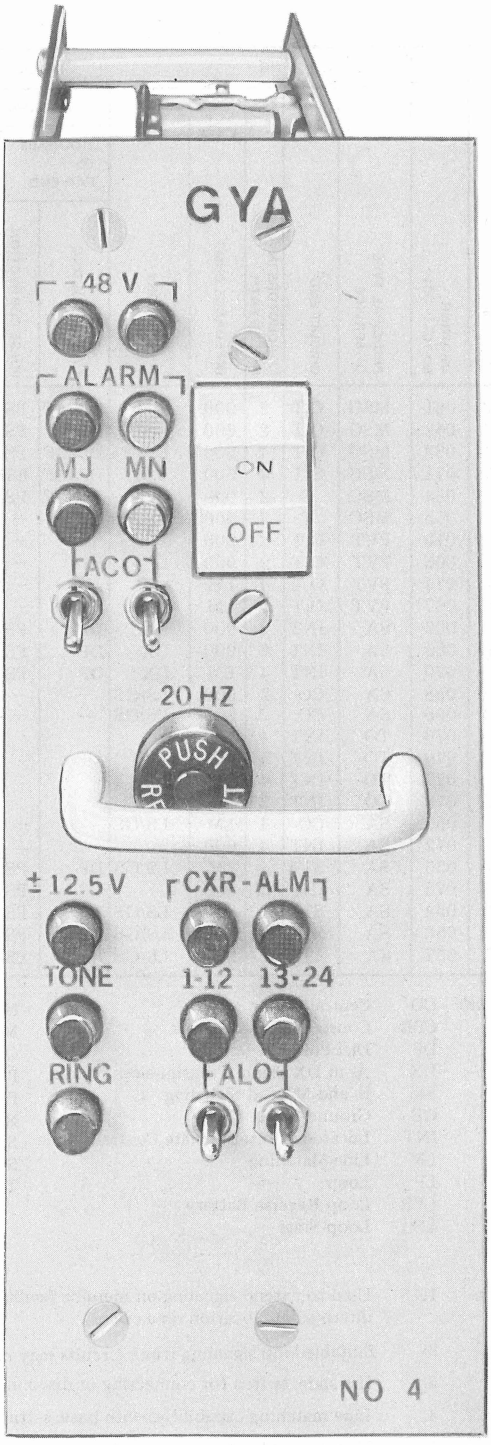

Fig. 8—GYA Unit

2.18 ***GE_ and GF_ Units:*** The GEA and GFA are private line automatic ringdown units and the GEB and GFB are 2- and 4-wire ringdown units (see Table A). These units are intended for use on private line application which requires conversion from 20 Hz or dc to SF signaling and vice versa. The ringdown units have switches which allow for code selection of the ringing signal.

2.19 ***GG_ and GH_ Units:*** These units are 2- or 4-wire, 600- or 900-ohm, DX-SF units utilized on applications which require conversion from DX to SF signaling and vice versa (see Table A).

TABLE A

CODE OF SF UNIT	DRAWING SD-7C----01	SWITCHING					SIGNALING									NEAREST TYPE F SIGNALING UNIT	NEAREST TYPE E SIGNALING UNIT	NOTES
							ADDRESS											
							TRANSMIT TO FAR END		RECEIVE FROM FAR END									
		PRINCIPAL TYPE OF SERVICE	CIRCUIT END	CONDUCTORS IN SPEECH PATH	IMPEDANCE OHMS	SUPERVISORY	TYPE OF PULSING	PULSE CORRECTION	TYPE OF PULSING	PULSE CORRECTION	PULSING TOWARD OFF-HOOK	CGA TRUNK CONDITIONING	LINE BUILDOUT RESISTANCE	LIGHTNING PROTECTION				
GAA	061	MSG	O,T	2	900	E,M	DP,MF	PS	DP,MF	PS	Yes	Yes	—	No		FAA, FAF, FAC	E1A	3
GAB	062	MSG	O,T	2	600	E,M	DP,MF	PS	DP,MF	PS	Yes	Yes	—	No		FAB, FAD, FAF	E1A	3
GBA	063	MSG	O,T	4	600	E,M	DP,MF	PS	DP,MF	PS	Yes	Yes	—	No		FBA, FBB, FBC, FWA, FWC	E4B	5
GBM	071	MSG	O,T	4	600	E,M	DP,MF	PS	DP,MF	PS	Yes	Yes	—	No		FBM, FBN, FBO	E4B	
GCA	064	MSG	O	2	900	LPR	DP,MF	PS	—	—	Yes	Yes	No	Yes		FCA	E4C	2
GDA	065	MSG	T	2	900	LPR	—	—	DP,MF	CPB	Yes	Yes	Yes	Yes		FDA, FDB	E4D	2
GEA	075	PVT	O,T	2	900		—	—								None	None	
GEB	066	PVT	O,T	2	900	LP	RD	—	RD	—	—	—	—	Yes		FGM, FGN	None	
GFA	074	PVT	O,T	4	LM		—	—		—						None	None	4
GFB	067	PVT	O,T	4	LM	LP	RD	—	RD	—	—	—	—	Yes		FHM, FHN	None	4
GGA	068	SA	INT	2	900	DX	DP	PS	DP	PS	Yes	Yes	—	Yes		FGA	None	1
GGB	069	SA	INT	2	900	DX	DP	PS	DP	PS	Yes	Yes	—	Yes		FUD + FGA	None	
GHA	070	SA	INT	4	LM	DX	DP	PS	DP	PS	Yes	Yes	—	Yes		FHA	None	1,4
GLA	058	SA	CO	2	900	LS/GS	—	—		CPB	No	Yes	Yes	Yes		FLA, FLC	E2L/LA	
GLB	060	SA	CO	2	900	LS/GS	—	—		CPB	No	Yes	Yes	Yes		FUD + FLA, FUD + FLC		
GMA	076	TO	INT	4	600											FMA, FMF, FMG, FMJ		
GMB	079	TO	INT	4	600											FMB		
GMC	077	TO	INT	4	LM											FMC		4
GNA	078	TO	INT	2	LM											FMD, FME		6
GPA	059	SA	CO	4	LM	LS/GS	—	—	DP	CPB	No	Yes	Yes	Yes		FPA	E1P	4
GPD	072	SA	INT	4	600		—	—	DP	CPB	No	Yes	—	Yes		FPD		8,9
GRA	055	SA	STA	4	LM	LS/GS	DP	PS	—	—	No	Yes	No	Yes		FRA	E1R	4,7
GRD	073	SA	INT	4	600		DP	PS	—	—	No	Yes	—	Yes		FRD		8,9
GSA	054	SA	STA	2	900	LS/GS	DP	PS	—	—	No	Yes	No	Yes		FSA, FSC	E25/SA	
GSB	056	SA	STA	2	900	LS/GS	DP	PS	—	—	No	Yes	Yes	Yes		FUD + FSA, FUD + FSC	None	
GSC	057	SA	T	2	900	LS/GS	DP	PS	—	—	No	Yes		Yes				

Legend:

CO	Central Office	MF	Multifrequency Pulse
CPB	Constant Percent Break	MSG	Intertoll, Toll Connecting, and Other Trunks
DP	Dial Pulse	O	Originating
DX	As in DX Signal Transmission System	PS	Pulse Shaper
EM	E- and M-Lead Signaling	PVT	Private
GS	Ground-Start	RD	Ringdown
INT	Located at Intermediate Central Office	SA	Special Access Lines and Trunks
LM	Line Matching	STA	Station
LP	Loop	T	Terminating
LPR	Loop Reverse Battery		
LS	Loop-Start		

Notes:

1. Used to extend signaling on metallic facilities, by means of DX signal transmission, from a carrier terminal situated at an intermediate location on a circuit.
2. Suitable loop signaling trunk circuits may not be available for intertoll applications.
3. Has slide switch for connecting or disconnecting the 1 μF capacitor across the A and B leads.
4. Line matching capabilities with basic settings of 1200/600/150Ω.
5. Must be used with noncompandored facility in same building only.
6. Has line matching capabilities of 600Ω and 900Ω for FMD and FME units.
7. Automatic buildout resistance.
8. For use in tandem analog carrier—T1 carrier.
9. 2-state to 3-state conversion.

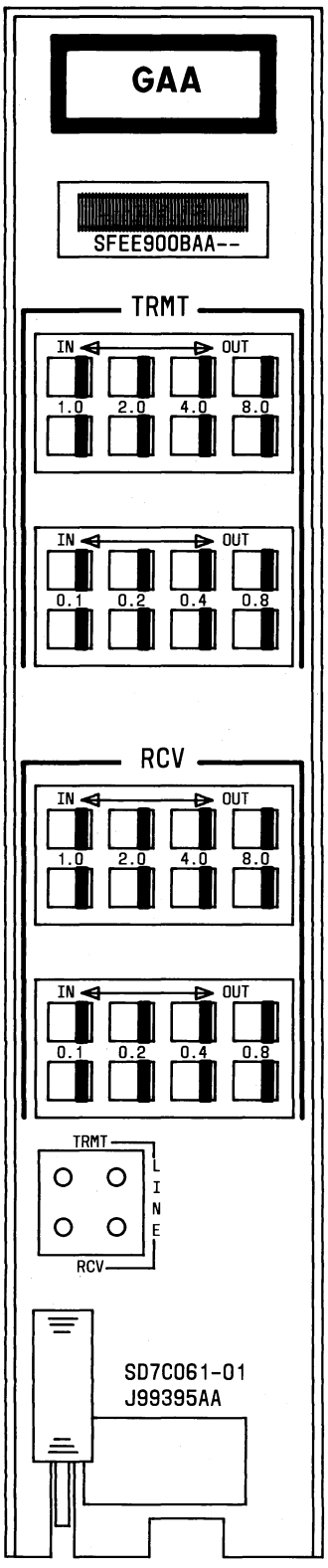

Fig. 9—GAA Unit

2.20 ***GL_, GP_, GR_, and GS_ Units:*** These units are 2-wire 900Ω or 4-wire 600Ω, loop-start and ground-start special access SF units (see Table A). The GL( ) and GPA units are utilized at the central office end, and the GRA and GS( ) units are utilized at the station end of the special access line or trunk applications. The GLB and GSB units are similar to the GLA and GSA except the GLB and GSB units have gain transfer features.

2.21 ***GM( ) and GNA Units:*** These units are nonsignaling 2-wire (GNA) and 4-wire (GMA, GMB, and GMC) transmit only units (see Table A). They provide a transmission interface to the associated office or station equipment from the carrier channel and are used in consolidated or unitized bay arrangements where signaling is not required. Such arrangements are: tandem operation of carrier channels, in private lines for data transmission, and in connections to other equipment for service not provided by presently available G-signaling units.

2.22 All 2-wire units except for the GA( ) and GGA have inductors in series with the A and B leads. The inductors provide three functions:

(1) Prevent external equipment connected to the leads from affecting return loss

(2) Prevent current from increasing rapidly and generating impulse noise on adjacent lines

(3) Prevent power supply and switching noises from entering the transmission circuits.

All 2-wire units have build-out capacitors (BOC) which can be switched in and out of the circuit to balance office wiring capacitance. In the GLB and GSB gain transfer units, the BOCs can be switched to the line side for building out the end section of loaded cable to 6 kft.

2.23 When 2-wire E and M lead signaling units are used (GA_), the T1/A and R1/B leads are extended to the office equipment for the option of removing the 1 μfd capacitor in the 2-wire terminating set of the G-signaling unit. The capacitor option is required for balanced improvement when the 1 μf capacitor is provided in an external signal converter unit. This is the only function of the T1/A and R1/B leads for these units.

E. GTA Test Extender

2.24 The test extender, SD-7C080-01, has been provided to facilitate monitoring of signals at the input and output ports or making adjustments to the SF units. The test extender, as illustrated in Fig. 10, consists of a printed wiring board, a 12-foot cable, and an adapter. When signals at the line or equipment ports are to be monitored or adjustments made, the G-signaling unit must be removed from the frame module and plugged into the adapter. Before the unit is removed and any adjustments or tests are made, the circuit must be made busy. The printed wiring board of the test extender must then be plugged into the module where the signaling unit was removed. The test extender allows the SF unit to remain electrically connected to the circuit. Figure 11 illustrates the connections necessary to place the test extender in a monitoring or adjustment mode of operation.

3. APPLICATIONS

3.01 Type G signaling units are available for a large variety of applications. Although the SF units are primarily intended to be used on analog carrier facilities, SF units may also be used on 4-wire metallic facilities and digital carrier channels. Signaling units are available for most all applications requiring conversion from loop signaling, E and M lead signaling, DX signaling, or 20-Hz ringing to 2600-Hz tone (SF) signaling. Figures 12 through 17 illustrate typical applications of Type G units. Signaling conversion is also a function of the system, eg, a 4-wire E and M unit may be used on one end of a circuit and a 2-wire DX unit used on the other end.

3.02 Type G signaling units are compatible with most of the SF units within the E- and F-type signaling system. G-signaling compatibility can be found in Section 179-100-312 and SD-99421-12.

4. OPERATIONAL REQUIREMENTS

4.01 The Type G signaling units function over the voice paths of 4-wire broadband L carrier, various radio transmission systems, N or O carrier systems, and T carrier systems. On any facility which is used, -16 dB and +7 dB transmission level points (TLP) must be used. The SF units should not be removed from the +7 and -16 TLPs by more than 3 dB overall combined net loss at 2600 Hz. This loss may be evenly divided between the transmitting and receiving ends.

4.02 The 2600-Hz tone, which is supplied by the GYA unit (SD-7C051) shall be within 5 Hz of the 2600-Hz frequency. The 2600-Hz tone is supplied to the individual SF signaling units at a fixed level of .246 volt ac. Reduction to -36 dBm (low-level tone) and -24 dBm (high-level tone) takes place in the SF signaling units for transmission at a -16 TLP.

4.03 The operating voltages, which are obtained from the 285A power unit (-48 volt dc to -12, +12, +5 volt dc), shall be held to within ±5 percent of the nominal values. These voltages are not adjustable in the field.

4.04 Loss through the receive path band-elimination filter is at least 40 dB at 2600 Hz ±10 Hz.

4.05 Message circuit noise must not exceed 50 dBrnc0 for noncompandored channels, 60 dBrnc0 for compandored channels, and voiceband signal power must not exceed +10 dBm0.

E and M Lead Units

4.06 E and M lead units function with circuits that furnish -48 volt battery on the M lead to the SF unit as an off-hook signal, and ground or open as an on-hook signal. The E and M lead unit furnishes ground or closed circuit condition on the E lead as an off-hook signal, and an open circuit as an on-hook signal.

4.07 The M lead earth potential difference when separate batteries are involved shall not exceed ±3.0 volts, and the external resistance on the M lead shall not exceed 1000 ohms.

4.08 Current through the E lead must not exceed 1/3 ampere. External contact protection must be provided for dial pulse operations when inductive (relay) loads are connected to the E lead.

DX Units

4.09 The maximum amount of resistance on the DX loop must not exceed 5000 ohms and the minimum amount of insulation resistance shall be 100,000 ohms.

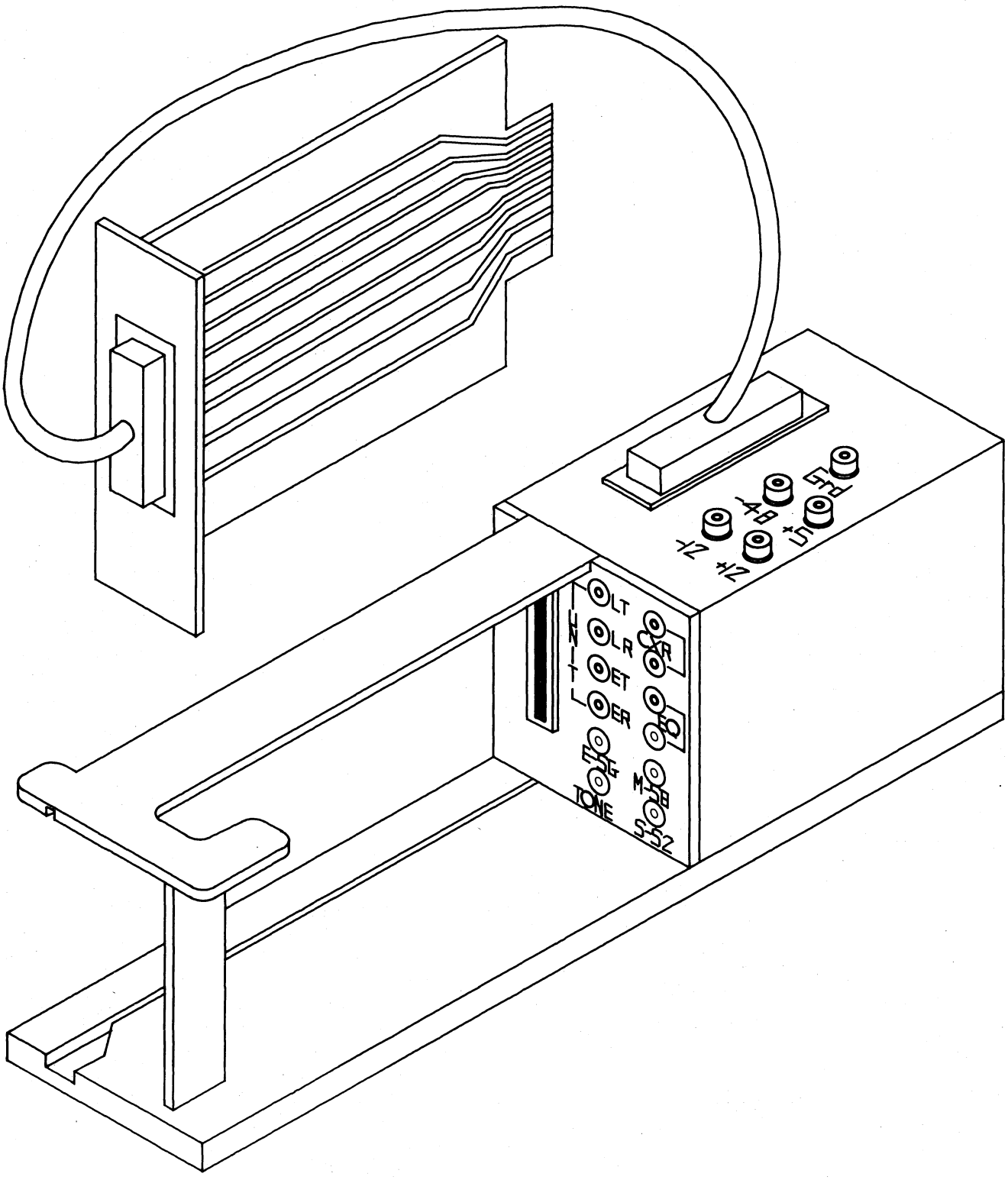

Fig. 10—G-Signaling Test Extender

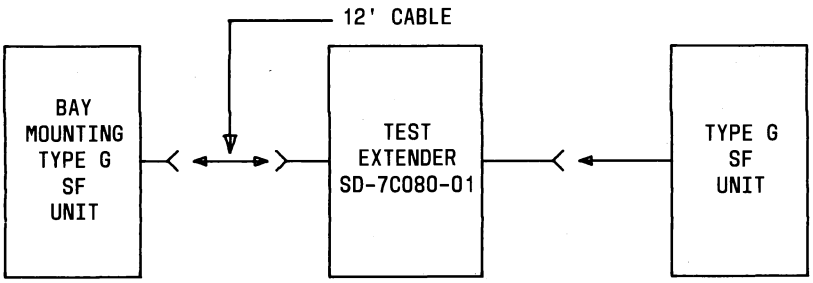

Fig. 11—Test Extender Connections

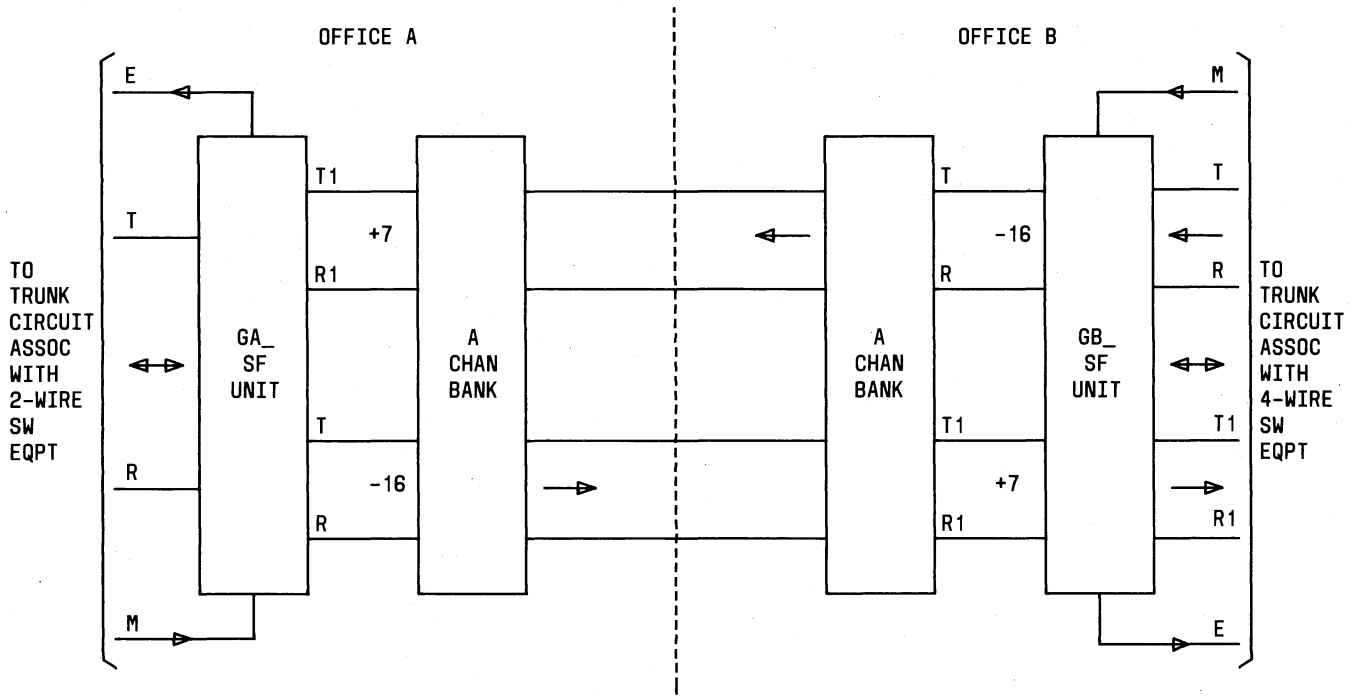

Fig. 12—Typical Application of GA_ and GB_ Units

4.10 The maximum amount of dc earth potential is ±30 volts and the maximum amount of induced longitudinal voltage shall not exceed 35 volts ac (RMS).

4.11 The pulse distortion shall be within ±2 percent break (both office batteries equal).

Ringdown Units

4.12 The ringdown unit changes dc signals or ac ringing signals to 2600 Hz, which is transmitted over the carrier, and converts 2600 Hz from the carrier to dc or ac ringing signals.

4.13 The ac ringing supply associated with the ringdown units must be no less than 84 Vrms and no greater than 110 Vrms at 17 through 35 Hz. The duration of the ring interval must be no less than 450 ms.

4.14 The dc signal voltage applied to the S1 lead must be negative and should not exceed -53 volts.

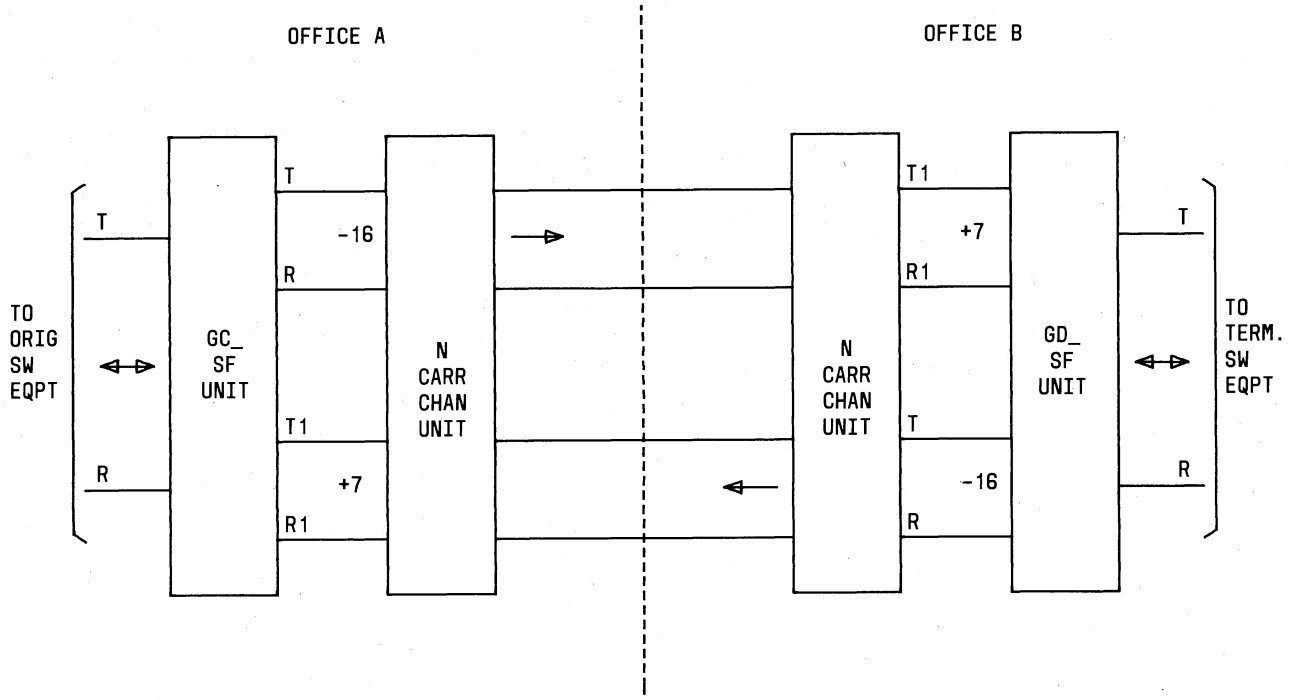

Fig. 13—Typical Application of GC_ and GD_ Units

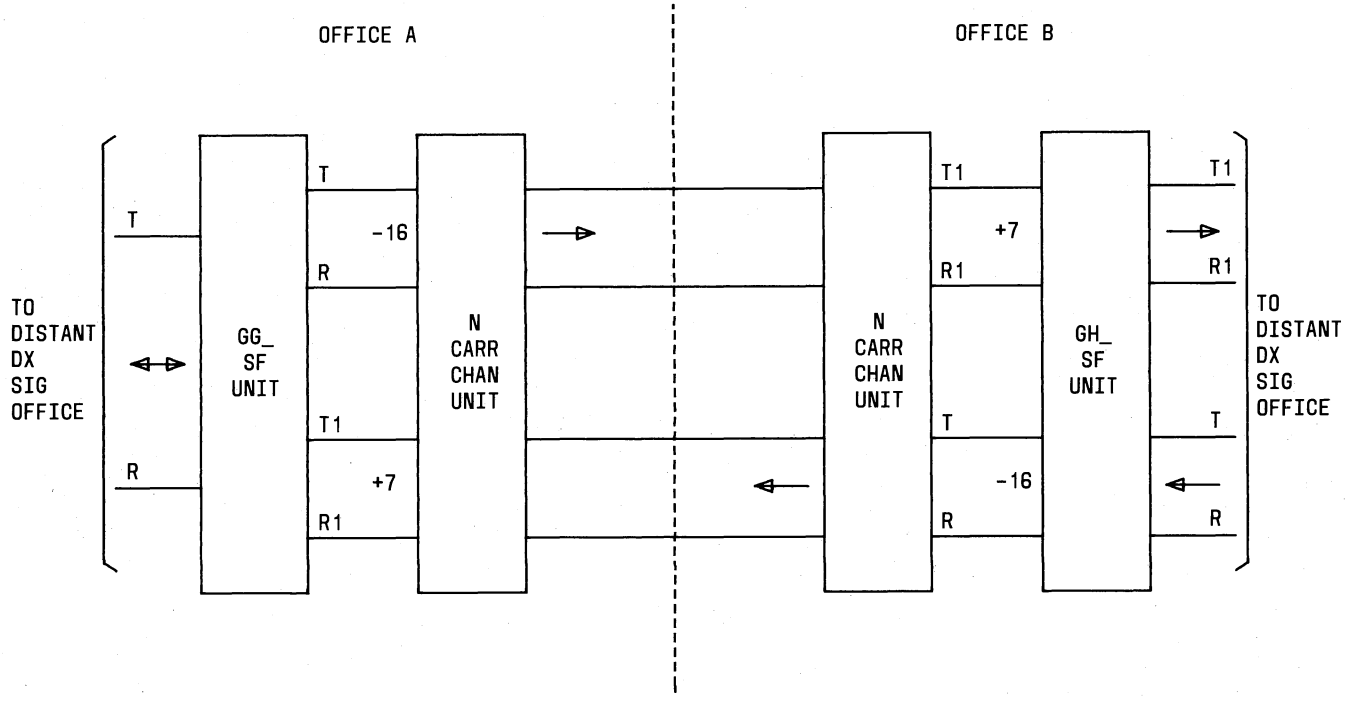

Fig. 14—Typical Application of GG_ and GH_ Units

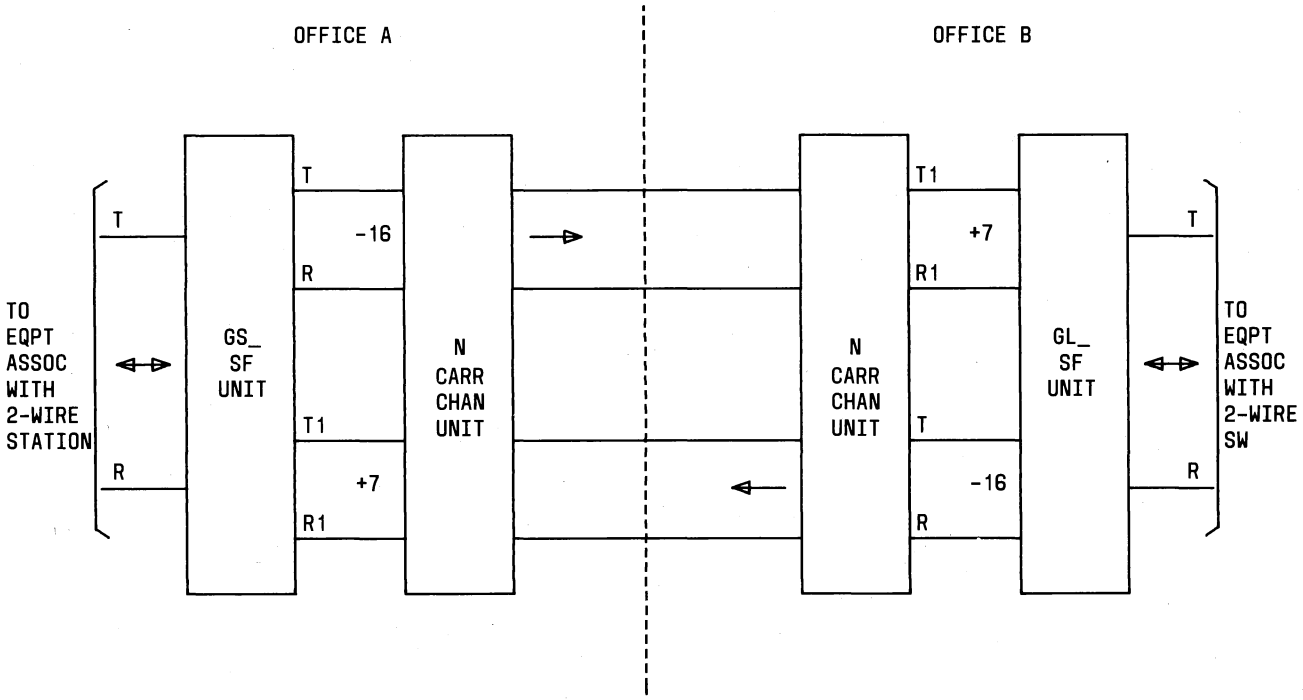

Fig. 15—Typical Application of GL_ and GS_ Units

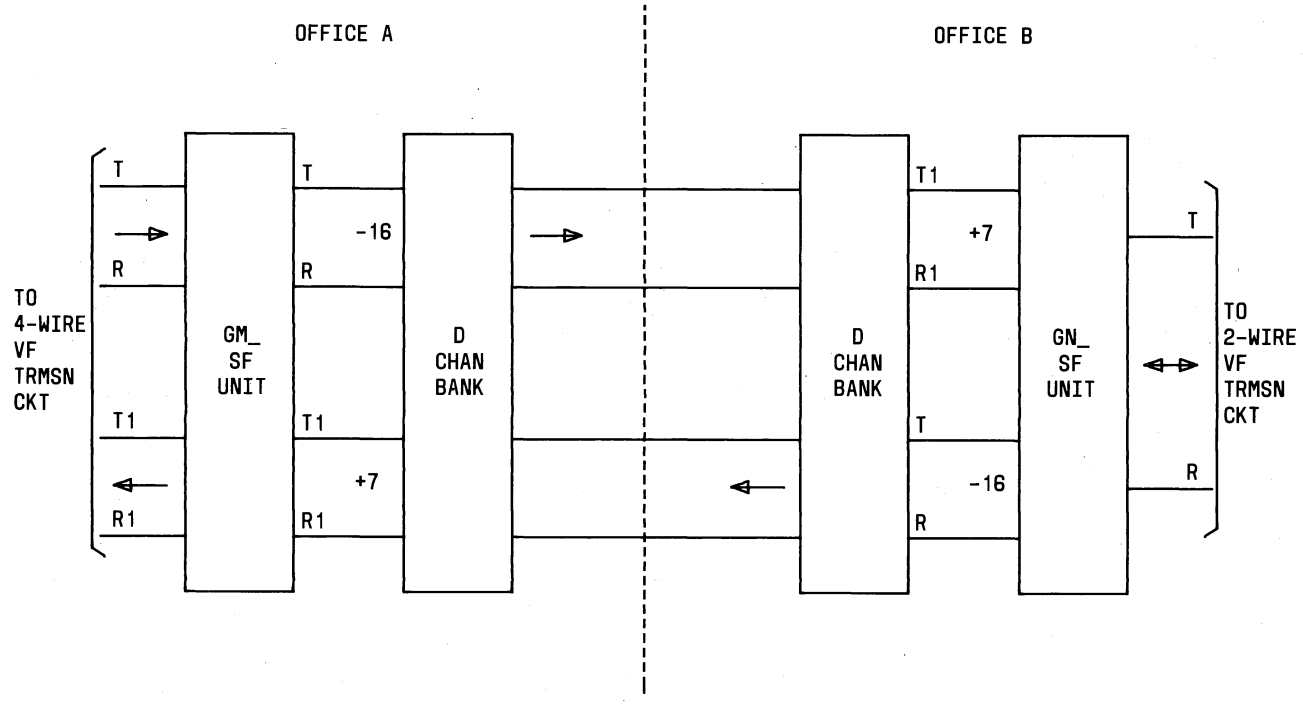

Fig. 16—Typical Application of GM_ and GN_ Units

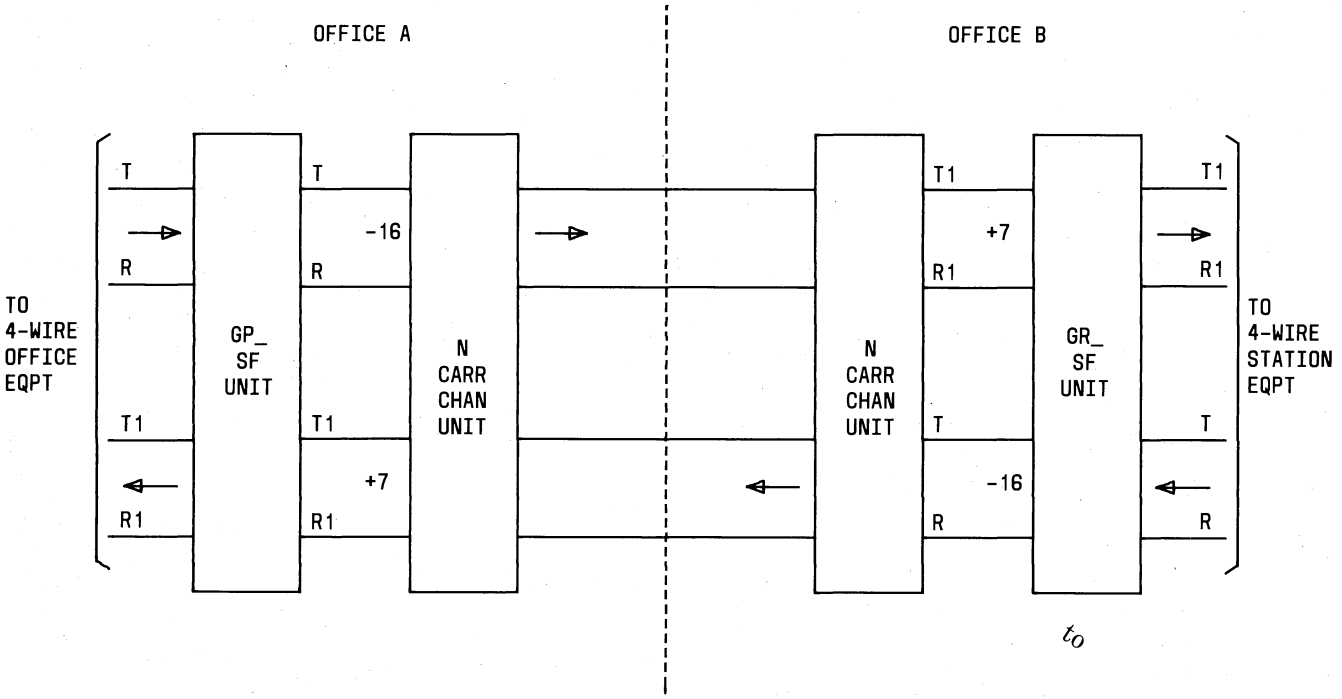

Fig. 17—Typical Application of GP_ and GR_ Units

4.15 The insulation resistance across the 2-wire loop or between any conductor and ground must be greater than 30,000 ohms.

4.16 The maximum absolute value of superimposed direct current is 53 volts.

4.17 The maximum 60-Hz longitudinal induced noise is 40 Vrms.

Units Employing Build-Out Resistors

4.18 Build-out resistors (BOR) for the loop reverse battery units will be manually inserted when the circuit resistance is less than 900Ω. Special access units will be automatically inserted.

Special Access Units

4.19 The ringing supply associated with special access units should have the following characteristics:

(a) Maximum ***negative*** superimposed dc voltages— -53 volts

(b) RMS ac voltage—60-120 volts

(c) Frequency:

Loop-start—17 to 35 Hz
Ground-start—17 to 35 Hz
G signaling office unit converts the 17 to 35 Hz ringing signal to 2600 Hz modulated with 20 Hz for transmission over carrier to station unit.

(d) Ringing detector requires grounded ringing source.

5. TYPICAL SF UNIT OPERATION

5.01 Basically, all Type G signaling units are similar in operating principles. Individual SF signaling units contain features which adapt to particular circuit applications. All SF units receive dc (ac for ringing) signals from office equipment and convert these signals into 2600-Hz tone signals which are applied to the transmission line toward an SF signaling unit at the distant end of the transmission facility. Receiving portions of an SF signaling unit must determine when a 2600-Hz signal is present at the incoming line and convert the signal to the appropriate dc (ac for ringing)

signal. Signals used for the various signaling units are listed in Tables B through G.

5.02 A GBA SF unit is described in this part of the section, since the operating principles of this unit are representative of most Type G units. Figure 12 shows a typical circuit arrangement—a 4-wire transmission facility terminating into a 2-wire switching office on one end and 4-wire switching office on the other end.

5.03 A functional diagram of a GBA SF unit is shown in Fig. 18. This unit is a complete signaling unit and can be divided into three circuits: (1) signaling, (2) transmitter, and (3) receiver.

Signaling Circuit

5.04 The signaling circuit consists of a transmit signal timer, receive signal timer, and carrier group alarm (CGA) interface. At the transmitting end of the signaling circuit, the condition of the signaling lead controls the operation of the transmit signaling timer. In the idle condition (on-hook), the M lead is grounded (or open), causing the transmit signal timer to operate the high/low (H/L) timer which applies low level (-36 dBm) 2600-Hz tone to the line toward the distant SF units. When a switching machine seizes a trunk, -48 battery is applied to the M lead which causes the tone cut circuit to remove the tone from the line toward the distant end as a seizure signal.

5.05 When dialing, ground or open and battery pulses are applied to the M lead, causing the M timing circuit to pulse, which turns the tone cut circuit off and turns the high level tone timer on. The timer allows high level (-24 dBm) tone pulses to be applied to the facility (transmit or MOD IN). During pulsing, the cut circuit is activated which cuts the transmission path while tone is being transmitted. This prevents noise or speech from interfering with the tone signals. The transmit signal timer has associated timing circuits internally within it to improve the pulses which are received on the M lead. This is called a pulse shaper circuit and it provides a guaranteed minimum interval between repetitive pulses and shortens long pulses.

5.06 At the end of pulsing, the transmit signal timer cuts the 2600-Hz tone and simultaneously removes the cut circuit from the transmission path.

5.07 At the receiving end of the signaling circuit, the condition of the 2600-Hz tone received at the receive port from the line facility controls the operation of the receive signal timer. In the idle condition (on-hook), 2600-Hz tone is present at the line receive port which causes the receive signal timer to be inactive. When the trunk is seized by a switching machine at the distant end, the tone is removed from the line causing the receive signal timer to operate the R relay. With the R relay operated, the loop between the SG and E leads is closed. For Type I and III E&M interfaces, option switch K is closed for providing a ground for the E lead when the R relay contacts are closed.

5.08 When dialing at the distant end, 2600-Hz tone pulses (at the dialing rate) are received at the line receive port, and detected and converted into dc pulses causing the R relay to pulse. Operate, release, and minimum break timing circuitry in the receive signal timer provides pulse correction. A minimum tone pulse of 34 milliseconds is required to operate the receiver. If the tone pulses are within the input limits, an output closure between the E and SG leads of at least 56 percent break is guaranteed.

5.09 When tone is being received, the output of the receiver signal timer goes high which releases the R relay and activates the guard timer circuit. The guard timer keeps the cut circuit turned on which disconnects the guard amplifier from the dc comparator. With the guard amplifier removed, the SF unit is in the broadband condition. The guard timer is slow in releasing the cut circuit (180 milliseconds) and, therefore, holds the cut circuit during pulsing. When the guard timer releases the cut circuit, the narrowband condition exists. The narrowband condition reduces false operation of the receive signal timer caused by speech interference.

Transmitter Circuit

5.10 The transmitter circuit consists of a clock circuit, H/L timer, tone gain control, tone cut circuit, cut timer and its associated cut circuit. The transmission path through the transmitter is operated by the cut circuit under the control of the cut timer (120 milliseconds). The 2600-Hz tone supply operates the clock circuit and also supplies tone to the tone gain control circuit. The H/L timer controls the tone to either a high- or low-level

TABLE B

SF SIGNALS USED IN E AND M LEAD SIGNALING

GA_ OR GB_ SF UNIT (CALLING END)				GA_ OR GB_ SF UNIT (CALLED END)			
SIGNAL OR STATE	M LEAD	E LEAD	2600 HZ TONE	2600 HZ TONE	E LEAD	M LEAD	SIGNAL OR STATE
Idle	Ground[2]	Open	On	On	Open	Ground[2]	Idle
Connect[1]	Batt	Open	Off	On	Ground	Ground[2]	Connect
Stop Dialing	Batt	Ground	Off	Off	Ground	Batt	Stop Dialing[1]
Start Dialing	Batt	Open	Off	On	Ground	Ground	Start Dialing[1]
Dial Pulsing[1]	Ground[2] Batt	Open	On Off	On	Open Ground	Ground[2]	Dial Pulsing
Off-Hook	Batt	Ground	Off	Off	Ground	Batt	Off-Hook[1] (Answer)
Ring Forward[1]	Ground[2] Batt	Ground	On Off	Off	Open Ground	Batt	Ring Forward
Ringback	Batt	Open Ground	Off	On Off	Ground	Ground[2] Batt	Ringback[1]
Flashing	Batt	Open Ground	Off	On Off	Ground	Ground[2] Batt	Flashing
On-Hook	Batt	Open	Off	On	Ground	Ground[2]	On-Hook[1]
Disconnect[1]	Ground[2]	Open	On	On	Open	Ground[2]	Disconnect

Note 1: Terminal originating signal

Note 2: Or Open

TABLE C

SF SIGNALS USED IN REVERSE BATTERY T AND R LOOP SIGNALING

GCA UNIT (CALLING END)				GDA UNIT (CALLED END)			
SIGNAL OR STATE	OFFICE T AND R TO SF UNIT	SF UNIT TO OFFICE T AND R	2600-HZ SF TONE	2600-HZ SF TONE	SF UNIT TO OFFICE T AND R	OFFICE T AND R TO SF UNIT	SIGNAL OR STATE
Idle	Open	Batt-Grd	On	On	Open	Batt-Grd	Idle
Connect[1]	Closure	Batt-Grd	Off	On	Closure	Batt-Grd	Connect
Stop Dialing	Closure	Rev Batt-Grd	Off	Off	Closure	Rev Batt-Grd	Stop Dialing[1]
Start Dialing	Closure	Batt-Grd	Off	On	Closure	Batt-Grd	Start Dialing[1]
Dial Pulsing[1]	Open Closure	Batt-Grd	On Off	On	Open Closure	Batt-Grd	Dial Pulsing
Off-Hook	Closure	Rev Batt-Grd	Off	Off	Closure	Rev Batt-Grd	Off-Hook[1] (Answer)
Ring Forward[1]	Open Closure	Rev Batt-Grd	On Off	Off	Open Closure	Rev Batt-Grd	Ring Forward
Ringback	Closure	Batt-Grd Rev Batt-Grd	Off	On Off	Closure	Batt-Grd Rev Batt-Grd	Ringback[1]
Flashing	Closure	Batt-Grd Rev Batt-Grd	Off	On Off	Closure	Batt-Grd Rev Batt-Grd	Flashing[1]
On-Hook	Closure	Batt-Grd	Off	On	Closure	Batt-Grd	On-Hook[1]
Disconnect[1]	Open	Batt-Grd	On	On	Open	Batt-Grd	Disconnect

Note 1: Terminal originating signal

TABLE D

SF SIGNALS USED FOR RINGING AND LOOP-START SIGNALING USING T & R LEADS

CALL ORIGINATING AT CENTRAL OFFICE END							
GL_ SF UNIT				GS_ SF UNIT			
SIGNAL OR STATE	OFFICE T AND R TO SF UNIT	SF UNIT TO OFFICE T AND R	2600-HZ SF TONE (CO UNIT TO STA UNIT)	2600-HZ SF TONE (STA UNIT TO CO UNIT)	SF UNIT TO STATION T AND R	STATION T AND R TO SF UNIT	SIGNAL OR STATE
Idle	Grd/Batt	Open	Off	On	Grd/Batt	Open	Idle
Seizure[1]	Grd/Batt	Open	Off	On	Grd/Batt	Open	Idle
Ringing[1],[2]	Grd/Batt and 20 Hz[2]	Open	On-Off[3]	On	Grd/Batt and 20 Hz[2]	Open	Ringing
Off-Hook Ring-Trip and Talk	Grd/Batt	Closure	Off	Off	Grd/Batt	Closure	Off-Hook[1] Ring-Trip and Answer
On-Hook[1] (Disc.)	Grd/Batt	Closure	Off	Off	Grd/Batt	Closure	Off-Hook
On-Hook (Hang-Up)	Grd/Batt	Open	Off	On	Grd/Batt	Open	On-Hook[1] (Hang-Up)
CALL ORIGINATING AT STATION END							
GS_ SF UNIT				GL_ SF UNIT			
SIGNAL OR STATE	STATION T AND R TO SF UNIT	SF UNIT TO OFFICE T AND R	2600-HZ SF TONE (STA UNIT TO CO UNIT)	2600-HZ SF TONE (CO UNIT TO STA UNIT)	SF UNIT TO OFFICE T AND R	OFFICE T AND R TO SF UNIT	SIGNAL OR STATE
Idle	Open	Grd/Batt	On	Off	Open	Grd/Batt	Idle
Off-Hook[1] (Seizure)	Closure	Grd/Batt	Off	Off	Closure	Grd/Batt	Seizure
Start Dial	Closure	Dial Tone and Grd/Batt	Off	Off	Closure	Dial Tone and Grd/Batt	Start Dial[1]
Dial-Pulsing[1]	Open-Closure	Grd/Batt	On-Off	Off	Open-Closure	Grd/Batt	Dial Pulsing
Waiting Answer	Closure	Audible Ring and Grd/Batt	Off	Off	Closure	Audible Ring and Grd/Batt	Waiting Answer[1]
Off-Hook (Talk)	Closure	Grd/Batt	Off	Off	Closure	Grd/Batt	Off-Hook[1] (Answered)
On-Hook[1] (Disc.)	Open	Grd/Batt	On	Off	Open	Grd/Batt	On-Hook (Disc.) Off-Hook

Note 1: Terminal originating signal.

Note 2: 20-Hz ringing (2 sec on, 4 sec off).

Note 3: 2600 Hz (2 sec on, 4 sec off).

TABLE E

SF SIGNALS USED FOR RINGING AND GROUND-START SIGNALING USING T & R LEADS

CALL ORIGINATED AT CENTRAL OFFICE END							
GL_ SF UNIT				GS _ SF UNIT			
SIGNAL OR STATE	OFFICE T AND R TO SF UNIT	SF UNIT TO OFFICE T AND R	2600-HZ SF TONE	2600-HZ SF TONE	SF UNIT TO STATION T AND R	STATION T AND R TO SF UNIT	SIGNAL OR STATE
Idle	Open/Batt	Open/Batt	On	On	Open/Batt	Note 3	Idle
Seizure[1]	Grd/Batt	Open	Off	On	Grd/Batt	Note 3	Make-Busy[3]
Ringing[1]	Grd/Batt and 20 Hz	Open	Note 4	On	Grd/Batt and 20 Hz[2]	Open	Ringing
Off-Hook Ring-Trip and Talk	Grd/Batt	Closure	Off	Off	Grd/Batt	Closure	Off-Hook[1] Ring-Trip and Answered
On-Hook[1] (Disc.)	Open/Batt	Closure	On	Off	Open/Batt	Open	On-Hook
On-Hook (Hang-Up)	Open/Batt	Open/Batt	Off	On	Open/Batt	Open	On-Hook[1] (Hang-Up)
CALL ORIGINATED AT STATION END							
GS_ SF UNIT				GL_ SF UNIT			
SIGNAL	STATION T AND R TO SF UNIT	SF UNIT TO STATION T AND R	2600-HZ SF TONE	2600-HZ SF TONE	SF UNIT TO OFFICE T AND R	OFFICE T AND R TO SF UNIT	SIGNAL
Idle	Open/Batt[3]	Open/Batt	On	On	Open/Batt	Open/Batt	Idle
Off-Hook[1]	Closure and Grd on Ring[3]	Open/Batt	Off	On	Batt/Grd	Open/Batt	Seizure
Start-Dial	Closure	Grd/Batt and Dial Tone	Off	Off	Closure	Grd/Batt and Dial Tone	Start Dial[1]
Dial-Pulsing[1]	Open-Closure	Grd/Batt	On-Off	Off	Open-Closure	Grd/Batt	Dial Pulsing
Waiting Ans.	Closure	Audible Ring and Grd/Batt	Off	Off	Closure	Audible Ring and Grd/Batt	Waiting Ans.[1]
Off-Hook (Talk)	Closure	Grd/Batt	Off	Off	Closure	Grd/Batt	Off-Hook[1] (Answered)
Off-Hook	Closure	Open/Batt	Off	On	Batt/Batt	Open/Batt	On-Hook[1] (Disc.)
On-Hook[1] (Disc.)	Open[3] /Batt	Grd/Batt	On	Off	Open/Batt	Open/Batt	On-Hook

Note 1: Terminal originating signal.

Note 2: 20-Hz ringing (2 sec on, 4 sec off).

Note 3: Function of connecting station equipment.

Note 4: 2600 Hz modulated at 20-Hz rate (2 sec on, 4 sec off).

TABLE F

SF SIGNALS USED FOR RINGING AND LOOP-START SIGNALING ON SX LEADS

CALL ORIGINATING AT CENTRAL OFFICE END							
GL_ OR GP_ SF UNIT				GR_ OR GS_ SF UNIT			
SIGNAL OR STATE	OFFICE A AND B TO SF UNIT	SF UNIT TO OFFICE A AND B	2600-HZ SF TONE (CO UNIT TO STA UNIT)	2600-HZ SF TONE (STA UNIT TO CO UNIT)	SF UNIT TO STATION A AND B	STATION A AND B TO SF UNIT	SIGNAL OR STATE
Idle	Grd/Batt	Open	Off	On	Grd/Batt	Open	Idle
Seizure[1]	Grd/Batt	Open	Off	On	Grd/Batt	Open	Idle
Ringing[1,2]	Grd/Batt and 20 Hz[2]	Open	On-Off[3]	On	Grd/Batt and 20 Hz[2]	Open	Ringing
Off-Hook Ring-Trip and Talk	Grd/Batt	Closure	Off	Off	Grd/Batt	Closure	Off-Hook[1] Ring-Trip and Answer
On-Hook[1] (Disc.)	Grd/Batt	Closure	Off	Off	Grd/Batt	Closure	Off-Hook
On-Hook (Hang-Up)	Grd/Batt	Open	Off	On	Grd/Batt	Open	On-Hook[1] (Hang-Up)
CALL ORIGINATING AT STATION END							
GR_ OR GS_ SF UNIT				GL_ OR GP_ SF UNIT			
SIGNAL OR STATE	STATION A AND B TO SF UNIT	SF UNIT TO OFFICE A AND B	2600-HZ SF TONE (STA UNIT TO CO UNIT)	2600-HZ SF TONE (CO UNIT TO STA UNIT)	SF UNIT TO OFFICE A AND B	OFFICE A AND B TO SF UNIT	SIGNAL OR STATE
Idle	Open	Grd/Batt	On	Off	Open	Grd/Batt	Idle
Off-Hook[1] (Seizure)	Closure	Grd/Batt	Off	Off	Closure	Grd/Batt	Seizure
Start Dial	Closure	Dial Tone and Grd/Batt	Off	Off	Closure	Dial Tone and Grd/Batt	Start Dial[1]
Dial Pulsing[1]	Open-Closure	Grd/Batt	On-Off	Off	Open-Closure	Grd/Batt	Dial Pulsing
Waiting Answer	Closure	Audible Ring and Grd/Batt	Off	Off	Closure	Audible Ring and Grd/Batt	Waiting Answer[1]
Off-Hook (Talk)	Closure	Grd/Batt	Off	Off	Closure	Grd/Batt	Off-Hook[1] (Answered)
On-Hook[1] (Disc.)	Open	Grd/Batt	On	Off	Open	Grd/Batt	On-Hook (Disc.) Off-Hook

Note 1: Terminal originating signal.

Note 2: 20-Hz ringing (2 sec on, 4 sec off).

Note 3: 2600 Hz (2 sec on, 4 sec off).

TABLE G

SF SIGNALS USED FOR RINGING AND GROUND-START SIGNALING ON SX LEADS

CALL ORIGINATED AT CENTRAL OFFICE END							
GL_ OR GP_ SF UNIT				GR_ OR GS_ SF UNIT			
SIGNAL OR STATE	OFFICE A AND B TO SF UNIT	SF UNIT TO OFFICE A AND B	2600-HZ SF TONE	2600-HZ SF TONE	SF UNIT TO STATION A AND B	STATION A AND B TO SF UNIT	SIGNAL OR STATE
Idle	Open/Batt	Open/Batt	On	On	Open/Batt	Note 3	Idle
Seizure[1]	Grd/Batt	Open	Off	On	Grd/Batt	Note 3	Make-Busy[3]
Ringing[1]	Grd/Batt and 20 Hz	Open	Note 4	On	Grd/Batt and 20 Hz[2]	Open	Ringing
Off-Hook Ring-Trip and Talk	Grd/Batt	Closure	Off	Off	Grd/Batt	Closure	Off-Hook[1] Ring-Trip and Answered
On-Hook[1] (Disc.)	Open/Batt	Closure	On	Off	Open/Batt	Open	On-Hook
On-Hook (Hang-Up)	Open/Batt	Open/Batt	Off	On	Open/Batt	Open	On-Hook[1] (Hang-Up)
CALL ORIGINATED AT STATION END							
GR_ OR GS_ SF UNIT				GL_ OR GP_ SF UNIT			
SIGNAL	STATION A AND B TO SF UNIT	SF UNIT TO STATION A AND B	2600-HZ SF TONE	2600-HZ SF TONE	SF UNIT TO OFFICE A AND B	OFFICE A AND B TO SF UNIT	SIGNAL
Idle	Open/Batt[3]	Open/Batt	On	On	Open/Batt	Open/Batt	Idle
Off-Hook[1]	Closure and Grd on Ring[3]	Open/Batt	Off	On	Batt/Grd	Open/Batt	Seizure
Start Dial	Closure	Grd/Batt and Dial Tone	Off	Off	Closure	Grd/Batt and Dial Tone	Start Dial[1]
Dial Pulsing[1]	Open-Closure	Grd/Batt	On-Off	Off	Open-Closure	Grd/Batt	Dial Pulsing
Waiting Ans.	Closure	Audible Ring and Grd/Batt	Off	Off	Closure	Audible Ring and Grd/Batt	Waiting Ans.[1]
Off-Hook (Talk)	Closure	Grd/Batt	Off	Off	Closure	Grd/Batt	Off-Hook[1] (Answered)
Off-Hook	Closure	Open/Batt	Off	On	Batt/Batt	Open/Batt	On-Hook[1] (Disc.)
On-Hook[1] (Disc.)	Open[3]/Batt	Grd/Batt	On	Off	Open/Batt	Open/Batt	On-Hook

Note 1: Terminal originating signal.

Note 2: 20-Hz ringing (2 sec on, 4 sec off).

Note 3: Function of connecting station equipment.

Note 4: 2600 Hz modulated at 20-Hz rate (2 sec on, 4 sec off).

state. The tone cut circuit either allows the tone to be transmitted or cut off.

Receiver Circuit

5.11 The receiver circuit consists of a signal guard (S/G) filter, comparator, band-elimination filter (BEF), BEF cut circuit, guard timer, and its associated cut circuit.

5.12 The transmission path of the receiver circuit consists of an input transformer, input amplifier, band-elimination filter (BEF), output amplifier, output transformer, and attenuator. The transmission path provides: a balanced 600-ohm input at the LINE RCV terminals, an attenuator controlled loss of 0 dB through 16.5 dB from LINE RCV port to EQPT RCV port, sufficient power output from the output amplifier to provide for a 10 dBm0 overload signal, a balanced 600-ohm output at the EQPT RCV terminals, and insertion of BEF at 2600 Hz to eliminate the signal tone from the transmission path.

5.13 The 2600-Hz tone which is received at the receiver circuit is directed through two separate paths. One path is via a bandpass filter, signal amplifier, rectifier, and on to a dc comparator. The other path is via a guard amplifier, a rectifier, and on to the dc comparator. The dc comparator is preset to operate when the ratio between the signal and guard amplifier energy is approximately 10 dB. This ratio will only be correct for 2600-Hz tone signals which are within the limits stated in Part 4.

5.14 When SF tone is received, the BEF timer is operated and two filters are inserted into the transmission path. A 2600-Hz signal-guard filter directs signal tone to a signal amplifier and filters out speech and noise signals. The BEF is inserted between the input and output amplifier stages in the transmission path, causing high losses at and close to the 2600-Hz frequency. The band-elimination filter allows speech to pass through but blocks signal tone (2600 Hz).

6. MAINTENANCE

6.01 No field adjustments are made on the various G-type signaling units other than pad adjustments, build-out capacitance, CGA functions, and units employing gain transfer. The GYA unit will indicate the failure status of the G module. These failures are described in Section 179-401-100. Any units not meeting circuit requirements should be replaced with spare units and defective units should be sent to Western Electric Company service center for repair.

7. REFERENCES

7.01 The following is a list of sections containing information on component units of the Type G signaling system.

SECTION	TITLE
179-100-312	Common Systems—Type G Signaling System—Signaling Compatibility—With Switching Circuits
179-401-100	J99395YA Fuse, Alarm, Power Control, 2600-Hz Tone Supply, and CGA—Description—Type G Single-Frequency Signaling System
179-405-100	J99395AA, AB, and BA E and M Signaling Units—Description—Type G Single-Frequency Signaling System
179-406-100	J99395CA and DA Loop Reverse Battery Signaling Units—Description—Type G Single-Frequency Signaling System
179-407-100	J99395LA, LB, PA, RA, SA, and SB Special Access Signaling Units—Description—Type G Single-Frequency Signaling System
179-407-501	J99395LB, PA, RA, and SB Signaling Units With Equalization or Gain Transfer—Adjustment Procedures

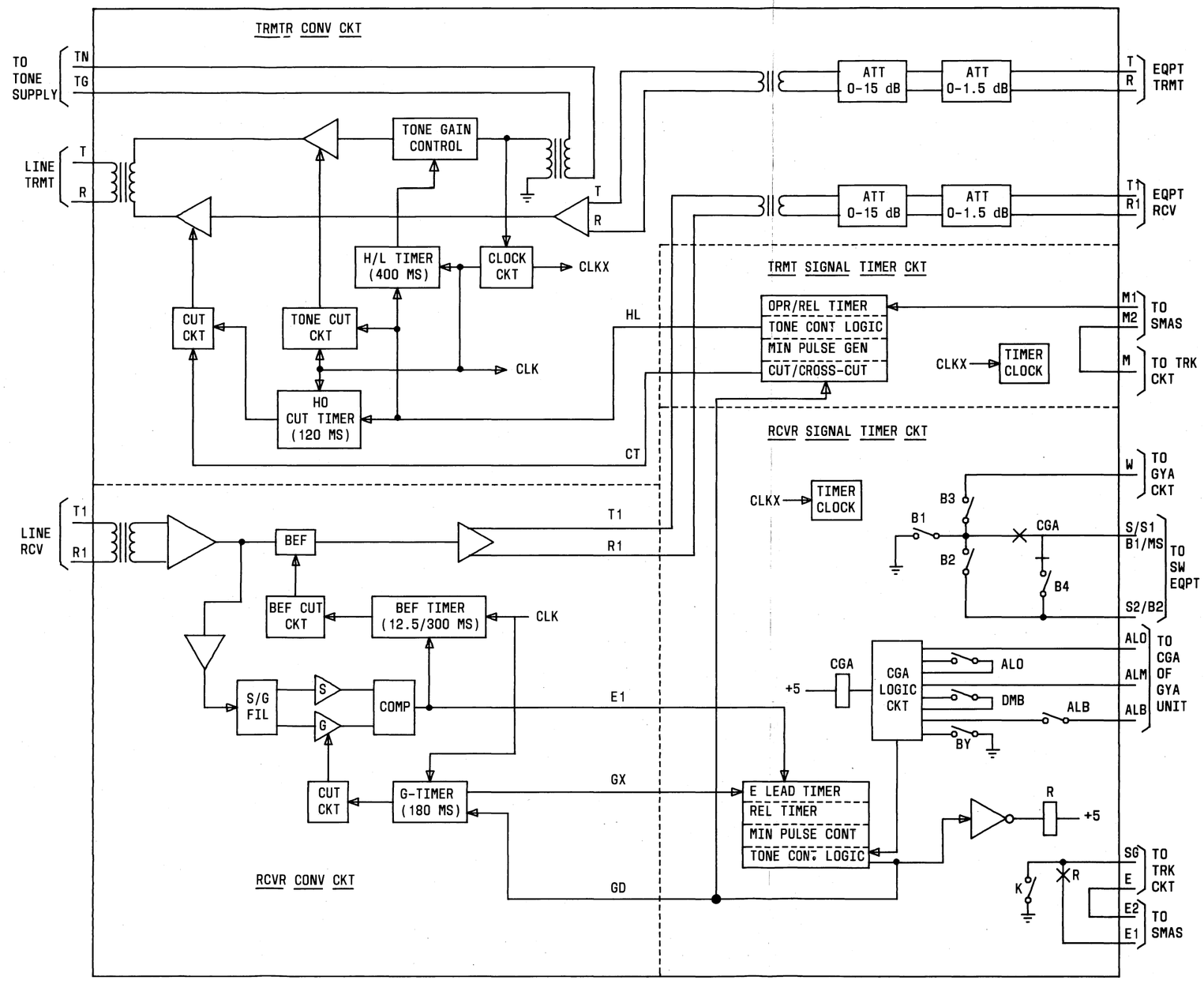

Fig. 18—GBA SF Unit