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INTEGRATED SERVICES NETWORK

## **Meridian SL-1**

### SL-1 and Console Line Packs Description and Operation

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## General information

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**1.01** This practice outlines the functions, interconnections, characteristics and operation of the SL-1 Business Communications System. SL-1 Line and Console Line circuit packs. The information is intended to be used as a guide when designing or engineering the connection of apparatus to the line circuit.

**1.02** The information in this practice applies to the following packs:

- QPC451 SL-1 Line ( $\mu$ -Law)
- QPC520 SL-1 Line (A-Law)
- QPC518 Console Line ( $\mu$ -Law) (superseded by the QPC451)
- QPC519 Console Line (A-Law)

**1.03** The four packs use identical circuit boards but are configured for their respective operation. The SL-1 line packs can each interface to up to eight SL-1 sets. The console line packs can interface to two attendant consoles. The QPC451 SL-1 line pack can be used for four attendant consoles without console power or two attendant consoles with console power.

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## Description

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### Functions

**2.01** The SL-1 and console line circuit packs each contain eight line circuits (see Fig. 2-1). The SL-1 line pack can use all eight circuits, each circuit interfacing to an SL-1 set. The console line pack uses pairs of line circuits to interface to attendant consoles: one pair may be used from the upper four circuits and one pair from the lower four to interface to two consoles.

**Note:** Line circuits on the SL-1 line pack are automatically powered up during signaling and transmission. The connected circuit pairs on the console line pack are continuously powered on.

**2.02** For SL-1 set connections, one pair of wires is used for transmission and a second pair for signaling (see Fig. 2-2). For attendant console connections, two pairs of wires are used for transmission connections and two pairs for signaling connections. These connections:

- (a) terminate the loop tip and ring conductors with a balanced 600-ohm termination;
- (b) provide  $\pm 15$  V power, phantomed over the transmission and signaling pairs, to the set or console terminals;
- (c) provide a measure of isolation of foreign potentials on the loop from portions of the transmission and signaling circuitry;
- (d) convert from the 2-wire transmission path of the loop to a 4-wire transmission path;

## 2-2 Description

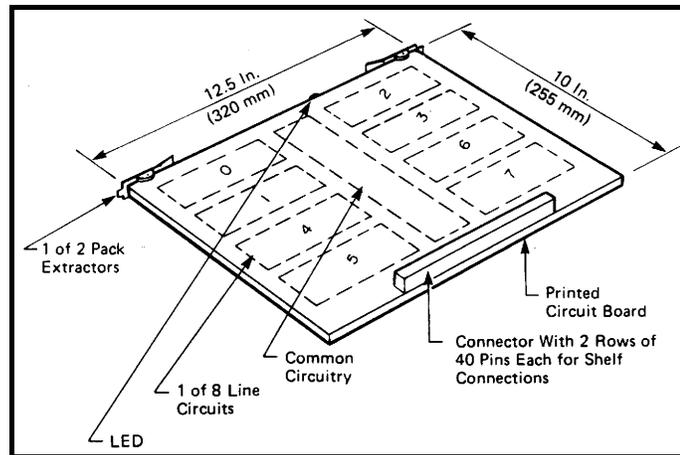
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- (e) provide analog-to-digital and digital-to-analog conversion of transmission signals.

**2.03** The circuit pack includes two common multiplexing circuits to:

- (a) interface the individual line circuits with the peripheral bus signaling channel;
- (b) retime digital signals received from the peripheral bus;
- (c) decode address information received from the peripheral bus and enable individual line circuits during selected time slots.

**2.04** The information and signaling relevant to the SL-1 set or console passes through the line circuit pack and is multiplexed with information from other circuit packs. A multiplex loop connects the input and output of up to two Peripheral Equipment (PE) shelves to the Common Equipment (CE) where switching takes place (see Fig. 2-2 and 2-3).



**Figure 2-1**  
**Identification of the Circuits on the Board**

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## Physical description

**2.05** The line circuits and common circuitry of the pack are mounted on a 12.5 in (320-mm) by 10 in (254-mm) printed circuit board. The front of the pack is equipped with two pack extractors and a Light Emitting Diode (LED). The rear of the pack is equipped with a connector capable of accepting 80 pins. Ten of these circuit packs may be mounted in one PE shelf but not to exceed 50% of the packs in a cabinet.

## Interconnection with shelf

**2.06** The 80-pin connector on the rear of the circuit pack connects to an 80-line bus system at the rear of the PE shelf. The bus lines feed into eight multi-pin connectors. Seven of these connectors link the line circuits to the corresponding terminal equipment and one feeds power to the PE shelf from the power converter shelf.

**2.07** Thirty-two of the 80 pins per circuit pack are connected to terminal equipment, 2 pins provide ground, 13 pins interface with the CE via the peripheral buffer and 15 pins provide voltages to the circuit pack.

**2.08** For detailed information on terminal set line connections to the four PE shelf connectors, refer to 553-2YY1-210.

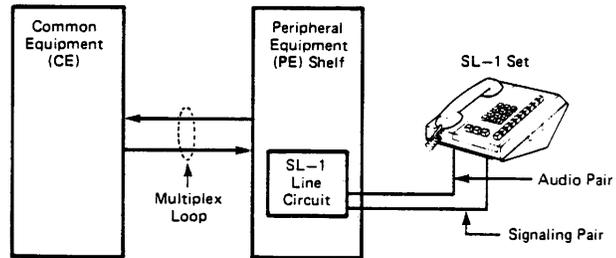
## Power supply to terminals

**2.09** The SL-1 set battery supply is  $-30$  V dc phantom over the audio and signaling leads to each terminal set.

**2.10** As a general installation guideline, sufficient power is available for the SL-1 set at a normal operating range of 189 ohms (see Loop Limits in Table 3-A).

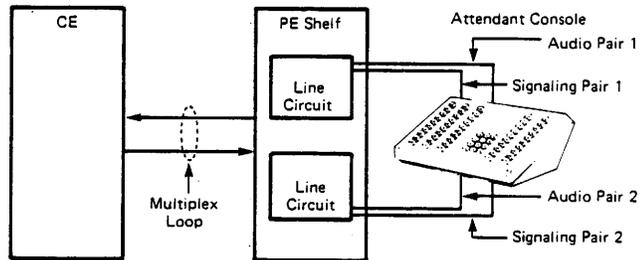
## 2-4 Description

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**Figure 2-2**  
**Line Circuit Connection to SL-1 Set**

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**Figure 2-3**  
**Line Circuit Connection to Attendant Console**

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## Circuit Characteristics

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**3.01** The circuit characteristics of the line pack are listed in Table 3-A.

**Table 3-A**  
**Circuit characteristics of the line pack**

CHARACTERISTICS	AS RELATED TO THE CIRCUIT PACK	
CIRCUITS PER PACK	Eight individual circuits	
OPTIONS	Nil	
IMPEDANCE		
Voice Pair	600 ohms	
Signaling Pair	600 ohms	
NOMINAL INSERTION LOSS	5 dB line-to-line	
LOOP LIMITS	<b>WIRE GAUGE</b>	<b>DISTANCE</b>
	22	6000 feet (1830 m)
	24	3700 feet (1150 m)
	26	2300 feet (675 m)
	<b>Note:</b> Under certain conditions the loop limits may be extended to 8000 feet (2450 m). see 553-2YY1-210.	
SIGNALING PAIR		

### 3-2 Circuit Characteristics

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Mode	Diphase
Rate	2.37K bit/s
Level	0.75 $\pm$ 0.05 V peak-to-peak across the line.

**Table 3-A Continued**  
**Circuit characteristics of the line pack**

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<b>CHARACTERISTICS</b>	<b>AS RELATED TO THE CIRCUIT PACK</b>
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AUDIO PAIR

Mode	Analog (audio)
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PHANTOMED POWER 30  $\pm$ 1 V divided as:

Audio Pair level	+15 $\pm$ 0.05 V
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Signaling Pair Level	-15 $\pm$ 0.05 V
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POWER INPUT FROM SHELF +6, -6, +2.5 V.

BACKPLANE 30 V dc balanced

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## Operation with SL-1 Set

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### Idle circuit states

**4.01 SL-1 Set On-Hook.** Multiplex control generates and sends scan message to SL-1 set (2.5 ms message every 10 ms). Message is sent via the signaling pair and hybrid transformer (Fig. 4-1).

- (1) Message detected by Scan and Signal Distributor (SSD). (See Fig. 4-2 and 4-3.)
- (2) No message is being sent to line circuit on signaling pair.
- (3) In time slot 0, CE scans each line circuit on loop in sequence, detecting any change in signaling on the data input bus.
- (4) Line circuit 0 is enabled in time slot 0. Signaling on data output bus indicates that CE is ready to receive data.
- (5) No message on data input bus to CE indicates line circuit 0 is idle.

### Call originated from an SL-1 set

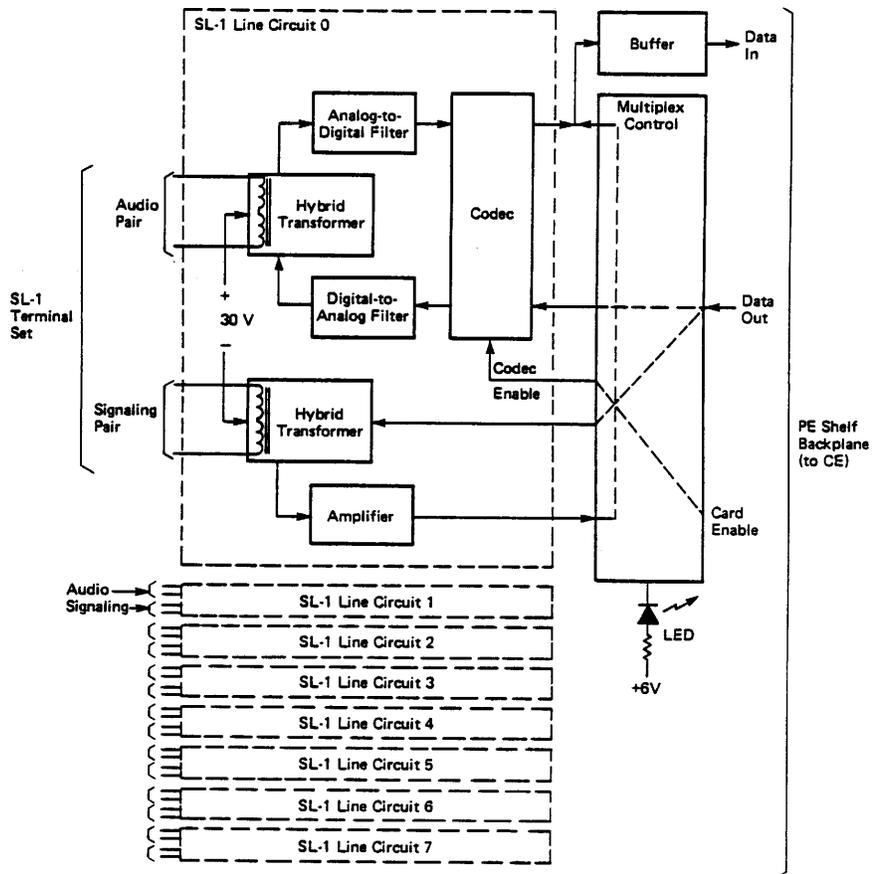
**4.02 Originating the Call.** SL-1 is off-hook (key operated). Off-hook is detected by SSD in SL-1 set.

- (1) SSD sends off-hook signaling to line circuit on signaling pair at 2.73K bit/s when scanned by message from multiplex control.
- (2) Off-hook message from line circuit 0 is multiplexed with messages from other line circuits and sent at a rate of 64K bit/s to the CE.

#### 4-2 Operation with SL-1 Set

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- (3) CE line scan detects change in signaling for line circuit 0.
- (4) CE line scan stops.
- (5) For the next 31 times, time slot 0 signaling message is sent to CE on data input bus from line circuit 0, then line scan continues.
- (6) CE detects signaling from line circuit 0 and determines circuit number (TN number).
- (7) CE assigns message time slot to line circuit from time slots 2 through 31.
- (8) Signaling from CE is applied to the SL-1 set or console on signaling pair. Rate is changed from 64K bit/s to 2.37K bit/s by multiplex control.
- (9) Signaling is detected by SSE.
- (10) SL-1 set directory number lamp is lit.
- (11) PCM codec is enabled during message time slot assigned by CE.
- (12) Dial tone on the data output bus is applied to SL-1 set via multiplex control, PCM codec, digital-to-analog filter, hybrid transformer and audio pair (during message time slot).
- (13) Dialed information from SL-1 set on signaling pair is applied to the data input bus during time slot 0 (signaling).
- (14) CE detects dialing and removes dial tone at start of dialing.
- (15) CE encodes dialed information.
- (16) Ringback tone on the data output bus is applied to SL-1 set over audio pair during message time slot assigned by CE (busy tone received if called number is busy).



**Figure 4-1**  
**Simplified Functional Block Diagram of Line Circuit Pack**

4-4 Operation with SL-1 Set

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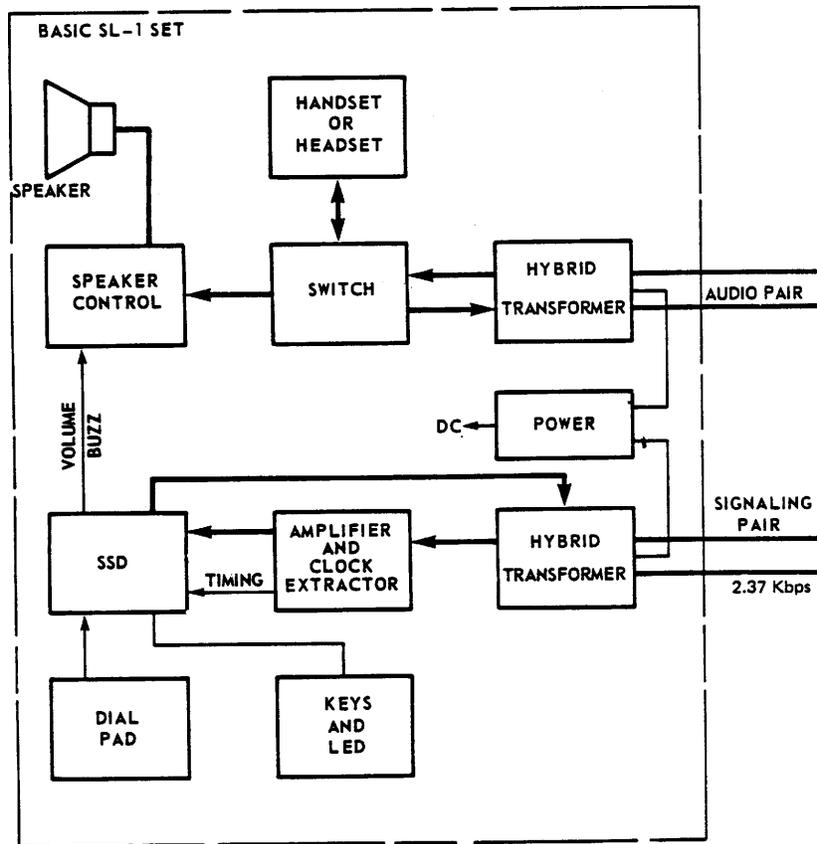


Figure 4-2  
SL-1 Line Circuit Connected to Basic SL-1 Set

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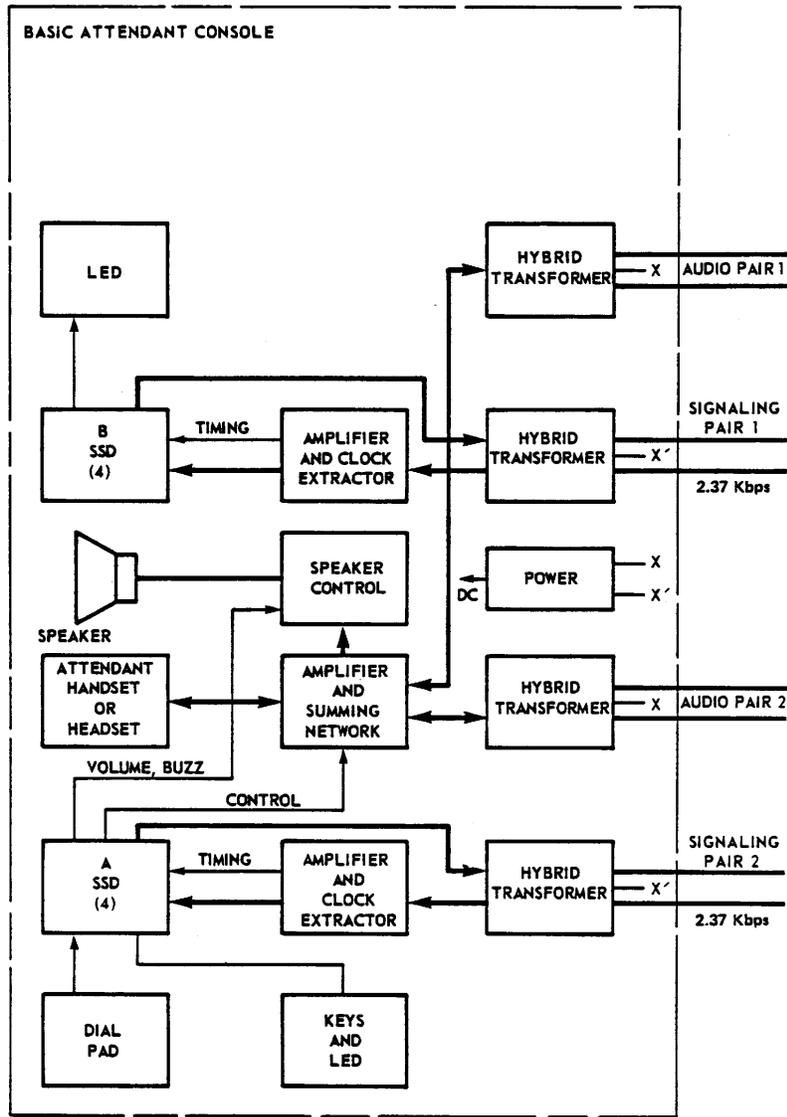


Figure 4-3  
Console Line Circuit Connected to Basic Attendant Console

**4.03 Talking Connection.** Called number answers.

- (1) Ringback tone is removed by CE.
- (2) Digital voice on data output bus is applied to SL-1 set via multiplex control. PCM codec, digital-to-analog filter, hybrid transformer and audio pair during message time slot.
- (3) Analog voice on audio pair from SL-1 set is applied to data input bus via hybrid transformer, analog-to-digital filter, PCM codec, multiplex control, and buffer (during time slot).

**4.04 Terminating the Call.** Assume SL-1 set goes on-hook first.

- (1) On-hook message is transmitted from set to line circuit.
- (2) Signaling on data output bus changes; SL-1 set lamp extinguishes.
- (3) ADD inputs removed (no signaling for line circuit 0).
- (4) Line circuit enable inputs are removed. (message time slot is no longer assigned to line circuit).
- (5) Circuitry in IDLE condition, ready for next call.

## Call to SL-1 set

**4.05 Signaling to the Terminal.** In time slot 0, CE scans each line on the loop in sequence

- (1) CE has call for line circuit 0.
- (2) CE determines line circuit 0 is idle (no signaling from circuit on data input bus during time slot 0).
- (3) CE assigns message time slot for audible signaling (from time slots 1 through 31).
- (4) Line circuit is enabled during time slot 0.

- (5) Visual signaling data on data output bus during time slot 0 is applied to multiplex control. Visual signaling data is applied to SL-1 set over signaling pair.
- (6) Signaling is detected by SSD (Line lamp of SL-1 set flashes).
- (7) PCM codec is enabled during message time slot.
- (8) Audible signaling applied to SL-1 set via digital-to-analog filter, hybrid transformer and audio pair.
- (9) SL-1 set signaled audibly (tone ringing).

**4.06 Terminal Answers.** SSD in SL-1 set sends off-hook signaling to line circuit on signaling pair.

- (1) Off-hook signaling data on data input bus during time slot 0 (via multiplex control and buffer).
- (2) CE detects signaling.
- (3) CE changes visual signaling on data output bus during time slot 0. Visual signaling is applied to SL-1 set on signaling pair. Line lamp of SL-1 set changes from flashing to steady light.
- (4) CE removes audible signaling from data output bus during message time slot (message time slot now assigned for voice communications).
- (5) Audible signaling at SL-1 set stops.

**4.07 Talking Connection.** PCM codec is enabled during message time slot.

- (1) Digital voice on data output bus is applied to SL-1 set via multiplex control. PCM codec, digital-to-analog filter, hybrid transformer, and audio pair.
- (2) Analog voice from SL-1 set is applied to data input bus via audio pair, hybrid transformer, analog-to-digital filter, PCM codec, multiplex control, and buffer.

**4.08 Terminating the Call.** Assume SL-1 set is put on-hook first.

- (1) SSD transmits on-hook message to line circuit.
- (2) On-hook message transmitted to CE through data input bus during time slot 0 at a rate of 64K bit/s.
- (3) CE detects a change in signaling.
- (4) Signaling on data output bus changes: SL-1 set line lamp extinguishes.
- (5) ADD inputs are removed (no signaling for line circuit 0).
- (6) Enable inputs are removed (message time slot no longer is assigned to line circuit 0).
- (7) Circuitry in IDLE condition; ready for next call.

## Class-of-service and features

**4.09** All calls originating from and terminating on stations connected to line and trunk circuits may be controlled with or without attendant assistance. Call restrictions to the exchange network and special services, are assigned through unique station/line circuit data blocks contained in the system memory. Similarly, feature assignments are arranged through the same data blocks. Refer to 553-2YY1-105 for a complete list and description of features and services. Refer to 553-2YY1-310 for a description of how features and services are created in the system memory.

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## Design Considerations

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### Foreign and surge voltage protection

**5.01** When telephone lines connected to the line circuit are exposed to foreign voltages by direct contact or induction (e.g., power line crosses or lightning), protection devices must be installed on the customer's premises. These devices must be capable of providing a path to ground from tip to ring for foreign voltages that exceed 600 V peak.

### Overload level

**5.02** Signal levels exceeding +7 dBm applied to the tip and ring will cause distortion in the system.

INTEGRATED SERVICES NETWORK

## **Meridian SL-1**

SL-1 line and console line packs description  
and operation

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