

SUBSCRIBER LOOP CARRIER 1 (SLC*-1) SYSTEM GENERAL DESCRIPTION

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B. Scattered Applications	4	1.02 This section is reissued to include information about two new SLC-1 features:	
C. Clustered Applications	4	(1) A new outdoor subscriber unit (NT12B) that replaces the (NT12) unit which is manufacture discontinued (Mfr Disc.).	
4. EQUIPMENT AND APPARATUS DESCRIPTION	5	(2) A new adapter (293A) provides remote power at the subscriber terminal.	
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B. Subscriber Equipment	5	1.03 The SLC-1 System is a solid-state analog carrier system that derives an additional telephone circuit (derived line) from an existing VF circuit (physical line). Bidirectional transmission is achieved by using a different carrier frequency for each direction of transmission.	
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and station transfers (LST) or defective pair recovery, and in areas where the placement of additional cable is impractical to prevent unreasonable delay of customer service.♦

Note: Improper use of single-channel carrier systems in the past, due to inadequate engineering or administrative guidelines, has resulted in impaired service. See Section 902-219-100 for application guidelines.

2. SYSTEM DESCRIPTION

A. Configuration

2.01 Figure 1 depicts the basic system, composed of the following four components:

- (1) Central Office Unit (COU) NS1 Circuit Pack—Provides the interface between the physical and derived central office (CO) line equipment and the cable pair. Optional PN1 and PN2 circuit packs provide the same functions and are compatible with Reliance AML* and Seiscor SSC-1 shelves.
- (2) SLC-1 System Main Frame Terminal Block—Provides a termination field for the physical and derived line equipment and the cable pair.
- (3) 1119A Filter—Provides isolation of carrier frequencies from the physical subset.
- (4) Subscriber Unit (SU) NT1, NT2, or NT12B Circuit Pack—Provides the interface between the derived customer subset and the cable pair.

B. Characteristics

2.02 System range is limited by a maximum insertion loss of 53 dB at 76 kHz, including the effects of bridged taps. This loss allows operation on all nonloaded (less than 18 kilofeet) resistance design loops of less than 1300 ohms and without bridged taps.

2.03 The maximum length of the subscriber VF drop is 50 ohms. This corresponds to about 1000 feet of 24-gauge station wire or 600 feet of 26-gauge wire.

*Registered trademark of Reliance Telcom.

2.04 Standard bridged ringing configurations can be used. On the derived line, three standard bridged 20-Hz ringers are allowed, including those in 500-type, PRINCESS†, and TRIMLINE‡ sets. Four ringers can be used if all are adjusted to the weak notch.

2.05 The system is compatible with TOUCH-TONE§, rotary, and automatic dial subsets. It is also compatible with data terminals operating at 4800 bits per second or less, ie, data sets using Type I, II, or III data. The SLC-1 System cannot be used for PBX trunks, tie lines, foreign-exchange WATS service, coin service, or any system requiring ground-start circuitry.

2.06 The NT1 SU circuit pack is not compatible with ESS COs. It will cause an automatic line insulation test (ALIT) failure on the physical line and will limit testing from the Repair Service Bureau.

2.07 The NT2 and NT12 (to be Mfr Disc.) circuit packs contain additional circuitry to allow operation with ESS COs, ALIT, and Repair Service Bureau testing. The NT2 and NT12 also provide twice the battery charging current of the NT1.

2.08 ♦The NT12B circuit pack provides the same functions as the NT12 circuit pack. The NT12B is identical in appearance, installation, and application to the manufacture discontinued (Mfr Disc.) NT12. The NT12B has improved low-temperature performance.♦

2.09 The NT1 and NT2 circuit packs must be installed indoors. The NT12B circuit pack provides the same functions as the NT2 but can be mounted outdoors.

2.10 The SLC-1 System is compatible with T1 carrier if used in pulp cables. The SLC-1 equipment is compatible with T1 carrier in PIC cable units which are nonadjacent to units containing more than ten T1 carrier lines. SLC-1 systems may be used in PIC cable units which are adjacent to units containing no more than ten T1 carrier

†Registered trademark of AT&T.

‡Registered trademark of AT&T.

§Registered service mark of AT&T.

lines. The SLC-1 System should not be installed with T1 carrier in the same PIC unit.

2.11 The SLC-1 System is compatible with noncompandored, single-channel carrier systems if used in different 25-pair counts.

C. Installation

2.12 ♦The SLC-1 COU shelf (J98729B) may be mounted in any available and convenient 23-inch bay in the CO except within 4 feet of a D channel bank power supply (J86498A), dc-to-dc converters, or adjacent to switching equipment.♦

2.13 All external wiring connections are made to the rear of the shelf assembly. Wire-wrap terminals for connecting CO line equipment, the cable pair, physical disconnect pair (shown unused in Fig. 1), and the -48V power and ground are provided for each channel.

2.14 Each derived channel terminates in the SLC-1 terminal block at the horizontal main distributing frame (HMDF) to provide access for service connections and denials. Service denial on the physical line requires a disconnect strap (or equivalent cross-connections) at the HMDF to maintain battery and ground on the derived line.

2.15 The SU is installed by mounting the unit on the customer premises and connecting it to the subscriber loop. The associated 1119A filter is installed in series with each physical circuit line drop.

2.16 The 158A test set, shown in Fig. 2, is used for go-no-go testing during SU installation. It provides the following test capabilities:

- (1) Transmit 28 kHz and measure the returned 76-kHz level.
- (2) Test for battery and ground.
- (3) Check SLC-1 battery voltage.
- (4) Check the SU battery charger operation.

This set also can be used for maintenance.

D. Maintenance

2.17 The SLC-1 System requires no external or internal adjustments during installation or operation. Most electronic troubles in the system can be corrected by replacing the defective COU, SU, or battery.

2.18 Replacement units, extra batteries, and charging equipment will be required at the garage to provide adequate troubleshooting. The 1A battery charger, shown in Fig. 3, is available for charging up to ten batteries simultaneously.

3. APPLICATIONS

A. General

3.01 Single-channel subscriber carrier is a highly flexible means of providing new service without additional cable pairs. Single-channel carrier can be used only for single-party residential service.

3.02 ♦Single-channel carrier should not be used without the 293A power adapter if high usage is expected to occur on either the derived or physical line, or both. High usage of either the derived or physical lines can deplete the battery for the derived line and interrupt service unless the remote powering feature is used in conjunction with the subscriber unit.

Note: The 293A power adapter will not operate properly with a transformer (2012A) used for dial lights. Separate transformers must be used to provide proper voltage to the 293A adapter.♦

3.03 The SLC-1 System can be used with automatic dial, rotary dial, or TOUCH-TONE service and is compatible with ESS, crossbar, step-by-step, and panel CO equipment. It is also compatible with data terminals operating at 4800 bits per second or less (Type I, II, or III data.). It cannot be used with range extenders or with open or rural wire.

3.04 Once the CO shelves have been installed, SUs can be used anywhere in the outside plant network, ***provided the transmission limits explained in Section 902-219-100 are met.*** Single-channel subscriber carrier should be restricted to locations where little or no cable rearrangement is required. Special line treatment

in the form of removing bridged taps may be warranted where clustered use is proposed, especially if the result is general plant improvement.

3.05 Single-channel carrier systems have the physical subscriber service on the physical pair up to the line side of the SU. Therefore, any telephone connected to the line side of the SU will appear on the physical subscriber service. Consequently, when the SU is used to provide service to a second subscriber, special precautions should be observed to prevent inadvertent or unauthorized connections to the physical line at the derived subscriber premises.

1. Where possible, the station protector and the SU should be installed close to each other. If this is not possible, special markers or a locally-provided tag should be used at the protector to identify a carrier line termination. This is to make the craftspeople aware of the carrier-derived service on subsequent visits.
2. Wiring between the station protector and the inside-mounted SU must be continuous with no intermediate connecting blocks.
3. All derived subscriber station sets must be bridged to the STA side of the SU. Installation craft should make call-back tests to verify any subsequent station set additions on the derived line service.

3.06 Applications of single-channel subscriber carrier can be divided roughly into three general areas:

- (1) Scattered at individual locations throughout the wire center area to provide service
- (2) Clustered at a single location to provide service at that location
- (3) Clustered at a single location to provide spare cable pairs for use in other locations.

The details of each of these applications are explained in paragraphs 3.07 through 3.10.

B. Scattered Applications

3.07 Scattered applications generally will result from a need to provide service where spare

physical facilities are not available. Such applications may not be part of a long-term plan, and economic considerations generally will be subordinated to the need for service. Typical situations where scattered applications are useful are:

- (a) Normal cable monitoring procedures have failed to discover a congested complement and a delayed order notification is received for the first time in a specific complement. Carrier permits the service to be connected immediately, thereby providing time for study and permanent relief.
- (b) Permanent relief orders have been issued but are not completed.
- (c) Budget restrictions, manpower shortages, or material shortages delay the completion of normal relief projects.
- (d) An area is in transition from single residential to multifamily units. Carrier will provide time to more accurately assess the extent and speed of transition and to provide rehabilitation, if necessary.
- (e) The demand is uncertain, as in new residential areas where ultimate plans are not available, or where it may fluctuate unpredictably, such as in marinas or universities. Caution must be used in applying carrier to meet short-term nonresidential demand in that these are frequently high-usage customers, and the possibility of service interruption due to battery failure must be considered.
- (f) Small relief jobs or rearrangements are to be followed by an estimate. These jobs can be eliminated by using carrier, allowing all the work to be done in conjunction with the estimate. This will save splicing time and eliminate the complications associated with many small changes.

C. Clustered Applications

General

3.08 The use of carrier in the situations described above is not limited to the scattered application. If at all possible, it is very desirable to use the clustered application. The advantage of clustering is a saving of plant installation time.

Clustered to Provide Service

3.09 Single-channel subscriber carrier can be used in clusters to meet pair shortages at a single location, such as an apartment complex with insufficient physical facilities. Enough carrier units should be provided on the initial installation so that sufficient physical and derived lines are available to serve the immediate demand.

Clustered to Provide Facilities

3.10 Single-channel subscriber carrier also can be clustered to release physical pairs for use elsewhere. The carrier equipment is installed at a convenient location where physical facilities are rewired to become derived circuits, making physical pairs available at other locations.

4. EQUIPMENT AND APPARATUS DESCRIPTION

4.01 The SLC-1 System consists of two main groupings of equipment and apparatus: (a) CO, and (b) subscriber.

A. Central Office Equipment

4.02 The CO grouping consists of the rack-mounted CO shelf (J98729B) and the COUs (NS1 circuit packs), shown in Fig. 4 and 5. The J98729B shelf mounts in a standard 23-inch equipment rack. Each shelf accepts up to 12 NS1 circuit packs (COUs). The shelf is a 2-piece metal stamping with the wiring field at the rear. The NS1 circuit pack is a printed wire product assembly. All components for each COU are located on individual plug-in circuit packs.

4.03 The PN1 and PN2 circuit packs (Fig. 6), which plug into existing AML or Seiscor SSC-1 shelves, are available as part of the SLC-1 System. The PN1 circuit pack uses circuitry identical to the NS1, except for the addition of a physical disconnect switch mounted on the unit, similar to the AML units. The PN1 should be used only with SLC-1 SUs. It should not be paired with AML, Seiscor, or other general trade SUs.

4.04 The PN2 circuit pack is used *only* if the PN1 physical disconnect switch is not to be used. The PN2 circuit pack is used in AML or Seiscor shelves, with up to 11 PN1 circuit packs to provide an alternate physical disconnect arrangement

whereby power to the derived line is maintained by main distributing frame (MDF) cross-connections.

B. Subscriber Equipment

4.05 The subscriber grouping, Fig. 7 through 10, consists of the NT1, NT2, or NT12B circuit pack with internal battery at the derived customer premises and an external filter at the physical customer drop. The NT1 and NT2 circuit packs mount on a metal baseplate and are enclosed by a molded plastic cover that is designed for indoor mounting only. The NT12B circuit pack is enclosed in a molded plastic weatherproof housing that slides onto a metal backplate. The 1119A filter is an indoor/outdoor-mounted unit enclosed in a plastic housing. ♦The 293A adapter mounts near the SU and can be used indoors or outdoors.♦

4.06 Two isolation filter mounting kits (Fig. 11) are available for providing increased mounting flexibility. Kit AT-8853B contains a magnetic plate used for attaching the filter to any convenient iron or steel surface in a pedestal. Kit AT-8853C contains a slotted plate which attaches to the filter and slides behind a protector or NT12B SU, thereby avoiding the need to drill additional mounting holes.

5. EQUIPMENT OPERATION

5.01 A brief description of the COU and SU is provided in paragraphs 5.02 through 5.11 to aid personnel interested in the basic system operation and its technical features.

A. Central Office Unit

5.02 The COU NS1 or PN1 circuit pack contains the complete circuitry for transmission and reception of carrier-derived voice signals as well as associated signaling and supervisory information. Transmission is via an amplitude-modulated, double-sidedband, transmitted-carrier system operating at 76 kHz in the COU-to-SU direction and 28 kHz in the SU-to-COU direction. The block diagram for the NS1 circuit pack is shown in Fig. 12.

5.03 When the subscriber subset is on-hook and no ringing is being supplied to the COU by the CO equipment, the SLC-1 System is idle. No carrier frequencies are being transmitted and the receivers are operating on standby.

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5.04 The COU call start is initiated when ringing is applied to the control module ring detector. The control module then keys the transmitter at a 20-Hz ringing rate. Thus, the ringing signal is transmitted to the SU by modulating the 76-kHz carrier.

5.05 When the derived party answers, 28 kHz is transmitted from the SU to the COU receiver, which generates the carrier detect signal. The control module then activates the 76-kHz transmitter, the compressor, and the loop closure relay. At this point, the COU is ready for VF communication. The VF input from the line equipment is applied through the voice hybrid to the compressor, which provides the compressed audio to modulate the COU transmitter. A compandor is used in the CO-to-subscriber direction to improve noise, interface, and crosstalk margins.

5.06 On SU-initiated calls, 28 kHz is transmitted from the SU. The COU detects the presence of the incoming 28-kHz carrier and activates the loop relay to the CO equipment. It also activates the compressor and the 76-kHz transmitter. The detected dial pulse information is sent through to the CO line equipment by activating and releasing the loop closure relay.

B. Subscriber Unit

5.07 The SU NT1, NT2, or NT12B circuit pack transmission circuitry is similar to that of the COU with the transmit and receive frequencies interchanged. Figure 13 is a block diagram of the SU. In the SU, the transmitted level of the 28-kHz carrier is regulated automatically by the received 76-kHz carrier level. Thus, if the system is installed in a short loop, the level of the 28-kHz carrier is lowered automatically. This improves the crosstalk interference in the SU-to-COU direction of transmission.

5.08 When the subscriber subset goes off-hook, the off-hook detector causes the control module to switch the battery supply to the expander, the transmitter, and the audio portion of the receiver. Steady-state 28-kHz carrier then is transmitted to the COU. At the COU, the received carrier is detected and the COU control module closes the loop relay to the CO equipment and activates the 76-kHz transmitter.

5.09 During dialing, the 28-kHz carrier is keyed at the 10-pps dial rate and transmitted to the COU. The COU receiver detects the pulsed 28-kHz incoming carrier and the dialing information is routed to the CO equipment through the loop relay.

5.10 When the SU subset is on-hook and a ringing signal is transmitted to the subscriber, the SU ring detector triggers the ringing generator, which causes the bell to ring.

5.11 On call completion, the SU control module removes power from the transmitter, the expander, and the audio portion of the receiver. The battery charger remains on the line to maintain a trickle-charge to the nickel cadmium battery.

C. System Power Arrangement

5.12 The SLC-1 COU is powered locally from the normal -48V CO battery. This voltage is supplied through a dropping resistor to a power regulation and control circuit on each channel card.

5.13 The SU contains a rechargeable KS20390,L6 nickel cadmium battery providing a 250 mA-hour capacity. Recharge current is supplied from the physical line talking battery to trickle-charge the battery when both physical and derived circuits are idle. During talking conditions, the SU operates from the internal 7.8V dc battery. Complete SU recharge time for the battery is about 48 hours for NT1 and 24 hours for NT2 and NT12B (± 50 percent, depending on the type of CO line equipment and cable resistance). A fully-charged battery provides approximately 6 hours of continuous talking capability.

5.14 ♦The 293A adapter with the associated 2012A transformer provides for remote powering at the SU. When the 293A adapter is used with a subscriber unit, the off-hook hours are increased to 12 to 15 hours per day.♦

5.15 Battery and ground connections are provided by the physical disconnect lugs at the SLC-1 terminal block on the HMDF. These connections are used via a disconnect strap to maintain power to the derived line when the physical line is disconnected.

6. SPECIFICATION SUMMARY**A. Carrier-Frequency Transmission**

- (a) COU-to-SU Frequency: 76 kHz.
- (b) SU-to-COU Frequency: 28 kHz.
- (c) Transit level: COU: +6 dBm into 128 ohms
SU: 0 to -30 dBm into 128 ohms.
- (d) Maximum System Loss: 53 dB at 76 kHz.

B. Derived Channel Voice-Frequency Transmission

- (a) Carrier Channel VF Response: 300 to 3000 Hz +1, -3 dB (referenced to 1000 Hz).
- (b) Nominal Channel Loss (1 kHz ref.): COU to Station: 4dB
Station to COU: 3.5 dB.
- (c) Channel Regulation: ± 2 dB under all conditions, nominally less than ± 1 dB.
- (d) Idle Channel Noise: COU to Station: Compandored to less than 10 dBrnC
Station to COU: Less than 20 dBrnC.
- (e) Longitudinal Balance: Greater than 55 dB.
- (f) Loop Current: Greater than or equal to 20 mA for 200-ohm set.
- (g) CO Return Loss: Echo: 18 dB referenced to 900 ohms to 2 μ F (900-ohm SU termination)
Singing: 10 dB referenced to 900 ohms and 2 μ F.

C. Signaling and Supervision

- (a) Dial Pulsing: Rotary or automatic dial, 10 pps, all types.
- (b) TOUCH-TONE: Manual or automatic.
- (c) Signaling Distortion: Less than 7 percent, physical or carrier.
- (d) Number of Ringers: Up to three high-impedance, straight-line ringers in strong notch; four in weak notch.

(e) On-Hook Impedance: With the station on-hook, the CO will see a dc resistance greater than 3 megohms.

(f) Off-Hook Impedance: With the station off-hook, the CO will see a dc resistance of 1000 ohms.

(g) CO Compatibility: NT1—All offices except ESS
NT2, NT12B—All offices.

(h) Maximum Subscriber Drop: 50 ohms (provides 20 mA for 200-ohm set).

D. Environmental Limits**(a) COU:**

1. Operating Temperature: CO ambient temperature range: +32°F (0°C) to +122°F (50°C).
2. Operating Humidity: CO relative humidity: 10% to 90%.

(b) SU:**NT1 and NT2**

1. Operating Temperature: Ambient temperature surrounding unit: -20°F (-29°C) to +120°F (50°C).
2. Operating Humidity: Relative humidity surrounding unit: 5% to 100%.

NT12B

1. Operating Temperature: Outdoor ambient temperature surrounding unit: -40°F (-40°C) to +120°F (50°C)
2. The outdoor ambient temperature range for the NT12 is -30°F (36°C) to 120°F (50°C). Infrequent short duration excursions to 40°F (40°C) can be tolerated. Short durations is approximately defined as 1 to 2 hours at -40°F.
3. Operating Humidity: Outdoor relative humidity surrounding unit: 5% to 100%.

(c) Filter

1. Operating Temperature: Outdoor ambient temperature surrounding units: -40°F (-40°C) to +120°F (50°C).
2. Operating Humidity: Outdoor relative humidity surrounding unit: 5% to 100%.

E. Dimensions

(a) Shelf: Standard 23" rack mounting, 6.40" verticals, 12" deep

NS1: 9.75" × 5.00" × 1.50"
PN1: 6.35" × 5.00" × 1.40"
PN2: 6.35" × 5.00" × 1.20"

(b) SU—NT1, NT2: 6.50" × 5.50" × 2.50"

—NT12B: 10.00" × 5.60" 2.40"

(c) Filter: 3.25" × 1.75" 1.56"

F. Power

(a) COU: -48V dc at 50 mA/channel.

(b) SU: 7.8V dc, 250 mAh nickel cadmium battery (provides 6-hour continuous off-hook capability).

NT1: 5.5 mA charge current; 3 mA current drawn from physical line during idle conditions.

NT2, NT12B: 10 mA charge current; 3.7 mA current drawn from physical line during idle conditions.

(c) Filter: None required.

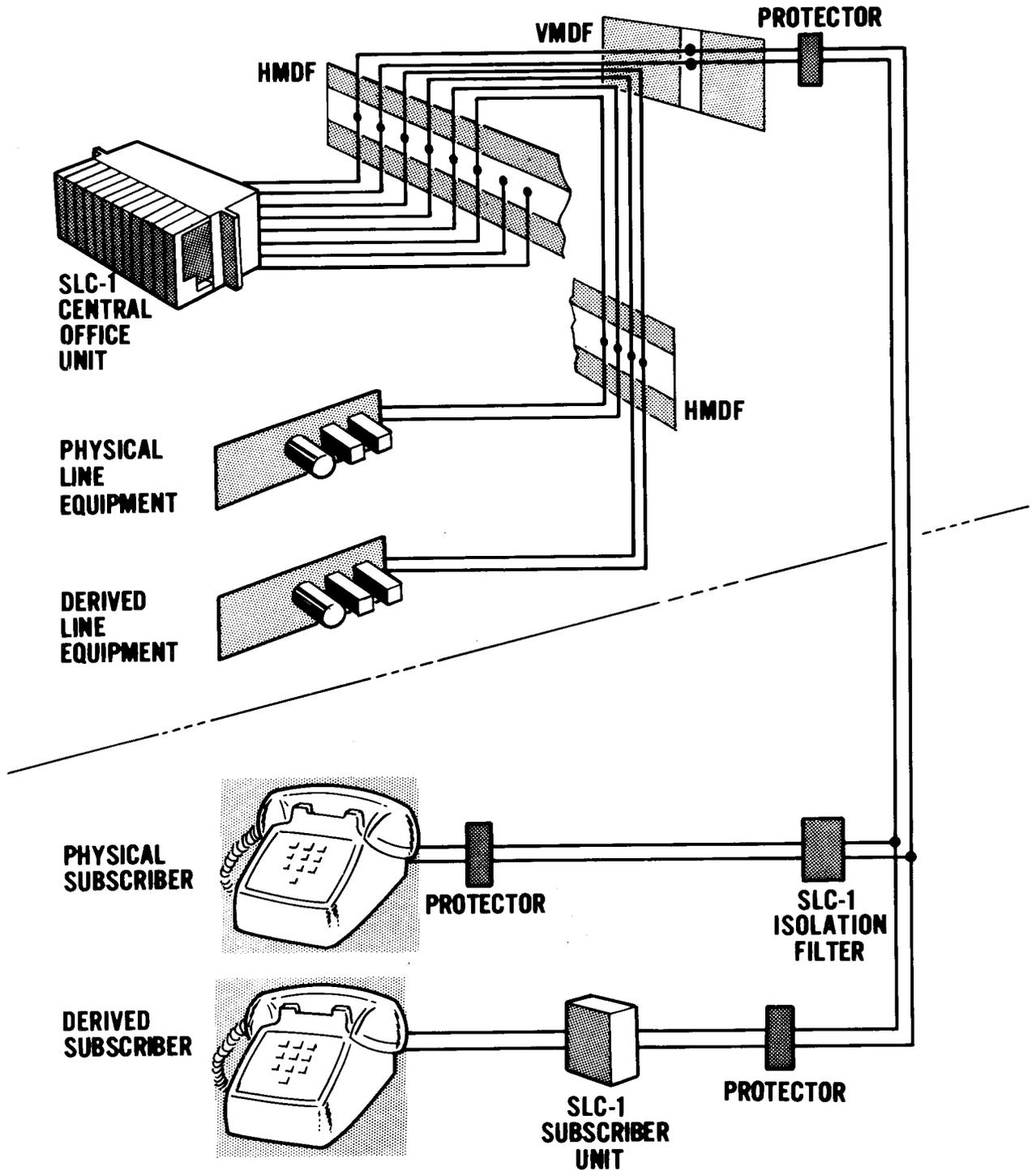


Fig. 1—Single-Channel Carrier System Concept



Fig. 2—158A Test Set

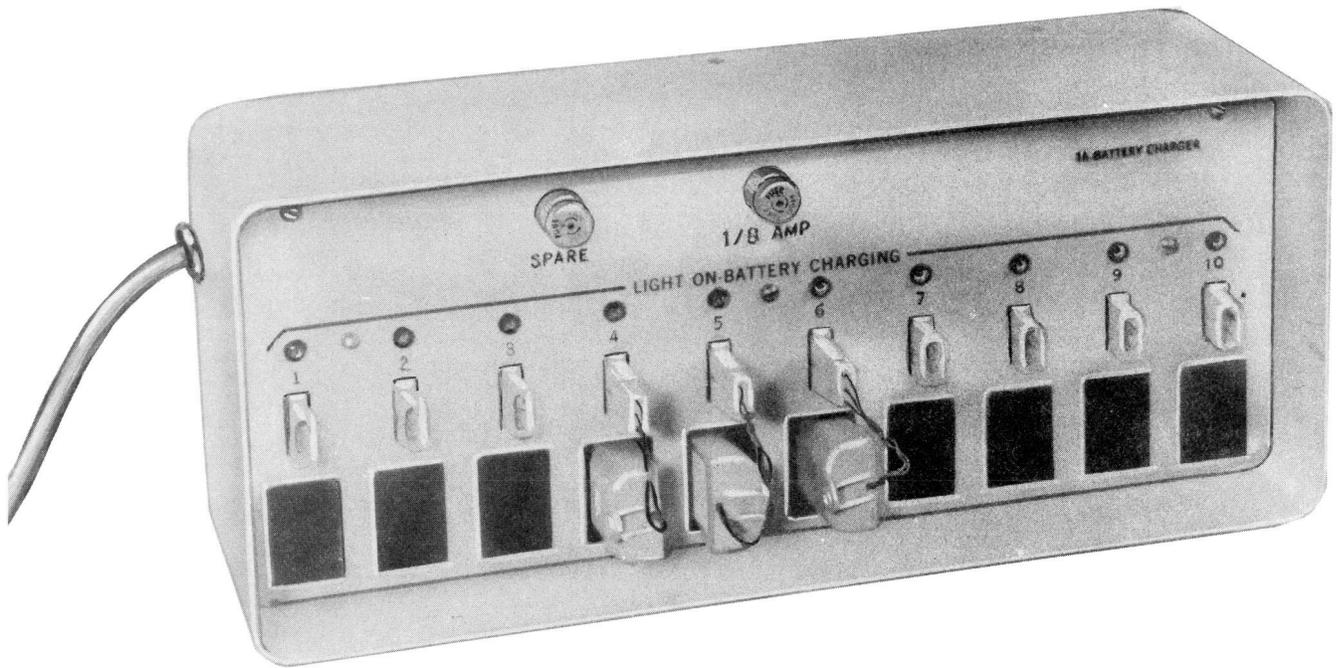


Fig. 3—1A Battery Charger

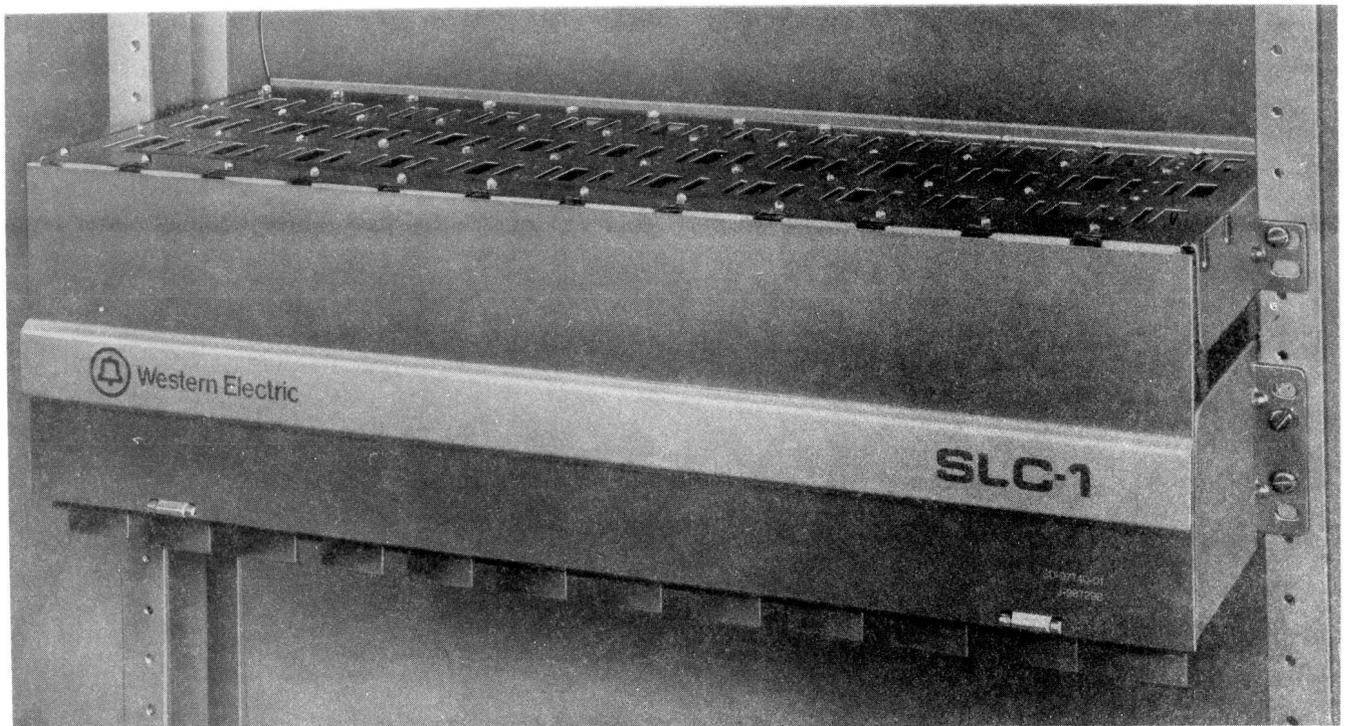


Fig. 4—J98729B Central Office Shelf

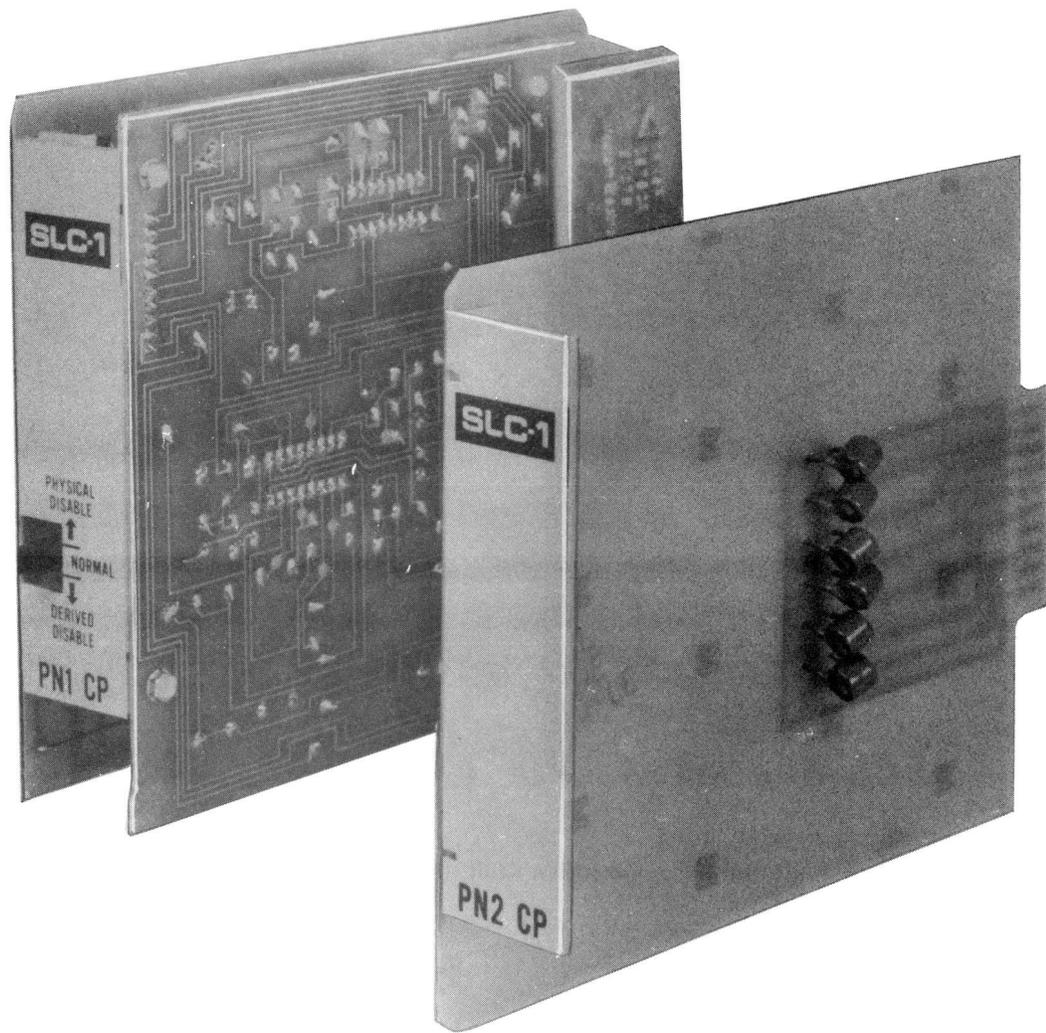
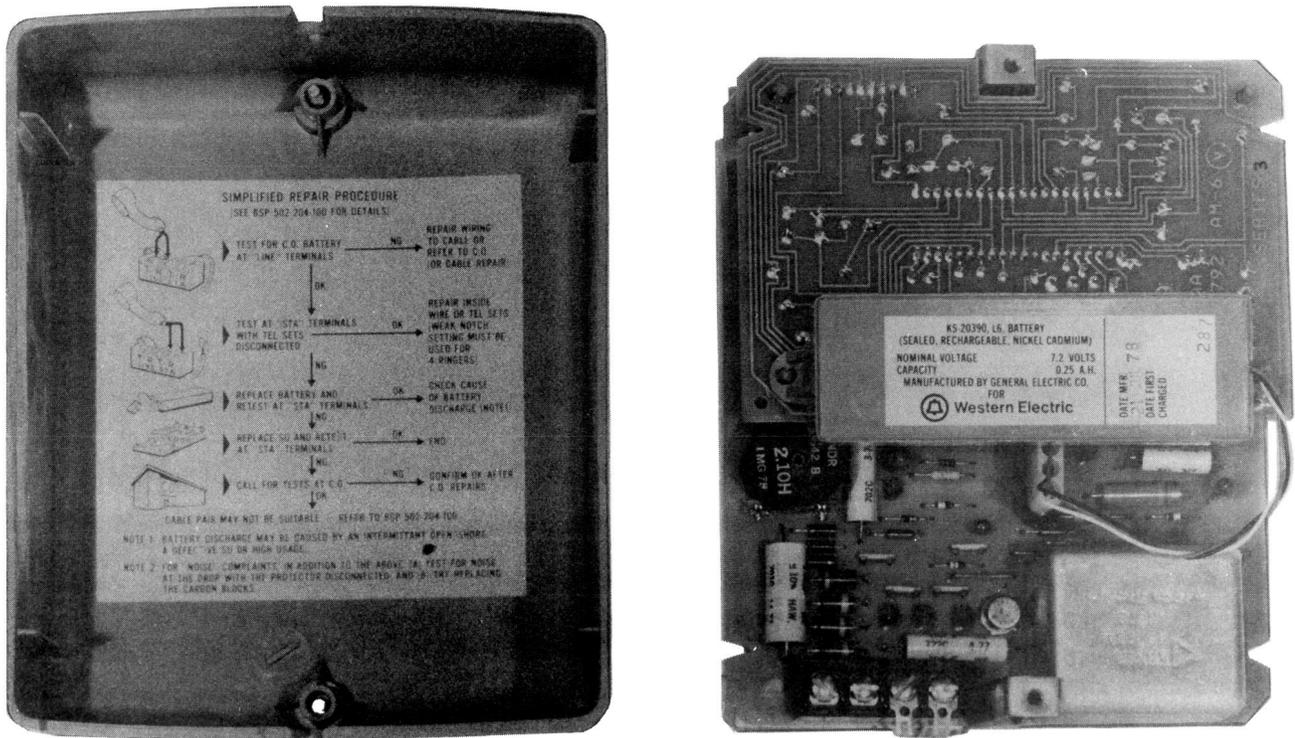


Fig. 6—PN1 and PN2 Circuit Packs



◆Fig. 7—Subscriber Unit (NT2 Shown)◆

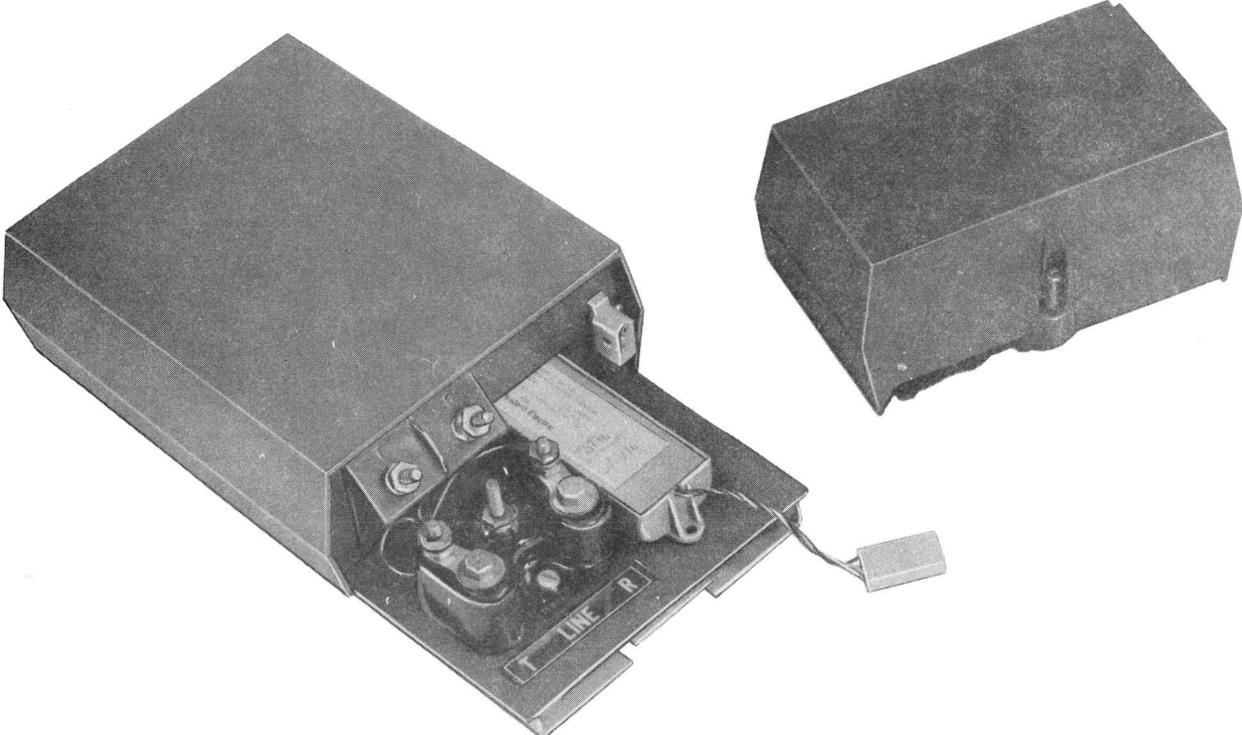
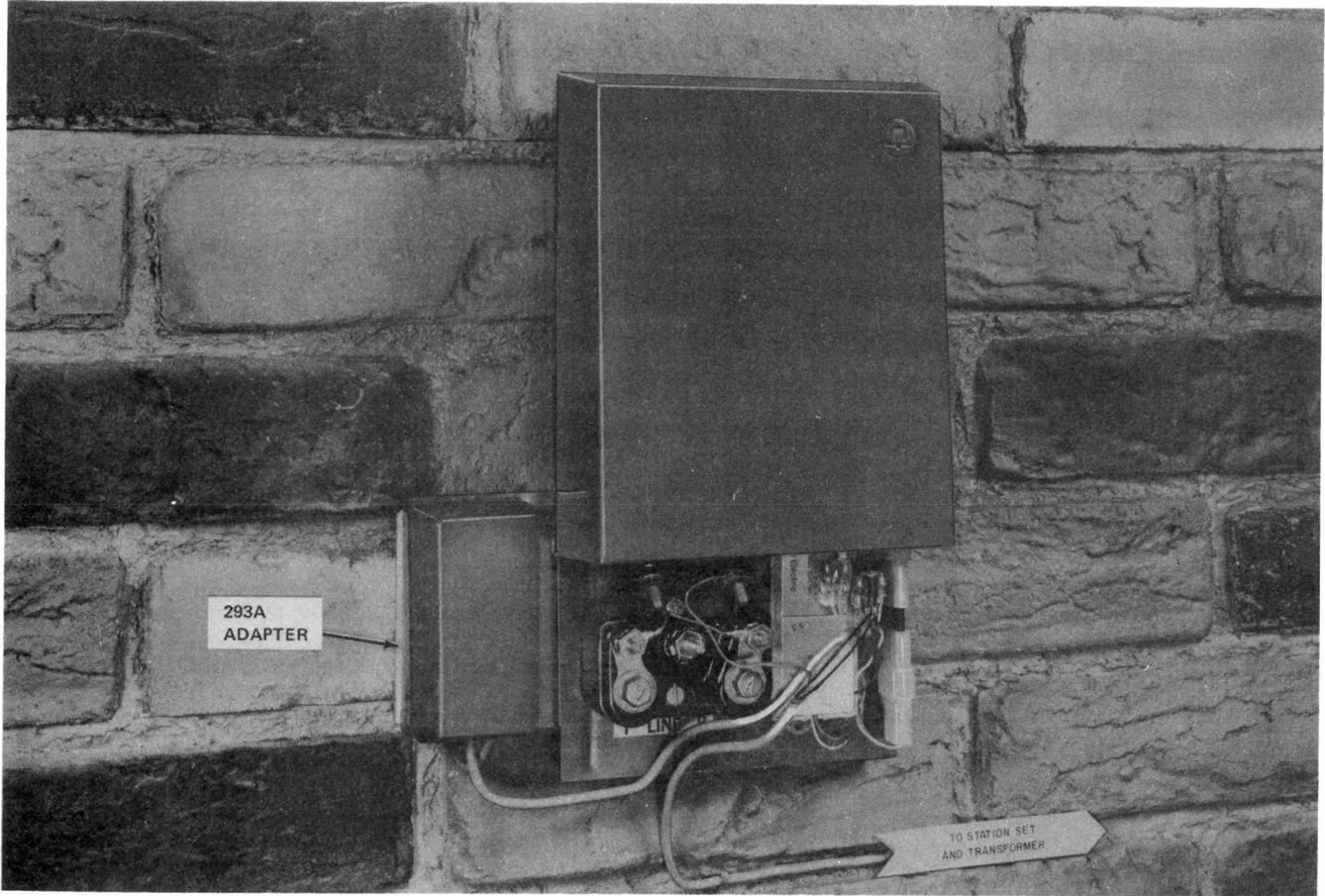


Fig. 8—NT12B Outdoor Subscriber Unit



◆Fig. 9—NT12B Outdoor Subscriber Unit With 293A Power Unit◆

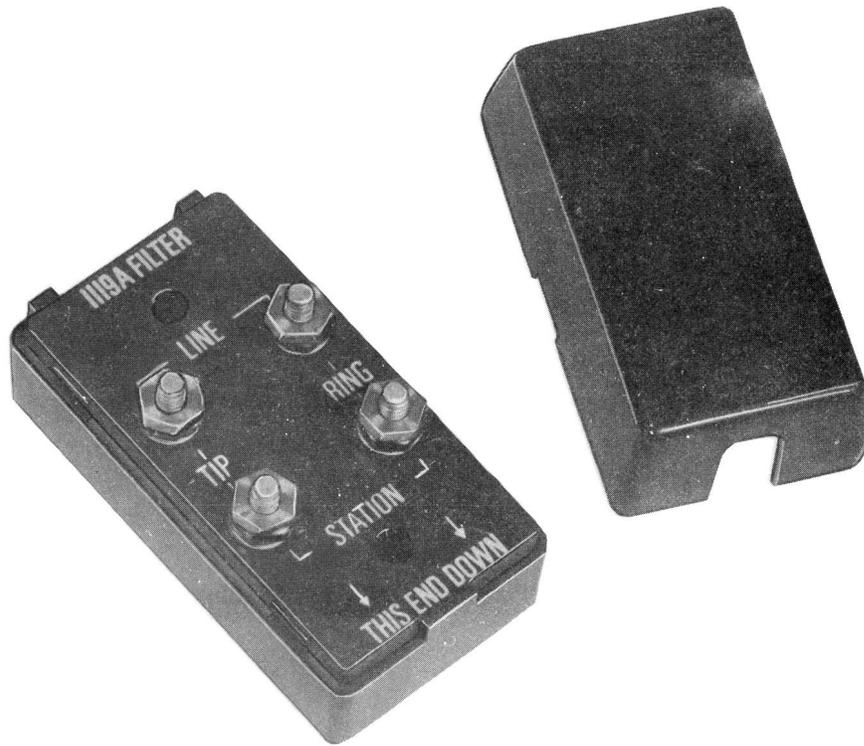
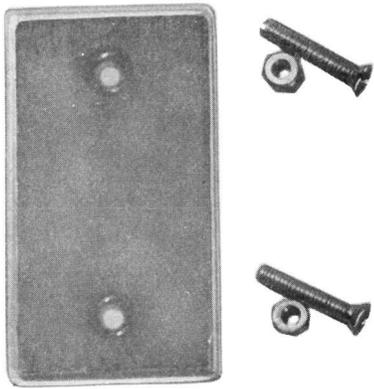
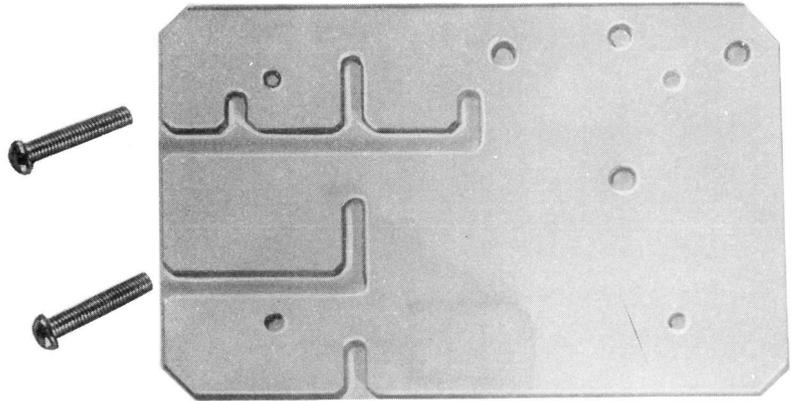


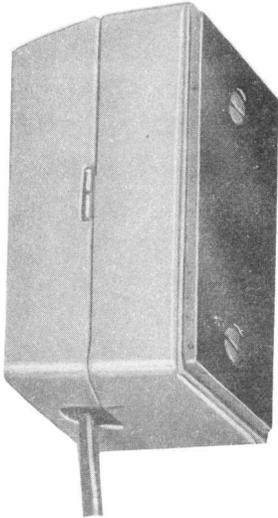
Fig. 10—1119A Isolation Filter



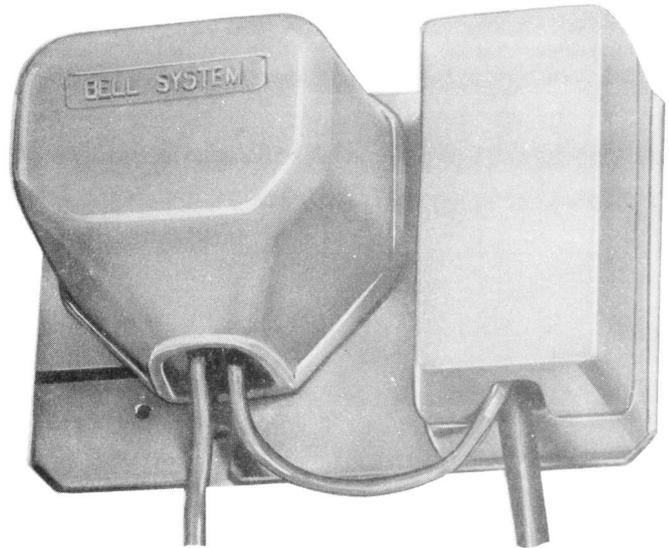
AT-8853 B MAGNET BRACKET KIT



AT-8853 C SLOTTED BRACKET KIT



AT-8853 B BRACKET ASSEMBLED



AT-8853 C BRACKET ASSEMBLED

Fig. 11—Filter Mounting Brackets (AT-8853B and AT-8853C)

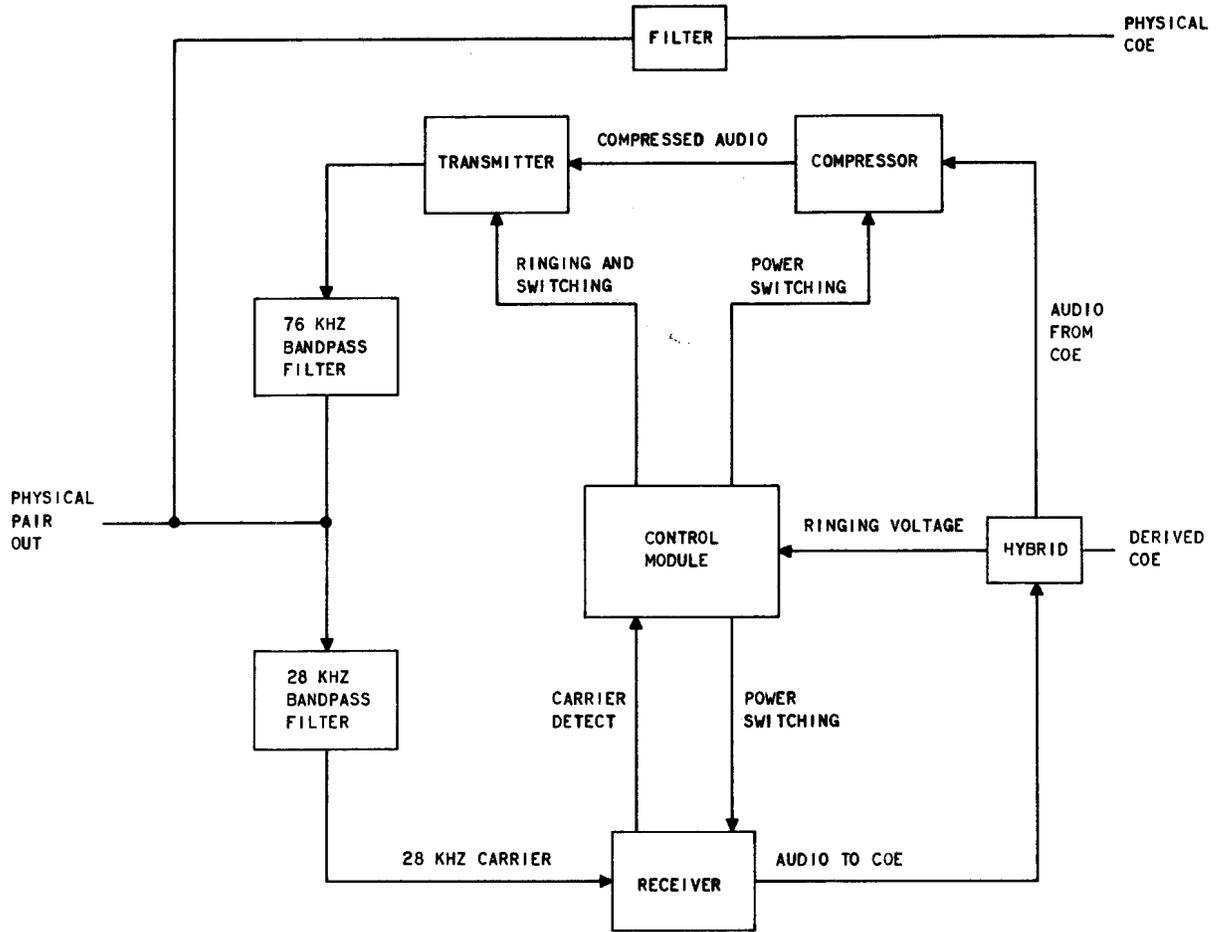


Fig. 12—NS1 Block Diagram

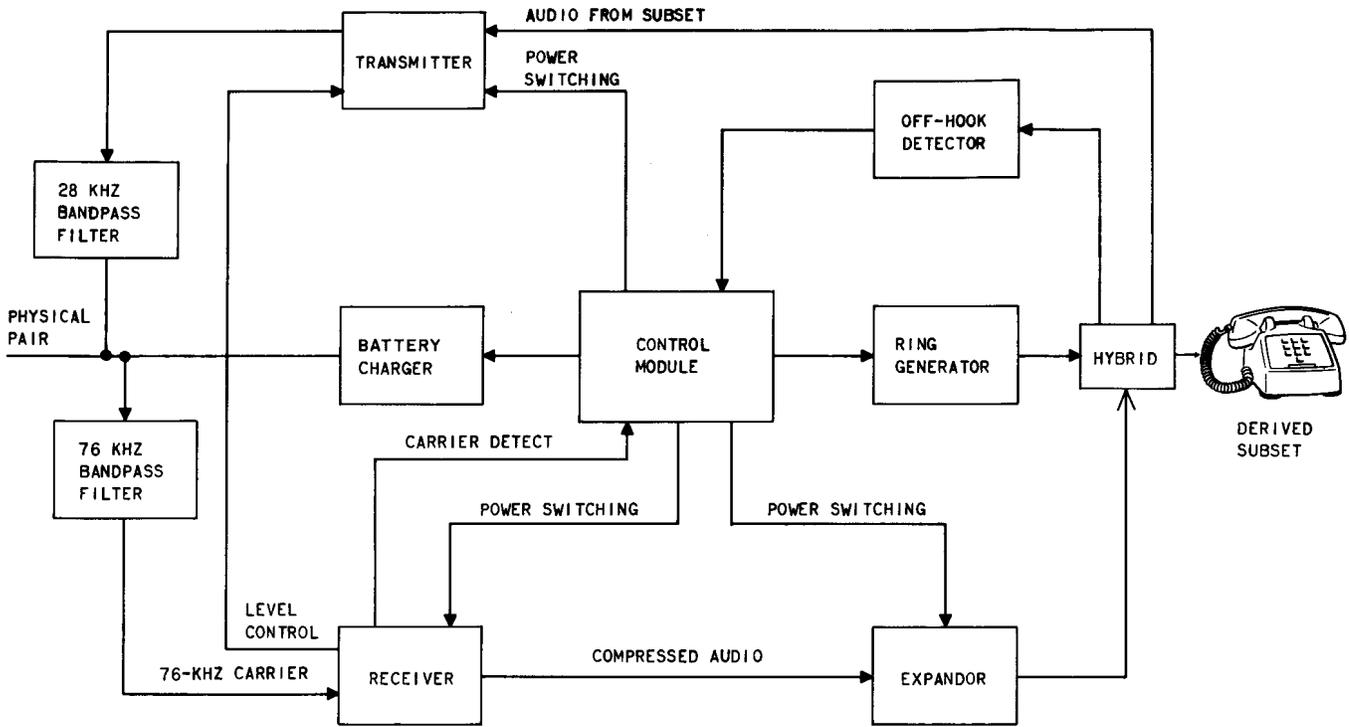


Fig. 13—NT1 Block Diagram