

AML

**ADDED MAIN LINE
SUBSCRIBER LINE CARRIER SYSTEM**

**INSTALLATION AND
MAINTENANCE PROCEDURES**

A Product of



**CONTINENTAL TELEPHONE
ELECTRONICS CORPORATION**

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TELEPHONE 214/328-8496

A Superior Continental Company

SUBSCRIBER LINE CARRIER SYSTEMS
ADDED MAIN LINE (AML) SYSTEM
DESCRIPTION AND INSTALLATION

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| | | |
| 1. <u>GENERAL</u> | | 3. <u>TECHNICAL DESCRIPTION</u> |
| 1.01 This section covers the description and installation engineering of the Added Main Line (AML) Subscriber Line Carrier. | | 3.01 AML is a one channel, completely transistorized, double side band, amplitude modulated system. It operates in the frequency bands of 25 to 31 KHz and 73 to 79 KHz, including side bands. |
| 1.02 The Added Main Line Subscriber Carrier System will be hereafter referred to in this section as the "AML" System. | | 3.02 The carrier from the C.O. to the subscriber is 76 KHz; from the subscriber to the C.O., 28 KHz. |
| 2. <u>SYSTEM DESCRIPTION</u> | | 3.03 The "derived" voice frequency circuit is the demodulated output from an AML System. |
| 2.01 One AML channel can be added to an existing subscriber circuit to provide one party service. The physical circuit can be either one party or multi-party service. | | 3.04 The "physical" voice frequency circuit is the cable pair over which the AML carrier frequencies are transmitted in both directions. This physical circuit must be a working line (connected to a working |
| 2.02 AML, as with all carrier systems, will not operate through conventional load coils. Therefore, the | | |

subscriber number in the central office).

3.05 Ringing the AML subscriber is accomplished by detecting the ringing voltage at the AML central office terminal. The COT then transmits carrier to the subscriber terminal. This carrier is detected and used to connect a 6 volt battery to an inverter which generates a nominal 70 volts at 20 Hz. The power provided is sufficient to ring up to three standard ringers.

3.06 Supervision and pulsing are accomplished by carrier on-off signaling controlled by either the telephone switch-hook or the dial.

4. INSTALLATION

4.01 Channel racks (shelves) of the various sizes are intended to mount on a 19" or 23" relay rack. This relay rack should be as near as possible to the MDF to keep inter-connecting cable length to a minimum.

4.02 Wiring connections to the shelves are made on the back of the shelf at wire wrap terminals. Typical wiring arrangements is shown in Figure 1.

4.03 The channel shelves should be permanently cabled to a six point terminal block on the horizontal MDF. From there the channels can be cross-connected to the proper group and terminal or line link appearance and cable pair. Each channel unit requires three pairs in the cable.

4.04 One AML-COT3 channel card requires 35 milliamperes at 48 volts. Therefore, a 12 channel

shelf will require about 420 milliamperes.

4.05 The battery terminals for all of the channels on a 10 or 12 channel shelf should be multiplied and fed from one 1 1/3 ampere fuse. This fuse can be located on a separate fuse panel at the top of the relay rack. On the 50 or 60 channel rack, each group of 10 or 12 channel units should be considered a separate shelf for purposes of providing battery and ground.

4.06 Each channel unit is equipped with an internal dropping resistor at the battery terminal. This will limit the current so that a component failure on a channel unit will not blow the common fuse. (See Figure 2.)

4.07 The ground terminals on each shelf should be strapped and tied to a common relay rack ground.

4.08 Wire wrap connections on the socket pins on the rear of the channel shelf are designated A, B, C, D, E, F, G, I, J, K and L, top to bottom. Cabling from the channel shelf to the MDF terminal block should correspond, front to back with the shelf socket pin connections top to bottom. The top two terminals on the shelf socket, A and B, are the carrier derived circuit tip and ring. The next two terminals, C and D, are the physical circuit tip and ring. Terminals E and F are the cable pair tip and ring. The next terminal, H, is blank. Terminal J is the ground connection. Terminal K is also blank and terminal L is the 48 volt battery connection point.

4.09 Installation of the Port-A-Pac unit is made as follows: (Fig. 3).

1. Hang the Port-A-Pac unit on the MDF ironwork by the brackets provided.
2. Plug the required number of AML-COT3 terminals into the shelf.
3. Run jumpers from the wire wrap terminal block in the Port-A-Pac to the assigned cable pairs, group and terminals or line link appearances, battery and ground.

terminal and telephone set across the cable pair at the main frame. If operation of the spare subscriber terminals is normal, the trouble is at the subscriber location.

3. If operation of the spare subscriber terminal is not normal, replace the associated AML-COT 3. If this does not clear the trouble completely, some problems also exist at the subscriber terminal.

5. TROUBLE LOCATION PROCEDURE

5.01 Trouble location on AML systems is entirely by a process of trouble analysis and substitution of spare parts. No special test equipment is required. A voltmeter is required to check the state of charge of the nickel-cadmium battery at the subscriber location.

5.02 The physical circuit subscriber provides a constant check on the outside plant facilities. A trouble affecting both the physical subscriber and the AML subscriber is most likely outside plant trouble.

5.03 Procedure for testing on an AML circuit is as follows:

1. Verify that the physical circuit subscriber's service is normal.
2. If the physical circuit tests good and the AML subscriber has reported "can't hear," "can't be heard" or "no ring," bridge a spare subscriber

6. AML SUBSCRIBER TERMINAL - DESCRIPTION

6.01 This unit consists of a molded plastic enclosure suitable for mounting on floor joists, backboards, walls or other convenient locations on the subscriber's premises. The physical dimensions of this assembly are 6" x 4½" x 1½".

6.02 The complete "AML-ST" or Added Main Line Subscriber Terminal circuit is contained on one printed wiring board which slides into grooves in the plastic base-mounting unit. Gas tube protectors and zener diodes are built in which coordinate with the station protection provided at the customer's premises.

6.03 Where second line service is to be provided on the same customer's premises, an isolation filter coded "AML-IF" is also used to separate the carrier circuit from the physical circuit. The isolation filter is always inserted between the station protector and any existing station wiring in order to provide

for isolation of the two services.

6.04 Where primary service via an AML channel is to be provided, isolation filters (AML-IF) must be installed at the terminal pole or pedestal on all physical parties working on the same pair with the AML channel or at the protector of the physical.

7. SUBSCRIBER TERMINAL - INSTALLATION INSTRUCTIONS

7.01 If the AML-ST unit has been in storage over 60 days, the nickel-cadmium battery may be at least partially discharged. In such cases it can be recharged by connecting the CXR line terminals to any working physical telephone line. An overnight charge should be adequate. Do not connect directly to any 48 volt battery or rectifier unless a 200 ohm, 1 watt resistor is connected in series to limit the current.

7.02 Remove the snap cover from the unit and slide out the printed circuit card.

CAUTION: Do not set the circuit board on any metal surface if battery is connected.

7.03 Mount the plastic base unit within the customer's premises as near to the station protector and to existing connecting blocks as possible. Be sure to leave sufficient room to remove the circuit card at a later date should this ever become necessary.

7.04 Replace the circuit card by sliding it into the plastic base mount and insert the 6 volt nickel-cadmium battery into its

holder on the card using associated quick-connect terminals.

7.05 Mount the isolation filter "AML-IF" adjacent to the drop wire terminal of each physical party working on the same pair with the AML channel.

7.06 Refer to application drawings on Figures 4, 5, 6 and 8 as appropriate for schematic wiring information. Refer to Figures 7 and 8 for the connection diagrams of a correctly-installed AML-ST unit.

7.07 The isolation filter should be connected to the line between the distribution plant and the drop wire with the blue and white pair from the filter tied to the distribution plant side.

7.08 The orange and white pair from the filter should be connected to the physical subscriber's drop wire.

7.09 At this point, follow normal check out procedures for the physical subscriber's circuit.

7.10 Connect the Added Main Line subscriber terminal "AML-ST" as shown in Figure 7, with the CXR leads wired direct to the station protector lugs. The AML-ST unit is, in effect, bridged directly onto the incoming drop.

7.11 Connect the tip (green) and ring (red) wires to the AML-ST unit as shown in Figure 7. Also connect the "bell" or yellow wire as shown.

CAUTION: Do not multiple the yellow lead from the telephone set to either the tip or the

ring from the set. A separate wire must be used all the way to the AML-ST unit.

7.12 Snap the plastic cover on the base mount for the AML-ST unit. This completes the installation and wiring.

7.13 The biasing spring should be in the "no tension" position.

CAUTION: Since the cable pair now provides service not only on the physical but also via an AML carrier channel, a lineman's telephone set should not be bridged directly across the cable pair, either at the station protector, or at one or more terminals along the cable route. It is suggested that the installer-repairman be equipped with a spare AML-IF isolation filter fitted with clips on the leads. The isolation filter should be inserted between the lineman's telephone set and the cable pair whenever test calls or connections are made on AML equipped cable pairs. Failure to follow these instructions will cause the AML subscriber's telephone during the interval of test to be out of service due to the shunting effect of the lineman's set at carrier frequencies.

7.15 In order to minimize the possibility that AML circuits will be placed out of service during other installation or repair work along the cable route, SSP treatment should be applied.

8. INSTALLATION RESTRICTIONS

8.01 The AML-ST unit, as presently constituted, is not considered to be compatible with key equipment, data sets, or other special-purpose station equipment such as "hard of hearing" sets, etc. Special purpose versions of the AML-ST unit are currently under development. Appropriate practices will be added or revised as required for these special AML-ST units.

8.02 The AML carrier system is designed to provide only individual line service. No party line or coin service can be provided. However, the working, non-loaded cable pair on which the carrier channel may ride can serve either an individual or a multi-party line.

8.03 The AML carrier system equipment is designed to function with a maximum of three ringers. The number of extension telephones is not otherwise limited.

9. AML SUBSCRIBER TERMINAL - MAINTENANCE

9.01 If trouble is isolated to telephone set, replace set. Verify that all connections to the AML-ST unit are correct. If not, correct connections or substitute spare AML-ST circuit board as indicated.

Defective AML units should be sent direct to Continental Telephone Electronics Corporation. If the unit is within the warranty period of one year as indicated by the manufactured date stamp, it will be replaced at no charge. If beyond the warranty period, it will be replaced at a flat repair charge.

a. First, contact Continental Telephone Electronics Corp., 130 Casa Linda Plaza, Dallas, Texas 75218, Telephone No. 214/328-8496 and request a "Return Material Authorization."

b. Pack the unit carefully using an original packing container if available. Enclose the return authorization as a packing slip and ship prepaid direct to:

CONTINENTAL TELEPHONE ELECTRONICS CORP.
1001 Pamela Drive - P. O. Box 579
Euless, Texas 76039

9.02 When storing AML-ST units, disconnect battery to prevent discharging or remove the battery and store separately, if preferred.

9.03 Satisfactory condition of the nickel-cadmium battery in the AML-ST unit can be checked with a voltmeter while the connected physical circuit is in an "off-hook" condition. (Thus, not charging the nickel-cadmium battery in the AML-ST unit.) The battery voltage should be equal to or higher than 6.1 volts. When an incoming 76 KHz carrier signal is applied to the AML-ST unit, the ringer should ring and the battery voltage should not drop below 5.7 volts. The 76 KHz carrier signal is supplied by the AML-COT whenever 20-hertz ringing voltage is applied to the AML telephone number group and terminal in the central office. (See Figures 9, 10 and 11.)

9.04 If all of the above procedures fail to clear the trouble at the AML subscriber's premises, there remains the possibility that a line trouble exists at carrier frequencies which does not affect the physical circuit to a noticeable degree.

10. TROUBLE INVESTIGATION OF THE HIGH - FREQUENCY LINE OUTLINE OF METHOD

10.01 The following information is intended as an outline guide for trouble investigation of the high-frequency line when the need for such a course of action is indicated on one or more specific loops equipped with AML channels.

10.02 In nearly every case, where the trouble fails to clear after performing all steps indicated in preceding paragraphs, the most likely condition is the existence of one or more unknown bridged taps or load coils which may be shunting down the received carrier level.

10.03 The nature of trouble on the AML circuit may be excessive noise (exceeding 20 dbmC and usually characterized by relatively loud "popping" and "dial click" noises). It may also take the form of the customer being able to place calls satisfactorily but cannot receive a ring or the bell rings "feebly."

The AML subscriber's set may also fail to operate under any conditions. It is assumed at this point that a spare AML-ST unit, known to be in good working order, has been substituted without clearing the difficulty.

10.04 The first requirement, at this stage of the trouble investigation is to obtain a well-calibrated sierra carrier frequency voltmeter.

10.05 Bridge the carrier frequency voltmeter directly across the

tip and ring of the station protector using a cord equipped with General radio type 274-MB plugs on one end and alligator clips on the other end. (See Figure 12.)

10-06 Check calibration of the test set and tune the dial to approximately 76 KHz on the frequency dial. Set the selector switch to 135 ohm bridging.

10.07 On the AML subscriber's set, dial a test line such as a milliwatt supply and monitor long enough to verify that the test line will not "time out" before carrier frequency measurements can be completed.

10.08 If the AML circuit does not return dial tone, refer to paragraph 10.14.

10.09 Slowly tune the frequency dial, searching for the 76 KHz received carrier signal, while progressively increasing the sensitivity of the test set with the attenuator knob.

10.10 "Peak" the reading of 76 KHz received level and switch the attenuator so that the meter reading obtained is in the upper portion of the scale. Read and record the measured level as the algebraic sum of the attenuator setting and the meter reading.

REQUIREMENT:

The received 76 KHz level should not be lower than -43.0 dbm under any conditions.

10.11 With the AML subscriber's telephone set off-hook and connected to a milliwatt supply

number in the central office; bridge the carrier frequency voltmeter across the cable pair terminals of the AML-COT unit and, in the same manner previously outlined, measure the 76 KHz transmitting level.

REQUIREMENT: +6.0dbm \pm 2db

10.12 If the requirement of paragraph 10.10 and the transmit level requirement of paragraph 10.11 have been met; check the received noise level at the AML subscriber's terminal with a noise measuring test set bridged across tip and ring while the telephone is off-hook and dialed into a "quiet" termination in the central office.

REQUIREMENT: 20 dbrnCO or less

10.13 If the station line noise measurements are met, turn the set up for service.

10.14 If, in paragraph 10.08, dial tone is not returned when the AML subscriber's set is taken off hook, it is an indication of very severe carrier attenuation either at 76 KHz, or at both 76 KHz and 28 KHz. Instead of excess bridged tap, it is probably a load coil inadvertently left on the pair of placed in error.

10.15 If requirements for received carrier level cannot be met, line sectionalization tests must then be performed on an out-of-service basis using a battery operated sierra carrier frequency voltmeter at various points along the cable route and with a balanced source of 76 KHz test power (135 ohms) connected to the bare cable pair in the central office.

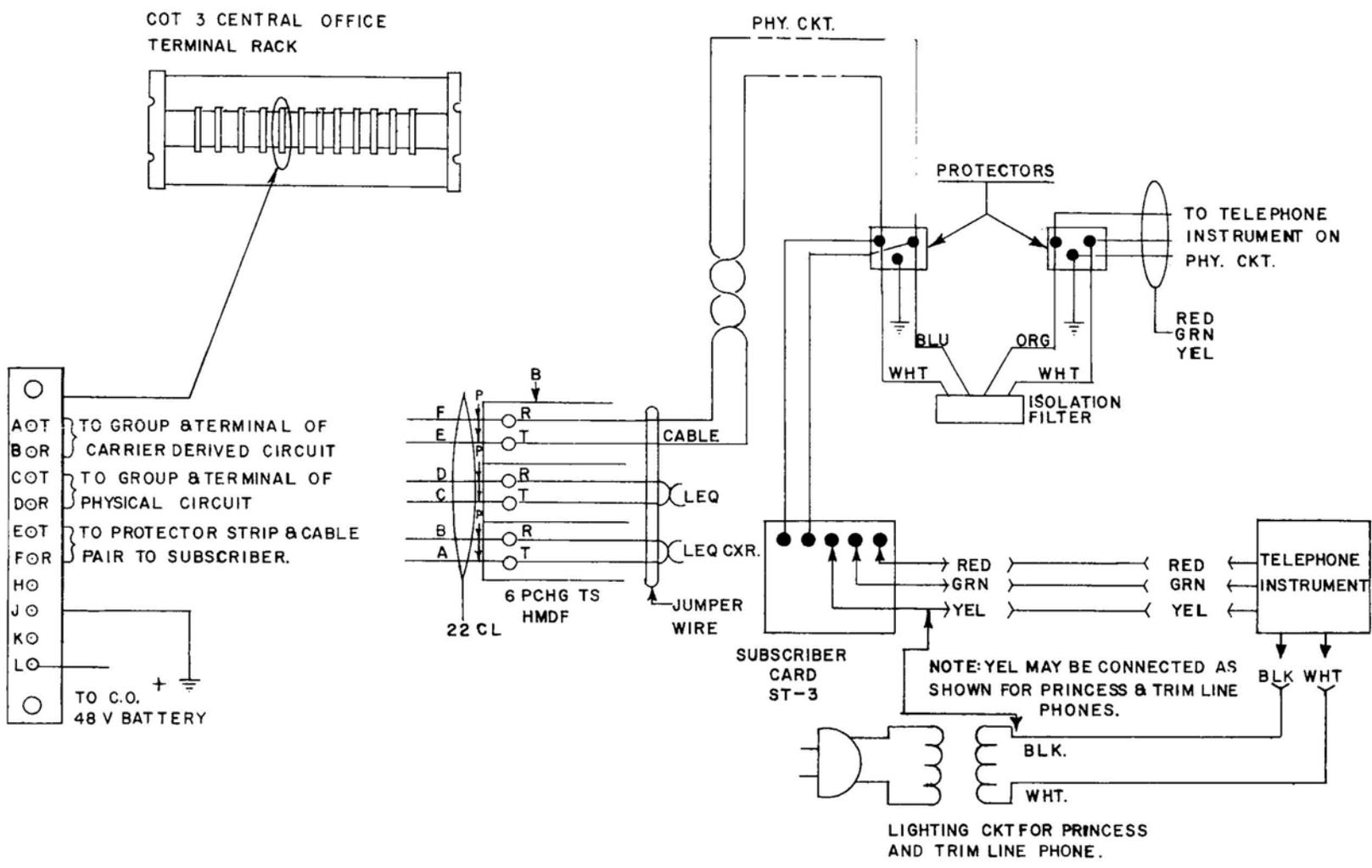


Figure No. 1

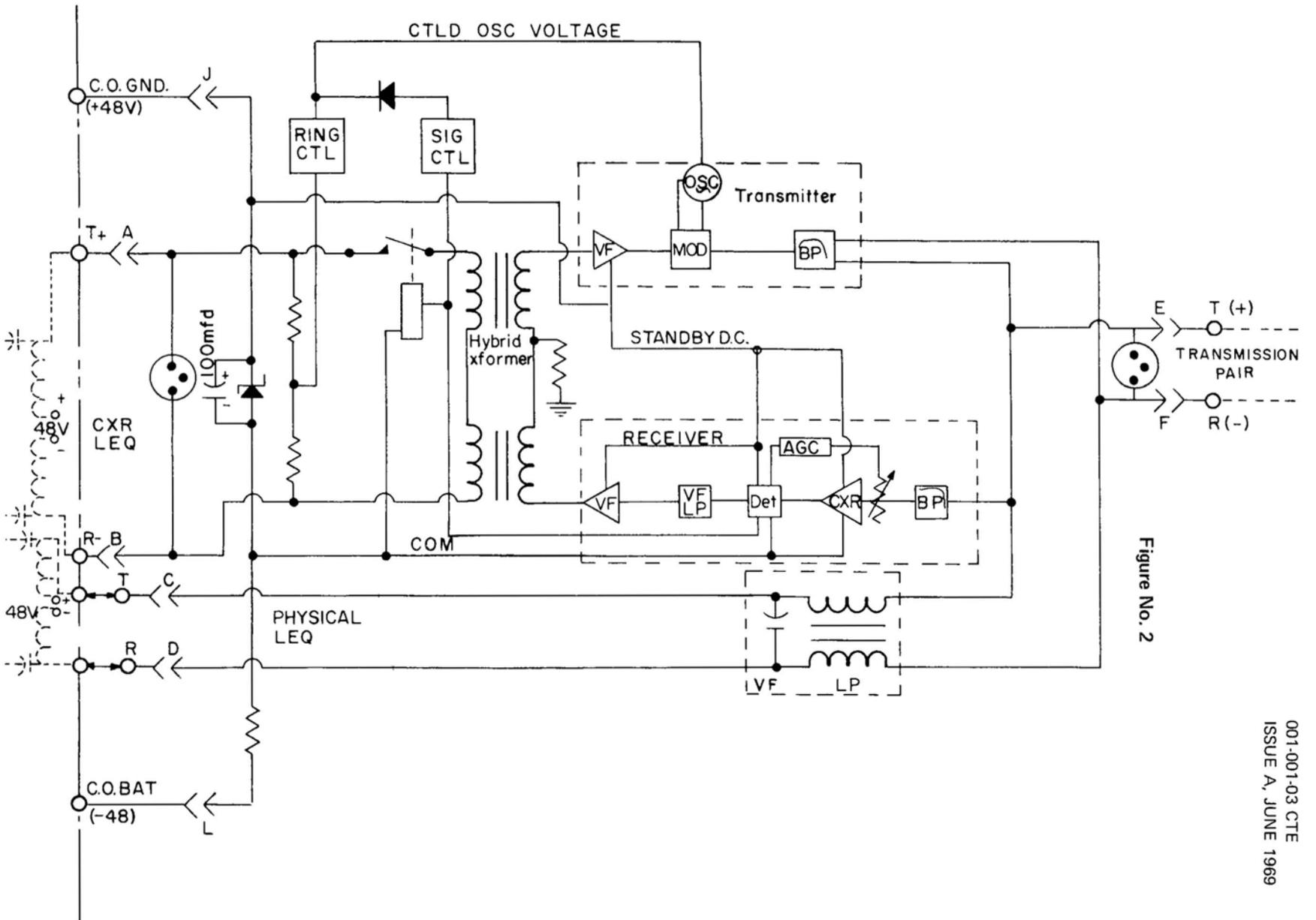
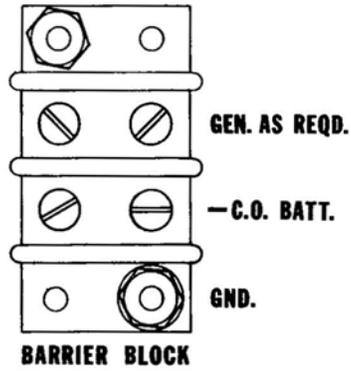
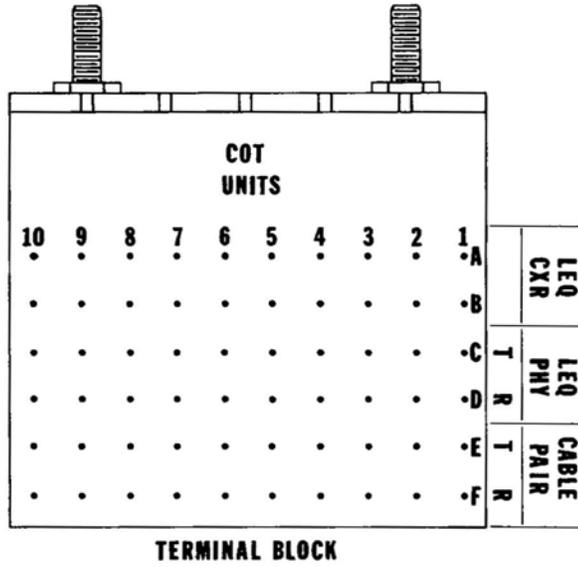


Figure No. 2

Figure No. 3

PORTA -PAC WIRING INSTRUCTIONS
 71-110-11



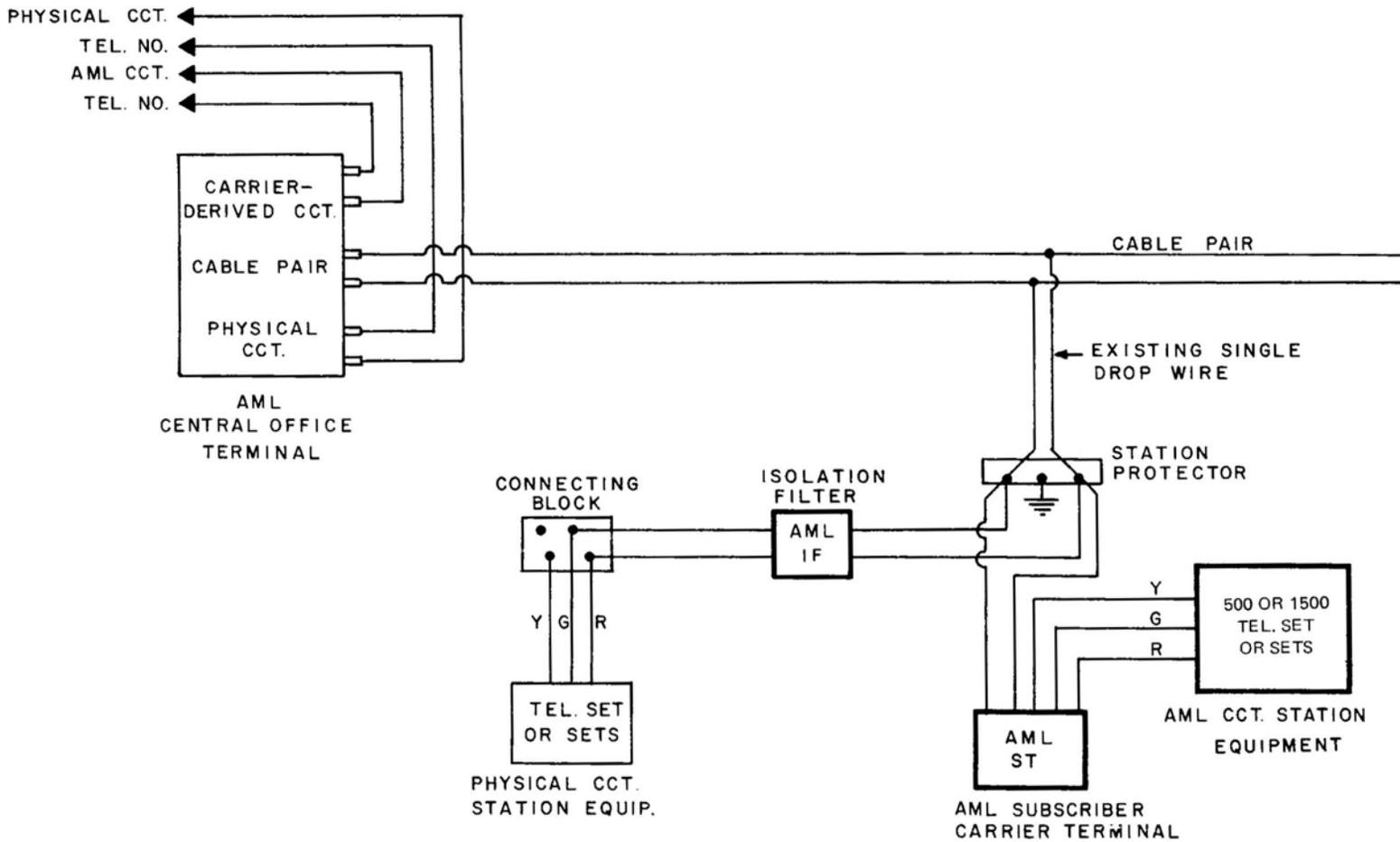
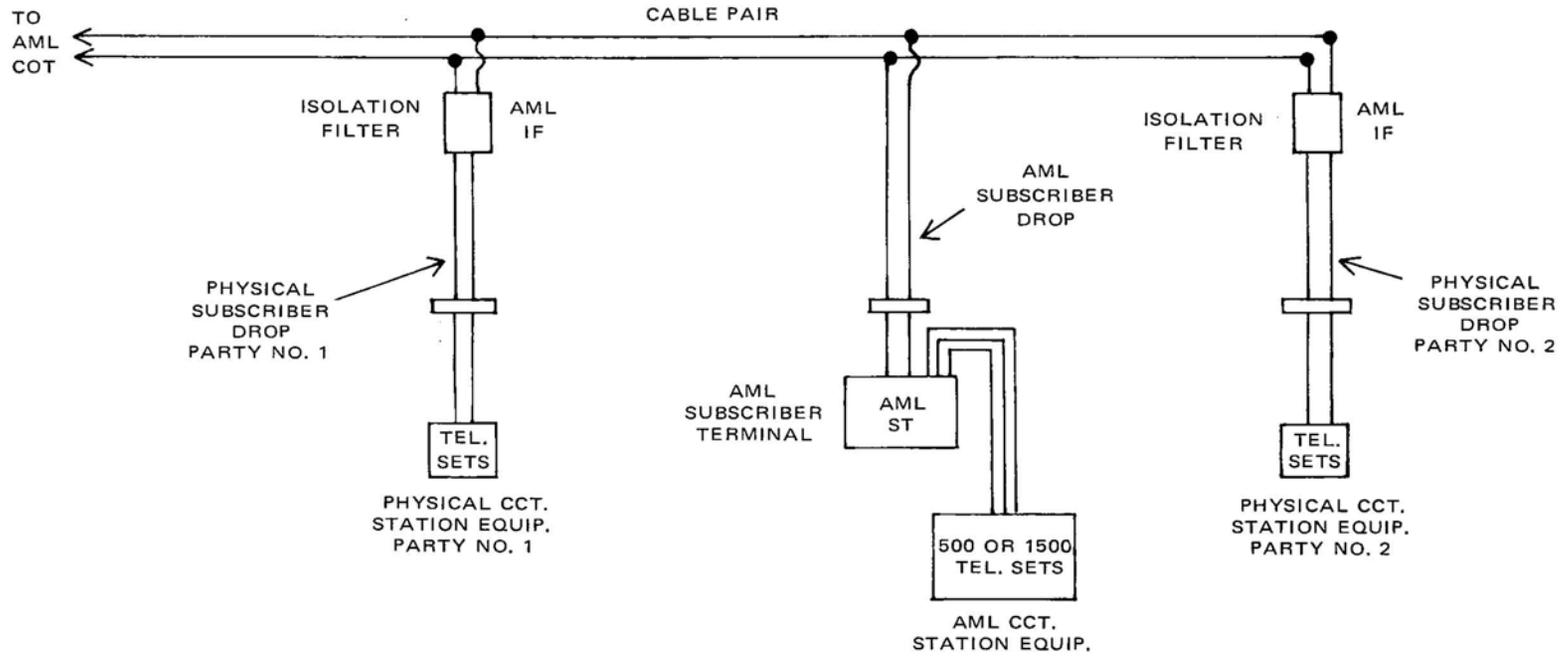


Figure No. 4

NOTE : AN ISOLATION FILTER IS ALWAYS INSERTED BETWEEN THE LINE AND ALL PHYSICAL STATION EQUIPMENT.



AML SYSTEM - TYPICAL APPLICATION: ADDED PRIMARY SERVICE ON AN EXISTING TWO-PARTY LINE.

Figure No. 5

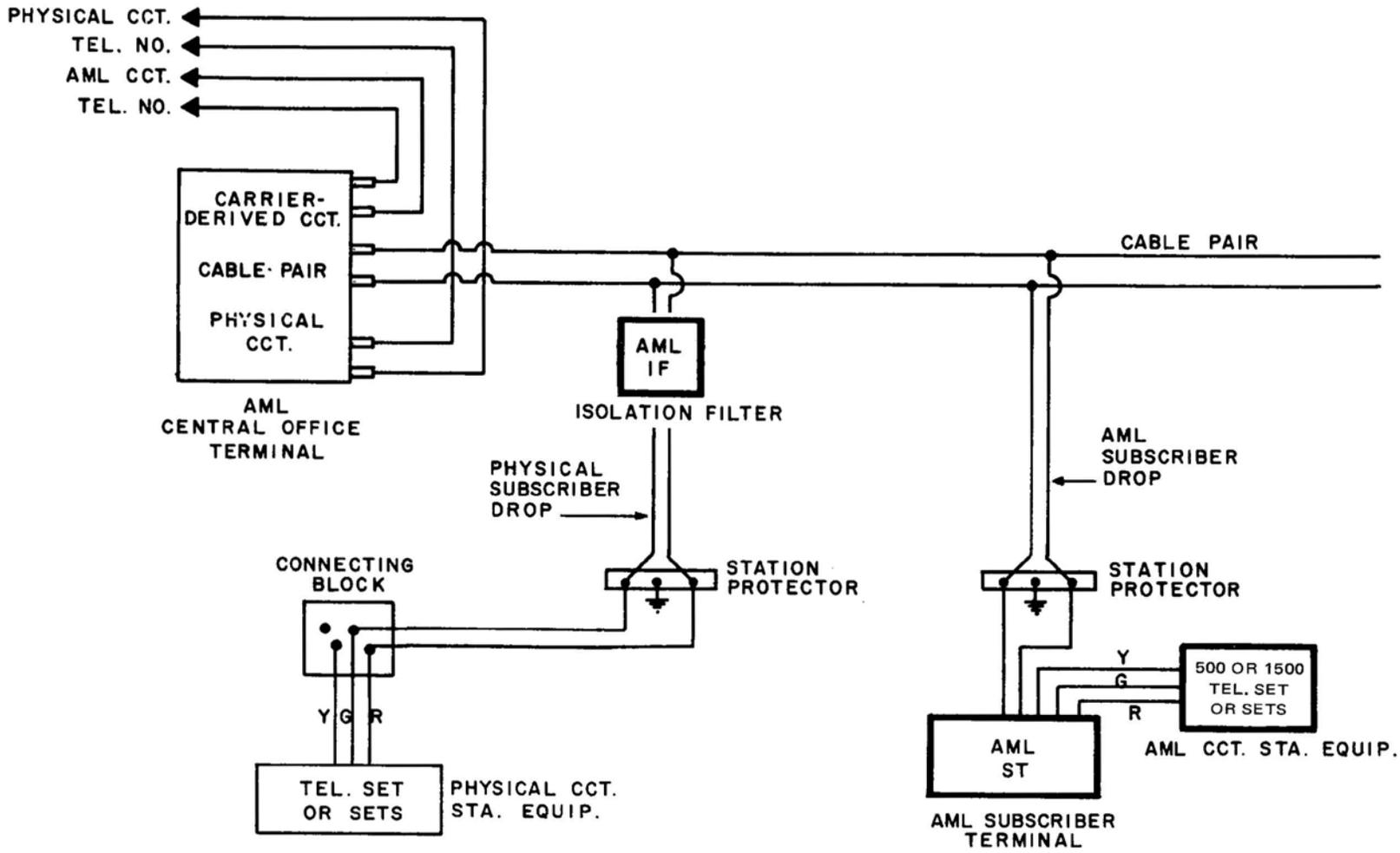
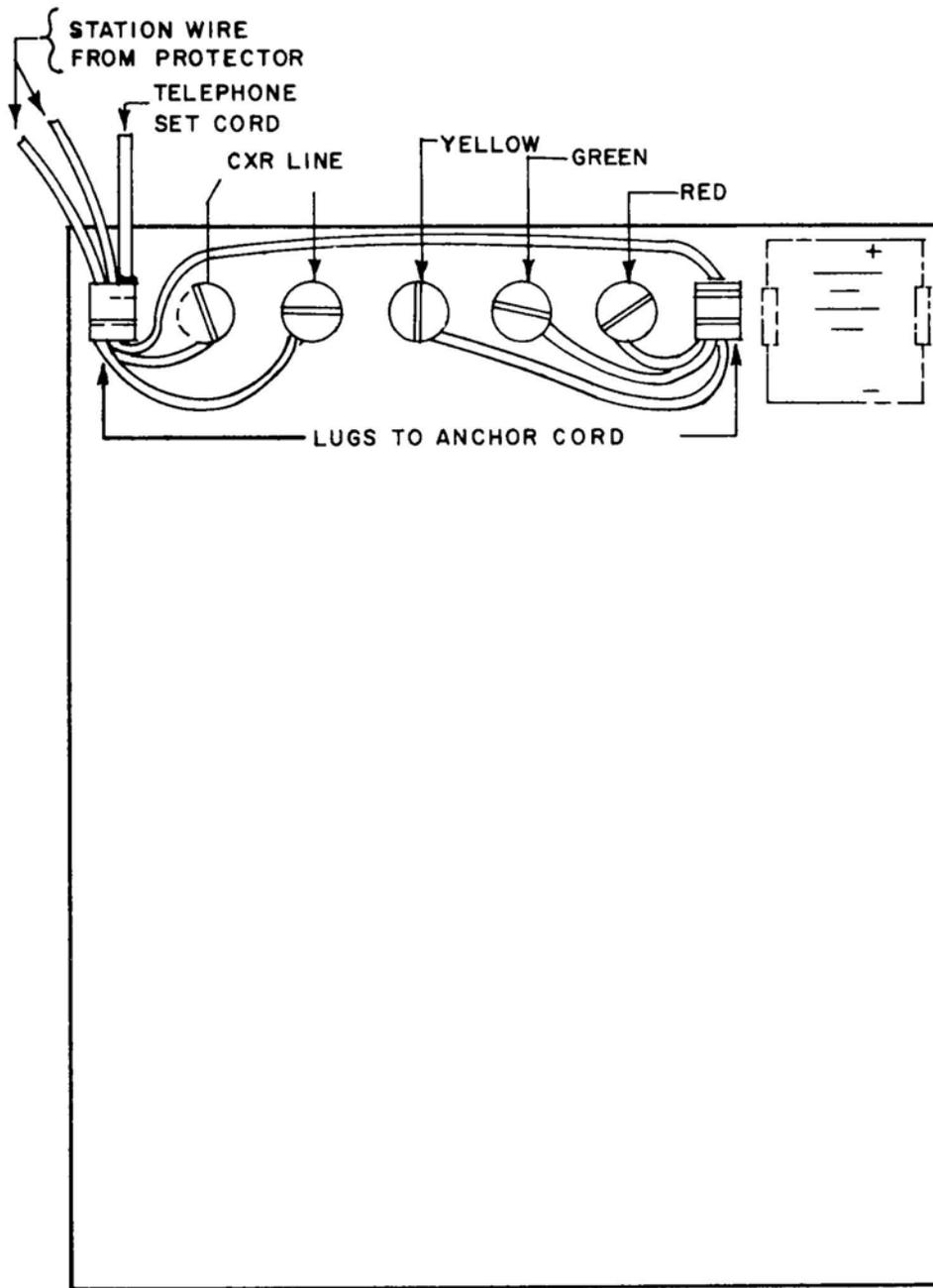


Figure No. 6

Figure No. 7



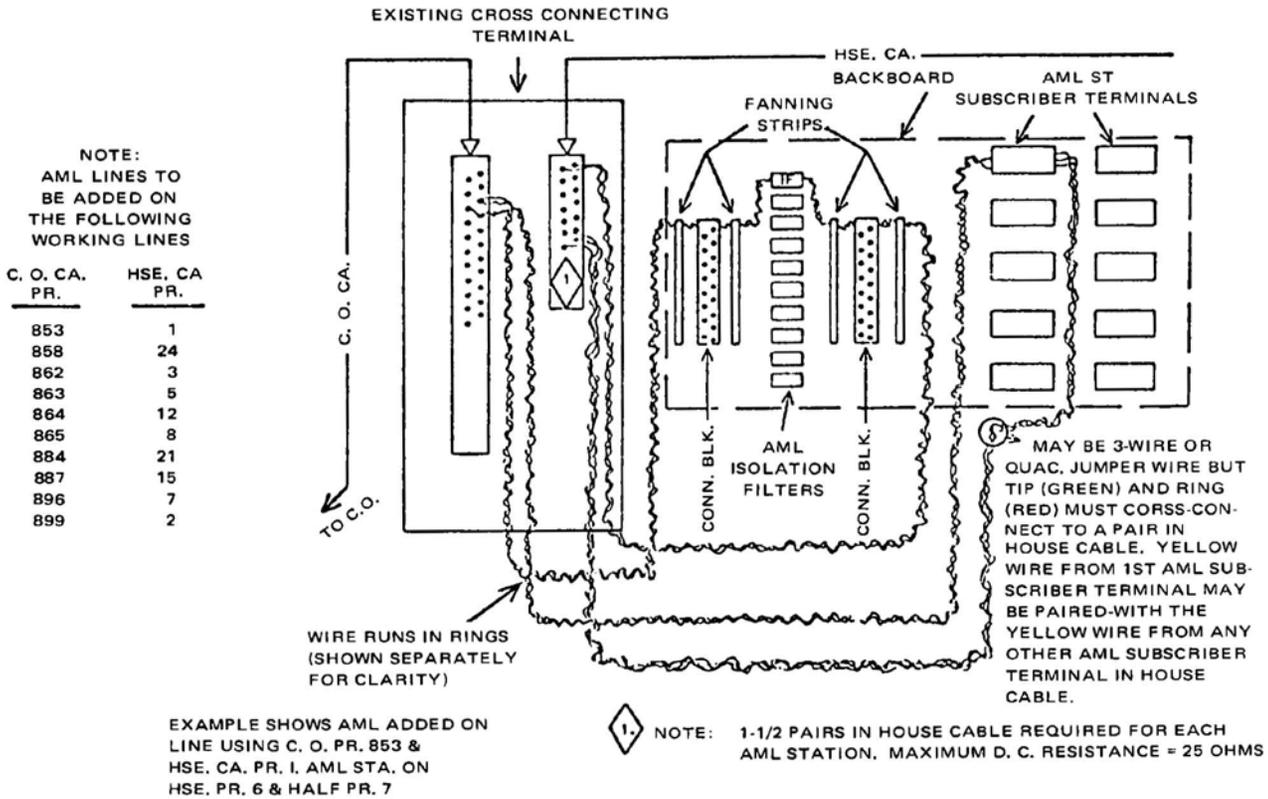
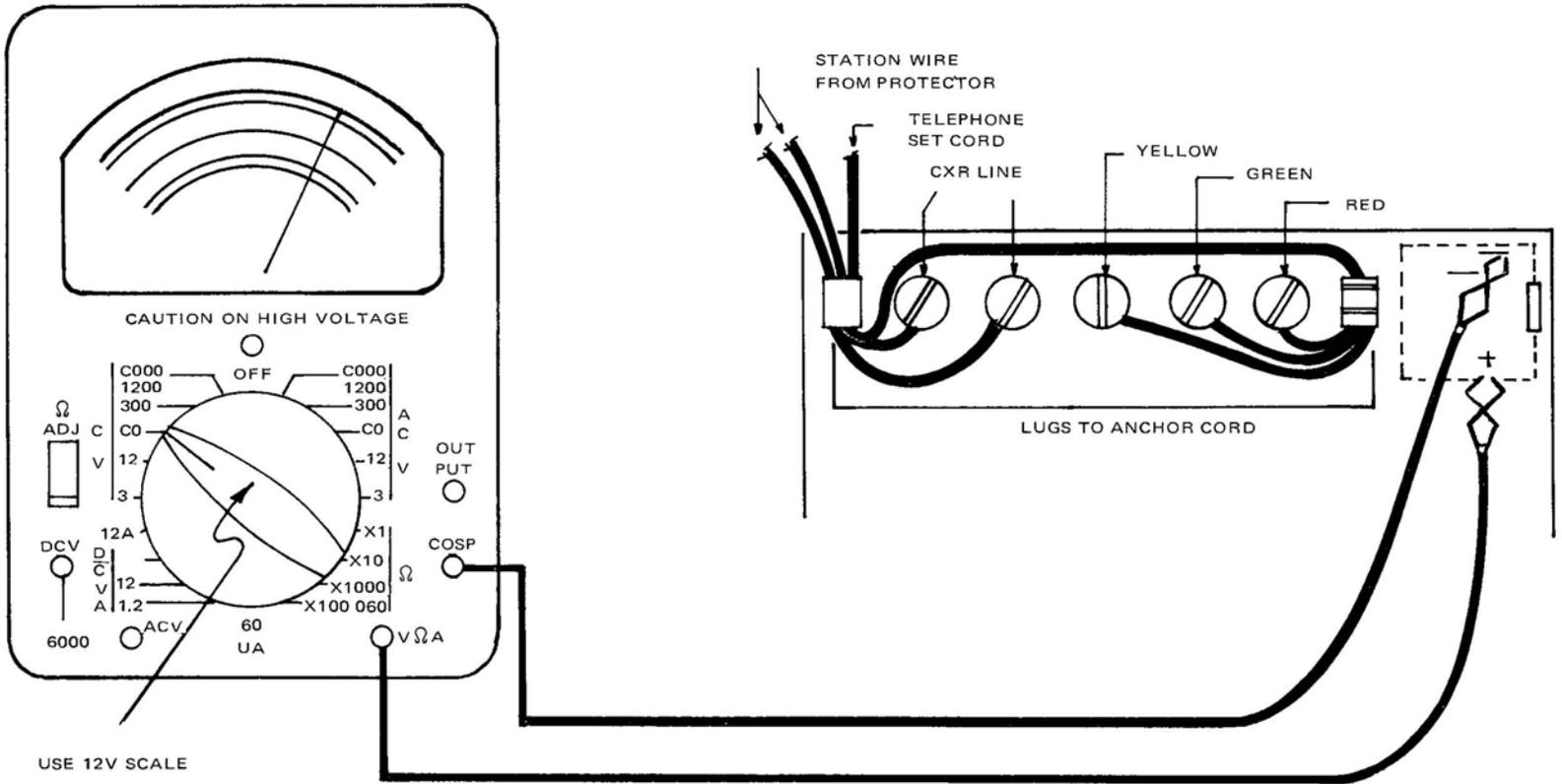


Figure No. 8

AML SYSTEM TYPICAL APPLICATION: ADDED PRIMARY SERVICE IN OFFICE BUILDING OR APARTMENT BUILDING

Figure No. 9



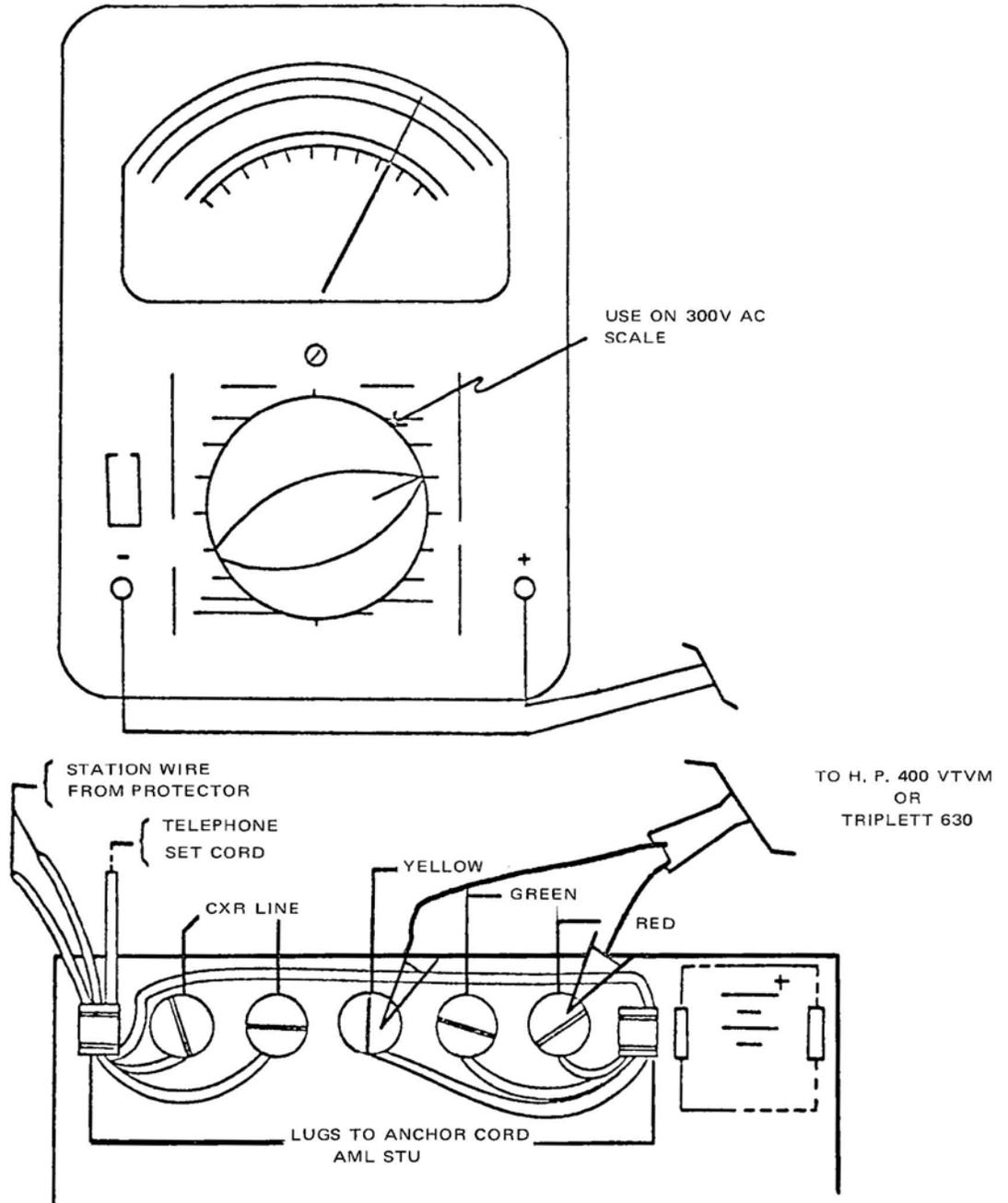
WITH VOLTMETER CONNECTED AS SHOWN BATTERY SHOULD NOT READ LESS THAN 5.7 VOLTS DURING RINGING CYCLE:

METHOD FOR MEASUREMENT OF BATTERY CONDITIONS

Figure No.10

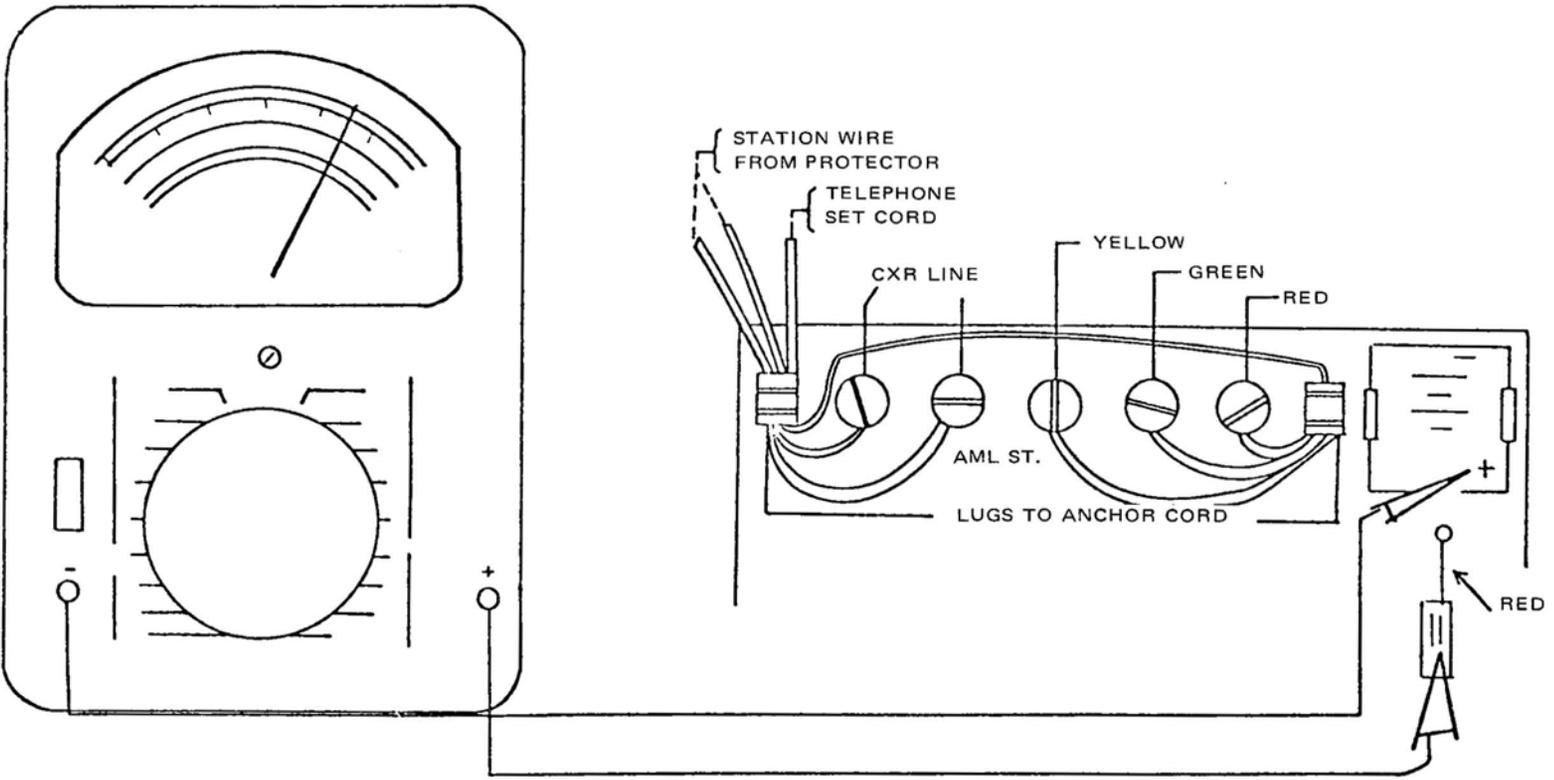
TO MEASURE RINGING OUTPUT VOLTAGE:

CONNECT AC VOLTMETER TO RED AND YELLOW LEADS ON ST UNIT. VTVM (HEWLETT PACKARD 400) WILL READ APPROXIMATELY 70 VAC. RECTIFIER TYPE METER (TRIPLETT 630) WILL READ APPROXIMATELY 90 VAC.



METHOD FOR MEASUREMENT OF RINGING
OUTPUT VOLTAGE WITH V. T. V. M. OR
V. O. M.

Figure No. 11



TO MEASURE CHARGING CURRENT:

OPEN RED OR + SLIDE OF BATTERY, INSERT METER AS SHOWN WITH SUBSCRIBER HANDSET ON HOOK. (SUB. END MAY TRY TO RING OR METER MAY READ IN REVERSE DUE TO INTERNAL RESISTANCE OF METER) REMOVE HANDSET AND REPLACE TO STOP RINGING OR METER REVERSAL. AML-3 SHOULD READ MORE THAN 5.5MA AND AML-2 SHOULD READ MORE THAN 3MA. READINGS BASED ON 50VDC CO BATTERY AND NORMAL ST BATTERY VOLTAGE.

METHOD FOR MEASUREMENT OF CHARGING CURRENT

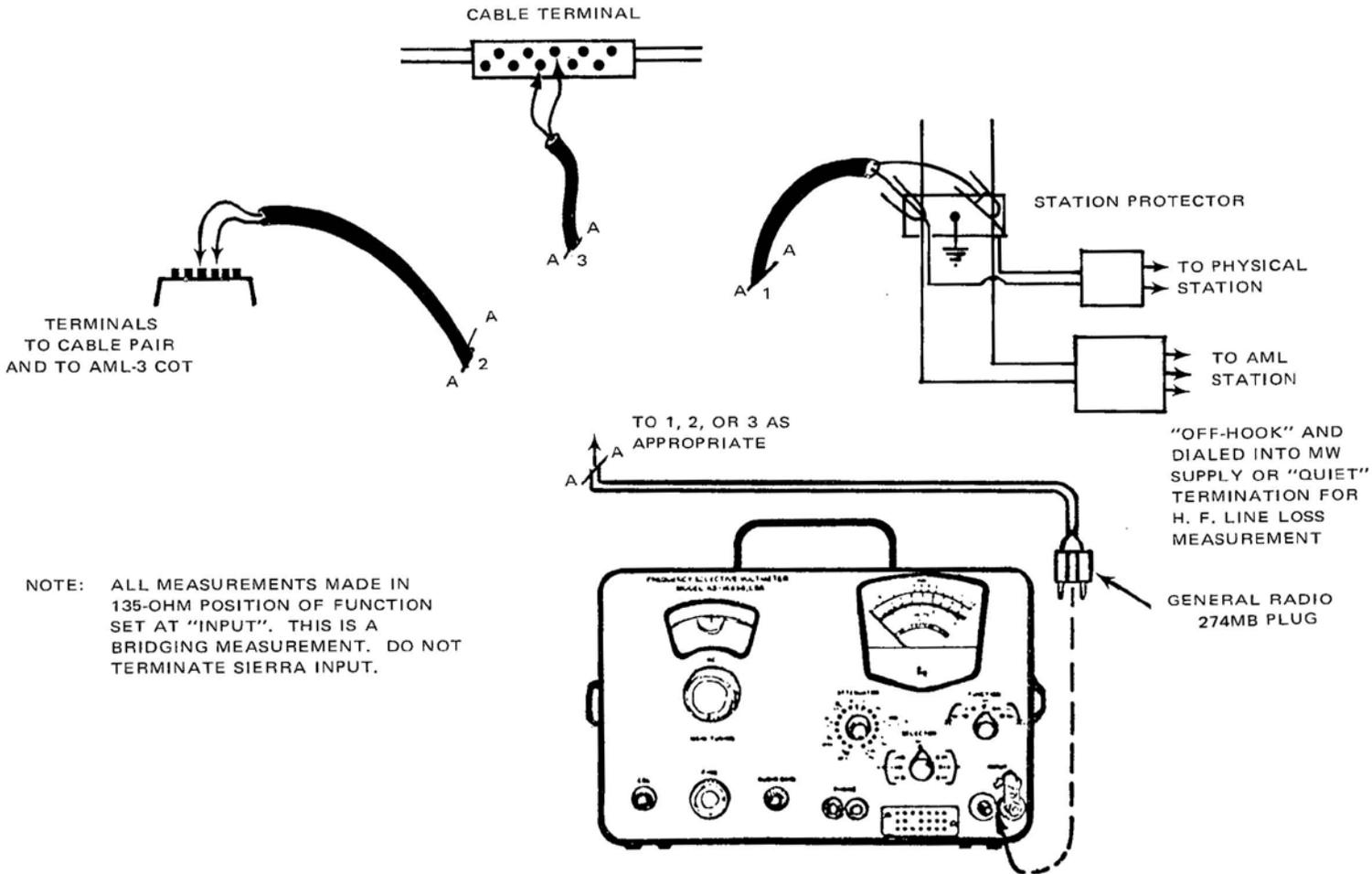


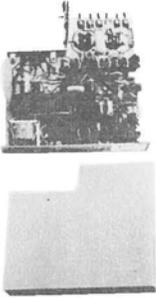
FIGURE 1 TROUBLE INVESTIGATION OF HIGH-FREQUENCY LINE - USING KS-15538 "SIERRA SET" FREQUENCY SELECTIVE VOLTMETER.

COMPONENTS

Product Catalog No. and Description

71-111-00

AML-COT2
Central Office Terminal



This unit consists of molded plastic enclosure suitable for mounting on the "bunching block" side of the main distribution frame. Can also be rack mounted, using mounting bars. This enclosure contains all circuitry required for the AML system in the central office. A terminal strip is provided on the top of the unit for connection of the three jumper wire pairs required to wire in the unit. The physical dimensions of this assembly are 6" x 6" x 1.5". Can not be used in K-60, NX-1, No. 1 and No. 5 Crossbar offices.

71-112-00

AML-COT3
Plug-in Central Office Terminal

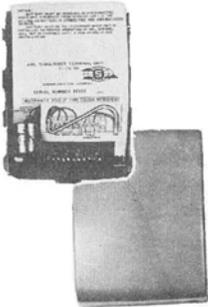


This unit consists of a channel card containing all circuitry required for the AML system in the central office. The card plugs into a 10-pin wire-wrap connector for connections of the four pairs of jumper wires required. Physical dimensions: 5" x 6 1/2".

NOTE: Designed for use with channel shelves shown on following page.

71-713-00

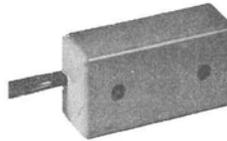
AML-ST3
Subscriber Terminal



This unit consists of molded plastic enclosure suitable for mounting on the wall of a subscriber's premises. Screw terminals are provided for connections to the physical pair and the telephone set. The physical dimensions of this assembly are 6" x 4 1/2" x 1 1/2".

71-700-12

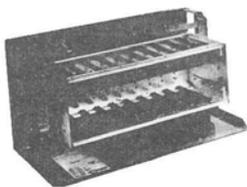
AML-IF
Isolation Filter



This unit consists of low pass filter used to separate the carrier circuit from the physical subscribers. The unit is suitable for mounting in a ready access terminal, pedestal or on the strand.

71-110-11

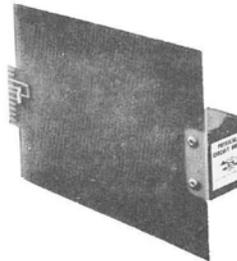
AML PORT-A-PAC



Portable mounting cabinet designed to provide emergency service while awaiting permanent rack or frame installation. Consists of a ten-channel AML shelf completely prewired and mounted in a portable housing. Unit can be placed in service without engineering assistance.

71-110-10

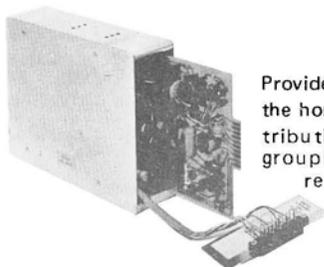
CENTRAL OFFICE JUMPER CARD



Provides a through path for the physical circuit where the AML COT3 plug-in card has been removed from its shelf or housing. Simplifies temporary service disconnects.

71-110-04

MAIN FRAME MOUNTED HOUSING



Provides for mounting an AML COT3 on the horizontal or vertical side of the distribution frame, in single or multiple groupings. All mounting hardware required is included.



A Superior Continental Company

REPLACEMENT COMPONENTS

| PRODUCT CATALOG NO. | DESCRIPTION |
|---------------------|-----------------------------------|
| 71-110-01 | AML-COT2 Card, Less Plastic Cover |
| 71-110-02 | AML-COT2 Plastic Cover |
| 71-710-05 | AML-ST3 Card, Less Plastic Cover |
| 71-710-02 | Cover and Base Plate for AML-ST3 |
| 71-710-03 | Cover for AML-ST3 |
| 71-710-04 | Base Plate for AML-ST3 |
| 71-811-00 | 6V Battery for ST3 |

CHANNEL SHELVES AND CABINETS

Product Catalog No. and Description

| | |
|---|--|
|  | <p>71-110-05 AML-CS19 Channel Shelf</p> <p>For 19" rack mounting. Holds ten plug-in AML-COT3 circuit cards. Shelf equipped with wire-wrap connectors. Dimensions: 19"x7"x6". 4 - 1 1/2" mounting spaces.</p> |
| | <p>71-110-06 AML-CS23 Channel Shelf</p> <p>For 23" rack mounting. Holds twelve AML-COT3 circuit cards. Shelf equipped with wire-wrap connectors. Dimensions: 23"x7"x6". 3 - 2" mounting spaces.</p> |
|  | <p>71-110-07 AML-CAB19 Channel Cabinet</p> <p>For 19" rack mounting. Holds fifty plug-in AML-COT3 circuit cards. Shelf equipped with wire-wrap connectors. Dimensions: 19"x7"x28". 16 - 1 1/4" mounting spaces.</p> |
| | <p>71-110-08 AML-CAB23 Channel Cabinet</p> <p>For 23" rack mounting. Holds sixty plug-in AML-COT3 circuit cards. Shelf equipped with wire-wrap connectors. Dimensions: 23"x7"x28". 14 - 2" mounting spaces.</p> |
|  | <p>71-809-01 MB-19 Mounting Bar</p> <p>Mounting bar for AML-COT2 Central Terminal on 19" rack. Holds eleven units. Dimensions 19" x 4" x 3".</p> |
| | <p>71-809-02 MB-23 Mounting Bar</p> <p>Mounting bar for AML-COT2 Central Office Terminal on 23" rack. Holds 14 units. Dimensions: 23"x4"x3".</p> |