LOW SPEED SIGNALING SYSTEM
USING DATA SET 115A
DESCRIPTION

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1. GENERAL

1.01 This section contains a description of the low speed signaling system using data set 115A. The low speed signaling system transmits alarm signals, such as fire and intrusion, from alarm transmitters at the protected premises to the alarm company central station. In addition to data set 115A, the low speed signaling system utilizes the following equipment:

- 43A1 data mounting which houses up to 14 data sets 115A
- Interface driver AE45 circuit pack (CP)
- 233C mounting plate which mounts up to 18 AE45 CPs
- Key and lamp panel
- Interoffice voiceband channels.

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

1.03 ***Because of the nature of the data transmitted by the low speed signaling system, it is imperative that the integrity of the system not be compromised. No maintenance is to be performed without the knowledge and permission of the alarm company.***

1.04 Data set 115A, in conjunction with the other equipment of the signaling system, provides the following:

- Elimination of alarm company-provided battery on individual alarm loops
- Standardization of alarm loop interconnections
- Improved means of alarm system maintenance
- Reduction of loop noise due to high voltage alarm signals
- Improved longitudinal balance in alarm loop cables
- Interface to voiceband data transmission facilities to eliminate the need for dedicated interoffice copper pairs for a single signaling system.

1.05 Data set 115A detects customer-originated alarm signals of 15 bits per second or less. An alarm circuit typically consists of one or more metallic loops, each terminated with one or more alarm transmitters connected in series to an alarm central station. Normally, each loop is closed and ungrounded. To signal the alarm central station, an alarm transmitter alternately opens, closes, and grounds, and then returns the loops to normal condition in a time coded sequence. In the low speed signaling system, loop open is designated $\overline{N}$ (not N, that is not normal) and loop ground is designated G.

Note: Ground as used in this section is earth ground.

1.06 A representative low speed signaling system circuit arrangement is illustrated in Fig. 1. An alarm station (protected premises) will have one or more alarm transmitters connected in series. The 2-wire alarm leg terminates at the telephone company (telco) central office in a key and lamp

panel. Alarm loop signals, $\overline{N}$ and G, are detected by data set 115A and converted to composite signals N′ and G′ where:

$$N' = \overline{N} \text{ AND } \overline{G} \text{ (loop open AND not grounded)}$$

and

$$G' = \overline{N} \text{ OR } G \text{ (loop open OR grounded).}$$

The interface driver (AE45 CP) converts the N′ and G′ signals to signals compatible with alarm company detection equipment.

1.07 In an alarm signal sequence, the state of the loop changes from loop open ($\overline{N}$) to loop ground (G) without passing through the loop normal condition. However, distortion from time division multiplexing could cause a loop normal state to be sensed between $\overline{N}$ and G transitions, presenting a possible ambiguous signal to the alarm company decoding equipment. The alarm company equipment is, however, conditioned to operate with overlapping $\overline{N}$ and G signals. The composite signals N′ and G′ are used between the data set 115A and the interface driver since these signals are not adversely affected by time division multiplexing.

1.08 When interoffice transmission links are used in a low speed signaling system, it is required that the N′ and G′ signals be communicated by separate links; that is, two transmitters and two receivers are required. However, remaining channels of the links may be used for other data transmissions including other separate low speed signaling systems. When data sets 405-type are used, operation of these data sets must be in the continuous scan mode at a sample interval of less than 20 ms.

2. PHYSICAL DESCRIPTION

2.01 The low speed signaling system includes a 43A1 data mounting, 233C mounting plate, and a key and lamp panel which fit in a 23-inch-wide central office frame. Power for the system is obtained from the −48V central office battery. All circuits will operate from −20 to +140°F in a relative humidity of 5 to 95 percent.

2.02 The 43A1 data mounting (Fig. 2) measures 5.9 inches high, 23 inches wide, and 6.7 inches deep, and weighs approximately 9 pounds. The data mounting accepts up to 14 data sets 115A in a slotted nest arrangement. The data mounting contains an 8-second alarm timer and voltage monitor (CK2 CP) and 5-volt power unit (DC-to-DC converter). Connection of the data mounting to other apparatus is made from wire-wrap terminals on the D5A terminal strips.

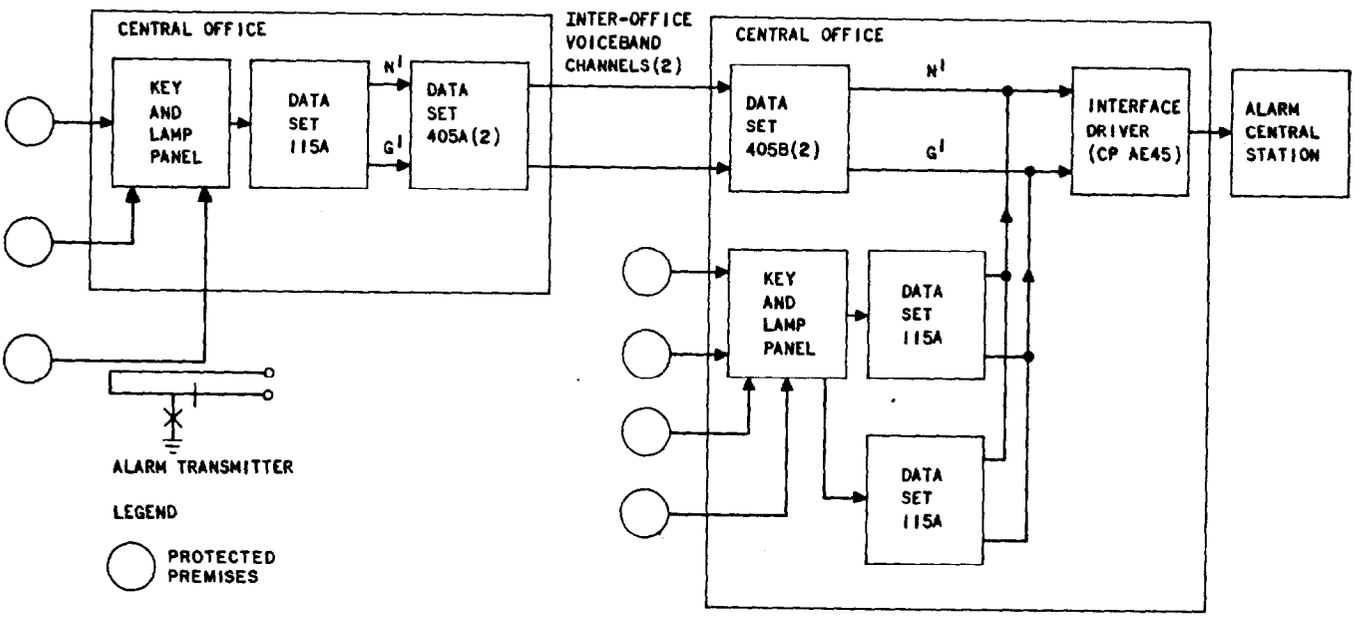

Fig. 1—Low Speed Signaling System—Representative Circuit Arrangement

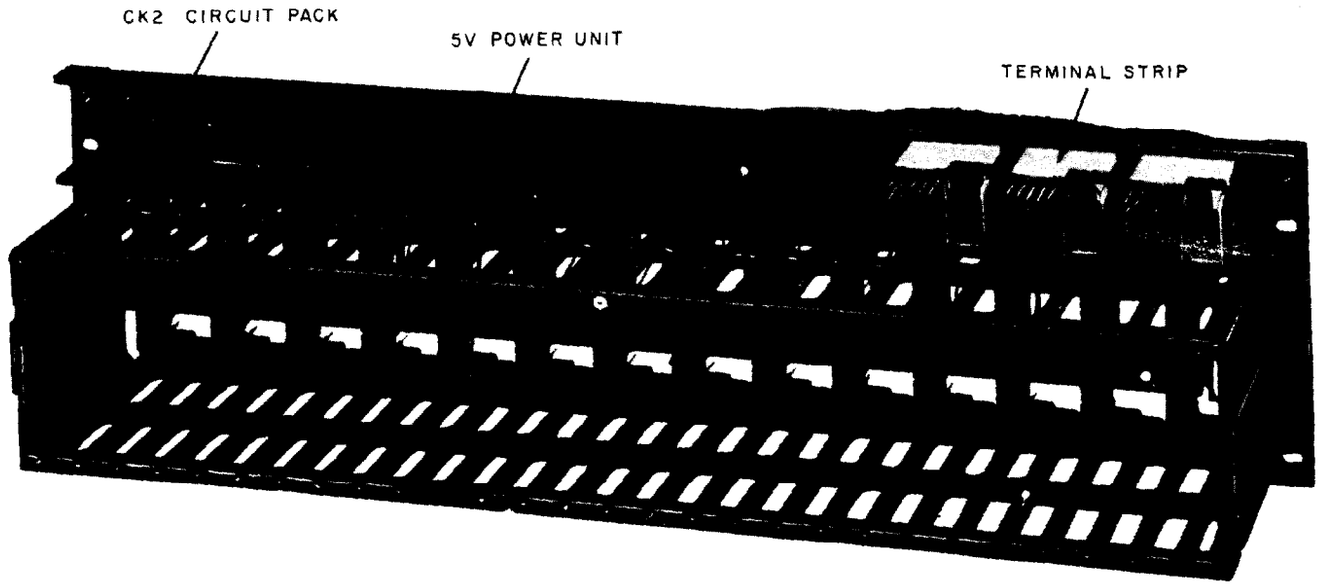

Fig. 2—43A1 Data Mounting

2.03 The 5-volt power unit measures 1-inch wide, 2 inches long, 1-inch high, and weighs 2.5 ounces. The unit is factory connected as part of the 43A1 data mounting to all data set positions.

2.04 The CK2 CP (Fig. 3) measures 1.7 inches wide, 4.05 inches long, and 1.26 inches high, and weighs 2.5 ounces. The CP is factory connected as part of the 43A1 data mounting to all data set positions.

2.05 Data set 115A (Fig. 4) is a plug-in CP measuring 5.3 inches long, 3.5 inches high, and 1.34 inches wide, and weighs approximately 7 ounces. The data set requires a maximum of 105 mA from the −48V central office battery and 70 mA from the 5-volt power unit in the 43A1 data mounting.

2.06 Interface driver AE45 CP (Fig. 5) measures 6 inches long, 3.73 inches high, and 0.75 inch wide, and weighs 7 ounces. The interface driver requires a maximum of 50 mA from the −48V central office battery. Connection to the interface driver is made via wire-wrap terminals.

2.07 The 233C mounting plate (Fig. 6) measures 4 inches high, 23 inches wide, and is punched to accept up to 18 interface driver AE45 CPs and four D5A terminal strips.

2.08 The key and lamp panel (Fig. 7) consists of a 248A jack mounting equipped with 547B key switches and 47A lamp holders as required. The key and lamp panel measures approximately 2 inches high, 23 inches wide, and 3 inches deep. Connections to the key and lamp panel are made directly to the solder terminals of the key switches and lamp holders.

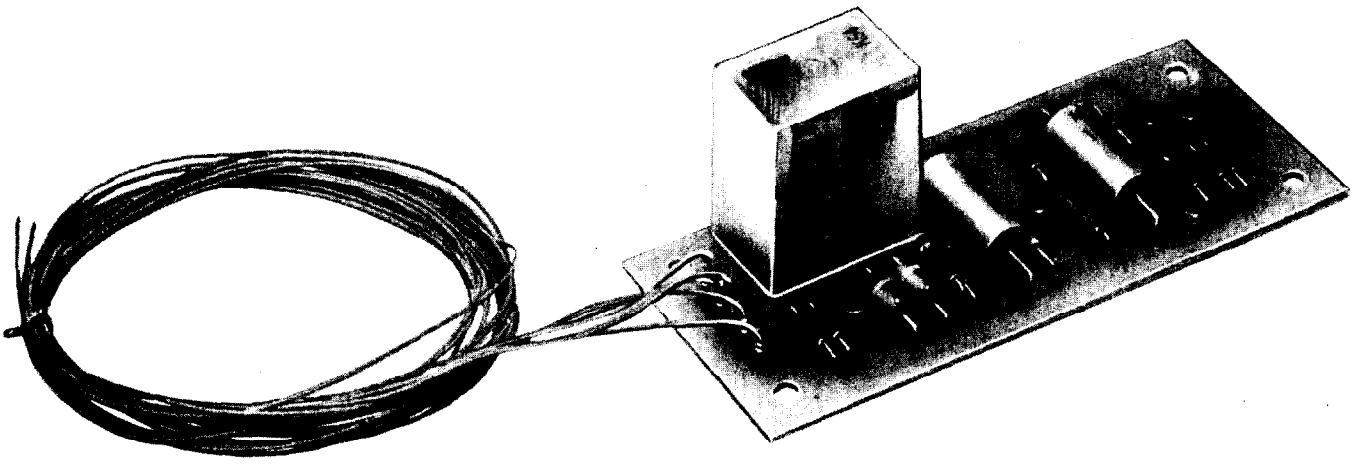

Fig. 3—CK2 Circuit Pack

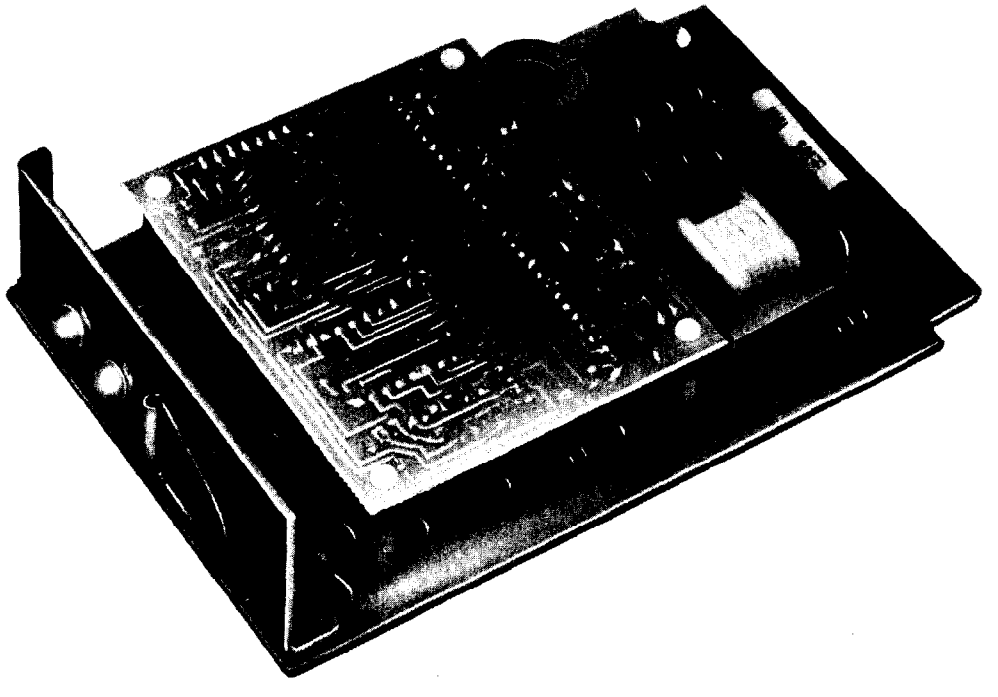

Fig. 4—Data Set 115A

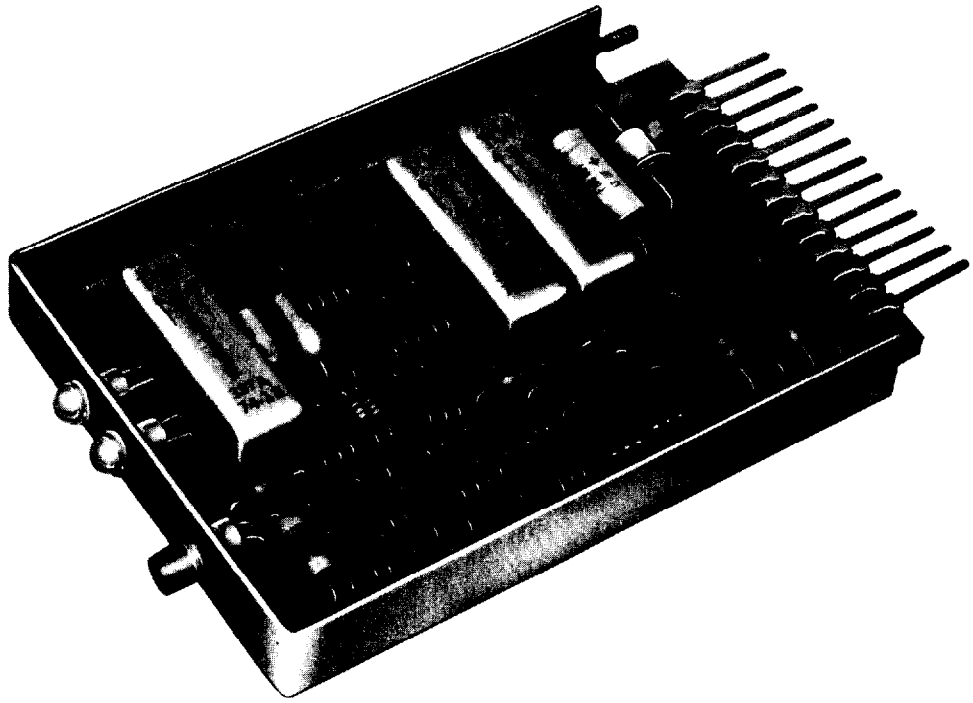

Fig. 5—Interface Driver AE45

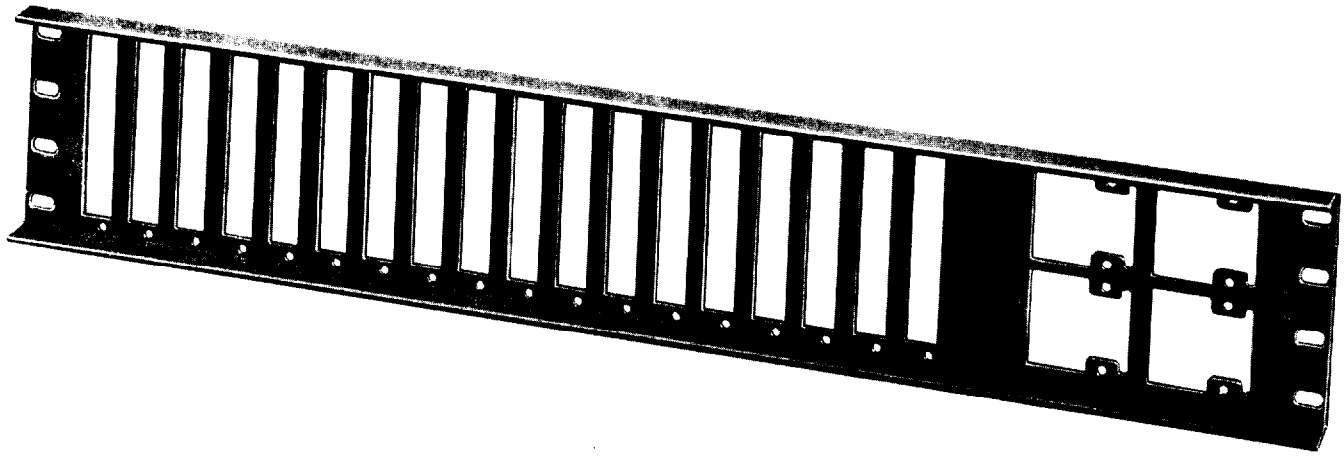

Fig. 6—233C Mounting Plate

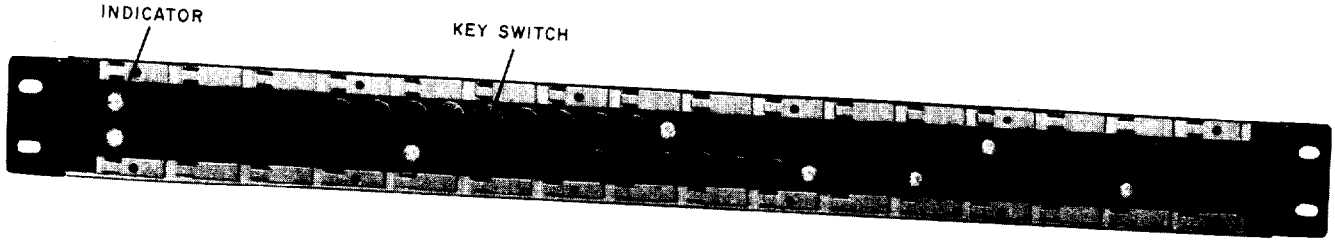

Fig. 7—Key and Lamp Panel

3. FUNCTIONAL DESCRIPTION

3.01 A representative low speed signaling system central office installation is illustrated in Fig. 8. The leg to the central office from each protected premises terminates at a 547B key switch on the key and lamp panel. When an alarm loop consists of more than one leg, the key switches for each leg are interconnected such that the total alarm loop is a single series circuit connected to the tip and ring inputs of a data set 115A.

3.02 The loop length and number of alarm transmitters connected into the loop are governed by the sensitivity of the data set 115A. The overall loop including alarm transmitters must have a series resistance equal to or less than 10K ohms and a leakage to ground equal to or greater than 65K ohms. To meet these criteria, large alarm loops may be divided into one or more smaller individual series loops, each with a data set 115A. The outputs of these data sets are then connected in parallel.

3.03 The 547B key switches, when depressed, open both sides of the alarm loop and replace the loop with a closed circuit. This simulates the loop normal condition to the data set 115A and is used as an aid in trouble isolation.

> ***Caution: Depressing a key switch interrupts alarm company service and may cause a trouble indication at the alarm company office. In no case will these switches be depressed without knowledge and permission of the alarm company.***

3.04 The data set 115A (Fig. 9) provides the floating 48V source for the alarm loop and detection of loop continuity and ground condition. The −48V central office battery voltage is converted to the required ungrounded voltage by a DC-to-DC converter.

3.05 The continuity detector circuit is connected across the alarm loop (between the tip and ring inputs). This detector senses loop closure (loop resistance < 10,000 ohms) or open ($\overline{N}$) (loop resistance > 30,000 ohms) by the presence or absence of current flow through the loop. When the loop is in the $\overline{N}$ condition, the continuity detector circuit causes a light-emitting diode (LED) to illuminate, providing a visual indication of the $\overline{N}$ condition. The continuity detector also excites an optical coupler which provides, through a driver amplifier, a $\overline{N}$ signal to logic module CM2. Since the continuity detector must function in both the absence or presence of a loop ground, the detector circuit is ungrounded. Isolation of the ungrounded $\overline{N}$ signal from the detector and the N signal to logic module CM2 is provided by the optical coupler.

3.06 The ground detector circuit is connected between the tip side of the alarm loop and the −48V battery. Presence of a ground on the loop is sensed by the resulting current flow from the −48 volts to this ground. When a ground is present on the loop, the G indicator LED is illuminated; also, an optical coupler is excited which provides a G signal to logic module CM2.

3.07 Within the logic module (CM2) the G < 1-second and the $\overline{N}$ < 1-second timers pass signals of less than 1-second duration without change, but lock up in the on state; that is, provide a continuous output when a signal exceeds 1 second. These timers reset when no signal is received for 1 full second. Since alarm signals are less than 1-second duration, lockup occurs only when a fault exists. Due to the 1-second reset time of the timers, the data set will not respond to short interruptions in a permanent fault condition. The logic within logic module CM2 causes a continuous N signal to give an N′ output only. Likewise, a continuous G signal will give a G′ output only.

3.08 In normal operation (no faults present), the G and $\overline{N}$ signals are ORed to form G′, and $\overline{G}$ and $\overline{N}$ are ANDed to form N′. The G′ > 18-ms and N′ > 18-ms timers reject signals of less than 18-ms duration such as would occur from contact bounce in the alarm transmitter. With data set 115A connected into the low speed signaling system, presence of an N′ or G′ signal at the output of the data set is seen as a low state (approximately ground), and the absence of a signal is seen as a high state (approximately −48 volts).

3.09 The G and $\overline{N}$ signals are combined by an OR logic circuit and the resultant signal (LMP output) used to illuminate a trouble alarm lamp on the key and lamp panel (Fig. 7). One lamp is associated with each data set. An identical but separate signal (ALM output) also is used to drive the CK2 CP 8-second timer and voltage monitor in the 43A1 data mounting. The trouble

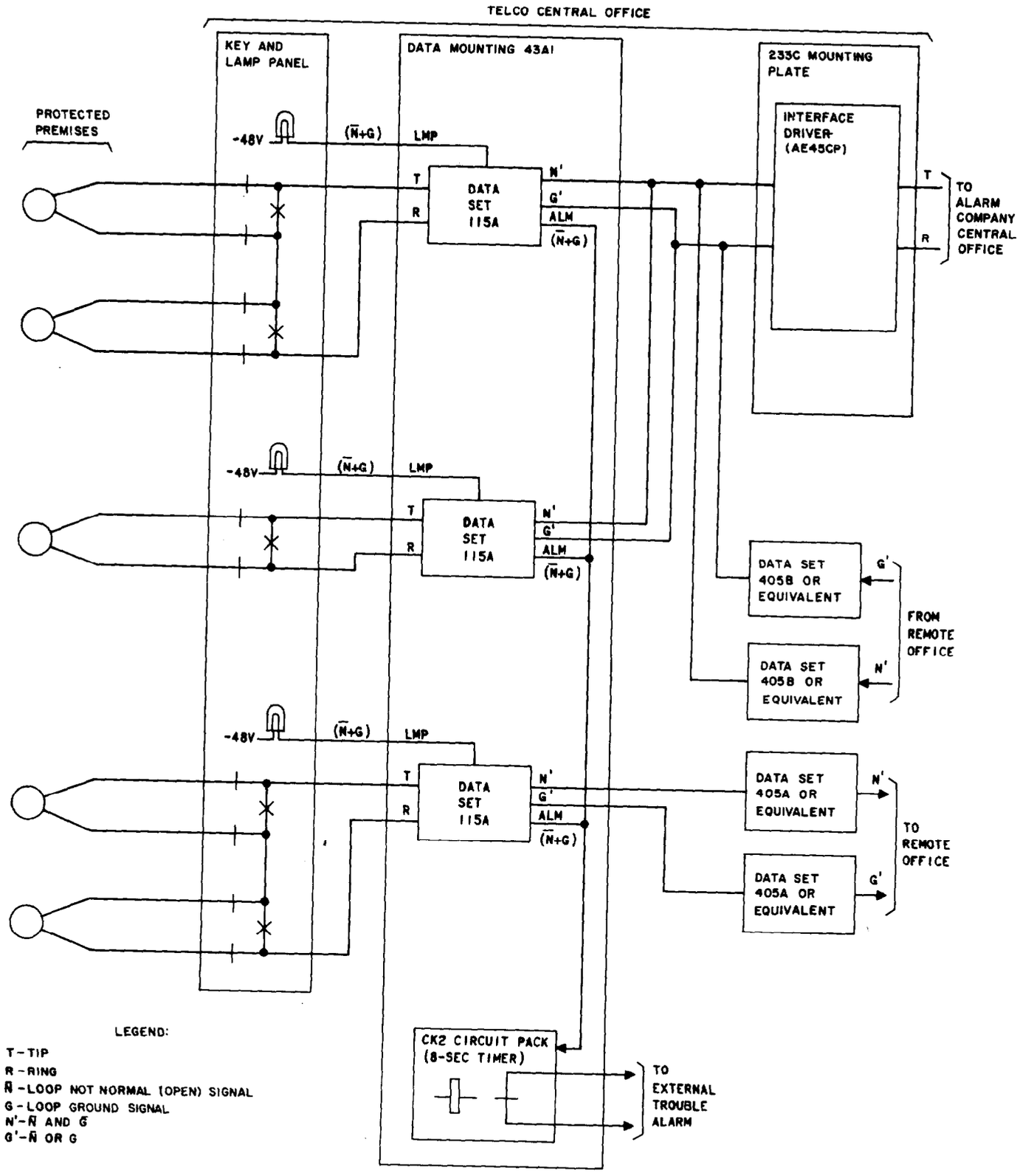

Fig. 8—Low Speed Signaling System—Central Office Block Diagram

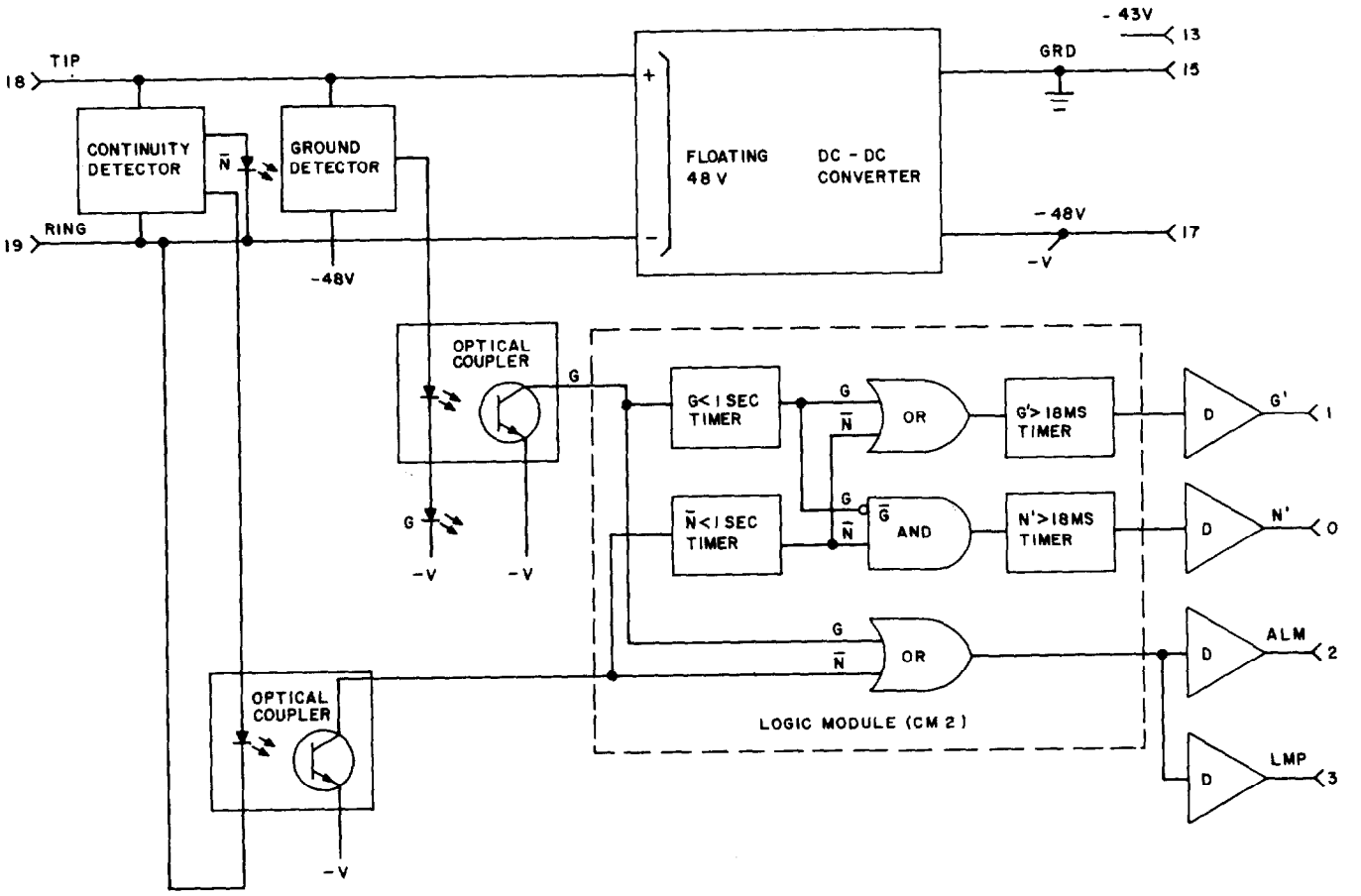

Fig. 9—Data Set 115A—Block Diagram

alarm outputs of all data sets are parallel connected to the CK2 CP. If a loop open or ground continues for 8 seconds or more, the relay in the output of the CP deenergizes and provides an alarm indication in the form of a contact closure. Since this relay is normally energized, loss of the −48V central office battery power in the data mounting will also cause a contact closure. A voltage sensor within the CK2 CP connected to the 5-volt power unit will cause an alarm output if the 5-volt power unit fails. The output of the CK2 CP will normally be connected to the central office major alarm.

3.10 The G′ and N′ output signals of data set 115A are interconnected to the interface driver (AE45 CP) either directly or via an interoffice link. Two or more data sets 115A and/or interoffice links may be paralleled at the input of an interface driver.

3.11 The N′ and G′ inputs to the interface driver (Fig. 10) control operation of the N′ and G′ interface relays. With both interface relays deenergized (alarm loop normal condition), the tip and ring lines are connected together causing a normal (closed) loop condition to the alarm central station. Energizing the N′ relay causes an open loop, while energizing the G′ causes a ground to be applied to the loop through contacts of the fault relay. LEDs in series with the interface relays provide a visual indication of the presence of G′ or N′ signals.

3.12 The loop current detector provides an output when the current in the loop to the alarm company central station reverses polarity. This loop current fault signal is ANDed with the inverted N′ signal to form a fault (F) signal.

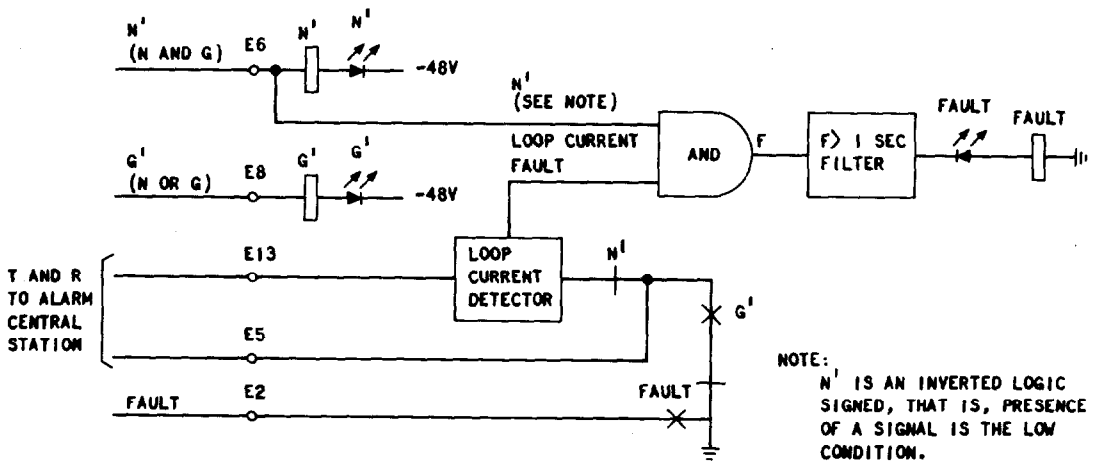

Fig. 10—Interface Driver AE45—Block Diagram

Note: The N′ and G′ signals are inverted from a logic standpoint, that is, presence of a signal is the low condition. The inversion occurs in data set 115A.

If a loop current fault exists in the absence of an N′ signal for more than 1 second, the F> 1-second timer locks up in the on state, illuminating the fault indicator and energizing the fault relay. The F> 1-second timer releases when a loop current fault exists for 1 full second. The F> 1-second timer prevents the fault relay and indicator from operating due to normal alarm signals or from releasing due to a short interruption of a permanent fault condition. The fault relay removes the ground path from the G′ relay contact and, therefore, removes the G′ signal from the loop to the alarm company central station. The fault relay also grounds the fault output connection from the interface driver which can provide a remote alarm indication.

3.13 The following options are provided by wire-wrap straps on the rear of the interface driver.

- ***Option Y***—Positive alarm company central station battery. Terminal E13 strapped to E3; tip input strapped to E12.

- ***Option Z***—Negative alarm company central station battery. Terminal E3 strapped to E12; tip input strapped to E13.

- ***Options W and X Installed***—Minimum current limiting in loop to alarm company central station. Terminal E9 strapped to E11; terminal E11 strapped to E13; terminal E5 strapped to E10; terminal E7 strapped to E10.

- ***Option W Installed—Option X Removed***—Medium current limiting in loop to alarm company central station. Terminal E9 strapped to E11; terminal E7 strapped to E10. Straps between terminals E5 and E10 and between E11 and E13 removed.

- ***Option W and X Removed***—Maximum current limiting in loop to alarm company central station. All straps except those for Options Y or Z removed.

4. FAULT INDICATORS

4.01 Fault indicators are provided on the key and lamp panel, data set 115A, and interface driver. All indicators are normally extinguished but continuously illuminated for 1 second or longer when a fault condition exists. All except the FAULT indicator LED on the interface driver will blink (the on period less than 1 second) when an alarm signal is being transmitted through the low speed signaling system.

4.02 Three conditions will cause the indicator on the key and lamp panel to illuminate:

- $\overline{N}$ (loop open)
- G (loop grounded)
- Data set 115A removed from connector in data mounting.

The last condition occurs due to contacts within the data set connectors (J1 through J14) of the 43A1 data mounting which apply a ground to the LMP output connect (contact 3). Grounds are also applied to N (contact 0) and G' (contact 1) causing steady N' and G' signals. With Option Z installed (pin 22 of the data set connector grounded) in the 43A1 data mounting, removal of data set 115A will cause an alarm input to the CK2 CP and result, after 8 seconds, in a central office major alarm.

4.03 The $\overline{N}$ and G indicator LEDs on data set 115A and the N' and G' indicator LEDs on the interface driver illuminate when the corresponding signal is present. Removal of the data set from its connector in the 43A1 data mounting or failure of the interoffice link also illuminates the N' and G' indicator LEDs on the interface driver. The FAULT indicator illuminates when a ground fault occurs on the tip (feed) side of the loop to the alarm company central station.

5. REFERENCES

5.01 For additional information relating to the low speed signaling system, refer to the following documents:

SECTION	TITLE
312-809-100	405-Type Data System—Description
312-812-180	Data Set 115A—Summarizing Specification
312-812-200	Low Speed Signaling System Using Data Set 115A—Installation and Connections
312-812-300	Low Speed Signaling System Using Data Set 115A—Maintenance
312-812-500	Low Speed Signaling System Using Data Set 115A—Test Procedures
590-001-111	Data Set 115A—Reference Guide
590-102-138	43A1 Data Mounting—Identification
591-038-100	Data Set 115A—Identification
880-350-110	Low Speed Signaling System Using 115A Data Sets—General Engineering Considerations

NUMBER	TITLE
CD- & SD-73104-01	Data Systems Central Office—Data Set 115-Type and 43A1 Data Mounting