DATA SET 109H-TYPE
PRIVATE LINE APPLICATION
DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This practice provides a physical and functional description of data set 109H-type. Information on the data set arrangements or features and general information on the applications of the data set are also provided by this practice.

1.02 Data set 109H-type is a low-speed, full-duplex (FDX), dc data set that presents an EIA interface to any associated business machine such as the M37 teletypewriter (TTY) or customer-provided terminal (CPT).

1.03 Data set 109H-type is a serial transmission data set designed for use over 2-wire metallic line facilities and employing a tri-level current baseband transmission scheme. The data set can operate in either the half-duplex (HDX) mode or FDX mode and therefore is compatible with all data sets 109-type.

1.04 Data set 109H-type will operate in the FDX mode at speeds up to 150 bauds in each direction over a loop with less than 2000-ohms resistance and up to 1 microfarad capacitance. The data set can operate in the HDX mode with an extended range to 2500-ohms resistance and up to 1-microfarad capacitance.

Note: Loops shorter than 2000 ohms are adjusted to a nominal 2000-ohm value by using a resistor pad that is provided as part of the data set. Information on making the pad adjustments is contained in the section entitled Data Set 109H-Type—Private Line Application—Installation (591-037-200).

2. PHYSICAL DESCRIPTION

2.01 Data set 109H-type in a private line application has one list number which provides an optional feature in addition to the basic data set functions. The basic data set is designated 109H-L1 (see Fig. 1). The additional list number (data set 109H-L1/5) is provided by the internally mounted GR1 circuit pack.

2.02 Data set 109H-L1 provides the basic GA1 circuit pack, 6-button key, spade-ended cord, baseplate, brackets, and plastic housing. A wall-mounted 2245A transformer that is used to obtain +24 volts and ±8 volts dc power is also provided as part of the basic data set. Since data set 109H-L1/5 is provided by an internally mounted circuit pack, the external physical appearance of the data set is not changed with the use of this optional list number.

2.03 The optional L1/5 feature is provided by a GR1 circuit pack that snaps on and is wired into the basic data set 109H-L1. The GR1 circuit pack is shown in Fig. 2 and provides loop current supervision (RS).

2.04 In addition to the feature that can be added to the basic data set by the optional list

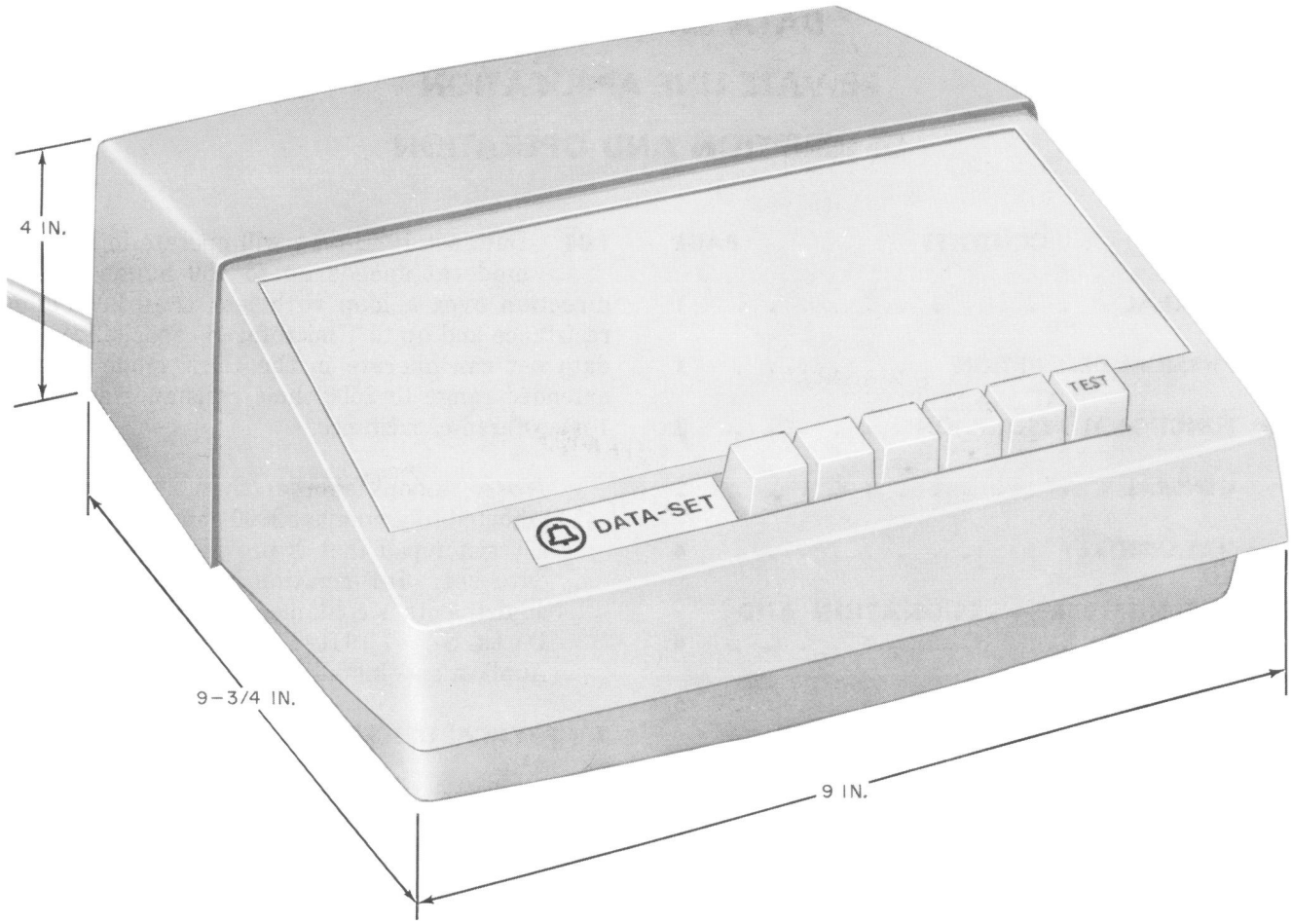


Fig. 1—Data Set 109H-L1

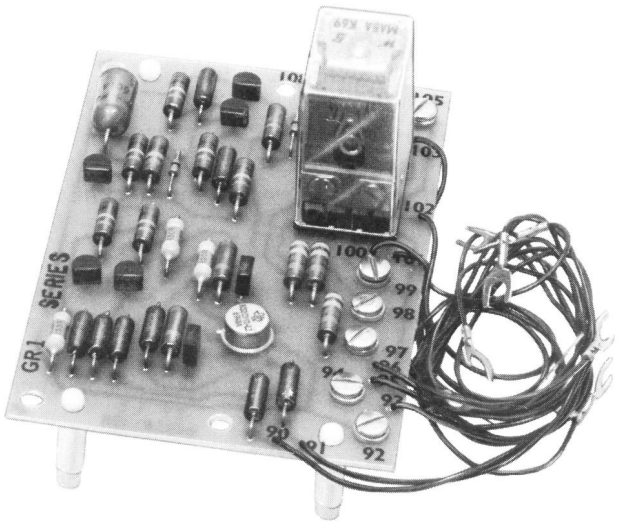


Fig. 2—GR1 Circuit Pack

number, the basic data set provides the screw switch options listed in Table A. The option switches are mounted on GA1 circuit pack. For information on the installation and use of these options, refer to Section 591-037-200.

3. FUNCTIONAL DESCRIPTION

GENERAL

3.01 Data set 109H-type presents an EIA interface to a terminal device. The interface leads are given in Table B. The data set is connected to the transmission line, and a positive data set ready indication is presented to the EIA interface unless there is a carrier fail condition and the RS option is used. When using data set 109H-L1, the data set ready lead is permanently ON.

TABLE A

OPTIONS

OPTION	FEATURE
Z	Space Crossover Shift
Y	Mark Crossover Shift (see Note 1)
X	No Crossover Shift
W	Frame Ground to Signal Ground
V	Isolated Signal ground
M	CB Lead Open
K	CB Looped to CA
J	CB Common to CC
H	CC Lead--Data in Test Mode
G	CC Lead--No Data in Test Mode (see Note 2)
F	CC Lead--Steady "On"
E	CC Lead--for Private Line 109H-L1 Arrangement Only (See 591-037-200, Tables A and B) (see Note 3)
B	CF Lead--Data in Test Mode
A	CF Lead--No Data in Test Mode (see Note 4)
ZA	CF Lead--Steady "On"

Note 1: Crossover shift is a bias added to the loop current detector so that either a mark or space appears on the BB lead whenever the loop current is zero. Option Y causes the terminal to receive a mark when loop current approaches zero. Option Z causes the terminal to receive a space when loop current approaches zero. Option X provides no crossover shift, which means no bias and less distortion.

Note 2: When in the test mode, data set 109H-L1/5 equipped with option H causes the CC lead to be "on"; when in test mode, data set 109H-L1/5 equipped with G option causes the CC lead to be "off". A current fail condition will turn the CC lead "off" when using option H, G, or F with data set 109H-L1/5.

Note 3: When in the test mode, data set 109H-L1 must be equipped with option E.

Note 4: Options A, B, and ZA cannot be provided for private line arrangements using the data set 109H-L1/5 (see 591-037-200, Tables A and C).

TABLE B

INTERFACE LEADS

LEAD DESIGNATION		FUNCTION
AA	Protective or Frame Ground	
AB	Signal Ground	
BA	Transmitted Data	Data is received by the data sets from the terminal on the BA lead and is transmitted over the transmission facility.
BB	Received Data	Data is received from the transmission facility and is presented to the terminal on the BB lead.
CA	Request to Send	See note.
CB	Clear to Send	See note.
CC	Data Set Ready	Indicates to the terminal that the data set is capable of performing all functions.
CF	Carrier Detector	This lead is attached to a positive voltage as a static condition except when the RS option is used. When the RS option is used, the signal on the CF lead is an indication of the state of the transmission facility.

Note: Leads designated by this note are not used by the data set but are optionally connected together by spade-ended leads, insulated and stored, or the CB lead is connected to the CC lead.

DATA SET KEY

3.02 A 6-button key provides the interface for operation of the data set. The functions of all keys and lamps except the TEST key are disabled. The TEST key, when depressed (locking), connects the received (BB) lead to the transmitted data lead (BA) of the data set at the EIA interface to provide a loop-around test. The test data is present on the received data lead. When the TEST key is depressed, the data set is slaved to the far end. If a mark is received, a mark is retransmitted; if a space is received, a space is retransmitted. Test mode will ensure that both data sets are transmitting a mark when the loop current is measured. When the remote data set TEST key is depressed, data that is transmitted by the local data set will be looped back by the remote data set to appear on the BB lead.

LIST NUMBERS—DESIGNATION AND FUNCTION

3.03 When the data set 109H-type is arranged for private line service, only one list number provides an optional feature in addition to the basic data set functions. The codes which can be ordered for the data set and the feature provided by the additional code are described in the following list.

- ***Data Set 109H-L1:*** The basic data set including plastic housing, baseplate and brackets, spade-ended cord, 6-button key,

GA1 circuit pack, and 2245A transformer. The data set interconnects to the terminal equipment via an EIA interface.

- ***Data Set 109H-L1/5:*** This data set consists of the basic data set plus GR1 circuit pack arranged piggyback style and connected to the GA1 circuit pack by four standoff posts. Electrical connections to the GR1 circuit pack are made with screw terminals and spade-ended leads. Data set 109H-L1/5 provides all the previously stated features of data set 109H-L1 plus loop current supervision. This option, called the receive supervision (RS) option, detects the presence of normal loop current. When the RS option is provided, a no-current condition results in negative signal on the CC and BB leads and the metallic loop being open. With current detected, the CC lead is positive and the loop is closed. These conditions are summarized in Table C.

TABLE C

RS OPTION CONDITIONS WITH DATA SET 109H-L1/5

LEAD	CURRENT	NO CURRENT
CC	Pos	Neg
CF	Pos	Neg
BB	--	Neg

OPERATION

3.04 The basic dc transmission system consists of a pair of data sets 109-type at each end of a 2-wire metallic loop (see Fig. 3). Each data set applies either a mark or space voltage to the metallic loop and monitors the loop current for a mark or space. The voltage applied to the loop by each data set can develop three possible current levels. Internal logic within each data set allows incoming data to be recovered from the loop current. All possible transmission states and the signal detected by each data set are shown in Table D and Fig. 4.

3.05 A functional block diagram of the data set is shown in Fig. 5. This diagram also shows the GR1 circuit pack.

GA1 CIRCUIT PACK

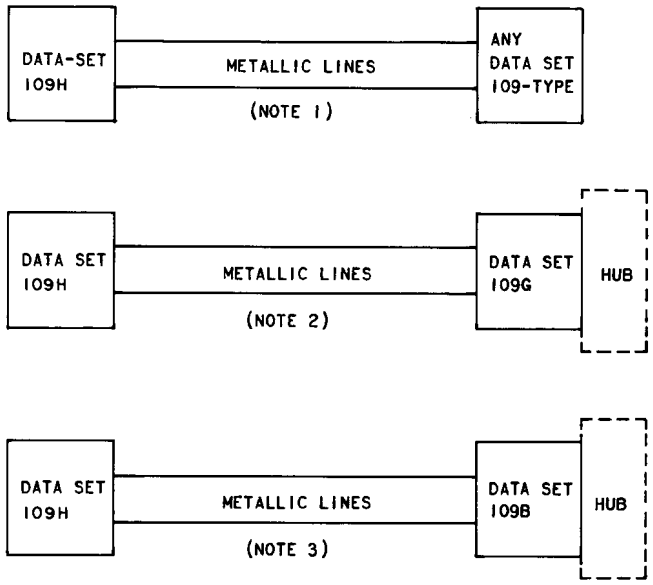
3.06 The GA1 circuit pack is the basic building block for data set 109H-type. The GA1 circuit pack includes the transmit and receive isolators, transmitter, receiver, bridge circuit, loop current adjusting resistors, power supply rectifiers and filters, and a 25-pin EIA connector.

3.07 The interface leads at the EIA connector are identified in Table B. The leads directly relating to the circuits on the GA1 circuit pack are the BA and BB leads.

3.08 Transmit data from the terminal is applied to the BA lead of the EIA connector. A negative signal on the BA lead causes the transmitter to develop a mark voltage across the varistor-diode bridge. A positive signal on the BA lead causes the transmitter to develop a space voltage across the bridge. These signals are then applied to the metallic loop. The monitor bridge and loop current adjusting resistors are between the varistor-diode bridge and the metallic loop.

3.09 The monitor bridge circuit develops a voltage that is proportional to loop current when the local data set is transmitting a mark and is receiving data from the remote end. When the local data set is transmitting a space, the bridge introduces a slicing level shift of the voltage developed at the bridge. The slicing level shifts whenever the local data set transmits a space. The overall effect is to develop a signal at the midpoint of the bridge that represents the data signal from the remote end while eliminating the signal due to locally transmitted data. The splicing level shift, in effect, factors out locally transmitted spaces.

3.10 The receiver consists of a high-gain operational amplifier in series with a slicing circuit. Data signals at the monitor bridge are applied to the operational amplifier, which acts as a switch by cutting off when receiving a space. The output of the amplifier is applied to the slicer. The signal developed at the output of the slicer is a copy of the data from the remote station data set. The



NOTES:

1. FOR POINT-TO-POINT SERVICE,THE BALANCE OF 2000 OHMS RESISTANCE NOT FURNISHED BY THE LINES IS EQUALLY DIVIDED BETWEEN THE DATA SETS.
2. WHEN LINE RESISTANCE IS LESS THAN 1500 OHMS,THE DATA SET 109G WILL BE PADDED WITH 522 OHMS AND THE BALANCE OF 2000 OHMS WILL BE PADDED AT THE DATA SET 109H. WHEN LINE RESISTANCE IS 1500 OHMS OR MORE,THE ENTIRE BALANCE OF 2000 OHMS WILL BE PADDED AT THE DATA SET 109H.
3. THE BALANCE OF 2000 OHMS RESISTANCE NOT FURNISHED BY THE LINE IS PADDED AT DATA SET 109H.

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Fig. 3—Block Diagram for Typical Private Line Configuration

TABLE D

TRANSMISSION STATES AND THE SIGNAL DETECTED

TRANSMITTING VOLTAGE			LOOP CURRENT (mA)	SIGNAL DETECTED BY	
DATA SET A (VOLTS) SEE NOTE 1	DATA SET B (VOLTS)	VOLTAGE AROUND LOOP (VOLTS) SEE NOTE 2		DATA SET A	DATA SET B
4 (M)	4 (M)	8 (M)	3 (M)	(M)	(M)
-12 (S)	4 (M)	-8 (S)	-3 (S)	(M)	(S)
4 (M)	-12 (S)	-8 (S)	-3 (S)	(S)	(M)
-12 (S)	-12 (S)	-24 (3S)	-9 (3S)	(S)	(S)

(M) = MARK
(S) = SPACE
(3S) = TRIPLE SPACE

Note: The metallic loop connections to the data sets are made so that when both data sets transmit a mark, the voltages applied to the loop are series-aiding. Refer to Fig. 4.

output of the receiver is applied through the receiver islator to the BB lead of the EIA connector.

3.11 The loop current-adjusting resistors allow the loop current to be adjusted to the proper current level for any loop less than 2000 ohms. The normal level, when both data sets transmit a mark or either data set transmits a space, is approximately 3 mA. For information on setting these resistors, refer to Section 591-037-200.

3.12 The power supply rectifiers and filters on the GA1 circuit pack are used in conjunction with the 2245A transformer to derive the +24 volts and ±8 volts power for the data set. The 24-volt supply is used on the loop side of the isolation interface and the 8-volt supplies are used on the terminal side of the isolation interface.

GR1 CIRCUIT PACK

3.13 The GR1 circuit pack is associated with L1/5 data sets and is used to implement the RS option. The GR1 circuit pack is secured or connected to the GA1 circuit pack piggyback style with four posts. The GR1 circuit pack is controlled by a signal which is proportional or loop current.

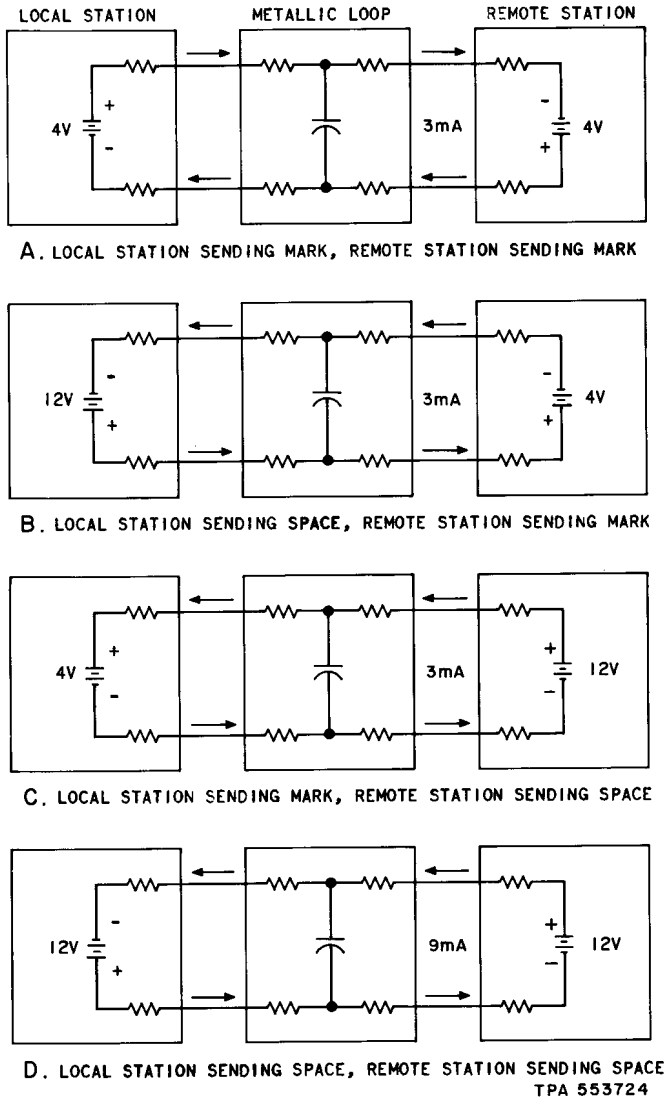

Fig. 4—Transmission States of Data Sets 109-Type (FDX System)

For private line application, the functions of the GR1 circuit pack are as follows:

(a) CC lead control

(b) CF lead control

(c) Mark hold on BB lead.

4. REFERENCES

4.01 For additional information on this data, refer to the following documents:

- CD-1D220-01
- SD-1D220-01.

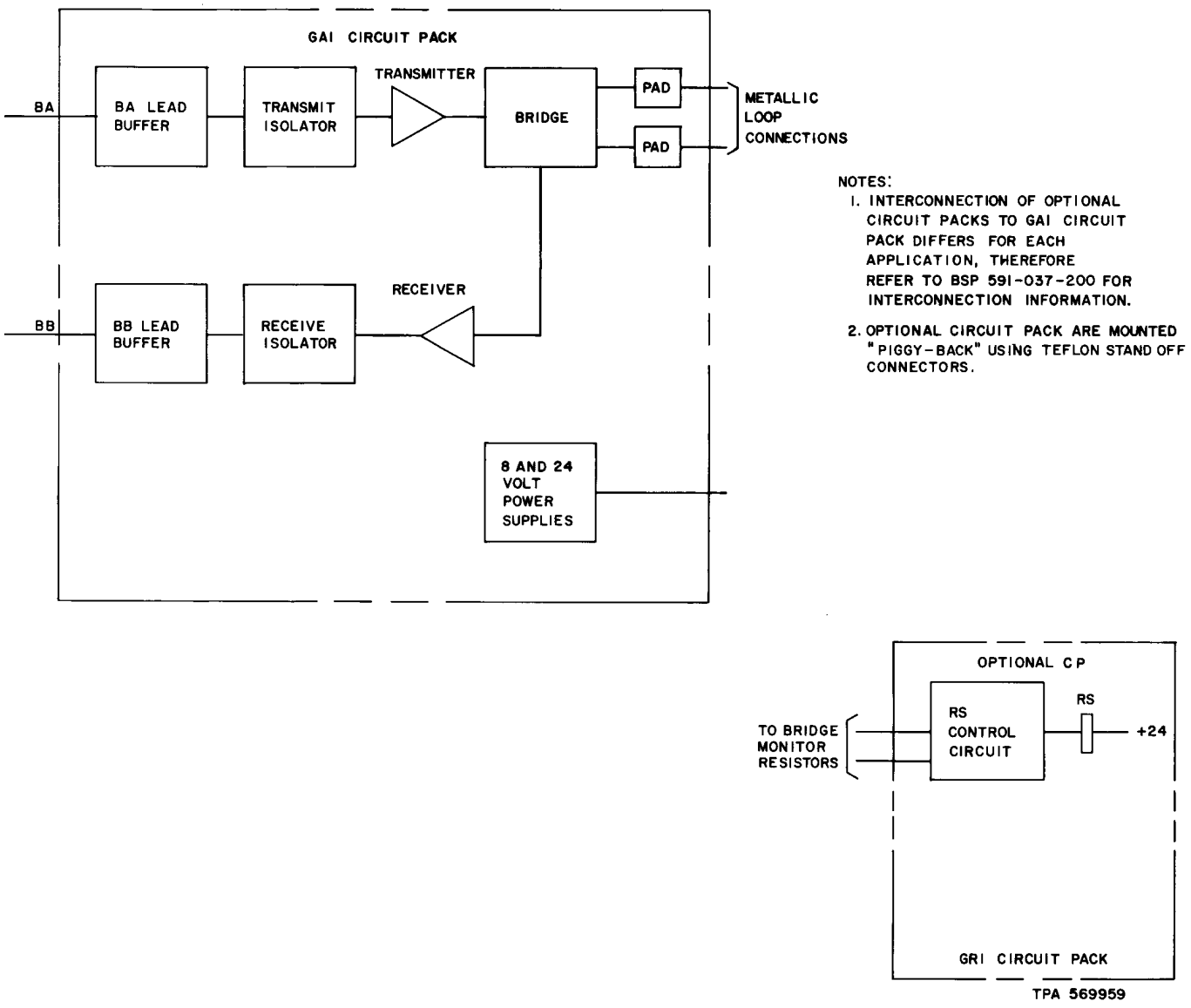

Fig. 5—Data Set 109H-Type—Functional Block Diagram