DATA SET 208A-TYPE

SUPPLEMENTARY INFORMATION

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1. GENERAL

1.01 This section covers data sets (DS) 208A-L1, 208A-L1A, and 208A-L1B in greater depth than the description, installation, maintenance, and test sections. Before reading this section, one should be familiar with the contents of all the other practices in this series as listed in Part 6 (REFERENCES). The information contained in this section supplements the information contained in other practices and is not required for installation, maintenance, or testing under normal circumstances. In this section, when referring to DS 208A-L1,

208A-L1A, and 208A-L1B, the term 208A-type will be used. Fig. 1 shows a front view of DS 208A-L1B.

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

1.03 DS 208A-type is a synchronous, binary serial 4800-bit-per-second (bps) data set for use on basic 3002-type 4-wire private line telephone channels. It is compatible for use only with another DS 208A-type.

1.04 The differences between DS 208A-L1, 208A-L1A, and 208A-L1B are as follows:

- ***208A-L1:*** This set is a transmitter-receiver with analog loop-back and digital loop-back test capability.
- ***208A-L1A:*** In addition to the features of DS 208A-L1, this set provides self test capability, additional status indicators, additional test switches, a lamp test capability, and an option to hold the data set ready lead ***on*** when the data set is in the analog loop-back mode.
- ***208A-L1B:*** This set is functionally the same as 208A-L1A. The backplane wiring is changed and a new circuit pack (HG26) is used which is not compatible with DS 208A-L1 or 208A-L1A. DS 208A-L1B utilizes the same housing and power supply as previous DS 208A-type.

1.05 DS 208A-L1 and -L1A are rated manufacture discontinued. DS 208A-L1B contains a new circuit pack (HG26), replacing circuit packs HG5, HG6, and HG17, which are rated A&M only to allow for repair of existing DS 208A-L1 and 208A-L1A.

2. EQUIPMENT CHARACTERISTICS

2.01 This part contains a description of the data set status indicators, test switches, and the power unit. In addition, the cabinet for multiple installation is described and associated equipment is identified.

STATUS INDICATORS

2.02 The data set status indicators monitor the power unit, certain interface leads, and the test switch(es). The status indicators are light emitting diodes (LEDs), visible through translucent designations located on the data set front cover.

A. DS 208A-L1

2.03 Data set status indicators are as follows:

ON—This indicator is lighted when the power cord is plugged into a 105- to 129-Vac 57- to 63-Hz source and the power unit is operating normally (refer to 2.34).

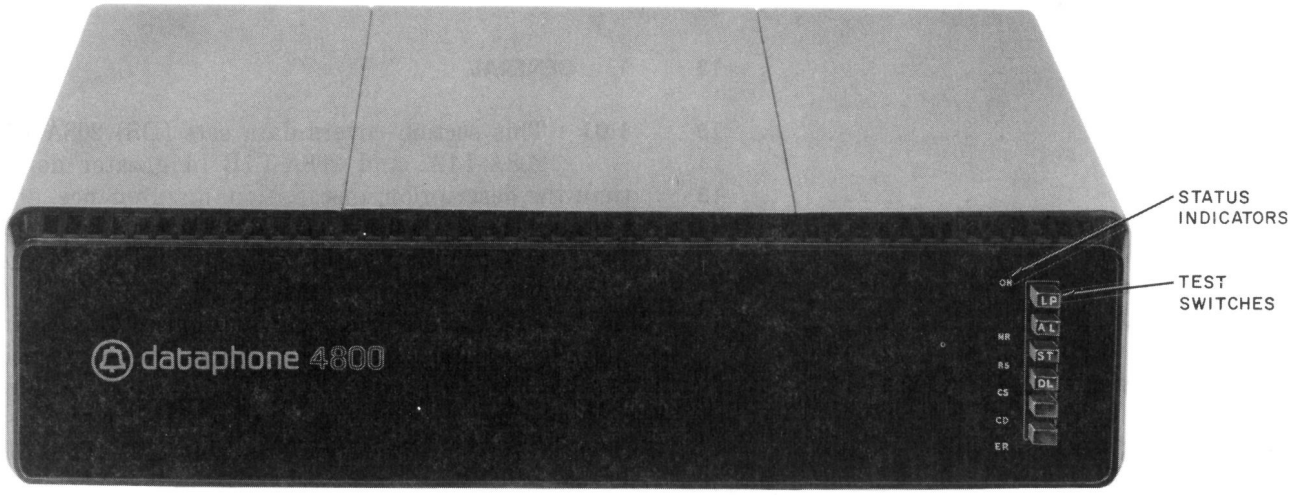


Fig. 1—DS 208A-L1B—Front View

RS—This indicator monitors the condition of the request-to-send lead and is lighted whenever the lead is in the ***on*** condition. When the data set is equipped for continuous request-to-send, the RS indicator is permanently lighted.

CS—This indicator monitors the condition of the clear-to-send lead and is lighted whenever the lead is in the ***on*** condition. This indicates that the data set is ready and will transmit the data present on the send data (BA) lead.

CO—This indicator monitors the condition of the carrier-on interface lead and is lighted when the lead is in the ***on*** condition. This indicates that the receiver has detected a signal which is within the data band. The signal must be received for approximately 45 ms before the CO indicator lights.

ER—This indicator monitors the condition of the equalizer mode (QM) interface lead and is off when the lead is in the ***on*** condition. Assuming that the data set is receiving a signal (CO indicator is lighted), the lighted ER indicator indicates that invalid data has been received and that the equalizer is retraining. When the CO indicator is off, the ER indicator should be lighted (assuming normal operation); when the CO indicator is lighted, the ER indicator should be off. Two CO/ER operations are possible in typical operating systems and are determined by customer application. In one system, where line signal is always being received, the CO indicator is always lighted and the ER indicator flashes only during retraining. In the other system, the CO indicator lights and goes off, and thus CO and ER will alternate. For this system, a lighted condition of ER indicates an abnormal condition only if the CO indicator is also lighted.

AL—This indicator monitors the data set test switch and lights whenever the switch is placed in the analog loop-back test position.

DL—This indicator monitors the data set test switch and lights whenever the switch is placed in the digital loop-back test position.

B. DS 208A-L1A and 208A-L1B

2.04 Data set status indicators are as follows:

ON—This indicator is lighted when the power cord is plugged into a 105- to 129-Vac 57- to 63-Hz source and the power unit is operating normally (refer to 2.34).

MR—This indicator monitors the condition of the data set ready lead and in normal operation, lights whenever the lead is in the ***on*** condition. When DAS 828A- or 829-type is used and is in the test mode, or when the data set is in the self-test (ST) mode or digital loop-back (DL) mode, the MR indicator is off. When the data set is in the analog loop-back (AL) mode, the MR indicator is off except when the DSR-on-in-AL-mode option (YM) is installed. When the compromise equalizer test enabled option is installed, the MR indicator is held off.

RS—This indicator monitors the condition of the request-to-send lead and in normal operation, lights whenever the lead is in the ***on*** condition. When the data set is equipped for continuous request-to-send (option YS), the RS indicator is permanently lighted. The RS indicator also lights when the data set is in the self-test mode.

CS—This indicator monitors the condition of the clear-to-send lead and lights whenever the lead is in the ***on*** condition. This indicates that the data set is ready and will transmit the data present on the send data (BA) lead.

CO—This indicator monitors the condition of the carrier-on interface lead and lights whenever the lead is in the ***on*** condition. This indicates that the receiver has detected a line signal which is within the data band. The signal must be received for approximately 45 ms before the CO indicator lights.

ER—This indicator monitors the condition of the equalizer mode (QM) interface lead and is off when the lead is in the ***on*** condition. Assuming that the data set is receiving a signal (CO indicator is lighted), the lighting of the ER indicator indicates that invalid data has been received and that the automatic equalizer is now retraining. When the CO indicator is off, the ER indicator should be lighted (assuming normal operation); when the CO indicator is lighted,

the ER indicator should be off. Two CO/ER operations are possible in typical operating systems and are determined by customer applications. In one system, where line signal is always being received, the CO indicator is always lighted and the ER indicator flashes only during retraining. In the other system, the CO indicator lights and goes off, and thus CO and ER will alternate. For this latter system, a lighted condition of ER indicates an abnormal condition only if the CO indicator is also lighted.

TEST SWITCHES

A. DS 208A-L1

2.05 DS 208A-L1 is provided with a 3-position loop-back test switch. In the center position, the switch allows data to proceed normally through the data set. In the digital loop-back position, the receiver is looped back to the transmitter at the customer interface, and the DL status indicator is lighted. In the analog loop-back position, the transmitter is looped back to the receiver through an attenuator on the line side, and the AL status indicator is lighted.

B. DS 208A-L1A and 208A-L1B

2.06 DS 208A-L1A and 208A-L1B are provided with four test switches, which are accessible through the front cover. The switches are depress-to-operate and depress-to-release type with the exception of the nonlocking LP (lamp test) switch. Test switch functions are as follows:

LP (Lamp Test)—This switch, when depressed, lights all status indicators with the exception of the ON indicator (which should be lighted whenever power is applied to the data set). Depressing this switch does not affect data set operation. When the compromise equalizer test enabled option is installed, depression of the LP switch, in addition to lighting the status indicators, also shorts the transmitted line signal.

Note: The compromise equalizer test enabled option is ***only*** used during initial installation and should not be installed for normal operation. When the option is installed, the data set ready lead and the MR indicator are held off.

AL (Analog Loop-Back)—This switch, when depressed, loops back the transmitter to the receiver through a channel simulator on the line side. This permits testing of the local data set with self-contained test circuitry or with external test equipment through the customer interface.

ST (Self Test)—This switch, when depressed, turns the data set transmitter on and conditions the data set to transmit steady marks. The ER indicator blinks in response to the occurrence of errors in the received data, and lights for approximately 100 ms whenever an error is detected.

DL (Digital Loop-Back)—This switch, when depressed, causes a loop-back at the data set customer interface. The received data (BB) lead is connected to the transmitted data (BA) lead; the serial clock receive (DD) lead is connected to the serial clock transmit external (DA) lead; and the signal quality detector (CG) lead is connected to the request-to-send (CA) lead. The data set functions as a regenerator. This permits testing of the facilities and both data sets.

Note: Do not operate the DL and AL test switches or the DL and ST switches simultaneously.

INTERFACE LEADS

A. Customer Interface

2.07 The customer interface is the point of connection between DS 208A-type and the customer-provided equipment (CPE). The customer must supply the plug and the necessary cable to connect the CPE to the data set.

2.08 The signals on all the DS 208A-type customer interface leads meet the requirements of EIA Standard RS-232C. Five of the interface circuits provided by DS 208A-type are not described by that standard. The distortion of the signal element (bit) timing circuits and the distortion of data circuits conform to EIA Standard RS-334.

2.09 All voltage levels on the customer interface leads are in respect to signal ground. The transmitted and received data leads are in the marking condition when the voltage present is more negative than -3 volts and are in the spacing condition when the voltage is more positive than +3 volts. The control leads are in the ***on*** condition when their voltage is more positive than +3 volts and are in the ***off*** condition when their voltage is

more negative than -3 volts. Table A gives a summary of the pin assignment of EIA data and control leads, signal states, EIA designations, and mnemonic designations.

2.10 The terminating impedance of the receiving end of a customer interface circuit has a dc resistance of not less than 3000 ohms and not more than 7000 ohms over the range of voltages for which the signal is defined. When the interface plug is disconnected, the interface voltage on terminating circuits is between -2 to +2 volts.

2.11 The operation of DS 208A-type terminator circuits is dependent only on the signal voltage on the interface lead and conforms to EIA Standard RS-232C with regard to the rise and fall time. On control leads the time required for the signal to pass through the transition region (-3 to +3 volts) during a change in state does not exceed 1 ms. On the received data, receive signal element timing, and transmit signal element timing circuits, the rise and fall time through the transition region does not exceed 8 μs. The rise and fall times of the transmitted data and transmitter signal element external (if used) signals should also conform to the above limits.

2.12 The open circuit driver voltage on any DS 208A-type interface circuit does not exceed -25 or +25 volts. All terminators will withstand any input signal that is within the -25 to +25 volt limit. The interface driver circuits are such that when the proper terminating impedance (3000 ohms to 7000 ohms) is provided and the terminator open circuit voltage is 0, the voltage at the point of interface is between +5 and +15 volts or -5 and -15 volts.

2.13 The DS 208A-type interface connector provides 16 EIA interface circuits for connection to the terminal equipment and three additional circuits for use with the telephone company test equipment. They are described in the following paragraphs.

2.14 ***Protective Ground (AA):*** This lead is electrically bonded to the data set housing and chassis. It is connected to local power ground through the third wire of the power cord.

2.15 ***Transmitted Data (BA):*** Mark and space signals generated by the CPE are delivered to the data set on this lead. The data set samples the signals on this lead during the negative transition of the transmitter signal element timing (DB) signal or the clock signal provided by the CPE for externally timed data sets. The terminal equipment must be arranged to transmit data on this lead only when an ***on*** voltage is present on both the clear-to-send (CB) and data set ready (CC) leads.

2.16 ***Received Data (BB):*** Mark and space signals generated by the data set in response to data signals received from the distant-end data set are delivered to the CPE on this lead. The data signals are clocked to the CPE and the CPE is timed to sample the data during the negative transitions of the received signal element timing signals. An ***off*** condition on the received line signal detector (CF) lead causes the received data lead to be clamped in the mark condition.

2.17 ***Request-to-Send (CA):*** With switched carrier operation, an ***on*** condition on this lead is an indication to the data set transmitter of the intent of the CPE to transmit data. After turning on this lead, the CPE should wait for an ***on*** condition on the clear-to-send lead before starting transmission. For a minimum delay between the ***on*** conditions of CA and CB, the positive going transition of CA should coincide with a positive transition of the divided clock transmitter circuit. When the CA circuit is turned ***off*** at the end of a message, the data set transmitter remains on about 2 ms to allow the last bits of data to clear the transmitter. With continuous carrier operation, the transmitter is kept on at all times. The user may choose, however, to use the CA circuit to control timing functions in the data terminal which require the CB circuit ***on*** condition. In this case, the data set provides a delay of 8 ±0.5 ms betwen an ***on*** condition of CA and an ***on*** condition of CB. If the CPE does not require this feature, it may be disabled. As a result, the request-to-send circuit is held ***on*** internally and is not under the control of the CPE. In either case, continuous carrier operation inhibits the data set from initiating a start-up training sequence which eliminates the 48.5-ms delay between request-to-send and clear-to-send.

2.18 ***Clear-to-Send (CB):*** Signals on this lead are generated by the data set to indicate whether the data set is ready to transmit data. In switched carrier operation, CB is turned ***on*** approximately 48 ms after the ***on*** condition of the request-to-send lead from the CPE. This is done to allow the adaptive equalizer in the distant data set to train itself and get into synchronization.

TABLE A

CUSTOMER INTERFACE

PIN NO.	FUNCTION	DATA SET MNEMONIC	EIA DESIGNATION (RS-232-C)
1	Frame Ground	FG	AA
2	Send Data	SD	BA
3	Receive Data	RD	BB
4	Request to Send	RS	CA
5	Clear to Send	CS	CB
6	Data Set Ready	DSR	CC
7	Signal Ground	SG	AB
8	Carrier On	COD	CF
9	+12V	CI9 (+12V)	Reserved for Data Set Testing
10	—12V	CI10 (—12V)	Reserved for Data Set Testing
11	Equalizer Mode	QM (Non-EIA)	Unassigned
14	New Sync	NS (Non-EIA)	SBA (Note)
15	Serial Clock Transmitter	SCT	DB
16	Divided Clock Transmitter	DCT (Non-EIA)	SBB (Note)
17	Serial Clock Receiver	SCR	DD
18	Divided Clock Receiver	DCR (Non-EIA)	Unassigned
21	Signal Quality Detector	COV	CG
24	Serial Clock Transmitter External	SCTE	DA
25	+5V	CI25 (+5V)	Unassigned

Note: These interface leads have functions different from the functions assigned to them by EIA Standard RS-232C.

The ***on*** condition of the CB circuit is an indication to the CPE that signals presented on the transmitted data circuit will be transmitted to the communications channel. The ***off*** condition of this circuit is an indication to the CPE that it should not transfer data on the transmitted data circuit. The ***off*** condition of CB will be maintained as long as the request-to-send lead is ***off.*** CB turns ***off*** when the request-to-send circuit is turned ***off*** so that another message can be initiated by turning request-to-send ***on*** again. In continuous carrier operation with the switched request-to-send option, the CB circuit turns ***on*** approximately 8 ms after the request-to-send circuit is turned ***on.*** This is to provide a time delay on the CB circuit for use by the CPE (if this feature is desired). The transmitter is always transmitting carrier signal, but the CPE must wait for the CB circuit to go

on before transmitting data. If the CPE does not require switched request-to-send control, this option is disabled and CB is ***on*** all the time, indicating availability of the data set to transmit data.

2.19 ***Data Set Ready (CC):*** Signals on this lead are generated by the data set to indicate to the CPE whether the data set is in the data mode. The ***on*** condition of this circuit indicates that the local data set is capable of transmitting and receiving data signals and is not in the test mode or talk mode (if the data set is arranged for alternate voice service). The ***on*** condition of this circuit alone should not be interpreted to mean that a communication channel has been established to a distant data station, nor should it be used to determine the status of any remote terminal equipment. This circuit is used in conjunction with request-to-send and clear-to-send cicuits when data is being transmitted.

2.20 ***Signal Ground (AB):*** This circuit establishes the common ground reference potential for all interface circuits except frame ground (AA). This circuit is normally connected to the frame ground circuit to minimize the introduction of longitudinal power line noise into electronic circuitry through the power transformer. Depending on local procedures and conditions, this connection to frame ground can be removed by the telephone company installer.

2.21 ***Received Line Signal Detector (CF):*** The ***on*** condition of this circuit indicates that the data carrier signal has been received for 45 ms or more. This circuit is timed to turn ***on*** approximately 41 ms after the signal quality detector circuit turns ***on.*** Normal levels of message circuit noise, impulse noise, and out-of-band signals as prescribed for private line channels should not cause this circuit to turn on. Without the 1-second holdover option, this circuit will go ***off*** if the line signal disappears for more than 2 ms due to the end of transmission or to a transmission line interruption. This ***off*** condition causes the received data circuit to be clamped to the mark condition. With the 1-second holdover option installed, the CF circuit remains ***on*** for 1 second beyond the time that data carrier signal is lost (if it does not reappear in the interim). During this 1 second, the received data circuit is not clamped to mark. Instead, it passes all signals to the CPE that are demodulated in this 1-second interval, even though the signals may not be valid.

2.22 ***Circuits 9 and 10:*** These circuits originate in the data set for use by the telco personnel in data set testing. Pin 9 provides an access to +12 volt dc supply; pin 10 provides an access to the -12 volt dc supply. The CPE must not be connected to these leads.

2.23 ***Equalizer Mode (QM—Non EIA):*** This circuit is used to indicate to the CPE that the adaptive equalizer in the receiver is reset or is retraining itself when error performance is poor. When the received line signal detector is ***on*** and QM is ***off,*** the data being provided on the received data circuit has a high probability of error. When QM is ***on,*** the automatic equalizer is in its normal trained mode and the signals on the received data lead have a low probability of error. QM turns ***off*** while the received line signal detector is ***on*** if the adaptive equalizer requires retraining in the local data set. This is done without a command signal from the transmitting data set. This feature is necessary in multipoint broadcast networks with a common transmitter or whenever continuous carrier operation is used in a remote transmitter.

2.24 ***New Sync (NS—Non EIA):*** This circuit may be used on an optional basis with a data set at the master station of a multistation private line network, such as in a polling operation, to ensure rapid resynchronization of the receiver on a sequence of messages from many different remote transmitters. This feature is necessary because the receiver clock maintains the timing information of the previous message for some interval after it has ended. This may interfere with resynchronization on receipt of the next message. The CPE can condition this circuit to turn ***on*** for 1 ms or more to squelch the existing clock after the end of a message is received. At all other times the ***off*** condition should be applied by the CPE. When the new sync option is not used, the new sync circuit is held ***off*** within the data set.

2.25 ***Transmitter Signal Element Timing (DB):*** For internally timed data sets, 4800-Hz square-wave signals on this circuit are used to provide the CPE with signal element timing information for the transmitted data circuit. This signal is present on interface lead 15 at all times when power is applied to the data set. The first signal element of the transmitted data signal should be presented by the CPE on the positive (off to on) transition of DB which coincides with the off

to on transition of the clear-to-send signal. (The clear-to-send signal turning ***on*** coincides with a positive transition of DB.) Transmitted data is sampled by the data set on negative transitions of DB. The DB circuit provides a timing signal which is phase-locked to the signal on circuit 24 (transmitter signal element timing external) for data sets timed externally by the CPE.

2.26 ***Divided Clock, Transmitter (DCT—Non EIA):*** A square wave signal at one-third the bit rate appears on this circuit whenever power is applied to the data set. Positive and negative transitions of this signal coincide with positive and negative transitions of transmitter signal element timing. This circuit indicates the rate at which phase changes are made in the transmitted signal. Three serial bits from the CPE are used to determine a phase change by the data set modulator, and the grouping of bits is according to the transitions on this circuit so that over one cycle of DCT, three serial bits from the CPE are encoded into one phase shift. If the shortest delay between request-to-send ***on*** and clear-to-send ***on*** is desired, the positive transition of request-to-send from the CPE should coincide with a positive transition of DCT.

2.27 ***Receiver Signal Element Timing (DD):*** The square wave signal on this circuit at the nominal 4800-Hz rate is used to provide the CPE with receiver signal element timing information. The transition from ***on*** to ***off*** indicates the center of each signal element on the received data circuit. This signal is provided at all times when power is applied to the data set except when the data set is in the digital loop-back test mode.

2.28 ***Divided Clock, Receiver (DCR—Non EIA):*** A square wave signal on this circuit provides the receiver timing information to the CPE at one-third the bit rate. Positive and negative transitions on this circuit coincide with positive and negative transitions on the receiver signal element timing circuit. By referring to the circuit, the CPE can define the 3-bit grouping of the decoded phase shifts of the received line signal. This means that in one cycle of DCR, three serial bits that were originally encoded into a phase shift by the transmitter are decoded into three bits with the same sequential relationship that existed at the transmitter. This signal is provided at all times when power is applied to the data set.

2.29 ***Signal Quality Detector (CG):*** This circuit provides to the CPE a signal similar to that of the received line signal detector. This circuit goes ***on*** if data carrier is received for approximately 4 ms or longer. It goes ***off*** if there is a loss of data carrier signal for 2 ms or longer. After the signal quality detector comes ***on,*** there is a delay of about 41 ms until received line signal detector goes ***on.*** The signal quality detector provides a fast-responding indication of the presence or absence of data carrier signal from a remote transmitter.

2.30 ***Transmitter Signal Element Timing External (DA):*** On data sets with the external timing option, this circuit is used by the CPE to provide bit rate timing to the transmitter. The ***on*** to ***off*** transition of this circuit indicates the center of each signal element on the transmitted data circuit. The timing signal from the CPE must have a frequency of 4800 Hz ±0.01 percent with a duty cycle from 49.5 to 50.5 percent as specified in EIA Standard RS-334. The transmitter signal element timing circuit on interface circuit 15 is phase-locked to this signal and the divided clock transmitter signal is derived from it. Signals should be available on this circuit at all times except when the data set is not in service.

2.31 ***Circuit 25 (Non-EIA):*** This circuit is reserved for use by the telco personnel in data set testing. It provides an access to the +5 volt dc supply. The CPE must not be connected to this circuit.

2.32 Refer to Table B for a summary of interface circuits between the CPE and the data set. Table B shows the interchange of control and data signals and the sequence in which the circuits are operated during use.

B. Telephone Line Interface

2.33 The telephone line interface is the point of connection between DS 208A-type and the 4-wire private line.

(a) ***Transmit Pair:*** The transmitter line signal goes out on the telephone line through leads DT1 (pin 7) and DR1 (pin 8). The output level is from -1.5 to +1.0 (nominal 0) dBm with a 600-ohm line impedance.

(b) ***Receive Pair:*** The line signal enters the receiver through leads DT (pin 9) and DR

TABLE B

SEQUENCE OF OPERATION OF INTERFACE CIRCUITS BETWEEN THE CPE AND DATA SET

PIN NO.	LEAD DESIGNATION	INTERFACE SEQUENCE			
		SWITCHED CARRIER		CONTINUOUS CARRIER	
		TRANSMIT	RECEIVE	TRANSMIT	TRANSMIT
1	Frame Ground				
2	Send Data	4		4	
3	Receive Data		4		1
4	Request-to-Send	2		2*	
5	Clear-to-Send	3		3	
6	Data Set Ready	1	1	1	1
7	Signal Ground				
8	Received Line Signal Detector		3		1
9	CI9 (+12V)				
10	CI10 (—12V)				
11	Equalizer Mode				
14	New Sync				
15	Serial Clock Transmitter	1	1	1	1
16	Divided Clock Transmitter	1	1	1	1
17	Serial Clock Receiver	1	1	1	1
18	Divided Clock Receiver	1	1	1	1
21	Signal Quality Detector		2		1
24	Serial Clock Transmitter External				
25	CI25 (+5V)				

* Unless continuous RS option is used

(pin 10). The receiver is designed to operate with a line signal level across DT and DR of -16 ±6 dBm.

(c) ***KTU:*** This lead (pin 13) is used in conjunction with the DIG GRD lead (pin 11). When DS 208A-type is used with DAS 828A-type, 829-type, or equivalent, this lead is used to give an indication to the CPE (on lead CC) when the channel is in the loop-back mode and not available for use.

(d) ***Voltage Leads:*** These leads connect to the power unit for test purposes only. Pin 2 carries a -12 volt potential, pin 3 carries a +5 volt potential, and pin 20 carries a +12 volt potential.

POWER UNIT

2.34 Data set power is provided by the internally mounted 83A power unit, which provides +12, -12, +5, and -6 volts. The power unit operates on an ac input of 105 to 129 volts at 57 to 63 Hz. Power consumption is approximately 26 watts.

2.35 Input power is supplied through a P3BJ or KS-14532-L24 cord. Output connections are made through screw terminals on TB1 at the rear of the power unit.

2.36 The power unit is protected by a self-resetting thermal overload switch that disables the power unit if the temperature rises excessively. The power unit is provided with an overvoltage protection device to prevent data set circuit damage. If for any reason the output voltages of the power unit rise excessively, the power unit protects the data set from the overvoltage, and the ON indicator goes off. When the cause of the overvoltage has been corrected and the power unit is operating normally, the ON indicator lights only after the data set power cord has been unplugged and plugged in again.

2.37 The power unit is factory-adjusted to precise levels and should not require field adjustment. If adjustments become necessary, refer to Part 5. Part 5 also contains instructions for removing the power unit from the housing for test and/or replacement.

MULTIPLE ARRANGEMENTS

2.38 This part contains information on multiple arrangements of DSs 208A-type in KS-20018 cabinets. The physical as well as the thermal limitations are discussed.

2.39 With the D-180467 mounting brackets attached, DS 208A-type can be mounted in 19-inch or 23-inch uprights such as those provided by KS-20018 cabinets. In general, the KS-20018-L11, -L12, -L15, or -L17 cabinets are recommended for multiple installation of DS 208A-type. Refer to Section 590-010-201 for detailed information on KS-20018 cabinets.

2.40 The KS-20018-L11, -L12, and -L15 cabinets rely on free air convection to dissipate the heat produced by DS 208A-type (approximately 88.7 BTU/hr). For proper heat dissipation, extend the cabinet levelers to provide a minimum of 1 inch clear space between the cabinet and the floor, or remove the large center knockout from the base panel. If the center knockout is removed, mount a grille assembly (no filter or blower assembly) over the knockout hole.

2.41 Forced air convection is standard in the KS-20018-L17 and is optional in the KS-20018-L15 cabinet. The blower requires 117-Vac 60-Hz power and delivers 150 cubic feet of filtered air per minute at zero static pressure. With a clear filter, the blower dissipates approximately 80 watts (273 BTU/hr) of cabinet heat. This efficiency decreases as the filter gets dirty and reduces to approximately 60 watts (205 BTU/hr) when the inlet air supply to the blower is completely blocked.

2.42 Refer to Fig. 2 for thermal considerations when planning a multiple installation of DS 208A-type in KS-20018-L15 or -L17 cabinets with and without blowers attached. When mounting eight DSs 208A-type on 5-inch vertical mounting centers which provide 1 inch of clear space between housings, a worst case temperature rise of 41° F or 23° C over external ambient is reached. If the vertical centers are increased to 6 inches (2 inches between housings), a temperature increase of approximately 22° F or 12° C is expected. Increasing the mounting centers to 7 inches (3 inches between housings) provides a temperature increase of approximately 15° F or 8° C. Therefore, in considering ambient conditions above a normal room temperature of approximately 75° F (24° C), these sets must either be mounted on vertical centers of 6 inches or greater, or forced air convection must be provided.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains information pertaining to the data set transmitter, receiver, oscillator, interface drivers, interface terminators, and test modes. Refer to Fig. 3 for a functional block diagram of DS 208A-L1A or 208A-L1B and Fig. 4 for a functional block diagram of DS 208A-L1 (MD).

3.02 DS 208A-type uses phase shift keying to transmit binary data signals over the analog telephone channel. The transmitter converts serial binary data into groups of three bits, called tribits, which modulate the 1800-Hz carrier. Each tribit is encoded into one of eight possible carrier phase shifts. The line signal consists of a serial train of phase-shifted signaling elements at one-third the bit rate.

3.03 At the receiver, the line signal is demodulated by the use of differential detection. This requires that the phase of each signaling element

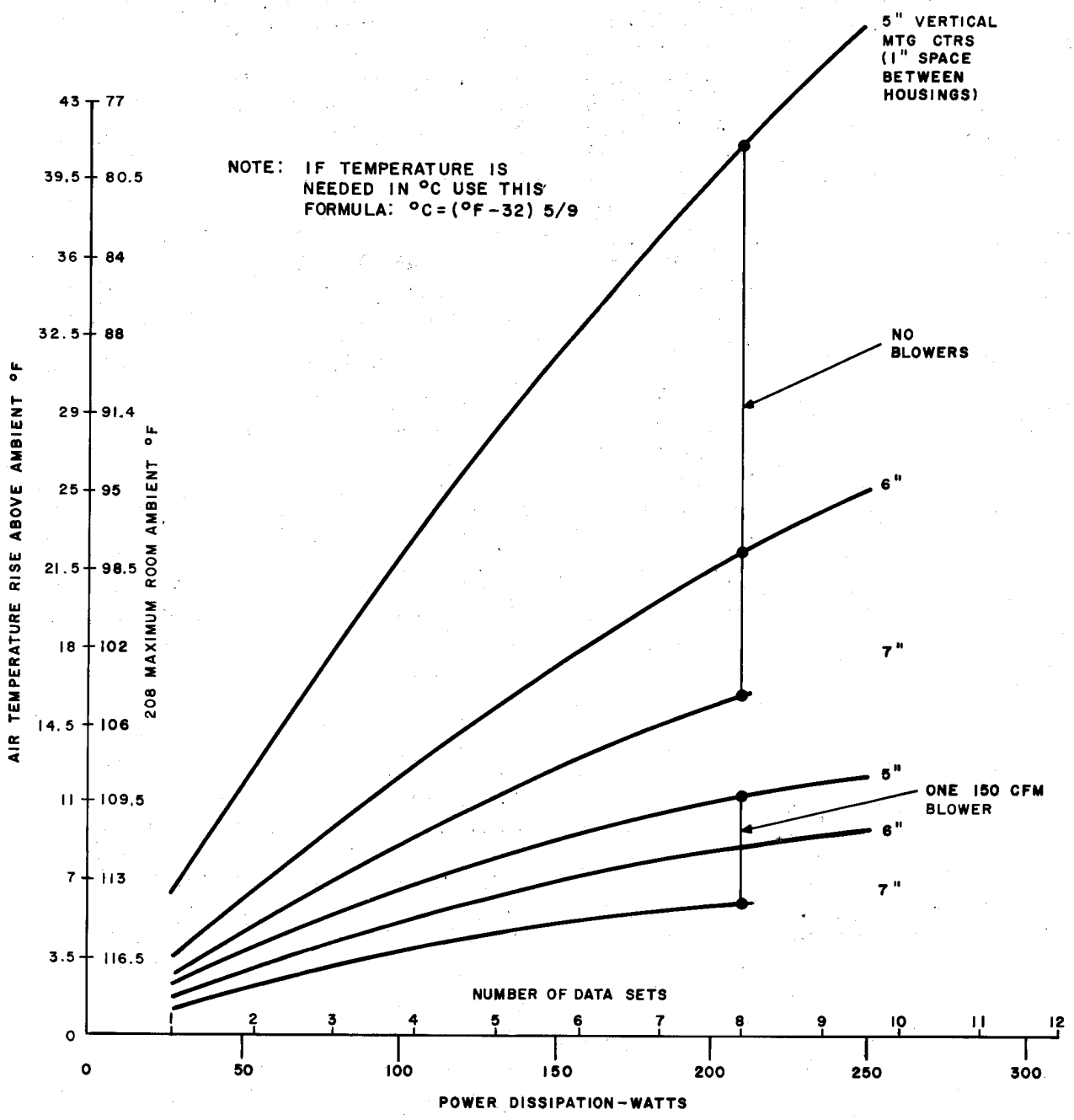


Fig. 2—Internal Air Temperature Rise vs. Power Dissipation in KS-20018-L15 or -L17 Cabinet for DS 208-Type

be compared with the previous one for decoding the received baseband signal.

3.04 The sensitivity of the data set to delay and amplitude distortion of the telephone channel requires that attention be paid to equalization to ensure proper demodulation. This is accomplished with an automatic equalizer in the receiver and a compromise equalizer in the transmitter.

TRANSMITTER

3.05 Refer to Fig. 3 or 4 for a functional block diagram of the transmitter, which includes the following circuits.

3.06 ***Transmitter Timing:*** These circuits generate the various internal clock signals required by the transmitter. They also generate the sampling clock (DB) used to sample the data on the BA lead from the CPE. The sampling clock can be generated by the data set and provided on the serial clock transmit interface lead (timing provided by data set); or if desired by the customer, it can be provided externally and fed to the transmitter on the serial clock transmit external (DA) lead. The transmitter timing is then phase-locked to this DA signal.

3.07 ***Pattern Generator And Scrambler:*** During start-up in switched carrier operation, the pattern generator and scrambler circuit supplies the start sequence to the phase modulator. Once the start sequence is complete (CB is ***on***), it converts the single stream of serial data from the CPE into three parallel data streams required by the phase modulator. In order to prevent sensitivity to data patterns chosen by the customer, a scrambler is inserted in the transmission path. The scrambler is self-synchronizing and operates on one of the parallel data streams. This results in improved error performance over what would be the case if the entire serial data stream were scrambled.

3.08 ***Start Sequence Controller:*** The transmitter can be conditioned to transmit a phase-modulated carrier continuously (continuous carrier) or it can be turned on or off by the CPE by use of the request-to-send (CA) interface lead (switched carrier). In continuous carrier operation, two modes of operation are possible.

(a) The transmitter can be optioned to ignore the state of the CA lead and to phase-modulate the carrier with the binary data appearing on the send data (BA) interface lead. This mode of operation is provided by the continuous request-to-send option.

(b) The transmitter can be optioned to honor the state of the CA lead and to place the clear-to-send (CB) lead ***off*** when CA is ***off.*** However, the transmitter will continue transmitting a steady mark signal. In this mode, the off-to-on transition of CA is followed in approximately 8 ms by the off-to-on transition of CB. Data on the BA interface lead is then used to phase-modulate the carrier.

When the CA interface lead is turned ***on,*** the start sequence controller goes through a start-up procedure consisting of 12 or 13 symbols of 4-phase idle code, 52 symbols of 4-phase 17-bit word, and 13 symbols in the 8-phase initialization period. During this start-up period, signals appearing on the BA lead will not be processed. At the end of the start-up procedure, the clear-to-send lead turns ***on,*** which informs the CPE that data can now be sent.

3.09 ***Phase Modulator:*** The phase modulator consists of a new phase calculator, two channel binaries and a data selector, and a digital envelope modulator. With phase modulation, information is conveyed from the transmitter to the receiver by changing the phase of the transmitted carrier each time the symbol changes. There are two carrier generators in the modulator. The phase change generated by one of these channel binaries is on-line during a particular symbol. At the same time, the customer data has been encoded and the phase of the next symbol with respect to the present (on-line) symbol is calculated and inserted into the off-line channel binary. The output of each channel binary is not put on-line suddenly. The transition from one channel binary to the next is made gradually under control of the digital envelope modulator.

3.10 ***Compromise Equalizer:*** The function of the compromise equalizer is to shape the transmitter line signal before sending it out on the telephone line. The equalizer is a 4-position manually adjustable filter. The first setting is a bypass position. The second setting inserts amplitude and symmetric delay compensation. The third setting inserts amplitude and high end delay

compensation. The fourth setting inserts amplitude and both symmetric and high end delay compensations. The proper setting of the equalizer is determined at the time of installation if the data set is optioned for switched carrier. If the data set is optioned for continuous carrier, the equalizer should be set for amplitude and symmetric delay compensation.

RECEIVER

3.11 Refer to Fig. 3 or 4 for a functional block diagram of the receiver. The receiver consists of the following circuits.

3.12 ***Shaping Filter:*** The receiver shaping filter removes out-of-band energy from the received line signal, thus eliminating some of the noise which may exist at the line terminals. The received signal is band-limited to from 600 to 3000 Hz before being sent to the automatic equalizer.

3.13 ***Automatic Equalizer:*** The automatic equalizer uses information fed back from the demodulator to adjust continuously its spectral shaping characteristic to compensate for delay and amplitude distortion introduced by the telephone channel.

3.14 ***Demodulator and Descrambler:*** The demodulator uses differential phase detection to recover baseband data. The phase of the line signal during one symbol interval is compared to the phase of the line signal one symbol interval earlier. The demodulated data is then descrambled to remove the randomization introduced by the transmitter.

3.15 ***Carrier Detector:*** The function of the carrier detector circuits is to provide an indication to the CPE when data signals are being received by the data set. The data signal must be in the 600- to 3000-Hz band at a level greater than -22 dBm for a period of 45 ms or longer. (Refer to 2.21 and 2.29.)

3.16 ***Timing Recovery:*** As mentioned previously, when the signal is modulated, the channel binaries are put on-line one at a time under control of a 1600-Hz envelope modulator (to avoid abrupt phase changes). The method of timing recovery in the receiver is to recover this 1600-Hz envelope. This 1600-Hz signal is squared up by a slicer circuit and then fed into a digital phase-locked loop. The result is a stable 1600-Hz clock which can be used to time the receiver circuits. Using option S4A, the timing recovery circuits can be optioned to provide a 1-second holdover. This allows the receiver to maintain synchronization and equalization with the distant transmitter for up to 1 second in the absence of a received line signal. If the receiver is equipped with the new sync option (S4C), the CPE is able to reset the receiver by applying a 1-ms or longer pulse on the new sync interface lead. This resets the 1600-Hz tank filter and causes the COV interface circuit (pin 21) to go ***off.***

3.17 ***Automatic Retrain Controller:*** The automatic retrain controller examines the received signal after demodulation to determine whether the equalizer has been properly adjusted to correct for the telephone channel distortion. The received data is decoded in three separate demodulators, using three separate decoding schemes. The output of each demodulator is compared in a majority detector, which has an output each time the majority decoded data differs from the straight decoded data. If the comparisons indicate many differences, the equalizer begins retraining. While the equalizer is retraining, the equalizer mode (QM) interface lead goes ***off*** and the ER indicator lights. This indicates that the data on the BB interface lead is invalid and that the equalizer is retraining. The automatic retrain controller can be disabled by the use of option switch S3B. However, this option is not recommended.

3.18 ***Equalizer Start-Up Controller:*** In switched carrier operation, these circuits condition the automatic equalizer to train on the special start-up pattern sent from the transmitter. In continuous carrier operation with the equalizer retrain option installed, these circuits also condition the equalizer to retrain itself under control of the automatic retrain controller without benefit of the special start-up pattern from the transmitter.

TEST MODES

A. DS 208A-L1

3.19 DS 208A-type is equipped with two test features, enabling the customer or telco employee to test the data set in analog loop-back and digital loop-back modes.

- ***Analog Loop-Back:*** This test mode is entered by operating the AL switch and

conditioning the CPE or external test equipment to operate duplex. If the CPE requires an ***on*** condition at the CC lead, DS 208A-L1A must be used to provide the DSR-on-in-AL-mode option. Test data is transmitted through the local data set, looped back at the telephone line interface, and received by the local data set. A delay of approximately 7 ms occurs through the set (transmitter and receiver) because of propagation delays in the data set circuitry. The analog loop-back is a test of the local data set only and not the facilities or distant-end data set.

- ***Digital Loop-Back:*** This test mode is entered by operating the DL switch located on the distant-end data set and conditioning the CPE or external test equipment connected to the local data set to operate duplex. Test data is transmitted by the local data set with the distant data set functioning as a regenerator. The digital loop-back is an inclusive test of the data channel.

B. DS 208A-L1A and 208A-L1B

3.20 In addition to the preceding test modes, DS 208A-L1A or 208A-L1B is equipped with self tests which do not depend on the CPE or external test equipment.

- ***Status Indicator Test:*** The lamp test (LP) switch is a nonlocking button that is used to light all status indicators to verify proper operation. This test can be done at any time since it does not affect normal data operation. During the compromise equalizer test, the data set is optioned such that the LP button can be used to short the transmitted line signal. Refer to 3.34 for more information on the compromise equalizer test option.

- ***Analog Loop-Back Self Test:*** This test mode is entered by depressing the AL and ST switches. This test allows the operation of the data set to be tested without depending on options, connections to the telephone line interface, or customer interface. The AL switch disconnects the transmitter from the telephone line and loops the transmitter output back to the receiver through a channel simulator. The signal applied to the receiver is at a level of approximately -16 dBm. The ST switch causes the transmitter to transmit steady marks and conditions the ER lamp to flash when errors (spaces) are received.

- ***Digital Loop-Back Self Test:*** This test mode is entered by depressing the DL switch on the distant data set and depressing the ST switch on the local data set. Depressing the DL switch on the distant data set conditions it to disconnect the associated CPE and function as a regenerator. Depressing the ST switch on the local data set conditions it to transmit steady marks. The ER indicator flashes as errors (spaces) are received. This end-to-end self test allows inclusive testing of the data sets and channel facilities.

- ***End-to-End Self Test:*** This test mode is entered by depressing the ST switches at both data sets. This action causes both transmitters to turn on and transmit steady marks. At both receivers, test circuits enable the ER indicator to be used to indicate any errors made in transmission.

C. Restrictions on Use of Self Test

3.21 If DS 208A-L1A or 208A-L1B is used as a remote extension of a DS 209A-L1 multiplex system or as a subrate off-net extension of DDS, the self test features can be used subject to the following restrictions.

(a) Analog loop-back self test cannot be performed at a remote extension with options as installed. If the internal timing option is temporarily installed at the remote extension, the test can be performed.

(b) Digital loop-back self test cannot be performed from a remote extension in toward the DS 208A-type collocated with DS 209A-L1 with options as installed. If the internal timing option is temporarily installed at the remote extension, this test can be performed.

(c) Digital loop-back self test cannot be performed from a remote extension in toward a hub office of the DDS with data set options as installed. If the internal timing option is

temporarily installed at the remote extension, this test can be performed.

CUSTOMER OPTIONS

3.22 DS 208A-type is provided with several optional features which may be requested by the customer. The desired optional features must be specified when the data set is ordered.

A. Carrier Control

3.23 With the switched carrier (XA) and switched request-to-send (YT) options, the data set transmitter turns on only when the request-to-send lead is ***on.*** The clear-to-send lead comes ***on*** approximately 50 ms after the request-to-send lead. The data set transmitter turns off 2 ms after the request-to-send lead has been turned ***off.*** This option is typically used at a remote station which is part of a multipoint polling system (refer to 4.04).

3.24 With point-to-point circuits and with master stations in multipoint circuits, it is advantageous to transmit a carrier signal all the time to eliminate the training sequence inherent in starting up the receiver (for detecting carrier and training the adaptive equalizer). If the continuous carrier option (XB) is used, the transmitter is permanently on when the data set is powered. When the continuous carrier feature is used, the request-to-send circuit may be used in either of two ways:

- If the CPE requires the use of the request-to-send and clear-to-send circuits, the switched request-to-send option (YT) must be used. This provides a delay of approximately 8 ms between these signals.

- If switched request-to-send control is not needed, it will be strapped ***on*** permanently in the data set by use of the continuous request-to-send option (YS). In this case, the clear-to-send circuit will also be permanently ***on.***

B. Internal or External Timing

3.25 With the internal timing option (YC), the data set provides a transmit clock signal to the CPE on the serial clock transmitter lead (pin 15).

3.26 With the external timing option (YD), the CPE can provide an EIA compatible transmit clock signal to the data set on the serial clock transmitter external lead (pin 24). This signal must conform to the distortion and frequency accuracy of EIA Standard RS-334, which requires peak individual distortion of no more than 0.5 percent and frequency accuracy within ±.01 percent of the bit rate. The internal timing of the data set is phase-locked to the external clock signal provided by the CPE and also appears on the interface circuit (pin 15) that usually provides internal transmitter timing. This allows the CPE to time the transmit data properly at the 4800-bps rate.

> ***Note:*** When the 1-second holdover option is used in the data set, the frequency accuracy of the clock signal from the CPE must be ±.005 percent.

C. 1-Second Holdover

3.27 The 1-second holdover option is recommended for use in data sets receiving continuous carrier from a distant transmitter. This option permits the receiving data set to maintain timing synchronization during periods of momentary line dropouts not exceeding 1 second. With this option, the received line signal detector circuit is kept ***on*** up to 1 second beyond the time that carrier signal is lost. Received data during the interval of data carrier signal loss is provided to the CPE, although it probably is not valid. The loss of received data carrier is indicated to the CPE on the signal quality detector circuit (pin 21) if the signal is absent for more than 2 ms. When the carrier signal reappears, the signal quality detector turns ***on*** after receiving this signal for 4 ms or longer.

3.28 If the 1-second holdover option is not provided, the loss of received line signal due to a transmission line interruption or dropout causes the received line signal detector circuit (pin 8) to turn ***off*** if the line signal is absent for longer than 2 ms. When this occurs, the data set will clamp the received data circuit to the mark state.

D. New Sync

3.29 The new sync option is recommended for use with a DS 208A-type at a master station in a multipoint network to ensure rapid resynchronization on a series of messages from different remote

transmitters. This option, which is recommended when the interval between successive messages is less than 100 ms, is necessary because of clock holdover in the receiver after the end of a message. This holdover may interfere with the start of synchronization on receipt of the following message. To use this feature, the CPE, after detection of an end-of-message code and after the received line signal detector circuit goes ***off,*** should apply a 1-ms (or longer) ***on*** condition to the new sync interface circuit (pin 14) to squelch the existing clock.

E. Equalizer Retrain

3.30 The start-up procedure of the receiver involves a training interval of less than 50 ms, during which a special sequence of signals from an associated transmitter is sent to the receiver. Once the receiver has been properly trained and data transmission is in progress, there is a chance that the receiver may require retraining due to channel impairments. If the data set is equipped with the retrain automatically option (YU), the receiver determines when the error rate approaches 1 error in 100 bits. At that time, the equalizer mode lead (pin 11) goes ***off,*** the adaptive equalizer retrains itself automatically, and the ER indicator lights momentarily.

> ***Note:*** The retrain automatically option (YU) should always be installed during normal data set operation.

F. DSR On in AL Test Mode

3.31 In addition to the preceding options, DS 208A-L1A or 208A-L1B also has an option whereby the data set provides an ***on*** indication to the CPE on the data set ready lead (pin 6) when the data set is in the analog loop-back test mode. This allows those CPE which require CC ***on*** for proper operation to loop signals through the data set for test purposes.

TELCO OPTIONS

3.32 The following options provided with DS 208A-type are to be selected and installed by the telco.

3.33 ***DAS Not Used:*** Normally, the 4-wire channel used with DS 208A-type is terminated with a DAS 828-type, 829-type, or equivalent. These line terminating devices [called channel interface units (CIU)] provide level adjustment and amplitude equalization. They may also provide alternate voice capability and switched network backup. In addition, the CIU provides an equal level loop-back capability to the central office, which allows the central office to test the channel. When the channel is looped back, the data set is not available for use by the CPE. The data set ready (DSR) lead (pin 6) to the CPE is controlled by the CIU (and the data set test switches) and turns ***off*** when the channel is looped back. If a CIU is not used or if the equivalent terminating device does not provide external control of the DSR lead, the DAS not used option (YJ) must be used. With this option, the DSR lead is controlled only by the data set test switches.

3.34 ***Compromise Equalizer Test Control:*** This option, provided by DS 208A-L1A and 208A-L1B, facilitates testing of the compromise equalizer and should only be installed while testing the compromise equalizer setting. Functionally this option allows the line signal to be squelched by use of the LP button. This replaces the necessity to withdraw the HG5 circuit pack, which must be done while testing DS 208A-L1. The data set ready interface lead and the HR indicator are turned off when this option is installed.

This option must be removed upon completion of the compromise equalizer adjustment.

4. APPLICATIONS

4.01 This part describes some of the applications in which DS 208A-type can be used. The proper options for each application are identified.

4.02 The applications described in this part are as follows:

- Point-to-Point
- Multipoint
- Extended Service
- Digital Data System Off-Net.

A. Point-to-Point

4.03 In point-to-point applications, one data station has access to only one other data station. The typical options for both data sets in a point-to-point system are shown in Table C.

B. Multipoint

4.04 Polling systems use multipoint private lines which allow a data terminal to access or be accessed by any number of remote data terminals. The centrally located data terminal (master or hub) can transmit data to or receive data from the remote data stations by accessing each station individually, setting up synchronization (handshaking), and either transmitting or receiving.

4.05 For transmission to the master data terminal, several remote terminals may wish to transmit simultaneously. However, only one terminal can transmit and the others must wait their turn. There are two popular methods which the centrally located terminal may use to select which remote terminal will transmit next: roll call polling and hub polling.

4.06 With hub polling, the centrally located data terminal works down a list of remote terminals and addresses each in turn. Some terminals may be polled more than others, or priority sequencing may be used. With roll call polling, the centrally located data terminal addresses only the terminal at the end of the line and the remote terminals pass the polling message down the line until all the remote terminals have been interrogated.

4.07 In a polling system, the master data set and the remote data sets are equipped with different options. The typical options for the master data set are shown in Table D and the typical options for the remote data sets are shown in Table E.

TABLE C

TYPICAL OPTIONS FOR POINT-TO-POINT SERVICE

FEATURE OR OPTION	SELECT	NOTES
DSR Condition in AL Mode	DSR OFF (YN)	1
Comp Equalizer Test Enabled or Disabled		2, 3
Continuous or Switched Request-to-Send	Either	4
Equalization		5
Transmit Internally or Externally Timed	Either	4
Retrain	Automatically (YU)	
DAS Used or Not Used		6
1-Second Holdover	Used (YX)	7
Continuous or Switched Carrier	Continuous (XB)	
New Sync Used or Not Used	Not Used (YA)	

Notes:

1. Unless requested otherwise by user.
2. Enabled during comp equalizer test; disabled all other times.
3. This option is not available on DS 208A-L1.
4. As required by CPE.
5. Determined at time of installation.
6. As required by installation.
7. 1-second holdover disabled if distant end has switched carrier.

TABLE D

TYPICAL OPTIONS FOR MASTER STATION IN MULTIPOINT POLLING NETWORK

FEATURE OR OPTION	SELECT	NOTE
DSR Condition in AL Mode	DSR OFF (YN)	1
Comp Equalizer Test Enabled or Disabled	Disabled	2
Continuous or Switched Request-to-Send	Either	3
Equalization	Symmetrical	
Transmit Internally or Externally Timed	Either	3
Retrain	Automatically (YU)	
DAS Used or Not Used		4
1-Second Holdover	Disabled (YW)	
Continuous or Switched Carrier	Continuous (XB)	
New Sync Used or Not Used	Used (YB)	3

Notes:

1. Unless requested otherwise by user.
2. This option is not available on DS 208A-L1.
3. As required by CPE.
4. As required by installation.

C. Extended Service

4.08 DS 208A-type can be used to provide a 4800-bps extension of a DS 209A-L1 multiplex system. In such a system, data from the CPE is fed into the extension DS 208A-type which transmits the data to another DS 208A-type collocated with a DS 209A-L1. DS 209A-L1 multiplexes the data with data coming in on other ports (two 2400-bit channels, or another 4800-bit channel). The data is transmitted at 9600 bps to a distant DS 209A-L1 which demultiplexes the data and transmits the 4800-bps data to the distant DS 208A-type. There are many multiplex system posibilities. for more information, refer to Section 592-032-100. The typical options for a DS 208A-type used as an extension are given in Table F. Refer to 3.21 for restrictions to the self test capability of DS 208A-L1A when it is being used in extended service.

D. Digital Data System Off-Net

4.09 DS 208A-type can be used as a 4800-bps subrate off-net extension of the Digital Data System (DDS). In such a system, data from the CPE is fed into the extension DS 208A-type which transmits the data over analog facilities to another DS 208A-type located in a DDS hub office. At this point the data is demodulated to a serial train of EIA voltages which are fed into the DDS and transmitted to the distant end. For more information, refer to Section 314-919-100. The typical options for a DS 208A-type used as a subrate off-net extension are given in Table G.

5. MAINTENANCE AND TESTS

5.01 It is recommended that DS 208A-type service be maintained on a circuit pack replacement basis when trouble is isolated to the data set. Maintenance test procedures are contained in Section 592-027-500. If the power supply is suspected of being defective, it can be tested and adjusted as directed in 5.04 through 5.08.

5.02 To aid in maintaining DS 208A-type service, maintenance kits have been made available. The maintenance kit for DS 208A-L1 and 208A-L1A

TABLE E

TYPICAL OPTIONS FOR REMOTE STATION IN MULTIPOINT POLLING NETWORK

FEATURE OR OPTION	SELECT	NOTE
DSR Condition in AL Mode	DSR OFF (YN)	1
Comp Equalizer Test Enabled or Disabled		2, 3
Continuous or Switched Request-to-Send	Switched	
Equalization		5
Transmit Internally or Externally Timed	Either	4
Retrain	Automatically (YU)	
DAS Used or Not Used		6
1-Second Holdover	Used (YW)	
Continuous or Switched Carrier	Switched (XA)	
New Sync Used or Not Used	Not Used (YA)	

Notes:

1. Unless requested otherwise by user.
2. Enabled during comp equalizer test; disabled all other times.
3. This option is not available on DS 208A-L1.
4. As required by CPE.
5. Determined at time of installation.
6. As required by installation.

is designated D-180657 and can be used to support maintenance of DS 208A-L1B if upgraded to include the HG26 circuit pack. A new maintenance kit designated D-180718 is available for maintenance of DS 208A-L1B. These maintenance kits contain the following:

- Complete set of circuit packs
- Two diode test pins (white, 840806327) for use with the 914-type data test set (DTS)
- Two resistor test pins (yellow, 840806335) for use with the 914-type DTS
- Four circuit pack shipping cartons.

TABLE F

TYPICAL OPTIONS FOR DATA SET USED IN EXTENDED SERVICE

FEATURE OR OPTION	SELECT	NOTE
DSR Condition in AL Mode	DSR OFF (YN)	1
Comp Equalizer Test Enabled or Disabled		2, 3
Continuous or Switched Request-to-Send	Either	4
Equalization		5
Transmit Internally or Externally Timed	External (YD)	
Retrain	Automatically (YU)	
DAS Used or Not Used		6
1-Second Holdover	Used (YW)	
Continuous or Switched Carrier		7
New Sync Used or Not Used	Not Used (YA)	

Notes:

1. Unless requested otherwise by user.
2. Enabled during comp equalizer test; disabled all other times.
3. This option is not available on DS 208A-L1.
4. As required by CPE.
5. Determined at time of installation.
6. As required by installation.
7. Switched carrier is required where DS 208A-type is collocated with DS 209A.

TABLE G

TYPICAL OPTIONS FOR A DATA SET USED AS A SUBRATE OFF-NET EXTENSION OF DDS

FEATURE OR OPTION	SELECT	NOTE
DSR Condition in AL Mode	DSR OFF (YN)	1
Comp Equalizer Test Enabled or Disabled		2, 3
Continuous or Switched Request-to-Send	Either	4
Equalization		5
Transmit Internally or Externally Timed	Externally (YD)	
Retrain	Automatically (YU)	
DAS Used or Not Used		6
1-Second Holdover	Used (YW)	
Continuous or Switched Carrier		7
New Sync Used or Not Used	Not Used (YA)	

Notes:

1. Unless requested otherwise by user.
2. Enabled during comp equalizer test; disabled at all other times.
3. This option is not available on DS 208A-L1.
4. As required by CPE.
5. Determined at time of installation.
6. As required by installation.
7. Switched carrier at hub office; continuous carrier at customer location.

5.03 Maintenance kits should be kept on hand according to the following schedule:

NUMBER OF SETS IN SERVICE IN MAINTENANCE TERRITORY	RECOMMENDED NUMBER OF MAINTENANCE KITS
1 to 9	1
10 to 35	2
36 to 55	3
56 to 80	4
Over 80	Not more than 5 percent of number of sets in service.

5.04 Existing DSs 208A-L1 and 208A-L1A cannot be converted to a DS 208A-L1B by circuit pack replacement because of backplane wiring differences. However, all circuit packs of DS 208A-L1B having codes common to those used in DS 208A-L1 or 208A-L1A may be used interchangeably. Refer to Table H for a listing of circuit packs contained in DS 208A-type.

Maintenance of 83A Power Unit

5.05 To remove the 83A power unit from the data set, proceed as follows.

(1) Disconnect the ac input and interface cords.

(2) Remove front and rear snaplock covers of data set.

(3) Remove top mounting screw of TS1, the screw at FG of TS1, and the metal strap

TABLE H

CIRCUIT PACK COMPLEMENT FOR DS 208A-TYPE

DS 208A-L1 (MD)		DS 208A-L1A (MD)		DS 208A-L1B	
CIRCUIT PACK	SEE NOTE	CIRCUIT PACK	SEE NOTE	CIRCUIT PACK	SEE NOTE
HG2		HG2		HG2	
HG3		HG3		HG3	
HG4		HG4		HG4	
HG5 (A&M)		HG5 (A&M)		—	
HG6 (A&M)		HG6 (A&M)		—	
HG7		HG7		HG7	
HG8		HG8		HG8	
HG9 (MD)		—		—	
HG11		HG11		HG11	
HG12	1	HG12	1	HG12	1
HG13		HG13		HG13	
HG14 (MD)		HG14B	3	HG14B	3
HG15 (MD)		HG15B	3	HG15B	3
HG16 (MD)		HG16B	3	HG16B	3
HG17 (A&M)		HG17 (A&M)		—	
HG21	2	HG21		HG21	
—		HG23	4	HG23	4
				HG26	5

Note 1: Two HG12 CPs are required in each data set.

Note 2: Early models of DS 208A-L1 may contain HG1 CP.

Note 3: HG14B, HG15B, and HG16B are direct replacements for HG14, HG15, and HG16, respectively.

Note 4: HG9 CP is replaced by HG23 in DS 208A-L1A and DS 208A-L1B.

Note 5: HG5, HG6, and HG17 are replaced by HG26 in 208A-L1B.

between FG and SG. Remove spade connections under screw connections 1 through 6 of TS1.

(4) Rotate the data set 90° counterclockwise (ccw) and place the data set on its side, exercising caution not to mar the housing.

(5) Remove the five screws which mount the power unit to the chassis.

(6) Remove the power unit from the front of the data set by pushing on the rear of the power unit.

5.06 To install the power unit, reverse the procedure in 5.05. The connections to TS1 are shown in Table I. If replacing a defective power unit, replace with one of the same or a higher series number, if available.

5.07 The power unit is factory-adjusted to precise levels and should not require adjustments in the field. However, if adjustments should become necessary, proceed as follows.

Note: If it is necessary to adjust the output voltage level (R11) and the over-voltage protection and alarm circuit (R8), adjust the

TABLE I

TERMINALS ON TS1 OF 83A POWER UNIT

COLOR	TS1 TERM
ORANGE	—12V
BLUE	—6V
GREEN	ALM
RED	+12V
RED/WHITE	+5V
BLACK (2 wires)	SG
BLACK (1 wire)	FG
Metal strap connects terminals SG and FG.	

over-voltage protection and alarm circuit (R8) first.

5.08 *Over-Voltage Protection and Alarm*

(1) Disconnect the ac power cord.

(2) Remove the power unit in accordance with 5.05.

(3) Rotate R8 fully clockwise (cw).

(4) Reconnect the ac input cord.

(5) Connect a suitable voltmeter to the +12V and SG terminals.

(6) Adjust R11 potentiometer for an output of 13.0 volts.

(7) Slowly rotate R8 ccw until K1 relay barely operates.

Requirement: The output voltage drops abruptly.

(8) To check the setting of R8, rotate R11 fully ccw.

(9) Momentarily disconnect input power to release K1 relay.

(10) Slowly rotate R11 cw.

Requirement: Output voltage increases to 13.0 ±0.1, then drops abruptly as K1 relay operates.

(11) Rotate R11 fully ccw.

(12) Disconnect input power.

(13) Make output voltage adjustment.

5.09 *Output Voltage Adjustment*

(1) If necessary, remove the power unit from the data set in accordance with 5.05.

(2) Load each output in accordance with Table J.

TABLE J

TEST LOADS

OUTPUT	LOAD
+5V	5Ω ±2%, 20W
+12V	20Ω ±2%, 30W
—6V	19Ω ±2%, 8W
—12V	58Ω±2%, 10W

(3) Reconnect ac input power.

Requirement: The input voltage is 117 volts.

(4) Connect a suitable digital voltmeter to the +12V and SG terminals.

(5) Adjust R11 potentiometer cw to increase and ccw to decrease the voltage.

Requirement: The voltmeter indicates 11.65 ±0.05 volts.

Note: If the output voltage should be increased until K1 relay operates, rotate R11 fully ccw and momentarily disconnect the ac input power to release the K1 relay, and then repeat (5).

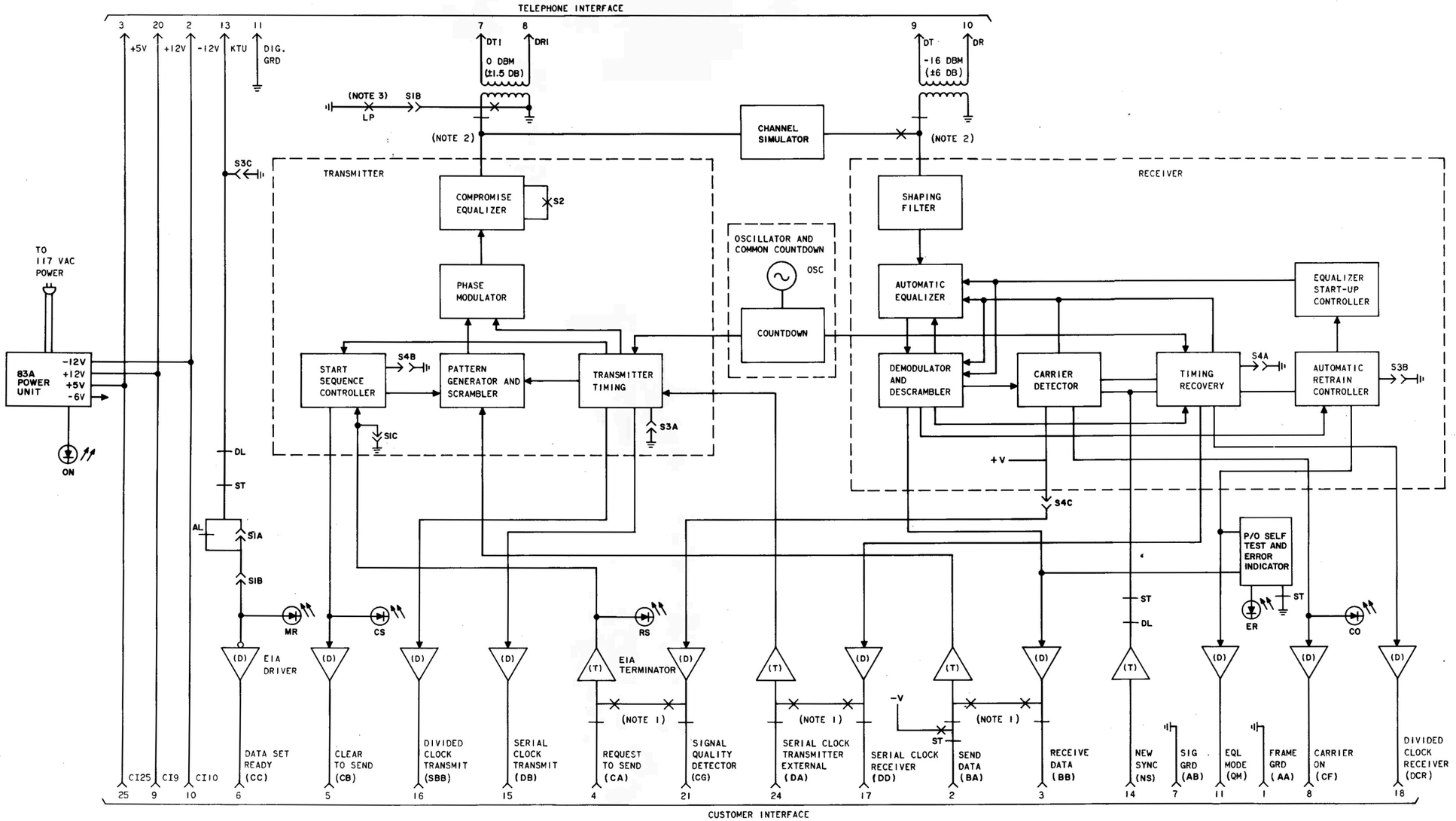
(6) Disconnect the voltmeter and the loading resistors.

6. REFERENCES

6.01 The following BSPs provide additional information:

SECTION	TITLE
314-919-100	Digital Data System Subrate Off-Net Extension Arrangements—Description
590-002-110	4800-Bit Per Second (BPS) Service Using Data Set 208-Type—Reference Guide
590-010-201	Data Sets, Multiple Installation Information
592-027-100	Data Set 208A-Type Transmitter-Receiver—Description and Operation
592-027-180	Data Set 208A-Type Transmitter-Receiver—SummarizingSpecification
592-027-200	Data Set 208A-Type Transmitter-Receiver—Installation and Connections
592-027-300	Data Set 208A-Type Transmitter-Receiver—Maintenance
592-027-400	Data Set 208A-Type Transmitter-Receiver—Wiring Information
592-027-500	Data Set 208A-Type Transmitter-Receiver—Test Procedures
592-032-100	Data Set 209A-L1 Transmitter-Receiver—Description and Operation
666-511-503	Test of Data Services Provided by Data Set 208A-Type From a Private Line Test Room
999-100-105	Data Set 208A-Type—How to Operate Manual

6.02 Detailed information pertaining to data set 208A-type is contained in CD- and SD-1D232-01.



NOTES:

1. DIGITAL LOOP SWITCH DEPRESSED CAUSES DRIVERS AND TERMINATORS TO BE TIED TOGETHER AND CUSTOMER INTERFACE LEADS OPENED AS SHOWN.
2. ANALOG LOOP SWITCH DEPRESSED CAUSES TRANSMITTER OUTPUT TO BE CONNECTED TO RECEIVER INPUT AS SHOWN. THE TEL LINE IS TERMINATED IN 600 OHMS.
3. LAMP TEST NON-LOCKING SWITCH DEPRESSED ILLUMINATES ALL INDICATORS. WHEN S1B IS IN THE COMPROMISE EQUALIZER TEST ENABLED POSITION, DEPRESSION OF THE LP SWITCH SHORTS THE TRANSMITTER OUTPUT WHILE ILLUMINATING THE LEADS.
4. SELF TEST LOCKING SWITCH DEPRESSED CONDITIONS CA ON, TRANSMITS STEADY MARKS ON BA LEAD, AND PERMITS THE ER INDICATOR TO INDICATE RECEIVED ERRORS.
5. OPTIONS ARE AS FOLLOWS:
   - S1A - CC ON OR OFF IN AL MODE
   - S1B - COMPROMISE EQUALIZER TEST ENABLED OR DISABLED
   - S1C - CONTINUOUS OR SWITCHED REQUEST TO SEND
   - S2 - COMPROMISE EQUALIZER
   - S3A - INTERNAL OR EXTERNAL TIMING
   - S3B - AUTOMATIC EQUALIZER RETRAINING
   - S3C - DAS 828A USED OR NOT USED
   - S4A - 1-SECOND HOLDOVER
   - S4B - SWITCHED OR CONTINUOUS CARRIER
   - S4C - NEW SYNC

Fig. 3—DS 208A-L1A or L1B—Functional Block Diagram

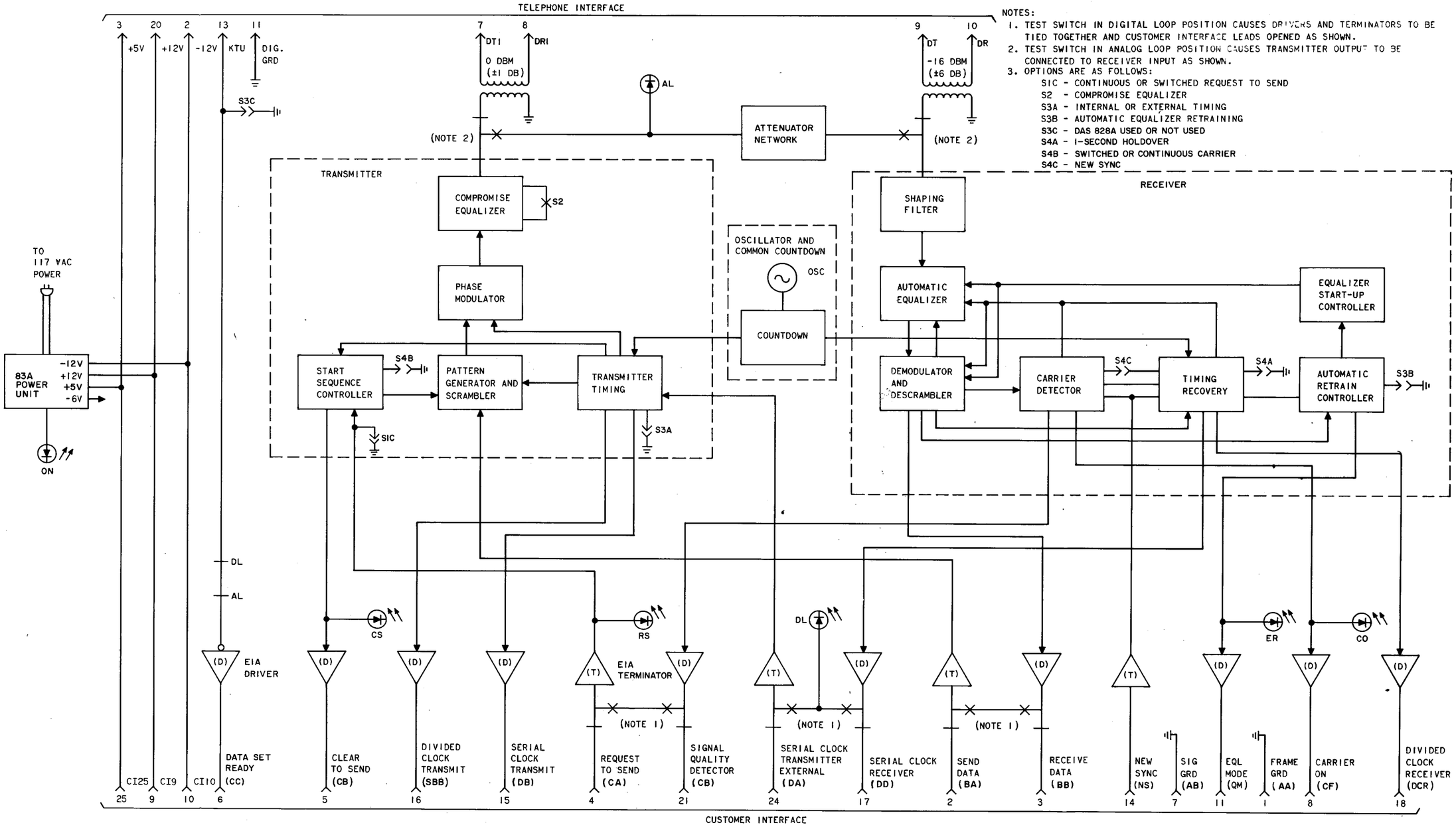


Fig. 4—DS 208A-L1—Functional Block Diagram