D3B CHANNEL BANK
DATAPORT OPERATION
DESCRIPTION, APPLICATION, AND TROUBLESHOOTING
DIGITAL TRANSMISSION SYSTEMS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the D3B channel bank.

The reader should be familiar with the D3 channel bank described in Section 365-150-100. The D3B channel bank is a D3 channel bank that is equipped for dataport operation. This section covers items peculiar to dataport operation in the following areas:

- Physical description

- Functional description
- Modification information
- Timing information
- Applications information
- Establishing procedures check list
- Troubleshooting information.

Dataport connects digital data directly to the T1 line without a separate data multiplexer. Dataport operation is used primarily in the digital data system (DDS), but can also be used for a stand-alone system between two offices outside the DDS.

1.02 This section is being reissued for the following reasons:

- To specify that List 5 or later data logic unit (DLU) must be used with double wide 56-kb/s channel units.
- To mention that digital access and cross-connect systems (DACS) are not compatible with dataport
- To replace T Carrier Restoration and Control Center (TRCC) with Facility Maintenance and Administration Center (FMAC)
- To add information about mixing DLUs in a bay (see Table C)
- To remove tables covering KS-20908 and KS-20909 Data Test Sets. (Tables were redundant to Sections 107-600-100 and 107-601-100)
- To remove dataport test procedures chart which was redundant to Section 365-800-003 (TOP).

Much of the original data has been rearranged in an effort to make this section easier to use. Revision arrows are used to emphasize the more significant changes. Equipment Test Lists are not affected.

1.03 A D3 channel bank is converted to a D3B channel bank by:

(1) Removing the interface unit (IU) and installing a data logic unit (DLU) which fills the IU slot and the unused slot labled TMU next to it.

(2) Verifying that appropriate modifications for timing have been made (see Table A and paragraphs 4.01 through 4.05)

(3) Installing appropriate dataport channel units. (Table B lists dataport equipment including plug-ins and related test fixtures.)

1.04 The main use of D3 dataport is extending the DDS network. Hub offices serve as test centers and concentration points for connecting to long haul carrier facilities. Offices using dataports to serve customer loops are called dataport offices when the offices provide no deeper entry and no other function in the DDS. In addition to the predominant application in DDS offices, dataport operation can be applied to stand-alone service. The stand-alone facility provides 2.4, 4.8, 9.6, or 56-kb/s data service between two locations with synchronized timing. The transmit clock in one bank operates in the local mode and the clock in the other bank operates in the loop-time mode.

2. PHYSICAL DESCRIPTION

2.01 Dataport (DP) plug-in units are the office channel unit (OCU) DP, the digital signal zero (DSØ) DP, and the data logic unit (DLU) (Fig. 1). The dataport channel units and the DLU common unit are distinguished from regular units by the blue faceplates and special faceplate connectors. One of the faceplate connectors on the DLU must connect, by an ED-3C832 jumper, to a faceplate connector of a dataport channel unit during operation (Fig. 2). For this reason only four dataport channel units can be used in a D3B channel bank. The other channel unit slots may be used for voice service.

2.02 The DLU, Fig. 1, occupies both the TMU and IU slots on the common equipment shelf. It provides CODE IN jack access for the 1-kHz code generator signal during bank turnup. The LOCAL and EXT jacks on the DLU allow 8-kHz timing signals to be observed with an oscilloscope. The TST jack supplies 8- and 64-kHz clock for the DDS KS-type data test sets via the ED-3C792 test interface unit.

2.03 All dataport channel units have a TST jack, Fig. 1, a card jack that provides 2-way test access at 64-kb/s points. Each of the four leads is wired through a set of contacts on the TST jack so that when a card plug is inserted, it will break the path

and contact both sides of the circuit. When inserted, the ED-3C793 loopback connector places a loop on both sides of the circuit at the 64-kb/s DSØ point and provides jack access.

2.04 The subrate DSØ DP, OCU DP, 56-KB OCU DP, and DLU dataport units have selectable options. (The 56-KB DSØ DP has no selectable options.) These options, their functions, and physical location on the unit, are described in Fig. 3, 4, and 5. The mechanical methods of selecting the options are shown in Fig. 6.

2.05 56-KB dataport channel units have double wide faceplates. The duplicate connectors on the front of the dataport channel units are wired in parallel and accommodate ED-3C832 jumpers for coupling to one of the four connectors on the DLU faceplate (see Fig. 7).

3. FUNCTIONAL DESCRIPTION

A. D3B Channel Bank Circuits

3.01 The D3B channel bank performs the normal functions of multiplexing 24 channels into a digital signal at the DS1 rate (1.544 Mb/s). Figure 8 shows the block diagram of the D3B channel bank. The main difference between D3 and D3B channel banks is the substitution of the DLU common plug-in for the IU and the use of the external clock. In essence, the DLU unit replaces the IU, performs all of its functions for D3 message channels, and supplies timing to the DSØ DP, OCU DP and the 56-KB channel units. Section 365-150-100 provides a description of the conventional D3 channel bank.

▶B. Byte Stuffing

3.02 Data comes from customer equipment at 2.4-, 4.8-, 9.6-, or 56-kb/s to the OCU DP or a miscellaneously mounted OCU (Fig. 9). The OCU adds bits to the incoming signal to convert it to 64-kb/s. If the incoming signal is a subrate (2.4-, 4.8-, or 9.6-kb/s) the signal is repeated by the OCU several times before bits are added. The above process is called byte stuffing. The added bits are removed at the far end OCU. The repeated subrate signals are used to reduce errors by selecting the bit that occurs most often in the repeated bytes.◀

C. DLU Circuits

3.03 The DLU inserts the dataport channel outputs on the Pulse Code Modulation (PCM) bus of the transmit unit (TU), supplies 8- and 64-kHz timing for the dataports (Fig. 10), and also contains its own logic powering circuit. Options on the DLU select whether the D3B channel bank uses local, looped, or external timing (select options per Fig. 3). The clock in the transmit unit generates the timing in the local mode and produces timing from the received DS1 signal in the looped mode. An office DDS source supplies the timing in the external mode. In the DLU, the phase lock circuit produces the 8- and 64-kHz dataport signals with local and looped timing, and the composite clock circuit produces the signals with external timing. In either case the signals are applied to the dataports through the integrated clock circuit. One regenerated composite clock output is available at the DLU position for timing DDS equipment, and 8- and 64-kHz signals are available at the TST jack for the KS test sets. The four identical jacks on the DLU are multipled together. They couple the data and timing signals between the dataport channel units and the DLU via faceplate connectors. Like the IU for the conventional D3 channel bank, the DLU connects the incoming DS1 signal through the CODE IN jack to the receive unit. When the D3 code generator is connected, the DLU syncs the receiver with the test signal, inhibits alarms, and keeps the trunk processor operated during the tests.

D. DSØ DP Circuits (J98718BM)

3.04 This is a 4-wire unit that matches the office connecting circuits, accomplishes signal conversions in each direction, and for subrate data corrects errors. In the transmit path of Fig. 11, the data is applied to the 135-ohm input and converted from bipolar to unipolar form for processing. Under control of the control logic, data is read into the shift registers and onto the bank data-out bus during the channel sampling time. There is no Pulse Amplitude Modulation (PAM) to PCM conversion; dataport information is inserted beyond the encoding circuitry of the bank TU. In the receive path, channel information is demultiplexed from the carrier PCM signal, read into shift register at 1.544 Mb/s rate and read out at the 64 kb/s rate. The error correcting circuit improves performance in the presence of errors on the T-Carrier line by using a majority vote of the bytes. This circuit is selected by the EC option on the faceplate and is effective only for byte-stuffed 2.4-, 4.8-, and 9.6-kb/s customer data. If carrier synchronization is lost, the DSØ DP also sends a mux-out-of-sync signal toward the end office. The contacts of the TST jack are placed in the circuit to provide 2-way

access to the 64 kb/s signals on the office side of the unit at the T, R, T1, and R1 leads.

3.05 The DSØ DP 56-KB unit is used similarly to subrate units but includes forward error correction as described in paragraph 3.12.

E. OCU DP Circuits

3.06 The OCU DP subrate unit contains most of the DSØ DP circuitry plus additional circuits for processing subrate data and connecting to the customer loop. The input circuit to the transmit path of Fig. 12 contains a transformer producing a 135-ohm balanced input and contains circuits for bipolar to unipolar signal conversion, and automatic line buildout (ALBO). One side of the sealing current feed to the loop connects to the transformer and a surge protection diode connects across the input. The ALBO produces a fixed level input signal by adjusting the amount of loss inserted in the path; an additional 10 dB of loss can be introduced in the output signal path by means of the fixed line buildout (FLBO) option to compensate for short loops. Byte stuffing to bring the subrate data up to the 64 kb/s rate is performed in the subrate conversion logic unit. Shift registers in the transmit and receive paths read the 64 kb/s data into and out of the carrier channel. The shift registers and error correction circuitry are the same as those used in the DSØ DP except that error correction is always connected. The contacts on the TST jack provide 2-way access on the 64 kb/s DSØ side of this circuitry. The subrate conversion logic in the circuit path toward the customer produces the subrate data and detects system control codes which operate the remote looping relay. The output circuit contains a surge protection diode and connects the other side of the sealing current supply to the transformer which produces the 135-ohm balanced output.

> ***Note:*** The OCU DP error correction is always connected except as noted in paragraph 4.05.

3.07 The subrate conversion logic checks the data received from the carrier once every 5, 10, or 20 bytes (depending on the speed) for all-zeros or system control codes (idle, OCU loopback, CHAN loopback). If the OCU loopback code is detected, the logic circuit operates the loopback relay to loop the signal toward the Service Testing Center (STC). If CHAN loopback is received, the OCU DP signals the customer equipment to loop by reversing the polarity of the simplex sealing current.

F. 56 KB-Dataport Channel Units

3.08 By using these channel units (J98718DA and DB), qualifying T1 lines for 56-kb/s data transmission is no longer necessary. The 56-KB dataport channel units make use of an error-correction scheme which can remove a substantial number of bit errors which might be introduced by the T-carrier. This allows any T1 facility which meets voice quality requirements to meet DDS specifications for 56-kb/s data service quality.

3.09 The 56-KB dataport channel units are similar to the subrate dataport units. There are DSØ DP and OCU DP versions. The OCU DP interfaces directly with the 56-kb/s customer loop (Fig. 13), converts data to DSØ-A (64-kb/s) format, and applies the error correction algorithm before inserting the data and parity bytes into the PCM stream at the 1.544 Mb/s (DS1) rate. The DSØ DP contains only the circuitry for error correction and rate conversion from 64 kb/s (DSØ) to 8-bit bursts at the DS1 rate.

3.10 These 56-KB channel units have double-width faceplates and each occupies two channel positions in the D3B channel bank. A channel unit uses consecutive time slots for the data and parity words. Parallel wired faceplate jacks allow access to the DLU common unit.

> ***Note:*** When using the 56-KB channel units, the J98718AH-2, L5 or later version of the DLU must be used (see Fig. 7).

The double wide 56-KB channel units use channels 3 and 4, 5 and 6, 15 and 16, or 17 and 18 (Fig. 7). These channel units physically occupy two slots even though the printed wiring board of the channel unit mates with the left connector only. For this reason, the error correction algorithm is always provided in D3, as both channels will be occupied in any case. This is to eliminate the administration of channel slots which must be left open.

> ***Note:*** The drop side connection should be made the into channel with the lower number.

3.11 The 56-KB OCU DP channel unit must have proper option switch settings upon installation in a D3B channel bank (the 56-KB DSØ DP channel unit has no options to set). The option switch (see Fig. 4) is labeled CSU/DSU, CM/OUT, and CRTC/OUT. The CSU/DSU option should correspond to the

type of equipment on the customer premises (ie, a channel service unit or a data service unit). The CM option is for use of a customer multiplexer DSU at the station equipment. When this station multiplexer DSU is available, this option can be used. Until then this part of the switch should be set to "OUT". The CRTC/OUT option should be set to "OUT" for the same reason. The CRTC (customer remote test control) allows a customer to cause a loopback at the far end DSU (or CSU, depending on the far end OCU DP option). This allows an end-to-end test capability, to isolate trouble to either transmission equipment or customer terminal equipment.

> ***Note:*** Both CM and CRTC should not be used simultaneously on a given OCU DP channel unit.

The plug-type option (Fig. 6) has a position labeled D and one labeled T. The plug should be in the D position since the T position is for factory testing only.

G. 56 kb/s-Error Correction

3.12 Error correction in the 56-KB dataport channel units is accomplished by using a (17, 9) cyclic code which has been shortened to a (16, 8) code. So, for each eight bits of data, a 16-bit codeword is transmitted over the T Carrier, requiring ***two*** channel time slots. The first eight bits of this codeword are the data bits and the second eight bits are called the parity word (see Fig. 14). If zero, one, or two out of the 16 received bits are in error, the correct data byte will always be recovered. About one-third of those cases with three errors can be decoded correctly. For randomly occurring bit errors, an uncorrected error rate of 10^{-3} will be improved to about 6 (10^{-8}) after correction.

4. MODIFICATIONS AND CONFIGURATION

4.01 The dataport approach for D3 requires no backplane modifications. Instead, connectors on the front of the channel bank provide the additional connections between the dataport channel units and the new common equipment plug-in data logic unit (DLU). D3 channel banks can be equipped for D3B operation and any of the dataport applications if the currently required wiring for loop timing and the correct external clock termination are provided. All vintages of D3 channel banks except very early ones have the correct loop timing wiring; the early ones must be modified per CN6482MV which can be done with the channel bank in service. In addition, the correct external clock connection must be verified per paragraph 4.02 for operation in a hub office.

> ***Note:*** The installation of modification CN6482MV can be verified by the following ohmmeter readings: J108 (behind IU) Term 5 to Term 9: approx. 180 ohms; Term 9 to Term 33: 0.0 ohms.

4.02 Externally supplied composite clock is terminated in a resistor-capacitor network on an equalizer and distribution panel (J98718A, B, and C bays) or a power distribution panel (J98718J, K, and L bays) at the top of the bay and bridged to all of the remaining channel banks in that bay.

> ***Note:*** The number of banks that can be bridged to one timing tap will vary, depending upon the list number of the DLU unit as ▶shown in Table C. L5 and later DLUs may be mixed with other DLUs only if modification CN7732MV or CN7733MV has been made.◀

The wiring details for external timing are shown in CAD 48 and 49 of SD-3C104-01 for the J98718A, B, and C (−1 or −2) D3 bays and in CAD 16 of SD-3C104-02 for the J98718J, K, and L (−1) D3 bays. Connections to the clock termination must be provided by option M wiring, which includes CAD 16 for the J, K, and L bays. Very early vintages of the J98718A, B, and C bays that will be receiving external clock require a modified CAD 25 or 35 of SD-3C104-1 to correct the clock termination. This modification is not required if only loop timing is used.

> ***Note:*** Presence of an external timing signal waveform similar to that shown in Fig. 15 can be verified using a dual-trace oscilloscope and by probing J108 pins 10 and 35 behind the DLU unit on the backplane of the D3B channel bank.

4.03 The rules on the use of shielded cable for dataport operation evolved from the existing arrangements for DDS equipment and for the D3 channel bank. Shielded cables are used between the DSX-Ø cross-connect bay and the DDS equipment for both directions of transmission. Existing unshielded cable is used for the drop channel wiring from the D3B channel bank to the distributing frame. At a hub office, the tie cable from the intermediate distribution frame (IDF) to the DSX-Ø must be shielded. At

an end office, shielded cable is not used with the OCU DP; but, if a digital data group terminal (DDGT) or DDS OCU arrangement is used, shielded connections are made from the DDS equipment to the associated distributing frame. All clock leads to DDS equipment and channel bank must be shielded.

4.04 Once the dataport DLU is installed, dataport capability exists for four dataport circuits, subrates on channels 4, 5, 16, and 17 and 56 kb/s services on channels 3 and 4, 5 and 6, 15 and 16, and 17 and 18. Except when the wide units are used, any of these channels not being used for dataport can accommodate message or special service channel units. However, none of the other channels may be used for 5– or 8-kHz program units. The D3 reframe counter unit cannot be used in a D3B channel bank because the DLU occupies the slot of the removed IU unit and the adjacent vacant slot.

4.05 A special application of D3 dataport requires an OCU-DP modification per CCN278MV. This modification, which inhibits the forward-error-correction feature from the OCU-DP, is used on the master leg of a multipoint circuit which does not subrate multiplex between the master station and the multipoint junction unit (MJU). Application of this modification requires that the associated T1 line be qualified per DDS requirements, see Section 365-228-500. ▶Error correction applies when transmitting from the MJU to an end office, but not from an end office to the MJU.◀

5. TIMING, WAVEFORMS, T1 LINE SELECTION

A. Timing

5.01 The timing of the DDS equipment is synchronized to produce the correct phase relationship throughout the system. This network synchronization produces the precise transmit and receive timing required for data transmission. ▶DDS synchronization is not compatible with the digital access and cross-connect system (DACS).◀ The DDS reference source is the Master Timing Supply located at Hillsboro, Missouri. Timing supplies in hub offices derive timing information from the network of T1 lines which includes connection to the master timing supply. Each timing supply produces an office clock signal containing both byte timing (8 kHz) and bit timing (64 kHz) which is distributed to the DDS equipment in the office. When the D3B channel banks function as part of the DDS, the banks must be synchronized to the timing reference. At hub offices, the office clock signal from the timing supply is cabled to the D3B channel bank which is arranged for external timing (properly equipped, one clock input can time all banks in the bay). Refer to note in paragraph 4.02. At end offices, the D3B channel bank is arranged for loop timing which locks the transmit timing of the bank to the timing of the received T1 signal. In this case, the timing at the dataport office is synchronized to the office at the other end of the carrier.

B. Waveforms

5.02 With the dataport channel unit installed in the D3B channel bank, the channel unit faceplate connector can provide oscilloscope probe access for the purpose of verifying the following:

(a) The 8- and 64-kHz integrated clock at pin 3.

(b) Data load pulse (DLP) at pin 4. (Single pulse for subrate and double pulse for 56 kb/s.)

(c) Transmit clock (TCLOCK) (1.544 MHz) at pin 5.

(d) Transmit data (TDATA) at pin 6.

(e) Receive data (RDATA) at pin 7.

(f) Receive clock (RCLOCK) (1.544 MHz) at pin 8.

Pins 1 and 2 are ground and −48V, respectively.

5.03 The "EXT" jack on the face of the DLU unit can provide oscilloscope probe access for observing the 8-kHz clock waveform. On the backplane at the DLU unit position at J108, using two probes, a differential measurement can be made at pins 10 and 35 to observe the waveform of the office DDS composite clock input to the D3B channel bank. Also, at J108 pin 28 the waveform of the 8-kHz clock from the transmit unit (TU) can be observed. Refer to Fig. 15 through 21 for examples of typical waveforms which should be observed when probing the points shown. Unless otherwise indicated all pin numbers are on the channel unit faceplate connector.

C. T1 Line Selection

5.04 Although the minimum requirement for general-voice use of T1 lines is an error rate of

10^{-6} (one error per million bits), most lines are better and lines can be selected for the more critical DDS application. Lines for conventional DDS data banks are tested to ensure that the performance meets the DDS objective, but lines for dataport-equipped carrier system handling byte-stuffed 2.4, 4.8, or 9.6-kb/s data and 56 kb/s data with the double wide 56 kb/s office channel units need not be tested because the OCU and DSØ dataports have error correcting circuitry to prevent T-line errors from causing customer data errors.

6. APPLICATION INFORMATION

6.01 Two basic arrangements for serving customer loops at dataport offices are (1) the use of a OCU DP unit for a subrate-data speed, and (2) the use of the 56-KB OCU & DSØ dataport channel units with forward error correction. (See paragraph 3.08.) When connecting the customer for subrate data to a DDS hub office or a dataport tandem office, a DSØ DP is always used at the other end of the channel. At a dataport tandem office, the DSØ DP is connected back-to-back with another DSØ DP unit. In stand-alone operation, the first two arrangements for dataport offices are used at both ends. These very basic applications are shown in Fig. 9, 22, 23, and 24. The OCU DP includes error correction as a design feature, but is obtained by option selection in the J98718BM DSØ DP. This option is only selected for a 64 kb/s signal produced from byte-stuffed subrate data, not for 56 kb/s or multiplexed data. The basic applications are discussed further in the following paragraphs.

A. DDS Subrate-Data Application

6.02 This application of D3 dataport operation is to extend subrate service to a dataport office from the hub office as shown in Fig. 22. The hub-end D3B channel bank bay receives DDS composite clock from the timing-supply bay. Selected banks within the bay are optioned to accept the external clock at the dataport DLU unit. For this subrate application the DSØ DP unit at the hub end is optioned with the error correction feature "in". At the dataport office the D3B channel bank is operated on loop timing from the incoming T1 line. Its OCU DP for the selected subrate is connected directly to a 4-wire customer loop.

B. DDS 56 kb/s-Data Application With DSØ DP Code J98718BM Channel Unit

6.03 For this type 56-kb/s service, it is necessary to use the J98718BM DSØ DP channel units in the D3B channel banks in both the hub and dataport offices, Fig. 9. At the dataport office, a conventional DDS OCU unit is mounted in a suitably equipped OCU or DDGT shelf. The OCU unit then interfaces on one side at the 56 kb/s rate with customer 4-wire loops and on the other side at the 64 kb/s DSØ rate with the DPØ DP channel unit. Timing at the hub office is operated from external clock and at the end office on loop timing received from the T1 line. However, at the dataport office the received composite clock must be wired from the D3B channel bank to the OCU or DDGT shelf. When more than one system is loop timed in the office, the data circuits deriving timing from one such system cannot be cross-connected to another because the timing may differ. The DSØ DP channel units at both ends have the error correction feature "out". This type 56 kb/s service requires qualification of the T1 line in accordance with Section 365-228-500.

C. Dataport Tandem Connections

6.04 Figure 23 shows a DDS dataport tandem office using back-to-back D3B channel banks. The bank nearest the hub office is operated on loop timing. Composite clock is wired from the hub-office-side D3B channel bank to the D3B channel bank on the dataport-office side which uses external timing. The tandem connection will accommodate either subrate data or 56 kb/s. When J98718BM channel units are used back-to-back, both DSØ DP channel units are optioned with the error correction "in" for subrate data and "out" for 56 kb/s data. T1 lines to the hub and dataport offices should be qualified in accordance with Section 365-228-500 when using J98718BM channel units for 56-kb/s operation. 56 KB DSØ DP can also be used for tandem if the J98718DA channel units are used. Qualification of the T1 lines is not necessary in this case.

D. Stand-Alone Applications

6.05 Stand-alone dataport operation, shown in Fig. 24A for subrate data and Fig. 24B for 56-kb/s data, is essentially the same as that described for DDS in paragraphs 6.02 and 6.03. The main difference is that DDS composite clock is not available and clock must be supplied by the channel bank in one office operating on local timing. Other differences are that service testing center (STC) testing capability is not available and there may not be a single point of contact for the customer. The T1 line supplies clock to the channel bank, operating on loop timing, in the

other office. In this case, the channel bank on local timing acts as the master clock for both channel banks and both customer stations.

7. ESTABLISHING D3B DATAPORT SERVICE

7.01 Table A provides a suggested list of tasks to be performed in establishing D3 dataport service. Table A applies to DDS hub, dataport tandem, and dataport offices as well as stand-alone dataport offices for subrate and 56-kb/s data service. It is assumed that the channel bank is already carrying message service. The exact sequence in which the tasks are performed may be varied depending on local conditions. Once a D3 channel bank has been converted to a D3B channel bank, adding an additional dataport channel is a much simpler task. The following paragraphs discuss some considerations involved in performing the tasks in Table A.

A. Local Loop Qualification Tests

7.02 At the DDS or stand-alone dataport office (Fig. 9 and 24), the drop-side cable pairs going outside the office must undergo acceptance tests to ensure that they are suitable for digital data before service is applied. The tests are made from the OCU DP channel unit position by means of the D3 ED-3C947 cable pair access tool. This tool plugs into the channel slot and is shown in Fig. 25. For 56 kb/s service without error correction, the tests are made from the DDS OCU or DDGT shelf using the DDS 789A tool plugged into the OCU unit slot as shown in Fig. 26. The cable acceptance tests to be used are covered in Section 314-410-510. The results are to be recorded on the DDS E-6528 series of forms. These tests require two testers, one at each end of the cable. The required tests are named below:

E. Foreign Voltage

F. Insulation Resistance

G. Loop Resistance

H. Insertion Loss

I. Background Circuit Noise

J. Impulse Noise.

B. Channel Bank and T1 Line Considerations

7.03 Table A also deals with checking that the channel bank is configured for dataport operation, optioning and installing the dataport plug-ins, removing and restoring message service, and making DSØ signal connections at the distribution frame, if applicable. References in Table A may be helpful in understanding these tasks. Some of these tasks (eg, cabling for external timing) may be performed by the Western Electric Company installation forces in preparation for dataport service.

> ***Note:*** DDS and T Carrier terminals may follow different conventions for the T, R, and T1, R1 designations. Before cross-connecting the DSØ signals at the distribution frame, verify the proper assignment of T, R, and T1, R1.

C. DDS Preservice Tests

7.04 Loopback tests from the STC toward the dataport office and customer premises normally do not require assistance at the D3B channel bank. DDS Section 314-901-500 provides these preservice tests. In the event of a trouble occurring during the test, the carrier craftperson may be required to manually loop back the DSØ level signal and/or use the KS data test sets to sectionalize the trouble.

D. Stand-Alone Preservice Tests

7.05 Before service is applied to a stand-alone system, the carrier channel and customer loops must be tested for data transmission without errors using the DDS digital test sets, KS-20908 receiver and KS-20909 digital transmitter. The KS-20908 receiver and KS-20909 transmitter are similar in appearance and operate on 115 volts ac. Several different outputs can be obtained from the transmitter including quasi-random testwords, control and loopback signals and selectable byte patterns. The receiver indicates detection of control codes and byte patterns by lighting of lamps, and indicates errors on a counter. Detailed information and operational tests for the test sets are found in Section 107-600-100 for the transmitter and Section 107-601-100 for the receiver.

7.06 ▶Section 365-800-003 (TOP)◀ contains the procedures for using dataport test fixtures and the data test sets. These procedures cover the connections that may be required for turnup or troubleshooting, (eg, establishing a loopback at the dataport and testing toward the carrier or drop side). Any or all of the tests can be used, but the Preservice Cus-

tomer Loopback Test, performed alternately from each office is the best preservice test, checking the carrier and both customer loops. Figure 27 shows the test fixtures for the procedures ▶found in Section 365-800-003 (TOP).◀

E. Dataport Pre-Test Evaluation

7.07 Examples of some dataport system problem evaluations are given in Fig. 28, 29, 30, 31, and 32 using a single D3B channel bank at each end of the dataport system. Figure 28 is a troubleshooting flow chart that branches out to Loopback Tests "A", "B", and "C" (Fig. 29, 30, and 31 respectively). Figure 32 shows the points in a system that may be looped remotely or locally.

8. TROUBLESHOOTING CONSIDERATIONS

8.01 Most initial troubles are cleared by replacing dataport plug-in units or correcting option settings. The DLU at either end would be suspected if the system does not restore after installing these units. Furthermore, an alarm accompanying the installation of a dataport channel unit indicates that the unit is defective. The placement of plugs on the socket-plug option blocks must be checked with Fig. 3 through 6 since the options directly affect the operation. Some options are selected by placing the plug so that the white half of the socket block is showing. When both halves of the socket block correspond to an option, however, the plug is placed alongside the designation for the required option.

A. DDS Dataport Procedures

8.02 To provide the grade of service required for DDS, the T Carrier facility must be treated like a high priority special service by identifying frame terminations and jack access to prevent service interruption. Concentrated effort using the guidelines in this part of the section and coordination with the STC and ▶Facility Maintenance and Administration Center (FMAC)◀ will be required to restore lost service within the 30-minute DDS objective. Before attempting any maintenance, confirm that the data service has been released for testing by contacting the STC.

8.03 Generally, there are two categories of trouble: carrier failures with resulting alarms, and channel troubles bringing customer complaints. Alarm indications and channel bank looping are used to isolate trouble in the first category. Trouble in the second category is isolated by knowing the extent of the trouble and making channel tests. For trouble on a single data channel, the STC or responsible office will sectionalize the circuit using loopback and end-to-end tests that involve the channel test procedures ▶in Section 365-800-003 (TOP)◀ at the dataports. If isolated to the customer loop, loop troubleshooting tests A through J provided in Section 314-410-310 will confirm the need for cable repairs or cable reassignment. Whether both voice and data are affected by multichannel trouble must be considered in determining whether separate data or common plug-ins should be replaced at the D3B channel bank.

B. Stand-Alone Dataport Procedures

8.04 For troubleshooting stand-alone dataport, the channel bank and T1 line considerations given in paragraphs 8.02 and 8.03 are valid. Trouble sectionalization and restoral of dataport channel service must be performed using the DDS digital test sets and D3 dataport test fixtures. The test procedures provided in ▶Section 365-800-003 (TOP)◀ are also applicable to trouble clearance as are the customer loop tests A through J given in Section 314-410-310.

9. BSP REFERENCES

9.01 The 365 Division of Bell System Practices contains many sections which describe the channel bank and the T1 line and their operation and maintenance. Consult Section 365-000-000 for a listing of these BSPs.

9.02 The DDS BSPs listed below are being updated to cover dataport operation.

SECTION	TITLE
314-410-310	DDS Local Loop Maintenance
314-410-510	DDS Local Loop Tests
314-900-100	DDS Private Line Service Description
314-900-300	STC 2-Point Private Line Maintenance
314-901-500	STC 2-Point Private Line Circuit—Test Procedures
314-910-100	Office Channel Unit and Auxiliary Circuits

SECTION	TITLE
314-918-100	DDGT Description
314-918-300	DDGT Troubleshooting and Testing
◗365-150-100	D3 Channel Bank Description◖
365-228-500	T1 Digital Line Qualification Tests
365-800-003	D1, D2 & D3 Channel Banks and T1 Line Maintenance Tasks (TOP)
880-601-110	Engineering Considerations Synchronization Network◖

▶TABLE A◀

ACTIVITIES TO ESTABLISH D3 DATAPORT SERVICE

ACTIVITY	APPLICABLE TO				DETAILED REFERENCES
	DDS HUB OFFICE	DDS DATAPORT END OFFICE	DDS DATAPORT TANDEM OFFICE	STAND-ALONE DATAPORT OFFICES	
		SUBRATE AND 56 kb/s		SUBRATE AND 56 kb/s	
A. Make Cross-Connections At DF, cross-connect local loop to D3, OCU shelf, or DDGT; as applicable.		X		X	None
B. Use of ED-3C947 Test local loop using ED-3C947 tool at D3 OCU DP slot.		X		X	814-410-510
C. Check for Timing and Clock					
• For early D3 channel banks, verify loop timing capability (CN6482MV).	X	X	X	X	Para. 4.01
• Verify that DDS composite clock is wired to D3 frame and multipled to D3 channel bank.	X		X		Para. 4.02
• Verify that composite clock is wired from D3 channel bank on hub side to D3 channel bank on opposite side, for tandem connection.			X		Para. 6.04
D. Optioning Channel Units					
• Option DLU unit as required.	X	X	X	X	Para. 3.03
• Option J98718BM, DSØ DP unit per circuit layout record card. (56 KB has no options.)	X	X	X	X	Para. 3.04
• Option OCU DP unit per circuit layout record card.		X		X	Para. 3.05

TABLE A (Contd)

ACTIVITIES TO ESTABLISH D3 DATAPORT SERVICE

ACTIVITY	APPLICABLE TO				DETAILED REFERENCES
	DDS HUB OFFICE	DDS DATAPORT END OFFICE — SUBRATE AND 56 kb/s	DDS DATAPORT TANDEM OFFICE	STAND-ALONE DATAPORT OFFICES — SUBRATE AND 56 kb/s	
E. Removing Service from Channel Bank					
• Have service removed from D3 channel banks to be equipped with dataports and remove channel units from positions 3, 4, 5, 6, 15, 16, 17, or 18 which are being reassigned to dataport service.	X	X	X		Local Telco Option
• Remove IU common unit from D3 channel banks.	X	X	X	X	None
F. Install DLU					
• Install DLU L1A, L4, or L5 unit in D3 channel banks. (Use L5 or later for 56 kb/s service.)	X	X	X	X	Para. 2.01
G. Verification					
• Verify that system is in frame (no alarms)	X	X	X	X	None
H. Restore Service					
• Restore D3 service removed in Step 1 Procedure E.	X	X	X	X	None
• Install DSØ DP unit in D3 channel banks.	X	X	X	X	None
• Install OCU DP unit in D3 channel banks.					None
• Install (carefully) ED-3C832 jumper between DSØ DP or OCU DP and DLU unit in D3 channel banks.	X	X	X	X	Para. 2.01
• At DF, make DSØ cross-connections between D3 channel bank and DSX-Ø, OCU shelf, or DDGT shelf; as applicable.	X	X	X	X	None

TABLE A (Contd)

ACTIVITIES TO ESTABLISH D3 DATAPORT SERVICE

ACTIVITY	APPLICABLE TO				DETAILED REFERENCES
	DDS HUB OFFICE	DDS DATAPORT END OFFICE SUBRATE AND 56 kb/s	DDS DATAPORT TANDEM OFFICE	STAND-ALONE DATAPORT OFFICES SUBRATE AND 56 kb/s	
I. Perform Loop Test					
• At STC, perform preservice looped tests of D3 dataport circuit to end office and customer premises.	X	X			314-901-500 Para. 7.04
• Perform preservice looped tests of D3 dataport circuit to customer premises using KS-20908 and KS-20909 data test sets.	X			X	365-800-003 Para. 7.06
J. Establish Service					
• Establish D3 dataport service.	X	X	X	X	Local Telco Option

♦TABLE B♦

D3 DATAPORT UNITS AND TEST ACCESSORIES

EQUIPMENT	EQUIPMENT CODE	SD/CD	FUNCTION
BANK PLUG-INS AND CONNECTORS			
DLU (Data Logic Unit) Common Unit	J98718AH-1	3C410-01	Timing and interface between D3 channel bank common circuits and DSØ DP and OCU DP units
	J98718AH-2	3C410-02	Same as -1, but allows 56 kb/s service and 7 bank/clock terminations.
DSØ DP (Digital Signal Zero Dataport) Channel Unit	J98718BM-1	3C411-01	64 kb/s data access for DDS or stand-alone applications with error correction for subrate data but not for 56 kb/s data
OCU DP (Office Channel Unit Dataport) Channel Units	J98718BN	3C412-01	Subrate-data access to local loop for DDS and stand-alone applications
2.4 kb/s 4.8 kb/s 9.6 kb/s	List 1, 4, 4A, 7, 7A List 2, 5, 5A, 8, 8A List 3, 6, 6A, 9, 9A		
56 KB DSØ DP Channel Unit (Double Wide)	J98718DA	3C419-01	Provide for 56 kb/s error corrected dataport service
56 KB OCU DP Channel Unit (Double Wide)	J98718DB	3C446-01	Provide for 56 kb/s error corrected dataport service
Front Plate Connector (Jumper)	ED-3C832		Connects DSØ DP or OCU DP units to DLU unit circuits

▶TABLE B◀ (Contd)

D3 DATAPORT UNITS AND TEST ACCESSORIES

EQUIPMENT	EQUIPMENT CODE	SD/CD	FUNCTION
TEST FIXTURES			
Test Interface Unit	ED-3C792	3C403-01	Connects 8 kHz and 64 kHz clock from DLU unit to KS-20908 and KS-20909 data test sets
Loop Back Connector	ED-3C793	3C404-01	1. Provides DSØ level loopback at DSØ DP or OCU DP units for DDS STC testing 2. Provides jack access at DSØ DP or OCU DP unit DSØ level toward drop or line for KS-20908 and KS-20909 data test sets
Interface Unit Cord	COM CODE 824725111	3C403-01	Connects DLU unit to test interface unit
D3 Dataport Access Tool	ED-3C947		Provides 4-wire access to OCU DP unit slot for customer loop qualification tests

▶TABLE C◀

DLU COMBINATIONS PER D3 BANK BAY (NOTE)
(CONNECTIONS TO EXTERNAL CLOCK)

DLU LIST NUMBER		
L1	L1A OR L4	L5
0	0	up to 7
1	0	up to 6
0	1	up to 6
0	2	up to 5
0	3	up to 4

Note: To determine allowable combinations per bay, read across.

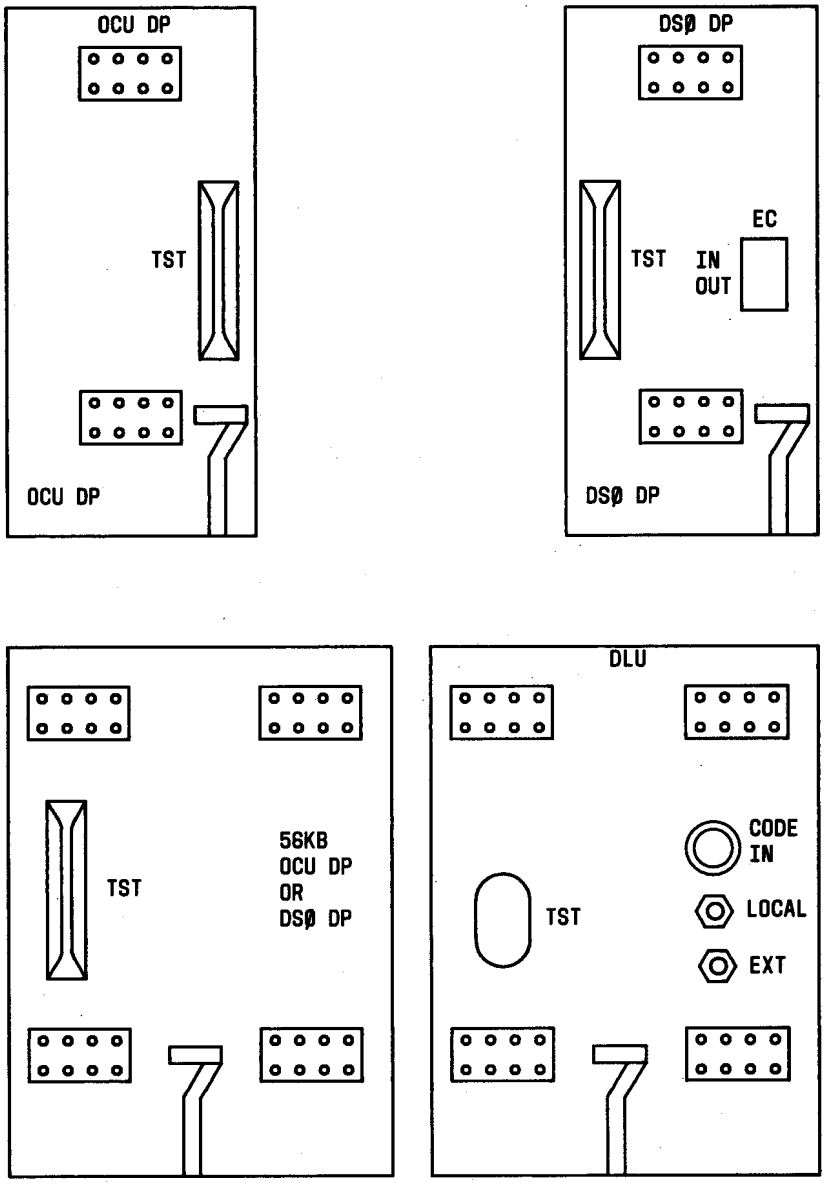


Fig. 1—Dataport Plug-ins

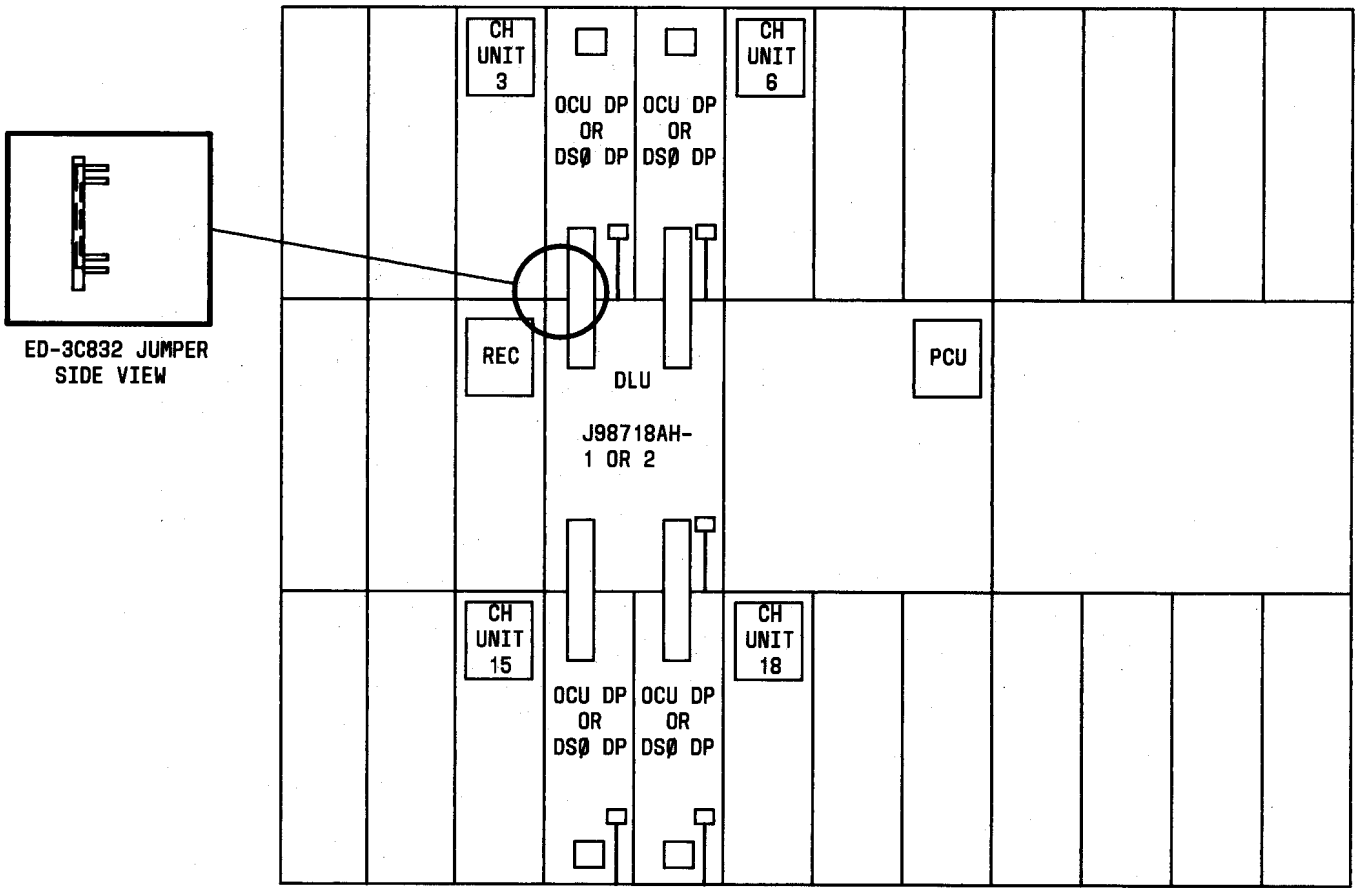


Fig. 2—D3B Channel Bank Configuration

OPTION	FUNCTION
LP, EXT OR LOC, (socket & plug)	Select one for required bank timing: LP - loop timing for DDS when no office clock is available EXT - external timing for connection to office clock LOC - locally generated, for stand-alone application
L & L or EXT (socket & plug)	Select one to match bank timing: L & L matches LP and LOC; EXT matches external
D or T (socket & plug)	Select D for normal use; T is only for factory tests
C (socket & plug)	Select C for normal operation; provides off hook during bank reframing that follows carrier hit

LOCATION

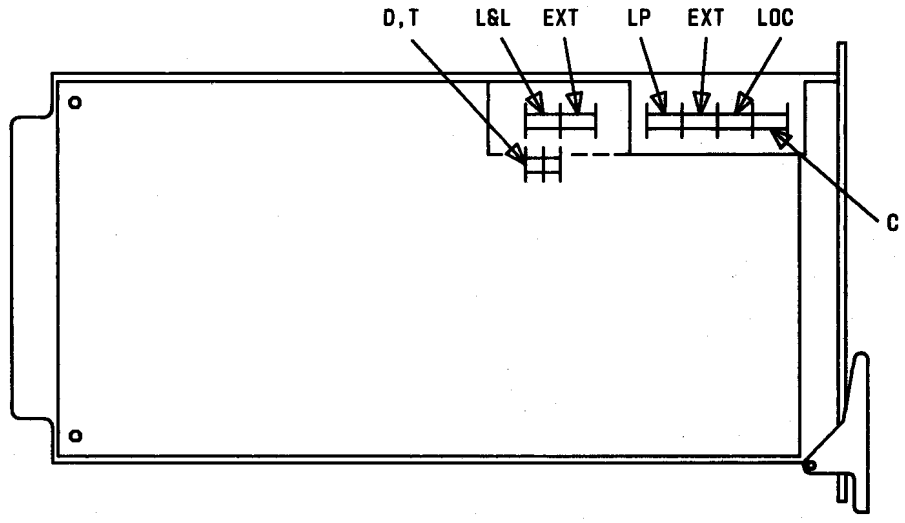


Fig. 3—DLU Options

OPTION	FUNCTION
FLBO, IN or OUT (rocker switch)	Set IN only for short loops (<10 dB) to insert 10 dB in T, R pair coming from customer premises; otherwise OUT
CRTC, IN or OUT (rocker switch)	Set IN only if station has CRTC feature
DSU or CSU (rocker switch)	Select DSU for data service unit at station; Select CSU with chan service unit.
D or T (2 sockets & plugs)	Select D for normal use; T is only for factory tests.
CM	Set Out - This option is for future use with customer multiplexing at the station equipment.

LOCATION

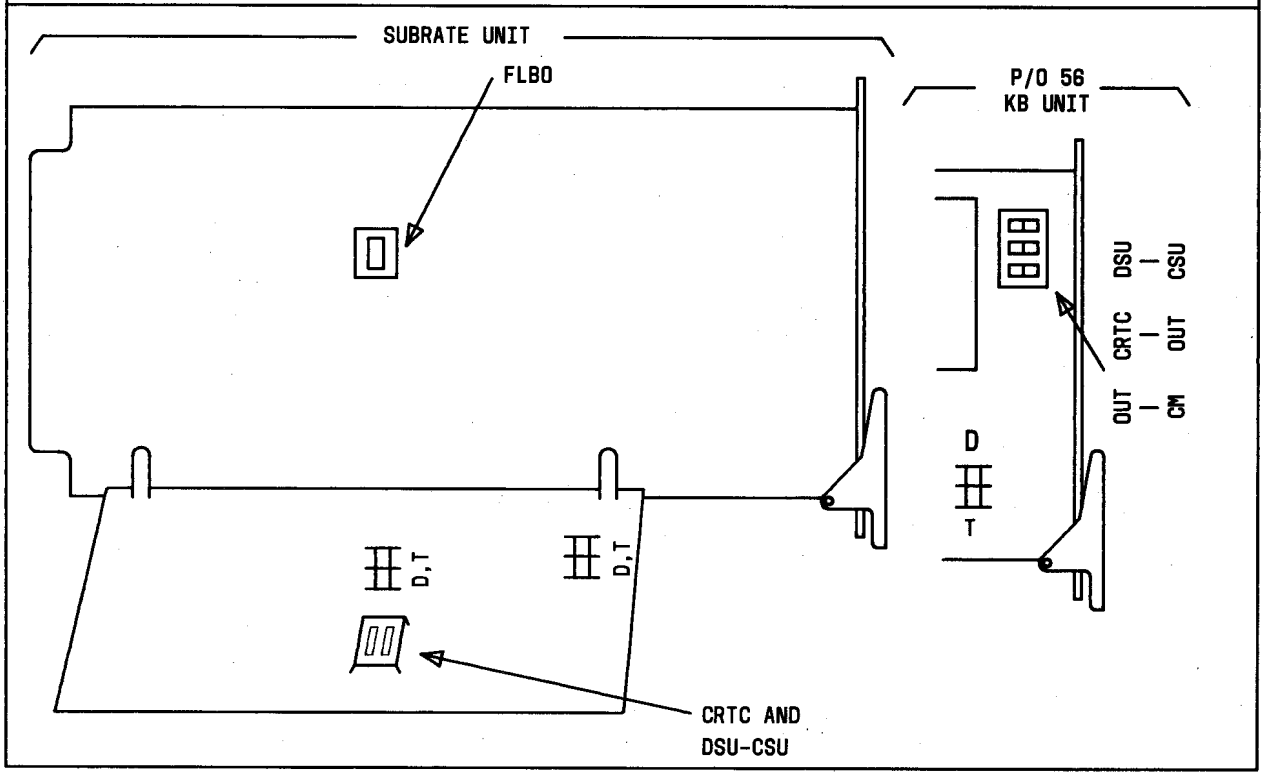


Fig. 4—OCU Options

OPTION	FUNCTION
EC, IN or OUT (socket & plug)	Set IN only for byte-stuffed data (2.4, 4.8 or 9.6 kb/s); otherwise OUT
D or T (socket & plug)	Select D for normal use; T is only for factory tests
(56KB DSØ DP has no options)	

LOCATION

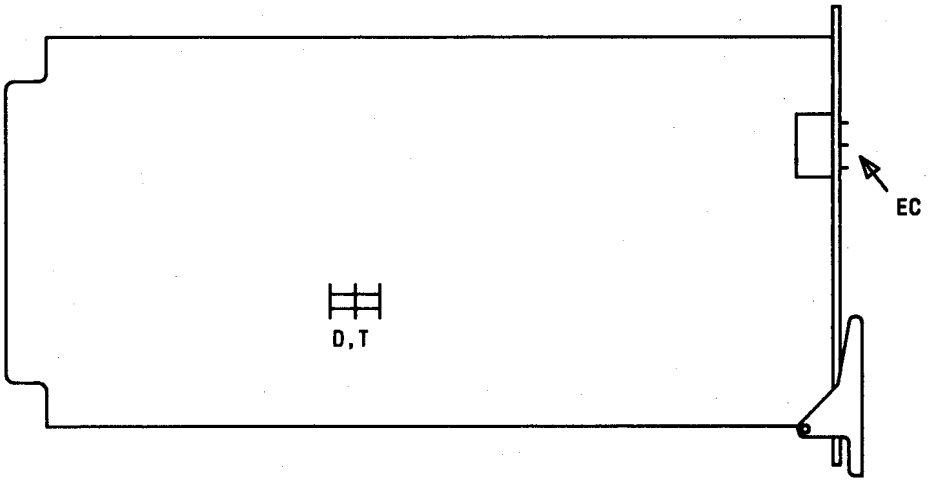


Fig. 5—DSØ Options

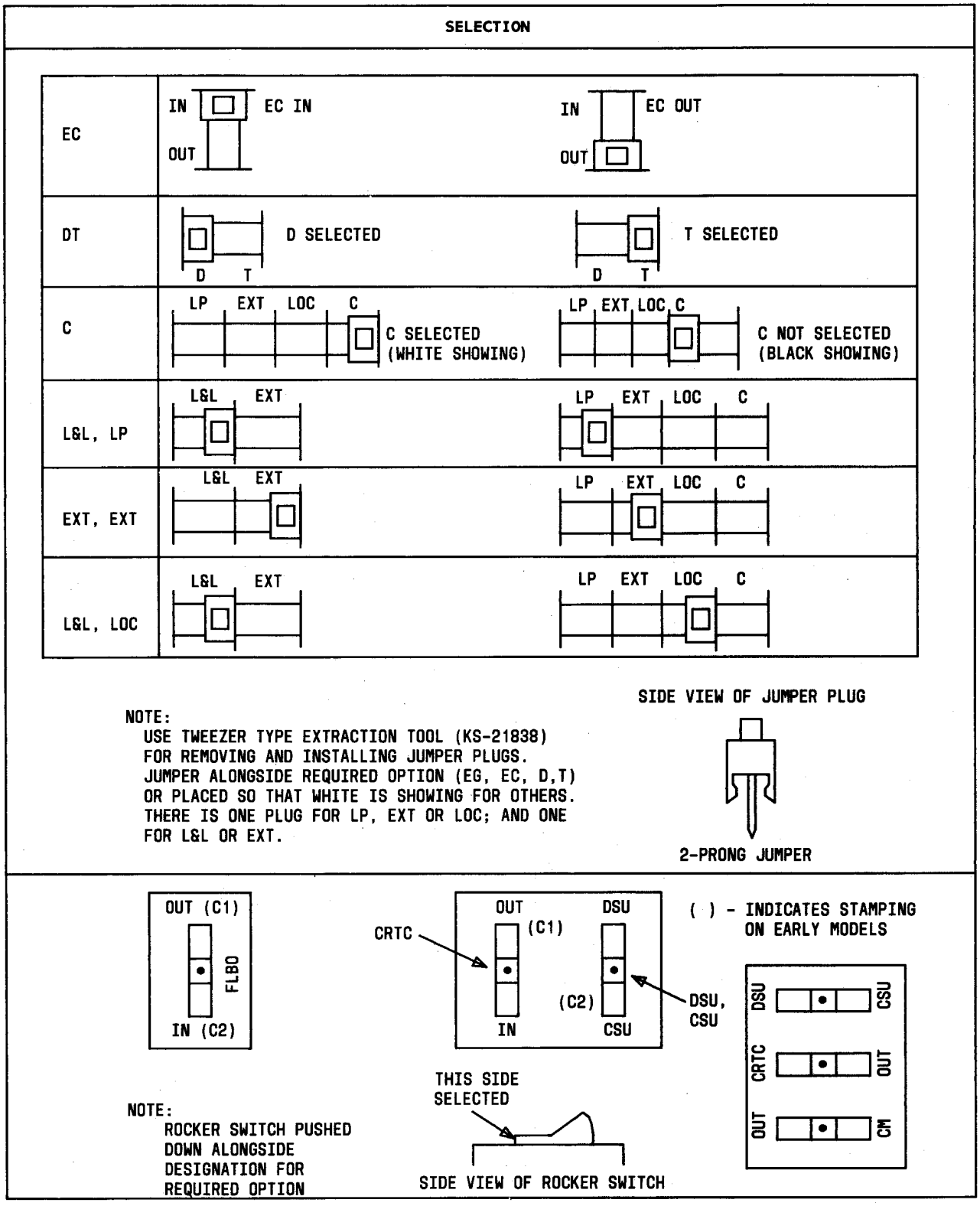


Fig. 6—Methods for Selecting Options

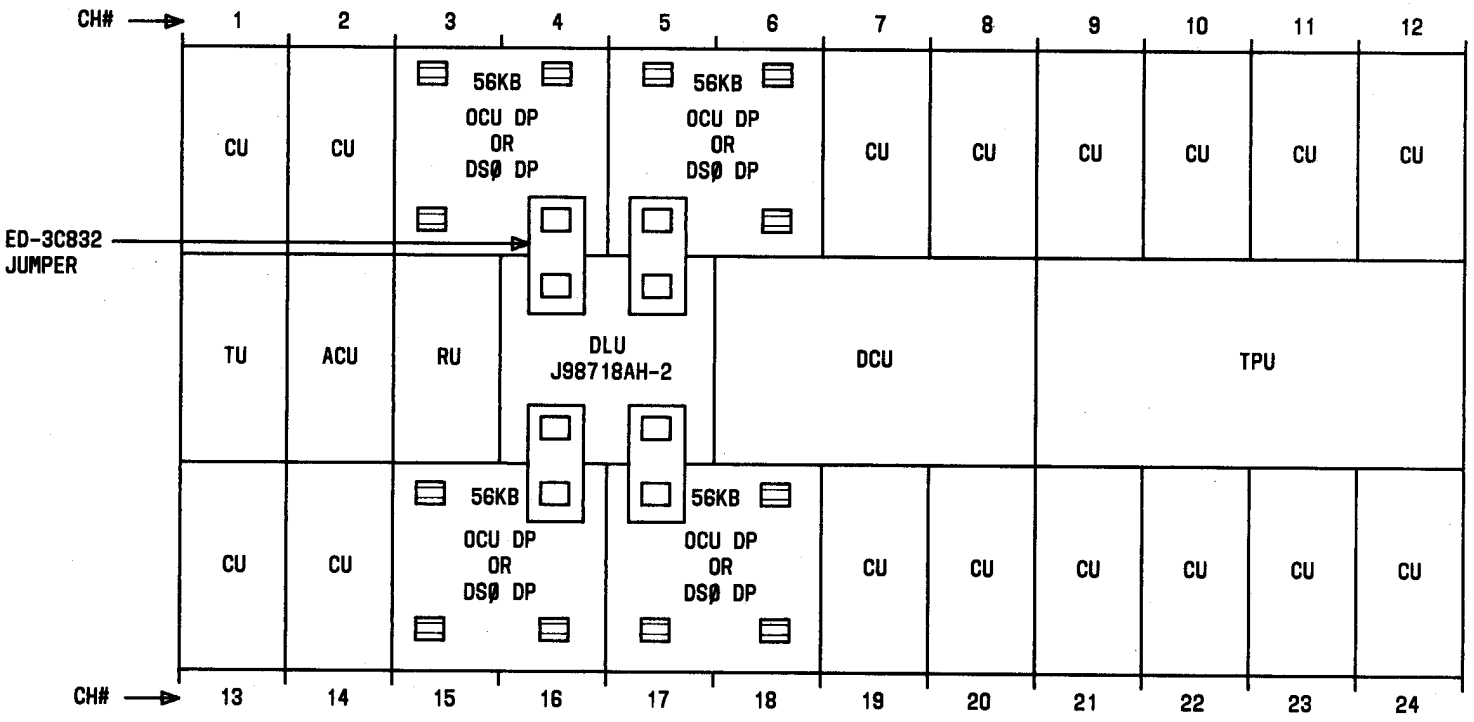


Fig. 7—Channel Bank Configuration With 56-KB Channel Units

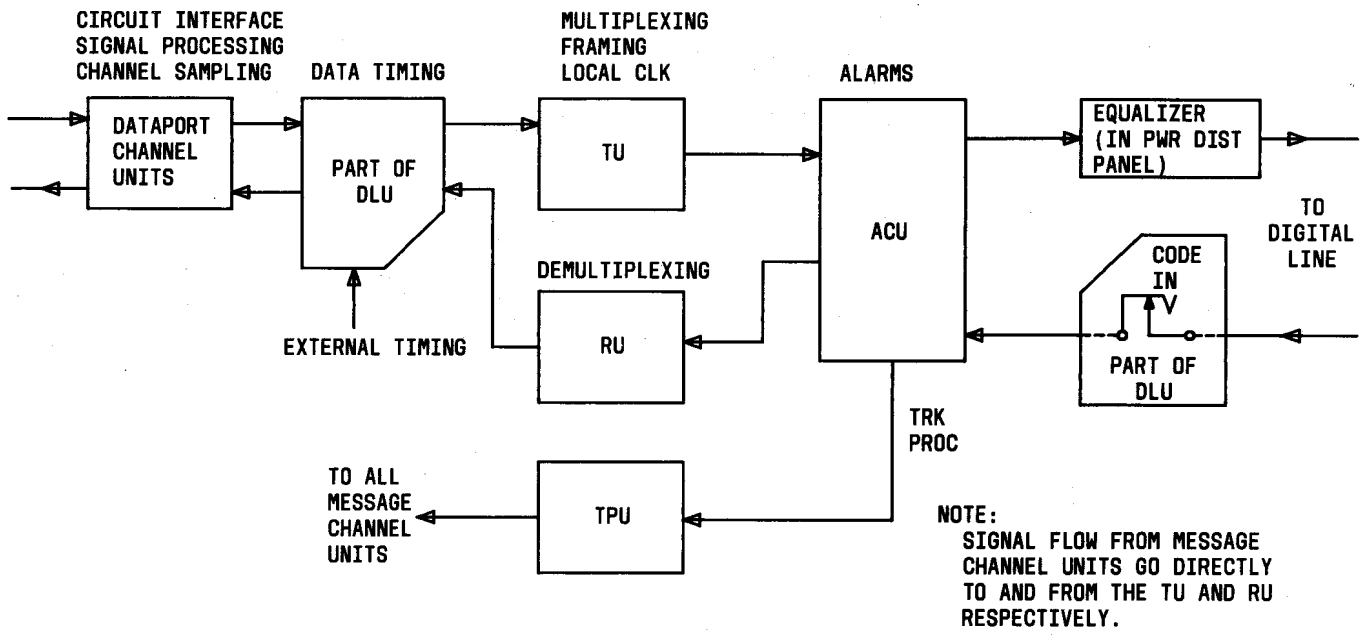


Fig. 8—D3B Block Diagram

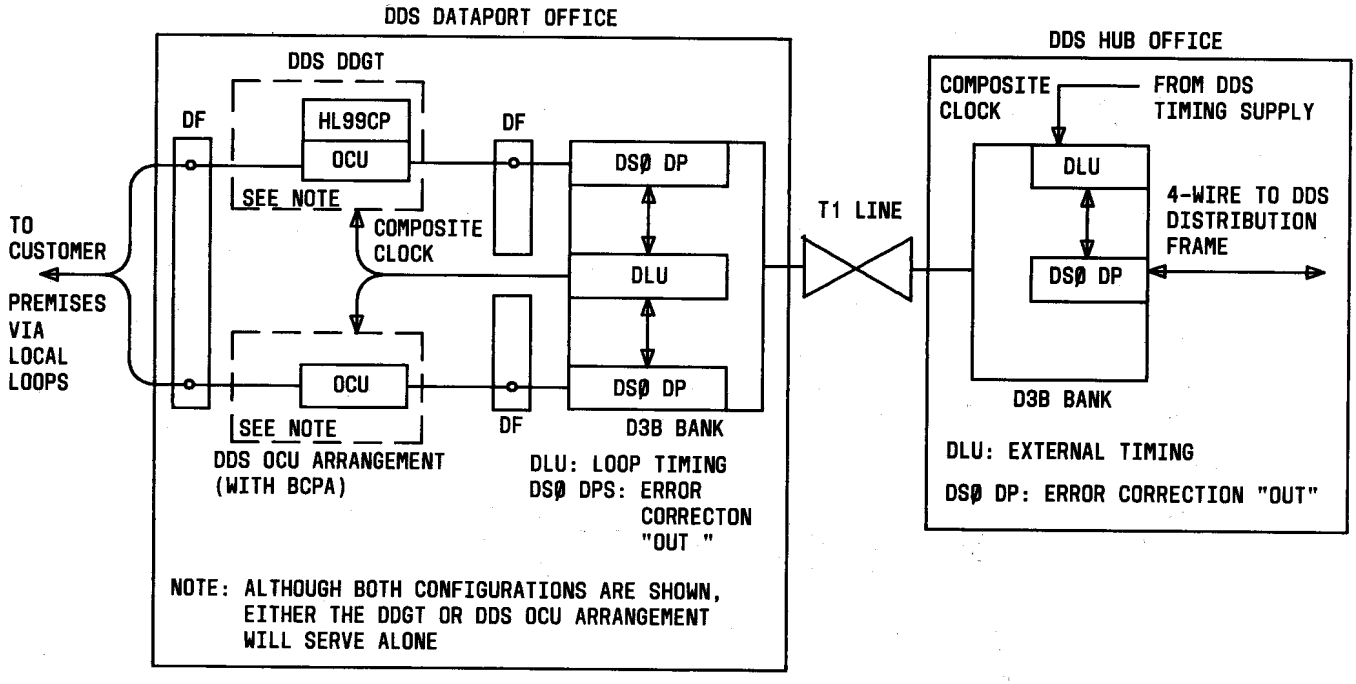


Fig. 9—56-kb/s DDS Dataport Application Without Error Correction

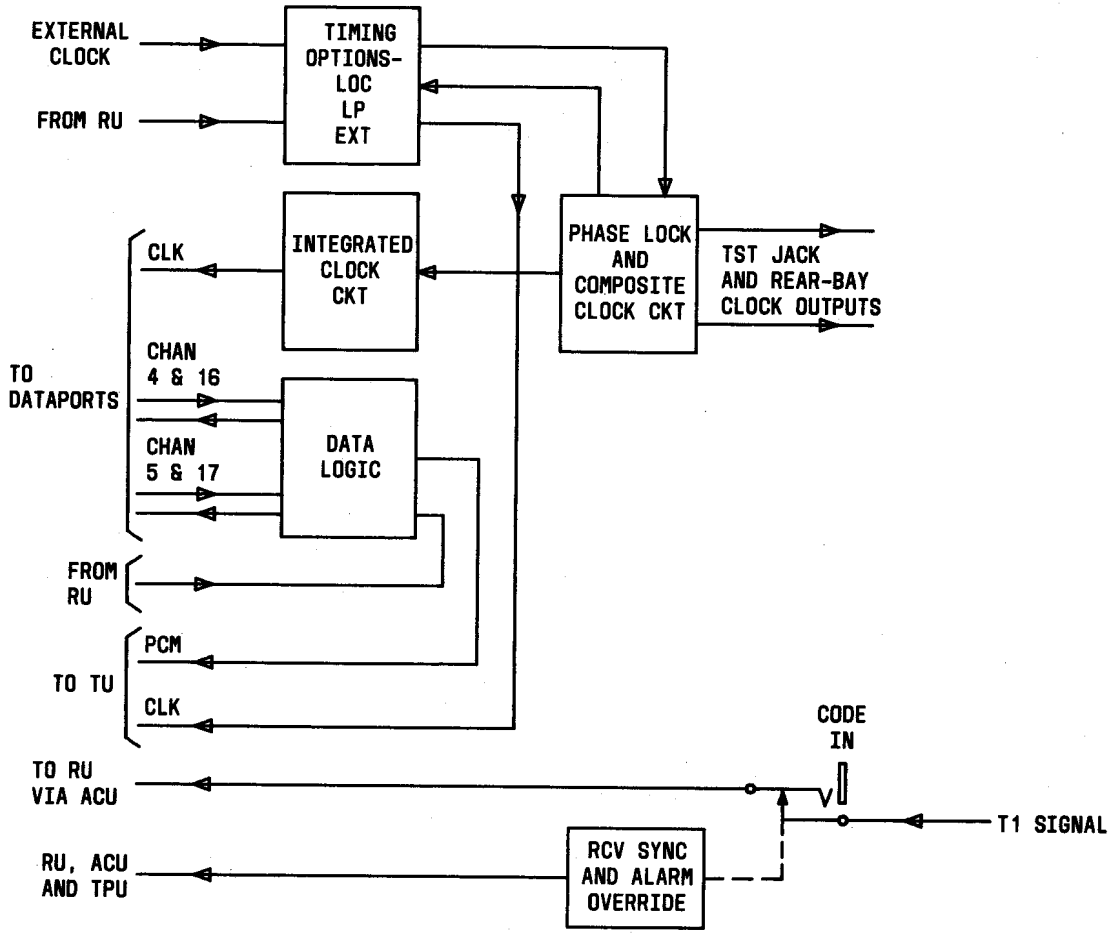


Fig. 10—DLU Block Diagram

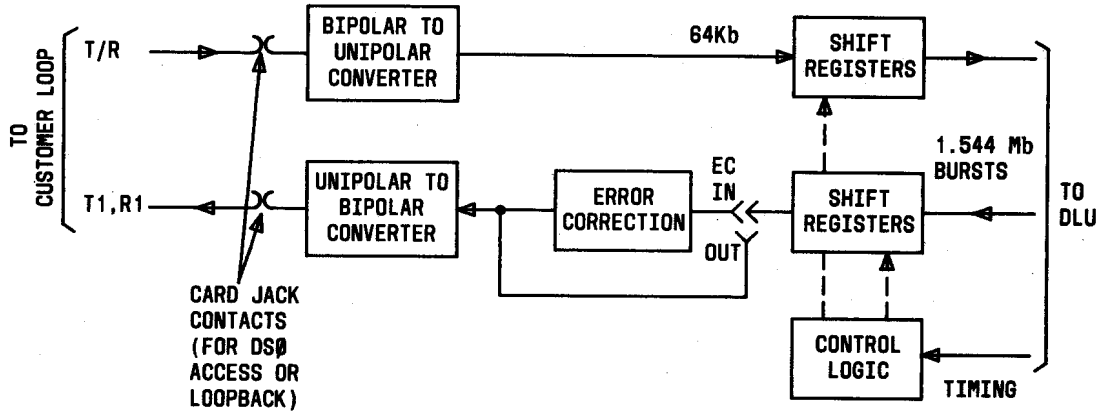


Fig. 11—DSØ DP (J98718BM) Block Diagram

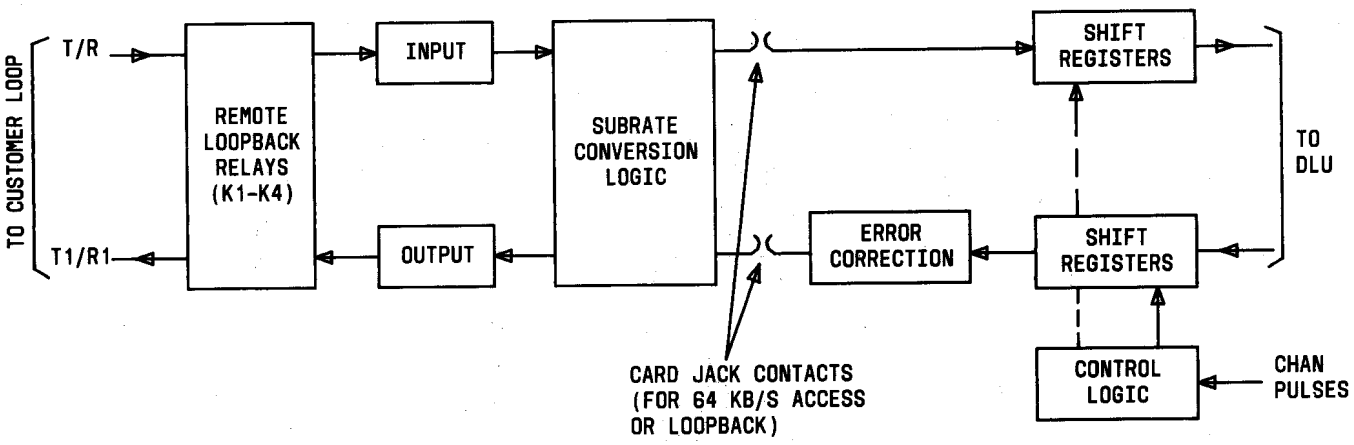
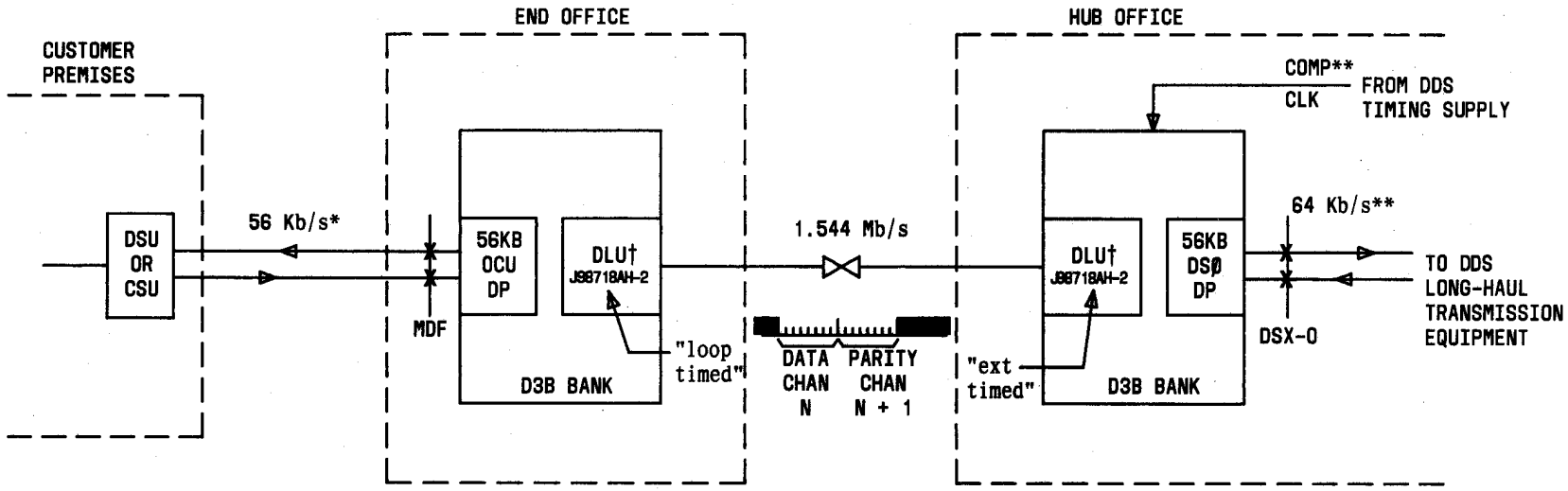


Fig. 12—Subrate OCU DP Block Diagram



* LOOP IS SUBJECT TO DDS 56 Kb/s REQT

† LIST 5 OR LATER

** COMP CLK AND 4-WIRE CONNECTIONS ARE SUBJECT TO THE SAME SPECS (AND 1500 FT. LIMIT) AS OTHER DDS CONFIGURATIONS (SEE IL79-07-348)

NOTE: T1 LINE DOES NOT NEED TO BE QUALIFIED.

Fig. 13—56-KB Dataport Application With Automatic Error Correction

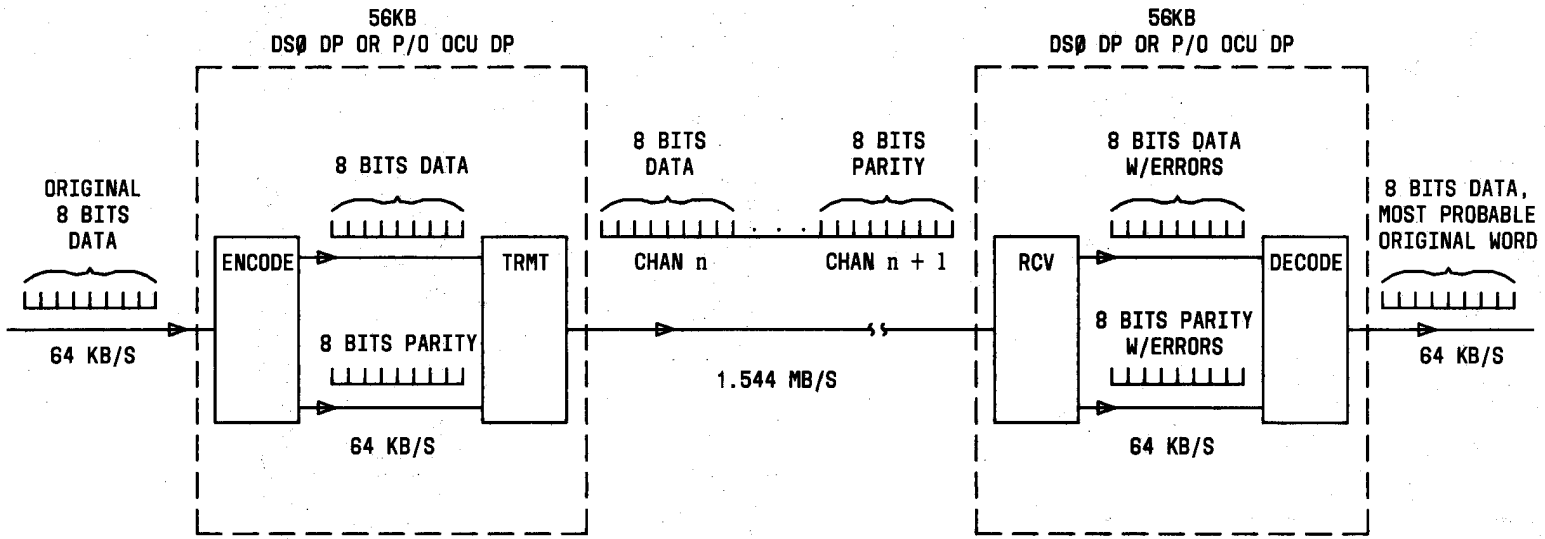
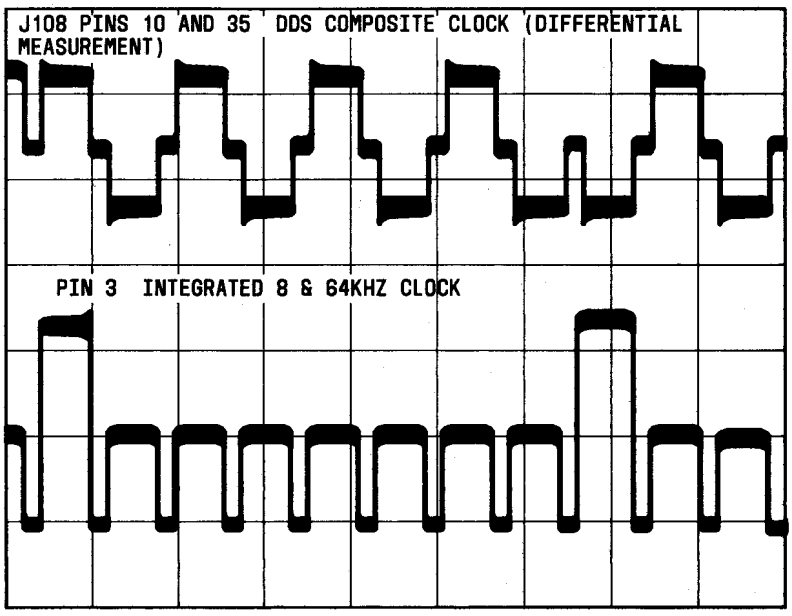
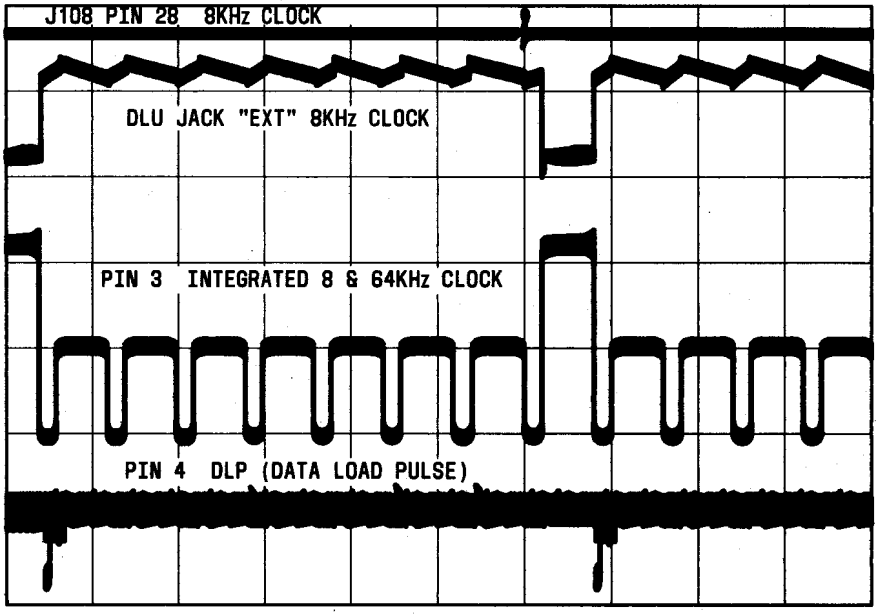


Fig. 14—56-KB Error Correction Scheme



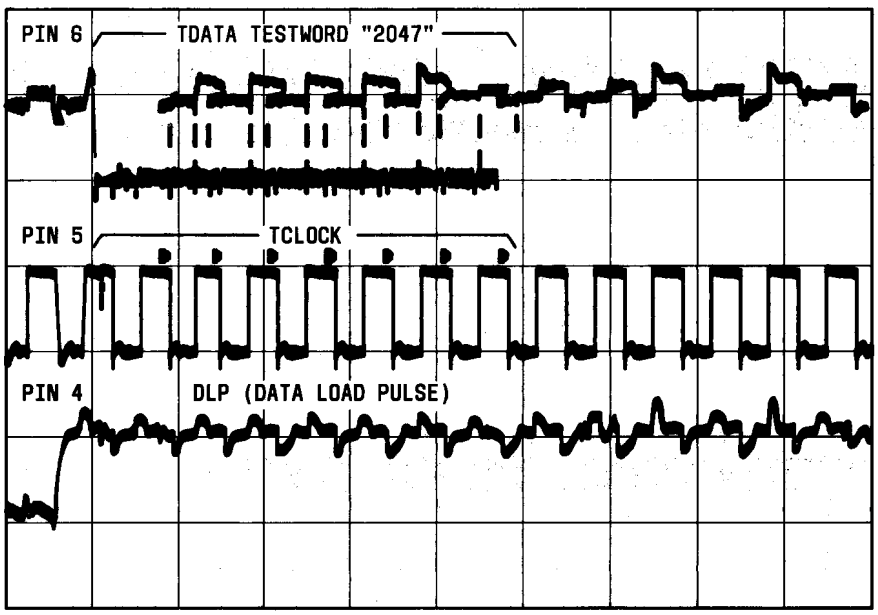
(5V/DIV 20μSEC/DIV SYNC'D ON INTERGRATED CLOCK)

Fig. 15—DDS Composite Clock and Integrated Clock



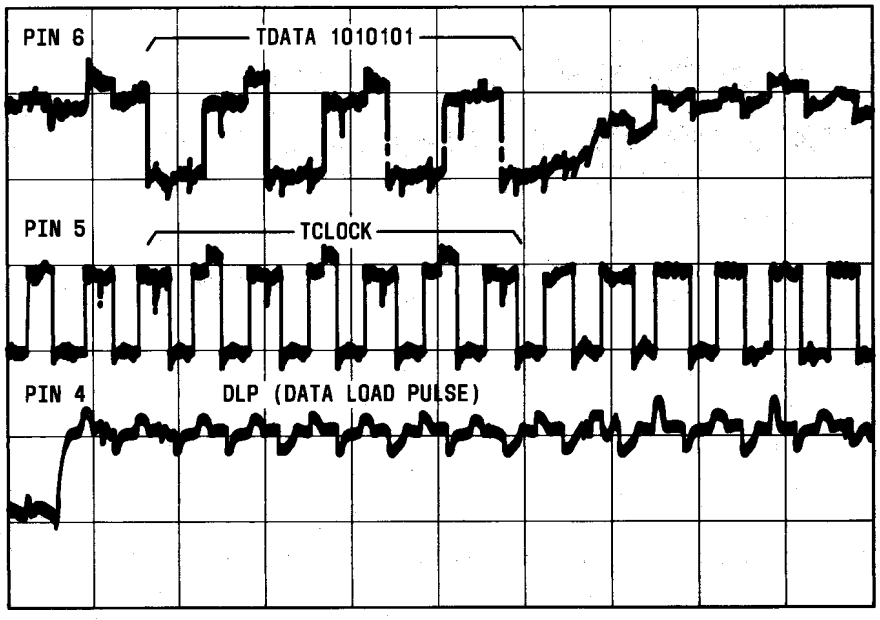
(5V/DIV 20μSEC/DIV SYNC'D ON DATA LOAD PULSE)

Fig. 16—8-kHz Clock at Back of Bank and Front of Integrated Clock and DLP



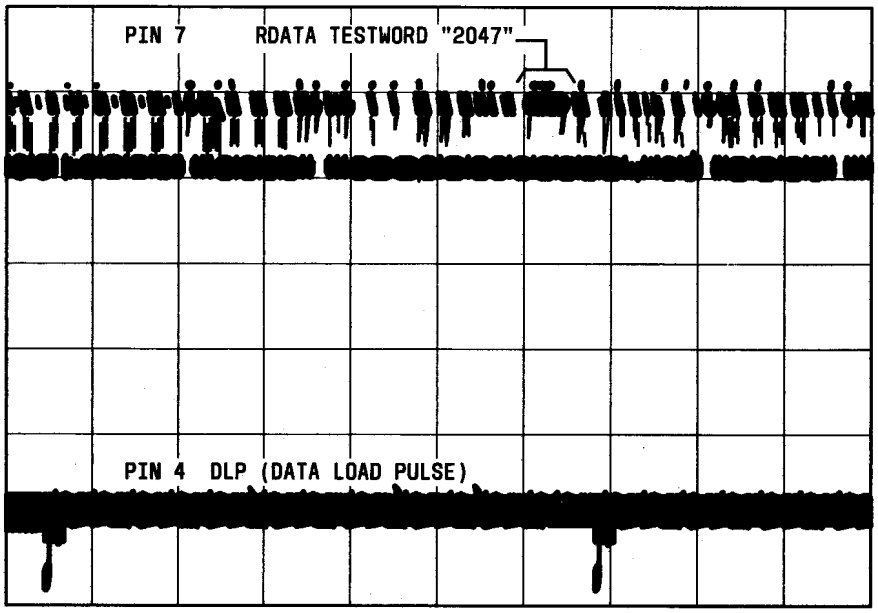
(5V/DIV 1μSEC/DIV SYNC'D ON DATA LOAD PULSE)

Fig. 17—TDATA Testword, TCLOCK, and DLP



(5V/DIV 1μSEC/DIV SYNC'D ON DATA LOAD PULSE)

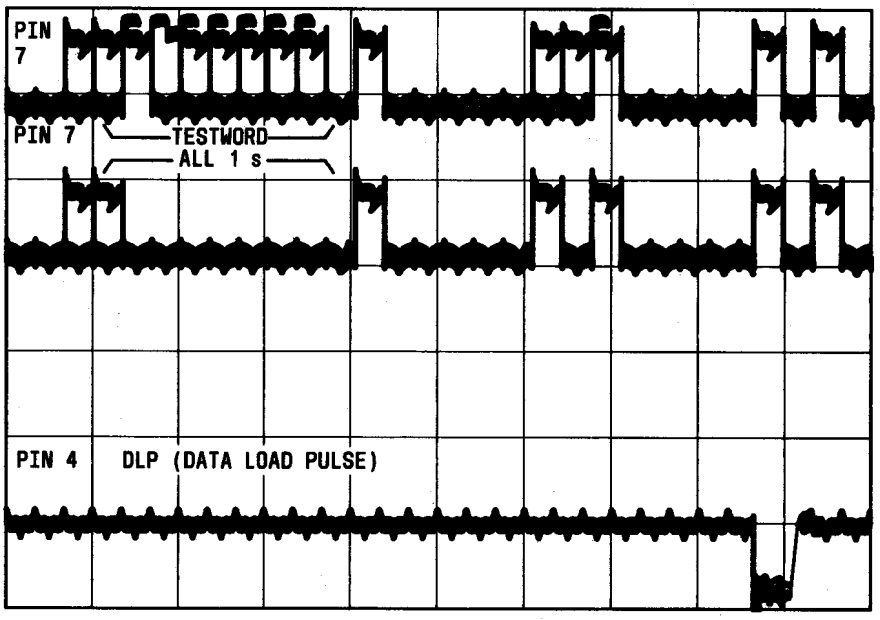
Fig. 18—TDATA Ones and Zeros, TCLOCK, and DLP



(5V/DIV 20μSEC/DIV SYNC'D ON DATA LOAD PULSE)

NOTE: BETWEEN THE TWO DATA LOAD PULSES, ALL 24 CHANNEL DATA IS PRESENT ON THE TRACE AT THE TOP PLUS THE TESTWORD. BY DEPRESSING THE ALL 1 BUTTON, ON THE DATA TEST SET, WILL BLANK OUT PULSES WHERE TESTWORD WAS LOCATED.

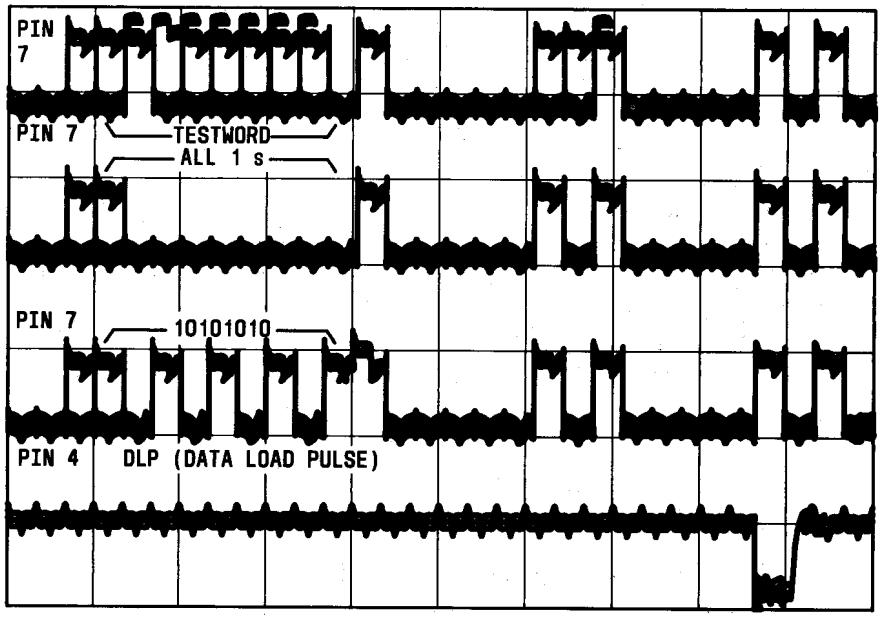
Fig. 19—RDATA Testword and DLP



(5V/DIV 2μSEC/DIV (SWEEP - 20μSEC DELAY) SYNC'D ON DATA LOAD PULSE)

NOTE: THE TRACES AT PIN 7 ALSO INCLUDES DATA FROM OTHER CHANNELS

Fig. 20—RDATA Testword, All 1s, and DLP



(5V/DIV 2μSEC/DIV (SWEEP - 20μSEC DELAY) SYNC'D ON DATA LOAD PULSE)

NOTE: THE TRACES AT PIN 7 ALSO INCLUDES DATA FROM OTHER CHANNELS

Fig. 21—RDATA Testword, All 1s, Ones and Zeros, and DLP

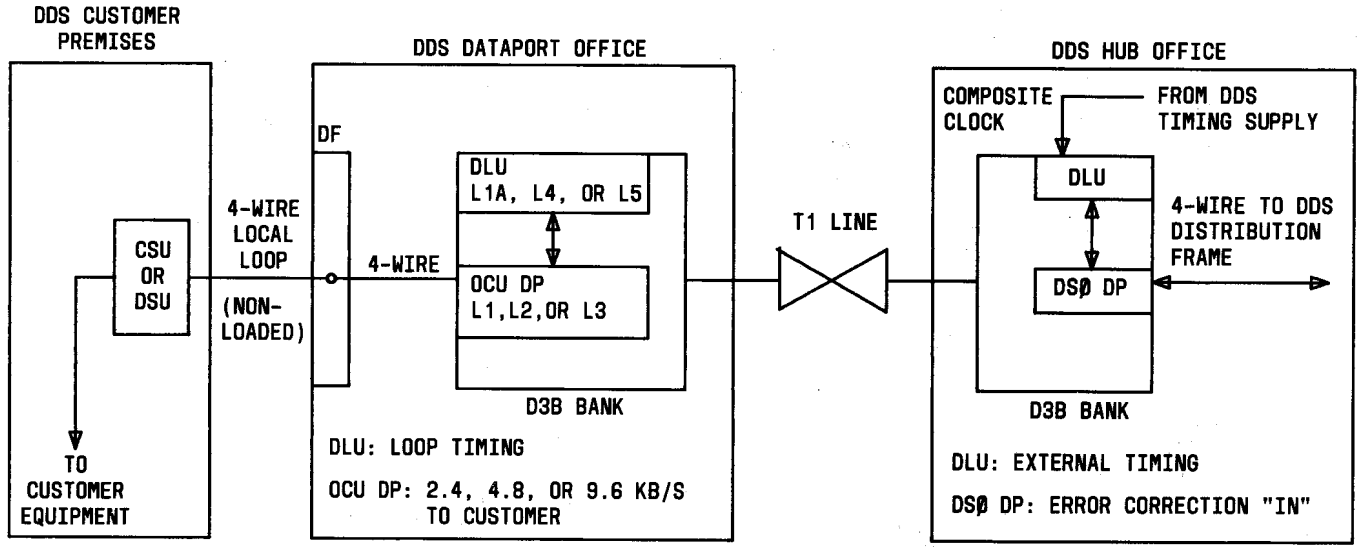


Fig. 22—DDS Dataport Subrate-Data Application

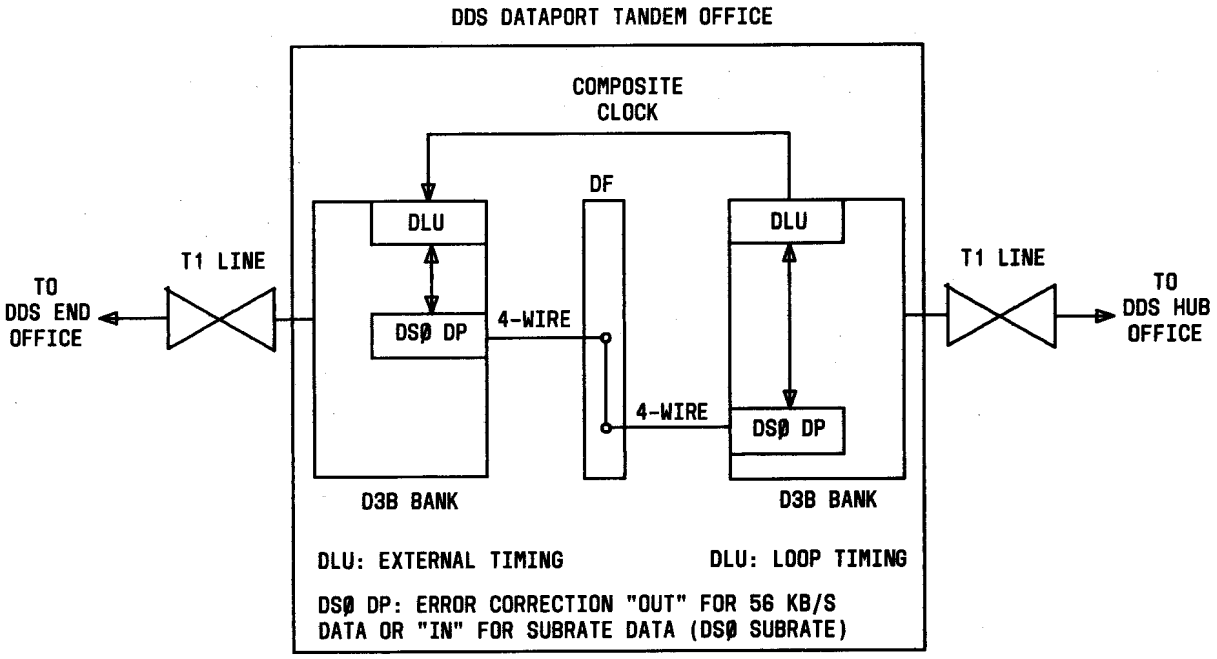


Fig. 23—Connections at Dataport Tandem Office

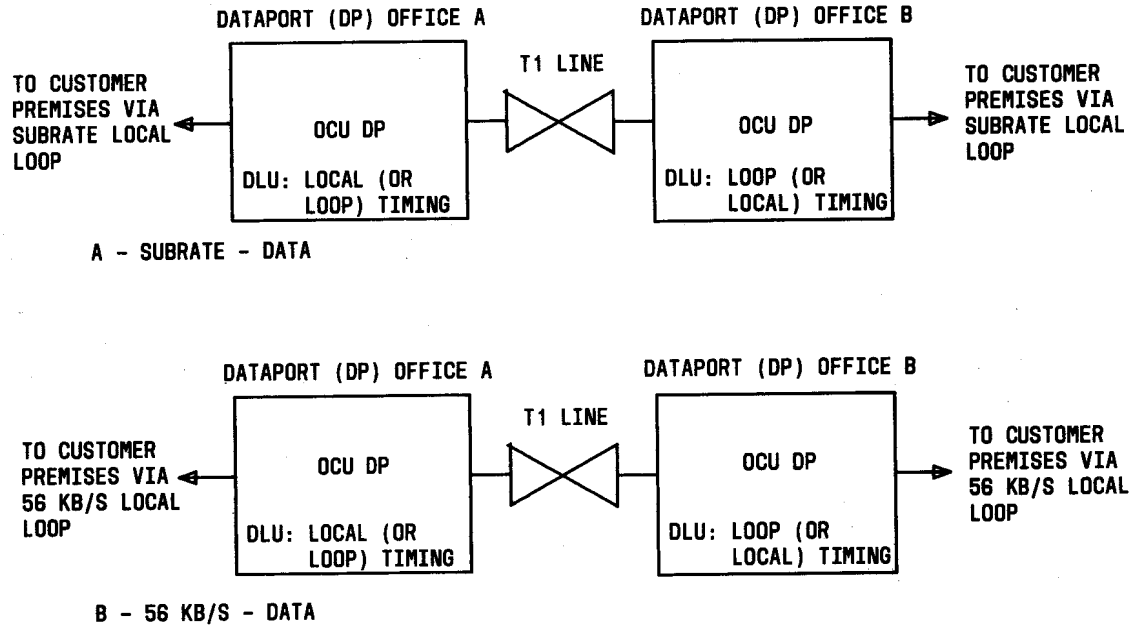


Fig. 24—Dataport Stand-Alone Application

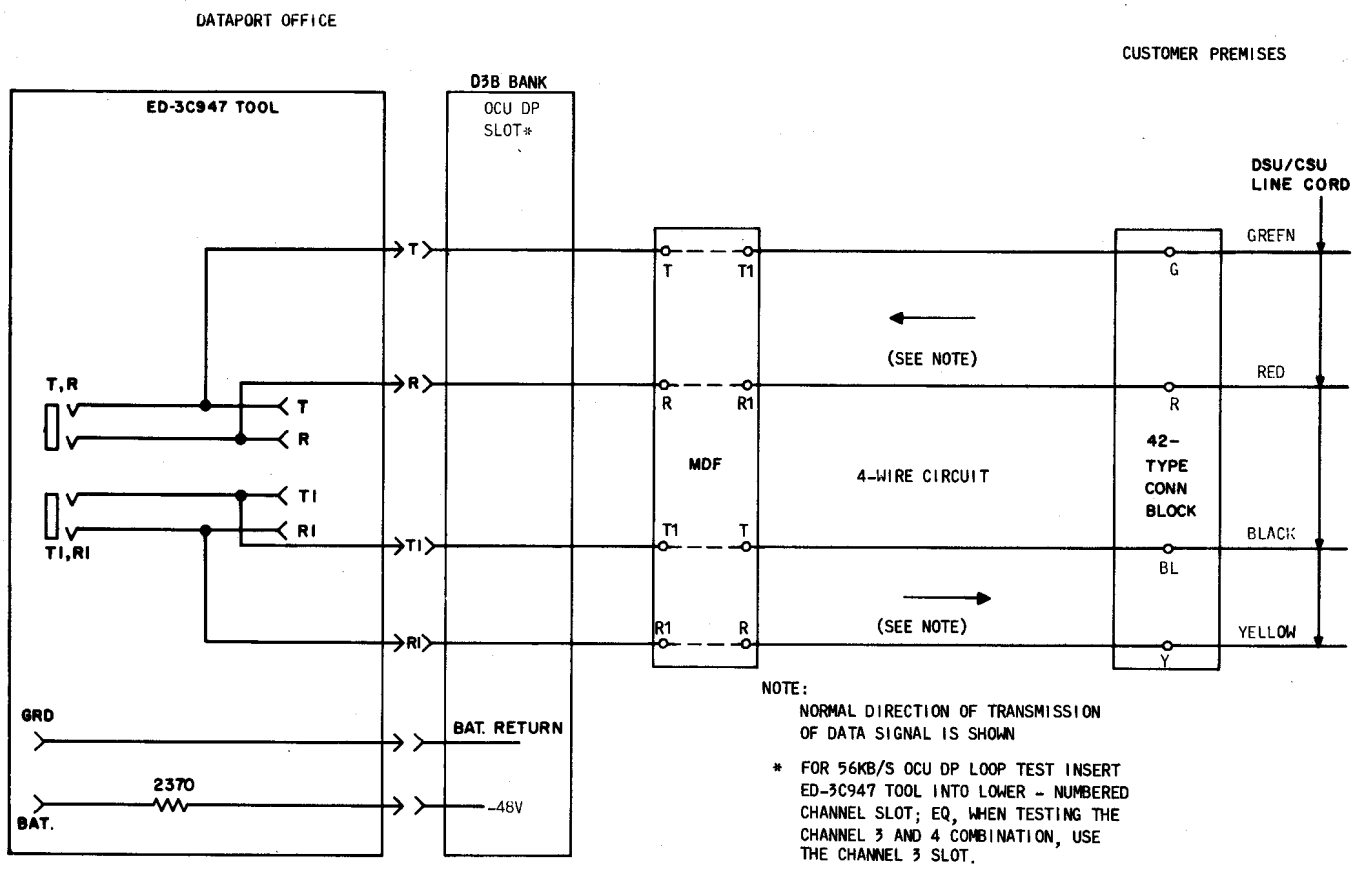


Fig. 25—Test Access For Subrate-Data Local Loop Tests

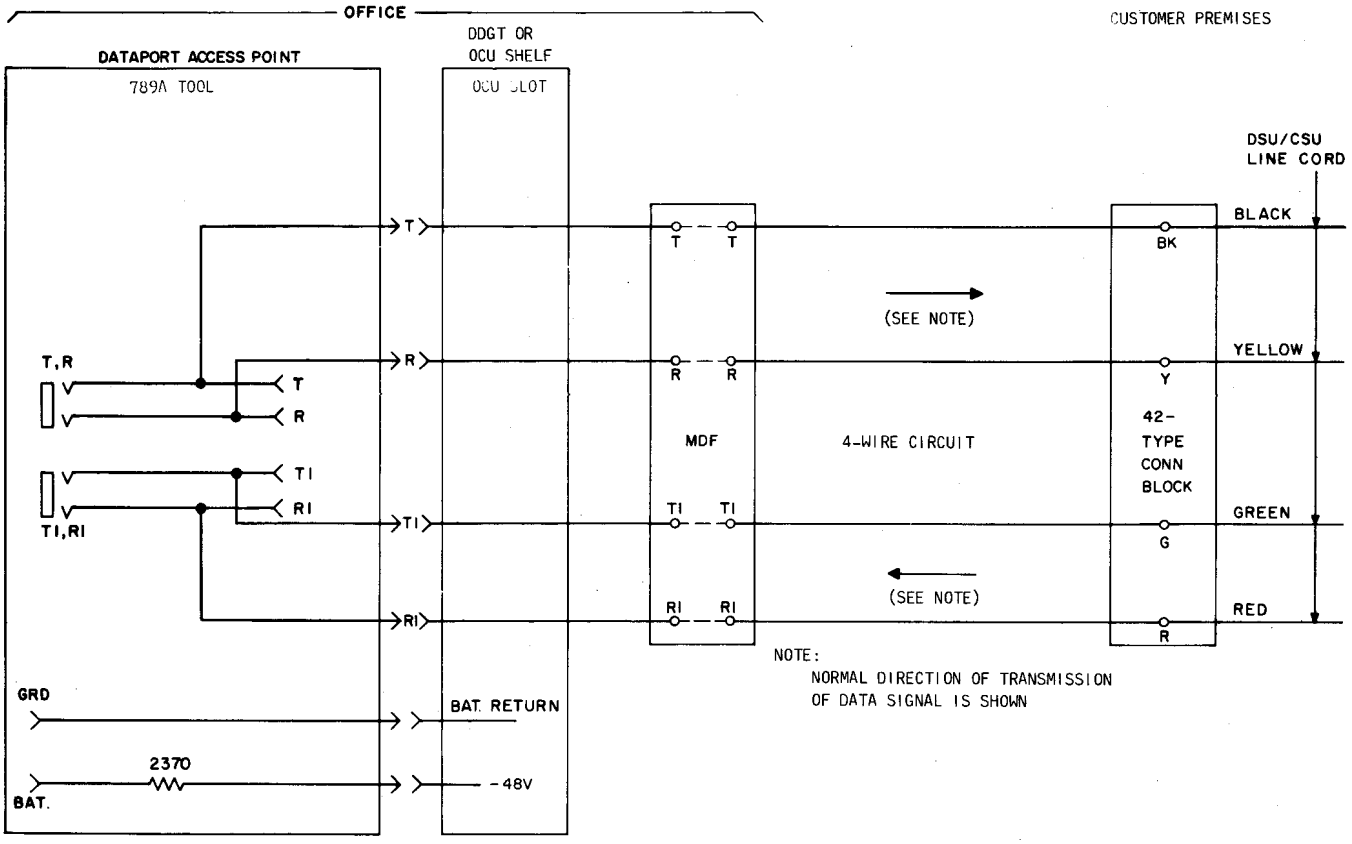


Fig. 26—Test Access For Data (Without Error Correction) Local Loop Tests

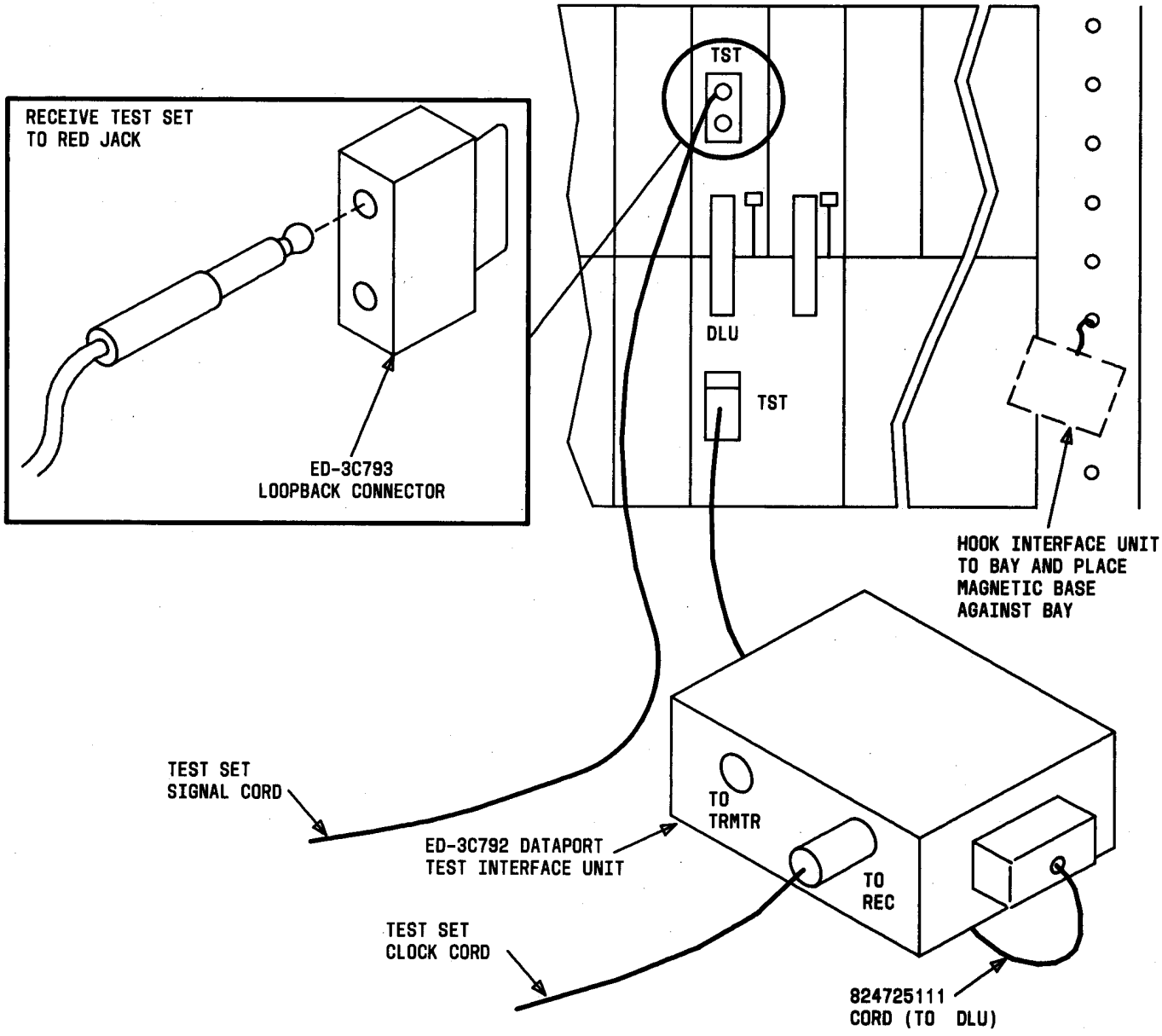


Fig. 27—Test Connections At Dataport Units

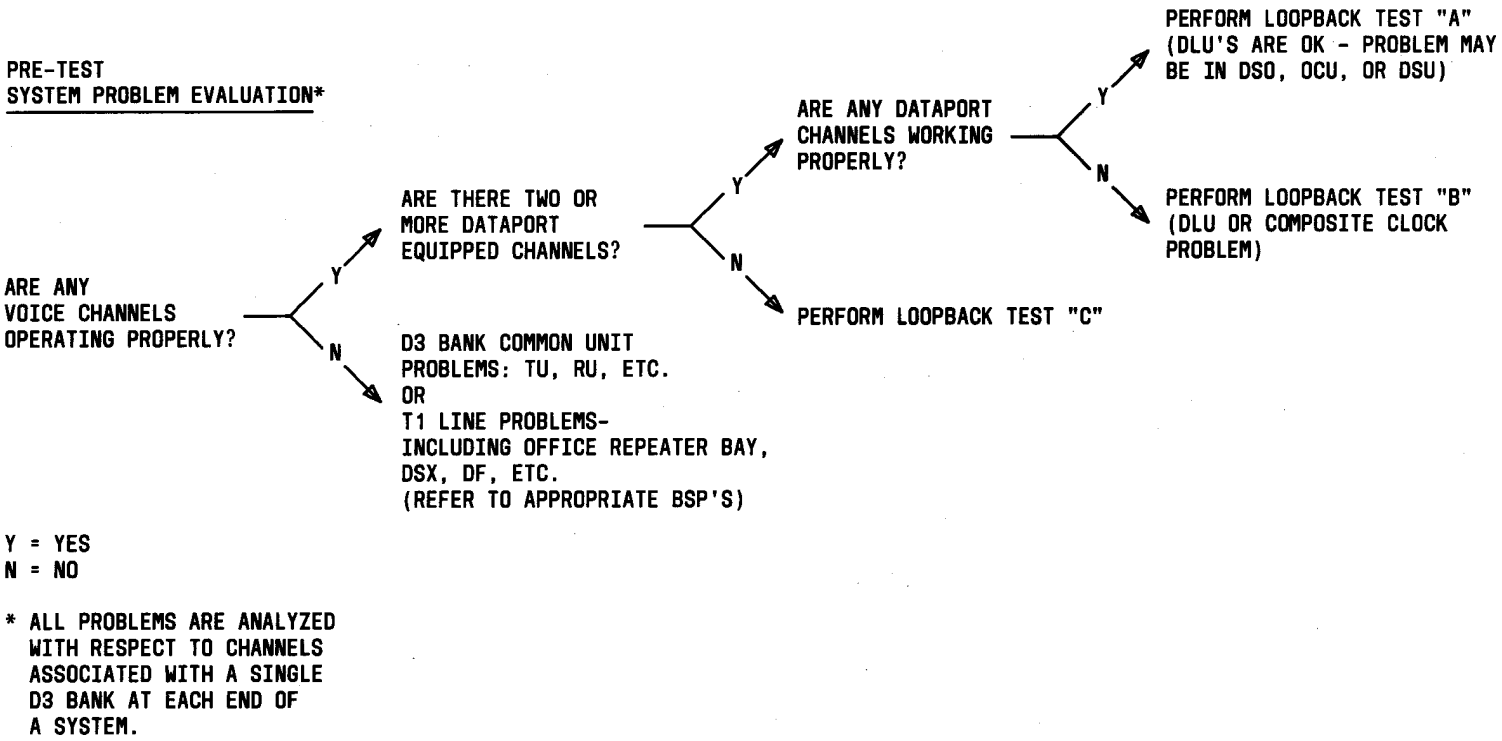
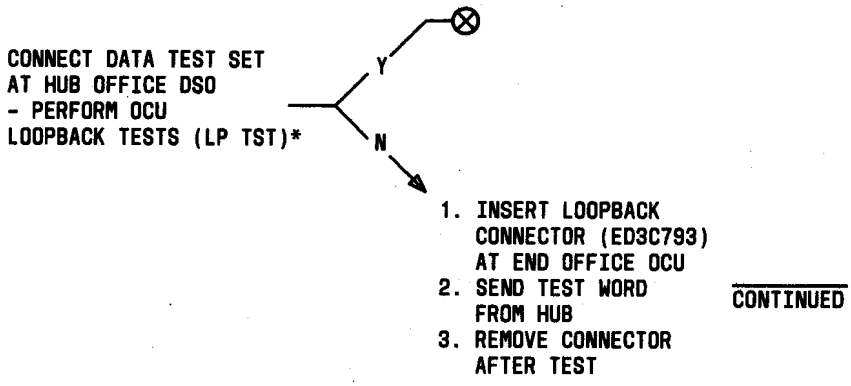


Fig. 28—Dataport Pre-Test Problem Evaluation

LOOPBACK TEST "A"



CONTINUED

Y = PASSES TEST
N = DOES NOT PASS TEST

⊗ PERFORM "CHAN" & "DSU" LOOPBACK TESTS.
- IF LOOPBACK TESTS ARE UNSUCCESSFUL:
1. CHECK FOR PROPER "DSU/CSU", "FLBO IN", AND "CRTC OUT" OPTIONS IN OCU
2. REPLACE CUSTOMER DSU.
3. CHECK CUSTOMER "DROP" BY LOOPING T&R LEADS AT END OFFICE DF AND AT INPUT TO CUSTMER DSU.

* OCU LOOPBACK TESTS ARE PERFORMED IN ALL SUBSEQUENT STEPS UNLESS OTHERWISE SPECIFIED.

Fig. 29—Dataport Loopback Test A (Sheet 1 of 2)

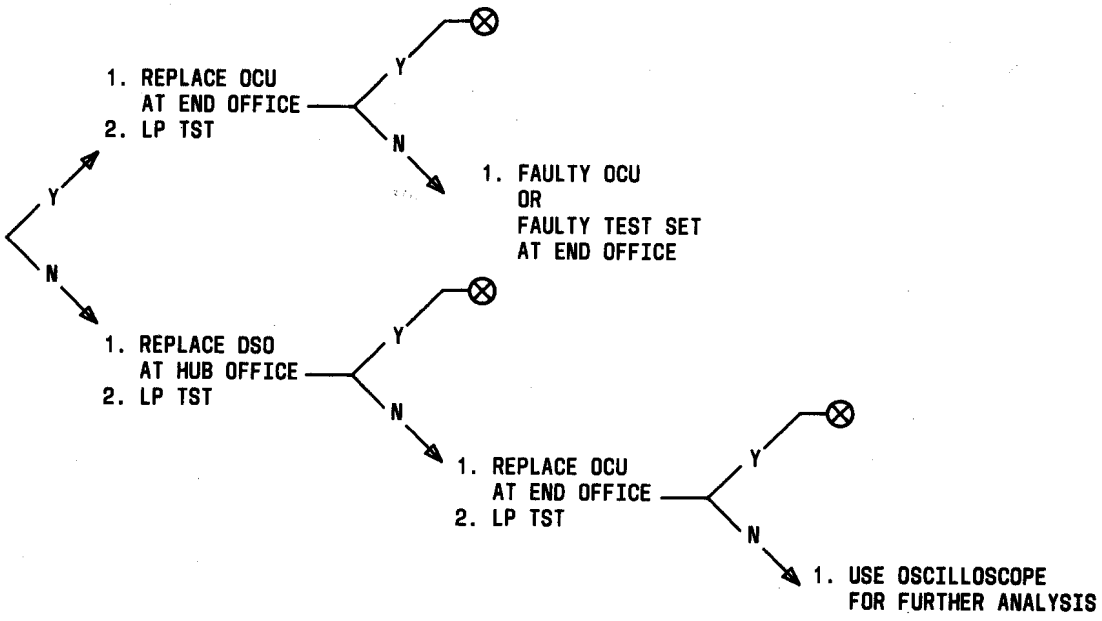
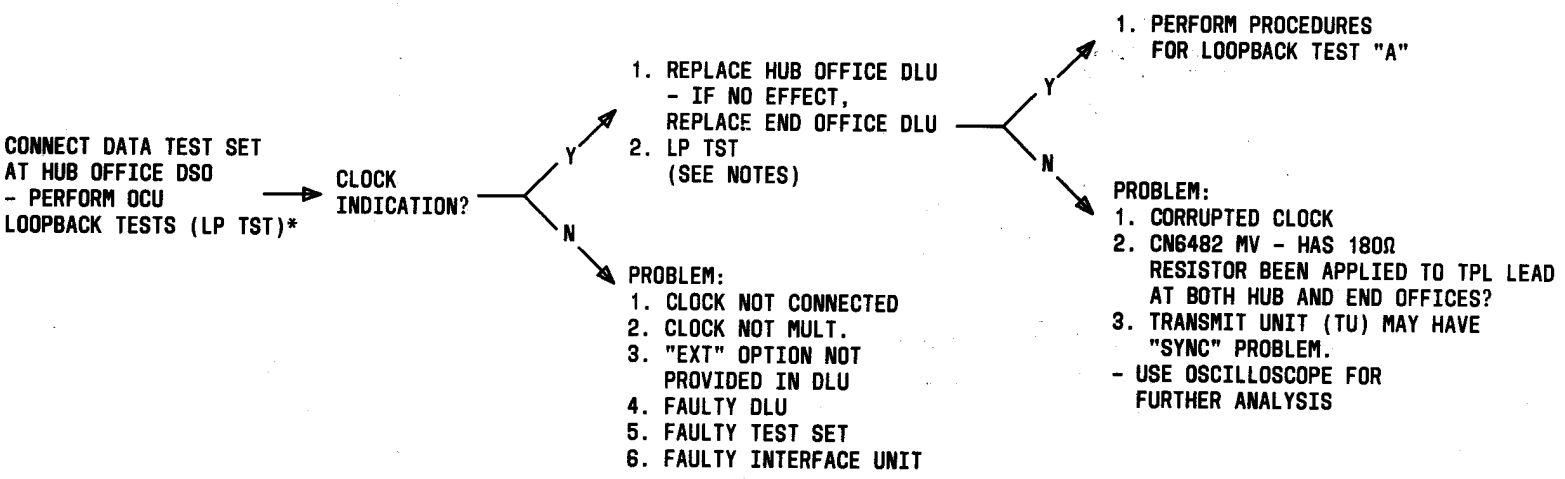


Fig. 29—Dataport Loopback Test A (Sheet 2 of 2)

LOOPBACK TEST "B"

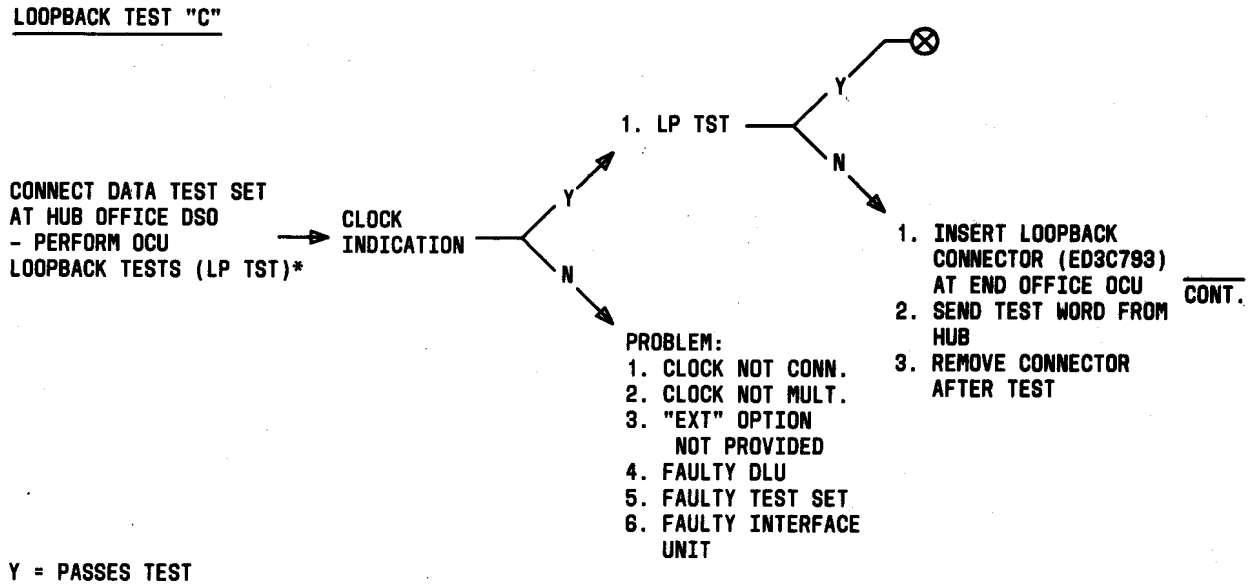


Y = PASSES TEST
N = DOES NOT PASS TEST

* OCU LOOPBACK TESTS ARE PERFORMED IN ALL SUBSEQUENT STEPS UNLESS OTHERWISE SPECIFIED.

NOTES:
1. IF MORE THAN ONE DATAPORT PLUG-IN ARE FAULTY, THE NUMBER OF POSSIBLE EQUIPMENT REPLACEMENT COMBINATIONS MAKE IT DIFFICULT ISOLATING THE PROBLEM BY SINGLE UNIT SUBSTITUTION. IN SUCH A SITUATION, BOTH DLU'S, THE DSO & OCU SHOULD BE SUBSTITUTED BEFORE ANY OF THE ORIGINAL UNITS ARE PUT BACK IN THE SYSTEM.
2. REPLACING DLU WILL INTERRUPT POWER TO ENTIRE BANK.

Fig. 30—Dataport Loopback Test B



Y = PASSES TEST
N = DOES NOT PASS TEST

⊗ PERFORM "CHAN" & "DSU" LOOPBACK TESTS.
- IF LOOPBACK TESTS ARE UNSUCCESSFUL:
1. CHECK FOR PROPER "DSU/CSU", "FLBO IN", AND "CRTC OUT" OPTIONS IN OCU
2. REPLACE CUSTOMER DSU.
3. CHECK CUSTOMER "DROP" BY LOOPING T&R LEADS AT END OFFICE DF AND AT INPUT TO CUSTOMERS DSU.

* OCU LOOPBACK TESTS ARE PERFORMED IN ALL SUBSEQUENT STEPS UNLESS OTHERWISE SPECIFIED.

Fig. 31—Dataport Loopback Test C (Sheet 1 of 2)

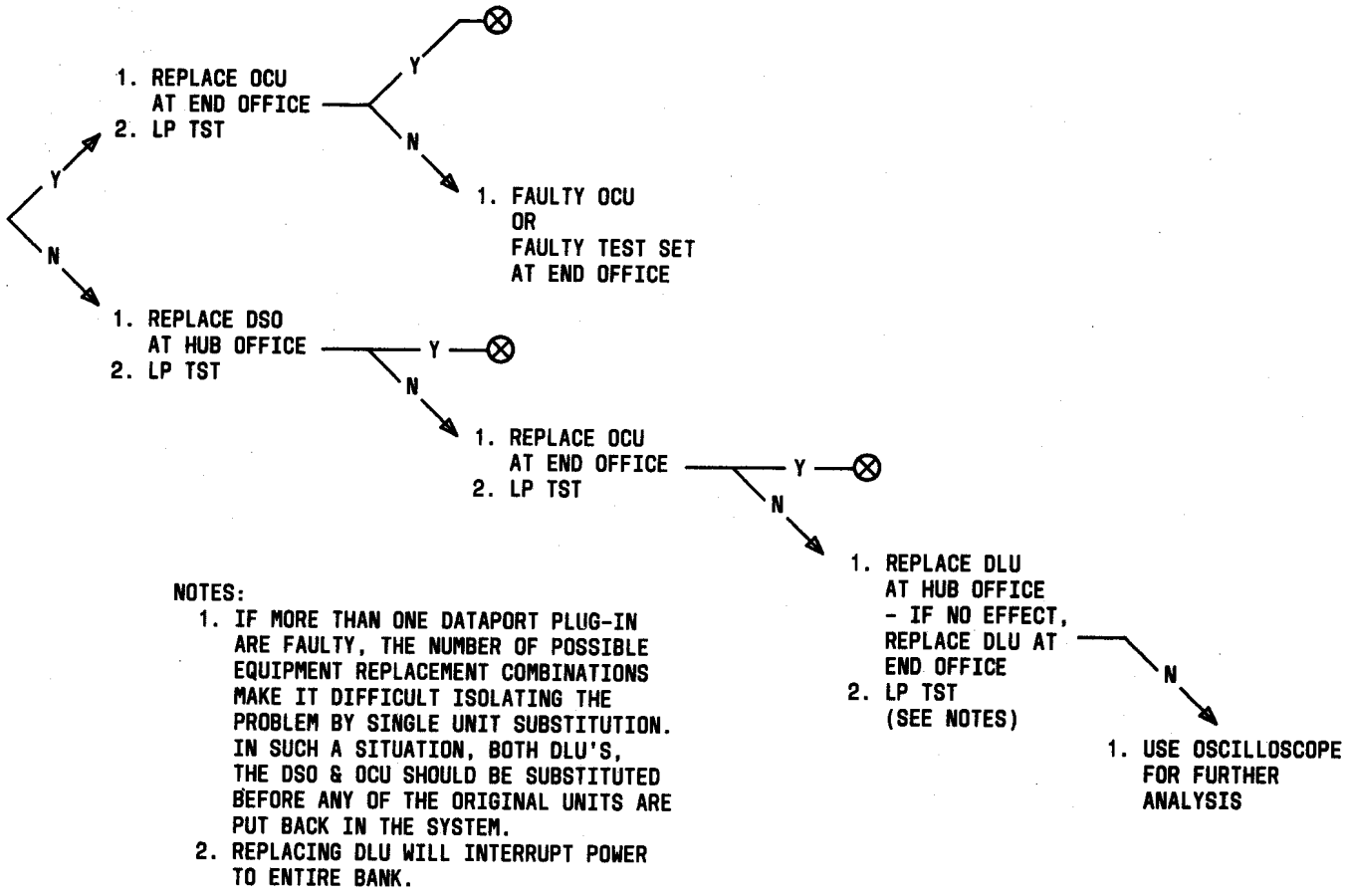


Fig. 31—Dataport Loopback Test C (Sheet 2 of 2)

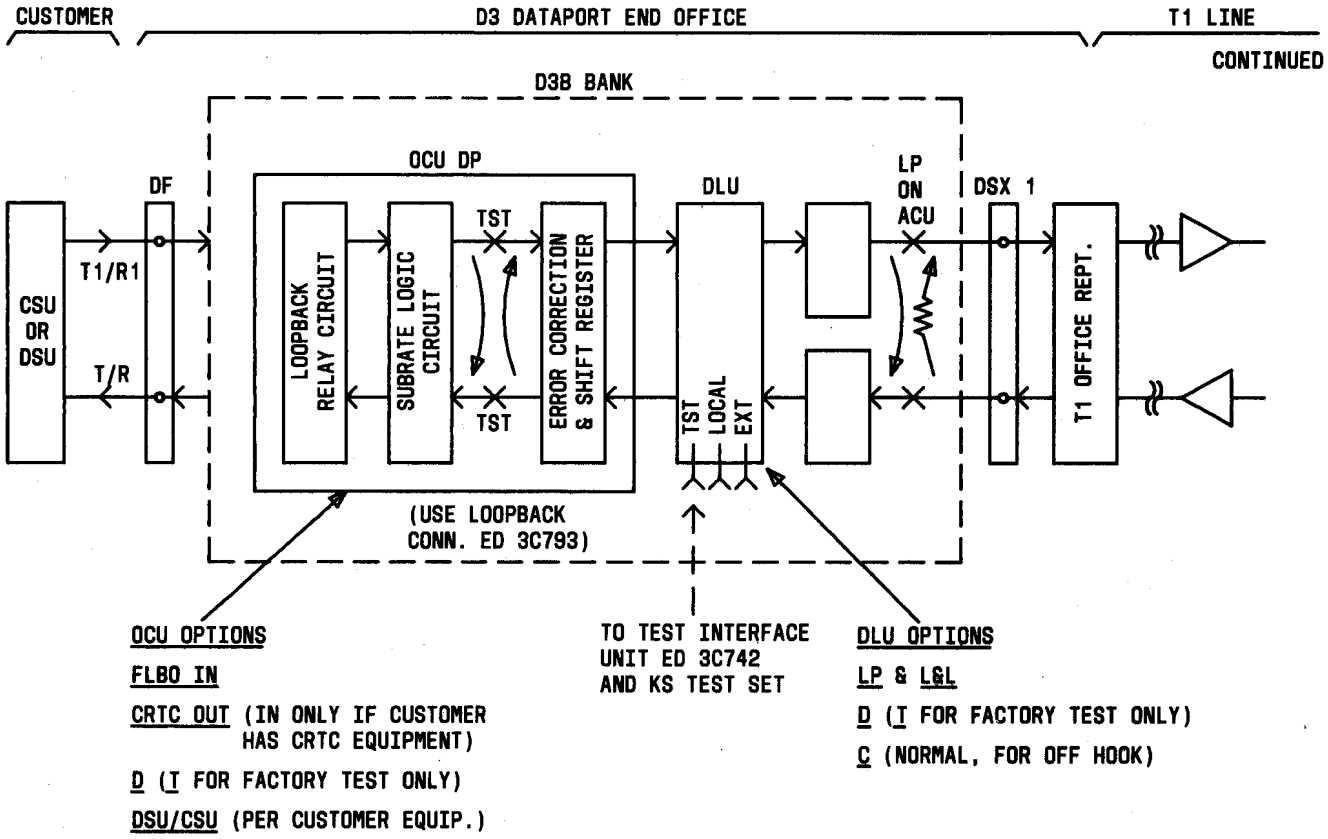


Fig. 32—Typical Arrangement of D3 Dataport For Pre-Test Problem Evaluation (Sheet 1 of 2)

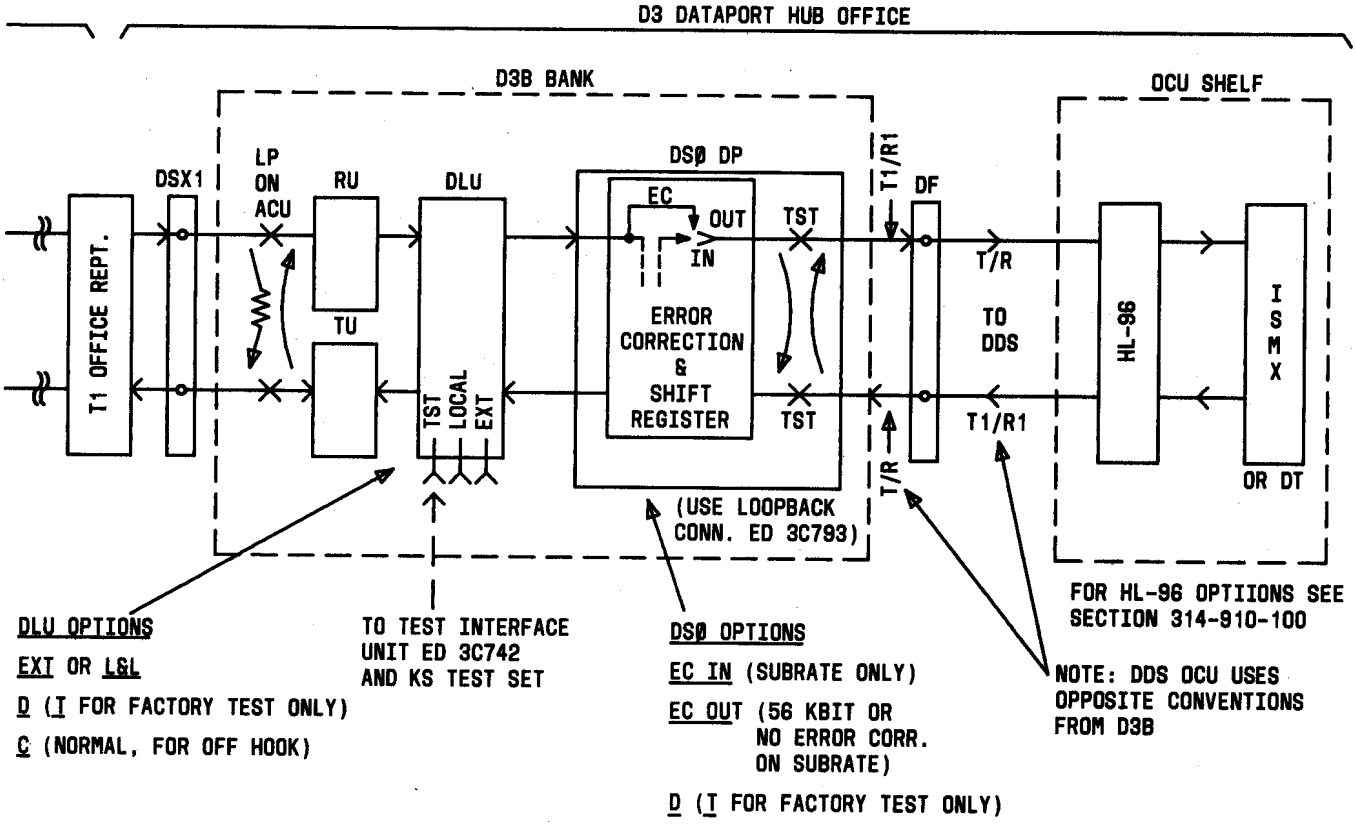


Fig. 32—Typical Arrangement of D3 Dataport for Pre-Test Problem Evaluation (Sheet 2 of 2)