CENTREX DATA LINK AND ATTENDANT TELEPHONE CONSOLE MAINTENANCE PROCEDURES USING MAINTENANCE TELETYPEWRITER 2-WIRE NO. 1 ELECTRONIC SWITCHING SYSTEM

1. GENERAL

1.01 This section describes some of the techniques available for controlling maintenance program activity on Centrex data links and Centrex attendant telephone consoles during periods of installation and maintenance in the No. 1 Electronic Switching System (ESS).

1.02 Maintenance personnel in a Centrex office have available through the use of the maintenance teletypewriter (TTY) a variety of features for controlling the data link and associated attendant telephone consoles. These features, which are provided by the Centrex maintenance supervisory program, are as follows:

(a) The ability to unconditionally restore or remove a data link from service

(b) The ability to force the data link to use a specified bus and/or central pulse distributor choice

(c) The ability to initiate the diagnosis of a specified data link or all data links

(d) The ability to determine the status of all data links

(e) The ability to remove from or restore to service a single attendant console

(f) The ability to initiate the Centrex console demand exercise routine to aid in console maintenance.

1.03 This section gives an explanation of the Centrex data link states, the Centrex console states, and the various TTY input messages used to control these states. Explanations of the use of related TTY messages for diagnostic and demand exercises are included.

1.04 Three examples are given in the appropriate parts to clarify the use of the override states and to illustrate the usefulness of these states in controlling maintenance activity.

1.05 Reference should be made to the input and output message manuals for exact details on the formats and use of all TTY messages included in this section.

2. DATA LINK MAINTENANCE CONTROL

2.01 The data link state is defined in detail in PD-1A057; however, a basic explanation is given in the following paragraphs.

2.02 The data link state, maintained by the maintenance supervisory program, is determined by a 3-bit binary item used by the Centrex maintenance supervisory (CXMS) program as an index to a table of program orders. These orders initiate the appropriate action.

2.03 By considering the combination of the three binary bits (the out-of-service bit, the override bit, and the diagnostic bit, respectively), eight possible states can be formed; however, three states are invalid. Table A indicates the significance of each possible data link state. Fig. 1 is a diagram which shows the five legal states in which a data link may exist and the program actions or TTY messages which can cause the data link state to change.

TABLE A

SIGNIFICANCE OF DATA LINK STATES

STATE		SIGNIFICANCE
DECIMAL	BINARY (See Note)	
0	000	Normal in-service state. Unequipped data links by definition are in state 0.
1	001	Invalid state since diagnosis cannot be performed on an in-service link.
2	010	Forced-into-service state. No fault recognition is performed.
3	011	Invalid state since a diagnosis cannot be flagged on a data link forced into service.
4	100	Normal-out-of-service state.
5	101	Normal-out-of-service state with diagnosis flag set.
6	110	Forced-out-of-service state. No periodic attempts to restore link will occur.
7	111	Invalid state since a diagnosis cannot be flagged on a link forced out of service.

Note: The leftmost binary bit is the out-of-service bit, the center bit is the override bit, and the rightmost bit is the diagnostic bit.

OVERRIDE STATES

2.04 The in-service (I/S) override and out-of-service (O/S) override states are used for controlling maintenance activity on the data link. These states may only be reached as a result of an entry on the maintenance TTY; furthermore, a data link in either of these two states will not assume any other state unless a proper entry is made on the TTY. The only exception is that during an emergency action phase 1 all data links in state 2 are restored to state 0 (normal I/S state); this protects against a possible large volume of erroneous inputs from a faulty data link causing repeated emergency actions.

A. In-Service Override State (010)

2.05 This state is derived as follows:

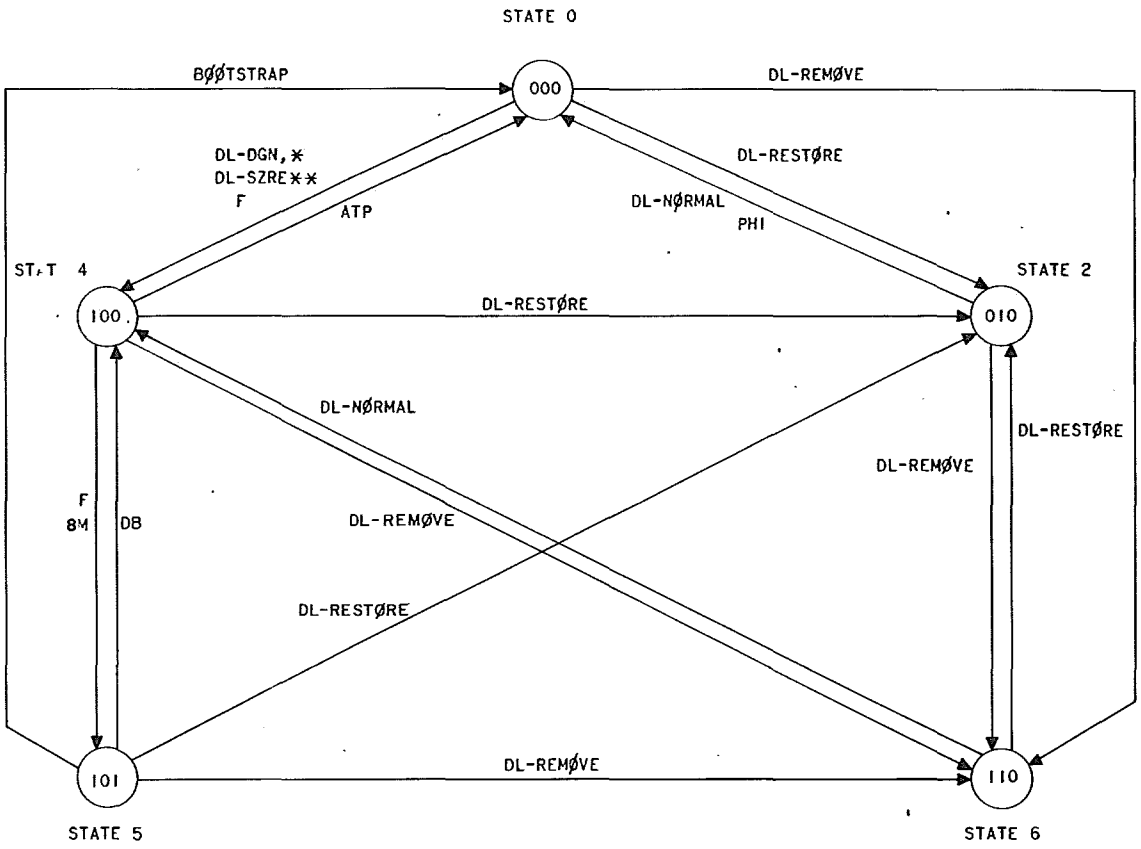
- The O/S bit is not set; therefore, the link is in service.
- The override bit is set; therefore, the link is forced into service. (That is, fault recognition is limited to a single retrial if an all-seems-well failure occurs.)
- The diagnostic bit is not set.

The link is therefore forced into service and diagnosis of the link is inhibited. The system will operate the link by using the bus and central pulse distributor determined by the variables in the input message. (See 2.06.) (If an F-level interrupt occurs, the system choices of a bus and a central pulse distributor will be used.)

Placing a Link in the In-Service Override State

2.06 To place a data link in the I/S override state, type the following message on the maintenance TTY:

DL-RESTØRE-a b c d.



*IF THIS MESSAGE FAILS BECAUSE ALL CUSTOMERS ARE NOT ON NIGHT SERVICE, DL-SZRE MAY BE USED.

**ONLY VALID FROM STATE 0

PROGRAM ABBREVIATIONS:
PHI -- EMERGENCY ACTION PHASE I
F -- FAULT RECOGNITION DETECTED FAILURE (ASW, ALWAYS BUSY, ERROR COUNT)
8M -- 8-MINUTE CHECK CAUSES STATE CHANGE (SETS DIAGNOSTIC FLAG)
DB -- DIAGNOSIS BEGINS
ATP -- ALL TESTS PASSED ON DIAGNOSIS
BOOTSTRAP -- IF IN STAGE 5 FOR 8 MINUTES, LINK IS RESTORED WITHOUT DIAGNOSIS

LEGEND:

DATA LINK STATES:
STATE 0 - 000 - NORMAL IN-SERVICE STATE
STATE 1 - 001 - INVALID
STATE 2 - 010 - IN-SERVICE OVERRIDE STATE
STATE 3 - 011 - INVALID
STATE 4 - 100 - NORMAL OUT-OF-SERVICE STATE
STATE 5 - 101 - OUT-OF-SERVICE DIAGNOSIS FLAGGED STATE
STATE 6 - 110 - OUT-OF-SERVICE OVERRIDE STATE
STATE 7 - 111 - INVALID

Fig. 1—Data Link State Diagram

a = frame number (0 through 3)
b = link number (0 through 7)
c = bus (0 or 1)
d = central pulse distributor (0 or 1)

The system responds with a CTX12 message, indicating that the link is forced into service.

Caution: It is not recommended that the data link be left in this state for long since this state may mask problems with the link and/or degrade customer service.

2.07 A CTX14 output message in the hourly printout messages indicates the links placed in the I/S override state.

Taking a Link Out of the In-Service Override State

2.08 To take a data link out of the I/S override state and restore it to normal (I/S state with fault recognition), enter the following message on the maintenance TTY:

DL-NØRMAL-a b.

a = frame number (0 through 3)
b = link number (0 through 7)

The system responds with a CTX12 message, indicating the link has been placed in a normal state.

Use of the In-Service Override State

2.09 Many situations may arise where the I/S override state is a valuable maintenance aid; the following two examples illustrate the usefulness of this state.

2.10 ***Usable Data Link Will Not Stay in Service:*** If certain types of failures occur, such as a failure within the all-seems-well circuitry, the fault recognition programs may determine that a usable data link is bad and take it out of service. It is also possible that the existence of some problem or failure (such as a noisy line) is degrading service somewhat but the link is still useful. If such conditions should occur, the data link may be forced to continue service by placing it in the I/S override state by using the DL-RESTØRE message as described in 2.06. Under this condition the link will never be removed from service by the fault recognition program. The bus and central pulse distributor choice for the link will never be changed unless a serious system problem occurs (an F-level interrupt, an emergency action phase 1, or a demand-enable update). When the necessary repairs are completed, the link may be restored to normal service by using the DL-NØRMAL message as described in 2.08.

2.11 ***Wiring Changes Are Required for a Data Link Frame:*** Occasionally it becomes necessary to work on the common equipment portion of the Centrex data link frame. The peripheral bus connection circuitry on a data link frame is shared by all links on the frame. In such a situation it is desirable to force a data link (or several data links) to use a certain bus and central pulse distributor choice. As an example, if a data link comes out of service and the trouble number indicates that a circuit pack must be replaced in the bus 0 common equipment portion of the data link frame circuitry, the DL-RESTØRE message should be used to force all data links on the frame to use the bus 1 choice (as explained in 2.06). The power may be removed on the bus 0 receiving circuitry for that frame and the circuit pack may be replaced. When the procedure is completed, all data links should be restored to normal by typing the DL-NØRMAL message as described in 2.08.

2.12 It may become necessary to remove power on a central pulse distributor. If so, the procedure in 2.11 may also be desirable since the probability that a data link will come out of service is raised because an O/S central pulse distributor removes two of the four possible routes to the data link controller.

B. Out-of-Service Override State (110)

2.13 This state is derived as follows:

- The O/S bit is set; therefore, the link is out of service
- The override bit is set; therefore, the link is forced out of service.
- The diagnostic bit is not set; therefore, no diagnostic will be run.

The link is unconditionally removed from service and automatic diagnosis of the link is inhibited. No periodic attempts to restore the link to service will occur.

Placing a Link in the Out-of-Service Override State

2.14 To place a data link in the O/S override state, enter the following message on the maintenance TTY:

DL-REMØVE-a b.

a = frame number (0 through 3)

b = link number (0 through 7)

The system responds with a CTX12 message indicating the link is forced out of service.

2.15 A CTX14 output message in the hourly printout messages indicates the links placed in the O/S override state.

Taking a Link Out of the Out-of-Service Override State

2.16 To take a data link out of the O/S override state and restore it to normal (O/S state), use the DL-NØRMAL message as described in 2.08.

Use of the Out-of-Service Override State

2.17 Although many situations might arise where the O/S override state is a valuable maintenance

aid, the following example illustrates the usefulness of this state.

2.18 ***Continual Diagnosis of a Link:*** During installation or growth periods, data links are often placed in translation (in the unit-type, member-number translator) without having the customer console control cabinet connected to the central office data link. In such a configuration the data link will come out of service since no all-seems-well answer is received from the customer cabinet when an order is transmitted. (Periodically the system sends a pair of maintenance orders to each data link even though there is no normal key signal or lamp order traffic on the data link.) Every eight minutes the system will set a diagnostic flag for an O/S data link. The data link will always fail phase 3 of the diagnosis. The trouble number printed on the maintenance TTY will indicate that no customer console control cabinet is present. Furthermore, if the diagnostic flag is not answered by the CXMS program within eight minutes, the link is put back into service without diagnosis. These actions are taken so that a usable data link which has been taken out of service due to a momentary fault will not remain out of service for an extended length of time.

2.19 If the diagnostic activity discussed in 2.18 is objectionable (such as during an installation period), the message DL-REMØVE should be typed on the maintenance TTY as explained in 2.14. This causes the link to be placed in the O/S override state and thus inhibits all automatic maintenance activity on the link. The only indication that the system ever gives that this link has been placed in the override state is a CTX14 message in the hourly printout messages. (A diagnostic will be performed at midnight on links forced out of service.)

2.20 A diagnosis may still be requested while the data link is in the O/S override state by entering the DL-DGN message on the TTY as described in 2.25; however, even if the data link passes diagnosis, it will not be restored to service.

STATES UNDER NORMAL PROGRAM CONTROL

2.21 The normal I/S state, the normal O/S state, and the O/S diagnosis flagged state are normally reached through program control; however, as explained in 2.08 and 2.16, the normal I/S and normal O/S states may also be reached by input messages.

A. Normal In-Service State (000)

2.22 The normal I/S state is derived as follows:

- The O/S bit is not set; therefore, the link is in service.
- The override bit is not set; therefore, the link is not forced into service.
- The diagnostic bit is not set; therefore, no diagnostic is requested for the link.

The link is in normal service and fault recognition will be performed. A diagnosis cannot be performed on a normal I/S link unless all customers are on night service.

2.23 Each day all available links will be diagnosed automatically. Available links are defined as those links having all their customers on night service.

Placing a Link in the Normal In-Service State

2.24 This state is normally attained under program control as previously explained; however, if a link is initially in the I/S override state, the procedure described in 2.08 will place the link in the normal I/S state.

Taking a Link Out of the Normal In-Service State

2.25 To take a link out of the normal I/S state and to place it in the I/S override state, refer to 2.06. To take a link out of the normal I/S state and to place it in the O/S override state, refer to 2.14.

Requesting a Diagnosis of a Link in the Normal In-Service State

2.26 If trouble is suspected on a link, a diagnosis of the specified link may be requested if all customers using the link are on night service by typing the following message on the maintenance TTY:

DL-DGN-a b c.

a = N - Normal printout

= R - Raw data printout

b = frame number (0 through 3)

c = link number (0 through 7)

The system responds with DR04, DR05, DR06, CTX10, or CTX12 message, depending upon conditions encountered. If the data link passes all tests, it is returned to service.

2.27 If diagnosis of a data link cannot be carried out because all customers are not on night service, the following message may be used to secure the link for diagnosis by removing it from service:

DL-SZRE-a b c.

a = N - normal printout

= R - raw data printout

b = frame number (0 through 3)

c = link number (0 through 7)

The system responds with a DR04, DR05, DR06, CTX12, or CTX10 message, depending upon conditions encountered. If the data link passed all tests, it is returned to service.

Caution: This message should only be used in cases where severe customer difficulties are being experienced because all customers on the link will lose attendant services and all calls to the attendant will be lost. Future attendant calls will be routed to the night station.

B. Normal Out-of-Service State (100)

2.28 The normal O/S state is derived as follows:

- The O/S bit is set; therefore, the link is out of service.
- The override bit is not set; therefore, the link was not forced out of service.
- The diagnostic bit is not set; therefore, no diagnostic request is set for the link.

The link is out of service, but not forced out. The link ***will*** be placed in the diagnosis flagged state every eight minutes by the CXMS program, and, if there is no higher priority work to be undertaken at that time, a diagnosis will be performed within the next eight minutes. If the link passes, it is put back into service. If a diagnosis cannot be performed within the next eight minutes, the link is automatically returned to the normal I/S state (bootstrap).

Placing a Link in the Normal Out-of-Service State

2.29 This state is normally attained when the fault recognition program detects a failure or when the error count becomes abnormally high; however, if a link is initially in the normal I/S state, the procedure described in 2.26 will place the link in the normal O/S state (for diagnosis).

2.30 If the link is initially in the O/S override state, the procedure described in 2.16 also will place the link in the normal O/S state.

Taking a Link Out of the Normal Out-of-Service State

2.31 To take a link out of the normal O/S state and to place it in the I/S override state, refer to 2.06. To take a link out of the normal O/S state and to place it in the O/S override state, refer to 2.14.

C. Out-of-Service Diagnosis Flagged State (101)

2.32 The O/S diagnosis flagged state is derived as follows:

- The O/S bit is set; therefore, the link is out of service.
- The override bit is not set; therefore, the link is not forced out of service.
- The diagnostic bit is set; therefore, a diagnosis will be performed on the link.

The link is out of service, but was not forced out, and will undergo diagnosis.

Placing a Link in the Out-of-Service Diagnosis Flagged State

2.33 This state is always directly attained through the CXMS or Centrex maintenance control program (PD-1A057 or PD-1A056). No TTY message will cause a link to be placed directly in this state.

Taking a Link Out of the Out-of-Service Diagnosis Flagged State

2.34 To take a link out of the O/S diagnosis flagged state and place it in the I/S override state, refer to 2.06. To take a link out of the O/S diagnosis flagged state and place it in the O/S override state, refer to 2.14.

GENERAL MAINTENANCE CONTROL PROCEDURES

2.35 The following procedures and their associated messages are useful when general information affecting maintenance activity on all data links is desired. Since the requests are of a general nature, the states of individual links have no bearing on when the messages may be used; that is, they may be used at any time.

2.36 ***Determining the Status of All Data Links:*** If the state of any or all data links in the central office is desired, type the following message on the maintenance TTY:

DL-STATUS-.

The system responds with a CTX13 message followed by status information.

2.37 ***Diagnosing All Available Data Links:*** If a general diagnosis of all available data links (that is, those with all customers on night service) is desired, type the following message on the maintenance TTY:

DL-DGNALL-.

The system responds with a DR04, DR05, DR06, CTX10, or CTX12 message, depending upon the system action.

3. CONSOLE MAINTENANCE

3.01 The ability to remove from service and to restore to service individual consoles is provided in the CXMS program. The console state exists independently of the data link state. Therefore, if a link is to be restored to service and a given console on that link is out of service, that particular console would not be usable for calls. Similarly, if an O/S console is restored on an O/S link, the console is not actually put in service although its O/S bit is reset.

CONSOLE STATES

3.02 The Centrex customer console may be placed in either of two states; the I/S state or the O/S state. Both of these states are attained by typing in the appropriate message on the maintenance TTY.

A. Removing a Console from Service

Caution: All calls on a console are lost when it is removed from service.

3.03 To remove a console from service, type the following message on the maintenance TTY:

CSL-REMØVE-a b c.

a = frame number (0 through 3)

b = link number (0 through 7)

c = console number (0 through 3)

The system responds with a CTX17 message if the request is accepted. The console must be properly restored to service when maintenance is completed as explained in 3.04.

B. Restoring a Console to Service

3.04 To restore a console to service, type the following message on the maintenance TTY:

CSL-RSTØRE-a b c.

a = frame number (0 through 3)

b = link number (0 through 7)

c = console number (0 through 3)

The system responds with a CTX17 message if the request is accepted.

DETERMINING CONSOLE STATUS

3.05 To determine the state of any or all consoles, type the following message on the maintenance TTY:

CSL-STATUS-.

The system responds with a CTX18 or a CTX16 message depending on the states of the consoles.

CENTREX DATA LINK AND CONSOLE DEMAND EXERCISE ROUTINE

3.06 The Centrex data link and console demand exercise (CXDX) routine is available to facilitate maintenance on Centrex control consoles and attendant consoles. The routine can be initiated from the maintenance TTY or the attendant console on the customer's premises and is used to identify faults in units that have been placed in an O/S state. The associated data link must be in service and the console must be out of service.

3.07 ***Initiating the CXDX Routine:*** Use the following procedure to initiate the CXDX routine.

(1) Determine if the data link associated with the console under test is in service by typing in the DL-STATUS message as described in 2.35.

(2) Take the console control to be tested out of service by typing in the CSL-REMØVE message as described in 3.03.

(3) At the maintenance TTY, type input message CTX-EXC and associated variables which are explained in detail in Section 231-202-301.

The system responds with the specified exercises on the indicated console.

> ***Note:*** The complete CXDX routine can be initiated from the attendant console. Refer to Section 540-576-305 for details.