

**DYNAMIC OVERLOAD CONTROL (DOC)
SWITCHING, BILLING, AND CENTRAL OFFICE SYSTEMS MANAGEMENT
NETWORK SERVICES METHODS**

	PAGE		PAGE
1. GENERAL	2	C. Automatic Control Activation	11
2. OVERVIEW	3	D. Equipment Required	12
3. CONTROL STRATEGIES	4	6. 5XB DOC RECEIVE	13
A. General	4	A. General	13
B. Trunking Affected by DOC	4	B. Overrides	13
C. DOC Signals	4	C. Automatic Control Activation	14
D. DOC Hierarchy	5	D. Multiple RT Activation - One DOC Signal	14
E. DOC Control Examples	6	E. Equipment Required	15
4. TRANSMITTING DOC	7	F. 5XB ETS	15
A. General	7	7. FACILITIES	15
B. 1/1A ESS	7	A. General	15
Generation of DOC Signals	7	B. Facility Arrangements	16
Sending DOC Signals	8	Radial Signaling	16
Equipment Required	9	Daisy-Chain Signaling	16
C. 4ESS	9	C. Balanced Loop Signaling	17
Generation of DOC Signals	9	D. E&M Signaling	17
Sending DOC Signals	10	E. 43A1 Carrier Telegraph Signaling	18
Equipment Required	10	F. 43B1 Carrier Telegraph Signaling	18
5. 1/1A ESS DOC RECEIVE	10	G. Data	18
A. General	10	8. COMMON CHANNEL INTEROFFICE SIGNAL- ING (CCIS) DOC	18
B. Overrides - Preprogrammed Versus Flexible Controls	11	A. General	18

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CONTENTS	PAGE
B. Generation of CCIS DOC Signals . . .	19
C. 1/1A ESS DOC for CCIS Trunk Groups	20
Figures	
1. DOC Example—Dual Home DDD . . .	21
2. DOC Example—Dummy Group Usage .	23
3. DOC Example—TSPS and DDD . . .	25
4. DOC Congestion Signals —Cancellation Controls	27
5. DOC Congestion Signals—Cancellation and Reroute Controls	29
6. Equipment Requirements—1/1A ESS DOC Transmit	31
7. Equipment Requirements—4ESS DOC Transmit	33
8. DOC Activation Paths—1/1A ESS and 5XB Receive DOC	35
9. NM13 Output Messages—1/1A ESS . .	36
10. CT Frame Termination for 1/1A ESS . .	37
11. Receive DOC Cross-Connection for 1/1A ESS	38
12. Equipment Requirements—1/1A ESS DOC Receive	39
13. CT Looping Arrangement (SD-27970) .	41
14. Equipment Requirements—5XB DOC Re- ceive	43
15. 5XB ETS Cross-Connection for Receive DOC	45
16. Facility Options for SD-27970	46
17. Radial Signaling	47
18. Daisy-Chain Signaling	48

CONTENTS	PAGE
Tables	
A. 1/1A ESS Override Capabilities . . .	49
B. CCIS DOC Response Categories—4A and 4ESS Switching Systems	50
C. 1/1A ESS CCIS DOC Response Categories	51
1. GENERAL	
1.01 This section describes the philosophy, control strategies, hardware, and facility arrangements used in implementing Dynamic Overload Control (DOC). This section provides documentation for the implementation of conventional DOC hardware in various switching systems. Presently, this information is scattered among various documents.	
1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.	
1.03 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.	
1.04 This section recognizes that there are two types of DOC: Common Channel Interoffice Signaling (CCIS) and Conventional. Conventional DOC is discussed in detail in this section; CCIS DOC is discussed only in Part 8.	
1.05 Examples are given in this section detailing “typical” deployment of DOC. However, each switching network has to be judged on its own merit.	
1.06 This section discusses conventional transmitting DOC equipment for 1/1A ESS and 4ESS switching systems. It also discusses receive DOC equipment for 1/1A ESS and No. 5 Crossbar (5XB) switching systems. Transmitting and receiving conventional DOC equipment is available for other types of switching systems; namely, 4A XB and crossbar tandem (XBT). These are not discussed in detail in this section.	
1.07 Proper operational tests and routine maintenance for DOC equipment and facilities are essential in assuring a usable, conventional DOC sys-	

tem. Test procedures are described in Section 231-055-004 and routine intervals are given in Section 231-001-021 which contains Equipment Test Lists (ETLs).

2. OVERVIEW

2.01 DOC equipment is used to initiate internal switching system controls in electromechanical switching systems, restrict traffic routing from connected systems during congestion, and reduce connected switching system congestion during major failures. It is needed to adjust for unpredictable traffic surges caused by holiday calling, emergencies, and natural disasters (such as snowstorms, floods, earthquakes, switching system failures, and blackouts) that subject the telecommunications network to unusual service demands.

2.02 If an electromechanical switching system is offered more attempts than its senders can receive, a queue of waiting calls develops. These bids for service from senders in connecting switching systems throughout the country, unless controlled, will rapidly spread congestion throughout the network. Distant senders are waiting for a start dial (or sender attached) signal from the affected switching system. During this waiting time, these distant senders are being inefficiently used, since they are neither receiving nor transmitting digits. This inefficient usage causes a shortage of sender capacity in the connecting switching systems. The feedback (or snowballing) effect of senders waiting for senders will further spread when numerous switching systems, including the affected switching system, are forced to wait for sender attachment in other sender queues. If not controlled, this kind of congestion spreads rapidly throughout the network.

2.03 DOC prevents this heavy spread of congestion by detecting the buildup of calls waiting for equipment. It automatically activates traffic controls that avoid inefficient use of equipment when a preselected threshold of calls waiting is reached.

2.04 Internal switching system controls activated by DOC in certain electromechanical switching systems are: cancellation of marker and decoder channel (if applicable) second trial attempts and cancellation of short sender timing. This is controlled from marker/decoder queue circuits in the traffic control circuit. Electronic switching systems initiate their own internal controls as directed by the inter-

nal overload control program, and the existence of these controls activates DOC transmit equipment or software.

2.05 External DOC controls for electromechanical switching systems are keyed by the sender queue circuits. Two levels of sender queue can be developed by the electromechanical switching system. These are sender queue low (SQL) and sender queue high (SQH). SQH indicates a greater degree of congestion in the affected switching system than SQL. Restrictive controls activated by SQH are generally more severe than those activated by SQL and normally involve restrictive controls in more connected switching systems.

2.06 External DOC signals for electronic switching systems are initiated by the overload program in the form of machine congestion (MC) signals. These are MC1 and MC2 signals. MC1 and MC2 compare roughly with SQL and SQH, respectively, in electromechanical switching systems. An additional DOC signal, not related to congestion, is the MC3 signal. MC3 indicates a complete halt in call processing until the switching system recovers. External controls activated by MC1 and MC2 are normally very similar to those activated by SQL and SQH, respectively, for electromechanical switching systems. These signals are generated based upon the specific signaling type affected, multifrequency (MF), dial pulse (DP), or CCIS. MC3 affects all signaling types and represents a switching system failure.

2.07 In order for DOC to be effective, it must have some means of transmitting the queue or DOC signals to distant switching systems' receive DOC units which cause activation of the desired controls. For conventional (non-CCIS) DOC signals, this is done over either metallic or carrier facilities which are discussed in detail in Part 7 of this section.

2.08 Conventional DOC transmit signals contain no coded information. These signals perform a simple ON/OFF function with timed interruptions to validate the signals to and from the distant end. In cases where older equipment is not capable of accepting an interrupted signal, a steady signal can be applied.

2.09 In electromechanical switching systems, DOC benefits both the congested switching system (DOC transmit location) and those switching systems attempting to complete calls into the congested

SECTION 780-200-050

switching system (DOC receive location). Proper control response to DOC signals results in reduced attempts on the congested switching system and reduces the likelihood of congestion in the connected switching systems.

2.10 Electronic switching systems are designed to ignore incoming traffic until it can be handled (Phase 2, 3, or 4). However, DOC controls in response to MC1 and/or MC2 provide relief to the congested electronic switching system and will shorten the time required for the congested system to recover from MF or DP queue or real time problems. ***DOC is extremely important to switching systems connected to the congested switching system*** because an overloaded electronic switching system will not attach a receiver to their bids for service in a timely manner. This causes the connected systems' senders or MF transmitters (outpulsers) to be tied up waiting on the electronic switching system. Proper deployment of receive DOC units and use of appropriate controls in response to the DOC signals received from the electronic switching system will greatly relieve the resulting congestion in the connected switching systems. DOC control strategies and guidelines are covered in Part 3 of this section.

3. CONTROL STRATEGIES

A. General

3.01 The purpose of this section is ***not*** to establish DOC control policy. Rather, it discusses different methods of controlling in response to overload situations. Specific control decisions are the responsibility of DOC planners and network managers.

3.02 It is expected that any arrangement should meet or exceed the system guidelines for network service continuity.

B. Trunking Affected by DOC

3.03 A receive DOC switching entity will often have more than one kind of traffic to the transmitting DOC switching system. Some of the different kinds of traffic could include the following:

- (a) Direct Distance Dialed (DDD) Access — Local Automatic Message Accounting (LAMA), Automatic Message Accounting (AMA), Centralized Automatic Message Accounting (CAMA):

- (1) 7-digit

- (2) 10-digit

- (b) Traffic Service Position System (TSPS) — 0+

- (c) TSPS — 0-

- (d) TSPS — Coin

- (e) TSPS — Non-coin

- (f) TSPS — Coin/Non-coin

- (g) Directory Assistance

- (h) Wide Area Telecommunications Service (WATS)

- (1) Outward Wide Area Telecommunications Service (OUTWATS)

- (2) 800 Service (formerly INWATS).

3.04 The kinds of traffic listed in paragraph 3.03 may be separated, requiring an individual trunk group for each kind of traffic; or, two or more kinds of traffic may be combined on the same trunk group.

3.05 Since the objective of DOC controlling is to prevent the spread of network congestion into other switching systems, the network manager should consider the application of DOC on ***all*** kinds of traffic from the receive DOC switching system to the transmitting DOC switching system. Traffic such as DDD and OUTWATS may be subjected to cancel or reroute type controls. However, TSPS traffic should never be cancelled by DOC. This limits controls which may be used for TSPS trunk groups to reroutes only. And, with TSPS, the amount of traffic rerouted should not exceed that which would cause a maximum of 30 percent overflow on the via route.

3.06 The proper use of End Office Trunking (EOT) and/or reroute and cancellation type controls should allow the system's network service continuity guidelines to be met and, at the same time, prevent the spread of network congestion.

C. DOC Signals

3.07 As stated in Part 2, electronic switching systems are capable of transmitting three DOC signals (MC1, MC2, and MC3). Ideally, if cost were

not a consideration, all three signals should be transmitted to each receive DOC switching system with alternate (ALT) routed and/or hard-to-reach (HTR) traffic being controlled in response to MC1 and direct and ALT (DAR) traffic being controlled in response to MC2. Controls in response to MC3 should always be 100 percent, with the exceptions for TSPS as described in paragraph 3.05.

3.08 However, due to the high cost of facilities, most DOC arrangements will have to be limited to the transmission of two, and, in some cases, only one, DOC signal to each receive DOC location. If only one level of conventional DOC is implemented, it will generally be the MC3 signal to meet service continuity objectives.

3.09 Due to problems inherent with using only one DOC signal, the DOC planner may want to consider using a minimum of two DOC signals to each receive DOC location in order to avoid prolonged (MF or DP) queue occurrence during the transmitting DOC switching system's recovery process. The following paragraphs describe what can happen when only one DOC signal is used.

3.10 When using only one DOC signal, control responses will have to be more severe than they would have to be in response to the first of two signals, if two signals were being used.

3.11 This results in large amounts of traffic being redirected (either to an announcement or to another trunk group) in response to the one DOC signal. Once the transmitting DOC switching system recovers and removes the DOC signal, all DOC receive controls are released and this large volume of traffic is allowed to bid for service, all at one time, in the transmitting DOC switching system. This large influx of traffic can cause the transmitting DOC switching system to go into an MF or DP queue or a real-time overload.

3.12 Another consideration is that, when only one DOC signal is used, generally, it is the MC3 signal. MC3 is not related to machine congestion and will not be sent as a result of congestion. This means that, when the transmitting DOC location becomes congested and reaches the stage at which MC1 or MC2 is normally transmitted, no DOC signal is sent if the congested switching system is arranged to transmit MC3 only. Therefore, the congestion is allowed to spread uncontrolled until manual controls can be applied.

3.13 In a DOC arrangement where two DOC signals are transmitted, such as MC1 and MC3 or MC2 and MC3, protection against congestion (MC1, MC2) **and** failure (MC3) is provided. This is much more acceptable than the situation described in paragraph 3.12 where no protection for congestion was provided.

3.14 In the two-signal DOC arrangement described in paragraph 3.13, MC1, if used, would cancel 100 percent of all ALT routed traffic and should be used on those groups sending mostly alternate routed traffic to the congested switching system. MC2 should be used on trunk groups sending mostly first, or direct, routed traffic to the congested switching system. Typical control response for MC2 would be cancellation (or reroute) of 100 percent alternate routed traffic and 75 percent direct routed traffic. Adequate control response to DOC should be the removal of 40 percent to 50 percent of total incoming traffic when MC2 is transmitted. This total includes that traffic removed in response to the MC1 signal. As stated in paragraph 3.07, controls in response to MC3 should always be 100 percent of all traffic except TSPS (see paragraph 3.05).

3.15 If the decision is made to use only MC3, some protection against congestion can be gained by selecting only a few of the large connected switching systems to receive two DOC signals.

D. DOC Hierarchy

3.16 Traditionally, DOC signals have been confined to those switching systems subtending the transmitting DOC switching system, ie, down-chain DOC'ing. However, there are no ironclad rules prohibiting the use of DOC on a lateral or up-chain basis. In fact, lateral and/or up-chain DOC'ing is encouraged if it would obviously enhance the performance of the network during a failure situation. Economic studies for each location are necessary to ascertain whether lateral or up-chain DOC is feasible with conventional DOC.

3.17 This philosophy has already been introduced into the network with CCIS DOC. In the CCIS network, DOC signals are sent to **all** switching systems having CCIS trunks to the transmitting DOC switching system, regardless of the distant switching system's place in the hierarchy (subtending, up-chain, or lateral). CCIS DOC is discussed in more detail in Part 8 of this section.

E. DOC Control Examples

3.18 The examples in this section are intended to illustrate several of the techniques available to DOC planners. The use of "dummy" groups, reroutes (regular and immediate) and cancellation controls is discussed.

3.19 As mentioned in paragraph 3.01, these DOC control examples do not constitute a system recommendation concerning DOC strategy. However, they do represent several possible ways to handle traffic in an overload situation. Two themes which should be uppermost in the DOC planner's mind are to meet or exceed the system guidelines for network service continuity and to prevent or minimize the spread of network congestion. For simplicity, most examples shown use only one DOC signal. In actual practice, two or three DOC signals may be used in order to provide for protection against congestion and against switching system failure.

3.20 Figure 1 shows an end office which is dual homed on two tandems. As indicated, selective routing is used to each tandem. That is, numbering plan areas (NPAs) A, B, and C are routed to tandem A and NPAs X, Y, and Z are routed to tandem Z. This is a simple DOC arrangement in which only one DOC signal is used from tandem A to end office B. When tandem A fails, it will send an MC3 signal to end office B which will activate a preprogrammed control. This preprogram consists of 100 percent immediate reroute from the B to A trunk group to the B to Z trunk group. The size of the trunk group from B to Z will limit the amount of traffic directed to tandem Z. If a reroute figure of less than 100 percent is desired, Fig. 2 shows one way of handling the traffic.

3.21 Figure 2 uses the same trunking arrangement shown in Fig. 1 with a dummy group built into the routing in order to allow two types of controls on the same traffic. This is necessary since two preprogrammed controls cannot be active on one trunk group at the same time (1/1A ESS). The objective of this arrangement is to reroute 50 percent of the traffic and not allow the remainder of the traffic to make attempts on the B to A trunk group. In this arrangement, the NPAs A, B, and C are first-routed to the dummy group which overflows to the B-A trunk group. Since there are no trunks in the dummy group, all traffic overflows to the B-A group. Activating a reroute (immediate or regular) of 50 percent DAR on the dummy group sends 50 percent of the

traffic to the B-Z group and allows the remainder to go to the B-A trunk group. The second control, which requires an additional preprogram, cancels 100 percent of the traffic directed to the B-A trunk group. Both preprogrammed controls are activated by a single DOC signal from the "A" tandem to the "B" end office. The result of these controls is that 50 percent of the B-A traffic is rerouted to the B-Z trunk group and the remainder is not allowed to make an attempt on the B-Z trunk group.

Note: "Dummy" groups are not used in 5XB switching systems.

3.22 The arrangement shown in Fig. 2 could also be used for tandem Z. Figures 1 and 2 show only one type of traffic. Other types of traffic must also be considered.

3.23 Figure 3 shows an arrangement similar to Fig. 1 which includes TSPS traffic. The TSPS traffic is controlled the same way as the DDD traffic (see Fig. 1). In fact, all types of traffic could be controlled in the same manner shown in Fig. 1.

3.24 All controls mentioned in paragraphs 3.20 through 3.23 for a failure of tandem A can be activated with the receipt of one DOC signal from tandem A to end office B. See paragraph 5.16 for multiple control activation from a single received DOC signal. A different signal would have to be received from tandem Z to activate similar controls on traffic destined for tandem Z.

3.25 The controls described in paragraphs 3.20 through 3.23, with the exception of dummy groups, can also be implemented in a 5XB end office with the proper RT key wiring. See Part 6D for information concerning multiple control activation in a 5XB switching system.

3.26 Paragraphs 3.20 through 3.24 describe examples in which reroutes are the response to an MC3 signal. This section recognizes that there are many cases where an acceptable via route is not available immediately and, thus, cannot be implemented on an automatic basis by DOC. In these cases, the appropriate action would be to use a 100 percent CANCEL-TO DAR control on the trunk group to the failed switching system and make adjustments as soon as possible with manual controls. See Part 5B for information on overriding DOC controls in 1/1A ESS receive DOC locations.

3.27 The DOC situations shown in Fig. 4 and Fig. 5 indicate two of many possible control actions in response to a congestion signal (MC1 or MC2).

3.28 Figure 4 shows a 4ESS switching system (office B) with two subtending switching systems (offices C and D). In this example, office B goes into congestion and, as discussed in paragraph 3.14, sends an MC1 signal to office C which sends mostly alternate routed traffic to office B. This provides immediate relief to office B without affecting any direct routed traffic. Should office B progress to the second stage of congestion and send an MC2 signal, office D will respond with a CANCEL-TO control affecting 100 percent of alternate routed traffic and 75 percent of direct routed traffic. Offices C and D would also be equipped to receive MC3 from office B, if it should enter a failure condition.

3.29 Figure 5 displays a slightly more complicated DOC arrangement in which a reroute control is used in addition to the CANCEL-TO controls shown in Fig. 4. The balance of traffic on the C to B trunk group is the same but the traffic on the D to B group is changed. This is the result of allowing world traffic to "flow-through" the dummy group before attempting to find a trunk on the D to B group. For this reason, the CANCEL-TO control for alternate routed traffic on D to B is reduced to 75 percent. The 25 percent direct routed traffic on each group is destined for end offices subtending the B and A switching systems. MC1 would still be used to office C since it sends mostly alternate routed traffic to office B. Although the balance of traffic on the D to B trunk group appears to be different, the D to B group is still the first route for all traffic handled on the D to B trunk group. However, due to the dummy group arrangement, the D switching system's processor treats the world traffic as alternate routed traffic. Considering that all traffic on the D to B trunk group is really first routed traffic, office D would be arranged to respond to an MC2 signal from office B. With the reception of the MC2 DOC signal, the D switching system will CANCEL-TO 75 percent DAR on the D to B trunk group and implement a 50 percent reroute on world traffic from the dummy group to the D to C full group. Since office C has trunk groups to the world, part of office D's world traffic has been given a chance to complete without making an attempt on the D to B trunk group.

4. TRANSMITTING DOC

A. General

4.01 As discussed in Part 2, conventional (non-CCIS) DOC signals can be transmitted by

some electromechanical and electronic switching systems.

4.02 Electromechanical switching systems capable of transmitting DOC signals are XBT and 4A XB systems. These switching systems transmit signals triggered by Sender Queue Low (SQL) and Sender Queue High (SQH), which correspond roughly to the MC1 and MC2 signals transmitted by electronic switching systems. Equipment exists today for transmitting conventional DOC signals which makes these systems compatible with the receive DOC equipment discussed in Parts 5 and 6. However, only electronic systems will be discussed in detail for transmitting DOC application in this section.

4.03 Electronic switching systems, 1/1A ESS and 4ESS, are capable of transmitting three types of DOC signals. These are MC1, MC2, and MC3. The events leading to the transmission of these signals are discussed later for each type of switching system.

4.04 The DOC signals generated by electronic switching systems can be transmitted to the receive DOC locations over a variety of facilities. The different types of facilities are discussed in Part 7 of this section.

B. 1/1A ESS

Generation of DOC Signals

4.05 DOC signals are sent from a No. 1/1A ESS switching system because of a shortage of real time; a shortage of multifrequency (MF), dial pulse (DP), or revertive pulse (RP) receivers; or a lack of ability to switch any calls. The signal sent when the No. 1/1A ESS is unable to switch calls is a hardware function. This is the MC3 signal.

4.06 Two levels of signaling exist for the shortage of real time and the shortage of receivers (congestion). These levels are MC1 and MC2. MC1 indicates that the switching system is sufficiently congested to cause substantial delays in receiver attachment. Delays in the range of 20 to 40 percent of the receiver holding time are considered substantial. MC2 indicates that the switching system is considerably more congested than the MC1 level. At MC2, delays in the range of 40 to 80 percent of the receiver holding time would be expected.

4.07 In switching systems equipped for 4-wire transmission using the HILO feature, the 4-

SECTION 780-200-050

wire MF and DP receivers are monitored for delay instead of the 2-wire MF and DP receivers. Even if delays of 2-wire MF and DP receivers develop, DOC signals will not be transmitted. The 2-wire RP receivers are still monitored, and can trigger DOC signals.

4.08 The thresholds for real-time and receiver delays are checked every 2 seconds. When a threshold is crossed at two consecutive 2-second checks, the sending of the associated DOC signals is initiated. DOC signals will cease at the first 2-second check at which the threshold is no longer crossed.

Sending DOC Signals

4.09 Conventional DOC signals for MC1 and/or MC2 levels may be sent to a maximum of 64 switching systems, if a radial signaling arrangement is used, or to a maximum of 64 loops, if a daisy-chain signaling arrangement is used. (See note below.) With radial signaling, the switching system receiving the DOC signals must return the acknowledgment to the sending switching system. With daisy-chain signaling, the acknowledgment may be transmitted to another switching system which will accept it as a DOC signal. This switching system must either return the acknowledgment or transmit it to another switching system. The limit on the number of switching systems in a daisy-chain is the return of the acknowledgment to the signaling office within 2 seconds of the initial transmittal. Also, each link between different receive DOC units (SD-27970), that used a balanced loop facility, must not exceed 4500 ohms loop resistance. The sum of the number of MC1 and MC2 signals must not exceed 64. Thus, if MC1 signals are sent to 48 switching systems, MC2 signals can be sent to only 16. In some cases, when MC1 signals are sent to a switching system, MC2 signals will also be sent, thereby using two of the 64 signals.

Note: With radial signaling, multiple switching systems within the same building may be controlled with the same received DOC signal. Consequently, a number of trunk groups may be controlled with a single DOC signal. This means that, even with radial signaling, the failure of one signaling loop can indicate the failure of a number of switching systems to respond to a DOC signal. Any set of switching systems responding to a single MC1 or MC2 signal should all use the same type signaling to the transmitting DOC system (MF, DP, etc).

4.10 The MC3 signal is sent when the 1/1A switching system is incapable of processing calls.

This is a hardware function and **results in the removal of MC1 and MC2 signals.** (This is true for 1/1A ESS only.) Therefore, any switching system with controls active as a result of MC1 and/or MC2 receptions from the sending office will remove those controls when the sending office transmits an MC3 signal. For this reason, it may be desirable to have the receiving system respond to MC3 rather than, or in addition to, MC1 and MC2. With radial signaling, the MC3 signal can be sent to a maximum of 32 switching systems. The MC3 signal continues to be sent for approximately 2 seconds after call processing has resumed.

4.11 Interfaces with three types of signaling facilities are provided with options on a per signal basis. The three facility types are:

(a) Balanced Loop

- ON: Loop closure
- OFF: Loop opening.

(b) E&M Signaling

- ON: -48 Vdc on the M lead via the E&M Applique Circuit SD-99774-01
- OFF: Ground on M lead via E&M Applique Circuit SD-99774-01.

(c) Data Set

- ON: +5 to +15 Vdc to the SL lead of Data Set 108E
- OFF: -5 to -15 Vdc to the SL lead of Data Set 108E.

4.12 For each of up to 96 signals transmitted, an acknowledgment is returned to the sending switching system. This acknowledgment is used to determine that connected switching systems have correctly received a conventional DOC signal. The acknowledgment continues as long as the signal is being sent.

4.13 These acknowledgments are detected at the switching system via supervisory scan points at the master scanner circuit. The signaling facility for the acknowledgment must be identical to its associated DOC transmit signal. These facilities are:

(a) Balanced Loop

- ON: Far-end loop closure
- OFF: Far-end loop ending.

(b) E&M Signaling

- ON: Ground on the E lead via the E&M Applique Circuit SD-99774-01
- OFF: Open on the E lead via the E&M Applique Circuit SD-99774-01.

(c) Data Set

- ON: +5 to +15 Vdc from the TL lead via Data Set 108E
- OFF: -5 to -15 Vdc from the TL lead via Data Set 108E.

4.14 The signal transmitted by the DOC transmit circuit is an ON signal interrupted by an OFF signal every 30 seconds. The duration of the OFF signal is approximately 1 second. This interruption is inserted to validate the DOC transmit signal. Since the acknowledgment that is returned from the DOC receive switching system is identical to the transmitted signal, the interruption also exists in the acknowledgment signal.

4.15 Acknowledgments for all conventional DOC signals are expected within 2 seconds of sending the signal. On an operational check, if either the acknowledgment is not received or an acknowledgment is received but not expected, the loop on which the failure occurred is taken out of service, and the central office work forces are notified via both the minor alarm and an **NM26** message at the maintenance TTY. This message also appears on the Switching Control Center (SCC) ALERTER terminal and identifies the failing loop. The local maintenance and/or SCC personnel should have standing instructions to notify the responsible network management center whenever **NM26** is printed. After correcting the problem, the craft personnel place the loop back in service via TTY input message **DOCX-REST**. This message can only be input from maintenance and SCC teletypes.

Equipment Required

4.16 The 1/1A ESS requires a DOC transmitter frame (J1A083A-1) for transmitting conven-

tional DOC signals. Different list numbers are required for different types of facilities. Figure 6 gives the requirements for each situation.

4.17 Each MC1 and MC2 signal to be transmitted by the 1/1A ESS switching system must be assigned a scan point in accordance with Note 1.3.20 in Assignment Drawing SD-1A272-01. Care must be taken to ensure that these scan points are provided.

C. 4ESS

Generation of DOC Signals

4.18 Congestion which results in service degradation can be caused by a heavy traffic load or a real-time delay in the central processor. To detect and correct congestion situations, the 4ESS has been provided with various software programs. The major program for monitoring capacity is the 2-pronged overload (OVLD) program. One OVLD program monitors the traffic load through incoming traffic offered to the switching system. Another OVLD program monitors real-time delay by measuring the base level cycle (BLC) length of the central processor.

4.19 The traffic load in the 4ESS is measured by call type: multifrequency (MF), dial pulse (DP), and Common Channel Interoffice Signaling (CCIS). The OVLD program determines whether the MF origination queue, DP origination queue, or CCIS origination queue exceeds the preset threshold levels for each signaling type. The real-time OVLD program measures time in the BLC of the central processor.

4.20 Traffic congestion is determined by comparing, by call type, the offered load (incoming) against the accepted load. If the difference is excessive, the OVLD program requests DOC signals to be sent for the appropriate machine congestion level for the call type experiencing the excess load. These signals could be MC1 or MC2 for MF or DP (conventional DOC), or CCIS (CCIS DOC). MC3 is not triggered as a result of congestion. It is triggered only when the 4ESS is in a major recovery phase and is unable to process any traffic. MC3 is unilaterally applied to all types of traffic. MC3 in the 4ESS is different from the 1/1A ESS in that it does not result in the removal of MC1 and MC2. For conventional (non-CCIS) DOC, the 4ESS sends MC1, MC2, and MC3 simultaneously when MC3 is transmitted.

Sending DOC Signals

4.21 The 4ESS is capable of transmitting three levels of conventional DOC (MC1, MC2, and MC3) on a maximum of 64 trunk subgroups (TSGs) and receiving acknowledgment on each signal transmitted.

4.22 Scan and signal distributor (SD) points must be assigned for each signal which is to be transmitted or received. The assignments for these points are made at initial cutover of the machine and are entered into translations through the Office Data Assembler (ODA) program. The network manager is responsible for the assignment of scan and SD points.

4.23 In cases where more than 64 switching systems need to receive the DOC signals from the 4ESS, daisy-chain signaling arrangements may be used where the acknowledgment signal from the first system is sent to another switching system which treats it as a receive DOC signal. The second system either returns the acknowledgment to the 4ESS or sends it to another system, etc, with the last system in the chain returning the acknowledgment to the 4ESS.

4.24 In the daisy-chain signaling arrangement associated with an MC1 or MC2 DOC signal, all switching systems in the chain must use the same type of signaling to the 4ESS, ie, all MF or all DP. Also, in the daisy-chain arrangement, only one of the trunk groups in the chain may be associated with the DOC transmit unit in the 4ESS software.

Note: As mentioned in the note in paragraph 4.09, even with radial signaling, more than one trunk group can be affected by a single DOC signal. In these cases, the restrictions cited in paragraph 4.24 also apply to radial signaling.

4.25 As with the 1/1A ESS, the 4ESS can transmit these signals over a variety of types of facilities. These are:

- (a) EIA Standard (DATA)—only 43B1, 108, and 109 type data sets are acceptable.
- (b) Balanced Loop—loop resistance must be less than 4500 ohms.
- (c) E&M—E&M applique must be used
- (d) 43A1 Carrier Telegraph.

4.26 It should be noted that there have been occurrences of 4ESS failure where the system was

unable to transmit MC1, MC2, and MC3 signals. A possible cause of this type problem could be where the signal processor responsible for activating the DOC transmitters duplex fails and causes the 4ESS to enter a recovery phase. With this in mind, the network management center may want to consider establishing procedures with the 4ESS maintenance group for manual activation of MC3 when the 4ESS is not able to transmit machine congestion signals. **Caution should be used to avoid leaving the manual MC3 active any longer than absolutely necessary.**

Equipment Required

4.27 The 4ESS requires a Network Management Display Control Frame (J4A011A-1) for the transmission of DOC signals. Figure 7 gives the requirements for each situation, such as number of signals to be transmitted and type facilities.

5. 1/1A ESS DOC RECEIVE**A. General**

5.01 1/1A ESSs are capable of responding to a maximum of thirty requests for conventional DOC (automatic) activation of preprogrammed controls. These controls may also be activated by Engineering and Administrative Data Acquisition System/Network Management (EADAS/NM) and could consist of CANT (CANCEL-TO), CANF (CANCEL-FROM), SKP (SKIP), or REROUTE (regular or immediate). For those locations which interface with EADAS/NM, discretes are furnished to the EADAS/NM computer to alert network management personnel when DOC signals are received. For additional information on DOC discretes for EADAS/NM, see Program Application Document PA-3B021, Sections 4 and 11.

5.02 Each preprogrammed control subject to automatic activation (DOC) must be assigned as such in accordance with SD-1A272-01, Section 1.3.21.

5.03 A priority code must also be assigned to each DOC controlled preprogram. The code to be used is equal to the level of congestion triggering the received DOC signal. This is true, even if only one DOC signal is to be received. If the preprogram is to be activated by an MC3 signal from the transmitting DOC office, the priority code should be set as three (3). A preprogrammed control to be activated in re-

sponse to an MC2 signal should be set as priority two (2) and MC1 activated preprogrammed controls should be set to priority one (1). If more than one DOC controlled preprogram exists for the same trunk group, all should have the same pointer on Form 1506. Otherwise, audits will occur in the 1/1A ESS when more than one level of congestion is received.

B. Overrides - Preprogrammed Versus Flexible Controls

5.04 As mentioned in paragraph 5.03, preprogrammed controls used by DOC must have a priority code assigned. A DOC activated control with a priority of "3" will override another DOC control on the same trunk group with a priority of "2" or "1". A priority of "2" will override another control on the same trunk group with a priority of "1".

5.05 Paragraph 5.04 is straight-forward and is done automatically when DOC tries to apply more than one control to the same trunk group through the reception of more than one level of congestion from the transmitting DOC switching system. However, once a preprogrammed control has been implemented automatically, there are only three ways to remove its effects from the trunk group. These are:

- (a) Remove the received DOC signal
- (b) Send a **PP-EXC-XX** message to the 1/1A ESS processor via its network management teletype or from the serving SCC
- (c) Override it with another control.

5.06 Since (a) and (b) in paragraph 5.05 are usually not available to the remote network manager, any removal or alteration of network management control on the affected trunk group has to be done with another control which will override the DOC control. This may be more complex than it seems since the use of flexible controls by the network manager may result in **both** the flexible **and** the DOC control being in effect at the same time.

5.07 Table A shows the result of various types of simultaneous control activations on the same trunk group. After studying this table, the network manager responsible for DOC planning may want to build additional preprogrammed controls to be used for manually overriding DOC controls in failure situations.

5.08 Another means of handling traffic destined for a trunk group controlled by DOC is to build a "dummy" group (no members in the group) which overflows to the real trunk group and direct the traffic to the dummy group first. In this case, the DOC control affects the traffic only after it has "flowed through" the dummy group. The network manager can take control on the dummy group and affect the traffic before it gets to the DOC control.

C. Automatic Control Activation

5.09 The 1/1A ESS processor looks at two scan points for each automatic (DOC implemented) preprogrammed control. One of these is a **supervisory** scan point and the other is a **directed** scan point. The ESS does not look at the **directed** scan point until it sees a change-of-state on the **supervisory** scan point. If the ESS sees a corresponding change-of-state on the **directed** scan point, it will implement the associated preprogrammed control. The control will remain activated until the ESS sees another change-of-state on the **supervisory** scan point accompanied by a change-of-state on the associated **directed** scan point.

5.10 The **supervisory** and **directed** scan points are controlled by the DOC receiver (SD-27970-01) through a "Remote Master Scanner Applique" (SD-1A210-01). Two 2-wire loops are required from the DOC receive unit to the applique unit for each preprogrammed control to be activated by DOC. One loop is the "Primary" loop and controls the **supervisory** scan point. The other loop is the "Secondary" loop and controls the **directed** scan point. These loops provide a "loop open" or "loop closure" to the applique units. Normal (nonactivated) condition for these loops is as follows: The primary loop (T, R 00-29) provides a "1" (open loop) and the secondary loop (T, R 30-59) provides an "0" (closed loop). The activated condition is: Primary loop provides an "0" (loop closure) and the secondary loop provides a "1" (open loop). These loops are shown in FS 3 of SD-27970-01. Figure 8 shows the basic activation path from receive DOC unit to the 1/1A ESS master scanner.

5.11 The **supervisory** and **directed** scan points should **always** have opposite states. That is, an "0" on the supervisory scan point should be accompanied by a "1" on the corresponding directed scan point and vice versa. If, at any time, due to a false

cross or ground, the ESS sees the same state on both scan points, it will print out an **NM13 FCGF PPXX** message on the 1/1A ESS network management teletypewriter and activate a minor alarm in the 1/1A ESS. While the problem exists, the indicated preprogrammed control is not available for DOC activation. Once the trouble is cleared, the ESS prints out an **NM13 RST PPXX** message indicating the preprogram is enabled for DOC control. Figure 9 shows the **NM13** output message.

5.12 An **NM13** message can also be printed to indicate receipt of a steady (noninterrupted) activation signal by the DOC receive "CT" unit. However, this must be assigned properly in the 1/1A ESS and wired from the receive DOC unit (SD-27970) to the correct scan point ("SC00" in SD-1A272-01, Item 1.3.21) or the indication will be lost. Receipt of message **NM13 INT FAIL** indicates the receive DOC unit has failed to receive the expected interruption after 29 seconds (actually 31 to 38 seconds) and is treating the received signal as false. As long as this trouble condition persists, the ESS will issue an hourly follow-up message **NM13 TBL DOC**. Once the trouble is cleared, the ESS will print **NM13 INT OK** indicating the interruption is now being received properly by the receive DOC unit or the steady signal has been removed.

5.13 Since the messages discussed in paragraphs 5.11 and 5.12 are not available at the remote network management center, the on-site and/or SCC personnel responsible for monitoring these printouts should be made aware of their importance and should report them immediately to the responsible network management center. These messages should be displayed by the SCC's ALERTER terminal thereby bringing the problem(s) to SCC personnel's attention immediately.

D. Equipment Required

5.14 Each receive DOC location uses the same basic units to receive DOC signals (SD-27970/J23058CT-50) and to provide the associated office alarms (SD-27970/J23058BP-50). However, wiring options and list numbers may differ depending upon where the units are located, type of facilities being used, and type of switching entities being served.

Note: The "CADs" for terminating the primary and secondary loops from the SD-27970 (CT) unit are not shown on the SD-27970 draw-

ing. As a result, these frame blocks are commonly omitted on the installation job. These CADs are shown on the SD-1A210 drawing, CADs 3, 8, or 9. Figures 10 and 11 in this section show these CADs as frame blocks A, B, C, and D.

5.15 In addition to the basic receive DOC equipment mentioned in paragraph 5.14, the 1/1A ESS switching entity must use remote master scanner applique circuits (SD-1A210-01/J1A033GA) to interface between the receive DOC signal unit and the 1/1A ESS master scanner. See Figure 12 for additional information concerning equipment required. It should be noted that "SC00", discussed in paragraph 5.12, is an additional scan point and therefore requires an additional remote master scanner applique circuit (SD-1A210-01).

Note: An E&M applique circuit (SD-99774-01) may also be required under certain conditions. See paragraph 7.21 in this section.

5.16 "Standard" wiring diagrams indicate that, for each DOC control activation in a particular switching entity, a separate receive DOC signal is required, necessitating an additional facility. However, in some cases, it is possible to activate more than one control with a single received DOC signal. Figures 10, 11, and 13 show two possible methods of obtaining multiple control activation with one received DOC signal. They are:

- (a) Provide additional CT units (one for each control) and loop the acknowledgment signal from one CT to the input of the next CT. (See Fig. 13.)
- (b) Provide special wiring in accordance with Fig. 10 and Fig. 11.

Note: Method (a) is more useful in multiple entity locations. Method (b) is more useful in single entity locations.

5.17 If more than one DOC signal is to be received by a switching entity, the amount of equipment must be increased accordingly.

5.18 The basic receive DOC signal unit CT is capable of activating controls in a number of switching systems with the same received DOC signal. The systems controlled by a particular CT unit

should all be in the same building and can be all of one type or a mixture of 1/1A ESS and electromechanical offices. Following is a list of the possible combinations of switching systems which can be controlled by one receive DOC unit: (Note 307 in SD-27970.)

- (a) Four 1/1A ESS switching systems
- (b) Three 1/1A ESS and two electromechanical switching systems
- (c) Two 1/1A ESS and four electromechanical switching systems
- (d) One 1/1A ESS and six electromechanical switching systems
- (e) Eight electromechanical switching systems.

5.19 In a receive DOC location where the receive DOC unit is controlling a mix of ESS and electromechanical switching entities, the normal procedure is to locate the receive DOC equipment in the maintenance area of the electromechanical system work force.

5.20 In those cases where multiple switching entities are to be served by a single receive DOC unit, special instructions should be given to the Western Electric engineer concerning location of the receive DOC equipment, frame appearances, etc. ***Special care should also be taken to avoid omitting the necessary CADs on SD-1A210-01 for termination of the 1/1A ESS control loops from the CT units. (See note in paragraph 5.14.)***

6. 5XB DOC RECEIVE

A. General

6.01 In 5XB switching systems, a maximum of 20 route transfer (RT) relays can be operated in response to receive DOC signals. For those locations which interface with EADAS/NM, discrettes are furnished to the EADAS/NM computer to alert network management personnel when DOC signals are received. For additional information on DOC discrettes for EADAS/NM, see Program Application Document PA-3B021, Sections 4 and 11.

6.02 These RT relays divert traffic from its normal route when they are operated. This diverted

traffic can be sent to another trunk group (reroute or skip) or to an announcement group (cancel-to or cancel-from).

6.03 The percentage of traffic affected by each control depends upon how many completing markers have been wired to respond to the control request. For example, a 50 percent control in a switching system having eight completing markers would have the RT- to RTW- punchings, for the RT relay in question, cross-connected for only four completing markers. The other four completing markers would do nothing in response to a control request on that RT relay. A 100 percent control would have the RT- to RTW- punchings, for the RT relay in question, cross-connected in all eight completing markers.

6.04 If code grouping is not fully utilized on the trunk group to be controlled, more than one RT relay per marker may be required to control the trunk group. See Part 6D for multiple RT activations.

6.05 This section recognizes that, in some cases, even after the optimum use of code grouping and the most efficient use of screening relays, some trunk groups will still have different segments of traffic. Each segment will require a separate RT relay. To control all the traffic on this type trunk group will require multiple RT relay operation.

B. Overrides

6.06 Once an RT relay has been operated by DOC control, there are only three ways to remove the control:

- (a) Remove the DOC signal
- (b) Transfer the EADAS/NM control (if EADAS/NM is provided)
- (c) Take action locally, such as operate the CRT key or manually block a relay.

6.07 Since (a) and (c), paragraph 6.06, are usually not available to the remote network manager, (b) would normally be used if adjustment to the DOC control is required. Transfer to EADAS/NM control gives the network manager the ability to operate or release the affected RT relay(s) and others if necessary.

6.08 It should be noted that, with standard cross-connections, if the network manager chooses

to transfer control of the shared RT relays to EADAS/NM, this action releases *all* shared RT relays presently operated by all receive DOC signals to this particular switching entity.

6.09 It should also be noted that transfer to EADAS/NM control for the shared RT relays (normally 20-39) is the only way EADAS/NM can control any of these RT relays. That is, with standard cross-connections, control of these RT relays is either entirely by EADAS/NM or completely by DOC. They are mutually exclusive.

C. Automatic Control Activation

6.10 As shown in Fig. 8, reception of the DOC signal by the DOC signal unit (CT) causes a ground to be applied to the C-lead. This ground is passed through the CD punching, the released contact of TR-relay (if control is not passed to EADAS/NM), and to the CF punching. If CF to CH punchings are cross-connected, the ground passes through the released contact of the CRT key (if maintenance personnel haven't assumed manual control) to the C-punching. At this point, if the C- to CA punchings have been cross-connected, the RTCA- and RTCB-relays operate and cause ground to be applied to the RT- punchings. If the RT- punching is cross-connected to the RTW- punching, this will operate the RT relay in the associated completing marker.

6.11 The previous paragraph describes RT relay activation where the RT is shared by DOC and EADAS/NM. This is the most common arrangement. Note 402 (SD 25762-01) gives instructions on proper cross-connections for other modes of operation.

D. Multiple RT Activation - One DOC Signal

6.12 As mentioned in paragraphs 6.04 and 6.05, there are cases where more than one RT relay is required to control all the traffic on a particular trunk group.

6.13 It is also common for a receive DOC switching system to have more than one trunk group to the affected transmitting DOC switching system. This is discussed in Part 3 of this section.

6.14 Paragraphs 6.11, 6.12 and 6.13 mention a common problem in conditioning a switching system to respond properly to a received DOC signal. Often, it is desirable to control traffic on more than

one trunk group to the transmitting DOC office. This necessitates the operation of two or more RT relays with a single received DOC signal.

6.15 This presents no problem in an office controlled by DOC only. It is simply a process of strapping a single RT- punching to multiple RTW-punchings. Each RTW- punching represents a different RT relay. Thus, if RT relays 20-24 were to be operated by a single DOC signal, the RT- punching associated with the DOC signal would be cross-connected to one of the RTW- punchings (20-24) and RTW- 20-24 would be strapped together. This would result in five RT relays being operated with a single receive DOC signal. (See Note, paragraph 6.18.)

6.16 However, in a switching system employing both DOC and EADAS/NM, strapping RTW punchings results in multiple RT relay operation for a single received DOC signal *and for a single EADAS/NM control request*. In fact, the strapping of RTW punchings eliminates the ability of the EADAS/NM system to selectively activate and/or release the involved RT relays on a one-at-a-time basis. This ability is lost regardless of whether control of the relays is transferred to EADAS/NM or not. In this case, all involved RT relays are operated or all are released. (See Note, paragraph 6.18.)

6.17 There are several methods of obtaining multiple RT activations with one received DOC signal. However, most of them affect the ability of the EADAS/NM system to take selective controls. This is due to the normal wiring arrangement where both DOC and EADAS/NM share control of RT relays 20-39.

6.18 Following are two methods of obtaining multiple RT activations for DOC and reserving the EADAS/NM system's ability to selectively activate RTs on a one-at-a-time basis:

Method 1—Signal Unit (CT) Looping: Fig. 13 shows how to loop CT units within the same receive DOC unit. With this method, the network manager and/or engineer determines how many RT relays are to be activated with the single received DOC signal and provides one CT unit for each RT relay. Thus, if five RT relays are to be operated with one received signal, five CT units are provided and looped as shown in Fig. 13. In this case, each CT is controlling one RT relay in each switching entity served by that CT, up to a maximum of eight 5XB switching systems. This

arrangement allows both DOC and EADAS/NM to share control of the involved RT relays while EADAS/NM retains the ability to selectively operate any of the RT relays, one at a time.

Method 2—Allocation of RT Relays: In this method, the network manager designates certain RT relays to be used by DOC and other RT relays to be used by EADAS/NM with no sharing of RT relays. This approach allows the strapping of RTW punchings to activate as many RT relays as desired (up to the number allocated) with one received DOC signal. The other RT relays can be activated or released individually by EADAS/NM. While this method uses only one CT unit for up to eight 5XB switching systems, it does severely limit the number of RT relays available to be controlled by each mode of operation (EADAS/NM or DOC).

Note: Often, it is desirable to affect traffic on all trunk groups to the transmitting DOC switching system. If EADAS/NM controlling on these trunk groups is done in the same manner; that is, all groups to the affected office at the same time, these RT relays could be ganged as discussed in paragraph 6.15 and could be shared by both DOC and EADAS/NM.

6.19 In cases where the maximum number of RT relays is not sufficient, some operating companies have taken advantage of the spare contacts on RT relays 20-39 to gain, in effect, an additional RT relay in each marker for each set of contacts wired. There are two sets of spare contacts on each relay and a total of 40 RT relays could be gained using this arrangement. However, it should be noted that any spare contacts used will be operated at the same time the basic RT relay is operated. Thus, only different traffic types *to the same trunk group* should be wired through this arrangement.

E. Equipment Required

6.20 As with the 1/1A ESS switching system, the 5XB uses the same basic units to receive DOC signals (SD-27970/J23058CT-50) and to provide the associated office alarms (SD-27970/J23058BP-50).

6.21 In addition to the basic receive DOC equipment, the 5XB switching entity uses the following:

- (a) Route Transfer Control Unit - J23252BS-50
- (b) Supplementary Route Transfer Unit - J28760SL-50

(c) Go Relay Unit - J28153AR-50

(d) Supplementary Relay Unit E - J23255BD-50.

6.22 Figure 14 gives more detailed information regarding list numbers and wiring options required for the various types of equipment.

6.23 In those locations with a mix of 1/1A ESS and electromechanical switching systems, the restrictions and precautions outlined in paragraphs 5.18, 5.19, and 5.20 should be observed.

F. 5XB ETS

6.24 The 5XB ETS switching system is capable of taking DOC controls similar to those mentioned for the 1/1A ESS on a receive basis. It can also be controlled by DOC and EADAS/NM.

6.25 This system controls trunk groups rather than different types of traffic. Controls available are SKIP, CANCEL-TO, IMMEDIATE REROUTE, CANCEL-FROM, and REGULAR REROUTE. A maximum of 20 controls can be implemented by DOC, and less equipment is required than with the non-ETS 5XB. Figure 15 shows the equipment required and a sketch showing basic cross-connections to activate the preprogrammed controls under DOC.

6.26 For additional information concerning 5XB ETS, refer to Bell System Practices 218-799-345 and 218-799-346.

7. FACILITIES

A. General

7.01 This part discusses standard facility arrangements in accordance with the transmit DOC "J" and "SD" drawings for 1/1A ESS and 4ESS and for the receive DOC circuit SD-27970-01.

7.02 Facility arrangements, other than those discussed in this section, exist in the field today. However, they are not documented in the "SD" drawings for DOC and must be engineered on-site in some cases.

7.03 Any facility is acceptable which can deliver the on/off information from the transmit DOC unit to the receive DOC unit in the expected format and return the acknowledgment signal from the

SECTION 780-200-050

receive DOC unit to the transmitting DOC unit in the expected format.

7.04 The standard DOC unit (SD-27970-01) is capable of interfacing directly with numerous types of facilities. However, different wiring options are required in the receive unit for different types of facilities. Figure 16 provides a listing of the options required for each type facility and an explanation of what the receive DOC unit expects to receive or transmit in each case.

7.05 The standard receive DOC unit can receive a DOC signal over one type facility and transmit the acknowledgment over a different type facility if necessary. This feature enables the DOC planner to use a mix of facilities as necessary to assemble a daisy-chain arrangement. However, the final acknowledgment signal which is returned to the transmitting DOC switching system must be on the same type facility used to transmit the signal originally.

B. Facility Arrangements

7.06 There are two basic types of facility arrangements used in transmitting DOC signals and receiving the associated acknowledgments. These are "radial" and "daisy-chain" signaling loops. Each type arrangement is discussed in the succeeding paragraphs.

Radial Signaling

7.07 In this type of signaling arrangement, the transmitting DOC switching system has a separate facility to each receive DOC unit it is controlling. Therefore, it sends a separate DOC signal to each receive DOC unit and receives a separate acknowledgment from each receive DOC unit. Figure 17 illustrates a typical radial signaling arrangement.

7.08 The radial signaling method is far superior to the daisy-chain signaling method when the maintenance personnel are testing DOC operation or trying to isolate a problem.

7.09 One receive DOC unit can serve several switching entities in the same building. Paragraph 5.18 describes the different arrangements possible with a single receive DOC unit. In Fig. 17, the switching entities controlled by the various receive DOC units range from one 1ESS or 5XB in units "A" and "E" to three ESS switching entities and two 5XB

switching entities controlled by unit "D". The only requirement other than those stated in paragraph 5.18 is that all switching entities controlled by a particular receive DOC unit should be in the same building with the receive DOC unit. (See note, paragraph 4.09.)

Daisy-Chain Signaling

7.10 In some cases, radial signaling cannot be economically justified due to the cost of facilities.

A daisy-chain signaling arrangement often uses a lower number of links or facilities than required by a radial signaling arrangement. Also, in many cases, facilities are available between different receive DOC units which are cheaper than those available between the transmitting DOC switching system and the individual receive DOC locations. In these cases, it is cheaper to link the more closely grouped individual receive DOC locations together in a "chain" and use only one facility to the chain from the transmitting DOC location and another facility from the chain to the transmitting DOC location to return the acknowledgment signal.

7.11 Figure 18 shows a simple daisy-chain signaling arrangement which includes receive DOC units B, C, D, and E. In this example the transmit DOC signal is originally sent to unit B. When unit B sends an acknowledgment signal, it is sent to unit C which accepts it as a receive DOC signal. This relaying of the DOC signal continues from unit C to unit D and from unit D to unit E. The last unit in the chain (unit E) returns the acknowledgment signal to the transmitting DOC switching system.

7.12 Any number of receive DOC units can be included in a daisy-chain signaling arrangement provided the acknowledgment signal is received by the transmitting DOC switching system within two seconds after transmission.

7.13 As mentioned in paragraph 7.05, the receive DOC unit is not required to return the acknowledgment signal over the same type of facility used to receive the DOC signal unless it is being sent to the transmitting DOC office. Thus, in the daisy-chain shown in Fig. 17, the original transmitted DOC signal could have been sent over a data facility while the acknowledgment signal from unit B to unit C could have been sent over a balanced loop with C to D being E&M signaling, etc. However, unit E is required to return the acknowledgment signal to the

transmitting DOC switching system over the same type facility as was used for the original transmitted DOC signal.

7.14 While the daisy-chain signaling arrangement may be more economical, it presents some very serious problems when trying to make routine tests or when trying to isolate the source of a problem on a malfunctioning loop. When the transmitting DOC switching system fails to receive the expected acknowledgment signal, it is very difficult to determine the location of the problem. Usually, it involves communication between the maintenance personnel in the transmitting DOC location and those in one or possibly all of the receive DOC locations simultaneously.

7.15 Another disadvantage of the daisy-chain signaling arrangement is that, when the loop malfunctions, all receive DOC units in the chain are inoperative. Conversely, if a loop malfunctions in a radial signaling arrangement, only one receive DOC unit is affected. For this reason, the DOC planner should use radial signaling whenever possible.

7.16 Another situation which may make a daisy-chain arrangement necessary is that, in some cases, more than 64 receive DOC units must respond to the same DOC signal. This limitation is reduced to 32 for an MC3 signal from a 1/1A ESS. See paragraphs 4.09, 4.10, and 4.21 for a discussion on the maximum number of DOC signals which can be sent.

7.17 Figure 18 also shows two radial loops. One is to receive DOC unit A and the other is to receive DOC unit F. Most transmit DOC locations will have a mix of both radial and daisy-chain loops based upon available facilities and number of receive DOC units to be controlled.

C. Balanced Loop Signaling

7.18 This type facility uses one pair of wires for transmitting the DOC signal and another pair of wires to receive the acknowledgment signal. As shown in Fig. 16, a DOC signal request is accomplished at the receive DOC location with a loop closure on the T1/R1- leads. The acknowledgment signal is sent from the receive DOC unit with a loop closure on the T-/R- leads.

7.19 There are several loop resistance maximum criteria which must not be exceeded when building DOC signaling loops. They are as follows:

(a) The loop resistance between a 4ESS transmitting DOC switching system and a receive DOC unit (SD-27970) must not exceed 4500 ohms. If a balanced loop is used, and the loop resistance exceeds 4500 ohms, an E&M applique circuit (SD-99774-01) must be used at the transmit DOC end and the SD-27970 receive DOC unit must be optioned for E&M signaling. An E&M applique may also be required at the receive end. See paragraph 7.21.

(b) The loop resistance between a 1/1A ESS transmitting DOC location and a receive DOC unit must not exceed 6000 ohms. If a balanced loop is used, and the loop resistance exceeds 6000 ohms, an E&M applique circuit (SD-99774-01) must be used at the transmit DOC end and the SD-27970 receive DOC unit must be optioned for E&M signaling.

(c) In daisy-chain signaling, if a balanced loop is used between two SD-27970 receive DOC units, the loop resistance must not exceed 4500 ohms.

D. E&M Signaling

7.20 This type signaling can be used on a balanced loop as described in Part 7C or for carrier circuits using "in-band" signaling (SF signaling) or "out-of-band" signaling such as T-Carrier.

7.21 In every case, with E&M type signaling, an E&M applique circuit is required at the transmitting DOC switching system, 1/1A ESS or 4ESS. An E&M applique is also required at the receive DOC location if the receive DOC unit (SD-27970) is located in 1/1A ESS quarters. It is not required at the receive location if the receive DOC unit is located in an electromechanical switching system's quarters. If the E&M facility is a T-Carrier facility which is equipped with D3 or D4 channel banks, the E&M applique unit is not required at either end of the facility because it is contained within the channel banks.

7.22 At the receive DOC unit, a ground on the E lead indicates an active DOC request and the receive DOC unit acknowledges with -48V on the M lead. This same convention is used at the transmitting DOC unit for both 1/1A ESS and 4ESS. The application of -48V on the M lead through the E&M applique circuit transmits the DOC signal and the associated acknowledgment signal is recognized by a ground on the E lead through the E&M applique circuit.

E. 43A1 Carrier Telegraph Signaling

7.23 Per standard drawings, only the 4ESS switching system is capable of using this type signaling to a receive DOC unit.

7.24 At the receive DOC unit, current in the T1-/R1 leads (62.5 ma) indicates the reception of a DOC signal and the receive DOC circuit acknowledges with a closure on the T-/R- leads.

7.25 At the 4ESS transmitting DOC switching system, this type signaling is done through a 43A1 carrier telegraph interface circuit (SD-4A082-01). To transmit a DOC signal, the 4ESS sends a loop closure on the XYTA/XYTB leads which results in a closure on the T/R leads from the interface to the 43A1 telegraph set. The acknowledgment signal results in a loop closure on the XYRR/XYRRR leads to the DOC transceiver which recognizes this as the appropriate response to the transmitted signal.

7.26 The carrier link must be equipped with a supervisory (SA) relay to open the receive loop on carrier failure. The carrier link must be arranged to respond as follows:

(a) Circuit Idle (No Signal)

- Receive—No Current (Spacing)
- Transmit—No Current (Spacing)

(b) Circuit Activated (Signal Transmitted)

- Receive—Current (Marking)
- Transmit—Current (Making)

F. 43B1 Carrier Telegraph Signaling

7.27 As with 43A1, standard drawings indicate that only the 4ESS is capable of using this type facility. The receive DOC unit expects to receive current in the RL- lead followed by ground or a closure on the RLA-/RLB- leads. Its response (acknowledgment) is either a ground on the SLA- lead or a closure on the SLA-/SLB- leads followed by -10V on the SL- lead.

7.28 The 4ESS DOC transceiver transmits a DOC signal over the XYIST lead to the 43B1 data set and receives the acknowledgment over the XYISR lead from the 43B1 data set.

7.29 Normally, the 43B1 data set must be located within 50 feet of the 4ESS DOC transceiver circuit. However, where greater distances occur, a 1A data station (SD-1D148) may be used. The 1A data station must be within 50 feet of the 4ESS DOC transceiver circuit.

G. Data

7.30 Per the 1/1A DOC transceiver drawing, the 1/1A ESS can interface with 108-type data sets. This is done through a data set mounting which is provided as a list number (List 4) from the basic DOC control frame for 1/1A ESS switching systems. This is the J1A083-1 DOC transmitter frame. 108D data sets are used at the DOC transmit end and 108E data sets are used at the DOC receive end. The 1/1A ESS sends a DOC signal by applying a loop closure on the T/R leads and recognizes the acknowledgment signal with a loop closure on the T1/R1 leads.

7.31 The only acceptable data sets for the 4ESS DOC transceiver circuit (per standard drawings) are 43B1, 108D, 108E, 109E, and 109H. The transmit and acknowledgment signals are sent as described in paragraph 7.28.

7.32 It should be noted that there are other types of data sets and facility arrangements which will function properly. Some of these are General Trade products and some provide the capability to transmit more than one signal over the same facility. However, most of these require some deviation from the standard method of facility interconnection described in 1/1A ESS and 4ESS DOC transceiver documentation and in DOC receive unit documentation.

Note: While the 108-type data sets can be ordered by list number for the 1/1A ESS DOC transmitting location, it is preferred that the local telephone company provide this equipment. This will assure proper maintenance procedures for the data equipment.

8. COMMON CHANNEL INTEROFFICE SIGNALING (CCIS) DOC

A General

8.01 CCIS DOC is called SDOC (Selective DOC). This term is appropriate in that SDOC selectively controls different categories of traffic depending upon the DOC response category programmed

into the receiving switching system's software for the particular trunk group described in the SDOC request.

8.02 Table B shows SDOC response categories and the percentage of each type of traffic affected by each category for 4ETS/CCIS and 4ESS only. Normally, response category D is used for interregional trunk groups and response category F is used for intraregional trunk groups.

8.03 Two control options are available with each SDOC response category. These are CANCEL-TO and SKIP. CANCEL-TO will be used in all cases unless the distant regional center authorizes use of the SKIP option.

8.04 The percentages indicated in Table B are generically controlled for each response category. This is true for 4ETS/CCIS and 4ESS locations. However, the response category assignment for individual trunk groups can be altered or initially input in error. Therefore, a periodic check of the SDOC response category for each trunk group is required to ensure the proper control actions during overload situations. The CANCEL/SKIP option should also be checked at the same time.

8.05 Another feature available on CCIS trunk groups is the ability to ignore, or inhibit the response to, incoming DOC signals on an individual trunk group basis. This feature is available for 4ETS/CCIS and 4ESS offices and results in ignoring all CCIS DOC signals (MC1, MC2, and MC3).

8.06 Currently, the only switching systems capable of responding to CCIS DOC signals are 4A/CCIS and 4ESS systems. 1ESS and 1A ESS systems can switch CCIS traffic but are not capable of responding to CCIS DOC signals. The ability to respond to CCIS DOC signals will be included in generic 1/1AE7 for 1/1A ESS systems. Table C shows the CCIS DOC response categories planned for generic 1/1AE7. If the proposed date for conversion to generic 1/1AE7 is not in the near future, the DOC planner for each 1/1A ESS switching system may want to use the hybrid arrangement described in Part 8C in order to respond to DOC signals for CCIS trunk groups.

8.07 As mentioned in paragraph 3.17, CCIS DOC signals are not restricted to down-chain trunk groups. These signals are sent to *all* CCIS connected switching systems regardless of their place in the

network hierarchy. Thus, a toll center switching system could send a CCIS DOC signal to a regional center switching system and effect traffic controls in the regional center.

8.08 There are several advantages in CCIS DOC as compared to conventional DOC arrangements. Some of them are as follows:

(a) CCIS DOC signals travel over the CCIS signaling network and, therefore, do not require additional facilities to transmit DOC signals and receive the associated acknowledgment signals.

(b) Since no additional facilities are required, MC1, MC2, and MC3 signals can all be transmitted to all CCIS-connected switching systems. This results in control action at the receive DOC locations which is much more selective than that obtained by conventional DOC using only one DOC signal.

(c) No additional hardware equipment is required to enable a CCIS switching system to respond to CCIS DOC signals once it is equipped for CCIS signaling. An exception to the previous statement is the 1/1A ESS system not yet equipped with generic 1/1AE7. See paragraph 8.06 and Part 8C of this section.

(d) Since the response categories are generically defined, preprogrammed controls or RT key wiring are not necessary in order to take DOC controls on CCIS trunk groups.

8.09 While conventional DOC responses include the ability to reroute the affected traffic, there are presently no provisions for rerouting traffic in response to CCIS DOC signals. This may be considered a disadvantage when sending DOC signals to subtending offices.

B. Generation of CCIS DOC Signals

8.10 4ESS and 1/1A ESS switching systems (generic 1/1AE7 or later) can transmit CCIS DOC signals. 1/1A ESS systems equipped with generic 1/1AE6 can also transmit CCIS DOC signals if the proper overwrite has been installed. 4 ETS/CCIS can also transmit CCIS DOC signals.

8.11 MC1 and MC2 signals are a result of machine congestion and may result from heavy traffic

or a shortage of equipment and/or real time. The generation of MC1 and MC2 signals for all types of signaling is discussed in paragraphs 4.18, 4.19, and 4.20 for the 4ESS.

8.12 MC3 is not load related. There are two cases in which an MC3 signal may be transmitted. One is when the 1/1A ESS or 4ESS is about to run a phase of software initialization. In this case, the switching system sends its own MC3 signal. Another situation is when the processor for some reason fails to service the CCIS terminal within the expected length of time. In this case, the CCIS terminal sends a PRO (processor outage signal) to the signal transfer point (STP) which, in turn, transmits an MC3 signal for the affected switching system.

C. 1/1A ESS DOC for CCIS Trunk Groups

8.13 As discussed in paragraph 8.06, 1/1A ESS systems not equipped with generic 1/1AE7 cannot respond to CCIS DOC signals. This can cause serious problems where large CCIS trunk groups are involved. Consequently, the DOC planner may want to consider, as an interim arrangement, using an external facility from the transmitting DOC switching system to the 1/1A ESS switching system. Paragraphs 8.14 through 8.20 describe how this might be done. This interim arrangement should not be used for 1/1A ESS locations which will update to generic 1/1AE7 in the near future.

8.14 Since there is no way to key a conventional DOC transmitter from a CCIS overload, MC1 and MC2 cannot be used in this arrangement. However, when an MC3 is transmitted, this signal is sent for all types of signaling (DP, MF, and CCIS). Thus, when MC3 is sent, it does not matter whether the signal is keyed on an MF, DP, or CCIS basis. The result would be the same in any case.

8.15 An exception to this is the situation where the 4ESS system fails to service the CCIS terminal and the STP sends an MC3 for the 4ESS. In this case, the MC3 is transmitted only over the CCIS network and MF and DP signals are not sent. MC3 for MF and DP is sent only when the 4ESS is entering Phase 2, 3, or 4.

8.16 In the 4ESS, the arrangement described in paragraphs 8.14 through 8.20 must key from

an MF or DP trunk group. This group should be one for which no DOC activity is planned. The group should be entered in software as DOC equipped for MC3 only and a DOC transmit unit must be assigned in the normal manner.

8.17 The facility used can be any of those discussed in Part 7 and the signal is received by the standard DOC receive unit (SD-27970).

8.18 In the 1/1A ESS, a preprogrammed control is built for the CCIS trunk group taking the desired control in response to an MC3 signal. For CCIS trunks, this would be CANCEL-TO 100 percent for all traffic. However, since this arrangement uses a preprogrammed control, all preprogrammable control options are available.

8.19 The hardware and wiring requested and scan point assignments used in the 1/1A ESS are the same as those discussed in Part 5 for 1/1A ESS.

8.20 Several items to consider concerning this arrangement are as follows:

(a) The trunk group used in the 4ESS can be any MF or DP group on which there are no plans to implement DOC.

(b) The trunk group used in the 4ESS software is different from the group in the 1/1A ESS that is being controlled by the DOC signal. Therefore, if a problem develops and the proper acknowledgment is not returned to the 4ESS, the 4ESS will print DOC acknowledgment failures on the surrogate group and not on the CCIS group. This could cause confusion if proper records are not kept.

(c) No DOC signal will be sent for duplex CCIS link failures or for any MC3 signals initiated by the STP.

(d) Equipment, facility, and software requirements for this arrangement are the same as for a normal MF or DP DOC circuit.

(e) With this arrangement, the DOC response is not limited to the generically defined CCIS response to MC3 signals. Also available are SKIP and REROUTE controls if desired.

CONTROL TAKEN IN B OFFICE

B - A TRUNK GROUP = IMMEDIATE RR 100% DAR TO B - Z GROUP

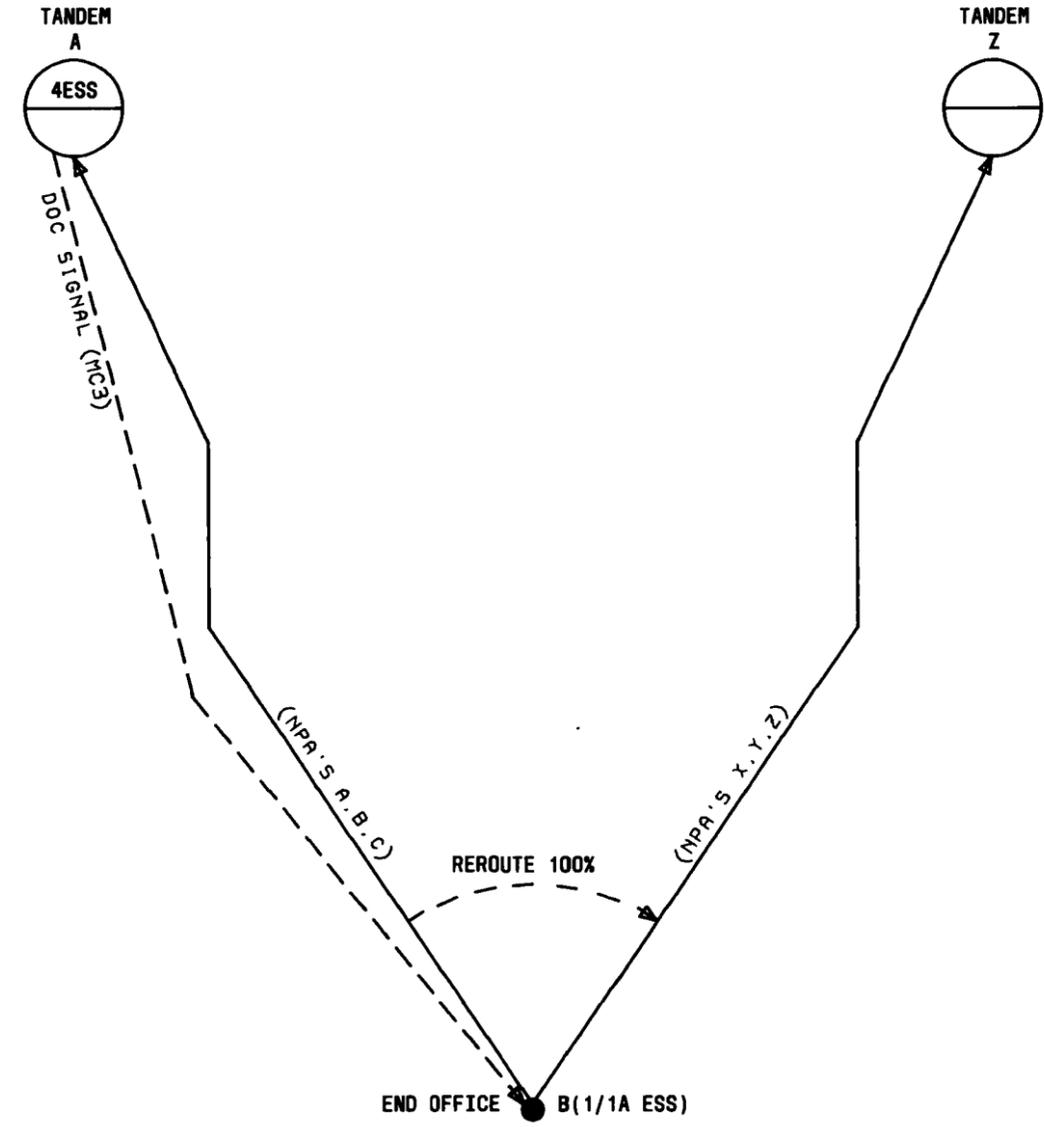


Fig. 1—DOC Example—Dual Home DDD (3.20-3.23)

CONTROL TAKEN IN B OFFICE

B - A TRUNK GROUP = CANCEL TO 100% DAR

B TO DUMMY TRUNK GROUP = REGULAR OR IMMEDIATE REROUTE 50% DAR TO B - Z GROUP

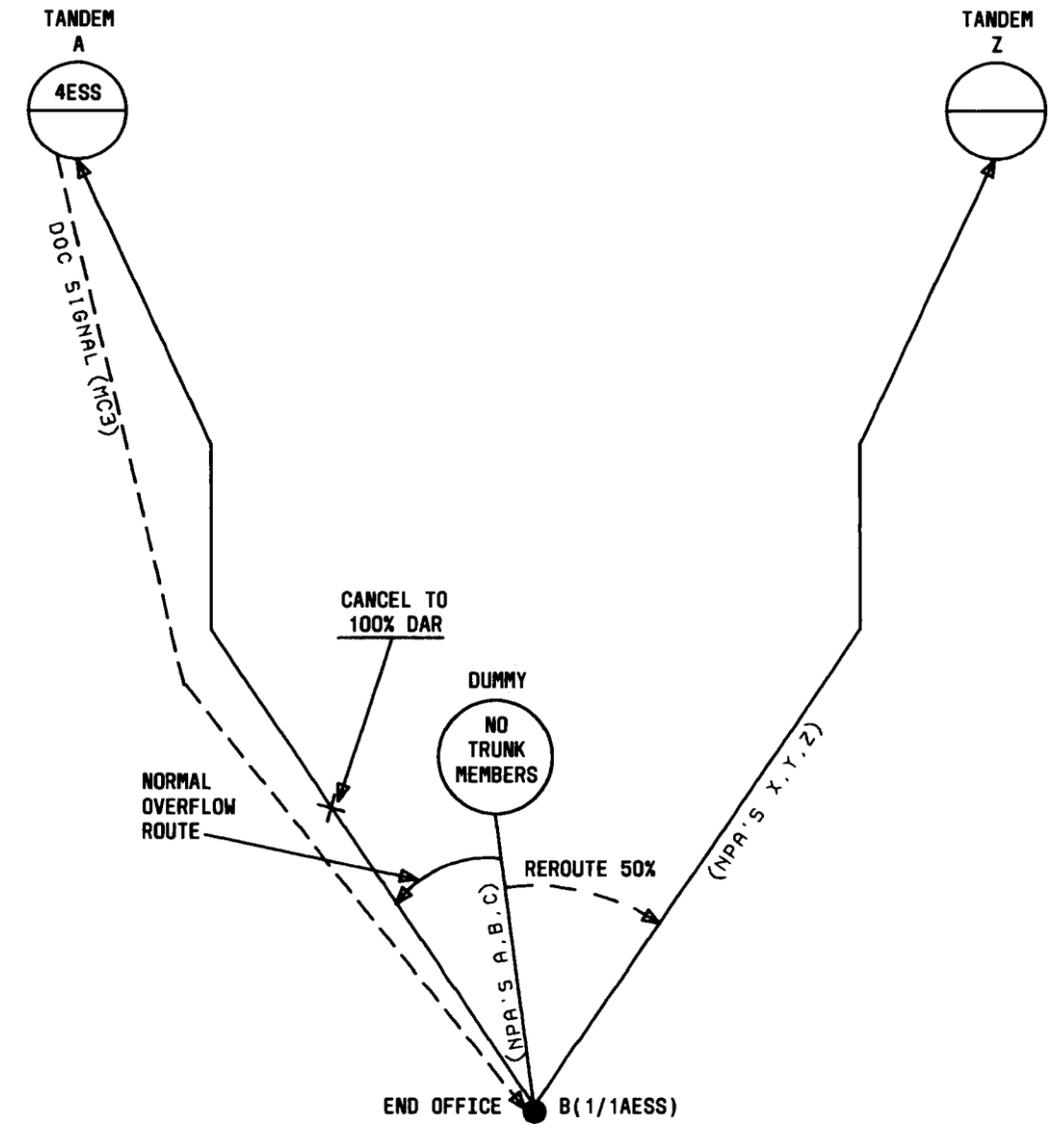


Fig. 2—DOC Example—Dummy Group Usage (3.20-3.22)

CONTROLS TAKEN IN B OFFICE

B - A (TSPS) TRUNK GROUP = IMMEDIATE REROUTE 100% DAR TO B - Z GROUP
B - A (DDD) TRUNK GROUP = IMMEDIATE REROUTE 100% DAR TO B - Z GROUP

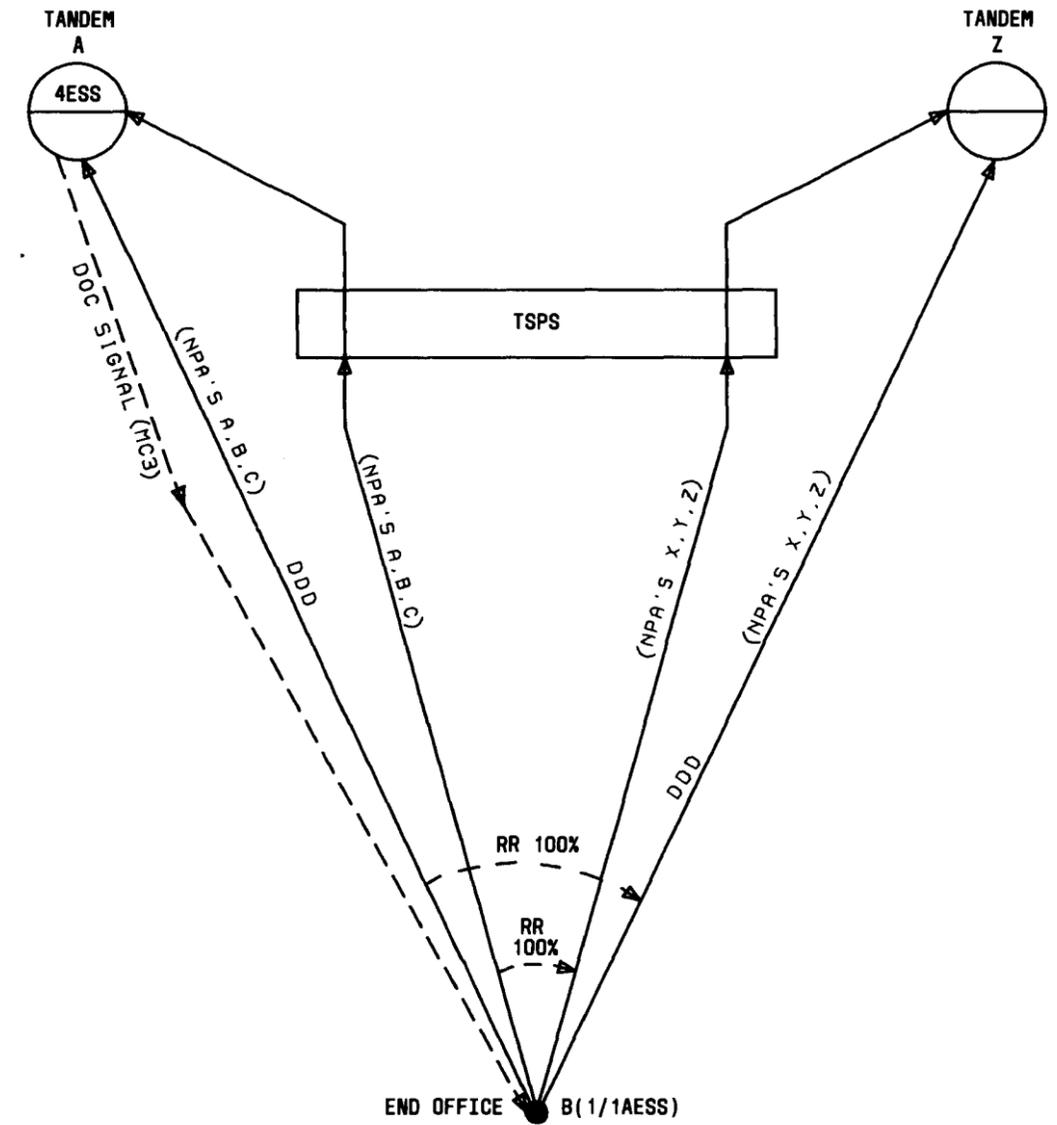


Fig. 3—DOC Example—TSPS and DDD (3.23)

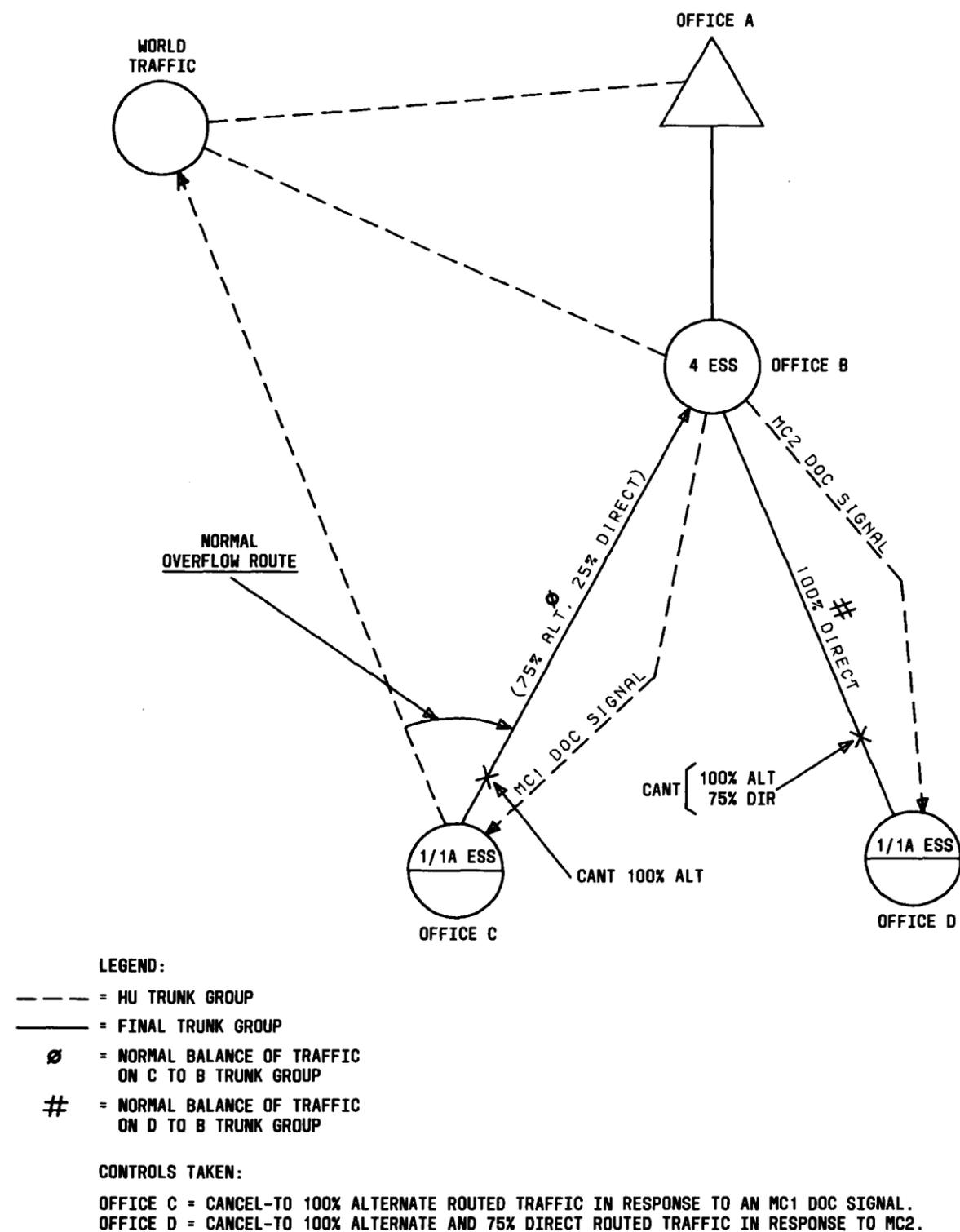
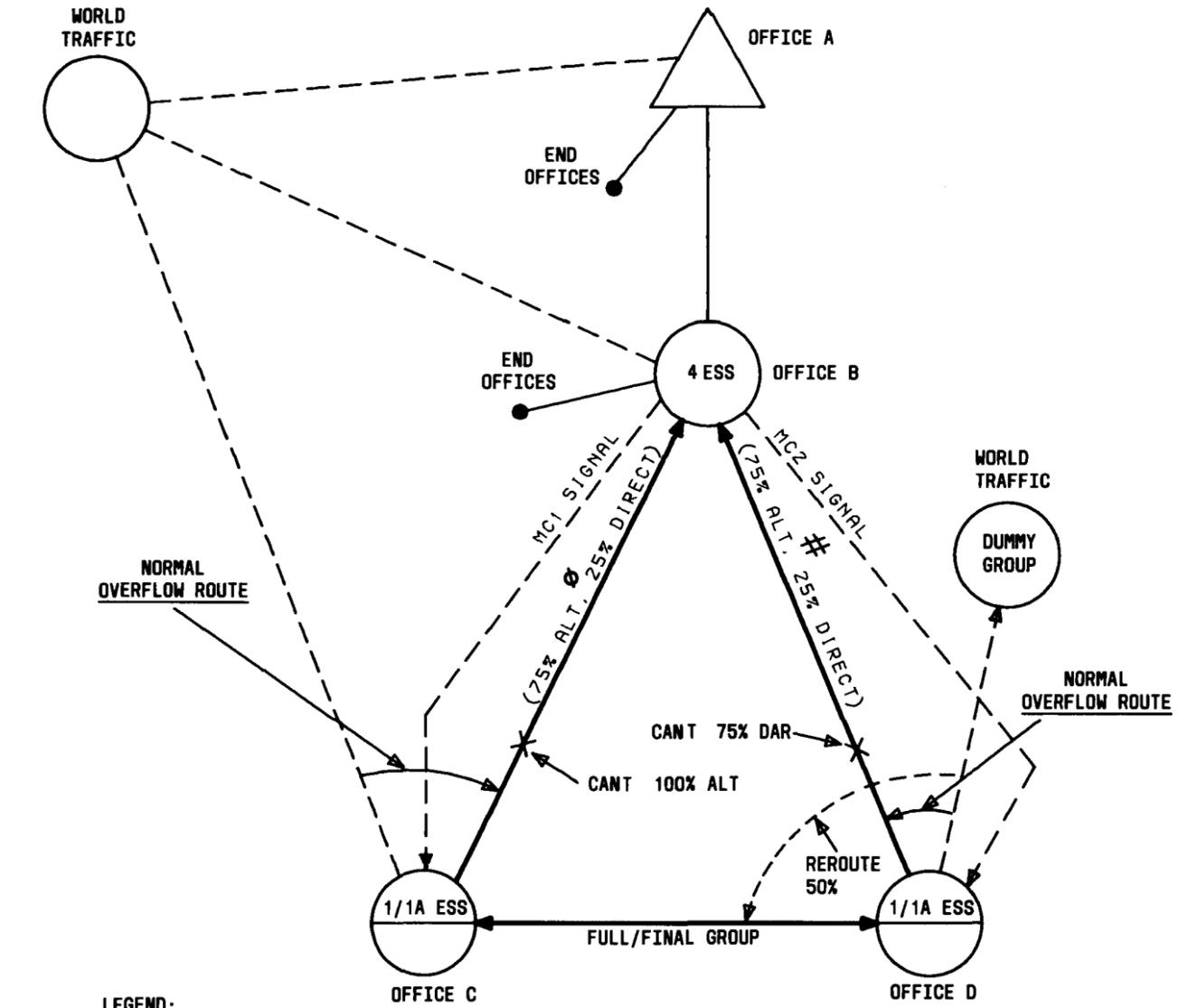


Fig. 4—DOC Congestion Signals —Cancellation Controls (3.27-3.29)



- LEGEND:**
- = HU TRUNK GROUP
 - = FUL/FINAL TRUNK GROUP
 - ∅ = NORMAL BALANCE OF TRAFFIC ON C TO B TRUNK GROUP
 - # = NORMAL BALANCE OF TRAFFIC ON D TO B TRUNK GROUP

CONTROLS TAKEN:

OFFICE C = CANCEL-TO 100% ALTERNATE ROUTED TRAFFIC IN RESPONSE TO AN MC1 DOC SIGNAL.

OFFICE D = CANCEL-TO 75% DIRECT AND ALTERNATE ROUTED TRAFFIC IN RESPONSE TO MC2.

= REROUTE 50% (IMMEDIATE OR REGULAR) DAR FROM D "DUMMY" GROUP TO D TO C TRUNK GROUP.

Fig. 5—DOC Congestion Signals—Cancellation and Reroute Controls (3.27, 3.29)

EQUIPMENT REQUIREMENTS

DOC TRANSMIT

1/1A ESS

EQUIPMENT	LIST/WIRING	FACILITIES (Note 7)		
		LOOP	E&M	DATA
J-1A083A-1 (DOC Transmitter Frame)	1 (Note 1)	✓	✓	✓
	2 (Note 2)	✓	✓	✓
	3 (Note 3)	✓	✓	✓
	4 (Note 4)			✓
	5 (Note 5)			✓
SD-99774-01 (E&M Applique Circuit)	(Note 6)		✓	

Note 1: List 1 provides the equipment required for:

- (a) Transmitting a total of 16 MC1 or MC2 DOC signals or any mix of MC1 and MC2 signals not totaling more than 16 (J-1A083AB).
- (b) Transmitting a total of 32 MC3 DOC signals (J-1A083AC).
- (c) A DOC control unit mounted in the DOC transmitter frame (J-1A083AF).
- (d) Does not supply facility-related equipment (See Note 7).

Note 2: List 2 provides equipment required for transmitting an additional 16 MC1 or MC2 DOC signals or a mix as described in Note 1(a). A maximum of 3 list 2s can be provided. This gives a maximum of 64 MC1 or MC2 signals or any mix resulting in a total of 64 or less (J-1A083AB).

Note 3: List 3 provides one network management indicator circuit. A maximum of eight list 3s can be provided (J-1A083AE).

Note 4: List 4 provides equipment required for one data set mounting capable of housing eight 108-type data sets (J-1A083AH, list 1). It also provides one 108E data set (J-1A083AH, list 2). A maximum of two list 4s can be ordered.

Note 5: List 5 provides one 108E data set (J-1A083AH, list 2). A maximum of seven list 5s can be ordered for each list 4.

Note 6: An E&M applique circuit is required for each MC1, MC2, or MC3 DOC signal which will be using E&M signaling to the receive DOC switching system.

Note 7: The 1/1AESS can transmit DOC signals over three types of facilities. A check (✓) indicates the type facility a particular list number or piece of equipment works with. Lists 1, 2, and 3 in the DOC transmitter frame are basic DOC components required with all types of facilities. Signaling considerations are:
Balanced Loop — No equipment required in addition to lists 1, 2, and 3 unless loop resistance exceeds 6000 Ω; then must go to E&M signaling described below.

E&M — Facilities using E&M signaling (balanced loop, "T", CXR, etc) must also use an E&M applique circuit (SD-99774-01).

Data — The DOC transmitter is capable of working with 108-type data sets if list 4 (and list 5, if necessary) is provided. A 108D data set is required on the receiving end of the facility.

Fig. 6—Equipment Requirements—1/1A ESS DOC Transmit (4.16)

EQUIPMENT REQUIREMENTS

DOC TRANSMIT

4ESS

EQUIPMENT	LIST	FACILITIES (NOTE 11)			
		LOOP	E&M	DATA	43A1
J-4A011A-01 (NM Display & Cont. Frame)	1 (Note 1)	✓	✓	✓	✓
	2 (Note 2)	✓	✓	✓	✓
	4 (Note 3)	✓	✓	✓	✓
	8 (Note 4)				✓
	9 (Note 5)				✓
	12 (Note 6)	✓	✓	✓	✓
	13 (Note 7)	✓	✓	✓	✓
SD-99774-01 E&M Applique Unit	(Note 8)	(Note 10)	✓		

Note 1: List 1 provides the following equipment and capabilities:

- (a) One DOC transmitter unit (J-4A011AA-1, List 1) equipped for transmitting MC1, MC2, and MC3 DOC signals on two trunk subgroups and receiving the returned acknowledgment signals (Unit "O") (See Note 9).
- (b) One DOC receiver unit (J-4A011AA-1, List 1) equipped for receiving MC1, MC2, and MC3 DOC signals on two trunk subgroups and transmitting the required acknowledgment signals (Unit "4").
- (c) One control panel (J-4A011AC-1, List 1)
- (d) One network management remote and distribution unit (J-4A011AB, List 1)

Note 2: List 2 furnishes the equipment required in addition to List 1, 4, 12, or 13 to provide for an additional two trunk subgroups to transmit MC1, MC2, and MC3 DOC signals and receive the associated acknowledgment signals. A maximum of 28 List 2s may be ordered (7 per List 1, 4, 12, and 13) (J-4A011AA-1, List 2) (See Note 9).

Note 3: List 4 provides one DOC transmitter unit (J-4A011AA-1, List 1) equipped for transmitting MC1, MC2, and MC3 DOC signals on two trunk subgroups and receiving the returned acknowledgments (Unit "1") (See Note 9).

Note 4: List 8 provides the following equipment and capabilities:

- (a) One 43A1 carrier telegraph interface unit capable of transmitting six machine congestion levels and receiving six acknowledgment signals. These six levels could be MC1, MC2, and MC3 on two trunk subgroups or a single machine congestion level on six separate trunk subgroups (J-4A011AG-1, List 1).

Note 5: List 9 provides an additional 43A1 carrier telegraph interface unit (J-4A011AG-1, List 1) with the same capabilities described in Note 4. A maximum of nineteen List 9s may be ordered.

Note 6: List 12 provides one DOC transmitter unit (J-4A011AA-1, List 1) equipped for transmitting MC1, MC2, and MC3 DOC signals on two trunk subgroups and receiving the returned acknowledgment signals (Unit "2") (See Note 9).

Note 7: List 13 provides one DOC transmitter unit (J-4A011AA-1, List 1) equipped for transmitting MC1, MC2, and MC3 DOC signals on two trunk subgroups and receiving the returned acknowledgment signals (Unit "3") (See Note 9).

Note 8: One E&M applique circuit (SD-99774-01) is required for each machine congestion signal using E&M signaling.

Note 9: Each DOC transceiver unit provided by J-4A011AA-1 List 1 and/or List 2 is capable of transmitting MC1, MC2, and MC3 on two trunk subgroups. The 4ESS will transmit each of these signals and expects an acknowledgment for each signal regardless of whether they are wired to facilities to distant offices or not. Therefore, if MC1

is not used on a particular trunk subgroup which is using other MC levels, the output for MC1 must be looped to the input on that DOC transceiver unit to provide the acknowledgment expected by the 4ESS. Otherwise, the 4ESS will print out a DOC acknowledgment failure. This applies to all unused levels on the DOC transceiver units.

Note 10: As indicated in paragraph 4.25(b), the loop resistance must be less than 4500 Ω. If this is not true, E&M signaling must be used. This requires an E&M applique circuit (SD-99774-01).

Note 11: The check marks (✓) indicate the type signaling each type of equipment is capable of working with. Paragraph 4.25 lists the standard facility arrangement possible for 4ESS locations. However, there are other methods available. These are discussed in Part 7.

Fig. 7—Equipment Requirements—4ESS DOC Transmit (4.27)

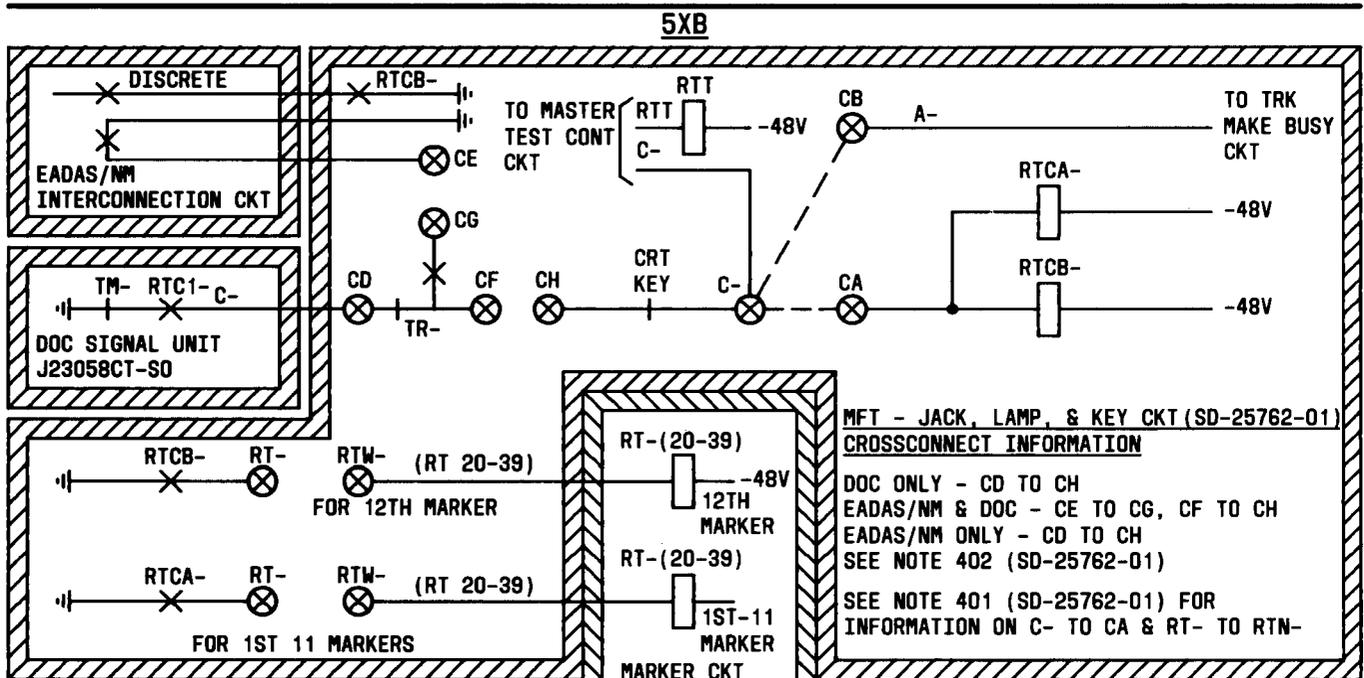
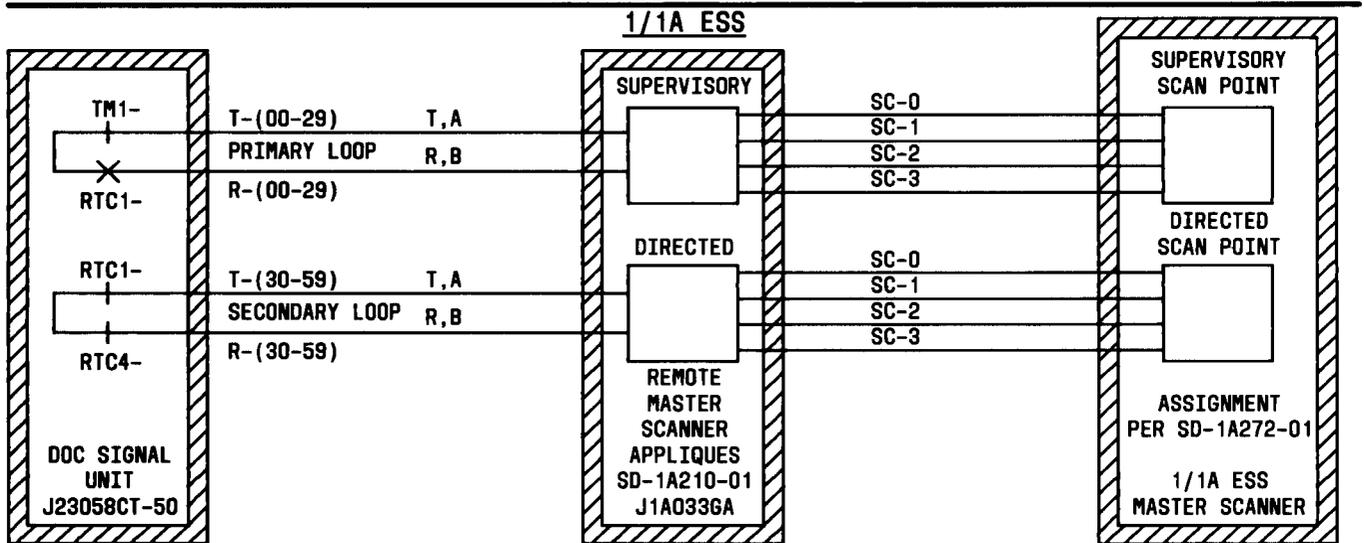
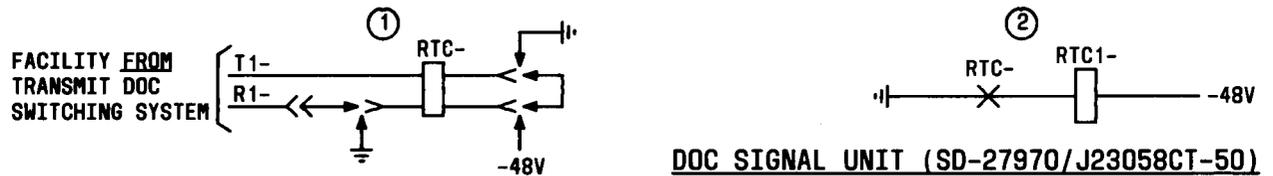


Fig. 8—DOC Activation Paths—1/1A ESS and 5XB Receive DOC (5.10, 6.10)

1. OUTPUT MESSAGE FORMAT¹

NM13 [6]

NM13 aaaa bbbb

2. EXPLANATION OF MESSAGE

This message indicates a failure or restoral of the dynamic overload control (DOC) circuit (SD-27970-01) of the connection between the DOC circuit and associated scan points. Detection of a failure in the circuit or a detection of a failure in the connection will cause a minor alarm to be sounded.

3. EXPLANATION OF VARIABLE FIELD

aaaa bbbb = FCGF PPxx (where xx equals network management trunk group control preprogram number). A false cross or ground condition exists between the DOC circuit and the scan points associated with the preprogram number identified by xx. This condition was detected by network management audit 32. This preprogram cannot be controlled automatically via DOC signals until the failure is cleared.

RST PPxx The false cross or ground condition described above has been cleared and the trunk group control preprogram identified by xx can be controlled automatically via DOC signals.

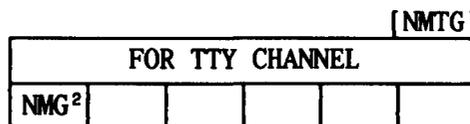
INT FAIL The DOC circuit is receiving a false signal. This message will be followed hourly by output message NM13 - TBL DOC option as described below until the trouble is cleared.

TBL DOC If NM13 - INT FAIL option was printed, this message is printed hourly until the trouble is cleared.

INT OK The trouble which caused the DOC circuit to receive a false signal has been cleared.

4. ACTION TO BE TAKEN

Proceed in accordance with local practices.



No. 1 ESS 2-WIRE

ISSUE 26

OM-1A001-C1003

Fig. 9—NM13 Output Messages—1/1A ESS (5.11)

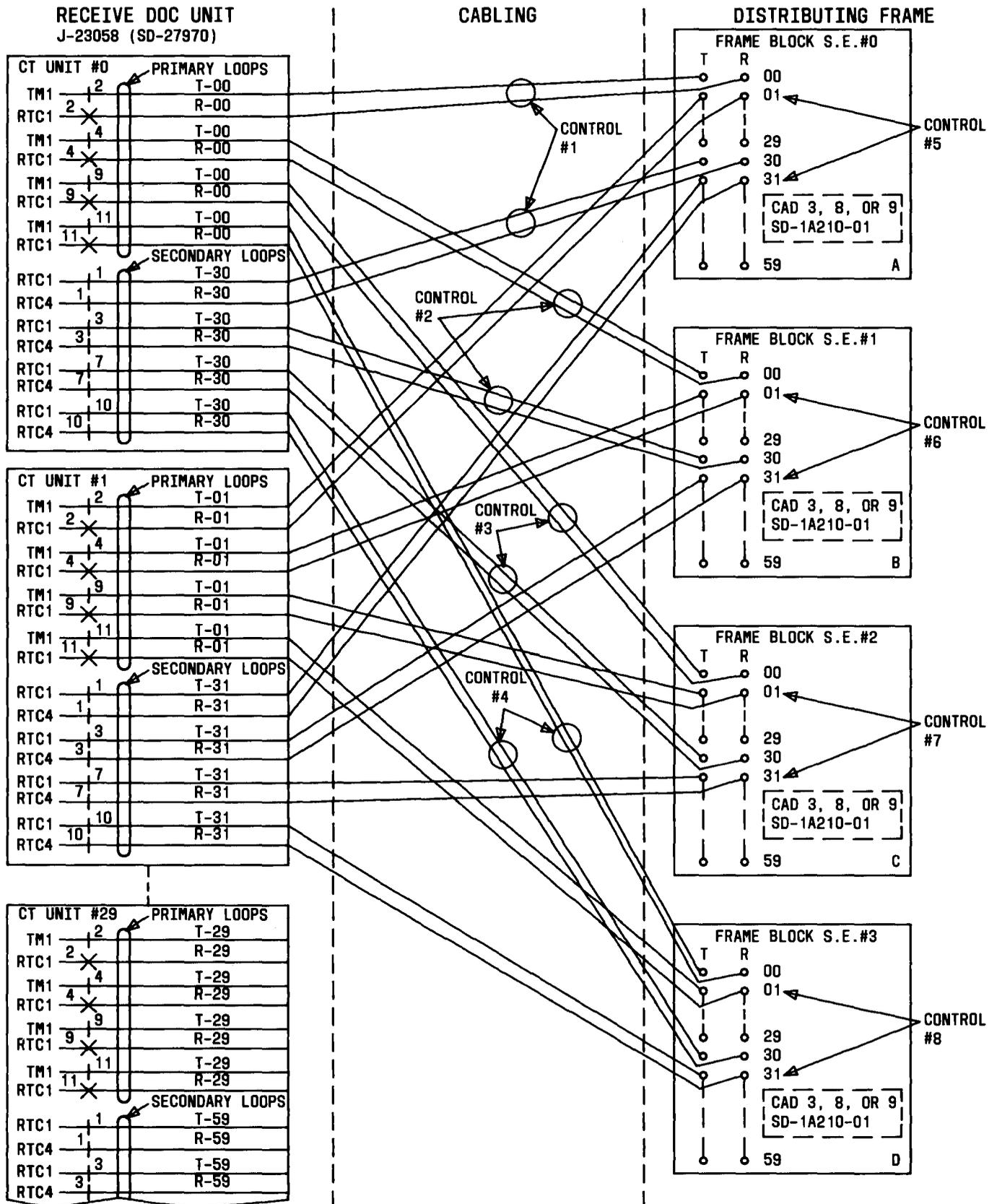


Fig. 10—CT Frame Termination for 1/1A ESS (5.14, 5.16)

DISTRIBUTING FRAME | CROSS-CONNECTIONS | DIST. FRAME | CABLING | REMOTE SCANNER APPLIQUES | CABLING | 1/1A ESS MASTER SCANNER

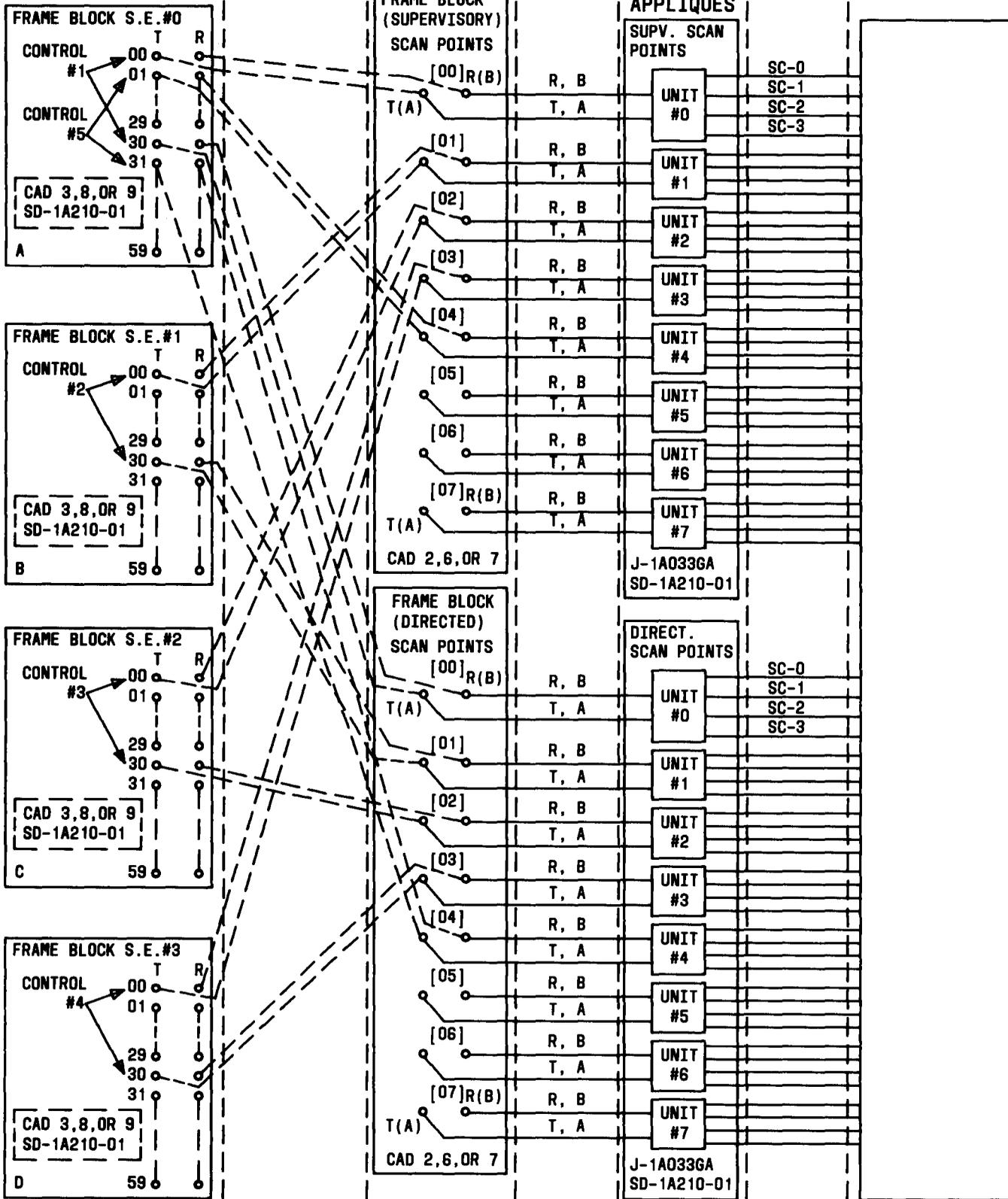


Fig. 11—Receive DOC Cross-Connection for 1/1A ESS (5.14, 5.16)

EQUIPMENT REQUIREMENTS

RECEIVE DOC					
1/1AESS					
EQUIPMENT	LIST/WIRING	QUANTITY (Note 1)	43A1	43B1	MAX. CTRLS (Note 1)
SD-27970-01 (DOC)					
J-23058CT-50 (Signal Unit)	1, 2, WA	1 Each	L3	L4	4
J-23058BP-50 (Alarm Unit)	2, WA	1 Each	—	L4	—
SD-1A210-01					
J1A033GA (Remote Mstr. Scan Applique)	1	2 (Note 2)	—	—	8
SD-99774-01 E&M Applique Unit					
		(Note 5)			

Note 1: The quantity of "CT" units to be provided depends upon how many controls are to be activated by each received DOC signal. With special instruction to the WECO engineer, one "CT" unit can activate a maximum of four controls from a single received DOC signal. Figures 2 and 3 show how this may be done (see Note 3).

Note 2: One of these units must be wired to supervisory scan points and the other must be wired to directed scan points. Two of these units provide a capability for activating eight controls. Following is a list of quantities required for varying numbers of controls and receive DOC signals:

- 1 Signal, 1 Control = 2 Applique Units (1 Supv., 1 Directed)
- 1 Signal, 4 Controls = 2 Applique Units (1 Supv., 1 Directed)
- 1 Signal, 5 Controls = 2 Applique Units
- 1 Signal, 8 Controls = 2 Applique Units
- 2 Signals, 4 Controls each = 2 Applique Units
- 2 Signals, 8 Controls each = 4 Applique Units (2 Supv., 2 Directed)

Note 3: The quantities shown above are for one received DOC signal, such as "MC3". If other DOC signals are to be received (MC1, MC2), the number of "CT" units has to be increased accordingly. Also, if more than four controls are to be activated with each received DOC signal, the number of "CT" units per receive DOC signal has to be increased by one for each four controls. See below:

- 1 Signal, 4 Controls = 1 "CT"
- 1 Signal, 5 Controls = 2 "CT"s
- 1 Signal, 8 Controls = 2 "CT"s
- 2 Signals, 4 Controls each = 2 "CT"s
- 2 Signals, 8 Controls each = 4 "CT"s

See Figures 1, 2, and 3.

Note 4: Different wiring options are required in the receive DOC unit for different types of facilities. Figure 16 lists the various incoming and outgoing options for SD-27970.

Note 5: An E&M applique circuit is required for each DOC signal received over E&M facilities if the receive DOC unit (SD-27970) is located in 1/1A ESS quarters. Otherwise, it is not required. See paragraphs 7.19 and 7.21.

Fig. 12—Equipment Requirements—1/1A ESS DOC Receive (5.15)

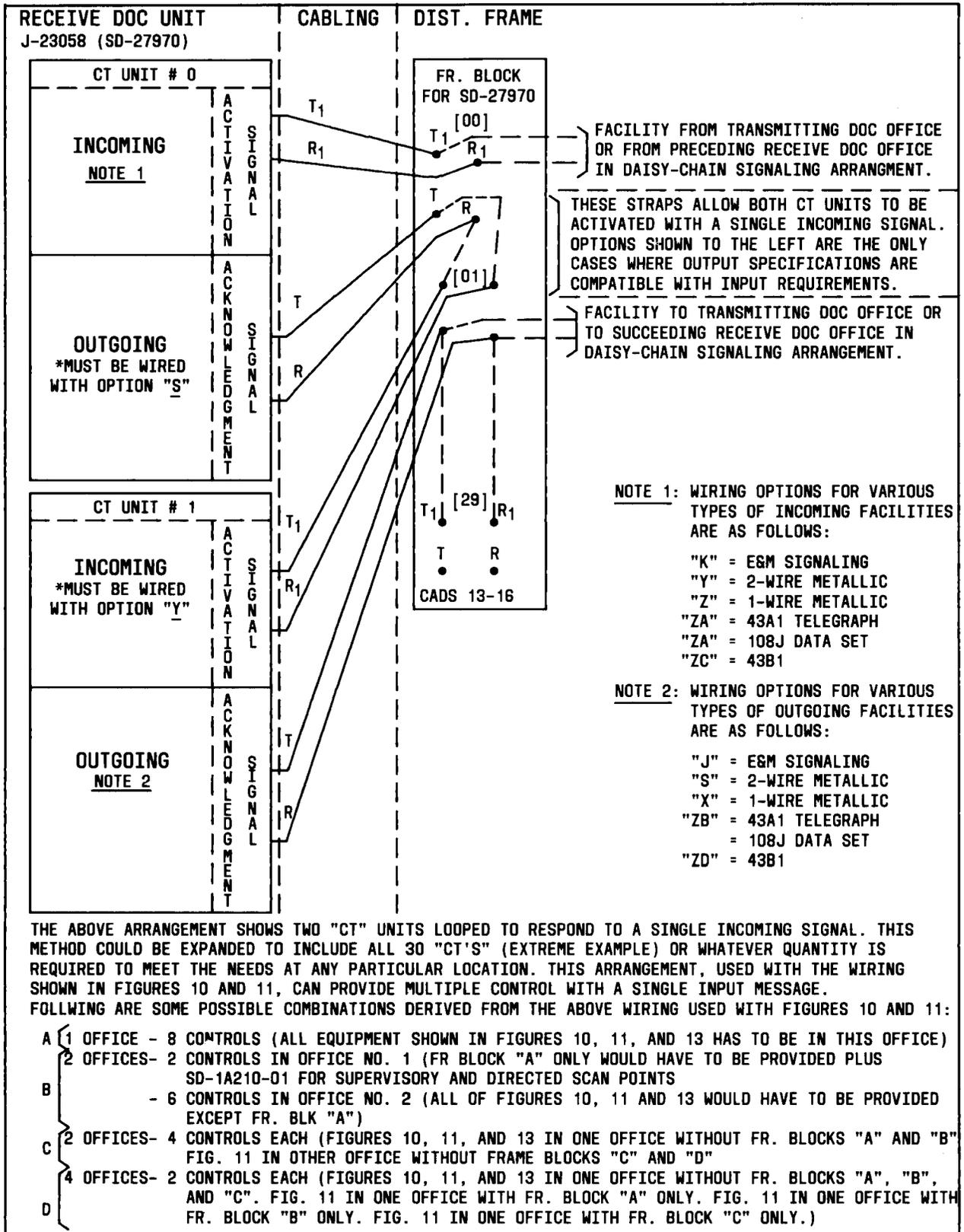


Fig. 13—CT Looping Arrangement (SD-27970) (5.16, 6.18)

EQUIPMENT REQUIREMENTS

RECEIVE DOC

5XB

EQUIPMENT	LIST/WIRING	QUANTITY	43A1	43B1	MAX. CTRLS
<u>DOC</u>					
SD-27970-01					
J-23058CT-50 (Signal Unit)	1, 5, WB	1 Each (Note 1)	L3	L4	1 (Note 6)
J-23058BP-50 (Alarm Unit)	2, 3	1 Each	—	L4	—
<u>5XB</u>					
J-23252BS-50 (RTE XFER Cont. Unit)	1, B	1 (Note 2)			20
	2	(Note 2, 3)			(Note 2, 3)
	3	(Note 4)			—
	4	(Note 2, 5)			(Note 2, 5)
J-287605L-50 (Supl. RTE XFER Unit)	1	(Note 7)			(Note 7)
	2	1 Per Each L1			—
J-28153AR-50 (Go Relay Unit)	1	1 (Note 2)			—
	2	(Note 8)			—
J-23255BD-50 (Supl. Relay Unit E)	1, 3	1 Each (Note 2)			—

Note 1: One "CT" unit is required if only one DOC signal is to be received, such as "MC3". If other DOC signals are to be received (MC1, MC2), the number of "CT" units has to be increased accordingly (see Note 6).

Note 2: If the switching system being equipped for receive DOC is presently arranged for EADAS/NM control, these units may already be installed.

Note 3: List 1 provides for routes 20 and 21. One List 2 should be provided for each additional route requiring transfer (routes 22-39) up to a maximum of 18 List 2s.

Note 4: Four markers are already properly equipped for List 3. One List 2 should be provided for each two markers up to a maximum of four List 2s. This will fully equip an office having twelve completing markers.

Note 5: One List 4 is required for each two routes requiring transfer for routes 20-39 up to a maximum of 10 List 4s.

Note 6: One "CT" is designed to operate one "RT" relay. If activation of more than one control is required on the receipt of a single DOC signal, Method 1 or 2, as discussed in the 5XB receive DOC part of this section, may be used with the resulting penalty of: (a) ordering additional "CTs" (Method 1) or; (b) loss of selective activation by EADAS/NM or; (c) allocation of "RT" relays to EADAS/NM and DOC (Method 2).

Note 7: Specify one List 1 per completing marker for each ten supplementary route transfer relays required (maximum two List 1s per marker).

Note 8: One List 2 is required for each marker, up to a maximum of ten List 2s.

Note 9: In a 5XB switching system with the full complement of combined and/or completing markers, the following equipment would be required to provide automatic DOC control for the maximum 20 RT relays:

	Qty
J-23252B5-50, List 1,B	1
List 2	18
List 3	4
List 4	10
J-28760SL-50, List 1	24
List 2	24
J-28153AR-50, List 1	1
List 2	10
J-23255BD-50, List 1, 3 (Note 2 still applies)	1

Fig. 14—Equipment Requirements—5XB DOC Receive (6.22)

5XB ETS
RECEIVE DOC

EQUIPMENT	LIST/WIRING	QUANTITY	43A1 (NOTE 2)	43B1 (NOTE 2)	MAXIMUM CONTROLS
DOC					
SD-27970-01					
J-23058CT-50 (SIGNAL UNIT)	1, 5, WB	(NOTE 1)	L3	L4	(NOTE 1)
J-23058BP-50 (ALARM UNIT)	2, 3	1	-	L4	-
5XB					
J-23252BS-50 (RTE, XFER, CONT, UNIT)	1, B	1 (NOTE 2)			
	2	(NOTE 2, 3)			
	4	(NOTE 2, 4)			

NOTE 1: ONE "CT" UNIT IS REQUIRED IF ONLY ONE DOC SIGNAL IS TO BE RECEIVED, SUCH AS "MC3". IF OTHER DOC SIGNALS ARE TO BE RECEIVED (MC1, MC2), THE NUMBER OF "CT" UNITS HAS TO BE INCREASED ACCORDINGLY. IF MORE THAN ONE PREPROGRAMMED CONTROL MUST BE ACTIVATED BY ONE RECEIVE DOC SIGNAL, "CA" PUNCHINGS MAY BE STRAPPED TOGETHER ("T" LEADS). SEE FIGURE BELOW.

NOTE 2: IF THE SWITCHING SYSTEM BEING EQUIPPED FOR RECEIVE DOC IS PRESENTLY ARRANGED FOR EADAS/NM CONTROL, THESE UNITS MAY ALREADY BE INSTALLED.

NOTE 3: LIST 1 PROVIDES FOR ROUTES 20 & 21. ONE LIST 2 SHOULD BE PROVIDED FOR EACH ADDITIONAL ROUTE REQUIRING TRANSFER (ROUTES 22-39) UP TO A MAXIMUM OF 18 LIST 2'S.

NOTE 4: ONE LIST 4 IS REQUIRED FOR EACH TWO ROUTES REQUIRING TRANSFER FOR 20-39 UP TO A MAXIMUM OF 10 LIST 4'S.

NOTE 5: ONE "CT" UNIT CAN ACTIVATE CONTROLS IN A MAXIMUM OF 8 5XB-ETS' IN THE SAME BUILDING

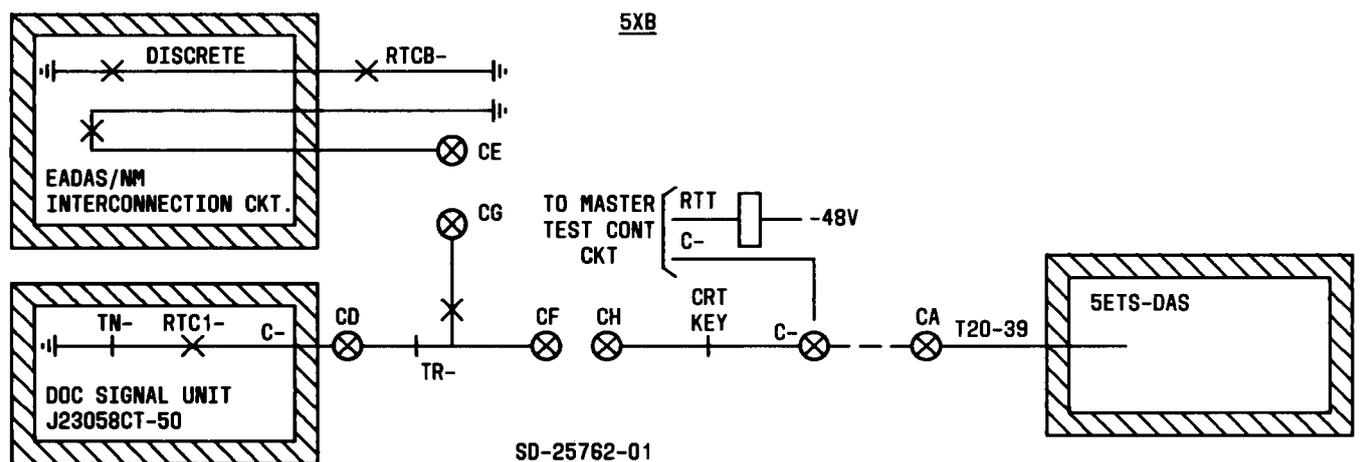
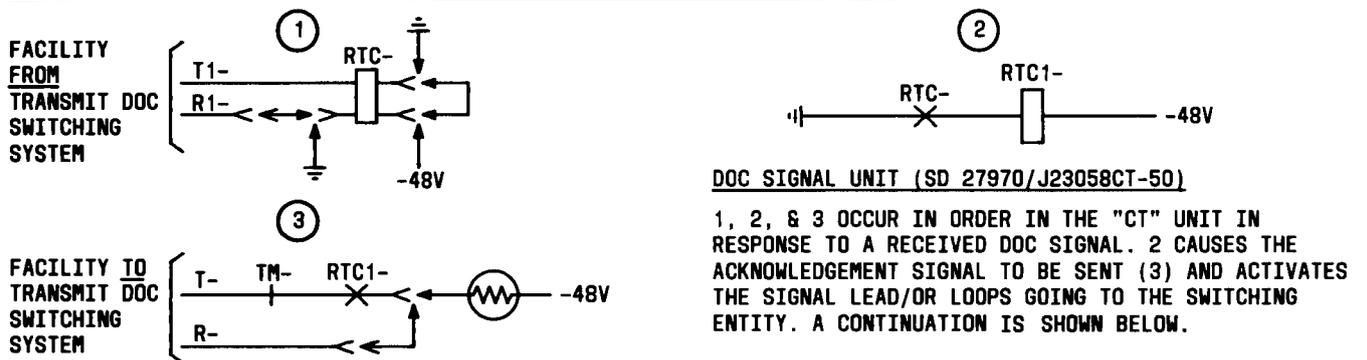


Fig. 15—5XB ETS Cross-Connection for Receive DOC (6.25)

RECEIVE OPTIONS (SD-27970-01)

TYPE SIGNALING	OPTION	MUST RECEIVE
E&M	K	Ground on E-lead
Balanced Loop	Y	Loop closure on T1-/R1-leads
1-Wire Metallic	Z	-48V on T1-lead
43A1 Telegraph	ZA	Current in T1-/R1-leads
108 Data Set	ZA	Current in T1-/R1-leads
43B1	ZC	Current in RL-lead of VFCD interface, followed by either ground, where option F is applied, or a closure on leads RLA-/RLB-, where apparatus Fig. 5 is provided.

TRANSMIT OPTIONS (SD-27970-01)

TYPE SIGNALING	OPTION	SIGNAL TRANSMITTED
E&M	J	-48V on the E-lead
Balanced Loop	S	Closure on the T-/R-leads
1-Wire Metallic	X	-48V on T-lead
43A1 Telegraph	ZB	Closure on the T-/R-leads
108 Data Set	ZB	Closure on the T-/R-leads
43B1	ZD	Either ground on the SLA-lead, where option F is applied, or a closure on leads SLA-/SLB-, where apparatus Fig. 5 is provided, followed by -10V on the SL-lead of the VFCD interface.

Fig. 16—Facility Options for SD-27970 (7.04, 7.18)

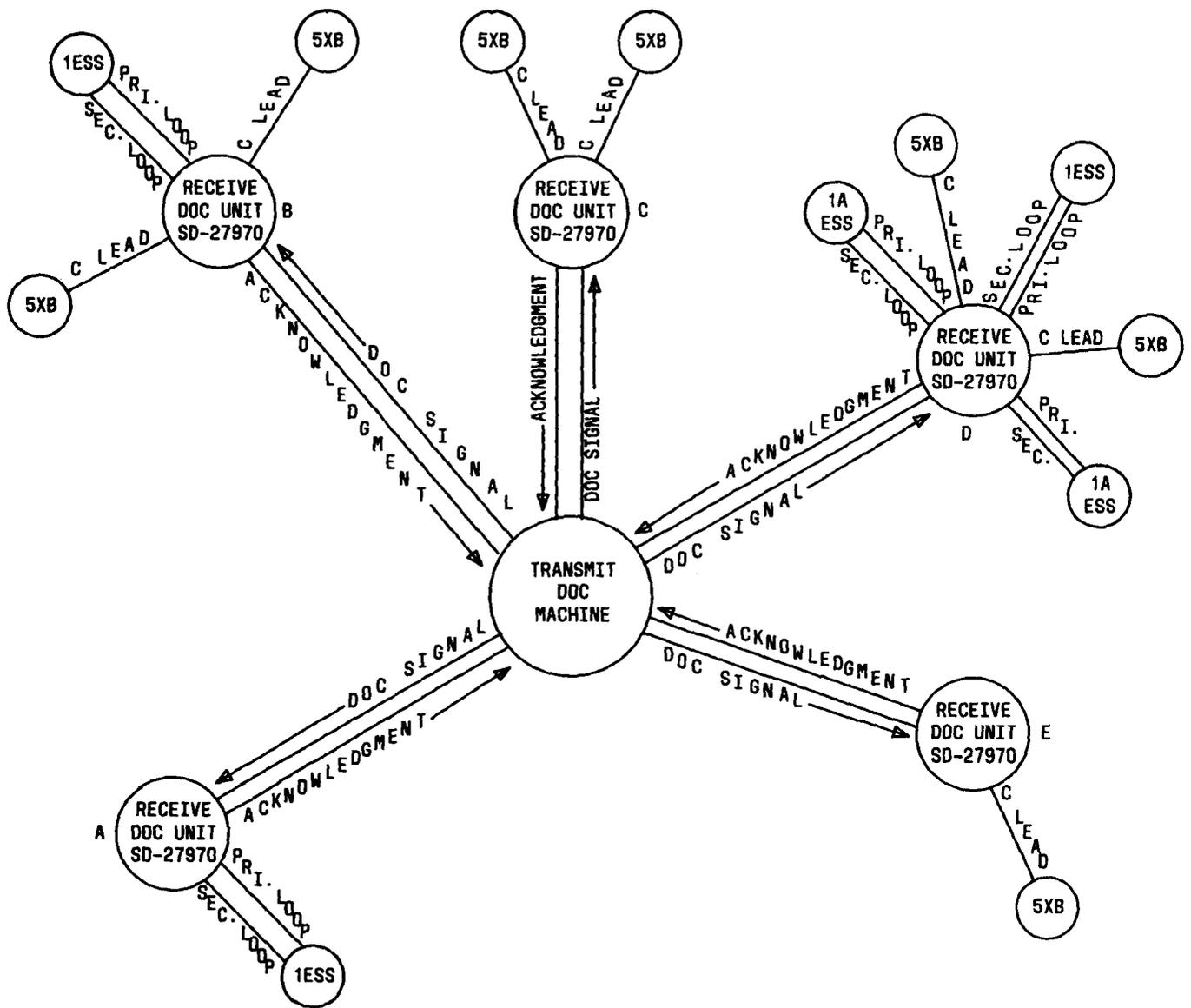


Fig. 17—Radial Signaling (7.07, 7.09, 7.13)

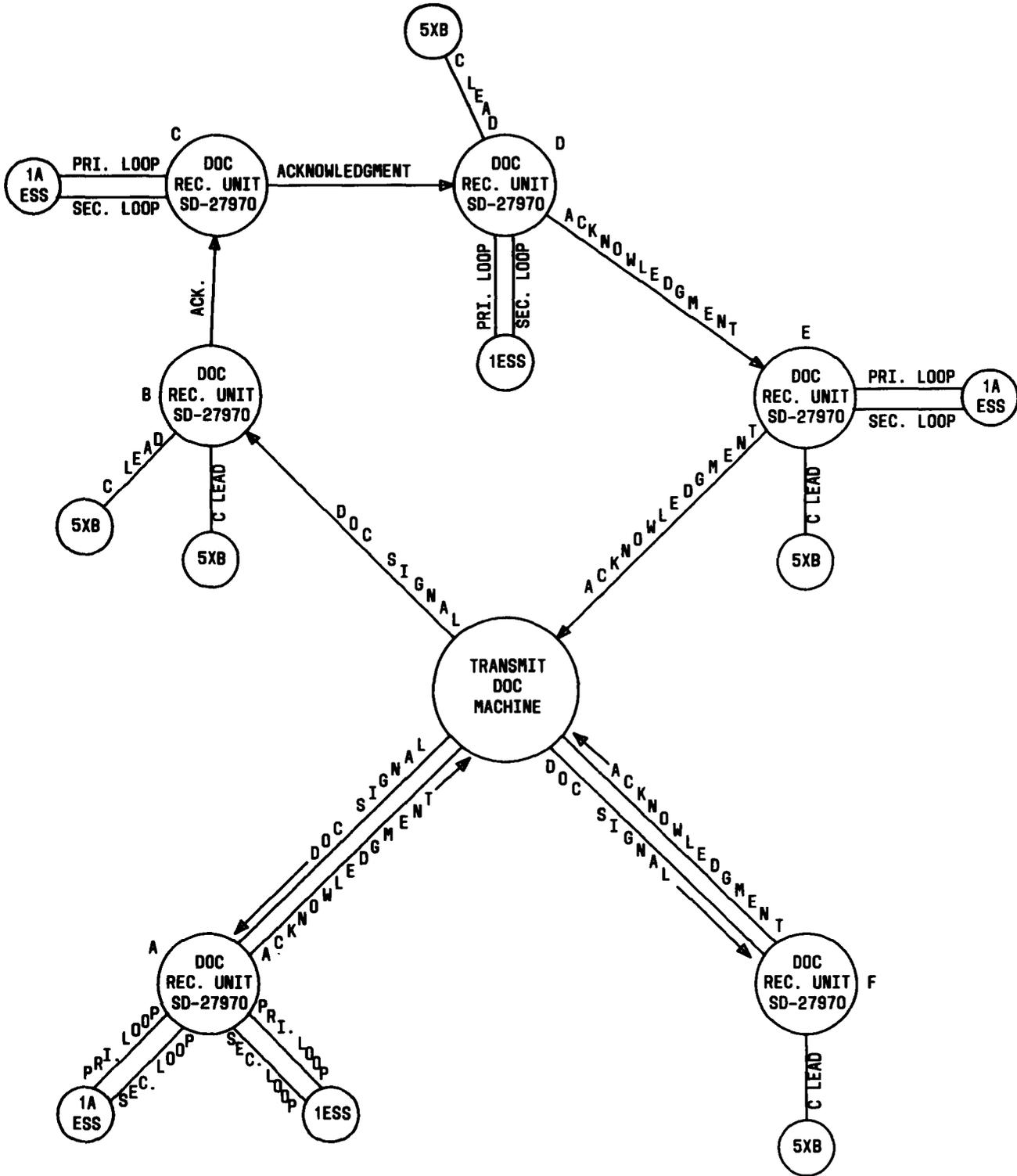


Fig. 18—Daisy-Chain Signaling (7.11, 7.17)

TABLE A
1/1A ESS OVERRIDE CAPABILITIES

		PP				FLEX			
		MAN		AUTO		MAN		AUTO	
		TO	FROM	TO	FROM	TO	FROM	TO	
PP	MAN	TO	O	O	M	M	O	O	M
	MAN	FROM	X	O	M	M	O	O	M
	AUTO	TO	X	X	P	P	B	A	B
	AUTO	FROM	X	X	X	P	B	A	B
FLEX	MAN	TO	X	X	X	X	O	O	M
	MAN	FROM	X	X	X	X	O	O	M
	AUTO	TO	X	X	X	X	X	X	F
	AUTO	FROM	X	X	X	X	X	X	F

LABELS

- PP - PREPROGRAMMED CONTROL
- FLEX - FLEXIBLE CONTROL
- MAN - ACTIVATED VIA TTY OR EADAS/NM
- AUTO - ACTIVATED VIA DOC/GSC
- NOTE 1: CONVENTIONAL DOC ACTIVATES PP CONTROLS
- NOTE 2: CCIS DOC ACTIVATES FLEX CONTROLS
- TO - TO CONTROL (CANT, SKIP, TR, IRR)
- FROM - FROM CONTROL (CANF, RR)

SYMBOLS

- O - SECOND CONTROL OVERRIDES, THE FIRST SO ONLY SECOND CONTROL IS ACTIVE.
- P - THE PP OF HIGHEST PRIORITY HAS CONTROL.
- A - AUTO PP IS EFFECTIVE AND FLEX CONTROL IS IGNORED.
- M - MAN CONTROL IS EFFECTIVE AND AUTO CONTROL IS IGNORED.
- B - BOTH CONTROLS ARE ACTIVE. THE MANUAL CONTROL IS FIRST CONSIDERED. IF THE MANUAL CONTROL DOES NOT AFFECT THE CALL, THE AUTOMATIC CONTROL THEN HAS A CHANCE TO CONTROL THE CALL.
- F - THE MOST RECENT DOC CONTROL RECEIVED OVERRIDES THE EXISTING DOC (REGARDLESS OF PRIORITY) SO ONLY ONE CONTROL IS ACTIVE. A GSC CONTROL CAN ONLY OVERRIDE MC1 AND MC2. IF MC3 IS ACTIVE, THE GSC CONTROL WILL BE IGNORED.

TABLE B

CCIS DOC RESPONSE CATEGORIES—4A AND 4ESS SWITCHING SYSTEMS

MC1—DOC RESPONSE CATEGORIES						
TRAFFIC TYPE*	A	B	C	D	E	F
Alternate Routed HTR	0	0	100	100	100	100
First Routed HTR	0	0	0	100	100	100
Alternate Routed Unspecified	0	0	0	0	0	100
First Routed Unspecified	0	0	0	0	0	0
MC2—DOC RESPONSE CATEGORIES						
TRAFFIC TYPE*	A	B	C	D	E	F
Alternate Routed HTR	100	100	100	100	100	100
First Routed HTR	0	100	100	100	100	100
Alternate Routed Unspecified	0	0	0	100	100	100
First Routed Unspecified	0	0	0	0	75	75

*Special treatment may be provided for traffic that has been previously skipped by action of network management controls and for traffic that is routed out-of-chain. The treatment of this traffic in response to a DOC signal varies according to the type of switching system. Treatment also depends upon whether the system is the originating office or a subsequent office. In some cases, treatment also varies with the type of outgoing trunk.

TABLE C

1/1A ESS CCIS DOC RESPONSE CATEGORIES

MC1—DOC RESPONSE CATEGORIES*			
TRAFFIC TYPE	A	B	C
Alternate Routed	0	0	100
First Routed	0	0	0
MC2—DOC RESPONSE CATEGORIES*			
TRAFFIC TYPE	A	B	C
Alternate Routed	100	100	100
First Routed	0	75	75
MC3—DOC RESPONSE CATEGORIES*			
All Traffic		100	

*This table is valid beginning with Generic 1/1AE7.