FEATURE DOCUMENT

NETWORK MANAGEMENT FEATURE

2-WIRE NO. 1 ELECTRONIC SWITCHING SYSTEM

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FEATURE DEFINITION AND DESCRIPTION

1. DEFINITION

1.01 The network management feature provides the capabilities to improve total network processing by selectively limiting traffic destined for congested offices or areas. The capabilities include:

(a) Code blocking (manual)

(b) Trunk group controls (manual and automatic via receipt of dynamic overload control (DOC) signals)

(c) Generation of DOC signals

(d) Providing an interface for a remote display of office and network discrete indicators.

2. DESCRIPTION

USER PERSPECTIVE

2.01 The network management feature was developed to deal with traffic overloads that have resulted from equipment outages or mass calling due to earthquakes, snowstorms, and telethons which create severe congestion in the switching network. This congestion initially appears as a lack of switching facilities due to trunks out of service, underengineering, or heavy traffic. Increased alternate routing is necessary to complete calls, thereby using more links of the network. This increased alternate routing tends to propagate the congestion to connected offices, which may be congested if the problem is the result of heavy traffic. This congestion spreads throughout the network with a snowballing effect. As available facilities are used, more calls are blocked resulting in increased reattempts. These reattempts tend to tie up common control equipment by increasing the calling load. Without control, the situation will result in both gross misuse of network facilities and poor customer service.

2.02 The network management feature provides the capabilities to limit the amount of traffic leaving an office that is destined for a congested area, completing as many calls as possible and utilizing as much capacity as possible in the network without allowing the congestion to spread. These capabilities include:

- code blocking
- trunk group controls to include receipt of DOC signals
- sending of DOC signals
- interface for network management discrete indicators.

Code Blocking (CTX-6 and Later)

2.03 Code blocking provides the capability to limit traffic to a congested area based on the destination code. For traffic using the local 3-digit translator, this code can be one of the following:

NPA—area code

NXX—central office code

NPA—NXX

NPA-NXX-XXXX—3-digit area code plus 7-digit directory number

NXX-XXXX—7-digit directory number.

In addition to these codes, an access code of 0 or 1 can be specified if it is required in that particular office.

2.04 The control for each code is provided for any one of four percentages of the attempts to that code—50, 75, 87 1/2, or 100. Calls affected by code block control are routed via one of three fixed route indexes to either a no circuit announcement (NCA) or one of two emergency announcements (EA1 or EA2).

2.05 Code blocking controls are activated and removed manually via TTY input messages. The code that needs to be controlled, the percentage of attempts desired to be canceled, and the disposition (one of three announcements) of the canceled calls

must be specified in the TTY message at the time of the activation. These TTY messages are:

MESSAGE	FUNCTION
CB-ACT	This message is used to activate code blocking on an NPA, NXX, NPA-NXX, NPA-NXX-XXXX, or NXX-XXXX or to change the announcement index and/or the percent of control of an existing code block.
CB-CLEAR	This message is used to remove all code block controls that are currently active.
CB-REM	This message is used to remove code blocking from an NPA, NXX, NPA-NXX, NPA-NXX-XXXX, or NXX-XXXX.
CB-STATUS	This message is used to request that the codes and control information be printed for all active code block controls, if any.
CB-TRAFFIC-.	This message is used to request traffic peg counts for network management code block controls.

2.06 A maximum of 31 unique codes can be activated simultaneously. The maximum number provided in an office is a parameter which can be greater than or equal to 4 and less than or equal to 31.

Trunk Group Controls

2.07 Trunk group controls (TGCs) provide the capabilities to limit traffic to a congested area based on the trunk group over which a call is to be routed. Effectively, this provides a direct means of controlling attempts to offices to which the No. 1 ESS has outgoing one-way or 2-way trunks.

2.08 Four types of trunk group control are provided:

- CANCEL-TO: Controls the number of attempts offered to a trunk group. Upon encountering this control, a call which is to be affected is inhibited from searching any trunk group for an idle trunk and is routed to no circuit announcement (NCA). Control variables include the trunk group on which the control is to be active, percent of direct-routed traffic to be affected, and percent of alternate-routed traffic to be affected.

- SKIP: Controls the number of attempts offered to a trunk group. Upon encountering this control, a call to be affected is inhibited from searching this trunk group for an idle trunk but is allowed to alternate route to the next trunk group. Control variables include the trunk group on which the control is to be active, percent of direct-routed traffic to be affected, and percent of alternate-routed traffic to be affected.

- CANCEL-FROM: Controls the number of attempts overflowing a trunk group. Upon encountering this control, a call to be affected is inhibited from hunting for an idle trunk after overflowing this trunk group. The call is routed via a fixed route index to NCA. Control variables include the trunk group on which the control is to be active and the percent of overflow traffic to be affected.

- TRUNK RESERVATION: Makes it possible to reserve a specified number of trunks in a trunk group. It limits the number of attempts offered to a trunk group when fewer than the specified number of trunks remain available. The function of the control is to dynamically sense when less than a specified number of trunks are idle in the trunk group, at which time the control is activated. Two thresholds are provided per trunk group: protectional reservation of equipment (PRE) threshold and directional reservation of equipment (DRE) threshold. Information that must be included in the input message includes the trunk group on which the control is to be active, the PRE threshold, and the DRE threshold. The threshold values must be less than or equal to the number of equipped trunks in the specified trunk group.

  (1) PRE is useful in reserving facilities for first-routed traffic. If the PRE

threshold is crossed, all traffic alternate routed to this trunk group is inhibited from searching for an idle trunk in any trunk group and is routed to NCA.

(2) DRE is useful in reserving facilities for incoming traffic. Thus, DRE has meaning only on 2-way trunk groups. If the DRE threshold is crossed, all traffic to this trunk group is inhibited from searching for an idle trunk in any trunk group and is routed to NCA.

2.09 First-routed (direct) and/or alternate-routed traffic can be controlled in any of the following percentages for the CANCEL-TO and SKIP controls:

Direct: 0, 50, 75, or 100

Alternate: 50, 75, or 100.

For the CANCEL-FROM control, 50, 75, or 100 percent of the overflow traffic can be controlled.

2.10 Trunk group controls are available as either preprogrammed, i.e., defined in translations, or flexible, i.e., defined as TTY input.

Preprogrammed Trunk Group Controls (CTX-6 and Later)

2.11 A trunk group control which has its control information stored as translation data is called a preprogram. This control information consists of one of the control options (CANCEL-TO, SKIP, or CANCEL-FROM), associated percentage(s) of attempts to be affected, and the trunk group to which this control is to be applied. Note that the trunk reservation feature is not available for use with trunk group control preprograms.

2.12 The maximum number of trunk group control preprograms available for No. 1 ESS is 63. The actual number in an office is a parameter which can be chosen in the range of 0 to 63. These preprograms can be activated either manually via TTY input or automatically via DOC signals. DOC signals are ON/OFF signals received from another office through the common systems dynamic overload control circuit, SD-27970-01. Each automatic DOC signal is associated with one preprogram. All preprograms can be activated manually, and as many as 30 can be activated automatically.

2.13 Any subset of the preprograms that can be activated by manual input only (no associated DOC signal) and as many as three preprograms that can be activated by automatic input can refer to control of the same trunk group. However, a trunk group can be controlled by only one preprogram at any given time. Preprograms that can be activated automatically via a DOC signal must have priority assigned to them and be stored with the translation data. This priority is associated with the machine congestion level of the office when it sends the DOC signal. Priorities are assigned as 1, 2, or 3 correlating with machine congestion levels 1, 2, or 3 at the office sending the signal. Thus, the three automatic preprograms referring to control on the same trunk group must be assigned different priorities. A unique DOC signal is required for each priority.

2.14 A preprogram manually activated will assume immediate control of the associated trunk group replacing any manual control currently on that trunk group and overriding any activation requests received automatically via DOC signals. In the absence of a manual control on a trunk group, the preprogram of the highest priority for that trunk group for which a DOC signal is being received will control that trunk group. TTY input can manually exclude a preprogram from automatically taking control on a trunk group causing the DOC signal to be ignored. This exclusion is done on a preprogram basis, allowing the trunk group to remain controlled by another automatic preprogram or by a manual preprogram.

2.15 The TTY messages used to manually activate and control trunk group control preprograms are:

MESSAGE	FUNCTION
PP-ACT	This message is used to activate network management trunk group control preprograms. Activation of the preprograms overrides the existing control, manual or automatic, on this trunk group. Subsequent automatic DOC requests are ignored for this trunk group until control is removed manually.

PP-CLEAR	This message is used to remove all network management preprogramed trunk group controls that are currently in a manual state. The trunk groups remain controlled by the automatic DOC signal.
PP-DATA	This message is used to request that the control information in translations associated with each network management trunk group control preprogram be printed.
PP-REM	This message is used to remove a network management trunk group control preprogram. Removal of the manual control will allow the trunk group to be controlled automatically by DOC signals.
PP-EXC	This message is used to exclude a network management trunk group control preprogram from being activated automatically via DOC signals. In addition, this preprogram, if active, will be removed from control of the trunk group.
PP-STATUS	This message is used to request that a list of the active network management preprogrammed trunk group controls and their active state be printed.
PP-TRAFFIC	This message is used to request traffic peg counts for network management preprogrammed trunk group controls.

Flexible Trunk Group Controls (CTX-7 and Later)

2.16 Trunk group controls that are not defined in translations and are not associated with the receipt of a DOC signal are flexible trunk group controls. For flexible controls, the control information is supplied as part of a TTY input message. The control information consists of the control option (CANCEL-TO, SKIP, CANCEL-FROM, or TRUNK RESERVATION) associated percentages of attempts to be affected, associated thresholds at which controls become active, and the trunk group to which the control is to be applied.

2.17 Each active flexible control uses one control slot. The maximum number of flexible control slots available for the ESS is 63. The actual number in an office is a parameter which can be chosen in the range of 0 to 63.

2.18 As explained in 2.16, these flexible trunk group controls are activated via TTY input only. All information must be inputted at the time of activation of the control. The TTY messages available for the activation and control of the trunk groups are:

MESSAGE	FUNCTION
CF-ACT	This message is used to activate a flexible CANCEL-FROM control on a trunk group.
CT-ACT	This message is used to activate a flexible CANCEL-TO control on a trunk group.
FLEX-CLEAR	This message is used to deactivate all network management flexible trunk group controls and flexible trunk group peg and overflow counters that are presently active.
FLEX-DEACT	This message is used to deactivate a network management flexible trunk group control or a flexible trunk group peg and overflow counter.
FX-STATUS	This message is used to request that a list of the active network management flexible trunk group controls and flexible trunk group peg and overflow counters be printed.
FX-TRAFFIC	This message is used to request traffic peg counts for network management flexible trunk group controls and flexible trunk group peg and overflow counters.
SK-ACT	This message is used to activate a flexible skip control on a trunk group.

TR-ACT — This message is used to activate the trunk reservation function on a trunk group.

Sending Dynamic Overload Control Signals (CTX-7 and later)

2.19 Dynamic overload control (DOC) signals are sent from a tandem or toll office to connected offices requesting that they limit the amount of traffic sent to that tandem or toll office. These signals are sent because there is a high probability that the traffic could not be processed in the office sending DOC signals and the equipment would be tied up in the office receiving DOC signals. This would tend to deny service to calls in the DOC receiving office which are not directed to the DOC sending office.

2.20 DOC signals are sent from No. 1 ESS 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 ESS machine is unable to switch calls is a hardware function. (See 2.43.)

2.21 Two levels of signaling exist for the shortage of real time and the shortage of receivers. These levels are machine congestion level 1 (MC1) and machine congestion level 2 (MC2). MC1 indicates that the machine 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 machine 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.

2.22 A shortage of real time is determined indirectly from the E-E cycle time through the length of the incoming overload control queue. This queue indicates the number of incoming calls waiting to be served. Calls in this queue have not been attached to a receiver, nor have they been allowed to attempt to seize a receiver. The length of this queue is used as a threshold for both levels of DOC for a shortage of real time by assuming an acceptable delay in the queue and using the queue unloading rate. The unloading rate of the queue varies according to the state of the machine (normal, minor overload, and major overload). For example, a call remains in the queue longer when the machine is in major overload than when it is in a normal state. Six thresholds then are used for a shortage of real time, two levels for each of the three states of the machine. These thresholds are defined as constant generic values.

2.23 A shortage of receivers for each receiver type is determined by the length of the queue for that receiver type. Calls which are unable to seize an idle receiver are placed in the queue for that receiver type. The length of each of these queues (MF, DP, and RP receiver queues) is used as a threshold for both levels of DOC for a shortage of each receiver type by assuming an acceptable delay on the queue and using the queue unloading rate. The unloading rate does not vary with machine state. Instead, it depends on the average holding time of the receivers and the number of receivers in the office. Two thresholds are used for each receiver type, one for each level. These thresholds are defined as generic parameters based on the number of receivers equipped in the office.

2.24 The thresholds for real time and receiver shortage 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 to be sent at the first 2-second check at which the threshold is no longer crossed.

2.25 DOC signals for MC1 and MC2 levels may be sent to a maximum of 64 offices if a radial signaling arrangement is used or to a maximum of 64 loops if a tandem signaling arrangement is used. With radial signaling, the office receiving the DOC signals must return the acknowledgment to the sending office. With tandem signaling, however, the acknowledgment may be transmitted to another office which will accept it as a DOC signal. This office must either return the acknowledgment or transmit it to another office. The only limit on the number of offices in the tandem loop is that the acknowledgment must be returned to the signaling office within 2 seconds of the initial transmittal. The sum of the number of MC1 and MC2 signals must not exceed 64. Thus, if MC1 signals are sent to 48 offices, MC2 signals can be sent to only 16. In some cases, when MC1 signals are sent to an office, MC2 signals will probably also be sent, thereby using two of the 64 signals.

2.26 Crossing each of the eight thresholds (MC1 and MC2 for shortage of real time, MF receivers, DP receivers, and RP receivers) causes DOC signals to be sent on some subset of the 64 signals. These subsets are identified in translations. The interface between software and hardware for sending DOC signals is via signal distributor (SD) points. See Fig. 1 for calculation of DOC transmit thresholds for MC1 and MC2.

2.27 Using a TTY input message, the network manager may send any of the 64 individual signals at any time, regardless of congestion level. In addition, the network manager may at any time use a TTY input message to exclude any of the 64 individual signals from being sent even if the threshold for that signal is crossed. Several TTY messages are available to the network manager to provide control of DOC signals. These TTY messages are:

MESSAGE	FUNCTION
DOC-CLEAR	This message is used to remove the manual control of all network management DOC signaling loops.
DOC-EXC	This message is used to manually exclude a network management DOC signal from being sent automatically to the loop or office specified.
DOC-REM	This message is used to remove the manual control (send or exclude from send) of a network management DOC signal to the loop or office specified.
DOC-SND	This message is used to manually send a network management DOC signal to the loop or office identified by the index variable.
DOC-STATUS	This message is used to request that a list of the active network management DOC loops be printed.
DPD-MCONE	This message is used to request a printout of the translation data which identifies those offices or loops and corresponding index (used in input messages DOC-SND, DOC-EXC, and DOC-REM) to which network management DOC signals are sent upon crossing the threshold for MC1 for trunk dial pulse receiver congestion.
DPD-MCTWO	This message is used to request a printout of the translation data which identifies those offices or loops and corresponding index (used in input messages DOC-SND, DOC-EXC, and DOC-REM) to which network management DOC signals are sent upon crossing the threshold for MC2 for trunk dial pulse receiver congestion.
LST-MCTHREE	This message is used to request a printout of the translation data which identifies those offices or loops and corresponding index to which network management DOC signals are sent for MC3. These signals are sent only when the office is incapable of processing calls.
MFD-MCONE-	This message is used to request a printout of the translation data which identifies those offices or loops and corresponding index to which network management DOC signals are sent upon crossing the threshold of MC1 for MF receiver congestion.
MFD-MCTWO	This message requests a printout of the translation data which identifies those offices or loops and corresponding index to which network management DOC signals are sent upon crossing the threshold for MC2 for MF receiver congestion.
RPD-MCONE	This message requests a printout of the translation data which identifies those offices or loops and the corresponding index to which network management

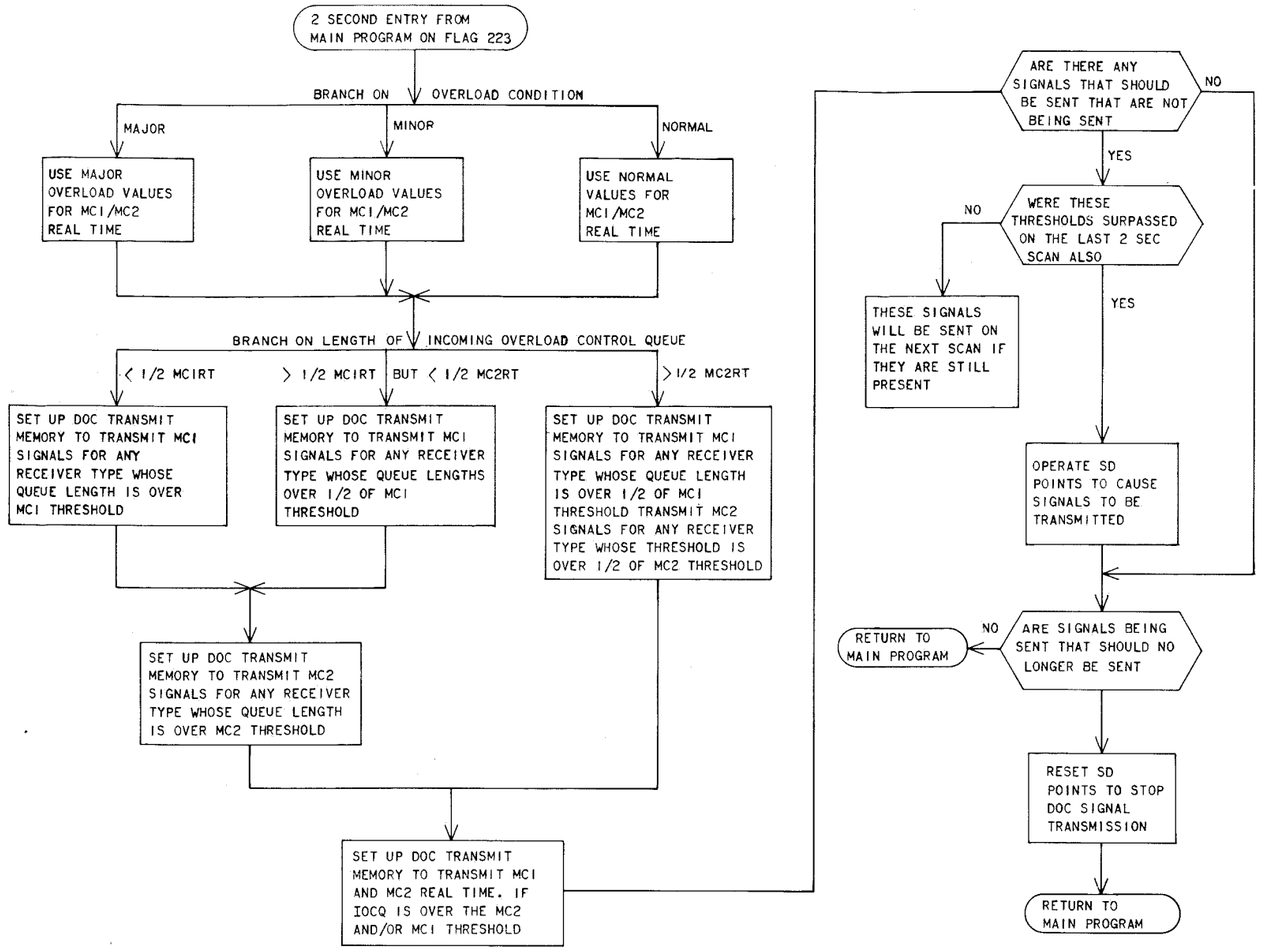


Fig. 1—Calculation of DOC Transmit Thresholds for MC1 and MC2

DOC signals are sent upon crossing the threshold for MC1 for revertive pulse receiver congestion.

RPD-MCTWO — This message is used to request a printout of the translation data which identifies those offices or loops and corresponding index to which network management DOC signals are sent upon crossing the threshold for MC2 for revertive pulse receiver congestion.

RTD-MCONE — This message requests a printout of the translation data which identifies those offices or loops and corresponding index to which network management DOC signals are sent upon crossing the threshold for MC1 for real-time congestion.

RTD-MCTWO — This message requests a printout of the translation data which identifies those offices or loops and corresponding index to which network management DOC signals are sent upon crossing the threshold for MC2 for real-time congestion.

Interface for Network Management Discrete Indicators (CTX-7 and Later)

2.28 In order to better manage the network associated with an ESS, it is desirable to produce visual displays of current machine and network status. These displays are usually located in a network management center where many switching offices are monitored. To provide a network management center with information for these displays, periodic samples of system resources and network conditions are taken. Binary (ON/OFF) indicators are then provided as closed/open contacts for use by suitable data-gathering devices.

A. Machine Status Indicators

- ***Transmitters***—An indicator is provided for each of three types of transmitters: multifrequency, dial pulse, and revertive pulse. If at the time of the sampling the requests for a type of transmitter exceed the number of transmitters of that type available, an overflow condition exists, and the binary indicator is placed in the ON state. If the overflow condition does not exist, the binary indicator is placed in the OFF state.

- ***Line Load Control***—A binary indicator is placed in the ON state if at the time of the sampling the line load control program is denying service to any lines. Otherwise, it is placed in the OFF state.

- ***Machine Congestion***—A corresponding binary indicator is placed in the ON state if the ESS is in any of the following congestion levels at the time of the sampling: MC1 or MC2 for shortage of real-time or receivers (MF, DP, or RP). Otherwise, the indicator is placed in the OFF state.

- ***Incoming Load Control***—If the ESS is transmitting or excluding from transmission any DOC signals to a connected office at the time of sampling, an indicator is placed in the ON state. If no DOC signals are being sent, the indicator is placed in the OFF state.

- ***Incoming Terminating Matching Loss***—If during a period of up to 3 minutes previous to the sampling there was matching loss greater than 10 percent in the trunk link networks, an indicator is placed in the ON state. Otherwise, the indicator is placed in the OFF state. The matching loss indicator is active only while line load control is in the automatic ON or manual ON mode.

- ***Incoming Overload Queue***—A binary indicator is placed in the ON state if the length of the incoming overload queue exceeds a generic parameter at the time of the sampling. Otherwise, the indicator is placed in the OFF state.

- ***Internal Queues***—If internal queues are active at the time of sampling (currently only the peripheral order buffer queue is considered), an indicator is placed in the ON state. Otherwise, the indicator is placed in the OFF state.

- ***Outgoing Load Control***—A binary indicator is placed in the ON state if, at the time of

sampling, toll network protection (TNP) is in effect or if the ESS has done any of the following:

(1) Activated a code blok

(2) Activated a trunk group control (either manually or automatically via dynamic overload control signals)

(3) Excluded a trunk group control preprogram from automatic activation.

Otherwise, the indicator is placed in the OFF state.

- ***Receivers***—A corresponding indicator is placed in the ON state if there is an overload on any of the following receiver queues at the time of sampling:

(1) Customer TOUCH-TONE®

(2) Customer dial pulse

(3) Multifrequency

(4) Revertive pulse

(5) Trunk dial pulse.

If no receiver queues are experiencing overload, each indicator is placed in the OFF state.

B. Network Status Indicators

- Trunk group no-circuit indicators are available for a maximum of 112 trunk groups. The numbers of the trunk groups to be sampled are placed in translations. Both outgoing one-way and 2-way trunk groups may be designated. A no-circuit condition exists if, at the time of the sampling, all circuits in the trunk group are busy due either to maintenance or traffic. If the no-circuit condition exists, an indicator corresponding to the trunk group is placed in the ON state. If circuits are available in the trunk group, the corresponding indicator is placed in the OFF state.

- ***Work Segments and Update Intervals***—The sampling cycle of the indicators is divided into four segments. During the first segment, all machine status indicators, plus the first 16 trunk groups, are sampled. During each of the remaining segments in the cycle, 32 trunk groups are sampled. The interval between segments is 10 seconds; thus, each indicator is updated every 40 seconds. Receiver attachment delay report (RADR) indicators are administered separately and are updated every 30 seconds.

- If the ESS is not equipped with the total of 112 trunk group no-circuit indicators, the update interval for each assigned indicator remains at 40 seconds.

- Upon completion of the sampling, the current state of the signal distributor (SD) points is compared with the desired state. If any need to be changed, the appropriate orders are dispatched to the signal distributor.

NETWORK MANAGEMENT TTY

2.29 The primary interface between the network management personnel and the ESS is the TTY. It is possible to input all network management messages through the local or remote maintenance and administrative traffic TTYs. In addition, there is an option which allows a TTY to be dedicated to network management. If a TTY is not dedicated, then the administrative traffic TTY can be used as the network management channel. In this case, the administrative traffic TTY will by default be the network management TTY.

2.30 All network management requests to activate, deactivate, or override a control are echoed as an output message to the channel from which the input message was received. In addition, all of these echoed responses are always sent to the network management channel. Responses to requests for traffic data and listings of control status or data are made only to the channel from which the input message was received.

GENERAL

2.31 The audit for network management control data is audit 32. The audit routinely checks for validity and consistency of network management translations, parameters, call store, and hardware. Where possible, the audit corrects the error; otherwise, the audit reinitializes the call store

associated with the network management function. SA03 error messages are printed at the maintenance TTY to identify specific errors. An output message indicating that one or more errors have been found is outputted over the network management channel.

2.32 During any system initialization of EA phase 3 or higher, all manually controlled DOC signals and all network management control entries are destroyed. The DOC signals are reinstituted automatically, but all manual network management functions must be restored using the appropriate TTY message. The audit will restore the trunk group control preprograms to the proper automatic state according to the state of the scan points associated with corresponding DOC signals.

2.33 The ESS is capable of interfacing with a remote network management center, which will be able to activate network management controls at many remote end offices. It is conceivable that the control center may not require a complete repeat back of commands from every office. Therefore, it should be possible to ignore certain response messages from end offices. To facilitate these plans, a nonprinting accept or reject character is generated and transmitted with the echoed response to a request to activate, deactivate, or override a control or signal. The character is transmitted as early as possible in the message but never before the identification of the message, e.g., NM14. The nonprinting accept character is octal 30; the nonprinting reject character is octal 34. The accept character indicates that the machine accepted and executed a request. These characters are also transmitted with the message indicating audit errors or hardware failures in the DOC circuits.

SYSTEM IMPLEMENTATION

Code Blocking

2.34 A request to activate a code block control results in temporary recent change being inserted on the 3-digit translators corresponding to the first three digits of designated code, either NPA or NXX. Many offices will be equipped with only the local 3-digit translators which will handle all types of calls, e.g., originating, terminating, and tandem. In these offices, code blocking could be applied to every call in the office. Some offices will be equipped with the toll 3-digit translators in addition to their local 3-digit translators. Even in these offices, a portion of the calls may use the local translators and therefore can be subjected to code blocking. However, at present, calls requiring the toll translators cannot be code blocked. The insertion of a temporary recent change on the local 3-digit translators takes place in all code blocking. Since more than one code can begin with the same three basic digits (e.g., 312-682 and 312-355), the information relative to the desired code block control (code, amount of control disposition, etc.) cannot be stored in the temporary recent change because there are not enough bits available but is stored in a call store block called a code blocking slot. One slot is maintained per requested code block control. A temporary recent change points to the slot that contains the code of the greatest number of digits beginning with the three basic digits associated with this 3-digit translator. All other slots beginning with the same three digits are linked in order of lesser number of digits in the code. A slot that contains a code that begins with different three basic digits is not linked to these slots. If a conflict can exist, i.e., the same three digits can be used for either NPA or NXX, those slots containing codes whose first three digits are NPA are not linked to slots containing codes whose first three digits are NXX. This is true since conflict resolution yields different 3-digit translators, and thus a temporary recent change can be inserted on each translator. The activation of a code block control causes the outgoing load control lamp on the master control center (MCC) to be lighted.

2.35 In the processing of a call, the possible existence of a code block control will be detected by finding the temporary recent change upon performing the 3-digit translation for the call. This temporary recent change will point to the (linked) code block control slot(s) where a comparison will be made of the dialed digits and the specified code(s) for code blocking. The dialed digits are allowed to match with only one of the code block slots. For example, if code blocking is activated on 312-682 (75 percent) and 312 (50 percent), calls to 312-682 will be blocked on a 75-percent basis, and calls to all other office exchanges in area code 312 will be blocked on a 50-percent basis.

Trunk Group Controls

2.36 A request to activate a trunk group control either manually or automatically via a DOC signal results in the outgoing load control bit being set in the trunk group head cell of the trunk group on which the control is to be applied. In addition,

other call store associated with trunk group controls is updated to reflect the control option and percentages or thresholds for this control. The activation of a trunk group control, with the exception of trunk reservation, or the exclusion of a preprogram from automatic control causes the outgoing load control lamp on the MCC to be lighted.

2.37 In order to conserve real time, the interaction of individual controls is limited. The general philosophy is that a manual request to place a control on a trunk group will remove any manual control currently on that trunk group and activate the requested control. A TTY output message will advise network management personnel of the control that was removed. In addition, if the manual request was to activate a preprogram, any preprogram currently active on the trunk group because of the existence of a DOC signal will be overridden, and any DOC signal received requesting action on this trunk group will be ignored. However, if the manual request was to activate a flexible control on the trunk group, the DOC signals for this trunk group will continue to cause preprograms to be activated and deactivated. Removal of a manual preprogram control will allow the automatic DOC controls to resume.

2.38 In the processing of a call, the possible existence of a trunk group control is detected by finding the outgoing load control bit set in the trunk group head cell upon preparing to search the trunk group for an idle trunk. Only one flexible control and one automatic preprogram may be active on a single trunk group.

2.39 Maintenance is provided for the DOC circuit, SD-27970-01, and for the connection between the DOC circuit and the scan points on the remote master scanner applique circuit, SD-1A210-01.

2.40 The DOC circuit will interconnect with the ESS for detection of receipt of a false signal. To facilitate this detection, the DOC circuit is arranged to accept two levels of signal, ground or −48 volts. A valid signal will be an interrupted −48 volt signal where the interruption is approximately one second every 30 seconds. Any steady signal will be detected as a false DOC command and will signal the ESS through a single scan point causing the printing of an output message and the sounding of a major alarm. During the time that a signaling problem exists, the DOC command will not be received by the ESS for the specific preprogram associated with the ESS for the specific preprogram associated with that DOC signal. The preprogram can be controlled manually via TTY input if so desired. All other preprograms will continue to be controlled automatically by their DOC signals.

2.41 To check the integrity of the connecting paths between the DOC circuit and ESS, two signaling paths with an associated scan point per path are provided for each DOC signal. The state of the two scan points for a particular signal should always be opposite. If a false cross or ground/open condition exists in either of the signal paths, the state of the two scan points would be equal. The preprogram is taken out of service and responds as if it were in a manually excluded state. When the false cross or ground/open condition is detected, a TTY output message will be printed identifying the preprogram affected, and a major alarm sounds.

Sending DOC Signals

2.42 The DOC transmit circuit will transmit up to 96 DOC signals. Three types of signals are provided: MC1, MC2, and MC3. The transmitter accepts input for MC1/MC2 signals from signal distributor (SD) points and transmits a signal only when the SD point is operated. Sixty-four SD points may be provided to send 64 MC1/MC2 signals.

2.43 The MC3 signal must be sent when the switching machine is incapable of processing calls. The command source for this type of signal is derived from either of two lamp signals on the master control center (MCC). These lamp signals are: (1) emergency action (EA) phase in progress, which is on when a software problem exists and call processing has ceased in an attempt to correct the problem and (2) repeated time out (RTO) which is on when a hardware problem exists. In most cases, a manual action is required to correct the problem.

2.44 The MC3 signal is a broadcast signal sent to up to 32 connected offices. This signal is sent when the repeated time out (RTO) or EA lamp signal is on. The RTO lamp signal is extinguished a short time after call processing has resumed. When the command source is the EA phase in progress lamp signal, the MC3 signal continues to be sent for approximately 2 seconds

after the lamp has been extinguished and call processing has resumed.

2.45 Interface with three types of signaling facilities are provided with options on a per-signal basis. The three facility types are:

(1) Balanced Loop

ON—Loop closure

OFF—Loop opening.

(2) E and M Leads

ON—48 Vdc on M lead via E and M applique circuit, SD 99774-01.

OFF—Ground on M lead via E and M applique circuit, SD 99774-01.

(3) Data Set

ON—+5 to +15 Vdc to SL lead of data set 108E

OFF—−5 to −15 Vdc to SL lead of data set 108E.

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

2.47 These acknowledgments are detected at the switching machine 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:

(1) Balanced Loop

ON—Far end loop closure

OFF—Far end loop opening.

(2) E and M Leads

ON—Ground on E lead via E and M applique circuit, SD-99774-01.

OFF—Open on E lead via E and M applique circuit, SD-99774-01.

(3) Data Set

ON—+5 to +15 Vdc from TL lead via data set 108E

OFF—−5 to −15 Vdc from TL lead via data set 108E.

2.48 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 one second. This interruption is inserted to validate the DOC transmit signal. Without the interruption, a steady ON DOC signal is indistinguishable from a shorted pair in the transmission facility between the two switching offices. The interruption is provided by a duplicated hardware interrupter.

2.49 Since the acknowledgment that is returned from the DOC receiving office is identical to the transmitted signal, the interruption exists in the acknowledgment signal also. To avoid unnecessary processing during the change of states of the scan point, the interruptions are nullified and are continuous ON signals at the scan point.

2.50 If any DOC transmit loop is in a nonidle state, ie., send or exclude, the incoming load control lamp on the MCC will be lighted.

2.51 Maintenance is provided for the DOC transmit circuit, SD-1A334-01. The maintenance is primarily operational and provides fault indication only. Except for the interrupter, which is discussed in subsequent paragraphs, no special provision will be made to facilitate internal diagnostics or fault isolation.

2.52 On a daily basis or on demand via TTY input message DOCX-EX, the timers included in the transmit circuit are tested to insure correct operation and accurate timing. The timings involved include:

(1) The nominal 1-second interruption in the DOC signal every 30 seconds

(2) The blocking of the interruption in the acknowledgment as it is seen by the ferrod

(3) The continuance of the MC3 signal for approximately 2 seconds after the emergency action phase in progress lamp has been extinguished.

2.53 Duplicated hardware interrupters are included which provide the 1-second interruption and the blocking of the interruption. As a daily routine, both interrupters are tested; and if both are operating correctly, the active and standby interrupters are switched to allow for equal use. If only one interrupter functions correctly, the minor alarm sounds, and a message is printed at the maintenance TTY informing the craft personnel that the standby interrupter is out of service. If neither interrupter functions correctly, the major alarm is sounded, and a message is printed at the maintenance TTY.

2.54 A hardware timer is provided to continue the MC3 signal after the emergency action phase in progress lamp has extinguished. As a daily routine, this timer is tested for accurate timing. If the timing is not accurate, the minor alarm sounds and a message is printed at the maintenance TTY. However, the MC3 signaling circuitry remains functional.

2.55 The active interrupter for DOC signals runs only while a DOC signal is being transmitted. A faulty interrupter might cause the DOC receive circuit (SD-27970-01) at the receiving office to ignore the DOC signal. For this reason, the interrupter is monitored while it is running. If a fault occurs, the maintenance software inserts an interruption, switches to the standy interrupter, sounds the minor alarm, and prints a message at the maintenance TTY. If the standby interrupter had already been placed out of service, a major alarm is sounded, and a message is printed at the maintenance TTY. A faulty interrupter will not be detected during the sending of an MC3 DOC signal.

2.56 Acknowledgments for all 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 occured is taken out of service, and the attendant is notified both via the minor alarm and a message at the maintenance TTY. This message identifies the failing loop. After correcting the problem, the craft personnel places the loop back in service via TTY input message DOCX-REST.

2.57 The receipt of an acknowledgment for MC3 signals cannot be monitored continuously while sending the MC3 signal. However, the acknowledgments can be checked after the system regains sanity since MC3 signals are sent for a few seconds after call processing has resumed following a repeated time-out or emergency action phase problem. The minor alarm sounds, and a TTY output message will be printed at the maintenance TTY for each MC3 loop on which an acknowledgment was not received.

2.58 An acknowledgment received for MC3 when it should not be, ie, when the office is running, is an indication of a problem. At this time, the maintenance software prevents the problem from persisting by isolating the MC3 portion of the transmit circuit from the facilities. The minor alarm sounds, and a message is printed at the maintenance TTY. After correcting the problem, the MC3 circuitry is restored via TTY input message DOCX-REST.

2.59 During a manually requested test of the EA phase in progress lamp on the MCC, the MC3 circuitry of the DOC transmit circuit is isolated from the facilities so that no MC3 signal is transmitted.

Interface for Machine and Network Status Displays

2.60 The software-activated indicators are provided as closed contacts controlled by SD points. A maximum of 167 contacts can be required. Included in this total is a maximum of 33 indicators for use by the receiver attachment delay report (RADR) feature. The 167 contacts are composed of the following:

(a) Machine status indicators—maximum of 22

(b) Trunk no-circuit indicators—maximum of 112

(c) RADR indicators—maximum of 33.

2.61 Each of these 167 contacts is wired to a distributing frame. Any use of the contacts is up to the operating company. No standard display unit is provided. Three additional indicators are available from existing office hardware. These indicators are the repeated time-out and EA phase in progress lamps and the MC3 condition from the DOC transmit circuit. These three indicators are available on the DOC transmit circuit, SD-1A334-01.

If the office does not have the DOC transmit circuit, the repeated time-out and EA phase in progress indicators are available from the MCC circuit, SD-1A122-01. A binary ON state corresponds to a closed contact on the network management indicator circuit.

3. FEATURE FLOW DIAGRAM

3.01 See Fig. 2.

4. INTERACTIONS

Calling Line Identification (CLID)

4.01 The trace-on-outgoing-calls portion of calling line identification (CLID) and code blocking perform similar functions. Both have to determine whether a match exists between dialed digits and a prespecified code or directory number. To provide program store and real-time savings, a portion of the CLID feature implementation was incorporated into the code blocking. This incorporation enhanced the capability of CLID by allowing more than four CLID entries simultaneously without real-time penalities and allowing distinction between no prefix, prefix 1, and prefix 0 access codes. In addition, if the audit finds an error in the slot used for CLID, it will remove only that entry in error. If the audit cannot find the number of CLID entries which the machine has stored as the count of CLID entries, all CLID entries are removed. In all cases, the list of entries is printed prior to destroying any entry.

4.02 The more CLID entries currently active, the fewer the number of slots available for code blocking. The sum of the two cannot exceed the number of slots provided for this feature by the office parameter. For example, if the office parameter is set to provide for 28 slots, any combination of code blocking and CLID entries, up to a maximum of 28, can be active simultaneously.

Toll Network Protection (TNP)

4.03 The implementation and activation of toll network protection has not changed. However, for those trunk groups for which network management trunk group controls are provided, the trunk group controls will replace the toll network protection function when the trunk group controls are active. In addition, calls originating from toll essential lines will not be excluded from code block control.

Receiver Attachment Delay Report (RADR)

4.04 Receiver Attachment Delay Report (RADR) is a CTX-7 feature that determines the delay in attaching a receiver to an incoming test call. RADR is the equivalent of sender attachment recorder (SADR) in electromechanical systems. A visual display of current RADR percentages for the ESS machine is not available to the network manager without the interface for network management indicators discussed in 2.28.

ATTRIBUTES

5. STATION/SYSTEM

5.01 Code block controls are provided for ESS as a system and can be activated for any code described in 2.03 through 2.06 for which routing translations are provided in the office. Code blocking is provided so that an office can choose the number of code blocking (and CLID) slots desired at a cost of an additional eight call store words per slot up to a maximum of 31 slots.

5.02 In addition, an office which has many rate centers should be aware that the activation of a code block (or CLID) entry results in a temporary recent change on the 3-digit local translators in all designated rate centers. Several simultaneous entries requiring temporary recent change on many translators may use a significant portion of the recent change area. For example, the activation of code blocks that will cause recent change to be inserted on 20 3-digit translators in an office with five rate centers will use 200 words of the recent change area. Each temporary recent change requires two words per code block per rate center.

5.03 Trunk group controls are provided for ESS as a system. The number of preprograms is limited to 63 with each preprogram costing five program store and six call store words (CTX-7 and later) or five program store words and four call store words (CTX-6). The number of trunk groups in an office, which can be controlled by preprogrammed trunk group control, is limited by the number of preprograms in the office (63) and the number or preprograms for the same trunk group. This is true because each preprogram is a single function (cancel to, skip, or cancel from) on a single trunk group. An absolute maximum number of trunk groups that can be controlled is 63, but a more practical maximum is somewhat

less than 63 because, in most cases, more than one preprogram will be desired per trunk group. Each such trunk group costs two call store words. The number of flexible control slots is limited to 63, with each slot costing six call store words. These slots are also used for peg and overflow counts on flexible trunk groups. Any one-way outgoing or 2-way trunk group can be controlled by flexible trunk group controls.

5.04 The common system dynamic overload control (DOC) circuit, SD-27970-01, used for receiving automatic activate/deactivate signals needs to be interconnected for maintenance purposes in only one switching entity in the wire center. This circuit can distribute up to 30 DOC signals to a maximum of eight switching entities in a wire center.

5.05 DOC signals are provided for ESS as a system. If the DOC transmit circuit is installed, the basic package includes equipment for sending 16 MC1/MC2 signals and 32 MC3 signals. MC1/MC2 signals may be added in increments of 16 to a maximum of 64. The incremental cost of peripheral equipment is 16 SD points and one supervisory MS row per 16 signals.

5.06 Network management indicators are provided for ESS as a system. If the network management indicator circuit is installed, up to 22 software-activated machine status indicators and 112 trunk group no-circuit indicators are available. In addition, up to 33 additional indicators may be assigned to the RADR feature. Hardware for SD-1A335-01 is installed in increments of 24 individual indicators. Each indicator requires one SD point.

6. LIMITATIONS

6.01 Code blocking is available only on calls which use the regular 3-digit translators. Calls which use the toll 3-digit translators, developed as part of the operator tandem feature for toll center operation, or CCSA 3-digit translators cannot be code blocked. See 5.01, 5.02, 5.03, 5.05, and 5.06.

7. RESTRICTION CAPABILITY

7.01 Not applicable.

8. COST DATA

8.01 The following costs can be attributed to the network management feature in CTX-6 or CTX-7 generic programs.

PROGRAM STORE WORDS

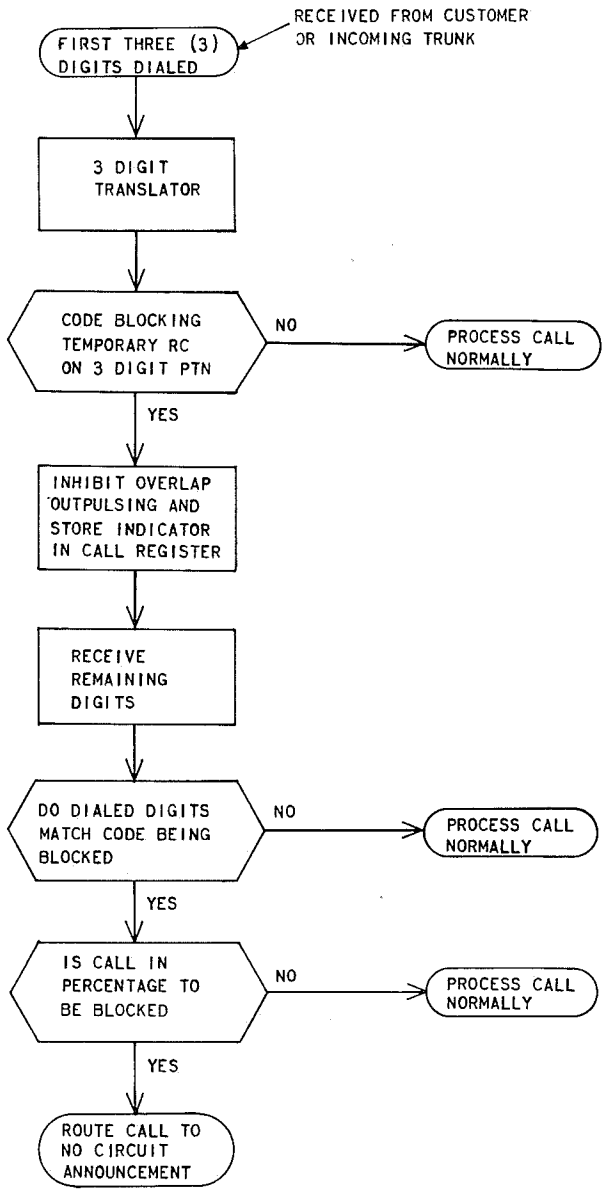
A. Generic

(a) 3040 words for CTX-6 generics

(b) 6440 words for CTX-7 and later generics

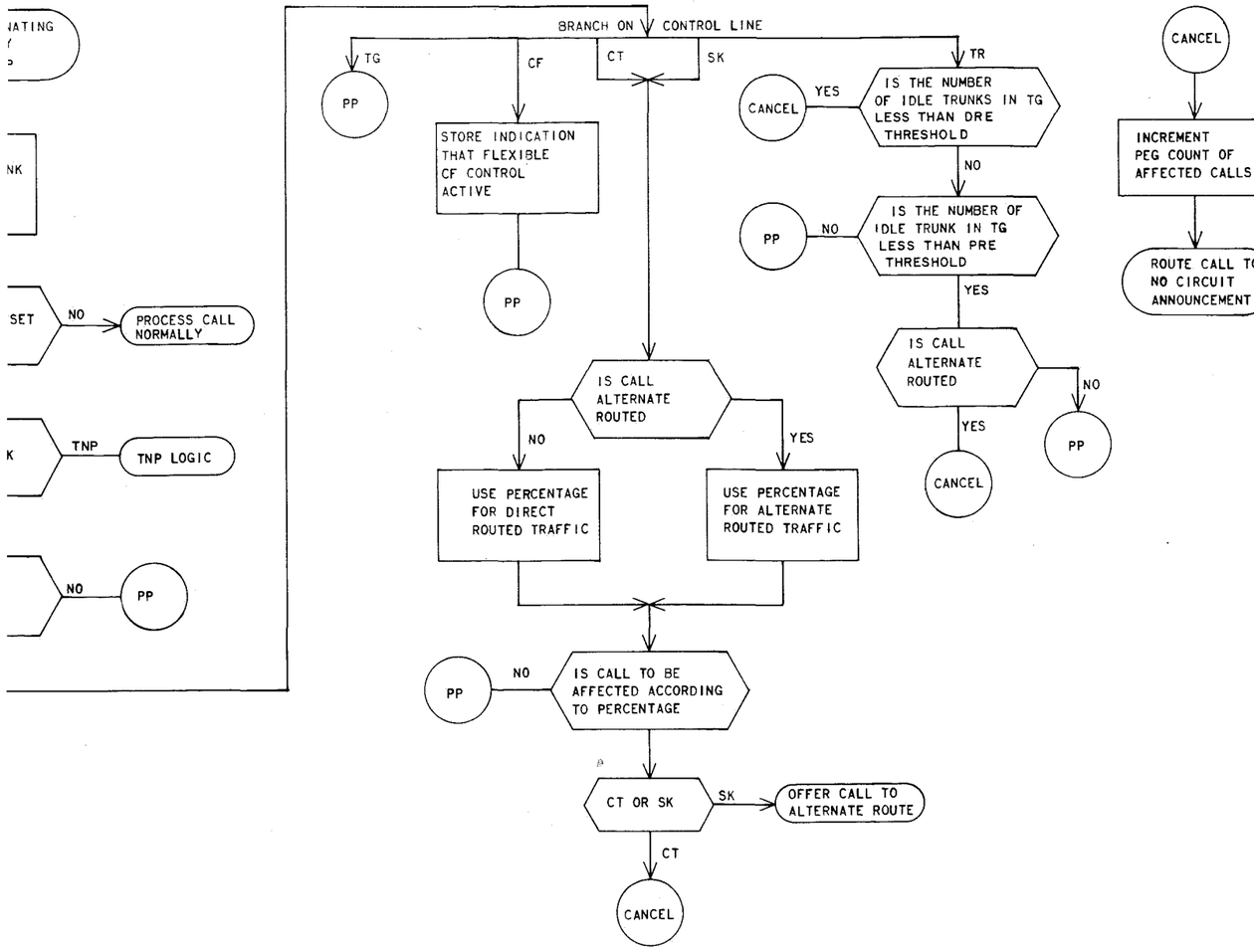
B. Translation

(a) 5 words per assigned preprogram for CTX-6 and later generics

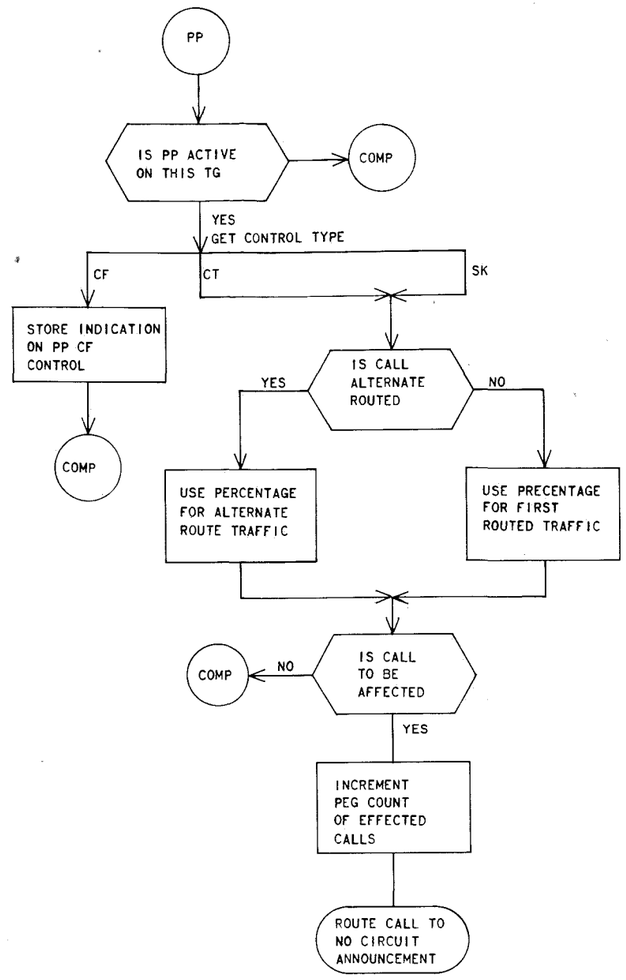


A. CODE BLOCKING CALL PROCESSING INTERFACE

Fig. 2—Network Management Feature Flow Diagram (Sheet 1 of 2)



B. TRUNK GROUP CONTROL CALL PROCESSING INTERFACE



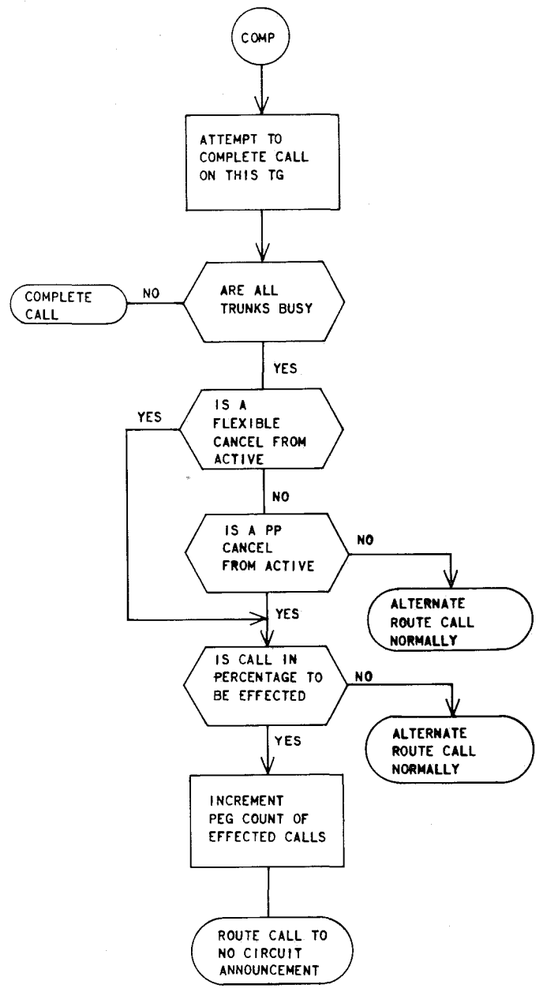
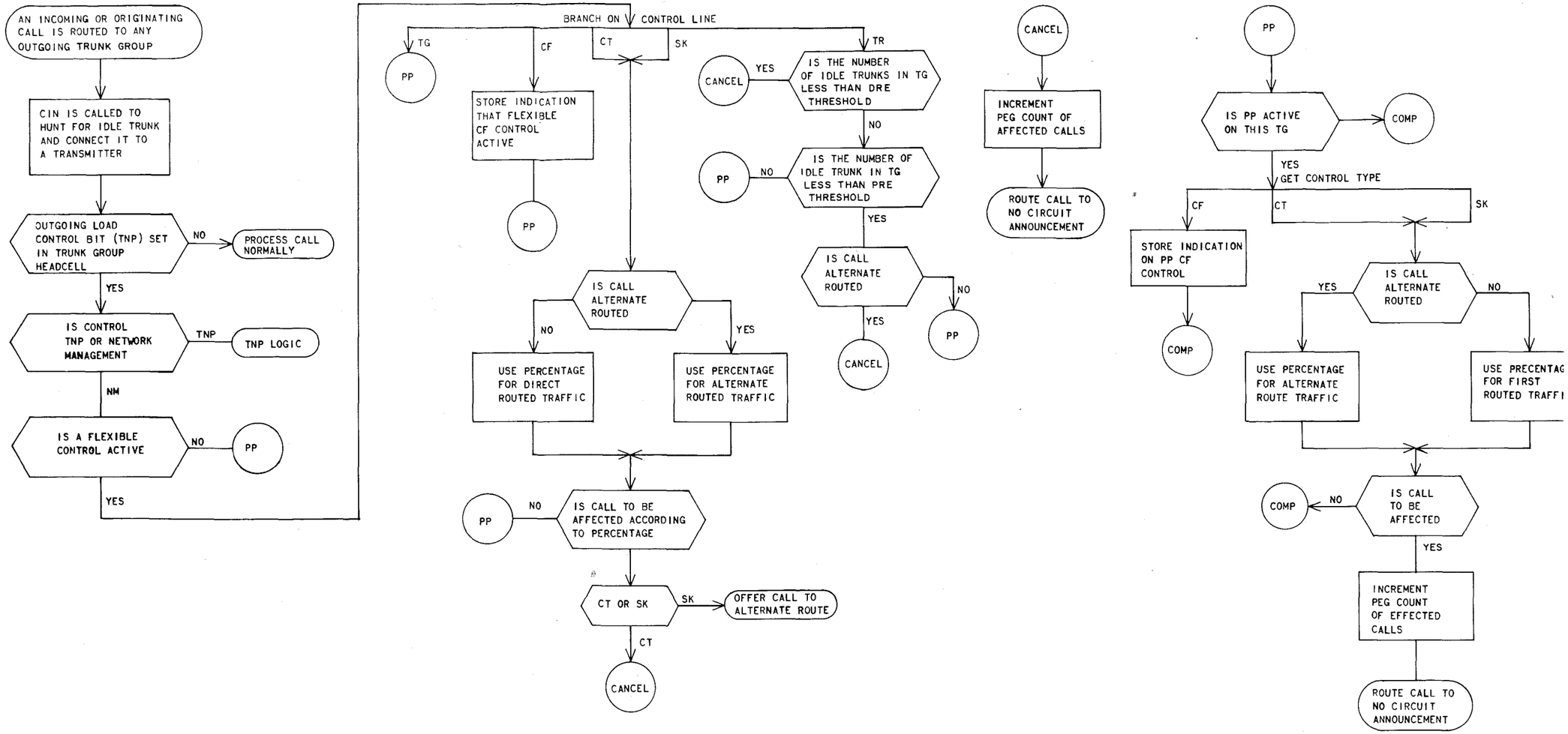


Fig. 2—Network Management Feature Flow Diagram (Sheet 2 of 2)



B. TRUNK GROUP CONTROL CALL PROCESSING INTERFACE

(b) 24 words for indicator circuit for CTX-7 and later generics

(c) 2 words per trunk group no-circuit indicator for CTX-7 and later generics

(d) 49 words for transmit circuit for CTX-7 and later generics

(e) 1 word per MC3 signal for CTX-7 and later generics

(f) 2 words per MC1/MC2 signal for CTX-7 and later generics

C. Parameter

(a) 4 words for CTX-6 generics

(b) 14 words for CTX-7 and later generics

CALL STORE WORDS

A. Fixed

(a) 30 words for CTX-6 generics

(b) 37 words for CTX-7 and later generics

B. Variable

(a) 8 words per code blocking/calling line identification slot for CTX-6 and later generics

(b) 1 word per trunk group for every trunk group in the office for CTX-6 and later generics

(c) 2 words per trunk group with trunk group controls for CTX-6 and later generics

(d) 4 words per preprogram for CTX-6 generics

(e) 6 words per preprogram for CTX-7 and later generics

(f) 56 words for transmit circuit for CTX-7 and later generics

(g) 24 words for indicator circuit for CTX-7 and later generics

(h) 6 words per flexible control slot for CTX-7 and later generics

REAL TIME

8.02 The real-time cost for network management controls depends upon the number of simultaneous controls, the amount of traffic in the office directed to the overload, and the severity of the controls taken. Typical values for these variables for code blocking controls show a savings of approximately 0.4 percent of real-time and maximum values costing approximately 0.5 percent. The savings results from the routing to announcement of calls which have a low probability of completion and were canceled as a result of a code block control. For trunk group controls, typical values yield a negligible real-time cost and maximum values costing less than 0.5 percent.

8.03 Real-time equivalent cost for transmitting dynamic overload control signals varies according to the amount of traffic and the state of the system. If no overload exists, a negligible real-time equivalent cost of approximately 0.025 percent is incurred.

8.04 The real-time cost associated with updating the network management indicator circuits depends on the number of changes of state since the last entry for the group of indicators. On the average, few indicators will need to be placed in a new state, and a negligible real-time equivalent cost of 0.05 percent can be expected.

ASSIGN/UNASSIGN COSTS

8.05 A single recent change message will be required to assign a new trunk group control preprogram, followed by cardwriting. To change an existing preprogram, two recent change messages are required, one for unassigning the existing preprogram and one for assigning a new preprogram, followed by cardwriting.

HARDWARE USAGE COSTS

A. Circuits

(a) Common systems dynamic overload control (receive) circuit, SD-27970-01

(b) Dynamic overload control transmit circuit, SD-1A334-01

(c) Network management indicator circuit, SD-1A335-01

(d) An engineered number of announcement trunks for disposing of affected attempts [see Traffic Engineering Guide, Sections 1, 3, and 8 (updates October, 1972)].

B. Master Scanner Points

(a) Quantity—up to 162

(b) Uses

(1) 2 scan points per DOC signal received SD-27970-01

(2) 1 scan point for alarm indicator for the DOC circuit, SD-27970-01

(3) 64 MC1/MC2 signals; DOC transmit circuit SD-1A334-01

(4) 32 MC3 signals; DOC transmit circuit SD-1A334-01

(5) 5 maintenance; DOC transmit circuit, SD-1A334-01

C. Signal Distributor Points

(a) Quantity—up to 237

(b) Uses

(1) 64 MC1/MC2 signals; DOC transmit circuit SD-1A334-01

(2) 2 interrupters; DOC transmit circuit SD-1A334-01

(3) 4 maintenance; DOC transmit circuit SD-1A334-01

(4) 167 indicator circuit SD-1A335-01

D. Central Pulse Distributor Points

(a) Quantity—2 bipolar points

(b) Use—Maintenance of DOC transmit circuit SD-1A334-01

INCORPORATION INTO SYSTEM

9. PLANNING

A. Coordination

9.01 Since this feature is concerned with the hierarchical switching network, the operating companies must plan for network management in such a way that each individual office fits the overall network plan. This requires coordination among network management, dial administration, plant, and traffic engineering personnel.

B. Equipment, Space Requirements and Current Drain

9.02 The common systems DOC receive circuit, SD-27970-01, is located on a miscellaneous frame (J1A048A) if located in the ESS office. For an ESS office with CTX-6 or later generic programs, the circuit consists of one control and alarm circuit (J23058 BP) and up to 30 receive circuits (J23058 CT). The control and alarm unit requires 2 frame inches, and each receive unit requires 4 frame inches. The maximum current drain on the −48 volt power supply is 6.2 amps.

9.03 The DOC transmit circuit, SD-1A334-01, required in the ESS central office is located on one DOC frame (J1A083A). The basic DOC unit requires 26 frame inches which can expand to 56 frame inches. The maximum current drain on the +24 volt power supply is 3.5 amps. The maximum current drain on the −48 volt power supply is 6.8 amps.

9.04 The network management indicator circuit, SD-1A335-01, required in the ESS office is located on the DOC frame (J1A083A) if it is present. Otherwise, it is located on a miscellaneous trunk frame (J1A033C). The circuit consists of up to seven network management indicator units (J1A083AE). Each unit provides for 24 individual indicators. The number of panels is optional and depends on the number of machine status, trunk group no-circuit, and RADR indicators required. Each contact panel requires 2 frame inches. A terminal on the transmission facility is required for each indicator—whether software or hardware activated. Therefore the maximum number of terminals required is 170.

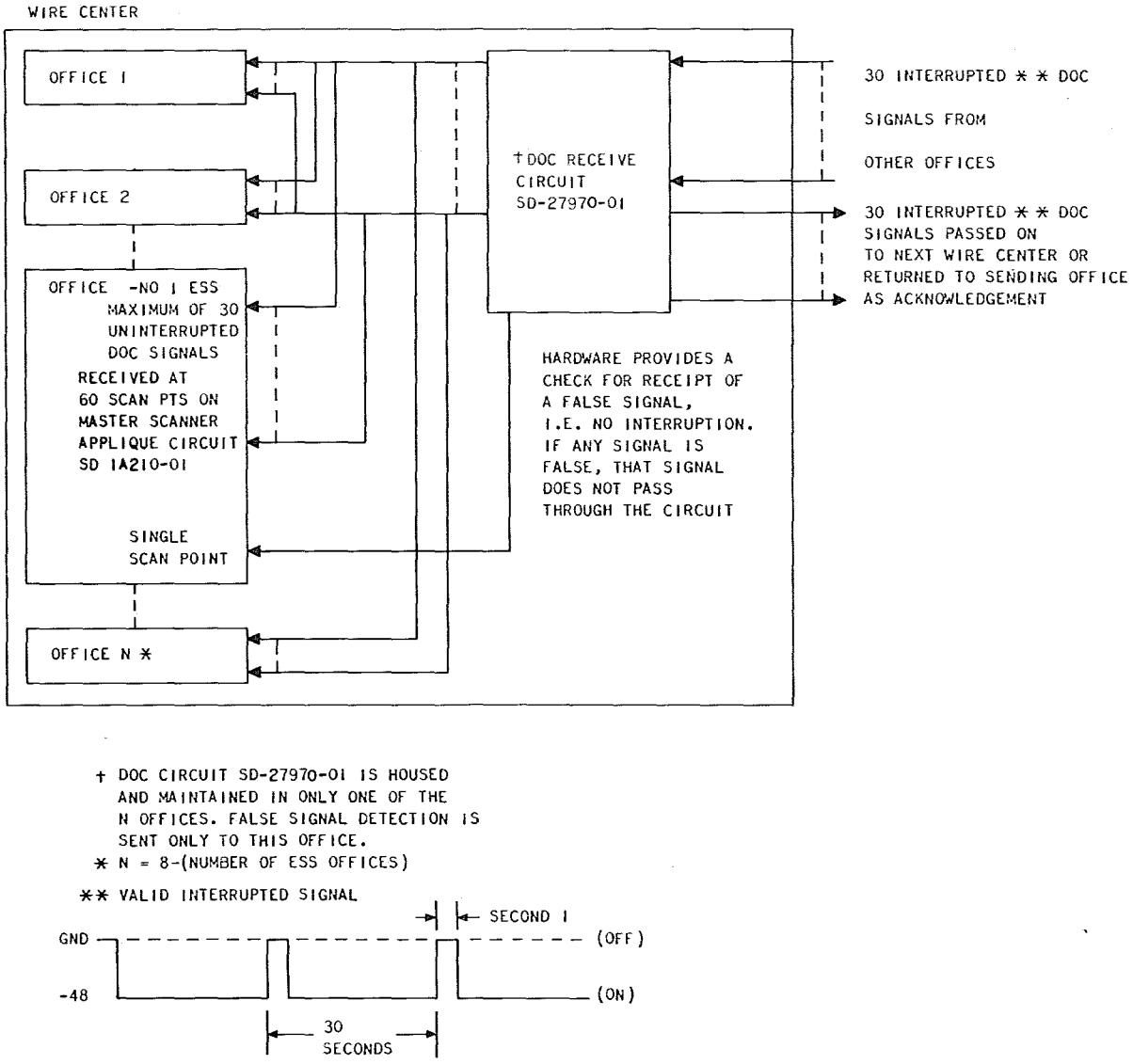


Fig. 3—Functional Hardware Schematic for Dynamic Overload Control [Receive] Circuit

9.05 It is important to note that the network management indicator circuit provides only the interface for a network management display. Open/closed contacts are provided for each indicator to be used to light the lamps, to transmit to a remote location via some transmission system, eg., Status Assembly System (SAS), or to use in any other manner at the discretion of the operating company.

10. HARDWARE ENGINEERING

10.01 No. 1 ESS will require new hardware for receiving dynamic overload control (DOC) signals from higher level offices (Fig. 3). The hardware used for this function is common systems dynamic overload control (DOC) circuit, SD-27970-01, with class D modifications included in Issue 5D of this circuit.

10.02 This DOC circuit can receive up to 30 DOC signals from higher level offices and can distribute all 30 signals to up to N offices, located in a wire center, where N equals eight minus the number of electronic switching systems and the maximum number of electronic switching system is equal to four. Each signal is used for automatic activation/deactivation of ***one*** trunk group control preprogram. These 30 signals are received in the No. 1 ESS via 60 scan points on the remote master scanner applique circuit, SD-1A210-01. Two scan points (one supervisory and one directed) are provided per DOC signal for checking the condition of the connections between the DOC circuit and the remote master scanner applique circuits; the two scan points should always be in opposite states for each DOC signal. If this circuit is to be housed in the ESS office, an additional scan point is required for maintenance.

10.03 One of the up to N offices is used for maintenance of the DOC circuit. The hardware includes a check for the receipt of a false signal by the DOC circuit. To facilitate this integrity check, a true signal is interrupted every 30 seconds for approximately 1 second. If any of the 30 DOC signals are detected by hardware as false signals, the office chosen for maintenance of the circuit is signaled. If this office is a No. 1 ESS office, the signaling is via a single supervisory scan point on the remote master scanner applique circuit.

10.04 In addition to passing the DOC signals on to the offices in the wire center, the DOC circuit is equipped so that the DOC signals are transmitted either to another wire center equipped with a DOC circuit or to the office sending the signal. When the office which is sending the signal receives a return of the signal, it accepts it as an acknowledgment that the controlled office(s) received the original signal.

10.05 Offices which either cannot or do not desire to receive automatic DOC signals from higher level offices will not need to buy the DOC circuit but can still use trunk group controls on a manual input only.

10.06 No. 1 ESS requires new hardware for transmitting dynamic overload control signals to connected offices (Fig. 4). The hardware used for this function is the network management dynamic overload control transmit circuit, SD-1A334-01. The DOC transmit circuit is interconnected with the rest of ESS by means of SD points, central pulse

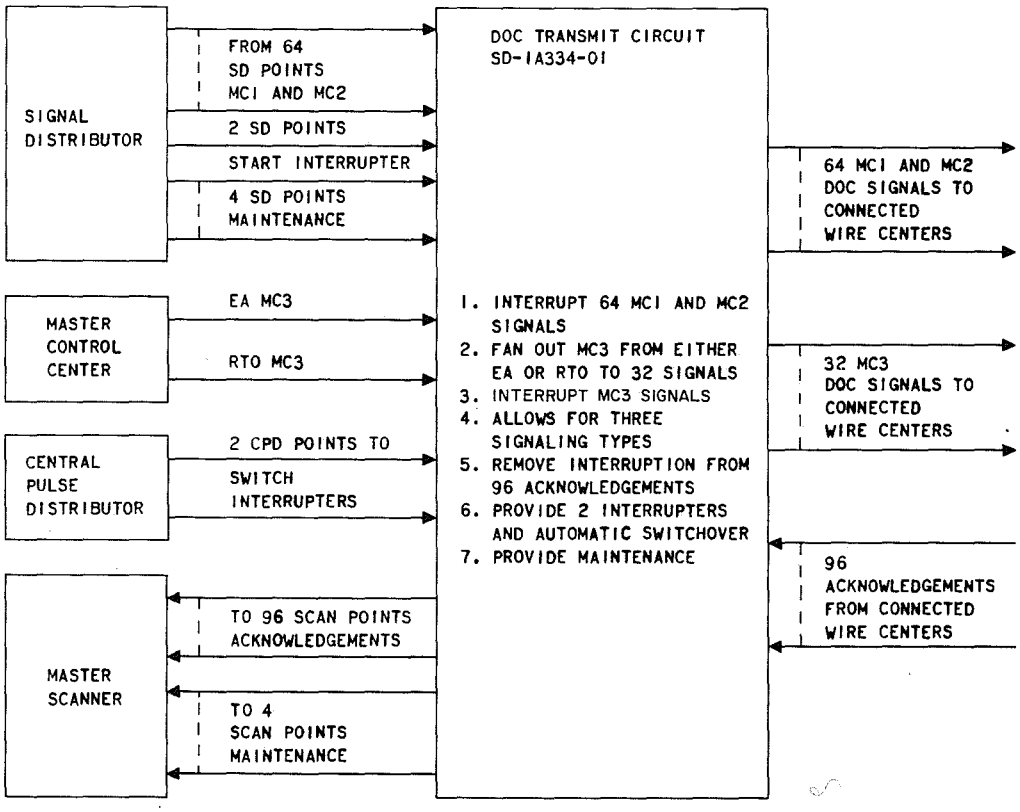


Fig. 4—Functional Hardware Schematic for Dynamic Overload Control Transmit Circuit

distributor (CPD) points, and master scanner (MS) points. Twenty-two SD points, two bipolar CPD points, three supervisory MS rows, one directed MS point and four supervisory MS points are required for the basic DOC transmit circuit. Each additional group of 16 MC1/MC2 signals requires 16 SD points and one supervisory MS row.

10.07 New hardware, circuit SD-1A335-01, is required to provide ESS with the interface for network management indicators. The circuit includes the machine status, RADR, and the trunk group status indicator interface. The network management indicator circuit is interconnected with the rest of No. 1 ESS by means of signal distributor (SD) points. One SD point is required for each software activated indicator. A maximum of 167 SD points can be required.

10.08 Decide whether a new TTY channel will be required for network management. In all cases, the maintenance channels, both local and remote, may be used for network management. A new channel may be chosen for network management, or the traffic channel may be used as the network management channel.

10.09 Announcement trunks for the network management no circuit announcement and emergency announcements 1 and 2 are required for disposing of calls affected by network management controls.

11. SOFTWARE ENGINEERING

11.01 Identify those rate centers from which calls should be affected by code blocking. Since the trace-on-outgoing-calls portion of the calling line identification feature shares in the implementation procedure, the rate centers identified will, by necessity, be the rate centers from which calls may be traced. This information is supplied on ESS Form 1507.

11.02 Choose the number of code blocking slots to be provided. This number can be chosen from 4 to 31 and limits the number of code blocking controls (and calling line identification entries) that can be active simultaneously. This information is supplied on the call store worksheet.

11.03 Choose the number of and the identification of trunk groups for which network management controls will be provided. The number must be less than 64 and should be much smaller so that more than one preprogram may be designated for each trunk group. Any outgoing one-way or 2-way trunk group may be chosen for network management controls. The information is supplied on the call store worksheet and ESS Form 1506.

11.04 Choose the number of trunk group control preprograms. Each preprogram is single function (cancel-to, skip, or cancel-from) with specified percentage of attempts to be affected on a single trunk group. In addition, each priority desired requires a preprogram. The total number of preprograms must be less than 64. This information is supplied on the call store worksheet and ESS Form 1506. If preprograms are to be used for receiving DOC signals, a common systems dynamic overload control circuit, SD 27970-01, must be ordered on the E8056 questionaire. This circuit need not be ordered on this form if it is to be housed in another switching entity in the wire center.

11.05 Identify the trunk group and the number of trunks to be provided in the trunk groups for each of the three announcements (fixed RIs 180, 181, 182) used for calls affected by network management controls. Calls which find no trunk available when routed to one of these announcements will alternate route to regular overflow (fixed RI 80). This information is supplied on ESS Forms 1212 and 1303.

11.06 Identify those offices to which is it desirable to send DOC signals. Determine the type of traffic, e.g., MF, received from the office in order that the correct DOC signal may be associated with the office. Group the offices, if desirable, into tandem signaling loops so that one signal will be received by many offices. This information is supplied on ESS Forms 1509 A/B. In addition, a dynamic overload control transmit circuit, SD 1A334-01, must be ordered on the E8056 questionaire.

11.07 Determine which of the machine status indicators in the network management indicator circuit are applicable to the office. For example, a customer dial pulse receiver queue overflow indicator is not necessary for a trunk-only office. Determine if RADR percentages are to be included in the displays. The information is supplied on the E8056 questionaire. If any of the machine status indicators, RADR displays, or the trunk group no-circuit indicators described in the next paragraph will be required, a network

management indicator circuit, SD 1A335-01, must be ordered on the E8056 questionaire.

11.08 Determine the number and the identity of the trunk groups on which it is desirable to have no-circuit indicators. The number of indicators can range from 0 to 112. This information is supplied on the E8056 questionnaire and ESS Form 1506.

11.09 Choose the number of flexible trunk group control slots to be provided. These slots are used for both control activation and flexible trunk group peg and overflow counter activation. The number can be chosen from 0 to 63. The information is supplied on the call store worksheet.

12. COMPATIBILITY

12.01 The dynamic overload control transmit circuit, SD-1A334-01, compatible with CTX-7 and subsequent generic programs, will interface with common systems dynamic overload control (receive) circuit, SD-27970-01. If the office is a No. 1 ESS office, it must be equipped with Issue 5D or later of SD-27970-01. Existing electromechanical offices may use any issue of SD-27970-01.

12.02 The network management indicator circuit, SD-1A335-01, provides only the interface at the distributing frame. This interface provides for open/closed loops. The use of these loops must be determined by the operating company; e.g., for use in lighting lamps.

13. OFFICE DATA

TRANSLATIONS

A. Translation Layouts

13.01 A rate center status translator must be built to indicate those rate centers in an office from which calls should be affected by both network management code block controls and calling line identification. This translator is built according to information supplied by the operating company on the ESS 1507 form. (See Fig. 5 to build rate center status translator.)

13.02 The translation data associated with each trunk group control preprogram is accessed via a unit type number (UTYN) and member number (MEMN) translation. The UTYN MEMN translation produces the address of a 4-word auxiliary block (Fig. 6 and 7) containing the translation data.

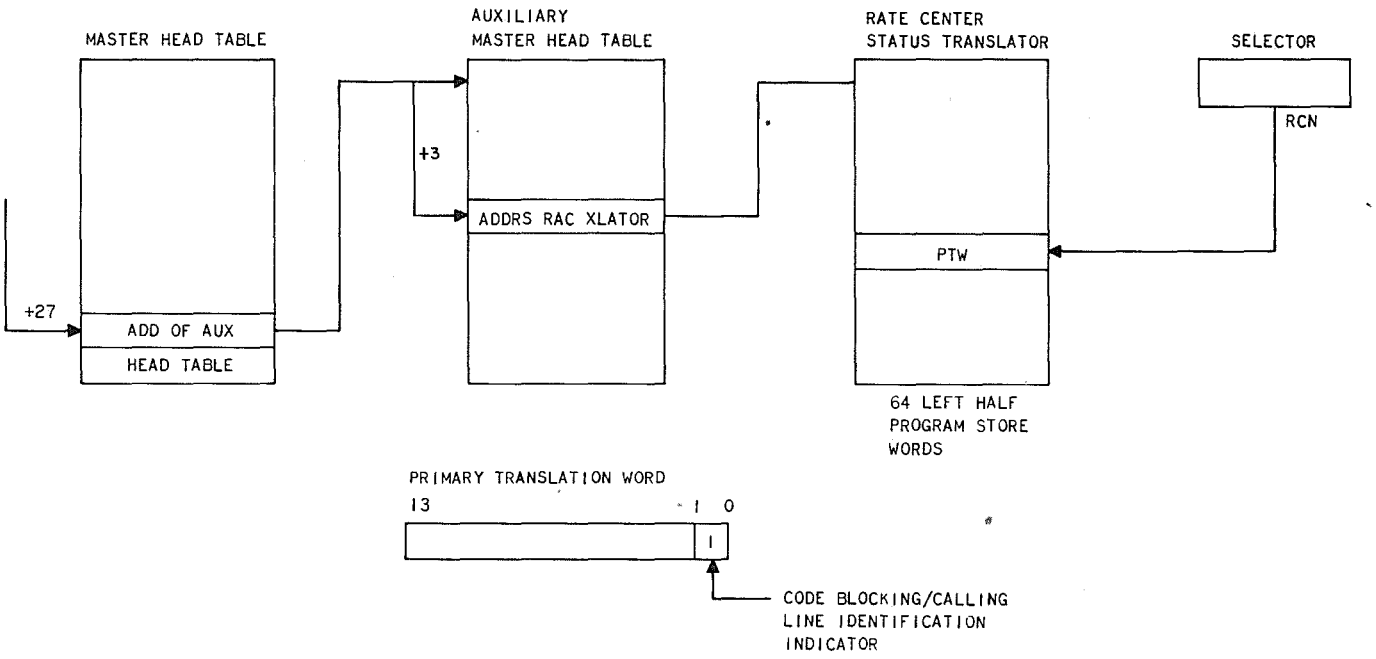


Fig. 5—Building a Rate Center Status Translator

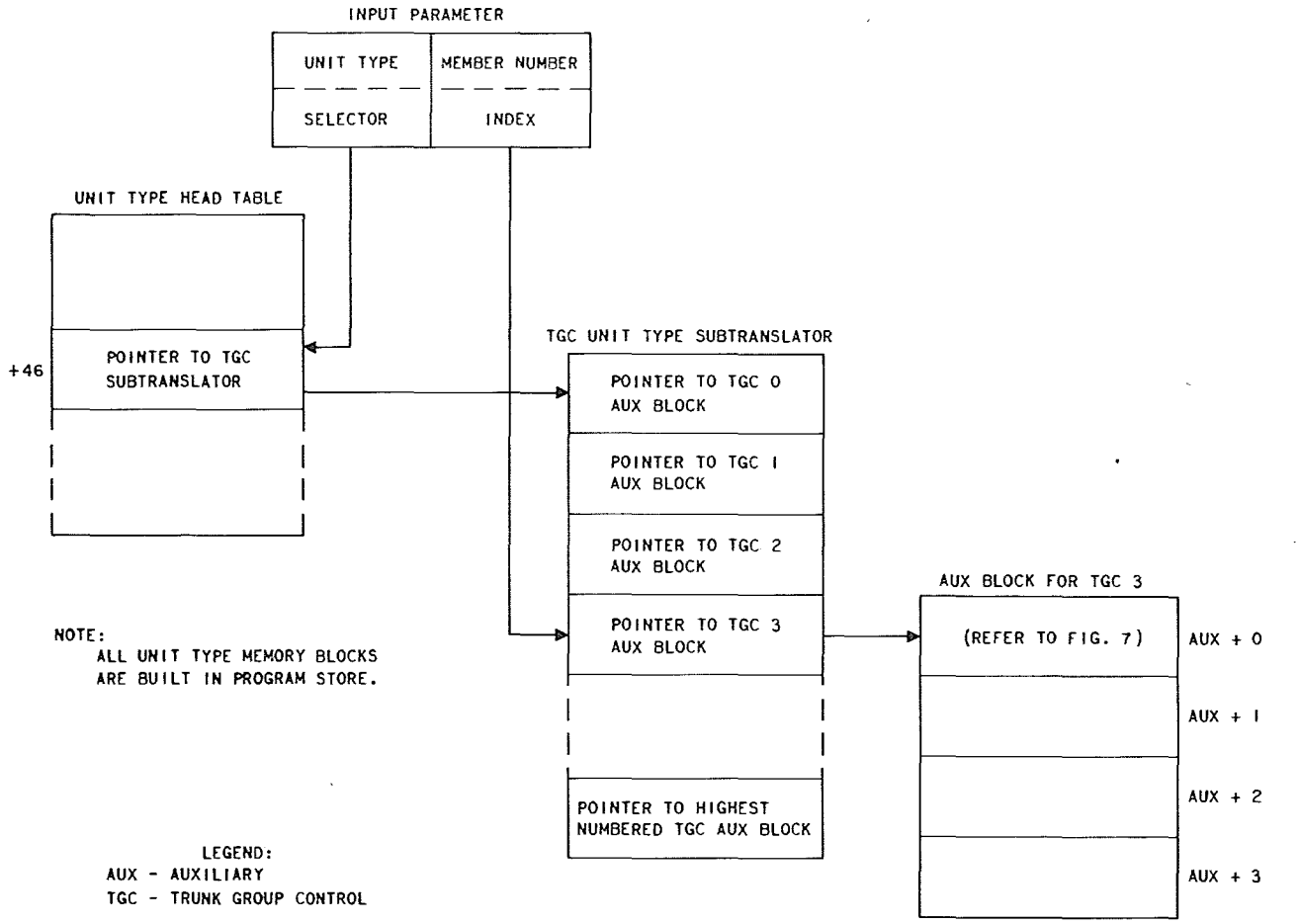


Fig. 6—Layout of TGC Unit Type Translator

13.03 The first word of the auxiliary block contains the word number that indicates the number of words in the auxiliary block and the master scanner number (MSN) of the supervisory scan point associated with an automatic DOC signal for this preprogram. The MSN is provided to allow a directed scan of the scan point associated with automatic activation of this preprogram.

13.04 The second word contains the control function (Fig. 8) provided by the preprogram. The type and amount of control are specified in the control function. Also stored in this word is the number of the preprogram to which the translation information pertains. This word is copied into the appropriate trunk group control word (TGCW) in the TGC preprogram control/activity block when the preprogram is activated.

13.05 The third word contains the priority information (PR) for the preprogram (PR=0 for manual activation only). This is used by the automatic-activate and automatic-reset routines. Also stored in this word is the trunk group number for which the preprogram is defined and the index used for accessing the appropriate trunk group activity word (TGAW) and TGCW word. The index information is also used to link the trunk group head cell to the TGCW in the preprogram trunk group control/activity block.

13.06 The fourth word is provided for maintenance purposes only. It contains the MSN of the directed scan point associated with the DOC signal for this preprogram. The state of this scan point is always to be opposite that of a supervisory scan point. These two scan points provide the capability to detect FCG errors in the facilities connecting the DOC circuit to the scan points.

13.07 The unit type for network management trunk group controls is decimal 46. Member

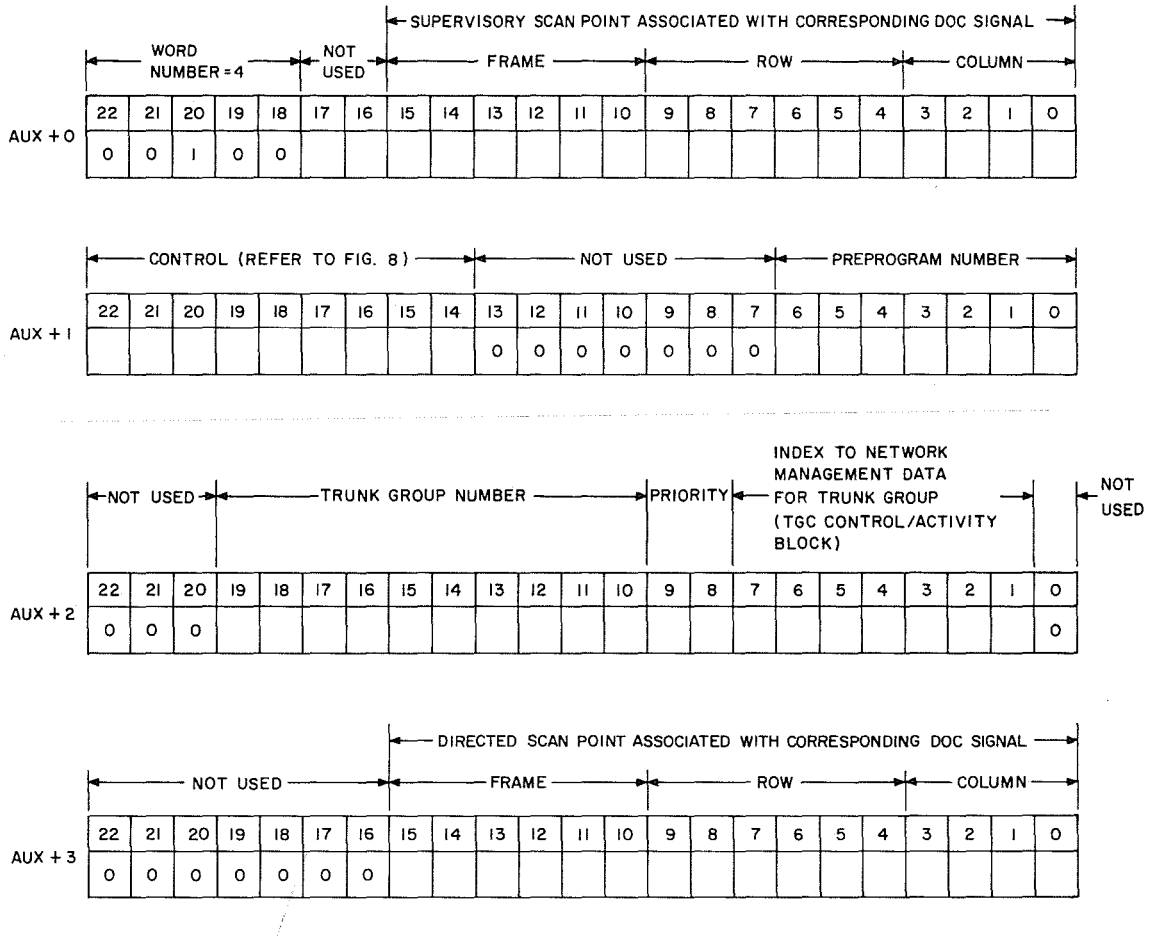


Fig. 7—Layout of TGC Auxiliary Block

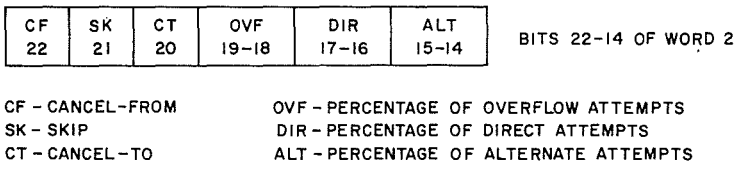


Fig. 8—Control Function

number 0 is associated with the DOC circuit alarm and requires no unit type translations. Member numbers 1 through 63 are associated with trunk group control preprograms 1 through 63, respectively, and each requires unit type translations. The translator for this unit type is built according to information supplied on ESS 1506 and ESS 1600 forms. For detailed procedures required for building unit type translations, refer to Section 231-119-320.

13.08 ESS Form 1506 provides the control information for the preprogram. Items identified on this form are type of control, percentage of attempts to be controlled, trunk group number, pointer assigned to this trunk group, and priority of preprogram. ESS 1600 form provides the master scanner numbers which identify the scan points associated with each preprogram that can be controlled automatically via DOC signals.

A suggested procedure for assigning network management trunk group control preprograms would be as follows:

(a) Decide which trunk groups should be controlled by network management (must be less than 64).

(b) Assign each of these trunk groups a number, beginning with 1 and numbering consecutively. Administrative Form ESS 1508 should be used for this purpose. This number is used as the value of pointer (PTR) on ESS 1506 form for its respective trunk group number.

(c) Decide whether any trunk group can be controlled automatically via DOC signals. If so, the office must be connected to DOC circuit SD-27970-01. Scan point assignments and member number will be found on master scanner record, ESS 1600 form.

(d) For each member number found on ESS 1600 form, assign control information on ESS 1506 form:

1. Determine office sending signal.

2. Determine reason for sending signal.

3. Assign priority (PR) according to congestion level of office sending signal.

PR	Congestion Level
1	MC1
2	MC2
3	MC3

4. Determine trunk group which is to be affected.

5. Assign trunk group (TG) and PTR [see (b) above].

6. Assign control (CTR) option desired—cancel-to (CT), skip (SK), or cancel-from (CF).

7. Assign percentages of attempts to be affected. Note that overflow (OVF) percentage only is assigned if the control is CF, direct routed (DIR) and alternate routed (ALT) only if control is CT or SK.

(e) Insure that no more than three preprograms (member numbers) have been assigned per trunk group and that where the trunk groups are identical the priorities are different.

(f) Decide whether any additional controls are desired which can be activated manually via TTY input message only. Note that any control which can be activated automatically via DOC signals can also be activated manually via TTY input message.

(g) Using any preprogram numbers not currently assigned, assign control information on ESS 1506 form:

1. Assign priority (PR) = 0.

2. Perform steps 4 through 7 in (d) above. Note that any number of preprograms with priority = 0 may be assigned for the same trunk group.

(h) Total number of member numbers (i.e., preprograms) must not be greater than 63.

(i) Choose those preprograms for which traffic peg counts of affected calls are desired to be printed on the H schedule. Indicate these preprograms on ESS 1400 form.

13.09 A new unit type is defined as decimal 56 (Fig. 9). Eighteen member numbers are provided:

(a) 0—Unused

(b) 1—RADR

(c) 2—Network management indicators

(d) 3—DOC transmit circuit maintenance and interrupter

(e) 4—MC3 DOC signal acknowledgment and administration

(f) 5—MC1/MC2 DOC signal administration

(g) 6 through 9—MC1/MC2 DOC signal acknowledgments

(h) 10 through 17—MC1/MC2 DOC offices for each congestion reason.

13.10 The translator for this unit type is built according to information supplied on the ESS 1506, ESS 1509A, and ESS 1509B forms and on the E8056 questionnaire.

13.11 ***RADR***—Member number 1 contains the miscellaneous trunk distributor numbers (MTDNs) used by the network management indicator circuit to display the receiver attachment delay report (RADR) percentages. There can be 11, 22, or 33 MTDNs indicated in the member number depending on how many receiver types are being tested by the RADR feature. If no RADR percentages are to be displayed, the member number auxiliary block is not necessary. (See Fig. 10.)

13.12 ***Network Management Indicators***—Member number 2 contains the MTDNs associated with the machine status indicators and the trunk group numbers (with an associated MTDN) to which no-circuit indicators are assigned. The trunk group numbers to which the no-circuit indicators are to be assigned is supplied on an ESS 1506 form. If no machine status indicators or trunk group no-circuit

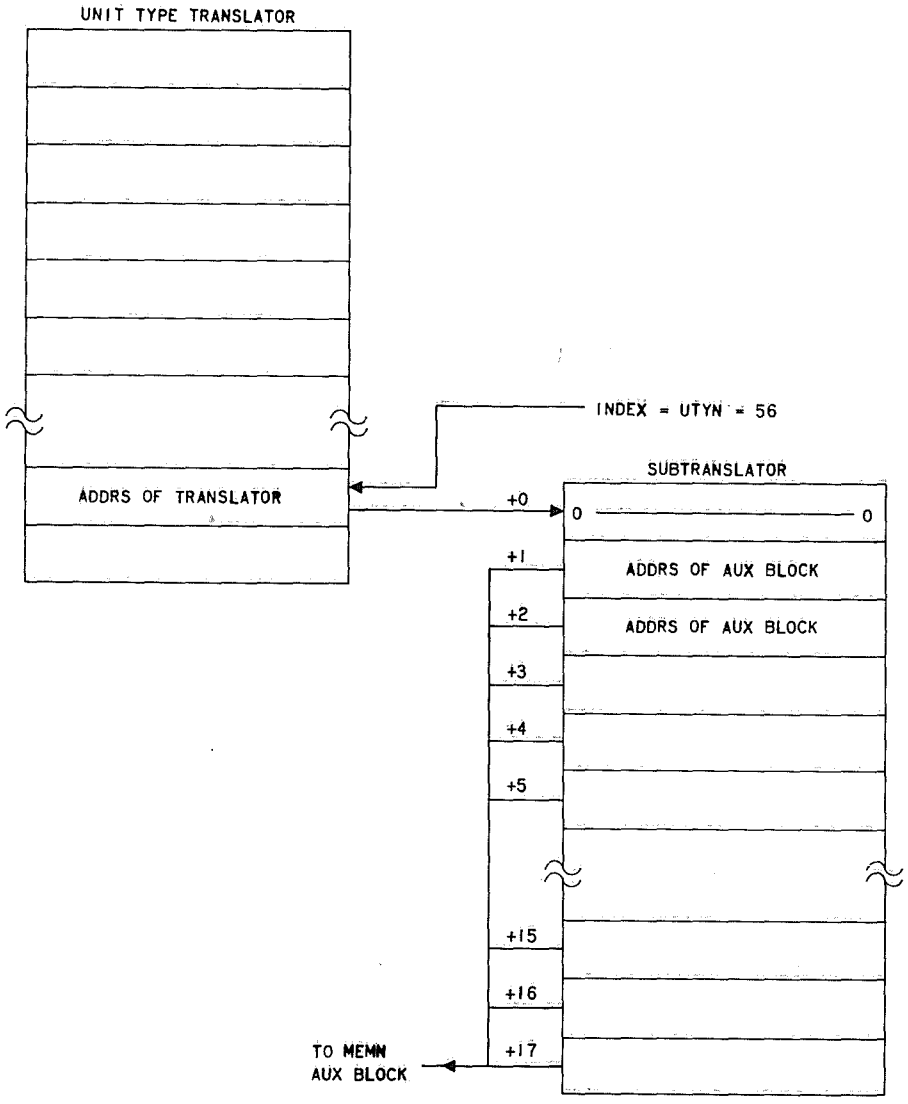


Fig. 9—UTYN Translator

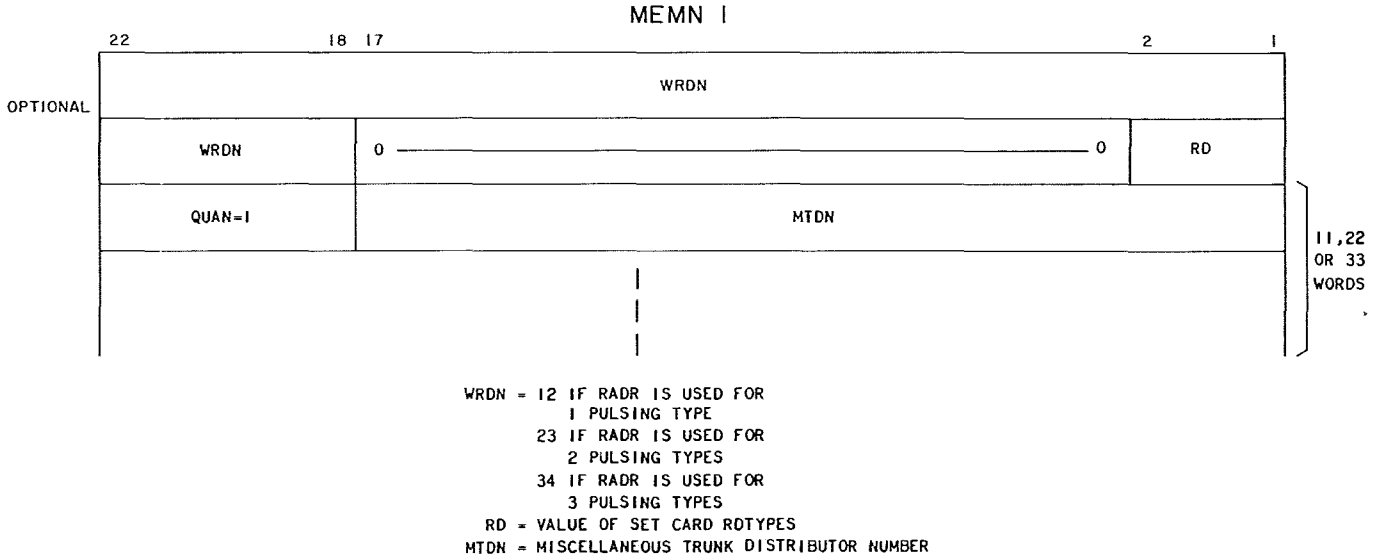


Fig. 10—MEMN 1 Aux Block

indicators are to be provided, the member number auxiliary block is not necessary. (See Fig. 11.)

13.13 *Sending DOC Signals*—Member numbers 3 through 17 (Fig. 12) contain the information necessary for sending DOC signals to connected offices. If DOC signals will not be transmitted by the office, the auxiliary blocks for member numbers 3 through 17 are not necessary.

13.14 Member number 3 identifies the two central pulse distributor points, the six MTDNs, and the four MSNs used for maintenance and control of the DOC circuit signal interrupter.

13.15 Member number 4 identifies the base supervisory MSN for detecting the receipt of MC3 signal acknowledgments. Also included in this member number is a list of the offices (using three alphanumeric characters) to which the MC3 signal is sent.

13.16 Member number 5 identifies each office (using three alphanumeric characters) to which an MC1/MC2 signal is sent. Associated with each office is an MTDN, identifying the signal distributor point used to send the signal.

13.17 Member numbers 6 through 9 each contain a base supervisory MSN, which is the first point on a supervisory scanner row. These scan points are used to detect reception of the acknowledgment to an MC1/MC2 signal.

13.18 Member numbers 10 through 17 are each four words in length. Bits 15 through 0 of these words serve as indexes for offices which will receive MC1/MC2 DOC signals when the predetermined machine thresholds are crossed. Each member number is associated with a different type of congestion; eg, member number 10 identifies the offices to receive a signal when the MC1 real-time threshold is crossed; member number 11 identifies the offices to receive a signal when the MC1-MF receiver threshold is crossed and so on for MC1-DP receiver, MC1-RP receiver, MC2 real-time, MC2-MF receiver, MC2-DP receiver, and MC2-RP receiver thresholds.

13.19 *Master Scanner Number Translation*—Master Scanner points are used by the

MEMN 2

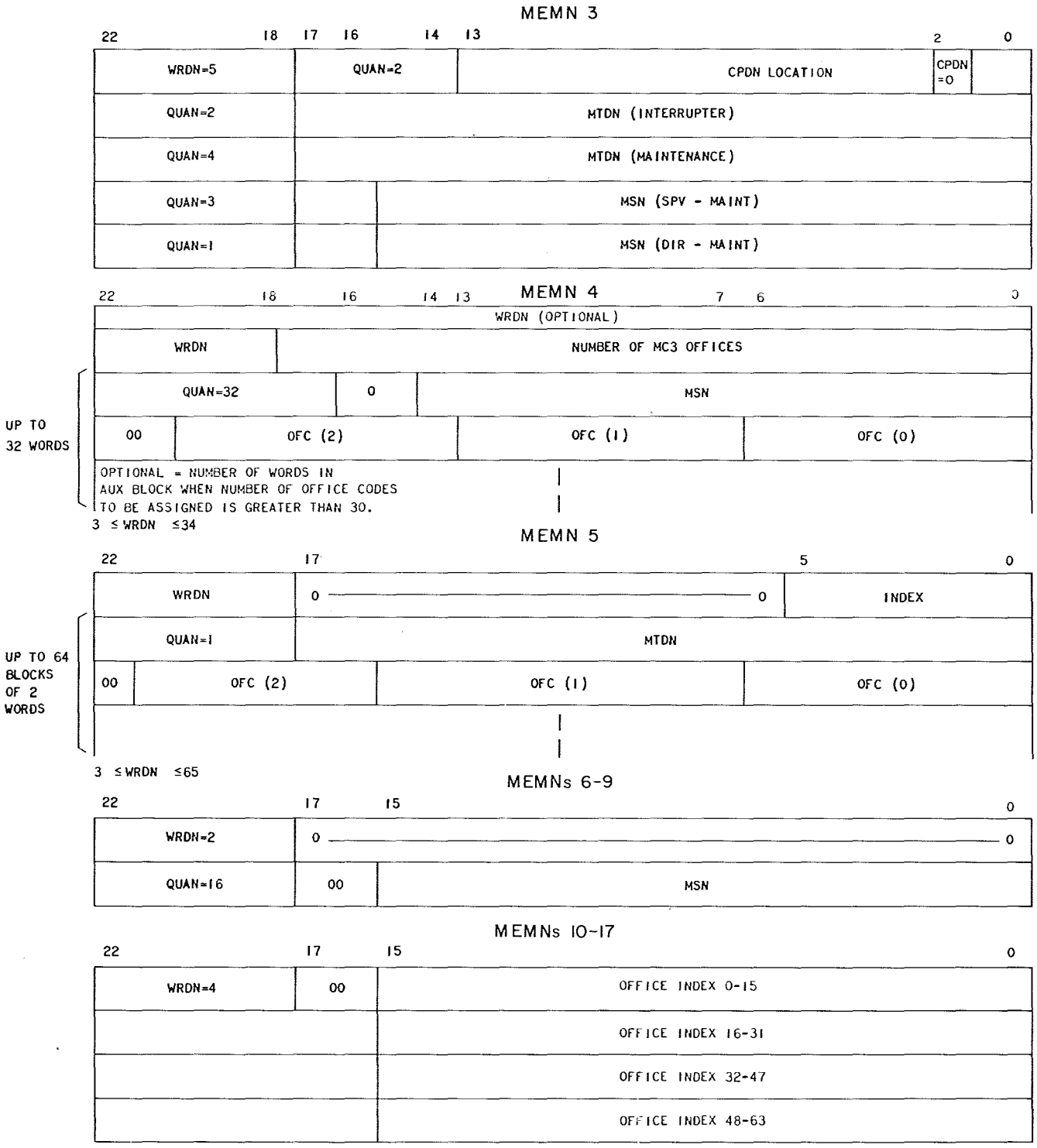
OPTIONAL	
WRDN	NUMBER OF TGNS
QUAN=1	MTDN (MF XMTR OVLD)
QUAN=1	MTDN (DP XMTR OVLD)
QUAN=1	MTDN (RP XMTR OVLD)
QUAN=1	MTDN (LLC DYNG SVC)
QUAN=1	MTDN (MC1 - RT)
QUAN=1	MTDN (MC1 - MF)
QUAN=1	MTDN (MC1 - DP)
QUAN=1	MTDN (MC1 - RP)
QUAN=1	MTDN (ILC)
QUAN=1	MTDN (MC2 - RT)
QUAN=1	MTDN (MTL > 10%)
QUAN=1	MTDN (MC2 - MF)
QUAN=1	MTDN (IOQ)
QUAN=1	MTDN (INTL Q)
QUAN=1	MTDN (OLC)
QUAN=1	MTDN (MC2 - DP)
QUAN=1	MTDN (MC2 - RP)
QUAN=1	MTDN (CTT)
QUAN=1	MTDN (CDP)
QUAN=1	MTDN (MFR)
QUAN=1	MTDN (RPR)
QUAN=1	MTDN (DPR)
0 —— 0	
0 —— 0	TGN
QUAN=1	MTDN (TGN)

UP TO 112 BLOCKS OF 2 WORDS

TREAT AS 2 WORD BLOCK

OPTIONAL = NUMBER OF ASSIGNED TRUNK GROUPS IS GREATER THAN 3. WORDS IN THE AUX BLOCK WILL BE TWO TIMES NUMBER OF ASSIGNED TRK GRPS PLUS TWENTY-FIVE.

Fig. 11—MEMN 2 Aux Block



CPDN = CPD POINTS USED BY MAINTENANCE PROGRAM
MSN = MASTER SCANNER NUMBER
MTDN = MISCELLANEOUS TRUNK DISTRIBUTOR NUMBER
OFC(X) = ALPHANUMERIC CHARACTERS TO IDENTIFY OFFICES OR LOOPS

Fig. 12—MEMN 3, 4, 5, 6-9, 10-17 Aux Blocks

DOC transmit circuit for maintenance (fuse alarm and interrupt timing) and the reception of acknowledgment signals and by the DOC receive circuit for maintenance and reception of DOC signals. See Fig. 13.

B. Recent Change (RC) Messages

13.20 Recent change message formats affected by the network management feature are:

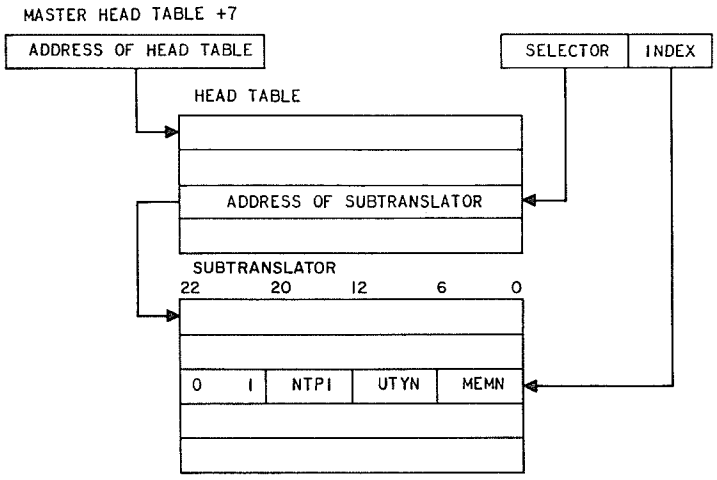
MESSAGE	FUNCTION
RC:NMTGC:	Add a preprogram block (member number of unit type 46) to network management trunk group control.
RC:NMTGC;OUT:	Delete a preprogram block from network management trunk group control.
RC:MSN:	Add or replace master scanner number translations.
RC:PSWD:	Build unit type translations for Unit Type 56.

C. Service Order (SO) Messages

13.21 None.

D. Uniform Service Order Codes (USOC)

13.22 None.



NON-TRUNK PROGRAM INDECES

UNIT TYPE NO.	SCAN POINT	NTPI	MNEMONIC	REMARKS
46	I SCAN POINT SC00 MEMBER NUMBER 00	28	DOC	DOC RECEIVE CIRCUIT MEMBER NUMBER 00 ONLY
	I SUPERVISORY SCAN POINT	57		MEMBER NUMBER 01-63
56	SC00-15	57		DOC TRANSMIT CIRCUIT
	SC16-47	57		MEMBERS 6-9
	SC48, SC49	27		MEMBER 4
	SC50	57		MEMBER 3
	SC51	0		MEMBER 3
44	SC52	39		DOC TRANSMIT CIRCUIT

Fig. 13—Master Scanner Translator

PARAMETERS

Code Blocking

13.23 A new block of call store called code blocking/CLID control slots (Fig. 14) must be provided for storing information relative to an active code block control or calling line identification entry. Each slot requires eight call store words. These eight words are:

(a) ***Word 0:*** Word 0 contains the CB/CLID bit that distinguishes CB from CLID, the percent bits that are used as a mask on a random word to determine if the call is affected, the NOD bits representing the number of digits in the code to be blocked (these bits are used to obtain the mask for the matching of digits in the call store subblock and the call register), the NPA bit that distinguishes area code from office codes. The backward index and forward index, which provide the forward and reverse links and are used to link all codes that are in effect on the same three basic digits. The forward link is necessary because the initial entry into the code control area is via a temporary recent change on the 3-digit translator. Since it is possible to have more than one code beginning with the same three basic digits being controlled at any time, a check must be made of all these codes. The link provides the means for moving through the code control area for this purpose. The reverse link is used in activating and deactivating a contol on a code and in auditing the controls.

(b) ***Word 1:*** Word 1 contains the disposition index that leads into a 4-word block containing the fixed route indexes for a no circuit announcement or one of two emergency announcements. Also, word 1 contains an accumulator for attempts affected by this code for the current clock quarter-hour.

(c) ***Words 2 and 3:*** Word 2 contains the access code and half of the digits to which attempts are to be blocked. Word 3 contains the remainder of the digits to which attempts are to be blocked.

(d) ***Words 4 and 5:*** Word 4 contains the control mask for digit word 1. Word 5 contains the control mask for digit word 2.

(e) ***Words 6 and 7:*** Words 6 and 7 are holding registers. Word 6 contains a traffic count of attempts affected by this code for the last clock quarter-hour. Word 7 contains a traffic count of attempts affected for the clock quarter-hour previous to the last.

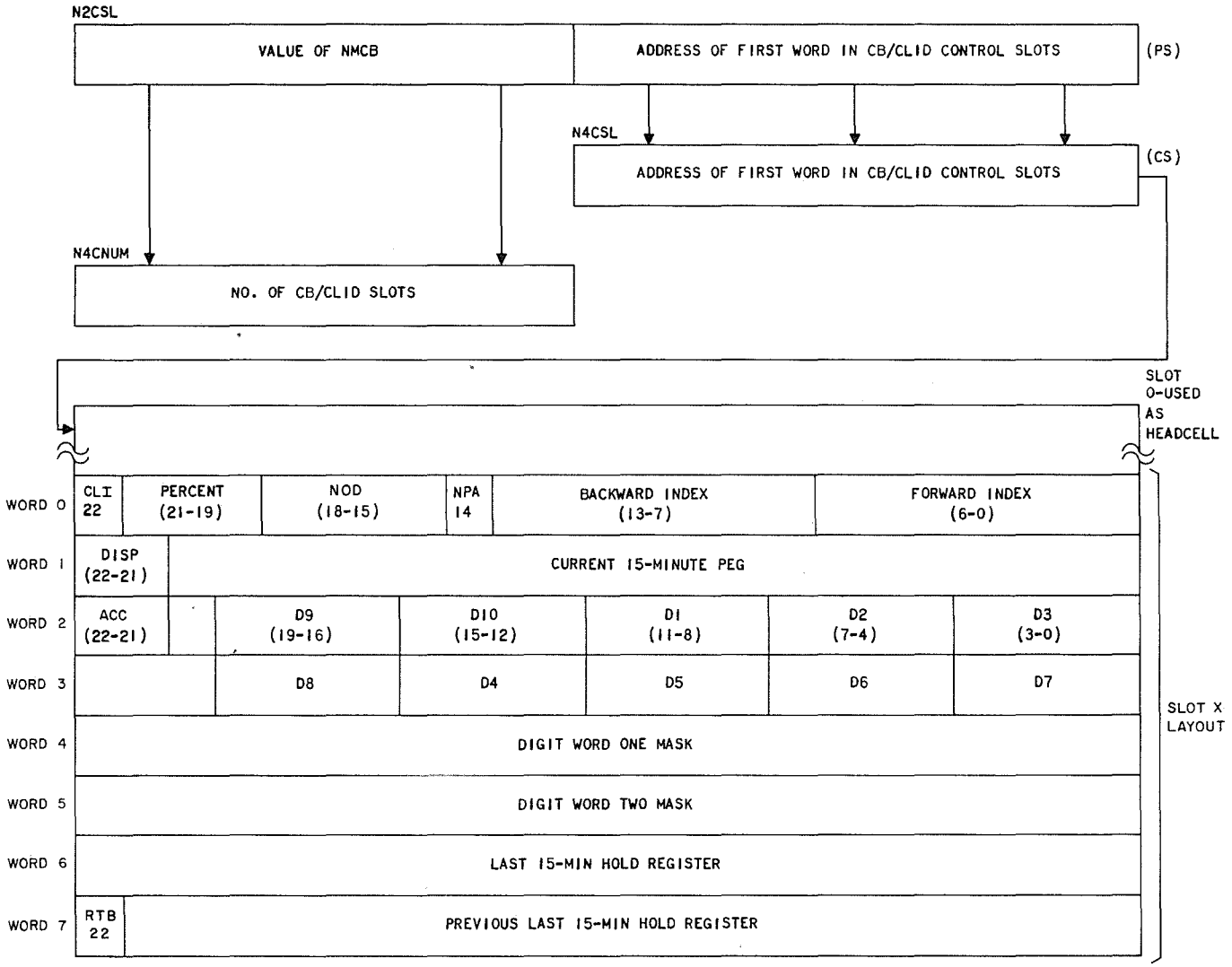
The number of slots provided limits the number of code block controls (and calling line identification entries) that can be active simultaneously and is indicated by a new parameter set card NMCODE. This call store block is of variable size consisting of from 40 to 256 words divided into from 5 to 32 subblocks of the eight words described above. Subblock (slot) zero is used as a headcell.

Preprogrammed Trunk Group Control

13.24 A block of call store called trunk group headcell annex, Fig. 15, is required for use as an indication that a network management control is active on a specific trunk group. One word is required per trunk group in the office, indicated by set card NMTGC. This block is not required if network management trunk group controls are not to be provided and set card NMTGC is zero. If the set card NMTGC is missing, no call store is allotted, and N2TGNANX is all zeros.

13.25 A block of call store called trunk group control and activity block, Fig. 16, is required for each trunk group in the office for which preprogrammed controls may be applied. Two words for each of these trunk groups are required to indicate the specific control that is active on the trunk group and to store the activity of the automatic DOC signals applicable to this trunk group. The number of controllable trunk groups is indicated by a set card NMTGC. The call store block is of variable size consisting of from 4 to 128 words divided into from 2 to 64 subblocks of two words each. Subblock zero is presently unused. These subblocks are used to store TGC control and activity information related to a trunk group.

13.26 A block of call store called preprogram trunk group control status and traffic block (Fig. 17) is required for each trunk group control preprogram. This block is used to store the status, automatic active, manually excluded, etc., and to store the traffic peg counts of affected attempts. A set card NMTGPP is required, the value of which should be set equal to the highest numbered trunk group control preprogram. This call store block is of variable size consisting of from 8 to 256



ACC = ACCESS CODE
CLI = 1 IF CLID ENTRY
0 IF CB ENTRY
DISP = DISPOSITION INDEX TO NO-CIRCUIT ANNOUNCEMENT, EMERGENCY ANNOUNCEMENTS NOS. 1 AND 2
D1-D10 = BLOCKED DIGITS
INDEX = SLOT NUMBER
NOD = NUMBER OF DIGITS
NPA = 1 IF DIGITS D1, D2 AND D3 ARE NPA
0 IF DIGITS D1, D2 AND D3 ARE NNX
PERCENT = PERCENT OF CONTROL
RTB = REAL TIME BREAK INDICATOR FOR ACTIVATION

Fig. 14—CB/CLID Control Slots Layout

words divided into from 2 to 64 subblocks of four words each. Word 0 holds the current clock quarter-hour peg count of attempts affected by the preprogram for this block. Word 1 serves as a holding register for the peg count over the previous clock quarter-hour. Word 2 serves as a holding register for the peg count previous to the last clock quarter-hour. Word 3 is the accumulator for the hourly peg count of attempts affected. In addition to serving traffic requirements, this block also contains the current status of the preprogram.

13.27 A 2-word annex (Fig. 18) has been added in CTX-7 to each trunk group control

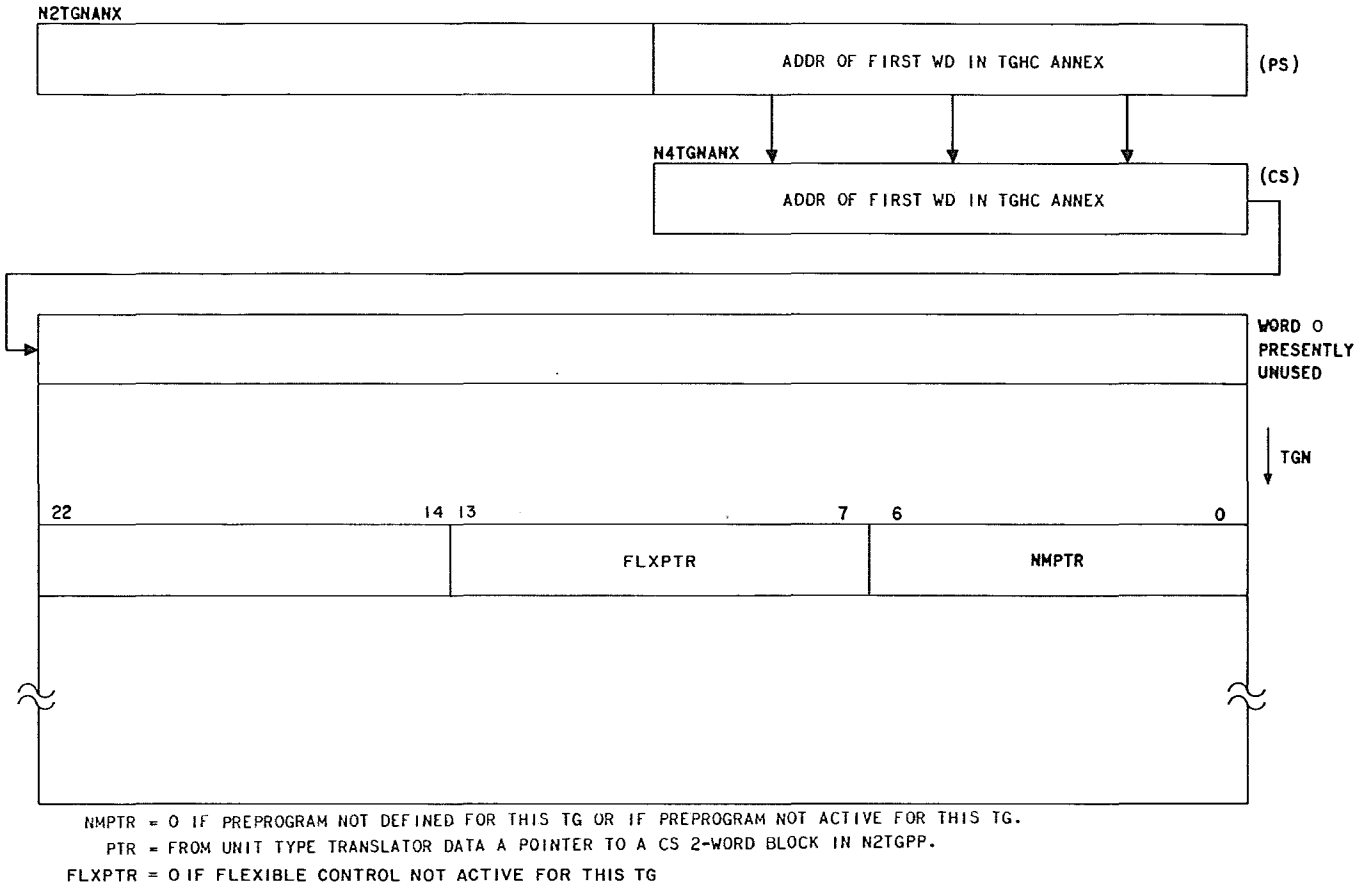


Fig. 15—Trunk Group Headcell Annex Layout

preprogram status and traffic block (Fig. 17). The number of status and traffic blocks is variable. The two words are used to gather the following traffic counts for each preprogram:

(a) Peg count during the last clock quarter-hour of attempts on the trunk group controlled by the preprogram.

(2) Peg count during the last clock quarter-hour of overflows from the trunk group controlled by the preprogram.

If no preprograms are defined for the office, i.e., set card NMTGPP = 0, then no annex block is necessary.

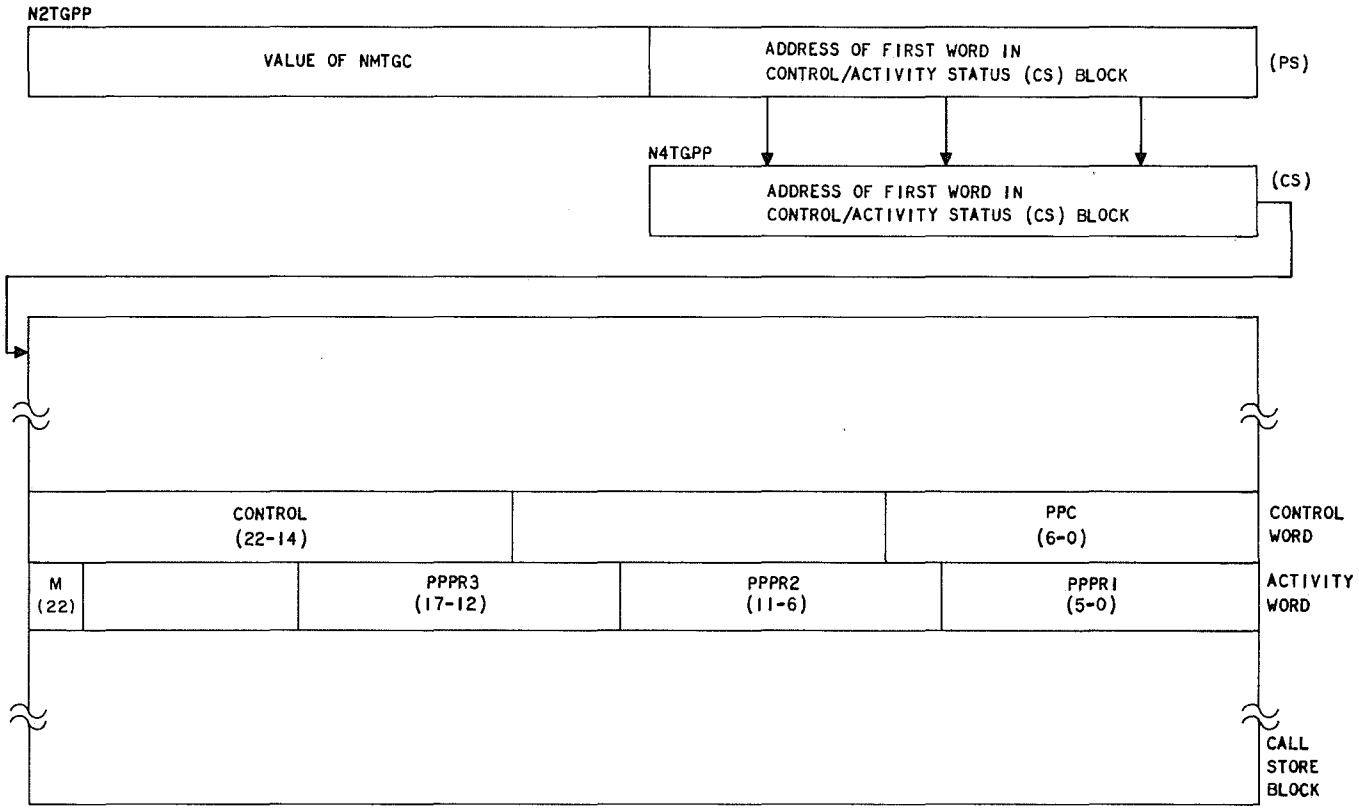
Flexible Trunk Group Control Block

13.28 A block of call store must be provided to implement flexible trunk group controls (Fig. 19). The block is divided into 2-word slots. Each slot may contain the control information for one flexible trunk group control or the activation information for one flexible trunk group peg and overflow counter. The index into the control slots is a pointer in the trunk group head cell annex. The number of slots provided limits the number of flexible trunk group controls (and flexible trunk group peg and overflow counters) that can be active simultaneously. The number is indicated by set card NMFLXC, the value of which can range from 0 to 63. The call store block is of variable size consisting of from 4 to 128 words, divided into from 2 to 64 subblocks of 2 words each.

Flexible Trunk Group Control Traffic Slots

13.29 A block of call store must be provided to accumulate traffic counts for each flexible trunk group control and flexible trunk group peg and overflow counter (Fig. 20). This block is divided into 4-word slots, one slot associated with each flexible trunk group control slot. The traffic slots maintain peg counts for:

(a) Calls affected by the control during the current clock quarter-hour



CONTROL = TGC OPTION AND PERCENTAGE OF CONTROL
M = 1 IF TG IS CONTROLLED MANUALLY BY A PREPROGRAM
0 OTHERWISE
PPC = CONTROLLING PREPROGRAM (PP) NUMBER FOR THIS TG
PPPR'X' = 0 IF AUTOMATIC PREPROGRAM OF PRIORITY 'X' IS NOT ACTIVE
PP NUMBER OF AUTOMATIC PREPROGRAM OF 'X' IS ACTIVE
(ACTIVE WHEN RECEIVING AUTOMATIC SELECTIVE DYNAMIC OVERLOAD CONTROL (DOC) SIGNAL)

Fig. 16—Trunk Group Control/Activity Block Layout

(b) Calls affected by the control during the last clock quarter-hour

(c) Attempts on the trunk group during the last clock quarter-hour

(d) Overflows from the trunk group during the last clock quarter-hour.

This call store block is of variable size consisting of from 8 to 256 words divided into from 2 to 64 subblocks of 4 words each.

Trunk Group Head Cell Annex

13.30 A block of call store called the trunk group head cell annex was introduced in the CTX-6 generic for use by the preprogrammed trunk group controls. The annex contains a pointer into the preprogram active on a specific trunk group. One word of call store per trunk group in the office is required for the annex. Flexible trunk group controls in generics CTX-7 and later will use the same annex for the pointer into the flexible controls slots and flexible control traffic slots. The annex was formerly allocated if set card NMTGC (indicating the highest numbered preprogram) was greater than zero. With CTX-7 and later, the annex is

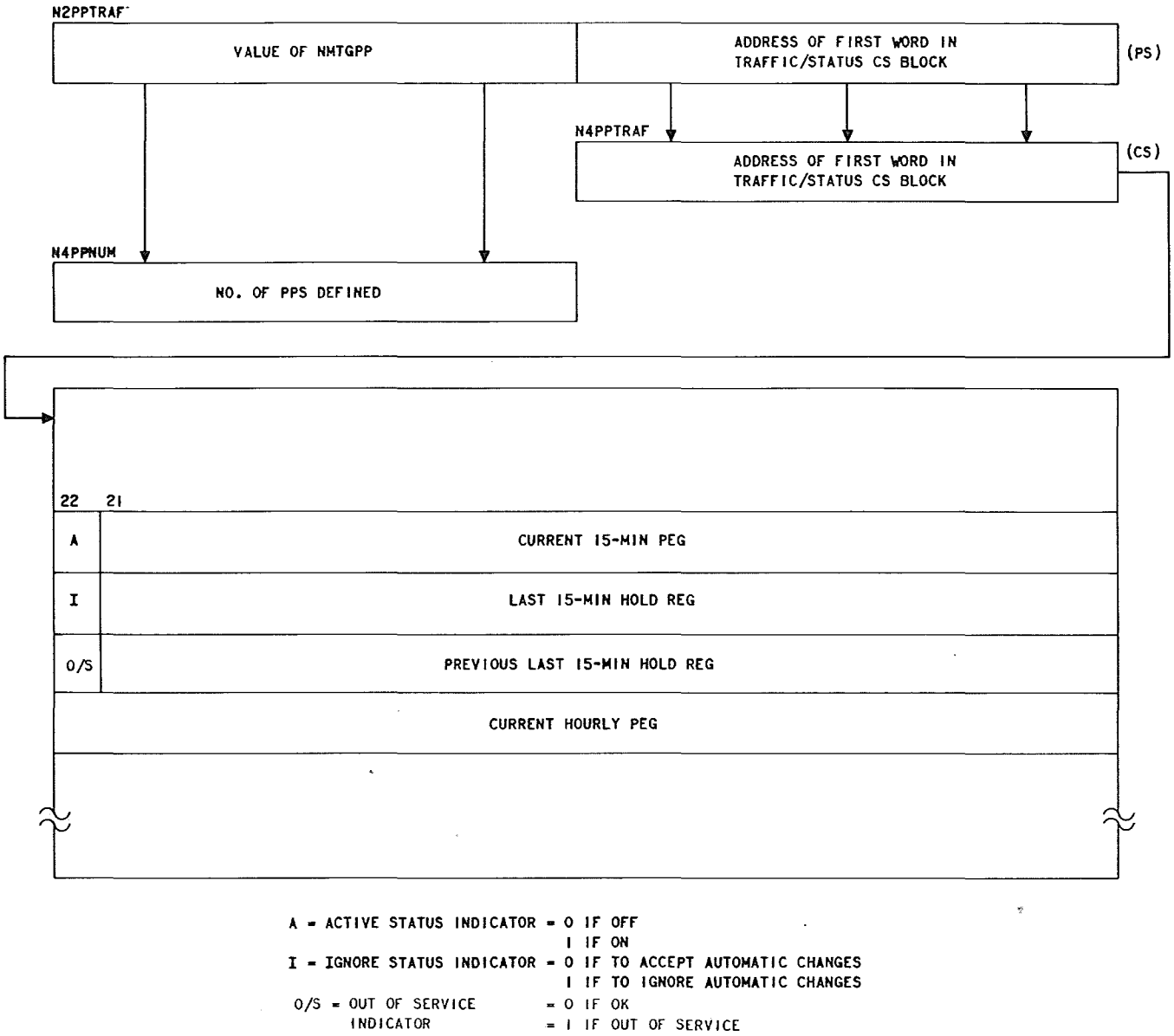


Fig. 17—Trunk Group Control Status and Traffic Block Layout

allocated if either set card NMTGC or set card NMFLXC (indicating the number of flexible control slots) is greater than zero.

TTY Channel Set Cards

13.31 Two set cards are required if a new network management TTY channel is to be defined. Set card NMGTT will indicate member number of the TTY channel to be used as a dedicated TTY channel, and set card NMGTD will indicate whether or not a 105A data set is to be provided for this channel.

Detection of Machine Congestion

13.32 A 2-word block of call store called the machine congestion flag/state couplet (Fig. 21) must be available to indicate that the machine has crossed one or more of the two generic thresholds of congestion. This couplet is based on the union of two set cards NMDOC and NMSTAT. If either of these cards is set equal to 1, the couplet must be provided. If both cards are 0, the couplet is not allocated. The couplet (N2DOCFLG) is a 2-word block used by timed entries to indicate that the machine has crossed a predetermined threshold of

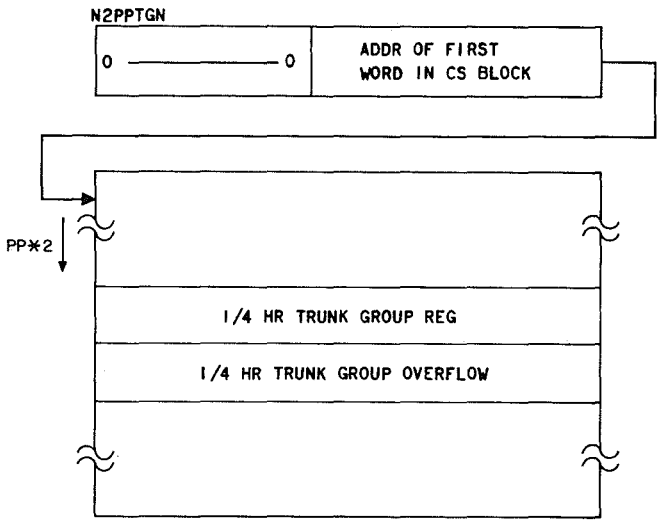


Fig. 18—Preprogram Traffic Annex Block Layout

congestion. Word 0 contains last-look bits, and word 1 contains current-state bits. Other bits are used for administrative and maintenance functions.

Sending Dynamic Overload Control Signals

13.33 Four blocks of call store consisting of 54 words are necessary for the sending and administration of dynamic overload control signals. All blocks are based on the new set card NMDOC. If NMDOC is 1, the blocks must be provided; if it is 0, the blocks are not necessary.

(1) ***Signal Distributor Administration Table (N2DOCXMT)***—A 24-word block of call store is necessary to administer the signal distributor points associated with the MC1/MC2 signals of the network management dynamic overload control circuit. The table identifies the state of the control signal and the state of the associated acknowledgment signal. This call store block is made up of six subblocks of four words each used to indicate the state of each signal and the state of the associated acknowledgment signal. A layout of the signal distributor administration table is shown in Fig. 22.

(2) ***Traffic Accumulator Block (N2MCTRAF)***—A 16-word block of call store is necessary to store peg and usage counts for MC1/MC2 dynamic overload control signals. The block is divided into eight 2-word subblocks, one subblock for each type of MC1/MC2 signal. This call store block is made up of eight subblocks of two words each used to store a peg and usage count for an associated type of DOC signal. The index into the block is the DOC reason number (0 thru 7) times 2. A layout of the traffic accumulator block is shown in Fig. 23.

(3) ***Pseudo Call Register (N2XMTCR)***—Ten words of call store will be used as a dedicated call register for use in administering the peripheral order buffers containing the signal distributor orders for the DOC signal. A layout of pseudo call register block is shown in Fig. 24.

(4) ***MC3 Acknowledgment Administration (N2MC3)***—MC3 signal acknowledgments are administered by a 4-word block of call store. The block is arranged in two couplets. One couplet is used to record the presence of the acknowledgment; the other is used to mark the signal out of service due to hardware failure. A layout of the MC3 acknowledgment administration block is shown in Fig. 25.

Network Management Indicators

13.34 Two blocks of call store consisting of 25 words are necessary to provide the interface for the network management status displays. Both blocks are based on the set card NMSTAT. If NMSTAT is 1, they must be provided; if NMSTAT is 0, they are not necessary.

(1) ***Flag and State Word (N2NMFLG)***—A 16-word block of call store (Fig. 26) is necessary to administer the signal distributor points associated with the network management indicator circuit. The first 8 words indicate the current state of the SD point, and the second 8 words indicate the desired state.

(2) ***Pseudo Call Register (N2CREG)***—A call store block of nine words serves as a dedicated call register for the network management indicator circuit. The call register is used to administer the peripheral order buffers containing the signal distributor orders for the indicator circuit. A layout of the pseudo call register for the network management indicator circuit is shown in Fig. 27.

14. GROWTH/RETROFIT PROCEDURES

14.01 To provide the CTX-6 portion of the network management feature in a working

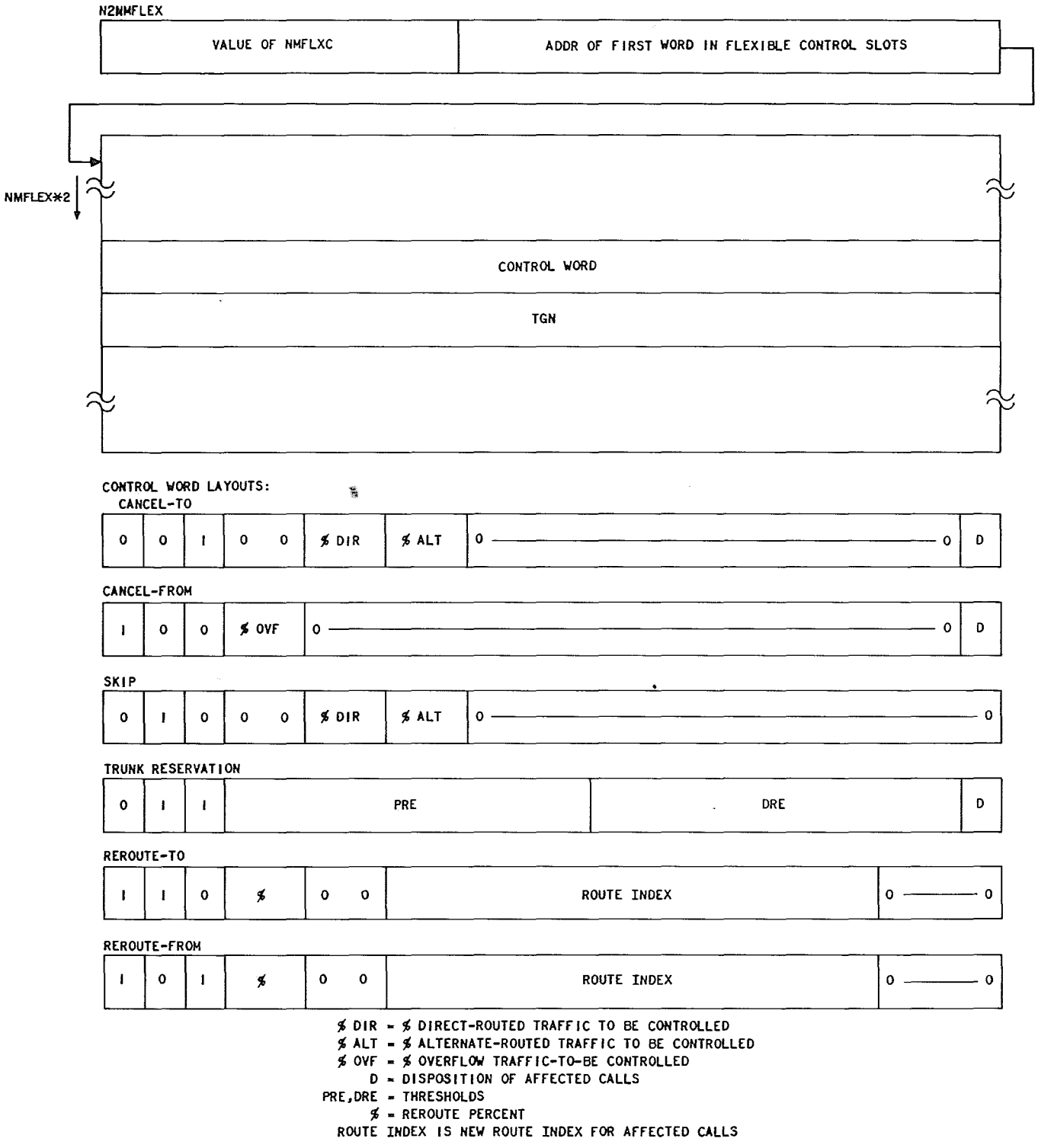


Fig. 19—Flexible Trunk Group Control Block Layout

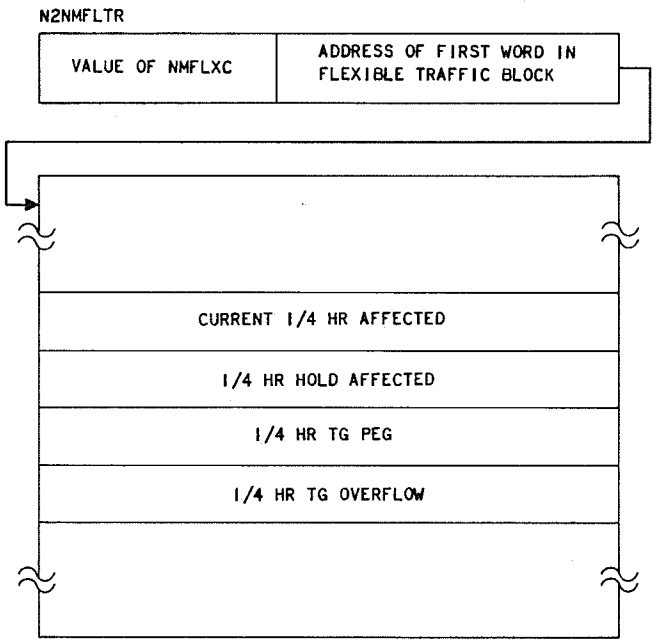


Fig. 20—Flexible Traffic Annex Block Layout

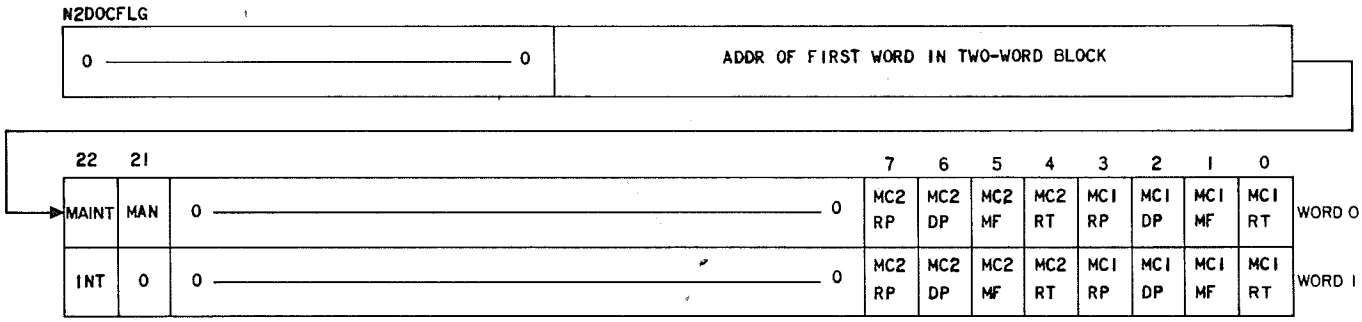
office, the required changes must be implemented in the following sequence.

(1) Install a PDA run that includes the set cards for network management capabilities in CTX-6.

(2) Install the CTX-6 generic.

(3) Using the recent change message RC:NMTGC, build the unit type translations for the trunk group control preprograms. Unit type translations are not recent change hunted; and therefore, the program store memory cards must be written in order that the data entered by the RC:NMTGC message can be effective.

If a DOC circuit is to be added, it can be installed at any time in the sequence prior to entering the unit type translation via recent change message RC:NMTGC for the preprograms to be controlled automatically via DOC signals.



MAINT = DOC TRANSMIT CIRCUIT MAINTENANCE BIT
MAN = MANUAL STATE CHANGE BIT
INT = INTERRUPTER RUNNING
BITS 7-0:
WORD 0 IS FLAG WORD
WORD 1 IS STATE WORD
1 = SENDING FOR THIS REASON
0 = NOT SENDING FOR THIS REASON

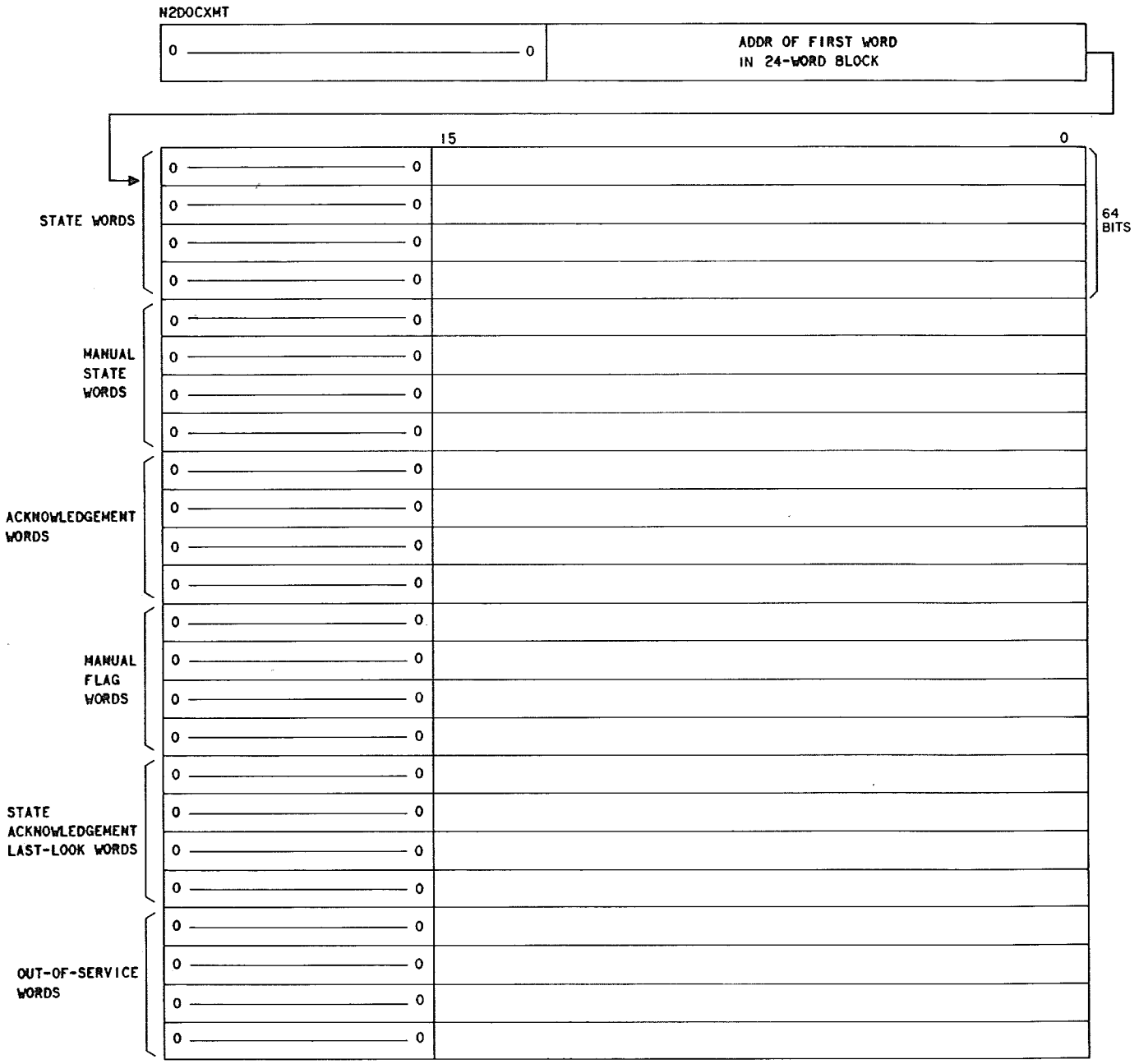
Fig. 21—Flag/State Couplet

14.02 To provide the CTX-7 portion of the network management feature in a working office, the required changes must be implemented in the following sequence.

(1) Install a parameter data assembler (PDA) run with values for set cards NMSTAT, NMDOC, NMFLXC.

(2) Install the CTX-7 generic.

(3) If the dynamic overload control transmit circuit (SD-1A334-01) and/or the network management indicator circuit (SD-1A335-01) are to be installed in the office, indicate their addition using the No. 1 ESS Equipment Questionnaire E8056.



STATE: 1 = SENDING
MANUAL STATE: 1 = MANUAL STATE
ACKNOWLEDGEMENT: 1 = ACKNOWLEDGEMENT RECEIVED
MANUAL FLAG: 1 = CHANGE STATE (MANUAL INPUT)
STATE ACKNOWLEDGEMENT: 1 = NO ACKNOWLEDGEMENT RECEIVED AT LAST-LOOK (WAS SENDING)
OUT OF SERVICE: 1 = OUT-OF-SERVICE

Fig. 22—Signal Distributor Administration Table

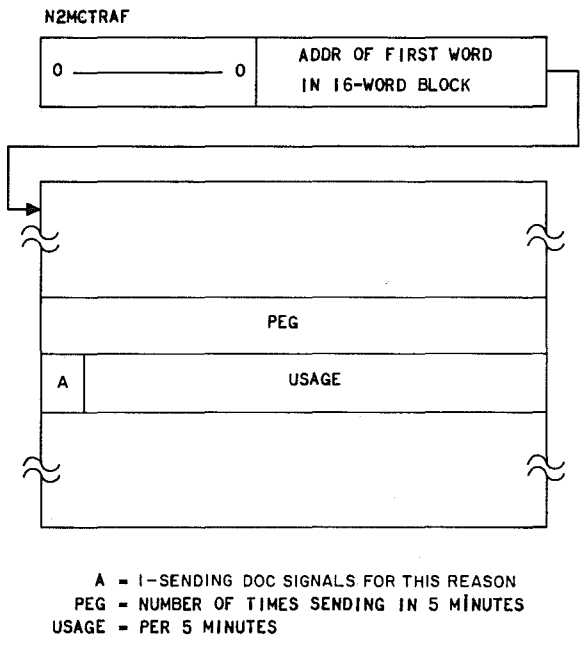


Fig. 23—Traffic Accumulator Block Layout

(4) Install the new hardware.

(5) Build the necessary translations in accordance with procedures outlined in Fig. 28.

15. TESTING

15.01 Testing procedures for dynamic overload control circuit, SD-27970-01, are described in Section 231-123-501.

15.02 Testing procedures for dynamic overload control circuit, SD-1A334-01, are described in Section 231-123-302. These testing procedures, dynamic overload loop testing, should be performed as routine maintenance.

ADMINISTRATION

16. MEASUREMENTS

Code Blocking (CTX-6 and Later)

16.01 Traffic measurements are available for code block controls on request via TTY input message CB-TRAFFIC. The measurements will be listed as peg counts of affected calls during each of the last two clock quarter-hours (CTX-6) and during last clock quarter hour (CTX-7 and later) for each code for which a code block control is currently active. Note that these counts do not include current clock quarter-hour. The output format will list the code identity along with the peg counts. The traffic counts for a code are not available after the code control has been removed for that code. The code block peg counts are not available on the H, C, or DA15 schedules. In CTX-7 and later generics, a total code block count is available as type measurement code (TMC) 05 and equipment group or office count number (EGO) 236.

Trunk Group Controls (CTX-6)

16.02 Traffic measurements are available for preprogrammed trunk group controls on request via TTY input message PP-TRAFFIC or on the H or C schedules as TMC 51 and EGO equal to preprogrammed number. The measurements will be listed as peg counts of affected calls during each of the last two clock quarter-hours for each preprogram. In addition, a peg count of total affected calls can be requested on the H, C, or DA15 schedule as TMC 05 and EGO 234.

Other Demand Network Traffic Data (CTX-6)

16.03 In addition to the traffic data listed above, network management personnel can request a limited set of traffic data via TTY input message NMG TRAFFIC. Data available includes:

Total office outgoing no-circuit peg count of number of calls that were not completed because either no trunk or no service circuit was available.

Transmitter time-out peg count of number of calls that were not completed because of transmitter time-out or preemption while waiting for a receiver to be connected. These peg counts are listed by transmitter type: multifrequency, dial pulse, revertive, or panel call indicator.

These measurements are printed for each of the last two clock quarter-hours. In addition, the total number of incoming and originating calls is printed for the last clock quarter-hour.

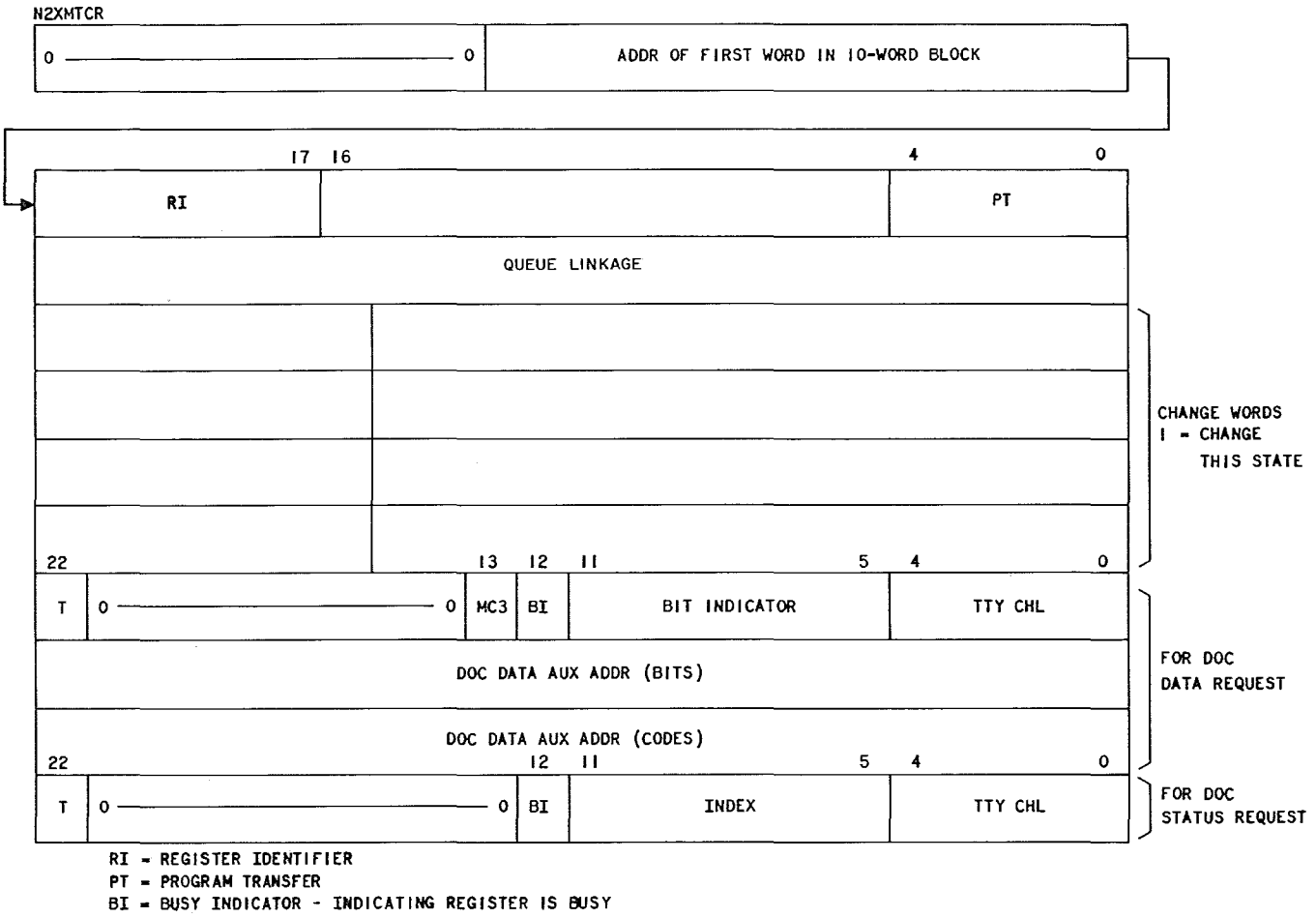


Fig. 24—Pseudo Call Register

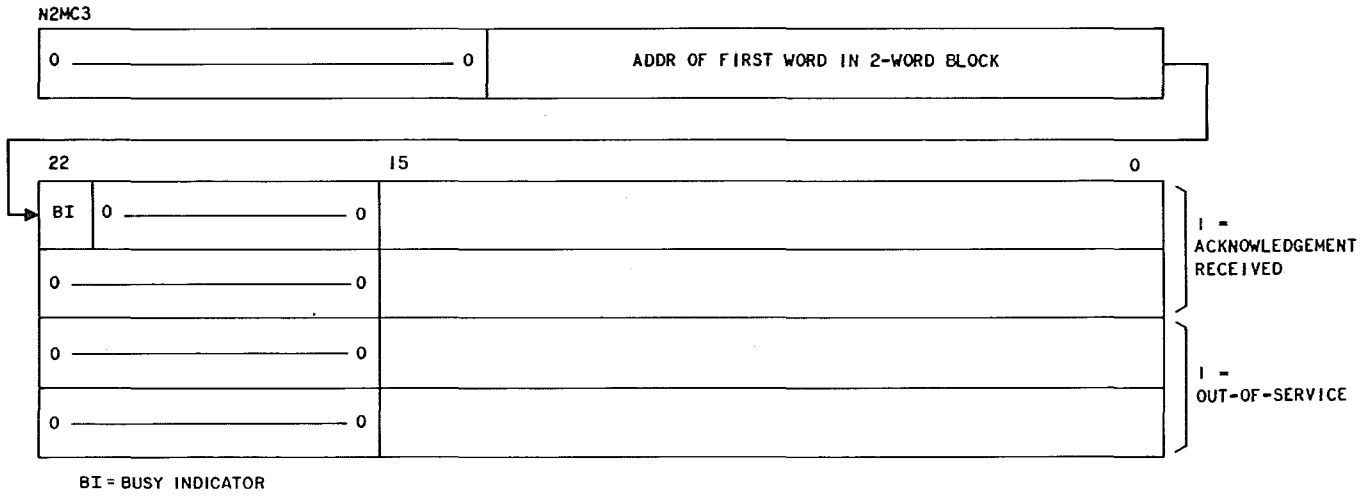


Fig. 25—MC3 Acknowledgment Administration Block Layout

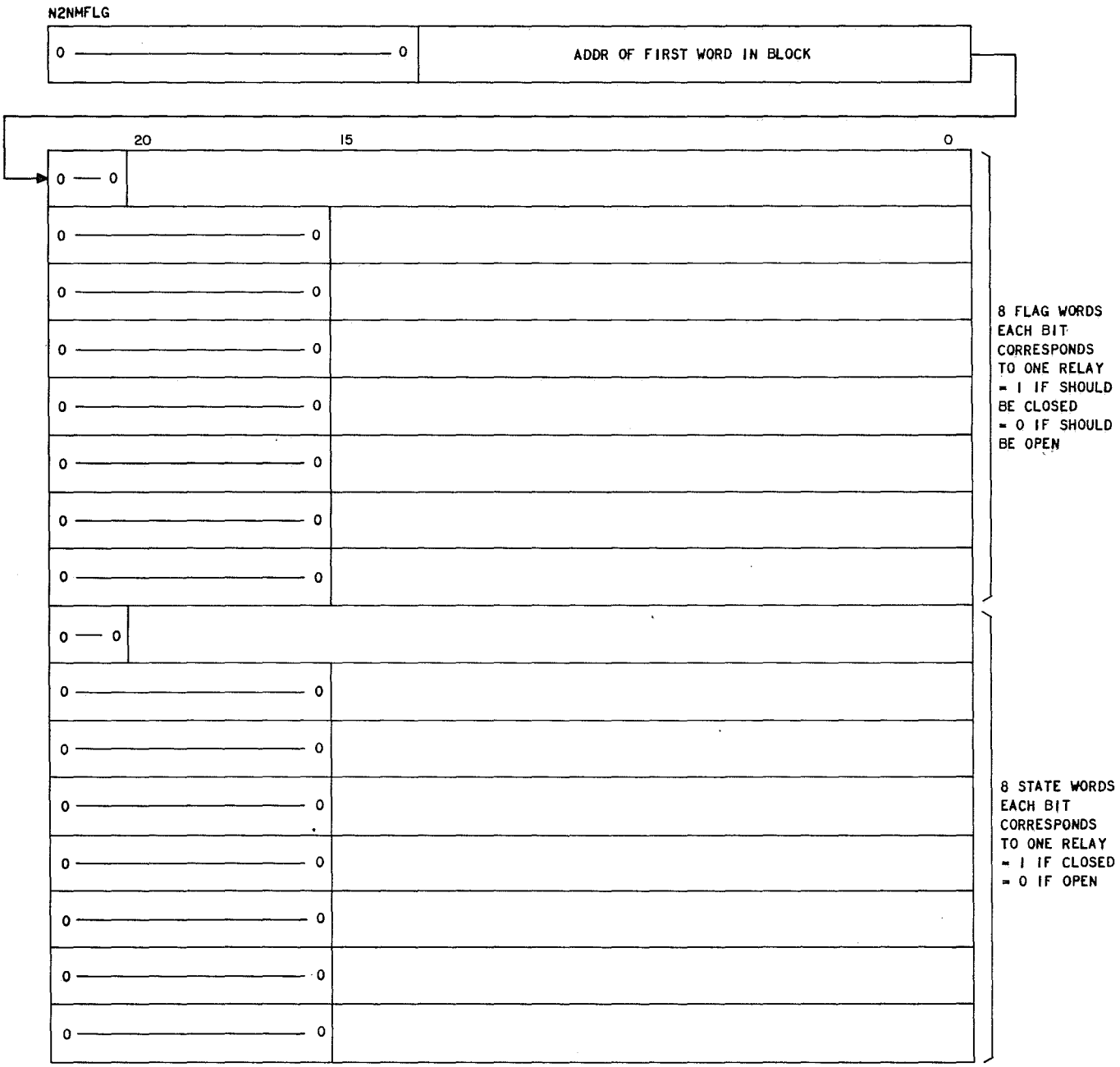


Fig. 26—Flag/State Word Block Layout

Trunk Group Controls (CTX-7 and Later)

16.04 Traffic measurements in CTX-7 are available for trunk group controls (both preprogrammed and flexible) on request via TTY input messages PP-TRAFFIC and FX-TRAFFIC or on an hourly printout. These measurements are listed as peg counts of affected calls during the last quarter-hour, peg counts of attempts on the trunk group during the last clock quarter-hour, and peg counts of overflows of the trunk group during the last clock quarter-hour. The peg counts are listed per preprogram and per trunk group controlled by a flexible control during the quarter-hour. Note that counts of affected calls for the previous to last clock quarter-hour are no longer available for

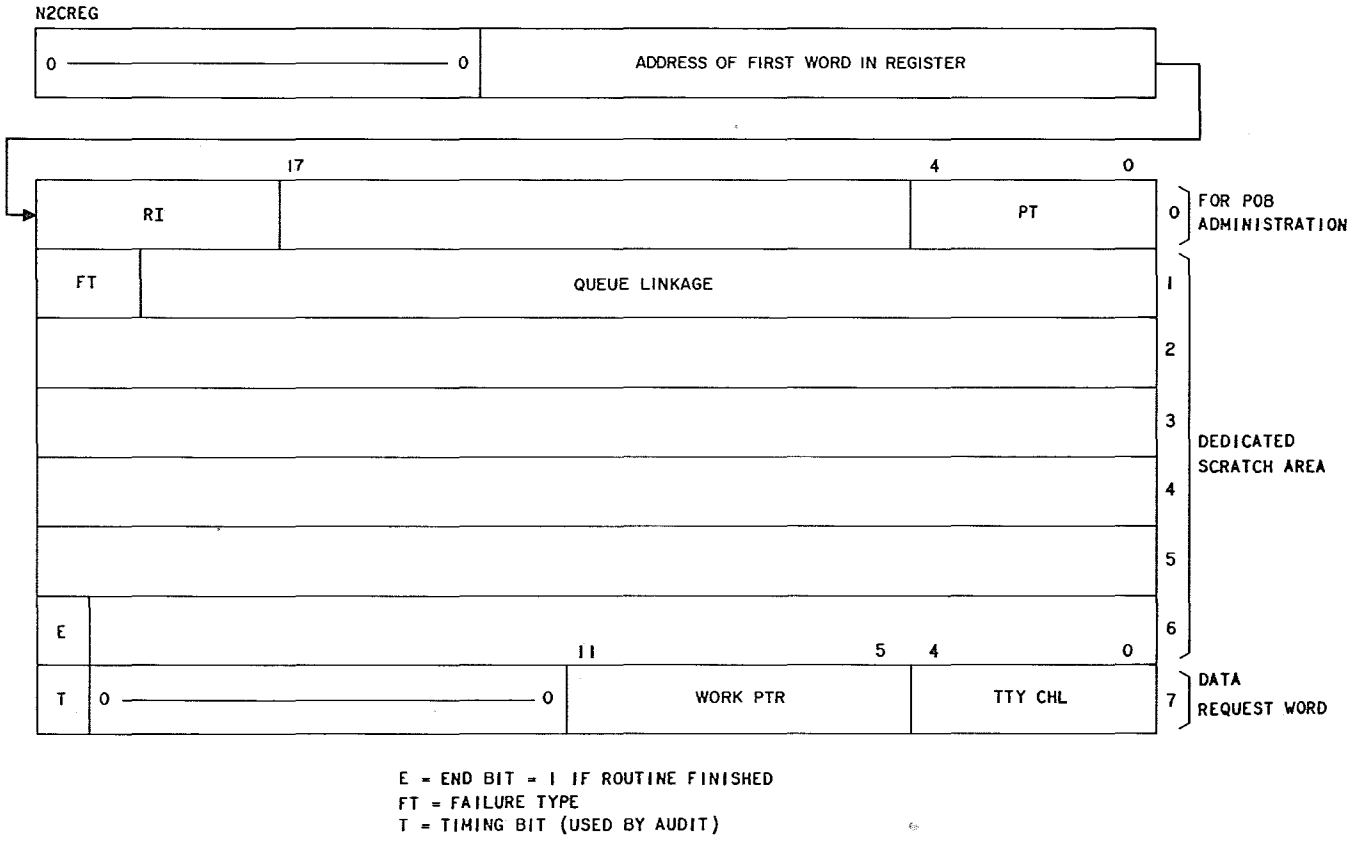


Fig. 27—Pseudo Call Register Layout for Network Management Indicator Circuit

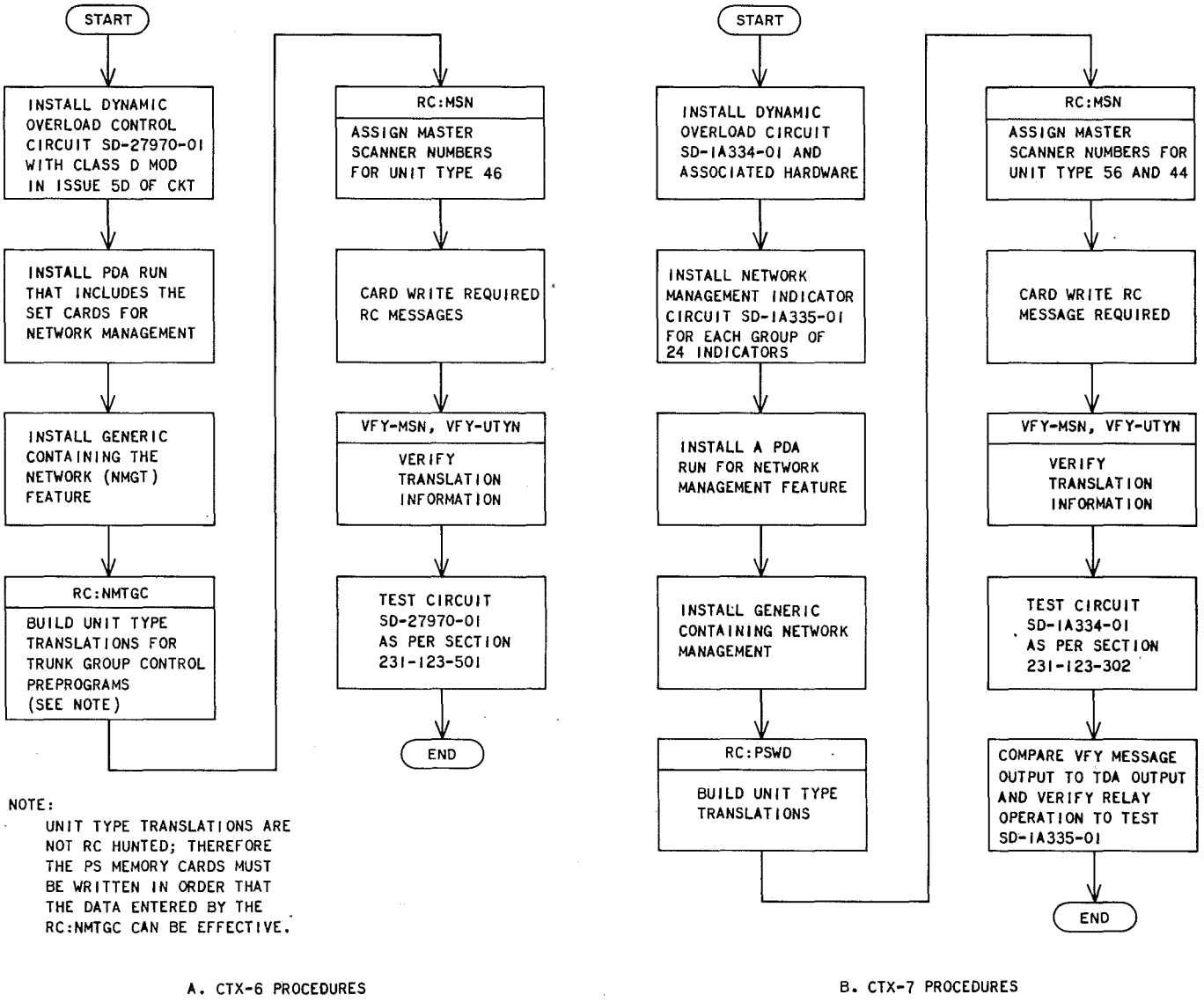


Fig. 28—Network Management Growth/Retrofit Procedures

preprograms. Hourly peg counts of the calls affected by each preprogram (TMC 51, EGO equal to preprogrammed number), a total of the calls affected by all preprograms (TMC 05, EGO 234), and a total of the calls affected by all flexible controls (TMC 05, EGO 233) can be requested on the H, C, or DA15 schedule.

Trunk Group Peg and Overflow (CTX-7 and Later)

16.05 A flexible trunk group peg and overflow counter may be activated via TTY input message TG-ACT on any trunk group in the office. Activation of this counter allows network management personnel to obtain on demand via TTY input

message FX-TRAFFIC and via scheduled printouts peg counts of attempts on the trunk group during the last clock quarter-hour and peg counts of overflows of the trunk group during the last clock quarter-hour. This is made possible by sharing the call store for flexible trunk group controls. The sum of the two, i.e., flexible trunk group controls and flexible peg and overflow counters, active simultaneously must not exceed the number of slots engineered in the office.

Other Demand Network Traffic Data (CTX-7 and Later)

16.06 Other traffic data available via TTY input message NMG-TRAFFIC (replaces that described in 16.03) on a last clock quarter-hour basis includes:

(1) Peg count of failure due to no circuit (i.e., no trunk) of

(a) Originating calls

(b) Tandem calls

(2) Total transmitter time-outs of

(a) MF

(b) DP

(c) RP

(3) Total originating attempts.

(4) Total tandem attempts.

(5) Total incoming attempts.

Exception Traffic Data (CTX-7 and Later)

16.07 A message is printed at the network management TTY after any clock 5-minute period during which the machine crossed or remained across any of the DOC congestion thesholds. The message gives a peg count of the number of times each threshold was crossed and a usage count (based on a 10-second scan) for the 5-minute period.

16.08 A message is printed at the network management TTY after any clock 5-minute period during which the RADR percentage for any receiver type was above an office threshold. The message gives the current percent RADR for each receiver type. The threshold is an office parameter.

Scheduled Traffic Data (CTX-7 and Later)

16.09 Every 15 minutes, all network management traffic measurement messages can be printed at the network management TTY. These messages include:

(1) Code block control traffic counts per active code block

(2) Preprogrammed trunk group control traffic counts per preprogram

(3) Flexible trunk group control traffic counts per active flexible trunk group control plus counts for all active flexible trunk group peg and overflow counters

(4) Other assorted traffic counts as described in 17.03. .

16.10 The printing of these messages is optional. A TTY input message LS-NMQU is used to allow or inhibit the printout. These 15-minute measurements are available to be scheduled only if the office is equipped with a dedicated network management TTY or two traffic TTYs.

16.11 Three other traffic-associated messages will be printed on the network management TTY. These are the TC15 and the two traffic overload control (TOC) messages, TOC01 and TOC02. Two network management related counts have been added to the TC15 message. They are: (1) number of calls affected by code blocking and (2) number of calls affected by trunk group controls, both preprogrammed and flexible. It will be possible to request a current TOC message from the network management TTY.

GENERAL (CTX-6 and Later)

16.12 Calls affected by code block controls do not peg as an attempt or overflow on any trunk group. Calls affected by trunk group controls CANCEL TO, SKIP, or TRUNK RESERVATION do not peg as an attempt or overflow on the trunk group on which the control is active. Calls affected by CANCEL FROM peg as both an attempt and an overflow on the trunk group on which the control is active. The originating and tandem

counts are scored appropriately and are not affected by network management controls.

17. RECORD KEEPING

Activity Data

17.01 A list of the code block controls that are currently active can be requested via TTY input message CB-STATUS. The list will give the date and time the request was processed and each active code with its disposition and percent of attempts to be affected.

17.02 A list of the trunk group control preprograms that are currently active can be requested via TTY input message PP-STATUS. The list will give the date and time the input message was processed and all active preprograms with their status. All preprograms that are in a nonreset state are considered active; thus, the list will contain preprograms that have been excluded from control and that are out of service for automatic DOC control because of faulty connections between the DOC circuit and the scan points.

17.03 A list of the flexible trunk group controls that are currently active can be requested via TTY input message FX-STATUS. The list gives the date and time the request was processed and each active control with its control information. Also included in the list are the active flexible trunk group peg and overflow counters.

17.04 A list of the DOC signals that are currently active can be requested via TTY input message DOC-STATUS. The list gives the date and time the input message was processed and the status of all active signals. All signals that are in a nonreset state are considered active. Thus, the list includes signals that have been excluded from use and signals that are out of service because of hardware failures of maintenance testing.

Teletypewriter Activity Log

17.05 A network management teletypewriter activity log may be maintained on Administrative Form ESS 1406.

Translation Information

17.06 The translation information associated with trunk group control preprograms can be requested via TTY input message PP-DATA. The list will contain the date and time the input message was processed. It will output each preprogram with the associated trunk group number, the priority, the control option, and the percent of attempts to be affected.

17.07 The translation information identifying the offices to which DOC signals may be sent can be requested via TTY input messages RTD-MCONE, RTD-MCTWO, MFD-MCONE, MFD-MCTWO, DPD-MCONE, DPD-MCTWO, RPD-MCONE, RDP-MCTWO and LST-MCTHREE. Nine lists of offices can be requested, one list for each congestion reason. Each list contains the date and time the input message was processed. The offices or loops are identified by three alphanumeric characters and a 2-digit index.

17.08 A list of the trunk group numbers for which no-circuit indicators are provided can be requested via TTY input message TGN-DATA. This list gives the date and time the input message was processed.

17.09 The following ESS translation forms are affected by the network management feature (see TG-1A).

(a) ESS 1303—Trunk and Service Circuit Route Index Record. This form is used for assignment of trunk group numbers to the three fixed route indices (180, 181, and 182) for no circuit announcement and emergency announcements.

(b) ESS 1400—Traffic Register Assignment Record. This form is used to identify those items that are desired on the H, C, or DA15.

(c) ESS 1406—Network Management Teletypewriter Activity Log.

(d) ESS 1506—Miscellaneous Assignment Information Record. This form is used for assignment of control information for trunk group control preprograms and for network management indicator (available with CTX-7 and later generics) assignment.

(e) ESS 1507—Supplementary Rate Center Record. This form indicates that code blocking and calling line identification are applicable to specific rate centers.

(f) ESS 1508—Network Management Trunk Group Control (Pointer) Index Record. This form is used for assigning those trunk groups associated with network management to network management trunk group indexes.

(g) ESS 1509 A/B—Network Management Dynamic Overload Control Office Record. These forms are used to provide translation data pertaining to automatically generated DOC signals for transmission to remote central offices.

(h) ESS-1600—Master Scanner Record. This form is used for assignment of master scanner numbers for DOC trunk group control preprograms.

For a detailed explanation of the forms described previously, refer to the Translation Guide TG-1A.

18. CHARGING

18.01 Not applicable.

AVAILABILITY

19. NEW INSTALLATIONS

19.01 The network management feature controls of code blocking and preprogrammed trunk group controls are available with Issue 1 of CC-CTX-6 or SP-CTX-6 or later generic programs for No. 1 ESS. The dynamic overload control circuit with modifications required for compatibility with No. 1 ESS is available with Issue 5D of the circuit.

19.02 The network management feature controls and capabilities of sending DOC signals, providing interface for network management discrete indicators, and providing flexible trunk group controls are available with Issue 1 of the CC-CTX-7 or SP-CTX-7 and later generic programs.

19.03 The dynamic overload control transmit circuit (SD-1A334-01) and the network management indicator circuit (SD-1A335-01) are presently available.

20. GROWTH/RETROFIT

20.01 At this time, no plans exist for retrofitting the CTX-7 portion of network management into CTX-6, and no plans exist for retrofitting network management in generics prior to CTX-6.

SUPPLEMENTARY INFORMATION

21. GLOSSARY

Radial Signaling—This signaling is used when DOC signals are transmitted to wire centers which have a 2-wire path established between the transmitter and destined wire center. Each wire center must send back an acknowledgment of the receipt of DOC signals to the transmitter.

Tandem Signaling—This signal is used when DOC signals are transmitted to wire center in a serial loop. The last wire center which receives the DOC signals returns an acknowledgment of the receipt of DOC signals back to the transmitter.

Preprogram—This term applies to trunk group controls which have the control information stored in translations.

Rate Center—A specified geographical location within an exchange area from which mileage measurements are determined for the application of interchange mileage rates.

Incoming Terminating Matching Loss—The calculation is used in conjunction with line load control and is determined every 3 minutes while line load control is active. The calculation is performed to determine whether the sum of the trunk link network incoming call overflow counts (type measurement code 14) is greater than 10 percent of the sum of the trunk link network incoming call peg counts (type measurement code 13).

22. REASONS FOR REISSUE

22.01 Not applicable.

23. REFERENCES

OFFICIAL DOCUMENTATION

23.01 The following documentation contains information on the network management feature.

(1) PD- and PF-1A080 Network Management Program

(2) Section 231-123-101, Network Management, 2-Wire No. 1 Electronic Switching System

(3) Section 231-123-301, Network Management Procedures, Centrex 6 and Later Generics, 2-Wire No. 1 Electronic Switching System

(4) Section 231-112-303, Analyzing Audit Output Messages SA03 (CTX-5 Iss 7, CTX-6 Iss 7, and CTX-7) 2-Wire No. 1 ESS

(5) Section 231-123-501, Dynamic Overload Control Circuit SD-27970-01 Tests, 2-Wire No. 1 ESS Offices

(6) Section 231-123-302, Dynamic Overload Control Transmitter Circuit SD-1A334-01 Tests—Trouble Locating and Exercise Procedures, 2-Wire No. 1 ESS

(7) Section 231-119-334, Network Management Growth

(8) Section 231-118-325, RC Procedures for PSWD, PSBLK, SUBTRAN, DHNT, NOGRAC, MSN, CPD, TMBL GA, CAMA, ANIDL, ROTL, PLM, and NMTGC (CTX-6 and Later Generic Programs), 2-Wire No. 1 ESS

(9) Section 817-505-153, Traffic Control Frame and Traffic Control Console, Crossbar Tandem System (Issue 1)

(10) Section 818-041-150, Alternate Route Traffic Control and Traffic Control Frames, No. 4-Type Toll Switching Systems

(11) CD- and SD-27970-01, Common Systems Dynamic Overload Control (Receive) Circuit

(12) CD- and SD-1A334-01, Dynamic Overload Control Transmit Circuit

(13) CD- and SD-1A335-01, Network Management Indicator Circuit

(14) SD-1A270-01, Central Pulse Distributor Assignments (Issue 15B and Later)

(15) SD-1A271-01, Signal Distributor Assignments (Issue 14B and Later)

(16) SD-1A272-01, Master Scanner Assignments (Isuue 22B and Later)

(17) Translation Guide, TG-1A, Division 3, Section 4H (December 1973 Issue and Later), Use of Network Management Teletypewriter Activity Log, Form ESS 1406

(18) Translation Guide, TG-1A, Division 7, Section 17 (November 1973 Issue and Later), Assignment of Signal Distributor Master Scanner and Central Pulse Distributor Points

(19) Translation Guide, TG-1A, Division 7, Section 17 (November 1973 and Later), Trunk Layout of Miscellaneous Trunk Frame (Use of Network Management Circuit ON MT Frame)

(20) Translation Guide, TG-1A, Division 3, Section 5H, ESS Form 1506 (December 1972 Issue and Later, Assignment of Control Information for Trunk Group Control Preprograms

(21) Translation Guide, TG-1A, Division 3, Section 5H, Paragraph 14, ESS 1506 Form (November 1973 Issue and Later), Assignment of TGN for No Circuit Indicators

(22) Translation Guide, TG-1A, Division 3, Section 3D, ESS 1303 Form, Assignment of TGN to the Fixed Route Index for No Circuit Announcement and Emergency Announcements No. 1 and No. 2

(23) Translation Guide, TG-1A, Division 3, Section 5I, ESS 1507 Form (December 1972 Issue and Later), Assignment of Rate Centers Applicable for Code Blocking CLID

(24) Translation Guide, TG-1A, Division 3, Section 6A, ESS 1600 Form (December 1972 and Later), Assignment of Master Scanner Numbers for DOC Trunk Group Control Preprograms

(25) Translation Guide, TG-1A, Division 3, Section 5K, ESS 1509 A/B Forms (November 1973 Issue and Later), Assignment of DOC Transmit Loops

(26) GL 73-10-100 (EL 2876), "No. 1 ESS Toll Center Operation: Operator Tandem Feature," October 18, 1973

(27) GL 74-05-162 (EL 2006), "Common System Dynamic Overload Control (DOC) (Receive) for Panel, No. 1 Crossbar, No. 5 Crossbar, and No. 1 ESS End Offices" May 28, 1974

(28) GL 75-06-077, "No. 1 ESS Network Management Recommendations" June 10, 1975

(29) FD 231-190-309, Receiver Attachment Delay Report Feature (To be issued)

(30) Traffic Engineering Guide, Sections 1, 3, and 8 (October 1972 Updates)

(31) PA-591001, Sections C, E, and G (Issue 35 and Later), Parameter Information and Call Store Work Sheets

(32) No. 1 ESS Equipment Questionaire E8056, Issue 16, and Later

(33) PA-591003, Section 30 (Issue 18 and Later), Unit Type Translations for Dynamic Overload Control Transmit Circuit, Network Management Indicator Circuit, and Trunk Group Control Preprograms

(34) PA-591003, Section 07 (Issue 18 and Later), Master Scanner Number Translations for DOC SCan Points

(35) PS-591003, Section 603 (Issue 17 and Later), Rate Center Status Translator for Code Blocking/CLID

(36) TTY Input Message Manual, IM-1A001

(37) TTY Output Message Manual, OM-1A001.