ENGINEERING AND ADMINISTRATIVE DATA ACQUISITION SYSTEM/NETWORK MANAGEMENT (EADAS/NM) DESCRIPTION

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1. GENERAL

1.01 EADAS/NM is a computerized system which allows centralized, near real-time surveillance and control of most levels of the switching hierarchy within predefined segments of the network. EADAS/NM monitors the status of switching machine and trunk group functions and reports immediately when potential congestion is imminent. This is accomplished by analyzing traffic data as it is being gathered from various types of switching machines via EADAS or directly from 4A ETS-PBC and No. 4 ESS machines. This provides an effective and responsive network management capability to maintain the switching efficiency of the network. See Fig. 1 for EADAS/NM generalized arrangements.

1.02 This section is reissued to correct Fig. 5.

1.03 This section contains information that is applicable to maintenance, traffic engineering, and network administration. Information specific to traffic engineering and traffic administration remains in sections previously containing that information. Information pertaining specifically to maintenance is in Section 190-540-200.

1.04 References in this section to methods, planning, data requirements, service levels, and equipment quantities are based on American Telephone and Telegraph Company recommendations.

2. SYSTEM DESCRIPTION

A. General

2.01 EADAS/NM employs a Digital Equipment Corporation (DEC*) PDP*-11/70 processor and peripherals to provide centralized surveillance of switching machine and trunk group interaction, and to permit centralized network management control. To accomplish this:

(a) Each 5 minutes, EADAS/NM gathers network data and performs calculations. The results of these calculations are matched against pre-set thresholds in the data base. Results which equal or surpass these thresholds cause the computer to activate indicators on the display board, and to present a hard copy exception printout.

*Registered trademark of Digital Equipment Corporation.

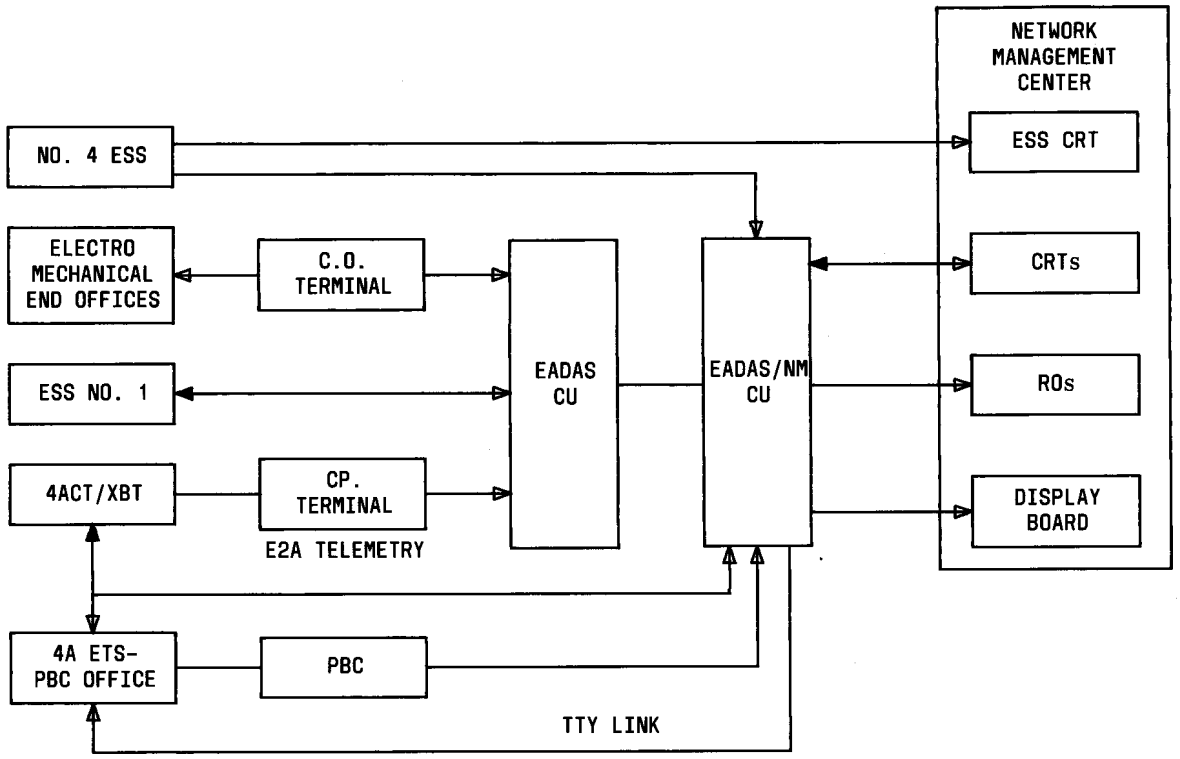

Fig. 1—EADAS/NM Generalized Arrangements

(b) Each 20 seconds, EADAS/NM updates and displays the status of discretes (off-on status conditions) on the display board.

(c) EADAS/NM provides centralized, remote network management control capability via the interactive mode of the keyboard-display-printer (KDP) terminals. This capability enables the network manager to institute expansive or protective controls quickly when required to maintain and protect the call carrying capacity of the network.

2.02 Substantial savings have been realized by integrating EADAS with the Network Management System (EADAS/NM). The terminal equipment at the switching locations and the dedicated data links, which together amount to the major cost of these systems, are shared. A block diagram of the total EADAS/NM System configuration is shown in Fig. 2.

2.03 The major components of the EADAS/NM System are:

(a) Central control unit minicomputer (PDP-11/70)

(b) Ferranti-Packard network exception display board

(c) TELETYPE* keyboard display printers (KDP)

(d) TELETYPE receive only printers (ROP)

(e) E2A telemetry computer translators (TCT).

B. Central Control Unit (CCU)

2.04 The EADAS/NM CCU is a coordinated lineup of Digital Equipment Corporation (DEC) cabinets housing all the necessary DEC and WESTERN ELECTRIC† equipment. Depending upon the number and types of data sources and

* Registered trademark of Teletype Corporation.

† Registered trademark of Western Electric Co.

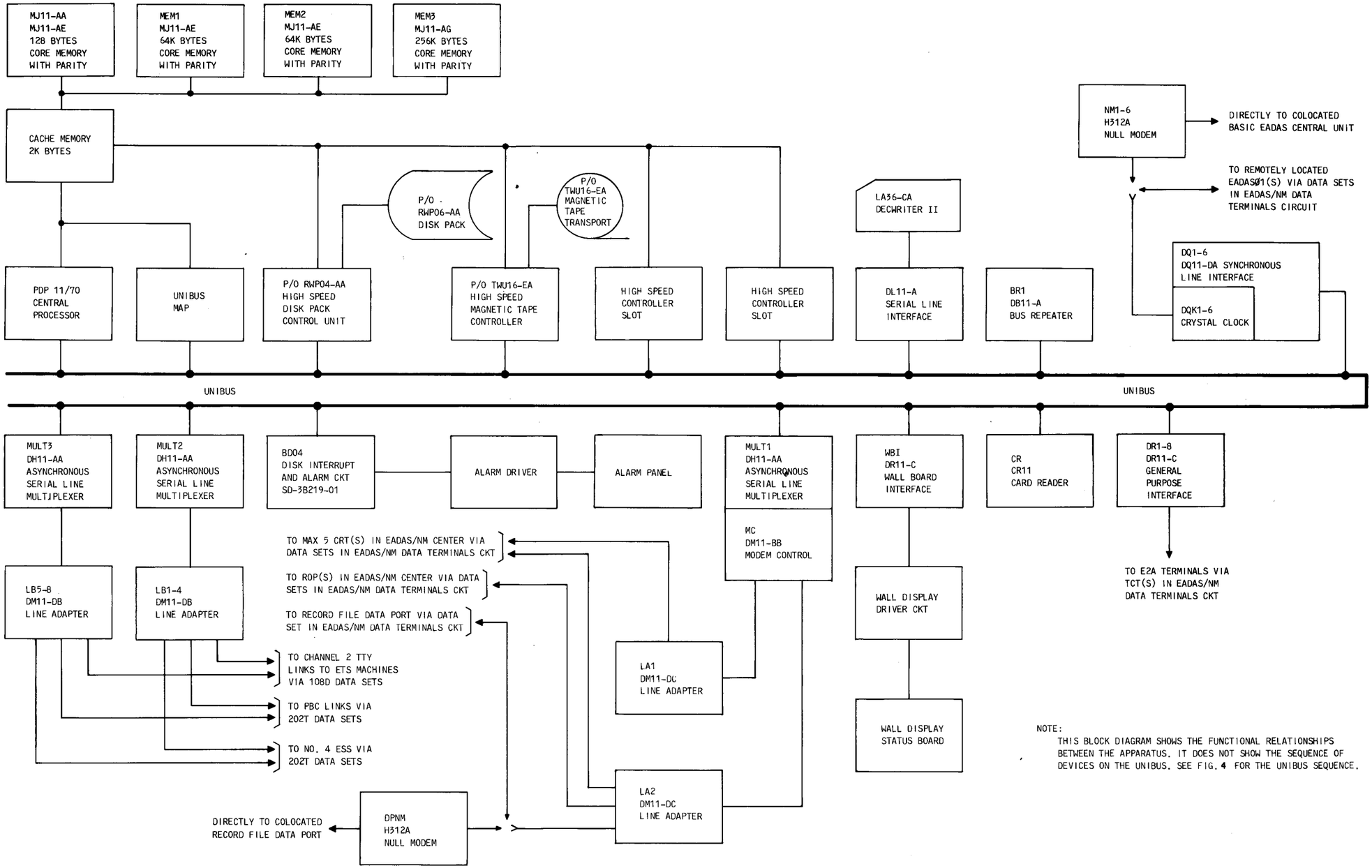

Fig. 2—Block Diagram of EADAS/NM

switching machines being accommodated, the CCU consists of between seven and eight cabinets (Fig. 3). Of the seven basic cabinets, five house the DEC minicomputer hardware, including the processor, core memory, a 9-track, 1600-bit per inch magnetic tape unit, and other assorted equipment which is required for all installations. As the Network Management System approaches its maximum configuration, an eighth cabinet will be required to house additional WESTERN ELECTRIC equipment (E2A telemetry, data sets, etc). In addition to the cabinet configuration, the CCU includes a free-standing disk drive, a table top mounted punched card reader, and a free-standing terminal device which serves as the processor console (called a DECwriter). See Fig. 4 for the CCU sample floor plan.

2.05 The generic program that controls standard EADAS/NM functions such as arithmetic calculations, priority procedures, cathode ray tube (CRT) routines, etc, is common to all EADAS/NM installations. This program is developed and maintained by the Bell Telephone Laboratories and installed in the system by the Western Electric Company during the testing phase of the installation. Updates or revisions of the program are issued by Western Electric Company, as required.

2.06 The generic program, in conjunction with the data base, which is user defined, provides the system with the unique ability to perform its function for all clusters. The data base includes information relative to the switching offices (switcher profiles), trunking arrangements, routing information, control assignments, etc, and is coordinated with the display board and CRT routines.

C. Network Exception Display Board

2.07 A system standard network exception display board is an integral part of the system. It is designed to display network exception conditions and control status.

2.08 The network exception display board consists of an array of luminescent, reflective, electro-magnetically controlled indicators. Up to 8190 indicators may be assigned for computer activation.

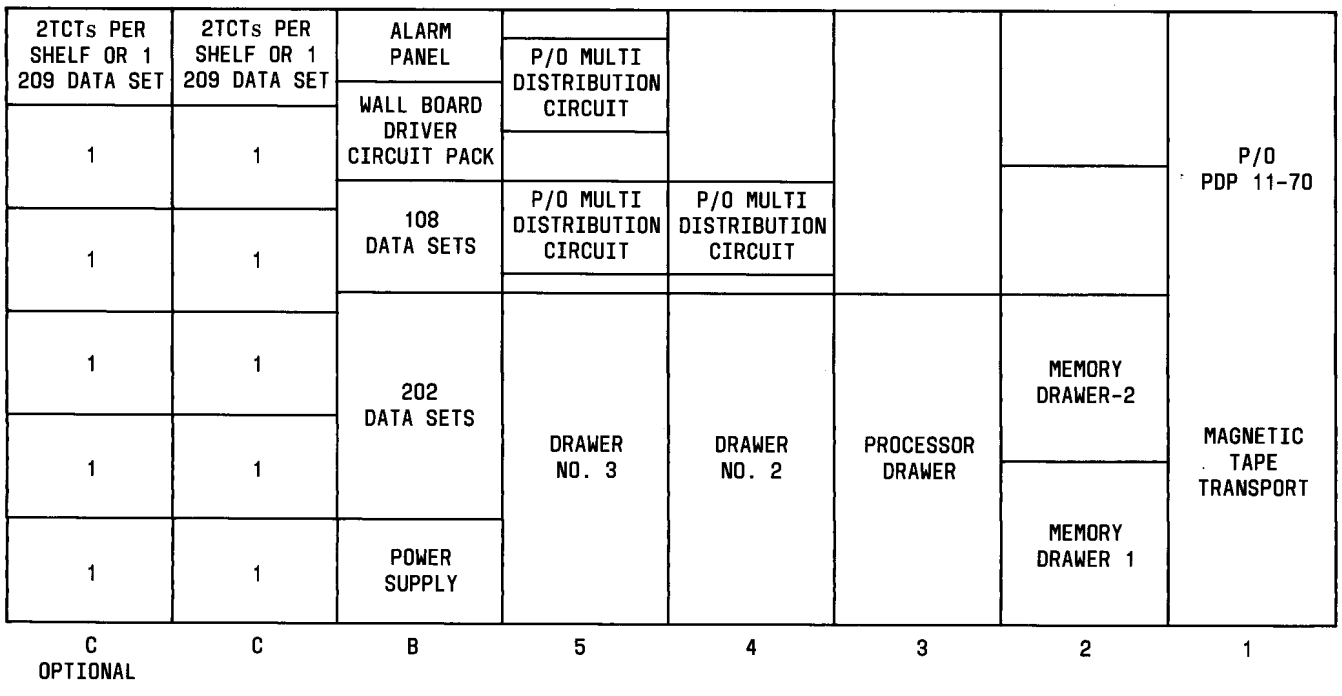

Fig. 3—EADAS/NM Cabinet Configuration (Maximum Condition)

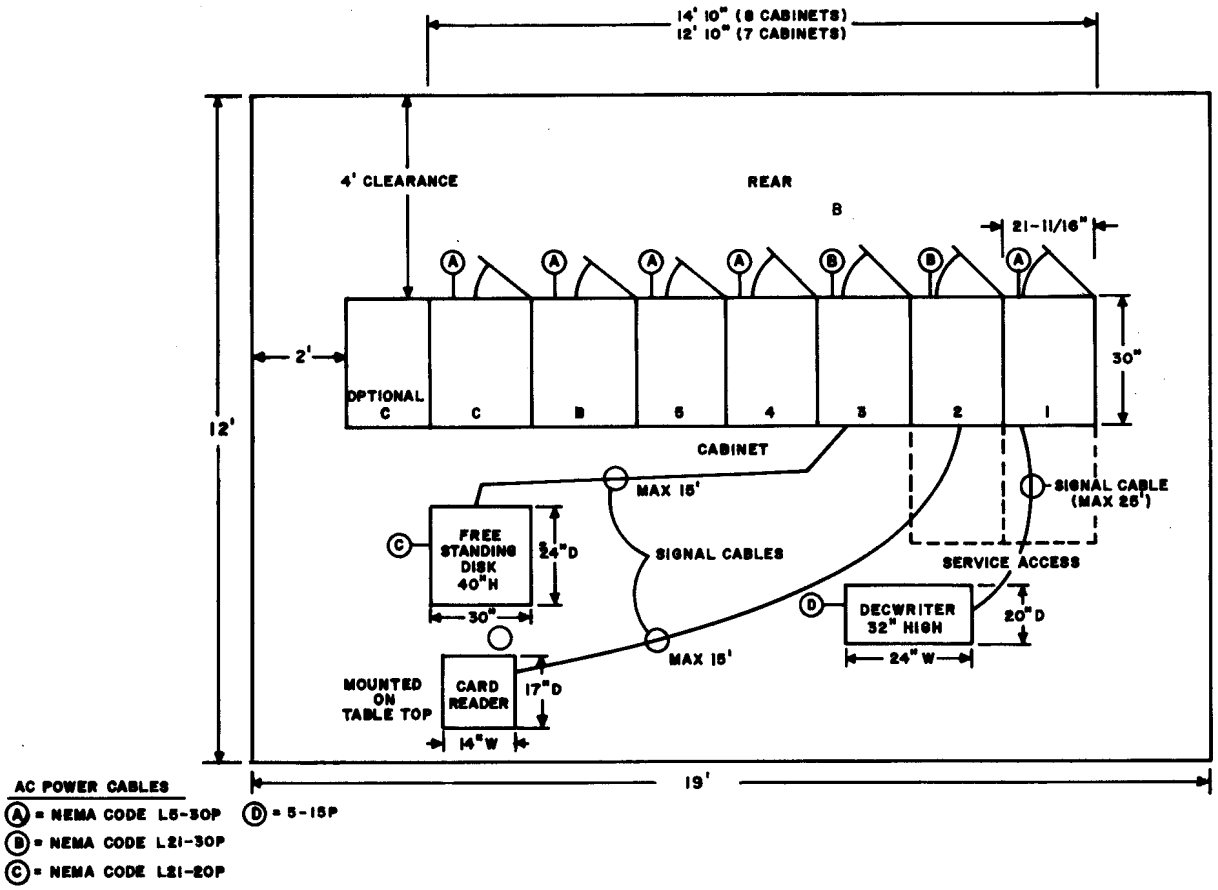

Fig. 4—EADAS/NM CCU Sample Floor Plan

2.09 The indicators are individually mounted in slots on metal panels, with four such panels mounted on a modular framework to form one display column. Each column has a display area 88 inches high and either 36 or 22 inches wide, corresponding to internal and external columns, respectively. These columns are assembled to form the network exception display board (Fig. 5).

D. Keyboard Display Printers (KDP)

2.10 The KDP terminal devices are used to request and display data on demand and to initiate control action. These terminals are equipped with a full keyboard send-receive (KSR) for entry of requests, a CRT for display of the response, and a line printer to provide a hard copy of the displayed response. These devices are DATASPEED* 40 terminals.

* Registered trademark of AT&T.

E. Receive Only Printers (ROP)

2.11 Two ROPs are required with each EADAS/NM System. One ROP provides a hard-copy record of calculations that exceed assigned thresholds (ie, exceptions). A second ROP is used by the monitor subsystem. The printers are Teletype Corporation ROPs.

F. E2A Telemetry Computer Translators (TCT)

2.12 The E2A TCT is basically an interface device used to connect the E2A remote units over the telemetry link to the central unit. The E2A TCT functions with E2A remote units located in crossbar tandem or No. 4 crossbar switching machines. E2A telemetry is not employed with

No. 5 crossbar, No. 1 crossbar, or ESS offices. The central unit may be equipped with a maximum of eight TCTs, which will serve up to 32 remote units (4 per TCT).

3. OPERATION

A. Data Acquisition

3.01 EADAS collects network data in real time via EADAS traffic data converter (ETDC) or traffic data recorder system (TDRS) converters from electromechanical switching systems. The peripheral bus computer (PBC) performs the same function in real time for 4A/ETS switching systems. No. 1 ESS and outside vendor (OSV) scanner accumulator terminals are polled at 5-minute intervals by EADAS to acquire the network management data.

B. Exception Calculations

3.02 At the end of each 5-minute interval, EADAS/NM requests specific groups of data from EADAS Systems and peripheral bus computers for analysis. Select items which best reflect network abnormalities (such as trunk group peg count, overflow and usage, plus machine performance data items such as office overflow, sender attachment delay counts, etc) are specified as part of the exception system. Calculations are performed using this data at the 5-minute intervals. These results are then compared to pre-set thresholds in the data base. If these results match or exceed the threshold value, the computer flags them as exceptions. Upon completion of all calculations, the computer updates the exception indicators on the display board to reflect the latest 5-minute data interval. In some cases, the exceptions cause an audible alarm and/or printouts on the exception printer. This exception system data plus all the remaining available data (referred to as demand data) are available for network manager analysis when requested via a CRT terminal.

C. Discretes

3.03 Discretes (off-on indications) reflecting the status of dynamic overload control (DOC), short sender timing, etc, are processed in the following manner:

(a) E2A telemetry is utilized for 4A switching systems and crossbar tandems equipped with traffic supervisory cabinets. The switching system circuits are connected to the E2A remote unit. Since the remote units are connected directly to EADAS/NM, the computer simply requests the discretes at 20-second intervals for analysis.

(b) The ETDC is employed for No. 5 crossbar and crossbar tandems without traffic supervisory cabinets. Discretes from the switching system circuits interface via discrete cards located in the ETDC. EADAS requests the discretes at 20-second intervals via the ETDC data link and transmits the information to EADAS/NM for analysis.

(c) No. 1 ESS uses the same high-speed data link used by EADAS for data collection to process discretes at 20-second intervals. Similar to ETDC operation, discretes are transmitted from the No. 1 ESS to EADAS/NM via EADAS.

D. Reverse Controls

3.04 Reverse controls are initiated by network management personnel operating the KDP devices. Some control actions that are available are: rerouting of traffic, directional reservation equipment (DRE) functions, code blocks, etc. Reverse controls are processed as follows:

(a) A dedicated ASCII teletype link is connected direct from EADAS/NM to the 4A/ETS channel 2 teletype circuit. 4A/ETS console functions, such as code blocks, preprogrammed controls, etc, are executed via the teletype link.

(b) E2A telemetry is employed for 4A switching systems and crossbar tandems with traffic supervisory cabinets. The EADAS/NM computer encodes a message in response to the control request and transmits the request to the E2A remote unit. The E2A unit takes the control action and returns a discrete to EADAS/NM during the next 20-second period confirming that the action was completed.

(c) The ETDC is employed for No. 5 crossbar and crossbar tandems without supervisory cabinets. In response to a request for control action at KDP, the EADAS/NM computer encodes a message and transmits the request via EADAS to the "command module" associated with the ETDC. The command module activates the

control with a contact closure in the switching system and transmits a message via EADAS to EADAS/NM confirming that the action was completed.

(d) No. 1 ESS employs the same high-speed data link used by EADAS for data collection to process reverse controls. Reverse controls are transmitted from EADAS/NM via EADAS to the ESS.

(e) A discrete message is transmitted on request by No. 4 ESS to the EADAS/NM via the No. 4 ESS dedicated data link.

E. Network Exception Display Board

3.05 Activation of the display board indicators, which are electromagnetic, is accomplished by the EADAS/NM computer as follows:

(a) The computer receives network data and performs exception calculations at 5-minute intervals. Calculation results which equal or exceed the user-defined thresholds for such items as attempts per circuit per hour (ACH), overflow, connections per circuit per hour (CCH) etc, are marked as exceptions by the computer. Upon completion of all calculations, the computer updates the display board by activating or deactivating the appropriate exception indicators for all exceptions.

(b) The EADAS/NM computer receives discrete updates at 20-second intervals, and updates (activates or deactivates) the indicators on the display board immediately.

F. Cathode Ray Tube

3.06 Analysis of the exception indicators on the display board and exception printouts may suggest the requirement for additional information. KDP terminals are utilized by network management personnel to interrogate the computer for additional information relative to the network problem. The information requested will be displayed to the network manager on the CRT screen in a format referred to as a CRT page. Typically, the CRT page(s) will identify congested trunk groups and inactive components.

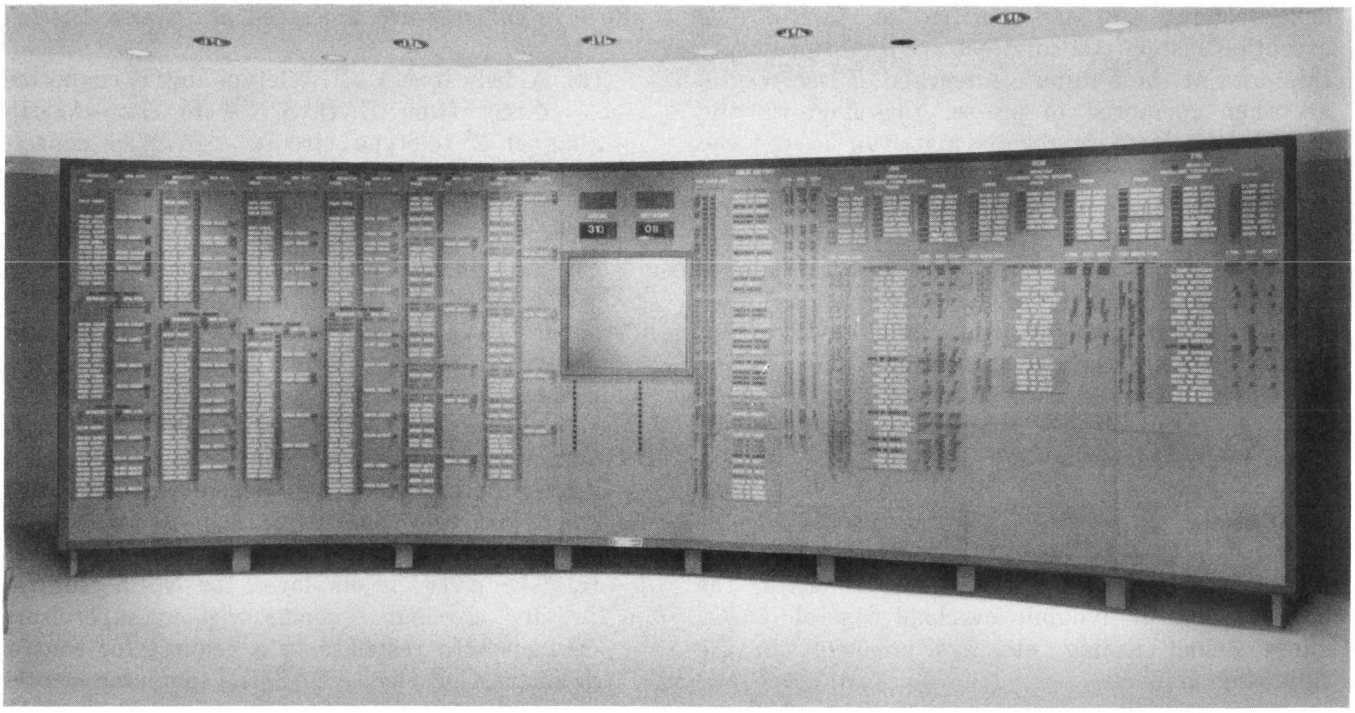

Fig. 5—Typical Example of Network Exception Display Board