

**NO. 4 ELECTRONIC SWITCHING SYSTEM
 CIRCUIT MAINTENANCE SYSTEM 1A**

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1. GENERAL

1.01 The Circuit Maintenance System 1A (CMS 1A) is designed to meet the maintenance needs for circuits terminated on telephone switching systems. CMS 1A will be used in conjunction with the No. 4 Electronic Switching System (ESS).

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The system provides a number of features which can be divided into three major categories; operational, administrative, and data base.

1.04 The operational features include interactive man-machine interfaces. These interfaces are located in various work centers and are used to facilitate test and maintenance procedures.

1.05 The administrative features provide control area organization, activity logs for control areas and administrative reports.

1.06 The data base in the CMS 1A stores circuit layout records, office equipment records, test data, trouble records, circuit orders, and translations that permit communications with other automated maintenance and test systems. CMS 1A centralizes the capabilities of several automated systems. Since these systems are accessed in several ways the CMS 1A makes all necessary translations to enable use of these systems.

1.07 For maintenance purposes the CMS 1A interfaces with the following systems.

- Centralized Automatic Reporting on Trunks (CAROT)
- Carrier Transmission Measuring System (CTMS)
- No. 4 ESS 1A Processor
- Switched Maintenance Access System (SMAS)
- 51A Test position.

1.08 The versatility of CMS 1A makes it possible to utilize this system for circuit order functions. CMS 1A provides mechanization of the record keeping process and circuit order coordination.

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To accomplish these functions, interfaces are established with the Long Lines circuit layout system (LLCL) and the associated company business information system/trunk integrated record keeping system (BIS/TIRKS). Circuit order information is exchanged between CMS 1A and these systems.

1.09 The Long Lines toll service results plan (TSRP) is provided with trouble ticket analysis data by the CMS 1A.

1.10 A more detailed description of CMS 1A can be found in BSP 234-104-003.

2. ORGANIZATION

2.01 Several machine administration functions depend upon the use of CMS 1A and an accurate data base in the CMS 1A. These include circuit order information contained in the CMS 1A, assignments which are input to the CMS 1A via the circuit order displays and assignments to the No. 4 ESS which are required. It is recommended that the machine administrator be responsible for the circuit order and CMS 1A functions. This document reflects the recommendation that the machine administrator is responsible for the CMS 1A operation.

2.02 For those locations which have a supervisor in charge of CMS 1A, other than the machine administrator, the responsibilities of the machine administrator, as stated in this document, will be assumed by the CMS supervisor.

2.03 The CMS 1A system maintenance center (CMSMC) consists of a CRT terminal and two system terminal devices through which the system maintenance center (CMSMC) operator can control the operation and maintenance of the CMS 1A. The interface gives the operator the capability of modifying the status, configuration and assignments of the system. It also enables the operator to control the craft work assignments on a control area basis and to maintain the office data base. In order to deal with these specific areas, the operator has six basic commands to accomplish the changes. The 3 digit command 000 lists the following:

- 010 Craft and Work Assignment Tables
- 020 Miscellaneous Parameter Entry
- 030 Program Execution Controls.
- 040 System Status and Configuration

2.04 Using the 032 command the operator receives a list of instructions that will enable the CMS 1A to read the magnetic tape output from the Western Electric circuit assignments record transfer system (CARTS). A subcommand starts the execution of the CARTS program.

2.05 The 033 command keyed into the system provides the operator with a list of instructions which will enable the CMS 1A system to prepare a magnetic tape output to be used by the office data assembler system (ODA).

3. SYSTEM CONFIGURATION

3.01 CMS 1A is a dual processor system using two mini-computers and associated hardware to provide the record keeping and interface functions within the maintenance environment. The two processors provided are the circuit maintenance processor (CMP) and the circuit data processor (CDP). The CDP acts as a "Hot Spare" for the CMP. The CMP provides administrative functions, such as, trouble ticket information and circuit data retrieval. This processor also acts as an interface between other systems and the operating personnel.

3.02 The CDP acts as a backup processor for the CMP and is capable of taking control of any peripherals when the CMP fails.

3.03 The main system storage is magnetic disk backed up by magnetic tape.

3.04 The CMS 1A is designed with sufficient hardware redundancy to maintain system integrity under certain types of hardware failure. When failures occur, the system must be reconfigured to eliminate the effects of the hardware failure. When the configuration is necessary, certain equipment is required to provide a minimum operational system. This minimum operational system consists of:

- (a) One of the two processors including associated core, associated watch dog device, and associated writer and controller
- (b) One tape transport and associated controller
- (c) One disk controller and all but the spare disk drive

(d) Sufficient line multiplexer units to handle all operational interface units and sufficient work center channels to handle a minimum work load.

(e) One of two bus switches.

3.05 The machine administrator must ensure that these minimum requirements are not violated when the system is reconfigured.

3.06 The machine administrator must be aware of general precautions which must be observed in the CMS maintenance center (CMSMC). These precautions pertain to the processor, disk drive and disk pack units, and magnetic tapes.

3.07 It is recommended that the power key be removed from the processor once the correct switch and knob positions are obtained. This will prevent accidental manipulation of processor controls which could cause loss of service. These keys should be stored in a place readily accessible, should the need arise to reconfigure the system.

3.08 The following precautions apply to disk pack and magnetic tapes:

Do not stack disk packs on top of one another

Do not open the cover of the disk drive, or in any way move the disk drive while in operation

Carry the disk pack by the handle of the protective cover with one hand and support the bottom with the other hand

Do not touch the disk pack

Store tapes inside their containers. Keep containers closed

Handle the tape reel by the hub hole

Do not touch the tape between the beginning of tape (BOT) and the end of tape (EOT) markers

Do not allow the end of the tape to drag on the floor

Do not open the tape transport cover while the transport is in operation.



Smoking should not be permitted in the CMSMC area.

3.09 In supervising the CMSMC the machine administrator has three major areas of responsibility: acceptance, operation, and maintenance.

3.10 Acceptance of CMS 1A involves initial acceptance of the system and accepting the system after additional hardware installation required due to growth. When maintenance has been performed, the hardware which has been repaired must also be accepted.

3.11 The machine administrator must ensure that the system meets all BSP requirements before accepting as an operational system. See TOP BSP 234-154-001.

3.12 Under the operation category various tasks are performed to update or optimize the system to meet the changing needs of the office. These changes are accomplished using the CMSMC terminals. Through a series of displays and associated commands, various reports are obtained. Modification of various lists, assignments and office related system parameters is also accomplished.

3.13 The backup data base for CMS 1A must also be created and maintained. This requires manipulation of log tapes and the creation of image copy tapes from the disk files. A primary image copy is maintained on disk file and two tape transports are provided to make image copy tapes and log tapes.

3.14 Log tapes are generated on one of the tape transports as a result of data changes made in the disk files. As data is changed or added to the disk files, these entries are entered on a log tape. There are two log tapes provided. When the first log tape is full, the system automatically switches to the second. The first tape must be manually replaced with a new tape. This must be accomplished in time to permit the system to switch back to the first tape when the second tape is full.

3.15 The image copy tape is a duplication of the CMS 1A data base. The image copy tape, along with the log tapes, is used to generate a

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new disk data base in the event of disk failure. The image copy is generated by transferring the contents of all data files on each system disk, to a set of magnetic tapes. This is a manual operation performed by the CMSMC personnel. It is recommended that this transfer be accomplished when two log tapes are full. The machine administrator must monitor this operation to ensure that timely updates of the image copy tape are made. The machine administrator may deem it necessary to initiate this operation at other than the recommended interval.

3.16 When new disk packs are received, they should be formatted and verified. Reliability diagnostics should also be executed on these packs before the system software is loaded onto them. A software program called Bad-Track takes the output of the reliability routine which consists of a listing of bad spots on the disk and reallocates areas on the disk pack to store data that would have been entered in the bad spots.

3.17 The maintenance responsibilities of the CMSMC will consist of preventive maintenance, reconfiguring the system, and notifying the appropriate maintenance personnel when hardware fails. Maintenance of the CMS 1A may be handled by vendor contract or TELCo maintenance groups. It is imperative when maintenance is being performed that the minimum system configuration is maintained. All operations by maintenance and installations forces should be accomplished under supervision of the CMSMC personnel.

3.18 The machine administrator should require that methods of procedure (MOPs) be established when acceptance or maintenance operations could jeopardize service.

4. MAINTENANCE ENVIRONMENT

4.01 The CMSMC is located with the processors and peripheral equipment. A CRT and two system terminals are provided to monitor and interact with the CMS 1A. In case of system failure, actions must be taken by CMSMC personnel to restore the system.

4.02 The CMS 1A interfaces directly with three work centers in the No. 4 ESS environment. This is accomplished with access ports on the CMS 1A.

4.03 There are a maximum of 96 ports available on the system. Within the CMS 1A there is a maximum of 10 control areas. No more than 10 ports can be associated with a given control area. The MAC may have a maximum of two control areas. The remaining control areas are divided between the TOC and TEC.

4.04 Assignments of access ports and control areas must be made in the CMS 1A data base. The machine administrator will make these assignments based on requirements obtained from the TOC and TEC supervisors.

5. WORK CENTER INTERFACES

A. Trunk Operations Center (TOC)

5.01 The trunk operations center (TOC) has as its primary responsibility trunk maintenance. Its activities involve testing and sectionalizing trunk troubles, referring these troubles to the proper equipment repair groups, verification of trouble clearance and return of the trunks to service. Coordination of turn-down and turn-up of trunks for circuit order activity, end to end testing on new trunks and routine testing of trunks.

5.02 The trunk operations center consists of groups of 51A toll testboard positions. These groupings are called control areas. The maximum number of control areas associated with a No. 4 ESS are ten, with a maximum of ten positions per group. In each of the control groups there is one position designated as the control position. This position has the responsibility for all positions within the control area. It has the ability thru CMS 1A to monitor the work load, redistribute the work from one position to another by reassigning either individual troubles or an entire work list to a different test position. The control position also obtains a list of several reports for the control area each day. These include outage ticket listing for the preceding day, the morning out-of-service report, and the monthly out-of-service report.

5.03 The trunk operations center personnel interface CMS 1A with a cathode-ray tube teletype DATASPEED Model 40 KD type terminal. This is part of the 51A toll testboard position. The 51A toll testboard has two methods of operation in testing circuits.

5.04 The first is the interactive mode where all requests are made to CMS 1A via 3-digit command into the 51A CRT. The CMS 1A then controls the testing through the No. 4 ESS and reports back to the 51A position via the CRT. These are all automatic tests and the individual circuit is not connected to the 51A position in any way. All communication is between the 51A CRT and CMS 1A. The CMS 1A sends a request to centralized automatic reporting on trunks (CAROT) 2 or the 1A processor for the tests to be made. Either all tests, or a specified list of tests can be requested depending on the 3-digit code keyed into the 51A CRT. CAROT 2 or the 1A processor will then return the results to CMS 1A as the tests are performed.

5.05 The second is the manual mode of operation.

Requests are made via CMS to switch a trunk into the 51A testboard position by either the No. 4 ESS or the switched maintenance access system (SMAS) if the office is equipped with SMAS. The trunk that is to be tested is connected to one of two test trunks (TAT 0 or TAT 1) associated with the position. Once the trunk is connected to a TAT, it can be tested on a manual basis sending and receiving tone or it can be tested through the No. 4 ESS machine using 3-digit codes via CMS 1A. If CMS is used to outpulse a test code such as 102, the tone will be received at the 51A test position and will be measured manually.

5.06 The 51A testboard position personnel call up various man-machine displays by using 3-digit input codes from 100 to 900. Each code has a specific format and use for the maintenance of trunks. Code 100 is the base display for the TOC since it outlines the functional categories of the system. This display is used as a guide or index to determine what 3-digit code should be used for sectionalizing troubles, circuit order activity or routine testing. Circuit troubles and circuit order work is assigned to individual 51A testboard positions. CMS 1A will automatically fill out a trouble ticket or a circuit order work ticket for each item referred to the TOC. The trouble ticket display is coded 300 while the circuit order ticket is coded 350.

5.07 The trunks in the No. 4 ESS will be divided over the control areas of the TOC at the discretion of the TOC supervisor. The MAC will make these assignments at the direction of the TOC supervisor.

B. Terminal Equipment Center (TEC)

5.08 The terminal equipment center (TEC) is responsible for maintenance of terminal equipment. The personnel repair equipment troubles and verify clearance and the repair of circuits. They also add and remove cross connect wiring, install plug-in units and check cross office continuity and transmission. The terminal equipment center is also equipped with CRT devices which have access to the CMS 1A system without the 51A testboard position. The TEC can be divided into several control areas. Each control area consists of up to ten CRT terminals. One terminal is designated as the control position. It consists of a desk and hard copy device (teletypewriter) as well as the CRT terminal. The remaining terminals may consist of mobile CRT keyboard units.

5.09 The CMS 1A provides essentially the same interactive type display and operation to the TEC for repair, testing and circuit order functions as was outlined for the TOC with some small variations. Circuit troubles and circuit order work are assigned to the TEC by the referrals from the TOC or MAC via CMS. CMS 1A will automatically fill out a trouble ticket for each circuit trouble referred to the TEC. The CMS 1A system automatically generates a circuit order ticket when a circuit order is entered into the circuit order subsystem by the machine administration center. In the case of service circuits or common equipment, the troubles are referred by the No. 4 ESS automatically to the TEC. CMS 1A provides the administrative functions to the TEC the same as it does to the TOC. A daily outage report for each control area along with several summaries (900 series displays) is generated for each control position.

C. Machine Administration Center (MAC)

5.10 The machine administration center (MAC) has the responsibility for an automated circuit order and dial administration operation. The CMS 1A has a data link interface to the circuit layout computer to obtain circuit orders. In effect or delay status reports are also sent to the circuit layout computer via the data link by use of 3-digit commands to CMS 1A.

5.11 Once the various due dates are established and particular equipment assignments are specified, the orders are dispatched to the various

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work centers. A maximum of two circuit order administration areas may exist within a CMS 1A environment. They may consist of from one to ten positions. Each position consists of a teletype DATASPEED MODEL 40 KDP CRT with an associated hard copy device. The machine administrator has the responsibility for the following:

1. Scheduling circuit order work to meet test and due dates.
2. Overall circuit order coordination with:
 - (a) The machine administrator center (MAC).
 - (b) The terminal equipment center (TEC).
 - (c) The trunk operations center (TOC).
3. Provide CMS 1A data required for building trunk subgroup tables.
4. Verify that the centralized automatic reporting on trunks (CAROT) data base is updated.
5. Notify the circuit layout computer of circuit order status, ie, in effect or delay.
6. Maintain circuit order work units.
7. Update circuit inventory.

5.12 The circuit order subsystem in CMS 1A is structured so that circuit order responsibility may be divided by issuing company. Long Lines orders may be assigned to one circuit order administration area and associated company assigned to the other area. Long Lines will have direct input from the circuit layout computer and the associated company may have a direct input from a separate interface, by magnetic tape or by manual input from paper record.

5.13 The circuit order personnel communicate with the CMS 1A via a Teletype DATASPEED MODEL 40 KDP CRT with a series of 3-digit codes similar to the manner in which the TOC and TEC access CMS 1A. The 100 3-digit code will display the various 100 type subcommands and the 200 through 900 commands or displays that are associated with the MAC.

6. SYSTEM INTERFACES

6.01 As stated, the CMS 1A interfaces with other automatic systems in the No. 4 ESS environment. This arrangement requires certain actions by the machine administrator to maintain integrity of the data and interfaces for these systems.

A. CAROT

6.02 Centralized automatic reporting on trunk 2 (CAROT-2) is interfaced with a data link by CMS 1A for reporting routine test results, testing of individual trunks or trunk subgroups and facility groups on a demand basis and updating of the data base. Test results are transmitted from CAROT 2 to CMS 1A on a real time basis for trunks exceeding transmission immediate action limits. The results contain information as to whether the CAROT 2 has made the circuit busy. Once a day CAROT 2 provides listing of routine test results. The reports of the results are forwarded to CMS 1A which will process the information and return a message to the craft personnel as required. CMS 1A will update the CAROT 2 data base by transmitting to it all of the required per circuit information from the installing circuit order. Update to other than individual circuits must be done manually.

B. CTMS

6.03 Carrier transmission maintenance system (CTMS) is a processor controlled transmission measuring system that has the capability of measuring group pilot levels, noise in specific frequency bands, channel power, tone levels at any frequency, etc. The CMS 1A enables craft to interface CTMS to initiate demand tests for the purpose of sectionalizing troubles. The CTMS measures pilot levels and 1000 HZ at the high frequency carrier mastergroup access point and it measures the group pilot at the group access point.

C. SMAS

6.04 CMS 1A interfaces with the switched maintenance access system-3 (SMAS-3) in order to automate SMAS access for maintenance of circuits by 51A test positions. A craft can establish a SMAS connection to the circuit by keying in a 720/X command on the CRT. The digit X specifies the test access trunk to which

the connection is to be made. During the call processing sequence, SMAS-3 passes the facility information to the 51A to prepare it for the type of circuit it is accessing. After the processing is complete. SMAS-3 will return call disposition and circuit status information to CMS, which will process the information and return a message to the craft personnel, if required.

D. 51A Test Positions

6.05 Each 51A position is connected to the voice interface unit of the No. 4 ESS through two access circuits. Through these circuits a test position can be connected to any trunk or service circuit. This access is accomplished by CMS 1A. Assignments and translation information must be made in both CMS 1A and the No. 4 ESS. The machine administrator is responsible for these inputs.

E. No. 4 ESS 1A Processor

6.06 The CMS 1A system interfaces with the 1A processor of the No. 4 ESS switching machine, other maintenance systems and other data processing and off-line systems.

6.07 The CMS 1A processor communicates with the 1A processor via a data link. These

data links are duplicated in case of channel failures. CMS 1A can request the following data or action from the 1A processor.

1. List/trunk subgroup status.
2. Operational tests to be performed on trunks.
3. Modify the status of trunks.
4. Connect trunks through the switch to a 51A test position.
5. Trace, hold and release hold on a trunk.
6. Reconfigure terminal requirement to assist in troubleshooting.
7. Transfer 101 call responsibility during off hours.
8. Control and monitor E & M leads.

6.08 During the precutover period the No. 4 ESS system generic will not be available. The installation test system (ITS) will provide a version of the system generic that will allow craft personnel to conduct various tests.