

**DIAL FACILITIES MANAGEMENT PRACTICE
ENGINEERING AND ADMINISTRATION DATA ACQUISITION SYSTEM
SYSTEM DEFINITIONS**

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL	3	2. Valid System Definition Commands with Subordinate Modal Message Formats	24
2. SCOPE	3	3. System Responses (3 Sheets)	25
3. COMMAND LANGUAGE	3	4. Example of Entering System Parameters	28
4. SUPPLYING, VERIFYING, RECORDING AND MODIFYING SYSTEM DEFINITIONS	4	5. 30 Minute System Period, 1 Hour Mag Tape Writing Interval (2 Sheets)	29
5. SYSTEM PARAMETERS	5	6. Sample Schedules	31
6. SCHEDULES	7	7. Sample Hourly Report Format (5XB)	32
7. CHANNELS	10	8. Sample of Verification of Entity	33
8. HOURLY REPORT FORMATS	11	9. Glossary of Calculation Related terms (2 Sheets)	34
9. ENTITIES	13	10. Exception Report Examples	36
10. CALCULATIONS	15	11. Sample of All Entity Verification	36
 FIGURES			
1. Special Control Characters; Valid Action Verbs; Valid Identification Nouns	23		

DIAL FACILITIES MANAGEMENT PRACTICE

ENGINEERING AND ADMINISTRATION DATA ACQUISITION SYSTEM

SYSTEM DEFINITIONS

1. GENERAL

1.01 This section covers the Engineering and Administration Data Acquisition System (EADAS) input generally referred to as system definitions. Included are explanations of the purpose of each portion of the system definition, and in some instances, a description of "how to" enter, verify, modify or delete the respective system definitions.

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

1.03 DFMP, Div. D, Sec. 4e "Operating the CCU" contains a comprehensive Position Practice, Appendix B, providing detailed instructions on the mechanics of supplying, verifying, modifying and deleting all system definitions. It is intended to be used at the clerical level for actual inputting or changing any of the system definitions. Hereafter this will be referred to as "Position Practice".

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.

1.05 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

1.06 A general description of EADAS is available in TFP Division B, Section 9a, dated Jan. 1974.

2. SCOPE

2.01 Since EADAS is a general purpose data collection system, it must be supplied with certain information unique to each installation. Thus, it may be customized within certain broad constraints to serve its customers appropriately. The features that must be entered in each EADAS are called system definitions.

2.02 This section describes the EADAS system definitions, which are procedures for defining

and entering (supplying) the definitions into the EADAS Central Control Unit (CCU), verifying their accuracy, and subsequently modifying and deleting system definitions.

2.03 The system definitions included in this document are:

- (a) Parameters
- (b) Schedules
- (c) Channels
- (d) Hourly report formats
- (e) Entities
- (f) Calculations

2.04 A description of the means for utilizing the EADAS command language which supplies system definitions is included. Subsections covering special control characters and utility orders input to the EADAS are also included. A catalog of EADAS messages indicating problem situations are included in Div. D, Section 4i.

3. COMMAND LANGUAGE

3.01 The command language used in EADAS is the primary communication link between people and the Central Control Unit (CCU) in the operation of the total EADAS System.

3.02 The general command format used by EADAS consists of up to three fields, each separated by a delimiter (:). The first two fields are made up of two alphabetic characters each. The first field is called the *action field*. Its purpose is to define the basic function of the command. The second field is called the *identification field*. The purpose of this field is to specify the object of the action to be performed. A complete list of action verbs and valid identification nouns is included in Fig. 1. The third field, which in many instances is optional, is called the *data field*. If this field is utilized, it consists of a variable

number of parts required to execute the command. When the data field is used, the principal delimiter used in multiple inputs is the comma (,), however, the total command may not exceed one teletype line. The only exception to the comma application is spelled out in 3.05. If the data field is not needed, it is left blank. However, the second delimiter (:) following the identification field is always required, i.e., DU:KW:! The CCU is programmed to receive specified combinations of the first two fields. These are included in system definitions, Fig. 2 and are described later in this practice. All characters entered are buffered until an "execute" special control character (!) is received. At this point, the entire command is transferred to the CCU interpreter.

3.03 The CCU responds to a command to indicate whether the command is valid or invalid. Some messages are unique to a command, others will be used throughout the command language dialogue. Fig. 3 gives the *system responses* and their meanings. The Position Practice (see 1.02) includes corrective procedures to be followed upon receipt of a system response.

3.04 There are two types of commands available in EADAS command language: action and mode.

A. **Action Commands** cause the system to do something at the time they are entered. For example, the command to "dump the keyword table" (DU:KW:), (purpose explained in Section 4i of this series), causes the line printer to print all of the keywords in the CCU.

B. **Mode Commands** prepare the system to receive further instructions. They do not cause the system to do anything specific at the time they are executed (!). Mode commands always have an action verb of enter mode (EM:XX:). In the modal state, the inputs are much more conversational and less structured than the action command state which is rigidly programmed to accept only specific alphanumeric combinations. It is through this type of command that system definitions (described later) are supplied. The teletype remains in the modal state until the exit command (EX:) is entered.

3.05 In utilizing command language procedures, there are certain control characters which have a special meaning to the EADAS System. It

is important to remember that these characters are limited in their uses. For example, the colon (:) may *not* be used as a colon, except in the third field when listing a time (HH:MM:SS) or a date (MM:DD). Its primary use is as a delimiter between the action, identification, and data fields in a command. For a presentation of all control characters see Fig. 1.

3.06 Most actions initiated by a command preclude the entering of another command while the initial command is being executed. As will be explained, some actions require a considerable time interval. The EADAS program, while executing a command watches for the entering of an exit (EX:) command. Therefore, if it becomes desirable to stop a particular command before it is completed, simply type (EX:!) and the command is terminated.

4. SUPPLYING, VERIFYING, RECORDING AND MODIFYING SYSTEM DEFINITIONS

4.01 In accomplishing the tasks outlined in the Position Practice (see 1.02), there are several important points which should be fully understood by all members of the EADAS team:

- (a) All system definitions may be supplied, verified, modified and deleted at the CCU TTY.
- (b) The dial administrators may verify only channel numbers and calculations from their teletypewriters.
- (c) Verification of any system definition from any teletype will not change its content.

4.02 Although EADAS provides the capability of modifying all system definitions, experience has shown that for the most part (with the general exception of calculation sets) few such modifications will be required. Should there be a need to make such a change, the interdependency of the various components must be fully understood prior to actually making a modification. As a result, caution should be exercised in accomplishing this task.

4.03 So that an administrative control on active system definitions in an EADAS may be established, suggested source documents have been included in Section 4e of this series to be used for reference at the CCU. It is fully understood that any single EADAS may need to customize

similar documents. Regardless of how the forms are customized locally, we would urge that each CCU retain a record of all current system definitions.

4.04 System definitions must be entered in a logical sequence. Since information supplied in some definitions depends upon information entered in previous definitions, it is critical that these definitions be entered sequentially. The next six sections present the definitions in their proper sequence, which is:

- (a) Parameters
- (b) Schedules
- (c) Channels
- (d) Hourly reports
- (e) Entities
- (f) Calculations

5. SYSTEM PARAMETERS

5.01 System parameters consist of four broad options—*system period, magnetic tape writing period, long term data storage interval* and *automatic TUR detector test*. Each option requires a considerable amount of research, and decision making on the part of the EADAS team. For the most part the system parameters are interdependent with or materially effect subsequent system definition decisions. It is strongly suggested that in implementing an EADAS, experienced dial administrative and other appropriate users reach a consensus of these definitions and fully understand the constraints their decisions will have on the EADAS output capabilities for both surveillance and downstream data processing. The command for entering the system parameter mode (EM:PA:) puts the teletype in a conversational mode with the user so that the four options may be discussed. Fig. 4 includes an example of entering system parameter commands (EM:PA:). **Note:** In this system "intervals" always refer to data collection periods.

5.02 *The system period* is the first option to be considered. This option determines when the register counts during that time frame are accumulated, when calculations are performed and when exception reports will be printed. In defining

the system period, there are two possible intervals: 15 or 30 minutes. Intervals begin on even (full, half or quarter) hour time. At the end of the selected interval, a "snapshot" of all register counts received during this period is taken. These data are used for reports and magnetic tape writing as described later. While reports are being generated using the accumulated data, incoming data are not disturbed. Since the system period directly or indirectly affects every level in the system definition hierarchy, extreme care should be exercised in its alteration. For example, changing the system period from 30 to 15 minutes will have the following effects:

1. Long term data storage intervals will be reduced from an accumulated total of 48 to 24 hours.
2. Exception (surveillance) reports may appear every 15 minutes and will be based on 15 minutes versus 30 minutes of accumulated data with a resultant loss of statistical reliability.
3. Some calculation and thresholds may require modifications to reflect 50 percent less time.
4. The magnetic tape (mag tape) writing period, if it equalled the original system period, must be modified to reflect the new system period.

Going from 15 to 30 minutes will have not only the opposite effect of the above four items, but will also require that all schedules be changed to half hour/hour basis as compared to a quarter hour/half hour basis. These schedules include long term data schedules, mag tape writing intervals, automatic TUR detector tests, **ALL** schedules defined under the command (EM:SC:), and busy period schedules for entities. Please note that should the system period be changed, it is necessary to reset the system time. If an EADAS plan includes data collection from ESS offices prior to CTX8, Issue 2, it is recommended that a 30 minute system period be selected to minimize the delay effect of EADAS processing ESS accumulated data.

5.03 *The magnetic tape writing period* is a compilation of the "snapshots" of register

counts taken at the end of each system period. These are then written on mag tape and are utilized for downstream user program applications. This parameter has two options available. It must either be defined as 60 minutes or equal to the system period. If it is equal to the system period, register totals are copied (subject to the magnetic tape writing schedule) onto the tape for the previous period. If the 60 minute option is chosen, register totals are accumulated for four consecutive periods—if a 15 minute system period has been selected—or for two periods if the system period is 30 minutes. Please note that the mag tape writing interval is a span of time, not a specific clock time. It says "write tape every 60 minutes," not "write tape at 9 o'clock and 10 o'clock." Another consideration is that tape will not necessarily be written every available interval, but rather follows the schedule defined in the schedule mode (see 6.01). Furthermore, if a 60 minute magnetic tape interval is used, overlapping hourly reports and magnetic tape writing may not be scheduled on a given channel as the data for each are stored in the same disk area. Finally, overlapping 60 minute study periods, i.e., 9:30-10:30, 10-11 may not be collected from the same channel. As in 5.02, an ESS pre CTX 8, Issue 2 office, will justify the selection of 1/2 hour mag tape writing periods to maximize the flexibility of routine (hourly) report coverage.

5.04 Long term data storage interval is the daily period of time during which results of all mathematical calculations performed in the system are retained within disk storage. This is specified in military time, i.e., a 24 hour clock, as "start" and "end" hours and minutes. The times must be expressed in even multiples of the system period. The term data storage holds 96 system periods of the daily interval specified. After 96 periods have been accumulated, the "oldest" period is dropped at each successive new period. The number of days of results available may be calculated according to the following formula:

$$\frac{96}{\text{total daily collection hours (System Per/Hr.)}} = \text{days}$$

For example:

$$\begin{aligned} \text{Daily collect. hrs.} &= 9:00 \text{ to } 17:00 \\ &= 8 \text{ total hrs/day} \end{aligned}$$

System period = 30 min. or 2 System Per/Hr.

$$\text{Thus: } \frac{96}{8(2)} = 6 \text{ running days of calculated results retained in long term data storage}$$

Note: Due to an approximate 1/2 hour delay in obtaining ESS calculation results in pre CTX 8, Issue 2 offices, the long term storage intervals must be designed to provide for this.

This feature has two primary uses:

- (a) If a group of calculations yield unexpected results, a historical (96 system periods) record of previously calculated results may be obtained to determine when the results began to go awry.
- (b) Calculations may be defined for special studies covering several days. Rather than print results on hourly or exception reports, results are stored for 96 system periods and then may be 'dumped' on the high speed line printer. If an entire day's data is to be stored, the inclusive times should be either: "00:00 to 23:30" for a 30 minute system period or "00:00 to 23:45" for a 15 minute system period.

Note: Long term data storage is completely independent of any consideration other than those mentioned above.

- (c) Sum calculations (SU:CA:) provides a calc result for a single entity's calculation for up to 48 hours. A possible use of this feature might be to collect originating peg count data for an entity for 24 hours.

5.05 Automatic TUR detector test is scheduled generally in light activity periods, usually either prior to or following the day's study collection period. All TURs controlled by either ETDCs or TURCs can be included in this test. However, if there is ETDC concentration, a maximum of 4 TURs can be tested on a single channel. Please keep the following in mind when selecting the appropriate detector test schedule:

- (a) This test must be a multiple of the system period.
- (b) Test scans cannot extend from one system period into another if there are the maximum 4 TURs on a single channel. Since a total of 18.3 minutes is required to test all TURs in this case, this test cannot be used in conjunction with a 15 minute system period. Its use would result in the second 15 minutes of data being distorted and therefore invalid. See DFMP, Div. D, Sec 4i par. 5.04 for an explanation of these time segments.
- (c) After this test, all TURs are turned off until the beginning of the next system period. They are then subject to the TUR schedule defined in the schedule mode. (See 6.04.)
- (d) During the detector tests, only the exit command (EX:) is accepted by the CCU teletype. This command stops the testing and causes all the TURs to be turned off for the remainder of the system period.
- (e) Tape writing is performed automatically for downstream analysis. No manual scheduling is required.
- (f) Detector tests should be scheduled during light hours. Otherwise ETDCs having two TUR frames scanning simultaneously and a heavy peg count load at the same point may experience buffer overflow problems. (see TFP Div. B, Sec. 9b)

5.06 After accepting the new system parameters, the machine will exit the parameter definition mode by typing COMPLETED.

6. SCHEDULES

6.01 EADAS schedules identify when:

- (a) Accumulated raw data will be written on mag tape.
- (b) Hourly reports will be written.
- (c) TURs will be turned on and off.
- (d) DTS equipment will be turned on and off.
- (e) ICUR data will be written on ICAN mag tape.
- (f) Load Balance data will be written on mag tape.

Note: The latter three, (d), (e) and (f) are intended for future applications and are therefore not currently utilized.

6.02 A maximum of sixteen schedules can be defined. Each is made up of one or more of the six items described in 6.01. Each schedule is defined for seven days in terms of the selected system period. Each defined channel must operate under only one of these 16 schedules. If an hourly report involves registers from two or more channels, (see 6.07 for a suggested approach) these channels should be assigned to the same schedule arrangement.

6.03 Each EADAS administrator will need to determine the total data collection needs of all known or forecasted users such that the 16 schedules can provide the maximum reports desired and minimize the need for changes in schedule assignments. The suggested matrix described in 6.07 may provide certain users with more data than they need, but this is due to the constraint of only 16 schedules being allowed.

6.04 Certain values within the schedule mode, and between the schedule and parameter mode must be consistent. These are:

(a) **Magnetic tape (MT) writing schedule**

- (1) The interval must be equal to, or whole multiples of, the mag tape writing period or an "INVALID INPUT" message will result.

- (2) If more than one schedule is specified, the schedules must be sequential and not overlap. **Example:**

Valid Schedule: 8:00—10:00, 11:00—13:00

Invalid Schedule: 8:00—10:00, 9:00—11:00

- (3) If tape is to be written across a daily boundary, the schedules for the two days should be set up so that all open ends match.

Example:

Day 1	Day 2
0800-1200, 2000-	-0200, 0800-1700

- (4) If hourly reports are scheduled at about the same time as mag tape writing, the hours must coincide. See (b) (1) below.

(b) **Hourly report (HR) schedules**

- (1) They must not conflict with mag tape writing schedules. An "INVALID INPUT" will printout if MT and HR conflict. Therefore, if the mag tape writing period is one hour, the hours assigned to both the mag tape and hourly report schedules must coincide as follows: **Example:**

MT writing schedule = 8-12

MT writing period = 60 min.

(Thus, hourly reports must begin on the hour if they are scheduled during the 8-12 period.)

- (2) At times when mag tape writing is not scheduled or when the MT schedule equals the system period, hourly reports may be scheduled at the beginning of a system period. Fig. 5, shows unacceptable and acceptable combinations of hourly report and magnetic tape writing schedules. In Fig. 5, page 1 of 2, please note the HR request for the second period of the day starts at 8:00, which is fine, insofar as MT writing is concerned but ends at 10:30, which is clearly an invalid input. In Fig. 5, page 2 of 2, when each (MT and HR) are scheduled, they appropriately coincide and therefore are acceptable.

- (3) Caution is urged in scheduling hourly reports to cover a large number of channels. For example, while an hourly report reflecting dial tone speed and/or incoming matching loss results for an entire division or administrative area, or a similar reporting concept covering key trunk groups in a large number of offices might seem desirable, this is *not* an efficient arrangement as EADAS is presently designed, since it requires that all channels involved be assigned a common hourly report schedule. The most extreme example would be the production of all hourly reports on all channels for all hours of the day. The result would be a great waste of paper and inappropriate use of this EADAS feature.

(c) **TUR Schedules**

EADAS no longer automatically schedules TURs to be turned on based on a composite hourly report and magnetic tape schedule. This schedule therefore demands a completely separate consideration as to data collection requirements.

- 6.05** In addition to the above considerations, there are three general scheduling constraints which should be evaluated when planning an overall schedule. They are:

- (a) Mag tape writing times must allow for a 30 minute "delay" in writing pre CTX 8, Issue 2, ESS data to tape. Hourly report schedules do not apply to ESS reports which are generated automatically if data is received. Any one of the sixteen schedules may be selected individually for both "C" and "H" block applications during channel definitions.
- (b) If there is ETDC concentration, then one schedule must be devised to serve the home office and all remote offices as well.
- (c) If a switching machine has two distinct bulk classes of service and their busy hours overlap, an hourly report may be selected to provide only one of the two busy hour collections. For example, in a step-by-step office, it is possible to have separate line finder groups associated with flat rate and coin business. Their respective busy hours might be 1000 to 1100 and 1030 to 1130. You may opt for either

one depending on your requirements, but you may not have both.

6.06 One possible way to overcome the constraints in 6.05 (b) and (c), would be to utilize the multiple entity definition feature per channel. As described in 9.02, each channel may have up to six entities. In 6.05 (a), this procedure could allow you, on an "always print (AP)" basis, exception reporting for the remote office. In the case of 6.05 (b), again using "AP" on an exception basis, it would be possible to print the two consecutive 30 minute intervals and manually combine the results. Of course, this method presumes that the magnetic tape writing schedule is no more than 30 minutes.

6.07 A full data collection schedule assures that all six items listed in 6.01 are collected each day of the week. The objective of data collection scheduling is to meet the individual needs of all users of a reasonably loaded EADAS which has a fair mix of different types of switchers and downstream users. The following scheduling procedure (see Fig. 6) is suggested:

(a) Begin by setting up three separate study sessions covering the morning, afternoon and evening. These intervals may overlap. For example, 8:00—13:00 (morning), 12:00—18:00 (afternoon) and 17:00—22:00 (evening).

(b) Next, create seven schedules containing all possible combinations of the three study sessions developed in (a) above. (See Fig. 6, Schedules 0-6, inclusive.)

(c) Arrange these seven schedules so that magnetic tape writing and TUR scanning is done during the sessions indicated, and hourly reports are generated on the clock hour during these intervals. Magnetic tape writing should be done at the end of each system data collection period during these sessions, i.e., at 15 or 30 minute intervals.

(d) Set up seven additional schedules which provide the same schedules for TUR scanning and magnetic tape recording as the first group. Arrange these schedules so that hourly reports are generated on the half-hour.

6.08 The above schedule arrangement permits magnetic tape recording and printing of

hourly reports during any desired combination of morning, afternoon and evening busy hours. This approach assumes that if an office has a morning busy hour, say 10:00—11:00, then most of the side hours covered in the morning study session would also be of interest to dial administration. By writing tape at 15 or 30 minute intervals, user requests for overlapping study hours can always be satisfied. For example, trunk engineering data can be collected for 14:00—15:00 and common equipment studies can be taken simultaneously for 14:30—15:30.

6.09 This arrangement leaves two spare schedules for special study purposes. One of these could be dedicated to minutes of use studies for toll separations purposes, or possibly schedules 0 and 7 could be expanded to cover this need, depending on local policy concerning the number of hours and days of the week to be covered in these studies. In installations covering more than one time zone, it may be necessary to expand all of the study sessions slightly.

6.10 The schedules shown permit the generation of hourly reports on either the hour or the half-hour for any desired combination of study sessions. This provides more opportunities for printing hourly reports which cover official busy hours, thus providing the data needed for dial line index calculations.

6.11 To enter the schedule definition mode, the proper command (EM:SC:) is typed on the CCU teletype. The EADAS program will then sequentially request the following information in order to complete this definition.

(a) Schedule for day—the first 2 characters of the day wanted should be entered. Only one day may be entered at a time.

(b) Schedule number—0 to 15 are the only choices. (See Fig. 6 for suggested schedules.)

(c) If there is no schedule, the program will need a specific time (HH:MM) for each of the following:

(1) Magnetic tape schedule

(2) Hourly report schedule

(3) TUR Schedule

(d) The next three items for DTS-, ICAN-, and LB- are intended for future use and should not be considered at this time.

6.12 Any new schedule will take effect the next time the day specified occurs. For example, if a schedule is entered Wednesday (WE) for Saturday (SA), it will take effect in three days. If a new schedule is entered on the same day of the week it addresses, i.e., enter a Wednesday schedule on Wednesday, it will take effect within 15 minutes.

6.13 In the schedule mode, all responses should be followed by an exclamation point(!). If an invalid answer is entered the program will respond with "INVALID INPUT" and the response should be reentered. This mode may be exited by typing (EX:!). It may be restarted by typing (FI:!). Exiting prematurely or restarting prior to completion will leave the previously existing schedule unchanged.

6.14 Refer to Task 4B of the Position Practice (see 1.02) to modify system schedules, or to 5B to verify existing schedules.

7. CHANNELS

7.01 When a channel from a data collection apparatus (DCA) is to be physically added to the system, the CCU must be informed of its existence. Normal scanning, updating of data or any other channel processing is not performed until specific channel parameters are defined.

7.02 The channel definition mode (EM:CH:) is used to enter key items of data intelligence, as follows:

- (a) **Identifies the channel number (0-99 maximum).** These are installed in the CCU in groups of 20. If only one group is installed, then the channels are numbered 0 to 19. The CCU accepts a channel definition only for valid channel numbers.
- (b) **Includes the channel name.** This is an 11 character DCU ID written on magnetic tape to identify the accompanying accumulated data. If these data are intended to be sent downstream the name must match that of TDAS

or its equivalent DCU ID. If common language is used, as in TDAS, it is made up as follows:

- (1) Four character city identifier
- (2) Two character state identifier
- (3) Two character building identifier
- (4) Three character DCU. For EADAS, the first character is "S". The last two characters are numbers which may indicate the unique data collection units within a building.

Example: PHLAPAGLS01—The Gladstone One office in Philadelphia, Pennsylvania.

- (c) **Each defined channel must operate under the control of one of sixteen schedules** defined under the schedule definition mode (see Section 6, Schedules). This decision determines: (1) When the TURs being collected over this channel, home and remote, will be turned on and off, and (2) when hourly reports and magnetic tape will be written for the data collected via the channel.
- (d) **Identifies the status of calculations, magnetic tape writing, and status of channel.** Either of the first two may be on or off [Yes (Y) or No (N)] but both require the channel to be on line (Y) to be effective.
- (e) **Specifies the type of data collection apparatus (DCA)** sending information to the CCU, i.e., TDC, PDT, etc. If a response to "CHAN TYPE" is ES1L for No. 1 ESS or ES2L for No. 2 ESS the following questions are posed:

- REGS IN C SCHED =
- REGS IN C T/G SCHED =
- DCU ID FOR H SCHED =
- REGS IN H SCHED =
- REGS IN H T/G SCHED =
- DCUID FOR W SCHED =
- REGS IN W SCHED =

Note: (1) The initial request for DCU ID applies to "C SCHED"

Note: (2) Both C&H T/G SCHED REGS must be no more than the REGS in C&H Sched as respectively

- (f) **Informs the CCU of the types of registers** wired to the DCU and the register number range associated with each type for non-ESS offices.

Note: The channel must not be defined until the appropriate input card is installed, that is, the new channel number must be included in one of the installed cards. See TFP 9b, paragraph 2.04 for further information.

- (g) Informs the CCU of the activation or not of this particular channel by a simple question "PUT ON LINE?"—The user responds with either "Y" or "N."

7.03 At the CCU, a special command (VE:CH:) is provided to verify one or all channels. The verified information is printed out on the CCU teletype if only one channel is requested or on the CCU line printer if all channels are to be verified. The verification includes:

- (a) Channel number
- (b) DCU ID
- (c) Channel data collection apparatus type
- (d) Schedule number
- (e) TUR status
- (f) Calculation status
- (g) Magnetic tape recording status
- (h) Internal channel number

7.04 Certain portions of a previously defined channel may be modified only from the CCU teletype while the system is on the line. These are:

- (a) DCU ID
- (b) Schedule number

- (c) Input Register Assignments
- (d) TUR information

To accomplish this, the channel definition mode "EM:CH:" is utilized. Please refer to task 2D of the Position Practice (see 1.02) for specifics. If the user responds to EADAS questions by typing an execute "!" the channel will be left unchanged. After updating the desired parameter, the program will restart the channel definition mode.

7.05 There are also two parameters which may not be changed without first deleting the entire channel, including all associated entity and calculation definitions. These two parameters are the:

- (a) Channel number assignment
- (b) Channel type

7.06 Modification of a channel's calculations, scheduled magnetic tape writing and "on-line", status may be accomplished by using the respective (ON:) and (OF:) commands. The command (OF:CH: channel number) leaves the channel definition untouched, but prevents the rest of the EADAS from knowing that the channel exists. Conversely, the (ON:CH: channel number) command makes the channel definition available to the system. For a further discussion of these utility commands, refer to section 4i of this series.

7.07 In order to permanently eliminate an entire channel definition, the command (DE:CH: channel number) must be given. This command deletes all associated calculations as well. After the channel has been deleted, a new channel utilizing the deleted channel number may be entered under the channel mode (EM:CH:).

8. HOURLY REPORT FORMATS

8.01 The hourly report capability of EADAS is intended to provide an overview of office performance plus additional items of information needed for index calculations. These reports are provided primarily for reference purposes pending availability of more complete reports from the downstream processing systems. Due to the "delayed" aspect of ESS data being processed in EADAS, these type of reports are more accurately described as "routine reports" for ESS switchers.

They are not intended for real-time machine management purposes.

8.02 An EADAS may accommodate up to 16 hourly formats. For example, a suggested format for No. 5 Crossbar offices is shown on Fig. 7. An hourly report format specifies where calculated values are to be printed, the headers and labels to be associated with them, spacing for legibility, etc. Each format specification is limited to a maximum of 64 fields for calculated values. Since a maximum of 16 report formats are available to a single EADAS, standardization of some common reports becomes necessary. For example, each basic type switching system might have an hourly report format (as in Fig. 7 for No. 5 Crossbar) which could be used by all similar switchers. On the No. 1 ESS Routine Report, only H schedule items should be included. It is recommended that H and C schedule calculations not be mixed on one routine report, since it is not likely that an office will be able to transmit both C and H data within one system period. Therefore, if routine reports are needed for "C" items, a separate format should be defined to obviate this additional format, C data may be treated as exception reports.

8.03 In creating the maximum 16 hourly report formats, there are a total of 4022 bytes available for use. A teletype character should be considered the equivalent of one byte, except for spaces. After each hourly format is entered, the user may enter a print command (PR:) and the line printer of the CCU will produce a report such as this example:

```

01          *** 5XB HOUR REPORT ***
02
03 ENTITY:  E
04 DATE:    D  HOUR ENDING:  H
05
06 ORIG
07 REGS      %DTS      OCC      MB      %OFL
08
09 DP        01 X.X      .XX      X.X      X.X
10 TT        05 X.X      .XX      X.X      X.X
11 TOT       09 X.X
12 N
= 143 BYTES
    
```

In this printout, the first column of numbers at the left gives the line numbers and the second column (01, 05, 09) gives the hourly report calculation

numbers of the first result appearing on each line that has one or more results. Thus, the calculation number of %DTS-DP is 01, that of OCC-DP is 02, and that of MB-TT is 07. When the hourly report calculations for each entity are defined and entered they must be identified by these numbers in column 2. The final entry in the example gives the user the number of bytes used up in formatting this particular hourly report.

8.04 The number of decimal places shown for calculation results on the hourly report format must correspond to the number of decimal places planned for the calculation's definition.

8.05 The effect of using decimals in hourly report calculation results should be fully understood. In EADAS, the hourly report values are limited as follows:

- (a) If an integer—65,535
- (b) If one decimal—6,553.5
- (c) If two decimals—655.35

Integers printed on hourly reports may be scaled in calculation definitions and then "de-scaled" on printing if an anticipated result will exceed these maximum values. For example:

```

CALC = PC/100

HR FORMAT POSITION XXXX00
    
```

See Task 3C of the Position Practice (see 1.02) for specific procedures on entering hourly reports.

8.06 There are some general items which should be understood when entering an hourly report format. Hourly report format names may not exceed two alphanumeric characters, i.e., 5X, 1X, SX, etc. In the example in 8.03, the user will see at initial entry:

```

*** 5XB HOUR REPORTING ***

ENTITY:  ↑E

DATE:   ↑D HOUR ENDING:  ↑H
    
```

:
:
↑N

These up-arrow characters plus one or more appropriate characters are used to indicate the following special actions:

↑E Entity Name

↑D Date calculations were made (MM/DD/YY)

↑H Hourly report ending time (HH:MM)

↑N End of an hourly report. The last line must contain this ↑N *only*.

↑ plus 0 to 4 X s and/or “_” Print hour calculation result in format indicated (up arrow counts as an “X”).

8.07 Hourly report formats must be defined prior to hourly calculations. As described in 8.03, hourly calculations are assigned sequentially starting with 01, as the results are encountered in the format.

8.08 A specific calculation result can appear only once on one hourly report.

8.09 After an hourly report format has been entered into EADAS, new calculation results should not be inserted in the middle. They will change all the calculation numbers for all the results occurring after the newly inserted number(s).

8.10 If a predefined hourly report format is to be enlarged, change is minimized if the additional calculation results can be added at the end of the existing format. Using the example in 8.03, the last line is 09(TOT), thus the user would type “IN:10!”, etc., plus the new format test.

9. ENTITIES

9.01 An entity consists of a group of calculations on one or more channels having meaning to a specific user, i.e., network administrator, trunking engineer, network manager, etc. It may be thought of as a map which directs the results of a certain set of calculations to the correct user group.

9.02 In non-ESS offices, an entity is frequently identified with one or more channels which collect from a single switching machine. ESS offices may not combine cross-channel referencing in defining a single entity. EADAS allows up to six entries to be defined for a given channel with an overall maximum of 170 entities per system. This feature might be used in two ways: (a) When ETDC concentration is used, each of the remote switchers (up to five) and the home switcher may be identified as a separate entity; and (b) if two different user groups, i.e., dial administration and trunk engineering, need calculation results from the same channel, a separate entity may be defined for each user group to obtain the desired data over that single data channel.

9.03 A defined entity provides the capability of specifying up to three busy period schedules. These schedules are used in conjunction with threshold values used in the entity's calculations. Although in most cases only one schedule will be required, this three schedule flexibility allows the user to define a busy period for incoming traffic, another busy period for outgoing traffic and a third busy period for common equipment. Each schedule specified represents 24 hours of collected information. Using the specified threshold schedule, the first value of the pair is used during non-busy hours, the second during busy hour. As many busy periods as desired may be specified within each schedule.

9.04 A particular hourly report format (see 8.02) in which data collected on an entity will be reported must be specified at the time an entity is defined. This format has locations where certain calculation results are expected to appear. (See 10.01)

9.05 In entering an entity name, since there is not a separate mode for defining entities, the command (EM:CA:) must be followed immediately by the submode command (IN:EN:). This will cause EADAS to accept the entity name as well as the other items identified in 9.01 through 9.04.

9.06 The entity name may consist of any combination of up to 12 alphanumeric characters which has meaning to the users. However, due to an inherent EADAS constraint, no blanks should be included in the entity name. If they are included, i.e., BA 85A, upon request to modify, verify or delete the entity, EADAS will strip away the embedded blank *before* the search for the matching

name commences. The effect is that EADAS will fail to recognize an apparently good entity name. In the verification mode EADAS will respond "NOT DEFINED". In the deletion and change modes, its response is "NOT FOUND". As described in 9.02, ESS offices may not cross-channel reference calculations, thus it is necessary to define separate entities for C and H schedules. Experience has shown it helpful if the "C" or "H" is included as the last character in the entity name.

Note: No entity definition is involved with a "W" schedule since calculations are not performed on "W" items.

9.07 When the status of an entity is verified (VE:EN: entity name), information about the entity as a whole is provided, followed by information about each calculation within the entity. Refer to Fig. 8 for the teletype output of an entity verification. The circled numbers identify the verified entity's piece parts. They are as follows:

- ① Entity name.
 - ② Channel number.
- Note:** ESS channel numbers should have the suffix "C" or "H" added as appropriate.
- ③ DA TTY which will receive the appropriate reports.
 - ④ Calculation block number utilized for this entity.
 - ⑤ Hourly report format with its two character identifier.
 - ⑥ Three threshold schedules assigned as appropriate.

Note: ESS schedules should be slipped 1/2 hour at each end to allow for ESS delay.

- ⑦ The Calc name(s).
- ⑧ Where used, the "M" or "S" letter indicates a master or slave designation.

Note: A single calculation may be entered without the "M" or "S" designation. But this Calc. set may never have a slave following it. If the user subsequently wants to attach

a slave to this calculation, the calculation must be deleted and reentered using the "M" in this field. Then the associated slaves may be entered. (See 10.08 for a discussion of master/slave calculations)

- ⑨ The threshold type/value and the number of threshold schedule.
- ⑩ Decimal places in the calculations are identified here. See 10.15 for a presentation on decimal place applications.
- ⑪ The hourly report data element number. This shows where in the report this calc result will be found. Please note that this is not printed for "exception only" calcs.
- ⑫ The U indication is only printed where usage or dial tone speed registers or SADR are involved.
- ⑬ The actual calculation definition (see 10.01) is printed in algebraic form.
- ⑭ Any term labels (key words) are listed in the order in which they appear. However, result labels are not listed.
- ⑮ Remaining spare calculation sets which may utilize this block. See 10.09.
- ⑯ Remaining calculation definition word capacity remaining in this block. See 10.10.

9.08 In EADAS, experience has shown that entities and their calculations change more frequently than other system definitions. Modifying an entity definition does not effect parameters, schedules, channel or hourly report format definitions. There are two methods of changing entity definitions. Both are submodes of the entity and calculation definition mode (EM:CA:).

- (a) The Change entity command (CG:EN:entity name) allows the user to change the name of the entity, the hourly report format number used, the DA TTY to which reports are sent, or the threshold schedules associated with the entity. If the hourly report format number is changed, the calculations must be reviewed to insure that the calculation results are reported in the correct location on the new hourly report format. If an old threshold schedule is to be

deleted, the proper command (DE:) is entered when the new threshold schedule is requested. Calculations assigned to a deleted threshold schedule are performed 24 hours per day and are compared to the nonbusy hour threshold.

- (b) An entire entity may be deleted along with all calculations associated with the entity by simply entering the deletion command (DE:EN:entity name!).

10. CALCULATIONS

10.01 Having provided channel and entity definition information, a series of calculations to be included within that entity (calculation set) must be defined. A calculation definition includes a calculation name and print control specifications. The results of an individual calculation may be printed in an hourly report, as a part of an exception message, in response to a user demand, or any desired combination of these.

10.02 Calculated results are obtained from EADAS by entering calculation definitions (EM:CA:) and other items of information needed to control printing functions at the CCU TTY. At most, a string of 270 characters may be entered for one calculation. Only the following operands may be used:

- + addition
- subtraction
- * multiplication
- / division

EADAS follows a set order of algebraic operations in arriving at calculated results. They are treated left to right. Parentheses () are used for algebraic grouping. The symbols "< >" are used to delimit terms, i.e., T1 <(R537+R538)>. The only valid letters that may be used are:

- R—unscaled register
- S—scaled register
- T—Term

Note: If either the numerator or denominator in a calculation set requires one or more

operands, a parenthesis around the numerator and/or denominator is mandatory. Example: $(100 * T1 < (R537 + S647) >) / (360 * R31)$

All numerics are valid, i.e., 0-9. The only other characters that can be used are the comma, the colon and the exclamation point. An EADAS installation may store up to 6800 such calculation definitions. Typical calculations include items such as percent incoming matching loss, percent marker occupancy, etc. Please refer to the Position Practice (see 1.02) for specifics on supplying, verifying, modifying and deleting calculations.

10.03 Calculated results can be printed on remote teletype machines at locations other than the central processor unit, for example, in dial administrator offices for the applications covered here. An EADAS processor can accommodate up to 16 such remote terminals. All exception results are duplicated on the CCU line printer unless they are turned off by using the command "OF:EX:!". To restore the line printer use the command "ON:EX:!"

10.04 Calculated results are generated at the end of each system period. The results may be printed as one line exception messages depending on threshold specifications associated with each calculation. This concept operates as follows:

- (1) The register differences specified in the calculation definition are manipulated according to the rules of the calculation.
- (2) The result of the calculation is compared against selected limits (threshold values).
- (3) A calculation result outside the threshold value will be printed on the appropriate TTY as an exception report.

Please note that only calculation results are included in EADAS long term data storage. Thus, if one wishes to retain a simple register difference, a calculation definition must be entered as being equal to that register.

10.05 During a calculation definition in order for calculation results to be more readable, keyword labels for its results and any desired terms (up to five) included in it may be printed. EADAS provides a maximum of 256 keywords.

These are generally words or abbreviations which would describe the calculation result and term label in a printout, such as %, OFL, PC, etc. It is recommended that a list of the keywords be kept for system application. Every effort should be made to use one keyword for the same thing, i.e.: say peg count = PC instead of PC, and PEGC, and PCT, each of which use another keyword. When a new keyword is entered, if the table is full (256), the system response will be, "KEYWORD TABLE FULL". At this point utilize the command "UP:KW:". This will purge the table of any keywords which had been previously defined but are no longer in use. If there are no unused keywords, then a discretionary decision will need to be made as to the choice of deleting a relatively unused keyword to make room for the proposed keyword. The system command "DU:KW:" will confirm your list of presently active keywords.

10.06 So that the composition of calculation sets and the interpretation of exception and demand reports may be fully understood, several basic descriptions of the calculation phraseology should be examined. Fig. 9 presents a glossary of terms of calculation definition based words.

10.07 There are five possible threshold type (limit test) specifications for control of exception message printouts. A threshold specification consists of up to four items: a threshold type, two threshold levels and a threshold schedule. The meaning of the value and schedule specifications varies, depending on the threshold type specified:

(a) Upper Bound (UB) type thresholds—this threshold type causes an exception message to be printed whenever a calculated result equals or exceeds its threshold level. Two threshold levels are specified, one which is applied in nonbusy hours and another for busy hours. The nonbusy threshold is specified first. These nonbusy/busy hours are defined by the threshold schedule specification. A maximum of three different threshold schedules are allowed for a given entity.

(b) Lower Bound (LB) type thresholds—this threshold type operates in a manner analogous to the UB threshold, except that it causes a message to be printed whenever a calculated result is less than or equal to its specified threshold level.

(c) Lower-Upper Bound (LU) type thresholds—this threshold type provides a double-sided test. Two threshold values are specified to define lower and upper bounds for the calculated result. Currently, a threshold schedule specification for this type has no meaning, since the test is carried out for 24 hours a day.

(d) Never Print (NP) type threshold—this specification prevents a calculation from ever being printed by itself as an exception message. It is useful in three situations: (1) when a calculation is used only for hourly report purposes, (2) when a calculation is to be printed only as a slave calculation in exception reports, or (3) when a calculation is defined only for demand reporting purposes.

(e) Always Print (AP) type threshold—this specification causes a calculation result to be printed for every data collection interval, i.e., every 15 or 30 minutes. This specification should be used sparingly if at all, since it tends to produce a cluttered teletype output.

Note: The number of decimal places specified in the threshold values must equal the number of decimal places specified for the calculation results. (See 10.15 for a description of decimal place applications.)

10.08 Several examples of exception message printouts are shown in Fig. 10. As shown by the first example, the calculation name is printed, followed by the calculated value, and possibly a result level such as a percent sign. The calculation definition may also be arranged to print up to five intermediate terms along with a calculated result, as shown by the second example in Fig. 10.

10.09 In utilizing the calculation capability, EADAS recognizes that certain calculation results are dependent upon other lesser calculations previously computed. This requires that all calculations, therefore, be identified as either master (independent calculation) or slave (calculation dependent on a master). In exception report applications, when a threshold for a master (M) is exceeded (or underrun depending upon the type), the results of both the master and any of its slaves will be printed out regardless of whether the slave has failed its own threshold or not. However, if a threshold on a slave (S) has failed, only the

slave's results will be identified. Additional considerations on the master/slave relationship are:

- (a) A master may have up to 15 slaves dependent upon adequate room in a calculation block. Experience has shown that when slaves exceed 5 to 6, it becomes extremely difficult to manage them.
- (b) A slave may have only one master.
- (c) Slave calculations must be defined immediately after their master calculation has been defined.
- (d) A slave calculation may appear on hourly as well as exception reports if it is given both an hourly report number and a threshold level.
- (e) If the slave result is needed only when the master exceeds its threshold, a never print (NP) type threshold is used for the slave.

An illustration of a master-slave calculation printout is given in example 3 of Fig. 10. Slaves are printed whenever they fail their own threshold or whenever their master failed its threshold.

10.10 In considering the definition of the maximum 6800 calculations possible such that those that are defined may fit in the 400 EADAS calculation blocks of storage, there are several system constraints which should be fully understood in attempting to maximize their use.

- (a) The general specification for the *calculation blocks* are that each may contain up to 185 definition words spread over the maximum 17 calculations per block. Therefore, using the maximum 17 calculations, each may average no more than 10 words.
- (b) Each calculation block may only be used by a single entity.
- (c) A given calculation must be wholly contained within a block. As a result, EADAS will inventory the remaining words in a block, if there is not sufficient capacity left, EADAS will place this calculation in the next block.

(d) A Master calculation and its associated slave calculations, (see 10.09) must be contained within one calculation block.

(e) If a calculation block has insufficient word capacity to accept the master-slave string and this fact is unknown to the EADAS user, EADAS will accept each calculation starting with the master until there is no longer adequate word capacity for a specific slave calculation. The system will then respond with this error message—"SLAVE NOT ON SAME BLOCK AS MASTER. PLEASE REPOSITION MASTER/." The string must then be entered in the next block which has sufficient total word capacity. Since the EADAS user has no capability of selecting a specific block, prior to entering a string of calculations, in order to save time at the CCU TTY, it would be well to know if the first block EADAS looked at will have sufficient overall capacity for this calculation set. This suggests the desirability of maintaining an inventory of spare block capacity for calculations and words. This may be accomplished, as described in 10.11, by verifying each existing entity. Please note that verification of all entities (VE:EN:ALL!) will only provide the information as illustrated in Fig. 11.

10.11 Upon determining the calculation block status as described in 10.10e, there appears to be insufficient free calcs and words in the first block available to accept the entire calculation set, i.e., master and all slaves, the EADAS user will need to fill the insufficient capacity with pseudo-calculations in each successive block until a block with adequate capacity is reached. Once the calculation set is entered, the pseudo-calculation(s) may be deleted.

10.12 In considering the constraints listed in 10.10, it is essential to understand how EADAS counts words. There are certain pieces of intelligence included in a calculation definition which do not count as words. These include the following items:

- (a) The Calculation Name
- (b) "M" (Master) or "S" (Slave). Also master name if associated with slave calculation.
- (c) Hourly report format location number (if the calculation is used on an hourly report).

- (d) The determination of TUR usage (Y or N).
- (e) The calculation label.
- (f) Up to five terms and labels.
- (g) Within a term, the operand for addition (+).

Note: Within a term only a “+” may be used.

The following rules apply in computing calculation word utilization:

<u>Item</u>	<u>Example</u>	<u>Comment</u>	<u># Words Used</u>
Single Register	R123	EADAS expects at least one operand so in this case it adds an extra word count.	2
Multiple Registers	R123,S465	1 per register	2
Constant	8191	1 per constant	1
Operands	+,-,*,/	1 per operand	4
Cross Channel Reference	R123:8	Does not count delimiter	2
Decimal Req'm't	,2	EADAS looks at this as “100*”	2
Term	T1 R3+R4+R5	See (g) above but EADAS expects another factor with this Term so it adds to the word count. Thus R3+R4 count 2 plus the added word.	4

10.13 In order to verify the number of calculation blocks with unused capacity (FREE CALCS) and the number of unused words (FREE DEF

WORDS) in each “used block”, use the “verify entity” command (VE:EN:).

Example 1. A particular entity had 5 calculations defined requiring 75 words.

FREE CALCS 12

FREE DEF WORDS 110

Example 2. 20 calculations were defined — 16 in block #1 used 185 words and the other 4 in block #2 used 65 words.

FREE CALCS 1

FREE DEF WORDS 0

FREE CALCS 13

FREE DEF WORDS 120

10.14 Calculated results are retained in memory for 96 data collection intervals. Thus, in a system arranged for 30 minute data collection intervals, calculated results are retained for 48 collection hours. These results can be printed by entering appropriate commands at either the Central Control Unit or the remote teletype. Demand reporting, as this feature is called, is useful in making special studies, e.g., customer line overflow studies, analysis of data problems, and in setting threshold levels.

10.15 EADAS performs calculations in an integer mode. That is, the results of divisions are truncated (not rounded) to integers (whole numbers) before being utilized in subsequent arithmetic operations or printing. Following are some numerical examples of the results when divisions are performed in this way:

$$30/10 = 3$$

$$25/10 = 2$$

$$2/10 = 0$$

10.16 A user may request that division results be printed to one or two decimal places. In this case, the EADAS processor "internally" scales the numerator of a division by 10^N where

n is the number of desired decimal places and then carries out the calculation in the integer mode. The final result is stored as an integer and upon printing a decimal point is merely inserted in the print field.

Example: Desired calculation is $50 \div 25$ and print to 2 decimal places. This would be accomplished by entering: 50/25,2! EADAS will store the "2" as "100*." Thus verification of this calculation would cause EADAS to print: 100* 50/25 = 2.00

10.17 The integer arithmetic mode of EADAS requires that the user consider the order in which arithmetic operations are carried out in order to minimize the effects of truncation error. Calculations are carried out in left to right order as included in the calculation definition. As a general rule, calculations should be expressed with a single, deferred division. To illustrate, consider the results of the following examples:

$$A = 5, B = 20 \text{ and } C = 100:$$

$$(A/C + B) * 100 = 2000$$

This is due to the truncation in an EADAS calculation that makes $5/100$ equal to 0 instead of .05. A more accurate result in this case is obtained by deferring the division to last using the following form:

$$(100 * (A + BC))/C = 2005$$

Note that the second example was rearranged in the form of a single division and the order of the definition is such that the division is performed *last* to reduce the truncation effect, and the constant (100*) multiplier was entered first.

10.18 Another general rule is that all calculations involving division should be printed to one more digit than is actually desired, since the last place printed is obtained by truncation rather than rounding. This is particularly important for statistics used in official indexes. For example, dial tone speed, which must be accurate to one decimal place for index purposes, should always be printed with two decimal places.

10.19 In some cases it may be necessary to specify a fractional constant in a calculation. These must be cleared algebraically since EADAS accommodates only integer constants. The following calculation, which gives the load on four completing markers expressed as a percent of the engineered high day capacity is an example:

$$\begin{aligned} \% \text{ CAP-CM} &= 1/5 (R291 + R292 + R293 \\ &+ R294) \times 100\%/115.2 \end{aligned}$$

where registers 291 through 294 are assumed to be 20 second scan usage measurements, and the high day capacity is assumed to be 115.2 CCS. For EADAS calculation definition purposes, the numerator and denominator may be multiplied by 10 to express the constants as integers, yielding the following:

$$\begin{aligned} \% \text{ CAP-CM} &= (200 * (R291 + R292 + R293 \\ &+ R294)/1152 \end{aligned}$$

10.20 As expressed above, the calculation provides a figure suitable for hourly report purposes since the TUR registers in this case reflects a 60 minute measurement interval. For exception report purposes, however, say at 30 minute intervals, the result is erroneous since it represents a half hour usage measurement compared to an hourly capacity figure. In many cases it is desirable to print the results of a single calculation in both types of reports. This can be done by "normalizing" as follows:

$$(\% \text{ CAP-CM}) * 18/\text{TUR Cycle Count}$$

Applying this in the previous example:

$$\% \text{ CAP-CM} = (3600 * (R291 + R292 + R293 + R294)) / (1152 * R2)$$

Where register 2 is assumed to be a TUR cycle count register which normally scores 18 times per hour. In general, those calculations involving usage registers and requiring normalization should be normalized by TUR cycle count. Calculations involving only peg count registers should be normalized by the ETDC cycle count registers

(normally input reg. 31 - scores 36 times per hour) so as to provide proper normalization during those periods when the TUR is off.

10.21 In the process of forming calculation results, EADAS can store intermediate results as large as $2^{30} - 1$, or approximately 1.07 billion. This limit can be exceeded in some cases. For example, assume that the calculation previously shown is to be corrected for "TUR Undermeasurement," (see Section 4h for a detailed description of TUR adjustment procedure) which is estimated at 15 milliseconds per call for wire spring No. 5 Crossbar markers. Following the suggested adjustment procedures, the calculation now becomes:

$$\begin{aligned} \% \text{ CAP-CM} &= ((1/5) \text{ MKR Usage Regs} + (1.5 \times 10^{-4}) \text{ MKR} \\ &\text{PC Regs}) / \text{HD CCS Capacity} * \\ &(18/\text{TUR Cycle Count}) * (100\%) \end{aligned}$$

Clearing of fractional constants:

$$\begin{aligned} \% \text{ CAP-CM} &= ((18) * (2 \times 10^4) * (\text{MKR PC Regs})) \\ &/ ((1000) * \\ &(\text{TUR Cycle Count}) * (\text{HD CCS Capacity})) \end{aligned}$$

The numerator of this expression could cause overflow trouble. Recall that if "n" decimals are specified in the printed result, the calculation is internally scaled by 10. Assuming only one decimal place is requested and there are eight markers, this calculation would frequently overflow an hourly report. To avoid the problem, constants in the numerator and denominator should be factored and cancelled to make them similar where possible, and requests for more decimal places than actually needed should be avoided. These precautions are not necessary for most calculation definitions, but are probably a good set of rules for general practice to minimize the possibility of overflow difficulties.

10.22 The final result of a calculation may not exceed $2^{16} - 1$, or 65,535. Values exceeding this limit cannot be stored or printed. Recall that all calculated results are stored as integers in their scaled form even though one or two decimal places may be specified for output. Thus, the limits become:

<u>No. of Decimal Places in Printed Result</u>	<u>Maximum Value of Calculated Result</u>
0	65,535
1	6,553.5
2	655.35

Here is another reason for refraining from requesting unnecessary decimal places.

10.23 Constants used in calculation definitions cannot exceed $2^{13} - 1$ or 8191. This restriction is easily overcome, when necessary, by expressing a large constant as a product or sum. For example, the high day capacity of four dial tone markers, 44,300 attempts, can be expressed in a calculation definition as $(443) * (100)$. The constant 8192 can be expressed as $(8 * 1000 + 192)$. This latter example could be expressed in a simpler form if it were rounded.

10.24 Verification of a calculation may be accomplished by using the verify calculation command (VE:CA:). The calculation definition for that calculation is printed on the CCU TTY.

10.25 Modification or deletion of a calculation does not effect any of the other system definitions. Like entity modification, calculation modification is accomplished under the entity and calculation definition mode (EM:CA:). Thus, there are, depending on the user's intention, two commands available: (a) To change an existing calculation definition, the change calculation command (CG:CA:) is utilized. This allows the following specifics to be revised:

- (1) Calculation name
- (2) Threshold value(s), type, or schedule
- (3) Hourly report number

Two considerations in accomplishing this task are:

- (1) The letters "DE" may be typed in response to a request for a new hourly report number. This will allow the status of the calculation to remain as an exception.
- (2) If the change to be made was specified as a threshold value modification, the calculation must be an exception calculation.

(b) Deletion of the entire calculation is accomplished by simply inputting the proper deletion command (DE:CA:).

SPECIAL CONTROL CHARACTERS			
<u>EADAS Character</u>	<u>Function of Character</u>	<u>Explanation of Function</u>	
!	EXECUTE	Indicates the end of an input message. The system will not attempt to process an input message until an execute is received and disables the TTY until the system responds or an EX is input.	
CR (Carriage Return Key)	CONTINUE	Indicates additional information which has exceeded one TTY line is to be expected.	
&	ABANDON MESSAGE	It is valid only in certain modes after a particular response. This character causes the system to ignore a command. It must be used before an execute is given. It is useful if it is discovered halfway thru entering a command, an error has been made.	
:	FIELD DELIMITER	This is used between the Action, Information and Data Fields of a command.	
,	DATA FIELD DELIMITER	This is used only as a delimiter between the parts (sometimes referred to as arguments) of the Data Field in certain commands.	
Delete or Rubout	ERASE LAST CHARACTER	This is used to erase the last character entered. Each time one of these is used, another character is erased.	
@	SUSPEND PRINT	It causes the system to stop normal printing on the teletype with the exception of error messages. It will remain disabled until receipt of the next execute character. Due to system constraints a maximum of two extra lines of a report may be printed after @ is typed. The user then has control of TTY to use as desired.	

<u>VALID ACTION VERBS</u>				<u>VALID IDENTIFICATION NOUNS</u>			
<u>Character</u>	<u>Meaning</u>	<u>Character</u>	<u>Meaning</u>	<u>Character</u>	<u>Meaning</u>	<u>Character</u>	<u>Meaning</u>
CG:	Change	MO:	Mount	CA:	Calculation	HR:	Hour Reports
DA:	Set Date	OF:	Off	CB:	Calculation Block	KW:	Keyword Table
DE:	Delete	ON:	On	CH:	Channel	LP:	Line Printer
DM:	Dismount	OP:	Output	CI:	Computer Interface	MT:	Magnetic Tape
DU:	Dump	PR:	Print	CO:	Core	PA:	Parameters
EM:	Enter Mode	RS:	Restore	CU:	Central Unit Teletype	RE:	Read (PDT 1A) Terminal
EX:	Exit	SU:	Sum	DA:	Dial Administration	RG:	Registers
FI:	Finish a Task	TI:	Set Time		Teletype	SC:	Schedules
IN:	Insert Line or Format	TS:	Test	EN:	Entity	SY:	System Backup
LI:	List Names	UP:	Update	EX:	Exception Reports	TA:	Mag Tape Dump
		VE:	Verify	HD:	Header	TC:	Traffic Data Converters
		ZE:	Zero			TU:	Traffic Usage Recorders

Fig. 1—Special Control Characters; Valid Action Verbs; Valid Identification Nouns (3.02, 3.05)

<u>Valid Input</u>	<u>Brief Description</u>	<u>Comments</u>	<u>Example of CCU TTY Commands</u>
EM:PA:	Enter parameter definition mode		EM:PA:!
EM:SC:	Enter scheduled definition mode including Mag tape, TUR, and Hourly Report Schedules		EM:SC:!
EM:CH:	Enter channel definition mode.		EM:CH:!
DE:CH:a	Delete channel	a = Channel No. (0-99)	
VE:CH:a	Verify channel	a = Channel No. (0-99) or "ALL"	VE:CH:01!
EM:HR:	Enter Hourly Report definition mode		EM:HR:!
IN:a	Insert Line or Format in HR mode	a = Line No. or "ALL"	IN:10!
PR:a	Print Hour Report Format or Line of HR Format	a = Line No. or "ALL"	PR:ALL:
DE:a	Delete Line or Format of HR Format	a = Line No. or "ALL"	DE:02!
CG:a	Change Format name	a = new Format name	CG:1X!
EM:CA:	Enter Calculation and Entity Mode		EM:CA:!
IN:EN:a	Insert entity name	a = entity name	IN:EN:DLY5XBTUSCA!
IN:CA:a	Insert calculation under entity name	a = entity name	IN:CA:PHLAPAGLS01!
CG:EN:a	Change entity name	a = entity name	CG:EN:PHLAPAGLS02!
CG:CA:a	Change calculation under entity name	a = entity name	CG:CA:WASHDC34S01!
DE:EN:a	Delete entity name	a = entity name	DE:EN:DLY5XBTUSCA!
DE:CA:a	Delete calculation under entity name	a = entity name	DE:CG:PHLAPAGLS02!
SU:CA:a,b,c,d,e	Sum entity's calculation for up to 96 intervals	a = entity name b = Calculation name c = Start time (HH:MM) d = Day (MM:DD) e = No. of Intervals Required	SU:CA:PHLAPAGLS02,%CMOCC,00:00, 03:30, 481
VE:EN:a	Verify Entity	a = entity name or "ALL"	VE:EN:ALL!
VE:CA:a, b	Verify calculation	a = entity name b = Calc name,	VE:CA:PHLAPAGLS02,%DTD!

Fig. 2—Valid System Definition Commands With Subordinate Model Message Formats (3.02)

<u>Response</u>	<u>Translation</u>	<u>What It Means (See Position Practice for "How To")</u>
OK	Good	Message was received, processed correctly, and the action was completed.
IP	In Progress	The request is being processed, the results may take a moment.
NG	No Good	Message format was valid but action requested was incompatible with status of system.
PF	Printout Follows	The request is being processed. A printout will appear momentarily.
RL	Repeat Later	Command was a valid request which may not be executed at this time due to un-available system resources such as system overload, excessive queue lengths, the requested program is busy or not enough time to complete the action before some system process renders the action invalid. Try again later.
?A	Action Field Error	The message contains an error in the action field. This could mean an improper character(s) was typed or that a field delimiter was omitted or incorrect. Example: EQ:SY:! ?A Since there is no EQ: Action Command, EADAS will respond with this.
?C	Illegal Continue	A multiple line input is not valid in the present mode of operation of the teletype. CR may only be used with certain commands.
?D	Data Field Error	The message contains an error in the data (third) field due to one of several causes: (1) the data field is incompatible with the action field and/or the identification field; (2) improper characters were entered in the data field; (3) correct characters were entered but exceeded the allowable limits for this type of data; (4) the delimiters (,) were used in the wrong position or were not present. Example of (4): OP:CA:DLY5XBTUSCA ALL, 09:30! ?D A comma is required prior to "ALL".
?E	Illegal Execute	The system is currently executing a previous command. This command is ignored. The command being processed be stopped by typing EX:! Then the latest command may be re-entered.

Fig. 3—System Responses (Sheet 1 of 3) (3.03)

<u>Response</u>	<u>Translation</u>	<u>What It Means</u>
?I	Identification Field Error	The message contains an error in the identification field. This may result from any one of 3 causes: (1) the identification field could be wrong due to too many characters or invalid characters; (2) the second delimiter could be missing; and (3) the action specified may not be in agreement with indicated identification.
?O	Overflow Condition	The Calculation Definition length has exceeded the maximum of 240 characters.
?S	Invalid Command	The input to various submodal queries were not compatible with EADAS programmed expectations. This may vary depending on specific piece of requested data. For example if received on: 1) HR Calc# = would mean invalid hour report number 2) Definition = would mean invalidly formulated Calc string 3) Output = would mean either a) result label contains more than 4 characters b) i in Ti is not within valid range (1 to 5) c) Term was not defined in the Calc definition Also could indicate an invalid piece of data within schedule string or more than 3 schedules specified. Causes entire string to be ignored. Also indicate an invalid piece of data within schedule string or more than 3 schedules specified. Causes entire string to be ignored. Also indicates invalid format name.
***(words)	Item input is inappropriate	Either re-enter or go to appropriate corrective procedure in Position Practice.
ALREADY ON FILE	Item was previously defined	This term entity or calc name has been used in a previous submodal command
ALREADY DEFINED, MODIFY DCUID, SCHED TUR, OR REG ASSIGNMENT?	Channel no. previously used	This channel number has previously been entered into EADAS, thus if now unused, must be deleted (DE:CH:a) or different channel no used in this instance or one of the requested components needs a positive response.
INVALID INPUT	Item input is inappropriate	Utilized in most modal commands to indicate wrong or incomplete entry. Refer to Position Practice.
KEYWORD TABLE FULL	New keyword entry has exceeded EADAS	A total of 256 entries of keywords may be specified. Use the update keyword table command (UP:KW:) when this response is received.

Fig. 3—System Responses (Sheet 2 of 3) (3.03)

<u>Response</u>	<u>Translation</u>	<u>What It Means</u>
NO MASTER CALC	All Calc sets require a "master" calculation	A slave calculation is dependent upon a master calculation. Thus, if a string is being defined, the slave(s) must be defined immediately, after the master.
NOT DEFINED	Item being modified has been previously entered into EADAS	Indicates either the entity or Calc name can't be found or is not on file.
NOT FOUND	Entity being deleted or changed, can't be located	Due to EADAS stripping embedded blanks in Entity name, user may attempt to effect entity with blank but EADAS doesn't find it. Try entity name without blank.
STORAGE CAPACITY EXCEEDED	Too many entities entered for EADAS	A maximum of 170 entities may be defined in EADAS.
CANNOT LOCATE REQUESTED DATA	Block(s) on Mag tape is not available	Although the format of the responses appear to be correct, the requested data cannot be found after a search of the entire tape.
TAPE READ ERROR MTRD = XXXXXX	Mag tape error has blocked completion of command	The data field contains the contents of the TU-10 READ LINES register in octal. This line is printed on the line printer replacing the record in error.
SLAVE NOT ON SAME BLOCK AS MASTER. PLEASE REPOSITION MASTER	Calculation block has insufficient word cap- acity to accept master/ slave calculation set	User must fill up this inadequate block word capacity with "Dummy" or pseudo- calculations so that EADAS can look for next calculation block with spare card capacity.

Fig. 3—System Responses (Sheet 3 of 3) (3.03)

1.0 As defined in Section 5 of this DFMP, we have made the following decisions relative to our EADAS decisions relative to our EADAS System Parameters.

1. The System Period will be 30 minutes.
2. The Mag Tape Writing Interval is to be 60 minutes.
3. Our Long Term Data Storage Interval begins each day at 8:30 AM and ends at 6:00 PM.
4. Our daily Automatic Detector Test is to be made at 11:30 PM.

2.0 "How To"

1. At the CCU Teletype Input

EM:PA:!

2. The CCU will respond

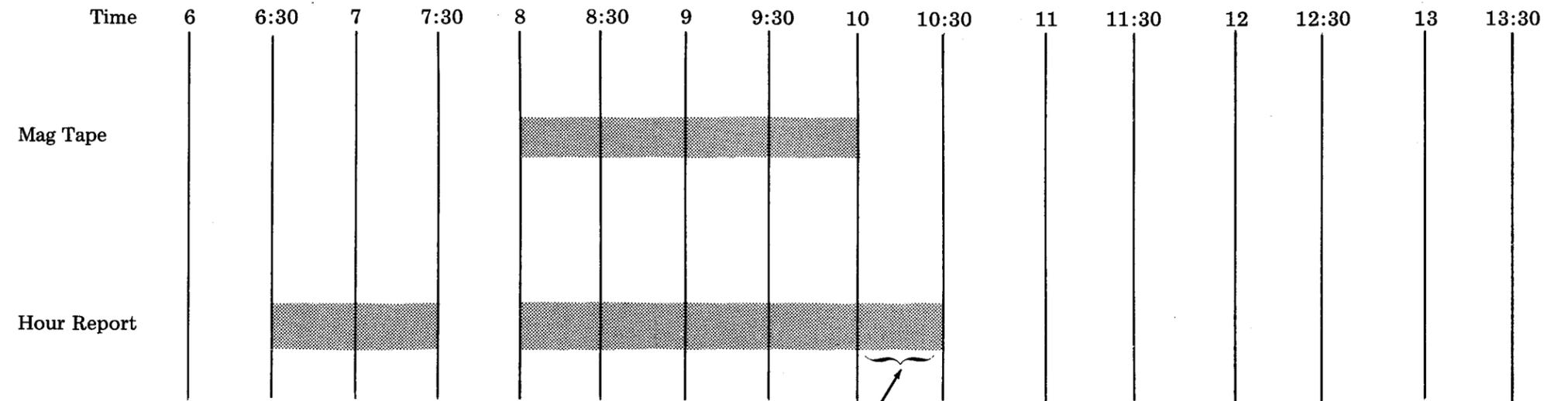
You will type in
after each line

PARAMETER DEFINITION MODE	30
SYSTEM PERIOD = NEW =	60
LONG TERM START = END =	
NEW START =	08:30
NEW END =	18:00
TUR DETECTOR TEST = NEW =	23:30
JOB COMPLETED	

3.0 For further assistance refer to Appendix A, page 8, Task 3a.

Fig. 4—Example for Entering System Parameters (5.01)

Unacceptable Conflict of Mag Tape Writing and Hourly Report Schedules



Schedules Entered as:

- Mag Tape 8-10
- Hour Report 6:30-7:30, 8:00-10:30

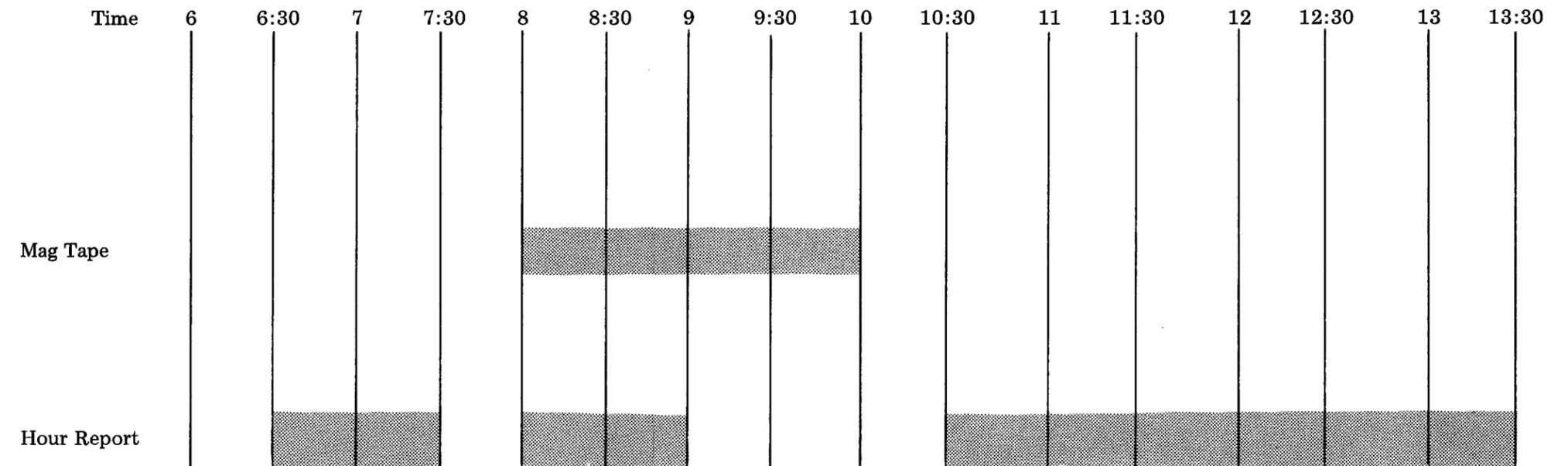
System Response

- Invalid Input

This period is unacceptable from 10-10:30 as the MT writing interval is one hour and this schedule indicates MT is to start on the whole hour at 8:00. Also it is illogical to attempt to collect Hourly Reports at 9, 10, and 10:30.

Fig. 5—30 Minute System Period, 1 Hour Mag Tape Writing Interval (Sheet 1 of 2) (6.04)

Acceptable Composite MT and Hourly Report Schedules



Schedules Entered as

- Mag. Tape 8-10
- Hour Report 6:30-7:30, 8-9, 10:30-13:30

Fig. 5—30 Minute System Period, 1 Hour Mag Tape Wiring Interval (Sheet 2 of 2) (6.04)

4.0 SAMPLE SCHEDULES

Sched. No.	SESSIONS					
	0800-1300	1200-1800	1700-2300	0830-1300	1230-1830	1730-2330
0	X	X	X			
1	X					
2		X				
3			X			
4	X	X				
5	X		X			
6		X	X			
7				X	X	X
8				X		
9					X	
10						X
11				X	X	
12				X		X
13					X	X
14						
15						

Fig. 6—Sample Schedules (6.07)

```

01                                     *** 5XB HOURLY REPORT ***
02
03
04     ENTITY:  E
05     DATE   :  D
06     TIME   :  H
07
08
09                                     %OFL    PC
10
11 01  ORIG          X.XX    XXXX
12 03  INC           X.XX    XXXX
13 05  INTRA        X.XX    XXXX
14 07  THRU         XXXX
15 08  TOT          XXXX    XXX    CCS/LLF
16
17
18 10  TRK GRP-A    X.XX
19 11          -B   X.XX
20 12          -C   X.XX
21 13          -D   X.XX
22
23
24                                     %CRL    MB
25
26 14  COMP MKR     XX.X    XX
27 16  DT MKR      XX.X    XX
28 18  AMA TV      XX.X    XX
29
30
31     ORIG REGS    %DTD    WTD    DLYS    TSTS    %CAP    MB
32
33 20  DP          X.XX    X.XX    XX     XX     XX.X    XX
34 26  TT          X.XX    X.XX    XX     XX     XX.X    XX
35
36
37     SDR GRPS          %OFL
38
39 32  0-3         X.XX    X.XX    X.XX    X.XX
40 36  4-7         X.XX    X.XX    X.XX    X.XX
41 40  8-11        X.XX    X.XX    X.XX    X.XX
42
43
44     INC REG GRPS          %CRIT LEV
45
46 44  0-3         XX.X    XX.X    XX.X    XX.X
47 48  4-7         XX.X    XX.X    XX.X    XX.X
48 52  8-11        XX.X    XX.X    XX.X    XX.X
49
=509 BYTES
    
```

Fig. 7—Sample Hourly Report Format (5XB) (8.02)

Note: Circled numbers described in 9.07

Command —

VE:EN:BA95A!

EADAS response —

1 2 3 4 5
 BA85A CHAN #00002 TTY #00001 BLK #00039 HR FORMAT = 5B

6
 THRESH SCHEDS=

1) ALL
 2) 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21
 3) 7 8 9 10 11 12
 IR12%CRL, M UB, 0100.0/01.00.0, 1 HR# 38 U
 (360*R842) / (R748*180) 13
 TERM LABELS: USG 14

IR12HT, S, LU, 0001.8/0002.6, 1 U
 ((20*R842) - (200*R871)) / S616
 TERM LABELS: USG, MTC, PC

IR12%GBT, S UB, 0001.0/0001.0, 1 U
 R321/(R748*2)
 TERM LABELS: OFL

ORHT, S LU, 0008.0/0014.0, 1 U
 (200*(R814-R817)) / (<S244+S245+S246+S247+S248>-R288)
 TERM LABELS: USG, MTC, PC, TST

%AORB, S UB, 0000.5/0000.5, 1 HR# 46
 (<R345+R346+R347+R348+R349>*100) / <S244+S245+S246+S247+S248+R345+R346+R347+R348+R349>
 TERM LABELS: OFL, PC

TOTFCPC, M NP, 00000 /00000 ,1 HR# 06
 S576+S577+S578+S579+S580+S581+S582+S583+S584+S585+S586+S587+S588+S589+
 S590+S591+S592+S593+S269+S270+S271+S272+S273+S274+S275+S276+S277+R74+R
 75+R76+R77+R78+R79+R80+R81+R82
 TERM LABELS:

IAOFROFL, M NP, 00000 /00000 ,1 HR# 51
 R384
 TERM LABELS:

DOPC, M NP, 00000 /00000 ,1
 (S576+S578+S579+S580+S581+S582+S583+S584+S585+S586+S587+S588+S589
 +S590+S591+S592+S593+R6+R7) -R448
 TERM LABELS: OPC, APD, PSH

15 16
 FREE CALCS 00009, FREE DEF WRDS 00027

Fig. 8—Sample of Verification of Entity (9.07)

- Calculation Name** — up to 8 character alphanumeric identification for an output (result) of an EADAS processed computation. If a name is used, it may not be used later within the same entity.
- Calculation Number** — used in hourly report format to identify a specific computation in the preparation of the hourly report. Can be 01 to 64.
- Calculation Set** — An algebraic representation of traffic registers and constants which causes a specific result to be produced. The printing of the result will depend upon its being:
 (1) a demand, or (2) always print, or (3) an exception calculation which exceeded its predetermined parameters (thresholds).
- Calculation Block** — disc storage for modular storage in blocks. Up to 17 calc definitions may be stored in a block. Each entity may use one or more blocks. The total calculation capacity is dependent on the length of the calculations but will range between 5000 and 6800.
- Terms** — a feature of EADAS calculations allows certain portions of the Calc Set to be printed with the Calc Set result. The only type of arithmetic which may be performed within a term is addition. Each Calc Set may contain up to five terms. Each may consist of up to three characters. Each is preceded by T1 thru T5. After the term designation, i.e., T1, T2, etc., the items are incorporated within the symbols "<>".
 Example: T1 <R500> *100/T2 <100+R510> , 2!
 These terms (T1 and T2) will be printed on exception reports only if a ";P!" has been entered following the string of characters used in the output format.
- Result Label** — used to describe the total value of the calculation. It may have up to a maximum of four alphanumeric characters.
- Truncation** — method of processing by CCU. All division results will be expressed in lower whole number. Only whole numbers carried to subsequent operations.
 Examples — $30 \div 10 = 3$ OK
 $25 \div 10 = 2.5$ but EADAS will print only "2" thus dropping .5
 $3 \div 10 = .3$ but EADAS will print only "0" thus dropping .3
- Integer Arithmetic** — method of arithmetic computation used in EADAS processing. This requires that calculation sets be arranged in a particular sequence to minimize the effects of truncation error. The order of computations is carried out in a FORTRAN manner generally from left to right. As a general rule, calculations should be

Fig. 9—Glossary of Calculation Related Terms (Sheet
 1 of 2) (10.06)

expressed using division as a single last function in the calculation sequence.

Further, it is suggested that all calculations involving divisions should be printed to one more significant digit than is actually desired, since the last place printed is obtained by truncation rather than by rounding.

Keywords — labels assigned up to four alphanumeric characters each, to identify calculation results and term labels with up to 3 characters each. EADAS has a maximum of 256. Should a calculation set be deleted, any associated keywords remain in the keyword table until they are purged via the update keyword table command (UP:KW:). Please note: Result labels are to be distinguished from term labels.

**Fig. 9—Glossary of Calculation Related Terms (Sheet
2 of 2) (10.06)**

Example

1. %DTD-FR = 2.4%
2. %DTD-FR = 2.4%, DLY = 12, TST = 500
3. %DTD-FR = 2.4%, DLY = 12, TST = 500 — This is the master
 CCS/LFG = 465.3 — This is the slave
 to % DTD-FR

Fig. 10—Exception Report Examples (10.08)

Command —

VE:EN:ALL!

EADAS response —

AMD	CHAN #00005	TTY #00000	BLK #00012	HR FORMAT =AR
BA85T	CHAN #00002	TTY #00001	BLK #00007	HR FORMAT =
BA85A	CHAN #00002	TTY #00001	BLK #00004	HR FORMAT =5B
CA22T	CHAN #00005	TTY #00003	BLK #00003	HR FORMAT =
CA22A	CHAN #00005	TTY #00003	BLK #00002	HR FORMAT =5B
OL93T	CHAN #00016	TTY #00004	BLK #00005	HR FORMAT =
OL93A	CHAN #00016	TTY #00004	BLK #00006	HR FORMAT =5B
CA55EC	CHAN #00031	TTY #00007	BLK #00042	HR FORMAT =
CA55EH	CHAN #00031	TTY #00007	BLK #00043	HR FORMAT =

Fig. 11—Sample of All Entity Verification (10.10)

(Fig. 10 and 11)