BUSINESS COMMUNICATIONS SYSTEM

SL-1*

TRAFFIC MEASUREMENT

CONTENTS PAGE

CONTENTS PAGE

CONTENTS PAGE

Reason for Reissue: This practice is reissued to incorporate changes and additions resulting from the introduction of Generic X11 Releases 3 and 4. Because of the extent of revisons, bracketing arrows and arrowheads have been omitted.

* SL-1 is a trademark of Northern Telecom Limited

1. GENERAL

1.01 Traffic measurements are essential for monitoring the performance of a switching machine, for identifying potential congestion problems and for planning future growth of the switching machine. The SL-1 Business Communications Systems are equipped with traffic data accumulation capabilities which are resident in the system memory and function as part of the normal call processing software operations.

1.02 The purpose of this practice is to describe the traffic measurement data acquired at an SL-1 switch, discuss the conditions under which the data is accumulated, interpret the traffic measurement data output formats and explain the command structures that are available to control the traffic data collection and printing.

Reference Documentation

1.03 Overlay loading instructions are provided in the following practices (depending on machine type):

553-2001-315	General Input/Output Information
553-2YY1-311	Data Administration Manual II: Input/Output Reference Manual.

1.04 For maintenance diagnostic information, refer to the following practices (depending on machine type):

553-2001-505	Diagnostic Programs Description and Input/Output
553-2301-511	Maintenance Manual II: Diagnostic Programs Description and Input/Output Reference Manual.

2. TRAFFIC MEASUREMENT OVERVIEW

2.01 Switching in an SL-1 system is accomplished via network loops and, for larger SL-1 systems, via network loops and network groups. (A network group consists of up to 16 or 32 network loops, depending on the system.) A network loop has 30 time slots that can be used to establish a network path (i.e., connection.) Time slots are grouped into matching pairs so that each time slot can be used with only one other time slot on the same or different network loop (except with Generic X11 Release 4 and later versions). A network path is a matched pair of time slots.

> **Note:** Generic X11 Release 4 and later versions do not have the time slot pairing constraint; i.e., any idle time slot on one network loop may be matched with any idle time slot on the other network loop to form a connection.

2.02 A time slot is busy if it is in actual use or is reserved by the Central Processing Unit (CPU) for future use. Thus, a matching pair of time slots (i.e., network path) is idle only if both time slots are idle (except in Generic X11 Release 4 and later versions).

2.03 There are three types of network path:

(a) **Intra-Loop.** An intra-loop network path is a connection between a source and a destination that are on the same network loop. An intra-loop network path is idle only if there is an idle matching pair of time slots on the same network loop (except in Generic X11 Release 4 and later versions).

(b) **Interloop (same network group).** An interloop (same network group) network path is a connection between a source and a destination that are in different network loops, but are in the same network group. An interloop (same network group) network path is idle only if there is an idle matching pair of time slots, one time slot on each network loop (except in Generic X11 Release 4 and later versions).

(c) **Interloop (different network group).** An interloop (different network group) network path is a connection between a source and a destination that are on different network loops within different network groups. An interloop (different network group) network path is idle if:

- there is an idle matching pair of time slots, one time slot on each network loop (Generic X11 Release 4 and later versions allow the use of any idle time slot on either network loop)
- the matching time slots are idle in at least one of the four junctors between the two network groups (eight junctors with Generic X11 Release 4 and later versions).

DEFINITIONS

2.04 Terminal. A terminal is any set (500/2500-type or SL-1), trunk or attendant console.

2.05 Connection Point. A connection point is any point to and from which a network path is possible.

2.06 Peg Count. A peg count is a count of a particular event.

2.07 Failure to Match. A Failure To Match (FTM) occurs if no idle network path can be found between two given connection points.

2.08 Usage. The usage of a resource (e.g., time slots of a loop, trunks of a given trunk group, junctors between network groups) is the time measurement, in 100 call-seconds (CCS), of how long the elements of the resource have been busy.

2.09 Established Path. An established path between two terminals is a path in which the called terminal has answered and both terminals are in the talking connection. There are cases involving outgoing trunks in which the terminals are in a talking connection but, because the SL-1 does not yet consider outpulsing to be complete, the path is not an established path. If this path is idled, then measurements requiring 'established connections' will not be accumulated.

2.10 Service Loop. A service loop is either a Tone and Digit Switch (TDS) loop or an MF Sender (MFS) loop. As both types of loops serve similar functions, they have similar traffic measurements. Whenever the term 'service loop' is used, it refers to either a TDS loop or an MFS loop.

MEASUREMENT PROCESS

2.11 There are five facets to traffic data collection in SL-1: Accumulation, Holding, Printing, Control and Outputting.

2.12 Accumulation. When the SL-1 system takes any action that has associated traffic measurement(s), the relevant peg counts, usages, etc., are updated in accumulating registers associated with those measurements. The traffic data are automatically accumulated by the call processing software regardless of any measurement schedules, options, thresholds, etc., that may or may not be in effect at the time.

2.13 Whenever any network path is seized, the time of day, in units of 2 s, is stored in a register associated with that network path. When the path is subsequently idled, the previously stored time is subtracted from the current time of day to give a 'usage' on the path. This usage is added to the appropriate accumulating register(s) according to what the network path was used for (e.g., dial tone, outgoing trunk connection, conference connection). All usages are collected in units of 2 s and converted to CCS at the time of printing.

> **Note:** Because the usage (in CCS) is rounded off to the nearest integer, usage of less than 50 call-seconds is printed as 0 CCS.

2.14 Holding. According to user-defined schedules, the data in the accumulating registers are transferred into another set of registers, the holding registers. There is one holding register for each accumulating register. As a measurement is transferred from an accumulating register to the associated holding register, the accumulating register is set to zero so that it can start collecting data for the next period. The data in the holding registers can be examined and printed at will. Data in the holding registers do not change until the next scheduled transfer of data from the accumulating registers.

2.15 Certain traffic measurements have an associated threshold. When measurement data is transferred into the holding registers, such measurements are compared with their thresholds and, if a measurement exceeds its threshold, then, regardless of the print options, a special message is printed together with one or more blocks of associated data.

2.16 Printing. When data is transferred from the accumulating registers to the holding registers, there are printing options that allow given blocks of data to be printed immediately. Furthermore, at any time before the next scheduled transfer of data, the holding registers can be accessed via the Traffic Control Overlay Program and blocks of data can be printed at will. It is only possible to print data from the holding registers. The accumulating registers are not accessed other than to transfer data from them to the holding registers.

> **Note:** Depending on the amount and type of data requested to be printed, a fast printer (e.g., 1200 baud with no 300 baud machine sharing the same function) may be required for large systems.

2.17 Control. The traffic measurement schedules, printing options, threshold levels and all other traffic-oriented parameters are controlled through the Traffic Control Overlay Program. This program may be loaded into the overlay area of the system memory to print, adjust or redefine any of the control parameters.

2.18 Outputting. The cycle of transferring data from the accumulating registers to the holding registers and the outputting of data is repeated in accordance with the user-defined traffic measurement schedules. When data is being output at the teletypewriter (TTY), the rate of printing is controlled by the amount of time the CPU can allocate to the task. As a result, all data may be output at once or may be output at intervals over a short period. Outputting of data starts when the data has been transferred from the accumulating registers to the holding registers and is completed prior to the next data transfer from the accumulating registers.

MEASUREMENT SOFTWARE

2.19 In addition to the traffic data accumulation programs in the call processing software, two traffic programs, a resident traffic print program and a traffic control overlay program, are used by the SL-1 system to print and control the call processing traffic measurements. (See the maintenance diagnostics reference manual for information about the relationship of these two programs to the other resident and overlay programs used by the SL-1 system to monitor and maintain call processing.)

2.20 Permanently in system memory, the resident Traffic Print program performs the following functions automatically:

- examines the traffic measurement schedules set up in the system
- transfers traffic data from the accumulating registers to holding registers according to the defined schedules
- prints the traffic data.

2.21 The Traffic Control overlay program resides on system tape and is designated overlay number 02. Before performing any tasks, this program must be loaded into the overlay area of the system memory. Loading can be done only from a teletypewriter (TTY). Once loaded the program enables the following functions to be performed:

- query traffic schedules, traffic options, threshold levels, system identification (ID) and system time-of-day
- modify the traffic schedules, traffic options and threshold levels
- access traffic data in the holding registers
- set the system time-of-day
- change the system ID.

2.22 When the required tasks are completed, the Traffic Control overlay program is aborted (by entering ****). With the traffic requirements defined to the system, control of the measurements is transferred to the resident traffic programs.

MEASUREMENT SCHEDULES

2.23 The SL-1 system can be programmed to provide traffic measurement outputs:

(a) for any defined day(s) of the week during a defined period of the year, specified by start day and end day

(b) for any defined period of the day specified by the start and end hours; i.e.,

- hourly, on the hour
- hourly, on the half-hour
- half-hourly, on the hour and half-hour.

2.24 The traffic measurement schedules are defined to control the period over which measurements are accumulated (hourly or half-hourly). After the proper interval, the resident Traffic Print program transfers the data from the accumulating registers to holding registers and resets the accumulating registers to zero so that measurements begin to accumulate for the next period. This transfer of data can occur hourly on the hour, hourly on the half-hour or every half-hour, as defined by the schedules.

RESTRICTIONS

2.25 An SL-1 system reset (system reload) or system initialization causes traffic measurements to be lost. When a reset occurs it is indicated by SYS000 being printed at the teletypewriter. An initialization is indicated by INI000 being typed.

2.26 System reset can be invoked manually or automatically by the system. It is invoked automatically in the event of a power failure or when system control dictates. On a system reset:

- data on the system tape is read into the system memory
- calls cannot be originated while the reload is in progress

- traffic data in the accumulating and holding registers is lost
- any changes to traffic schedules, traffic options or threshold levels made since last Equipment Data Dump must be redefined via the teletypewriter via the Traffic Control overlay program.

2.27 Initialization can be invoked automatically by the system or by manually operating the INITIALIZE button at the equipment. On a system initialize:

- the system automatically rebuilds the transient data area required for call processing
- call processing continues immediately following the initialization, which takes about 5 s
- traffic data in the accumulating and holding registers is lost and the registers are set to zero. The traffic program then continues in the normal manner.

WARNING MESSAGES

2.28 Whenever certain events occur during the accumulation of traffic data (e.g., initialization, system reload, change to the traffic schedule), a warning message is output preceding the traffic measurement data.

2.29 TFS301. This message precedes traffic data that is output after an SL-1 initialization. The message warns that data has been corrupted by the initialization and should be ignored.

2.30 TFS302. This message warns that the traffic schedule was changed during the interval covered by the traffic measurement data.

2.31 TFS303. The associated traffic measurement data were accumulated over a period greater than one hour.

Connections With High Usage

2.32 When a network path is held for longer than one hour (36 CCS), the accumulated usage can have a detrimental effect on hourly traffic studies. High-usage connections can result from:

- data terminal connections
- loop-start trunks that fail to provide suitable supervision
- long talking connections
- call processing faults
- telephone set problems.

2.33 To report connections with excessive CCS, two warning messages are provided:

(a) **TFS401.** This message identifies connections that were held for at least 36 CCS but less than 50 CCS. The message includes the measurements (pegs and usage) in the regular traffic data.

(b) **TFS402.** This message identifies connections that were held for 50 CCS or longer. The message does not include the measurements (pegs and usage) in the regular traffic data.

2.34 Message output format is as follows:

TFS40X CCS TN1 TN2 TYPE

where,

- CCS gives the usage on the connection.
- TN1 and TN2 identify the terminals (Loop, Shelf, Card, Unit) involved in the connection. (Because the loops involved are identified, TFS001 figures can be corrected for previous hours. Also, the information can be used to identify faulty hardware where this is the cause of the long holding time.)
- TYPE is a number which identifies what use the network path was put to (see Table 2-A).

Table 2-A
NETWORK PATH USAGE IDENTIFICATION

TYPE NUMBER	USE
0	Dial Tone
1	Busy Tone
2	Overflow Tone
3	Ringback Tone
4	Tone Ringing
5	Miscellaneous Tone
6	Outpulsing
7	Unknown use of a TDS
8	Digitone Receiver
9	Incoming trunk speech path
10	Outgoing trunk speech path
11	Intracustomer speech path
12	Tandem trunk speech path
13	Reserved path not used

2.35 The traffic TTY may not always be on-line to receive messages. There is, therefore, a requirement for some indication of connections with high holding times with the regular traffic data. Both TFS411 and TFS412 will be given with the regular traffic output if and only if either measurement is nonzero when at least one block of data (system or customer) is scheduled.

(a) **TFS411.** This message provides a peg count of the number of connections that were held for at least 36 CCS but less than 50 CCS, together with the total usage (CCS) on the connections.

(b) **TFS412.** This message provides a peg count of the number of connections that were held for 50 CCS or longer, together with the total usage on the connections.

2.36 If these figures indicate a potential problem, then the traffic TTY can be turned on for subsequent hours and the TFS 401/402 messages used to obtain more information.

Small Quantities

2.37 Pegs, CCS, and timing measurements taken over a small number of calls (i.e., less than 5) should not be considered in isolation. The resolution of time measurements does not allow accurate timing for small samples.

TRAFFIC AUDIT MESSAGES

2.38 TFS501 and TFS502 are printed on the traffic TTY by the Audit program (overlay 44) if it encounters lost time slots on a loop or junctor, respectively. (A lost slot is one which has been incorrectly marked as busy by the system.) The Audit program releases all such lost time slots. These messages are intended as 'information only' for those analysing traffic statistics. As lost time slots are not allocated by the system to new connections, they present the problem of higher blocking probability on the affected loop or junctor. These warning messages should be taken into consideration when analysing the traffic statistics for the loops in question.

2.39 TFS501 identifies the loop number and the number of time slots that were recovered. TFS502 identifies the junctor group number and the number of time slots that were recovered.

SCOPE OF MEASUREMENTS

2.40 When an SL-1 system is installed, a traffic measurement schedule is defined for the system and a possibly different schedule is defined for each customer sharing the system. Given the schedule, the traffic measurements involve the following:

(a) The time-of-day.

(b) A set of system traffic measurements which consists of:

- peg count, usage and FTM of network
- peg count, usage and FTM of services
- dial tone delay
- processor load
- peg count, usage and FTM of lines
- peg count, usage and FTM of junctors.

(c) A set of customer measurements which consist of:

- peg count, usage and FTM of incoming, outgoing, intracustomer and tandem calls, and peg count of unsuccessful attempts
- trunk group peg count, usage and overflow count
- attendant queue characteristics
- attendant console traffic
- route list usage
- Network Class-of-Service (NCOS)
- peg count of features.

(d) Comparisons with the system threshold levels for:

- dial tone speed
- loop traffic
- junctor traffic.

(e) Comparisons with the customer threshold levels for:

- incoming matching loss
- outgoing matching loss
- average speed of answer
- percent all trunks busy
- Off-Hook Queuing (OHQ) overflow.

TIME-OF-DAY AND DATE

2.41 The SL-1 system contains circuitry which generates timing signals that enable the CPU to execute real-time functions and keep an accurate time-of-day and date. To compensate for component tolerances, the time-of-day is corrected by making a daily adjustment. This adjustment is made automatically once a day at midnight.

2.42 The time-of-day and date of the system can be queried and adjusted manually if required. The query and adjustment are made via the teletypewriter. The manual adjustment is also required in the event of a system reset.

Time-Of-Day And Date Output

2.43 The time-of-day and date is included as part of scheduled traffic data outputs. It immediately follows the TFS000 header and precedes the traffic data. When the traffic data output is invoked via the Traffic Control program, then the time-of-day and date is not output. The time-of-day and date can, however, be queried via the Traffic Control program.

Note: In Generic X11, the length of each field in the time and date is increased by one digit.

Setting Time-of-Day and Date

2.44 The time-of-day and date must be redefined after a system reset (system reload) occurs.

WARNING: Since the traffic measurement schedule and midnight routines reference the time-of-day clock, these programs can be inadvertently triggered by time adjustment. For example, adjusting the time from 11:05 to 10:55 will result in the output of traffic data when the system clock reads 11:00, provided it is scheduled.

SYSTEM IDENTIFICATION

2.45 The system Identification (ID) is required when the SL-1 system is controlled from a central administration center. The system ID identifies the system from which the traffic measurements originate. Each SL-1 system is identified by a unique 3-digit number which is output as part of the traffic data.

2.46 The 3-digit system ID is assigned to the system when the traffic measurement schedules and options are defined. It is input the first time traffic schedules are defined. When traffic schedules or options are changed, the system ID number need not be redefined. It is redefined only when it is deemed necessary to change the system ID. A system ID can be queried if required. The system ID may also be changed using the configuration record program (overlay program 17). Any change to the ID is reflected throughout the system, irrespective of the overlay program used to make the change.

MEASUREMENT OUTPUTS

2.47 Traffic data available for output are (schedules for each type of measurement can be defined independently):

- System Measurements (accumulated on a system basis)
- Customer Measurements (accumulated on a customer basis)
- System Threshold Violations (tests on system measurements)
- Customer Threshold Violations (tests on customer measurements).

System Measurements

2.48 System measurements are identified by the prefix TFS. The 3-digit code following the prefix identifies the type of measurement:

- TFS001 - Networks (per loop)
- TFS002 - Services
- TFS003 - Dial Tone Delay
- TFS004 - Processor Load
- TFS005 - Lines
- TFS007 - Junctor Group Traffic.

Customer Measurements

2.49 Customer measurements are identified by the prefix TFC. The 3-digit code following the prefix identifies the type of measurement:

- TFC001 - Networks (per customer)
- TFC002 - Trunks
- TFC003 - Queue
- TFC004 - Console
- TFC005 - Features (Note)
- TFC006 - ARS and Ring Again (not applicable with Generic X11)
- TFC007 - System Park (Generic X07)
- TFC007 - Call Park (Generic X11, X37)
- TFC008 - Integrated Messaging System (IMS) and Integrated Voice Messaging System (IVMS).

Note: Feature measurements can only be made on one customer at a time for a given system because only one holding area is provided.

Customer Network Measurements

2.50 Customer network measurements (Generic X11) are identified by the prefix TFN. The 3-digit code following the measurement identifies the type of measurement:

- TFN001 - Route Lists
- TFN002 - Network Class-of-Service
- TFN003 - Incoming Trunk Group.

Threshold Violation Measurements

2.51 System threshold levels can be defined for:

(a) **Dial Tone Speed.** Failure to provide dial tone to a set within 3 s of the system recognizing the seizure of the line. Expressed as a percentage of total dial tone requests in units of 0.1%.

(b) **Loop Traffic.** The network loop usage per hour. Expressed in CCS.

(c) **Junctor Traffic.** The junctor group usage per hour. Expressed in CCS.

2.52 Customer threshold levels can be defined for:

(a) **Incoming Matching Loss.** Failure to match while attempting to set up a connection between an incoming trunk and an idle called line. Expressed as a percentage of total incoming connections in units of 0.1%.

(b) **Outgoing Matching Loss.** Failure to match while attempting to set up a connection between a line and an idle outgoing trunk. Expressed as a percentage of total outgoing connections in units of 0.1%.

(c) **Average Speed of Answer.** Average time, in units of 0.1 s, that calls wait to be answered by the attendant.

(d) **Percent Last Trunk Busy.** Last enabled trunk in a trunk group is made busy (incoming or outgoing). Expressed as a percentage of the total trunk connections in units of 0.1%.

Line Traffic Measurement

2.53 For each network loop a special set of lines and/or trunks can be defined. In addition to the normal traffic measurements, additional peg and usage measurements are made for this set of terminals. Lines and/or trunks to be included in this set are given the ITM (Individual Traffic Measurement) class-of-service (COS) and may be defined to the system via the Traffic Control program. (Attendants may not be given the ITM COS.)

3. SYSTEM TRAFFIC MEASUREMENT OUTPUTS

3.01 Following are descriptions of the system measurements and their output formats. An example of an actual printout is included for each measurement. Peg count and thresholds are always given as a 5-digit number. Usage (accumulated CCS) and console measurements are given as 7-digit numbers.

TFS000 TRAFFIC PRINT PROGRAM ENTRY

3.02 When the traffic data is first printed, TFS000 is output before either time-of-day or any other traffic data.

TFS001 NETWORKS

3.03 Measurements of peg count, usage and Failure to Match (FTM) are made. Usage measurements are accumulated for each network path as it is idled, regardless of its use (or non-use). It gives the total time that time slots are marked as busy in the network maps and therefore unavailable for other use. Peg count and FTM measurements are never accumulated for maintenance functions (e.g., background signaling tests).

3.04 One line of output is provided for each loop in the system. Although the format (Table 3-A) and measurements for each loop appear to be the same, the meanings of the measurements differ according to loop type. There are four types of network loops:

- TERM(inal) - a loop containing lines, trunks, etc.
- TDS - a loop providing tones and DTMF or dial pulse outpulsing
- MF(SENDER) - a loop providing multifrequency outpulsing (ANI)
- CONFERENCE - a conference loop.

Note: TDS and MFS loops are termed service loops.

Terminal Loops

3.05 Loop Peg Count. This measurement is incremented when an established path between two terminals is made idle. Idling the busy paths to tones, outpulses, etc., will not increase the TERMINAL loop peg count but accumulates the peg counts on the service loops. In a conference call, adding a new conferee terminal to the conference requires first establishing a path between the new conferee and the conference controller (the terminal initiating the conference). As the conference is established this direct path is idled, providing one peg for the conferee and one peg for the controller. When a conferee leaves a conference, a peg is made only on the conference loop. The overall effect is:

(a) one peg per added conferee on its terminal loop

(b) one peg per conferee, including the controller, on the conference loop

(c) one peg per added conferee on the controller's terminal loop; e.g., a 6-party conference will give 5 pegs under (a), 6 under (b) and 5 under (c).

Note: The pattern of FTMs accumulated can indicate which loop(s) cause the blocking.

3.06 Loop Usage. The loop usage of a particular loop gives the total time that the time slots of the loop have been marked as busy and unavailable for other use.

3.07 Loop FTM. The loop FTM is incremented when:

(a) A terminal to terminal connection is blocked. In this case the loop FTM of both network loops is incremented.

(b) A terminal or DTR to service loop path is blocked. An FTM will accumulate on both the service loop and the terminal loop. For any one call, at most one pair of FTM due to failure to find a tone path and/or one pair of FTM due to failure to find an outpulsing path can occur.

(c) A 2500-type set to DTR path is blocked. An FTM will accumulate on both the DTR loop and the terminal loop. For any one call, at most one pair of FTM per blocked idle DTR can occur. After the first pass at all DTRs, further attempts to find an idle DTR and a path to it (the system tries again automatically) will not accumulate further loop FTM.

(d) A terminal loop to conference loop connection is blocked when either trying to form a new conference or to add a new conferee to an existing conference.

3.08 Intraloop Peg Count. If a path is eligible for Loop Peg Count and both terminals are on the same network loop, then the Loop Peg count is incremented twice, once for each terminal, and the Intraloop Peg Count is incremented once.

3.09 Intra-loop Usage. If the path is between two connection points on the same loop, then the usage for the call is added twice to Loop Usage (each connection point occupied one time slot and therefore two time slots were busy on the loop) and once to the Intraloop Usage.

3.10 Intraloop FTM. When a path is eligible to accumulate Loop FTM and both terminals are on the same loop, then loop FTM is incremented twice (once for each terminal) and Intraloop FTM once.

Service Loops

3.11 Loop Peg Count. The count is incremented whenever a path to the loop is made idle.

3.12 Loop Usage. Loop usage gives the total time that time slots of this loop have been marked busy and unavailable for other use.

3.13 Loop FTM. When a path (for either a tone or outpulsing) is required between a terminal loop and service loop then, in general (maintenance routines are one exception), all service loops (of the appropriate type) in the system will be looked at to see if a path is available. If no path can be found to any service loop, then Loop FTM is incremented on the LAST service loop looked at. If a path is found, then no Loop FTM is accumulated for any loop. Within a given network group, service loops are looked at in a fixed order. Normally, one service loop, the first choice, accumulates most of the peg and usage traffic, whilst another service loop, the last choice, accumulates all of the Loop FTM measurements. When repeated attempts are made by the system to find a path to provide a service (e.g., dial tone) then any attempt after the first does not accumulate further Loop FTM.

3.14 Intraloop Peg Count, Usage and FTM. These measurements have no meaning for service loops and should always be zero.

Conference Loops

3.15 Loop Peg Count. This is incremented once when an established path between a connection point and the conference loop is idled. The connection point's loop peg count is not incremented. Each conferee of a conference requires one path between that terminal and the conference loop. This measurement, therefore, gives the total number of conferees that were involved with the given conference loop.

3.16 Loop Usage. This measurement gives the total time that time slots of this loop have been marked as busy and unavailable for other use.

3.17 Loop FTM. The conference loop FTM is incremented in two circumstances:

(a) No conference loop can be found to establish a new conference. In this circumstance, all conference loops of the system will have been looked at and the measurement will accumulate against the last conference loop to be looked at. The order in which conference loops are used is not fixed and, therefore, the last one to be looked at is not always the same one.

(b) A new conferee cannot be added to an existing conference.

3.18 Intraloop Peg Count, Usage and FTM. These measurements are meaningless for conference loops and should always be zero.

3.19 Each individual failure to match indicates that no idle path could be found between the two loops but does not reflect the busy/idle status of the loop(s). The pattern of FTM accumulated can indicate which loop(s) cause the blocking. When a path to a service loop is required, each service loop in the system is searched to find the path. If a path to a service loop cannot be found, the FTM is pegged on the terminal loop of the LAST service loop tested. Example:

(a) A single SL-1 set to SL-1 set interloop call pegs once on each of the terminal loops.

(b) A 3-party conference pegs once on each terminal loop involved and three times on the conference loop.

Note: In both examples the tones involved peg once per tone on the relevant tone and digit loop but not on the terminal loops.

Table 3-A
TFS001 NETWORKS - FORMAT AND EXAMPLE

FORMAT:

System ID TFS001

Loop Number	Loop Type	Intra FTM	Intra CCS	Intra PC	Loop FTM	Loop CCS	Loop PC

EXAMPLE:

200 TFS001

00	TERM	00000	0000006	00004	00000	0000064	00056
01	TERM	00000	0000035	00022	00000	0000123	00086
02	TERM	00000	0000031	00020	00000	0000126	00075
05	CONF	00000	0000000	00000	00000	0000000	00000
07	TDS	00000	0000000	00000	00000	0000000	00000
08	TERM	00000	0000019	00011	00000	0000143	00098
09	TERM	00001	0000089	00066	00002	0000194	00149
13	TERM	00000	0000000	00000	00000	0000025	00006
15	TDS	00000	0000000	00000	00000	0000031	01496

Note: In Generic X11, the loop number is expressed as a 3-digit number.

TFS002 SERVICES

3.20 TFS002 gives three categories of service measurements. The meaning of the measurements differs according to the type of service. The following measurements are provided for all services except Digitone receivers and Conference loops:

(a) **Service Request Peg Count.** This measurement is incremented whenever a path between a terminal and a service loop is idled. The service provided (tone, outpulser or mf tones) defines which service request peg count to be incremented. An outpulser is held busy for the duration of outpulsing. This measurement, therefore, increments once per outgoing (or tandem) call that at least starts to outpulse digits. If it cannot be determined which service was being provided by a TDS loop then miscellaneous tone is assumed and the miscellaneous tone service peg count is incremented.

(b) **Service Usage.** This gives the time that the path to the service loop was busy. This is not necessarily the same time as the time during which the service was actually applied, as certain paths (e.g., outpulsing) are reserved before they are to be used and only idled when it is certain that they are no longer required.

(c) **Service FTM.** When no path can be found between a terminal and any service loop then the appropriate Service FTM, according to the path's purpose, is incremented. When repeated attempts are made by the system to obtain a path for a service (i.e., dial tone, overflow tone or outpulser) then any attempts after the first will not accumulate further Service FTMs.

Conference Service

3.21 The conference service measurements are obtained by adding together all the TFS001 Network measurements for all conference loops in the system. Conference measurements are on a per conferee basis, e.g., a 3-party conference held for 200 s pegs three times with usage equal to 6 CCS.

Digitone Service

3.22 Service Request Peg Count. This count is incremented when a path between a Digitone receiver and a terminal is idled. It gives the number of times that Digitone receivers are used.

3.23 Service Usage. This gives the time that the path between the Digitone receiver and the originating party was busy. It is accumulated when that path is made idle.

3.24 Service FTM. This count is incremented when at least one idle Digitone receiver exists in the system but the system cannot find a path between the originating party and any of those DTRs. It is not incremented in the case where some idle DTRs cannot be used due to network blocking and a subsequent idle DTR is successfully used for the call. In the case where the system cannot provide dial tone through a DTR but the path between the originating party and the DTR is available, one dial tone FTM is accumulated under TFS002. DTR FTM does not peg unless no path can be found between the originating party and any idle DTR. When the system makes repeated attempts to find a path to an idle receiver, any attempts after the first do not accumulate further Service FTM.

SL-1 Tone Detector (SL1TD) Service

3.25 Service Request Peg Count. This peg is incremented when the path between the SL1TD and the trunk is idled. It gives the total number of times that tone detectors are used.

3.26 Service Usage. The service usage peg is accumulated when the path between the tone detector and trunk is idled and gives the amount of time that the path was busy.

3.27 Service Failure To Match (FTM). This peg is incremented when no path is available between an idle tone detector and a trunk.

3.28 One line of output is provided for each type of service in the system (Table 3-B). Each type of service is identified by a number (expressed as 3-digits in Generic X11):

00 for Dial Tone

01 for Busy Tone

02 for Overflow Tone

03 for Ringback Tone

04 for Tone Ringing SL-1 Sets

05 for Miscellaneous Tone

06 for Outpulsers

07 is Spare

08 for Digitone Receiver

09 for Conference

10 for MF tone for ANI

11 for SL-1 Tone Detector.

3.29 Dial tone, busy tone, overflow tone, ringback tone, tone ring and Digitone receiver all peg once per connection to the service. Outpulsers peg once each time they are used in a normal outgoing call. Miscellaneous tone includes override, busy verification, etc. When an attempt to find a network path between a terminal and a service loop results in a failure to match:

(a) Requests for Digitone receivers, dial tone, overflow tone and outpulsers connections are placed in queues and periodic attempts to find a network path are made.

(b) Requests for tones other than dial tone and overflow tone are abandoned.

(c) Conference connections are replaced by overflow tone. The console tone and the SL-1 buzzing tone are not provided by the tone and digit switch.

Table 3-B
TFS002 SERVICES - FORMAT AND EXAMPLE

FORMAT:

System ID TFS002

Service Number	Request FTM	Service Usage	Request PC

EXAMPLE:

200 TFS002

00	00000	0000005	00317
01	00000	0000001	00027
02	00000	0000001	00004
03	00000	0000013	00154
04	00000	0000007	00091
05	00000	0000000	00000
06	00000	0000004	00898
07	00000	0000001	00005
08	00000	0000000	00000
09	00000	0000025	00006

Note: In Generic X11, the service number is expressed as a 3-digit number.

TFS003 DIAL TONE DELAY

3.30 TFS003 measurements (Table 3-C) give details of delays between the time the system recognizes a request for dial tone and the time when either that tone is provided or the requesting terminal abandons.

(a) **Dial Tone Delay for greater than 3 s.** This is a count of the number of calls for which dial tone was delayed for greater than 3 s.

(b) **Dial Tone Delay for greater than 10 s.** This is a count of the number of calls for which dial tone was delayed for greater than 10 s. A call that is delayed for greater than 10 s will increment both this count and the greater than 3 s count.

(c) **Total of All Delays Not Less Than 1 s.** This measurement, in units of 1 s, gives the total delay suffered by requests for dial tone for all requests that were delayed for at least 1 s.

Note: These peg counts include both successful and aborted connections. Delays longer than 10 s increment both pegs.

Table 3-C
TFS003 DIAL TONE DELAY - FORMAT AND EXAMPLE

	FORMAT:		
	System ID TFS003		
	Delay >3 s	Delay >10 s	Total Delays > or = 1 s
	EXAMPLE:		
	200 TFS003		
	00003	00001	0040

TFS004 PROCESSOR LOAD

3.31 The Processor Load output (Table 3-D) gives peg counts for idle cycle count, total CPU attempts, load peak peg, input/output buffer overflow and call register overflow.

3.32 Idle Cycle Count. The idle cycle count gives an indication of the load on the CPU. As the load increases, the idle cycle count decreases and vice-versa. This count is incremented every time the processor does not have any of the following tasks to perform:

- Input messages (including timing marks)
- 128 ms timing tasks (high-priority or low-priority)
- Ring/queue activity
- TTY input.

3.33 Total CPU Call Attempts. This is incremented once for each of:

- Dial tone request
- Incoming trunk seizure
- Attendant origination to initiate a call
- Each attempt the attendant makes to extend a call.

3.34 Load Peak Peg. This is a count of the number of times that, within a 128 ms period, the processor does not have time to complete all the necessary 128 ms timing tasks (or tasks of a higher priority than the 128 ms timing).

3.35 I/O Buffer Overloads. These are counts of the number of times that incoming or outgoing signaling messages have been lost due to buffer overflow. The buffers involved are the high-priority input buffers (HPIB) and low-priority input buffers (LPIB) and the output buffers (OB) - one for output to SL-1 sets and one for output to other than SL-1 sets (e.g., 500/2500 sets, trunks, etc.). If any I/O buffer overflow peg is non-zero, it indicates either an extreme traffic load, a hardware fault or that the given buffer is under-engineered. (Refer to 553-2YY1-151 for recommended buffer sizes.)

3.36 Call Register (CR) Overflow. This is a count of the number of times call processing software failed to find an idle call register. Each peg represents either a lost CDR (Call Detail Recording) record, a lost call or an incompleted feature. When a call register is required for either a call or a feature and none are free, but there are CDR records awaiting processing, then a call register is removed from the CDR queue and used for the call or feature. In this way calls and features are completed at a possible expense of CDR records. (Refer to 553-2YY1-151 for call register provisioning guidelines.)

Real Time Load

3.37 To determine the real time load, two measurements are required: an 'idle' idle cycle count and a 'busy' idle cycle count.

(a) The 'idle' idle cycle count should be measured over a 1 h period when the switch is, ideally, not processing any calls (Note). Too, the background overlay program, as defined in the configuration record, should be removed from the configuration record for the duration of the measurement period and all TTY ports should be in a logged out state.

Note: A few calls can be tolerated to provide a fairly accurate 'idle' idle cycle count, however, the number of calls processed should not exceed 3% of calls processed during a busy hour.

(b) The 'busy' idle cycle count should be measured over the 'busy hour' of the day (i.e., normal call processing operation, background overlay program running) in the average busy season. Typically, this measurement should be accumulated over a traffic study period of two weeks, the results averaged, and the resultant figure used as the 'busy' idle cycle count.

3.38 The percentage of real time used (%RTU) can be determined with the following formula:

$$\% \text{ RTU} = [(\text{IICC} - \text{BICC})/\text{IICC}] \times 100$$

where

IICC = 'idle' idle cycle count
BICC = 'busy' idle cycle count

3.39 To calculate the percentage of real time remaining (% RTR), use the following formula:

$$\% \text{ RTR} = [(\text{BICC}/\text{IICC}) - (1 + 2500/3600)] \times 100.$$

Note: The factor 2500 is derived by derating the number of seconds in one hour (3600) such that there is 91% real time occupancy at 1.3 times the Average Busy Season Busy Hour (ABSBH) traffic, to provide the High Day Grade of Service (i.e., 20% of calls experience dial tone delay greater than 3 s).

Table 3-D
TFS004 PROCESSOR LOAD - FORMAT AND EXAMPLE

FORMAT:

System ID TFS004

(Idle Cycle Count) (CPU Attempts) (Load Peak Peg)
(HPIB Overflow Peg) (LPIB Overflow Peg)
(500/2500 OB Overflow Peg) (SL-1 OB Overflow Peg)
(CR Overflow Peg)

EXAMPLE:

200 TFS004

1474233	00446	00001
00000	00000	
00000	00000	
00000		

TFS005 LINES

3.40 These measurements (Table 3-E) are associated with a given set of terminals (not including attendants) on each loop. These are the terminals that are assigned the ITM COS. Usage and peg count measurements are accumulated for any one group of lines and/or trunks per terminal loop. The measurements include all the counts that are pegged in TFC001.

3.41 Line Peg Count. For terminals other than trunks. When an established path involving a terminal with ITM COS is idled, then Line Peg Count is incremented for the terminal's loop. If both terminals of an established path have ITM COS then two Line Peg Counts will accrue, one for each terminal. In addition, when an established path between a terminal and a conference is idled then, if that terminal has ITM COS, Line Peg Count is incremented for the terminal's loop.

3.42 For all trunk terminals the Line Peg Count is incremented when the trunk with ITM COS is idled if, at any time since the trunk was seized, it was involved in an established connection.

3.43 Line Usage. This is the total usage for all calls contributing to Line Peg Count.

Table 3-E
TFS005 LINES - FORMAT AND EXAMPLE

FORMAT:

System ID TFS005

Loop Number	Line Usage	Line PC

EXAMPLE:

200 TFS005

00	0000034	00045
01	0000012	00009
02	0000054	00012
08	0000121	00101
09	0000021	00019
13	0000000	00000

TFS007 JUNCTOR GROUP TRAFFIC

3.44 A Junctor Group consists of four unidirectional junctors (eight in Generic X11 Release 4 and later versions) between one network group and another. The Junctor Group going from network group X to network group Y is specified by the number XY. The numbering of the network groups and their respective loops are:

- network group 0 contains loops 0 to 15 (0 to 31 in Generic X11 Release 4 and later versions)
- network group 1 contains loops 16 to 31 (32 to 63 in Generic X11 Release 4 and later versions)
- network group 2 contains loops 32 to 47 (64 to 95 in Generic X11 Release 4 and later versions)
- network group 3 contains loops 48 to 63 (96 to 127 in Generic X11 Release 4 and later versions)
- network group 4 contains loops 64 to 79 (128 to 159 in Generic X11 Release 4 and later versions).

Example: Junctor 02 is the junctor between network group 0 (loops 0 to 15 or 0 to 31) and network group 2 (loops 32 to 47 or 64 to 95).

3.45 The measurements under TFS007 (Table 3-F) all refer to paths between two connection points that are on different network groups and therefore involve the intergroup junctors. Three items are measured: the junctor peg count, the junctor usage and the junctor Failure To Match (FTM).

3.46 Junctor Peg Count. The Junctor Peg Count is the total count for completed calls between network groups where a talking path has been established. Connections from tone and digit loops do not affect the peg count. The Junctor Peg Count is incremented whenever the path satisfies the conditions specified under TFS001, Loop Peg Count.

3.47 Junctor Usage. When any path between two connection points on different network groups is idled, the usage of that path is accumulated in Junctor Usage. This measurement, therefore, gives the total time that time slots of the junctor group were busy and unavailable for other use.

3.48 Junctor FTM. The Junctor FTM is the count of a failure to match while attempting to set up a connection between network groups. The Junctor FTM is incremented whenever a path is blocked and the conditions under TFS001, Loop FTM, are satisfied.

3.49 One line of output containing the junctor number, junctor failure to match, junctor usage and junctor peg count is given for each junctor group.

Table 3-F
TFS007 JUNCTORS - FORMAT AND EXAMPLE

FORMAT:

System ID TFS007

Junctor Group	Junctor FTM	Junctor Usage	Junctor PC

EXAMPLE:

222 TFS007

01	00001	0002344	01667
02	00000	0002122	01322
12	00002	0001993	00922

3.00 SCOPE OF MEASUREMENTS

3.01 When an SL-1 system is installed, a traffic measurement schedule is defined for the system and a possibly different schedule is defined for each customer sharing the system. Given the schedule, the traffic measurements involve the following:

a) time-of-day.

b) a set of system traffic measurements consisting of

1) peg count, usage (CCS) and PTM of network,
2) peg count, usage and PTM of services,
3) dial tone delay,
4) processor load,
5) peg count, usage and PTM of lines
6) peg count, usage and PTM of junctors

c) a set of per customer measurements consisting of

1) peg count, usage and PTM of incoming, outgoing, intra-customer and tandem calls, and peg count of ineffective attempts,
2) trunk group peg count, usage and overflow count,
3) attendant queue characteristics,
4) attendant console traffic,
5) peg count of features

d) comparisons with the system threshold levels of

1) Dial tone speed,
2) Loop traffic,
3) Junctor Traffic

e) comparisons with the customer threshold levels of

1) Incoming matching loss,
2) Outgoing matching loss,
3) Average speed of answer,
4) Percent all trunks busy.

3.02 The request for this information must be put into the system by the operating company, using the procedures outlined in this section. Detailed descriptions of the measurements are given in Parts 4 to 9.

4. CUSTOMER TRAFFIC MEASUREMENT OUTPUTS

4.01 Following are the descriptions of the customer measurements and their output formats. An example of the actual printout of each measurement is given.

TFC001 NETWORKS

4.02 The measurements under TFC001 give the peg count, usage and FTM of incoming, outgoing, intra-customer and tandem calls. Counts of ineffective attempts are also included. The output is printed on a customer basis (Table 4-A).

Incoming Calls

4.03 Incoming Peg Count. Incremented when a trunk is idled if:

(a) when originally seized it was incoming, and

(b) at some time since it was seized it was involved in an established connection.

4.04 Incoming Usage. When an established path between any terminal and a trunk is idled and if the trunk was originally incoming, the Incoming Usage is accumulated.

4.05 Incoming Failure to Match. If, at any time between an incoming call being recognised by the system and the time that the trunk is idled the call suffers blocking so that a given stage of the call cannot be completed, then Incoming FTM is incremented. Any one call, at most, increments Incoming FTM once.

4.06 Example. If a call cannot be presented to an idle attendant due to blocking, then an Incoming FTM is incremented. If the call is successfully presented to an attendant, but the attendant cannot extend the call to an idle terminal due to blocking, then an Incoming FTM is incremented. Even though a call may suffer both these types of blocking Incoming FTM is incremented only once.

Outgoing Calls

4.07 Outgoing Peg Count. Incremented when a trunk is idled if:

(a) when originally seized it was outgoing, and

(b) at some time since it was seized it was involved in an established connection with another terminal.

4.08 Outgoing Usage. When an established path is idled and one of the terminals is a trunk, then, if that trunk was outgoing when originally seized, the outgoing usage is accumulated.

4.09 Outgoing FTM. If a path to an idle outgoing trunk cannot be found due to network blocking then the outgoing FTM is incremented. Any one call can only increment the outgoing FTM once. Further attempts to secure a trunk via, for example, Ring Again will not cause further outgoing FTM.

Intracustomer Calls

4.10 Intracustomer Peg Count. Incremented when an established path between two terminals, neither of which is a trunk, is idled.

4.11 Intracustomer Usage. The total usage of all calls that increment Intracustomer Peg Count.

4.12 Intracustomer FTM. Incremented when a path cannot be found between two terminals, neither of which is a trunk.

Tandem Calls

4.13 Tandem Peg Count. Incremented when an established connection between two terminals, both of which are trunks, is idled and both trunks are also to be idled. A tandem call does not increment either Incoming or Outgoing Peg Counts.

4.14 Tandem Usage. When an established path between two terminals, both of which are trunks, is idled then tandem usage is accumulated.

4.15 Tandem FTM. When a path between two terminals, both of which are trunks, cannot be found due to network blocking, then Tandem FTM is incremented. Two attempts are made to find a path between the originating trunk and an idle outgoing trunk. If both attempts fail, one tandem FTM is pegged.

Ineffective Attempts

4.16 Partial Dial. Incremented for 2500-type sets only when dialing is not completed within 30 s.

4.17 Abandon. Incremented when a terminal, other than a trunk, goes on-hook and thus abandons a call before having dialed a complete directory number or a trunk access code. This count will not increment if a partial number has been outpulsed on a trunk route.

4.18 Permanent Signal. Incremented when:

- a terminal does not start dialing within 30 s of receiving dial tone
- a terminal, other than a trunk or attendant, does not continue dialing once it has started and is placed into the line-lockout condition.

Table 4-A
TFC001 NETWORKS - FORMAT AND EXAMPLE

FORMAT:

System ID TFC001

Customer Number

Incoming FTM	Incoming CCS	Incoming PC
Outgoing FTM	Outgoing CCS	Outgoing PC
Intra-Customer FTM	Intra-Customer CCS	Intra-Customer PC
Tandem FTM	Tandem CCS	Tandem PC
Permanent Signal	Abandon	Partial Dial

EXAMPLE:

200 TFC001

00

00000	0000092	00072
00000	0000114	00074
00000	0000063	00083
00000	0000005	00003
00001	00016	00000

Note: In Generic X11, the customer number is expressed as a 3-digit number.

TFC002 TRUNKS

4.19 An output (Table 4-B) is given for each trunk group of each customer. The data includes peg count, usage, overflow, all trunks busy and toll peg count. The trunk type may be:

- Watts lines (WATT)
- Foreign Exchange (FEX)
- Common Control Switch Arrangement (CCSA)
- Direct Inward Dialing (DID)
- Central Office (CO)
- TIE trunks (TIE)
- Paging (PAGE)
- Dictation (DICT)
- Recorded Announcement (RAN)
- Automatic Identification of Outgoing Dialing (AIOD)
- Centralized Automatic Message Accounting (CAMA).

Trunk Status

4.20 Trunks Equipped. This is the number of trunks configured in the route at the current time.

4.21 Trunks Working. This is the number of trunks enabled in the route at the current time.

4.22 All Trunks Busy. Only valid for trunk groups with more than one equipped member. Incremented whenever the last enabled trunk of the group is made busy.

Incoming Trunks

4.23 Incoming Trunk Peg Count. If a path is eligible to be included in TFC001, Incoming Peg Count, then the Incoming Trunk Peg Count for the appropriate trunk group is also incremented.

4.24 Incoming Trunk Usage. If a path is eligible to be included in TFC001, Incoming Usage, then the usage is also added to Incoming Trunk Usage for the appropriate trunk group.

Outgoing Trunks

4.25 Outgoing Trunk Peg Count. If a path is eligible to be included in TFC001, Outgoing Peg Count, then Outgoing Trunk Usage is also incremented for the appropriate trunk group.

4.26 Outgoing Trunk Usage. If a path is eligible to be included in TFC001, Outgoing Usage, then the usage is also added to Outgoing Trunk Usage for the appropriate trunk group.

4.27 Outgoing Trunk Overflow. Incremented when a request for a trunk on this group fails, there being no idle, enabled trunk available. The overflow is counted even though the request may continue through (e.g., the ARS feature) to search other routes for an idle trunk. If a trunk is idle and enabled, but completion to that trunk is not possible due to network blocking, then Outgoing Trunk Overflow is not incremented.

> **Note 1:** Outgoing trunk connections are not considered complete until the End-Of-Dialing (EOD) timer expires after the last digit is dialed (normally 13 s). This means that connections of less than the EOD timer will not accumulate traffic data as complete connections. End of dialing may be forced by dialing an octothorpe (#). In this case the EOD timer is superceded.
>
> **Note 2:** If an outgoing trunk call is disconnected before the EOD timer expires, TFS001 usage will be accumulated. TFS001 peg count, TFC001 and TFC002 will not be incremented.

Toll Peg Count

4.28 Only valid for CO and FEX routes. Incremented when the first meaningful digit dialed after the access code is either a '0' or a '1'. A meaningful digit is one that is not absorbed by either the SL-1 or by the connecting central office. The measurement is incremented as soon as the first meaningful digit is dialed. Even if it is abandoned directly after the first meaningful digit, the Toll Peg Count will still have been accrued. It is possible, therefore, to get Toll Peg Count in excess of the number of completed outgoing calls.

Table 4-B
TFC002 TRUNKS - FORMAT AND EXAMPLE

FORMAT:

System ID TFC002

Customer Number

Group Number	Trunk Type
Trunks Equipped	Trunks Working
Incoming Usage	Incoming PC
Outgoing Usage	Outgoing PC
Outgoing Overflow	All Trunks Busy
Toll PC	

EXAMPLE:

200 TFC002

07

004	CO
00008	00007
0000051	00043
0000004	00004
00000	00000
00006	

Note: In Generic X11, the customer number is expressed as a 3-digit number.

TFC003 QUEUE

4.29 Timing measurements for TFC003 (Table 4-C) are accumulated in the SL-1 in units of 2 s. They are printed in units of 0.1 s, being the average taken over a reasonable number of calls. If traffic data is taken over a small number of calls (e.g., less than 10), then the accuracy of the data will suffer accordingly.

4.30 Average Attendant Response. This is the average time elapsed between a call being presented to an attendant console and the attendant answering it. If the attendant answers a different call via the ICI keys, then the time is accumulated as if the call answered was the one first presented (i.e., the measurement still gives a true indication of the attendant's response).

4.31 Average Time in Queue. This is the time that calls spend in the attendant queue averaged over all calls that are placed into that queue. Timing starts when the call is placed into the queue. If a call is presented to the attendant but a different call is selected via the ICI keys, then the time accumulated is adjusted as if the selected call had been presented in the first place.

4.32 Average Speed of Answer (ASA). This is the time that a call waits after its request to terminate at an attendant is recognised by the system and before it is answered. It is calculated by the following formula:

ASA = [(calls delayed × average time in queue)/total calls] + average attendant response.

> **Note 1:** The percentage of the total calls that have to enter the attendant queue are not recorded. Therefore, no correlation between Average Speed of Answer, Average Attendant Response and Average Time in Queue can be made.
>
> **Note 2:** Total calls include all incoming calls, dial '0', and recalls.

Example:

Customer 3, 4th. of October, 9:00
Peg Count in queue = 2
Average time in queue = 3 s
Average attendant response = 2.4 s
Total calls = 9

ASA = (2×3)/9 + 2.4 = 3.1 s.

4.33 Peg Count of Calls Delayed. Incremented whenever a call is removed from the attendant queue. If a call is removed from the queue and is presented but then is replaced into the queue because a second call has been selected via an ICI, this measurement is only incremented once as if the first call had remained in the queue throughout. Abandoned calls do not increment this count, whether they abandon while in the queue or after they are presented.

4.34 Peg Count of Abandoned Calls. Incremented whenever a call abandons before being answered by the attendant.

4.35 Average Waiting Time of Abandoned Calls. The average time that a call counted in Peg Count of Abandoned Calls waited before abandoning.

> **Note:** For systems equipped with the Centralized Attendant Service (CAS) remote feature (Generic X05 and later), TFC003 measurements are also kept for RLT. The measurements for the local attendant(s) at the remote location and the RLT are combined in TFC003. (The CAS feature is described in 553-2681-100.)

Table 4-C
TFC003 QUEUE - FORMAT AND EXAMPLE

FORMAT:

System ID TFC003

Customer Number

(Avg. Speed of Answer)
(PC of Calls Delayed)
(PC of Abandoned Calls)

(Avg. Attendant Response)
(Avg. Time in Queue)
(Avg. Wait Time of Abandoned Calls)

EXAMPLE:

200 TFC003

03

00092	00048
00006	00129
00003	00135

Note: In Generic X11, the customer number is expressed as a 3-digit number.

TFC004 CONSOLE

4.36 These measurements (Table 4-D) relate to calls handled by the attendants. If a call is answered by the attendant and extended then, if that call returns to an attendant as a recall it appears as a new call as far as this set of measurements is concerned. (Should it involve a trunk then it will count as only one call under TFC001 and TFC002).

4.37 Total Time Spent Servicing Internal Requests. This is the total time, in units of 1 CCS, that an attendant has calls that originated within the SL-1 system active on the console, i.e., internal or outgoing calls. The time is accrued when such a call is removed from or held on the console. A held call will start accumulating further time when it is reactivated.

4.38 Peg Count of Internally Originated Calls Handled by Attendant. This measurement is incremented when the call is finally removed from the console. It includes calls originated by the attendant.

4.39 Total Time Spent Servicing External Requests. This is the total time, in units of 1 CCS, that an attendant has calls that originated outside the SL-1 system active on the console, i.e., incoming calls. The time is accumulated when such a call is removed from or held on the console. A held call starts to accumulate further time when it is reactivated.

4.40 Peg Count of Externally Originated Calls Handled by Attendant. A count of all incoming calls answered by the attendant. The measurement is incremented when the call is finally removed from the console.

4.41 Total Time Spent Servicing Calls. Total Time Spent Servicing Internal Requests plus Total Time Spent Servicing External Requests with perhaps an error of plus or minus 2 CCS, because of rounding in the CPU.

4.42 Total Time Console is Manned. The total time that the console was neither in Night Service nor Position Busy. Although a console is in Night Service or Position Busy, a call at present on the console can still be completed and, therefore, accumulate time. Also, new calls can still be originated by the attendant from the console. It is therefore possible to have a Total Time Spent Servicing Calls Greater than Total Time Console is Manned.

4.43 Number of Times All Attendant Loops are Busy. Incremented whenever the last attendant loop on the console is made busy.

4.44 One output is provided for each attendant. Data includes peg count and work time. 'Total time' measurements are expressed in CCS. Internal calls include those originated by the attendant.

4.45 The total time spent servicing calls may not exactly equal the sum of the total times spent servicing internal and external requests due to rounding (e.g., 1.3 and 1.4 both round down to 1, but their sum, 2.7, rounds up to 3). The total time a console is manned equals the total time the console is NOT in Night service and is NOT Position Busy. A position busy console may make outgoing calls and complete any incoming call presented to the console before the console was made position busy.

Table 4-D
TFC004 CONSOLE - FORMAT AND EXAMPLE

FORMAT:

System ID TFC004

Customer Number

(PC of Internally Originated Calls Handled by Attendant)
(PC of Externally Originated Calls Handled by Attendant)
(Total Time Console is Manned)
(Number of Times all Attendant Loops are Busy)

(Total Time Spent Servicing Internal Requests)
(Total Time Spent Servicing External Requests)
(Total Time Spent Servicing Calls)

EXAMPLE:

200 TFC004

00

02

00008	0000002
00025	0000004
0000015	0000005
00000	

Note: In Generic X11, the customer number and attendant number are expressed as 3-digit numbers.

TFC005 FEATURES

4.46 These measurements (Table 4-E) apply only to features activated by keys on either an SL-1 set or an attendant console. Features activated by code dialing on either 500 or 2500-type sets are not included.

4.47 Auto Dial, Call Forward and Speed Calling are incremented once per operation of the feature but not when the feature is reprogrammed.

4.48 Call Pickup, Call Transfer, Call Waiting, Ring Again, Manual Signaling, Override, Privacy Release, Attendant Recall, Voice Call, Volume Control, Busy Verify, Barge In, Private Line Service, Call Selection and Stored Number Redial are each incremented once per use or attempted use of the feature.

4.49 Three-party Conference and Six-party Conference are incremented once for each new conferee added to the conference (e.g., a 5-party conference pegs three times, once for each conferee added to the original two parties).

4.50 A peg count is given for each feature for one specified customer. Each line of output is a feature. Features are identified by number (see Table 4-F).

Table 4-E
TFC005 FEATURES - FORMAT AND EXAMPLE

FORMAT:

System ID TFC005

Customer Number

(Feature Number) (Peg Count)

EXAMPLE:

200 TFC005

00

00 00012
01 00002
02 00003
03 00015
04 00002
05 00000
etc.

Note: In Generic X11, the customer number and feature number are expressed as 3-digit numbers.

Table 4-F
TFC005 FEATURE KEY NUMBERS

NUMBER	FEATURE	NUMBER	FEATURE
00	Auto Dial	17	Call Selection (ICI)
01	Call Forward	18	Attendant Recall
02	Call Pickup	19	Dial Intercom
03	Call Transfer	19	Message Center INCALLS (X07)
04	Call Waiting	20	SL-1 Set Message Waiting
05	3-Party Conference	20	Attendant Message Indication (X07)
06	6-Party Conference	21	SL-1 Set Message Indication (X07)
07	Manual Signaling	21	Message Indication
08	Override	22	SL-1 Set Message Waiting (X07)
09	Privacy Release	22	Message Cancellation
10	Private Line Service	23	Message Center INCALLS
11	Ring Again	24	Attendant Overflow
12	Speed Call	25	Group Call
13	Voice Call	26	Auto Answerback
14	Volume Control	27	spare
15	Busy Verify	28	spare
16	Barge In	29	Call Park
		30	Stored Number Redial

Table 4-F Continued
TFC005 FEATURE KEY NUMBERS

NUMBER	FEATURE	NUMBER	FEATURE

Note: The feature number (01, 07, etc.,) is increased by a single digit (001, 007, etc.,) in Generic X11.

TFC006 ARS QUEUING/RGA

4.51 These measurements (Table 4-G) give the number of calls dealt with by the ARSQ and the Ring Again (RGA) feature. Measurements are accumulated for each ARSQ code, and also for each Routing, if the call involved the ARS package.

> **Note:** ARS is replaced by BARS/NARS in Generic X11. TFC006 data is, therefore, neither accumulated nor printed on systems equipped with Generic X11. Traffic data related to BARS/NARS is identified in Network Traffic Measurements.

4.52 ARS Originations. This item is a peg count of each fully dialed ARS call that successfully translated to a Routing.

4.53 ARS Immediate Terminations. This item is a peg count of each ARS call that terminated immediately (i.e., upon dialing an ARS access code) or terminated after an ARS pause timeout (i.e., after waiting T seconds as specified for the DELY prompt of overlay 27).

4.54 RGA Cancellations. This item is a peg count of each call that activated RGA and then was cancelled (either by the system or by the user).

4.55 RGA Cancellation Wait. This item is the average time spent in the RGA queue by a call waiting to access a trunk. The timing measurement is accumulated in units of 2 s. It is printed in units of 0.1 s, which is the average taken over the number of calls. If traffic data is taken over a small number of calls, then the accuracy of the data will suffer accordingly.

4.56 RGA Acceptance. This item is a peg count of each call that activated RGA and subsequently accepted the call offered by the system.

4.57 RGA Acceptance Wait. This item is the average time spent in the RGA queue by a call waiting to access a trunk. The value is expressed in units of 0.1 s.

4.58 RGA Expensive Route Wait Timeouts. This item is a peg count of each call that activated RGA and whose Expensive Route Wait Timer expired.

4.59 ARS Total Terminations. This item is a peg count of each ARS call that eventually terminated. The termination may have been immediate (i.e., after the ARS access code was dialed), after the ARS pause timeout or via the operation of RGA. Peg counts are also kept on a trunk route basis for each Routing.

4.60 The output is a breakdown over ARSQ codes (0 to 3), over defined Routings (0 to 255) and over associated routes of a Routing for the ARS Total Terminations peg. There is no breakdown over individual traffic items.

4.61 Each line of output is identified by a mnemonic: QC for ARSQ code, SB for Routing and RT for a route of a Routing. The ordering of the output is all ARSQ codes scheduled for printing followed by all Routings sheduled for printing. Each Routing is followed by the route breakdown for the ARS Total Termination peg.

Table 4-G
TFC006 ARSQ/RGA - FORMAT AND EXAMPLE

FORMAT:

System ID TFC006

Customer Number

QC (ARSQ code) (a) (b) (c) (d) (e) (f) (g) (h)
.
.
.
SB (Routing number) (a) (b) (c) (d) (e) (f) (g) (h)
RT (route number) (PC of terminations)
.
.
.

where:

(a) - PC ARS Originations
(b) - PC of ARS Immediate terminations
(c) - PC of RGA Cancellations
(d) - Average time of RGA Cancellations
(e) - PC of RGA Acceptances
(f) - Average time of RGA Acceptances
(g) - PC of RGA Expensive Route Wait Timeouts
(h) - PC of ARS Total Terminations

EXAMPLE:

200 TFC006

00

QC	0	00005	00003	00001	00200	00001	00600	00001	00004
QC	2	00002	00002	00000	00000	00000	00000	00000	00002
SB	001	00004	00001	00000	00000	00003	00300	00002	00004
		RT 01	00001						
		RT 14	00001						
		RT 15	00002						

TFC007 SYSTEM PARK (Generic X07)

4.62 These measurements (Table 4-H) provide the statistics related to the usage of the system park feature of Generic X07.

4.63 System Park Usage Peg Count. Incremented each time a call is parked on a system park number. Recalls which are returned to system park are not included.

4.64 Park Overflow Peg Count. Incremented each time a park number is requested and no park number is available.

4.65 System park Recalls. Incremented each time a parked call is presented to an attendant as a recall.

4.66 Average Wait Time of System Park Number. This is the average time that calls wait on system park numbers. The time includes calls that are abandoned, pickup up by the paged party or released by the attendant on recall. The value is expressed in units of 0.1 s.

Table 4-H
TFC007 SYSTEM PARK - FORMAT AND EXAMPLE

FORMAT:

System ID TFC007

Customer Number

(Usage Count) (Overflow PC) (Recall PC) (Avg. Wait Time)

EXAMPLE:

200 TFC007

00

00002 00009 00003 00157

TFC007 CALL PARK (Generic X11, X37)

4.67 Traffic measurement data is accumulated for the following items related to usage of the Call Park feature (Table 4-I).

4.68 System Park Usage. This count identifies the number of calls that were parked to a System Park DN.

4.69 Station Park Usage. This count identifies the number of calls that were parked to a Station Park DN.

4.70 System Park Overflow. This count identifies the number of calls that could not be parked because a System Park DN was not available.

4.71 Parked Access. This count identifies the number of parked calls that were successfully accessed.

4.72 Park Recall. This count identifies the number of parked calls that were recalled after the Call Park Recall Timer (service changeable) expired.

4.73 Average Wait for Access. This value (expressed in units of 0.1 s) reflects the average time that parked calls waited before being accessed.

Table 4-I
TFC007 CALL PARK - FORMAT

System ID TFC007

Customer Number

aaaaa bbbbb ccccc ddddd eeeee fffff

where,

a = system park usage count

b = system park overflow count

c = station park usage count

d = parked call access count

e = parked call recall count

f = average wait time in park (in units of 0.1s).

TFC008 INTEGRATED MESSAGING SYSTEMS

4.74 The traffic control program (overlay 02) is modified to enable traffic measurement data related to usage of the IMS and IVMS features (553-2781-100 and 553-2881-100) to be accumulated and printed (Table 4-J). A new customer option number, '8', is used in conjunction with the SOPC command to select the IMS/IVMS traffic measurement option.

4.75 Measurements for the Telephone Status feature, Telephone Set Messaging feature, IMS Message Attendant and IVMS call processor are accumulated for each ACD-DN (i.e., message center DN), while the Auxiliary Processor Link (APL) statistics are accumulated for each APL.

Table 4-J
TFC008 IMS/IVMS - FORMAT

System ID TFC008

Customer Number

APL

APL#	OUTQ OVFL	INPQ OVFL	AVGOQ SIZE	AVGIQ SIZE	DOWN TIME	OCR UAV	ICR UAV	TO	NAK	CHAR UNSYNC

OMSG	MSG0	MSG1	...	MSG9
	MSG10	MSG11	...	MSG19
IMSG	MSG0	MSG1	...	MSG9
	MSG10	MSG11	...	MSG19

PACKET XXXXX

MAQ

ACD-DN	QLNGTH	MADRCT	MAINDRT	ABNDN	ABNDN AVG WAIT	AVG DLY	DCP	PCP

TST

ACD-DN	TOTAL CALLS	SPRE	CFW	UST	FAIL

TMG

ACD-DN	QLNGTH	TOTAL CALLS	SUCC	ABNDN	FAIL	AVG TIME	MARQST

where,

(a) APL

APL#	=	the number of the APL
OUTQ OVFL	=	output queue overflow
INPQ OVFL	=	input queue overflow
AVFOQ SIZE	=	average output queue size
AVGIQ SIZE	=	average input queue size
DOWN TIME	=	total APL down time in seconds
OCR UAV	=	output message call register unavailable
ICR UAV	=	input message call register unavailable
TO	=	total timeout count
NAK	=	total number of negative acknowledgements

Table 4-J Continued
TFC008 IMS/IVMS - FORMAT

	CHAR UNSYNC	=	input characters out of synchronization
	OMSG	=	output message traffic count (by message type)
	IMSG	=	input message traffic count (by message type)
	PACKET	=	output packeted message count
(b)	MAQ		
	ACD-DN	=	the ACD-DN being reported
	QLNGTH	=	total number of calls in the message attendant queue or VMS processor queue
	MADRCT	=	total number of direct calls to the message attendant or VMS processor queue
	MAINDRT	=	total number of indirect calls to the message attendant or VMS processor queue
	ABNDN	=	total number of calls to this ACD-DN that were abandoned before being answered
	AVG WAIT	=	the average time (in seconds) that calls waited before being abandoned
	AVG DLY	=	the average delay = total waiting time for all calls divided by the number of calls answered for this ACD-DN
	DCP	=	direct call processing time: average time (in seconds) that each message attendant spent handling answered calls to this ACD-DN
	PCP	=	post call processing: average time (in seconds) that each message attendant or VMS processor was 'not ready' per answered call to this ACD-DN.
(c)	TST		
	ACD DN	=	identification of ACD DN reported
	TOTAL CALLS	=	the total number of Telset status calls
	SPRE	=	total number of Special Prefix access calls
	CFW	=	total number of call forward access calls
	UST	=	total number of user status key access calls
	FAIL	=	total number of unsuccessful Telset status calls
(d)	TMG		

Table 4-J Continued
TFC008 IMS/IVMS - FORMAT

QLNGTH	=	total number of calls queued for the message attendant
TOTAL CALLS	=	total number of Telset messaging calls
SUCC	=	total number of successful Telset messaging calls
ABNDN	=	total number of abandoned Telset messaging calls
FAIL	=	total number of unsuccessful Telset messaging calls
AVG TIME	=	average Telset messaging processing time in seconds
MARQST	=	total number of Telset messaging calls that requested the message attendant.

5. CUSTOMER NETWORK TRAFFIC MEASUREMENT OUTPUTS

5.01 Network traffic measurements are available at an SL-1 switch equipped with the Network Traffic (NTRF) feature of Generic X11. The measurements pertain to the following Generic X11 features:

- Basic Alternate Route Selection (BARS) - 553-2751-100
- Network Alternate Route Selection (NARS) - 553-2751-100
- Network Queuing Features - 553-2751-101
- Coordinated Dialing Plan (CDP) - 553-2751-102.

TFN001 ROUTING MEASUREMENTS

5.02 A route list is a list of outgoing alternate trunk routes to a specific location from an SL-1 switch. Trunk routes in a route list are termed route list entries. The number of route lists/entries that can be defined at an SL-1 switch depends on the features equipped at that switch. Table 5-A lists the parameters for the different features and feature combinations.

Table 5-A
SUMMARY OF SL-1 NETWORKING FEATURE PARAMETERS

	FEATURES EQUIPPED AT SWITCH				
PARAMETER	BARS	NARS	CDP	CDP WITH BARS	CDP WITH NARS
NCOS Groups	0-3	0-15	0-3	0-3	0-15
Facility Restriction	0-7	0-7	0-7	0-7	0-7
Digit Manipulation Tables	1-255	1-255	1-31	1-255	1-255
Route Lists	0-127	0-255	0-31	0-127	0-255
Route List Entries	0-7	0-7	0-2	0-7	0-7
FCAS Tables	1-127	1-255	-	1-127	1-255
SDR Tables	0-31	0-255	-	0-31	0-255
Steering Codes	-	-	1-5000	1-5000	1-5000

Note 1: NCOS = Network Class-of-Service
FCAS = Free Calling Area Screening
SDR = Supplemental Digit Restriction.

Note 2: If the NARS and BARS features are equipped in the same switch but for different customers, the highest parameter values apply to that switch; e.g., if one customer has NARS and another customer has BARS, the NARS parameters apply to the BARS customer.

Note 3: If the New Flexible Code Restriction (NFCR) feature is equipped in conjunction with either BARS or CDP, the number of available NCOS groups is 8 (0 to 7). If the AUTOVON feature is equipped with BARS or CDP, 16 (0 to 15) NCOS groups are available.

5.03 The routing traffic measurements (TFN001) provide data related to route list utilization. The measurements show how often a route list was accessed, which entries in the list were used and whether the call was successful in completing a selection or connection. Routing traffic measurements are available at SL-1 Node and SL-1 Main switches.

5.04 Routing traffic measurements (Table 5-B) are provided for each defined route list at an SL-1 switch.

5.05 Route List Requests. This measurement identifies the total number of attempts (calls) in which the called destination translations identified this route list to attempt call completion. The count is incremented each time the route list is selected to attempt route selection.

5.06 Route List Requests Served Without Delay. This measurement identifies the number of calls which were routed without encountering blockage or queuing. The count is incremented when a route list is selected and an available trunk is chosen without being offered Off-Hook Queuing (OHQ) or Call-Back Queuing (CBQ). The count includes expensive route acceptances.

5.07 Expensive Route Acceptances. This measurement identifies the number of times calls were routed over an expensive route choice after the caller was informed of the additional cost of the call. The count is incremented after a caller receives Expensive Route Warning Tone (ERWT) and elects to complete the call over the expensive facility.

5.08 Route List Requests Standard Blocking. This measurement identifies the number of call attempts that could not be served because a route or queuing process was not available to the caller. The blocked call may have been given overflow tone or recorded announcement, or routed to the attendant. The count is incremented if:

- the caller's Facility Restriction Level (FRL) is not sufficient to select any route choice
- no route choice is available and the caller is only allowed OHQ but too many calls are already queued
- the call times out in the OHQ
- blocking occurred and the system could not select another route choice and neither OHQ nor CBQ is allowed.

5.09 Route List Entry Usage Count. This measurement identifies the number of calls that were successfully routed over a particular route list entry (trunk route). A count is maintained for each route list entry. The count is incremented when:

- an entry is selected without being offered OHQ or CBQ
- an entry is selected after OHQ or OHQ timeout

- an entry is selected to process a CBQ callback.

Off-Hook Queuing Measurements

5.10 Traffic measurements for Off-Hook Queuing (OHQ) are associated with each route list and identify the utilization of the OHQ feature. The OHQ measurements are included with the routing traffic measurements (TFN001).

5.11 Quantity of Calls Placed in OHQ. This measurement identifies the number of calls which attempted to use a route in the route list but, because facilities were not immediately available, the call was allowed to remain off-hook to wait for facilities. The count is incremented each time a call (Note) is placed in the OHQ.

> **Note:** This measurement includes calls which originated from stations at an SL-1 Node, SL-1 Main or Conventional Main, or which were made via the Direct Inward System Access (DISA) feature.

5.12 Average Time in OHQ. This measurement identifies the average time that calls waited in the OHQ for a facility to become available. The time is computed and presented in units of 0.1 s. The queue handler obtains a timestamp when a call is placed in the OHQ and when it is removed from the OHQ. The time difference is added to an accumulating count for the route list only under the following conditions:

- a route becomes available
- the OHQ time limit expires and the call is removed from the OHQ
- the caller abandons a call while waiting in the OHQ.

5.13 Quantity of Calls Abandoned While In OHQ. This measurement identifies the number of calls that were placed in the OHQ but were abandoned before a route became available or the OHQ time limit expired. The count is incremented when a station set an SL-1 Node, SL-1 Main or Conventional Main disconnects during the OHQ offer or while waiting in the OHQ.

Call-Back Queuing Measurements

5.14 Traffic measurements for Call-Back Queuing (CBQ) are associated with each route list and identify the utilization of the feature. CBQ measurements are included with the routing traffic measurements (TFN001).

5.15 Quantity of Call-Back Queued Calls. This measurement identifies the number of calls which were offered Call-Back Queuing (CBQ), accepted the offer and were placed in the CBQ. The count is incremented each time a call is placed in the CBQ.

5.16 Average Time in CBQ. This measurement identifies the average duration calls remained in the CBQ. The measurement is incremented when a local station has accepted the CBQ offer and is placed in the CBQ.

5.17 The queue handler obtains a timestamp when a call is placed in the CBQ and when it is removed from the CBQ. The time difference is added to the accumulating count for the route list. Output is in units of 0.1 s.

5.18 Quantity of CBQ Offerings. This measurement identifies the number of CBQ calls that were offered CBQ callbacks regardless of whether the CBQ callback was answered. The count is incremented when the caller is presented with the CBQ callback.

5.19 Quantity of CBQ User Cancellations. This measurement identifies the number of CBQ calls that were removed from the CBQ at the user's request. The count is incremented when:

- a local station (500/2500-type set) dials the Ring Again cancellation code
- a local station (SL-1 set) depresses the Ring Again feature key when the associated lamp is steadily lit.

Note: Only those calls actually found in the CBQ and removed are counted.

5.20 With Generic X11 Release 3, traffic measurements for the SL-1 Tone Detector (SL1TD) are included in the TFN001 message. The peg is incremented when a trunk is seized but released when alternate routing is performed during a call involving an SL1TD.

Table 5-B
TFN001 ROUTING - FORMAT

System ID TFN001

Customer Number

RLST	xxx	aaaaa	bbbbb	ccccc	ddddd	eeeee	fffff		
	RT	ggggg	ggggg	ggggg	ggggg	ggggg	ggggg	ggggg	ggggg
		ppppp	ppppp	ppppp	ppppp	ppppp	ppppp		
	OHQ	hhhhh	iiiii	jjjjj					
	CBQ	kkkkk	lllll	mmmmm	nnnnn				

where,

a = route list requests

b = route list requests served without delay

c = expensive route acceptances

d = route list requests standard blocking

e = not defined (all zeros)

f = not defined (all zeros)

g = route list entry usage count for each entry in the route list

h = quantity of calls placed in OHQ (Note)

i = average time in OHQ (units of 0.1 s)

j = quantity of calls abandoned from OHQ

k = quantity of CBQ calls (Note)

l = average time in CBQ (units of 0.1 s)

m = quantity of CBQ offerings

n = quantity of CBQ user cancellations

p = quantity of calls involving SL1TD on which alternate routing was performed during the call

x = route list number

Note: OHQ and/or CBQ information is printed only if the feature is equipped and activated.

TFN002 NETWORK CLASS-OF-SERVICE MEASUREMENTS

5.21 Traffic measurements are collected for each defined NCOS group (0 to 15) to indicate the grade of service, in terms of blocking and queuing delay, being provided by the system. If a grade of service is determined by the communications manager to be appropriate for users in a particular NCOS group, then the communications manager can either reassign the users to another NCOS group, redefine the characteristics of the existing NCOS group or change the routing parameters (see Table 5-C).

5.22 Quantity of Calls Received. This measurement identifies the total number of network call attempts generated by users assigned to this NCOS group.

5.23 Routing Requests Served Without Delay. This measurement identifies the number of call attempts that were routed without encountering blockage or being offered queuing.

5.24 Expensive Route Acceptances. If the NCOS group is defined to provide an Expensive Route Warning Tone (ERWT) to the call originator when an expensive route is selected for call completion, the count is incremented if the user allows the call to complete over the expensive facility after having received the ERWT.

5.25 Network Call Standard Blocking. This measurement identifies the number of call attempts, by users in this NCOS group, that could not be served because a route or queuing process was not available to the user.

5.26 Calls Refusing Expensive Routes. This measurement identifies the number of callers that received ERWT and either abandoned the call or activated the Ring Again feature to place the call in the Call-Back Queue.

5.27 Quantity of Calls Placed in OHQ. This measurement identifies the number of calls, generated by users in this NCOS group, that were offered Off-Hook Queuing (OHQ) and accepted the offer.

5.28 Average Time in OHQ. This measurement identifies the average duration that calls remained in the OHQ. The time is expressed in units of 0.1 s. (Calls which time out in the queue are included in the average.)

5.29 Quantity of CBQ calls. This measurements identifies the number of calls that were offered Call-Back Queuing (CBQ) and accepted (i.e., invoked Ring Again) the offer.

5.30 Average Time in CBQ. This measurement identifies the average time (in units of 0.1 s) that calls in this NCOS group waited in the CBQ for an available route. The measurement includes calls which requested a CBQ cancellation, calls which were completed and calls that initiated direct Ring Again against trunks.

Table 5-C
TFN002 NCOS - FORMAT

System ID TFN002

Customer Number

NCOS	xxx	aaaaa	bbbbb	ccccc	ddddd	eeeee	fffff
	OHQ	ggggg	hhhhh				
	CBQ	iiiii	jjjjj				

where,

a = quantity of calls attempted

b = routing requests served without delay

c = expensive route acceptances

d = network call standard blocking

e = not defined (all zeros)

f = quantity of calls refusing expensive routes

g = quantity of calls placed in OHQ (Note)

h = average time in OHQ (in units of 0.1 s)

i = quantity of CBQ calls (Note)

j = average time in CBQ (in units of 0.1 s)

x = network class of service group

Note: OHQ and/or CBQ information is printed only if the feature is equipped and activated.

TFN003 INCOMING TRUNK GROUP MEASUREMENTS

5.31 The Incoming Trunk Group (TFN003) measurements (Table 5-D) provide an indication of the incremental traffic that was imposed on incoming trunk groups by the network queuing features. Data are provided for each incoming or 2-way trunk group that is offered OHQ, CCBQ or CBQCM. These measurements are available at SL-1 Node and SL-1 Main switches.

5.32 Quantity of Calls Placed in OHQ. This measurement identifies the number of incoming trunk calls that were placed in the OHQ for possible connection to another trunk group.

5.33 Average Time in OHQ. This measurement reflects the average time (in units of 0.1 s) that calls waited in the OHQ for a trunk to become available. The average time includes those calls that were removed from the OHQ by caller abandonment or were removed from the queue after expiration of the OHQ time limit.

5.34 Quantity of Incoming Calls Offered CCBQ or CBQCM. This measurement identifies the number of incoming trunk calls that were blocked at the SL-1 Node and the user was given the option of accepting an SL-1 Node initiated callback when facilities become available. The measurement relates to use of the CBQ feature by users at an SL-1 Main (Coordinated Call-Back Queuing) or Conventional Main (Call-Back Queuing for Conventional Mains).

5.35 Quantity of Calls Accepting CCBQ or CBQCM. This measurement identifies the number of incoming trunk calls that were blocked at the SL-1 Node, were offered CBQ and accepted the offer. The count relates to CBQ acceptances by users at an SL-1 Main or Conventional Main.

5.36 Average Time in CBQ. This measurement (expressed in units of 0.1 s) reflects the average time that users at an SL-1 Main or Conventional Main remained in the CBQ (at the SL-1 Node) for a facility to become available.

> **Note 1:** When a CCBQ callback is offered to a busy station at an SL-1 Main, the call is removed from the queue for 5 minutes then reinserted in the queue. This process occurs only once. The additional queuing time is added to the average time. The 5 minute suspension time is not included in the average time, nor is reinsertion into the queue pegged as another CBQ call.
>
> **Note 2:** When a CBQCM callback is offered to a station at a Conventional Main that is busy or fails to answer the callback, the call is removed from the queue and reinserted into the queue as specified in Note 1.

5.37 Quantity of Calls Blocked in Callback. This measurement identifies the number of CBQ callbacks (CCBQ or CBQCM) initiated by the SL-1 Node that could not be completed because an outgoing trunk group (to the SL-1 Main or Conventional Main) was not available.

5.38 Callback Attempts No Answer and Cancellation. This measurement identifies the number of callback attempts that were not successful because the caller failed to answer the callback. CBQ callbacks to a station at an SL-1 Main that has previously cancelled CBQ are treated as callback attempts no answer.

Table 5-D
TFN003 INCOMING TRUNK GROUP - FORMAT

System ID TFN003

Customer Number

TRKG xxx
OHQ aaaaa bbbbb
CBQ ccccc ddddd eeeee fffff ggggg

where,

a = quantity of calls placed in OHQ

b = average time in OHQ (in units of 0.1 s)

c = quantity of incoming calls offered CBQ (CCBQ or CBQCM)

d = quantity of calls accepting CBQ offer (CCBQ or CBQCM)

e = average time in CBQ (in units of 0.1 s)

f = quantity of blocked CBQ callbacks (CCBQ or CBQCM)

g = quantity of callback attempts not answered or cancelled

x = incoming trunk group number (0 to 127)

TFN101 OHQ OVERFLOW THRESHOLD

5.39 The Off-Hook Queue (OHQ) overflow threshold measurement provides an indication that more than the expected number of users are timing out in the OHQ. This means that OHQ is offered and accepted but a trunk does not become available before the service-changeable OHQ time limit expires. This could result from trunks being out of service, an incorrectly defined OHQ time limit or temporary traffic overload.

5.40 OHQ Overflow Threshold Format.

System ID TFN101
Customer Number

OHQT aaaaa bbbbb

where,

aaaaa = the number of OHQ calls which timed out (overflowed) in the OHQ before an available trunk was found.

bbbbb = the threshold. This value (expressed in units of 0.1 percent) represents the total number of OHQ overflow, divided by the total number of OHQ offers plus the OHQ overflows.

6. THRESHOLD VIOLATION OUTPUTS

6.01 The outputs described here are given only when threshold levels are exceeded. The measurements are checked against the threshold levels and the specified traffic schedule for that system or customer. Threshold violations trigger the associated system and customer measurements to be output, whether or not these measurements are scheduled to be output. Not setting a threshold is equivalent to setting it to zero and may result in an exception report.

TFS101 DIAL TONE SPEED

6.02 A threshold level set on the percentage of all calls that experience dial tone delay in excess of 3 s expressed in units of 0.1%. Also output when a threshold violation occurs are:

- TFS002 - Services
- TFS003 - Dial Tone Delay
- TFS004 - Processor Load.

6.03 Dial Tone Speed Threshold Format.

System ID TFS101

(Percent Dial Tone Delay) (Threshold)

6.04 Example.

200 TFS101

00017 00015

TFS102 LOOP TRAFFIC

6.05 This is a threshold level, expressed in CCS, set on the loop usage per measurement period. Also output when a threshold violation occurs is TFS001, Networks. The threshold is set for all loops and cannot be set on a loop basis.

6.06 Loop Traffic Threshold Format.

System ID TFS102

(Loop Number) (Loop Usage) (Threshold)

6.07 Example.

220 TFS102

01 0000550 00450

TFS105 JUNCTOR TRAFFIC

6.08 This is the threshold level, expressed in CCS, set on the junctor usage per measurement period. When the junctor traffic threshold is exceeded, TFS007 Junctor Traffic is printed. The threshold is same for all junctor groups and cannot be set on a junctor group basis.

6.09 Junctor Traffic Threshold Format.

System ID TFS105

(Junctor Group) (Junctor Usage) (Threshold)

6.10 Example.

222 TFS105

13 0002341 0002000

TFC101 INCOMING MATCHING LOSS

6.11 This is a threshold level set on the percentage of incoming calls where a failure to match occurs while attempting to set up a connection between an incoming trunk and a called line or the attendant, or the attendant fails to extend the call due to a failure to match. It is expressed in units of 0.1%. Also output when a threshold violation occurs is TFS001, Networks.

> **Note:** When an incoming call is not presented to an attendant due to a failure to match, it is included in the Incoming Matching Loss (IML) figure but it is not necessarily lost. The call is placed in the attendant queue and regular attempts are made to present it to an attendant when the network permits. A call contributes at most one failure to match count to the IML measurement regardless of further failures to complete due to failures to match.

6.12 Incoming Matching Loss Threshold Format.

System ID TFC101

Customer Number

(Incoming Matching Loss) (Threshold)

6.13 Example.

200 TFC101

00

00014 00010

TFC102 OUTGOING MATCHING LOSS

6.14 This is a threshold level set on the percentage of outgoing calls where a failure to match occurs while attempting to set up a connection between a line equipment and an outgoing trunk. It is expressed in units of 0.1%. Also output when a threshold violation occurs is TFS001, Networks. Each outgoing call can be pegged only once for outgoing matching loss.

6.15 Outgoing Matching Loss Threshold Format.

System ID TFC102

Customer Number

(Outgoing Matching Loss) (Threshold)

6.16 Example.

200 TFC102

02

00014 00010

TFC103 AVERAGE SPEED OF ANSWER

6.17 This is a threshold level set on the average time, in units of 0.1 s, that calls wait to be answered by the attendant. Also output when a threshold violation occurs are TFC003, Queue, and TFC004, Console.

6.18 Speed of Answer Threshold Format.

System ID TFC103

Customer Number

(Average Speed of Answer) (Threshold)

6.19 Example.

200 TFC103

00

00152 00120

TFC104 PERCENT ALL TRUNKS BUSY

6.20 This is a threshold level set on the percentage of trunk connections where the last trunk in a trunk group is made busy. It is expressed in units of 0.1%. The All Trunks Busy measurement is only made for trunk groups that have more than one member. The equation for calculating this threshold is:

All Trunks Busy Peg Count/(Successful Calls + Overflows)

> **Note:** Successful calls are defined as those that have been answered or reached the established state. All calls except outgoing trunk calls are considered successful as soon as they are answered. Outgoing trunk calls are considered successful only when the End-Of-Dialing (EOD) timer has expired or an octothorpe (#) has been dialed to force an end of dialing.

6.21 Percent All Trunks Busy Threshold Format.

System ID TFC104

Customer Number

Trunk Group

(All Trunks Busy) (Threshold)

6.22 Example.

200 TFC104

02

04

00024 00017

6.00 TRAFFIC MEASUREMENT OUTPUTS - OVERVIEW

GENERAL

6.01 Traffic data available for output are:

System Measurements - Accumulated on a system basis.
Customer Measurements - Accumulated on a per customer basis.
System Threshold Violations - Tests on system measurements.
Customer Thresholds Violations - Tests on customer measurements.

Schedules for each type of measurement can be defined independently.

SYSTEM MEASUREMENTS

6.02 System measurements are identified by the prefix TFS. The 3-digit code following the prefix identifies the type of measurement.

CODE	DESCRIPTION
TFS001	Networks (per loop)
TFS002	Services
TFS003	Dial Tone Delay
TFS004	Processor Load
TFS005	Lines
TFS007	Junctor Group Traffic (not applicable for ST/NT because 1 group system)

CUSTOMER MEASUREMENTS

6.03 Customer measurements are identified by the prefix TFC. The 3-digit code following the prefix identifies the type of measurement.

CODE	DESCRIPTION
TFC001	Networks (per customer)
TFC002	Trunks
TFC003	Queue
TFC004	Console
TFC005	Features
TFC006	ARS and Ring Again (not applicable for VII software)

6.04 Feature measurements can only be made on one customer at a time for a given system because only one holding area is provided. This customer must be pre-specified in the manner explained in 11.23.

THRESHOLD VIOLATION MEASUREMENTS

6.05 System threshold levels can be set for:

a) Dial Tone Speed - Failure to provide dial tone to a set within 3 seconds of the system recognizing the seizure of the line. Expressed as a percentage of total dial tone requests in units of 0.1%.

b) Loop Traffic - The network loop usage per hour. Expressed in ccs.

c) Junctor Traffic - The junctor group usage per hour. Expressed in ccs.

6.06 Customer Threshold levels can be set for:

a) Incoming Matching Loss - Failure to match while attempting to set up a connection between an incoming trunk and an idle called line. Expressed as a percentage of total incoming connections in units of 0.1%. Not significant beyond Release 11.2

b) Outgoing Matching Loss - Failure to match while attempting to set up a connection between a line equipment and an idle outgoing trunk. Expressed as a percentage of total outgoing connections in units of 0.1%.

c) Average Speed of Answer - Average time in units of 0.1 seconds that calls wait to be answered by the attendant.

d) Percent Last Trunk Busy -Last enabled trunk in a trunk group is made busy (incoming or outgoing). Expressed as a percentage of the total trunk connections in units of 0.1%.

6.07 The threshold levels are set when the measurement requirements are input to the system from a TTY. Part 11 describes how thresholds are set and Part 8 shows the format of the outputs.

LINE TRAFFIC MEASUREMENT

6.08 For each network loop a special set of lines and/or trunks may be defined. Beside the normal traffic measurements additional peg and usage measurements are made for this set of terminals. Lines and/or trunks to be included in this set are given the ITM (Individual Traffic Measurement) class of service and may be defined to the system via the Traffic Control Overlay Program. See Part 11.16. Attendants may not be given the ITM class of service.

7. MEASUREMENT VERIFICATION

7.01 A number of cross-reference checks may be made to verify the traffic data. Certain of the verifications given here contain a tolerance (e.g., ±15%). This is because there are a number of cases where a path is reserved but never actually used or is used but is neither a tone and digit loop connection nor a part of a completed call under the definition of TFC001. In these cases TFS001 usage is accumulated as the time slots involved are considered occupied, however, no usage is accumulated in either TFC001 or TFS002, e.g.:

(a) Ring - No answer. A path is reserved between the two terminals, but never used.

(b) Call waiting - Abandoned. Again a path is reserved, but not used.

TFS001 AND TFC001

7.02 The sum of TFS001 usages on all terminal loops, minus the sum of TFS001 usages on tone and digit loops should equal twice the sum of all TFC001 usages for all customers ±25%.

TFC001 AND TFC002

7.03 For each customer the following figures should be within ±2%:

- TFC001, outgoing usage should equal TFC002, outgoing trunk usages for all groups
- TFC001, outgoing peg count should equal TFC002, the sum of all outgoing trunk peg counts for all groups
- TFC001, incoming usage should equal TFC002, the sum of all incoming trunks usages for all groups
- TFC001, incoming peg count should equal TFC002, the sum of all incoming trunk peg counts for all groups.

TFS001 AND TFS002

7.04 The following figures should be equal within ±15%:

- TFS001, the sum of loop failure to match over all TDS loops should equal TFS002, the sum of failure to match over all services except Digitone receiver and conference loops
- TFS001, the sum of loop usage over all TFS loops should equal TFS002, the sum of service usage over all services except Digitone receiver and conference
- TFS001, the sum of loop peg over all TDS loops should equal TFS002, the sum of service peg over all services except Digitone receiver and conference.

7.05 The following figures should be within ±2%:

- TFS001, the sum of loop failure to match over all conference loops should equal TFS002, failure to match - conference only
- TFS001, the sum of loop usage over all conference loops should equal TFS002, service usage - conference only

- TFS001, the sum of loop peg over all conference loops should equal TFS002, service peg - conference only.

8. COMMUNICATING WITH SYSTEM

8.01 The Traffic Control overlay program (Program 02) is used when any of the following tasks are to be performed:

- Query system ID, system time-of-day, traffic schedules, traffic options or threshold levels
- Set system ID
- Set system time-of-day
- Change system or customer traffic measurement schedules
- Change traffic options
- Change threshold levels
- Access traffic data in the holding registers.

ACCESSING THE SYSTEM

8.02 All inputs to the system are made via the teletypewriter (TTY). When the Traffic Control program is loaded, the appropriate commands are input. Should an error or invalid data be input, the system returns an error message (Table 8-C). When the task has been completed, the Traffic Control program must be aborted and a background overlay program loaded. Maintenance personnel should be notified when the system fails to provide the correct responses.

COMMANDS

8.03 There are four types of commands, each type identified by the command's first letter. The command types are:

(a) **T Commands.** Used to query schedules, etc. When these commands are input the system automatically outputs a response, i.e., RETURN does not need to be depressed.

(b) **S Commands.** Used to set schedules, etc. These commands are in three parts: an S command name input by the user; a response output by the system; and a second input by the user. When the S command is input, the system responds automatically with the data asked for and then outputs a double dash (--). If the data is to be changed, the change is keyed in immediately following this prompt. If no changes are necessary, the user depresses the RETURN key.

(c) **C Commands.** Used to remove or clear an option. The format is similar to that of the corresponding S command.

(d) **I Commands.** Used to access data in the holding register. The data is output immediately.

8.04 Note the following points:

(a) The data fields are separated by a space. No other delimiter is necessary and no space is needed following a command name.

(b) The last parameter of the line may be followed by a carriage return which acts as a delimiter as well as terminating the command.

(c) A period (.) prompt indicates that the system is ready to receive a new command from the teletypewriter.

(d) A double dash (--) prompt is output after an S or C command and indicates that the system is now ready to receive data.

(e) An asterisk (*) in the command definition indicates that the carriage return should be depressed.

(f) In this practice, the commands input by the user are written in upper case and the system responses are written in lower case.

(g) Table 8-C gives a listing of error messages that can be output while using the Traffic Control program.

Abbreviations

8.05 The following abbreviations are used to define the various data fields within a traffic measurement command.

sh = start hour
eh = end hour
sd = start day
ed = end day
sm = start month
em = end month
so = schedule options
tc = threshold codes
tv = threshold values.

TRAFFIC MEASUREMENT SCHEDULES

8.06 Traffic measurement schedules can be set independently for system and customer measurements. The schedule options are:

0 - No traffic scheduled

1 - Hourly, on the hour

2 - Hourly, on the half-hour

3 - Half-hourly, on the hour and half-hour.

8.07 A schedule period runs from the start hour of the start day to the end hour of the end day, only on the days of the week specified.

8.08 The start day, the start month, the end day and the end month are numerical representations of the date. For example, August 17 is entered as 17 8. The days of the week are specified as follows:

1 = Sunday

2 = Monday

3 = Tuesday

4 = Wednesday

5 = Thursday

6 = Friday

7 = Saturday.

8.09 The start hour and stop hour codes are 1 or 2-digit numbers based on the 24 h clock (i.e., 1:00 p.m. is entered as 13). No half-hour start or stop hours are possible. Data is output at all scheduled times within the time period including the start and stop hours.

8.10 Query System Traffic Measurement Schedule. The input command structure used to query the system traffic measurement schedule is:

TSHS (sd) (sm) (ed) (em)
(sh) (eh) (so)
(d)

Example:

.TSHS 25 4 16 7
12 21 2
2 3 4 5 6
.

8.11 Set System Traffic Measurement Schedule. The input command format used to set the system traffic measurement schedule is:

SSHS (sd) (sm) (ed) (em) -- (SD) (SM) (ED) EM)
(sh) (eh) (so) -- (SH) (EH) (SO)
(d) -- (D)

Note: To clear the schedule enter 0.

Example:

.SSHS 25 4 16 7 -- 1 10 1 12
12 21 2 -- 0 23 1
2 3 4 5 6 -- 1 7
.

8.12 Query Customer Traffic Measurement Schedule. The format of the command used to query a customer schedule is:

TSHC (CUSTOMER) (sd) (sm) (ed) (em)
(sh) (eh) (so)
(d)

Example:

.TSHC 0 16 7 12 5
12 21 2
2 3 4
.

8.13 Set Customer Traffic Measurement Schedule. The format of the command to set a customer schedule is:

SSHC (CUSTOMER) (sd) (sm) (ed) (em) -- (SD) (SM) (ED) (EM)
(sh) (eh) (so) -- (SH) (EH) (SO)
(d) -- (D)

Note: To clear the schedule enter 0.

Example:

```
.SSHC 0 16 7 14 5 -- 1 6 12 6
12 21 3 -- 0 23 3
2 3 4 5 6 -- 1
.
```

TRAFFIC MEASUREMENT OPTIONS

8.14 System Measurement Options. The system measurement options are:

Option 1 - Networks (per loop)

Option 2 - Services

Option 3 - Dial Tone Delay

Option 4 - Processor Load

Option 5 - Lines

Option 7 - Junctor Group Traffic.

8.15 Customer Measurement Options. The customer measurement options are:

Option 1 - Networks (per customer)

Option 2 - Trunks

Option 3 - Queue

Option 4 - Attendant Console

Option 5 - Features

Option 6 - ARSQ/RGA (not applicable in X11)

Option 8 - Integrated Messaging System and Integrated Voice Messaging System.

Note: If no options are currently set, NIL is output by the system. If option 5 is to be set for a customer then the customer must be defined via command SCFT.

8.16 Network Measurement Options. The network measurement options (set on a customer basis) are:

Option 1 - Route List Measurements

Option 2 - Network Class-of-Service Measurements

Option 3 - Incoming Trunk Group Measurements.

8.17 Query System Traffic Measurement Options. The format of this command is:

TOPS (options)

Example:

.TOPS 3 5
.

8.18 Set System Traffic Measurement Options. The format for this command is:

SOPS (options) -- (OPTIONS)

Example:

.SOPS 3 5 -- 2
.

8.19 Clear System Traffic Measurement Options. The format for this command is:

COPS (options) -- (OPTIONS)

Example:

.COPS 2 3 5 -- 3
.

8.20 Query Customer Traffic Measurement Options. The input format for this command is:

TOPC (CUSTOMER) (options)

Example:

.TOPC 0 4 5
.

8.21 Set Customer Traffic Measurement Options. The input format for this command is:

SOPC (CUSTOMER) (options) -- (OPTIONS)

Example:

.SOPC 0 4 5 -- 1
.

8.22 Clear Customer Traffic Measurement Options. The input format for this command is:

COPC (CUSTOMER) (options) -- (OPTIONS)*

Example:

.COPC 0 1 4 5 -- 4 5
.

8.23 Set Customer Network Traffic Options. The input command structure used to set the network traffic options is as follows:

SOPN (CUSTOMER) (options) -- (OPTIONS)

Example:

.SOPN 0 2 -- 1
.

8.24 Query Customer Network Traffic Options. Use the following command to query the network traffic options:

TOPN (CUSTOMER) (options)

Example:

.TOPN 0 1 2
.

8.25 Clear Customer Network Traffic Options. Use this command to clear the network traffic options:

COPN (CUSTOMER) (options) -- (OPTIONS)

Example:

.COPN 0 1 2 -- 1
.

THRESHOLDS

8.26 Threshold levels can be queried or set for the system or for each customer. The system thresholds with their respective codes and ranges of values are given in Table 8-A. The customer thresholds with their respective codes and ranges of values are given in Table 8-B.

Table 8-A
SYSTEM THRESHOLDS

CODE	MEASUREMENT	RANGE
1	Dial Tone Speed	00.0% to 99.9%
2	Loop Traffic	000 to 999 CCS
3	Junctor Group Traffic	0000 to 9999 CCS

Table 8-B
CUSTOMER THRESHOLDS

CODE	MEASUREMENT	RANGE
1	Incoming Matching Loss	00.0% to 99.9%
2	Outgoing Matching Loss	00.0% to 99.9%
3	Average Speed of Answer	00.0 to 99.9 s
4	Percent All Trunks Busy	00.0% to 99.9%
5	Percent OHQ Overflow	00.0% to 99.9%

8.27 Query System Threshold Level. The input format for this command is:

TTHS (TC) (tv)

Example:

.TTHS 1 015

8.28 Set System Threshold Value. The format for this command is:

STHS (TC) (tv) -- (TV)

Example:

.STHS 1 020 -- 015

8.29 Query Customer Threshold Value. This command format is:

TTHC (CUSTOMER) (TC) (tv)

Example:

.TTHC 0 2 10

8.30 Set Customer Threshold Value. The command format is:

STHC (CUSTOMER) (TC) (tv) -- (TV)

Example:

.STHC 0 2 10 -- 12

LINE TRAFFIC TERMINALS

8.31 These commands are used to query and change the Individual Traffic Measurement (ITM) class-of-service for given Terminal Numbers (TN). SL-1, 500/2500-type or trunk terminals can have this class-of-service. Terminals with ITM set are included in the groups for which Line Traffic Measurements ae recorded.

8.32 Query Line Traffic TN. The format for this command is:

TITM
(tn)
(tn)
(tn)
etc.

Note: If only the loop number is printed, it means that all equipped terminals have ITM set. If only the loop and shelf numbers only are printed, it means that all equipped terminals on the specified shelf have ITM set. If the loop, shelf and card numbers are printed, it means that all equipped terminals on the specified card have ITM set.

Example:

.TITM
SHELF 04 0
LOOP 05
TN 11 3 4 1
CARD 13 2 1
TN 15 1 2 0

8.33 Set Line Traffic TNs. The format for this command is:

SITM
(tn)
(tn)
(tn)
etc.
-- (TN)
-- (TN)
-- (TN)
-- *

Note 1: If only the loop number is entered and RETURN is depressed, it requests that all equipped TNs on the specified loop have ITM set.

Note 2: If only the loop and shelf numbers are entered and RETURN is depressed, it requests that all equipped TNs on the specified shelf have ITM set.

Note 3: If the loop, shelf and card numbers are entered and RETURN is depressed, it requests that all equipped TNs on the specified card have ITM set.

Note 4: If the loop, shelf, card and unit numbers are entered, it requests that the given terminal has ITM set.

Note 5: If ALL is entered, this sets ITM for all equipped TNs in the entire system.

Example:

```
.SITM
SHELF 04 1
LOOP  05
TN    11 3 4 1
CARD  19 1 1
-- 07
-- 06 1
--
.
```

8.34 Clear Line Traffic TNs. The format for this command, CITM, is exactly the same as for command SITM except that the ITM class of service is removed from the terminals specified.

TIME-OF-DAY

8.35 Query System Time of Day. The command format is:

TTAD (day) (month) (year) (hour) (minute) (second)

Example:

```
.TTAD WED 24 11 1976 15 41 49
.
```

8.36 Set The Time of Day and the Date. The command format is:

STAD (DAY) (MONTH) (YEAR) (HOUR) (MINUTE) (SECOND)

Example:

```
.STAD 28 12 1975 11 15 47
.
```

Note 1: Except for the year, the other entries in the time-of-day output are 2-digit numbers. The year may be any year from 1901 to 2099 inclusive. It may be input as a full 4-digit field or as a 2-digit short form. The 2-digit short form is assumed to be in the range 1976 to 2075 and the appropriate addition is made when calculating the day-of-week and leap years.

Note 2: The time-of-day printed is the present time-of-day, not the time-of-day that traffic data was last collected into the holding registers.

Note 3: When the date is defined via the STAD command, the system calculates the correct day of the week. This is then printed with future TTAD commands and is used to check the "days of the week" portions of the schedules.

Time-of-Day Adjustment

8.37 The time-of-day can be adjusted from 0 to ± 60 s in increments of 100 ms. The increment is prefixed with the digit 1 for positive and 0 for negative increment. The commands for time-of-day adjustments are:

8.38 Query The Time-Of-Day Adjustment.

TDTA (adjustment)

Example:

.TDTA 0 12
.

8.39 Set System Time-Of-Day Adjustment.

SDTA (adjustment) -- (ADJUSTMENT)

Example:

.SDTA 0 12 -- 1 142
.

ACCESSING DATA IN HOLDING REGISTERS

8.40 Data held in the holding registers can be output immediately and/or tested against threshold values. The data is accumulated over the previous measurement period. Data in the accumulating registers is not accessible.

8.41 Both the system and the customer traffic measurement data can be printed immediately. The data is output from the holding registers and is that data which was collected the last time the relevant traffic was scheduled.

8.42 Invoke System Traffic Data. The following command is used to invoke the immediate printing of system traffic data:

INVS (OPTIONS)

Example:

.INVS 1 3
.

8.43 Invoke Customer Traffic Data. Use the following command to invoke immediate printing of customer traffic data:

INVC (CUSTOMER) (OPTIONS)

Example:

.INVC 0 1 3
.

8.44 Invoke Customer Network Traffic Data. Use the following command to invoke immediate printing of customer network traffic data:

INVN (CUSTOMER) (OPTIONS)

Example:

.INVN 0 2
.

8.45 The threshold tests are for the system and/or customer thresholds. When an invoked threshold test passes, OK is output.

8.46 Invoke System Threshold Tests. The command format is:

ITHS (THRESHOLD CODES)

Example:

.ITHS 1 2
.

8.47 Invoke Customer Threshold Tests. The command format is:

ITHC (CUSTOMER) (THRESHOLD CODES)

Example:

.ITHC 0 1 3
.

CUSTOMER WITH FEATURE MEASUREMENTS

8.48 Query Customer Set For Features Measurements. The format for this command is:

TCFT (customer)

Example:

.TCFT 2
.

8.49 Set Customer To Receive Feature Measurements. The format for this command is:

SCFT (customer) -- (CUSTOMER NUMBER)

Example:

.SCFT 2 -- 1
.

SYSTEM IDENTIFICATION

8.50 Each SL-1 system has a unique system ID number selected from 000 to 999. The 3-digit ID number can be queried or set by the following commands.

8.51 Query System Identification. The command format is:

TSID (system identification number)

Example:

.TSID 213
.

8.52 Set System Identification. The command format is:

SSID (system id number) -- (SYSTEM ID NUMBER)

Example:

.SSID 213 -- 216
.

IDLE TITLES

8.53 The IDLT command is used to suppress the printing of the title (i.e., TFS000) and the date and time in cases where traffic measurement is scheduled but no other data is printed. There are two options:

0 - No title will be printed unless further data is also to be printed.

1 - The title will be printed whenever traffic measurement is scheduled even when no other data is to be automatically printed.

8.54 The default option is 1, i.e., the title is normally printed. The format of the command is:

IDLT (option)

Example:

.IDLT 0
.

ARS QUEUING

8.55 Query ARSQ Code Options. The command format is:

TACC (CUSTOMER) (options)

Example:

.TACC 2 0 2 3
.

8.56 Set ARSQ Code Options. The command format is:

SACC (CUSTOMER) (options) -- (OPTIONS)*

Example:

.SACC 2 0 2 3 -- 1
.

8.57 Clear ARSQ Code Options. The command format is:

CACC (CUSTOMER) (options) -- (OPTIONS)*

Example:

.CACC 2 0 2 3 -- 2 3
.

8.58 Accessing data in ARSQ code holding registers. The command format is:

IACC (CUSTOMER) -- (OPTIONS)*

Example:

.IACC 2 -- 0 1 2 3
.

ARS ROUTINGS

8.59 The Set/Clear/Invoke commands for Routings differ from other TFC commands in that the system will accept, at most, 12 entries per line. As the number of Routings for a customer can reach 255, the system will automatically go to a new line and prompt the user for further options. Depressing the carriage return terminates further prompting.

8.60 Query Routing Options. The command format is:

TSBC (CUSTOMER) (options)

Example:

.TSBC 3 1 2 7 10 11
.

8.61 Set Routing Options. The command format is:

SSBC (CUSTOMER) (options) -- (OPTIONS)*

Example:

.SSBC 3 1 2 7 10 11 -- 4 5
.

8.62 Clear Routing Options. The command format is:

CSBC (CUSTOMER) (options) -- (OPTIONS)*

Example:

.CSBC 3 1 2 7 10 11 -- 1 7 11
.

8.63 Accessing data in Routing holding registers. The command format is:

ISBC (CUSTOMER) -- (OPTIONS)*

Example:

.ISBC 3 -- 1 2 3 4 5 6 7 8 9 10 11 12
-- 20 21 22 23 24 25 26 27 28 29 30 31 32
-- 41 42
.

Table 8-C
TRAFFIC MEASUREMENT ERROR MESSAGES

ERROR MESSAGE	INTERPRETATION
TFC200	Syntax. Illegal character has been input.
TFC201	The parameter specified is out of range.
TFC202	The loop specified is not equipped.
TFC203	The card specified is not equipped.
TFC204	The unit specified is not equipped.
TFC205	Program bug - should never happen.
TFC206	Customer specified is not equipped.
TFC207	Traffic Print program is busy with scheduled output.
TFC208	Traffic Control program cannot be invoked from an SL-1 maintenance set.
TFC209	ARST package unavailable.
TFC209	The Network Traffic (NTRF) feature is not equipped (Generic X11).
TFC210	ARS unequipped for customer.
TFC210	There is no ESN customer data block (Generic X11).
TFC211	Traffic block does not exist.
TFC211	There is no ESN Data for the requested item (Generic X11).
TFC212	The NCOS data block does not exist in the system (Generic X11).
TFC213	IMS package not equipped.
TFC213	Password does not have access to this customer data (Generic X08).
TFC214	Password does not have access to system commands (Generic X08).
TFN401	Routing control has been invoked from an attendant console; the time (hh mm ss) and termination number (TN) of the console are included in the message.

Table 8-C Continued
TRAFFIC MEASUREMENT ERROR MESSAGES

ERROR MESSAGE	INTERPRETATION
TFN402	Routing control has been deactivated from an attendant console; the time and TN of the console are included in the message.