

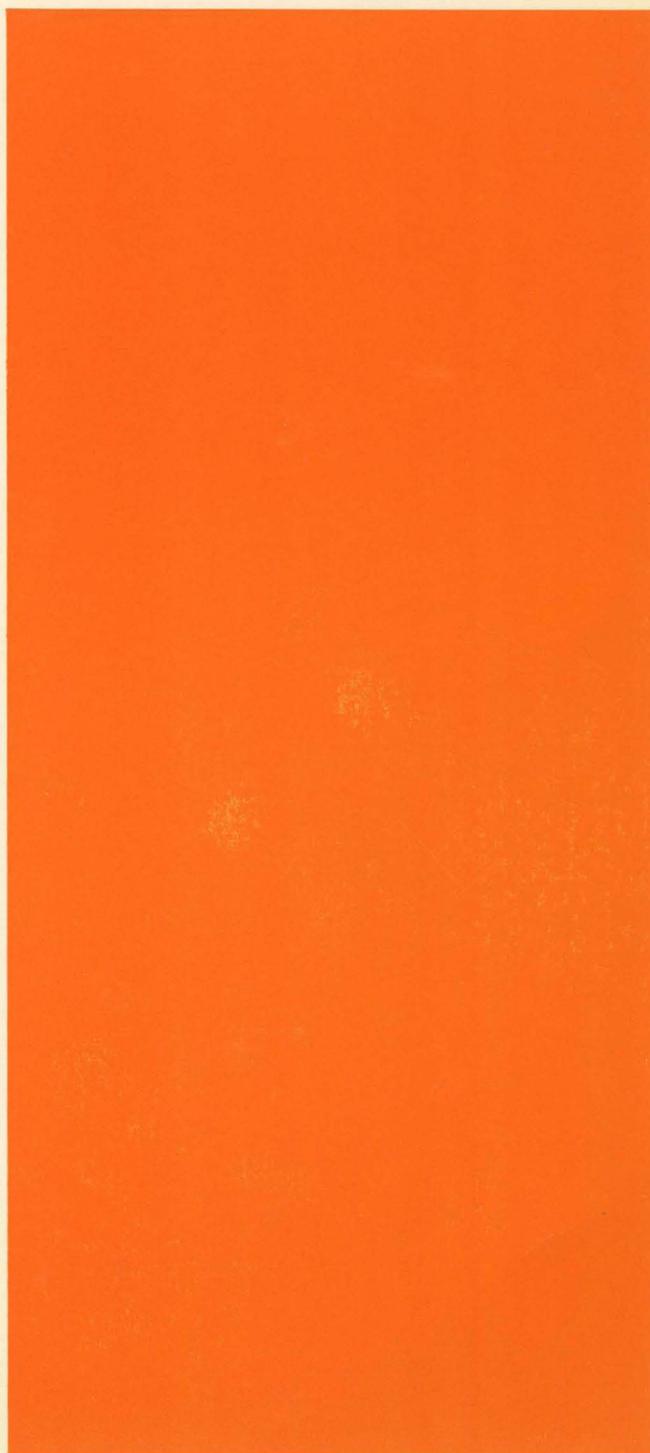
Honeywell

REMOTE TERMINAL SUPERVISOR
(GRTS)

SERIES 60(LEVEL 66)/6000

GCOS

SOFTWARE



Honeywell

REMOTE TERMINAL SUPERVISOR (GRTS)

SERIES 60(LEVEL 66)/6000

GCOS

SUBJECT:

Describes the Remote Terminal Supervisor System Operation, Programming Procedures, Remote Computer Terminal Interface and System Hardware Configuration.

SPECIAL INSTRUCTIONS:

This manual replaces Remote Terminal System (GRTS), Order No. DA79 for Series 6000 System users. Order No. DA79 must be used by Series 600 System users and by Series 6000 System users who are on prior software releases.

INCLUDES UPDATE PAGES ISSUED AS ADDENDUM A IN MARCH 1975.
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SOFTWARE SUPPORTED:

Series 60 Level 66 Software Release 2
Series 6000 Software Release H

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DD40, Rev. 0

PREFACE

The following mnemonic and nomenclature conventions are used in this manual:

GRTS - Remote Terminal Supervisor; equally applicable to GRTS/305, GRTS/355 and GRTS/6600 unless otherwise stated.

FNP - Front-End Network Processor; equally applicable to the DATANET 305 FNP, the DATANET 355 FNP and the DATANET 6600 FNP unless otherwise stated.

RNP - Remote Network Processor; number following designates software package.

GCOS - Comprehensive Operating Supervisor; the executive software in the central system.

Central system or Central processor - equally applicable to the Honeywell Series 6000 and Honeywell Series 60 Level 66 information processing systems, unless stated otherwise.

Control program - the specific Remote Terminal Supervisor (GRTS) software used with the appropriate Front-End Network Processor (FNP), i.e.,

GRTS/30 for DATANET 30 FNP
GRTS/305 for DATANET 305 FNP
GRTS/355 for DATANET 355 FNP
GRTS/6600 for DATANET 6600 FNP

GRTS/115 - the software modules of the overall Supervisor (GRTS) that reside in the Honeywell G-115 computer when configured as a remote terminal.

GRTS/central system - the software modules of the overall Supervisor (GRTS) that reside in the central system for interface with the configured FNP.

The Series 60 level 66 is hereafter referred to as the Series 60. The information in the manual refers to both Series 6000 and Series 60, unless otherwise specifically stated.

FUNCTIONAL LISTING OF PUBLICATIONS
for
SERIES 60 (LEVEL 66) and SERIES 6000 SYSTEMS

FUNCTION	APPLICABLE REFERENCE MANUAL	ORDER NO.
	<u>TITLE</u>	
	Series 60 (Level 66)/Series 6000:	
Hardware reference:		
Series 60 Level 66 System	Series 60 Level 66 Summary Description	DC64
Series 6000 System	Series 6000 Summary Description	DA48
DATANET 355 Processor	DATANET 355 Systems Manual	BS03
DATANET 6600 Processor	DATANET 6600 Systems Manual	DC88
Operating system:		
Basic Operating System	General Comprehensive Operating Supervisor (GCOS)	DD19
Job Control Language	Control Cards Reference Manual	DD31
Table Definitions	System Tables	DD14
I/O Via MME GEINOS	I/O Programming	DB82
System initialization:		
System Startup	System Startup	DD33
System Operation	System Operation Techniques	DD50
Communications System	GRTS/355 and GRTS/6600 Startup Procedures	DD05
Communications System	NPS Startup	DD51
DSS180 Subsystem Startup	DSS180 Startup	DD34
Data management:		
File System	File Management Supervisor	DD45
Integrated Data Store (I-D-S)	I-D-S/I Programmer's Guide	DC52
Integrated Data Store (I-D-S)	I-D-S/I User's Guide	DC53
File Processing	Indexed Sequential Processor	DD38
File Input/Output	File and Record Control	DD07
File Input/Output	Unified File Access System (UFAS) (Series 60 only)	DC89
I-D-S Data Query System	I-D-S Data Query System Installation	DD47
I-D-S Data Query System	I-D-S Data Query System User's Guide	DD46
Program maintenance:		
Object Program	Source and Object Library Editor	DD06
System Editing	System Library Editor	DD30
Test system:		
Online Test Program	Total Online Test System (TOLTS)	DD39
Test Descriptions	Total Online Test System (TOLTS) Test Pages	DD49
Error Analysis and Logging	Honeywell Error Analysis and Logging System (HEALS)	DD44
Language processors:		
Macro Assembly Language	Macro Assembler Program	DD08
COBOL-68 Language	COBOL	DD25
COBOL-68 Usage	COBOL User's Guide	DD26
JOVIAL Language	JOVIAL	DD23
FORTTRAN Language	FORTTRAN	DD02
Generators:		
Sorting	Sort/Merge Program	DD09
Merging	Sort/Merge Program	DD09

FUNCTION

APPLICABLE REFERENCE MANUAL

ORDER
NO.

	<u>TITLE</u>	
	Series 60 (Level 66)/Series 6000:	
Simulators:		
DATANET 355/6600 Simulation	DATANET 355/6600 Simulator	DD32
Service and utility routines:		
Loader	General Loader	DD10
Utility Programs	Utility	DD12
Utility Programs	UTL2 Utility Routine (Series 60 only)	DC91
Media Conversion	Bulk Media Conversion	DD11
System Accounting	Summary Edit Program	DD24
FORTTRAN	FORTTRAN Subroutine Libraries	DD20
FNP Loader	DATANET 355/6600 Relocatable Loader	DD35
Service Routines	Service Routines	DD42
Software Debugging	Debug and Trace Routines	DD43
Time Sharing systems:		
Operating System	TSS General Information	DD22
System Programming	TSS Terminal/Batch Interface	DD21
System Programming	TSS System Programmer's Reference Manual	DD17
BASIC Language	Time Sharing BASIC	DD16
FORTTRAN Language	FORTTRAN	DD02
Text Editing	Time Sharing Text Editor	DD18
Remote communications:		
DATANET 30/305/355/6600 FNP	Remote Terminal Supervisor (GRTS)	DD40
DATANET 355/6600 FNP	Network Processing Supervisor (NPS)	DD48
DATANET 700 RNP	RNP/FNP Interface	DB92
Transaction processing:		
User's Procedures	Transaction Processing System User's Guide	DD41
Handbooks:		
System-operator communication	System Console Messages	DD13
Pocket guides:		
Control Card Formats	Control Cards and Abort Codes	DD04
FORTTRAN	FORTTRAN Pocket Guide	DD82

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SECTION I

REMOTE TERMINAL SUPERVISOR

The Remote Terminal Supervisor (GRTS) provides the communications capabilities for a Honeywell Series 6000 or a Series 60 Information Processing System operating under the General Comprehensive Operating Supervisor (GCOS). GRTS is an extension of GCOS that permits a variety of remote terminal devices - remote computer terminals, keyboard/display terminals, teleprinter terminals and others - to communicate with the central system via the DATANET Front-End Network Processors.

Each of the Front-End Network Processors (FNP) has its own GRTS control program.

- GRTS/30 in a DATANET 30 FNP
- GRTS/305 in a DATANET 305 FNP
- GRTS/355 in a DATANET 355 FNP
- GRTS/6600 in a DATANET 6600 FNP

This manual describes the programming of GRTS/305, GRTS/355, GRTS/6600 and GRTS/30 aspects that relate to the coexistence environment. Standard GRTS/30 programming procedures are described in the GRTS/30 Programming reference manual.

GRTS FUNCTIONS

Operating under the Remote Terminal Supervisor, a user at a remote computer terminal can perform such functions as:

1. Enter a job deck at a remote computer terminal for processing by the central system. The user may wait for the output or call back later to retrieve it.
2. Direct output to be printed or punched at the originating terminal, at another terminal, or at the central system.
3. Obtain the status of jobs in the central system.
4. Enter into direct, interactive communication with a user program executing in the central system.
5. Abort a file that is being output (by a console switch) or abort a job that has been input (via a GRTS control record).
6. Backspace an output operation.

Using a teleprinter or keyboard/display terminal, a user can enter into an interactive exchange of information with a direct access program (e.g. Time Sharing System, Transaction Processing System, etc.) executing in the central system. In this mode, the user communicates directly with the DAC program and GRTS assumes a passive role, passing messages back and forth between the DAC program and the terminal.

FRONT-END NETWORK PROCESSOR APPLICATIONS

Four Front-End Network Processors (FNP), each with its own operating system, are available for use with a central system. The communications requirements of the particular computer system determine which FNP should be used.

The FNPs and their applications are as follows:

- DATANET 30 - Medium size communications network - Series 6000
- DATANET 305 - Small-to-medium communications network - Series 6000
- DATANET 355 - Large communications network - Series 6000
- DATANET 6600 - Large communications network - Series 60 only

DATANET 30 FNP

The DATANET 30 FNP operates with the GRTS/30 control program to accommodate up to 128 narrow-band transmission lines in a medium size communications network. As the only FNP type interfacing with a single central system, the DATANET 30 FNP utilizes either the G30 or GT30 software programs. In a coexistence environment with other FNP types, the CX30 software package is required. (See Appendix D.)

The DATANET 30 FNP has 16K word memory, a Computer Interface Unit (CIU) for interfacing with the central system, and appropriate line buffers, data sets and patch plug options to interface with the configured terminals. Optional peripheral equipment includes a card reader and line printer. Note that configuring the maximum of 128 transmission lines may degrade system operation.

DATANET 305 FNP

Operating under the GRTS/305 control program, the DATANET 305 FNP serves the small-to-medium scale communications requirements of a central system. This system permits direct access operations for up to 20 teleprinter terminals (110-300 bps) if no other terminal types are configured. In a multi-type terminal network the maximum configuration is eight low-speed channels for teleprinters (up to 150 bps) plus three synchronous, half-duplex channels (2000 or 2400 bps) for remote batch terminals, plus two synchronous channels (up to 2400 bps) for keyboard/display terminals.

Up to 10 VIP controllers on a poll and select configured channel are accommodated. Each of these controllers can have a maximum of two display terminals. For a non-poll-and-select channel, a maximum of 32 controllers may be configured, however, for each case this number of terminals may degrade system operation.

The DATANET 305 FNP interfaces with the central system via the common peripheral channels of the IOM. Up to three DATANET 305 FNPs may be configured on the same central system.

DATANET 355 FNP

Operating under the GRTS/355 control program, the DATANET 355 FNP can handle up to 200 remote terminals simultaneously. A variety of terminals, with transmission rates ranging from 110 bps (bits per second) to 50,000 bps, may be configured on this FNP. The compatible terminal types are remote computer terminals (Model G-115 or equivalent), teleprinters, keyboard/display terminals, banking teller terminals, DATANET 700 Remote Network Processors (RNP), remote line printer and the IBM 2780 Data Transmission Terminal.

Multiple DATANET 355 FNPs may be configured on the same central system to provide a communications system large enough for most network requirements.

DATANET 6600 FNP

The DATANET 6600 FNP operates with the GRTS/6600 software control program. It has expanded configuration capabilities when compared to the DATANET 355 FNP. It serves all applications of the DATANET 355 with a smaller physical cabinet. The DATANET 6600 FNP can be configured with up to 380 line terminations and incorporates the new General Purpose Communications Base and Asynchronous Communications Base for interfacing with high- and low-speed transmission lines, respectively.

Coexistence of FNP Types

The coexistence of the DATANET 30, DATANET 305 and DATANET 355 FNPs in a single system hardware configuration is permissible. The maximum unmixed configuration is three DATANET 355 FNPs, or three DATANET 305 FNPs or three DATANET 30 FNPs. The sum of all DATANETs configured in a mixed configuration cannot exceed three FNPs per central system.

The DATANET 6600 FNP interfaces with the Series 60 central systems only, and is not configured in a coexistence environment. A single Series 60 central system will interface with a maximum of four DATANET 6600 FNPs.

MODES OF OPERATION

The Remote Terminal Supervisor permits the user at a remote terminal to use one of three operating modes: remote batch, direct access or remote batch utility.

Remote Batch

The remote batch mode gives a user at a remote computer terminal the ability to input batch jobs (in card deck form) to the central system for execution. The card deck for one or more jobs is read into the remote computer terminal which transmits it via the communications network to the central computer system. In the central system, the job is executed along with other batch jobs. When the job is completed, the output can be sent to the originating terminal, to another terminal specified in the program deck, or output at the central system.

The remote batch mode also provides the capability to obtain status of jobs being processed, to abort an activity of a job that is being output, or to backspace an output operation.

Direct Access

Direct Access (DAC) is an interactive mode of operation in which the user at a terminal is in direct communication with a program in execution in the central system. The two-way communication is accomplished by a question-response sequence carried on intermittently as the program runs. The interactive exchange continues until terminated by either the terminal, or the DAC program.

All three types of remote terminals (remote computer, teleprinters keyboard/display) can operate in the direct access mode. However the Model G-115 control program does not contain DAC capability, though this mode is permitted by the GRTS/355 and GRTS/6600 remote computer interfaces. This feature may be implemented by a user if required.

Remote Batch Utility

The Remote Batch Utility program is a free-standing privileged slave program residing in the central system, to provide a remote batch capability for keyboard terminals. The function is accomplished by simulating the GRTS remote batch interface in the direct access mode, using appropriate interface disciplines for system input, system output and job control.

The remote batch utility feature is provided to maintain keyboard terminal capability in the event the Time Sharing System interface (CARDIN and Jxxx subsystems) is not available.

COMMUNICATIONS/MASS STORAGE LINK

The communications Mass Storage Link facilities of GRTS/355 and GRTS/6600 permit GCOS and the Remote Terminal Supervisor to share a common file space in DSS180, DSS181, DSS190, and MSU0310 (Series 60 only) Disk Storage subsystems. This link facility provides more efficient utilization of system resources and more continuity in input operations from a remote computer terminal.

The mass storage link functions:

- Provide a direct input from the DATANET 355 FNP and DATANET 6600 FNP to mass storage. This permits continuation of input (within limits) from a remote computer terminal, even when the central system is not available for processing.
- Provide more efficient processing of remote batch input because the pass through the central system enroute to mass storage is eliminated. This reduces the use of central system resources required for storage cycles and mass storage channel time.

The mass storage link facility is configured in the system at startup, and its operation is transparent to the terminal user. The initialization of the mass storage link is covered in the following manuals:

1. Configuration of mass storage link in the central system is covered in the System Startup and Operation reference manual.
2. Configuration and definition of mass storage link in the DATANET 355 FNP and DATANET 6600 FNP are covered in the GRTS/355 and GRTS/6600 Startup Procedures reference manual.

STANDARD REMOTE COMPUTER TERMINAL INTERFACE

In order to function as a remote computer terminal on a DATANET FNP, a computer must meet the requirements of the Remote Computer Interface (Section IV). This is a software interface which operates under the GRTS/355 or GRTS/6600 control programs.

The basic requirement of this interface is that information and control messages must be in a format acceptable to GRTS. In addition, the remote computer operates in a message/response mode. Only the operations defined in the interface descriptions can be used by the remote computer terminal operating with GRTS.

In addition to defining the transmission of information between the remote computer and the FNP, this interface also provides error checking and recovery procedures to assure that the data accepted contains no errors and that no data is handled more than once. When a data message is in error, the remote system is asked to retransmit the message, and the message containing the error is deleted. In conjunction with this error checking and recovery, the DATANET FNP generates and checks parity on the seven-bit characters received from, and transmitted to, the remote computer.

The remote computer interface also provides direct access (DAC) capability for remote computer terminals. (DAC is not used by the standard Model G-115 system software). This capability permits the remote computer to communicate directly with a specified program being executed in the central system. The accessed program assumes control in the DAC mode of operation, and GRTS functions as a passive unit, transferring messages between the program and the remote computer.

SECTION II

SYSTEM OPERATION

GRTS permits a user at a remote location to utilize the capabilities of a large-scale information processing system. The user has broad flexibility in the types of terminals he may use in submitting his jobs, and in the types of transmission line service required for the terminals.

A GRTS user can carry on a conversational (interactive) exchange of information with a program executing in the central system by using the Direct Access (DAC) mode of the following terminals:

- Teleprinter - Teletype Models 33, 35, 37 or 38; GE TermiNet 300 and 1200, IBM 2741, Hazeltine 2000, Execuport 1200, or equivalent.
- Keyboard/Display - DATANET 760 VIP, VIP Series 765, VIP Series 775, VIP 785, VIP 7700, MTS 7500 or equivalent. The DATANET 305 processor supports only the DATANET 760, VIP 775 and VIP 785 keyboard/display terminals.
- Banking Teller Terminals - BTT7340 and BTT7340E (with or without Data Capture Cassette unit(s))
- Remote Computer - The GRTS remote computer interface permits a computer system at a remote location to operate in the Direct Access (DAC) mode. At present, the standard GRTS/115 software does not include DAC capability. However, computer systems that meet the requirements of the remote computer interface for DAC capability may use this facility.
- Remote Network Processors - Type RNP 702 Standard System and Type RNP 707 Multifunction System.

The primary use of the remote computer terminal is the submission of batch jobs to the central system for processing. Jobs entered at a remote computer terminal are transmitted to the central system via a DATANET FNP. In the central system, the job from the terminal enters the normal processing stream and is handled like any other job. The user may wait for the program output or reconnect later to retrieve the output. The user may redirect the output to another remote computer terminal or request that the output be printed/punched at the central system.

GRTS permits the use of up to six document reader/sorters per DATANET FNP. Honeywell MRS200, DRD200, DRD236, and DHU1600 (Series 60 only) reader/sorters may be used for data entry to a central system Direct Access (DAC) program. The interface to the DAC program consists of 6-bit BCD data, rather than the 9-bit ASCII data used with other DAC terminals. These reader/sorters do not operate in batch mode. The main characteristics of these reader/sorters are:

- MRS200 - MICR (Magnetic Ink Character Recognition) Reader/Sorter
 - E13B MICR Font
 - 1200 Documents per minute
 - 12 pockets

- DRD200 - Optical Document Reader/Sorter
 - COC5 Optical Bar Font
 - Mark Sense Recognition (optional)
 - 1200 Documents per minute
 - 2 pockets

- DRD236 - High-speed MICR Reader/Sorter
 - E13B MICR Font
 - 1625 Documents per minute
 - up to 32 pockets

- DHU1600- Same as DRD236

DIRECT ACCESS JOB FLOW

Teleprinter DAC

A user at a teleprinter terminal communicates in an interactive, conversational exchange of messages with a direct access program executing in the central system. After the user has established a connection to the program, the program takes control of the two-way exchange of messages.

The DAC mode of operation is initiated by a dial-in to a line dedicated to a specific DAC program or by dialing in to a non-dedicated GRTS line and requesting connection to any DAC program required. Automatic connection (direct dial-in to a DAC program) may be made to any one of eight DAC programs, including the Honeywell-supplied Time Sharing System and Transaction Processing System.

SEQUENCE OF OPERATION

The sequence of direct access operation from a teleprinter is as follows:

1. The connection is established by:
 - a. Dialing a number assigned to a particular program (direct connection) or a number assigned to GRTS, and effecting a carriage return after the dial-up has been answered. This connection sequence is for public telephone line service. If the line is on a DATANET High Speed Line Adapter (HSLA)/General Purpose Communications Base (GPCB), the terminal transmission rate is tested to see if the HSLA/GPCB subchannel needs to be reconfigured to accommodate the speed. If the terminal's rate is less than 300 bps, the subchannel is automatically reconfigured to fit the speed of the terminal.
 - b. Pressing the DATA pushbutton on the data set if the terminal is on a private line. (Private lines vary with the various types and models of terminals. Consult the manual for a particular terminal for the correct private line connect sequence.)
2. Once the connection is established, the succeeding operation depends on whether or not the connect is to a DAC program or to GRTS. In both connections via a DATANET FNP, the system responds to the connect with a six-digit configuration definition number (see Section IV).
 - a. If the connect is directly to a DAC program, the program assumes control and requests information pertinent to that program's log-on procedure. For example, after a dial-in the Time Sharing System responds with:

HIS SERIES 6000, ON date AT time CHANNELnnnn

Where: date - Date in form mmddyy.

time - Time in hours and thousandths of an hour (hh.hhh).

nnnn - Channel number.

- b. If the connect is to GRTS, the system responds with:

PROGRAM NAME-

The terminal user must then enter the name of the DAC program to be connected.

3. If the DAC program is not in the system, a message describing the condition is sent to the terminal. If the program is in the system, the program assumes control of the communications with the terminal.

4. In the two-way communication between the program and the terminal, the program requests GRTS to send a message to the terminal. GRTS then requests the program in the FNP to transmit the message to the terminal. When the user at the terminal responds to the message, GRTS accepts the line of input from the terminal and sends it to the DAC program. Thus GRTS assumes a passive role in direct access, passing information between the DAC program in the central system and the user at the terminal.
5. This interactive flow of information continues until terminated by the terminal user or by the DAC program.

PAPER TAPE INPUT

If data is to be input from paper tape, the punched tape should be in the reader when the terminal user types in TAPE and gives a carriage return. The system responds with READY. The tape reader is turned on manually and a block of information is read into the central system. This information must contain all control records for the program, including line numbers.

Under GRTS, if the data cannot be processed as it is read in, the BREAK light on the terminal is turned on and the paper tape mode is terminated. The DAC program may then request more input or terminate the operation. In normal paper tape mode, an X-OFF character causes a message to be sent to the central system to terminate the paper tape operation.

Paper tape input requires special buffering to accumulate multiple lines before transmitting the job to the central system. X-OFF is not part of the termination for each line of paper tape input, but it is the only way to terminate the paper tape input mode.

If an error occurs in the central system during paper tape input, the tape reader is stopped, and an error message is sent to the terminal to describe the malfunction.

1200 Baud Teleprinter DAC

GRTS accommodates Hazeltine 2000, Execuport 1200, and GE TermiNet 1200 teleprinter terminals connected with Bell 202C data sets operating at 1200 baud. The 202C modems must be equipped with the following options:

1. EIA interface
2. Reverse channel
3. Data rate - over 900 BPS
4. No operation with ACU
5. Auto answer controlled by data auxiliary set key.

HAZELTINE 2000

For the Hazeltine 2000 terminal the reverse channel option in the data sets may be field installed by phone company service personnel. A simple strapping operation will effect this option that is required for line-break capability.

The Hazeltine 2000 terminal is configured on the \$ HSLA card using the HSTTY option. Both the speed and the terminal mnemonic must be specified:

```
$ HSLA-n SCH-m,TTY,LNMODE/ASYN,HSTTY/1200/HZ2000
```

Operation

To use the Hazeltine set the control panel switches as indicated below. The control panel is located behind a hinged panel just below the face of the CRT.

Power Switch	-	On
EOT/CR Switch	-	EOT
Parity Knob	-	Even
Contrast Knob	-	As desired
Half/Full/Batch Knob	-	Half
Baud Rate Knob	-	Same as on HSLA/GPCB subchannel configuration card Usually 1200 Baud
CA ON/AUTO Switch	-	CA Auto

After setting the control panel switches, turn the unit on by pushing the ON/OFF button on the right side of the keyboard. After approximately 30 seconds warm-up there will usually be random characters displayed on the screen. Clear the screen by simultaneously depressing the SHIFT and CLEAR keys. The cursor will appear in the upper left-hand corner of the screen. Place the terminal in receive mode by pressing the RESET button on the lower right-hand side of the keyboard. The RECEIVE mode light should be on and the terminal is now ready to connect to the FNP. The dialing is done in the normal manner.

Shortly after the calling sequence is completed, the RECEIVE mode light will extinguish. Send an EOT character (Control-D) to the FNP and the seven-character header reply will appear on the screen. This is one of the major differences between the Hazeltine and a Teletype terminal. On the Hazeltine, the EOT character is used in lieu of the carriage return for input. If a carriage return is typed it does not terminate the input mode as on a Teletype. GRTS continues to accept and edit data until it receives an EOT. The edit is terminated by either a carriage return or an EOT. (The EOT is converted to a carriage return.) Thus, it is not necessary to type a carriage return, but if done it will be the last character transmitted to the central system. Any characters between the carriage return and the EOT are lost. Characters are transmitted from the Hazeltine to the FNP as they are typed, so errors cannot be corrected by backing up the cursor and overtyping. The characters, @ (character delete), Control-X (line delete), and Control-C (logical disconnect) retain the normal meaning on the Hazeltine, except that the Control-X and Control-C must be followed by an EOT before anything happens. When in logical disconnect mode an EOT is the logical reconnect character instead of Control-A.

Limitations

Since the system does not page the output, a long list results in the data rolling off the top of the screen faster than it can be read.

It is not possible to generate a password hash, so the passwords are displayed for all to see. Because of the data roll-up presentation, security markings continuously roll off the screen unless output is user formatted on a page basis.

No tape mode is implemented for the Hazeltine 2000 terminal.

EXECUPORT 1200

The Execuport 1200 terminal is configured on the \$ HSLA card using the HSTTY option. Both the speed and the terminal mnemonic must be specified:

```
$ HSLA-n SCH-m,TTY,LNMODE/ASYN,HSTTY/1200/EX1200,RVCHAN/YES
```

GRTS supports this terminal by utilizing the modules GTCM, GHTY, GTXP and GX12 and only by a dial-up line connection.

Prior to dialing the FNP the following switches should be set as indicated.

```
Power - On
QSL - Ignore
Parity - Even
Duplex - Full
Mode - Split
Speed - 120
```

In addition, the Transmit Frequency switch on the "stunt" box (auxiliary controller) should be set to HF. This switch on the "stunt" box replaces the equivalent switch on the terminal console.

After the dial-up connection has been made, wait approximately three seconds. The initial carriage return (CR) may be entered when the Clear-to-Send lamp (on the "stunt" box) comes on. No input should be attempted before this lamp is on.

This terminal does not respond to the normal teleprinter control characters, but instead responds to changes in the primary and secondary carriers (reverse channel). These changes effect line breaks and mode switching (receive-transmit-receive). The configuration option RVCHAN is required for this method of line control and is therefore a mandatory entry on the \$ HSLA card.

Repeated backspacing (either keyboard or program generated) may "lock-up" the print-head so that it will not forward space. This condition may be cleared by a momentary toggle of the RESET switch on the console. This action will backspace, or justify, the print-head to the left margin.

No paper tape mode is implemented for the Execuport 1200.

TERMINET 1200

GRTS supports the GE TermiNet 1200 teleprinter by utilizing the modules GTCM, GHTY, GTXP and GT12. Configuration for this terminal is defined on the \$ HSLA card in the startup deck, as follows:

```
$ HSLA-n SCH-m,TTY,LNMODE/ASYN,HSTTY/1200/TN1200
```

Additional configuration information may be found in GRTS/355 and GRTS/6600 Startup Procedures.

Prior to physical connection, field service personnel should verify that the terminal is equipped with the correct strapping options and the special adapter cable is available for connecting the terminal and the data set. In addition, verification of the correct strapping to effect the data set reverse channel option should be made.

The six switches at the front of the terminal should be set as follows, prior to dialing the FNP:

```
Transparency - OFF
Inhibit      - NORM
Rate         - 120
Line Space   - as desired (normally 1)
All caps     - as desired
Auto LF      - as desired (normally off)
```

The ON-LINE push button lamp must be illuminated prior to dialing. Dialing is performed in the normal manner. At the completion of dialing the READY lamp should be illuminated and the INTERRUPT lamp off. If on, it may be cleared by pushing it. The ON-LINE and READY lamps should be on, and all others off. Conversation may be initiated by typing either an ACK (control-F) or ENQ (control-E) character. GRTS responds with the seven-digit header and then proceeds to the normal connect sequence. When typing on the terminal, the line terminate character is either an ACK or an ENQ in lieu of a carriage return. If a carriage return is typed it is treated as a text character, and does not signal GRTS to process the data just typed. GRTS waits for the ACK or ENQ character, converts it to a carriage return, and then edits the input. The edit is terminated by the first carriage return encountered. If text is typed between the carriage return and the ACK or ENQ, it is lost. A line may be deleted with the control-X character, but this must be followed by an ACK or ENQ character. The character delete (@) has the same function as on several Teletype models. A line break may be generated while the terminal is receiving, by pressing the INTERRUPT lamp. When the terminal is transmitting, this action has no effect. A NAK (control-U) character is recognized as a line break while in transmit mode. The NAK is recognized as such, and need not be followed by an ACK or ENQ character. The logical disconnect functions as on Teletype terminals. The ETX (control-C) need not be followed by an ACK or ENQ; however, for a logical reconnect, the control-A must be followed by one of these characters.

Paper Tape mode operates the same as on other teleprinters, except for termination. Paper Tape mode is terminated by any of the four line-turnaround characters, ACK, NAK, ENQ, or ETX. If an X-OFF character is included in the text, all text following the X-OFF is ignored, but termination does not occur until one of the line-turnaround characters is transmitted.

Transparent paper tape input is also permitted from the TermiNet 1200. It is initiated from the central system slave program in the same manner as for a low speed terminal. However, after the message requesting the paper tape input is typed the operator should not attempt to input any data for a period of one second after the last output character is typed. Any data input during this period may or may not be recognized by the FNP. If it is recognized it initiates the timeout that terminates transparent paper tape mode. To read the paper tape in transparent mode, two switches on the TermiNet 1200 must be reset. The transparency switch is reset to the ON position and the inhibit switch is reset to the PRINT position. With the switches in these positions the tape reader will read tapes containing X-OFF, ACK, NAK, ETX, and ENQ characters. As in transparent mode on low speed devices, GRTS ceases to accept data after remaining idle for approximately five seconds. However, in the case of the TermiNet 1200, GRTS cannot send any output data to the terminal until the line is turned around by the terminal operator. This is done by placing the two switches noted above in their normal positions (the transparency switch in the OFF position and the inhibit switch in the NORM position) and then typing a line turnaround character - ACK or ENQ.

Data sent to the terminal from a central system slave program is edited by GRTS to insert the fill characters, following line feed and backspace characters, required by the terminal. Paper tapes cannot be punched from the TermiNet 1200 during operation at 1200 baud since the paper tape punch operates at a maximum rate of 300 baud.

Keyboard/Display Terminal DAC

The keyboard/display terminal (DATANET 760 VIP, VIP Series 765, VIP Series 775, VIP Series 785, VIP Series 7700, MTS 7500) permits the user to execute the following direct access functions:

- Entry and display of data or requests.
- Transmission of information to the central system.
- Receipt and display of responses from the central system.

As a terminal on the DATANET FNP, a keyboard/display terminal operates only in the direct access mode and normally transmits data on a one line up to one page basis. This type terminal uses the following GRTS control records:

- Identification
- Break
- Disconnect

SEQUENCE OF OPERATION

The sequence of direct access operations for a keyboard/display terminal is as follows:

1. Operation is initiated when the operator dials in to the assigned GRTS number.
2. When the connection is made, the system requires a GRTS control record (card image) for identification. This record must provide a terminal ID, a user id, a password (required for computer system access), terminal page size in number of lines (number of lines depends on number of terminals on that controller), and the name of the DAC program to be connected.

If no program name is given, the terminal waits until a program executing in the central system accesses it by the terminal ID. The DATANET FNP checks the ID control record as follows:

- a. If the input is correct, GRTS sends a message to the central computer system requesting acceptance of the terminal. If the input is not acceptable, a rejection message is transmitted to the terminal.
- b. If a program name is specified in the control record, only that program may contact the terminal. If no program is specified, any DAC program may access that terminal by addressing it by the terminal ID.
- c. If the user does not wish to wait for a DAC program that is not yet available, the terminal may be disconnected by transmitting the `*$DIS` message, making it available for other communications.

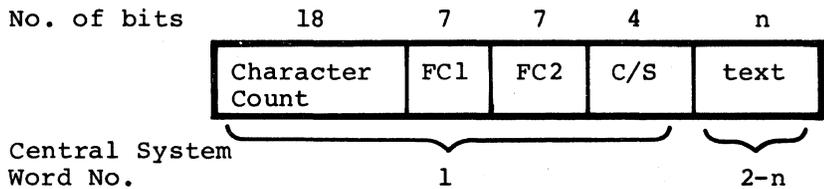
3. When the user is validated by the central computer system, the DAC program in the system assumes control and a two-way flow of information takes place. This communication is on the basis of a message from the DAC program being answered by the user at the terminal (the answer may be only an acknowledgment (ACK) that the message was received).
4. The two-way exchange of messages continues until terminated by the terminal user or the DAC program.

VIP LINE DISCIPLINE DEVICE MESSAGE FORMATS

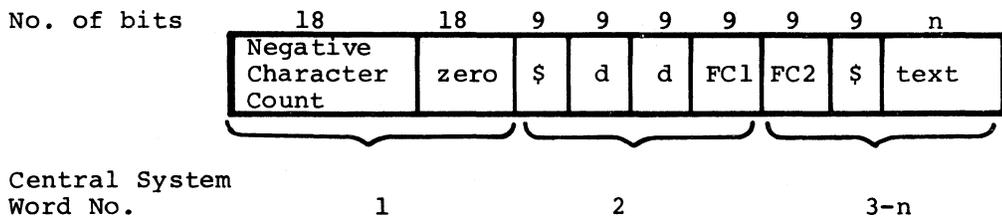
The support of the print page adapter and the cassette on a 7700 Series VIP terminal has required the definition of an optional text header as outlined below. Previously (format 1), special control functions such as function codes or an input PRINT status were sent to/received from the central system in an 18 bit command/status field following the character tally. The lack of expansion capability necessitated this new control procedure (format 2).

VIP line discipline device messages which are passed back and forth between the central system user programs and the DATANET VIP module are in one of the following formats.

1. If word one of the output buffer is positive:



2. If word one of the output buffer is negative:



The character count in the first format is the tally of nine-bit ASCII character bytes in the text field.

The negative character count in the second format includes the count (six) of the text header characters with the text field tally.

FC1 and FC2 are function codes transferred to/from the VIP in the message header format. These are ASCII characters with the parity and unused ninth bit removed to save space in format 1. All supported devices using the VIP line discipline transmit function codes to the central system. The DATANET 760 VIP, 765 Series VIP, 775 and 785 do not use these when they are received from the central system. However, the 7700 Series VIP does utilize these function codes when received from the central system. Default function codes sent by the terminal are ASCII space codes (40 octal).

The C/S field in the first format is a four-bit command (sent to terminal) or status (received from terminal) field defined as follows:

Send

- bit 1 - Reserved for future use.
 2 - Not yet defined.
 3 - Not yet defined.
 4 - Not yet defined.

Receive

- bit 1 - Print status (GRTS)
 2 - Not yet defined.
 3 - Not yet defined.
 4 - Truncation warning status; text character count originally exceeded 320 x 36-bit words and will be truncated at the FNP/central system interface.

The characters dd in the second format specify unique destination codes for messages sent to the 7700 Series VIP.

Output from Central System:

<u>dd</u>	<u>Function</u>	<u>VIP Address Codes</u>
PT	print display mode	150+NUL
W1	write cassette 1	160+esc E esc S ff del Text...
W2	write cassette 2	160+esc F esc S ff del Text...
W1	write EOF on cassette 1	160+esc E esc S ff del E O F
W2	write EOF on cassette 2	160+esc F esc S ff del E O F
R1	read cassette 1	160+esc E esc R
R2	read cassette 2	160+esc F esc R
B1	backspace cassette 1, one record	160+esc E esc D
B2	backspace cassette 2, one record	160+esc F esc D
D1	rewind cassette 1	160+esc E esc P
D2	rewind cassette 2	160+esc F esc P

Input to Central System:

P	print request	140+PRT
CØ	source cassette	160
CØ	source cassette, EOF	160, Text = EOF only

When input to the central system, all text messages are followed by an ETX character.

The central system-resident applications programs may use either of the text header formats shown above, depending on the number of unique destination codes required. However, when the format 2 text header is first sent to the terminal, all subsequent transmissions from the terminal to the central system will be in this format, until a disconnect is effected.

Remote Computer DAC (GRTS/355 and GRTS/6600)

The following sequence of operations describes Direct Access (DAC) input from a remote computer terminal. (The standard GRTS/115 program does not include DAC capability; however, this mode is accepted by the remote computer interface of the DATANET 355/6600 FNP.) A remote computer terminal operating in DAC mode must meet the requirements of the appropriate remote computer interface.

Connection and terminal identification are performed the same as for the remote batch operation. When the terminal ID has been validated, GRTS reads the second control record of the input deck, which in this procedure is a \$*DACnnnnn. The DAC specifies direct access mode, and nnnnn is the six-character name of the DAC program to which the terminal is to be connected. If the name field is left blank, the terminal waits until a program addresses it by the terminal ID.

As in other direct operations, when the terminal is connected to the user program the program assumes control and the remote computer terminal responds to requests issued by the program. This two-way flow of information continues until terminated by the terminal or the user program.

DAC FOR DOCUMENT READER/SORTERS

Connecting to DAC Program

Document reader/sorters are connected directly to the DATANET 355/6600 FNP. In order to initiate a connect to a DAC program, the reader/sorter must make a transition from not ready, to ready. This action causes the reader/sorter to be connected to a program having a program name of DES600.

Programming Considerations

Document reader/sorters are input only devices, but prestructured data is output by the DAC program to GRTS to direct it in making pocket selection decisions. This prestructured data must be present in the DATANET FNP before document entry may occur. Control of the document reader/sorter is accomplished by the DAC program since it starts and stops the reader/sorter.

Certain MME GEROUT op-codes have been defined for document reader/sorters. The following list gives valid op-codes for document reader/sorters and a brief explanation of each:

<u>Op-code (octal)</u>	<u>Meaning</u>
03	Send Table Data
04	Send Last Table Data and Receive Status
21	Control (Start handler, Table size, etc.)
22	Continue Reading
30	Stop Handler
05	Program Inquiry
06	Request Terminal Type
17	Disconnect line
20	Request line status

One final consideration should be noted. Data is input to the DAC program in blocks not exceeding 320 words (up to 20 documents). Data is double-buffered in the DATANET FNP in the same manner as paper tape operation for teleprinter devices. This implies that the DAC program must request its next block of data within a finite time (dependent on document input rate), to effect continuous data entry.

For a discussion of command and data formats, see Document Entry Subsystem Implementation Guide.

REMOTE COMPUTER BATCH OPERATION

The remote batch facility of GRTS permits a user at a remote computer terminal to submit programs in card deck form for processing by the central system.

NOTE: In this description, the Model G-115 Information Processing System is the remote computer described. However, other computer systems that meet the requirements of the GRTS remote computer terminal interface may be used as a remote computer terminal on the DATANET FNP. Certain models of the IBM 360 computer systems may be interfaced with a Honeywell central system via GRTS. For reference see the Remote Entry Station Program/360 manual.

Remote computer terminals use six GRTS control records to communicate with the GRTS control program:

- Identification
- Input
- Send Output
- Disconnect
- Abort
- Request Status

In addition to these GRTS control records, the remote computer terminal has two manual controls that allow the operator to perform key output functions. He can abort a file being output to the terminal, or backspace data being output to the terminal. The data can be backspaced the equivalent of two pages.

Sequence of Operation

The following sequence of operations describes the processing of batch jobs submitted from a remote computer terminal:

1. The terminal operator loads the job deck, including the appropriate GRTS cards, into the terminal card reader. (Example decks are illustrated in Appendix A.)
2. The connect to the DATANET FNP depends on the type of line service:
 - a. On a standard telephone line service, the connect is accomplished by the operator dialing the assigned GRTS telephone number.
 - b. On a private line, the connection is continuous and operation is initiated by loading the job deck and pressing the OPERATE pushbutton.
3. When the connection is made, GRTS reads the first card, which contains the terminal ID and the user's identification and password¹ required to access the central system. The terminal ID is passed to the central system where it is checked with the System Master Catalog (SMC) to determine its validity. (Each valid terminal ID has a matching SMC entry.)
4. When the ID is checked, an acceptance or rejection message is sent to the terminal. If the central system rejects the ID, GRTS informs the FNP to transmit a rejection message containing a reason code to the terminal. After the rejection message is sent, the line is terminated (logical disconnect). If the ID is accepted, the read-in of the job deck continues.
5. When the ID is accepted, GRTS reads the second control record, specifying the operation to be performed. This must be a GRTS control record, and it must contain:
 - Control record identification (\$*\$)
 - Definition of function to be performed

¹GRTS does not require the userid \$ password entry. However, this information may be included on the card without affecting the operation. Card image formats and sample deck setups in this manual include this information.

The control record may be one of the following:

- a. Send Output - GRTS stops reading cards and performs the requested function. Available output is sent to the terminal for printing and/or punching. A LINE TERMINATE message is sent to the terminal when output is complete.

If data is not available for output, the terminal goes idle until timeout. The timeout period is five minutes for a timeout by the G-115 terminal or seven minutes for a GRTS timeout. Following the timeout, the line is disconnected.
 - b. Direct Access (DAC) - The terminal is put in direct communication with the specified DAC program in the central system (see Remote Computer DAC).
 - c. Abort (ABT) or Request Status (STS) - GRTS informs the central system of the specified condition: status of a specified job, or abort of a specified job. After the output is transmitted, a request is sent to the terminal to read more control records (other than the ID records).
 - d. Read Card (RCD) - A Read Card control record must be followed by one or more job decks for processing by the central system. Each deck consists of GCOS control cards and data cards. Multiple jobs, separated by SNUMB cards, may be contained in a single input deck.
6. GRTS reads the input records (control and data card images) from the terminal and receives the data in bit-serial form. The messages are checked for correct parity and the parity bits are removed; the seven-bit characters from the terminal are converted to central system format (six-bit characters); and the messages are stored in a 320-word holding buffer. This storage procedure creates 320-word blocks of information that are compatible with the storage format of the central system.
 7. When the storage buffer is full or a control record is received that indicates end of data, the information in the holding buffer is transferred as a block to central system disk storage via the Mass Store Link facility, and the central computer system is told that the job is available. If the Mass Store Link is unavailable or excluded by the NOMSL option on the RCD card, the data is transferred to the central computer system via the Intercomputer Adapter (ICA) or the Direct Interface Adapter (DIA). In the latter case, GRTS opens a file on mass storage and stores the information there: files are opened for each job as it is received in the central system.

If the job cannot be accepted, the terminal is notified by GRTS of the rejection and the reason for the rejection. The line is then terminated.

8. Within the central computer system, the job from the remote computer is handled like a batch job from any other source. The job goes through core and peripheral allocation, scheduling, and execution.
9. In the central system, GCOS processes the job, performing the specified operations, creating new files as required, and storing them on the storage device(s) specified in the job.
10. When execution is completed, GRTS central system directs the output to the originating terminal or to another terminal specified on a \$ REMOTE control card in the job deck. The File and Record Control subroutines within the user's program transmit the files to GRTS central system in 320-word blocks (maximum of 320 words per block) for SYSOUT storage.
11. If the remote computer terminal waits for the job to terminate, GRTS transmits output to the terminal after completion of the job. If the terminal did not wait for the output, the blocks of information remain in the central computer system until requested by the terminal, or until the central system console operator requests that the output be stored on magnetic tape or directed to another terminal.
12. GRTS transfers the blocks of data to the DATANET FNP, edits each line (unless the terminal requests no edit), deletes all trailing blanks, performs code conversion, and formats each line for transmission to the remote computer terminal.
13. At the remote computer terminal, the data is converted to digital format and output on the remote computer's printer and/or punch.

TERMINATION

A terminate may be initiated by the operator at the remote computer terminal or by GRTS. If the connect is established, GRTS/115 sends a terminate message when the operator intervenes in the operation by pressing RESET and RUN (CLEAR and START on a Model 2 G-115 terminal). GRTS precedes its terminate with a message, unless the remote computer interface received a terminate from the terminal. The RESET and RUN function does not work with EIA interfaced line controllers (dial-up only). The line is disconnected by the hardware when the RESET button is pushed.

A terminate causes re-initialization of the system and halts data transmission. However the transmission line remains physically connected. The remote computer operator may restart his operation by loading a card deck in the card reader and pressing RUN (or OPERATE) to send a select.

REMOTE BATCH UTILITY OPERATION

The Remote Batch Utility Program performs the following functions:

1. Log-on of keyboard terminals (Station ID and password validation).
2. GRTS control record interpretation:
 - *\$SRC - input control record
 - *\$OUT - send output control record
 - *\$STS - request status control record
 - *\$ABT - abort control record
 - *\$DAC - direct access control record
 - *\$DIS - disconnect control record
 - *\$PPT - papertape control record
 - *\$KEY - Keyboard control record
3. Input of remote batch jobs from terminals (keyboard or papertape): transliteration from ASCII to BCD card images, formatting of card images into standard system format, buffering of input blocks on temporary mass storage files, passing of job files to system input.
4. Output of remote output files to terminals: re-formatting from sysout storage format, transliteration from BCD edited print line images to ASCII print images, including control character interpretation and print line folding, file backspace, and file abort.
5. Job status and abort request processing.
6. Switch of terminal to direct access mode under control of another slave program.
7. Miscellaneous related functions.

User Interface

User interface at a keyboard terminal under control of the Remote Batch Utility Program is identical to the normal Remote Batch GRTS interface, except as constrained by the direct access mode.

Operation (GRTS/355 and GRTS/6600)

The Remote Batch Utility Program is operated as a privileged slave program. An operator using the program stores it in the "operations utility" file, and initiates it with a "SPAWN" command from the console. Since the program requires PRIVILEGE, the operator must further acknowledge its initiation by typing "RUN" at the appropriate time. Communication lines on a DATANET FNP may be dedicated to the remote batch function by assigning the direct access program name - GERTS - to the configuration card for the line; otherwise the user may manually connect by typing "GERTS" in response to the "PROGRAM NAME--" request.

System Interface

1. SYSTEM INPUT - Remote batch jobs input from a terminal are entered into the job stream by passing the job file to System Input in a manner similar to that used by Remote System Input. In a system scheduler environment, jobs entered by this program are subject to the same discipline as if they had been submitted from a remote batch computer terminal.
2. SYSTEM OUTPUT - Output, status and abort requests are passed to sysout (GEOT) as if they had come directly from a remote batch computer terminal. GEOT processes the requests in the normal manner, except that output data and status blocks are passed back to the program, instead of to the terminal. In a mass storage link environment, keyboard terminals do not use the link, just the direct access mode.
3. DIRECT ACCESS LINE SWITCH - A method similar to that used by time sharing to transfer control of a terminal to another direct access program is used in this application.
4. TERMINAL INPUT/OUTPUT - All input and output for keyboard terminals is done by means of MME GEROUT. The direct access program name is "GERTS".
5. MASS STORAGE REQUIREMENTS - Mass storage is allocated to the program only as required for job input files. MME GEMORE is used to obtain space.

ADDITIONAL REMOTE BATCH TERMINALS

Currently two additional terminals may use the GRTS interface to communicate with the central system in the remote batch mode. These terminals are:

- IBM 2780 Data Transmission Terminal
- Remote Line Printer - RLP300

IBM 2780 Terminal (DATANET 355 FNP and DATANET 6600 FNP)

The IBM 2780 terminal operates under Binary Synchronous Communications (BSC) procedures using the standard GRTS remote batch interface disciplines. A BSC355 subchannel option must be installed in HSLA/GPCB to configure this terminal. GRTS does not support this terminal in the DAC mode.

The following optional features of the IBM 2780 are required for interface with GRTS/GCOS:

- Print line - the 144 character print line must be used to accommodate the GCOS SYSOUT line of 137 characters.
- The carriage tape for printer control, (TOP OF PAGE), must be punched in channel 1.

The following optional features of the IBM 2780 are not supported:

- Auto-turnaround feature
- Auto-answer - 21 second recovery time
- Multipoint Line Control
- Transparent text mode

The following optional features of the IBM 2780 terminal are supported by GRTS and GCOS:

- Models 1 and 2 (Model 2 recommended)
- Synchronous, 2000 to 4800 baud, dial-up or private, 2- or 4-wire communications lines
- Multirecord transmission
- EBCDIC or ASCII transmission codes
- Card input and output may be IBM punched code or Honeywell central system punched code, but not both simultaneously
- All character sets, i.e., 63, 52 and 39 characters

Character Conversion Differences

1. Some BCD characters have no EBCDIC equivalent. GRTS software accommodates these characters by making the listed conversions:

BCD	to	EBCDIC
[(
])
\		
↑		┘
←		└

2. When making an EBCDIC or ASCII to BCD conversion, GRTS converts all characters having no BCD equivalent, to the BCD blank.

OPERATING PROCEDURES

The IBM 2780 terminal cannot read or punch binary cards. If binary punched cards are included in the output, the binary file will be aborted, and the following message:

```
FILE ABORTED - BIN
```

is printed at the terminal.

All standard GRTS control cards can be used with the IBM 2780, i.e.,

```
$$$ID$/USERID$PASSWORD  
$$RCD  
$$OUT  
$$STS  
$$DIS  
$$ABT
```

Since the IBM 2780 reads a minimum of two cards per transmission, all control cards that cause a line turn around (except \$\$RCD), are considered to be an end-of-file indication. The line is logically disconnected after the associated output message and the next job must start with a \$\$\$ID\$ card. Three examples of correct deck set-up are:

1. \$\$\$ID\$/USERID\$PASSWORD
 \$\$ABTSNUMB
 (END-OF-FILE light-on)
2. \$\$\$ID\$/USERID\$PASSWORD
 \$\$STS
 (END-OF-FILE light-on)
3. \$\$\$ID\$/USERID\$PASSWORD
 \$\$OUTSNUMB
 (END-OF-FILE light-on)

Initialization

To enter or receive data on the IBM 2780, the following initial steps are required:

1. Turn the main power switch on (located on the right side of the unit).
2. Rotate the MODE switch to the TSM position; if already on TSM rotate one position either way and return to TSM.
3. If a dial-up line is to be used, dial the desired number. When the connection is established the data-set READY light will be turned on at the operator panel.
4. For private lines, the data-set READY light will be on as soon as the DATANET FNP is operational.
5. The terminal is now ready for operation with the FNP.

Input a Job

1. Load the input deck in the card reader.

(Sample input deck)

```
$*SIDUSERID$PASSWORD  
$*$RCD  
$      SNUMB  
  
$      ENDJOB  
$      SNUMB  
  
$      ENDJOB  
$*$OUT
```

The last \$*\$ card is not necessary if the end-of-file condition is activated. The line will be logically disconnected with a blank reason code.

2. If the entire input deck can be placed in the reader hopper, turn the END-OF-FILE button.
3. Ready the line printer so that any output messages can be printed. Rotating the MODE switch initializes the IBM 2780.
4. Push and hold the reader START button until the cards start to feed.
5. The input may be stopped at any time by pressing the STOP button. To continue input, press the START button. Since the STOP button drops printer ready, ready this again.
6. If the last card read is not a \$*\$ card and the end-of-file condition is not activated, place a \$*\$ card (DIS,OUT,etc), or the rest of the input deck in the hopper, turn the END-OF-FILE light on and push the START button.
7. After the last card, the line is switched and the appropriate output sent to the IBM 2780.

Output a Print Job Only

1. Load the following cards into the card hopper:
 `$$IDØUSERID$PASSWORD`
 `$$ØOUT`
 (END-OF-FILE light-on)
2. Proceed as in job input, steps 2 to 4.
3. To stop the printer while printing, press the STOP button on the reader panel. Never rotate the MODE switch to accomplish this, since this initializes the IBM 2780 logic, and all timing is lost to the print bar.

The DATANET FNP waits 10 minutes for the printer to be readied.

Output a Job with Punch Data

1. Load the following cards into the card hopper:
 `$$IDØUSERID$PASSWORD`
 `$$ØØT`

 BLANK cards for the punch output
2. Proceed as in job input, steps 2 to 4.
3. The MODE switch must be in the REC position in order to punch. Therefore, after the first 2 cards are read (the reader is stopped), push the STOP button on the reader panel, turn the MODE switch to the REC position, and ready both the printer and reader/punch. Output will now continue (punch or printer).
4. If the INCP (Incomplete) lamp is illuminated, reset the MODE switch and reload the deck set-up listed in step 1.

Output, Stop, and Input a Job

If it is desired to input a job while output is in process, the following steps are required:

1. Push the STOP button on the operator panel.
2. Load the input deck in the hopper.
3. Handle the end-of-file condition as in job input.
4. Rotate the MODE switch at least one position and return it to the TSM position (this initializes the IBM 2780 to gain line control).
5. Immediately after step 4, push the START button, and the job will proceed as in job input.

Remote Line Printer - RLP300 (GRTS/355 and GRTS/6600)

The RLP300 on a DATANET FNP interfaces with the central system similar to a printer on a G-115 remote computer terminal. The data is transmitted over a voice-grade (2400 baud) line in blocks of up to 320 words and in compressed A-B pair format.

When the RLP300 terminal is powered on, a signal is sent to the FNP. The FNP in turn sends a Send Initial Output command to the central computer system. The central system never responds to the RLP300 terminal with Output Not Available. If no output is ready to send, the central system sends Wait For Output, to be followed sometimes with Output Ready After Wait. The FNP again requests output. GCOS checks the terminal type when there is no output to send, and sends the Wait For Output message.

SEQUENCE OF OPERATION

The following procedure is used to operate the RLP300 terminal:

1. Initialize the DATANET FNP Processor with the RLP300 defined in the startup deck (\$HSLA card).
2. Turn on power to the RLP300 printer.
3. Wait for the CHECK indicator (red light) to extinguish (approximately 30 seconds).
4. Place the RLP300 printer in operation by pressing the START pushbutton.

The RLP300 printer is now online and sends a Select message to the DATANET Processor. From this point on, output is automatically directed to the RLP300 printer as it becomes available. With the exception of processing error conditions (out of paper, jam, etc.), no additional operator intervention is required.

RLP300 ERROR RECOVERY

All messages transmitted to/from the RLP300 are checked for character parity and longitudinal parity by both the DATANET FNP and the RLP300. Any errors detected result in an automatic retry by the FNP. Up to seven retries are attempted before the channel is considered inoperable. If the printer subsystem itself is inoperable (paper out, jam, etc.), the subsystem notifies the DATANET FNP with a "wait - subsystem requires manual intervention" message. The FNP then sends an ABORT to the central system processor and enters a wait mode. SYSOUT then notifies the central system operator with a console message and the operator enters the recovery dialogue with the system.



SECTION III

PROGRAMMING PROCEDURES

GRTS CONTROL RECORDS

The control records (control cards or control data) for the Remote Terminal Supervisor direct operations and actions involved in the remote terminal functions. These control records are entered at a remote terminal and direct the actions of the GRTS control program in the FNP.

NOTE: Except as specified in the text, the control records described in the following paragraphs apply to GRTS/305, GRTS/355 and GRTS/6600 control programs.

Other types of records which may be encountered in the input job stream are GCOS control records, which direct central system operations, and data records, which contain data and/or instructions.

Each job submitted from a remote computer terminal must contain the GRTS control records necessary to access the central system and to perform the functions required by the terminal user, as well as the data for the job. In direct-access, data records are submitted in reply to a user program request during program execution.

The general format for a GRTS control record (except for keyboard/display terminals) is:

1 4 7

\$\$xxxxyyyyyy

Where: **\$\$** - Uniquely identifies a GRTS control record.

xxx - Operation field containing a mnemonic code specifying the operation GRTS is to perform. This field contains the terminal ID for the identification control record.

yyyyyy - Data field specifying the job number or program name. This field contains the user ID and password for the identification control record.

With the current GRTS software, teleprinters are automatically connected when the dial-in is performed, thus the identification control record is not required. If the dial-in is to the Time Sharing System, the Time Sharing System requests the user's id and password as a part of the log-on procedure.

The keyboard/display terminal operator interface is an exception to the normal GRTS control record format. The connection to GRTS and entrance to the direct access mode is accomplished by dialing in on the appropriate line. The terminal ID and other log-on information is provided by a single GRTS control record with the following format:

1 4 7

`$$IDuserid$passwd,nn,yyyyyy`

Where: ID - Terminal identification.

userid - User identification.

passwd - Password.

nn - Log-on code indicating page size as follows:

Log-on Code	Lines	x	Characters per Line	Terminal Type	Device Type Code (octal)
04	4		46	DATANET 760	5
08	8		46	DATANET 760	6
16	16		46	DATANET 760	7
26	26		46	DATANET 760	10
22	22		46	VIP 765/775	11
22L	22		92	VIP 785/786	12
12	12		80	VIP 7700	13
22N	22		46	VIP 7700	14
24	24		80	VIP 7700	15

yyyyyy - DAC slave program name.

In this control record, no operation code is required because the keyboard/display terminal operates only in the direct-access mode. The only control records used by this type terminal are Break (BRK), Disconnect (DIS), and Identification (ID). Of these, the terminal has exclusive use of the Break control record.

NOTE: GRTS/355 and GRTS/6600 do not require definitive entries for the userid and password fields. Log-on is accomplished with or without these entries.

GRTS/305 however, does require entries in these fields. (A minimum entry, for example; A\$B.)

Identification Control Record

The identification (ID) control record identifies the terminal, provides the required password for central system access, and defines the System Master Catalog (SMC) first entry. This control record must be the first entry of each job entered into GRTS from a remote computer terminal.

The ID control record for a remote computer terminal is as follows:

1 4 6 7

\$*\$ID~~Ø~~userid\$passwd

Where: ID - Terminal identification, followed immediately by ~~Ø~~ (blank).

userid\$passwd - may be up to 25 characters in length.

Input Control Record

The input control record tells the FNP that a remote computer terminal is ready to enter a job deck for batch mode processing by the central system. The format is:

1 4 7

\$*\$RCDyyyyyy

Where: RCD - Read Card.

yyyyyy = Blank - No constraints on reading the card deck.

= ~~Ø~~NOMSL - No Mass Store Link (GRTS/355 and GRTS/6600 only).

Send Output Control Record

The Send Output Control Record indicates that a remote computer terminal is ready to receive output from the central system.

1 4 7

\$*\$OUTyyyyyy

Where: yyyyyy is one of the following:

Blank - Any output for the terminal is acceptable.

SNUMB - Terminal requires output for specified program (SNUMB) only.

C - Terminal wishes to continue (from point of interruption) an output file that was interrupted previously. Some duplication of output usually occurs with this feature.

Disconnect Control Record

The Disconnect control record informs GRTS that the terminal (remote computer or keyboard/display terminal) has completed its input and the line should be disconnected. The format is:

For a remote computer terminal -

1 4

\$\$DIS

For a keyboard/display terminal -

\$\$DIS

Direct Access Control Record

The Direct Access control record requests that a terminal (required for remote computer interface user-coded module) be connected directly to a user program being executed in the central system. The format is:

1 4 7

\$\$DACyyyyyy

Where: yyyyyy is one of the following:

Blank - Terminal will wait until a user program addresses it by its station ID.

Program Name (six characters) - specifies the program to which the terminal is to be connected. This is the program name given as the second argument by the user program in the MME GEROUT when using a remote terminal inquiry (00000 is illegal).

Direct access is entered from a keyboard/display terminal and teleprinter terminals by the dial-in operation.

Abort Control Record

The Abort control record aborts a job that has been submitted, but is not yet in the termination phase. Once termination has begun, the Abort control record has no effect.

1 4 7

\$\$ABTSNUMB

Request Status Control Record

The Request Status control record requests that the status of one or all jobs submitted from the terminal requesting status, and currently in the central system, be returned to the originating terminal or another specified terminal. The format is:

1 4 7

*\$STSyyyyyy

Where: yyyyyy is one of the following:

Blank - Status of all jobs for the terminal.

SNUMB - Status of a specific job specified by SNUMB.

ID - Status of all jobs for another terminal specified by ID.

The possible status responses from the central system are:

READING-RMT	}	SNUMB ACT-NO XX
READING-CR		
READING-MT		
READING-D/D		
WAIT-ALOC		
WAIT-PERIP		
WAIT-CORE		
IN HOLD		
IN LIMBO		
EXECUTING		
SWAPPED		
WAIT-TAPE		
TOO BIG		
OVERDUE		
IN RESTART		
TERMINATING		

SNUMB OUTPUT	}	RELEASED
		FINISHED
		STARTED
		WAITING

SNUMB IN CATALOG CLASS .NAME

The \$*STS control record may also be used to list the special request against the terminal sending the record or to redirect the output for the terminal to the online printer at the central system.

In the \$*SSTS control record, if yyyyyy = !ONL~~Ø~~ the output for the terminal is printed at the central system. Two possible system responses are:

REDIRECT ID TO ONL ACCEPTED

or

SYSOUT QUEUE FULL, RETRY REDIRECT REQUEST

After the request is accepted, system operator approval of the redirection is asked:

*OPER, CAN STA id REDIRECT HIS SYSOUT TO ON-LINE

TYPE YES IF OK,

EOM IF NOT OK

If the operator answers YES, the Redirect request is carried out; if his response is EOM, the request is ignored and normal processing continues. The operator must base his decision on whether or not he has issued a special request to redirect output for the requesting station. If he has issued this special request, he responds with an EOM; if not, he types YES followed by an EOM.

The Redirect request is handled by GCOS as a special request. If problems are encountered in processing the request, the following denial message is printed at the online central system console to tell the operator that the ID in the request is not in the system, or that the request was cancelled by an earlier cancellation request.

*RE RDIO, SYSOUT CAN'T

The Redirect request cannot be cancelled from the remote terminal: it can only be cancelled by the operator at the system console. A terminal requesting Redirect may only redirect its own jobs.

If yyyyyy = !LSTR, all of the SYSOUT Redirect requests outstanding against the requesting terminal are listed. Possible responses to this request are:

REMOTE SPECIAL REQUESTS

(followed by a list of special requests queued against this terminal)

or

NO SPECIAL REQUESTS FOR THIS STATION

Break Control Record (GRTS/355 and GRTS/6600 Only)

The Break control record is used only on a keyboard/display terminal. It simulates a break condition, which attempts to interrupt the system. The format is:

\$*\$BRK

This is the normal procedure to send a line break from a VIP terminal.

FUNCTION CODE KEYS - VIP TERMINALS

Function Key Break (GRTS/355 and GRTS/6600 Only)

The function code keys are a keyboard option on all VIP terminals except the 7700 Series VIP. These keys are a standard "built-in" capability on the 7700 Series VIP. A function code sequence may be inserted in any terminal transmit frame to be interpreted by the DATANET VIP module (G76M), as a line break. This line status is sent to the central system, ignoring any text that may have been sent in that transmission.

The standard text frame transmitted by a VIP terminal, has the following format:

SOH,Screen address,Status,FC1,FC2,STX,text,ETX,long parity

Where: FC1, FC2 are the function code characters.

When the terminal operator does not use the function code keys, the FC character slots are filled with ASCII blanks. Legal function characters are shown in Tables 3-1 and 3-2 below. (See GRTS/355 and GRTS/6600 Startup Procedures, for method of specifying Function Code Break on the \$ HSLA card.)

Table 3-1. Function Codes Generated by VIP Keyboard Options
For 765 Series VIP, 775 Series VIP, 785 Series
VIP Terminals

EKB 761 WITH FKG 761/766	EKB 763 WITH FNG 762	EKB 764 WITH AKG 761/762/763	FUNCTION CODE ENTERED	
KEY LABEL	KEY LABEL	KEY LABEL	FC1	FC2
CLR	CLR			
A	A	S101 S201 S301	A	
B	B	S102 S202 S302	B	
C	C	S103 S203 S303	C	
D	D	S104 S204 S304	D	
E	E	S105 S205 S305	E	
F	F	S106 S206 S306	F	
G	G	S107 S207 S307	G	
1		S108 S208 S308	1	
2		S109 S209 S309	2	
3		S110 S210 S310	3	
4		S111 S211 S311	4	
5		S112 S212 S312	5	
6		S113 S213 S313	6	
7		S114 S214 S314	7	
8		S115 S215 S315	8	
		SGL LINE	B	1
		PTL LINE	A	1

- NOTES:
1. All keyboards listed, automatically transmit when a function code key is depressed.
 2. For EKB 761 and EKB 763, FC2 is a blank code for all keys.
 3. For EKB 764, FC2 is a "blank" code for S101 through S115, "A" for S201 through S215, and "B" for S301 through S315.
 4. EKB 764 automatically clears the function codes after transmission, EKB 761 and EKB 763 do not.

Function Key Break (GRTS/305)

GRTS/305 permits the first function character (FC1) to be any character from A through G or 1 through 8. The second function character (FC2) can be the same as FC1 and in addition, a blank can be used.

Function key information is supplied to the program on configuration cards beginning at location 31400 (octal) of the central system. The function characters are presented as two seven-bit ASCII characters, each stored in a nine-bit field of the same 18-bit word. Refer to System Startup manual for complete details on function key break configuration.

*

7700 Series VIP Function Codes

Function codes provide a special labeling capability for messages transmitted from the 7700 Series VIP terminal. The function codes contained in the message header may be used as a means of identifying the message and/or initiating software defined operations in the central system.

Function codes may be entered automatically by the central system and manually by the operator. Contents of the function code position in data messages from the central system are stored by the terminal and retransmitted to the central system in the next data message. The operator can override the stored function codes by manual entry from the keyboard.

In the function code "reset" condition, SPACE codes are inserted in the function code positions of transmitted messages.

Operator Function Code Entry

The alphanumeric area of the 7700 Series VIP keyboard and the "numeric pad" of the keyboard provide for operator entry of function codes. Each key, plus the control (CTR) key, generates a unique function code.

The 0 key in the numeric pad generates a "Function Clear" which resets existing function codes to SPACE codes. Entry of function codes from the keyboard are accepted into the FC1 position and previous contents of FC1 are shifted to the FC2 position. Any number of function code entries can be made prior to transmission and the last entry will be in the FC1 position and the next to the last entry will be in the FC2 position.

A one-character (FC1) or two-character (FC1,FC2) function code break must be configured on the \$ HSLA configuration card. Any of the F.C. () characters listed in column 4, Table 3-2 may be used.

The screen (CRT) should be cleared of any text, depress the control key (CTR) and the key listed in column 1, Table 3-2, as being equivalent to the configured function code character.

Example: If A is the configured entry for FC1 - depress the CTR key and the 7 key (numeric pad). In this case "Control, 7" is equivalent to the F.C. (A) for function code use.

This action enters the code for transmission. To transmit the break to the FNP - depress and hold the CTR key and then depress the TRANSMIT key.

Table 3-2 shows all 7700 Series VIP key legends and corresponding function codes generated.

Function Code Reset Conditions

The contents of FC1 and FC2 are reset to SPACE codes under the following conditions:

- Power on
- CTR/0 (zero key in numeric pad)
- Receipt of ACK
- CTR/CLEAR (keyboard command to clear display and reset the terminal to its initial conditions).

Central System Function Code Entry

The function codes contained in received NUL messages are entered into the terminal function code storage and, unless modified by subsequent operations, are retransmitted by the terminal with the next NUL message (also contained in the ACK message).

Additional information concerning operating procedures may be found in 7700 Series Visual Information Projection (VIP) Systems.

Table 3-2. 7700 Series VIP Keyboard Functional Description

Key Legend	Unshifted	Shifted	Control (CTR)
CLEAR	clear display	clear display	clear all
TAB S/C	tab set	tab set	tab clear
LINE CLR	line clear	line clear	clear to end of page
CHAR I/D	char. insert	char. insert	character delete
LINE I/D	line insert	line insert	line delete
TAPE READ	tape read	tape read	tape read
TAPE WRITE	tape write	tape write	tape write
PRINT	print disp.	print disp.	print disp.
HOME	home	home	home
←	backspace	backspace	backspace
↑	reverse line feed	reverse line feed	reverse line feed
↓	line feed	line feed	line feed
→	forward space	forward space	forward space
TRANSMIT MSG/PAGE	transmit message	transmit message	transmit page
BLANK/BLINK	blink	blank	F.C. (N)
LINE RETURN	line return	line return	line return
TAB	forward tab	forward tab	reverse tab
NEW LINE	new line	new line	new line
1 !	1	!	F.C. ¹ (!)
2 "	2	"	F.C. (")
3 #	3	#	F.C. (#)
4 \$	4	\$	F.C. (\$)
5 %	5	%	F.C. (%)
6 &	6	&	F.C. (&)
7 '	7	'	F.C. (')
8 (	8	(	F.C. ((
9)	9	)	F.C. ())
0 (zero)	0	0	F.C. (0)
- = (minus)	-	=	F.C. (=)

Table 3-2 (cont). 7700 Series VIP Keyboard Functional Description

Key Legend	Unshifted	Shifted	Control (CTR)
— (overline)	—	—	F.C. (L)
Q	Q	Q	F.C. (q)
W	W	W	F.C. (w)
E	E	E	F.C. (e)
R	R	R	F.C. (r)
T	T	T	F.C. (t)
Y	Y	Y	F.C. (y)
U	U	U	F.C. (u)
I	I	I	F.C. (i)
O	O	O	F.C. (o)
P	P	P	F.C. (p)
@	@	@	F.C. (˘) (grave accent)
| (left bar)	|	|	F.C. (K)
┌	┌	┌	F.C. (O) (alpha)
A	A	A	F.C. (a)
S	S	S	F.C. (s)
D	D	D	F.C. (d)
F	F	F	F.C. (f)
G	G	G	F.C. (g)
H	H	H	F.C. (h)
J	J	J	F.C. (j)
K	K	K	F.C. (k)
L	L	L	F.C. (l) (alpha)
; +	;	+	F.C. (+)
: *	:	*	F.C. (*)
| (right bar)	|	|	F.C. (M)
Z	Z	Z	F.C. (z)
X	X	X	F.C. (x)
C	C	C	F.C. (c)
V	V	V	F.C. (v)
B	B	B	F.C. (b)
N	N	N	F.C. (n)
M	M	M	F.C. (m)
, >	,	>	F.C. (>)
/ ?	/	?	F.C. (?)
SPACE BAR	(SPACE)	(SPACE)	F.C. (SPACE)
1 (Numeric Pad)	no operation	1	F.C. (C)
2 (Numeric Pad)	no operation	2	F.C. (F)
3 (Numeric Pad)	no operation	3	F.C. (I)
4 (Numeric Pad)	no operation	4	F.C. (B)
5 (Numeric Pad)	no operation	5	F.C. (E)
6 (Numeric Pad)	no operation	6	F.C. (H)
7 (Numeric Pad)	no operation	7	F.C. (A)
8 (Numeric Pad)	no operation	8	F.C. (D)
9 (Numeric Pad)	no operation	9	F.C. (G)
0 (Numeric Pad)	no operation	0	function code clear
- (Numeric Pad) (minus)	no operation	-	F.C. (-)

¹F.C. = function code

PAGE OVERFLOW RECOVERY PROCEDURES

All 7700 Series VIP terminals send a special status to GRTS when a message being received from GRTS overflows the display memory, i.e., the message exceeds the limit of page size and is lost at the bottom of the screen. When this occurs, the ERROR light on the terminal panel is illuminated.

The operator may recover by repositioning the cursor and transmitting any message to GRTS for a retry. If a retry is not desired, or subsequent retry analysis indicates faulty text editing by the central system, the user should transmit a break message. This may be accomplished with the `*$BRK` control record or by sending any message with proper function code break as defined on the `$HSLA` configuration card. The break causes the message waiting for retry to be discarded and the next message for the central system may be entered by the operator.

PRINT PAGE ADAPTER AND CASSETTE UNITS

The 7700 Series VIP print page adapter is supported for online operations with the following restrictions. The ppa is indirectly addressable via the display address only (150). No free-standing printer operation is supported. The keyboard/display unit plus the printer are considered to be a single end-point. Therefore, only one mode of operation at a time is permitted, i.e., no overlapping of print and keyboard/display functions.

The tape cassette unit provides a recording and playback capability using tape cassettes. Single or dual cassette units are available. Either unit may be written to/read from using the display memory as a page buffer. The cassette tape may also be read, displayed, and printed in offline operation by a control on the tape unit. In addition the cassette unit may be recorded or read by command from the central system.

Any illegally formatted output messages from the central system result in an error message to the terminal. The message `DAC PROGRAM ERROR` is sent and the terminal is disconnected. Once the central system `DAC` program is operating properly this condition will not be encountered. It should be noted that a destination code which causes a write cassette operation copies the complete screen display to the cassette tape. GRTS clears the screen prior to the write cassette message text. The user's program must consider this when formatting output. For this reason and for facilitating error recovery procedures, write cassette or printer messages should be sent to the terminal in one block (up to display memory size limits) and not partitioned.

An example of the print page adapter operation with TSS is shown in Figure 3-1. Operation of the tape cassette with TSS is shown in Figures 3-2 and 3-3.

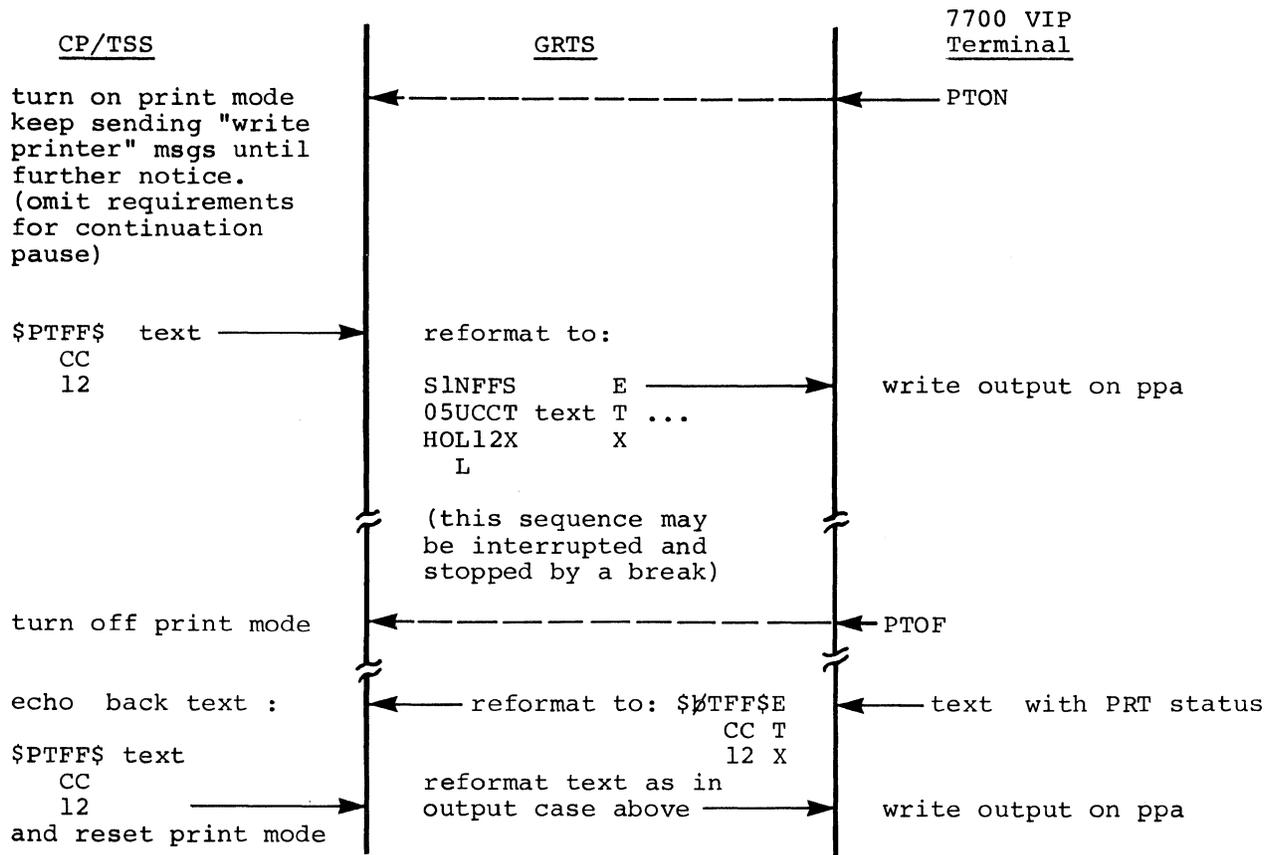


Figure 3-1. Operation of the Print Page Adapter with TSS

Input:

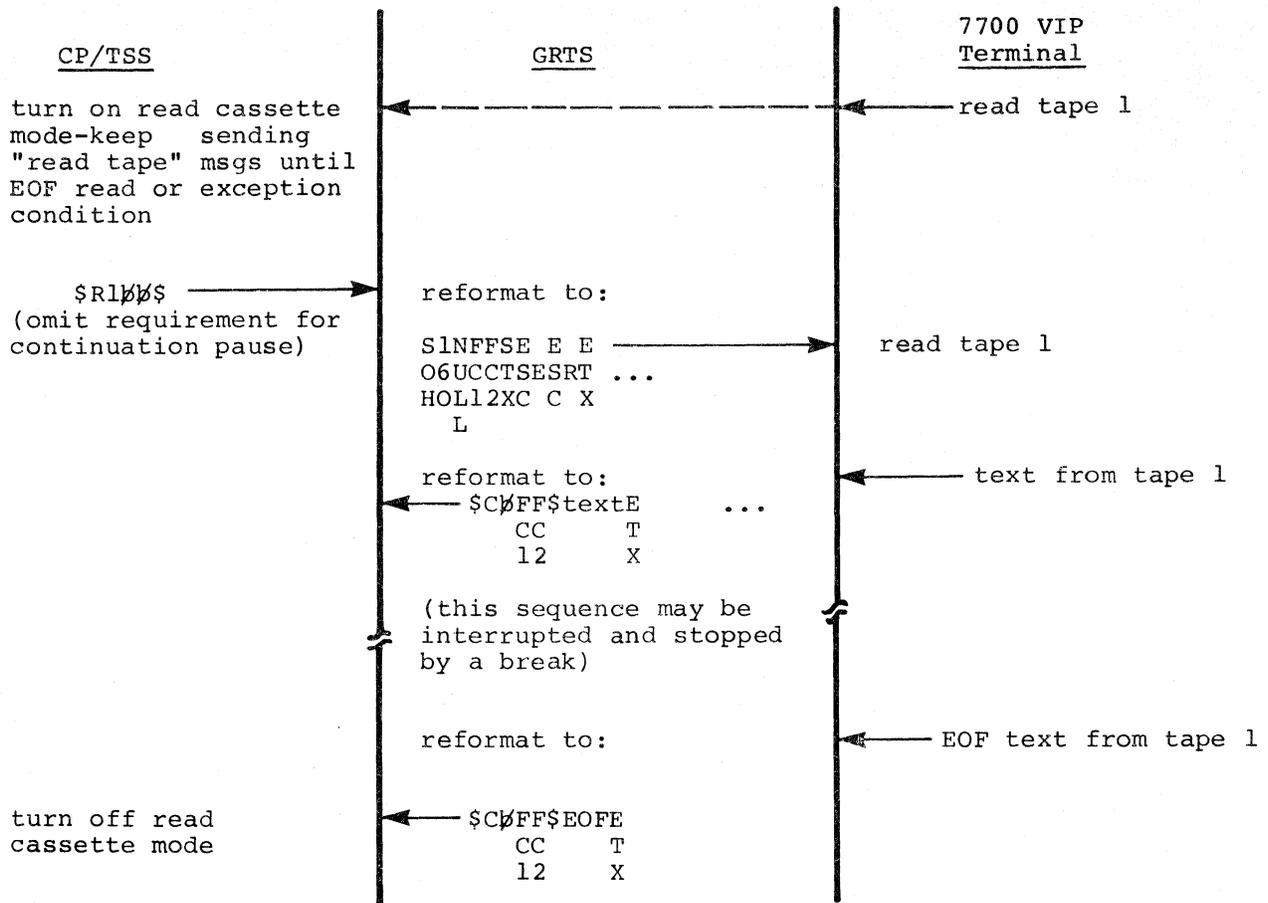


Figure 3-2. Operation of the Tape Cassette with TSS

Output:

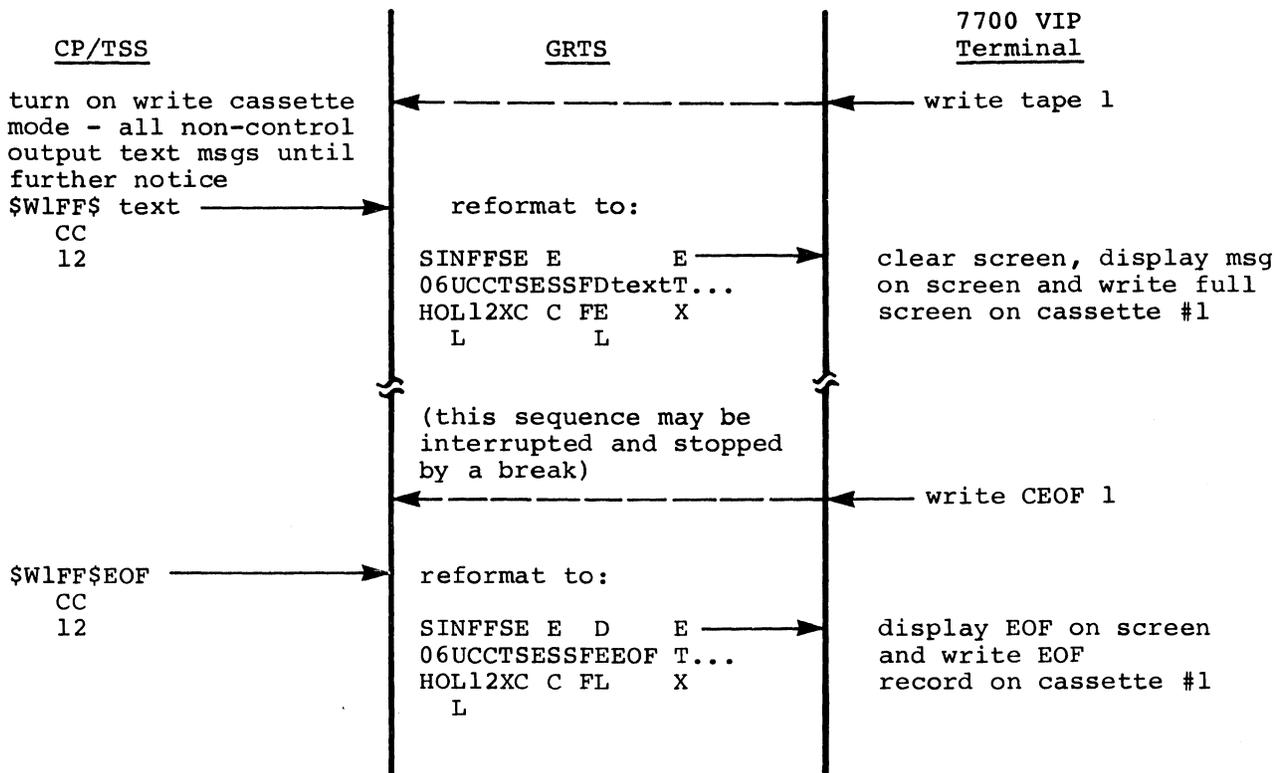


Figure 3-3. Operation of the Tape Cassette with TSS

Error Recovery Procedures

1. There are several situations that can cause the status condition "Device Not Available" (155 octal):

A TermiNet 300 or TermiNet 1200 printer with status monitoring option, direct connected to the 7700 Series VIP reports this status in response to a central system output text message if power is off, printer is in local mode, paper is out, or the print shield is lifted. A cassette reports this status in response to a central output text message if the cassette is not present, the cassette mode SW is not in REMOTE, the cassette is not READY, or the cassette is write protected and a write command resulted in an unrecoverable read or write error.

2. Recovery procedure -

Upon receipt of the above status condition, a message:

FIX.PRINTER

or

FIX.CASSETTE

is sent to the display screen to inform the operator that manual intervention is required. Upon receipt of a null input transmission (no text), a retry is attempted. The operator may exit from the retry loop by transmitting a break message (\$*\$BRK or a function code break, if configured).

Terminal Connected by Time Sharing System

A direct access program may be put into execution and then accessed by the terminal, while still connected by TSS, i.e., using the CARDIN/RUN/TALK mode of operation. The communications processor is not aware that this has occurred. If a printer or cassette has been used previously during the current connect period, enabling the text header mode of operation, then the direct access program now in execution must be capable of servicing the new text headers. If the direct access program does not have this capability the user must disconnect the terminal to disable the text header mode of operation and then reconnect to the direct access program without prior use of the printer or cassette.

Banking Teller Terminal Interface (DATANET/355 and DATANET/6600 Only)

The Honeywell Banking Teller Terminals, BTT7340 and BTT7340E utilize the VIP keyboard/display terminal line discipline. GRTS uses the VIP module G76M, the poll and select submodule GPSM and the BTT submodule GTBM to interface with these terminals.

The Banking Teller Terminals operate in the poll and select mode only, and may share a common line with other BTTs and VIP keyboard/display terminals; however, synchronous and asynchronous terminals may not be connected on the same line.

The BTT operator cannot communicate directly with GRTS using keyboard input, as in the normal operation of a VIP keyboard/display terminal. Therefore, GRTS performs several functions automatically for this terminal:

1. Automatic log-on to the down-line load program upon receipt of the terminal request. The down-line program name (.MTBLD) must be defined on the \$ PTI card.
2. Broadcast addressing of down-line load data blocks.
3. Automatic log-on to the proper online operations direct access program upon receipt of the first input after the down-line load request.

4. Automatic accommodation of the break prior to the data input sequence when the terminal is in conversation with the transaction processor direct access program.

The BTT message format accepted by the central system conforms to the format for VIP line discipline devices described previously in Section II of this manual. The 36-bit header that contains the character count and function codes is also used by the transaction processor module TPAP after reformatting. TPE formats may be found in the Transaction Processing System Users Guide.

User cognizance of the following items is very important to proper operation of the BTT7340 terminal.

1. The down-line load file builder program .MTBLD must have completed execution before the central system issues the ACALL message to GRTS.
2. In online operation the input message FC2 field contains the input message sequence number that is generated by the BTT firmware.
3. GRTS deletes duplicate messages, but missing messages must be recovered in the user program by instructing the operator to restart the transaction.
4. The output message FC1 field should always be set by the user's program to an ASCII E (for print or display messages), or an ASCII A (to indicate the received transaction is valid).

DOWN-LINE LOADING THE BTT7340 TERMINAL

The file creation for the down-line load program in the central system is described in the System Startup manual.

To effect a down-line load from a BTT, the terminal must be initialized from the power off state. After power has been turned on, the supervisor key is inserted in the appropriate lock and turned on, the MODE switch set to 1 and the table to be loaded selected by pressing the key that corresponds to the table name. This procedure should be repeated for each terminal to be loaded with the same table. Terminals to be loaded with other tables may also be initialized at this time since the down-line load program broadcasts table data for all requested tables to all initialized terminals. After all desired terminals are initialized, the down-line data loading is started by pressing the END OF TRANS key on the last terminal. GRTS connects to the down-line load program and processes the data block requests until all connected terminals are satisfactorily loaded. A terminal is loaded when the CALL and RECEIVE lamps remain extinguished. It is permissible to down-line load one or more BTTs at any time, totally independent of other activity on the line.

ONLINE OPERATION

The BTT operates with any direct access program that conforms to the conversational mode diagrammed in Figure 3-4. It also operates with the central system transaction processor program identified with the name HI-TRX on the \$ PTI card in the startup deck.

All user-generated direct access programs should require the first input message from a just connected terminal, to be a supervisory or teller log-on. This message must contain enough information to uniquely identify the operator(s) and the physical location of the terminal. The application program should also correlate this log-on information with an arbitrary, but unique, two-character (BCD) identification code assigned by GRTS when the subject terminal is connected to the direct access program (including HI-TRX). This ensures all subsequent input messages from that terminal are properly recognized and processed.

If a connect to an online program or a down-line load is attempted before the central system enables GRTS to accept calls (ACALL), the message is ignored. If a connect to an online program is attempted before the program is in execution the following message is printed on the BTT journal:

(name of program) NOT KNOWN

If the terminal is not disconnected, and the direct access program begins execution, the operator is notified with the following journal message:

RETRANSMIT

At this point, the supervisory log-on should be retried.

Messages that are common to other communications terminals may also be sent to the BTT. GRTS forces printing on the journal by inserting the appropriate function codes and text control characters.

TERMINATION

The BTT terminal may be disconnected at any time by the user's program, by central system operator intervention, or by turning off the terminal. When the central system originates the disconnect, the following message is printed on the journal:

LINE TERMINATED - - CP

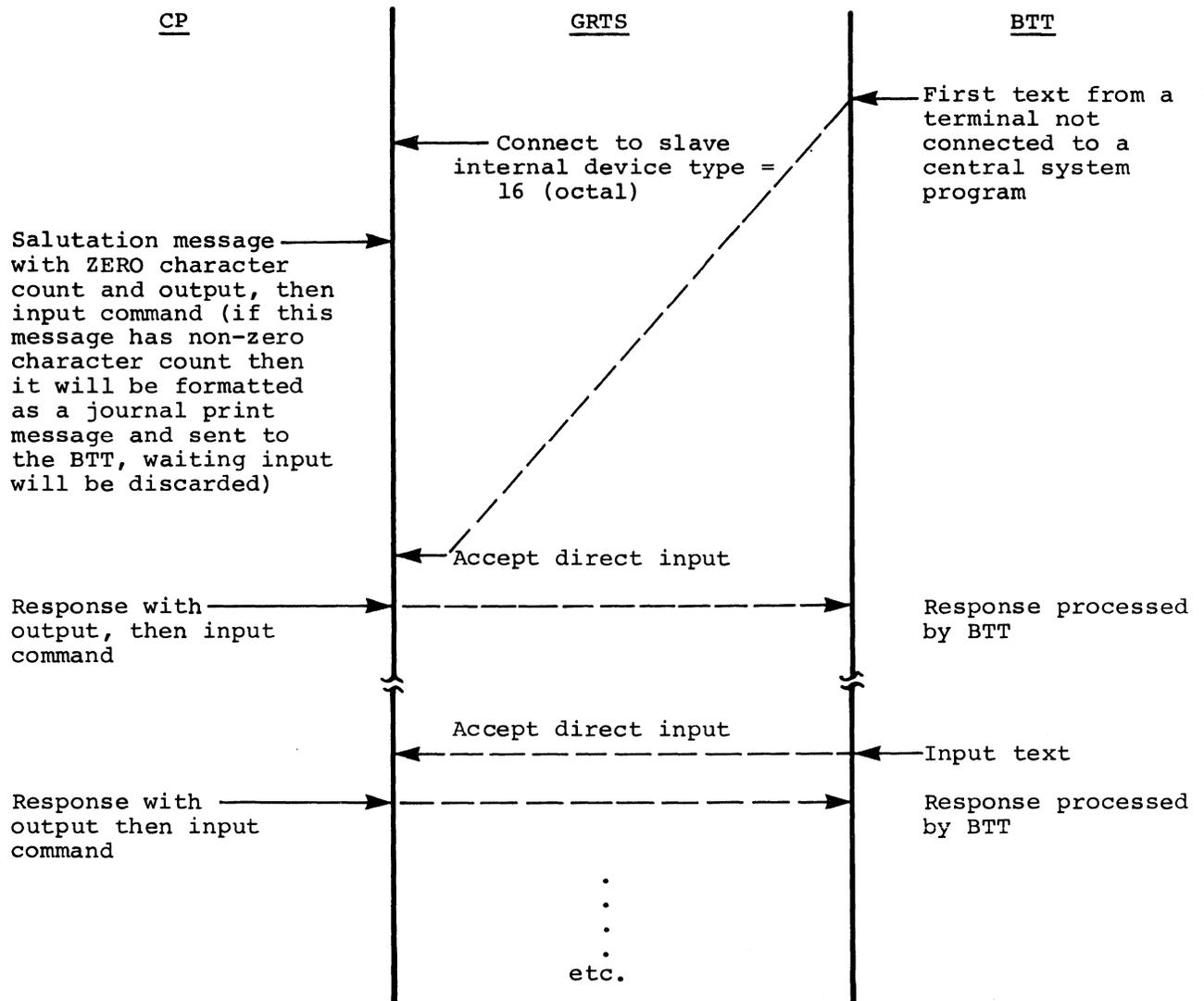


Figure 3-4. BTT Online Direct Access Operation Sequence

DATA CAPTURE CASSETTE UNIT (DCC)

The Data Capture Cassette Unit (DCC) has the capability of recording BTT transactions on tape while the communications line and/or the central system is inoperable. When online operation is resumed, the DCC transmits these transactions to the central system to update the data base. This terminal operates with the VIP line discipline, on a poll and select line and may be operated simultaneously with other BTTs and VIPs on the same line. Standard software packages are supplied on cassette tapes allowing a single DCC to be either a synchronous or an asynchronous device by loading the proper software from its own cassette. However, when configuring DCCs, BTTs or VIPs on the same line, all terminals must be either synchronous or asynchronous.

The Data Capture Cassette Unit differs in several respects from the Bank Teller Terminal:

- There is no message display device attached to a DCC therefore, the only legal error message is a negative acknowledgment (NAK).
- Operation, once started, is fully automatic, and extra protection is required to preclude lost transactions. The DCC input transaction is not acknowledged (ACKed) by GRTS until a "prompt" is received from the central system applications program, indicating receipt of that transaction.
- Since the DCC repeats an input transaction until it is ACKed, polling of the DCC is inhibited between a transaction input and the ACK to prevent undue loading of the communications line.
- Special routing information for TPS only is appended as a text header on all input transactions. This is specified on the GRTS \$ PTI configuration card. (See GRTS/355 and GRTS/6600 Startup Procedures.)

Figures 3-5 and 3-6 show the operation of the DCC with the Transaction Processing System and a typical direct access program. Note that all of the normal central system responses are text messages with a character tally of zero. Any nonzero response is considered an error return.

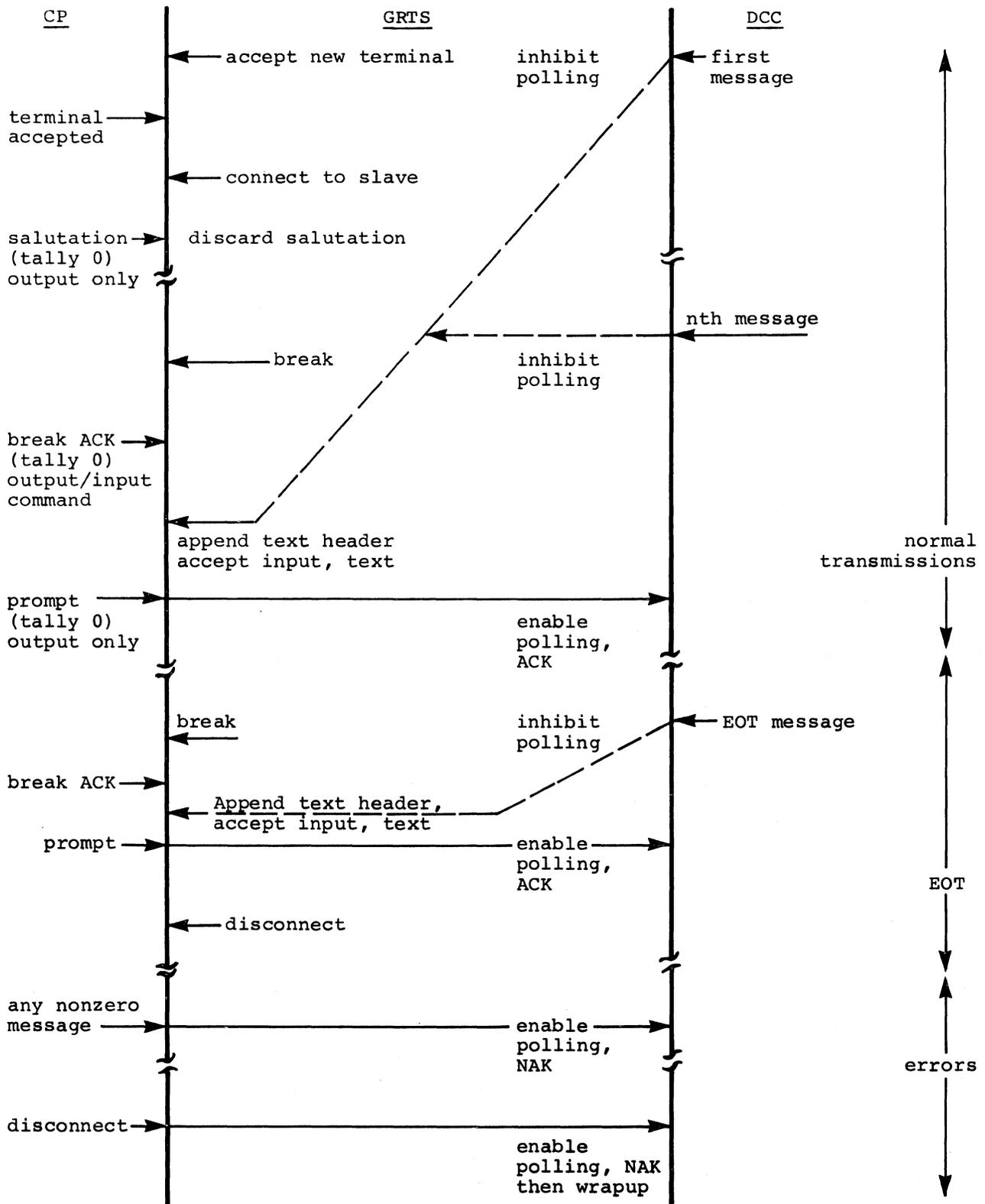


Figure 3-5. DCC Batch Input to Transaction Processing System

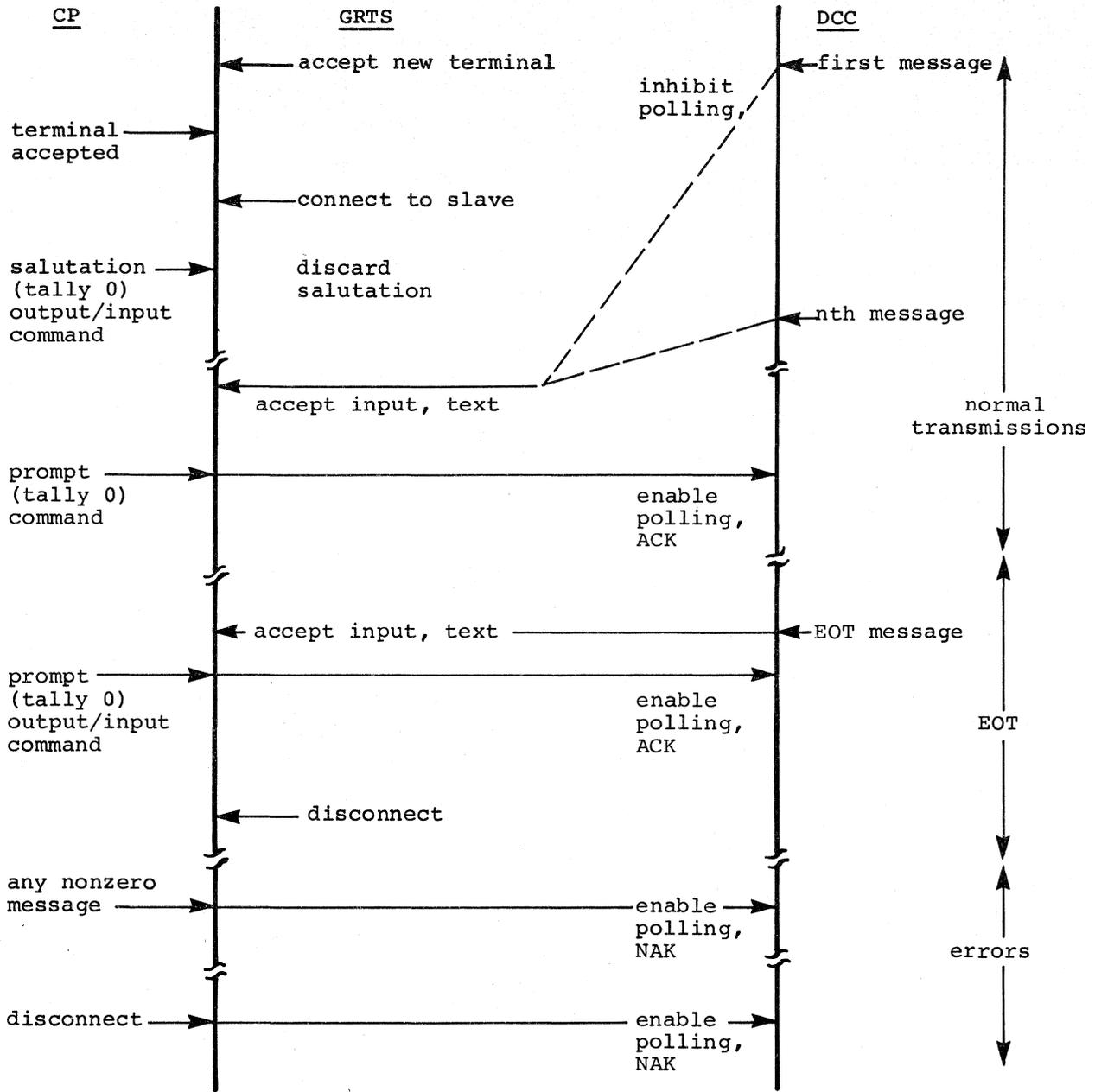


Figure 3-6. DCC Batch Input to a Non-TPS DAC Program

GCOS CONTROL RECORDS

\$ REMOTE Control Record

The \$ REMOTE control record is a GCOS control card which specifies the terminal to which output is to be sent. This card is placed in a GRTS job deck to assign an output file to a remote computer terminal other than the originating terminal. The receiving terminal must be specified by ID on the card. A maximum of nine files may be output per activity. If the output is a standard SYSOUT file which is to be returned to the originating terminal, a \$ REMOTE control record is not needed. The format for a \$ REMOTE control record is as follows:

<u>1</u>	<u>8</u>	<u>16</u>
\$	REMOTE	aa,bb

- Where: aa - A two-character file code the programmer assigns to a file. System output files such as P* may also be assigned.
- bb - A two character, alphanumeric destination code identifying the terminal to which the output file should be sent.

The file codes most commonly used within software programs, such as GMAP and FORTRAN, are as follows:

- P* - Contains the material normally sent to SYSOUT for printing at the central system.
- C* - Contains binary punch card information generated by the compilers and assemblers.
- K* - Contains COMDK cards generated by the File and Record Control program.

The \$ REMOTE card is not used exclusively by remote terminals. A user job submitted at the central system may contain a \$ REMOTE card to designate some files as terminal output. In this use, the \$ REMOTE card must contain the bb field.

Message (MSGn) Cards

The MSG1 and MSG2 cards permit a remote terminal user to communicate with system operators at the central system. The general format of the message card is:

1	8	16
\$	MSGn	c,message text

Where: n = 1 or 2 (MSG3 is used for System Scheduler HOLD function).

c = Logical console number (1-4) corresponding to console TY1, TY2, TY3 or TY4.

MSG1 causes the message text to be output on the designated console during the initial job scan and causes the job to be put in a HOLD status. An operator must then request RUN to execute the job.

MSG2 causes the text to be output the first time the associated activity is considered for allocation. This causes no job delay other than I/O time.

GRTS/355 and GRTS/6600 MESSAGES

The messages described in the following paragraphs are sent to the remote terminals by GRTS to describe various system conditions.

These messages are sent to a remote computer terminal and to an IBM 2780 Data Transmission terminal.

LINE DISCONNECTED -- xxx

Where: xxx = CP - Central system disconnects.
= DIS - Received DIS GRTS control record.
= ICC - Invalid command from central system.

LINE TERMINATED -- xxx

Where: xxx = PAS - Did not receive user ID password.
= ABT - No SNUMB on Abort control card.
= S/I - Missing SNUMB or IDENT card.
= ONA - Output not available.
= INV - Invalid control card.
= IMF - Invalid message format.
= SLV - Slave program not in system (DAC only).
= OC - Output complete.
= SPD - Link space denied.
= NSA - No link space available.
= LNE - Link number error.
= 6UA - Central system unavailable.
= RCE - Retry count exhausted.
= DOL - Device off-line.
= EOF - End-of-File (EOF status cannot recover).
= TNK - Terminal not known.
= RCM - Remote computer module.

One of the following reason codes may be supplied by the central system in place of the above GRTS reason codes:

XID - Blank or zero ID.
*ID - Duplicate ID.
PTF - No PAT entries available for input.
SNB - Missing \$ SNUMB card.
SIZ - Job source too long.
NUM - No available program number for job.

DSC - Excessive disk errors.
DUP - Duplicate SNUMB's.
LNK - No disk links available.

FILE BACKSPACED

FILE ABORTED -- xxx

Where: xxx = BCW - Block control word and record control word do not agree.
= EOF - Received EOF record, but not final output from central system.
= OP - Operator aborted this file.
= ND - No data received from central system.
= RCW - Record control word too long for empty line buffer (no split).

GRTS/305 MESSAGES

The messages described below are sent to a remote computer terminal by the GRTS/305 control program.

LINE DISCONNECTED - xxx

Where: xxx = CP - Central computer system disconnects.
= DIS - Received GRTS DIS control record.
= ICC - Invalid command from central system.
= CIU - Errors in Computer Interface Unit.
= BUF - No buffers available.

INPUT RECEIVED

INPUT TERMINATED REASON xxx (reason code xxx from central system)

Where: xxx = PTF - No PAT entries available for input.
= SNB - Missing SNUMB card.
= SIZ - Job source too long.
= NUM - No available program number to assign to job.
= DSC - Excessive disk errors.
= DUP - Duplicate SNUMB's.
= LNK - No disk links available.
= ID - Duplicate ID.

GRTS/305/355/6600 MESSAGES

The GRTS control program may send one of the following messages to a keyboard/display terminal.

LINE TERMINATED -- xxx

Where: xxx = INC - Invalid control card.

= IMF - Invalid message format.

= IPS - Invalid page size.

= CP - Central system disconnects.

= DIS - Disconnect from keyboard/display terminal or invalid op code sent by central system.

= TIMEOUT - Timeout.

= EXCESS RETRIES - Too many retries due to negative acknowledgements, or busy status from the terminal.

= NO TERML. RESP. - No response from terminal.

= CP REJECTED - Central system rejects op code.

= DAC ERROR - Invalid op code from central system.

= CIU - Errors in Computer Interface Unit (GRTS/305 only).

= BUF - No buffers available (GRTS/305 only).

RETRANSMIT LAST MESSAGE - PARITY ERROR

All GRTS control programs may send any of the following messages to a teleprinter terminal.

PAPER TAPE TIMING ERROR - Timing error detected during paper tape input. All data up to the line being input was transmitted successfully.

RETRANSMIT LAST LINE - Error encountered in normal input mode.

DAC ERROR - Meaningless operation code (illegal or out of context) sent by central system during direct access operation.

TIMEOUT - Terminal timed out waiting for input (followed by line disconnect).

NO RESPONSE FROM CP - Central system does not answer GRTS call.

CP DISCONNECTS - Central system disconnects

PROGRAM NAME - Terminal operator must supply the name of the CP program to be accessed.

MESSAGES ORIGINATING IN CENTRAL COMPUTER SYSTEM

The following messages are generated by the central system and transmitted to the terminals, as applicable. Each message is preceded by activity and SNUMB information in the following form:

sssss aa

Where: sssss - Job sequence number.

aa - Activity number.

Status Request Responses for a Specific Job

The following messages are sent to the inquiring terminal in response to a status request for a specific job.

NOT IN SYSTEM - Job was not found. In some cases, the SNUMB may have been temporarily hidden.

xxxOUTPUT RELEASED

Where: xxx = ONL if there is online output for this job.

= two-character station ID. The SYSOUT space assigned to this job for this destination has been released and is no longer printable.

xxxOUTPUT FINISHED

Where: xxx is treated the same as for OUTPUT RELEASED. SYSOUT has finished outputting this job to the specified destination, but it is still available for reprinting. The SYSOUT space could be released at any moment.

xxxOUTPUT WAITING

Where: xxx is treated the same as for OUTPUT RELEASED. Output for this job is either waiting to be printed or punched or is in the process of being printed or punched. This message will always reflect all output destinations and the status of the output for these destinations.

xxNO OUTPUT

Where: xx = two-character station ID. Although output was designated for this station, there is no output.

Status Request Responses for Job and Station ID

OUTPUT RDY	Output is ready for this job.
EXECUTING	Job is currently executing.
SWAPPED	Job temporarily swapped out of core storage.
WAIT-CORE	Execution is being held until enough storage is available to load this job.
WAIT-PERIP	Execution is being held until peripheral requirements become available.
WAIT-ALOC	Job is not a candidate for allocation. System conditions prevent allocation of any program at this time.
WAIT-TAPE	Job requirements for magnetic tape units exceed the number of units currently available.
TOO BIG	Job requirements exceed limits set at the central system. Before this job can run, permission must be granted at the central system console.
IN HOLD	Job is not eligible for allocation at this time. Temporarily placed in HOLD by the central system operator.
IN LIMBO	Job is being held until central system operator retrieves the magnetic tape files.
OVERDUE	Allocation for this job is overdue.
READING-RMT	Job is currently reading into the system from a remote station.
READING-MT	Job currently reading into the system from a central system magnetic tape.
READING-D/D	System Input program for disk is reading (jobs submitted through TSS CARDIN or GRTS/115 batch).

Responses to \$\$DAC Requests

xxxxxx IS NOT KNOWN	Program represented by xxxxxx is not currently known. It may, or may not, start.
xxxxxx WILL NOT START	This is a known program, but the operator will not run it.
xxxxxx WILL START AT APPROXIMATELY tt.tt	The program represented by xxxxxx will start at approximately this time.

Other Messages

SNUMB NOT FOUND IN SYSTEM
SNUMB ABORT IN PROGRESS

TELEPRINTER CONFIGURATION MESSAGE (DATANET 355 and DATANET 6600 FNP)

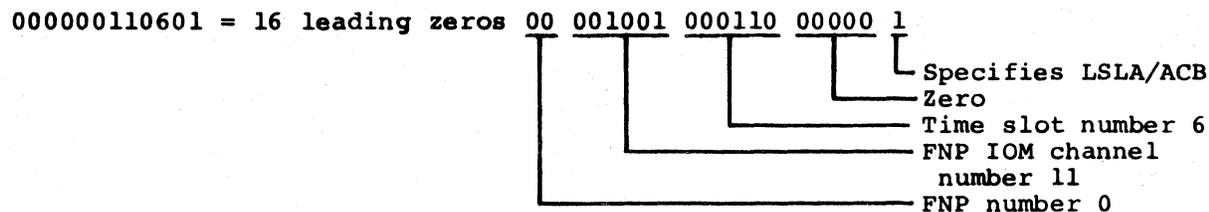
When a teleprinter terminal first rings into the DATANET FNP, a twelve-digit configuration identification message is sent to the terminal as word 2 (3rd, 36-bit word) of the channel mailbox. These digits are octal and must be expanded to binary bits. The bits are interpreted by comparing them with the following table to determine the configuration:

	0	15 16 17 18	21 22 23 24	28 29 30	34 35		
For HSLA/GPCB	ZERO	FNP#	CH#	H/G#	SCH#	VIP ADDRESS	0
or For LSLA/ACB	ZERO	FNP#	CH#	TS#	ZERO		1

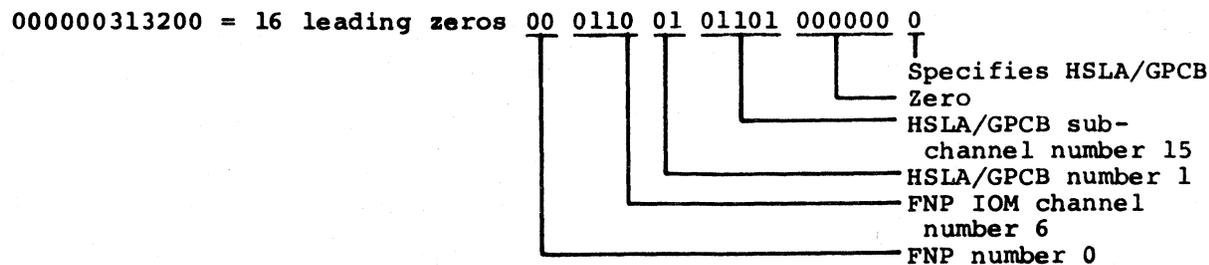
- Where:
- HSLA/GPCB - High Speed Line Adapter or General Purpose Communications Base
 - LSLA/ACB - Low Speed Line Adapter or Asynchronous Communications Base
 - FNP# - DATANET FNP number
 - CH# - DATANET FNP IOM channel number
 - H/G# - Relative number (1-3) of HSLA or GPCB
 - SCH# - Subchannel number (HSLA/GPCB)
 - TS# - Time slot number (LSLA/ACB)
 - Bit 35 - Format flag bit, 0 = HSLA/GPCB, 1 = LSLA/ACB

Examples:

The configuration definition number 000000110601 defines the following:



The configuration definition number 000000313200 defines the following:



NOTE: In these examples, spaces have been inserted in the binary representation for clarity.

MME GEROUT

MME GEROUT Definition

Remote System Input/Output (GEROUT) forms an integral part of the remote access system within GCOS. GEROUT serves as a remote terminal interface and coordinator for the following GCOS programs:

- Remote SYSOUT (.MROUT)
- Remote System Input (.MRGIN)
- Direct Access GCOS Programs (Direct Access Output, Direct Access Output/Input, Remote Inquiry, Terminal Identification)

All remote I/O requests for these programs are initiated by MME GEROUT calling sequences. The MME GEROUT calling sequences are an integral part of the user program executing in the central computer system and are used when the program needs to communicate with a terminal. In the direct access mode of operation, GEROUT enables the user program to communicate with a terminal to perform the following types of operations:

- Send output to/receive output from the terminal
- Identify the terminal
- Obtain the status of the terminal
- Disconnect a terminal

The general format is as follows:

```
L      MME      GEROUT
L+1    VFD      18/Record Pointer,6/OP,H12/Terminal ID
L+2    ZERO     Status Word Pointer, Courtesy Call
L+3    Next Instruction
```

Where: L+1 is as follows:

```
Bits  0-17  Record Pointer
       18-23 Operation Code
       24-35 Terminal ID
```

Various applications of the MME GEROUT are described in the following paragraphs.

COMMAND BITS

Certain MME GEROUT functions - Direct Access Output; Direct Access Output, then Input; Direct Access Output/Prepare to Receive Paper Tape Input; Accept DAC Paper Tape Input - use the lower half of word 0 (input buffer) or word 1 (output buffer) of the data block as command bits. These bits control input (FNP to central system) and output (central system to FNP) operations.

Output command bits are defined as follows:

1. For teleprinter:

Bit 31=1 Output data will not be passed to the G30M module for editing, even though the terminal is a 150- or 300-bps terminal and the 300-bps option was selected on the GOPT card when the FNP was configured.

Bit 32=1 This bit is defined only for terminals connected via the HSLA/GPCB and only in conjunction with a Direct Access Output/Prepare to Receive Paper Tape Input operation. This bit is ignored for terminals connected via the LSLA/ACB or performing any other operation. This bit set causes all input characters to be treated as data and sent to the central system. This mode cannot be terminated by X-OFF; instead, it will terminate when no data has been received for a period of five seconds.

Bit 33=1 This bit is defined only for terminals connected via the HSLA/GPCB and only in conjunction with a Direct Access Output/Prepare to Receive Paper Tape Input operation. This bit is ignored for any terminal connected via the LSLA/ACB or for any other op code. This bit set disables parity checking on the paper tape input. The data is passed to the central system with the parity bits intact. (Bits 32 and 33 are normally used together, and their use constitutes the transparent paper tape input (LUCID) mode.)

Bit 34=1 This bit set inhibits parity generation on the output for this transmission.

Bit 35=1 Used in conjunction with the Direct Access Output/Then Input op code, this short timeout bit causes GRTS to disconnect the terminal after one minute instead of the normal 10-minute timeout.

2. These command bits are not used by remote computer and keyboard/display terminals.

Input command bits are as follows:

1. For keyboard/display terminals -

Bits 18-24/25-31 - ASCII function characters (FC1 and FC2 respectively) entered from special keys on the terminal keyboard.

Bit 32 - Print status if terminal operator sent data using PRT key instead of TX key.

Bits 33-34 - Not used.

Bit 35 - Truncation warning flag set at intercomputer interface if central system program has not provided sufficient buffer space for complete input text.

2. For remote computer terminals -

Bits 18-34 - Not used.

Bit 35 - This bit set indicates the data received exceeded the allowable number of characters (was greater than 1272 characters).

3. For teleprinter terminals -

Bit 33=1 - Used with paper tape input to indicate that the paper tape mode is terminated because the central system did not take the data fast enough.

Bit 34=1 - This bit set indicates that this is the last block of paper tape input.

Direct Access Output

The Direct Access Output MME allows a slave program in execution to send output to one or more terminals. The calling sequence is as follows:

L MME GEROUT
L+1 VFD 18/Record Pointer,06/03,H12/Terminal ID
L+2 ZERO Status Word Pointer, Courtesy Call
L+3 Next Instruction

For a DATANET 305 FNP, the record pointer designates the symbolic location of word 0 of the data block, which contains the number of words in the block and the media code of the output if to a voice-grade terminal. If transmission is to a Model G-115 terminal, the format of words 1 to n is one print line, using six-bit characters, with an octal 77 indicating the end of print line and the next character used as the slew character. If transmission is to a teleprinter, word 0 does not include a media code, and word 1 contains the count of the characters to be transmitted (312 characters). Words 2 to n contain the actual characters to be transmitted. The characters are right-justified within a nine-bit field. Characters in partial words are left-justified in the word.

For a DATANET 355/6600 FNP, the record pointer points to the location of word 0 of the data block, which contains the number of words in the block. The upper half of word 1 designates the count of characters to be transmitted (1272 characters - two characters per FNP word). The lower half of word 1 contains the indicators described under MME GEROUT definitions. On output from the central system, GRTS interprets these. Words 2 to n are the actual characters to be transmitted; each character right-justified within a nine-bit field. Characters in a partial word are left-justified in the word.

0	1718	35
0	No. of central system words	
1	No. of Chars.	Control bits
2	Chars. to be transmitted	
.	.	
.	.	
.	.	
.	.	
n		

Op Code - 03 specifies a direct access output to a terminal.

Terminal ID is a two-character code identifying the terminal.

Status Word Pointer points to a word that contains the status of the operation in process. The format of the word is as follows:

- Bits 0-17 Not used
- 18-23 Keyboard/display terminal hardware status:
 - 18-21 = 0
 - 22 = 1 PRINT key pressed to initiate transmission.
 - 23 = 1 Transmission failed after 16 attempts.
- 24-30 Not used
- 31 A terminal status to be defined later.
- 32 If = 1, GRTS/central system cannot acknowledge I/O request because terminal is busy with I/O.
- 33 If = 1, output transmission completed.
- 34 If = 1, terminal has not called in and connected or has disconnected.
- 35 If = 1, operator sent BREAK message which terminated operation.

Example: MME GEROUT - Terminal DAC Output -

```

*      INITIALIZE VFD INSTRUCTION OF MME GEROUT
      LDA      SVID          INSERT STATION ID IN MME SEQUENCE
      STCA     VFD,03
      EAX1     BUFFER        INSERT ADDR OF DATA BUFFER
      STX1     VFD
VFD    MME      GEROUT       TERMINAL DAC OUTPUT
      VFD      18/0,6/3,12/0
      ZERO     STATUS,0      STATUS=LOCATION OF I/O STATUS WORD
*      EXAMINE I/O STATUS WORD
      LDA      STATUS        STATUS WORD FOR I/O REQUEST
      TZE     WAIT          I/O IS STILL IN PROGRESS
      ERA     4,DL          BIT 33 = 1 IF NORMAL TERMINATE
      TZE     DONE          NORMAL TERMINATE, CONTINUE PROCESSING
      ALR     32            BIT 32 = 1 IF GRTS BUSY ALREADY
      TMI     GBUSY        STATION HAS I/O GOING ON PRESENTLY
      ALR     2            BIT 34 = 1 IF DISCONNECT OCCURRED
      TMI     DISCN        DISCONNECT - TERMINAL NO LONGER CONNECTED
*      BREAK CONDITION MUST HAVE OCCURRED, BIT 33 = 1
      ...BREAK CONDITION PROCESSING...
BUFFER ZERO    6,0          WORD COUNT
      ZERO    20,0         CHARACTER COUNT
      OCT     015012110105  CR LF H E
      OCT     114114117040  L L O
      OCT     117125124040  O U T
      OCT     124110105122  T H E R
      OCT     105040015012  E   CR LF

```

Direct Access Output, Then Input

This MME allows the user program executing in the central computer system to transmit a data message to a terminal and to receive a data response from that terminal.

In addition to the requirements for the DAC Output MME GEROUT, the user program must provide an input buffer address in the lower part of word 0 of the data block for the Output/Input MME. GRTS inserts a nonzero I/O status in the user program only after the input data has been received and placed in the user input buffer.

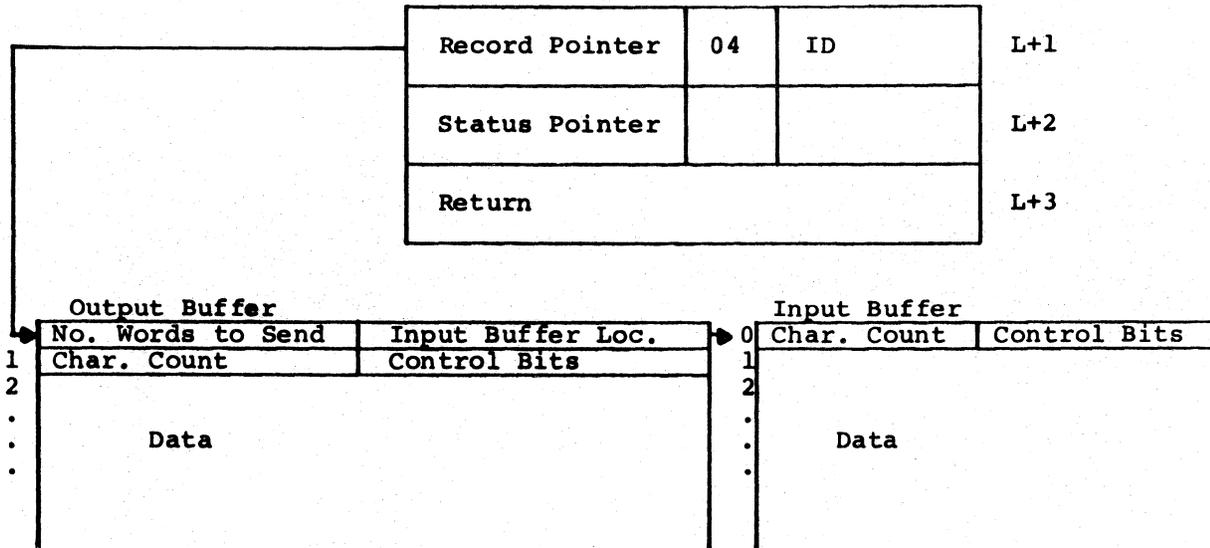
A maximum of 21 data words is placed in the user input buffer when input is received from a teleprinter terminal. The carriage control character on the teleprinter input is transmitted to the computer system.

```

L      MME      GEROUT
L+1    VFD      18/Record Pointer,6/04,H12/Terminal ID
L+2    ZERO     Status Word Pointer, Courtesy Call
L+3    Next Instruction

```

The record pointer designates the symbolic location of word 0 of the output data block, which contains the number of words in the data block and the address of the input buffer.



The status word pointer points to a word that contains the status of the operation in progress. The format of this control word is the same as described in Direct Access Output except that bit 33 = 1 indicates output transmission has been completed and the input received has been placed in the user's input buffer.

Example: MME GEROUT - Terminal DAC Output/Input -

```

*      INITIALIZE VFD INSTRUCTION OF MME GEROUT
      LDA      SVID          INSERT STATION ID IN MME SEQUENCE
      STCA    VFD,03
      EAX1    BUFFER        INSERT ADDR OF DATA BUFFER
      STX1    VFD
      MME     GEROUT        TERMINAL DAC OUTPUT/INPUT
VFD    VFD      18/0,6/4,12/0
      ZERO    STATUS,0      LOCATION OF I/O REQUEST
*      EXAMINE I/O STATUS WORD
      LDA     STATUS        STATUS WORD FOR I/O REQUEST
      TZE    WAIT          I/O IS STILL IN PROGRESS
      ERA    4,DL          BIT 33 = 1 IF NORMAL TERMINATE
      TZE    DONE          NORMAL TERMINATE, CONTINUE PROCESSING
      ALR    32            BIT 32 = 1 IF GRTS BUSY ALREADY
      TMI    GBUSY        I/O IN PROCESS FOR THAT STATION
      ALR    2             BIT 34 = 1 IF DISCONNECT OCCURRED
      TMI    DISCN        DISCONNECT TERMINAL - NO LONGER CONNECTED
*      BREAK CONDITION ASSUMED, BIT 33 = 1
      ...BREAK CONDITION PROCESSING...
BUFFER ZERO    6,INBUF     WORD COUNT OF OUTPUT, INPUT BUFFER ADDR
      ZERO    20,0         CHARACTER COUNT
      OCT    015012110105   CR LF H E
      OCT    114114117040   L L O
      OCT    117125124040   O U T
      OCT    124110105122   T H E R
      OCT    015040015012   E CR LF
  
```

User-Program Inquiry to Terminal

When a user program is ready to communicate with a terminal that requested direct access with that program, the program enters a program identification name, which is passed on to GRTS/central system by the following:

```
L      MME      GEROUT
L+1    VFD      18/0,06/5,12/0
L+2    BCI      1, User Program Identification
L+3    Next Instruction
```

GRTS maintains a list of all terminals which have transmitted a direct access control record. Thus, when a program running in the central system requests program connection to a remote terminal, GRTS scans this list for a match in identification. When a match is found, the terminal identification is placed in the right 12 bits of the word directly after the MME GEROUT. The user program can send an appropriate message directly to the terminal.

If a match in program identification cannot be found, GRTS retains the request until a terminal calls in at a later time and wishes to connect to that user program. GRTS establishes the connection and inserts the station ID in the user program's outstanding MME. Thus, the Remote Inquiry request is active until a positive response can be given to the user program.

Control is returned to the user program whether or not a new terminal has been connected.

A remote terminal, which does not specify a user program identification when it issues a DAC command, is connected only to a slave program which issues a MME GEROUT specifying that station's ID. Terminal connection in this case is made by station ID. MME GEROUT's which can accomplish this connection are:

```
DAC Output
DAC Output/Input
DAC Output/Prepare PPT
```

An operation code of 05 specifies user program inquiry regarding direct access.

The user program may have two outstanding I/O inquiries at a time. The inquiries must be issued from unequal locations and have unequal inquiry names. Equal combinations cause the program to be aborted.

To determine whether a positive response was received, the user program should initialize (set to zero) the terminal identification field of the MME sequence prior to using the remote inquiry.

The BCD user program identification is a six-character BCD word by which the user identifies his DAC program.

Example: MME GEROUT - Remote Inquiry -

	MME	GEROUT	REMOTE INQUIRY
SID	VFD	18/0,6/5,12/0	LAST 12 BITS ARE FOR STATION ID
	BCI	1,NAME	NAME OF DAC SLAVE PROGRAM (maximum six characters)
*	TEST STATION ID FIELD OF VFD INSTRUCTIONS FOR NONZERO ID		
TEST	LDA	SID	VFD INSTRUCTION OF MME
	ANA	=07777,DL	SAVE ONLY ID
	TNZ	*+4	NEW STATION CALLED IN
	LDQ	=01161000	NO NEW STATION
	MME	GEWAKE	CALL ME BACK IN FIVE SECONDS
	TRA	TEST	TEST FOR NEW STATION
*	HAVE CONNECTED TO A TERMINAL; SAVE STATION ID FOR FURTHER USE IN OTHER DAC MME GEROUT INSTRUCTIONS		
	STA	SVID	SAVE STATION ID

Program Requests Terminal Type

Once connected to a terminal, the user program can determine its type by means of the Terminal Type MME GEROUT.

L	MME	GEROUT
L+1	VFD	6/Type,12/0,06/06,H12/Terminal ID
L+2	Terminal Not Connected	
L+3	Next Instruction	

Type indicates whether the terminal is a remote computer, teleprinter, or keyboard/display terminal.

An operation code of 06 specifies a user program request for the terminal type. GRTS stores the terminal device code in bits 0-5 of L+1 when it encounters this operation code. Refer to General Comprehensive Operating Supervisor (GCOS) manual for listing of device codes.

A more fundamental use of MME GEROUT is to determine if the terminal is still connected to the user program.

The return from the Terminal Type MME is to location MME + 2 if the terminal has disconnected, and to MME + 3 if the terminal is still connected to the user program.

Example: MME GEROUT - Terminal Type Inquiry -

*	INSERT STATION ID OF TERMINAL IN VFD OF MME GEROUT		
	LDA	SVID	STATION ID IN CHAR 4 AND 5
	STCA	INQ,03	INSERT IN VFD OF MME
	MME	GEROUT	TERMINAL TYPE INQUIRY
INQ	VFD	6/0,12/0,6/6,12/0	
*	FIRST SIX BITS OF VFD WILL BE SENT TO APPROP. TERMINAL TYPE CODE		
	TRA	DISC	TERMINAL HAS DISCONNECTED
	LCA	=0010000,DU	MASK TO RETAIN ONLY FIRST SIX BITS OF VFD
	ANA	INQ	A=TERMINAL TYPE CODE
	CMPA	=0040000,DU	IS TERMINAL A KEYBOARD TERMINAL
	TRC	KEYBD	YES, USE 9-BIT ASCII CODE

COLTS Module Activation (GRT/355 and GRTS/6600 only)

This MME GEROUT, operation code 07, activates the T and D module in GRTS. This MME is restricted to online communications T and D for the DATANET FNP. A non-T and D program attempting to use op code 07 will be aborted.

Program Requests Line Disconnect

A user program can request that GRTS disconnect a particular remote terminal by using:

```
L      MME      GEROUT
L+1    VFD      18/0,06/17,H12/Terminal ID
L+2    ZERO     Status Word Pointer, Courtesy Call
L+3    Next Instruction
```

An operation code of 17 (octal) specifies a line disconnect request.

The terminal ID is a two-character code identifying the terminal to be disconnected.

If a status word pointer is given, GRTS sets bit 34=1 to show the line disconnected. In response to this MME, GRTS sends a command to the FNP to disconnect the station specified by the user program. This program must not issue further I/O commands to that station ID while the disconnect MME is in progress. As soon as the disconnect appears in the status word, the user program may attempt to connect to that station ID again, either through a Remote Inquiry or by issuing another I/O command referencing the station ID.

Example: MME GEROUT - Line Disconnect -

```
*      INSERT STATION ID OF TERMINAL TO BE DISCONNECTED
      LDA      SVID      INSERT STATION ID IN CHARACTERS 4 AND 5
      STCA    DIS,03    INSERT IN VFD OF MME
      MME      GEROUT    LINE DISCONNECT
DIS    VFD      18/0,06/17,12/0
      ZERO     STATUS    STATUS WORD POINTER
```

Direct Access Current Line Status

A user program can request the current line status of a particular remote terminal by using:

```
L      MME      GEROUT
L+1    VFD      18/0,06/20,H12/Terminal ID
L+2    ZERO     Status Word Pointer
L+3    Next Instruction
```

An operation code of 20 (octal) specifies a request for current line status.

The terminal ID is a two-character code identifying the terminal whose line status is requested.

In response to the MME, GRTS sets the user program status word to nonzero by setting the appropriate status bit. It also inserts the terminal type in bits 0-5 of the VFD instruction of the MME. One bit of the user program status word is set to 1 as follows:

<u>Bits</u>	<u>Meaning</u>
0-28	Zero.
29=1	Line connected to another slave program.
30=1	Line waiting to connect to slave program.
31	Set to 1 if terminal is idle.
32	Set to 1 if terminal is presently involved in a DAC I/O.
34	Set to 1 if terminal either has never called in or has disconnected.
35	Set to 1 if terminal operator has indicated a break condition.

Example: MME GEROUT - Current Line Status -

```

*      INSERT STATION ID OF TERMINAL WHOSE STATUS IS DESIRED
LDA      SVID          STATION ID IN CHARACTERS 4 AND 5
STCA     STS,03        INSERT IN VFD OF MME
MME      GEROUT        CURRENT LINE STATUS
STS      VFD           6/0,12/0,06/20,12/0
ZERO     STATUS        STATUS WORD POINTER
*      TEST STATUS WORD TO SEE CONDITION OF TERMINAL
LDA      STATUS
ALS      31            PREPARE TO TEST INDIVIDUAL BITS
TMI      IDLE          TERMINAL IS IDLE--BIT 31
ALS      1             BIT 32
TMI      BUSY          DAC I/O IS IN PROGRESS--BIT 32
ALS      2
TMI      DIS           NO LONGER CONNECTED TO TERMINAL--BIT 34
*      TERMINAL HAS INDICATED BREAK CONDITION

```

Direct Access Output/Prepare to Receive Paper Tape Input

A user program can send a message to a teleprinter and in return receive paper tape input from the terminal. The message is:

L	MME	GEROUT
L+1	VFD	18/Record Pointer,06/21,H12/Terminal ID
L+2	ZERO	Status Word Pointer, Courtesy Call
L+3		Next Instruction

The record pointer is a pointer to the output data block. (This is the same as the record pointer described earlier in the section under Direct Access Output, Then Input.)

An operation code of 21 (octal) indicates output and initiation of paper tape mode.

The terminal ID is a two-character code identifying the teleprinter.

The status word pointer is the same as for Direct Access Output, Then Input. The format of the input and output command bits is as described under MME GEROUT Definition.

In response to this MME, GRTS transmits the user program data to the FNP and informs GRTS that the terminal will now send paper tape input. Prior to the execution of the MME, the user program must have words 0 and 1 of the output data in the proper format in the data buffer.

Word 0 of the data buffer must contain the number of words to be transmitted (including the character count word) and the address of the input buffer which will receive the first block of PPT input. Word 1 must contain the number of nine-bit characters to be transmitted (a maximum of 312 characters is allowed).

The status word will be set to zero when the data has been picked up from the slave program and will be set to nonzero when the MME request has been completed.

The format of the paper tape input data is the same as that of the DAC input data block, except that a maximum of 31 words will be received (character-count control word and 30 data words). In the control word, bit 34 is set to 1 if an end of paper tape is received by the FNP. Bit 33 is set to 1 if a timing error occurs (this means that input was received by the FNP faster than it was requested by the slave program). In the case of a timing error, the last line of data is unreliable (garbled), and the last line must be retransmitted.

Example: MME GEROUT - DAC Output/Prepare PPT Input -

```
*      INSERT STATION ID OF TERMINAL WHICH IS TO GO INTO PPT MODE
LDA      SVID          STATION ID IN CHARACTERS 4 AND 5
STCA     PPT,03       INSERT IN VFD OF MME
MME      GEROUT       DAC OUTPUT PREPARE PPT INPUT
PPT      VFD          18/MSG,06/21,12/0
ZERO     STATUS
*      TEST STATUS WORD
TEST     LDA          STATUS          TEST TO SEE IF MME REQUEST HAS BEEN COMPLETED
TNZ      *+4          NONZERO STATUS
LDQ      =01161000    I/O STILL IN PROGRESS
MME      GEWAKE       CALL ME BACK IN 5 SECONDS
TRA      TEST         REPEAT STATUS CHECK
CMPA     2,DL
TZE      NCON         TERMINAL IS NOT CONNECTED TO SLAVE
CMPA     4,DL
TZE      ACCPPT       NORMAL TERMINATE-PROCESS INPUT DATA
CMPA     1,DL
TZE      BREAK        BREAK CONDITION AT TERMINAL
*      TERMINAL WAS BUSY WITH PREVIOUS I/O
MSG      ZERO        7,INPUT          OUTPUT MESSAGE WORD COUNT
ZERO     24,0         "PREPARE PPT READER" CR LF
OCT      012015120122  LF CR P R
OCT      105120101122  E P A R
OCT      105040120120  E P P
OCT      124040122105  T R E
OCT      101104105122  A D E R
OCT      012015040040  LF CR
```

Accept DAC Paper Tape Input

NOTE: A special user consideration exists for DAC paper tape input. The user must ensure that the input data buffer begins at least 320 words prior to the last location of allocated memory when GRTS is high-loaded into memory. If the GRTS low-load option is exercised this restriction is not applicable. (See Relocatable Loader manual for GRTS high-load and low-load procedures).

After initiating the paper tape mode by issuing a MME GEROUT with an op code of 21 (octal), a user program can request that another block of paper tape input be inserted in its data area. The request format is:

```
L      MME      GEROUT
L+1    VFD      18/Record Pointer,06/22,H12/Terminal ID
L+2    ZERO     Status Word Pointer,Courtesy Call
L+3    Next Instruction
```

The record pointer points to an input buffer which received the block of paper tape input.

A maximum of 31 words (1 control word and 30 data words) is transmitted to the slave buffer. Word 0, bits 0-17, contain a count of the number of nine-bit ASCII characters transmitted. (Does not include the control word itself.) The input command bits are as defined under MME GEROUT Definitions.

An operation code of 22 (octal) indicates a request for a block of paper tape input.

The terminal ID is a two-character code identifying the teleprinter.

The status word pointer is the same as for Direct Access Output.

Example: MME GEROUT - Accept DAC PPT Input -

```
*      INSERT STATION ID OF TERMINAL IN PPT MODE
LDA      SVID          STATION ID IN CHARACTERS 4 AND 5
STCA     INPPT,03      INSERT IN VFD OF MME
MME      GEROUT
INPPT    VFD           18/INPUT,06/22,12/0
          ZERO        STATUS
*      TEST FOR COMPLETION
TEST     LDA          STATUS
          TNZ         *+4          NONZERO STATUS
          LDQ         =01161000    I/O STILL IN PROGRESS
          MME         GEWAKE       CALL ME BACK IN FIVE SECONDS
          TRA         TEST        TEST FOR NEW STATION
          CMPA        4,DL        NORMAL TERMINATE
          TZE         NORM        YES, TEST FOR EOT OR TIMING ERROR
          CMPA        2,DL
          TZE         DISCON      TERMINAL DISCONNECTED
          CMPA        1,DL
          TZE         BREAK       BREAK CONDITION
*      TERMINAL WAS BUSY
          ...
NORM     LXL2         INPUT        X2 = LOWER OF 1ST WORD OF BUFFER
          CMPX2       6,DU        TIMING ERROR
          TZE         ERROR       YES
          CMPX2       2,DU        END OF DATA TEST
          TZE         END
*      PROCESS INPUT DATA AND ASK FOR ANOTHER BLOCK
          ...
INPUT    BSS         31          INPUT BUFFER FOR BLOCK OF PPT INPUT
STATUS  OCT         0
```

Time Sharing to Direct Access Switching

The following calling sequence is used for switching the line mode from Time Sharing to Direct Access:

```
L      MME      GEROUT
L+1    VFD      18/0,06/25,H12/Station Identification
L+2    BCI      1,SNUMB Number
L+3    Normal Return
```

Direct Access to Time Sharing Switching

The following calling sequence is used for switching the line mode from Direct Access to Time Sharing:

```
L      MME      GEROUT
L+1    VFD      18/0,06/26,12/0
L+2    BCI      1,SNUMB Number
L+3    Normal Return
```

This calling sequence switches the mode of the line connected to the slave program identified in the L+2 from Direct Access mode to Time Sharing mode. If the line connected to the slave program was originally a Time Sharing line, the switch is made and the station identification of that line is put in bits 24-35 of L+1 of the calling sequence. Time sharing is the only program which can issue this MME.

Generalized Direct Access Line Switching

This MME GEROUT is used to switch control of a specified direct access line to another program. The calling sequence is as follows:

```
L      MME      GEROUT
L+1    VFD      18/Status,06/27,H12/id
L+2    BCI      1,Name
L+3    Return
```

A nonzero status points to one word of line status, as follows:

```
Bit 29 = 1 Line logically disconnected, connected to another slave.
      30 = 1 Line logically disconnected, waiting to connect to slave.
      32 = 1 Line busy, cannot complete switch.
      34 = 2 Line no longer connected to system.
      35 = 1 Break received, line switch request ignored. Break status
              is reset.
```

Station ID is a two-character code identifying line to be switched.

Name is the remote inquiry name of the program receiving the line.

Stop Paper Tape Input

To stop paper tape input prior to sending an error message to the terminal, a DRL STOPPT in the user program causes the executive program to issue a MME GEROUT with an op code of 30 (octal). The request format is:

```
L      MME      GEROUT
L+1    VFD      18/0,06/30,H12/Terminal ID
L+2    ZERO     Status Word Pointer, Courtesy Call
L+3    Next Instruction
```

The operation code of 30 (octal) is a request to stop paper tape input.

The terminal ID is a two-character code identifying the teleprinter terminal.

The status returned is always "normal".

Courtesy call is delayed until GRTS determines that paper tape input has stopped.

Example: MME GEROUT - Stop Paper Tape Input -

```
*      INSERT      STATION ID OF TERMINAL IN PPT MODE
      LDA          SVID          STATION ID IN CHARACTERS 4 AND 5
      STCA         INPPT,03      INSERT STATION ID IN VFD OF MME
      MME          GEROUT
INPPT  VFD         18/0,06/30,12/0
      ZERO        STATUS, COURTESY CALL
*      TEST FOR COMPLETION
```

Change Terminal Characteristics

All teleprinter terminals are assumed to have a carriage width of 80 characters. A direct access program may specify the carriage width of a given terminal (that deviates from this standard input line of 80 characters) via MME GEROUT function code 44. The calling sequence is as follows:

```
L      MME          GEROUT
L+1   VFD          18/BUF,06/44,H12/ID
L+2   ZERO         L (status),L(courtesy call)
L+3   Normal return

BUF   ZERO         # words,0
      ZERO         4,0 (data sent to FNP)
      VFD         9/1,27/# characters (new input line limit)
```

GRTS establishes the new line length and requests output from the central system. This new line length remains until the central system sends a new command to alter it or the terminal disconnects which restores the line limit to 80 characters plus a carriage return.

ABORTS

The following aborts may occur as a result of executing MME GEROUT function code 44.

Invalid MME Parameter

Contents of BUF+2 are invalid; that is, bits 0-8 are not equal to 1 and/or the number of characters specified in bits 9-35 does not fall within the limits of 4-4095 (decimal). The MME request may be made from any terminal type, however, output will occur only for a teleprinter terminal.

```
K2 = Bad status return pointer
K4 = Invalid DCW pointer
K5 = Invalid courtesy call pointer
```

RMT Terminal Record Size

The number of words times four is less than the number of characters.

Status Return

The direct access slave can receive either one of the new codes if the line in question is connected through a DATANET FNP.

200 = Illegal characteristic type
400 = Illegal parameter

Normal status return (4) indicates the request was successful.

DATANET 305 FNP

A new ICM op-code (22) is sent to the DATANET 305 FNP as the result of a valid function code 44. The FNP responds with any of the following op-codes:

27 = Send output; request terminated successfully
31 = Line break; request unsuccessful
36 = Line disconnect
37 = ICM reject; direct access slave will see a disconnect status

DATANET 355/6600 FNP

As a result of a valid function code 44, op-code 36 is sent to the DATANET FNP and it responds with one of the following op-codes:

101 = Line disconnect
113 = Line break; request unsuccessful
125 = Terminal characteristics change acknowledgement

Remote Status Inquiry for Break/Disconnect Report

This MME GEROUT function, operation code 45, allows a slave program operating in Direct Program Access (DAC) mode to request the break/disconnect status of a line connected to the program and/or to acknowledge previously returned status.

The calling sequence is as follows:

L	MME	GEROUT
L+1	VFD	18/ID,06/45,12/0
L+2	ZERO	Status Return Pointer, Courtesy Call Address
L+3		Next Instruction

Operation code 45 is a request for break/disconnect status of a terminal and/or to acknowledge previous break/disconnect status for a specified terminal. If the DAC program is acknowledging a previously reported status, the ID field identifies the terminal. If no acknowledgement is being made, this field contains zeros.

This MME GEROUT gives a DAC slave program the ability to request the return of break or disconnect status received for any line connected to the program. If there are no unreported break or disconnect statuses to be returned when .MROUT receives the request, the condition is retained in a manner similar to Remote Inquiry processing.

Return of break acknowledgement or disconnect accepted operation codes to the Front-End Network Processor are delayed until the DAC program connected to the line has acknowledged receipt of the status. Disconnects are acknowledged immediately if the DAC program is aborting.

When .MROUT receives this MME GEROUT, all subsequent status returns are handled as defined for this MME. Therefore, a DAC slave program intending to use this capability should issue the generalized remote status inquiry immediately prior to its first Remote Inquiry MME GEROUT (type 5) upon entering execution.

When operating in main level, a DAC program, using courtesy call to satisfy a remote status inquiry, must not issue a break/disconnect acknowledgement at courtesy call level and then return to main level and issue I/O to that terminal.

The status return pointer specifies the location of a word containing status formatted as follows:

Bits 0-17 - Identification of terminal status applies to
18-35 - Status:
1 = Break
2 = Disconnect

When operating in the generalized remote status inquiry mode, these statuses will only be reported via a new or outstanding MME GEROUT, operation code 45. Status returned on I/O that has been terminated because of a break or disconnect is defined as:

400 (octal) - I/O aborted

The .MROUT module maintains a table that is used to record outstanding status inquiries. Each two-word entry in the table is formatted as follows:

Word 0	Bits	0-17	Program number
		18-35	Relative location of MME+1
Word 1	Bits	0-17	Status return pointer
		18-35	Courtesy call queue offset

Word 1 contains an offset to the reserved I/O queue (zero if courtesy call is not requested).

When an entry is made to this table, .MROUT obtains an I/O queue if courtesy call is requested in the MME GEROUT call. If courtesy call is requested, any break/disconnect status is reported to the DAC program immediately.

The .MDNET module maintains a two-word table that is used to record the status reporting mode selected by a DAC slave program. Each bit position in this table corresponds to a program number. A bit = 1 indicates that the corresponding program is in the generalized remote status inquiry role. Also, a word added to each entry in the terminal line table contains status bits as follows:

Bit 0- =1, Break received, slave program not notified
1- =1, Break returned to DAC program, not acknowledged
2- =1, Disconnect received, not reported to DAC program
3- =1, Disconnect returned to DAC program, not acknowledged
4- =1, Last line for which status was returned

BTT Load/Start

The MME GEROUT instruction for BTT Load/Start operations (operation code 46 octal) is used to initiate communications and to load program files into a Banking Teller Terminal (BTT7340) configured on a line of the DATANET 355/6600 Front-End Network Processor. The calling sequence is as follows:

```
L      MME      GEROUT
L+1    VFD      18/0,06/46,H12/Terminal ID
L+2    ZERO     Status Word Pointer, Courtesy Call
Next Instruction
```

Operation code 46 (octal) specifies that the BTT Loader program (.MBTLD) is ready to commence BTT loading and notifies the DATANET 355/6600 processor that the Loader program is ready to process load requests for the BTT.

The terminal identification is a two-character code that identifies the terminal issuing the request for the load file.

When the BTT Loader program is in execution and receives a request for load service for a BTT line (via the remote inquiry interface), the program responds with the MME GEROUT instruction with operation code 46. This causes the establishment of an I/O queue for use in loading a BTT load file, and the DATANET 355/6600 processor is notified that the Loader program is ready to process load requests for this BTT line. This notification is via an operation code 41 (octal) used with the Write Control Data (WCD) command. The DATANET processor requests data blocks (64 words each) using a Read Control Data (RCD) command, with an operation code of 126 (octal). The processor also supplies the load file identification character and block number.

The central computer system transmits the data using the Accept Direct Output operation code (12 octal), used with a Write Text (WTX) command. A subsequent request for a data block is not sent until the DATANET processor issues a Write Terminate for the data block previously transmitted for that terminal. When the last data block from a load file has been transmitted to the BTT, the DATANET processor issues a Send Output operation code (105 octal) instead of the Load Request operation code (126 octal). This enables the .MDNET program to forward the last status I/O to the loader program, then the loader program can issue a disconnect for that line.

NOTE: Although GCOS is aware of the transmission of the last data block from a load file, the system cannot assume that the line is ready to disconnect. This is because other terminals on the line may be receiving data from another load file or may be requesting retransmission of data from the original file. Therefore, the DATANET processor must not send the 105 operation code until all terminals on the line are completely serviced.

Requests for data blocks from the DATANET processor include the table definition character in word 2 of the channel mailbox (right justified) and the data block number in word 3 (right justified).

The Loader program initiates the transmission of a block of data via the MME GEROUT for Direct Access Output. The status word pointer in the original MME instruction points to the location of a three-word block that contains the following:

Word 0, Bits 0-35 - Normal I/O status return
Word 1, Bits 0-17 - Request code (126 octal)
 18-35 - Table Definition character (ASCII)
Word 2, Bits 0-35 - Block number (binary) for next load

Courtesy call may be used.

MASS STORAGE LINK CONSIDERATIONS

Although the operation of the Mass Store Link is normally transparent to the terminal user, certain factors of the link facility must be considered:

1. If the DATANET FNP dump program (355D) is executed while the DATANET FNP is in operation and accumulating jobs from the remote terminals, all jobs will be lost; even those accumulated on the FNP input list. To assure that accumulated jobs are saved, it is necessary to cause a fault in the FNP before executing the dump program.

2. While in the Mass Store Link mode, a small input job may appear lost, since it has been completely read in, including the following card. The job is not lost, but if the FNP can no longer accept input, it terminates the line with an appropriate message and ignores the job. The last card read may be a GRTS control card or an SNUMB card, which GRTS considers an end-of-job, for the current job in process. This job is sent to the Mass Store Link (MSL) module to be placed on disk storage. If, for example, no storage space is available for the program, the MSL module attempts to reroute the job to the central system. If the central system is unavailable, the FNP has no place to keep this job so it is discarded and a message is sent to the console operator to explain the condition. Since the card following the discarded job has been read in, the operator may associate the message with the following job.
3. If the size of the available MSL space is less than a preset threshold, (currently five links), any new jobs input will be routed to the central processor through the ICA or DIA.
4. An important operational consideration arises when a Mass Store Link device, using the DSS181, DSS190 or MSU0310 (Series 60 only) subsystems, is placed in the Write Protect mode. To bring the device back online from this mode, it must be powered down (off) and then powered up (on).

TERMINAL ALLOCATION/DEALLOCATION IN DAC

When a terminal requests direct access, either by a blank data field or by a specific program name, the terminal becomes available for allocation to a user program in the central system. This condition is retained in a GRTS table.

If a terminal requests direct access with a blank data field, the first user program activity that issues a DAC I/O command specifying that terminal's ID is marked allocated to that terminal. No other user program may communicate with the terminal.

When a terminal requests direct access to a specific user program, the terminal cannot be allocated to the program until it issues a remote inquiry to GEROUT. If there is a terminal in the availability list with that user program name, the terminal is allocated to that program. When the activity terminates, the terminal again becomes available for allocation. Thus, multiple activities must execute either a remote inquiry operation or a DAC I/O command specifying that terminal ID in order to read from or write to the terminal. Only the specified user program may be allocated to the terminal.

When an activity terminates, all terminals allocated to that activity for direct access are deallocated, but not disconnected. When a job terminates, any terminals allocated to that job are disconnected. When an activity terminates, the operator receives an ACTIVITY TERMINATED message. If this is his last activity, the terminal is disconnected following the message. Whenever a line disconnects, the terminal ID is removed from the list of direct access terminals.

PRINT LINE FORMATTING

The GRTS control program permits the terminal user to perform all of the functions permitted by the common peripheral printers operating in the edit mode. This is the standard mode for all software.

COMMAND FILL CHARACTER FORMATTING FOR VIP TERMINALS

GRTS does not automatically provide fill character formatting for VIP terminals. The programmer must provide this formatting as shown below.

The combination of transmission rates, memory access rate, and the time for entry marker compare, once the entry marker has been repositioned, requires fill (DEL-177 octal) characters to be inserted after certain command characters are transmitted to the DCU. The number of fills required for a command received is shown, for each bit rate, in Figure 3-7.

Command Character	Number of Fill Characters Required to Follow a Command at Respective Bit Rates			
	2000	2400	3600	4800
PR	0	0	0	4
FF	2	3	5	9
LR	0	0	0	4
LF	0	0	0	0
RLF ¹	0	0	0	4
FS	0	0	0	0
BS ²	0	0	0	4
LR-LF ³	0	0	0	0
TAB ⁴	4	6	8	14
EM	0	0	0	4

¹RLF - If repeated RLFs are to be performed, after the first RLF code is inserted into the message, subsequent RLF codes may be used in place of the specified number of fill characters. For example, if two RLFs are to be executed, the following sequence of characters can be inserted into the message at the 4800-bps rate:

RLF-RLF-DEL-DEL-DEL

Repeated RLFs must follow immediately after each other. If five or more RLFs are to be performed, it is not necessary to insert fill characters after the last RLF.

²BS - The same is true for repeated BS commands as for the RLF command described above.

³LR-LF - A LR followed by a LF requires no fill characters.

⁴TAB - This example defines the worst case for tabbing down the page.

Figure 3-7. Command Fill Characters

SECTION IV

STANDARD REMOTE COMPUTER TERMINAL INTERFACE

GRTS INTERFACE

Computer systems, which are to be used as remote terminals on a DATANET FNP under the GRTS control program, must satisfy the requirements of the Standard Remote Computer Interface. Basically this software interface requires that information and control messages transmitted to the DATANET FNP be in the format specified in this section. Where applicable, the terminal must acknowledge (either positively or negatively) each message sent by GRTS and must execute any commands contained in the message.

Information And Control Record Messages

Information and control record messages relate to the transmission of data between GRTS and the remote terminal. These messages are made up of eight-bit (seven-bits plus parity) ASCII characters (both control and data characters must be in ASCII code). They must be in the following general format for transmission to the DATANET FNP.

Header

S	S	S	S	S	F	S	A	O	I		STX	Text (0-324 characters)	ETX	BCC
Y	Y	Y	Y	O	C	C	C	C	C					
N	N	N	N	H										

- SYN - Synchronization character (0010110)
- SOH - Start of header character (0000001)
- FC - Format code
- SC - Sequence code (1000001 or 1000010)
- AC - Address code (1000000)
- OC - Operation code
- IC - Identification code (1000000)¹
- STX - Start of text character (000010)
- ETX - End of text character (000011)
- BCC - Block check character

¹Included in message but not used by GRTS.

A message without text may use any of the information format codes. This type of message takes the form:

SYN	SYN	SYN	SYN	SOH	FC	SC	AC	OC	IC	STX	ETX	BCC
-----	-----	-----	-----	-----	----	----	----	----	----	-----	-----	-----

SYNCHRONIZATION CHARACTER

Two connecting synchronization characters (SYN) must be recognized by the receiving computer. This assures that the two systems are synchronized before data transmission begins, thus reducing the possibility of lost or erroneous data. More than two SYN characters may be used.

START OF HEADER

The Start Of Header character (SOH) indicates the beginning of a message.

FORMAT CODE

The Format Code (FC) character specifies the meaning of the message and the format of the text in the message. Seven format codes define the different combinations of message types and formats. An information message may be sent without text. The following format codes may be used:

1. Special control record, no compression (1000100) - this code is sent to the remote computer operator by the GRTS control program. Also, a control record with this FC may be sent from the remote computer to GRTS. The text of the message is not compressed and contains only one control record, which must not be split across messages.
2. Special control record, compression (1000101) - GRTS does not transmit this format code, but recognizes it and processes the data properly. The text may be compressed and may contain one record, which must not be split across messages.
3. Information message, no split, no compression (1001000) - the text in the message with this FC is not compressed and contains only complete records. The text may contain multiple records, but all of them must be complete within the message. Each record must be enclosed by a Media Code (MC) and Record Separator (RS). A Media Code (MC) must follow the STX and a Record Separator (RS) must precede the ETX.
4. Information message, no split, compression (1001001) - the text of a message with this format code may be compressed; but the text must contain complete records. The text may contain multiple records. Each record must be enclosed by a MC and a RS. A Media Code (MC) must follow the STX, and a Record Separator (RS) must precede the ETX.
5. Information message, split, no compression (1001010) - the text is not compressed, but records in the text may be split across messages. An uncompleted record at the end of the message is continued after the STX of the next message. The text may contain multiple records.

6. Information message, split, compression (1001011) - the text may be compressed and records in the text may be split across messages. An uncompleted record in a message is continued after the STX of the next message. The text may contain multiple records.
7. Information message, user defined text (1001101) - the text of a message with this FC may be in any format defined by the user. If compression is specified by the select auxiliary field, output data is compressed by GRTS. Also, each output character is scanned for a termination character - ETX, ETB, or EOT. If a termination character is found, it is replaced with a rubout character (1111111). The user should keep in mind that the DATANET FNP hardware recognizes the termination characters ETX and ETB on input.

SEQUENCE CODE

The Sequence Code (SC) is used to assure that data is neither lost nor used more than once. This code alternates between 1000001 and 1000010.

ADDRESS CODE

Although not used for GRTS, the Address Code (1000000) is a part of the standard interface and must be included in the message format.

OPERATIONS CODE

The Operations Code (OC) character specifies the operation to be performed and describes the acknowledgements which may be given.

Bits 1-3 of the OC character define the instructions which specify operations to be performed.

<u>Bits</u> 3 2 1	<u>Operations</u> <u>Instruction</u>	<u>Operation</u> <u>Specified</u>
0 0 0	No Request	This instruction neither requests nor inhibits the sending of data by the receiving computer.
0 1 0	Transmit Data	This instruction is used by GRTS to request that data be sent to the system. This is not used when text is included. The remote computer never transmits this instruction, since the output control card makes the data request.
1 0 0	Wait	This instruction is sent by the remote terminal with or without text (even though GRTS does not handle text if included) to request that GRTS delay communications. GRTS waits seven seconds and then transmits the previous message with the sequence code unchanged. GRTS does not send a WAIT instruction.

The operations code character is formatted as follows:

Bits	7	6	5	4	3	2	1
Use	1	Acknowledgements			Operational Instructions		

Bits 4-6 of the operations code character define the type of acknowledgment. These are described in the table below.

<u>Description</u>	<u>Bit Position</u>		
	<u>6</u>	<u>5</u>	<u>4</u>
Positive Acknowledgement	0	0	0
Negative Acknowledgement	0	0	1
Negative - BCC in Error	0	1	0
Negative - Char Parity Error	0	1	1
Negative - SC Wrong	1	0	0
Negative - OC Wrong	1	0	1
Negative - STX Missing	1	1	0
Negative - ETX Missing	1	1	1

The only NAK (negative acknowledgement) transmitted by GRTS is 001. All NAK codes are recognized.

IDENTIFICATION CODE

The identification code character (1000000) is not used for GRTS, but it is a part of the standard interface and must be included in the message format.

START OF TEXT/END OF TEXT

The Start of Text (0000010) and End of Text (0000011) characters enclose the text portion of a message.

TEXT

The text portion of an information message or a special control record message contains the data and control characters for the message. This data contains one or more data records and the associated control characters. Control characters that must be included with each record are a Media Code (MC) and a Record Separator (RS) (if in batch mode). Additional control characters, which may be included in a record when applicable, are a Slew character (SL), Unit Separator (US), and compression count (CC). The Slew character must immediately precede the RS.

BLOCK CHECK CHARACTER

The Block Check Character (BCC) is an Exclusive OR of the message characters following the SOH and up to and including the ETX. Since the DATANET FNP checks for odd parity, the BCC must have odd parity.

SAMPLE MESSAGE FORMATS

The following sample messages illustrate the remote computer interface message operation:

1. No split, no compression:

SOH,FC,SC,AC,OC,IC,STX,MC--#1--RS,MC--#2--RS,MC--#3--RS,ETX,BCC

2. Split, no compression:

SOH,FC,SC,AC,OC,IC,STX,MC--#1--RS,MC--#2--RS,MC--#3--ETX,BCC

3. Split, compression:

SOH,FC,SC,AC,OC,IC,STX,MC--#1--RS,MC--#2--X,US,CT--RS,
MC--#3--ETX,BCC

Data Compression¹

When a record contains a series of three or more of the same data characters, the series is compressed to reduce the number of characters being transmitted. When compression occurs, a string of repeated characters is transmitted as follows:

----X,US,CC----

Where: X - Any repeated data character.

US - An ASCII character (0011111).

CC - A six-bit binary count. The BCD character represented by the binary count must be translated to ASCII for transmission to the FNP. This count is the number of times the compressed character is to be repeated (maximum 63).

This data compression technique permits compression of any character and also allows for the compression of different characters within the same record.

¹The DATANET 305 data from the central system is edited and compressed by the central system.

Special Control Record Data Format

The special control record tells the receiving system that there may be information for the communication system, and that this information may require special attention. This message can contain only one record. In this record the media code follows the STX and the record separator precedes the ETX.

REMOTE COMPUTER TO GRTS

The special control record sent to GRTS by the remote computer may or may not be compressed. The media code must always indicate BCD. GRTS accepts only the standard special control records in the following formats.

For input to GRTS, the special control record must always begin with a \$, and conversely, all BCD records which begin with a \$ must be sent as special control records. The format is:

```
S M $ R E B
T C   S T C
X           X C
```

On output from GRTS, the remote computer may send a special control record requesting GRTS to backspace or abort the file that is being output to the remote. The formats are:

BACKSPACE

```
S M X R E B
T C   S T C
X           X C
```

Where: X - 0110010

ABORT

```
S M X R E B
T C   S T C
X           X C
```

Where: X - 0110001

GRTS TO REMOTE COMPUTER

The special control record transmitted by GRTS to the remote computer is not compressed. The media code indicates BCD information to the teleprinter and is a message to the remote computer operator.

When the remote computer receives a special control record, any partial record being saved for the next message, either input or output, should be ignored. If further information messages are to be transmitted or received, the text must begin a new record.

Media Codes

Each record begins with a Media Code (MC) containing the device identification, if required, and the type of encoding used on the data in the associated record. These media codes are defined as follows:

- 1. Input media codes (from remote computer to GRTS):
 - BCD record - 1001000
 - Binary record - 1010000

- 2. Output Media Codes (from GRTS to remote computer):
 - Punch BCD - 1001111
 - Punch Binary - 1010111
 - Teleprinter - 1001110 -- This code is used for operator messages from GRTS and will be used only with a special control record. Data is always BCD.
 - Print - 1001100 -- Data must always be BCD. When this code is used, the character preceding the record separator is a slew code governing the slewing of the printer. This is the only code which includes a slew code. This dictates that the line is to be printed, and then the printer spaced up.

The binary slew code must be translated to ASCII for transmission to the FNP. The seven-bit ASCII configurations for slew codes are as follows:

<u>BIT PATTERNS</u>	<u>MEANING</u>
<u>7</u> <u>6</u> <u>5</u> <u>4</u> <u>3</u> <u>2</u> <u>1</u>	
0 1 1 0 0 0 0	No slew
0 1 0 0 0 0 0	Top of Page
0 1 1 0 0 0 1	1 Line
0 1 1 0 0 1 0	2 Lines
0 1 1 0 0 1 1	3 Lines
0 1 1 0 1 0 0	4 Lines
0 1 1 0 1 0 1	5 Lines
0 1 1 0 1 1 0	6 Lines
0 1 1 0 1 1 1	7 Lines
0 1 1 1 0 0 0	8 Lines
0 1 1 1 0 0 1	9 Lines

<u>BIT PATTERNS</u>	<u>MEANING</u>
1 0 1 1 0 1 1	10 Lines
0 1 0 0 0 1 1	11 Lines
1 0 0 0 0 0 0	12 Lines
0 1 1 1 0 1 0	13 Lines
0 1 1 1 1 1 0	14 Lines
0 1 1 1 1 1 1	15 Lines
1 0 0 0 0 0 1	VFU-1
1 0 0 0 0 1 0	VFU-2

RECORD SEPARATOR

Each record in the text portion of a message ends with the record separator character (0011110).

Service Messages

The service message of the remote computer interface enables one computer to send instruction or operation information to another computer concerning the communications between the two. They are used for initiating or terminating communications. The formats for service messages are as follows:

1. Service Message, No Auxiliary Fields

S	S	S	S	S	F	S	A		I	S	E	B
Y	Y	Y	Y	O	C	C	C	TYPE	C	T	T	C
N	N	N	N	H						X	X	C

Where: FC - 1000010

This format may be used for all service messages.

2. Service Message, Auxiliary Fields

S	S	S	S	S	F	S	A		I	AUX	S	E	B
Y	Y	Y	Y	O	C	C	C	TYPE	C	FIELDS	T	T	C
N	N	N	N	H							X	X	C

Where: FC - 1000011

This format may optionally be used by the remote computer when sending a SELECT to GRTS. GRTS never sends this message.

SYN, SOH, SC, AC, IC, STX, ETX and BCC have identical meanings to those described for information messages.

The message type character contains an instruction field and an acknowledgment field. The message type character bit assignments (in ASCII) are as follows:

BITS	7	6	5	4	3	2	1
USAGE	1	ACKNOWLEDGEMENT FIELD			INSTRUCTION FIELD		

The acknowledgement field has the same meaning as the acknowledgement field of the operations code of an information message, except that the Negative-OC Wrong is replaced by Negative-Type Wrong. See OC Acknowledgements.

The coding for the instruction field of the type character is as follows:

<u>Instruction</u>	<u>Bits</u>		
	<u>3</u>	<u>2</u>	<u>1</u>
No Instruction	0	0	0
Select	0	1	0
Terminate	0	1	1
Ready for Disconnect (RFD)	1	0	0
Not Ready for Disconnect (NRFD)	1	0	1
Disconnect	1	1	0

- No Instruction - Used by the remote computer to send acknowledgement information to GRTS in response to a service message. GRTS never sends this instruction, but accepts this as a valid acknowledgement to any service message.
- Select - Indicates that the sending computer is ready to transmit data. This causes both computers to go into an active mode. After GRTS has accepted a Select, all preceding Select instructions are ignored until the line is placed in the idle mode (terminated or disconnected). If GRTS receives a Select, while in the active mode, it transmits the previous message.
- Terminate - Informs the receiver that no more data is to be transmitted, but the line is to remain connected. This puts GRTS and the terminal in idle mode. In idle mode, each computer must remain ready to receive another service message. Terminate is ignored if the line is already in idle. To avoid an unrecoverable situation caused by operator intervention, GRTS will not accept a Terminate service message response to a Terminate service message.

- Ready for Disconnect (RFD) - Informs the receiver that the sender is going to disconnect the line. This should be acknowledged with an RFD or a No Instruction service message. If GRTS receives a RFD, it responds with a RFD and disconnects the line.
- Not Ready for Disconnect (NRFD) - Is not sent or recognized by GRTS. If GRTS receives a NRFD, when a response is expected, it will retransmit; otherwise the message is ignored.
- Disconnect - Informs the receiver that the sender is disconnecting the line. No reply is expected, and both stations are to disconnect the line.

One auxiliary field may be transmitted with a Select service message from the remote computer to GRTS when required by the terminal. GRTS does not transmit any auxiliary fields.

The auxiliary field indicates to GRTS which of the several available formats are to be used for output data from GRTS to the remote computer terminal. The auxiliary field may be as follows:

<u>Compression</u>	<u>Edit</u>	<u>Split Records</u>	<u>Auxiliary Field Bit Assignment (ASCII)</u>	<u>FCODE Used for Output Data (ASCII)</u>
YES	YES	YES	1000000	1001011
YES	YES	NO	1000001	1001001
YES	NO	YES	1000010	1001011
YES	NO	NO	1000011	1001001
NO	YES	YES	1000100	1001010
NO	YES	NO	1000101	1001000
NO	NO	YES	1000110	1001010
NO	NO	NO	1000111	1001000

Edit affects data to the printer only. The print output from GCOS will often contain edit characters which cause the common peripheral printer to edit the data. When the remote computer asks that the data be edited, GRTS performs the same editing function on the data as that performed by the common peripheral printer.

When no auxiliary field is used, the output data records will be compressed and edited, and may be split across messages.

Connect

The Connect to GRTS takes one of several forms depending on the type of service used by the remote computer terminal.

1. On switched lines, the remote computer operator dials in to the DATANET FNP. GRTS responds to the dial-in, brings up data terminal ready; and goes into an idle mode.
2. On private (hard-wired) lines, GRTS accepts the data set ready signal from the terminal and enters the idle mode. Dial-in is not required for private lines.

In the idle mode, no messages are exchanged, but the line remains connected to the remote computer terminal and in receive mode. If the system remains in the idle mode for seven minutes, GRTS disconnects the line. While in the idle mode, the remote computer must be ready to receive/transmit a Select or a Ready for Disconnect.

There are two conditions of idle mode:

1. Line Connected to central computer system - This condition is present when waiting for initial output from the system.
2. Line disconnected from the central computer system.

START ACTIVE MODE (EXCHANGE OF MESSAGES)

When the line is connected to the central computer system, two situations can occur:

1. GRTS can receive a Select from the remote computer before initial output data is received from the central computer system. This occurs when the remote computer needs to send more data to or make a request of (via control cards) the computer system.
 - a. The computer system is disconnected.
 - b. An information message with no data and a transmit data operation code is sent to the remote computer.
2. GRTS can receive initial output from the central computer system.
 - a. A select is sent to the remote computer.
 - b. The remote computer is expected to acknowledge the select with a No Instruction service message.
 - c. Upon receiving the acknowledgement, active mode is entered and output data is sent to the remote computer.

If these two situations occur at the same time (GRTS receives a select from the remote computer and output data from the central computer system simultaneously), the central computer is given priority and the select from the remote computer is ignored.

When the line is not connected to the central computer, GRTS waits to receive a select from the remote computer. When this occurs an information message with no data and a transmit data operation code is sent to the remote computer and the active mode is entered.

If a Select is received in error by GRTS, it is ignored.

ACTIVE MODE

When messages are being exchanged over a line, GRTS and the remote computer are in active mode with respect to that line. During active mode, the remote computer must be prepared to accept any of the following messages:

1. Information message with or without data.
2. Special Control Record
3. Service Message - Terminate
4. Service Message - Ready for Disconnect
5. Service Message - Disconnect

DATA INPUT (DATA FROM REMOTE COMPUTER TO GRTS)

Input is initiated by a Select message (during idle mode) from the remote computer. The message may or may not have the defined auxiliary field. After receiving the Transmit Data message, the terminal begins to send data records. Data is sent as follows:

1. Each control record (BCD record with \$ as first character) is sent one record per message with a special control record format code. The record may or may not be compressed.
2. All other data records are sent with an information message format code. There may be more than one record per message. A record may be compressed and may be split across messages, and may contain as many as 324 data characters.

A new data message should not be sent to GRTS until the remote computer has received a Transmit Data operation code with an ACK. A Transmit Data message from GRTS contains no data.

DATA OUTPUT (DATA FROM GRTS TO REMOTE COMPUTER)

If GRTS receives initial output for the remote computer while in idle mode, a Select service message will be sent to the remote computer. This is true even if the remote computer terminal has just sent a Select. The terminal must then send an Acknowledgement service message with no instruction in the Type instruction field. When data is received, the format code will indicate the nature of the data, and the operation code will be No Request. The terminal should handle the data, if received error free, and answer with an information message with a No Data, No Request operation code, and an acknowledgement. GRTS then sends the next message. This operation continues until data output is completed.

WAIT MESSAGES

If the remote computer terminal cannot handle data or send data, it may send an information message with a Wait operation code. GRTS waits seven seconds and then transmits the previous message.

This wait may occur when a required peripheral is not available to the remote computer terminal. Any data sent with a Wait operation code is not handled by GRTS. If communication is kept in a wait condition for 15 minutes, GRTS will initiate disconnect procedures by sending a Ready for Disconnect service message to the terminal.

The "wait" op code message may, or may not, have its sequence code changed. If it is changed, input data may be lost. It is best to keep the same sequence code and change it only when new data is being entered. If the remote computer is receiving data from the DATANET FNP, the sequence code is meaningless if the "wait" op code is in effect.

GRTS never sends a Wait message to the remote computer terminal.

SPECIAL CONTROL RECORDS

Special control records are sent one record per message.

GRTS may send a special control record at any time during active mode.

1. The format code for a special control record will be 1000100 indicating no compression.
2. The media code on the record will be 1001110 indicating BCD data to the teleprinter. This is a message to the operator at the remote computer.

SPECIAL CONTROL RECORDS FROM REMOTE COMPUTER

During input, any BCD record with a \$ as the first data character will be sent as a special control record. This may or may not be compressed. During output, one of two special control records (File abort or File Backspace) may be sent to GRTS. The format code may be either 1000100 or 1000101, and the media code must be 1001000. The text consists of one character indicating either file abort (0110001) or file backspace (0110010). This character is followed by a record separator, end of text, and block check character.

1. File Abort (0110001) causes GRTS to send an abort message to the central computer system specifying a file to be aborted. The file is aborted from the system, an operator message (special control record) is sent to the remote terminal, and output continues with the next file.
2. File Backspace (0110010) causes GRTS to send a file backspace message to the central computer system and an operator message to the remote terminal. The central computer backs up several data blocks in the present output file, and output to the remote computer continues.

Error Recovery

The sequence code and the acknowledgement field of the OC are used to ensure that all data accepted over the line is without errors and that no data is handled more than once. Each computer must adhere to the following rules. In these rules, the sequence code (SC) refers to the code alternating between 1000001 and 1000010, and pertains to the data in the message. A changed SC indicates new data when data is present. Data message refers to a message with data between the STX and ETX. The acknowledgement field refers to whether or not a message was received in error. The rules apply equally to GRTS and the remote terminal.

1. Received data message in error. Retransmit last message with negative acknowledgement (NAK) and same transmit sequence code.
2. Received data message error-free - Received message contained positive acknowledgement (ACK).
 - a. Received SC altered from last accepted message - Process data, alter transmit sequence code and transmit next message with acknowledgement.
 - b. Received sequence code same as last accepted message - Data contained in this message has already been processed; alter transmit sequence code and transmit next message (not necessarily next data message) with acknowledgement.
3. Received data message error-free - received message contained NAK.
 - a. Received sequence code altered from last accepted message - Process data, alter transmit sequence code, and transmit next message with ACK. (The data, being transmitted in one direction, has been received error free).
 - b. Received sequence code same as last accepted message - Data contained in this message has already been processed. Retransmit last message with same transmit sequence code and acknowledgement.

4. Received message in error containing no data - Retransmit last message with NAK and same transmit sequence code.
5. Received message error-free containing no data - Received message contained ACK.
 - a. Received sequence code altered from last accepted message - Change transmit sequence code and transmit next message with acknowledgement and new data.
 - b. Received sequence code same as last accepted message - Alter transmit sequence code and transmit next message with acknowledgement and new data.
6. Received message error-free containing no data - Received message contained NAK.
 - a. Received sequence code altered from last accepted message - Retransmit last message with same transmit sequence code and acknowledgement.
 - b. Received sequence code same as last accepted message - Retransmit last message with same transmit sequence code and acknowledgement.

Received Message Contains Data

<u>Same SC</u>	<u>Change SC</u>	<u>ACK</u>	<u>NAK</u>	<u>ERR</u>	
				X	Retransmit last message with NAK and same transmit SC
	X	X			Process data -- change transmit SC Transmit next message with ACK
	X		X		Process data -- change transmit SC Transmit next message with ACK
X		X			Data already processed, changed SC transmit next message with ACK
X			X		Data already processed, retransmit message with same transmit SC and ACK

Received Message Contains No Data

<u>Same SC</u>	<u>Change SC</u>	<u>ACK</u>	<u>NAK</u>	<u>ERR</u>	
				X	Retransmit last message with NAK and same transmit SC
	X	X			Change transmit SC, transmit next message with ACK and new data
X		X			Change transmit SC, transmit next message with ACK and new data
	X		X		Retransmit last message with ACK and same transmit SC
X			X		Retransmit last message with ACK and same transmit SC

After transmitting a message to the remote computer terminal GRTS begins a seven-second timeout. If no response is received from the remote computer within seven seconds, GRTS retransmits the last message with the same sequence code and a negative acknowledgement (NAK).

Return To Idle Mode

A Terminate service message from either GRTS or the remote computer initiates a return to the idle mode (switched line or private line). Also, any of the Disconnect procedures defined under Line Disconnect causes a return to idle mode on private lines. A Terminate may be sent at any time during active mode. When this occurs, the present activity ceases. That activity can only be restarted from the beginning.

TERMINATE FROM GRTS

When GRTS sends a Terminate service message, the remote computer terminal must answer with a service message with no instruction in the type field. Both terminals then go into the idle mode.

GRTS sends a Terminate when control records are not as expected or when a control record requesting output is encountered. On the latter terminate condition, the line remains connected to the central computer system to wait for output. All other terminations cause the line to be disconnected from the central system even though the line remains physically connected between GRTS and the terminal.

TERMINATE FROM TERMINAL

When the remote computer terminal sends a Terminate service message to GRTS, the response is another Terminate. If the answer from GRTS is not a Terminate, it can be assumed that the message was missed and the remote computer must transmit another Terminate. On receiving the Terminate response from GRTS, the terminal must respond with a service message containing no instruction in the type field. The line is disconnected from the central system.

Line Disconnect

A Line Disconnect may occur in either active or idle mode. This causes a switched line to be physically disconnected or a private line to enter idle mode. In either case, GRTS insures that the line is disconnected from the central system and any activity on the line (input or output) is destroyed. To continue, the activity must restart from the beginning.

DISCONNECT INITIATED BY GRTS

When a Disconnect is initiated by GRTS, the following messages are used:

1. Ready for Disconnect service message (RFD) - GRTS precedes this message with a message to the terminal (special control record) giving the reason for the disconnect.

The remote computer must answer this message with an RFD or a No Instruction service message and then disconnect the line. The remote computer may not answer with a Not Ready for Disconnect message, as the instruction by GRTS must be executed.

2. Disconnect - The Disconnect service message will be sent when the line is too bad to properly handle a RFD. Upon receiving this message, the remote computer disconnects the line without sending a response.

DISCONNECT INITIATED BY REMOTE COMPUTER

When the disconnect function is initiated by the remote computer, the following messages are used:

1. Ready for Disconnect Service (RFD) - No reason for the disconnect is sent to GRTS. GRTS responds with a RFD, and the line is then disconnected by the remote computer and by GRTS.
2. Disconnect - If GRTS receives a disconnect it will drop the line without answering the message.

Remote Computer Direct Access (DAC)

To enter the Direct Access mode after the terminal has been accepted, requires a DAC Control card. This card establishes the connection to a program executing in the central system, so that the terminal and program may communicate with each other.

\$*\$DACnnnnnn

Where: nnnnnn - Name of the slave program executing in the central system with which the terminal wants to communicate.

When the DAC control card is detected, GRTS sends the Connect to \$slave operation code and the name of the job to the central system. At this point, the program assumes control, the GRTS remote computer software functions as a passive unit passing messages between the central system and the remote computer terminal as directed by the slave program. The format character (FC) will state "User Defined Text".

FC = 1001101 (user defined text)

COMMANDS ACCEPTED FROM CENTRAL COMPUTER SYSTEM

The remote computer interface recognizes the following central system commands:

- Accept Direct Output
- Accept Direct Output/Wait for Input
- Disconnect this Line

Accept Direct Output

The Accept Direct Output command from the central system instructs the remote computer DAC interface to transmit the supplied data to the remote computer terminal. After the terminal has accepted the data, GRTS requests more output from the program executing in the system.

Each block of data from the central system is examined for valid word count and character count. The data (if any) is ignored under the following conditions, and GRTS requests more data:

1. Word count is 0, or greater than 319.
2. Character count is 0, negative, or greater than 1272 characters.

When transmitting data characters to the remote computer, each character is checked for an ASCII termination character (ETC, ETX or EOT). If a termination character is found, it is replaced with a rubout character (111111).

Accept Direct Output/Wait for Input

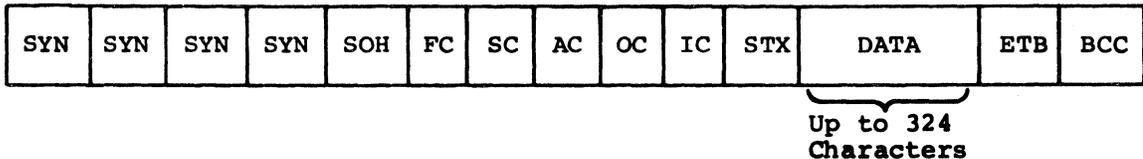
The Accept Direct Output/Wait for Input command from the central system is similar to the Accept Direct Output command with the following exception. After the remote has accepted all output data, GRTS sends a Transmit Data operation code to the remote computer. This code requests data, and when the data is received, GRTS sends it to the central system with the command Accept Direct Input.

As in the Accept Direct Output command, the word count and character count of each block of data sent to the central system is checked. If a block of data contains an illegal count, the data is ignored. GRTS then sends a Transmit Data operation code to the remote computer requesting input data.

A maximum of 1272 characters can be sent to the central system. If GRTS receives more than this, it sends the accumulated characters with an indicator bit which informs the program in the central system that this data has been truncated.

MESSAGE FORMAT

In the DATANET FNP, a maximum of 324 characters can be transmitted or received in one message. Since one block of data to or from the central system may contain 1272 characters (four characters per word X 318 words; two words of each 320-word block are used for control), data is transmitted to the FNP in several messages. To inform the receiving station that more data will follow in the next message, the ASCII control character ETB is used to terminate the message. The last message of the group of messages is terminated by an ETX character, which indicates all the data for this data block has been transmitted.



General System Characteristics

COMPRESSION

In DAC mode, a remote computer may request compress/no compress on data. This request is made in the auxiliary field of the Select service message. If compression is specified, the remote computer DAC interface compresses repeated characters in the output strings as follows:

----X,US,CC----

Where: X - The repeated data character.

US - An ASCII character (0011111)

CC - A count of the number of times the compressed character is to be repeated.

If compression is specified, GRTS checks each input character to determine if it is the compression character. This character is used in expanding the input for transmission to the program in the central system.

BREAK

Each message from the remote computer is checked for a special control record format character. When this character is found, the second character following the STX character is checked for an ASCII (0110001). The remote computer DAC interface interprets a 1 as indicating a Break condition and sends this information to the central system. If the character is not a 1 and GRTS was expecting a response, the message is treated as an error condition and causes GRTS to retransmit the last message with an acknowledgement and changed transmit sequence code. If no response was expected the message will be ignored. This message is as follows:

SYN	SYN	SYN	SYN	SOH	FC	SC	AC	OC	IC	STX	MC	ASCI	RS	ETX	BCC
-----	-----	-----	-----	-----	----	----	----	----	----	-----	----	------	----	-----	-----

PARITY

The DATANET FNP generates/checks odd parity on a seven-bit character.

REMOTE COMPUTER IN DAC MODE

To allow the remote computer more flexibility while operating in the DAC mode, two command bits, controlled by the DAC program, have been implemented in the DATANET FNP.

The command bits are located in word three (3) of the DATANET FNP buffers with the following definitions:

Bit 17 = 1 Long wait time
Bit 16 = 1 DAC-IDLE

Long Wait Time Command Bit

This is associated with the "Wait for Input" portion of the "Output/Wait for Input" command from the DAC program. For each message the FNP transmits to the remote computer, a response is expected within 7 seconds. If the terminal is not ready to send the input data, it may respond with a "Wait" message. This will cause the FNP to delay 7 seconds and then ask for the input data again.

For dial-up lines, the wait response loop is allowed for 15 minutes, then the line will be disconnected. To give more time to prepare the input data, the Long Wait command bit will extend the time to 30 minutes before the line will be disconnected. This function is set/reset on each command from the DAC program.

DAC-IDLE Command Bit

Once a remote computer establishes contact with a DAC program, the Remote Computer Module takes commands from the DAC program to control the terminal. After each command sequence has been completed, the Remote Computer Module places the communication lines in the transmit mode, returns control to the DAC program and waits for the next command. The assumption here is that the DAC program always has something to do with the terminal. This is not always the case since the last input data received may have completed the transaction. In this situation, the DAC program may retire and wait for a "break" from the terminal.

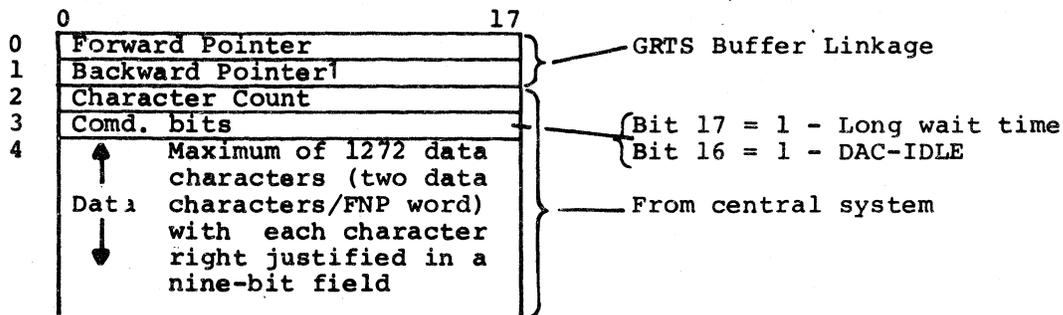
To prevent a remote computer lockout condition when the DAC program has no data for the terminal, the DAC program sends a command with the DAC-IDLE bit on. After the command sequence is complete, the communication line is placed in the receive mode and the DAC program informed of the completed command. In the DAC-IDLE mode, the FNP either accepts a "break" message from the remote computer, or the next command from the DAC program, whichever arrives first. Either condition ends the DAC-IDLE mode.

Depending upon the character count field, a data message will, or will not, be transmitted to the terminal. If the character count is illegal or "0", the FNP ignores the output data and proceeds with the remainder of the command. If the command was "Accept Direct Output", the FNP requests more output data from the DAC program. "Accept Direct Output/Wait for Input" command results in the FNP asking the remote for the input.

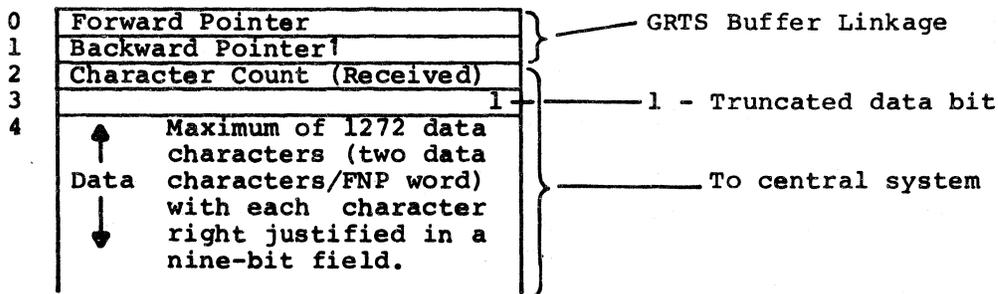
REMOTE COMPUTER DAC BUFFER FORMAT

Data from central system:

The central system word count is placed in the TIB (TBBKWC) by the intercomputer module (GICM).



Data to central system:



¹DATANET 305 FNP buffers do not have Backward Pointers.

REMOTE COMPUTER DOUBLE BUFFERING

The remote computer module (GRCM) will double buffer output data from the central system to the remote terminal if configured at startup. (See GRTS/355 and GRTS/6600 Startup Procedures.)

When the central system responds to a request for output with the Accept Output command, GRCM requests a second 192-word buffer. If for any reason the second buffer cannot be obtained, GRCM automatically continues with a single buffer.

In the double buffer mode GRTS attempts to keep both buffers loaded at all times by an overlap of activities. One buffer is loaded with data from the central system while the alternate buffer is configured for transmitting data to the remote computer. When the block of data from the central system is complete the buffer functions are swapped, i.e., the buffer previously accepting data from the central system is set up for transmitting data to the remote computer and the alternate buffer waits to be loaded with the next block of data from the central system.

The double buffering option is used for the remote batch mode of operation only.



SECTION V

SYSTEM CONSIDERATIONS

The basic components for a remote terminal system are:

- Central Information Processing System
- GCOS Software
- DATANET FNP
- GRTS Software
- Terminals
- Data Communications Equipment

Representative system configurations are illustrated in Figures 5-1, 5-2 and 5-3.

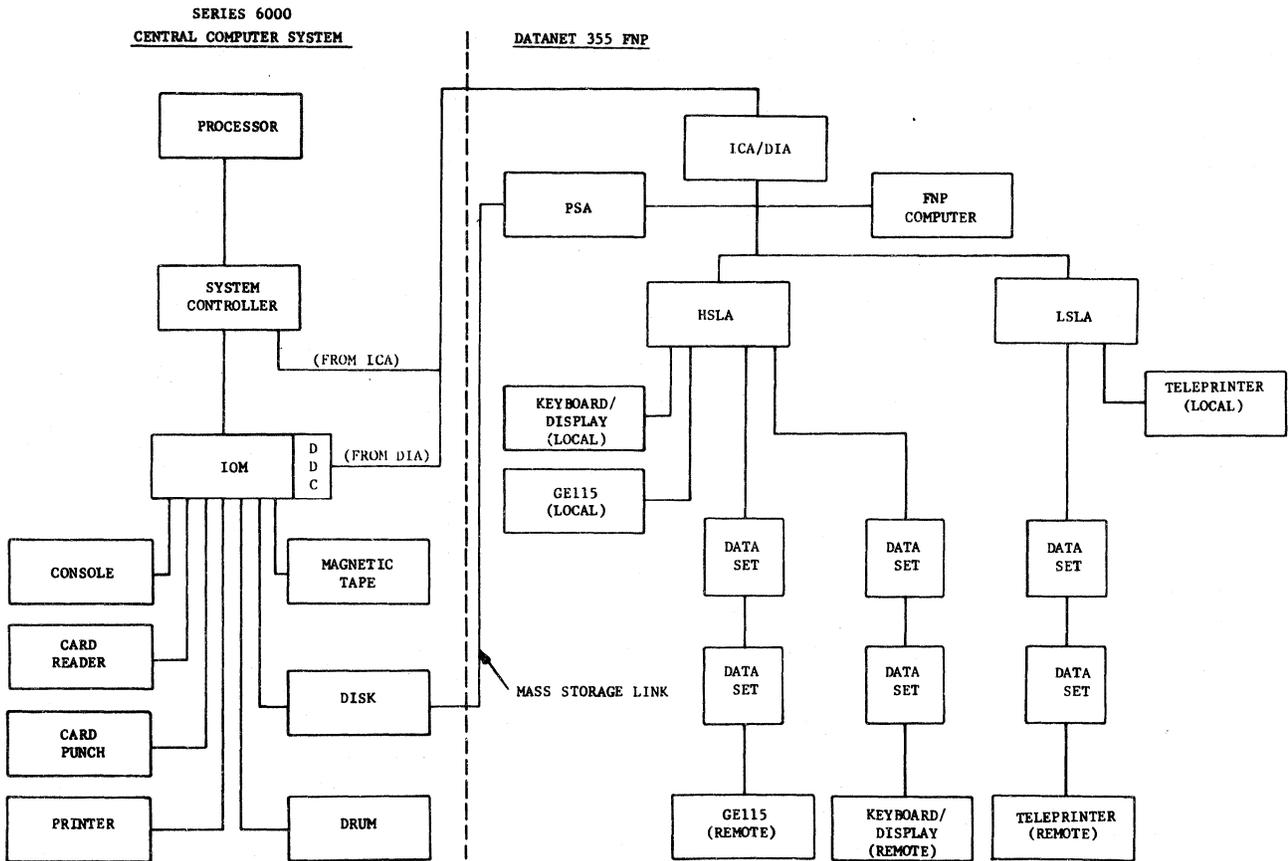


Figure 5-1. System Layout with DATANET 355 FNP

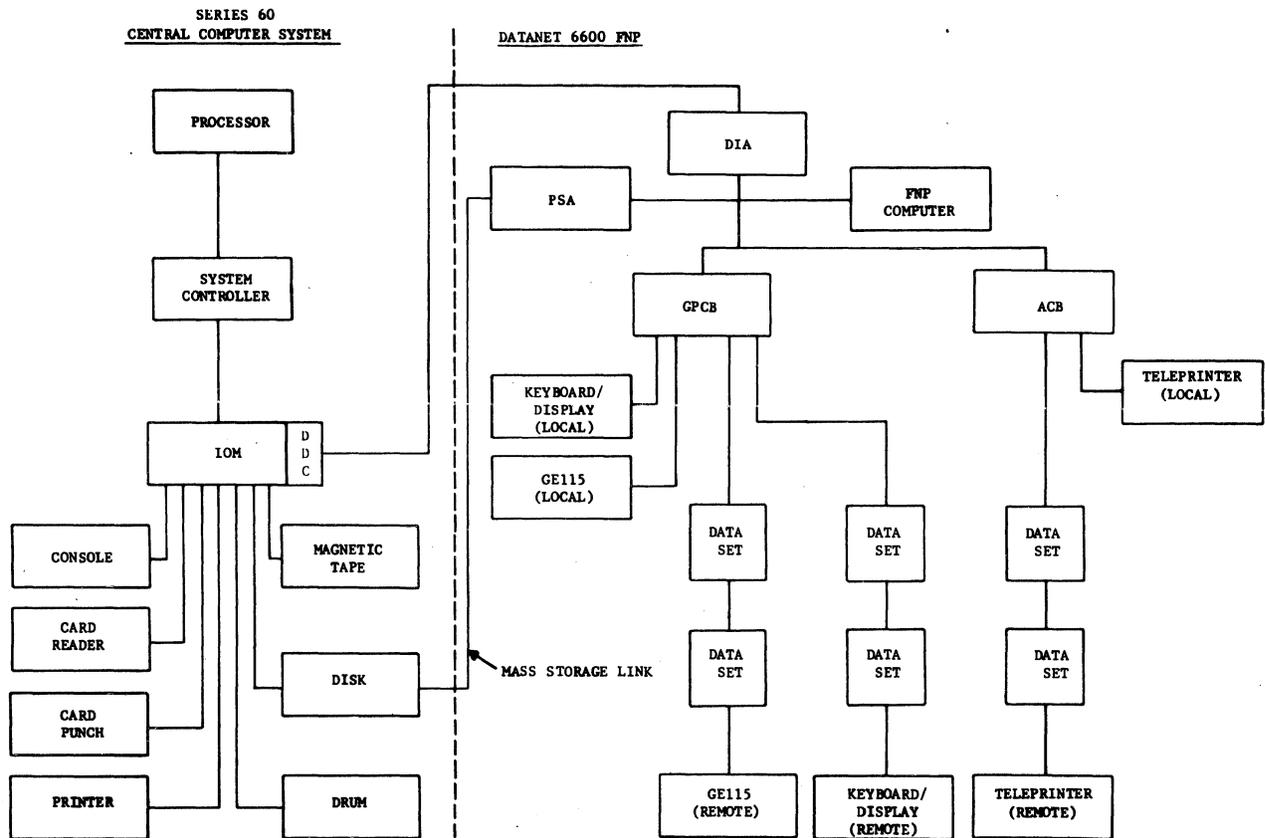


Figure 5-2. System Layout with DATANET 6600 FNP

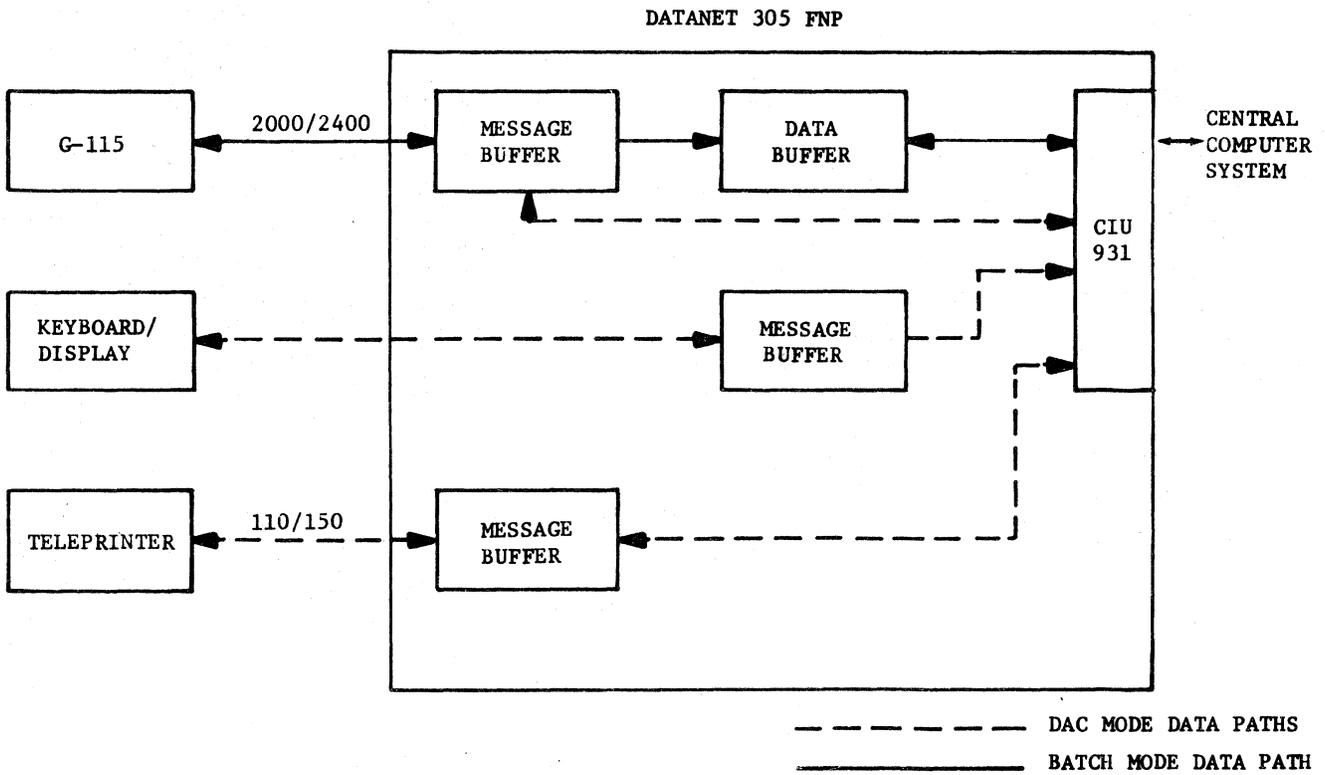


Figure 5-3. DATANET 305 FNP System Layout

CENTRAL INFORMATION PROCESSING SYSTEM

The Central Information Processing System is a large-scale, digital information processing system with multi-dimensional operating capabilities. The system is modular in design, permitting a high throughput rate and enabling it to serve many users simultaneously. The basic central system consists of:

- Processor
- Memory Module
- Input/Output Multiplexer
- System Console

In addition, the system requires standard peripherals such as card reader(s), printer(s), punch(es), etc. The equipment for a specific system is sized and configured to satisfy the processing needs of the user. The software for the computer system includes the following:

- GCOS - The operating system which supervises the overall programming and operation of the system.
- GRTS - An associated three-part routine to GCOS which controls the operation of the remote terminal system. The version of GRTS to be used depends on which FNP is configured.
- Mass Storage Link - The facility that allows the DATANET FNP and the central system to share a dedicated area in the DSS180, DSS181, DSS190 or MSU0310 (Series 60 only) subsystem.
- Language Processors - FORTRAN, COBOL, ALGOL, and JOVIAL compilers which provide a flexible applications capability.
- Library System - The many special routines which make GCOS a highly efficient system, capable of performing a great variety of processing functions.
- System Editor - The maintenance package which permits modification, expansion and improvement of the operating system.
- Time Sharing System - The program in the central system which permits time sharing operations.

DATANET 355/6600 FNP

The DATANET FNP is a high performance communications processor which can link a variety of terminals to the system. The flexibility designed into the DATANET FNP permits the use of terminals with widely differing operating characteristics and data transmission speeds. The DATANET FNP is made up of the following components:

- DATANET 355/6600 Computer (Processor, Store Module, and Input/Output Module)

- High Speed Line Adapter (HSLA)/General Purpose Communications Base (GPCB)
- Low Speed Line Adapter (LSLA)/Asynchronous Communications Base (ACB)
- Intercomputer Adapter(ICA-DATANET 355 only) or Direct Interface Adapter(DIA)

The DATANET FNP receives data from remote terminals, temporarily stores it, processes it, and forwards it to the central system for processing. When the processing is completed, this sequence is reversed, with the data sent to the originating terminal, to a terminal specified by the program, or output at the central system. In direct access mode, the DATANET FNP assumes a passive role, transferring information back and forth between a user program executing in the central system and a terminal communicating with that program.

The Intercomputer Adapter (ICA) links the input/output bus of the DATANET 355 FNP Input/Output Multiplexer (IOM) with each central System Controller. In the operation of the communications network, the ICA transfers data and control information back and forth between the DATANET FNP memory and the central system memory. If input is via the communications/mass storage link facility, the ICA may be used to transfer control information and/or data to the central system.

The Direct Interface Adapter (DIA) links the input/output bus of the FNP Input/Output Multiplexer (IOM) with the Direct Data Channel (DDC) on the central system Input/Output Multiplexer (IOM).

In normal data transfer, the ICA or DIA acts as the agent of the DATANET FNP. However, the central system can initialize (bootload) or program interrupt the FNP via the ICA or DIA. This adapter can also respond to interrupts from the central system, thus permitting the ICA or DIA to assume input/output processor functions if desired.

The High Speed Line Adapter (HSLA) or General Purpose Communications Base (GPCB) provides the means for connecting a variety of terminals to the DATANET FNP. The HSLA/GPCB is a multiline controller and can interface with both voice-grade (including teleprinter terminals) and/or Telpak data communication lines. The terminals on these lines may operate at speeds ranging from 110 to 50,000 bits per second. Each communication line can be used in either simplex, half-duplex, or full-duplex transmission in two-wire or four-wire operation. Normally, the HSLA/GPCB can service any terminal that can transmit and/or receive character-oriented bit-synchronous messages with information codes up to eight bits in length.

The Low Speed Line Adapter (LSLA) or Asynchronous Communications Base (ACB) is a local communications controller which provides the primary facility for connecting up to 52 low-speed terminals to the DATANET FNP. It has the capability for time-division (time-slot) multiplexing by character, to/from the FNP. The LSLA/ACB operates with low speed terminals (110-300 bps) in half-duplex or full-duplex mode for asynchronous data transfer.

DATANET 305 FNP

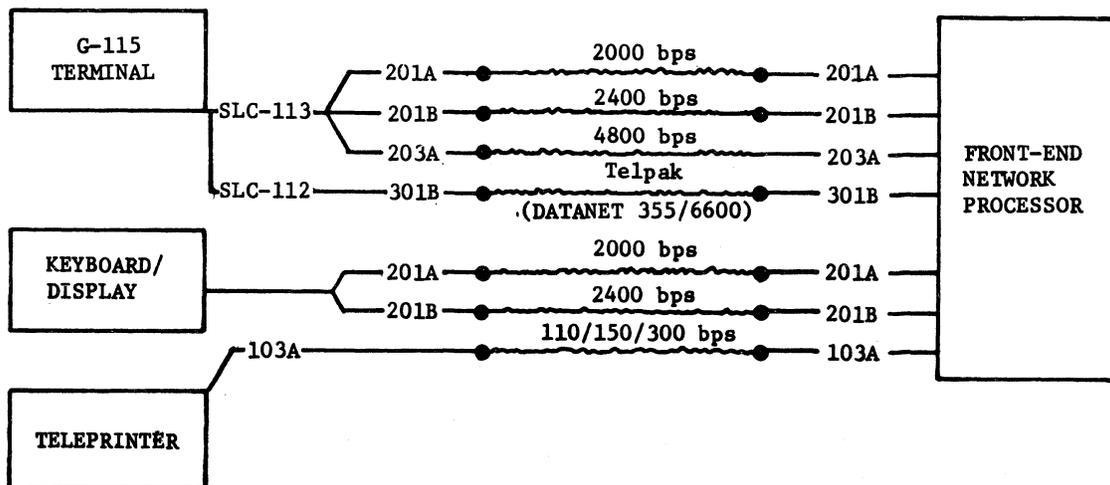
The DATANET 305 FNP is designed to handle the small-to-medium scale communications requirements for a central system. Operating under GRTS/305, this FNP receives, temporarily stores, processes, and forwards data from remote terminals to a central system for processing. In the reverse of this procedure, the processed data is sent to a terminal via the FNP. The output may be sent to the originating terminal or to another terminal specified in the program deck. The data may also be output via an online printer in the central system.

The DATANET 305 FNP hardware configuration is as follows:

- Processor with 16K memory.
- CIU933 Computer Interface Unit Group 1 (provides FNP to central system interface).
- Line Buffers:
 1. Low speed line buffers are BBU933 Bit Buffer Units, which use BBC932 and BBC933 Bit Buffer Channels. Line speeds may not be mixed on a BBU. Configuring terminals with various speeds will require several BBU's. Addresses assigned contiguously from 3 to 14 (depending on devices configured).
 2. High speed line buffer is the CWU931 Character Word Unit which can interface up to two CBC931 Character Buffer Channels (2000/2400/4800 bps). Code level -16, sync code - 13026 (octal). Addresses assigned 1 and 2 for G-115 terminal.

DATA COMMUNICATIONS EQUIPMENT

Data communications is the transfer of encoded data between two or more points via one or more types of electrical transmission mediums such as wire, coaxial cable, and microwave. As described in this manual, data communications requires a data set to interface the computer equipment with the transmission system. A basic data communications configuration may contain the following elements:



These elements may be divided in two groups:

- Data sets - to interface the transmission channels to the terminals, and to the FNP.
- Transmission Channels - to convey information from one point to another.

The data sets used in a remote terminal system must be matched to the requirements of the terminals. In addition, the data sets at each end of a transmission line must be compatible. The following list matches typical terminal/data set combinations and indicates the types of operation for each.

<u>Terminal</u>	<u>Interface Unit</u>	<u>Data Set (Typical)</u>	<u>Transmission Network</u>		<u>Rate (baud)</u>
RNP	SSLC	Bell 203A	Synchronous	Private	9600
RNP	SSLC	Bell 201A	Synchronous	Switched	2000
Model G-115	SLC-114	Bell 203A/ GE TDM	Synchronous	Private	9600/7200
Model G-115	SLC-112	3300 Bell 203A/ 201B	Synchronous	Private	4800/2400
Model G-115	SLC-113	Bell 303C	Synchronous	Wideband	40800
Model G-115	SLC-113	Milgo			
Model G-115	SLC-112	4400/48 Bell 201B	Synchronous	Private	4800
Model G-115	SLC-112	Bell 201A	Synchronous	Private	2400
Model G-115	SLC-112	Bell 201A	Synchronous	Switched	2000
RLP300	None	Bell 201B	Synchronous	Private	2400
VIP ^a	Data Line Controller	Bell 201B	Synchronous	Private	2400
VIP ^a	Data Line Controller	Bell 201A	Synchronous	Switched	2000
VIP ^a	Data Line Controller	Bell 208D	Synchronous	Private	4800
VIP 765	Data Line Controller	Bell 202C	Asynchronous	Switched	1200
VIP 765	Data Line Controller	Bell 202D	Asynchronous	Private	1200
TTY (33)	None	Bell 101C	Asynchronous	Switched	110
TTY (35)	None	Bell 101C	Asynchronous	Switched	110
TTY (37)	None	Bell 103	Asynchronous	Switched	110
GE TermiNet 300	None	Bell 103	Asynchronous	Switched	110/150/300
GE TermiNet 1200	None	^b Bell 202C	Asynchronous	Switched	1200
IBM 2741	None	Bell 103	Asynchronous	Switched	134.5
Hazeltine 2000	None	^b Bell 202C	Asynchronous	Switched	1200
Execuport 1200	None	^b Bell 202C	Asynchronous	Switched	1200
IBM 2780	None	Bell 201A or 201B	Synchronous	Switched or Private	to 4800
BTT	Data Line Controller	Bell 208D	Synchronous	Private	4800

In the send mode, the data set at the sending end converts digital data to signal form for transfer over the transmission channel. In the receive mode, the data set takes signal formatted data from the transmission channel and converts it to a format acceptable to the terminal or to the computer's communications interface.

^aThese application examples may apply to any configurable keyboard/display terminal, except VIP 765.

^bFor these applications the Bell 202C modems must be equipped with the reverse channel option.

Numerous data sets of various makes are available either from common carriers (communications network operators) or by direct purchase from the manufacturers. For terminals operating at speeds up to 300 bps, acoustic couplers are frequently used in place of direct-connection data sets to provide flexibility of use at different telephone locations. Other brands of data sets may be used in place of the Bell units in the above table as long as they are equivalent in operating characteristics and meet the EIA interface requirements.

Transmission channels link the remote terminals and the FNP. The following common carrier services are typical of those used for such connections:

- Common Carrier Switched Network - With this regular telephone service and suitable data sets, different types of transmission and a variety of bit rates are available to the user; e.g.:

Bell 103A Asynchronous up to 300 bps
Bell 201A Synchronous - 2000 bps.

- Private Line Service - Voice-grade - Half-duplex service with:

Bell 103F Asynchronous up to 300 bps
Bell 201B Synchronous - 2400 bps

Duplex service with:

Bell 203A Synchronous - 4800 bps

- Private Line Service - Wideband - High-speed service with:

Bell 301B Synchronous 40,800 bps
Bell 303C Synchronous 50,000 bps.

Switched network service permits interconnection with terminals at telephones located locally or at remote locations. WATS (Wide Area Telephone Service) provides volume usage on a flat or measured basis and is frequently used with switched service.

Private telephone lines are suitable when only a few locations are to be interconnected and has the advantage of restricted line usage. This service is also available on a full-duplex basis. Full-duplex mode permits continuous transmission capability in both directions. This can be used with some data sets to eliminate channel turn around time.

As with data sets, channel facilities are available (in some cases) from several network operators. The specific facilities to be used will be determined by the availability of services and the specific needs of the system.

The grade of service used by a system depends on the communications requirements of the system: i.e., amount of data to be transferred, privacy of line, availability of lines, types of data communications, types of terminals on the system, and cost considerations.

TERMINALS

G-115 Information Processing System

The G-115 is a small-scale information processing system designed to operate as:

- A card processing system to perform the functions carried out in a punched card tabulation installation.
- A remote terminal on a central system.
- An independent information processing system capable of being programmed for many applications, particularly data processing associated with tabulations, inventories, record keeping, and file updating.

The basic G-115 system consists of a processor with 4k of core storage, an input/output unit, a printer, a card reader, and other (optional) peripherals. Programming for the G-115 system is done by the G-115 assembly language, a basic assembly language that provides simple mnemonics and symbolic phrases. In addition, the supporting programs include a report generator, loader, utility routines, conversion routines, service routines, and arithmetic routines.

As a terminal on the DATANET FNP, a G-115 system may operate in one of two modes depending on the interface unit. With a SLC-113 or SLC-114 interface unit, the G-115 uses the voice-grade GRTS program and voice-grade transmission service. With a SLC-112 interface unit, the G-115 uses the broadband GRTS program and broadband transmission service (Telpak).

PROCESSOR CONTROL PANEL

The controls and indicators on the control panels of two different models of G-115 Processor are shown in Figure 5-4 and Figure 5-5.

The switches and indicators are described following each figure.

DC ALARM	DC READY	ON	READY		ALERT	SWITCH 1	SWITCH 2	SINGLE	HALT	WAIT
OFF			RESET	LOAD 2	LOAD 3			STOP	RUN	

Figure 5-4. Model 1, G-115 Indicators and Switches

Model 1 Processor

<u>Switch/Light</u>	<u>Purpose/Action</u>
DC ALARM	Indicates excessive temperature in the Processor. DC power is automatically turned on when this light goes off. Notify Field Engineer.
DC READY	DC power is on.
OFF	Turns off DC power to Processor and terminals.
ON	Indicates Processor is ready for operation.
READY	Indicates Processor is ready for operation.
RESET	Sets Processor to initial status.
LOAD 2	Selects card reader on connector 2.
LOAD 3	Selects input unit on connector 3.
ALERT	Indicates GRTS/115 attempting to use peripheral which is not ready.
SWITCH 1	Used to abort GRTS output file and to bypass checksum testing during input.
SWITCH 2	Used to backspace an output file. Used with RESET and RUN to send a Select.
SINGLE/STOP	SINGLE switch allows system to run in automatic mode. STOP switch allows the program to be executed step by step; i.e., one instruction executed each time the RUN switch is pressed. The SINGLE/STOP switch may be disabled by the INS instruction.
RUN	Starts program in mode established by SINGLE/STOP switch.
HALT	Indicates program stopped in single mode or on HALT instruction.
WAIT	Indicates Processor is waiting for order from peripheral unit, Front-End Network Processor, or central computer system.
PC	Program Address Counter (PC) indicates, in hexadecimal, address of op code in next instruction to be executed.
IR	Instruction Register (IR) indicates, in hexadecimal, address of op code in next instruction to be executed.
SC	Sense Condition (SC) indicates that condition tested by jump instruction was present. Light remains on until RESET is pressed or until Jump instruction is executed in which tested condition is not present.
IE	Internal Error (IE) indicates parity error during internal operation, such as move or add. RESET must be pressed to turn light off. Store must be cleared or program reloaded to eliminate error.

ON	DC ALERT	POWER ON	MAINT ON	SWITCH 1	SWITCH 2	STEP BY STEP	LOAD 1
	POWER OFF		LAMPSCHECK				LOAD 2
	STANDBY		MEM CLEAR	CLEAR	LOAD	HALT	OPERATOR CALL
						START	

Figure 5-5. Model 2, G-115 Indicators and Switches

Model 2 Processor

<u>Switch/Light</u>	<u>Purpose/Action</u>
ON	Turns Processor AC power on or off.
DC ALERT	Indicates excessive temperature in Processor. DC power is automatically turned on when this light goes off. Notify Field Engineer.
POWER OFF	Turns off DC power.
POWER ON	Turns on DC power.
MAINT. ON	Indicates a maintenance switch is on. Notify Field Engineer.
LAMPSCHECK	Checks lamps on operator's panel. If lamps do not light, notify Field Engineer.
SWITCH 1	Used to abort a GRTS output file and to bypass checksum testing during input.
SWITCH 2	Used to backspace on output file. Used with RESET and RUN to send a Select.
STEP BY STEP	This switch lets program be executed one instruction at a time: RUN switch serves as stepping switch. This switch may be disabled by INS instruction.
LOAD 1	Selects card reader on connector 1.
LOAD 2	Selects input unit on connector 2.
STANDBY	Indicates Processor is awaiting order from a peripheral unit.
MEM CLEAR	Clears core store.
CLEAR	Sets internal conditions to initial status.
LOAD	Loads input from unit selected by LOAD 1 or LOAD 3.
HALT	Indicates program stopped in single mode or on a HALT instruction.

START	Starts program in mode established by setting of STEP BY STEP switch.
OPERATOR CALL	GRTS/115 attempting to use peripheral which is not ready.
PC	Program Address Counter (PC) indicates, in hexadecimal, address of op code in next instruction to be executed.
IR	Instruction Register (IR) indicates, in hexadecimal, op code character in next instruction to be executed.
SC	Sense Condition (SC) indicates condition tested by Jump instruction was present. Light remains on until Jump instruction is executed in which tested condition is not present.
IE	Internal Error (IE) indicates parity error during internal operation, such as move or add. Press CLEAR to turn off light. Core storage must be cleared or program reloaded to eliminate error.

INITIALIZATION

Processor

Startup of the G-115 Processor is accomplished as follows:

1. Move circuit breaker on power panel to ON.
2. Remove base panel on wing 3 in back of unit and check that the circuit breaker is in the ON position.
3. Remove wing 3 above base panel and check that the INTERRUPTTORE GENERALE switch is in the ON position.
4. Replace panel covers.
5. Press ON button located in front of unit above base panel on wing 2.
6. Assure that the yellow light is on and that power supply fans are operating.
7. Press ON button located on left side of operator panel.
8. Assure that operator panel lights are on and the main unit fans are operating.
9. Press READY/RESET to assure that the PC/IR indicator lights are operating.

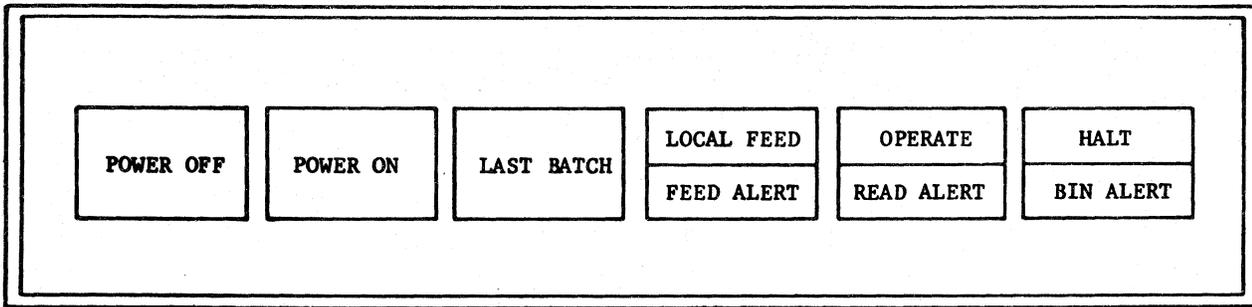


Figure 5-6. CRZ100 Controls and Indicators

Card Reader

Startup of the CRZ100 Card Reader is as follows:

1. Press POWER ON pushbutton.
2. Load the card deck, face down, with card row 9 closest to the operator.
3. Place card weight on deck.
4. Press OPERATE pushbutton.

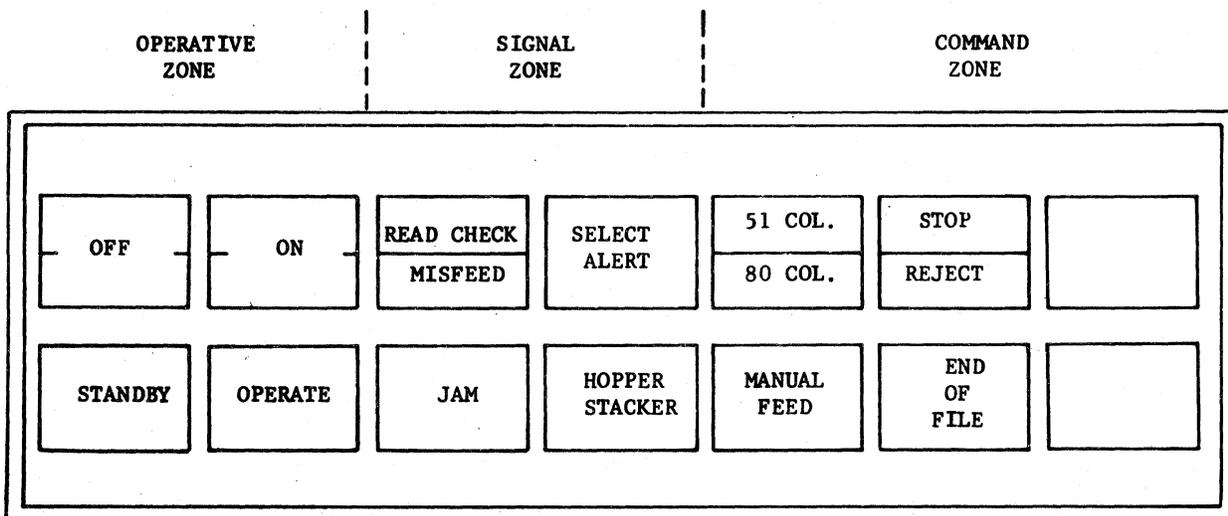


Figure A-4. CRZ120 Controls and Indicators

Startup of the CRZ120 Card Reader is as follows:

1. Press ON pushbutton (STANDBY light comes on).
2. Load the card deck. Top edges must be down and the first column must be to the right.
3. Press OPERATE pushbutton.
4. END OF FILE must be off.
5. 80 COL. should be on.
6. STOP should be on.

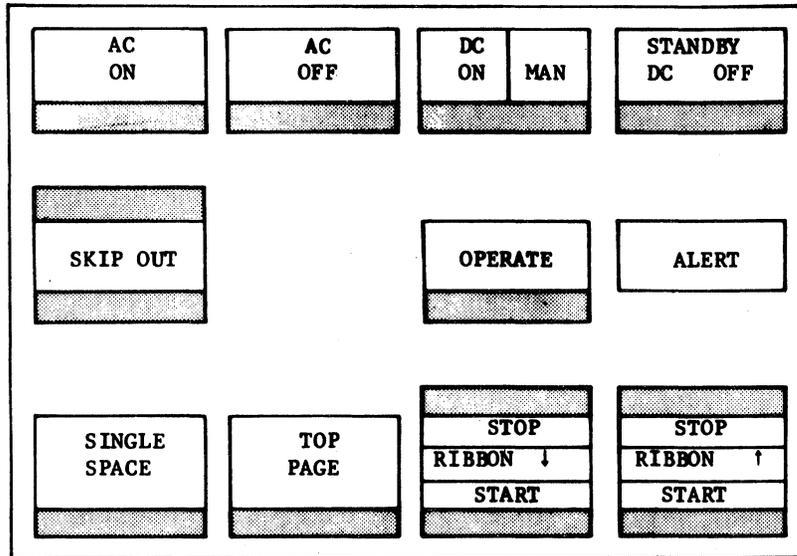


Figure 5-8. Printer Controls and Indicators

Printer

Startup of the Common Peripheral Printer is Performed as follows:

1. Press AC ON. Assure that panel lights are on and fans are operating.
2. Press and hold the DC ON/MAN pushbutton until the indicator light comes on.
3. Press the OPERATE pushbutton.
4. The DC ON/MAN must be in MAN for TOP PAGE or SINGLE SPACE controls to operate.

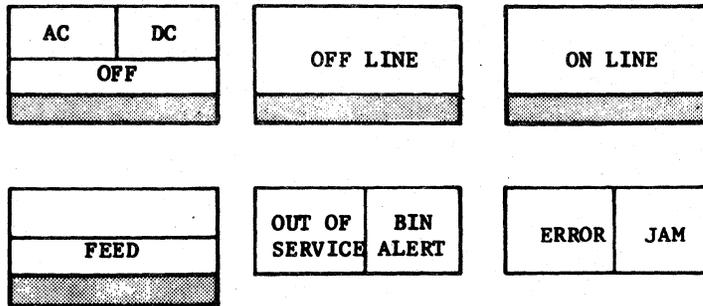


Figure 5-9. CPZ101 Controls and Indicators

Card Punch

Start the CPZ101 Card Punch by the following procedure:

1. Press the OFF LINE pushbutton. Assure that the light is on.
2. Press the ON LINE pushbutton. Assure that the light is on.
3. Press OFF LINE then FEED for manual feed.
4. Put back ON LINE.

Start the CPZ103 Card Punch as follows:

1. Press PWR ON (the STD BY light comes on indicating manual mode).
2. Load cards in hopper, face down, with 9-edge first.
3. Press OPER (STD BY light goes off, indicating automatic mode).

Cards may be added into the CPZ103 while the punch is operating if the hopper contains at least 200 cards at the time the cards are added. Cards may be removed during operation if at least 600 cards are left in the stacker.

To stop CPZ103:

1. If punching has stopped, remove cards and press the OPER pushbutton.
2. Press PWR OFF pushbutton.

SHUTDOWN

The G-115 system may be shutdown as follows:

1. Press POWER OFF pushbutton on card reader.
2. Press DC OFF and AC OFF on printer.
3. On the G-115 processor, press the OFF pushbutton (ON pushbutton on a Model 2) on the control panel and the OFF pushbutton located at the bottom front of the unit.
4. Assure that the yellow light near the master power switch is off.

OPERATING WITH GRTS

Loading GRTS/115 Control Program

To operate the G-115 system as a terminal, the GRTS/115 control program must be loaded via the card reader in the G-115 system.

1. With the G-115 operating, load the GRTS/115 control program deck into the hopper of the card reader.
2. Press the following processor control panel pushbuttons in the sequence given (Note: on a Model 1 G-115 system, the LOAD1 light must be on):

<u>Model 1</u>	<u>Model 2</u>
RESET	CLEAR
LOAD2	LOAD
RUN	START

3. The cards are then read.
4. After reading the cards, the terminal is ready for GRTS operations.

NOTE: If a Telpak line is to be used on a DATANET FNP, a configuration card must be included as the next to last card in the bootload deck.

Configuration Patch Cards (DATANET 355/6600 Only)

The standard GRTS/115 deck for a DATANET FNP is for operation with standard voice-grade G-115 configurations. Nonstandard hardware configurations require patches to the GRTS/115 deck.

1. The peripheral address of the card punch in the G-115 system is assumed to be 00 by the GRTS/115 program. If the card punch is at some other address, a patch card specifying the actual address must be inserted in front of the last card in the GRTS/115 desk. This card is as follows:

1
DN550105F1xx

Where: xx - A two-digit hexadecimal number specifying the correct address of the card punch. Normally when a Multiple Peripheral Adapter is used on connector 03, the card punch is connected to a slot with a peripheral address of 20.

2. The GRTS/115 control program is normally used with voice-grade lines. In order to run GRTS/115 on Telpak Lines (broadband), the following configuration patch card must be inserted just before the last card in the GRTS/115 program deck:

1
DN5501061500

3. GRTS/115 operates with 2000/2400/4800 bps lines and standard peripherals. However, if a slow speed card reader (i.e., model CRZ100) is used on a 4800 bps line, the following configuration patch card must be inserted just before the last card of the GRTS/115 program deck:

1
DN5502041C0500

4. The GRTS/115 deck card count is punched in columns 71-74 of the last card in the deck. This is checked after the deck is loaded to detect lost or additional cards. If the count and the actual number of cards in the deck differ, the start pushbutton must be pressed twice to start the G-115 system. This can be averted by correcting the card count to accommodate any added patch cards.

Example: If a configuration patch card has been added to a GRTS/115 deck whose last card shows a card count of 7C in columns 71-74, the card count is increased by one by reproducing the last card and punching the character "D" in column 74. This makes the card count show the addition of the patch and allows the program to begin after pressing the start button only once.

Entering GRTS Input

Batch input under GRTS/115 is accomplished as follows:

1. Assure that GRTS/115 is in the G-115 core storage.
2. Assure that the printer is set to operate.
3. Check the VFU loop for required printout format.
4. With the input deck arranged for remote input (GRTS control cards included, etc.) load the deck into the Card Reader and press the OPERATE pushbutton.

5. To bypass the checksum tests, set SWITCH 1 on the control panel during the program input. Unless this is done, GRTS/115 tests each binary card for a checksum error.
6. Press RUN pushbutton once (refer to configuration patch card definitions).
7. Perform the terminal call-in as follows:

Voice-grade line:

- a. Press TALK pushbutton on data set.
- b. Lift handset and wait for dial tone.
- c. Dial the assigned GRTS numbers.
- d. When the high pitch tone is received, press the DATA pushbutton and replace the handset on the data set cradle.

Private line:

- a. With a handset type data set, the procedure is the same as for a voice-grade line except that the wait for dial tone and dialing the number are not required. The line connects as soon as the handset is lifted from the cradle.
- b. For a data set without a handset, the procedure is the same as for a Telpack line.

Telpak line:

No call-in procedure is required, pressing the RUN pushbutton on the processor control panel connects the line.

8. The FNP now controls the read-in of the program deck.
9. Normal termination of input is caused by the appropriate GRTS/control record.

Terminal/Reconnect

To send a terminate message, press RESET¹ and RUN, the program will put the printer in standby.

To send a Select message:

1. Put the printer in ready.
2. Press SWITCH 2 to on.
3. Press STEP BY STEP pushbutton to halt the idle loop (if one exists).

¹The RESET and RUN function does not work with EIA interfaced line controllers (dial-up only). The line is disconnected by the hardware when the RESET button is pushed.

4. Press STEP BY STEP pushbutton to restore automatic mode.
5. Press RESET and RUN to send Select message.
6. Press SWITCH 2 to off.

Manual Abort During GRTS Output

Use the following procedure to abort a file being printed or punched at the terminal:

1. Set SWITCH 1 on the Processor control panel (light comes on).
2. Wait for the message FILE ABORT - OP on the console.
3. Reset SWITCH 1 (light goes off).

Printing or punching is assumed if there are more files to the job. Repeat this procedure for each file to be aborted.

Backspace During GRTS Output

To perform a backspace operation during output:

1. Set SWITCH 2 on the Processor control panel (light comes on).
2. Wait for the message FILE BACKSPACED.
3. Reset SWITCH 2 (light goes off).

The files within the central computer system are backspaced to a maximum of eight 320-word blocks. This backspacing is approximately three printed pages or 85 binary card images.

Online Restart Procedure

The online restart procedure for the G-115 terminal is performed at the G-115 processor control panel.

1. Press SINGLE/STOP pushbutton (lower).
2. Press RESET¹ pushbutton.
3. Press SINGLE/STOP pushbutton (upper).
4. Press RUN pushbutton.
5. Put printer in operate mode.

¹The RESET and RUN function does not work with EIA interfaced line controllers (dial-up only). The line is disconnected by the hardware when the RESET button is pushed.

GRTS/115 is reinitialized and is ready to read in a job when RUN is pressed a second time. A disconnect message occurring on the printer indicates that GRTS/115 has received a disconnect due to "n" consecutive errors occurring.

Card Punch Error Recovery

When an error occurs, the program tests to determine which punch is being used and then enters the appropriate recovery routine.

The operator procedure for recovery on a CPZ101 is as follows:

1. Remove last card from the output stacker (card containing error).
2. Press ON LINE pushbutton. The error card will be repunched and will continue.

The only operator action necessary for error recovery on a CPZ103 is the pressing of the ON LINE pushbutton. The error card and the card following it are routed to the reject stacker. Both cards are repunched and another error test is made. If no error exists, normal punching is resumed.

NOTE: Do not remove any cards from the output stacker.

At the completion of a punch file, a cleanup test is performed on the last card punched. On the CPZ103 punch, an additional blank card is fed through the punch, making it unnecessary to manually eject the last card. On a CPZ101 punch, this results in a blank card at the end of the deck.

Bottom-of-Page Detection

In order to be compatible with the central system printer, GRTS/115 automatically slews to the top of the page when the hardware bottom-of-page condition is detected. Most central system output uses a line counter so that top-of-page slew commands are issued when the proper number of lines has been printed. When no line counter is used, the printer slews to the top of the page when the bottom-of-page condition is detected by the G-115 VFU loop.

For proper operation, the number of lines per page on the G-115 VFU loop must be slightly larger than the number of lines per page allowed by the central computer system line counter. If the VFU loop is incorrect, partial pages without page headings will be printed.

A VFU loop with the following punches should be used with the GRTS/115 program (based on 66 lines per page for 11-inch page).

<u>Line Number</u>	<u>Punch Channel Number</u>
4	7 (top of page)
13	1
21	2
29	3
37	4
45	5
53	6
62	8 (bottom of page)

This provides about 58 lines per page. The punches in channels 1-6 are included in case a slew-to-channel command is given. If such a command is given and there is no punch in the channel, the paper will run away.

DATANET 700 Remote Network Processor (RNP)

The DATANET 700 RNP is a solid-state, stored-program, general-purpose computer system. Two packed 8-bit characters per 16-bit word are the basic units in the expandable memory. Memory expansion is by 8K-character increments to 128K-characters maximum. The RNP hardware/software combination interfaces with many terminal-types providing up to eight different peripheral functions. Remote processing capabilities include remote batch, remote access, remote message concentration, transaction processing and time sharing. This multidimensional processing capability is structured in the remote networking configuration of a Honeywell central system and an interconnecting DATANET Front-End Network Processor.

These remote processing and concentration functions of the DATANET 700 RNP increase the throughput and concomitantly reduce the hardware and software resources required at the central system.

The RNP is available in a standard configuration providing a basic remote batch/remote job entry function, or in a multifunction system configuration that adds remote message concentration, remote file management, concurrent batch and message concentration functions and the power of the OS/700 operating system.

Available peripheral equipment includes magnetic tape systems with densities to 1600 bpi, a cassette tape subsystem with 600K-character capacity, disk subsystems with capacities ranging from 65K words to 30 million words, card readers, a card reader/punch, several models of teleprinters, line printers with speeds up to 1100 lines per minute and most VIP subsystems.

7700 Series VIP

The 7700 Series VIP is a keyboard/display terminal that operates as a single station, or in clusters of up to 10 stations on a single line. Communication with the DATANET FNP is synchronous, 2-way alternate, at speeds up to 4800 baud. Clustered stations operate in the polled mode.

A 12-inch CRT screen displays a full set of 63 characters and symbols in 960 character locations (12 lines x 80 characters/line) or with the expanded, optional feature: 1920 character locations (24 lines x 80 characters/line).

Keyboard features include entry marker controls, text editing keys, command control keys and designation of up to 13 keys as function keys.

Standard terminal features include forms mode control, cassette tape storage and expanded data entry control. In addition, two types of page printers are available (optional) for hard copy of received messages.

MTS 7500 Multifunctional Terminal System

The MTS 7500 Multifunction Terminal System includes a programmable controller, an alphanumeric keyboard for data entry, a CRT display screen and two read/write tape decks for program and data storage. Optional MTS 7500 features include memory expansion, in 4K-word increments to a 16K-word maximum, a random-access disk storage unit, a serial page printer and up to eight operator stations per system.

The MTS 7500 accommodates both asynchronous and synchronous communications adapters operating at any speed up to 9600 bps. Any asynchronous code and ASCII or EBCDIC synchronous codes are compatible with this terminal system. A multistation adapter unit connects up to eight operator stations to a programmable controller equipped with a 16K-word memory and the optional disk storage unit.

7340 Banking Teller Terminal

Banking Teller Terminal (BTT) 7340 is an online terminal designed to meet the requirements of the banking industry. This terminal operates in online, offline, add or test modes to process financial transactions, and interfaces with a central system for account inquiry, passbook update, posting, and routine addition and subtraction.

A self-contained microprocessor allows the user to program individual transaction sequences. These sequences control keyboard action, passbook and journal printing, message transmission format, and optional data and tutorial displays.

The printer rapidly updates a horizontal- or vertical-fold passbook and produces an audit journal, utilizing high-speed bidirectional electronic tabbing. It also provides validation printing of checks and no-book receipts.

Status lamps inform the operator of the condition of the terminal and communications lines. Security is ensured by teller, supervisor, journal and maintenance locks.

Optional features include an alphabetic keyboard with additional function keys, dynamic data display, tutorial indicators, black-light signature verification and offline load-only cassette unit.

APPENDIX A

SAMPLE DECK SETUPS

The deck setups in this Appendix are examples of various types of jobs entered into the central system from a remote computer terminal.

```
/$*$SOUT  
/$ ENDJOB  
/$ REMOTE PR  
  
ACTIVITY 2  
/$ REMOTE AB  
  
ACTIVITY 1  
/$ SNUMB  
/$ ENDJOB  
  
ACTIVITY 2  
  
ACTIVITY 1  
/$ SNUMB  
/$*$SRCD  
/$*$ID$USERID$PASSWORD
```

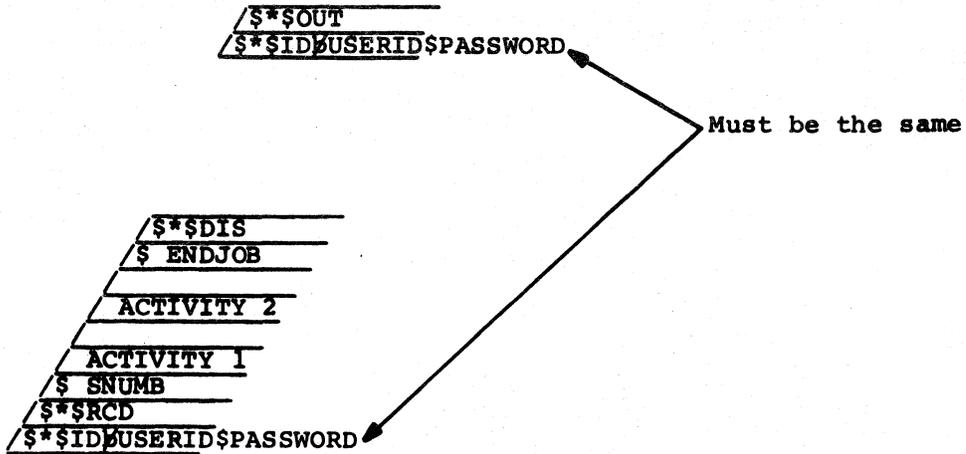
Where: AB and PR are file codes for user's output files.

Multiple Job from Remote Computer, Wait for Output

```
/$*$OUT$SNUMB  
/$ ENDJOB  
/$ REMOTE PR  
  
ACTIVITY 2  
/$ REMOTE AB  
  
ACTIVITY 1  
/$ SNUMB  
/$ ENDJOB  
  
ACTIVITY 2  
  
ACTIVITY 1  
/$ SNUMB  
/$*$RCD  
/$*$ID$USERID$PASSWORD
```

Where: AB and PR are codes for user's output files.

Multiple Job from Remote Computer, Wait for Output with SNUMB



Job from Remote Computer, Disconnect and Call Back for Output

```

  /$*$OUT$numb
  /$*$ID$USERID$PASSWORD
  
```

Where: numb must be same
as \$ SNUMB in input
deck.

```

  /$*$DIS
  /$ ENDJOB
  /ACTIVITY 2
  /ACTIVITY 1
  /$ SNUMB
  /$*$RCD
  /$*$ID$USERID$PASSWORD
  
```

Job from Remote Computer, Disconnect and Call Back for Output with SNUMB

/\$*\$OUT
/\$*\$ID\$USERID\$PASSWORD

/\$*\$OUT
\$ ENDJOB
ACTIVITY 1
\$ SNUMB
\$ ENDJOB
ACTIVITY 1
\$ SNUMB
/\$*\$RCD
/\$*\$ID\$USERID\$PASSWORD

Multiple Job from Remote Computer, Receiving Output, No Response from Central System - Line Disconnected, Call Back for Output

/\$*\$OUTC
/\$*\$ID\$USERID\$PASSWORD

/\$*\$OUT
\$ ENDJOB
ACTIVITY 1
\$ SNUMB
\$ ENDJOB
ACTIVITY 1
\$ SNUMB
/\$*\$RCD
/\$*\$ID\$USERID\$PASSWORD

Multiple Job from Remote Computer, Receiving Output, No Response from Central System - Line Disconnected, Call Back to Continue Output

```

/__$DIS
/$ABT$snumb
/__$ID$USERID$PASSWORD

```

Where: snumb identifies job to be aborted.

```

/__$DIS
/$ENDJOB
JOB 3
/$SNUMB
/$ENDJOB
JOB 2
/$SNUMB
/$ENDJOB
JOB 1
/$SNUMB
/$SRCID
/__$ID$USERID$PASSWORD

```

Multiple Job from Remote Computer, Call Back to Abort a Job

```

/__$DIS
/$STS$snumb
/$STS$snumb
/$STS$snumb
/__$ID$USERID$PASSWORD

```

Where: snumb identifies job on which status is being checked.

```

/__$DIS
/$ENDJOB
JOB 3
/$SNUMB
/$ENDJOB
JOB 2
/$SNUMB
/$ENDJOB
JOB 1
/$SNUMB
/$SRCID
/__$ID$USERID$PASSWORD

```

Multiple Job from Remote Computer, Call Back for Status of Each Job

APPENDIX B

GRTS ABORT CODES

- 41 Invalid I/O status pointer in MME GEROUT calling sequence.
- 43 Invalid DCW pointer. This abort code is also used when an illegal character count is encountered.
- 72 Invalid MME GEROUT op code.
- 73 PAT area has been exhausted.
- 74 Output record too large for terminal type.
- 75 Undefined remote terminal station ID. The abort code is also used when there is a duplicate remote inquiry name.
- 76 Invalid GEROUT program identification. Nonprivileged slave program has identified itself as Time Sharing System. The abort code is also used when the program number is illegal.

APPENDIX C

CHARACTER SETS AND CODES

OCTAL AND HEXADECIMAL - CHARACTER CODES

<u>Character Set</u>	<u>Central System 6-bits</u>	<u>G-115 8-bits</u>	<u>TTY/ASCII DATANET-760 7-bits</u>
	<u>Octal</u>	<u>Hexadecimal</u>	<u>Octal</u>
0	00	40	60
1	01	41	61
2	02	42	62
3	03	43	63
4	04	44	64
5	05	45	65
6	06	46	66
7	07	47	67
8	10	48	70
9	11	49	71
A	21	51	101
B	22	52	102
C	23	53	103
D	24	54	104
E	25	55	105
F	26	56	106
G	27	57	107
H	30	58	110
I	31	59	111
J	41	A1	112
K	42	A2	113
L	43	A3	114
M	44	A4	115
N	45	A5	116
O	46	A6	117
P	47	A7	120
Q	50	A8	121
R	51	A9	122
S	62	B2	123
T	63	B3	124
U	64	B4	125
V	65	B5	126
W	66	B6	127
X	67	B7	130
Y	70	B8	131
Z	71	B9	132
(Blank)	20	50	40
[	12	4A	133
#	13	4B	43
@	14	4C	100
:	15	4D	72
>	16	4E	76
?	17	4F	77

<u>Character Set</u>	<u>Central System 6-bits</u>	<u>G-115 8-bits</u>	<u>TTY/ASCII DATANET-760 7-bits</u>
	<u>Octal</u>	<u>Hexadecimal</u>	<u>Octal</u>
6	32	5A	46
.	33	5B	56
]	34	5C	135
(	35	5D	50
<	36	5E	74
\	37	5F	134
↑	40	A0	136
-	52	BA	55
\$	53	AB	44
*	54	AC	52
)	55	AD	51
:	56	AE	73
;	57	AF	47
+	60	B0	53
/	61	B1	57
←	72	BA	137
,	73	BB	54
'	74	BC	45
=	75	BD	75
!	76	BE	42
:	77	BF	41
;			
?			
Δ			

OCTAL/ASCII CONVERSION EQUIVALENTS

<u>OCTAL NUMB.</u>	<u>ASCII CHAR.</u>	<u>OCTAL NUMB.</u>	<u>ASCII CHAR.</u>	<u>OCTAL NUMB.</u>	<u>ASCII CHAR.</u>	<u>OCTAL NUMB.</u>	<u>ASCII CHAR.</u>
000	NULL	040	SP	100	@	140	GRA
001	SOH	041	EXP	101	A	141	a
002	STX	042	"	102	B	142	b
003	ETX	043	#	103	C	143	c
004	EOT	044	\$	104	D	144	d
005	ENQ	045	%	105	E	145	e
006	ACK	046	&	106	F	146	f
007	BELL	047	'	107	G	147	g
010	BSP	050	(	110	H	150	h
011	HT	051	)	111	I	151	i
012	LF	052	*	112	J	152	j
013	VT	053	+	113	K	153	k
014	FFD	054	,	114	L	154	l
015	CR	055	-	115	M	155	m
016	SO	056	.	116	N	156	n
017	SI	057	/	117	O	157	o
020	DLE	060	0	120	P	160	p
021	DC1	061	1	121	Q	161	q
022	DC2	062	2	122	R	162	r
023	SX3	063	3	123	S	163	s
024	DC4	064	4	124	T	164	t
025	NAK	065	5	125	U	165	u
026	SYN	066	6	126	V	166	v
027	ETB	067	7	127	W	167	w
030	CAN	070	8	130	X	170	x
031	EM	071	9	131	Y	171	y
032	SUB	072	:	132	Z	172	z
033	ESC	073	;	133	LBK	173	LBR
034	FS	074	LTN	134	RSL	174	VTL
035	GS	075	=	135	RBK	175	RBR
036	RS	076	GTN	136	CFX	176	TLD
037	US	077	?	137	—	177	DEL

See the following page for definition of terms.

Definition of Terms

COMMUNICATIONS CONTROL:

ACK	Acknowledgement
CAN	Cancel
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
DLE	Data Link Escape
EM	End of Medium
ENQ	Enquiry (WRU)
EOT	End of Transmission
ESC	Escape (Alternate Mode)
ETB	End of Transmission Block
ETX	End of Text
NAK	Negative Acknowledgement
SOH	Start of Heading
STX	Start of Text
SUB	Substitute Character
SYN	Synchronous Idle

FORM EFFECTORS:

BSP	Backspace
CR	Carriage Return
FFD	Form Feed
HT	Horizontal Tabulation
LF	Line Feed
VT	Vertical Tabulation

ITEM SEPARATORS:

FS	File Separator
GS	Group Separator
RS	Record Separator
US	Unit Separator

TEXTUAL MATERIAL:

BELL	Bell, or other attention signal
CFX	Circumflex
DEL	Delete (Rubout)
EXP	Exclamation Point
GRA	Grave (reversed) Accent
GTN	Greater Than (mathematical symbol)
LBK	Left Bracket
LBR	Left Brace
LTN	Less Than (mathematical symbol)
NULL	Null
RBK	Right Bracket
RBR	Right Brace
RSL	Reverse Slash
SI	Shift In
SO	Shift Out
SP	Space
TLD	Tilde
VTL	Vertical Line

APPENDIX D

GRTS DECKS IDENTIFICATION

<u>Catalog Number</u>	<u>None</u>	<u>Application</u>
CDD30E0.002	CIUL	Computer Interface Unit loader for DATANET 30 and DATANET 305 FNP.
CDD30E0.003	G30	GRTS control program for DATANET 30 FNP, non-coexistence environment.
CDD30E0.004	GT30	GRTS control program for DATANET 30 FNP with 50 line terminations, non-coexistence.
CDD30E0.006	G305	GRTS control program for DATANET 305 FNP, with 300 baud teleprinters and 4800 baud voice-grade remote computer lines.
CDD30E0.007	CX30	GRTS coexistence control program for DATANET 30 and DATANET 305 FNPs with 150 baud teleprinters and 2400 baud voice-grade lines.
CDD30B2.011	CIUD	Dump program for DATANET 30 and DATANET 305 FNPs.
None assigned	D3DL	Central system object deck for CIUD; dumps FNP via CIU to central system online printer.
CD100E0.004	DN10	GRTS/115 to DATANET 30 FNP voice-grade lines. G-115 memory of 4K minimum.
CD100E0.005	DN12	GRTS/115 to DATANET 30 FNP wide-baud (Telpak) lines. G-115 memory of 4k minimum.
CD100E0.006	D12T	GRTS/115 to DATANET 30 FNP wide-baud (Telpak) lines. G-115 memory of 8K minimum accepts tape or card input and transmits output to tape or printer.
CD100E0.007	TP01	GRTS/115 to DATANET 30 FNP offline tape input/output. G-115 memory of 8K minimum.
CD100E0.011	DN55	GRTS/115 to DATANET 305/355/6600 FNP voice-grade lines to 4800 baud. With addition of one configuration card, DN55 will accommodate Telpak lines on DATANET 355 and 6600 FNP.
CD100E0.016	G115	GRTS/115 to DATANET 355 or 6600 FNP 7200/9600 baud lines. G-115 memory of 8K minimum.

APPENDIX E

GLOSSARY

Alphanumeric character	General term for an alphabetic, numeric, or special character.
ASCII	American Standard Code for Information Interchange.
ASCII eight-level code	Standard code used for data communications. It consists of seven data bits and one parity bit.
ASR	Automatic Send-Receive.
Batch	The grouping of control records (both GRTS and GCOS) and data records into a single deck of punched cards that is entered as a job deck for processing.
BCD	Binary Coded Decimal.
bps	Bits per second.
Buffer	A device used to store encoded data temporarily. It is primarily used to compensate for differences in data rates or the time of occurrence of events between two different devices.
Call-in	Procedure consists of (1) press TALK pushbutton on telephone handset, (2) lift receiver off cradle and wait for dial tone, (3) dial the assigned GRTS number, (4) when another and different tone is heard, press DATA pushbutton, (5) replace receiver on the cradle, and (6) when transmission is completed, lift receiver, press TALK pushbutton, and replace receiver on the cradle.
Character code	The numeric system (such as octal or hexadecimal) used to represent the internal bit configuration of a computer character.
Character set	The complete set of alphabetic, numeric and symbolic characters utilized by a data processor or a terminal.
Common Carrier Switched Network (CCSN)	The general telephone service available to the public for business and personal use.

Communications common carrier	A company that provides communications services to the general public and is regulated by appropriate state and federal agencies.
Control record	GCOS - Contains prescribed information required to direct the GCOS operating system. GRTS - Contains prescribed information that indicates to GRTS the function to be performed; i.e., input, send output, disconnect, etc.
CR	Teleprinter control signal that produces a carriage return at the printer mechanism.
DAC	Mnemonic for Direct Access.
Data-Phone Service	A data service that allows a subscriber to use his telephone exchange service for either voice or data communications.
Data record	Contains encoded data (1-80 characters for a teleprinter, and 80 to 160 characters for G-115 system) in binary or BCD form, which is used to input data into GRTS for subsequent processing.
Data set	Subscriber equipment supplied by the communications common carriers. It converts digital data at a sending station into a form suitable for transmission over communications lines and reconverts it to the original form at the receiving station. (Also called a modem or digital subset.)
DATANET 355 or DATANET 6600	A communications-oriented data processor that serves as the message control center for GRTS.
Dedicated line	A private communication line assigned to one user; it is not part of a switched network.
Direct access	Direct interaction between an online user program (that is in execution in the central system) and a terminal, with the user program controlling the requests for data and the immediate output of data.
G-115	A small-scale data processor which may be used as a terminal in a FNP configuration.
GCOS	General <u>C</u> omprehensive <u>O</u> perating <u>S</u> upervisor; the executive program for the central system software.
GRTS	<u>R</u> emote <u>T</u> erminal <u>S</u> upervisor.

ICM	Intercomputer message.
Interact (with)	Refers to direct access of a terminal with a user program that is in execution in the central system.
Job deck	Consists of GCOS control records (beginning with \$ SNUMB and ending with \$ ENDJOB) and the accompanying data records to be processed. It is the standard job deck that is submitted at the central system, as distinguished from the GRTS deck.
Job number	SNUMB of job to be processed by GCOS.
KSR	Keyboard Send-Receive.
LF	A teleprinter control signal that produces a line feed at the printer mechanism.
Line switching	The process of electrically connecting two stations for a temporary communication.
lpm	Lines per minute.
Message control center	A DATANET 355 FNP or DATANET 6600 FNP that (1) controls data-message transfers, (2) coordinates the general system operation, and (3) prepares data in a form suitable either for entry into the central system or transmission to the terminals.
Messages	<p><u>ICM</u></p> <p>Communication between the FNP and central system that indicates pertinent information concerning actions taken and to be taken. It may include a block of data.</p> <p><u>Printout</u></p> <p>Communication generated by the FNP or central system that is sent to a terminal printer for the attention of the operator.</p> <p><u>System</u></p> <p>One of two types of fixed-length communications between the FNP and a terminal in which control information and/or data is sent. Each message is equivalent in length to two BCD cards or one binary card. The two types are:</p> <p>Short - contains operational control information.</p> <p>Long - contains data characters and operation control information.</p>

Multiprocessing A system configuration of two or more processors connected to a common memory and executing two or more programs concurrently.

Teleprinter General term used to refer to the keyboard type terminal equipment.

Terminal Can be a remote computer, a teleprinter, a keyboard/display terminal, a banking teller terminal, an RNP, etc., and serves as a means for remotely entering and receiving data.

Terminal ID Two alphanumeric characters that uniquely identify a GRTS terminal.

TTY Mnemonic for teleprinter terminal.

Voice grade line A line that is capable of handling transmissions at either 2000 or 2400 bps.

Wideband (Broadband) A private line service offered by communications common carriers, in which wideband channels can be leased between two or more points. It is equivalent to 12 standard voice-grade lines and is capable of transmission rates of up to 50,000 bps.

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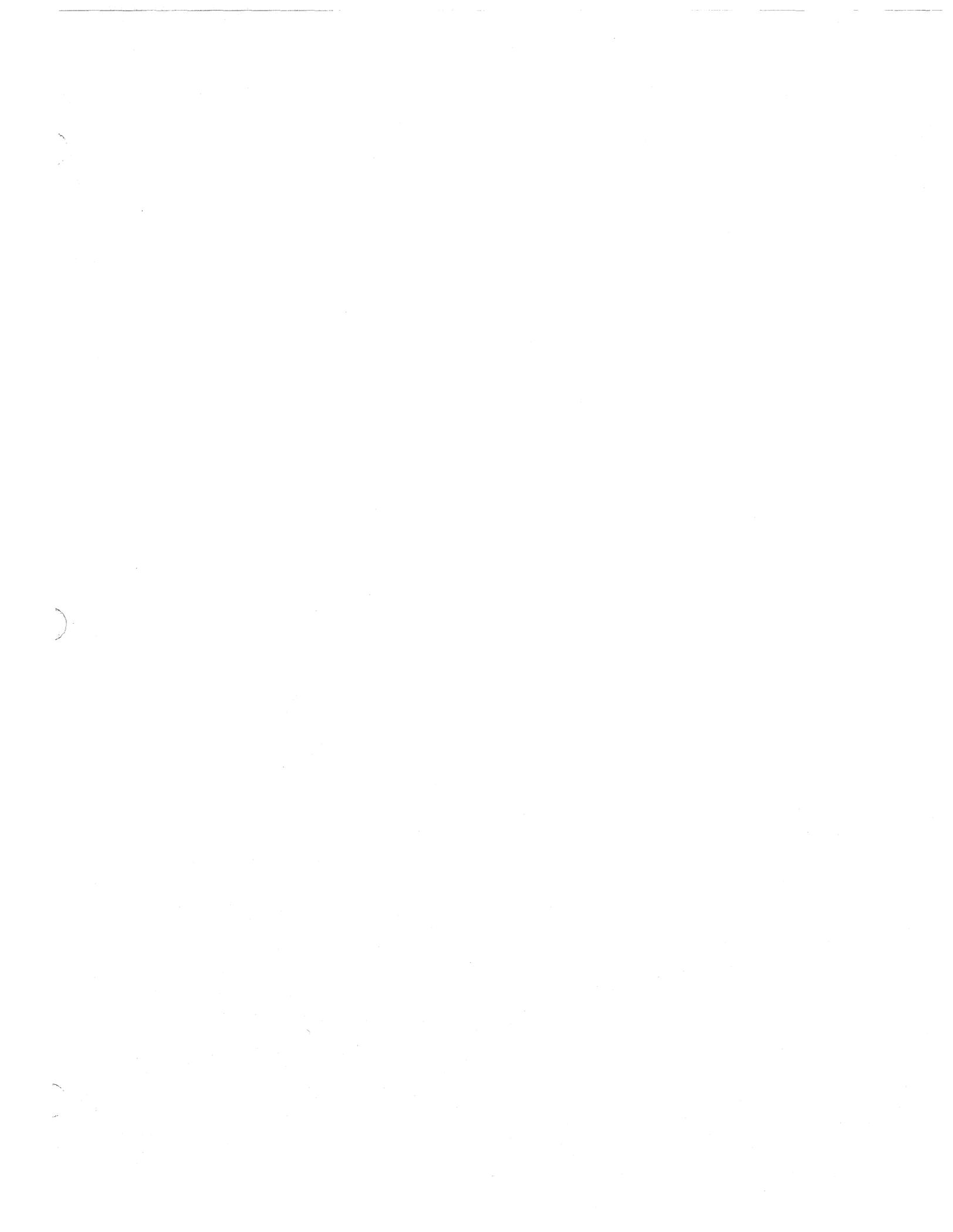
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REMOTE TERMINAL SUPERVISOR
(GRTS)
ADDENDUM B

SERIES 60 (LEVEL 66)/6000

GCOS

SOFTWARE

SUBJECT:

Additions and Changes to the Remote Terminal Supervisor (GRTS).

SPECIAL INSTRUCTIONS:

This is the second addendum to DD40, Revision 0, dated June 1974.

Insert the attached pages into the manual according to the collating instructions on the back of this cover. Change bars in the margins indicate technical additions and changes; asterisks indicate deletions. These changes will be incorporated into the next revision of the manual.

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3-1, 3-2	3-1, 3-2
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SECTION II

SYSTEM OPERATION

GRTS permits a user at a remote location to utilize the capabilities of a large-scale information processing system. The user has broad flexibility in the types of terminals he may use in submitting his jobs, and in the types of transmission line service required for the terminals.

A GRTS user can carry on a conversational (interactive) exchange of information with a program executing in the central system by using the Direct Access (DAC) mode of the following terminals:

- Teleprinter - Teletype Models 33, 35, 37 or 38; GE TermiNet 300 and 1200, IBM 2741, Hazeltine 2000, Execuport 1200, or equivalent.
- Keyboard/Display - DATANET 760 VIP, VIP Series 765, VIP Series 775, VIP 785, VIP 7700, MTS 7500 or equivalent. The DATANET 305 processor supports only the DATANET 760, VIP 775 and VIP 785 keyboard/display terminals.
- Banking Teller Terminals - BTT7340 and BTT7340E (with or without Data Capture Cassette unit(s))
- Remote Computer - The GRTS remote computer interface permits a computer system at a remote location to operate in the Direct Access (DAC) mode. At present, the standard GRTS/115 software does not include DAC capability. However, computer systems that meet the requirements of the remote computer interface for DAC capability may use this facility.
- Remote Network Processors - Type RNP 702 Standard System and Type RNP 707 Multifunction System.

The primary use of the remote computer terminal is the submission of batch jobs to the central system for processing. Jobs entered at a remote computer terminal are transmitted to the central system via a DATANET FNP. In the central system, the job from the terminal enters the normal processing stream and is handled like any other job. The user may wait for the program output or reconnect later to retrieve the output. The user may redirect the output to another remote computer terminal or request that the output be printed/punched at the central system.

GRTS permits the use of up to six document reader/sorters per DATANET FNP. Honeywell MRS200, DRD200, DRD234, DRD236, and DHU1600 (Series 60 only) reader/sorters may be used for data entry to a central system Direct Access (DAC) program. The interface to the DAC program consists of 6-bit BCD data, rather than the 9-bit ASCII data used with other DAC terminals. These reader/sorters do not operate in batch mode. The main characteristics of these reader/sorters are:

- MRS200 - MICR (Magnetic Ink Character Recognition) Reader/Sorter
 - E13B MICR Font
 - 1200 Documents per minute
 - 12 pockets
- DRD200 - Optical Document Reader/Sorter
 - COC5 Optical Bar Font
 - Mark Sense Recognition (optional)
 - 1200 Documents per minute
 - 2 pockets
- DRD234 - High-speed MICR and optical (OCR) Reader/Sorter
 - OCRA,OCRB,E13B,CMC7 Fonts and OMR
 - any combination of above fonts
 - 830 Documents per minute
 - Selective data reading via auto-load
 - 3 or 14 pockets
- DRD236 - High-speed MICR Reader/Sorter
 - E13B MICR Font
 - 1625 Documents per minute
 - up to 32 pockets
- DHU1600- Same as DRD236

DIRECT ACCESS JOB FLOW

Teleprinter DAC

A user at a teleprinter terminal communicates in an interactive, conversational exchange of messages with a direct access program executing in the central system. After the user has established a connection to the program, the program takes control of the two-way exchange of messages.

The DAC mode of operation is initiated by a dial-in to a line dedicated to a specific DAC program or by dialing in to a non-dedicated GRTS line and requesting connection to any DAC program required. Automatic connection (direct dial-in to a DAC program) may be made to any one of eight DAC programs, including the Honeywell-supplied Time Sharing System and Transaction Processing System.

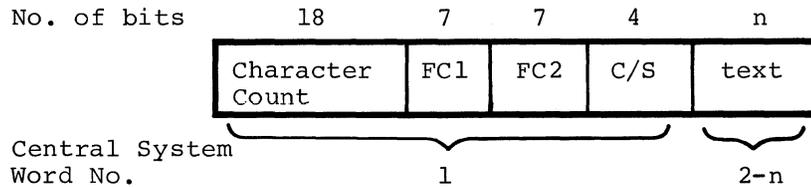
3. When the user is validated by the central computer system, the DAC program in the system assumes control and a two-way flow of information takes place. This communication is on the basis of a message from the DAC program being answered by the user at the terminal (the answer may be only an acknowledgment (ACK) that the message was received).
4. The two-way exchange of messages continues until terminated by the terminal user or the DAC program.

VIP LINE DISCIPLINE DEVICE MESSAGE FORMATS

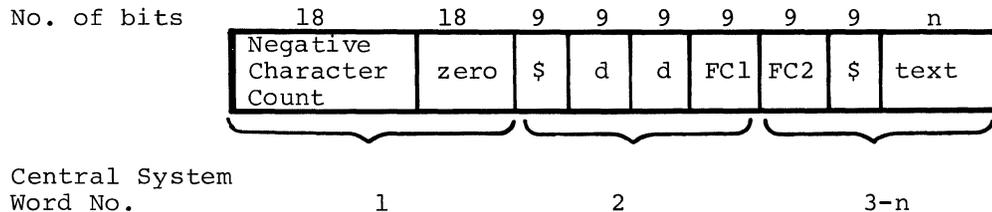
The support of the print page adapter and the cassette on a 7700 Series VIP terminal has required the definition of an optional text header as outlined below. Previously (format 1), special control functions such as function codes or an input PRINT status were sent to/received from the central system in an 18 bit command/status field following the character tally. The lack of expansion capability necessitated this new control procedure (format 2).

VIP line discipline device messages which are passed back and forth between the central system user programs and the DATANET VIP module are in one of the following formats.

1. If word one of the output buffer is positive:



2. If word one of the output buffer is negative:



The character count in the first format is the tally of nine-bit ASCII character bytes in the text field.

The negative character count in the second format includes the count (six) of the text header characters with the text field tally.

FC1 and FC2 are function codes transferred to/from the VIP in the message header format. These are ASCII characters with the parity and unused ninth bit removed to save space in format 1. All supported devices using the VIP line discipline transmit function codes to the central system. The DATANET 760 VIP, 765 Series VIP, 775 and 785 do not use these when they are received from the central system. However, the 7700 Series VIP does utilize these function codes when received from the central system. Default function codes sent by the terminal are ASCII space codes (40 octal).

The C/S field in the first format is a four-bit command (sent to terminal) or status (received from terminal) field defined as follows:

Send

- bit 1 - Reserved for future use.
2 - Not yet defined.
3 - Not yet defined.
4 - Not yet defined.

Receive

- bit 1 - Print status (GRTS)
2 - Not yet defined.
3 - Not yet defined.
4 - Truncation warning status; text character count originally exceeded 320 x 36-bit words and will be truncated at the FNP/central system interface.

The characters dd in the second format specify unique destination codes for messages sent to the 7700 Series VIP. (See VIP Text Header Option in Section III.)

*

Remote Computer DAC (GRTS/355 and GRTS/6600)

The following sequence of operations describes Direct Access (DAC) input from a remote computer terminal. (The standard GRTS/115 program does not include DAC capability; however, this mode is accepted by the remote computer interface of the DATANET 355/6600 FNP.) A remote computer terminal operating in DAC mode must meet the requirements of the appropriate remote computer interface.

Connection and terminal identification are performed the same as for the remote batch operation. When the terminal ID has been validated, GRTS reads the second control record of the input deck, which in this procedure is a \$*SDACnnnnnn. The DAC specifies direct access mode, and nnnnnn is the six-character name of the DAC program to which the terminal is to be connected. If the name field is left blank, the terminal waits until a program addresses it by the terminal ID.

As in other direct operations, when the terminal is connected to the user program the program assumes control and the remote computer terminal responds to requests issued by the program. This two-way flow of information continues until terminated by the terminal or the user program.

DAC FOR DOCUMENT READER/SORTERS

Connecting to DAC Program

Document reader/sorters are connected directly to the DATANET 355/6600 FNP. In order to initiate a connect to a DAC program, the reader/sorter must make a transition from not ready, to ready. This action causes the reader/sorter to be connected to a program having a program name of DES600.

Programming Considerations

Document reader/sorters are input only devices, but prestructured data is output by the DAC program to GRTS to direct it in making pocket selection decisions. This prestructured data must be present in the DATANET FNP before document entry may occur. Control of the document reader/sorter is accomplished by the DAC program since it starts and stops the reader/sorter.

Certain MME GEROUT op-codes have been defined for document reader/sorters. The following list gives valid op-codes for document reader/sorters and a brief explanation of each:

<u>Op-code (octal)</u>	<u>Meaning</u>
03	Send Table Data
04	Send Last Table Data and Receive Status
21	Control (Start handler, Table size, etc.)
22	Continue Reading
30	Stop Handler
05	Program Inquiry
06	Request Terminal Type
17	Disconnect line
20	Request line status

IBM 2780 Terminal (DATANET 355 FNP and DATANET 6600 FNP)

The IBM 2780 terminal operates under Binary Synchronous Communications (BSC) procedures using the standard GRTS remote batch interface disciplines. A BSC355 subchannel option must be installed in HSLA/GPCB to configure this terminal. GRTS does not support this terminal in the DAC mode.

The following optional features of the IBM 2780 are required for interface with GRTS/GCOS:

- Print line - the 144 character print line must be used to accommodate the GCOS SYSOUT line of 137 characters.
- The carriage tape for printer control, (TOP OF PAGE), must be punched in channel 1.

The following optional features of the IBM 2780 are not supported:

- Auto-turnaround feature
- Auto-answer - 21 second recovery time
- Multipoint Line Control
- Transparent text mode

The following optional features of the IBM 2780 terminal are supported by GRTS and GCOS:

- Models 1 and 2 (Model 2 recommended)
- Synchronous, 2000 to 4800 baud, dial-up or private, 2- or 4-wire communications lines
- Multirecord transmission
- EBCDIC or ASCII transmission codes
- Card input and output may be IBM punched code or Honeywell central system punched code, but not both simultaneously
- All character sets, i.e., 63, 52 and 39 characters

Character Conversion Differences

1. Some BCD characters have no EBCDIC equivalent. GRTS software accommodates these characters by making the listed conversions:

BCD	to	EBCDIC
[(
])
\		
↑		┌
←		└

2. When making an EBCDIC or ASCII to BCD conversion, GRTS converts all characters having no BCD equivalent, to the BCD blank.

Binary Punch Card Restriction

Since the IBM 2780 does not punch binary cards, any banner cards normally used for job separation, are left blank (not punched).

Printer Slew Restriction

Since the IBM 2780 does not slew zero lines, any reports using the "Write After Advancing" command will be in spacing error by plus one line, i.e., single-spaced reports are double-spaced. To get single spacing using this command requires modification of the emulator software.

OPERATING PROCEDURES

If binary punched cards are included in the output, the binary file will be aborted, and the following message:

```
FILE ABORTED - BIN
```

is printed at the terminal.

All standard GRTS control cards can be used with the IBM 2780, i.e.,

```
$$ID$USERID$PASSWORD  
$$RCD  
$$OUT  
$$STS  
$$DIS  
$$ABT
```

Since the IBM 2780 reads a minimum of two cards per transmission, all control cards that cause a line turn around (except `$$$RCD`), are considered to be an end-of-file indication. The line is logically disconnected after the associated output message and the next job must start with a `$$ID` card. Three examples of correct deck set-up are:

1. `$$ID`~~`USERID`~~`$PASSWORD`
`$$ABTSNUMB`
(END-OF-FILE light-on)
2. `$$ID`~~`USERID`~~`$PASSWORD`
`$$STS`
(END-OF-FILE light-on)
3. `$$ID`~~`USERID`~~`$PASSWORD`
`$$OUTSNUMB`
(END-OF-FILE light-on)

SECTION III

PROGRAMMING PROCEDURES

GRTS CONTROL RECORDS

The control records (control cards or control data) for the Remote Terminal Supervisor direct operations and actions involved in the remote terminal functions. These control records are entered at a remote terminal and direct the actions of the GRTS control program in the FNP.

NOTE: Except as specified in the text, the control records described in the following paragraphs apply to GRTS/305, GRTS/355 and GRTS/6600 control programs.

Other types of records which may be encountered in the input job stream are GCOS control records, which direct central system operations, and data records, which contain data and/or instructions.

Each job submitted from a remote computer terminal must contain the GRTS control records necessary to access the central system and to perform the functions required by the terminal user, as well as the data for the job. In direct-access, data records are submitted in reply to a user program request during program execution.

The general format for a GRTS control record (except for keyboard/display terminals) is:

1 4 7

\$*\$xxxxyyyyyy

Where: \$*\$ - Uniquely identifies a GRTS control record.

xxx - Operation field containing a mnemonic code specifying the operation GRTS is to perform. This field contains the terminal ID for the identification control record.

yyyyyy - Data field specifying the job number or program name. This field contains the user ID and password for the identification control record.

With the current GRTS software, teleprinters are automatically connected when the dial-in is performed, thus the identification control record is not required. If the dial-in is to the Time Sharing System, the Time Sharing System requests the user's id and password as a part of the log-on procedure.

The keyboard/display terminal operator interface is an exception to the normal GRTS control record format. The connection to GRTS and entrance to the direct access mode is accomplished by dialing in on the appropriate line. The terminal ID and other log-on information is provided by a single GRTS control record with the following format:

1 4 7

`*IDuserid$passwd,nn,yyyyyy`

Where: ID - Terminal identification.

userid - User identification.

passwd - Password.

nn - Log-on code indicating page size as follows:

Log-on Code	Lines	x	Characters per Line	Terminal Type	Device Type Code(octal)
04	4		46	DATANET 760	5
08	8		46	DATANET 760	6
16	16		46	DATANET 760	7
26	26		46	DATANET 760	10
22	22		46	VIP 765/775	11
22L	22		92	VIP 785/786	12
12	12		80	VIP 7700	13
22N	22		46	VIP 7700	14
24	24		80	VIP 7700	15

yyyyyy - DAC slave program name.

In this control record, no operation code is required because the keyboard/display terminal operates only in the direct-access mode. The only control records used by this type terminal are Break (BRK), Disconnect (DIS), and Identification (ID). Of these, the terminal has exclusive use of the Break control record.

- NOTES:
1. GRTS/355 and GRTS/6600 do not require definitive entries for the userid and password fields. Log-on is accomplished with or without these entries.
 2. GRTS/305 however, does require entries in these fields. (A minimum entry, for example; A\$B.)
 3. The 7700 Series VIP keyboard/display terminal is supported by GRTS/355 and GRTS/6600 only. If the 7700 Series VIP is equipped with a 1200 bps print page adapter, i.e., GE TermiNet 1200 printer, the operator log-on record requires another field (entry):

`*IDPPA1200,nn,yyyyy`

This forces the GRTS module G76M to pad transparent print mode messages for the mechanical timing restrictions of the TermiNet 1200 printer. If this log-on format is not used, a 300 bps printer is assumed.

Identification Control Record

The identification (ID) control record identifies the terminal, provides the required password for central system access, and defines the System Master Catalog (SMC) first entry. This control record must be the first entry of each job entered into GRTS from a remote computer terminal.

Request Status Control Record

The Request Status control record requests that the status of one or all jobs submitted from the terminal requesting status, and currently in the central system, be returned to the originating terminal or another specified terminal. The format is:

1 4 7

\$\$STSyyyyyy

Where: yyyyyy is one of the following:

Blank - Status of all jobs for the terminal.

SNUMB - Status of a specific job specified by SNUMB.

ID - Status of all jobs for another terminal specified by ID.

*

The \$\$STS control record may also be used to list the special request against the terminal sending the record or to redirect the output for the terminal to the online printer at the central system.

In the \$*SSTS control record, if yyyyyy = !ONLØ the output for the terminal is printed at the central system. Two possible system responses are:

REDIRECT ID TO ONL ACCEPTED

or

SYSOUT QUEUE FULL, RETRY REDIRECT REQUEST

After the request is accepted, system operator approval of the redirection is asked:

*OPER, CAN STA id REDIRECT HIS SYSOUT TO ON-LINE

TYPE YES IF OK,

EOM IF NOT OK

If the operator answers YES, the Redirect request is carried out; if his response is EOM, the request is ignored and normal processing continues. The operator must base his decision on whether or not he has issued a special request to redirect output for the requesting station. If he has issued this special request, he responds with an EOM; if not, he types YES followed by an EOM.

The Redirect request is handled by GCOS as a special request. If problems are encountered in processing the request, the following denial message is printed at the online central system console to tell the operator that the ID in the request is not in the system, or that the request was cancelled by an earlier cancellation request.

*RE RDIO, SYSOUT CAN'T

The Redirect request cannot be cancelled from the remote terminal: it can only be cancelled by the operator at the system console. A terminal requesting Redirect may only redirect its own jobs.

If yyyyyy = !LSTR, all of the SYSOUT Redirect requests outstanding against the requesting terminal are listed. Possible responses to this request are:

REMOTE SPECIAL REQUESTS

(followed by a list of special requests queued against this terminal)

or

NO SPECIAL REQUESTS FOR THIS STATION

Function key information is supplied to the program on configuration cards beginning at location 31400 (octal) of the central system. The function characters are presented as two seven-bit ASCII characters, each stored in a nine-bit field of the same 18-bit word. Refer to System Startup manual for complete details on function key break configuration.

7700 SERIES VIP FUNCTION CODES

Function codes provide a special labeling capability for messages transmitted from the 7700 Series VIP terminal. The function codes contained in the message header may be used as a means of identifying the message and/or initiating software defined operations in the central system.

Function codes may be entered automatically by the central system and manually by the operator. Contents of the function code position in data messages from the central system are stored by the terminal and retransmitted to the central system in the next data message. The operator can override the stored function codes by manual entry from the keyboard.

In the function code "reset" condition, SPACE codes are inserted in the function code positions of transmitted messages.

Operator Function Code Entry

The alphanumeric area of the 7700 Series VIP keyboard and the "numeric pad" of the keyboard provide for operator entry of function codes. Each key, plus the control (CTR) key, generates a unique function code.

The 0 key in the numeric pad generates a "Function Clear" which resets existing function codes to SPACE codes. Entry of function codes from the keyboard are accepted into the FC1 position and previous contents of FC1 are shifted to the FC2 position. Any number of function code entries can be made prior to transmission and the last entry will be in the FC1 position and the next to the last entry will be in the FC2 position.

A one-character (FC1) or two-character (FC1,FC2) function code break must be configured on the \$ HSLA configuration card. Any of the F.C. () characters listed in column 4, Table 3-2 may be used.

The screen (CRT) should be cleared of any text, depress the control key (CTR) and the key listed in column 1, Table 3-2, as being equivalent to the configured function code character.

Example: If A is the configured entry for FC1 - depress the CTR key and the 7 key (numeric pad). In this case "Control, 7" is equivalent to the F.C. (A) for function code use.

This action enters the code for transmission. To transmit the break to the FNP - depress and hold the CTR key and then depress the TRANSMIT key.

Table 3-2 shows all 7700 Series VIP key legends and corresponding function codes generated.

Function Code Reset Conditions

The contents of FC1 and FC2 are reset to SPACE codes under the following conditions:

- Power on
- CTR/0 (zero key in numeric pad)
- Receipt of ACK
- CTR/CLEAR (keyboard command to clear display and reset the terminal to its initial conditions).

Central System Function Code Entry

The function codes contained in received NUL messages are entered into the terminal function code storage and, unless modified by subsequent operations, are retransmitted by the terminal with the next NUL message (also contained in the ACK message).

Table 3-2 (cont). 7700 Series VIP Keyboard Functional Description

Key Legend	Unshifted	Shifted	Control (CTR)
— (overline)	—	—	F.C. (L)
Q	Q	Q	F.C. (q)
W	W	W	F.C. (w)
E	E	E	F.C. (e)
R	R	R	F.C. (r)
T	T	T	F.C. (t)
Y	Y	Y	F.C. (y)
U	U	U	F.C. (u)
I	I	I	F.C. (i)
O	O	O	F.C. (o)
P	P	P	F.C. (p)
@	@	@	F.C. (˘) (grave accent)
| (left bar)	|	|	F.C. (K)
⌈	⌈	⌈	F.C. (O) (alpha)
A	A	A	F.C. (a)
S	S	S	F.C. (s)
D	D	D	F.C. (d)
F	F	F	F.C. (f)
G	G	G	F.C. (g)
H	H	H	F.C. (h)
J	J	J	F.C. (j)
K	K	K	F.C. (k)
L	L	L	F.C. (l) (alpha)
; +	;	+	F.C. (+)
: *	:	*	F.C. (*)
| (right bar)	|	|	F.C. (M)
Z	Z	Z	F.C. (z)
X	X	X	F.C. (x)
C	C	C	F.C. (c)
V	V	V	F.C. (v)
B	B	B	F.C. (b)
N	N	N	F.C. (n)
M	M	M	F.C. (m)
, >	,	>	F.C. (>)
/ ?	/	?	F.C. (?)
SPACE BAR	(SPACE)	(SPACE)	F.C. (SPACE)
1 (Numeric Pad)	no operation	1	F.C. (C)
2 (Numeric Pad)	no operation	2	F.C. (F)
3 (Numeric Pad)	no operation	3	F.C. (I)
4 (Numeric Pad)	no operation	4	F.C. (B)
5 (Numeric Pad)	no operation	5	F.C. (E)
6 (Numeric Pad)	no operation	6	F.C. (H)
7 (Numeric Pad)	no operation	7	F.C. (A)
8 (Numeric Pad)	no operation	8	F.C. (D)
9 (Numeric Pad)	no operation	9	F.C. (G)
0 (Numeric Pad)	no operation	0	function code clear
- (Numeric Pad) (minus)	no operation	-	F.C. (-)

¹F.C. = function code

Page Overflow Recovery Procedures

All 7700 Series VIP terminals send a special status to GRTS when a message being received from GRTS overflows the display memory, i.e., the message exceeds the limit of page size and is lost at the bottom of the screen. When this occurs, the ERROR light on the terminal panel is illuminated.

The operator may recover by repositioning the cursor and transmitting any message to GRTS for a retry. If a retry is not desired, or subsequent retry analysis indicates faulty text editing by the central system, the user should transmit a break message. This may be accomplished with the \$*\$BRK control record or by sending any message with proper function code break as defined on the \$ HSLA configuration card. The break causes the message waiting for retry to be discarded and the next message for the central system may be entered by the operator.

PRINT PAGE ADAPTER AND CASSETTE UNITS

The 7700 Series VIP print page adapter is supported for online operations with the following restrictions. The ppa is indirectly addressable via the display address only (150g). No free-standing printer operation is supported. The keyboard/display unit plus the printer are considered to be a single end-point. Therefore, only one mode of operation at a time is permitted, i.e., no overlapping of print and keyboard/display functions.

The tape cassette unit provides a recording and playback capability using tape cassettes. Single or dual cassette units are available. Either unit may be written to/read from using the display memory as a page buffer. The cassette tape may also be read, displayed, and printed in offline operation by a control on the tape unit. In addition the cassette unit may be recorded or read by command from the central system.

VIP Text Header Option

TEXT HEADER FORMATS

A VIP text header for function codes and destination codes interfaces Central System applications programs with communications software. The format is:

```
$ DD FC1 FC2 $ TEXT...
```

where:

DD is a two-character destination code.

Since this is a conditional text header, a flag must be set indicating its existence. Therefore, each time it is used, the character tally is set negative. This facilitates VIP interface with COBOL programs. In Conversational DAC mode, the header is enabled by the applications program using it first. The C/S interface module then sets a flag in the conversational TIB.

The following is a complete list of VIP destination codes and definitions. The numerics given in the VIP addressing column indicate the terminal address specified in a text or status message.

<u>Destination Code</u>	<u>VIP Addressing</u>
Output from C/S:	
DD= TP transparent print	150+PRT+printer timing fills
PT print display mode	150+NUL
W1 write cassette 1	160+ESC E ESC S FF DEL TEXT...
W2 write cassette 2	160+ESC E ESC S FF DEL TEXT...
W1 write EOF on cassette 1	160+ESC E ESC S FF DEL EOF
W2 write EOF on cassette 2	160+ESC F ESC S FF DEL EOF
R1 read cassette 1	160+ESC E ESC R
R2 read cassette 2	160+ESC F ESC R
B1 backspace cassette 1, one record	160+ESC E ESC D
B2 backspace cassette 2, one record	160+ESC F ESC D
D1 rewind cassette 1	160+ESC E ESC P
D2 rewind cassette 2	160+ESC F ESC p

Input to C/S:

DD= ⌘P print request	140+PRT
C⌘ source cassette	160
C⌘ source cassette, EOF	160,TEXT = EOF only

Any illegally formatted output messages from the Central System result in an error message to the terminal. The message DAC PROGRAM ERROR is sent and the terminal is disconnected. Once the central system DAC program is operating properly this condition will not be encountered. It should be noted that a destination code which causes a write cassette operation copies the complete screen display to the cassette tape. GRTS clears the screen prior to the write cassette message text. The user's program must consider this when formatting output. For this reason, and for facilitating error recovery procedures, write cassette or printer messages should be sent to the terminal in one block (up to display memory size limits) and not partitioned.

Examples of the print page adapter operation with TSS are shown in Figures 3-1 and 3-1.1. Operation of the tape cassette with TSS is shown in Figures 3-2 and 3-3.

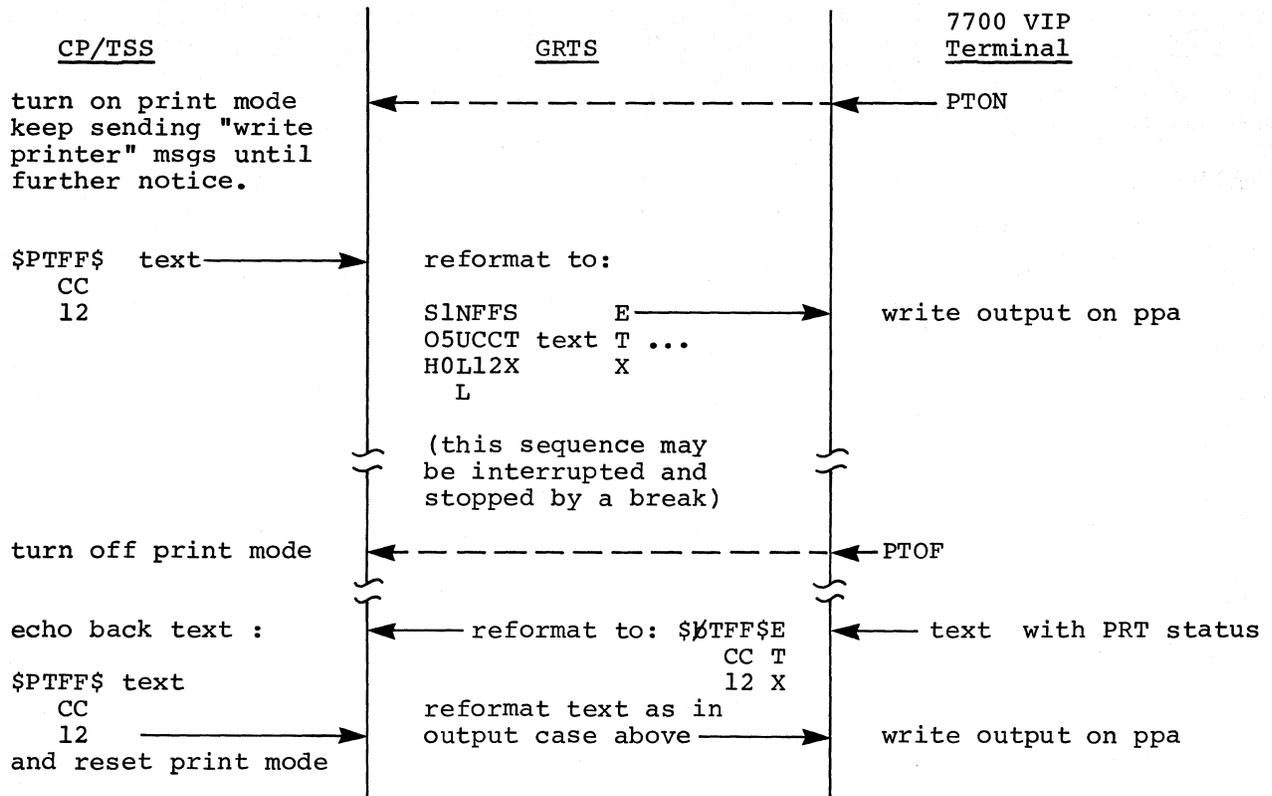


Figure 3-1. Display Copy Mode Operation of the Print Page Adapter with TSS

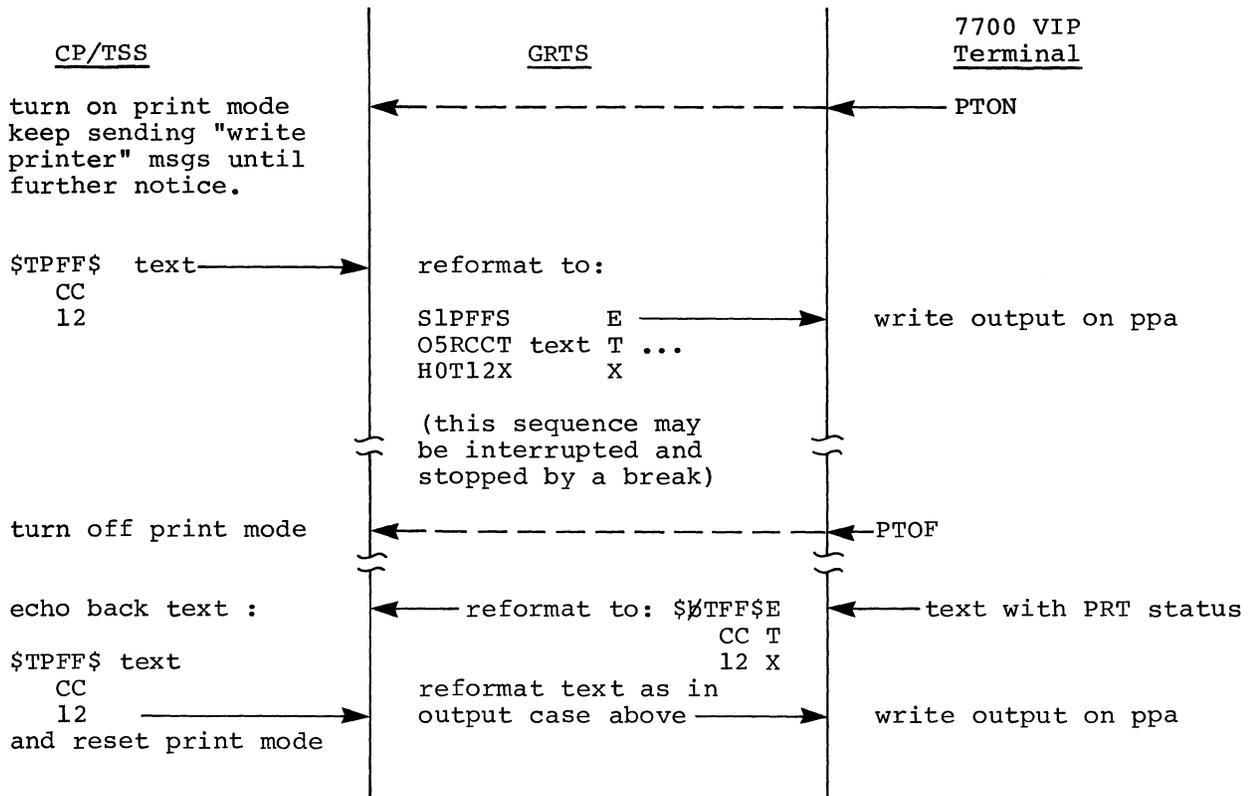


Figure 3-1.1. Transparent Print Mode Operation of the Print Page Adapter with TSS

Input:

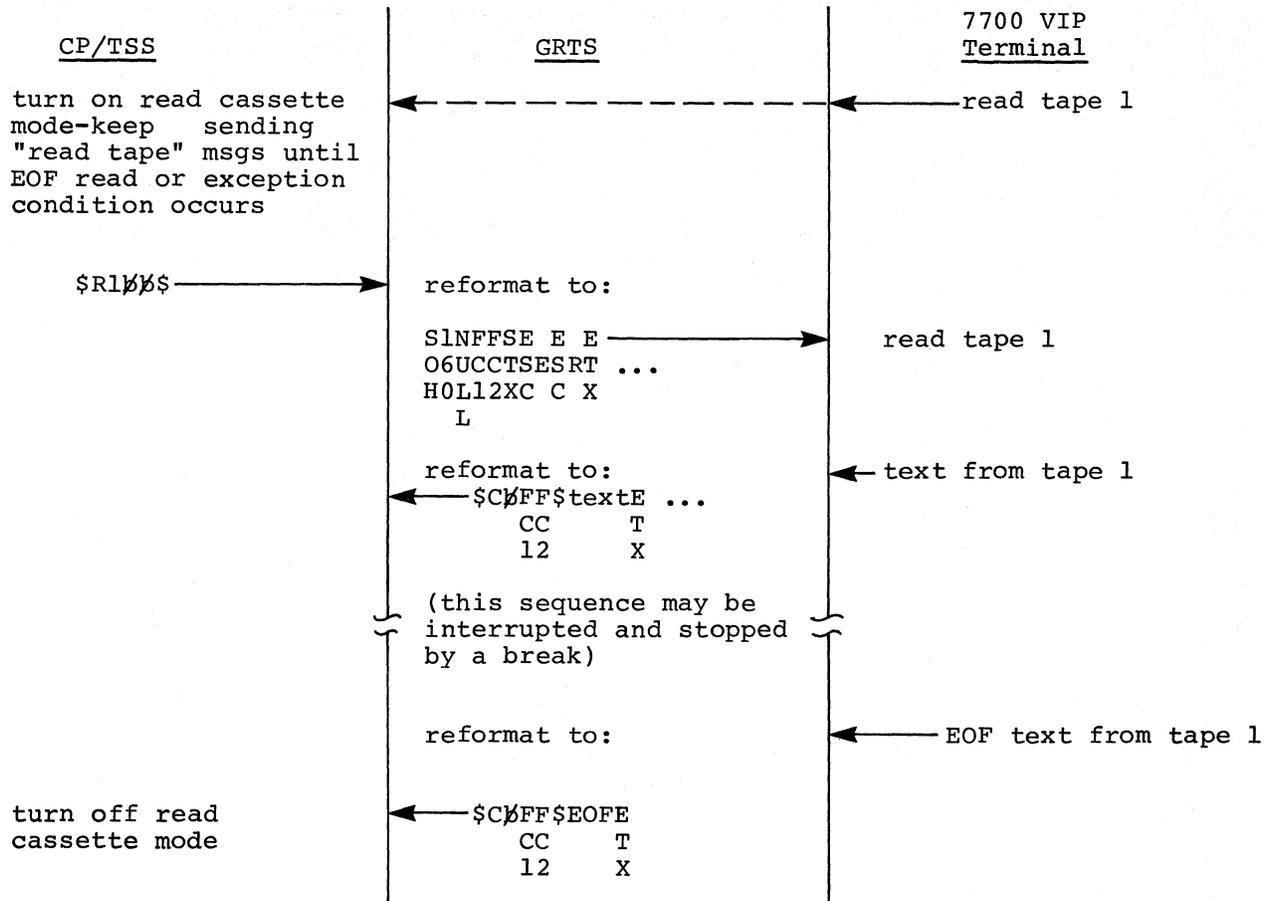


Figure 3-2. Operation of the Tape Cassette with TSS

Output:

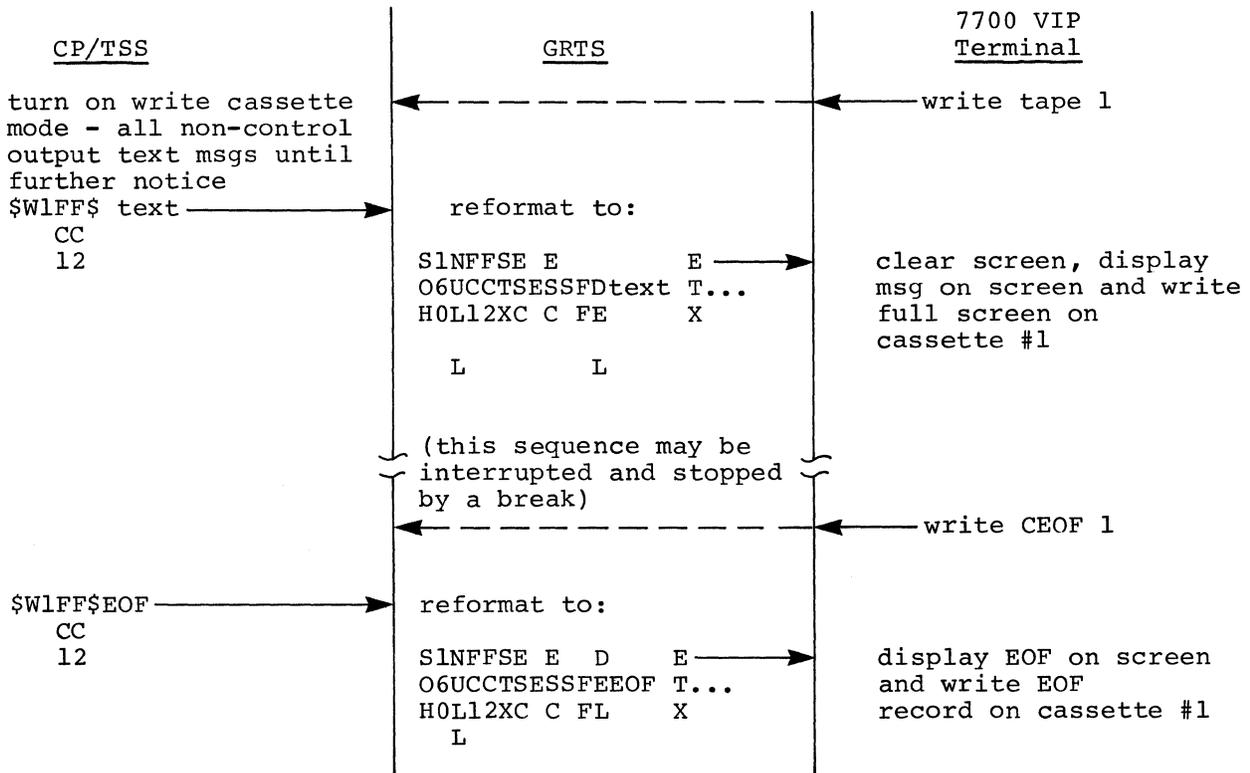


Figure 3-3. Operation of the Tape Cassette with TSS

ERROR RECOVERY PROCEDURES

1. There are several situations that can cause the status condition "Device Not Available" (155 octal):

A TermiNet 300 or TermiNet 1200 printer with status monitoring option, direct connected to the 7700 Series VIP reports this status in response to a central system output text message if power is off, printer is in local mode, paper is "out", or the print shield is lifted. A cassette reports this status in response to a Central System output text message if the cassette is not present, the cassette mode switch is not in REMOTE, the cassette is not READY, or the cassette is write protected and a write command resulted in an unrecoverable read or write error.

2. Recovery procedure -

Upon receipt of the above status condition, a message:

FIX.PRINTER

or

FIX.CASSETTE

is sent to the display screen to inform the operator that manual intervention is required. Upon receipt of a null input transmission (no text), a retry is attempted. The operator may exit from the retry loop by transmitting a break message (\$*\$BRK or a function code break, if configured).

TERMINAL CONNECTED BY TIME SHARING SYSTEM

A direct access program may be put into execution and then accessed by the terminal, while still connected by TSS, i.e., using the CARDIN/RUN/TALK mode of operation. The communications processor is not aware that this has occurred. If a printer or cassette has been used previously during the current connect period, enabling the text header mode of operation, then the direct access program now in execution must be capable of servicing the new text headers. If the direct access program does not have this capability the user must disconnect the terminal to disable the text header mode of operation and then reconnect to the direct access program without prior use of the printer or cassette.

BANKING TELLER TERMINAL INTERFACE (DATANET/355 AND DATANET/6600 ONLY)

The Honeywell Banking Teller Terminals, BTT7340 and BTT7340E utilize the VIP keyboard/display terminal line discipline. GRTS uses the VIP module G76M, the poll and select submodule GPSM and the BTT submodule GTBM to interface with these terminals.

The Banking Teller Terminals operate in the poll and select mode only, and may share a common line with other BTTs and VIP keyboard/display terminals; however, synchronous and asynchronous terminals may not be connected on the same line.

The BTT operator cannot communicate directly with GRTS using keyboard input, as in the normal operation of a VIP keyboard/display terminal. Therefore, GRTS performs several functions automatically for this terminal:

1. Automatic log-on to the down-line load program upon receipt of the terminal request. The down-line program name (.MTBLD) must be defined on the \$ PTI card.
2. Broadcast addressing of down-line load data blocks.
3. Automatic log-on to the proper online operations direct access program upon receipt of the first input after the down-line load request.

4. Automatic accommodation of the break prior to the data input sequence when the terminal is in conversation with the transaction processor direct access program.

The BTT message format accepted by the central system conforms to the format for VIP line discipline devices described previously in Section II of this manual. The 36-bit header that contains the character count and function codes is also used by the transaction processor module TPAP after reformatting. TPE formats may be found in the Transaction Processing System Users Guide.

User cognizance of the following items is very important to proper operation of the BTT7340 terminal.

1. The down-line load file builder program .MTBLD must have completed execution before the central system issues the ACALL message to GRTS.
2. In online operation the input message FC2 field contains the input message sequence number that is generated by the BTT firmware.
3. GRTS deletes duplicate messages, but missing messages must be recovered in the user program by instructing the operator to restart the transaction.
4. The output message FC1 field should always be set by the user's program to an ASCII E (for print or display messages), or an ASCII A (to indicate the received transaction is valid).

Down-Line Loading the BTT7340 Terminal

The file creation for the down-line load program in the central system is described in the System Startup manual.

To effect a down-line load from a BTT, the terminal must be initialized from the power off state. After power has been turned on, the supervisor key is inserted in the appropriate lock and turned on, the MODE switch set to 1 and the table to be loaded selected by pressing the key that corresponds to the table name. This procedure should be repeated for each terminal to be loaded with the same table. Terminals to be loaded with other tables may also be initialized at this time since the down-line load program broadcasts table data for all requested tables to all initialized terminals. After all desired terminals are initialized, the down-line data loading is started by pressing the END OF TRANS key on the last terminal. GRTS connects to the down-line load program and processes the data block requests until all connected terminals are satisfactorily loaded. A terminal is loaded when the CALL and RECEIVE lamps remain extinguished. It is permissible to down-line load one or more BTTs at any time, totally independent of other activity on the line.

Online Operation

The BTT operates with any direct access program that conforms to the conversational mode diagrammed in Figure 3-4. It also operates with the central system transaction processor program identified with the name HI-TRX on the \$ PTI card in the startup deck.

All user-generated direct access programs should require the first input message from a just connected terminal, to be a supervisory or teller log-on. This message must contain enough information to uniquely identify the operator(s) and the physical location of the terminal. The application program should also correlate this log-on information with an arbitrary, but unique, two-character (BCD) identification code assigned by GRTS when the subject terminal is connected to the direct access program (including HI-TRX). This ensures all subsequent input messages from that terminal are properly recognized and processed.

If a connect to an online program or a down-line load is attempted before the central system enables GRTS to accept calls (ACALL), the message is ignored. If a connect to an online program is attempted before the program is in execution the following message is printed on the BTT journal:

(name of program) NOT KNOWN

If the terminal is not disconnected, and the direct access program begins execution, the operator is notified with the following journal message:

RETRANSMIT

At this point, the supervisory log-on should be retried.

Messages that are common to other communications terminals may also be sent to the BTT. GRTS forces printing on the journal by inserting the appropriate function codes and text control characters.

Termination

The BTT terminal may be disconnected at any time by the user's program, by central system operator intervention, or by turning off the terminal. When the central system originates the disconnect, the following message is printed on the journal:

LINE TERMINATED - - CP

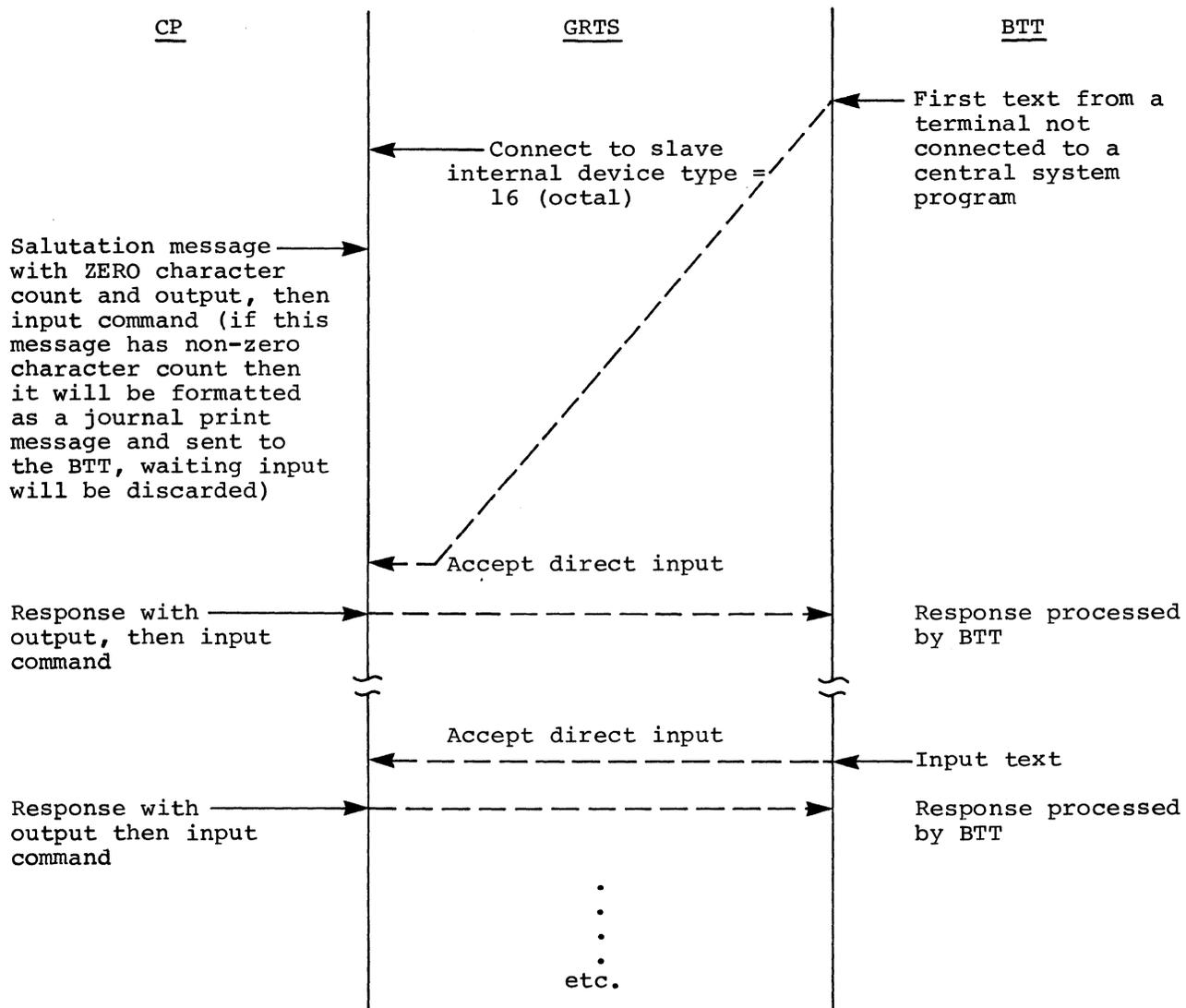


Figure 3-5. BTT Online Direct Access Operation Sequence

Data Capture Cassette Unit (DCC)

The Data Capture Cassette Unit (DCC) has the capability of recording BTT transactions on tape while the communications line and/or the central system is inoperable. When online operation is resumed, the DCC transmits these transactions to the central system to update the data base. This terminal operates with the VIP line discipline, on a poll and select line and may be operated simultaneously with other BTTs and VIPs on the same line. Standard software packages are supplied on cassette tapes allowing a single DCC to be either a synchronous or an asynchronous device by loading the proper software from its own cassette. However, when configuring DCCs, BTTs or VIPs on the same line, all terminals must be either synchronous or asynchronous.

The Data Capture Cassette Unit differs in several respects from the Bank Teller Terminal:

- There is no message display device attached to a DCC therefore, the only legal error message is a negative acknowledgment (NAK).
- Operation, once started, is fully automatic, and extra protection is required to preclude lost transactions. The DCC input transaction is not acknowledged (ACKed) by GRTS until a "prompt" is received from the central system applications program, indicating receipt of that transaction.
- Since the DCC repeats an input transaction until it is ACKed, polling of the DCC is inhibited between a transaction input and the ACK to prevent undue loading of the communications line.
- Special routing information for TPS only is appended as a text header on all input transactions. This is specified on the GRTS \$PTI configuration card. (See GRTS/355 and GRTS/6600 Startup Procedures.)

Figures 3-5 and 3-6 show the operation of the DCC with the Transaction Processing System and a typical direct access program. Note that all of the normal central system responses are text messages with a character tally of zero. Any nonzero response is considered an error return.

These messages are sent to a remote computer terminal and to an IBM 2780 Data Transmission terminal.

LINE DISCONNECTED -- xxx

Where: xxx = CP - Central system disconnects.
= DIS - Received DIS GRTS control record.
= ICC - Invalid command from central system.

LINE TERMINATED -- xxx

Where: xxx = PAS - Did not receive user ID password.
= ABT - No SNUMB on Abort control card.
= S/I - Missing SNUMB or IDENT card.
= ONA - Output not available.
= INV - Invalid control card.
= IMF - Invalid message format.
= SLV - Slave program not in system (DAC only).
= OC - Output complete.
= SPD - Link space denied.
= NSA - No link space available.
= LNE - Link number error.
= 6UA - Central system unavailable.
= RCE - Retry count exhausted.
= DOL - Device off-line.
= EOF - End-of-File (EOF status cannot recover).
= TNK - Terminal not known.
= RCM - Remote computer module.
= ACT - Line active.
= NDS - Line not completely disconnected.
= MCE - Media code error

One of the following reason codes may be supplied by the central system in place of the above GRTS reason codes:

XID - Blank or zero ID.

"ID - Duplicate ID.

PTF - No PAT entries available for input.

SNB - Missing \$ SNUMB card.

SIZ - Job source too long.

NUM - No available program number for job.

- DSC - Excessive disk errors.
- DUP - Duplicate SNUMB's.
- LNK - No disk links available.

FILE BACKSPACED

FILE ABORTED -- xxx

- Where: xxx = BCW - Block control word and record control word do not agree.
- = EOF - Received EOF record, but not final output from central system.
 - = OP - Operator aborted this file.
 - = ND - No data received from central system.
 - = RCW - Record control word too long for empty line buffer (no split).

GRTS/305 MESSAGES

The messages described below are sent to a remote computer terminal by the GRTS/305 control program.

LINE DISCONNECTED - xxx

- Where: xxx = CP - Central computer system disconnects.
- = DIS - Received GRTS DIS control record.
 - = ICC - Invalid command from central system.
 - = CIU - Errors in Computer Interface Unit.
 - = BUF - No buffers available.

INPUT RECEIVED

INPUT TERMINATED REASON xxx (reason code xxx from central system)

- Where: xxx = PTF - No PAT entries available for input.
- = SNB - Missing SNUMB card.
 - = SIZ - Job source too long.
 - = NUM - No available program number to assign to job.
 - = DSC - Excessive disk errors.
 - = DUP - Duplicate SNUMB's.
 - = LNK - No disk links available.
 - = ID - Duplicate ID.

Status Request Responses for Job and Station ID

OUTPUT RDY Output is ready for this job.

EXECUTING Job is currently executing.

SWAPPED Job temporarily swapped out of memory.

WAIT-CORE Execution is being held until enough memory is available to load this job.

WAIT-PERIP Execution is being held until peripheral requirements become available.

WAIT-ALOC Job is not a candidate for allocation. System conditions prevent allocation of any program at this time.

WAIT-TAPE Job requirements for magnetic tape units exceed the number of units currently available.

TOO BIG Job requirements exceed limits set at the central system. Before this job can run, permission must be granted at the central system console.

IN HOLD Job is not eligible for allocation at this time. Temporarily placed in HOLD by the central system operator.

IN LIMBO Job is being held until central system operator retrieves the magnetic tape files.

OVERDUE Allocation for this job is overdue.

READING-RMT Job is currently reading into the system from a remote station.

READING-CR Job is currently reading into the system from a card reader.

READING-MT Job currently reading into the system from a central system magnetic tape.

READING-D/D System Input program for disk is reading (jobs submitted through TSS CARDIN or GRTS/115 batch).

Responses to \$*DAC Requests

xxxxxx IS NOT KNOWN Program represented by xxxxxx is not currently known. It may, or may not, start.

xxxxxx WILL NOT START This is a known program, but the operator will not run it.

xxxxxx WILL START AT APPROXIMATELY tt.tt
The program represented by xxxxxx will start at approximately this time.

Other Messages

(SNUMB) NOT FOUND IN SYSTEM
(SNUMB) ABORT IN PROGRESS
(SNUMB) IN CATALOG CLASS.xxxxx

Where: (SNUMB) = Five digit serial number
xxxxx = Central system user-defined scheduler catalog class

Internal SNUMBs

Occasionally, SNUMBs appearing in system responses to job status requests are not those assigned to the job by the user. When a remote job is read, a copy of Remote System Input is generated under the SNUMB of the remote job. System Input then reformats the remote job into the normal J* and *J format and sends it back to the System Scheduler as a new job under the original SNUMB. At this point, the SNUMB of the copy of Remote System Input may still be in .CRSNB. To avoid duplicate SNUMBs, the entry in .CRSNB is overlaid with the program number of the slot; for example, program number 27 (a copy of Remote System Input) will have an SNUMB of OOG00 until its entry is cleared from .CRSNB. If a request is received for the status of the original SNUMB after .CRSNB has been overlaid but before it is cleared, the SNUMB OOG00 (in this specific example) appears in the message instead of the original SNUMB. This condition exists for a very short period of time; therefore, the user should request status again to obtain the proper SNUMB.

TELEPRINTER CONFIGURATION MESSAGE (DATANET 355 and DATANET 6600 FNP)

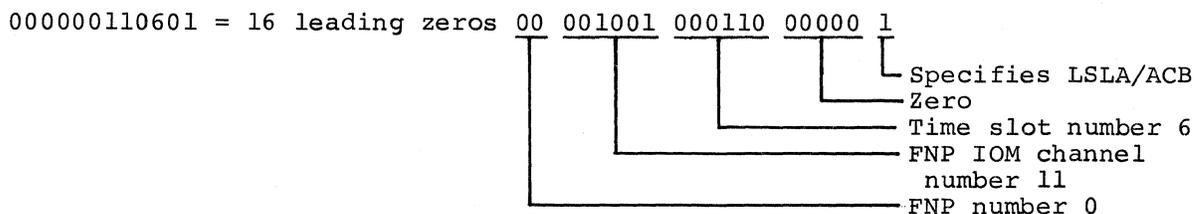
When a teleprinter terminal first rings into the DATANET FNP, a twelve-digit configuration identification message is sent to the terminal as word 2 (3rd, 36-bit word) of the channel mailbox. These digits are octal and must be expanded to binary bits. The bits are interpreted by comparing them with the following table to determine the configuration:

	0	15 16 17 18	21 22 23 24	28 29 30	34 35		
For HSLA/GPCB	ZERO	FNP#	CH#	H/G#	SCH#	VIP ADDRESS	0
or For LSLA/ACB	ZERO	FNP#	CH#	TS#	ZERO		1

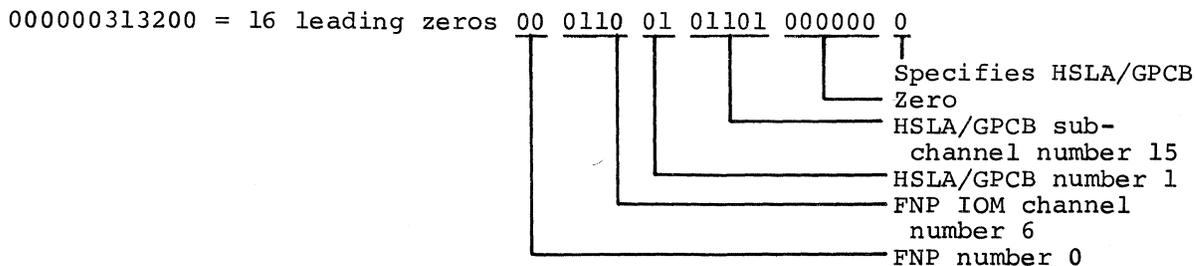
- Where:
- HSLA/GPCB - High Speed Line Adapter or General Purpose Communications Base
 - LSLA/ACB - Low Speed Line Adapter or Asynchronous Communications Base
 - FNP# - DATANET FNP number
 - CH# - DATANET FNP IOM channel number
 - H/G# - Relative number (1-3) of HSLA or GPCB
 - SCH# - Subchannel number (HSLA/GPCB)
 - TS# - Time slot number (LSLA/ACB)
 - Bit 35 - Format flag bit, 0 = HSLA/GPCB, 1 = LSLA/ACB

Examples:

The configuration definition number 000000110601 defines the following:



The configuration definition number 000000313200 defines the following:



NOTE: In these examples, spaces have been inserted in the binary representation for clarity.

MME GEROUT

MME GEROUT Definition

Remote System Input/Output (GEROUT) forms an integral part of the remote access system within GCOS. GEROUT serves as a remote terminal interface and coordinator for the following GCOS programs:

- Remote SYSOUT (.MROUT)
- Remote System Input (.MRGIN)
- Direct Access GCOS Programs (Direct Access Output, Direct Access Output/Input, Remote Inquiry, Terminal Identification)

All remote I/O requests for these programs are initiated by MME GEROUT calling sequences. The MME GEROUT calling sequences are an integral part of the user program executing in the central computer system and are used when the program needs to communicate with a terminal. In the direct access mode of operation, GEROUT enables the user program to communicate with a terminal to perform the following types of operations:

- Send output to/receive output from the terminal
- Identify the terminal
- Obtain the status of the terminal
- Disconnect a terminal

The general format is as follows:

```
L      MME      GEROUT
L+1    VFD      18/Record Pointer,06/OP,H12/Terminal ID
L+2    ZERO     Status Word Pointer, Courtesy Call
L+3    Next Instruction
```

Where: L+1 is as follows:

```
Bits  0-17  Record Pointer
       18-23 Operation Code
       24-35 Terminal ID
```

Various applications of the MME GEROUT are described in the following paragraphs.

COMMAND BITS

Certain MME GEROUT functions - Direct Access Output; Direct Access Output, then Input; Direct Access Output/Prepare to Receive Paper Tape Input; Accept DAC Paper Tape Input - use the lower half of word 0 (input buffer) or word 1 (output buffer) of the data block as command bits. These bits control input (FNP to central system) and output (central system to FNP) operations.

Output command bits are defined as follows:

1. For teleprinter:

Bit 31=1 Output data will not be passed to the G30M module for editing, even though the terminal is a 150- or 300-bps terminal and the 300-bps option was selected on the GOPT card when the FNP was configured.

Bit 32=1 This bit is defined only for terminals connected via the HSLA/GPCB and only in conjunction with a Direct Access Output/Prepare to Receive Paper Tape Input operation. This bit is ignored for terminals connected via the LSLA/ACB or performing any other operation. This bit set causes all input characters to be treated as data and sent to the central system. This mode cannot be terminated by X-OFF; instead, it will terminate when no data has been received for a period of five seconds.

Bit 33=1 This bit is defined only for terminals connected via the HSLA/GPCB and only in conjunction with a Direct Access Output/Prepare to Receive Paper Tape Input operation. This bit is ignored for any terminal connected via the LSLA/ACB or for any other op code. This bit set disables parity checking on the paper tape input. The data is passed to the central system with the parity bits intact. (Bits 32 and 33 are normally used together, and their use constitutes the transparent paper tape input (LUCID) mode.)

Bit 34=1 This bit set inhibits parity generation on the output for this transmission.

Bit 35=1 Used in conjunction with the Direct Access Output/Then Input op code, this short timeout bit causes GRTS to disconnect the terminal after one minute instead of the normal 10-minute timeout.

2. These command bits are not used by remote computer and keyboard/display terminals.

A 12-inch CRT screen displays a full set of 63 characters and symbols in 960 character locations (12 lines x 80 characters/line) or with the expanded, optional feature: 1920 character locations (24 lines x 80 characters/line).

Keyboard features include entry marker controls, text editing keys, command control keys and designation of up to 13 keys as function keys.

Standard terminal features include forms mode control, cassette tape storage and expanded data entry control. In addition, two types of page printers are available (optional) for hard copy of received messages.

*

7340 Banking Teller Terminal

Banking Teller Terminal (BTT) 7340 is an online terminal designed to meet the requirements of the banking industry. This terminal operates in online, offline, add or test modes to process financial transactions, and interfaces with a central system for account inquiry, passbook update, posting, and routine addition and subtraction.

A self-contained microprocessor allows the user to program individual transaction sequences. These sequences control keyboard action, passbook and journal printing, message transmission format, and optional data and tutorial displays.

The printer rapidly updates a horizontal- or vertical-fold passbook and produces an audit journal, utilizing high-speed bidirectional electronic tabbing. It also provides validation printing of checks and no-book receipts.

Status lamps inform the operator of the condition of the terminal and communications lines. Security is ensured by teller, supervisor, journal and maintenance locks.

Optional features include an alphabetic keyboard with additional function keys, dynamic data display, tutorial indicators, black-light signature verification and offline load-only cassette unit.

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