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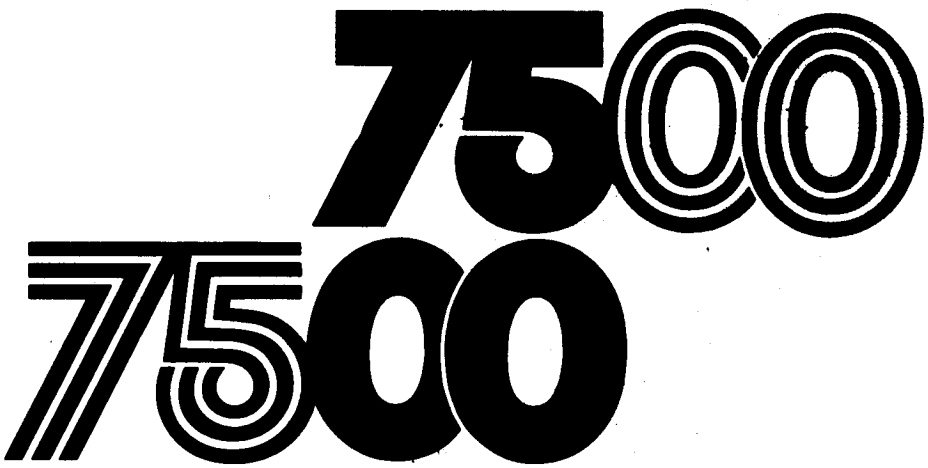
7500 System



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PREFACE

This publication is intended for the systems designer and programmer who has read the ICL publication *Introduction to 7500 Range*, Edition 1, TP 4800, and has a general knowledge of the philosophy and capabilities of the 7500 range.

By reading this publication the systems designer will be able to identify his needs in relation to the hardware and Terminal Control Program requirements of a proposed system and decide on the viability of such a system when connected to a particular mainframe computer. He is also given guidance on operational considerations, such as the factors to be taken into account when setting up a 7500 system.

The programmer is provided with implementation details of the facilities available on 7500 range, in particular the screen validation and hard copy formatting facilities of 7500 video systems and the local data validation facilities of 7503.

For detailed operating information the user should consult the following ICL publications:

7503 Operating, Preliminary Edition, TP 4801

7502 Operating (to be published)

Operating 7500 Range Videos (to be published)

CONTENTS

The text of this publication is divided into chapters in the normal way, and each chapter is subdivided into sections. A section's level in the hierarchy is indicated by its number. Therefore, within Chapter *n*, first level section headings are numbered *n*.1, *n*.2 and so on; second level headings are numbered *n*.1.1, *n*.1.2 ... *n*.2.1 and so on; third level headings are numbered *n*.1.1.1, *n*.1.1.2 ... *n*.1.2.1 and so on.

The contents list and index, and cross-references in the text, all refer to section numbers.

Pages are numbered within chapters, in the form *c*-*p*, where *c* is the chapter number and *p* the page number within that chapter. Figures and tables, where they appear, are also numbered within chapters, so that Figure *n*.2 is the second figure in Chapter *n*, and Table *n*.2 is the second table in that chapter.

Section numbers, page numbers and figure and table numbers in appendices are preceded by the letter A.

INTRODUCTION

CHAPTER 1

This publication describes the 7500 range of Modular Terminal Systems (MTS), which provide a remote communications capability for ICL's mainframe computers.

The range is based on two intelligent Modular Terminal Processors (MTPs): the 7502 and the 7503, and a number of peripheral devices: video terminals, hard copy printers, line printers, card and paper tape readers and magnetic tape cassette units. (An operator's console is also required in some configurations.)

An MTS is capable of supporting a variety of configurations and roles; this flexibility is due to the provision of a series of Terminal Control Programs (TCPs). A TCP is loaded into the MTP's store and controls the communications line, the peripherals and the processing requirements. By selection of an appropriate hardware configuration (processor and peripherals) and Terminal Control Program, the 7500 range will support clusters of video terminals and hard copy printers for interactive modes of use (such as Transaction Processing and Multi-access), and bulk peripheral configurations for Remote Job Entry and bulk data input/output.

Users who require a general introduction to the capabilities, features and components of the 7500 range should first read the ICL publication *Introduction to 7500 Range* (Edition 1, TP 4800). The present publication goes on to describe in more detail the 7500 range hardware and Terminal Control Programs, the data validation and video facilities, and provides guidance on operational considerations.

In general, the facilities are described without reference to any particular mainframe system. However, it should be noted that in a number of cases, support of certain 7500 facilities is restricted or not available on specific mainframes. There may also be restrictions on the mainframe communications hardware and software environment which affect the viability of a particular 7500 configuration or mode of use. The user should refer to Chapter 7 for his particular mainframe before concluding that a specific facility is supported.

This chapter describes those aspects of the 7500 hardware that are of particular interest to the systems designer, such as facilities and performance. Detailed operating instructions are not given. For this the reader should refer to the relevant 7500 operating publication for the processor concerned.

A complete list of 7500 range equipment is given in Appendix 1.

2.1 7500 Modular Terminal Processors

2.1.1 The 7502 Processors

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There are two variants of the 7502: the 7502/1, which has a basic store size of 8K bytes, and the 7502/3 with a basic store size of 12K bytes. Both processors support small and medium sized video systems up to a maximum of eight video terminals and four hard copy printers. The 7502 will not support other 7500 peripherals.

The 7502/1 basic system comprises a cabinet containing the Modular Terminal Processor, 8K bytes of store, a modem interface, power supply and 1K bytes of Read Only Memory (ROM). The ROM contains a fixed program which, by using a minimal sub-set of the appropriate line control procedures, is able to communicate with the mainframe system. The fixed program is executed whenever Teleload or Teledump facilities are required. A TCP can thus be transmitted from the mainframe to the terminal and loaded into the 7502's program store. Similarly, a TCP post mortem dump can be taken by transmission from terminal to mainframe.

The modem interface can be adopted for half-duplex operation at 600, 1200, 2400 or 4800 bits per second (bit/s) using UK Post Office modems or the following approved OEM modems:

1200 bit/s asynchronous

ITT GH 2002	APO Plan 32
ITT GH 2052	ZAT 120
ITT GH 2011	

1200 bit/s synchronous

Racal Milgo 2200/12E	APO Plan 32
ITT GH 2002	ZAT 1200
ITT GH 2052	

2400 bit/s synchronous

Racal Milgo 2200/24	APO Plan 32
Lenkurt 26C	ZAT 2400
ITT GH 2024	

4800 bit/s synchronous

Racal Milgo 4400/48	Racal Milgo 4600/48
Lenkurt 26D	TRT 4801
Rixon DS 4801	CASE 440/48

Point to point only, no multidrop:

ITT GH 2005	Racal Milgo 4500/48

Direct connection of 7502/1 is allowed, provided that the mainframe communications controller is within 33 metres cable length of the terminal processor.

Conversion C1597 provides enhancement from the 7502/1 to the 7502/3.

The 7502/3 is identical to the 7502/1 except that it contains 12K bytes of store. This may be extended to 16K bytes by store module type 7512/1: additional 4K bytes of store. The store required for any particular facility level is given in Chapter 3.

2.1.2 The 7503 Processor

The 7503/1 basic system comprises a cabinet containing the Modular Terminal Processor, 16K bytes of store, a modem interface, power supplies and space for mounting a number of alternative peripheral couplers. Since a Magnetic Tape Cassette Unit (TMC) is mandatory for program loading, the coupler for the TMC is included in the basic 7503/1 cabinet.

The modem interface can be adapted for half-duplex operation at 600, 1200, 2400 or 4800 bit/s using UK Post Office or approved modems, as given for the 7502 processor.

The basic store size of 16K bytes can be extended in steps of 4K or 8K bytes using store module types 7513/1 or 7513/2 respectively. The 7503 supports medium to large video configurations and remote job entry configurations with bulk peripherals. The store requirement for a particular usage of facility level is given in Chapter 3.

Direct connection of 7503 video configurations is allowed, provided that the mainframe communications controller is within 33 metres cable length of the terminal processor.

2.2 7500 peripherals

2.2.1 Summary of 7500 peripherals

Mnemonic	*Type number*	*Name*	
TTC	7506/1	Typewriter Console	
TVC	7507/1	Video Console	
TLP-150	7527/0	Line Printer	150 lpm
TLP-300	7527/1	Line Printer	300 lpm
TLP-500	7527/2	Line Printer	500 lpm
TCR-300	7532/1	Card Reader	300 cpm
TPR-500	7537/1	Paper Tape Reader	500 cps
TMC(single)	7542/1	Magnetic Tape Cassette Unit	Single drive
TMC(twin)	7542/2	Magnetic Tape Cassette Unit	Twin drive
~~VT-960~~	~~7561/1~~	~~Vido Terminal and Keyboard~~	~~960 character display~~
VT-2000	7561/1	Vido Terminal and Keyboard	2000 character display
Hcl-60	7572/01	HARD COPY PRINTER	

2.2.2 7506/1 Typewriter Console (TTC)

Processor

7503

Environment

T3A*x*

Use

The TTC is used as an operator's console and provides for operator communication with the host system (system use) and operator control of terminal functions (local use). The TTC can also be used as an output peripheral during off-line copying (T3A6).

Connection

Via a F1763 coupler

Printing speed

10 characters per second (maximum)

Characteristics

The TTC is a table top keyboard-send-receive (KSR) unit with a friction feed paper mechanism. Paper tape facilities for automatic-send-receive (ASR) are not provided. The TTC is sited on the 7503 console desk.

A console device must be provided when operating under T3Ax programs. In general this may be either a TTC or TVC (but see below).

Technical limitations prevent the use of the alternative video console in GEORGE 3/4 and System 4 Multijob environments. A TTC is therefore mandatory when the host processor is running under either of these operating systems.

The following variants cater for different mainframe requirements:

Feature F1726 1900 code

Feature F1727 System 4 code

2.2.3 750//1 Video Console (TVC)

Processor

7503

Environment

T3Ax

Use

The TVC may be used as an alternative to the TTC operator's console except in GEORGE 3/4 and System 4 Multijob environments.

Connection

Via a F1764 coupler

Characteristics

The TVC is a table top unit comprising a keyboard, video monitor tube and control electronics. The device has a display capacity of 16 lines, 80 characters per line. Input and output enter at the bottom of the screen (line 16) and each line is racked-up as further lines are added to the display. Once 16 lines are displayed, new information entering on line 16 causes the information on line 1 to be lost.

Input messages are limited to 160 characters. Further characters will not appear on the screen or enter the store.

No hard copy facilities are provided for the video console.

The following variants cater for different mainframe requirements:

Feature F1728 1900 code

Feature F1729 System 4 code

2.2.4 7527/0, /1 and /2 Line Printers (TLP-150, -300 and -500)

Processor

7503

Environment

T3A*x*

Use

These line printers are used for the following purposes:

1 To print bulk data output to the terminal from the mainframe (T3A1 or T3A2)

2 To produce a copy of validated card data during off-line validation (T3A3 or T3A4)

3 To produce a printed version of data input on another medium during off-line copying (T3A6)

Connection

Via a 1766 coupler

Printing speeds

The maximum printing speeds are:

TLP-150 150 lines per minute

TLP-300 300 lines per minute

TLP-500 500 lines per minute

Actual printing speeds under on-line operation are dependent upon several other factors, including character distribution on a line, paper throw requirements and the line speed being used.

Characteristics

The printers are free-standing units, identical in outward appearance, sited at the right hand side of the console desk. The printers have 132 print positions and operate with a 64 character set.

The paper feed mechanism on the printers caters for up to 4 part folded continuous stationery of widths 4 to 15.3 inches and form lengths 6 to 18 inches. A paper throwing rate of 22 inches per second (in/s) utilised with long paper throws restricted to 10 in/s to provide satisfactory stacking.

A line pitch of 6 or 8 lines per inch may be selected by an operator's switch.

The print format is under terminal control. A format loop is not used but is simulated by the TCP. The simulated loop is set up by instructions loaded from the card reader, paper tape reader or magnetic cassette, under control from the operator's

console. Further details are given in the ICL publication *7503 Operating* (Preliminary Edition, TP 4801).

Controls are provided for operator adjustment of vertical positioning and print density, and the point at which detection of paper low is indicated is operator selectable.

To cater for different mainframe requirements and other character set variations the following print barrels are available:

Feature F1700	1900 Series standard print barrel
Feature F1711	System 4 standard print barrel
Feature F1712	Swedish print barrel
Feature F1713	Russian Cyrillic print barrel (1 00)
Feature F1714	Russian Cyrillic print barrel (System 4)
Feature F1715	Danish print barrel
Feature F1701	Special print barrel with up to five non-standard characters and/or rearrangement of the standard 64 character set
Feature F1702	Spare special print barrel required when F1701 is ordered

Events that need to be reported to the operator (which are not otherwise covered by the normal complement of printer controls and indicators) are displayed on the control console. These events include notification of completion of printing (in off-line use only) and reports of printer faults. The control console is also used as a means of modifying the format control parameters and of obtaining the format identifier.

2.2.5 7532/1 Card Reader (TCR-300)

Processor

7503

Environment

T3A*x*

Use

The TCR is used for the following purposes:

1 To input bulk data and/or job control statements to the mainframe (T3A1 or T3A2)

2 To input data for validation by the MTP during off-line validation (T3A3 or T3A4)

3 To input data for transcription to another medium (magnetic cassette tape, line printer) during off-line copying (T3A6)

4 To load line printer format control information into a TCP (T3A1, T3A2 or T3A6) (see section 2.2.4)

Connection

Via a F1767 coupler

Speed

Three hundred cards per minute (maximum)

Characteristics

The TCR is a table-top unit sited on top of the 7503 processor cabinet. The hopper and the stacker have a maximum capacity of 400 cards each. Loading and unloading of cards cannot be performed whilst reading is in progress.

Facilities for blank column suppression, data end code and reduced card capacity (known as short block working on the 7020) are provided as standard within the TCPs. Further details are given in *7503 Operating*.

Events that need to be reported to the operator (which are not otherwise covered by the normal complement of card reader controls and indicators) are displayed on the control console. Variations in the procedure followed when inputting data to the system, via the card reader, are also controlled via the control console: blank column suppression and reduced card capacity, for example.

2.2.6 7537/1 Paper Tape Reader (TPR-500)

Processor

7503

Environment

T3A*x*

Use

The TPR is used for the following purposes:

1 To input bulk data and/or job control statements to the mainframe (T3A1 or T3A2)

2 To input data for transcription to another medium (magnetic cassette tape, line printer) during off-line copying (T3A6)

3 To load line printer format control information into a TCP (T3A1, T3A2 or T3A6) (see section 2.2.4)

Connection

Requires a F1767 coupler if not already specified for the TCR

Speed

500 characters per second (maximum)

Characteristics

The TPR is a table-top unit sited either on top of the 7503 processor cabinet, or on an additional 7591/2 Console Desk when the configuration includes a TCR. The TPR reads standard one inch, eight track tape. The unit is provided with a simple tape dispenser capable of holding a five inch spool of tape. Tape out detection and operator tape run-out facilities are provided.

Events that need to be reported to the operator (which are not otherwise covered by the normal complement of paper tape reader controls and indicators) are displayed on the control console. Selection of record format is made via the control console, and blank suppression choices may be modified (from those defined in the initial program load). Further details are given in *7503 Operating*.

2.2.7 7542/1 and /2 Magnetic Tape Cassette Units (TMC)

Processor

7503

Environment

T3A*x*, T3B*x* (operation 7 below only)

User

The TMC is used for the following purposes:

1 To produce a cassette containing spooled, validated data input via a TCR (T3A4)

2 To produce a cassette containing spooled data input via a TCR (T3A6)

3 To subsequently input the spooled data, produced in operation 1 or 2, to the mainframe (T3A2)

4 To receive data output from the mainframe (T3A2)

5 To subsequently de-spool the data received in operation 4, for output to a TLP (T3A6)

6 Where a twin drive TMC is available, to copy the contents of one cassette to another cassette (T3A6)

7 To provide a storage medium for program segments, consolidated TCPs, utility programs and postmortem dumps

8 To provide a storage medium for line printer format control information (produced using utility program SX8) for subsequent input to a TCP

Connection

Via a coupler integrated into the 7503 processor cabinet.

Characteristics

The TMC consists of a single (7542/1) or twin (7542/2) drive unit mounted on top of the 7503 cabinet. Computer grade magnetic tape cassettes are used which conform to the ECMA 34 standard. The cassettes have two tracks, referred to as side A and side B, and must be removed and inverted in order to change tracks.

The average capacity is 160K bytes per side with 80 byte blocks. The length of tape is 86 metres (282 feet) and the tape speed during a reading or writing operation is 19 cm per second (7.5 in/s). The entire tape will rewind within 45 seconds.

17/3/76 (1) 2.2.8 7561/1 Video Terminal and Keyboard (VT-960 and VT-2000)

Processor

7502 or 7503

Environment

T2Bx, T3Bx

Use

A VT is used for the following purposes:

1 As a remote interactive device for transaction processing and multi-access applications

2 As an operator's console during TCP consolidation and loading. On completion of this action the VT is returned to its normal function (T3Bx)

3 As a monitoring device during Teleload and Teledump in order that the terminal operator can be aware of the progress of the load or dump, and in particular any untoward incident. On completion the VT is returned to its normal function (T2Bx)

Connection

The coupler required depends upon the processor, the number of videos and the screen capacity required as follows:

7502 Coupler	*Videos supported*	*Screen size (characters)*
F1935/1	Up to 4	960
F1935/2	5th, 6th, 7th and 8th	960
F1936/0	1ST, 2ND OR 4TH PAIR OF 7561/01	2000
F1936/1	Up to 2	2000
F1936/2	3rd and 4th	2000
F1936/3	5th and 6th	2000
F1936/4	7th and 8th	2000
F1976/0	3RD PAIR OF 7561/1	2000

7503 Coupler	*Videos supported*	*Screen size (characters)*
F1769	Up to 4	960
F1770	Up to 2	2000
F1771	Up to 8	960
F1772	Up to 4	2000

Characteristics

The VT is a free-standing unit which may be sited up to one kilometre cable length from the MTP. The screen has a diagonal of 15 inches and has a capacity of either 960 characters (in 12 lines of 80 characters each) or 2000 characters (in 25 lines of 80 characters each) depending on the coupler to which it is attached: these are referred to as the VT-960 and VT-2000 respectively.

The VT can display a 96 character set selected from a full set of 128 characters, determined by a combination of coupler and TCP. In this way English (code 1 and code 2) and national character sets for Denmark, and Sweden are catered for.

The code set for System 4 is that of the 7181/2 code 1 Feature F1749. The code set for 1900 (identical except for interchanging £, $ and # codes) is that of the 7181/2 code 2 Feature F1800. However, many present 1900 users already use 7181/2 videos with the System 4 code set (since this was standard until recently) and this may need to be taken into account for compatibility.

The choice of code is controlled by the TCP and hence is specified either when the TCP is ordered for 7502 or during consolidation for 7503. A mixture of language sets on a system is not permitted.

The keyboard on the VT is physically separate from the display. The keyboard layout is similar to the 7181/9 keyboard with an alpha-numeric block, a shift free numeric block and a control block. The range of language options is catered for by differences in appropriate key tops together with the selection of an appropriate TCP.

Note that for UK versions of the code 1 and code 2 character sets, the same standard keyboard is used. This has some minor differences from current 1900 and System 4 versions of the 7181/9 keyboard.

The keying of CONTROL together with any other key is encoded and transmitted to the mainframe as an action message (as on 7181/2 videos) under standard TCP facilities.

For security purposes, a key reader may be included on the VT keyboard as an optional item (F1779/01). The key reader is designed to accept a personal identification device in the form of a pen coded with an 8-bit binary pattern. This provides a fixed length field of three numeric characters in the range

000 to 250 which is transmitted to the mainframe as part of every input message (see section 5.1.4).

2.2.9 7572/1 Hard Copy Printer (HCP-60)

Processor

7502 or 7503

Environment

T2B*x*, T3B*x*

Use

A HCP is used for the following purposes:

1 To produce a hard copy record of the contents of a VT screen, initiated by the VT operator. Optional TCP facilities enable formatting of the output and insertion of additional data into the printout

2 To print data sent directly from the mainframe program. The data is not displayed on the VT screen and is not subject to any hard copy formatting

Connection

Via F1939 couplers for 7502, or F1773 couplers for 7503. Each coupler supports up to four HCPs

Speed

60 characters per second (maximum)

Characteristics

The HCP is a receive-only device based on the ICL termiprinter mechanism and has 118 print positions at 10 characters per inch horizontal pitch. The vertical pitch of 6 lines per inch is controlled by a sprocket feed mechanism.

The HCP may be sited up to one kilometre cable length from the MTP.

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The 7500 Modular Terminal Processors and associated peripherals may operate in a number of different ways under the control of one of a number of Terminal Control Programs (TCPs). This chapter describes the available 7500 TCPs: what facilities they provide, what peripherals they support and how much terminal store they require.

The TCPs are divided into three categories as follows:

1 T3A*x* SERIES These programs support the 7503 MTP as a remote job entry terminal. The configuration will normally include a number of bulk peripherals for fast input/output of data. Other facilities are provided by TCPs in the T3A*x* series: off-line validation of data, data spooling, local copying and terminal to terminal transmission

2 T3B*x* SERIES The T3B*x* programs enable the 7503 to support a configuration of video terminals and hard copy printers. Facilities may be incorporated into a TCP to provide screen validation and hard copy formatting

3 T2B*x* SERIES The T2B*x* programs support the 7502 MTP with a configuration of video terminals and hard copy printers. Certain TCPs also provide screen validation and hard copy formatting facilities

The facilities provided by 7502 T2B*x* programs are, in general, identical to those provided by 7503 T3B*x* programs. However, larger configurations of video terminals and hard copy printers are possible with a 7503 (see description of individual TCPs for details).

3.1 7503 T3A*x* programs

3.1.1 Program T3A1

Program T3A1 is the basic on-line bulk input/output program and is designed to operate in the 7503 minimum store size of 16K bytes. Alternative programs can be consolidated, utilising either the TTC or TVC operator's console, one of which must be specified. A TVC is not allowed under certain mainframe environments (see Chapter 7 for details).

T3A1 supports the use of the following combination of peripherals:

1 A card reader (TCR) and a line printer (TLP), or

2 A paper tape reader (TPR) and a line printer (TLP)

A magnetic tape cassette unit (TMC) must be available for program loading but cannot be used as a data store.

A TCR and TPR may both be included in the hardware configuration but cannot be operated by the same program in 16K bytes of store.

The program can be used with the mainframe environments given in Chapter 7 for bulk input/output of data to and from the mainframe system and, where appropriate, for remote job entry.

3.1.2 Program T3A2

Program T3A2, which operates in 24K bytes of store, offers all the T3A1 facilities with the following additions:

1 Support for direct on-line to mainframe operation of both the card reader and paper tape reader

2 Transmission to the mainframe of spooled data on magnetic tape cassette that has been previously recorded using programs T3A4 or T3A6

3 Transmission from the mainframe of spooled data onto magnetic tape cassette for subsequent output to the line printer under control of program T3A6

The following hardware configuration is required:

1 7503/1 MTP with 24K bytes of store

2 A TTC or TVC operator's console

3 A single or twin magnetic tape cassette unit

4 A card reader (optional)

5 A paper tape reader (optional)

6 A line printer (optional)

3.1.3 Program T3A3

Program T3A3 is used off-line from the mainframe to perform validation checks on input card data and to optionally tabulate the results on the line printer.

The following hardware is required:

1 7503/1 MTP with 24K bytes of store

2 A TTC or TVC operator's console

3 A card reader

4 A line printer

5 A magnetic tape cassette unit (for program loading only)

Other peripherals may be attached to the MTP but are not used.

The facility to validate paper tape data is not available.

Full details of the validation and tabulation facilities are given in Chapter 4.

3.1.4 Program T3A4

Program T3A4 provides identical facilities to T3A3 but with the following additions:

1 The ability to spool validated data onto the magnetic cassette tape for subsequent transmission to the mainframe

2 The facility to merge additional text material, held on cassette, into the line printer output

The following hardware is required:

1 A 7503/1 MTP with 32K bytes of store

2 A TTC or TVC operator's console

3 A card reader

4 A line printer

5 A magnetic tape cassette unit. (A twin drive TMC is required when spooling and text merging are both performed)

Other peripherals may be attached to the MTP but are not used.

Full details of the validation, tabulation and spooling facilities of T3A4 are given in Chapter 4.

3.1.5 Program T3A6

Program T3A6 provides facilities for copying data from any input peripheral to any output peripheral. Three versions of T3A6 are available, operating in different store sizes and providing different ranges of facilities. The facilities of each version are described below.

3.1.5.1 Program T3A6K16

T3A6K16 operates in 16K bytes and may be consolidated to perform either of the following copy operations:

1 Card reader to line printer

2 Paper tape reader to line printer

3 MT CASSETTE TO MT CASSETTE COPY WHEN 7542/2 AVAILABLE

3.1.5.2 Program T3A6K24

T3A6K24 operates in 24K bytes and in addition to the above copy operations it supports:

1 Magnetic tape cassette for input and output spooling

2 Use of the operator's console as an output device

3 A test print facility

Several versions may be consolidated, supporting different combinations of peripherals, as follows:

1 Card reader, line printer, magnetic cassette and console

2 Paper tape reader, line printer, magnetic cassette and console

3 Card reader, tape reader, magnetic cassette and console

4 Magnetic cassette, line printer and console

5 MT CASSETTE TO MT CASSETTE COPY WHEN 7542/2 AVAILABLE.

Versions 1 and 2 are used with configurations with a card reader or paper tape reader respectively. Since there is insufficient store space available to consolidate both card reader and paper tape reader into one version, it is recommended that installations with both these peripherals consolidate one version for input spooling (version 3 above) and one for output spooling (version 4 above).

3.1.5.3 Program T3A6K32

T3A6K32 operates in 32K bytes and supports all the above as copying peripherals. In addition it supports:

1 Test printing

2 Editing from the console

3 Cassette searching

4 Console input

5 Multiple copying

3.1.5.4 Facilities

Test printing

This is supported by the 24K and 32K versions and enables a test print, from magnetic cassette to line printer, to be made before starting a copying job or before continuing after a printer malfunction.

It is also possible with the 24K and 32K versions to test the mechanical operation of both input and output peripherals. For input peripherals, the data is read from the card reader, paper tape reader or cassette and effectively discarded. The input device is thus tested without waste of paper through printing. For output peripherals, a standard pattern is generated by the TCP and output to the line printer or console.

Editing

In the 32K version, data from a source device can be edited from the console on a record by record basis. Data from the source can be copied or omitted (skipped), and data from the console can be added to that from the source.

Cassette searching

In the 32K version the operator can opt for data anywhere on the cassette to be displayed on the console. This enables the operator:

1 To find out what data is on the cassette (if necessary, displaying the contents of the entire cassette on the console)

2 To find a specific record and its position on a cassette (of particular use when editing a paper tape image cassette where paper tape records of more than 80 characters are copied to cassette in fragmented form, covering two or more cassette records)

Multiple copying

In the 32K version it is possible to perform more than one copying operation at the same time, for example card reader to line printer and paper tape reader to magnetic cassette.

Full details of the operating aspects of program T3A6 are given in the ICL publication *7503 Operating*, Preliminary Edition, TP 4801.

3.2 7503 T3B*x* programs

The T3B*x* programs control configurations of video terminals and hard copy printers attached to a 7503 MTP. A magnetic tape cassette unit is required for consolidation and program loading but may not be used for any other purpose. Other peripherals may be attached to the MTP but are not used in this environment.

Screen validation and, where appropriate, hard copy formatting facilities may be incorporated into the TCPs at consolidation time. Hard copy output is available whether or not formatting is specified.

The T3B*x* programs provide a facility whereby mainframe programs can send data directly to a hard copy printer without first directing the output to a video terminal. This facility is intended for low volume, intermittent printing. Note that this facility is not available under all mainframe environments (see Chapter 7 for details).

A full description of the available video facilities is given in Chapter 5.

The way in which hard copy printers are allocated to video terminals is not a fixed one-to-one relationship, but is a flexible arrangement established at consolidation time. HCPs and VTs are grouped together so that any desired sharing of HCPs among VTs is possible. Output from a VT will be printed on the first available HCP in that group.

3.2.1 Program T3B1

T3B1 is the basic TCP, capable of handling up to eight VT-960 or VT-2000 units and is designed to operate in the 7503 minimum store size of 16K bytes. The screen validation facility requires an additional 8K bytes of store.

3.2.2 Program T3B2

T3B2 provides control for up to eight ~~VT-960 or~~ VT-2000 units and up to four HCP-60 Printers. The program requires 20K bytes of store.

Optionally, screen validation and/or hard copy formatting may be incorporated into T2B2. These facilities require an additional 8K bytes of store each.

3.2.3 Program T3B4

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T3B4 provides control for up to sixteen VT-960 or VT-2000 units and one or two HCP-60 Printers. The program requires 20K bytes of store.

Screen validation and/or hard copy formatting may be incorporated into the program as for T3B2.

3.2.4 Program T3B6

T3B6 provides control for up to ~~twenty-four VT-960 units or~~ EIGHT ~~sixteen~~ VT-2000 units and up to eight HCP-60 Printers. The program requires 24K bytes of store.

Screen validation/hard copy formatting may be incorporated into the program as for T3B2. THE OPTION REQUIRES 8K BYTES OF STORE

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3.3 7502 T2B*x* programs

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The T2B*x* programs control configurations of video terminals and hard copy printers attached to a 7502 MTP. The 7502 will not support other 7500 peripherals.

Screen validation, hard copy formatting and direct output facilities are provided by certain T2B*x* TCPs (see individual TCP descriptions below). Hard copy output is available whether or not formatting is specified.

A full description of the available video facilities is given in Chapter 5.

The way in which hard copy printers are allocated to video terminals is established by hardware connections, set up at installation time. Each VT may be assigned an HCP. Each HCP may be assigned an alternative, which itself may have an alternative and so on. The alternative HCP is used by T2B1 only when the original is inoperable, and by T2B2, T2B3, T2B4 and T2B5 when the original is inoperable or busy. A TCP will follow the alternatives until either it finds an HCP that will accept the hard copy, or it is returned to the first HCP it tried. In the latter case, the ERROR indicator on the VT will be illuminated (see section 5.2).

A printer can be assigned exclusively to direct output by not assigning it to a VT (see section 5.3).

3.3.1 Program T2B1

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T2B1 is the basic TCP, capable of handling up to eight ~~VT-960~~ or VT-2000 units with up to four HCP-60 printers. The program is designed to operate in the 7502 minimum store size of 8K bytes. The HCPs can only be used for local copy. Screen validation and hard copy formatting facilities are not provided.

3.3.2 Program T2B2

T2B2 provides the same facilities as T2B1, but in addition allows direct output to the HCPs. The program requires 12K bytes of store.

3.3.3 Program T2B3

T2B3 provides the same facilities as T2B1, but in addition provides screen validation facilities. The program requires 12K bytes of store.

3.3.4 Program T2B4

T2B4 provides the same facilities as T2B1, but in addition allows hard copy formatting. The program requires 12K bytes of store.

3.3.5 Program T2B5

T2B5 provides the facilities of all the above programs (that is, direct output, screen validation and hard copy formatting). The program requires 16K bytes of store.

3.3.6 Program T2B6

T2B6 controls one or two HCPs for direct output from the mainframe, thus providing a slow remote printing capability. Hard copy formatting is not possible with this configuration. The program requires the basic 8K bytes of store.

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3.4

7503 DATA VALIDATION PROGRAMS (T3A3 AND T3A4)

CHAPTER 4

Programs T3A3 and T3A4 are available to provide facilities for the input validation of card data and tabulation of the results on the line printer.

The data input to programs T3A3 or T3A4 consists of a batch of 80 column cards of identical format, each card constituting a complete record. The programs perform validation on fields within the record. Subtotalling and limited multiplication of selected fields may also be performed.

The validation and tabulation are performed according to parameters, specified by the user, which are input on control cards placed at the head of the card pack.

The programs produce as output a tabulation with page headings, if required, on the line printer.

While program T3A3 provides a purely local function, T3A4 has the additional facility for storing the validated data on magnetic cassette tape for subsequent transmission to the mainframe computer. T3A4 also provides facilities for the merging of additional text information from a magnetic cassette into the tabulated line printer output. The text could be, for example, customers' names and addresses associated with the customers' code numbers punched on the input data cards. Details of each customer's orders, payments etc. could then be preceded by this additional information in the line printer listing.

4.1 Program T3A4

4.1.1 Store and peripheral requirements

Program T3A4 requires 32K bytes of store, a control console, a card reader, a line printer and a magnetic tape cassette unit.

4.1.2 Input to the program T3A4

The input to the program consist of a card pack, including the data to be validated, assembled in the following sequence:

1 Six parameter cards specifying the processes to be performed on the input data (see section 4.1.11)

2 A check digit card specifying the user's check digit system (if requested by the parameter cards) (see section 4.1.13.1)

3 List card(s) (if requested by the parameter cards) (see section 4.1.13.2)

4 Four range check cards (if requested by the parameter cards) (see section 4.1.13.3)

5 Page heading card(s) (optional) (see section 4.1.13.4)

6 A text file header card specifying the file identifier of the text file to be created (if any) (see section 4.1.13.5)

7 A data file header card specifying the file identifier of the data file to be created (if any) (see section 4.1.13.6)

8 Text cards if required, providing text information to be copied to a text cassette tape and subsequently merged with the data in the output tabulation (see section 4.1.13.7)

9 Data cards not to be validated (if any)

10 Start validation control card (see section 4.1.13.8)

11 Data cards to be validated

12 Restart control card (see section 4.1.13.9)

13 Data cards to be validated

14 Stop validation control card (see section 4.1.13.10)

15 User's end card for mainframe process (if required)

16 TCP end card (see section 4.1.13.1)

To permit restarting of the validation run from several points, items 12 and 13 may be repeated as many times as required (see operation under mode 2, section 4.1.3.2).

Also, in order to facilitate the spooling of input data containing several sequences of data cards not to be validated, items 9 to 14 inclusive may be repeated. This will be useful where mainframe job control cards are contained in the input pack.

4.1.3 Modes of operation

T3A4 runs in any one of six different modes, selected by the operator when the program is activated.

Depending on the mode selected (see below) the user has the option to perform one or more of the following functions:

1 Validation of the input data according to the parameters supplied on the control cards at the head of the pack

2 Tabulation of the results on the line printer as specified by the control card parameters

3 Merging text from a text cassette with the input data, for inclusion in the line printer tabulation

4 Production of a magnetic cassette containing a spooled copy of the validated data for subsequent on-line transmission to the mainframe

The modes which may be selected are as follows:

Mode	*Procedure selected*	
00	Validation and tabulation (equivalent to T3A3)	
01	Validation, tabulation and text merging	see note 3
02	Validation, tabulation and text merging (using a previously created text file)	see note 3
10	As mode 00, plus spooling validated input data to cassette	
11	As mode 01, plus spooling	
12	As mode 02, plus spooling	
*xy*1	As for mode *xy*, plus a listing of the control cards at the head of the tabulation	
2	This mode provides facilities for restarting a validation run after a failure. See section 4.1.3.2 for further details	

Notes:

1 In all modes, data cards failing validation checks may be either identified in the line printer tabulation, for subsequent re-submission at a later stage, or displayed on the console device for immediate correction by the operator. This is achieved by punching in column 26 of parameter card 3A (see section 4.1.11.4)

2 The spooled cassette contains only card images of cards which have satisfied the validation checks applied to them. Data cards containing fields which have failed validation checks are not transcribed to cassette. Note also that product and total fields, page headings, inserted text etc. are not transcribed to the spooled cassette; these appear only in the line printer tabulation

3 Modes 01 and 02 differ only in their source of text. For mode 01 a text cassette is created from text cards contained in the input card pack. The text cassette is rewound and merged with the following input data.

Mode 02 uses a text cassette previously created using mode 01. This will prove useful where the text to be merged remains unchanged from run to run but different input data is involved. Mode 01 should be used for the first run and mode 02 for subsequent runs

4 Since modes 11 and 12 involve the use of a spooled data cassette and a text cassette, a twin drive unit is required

4.1.3.1 Normal operation

The control cards are read by T3A4. Any control card rejected will be displayed on the console for correction by the operator. Alternatively the operator may choose to restart the program. Note that the user should always present an error free set of

control cards to T3A4 before proceeding further.

Cassettes required for text or data are requested and named according to the text or data file header cards. A text cassette is created from the text cards under modes 01 and 11.

T3A4 then proceeds to the main part of the program which is to read the data cards and list them on the line printer, performing validation and formatting as specified by the control cards.

Note that validation will only commence after receipt of a start validation control card.

Copying valid data to cassette and merging text information into the output listing is performed if specified by the mode of operation.

T3A4 terminates on detection of a TCP end card. The program produces a summary on the line printer and operator's console of the number of errors uncorrected and the sheet number of the last such error.

The program may be restarted by the operator to perform a further data validation run. This action is similar to initially starting the program; any mode of operation may be selected and a complete card pack is required. Validation will again only commence after receipt of a start validation control card. If an input spooling cassette has been created, the cassette file will be closed and made free but will remain operable and positioned at the end of the newly created file. A subsequent restart involving spooling will cause new data to be spooled behind the old. If this is not desirable the operator should unload the old spool cassette and force T3A4 to request a new scratch cassette for spooling.

4.1.3.2 Restarting a validation run

Facilities are provided to enable the input data spooling operation to be continued from any convenient point and so avoid lengthy reruns of the validation and spooling operation.

This is achieved by including restart control cards in the input card pack at points where restarts may be made. These are copied, along with data records, onto the spooling file on cassette.

Under mode 2 operation, a previously created input spooling cassette is read forwards and all header labels and restart points are listed on the console device. The program offers the user the option of restarting the validation and spooling process from any such point. If the option to restart is exercised the tape will be rewound over the header label or restart card image, ready for restarting under normal operation. The header label or restart card and data beyond the restart point will be effectively destroyed.

The program should be presented with a complete set of control and data cards. The overwritten restart card should be included

if the user wishes to record it on the cassette.

4.1.4 Validation options

The following validation checks can be applied, during the initial reading of each card prior to tabulation:

1 Field contains only numeric (0-9) or space characters

2 Field contains only alphabetic (A-Z) or space characters

3 Field contains only space characters, except on the first data card. The contents of the field on the first data card are copied into the same field on all subsequent card images

4 The contents of the field satisfy the check digit system modulus 10, with weighting factors 2 and 1 alternately from right to left

5 The contents of the field satisfy the check digit system modulus 11, with weighting factors 7, 6, 5, 4, 3, 2 from right to left

6 The contents of the field satisfy the user's own check digit system modulus 10 or 11, with weighting factors as specified on the check digit card (see section 4.1.13.1)

7 The contents of the field belong to a list of acceptable values as specified on the list cards (see section 4.1.13.2)

8 The contents of the field lie in the range as specified on the range check cards (see section 4.1.13.3)

4.1.5 Totalling options

The same numeric field on successive data cards may be specified to be summed, and the sub-total displayed in the tabulation. Up to ten numeric fields may be selected for totalling; however, fields so selected cannot also be selected for check digit processing.

Control of sub-total printout is achieved by selecting up to four fields, on the data cards, to act as *control fields* (but see note 2, below). Totalling of the selected numeric fields occurs when the value of a control fields changes between successive cards.

If two or more fields are selected as control fields, then the user assigns a relative level to them: level 1 (lowest) to level 4 (highest). If there is a change in the value of a higher level control field, then sub-totals for the lower levels are produced as well as for the higher level.

Display of the basic fields for totalling and the sub-totals themselves are always right justified though the original data on the cards may be left justified. The user must allow for expansion of the totals field in a leftward direction in the display.

The totals may be displayed as follows:

1 In the same print position as the basic field

2 Preceded by 'TOTALS FOR *x...x*' display, where *x...x* is the control field value

3 Offset to one side of the basic field position (see note 3)

4 After a defined line spacing for each level

Notes:

1 A numeric field selected for totalling cannot also be selected for check digit processing

2 If list checking is specified, only one level of totalling control field can be used

3 Print positions for the total fields can be specified for each level of control field. The print position used for level 2 totals can therefore be different from those used for level 1 totals, and so on

4 Sub-total values are not carried forward between separated groups of cards having the same control field value

4.1.6 Multiplication options

The product of two numeric fields on the data card may be displayed in the tabulation, on the same line as other data from the card.

The contents of the field used as the multiplier may be signed or unsigned (the multiplicand must be unsigned). The product may be treated as a data field for sub-totalling purposes.

Display of the product is always right justified, though the mulitplier and multiplicand may be left justified. The user must allow for expansion of the product field in a leftward direction in the display.

4.1.7 Tabulation options

The following general tabulation options apply:

1 Fields on data cards may be chosen to be non-printing, except those selected for totalling

2 The display position of a field may be anywhere on the line of print, with the exception that control fields as printed must be in ascending level (level 1 to level 4), left to right. All the print positions within one field (data or control) remain contiguous, and in the same sequence of appearance as on the data card

3 Printout of a field may be chosen to be suppressed if its value is the same as on the previous data card and there has been no intervening text, headers or totalling

4 The appropriate check digit may be calculated and added to the line printer tabulation

5 A comma may be inserted into numerical field displays in a position which provides a constant number of decimal places (as selected for that field). The user must allow for this in the output display

6 A defined line spacing may be made before printing data appropriate to a new control field value

4.1.8 Page heading options

'SHEET NO' and user-defined headings can be printed on all new sheets (pages or forms). It is also possible to prevent printing within the sheet boundary area.

4.1.9 Format of the input data cards

Data cards are regarded as being composed of a number of fields; each field occupying a group of contiguous columns. Only graphic characters may be punched on data cards in the code appropriate to that required by the mainframe system.

Fields to be checked for numeric content must be either left or right justified and may be signed or unsigned; a decimal point is not permitted.

A field declared as a signed numeric field should have either a space character or minus sign in the rightmost column of the field. The numeric content must be either left or right justified.

The contents of a field used as a multiplier may be signed or unsigned; the multiplicand, however, must be unsigned.

The minimum number of columns constituting a field depends on the chosen processing options as follows:

Option	*Minimum field*
Check digit check	Three columns
Partial prints suppression	Two columns
Other options	One column

NOTE THAT A SIMPLE NUMERIC FIELD (TYPE I) MUST BE UNSIGNED.

4.1.10 Format of the printed output

The format of the printout is as defined in parameter cards 2A, 2B, 2C and 3A (see section 4.1.11). Each sheet is numbered serially (unless card 3A specifies otherwise) and page headings appear as defined in the page heading cards (see section 4.1.13.4). If mode *xyl* is specified, the control cards will be listed at the head of the tabulation (see section 4.1.3).

Errors will be displayed in the output if error correction at the console has been waived. Procedure in the case of an error being found is as follows:

1 The paper is thrown to a new sheet

2 The invalid text or data card is printed, with errors indicated by the sign ! above each invalid character. This display is of the following form:

```
DATA ERROR 0005
LAST ERROR ON SHEET 4
       !
JOHN SM1TH
```

An invalid text card would be printed in a similar way, headed by the phrase TEXT ERROR *n*

3 The paper is thrown to a new sheet and printing recommences from the position on the format at which the invalid data would have been printed. This new sheet will include any usual page heading and will bear the same sheet number as the previous sheet, annotated with an asterisk.

At the end of the printout an error summary of the following form is printed:

```
0003 TEXT ERRORS
0006 DATA ERRORS
LAST ERROR ON SHEET 0015
```

The final line of this summary, in conjunction with the similar lines in the individual error statements, provides a convenient means of checking through every error in the data, from the last to the first

4.1.11 Format of parameter cards

The parameters required by the program are supplied to it by the first six cards of the input pack. These cards must all be present and in the correct sequence.

Card	*Purpose*
1A and 1B	Identify the positions of the field on the data cards
2A, 2B and 2C	Define the display position and the processes to be applied to the contents of each field
3A	Defines the format of the tabulation

4.1.11.1 Cards 1A and 1B

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 to 50	A string of alphanumeric identification characters (0 to 9, A to Z) defining the input data card format (see notes below)

Column number	*Content*
51 to 78	Not used
79 to 80	1A (for card 1A) or 1B (for card 1B)

Notes:

1 Columns 11 to 50 of card 1A and columns 11 to 50 of card 1B correspond respectively to columns 1 to 40 and 41 to 80 of the input data cards and are a mask of the position and size of the input data fields. All columns forming one field are punched with the same identification character.

The numbering of fields must be in the sequence required in the tabulated printout. 0 identifies all columns which together make the first (leftmost) field to appear in the printed display. 1 identifies the second field, and thereafter in the sequence 2,3,4,...,9,A,...Z. Gaps in sequence numbers are not permissible.

Unprinted fields should be allocated a higher sequence number than printed ones. Printed fields derived from offset subtotals or products should not be included in the above numbering scheme

2 A field which is to be suppressed if its value is the same as on the previous data card (see section 4.1.7, item 3) should be identified by an open parentheses in the column corresponding to the first column of the field, followed by the identification character in all other columns of the field

3 Control fields are allocated relative levels in the sequence in which they are printed (that is, first printed is the lowest level etc.)

4 A field may not be split either by unused columns or by another field

4.1.11.2 Cards 2A and 2B

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 to 60	Symbols, as specified in section 4.1.12, defining: 1 The print positions to be used for display of the basic data fields 2 The checks to be performed or the data displayed at these positions 3 The print positions to be used for subtotals and products
61 to 78	Not used
79 to 80	2A (for card 2A) or 2B (for card 2B)

4.1.11.3 Card 2C

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 to 42	As 11 to 60 of cards 2A and 2B
43 to 78	Symbols defining the processes to be applied to fields on the data cards that are not to be printed. Fields must be defined in the sequence of their identification codes used on cards 1A and 1B
79 to 80	2C

Notes:

1 The card columns of cards 2A, 2B and 2C correspond to print positions on the output display as follows:

Card columns	*Print positions*
11 to 60 of card 2A	1 to 50
11 to 60 of card 2B	51 to 100
11 to 42 of card 2C	101 to 132

2 If all the processes are defined in columns 43 to 78 of card 2C and none in the columns listed in note 1 above, then a tabulation will not be produced

4.1.11.4 Card 3A

Column number	*Content*
1 to 4	&&&&
5 and 6	22
7 to 10	Not used
11 to 12	The form length in lines if other than 66 lines
13	The line spacing if other than single line spacing
14	A code specifying the paper throw before printing subtotals, when the value of the lowest level control field changes (see note 1)
15 to 17	As column 14 but applying respectively to the three higher level control fields: level 2 to level 4 (see note 1)
18	A code specifying the paper throw before printing text following a change in the value of the lowest level control field (see note 1)

Column number	*Content*
19 to 21	As column 18 but applying respectively to the three higher control fields: level 2 to level 4 (see note 1)
22	A code specifying the paper throw before printing subsequent data, following a change in the value of the lowest level control field (see note 1)
23 to 25	As column 22 but applying respectively to the three higher level control fields: level 2 to level 4 (see note 1)
26	Any punching causes data cards containing errors to be displayed on the console
27	A blank column prevents printing taking place within three lines of the top or bottom of the sheet (page or form)
28	Any punching inhibits the printing of 'SHEET NO *n*' on all new sheets (pages or forms)
29	Any punching inhibits the printing of 'TEXT NO *x*' prior to the output of text for control field value *x*
30	Any punching inhibits the printing of 'TOTALS FOR *x*' when displaying subtotals for control field value *x*
31 to 32	The print line of the sheet or form to which paper is thrown when A is specified in any of the columns 14 to 25 (see note 1)
33 to 34	As for 31, 32 but applies for code B
35 to 36	As for 31, 32 but applies for code C
37 to 38	As for 31, 32 but applies for code D
39 to 78	Not used
79 and 80	3A

Notes:

1 The following characters may be punched in any of the columns 14 to 25 to specify the paper throw required:

Character	*Paper throw*
No punching	Single line spacing
0	Throw to top of next sheet
9	Throw to bottom line of current sheet
1 to 8	Throw the specified numbers of lines, with line spacing as defined in column 13 of card 3A

Character	*Paper throw*
Z	No paper throw (print on the same line)
A,B,C or D	Throw to the print line indicated in columns 31 to 38 of card 3A

4.1.12 Symbols specifying processing options

The symbols listed below are punched on cards 2A, 2B and 2C to specify the check or process to be applied to each field. The data field to which the check applies is derived from the sequence number given on card 1A or 1B, since the data fields are printed in ascending order of sequence numbers.

The symbols are punched in the card columns corresponding to the leftmost print position of the fields to which they refer (or punched starting in the leftmost print position for symbols consisting of more than one character).

4.1.12.1 Validation symbols

The following symbols are used to specify the validation checks to be performed on the input data fields.

A data field that is also to be used as a control field for totalling purposes is specified, when appropriate, by a different symbol, as shown in the second column of the table.

Symbol		*Processing option*
Data field	*Control field*	
I	C	Check for unsigned numeric content
~~I-~~		~~Check for signed numeric content~~
I,*n*	C,*n*	Check for unsigned numeric content, insert a comma in output display to provide *n* decimal places
I-,*n*		As I,*n* but with signed field
J	D	Check for alphabetic content
K	E	No check on content
T		Unsigned field to be totalled; check for numeric content (see note 1)
T-		Signed field to be totalled; check for numeric content (see note 1)
T,*n*		Unsigned field to be totalled; check for numeric content; insert a comma in output display to provide *n* decimal places in basic field and subsequent sub-totals for this field (see note 1)
T-,*n*		As T,*n* but with signed field (see note 1)

Symbol		*Processing option*
Data field	*Control field*	
B	A	Check data against list of acceptable values supplied on list card(s) (see note 2)
R		Check data is numeric, unsigned and contained within upper and lower range limits specified on range check cards (see note 1)
R-		As for R but with signed field (see note 1)
R,*n*		As for R but with a comma inserted in output display to give *n* decimal places (see note 1)
R-,*n*		As R,*n* but with signed field (see note 1)
L00	F00	Check against check digit system modulus 10
L10	F10	Check against check digit system modulus 11
L20	F20	Check against user's check digit system as specified on check digit card
L01	F01	Calculate and incorporate check digit modulus 10 into printed display
L11	F11	As L01 or F01 but using modulus 11
L21	F21	As L01 or F01 but using user's check digit system as specified on check digit card
Z		Check for blank in all columns and substitute data from corresponding field of the first data card in the pack. The field is also transcribed to the spooled data cassette

Notes:

1 A field consisting entirely of spaces is an acceptable value for a field to be totalled or range checked and is interpreted as meaning zero in the totalling process or range check

2 Only one list symbol (A or B) is allowed per validation run. When listing is specified, totalling facilities are limited to one control field

3 Columns 43 to 78 of card 2C must not contain symbols implying printing, that is, those specifying multiplication, totalling and the provision of decimal places. Only the following symbols are therefore permissible:

I	C	B	A
I-	C-	R	R-
J	D	FxO	LxO
K	E	Z	

4.1.12.2 Multiplication symbols

The following symbols are used to specify the print positions of products in the tabulated display. A product field to be totalled is specified by using the symbols shown in the second column.

Symbol		*Processing option*
Multiply only	*Multiply and total*	
M*pq*	N*pq*	Multiply field *p* by field *q* and print product here. *p* and *q* are the sequence numbers of input data fields as defined on cards 1A and 1B. The contents of fields *p* and *q* are checked for numeric content and justification. Both must be unsigned
M*pq-*	N*pq-*	As above but with a signed multiplier *q*. Multiplicand *p* must be unsigned
M*pq,n*	N*pq,n*	As M*pq* and N*pq* but with a comma inserted in the output display to provide *n* decimal places in the product and subsequent sub-totals (if any)
M*pq-,n*	N*pq-,n*	As M*pq,n* and N*pq,n* but with a signed multiplier *q*. Multiplicand *p* must be unsigned

Notes:

1 The symbol M (or N) must be punched in the column corresponding to the print position of the most significant digit of the product when the multiplicand *p* is 1 and the multiplier *q* is maximum. When *q* is a very short field, the print positions corresponding to -,*n* may be utilised for leftwards overflow from an adjacent totalling or product field

2 The basic field of a signed multiplier must be specified as an unchecked field

3 A field consisting entirely of spaces is an acceptable value for field *p* or field *q* and is interpreted as meaning zero

4.1.12.3 Totalling symbols

The following symbols are used to specify the print positions of sub-totals in the tabulated display.

The symbols are required only if the subtotals are to be offset. If the symbols are omitted then the sub-totals appear under their basic field print positions.

Symbol	*Processing option*
T1	Selection of print position for a subtotal when the value of the lowest level control field changes. When two or more fields are selected for totalling then the sequence of print positions must be in the same sequence as the print positions of the basic data fields
T2 T3 T4	As T1 above but applied respectively to subtotals for the three higher level control fields

Notes:

1 If one sub-total for one level is offset then all sub-totals for that level must be offset

2 If a level is not selected for offset display then the subtotals for that level will appear in the print positions used for the next lower level

4.1.13 Format of other control cards

4.1.13.1 Check digit card

This card is required if checking or generating of the user's check digit system is specified on cards 2A, 2B or 2C.

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 to 78	$m\ w_1\ w_2\ \ldots\ldots\ w_n$ where m is the modulus of the user's check digit system (10 or 11) w_1 ... w_2 are the weights used (must be less than the modulus) separated from each other and the modulus by single spaces
79 to 80	CC

Weight w_n applies to the least significant digit (excluding the check digit), and w_n-1, ..., w_2,w_1 respectively apply to the next n-1 digits in ascending order of significance. If there are more than n digits in the number, the weights are repeated, from w_n onwards in the same order.

Example

If columns 11 to 78 contain 11 7 6 5 4 3 2 and the program is calculating a check digit for 70546931, the process is as follows:

```
  7   0   5   4   6   9   3   1
× 3 × 2 × 7 × 6 × 5 × 4 × 3 × 2
 21 + 0 +35 +24 +30 +36 + 9 + 2      = 157 ÷ 11 = 14, remainder 3
```

Therefore check digit = 11 - 3 = 8.

4.1.13.2 List cards

List cards are required if list checking is specified (symbols A or B) on cards 2A, 2B or 2C

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 (first card)	User specified item separator
12 (first card)	User specified end of list symbol
13 to 77 (first card), or 11 to 77 (other cards)	List items separated by item separator symbol and terminated by an end of list symbol
78	Not used
79 to 80	LL

Notes:

1 List items are space filled up to the length of the data field to be checked, as given on cards 1A or 1B

2 The maximum list length is 420 characters so that if the data field to be checked is *x* characters long, the number of list items allowed is 420 ÷ *x*

3 The contents of column 78 are not checked by the TCP but may be used for a user's sequence number, as in the example below

Example

```
Card 1:   &&&&22    ,←AUSTIN,FORD,VAUXHALL,...,CITR1LL
Card 2:   &&&&22    OEN,SKODA,...,SAAB←            2LL
```

4.1.13.3 Range check cards

Four range check cards are required if range checking is specified on cards 2A, 2B or 2C.

The range check cards are numbered 1U, 2U, 1L, 2L in that order. Cards 1U and 2U define the upper range limits, while 1L and 2L define the lower range limits.

Any number of data fields can be checked for range on one run.

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 to 50	Data providing upper (cards 1U and 2U) and lower (1L and 2L) limits for data on data cards. The limits are included in the allowed range of values. Columns 11 to 50 of 1U, 1L correspond to columns 1 to 40 of the data cards. Columns 11 to 50 of 2U, 2L correspond to columns 41 to 80 of the data cards
51 to 70	Not used
77 to 78	1U, 2U, 1L or 2L
79 to 80	RR

4.1.13.4 Page heading cards

These cards are optional and specify a heading message to be printed at the top of each sheet of the printout.

Column number	*Content*
1 to 4	&&&&
5 to 6	22
11 to 77	Page heading text (see note 1)
78	Not used
79 to 80	PP

Notes:

1 The following characters have special significance in page heading text and should not be used for any other purpose:

- ↑ Newline
- * Horizontal tabulation (followed by a two digit decimal number giving the spacing required)
- ← End of page heading

2 There are the following restrictions on page heading cards:

- (a) There must be no more than three cards
- (b) There must be no more than 200 characters on the cards
- (c) There must be no more than 132 print positions required per print line

If the heading contains horizontal tabulation commands for more than 63 positions, the 200 character limit is reduced by three characters for each tabulation command

4.1.13.5 Text file header card

This card provides a file identifier for the text cassette created when running under modes 01 or 11.

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 to 31	***filename***
32 to 78	Not used
79 to 80	TT

filename is the 17 character file identifier given to the created file.

4.1.13.6 Data file header card

This card provides a file identifier for the data cassette created under modes 10, 11 and 12.

Column number	*Content*
1 to 4	&&&&
5 to 6	22
7 to 10	Not used
11 to 26	***filename***
27 to 78	Not used
79 to 80	Not used (must be blank)

filename is the last 12 characters of the file identifier. The characters ISCRV are prefixed to *filename* by the TCP to identify the file as an input spooling file.

4.1.13.7 Text cards

Text cards are used under modes 01 and 11 to create a text file on cassette. The text is subsequently merged into the data in the output listing when control field values match, text being printed before data.

Column number	*Content*
1 to *n*	Control field values (highest level first)
n+1 to 77	Text detail
79 to 80	TT

Notes:

1 The following characters have special significance in the text and should not be used for any other purpose:

↑ New line

* Horizontal tabulation (followed by a two digit decimal number giving the spacing required)

← End of text

2 During merging, any text with no matching data will be ignored. However, if text is always to be printed, this can be achieved by specifying all spaces as the value of one or more of the fields which together constitute the control field value of the text information

4.1.13.8 Start validation control card

All input following this card will be validated according to the parameter card specification until a stop validation control card or TCP end card is read.

Column number	*Content*
1 to 4	&&&&
5 to 6	20
7 to 80	Not used

4.1.13.9 Restart control card

This card is used to specify suitable restart points for spooling, in the input data stream (see section 4.1.3.2).

Column number	*Content*
1 to 4	&&&&
5 to 6	24
7 to 10	Not used
11 to 20	User's identification for the restart point
21 to 80	Not used

4.1.13.10 Stop validation control card

All input data following this card will be listed and spooled without any validation taking place, until a start validation card is received.

Column number	*Content*
1 to 4	&&&&
5 to 6	21
7 to 80	Not used

4.1.13.11 TCP end card

This card causes T3A4 to close all files, reset all devices and provide a summary of uncorrected errors. The program then terminates and awaits activation to perform a further validation job.

Column number	*Content*
1 to 4	&&&&
5 to 80	Not used

4.2 Program T3A3

Program T3A3 is identical to program T3A4 with the exception that spooling and text merging facilities are not provided. The following sections outline the differences from T3A4.

4.2.1 Store and peripheral requirements

Program T3A3 requires 24K bytes of store, a control console, a card reader and a line printer. A magnetic tape cassette unit is required for program loading only.

4.2.2 Input to the program

File header card, text cards and restart cards are not required. The following reduced card pack is used when running T3A3:

1 Six parameter cards

2 Check digit card

3 List cards

4 Four range check cards

5 Page heading cards

6 Data cards not to be validated

7 Start validation control card

8 Data cards to be validated

9 Stop validation control card

10 TCP end card

4.2.3 Mode of operation

The mode of operation is equivalent to running T3A4 under mode 00 and provides:

1 Validation of the input data according to the parameters supplied on the control cards at the head of the pack

2 Tabulation of the results on the line printer as specified by the control card parameters

4.2.4 Card formats

The formats of all cards used are as described for T3A4 (sections 4.1.9 and 4.1.11 to 4.1.13) with the exception that columns 18 to 21 and column 29 of card 3A, which relate to text insertion, are not used for program T3A3.

This chapter describes the facilities provided by 7500 video systems that enable a mainframe user program to control the operation of the video terminals and hard copy printers.

In addition to the general video facilities described in section 5.1 the following principal facilities additional to those on 7181/2 video systems are provided:

1 Screen validation

2 Hard copy formatting

3 Direct output to hard copy printers

The screen validation facility also provides additional screen controls over those provided by 7181/2 systems.

The Terminal Control Programs that provide these additional facilities and the store sizes required to hold these TCPs are described in Chapter 3. Information on the hardware characteristics of the video terminals and hard copy printers is given in Chapter 2.

5.1 General 7561/1 Video Terminal facilities

5.1.1 Display characteristics

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The character set and codes applicable to the 7561/1 Video Terminal are given in Appendix 2. The characters are represented in ISO 7-bit code as transmitted along the line. The translations to the internal code of the mainframe are described in the appropriate mainframe communications software publications.

Where reference is made in this chapter to a code it is given as two decimal numbers, the first representing the most significant three bits and the second representing the least significant four bits, for example:

Character	*Code*	*Representation*
2	0110010	3/2
B	1000010	4/2
ESCAPE	0011011	1/11

For clarity, the control codes are represented by their appropriate mnemonics surrounded by angular brackets, for example code 1/11 is given as <ESC> and code 1/4 as <DC4>.

In addition to the displayable characters given in the table in Appendix 2, the following characters are also represented on the display screen:

Character	*Meaning*	*Use*
‾ _	Cursor	Underlines and overlines the position at which the next character typed will be entered. During typing the cursor moves to the next display position in sequence. *Line wrap around* occurs when the cursor reaches the last position on a line, that is, the cursor moves to column 0 of the next line. *Frame wrap around* occurs when the cursor reaches the last position on the screen, that is, the cursor moves to line 0, column 0. The cursor may be repositioned to any display position on the screen by the operator or by the central system. Note that the cursor does not occupy a display position
|	Start of message (SOM)	The SOM marker appears to the immediate left of the start of message position and identifies the beginning of an input message to the central system, The SOM marker does not occupy a display position
└	Start unprotected field	Indicates the start of a field into which the operator can type variable data (see section 5.1.2)
┘	Start protected field	Indicates the start of a fixed data field sent from the central system (see section 5.1.2)
■	Undisplayable code	Indicates that an undisplay-able code has been received for this display position. The invalid character is translated to <SUB>
⋮ ⋮ ⋮	Error character	Indicates that a character with a parity error has been received for this display position. The character is translated as <DEL>

Character	*Meaning*	*Use*
⌐	Newline	Inserted at the current cursor position when the operator presses the NEWLINE key. The remainder of the unprotected fields to the right of the newline symbol are erased to spaces and the cursor is moved to column 0 of the next line. The operator is prevented from entering data between the newline symbol and the end of the line. The newline symbol is not protected and may be overwritten by the operator. The symbol is stored as <NL>
_	Special underline	Used as an alternative to the space character when the screen editing functions are used (see section 5.2.2.1)

5.1.2 Protected and unprotected fields

Data displayed on the screen can be grouped together into fields; each field being a string of characters related to each other and stored in contiguous display positions. The fields may be one of two types: either *protected data fields* or *unprotected data fields*.

Protected data fields are those which are sent from the mainframe applications program to the video terminal and consist of fixed data, such as table headings forming a *template*.

The operator is allowed to insert or alter data only in unprotected fields on the screen. Such data is termed variable data. The operator can position the cursor in protected fields but if an attempt is made to type a character the keyboard is locked and the audible alarm sounded. The keyboard remains in this state until the operator presses the INTERLOCK key. The whole screen can, however be cleared by the operator by a Clear Screen operation (but see section 5.2.2).

Subject to the overall limit of screen capacity, any number of protected and unprotected fields of any length may be displayed.

Protected and unprotected fields may be steady or flashing (at two cycles/sec).

The characters used to define the start of protected and unprotected fields are as follows:

Character code	*Symbol displayed*	*Meaning*
1/1 (DC1)	⌟	Start protected steady field
1/2 (DC2)	⌟	Start protected flashing field
1/3 (DC3)	⌞	Start unprotected flashing field
1/4 (DC4)	⌞	Start unprotected steady field

The start field characters are themselves considered as protected data and cannot be overwritten by the operator.

The start field characters are used not only to distinguish between fields but also to separate like fields, for example an unprotected field can be followed immediately by another unprotected field, headed by a similar start field character.

Notes:

1 To improve legibility, it is recommended that a space is used as the last character of each protected field

2 Where use is made of the 7500 screen validation facilities it is recommended that <DC3> (start unprotected flashing field) is not used (see section 5.2.1) EXCEPT TO INDICATE AN ERROR (FOR EXAMPLE, WHERE A FIELD PASSES TERMINAL VALIDATION BUT IS REJECTED BY THE MAINFRAME APPLICATIONS PROGRAM)

5.1.3 Output from the central system to the video terminals

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The control sequences, if used, must appear in the following order within a message:

<STX>*abcd*<ETX>

where

a is a clear screen or rack up command

b is a set screen control mode and/or hard copy formatting program. (These facilities are only available with a TCP supporting screen validation and hard copy formatting respectively: see sections 5.2.2 and 5.3.1)

c is a display data (including validation parameters when the screen validation facilities are used: see section 5.2)

d is a set local output mode, set send mode or <BEL> command. (The use of set send mode by user program is exceptional)

5.1.3.1 Clear screen

Clear screen is achieved by including either of the following control sequences in the correct position within the output messages:

<ESC>3/5 or <ESC>4/0

The control sequence should be followed by 24 <SYN> characters to allow time for completion of the operation.

The sequence causes the entire screen to be cleared to spaces and repositions the cursor and SOM marker to line 0 column 0. The sequence is not stored or displayed.

For the additional effect on screen validation parameters and/or hard copy formatting parameters when these facilities are used see sections 5.2 and 5.3.1.1.

Clear screen may also be achieved by the operator keying CLEAR SCREEN with INTERLOCK.

5.1.3.2 Rack up

Rack up is achieved by including the following sequence in the correct position within the output message:

<ESC>3/7

The control sequence should be followed by 24 <SYN> characters to allow time for completion of the operation.

The sequence causes the entire screen contents, including fields and their delimiters, to be moved two lines up the screen. The current top two lines, including field delimiters are lost and the vacated bottom two lines are replaced by spaces (but see also section 5.2.1.2, note 3). The cursor and SOM marker do not move with the text but retain their position relative to the screen. The sequence is not stored or displayed.

5.1.3.3 Cursor control

Data is inserted on the screen beginning at the current cursor position. In the absence of any cursor positioning information in the text of an output message, the text will be displayed commencing at the position set at the end of the previous transaction (normally the position immediately following the last character inserted by the operator), line and frame wrap around occurring automatically.

The cursor may be repositioned at any location on the screen by including the following control sequence in the text of an output message:

<VT>*y*<HT>*x*

where

y is the line number +32 of the new cursor position
x is the column number +32 of the new cursor position

The new cursor position is relative to the beginning of the screen (that is line 0, column 0), for example <VT>2/5<HT>3/9 positions the cursor at line 5 column 25.

y must be in the range 2/0 to 2/11 on 12 line displays or 2/0 to 3/8 on 25 line displays. *x* must be in the range 2/0 to 6/15. Invalid qualifiers are not actioned.

For movement along one axis only, either sequence <VT>*y* or <HT>*x* may be sent alone. The two character sequence <VT>*y* or

<HT>*x* must be followed by four <SYN> characters. For movement along both axes, the sequence <VT>*y*<HT>*x* must be followed by two <SYN> characters.

Data on the screen is unchanged by cursor positioning. The control sequence is not stored or displayed.

Cursor positioning may also be achieved by the operator using the cursor control keys.

5.1.3.4 SOM positioning

The start of message position must normally be defined by the central system in the output text, prior to the operator inserting data. This is achieved by including the following sequence in the text of an output message:

<ESC>3/6

The control sequence causes the SOM marker to be moved to the immediate left of the current cursor position.

The SOM position can also be changed by the central system sending a clear screen control sequence and by the operator keying CLEAR SCREEN and INTERLOCK or SOM and INTERLOCK. The latter operation can be inhibited when the addition screen controls provided by the screen validation facility are used.

5.1.3.5 Newline

The single character code <NL> sent at any position in the text of an output message causes the remainder of the line, from and including the current cursor position, to be erased to spaces, and the cursor to be repositioned to column 0 of the next line. Frame wrap around occurs if necessary.

The facility is provided so that the transmission of redundant data is avoided, where possible. The newline code <NL> is not stored or displayed (compare with NEWLINE operation by the terminal operator, section 5.1.1).

5.1.3.6 Audible alarm

The single character code <BEL>, received in the correct position in an output message, causes the audible alarm to sound until reset by the operator pressing the INTERLOCK key.

The audible alarm is also sounded under the following conditions:

1 If an attempt is made to type a character into a protected field

2 When using the screen validation facility, if a validation error is detected (see section 5.2)

3 If the power is on at the video terminal but the program module controlling it is not loaded in the terminal processor

5.1.3.7 Summary of video terminal control sequences

The following list summarises the control sequences relevant to 7561/1 video terminals. Where applicable, the effects on validation parameters, print formatting parameters and screen control modes, used with screen validation and hard copy formatting facilities, are also given. Further details are given in sections 5.2 and 5.3.1.

Sequence	*Interpretation*
<ESC>3/1	Set receive mode
<ESC>3/2	Set local output mode
<ESC>3/4	Set send mode
<ESC>3/5	Clear screen, ~~reset~~ validation parameters, screen control modes and print formatting parameters
<ESC>3/6	Set start of message (SOM)
<ESC>3/7	Rack up
<ESC>4/0	Clear screen and reset validation parameters only (NOT THE FORMATTING PARAMETERS AND SCREEN CONTROL CODES)
<ESC>4/1	Reset screen control modes and print formatting parameters and inhibit validation. This control sequence is not implemented until either the operator presses the INTERLOCK and CLEAR SCREEN key or another control sequence is received (apart from a repeat of <ESC>4/1)
<ESC>4/3	Set screen control mode (next character is mode character)
<ESC>4/4	Set print formatting parameters (immediately followed by format program)
<ESC>4/5	End of format program

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5.1.4 Input from the video terminals to the central system

The operator inputs data to the video terminal by first moving the cursor to the required position and then depressing the required keys. This causes the corresponding symbols to be displayed in the selected positions, so overwriting any existing information. The cursor moves across and down the screen accordingly.

When the typing of data is completed, the SEND key is depressed to allow the message to be input to the central system in response to the issue of a polling message. (Exceptionally, data may be sent to the central system by output of a message from the central system containing a set send mode control sequence.)

The start and end of the transmitted text are defined by the SOM marker and the character position immediately preceding the cursor position at the time the SEND key is depressed. Within the SOM/cursor limits only unprotected data is transmitted, to save transmission time.

Although the character defining the start of unprotected fields (<DC3> and <DC4>) are considered as protected data, they are still transmitted from the video terminal to the central system together with the unprotected data. This allows the central system to distinguish between each field.

The remainder of a line following a NEWLINE symbol inserted by the operator is not transmitted. All other characters are transmitted as stored except that <DEL> is translated to <SUB>.

Line 0 column 0 is assumed to be the first character of an unprotected field unless a start protected field character (<DC1> or <DC2>) appears in that position or unless on transmission to the central system frame wrap around occurs. The latter occurs when the SOM is further down the screen than the cursor and in this case the beginning of screen is assumed to be of the same field type as the last character on the screen.

The SOM position and cursor position are not changed by an input transmission.

If a video terminal is fitted with a key reader all messages transmitted to the central system are immediately preceded by identification data. The input message format is of the following form:

<STX>*it*<ETX>

where

i is the key reader identification data

t is the text of the input message

When a pen is present in the key reader, the identification data is as follows:

<IS4>*ddd*<IS4>

where *ddd* is the three digit identifier encoded on the pen (leading zeros retained).

If no pen is present the number *ddd* does not appear and the identification data consists only of the following:

<IS4><IS4>

5.1.4.1 Action messages

No specific keys are provided on the keyboard as action keys but, when in type mode, operation of any alphanumeric or numeric key in conjunction with the CONTROL key is treated as an action key and causes a message in the following format to be sent to the central system:

<STX>*i*<ESC>*n*<ETX>

where

i is the key reader identification data (if a key reader is fitted)

n is the code of the alphanumeric or numeric key pressed

Unlike 7181/2 videos, the action message can be re-polled if necessary.

Data on the screen is not changed by transmission of an action message.

5.2 Screen validation

The principal feature of 7500 screen validation is that it is performed at the terminal, before transmission. This saves operator time, line time in only sending correct data down the line, and saves the central system processing time that would have been required to validate the data.

The following validation checks are available:

1 Check alphabetic (characters A to Z, with or without space being valid) AND NEWLINE

2 Check alphanumeric (characters A to Z, 0 to 9, with or without space being valid) AND NEWLINE

3 Check numeric (characters 0 to 9) AND NEWLINE

4 Check integer against check digit system modulus 10, weights 1. A field of all spaces is acceptable (see also section 5.2.1.1, note 4)

5 Check integer against check digit system modulus 11, weights 1. A field of all spaces is acceptable (see also section 5.2.1.1, note 4)

6 Check integer against check digit system modulus 10, weights 1 and 3 alternately from right to left. A field of all spaces is acceptable (see also section 5.2.1.1, note 4)

7 Check integer against check digit system modulus 11, weights 1, 2, 3, 4, ..., 10, 1, 2, ... etc. from right to left. A field of all spaces is acceptable (see also section 5.2.1.1, note 4)

8 Check integer against check digit system modulus 10, weights 1 and 2 alternately from right to left. In this system, if the product of a digit and its weight is 10 or more than 1 is added to the total. A field of all spaces is acceptable (see also section 5.2.1.1, note 4)

9 Check integer (characters 0 to 9 with optional leading and trailing spaces)

10 Check pure numeric (characters 0 to 9 including a mandatory decimal point: optional leading and trailing spaces)

11 Check full numeric (optional leading spaces, followed by an optional + or -, followed by character 0 to 9 including an optional decimal point, followed by optional trailing spaces)

12 Check total. This may be achieved with any of the three foregoing numeric checks. The totalled fields are added

into an accumulator and the total field on the screen compared with the total in the accumulator. After this comparison the accumulator is cleared

Validation can be performed on every unprotected field and is carried out on the following occasions:

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1 Whenever the operator has finished typing a field requiring validation, and presses the TAB key

2 Whenever the operator has finished typing a message and presses the SEND key

3 Whenever the operator has finished typing a message and presses the PRINT key

The validation is carried out on all three occasions irrespective of whether some or all of the fields have been previously validated. Note that a set send or set local output command from the central system does not initiate screen validation.

Validation may be inhibited so that invalid data can be forced into an input message. This is done by setting bit 2^2 of the mode character (see section 5.2.2.1).

The validation process is governed by parameters transmitted from the central system to the video terminal. The validation specified by these parameters applies only to the specified fields subsequently entered on that particular video terminal. The validation checks will be applied to all such subsequent entries on that video until the validation parameters are reset by one of the following events:

1 A new TCP is loaded

2 The operator presses the keys CLEAR SCREEN and INTERLOCK

3 A clear screen message is received from the central system. This message may be either <ESC>3/5 or <ESC>4/0. (The former resets all validation and print formatting parameters and screen control modes; the latter resets only the validation parameters; see section 5.4)

Validation may also be inhibited by an <ESC>4/1 message from the central system. This message resets the screen control modes and print formatting parameters but does not clear the screen or reset validation parameters.

Note: If a start of unprotected field marker is overwritten by output from the central system, the validation may be changed for that field and subsequent fields on that screen.

If, during validation, no errors are detected then TAB, SEND or PRINT is executed normally.

If any error is detected then TAB, SEND or PRINT are not implemented and the following actions are taken:

1 The audible alarm is sounded and all key depressions are ignored until the INTERLOCK key is pressed

2 All characters detected as being in error are set flashing and remain in that state until the field is revalidated. Errors not attributable to a single character (for example, check digit error) are indicated by flashing of all characters in that field

3 After TAB, the cursor is positioned over the first error character in the field. If several errors are indicated repeated sequences of TAB, INTERLOCK, correct error, will successively position the cursor over each error in that field.

After SEND or PRINT the cursor is positioned over the first error on the screen. Correction of each field is then as described above. Totalling errors are indicated by flashing the totals field only

It is recommended that the diagnostic message option of the mode character (see sections 5.2.1.2 and 5.2.2.1), is used in conjunction with validation. The message, commencing with a start protected steady field characters, appears on the last line of the video screen.

5.2.1 Specifying validation

The validation type for a particular unprotected field is specified by transmitting an additional character which follows a special start unprotected field character for that field within an otherwise normal message from the central system to the video terminal. Thus, when validation is required for a field the sequence:

<IS4>*q*

should precede the field rather than the normal <DC4> character.

q is the character specifying validation and is made up as follows:

Bits	*Meaning*
1 to 5 (2^0 to 2^4)	Validation type code (see section 5.2.1.1)
6 (2^5)	0 always
7 (2^6	1 always

The character *q* corresponds exactly to the bit pattern which is transmitted down the line and must be generated at the central system from the mainframe's own internal code.

Before input to the central system the sequence <IS4>*q* is translated to a <DC4> character.

If validation is not to be specified for a field, either a <DC3> or <DC4> character can be used. However, it is recommended that <DC3> (start unprotected flashing field) should not be used when any validation is to be performed on the screen. This would lead to confusion between flashing fields when errors are detected.

5.2.1.1 Validation codes

The codes (*q*) to specify the various types of validation are given in the following table:

q in ISO 7-bit code	*Bits 2^0 to 2^4 of q in decimal*	*Validation*
4/0	0	None
4/1	1	Blanked: no validation (see note 3)
4/2	2	Check alphabetic
4/3	3	Check alphanumeric
4/4	4	Check alphabetic or space
4/5	5	Check alphanumeric or space
4/6	6	Check numeric
4/7	7	Check integer against check digit system modulus 10, weights 1 (see note 4)
4/8	8	Check integer against check digit system modulus 11, weights 1 (see notes 4 and 5)
4/9	9	Check integer against check digit system modulus 10 weights 1, 3 alternately from right to left (see note 4)
4/10	10	Check integer against check digit system modulus 11, weights 1, 2, 3, .. 9, 10, 1 etc. from right to left (see notes 4 and 5)
4/11	11	Check integer against check digit system modulus 10, weights 1, 2 alternately from right to left. If the product of a digit and its weight is 10 or more then 1 is added to the total (see note 4)
4/12	12	Check integer
4/13	13	Check pure numeric
4/14	14	Check full numeric
4/15	15	Check integer and add into accumulator
5/0	16	Check pure numeric and add into accumulator

q in ISO 7-bit code	*Bits 2^0 to 2^4 of q in decimal*	*Validation*
5/1	17	Check full numeric and add into accumulator
5/2	18	Check integer and compare with and clear accumulator
5/3	19	Check pure numeric and compare with and clear accumulator
5/4	20	Check full numeric and compare with and clear accumulator
5/5 to 5/15	21-31	Not used (no validation)

Notes:

1 If unrecognised validation type codes are received at the 7500 MTP no validation is carried out on the associated field and no error is reported back to the central system

2 The character *q* does not occupy or imply a character position on the screen

3 The code 4/1 does not specify a validation type; it specifies that the characters keyed into the field to which it refers will not be displayed on the screen, though they will be transmitted to the central system. This code can be used for fields containing passwords or other security information

4 Integers for check digit validation can be positioned anywhere in the relevant field, leading and/or trailing spaces being valid. Weights are applied from the least significant digit entered, so that the field is effectively right justified internally (but not on the screen).

The check digit validation types will accept fields of all spaces

5.2.1.2 Validation error messages

The screen validation facility includes an option for diagnostic messages to be displayed when errors are found during validation. This option is selected by setting bit 2^1 of the mode character (see section 5.2.2.1).

The diagnostic messages appear on the bottom line of the screen and have the following format:

␣***FIELD TYPE=*fieldtype****ERROR=*error*

fieldtype is one of the following:

ALPHABETIC NO SPACE
ALPHABETIC OR SPACE
ALPHANUMERIC NO SPACE
ALPHANUMERIC OR SPACE
NUMERIC
INTEGER
PURE NUMERIC
FULL NUMERIC

error is one of the following:

CHARACTER INVALID
DECIMAL POINT REQUIRED
CHECK DIGIT ERROR
CHECK TOTAL ERROR
TOO MANY DIGITS
ACCUMULATOR OVERFLOW

A diagnostic message is cleared when the next error-free validation occurs. The bottom line of the screen is then cleared to protected spaces.

Notes:

1 Diagnostic messages commence with a start protected field character (<DC1>, displayed as ⌊) and are thus protected data

2 If the diagnostic option has been selected, a diagnostic message will overwrite any protected or unprotected data on the bottom line of the screen

3 If the diagnostic option has been selected, a rack up command will not affect the bottom line of the screen (whether this contains a diagnostic message or not). Thus the contents of the screen, excluding the bottom line, is moved up two lines, creating two clear lines directly above the bottom line

5.2.2 Control of the screen by the central system

The screen validation facilities also include provision for the central system to vary the mode of operation of the video terminal. The central system can control or enable any or all of the following aspects of operation:

1 Movement by the operator of the start of message (SOM) marker

2 Inclusion of validation error messages

3 Forcing of invalid data fields into an input message to the central system

4 Insertion of underlines in unprotected fields when the screen editing functions DELETE, INSERT, ERASE LINE and ERASE MESSAGE are used

5.2.2.1 Specifying modes of operation

To control the mode of operation of the video terminal, the central system transmits the following control sequence at the start of an output message to an individual video terminal:

<ESC>4/3*b*

where *b* is a 7-bit *mode character* specifying the mode of operation.

The mode character *b* is bit significant as follows:

Bit	*Effect when set*
2^0	Inhibits the operator from using the SOM key to move the SOM marker
2^1	Reserves bottom line of screen for display of validation error message (see section 5.2.1.2)
2^2	Allows operator to force invalid data fields into an input message (see note 1)
2^3	Reserved. Must be zero
2^4	Causes special underline characters to be inserted in unprotected fields when the screen editing functions DELETE, INSERT, ERASE LINE and ERASE MESSAGE are used. An underline inserted in this way in any position is removed when a character is inserted in that position. If the TAB key is pressed before a field is full, the remaining underline characters in that field are clared to spaces. Underlines not cleared when the SEND key is pressed are transmitted as spaces
2^5	Reserved. Must be zero
2^6	Must be 1

Notes:

1 To transmit invalid data when bit 2^2 is set, the operator should press the CONTROL key with the SEND key, instead of the SEND key on its own. No validation will take place.

Invalid fields thus forced are indicated by a <CAN> character following the <DC4> sent to the mainframe program for that field. Thus an invalid field *abcd* sent in this way would appear in the mainframe as <DC4><CAN>*abcd*

2 As in the case of the validation character, the mode character must be generated at the central system from the mainframe's own internal code

3 INITIALLY (AND WHEN RESET BY <ESC>3/5 OR <ESC>4/1, THE MODE CHARACTER HAS A SETTING AS FOLLOWS:

BITS 2^0 TO 2^5 = 0
BIT 2^6 = 1

5.2.2.2 Clearing a mode character

As mentioned previously, a mode character affects the current and all subsequent messages sent from the central system to the video terminal concerned, until the mode character is cleared.

It is cleared when any of the following occurs:

1 A new mode character is sent

2 A new TCP is loaded

3 The central system transmits the Clear Screen sequence <ESC>3/5

4 The operator presses the INTERLOCK and CLEAR SCREEN keys

5 The central system transmits a special resetting sequence <ESC>4/1. THE SEQUENCE ALLOWS A MAINFRAME APPLICATION PROGRAM TO RESET THE TERMINAL TO FUNCTION LIKE A 7181/2 SYSTEM.

5.3 Hard copy output

A hard copy of data on a video screen can be initiated in one of two ways:

1 By the terminal operator pressing the PRINT key

2 By the central system including the sequence <ESC>3/2 in the output message to the video terminal

In both cases the area of the screen read for printing is from the SOM marker up to the character before the current cursor position, and includes both protected and unprotected fields. Movement of either the SOM marker or the cursor by the operator or central system during local hard copy output will have unpredictable results on the output.

Once hard copy output has been initiated the video terminal is locked in local mode until local printing is finished. Thus the contents of the screen cannot be altered until printing is complete except:

1 By the operator pressing the INTERLOCK key and so setting *type mode*

2 By the central system sending a message to the video terminal which is prefixed by SET RECEIVE, <ESC>3/1

If the hard copy printer is inoperable or no hard copy printer is available then the LOCAL ERROR indicator on the VT is illuminated. The error condition is not reported to the central system, regardless of the method of initiation of the local hard copy (that is, whether by the operator pressing the PRINT key or by the central system sending <ESC>3/2). The error condition is cleared by the operator pressing the INTERLOCK key.

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5.3.1 Hard copy formatting

Unless otherwise specified, hard copy output is in the same format as the screen. To specify another format, the additional formatting facilities are used.

As in the case of screen validation the print formatting facilities are under the direct control of the central system.

The following formatting options are available:

1 Omission of selected fields

2 Printing of the video terminal number

3 Insertion of spaces or blank lines

4 Insertion of text sent from central system

5 Repetition of format types for different fields

6(α) Setting of a condition flag ~~to inhibit printing~~ of a field starting with a specified character string

(ℓ) SELECTIVE PRINTING OF THE CURRENT AND SUBSEQUENT FIELDS DEPENDING ON THE SETTING OF THE CONDITION FLAG.

5.3.1.1 Specifying hard copy formatting

To specify the print format, the central system transmits the following character sequence to the video terminal (as all or part of a message; see section 5.1.3):

<ESC>4/4*p*<ESC>4/5

p is a character sequence that defines the format required and is called the *format program* (see section 5.3.1.2).

This will apply to all subsequent hard copy until one of the following occurs:

1 Another format is specified

2 The operator presses the keys CLEAR SCREEN and INTERLOCK

3 A reset message is received from the central system. This may either be <ESC>3/5 (reset validation and print formatting parameters and screen control modes) or <ESC>4/1 (reset screen control modes and print formatting parameters)

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5.3.1.2 Formatting codes

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The characters used to define a print format program are the ISO transmission codes 2/0 to 7/15 and the control code <DC1>. The graphic codes 6/0 to 7/15 are interpreted either as format instructions or, following certain parameters specified below, as text with normal character significance. The instruction codes 2/0 to 5/15 are reserved for use as counts in perform loops and multiple space instructions: the codes represent 0 to 63 respectively.

The table below defines the print formatting codes used. The symbol *s* represents a text string and the symbol *n* represents a numeric count (given by codes 2/0 to 5/15, as described above).

Code	*Effect*	*Remarks*
6/0	Omit field	The field referred to does not include field delimiters. Subsequent instructions refer to following fields
6/1	Print field unless condition flag is set (see below)	

Code	*Effect*	*Remarks*
6/2	Not used	
6/3	Print VT number	This number is a two digit hexadecimal number assigned serially to VTs in correspondence to their relative addresses
6/4	Print newline unless the previous line on the hard copy is all spaces (see note 1)	
6/5	Print newline (see note 1)	
6/6*n*	Print *n* spaces	
6/7*s*<DCl>	Print string *s*	
6/8*s*<DCl>	Set condition flag if field begins with string *s* (see example)	Subsequent instructions refer to the same field
6/9	Clear condition flag	
6/10	Invert condition flag	
6/11*in*	Perform instruction sequence *i*, and repeat a further *n* times	*i* can contain any combination of the instruction codes described above

Notes:

1 Characters overflowing a print line are lost, so that any newlines required must be explicitly defined in the format program

2 Printing is terminated if an attempt is made to read the screen cursor

3 There is no facility to alter the order of fields from the display to the hard copy

Example

A VT display is as follows (└ prefaces as unprotected field, ┘ a protected field):

```
┘NAME              └ INTERNATIONAL COMPUTERS LIMITED
┘ADDRESS           └ ICL HOUSE
┘                  └ PUTNEY
┘                  └ LONDON
┘                  └ SW15 1SW
┘STOCK               QUANTITY                    PRICE
└ YES              └ 6                         └£0.16
└ NO               └ 2                         └£0.00
└ YES              └ 4                         └£0.95
└                  └                           └
└                  └                           └
└                  └                           └
┘                  TOTAL                       └£4.76
```

The following is the required printout:

1 The name and address

2 A blank line

3 The heading: STOCK QUANTITY PRICE

4 The quantity and price of items whose STOCK indicator is YES

5 The heading TOTAL

6 The total field

Thus the printout would be as follows:

```
INTERNATIONAL COMPUTERS LIMITED
ICL HOUSE
PUTNEY
LONDON
SW15 1SW

STOCK                    QUANTITY                PRICE
                         6                       £0.16
                         4                       £0.95

                TOTAL                            £4.76
```

The following format program is required:

Codes sent	*Effect*	
6/11	Start of cycle	
6/0	Omit field	
6/1	Print field	Cycle 1 (item 1 above)
6/5	Newline	
2/4	Repeat a further four times	
6/5	Newline	
6/1	Print field	Items 2 and 3 above
6/5	Newline	
6/11	Start of cycle	
6/8 5/9 4/5 5/3 1/1	Set condition flag if field starts with the character string YES (1/1 is string terminator)	
6/10	Invert condition flag	
6/0	Omit field	
6/6 2/8	Print eight spaces	Cycle 2 (item 4 above)
6/1	Print field (unless condition flag set)	
6/6 2/5	Print five spaces	
6/1	Print field (unless condition flag set)	
6/5	Newline	
6/9	Clear condition flag	
2/5	Repeat a further five times	
6/1	Print field	Items 5 and 6 above
6/1	Print field	

5.4 Direct output to HCPs

Data can be transmitted directly from the central system to a hard copy printer without first being transmitted to a video terminal. For this purpose, each hard copy printer has a unique address, separate from any video terminal, by which it can be addressed directly (see section 6.4).

The HCP is operated as a *quasi-interactive* device: that is, it generates an input message in reply to each output message. This input message, termed the *status message*, indicates whether the HCP is able to accept further output. The mainframe

program must examine and accept the status message before attempting any further output to the HCP. All status control is the responsibility of the mainframe program. This status control includes the action to be taken when conditions such as paper low and printer inoperable occur (see section 5.4.1).

When an HCP has been set into direct output mode, by successful transmission of an output message from the central system, it is locked in this mode. The HCP cannot then be used for local output until the central system frees it by transmitting a <DC1> or <DC2> character as the last character of text (see section 5.4.2).

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5.4.1 The status message

The status message consists of the two characters 2/1r, *where r* is bit significant as follows:

Bit setting	*Meaning*
Bit 2^0 = 1	Printer inoperable
Bit 2^1 = 0	(This bit is always 0)
Bit 2^2 = 0	(This bit is always 0)
Bit 2^3 = 0	Output buffer available
Bit 2^4 = 1	Paper low
Bit 2^5 0	(This bit is always 0)
Bit 2^6 = 1	(This bit is always 1)

Note: Both 2/1 and *r* are transmission characters and require translation to mainframe internal codes.

Because output is buffered, the status message following an output message describes the state of the HCP during the printing of the previous output message. Therefore, to obtain confirmation of completion of satisfactory printing, the central system must output two dummy blocks at the end of a direct output transmission.

If a message is transmitted to an HCP when no output buffer is available, the message is discarded.

5.4.1.1 Restart action

To accomplish restarts after an HCP becomes inoperable, the mainframe must be able to recall and reprint at least the previous two output messages (as output is buffered: see above). If pre-printed stationery is being used, the mainframe program should restart printing from the top of the current output form (or of the previous form, if the current position is less than two messages from the current top of form). Operator action is required to reposition the paper at top of form and re-allocate the printer (by pressing the INTERRUPT switch on the printer).

5.4.1.2 Paper low

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When paper low is indicated by the status message, the central system can still continue outputting to the HCP until a convenient point is reached (for example, the end of the current sheet).

The HCP can then be freed, for the loading of more paper, by a message with the character <DC3> as the last character of text (see section 5.4.2). When the <DC3> character is received at the 7500 terminal and a paper low condition exists, the next status message to the central system is delayed until the <DC3> has been actioned (unless an error occurs in printing messages received up to the <DC3> character).

Following the <DC3> character the status message will indicate one of the following:

1 Operable, buffer space available, paper not low. In this case the <DC3> character will have no effect

2 Inoperable and paper low. The <DC3> will have been actioned and all data up to the <DC3> will have been printed

3 Inoperable, paper not low. The printer will have become inoperable and there may be some loss of data. A restart is necessary (see section 5.4.1.1)

Note: Because of the possibility described in item 1, the central system can transmit a <DC3> character at any convenient point (for example, the end of every sheet) and the <DC3> need not be preceded by any dummy blocks. The <DC3> will only have an effect when the paper is low, and all outstanding messages up to the <DC3> will be processed before the status message is transmitted.

In either of the cases described in items 2 and 3 above, no further status message will subsequently be received without the central system first transmitting a message to the now inoperable HCP. Thus the central system must send dummy messages to the HCP until a status message indicating operable is received. (See section 5.4.4 for a suitable dummy message.)

5.4.2 Control characters

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The following characters are used to control the operation of HCPs in direct output mode:

Character	*Code*	*Function*
<HT>(FE1)	0/9	Indicates a horizontal tabulation by the number of print positions specified by a qualifier immediately following the <HT> character. The qualifier is a code in the range 4/1 to 5/15, 2/0 to 3/15. 4/1 to 5/15 correspond respectively to tabulations of 1 to 31 print positions; 2/0 to 3/15 correspond to 32 to 63 print positions

Character	*Code*	*Function*
<NL>(FE2)	0/10	Initiates a combined paper feed of one line and reset of the printing position to position 1
<VT>(FE3)	0/11	Initiates a combined vertical throw of paper and reset of printing position to position 1. The paper throw is defined by the printer format disc (see section 5.4.3). If one is not in use the paper is thrown for approximately two seconds. The <VT> character is followed by a numeral in the range 1 to 7 (ISO 3/1 to 3/7). A <VT>3/1 sequence causes a throw to top of form (next hole in ~~outer~~ INNER track of the format disc). Sequences <VT>3/2 to <VT>3/7 cause throws to the next hole in the ~~inner~~ OUTER track of the format disc
<FF>(FE4)	0/12	Causes a paper throw to the top of the next form (next hole in the ~~outer~~ INNER track of the format disc). If a format disc is not being used, the paper is thrown for approximately two seconds
<CR>(FE5)	0/13	Resets the print position to position 1 without advancing the paper. This enables overprinting
<DC1>	1/1	Releases HCP from direct output mode and causes it to be treated as inoperable (that is, it cannot be used for any purpose until the operator attends to it)
<DC2>	1/2	Releases HCP from direct output mode but retains it as operable (that is, it becomes available for local output from a VT or for further direct output)
<DC3>	1/3	If a paper low condition exists, causes the HCP to be treated as inoperable but still held in direct output mode. The printer is treated as operable after the terminal operator has replenished it with paper and pressed the INTERRUPT switch
<DC4>	1/4	Causes the HCP to be treated as inoperable. It is treated as operable after the terminal operator has pressed the INTERRUPT switch on the printer. (It will still be in direct output mode)

5.4.3 Format control

A 7500 range HCP has an exchangeable format disc, which specifies paper throws in a similar manner to a conventional paper tape format loop. The format disc has two tracks.

Each revolution of the format disc corresponds to an advance of the paper of 66 lines. Intermediate paper throws are specified by punching holes in the disc at required intervals. When a <VT>3/1 sequence is reached from the central system, the paper is advanced to the top of the next form, whose position is defined by the next hole in the ~~outer~~ INNER track of the format disc. When any other <VT> sequence is received (<VT>3/2 to <VT>3/7) the paper is thrown to the position corresponding to the next hole in the ~~inner~~ OUTER track of the format disc, in its direction of revolution.

Note: Pre-printed forms must have a distance between folds of 22, 33 or 66 lines (66 lines = 11 inches).

5.4.4 Message formats

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Messages transmitted to HCPs are restricted to 128 characters, excluding transmission control characters. Any excess text characters are discarded. Data for one line of print must not be split between messages (unless the appropriate horizontal tabulation sequence to start printing from the end of the previous message is included in the second message).

Each message must be preceded by an <STX> character and terminated by an <ETX> character. The first character of each message must be in the range <FE2> to <FE5>, so that the current printing position returns to position 1. The last character of each message (apart from any <FE>*n* qualifiers or <DC*n*> characters) must also be in the range <FE2> to <FE5>.

Note: The above rules apply also for dummy messages sent to HCPs that have been declared inoperable in the status message (see section 5.4.1.1) or sent to clear buffers at the end of printing. In these circumstances, a sufficient message would be:

<CR><NUL>(0/0)<CR>

6.1 7503 consolidation

The 7503 firmware is supplied as a series of program segments held on a cassette tape library. The segments are consolidated at the terminal into a TCP by utilising a TMC and a console device. During consolidation the operator specifies which firmware modules are to be included, by means of a series of entries on the console device. The TCP created may then be dumped in consolidated form onto cassette tape and can subsequently be loaded into the MTPs store wherever it is required. The TCPs that can be generated in this way are described in sections 3.1 and 3.2.

An outline of the TCP consolidation process is described in section 6.1.1.

A number of utility programs are required to enable consolidated TCPs to be dumped to cassette tape. These utilities must first be created before consolidated dumps of TCPs can be made. The purpose of the utilities is described in section 6.1.3 and the initial setting up procedure is described in section 6.1.4.

6.1.1 Contents of the library cassette

The firmware segments appear on the library cassette in the following order:

1 Primary Activity Manager (PRAM)

2 Consolidator

3 Console device managers

4 Other device managers

5 Code conversion tables

6 System managers

A listing identifying and describing all the firmware segments is supplied with the library cassette containing the firmware.

6.1.2 TCP consolidation process

This section describes in general the 7503 consolidation process. Detailed operating instructions are given in *7503 Operating*.

Before the operator can commence his specification of the TCP to be consolidated, three firmware segments must first be loaded: PRAM, Consolidator and an appropriate console device manager. The loading is accomplished by operation of the AUTOLOAD button which causes the following sequence of events:

1 PRAM is loaded into store commencing at address 0

2 The instructions now held in store are acted upon. During this processing the store capacity is determined and the Consolidator is read into high address store

3 The Consolidator is entered and performs the following functions:

(a) Zeroises areas of store containing redundant parts of PRAM

(b) Establishes which coupler is connected to a suitable console device

(c) Determines the type of console device

4 The Consolidator then searches the library cassette for the appropriate console device manager and loads it into store following the PRAM

5 The PRAM, Consolidator and console device manager are identified on the console

The 7503 then requests the operator to provide details of the configuration to be consolidated. For each device type to be used the operator should specify:

1 The relevant device manager and its issue number

2 The appropriate code table for the mainframe system involved (this only applies to TCR, TPR and TLP, but see note 3)

3 The operator's unit number of the device. (For T3A*x* systems this should conventionally be the same as the plastic label on the device. On T3B*x* systems it is not used and should be set to zero.)

4 The physical hardware address (or addresses), in the range 0 to 14, of the data highway(s) to which the device is connected. For T3B*x* video systems this will be the group of highways to which the video couplers are connected

Notes:

1 It is not necessary to specify device managers for devices which will not be used in the mode of operation for which the consolidation is undertaken (for example, there would be no line unit used in T3A3 or T3A4 local data validation and hence no requirement to specify a device manager for it in this instance)

2 During the above process of specifying the system configuration it is necessary to provide for an additional device manager to cater for loading a line printer format specification (see *7503 Operating* for details)

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3 The console device (TVC or TTC) does not require a code table to be specified, but System 4 codes are specified by giving the console as unit number 4

On completion of the device manager specifications, the 7503 requests the operator to specify the system manager required.

The relevant segments for the system manager requested are located on the library cassette and loaded into store.

6.1.3 7503 utility programs

A set of utilities exists that provide all the facilities required for the creation and maintenance of a TCP library. The facilities offered by these utilities are described in the following sections.

6.1.3.1 Utility SX2

SX2 is used to perform the following functions:

1 To create Reloader tapes (see section 6.1.3.2)

2 To create a Consolidator Dump tape (see section 6.1.3.3)

3 To create a Postmortem Dump tape (see section 6.1.3.4)

4 To produce scratch tapes (that is, to erase the contents of a previously used tape)

6.1.3.2 Reloader

In order to be able to load a TCP from cassette tape it is necessary to use a bootstrap routine which is read into store by operation of the AUTOLOAD button and which then loads the TCP.

The bootstrap or Reloader does not exist in the store image of a consolidated TCP and therefore must be placed at the head of the cassette tape prior to dumping the TCP onto it. This is accomplished as a quite separate task using the Reloader option of SX2.

6.1.3.3 Consolidator Dump (CONS DUMP)

In order to dump a consolidated TCP onto cassette tape it is necessary to use the dumping routine CONS DUMP. The CONS DUMP routine is autoloaded from cassette tape into a redundant part of the store containing the consolidated TCP. The routine then dumps the contents of store onto a cassette tape suitably prepared with a Reloader bootstrap.

A tape containing CONS DUMP, used in this process, is created by utility SX2. (The cassette in this case does not require prior preparation by the Reloader option: a bootstrap routine is automatically written to cassette tape by SX2 before dumping CONS DUMP.)

6.1.3.4 Postmortem Dump (P/M DUMP)

The creation and operation of Postmortem Dump is similar to that of CONS DUMP. Postmortem Dump, however, is used after a failure condition to produce a dump for subsequent analysis and diagnosis of the fault (see *7503 Operating*, Chapter 5 for further details).

6.1.4 Setting up the system

Before consolidating TCPs for normal day to day usage it is necessary to generate the utility CONS DUMP and to produce a number of cassette tapes, primed with the Reloader bootstrap, onto which the TCPs can be dumped. At the same time the Postmortem Dump utility can be generated and written to cassette for subsequent use, and SX2 itself can be written to cassette in consolidated form.

The various stages of setting up the system are described below. Full details of the operating procedure are given in *7503 Operating*, Chapter 3.

1 CREATION OF CONS DUMP, P/M DUMP AND RELOADER TAPES

(a) Load the library cassette and AUTOLOAD the Primary Activity Manager. (The events as outlined in section 6.1.2 take place)

(b) Consolidate utility SX2, as for any other TCP, specifying:

(i) Console device manager

(ii) Magnetic tape cassette device manager

(iii) System manager SX2

(c) Using option 2 of SX2 create a tape containing the CONS DUMP utility program. The tape does not require priming with RELOADER since it will automatically be written onto the start of the tape

(d) Using option 3 of SX2 create a tape containing the P/M DUMP utility program. The tape again does not require priming with RELOADER

(e) Using option 1 of SX2 create a number of tapes containing the RELOADER bootstrap. These tapes will be used subsequently to hold consolidated TCPs and should be labelled accordingly. A tape should also be prepared to hold a consolidated version of SX2 (see operation 2(b) below)

2 DUMPING A CONSOLIDATED VERSION OF SX2 TO CASSETTE TAPE

(a) With SX2 still in store, load the cassette containing the CONS DUMP program, created in 1(c) above, and press AUTOLOAD. The action writes the consolidation dump program into high address store ready to dump SX2

(b) Load a cassette created in 1(e) above to accept SX2. The consolidator dump program skips over the reloader bootstrap and writes the contents of store, up to the base of CONS DUMP, onto the cassette. The tape is then rewound and unloaded

(c) If required, further copies of SX2 may be made by repeating action 2(b). The cycle is continued until the 7503 is reset

3 CONSOLIDATION AND DUMPING OF TCPs

(a) Load the library cassette, AUTOLOAD the Primary Activity Manager and consolidate the first TCP required, as described in *7503 Operating*, section 3.2

(b) Dump the consolidated program to cassette tape as described in *7503 Operating*, section 3.4. Repeat the process if further copies of the TCP are required

(c) Repeat 3(a) and 3(b) for each subsequent TCP required

6.1.5 Number of cassettes required

In order to maintain a TCP library it is necessary to have cassettes containing:

SX2 utility
CONS DUMP utility

In order to be able to take a post mortem dump it is necessary to have a cassette containing:

P/M DUMP utility

As the post mortem procedure requires that a virgin copy of the TCP be despatched in addition to the post mortem dump, it is necessary to have cassettes onto which the TCP can be redumped. These would be held as:

RELOADER cassettes

Each TCP to be used in day to day operation requires a cassette, for example:

T3A1 (on-line system)
T3A3 (local data validation)
T3A6 (local peripheral copy)

plus at least one security copy of each of the program tapes. Each side of a cassette can hold one TCP. However, it is unwise to hold a security copy of a program on the reverse side of the same cassette that holds the normal daily used copy.

If each cassette is to hold only one TCP, and only one security copy of each is required, then the following number of cassettes would be required for a system using T3A1, T3A3 and T3A6:

Utility SX2	2	
CONS DUMP	1	} Since these will not normally be used daily, they may share a cassette, as may their security copies
P/M DUMP	1	}
RELOADER cassettes	2	
T3A1	2	
T3A3	2	
T3A6	2	
Total	12 cassettes	

The above does not allow for any spare cassettes nor for any which may be used for data (for example, during spooling or

for line printer format loop libraries).

6.2 Teleload and Teledump (TLD)

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The 7500 range of Modular Terminal Systems includes a facility to transfer TCPs from the central system to the terminal, instead of loading them directly from a cassette unit at the terminal end. The remote loading process is known as *Teleload*, and is used on 7502 systems.

This facility also enables postmortem dumps to be taken from the terminal to the central system. This process is known as *Teledump*, and Teleload and Teledump together are abbreviated to *TLD*.

Initially, only a single-shot version of TLD will be available (see section 7.9). TCPs will be loaded at the mainframe on cards or paper tape, and dumps will be to a disc file. Each dump is added to the existing contents of the dump file until it is full, and further dumps will then overwrite from the beginning of the file (that is, starting from the earliest dump).

Note: Only one dump file exists for the whole system, so dumps will be recorded in chronological order.

Dump analysis is carried out subsequently, using free standing routines that extract selected dumps and erase them after processing.

6.2.1 Monitoring TLD at the terminal

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For the operator's convenience, one VT should be used as a console during Teleload (see section 6.3), and during Teledump. The operator can then be aware of the loading or dumping process and, in particular, of any untoward incidents.

When the terminal is switched on, the VT console screen will show a pulsating pattern of random characters.

When the mainframe system can poll the terminal, the REC DATA and POLLING indicators on the MTP flicker at regular intervals.

When a Teleload commences, the TCP is displayed, as it is received, on the top line of the VT console screen. When the Teleload is complete the VT console screen may be released for interactive use, or retained permanently as the console (see section 6.3).

When a Teledump is initiated, the top line of the VT console screen will contain a string of characters which remains unchanged except for the first character. The REC DATA and POLLING indicators on the MTP will flicker while the data being dumped is transmitted from the terminal to the mainframe.

It is recommended that the VT selected for the console should be adjacent or near to the 7502 processor, since the indicators

on the processor monitor Teleload and Teledump, and some of the controls need to be set by the operator.

Note: No other console device (TVC or TTC) may be employed to control and monitor TLD.

6.3 Use of a VT as a console

During consolidation of a 7503 T3B*x* program, a console is required for input of the required parameters. Unless a TVC or TTC is available, this console must be a VT. In this role the VT provides much the same facilities as the 7507/1 Video Console (TVC).

The VT with the lowest address of those operable is treated as the console.

6.4 Device addressing

6.4.1 7503 systems

The polling addresses of the 7503 VTs and HCPs can be specified by the user at consolidation time. If the addresses are not specified, default addresses are assumed.

The default addresses for the emulated QLSA, VTs and HCPs are contiguous, commencing from hexadecimal 20, and allow for the maximum number of VTs and HCPs that can be supported by the TCP.

For example, the following default addresses would be generated for a T3B2 TCP (which is capable of supporting eight VTs and four HCPs: see Chapter 3):

Hexadecimal addresses	*Device*
20, 21, 22, 23	QLSA
24 and 25	Reserved
26 and 27	VT1
28 and 29	VT2
2A and 2B	VT3
2C and 2D	VT4
2E and 2F	VT5
30 and 31	VT6
32 and 33	VT7
34 and 35	VT8
17/3/76(1) 36 and 37	HCP1
38 and 39	HCP2
3A and 3B	HCP3
3C and 3D	HCP4

Note: The above default addresses are the same for each TCP regardless of the number of devices physically connected. Thus, for example, a T3B2 TCP supporting only six VTs and three HCPs would still allocate 36 as address 1 of the first HCP.

During the consolidation of 7503 TCPs it is possible to increase the base address of the QLSA (address 1) in multiples of four. All other addresses are modified accordingly.

6.4.2 7502 systems

The polling addresses of the 7502 VTs and HCPs are controlled by an internal hardware switch, which can be altered on site during commissioning. This switch enables the base address of the QLSA (address 1) to be increased in multiples of four and all other addresses are modified accordingly. All addresses of connected devices are contiguous and the default address (as delivered) of the QLSA is hexadecimal 20 and of the first device is hexadecimal 26. For example, for a 7502 system with six VTs and three HCPs, the addresses at delivery are as follows:

Hexadecimal address	*Device*
20	QLSA
24 and 25	Teleload addresses
26 and 27	VT1
28 and 29	VT2
2A and 2B	VT3
2C and 2D	VT4
2E and 2F	VT5
30 and 31	VT6
32 and 33	HCP1
34 and 35	HCP2
36 and 37	HCP3

6.5 Alternate batch/interactive use of 7503

It is possible to hardware configure a *mixed* 7503 terminal system, that is, a system capable of either batch or interactive working. Such a configuration will include batch peripherals (TLP, TCR, TPR, TMC) and interactive devices (VT, HCP). The console device can be either a TTC, a TVC or a dedicated VT (see section 6.3).

The mode of operation of the terminal is changed by loading the appropriate TCP via the cassette unit. Note that it is not possible to load two programs simultaneously, so the MTP need contain only sufficient store to hold the largest TCP to be used.

In an on-line application it is also necessary for the mainframe to be made aware of the change. This aspect of alternate batch/interactive use is described in section 7.10.

This chapter describes factors that should be taken into account by a mainframe user who is extending his data processing system to include any 7500 range terminals.

The chapter first describes the general support for 7500 given by each type of ICL mainframe, under each type of operating system. This part of the chapter describes mainframe software requirements, the types of communications controller required and any limitations on the 7500 hardware configuration or the 7500 facilities employed.

The rest of the chapter deals with the compatibility of 7500 systems with existing applications, mainframe support of Teleload and Teledump (TLD), and support of alternate batch and interactive working.

7.1 1900 Series systems

7.1.1 MPOE systems (with or without GEORGE 2)

7.1.1.1 Support of 7503 T3Ax

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7503 T3Ax systems can be connected via either a 7920 or 7930 scanner-only system, or a 7903 Communications Processor.

Support is provided by the GEORGE 2 remote input/output package #XKVB, operating via Communications Manager. It is also possible, provided that terminal spooling is not used, to operate the T3Ax terminal connected via a scanner-only system with #XKVA.

Note: Terminal spooling can only be used in conjunction with #XKVB.

7.1.1.2 Support of 7503 T3Bx or 7502 T2Bx

T3Bx or T2Bx systems can be connected via either a 7920 or 7930 scanner-only system, or a 7903 Communications Processor.

Support requires the use of Communications Manager, except for those users who are running a 7503 merely as an extension of a 7181/2 system. Such users are permitted to use character or message buffering housekeeping.

7.1.2 GEORGE 3 systems

17/3/76(1) 7.1.2.1 Support of 7503 T3Ax

Support is provided by character or message buffering housekeeping.

The 7507/1 Video Console (TVC) cannot be used in a GEORGE 3 environment; a 7506/1 Typewriter Console (TTC) is therefore mandatory with T3Ax programs.

7.1.2.2 Support of 7503 T3B*x*

T3B*x* working is possible in conjunction with either a 7920 or 7930 scanner-only system, or a 7903 Communications Processor. Support is provided by character or message buffering housekeeping.

Note: Vidimop is available only in connection to a 7903 Communications Processor, and requires displays to have a 2000-character screen (VT-2000). See also section 7.8.1.

7.1.2.3 Support of 7502 T2B*x*

T2B*x* systems require connection via a 7903 Communications Processor. Support is provided by message buffering housekeeping.

Note: Vidimop requires displays to have a 2000-character screen (VT-2000). See also section 7.8.1.

7.1.3 GEORGE 4 systems

The information given above about running 7500 systems in connection with GEORGE 3 environments applies equally to GEORGE 4, except that GEORGE 4 always requires connection via a 7903 Communications Processor.

7.1.4 1901T/2T systems

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On 1901T/2T systems, only T2B*x* and T3B*x* systems are possible. Connection is as for other 1900 systems and not via the integrated VDU coupler.

7.2 System 4 systems

In general, 7500 Modular Terminal Systems can be connected to a System 4 mainframe system via an MCCCU with CCP running under the J or Multijob operating systems.

Restrictions applying to particular 7500 applications in particular environments are described below.

7.2.1 J systems

7.2.1.1 Support of 7503 T3B*x* or 7502 T2B*x*

Using the J Operating System all T3B*x* and T2B*x* facilities can be accessed by a Communications User Program via CCP. The terminal should be identified to CCP at generation time as a QLSA with the appropriately addressed video terminals, which must include any 7572/1 Hard Copy Printers that are to be accessed in Direct Output mode. The Teleload device address must be specified as if it were a separate video connected via a TLSA.

7.2.2 Multijob systems

7.2.2.1 Support of 7503 T3B*x* or 7502 T2B*x*

The same facilities as described above for J apply to use under Multijob except when Multi-access facilities (MCO: Multiconsole Organiser) are used.

When MCO is to be used, two restrictions apply:

1 The 7502 terminal must be specified to CUP as a TLSA. Although it is not it must appear as if it were a TLSA since MCO cannot allow CUP to utilise the Group Poll feature of a QLSA

2 The list of video terminals attached to the 7502, which is supplied to CUP at generation time, must only mention video terminals and no other devices (hard copy devices etc). MCO itself cannot make use of them, and they are not available for use by a CUP running in parallel with MCO

Multi-access under Multijob is only possible using VT-2000 units.

7.3 2903 systems

7.3.1 Integrated Coupler

All 7500 range connections to a 2903 system are made through the 2903 Integrated Coupler.

7.3.1.1 Support of 7503

A 7503 cannot be connected to a 2903.

7.3.1.2 Support of 7502

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T2B*x* systems can be connected in the same way as 7181/2 videos connected via a 7182/2 QLSA. The total number of 7181/2 and 7561/1 videos allowed is eight.

Direct output to hard copy printers is not supported by 2903.

7.4 2900 Series systems

7500 Modular Terminal Systems can be connected to a 2900 Series mainframe system via a Communications Link Controller (CLC) or a Communications Network Processor (CNP). Alternatively, a 7903 Communications Processor may be employed by users moving from the 1900 Series to the 2900 Series.

7.5 7905 systems

7500 Modular Terminal Systems can be supported by 7905 with any of its permissible links to 1900 and System 4 mainframes. Users moving from 1900 Series or System 4 to 2900 Series may also support 7500 with a 7905 connected to a 2900 Series mainframe.

In all cases use of 7905 is dependent on the necessary mainframe facilities being available.

7.6 Direct connection

Direct connection (that is, without modems) of 7500 systems to 1900, System 4, 2903 or 2900 mainframe communications controllers is available only in 7503 T3Bx and 7502 T2Bx applications. (Direct connection to 1900 System 4 or 2903 configurations provides a similar system to that offered by 7182/1 TLSAs and 7182/2 QLSAs.) Direct connection employs either F1934 (for 7502) or F1827 (for 7503).

The 7500 processor can be sited up to 33 metres from the mainframe communications controller. Hardware and software support is as described above for the appropriate mainframe system.

Note that neither the 7503 nor the 7502 can be connected via a 7182/1 TLSA or a 7182/2 QLSA.

7.7 Compatibility of 7503 with existing 7020 systems

Under the T3A1 Terminal Control Programs, the 7503 can be used in all 1900 and System 4 configurations which at present support a 7020 provided that

1 The same card, paper tape and printer codes and data formats are used

2 There is no requirement for a paper tape punch in the terminal configuration

7.8 Compatibility of 7500 video systems with existing 7181/2 application programs

7.8.1 Current ICL and Dataskil programs

All current ICL and Dataskil application programs written for 7181/2 visual display units (for example, Datafeed, Dataview and Vidimop) will work unchanged with a 7500 configuration incorporating VT-2000 units. These units should not have the key reader option or compatibility is destroyed. However, in the case of Vidimop the presence of a key reader is immaterial.

Vidimop requires VT-2000 units to be used.

Note: Compatibility may also be destroyed if the additional video facilities described in Chapter 5 are used. Each case should be individually examined with reference to Chapter 5.

7.8.2 Current user written programs

Current user written programs for 7181/2 visual display units will usually be of three types:

1 Those programs for 7181 VDUs which do not have the badge reader option included in the hardware. User written programs will work unaltered with VT-2000 units that do not have the key reader option specified in the hardware

2 Those programs for 7181 VDUs which have the badge reader option included in the hardware but it is not used in the programs concerned. User programs will work unaltered with VT-2000 units which have the key reader option specified in the hardware, provided no key is inserted in the key reader

3 Those programs for 7181 VDUs which have the badge reader option included in the hardware and it is used in the programs. Such programs will almost certainly not work, without alteration, with VT-2000 units even if the key reader option is specified. The reason for this is that the 7181 badge can input up to 14 characters (variable length) whereas the 7500 key reader has a fixed 3 digit numeric capacity from 0 to 250. Thus only in those cases where this numeric range of the 7181 badge is used will the program accept the same type of data input via the 7500 key

Note also that 7181 badges and 7500 pens are not physically interchangeable; that is, a 7500 key reader will not accept a 7181 plastic badge, and a 7181 badge reader will not accept a 7500 pen.

The key reader is described in section 5.5.

Notes:

1 Current user programs written for 7181 VDUs will normally have been written to take advantage of the capabilities of the 2000 character screen (25 lines of 80 characters each) in such a manner as to preclude the use of the 960 character screen (12 lines of 80 characters each). However, this, although usual, will not always be true. Individual programs could therefore work with VT-960 units without change. Each case must be individually examined

2 Any validation of data required currently is incorporated within the mainframe programs, since hitherto it has not been a terminal facility. Thus in the case of current programs, the 7500 terminal validation facilities will not be utilised

7.9 Support of Teleload and Teledump (TLD)

7.9.1 Teleload

ICL provides two packages for Teleload, known as a *single shot* and a *multiload* package. These are described below.

1 SINGLE SHOT This package is capable only of loading one terminal at a time. It is intended for use whilst the system is operating. Use of this package ensures that terminals requiring loading or reloading after system

initialisation do not disrupt the whole system.

Because it is used during normal running, the single shot package is designed to occupy the minimum amount of store, rather than to perform a load in the minimum time.

This package can retrieve TCPs from a disc library or it can load TCPs supplied on cards or paper tape.

According to the user's needs this package can be either:

(a) Kept in store throughout normal running, or

(b) Loaded only when required

In case (a) the operating procedure for initiating a load is simpler and quicker than it is in case (b)

2 MULTILOAD This package is capable of loading several terminals simultaneously. It is intended for use at system initialisation. The design aim has therefore been to load terminals in the minimum time, rather than to minimise store occupancy.

The user should load this package into the area of store that is normally occupied by transaction processing programs. When terminal loading is complete the multiload package should be deleted and the required TP programs loaded.

This package accepts TCPs only from a disc library

Facilities are also provided for creating and updating the disc library using TCPs supplied on cards or paper tape.

7.9.2 Teledump

The Teledump package dumps the store contents of one terminal at a time, recording the dumped data on a pre-established disc file. As with the single shot Teleload package, the user can either load the Teledump package when required or leave it in store permanently. (The Teledump package is designed to occupy the minimum amount of store, rather than to perform a dump in the minimum time.)

Facilities are also provided to extract dumps from the dump file and produce a line printer output. This package can be run at any time convenient to the user.

7.9.3 TLD on 1900 Series systems

7.9.3.1 MPOE systems

Teleload and Teledump can be supported by all systems that use Communications Manager. The TLD packages interface with Communications Manager in the same way as other communications applications programs.

7.9.3.2 GEORGE 3 and 4 systems

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Teleload and Teledump can be supported by all systems that use a 7903 or a local 7905 Communications Processor. The TLD

initialisation do not disrupt the whole system.

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7.9.3 TLD on 1900 Series systems

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Teleload and Teledump can be supported by all systems that use Communications Manager. The TLD packages interface with Communications Manager in the same way as other communications applications programs.

7.9.3.2 GEORGE 3 and 4 systems

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Teleload and Teledump can be supported by all systems that use a 7903 or a local 7905 Communications Processor. The TLD

packages interface with the Conceptual Teleprocessor facility.

7.9.4 TLD on System 4 systems

The TLD packages take the form of Communications User Programs interfacing with CCP. There are also utility programs for creating TCP disc files and analysing dumps.

7.9.5 TLD on 2903 systems

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ICL supplies two utility programs, one for single shot Teleload and one for Teledump. These programs run in the enquiry program slot and transfer TCPs to and from pre-established disc files.

There are also utilities for creating the TCP disc library and for analysing dumps. These programs run in the batch program slot of the 2903.

Note: It is not possible to perform Teleload or Teledump whilst an enquiry program is operating as both functions require the enquiry program slot.

7.9.6 TLD on 2900 Series systems

(To be supplied)

7.10 Alternate batch/interactive use of 7503

The recommended method of supporting alternate batch and interactive use of a 7503 is by the provision of two channels on the communications controller. One channel is configured for T3A*x* operation and the other for T3B*x*, the line to the terminal being switched to the appropriate channel when the TCP is changed. Switching facilities are available in two forms, either situated between the line and the modem (in which case they are provided by the local PTT authority) or situated between the modem and the communications controller in the form of CCITT switches (which can be obtained from ICL).

In cases where it is impractical to provide two channels it is possible to achieve the switching by loading alternative software in the mainframe system. The exact method of switching varies with the type of communications controller but normally involves a complete close down of all communications activities, and in some cases of the complete system.

Note that where two or more terminal systems are multidropped on one line, at any instant they must all be operating under TCPs from one group, that is, T3A*x* or T3B*x*.

7500 RANGE EQUIPMENT LIST

APPENDIX 1

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A1.1 7502 equipment

Type number	*Mnemonic*	*Description*
7502/1	MTP2	Modular Terminal Processor with 8K bytes of store and line unit at 600, 1200, 2400 and 4800 bit/s
7502/3	MTP2	Modular Terminal Processor with 12K bytes of store and line unit at 600, 1200, 2400 and 4800 bit/s
C1597		Conversion of 7502/1 to 7502/3
F1940		Extension cabinet
F1930		Terminal self tester
F1931		Connector for UK Post Office Modems numbers 1, 7B and 7C
F1932		Connector for approved OEM Modems (see section 2.1.1)
F1933		Connector for TRT Sematrans Modems 1203, 2401, 4801
F1934		Direct connection (without modems)
F1945		Unclocked modem facilities
7512/1		Additional 4K bytes of store for 7502/3
7561/1	VT-960 or VT-2000	Video terminal and keyboard, 960 characters (VT-960) or 2000 characters (VT-2000) depending on coupler used
F1779/01		Key reader
F1775		English language set on VT (1900, System 4, 2900 and 2903)
F1776		Swedish language set on VT (1900, System 4, 2900 and 2903)
F1777		Danish language set on VT (1900, System 4, 2900 and 2903)
F1935/1		Coupler for up to 4 × VT-960
F1935/2		Coupler for 5th, 6th, 7th and 8th VT-960
F1936/1		Coupler for up to 2 × VT-2000
F1936/2		Coupler for 3rd and 4th VT-2000

Type number	*Mnemonic*	*Description*
F1936/3		Coupler for 5th and 6th VT-2000
F1936/4		Coupler for 7th and 8th VT-2000
7572/1	HCP-60	Hard copy printer, 60 character per second, 118 print positions, sprocket feed
F1785		English language set on HCP (1900, System 4, 2900 and 2903)
F1786		Swedish language set on HCP (1900, System 4, 2900 and 2903)
F1787		Danish language set on HCP (1900, System 4, 2900 and 2903)
F1939		Coupler for up to 4 × HCP-60
F1946		8-way junction box

A1.2 7503 equipment

Type number	*Mnemonic*	*Description*
7503/1	MTP3	Modular Terminal Processor with 16K bytes of store and line unit at 600, 1200, 2400 and 4800 bit/s
F1824		Connector for UK Post Office Modems numbers 1, 7B and 7C
F1825		Connector for approved OEM Modems (see section 2.1.1)
F1826		Connector for TRT Sematrans Modems 1203, 2401 and 4801
F1827		Direct connection (without modems)
F1761		Extension cabinet
F1762		Additional power supply
7513/1		Additional 4K bytes of store for 7503/1
7513/2		Additional 8K bytes of store for 7503/1
C1345		Conversion of 7513/1 to 7513/2
7506/1	TTC	Typewriter console (requires F1763 if not already specified)
F1763		Coupler for TTC and TPR
F1726		1900 code for TTC
F1727		System 4 code for TTC
7507/1	TVC	Video console, 16 lines, 80 character/line
F1764		Coupler for TVC

Type number	*Mnemonic*	*Description*
F1728		1900 code for TVC
F1729		System 4 code for TVC
7527/0	TLP-150	Line printer, 132 print positions, up to 150 lines per minute
C1347		Conversion of TLP-150 to TLP-300
C1348		Conversion of TLP-150 to TLP-500
7527/1	TLP-300	Line printer, 132 print positions, up to 300 lines per minute
C1343		Conversion of TLP-300 to TLP-500
7527/2	TLP-500	Line printer, 132 print positions, up to 500 lines per minute
F1766		Coupler for TLP-150, TLP-300 or TLP-500
F1700		1900 Series standard print barrel
F1711		System 4 standard print barrel
F1712		Swedish print barrel
F1713		Russian Cyrillic print barrel (1900 Series)
F1714		Russian Cyrillic print barrel (System 4)
F1715		Danish print barrel
F1701		Special print barrel with up to 5 non-standard characters and/or rearrangement of standard 64 character set
F1702		Spare print barrel required when F1701 is ordered
7537/1	TPR-500	Paper tape reader, 500 characters per second (requires F1763 is not already specified)
7532/1	TCR-300	Card reader, 300 cards per minute
F1767		Coupler for TCR-300
7542/1	TMC	Single magnetic tape cassette unit (coupler included)
7542/2	TMC	Twin magnetic tape cassette unit (coupler included)
C1342		Conversion of 7542/1 to 7542/2
7561/1	VT-960 or VT-2000	Video terminal and keyboard, 960 characters (VT-960) or 2000 characters (VT-2000) depending on coupler used
F1779/01		Key reader

Type number	*Mnemonic*	*Description*
F1775		Englich language set on VT (1900 and System 4)
F1776		Swedish language set on VT (1900 and System 4)
F1777		Danish language set on VT (1900 and System 4)
F1769		Coupler for 4 × VT-960
F1770		Coupler for 2 × VT-2000
F1771		Coupler for 8 × VT-960
F1772		Coupler for 4 × VT-2000
7527/1	HCP-60	Hard copy printer, 60 character per second, 118 print positions, fproket feed
F1785		English language set on HCP (1900 and System 4)
F1786		Swedish language set on HCP (1900 and System 4)
F1787		Danish language set on HCP (1900 and System 4)
F1773		Coupler for 4 × HCP-60
7591/1		Console desk, type 1
7591/2		Console desk, type 2
F1946		8-way junction box

$2^3\ 2^2\ 2^1\ 2^0$ / $2^6\ 2^5\ 2^4$		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	000		SOH	STX	ETX	EOT	ENQ	ACK	BEL		HT	NL	VT				
1	001		DC1	DC2	DC3	DC4	NAK	SYN		CAN		SUB	ESC	IS4			
2	010	(SPACE)	!	"	\ / £	£ / $	%	&	'	(	)	*	+	,	–	.	/
3	011	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	100	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	101	P	Q	R	S	T	U	V	W	X	Y	Z	[	$ / \	]	^	—
6	110	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	111	p	q	r	s	t	u	v	w	x	y	z	{	|	}	—	(DELETE)

Additional displayed symbols

- ⌊ Start of unprotected field
- ⌋ Start of protected field
- ≡ New line
- ⁞ Error character (as 7/15, Delete)
- | Start of message (SOM)
- ■ Undisplayable code
- ⌶ Cursor
- ___ Special underline

Notes:

1 The keyboard used for the English language set is identical in layout for 1900 Series, System 4, 2903 and 2900 Series. However, there are some differences in the way in which the codes are interpreted by the Terminal Control Program, depending on the mainframe system to which the terminal is connected. These are:

Code	*Code 1*	*Code 2*
3/3	£	\
3/4	$	£
5/12	\	$

Code 1 is used for System 4 and 2900 Series systems and code 2 on 1900 Series and 2903 systems. In a number of cases, however, existing 7181/2 systems connected to 1900 Series use the Code 1 Feature and this should be taken into account when compatibility is required with existing systems

2 The interpretation of the following characters should be noted:

Character	*Code*	*Meaning*
-	2/13	Minus sign
_	5/15	Underline (␣ on keyboard)
¯	7/14	Overline (¬ on keyboard)
_	None	Special underline. Used in screen editing functions (see section 5.2.2.1). The character cannot be generated by the central system or from the keyboard

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PAGE CHECKLIST

This is a checklist of the current issue numbers as at March 1975 of the pages of *7500 System* (Technical Publication 4802). Readers may use the list to verify they have all the correct pages that make up the current version of this publication. The issue number of each page is printed at its bottom inside corner, after the technical publication number. The issue number of a page that has not been amended is 0.

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v	0	4-11	0	6-2	0
vi	0	4-12	0	6-3	0
vii	0	4-13	0	6-4	0
viii	0	4-14	0	6-5	0
ix	0	4-15	0	6-6	0
x	0	4-16	0	6-7	0
1-1	0	4-17	0	6-8	0
		4-18	0	6-9	0
2-1	0	4-19	0		
2-2	0	4-20	0	7-1	0
2-3	0	4-21	0	7-2	0
2-4	0			7-3	0
2-5	0	5-1	0	7-4	0
2-6	0	5-2	0	7-5	0
2-7	0	5-3	0	7-6	0
2-8	0	5-4	0	7-7	0
2-9	0	5-5	0		
2-10	0	5-6	0	A1-1	0
2-11	0	5-7	0	A1-2	0
		5-8	0	A1-3	0
3-1	0	5-9	0	A1-4	0
3-2	0	5-10	0		
3-3	0	5-11	0	A2-1	0
3-4	0	5-12	0	A2-2	0
3-5	0	5-13	0		
3-6	0	5-14	0	I-1	0
3-7	0	5-15	0	I-2	0
		5-16	0	I-3	0
4-1	0	5-17	0	I-4	0
4-2	0	5-18	0	I-5	0
4-3	0	5-19	0	I-6	0
4-4	0	5-20	0	I-7	0
4-5	0	5-21	0	I-8	0
4-6	0	5-22	0	I-9	0
4-7	0	5-23	0	I-10	0
4-8	0	5-24	0	I-11	0
4-9	0			I-12	0