Merlin
British Telecom Business Systems

MERLIN DATELMUX 5500/USO

USOs
2, 3, 20

Merlin
Business Systems Business Systems Business Systems Business Systems Business Systems Business Systems Business Systems Business Systems

Merlin

British Telecom Business Systems

MERLIN DATELMUX
5500/USO

USOs
2, 3, 20

Merlin

CONTENTS

lc

7AJ

CONTENTS (Cont)

CONTENTS (Cont)

CONTENTS (Cont)

FIGURES

TABLES

PAGE

SECTION 1

INTRODUCTION

1.1 THE DATELMUX 5500/USO

The BT MERLIN DATELMUX 5510 card is an enhancement of the DATELMUX 5500, providing the additional facilities of User Switching, Short-form and Alphanumeric Addressing, Port Contention, Automatic Re-routing, and Network Monitoring. These extra facilities are provided by a unit known as the User Switching Option (USO), which is available in two versions, the standard USO2, the advanced USO20 and the high capacity USO3, the latter supporting very large networks and providing improved user interfaces.

User Switching enables DATELMUX network users at terminals or computers to connect their equipment to other terminals or computers of their choice on the network. Short-form and Alphanumeric Addressing simplify this operation.

The Contention facility has a variety of applications including connection of a terminal to any one of a number of computers located at various local or remote sites, allowing several terminal users to contend for a restricted number of computer ports, and enabling a computer to use one port to output data to a number of terminals in turn.

The Automatic Re-routing facility enables connections between certain types of ports to be automatically reconnected via alternative paths should any of the composite links or 5500/USO nodes comprising their current paths fail.

The network is continuously monitored, and hard copy reports of all noteworthy network events can be provided in the form of an Event Log.

The Network Supervisor, who is in control of the whole network, is provided with a powerful and comprehensive set of commands for control at Node, Link and Port levels.

As explained in its section the DATELMUX 5500 has a system of fixed channel numbering: physically adjacent channels have consecutive numbers. The DATELMUX 5500/USO introduces an additional system of "port" numbering, whereby each port represents one channel. The relationship between port numbers and channel numbers is set up by the Supervisor. This results in a more convenient system for large networks.

1.2 SCOPE OF GUIDE

The purpose of this guide is to provide full information to enable personnel to configure and operate DATELMUX 5500/USO multiplexer networks, to understand the reporting system for both correct and erroneous working, and to carry out procedures to establish the cause of errors in the system.

In general, there will be two types of personnel using 5500/USO's: the Network Supervisor (referred to as "Supervisor" and the Terminal or Computer User (referred to as "user"). The Supervisor will need to read and refer to the whole of the 5500 and 5500/USO User Sections. The user needs only the relevant instructions in Section 6.4 of this 5500/USO guide.

The DATELMUX 5500/USO comprises a hardware and software upgrade to the DATELMUX 5500. The information in the 5500 will not therefore be repeated in this guide, but is treated as the basic document to which this guide is an addendum. The section-by-section layout of the two guides is the same.

This guide covers both the standard (USO2), the advanced (USO20) and the high capacity (USO3) versions of the 5500/USO Multi-node Multiplexer.

The information in this guide reflects software level 2.7 in the USO2, and 3.1 in the USO3. There are one or two very minor differences between the Supervisor display of the USO2 with 2.7 and Section 4 in this guide, but these do not affect operational procedures.

1.3 SPECIFICATION SUMMARY

The specification summary of the 5500 (given in Section 1.3 of the 5500 section) also applies to the 5500/USO, with the addition of:-

Special Features

                     User Switching

                     Short Form & Alphanumeric Addressing

                     Contention

                     Automatic Connection Retry to busy destinations

                     Automatic Re-routing

                     Enhanced Network Monitoring

                     Comprehensive Supervisor Control

Network Capacities

Number of 5500/USO nodes	Up to 255 for USO3, 63 for USO2 and USO20
Switchable ports per node	Up to 255
Short-form addresses	Up to 256 for USO3, and USO20, 100 for USO2
Alphanumeric names	Up to 256 for USO3 and USO20, 32 for USO2, each from 2 to 8 characters in length.
Text strings	Three Supervisor-definable "welcome" strings, each up to 80 characters in length; and (for USO3 and USO20), ten Supervisor-definable "connection response" strings, each up to 40 characters in length.
Welcome page	Only available on the USO20 and providing up to 25 lines of supervisor-definable text, each up to 80 characters in length.
Routes	Up to 4 alternative routes to every other node in the network.
V24 Control Signals	The V24 control lines may be used by the 5500/USO both to control and to check the state of attached devices, eg terminals and computers. They may also be used by the attached devices to attract the attention of the 5500/USO, ie connection or disconnection requests.

1.4 THE 5500/USO IN DATELMUX NETWORKS

The substitution of a 5500/USO for any 5500 in the example networks described in Section 1.4 of the 5500 Section, would add the relevant 5500/USO features to the network.

Figure 1-1 in this 5500/USO Section shows an example of a relatively complex DATELMUX network making extensive use of 5500/USO nodes. The network supports users at eight sites, each given access to five computer systems located at four major processing sites. Network integrity is assured by "triangulating" the major nodes, thus providing at least two alternative paths between any two nodes. The features provided by such a network are as follows:-
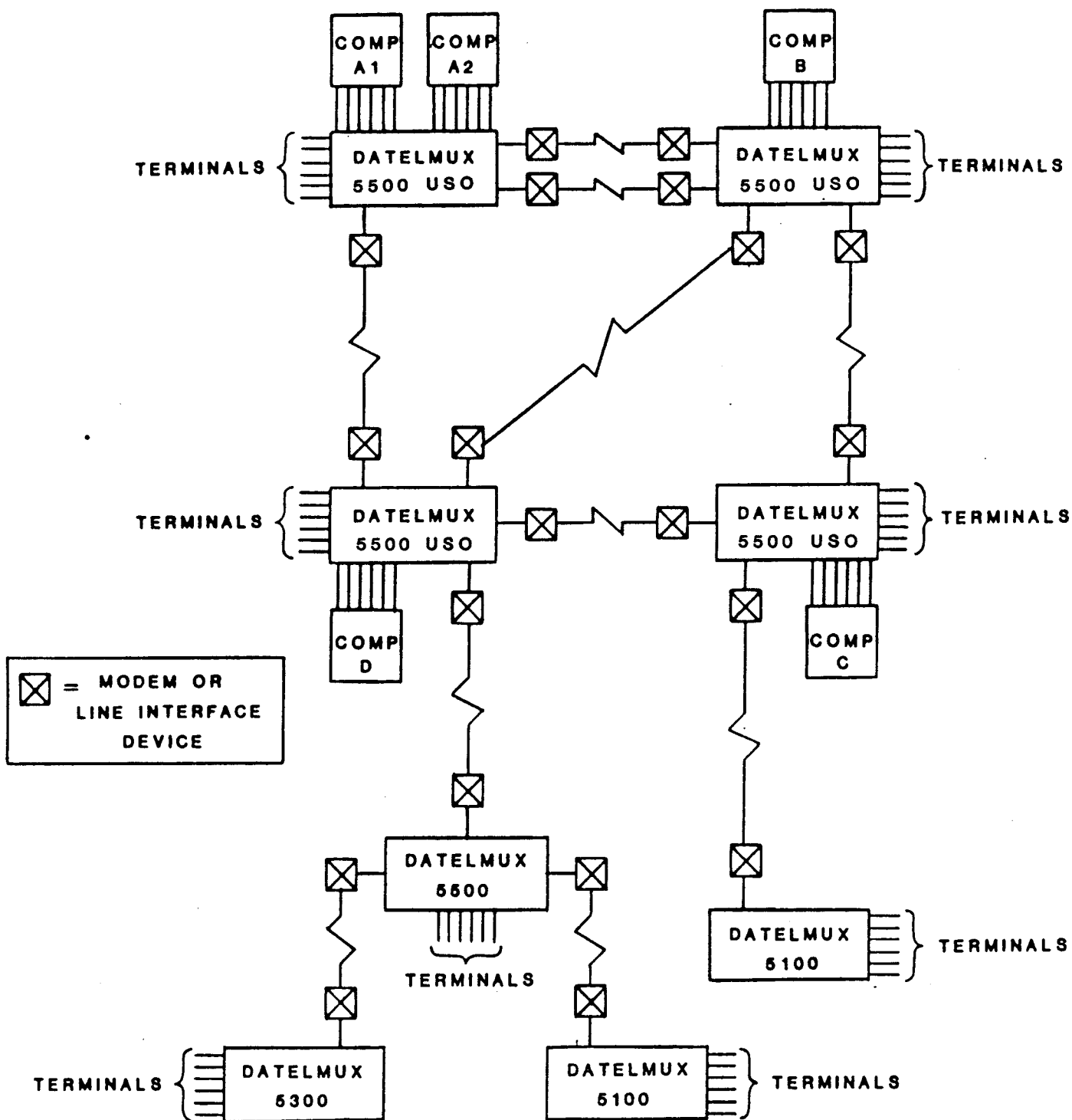
FIGURE 1-1

EXAMPLE OF MULTINODE 5500   USO NETWORK

a)   Terminal users at any of the eight sites can connect
        themselves to any (compatible) port on any of the five
        computers, and subsequently disconnect themselves.

b)   By using Short-Form/group Addresses (SFAs), users may
        connect themselves to a particular computer service which
        may be available at a number of computer ports located at
        more than one site. The computer ports are arranged as
        hunting groups, the user being connected on a "first one
        free" basis. Short-form/group addresses may also be used for
        groups of computer ports set to various different baud
        rates; a user requesting such a group being connected to the
        first free port having a speed compatible with his own. An
        alphanumeric name may be used instead of the short-
        form/group address. Alphanumeric names of greater than 8
        characters in length are truncated to the first 8
        characters.

c)   If any of the computers have a limited number of ports,
        users can contend for use of those ports.

d)   Connections which are likely to be in constant use can be
        configured as "permanent" (Internally mapped) connections.
        These are protected by the automatic rerouting feature so
        that should any of the nodes or links comprising such a path
        fail, the connection would be rerouted using whatever
        alternative route is available.

e)   Where composite links are duplicated (as between sites A and
        B in the diagram), connections using those links are arranged
        in such a way as to share the load between them.

f)   All connections and disconnections and other notable events
        at each node are reported on an Event Log which may be
        output at any designated 5500/USO port.

g)   Supervisory facilities may be made available to an operator
        at any suitable terminal after inputting the necessary
        security codes. These facilities include opening and
        closing of nodes, links and ports, and dynamic
        reconfiguration of all or selected parts of the network.

h)   Selected channels can, if desired, be controlled directly
        from the MTP in the same way as if the node were a 5500.

i)   If a selected destination is busy, the user may request the
        system automatically to retry the connection at regular
        intervals, and inform the user when it has been successful.

1.5 GLOSSARY

The following definitions apply to words that are given specific
meanings in the 5500/USO. They are explained more fully in the text,
but are listed together here for convenience.

AMP. An AMP (Automatically Mapped Port) is a port which may be
connected or disconnected by user request, but which requires no
connection dialogue.

CONNECTION EVENT. This is the action performed by a user at an
idle port to request service from the USO. (Not applicable to
IMPs.)

DISCONNECTION EVENT. This is the action performed at a User Mapped
Port or an Automatically Mapped Port to indicate to the USO that
the existing connection involving that port is to be terminated.

GROUP. This is a synonym for Short-Form/group Address (SFA).

IMP. An IMP (Internally Mapped Port) is a port which can be
connected to or disconnected from another IMP by Supervisor
command only.

LOCAL PORT. A local port is a port configured on Device 0, and
will be an LSC in either the master frame or an extension frame.

NETWORK. A network comprises all the Datelmuxes that are interconnecte
by high speed links.

NODE. A node is a DATELMUX 5500/USO, plus all the ports (either
in the same 5500/USO in other DATELMUXs) that are able to
communicate with it, without involving another DATELMUX 5500/USO.

PIPE. A pipe is a collection of one or more composite links,
considered by the USO as being connected to the same 5500/USO
node at their remote ends.

PMC. A PMC (Permanently Mapped Channel) is a channel which has
been "mapped" to another channel by using the MTP. A PMC can be
"unmapped" or "remapped" from the MTP only.

PORT. A 5500/USO port is a low speed channel connected to the
5500/USO node either directly, or indirectly via a remote non-
5500/USO type DATELMUX, for which a number of attributes (eg type
of Connection Event, type of port) have been defined by the
Supervisor.

SFA. An SFA (Short-Form/group Address) is a collection of one or
more UMPs to which a user may request connection on a "first free
compatible" basis.

SUPERVISOR. The operator at a logged-on Supervisor Station.

UMP. An UMP (User Mapped Port) is a port which can be connected or disconnected by user request to any other compatible UMP on the network.

USER. The operator (or equipment) connected to an 5500/USO port.

USO. The USO (User Switching Option) is a plug-in unit which provides the user switching facilities of a DATELMUX 5500/USO node.

USO CONFIGURATION. The information relating to the network and node, that is retained in a non-volatile area of the USO memory.

VIRTUAL PORT. A virtual port is a port at a remote (non-5500/USO) DATELMUX, which is connected via a composite link to an ARQ at the 5500/USO.

SECTION 2

FUNCTIONAL DESCRIPTION

2.1 THE DATELMUX 5500/USO

Figure 2-1 shows the main functional components of the DATELMUX 5500/USO.* In addition to the modules of a DATELMUX 5500, it also contains the USO (User Switching Option) module which provides all the features that characterise the 5500/USO.

A Supervisor Station is necessary for setting up and controlling the system. It can be any ASCII terminal that has been logged-on at any one of the ports of the network. Its location may be changed at any time. Once a system is in operation, it can continue without a Supervisor Station until a change is necessary. There can be no more than one Supervisor Station at any one node.

The Event Log Station is an ASCII terminal connected to a port nominated by the Network Supervisor. Alternatively (for USO20 only, with software level 20.2 and later), the Event Log Station may be configured to produce binary records compatible with CASE Network Management Systems.

Terminals and computer ports from which user-specified connections are to be made, must be capable of communicating in the ASCII code (during the connection dialogue) and must also be able to control one of the V24 control signals Carrier Detect (CD) or Data Terminal Ready (DTR), or cause a "Line Break" condition to occur, or generate the ASCII DC4 character (Control-T).

* To avoid confusion in this and subsequent diagrams, all data routes are shown by double lines; this includes system data routes (eg messages from USO, and to Supervisor station).

2 - 1
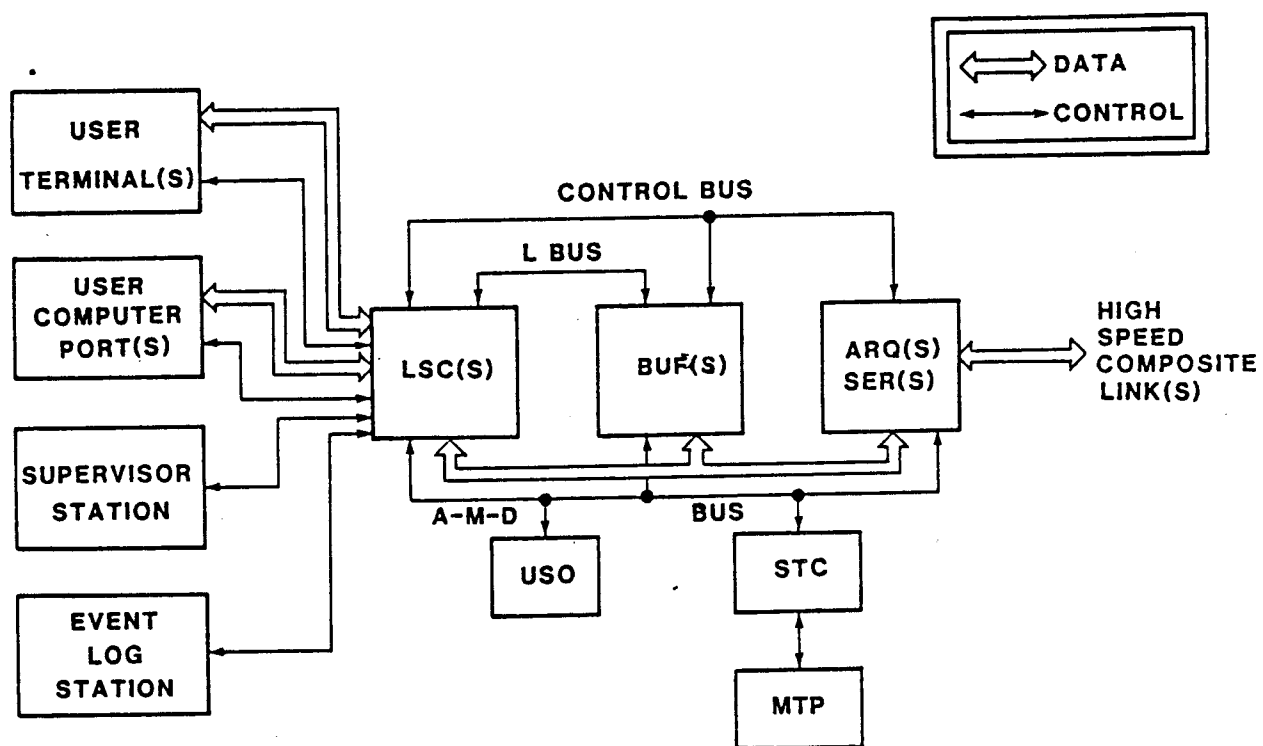
FIGURE 2-1

5500 USO SIMPLIFIED BLOCK DIAGRAM

2.2 THE USO MODULE

The USO is a microprocessor-based module, which performs all the control and monitoring functions peculiar to the 5500/USO. Its interface with the other DATELMUX modules is via the A-M-D bus as shown in Figure 2-2. The major functional units comprising the USO are described in the following paragraphs.

2.2.1 CONTROL CODE MONITORING DEVICE

The Control Code Monitoring Device (CCMD) monitors the A-M-D bus for specific "internal" control codes, amongst which are "Connection Events" and "Disconnection Events" coming from low speed ports. These are the codes with which the users request service (eg to be connected or disconnected). They are entered into the processor memory for subsequent processing.

2.2.2   REAL TIMING CLOCK AND WATCH DOG TIMER

The real time clock provides clock interrupts to the processor, and the watch-dog timer monitors the processor for malfunctions.

2.2.3   BATTERY

The USO Configuration memory is powered by a battery which is trickle-charged while the USO is powered on. If fully charged, it should keep the contents intact for a least a week in the event of mains power failure.
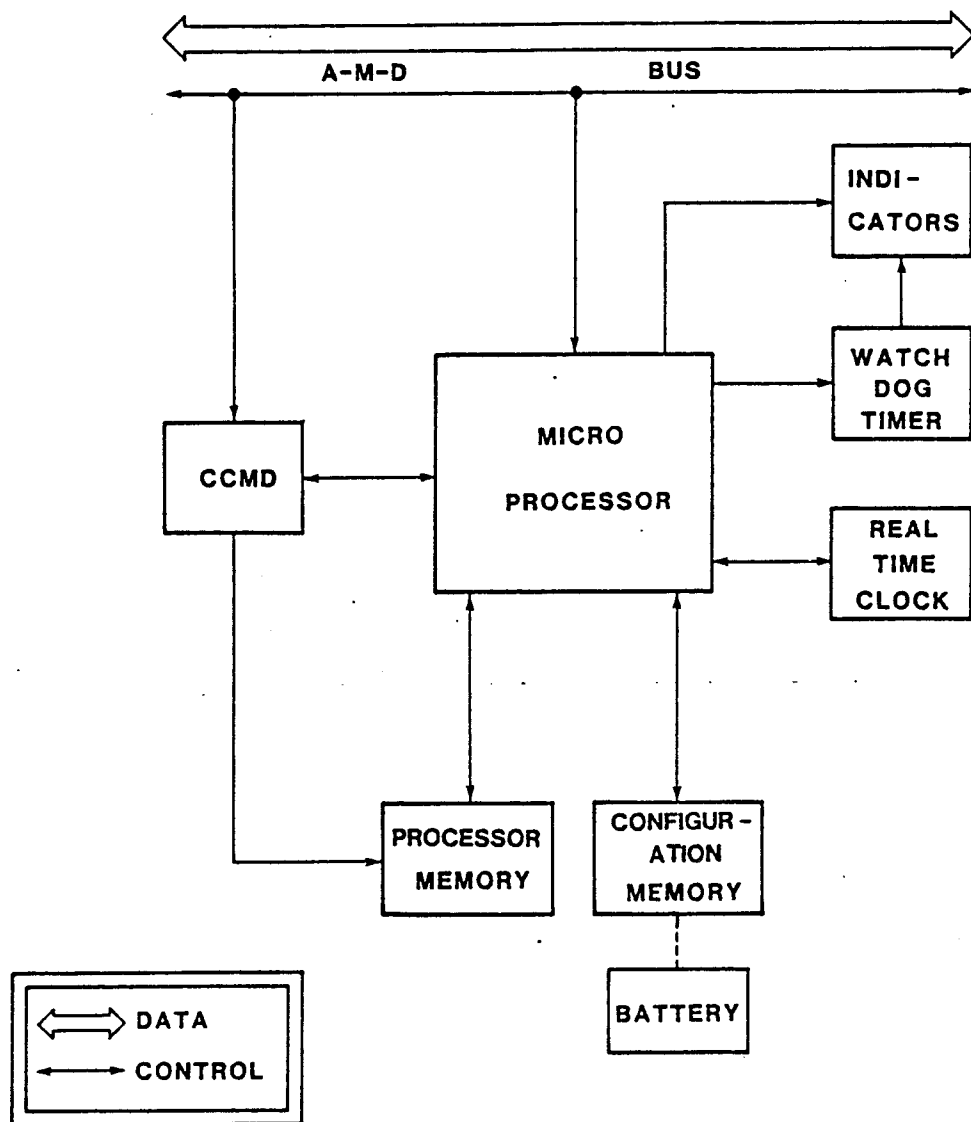
FIGURE 2-2
USO MODULE SIMPLIFIED BLOCK DIAGRAM

2.2.4   CONFIGURATION MEMORY

In the USO is a special area of memory which holds what is
known as the "USO Configuration" data.   This comprises
information such as date/time, short-form/group address
specifications, port, link and route details, and user text
strings.

2.2.5   PROCESSOR MEMORY

The processor memory holds the program instructions which
control the microprocessor, and provides random access
memory for use as formal data structures and temporary work
areas.

2.2.6   DEVICE MAPS

See para 2.6.2 of the 5500 Section.   The USO module is
classed as a "Device" and needs to be included in the Device
Map.   It is always Device 15.   The channels allocated to it
will provide the paths along which the users' requests for
interconnections will be made.

2.2.7   CHANNEL MAPS

See para 2.6.3 of the 5500 Section.   Any channels for which
the 5500/USO features are not required, may be mapped as
described for the 5500.   These Permanently Mapped Channels
(PMCs) will be completely ignored in all 5500/USO functions,
and will behave exactly as if the unit were a 5500.
Channels that are to be part of the 5500/USO must,
initially, all be self-mapped, to enable them to be accessed
by the USO for making interconnections, eg:

DEVICE.CHANNEL   TO   DEVICE.CHANNEL

        0.1   -   0.1
        0.2   -   0.2
        0.3   -   0.3
        0.4   -   0.4
        1.1   -   1.1
        etc.

2.3 SUPERVISOR STATION

The Supervisor Station can be any suitable ASCII terminal,
typically a VDU or printer with keyboard, attached at any UMP on
the network. A Supervisor Station is "logged-on" when the
Supervisor enters a pre-determined 6-digit password, and it can
then be used for all Supervisor functions listed in this
subsection.

2.3.1 SUPERVISOR LOG-ON/LOG-OFF

An ASCII terminal must be logged-on before it can acquire
Supervisor Station status. It may be logged-on as
Supervisor Station either for the 5500/USO node to which it
is directly connected, or for any remote 5500/USO node to
which its node has a valid route. There must be no other
logged-on Supervisor Station for the node at the time, and
the Supervisor must input the correct log-on code. (The
log-on code is specified via the MTP.) The Supervisor can
log-off the Station when it is no longer required.

2.3.2 SUPERVISOR MONITOR AND UPDATE MODES

When a Supervisor Station is logged-on it automatically
enters "Monitor" mode. In this mode the Supervisor can
examine any of the parameters and characteristics of the
node and its links and ports, but may not change them.
Changes to a node's configuration data can only be made from
a Supervisor Station which is in "Update" mode. The
transition to Update mode can be made by the Supervisor
entering an appropriate password at a Supervisor Station
which is in Monitor mode. (The password can only be defined
by a logged-on Supervisor in Update mode.) A Supervisor
Station which is in Update mode will re-enter Monitor mode
either when requested to do so by the Supervisor, or after a
ten minute period of Supervisor inactivity.

2.3.3 USO CONFIGURATION DATA

Details of a node's configuration can be defined, displayed
and modified by the Supervisor. They are in two main
categories: node and port.

Node Parameters

a) Short-form and group address definitions.

b) Alphanumeric group name definitions.

c) "Service Ready," "Invitation to Select," and "Recorded Announcement" texts.

d) The identity of the port to which the Event Log is output.

e) The date and time of the Real Time Clock.

f) Port busy-out time after disconnection.

g) Node identity.

h) Definition of routes to other nodes in the network.

i) Update mode password.

j) The ten connection response texts (US03 and US020 only).

k) The correlation between logical and physical node numbers (US03 only).

l) The "Welcome Page" text (US020 only).

Node Characteristics

In addition to the above parameters, certain node characteristics can be displayed:

a) The node status (On-line or Off-line) and Supervisor Station mode (Monitor or Update).

b) The configuration details and statistics for each composite link.

c) Whether the automatic retry feature is enabled.

d) The number of users retrying for each destination.

e) The node addressing mode (Physical or Logical) (US03 only).

f) Whether automatic output of link statistics to Supervisor Station is enabled (US03 or US020 only).

g) Whether the Event Log is configured for ASCII text or binary records (US020 only with software level 20.2 or later).

Port Parameters

a) The device and channel number allocated to the port.

b) The parity of outgoing USO generated data.

c) The port type (IMP, AMP or UMP).

d) Whether port speed is fixed or down line load (DLL).

e) Whether system messages (eg CNX FAILURE PLEASE REQ RECONNECTION) are to be output or suppressed.

f) Whether or not characters input from the terminal during the the connection dialogue are to be echoed back.

g) If IMP, the destination port, or if AMP, the destination group.

h) If AMP or UMP, the "Connection Event" (method of initiating a user connection).

i) If AMP or UMP, the "Disconnection Event" (method of terminating a user connection).

j) If UMP, the "Access Level" (the range of ports or groups to which access is allowed).

k) If AMP or UMP, the "neutral state" of the V24 output control lines.

l) If UMP, whether or not DTR should be tested when another UMP attempts a connection to it.

Port Characteristics

In addition to the above parameters that can be specified by the Port command, certain port characteristics can be displayed:

a) Whether the port is open or closed.

b) The port's last reported speed.

c) If connected, the identity of the remote end of the connection.

2.3.4 OPENING AND CLOSING FUNCTIONS

Any port, node, or link can be opened or closed to traffic
immediately, irrespective of current activity.
Alternatively disconnection of existing connections using a
port, node or link due for closure can be delayed until a
specified time or time interval, in which case the closure
is immediate, but the disconnection happens either when
initiated by the user or at the time specified, whichever is
the sooner.

2.3.5   ALPHANUMERIC AND SHORT FORM/GROUP ADDRESSES

The Supervisor can dynamically define and re-define alpha-
numeric and short-form/group addresses of ports or groups of
ports. Such changes do not affect existing connections.

2.3.6 DUMPING AND LOADING THE USO CONFIGURATION DATA

The Supervisor can cause a machine-readable hard copy of
the USO Configuration data to be output via a nominated
port, or cause a copy previously produced in this way to
be loaded into the 5500/USO to become its USO Configuration
data.

2.4 EVENT LOG STATION

The Event Log Station can be any suitable ASCII terminal, for
example a printer with continuous stationery, attached at any UMP
on an 5500/USO node. The port number is specified by the
Supervisor, and it is then used by the node to print out the
Event Log. The Event Log is a record of the following
events, each accompanied by the node identity and the time of
day:

a)   Successful user connection and disconnections (originating
      port and destination port or group).

b)   Unsuccessful user connections (originating port and
      requested destination).

c)   Opening or closing of ports, links or node.

d)   Link failure (link identity).

e)   Link reinstatements (link identity).

f)   Buffer overflows, overloads and failures.

g)   Supervisor log-ons and log-offs.

h)   Changes of Supervisor Station mode.

i) Inconsistencies, detected during start-up, between 5500 Device and Channel Maps and USO configuration data.

j) Changes of node addressing mode (USO3 only).

A full list of Event Log messages is given in Section 6.

For a USO20 with software level 20.2 or later, the Event Log may be configured for binary records. In this case, a sequence of 8-bit bytes is sent to the Event Log Station.

2.5 USER PORTS

User ports are DATELMUX channels to which typically a terminal or computer has been connected either directly or via a modem or other data communications device, and which have been allocated port numbers within the USO configuration file.

From this it can be seen that a 5500/USO user port may be configured on an LSC card in either the DATELMUX 5500/USO master bay or an expansion bay; on any channel of a composite link connected at its remote end to one of the lower order DATELMUX multiplexers (5100, 5300 etc); or to a channel on a composite link connected at its remote end to a DATELMUX 5500 or 5500/USO node provided that channel is STC-mapped at the remote end to a channel on an LSC card.

It should be noted that the use of user ports configured on "onward linked" channels is not recommended.

2.5.1 TYPES OF USER PORTS

User ports may be one of three types:

a) User Mapped Ports (UMPs). These may be connected to (or disconnected from) any other free, speed-compatible UMPs on the network at the user's request. UMPs have Supervisor defined Connection and Disconnection Events which are performed by the user to initiate connection or disconnection procedures. During the connection procedure the user receives a "welcome" message and an identification of his node and port. For a USO20 only, if the welcome page is enabled the user will receive this also. The user, should then input the identity of the desired destination, either as a specific port at a specific node, or as a short-form/group address code, or as an alphanumeric name. On completion of the connection procedure the user receives an indication of whether or not the connection was successful, and the reason for any failure.

b)   Automatically Mapped Ports (AMPs). These may be
        connected to (or disconnected from) a free speed-
        compatible UMP, contained within a Supervisor-Specified
        short-form/group address, at the user's request. As
        with UMPs, AMPs have Supervisor-defined Connection and
        Disconnection Events, but there is no connection
        dialogue involved. On performing the Connection Event
        the user will be connected to the first suitable port
        in the short-form/group address associated with that
        AMP. Indication of the success or failure of the
        connection is the same as for UMPs.

c)   Internally Mapped Ports (IMPs). IMPs are ports that
        can be interconnected only by the Supervisor. The
        Supervisor must specify to which other speed-compatible
        IMP on the network each IMP should be connected. When
        both ends of an IMP pair are opened, a connection is
        established between them. If for any reason the
        connection fails (eg line failure), the network will
        attempt to restore the connection using an alternative
        route. IMP connections may be broken by the Supervisor
        by closing either of the IMPs. When an IMP connection
        is to be restored, one end of the connection is
        nominated the "originator" and re-attempts the
        connection every minute while the other end plays a
        passive role awaiting the connection attempt. The
        originating IMP is that configured at the node with the
        higher physical node number, or if both are at the same
        node, is the one with the higher port number.

2.5.2   CONNECTION EVENTS

A port's Connection Event is the action to be taken by a
user at a free port in order to initiate the connection
procedure. UMPs and AMPs may be configured with one of the
following Connection Events:

a)   Data Terminal Ready (DTR, channel pin 20) becoming true
        (0 to 1). For many terminals this happens when the
        LINE/LOCAL switch is set to LINE.

b)   Carrier Detect (CD, channel pin 4) becoming true (0 to 1).
        For use with leased line (private wire) modems.

c)   End of Line Break. For use with terminals having a
        BREAK key which causes the line to stay in the "space"
        condition for at least one character period.

d)   Ring Indicator (RI, channel pin 25) becoming true (0 to
        1) followed within 10 seconds by the presence of
        Carrier Detect (CD, channel pin 4). For use with dial-
        up (PSTN) modems.

e)   CONTROL-T (ASCII DC4) character being input at the
     port. For use when control of the V24 signals is not
     possible and use of line break is inconvenient.

     When a Connection Event is recognised, the USO raises
     DSR, CD and CTS (channel pins 6, 8 and 5) outgoing to
     the port,* and in the case of UMPs, a short dialogue is
     conducted during which the user enters the address
     (full, alpha-numeric or short-form) of the desired
     destination. If the request is successful, the user
     becomes connected to the destination port, and remains
     so until termination of the connection is requested by
     a Disconnection Event.

2.5.3   DISCONNECTION EVENTS

A port's Disconnection Event is the action to be taken by
the user at a connected port in order to initiate the
disconnection procedure. UMPs and AMPs may be configured
with one of the following disconnection events.

a)   Data Terminal Ready (DTR, channel pin 20) becoming
     false (1 to 0).

b)   Carrier Detect (CD, channel pin 4) becoming false (1 to
     0). For use with both leased line (private wire) and
     dial-up (PSTN) modem.

c)   Start of Line Break.

d)   CONTROL-T (ASCII DC4) character.

* For the dial-up Connection Event the process differs
slightly in that on receipt of RI from the modem, the USO
raises DTR (channel pin 6) and on receipt of CD it raises
DTR, RTS and DRS (channel pins 6, 8 and 5).

The disconnection procedure consists of breaking the
connection, sending the disconnect message to each end as
appropriate, dropping all V24 controls at each end for a
minimum period of 1 second, then restoring the controls to
the port's specified output neutral state. The destination
end of the connection will then not be available for
reconnection until after the node's busy-out delay has
expired (2 seconds minimum).

2.5.4 NIL CONNECTION AND DISCONNECTION EVENTS

There is also a "nil" Connection or Disconnection Event
which can be used in situations where it is undesirable for
the user to be allowed either to initiate or to terminate
connections (eg it is often necessary to prevent computer
ports initiating connections, but to allow them to terminate
connections).

2.5.5 DUAL-LEVEL DISCONNECTION

A dual-level disconnection is available for use with dial-up
modems. This feature enables dial-up users to carry out a
number of transactions requiring connections to different
destinations, without having to redial. One disconnect
level is operated by Line Break, the other by Carrier
Detect. Start of Line Break causes "partial" disconnection
(ie disconnects the DATELMUX connection, but not the
dialled PSTN connection), followed by an invitation to
request a new connection.

Carrier Detect (CD, channel pin 4) becoming false (1 to 0)
causes "full" disconnection (ie disconnects both the
DATELMUX and the PSTN connections).

Note that dual-level disconnection is not available for
AMPs.

2.5.6 OPENING AND CLOSING PORTS

Channels at a DATELMUX 5500/USO node that are unused, or that
have ports configured on them which are closed, are
available to the MTP for its full range of channel
operations. When a USO port is opened, its channel comes
under complete control of the USO and cannot be accessed
from the MTP except to display its mapping. Conversely,
channels whose mapping has been set to anything other than
"self-mapped" from the MTP cannot be accessed by the USO
(ie ports configured on such channels cannot be opened).

2.5.7   DESTINATION PORTS

Destination ports may be either UMPs or IMPs. If the destination port is an UMP, connection can only be made to it if the requesting port is an UMP or AMP, and conditions a, b, c and d below are fulfilled.

If the destination port is an IMP, then the originating port must be the IMP to which the destination port is configured as being connected. Only requirements a, b and c below need be fulfilled to complete an IMP connection.

a)   The destination node and port must be OPEN.

b)   If the destination port is connected to the DATELMUX 5500/USO node via a composite link, that link must also be OPEN.

c)   If the destination is configured as fixed speed (SPD=F), its channel speed must correspond to that of the requesting port. (If the destination is configured for Down Line Load (SPD=D), no speed matching is performed, but the requesting channel will down-load its own speed to the destination.)

d)   If the destination port is configured as requiring functional test (TST=1), it must respond to the 1 second pulse Ring Indicator (channel pin 25) which is generated by the USO at this time, by raising DTR (channel pin 6) within 2 seconds. (If the destination is configured with TST=0, the pulse of Ring Indicator is still generated but no test for DTR is performed.)

2.5.8 CONNECTION TO ALPHANUMERIC AND SHORT-FORM/GROUP ADDRESS DESTINATIONS

Connections either to a named group or to a short-form/group address are essentially the same, the name being converted to a short-form address using the conversion table in the configuration memory of the requesting port's node.

Short-form/group addresses are defined as one or more contiguous "sets" of ports which may be all at the same node or at various nodes around the network. The node at which the request for a short-form/group address is made, interrogates its address table to find the node number containing the first set of ports. If it is the local node the ports are examined in numerical order looking for one that is open, free, speed compatible and functioning. If the node is elsewhere in the network a connection request packet is sent specifically to that node, asking for connection to a suitable port on the requested short-form/group address. If after examination of the ports specified in that node's address table as being included in the address, none are found that are both suitable and available, the node will send a "connection attempt failed" response and the originating node will then examine the next set of ports (if any) configured for that address.

Two points regarding connections to short-form/group addresses should be borne in mind. Firstly, a remote node receiving a request from another node for connection to an address, will only examine ports local to itself, even if its address table indicates these are ports for that address at other nodes, and if none are available it will respond with "connection unsuccessful". Secondly, a remote node will examine the port identified in its own address table as being part of the specified group, but this need not necessarily be the same ports as were specified by the originating node's address table.

As an example, if a user at Node 1 requests connection to short-form/group address 23, which is configured in that node's address table as:

    2.1 3.1 1.1-5 (ie Port 1 at Node 2, Port 1 at Node 3
                    and Ports 1 to 5 at this node (Node 1))

the USO would first send a connection request to Node 2 for address 23, then if that failed to Node 3, and only if that too failed would it examine its own ports 1 to 5. Also, if address 23 is configured in Node 2's address table as:

    1.1-5 2.20-23 3.1

Node 2 will examine only its own ports 20 to 23 (and not Port 1 as Node 1 was led to believe it would do).

2.5.9 SPLIT BAUD RATE CHANNELS

The USO supports user ports connected to channels set to 75/1200 baud split speed. During the connection dialogue, characters are input to the DATELMUX at 75 baud and output from it at 1200. Users at such ports may request connection to any destination but the connection will only be implemented if the destination channel is set to 1200/75 baud split rate or 1200 baud fixed rate. The destination port must also be configured within its USO as fixed speed (SPD=F).

2.6 EXAMPLE NETWORK, SINGLE 5500/USO NODE

Figures 2-3 to 2-6 show diagrammatically a very simple network to illustrate the features of a 5500/USO. Site 1 is a 5500/USO with two composite links, one connected to an 5100 at Site 2 and the other to a 5500 at Site 3. (For the purpose of the diagrams, channels are shown routed through the STC maps and the USO; in practice of course the data is held in the buffers, and the addresses are held in the maps, as explained in the 5500 Section)

2.6.1 STC MAPPING

Figure 2-3 shows the hardware, with the STC device and channel mapping completed at the MTPs of the 5500 (and 5500/USO). The 5100 at Site 2 has four terminals (T3 to T6) connected to its channels 1 to 4.

The 5500 at Site 3 also has four terminals (T7 to T10) on its channels 1 to 4. Its STC maps are:-
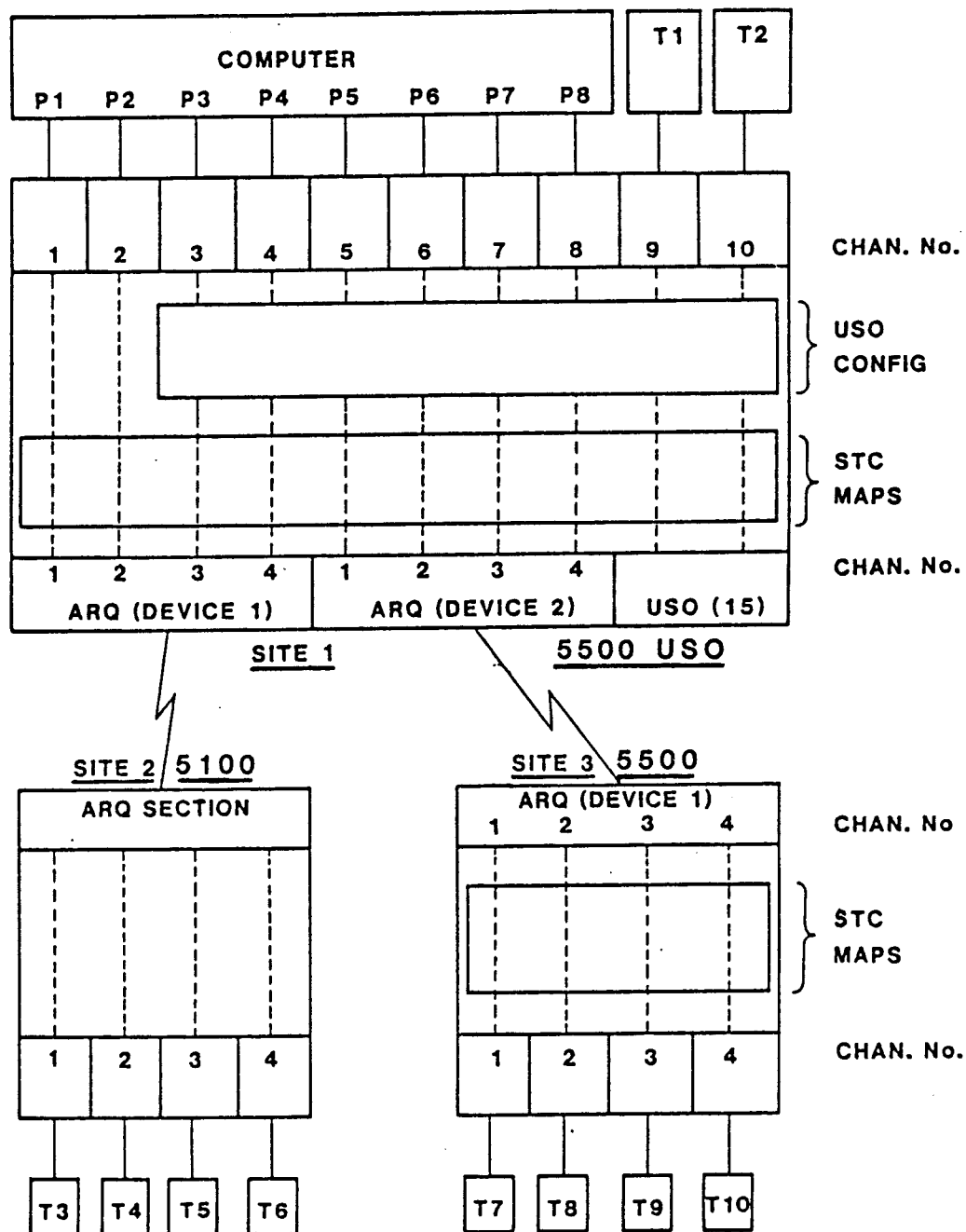
FIGURE 2-3
EXAMPLE SINGLE NODE NETWORK – STC MAPPING

5500 DEVICE MAP:

Device	Base	Size
0	1	4
1	5	4

5500/USO CHANNEL MAP:

DEV.CHN	to	DEV.CHN
0.1	-	1.1
0.2	-	1.2
0.3	-	1.3
0.4	-	1.4
1.1	-	0.1
1.2	-	0.2
1.3	-	0.3
1.4	-	0.4

The 5500/USO STC mapping allows for expansion and flexibility. The 5500/USO has eight computer ports (P1 to P8) and two terminals (T1 and T2) connected to its low speed channels 1-10. It was decided to allow users to make fourteen connection or disconnection acts simultaneously (Device 15 Size = 14+6, see para 6.2.1), and to interconnect two sets of channels "permanently" (PMC's), so that they could not be accessed from the Supervisor Station or User Terminals (P1 to T3 and P2 to T4); the remainder of the channels are self-mapped. The 5500/USO STC maps are:-

5500/USO DEVICE MAP:

Device	Base	Size
0	1	64
1	65	10
2	75	10
15	85	20

5500/USO CHANNEL MAP:

DEV.CHN	to	DEV.CHN		
0.1	-	1.1		
0.2	-	1.2		
0.3	-	0.3		
0.4	-	0.4		
0.5	-	0.5		
0.6	-	0.6		
0.7	-	0.7		
0.8	-	0.8		
0.9	-	0.9		
0.10	-	0.10	etc.	to 0.64 - 0.64
1.1	-	0.1		
1.2	-	0.2		
1.3	-	1.3		
1.4	-	1.4	etc.	to 1.10 - 1.10
2.1	-	2.1		
2.2	-	2.2		
2.3	-	2.3		
2.4	-	2.4	etc.	to 2.10 - 2.10
15.1	-	15.1		
15.2	-	15.2		
15.3	-	15.3		
15.4	-	15.4		
15.5	-	15.5		
15.6	-	15.6	etc.	to 15.20 - 15.20

2.6.2 NODE CONFIGURATION

The Supervisor logged-on at Channel 0.11 and constructed the
USO Configuration data (this could have been done at any
channel, see para 6.3.1). Port numbers were allocated to
the relevant self-mapped channels as shown in Figure 2-4.
Ports 104 and 105 (Computer ports P7 and P8) were classified
as IMPs (I on diagram) and were internally mapped to Ports
022 and 023 (T9 and T10 on Site 3). Port 21 was configured
as an AMP (A On diagram), contending for the computer ports
(short-form address 0). The remaining ports were classified
as UMPs (U on diagram).

The node and all ports were "opened" by the Supervisor.

Port 002 was selected as destination for the Event Log,
which will print out on T2. The Supervisor then logged-off
from Channel 0.11 and logged-on at Port 001 (Terminal T1).
At that stage the internal connections were as shown
diagrammatically in Figure 2-4. A display of all configured
ports requested by the Port Command (see Section 4.21) would
be:

COMPUTER

P1	P2	P3	P4	P5	P6	P7	P8	T1 SPV	T2 EVT

| — — 1 | — — 2 | U 100 3 | U 101 4 | U 102 5 | U 103 6 | I 104 7 | I 105 8 | U 001 9 | U 002 10 | U or I · PORT No. · CHAN. No. |

USO CONFIG

STC MAPS

1	2	3	4	1	2	3	4	·	CHAN. No.
ARQ (DEVICE 1)				ARQ (DEVICE 2)				USO (15)	

SITE 1

5500 USO

SITE 2 5100

ARQ SECTION

1 — —	2 — —	3 010 U	4 011 U

| T3 | T4 | T5 | T6 |

SITE 3 5500

ARQ (DEVICE 1)

1	2	3	4	CHAN. No.

STC MAPS

| 1 020 U | 2 021 U | 3 022 I | 4 023 I | CHAN. No. · PORT No. · U or I |

| T7 | T8 | T9 | T10 |
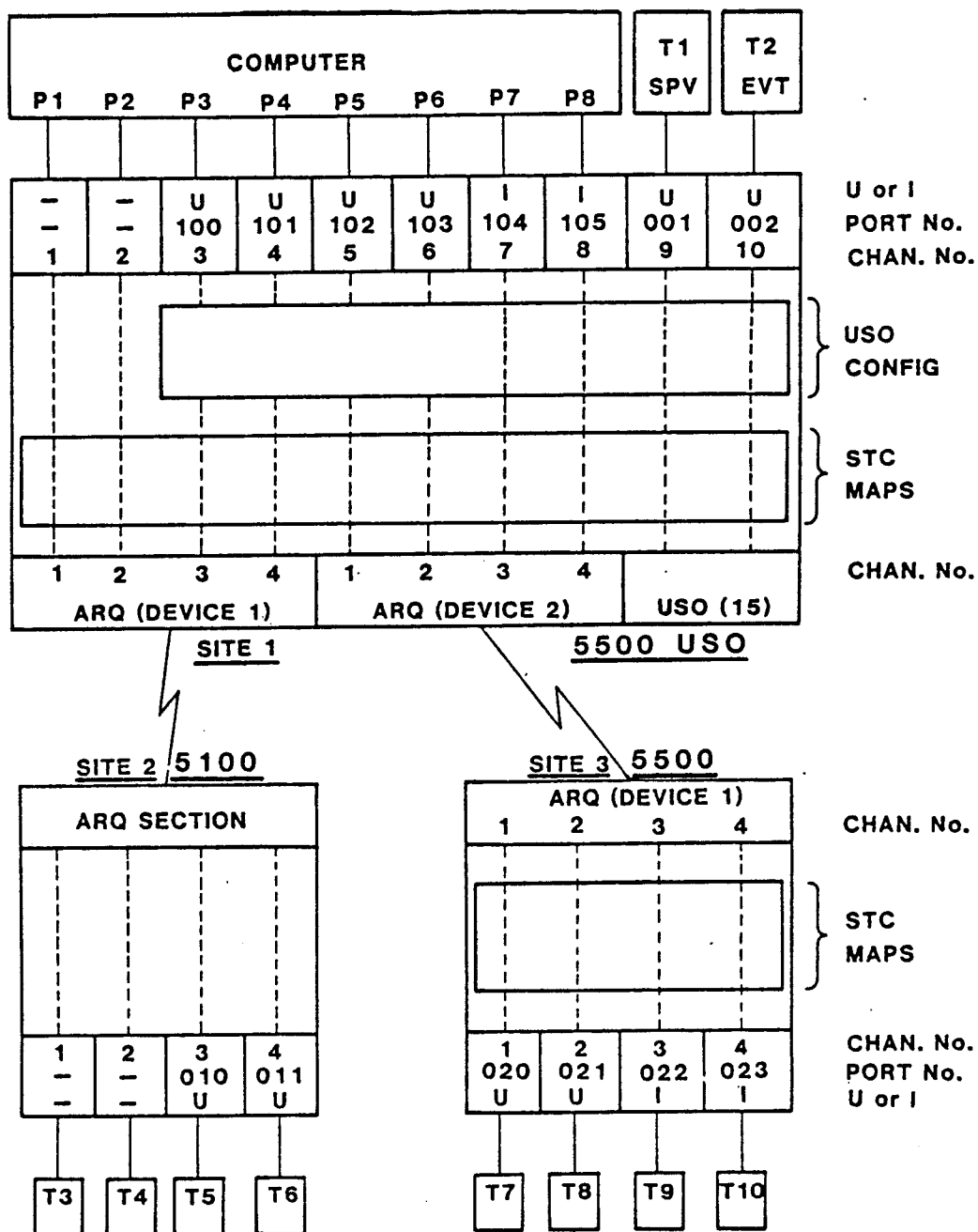
FIGURE 2-4

EXAMPLE SINGLE NODE NETWORK – PORT CONFIGURATION

```
PORT   DEV:CHN   STATUS   TYP   DST

001    00:009    0        U     SPV
002    00:010    0        U     EVT
010    01:003    0        U     N/C
011    01:004    0        U     N/C
020    02:001    0        U     N/C
021    02:002    0        A     N/C
022    02:003    0        I     01.104
023    02:004    0        I     01.105
100    00:003    0        U     N/C
101    00:004    0        U     N/C
102    00:005    0        U     N/C
103    00:006    0        U     N/C
104    00:007    0        I     01.022
105    00:008    0        I     01.023
```

The Supervisor then allocated the following short-form/group
addresses and names to groups of UMPs on each DATELMUX:

PORTS		ADDRESS	NAME
100-103	(P3-P6)	0	COMPSYSA
001	(T1)	1	-
010-011	(T5-T6)	2	2TERMS
020	(T7)	3	-

so that to a user (at terminal or computer), the network
appeared as in Figure 2-5. The only reference a user needs
to enter, to be connected to the first free port on another
site, is the address number or its alphanumeric name. A
user at Port 21 can only connect to one of the computer
ports, but is not required to input an address number to
achieve that connection.

2.6.3 USER CONNECTIONS

The Supervisor Station was then logged-off. A user at
address 2 (T6) then made a connection to the computer
(switched terminal to LINE and typed (CR), then after the
Invitation to Select response, typed : 0(CR)), and the
computer made connections to Address 3 and Address 1. A
user at Port 21 (T8) was able to connect to the computer
simply by switching the terminal to LINE. The connections
are now as shown diagrammatically in Figure 2-6, and the
display of all configured ports is:

ADDRESS 0

ADDRESS 1

COMPUTER

T

(4 lines)

ADDRESS 3

T

T   T

ADDRESS 2

T

ADDRESS 4
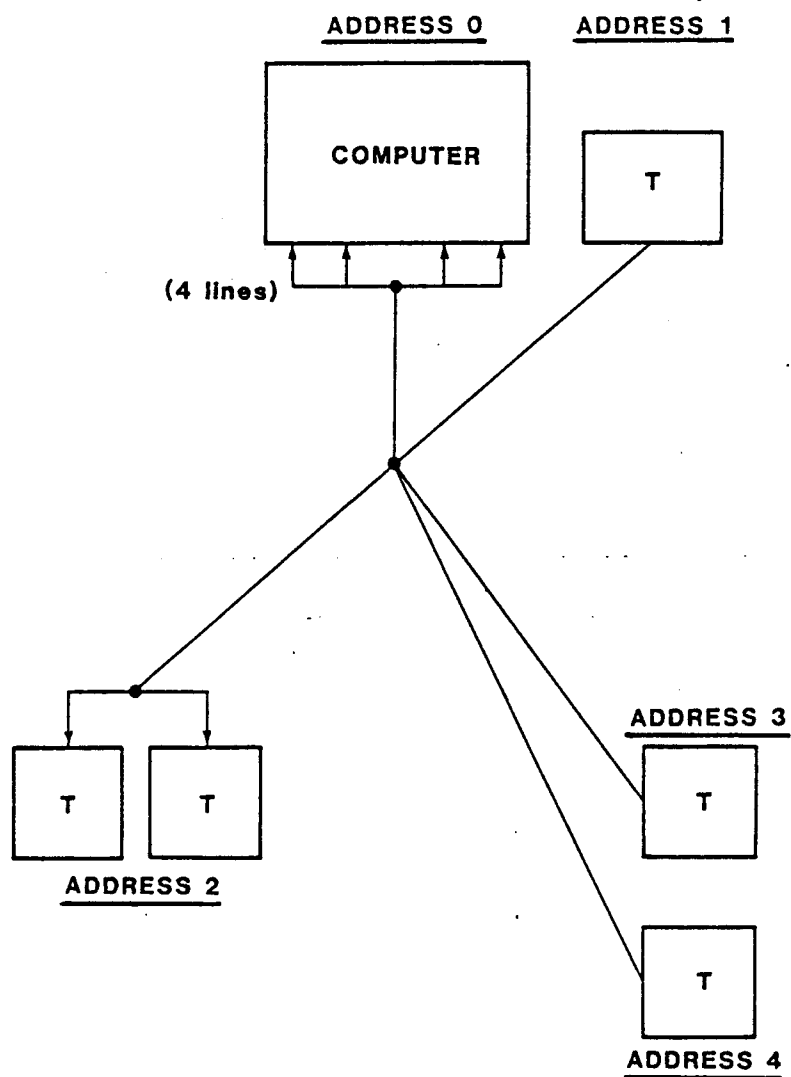
FIGURE 2-5
USERS VIEW OF FIGURE 2-4
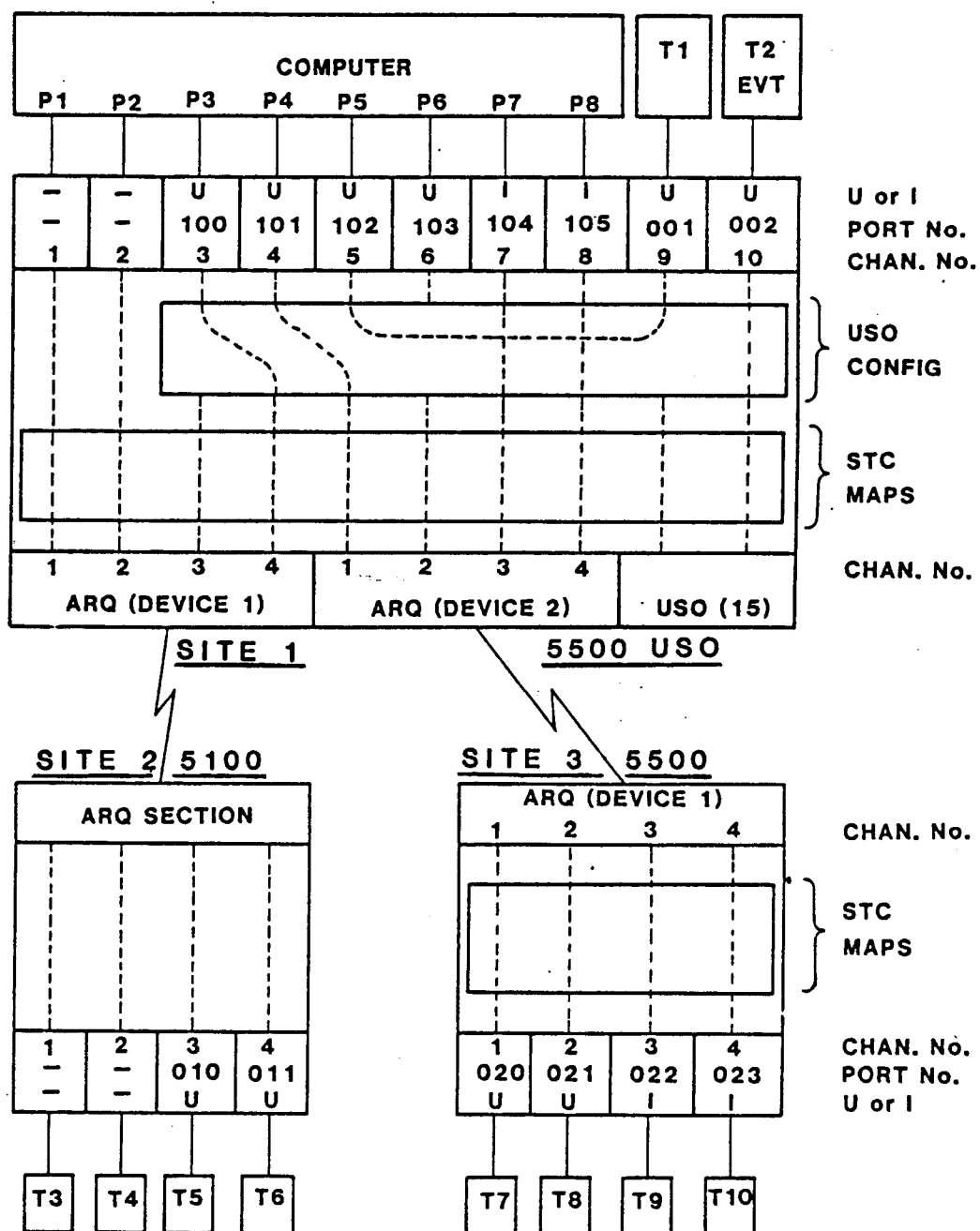
FIGURE 2-6

EXAMPLE SINGLE NODE NETWORK - USER CONNECTIONS

2 - 23

```
PORT    DEV:CHN   STATUS   TYP    DST
001      00:009     0        U     01.102
002      00:010     0        U     EVT
010      01:003     0        U     N/C
011      01:004     0        U     01.100
020      02:001     0        U     01.101
021      02:002     0        A     00
022      02:003     0        I     01.104
023      02:004     0        I     01.105
100      00:003     0        U     01.011
101      00:004     0        U     01.020
102      00:005     0        U     01.001
103      00:006     0        U     01.021
104      00:007     0        I     01.022
105      00:008     0        I     01.023
```

2.7 COMPOSITE LINKS BETWEEN 5500/USO NODES

It can be seen from the previous example that channels on a
composite link connected to a 5500/USO fall into three categories:-

a)   Channels configured as 5500/USO ports (eg Channels 3 and 4 on
      the 5100 link and Channels 1 to 4 on the 5500 link in the
      example). Such channels would normally be permanently
      mapped to an LSC at the remote end of the link.

b)   PMC channels. (eg Channels 1 and 2 on the 5100 link in the
      example.) These channels are STC-mapped and are not
      configured as 5500/USO ports. They are considered by the USO as
      inviolable.

c)   Unused channels (eg Channels 5 to 10 on both links in the
      example). These channels are self-mapped and not configured
      as 5500/USO ports.

Channels of type c) can be changed into PMCs (by operator action
at the MTP), or can have 5500/USO ports configured on them (by
5500/USO Supervisor action) at any time. In addition to this, in
multi-5500/USO-node systems, a USO can acquire an unused channel
to implement an inter-5500/USO connection. This introduces a fourth
category of composite link channel - the "network" channel.
Network channels cannot be mapped from the MTP, and cannot have
5500/USO ports configured on them. Once the connection for
which a network channel was acquired is broken, the channel
reverts to its previous "unused" state.

For this reason, composite links between 5500/USO nodes should be
configured with sufficient unused channels to handle the expected
number of concurrent inter-node connections required.

2.8 PIPES AND ROUTES

A "pipe" is defined as one or more composite links that are considered to be parallel paths to the same neighbouring 5500/USO node. Each 5500/USO node should have a "route" to every other 5500/USO node in the network. A route comprises one or more pipes. When a USO needs to make a connection to a remote node, it examines the first (or only) pipe defined in the route to that node, ascertains which link in that pipe is best able to take the extra load, and attempts the connection using the next free channel on that link. If no response is received, the connection attempt is retried with up to three free channels on the same link, before it is treated as a failure. If the connection fails, the USO tries the next pipe in the route. This continues until either there are no more specified pipes, or a connection is made.

The example shown in Figure 2-7 should help to clarify this. Considering Node 1, it has three parallel links to Node 2 (Links 1, 2 and 3) configured as Pipe 1, and two parallel links to Node 3 (Links 4 and 5) configured as Pipe 2. The primary route to Node 2 would be Pipe 1, and the secondary route Pipe 2 (via Node 3); whilst the primary route to Node 3 would be Pipe 2 and the secondary route Pipe 1 (via Node 2).

If the USO at Node 1 needed to make a connection to a port at Node 3, it would find the primary route (Pipe 2) and examine the links comprising that pipe (Links 4 and 5). If both links were heavily loaded and neither could support the additional load, then the USO would examine a subsidiary route to Node 3, represented by Pipe 1. Assuming that at least one of the links in Pipe 1 (Links 1, 2 or 3) could take the extra load, the USO would map the connection to a free channel on one of those links.

2.9 LOGICAL NODE ADDRESSING (USO3 ONLY)

The USO3 has a facility allowing nodes to be allocated node numbers in the range 1 to 999. Although this does not extend the maximum USO3 network size of 255 nodes, it allows greater flexibility than the conventional physical-node addressing mechanism.

Logical node addressing is based on a "node number conversion table" set up by the Supervisor at each node. This table holds the physical node number corresponding to each configured logical node. When a node is operating in physical addressing mode, the conversion table is ignored and all node numbering is physical (ie 1 to 255). If the node is switched into logical addressing mode, all communication with the outside world uses logical node numbers (1 to 999), while all communication within and between USO modules uses physical node numbers, the conversion table being used to translate between the two.

PIPE 1   PIPE 2

L1   L4

5500 USO L2   L3 5500 USO

NODE 1 L3   L2 NODE 2

L4   L1

L5

PIPE 2   PIPE 1

L2

PIPE 1 L1   PIPE 2

5500 USO

NODE 3
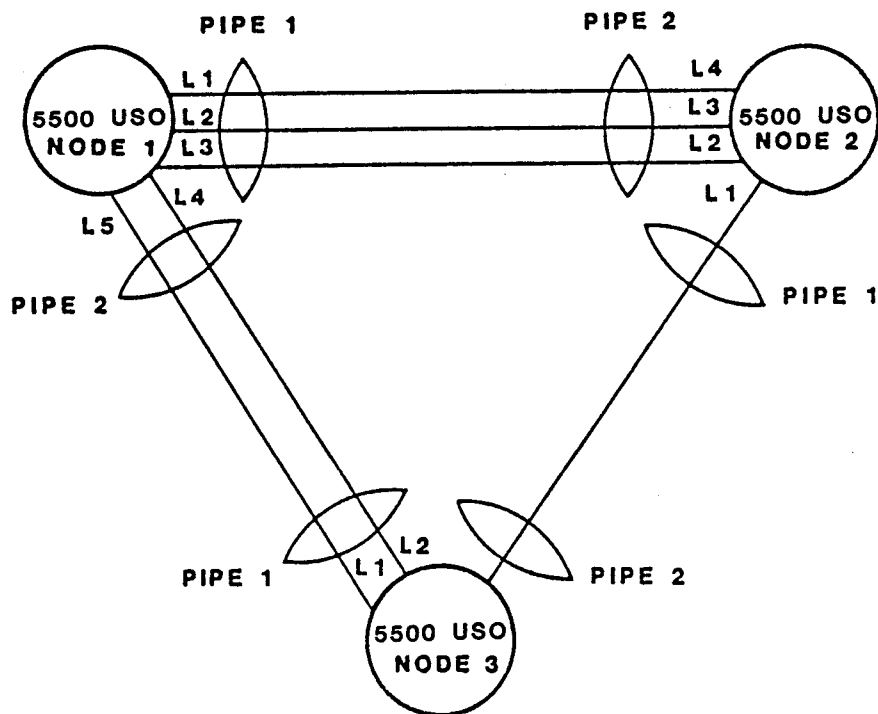
FIGURE 2-7

EXAMPLE OF NETWORK ROUTING

The conversion table may be set up by the Supervisor while the node is operating in physical addressing node by means of the LPNODE command (see Section 4.12). Having done this it is necessary to "validate" the table before the logical addressing can be selected. Validation checks for and reports any physical node numbers that are configured on more than one logical node. Once the table has been validated, logical addressing can be selected after closing the node. When in logical mode the contents of the conversion table can still be changed, but the use of a physical node number on more than one logical node is prohibited.

As an example consider a node having physical node number 1 and running in physical addressing node. It has routes to three other nodes (physical numbers 2, 3 and 4); four short-form/group addresses are configured (0, 1, 2 and 3); and (among other ports) has an IMP configured as Port 1 whose destination end is Port 1 at Node 3. The ROUTE and ADDRESS commands would generate output of the form:-

```
RTE    PIPE(S)                        ADDRESS

002    001 099                  000   001.010-019
003    099 001                  001   002.010-019
004    007 099                  002   003.010-019
                                003   003.020   004.010-019
```

Suppose it is desirable to address the nodes using their IDD telephone codes. Node 1 is in Rome (IDD code 396), Node 2 in Paris (IDD code 331), Node 3 in Brussels (IDD code 322) and Node 4 (although not yet connected) will be in Wellington, New Zealand (IDD code 644). To achieve this the Supervisor sets the node number conversion table as follows:

```
logical node 396 corresponds to physical node 1
logical node 331 corresponds to physical node 2
logical node 322 corresponds to physical node 2
```

Note the last "2" is a mis-key, it should have been "3". Also, as the Wellington node is not yet in use, the Supervisor has forgotten to configure it in the conversion table.

When the Supervisor tries to validate the table, an error report is generated, identifying logical node 331 as being invalid (physical node 2 has already been used). This is corrected by re-configuring logical node 322 as corresponding to physical node 3, after which the table is validated and the Supervisor selects the logical addressing mode. If at this time the EDIT pad on the node's MTP is depressed, the node number displayed on the MTP will change from 1 to 396. The ADDRESS command will generate the output:
```
                00    396.010-019
                01    331.010-019
                02    322.010-019
                03    322.200   004*010-019
```

It will be noticed that address 3 has an asterisk following node number 4. This indicates that this set of ports is configured on a physical node which has no corresponding logical node number. The ROUTE command will generate the output:

```
RTE          PIPE(S)
322          099 001
331          001 099
```

Note that only two routes are reported. This is again because node 4 has not been allocated a logical node number and, as far as this node is concerned, does not exist in logical mode. This omission can be corrected without reverting to physical mode by configuring logical node 644 as physical node 4. The ROUTE command will now generate the output:

```
RTE     PIPE(S)

322     099 001
331     001 099
644     007 099
```

and the ADDRESS command will generate:

```
00   396.010-019
01   331.010-019
02   322.010-019
03   322.020   644.010-019
```

The IMP at Port 1 on this node will now be reported as having Port 1 at logical node 322 as its destination end. The decision as to which end of an IMP pair is the one which initiates reconnection (ie that at the higher numbered node) is not affected by the addressing mode as it is always based on the physical node numbers. Whilst in logical addressing mode all node numbers reported on the event log will be logical, and node numbers input by users as part of connection requests will be considered as being logical.

2.10   EXAMPLE NETWORK, MULTIPLE 5500/USO NODES

Figure 2-8 shows a network comprising three 5500/USO nodes. The USOs are all running, the configurations have been set up, but no UMP connections have yet been made.
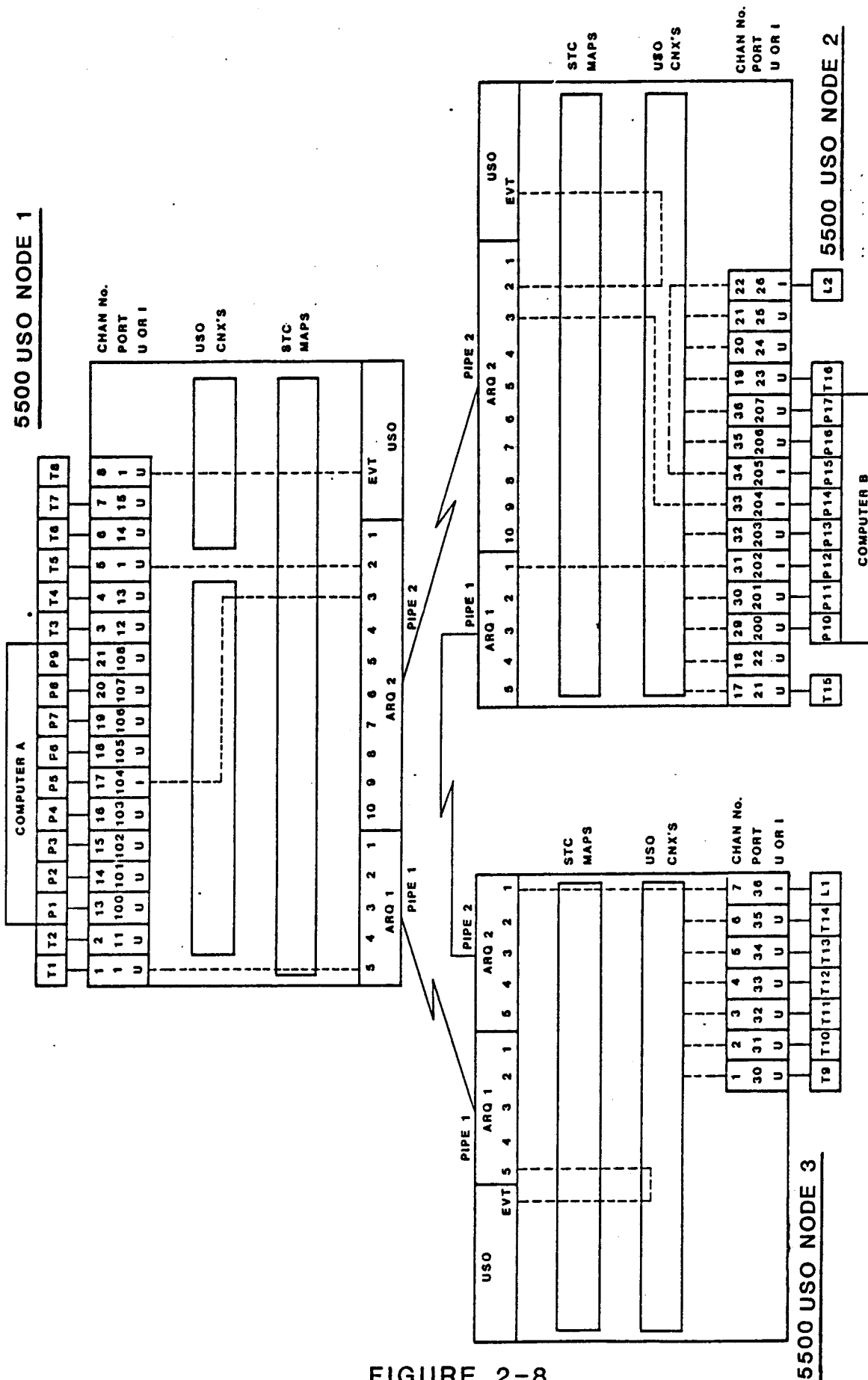
FIGURE 2-8

EXAMPLE 3-NODE NETWORK – PORT CONFIGURATION

Node 1 has eight terminals (T1-T8) and a computer (A) with nine ports (P1-P9). Terminals T1 and T5 are PMCs permanently mapped to channels in Nodes 3 and 2 respectively, where they are connected as the USO Event Log ports. Terminal T8 is configured as the local node's Event Log port. All three Event Log terminals are located at Node 1, and all are configured as Port 1 (this is possible because the ports for Nodes 2 and 3 are actually configured at the respective nodes, then extended to Node 1 using the PMCs). Two terminals, T2 and T3, have been configured as AMPs. Terminal T2 is reserved to access Computer A, contending for a free port in the computer's range of ports (SFA 1) when access is required. Similarly Terminal T3 is reserved to access Computer B, contending for its range of ports (SFA 2) when necessary.

Node 2 has two terminals (T15 and T16), a line-printer (L2) and a computer (B) with eight ports (P10-P17). Node 3 has six terminals (T9-T14) and a line-printer (L1).

There are three IMP connections specified: P5 on Computer A (Port 1.104) is connected to P14 on Computer B (Port 2.204), P12 on Computer B (Port 2.202) is connected to L1 (Port 3.36) and P15 on Computer B (Port 2.205) is connected to L2 (Port 2.26).

The following short-form/group addresses are configured at each node:-

SFA	Ports
1	1.100-103, 1.105-107
2	2.200-201, 2.203
3	2.206-207
50	1.108

As there are no duplicated links in this network the pipes have been configured to correlate directly with the links:-

PIPE NO.	LINK NO.		
	NODE 1	NODE 2	NODE 3
1 2	1 2	1 2	1 2

The routing is also necessarily simple, there being only two possible routes between any two nodes:-

NODE	PIPES TO NODE		
	1	2	3
1	LOCAL	2,1	1,2
2	2,1	LOCAL	1,2
3	1,2	2,1	LOCAL

A display of the ports at this stage would yield the appropriate information at each node:-

at Node 1:

```
PORT    DEV:CHN    STATUS    TYP    DST
001      00:008      0        U     EVT
011      00:002      0        A     N/C
012      00:003      0        A     N/C
013      00:004      0        U     N/C
014      00:006      0        U     N/C
015      00:007      0        U     N/C
100      00:013      0        U     N/C
101      00:014      0        U     N/C
102      00:015      0        U     N/C
103      00:016      0        U     N/C
104      00:017      0        I     02.204
105      00:018      0        U     N/C
106      00:019      0        U     N/C
107      00:020      0        U     N/C
108      00:021      0        U     N/C
```

at Node 2:

```
PORT    DEV:CHN    STATUS    TYP    DST
001      02:002      0        U     EVT
021      00:017      0        U     N/C
022      00:018      0        U     N/C
023      00:019      0        U     N/C
024      00:020      0        U     N/C
025      00:021      0        U     N/C
026      00:022      0        I     02.205
200      00:029      0        U     N/C
201      00:030      0        U     N/C
202      00:031      0        I     03.036
203      00:032      0        U     N/C
204      00:033      0        I     01.104
205      00:034      0        I     02.026
206      00:035      0        U     N/C
207      00:036      0        U     N/C
```

at Node 3:

```
PORT    DEV:CHN   STATUS   TYP    DST
001     01:005      0        U     EVT
030     00:001      0        U     N/(
031     00:002      0        U     N/C
032     00:003      0        U     N/C
033     00:004      0        U     N/C
034     00:005      0        U     N/C
035     00:006      0        U     N/C
036     00:007      0        I     02.202
```

From the user's point of view the network appears as shown in
Figure 2-9. Figure 2-10 shows the same network after a number of
user connections have been made.   The operator at Node 1 Port 15
(T7) has logged-on as remote Supervisor at Node 2, the connection
using Channel 1 of ARQ 2 at both nodes.   The user at Node 1 Port
12 (T3) requested connection (to its configured destination, SFA
2), and became connected to Port 203 at Node 2, this being the
first free port included in that address to be speed-compatible
with T4; the connection uses Channel 4 of ARQ 2 at both nodes.   A
user at Node 2 Port 23 (T16) requested connection to SFA 50 and
was connected to Port 108 at Node 1 (the only port in this
address), the connection using Channel 5 of ARQ 2 at both nodes.
Users at Ports 2.21 (T15), and 3.35 (T14) both requested
connection to SFA 2, the former getting connected to 2.200 and
the latter to 2.201 (via Channel 2 of ARQ 2 at Node 3 and ARQ 1
at Node 2).   The user at Node 1 Port 11 (T2) requested connection
to its configured destination, SFA 1, and users at Node 3 Ports
30 (T9) and 31 (T10) also requested connection to SFA 1.   They
were connected to Ports 100, 101 and 102 at Node 1, the latter
two using Channels 2 and 1 of ARQ 1 at both nodes.

A display of the ports would now show the appropriate information
at each node:-

at Node 1:

```
PORT    DEV:CHN   STATUS   TYP    DST
001     00:008      0        U     EVT
011     00:002      0        A     00
012     00:003      0        A     98
G13     00:004      0        U     N/C
014     00:006      0        U     N/C
015     00:007      0        U     02.000
100     00:013      0        U     01.011
101     00:014      0        U     03.030
102     00:015      0        U     03.031
103     00:016      0        U     N/C
104     00:017      0        I     02.204
105     00:018      0        U     N/C
106     00:019      0        U     N/C
107     00:020      0        U     N/C
108     00:021      0        U     02.023
```
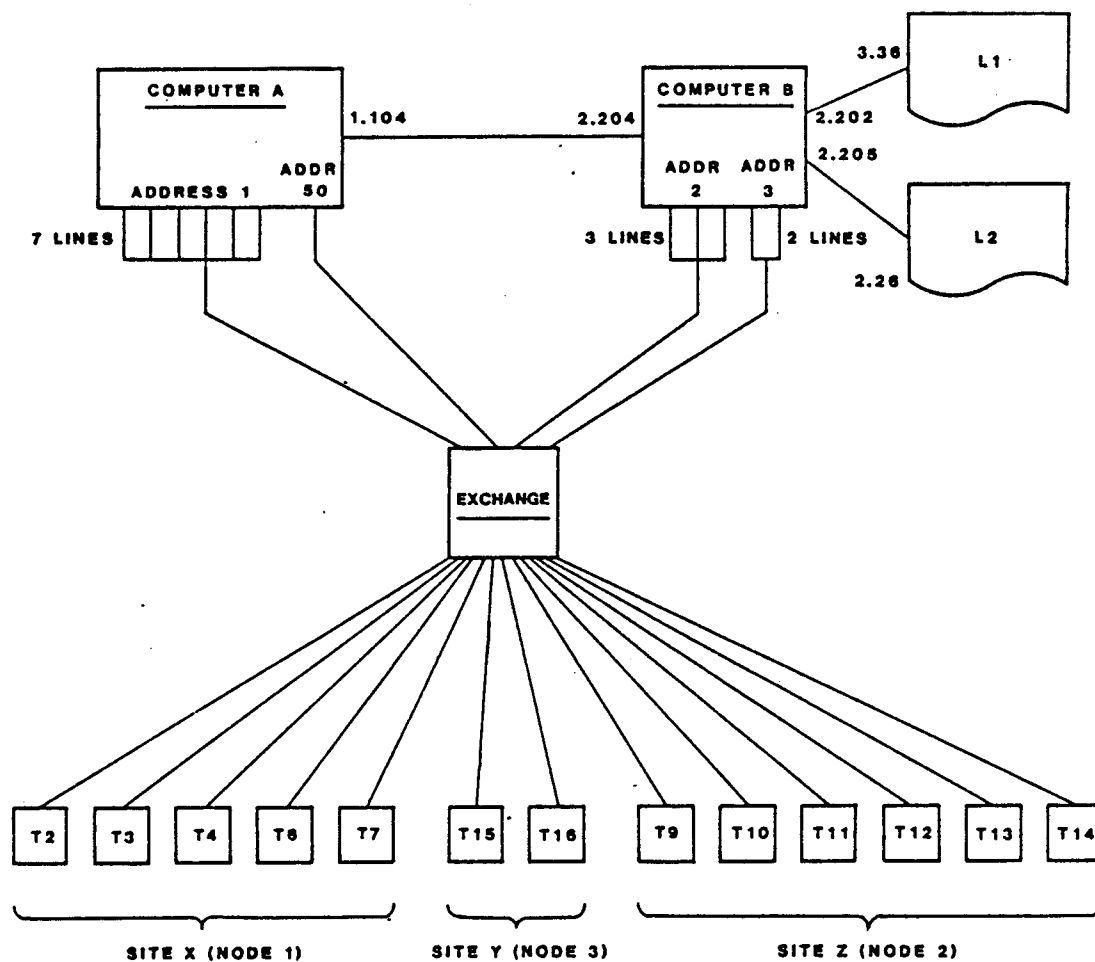
FIGURE 2-9
USER'S VIEW OF FIGURE 2-8
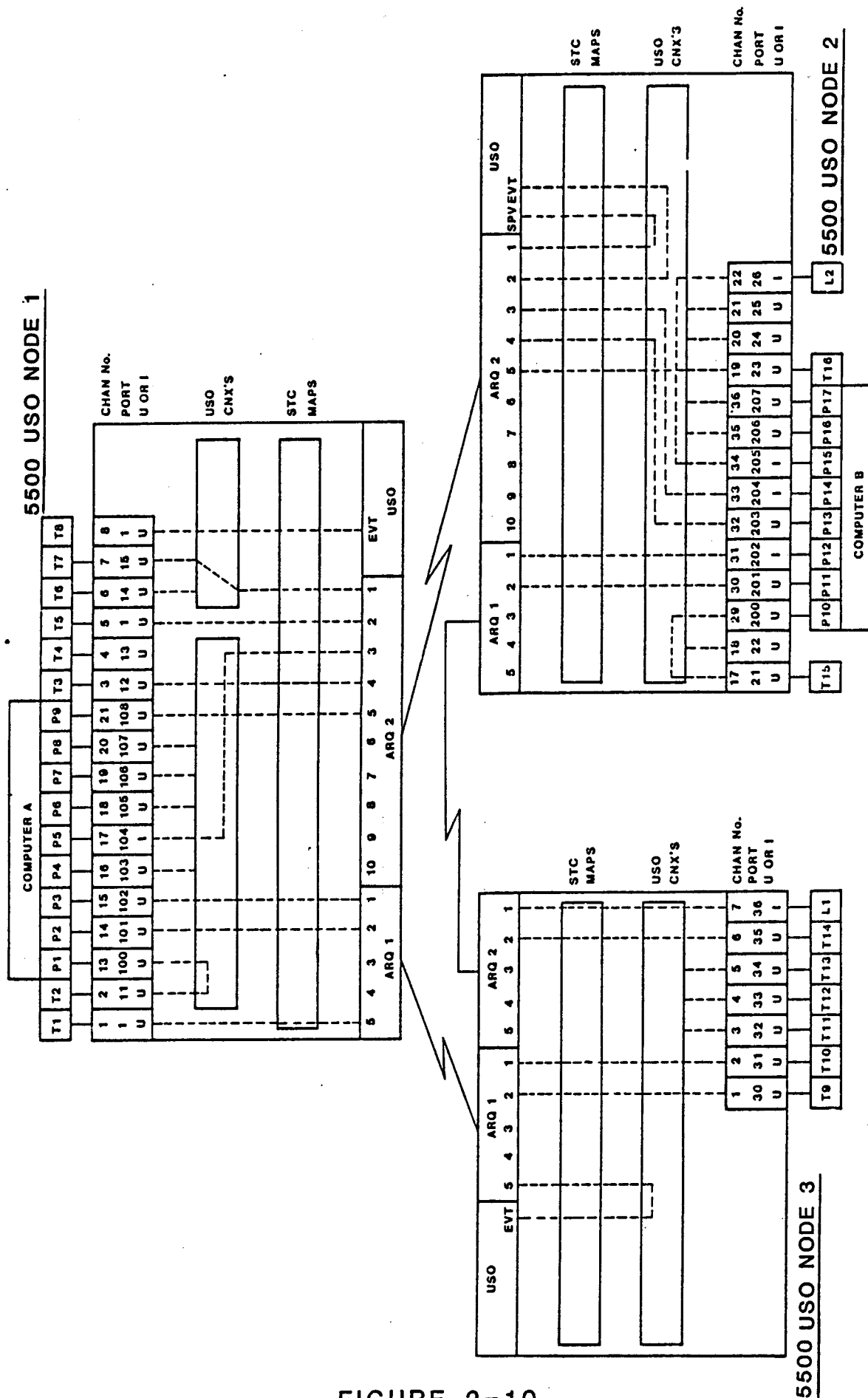
FIGURE 2-10

EXAMPLE 3-NODE NETWORK – USER CONNECTIONS

at Node 2:

PORT	DEV:CHN	STATUS	TYP	DST
001	02:002	0	U	EVT
021	00:017	0	U	02.200
022	00:018	0	U	N/C
023	00:019	0	U	01.108
024	00:020	0	U	N/C
025	00:021	0	U	N/C
026	00:022	0	I	02.205
200	00:029	0	U	02.021
201	00:030	0	U	03.035
202	00:031	0	I	03.036
203	00:032	0	U	01.012
204	00:033	0	I	01.104
205	00:034	0	I	02.206
206	00:035	0	U	N/C
207	00:036	0	U	N/C

at Node 3:

PORT	DEV:CHN	STATUS	TYP	DST
001	01:005	0	U	EVT
030	00:001	0	U	01.101
031	00:002	0	U	01.102
032	00:003	0	U	N/C
033	00:004	0	U	N/C
034	00:005	0	U	N/C
035	00:006	0	U	02.201
036	00:007	0	I	02.202

SECTION 3

PRODUCT DESCRIPTION

3.1 5500/USO UNIT

A DATELMUX 5500/USO comprises a DATELMUX 5500 (as described in the
5500 Section with the addition of a USO (User Switching Option
5510) card in the Master Frame (see Section 5.1).

3.2 USO CARD FIGURE 3-1

The USO is a standard size card occupying one slot. It has
twelve LEDs, including two (labelled ** and *) reserved for
future use.

3.2.1 X INDICATOR

Watch Dog Timer Alarm. This monitors software activity. If
a pulse is not received every half-second, the LED is
illuminated.

3.2.2 T INDICATOR

Software Trap. When the T indicator is off, each other
error and status indicator has its own meaning. When on, it
indicates that the USO has detected an irrecoverable error
condition and has ceased to function, and the error and
status indicators collectively show a trap number
(see para 3.2.5).

3.2.3 ERROR INDICATORS

When T is off, the three error indicators have the following
meanings when lit:-

DNG   Danger. The USO working memory is almost fully
committed. While this condition persists the USO will
restrict its activities to clearing the backlog, and
will not take on any additional work. When the
overload has been relieved the DNG indicator will be
extinguished.

CUS   Configuration Unsuitable. The size of Device 15 is
inadequate, or one (or more) of its channels is not
self-mapped.

ORN   Overrun. More DATELMUX control codes are monitored
than can be processed, consequently some have been
discarded. Once lit, this indicator will remain on
until the USO is restarted.

USO 2

USO 3

USO 20

X
T
* *
*
DNG
CUS
ORN
FUN
ONL
OFL
LOC
ENB
USO

X
T
* *
*
DNG
CUS
ORN
FUN
ONL   +
OFL   +
LOC   P1
ENB   P0
USO   III

X
T
* *
*
DNG
CUS
ORN
FUN
ONL   +
OFL   +
LOC   P1
ENB   P0
USO   XX

(handwritten notes on USO 2:) ORN 4, FUN 2, ONL 1 } MSD (octal) — WHEN TRAP LIGHTS ON; OFL 4, LOC 2, ENB 1 } LSD

FIGURE 3-1
USO CARD INDICATORS

3.2.4   STATUS INDICATORS

When T is off, the five status indicators have the following meanings when lit:-

    FUN   Special Function being used (see Section 3.2.6).
    ONL   USO on-line (node opened by Supervisor).
    OFL   ·USO off-line (node closed by Supervisor).
    LOC   Local (USO Halted from MTP).
    ENB   Enabled (USO Run from MTP).

3.2.5   TRAP NUMBER

When the T indicator is on, the error/status indicators collectively show a trap number in the form of two octal digits. The first (most significant) digit is represented by the ORN, FUN, and ONL indicators, and the second (least significant) digit is represented by the OFL, LOC and ENB indicators. (As an example, the T, ONL, LOC and ENB indicators on would represent TRAP 13.) When a trap has occurred the display alternates between the trap number and the error and status indications that were prevailing at the time of the trap.

If this occurs, the trap number should be noted down for reporting to BT.

3.2.6   SPECIAL FUNCTIONS

The USO has facilities to enable BT engineering staff to perform the following functions:-

a) Cold Start - Restart the USO after clearing down the
    entire configuration data area.

b) System Dump - Halt the USO software and dump the RAM area
    to a DATELMUX channel in Intel-hex format.

c) For a USO3 and USO20 only - load and convert a USO2
    configuration dump for USO3 operation.

3.3 US03 AND US020 CARDS

The US03 and US020 is similar to the standard USO except that it comprises the standard USO printed circuit board plus a daughter board housing extra Read Only and Random Access Memory, and occupies two adjacent card slots in the Master Frame. In addition to the indicators described for the standard USO, US03 has four additional LEDs (mounted on the front of the daughter board), two of which are labelled + and are reserved in future use whilst the other two (labelled P1 and P0) indicate the ROM page currently selected as follows:

P1	P0	ROM PAGE SELECTED
OFF	OFF	1
OFF	ON	2
ON	OFF	3
ON	ON	4

The state of these two LEDs should be reported to BT along with the TRAP number should a software trap ever occur (see Section 3.2.5).

SECTION 4

SUPERVISOR COMMANDS

4.1 INTRODUCTION

In addition to the basic 5500 functions that are described in the 5500 Section the 5500/USO has its own commands that can be carried out by the Supervisor at a Supervisor Station.

The 5500/USO commands enable the Supervisor to define, display and modify details of the configuration of the node at which the Supervisor Station is logged-on, and to open and close selected elements of the network to users.

4.1.1 USO2, USO3 AND USO20

The User Switching Option is available in two versions. The standard USO2 (a single card marked USO) will support up to 63 nodes, and the enhanced USO3 (a twin card unit marked USO III) will support up to 255 nodes. The advanced USO20 (a twin card unit marked USO XX) will support up to 63 nodes and Network Management Systems. The USO3 and USO20 can accommodate more alphanumeric names, and more short-form/group addressed. Apart from the increase in nodes, a USO3 can accommodate more alphanumeric names, and more short-form/group addresses.

Special features of the USO3

A USO3 may be operated in "physical mode" or "logical mode".

In physical mode, node numbers up to 255 are supported and are always available.

In logical mode, node numbers up to 999 are supported, but only 255 may be used. Those nodes in use must be configured to a physical node using the LPNODE command. Requests for connection from a local port have the requested node number converted to the physical node (as specified by the local node), before being transmitted over the network. For correct network operation, the node mapping table (maintained by the LPNODE command) should be the same at every node.

Special features of the USO20

The USO20 allows a supervisor-definable "welcome page" to
be presented to a user when making a connection request.
The page consists of up to 25 lines, each of up to 80
characters. Each line is terminated with a (RETURN)
(LINE FEED) pair. The characters in a line can be any valid
ASCII character (1 to 176 octal), allowing control codes and
escape sequences to be included.

The Supervisor Information Text (IT) command allows the page
to be edited on a line basis, or displayed with or without
control characters. The welcome page may be enabled or
inhibited on a per-node basis, as selected by the IT command.

4.1.2 COMMAND SYNTAX

The sequence in which keys are pressed to enter commands
should be followed if errors are to be avoided. Compulsory
spaces (SP) must be entered where shown. (In some places
additional spaces may be entered without producing an error,
as they are ignored by the USO.)

When a command or a number has to be entered, the minimum
number of characters required is underlined in the text.
Either the minimum or up to the maximum number of characters
may be entered, for example:

        for OPEN enter OP or OPE or OPEN.

Options in commands are enclosed in square brackets [ ], for
example:

        AD [(SP) nn (SP) nn] (CR)

The brackets are NOT part of the command. The entire
contents of the square brackets must be entered or omitted.
(The range of legal values that may be substituted for nn
will be found in 4.1.2.)

Commands having a choice of two or more options have the
options listed vertically, and are enclosed by square
brackets. For example:

        CL   (SP) N [(SP) D (SP) mm] (CR)
                   [(SP) T (SP)nn.mm]

With nested brackets, if an option in the inner bracket is
required, one of the options in the outer bracket must also
be specified. For an example, see 4.5.3.

Error Messages

Error messages which may be produced as a result of entering
a command, fall into two categories:

a) Errors common to all commands, which are:

?? COMMAND	Supervisor in wrong mode
?? SYNTAX	illegal command was entered
?? VALUE	illegal data was entered
...INPUT WSP FULL	more characters were entered than are allowed
...INV	data entry not allowed in Monitor mode
...NODE ONL	the node must be OFF-LINE (ie closed) to action
...NOT CNFGD	the specified item is not configured
...OVFL	Free memory is low - the command has been abandoned

b) The command-specific errors, which in this manual are
listed after the command description.

4.1.3 ABBREVIATIONS

Throughout Section 4, numeric fields are indicated by "n",
"nn" or "nnn", and alphanumeric fields by "aaa". The values
that may be assumed by them are:

FIELD	VALUE	
	US02	US03
Alphanumeric name:		
First character	0 thru 9, A thru Z,	A thru Z, a thru z
Chars 2 thru 8	0 thru 9 A thru Z	thru (176 octal)
Short-form/ group address	0 thru 99	0 thru 255

Device	0 thru 14	0 thru 14
Link	1 thru 14	1 thru 14
Channel	1 thru 511	1 thru 51
Port	1 thru 255	1 thru 255
Pipe	1 thru 99	1 thru 999
Node	1 thru 63	1 thru 255 (Physical) 1 thru 999 (Logical)

The following fixed fields may also appear:

hours	hh	0 thru 23
minutes	mm	0 thru 59

4.1.4 TIMEOUT

There is a timeout on Supervisor commands.   If during a command there is no keyboard activity for 30 seconds, the command automatically aborts.

4.1.5 CORRECTIONS

Corrections may be made to characters wrongly entered on the keyboard before (CR) is entered, by using any facility provided on the terminal for generating the Delete character (eg use of a DEL or RUB-OUT key).

4.1.6 SUPERVISOR MODES

The Supervisor Station, when initially logged-on, is in Monitor mode. This allows the Supervisor to display details of the node's configuration and characteristics, but not to change them. By entering the appropriate password the Supervisor can switch the station into Update mode, which then permits updating of the node's configuration. The Station reverts from Update mode to Monitor mode automatically after 10 minutes of keyboard inactivity.

4.1.7 SUMMARY OF COMMANDS

The commands are summarised in Table 4-1.

COMMAND	PARA	FUNCTIONS AVAILABLE	
		MONITOR MODE	UPDATE MODE
ADDRESS	4.2	Display one or more short-form/group address(es)	Display one or more short-form/group address(es) and invite redefinition
ANNOUNCE	4.3	Display a list of short-form/group addresses which will receive the Recorded Announcement text	Display, then add or delete, short-form group addresses which will receive the Recorded Announcement text
CHANNEL	4.4	Display a list of free unallocated channels	Display a list of free unallocated channels
CLOSE	4.5	-	Close the node, a specified link, a port, a range of ports or all ports
DELAY	4.6	Display the busy-out delay	Display the busy-out delay and invite redefinition

* Only available on a US03

TABLE 4-1

SUPERVISOR COMMANDS

COMMAND	PARA	FUNCTIONS AVAILABLE	
		MONITOR MODE	UPDATE MODE
DUMP	4.7	-	Output the USO configuration data
EVENT	4.8	Display the Event Log Station port	Display the Event Log Station port and invite redefinition
ITEX	4.9	Display the welcome page	Enable or Inhibit presentation of the welcome page, or modify the text
LINK	4.10	Display a list of characteristics of all composite links	Display a list of the characteristics of all composite links
LOAD	4.11	-	Restore a USO configuration
LOGOFF	4.12	Disconnect the Supervisor Station	Disconnect the Supervisor Station
LPNODE*	4.13	Display one or more logical to physical node relationships	Display one or more logical to physical node relationships and invite redefinition, or change the node's operating mode
LSTAT	4.14	Display one or more link statistics	Display one or more link statistics, then optionally reset them
MODE	4.15	Display information about the node and Supervisor	Display information about the node and Supervisor
MONITOR	4.16	-	Switch Supervisor Station to Monitor mode
NAME	4.17	Display one or more alphanumeric names	Display one or more alphanumeric names and invite redefinition
NODE	4.18	-	Set the node identity
OPEN	4.19	-	Open the node, a specified link, a port, a range of ports or all ports

* Only available on a USO3.

TABLE 4-1
SUPERVISOR COMMANDS

COMMAND	PARA	FUNCTIONS AVAILABLE	
		MONITOR MODE	UPDATE MODE
PASSWORD	4.20	-	Change the node's "Update Mode" password
PIPE	4.21	Display one or more pipes	Display one or more pipes and invite redefinition
PORT	4.22	Display a list of ports or charactistics of a specified port	Display a list of ports or charactistics of a specified port then invite redefinition
QUEUE	4.23	Display a list of ports and/or short-form/group addresses on the Auto Retry Queue	Enable or inhibit queueing, or display a list of ports and/or short-form/group addresses on the Auto Retry Queue
ROUTE	4.24	Display one or more routes	Display one or more routes and invite
SCLEAR*	4.25	Display status of automatic output of link stats and reset time	Enable or inhibit automatic output of link stats, or display stats reset time and invite redefinition
STATS	4.26	Display USO system statistics	Display, and optionally reset, USO system statistics
TEXT	4.27	Display one or more Connection Event (or system*) messages	Display one or more Connection Event (or system*) messages and invite redefinition
TIME	4.28	Display the system date and time	Display the system date and time and invite redefinition
UPDATE	4.29	Switch Supervisor	-

* Only available on a USO3.

TABLE 4-1

SUPERVISOR COMMANDS

4 - 7

4.2 ADDRESS

The Address command is used:

a) to display a list of short-form/group addresses configured at the node, or

b) to display the characteristics of a specified short-form/group address, and in Update mode allow redefinition.

4.2.1 LIST OF CONFIGURED ADDRESSES

   AD [(SP) nn (SP) nn] (CR)

Examples:

   AD   list all configured addresses

   AD 10 25   list all configured addresses from 10 to 25
                       inclusive

Note that the optional range of addresses is only available with a US03 or US020.

The list consists of up to ten addresses, each address being displayed with one or more sets.   A set may be one port, or a contiguous range of up to 127 ports, at the specified node; for example:

   1.14   port 14 at node 1

   4.1-19   ports 1 to 19 inclusive at node 4

The sets are listed six per line (five with a US03), for as many lines as necessary, for example:

   04   1.1-4   1.8   1.14-16   2.4-20   2.40   9.1-10
        9.14
   24   1.1-4   2.4-20   34.50-59

After ten addresses have been listed, (LF) may be entered to request the next ten, or (CR) to terminate the command.   The command will terminate after the last specified address has been listed.

Note that a US03 operating in logical mode may display a physical node number followed by a "*" instead of a logical node number followed by a ".".   This will occur if the address is configured in physical mode and no logical node is configured on that physical node.

4.2.2 CHARACTERISTICS OF A SPECIFIED ADDRESS

AD (SP) nn (CR)

Examples:

AD 4	display characteristics of address 4
AD 81	display characteristics of address 81

The information displayed depends on whether or not the address is configured. An unconfigured address will display

> nn...NOT CNFGD

and a configured address will be the same as for the address list.

After displaying the address, the cursor may (a) remain at the end of the last line (Monitor mode), or (b) move to the start of the next line (Update mode).

a)   If the Supervisor is in Monitor mode, (CR) or (LF) are the only legal responses. (CR) will terminate the address command, (LF) will display the next address. If the current address was configured, the next sequential address will be displayed. If the current address was not configured, the next configured address will be displayed. If the maximum address number has been reached or there are no more configured addresses the command will terminate.

b)   If the Supervisor is in Update mode, (CR) or (LF) may be entered as in (a) above, or the address may be configured, reconfigured or deconfigured.

The address may be configured or reconfigured by entering a new configuration defining the nodes and ports in this address. Up to 33 sets (see the address list (4.2.1) for the definition of a set) may be entered (separated by (SP)), depending on the length of the input line. Up to a total of 200 (512 with a US03 or US020) sets may be configured at the node.

The address may be deconfigured by entering 00.

The input data is terminated with (CR) or (LF), and the address command will proceed as for (a) above.

Possible errors:

...TABLE FULL	the maximum number of short-form/group addresses have been configured.

4.3 ANNOUNCE

The Announce command is used to display a list of short-form/group addresses to which connection is not currently permitted. Instead, the requesting port is sent the Recorded Announcement text from its local node (not the destination node).

        AN (CR)

This will display a list of short-form/group addresses or the message:

        ...NO S-F ADDR SET

Up to twenty (sixteen with a US03) addresses are listed per line.

Example:

        04   05   08   19   23

If the Supervisor is in Monitor mode, the Announce command will terminate after listing all short-form/group addresses.

If the Supervisor is in Update mode, the cursor will move to the start of the next line to allow addresses (a) to be added to the list, or (b) to be deleted from the list, or a new list entered.

Entering (CR) without any other input will terminate the command.

a)   Add one or more addresses to the list:

        A (SP) nn [(SP)nn]

where the optional address may be repeated to add further addresses.

b) Delete one or more addresses from the list:

        D (SP) nn [(SP)nn]

where the optional address may be repeated to delete further addresses.

The input data is terminated with (CR) and the announce command will terminate.

Possible errors:

        nn...NOT CNFGD   The specified short-form/group address
                                nn is not configured

4.4   CHANNEL

The Channel command is used to display a list of all free unallocated channels.

    CH (CR)

The free unallocated channels are listed in the form:

    dev:chn

Up to eight channels are listed per line.

Example:

    00:001 00:002 00:009 00:020 00:021 01:009

After eight lines of channels have been listed, (LF) may be entered to request the next eight, or (CR) to terminate the command. The command will terminate after the last channel has been listed.

4.5   CLOSE

The Close command is only valid in Update mode and is used to close:

a) the node

b) a specified link

c) a specified port, range of ports or all ports.

The close will take effect immediately unless the optional Delay or Time is specified. In this case, closure is immediate to new connections, but existing connections will not be broken until the Delay or Time is satisfied.

4.5.1   CLOSE THE NODE

    CL (SP) N [(SP) D (SP) mm] (CR)
              [(SP) T (SP) hh.mm]

Examples:

    CL N   close the node immediately

    CL N D 10   close the node in 10 mins

    Possible errors:

        ...NODE OFL   node is already closed.

4 - 11

4.5.2 CLOSE A LINK

```
CL (SP) L (SP) nn [(SP) D (SP) mm   ] (CR)
                   [(SP) T (SP) hh.mm]
```

Examples:

```
CL L 1                  close link 1 immediately
CL L 8 T 09.00          close link 8 at 09.00
```

Possible errors:

```
?? LINK NOT CNFGD       no channels allocated in device map

?? LINK CLSD            link is already closed

...NODE OFL             node is already closed
```

4.5.3 CLOSE A PORT

```
CL (SP) P [(SP) nn           [(SP) D (SP) mm   ]] (CR)
           [(SP) nn (SP) nn [(SP) T (SP) hh.mm]]
```

Examples:

```
CL P 21              close port 21 immediately

CL P 30 39 D 15      close ports 30 to 39 inclusive in
                     15 mins

CL P 0 T 18.45       close all ports at 18.45
```

Note that the optional range of ports is only available with a US03.

Possible errors:

```
?? PORT NOT CNFGD       port is not configured

?? PORT CLSD            port is already closed

???                     attempt to close the port used as
                        the Event Log Station or Supervisor
                        Station
```

Note that closing a range of ports or all ports will not produce any errors.

4.6 DELAY

The Delay command is used to display the "busy-out" delay, and in Update mode allow redefinition. The delay is the time (in seconds) after a disconnection during which the destination UMP is unavailable for a new connection. The minimum delay of 2 seconds is applied if the busy-out delay is 0 or 1.

> DE (CR)

This will display the "busy-out" delay as a three-digit number.

If the Supervisor is in Monitor mode, the delay command will terminate.

If the Supervisor is in Update mode, the cursor will move to the start of the next line to allow a new delay to be entered.

Examples:

12 (CR) change delay to 12 seconds

(CR)   delay remains unchanged

The delay command terminates after the (CR).

4.7 DUMP

The Dump command is only valid in Update mode and is used to
output the USO configuration data to a specified UMP (to which
would be connected a suitable device, eg tape or disc recorder).
The configuration data may subsequently be restored using the
Load command.

Note that dumps from a USO2, USO3 and USO20 are not compatible.

    DU [(SP) nnn] (CR)

The configuration data will be dumped to the Supervisor Terminal
or, optionally, to port nnn.

    The message:-

    PREPARE LOAD/DUMP DEVICE

is output, and the recording device should be made ready.
Entering (CR) will start the dump. The dump may be aborted at
any time by entering (ESC), when the command will terminate.

The Dump command will terminate after all the configuration data
has been output.

Possible errors:

?? NOT FREE UMP	specified port is not free
?? PORT CLSD	specified port is closed
?? PORT NOT FUNCL	specified port is not functional
?? PORT NOT CNFGD	specified port is not configured
?? LINK NOT FUNCL	link used for specified virtual port is not functional
?? LINK OVERLOADED	link used for specified virtual port is overloaded
???	specified port is requesting disconnection
...ABORT	command has been aborted

4.8 EVENT

The Event command is used to display the port number of the Event Log Station, and in Update mode allow redefinition.

        EV (CR)

This will display the Event Log Station port number, or 000 if the Event Log Station is not configured.

If the Supervisor is in Monitor mode, the command will terminate.

If the Supervisor is in Update mode, the cursor will move to the start of the next line to allow the Event Log Station to be configured, reconfigured or deconfigured.

The Event Log Station may be configured or reconfigured by entering the port number of a free and open UMP.

Alternatively, the Event Log Station may be cancelled by entering 0.

        Examples:

            18 (CR)   configure/re-configure event log on
            port 18

            0 (CR)   cancel event log

            (CR)   event log remains unchanged

The event command terminates after the (CR).

Possible errors:

            ?? NOT FREE UMP   specified port is not free

            ?? PORT CLSD   specified port is closed

            ?? PORT NOT FUNCL   specified port is not functional

            ?? PORT NOT CNFGD   specified port is not configured

            ?? LINK NOT FUNCL   link used for specified virtual port
                                 is not functional

            ?? LINK OVERLOADED   link used for specified virtual port
                                 is overloaded

            ?? NODE ID   the node identity is not set

4.9   ITEXT

The Information Text command is only available with a US020.

The command is used:

a)   to display the welcome page, or

b)   in Update mode, to enable or inhibit presentation of the Welcome page to users, and modify the contents of the page.

4.9.1   DISPLAY WELCOME PAGE

IT (CR)

The welcome pge is displayed exactly as it would be presented to a user making a connection request. This will include any control characters or escape sequence that may be in the text, so the Supervisor terminal must be able to cope with these.

After the page has been displayed, the command will terminate.

4.9.2   ENABLE OR INHIBIT PRESENTATION OF WELCOME PAGE

IT [(SP)E]
   [(SP)I]

This command is only valid in Update mode and will enable or inhibit presentation of the Welcome page to a user when making a connection request.

4.9.3   MODIFY THE WELCOME PAGE

The Modify command is only valid in Update mode. Entering the Modify command automatically inhibits presentation of the Welcome page to users, which must be enabled after exiting from the Modify command.

IT (SP) M [(SP)nn] (CR)

The option numeric field specifies the screen width in characters before the line is automatically wrapped, and must be in the range 25 to 132. If omitted, the default is 80.

Example:

IT M `   enter modify mode, set screen width to 80.
IT M 132   enter modify mode, set screen width to 132.

If the Welcome page was enabled and user connections are in progress, the message:

PLEASE WAIT: IT Table in use

will be displayed.

Once the table becomes available, the modify prompt:

>>

will be displayed and any of the following commands may be entered:

C	Create an empty page
I*	Insert one line at the line pointer position
I*	Insert one or more lines at the line pointer position
K	Kill the line pointed to by the line pointer
M [x]	Move the line pointer to line x (* will move to the last line in the page)
P	Preview the page as it would be presented to a user
R	Review the page expanding non-printing characters
X	Exit modify command

On completion of any command, except X, the modify prompt >> will be displayed.

4.9.3.1 CREATE

The Create command is used to clear the entire welcome page before inserting new text.

4.9.3.2 INSERT

The Insert command is used to insert one or more lines at the line pointer position. The I command will insert one line, after displaying the message:

INSERT LINE

The I* command will insert sequential lines, after displaying the message:

BLOCK INSERTION: (CR).(CR) to Exit

Lines are inserted before the line pointed to by the line pointer. Up to 80 characters may be entered per line, terminated by (CR). If one line is being inserted (I), the Insert command will terminate after entering (CR) to terminate the line. If several lines are being inserted (I*), it is necessary to type (CR).(CR) to terminate input, ie a line with only a full stop in it.

Control characters may be inserted by typing (CTRL A) to enter
Control Mode. A left angle bracket < will now be displayed.
This is not part of the text, but an indication that control
mode has been entered. Control characters may now be entered
by typing the decimal equivalent of the character.
For example, an (ESCAPE) may be entered by typing 27.
Further control characters may be entered by separating numbers
with (SPACE).   To exit Control Mode and resume normal input,
type (CTRL A) again. A right angle bracket > will be displayed
to indicate the end of a sequence of control characters.

Alternatively, Control Mode may be entered implicity by typing
a control character. Further control characters may be entered
by typing the control characters, or their decimal equivalent
separated by spaces.

Typing errors may be corrected by typing (DELETE) , which will
echo the deleted character. If (DELETE) is typed while in
Control Mode, the previous control character will be deleted
and ! will be echoed. If the decimal equivalent of a control
character is being entered, typing (DELETE) will delete the
control character, NOT the digit last typed.

4.9.3.3   KILL

The Kill command is used to kill the line pointed to by the line
pointer (use Review to locate the line pointer).

4.9.3.4   MOVE

The Move command is used to move the line pointer to the
specified line. If M* is specified and the table is full, the
pointer will move to line 25. Otherwise the pointer will move to
the line following the last in the page. The line now pointed
to will be displayed.

4.9.3.5   PREVIEW

The Preview command is used to display the Welcome page as if IT
(CR) had been entered to the Supervisor prompt. The command
allows the effect of any edits to be viewed while still in the
Modify command.

4.9.3.6 REVIEW

The review command is used to display the Welcome page with
control characters expanded to their decimal equivalent, enclosed
in angle brackets, <...>. This allows escape sequences to be
seen easily. Each line is displayed with its line number and
automatically wrapped when the specified screen width has been
reached. The line pointed to by the line pointer is shown with >
following the line number, for example:

01 During week 16, some new service will be available
02>Information on these will be placed in HELP as it
03 becomes available
+

The end of page is shown with + in the line number field.

After twelve lines have been displayed, (LF) may be entered to
request the remaining lines, or (CR) to return to the Modify
prompt

4.9.3.7 EXIT

The Exit (X) command is used to return to the Supervisor prompt.
Note that the welcome page will remain inhibited, even if it was
enabled when the Modify command was entered.

Possible errors:

?? COMMAND (X to Exit)	an invalid command character was entered to the Modify prompt
...TABLE FULL	an attempt was made to insert a line when the welcome page was full (25 lines)
...TIMEOUT	nothing has been entered for three minutes, and the Modify command has automatically performed an exit

4.10 LINK

The Link command is used to display a list of the characteristics of the composite links at the node.

LI (CR)

The list of links is preceded by a header line, and the command terminates after displaying the characteristics of all links.

Example for a USO2:

STATUS	BASE	SIZE	NET-CHN	UTIL	SPEED
01 F 0	017	016	001	08	09600
02 N C	033	016	000	00	09600

Example for a USO 3 or a USO20:

STATUS	BASE	SIZE	NET-CHN	ACT-UTIL	ADJ-UTIL	SPEED
01 F 0	017	020	001	00	00	09600
02 F C	057	006	000	00	00	01200
05 F 0	063	040	000	44	46	09600

The information given is:

STATUS	link number (1 to 14), functional status (Functioning or Not Functioning), link status (open or Closed)
BASE	base channel number (set in Device Map)
SIZE	number of channels (set in Device Map)
NET-CHN	number of channels on this link currently in use as network (inter-5500) channels
UTIL and ACT-UTIL	link utilisation average over last minute as a percentage of capacity
ADJ-UTIL	adjusted link utilisation averaged over last minute as a percentage of capacity - includes the artificial load added by the USO for new connections
SPEED	link capacity in bits per second

4.11 LOAD

The Load command is only valid in Update mode and is used to restore a USO configuration that was previously dumped with the Dump command. The node must be OFF-LINE (ie closed) before a load may be performed.

Note that dumps from a USO2, USO3 and USO20 are not compatible.

        LO [(SP) nnn] (CR)

The configuration data will be loaded from the Supervisor Terminal or, optionally, from port nnn.

There will be a pause while the USO re-initialises ready for the load, and the message:

        PREPARE LOAD/DUMP DEVICE

will be output. Entering (CR) will start the load and the recording device should be set to operate. The load may be aborted at any time by entering (ESC), when the command will terminate. In this case the original configuration remains unchanged.

If the load is successful, the USO will perform a power-up initialisation with the restored configuration. The Supervisor is logged-off.

        Possible errors:

?? NOT FREE UMP	specified port is not free
?? PORT CLSD	specified port is closed
?? PORT NOT FUNCL	specified port is not functional
?? PORT NOT CNFGD	specified port is not configured
?? LINK NOT FUNCL	link used for specified virtual port is not functional
?? LINK OVERLOADED	link used for specified virtual port is overloaded
?? FILE	file start address is invalid
?? FORMAT	data format is invalid
?? CHECKSUM	sum-check error on read
???	specified port is requesting disconnection
...ABORT	command has been aborted.

4.12 LOGOFF

The Logoff command is used to disconnect the Supervisor Station, and is equivalent to performing a Disconnection Event at the Supervisor Terminal. Once the Supervisor has logged-off, any free UMP or unconfigured port may log on as Supervisor.

        LOGOFF (CR)

4.13 LPNODE

The Logical Physical node command is only available on a US03 and is used:

a) to display a list of configured nodes, or

b) to display the logical node(s) on which a specified physical node is configured, or

c) to display a specified logical node with its physical node (if configured), and in Update mode allow redefinition, or

d) in Update mode, to verify the node mapping table and switch the node between logical and physical mode.

4.13.1 LIST OF CONFIGURED LOGICAL NODES

        LP [(SP) nn (SP)nn] (CR)

Examples:

        LP   list all configured nodes

        LP 180 230   list all configured nodes from 130 to
                                    270 inclusive.

The list consists of pairs of node numbers, in the form

        Logical node - physical node

Up to eight pairs are listed per line.

Example:

        004-048   080-010   141-002   303-133   418-063

After ten lines of node pairs have been listed, (LF) may be entered to request the next ten, or (CR) to terminate the command. The command will terminate after the last configured node has been listed.

4 - 22

4.13.2 LIST LOGICAL NODE(S) CONFIGURED ON A SPECIFIED PHYSICAL NODE

       LP (SP) O (SP) nn (CR)

Examples:

       LP O 80   list logical node(s) configured on
                                    physical node 80

       LP O 4   list logical node(s) configured on
                                    physical node 4.

The list format is similar to that produced by a list of configured nodes, but only logical-physical pairs for the specified physical node will be displayed. Note that two or more pairs will only occur in physical mode, as duplicates are not allowed in logical mode.

4.13.3 DISPLAY SPECIFIED LOGICAL NODE

       LP (SP) nn (CR)

Examples:

       LP   14
       LP   303

The information displayed depends on whether or not the logical node is configured. An unconfigured node will display

       nnn...NODE NOT CNFGD

and a configured node will display a logical-physical pair.

After displaying the logical node, the cursor may (a) remain at the end of the last line (Monitor mode), or (b) move to the start of the next line (Update mode).

a)   If the Supervisor is in Monitor mode, (CR) or (LF) are the only legal responses. (CR) will terminate the command, (LF) will display the next node. If the current logical node was configured, the next sequential logical node will be displayed. If the current logical node was not configured, the next configured logical node will be displayed. If the maximum node number has been reached or there are no more configured logical nodes, the command will terminate.

b)   If the Supervisor is in Update mode, (CR) or (LF) may be entered as in (a) above, or the node may be configured, reconfigured or deconfigured.

       The node may be configured or reconfigured by entering a new physical node number. The node may be deconfigured by entering O.

The input data is terminated with (CR) or (LF), and the
command will proceed as for (a) above.

Possible errors:

    ...NODE ALREADY CNFGD   in logical mode, attempting to
                                      configure a logical node with
                                      a physical node a ready
                                      configured on another logical node

4.13.4 CHANGE THE NODE'S OPERATING MODE

These commands are only valid in Update mode.

Once the logical to physical node relationships have been
defined, the node may be changed to logical mode. However,
it is necessary to verify the mapping table first to ensure
that each physical node is only configured on one logical
mode. The mapping table is verified by entering:

    LP (SP) V (CR)

If the table is correct, the command will terminate.

If a physical node is configured on more than one logical
node, the message:

VALIDATION ERROR AT LOGICAL NODE 111:PHYSICAL NODE PPP ALREADY CONFIGURE

will be output. All of the logical nodes in error must be
reconfigured or deconfigured for each physical node with
duplicates, and the verification repeated. If the
supervised node is not configured, the message:

    ...LOCAL NODE NOT CNFGD

will be output. The supervised node should be configured
and the verification repeated. The verification command is
only valid when the node is in physical mode.

The following commands are only valid with the node OFF-LINE
(ie   closed):

The node may be changed to logical mode by entering:
    LP (SP) LOGICAL (CR)

The node may be changed to physical mode by entering:
    LP (SP) PHYSICAL (CR)

Possible errors:

    ..NODE ONL   node must be closed first

    ..MAPPING NOT VERIFIED   mapping has been changed since
                                   table was last verified

4.14 LSTAT

The Link Statistics command is used to display the statistics of
one or all links at the node, and in Update mode allow the
statistics to be reset.

a)   Display statistics for a specified link or all links:

                LS [(SP) nn] (CR)

b)   Display statistics for a specified link or all links, then
     reset those statistics. Only valid in Update mode.

            LS [(SP) nn (SP) C] (CR)
                [(SP) 0 (SP) C]

     Examples:

        LS 4   display statistics for link 4

        LS 0 C   display statistics for all links and reset
                          them

The link statistics are preceded by a header block. A USO3 or
USO20 will output an extra header line, for example:

        LINK STATISTICS AT 14.21 ON 82/04/18

The Link Statistics command terminates after displaying the
specified statistics.

Note that the link statistics are automatically reset every 24
hours. With a USO2, they are reset at midnight (00.00). With a
USO3 or USO20, they are reset at the time specified by the Statistics
Clear (SCLEAR) command. The statistics are also reset if the
5500/USO is powered off.

     Example:

```
LINK STATISTICS AT 16.51 ON 83/06/19
LINK STATS    %-IN-USE     AVERAGE-UTIL    MAX-UTIL               MAX-ERRS
      START               TRUE   NON-ZERO
      TIME    TX  RX   TX  RX   TX   RX    TX        RX         TX         RX
01 16.35  012 012  02  02  21   21   32 @16.43 31 @16.44 001 @16.44 001 @16.44
02 16.35  011 001  00  00  01   01   02 @16.46 02 @16.46 000 @00.00 000 @00.00
```

The information displayed is:

LINK   link number to which statistics
                        refer

STATS START TIME   time at which statistics were
                        last reset

%-IN-USE   percentage of total reporting period
                        during which link was transmitting (TX)
                        and receiving (RX) data

AVERAGE-UTIL TRUE   true average transmit (TX) and receive
                        (RX) utilisation over current reporting
                        period as a percentage of capacity

AVERAGE-UTIL   average transmit (TX) and receive (RX)
NON-ZERO   utilisation whilst link in use (ie
                        ignoring zero utilisation periods) over
                        current reporting period as a percentage
                        of capacity

MAX-UTIL   maximum recorded transmit (TX) and
                        receive (RX) utilisation as a percentage
                        of capacity, and time of occurrence

MAX-ERRS TX   maximum recorded number of re-
                        transmitted frames in a 2.8 sec period,
                        and time of occurrence MAX-ERRS RX
                        maximum recorded number of bad frames
                        received in a 2.8 sec period, and time
                        ·of occurrence

MAX-ERRS RX   maximum recorded number of bad frames
                        received in a 2.8 sec period, and time
                        of occurrence.

4.15 MODE

The Mode command is used to display information about the node and Supervisor status.

        MO (CR)

   The display is in the form:

        NODE nn [OFL]   Q [INHIBITED]
                [ONL]   [ENABLED]

        NODE ADDRESSING IS [PHYSICAL]
                           [LOGICAL]

        SUPERVISOR [MONITOR] MODE - [LOCAL]
                   [UPDATE]   [REMOTE]

   where:

        nn   =   node identity

        OFL =   OFF-LINE (node closed)

        ONL =   ON-LINE (node open)

        Q   =   queueing of local ports (AMPs or UMPs) to the Auto
                 Retry Queue is Inhibited or Enabled

        NODE ADDRESSING is only applicable to a USO3

        LOCAL   = Supervisor Terminal is a local port

        REMOTE = Supervisor Terminal is at another node

        WELCOME PAGE is only applicable to a USO20.

4.16 MONITOR

The Monitor command is only valid in Update mode and is used to switch the Supervisor Station from Update mode to Monitor mode.

        MONITOR (CR)

   The Supervisor Station will automatically switch from Update to Monitor mode after 10 minutes of inactivity.

4.17 NAME

The Name command is used:

a)   to display a list of alphanumeric names configured at
     the node (with the corresponding short-form/group
     address), or

b)   to display the short-form/group address configured on a
     specified alphanumeric name, and in Update mode allow
     redefinition.

4.17.1 LIST OF CONFIGURED ALPHANUMERIC NAMES

        NA (CR)

Each alphanumeric name is followed by the short-form/group
address configured on it. Three name-address pairs are
listed per line, and up to ten lines may be displayed. The
list is preceded by a header line.

Example:

```
NAME        ADDRESS    NAME        ADDRESS    NAME        ADDRESS
GRAPHICS    18         ENQUIRY     08         HELP        00
```

The names are listed in the order in which they are stored in
the USO. This in turn depends on the order of entry and whether
any names were deconfigured. A new name will be inserted in the
first empty entry.

After ten lines have been output, (LF) may be entered to request
the next ten, or (CR) to terminate the command. The command will
terminate after all configured alphanumeric names have been
listed.

4.17.2 DISPLAY ADDRESS CONFIGURED ON A SPECIFIED ALPHANUMERIC NAME

NA (SP) aaa (CR)

Example:

        NA GRAPHICS

The information displayed depends on whether or not the name
is configured. An unconfigured name will display:

        aaa   ...NOT CNFGD

and a configured name will display:

        aaa   nn

where aaa is the alphanumeric name
      nn is the short-form/group address configured on it

After displaying the name, the cursor may (a) remain at the
end of the last line (Monitor mode), or (b) move to the
start of the next line (Update mode).

a)   If the Supervisor is in Monitor mode, (CR) or (LF) are the
     only legal responses. (CR) will terminate the Name command,
     (LF) will display the next alphanumeric name.   If the
     current name was configured, the next entry in the table
     will be displayed. If the current name was not configured,
     the next configured name in the table will be displayed.
     If the maximum number of names has been reached or there are
     no more configured names, the command will terminate.

b)   If the Supervisor is in Update mode, (CR) or (LF) may be
     entered as in (a) above, or the alphanumeric name may be
     configured, reconfigured or deconfigured.

     The alphanumeric name may be configured or reconfigured by
     entering a new short-form/group address. Only one address
     is allowed per name, but the same address may be used for
     several names. Alternatively, a new name and address may be
     entered (separated by (SP)). For example:

         SYSTEMB 21

     If the name is not configured and (LF) is entered to step to
     this entry, both a name and address must be entered. Up to
     a total of 32 (256 with a US03) names may be configured at
     the node.

     The alphanumeric name may be deconfigured by entering (SP).

     The input data is terminated with (CR) or (LF), and the name
     command will proceed as for (a) above.

     Possible errors:

         ?? DUPLICATE NAME   the name entered is already
                                    configured

         ...TABLE FULL   the maximum number of alpha-
                                    numeric names have been
                                    configured

4.18 NODE

The Node command is only valid in Update mode, and is used to set the node's identity (node number). The node must be OFF-LINE (ie closed) before the node identity may be changed. Care should be taken when changing the node identity, as short-form/group addresses and routing information at other nodes could be invalidated.

        NO (SP) nn (CR)

    Examples:

        NO 28   set node identity to 28

        NO 406   set node identity to 406

    The ranges of valid node numbers are:

        US02 or US020   - 1 to 63 inclusive

        US03 physical mode - 1 to 255 inclusive

            logical mode   - 1 to 999 inclusive

                Note that the node must have been
                configured using the LP command, or the
                message:

                ...NODE NOT CNFGD

                will be output.

4.19 OPEN

The Open command is only valid in Update mode and is used to open:

    a) the node,
    b) a specified link,
    c) a specified port, range of ports, or all configured ports.

4.19.1 OPEN THE NODE

        OP (SP) N (CR)

Possible errors:

        ?? NODE ID   the node identity is not set

        ...NODE ONL   the node is already open.

4.19.2 OPEN A SPECIFIED LINK

        OP (SP) L (SP) nn (CR)

Examples:

        OP L 1   open link 1

        OP L 12   open link 12

Possible errors:

        ?? LINK NOT CNFGD   no channels set in Device Map

        ?? LINK NOT FUNCL   link is not functioning

        ?? LINK OPND   the link is already open

        ...NODE OFL   the node must be opened first

4.19.3 OPEN A PORT

        OP (SP) P [(SP) nn   ] (CR)
                  [(SP) nn (SP) nn]

Examples:

        OP P 81   open port 81

        OP P 183 211   open all configured ports from 183 to
                                211 inclusive

        OP P   open all configured ports

Possible errors:

    ?? PORT NOT CNFGD   port is not configured

    ?? PORT OPND   port is already open

    ...CHAN NOT AVAIL   channel in use by STC

Note that opening a range of ports or all ports will not
produce any errors.

4.20 PASSWORD

The Password command is only valid in Update mode and is used to
set or change the node's "Update Mode" password.

After entering the command, the cursor moves to the start of the
next line. A new password may now be entered, consisting of up
to 80 alphanumeric (upper case only for a US02) characters. As
each character is entered, a (SP) is echoed in place of the
character. An invalid character will cause the message:

    ?? PASSWORD

to be output and the command will terminate. Note that (DELETE)
or (RUBOUT) may not be used to correct typing mistakes.

The command is terminated with (CR), and the new password then
becomes active.

4.21 PIPE

Pipes (and Routes) should only be configured when the node is part of a multi-node network.

The Pipe command is used to group one or more composite links of multi-node networks into "pipes" to facilitate the specification of routes to other nodes. All links configured in one pipe are considered as equivalent by the USO when routing connections, and the load will be shared between them.

The command is used:

a) to display a list of pipes configured at the node or,

b) to display the links configured in a specified pipe, and in Update mode allow redefinition.

4.21.1 LIST OF CONFIGURED PIPES

        PI (CR)

The list is preceded by a header line, for example:

        PIPE   LINK(S)
        01   04
        18   07   08
        47   01   02   03

4.21.2 LINKS IN SPECIFIED PIPE

        PI (SP) nn (CR)

Examples:

        PI 56   display links in pipe 56
        PI 9   display links in pipe 9

The information displayed depends on whether or not the pipe is configured. An unconfigured pipe will display

        nn ...NOT CNFGD

and a configured pipe will be the same as for the pipe list (para 4.21.1).

After displaying the pipe, the cursor may (a) remain at the end of the last line (Monitor mode), or (b) move to the start of the next line (Update mode).

4 - 34

a) If the Supervisor is in Monitor mode, (CR) or (LF) are the only legal responses. (CR) will terminate the pipe command, (LF) will display the next pipe. If the current pipe was configured, the next sequential pipe will be displayed. If the current pipe was not configured, the next configured pipe will be displayed. If the maximum pipe number has been reached or there are no more configured pipes, the command will terminate.

b) If the Supervisor is in Update mode, (CR) or (LF) may be entered as in (a) above, or the pipe may be configured, reconfigured or deconfigured.

The pipe may be configured or reconfigured by entering one or more link numbers, each one separated by (SP).

The pipe may be deconfigured by entering 0.

The input data is terminated with (CR) or (LF), and the pipe command will proceed as for (a) above.

Possible errors:

    ?? LINK NOT CNFGD   an unconfigured link was specified (no channels set in Device Map)

    ?? LINK IN USE   a specified link is already in another pipe

    ?? PIPE IN USE   attempting to deconfigure a pipe currently used in one or more routes

4.22 PORT

The port command is used to display:

a) a list of ports configured at the node, or

b) the characteristics of a specified port, and in Update mode allow redefinition.

4.22.1 LIST OF CONFIGURED PORTS

PO [(SP) nn (SP) nn] (CR)

Examples:

PO   list all configured ports

PO 1 50   list all configured ports from 1 to 50
                            inclusive

Note that the optional range of ports is only available with a US03.

The list of ports is preceded by the header line:

PORT DEV:CHN   STATUS   TYP   DST

and·followed by details of up to ten ports.

For each port the information given is the port number, the device and channel on which it is configured, its status (Open or Closed), type (IMP, AMP or UMP), and destination.

The destination field may contain one of the following:

N/C   not connected

CIP   connection attempt in progress

nn.pp**   node (nn) and port (pp) that this port is
           connected to (a port number of 00 indicates a
           port acting as a remote supervisor at node nn)

nn   short-form/group address to which this port is
           connected

QUE   connection attempt queued to Auto Retry Queue

DIP   disconnection in progress

EVT   port is an Event Log Station
SPV   port is this Supervisor

After ten ports have been listed, (LF) may be entered to request the next ten, or (CR) to terminate the command. The command will terminate after the last specified port has been listed.

4.22.2   CHARACTERISTICS OF A SPECIFIED PORT

     PO (SP) nn (CR)

Examples:

     PO 4   display characteristics of port 4
     PO 127   display characteristics of port 127

Information Display

The display is in the form of two sets of information. The first set displays characteristics that cannot be changed by this command, and the second set displays characteristics that can be changed by the command. The information displayed depends on whether or not the port is configured.

a)   Unconfigured port.

The first set consists of the two lines:

     P=nnn
     ...NOT CNFGD

and the second set a single line:.

     DEV:CHN PAR TYP SPD SYSM ECHO CNX/DCNX/LVL/NEU/TST I/A-DST

b)   Configured port

The first set consists of the two lines:

     P=nnn
     STATUS DST CUR-SPEED

and a third line defining the port status (Open or Closed), destination (see para 4.22.1 for details) and current speed. The current speed is that last reported by the relevant channel, and may be one of the following:

     nnnn   speed in bps

     DLL   Down Line Load

     SBR   Split Baud Rate

     EXT   External Clock may be reported if switch
                       6 of the speed/code option of a 5100 is
                       incorrectly set).

                       4 - 37

ABR-PENDING   channel set to Automatic Baud Rate and has
                     not received a character

???   unallocated speed/code option

The second set consists of the two lines:

```
DEV:CHN PAR TYP SPD SYSM ECHO CNX/DCNX/LVL/NEU/TST I/A-DST
nn:nnn   a   a   a    a    a     n/n/n/n/n           nn.nnn
```

The fields below the heading may contain the following
information:

DEV:CHN   device and channel on which the port is
                     configured

PAR   parity to which out-going USO generated
                     data will be set:
                        O = odd
                        E = even
                        M = mark
                        Z = zero (space)

TYP   port type:
                        I = Internally Mapped Port
                        A = Automatically Mapped Port
                        U = User Mapped Port

SPD   Speed matching required when this port is
                     a destination:
                        F = fixed speed (must match speed of
                        orginator) also required for SBR.
                        D = DLL (no speed matching; speed will
                        be set to that of originator if
                        channel is set to ABR or DLL).

SYSM   System messages:
                        E = enabled
                        I = Inhibited
                        . = field not applicable (IMPS only)

ECHO   echo data back to DTE during connection
                     request:
                        E = echo required
                        N = echo not required
                        . = field not applicable (IMPs only)

For IMPs only:

CNX through TST   field not applicable, a full stop is
                     displayed

```
    I/A-DST                    destination node and port**
```

**   Note that a US03 operating in logical mode may display a
     physical node number followed by a "*" instead of a logical
     node number followed by a ".".   This will occur if the port
     is configured in physical mode and no logical node is
     configured on that physical node.

     For AMPs and UMPs:

     CNX   Connection Event:
                                0 = DTR (channel pin 20) on
                                1 = CD (channel pin 4) on
                                2 = BREAK
                                3 = nil (port cannot be connected by
                                    user)
                                4 = RI (channel pin 25) on, followed
                                    by CD (channel pin 4) on (dial-up)
                                5 = ASCII DC4 (CONTROL T)*

     DCNX   Disconnection Event:
                                0 = DTR (channel pin 20) off
                                1 = CD (channel pin 4) off
                                2 = BREAK
                                3 = nil (port cannot be
                                    disconnected by user)
                                4 = Dual Level Disconnect
                                     (applicable only to UMPS),
                                    BREAK, or
                                    CD (channel pin 4) off
                                5 = ASCII DC4 (Control T)*

                         * Only operable on channels having
                           in-band Terminal Flow Control selected.

     LVL   access level code (applicable only to UMPS)
                           A value of 0 allows access to all short-
                           form/group addresses and all ports. A value
                           of 1 to 7 allows access only to short-
                           addresses in the range 0 to 9, 100 to
                           109, 200 to 209, plus the following:

                           Value Access permitted to additional addresses

                             1   10 to 19,   110 to 119,   210 to 219
                             2   20 to 29,   120 to 129,   220 to 229
                             3   30 to 39,   130 to 139,   230 to 239
                             4   40 to 49,   140 to 149,   240 to 249
                             5   50 to 59,   150 to 159,   250 to 255
                             6   60 to 69,   160 to 169
                             7   all short-form/group addresses

                           Note that a US02 will only allow short-
                           form/group addresses up to 99.
                           For AMPs, a 0 will be displayed.

                                   4 - 39

```
NEU                    output neutral state of open and free
                       ports:
                            0 = all controls off
                            1 = DSR (channel pin 6) only on

TST                    functional test for destination ports:
                            0 = DTR will not be tested
                            1 = DTR will be tested (connection only
                                made if on)

I/A-DST                destination short-form address (applicable
                       only to AMPS):
                            nnn = destination short-form address
                            .   = field not applicable (UMPS only)
```

After Display

After displaying the port charactistics the cursor may (a)
remain at the end of the last line (Monitor mode, or Port
open), or (b) move to the start of the next line (Update
mode).

a)   If the port is open or the Supervisor is in Monitor mode,
     (CR) or (LF) are the only legal responses. (CR) will
     terminate the port command, (LF) will display the next port.
     If the current port was configured, the next sequential port
     will be displayed. If the current port was not configured,
     the next configured port will be displayed. If the maximum
     port number has been reached or there are no more configured
     ports, the command will terminate.

b)   If the Supervisor is in Update mode and the port is closed
     or not configured, (CR) or (LF) may be entered as in (a)
     above, or the port may be configured, reconfigured or
     deconfigured.

     The port may be configured or reconfigured by entering a
     full line of configuration data, as appropriate for the type
     of port. An entry must be made for each field and separated
     by (SP). Note that CNX through TST count as one field.

     Examples:

         0:12 Z U F E E 2/2/7/1/0

         1:4   E A F I E 2/2/0/1/1 24

         0:42 M I D . . . 29.4

For an IMP, a . or an I may be entered for the SYSM field,
and a . or an N for the ECHO field.

Examples:

2:1 Z I F I . . 41.1

1:1 Z I F . N . 40.1

For an AMP, the CNX-TST field may be shortened or replaced with a . .
For an UMP, the CNX-TST field may be shortened or omitted
completely. In this case, default values will be used.   Only
trailing digits may be omitted.

Examples:

0:4   Z A F I E 2/2 38

0:19 M U D I E 2/2

In both examples, only CNX and DCNX have been specified;
LVL, NEU and TST will assume the default values.

The default values are 0/0/0/1/1.

The port may be deconfigured by entering 0:0.

It is also possible to configure subsequent ports using the
Step and Run commands. These commands allow one or more
sequential ports (if not configured) to be configured on
sequential channels (if free) using the same characteristics
as those of the currently displayed port.

Examples:

S   configure next port on next channel

R   13   configure next 13 ports on sequential
                 channels

The input is terminated with (CR) or (LF). If a single port
has been configured or reconfigured, the new charactistics
will be displayed. The Port command will then proceed as
for (a) above.

Possible Errors:

...CHANNEL NOT AVAIL   channel in use by STC, or as a
                          network channel, or already
                          configured on another port

...RUN INCOMPLETE   the RUN command encountered a
                          configured port before all the
                          specified ports had been configured

4.23 QUEUE

The Queue command is used:

a) to display a list of short-form/group addresses and/or ports which have local ports queued to them (the Auto Retry Queue), or

b) in Update mode only to enable or inhibit local ports from queuing to the Auto Retry Queue.

4.23.1 LIST ADDRESSES AND/OR PORTS QUEUED

```
QU [(SP) A] (CR)
   [(SP) P]
```

Examples:

QU A   list short-form/group addresses with ports queued

QU P   list ports having local ports queued to them

QU   list both "A" and "P"

The list consists of pairs of entries, the destination port or address, and the number of ports queued to that destination. Three pairs are listed per line, and up to ten lines may be displayed. The list is preceeded by a header line.

Example:

```
DEST        QLEN    DEST        QLEN    DEST        QLEN
P001.021    002     P024.134    001     A004        012
A023        003
```

where:

DEST   indicates the destination port (P) or short-form/group address (A) to which local ports are queued

QLEN   the number of ports queued to that destination

After ten lines have been output, (LF) may be entered to request the next ten, or (CR) to terminate the command. The command terminates after all queue elements have been listed.

4.23.2 ENABLE OR INHIBIT QUEUEING

```
QU      [(SP) E] (CR)
        [(SP) I]
```

This command is only valid in Update mode and will enable or
inhibit AMPS and UMPS from queueing to the Auto Retry Queue.
Note that IMPs will always be queued automatically by the
USO if they cannot be connected. Any AMPs or UMPs on the
queue when queueing is inhibited will be dequeued.

4.24 ROUTE

Routes (and Pipes) should only be configured when the node is part of a multi-mode network.

The Route command is used to display:

a)   a list of routes to all other nodes in the network configured at the node, or

b)   the pipes comprising the route to a specified node, and in Update mode allow redefinition.

Note that with a US03, node numbering depends on the operating mode currently selected by the LP command (ie physical or logical).

4.24.1 LIST OF CONFIGURED ROUTES TO OTHER NODES

RO [(SP)nn (SP)nn] (CR)

Examples:

RO   list all configured routes

RO 20 28   list all configured routes from 20 to 28 inclusive

Note that the optional range of routes is only available with a US03 or US020.

The list consists of up to ten routes, each route being displayed with up to four pipes comprising alternate paths to that node (in priority order). The list is preceded by a header line.

Example:
```
RTE    PIPE(S)
20     01  44  71
24     44  01
37     71
59     01  44
```

After ten routes have been output, (LF) may be entered to request the next ten, or (CR) to terminate the command. The command will terminate after all configured routes have been listed.

4.24.2 DISPLAY PIPES IN A SPECIFIED ROUTE

RO (SP) nn (CR)

The header is output (as for the route list) together with the specified route. The contents of the pipe field depends on whether or not the node is configured (USO3 only), the route is configured or the route is to the supervised node.

An unconfigured node (USO3 only in logical mode) will display:

...NODE NOT CNFGD

An unconfigured route will display:

...NOT CNFGD

The route to the supervised node will display:

LOCAL

After displaying the route, the cursor may (a) remain at the end of the last line (Monitor mode), or (b) move to the start of the next line (Update mode)

a)   If the Supervisor is in Monitor mode, (CR) or (LF) are the only legal responses. (CR) will terminate the route command, (LF) will display the next route. If the current route was configured or is the supervised node, the next sequential route will be displayed. If the current route was not configured, the next configured route will be displayed. If the maximum number of routes has been reached or there are no more configured routes, the command will terminate.

b)   If the Supervisor is in Update mode, (CR) or (LF) may be entered as in (a) above, or the route may be configured, reconfigured or deconfigured.

The route may be configured or reconfigured by entering one to four pipe numbers, each separated by (SP). The order of the pipes is significant, as the USO will try the first pipe (the primary route) when making a connection attempt and then the next if it fails (and so on).

The route may be deconfigured by entering 0.

4 - 45

The input data is terminated with (CR) or (LF), and the
Route command will proceed as for (a) above.

Possible errors:

?? PIPE(S) NOT CNFGD   one or more of the specified pipes
                                are not configured

4.25 SCLEAR

The Statistics Clear command is only available with a USO3 or USO20.

The command is used:

a)   to display the status of automatic listing of link
      statistics to the Supervisor, and the time when the
      statistics will be reset, (in Update mode the time may be
      redefined), or

b)   In Update mode, enable or inhibit automatic output of link
      statistics to the Supervisor Terminal.

4.25.1 DISPLAY STATUS AND RESET TIME

SC (CR)

The display is in the form:

AUTOMATIC OUTPUT OF LINK STATS TO SUPERVISOR IS [INHIBITED]
hh.mm   .   [ENABLED]

The link statistics will be reset at hh.mm. If automatic
output of link stats to Supervisor is enabled and a
Supervisor is logged on, then the link stats will be output
before being reset. The statistics are output in the same
format as for the LSTAT command.

If the Supervisor is in Monitor mode, the command will
terminate.

If the Supervisor is in Update mode, the cursor will move to
the start of the next line to allow the reset time to be
redefined. The new time, if required, should be entered in
the form hh.mm. The command is terminated by entering (CR).

4.25.2 ENABLE OR INHIBIT AUTOMATIC OUTPUT OF LINK STATS

SC [(SP) E] (CR) " [(SP) I]

This command is only valid in Update mode and will enable or
inhibit automatic output of link stats to the Supervisor
Terminal. Once automatic output is enabled, link stats will
be output to the Supervisor Station (if logged on) every
time the system time and reset time are equal.

4.26 STATS

The Stats command is used to display certain USO system statistics which are intended primarily for use by BT personnel.

        ST [(SP) C] (CR)

Examples:

        ST   display USO statistics

        ST C   display USO statistics and then reset them

Note that the statistics may only be reset in Update mode.

The output is in the form:

```
CUR     MAX     MIN     RBC     RBM     TML
13750   17142   08562   00024   00041   00000
USO   CHANNEL USAGE
001   001   017   017   010   009   007   002   001   001
001   000   000   000   HLD   SNK
```

The information given is:

CUR	current amount of unused working memory (in bytes)
MAX	maximum recorded amount of unused working memory
MIN	minimum recorded amount of unused working memory
RBC	current number of free RBs
RBM	maximum recorded number of free RBs
TML	number of times the TIME task was not run due to a heavy system load
USO CHANNEL USAGE	number of times each configured USO channel (Device 15) has been used by the USO (see Section 6.2.1 for guide to interpretation)

Clearing the USO stats will zero MAX, TML and the channel usage counts, and reset MIN to the maximum memory.

4.27   TEXT

The Text command is used to display the text of the Connection
Event messages, and in Update mode allow redefinition. The
messages are selected by a single upper case alphabetic
character and are:

    A   Recorded Announcement text
    I   Invitation to Select text
    S   Service Ready text

The text may be up to 80 characters and may contain any
characters except (ESC), (LF) and (CR).

A US03 or US020 also allows the system messages to be redefined. The
messages are selected by the first two or three characters of
the default CCITT message:

Select Characters	Default CCITT Message
COM	COM
DER	DER
DIS	DISC
ERR	ERR
INV	INV
MOM	MOM
NA	NA
NC	NC
NP	NP
OCC	OCC

The redefined message may be up to 40 characters and may consist
of any characters except (ESC), (LF) and (CR).

    TE [(SP) aaa] (CR)

Examples:

    TE S   display Service Ready text
    TE DER   display DER message
    TE   display Recorded Annoucement text

The display consists of the select character(s) followed by the
text, unless A, I or S are not defined, in which case:

    ...STRING NOT SET

will be output.

After displaying the text, the cursor may (a) remain at the end
of the line (Monitor mode), or (b) move to the start of the next
line (Update mode).

a)   If the Supervisor is in Monitor mode (CR) or (LF) are the
      only legal responses. (CR) will terminate the text
      command, (LF) will display the next message. The messages
      are displayed in the order A, I, S, COM, etc. After
      displaying the S text (OCC with a USO3), (LF) will
      terminate the command.

b)   If the Supervisor is in Update mode, (CR) or (LF) may be
      entered as in (a) above, or the text may be redefined or set
      to a null string.

      The text may be redefined by entering up to 80 characters
      (40 for COM thru OCC with a USO3 or USO20).

      The text may be set to a null string by entering a single
      (SP). With a USO3 or USO20, system messages will be set to the
      default CCITT string instead of a null string.

      The input data is terminated with (CR) or (LF), and the text
      command will proceed as for (a) above.

4.28 TIME

The Time command is used to display the system time, and in Update mode allow it to be changed.

        TI (CR)

The display is in the form:

        year/month/day hour.minute.second

Example:

        83/06/19 16.24.18

If the Supervisor is in Monitor mode, the time command will terminate.

If the Supervisor is in Update mode, the cursor will move to the start of the next line to allow a new date and time to be entered. Ten digits only must be entered: two each for year, month, day, hour and minute. Note that seconds are not allowed.

Examples:

        8306191631(CR)   specify new date and time

        (CR)   date and time remain unchanged

The Time command terminates after the (CR).

4.29   UPDATE

The Update command is only valid in Monitor mode and is used to switch the Supervisor Station from Monitor mode to Update mode.

    UPDATE (CR)

The USO will now output the message:

    I/P PASSWORD

The node's "Update Mode" password should now be entered (as set by the Password command). The password will not be echoed as it is entered. If the password is correct, the Supervisor Station will enter Update mode and output the message:

    SUPERVISOR UPDATE MODE ENTERED AT NODE nn

An Event Log message is also generated. The Supervisor may now change the node's configuration.

Possible errors:

    ?? PASSWORD   incorrect password entered

SECTION 5

CONFIGURATION AND INSTALLATION

5.1 USO CARD LOCATION

The DATELMUX 5500/USO comprises a DATELMUX 5500 as described in the 5500 Section with the addition of a USO card 5510. This card may be located in any free position in the (master) frame (ie not in a slot required for STC, master ARQ or BUF card). See Figures 5-1 and 5-2 of the 5500 Section. Its presence will, of course, reduce by one (or two in the case of US03 or US020) the number of positions available for other cards.

5.2 USO CARD STRAPPING

US02 cards have three sets of factory-installed links, but these are not available to users. Links A, B, C, D, determine diagnostic sub-sets. Link H is set for 32K memory, link J for 64K memory. Link G is set to connect the battery this link should be removed when the card is it storage for more than 24 hours to conserve battery life). Link F and RST are not strapped, but are for engineers to cause Software Abort and Reset respectively. US03 and US020 cards have only links A, B, C and D.

5.3 CHECKOUT PROCEDURE

This procedure is for checking a USO card in a 5500 that has already been fully checked out (see 5500 Section 5.9), although the values given may not be suitable for operational running. Carry out the following actions and check that the stated responses are received:-

i)   Turn off mains power.

ii)   Insert USO card in the master frame (see Section 5.1).

iii)   Insert LSC card in slot 5 (Channels 17 to 20), connect 3 terminals to the Channels 17, 18, 19.

iv)   Turn on mains power.

v)   Set up STC map via MT panel:
        Device 0 with BASE = 1, SIZE = 64. Device 15 with

        BASE = 65, SIZE = 13. Make this the Active map.

vi)   Carry out the Cold Start procedure (engineers only).

vii) ON STC panel enter Log-on code: press LOGIN followed by
123456 ENABLE. Press ACTIVE RUN ENABLE. Response on STC
panel: USO run.

viii) Log-on Supervisor:-

On the terminal connected to Channel 17, raise DTR (on
some terminals, switching LINE/LOCAL to LINE does this;
if in LINE already, switch to LOCAL then back to LINE).

type: (CR)
response: 00:000
type: LOGON(CR)
response: I/P LOGIN CODE
type: 123456(CR)
response: SUPERVISOR MONITOR MODE ENTERED AT NODE 00
type: UPDATE(CR)
response: I/P PASSWORD
type: (CR)   (password not yet set up)
response: SUPERVISOR UPDATE MODE ENTERED AT NODE 00
type: PASSWORD(CR)
response: (LF) (USO issues a line feed)
type: WHAT A GOOD JOB COWS DONT FLY(CR)
            (sets the Update mode password)
type: NO(SP)1(CR)   (sets node identity = 1)

ix) Configure port 1 (Channel 18):-
type: PO(SP)1(CR)
response:
P=001
...NOT CNFGD
DEV:CHN PAR TYP SPD SYSM ECHO CNX/DCNX/LVL/NEU/TST I/A-DST

Enter the data:

   0:18(SP)E(SP)U(SP)F(SP)I(SP)E(SP)O(LF)

The response is a repeat of Port 1 configuration, plus:
P=002
DEV:CHN PAR TYP SPD SYSM ECHO CNX/DCNX/LVL/NEU/TST I/A-DST

x)   Configure Port 2 (Channel 19):-

        Enter the data:
         0:19(SP)E(SP)U(SP)F(SP)I(SP)E(SP)O(CR)
        The response is a repeat of this data.

xi)   Log-off the Supervisor:-

        On the terminal connected to Channel 17, lower DTR (eg
        switch LINE/LOCAL to LOCAL) or type LOGOFF(CR).   Then
        raise DTR (eg switch back to LINE) to prepare for (xv)
        below.

xii)   Log-on the Supervisor at Port 1 (Channel 18):-

        On the terminal, raise DTR (eg LINE/LOCAL switch to
        LINE).

        type: (CR)
        response: 01.001
        type: LOGON (CR)
        response: I/P LOGIN CODE
        type: 123456(CR)
        respose: SUPERVISOR MONITOR MODE ENTERED AT NODE 01
        type: UPDATE(CR)
        response: I/P PASSWORD
        type: WHAT A GOOD JOB COWS DONT FLY(CR)
        response: SUPERVISOR UPDATE MODE ENTERED AT NODE 01

xiii) Configure Port 3 (Channel 17):-

        type: PO(SP)3(CR)
        response:
        P=003
        ...NOT CNFGD
        DEV:CHN DAR TYP SPD SYSM ECHO CNX/DCNX/LVL/NEU/TST I/A-DST

Enter the data:
0:17(SP)E(SP)U(SP)F(SP)I(SP)E(SP)O(CR)
to which the response should be a repeat.

xiv)   Open all configured ports:-

        type: OP(SP)P(CR)

xv)   Make Port 3 the Event Log Station:-

        type: EV (CR)
        response: 00
        type: 3(CR)

xvi)   Open the Node:-

        type: OP(SP)N(CR)

xvii)   Log-off Supervisor:-

        Drop DTR (eg switch LINE/LOCAL to LOCAL).   Then raise
        DTR (switch back to LINE) to prepare for (xviii) below.

xviii) Make a connection between two UMP ports (Port 2 to Port
        1):-

        Make a Connection Event at Port 2 (Channel 19) by
        raising DTR (eg switch LINE/LOCAL to LINE).

        type: (CR)
        response: 01.002
        type: 01.001 (CR)
        response: COM   (successful connection to Port 3)

xix)   Ensure that this connection is logged on the Event Log.

xx)   If possible, exchange data between the two terminals
        (if they can activate the necessary control lines).

SECTION 6

OPERATING PROCEDURES

6.1 INTRODUCTION

There are four main places where operators may access the DATELMUX 5500/USO:-

    i)   at the LSC cards,

    ii)   at the Mapping and Test Panel (MTP),

    iii) at the Supervisor Station, and

    iv)   at the user terminals connected to designated ports (UMPs) on the network.

All the procedures for i) and most of the procedures for ii) are given in the 5500 Section. The remainder are given here.

6.2 MTP PROCEDURES

There are additions to be made to the operations in the 5500 Sections for setting up the Device and Channel maps, and for switching the USO on and off.

6.2.1 CONSTRUCTING DEVICE MAPS

Refer to para 6.4.2 of the 5500 Section. The Device map should include the USO as Device 15. Allocate a size to it of the maximum anticipated number of simultaneous connections and disconnections, plus 6. This applies to AMPs, IMPs and UMPs. (A connection requires one of Device 15's channels for the time spent selecting the destination port; a disconnection requires one of these channels for the time specified as the busy-out delay). A reasonable starting value for the size of Device 15 is 20, but this may have to be adjusted after examination of the "USO channel usage" displayed by the STats command.

The Supervisor STats command (see Section 4.25) displays the
number of times each USO channel has been used. A USO
channel is needed every time a user requests a connection or
disconnection, every time the Supervisor breaks a user
connection by closing elements of the network, and every
reroute/reconnection attempt made on behalf of an IMP or
queued UMP or AMP. The first USO channel is reserved for
the node Supervisor (its usage count indicates the number of
times a Supervisor has logged-on at the node), the second
will normally (through not always) be used for the Event
Log, and the last two are reserved for system use. The usage
of the remaining channels (third to last but two) indicate
the suitability of the size of Device 15 for the work load
of the node.

Ideally the USO channel utilisation should reduce as the
channel number increases, the last few having similar and
low usage. If the utilisation of the last few channels
still shows a marked reduction from one to the next and the
last is non-Zero then there are insufficient USO channels to
support the load. If the utilisation of the last six or
seven channels are all zero (or the same low value) then the
number of USO channels could safely be reduced by three or
four. If the last few USO channels have similar non-zero
utilisation, this indicates that there are sufficient
channels for normal working, but not to support occasional
peak load conditions.

6.2.2   CONSTRUCTING CHANNEL MAPS

Refer to para 6.4.3 of the 5500 Section. The Channel map
for Devices 0-14 should have self-mapped all those channels
that are to be available to the USO for AMPs, IMPs, UMPs or
network (inter-5500/USO) channels. The Channel map for Device
15 (the USO) must have all its channels self-mapped.

6.2.3   SWITCHING USO TO RUN AND HALT

The USO may either be in Run, when all facilities of the
5500/USO are available, or Halt, when the USO is virtually
switched off and the multiplexer behaves as if it were a
5500. The USO when at System level as either:

USO run or
USO hlt

Initially the USO will be in Halt. To switch to Run press
the following key sequence:

Edit
Active
Run
Enable

The display will change to USO run.   On the USO card LOC
will go off, and ENB and OFL will go on (if CUS instead of
OFL goes on, it indicates an unsuitable configuration, eg
Device 15 has less than 6 channels allocated to it, or one
of those channels is not self-mapped). To switch to Halt
press the following key sequence:

Edit
Active
Halt
Enable

The MTP display will change to USO hlt. On the USO card OFL
(or ONL) and ENB will go off, and LOC will go on.

6.2.4   USE OF MTP WITH USO RUNNING

When the USO is running (ie   MTP indicate USO run and USO
card LEDs ENB, and OFL or ONL, are on), it is only possible
to modify the Active Channel map from the MTP if the
channel(s) concerned are "free" (ie   the channels are not
in use as network channels and are not configured as 5500/USO
ports which are open the mapping of closed 5500/USO ports can be
changed from the MTP).

Error codes relating to the 5500 that can be reported on the
MTP are included in Tables 4-6 and 4-7 of the 5500 Section.

6.3   SUPERVISOR STATION PROCEDURES

6.3.1 TO LOG-ON AND LOG-OFF

There can be only one logged-on Supervisor Station at a time
at any given node. A node may be supervised "locally" from
one of its own ports or "remotely" from a port at another
5500/USO node.

i) Ensure that the USO is in Run mode from the MTP.

ii) From any suitable terminal (ie one connected either to a configured 5500/USO UMP port, or to a self-mapped channel on the node), generate a "Connection Event". If the channel is a configured UMP, use its specified method (see para 6.4.1); if the channel is not a configured port, raise DTR (on some terminals, switching LINE/LOCAL to LINE does this; if in LINE already, switch to LOCAL then back to LINE). Then request service by inputting (CR).

iii) The USO will respond with the "Service Ready" message, followed by the node and port identity, followed by the "Invitation to Select" message. (If the message texts have not been specified, only the node and port number will be output.)

iv) If it is required to log-on as Supervisor at this node, type: LOGON(CR). To log-on as Supervisor at any other node on the network to which this node has a viable route, type: nn.O(CR), where nn is the identity of the desired node.

v) If no other port is logged-on as Supervisor at the node, the USO will respond I/P LOGIN CODE. (If the response is OCC, DER or NC, it means the USO could not establish communication with the remote node, either because the remote USO was not responding, or because a route to it could not be found).

vi) If no log-on code has been set up at this node's STC, type (CR). If the STC log-on code has been set up, type it in on the keyboard, followed by (CR). (A space will be echoed back for each digit typed.)

vii) If the log-on code is correct the USO will respond SUPERVISOR MONITOR MODE ENTERED AT NODE nn and an entry will be made on the Event Log. If the log-on code is incorrect the USO responds INV followed by a return to "Service Ready". Having logged-on, the Supervisor can use any of the facilities available in Monitor mode. If it is necessary to change any of the configuration details, the Supervisor must first change the Station to Update mode as in steps (viii) to (xi).

viii) Type UPDATE(CR)

ix) The USO will respond I/P PASSWORD

x) If the Update mode password has not been set up, type (CR), otherwise input the password followed by (CR).

xi) If the password is correct the USO will respond SUPERVISOR UPDATE MODE ENTERED AT NODE nn and an entry will be made on the Event Log. If the password is incorrect the USO will respond ?? PASSWORD and remain in Monitor mode.

When in Update mode the Supervisor may make changes to the
configuration of the node to which the Station is logged-on.
This includes setting or changing the node's Update mode
Password (the only other method of changing this password is
to cold-start the USO, which has the effect of cancelling
the existing password). When in Update mode, if there is no
activity at the Supervisor station for 10 minutes, the
Station will automatically revert to Monitor mode.

xii) To log-off the Supervisor Station, from either Update
or Monitor mode, make the appropriate "Disconnection Event"
for the port (see para 6.4.2), or type LOGOFF(CR)

6.3.2   TO SET UP USO CONFIGURATION DATA

First, the network should be planned on paper, numbering all
nodes, pipes, links, ports and short-form/group addresses.
The blank forms in Appendix A can be used to help with this.
Allow a port at each node for the Event Log Station and
another port for the Supervisor Station. Then take the
following steps, using the commands detailed in Section 4:-

i)   Run the USO at each 5500 node in the network.

ii) Log-on as Supervisor at one of the nodes and enter
Update mode (LOGON ,and UPDATE command).

iii) Set up the node number (NOde command).

iv) Specify the ports, short form and group addresses, and
text strings (POrt, ADdress and TExt commands).

v) Set up the time of day (TIme command).

vi) Open the port to be used as Event Log and route the log
to it (OPen and EVent commands).

vii) Specify the pipes and rotes to other nodes in the
network (PIpe and ROute commands).

viii) Log-off the Supervisor Station, then log-on as
Supervisor at one of the neighbouring nodes (this may either
be done remotely from a terminal at the first node, or
locally at the node in question).

ix) Set up the configuration of this node in a similar
manner to that described above, and repeat for the rest of
the nodes in the network.

x) Re-log-on to each of the nodes in turn opening the ports
and the node at each.

6.3.3 TO OPEN AND CLOSE NODES, LINKS OR PORTS

To open or close nodes, links or ports, use the appropriate
Open or CLose commands (user connections can only be made
between open ports, via open links and nodes).

6.3.4 TO CHANGE USO CONFIGURATION DATA

Use appropriate commands preceded, if appropriate, with
CLose commands.

6.3.5 TO DUMP AND LOAD USO CONFIGURATION DATA

i) Connect an appropriate recording device (with V24
interface) to an UMP.

ii) Set LSC speed to match the device.

iii) Use DUmp command to write to the medium.

iv) Use LOad command to read from the medium.

6.4 USER TERMINAL PROCEDURES

There are two procedures that a DATELMUX 5500/USO network user
can carry out from a terminal, providing the port to which it is
connected has been designated by the supervisor as a User Mapped
Port (UMP) or an Automatically Mapped Port (AMP). These are:-

i) To make a request for the UMP or AMP to be connected to
another UMP in the network.

ii) To make a request for the UMP or AMP to be disconnected.

6.4.1 CONNECTING USER MAPPED PORTS

An UMP may be connected to any other UMP in the network
providing:-

a) the correct procedure is followed,

b) a valid node/port number or an accessible short-form
/group address (SFA) or alphanumeric name is used,

c) the requesting port and the node are opened,

d) a route can be found to the remote node,

e) the remote UMP is not closed, engaged or out-of-order,
and
f) the two UMPs are at the same speed.

The procedure is in two stages: contacting the User Switching Option (USO) in the 5500/USO (this is referred to as a "Connection Event"), and specifying the address of the required remote port.

There is an optional third stage for automatic retry of the connection request.

6.4.2 CONNECTING AUTO MAPPED PORTS

An AMP may be connected to the group or short-form address (SFA) configured for it by the Supervisor, providing:-

a) the correct procedure is followed,

b) the requesting port and the node are open,

c) a route can be found to the remote node (if connection is to a remote node),

d) the destination port is not closed, engaged or out-of-order, and

e) the requesting and destination ports are at the same speed.

The procedure consists only of contacting the User Switching Option (USO) in the 5500/USO (this is referred to as a "Connection Event").   The USO will then automatically attempt a connection to the pre-specified (by the Supervisor) destination SFA or group. If the connection attempt fails with the response OCC or NC and if Automatic Retry Queueing is enabled, then the AMP will automatically be put on the Retry Queue and the user will be informed of this by the message QUEUED.

6.4.3 CONTACTING THE USO

There are a number of possible ways of contacting the USO module (ie causing a Connection Event), depending on the type of terminal and the way in which it is connected to the port. The method appropriate to each terminal will have been specified by the Supervisor. It will probably be one of the following:-

a)   From a terminal connected by a dialled line: make the dialled connection, and depress the Carriage Return* (CR) key.

b)   From a terminal connected by cable or by a leased line: typically, either change the LINE/LOCAL switch to LINE followed by Carriage Return* (CR), or depress the BREAK key followed by Carriage Return* (CR).

*Two Carriage Returns are required if the port's
channel is set to Automatic Baud Rate detection (ABR).
If the port is configured as an AMP and its channel is
set to fixed speed, then no Carriage Returns are
required.   See section 6.4.8 for details of support for
Viewdata terminals.

In the case of UMPs, when the appropriate Connection
Event has been made, the USO will respond with a three-
line message at the terminal. The first line is a
"Service Ready" message. The second line is the address
of the port (in the format node.port). The third line
is an "Invitation to Select" message, eg:-

SYSTEM AVAILABLE
03.016
PLEASE SELECT

(the first and third lines are specified by the
Supervisor, and may be absent).

If a terminal is connected to the 5500/USO node via a
composite ARQ link, and that link is heavily utilised,
it is possible that the user will receive the message
NC in response to the connection event, instead of a
Service Ready message as above. This indicates that
there is insufficient capacity on the link to
accomodate a connection to the user's terminal, and the
user should retry later.

6.4.4   MAKING A CONNECTION (UMPS ONLY)

When the USO response is received, a request may be made for
interconnection to any other UMP on the network (this
request should be made within 30 seconds, or the USO will
send a message TIMEOUT and automatically disconnect the
port; contact will have to be re-established). The request
is made either by typing in the node and port number
required, followed by Carriage Return, eg:-

    2.14 (CR)

or (if the Supervisor has established short-form addresses
or alphanumeric names), either a colon or asterisk followed
by the short-form address of the port or group of ports
required, followed by Carriage Return, or an alphanumeric
name followed by Carriage Return eg:-

    :4 (CR) or *4 (CR) or XYZ1(CR)

(For short-form address 0, the 0 may be omitted).

When the connection has been made, the originating port receives the COM message, and the remote port receives a 1 second pulse of Ring Indicator, after which all V24 controls and data originating at either end are passed directly through the 5500/USO.

The USO may send other connection response messages to the user. Their meanings are given in Table 6-1. (Note: Users at USO3 nodes may receive response messages other than the standard CCITT messages listed in Table 6-1, but they will have been informed of the equivalent messages and meanings by their network administrator).

6.4.5 AUTOMATIC RETRY (UMPS AND AMPS)

If the response to a connection request is OCC (Requested port is busy), or NC (Network Congested), on a port configured as an UMP, the user can request the USO to retry the connection attempt automatically at regular intervals, by entering Q followed by Carriage Return (CR). If the port is successfully added to the queue the response QUEUED will be output.

For AMPs and IMPs, the connection attempt is automatically queued, by the USO, to the Auto Retry Queue.

A request can be removed from the Auto-Retry Queue at any time by performing a Disconnect Event (see para 6.4.6) at the requesting UMP or AMP.

The node Supervisor may display the number of ports at this node which are queued to destinations throughout the network by use of the Queue command.

Queueing of AMPs and UMPs may be inhibited or enabled by the node Supervisor, but IMPs will always be queued automatically to the Auto Retry Queue if a reconnection attempt fails.

A list of the coded messges that the system can send to the user as connection responses is given in Table 6-1, together with the actions to be taken by the user.

Table 6-2 lists system messages that may be sent subsequently.

CODE	MEANING	ACTION
COM [1]	Connection made.	Data can be exchanged
MOM	The attempt failed but the USO will try again	Wait for another USO message
ERR	There was an error in selection protocol (eg non-alphanumeric character was entered as part of an alphanumeric name, or an invalid number of characters was entered.)	Try again, following correct procedure
	The requesting port or node is closed	Contact Supervisor
INV	Invalid selection request (eg destination port set to incompatible speed or is not an UMP), or request to queue the connection request to the Auto Retry Queue when no connection attempt has been entered or the USO's response on the previous attempt was ERR, INV, NP or DER	Enter valid connection request
NP	Non-existent port, short-form address or alphanumeric name (eg port not configured), or no route configured for inter-node connections	Try again, using configured port number, short-form address, or alphanumeric name or route
OCC	The port requested is occupied (engaged), or all suitable ports on the reqested short-form/group address are occupied	Re-contact USO when another attempt required, or queue the connection attempt to the Auto Retry Queue (UMPs only)
DER	The port requested is closed or out-of-order, or [for inter-node connection] no open and working routes available, or the number of inter-node links for the connection has exceeded the maximum value [2]	Re-contact USO when another attempt required or contact Network Supervisor

TABLE 6-1

CONNECTION RESPONSE MESSAGES

CODE	MEANING	ACTION
NA	The port originating the connection request is not permitted to access the port, SFA or name requested, or queuing to the Auto retry queue is inhibited	Report to Network Supervisor
NC	No free channels available on link 2 (for inter-node connections), or requesting/ destination port's link is overloaded	Re-contact USO when another attempt required or queue the connection attempt to the Auto Retry Queue
QUEUED	The connection attempt has been queued to the Auto Retry Queue	Wait for another USO message (NP, NA, COM, INV or DER)

1   If a connection attempt is successful after it has been
     queued to the Auto Retry Queue, a Bell character will be
     output before and after the COM message.

2   Multi-node systems only.

TABLE 6-1

CONNECTION RESPONSE MESSAGES

MESSAGE	MEANING	ACTION
.. OVFL	The USO working memory is almost fully committed	This situation may occur for short intervals when the USO has a sudden heavy workload, but should clear itself in due course
(BELL) DISC (BEL1)	The two connected ports have been disconnected	Re-contact the USO when another connection attempt is required
CNX FAILURE PLEASE REQ RECONNECTION	The two connected UMPs at different nodes have been disconnected due to inter-node link failure	Contact the USO to re-connect the UMPs
DATA LOST [1]	The two connected IMPs have been forcibly disconnected	Report to Network Supervisor.

1   A USO control code for this message will be sent to the channel card. The message will be output only if the system messages have been enabled on the channel card (refer to DATELMUX 5500 Section.

TABLE 6-2

SYSTEM MESSAGES

6.4.6 DISCONNECTING USER MAPPED OR AUTOMATICALLY MAPPED PORTS

A terminal or computer user at either end of a DATELMUX 5500/USO connection may disconnect using a "Disconnect Event" procedure specified by the Supervisor. This will probably be one of the following:-

a)   From a terminal connected by a dialled line: disconnect the terminal from the line by the usual procedure. If the port is configured for Dual-level Disconnection (see para 6.4.7), either a partial or a full disconnection may be carried out with the appropriate Disconnection Events.

b)   From terminal connected by cable or by a leased line: typically, either change the LINE/LOCAL switch to LOCAL, or depress the BREAK key.

A "DISC" message will be output to disconnected ports configured with system messages enabled.

For the originating port, allow approximately two seconds for the disconnection to take place before requesting another connection.

A protective delay (between 2 seconds and 15 minutes, specified by the Supervisor) "busies out" the destination port, preventing any subsequent connections to it until the delay has expired.

6.4.7 DUAL-LEVEL DISCONNECTIONS

Dual-level Disconnection (DCNX code 4) is intended for use with ports using dial-up type modems. Disconnection from the distant port can be achieved either by dropping Carrier Detect (hanging up) or by Line Break.

To break only the DATELMUX connection (partial disconnect), leaving the originating port in the Service Ready state to allow the user to request another DATELMUX connection without having to re-dial, cause a Line Break (eg by pressing BREAK).

To break both the DATELMUX connection and the PSTN connection (full disconnect), drop Carrier Detect by "hanging up".

6.4.8 Support For Viewdata Terminal

Users at Viewdata terminals configured as UMPs can request
connections to short-form or group addresses by using the
ASCII underline character in place of the carriage return,
and the asterisk instead of the colon, in the normal
connection dialogue.   For example a connection request for
address 23 would then be in the following form:

<Connection Event< <ASCII underline>   User input
<Service Ready text>
nn.ppp   ) USO output
<Invitation to Select text>   )
*23 <ASCII underline>   User input
COM   USO output

6.5 DATELMUX 5500/USO EVENT LOG MESSAGES

Each Event Log message comprises two lines of text, the first
containing the node identity and a time/date stamp, and the
second containing a description of the event.   The first line is
of the form:-

                 NODE nn AT hh.mm ON yy/mm/dd.

The second line contains one of a number of messages that are
listed on the following pages.   Symbols shown against the message
(not part of the message) have the following meanings:-

* Any of these Event Log entries will be preceded by 3 (BEL)
characters, and (for a US03 or US020) indented five spaces.

= Any of these Event Log entries will prevent the node from auto-
opening after initialisation (ie will remain OFF-LINE) due to
configuration error(s).   The Event Log entries will be preceeded
by 3 (BEL) characters, and (for a US03 or US020) indented five spaces.

+ Only applicable to a US03.

The second line may be any of the following (note that in the
first four messages, buffers are numbered starting at 0):-

*   BUFFER n OVERFLOW

Buffered data has completely filled buffer n and the
longest data queue has been deleted (see note 3).

* BUFFER n OVERLOAD MAD = xxx

Buffered data has exceeded a fixed percentage of buffer n's
capacity (see note 4).   The channel with the highest buffer use
can be found from xxx (see note 2).

6 - 14

* BUFFER n PARITY OR MEM FAIL

Buffer n has detected a parity error or memory fault (see note 3).

* BUFFER n OK

Buffer n has recovered from the fault condition.

= CORRUPT BUSY OUT DELAY - DEFAULTING TO ZERO

The busy-out delay was found to be >999 during initialisation and has been set to 0.

= CORRUPT SYSTEM/STATS CLEAR TIME OR DATE

The system date or time (or stats clear time) + was found to be corrupt during initialisation and has been reset.

=   CORRUPT SYSTEM MESSAGE/TEXT STRING

A connection response message, welcome message, or system message was found to be corrupt during initialisation and has been reset.

= DEVICE nn BASE/SIZE CHANGED FROM nnn/nnn TO AGREE WITH DEVICE MAP

The USO-stored information about the device map has been changed as a result of running the USO with an altered device map.

EVENT LOG CANCELLED

The Event Log station has been deconfigured by the Supervisor.

* EVENT LOG DATA LOST

Event Log data was generated while the Event Log Station was not configured, and has been lost.

EVENT LOG PORT CHANGED FROM nnn TO mmm

The Event Log Station has been transferred from port nnn to port mmm. If nnn is 000, the Event Log Station was not previously configured.

= GROUP nn ADJUSTED TO CORRECT ERROR

During initialisation short-form/group address nn was found to have one or more sets corrupt. Those have been deleted.

= INVALID GROUP NAME CANCELLED

During initialisation a group name was found to be corrupt and
has been deleted.

LINK nn CLOSED

Link nn has been closed as a result of the Supervisor closing the
link or the node.

* LINK nn CLOSED - LINK FAILURE - STATUS = ss

ARQ nn has reported non-functional (see note 1).

LINK nn - FAULT CLEARED
ARQ nn has reported functional.

LINK nn OPENED

Link nn has been opened as a result of being powered-up, or the
USO being reset, or the Supervisor opening the link or the node.

* LOC SPVSR LOGGED-ON AT PORT nn.ppp

A Supervisor has logged in at this node (nn) from port ppp. If
ppp is 000, the channel used is not a configured port.

LOC SPVSE RETURNED TO MONITOR MODE (PORT nn.ppp)

The local Supervisor of this node has switched to Monitor Mode.

LOC SPVSR UPDATE MODE ENTERED (PORT nn.ppp)

The local Supervisor of this node has switched to Update Mode.

= LOGICAL NODE nnn DECONFIGURED+

Logical node nnn was found to be configured on a physical node
that is already configured on another logical node, and has been
deconfigured.

* NODE ADDRESSING MODE CHANGED TO LOGICAL+

The node addressing mode has been changed from physical to
logical by the Supervisor.

* NODE ADDRESSING MODE CHANGED TO PHYSICAL+

The node addressing mode has been changed from logical to
physical by the Supervisor.

NODE nn STATUS CHANGE LOC TO OFL

The node status has changed from LOCAL to OFF-LINE as a result of
being powered-up or the USO being reset or run from the MTP.

NODE nn STATUS CHANGE LOC TO ONL

The node status has changed from LOCAL to ON-LINE as a result of being powered-up or the USO being reset.

NODE nn STATUS CHANGE OFL TO ONL

The node status has changed from OFF-LINE to ON-LINE as a result of the Supervisor opening the node.

NODE nn STATUS CHANGE ONL TO OFL

The node status has changed from ON-LINE to OFF-LINE as a result of the Supervisor closing the node.

PIPE nn CANCELLED - CONFIGURATION ERROR

During initialisation pipe nn was found to contain an invalid link, a link used in another pipe or an unconfigured link and has been configured.

PORT nnn CLOSED

Port nnn has been closed as a result of the Supervisor closing the port, a range of ports, or all ports.

PORT nnn TO nn.ppp - CONNECTED OK

Local port nnn (AMP or UMP) has been connected to port ppp at node nn. If ppp is 000, port nnn is remotely supervising node nn.

PORT nnn FROM nn.ppp - CONNECTED OK

Local port nnn (UMP) has been connected from port ppp at node nn.

PORT nnn TO nn.ppp - USER DSCNX

Local port nnn (AMP or UMP) has performed a Disconnection Event and has been disconnected from port ppp at node nn. If ppp is 000, port nnn has logged-off as remote Supervisor at node nn.

PORT nnn FROM nn.ppp - USER DSCNX

Port ppp (UMP) at node nn has performed a Disconnection Event and has been disconnected from local port nnn.

PORT nnn TO nn.ppp - CNX FAILED

If local port nnn (AMP or UMP) was not previously connected, a connection attempt to port ppp at node nn has not been successful. If nn is 00, ppp is the short-form/group address requested when the destination is at another node.

If local port nnn was previously connected, the connection has failed as a result of a link failure or the Supervisor closing the link (multi-node ccnnections only) or port nnn, or this node.

PORT nnn FROM nn.ppp - CNX FAILED

The connection from port ppp at node nn to local port nnn has failed as a result of a link failure, or the Supervisor closing the link (multi-node connections only), or port ppp or node nn being closed by the Supervisor at that node.

PORT nnn TO nn.ppp - CNX REROUTED

Local port nnn has been re-routed to port ppp at node nn as a result of the original route failing (IMPs only).

PORT nnn FROM nn.ppp - CNX REROUTED

The connection from port ppp at node nn to local port nnn has been re-routed as a result of the original route failing (IMPs only).

PORT nnn TO nn.ppp - CNX RESTORED

Local port nnn has been connected or reconnected to port ppp at node nn (IMPs only).

PORT nnn FROM nn.ppp - CNX RESTORED

Port ppp at node nn has been connected or reconnected to local port nnn (IMPs only).

PORT nnn OPENED

Local port nnn has been opened as a result of the Supervisor opening the port, a range of ports or all ports.

=   PROBABLE ERROR IN PIPE CONFIGURATION

A pipe was found to be corrupt during initialisation and has been deconfigured.

* REM SPVSR LOGGED-ON AT PORT nn.ppp

A remote Supervisor has logged in at this node from port ppp at node nn.

REM SPVSR RETURNED TO MONITOR MODE (PORT nn.ppp)

The remote Supervisor (port ppp at node nn) has switched to Monitor Mode.

REM SPVSR UPDATE MODE ENTERED (PORT nn.ppp)

The remote Supervisor (ports ppp at node nn) has switched
to Update Mode.

= ROUTE TO NODE nn ADJUSTED TO CORRECT ERROR

During initialisation the route to node nn was found to use an
unconfigured pipe, and has been truncated or deconfigured.

SVSR LOGGED-OFF

The Supervisor of this node has logged off.

Note 1. The value ss is a 2 digit number representing the ARQ's
internal DATELMUX status byte. Its display is intended
primarily for use by BT personnel.

Note 2. The value xxx is the address of the queue within buffer
n, containing the largest number of blocks. The absolute DATELMUX
channel number can be obtained by inserting the values in one of
the following formulae:

if xxx < or = 63

DATELMUX channel number = $xxx + (64 \times n) + 1$

if xxx > 63

DATELMUX channel number = $(xxx - 63) + 64 (n + c)$
where c is the number of BUF or BEM cards
in slots 1 to 4 of the DATELMUX master frame.

Note 3. When either of these buffer warning messages is output,
the buffer card in question must be cleared by pressing the RE
button on the front edge of the card before further Event Log
messages for that buffer can be produced.

Note 4. The percentage of full buffer required to generate a
buffer overload varies according to the buffer type, but is
typically 75% of capacity.

7.1

The
may
is i

When
MTP
netw
clos

7.2

Chan
self
the

Howe
circ
ther
USO.

SECTION 7

TESTING PROCEDURES

7.1 INTRODUCTION

The test procedures for the 5500, described in the 5500 Section, may all be used for testing the 5500/USO from the MTP when the USO is in Halt.

When the USO is in Run, tests may only be carried out from the MTP on "free" channels (ie channels that are not in use as network channels, and not configured as 5500/USO ports which are open; closed 5500/USO ports may be tested).

7.2 LOOPBACK TESTS

Channels which are not in use by either the STC or the USO are self-mapped. This self-mapping is in effect a loopback, and in the 5500 can be used for testing.

However in the 5500/USO, the USO periodically erases any data circulating in these unused channels, and loopback tests must therefore be made using an LSC or ARQ loopback, or by halting the USO.