DCX SM Monitor
Reference Manual

(Level 1.1)

STATUTORY NOTICES

CE

Case Technology Ltd declare that this product conforms with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of the member states relating to electromagnetic protection.

WARNING

The DCX 860 and 870 incorporate a panel in front of the plug-in modules. This panel may only be removed by suitably qualified personnel for installation or maintenance purposes, and must be replaced afterwards. Removal under any other circumstance would invalidate any RFI (Radio Frequency Interference) and Safety Type Approvals.

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Preface

The DCX SM Monitor is a card that can be plugged into a DCX 840, 850, 860 or 870, to allow one or more channels to be monitored, and the data routed to a port for display or printing on a terminal.

The purpose of this guide is to provide full information to enable users (normally system supervisors) to monitor DCX 840, 850, 860 and 870 systems in operation, 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.

Details of the DCX equipment that can be monitored are given in the appropriate DCX reference manuals

Note: This manual covers existing Monitor 30 hardware and software commands, with command variations detailed in the text.

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1 Introduction

1.1 The DCX SM Monitor

The SM Monitor is an optional DCX card (SM MON) which provides monitoring of the DCX "A-M-D" bus. It can be used in a DCX 840, 850, 860 or 870. One or more channels can be monitored locally from the Monitor card, and in addition remote connections can be made to the card, so that the local channels can be monitored from a remote location.

The monitored data is formatted and can be sent to a terminal on a DCX channel anywhere in the network. The same channel is used for defining the channel to be monitored (local to the card), and the nature of the data to be monitored.

1.2 Security in DCX 850/860/870

If the Monitor is configured as a port in the form of an UMP, then anyone in the network can attach to it (although the password must be known to actually use it).

It is therefore in the supervisor's interest to increase security by keeping the Monitor port closed and/or by configuring it as an IMP.

The supervisor can also increase security by using the access level feature on ports in the network that should not be allowed to attach to the Monitor.

The SUPER access level is protected by an independent password of up to 80 characters. Any disruptive activity to be performed by the supervisor requires the monitor to be at the SUPER access level. If SW4 is OPEN then this access level is barred and any attempts to attain it or any commands that are available only at this level will result in a **Sorry - Unrecognised command !** message.

The cold start default for the session inactivity timeout is 10 minutes. If no keyboard input is received for this period then the monitor reissues the sign-on screen and request for login password. This session timeout may be reconfigured via use of the TMOUT command at the SUPER access level. Defining this value as 0 disables the inactivity timeout completely.

(There are no references within the on-line Help information to the SUPER access level or any related commands.)

2 Monitor Description

2.1 The SM MON Card

SM MON is a standard DCX 840/850/860/870 sized card. It has 16 front panel indicators, an 8-way DIL switchbank and some links.

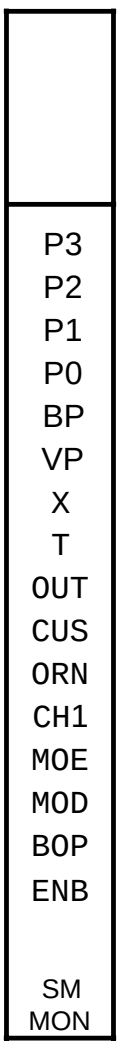


Figure 2-1 Front Panel

2.2 Indicators

P3-P0 EPROM paging bits.

BP BRAM paging bits.

VP VRAM paging bits.

X Watchdog timer. This monitors software. If a pulse is not received every 1.8 seconds, the indicator comes on.

T Software Trap. When off, each indicator has its own meaning. When on, it indicates that the Monitor has detected an error condition and has ceased to function, and the lower eight indicators collectively show a trap code.

OUT Comes on if the Output Buffer, used when Triggers are in operation has become full.

CUS Configuration unusable. Channel 1 on the device is not mapped, or cannot obtain a speed update.

ORN Too much traffic is being monitored for adequate processing to be performed. Normally because of a large magnification factor.

CH1 On when DMA channel 1 is active, off for channel 0 active.

MOE Output enabled.

MOD Output disabled.

BOP Output stream temporarily halted due to backlog of data in the external network on the console output channel.

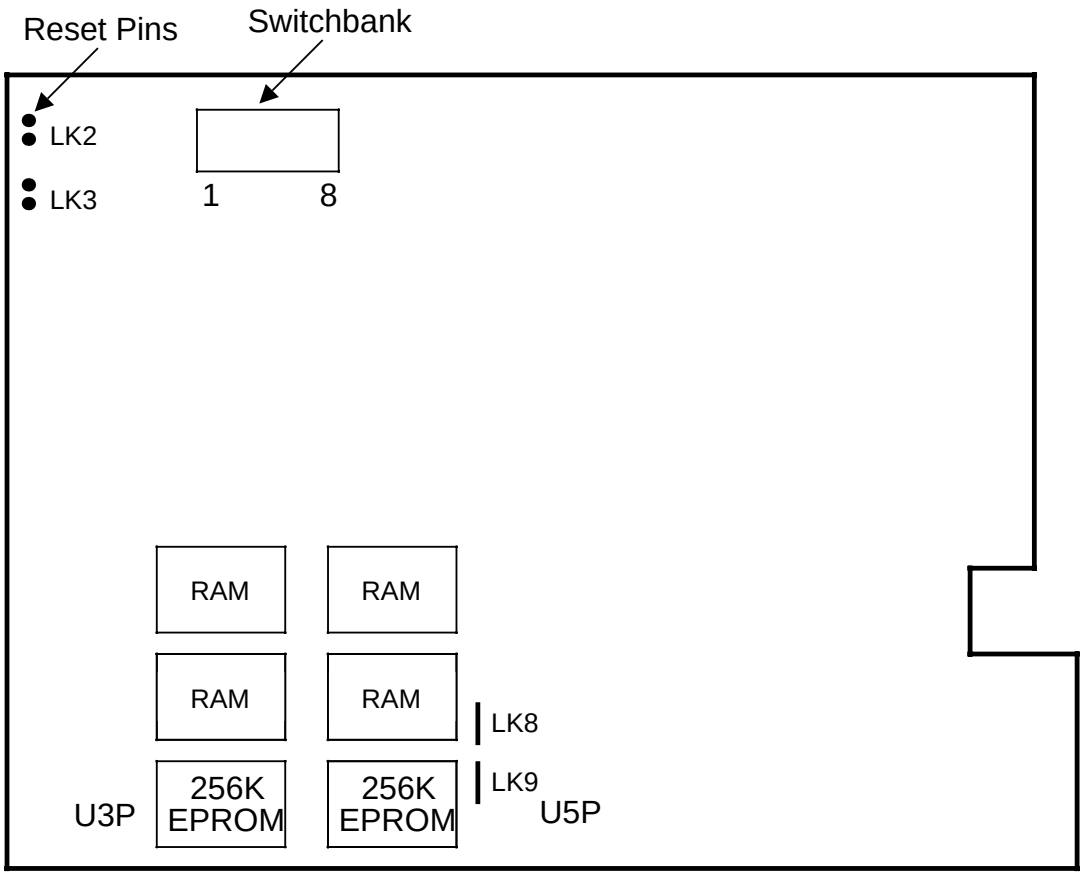
ENB Monitor card enabled. (Device has a non-zero size and is not self-mapped.)

If the **X** or **T** indicators light, the Monitor card must be restarted by powering down then up again, or briefly shorting the reset pins together.

2.3 DIL Switches and Links

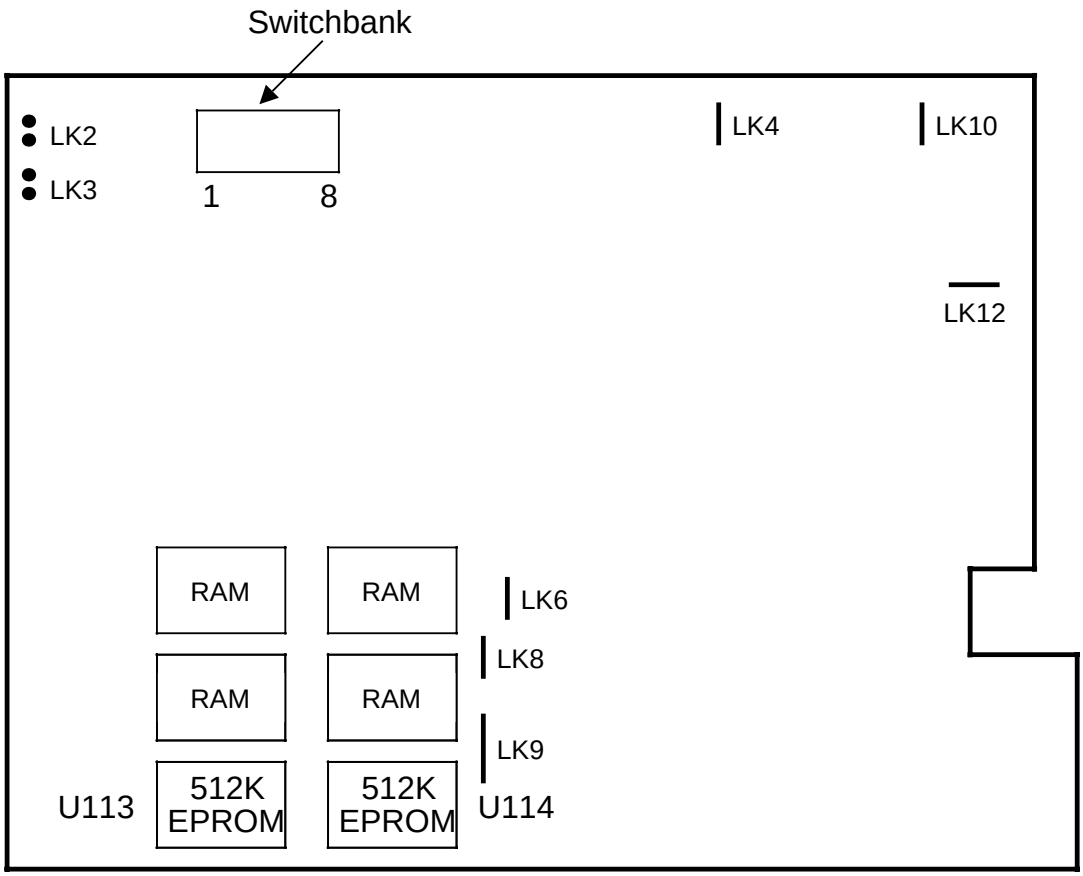
The DIL switchbank and links are shown in Figures 2-2 and 2-3.

Details of DIL switch settings are given in sections of the manual where they are explained. Unused switches should be left on the factory setting (closed).



LINK	FUNCTION	SETTING
LK2	RESET	NONE
LK3	N/A	NONE
LK8	RAM/ROM SELECTION	PINS 1-2
LK9	RAM/ROM SELECTION	PINS 1-2

Figure 2-2 Card Layout and Link Settings for MON 30 Hardware X840-605411



LINK	FUNCTION	SETTING
LK2	RESET	NONE
LK3	N/A	NONE
LK10	N/A	NONE
LK12	N/A	NONE
LK4	N/A	NONE
LK6	ROM TYPE	PINS 2-3
LK8	RAM SELECTION	PINS 1-2
LK9	RAM SELECTION	PINS 1-2

Figure 2-3 Card Layout and Link Settings for SM MON Hardware X840-608711

3 Installation

3.1 Location in DCX

The Monitor card may be inserted into any slot position in a DCX 840, 850 or 860 master card frame which is suitable for an ARQ card except next to the STC (see card configuring information in the appropriate reference manual). In a DCX 870 master card frame, the Monitor card may also be inserted in the Device 1 slot.

If DIL switch SW3 is open then the card will always respond as device 14 regardless of physical slot position. If DIL SW3 is closed then the card will respond according to the physical slot position in the same way as an ARQ or similar high speed device.

A connection can be made to the Monitor card using the MTP or NCAM, or through the USO/System Module if the monitor is configured as a USO/System Module port. It should be allocated a device size of 1 (or greater) so that the first channel on it may be used. No matter how great the size of the Monitor device, only channel 1 can be used.

3.2 Making Connection

3.2.1 Non-USO/System Module Mapped Connection

If the Monitor is housed in a non-USO/System Module DCX node it is necessary to map a channel connected to an ASCII terminal to the first channel on the device (e.g. 5.1). This terminal then becomes the Monitor control console.

3.2.2 USO/System Module Mapped Connection

(available with USO software Level 2.2 and above)

If the Monitor is configured as a special USO/System Module port by the supervisor, then any terminal user can make a connection directly to it.

The Monitor port may be either an IMP or an UMP. The configuration as an UMP on a System Module might be:

```
DEV:CHN PAR TYP  SPD SYSM  ECHO SEC CNX/DCNX/LVL/NEU/TST/ICRT/A-DST
  dd.ccc  x   x    x   x     x   x   x  /  x  /x  /  x /  x /  x    .
```

a typical example would be:

```
5:1 ZUDINI  5/0/0/0/1/0
```

Depending on the type of port, the connection can then be made in the usual way.

One possible application of this method would be to configure a group with the alphanumeric name 'MONITOR' containing the Monitor port. A connection could then be made to the Monitor card from an UMP simply by typing the word **MONITOR**. Since multiple SM MON cards may be installed in the same Node, this may be configured as a hunting group SFA.

NOTE: The Monitor card appears to be an ARQ with link speed of 9600 if the Link Status command is used.

3.3 Parity Selection

It is possible for the user to select the parity of characters output to the monitoring channel by DIL switch configuration.

The configurations are:

PARITY	SW5	SW6
ZERO	CLOSED	CLOSED
MARK	CLOSED	OPEN
EVEN	OPEN	CLOSED
ODD	OPEN	OPEN

4 Operating Procedures

4.1 Introduction

The SM Monitor provides the ability to extract information about the precise nature of data/traffic flow on the monitored connection(s).

Most asynchronous terminals (8 data + 1 stop) may be used to manage the basic features and facilities offered, but for the more sophisticated capabilities to be fully utilised, a VT100 or fully compatible terminal must be used.

Remote access to the Manager port (e.g. 14.1, 8.1, etc) may be via the DCX network from any convenient access point. The SM Monitor is able to monitor any channel or pair of channels within the node in which it is physically resident.

A series of user-friendly commands allows the parameters for the session to be defined. The high performance monitoring capabilities of this specially designed product ensure that it is of great assistance in the diagnosis of almost any complex network problem.

4.1.1 Glossary

Entity – either a data character or an internal control code.

Output Stream – a sequence of entities (data or control codes) as monitored on the configured channel(s) and presented to the control console.

Magnification Factor – the number of characters sent to the control console for each character monitored. This becomes large if highlighting and timestamping and BOTH windows are in operation.

4.1.2 Commands Summary

MONITOR	Dumb TTY Monitoring
FULL	VT100 Full Screen Monitoring
TOP	VT100 Top Half Screen Monitoring
BOTTOM	VT100 Bottom Half Screen Monitoring
BOTH	VT100 Top + Bottom Screen Monitoring
SELECT	Configuration for a Monitored Channel
PASSWORD	Define new Passwords (Login+SUPER)
SUPER	Change Access Level to SUPER
NORMAL	Revert Back from SUPER Access Level
BUFFER	Display Dynamic State of Buffers
TERMINAL	Define Type of Management Terminal
HELP	Display Information on SM MON Commands
CLOCK	Configure the Current Date and Time
HILITE	Define Monitored Data Display Attributes
BANNER	Configure the System Banner Heading
TOPMESS	Configure the Top Screen Text String
BOTMESS	Configure the Bottom Screen Text String
FULLMESS	Configure the Full Screen Text String
EXPMESS	Configure the Expert Screen Text String
WARM RES	Request a Warm Reset of the SM MON
COLD RES	Request a Cold Reset of the SM MON
MATCH	Define the Data Matching Template
CHANNEL	Define the Address Matching Template
EXPERT	Address and Data Template Monitoring
EXPRD	Define Direction as Read for Expert and Events
EXPWR	Define Direction as Write for Expert and Events
EXPRDWR	Define Read+Write Direction for Expert and Events
EVENTS	Data and Control Code Counting
TIMESTMP	Define the Timestamping Parameters
TUTORIAL	Tutorial Mode for Guiding a Pupil
TRIGGERING	
GENPAR	Define Parity on Data Generated by the Monitor
Command Abort	Entering the ! character will abort command input
Output Enable/ Disable	<SPACE> toggles monitoring activity on the selected channel(s)
Buffer Clear	<CR>, whilst the monitor function is enabled, will clear the monitor output buffer of all existing data

Input Timeout — TMOUT command (at Super Level) allows the default keyboard inactivity timeout of 10 minutes to be altered. 0 will disable the timeout completely. Max timeout = 999 seconds

4.1.3 Logging On

When the Monitor detects that it is enabled and mapped to a channel that it can talk to, the **CUS** indicator goes out, and the **ENB** indicator comes on.

Introductory text is then output to the terminal on the monitoring channel and a password is requested, in the form:

SM MONITOR
Configurable system banner
REVISION 1.1
Please input Password

The battery-backed-up password can consist of up to 80 printable characters (including the space character).

If the password is input correctly then login to the Monitor card has been successfully accomplished, and the prompt **>** will be displayed awaiting command input.

4.1.4 Command Input

SM MON will accept command input in upper or lower case in response to the **>** prompt. Each command needs to be terminated with **<CR>**. Command input may be aborted by entering the **!** character. Context-sensitive help may be invoked by entering the **?** character.

Commands may be entered either in full or truncated form. The truncated form of a command is shown in the HELP summaries as that part of the command not shown in square brackets. Thus, for example, the BU[FFER] command can be invoked by typing either **BUFFER** or **BU**. In either instance, the commands are space-sensitive and so should be entered exactly.

4.2 Commands

4.2.1 HELP

Brief summaries of the available commands can be called up as an online aide-memoire (but are more fully described in this Reference Manual).

For security reasons, no references are made within the online help to the SUPER access level or any associated commands.

4.2.2 TERMINAL

The type of terminal being used to control SM MON may be defined via the **TERMINAL** command. It may be defined as either Dumb or VT100. The cold start default is Dumb. Certain facilities require the terminal type to be a VT100, as they make use of cursor addressing and character attributes, etc. Once a VT100 terminal type is defined, the definition will remain until it is either reconfigured via the **TERMINAL** command, or a **COLD RES** command is performed.

4.2.3 SUPER

Certain functions offered by SM MON may be disruptive to the live operation of the network. Such aspects require an intending user to gain access to the SUPER level. This is protected by a password of up to 80 characters in length. The default password after a Cold Start is **<CR>**, which may be reconfigured by use of the PASSWORD command when at SUPER level. For security reasons, this command will not be acepted unless DIL switch SW4 on the card is CLOSED. Attempts to use this command with SW4 OPEN will result in a **Sorry - Unrecognised command!** error message.

4.2.4 BANNER

A number of SM MON cards may be installed in any node of a multiple node network. The BANNER command allows the system banner text string to be configured by the supervisor. This assists identification of the exact card to which a SM MON user is connected. Up to 50 characters may be entered. Termination of the string is via **<CR>**. Entering the **!** character will abort the command without updating the currently configured string. The **<BS>** or **<DEL>** character may be used to correct mistakes on entry.

4.2.5 Configurable Text String Commands

For each of the monitoring commands that present a status line, a separate configurable text string is available. Each may be up to 50 characters. VT100 escape sequences may be included to provide for Bold and Inverse, etc., display formats. In this instance, it should be noted that erroneous or incorrectly entered sequences may cause unpredictable effects on the screen formatting.

These text strings may be configured via the FULLMESS, TOPMESS, BOTMESS and EXPMESS commands. Typically they may be used to record the nature of the card or type of connection being monitored. They are displayed throughout active monitoring and provide an aide-memoire for extended periods of use.

4.2.6 CLOCK

SM MON is equipped with a battery backed-up Real Time Clock. This is used to accurately report the date and time at which specific events occur. The CLOCK command allows the setting of this clock. All dates and times are according to the format:

DD/MM/YY HH:MM:SS

The CLOCK command prompts for the relevant fields and expects a two-character response each time. The field termination characters are automatically provided. Each value is verified on entry. If such a value is invalid, or the **!** character is entered, then the command is aborted without updating the clock.

Entry of **<CR>** in a field requests that the currently displayed value of that field be used. Note that in all such instances, but most importantly for the seconds field, the value displayed remains fixed. Thus a delay of a few seconds on entry of a sequence of six **<CR>**s will result in an inaccurate setting of the clock.

The entry of the second character within the seconds field is the point at which the actual clock time is updated.

4.2.7 LOGOFF

After a session has been completed it is normally advisable to LOGOFF from the SM MON. This forces the next access to resubmit the correct password. It will normally terminate a USO or NCAM mapped connection.

4.2.8 COLD RES

If desired, the supervisor may cause the entire configuration of SM MON to reset to its default state by using the COLD RES command. Successful operation of this command requires SM MON to be at SUPER access level. To avoid its accidental use all eight characters must be entered including the **<SPACE>**. Two levels of confirmation prompt are presented: a negative answer to either will abort the command.

4.2.9 WARM RES

SM MON may be reset under software control via the WARM RES command. This prompts for confirmation but does not need to be at the SUPER access level.

4.2.10 BUFFER QUEUE MONITORING

A facility offered by SM MON is to regularly display the count of blocks of data allocated to each channel by the BAT/BUF cards. This gives a dynamic representation of the traffic occupancy within the BAT/Buffer card(s) on a per-channel basis. A VT100 compatible terminal is required for this facility.

When the BUFFER command is entered, the user is prompted for the Update time. This is the number of seconds between successive scans of the block counts. The minimum value of 1 performs a new scan and display update every 1 second. The maximum value is 999 seconds.

A screenful of information is displayed in ascending absolute channel number sequence. The relative device and channel number allocated by the Device Map is also displayed for each channel. The current length of the WRITE queue for that channel is reported as a three-digit number. All numeric values displayed by this command are in decimal. The overall information displayed for each channel is therefore in the form:

AAAA [DD:CCC] = LLL

where **AAAA**=Absolute channel number, **DD** is the relative device number, **CCC** is the relative channel number within that device, and **LLL** is the number of blocks currently in use for that channel within theBAT/BUF card. If [DD:CCC] is [**:***] it is an unallocated queue.

The size of each allocated block of data varies according to the type of BUF card:

BUF1 = 8 chars
BUF2 = 32 chars
BUF3 = 128 chars
BAT = 512 chars

Selection of a particular channel is achieved via cursor addressing around the screen. If the requested movement is on to the next screen of channel information, then a new screen is displayed. The currently selected channel is identified by the character **<** positioned alongside the Queue Length count.

Under certain conditions, it may be desirable to clear out the data within a queue. This may be achieved (only if at SUPER level) for the currently selected channel by entering **Z** (i.e. the ZAP command). After further confirmation is requested, the WRITE queue for that channel is flushed. It should be noted that this facility must be treated with care, since applying it to an operational channel will destructively disturb any active data flow.

It is also possible when at SUPER level to SEND a single character or internal control code to the selected write queue. This may be used to forcibly disconnect an unauthorised user of a network service. Again, the current position of the cursor identifies the Write channel to which this entity will be sent. A prompt then asks for the hexadecimal value of the data/control character to be sent. The parity with which data is sent out can be defined by the GENPAR command.

The Top left and End positions on the current screen may be simply accessed via entry of their first letter. The neXt page and Previous pages may similarly be selected, if available. Goto allows the user to select an absolute number, the entry of which will select the page containing that absolute number and place the cursor on that channel (only available on SM MON hardware X840-608711).

4.2.11 HILITE

Identification of a particular character or control code of interest in a lengthy data stream may be performed via the HILITE command. Any of the VT100 monitor commands will use the attributes as set up by this command to highlight that entity.

Only available to a VT100 terminal type, this presents two screens of numeric values from 000 to 511/777/3FF. The number base is displayed in the top right corner of the screen and may be Octal, Decimal or Hexadecimal. Entering the first character of the name of a new number

base (i.e. O, D or H) causes the entire screen to convert to the desired base. Cursor addressing around this screen is possible, as is moving to the neXt or Previous screen, or Top left or End position on the current screen.

Any character or control code may be highlighted in any one or more of the four possible attributes available on a VT100 screen. The first character of the name of the possible attribute(s): Inverse, Bold, Flash and Underscore causes the currently selected value to be displayed using that/those attributes. Entering the Normal attribute will reset these to off.

If all four attributes are combined together then, upon display of this entity in the output stream, a newline sequence will also be output. This may, in certain circumstances, aid the formatting on screen of particular traffic types for easier dissemination.

Multiple values may be highlighted with the same attribute, via one keystroke, by use of the Range facilities. These are detailed in Section 4.8.

4.2.12 SELECT

The SELECT command allows you to configure the operating parameters and conditions for the channel(s) to be monitored. A series of questions is asked. Some of these appear only if they are relevant to the current configuration of the system or previously defined parameters for that channel.

If the terminal type is currently defined as VT100, then question 0 is asked:

0. Which Output Window to Configure? F/T/B CURRENTLY F

The three possible types of window are Full, Top half or Bottom half of the VT100 screen. The latter two options may be used individually but can also provide simultaneous split screen monitoring of two channels. In each case, the subsequent questions relate to that particular window. Each such set of configuration information is independently maintained.

1. Which Channel do you want to Monitor? CURRENTLYDD:CCCC

where **DD** is the device number and **CCCC** is the channel number within that device.

Two formats of entry are allowable, either Relative or Absolute.

To define the channel in Relative format the reply should be given in **XX:YYYY** form. For instance, if you wish to monitor the tenth channel on the second ARQ device, enter **2:10**.

Entering a numeric value of up to four digits and terminated in **<CR>** will define this as an Absolute channel number. Subsequent display of this channel will take the form **Abs 0123**.

2. Reads, Writes or Both? R/W/B CURRENTLY B

The answer to this question defines the direction in which the data is to be monitored – e.g. data input on the keyboard of a terminal attached to the channel being monitored is considered to be WRITE data. The simplest way to determine which direction is which is always to relate to the BUF/BAT card. WRITE data goes **to** a BUF/BAT card, READ data comes **from** a BUF/BAT card.

3. Data, Internal Control Codes or Both? D/C/B CURRENTLY B

There are two different forms of data passed within the network. Any data that enters or departs from the network via an LSC port is 'data' in this context. The second form is 'Internal Control Codes' which do not appear outside the external network interfaces. SM MON has the ability to report on just one or the other or both together.

4. Output Base: Hex, Octal, Bin or Dec? H/O/B/D CURRENTLY H

Any monitored data entity that is to be displayed as a value rather than a printing ASCII character is converted to the desired number base. This option is a matter of personal choice.

5. Output Format: Num, ASCII, Trans, EBCDIC, Baudot? CURRENTLY A

If Numeric is selected, then all data characters will be displayed in the number case defined by question 4. If ASCII is chosen, then all printable characters will be translated into ASCII and sent to the control console; all non-printable characters will be output in the base selected in Question 4.

The Transparent option is normally used by the TUTORIAL command (see Section 4.5). If convenient, selecting **R**, **D** and **T** in response to questions 2, 3 and 5 respectively will operate in exactly the same way as the TUTORIAL command.

Entering EBCDIC or Baudot will request SM MON to convert from those character sets into ASCII prior to display on the control console.

If the terminal type is VT100 and the output window selected by question 0 is other than FULL, then question 5 is the last one asked. Further questions are suppressed and you are re-prompted for a new command.

However, if the FULL screen window is selected for a VT100 terminal, or the terminal type is DUMB, then one or more further questions are asked.

6. Do you want to Enable Output by Trigger? CURRENTLY Y

In a number of instances, the purpose of monitoring the selected channel is to establish whether any data is flowing at all. In these cases, it is unnecessary, and possibly undesirable, to specify that Triggers are required. Thus, the answer to question 6 is No and you are returned to the command input prompt.

In specialised instances, the use of Triggers will allow you to focus on the problem. This avoids having to wade manually through vast quantities of irrelevant monitored data printout until the actual problem area is identified. Answering Yes to question 6 enables the use of this powerful facility.

For more details on how Trigger operates on the SM MON refer to Section 4.9.

When Yes is answered to question 6, the currently configured Trigger Sequence is reported:

Currently configured Trigger Length = 0
No Trigger Sequence is currently defined

Trigger Sequence:

	Hex	ASCII	Oct	Dec		Hex	ASCII	Mask_Value
1st=	000	NUL	000	000	?	_		

The cursor is positioned immediately under the right-hand Hex column.

This display has identified a number of items of status about the current Trigger Sequence. The first is the number of currently defined positions or length. This defaults to 0 and the **No Trigger Sequence is currently defined** text confirms this. The subsequent six column headings apply to each element in the Trigger Sequence. The left hand four headings give different output representations of the currently defined element, the number of which is given at the left most position.

The question mark separates the status of the current element from the prompt, which allows the status to be modified. A number of different types of entry are now valid at the cursor position.

Entering a three-digit hexadecimal value in the range 000 to 1FF terminated by **<CR>** will define a new value for this element. Users who are unfamiliar with this number base will be reassured by the immediate update in Decimal, Hexadecimal, ASCII and Octal upon a 'best guess' at their desired value. If this is incorrect, then entering **–** (hyphen) will backtrack to that entry again for its subsequent redefinition.

Entering ***** (asterisk) will identify this position as a WILDCARD location. This will allow it to be subsequently matched against any data character or internal control code in the monitored data stream. The four left most column entries will be replaced by the text ******* WILDCARD *******. Elsewhere, when identifying the contents of the Trigger Sequence, such an entry will be identified as ******* or ************* depending on the number base defined in question 4.

Entering a **<TAB>** character will move the cursor across to a position under the ASCII heading (sixth column). At this point any keyboard character that is a valid ASCII character may be typed to define the new contents of that element. This includes the **!** character if necessary.

Entering a **<CR>** without any other prior input characters will skip on to the next position in the Trigger Sequence without any modification to the current setting.

Entering a **<SPACE>** character will terminate further input of this type and report the new Trigger Sequence as just defined. Any undefined locations from the current position to the end of the possible sequence are forced to 000. Note that entering **<SPACE>** as the terminator to a valid hexadecimal value will define that as the last entry and move on to the next phase of the command.

Entering a > character will move the cursor across to the Mask_Value field. This 9-bit binary entry field accepts **0**, **1** or **X** for each bit. A **0** or **1** entry fixes that bit value whilst an **X** entry defines it as 'Don't Care'. The value reported in the first four columns will have any **X** bit positions assumed to be **0**. This gives an indication of the pattern mask actually defined. Defining a bit position as Don't Care caters for matching against upper/lower case characters, with or without parity. It also allows variable factors such as Alpha/Beta Timing code bits to be ignored, etc. For example, setting a Mask value of **0X1 X00 001** will cause the Monitor to

trigger on Octal characters 101, 301, 141 and 341, which are ASCII upper and lower case 'A' of any parity setting.

In all instances where the previous entry has been redefined, the new contents will be redisplayed prior to prompting for the next position in the sequence.

Entering the command abort character **!** within the hexadecimal input field will immediately move on to the next phase without further changes to the sequence.

At the end of this definition phase, the current length and contents of the Trigger Sequence will be reported as numeric values on one line in the number base defined in question 4.

7. Event Counter for Trigger Sequence ? CURRENTLY001

Entering a monitoring command that has Triggers configured will commence initially with the output stream disabled. If the Event Counter is set to 001 (the cold start default) then, on the first occurrence of the Trigger sequence, the output stream will be enabled.

If this value is defined to be a larger number (maximum 511), then the output stream will only be enabled when that number of recognitions of the Trigger Sequence have occurred. In this way the tenth or fiftieth occurrence, for example, of the Trigger sequence may enable the output stream.

If this value is defined as 0, the output stream will be enabled immediately, and will continue to output all characters/codes until the second trigger sequence defined under 8 below is monitored. This makes use of the extensive on-board buffering offered by SM MON for the output stream. This introduces slightly slower throughput but relieves the node BUF cards of some of their work load.

8. How many Triggers? 0=ALL Triggers CURRENTLY 000

Once the output stream is enabled, it will continue for ever if this value is 000. Otherwise, after the specified number of Trigger Sequences have occurred, and the Post Trigger count defined in question 10 has expired, further output will be disabled.

If question 10 value is set to 0, then the output stream will become continuous once the final Event counter Trigger Sequence has been recognised.

9. Max length of PRE Trigger Stream? CURRENTLY 001

When the Event Counter has expired and the Trigger Sequence has occurred, the Pre-Trigger Stream count applies. The count of monitored data entities defined in this question is used to count backwards from the last character in the just-recognised sequence defined under 6 above. This position is then the first character sent to the output stream. This allows the immediately preceding 100 characters (say) before the Trigger Sequence, to be displayed.

If multiple Triggers are to be recognised and the Post Trigger stream has temporarily halted the output stream, this Pre-Trigger count will subsequently be applied upon recognition of the next Trigger Sequence.

10. Length of POST Trigger Stream? 0 =Infinite Length CURRENTLY 000

This value defines the number of characters occurring immediately after each Trigger Sequence to be output before further monitoring is suspended or, in the case of the final Trigger, disabled completely. If this value is set to **000** then output will continue indefinitely, effectively nullifying any figure set in 8 above.

11. Trigger on Reads, Writes or Both? R/W/B CURRENTLY B

You can specify which direction the Trigger Sequence is to be applied to, even though monitoring in Both directions. Note that this must be an included subset of the response to question 2. Thus, if question 2 defined the monitored direction as Read, the response to this question cannot meaningfully be Write.

Note that triggering on Both requires, for example, a sequence of FFOOXX if looking at a self mapped LSC channel with a QBF message generator attached. However FOX is required if the triggering direction is either Read or Write. Thus **Both** means **Both** not **Either**.

12. Wakeup Time of Day? NOW or HH:MM:SS CURRENTLYNOW

SM MON allows the active search for the configured Trigger Sequence to be delayed by up to 24 hours from entry of the monitoring command. The time reported in the question is the current time as set on the Real Time Clock. This is only displayed for information. The current configuration of this parameter is displayed as either **NOW** or **HH:MM:SS**. If the time entered as the response to this question has already passed at the time of the monitoring command, then it will cause SM MON to commence searching for the Trigger Sequence at that time tomorrow.

4.2.13 TIMESTAMP

Availability of a battery-backed Real Time Clock enables SM MON to report the Time and Date upon strategic events. This may be as often as once per second, or at the arrival of new monitored data after a configurable time period has elapsed.

There are two parameters to the TIMESTMP command. The first prompts asks:

Timestamping period (seconds) for new arrivals ?

The value (in seconds) can be thought of as a timeout period. If monitored entities arrive within that period then no timestamp information is displayed. If however, this period expired between the arrival of two such entities, the current date and time is displayed. The current setting of this period is also displayed in brackets. This provides indications as to the relative time sequencing of the monitored data stream. Entering a value of 0 disables this function completely.

The second prompt asks:

Update interval (seconds) for status line date + time?

This value, again in seconds, defines how often the current date and time information will be updated on the status line. The minimum time is 1 second for a VT100 terminal and 10 seconds if a Dumb terminal is used. In the event of such updates being made on a Dumb terminal, each commences on a new line. The maximum interval is 12-hours-worth of seconds (=43000). Entering a value of 0 disables this function completely.

It may be useful to note that when capturing Monitored traces onto PC disk or similar, the date and time updates on the status line should be disabled. This prevents wasting a large amount of disk storage. Using the Timestamping period facility provides for the date and time to be output at the point when new data is observed. This is more efficient in certain modes of monitoring with regard to disk space usage.

4.2.14 GENPAR

Certain commands (TUTORIAL and BUFFER when operating in SUPER mode) will result in the monitor generating data on a monitored channel's write queue. The parity of this data is defined using the GENPAR command. The options which can be selected are Zero, Mark, Even and Odd.

4.3 Monitor Commands

There are several commands available to allow activity on the A-M-D Bus within a node to be monitored, They are:

FULL
TOP
BOTTOM
BOTH
MONITOR
EXPERT
EVENTS

The principal ones are FULL and MONITOR to provide, for either a VT100 or Dumb terminal respectively, the ability to monitor and display activity on a single channel. Both support the ability to recognise a configurable Trigger sequence (of up to 12 entries) and act upon it.

If desired, the TOP and BOTTOM commands may be used to look at a different channel each. This may be independently via their respective names, or simultaneously via the BOTH command. In all such instances, the VT100 screen is split into two independently scrollable windows.

In some circumstances it may be desirable to monitor a range of channels at the same time, for a range of possible character/control code activity. The EXPERT command requires, by definition, a thorough understanding of how DCX operates and the ability to interpret the obtained results. The nature of traffic flow in a busy node may, if this feature is incorrectly configured, flood the console with large quantities of output. The MATCH and CHANNEL template commands define which character/control codes are to be monitored on which channels. The EXPRD, EXPWR and EXPRDWR commands define the direction of data flow to be monitored, namely Read, Write or Read and Write respectively. Handled correctly, this facility provides the ability to focus on a 300 baud terminal handling intermittent control codes updates even though the node itself is fully populated with high speed devices passing data. Conversely, it may monitor all Open or Connected USO channels for a single control code and then report the number of the affected channel.

The EVENTS command employs the same selection criteria defined by the MATCH, CHANNEL, EXPPD, EXPWR and EXPRDWR commands, but this timer simply maintains a count of such occurrences.

4.4 Screen Formats

When two channels are being simultaneously monitored, the split screen mode of operation is employed. This divides the controlling terminal screen (must be VT100 compatible) into two Windows, the Top half and the Bottom half.

The very top line of the screen details the banner as previously configured by the BANNER command. The date and time is regularly updated at the right-hand end of this line if suitably configured via the TIMESTMP command. This timestamp information may be disabled completely if desired.

Top Half

The second line on the screen displays status information on the operating parameters for the Top half of the screen. The current channel number being monitored, [DD:CCC] and (Absolute), direction and the type of traffic Data/Controls is provided here. The text string defined by the TOPMESS command is also displayed here.

The next ten lines are the active window which scrolls up as new information is displayed for that channel. A new line is started whenever the direction of monitored traffic changes.

Bottom Half

A second status line gives the operating parameters for the channel configured to use the bottom window on the screen. This is in the same format as that for the top half. Its position however, is at line 13 in the middle of the screen. The text string defined by the BOTMESS command is also displayed here.

4.5 Tutorial Mode

It is frequently desirable when new staff are learning their operating skills to have access to the knowledge of an Instructor. The TUTORIAL mode offered by SM MON provides a simple facility for such training.

The Instructor configures the SM MON to monitor the activity of the channel being used by the Pupil. Since TUTORIAL mode is enabled, the full capabilities of the intelligent terminals being employed allow the same screen image to be presented to both parties. There is no restriction on the type of asynchronous terminal to be used as long as both Instructor and Pupil have the same. The potential for remote access over the network to the SM MON manager port removes any restriction for the Instructor to have line-of-sight access to the terminal used by the Pupil.

In this mode, there is no status or change of direction, etc, information presented by the SM MON. The Instructor may prefer, or find it necessary, to enter character information to assist or recover a situation. Access must previously have been made to SUPER level, whereupon any character data entry made by the Instructor is processed as if entered by the Pupil.

The parity with which characters are sent can be defined by the GENPAR command.

It is important to note that this facility must be used with care. Mutual awareness of such TUTORIAL mode operation is advisable to avoid confusion on behalf of the Pupil.

Note: Certain codes may not be input from the tutorial terminal with the desired effect, e.g. the Control-T USO connection and disconnection event character. This is actually processed by the LSC channel and converted into a DCX control code which is then passed to the USO for processing. The only way to make such a connection/disconnection event on the pupil's behalf is to exit the tutorial mode and send the hexadecimal value of the DCX control code (e.g. 1E2=Control-T) from the BU[FFER] command screen to the pupil's channel as detailed in Section 4.2.10. The Hexadecimal/Octal/Decimal values of all the DCX control codes may be found under the MA[TCH] template command.

4.6 Expert Monitoring

SM MON provides a very powerful capability to monitor a range of selected characters and/or control codes on a range of selected channels. This facility requires a very sound knowledge of the internal operation of the DCX equipment for it to be correctly configured and the results interpreted. It is not possible to detail all such information here, but a brief operation of the SM MON is given to assist the application of such knowledge. Training Courses are provided by the Cray Training School.

Two commands, MATCH and CHANNEL, are used to configured filters or templates for matching desirable items to monitor. Additional commands EXPRD, EXPWR and EXPRDWR define the desired direction in which monitoring is to occur. Subsequent invocation of the EXPERT command allows only items meeting these criteria to be monitored and displayed.

How does the SM MON hardware architecture operate?

In simple terms, as a character is passed between cards within the node, it transits across the A-M-D bus. It appears in the form of an A-word (defining where it is to go) and a D-word (what it is). Contained within the A-word is additional information such as which direction is it travelling in – i.e. Written **to** the BUF card, or Read **from** the BUF card. All data transfers within DCX nodes operate in the same way.

SM MON allows the A-word to act as an indexing value into a large table known as the A-filter. There is one entry (maximum 512 or 1024) for each channel pointer.

Each such entry may further reference one of 16 separate large tables called D-Filters. When the D-word of the A-M-D bus transfer occurs, it is presented to the now selected D-Filter as an indexing value.

The resulting D-Filter entry (one selected from 512 possible data characters and control codes) defines how that particular transfer should be processed.

Each D-Filter has 256 entries for data characters 00 to FF (hex) and 256 entries for control character 100 (hex) to 1FF (hex). Thus, FF is the DEL character (7F) with even parity set and 100 (hex) is the V.24 control code indicating that all signals are inactive.

The direction of this particular transfer is the final ingredient to determine whether it should be monitored as 'interesting', or completely discarded.

The contents of the A-Filters and D-Filters are defined via use of the CHANNEL and MATCH template commands. Within each such command, the range of entries is presented as a set of numbers. The number base used is displayed in the top right hand corner of the screen. It may be changed by simply entering the first character of the new base – i.e. Octal, Decimal or Hexadecimal.

To identify whether a particular entry should be included as an ingredient in the monitoring equations, enter the first character of either Monitor or Not-Monitor. That entry will then be highlighted in inverse video if it is to be included in the monitoring equation.

Movement requests that take the cursor off the beginning or end of the current screen will display the previous or next page if available. If the current cursor position is an endpoint of the available entries, then no such movements will be allowed.

The Top left and End positions on the current screen may be simply accessed via entry of their first letter. The neXt page and Previous pages may be similarly selected, if available.

The CHANNEL template will only contain the number of entries defined by the available channel pointers. This is a function of the BAT or number of BUF cards installed in the node. Thus, a node with a single BUF card will provide a maximum of 128 entries in the CHANNEL template. The MATCH template always comprises the full range of 512 character and control code entries on two screens.

The Range setting facilities as described in Section 4.8 may be used in both the CHANNEL and MATCH commands. Once the desired range of entries has been identified, entering the M or N command will include or exclude them as appropriate.

The default monitoring direction for the EXPERT command using these templates is Write. This default is reset each time the SM MON is restarted and the Login Password is re-entered at the sign-on screen.

To modify this default direction, the EXPRD and EXPRDWR commands are available. To complete the set, the EXPWR command is also provided to avoid the need to reset the SM MON if the Write direction is once more required. The appropriate command must be executed before the EXPERT command to which it applies.

Since this EXPERT mode may monitor entities on several channels, the output stream will also report the channel number whenever this changes. This number corresponds to the absolute channel number as obtained via the MTP or NCAM Absolute function.

Thus, in EXPERT mode, it is possible to monitor a large number of channels and thereby generate a large amount of display output. It requires caution and thought to make best use and interpretation of the resulting information.

4.7 EVENTS

Once the MATCH and CHANNEL templates have been defined, it is possible to count the number of character or control code events that are monitored. The current values of these individual counts may be displayed and updated by the EVENTS command.

The display format of this command requires a VT100 compatible terminal. The system banner and current date and time (if enabled via the TIMESTAMP command) are displayed on the top status line.

The current base in use for the entry number is indicated in the top right corner of the screen. It may be changed by simply entering the first character of the new base – i.e. Octal, Decimal or Hexadecimal.

A total of 128 entries are displayed for each screen along with their current count values in decimal. Note that only the three-digit entry number is modified according to the selected number base – the four-digit count value is **always** in decimal. This value is limited to 9999 maximum.

Count values may be reset, either individually or collectively for the whole set, to 0000 upon request. Positioning the cursor using the cursor keys and then entering the first character of the Zap command clears, after confirmation, that single count value. Entering at any cursor position, the Clear command will, after confirmation, reset all 512 count values back to 0000.

When this command is entered for the first time after a reset/power-on, the first screen displayed commences with the first 128 of the count values for the Internal Control Codes. Thereafter, this starting position is determined by where the cursor was when last exited back to the system prompt.

4.8 Cursor Setting of Ranges

To simplify the inclusion or exclusion of multiple entries it is possible to define a range over which a single command may then apply. To set a range, position the cursor identification character **<** alongside the starting entry. Enter the **.** (full stop) character to initiate the start point. Subsequent movement of the cursor will identify all entries currently to be included within the range using the **<** character.

Note that the direction of the first cursor movement after defining the start point is important. If cursor movements continue in this direction, then identification of the new entries will be simple updates. If, however, the direction of motion is reversed, a complete screen update will occur for each cursor movement. If the overall direction of travel away from the start point is completely reversed from that set initially, then such updates will once more become straightforward. It is not possible to reposition the cursor at the initially-defined start point. In general, if a change of direction is necessary once a range is defined, it may be easier to redefine the end-point prior to that directional change, by typing Match or No match as required.

It is possible to redefine a new start point at any time by re-use of the **.** (full stop) character at the current cursor position. Entering **<CR>** will clear any currently defined range without actioning any changes.

The commands to be applied across the selected range of entries will depend on the actual command in operation. The HILITE command allows the attributes to be defined via I, F, B, U or N. The CHANNEL and MATCH commands cater for M and N as appropriate.

4.9 Triggering

All aspects of triggering are configured using the SELECT command.

There are three phases of Trigger processing. They all revolve around the recognition of the configured Trigger Sequence.

The first phase of processing depends on the operation of the Event Counter.

The second phase is called Synchronised whilst the third is called Resynchronising. They are both dependant on three parameters: Pre-Trigger Count, Post-Trigger Count and the Count of Triggers.

4.9.1 Phase 1

Phase 1 does not enable the outputting of data. This is suspended until the criteria are met for entry to Phase 2.

Each time the Trigger Sequence is recognised in the monitored data stream, the Event Counter is decremented. On a VT100, the new value is updated on the Trigger status line.

If the Event Counter has reached 0, then a transition occurs into Phase 2. At this point the Pre-Trigger Stream count is applied to the queued data stream. This count commences at the current write position within the internal queue and identifies which character should be the first to be displayed. This Read position is then identified to the Output Task which is then enabled.

4.9.2 Phase 2 – Synchronised

Upon entry to the Synchronised, Phase 2 processing, the current date and time are reported and the output of data is now active. The Trigger status line (if VT100) is now changed to report the number of Triggers to go.

You may regard this phase as placing a window on top of the monitored data stream. The size of this depends on the Pre-Trigger Count and the Post-Trigger Count. It may be offset to either side of the Trigger Sequence that was recognised by altering the ratio of the Pre- to Post-Trigger Counts.

The number of Triggers (and hence these windows on the data stream) is configurable. Once this has expired the date and time is reported together with (if VT100) the flashing **COMPLETE** status on the third line of the screen.

If further triggers are outstanding and the Post-Trigger Count value of entities (data characters or control codes) has been output, a transition to the Resynchronising Phase 3 occurs.

4.9.3 Phase 3 – Resynchronising

In the Resynchronising, Phase 3 processing, the monitor is awaiting the arrival of a further Trigger Sequence. Once this is recognised the Pre-Trigger Count is used to determine at what point output should be re-enabled. A transition then occurs back to the Synchronised, Phase 2 processing.

4.9.4 Trigger Sequence Recognition

Each time a Trigger Sequence is recognised the last character in the sequence is identified with the message **TRIGGER SEQUENCE RECOGNISED at –>**. This is preceded by the current value of the Event Counter (counting down) or the Trigger Counter (counting up). At the point of the Event counter reaching 000 then no such count value message is reported.

4.10 Notes

1. Attempting to monitor using BOTH, the same channel on the TOP and BOTTOM screens is possible but with the following restrictions:

   a) The direction of data must be the same.

   b) The type of traffic (Data/Control/Both) must be the same.

   c) The number base and formats may be different.

   d) Updating both windows for each character/control code monitored requires a large number of escape sequences. These appear to slow the output and rapidly occupy large amounts of buffering en route to the console.

2. The TUTORIAL command overrides any previously defined channel setting for questions 1 on the TOP or DUMB terminal mode within the SELECT command.

3. The output format used for any necessary output conversion in EXPERT is that defined for the FULL window in the SELECT command. The number base used by EXPERT is always OCTAL.

4. The default power-on/reset direction for the EXPERT and EVENTS commands is WRITEs to the BUF card. These may be changed by use of the EXPRD, EXPWR or EXPRDWR commands before entering the EXPERT or EVENTS commands which they are required to affect.

5. When managing the monitor through NCAM, it is better to 'logoff' rather than use Control-C.

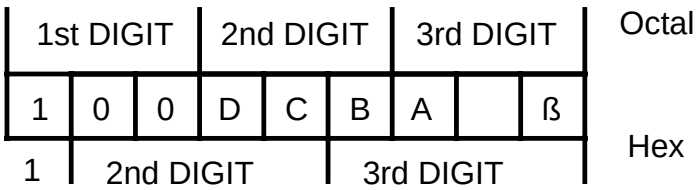
Appendix A DCX Control Codes

A.1 V24 Controls (C1)

Hexadecimal values are shown thus [ ]. Octal values are shown thus { }.

Codes {400-477} [100-13F]

Bit pattern:



Normal V24 control assignment:

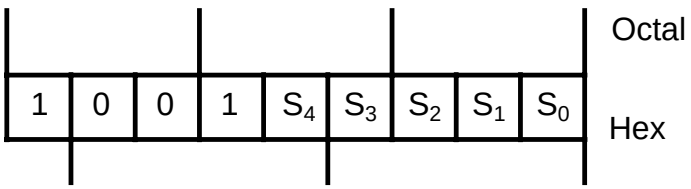
BIT SET	OUTPUT
D	CTS/DRS
C	RI/Busy Out
B	CD/RTS
A	DSR/DTR

ß : contains the multiplication factor to be applied to the subsequent C4 timing code (see A.4).

NOTE: The DCX synchronous transport devices (LSC5, 817 and 825-STP) are not transparent to CTS/DRS, so the corresponding set of C1 control codes {440-477} [120-13F] are used instead for communication between them:

Synchronous transport codes {440-450} [120-128], {470-474} [138-13C]

Bit pattern:



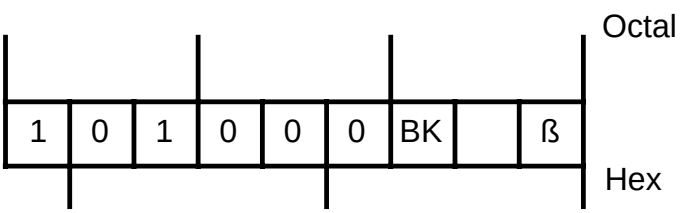
S_4	S_3	S_2	S_1	S_0	MEANING	OCTAL	HEX
0	0	0	0	0	Start of block	440	120
0	0	0	0	1	End of block	441	121
0	0	0	1	0	Start of transparent text	442	122
0	0	0	1	1	End of transparent text	443	123
0	0	1	0	0	End of Intermediate text block	444	124
0	0	1	0	1	Engage test box	445	125
0	0	1	1	0	Cancel test box	446	126
0	0	1	1	1	Inject error into test box message	447	127
0	1	0	0	0	Error in test box message	450	128
1	1	0	t_1	t_0	Test box status where: t_0=1 : remote test box engaged t_1=1 : test box initiated from remote end	470-473	138-13B
1	1	1	0	0	Synchronous channel validate confirm	474	13C

The special C1 code {477} [13F] behaves like an escape code when it is immediately followed by a C1 or C2 code instead of the expected C4 code. Both it and the following C1 or C2 code are ignored and no V.24 or line break changes are actioned by the LSC. It is used to report device/card software issue numbers in response to the relevant C6 Control Update Request.

A.2 **Break** (C2)

Codes {500-507} [140-147]

Bit pattern:



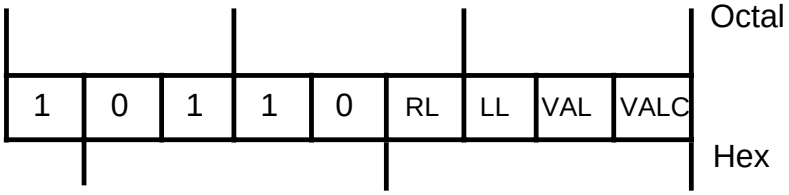
BK : if set then break on, if not then break off.

ß : contains the multiplication factor to be applied to the subsequent C4 timing code (see A.4).

A.3 Loopback/Validate (C3)

Codes {540-557} [160 -16F]

Bit pattern:

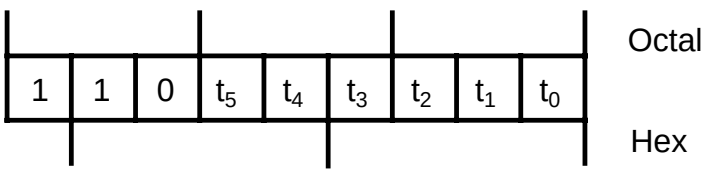


RL : Remote loopback
LL : Local loopback
VAL : Validate
VALC : Validate Confirmed

A.4 C1/C2 Time (C4)

Codes {600-677} [180-1BF]

Bit pattern:



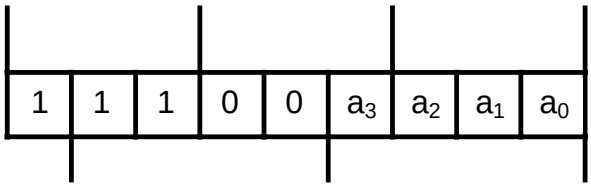
	ß	Time Interval	Minimum	Maximum	Steps
0	0	Max time	2048 ms	no max	-
0	1	$(t_5 - t_0) * 1$	0	504 ms	8 ms
1	0	$(t_5 - t_0) * 2$	512 ms	1008 ms	16 ms
1	1	$(t_5 - t_0) * 4$	1024 ms	2016 ms	32 ms

C1/C2 containing ß 00 is immediately followed by corresponding C4.
C4 not preceded by C1/C2 assumes ß = 01 and delay since last character output.

A.5 ABR Speed (C5)

Codes {700-717} [1C0-1CF]

Bit pattern:

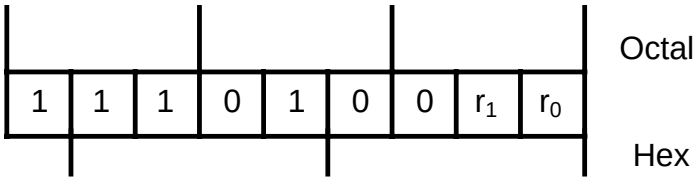


a_3 a_2 a_1 a_0	BPS	CPS	BITS	STOP	REMARKS
0 0 0 0	50	6 2/3	5	1	
0 0 0 1	75	10	5	1	
0 0 1 0	75	7	8	1	
0 0 1 1	100	10	8	1	
0 1 0 0	110	10	8	2	
0 1 0 1	134.5	15	7	1	
0 1 1 0	150	15	8	1	
0 1 1 1	200	20	8	1	
1 0 0 0	300	30	8	1	
1 0 0 1	600	60	8	1	
1 0 1 0	1200	120	8	1	
1 0 1 1	HEWLETT PACKARD ENQ				SPECIAL FEATURES
1 1 0 0	HEWLETT PACKARD ACK				
1 1 0 1	X-OFF T.F.C. FLOW CONTROL TRANSLATION				
1 1 1 0	X-ON T.F.C. FLOW CONTROL TRANSLATION				
1 1 1 1	CHANNEL IN ABR MODE				

A.6 Control Update Request (C6)

Codes {720-723} [1D0-1D3]

Bit pattern:

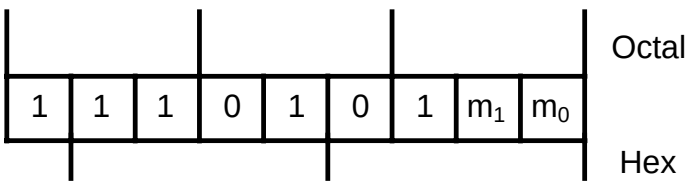


r_1	r_0	MEANING
0	0	Send channel issue number
0	1	Send C5/C11 speed code (ABR/non-ABR)
1	0	Send C1, C2, C3, C5/11 control codes
1	1	Send C1 and C2 control codes

A.7 Miscellaneous Utilities (C7)

Codes {724-727} [1D4-1D7]

Bit pattern:

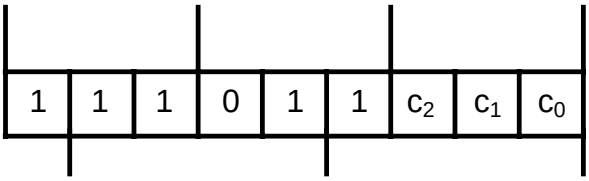


m_1	m_0	MEANING
0	0	Reset into ABR sampling mode
0	1	} remote terminal { X-ON DC1
1	0	} flow control { X-OFF DC2
1	1	} status { X-OFF DC3

A.8 Buffer Control (C8)

Codes {730-737} [1D9-1DF]

Bit pattern:

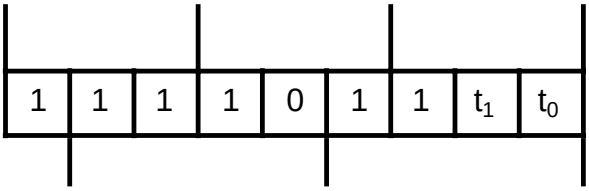


c_2	c_1	c_0	MEANING
0	0	0	X-OFF condition (generated by High Speed Device)
0	0	1	X-ON condition (generated by High Speed Device)
0	1	0	Port reset (clear buffer, clear terminal X-OFF)
0	1	1	Drop V24 controls temporarily (Internal LSC code)
1	0	0	Link down (generated by ARQ/SER)
1	0	1	Link up (generated by ARQ/SER)
1	1	0	Data lost (generated by BUF)
1	1	1	Data lost (generated by LSC)

A.9 Reverse Buffer Overflow Protection (C9)

Codes {754-757} [1EC-1EF]

Bit pattern:

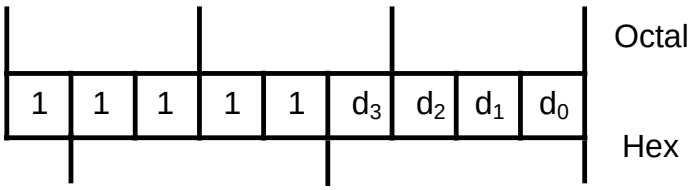


t_1	t_0	MEANING
0	0	Remote Assembly X-OFF
0	1	Remote Assembly X-ON
1	0	Terminal Flow Control update request
1	1	NCAM/ARQ4 protocol header

A.10 Non-ABR Speed (C11)

Codes {760-777} [1FO-1FF]

Bit pattern:

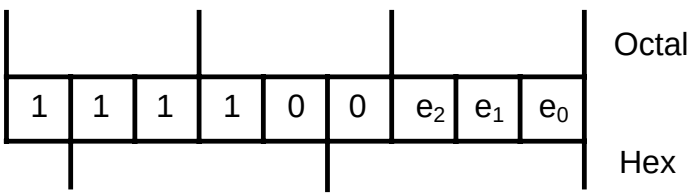


If the speed is a valid ABR speed, then a single C5 (ABR) control code is sent, as explained in Section A.5. If the speed is not a valid ABR speed, then two consecutive C11 (non-ABR) control codes are sent. Bits d_3-d_0 of the first contain bits 8-5 of the channel speed code, and bits d_3-d_0 of the second contain bits 4-1 of the channel speed code.

A.11 USO/System Module CNX Controls (C20)

Codes {740-747} [1E0-1E7]

Bit pattern:

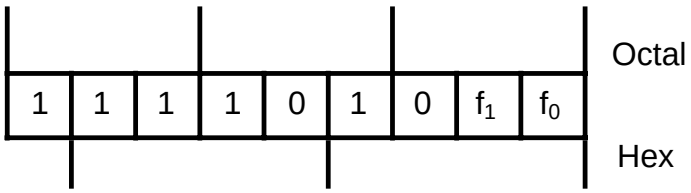


e_2	e_1	e_0	MEANING
0	0	0	Connection request (phase 2.1 only)
0	0	1	Connection acknowledgement (phase 2.1 only)
0	1	0	DC4 Connection/Disconnection (Control-T)
0	1	1	Inactivity timer (LSC disconnect/USO support)
1	0	0	Not used
1	0	1	Connection acknowledgement
1	1	0	Connection request
1	1	1	Connection O.K.

A.12 USO/System Module DCNX Controls (C21)

Codes {750-753} [1E8-1EB]

Bit pattern:



f_1	f_0	MEANING
0	0	User disconnection
0	1	Forced disconnection
1	0	Connection attempt failure
1	1	Port recovery

Appendix B Conversion Tables

B.1 ASCII/Binary/Octal Conversion

BINARY VALUE		b_7	0	0	0	0	1	1	1	1
		b_6	0	0	1	1	0	0	1	1
		b_5	0	1	0	1	0	1	0	1
b_4 b_3 b_2 b_1	**OCTAL VALUE**		**0**	**20**	**40**	**60**	**100**	**120**	**140**	**160**
0 0 0 0	**0**		NUL	DLE	SP	0	@	P	`	p
0 0 0 1	**1**		SOH	DC1	!	1	A	Q	a	q
0 0 1 0	**2**		STX	DC2	"	2	B	R	b	r
0 0 1 1	**3**		ETX	DC3	# (£)	3	C	S	c	s
0 1 0 0	**4**		EOT	DC4	$	4	D	T	d	t
0 1 0 1	**5**		ENQ	NAK	%	5	E	U	e	u
0 1 1 0	**6**		ACK	SYN	&	6	F	V	f	v
0 1 1 1	**7**		BEL	ETB	'	7	G	W	g	w
1 0 0 0	**10**		BS	CAN	(	8	H	X	h	x
1 0 0 1	**11**		HT	EOM	)	9	I	Y	i	y
1 0 1 0	**12**		LF	SUB	*	:	J	Z	j	z
1 0 1 1	**13**		VT	ESC	+	;	K	[	k	{
1 1 0 0	**14**		FF	FS	,	<	L	\	l	¦
1 1 0 1	**15**		CR	GS	–	=	M	]	m	}
1 1 1 0	**16**		SO	RS	.	>	N	^	n	
1 1 1 1	**17**		SI	US	/	?	O	_	o	DEL

Note: Obtain the octal value by adding the OCTAL VALUE row and column.

B.2 ASCII/Binary/Hex Conversion

BINARY VALUE	b_7	0	0	0	0	1	1	1	1
	b_6	0	0	1	1	0	0	1	1
	b_5	0	1	0	1	0	1	0	1
b_4 b_3 b_2 b_1	**HEX VALUE**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0 0 0 0	**0**	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	**1**	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	**2**	STX	DC2	"	2	B	R	b	r
0 0 1 1	**3**	ETX	DC3	# (£)	3	C	S	c	s
0 1 0 0	**4**	EOT	DC4	$	4	D	T	d	t
0 1 0 1	**5**	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	**6**	ACK	SYN	&	6	F	V	f	v
0 1 1 1	**7**	BEL	ETB	'	7	G	W	g	w
1 0 0 0	**8**	BS	CAN	(	8	H	X	h	x
1 0 0 1	**9**	HT	EOM	)	9	I	Y	i	y
1 0 1 0	**A**	LF	SUB	*	:	J	Z	j	z
1 0 1 1	**B**	VT	ESC	+	;	K	[	k	{
1 1 0 0	**C**	FF	FS	,	<	L	\	l	¦
1 1 0 1	**D**	CR	GS	–	=	M	]	m	}
1 1 1 0	**E**	SO	RS	.	>	N	^	n	
1 1 1 1	**F**	SI	US	/	?	O	_	o	DEL

B.3 ASCII/Binary/Decimal Conversion

BINARY VALUE	b_7	0	0	0	0	1	1	1	1
	b_6	0	0	1	1	0	0	1	1
	b_5	0	1	0	1	0	1	0	1
b_4 b_3 b_2 b_1	**DEC VALUE**	**0**	**16**	**32**	**48**	**64**	**80**	**96**	**112**
0 0 0 0	**0**	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	**1**	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	**2**	STX	DC2	"	2	B	R	b	r
0 0 1 1	**3**	ETX	DC3	# (£)	3	C	S	c	s
0 1 0 0	**4**	EOT	DC4	$	4	D	T	d	t
0 1 0 1	**5**	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	**6**	ACK	SYN	&	6	F	V	f	v
0 1 1 1	**7**	BEL	ETB	'	7	G	W	g	w
1 0 0 0	**8**	BS	CAN	(	8	H	X	h	x
1 0 0 1	**9**	HT	EOM	)	9	I	Y	i	y
1 0 1 0	**10**	LF	SUB	*	:	J	Z	j	z
1 0 1 1	**11**	VT	ESC	+	;	K	[	k	{
1 1 0 0	**12**	FF	FS	,	<	L	\	l	¦
1 1 0 1	**13**	CR	GS	–	=	M	]	m	}
1 1 1 0	**14**	SO	RS	.	>	N	^	n	
1 1 1 1	**15**	SI	US	/	?	O	_	o	DEL

Note: Obtain the decimal value by adding the DEC VALUE row and column.

B.4 Translation from ITA2 to ASCII

ITA2 COMBINATION NUMBER	ASCII EQUIVALENT WHEN ITA2 SHIFT IS LETTERS		ASCII EQUIVALENT WHEN ITA2 SHIFT IS FIGURES	
	OCTAL	ASCII CHAR	OCTAL	ASCII CHAR
1	101	A	055	–
2	102	B	077	?
3	103	C	072	:
4	104	D	005	ENQ
5	105	E	063	3
6	106	F	045	% (note 1)
7	107	G	100	@ (note 1)
8	110	H	043	£ (note 1)
9	111	I	070	8
10	112	J	007	BELL
11	113	K	050	(
12	114	L	051	)
13	115	M	056	. (full stop)
14	116	N	054	, (comma)
15	117	O	071	9
16	120	P	060	0
17	121	Q	061	1
18	122	R	064	4
19	123	S	047	' (apostrophe)
20	124	T	065	5
21	125	U	067	7
22	126	V	075	=
23	127	W	062	2
24	130	X	057	/
25	131	Y	066	6
26	132	Z	053	+
27	015	CR	015	CR
28	012	LF	012	LF
29 (note 2)		none		none
30 (note 2)		none		none
31	040	SPACE	040	SPACE
32		none		none

Note 1: Character combinations numbers 6, 7 and 8 are left undefined by CCITT so that their meaning and use can be defined differently by different administrations. The translations given above are compatible with current UK practice.

Note 2: Letter and figure shift are shown on the SM MON as < and >.