Chapter 4

NETWORKS

4.1 Introduction

A network connection normally consists of the following:

The PTS system is connected, via a modem, to a DC network and, via the network, to another computer (the remote DTE) also connected to the network. As far as the CREDIT programmer is concerned, it is not important which network is used and which type of computer is connected at the other end; it may be another PTS system, or a large mainframe.

In addition, the Monitor software (driver) is designed to look after the protocol that is being used by the network. This means that the CREDIT application has to set up the connection with the remote DTE with which it wants to communicate, and to prepare messages that it wishes to transmit, for example. The driver will ensure that the correct control characters for transport by the network are added, and that the message is acknowledged by the other system, and so forth.

In network connections, each DTE is known to the network by its network address, and the application by a symbolic DTE address. The relation between network address and symbolic address is defined in the configuration data (see chapter 5). If subaddresses are used to specify a task or terminal device, these must be handled by the application.

In a network connection, the Connect Active request can be used to establish a logical connection and the DTEs with which the connection must be made, can be specified in the request.

In error situations, network information may be obtained and may have to be acted upon by the application.

The general sequence of events that must be controlled by the application are as follows:

Opening the physical connection (by one of the tasks)
Establishing the logical connection
Transmitting messages and/or
Receiving messages
Closing the logical connection
Closing the physical connection (by one of the tasks, if no longer required).

Any task may open the physical connection, and then each task that is to use it must issue a connection request to establish the logical connection before it can send or receive messages. Each task that has established a logical connection must issue a disconnection request before the physical connection can be closed.

There are two instructions for establishing the logical connection: Connect Active and Connect Passive. Connect Active is used to notify the network that the task wants to establish a logical connection with the specified DTE. Connect Passive is used to notify the network that the task is ready to make a logical connection with a DTE that issues a Connect Active request.

In addition, the DSC instruction can be used for handling status and statistical information, as described in section 4.8.

In the following sections, the CREDIT statements for carrying out the communication over the line are described, with the exception of that for setting timeout.

The application may set a timeout value for the Open, Close, Connect, Send and Receive operations requested, by means of the DSC instruction with Control code X`0B´, as described in Section 2.8.4.

4.2 Opening the Communication Link

The OPEN .DC instruction is used to perform the physical connection of the computer to the communication line, since after IPL the DTE is considered to be inactive until this request is successfully completed.

The OPEN instruction may be issued by any of the application tasks, and it is the responsibility of the application to ensure that the OPEN has been successfully completed before any of the tasks issue a CONNECT instruction. CONNECT instructions issued by application tasks to set up a logical connection, will not be successful before an OPEN instruction has been successfully completed.

The instruction may be issued with Wait or No Wait, as required by the application.

One parameter is required for this instruction, to specify the local DTE-address as defined during the system design.

Optionally a table with network addresses may be supplied, which will then replace the network addresses supplied in the configuration data. This is described in the chapter for the appropriate driver in module M15A, Data Communication Driver Reference Manual.

The Condition Register will be set to one of the following values as a result of the Open instruction:

CR Value	Meaning
0	OPEN successful
2	Error condition

If the request is successful, the DTE is considered to be in Disconnected mode (i.e. Active and physically connected, but not logically ready for transmission). Before any messages can be sent or received, the logical connection must be made between the DTE and the DWT with a Connect instruction as described in the following section.

If an error occurs, the status word can be fetched by means of the XSTAT instruction. The meanings of the bits in the status word are given in the chapter for the appropriate driver in module M15A, Data Communication Driver Reference Manual.

Example of the OPEN instruction

```
OPEN   .DC,DSLIN,DTEAD,BUF,LENG
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

DTEAD This is a binary data item, containing the local DTE-address. The address must be supplied as the hexadecimal representation of two ASCII characters.

BUF Address of the string containing new network addresses. (Optional).

LENG Binary data item containing the length of string containing the new network addresses in bytes. (Optional).

4.3 Logically Connecting the Line

4.3.1 Connect Passive

The Connect Passive instruction is used to make the logical connection between the task that issues the request, and the local DTE. In addition it informs the driver that the task is ready to set up a logical connection, and that a Connect Active request from a remote DTE can be accepted.

The instruction may be used with Wait or No Wait, as required by the application.

One parameter is required, the local symbolic DTE address. As an option, it can be specified that a connection can be made with any system connected to the network, or the symbolic DTE address can be supplied of one DTE that is allowed to make a connection.

The Condition Register will be set as a result of this instruction to one of the following values:

CR Value	Meaning
0	CONNECT successful
2	Error condition

In the case of an error, the status word can be fetched from the driver with the XSTAT instruction. The meanings of the bits in this word are given in the chapter for the driver concerned in module M15A, Data Communication Driver Reference Manual.

| CONNECT .PAS |

Example of the CONNECT .PAS instruction

```
CONNECT .PAS,DSLIN,DTEAD,DTERAD,CPOPT
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

DTEAD This is a binary data item, containing the local symbolic DTE-address as the hexadecimal representation of two ASCII characters.

DTERAD This is a binary data item, containing the remote symbolic DTE-address as the hexadecimal representation of two ASCII characters. If no remote symbolic DTE address must be supplied but there are options to be specified, DTERAD must be included for syntax reasons as a dummy item, containing hexadecimal zeroes (X`0000´).

CPOPT This is a binary data item, containing the value X`00´ or the value for driver dependent options.

4.3.2 Connect Active

The Connect Active instruction is used to make the logical connection between the task that issues the request, and the local DTE. In addition it informs the driver that the task wants to set up a logical connection with a remote DTE, which must have issued a Connect Passive request.

The instruction may be used with Wait or No Wait, as required by the application.

Two parameters are required, the local and the remote symbolic DTE address. Driver dependent options can be included in the instruction parameters.

The Condition Register will be set as a result of this instruction to one of the following values:

CR Value	Meaning
0	CONNECT successful
2	Error condition

In the case of an error, the status word can be fetched from the driver with the XSTAT instruction. The meanings of the bits in this word are given in the chapter for the driver concerned in module M15A, Data Communication Driver Reference Manual.

Example of the CONNECT .ACT instruction

```
CONNECT .ACT,DSLIN,DTEAD,DTEREM,CAOPT
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

DTEAD This is a binary data item, containing the local symbolic DTE-address as the hexadecimal representation of two ASCII characters.

DTEREM This is a binary data item, containing a remote symbolic DTE address as the hexadecimal representation of two ASCII characters. If no remote symbolic DTE address must be supplied but there are options to be specified, DTERAD must be included for syntax reasons as a dummy item, containing hexadecimal zeroes (X`0000´).

CAOPT This is a binary data item, containing the value X`00´ or the value for driver dependent options.

| CONNECT .ACT |

4.4 Sending a Message

To send a message via the network, after performing the correct sequence of OPEN and CONNECT .PAS or .ACT instructions, the SEND instruction is used.

The SEND instruction requires two parameters specifying the data item containing the message and the length of the message. Driver dependent options may be set in addition to these parameters.

The Send Addressed instruction is used if the network protocol, the network driver or the application require that the local and/or remote symbolic DTE address is specified in the instruction. In that case the keyword .ADDR indicates that these items are included in the parameter list.

The instruction may be issued with or without Wait, as required by the application.

The Condition Register will be set as a result of this instruction to one of the following values:

CR Value	Meaning
0	SEND successful
2	Error condition

In the case of the Condition Register being set to zero, it is stilladvisable to fetch the status word via the XSTAT instruction, since, if bit 7 is set, this indicates that the SEND has been successfully completed, but that a message has been received for this task, and therefore a RECEIVE should be issued as soon as possible to collect the message. This does not apply for all network drivers, see module M15A, Data Communication Driver Reference Manual.

In the case of an error, the status word can be fetched from the driver with the XSTAT instruction. The meanings of the bits in this word are given in the chapter for the driver concerned in module M15A, Data Communication Driver Reference Manual.

Example of the SEND instruction

```
          SEND  .NW,DSLIN,MESBUF,MESLEN,OPTN
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

SEND

MESBUF This is a string data item, containing the message to be sent on the line. The driver will add the necessary framing characters before transmission.

MESLEN This is a binary data item, containing the length of the message to be sent in bytes. Thus the string data item may be longer than the actual message, as the number of characters sent is determined by the value in this data item.

OPTNS This is a binary data item containing the value for driver dependent options.

SEND

4.5 Receiving a Message

To receive a message on the line, after performing the correct sequence of OPEN and CONNECT .PAS instructions, the RECEIVE instruction is used.

The RECEIVE instruction requires two parameters, specifying the data item to contain the message and the length of the message.

The instruction may be issued with or without Wait, as required by the application.

The Receive Addressed instruction is used if the network protocol, the network driver or the application require that the local and/or remote symbolic DTE address is specified in the instruction. In that case the keyword .ADDR indicates that these items are included in the parameter list.

The Condition Register will be set as a result of this instruction to one of the following values:

CR Value	Meaning
0	RECEIVE successful
2	Error condition

In the case of an error, the status word can be fetched from the driver with the XSTAT instruction. The meanings of the bits in this word are given in the chapter for the driver concerned in module M15A, Data Communication Driver Reference Manual.

In the case of bit 7 being set in the status word, this indicates that at least one further message is waiting for this task, and another RECEIVE must be issued as soon as possible, in order to release the buffer. This does not apply for all drivers, see module M15A, Data Communication Driver Reference Manual. Note that, if only bit 7 is set, the Condition Register will still be zero, therefore it is recommended to fetch the status word in any case.

Example of the RECEIVE instruction

```
RECEIVE .NW,DSLIN,MESBUF,MESLEN
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

MESBUF This is a string data item, into which the message will be read from the line. The driver will remove any framing characters before placing the message in this data item.

MESLEN This is a binary data item, containing the maximum expected length of the message to be read, in bytes. Thus the string data item may be longer than the actual message, as the number of characters read is determined by the value in this data item. If the length is shorter than the actual message, an error will be reported via the Condition Register.

4.6 Logically Disconnecting the Line

The DISCNCT instruction is used to terminate the logical connection of the local and remote DTE.

After opening the communication line and performing the logical connection, a task may send and receive messages. Any task that has performed a logical connection must issue a disconnect request when transmission has been completed (i.e. the task no longer wishes to use the line). Disconnection must normally take place before the CLOSE instruction can be issued to physically disconnect the line, as described in section 4.7.

The Disconnect request is often used after a Receive has been completed with Timeout, to avoid receiving spontaneous messages. The sequence of instructions is in that case:
CONNECT - SEND - RECEIVE (Timeout) - DISCONNECT - CONNECT - etc.
The instruction may be used with Wait or No Wait, as required by the application.

Parameters required for this instruction are driver dependent, see module M15A, Data Communication Driver Reference Manual.

The Condition Register will be set as a result of this instruction to one of the following values:

CR Value	Meaning
0	DISCNCT successful
2	Error condition

If successful, the DTE is considered to be in the Disconnected mode, i.e. the only valid instructions that can be issued by this task are a Connect Active or Passive, Close, or Read Status.

In the case of an error, the status word can be fetched from the driver with the XSTAT instruction. The meanings of the bits in this word are given in the chapter for the driver concerned in module M15A, Data Communication Driver Reference Manual.

Example of the DISCNCT instruction

```
         DISCNCT  DSLIN
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

4.7 Closing the Communication Link

The CLOSE .DC instruction is used to perform the closing of the communication link, when no further transmission is to take place, as follows:

When all transmission has taken place successfully, and the application no longer requires to send or receive messages, the line must be logically disconnected, as described previously, and then physically closed by means of the CLOSE instruction.

The instruction may be used with Wait or No Wait, as required by the application.

The local symbolic DTE address is a parameter required for some drivers and optional for others.

For some DC drivers an optional parameter may be supplied, to indicate whether this request is to be Conditional or Unconditional, as follows:

- A Conditional Close request is only executed if no tasks are logically connected (i.e. all tasks that have issued a Connect Active or Passive have successfully issued a Disconnect request).
- An Unconditional Close request is always executed; thus if there are logical connections still active, the requests are completed with the value in the Status Word indicating "Physical Connection Error".

The Condition Register will be set as a result of this instruction to one of the following values:

CR Value	Meaning
0	CLOSE successful
2	Error condition

If successful, the DTE is considered to be Inactive, until an OPEN instruction is used to re-establish the physical connection.

In the case of an error, the status word can be fetched from the driver with the XSTAT instruction. The meanings of the bits in this word are given in the chapter for the driver concerned in module M15A, Data Communication Driver Reference Manual.

Example of the CLOSE instruction

```
CLOSE .DC,DSLIN,DTEAD,CLOPT
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

DTEAD This is a binary data item containing the local symbolic DTE address as the hexadecimal representation of two ASCII characters.

CLOPT This is a binary data item, containing a driver dependent value indicating Conditional or Unconditional Close.

4.8 Data Set Control Instructions

As well as sending and receiving messages, two further instructions may be used to handle status and statistic information concerning the line, as follows:

- Read status (DSC Control code `07´) enables the application to fetch the current state and type of connection.
- Read/reset statistics (DSC Control code `17´) enables the application to fetch statistical information from the software if the function was included in the driver during Monitor generation.

These instructions rae described in the following pages.

4.8.1 Read status

The DSC instruction to Read Status is used to fetch information as to the status of the connection. The instruction may be issued at any time, and may be issued with Wait or No Wait, as required by the application.
Depending on the driver used, additional network information may be obtained in the buffer specified in the instruction.

The Control Code for Read Status is X`07´, and the binary data item will have bits set to indicate the connection and type, as specified for the driver used and described in module M15A, DC Drivers Reference Manual.

Example of the DSC instruction for Read Status

```
RSTAT   EQU   X`07´
        DSC   DSLIN,RSTAT,LINEC
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

LINEC This is a binary data item, which, on completion, will have bits set to indicate the status of the connection.

4.8.2 Read/Reset Statistics

The DSC instruction to Read/Reset Statistics enables the application to fetch information from the statistics counters in the software. If required, it must be specified during Monitor generation. Optionally, the application may also request that the statistic counters are to be cleared (set to zero) with this instruction, but this option is not available in all DC drivers.

The instruction may be issued with Wait or No Wait, as required by the application.

The Control Code for Read/Reset Statistics is X`17´, and three data items are required to determine whether the counters are to be cleared, the string into which the information is to be read and the length of the string. The layout of the counters, as they appear in this data item, is shown in the appropriate chapter for the driver used, in module M15A, DC Drivers Reference Manual.

If the counters are to be cleared, the first binary data item must contain the value X`4300´, else zeroes.

The string data item must be long enough to contain all the counters that are required by the application, up to a maximum of 62 bytes.

The second binary data item must contain the length in bytes of the information to be read, i.e. if only the first two counters are required, this should contain a value of 4, being two bytes for each counter.

Note, however, that a request to reset the counters, when the specified length is less than the total statistic area, will only reset the counters that are read.

The Condition Register will be set as a result of this instruction to one of the following values:

CR Value	Meaning
0	Successful
2	Error condition

The only error condition that can arise is that the option to include the statistic counters was not specified during Monitor generation.

Example of the DSC instruction for Read & Reset Statistics

```
STATS    EQU   X`17´
         DSC   DSLIN,STATS,STOPT,CBUF,CLEN
```

DSLIN This is the data set identifier for the DC line. The TOSS file code must have been defined at Monitor generation, and must have been defined in the application for use in this terminal class.

STOPT This is a binary data item, containing the value X`4300´ to indicate that the statistic counters are to be cleared.

CBUF This is a string data item, into which the statistic counter information will be read.

CLEN This is a binary data item, containing the length of the data from the statistic counters that is required.