



DT-6xxx
BX.25 TO TCP/IP
IP-SLM APPLICATION
USER'S MANUAL



RELEASE 10.X

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1 FORWARD

The IP-SLM is a software emulation of the BNS BX.25 interface that is also known as the Synchronous Line Module (SLM). The IP-SLM application allows low cost and high density access points to terminate BX.25 interfaces common to Network Elements. The result is significant cost savings, and administrative simplification. The IP-SLM is also a migration vehicle which enables the reduction or elimination of proprietary network components for the Network Element support functionality.

2 GLOSSARY

BX.25	Bell System X.25 Protocol Specification.
CODEC	Coder / Decoder.
EADAS	Engineering and Administrative Data Acquisition System.
LSSGR	LATA Switching Systems Generic Requirements.
NDC	Network Data Collection
NDC/OS	Network Data Collection Operations System.
NE	Network Element
NM	Network Management
NTM	Network Traffic Management
NTM/OS	Network Traffic Management Operations System.
SCCS	No. 2 Switching Control Center System
SFMS	Switched Fault Maintenance System
SPCS/OS	Stored Program Control System / Operations System.
TOPAS	Testing, Operations, Provisioning, and Administrative System.
TNM	Total Network Management.
TSM	TNM Surveillance Module.



3 SUGGESTED REFERENCE

The following documents are resident at <http://www.datatekcorp.com> under the documentation button.

<u>Document</u>	<u>Scope</u>
DT-6061 Platform User's Manual.	Describes the DT-6061 Embedded Network Processor infrastructure and command set. This includes configuration information, hardware specifications, and SNMP MIB support. The DT-6061 is the infrastructure on which the IP-SLM application operates.
Universal Mediation Interface User's Manual.	Describes the Universal Mediation Interface Operations and Administration. The IP-SLM uses the UMI as the interface with the OS applications residing on the Datakit/BNS network.
DT-4000 User's Manual.	Describes the DT-4000 multi-protocol terminal server. The DT-4000 is used in some scenarios as the interface for the BX.25 links to the Network Elements.
DT-6061 Redundant Operation White Paper.	Describes the method of operating the DT-6061 in a 1+1 sparing configuration.
TelCordia Technologies TR-740 "Stored Program Control System/Operations System (SPCS/OS) – Network Data Collection Operations System (NDC OS) Interface", FSD 45-09-	Describes the functional interface between the BX.25 Network Element and the SLM at OSI Layers 4-7.



0100	
TelCordia Technologies TR-746 “Stored Program Control System Operations System (SPCS/OS) – Network Traffic Management Operations System (NTM OS) Interface via a Network Data Collection Operations System (NDC OS)	Describes the functional interface between the BX.25 Network Element and the SLM at OSI Layers 4-7.



4 IP-SLM INTERFACES

There are three distinct interface types on the IP-SLM DT-6061 application. These are the configuration circuits, the virtual BX.25 line circuits, and the Operations System circuits.

These are defined as follows:

Set	#Channels	TCP Port#	Usage
OA&M	1	10000 + instance#	Configuration and administration of the IP-SLM application for a particular BX.25 connection via Telnet.
BX.25	1	30000 + (instance# - 1) * 200 or Configured	One virtual BX.25 line is configured to receive on a TCP Port. This TCP port will then listen for the TCP call from the DT-4000, UMI, etc.
OS	1	BX.25 TCP Port# + 1	One TCP port is used for the OS connectivity to the IP-SLM application. All of the BX.25 LCNs interface on this single circuit. This TCP ports will listen for a call from the UMI when the OS makes a call to it.



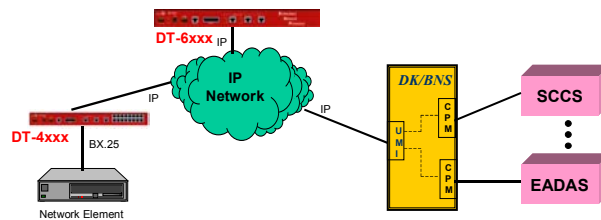
An example of how these circuits are used follows:

The IP-SLM application would have its BX.25 line configuration entered. This includes the base TCP port number that establishes the range of TCP ports relating to that BX.25 line.

Once restored to service, the BX.25 line TCP port listens for an inbound call from a DT-4xxx, DT-9480, DT-2xxx, UMI, etc port. This establishes the connectivity with the remote BX.25 network element endpoint.

The NDC/OS TCP port (BX.25 TCP Port Number plus One) will listen for inbound calls as well. The NDC/OS host, may make a call to this TCP port to establish SLM connectivity to the BX.25 connection. The protocol used on this interface is the SLM internal protocol.

A pictorial of the application architecture is as follows:



In the example above, the BX.25 network element has a synchronous HDLC connection with a DT-4xxx port. The DT-4xxx port is configured as *standalone originate* to the TCP port on the DT-6xxx terminating the X.25 line. The SLM function is in the aggregate of all the LCNs present on the BX.25 link. Individual LCNs are processed individually, but the interface with the NDC/OS is the internal SLM protocol on a single connection.

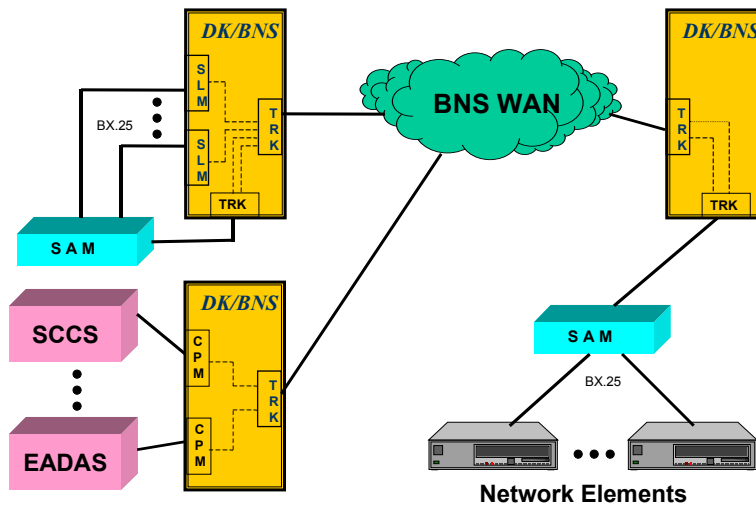
Each instance of the IP-SLM application supports multiple BX.25 virtual circuits on a single BX.25 line. Multiple lines are supported on the DT-6xxx by configuring multiple instances of the IP-SLM application.



5 SITUATION SYNOPSIS

The BX.25 telemetry connections from Network Elements to Network Data Collection Operations Systems (NDC OS) is predominantly done with a Datakit/BNS Synchronous Line Module (SLM). The following diagram depicts the typical deployment.

**NE BX.25 Data Link via SLM
Typical Deployment**



The diagram above represents a typical deployment for some RBOCs. Others will directly connect the Network Elements on the SLMs via 202T modem sets or equivalent. In the diagram, the SAM at the Network Element site acquires the BX.25 and transports it transparently to the SAM co-resident with the SLM modules. The co-resident SAM is used merely to provide centralized connectivity with the SLMs. Such an arrangement has also been done with Transparent Synchronous Modules (TSM).

The SLM is a two card module which supports four RS-232 BX.25 ports at 2400 baud, or one RS-232 BX.25 port at 9600 baud. In a typical deployed situation, many SLMs have more than one of its RS-232 ports in use. This allows a port density from 15 ports per BNS shelf to 60 ports per BNS shelf.



A significant issue arises with changes required in TR-746 and implemented in #5ESS release 5E14. These changes would increase the amount of data required from the Network Element within an allotted time frame. The Network Element manufacturers have suggested increasing the baud rate to 9600 baud in the interim; and 19,200 baud when possible.

The net result is the decrease of the SLM port density to 15 per shelf, and a requirement to re-deploy the BX.25 interfaces where more than one interface resides on a single SLM.

The IP-SLM application was designed to obviate the need to purchase additional SLM modules, and the BNS shelves in which they reside. The IP-SLM application uses inexpensive DT-4000 RS-232 ports for BX.25 access up to a rate of 115.2Kb each.

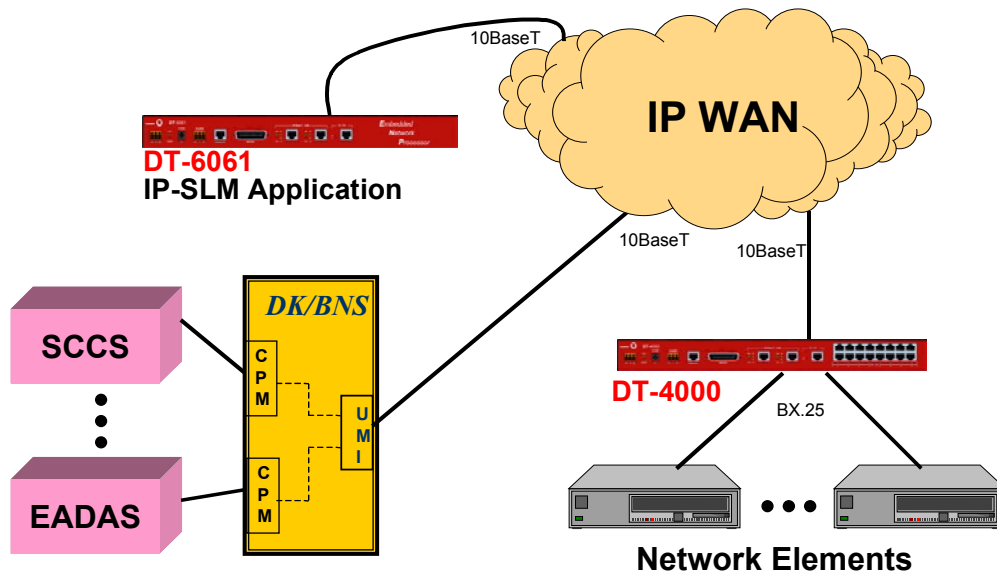


6 ESTABLISHING CONNECTIVITY

The IP-SLM is an application that operates on the DT-6061 embedded network processor. The DT-6xxx embedded network processor has no endpoint interfaces for the BX.25 network elements. These endpoints may be provided in many ways. Similarly, the Operations System interface resides on the BNS network in the form of a fiber host interface. It requires a BNS UMI module to communicate with the IP-SLM application. There is one connection to the OS, and one connection to the BX.25 port for each network element link.

The following is *arguably* the simplest method of establishing connectivity. It also represents the least expensive method of connectivity. It should be the preferred method when the Network Element BX.25 links are currently brought directly back to the SLM modules via modem sets.

NE BX.25 Data Link via DT-6061 & IP-SLM BNS to IP Migration Deployment



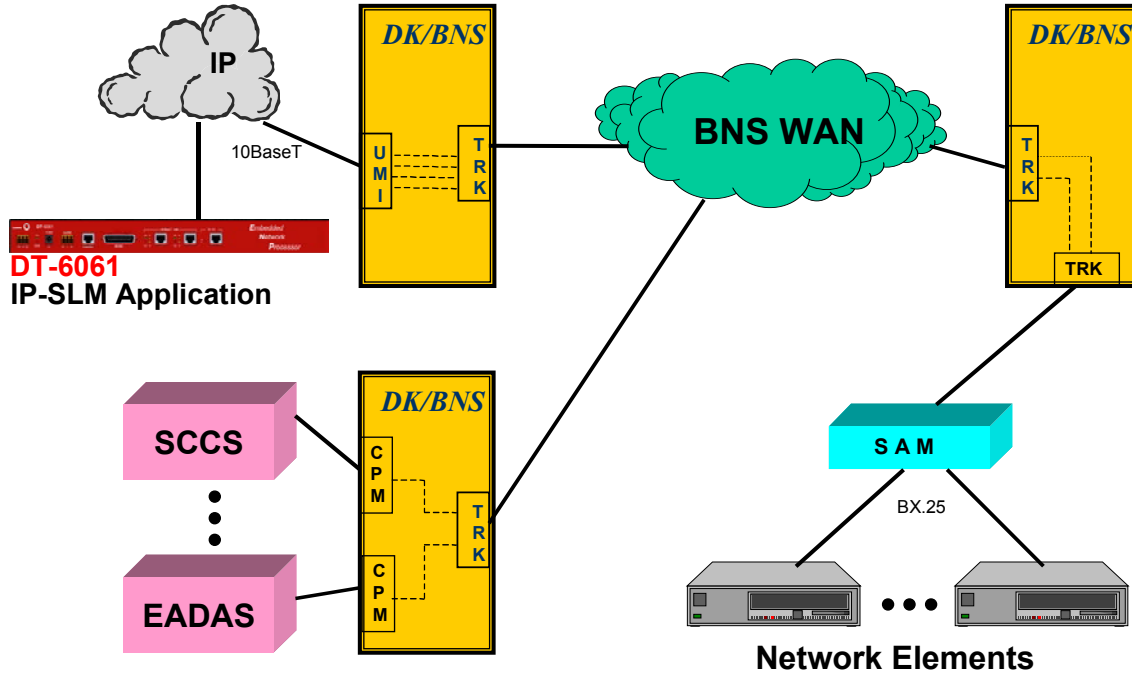
In the diagram above, the IP network may be a simple hub if a private network is desired. The DT-4000 ports are used to connect the BX.25 network elements. These may be co-located with the DT-6061, or may be co-located with the Network Element, as is required. The UMI provides the connectivity to the Operations Systems.

The diagram above has the following engineering provisions:

Number of Network Element Ports per DT-6061	30
Maximum Baud Rate of NE Port	115.2Kbps
Number of Network Element Ports per UMI	504

Some deployments may currently use a SAM concentrator to initially connect the BX.25 as was shown in the initial diagram of a typical configuration. When such a condition exists, it is sometimes more cost effective to provide BX.25 connectivity via the existing SAMs. The following diagram provides for this drop-in situation:

NE BX.25 Data Link via DT-6061 & IP-SLM “Drop-In” Integrated Deployment



Note: Each DT-6061 using the IP-SLM application will support 30 Network Elements.
Each UMI will support 250 Network Elements since two circuits are used per NE.

In the diagram above, the SAMs that reside with the Network Elements acquire the BX.25 and transport it to the DT-6061 IP-SLM application via the UMI module. Note that this configuration is identical to the original typical configuration with the exception that the node co-resident SAM and the SLMs have been replaced with the DT-6061 and UMI modules.

The diagram above has the following engineering provisions:

Number of Network Element Ports per DT-6061	30
Maximum Baud Rate of NE Port	9.6Kbps
Number of Network Element Ports per UMI	252



The reason the number of Network Element ports per UMI is less than the DT-4000 solution is that both the BX.25 connection, and the OS connection traverse the UMI. In the DT-4000 deployment, the BX.25 connection was direct between the DT-4000 and the DT-6061. It should be noted that a DT-4000 may also be used in its SAM emulation role. In that situation, the UMI would still have the SAM deployment characteristics and support 252 Network Elements. The baud rate per Network Element port would be as provided by the DT-4000 (up to 115.2Kbps).



7 IP-SLM APPLICATION COMMAND SET

7.1 INPUT CONVENTIONS

All parameters may be given on the command line. Parameters of the form **name=<value>** may be given in any order.

For several complex commands, listed below, missing parameters, or corrections of errors in given parameters, of the form **name=<value>** are collected by prompting the console user. The user responds to a prompt for the **name** by typing the required **<value>** followed by *newline*. Defaults are supplied in some cases, so the user need only enter *newline*.

Commands may be entered in upper or lower case.

Parameters of the form **name=value** may use upper or lower case for **name**.

Default values, if any, are shown in parenthesis as part of the prompt.

Case is not preserved for values.

Backspace erases one character.

7.2 LOGIN

Syntax: login PASSWD=<password>

The login command is used to allow access to the other configuration commands.

The login command is only visible when the application is in the *logged out* (i.e. secure) mode. The unit enters this mode whenever a *logout* command is issued or when the Telnet to the application instance OA&M TCP port is interrupted for any reason.

The password is not echo-suppressed. The password consists of up to seven alphanumeric characters. Special characters are not allowed.

It should be noted that every application instance may be assigned a different password.

The default password is "initial".



7.3 LOGOUT

Syntax: logout

The logout command is only allowed if the console user is logged *in*. It uses no arguments. It will set the console to the logged *out* mode.

7.4 CHANGE PASSWORD

Syntax: chpasswd PASSWD=<old> NEWPASS=<new> CONFIRM=<new>

The chpasswd command is used to change a user password on the system console. The command is only allowed if the user is logged *in*.

All three parameters must be given on the same line as the command. None of those entries are echo-suppressed.

If the current password is valid, and the two entries for the new password match, the password is changed to the new value.

7.5 HELP

Syntax: help [?] [Command]

The help command is always visible. The help command displays the currently allowed commands for the mode that the unit is currently entered. The alternate command for help is a question mark.

7.6 VERSION

Syntax: ver

The version command is only visible when the application is *logged in*. The command has no arguments. It displays the current software and database revisions of the application.

7.7 PLACING COMPONENTS IN SERVICE

Syntax: rs <LINK | OS>



The restore command is only visible when the application is *logged in*. The command is used to place the BX.25 Link, or the Operations System connection, into service. A TCP connection is not available until the component is placed into service.

At least one argument is required. That argument is the component type to be placed into service. There is only a single BX.25 link, and a single OS connection. All of the circuits for the BX.25 link are sent to the OS on the single TCP connection. This is necessary for proper emulation of the SLM.

Once the component is brought into service, it will await a TCP session if the connection type is rcv. On the other hand, if the connection type is orig, a TCP session will be established with the endpoint specified in the component configuration.

7.8 TAKING COMPONENTS OUT OF SERVICE

Syntax: rm <LINK | OS>

The remove command is only visible when the application is *logged in*. The command is used to place the BX.25 Link, or the Operations System connection, out of service. Any TCP connection using those components is automatically taken down when the component is removed from service.

At least one argument is required. That argument is the component type to be removed from service. There is only a single BX.25 link, and a single Operations System connection which may be individually removed from service.

7.9 CONFIGURING BX.25 LINK PARAMETERS

Syntax: Link [base=<TCP Port#>]

[type=<RCV|ORIG>]

[dest=<IP Address>] [dport=<TCP Port>]

[win=<#LAPB Frames>] [t3=<#Seconds | OFF | DEFAULT>]

[t1=<#Seconds>] [n2=<cnt>] [dx= <DCE | DTE>]

The base is the TCP port number base at which the BX.25 line is to be IP terminated.

The default is computed as follows:



Default TCP Base= $((\text{Application Instance\#} > -1) * 200) + 30000$

For example, instance #1 of the application will have its base address at 30000. The BX.25 link would be connected at that TCP port number. The Operations System connection would be at TCP 30001.

When the BX.25 link is to be on an incoming TCP session, the **type** would be set to **rcv**. The BX.25 link would reside at the TCP port specified by the **base** parameter. This is the default configuration for the IP-SLM application.

When the BX.25 link is to be on an outgoing TCP session, the **type** would be set to **orig**. The IP address would be specified by the **dest** parameter, and the TCP port at that IP address would be specified by the **dport** parameter.

The **numvcc** is the number of X.25 virtual circuits to be supported. The default is thirty-two, although all Network Elements use 8 or less. The TelCordia specification specifies three circuits.

The **win** specifies the LAPB window size to be used for transmission. The Window size is always eight frames for receive. The default transmission window size is 2 per the ITU specification X.25. It is provided as an option for non-standard configurations.

The **t1** option specifies the value of the T1 timer. The timer defaults to the recommendation of the ITU specification X.25. It is provided as an option for non-standard configurations.

The **n2** option specifies the value of the N2 retry counter. The value defaults to the recommendation of the ITU specification X.25. It is provided as an option for non-standard configurations.

The **t3** option specifies the value of the T3 timer. The timer defaults to the recommendation of the ITU specification X.25. It is provided as an option for non-standard configurations.

The **DXE** option specifies the LAPB sex assumed by the IP-SLM. The default is DCE, and may be changed to a DTE by configuration.



7.10 OPERATIONS SYSTEM CONFIGURATION

**Syntax: OS [type=<RCV|ORIG>
[dest=<IP Address>] [dport=<TCP Port>]**

The **os** command configures the connectivity between the IP-SLM application and the appropriate operations system.

The default TCP port is computed as follows:

OS Default TCP Port= <BX.25 Link TCP Port> + 1

For example, instance #1 of the application will have its BX.25 link TCP port at 30000. The Operations System would be connected at TCP 30001.

When the Operations System connection is to be on an incoming TCP session, the **type** would be set to **rcv**. The OS connection would reside at the TCP port specified by the BX.25 port plus one. This is the default configuration for the IP-SLM application.

When the OS connection is to be on an outgoing TCP session, the **type** would be set to **orig**. The IP address would be specified by the **dest** parameter, and the TCP port at that IP address would be specified by the **dport** parameter.

7.11 DISPLAY OF MEASUREMENTS

Syntax: dmeas [LINK | VC <#>]

The **dmeas** command is only visible when the application is logged in. The command is used to display the current measurements on either the BX.25 link, or a per virtual circuit on the BX.25 link.

The LINK option will display the measurement information for the BX.25 link being supported by this instance of the application.

The VC <#> option will display the measurement information for a particular X.25 virtual circuit on the link. The virtual circuit number is in the range of one through the maximum number supported by the application. Typical values are one through three for EADAS, and one through seven for SCCS.



7.12 VERIFY CONFIGURED OPTIONS

Syntax: `vfy [APP | LINK | OS | ALL]`

The **vfy** command is only visible when the application is logged in. The command is used to display the configured options on the BX.25 link, or the Operations System connection, or both. The current status of these interfaces is also displayed.

The **APP** option will display information about the IP-SLM application instance itself.

The **LINK** option will display the configuration information for the BX.25 link being supported by this instance of the application.

The **OS** option will display the configuration information for the Operations System connection.

The **ALL** option will display the **APP**, the **LINK** and the **OS** configurations together.

7.13 DISPLAYING CURRENT CONNECTIONS

Syntax: `dc`

The **dconn** command is used to display all of the current connections into the IP-SLM application. This includes the BX.25 link, and Operations System connection.

Please note that the command does not require any arguments. The command will issue a report that shows the connection peer for each active connection.

7.14 SNOOPING ON BX.25 TRAFFIC

Syntax: `snoop [OFF | L2 | <VC#>] [verbose]`

The IP-SLM application has a diagnostic ability to snoop on either the BX.25 link at the LAPB layer, or on an individual circuit at the packet layer. This is done with the **snoop** command. All output is directed to the OA&M connection.

If the command is invoked with no arguments, it produces a report of all active snooper configurations.

If the command is invoked with the **OFF** option, all of the snooper configurations are disabled.



If the command is invoked with the **L2** option, the LAPB interface to the BX.25 device is snooped. Output is displayed on the OA&M session. Please note that this could be extensive for a moderately busy BX.25 line.

If the command is invoked with a virtual circuit number in the range of 1 through the maximum number of BX.25 circuits; the packet layer of the circuit specified is snooped.

A second optional argument is **verbose**. When selected, the **verbose** argument displays the actual contents of packets received in hexadecimal. This output is in addition to the standard snoop display of the decoded BX.25 header information.

7.15 CLEAR MEASUREMENTS

Syntax: clr

The measurements displayed with the **dmeas** command are aggregated until cleared. The **clear** command will set all measurements to zero. The command has no arguments.

7.16 OA&M SESSION TIMER CONFIGURATION

Syntax: timeout [OFF | <Number of Seconds>]

The **timeout** command configures the session timer. When configured, the session timer will disconnect a user from the OA&M telnet port for this IP-SLM instance. No other IP-SLM instances are affected since each has its own OA&M connection.

7.17 PROMPT LABELS

Syntax: label [word (no spaces) | none]

The **label** command allows a user to add an identification of up to eight characters in length to the application console prompt. This identification string is useful when large numbers of application instances are present. An argument of **none** deletes the identification label.

7.18 APPLICATION COMMENTS

**Syntax: comment [L1="comment"
[L2="comment"
[L3="comment"**



The **comment** command allows a user to add user information to the application instance. The information is displayed during a **vfy app** command. Up to three lines of information may be provided. Each line may be up to 64 characters in length, may include spaces, and is double quoted. Each line may be changed individually. Comments may be cleared by setting the line value to a null comment (i.e. "").

7.19 DISPLAY OF REMOTE EIA LEADS

Syntax: deia

The **deia** command allows a user to display the EIA leads of the BX.25 Network Element connection from a DT-4xxx, DT-9480, or a SAM device. The command does not affect data transport, and may be done at any time.



8 IP-SLM MEASUREMENTS

This section itemizes the measurements available using the *display measurements* (**dmeas**) command. There are two options to the **dmeas** command. These are **link** and **vc**.

The **link** option provides BX.25 Link level measurements, and the **vc** option provides per virtual circuit measurements.

The base measurements are always displayed, and the error and exception counters are only displayed if nonzero.

The link level measurements available are as follows:

Measurement Description	Type
Number of LAPB Frames Received	Base
Number of LAPB Frames Transmitted	Base
Number of LAPB Bytes Received	Base
Number of LAPB Bytes Transmitted	Base
Number of Invalid Frames Received.	Base
Number of Frames Received with Channel out of Range.	Exception
Number of Frames Ignored when OS made Link Inactive.	Exception

The per virtual circuit measurements available are as follows:

Measurement Description	Type
Number of Packets Received from X.25 Link	Base
Number of Packets Sent to X.25 Link	Base
Number of Bytes Received from X.25 Link	Base
Number of Bytes Sent to X.25 Link	Base
Number of Call Request Packets Received	Exception



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Number of Call Accept Packets Received	Exception
Number of Clear Request Packets Received	Exception
Number of Clear Confirmation Packets Received	Exception
Number of Interrupt Packets Received	Exception
Number of Interrupt Confirm Packets Received	Exception
Number of REJ Packets Received	Exception
Number of RNR Packets Received	Exception
Number of Reset Request Packets Received	Exception
Number of Reset Confirmation Packets Received	Exception



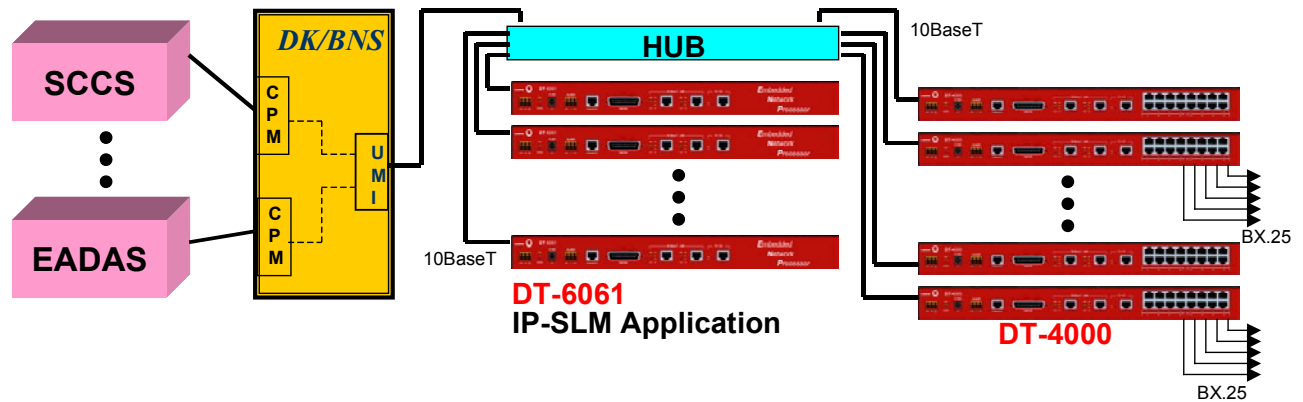
9 THE INSTALLATION COOKBOOK

This section is a collection of scenarios with step by step installation instructions. These include some suggestions for deployment.

9.1 A PRIVATE NETWORK DEPLOYMENT

This deployment is relevant when the network element BX.25 lines are brought directly to the SLM modules. A replacement of SLM modules may merely be a closed network on which the DT-6061 and DT-4000 reside. Since it is a closed network, there is no concern for acquiring official IP addresses. However, should this network not be closed, the configuration suggested would still apply. The only difference would be that official IP addresses would be required for each component.

Consider the following connectivity diagram:



In the diagram above, there is support for 450 individual BX.25 lines from the Operations System via the UMI. There are also 24 sessions available for access to the network for OA&M and other functions. Please note that the Network Elements are attached via a 202T or similar modem device.

Some suggestions in the deployment of this configuration are as follows:

Maintain Board/Port to TCP connectivity so that a single DT-6061 is mapped to a SAM BOARD on the UMI.



Only 30 of the 32 SAM PORTS per SAM BOARD are utilized on the UMI module. These have a PDD in the UMI to each instance of the IP-SLM application for OS connectivity.

SAM BOARD 16 on the UMI is used for remote access to the *private* network. This allows 24 sessions for access for OA&M configuration and debugging.

TWO DT-4000 devices support each DT-6061. Thirty of the ports are used for connection to the BX.25 links from the Network Elements. One port is used to connect to the DT-6061 system console. This would allow access to that console via the UMI on one of the debug sessions. One port is simply not used.

. Given the above, the deployment could be as follows:

1. Install each DT-6061 by assigning an IP address, gateway address (if any), and the IP_SLM application on all 30 instances. These are done by the **ipaddr <ip_address>**, the **gateway <ip_address>**, and the **app 1 cnt=30 type=ip_slm** commands on the DT-6061 system console. It will be necessary to reboot the DT-6061 following the IP address configuration. This step may be staged in advance of the deployment.
2. Configure the DT-4000 ports so that they initiate a TCP call to the IP_SLM application at the BX.25 TCP port for each instance. Since the Network Elements are attached via a 202T or similar modem device, the clocking for the data stream is provided by the modem and not the DT-4000.

```
Port <#> type=ORIG Dest=<DT-6061 IP Address> dport=<BX.25 TCP #>
```

```
Port <#> prot=HDLC pap=ON dxe=DTE
```

```
Rs <#>
```

The cable adapter is a SYNC DTE with a DB-25 Male. This attaches to the cable of the 202T modem to the Network Element. The <BX.25 TCP#> is as listed in the **link** command above. That is, 30000 for instance #1, 30200 for instance #2, and so on.

The <#> is the DT-4000 port number being configured. Since the “permanently active” option is configured, the TCP call will be immediately set up. Doing a “display



connections" command (dc) on either the DT-4000 or the IP-SLM OA&M session will show the BX.25 connection at this time.

3. Configure the UMI ports so that they initiate a TCP call to the IP_SLM application at the OS TCP port for each instance. Since there is a mapping of SAM BOARDS to DT-6061 hardware, this simplifies the administration of the UMI TCP connections. From this configuration, it is known that the first 30 ports are connected to the first DT-6061 at TCP 30001, 30201, etc. The next port is the DT-6061 console for the first DT-6061, and the 32nd port is unused. This is repeated for all of the SAM BOARDS.

```
Vport <vp#> type=ORIG dest=<DT-6061 IP addr> dport=<TCP#> prot=sync
```

The <vp#> is the virtual port number. It is in the range of 1-32 for the first SAM board, 33-64 for the second, and so-on. The 16th SAM BOARD has only 24 ports available. It is used for access to the network components through the UMI in this configuration. The <TCP#> is the TCP port number of the IP-SLM instance OS connection. This would be 30001 for the first instance, 30201 for the second, and so on.

4. Configure the Datakit Control Computer for each port on the UMI. Each individual port will require its own configuration since it will be the call receiver from the Operations System host that is typically CPM connected. Each of the OS connectivity ports will require a **group** name. This should refer directly to the network element to which it is connected. Since there is exact connectivity from a port to an IP-SLM instance to a BX.25 link; this can be the exact network element name. Once the **group** name has been entered, an **address** for that group may be entered. The **address** should be the one known by the Operations Systems host for the particular Network Element. The SAM PORT on the UMI may now be entered. The relevant parameters are that it be a **host** service type, **hdlc** protocol, and default all other values. In particular, it is important that the port not be permanently active, and that the baud rate not be autobaud.
5. Each UMI port may now be restored. The OS will connect to the port for a particular Network Element, and the UMI will make a connection to the relevant instance of the



IP-SLM application. The BX.25 connection to the IP-SLM application has already been made from the DT-4000 to that IP_SLM application. No further configuration is required.

In the scenario above, the DT-6061 system consoles were attached to the 15th port of the second DT-4000 associated with a particular DT-6061. That DT-4000 port should be configured as follows:

```
Port 15 type=rcv prot=async baud=9600 pap=on
```

```
Rs port 15
```

This will allow a telnet to the DT-4000 at TCP 50015 which is the default for port 15. A crossover cable is used between the DT-4000 port and the DT-6061 system console.

The UMI is configured so that all 24 ports on the 16th SAM BOARD may be used to access components on the private network. This is done with the following UMI command.

```
Vport 481 cnt=24 type=orig prot=async
```

An **address** and **group**, such as *privnet*, are configured on the Datakit CC. All the SAM PORTs for Board 16 are entered as service type **host**, *async*, group *privnet*, and other options defaulted. It is important that the ports not be configured for *pap* or *autobaud*.

Once the above is done, a Datakit call to the *privnet* address will present a **UMI DESTINATION** prompt. The DT-4000 IP address and TCP Port 50015 may now be entered to access the DT-6061 system console. The DT-6061 address and TCP Port <10000+IP_SLM instance#> may be entered to access the IP-SLM application instance OA&M console. These TCP numbers are 10001 for the 1st instance, 10002 for the 2nd instance, up to 10030 for the last instance on a particular DT-6061.



9.2 DISTRIBUTED DEPLOYMENT VIA A BNS / DATAKIT INFRASTRUCTURE

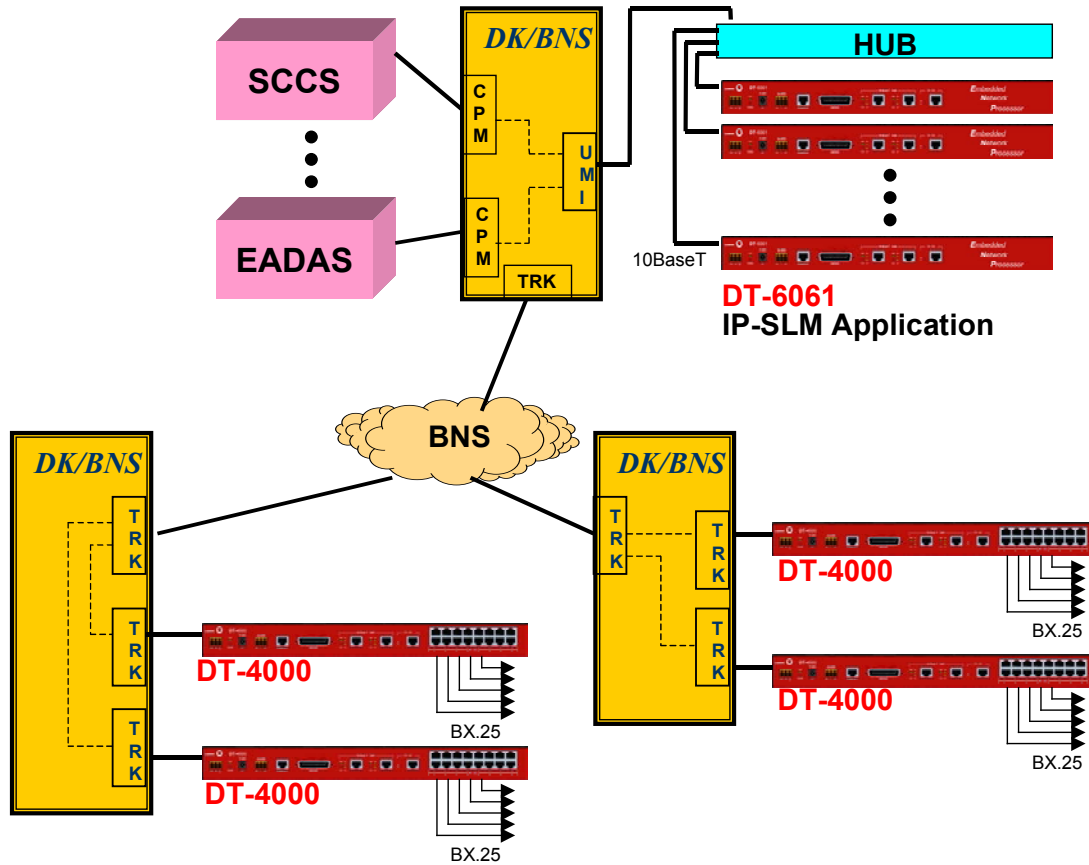
This deployment is relevant when the network element BX.25 lines are not brought directly to an SLM. Such a situation exists where BX.25 lines are back-hauled over the BNS network via SAMs, or in a new installation where it is desirable to have the access point as close to the Network Element as possible.

The DT-6061s may be anywhere in the BNS network. They may be connected to the BNS network using a private or a public IP network off the UMI. If the connection is a public network, there is no need to co-locate the DT-6061s with any BNS component.

In this particular scenario, it may be advantageous to make the network private so that the processing is strictly a BNS adjunct rather than a common network resource. Since it is a closed network, there is no concern for acquiring official IP addresses.

However, should this network not be closed, the configuration suggested would still apply. The only difference would be that official IP addresses would be required for each component.

Consider the following connectivity diagram:



In the diagram above, the DT-4000's are operating in their SAM16 emulation. The DT-4000 can support this emulation and have standalone functions simultaneously.

The configuration would be similar to the previous section on *private network deployment* except that both the BX.25 connection and the OS connection traverse the UMI. Because of this, the configuration supports about 210 BX.25 links per UMI. The configuration would have UMI boards 1-7 used for OS connectivity on a one for one basis with the respective DT-6061. Boards 8-14 are then used for BX.25 connectivity on a one for one basis with the respective DT-6061. Board 15 is not used, and board 16 is used for access to the IP network on which the DT-6061s reside.

Given the above, the deployment could be as follows:

1. Install each DT-6061 by assigning an IP address, gateway address (if any), and the IP_SLM application on all 30 instances. These are done by the **ipaddr**



<ip_address>, the gateway <ip_address>, and the **app 1 cnt=30 type=ip_slm** commands on the DT-6061 system console. It will be necessary to reboot the DT-6061 following the IP address configuration. This step may be staged in advance of the deployment.

2. Install each DT-4000 port somewhere in the Datakit/BNS network. These ports may be configured directly to the Network Element; or indirectly via a modem set such as a 202T. The difference is when they are directly attached, the DT-4000 port becomes the clock source. In that situation, the cable type is DCE and a DCE SYNC DB-25 adapter is used. When the DT-4000 is a DCE, the baud rate must be accurately specified. When the DT-4000 is connected to a modem set, it is the modem set that provides the clocking. This requires the DT-4000 to be configured with a cable type of DTE, and a DTE SYNC DB-25 adapter is used. Other options in common are the Datakit port group, protocol of HDLC, PAP is enabled, and the port is PDD'd to the appropriate UMI virtual port for the BX.25 connection of this network element via an address configured on the node containing the UMI.
3. Configure the UMI virtual ports starting at SAM BOARD 8 (vport 225) through SAM BOARD 14 so that they initiate a TCP call to the IP_SLM application at the BX.25 TCP port for each instance. In this configuration, up to 210 such connections are established per UMI.

VPort <#> type=ORIG Dest=<DT-6061 IP Address> dport=<BX.25 TCP #> prot=SYNC

The <BX.25 TCP#> is as listed in the **link** command above. That is, 30000 for instance #1, 30200 for instance #2, and so on. The <#> is the UMI virtual port number being configured. The TCP call will not be established until the Datakit based DT-4000 makes a Datakit call setup to the UMI. Once that is done, doing a "display connections" command (dc) on either the UMI or the IP-SLM OA&M session will show the BX.25 connection.

4. Configure the UMI ports so that they initiate a TCP call to the IP_SLM application at the OS TCP port for each instance. Since there is a mapping of SAM BOARDS to DT-6061 hardware, this simplifies the administration of the UMI TCP connections. From this configuration, it is known that the first 30 ports are connected to the first



DT-6061 at TCP 30001, 30201, etc. The next port is the DT-6061 console for the first DT-6061, and the 32nd port is unused. This is repeated for SAM BOARDS one through seven.

Vport <vp#> type=ORIG dest=<DT-6061 IP addr> dport=<TCP#> prot=sync

The <vp#> is the virtual port number. It is in the range of 1-32 for the first SAM board, 33-64 for the second, and so on. Please note that the 16th SAM BOARD has only 24 ports available. It is used for access to the network components through the UMI in this configuration. However, this scenario only configures SAM BOARDS one through seven. The <TCP#> in the command above is the TCP port number of the IP-SLM instance OS connection. This would be 30001 for the first instance, 30201 for the second, and so on.

5. Configure the Datakit Control Computer for each BX.25 port on the UMI. Each individual port will require its own configuration since it will be the call receiver from the DT-4000 co-resident with the Network Element. Each of the BX.25 connectivity ports will require a **group** name. This should refer directly to the network element to which it is connected. Since there is exact connectivity from a port to an IP-SLM instance's BX.25 interface; this can be the exact network element name. Once the **group** name has been entered, an **address** for that group may be entered. The **address** should be the one known by the PDD at the DT-4000 co-resident with the Network Element. The SAM PORT on the UMI may now be entered. The relevant parameters are that it be a **host** service type, **hdlc** protocol, and default all other values. In particular, it is important that the port not be permanently active, and that the baud rate not be autobaud. It should be noted that BX.25 connectivity ports will occur on SAM BOARDS 8 through 14 on the UMI, and only on ports 1 through 30 on those boards.
6. Configure the Datakit Control Computer for each port on the UMI. Each individual port will require its own configuration since it will be the call receiver from the Operations System host which is typically CPM connected. Each of the OS connectivity ports will require a **group** name. This should refer directly to the network element to which it is connected. Since there is exact connectivity from a port to an IP-SLM instance to a BX.25 link; this can be the exact network element name. Once



the **group** name has been entered, an **address** for that group may be entered. The **address** should be the one known by the Operations Systems host for the particular Network Element. The SAM PORT on the UMI may now be entered. The relevant parameters are that it be a **host** service type, **hdlc** protocol, and default all other values. In particular, it is important that the port not be permanently active, and that the baud rate not be autobaud. It should be noted that OS connectivity ports will occur on SAM BOARDS 1 through 7 on the UMI, and only on ports 1 through 30 on those boards.

7. Each UMI port may now be restored. The OS will connect to the port for a particular Network Element, and the UMI will make a connection to the relevant instance of the IP-SLM application.
8. The DT-4000 ports may now be restored. The BX.25 connection to the IP-SLM application is then made through the UMI immediately since the DT-4000 ports had been configured as permanently active.

In the scenario above, the DT-6061 system consoles would need to be attached to a local DT-4000 and accessed via the UMI; or via a SAM/DT-4000 port on the BNS/Datakit itself; or even a TY module. If they were attached to a DT-4000 port for simplicity of access via the UMI, these ports would be configured as follows:

Port <#> type=rcv prot=async baud=9600 pap=on

Rs port <#>

This will allow a telnet to the DT-4000 at TCP 50000+<#> which is the default for port <#>. A crossover cable is used between the DT-4000 port and the DT-6061 system console.

The UMI is configured so that all 24 ports on the 16th SAM BOARD may be used to access components on the private network. This is done with the following UMI command.

Vport 481 cnt=24 type=orig prot=async



An **address** and **group**, such as *privnet*, are configured on the Datakit CC. All the SAM PORTs for Board 16 are entered as service type **host**, *async*, group *privnet*, and other options defaulted. It is important that the ports not be configured for *pap* or *autobaud*.

Once the above is done, a Datakit call to the *privnet* address will present a **UMI DESTINATION** prompt. The DT-4000 IP address and TCP Port 50000+<#> may now be entered to access the DT-6061 system console. The DT-6061 address and TCP Port <10000+IP_SLM instance#> may be entered to access the IP-SLM application instance OA&M console. These TCP numbers are 10001 for the 1st instance, 10002 for the 2nd instance, up to 10030 for the last instance on a particular DT-6061.



10 IP-SLM DEBUGGING SUGGESTIONS

This section itemizes the steps to be taken when an IP-SLM connection does not operate when deployed.

1. Display the connections to the UMI on the BNS Control Computer. There should be a connection between the OS host, and the UMI port for the Network Element. The connection should be in talking state. Perform the operation again to verify that the packet count is increasing. If there is no connection, check the UMI address and group to verify that they are correct for the dialstring used by the OS host. Check to be sure the UMI port is in service. If a speedcall was used to re-direct the OS connection, make sure that the call is not being routed on the same facility on which it arrived. Finally, from an available destination prompt or host; connect to that UMI port to see if it accepts the call.
2. If the deployment had the BX.25 connections traversing the UMI, perform the same display connections for those as well. They too should be in talking state. However, their packet counts may not be increasing if the BX.25 has been disconnected due to lack of OS connectivity, or on a primary/secondary fault-over.
3. If using standalone DT-4000s, access the console via the UMI. After getting the UMI DESTINATION prompt, type in the address of the DT-4000 and allow the TCP port number to default to 23. This will access the DT-4000 console. A "display connections" (dc) will show the connections from the DT-4000 user ports. The BX.25 connection should be shown connected to the DT-6061 at the BX.25 TCP port (i.e. 30000, 30200, ...).
4. Access the IP-SLM console to check its status. After getting the UMI DESTINATION prompt, type in the address of the DT-6061 and a TCP port of 10000+<instance#> where <instance#> is the copy of IP-SLM you wish to access. These are numbers in the range of 1 through 30. If the suggested deployments were followed, this number is also the SAM PORT number on the SAM BOARD associated with that DT-6061. That is SAM BOARD 2 PORT 13 should be configured to instance 13 on the 2nd DT-6061 accessed by the UMI. The IP-SLM console for that instance would be 10013.



5. Once on the IP-SLM console, perform a “display connections”. Both the BX.25 connection, and the OS connection should be present. If either is not present, the interface will not function.
6. If both connections are present, perform a “vfy link” command. The BX.25 link and virtual circuit state will be displayed. For single links, this should be “active” with LCNs 1,2, and 3 present. For SCCS links, the BX.25 connection may be disconnected if this link has not been made active. If it was made active, the BX.25 link will be seen as “active” with LCNs 1 through 7 inclusive. Only LCNs 1 through 3 are actually used but SCCS enables all seven of them.
7. Finally, the BX.25 circuit can be monitored at either the LAPB layer, or at the individual circuit packet layer. Link operations such as restarting the packet layer are also visible by monitoring the LAPB layer. This is done with the **snoop L2** command. Individual circuits may be monitored with the **snoop <LCN#>** command. Any combination of snoop commands may be activated although it can get rather verbose. All snooping will be disabled with a **snoop off** command.



11 KNOWLEDGE BASE

This section is a random collection of information that may be relevant during the deployment of the IP-SLM application.

11.1 SAMs AND UDS 202T MODEM

The UDS 202T modem has an RTS lead that must be either driven, or optioned to be enabled permanently. The DT-4000 Synchronous DTE adapter (depicted in this section) will drive RTS whenever a call is present and therefore DTR is also driven. However, the obsolete AT&T SAM Synchronous DTE adapters had a race condition between RTS and CTS. If the AT&T Synchronous DTE adapters are to be used, the UDS 202T modem must be configured as **permanent** when operating with a SAM or DT-4000.

In either situation, the “cable type” configured in the DT-4000 or SAM connection is DTE. The adapter presents a 25 pin male connection to the UDS modem.

It should be noted that a UDS 202T in operation with a standard SLM most likely does not have the RTS option configured as permanent. It is recommended that the Synchronous DTE adapter depicted in this section be used for such connections.

11.2 SAMs AND AT&T/PARADYNE 2024 MODEMS

The AT&T Paradyne 2024 modem is a 2400 baud synchronous or asynchronous modem used for leased facilities. These modems are used on a great deal of SLM connections. The AT&T Paradyne 2024 modem is optioned by commands on a front panel via three levers and an “execute” button. The AT&T Paradyne 2024 modem does not provide proper clocking for a SAM or DT-4000 in its default configuration.

There are two methods to provide proper clocking from the AT&T Paradyne 2024 modem. Both methods will work properly with the DT-4000 Synchronous DTE adapter depicted in this section. Only one method will work with the obsolete AT&T synchronous DTE adapter.

The first method, which will operate correctly with the DT-4000 Synchronous DTE adapter, involves setting the modem such that the Tx Clock (Pin 15) is derived from the



external clock (Pin 24). This option is configured by setting option **B3** on the AT&T Paradyne 2024 modem from the front panel.

The second method, which will operate correctly with both the DT-4000 Synchronous DTE adapter and the obsolete AT&T Synchronous DTE adapter, involves setting the modem such that the Tx Clock (Pin 15) is a slave of the internal DDS timing. This option is configured by setting option **B2** on the AT&T Paradyne 2024 modem from the front panel.

The default configuration for the AT&T Paradyne 2024 modem is **B1** which is “internal” timing. In this default configuration, the clocks are not properly phased.

The AT&T Paradyne Modem does not have an RTS issue with either the DT-4000 Synchronous DTE adapter or the obsolete AT&T Synchronous DTE adapter.

The configuration of the AT&T Paradyne 2024 is described on pages 28 and 40 of its Operations manual. A synopsis of those instructions are as follows:

1. The modem is placed into command mode by setting the CMD/Test switch to CMD. The MDCK will display. Press EXEC twice to enable command input. The operating mode will change from MD/O to MD/I.
2. Using the FWD/BCK key, select the CHOP option, execute, and then enable **B3** (or **B2**) using the EXEC key.
3. The modem must be taken out of command mode by returning the MDCK display and setting the operating mode from MD/I to MD/O.

11.3 SAMs AND GENERAL DATAComm 201-7 MODEMS

The General DataComm 201-7 Modem is a 1200 or 2400 baud synchronous or asynchronous modem used for leased facilities. It is present on some SLM connections. The modem is optioned by DIP switches, and berg jumpers. The 201-7 modem does not provide proper clocking for a SAM or DT-4000 in its default configuration.

In order to provide proper clocking, the DT-4000 Synchronous DTE adapter depicted in this section must be used. The obsolete AT&T synchronous DTE adapter will not function properly with the General DataComm 201-7 modem.



The modem is properly configured by setting DIP Switch #9, position #1, to the “external” position. The default is the “internal” position. All other configuration is not altered.

This option will instruct the General DataComm 201-7 to use clock provided on Pin 24 of the interface as its Tx (or Pin 15) clock. This clock is bridged from the Rx Clock (Pin 17) by the DT-4000 Synchronous DTE adapter depicted below. The result is that both clocks are then properly phased.

The General DataComm 201-7 requires RTS asserted before proper operation can proceed. This modem does not allow a permanent enable of that lead. The DT-4000 Synchronous DTE adapter depicted in this section properly asserts RTS when the DT-4000 or SAM port has a call active.

11.4 REDIRECTING OS CONNECTIONS WITH A SPEEDCALL ADDRESS

The OS connection to an SLM may be re-directed to a remote UMI via a speedcall. It is important that the speedcall be set up so that the Datakit Control Computer does not try to route it over the same trunk on which it arrived. If such is the case, the call setup will fail.

11.5 CABLING TO A MODEM SET

The Cabling to a Modem Set requires the use of a DT-4000 Synchronous DTE adapter. This is not the same as an asynchronous DTE adapter and has a different order code. However, the same DT-4000 Synchronous DTE adapter may be used on SAM64, SAM128, SAM504, and DT-4000 ports. The port would be configured with a cable type of DTE. The pin description of the DT-4000 Synchronous DTE adapter is provided in this section. The use of the obsolete AT&T Synchronous DTE adapter is not recommended for IP-SLM installations.

11.6 CABLING DIRECTLY TO THE NETWORK ELEMENT

The Network Element is a synchronous DTE. It requires a clock source that is usually provided by a modem set. When cabling a SAM or DT-4000 directly to the Network Element; it requires the use of a Synchronous DCE adapter. This is not the same as an asynchronous DCE adapter and has a different order code. However, the same Synchronous DCE adapter may be used on the SAM64, SAM504, and DT-4000 user

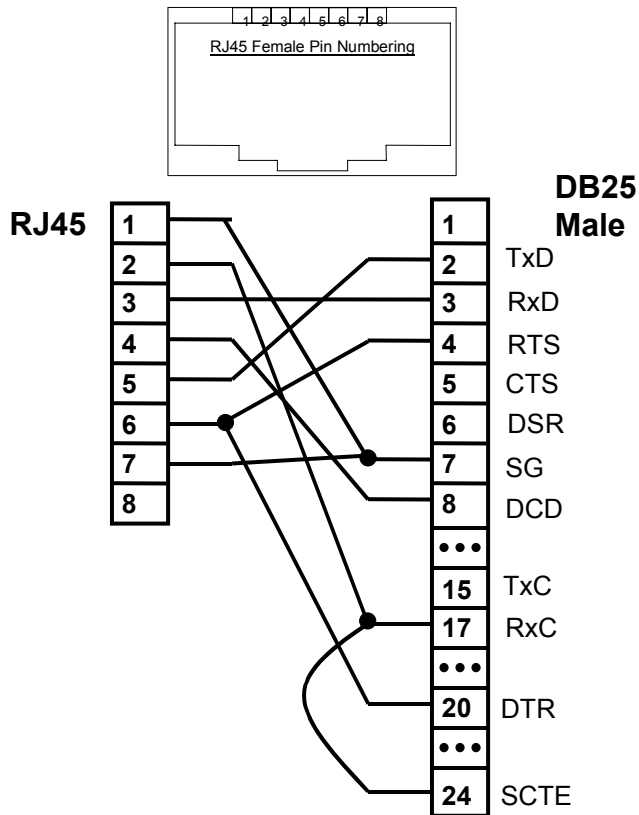


ports. The port would be assigned a baud rate appropriate for the Network Element (e.g. 2400 baud), and a cable type of DCE. The pin description of the synchronous DCE adapter is provided in this section.

11.7 THE SYNCHRONOUS DTE ADAPTER

Depicted below is the cabling description for the Synchronous DTE adapter to be used with DT-4000 ports configured as a cable type of synchronous DTE. The adapter may also be used with SAM64, SAM128, and SAM504 devices. This adapter is applicable when the DT-4000 is receiving the clocking to the interface between itself and a device. Generally, this interface adapter is used with Modem connections.

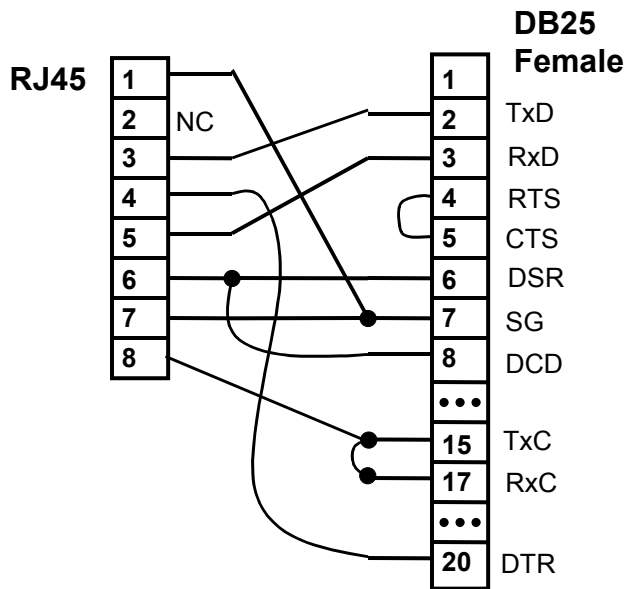
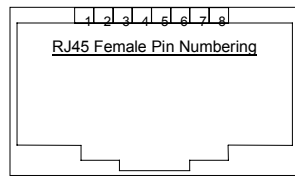
DT-4000 Sync DTE Adapter



11.8 THE SYNCHRONOUS DCE ADAPTER

Depicted below is the cabling description for the Synchronous DCE adapter to be used with DT-4000 ports configured as a cable type of synchronous DCE. The adapter may also be used with SAM64, SAM128, and SAM504 devices. This adapter is applicable when the DT-4000 is providing the clocking to the interface between itself and a device.

DT-4000 Sync DCE Adapter



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