

SCADA Point-to-Point Multiplexer

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1. DESCRIPTION

The DCB SR series statistical multiplexers are used in pairs to allow asynchronous RS-232 devices to communicate through a single composite (network) data link. The network may be synchronous or asynchronous, using leased lines or digital data service. Asynchronous terminal devices may be terminals, RTUs, computer ports, etc.

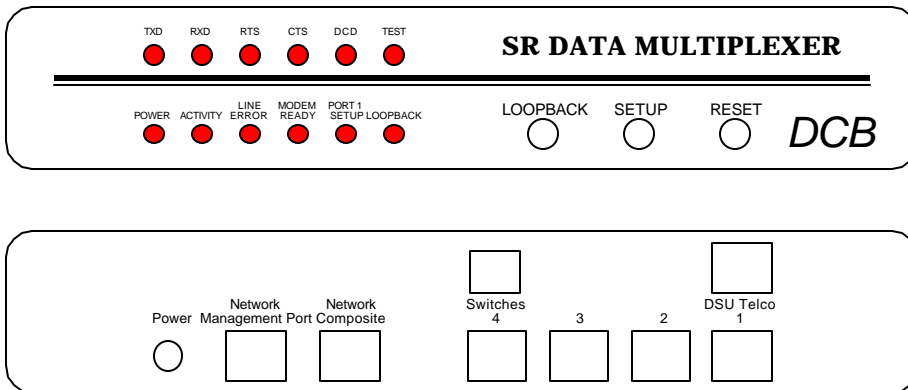
Each data port is configured individually at speeds up to 57,600 bps.

Network speeds may be as high as 115.2 Kbps asynchronous or 128 Kbps synchronous.

The multiplexer is configured using a network management port or port one of any unit using an asynchronous terminal or PC with terminal emulation software. Multiplexer configurations are kept in non-volatile memory.

Some features of the SR SCADA Multiplexer include:

- Monitor functions allow network management port user to monitor transmit or receive of any data port.
- Many test features allow diagnostics of the system and communications link.
- Power supplies available for 120 VAC, or 240 VAC.
- DC power options available.
- Built-in 56/64Kbps DSU/CSU option available.
- Built-in wireless modem option available. (4 port unit only)
- Rack mount options available.



4 Port SR Multiplexer shown with optional built-in DSU/CSU

2. SPECIFICATIONS

2.1 Data Ports

Port Speeds

Asynchronous only

300, 600, 1200, 2400, 4800, 9600, 19,200, 38,400 or 57,600 bps

Port Rate Selection

Selected per port through network management port control with an asynchronous terminal.

Data Format

10 bits/character, 1 start, 1 stop, 8 data (including parity)

8 data bits plus parity available with optional firmware

Interface

CCITT V.24, RS-232D, implemented in RJ-45, 8 position connectors. (RS-561 standard physical pin-out used on RJ-45 connectors)

Buffering

32K dynamically allocated

2.2 Composite Port

Full Duplex

Speed

Synchronous up to 128 Kbps

Asynchronous from 300 to 115,200 bps

Interface

RS-232D, implemented in RJ-45, 8 position connector

2.3 Physical / Electrical

10¼" W x 9¾" D x 2½" H

120 VAC external power supply

Optional DC and 240VAC power supplies available

30 watts, .25 amps

2.4 Environmental

Operation: -40 to +70° C, 10 to 95% relative humidity

Storage: -40 to +85° C, 10 to 95% relative humidity

2.5 Network Management Port Commands

Show Network Status

Show Port Configuration

Change Port Configuration

Change Delay Timeout

Configure Network

Configure Modem

Show / Change ID

Set Password

Activity Counters

Zero Activity Counters

Test Tools

Monitor Port Tx

Monitor Port Rx

NMP Parity

Ping Remote Mux

Reset Mux

Type

Repeat Last Command

Disconnect NMP

2.6 Other Specifications

Operating Modes

Multiplexing

Port Loopbacks

Front Panel Indicators

Power

Activity

Line Error

Modem Ready

Port 1 Setup

Loopback

Front Panel Switches

Loopback

Setup

Reset

2.7 Optional Built-In DSU/CSU Specifications

Compatible with Common Carrier digital signalling

56 or 64 Kbps

3. INSTALLATION

3.1 Unpacking

Remove the SR multiplexer from the shipping container and examine it carefully for external damage. If shipping damage is apparent, notify the shipper immediately.

The following accessories are included with all SR multiplexers:

- external power supply
- manual
- warranty, maintenance contract and repair information
- Modem to Composite cable (black) for connecting the SR to an external modem or DSU/CSU
- Network Management Port cable (green) for connecting the SR network management port to an asynchronous terminal or PC for configuration
- If your unit has the optional built-in DSU/CSU, a cable is included for connection to the phone line.

3.2 Setup

The composite port must be configured properly for the type of link used (Sync or Async). In addition, each data port must have the proper speed and parity settings. This is done using the network management port CN and CP commands (see Section 5).

3.3 Using Leased Line Modems

In this section, a reference to modem includes modems, digital radios or DSU/CSUs for leased line installations.

Connect the modems to the phone line and power ON the modems. Confirm the presence of carrier at each modem. If carrier is not detected at both ends, recheck the option settings. If carrier is still not present, check the cable from the telephone line to the modem. If everything is correct and still no carrier call the manufacturer of the modem or contact the telephone company for assistance.

Connect the SR composite port to the modem. A two foot RJ45 to DB-25 male cable connects the composite port of the SR (the RJ45 connector second from the left when viewed from the rear) to the data port of the modem (usually a DB-25 female connector). See Section 6 for cabling information.

Connect the multiplexers to power.

Power and Modem Ready indicators on the front panel of the SR must be ON indicating the on-line condition. (See Section 4).

3.4 Optional Built-In 56/64 Kbps DSU/CSU

For the 4 port unit, the optional DSU/CSU is configured using DIP switches accessible from the rear of the unit. See Section 4 for a description and location of these switches. The default settings should be correct for most applications.

For 8, 16, 24 or 32 port units, the DSU/CSU is configured using the CM command. See Section 5.

For line driver applications over customer owned wire (56K only), set one unit for Master Clock and the other unit to Slave Clock.

3.5 Optional Built-In Wireless Modem (4 port unit only)

Your SR-04 multiplexer with internal wireless modem was configured at the factory to work in most applications. If changes are required to the modem settings, connect a terminal to the multiplexer network management port (See Section 5) and follow the procedure below. User responses are shown in **BOLD**.

3.5.1 Set Mux Composite To Match Modem Setup Rate

```
AT YOUR COMMAND >> CN<Enter>
```

```
CONFIGURE NETWORK
```

```
-----  
ASYNC MODEM 57600
```

```
SYNC or ASYNC modem? [S/A] >> A<Enter>
```

```
ASYNC rate? [9600 / 19200 / 38400 / 57600 / 115200] >> 19<Enter>
```

```
ASYNC MODEM 19200
```

3.5.2 Enter Modem Setup Mode

AT YOUR COMMAND >> **CM<Enter>**

*** CONFIGURE NETWORK MODEM - Type ESC ESC to stop
*** WARNING: Network DCD is ON

MAIN MENU
Version 5.63 04-14-2000
Standard Hop Table
Modem Serial Number 903-6788

- (0) Set Operation Mode
- (1) Set Baud Rate
- (2) Edit Call Book
- (3) Edit Radio Transmission Characteristics
- (4) Show Radio Statistics
- (5) Edit MultiPoint Parameters
- (6) TDMA Menu
- (Esc) Exit Setup

Enter Choice

Make the required changes following the menu prompts. See the DGR-115 manual for options. Type Esc Esc to exit.

<Esc><Esc>

*** END CONFIGURE MODEM

3.5.3 Set Mux Composite To Match Modem Baud Rate

AT YOUR COMMAND >> **CN<Enter>**

CONFIGURE NETWORK

ASYNC MODEM 57600

SYNC or ASYNC modem? [S/A] >> **A<Enter>**

ASYNC rate? [9600 / 19200 / 38400 / 57600 / 115200] >> **57<Enter>**

AT YOUR COMMAND >>

3.6 Cabling

Cabling between the multiplexer and the computer ports or terminal devices is a common source of installation problems. The SR must have data from attached terminal devices or computer ports, as an input on Position 6 of the RJ45 connector. Data from the SR to any attached equipment will be transmitted on position 5 of the RJ45 connector. See paragraph 6.1 for position location on the RJ45 connector.

See Section 6 to determine the correct cables for your computer and terminal devices.

3.7 Parity Considerations

SR multiplexers transfer all character bits whether it is 7 data bits plus parity or 8 data bits. The SR does not verify parity for each character transferred. Consequently, the parity setting of the devices at either end of an SR channel must match.

Optional firmware is available to set 8 data bits plus parity (Even, Odd, Mark or None) on a port-by-port basis.

3.8 Resetting Factory Defaults

The factory default settings for the SR multiplexer ports are as follows:

Data Ports:

Loop	OFF
Rate	9600 No Busy

Composite Port:

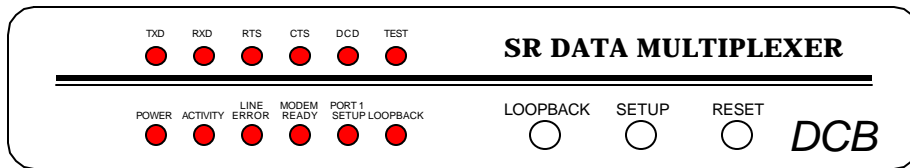
Modem type	ASYNC
Rate	57.6 Kbps
With Internal DSU/CSU	SYNC only

To reset the unit to factory defaults use the !R command from the network management port or perform the following steps using the front panel switches:

1. Depress and hold the SETUP switch while depressing the RESET switch.
2. Be sure to continue to hold the SETUP switch until the unit completes the reset and the lights return to normal.
3. All port settings should be at the factory defaults. Use the SC (Show Configuration) command to check the port settings.

4. CONTROLS AND INDICATORS

4.1 Switches



4.1.1 Front Panel Switches (4 port unit shown with built-in DSU)

Setup – Maps the network management port commands to the terminal attached to data port 1. When Port 1 Setup is active, the indicator is on.

Loopback – Disabled.

Reset – Performs a hardware reset of the multiplexer.

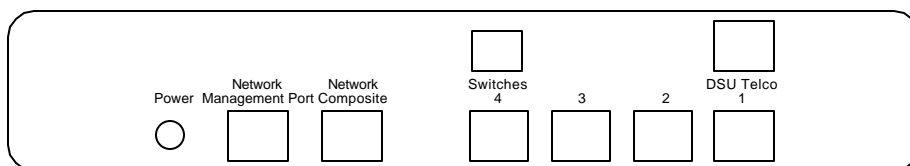
4.1.2 Optional Built-In DSU Switches (4 port unit only)

The DSU switches are located at the rear of the unit. Switch functions are shown in the following table:

Switch	Down	Up
1	56K	64K (optional)
2	Slave Clock	Master Clock
3	Must Be Down	
4	RTS Normal	RTS Forced ON
5	Normal	Local Loop ON
6	Not Used	

NOTE

RTS mode (sw 4) is active in 56Kbps mode only. In 64Kbps mode, RTS is forced on.



For normal operation with a telephone company line, set the DSU for SLAVE clock timing (switch position 2 DOWN). For in-house line driver applications (56K only), set the host DSU for MASTER timing (switch position 2 UP). The remote unit should remain set for Slave clock.

4.2 Multiplexer Indicators

POWER – ON when the SR is connected to power.

ACTIVITY

OFF – no data activity.

ON – data is being transmitted.

LINE ERROR – flashes when a speed or parity error is detected.

MODEM READY

ON – Data Carrier Detect is present from the composite link device indicating an active composite link.

OFF – Data Carrier Detect is not present from the composite modem or DSU/CSU indicating a problem with the composite link.

PORT 1 SETUP – ON when the network management port functions have been mapped to data port 1 by depressing the front panel switch. To return these functions to the network management port, depress the front panel switch again.

LOOPBACK – Disabled

4.3 Optional DSU/CSU Indicators (4 port unit only)

TxD	Flashing	Data is being sent over the link.
RxD	Flashing	Data is being received from the link.
RTS	ON	Forced on or high from the multiplexer.
	OFF	No RTS from the multiplexer.
CTS	Follows RTS	CTS signal to the multiplexer.
DCD	ON	Normal condition.
	OFF	No carrier signal received from the far end.
TEST	ON	Unit is in loopback (DIP switch 5 UP)
	Flashing	Telephone line in loopback.

5. NETWORK MANAGEMENT PORT

5.1 Introduction

The Network Management port (NMP) is used to configure the SR multiplexer for proper operation. This connection must be used to configure the SR composite and data ports. The NMP can also be used to configure remote SR ports after a link is established between the host and remote sites.

5.2 Connections and Setup

Connection to the NMP is made either through a port on the rear of the multiplexer or by using Port 1 Setup.

5.2.1 Port 1 Setup

The easiest way to access the NMP functions is by using a terminal connected to port 1 of the multiplexer. A switch located on the front panel performs this function. See paragraph 4.1.1 for information. This option cannot be used if a printer is connected to port 1.

5.2.2 Dedicated Terminal or PC

The NMP functions are also available through a port on the rear of the unit labeled Network Management Port. To connect a dedicated terminal to this port, use the green cable provided and the appropriate adapter for either a terminal or PC. Set the terminal device for 9600 bps, 8 data bits, no parity, one stop bit and no flow control.

5.2.3 Dedicated Modem

For remote access to NMP functions, a dial-up modem may be connected to the Network Management Port. You must fix the DTE interface speed of the modem at 9600 bps, 8 data bits, no parity and one stop bit. Refer to your modem manual for appropriate setup procedures. Use the appropriate cable from paragraph 6.3.3 for connection.

5.3 Using the Network Management port

To activate the NMP, press the ENTER key. When you see **AT YOUR COMMAND >>**, the NMP is active and ready for your commands. Type H <Enter> to display the command set.

5.4 Commands

5.4.1 Help (H or ?)

<u>COMMAND</u>	<u>LOCAL</u>	<u>REMOTE</u>	<u>PARAGRAPH</u>
Show: Config	SC	RSC	5.4.2
Network	SN		5.4.3
Change: Port Config	CP	RCP	5.4.4
Delay Timeout	CD	RCD	5.4.5
Config Network	CN		5.4.6
Config Modem	CM		5.4.7
Set ID	ID	RID	5.4.8
Set Password	PW		5.4.9
Activity Counters/Zero	AC/Z	RAC/RZ	5.4.10
Test Tools	TT		5.4.14
Type	TY	RTY	5.4.11
Repeat Last Command	*		5.4.12
Disconnect NMP	BYE		5.4.13

This Help screen shows the choice of commands available. The commands allow you to display the selected options (Show network and configuration), configure the SR (Configure ports and Set ID), and perform many different diagnostic functions such as send a test message, monitor data, perform loopbacks, show flow control state, show activity and other useful tests.

5.4.2 Show (Port) Configuration

The Show Config (SC) command shows the current port configuration settings for either the local or the remote (RSC) ports. Port numbers may be included with this command to limit the display range. If no port numbers are included, settings for all ports are shown. Use this command to verify proper port configuration.

5.4.3 Show Network (Configuration)

The Show Network (SN) command displays the current network (composite port) configuration (SYNC or ASYNC).

NOTE

Several commands allow port numbers or port number ranges to be included on the command line. When port numbers are included, the syntax is as follows:

(Command)1	Port 1
(Command)1,2,4	Ports 1, 2 & 4
(Command)1 3 4	Ports 1, 3 & 4
(Command)2-4	Ports 2 thru 4

5.4.4 Change Port Configuration

The Change Port Config (CP / RCP) command sets the data port loopback, rate and output flow control configuration for each data port. Follow the prompts and examples on the screen to select the port(s) and parameter(s) you wish to change. One or more ports may be set with a single command by selecting a range of port numbers. The factory default setting is loop off, no busy, 9600 bps.

With optional firmware, this command is also used to set ports for 8 data bits plus EVEN, ODD, MARK, or NO parity.

5.4.5 Change Delay Timeout

This command (CD) is used to change two timeout parameters, DCD to Rx data delay and DCD holdover delay. These delays may be adjusted to insure data block integrity.

5.4.6 Configure Network

The Configure Network command (CN) allows configuration of the multiplexer composite port for asynchronous or synchronous operation.

If an internal DSU is installed, only synchronous operation is allowed.

5.4.7 Configure Modem

The Configure Modem command (CM) establishes a direct connection between the network management port and the composite port.

In the 4 port unit, this command is used to configure the optional built-in wireless modem. See paragraph 3.5.

In the 8 – 32 port units, this command is used to configure the optional internal DSU/CSU.

Type two consecutive ESC characters to return to the AT YOUR COMMAND >> prompt.

5.4.8 Set ID

The Set ID (ID / RID) command allows you to set or change either the local or remote multiplexer identifier. IDs can be a maximum of 15 characters in length. Pressing <Enter> with no entry will leave the ID unchanged.

5.4.9 Set Password

Use the Set Password (PW) command to set a password for access to the network management port. The password may be up to 15 characters long and is case sensitive.

When password is active, the user is allowed three attempts and is then disconnected.

To clear the password, type DELETE at the PW prompt or reset the unit to defaults as described in paragraph 3.8.

5.4.10 Activity Counts / Zero

The Activity Counts (AC / RAC) command shows transmit and receive data statistics for all ports. The data are presented in terms of blocks of information sent and received by the network and each data port. Error counts are also shown. A range of ports may be included with this command to reduce the number of ports shown.

The Z and RZ commands are used to zero the counters so that current activity can be monitored.

5.4.11 Type

The Type (TY) command displays information about the local multiplexer including firmware version, number of ports and multiplexer ID. The Remote Type (RTY) command is used to display similar information about the remote multiplexer.

5.4.12 Repeat Last Command

To repeat the last command, simply press the * key. This is handy for repeating screens of constantly changing data.

5.4.13 Disconnect NMP

The BYE command toggles the CTS output from the Network Management port. This is used to disconnect equipment such as dial-up modems or the DCB Access Switch.

5.4.14 Test Tools

The Test Tools (TT) menu summarizes the test and troubleshooting commands. These commands are listed separately to reduce the clutter in the main help list, but are always available from the command prompt.

<u>COMMAND</u>	<u>LOCAL</u>	<u>REMOTE</u>	<u>PARAGRAPH</u>
Monitor Port Tx	MT#		5.4.15
Monitor Port Rx	MR#		5.4.15
NMP Parity	P		5.4.16
Ping Remote Mux	PING		5.4.17
Reset MUX	RESET	RRESET	5.4.18

5.4.15 Monitor Port TX or RX

The Monitor Port TX (MT#) command monitors data transmitted from the selected port to the corresponding port of the remote multiplexer. The Monitor Port RX (MR#) command monitors data received by the selected port from the corresponding port of the remote multiplexer. A local port number must be included on the command line.

When port monitor is active, two ESC characters are used to end the test.

5.4.16 NMP Parity

The NMP Parity command (P) sets the parity for the network management port. The factory default is SPACE (8,N,1).

5.4.17 Ping Remote Mux

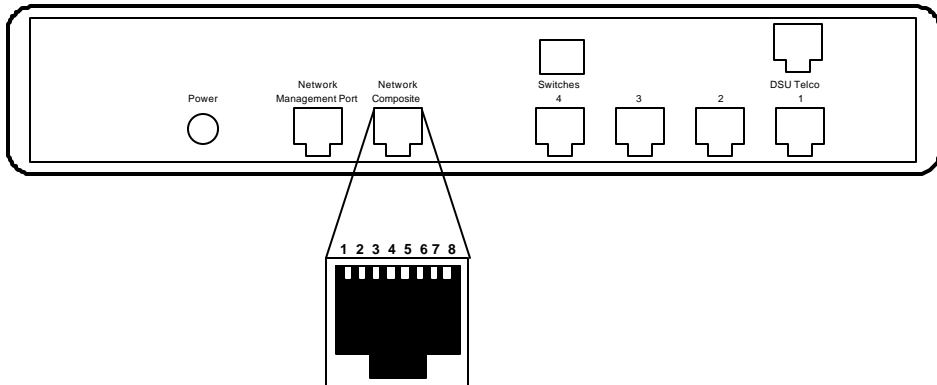
The PING command pings the remote multiplexer and displays the response time in milliseconds.

5.4.18 Reset Mux

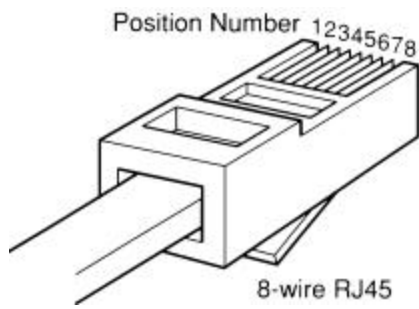
The Reset Mux (RESET) command performs a local multiplexer reset. To reset the remote multiplexer use RRESET.

6. INTERFACE SIGNALS AND CABLING

6.1 Connector Location and Pin Reference



SR 4 Rear Panel and RJ-45 Jacks



RJ-45 Plug Positions

6.2 Port Interface

6.2.1 Composite Port (RJ-45)

<u>Pin</u>	<u>Signal</u>	<u>In/Out</u>
1	Receive Clock	IN
2	Transmit Clock	IN
3	Data Carrier Detect	IN
4	Signal Ground	
5	Transmit Data	OUT
6	Receive Data	IN
7	Request to Send	OUT
8	Clear to Send	IN

6.2.2 Data Ports (RJ-45)

<u>Pin</u>	<u>Signal</u>	<u>In/Out</u>
1	Data Set Ready	OUT
2	Data Carrier Detect	OUT
3	Busy	IN
4	Signal Ground	
5	Receive Data	OUT
6	Transmit Data	IN
7	Clear to Send	OUT
8	Request to Send	IN

6.2.3 Network Management Port (RJ-45)

<u>Pin</u>	<u>Signal</u>	<u>In/Out</u>
1	Not Used	
2	Not Used	
3	Data Terminal Ready	IN
4	Signal Ground	
5	Receive Data	OUT
6	Transmit Data	IN
7	Clear to Send	OUT
8	Request to Send	IN

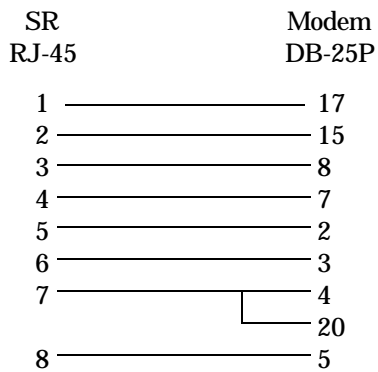
6.2.4 Optional Built-In DSU Interface (RJ-48S)

<u>Pin</u>	<u>Signal</u>	<u>In/Out</u>
1	Transmit Data	OUT
2	Transmit Data	OUT
7	Receive Data	IN
8	Receive Data	IN

6.3 Cables

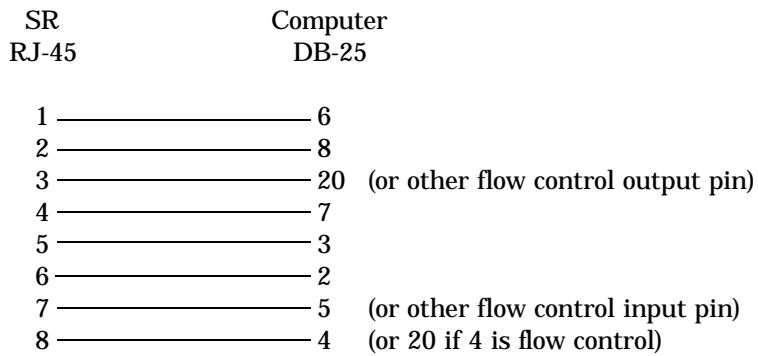
6.3.1 Composite Port to Modem

A two foot composite to modem cable is included with each SR multiplexer. The configuration is as follows:



6.3.2 Data Ports to Host Computer

Configured as DTE



6.3.2 Data Ports to Host Computer, continued

Configured as DCE

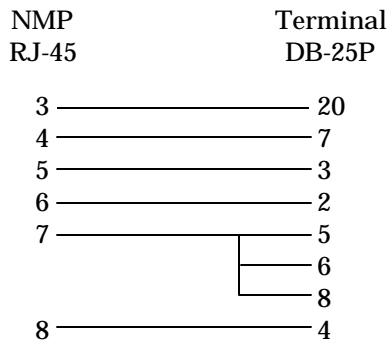
SR RJ-45	Computer DB-25
1	
2	20 (or 4 if 20 is flow control)
3	5 (or other flow control output pin)
4	7
5	2
6	3
7	4 (or other flow control input pin)
8	8

To a PC Com Port

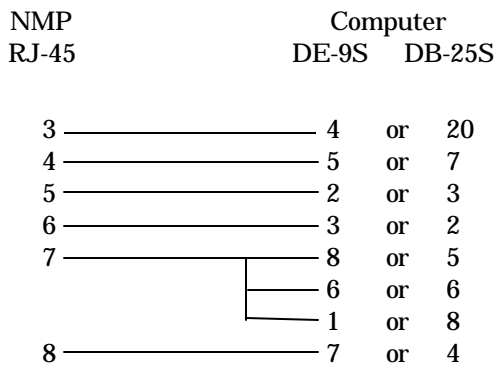
SR RJ-45	Computer DB-25S	DE-9S
1	6	or 6
2	8	or 1
3	4	or 7
4	7	or 5
5	3	or 2
6	2	or 3
7	5	or 8
8	20	or 4

6.3.3 Network Management Port

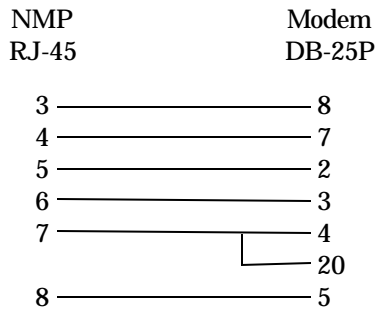
To a TERMINAL



To a PC using terminal emulation



To a dial-up MODEM for remote access



7. TROUBLESHOOTING

7.1 General Approach

When troubleshooting problems, a rational plan can save you many hours of frustration. The following is a brief outline of standard troubleshooting procedures.

1. Gather the facts to determine the exact nature of the problem.
2. Draw a picture of the system showing the equipment at both the host and remote ends and the phone lines or in-house wiring. Use this as a reference to note your observations, test steps and test results. A picture keeps you focused and often saves duplicate effort.
3. Record the front panel indications before changing anything. This is an important part of fact gathering
4. If you change anything, change only one thing at a time.
5. Use the built-in test functions, especially the loopback tests and record your results.

7.2 Loopback Tests

It is best to begin loopback testing at the remote terminal and work toward the host. If all the loopbacks are successful, the data communications equipment and the terminal are working correctly.

Put the remote multiplexer port in loopback and have someone type alpha characters on the keyboard of the affected terminal. If the characters appear correctly on the screen, the port is working. Next loop the associated port of the host multiplexer. If characters again appear correctly, the communications link and the ports on both multiplexers are working correctly. The problem then is with the host computer port or the cable between the host computer and the multiplexer.

Port loopbacks can be turned on and off from the Network Management port of the multiplexer. If a NMP terminal is not available, port loopback can be enabled using the Port 1 Setup function of the remote multiplexer

7.3 Installation Troubleshooting, Modems or DSUs

First, set up the Modems or DSUs without connecting the multiplexers. If DSUs are used they should be set to constant carrier, also called forced Request To Send, or constant RTS.

Carrier Detect should be ON at both locations.

7.4 Installation Troubleshooting, Multiplexers

Before trying terminals, make sure the multiplexers are able to “see” each other. Use the RTY command to verify a response from the remote multiplexer. If you get a correct response to RTY, the link is up and the multiplexers are communicating.

7.5 Installation Troubleshooting, Terminals

Terminal problems typically fall into four categories:

1. The terminal or printer gets no data
2. The terminal or printer gets “garbage” data
3. Blocks of data are lost
4. Terminals or printers seem to “hang”.

When a terminal gets no data, check to see the cables are wired correctly and that flow control is set properly.

If the terminal gets “garbage” data, check the speeds of the host and remote multiplexers, the terminal and the computer ports to make sure they match.

Blocks of data are lost most often when data is sent to a printer or a lot of data is being displayed on a terminal. Most of these problems are due to flow control not matching between the printer or terminal and the multiplexer.

If terminals and printers work for a while and then “hang”, check the flow control settings. When Xon/Xoff flow control is set to a different parity on the multiplexer than on the terminal or printer, the result is either a “hung” device that is flow controlled off but never back on, or a device that is never flowed off causing buffer overflow and lost data.

7.6 Assistance

If you need assistance troubleshooting your system, contact DCB customer support at (217) 897-6600 between 8:00 am and 5:00 pm central time Monday through Friday.

8. WARRANTY

DCB multiplexers are warranted to be free of defects in materials and workmanship for two years. Data Comm for Business will repair or replace any equipment proven to be defective within the warranty period. All warranty work is F.O.B. Dewey, IL. This warranty is exclusive of abuse, misuse, accidental damage, acts of God or consequential damages, etc. DCB liability shall not exceed the original purchase price.

All equipment returned for repair must be accompanied by a Returned Material Authorization (RMA) number. To receive an RMA number, call (217) 897-6600 between the hours of 8 AM and 5 PM central time. Equipment must be shipped prepaid to DCB and will be returned at DCB's expense.

Ship returned items to:

Data Comm for Business
2949 CR 1000E
Dewey, IL 61840

Data Comm for Business, Inc.
PO Box 6329
Champaign, IL 61826-6329

Tel (217) 897-6600
Fax (217) 897-1331
Email support@dcbnet.com