



Errata Sheet for Operation and Installation SC 5034

Publication 076R106-000, Issue 5

Overview

This publication reflects changes to the *Installation and Operation Instructions for Desktop V.F 28.8* manual.

FAX Software:

The description of the modem's FAX capabilities that appears in *Chapter 1, Introduction*, makes references to "Faxworks software supplied with the modem." GDC no longer supplies **FAX** software with the modem.

Currently, QuickLink FAX software is available separately from GDC to support the modem's FAX Class 1 transmission and reception capabilities. The GDC part number for that software is 759-052S001.

Additional Manual Updates:

Additional V.F 28.8 Modem updates and product release notes are listed on the GDC web site which can be found at: <http://www.gdc.com/>

The modem information is located in the Service & Support section under Modem/DSU support.

GDC 076R106-000
Issue 5 - August 1997

Installation and Operation

SpectraComm 5034

Data Set Emulator

Warning

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to CISPR 22 which is designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference. The user is cautioned that any changes or modifications not expressly approved by General DataComm void the user's authority to operate the equipment.

This digital apparatus does not exceed Class A limits for radio noise emissions from digital apparatus described in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

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4,841,561	5,146,472
5,048,056	5,265,151
5,291,520	5,465,273

Other patents pending. Some foreign patents may apply.

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Publication Update Bulletin for SpectraComm 5034 Data Set Emulator

New Features

This addendum describes two new features added to GDC V.34 modems that reside in a SpectraComm shelf. The first is terminal interface functionality, the second is a pair of new Private Line Handshake Modes for low speed operation.

Terminal Interface

GDC V.34 products housed in a SpectraComm shelf support terminal interface functionality for monitoring and configuration. Access to the terminal interface functions takes place through a SpectraComm Manager (SCM) card installed in the same shelf (or pair of shelves connected by daisy chain cables) with the V.34 unit. One SCM card can support interface functions for up to 15 units in a single shelf or up to 31 units in a pair of shelves.

The following list identifies the three V.34 products that support terminal interface functionality, and the firmware revision level of each at which the functionality was added:

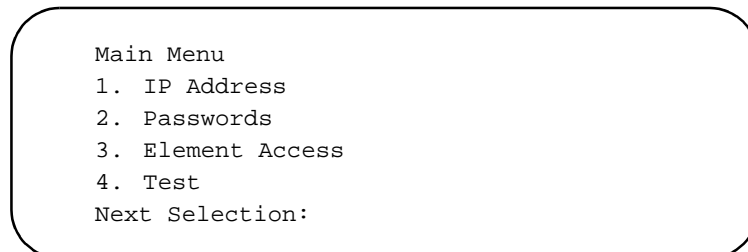
- V.F 28.8 Modem (SpectraComm version), Rev
- Dual V.34 Modem, Rev
- SpectraComm 5034 Data Set Emulator, Rev

Initiating a Terminal Interface Session

The first portion of a terminal interface session varies depending on whether you're using a VT100-compatible terminal connected directly to the SCM front panel or a computer with a Telnet connection to the SCM LAN port.

VT100-compatible Terminal

When you connect a terminal to the SCM front panel, the following screen is the first to appear



```
Main Menu
1. IP Address
2. Passwords
3. Element Access
4. Test
Next Selection:
```

Figure 1 SCM Terminal Interface Main Menu

Type 3 and press the Enter key. The screen then displays the Shelf Inventory screen that appears below.

The other selections in this menu all relate to SCM functionality. They are discussed in the *SpectraComm Manager Card Installation and Operation Manual*, GDC Publication Number 048R303-000.

Telnet Connection

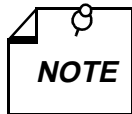
The *SpectraComm Manager Card Installation and Operation Manual*, GDC Publication Number 048R303-000 explains how to establish a Telnet connection to the SCM LAN port. When you do so, the following screen is the first to appear.

```
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Inc.
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SCM Application Version 3.2

login:
```

Figure 2 SCM Telnet Login

After you enter the login password the screen displays the Shelf Inventory screen that appears below.



There is a 10-minute timeout on the terminal interface. If you allow 10 minutes to pass with no activity, that is without pressing any key on the keyboard, the unit terminates the session. At that point the display returns to the SCM Main Menu if you are using a terminal connected to the SCM front panel, or to the SCM login screen if you are using a Telnet connection.

Selecting a Unit (Shelf Inventory Screen)

From this point, procedures are the same for both types of connection. The Shelf Inventory screen below is for a hypothetical two-shelf installation in which the first shelf contains an SC 5000 system with 12 SC 5034 Data Set Emulators, and the second shelf contains a mix of Dual V.34 modems and V.F 28.8 modems. The two columns for Slots 17 through 32 do not appear when there is only one shelf.

```

      SHELF INVENTORY
SlotCard          SlotCard
-----
[1] SCM          [17] DUAL V.34
[2] SC5001      [18] DUAL V.34
[3] SC5034      [19] DUAL V.34
[4] SC5034      [20] DUAL V.34
[5] SC5034      [21] DUAL V.34
[6] SC5034      [22] DUAL V.34
[7] SC5034      [23] DUAL V.34
[8] SC5034      [24] DUAL V.34
[9] SC5034      [25] VF2888
[10] SC5034     [26] VF2888
[11] SC5034     [27] VF2888
[12] SC5034     [28] VF2888
[13] SC5034     [29] VF2888
[14] SC5034     [30] VF2888
[15]            [31] VF2888
[16]            [32] VF2888

[0] Close Session

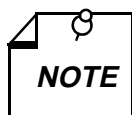
Enter slot number: [ ]

```

Figure 3 SCM Terminal Interface Shelf Inventory

The Shelf Inventory displays the word "alarm" in parentheses next to the name of any unit that currently has an active alarm condition.

Type the slot number of the unit you intend to work with, and press the Enter key. If the selected unit is a Dual V.34 modem or an SC 5034 DSE, the unit displays the line selection screen shown below. If the selected unit is a V.F 28.8 modem, it displays the Main Menu that is shown below the line selection screen.



You can return directly to the Shelf Inventory screen from any V.34 terminal interface screen by pressing the Control (Ctrl) key and the letter C at the same time.

```
[G] Go To -> Shelf Inventory
[1] Line 1
[2] Line 2
Enter selection:
```

Figure 4 V.34 Terminal Interface Line Selection

In the line selection screen, Line 1 equates to Modem A in the unit and Line 2 equates to Modem B. Type the selection number of the one you intend to work with and press the Enter key. The unit responds by displaying the Main Menu. The menu shown here is for the SpectraComm Dual V.34 modem; the header line varies in screens for the three units.

```
DUAL SPECTRACOMM V.34
SLOT: 08   LINE: 1

[1] AT SESSION           [2] ALARMS
[3] DTE STATUS           [4] CALL STATISTICS

[0] RETURN TO SHELF INVENTORY

Select:[ ]
```

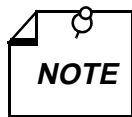
Figure 5 V.34 Terminal Interface Main Menu

Type the number that corresponds to the function with which you intend to work and press the Enter key.

AT Session

The AT Session selection from the Main Menu enables you to perform configuration by means of the terminal interface. Making this selection prepares the unit to accept a subset of the AT commands that includes the configuration commands and the commands, such as command set help or identification and checksum, that query the unit for information. Commands that you cannot use during a terminal interface AT Session are those for

- Remote configuration
- Call control (dialling or answering)
- Test functions
- Repeat last command (A/)
- Escape sequence (+++) that places a unit configured for private line operation into command mode.



The unit can be configured (by the %Vn command) to accept configuration commands in the AT format or in any one of three V.25 bis formats. Selecting AT Session through the terminal interface automatically forces the unit into the AT command mode.

If you intend the unit to accept V.25 bis commands, be sure to make the %V setting at the end of the AT Session. If you need to save a User Configuration Profile with %V set for V.25 bis commands, you must include that command (&Wn) on the same line with the %V command. Once you press the Enter key to put the command line into effect, the unit cannot accept any further standard AT commands.

Type AT< and press the Enter key to end the AT Session.

The AT parser that acts on the commands is located in DTE interface circuitry. Because of that, the unit can only accept AT commands while it is off-line (idle mode). If the unit is in data mode when you attempt to start an AT Session, it responds with the message "WARNING: THE MODEM IS ON LINE. Do you wish to Continue? (Y/N):"

If you do not want to interrupt the connection, type N and press the Enter key. The terminal interface display returns to the Main Menu.

The procedure for an AT Session differs between units configured for switched line operation and those configured for private line operation.

Switched Line Units

The procedure for a terminal interface AT Session involves the following steps when the selected unit is configured for switched line operation:

1. At the Main Menu screen, type 1 and press the Enter key.
2. If the selected unit is on-line, the screen displays the message "WARNING: THE MODEM IS ON LINE. Do you wish to Continue? (Y/N):" Type Y and press the Enter key to make the unit disconnect and enter the AT Session. If you choose not to interrupt communications, type N and press the Enter key.
3. When you're in the AT Session, either because the selected unit was not on-line or because you had it disconnect, the screen displays the message "To Exit AT Mode and Return to Main Menu, use the "AT<" Command !" Below that line the screen is blank except for the cursor.
4. Type AT commands to the unit just as you would from the DTE.
5. When you are done entering commands, type AT< and press the Enter key. The display returns to the Main Menu screen.

Private Line Units

The AT Session procedure for a unit configured for private line operation is complicated by the fact that as soon as the unit is disconnected, it begins retraining to return on-line. That process takes roughly 20 seconds.

The procedure for a terminal interface AT Session involves the following steps when the selected unit is configured for private line operation:

1. At the Main Menu screen, type 1 and press the Enter key.

The screen displays the message "WARNING: THE MODEM IS ON LINE. Do you wish to Continue? (Y/N):"

2. Type Y and press the Enter key to make the unit disconnect and enter the AT Session.

The screen then displays the message "To Exit AT Mode and Return to Main Menu, use the "AT<" Command !" Below that line the screen is blank except for the cursor.

Because it is configured for private line operation, the unit immediately begins retraining to return on-line. The retrain process takes roughly 20 seconds, during which time the unit can accept AT commands. The procedure that follows in steps 3 – 7 extends the time available for inputting AT commands.

3. Begin the AT Session by checking and recording two details from AT help screens so you can be sure to restore the settings correctly at the end of the AT Session:

Type AT &\$ and press the Enter key to display the current settings of the AT & options. Write down the setting of the &L option that determines what network type (switched, 2-wire private, or 4-wire private) the unit operates in.

Then type AT %\$ and press the Enter key to display the current settings of the AT % options. Write down the setting of the %O option that determines which band (originate or answer) the unit transmits on.

4. Next, type AT &L0 and press the Enter key. That places the unit into switched line mode so that it does not retrain. As long as the unit you are working with remains in switched line mode, the modem at the far end of the private line continues unsuccessful attempts to retrain.
5. Proceed to perform whatever configuration you need to on the unit, typing AT commands just as you would from the DTE. When you have completed all that you need to do, check the AT % option settings again to be sure that %O is set correctly.
6. Then issue the &L command to restore the unit to its original private line mode.
7. If you intend to save the configuration as a User Profile (&W command) do so, quickly, after you restore the unit to private line mode.
8. Type AT< and press the Enter key. If the unit has not completed retraining it returns to the Main Menu screen. If it *has* reconnected, there is no response; you then have to type AT< and press the Enter key again to return to the Main Menu.

Alarms

The terminal interface Alarms function displays a screen of status information concerning alarm conditions. *Figure 6* illustrates the Alarms screen.

The screen displays ON or OFF for each alarm condition to indicate whether or not the condition currently exists. Definitions of the alarm conditions appear below.

To dismiss the Alarms screen and return to the Main Menu, press the Enter key.

The Alarms screen is a snapshot of conditions at the moment you access the screen. You can update the display by dismissing the screen and then selecting it again from the Main Menu.

```

DUAL SPECTRACOMM V.34
SLOT: 08  LINE: 1
ALARMS

ALARM      STATUS      ALARM      STATUS
-----
NO DTR:    OFF        CONFIG CKSUM ERR:  OFF
NO TXD:    ON         CALL FAILED:       OFF
NO RXD:    ON         CALL LENGTH:       OFF
ON DBU:    OFF        RING NO ANSWER:   OFF
DCD LOSS:  ON         TEST TIMED OUT:   OFF
RETRAIN:   OFF

Hit a <CR> to Continue:

```

Figure 6 Alarms Screen

Alarms

No DTR – indicates the unit is not receiving Data Terminal Ready from the DTE

No TXD – occurs when a unit configured for constant TX carrier experiences one minute without transitions in the Transmit Data

No RXD – occurs when a unit configured for constant RX carrier experiences one minute without transitions in the Receive Data

On DBU – occurs when a modem that normally operates on a dedicated line connection has initiated a switched network connection due to problems with the dedicated line

DCD Loss – indicates loss of incoming data

Retrain – occurs when the number of retrains exceeds the configured retrain count threshold

Config Checksum Err – indicates that the non-volatile memory that stores configuration has become corrupted

Call Failed – can occur for a variety of reasons; check the Call Statistics screen for more detailed information when a Call Failed alarm occurs

Call Length – occurs when the duration of a call exceeds the configured call length threshold

Ring No Answer – occurs when an incoming call rings but the modem does not answer

Test Timed Out – occurs when a diagnostic test is ended automatically by the configured Test Time limit

Fsync Lost – appears only on the Alarms screen for the SC 5034 DSE; occurs when the unit loses frame synchronization

DTE Status

The terminal interface DTE Status function displays a screen of information concerning DTE interface signals. *Figure 7* illustrates the DTE Status screen, which displays the current status of eight DTE interface signals as OFF or ON.

To dismiss the DTE Status screen and return to the Main Menu, press the Enter key.

The DTE Status screen is a snapshot of conditions at the moment you access the screen. You can update the display by dismissing the screen and then selecting it again from the Main Menu.

```
DUAL SPECTRACOMM V.34
SLOT: 08  LINE: 1
DTE STATUS

RTS:      OFF          CTS:      ON
DTR:      ON           DSR:      OFF
RING:     OFF          DCD:      OFF
CLK:      OFF          TM:       OFF

Hit a <CR> to Continue:
```

Figure 7 DTE Status Screen

Call Statistics

The terminal interface Call Statistics function displays a screen of information concerning the current or most recent connection by the unit. If the unit is on-line when you display the screen, the statistics are those for the current connection. If it isn't on-line, it displays the statistics of the most recently completed connection. *Figure 8* illustrates the Call Statistics screen.

To dismiss the Call Statistics screen and return to the Main Menu, press the Enter key.

The Call Statistics screen is a snapshot of conditions at the moment you access the screen. You can update the display by dismissing the screen and then selecting it again from the Main Menu.

```
DUAL SPECTRACOMM V.34
SLOT: 08   LINE: 1
CALL STATISTICS

DTE RATE:           9600
DCE TX RATE:        00000
DCE RX RATE:        00000
CALL LENGTH (Sec):  00000
RETRAIN COUNT:      00
FALLBACK COUNT:     00
FALLFORWARD COUNT:  00
RX SIGNAL LEVEL(dB): 00
SNR(dB):            00
CONNECT PROTOCOL:   NONE
CONNECT MODE:       ORG

Hit a <CR> to Continue:
```

Figure 8 Call Statistics Screen

The Call Statistics window displays the following information:

DTE Rate – the speed, in bps, of the data exchange between the unit and its DTE

DCE Tx Rate – the speed, in bps, at which the transmitter connected to the remote modem

DCE Rx Rate – the speed, in bps, at which the receiver connected to the remote modem

Call Length (Sec) – up to 65535 seconds. During a current call, displays duration at the time the screen was accessed.

Retrain Count – number of times the unit had to perform a retrain sequence during the call (0 to 127)

Fallback Count – number of times the unit performed fallback to a lower connection speed during the call (0 to 127)

Fall Forward Count – number of times the unit performed fall forward to a higher connection speed during the call (0 to 127)

RX Signal Level – 0 to -48dBm

Signal-to-Noise Ratio – 0 to 40dB

Connect Protocol – protocol used to manage the connection, determined by the modems during handshake. When this displays NONE the modem is off-line and the statistics being displayed are from the last completed call.

Connect Mode – mode, Originate or Answer, in which local unit performed handshake to initiate connection

New Private Line Handshake Modes

Two new Private Line Handshake Modes, &P4 and &P5, are added for low speed operation:

&P n Private line handshake mode

&P n controls the selection of the private line handshake mode.

&P0	selects V.34 only (28.8 — 2400)
&P1	selects V.32 <i>bis</i> only (14.4 — 4800)
&P2	selects V.32 only (9600 and 4800)
&P3	selects IUT-T 212 (1200), Dual V.34 and SpectraComm V.F 28.8 only
&P4	selects IUT-T 103 (300), Dual V.34 and SpectraComm V.F 28.8 only



Publication Update Bulletin for SpectraComm 5034 Data Set Emulator

New Features

This addendum describes two new features that have been added to the SC 5034 DSE. One of them, terminal interface functionality, is a feature that has been added to all GDC V.34 devices that reside in a SpectraComm shelf.

The second feature, ISDN digital operation capability, is specific to the SC 5034 DSE. A group of new AT commands are added to the command set for the DSE to support this new capability.

Terminal Interface

GDC V.34 products housed in a SpectraComm shelf support terminal interface functionality for monitoring and configuration. Access to the terminal interface functions takes place through a SpectraComm Manager (SCM) card installed in the same shelf (or pair of shelves connected by daisy chain cables) with the V.34 unit. One SCM card can support interface functions for up to 15 units in a single shelf or up to 31 units in a pair of shelves.

The terminal interface functionality is present in the SpectraComm 5034 Data Set Emulator beginning with firmware revision Rev 6.3.0.0 (H-).

Initiating a Terminal Interface Session

The first portion of a terminal interface session varies depending on whether you're using a VT100-compatible terminal connected directly to the SCM front panel or a computer with a Telnet connection to the SCM LAN port.

VT100-compatible Terminal

When you connect a terminal to the SCM front panel, the following screen is the first to appear

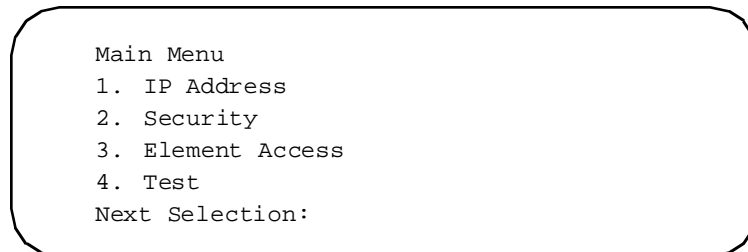


Figure 1 SCM Terminal Interface Main Menu

Type 3 and press the Enter key. The screen then displays the Shelf Inventory screen that appears below.

The other selections in this menu all relate to SCM functionality. They are discussed in the *SpectraComm Manager Card Installation and Operation Manual*, GDC Publication Number 048R303-000.

Telnet Connection

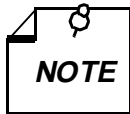
The *SpectraComm Manager Card Installation and Operation Manual*, GDC Publication Number 048R303-000 explains how to establish a Telnet connection to the SCM LAN port. When you do so, the following screen is the first to appear.

```
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SCM Application Version 3.2

login:
```

Figure 2 SCM Telnet Login

After you enter the login password the screen displays the Shelf Inventory screen that appears below.



There is a 10-minute timeout on the terminal interface. If you allow 10 minutes to pass with no activity, that is without pressing any key on the keyboard, the unit terminates the session. At that point the display returns to the SCM Main Menu if you are using a terminal connected to the SCM front panel, or to the SCM login screen if you are using a Telnet connection.

Selecting a Unit (Shelf Inventory Screen)

From this point, procedures are the same for both types of connection. The Shelf Inventory screen below is for a hypothetical two-shelf installation in which the first shelf contains an SC 5000 system with 12 SC 5034 Data Set Emulators, and the second shelf contains a mix of Dual V.34 modems and V.F 28.8 modems. The two columns for Slots 17 through 32 do not appear when there is only one shelf.

```

      SHELF INVENTORY
SlotCard          SlotCard
-----
[1] SCM          [17] DUAL V.34
[2] SC5001      [18] DUAL V.34
[3] SC5034      [19] DUAL V.34
[4] SC5034      [20] DUAL V.34
[5] SC5034      [21] DUAL V.34
[6] SC5034      [22] DUAL V.34
[7] SC5034      [23] DUAL V.34
[8] SC5034      [24] DUAL V.34
[9] SC5034      [25] VF2888
[10] SC5034     [26] VF2888
[11] SC5034     [27] VF2888
[12] SC5034     [28] VF2888
[13] SC5034     [29] VF2888
[14] SC5034     [30] VF2888
[15]            [31] VF2888
[16]            [32] VF2888

[0] Close Session

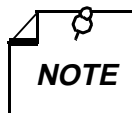
Enter slot number: [ ]

```

Figure 3 SCM Terminal Interface Shelf Inventory

The Shelf Inventory displays the word "alarm" in parentheses next to the name of any unit that currently has an active alarm condition.

Type the slot number of the unit you intend to work with, and press the Enter key. If the selected unit is a Dual V.34 modem or an SC 5034 DSE, the unit displays the line selection screen shown below. If the selected unit is a V.F 28.8 modem, it displays the Main Menu that is shown below the line selection screen.



You can return directly to the Shelf Inventory screen from any V.34 terminal interface screen by pressing the Control (Ctrl) key and the letter C at the same time.


```
[G] Go To -> Shelf Inventory
[1] Line 1
[2] Line 2
Enter selection:
```

Figure 4 SC 5034 Terminal Interface Line Selection

In the line selection screen, Line 1 equates to Modem A in the unit and Line 2 equates to Modem B. Type the selection number of the one you intend to work with and press the Enter key. The unit responds by displaying the Main Menu.

```
                SPECTRACOMM 5034
                SLOT: 08   LINE: 1

[1] AT SESSION           [2] ALARMS
[3] DTE STATUS           [4] CALL STATISTICS

                [0] RETURN TO SHELF INVENTORY

                Select:[ ]
```

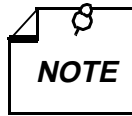
Figure 5 SC 5034 Terminal Interface Main Menu

Type the number that corresponds to the function with which you intend to work and press the Enter key.

AT Session

The AT Session selection from the Main Menu enables you to perform configuration by means of the terminal interface. Making this selection prepares the unit to accept a subset of the AT commands that includes the configuration commands and the commands, such as command set help or identification and checksum, that query the unit for information. Commands that you cannot use during a terminal interface AT Session are those for

- Remote configuration (*W, *R, *P, *X)
- Call control – dialling and answering functions (D, A, H, O)
- Test functions (&T)
- Repeat last command (A/)
- Escape sequence (+++) that places a unit configured for private line operation into command mode.



The unit can be configured (by the %Vn command) to accept configuration commands in the AT format or in any one of three V.25 bis formats. Selecting AT Session through the terminal interface automatically forces the unit into the AT command mode.

If you intend the unit to accept V.25 bis commands, be sure to make the %V setting at the end of the AT Session. If you need to save a User Configuration Profile with %V set for V.25 bis commands, you must include that command (&Wn) on the same line with the %V command. Once you press the Enter key to put the command line into effect, the unit cannot accept any further standard AT commands.

Type AT< and press the Enter key to end the AT Session.

The AT parser that acts on the commands is located in DTE interface circuitry. Because of that, the unit can only accept AT commands while it is off-line (idle mode). If the unit is in data mode when you attempt to start an AT Session, it responds with the message "WARNING: THE MODEM IS ON LINE. Do you wish to Continue? (Y/N):"

If you do not want to interrupt the connection, type N and press the Enter key. The terminal interface display returns to the Main Menu.

The procedure for an AT Session differs between units configured for switched line operation and those configured for private line operation.

Switched Line Units

The procedure for a terminal interface AT Session involves the following steps when the selected unit is configured for switched line operation:

1. At the Main Menu screen, type 1 and press the Enter key.
2. If the selected unit is on-line, the screen displays the message "WARNING: THE MODEM IS ON LINE. Do you wish to Continue? (Y/N):" Type Y and press the Enter key to make the unit disconnect and enter the AT Session. If you choose not to interrupt communications, type N and press the Enter key.
3. When you're in the AT Session, either because the selected unit was not on-line or because you had it disconnect, the screen displays the message "To Exit AT Mode and Return to Main Menu, use the "AT<" Command !" Below that line the screen is blank except for the cursor.
4. Type AT commands to the unit just as you would from the DTE.
5. When you are done entering commands, type AT< and press the Enter key. The display returns to the Main Menu screen.

Private Line Units

The AT Session procedure for a unit configured for private line operation is complicated by the fact that as soon as the unit is disconnected, it begins retraining to return on-line. That process takes roughly 20 seconds.

The procedure for a terminal interface AT Session involves the following steps when the selected unit is configured for private line operation:

1. At the Main Menu screen, type 1 and press the Enter key.

The screen displays the message "WARNING: THE MODEM IS ON LINE. Do you wish to Continue? (Y/N):"

2. Type Y and press the Enter key to make the unit disconnect and enter the AT Session.

The screen then displays the message "To Exit AT Mode and Return to Main Menu, use the "AT<" Command !" Below that line the screen is blank except for the cursor.

Because it is configured for private line operation, the unit immediately begins retraining to return on-line. The retrain process takes roughly 20 seconds, during which time the unit can accept AT commands. The procedure that follows in steps 3 – 7 extends the time available for inputting AT commands.

3. Begin the AT Session by checking and recording two details from AT help screens so you can be sure to restore the settings correctly at the end of the AT Session:

Type AT &\$ and press the Enter key to display the current settings of the AT & options. Write down the setting of the &L option that determines what network type (switched, 2-wire private, or 4-wire private) the unit operates in.

Then type AT %\$ and press the Enter key to display the current settings of the AT % options. Write down the setting of the %O option that determines which band (originate or answer) the unit transmits on.

4. Next, type AT &L0 and press the Enter key. That places the unit into switched line mode so that it does not retrain. As long as the unit you are working with remains in switched line mode, the modem at the far end of the private line continues unsuccessful attempts to retrain.
5. Proceed to perform whatever configuration you need to on the unit, typing AT commands just as you would from the DTE. When you have completed all that you need to do, check the AT % option settings again to be sure that %O is set correctly.
6. Then issue the &L command to restore the unit to its original private line mode.
7. If you intend to save the configuration as a User Profile (&W command) do so, quickly, after you restore the unit to private line mode.
8. Type AT< and press the Enter key. If the unit has not completed retraining it returns to the Main Menu screen. If it *has* reconnected, there is no response; you then have to type AT< and press the Enter key again to return to the Main Menu.

Alarms

The terminal interface Alarms function displays a screen of status information concerning alarm conditions. *Figure 6* illustrates the Alarms screen.

The screen displays ON or OFF for each alarm condition to indicate whether or not the condition currently exists. Definitions of the alarm conditions appear below.

To dismiss the Alarms screen and return to the Main Menu, press the Enter key.

The Alarms screen is a snapshot of conditions at the moment you access the screen. You can update the display by dismissing the screen and then selecting it again from the Main Menu.

```

                SPECTRACOMM 5034
                SLOT: 08  LINE: 1
                ALARMS

                ALARM      STATUS      ALARM      STATUS
                -----      -
                NO DTR:    OFF        CONFIG CKSUM ERR:  OFF
                NO TXD:    ON          CALL FAILED:       OFF
                NO RXD:    ON          CALL LENGTH:       OFF
                FALLBACK:  OFF        RING NO ANSWER:   OFF
                DCD LOSS:  ON          TEST TIMED OUT:   OFF
                RETRAIN:   OFF        FSYNC LOST:       OFF
                REMOTE CFG: OFF        POOR SIGNAL QUAL:  OFF

                Hit a <CR> to Continue:

```

Figure 6 Alarms Screen

Alarms

No DTR – indicates the unit is not receiving Data Terminal Ready from the DTE

No TXD – occurs when a unit configured for constant TX carrier experiences one minute without transitions in the Transmit Data

No RXD – occurs when a unit configured for constant RX carrier experiences one minute without transitions in the Receive Data

Fallback – occurs when a modem lowers its DCE connect rate because of poor line conditions

DCD Loss – indicates loss of incoming data

Retrain – occurs when the number of retrains exceeds the configured retrain count threshold

Config Checksum Err – indicates that the non-volatile memory that stores configuration has become corrupted

Call Failed – can occur for a variety of reasons; check the Call Statistics screen for more detailed information when a Call Failed alarm occurs

Call Length – occurs when the duration of a call exceeds the configured call length threshold

Ring No Answer – occurs when an incoming call rings but the modem does not answer

Test Timed Out – occurs when a diagnostic test is ended automatically by the configured Test Time limit

Fsync Lost – occurs when the unit loses frame synchronization

Remote Cfg – indicates a remote configuration session has been established

Poor Signal Qual – indicates a low signal-to-noise ratio on the network connection

DTE Status

The terminal interface DTE Status function displays a screen of information concerning DTE interface signals. *Figure 7* illustrates the DTE Status screen, which displays the current status of eight DTE interface signals as OFF or ON.

To dismiss the DTE Status screen and return to the Main Menu, press the Enter key.

The DTE Status screen is a snapshot of conditions at the moment you access the screen. You can update the display by dismissing the screen and then selecting it again from the Main Menu.

```
          SPECTRACOMM 5034
        SLOT: 08  LINE: 1
          DTE STATUS

      RTS:      OFF          CTS:      ON
      DTR:      ON           DSR:      OFF
      RING:     OFF          DCD:      OFF
      CLK:      OFF

Hit a <CR> to Continue:
```

Figure 7 DTE Status Screen

Call Statistics

The terminal interface Call Statistics function displays a screen of information concerning the current or most recent connection by the unit. If the unit is on-line when you display the screen, the statistics are those for the current connection. If it isn't on-line, it displays the statistics of the most recently completed connection. *Figure 8* illustrates the Call Statistics screen.

To dismiss the Call Statistics screen and return to the Main Menu, press the Enter key.

The Call Statistics screen is a snapshot of conditions at the moment you access the screen. You can update the display by dismissing the screen and then selecting it again from the Main Menu.

```
SPECTRACOMM 5034
SLOT: 08   LINE: 1
CURRENT CALL STATISTICS

DTE RATE:           9600
DCE TX RATE:        00000
DCE RX RATE:        00000
CALL LENGTH (Sec):  00000
RETRAIN COUNT:      00
FALLBACK COUNT:     00
FALLFORWARD COUNT:  00
RX SIGNAL LEVEL(dB): 00
SNR(dB):            00
CONNECT PROTOCOL:   NONE
CONNECT MODE:       ORG

Hit a <CR> to Continue:
```

Figure 8 Call Statistics Screen

The Call Statistics window displays the following information:

DTE Rate – the speed, in bps, of the data exchange between the unit and its DTE

DCE Tx Rate – the speed, in bps, at which the transmitter connected to the remote modem

DCE Rx Rate – the speed, in bps, at which the receiver connected to the remote modem

Call Length (Sec) – up to 65535 seconds. During a current call, displays duration at the time the screen was accessed.

Retrain Count – number of times the unit had to perform a retrain sequence during the call (0 to 127)

Fallback Count – number of times the unit performed fallback to a lower connection speed during the call (0 to 127)

Fall Forward Count – number of times the unit performed fall forward to a higher connection speed during the call (0 to 127)

RX Signal Level – 0 to -48dBm

Signal-to-Noise Ratio – 0 to 40dB

Connect Protocol – protocol used to manage the connection, determined by the modems during handshake.

Connect Mode – mode, Originate or Answer, in which local unit performed handshake to initiate connection

ISDN Digital Operation

The AT commands that appear below are only valid for the SC 5034 DSE.

Cn Digital protocol

Cn selects the protocol the DSE uses for digital ISDN calls. There are three potential modes:

- ITU-T V.120 asynchronous rate adaption
- PPP ("Internet Mode"), in which the DSE converts between synchronous PPP at the network interface and asynchronous PPP at the DTE interface
- Pass through, in which the protocol actually used on the link is directly determined by the DTE; the DSE converts between synchronous HDLC frames on the ISDN B channel and asynchronous HDLC frames at the DTE interface

Analog call protocol is selected by the `\Nn` command.

C0	selects V.120 asynchronous rate adaption only. DSE places outgoing calls using V.120, accepts only V.120 incoming digital calls.
C1	selects Auto (default). DSE places outgoing calls using V.120, identifies incoming digital calls as V.120 or PPP and operates in the appropriate mode, drops incoming digital calls that are neither V.120 nor PPP.
C2	selects asynchronous PPP ("Internet Mode") only. DSE places outgoing calls using PPP, accepts only PPP incoming digital calls.
C3	selects pass through

\Vn Connect message type

The `\V` command determines the type of connect message sent to the DTE when a data link is established. In order to accommodate the addition of ISDN capability, new messages have been added to the possible displays in two of the existing categories, `\V0` and `\V2`, and new category has been added, `\V5`.

Only the newly added display messages are included here; consult the manual for the complete listings of connect messages.

\V0 options the modem to send the standard GDC Connect message upon reaching data mode plus V.42 messages after the link negotiation. The connect message displays line speed.

MEANING	VERBAL RESPONSE	NUMERIC
ISDN LINK AT 56000	CONNECT 56000	52
ISDN LINK AT 64000	CONNECT 64000	53
ISDN USING V120 PROTOCOL	PROTOCOL:V120	83
ISDN USING PPP PROTOCOL	PROTOCOL:PPP	84

\V2 displays the link speed as does the `\V0` function. The difference is that the `\V2` function includes `/REL` at the end of the message when a V.42 error corrected link is established.

MEANING	VERBAL RESPONSE	NUMERIC
RELIABLE ISDN LINK AT 56000	CONNECT 56000/REL	46
RELIABLE ISDN LINK AT 64000	CONNECT 64000/REL	47

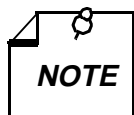
\V5 displays a two-line verbal connect message adapted specifically for ISDN connections, without a numeric. The first line of the message displays ANALOG or DIGITAL to indicate the type of connection, followed by the DTE rate. The second line displays the verbal protocol message as would V0. When the connection type is DIGITAL, PROTOCOL:NONE indicates Pass through mode.

P Dialing type/ISDN originate mode

This command serves two different functions depending upon how the :I command is configured. The :I command selects how the modem channel communicates with Telco switching equipment: T1/E1 VF line signaling (default) or ISDN signaling.

When T1/E1 VF line signaling is enabled, :I0, the P command controls Dialing Type. It directs the modem channel to use pulse dialing as the selected dialing method. The command may be used alone or as part of a dial string. P used alone as a command makes pulse dialing the default — to be used unless a dial string includes a tone modifier. P used in a dial string acts as a modifier that affects only the dialing of that string.

When ISDN signaling is enabled, :I1, the P command controls ISDN Originate Mode. It directs the modem channel to use digital mode when making an outgoing call. The P command may be used alone or as part of a dial string. P used alone as a command makes digital call origination the default — to be used unless a dial string includes the T modifier. P used in a dial string acts as a modifier that affects only the dialing of that string.



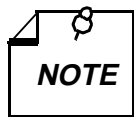
When ISDN signaling is enabled and the Security Callback feature is to be used, the ISDN Originate Mode modifier should be included in dial strings that are stored for callback use. The modifier ensures that the unit will use the appropriate mode, digital or analog, when it performs the callback.

T Dialing type/ISDN originate mode

This command serves two different functions depending upon how the :I command is configured. The :I command selects how the modem channel communicates with Telco switching equipment: T1/E1 VF line signaling (default) or ISDN signaling.

When T1/E1 VF line signaling is enabled, :I0, the T command controls Dialing Type. It directs the modem channel to use tone dialing as the selected dialing method. The command may be used alone or as part of a dial string. T used alone as a command makes tone dialing the default — to be used unless a dial string includes a pulse modifier. T used in a dial string acts as a modifier that affects only the dialing of that string.

When ISDN signaling is enabled, :I1, the T command controls ISDN Originate Mode. It directs the modem channel to use analog mode when making an outgoing call. Originate in analog mode is the default condition when ISDN signaling is enabled. The T command may be used alone or as part of a dial string. T used alone as a command makes analog call origination the default — to be used unless a dial string includes the P modifier. T used in a dial string acts as a modifier that affects only the dialing of that string.



When ISDN signaling is enabled and the Security Callback feature is to be used, the ISDN Originate Mode modifier should be included in dial strings that are stored for callback use. The modifier ensures that the unit will use the appropriate mode, digital or analog, when it performs the callback.

&Nn Caller ID

This command controls the display of the Caller Identification (CID) number for incoming calls.

&N0 disables display of Caller ID

&N1 enables display of Caller ID; incoming number is displayed after the first ring, once only, in the format

RING

CID=2035551212

RING

RING

If network does not supply CID, displays NONE, RESTRICTED, or NA.

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Preface

Scope

This manual describes how to install, configure, and operate a General DataComm SpectraComm 5034 Data Set Emulator. The SC 5034 DSE provides the DTE interface functionality of two V.34 modems. Network interface functionality is provided by a separate Line Terminating Unit to which the DSE is linked by the SpectraComm shelf backplane.

The manual is written for technicians and users, and assumes a working knowledge of modem and telephone system technology.

Revision History

This is Issue 3 of the manual. It has been revised to include information on new features and the AT commands by which they are implemented. The two chief areas of new functionality are MNP 10 mode operation, and the provision of AT commands for configuring network operating characteristics when SNMP control is not used.

Organization

This manual has six chapters and two appendices. The information is arranged as follows:

- *Chapter 1 - Technical Introduction* contains a description of the modem, a list of its features, information on communication software to be used in a personal computer connected to the modem, and a brief description of the modem's diagnostics.
- *Chapter 2 - Installation* contains instructions for inserting the modem into a SpectraComm shelf and connecting it to other equipment.
- *Chapter 3 - Operation* describes how the modem operates and provides instructions for using its functions.
- *Chapter 4 - AT Command Set Operation* contains detailed descriptions of the AT commands that can be used to configure and operate the modem from a terminal or computer.
- *Chapter 5 - V.25 bis Command Set Operation* contains detailed descriptions of the V.25 bis commands that can be used to operate the modem from a terminal or computer.
- *Chapter 6 - Tests* contains instructions for using the modem's diagnostic features.
- *Appendix A - Technical Characteristics*
- *Appendix B - DTE Interface Pin/Signal Assignments*

Document Conventions

Level 1 paragraph headers introduce major topics.

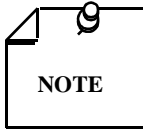
Level 2 paragraph headers introduce subsections of major topics.

Level 3 paragraph headers introduce subsections of secondary topics.

This typewriter font shows output that is displayed on the screen.

This bold font shows specific input that you type at the keyboard.

This bold italicized font shows variable input that you type at the keyboard.



Notes present special instructions, helpful hints or general rules.

Related Publications

The following documents have additional information that may be helpful when using this product:

- *TEAM 5034 Operation* GDC 058R085-V110

GDC publication numbers (e.g., *GDC 032R163-000*) are used to track and order technical manuals. Publication numbers use the following format:

GDC NNNRnnn-000 or GDC NNNRnnn-Vnnn

- NNN identifies the product family (e.g. APEX)
- R denotes a technical publication
- nnn a number assigned by Technical Publications
- 000 identifies a hardware product and does not change
- Vnnn the software version associated with a product may be updated periodically

The Issue Number on the title page only changes when a hardware manual is revised or when a manual is reprinted for some other reason; it does not automatically change when the software is updated. A new Software Version is always Issue 1. Other specialized publications such as Release Notes or Addenda may be available depending on the product.

Service and Support

General DataComm is committed to providing the service and support needed to install, manage, and maintain your equipment. For information about service programs or for assistance with your support requirements, contact your local Sales Representative or call General DataComm Service at the 24-hour toll free number listed below.

- • in the U.S. dial 1-800-243-1030
- • outside the U.S. dial 1-203-598-7526

Be ready with the site name and phone number, and a description of the problem. The next available support representative will promptly return your call.

Hands-on training courses are provided by GDC Educational Services. Courses range from basic data communications, modems and multiplexers, to complex network and ATM systems and are taught in Connecticut or at a customer location. To discuss educational services or receive a course schedule, call 1-800-243-1030 and follow the menu instructions.

Safety Instructions

Antistatic Precautions

Electrostatic discharge (ESD) results from the buildup of static electricity and can cause computer components to fail. Electrostatic discharge occurs when a person whose body contains a static buildup touches a computer component.

The equipment may contain static-sensitive devices that are easily damaged, so proper handling and grounding are essential. Use ESD precautionary measures when installing parts or cards, and keep the parts and cards in antistatic packaging when not in use. If possible, use antistatic floor pads and workbench pads.

When handling components or setting switch options always use an antistatic wrist strap connected to a grounded equipment frame or chassis. *If a wrist strap is not available, periodically touch an unpainted metal surface on the equipment.* Never use a conductive tool, such as a screwdriver or a paper clip, to set switches.

Safety Guidelines

The following symbols are used in this manual to draw your attention to potential hazards. A Caution indicates a hazard to equipment or data. A warning indicates a hazard to personnel.



Caution statements identify conditions or practices that can result in damage to the equipment or in loss of data.



Warning statements identify conditions or practices that can result in personal injury or loss of life.

Always use caution and common sense. *To reduce the risk of electrical shock, do not operate any equipment with the cover removed.* Repairs must be performed by qualified service personnel only.

- Never install telephone jacks in a wet location unless the jack is designed for that location.
- Never touch uninsulated telephone wires or terminals unless the telephone line is disconnected at the network interface.
- Use caution when installing telephone lines, and never install telephone wiring during an electrical storm.

Regulatory Notices

FCC Part 68 Compliance

Connection of data communications equipment to the public telephone network is regulated by FCC Rules and Regulations. This equipment complies with Part 68 of these regulations which require all of the following:

All connections to the telephone network must be made using standard plugs and telephone company provided jacks or equivalent. Connection of this equipment to party lines and coin telephones is prohibited. A label on the back of the front panel of data communications equipment and on the underside or rear panel of other equipment provides the FCC Registration number and the Ringer Equivalence Number (REN) for the unit. If requested, give this information to the telephone company.

The FCC registration number for the 5034 Dual V.34 Modem DSE is AG6USA-75851-MD-0.4B. For programmable network interface operation it should be connected to an RJ45S jack. For permissive network interface operation it should be connected to an RJ11C jack.

If the unit causes harm to the telephone network, the telephone company may discontinue your service temporarily and if possible, you will be notified in advance. If advance notice is not practical, you will be notified as soon as possible and will be advised of your right to file a complaint with the FCC. The telephone company may change its communication facilities, equipment, operations and procedures where reasonably required for operation. If so, the telephone company will notify you in writing. You must notify the telephone company before disconnecting equipment from 1.544 Mbps digital service. All repairs or modifications to the equipment must be performed by General DataComm. Any other repair or modification by a user voids the FCC registration and the warranty.

Canada DOC Notification

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas. *Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.*

Bundesrepublik Deutschland

Installieren Sie nie die Telefonleitungen während eines Gewitters. Installieren Sie nie die Telefonbuchsen in einem feuchten Raum es sei denn die Buchs ist spezielle für Feuchträume vorgesehen. Berühren sie nie unisolierte Telefonleitungen oder Einrichtungen es sei denn die Leitungen sind vom Telefonnetz getrennt. Vorsicht bei der Installierung oder Änderung von Telefonleitungen. *Achtung:* Es sind keine durch denn Anwender zu wartende Teils im Gerät. Wartung darf nur durch qualifiziertes Personal erfolgen. Vor Wartung vom Stromnetz trennen.

Glossary of Terms

Analog Loopback

A test mode in which a modem is disconnected from the communication line and its transmitter output is connected to its receiver input to permit the looping of test messages (originated at a terminal) through the modem to check the performance of the modem and the terminal.

Analog Loopback Self-Test

A test mode in which the modem is disconnected from the telephone line and its transmitter output is connected to its receiver input to permit the looping of test pattern (originated by the modem test circuitry) through the modem to check the performance of the modem.

Answer Mode

An operation in which a modem transmits and receives information using the answer mode frequencies; normally, the modem that answers a telephone call assumes the answer mode.

Answer Tone

A tone transmitted by an answering modem to indicate to an originating modem that it is ready to establish a data communication link.

Automatic Answer

A modem function that permits it to answer telephone calls without human intervention.

Automatic Dial

A modem function that permits it to originate telephone calls without human intervention.

Auto-Reliable Mode

In auto-reliable mode, the local modem attempts to negotiate a reliable link. If it fails, the modem connects in the normal mode instead of hanging up as it does in the reliable mode.

Command Mode

The state of operation in which the modem accepts commands from the terminal.

Data Compression

A technique used to reduce the amount of data being sent without reducing the information represented. In effect, modems with data compression transmit user data faster the non-compression types.

Data Mode

The state of operation in which the modem transfers data between the DTE and the telephone line.

Digital Loopback

A test mode in which a modem is disconnected from the terminal and its receiver output is connected to its transmitter input to permit the looping of test messages (originated at the opposite end) through the modem to check the performance of the communication line and the modem.

Direct Mode

The state of operation in which maximum throughput is equal to the connection rate, and the DTE rate must always match the connection rate.

Escape Code

A sequence of alphanumeric characters that are typed into a terminal keyboard to cause the modem to exit the current operating mode and return to the previous operating mode.

Factory Default

The state of a modem parameter at the time of initially powering up the modem.

ITU-T

Designation for telecommunications recommendations written by the International Telecommunication Union (ITU); an international telecommunication union agency involved in formulating international standards for data communications. (Formerly CCITT — International Telegraph and Telephone Consultative Committee.)

ITU-T V.24/V.28

An ITU-T standard for terminal-to-modem interfacing that specifies the interface signals, their electrical characteristics and the mechanical specifications of the interface.

ITU-T V.42

The V.42 protocol is an international standard for error control between modems. Both modems must employ this protocol. It is accomplished by assembling user data into packets before transmission.

ITU-T V.54 Local Loop 2

A test mode in which a modem is disconnected from the terminal and its receiver output is connected to its transmitter input to permit the looping of test messages (originated at the opposite end) through the modem to check the performance of the communication line and the modem.

ITU-T V.54 Local Loop 3

A test mode in which a modem is disconnected from the communication line and its transmitter output is connected to its receiver input to permit the looping of test messages (originated at a terminal) through the modem to check the performance of the modem and the terminal.

ITU-T V.54 Remote Loop 2

A test mode in which a local modem commands a remote modem to enter the ITU-T V.54 Local Loop 2 test mode.

Loopback

A diagnostic procedure in which data sent by the originator is looped back and re-sent to him. A test message is sent to a device being tested, which is then re-sent to the originator and compared with the original transmission.

(MNP™) Microcom Networking Protocol

An error correction protocol designed by Microcom. In this link level protocol, data is packetized prior to transmission. A CRC check is appended to each packet and automatic retransmission requests are made for bad packets. MNP can be implemented according to several different performance classes.

Normal Mode

In the normal mode, the modem provides data buffers. This allows the terminal rate to be different from the connection rate. However, the maximum modem-to-modem throughput continues to be equal to the connection rate.

Originate Mode

An operation in which a modem transmits and receives information using the originate mode frequencies; normally, the modem that initiates a telephone call assumes the originate mode.

Reliable Mode

In the reliable mode, the modem provides data buffers so that the terminal rate may be different than the connection rate. In addition, it provides the MNP protocol, for error detection and correction. Maximum modem-to-modem throughput is determined by the class of reliable connection negotiated, but will never exceed the terminal's slowest rate.

Remote Digital Loopback

A test mode in which a local modem commands a remote modem to enter the Digital Loopback test mode.

EIA/TIA-232-E (V.24/V.28)

Serial interface standard as specified by the Electronics Industries Association (EIA) and ITU-T, that defines the wires of the 25-position connector.

XON/XOFF

Control characters that are sent to the terminal by the modem along the receive path (RXD), or to the modem by the terminal along the transmit data path (TXD) to indicate when it may or may not send or receive data.

1 Technical Overview

Description

The GDC SpectraComm 5034 Data Set Emulator (SC 5034 DSE) provides the functionality of two full-duplex, multi-speed V.34 modems. Each of its two modem channels provides up to 33.6 Kbps operation and can be configured to a 2-wire switched line, a 2-wire private line, or a 4-wire private line. As a data set emulator, the SC 5034 DSE provides all the DTE interface functions of two V.34 modems. However, instead of connecting to telephone lines on its network side, its network interface takes place through a Line Terminating Unit (LTU) to which it is linked by the backplane of the SpectraComm shelf in which it is installed.

There are two LTUs available in the SpectraComm 5000 family of products: the SC 5001 LTU, which performs network interface functions to a T1 line composed of 24 DS0s; and the SC 5002 LTU, which performs network interface functions to an E1 line composed of 32 DS0s.

The LTU supports connection to a Telco central office at which the DS0s that compose its high-capacity line can be routed, individually or in groups, to a variety of destinations. Each modem channel of the SC 5034 DSE is output to the shelf backplane as a Pulse Code Modulated (PCM) channel that occupies one DS0. An SC 5034 modem channel appears to be a conventional V.34 modem to its remote modem.

Each modem channel can support asynchronous or synchronous DTE data rates up to 128 Kbps. Operation can be either synchronous or character asynchronous at all speeds down to 1200 bps. Operation is asynchronous at 0 to 300 bps. Synchronous rates above 28.8 Kbps require use of the synchronous data compression feature incorporated in the modem channel.

Each modem channel supports the following protocols:

- V.34 for negotiated high-data-rate connections
- V.42 (LAPM) error correction
- V.42 *bis* data compression
- MNP-2 through MNP-4 error correction
- MNP-5 data compression
- ITU-T (formerly CCITT) V.32 *bis*, V.32, V.22 *bis*, V.22, V.21
- Bell 212A and Bell 103 specifications

An SC 5034 modem channel can be controlled in a number of ways. It can accept commands from its local DTE using either the AT command set or the ITU-T V.25 *bis* command set. The AT commands can also be used for remote configuration performed through an off-site SC 5034 DSE and DTE. The modem includes front panel controls for performing tests.

The SC 5034 DSE software includes Simple Network Management Protocol (SNMP) Management Information Base (MIB) files that enable control by an SNMP network controller. A GDC SpectraComm Control Module (SCM) is required in order to access the MIBs.

SC 5034 DSE Features

- Compatible with GDC SpectraComm 5000 advanced architecture.
- Direct digital interface to 64 Kbps DS0 channels.
- Two modem channels per card.
- Integral synchronous/asynchronous operation.
- Synchronous DTE rates to 28.8 Kbps.
- Asynchronous DTE rates to 128 Kbps.
- 2-wire, full-duplex, switched network operation.
- 2- or 4-wire private line operation.
- Automatic VF line rate determination in V.34 and V.32 *bis* modes, with fallforward/fallback.
- V.42/MNP error control.
- V.42 *bis*/MNP-5 asynchronous data compression.
- Synchronous data compression (supports rates up to 128 Kbps).
- EIA/TIA-602 “AT” Command Set support.
- V.25 *bis* compatible command protocol support.
- TEAM 5034 management application — part of the TEAM 5000 family of management applications, operates in conjunction with a SpectraComm Manager (SCM) card to provide Simple Network Management Protocol (SNMP) control.
- Remote Configuration to change user configuration profile at the remote modem.
- Front panel push buttons for testing.
- Front panel status LEDs.
- Flash memory for downloading modem firmware.
- Permanent storage of modem configuration profiles in non-volatile memory.
- External, Internal, or Receiver Recovered transmit timing.
- Maximum line rate selection.
- Asynchronous character lengths of 8, 9, 10, and 11 bits.
- Password security.
- Security Callback to prevent unauthorized access to a remote modem.
- Intelligent Serial Terminal Dialer via the DTE interface, using the AT command set.
- Stores up to ten telephone numbers for easy dialing.
- Dialed pulse or DTMF tone dialing.
- Automatic answer.
- Analog Loopback with and without Self-Test features.
- Digital Loopback and Remote Digital Loopback.
- End-to-End Self-Test (511 or in FSK ALT pattern).
- Front panel lockout.
- Supports FAX Class 1 operation using V.27 or V.29 modulation.

Software Selection

There are two types of computer software for use with a modem: terminal emulation software and data communications software.

Terminal emulation software essentially “downgrades” your computer to a dumb terminal. It allows you to type at the keyboard and see responses on the video display or printer. Emulation programs are often used to communicate with mainframe or mini-computers, and usually do not support disk management or file transfers.

A full-featured data communications software package does allow file transfers, as well as providing a dial directory, a script language for automated sessions, and a host of other features. Of course, the more powerful and flexible a software package is, the more difficult it may be to master.

To take full advantage of the features of the SC 5034 DSE, your selected program should allow turning off the auto baud feature. You should also be able to toggle both XON/XOFF and hardware flow control. In addition, it should support several file transfer protocols designed to be used with an error-correcting modem.

Although your modem will work with most standard communications programs and file protocols such as XMODEM, there may be a throughput penalty when using a software error-detecting protocol due to the redundant error-checking overhead. File transfer protocols that are tailored for use with error-correcting modems are YMODEM-G and IMODEM.

FAX

An SC 5034 modem channel can support FAX Class 1 transmission and reception. The function requires use of ITU-T V.27 or V.29 modulation and the appropriate FAX software.

Refer to the documentation supplied with your FAX software for instructions on installing it in your PC and using it to send and receive FAX communications.

Diagnostics

To help you restore service quickly in the event of problems, the SC 5034 DSE offers an array of diagnostics for accurate detection of system faults. Included are Local Loop (ANALOOB), Local Loop Self-Test (ANALOOB Self-Test), Digital Loopback, Remote Digital Loopback, Remote Digital Loopback Self-Test, and End-to-End Self-Test. Some tests can be controlled by front panel switches and monitored through the front panel LEDs. Tests may also be controlled from a terminal or computer using AT commands, or from an SNMP controller.

Table 1-1 Equipment List

Description	GDC Part No.
SC 5034 Data Set Emulator	076P025-001
Dual DTE Adapter	010P165-001
Cabinets, Enclosures and Shelves	
EP-5 Cabinet	
EP-5 DeskTop Cabinet with door, 100/120 V ac	010C356-001
EP-5 DeskTop Cabinet with door, 220/240 V ac	010C356-002
SpectraComm MultiPak Enclosure ME-2	
Model 1 (100/120 V ac); includes DB25 Zone 3 connectors	010B163-001
Model 3 (220/240 V ac, international); includes DB25 Zone 3 connectors; line cord optional, specify type	010B163-002
Unless otherwise stated, SpectraComm MultiPak Enclosure systems include one enclosure, one power supply, and one ac power cord.	
SpectraComm Shelf MS-2	
Model 1 (100/120 V ac); includes two 8-slot, dual RJ45 Zone 1 connector panels	010M054-001
Model 2 (-48 V dc); includes two 8-slot, dual RJ45 Zone 1 connector panels	010M055-001
Model 3 (220/240 V ac, international); includes two 8-slot, dual RJ45 Zone 1 connector panels	010M056-001
Model 4 (100/120 V ac); includes one 16-slot, 50-pin/wire wrap Zone 1 connector panel	010M057-001
Model 5 (-48 V dc); includes one 16-slot, 50-pin/wire wrap Zone 1 connector panel	010M058-001
Model 6 (220/240 V ac, international); includes one 16-slot, 50-pin/wire wrap Zone 1 connector panel	010M059-001
Model 10 (-48 V dc, with redundant power supplies); includes two 8-slot, dual RJ45 Zone 1 connector panels	010M070-001
Model 11 (-48 V dc, with redundant power supplies); includes one 16-slot, 50-pin/wire wrap Zone 1 connector panel	010M071-001
Unless otherwise stated, SpectraComm Shelf systems include one base shelf, one power supply and power supply blank front panel, Zone 1 connector panels as stated, one 16-slot DB25 Zone 3 connector panel, two standard mounting brackets (19-/23-inch), and assorted mounting hardware.	

(Continued on next page)

Table 1-1 Equipment List (Continued)

Description	GDC Part No.
Cables (XXX = cable length in feet)	
Business Equipment (DTE) Cables	
EIA/TIA-232-E (25-pin male) to ITU-T V.35 (34-pin female) adapter cable	027H572-001
EIA/TIA-232-E cable, for 19.2 to 128 Kbps	028H511-XXX
Power cords for SpectraComm Shelf, SpectraComm MultiPak Enclosure ME-2 and EP-5 DeskTop Cabinet	
Domestic 100/120 V ac power cord (SpectraComm Shelf only)	830-002-002
Domestic 100/120 V ac power cord	830-024-003
European 220/240 V ac power cord	830-061-002
UK 220/240 V ac power cord	830-060-102
Applicable Publications	
EP-5 DeskTop Cabinet	010R315-000
SpectraComm MultiPak Enclosure	010R304-000
SpectraComm Shelf	010R302-000

2 Installation

Overview

This section describes installation of the SC 5034 DSE.



The installation of this unit is to be done by qualified service personnel only.

Unpacking Your DSE

When you remove the DSE from its box, make sure that it is undamaged. If any components are missing, call your local representative.

Keep the carton and protective packing material so you can re-pack the equipment for storage or shipment. If there is any visible damage to the DSE, record it on the freight bill, have the freight carrier acknowledge it, and submit your claim to the carrier.



Do not install or operate damaged equipment, as safety and performance may be affected.

Installation Procedures

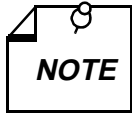
The V. 34 rack mounts in a SpectraComm Shelf, SpectraComm MultiPak Enclosure, or EP-5 Cabinet. Locate the unit in a ventilated area where the ambient temperature does not exceed 122°F (50°C). Do not install the unit directly above equipment that generates a large amount of heat (such as power supplies).

Shelf/Enclosure/ Cabinet Installation

To install the SpectraComm Shelf, refer to *Operating and Installation Instructions for SpectraComm Shelf*, GDC P/N 010R302-000. To install the SpectraComm MultiPak Enclosure, refer to *Operating and Installation Instructions for SpectraComm MultiPak Enclosure*, GDC P/N 010R304-000. To install the EP-5 DeskTop Cabinet, refer to *Instruction Manual for GDC EP-5 DeskTop Cabinet*, GDC P/N 010R315-000.



- a. *When using a SpectraComm Shelf, be sure to install shelves and power supplies as described in the SpectraComm Shelf manual. Failure to do so may result in overheating and subsequent power supply shutdown.*
- b. *A shielded cable is required to comply with FCC Class A and EN 55022 Class A EMI requirements.*



When connecting the high speed modem channel to an asynchronous port, it is important to confirm the highest speed supported by the DTE. Some asynchronous PC ports are restricted to 9600 bps or 19,200 bps operations. Special boards that support up to 115,200 bps are available for PCs, but the communication software that you use must be able to support it. The Technical Reference Section of your computer hardware manual will provide this information. Further restrictions may be placed on the asynchronous port performance by the computer operating system if “multitasking” or “Windows” is being used. Review your operating system limitations before selecting high speed operations.

DSE Installation

You can install a SC 5034 DSE in any unused slot that has the Zone 3 connector required for the business equipment. To install the SC 5034 DSE:

1. Pull down the ejector tab, insert the DSE into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Push up the ejector tab and firmly push the DSE in until it seats in the rear connectors.

Electrical Connections

The SpectraComm rear panel, illustrated in *Figure 2-2*, provides the DTE interface connector for the SC 5034 DSE, and the power supply front panel has a power On/Off switch. The rear panel also has either an ac power cord receptacle or a terminal block for dc power connections. Refer to the appropriate manual for details.

DTE Cables

Use dual EIA/TIA-232E DTE adapter (Part No. 010P165-001). The adapter enables the connection of two DTE cables through the single interface connector provided on the SpectraComm shelf back panel.

Special Considerations for High Data Rates

Because of the high data rates possible for an SC 5034 modem channel, the type and length of the DTE cable are important factors in ensuring data integrity. The higher data rates require use of shielded DTE cables. Further, the capacitance and resistance of the cable, which vary with its length, must be evaluated to ensure the cable can support the chosen data rate over the required distance.

Cable capacitance is specified in two categories: conductor-to-conductor (C-C) and conductor-to-shield (C-S). Each of those capacitance values is expressed in Pico Farads per foot (pF/ft). The total capacitance of a cable is arrived at by adding C-C to C-S and by its length in feet. The following example illustrates calculations for the total capacitance of a 10-foot cable with a C-C capacitance of 12.5 pF/ft and a C-S capacitance of 22.0 pF/ft:

$$\text{Total capacitance} = [(C-C) + (C-S)] * 10$$

$$\text{Total capacitance} = (12.5 + 22.0) * 10$$

$$\text{Total capacitance} = 34.5 * 10$$

$$\text{Total capacitance} = 345 \text{ pF}$$

The following table shows the greatest total capacitance that can be tolerated for each range of data rates.

Data Rate (Kbps)	Total Capacitance (pF)
0.0 — 20.0	2400
20.0 — 30.0	1200
30.0 — 60.0	900
60.0 — 100.0	450
100.0 — 128.0	200

A DTE cable for use with the SC 5034 DSE must have total resistance of 20 ohms or less. To calculate resistance for a cable, multiply its specified resistance value (in ohms per 1000 feet) by its length (in feet). The following example illustrates the calculation for a 10-foot cable with a resistance of 24 ohms/1000 ft:

$$\text{Total Resistance} = (24/1000) * 10$$

$$\text{Total Resistance} = 0.024 * 10$$

$$\text{Total Resistance} = 0.24 \text{ ohms}$$

The following table shows for two GDC DTE cables the greatest lengths that can be used at differing data rates. The two cables shown are 028H511-XXX (DB25 male-to-female) and 028H502-XXX (DB25 male-to-male). When ordering these cables, replace the -XXX with the three-digit dash number that indicates the desired length (50, 25, 10, or 5 feet).

Data Rate (Kbps)	028H511-				028H502-			
	-050	-025	-010	-005	-050	-025	-010	-005
0.0 — 20.0	X				X			
20.0 — 30.0		X				X		
30.0 — 60.0		X				X		
60.0 — 100.0			X				X	
100.0 — 128.0				X				X

Connections to Telephone Network

Network connection is made via either a T-1 line through an SC 5001 LTU or an E1 line through an SC 5002 LTU. Refer to appropriate manual for installation instructions.

Verifying Your Connections

Your DSE should now be connected. Verify your connections by following the steps listed below.

1. To verify that the power supply is connected properly, see if the ON LED is lit and the ALM LED is not flashing.
2. If you are using a terminal as your DTE, proceed to the next step. If you are using a computer as your DTE, then run your communications software and configure it for terminal emulation. If you are using an intelligent communications software package, it may be necessary to configure it for interactive mode. See *Chapter 3* for further details.

3. Type the command AT followed by a carriage return on the DTE. The DSE modem channel should respond with an OK message. If it does not respond with an OK message, then either your DTE interface cable is not connected properly or your DTE is not configured properly. See *Appendix A* for a complete list of compatible DTE configurations such as speed and parity.

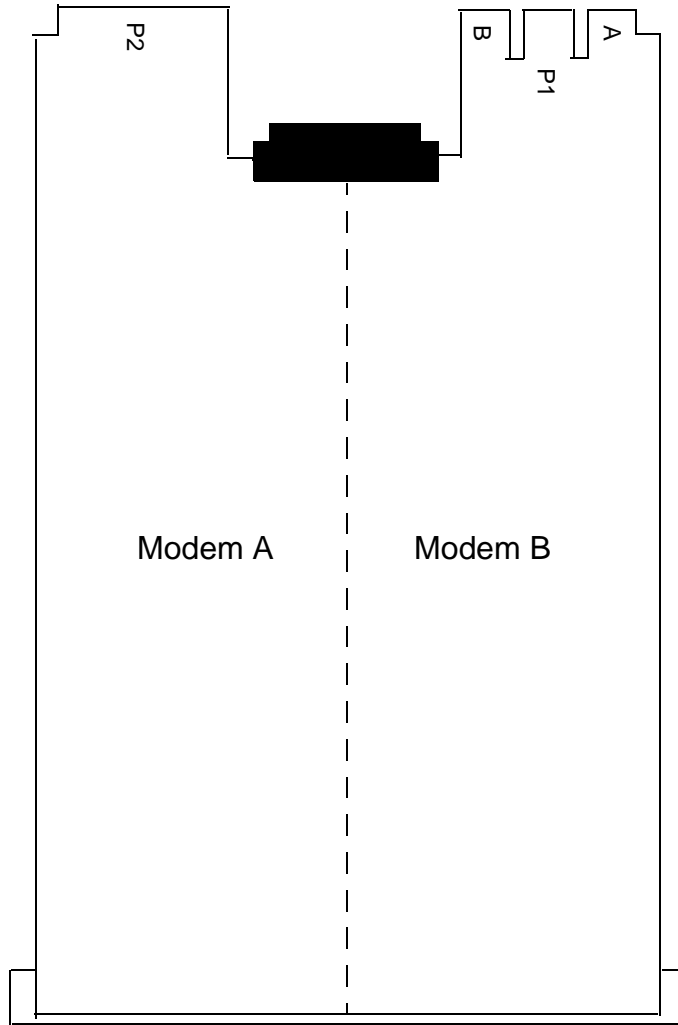


Figure 2-1 PC Card Layout

Table 2-1 Rear Panel

Name	Function
J1 to J16	Female DB25 connectors for connection to DTE using dual DTE adapter (computers or terminals). The Zone 3 connector panel.

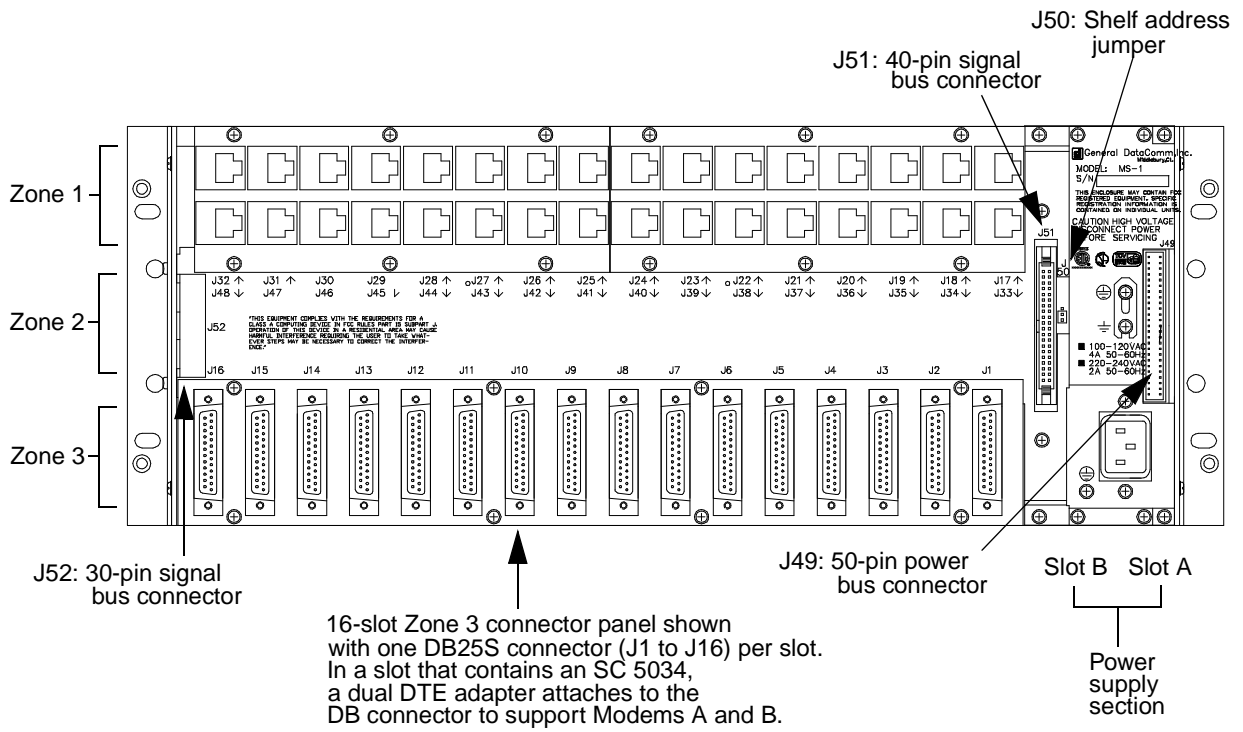


Figure 2-2 SpectraComm Shelf Rear Panel

3 Operation

Overview

This chapter describes how to operate and configure the modem channels of the SC 5034 DSE. You can perform modem channel control functions in three ways:

- by means of AT commands sent to the modem channel from a terminal, PC, or other asynchronous DTE;
- by means of ITU-T V.25 *bis* commands sent to the modem channel from a terminal, PC, or other DTE;
- by means of Simple Network Management Protocol (SNMP) commands sent to the modem channel through a SpectraComm Manager (SCM) card.

This chapter begins by describing the front panel indicators and switches. The front panel switches provide limited test function control, so their use is described in *Chapter 6, Tests*. The front panel description is followed by the call control functions of the modem, which are carried out principally by means of AT commands. The broader uses of the AT command set for configuration and control are then described.

Chapter 4 describes each AT command in detail, which involves also describing the configurable characteristics and functions that are controlled by the commands.

Chapter 5 describes the V.25 *bis* command set.

Front Panel

Controls and Indicators

The SC 5034 DSE front panel, illustrated in *Figure 3-1*, includes two test push buttons for each modem channel, and an array of status LEDs. *Table 3-1* describes front panel indicators (the LEDs) and *Table 3-2* describes the front panel controls. The push buttons allow you to perform some testing without connecting a terminal.

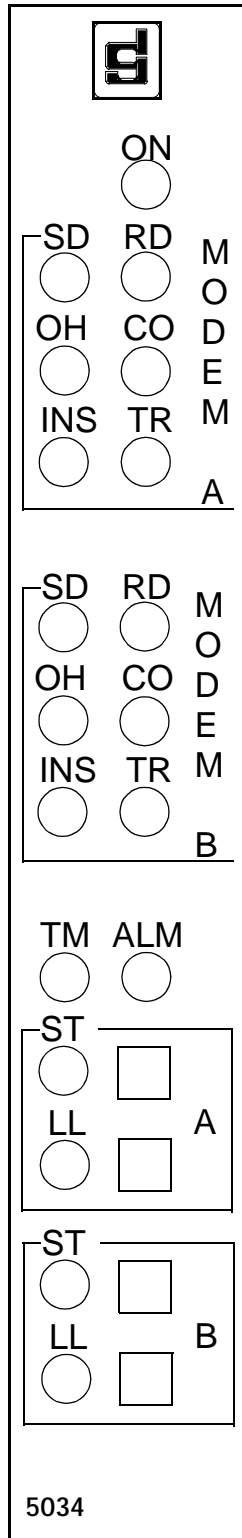


Figure 3-1 Front Panel

Table 3-1 Front Panel Indicators

LED	Definition	LED State	Description
ON	Power On	On	Power to the DSE is On
		Off	Power to the DSE is Off
SD	Send Data (Transmitted Data)	On	Indicates a SPACE condition in the modem channel transmitted data.
		Off	Indicates a MARK condition.
RD	Received Data	On	Indicates a SPACE condition in the modem channel received data.
		Off	Indicates a MARK condition.
OH	Off-Hook	On	Modem channel is in the off-hook state.
		Off	Modem channel is in the on-hook state.
		Flashing	Modem channel is handshaking with a remote modem.
CO	Carrier On	On	Modem channel has turned On DTE interface pin 8 (or DCD is On), indicating it is receiving data.
		Off	Modem channel has turned Off pin 8, indicating it is not receiving data.
INS	In Service	On	Modem channel is actively connected to backplane data highway.
		Off	Modem channel is in dormant state and isolated from backplane data highway.
TR	Terminal Ready	On	DTE has turned On DTE interface pin 20 (or DTR is On), indicating it is ready for data communications.
		Off	DTE has turned Off pin 20, indicating it is not ready for data communications.
TM	Test Mode (Common A & B)	On	Test mode is active at one or both of the modem channels.
		Off	Neither modem channel is in test mode.
ALM	Alarm (Common A & B)	On	A loss of frame synch has occurred on the backplane data highway, affecting both modem channels.
		Flashing	Hardware failure on one or both modem channels.
		Off	Normal
ST	Self Test	On	Modem channel is in Self Test
		Off	Modem channel is not in Self Test
		Flashing	Modem channel is in down load mode
LL	Local Loop	On	Modem channel is in Local Loop test
		Off	Modem channel is not in Local Loop test

Table 3-2 Front Panel Controls

Key	Function
ST	Starts End-to-End Self-Test. (Use LL to stop the test.) Can be used after LL for ITU-T V.54 Loop 3 with Self-Test.
LL	Starts/stops ITU-T V.54 Loop 3 (Local Loop or ANALOOP). Can be used before ST for ITU-T V.54 Loop 3 with Self-Test (Local Loop Self-Test or ANALOOP Self-Test).

Network Connections

Unlike a modem, which connects directly to a telephone network voice-grade line, the SC 5034 DSE operates in conjunction with a line terminating unit (LTU) that performs network interface functions for it. Two LTUs are available at the time this is written:

- the SC 5001 LTU operates on a T1 line composed of 24 DS0s, designated 1 – 24
- the SC 5002 LTU operates on an E1 line composed of 32 DS0s, designated 0 – 31; DS0s 0 and 16 are reserved for common channel trunk signaling, so 30 DS0s are available to carry data.

Each DS0 is equivalent to a voice-grade telephone line and can support one SC 5034 DSE modem channel. The T1 or E1 line as a whole is a permanent connection. Individual DS0s can be used to support either dial-up switched connections or permanent leased connections. The SC 5034 DSE supports both modes of operation.

Backplane Data Highways and Time Slots

The LTU delivers the DS0s from its network interface to the shelf backplane as data highway time slots. The shelf backplane supports four full duplex data highways, each composed of 32 time slots. A time slot is equivalent to one DS0. The number of time slots available and how they are designated depends on the type of LTU being used, T1 or E1. The modem channels of the SC 5034 have to be configured and assigned to operate into specific DS0 channels on a specific data highway. An example of such an assignment follows:

Data Highway	DS0	Assignment
1	1	SC 5034 in Slot 3 (Modem A)
1	2	SC 5034 in Slot 3 (Modem B)
1	3	SC 5034 in Slot 4 (Modem A)
1	4	SC 5034 in Slot 4 (Modem B)
1	5	SC 5034 in Slot 5 (Modem A)
1	6	SC 5034 in Slot 5 (Modem B)
1	7	SC 5034 in Slot 10 (Modem A)
1	8	SC 5034 in Slot 10 (Modem B)
	.	.
	.	.
1	19	SC 5034 in Slot 16 (Modem A)
1	20	SC 5034 in Slot 16 (Modem B)

When the SC 5034 DSE and its associated LTU are installed in a shelf that contains an SCM card and are running under SNMP control, the TEAM Core manager application provides a convenient graphical interface for making data highway and time slot assignments. Refer to the *TEAM Core Operation* manual for details.

The assignments can also be performed by means of AT commands, which are listed in *Chapter 4* of this manual.

Switched Network Operation

Trunk Signaling Selection

The SC 5034 DSE supports Loop Start, Ground Start, and E&M trunk signaling when it is connected through an SC 5001 LTU to a T1 line. The choice of which type to use is mainly determined by what is offered by the telephone company and user equipment at the premises. DTMF and dialed pulse signaling are supported.

Trunk signaling on an E1 line is always performed on a common channel basis, with DS0s 0 and 16 reserved for that purpose. The SC 5034 DSE supports MF signaling.

DS0 Signaling Selection

In order to emulate the operation of a standard modem the DSE modem channel requires a means of sending dialing signals and receiving ringer signals on its DS0/time slot. The method of accomplishing this is selectable to be either Robbed Bit signaling or ISDN Common Channel.

Frame Type

When the SC 5034 DSE is connected through an SC 5001 LTU to a T1 line it has to be configured for compatibility with the type of framing used to format its data on the line. The DSE supports Superframe/D4 and Extended Superframe (ESF) formats. The format you select for the DSE must match that selected for the LTU.

Call Direction

You can configure the SC 5034 DSE to initiate connections but not respond to incoming calls (Outgoing Only), to answer incoming calls but not initiate outgoing calls (Incoming Only), or to perform both operations (2-way Outgoing/Incoming).

Call Reception on an E1 DS0

An SC 5034 DSE modem channel requires some specialized configuration in order to receive switched network calls when it operates with an E1 DS0 through an SC 5002 LTU. It must be programmed with a subscriber number and a terminating sequence. It can also be programmed with an Automatic Caller Number Identification (ANI). Telephone number memory cells 9, 8, and 7 are reserved to hold these three numbers when the DSE is set for E1 operation by means of the Companding Law option. The &Z command, described in *Chapter 4*, stores values in the telephone number memory cells.

The subscriber number, which must be programmed in memory cell 9, is usually the telephone number that a remote dials to connect to the modem channel. The SC 5034 DSE provides flexibility by supporting the use of a wildcard character so that multiple modem channels can share subscriber numbers and answer incoming calls on a first available unit basis. The wildcard character for subscriber number programming is the comma; the DSE considers any digit a match for positions where a comma appears in a stored subscriber number. When a modem channel is first configured for switched network E1 operation it begins with a default subscriber number of four commas.

The terminating sequence must be programmed in memory cell 8. It is an exchange between the DSE modem channel and the remote modem that must take place once the modem channel has received all the digits of its subscriber number. The sequence consists of at least four alternating digits: first one sent by the DSE modem channel, then one sent by the remote modem. The number programmed in memory cell 8 must contain the digits of the sequence, both those the modem channel is to transmit and those it expects to receive. The default is 5131.

The ANI can be programmed in memory cell 7. If ANI is not used, leave the cell blank.

Call Control

Call control involves call initiation, completing a connection, call answering, and disconnecting a call.

The SC 5034 DSE can be made to initiate a call in any of three ways:

- Manually, using a telephone number supplied at the time the call is initiated
- Manually, using a telephone number stored previously in one of the 10 memory cells provided for that purpose
- Automatically in response to an Off-to-On transition of the DTR interface circuit, using a telephone number stored previously in memory cell 0

The following three headings describe the procedures required for each type of call initiation. *Table 3-4* describes common commands used for call initiation, answering, and disconnection. Call completion, answering, and disconnection are discussed under their own headings following the table.

Manual Call Initiation

The following example illustrates manual call initiation with a telephone number supplied at the time of the call. At the terminal or computer keyboard, type

```
AT D (809) 555-1234 (enter)
```

where:

AT	AT command prefix, instructs modem to pay attention to the characters that follow
D	dial command, instructs modem to dial
(809) 555-1234	number modem is to dial — it ignores parentheses, spaces, and hyphens
(enter)	pressing Enter or Return key sends command line to the modem

The description of the Dial (*Dn*) command that appears in *Chapter 4* includes the functions of all dial modifier characters).

Manual Call Initiation with a Stored Number

The following examples illustrate how to store a telephone number in one of the modem channel memory cells and how to initiate a manual call using a stored number.

To store a telephone number type

```
AT &Z3=(809) 555-1234 (enter)
```

where:

AT	AT command prefix, instructs modem to pay attention to the characters that follow
----	---

&Z3=(809) 555-1234 instructs modem to store the telephone number in non-volatile memory cell 3

(enter) pressing Enter or Return key sends command line to the modem

When you require a modem connection to that stored telephone number at any later time, type

AT DT S3 (enter)

where:

AT AT command prefix, instructs modem to pay attention to the characters that follow

D dial command, instructs modem to dial

T dial modifier, instructs modem to use tone dialing

S3 dial modifier, instructs modem to dial the number stored in memory cell 3

(enter) pressing Enter or Return key sends command line to the modem

The description of the Dial (*Dn*) command that appears in *Chapter 4* includes the functions of all dial modifier characters (such as T and S in this example).

Table 3-3 Common Call Control Commands

Command	This command...	Remember...
AT	alerts the modem that a command is to follow	this command must always precede any command line, except A/
AT D	instructs the modem to dial the specified telephone number that follows	your number can contain up to 30 digits
P (following D command)	tell the modem to pulse dial	you can use dial digits 0 through 9 for pulse dialing
T (following D command)	tells the modem to tone dial	you can use dial digits 0-9 and symbols A, B, C, D, #, * for tone dialing
W (as part of dial command)	indicates to the modem that it must wait for a dial tone before dialing the number that follows	use this command when you have to dial 9 to obtain an outside line
; (as part of dial command)	causes the modem to return to the command mode after it has dialed the number, rather than immediately entering data mode	this serves to separate a command string containing more than 30 characters (so as not to overflow the buffer)
Sn (following D command)	instructs the modem to dial a previously stored number	you can store 10 telephone numbers (n = 0 — 9) up to 30 digits each
R (as last character in dial command)	causes the modem to establish a call in answer mode when calling an originate-only modem	the R command must be the last character in the dial string before you enter a carriage return
AT A	forces the modem to answer incoming call	the modem does not wait for a ring; no matter what is specified in the S0 register (see S-Registers in Chapter 4). This command is used for manually answering a call.
AT H	forces the modem to hang up	if you are in data mode, you must first enter command mode before using this command

Automatic Call Initiation in Response to DTR

The AT commands %Z1 and %Z3 both instruct the modem to observe the state of the Data Terminal Ready (DTR) interface lead, and to perform automatic call initiation when an Off-to-On transition occurs on that lead. This function always uses the telephone number stored in memory cell 0.

When %Z1 is used, the modem dials automatically only when it detects a transition on the DTR lead.

When %Z3 is used, the modem dials automatically whenever it is not connected to a remote modem and the DTR lead is On. The significance of this is that the %Z3 command causes the modem to perform automatic re-dial for recovery of a broken connection with no DTE intervention.

Completing a Connection

Once you have issued a dial command, the front panel should display DIALING. If the connection is successful, a CONNECT result code will appear. This means you are connected to the remote end. See *Chapter 4* for a list of standard and extended result codes. The result codes appear on your DTE screen when you issue a command.

Usually you will need to press Enter or Return on the keyboard in order to receive a prompt from the answering equipment. If you do not do so, you may be disconnected.

The CTS and DCD indicators will remain on while the SC 5034 DSE is connected to the remote end. The TXD indicator will flash while the modem is sending data and the RXD indicator will flash while it is receiving data from the remote end.

Call Answering — Automatic

The SC 5034 DSE automatically answers and switches to the data mode if the automatic answering function is enabled. The modem has built-in “ring-detection” circuitry that can be enabled to provide automatic response to incoming calls. The value stored in S-Register 0 determines whether auto-answer is enabled. If the value is greater than 0, the modem will count ring signals on the line and display a RING message for each ring it counts. Once the ring count equals or exceeds the value of S0, the modem will go off hook and begin the handshaking procedure.



For more information on the S-Registers, see Chapter 4.

The default value of the S0 register is $n = 1$ (auto-answer enabled on the first ring). The value of n is programmable in AT modes of operation. For AT operation, refer to S-Register 0 in *Chapter 4*.

Call Answering — Manual

You may prefer that the modem not answer incoming calls automatically; for example, if both voice and data calls will be received on the same line. Storing the value 0 in S-Register 0 disables auto-answer so the modem will not answer calls by itself under any circumstances.

You can manually answer a data call from the keyboard. To answer from the keyboard, enter the command AT A (enter) upon receiving ring. This will cause the modem to go off-hook and begin the handshaking sequence.

Disconnecting a Call

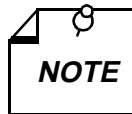
There are several ways to disconnect a call:

- **H command** — disconnects the modem from the VF line. When using the modem in the asynchronous mode, first type the ESCAPE sequence (ESCAPE is a programmable character string, default +++). When the modem returns an OK to the DTE, type AT H (enter) to terminate the connection.
- **Loss of DTR** — an irreversible data mode disconnect sequence occurs if circuit 108.2 (DTR) turns Off for more than 50 milliseconds when the modem is in data mode. The modem can be optioned for circuit 108.2 forced On (terminal dial mode) so that a DTE cannot cause a disconnect to occur using circuit 108.2.
- **Character abort** — when this feature is enabled, any character sent from the DTE to the modem at the originate end during dialing or the handshake sequence will abort the call. %Kn controls this function in all command modes.
- **Loss of carrier** — the modem will go on-hook if the handshake sequence is not completed successfully within the time specified in S-Register 7. This abort timer is programmable for 1 to 30 seconds via the S7=x command. The originating and answering modem both have the abort timer active during the handshake sequence.
- **No answer or busy** — when an originating call is not answered within the time specified by S-Register 7, the modem will disconnect. If it detects a busy tone, the modem will disconnect immediately and display the BUSY message.
- **Long space disconnect** — if optioned to do so via the Yn command, the V. 34 will initiate and respond to the long space disconnect procedure. When initiating disconnect (for any reason except loss of carrier) the modem will transmit 4 seconds of continuous spacing (receive data clamped to a mark), and then go on-hook. A modem receiving 1.6 seconds of continuous space on the VF line will go on-hook. This feature is only functional at speeds of 2400 bps and lower.

Passwords

The SC 5034 DSE provides a variety of configurable password security arrangements. The two principle categories are the general security (or "handshake") password, and the on-line password. An answering modem terminates the call if it does not receive a required password.

You can enable either type of password function, or both, by means of the %Sn command. A general security password, when used, is transmitted and checked as part of the handshake sequence between a calling modem and an answering modem. When an on-line password is enabled, the operator placing a call is prompted to supply further information manually after the modems make their initial connection.



In order to use a general security password the modems must use handshake mode V.34 (&H0, &H1, or &P0 command), V.32 bis (&H2, &H3, or &P1 command) or V.32 (&H4, &H5, or &P2 command).

The modem has ten memory cells for password storage. The command for storing a password is %Pn=xxx, where *n* is the password memory cell number and *xxx* is the password. The memory cell number can be any digit, 0 — 9. The password can be any string of up to ten alphanumeric and punctuation characters (one exception: comma ", " may not be used). The handshake password function always uses the contents of memory cell 0. The modem compares received on-line passwords to the contents of all ten memory cells in search of a match.

When an on-line password is required, the answering modem prompts the remote operator:

```
ENTER PASSWORD
```

The operator has 15 seconds to respond.

Security Callback

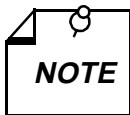
The Security Callback procedure is invoked by the AT dial command modifier $\backslash n$ ($n = 0 — 9$). A call placed using the modifier causes the answering modem to disconnect after handshaking, then dial a call back to the modem that made the original call. In the command modifier, n represents a phone number memory cell in the answering modem. For example, to call the remote modem at 555-1212 and have it call the phone number in cell 1, enter:

```
ATD5551212\1
```

After handshaking and a short delay, the remote modem terminates the call, then places a new call to the local modem, using the phone number that it has stored in cell 1.

Use of Security Callback requires the following:

- General security password must be enabled in both modems.
- The same general security password must be used by both modems (%Pn command).
- The phone number of the originating modem must be stored in one of the phone cells of the answering modem.



A telephone number stored for Security Callback use should always include the :n (retry) modifier. Specify that the modem is to make at least three attempts to dial the number. Retries compensate for any delay in receiving dial tone from the Central Office after termination of the initial connection.

On-line Password Callback Extensions

An operator sending an on-line password may be permitted to include one of several optional callback extensions. A callback extension causes the answering modem to disconnect and then call back to the modem that placed the original call. When you configure a password memory cell you must enable or disable its callback extension capability by means of the %Fn=x command. In this command n is the cell number and x defines whether and how the password in the cell can be used for callback (*see Chapter 4* for further details).

The comma, which cannot be used as a character in a password, functions as a special character to identify the callback request extensions described in the following paragraphs.

There are three callback request extensions that a remote operator may be permitted to add to an on-line password: R, C, or F. A password stored with password cell qualifier Fn=0 will not accept any callback extension. An answering modem will terminate the call if it receives an Fn=0 password with a callback extension attached.

The roving callback extension (,R) causes the answering modem to prompt the caller for a telephone number to use for the callback. Once the number is supplied, the answering modem disconnects the original call and places a return call using the number it has just been given. The password to which the roving callback extension is attached must have been stored in the answering modem with the appropriate password cell qualifier, Fn=1 or Fn=3.

The memory cell callback extension (,C) causes the answering modem to prompt the caller for the number (0 — 9) of a phone number memory cell in the answering modem. Once the cell number is supplied, the answering modem disconnects the original call and places a return call using

the telephone number stored in the specified memory cell. The password to which the memory cell callback extension is attached must have been stored in the answering modem with the appropriate password cell qualifier, $F_n=2$ or $F_n=3$.



A telephone number stored for callback use should always include the :n (retry) modifier. Specify that the modem is to make at least three attempts to dial the number. Retries compensate for any delay in receiving dial tone from the Central Office after termination of the initial connection.

The fixed callback extension (**,F**) is only valid when the answering modem is connected to an MMS controller. It causes the answering modem to disconnect the original call and place a return call using a number stored in the controller. Callback numbers are stored in the controller associated with user names. A user name has to be supplied as part of the on-line password procedure when the answering modem is connected to an MMS controller. This extension is not enabled by an F_n qualifier since it is administered by the controller, not the modem.

Private Line Operation

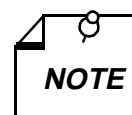
The SC 5034 network termination is essentially full duplex (equivalent to 4-wire). However, the SC 5034 supports 2-wire and 4-wire operations in leased-line mode because the remote modem at the other end may go through either type of loops.



Speeds below V.32 4800 bps are not supported in private line operation.

Two-wire or Four-wire Selection

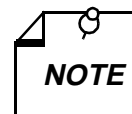
The SC 5034 DSE is capable of operation on private line networks, using either 4-wire or 2-wire circuits. Use **&L1** to select 2-wire operation or **&L2** to select 4-wire operation.



*When using Factory Default 0 (**&F0**) to set up a private line connection, make all other option settings before issuing the **&L1** or **&L2** command. The modem will begin its training sequence at once when it is given the **&L** command.*

Other Configuration

Configuring an SC 5034 modem channel for private line operation is very simple. In any private line connection, first designate one modem as the originate modem (**%O0**) and the other as the answer modem (**%O1**). Next, configure both modems for the type of communication they are intended to perform: these include normal or reliable modes (**\N** command), synchronous or asynchronous modes (**&M** command), DTE and VF modulation (**\T** and **&P** commands), etc. Select **&P0** (V.34 only), **&P1** (V.32 bis only) or **&P2** (V.32 only) to establish the desired modulation in private line.



*If an error-corrected link is desired, configure the modem for **\N2** (MNP reliable mode) or **\N4** (V.42 (LAPM) reliable mode) rather than **\N3** (V.42/MNP auto-reliable mode).*

Automatic and Manual Handshaking

The SC 5034 DSE utilizes a private line “idle” mode to facilitate the use of the AT command set for private line set up. The modems can be put into private line idle via the TEAM 5034 command Private Line Talk/Data. If the modems are already trained and option changes are desired, a “+++” sequence can be used to enter command mode. After the changes are complete, an O command can be used to go back on line or an H command can be issued to go to idle. From idle, either the talk/data switch or O can be used to initiate a new connection. Once told to handshake, the modems will continuously try to complete a handshake. When this process is complete, the modem will display a CONNECT message on the DTE.

When communicating with a different modem in private line operations, the following steps outline how to configure the modems:

1. Configure both modems for the type of communications they are intended to perform.
2. Configure the SC 5034 DSE as the ORIGINATE modem, using the %O0 command.
3. Again, use the &W command to permanently store the current configurations for both modems.

Communication Operation and AT Commands

This part of the chapter describes both communication operating procedures for the SC 5034 DSE and the AT commands by which you can implement those procedures. To operate an SC 5034 DSE using AT commands, you need to have a computer or terminal (the DTE). The port enables communication between the DTE and the modem. If a computer is being used as the DTE, it will also require a communications software package. If you plan on using error correction or data compression, the software package must support flow control.

Command Mode and Data Mode

There are two categories of communication between the SC 5034 DSE and its DTE: command mode and data mode. In command mode the DTE communicates with the modem itself to establish configuration and to initiate functions. In data mode the DTE communicates through the modem over a telephone line to a modem and DTE at another site.

The modem's essential functions are the transmission and reception of data that take place while it is in data mode. The commands given to the modem while it is in command mode determine how it accomplishes those functions.

Command mode is always asynchronous; data mode can be either asynchronous or synchronous. The modem can be configured (by the &M command) for asynchronous operation in both command and data modes or asynchronous operation in command mode and synchronous operation in data mode.

The modem is initially in command mode when it is powered On. It enters data mode when you command it to go on-line to another modem (by dialing a switched network connection or initiating handshake for a private line connection) or when it goes on-line in response to a connection initiated by a remote modem.

Depending on its option settings, you can cause the SC 5034 DSE to enter command mode and wait for the next AT command by using &D1, dropping DTR, or typing the Escape sequence (+++).

AT Command Mode

In command mode the modem looks at everything you type on the DTE keyboard, checking constantly for a valid command (AT commands are described below, and *Chapter 4* contains a complete list of available AT commands). When the modem detects a valid command, it will execute that command for you. In AT Command Mode, you may ask the SC 5034 DSE to answer a call, hang up or dial, change an S-Register value, or perform other command functions.

Configuration Profiles

A configuration profile consists of the set of AT commands the modem is given to establish its operating characteristics. Each SC 5034 modem channel can store up to eight configuration profiles: four factory-provided fixed profiles and four user defined profiles. By recalling and loading a stored profile you can completely re-configure the modem without having to change individual options.

The individual profiles in each of the two sets are identified as 0 — 3. The command to recall and load a fixed profile is `&Fn`. The description of the `&Fn` command in *Chapter 4* lists the characteristics of the four fixed profiles.

The command to recall and load a user defined profile is `Zn`. The command to store a user defined profile is `&Wn`. When it receives the `&Wn` command, the DSE stores the configuration options in effect at that time as user defined profile *n* for the modem channel.

Each time power to the DSE is turned On the modem channel recalls and loads a user defined profile. You specify which of the four user defined profiles it uses for that purpose by means of the Power Up User Configuration Profile command, `&Yn`. When the modem leaves the factory the initial default setting for `&Yn` is user defined profile 0. The factory default for user profile 0 is the same as fixed profile 0.

Command Syntax

An AT command takes the form of a single letter or a combination of a letter and a modifier character, often followed by one or more numeric characters. The modem interprets the AT command as a direction to set a configuration parameter or perform an action. The command (letter or letter and modifier) identifies the parameter or action, and the numeric value specifies (from a pre-established range of choices) how the parameter is to be set or how the action is to be performed. Some AT commands, such as those used to program telephone numbers, involve further modification through the use of an equal sign (=) followed by additional numeric characters.



There is one exception to the rule that an AT command is a letter or a letter/modifier combination: the command for displaying basic AT command set help is `$`. It can also be combined with any of the valid modifiers to display help for the extended AT command sets.

You send AT commands to the modem in the form of a "command line." Each command line is preceded by the letters AT or at, contains one or more commands, and ends with a carriage return. The letters AT stand for "ATtention" and signal the modem that a command (or commands) will follow. The modem determines the asynchronous data rate and parity settings of the local DTE from the command line's AT prefix.

The `A/` command is the one exception that does not require the AT command line prefix. It is discussed below under the Command Buffer heading.

It is possible to enter multiple commands on a single line, up to a maximum of 50 characters. The commands may be separated by space or line feed characters to improve readability. The unit ig-

nores space and line feed characters, so they do not count as part of the line's 50 characters. A carriage-return character must be entered at the end of a command line to signal the unit to process the commands.

While entering a command line you can correct mistakes by using the backspace, or Ctrl-H, character. It moves the cursor one character to the left and deletes the character. The AT prefix cannot be deleted.

Command Buffer

When the command line is sent to the modem, it is loaded into a command buffer with a capacity of 50 characters. The AT prefix, spaces, line feed characters, and carriage return are not loaded into the buffer, and so do not count as part of the 50-character limit. If a command line is more than 50 characters long, the modem will only act on commands that are contained in the first 50 characters.

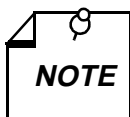
The A/ command instructs the modem to re-execute the command line currently in the buffer. It is to be sent to the modem as a command line that consists of only the A/ command and a carriage return — no AT prefix. This is the only command line that does not need to be preceded by the AT prefix.

Automatic DTE Speed and Parity Detection

In command mode the modem automatically detects the DTE operating speed and asynchronous character parity when it receives the AT prefix from the DTE.

The modem can automatically adapt to incoming data at any of the following asynchronous bit rates:

128,000 bps	115,200 bps	112,000 bps	96,000 bps
76,800 bps	72,000 bps	64,000 bps	57,600 bps
56,000 bps	48,000 bps	38,400 bps	33,600 bps
32,000 bps	31,200 bps	28,800 bps	26,400 bps
24,000 bps	21,600 bps	19,200 bps	16,800 bps
14,400 bps	12,000 bps	9600 bps	7200 bps
4800 bps	2400 bps	1200 bps	300 bps



Configuration via the &H command determines what modulation the modem will operate with at a DTE speed of 1200 or 300 bps. At 1200 bps the modem can be configured to use either ITU-T V.22 or Bell 212A modulation. At 300 bps the modem can be configured to use either ITU-T V.21 or Bell 103 modulation.

The modem can automatically adapt to the character length and parity of the characters coming from the DTE. It adapts to ODD, EVEN, SPACE, or MARK/NONE parity.

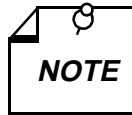
The automatic detection and adaptation function works for either lower case “at” or upper case “AT”. Mixed cases (“At” or “aT”) will not give predictable results.

Remote Configuration Using the AT Commands

Remote Configuration allows you to use a local SC 5034 DSE to connect to a remote GDC V.34 modem and view or change the current user configuration profile at the remote modem.

Before you initiate a Remote Configuration session, you must ensure the following:

- Modems must either both be in switched network mode or both be in private line mode.
- The local modem must be in AT command mode (%V0 or PRS AT command). The remote modem will be forced into AT command mode when the connection is established.
- The local modem must be in an asynchronous error correcting mode. The remote modem will be forced into asynchronous mode when the connection is established.
- Both modems must have the same remote configuration security password (*Pn command). If the remote modem does not have a remote configuration security password, you may configure one during the Remote Configuration session.
- The handshake mode of the remote modem must be V.34 (&H0, &H1, or &P0 command), V.32 *bis* (&H2, &H3, or &P1 command), or V.32 (&H4, &H5, or &P2 command).
- If you intend to save changes, you must enable remote configuration write access (*R0 command) at the remote modem before initiating the session.



NOTE

- a. *The DTE interface on the remote modem is disabled during the Remote Configuration session to prevent the remote DTE from inadvertently terminating the session.*
- b. *Responses and echoes from the remote to the local modem are enabled regardless of the optioning of the remote modem. If quiet mode is selected on the remote modem, it will still send echo back to the local modem.*

To initiate a Remote Configuration session, enter *W1 at the local modem. In private line mode, the connection is made automatically. In switched network mode, you must place the call to the remote modem. Upon connection, the local modem displays

```
OK REMOTE CONFIG SESSION VIEW
```

if Remote Configuration write access is disabled, or

```
OK REMOTE CONFIG SESSION EDIT
```

if Remote Configuration write access is enabled.

After you establish a Remote Configuration session, you may view or edit (change) the current user configuration profile at the remote modem in the same way you would at the local modem. The changes that you make do not affect the modem as you make them. Instead, they become part of a configuration profile. Once you have made all the changes you intend to, you have the following options:

- To terminate the session without saving or using the new configuration profile, enter *X0.
- To terminate the session and put the new configuration profile into use temporarily (i.e., modem will use the new configuration only until it is reset or power is cycled), enter *X1.
- To save the new configuration as a user defined profile that can be recalled and loaded in the future, use the &Wn command before entering *X1 to terminate the session and put the new configuration into use.

The following commands are invalid during a Remote Configuration session and will cause an error response:

- A (answer call)
- Dn (dial)
- Hn (hookswitch)
- On (on-line)
- &Tn (test mode), except &T4 and &T5

Data Mode

The SC 5034 DSE is in data mode while it has a telephone line connection to another modem or is in the process of establishing a connection. In Data Mode the modem transmits all the data it receives from the DTE over the phone line.

In data mode the modem can operate either asynchronously or synchronously, as specified by the &M command. A variety of data protocols are available for each type of operation. Some protocols provide error correction to improve reliability and/or data compression to increase throughput. The two types of data mode operation, and their protocols, are described at length in the following pages.

Each telephone line connection (whether switched network or private line) between two modems in data mode begins with a handshaking sequence. During that sequence the modems determine the VF (telephone line) speed, data protocol, and related parameters for the data link. Configuration determines the range of choices available to the modem in the negotiation process. Most configuration options in the SC 5034 DSE act to limit the range over which a parameter can be negotiated, rather than making specific assignments.

The DTE can cause the modem to enter data mode and initiate dialing (switched network) or handshaking (private line) by asserting the Data Terminal Ready (DTR) signal at the interface or by issuing an AT command to dial. Configuration determines whether or not the modem is controlled by DTR. The presence of a carrier from a remote modem causes the SC 5034 DSE to enter data mode and assert a Data Carrier Detect (DCD) signal to its DTE.

Asynchronous Operation

When you select Operating Mode 0 (&M0) the SC 5034 DSE operates asynchronously both while on-line (data mode — connected to the telephone line) and while off-line (Command Mode — disconnected from the telephone line).

The SC 5034 DSE can employ error correction (reliable) protocols to ensure error-free delivery of asynchronous data sent between computers. The error control methods are based on grouping data into frames with checksums determined by the contents of each frame. The receiving modem checks the frames and sends acknowledgments to the transmitting modem. When it detects a faulty frame, the receiving modem requests a re-transmission. Frame length varies according to the amount of data transmitted or the number of re-transmissions requested from the DTE.

The modem can achieve DTE speeds greater than the maximum VF speed through the use of a data compression protocol. Two asynchronous compression protocols are available in the SC 5034 DSE: ITU-T V.42 *bis* and MNP Level 5. They attempt to increase throughput by compressing the information to be sent before actually sending it. The modem is thus able to transmit more data in a given period of time. Characteristics of the individual compression techniques are discussed below.

The SC 5034 DSE supports the following asynchronous DTE speeds:

128,000 bps	115,200 bps	112,000 bps	96,000 bps
76,800 bps	72,000 bps	64,000 bps	57,600 bps
56,000 bps	48,000 bps	38,400 bps	32,000 bps
28,800 bps	26,400 bps	24,000 bps	21,600 bps
19,200 bps	16,800 bps	14,400 bps	12,000 bps
9600 bps	7200 bps	4800 bps	2400 bps
1200 bps	300 bps		

The SC 5034 DSE supports the following VF data speeds:

33,600 bps	31,200 bps	28,800 bps	26,400 bps
24,000 bps	21,600 bps	19,200 bps	16,800 bps
14,400 bps	12,000 bps	9600 bps	7200 bps
4800 bps	2400 bps		

Error Correcting Modes

The SC 5034 DSE can employ the following error correcting modes:

- MNP reliable mode
- V.42 (LAPM)/MNP auto-reliable mode
- V.42 (LAPM) reliable
- V.42 (LAPM)/MNP reliable mode

The `\N` command selects an error correcting mode for the SC 5034 DSE modem channel. The DSE interprets `\N` in combination with the `%C` command to determine what data compression protocol (if any) is available. *Table 3-3* shows the combinations of those commands that achieve the various available modes. The full characteristics of each command are described in *Chapter 4*.

Each mode has specific features that impact how the modem channel functions. One major distinction between the standard modem state and the error correction modem state is that bi-directional data buffering and flow control are required for error correction. Buffering and flow control allow the modem channel to operate with the computer serial port and the modem port set for different data rates. Flow control is discussed following the descriptions of the error correcting and compression protocols.

MNP Reliable Mode Error Correction (Levels 2 — 4)

An SC 5034 DSE modem channel can use an error correction protocol called MNP that has different service classes or levels to allow its use with older equipment as well as with more recent equipment. The SC 5034 DSE is compatible with MNP Levels 2 — 4.



Asynchronous DTE must be used for all levels of MNP error control.

When you enable a modem channel for MNP operation, you configure it to be compatible with a range of MNP levels, not for a specific level. The two available ranges are Levels 2 — 5 and Levels 2 — 4. The `\N` command determines whether the modem channel can use Levels 2 — 4. When those levels are enabled, the `&C` command determines whether Level 5 is available also. When attempting an MNP reliable connection, modems negotiate the connection for the highest common MNP service level permitted by their configuration.

In MNP Reliable Mode (`\N2`), an SC 5034 DSE modem channel can only connect with a modem that has an error correction system capable of establishing an MNP reliable link. When the connection is made, the modem channel immediately attempts to establish an MNP reliable link. If the attempt fails, the SC 5034 DSE disconnects. An attempt to secure an MNP reliable link might fail because:

- Remote modem does not support an MNP reliable link.
- Remote modem is an MNP modem, but is not in the proper mode.
- Telephone connection is so poor and noisy that even an MNP reliable link connection cannot assure dependable communications.

You may not want to use certain software error-correcting protocols with an MNP reliable link because redundant error checking will reduce the link's file transfer efficiency. There are file transfer protocols available that are designed for use with hardware error-correcting modems. Two such file transfer protocols are IMODEM and YMODEM-G. (Practical tests have shown ZMODEM to perform within a few percentage points of the other protocols.)

When using MNP reliable mode, it is important that you know the capabilities and status of the remote system. If you call a non-MNP or V.42 modem while in MNP reliable mode, your connection will fail. If you cannot obtain the appropriate information about the remote system, you should probably use V.42 (LAPM)/MNP auto-reliable mode.

The following list briefly describes characteristics of the three MNP levels that provide only correction.

- Level 2** is an asynchronous full-duplex protocol. Data frames and acknowledgments can be transmitted simultaneously. The maximum frame size is 256 bytes.
- Level 3** is a synchronous full-duplex protocol. The modem sends the call setup asynchronously and switches to synchronous mode when sending the data. The maximum frame size is 256 bytes.
- Level 4** provides synchronous framing with adaptive frame lengths. The frame length is automatically adjusted according to the line quality (based on number of re-transmissions). The frame header in Level 4 is shorter than in Level 3, which results in a slight improvement in throughput — about 20% improvement in comparison to nominal data rate.

MNP Reliable Mode with Data Compression (Level 5)

In addition to error correction, MNP Level 5 provides data compression for an improvement in throughput. For error correction, Level 5 provides synchronous framing with adaptive frame lengths. The sending modem performs data compression by detecting redundant data and re-coding it into fewer bits. The receiving modem decompresses the data before passing it to the receiving computer.

MNP Level 5 throughput is very sensitive to the data structure being transmitted. ASCII text files will produce the greatest throughput gains, about 70% improvement in comparison to nominal VF data rate. Files with .EXE, .COM and .ARC extensions may show as little as 60% of the throughput benefits accorded ASCII files.

V.42 (LAPM) Reliable Mode Error Correction

The V.42 (LAPM) reliable error correction mode (\N4) is very similar to the MNP reliable mode (\N2), except that, during the handshake, it first looks for the LAPM character. The modem transmits a Link Access Protocol (LAPM) character as part of the handshake when it attempts to negotiate a V.42 link. The V.42 protocol provides error correction compliant with the ITU-T V.42 error correction scheme and supports the ITU-T V.42 *bis* data compression algorithm.

In addition to its own error correction technique, the V.42 specification includes MNP-2 through MNP-5 capability. It is backward compatible with the current GDC MNP-5 FEM. Since the V.42 protocol also includes the MNP protocols, if the V.42 (LAPM) connection attempt fails, the modem will drop the call.

Due to increased complexities during the handshaking procedures, the V.42 (LAPM) reliable mode is recommended for use only with other V.42 modems when data integrity is critical.

All V.42/MNP options use AT commands only for set up.

V.42 *bis* Data Compression

V.42 *bis* data compression is only possible when the modem has established a V.42 (LAPM) error correcting connection. V.42 *bis* compression generally gives improved throughput results versus MNP 5 compression, particularly when transferring previously compressed files. V.42 *bis* only compresses files where it can improve performance. MNP 5 attempts to compress every file, even if doing so can't improve the throughput and results in degraded performance.

Many "bulletin boards" use a file compressor, such as PKZip, to store and send files. V.42 *bis* provides greater efficiency than MNP 5 for such files. V.42 *bis* advantages are only available using the V.42 (LAPM)/MNP reliable (\N5), V.42 (LAPM) reliable (\N4), or V.42 (LAPM)/MNP auto-reliable (\N3) operating modes.

V.42 (LAPM)/MNP Auto-reliable Mode

Since it is not always possible to know the type and status of the remote modem, the SC 5034 DSE supports V.42 (LAPM)/MNP Auto-reliable Mode (\N3). In this mode, the SC 5034 DSE modem channel first makes an initial connection then looks at the data stream from the remote modem for incoming V.42 or MNP characters. If it detects the appropriate characters, the SC 5034 DSE establishes a reliable link. If the modem channel cannot establish a reliable link, it falls back to Wire Mode or direct V.14 mode (described below under the heading Non-Error Correcting Modes). The AT command \C*n* determines what mode the modem channel falls back to and how it handles data it receives before its mode is established. *Chapter 4* provides details on the \C*n* command.

The handshake sequence that occurs when a SC 5034 DSE modem channel auto-answers a call in V.42 (LAPM)/MNP Auto-reliable Mode can have one of three outcomes:

- success, resulting in a negotiated error correcting link
- failure, resulting in a fallback to the mode specified by \C*n*
- reception of two successive fallback characters, if enabled by \C*n*, resulting in an immediate fallback to the specified mode. The %A*n* command defines the modem's fallback character.

Use of a fallback character permits the 4-second handshake sequence to be cut short when there is no chance of success.

V.42 (LAPM)/MNP Auto-reliable Mode or V.42 (LAPM)/MNP Reliable Mode the most commonly used configuration. Experimentation and experience, in conjunction with careful study of the command language, will indicate what works best for your application.

V.42/MNP Reliable Mode

The V.42/MNP reliable mode (\N5) is very similar in performance to the V.42/MNP auto-reliable mode (\N3). The difference is that failure to establish an error correcting link causes the modem to disconnect rather than to fall back to a non-error correcting mode.

Non-Error Correcting Modes

The SC 5034 DSE also employs the following non-error correcting modes:

- wire mode
- direct V.14 asynchronous mode
- V.13 mode

Like the MNP and V.42 protocols, these modes are configured using the \N command. *Chapter 4* contains full description of the options for that command.

Wire Mode

Wire mode (\N0) is used to communicate with standard, non-error correcting modems. An SC 5034 DSE modem channel falls back to wire mode if it fails in an attempt to negotiate an auto-reliable link with the remote modem. Error correction is not active in wire mode.

Wire mode provides data buffering so that the modem's DTE and VF interfaces can operate at different speeds. For example, the local DTE can exchange data with the modem channel at 19,200 bps while the link with the remote modem operates at 2400 bps. To do this, however, the local terminal emulation software must allow its auto baud feature to be turned off and allow flow control.

Direct V.14 Asynchronous Mode

In direct V.14 mode (\N1) there is no error correction, data compression, or data buffering. The modem channel DTE data rate and VF line speed must be set to the same value. If, for example, the link between the SC 5034 modem channel and the remote modem operates at 9600 bps, then the local DTE must exchange data with the modem channel at 9600 bps.

V.13 Mode

V.13 mode (\N6) is a simulated controlled carrier mode designed for polling applications. It uses the ITU-T V.13 RTS/DCD signaling method to control the remote modem's DCD lead via the local modem's RTS lead. It can be used for both synchronous and asynchronous data.

The RTS/DCD signaling can be configured for either bi-directional or unidirectional control by the &E command.

Flow Control

The SC 5034 DSE supports flow control on the modem channels. In combination with internal data buffering flow control permits portions of a data link to operate at different speeds. For example, the rate of transfer between the local DTE and the modem channel can be greater than the VF line speed negotiated between the modem channel and the remote modem, while the modem-to-DTE transfer rate at the remote site can differ from both. Buffers in the modem channel and the modem compensate for such differences to a large degree, but flow control comes into play when data traffic approaches the limits of buffer capacity. Flow control meters incoming data and can stop it from coming in when there is not enough room available in the internal buffer. Without flow control, data will be lost if the modem port and the VF line interface don't operate at the same bps rate.

Error correction and data compression are both sources of the rate differences that flow control and buffering compensate for.

Flow control can be achieved either by software or by hardware. Software flow control involves control characters inserted within the transmitted data. Hardware flow control is achieved by altering the voltage level of various signal lines at the interface between the computer's serial port and the modem. The SC 5034 DSE supports three forms of hardware flow control: one (described below) that is compatible with asynchronous operation, and two that are only for use with synchronous data compression.

Software Flow Control

Software flow control uses the XON and XOFF characters, which are also known as Control-Q and Control-S, respectively. The characters are inserted in the transferred data.

Use of XON/XOFF software flow control requires care to make sure that only the desired element

in the system responds to the flow control characters. If you are using XON/XOFF to control the local serial port, you may not want the flow control characters to be passed along to the remote modem with the data.

The \G command is used to determine whether the SC 5034 DSE processes the flow control characters and passes them to the remote modem along with the data, or simply processes them and deletes them from the data stream.

Hardware Flow Control

Hardware flow control can be either unidirectional or bi-directional. Exactly how you set the flow control commands depends on your application. Bi-directional hardware flow control is recommended if your application demands both file uploads and downloads and the transfer protocol does not support any form of XON/XOFF.

Hardware flow control for asynchronous operation usually uses the signals RTS (request to send) and CTS (clear to send). Study the commands \G and \Q in the Extended AT Command Set in *Chapter 4* for further information on this topic. In MNP Reliable Mode or V.42 Mode the protocol itself controls data flow on the modem port. Re-transmissions due to a very noisy phone line may cause the buffer to fill, however, so the use of flow control on the serial port is still important.

Table 3-4 lists the AT commands used to enable the different types of data compression and error correction.

Table 3-4 Enabling Error Correction/Data Compression

To Enable	Use AT Commands
V.42 Auto Reliable V.42 <i>bis</i> MNP 2-5 Wire	\N3 and %C1
V.42 (LAPM) and V.42 <i>bis</i> only	\N4 and %C1
V.42 only	\N4 and %C0
MNP Level 2-5 only	\N2 and %C1
MNP Level 2-4 only	\N2 and %C0
V.42, V.42 <i>bis</i> or MNP 2-5 only	\N5 and %C1
V.42 or MNP 2-4 only	\N5 and %C0
No data compression and no error correction	\N0 or \N1, and %C0

Synchronous Operation

Synchronous Operating Modes

The &Mn (Operating Mode) command selects between asynchronous and synchronous Data Mode operation. Its synchronous mode setting, &M1, supports asynchronous dialing with synchronous transmission.

Each synchronous operating mode is detailed on the following pages.

Following the descriptions of the dialing/data transmission modes the manual describes the three available synchronous protocols. The \Mn command selects the protocol that the modem channel follows while it is in synchronous Data Mode.

Asynchronous Dialing with Synchronous Transmission

The &M1 mode, Asynchronous Dialing with Synchronous Transmission, supports DTE that are capable of communicating synchronously or asynchronously over the same RS-232 port.

Your call is placed using the asynchronous command set. Once the call connection is established, the SC 5034 DSE modem channel automatically switches to synchronous operation.

The &M1 mode also permits you to use an asynchronous DTE to dial and then switch to a synchronous-only DTE once the call is connected. If the &D setting is other than &D0, the S25 register will determine the length of time permitted to switch DTE before the call is disconnected.

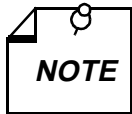
Direct Dialing in Synchronous Mode

Direct dialing in synchronous data mode can be accomplished in either of two ways:

- DTR dialing, selected by %Zn
- V.25 bis commands

When DTR dialing is enabled (%Z1), the SC 5034 DSE modem channel automatically dials the previously stored number (stored using the &Zn=nnn command) when it detects an OFF to ON transition on DTR.

If you wish to save this profile, issue the &W command. The modem channel then comes up in this mode any time power is applied.



Once DTR dialing has been selected, you may find that the modem channel goes off-hook and begins dialing the stored number the moment you connect your DTE. To prevent this, turn off your modem before you connect the DTE to the modem. When the connection is complete, turn the modem back on.

The V.25 bis command set is described in detail in *Chapter 5*.

Normal Synchronous Mode

The \M0 command selects the Synchronous Protocol for normal synchronous operation. The modem channel employs a constant carrier on the VF line. The DTE-to-VF speed relationship is direct, that is the two speeds must match.

The following DTE data rates are available (\Tn command) when the modem channel operates in normal synchronous mode:

28,800 bps	26,400 bps	24,000 bps	21,600 bps	19,200 bps
16,800 bps	14,400 bps	12,000 bps	9600 bps	7200 bps
4800 bps				

V.13 Synchronous Mode

The \M1 command selects the Synchronous V.13 Protocol. V.13 mode is a simulated controlled carrier mode designed for polling applications. It uses the ITU-T V.13 RTS/DCD signaling method to control the DCD lead at the remote modem via the RTS lead of the local modem channel.

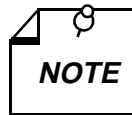
The RTS/DCD signaling can be configured for either bi-directional or unidirectional control by the &E command.

The following DTE data rates are available (`\Tn` command) when the modem channel operates in V.13 synchronous mode:

28,800 bps	26,400 bps	24,000 bps	21,600 bps	19,200 bps
16,800 bps	14,400 bps	12,000 bps	9600 bps	7200 bps
4800 bps				

Synchronous Compression Mode

The `\M2` command selects the Synchronous Compression Protocol. The modem channel can compress synchronous DTE data framed in HDLC/SDLC format, with a maximum frame length of 2048 bytes.



Synchronous Compression is an optional feature that is not included in all SC 5034 DSEs. To check the presence of the feature in your unit, use AT command 14 to display a list of information concerning the modem channel. Sync Compression On/Off is included in that list.

Synchronous compression supports the following DTE data rates (`\Tn` command):

128,000 bps	115,200 bps	112,000 bps	96,000 bps	76,800s
72,000 bps	64,000 bps	57,600 bps	56,000 bps	48,000 bps
38,400 bps	32,000 bps	28,800 bps	26,400 bps	24,000 bps
21,600 bps	19,200 bps			

Two techniques for modem-to-DTE hardware flow control are available for use with synchronous compression. Both require that the modem channel be configured for internal timing (see below). Flow control for synchronous compression can be accomplished by:

- Clock Stopping (`\Q5`) in which the modem channel prevents buffer overflow by sharply reducing the frequency of the transmit clock signal it outputs to the DTE.
- Clock Throttling (`\Q6`) in which the modem channel prevents buffer overflow by varying the rate at which it outputs the transmit clock signal to the DTE

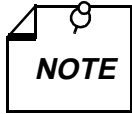
Clock Selection

The synchronous format relies on transmit and receive clocks to maintain character timing. It therefore does not need start and stop bits for each character as does the asynchronous format. An SC 5034 DSE modem channel can be configured to use one of the following three clock sources to transmit synchronous data:

- Internal (`&X0`) — transmit clock generated by the SC 5034 DSE.
- External (`&X1`) — transmit clock signal generated by the DTE is passed to the modem along with data.
- Receiver (`&X2`) — transmit clock derived by the local modem from the data it is receiving from the remote modem (also called wrap timing).

The preferred clock source varies for different computer systems. Consult your computer manual for its particular specifications.

Regardless of which transmit clock source it is using, an SC 5034 DSE modem channel always outputs its transmit clock signal to the DTE on pin 15 of the EIA interface. Pin 17 always provides the receive clock signal derived from the incoming data. When the DTE provides external transmit clock it does so on Pin 24.



The receive clock is always controlled by the remote modem that sends the data being received. It is not recommended to have the local and remote modems both configured to derive transmit clock from received data.

Testing the Modem

Chapter 6 describes basic diagnostics. Tests performed with the modem in asynchronous mode do not use error control. Consequently, by making the remote loop test during an error control connection, the error control mode is terminated and transmission errors caused by the transmission link can be detected.

4 AT Command Set Operation

Overview

This section describes the AT (attention) command set for the SC 5034 DSE. The complete AT command set includes the basic AT and extended AT&, AT%, AT\, AT: and AT* command sets.

This section includes several tables listing the AT commands. They group the commands as follows:

- By option name (*Table 4-1*) — Use this table if you know the name of an option and need to find out what its AT command is and on which page it's described.
- By the type of function (*Table 4-2*) — Use this table to find out which options apply to terminal configuration or diagnostics, for example.
- By command set (*Table 4-3*) — Use this table when you know that what you're looking for is, for example, an AT& command, but you can't remember if it's &Cn or &Dn.

The above tables list only the name and command. To quickly see the choices available for each command, use *Tables 4-4 through 4-9*: They provide brief descriptions of all of the choices for each command. Each table groups one command set. A detailed command reference follows the tables.

Commanding the Modem

The SC 5034 DSE supports the AT command protocol that permits you to:

- Obtain information from the modem channels
- Configure the modem channels
- Establish data communications
- Test the modem channels and data communications system

After the DSE is installed and/or powered up, its modem channels are in the command mode and will accept commands from the terminal. Each command line (except A/) must be preceded by the letters AT and followed by a carriage return or Enter. A/ is used to repeat the last command without entering the AT-prefix. When AT is entered, the modem channel detects the data rate and parity used by the terminal and begins operating at that same data rate and parity until it gets changed.



Special Considerations in Asynchronous Operation

The SC 5034 DSE is shipped from the factory with the data terminal (DTE) interface set for 7 bits with parity, at the last AT speed. This determines the modem's DTE speed when auto answering. If no commands are entered, to change and store a new default, set your terminal/ communication program to the desired speed, data length and parity. Then type "AT&W." This stores the DTE interface parameters. These parameters remain until an AT command is entered, which will change the modem's DTE speed from the stored values.

Up to 50 command characters may be entered. AT commands that exceed 50 characters will not be executed. The AT prefix, space, carriage return and line feed characters are ignored by the modem, and therefore do not count as part of the command line. A carriage-return character must be entered at the end of the command line, otherwise the command will not be processed. Mistakes may be corrected by typing the backspace character. This will move the cursor over the character to be corrected. The AT prefix cannot be deleted.

After each command is entered, the modem responds by sending a result code back to the terminal. Unless the result code function is disabled or the communications software being run on a computer emulating a terminal ignores result codes, the code is displayed by the terminal to indicate the result of the entered command. Valid commands return OK; invalid commands return ERROR.

New commands cannot be issued until a response to the previous command is received. If there is no response, a wait of three character times is required before the next command. If the DTE rate is changed, then 1 second must elapse.

Network Option AT Commands

There is a group of AT commands for network options that are provided for use when the SC 5034 DSE is installed in a shelf without an SCM card and is therefore not subject to SNMP control. The commands control functionality, such as data highway and time slot assignment, that is administered by other system components in an SNMP-controlled system. The following AT commands make up this group of network options:

:Cn	Switched Network Highway
:Dn	Switched Network Time Slot
:Fn	Private Line Time Slot
:Gn	Call Direction
:Hn	Trunk Type
:In	Signaling Method
:Jn	Companding Law
:Ln	Frame Type
:Mn	Private Line Highway
:Nn	Service State
:S	Store Network Options

AT command functionality for these options is normally disabled to minimize the chance of inadvertent changes that could interfere with the operation of other DSEs. To enable the use of AT commands for network options, enter the AT command:

```
*Y5034:X1
```

Use of the AT commands for network options remains enabled until you either cycle power to the unit or enter the AT command:

```
*Y5034:X0
```

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times.

The network options in this group are not included in the factory or user profiles that store other AT command settings in non-volatile memory for convenient loading. When the DSE receives network option settings it puts them into effect, but they are initially stored in volatile memory, subject to loss if power to the unit is interrupted.

The AT command :S stores the current settings of all network option AT commands to non-volatile memory.

Setup Procedures

1. Install the SC 5034 DSE as described in *Chapter 2*.
2. Select the proper communications port on the terminal or terminal emulator program.
3. Make sure that 10 bit ASCII is selected for the terminal or emulator.
4. If you're using a communications software package, it interfaces with the DSE modem channel with no further setup required. Refer to the documentation for the communication software package.
5. If you're using the modem channel interactively with a terminal or a terminal emulation package, issue AT\$ (enter). If the SC 5034 DSE is connected properly, it responds to the command by displaying the basic AT command set help menu.
6. Use the commands in this chapter to configure and operate the SC 5034 DSE as required.

Table 4-1 AT Commands Listed by Name

Name	Cmd.	Page
Answer call	A	4-20
Answer mode	%On	4-36
Asymmetric DCE rates	\Rn	4-39
Asynchronous protocol	\Nn	4-35
AT command set help	\$	4-20
AT% command set help	;%\$	4-20
AT& command set help	&\$	4-20
AT* command set help	*\$	4-20
AT: command set help	:\$	4-20
AT\ command set help	\\$	4-20
Auto-reliable fallback character	%An	4-21
Automatic answer	S0=x	4-40
Automatic fallback/fallforward	&An	4-20
Backspace character	S5=x	4-41
Break character handling	\Kn	4-33
Call Direction	:Gn	4-30
Call failures before modem make busy	S42=x	4-42
Call Progress Monitor	Xn	4-49
Call Progress Monitor message response speed	%Rn	4-38
Carriage return character	S3=x	4-41
Carrier loss timer	S10=x	4-41
Carrier presence timer	S9=x	4-41
Carrier, dial and ringback wait timer	S7=x	4-41
Cellular power level adjustment)Mn	4-34
Character abort	%Kn	4-32
Character length	\Bn	4-21
Command format	%Vn	4-46
Companding Law	:Jn	4-32

(Continued on next page)

Table 4-1 AT Commands Listed by Name (Continued)

Name	Cmd.	Page
Connect message type	\Vn	4-46
Country code	N?	4-35
CTS operation	&Rn	4-38
Data compression	%Cn	4-22
DCD operation	&Cn	4-22
DCE rate limit	&Gn	4-29
Default Highway and Timeslot Values	:Yn	4-50
Dial	Dn	4-23
Dial pause timer	S8=x	4-41
Dial tone wait timer	S6=x	4-41
Dialing type	P, T	4-36, 4-44
DSR operation	&Sn	4-43
DSR operation in test mode	%Dn	4-24
DTE speed	\Tn	4-44
DTR delay timer	S25=x	4-42
DTR dialing	%Zn	4-52
DTR On-to-Off transition	&Dn	4-24
Escape code character	S2=x	4-40
Escape code guard timer	S12=x	4-42
Fallback selection and pre-link data buffer	\Cn	4-22
Frame Type	:Ln	4-33
Front panel lockout	&In	4-32
Hang-up delay timer	S38=x	4-42
Hookswitch	Hn	4-30
Identification and checksum	In	4-31
Initial cellular power level setting	@Mn	4-34
Inactivity timer	%Tn	4-44
Line feed character	S4=x	4-41
Load fixed configuration profile	&Fn	4-25
Load user configuration profile	Zn	4-51
Local DTE echo	En	4-25
Long space disconnect	Yn	4-49
Make busy	%Bn	4-21
MNP link negotiation speed	*Hn	4-31
MNP10 mode	-Mn	4-34
Modem-to-DTE flow control	\Qn	4-38
Modem-to-modem flow control	\Gn	4-29
Network type	&Ln	4-33
On-line	On	4-36
Operating mode	&Mn	4-33

(Continued on next page)

Table 4-1 AT Commands Listed by Name (Continued)

Name	Cmd.	Page
Overspeed correction	\An	4-21
Parity type	\Pn	4-37
Password cell qualifier	%Fn=x	4-28
Password operation	%Sn	4-43
Power-up user configuration profile	&Yn	4-49
Private line handshake mode	&Pn	4-37
Private Line Heartbeat	%Hn	4-31
Private Line Highway	:Mn	4-34
Private Line Timeslot	:Fn	4-28
Remote configuration control	*Wn	4-48
Remote configuration exit	*Xn	4-49
Remote configuration security password	*Pn	4-37
Remote configuration write access	*Rn	4-39
Repeat command	A/	4-21
Response mode	Qn	4-37
Result code type	Vn	4-45
Retrain on poor signal quality	%Qn	4-37
Retransmission counter	S70=x	4-43
Ring counter	S1=x	4-40
RTS-to-CTS delay timer	S26=x	4-42
S-Register help	S\$	4-20, 4-40
S-Registers	Sn	4-39
Save settings as a user configuration profile	&Wn	4-48
Service State	:Nn	4-35
Set network configuration commands to defaults	:Yn	4-50
Signaling Method	:In	4-32
Simulated controlled carrier	&En	4-25
Store a phone number	&Zn=nnn	4-51
Store Network Options	:S	4-43
Store password	%P=nnn	4-37
Switched network handshake mode	&Hn	4-30
Switched network highway	:Cn	4-23
Switched network timeslot	:Dn	4-24
Synchronous protocol	\Mn	4-34
Test mode	&Tn	4-44
Test mode timer	S18=x	4-42
Transmit clock source	&Xn	4-49
Trellis coding	&Un	4-45
Trunk Type	:Hn	4-31
View stored phone numbers	&V	4-45

Table 4-2 AT Commands Listed by Function

Name	Command
AT Command Set Options	
AT command set help	\$
AT& command set help	&\$
AT% command set help	'%\$
AT\ command set help	\\$
AT: command set help	:\$
AT* command set help	*\$
Repeat command	A/
S-Register help	S\$
S-Registers	Sn
Configuration Profile Options	
Load fixed configuration profile	&Fn
Load user configuration profile	Zn
Power-up user configuration profile	&Yn
Save settings as a user configuration profile	&Wn
Diagnostics Options	
DSR operation in test mode	%Dn
Test mode	&Tn
Test mode timer	S18=x
Dialer Options	
Command format	%Vn
Dial	Dn
Dial pause timer	S8=x
Dial tone wait timer	S6=x
Dial wait timer	S7=x
Dialing type	P, T
DTR dialing	%Zn
Ringback wait timer	S7=x
Store a phone number	&Zn=nmn
View stored phone numbers	&V
Modem Options	
Answer call	A
Automatic answer	S0=x
Carrier loss timer	S10=x
Carrier presence timer	S9=x
Carrier wait timer	S7=x
Country code	N?
Front panel lockout	&In

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Table 4-2 AT Commands Listed by Function (Continued)

Name	Cmd.
Modem Options (Continued)	
General security password	%Pn
Hang-up delay timer	S38=x
Hookswitch	Hn
Identification and checksum	In
Long space disconnect	Yn
Make busy	%Bn
On-line	On
Remote configuration control	*Wn
Remote configuration exit	*Xn
Remote configuration security password	*Pn
Remote configuration write access	*Rn
Retransmission counter	S70=x
Ring counter	S1=x
Transmit clock source	&Xn
Network Options	
Call Direction	:Gn
Companding Law	:Jn
Default Highway and Timeslot Values	:Yn
Frame Type	:Ln
Network type	&Ln
Private Line Highway	:Mn
Private Line Timeslot	:Fn
Service State	:Nn
Signaling Method	:In
Store Network Options	:S
Trunk Type	:Hn
Protocol Options	
Answer mode	%On
Asynchronous protocol	\Nn
Auto-reliable fallback character	%An
Automatic fallforward/fallback	&An
Data compression	%Cn
Modem-to-modem flow control	\Gn
Private line handshake mode	&Pn
Retrain on poor signal quality	%Qn
Simulated controlled carrier	&En
Switched network handshake mode	&Hn

(Continued on next page)

Table 4-2 AT Commands Listed by Function (Continued)

Name	Cmd.
Protocol Options(Continued)	
Synchronous protocol	\M <i>n</i>
Trellis coding	&U <i>n</i>
Terminal (DTE) Options	
Backspace character	S5= <i>x</i>
Break character handling	\K <i>n</i>
Call Progress Monitor	X <i>n</i>
Call Progress Monitor message response speed	%R <i>n</i>
Carriage return character	S3= <i>x</i>
Character abort	%K <i>n</i>
Character length	\B <i>n</i>
Connect message type	\V <i>n</i>
CTS operation	&R <i>n</i>
DCD operation	&C <i>n</i>
DSR operation	&S <i>n</i>
DTE speed	\T <i>n</i>
DTR delay timer	S25= <i>x</i>
DTR On-to-Off transition	&D <i>n</i>
Escape code character	S2= <i>x</i>
Escape code guard timer	S12= <i>x</i>
Line feed character	S4= <i>x</i>
Local DTE echo	E <i>n</i>
Modem-to-DTE flow control	\Q <i>n</i>
Operating mode	&M <i>n</i>
Overspeed correction	\A <i>n</i>
Parity type	\P <i>n</i>
Fallback selection and pre-link data buffer	\C <i>n</i>
Response mode	Q <i>n</i>
Result code type	V <i>n</i>
RTS-to-CTS delay timer	S26= <i>x</i>

Table 4-3 AT Commands Listed by Command Set

Name	Cmd.
Basic AT Command Set	
Answer call	A
AT command set help	\$
Automatic answer	S0=x
Backspace character	S5=x
Call Progress Monitor	Xn
Carriage return character	S3=x
Carrier loss timer	S10=x
Carrier presence timer	S9=x
Carrier wait timer	S7=x
Country code	N?
Dial	Dn
Dial pause timer	S8=x
Dial tone wait timer	S6=x
Dial wait timer	S7=x
Dialing type	P
Dialing type	T
DTR delay timer	S25=x
Escape code character	S2=x
Escape code guard timer	S12=x
Hang-up delay timer	S38=x
Hookswitch	Hn
Identification and checksum	In
Line feed character	S4=x
Load user configuration profile	Zn
Local DTE echo	En
Long space disconnect	Yn
On-line	On
Repeat command	A/
Response mode	Qn
Result code type	Vn
Retransmission counter	S70=x
Ring counter	S1=x
Ringback wait timer	S7=x
RTS-to-CTS delay timer	S26=x
S-Register help	\$\$
S-Registers	Sn
Test mode timer	S18=x

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Table 4-3 AT Commands Listed by Command Set (Continued)

Name	Cmd.
Extended AT& Command Set	
AT& command set help	&\$
Automatic fallforward/fallback	&An
DCE rate limit	&Gn
CTS operation	&Rn
DCD operation	&Cn
DSR operation	&Sn
DTR On-to-Off transition	&Dn
Front panel lockout	&In
Load fixed configuration profile	&Fn
Network type	&Ln
Operating mode	&Mn
Power-up user configuration profile	&Yn
Private line handshake mode	&Pn
Save settings as a user configuration profile	&Wn
Simulated controlled carrier	&En
Store a phone number	&Zn= <i>nmn</i>
Switched network handshake mode	&Hn
Test mode	&Tn
Transmit clock source	&Xn
Trellis coding	&Un
View stored phone numbers	&V
Extended AT% Command Set	
Answer mode	%On
AT% command set help	%%\$
Auto-reliable fallback character	%An
Call Progress Monitor message response speed	%Rn
Character abort	%Kn
Command format	%Vn
Data compression	%Cn
DSR operation in test mode	%Dn
DTR dialing	%Zn
Make busy	%Bn
Password cell qualifier	%Fn= <i>x</i>
Password operation	%Sn
Retrain on poor signal quality	%Qn
Store password	%Pn= <i>nmn</i>

(Continued on next page)

Table 4-3 AT Commands Listed by Command Set (Continued)

Name	Cmd.
Extended AT\ Command Set	
Asynchronous protocol	\N <i>n</i>
AT\ command set help	\\$
Break character handling	\K <i>n</i>
Character length	\B <i>n</i>
Connect message type	\V <i>n</i>
DTE speed	\T <i>n</i>
Modem-to-DTE flow control	\Q <i>n</i>
Modem-to-modem flow control	\G <i>n</i>
Overspeed correction	\A <i>n</i>
Parity type	\P <i>n</i>
Fallback selection and pre-link data buffer	\C <i>n</i>
Synchronous protocol	\M <i>n</i>
Extended AT: Command Set	
AT: command set help	:\$
Call Direction	:G <i>n</i>
Companding Law	:J <i>n</i>
Current Settings Help Screen Display	:%
Default Highway and Timeslot Values	:Y <i>n</i>
Frame Type	:L <i>n</i>
Private Line Highway	:M <i>n</i>
Private Line Timeslot	:F <i>n</i>
Service State	:N <i>n</i>
Signaling Method	:I <i>n</i>
Store Network Options	:S
Switched Network Highway	:C <i>n</i>
Switched Network Timeslot	:D <i>n</i>
Trunk Type	:H <i>n</i>
Extended AT* Command Set	
AT* command set help	*\$
Remote configuration control	*W <i>n</i>
Remote configuration exit	*X <i>n</i>
Remote configuration security password	*P <i>n</i>
Remote configuration write access	*R <i>n</i>

Table 4-4 Basic AT Command Set Summary

Command	Action
\$	AT command set help
A/	Repeat command
A	Answer call
Dn	Dial command, followed by one or more dial command modifiers, manually dials a phone number: ! or & Flash hookswitch for 1/2 second , or < Pause before continuing. Time is in S-Register 8 (default: 2 seconds). :n Redial up to n times to achieve data mode : Return to AT command mode @ Wait for quiet answer before continuing. Time is in S-Register 7 (default: 60 seconds). Ln Link to cell n if modem can't achieve data mode \n Remote modem uses cell n for Security Callback P Pulse (rotary) dialing R Reverse to answer mode. Must be the last character entered. S Stored number T Tone (DTMF) dialing W Wait for dial tone before continuing. Time is in S-Register 6 (default: 2 seconds). *,#,A,B,C,D,0,1,2,3,4,5,6,7,8,9 (DTMF digits) 0,1,2,3,4,5,6,7,8,9 (pulse digits)
En	Local DTE echo
E0	Disable
E1	Enable
Hn	Hookswitch
H0	Go on-hook (hang up modem)
H1	Go off-hook
In	Identification and checksum
I0	Display product code
I1	Display calculated checksum
I2	(Reserved for future use)
I3	Display modem's firmware revision level
I4	Display listing of modem feature information
I5	Display modem's serial number
N?	Country code. Displays modem's current country code configuration.
On	On-line
O0	Go on-line (enter data mode)
O1	Go on-line and retrain (at any speed except 300 bps)
P	Dialing type: Pulse (rotary) dial
Qn	Response mode
Q0	Enable
Q1	Disable (enable quiet mode)
Q2	Disable in answer mode only
Sn	S-Registers
S\$	Display help menu for S-Registers
Sn?	Display contents of S-Register n
Sn=x	Set S-Register n to value x
T	Dialing type: Tone (DTMF) dial
Vn	Result code type
V0	Numeric result codes; connect message = VF line speed
V1	Alphanumeric (verbal) result codes; connect and protocol messages after link; connect message = DTE speed, except for ITU-T V.14 mode
V2	Alphanumeric (verbal) result codes; connect and protocol messages after link; connect message = VF line speed, except for ITU-T V.14 mode

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Table 4-4 Basic AT Command Set Summary (Continued)

Command	Action
X_n	Call Progress Monitor (CPM)
X0	CONNECT message only; disable CPM
X1	CONNECT message with speed; disable CPM
X2	CONNECT message with speed; and pre-dial CPM only
X3	CONNECT message with speed; and post dial CPM only
X4	CONNECT message with speed; full CPM
X5	CONNECT message with speed; full CPM and ringback detect
Y_n	Long space disconnect
Y0	Disable
Y1	Enable
Z_n	Load user configuration profile. Recalls (loads) user-defined configuration profile n ($n = 0$ to 3). Storable S-Registers are stored with user-defined settings. Profile does not include network (AT:) option settings.

Table 4-5 Extended AT& Command Set Summary

Command	Action
&\$	AT& command set help. Displays help menu for the extended AT& command set
& A_n	Automatic fallforward/fallback
&A0	Disable
&A1	Enable
& C_n	DCD operation
&C0	Force DCD On
&C1	Real mode (follows modem energy detection)
&C2	Force DCD On in Command mode; DCD real in Data mode
& D_n	DTR On-to-Off transition
&D0	Ignore (force DTR On)
&D1	Enter AT command mode
&D2	Go on-hook (hang up)
&D3	Same as &D2, but perform the Z_n command on a loss of DTR greater than S-25 timer
& E_n	Simulated controlled carrier (ITU-T V.13)
&E0	Enable in transmit and receive paths
&E1	Enable in transmit path only
&E2	Enable in receive path only
& F_n	Load fixed configuration profile
&F0	Switched network, asynchronous, ITU-T V.42 error correction, V.42 <i>bis</i> data compression
&F1	Switched network, synchronous
&F2	Two-wire private (leased) line, asynchronous
&F3	Two-wire private (leased) line, synchronous
& G_n	DCE rate limit
&G5	Maximum DCE data rate is 4.8 Kbps
&G6	Maximum DCE data rate is 7.2 Kbps
&G7	Maximum DCE data rate is 9.6 Kbps
&G8	Maximum DCE data rate is 12 Kbps
&G9	Maximum DCE data rate is 14.4 Kbps
&G10	Maximum DCE data rate is 16.8 Kbps
&G11	Maximum DCE data rate is 19.2 Kbps
&G12	Maximum DCE data rate is 21.6 Kbps
&G13	Maximum DCE data rate is 24 Kbps
&G14	Maximum DCE data rate is 26.8 Kbps
&G15	Maximum DCE data rate is 28.8 Kbps
&G16	Maximum DCE data rate is 31.2 Kbps
&G17	Maximum DCE data rate is 33.6 Kbps (default)

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Table 4-5 Extended AT& Command Set Summary (Continued)

Command	Action
&Hn	Switched network handshake mode
&H0	V.34 auto (33.6 Kbps to 300 bps)
&H1	V.34 only (33.6 Kbps to 2400 bps)
&H2	ITU-T V.32 <i>bis</i> automatic (14.4 Kbps to 300 bps)
&H3	ITU-T V.32 <i>bis</i> only (14.4 Kbps to 4800 bps)
&H4	ITU-T V.32 automatic (9600 bps to 300 bps)
&H5	ITU-T V.32 only (9600 bps to 4800 bps)
&H6	ITU-T V.22 <i>bis</i> only (2400 bps to 1200 bps)
&H7	ITU-T V.22 only (1200 bps)
&H8	Bell 212 only (1200 bps)
&H9	Bell 103 only (300 bps)
&H10	ITU-T V.21 only (300 bps)
&In	Front panel lockout
&I0	Front panel buttons enabled
&I1	Front panel buttons disabled
&Ln	Network type
&L0	Switched network
&L1	Two-wire private (leased) line
&L2	Four-wire private (leased) line
&Mn	Operating mode
&M0	Asynchronous data mode
&M1	Asynchronous command mode/synchronous data mode, with DTR-to-data delay (S-Register 25)
&Pn	Private (leased) line handshake mode
&P0	V.34 only (33.6 Kbps to 2400 bps)
&P1	ITU-T V.32 <i>bis</i> only (14.4 Kbps to 4800 bps)
&P2	ITU-T V.32 only (9600 bps to 4800 bps)
&Rn	CTS operation
&R0	Synchronous mode:RTS-CTS delay Asynchronous mode:On in command mode AT command mode:Force CTS On
&R1	Synchronous mode:Real Asynchronous mode:On in command mode AT command mode:Force CTS On
&R2	Synchronous mode:Real Asynchronous mode:Real AT command mode:Real
&R3	Synchronous mode:Force CTS On Asynchronous mode:Force CTS On AT command mode:Force CTS On NOTE: ITU-T V.13 simulated carrier (&En) and flow control (\Qn) options override the &Rn settings for CTS in data mode.
&Sn	DSR operation
&S0	Force DSR On; toggle Off on disconnect
&S1	Normal DSR operation
&S2	DSR follows carrier detect
&S3	Force DSR On
&Tn	Test mode
&T0	Cancel (terminate) test mode
&T1	Initiate ITU-T V.54 Loop 3 test (ANALOOP)
&T3	Initiate ITU-T V.54 Loop 2 test (Digital Loopback)
&T4	Enable ITU-T V.54 Loop 2 test (Remote Digital Loopback)
&T5	Disable ITU-T V.54 Loop 2 test (Remote Digital Loopback)
&T6	Initiate ITU-T V.54 Loop 2 test (Remote Digital Loopback)
&T7	Initiate ITU-T V.54 Loop 2 test
&T8	Initiate ITU-T V.54 Loop 3 test
&T9	End-to-End Self-Test

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Table 4-5 Extended AT& Command Set Summary (Continued)

Command	Action
&Un	Trellis coding
&U0	Enable
&U1	Disable
&V	View stored phone numbers. Displays all 10 stored phone numbers, in sequence.
&Wn	Save option settings as user configuration profile <i>n</i> in non-volatile RAM (<i>n</i> = 0 to 3)
&Xn	Transmit clock source
&X0	Internal clock (modem)
&X1	External clock (DTE)
&X2	Receiver wrap clock (network)
&Yn	Power-up user configuration profile. Loads user configuration profile <i>n</i> at power up (<i>n</i> = 0 to 3)
&Zn= <i>nmn</i>	Stores phone number <i>nmn</i> (including dial command modifiers) in cell <i>n</i> (<i>n</i> = 0 to 9)

Table 4-6 Extended AT% Command Set Summary

Command	Action
;%	AT% command set help. Displays help menu for the extended AT% command set
%An	Auto-reliable fallback character. Sets auto-reliable fallback character to <i>n</i> (<i>n</i> = ASCII 0 to 127).
%Bn	Make busy
%B0	Disable
%B1	Enable on loss of DTR
%B2	Enable in ITU-T V.54 Loop 3 test (ANALOOP)
%B3	Enable in ITU-T V.54 Loop 3 test (ANALOOP), or on loss of RTS or DTR
%B4	Enable on loss of RTS
%Cn	Data compression
%C0	Disable
%C1	Enable in transmit and receive paths
%C2	Enable in transmit path only in V.42 bis
%C3	Enable in receive path only in V.42 bis
%Dn	DSR operation in test mode
%D0	Force DSR On during ITU-T V.54 Loop 3 test (ANALOOP)
%D1	Force DSR Off during this test
%Fn= <i>x</i>	Assign password cell modifier; cell contents specified by %Pn= <i>xxx</i> (<i>n</i> = 0 — 9)
%Fn=0	Password in cell <i>n</i> permits pass-through connection — no callback
%Fn=1	Password in cell <i>n</i> permits pass-through connection or (upon request from originating site) roving callback connection
%Fn=2	Password in cell <i>n</i> permits pass-through connection or (upon request from originating site) callback connection using stored phone number
%Fn=3	Password in cell <i>n</i> permits pass-through connection or (upon request from originating site) callback connection — either roving or using stored phone number
%Kn	Character abort
%K0	2-second delay to character abort
%K1	Disable
%On	Answer mode
%O0	Answer mode if ringing
%O1	Force to answer mode
%O2	Automatic answer in originate mode
%Pn	Store password in non-volatile memory
%Pn= <i>xxx</i>	Define password in cell <i>n</i> (<i>n</i> = 0 — 9; <i>xxx</i> = 1 to 10 characters)
%Pn	Clear password in cell <i>n</i>

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Table 4-6 Extended AT% Command Set Summary (Continued)

Command	Action
%Qn	Retrain on poor signal quality
%Q0	Disable
%Q1	Attempt up to 3 consecutive retrains; disconnect if not successful
%Q2	Retrain until signal quality is good
%Rn	Call Progress Monitor (CPM) message response speed
%R0	Auto baud
%R1	Send at last connect speed
%R2	300 bps
%R3	1200 bps
%R4	2400 bps
%R5	4800 bps
%R6	7200 bps
%R7	9600 bps
%R8	12.0 bps
%R9	14.4 Kbps
%R10	16.8 Kbps
%R11	19.2 Kbps
%R12	21.6 Kbps
%R13	24.0 Kbps
%R14	26.4 Kbps
%R15	28.8 Kbps
%R16	31.2 Kbps
%R17	33.6 Kbps
%R18	38.4 Kbps
%R19	57.6 Kbps
%R20	79.8 Kbps
%R21	115.2 Kbps
%R22	128.0 Kbps
%R23	32.0 Kbps
%R24	48.0 Kbps
%R25	56.0 Kbps
%R26	64.0 Kbps
%R27	72.0 Kbps
%R28	96.0 Kbps
%R29	112.0 Kbps
%Sn	Password operation
%S0	All password security disabled
%S1	Handshake password using cell 0 enabled
%S2	On-line password enabled — remote user prompted on connection
%S3	Handshake and on-line passwords both enabled
%S4	Mandatory callback enabled
%S6	On-line password and mandatory callback enabled
%S7	Handshake and on-line passwords, and mandatory callback enabled
%Vn	Command format
%V0	AT command set
%V1	V.25 <i>bis</i> asynchronous command set
%V2	V.25 <i>bis</i> HDLC command set
%V3	V.25 <i>bis</i> BSC command set
%V4	None
%Zn	DTR dialing
%Z0	Ignore DTR
%Z1=x	Dial cell <i>x</i> on DTR Off-to-On transition
%Z2	Go off-hook on DTR Off-to-On transition and attempt handshake
%Z3=x	Dial cell <i>x</i> on DTR Off-to-On transition; redial if needed while DTR remains On

Table 4-7 Extended AT\ Command Set Summary

Command	Action
\\$	AT\ command set help. Displays help menu for the extended AT\ command set.
\An	Overspeed correction
\A0	1.25% (nominal) asynchronous overspeed correction
\A1	2.5% (extended) overspeed correction
\Bn	Character length (data bits/parity/stop bits)
\B0	6N1
\B1	7N1
\B2	7P1 (\Pn command sets parity type)
\B3	8N1
\B4	7P2 (\Pn command sets parity type)
\B5	8P1 (\Pn command sets parity type)
\Cn	Fallback selection and pre-link data buffer
\C0	Timeout and fallback; speed buffer; no data buffer
\C1	Timeout and fallback; speed buffer; buffer receive data
\C2	Auto-reliable; fallback with fallback character speed buffer; no receive data buffer
\C3	Timeout and fallback; ITU-T V.14; buffer receive data
\C4	Timeout or fallback with fallback character; ITU-T V.14; no data buffer
\Gn	Modem-to-modem flow control
\G0	Disable
\G1	Enable XON/XOFF in transmit and receive paths
\G2	Enable in transmit path only
\G3	Enable in transmit and receive paths, with pass-through
\Kn	Break character handling
\K0	Expedite break; destroy buffers
\K1	Expedite break; save buffers
\K2	Timed break; save buffers
\K3	Ignore break
\K4	Timed break until no break character; save buffers
\K5	Timed break until no break character; save buffers
\Mn	Synchronous protocol
\M0	Normal synchronous mode
\M1	ITU-T V.13 synchronous mode (simulated controlled carrier)
\M2	Synchronous compression mode
\Nn	Asynchronous protocol
\N0	Wire mode
\N1	Direct ITU-T V.14 asynchronous mode
\N2	MNP reliable mode (or drop call)
\N3	V.42/MNP auto-reliable
\N4	V.42 (LAPM) reliable mode (or drop call)
\N5	V.42 (LAPM)/MNP reliable or MNP mode (or drop call)
\N6	Simulated controlled carrier (ITU-T V.13)
\Pn	Parity type
\P0	Even
\P1	Space
\P2	Odd
\P3	Mark
\P4	Automatic (from last AT command)
\Qn	Modem-to-DTE flow control
\Q0	Disable in both directions
\Q1	Use XON/XOFF in both directions
\Q2	Use CTS
\Q3	Use RTS/CTS
\Q4	Use XON/XOFF from modem to DTE only
\Q5	Use Clock Stopping
\Q6	Use Clock Throttling

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Table 4-7 Extended AT\ Command Set Summary (Continued)

Command	Action
\Tn	DTE speed
\T0	Auto speed; %R sets CPM message response speed
\T1	Last AT speed
\T2	300 bps
\T3	1200 bps
\T4	2400 bps
\T5	4800 bps
\T6	7200 bps
\T7	9600 bps
\T8	12.0 kbps
\T9	14.4 kbps
\T10	16.8 kbps
\T11	19.2 kbps
\T12	21.6 kbps
\T13	24.0 kbps
\T14	26.4 kbps
\T15	28.8 kbps
\T16	31.2 kbps
\T17	33.6 kbps
\T18	38.4 kbps
\T19	57.6 kbps
\T20	76.8 kbps
\T21	115.2 kbps
\T22	128.0 kbps
\T23	32.0 kbps
\T24	48.0 kbps
\T25	56.0 kbps
\T26	64.0 kbps
\T27	72.0 kbps
\T28	96.0 kbps
\T29	112.0 kbps
\Vn	Connect message type
\V0	Connect message reports VF rate upon data mode, link message after link negotiation (GDC format)
\V1	Connect and protocol message sent after link negotiation, connect reported as DTE rate
\V2	Connect and protocol message after link negotiation and Microcom compatible, connect reported as VF rate
\V3	Connect message only after protocol negotiation, connect reported as DTE rate

Table 4-8 Extended AT: Command Set Summary

Command	Action
:\$	AT: command set help. Displays help menu for the extended AT: command set.
:Cn	Switched Network Highway; n = 1, 2, 3, or 4
:Dn	Switched Network Timeslot; n = 1 – 24 with T1 LTU, 1 – 32 with E1 LTU
:Mn	Private Line Highway; n = 1, 2, 3, or 4
:Fn	Private Line Timeslot; n = 1 – 24 with T1 LTU, 1 – 32 with E1 LTU
:Gn	Call Direction
:G0	2-way calling
:G1	Outgoing calls only
:G2	Incoming calls only

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Table 4-8 Extended AT: Command Set Summary (Continued)

Command	Action
:Hn	Trunk Type (valid only with T1 LTU)
:H0	FXO/FXS Loop Start
:H1	FXO/FXS Ground Start
:H2	E&M/FXS Immediate Start
:H3	E&M Wink Start 1
:H4	E&M Wink Start 2
:In	Signaling Method
:I0	T1/E1
:I1	ISDN
:Jn	Companding Law
:J0	u-Law
:J1	A-Law
:Ln	Frame Type
:L0	D4 Superframe
:L1	Extended Superframe (ESF)
:Nn	Service State (Disabled when SCM is present)
:N0	Out of Service
:N1	In Service
:S	Store Network Options
:Yn	Default Network Configuration setting
:Y0	T1 Defaults
:Y1	E1 Defaults
:%	Current Settings Help Screen Display

Table 4-9 Extended AT* Command Set Summary

Command	Action
\$	AT command set help. Displays help menu for the extended AT* command set,
*Pn	Remote configuration security password ($n = 1$ to 11 characters)
*P	Disable or clear the password
*Rn	Remote configuration write access
*R0	Enable write access (read/write)
*R1	Disable write access (read only)
*Wn	Remote configuration control
*W0	Disable remote configuration
*W1	Enable remote configuration
*Xn	Remote configuration exit
*X0	Terminate session without saving changes
*X1	Terminate session and save changes

AT Command Reference

All commands are assumed to be preceded by an AT and followed by a carriage return. The only exception is the A/ command, which is used to repeat the last AT command. A description of each command follows. They are organized alphabetically, with all variations of the letter grouped together as follows:

- The basic AT command.
- The extended AT& command.
- The extended AT% command.
- The extended AT\ command.
- The extended AT: command.
- The extended AT* command.

Not every letter of the alphabet has a command for each of these groups.

\$ AT command set help

This command causes the modem to display the help menu for the basic AT command set.

&\$ AT& command set help

This command causes the modem to display the help menu for the extended AT& command set.

%% AT% command set help

This command causes the modem to display the help menu for the extended AT% command set.

\\$ AT\ command set help

This command causes the modem to display the help menu for the extended AT\ command set.

:\$ AT: command set help

This command causes the modem to display the help menu for the extended AT: command set.

***\$ AT* command set help**

This command causes the modem to display the help menu for the extended AT* command set.

S\$ S-Register help

This command causes the modem to display the S-Register help menu. Only S-Registers not containing bit mapped options will be displayed.

A Answer call

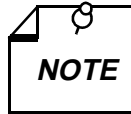
The A command directs the modem to answer an incoming call. It is used to go off-hook and generate the proper answer sequence.

&An Automatic fallback/fallforward

This command controls the automatic fallback and fallforward capabilities.

&A0 disables the fallforward/fallback feature.

&A1 enables the fallforward/fallback feature



The &A1 command functions only when the modem is optioned for synchronous data mode or for asynchronous with speed buffering, and only for V.34, V.32, and V.32 bis modes.

%An Auto-reliable fallback character

This command selects the modem's auto-reliable fallback character, specified by a number between 0 and 127. The fallback character is an ASCII character (alphanumeric, punctuation, or control) that the modem will check for when it performs auto-answer and attempts to negotiate an auto-reliable (\N3) error correcting link on the VF line. If the modem detects two successive fallback characters, it will terminate the negotiation process and go directly to a non-error correcting mode.

The \C command determines which non-error correcting mode (wire or direct) the modem will fall back to, and what will become of data transferred to the modem during the negotiation process.

Appendix E contains a table that lists the ASCII characters and their corresponding numeric values. Note that fallback character detection is case-sensitive, since upper and lower case letters are separate ASCII characters.

\An Overspeed correction

This option selects overspeed correction for V.14 asynchronous data modes.

- \A0** selects 1.25% (nominal) overspeed correction.
- \A1** selects 2.5% (extended) overspeed correction.

A/ Repeat command

The A/ command, the only command not preceded by an AT, is used to re-execute the most recent AT command line sent to the modem. This command can be used to cause redial of a previous number when a handshake attempt fails.

%Bn Make busy

This command controls the make busy option as follows:

- %B0** make busy disabled.
- %B1** make busy on loss of DTR.
- %B2** make busy in ANALOOP.
- %B3** make busy on loss of RTS, loss of DTR, or in ANALOOP.
- %B4** make busy on loss of RTS.

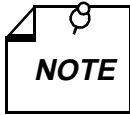
\Bn Character length

This command sets up the character length and format the modem uses in data mode for front ends that do not send AT commands. The character length includes start, data, parity, and stop bits. Default is \B2.

- \B0** character length = 8 bits (6 data)
- \B1** character length = 9 bits (7 data)
- \B2** character length = 10 bits (7 data, 1 parity). With automatic parity enabled (\P4), this

also accommodates 8 data bits with no parity.

- \B3** character length = 10 bits (8 data)
- \B4** character length = 11 bits (7 data, parity, 2 stop)
- \B5** character length = 11 bits (8 data, parity)



The V.42 and MNP protocols (\N2 through \N5) do not support 11-bit character lengths (\B4 and \B5).

&Cn DCD operation

The **&Cn** command controls the EIA Data Carrier Detect signal.

- &C0** selects DCD to be forced On.
- &C1** selects DCD to be real (follow modem energy detect).
- &C2** selects DCD to be forced On in Command mode, and real in Data mode.

%Cn Data compression

This option controls the selection of data compression for MNP-5 reliable, V.42 *bis* reliable, and synchronous data links.

- %C0** disables data compression.
- %C1** enables data compression in both directions.
- %C2** in V.42 *bis* or synchronous, enables data compression in the transmitter path. In MNP 5, enables data compression in both directions.
- %C3** in V.42 *bis* or synchronous, enables data compression in the receiver path. In MNP 5, enables data compression in both directions.

\Cn Fallback selection and pre-link data buffer

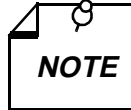
This command determines fallback selection. If an error correcting protocol is enabled, this command determines whether incoming data from the remote modem will be buffered while the receiver modem waits for establishment of the error correction link.

- \C0** receiver modem discards all incoming VF data from the remote modem until it has sent a PROTOCOL: NONE message to its DTE. Receiver modem then passes data through.
- \C1** receiver modem buffers incoming VF data (up to 200 characters) until it has sent a PROTOCOL: NONE message to its DTE. It then passes the buffered data through to the DTE. The modem will fall back to wire mode if more than 200 characters are received before an error correction link is established.
- \C2** receiver modem discards all incoming VF data until it detects two consecutive fallback characters (%An). At that point it falls back to wire mode. The receiver modem passes one fallback character through to its DTE as data.
- \C3** same as \C1, except that with no link the modem will fall back to V.14 (direct) mode.
- \C4** same as \C2, except that with no link the modem will fall back to V.14 (direct) mode.

:Cn Switched network highway

This command selects the backplane data highway the DSE modem channel employs for exchanging data with the LTU while performing switched network operations. This command is valid only when the Network Type (&L) option is set for switched network operation.

You can use this option to set an SC 5034 modem channel to use whichever highway you select, or you can use the :Y command to assign the channel to a default highway. The default highway assignment is based on the position of the SC 5034 DSE pc card in the SpectraComm shelf. When you use the :Y command, the resulting default assignment is written to this option.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

- :C0** no switched network data highway assignment; unit configured for private line operation, or under SNMP control
- :C1** switched network operation on data highway 1
- :C2** switched network operation on data highway 2
- :C3** switched network operation on data highway 3
- :C4** switched network operation on data highway 4

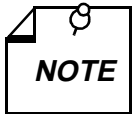
Dn Dial

The *Dn* command is used to initiate a phone number dial. This command, followed by the number to be dialed, directs the modem to go off-hook and dial the number (*n...*). Commands other than dial modifiers must not be placed after the D command. Any command that is placed after the D is either ignored or interpreted as a dial command modifier.

Dial Command Modifiers

- T** selects the numbers to be tone dialed.
- P** selects the numbers to be pulse dialed (if permitted by country code).
- Sn** selects a stored phone number to be recalled and dialed. The modem's default when the AT command DS is issued is to dial the phone number stored in cell 0. (*n* = 0 to 9)
- R** switches modem operation to handshake in the answer mode when this command appears as the last character in the dial string.
- , or <** pauses dialing for a programmable length of time determined by S-Register 8. Default is 2 seconds.
- W** directs the dialer to wait for a dial tone before continuing the dial string.
- @** directs the dialer to wait for a quiet answer before continuing the dial string.
- !** directs the dialer to place a 1/2 second hookswitch flash in the dial string.
- ;** directs the dialer to return the modem to command mode.
- :n** directs the dialer to redial the attempted dial string up to *n* times if the modem does not achieve data mode.
- Ln** directs the dialer to dial phone cell *n* if the modem fails to achieve data mode with

- the current dial string.
- \n** remote modem uses cell *n* for Security Callback
- J** directs the unit to perform MNP10 negotiations for the current call at 1200 bps
- K** enables power level adjustment during MNP10 negotiations for the current call
- A** causes the DTMF A tone to be generated.
- B** causes the DTMF B tone to be generated.
- C** causes the DTMF C tone to be generated.
- D** causes the DTMF D tone to be generated.
- 0 — 9** tone or pulse dial the appropriate number.



A, B, C, and D are ignored in Pulse mode.

&Dn DTR On-to-Off transition

The **&Dn** command controls the result of On-to-Off transitions of Data Terminal Ready.

- &D0** causes the modem to ignore Off transitions and forces internal DTR On.
- &D1** causes the modem to change to command mode when it senses an Off transition during an established data link.
- &D2** causes the modem to recognize Off transitions of DTR and respond by hanging up.
- &D3** functions the same as **&D2**, and additionally causes the modem to perform AT command Z.

%Dn DSR operation in test mode

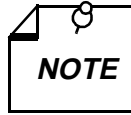
This command specifies whether Data Set Ready (DSR) will be On or Off during an ANALOOP test.

- %D0** DSR turns On whenever the modem is operating an ANALOOP test.
- %D1** DSR forced Off when in an ANALOOP test.

:Dn Switched network timeslot

This command selects the timeslot in the selected backplane data highway the DSE modem channel employs for exchanging data with the LTU while performing switched network operations. This command is valid only when the Network Type (**&L**) option is set for switched network operation.

You can use this option to set an SC 5034 modem channel to use whichever timeslot you select, or you can use the **:Y** command to assign the channel to a default timeslot. The default timeslot assignment is based on the position of the SC 5034 DSE pc card in the SpectraComm shelf. When you use the **:Y** command, the resulting default assignment is written to this option.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

- :D0** no switched network data highway timeslot assignment; unit configured for private line operation, or under SNMP control
- :D1 – :D31** selects corresponding timeslot on selected data highway for switched network operation; timeslot/DS0 numbers for T1 operation range from 1 to 24; timeslot/DS0 numbers for E1 operation range from 0 to 31 (with 0 and 16 reserved for network signalling and thus not available to be assigned to modem channels)

En Local DTE echo

The *En* command controls the status of local echo.

- E0** turns the local echo Off.
- E1** turns the local echo On.

&En Simulated controlled carrier

The *&En* command controls the selection of V.13 modes.

- &E0** selects Bi-directional V.13.
- &E1** selects V.13 TX side enabled.
- &E2** selects V.13 RX side enabled.

&Fn Load fixed configuration profile

The *&Fn* command loads the modem with factory-defined settings for a fixed configuration profile. *Table 4-10* lists the settings for the four fixed configuration profiles.

- &F0** selects asynchronous switched network operation, with V.42 error correction and V.42 *bis* data compression.
- &F1** selects synchronous switched network operation.
- &F2** selects asynchronous two-wire private line operation.
- &F3** selects synchronous two-wire private line operation.

Table 4-10 Fixed Configuration Profile Settings

Option (AT Command)	Fixed Profile 0	Fixed Profile 1	Fixed Profile 2	Fixed Profile 3
Answer mode (%O)	Ans. mode if ringing	Ans. mode if ringing	Ans. mode if ringing	Ans. mode if ringing
Asynchronous protocol (\N)	Auto-reliable	Auto-reliable	Auto-reliable	Auto-reliable
Auto-reliable fallback char. (%A)	“CR”	“CR”	“CR”	“CR”
Automatic fallforward/fallback (&A)	Disable	Disable	Disable	Disable
Break character handling (\K)	See \K5	See \K5	See \K5	See \K5
Call Progress Monitor (X)	Ext. results/ full CPM	Ext. results/ full CPM	Ext. results/ full CPM	Ext. results/ full CPM
Character abort (%K)	Enable	Disable	Enable	Disable
Character length (\B)	See \B2	See \B2	See \B2	See \B2
Connect message type (\V)	See \V3	See \V3	See \V3	See \V3
Country code (N)	USA	USA	USA	USA
CPM message response speed (%R)	Autobaud speed	Autobaud speed	Autobaud speed	Autobaud speed
CTS operation (&R)	See &R1	See &R2	See &R2	See &R2
Data compression (%C)	Enable both ways	Enable both ways	Enable both ways	Enable both ways
DCD operation (&C)	Real mode	Real mode	Real mode	Real mode
DCE rate limit (&G)	33.6 Kbps max	33.6 Kbps max	33.6 Kbps max	33.6 Kbps max
Dialing type (P, T)	Tone (T)	Tone (T)	Tone (T)	Tone (T)
DSR operation (&S)	Normal	Normal	Normal	Normal
DSR operation in test mode (%D)	Forced Off	Forced Off	Forced Off	Forced Off
DTE speed (\T)	Last AT speed	Autobaud	Last AT speed	Autobaud
DTR dialing (%Z)	Disable	Disable	Disable	Disable
DTR On-to-Off transition (&D)	Ignore	Go on-hook	Go on-hook	Go on-hook
Front panel lockout (&I)	Enable	Enable	Enable	Enable
Local DTE echo (E)	Enable	Enable	Disable	Disable
Heart beat timer (%H)	Disable	Disable	Disable	Disable
Inactivity timer (%T)	Disable	Disable	Disable	Disable
Long space disconnect (Y)	On	On	On	On
Make busy (%B)	Disable	Disable	Disable	Disable
Modem-to-DTE flow control (\Q)	Use CTS	Use CTS	Use CTS	Use CTS
Modem-to-modem flow control (\G)	Disable	Disable	Disable	Disable
Network type (&L)	Switched network	Switched network	Two-wire private line	Two-wire private line
Operating mode (&M)	Async data	Sync data	Async data	Sync data
Overspeed correction (\A)	Nominal	Nominal	Nominal	Nominal
Parity type (\P)	Auto	Auto	Auto	Auto
Pre-link data buffer (\C)	See \C2	See \C2	See \C2	See \C2
Private line handshake mode (&P)	V.34 only	V.34 only	V.34 only	V.34 only

(Continued on next page)

Table 4-10 Fixed Configuration Profile Settings (Continued)

Option (AT Command)	Fixed Profile 0	Fixed Profile 1	Fixed Profile 2	Fixed Profile 3
RDL options (&T4, &T5)	Disable RDL	Disable RDL	Disable RDL	Disable RDL
Response mode (Q)	Result codes	Quiet	Quiet	Quiet
Result code type (V)	Verbal	Verbal	Verbal	Verbal
Retrain on poor signal quality (%Q)	SQ Forever	SQ Forever	SQ Forever	SQ Forever
DSR operation (&Sn)	Normal	Normal	Normal	Normal
S-Registers (S)	Decimal (ASCII)	Decimal (ASCII)	Decimal (ASCII)	Decimal (ASCII)
0 Rings to answer on	1	1	1	1
2 Escape code character	43 (+)	43 (+)	43 (+)	43 (+)
3 Carriage return character	13 (CR)	13 (CR)	13 (CR)	13 (CR)
4 Line feed character	10 (LF)	10 (LF)	10 (LF)	10 (LF)
5 Back space character	08 (BS)	08 (BS)	08 (BS)	08 (BS)
6 Wait for dial tone	2 sec.	2 sec.	2 sec.	2 sec.
7 Wait for carrier for W and @	60 sec.	60 sec.	60 sec.	60 sec.
8 Pause time for , or <	2 sec.	2 sec.	2 sec.	2 sec.
9 Carrier detect response time	0.6 sec.	0.6 sec.	0.6 sec.	0.6 sec.
10 Loss of carrier to hang up delay	1.4 sec.	1.4 sec.	1.4 sec.	1.4 sec.
12 Escape sequence guard time	1 sec.	1 sec.	1 sec.	1 sec.
18 Modem test timer	0 sec.	0 sec.	0 sec.	0 sec.
25 Delay to DTR - all modes	0.05 sec.	0.05 sec.	0.05 sec.	0.05 sec.
%V0 or %V1 with sync data mode	5 sec.	5 sec.	5 sec.	5 sec.
26 RTS/CTS delay	0 sec.	0 sec.	0 sec.	0 sec.
38 Hang-up delay timer	20 sec.	20 sec.	20 sec.	20 sec.
S-Registers (S) (Continued)	Decimal (ASCII)	Decimal (ASCII)	Decimal (ASCII)	Decimal (ASCII)
42 Call failures before modem make busy (special feature, implemented only on a point-of-sale basis)	N/A	N/A	N/A	N/A
70 Max. no. of retransmissions	100	100	100	100
Simulated controlled carrier (&E)	Enable both ways	Enable both ways	Enable both ways	Enable both ways
Stored password (%P)	None	None	None	None
Switched network handshake mode (&H)	V.34 auto	V.34 auto	V.34 auto	V.34 auto
Synchronous protocol (!M)	Sync Mode	Sync Mode	Sync Mode	Sync Mode
Transmit clock source (&X)	Internal	Internal	Internal	Internal
Trellis coding (&U)	Enable	Enable	Enable	Enable
Power-up user configuration profile (&Y)	Fixed Profile 0	Fixed Profile 0	Fixed Profile 0	Fixed Profile 0

%Fn=x Password cell qualifier

The %Fn=x command determines which callback extension(s), if any, can be used with the password stored in a specified password memory cell. In the command, *n* represents the number (0 — 9) of a password memory cell.

This command does not affect use of the fixed callback extension (,F), which is administered by an MMS controller.

- %Fn=0** disables the use of callback extensions with the password stored in cell *n*. The modem will terminate any call in which it receives that password with a callback extension attached.
- %Fn=1** permits the roving callback extension (,R) to be used with the password stored in cell *n*. When the modem receives the ,R extension attached to the password it will prompt the remote user for a callback phone number and then perform the callback procedure. The password can be used without an extension, but the use of any extension other than ,R will cause the modem to terminate the connection.
- %Fn=2** permits the phone cell callback extension (,C) to be used with the password stored in cell *n*. When the modem receives the ,C extension attached to the password it will prompt the remote user for the number of a phone number memory cell in the answering modem. The answering modem will then use the phone number stored in that memory cell to perform the callback procedure. The password can be used without an extension, but the use of any extension other than ,C will cause the modem to terminate the connection.
- %Fn=3** permits the use of either the roving (,R) or phone cell (,C) callback extension with the password stored in cell *n*. When the modem receives an extension attached to the password it will issue the appropriate prompt to the remote user and perform the specified callback procedure. The password can be used without an extension.

:Fn Private line timeslot

This command selects the timeslot in the selected backplane data highway the DSE modem channel employs for exchanging data with the LTU while performing private line operations. This command is valid only when the Network Type (&L) option is set for private line operation.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

- :F0** no private line data highway timeslot assignment; unit configured for switched network operation, or under SNMP control
- :F1 – :F31** selects corresponding timeslot on selected data highway for private line operation; timeslot/DS0 numbers for T1 operation range from 1 to 24; timeslot/DS0 numbers for E1 operation range from 0 to 31 (with 0 and 16 reserved for network signalling and thus not available to be assigned to modem channels)

&Gn DCE rate limit

This command sets the maximum rate at which the modem can make a VF connection to a remote modem when using the V. 34, V.32, and V.32 *bis* modulation schemes. The allowable rates for each scheme are:

- V.34 — 2.4 to 33.6 Kbps
- V.32 only — 4.8 or 9.6 Kbps
- V.32 *bis* only — 4.8 to 14.4 Kbps

If the rate specified with this command is greater than the highest rate available with the type of modulation being used, the modem will use the highest available rate. If the rate specified with this command is less than the lowest rate available with the type of modulation being used, the modem will use the lowest available rate.

This command applies only to receiver speed when the Asymmetric DCE Rates command is enabled (\R1).

- &G5** 4.8 Kbps, maximum rate
- &G6** 7.2 Kbps, maximum rate
- &G7** 9.6 Kbps, maximum rate
- &G8** 12 Kbps, maximum rate
- &G9** 14.4 Kbps, maximum rate
- &G10** 16.8 Kbps, maximum rate
- &G11** 19.2 Kbps, maximum rate
- &G12** 21.6 Kbps, maximum rate
- &G13** 24 Kbps, maximum rate
- &G14** 26.4 Kbps, maximum rate
- &G15** 28.8 Kbps, maximum rate
- &G16** 31.2 Kbps, maximum rate
- &G17** 33.6 Kbps, maximum rate (default)

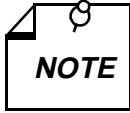
\Gn Modem-to-modem flow control

This command is used to provide modem-to-modem flow control for non-error corrected data links that require a constant speed DTE interface (Wire Mode).

- \G0** disables flow control between the two modems.
- \G1** enables bidirectional modem flow control based on XON/XOFF signaling. The XON/XOFF signals are detected, acted on, and deleted from the data stream.
- \G2** provides unidirectional flow control: the modem may send XON/XOFF signals to the remote modem, yet ignore and pass through to its DTE any that it receives as VF signals.
- \G3** same as \G1, except that, after they are acted upon, XON/XOFF signals are passed through to the DTE instead of being deleted.

:Gn Call direction

This command determines whether the DSE modem channel can only make outgoing calls, only accept incoming calls, or perform both functions.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

:G0 two-way calling

:G1 outgoing only

:G2 incoming only

Hn Hookswitch

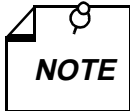
The *Hn* command controls the off-hook relay.

H0 opens the relay for on-hook condition (modem hang-up).

H1 closes the relay for off-hook condition. Modem remains off-hook until termination of on-line status, or until the H0 command is issued.

&Hn Switched network handshake mode

&Hn controls the selection of the switched network handshake mode.



a. *When the modem channel is optioned for an external transmit clock source (&X1), it should be optioned for a fixed handshake mode, not an automatic handshake mode (e.g., select V.32 bis only [&H3] instead of V.32 bis automatic [&H2]). The modem channel will then handshake only at the speed given to it by the DTE.*

b. *For 1200 bps V.22 operation, select &H7. &H6 is an auto mode, so setting the DTE to 1200 bps (\T3) will not force the connection to 1200 bps.*

&H0 selects V.34 auto (28.8 — 300)

&H1 selects V.34 only (28.8 — 2400)

&H2 selects V.32 bis automatic (14.4 — 300)

&H3 selects V.32 bis only (14.4 — 4800)

&H4 selects V.32 automatic (9600 — 300)

&H5 selects V.32 only (9600 — 4800)

&H6 selects V.22 bis only (2400 — 1200)

&H7 selects V.22 only (1200)

&H8 selects 212 only (1200)

&H9 selects 103 only (300)

&H10 selects V.21 only (300)

%Hn Private Line Heartbeat

The %Hn command controls how frequently the unit transmits a heartbeat signal on a dedicated line connection that is otherwise idle. The heartbeat signal consists of two ASCII characters: H and Carriage Return.

This command is not valid when the unit is configured for switched network operation.

- %H0** heartbeat signal transmission disabled
- %H1 – %H255** selects time between heartbeat signals in half-minute increments

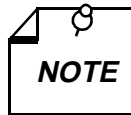
***Hn MNP link negotiation speed**

The *Hn command controls the connection speed the unit employs during negotiation of an MNP10 link with a remote modem that is connected to a cellular telephone link.

- *H0** highest supported speed – Default, do not change
- *H1** 1200 bps
- *H2** 4800 bps

:Hn Trunk type

This command determines the type of trunk signalling for use with a T1 LTU. It is only valid when the Companding Law (:J) option is selected as mu-Law (:J0) for T1 operations.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

- :H0** FXO/FXS Loop Start
- :H1** FXO/FXS Ground Start
- :H2** E&M/FXS Immediate Start
- :H3** E&M Wink Start 1
- :H4** E&M Wink Start 2

In Identification and checksum

The In command requests identification and checksum codes to be transmitted to the DTE.

- I0** displays the modem product code. The V. 34 product code is 288.
- I1** displays the stored checksum calculated for the modem's configuration.
- I2** (reserved for future use)
- I3** displays the revision level of the modem's firmware (an alphabetical character) followed by the OK message.
- I4** displays a listing of the following information:
 - Firmware Level — revision level as displayed by I3
 - Product Type — product code as displayed by I0
 - Management System — On/Off status of SNMP control
 - Sync Compression — On/Off status

Leased Line — On/Off status; Off = modem configured for switched network only operation
 DTE Card — 232, 530, or V35
 Country Code — as displayed by the N? command

I5 displays the DSE's serial number.

&In Front panel lockout

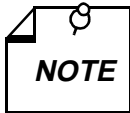
This option permits you to disable the DSE front panel switches.

&I0 enables front panel.

&I1 disables front panel.

:In Signaling method

This command determines the type of network signalling the SC 5034 modem channel uses to communicate with Telco VF switching equipment.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

:I0 T1/E1 signaling; control signaling takes place in-band, using robbed bit technique

:I1 ISDN signaling; control signaling takes place on a common channel

:Jn Companding Law

This command selects the "law" that governs pulse code modulation/demodulation of the data the DSE exchanges with its LTU over the backplane data highway. This must be set for compatibility with the type of LTU being used (T1 or E1).



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

:J0 mu-Law – T1 LTU, :H command must also be used to specify Trunk Type

:J1 A-Law – E1 LTU

%Kn Character abort

This option controls the character abort option. It is only available when the modem is in AT operation and asynchronous mode.

- %K0** enables character abort: any character typed at the DTE within 2 seconds after the modem goes off-hook will abort the dialing process.
- %K1** disables character abort.

\Kn Break character handling

This command determines how the modem will react to break characters received from the DTE during an error corrected data link.

- \K0** modem will immediately transmit a break character for a fixed time (300 ms) and destroy any currently buffered data.
- \K1** same as the \K0 option, except all buffered data will be saved.
- \K2** modem will transmit a fixed time break character in sequence with the rest of the data (default).
- \K3** modem will ignore all breaks received from the DTE.
- \K4** modem will transmit break characters in sequence with the rest of the data as long as the DTE is transmitting this character.
- \K5** same as \K4 — required for compatibility with some communication software.

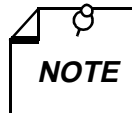
&Ln Network type

This option sets the modem for private line or switched network lines.

- &L0** switched network mode.
- &L1** 2-wire private line mode.
- &L2** 4-wire private line mode.

:Ln Frame type

This command determines the type of data framing for use with a T1 LTU. It is only valid when the Companding Law (:J) option is selected as mu-Law (:J0) for T1 operations.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

- :L0** Superframe (D4)
- :L1** Extended Superframe (ESF)

&Mn Operating mode

The &Mn command selects between asynchronous and synchronous operation in data mode. See the %Vn command to select command mode format.

- &M0** selects asynchronous operation in data mode. See the \Nn command to select an asynchronous protocol.
- &M1** selects synchronous operation in data mode. See the \Mn command to select a synchronous protocol.

\Mn Synchronous protocol

This command selects the synchronous protocols that are available to the modem.

- \M0** selects normal synchronous mode.
- \M1** selects synchronous V.13, simulated controlled carrier, mode. Select transmit, receive, or bidirectional with *&En* command.
- \M2** selects synchronous data compression mode. Modem must be configured for internal transmit timing, and either Clock Stopping (\Q5) or Clock Throttling (\Q6) flow control.

-Mn MNP10 mode

This command selects MNP10 mode operation. MNP10 mode supports communication with remote modems that use a cellular telephone connection.

The following commands are also concerned with MNP10 mode operation: *)Mn*, *@Mn*, and **Hn*. Descriptions of those commands appear in this manual. However, their functions apply primarily to the operation of a modem that is connected to a cellular telephone link. In the SC 5034 DSE, which always functions a central site unit, those commands should always be left in their default states. The defaults are identified in the command descriptions.

- M0** MNP10 mode disabled
- M1** MNP10 Auto Reliable mode (recommended when MNP10 is to be enabled)
- M2** MNP10 Reliable mode (no fallback to V.42 or V.42bis)

)Mn Cellular power level adjustment

When MNP10 mode is enabled this command, *)Mn*, determines when the unit can perform automatic adjustment of its transmit power level. The adjustment is required to accommodate the signalling requirements of the remote modem connected to a cellular telephone link.

-)M0** no power level adjustment during MNP10 link negotiation – Default, do not change
-)M1** power level adjustment permitted during MNP10 link negotiation

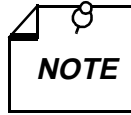
@Mn Initial cellular power level setting

When MNP10 mode is enabled this command, *@Mn*, sets the transmit power level to be used at the time of initial connection until line conditions are determined.

- @M0** initial power level -26 dBm – Default, do not change
- @M1** initial power level -30 dBm
- @M2 – @M10** initial power level -10 dBm
- @M11 – @M31** initial power level -11 dBm – -31 dBm in 1 dBm increments

:Mn Private line highway

This command selects the backplane data highway the DSE modem channel employs for exchanging data with the LTU while performing private line operations. This command is valid only when the Network Type (*&L*) option is set for private line operation.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

- :M0** no private line data highway assignment; unit configured for switched network operation, or under SNMP control
- :M1** private line operation on data highway 1
- :M2** private line operation on data highway 2
- :M3** private line operation on data highway 3
- :M4** private line operation on data highway 4

N? Country code

N? displays the country the modem is currently configured for. In general, the country code displayed is the international calling code for the country.

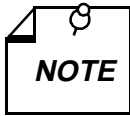
\Nn Asynchronous protocol

This command is used to select the various possible asynchronous protocols the modem is allowed to negotiate upon establishing a data link.

- \N0** options the modem to run in wire mode, performing speed buffering by copying characters from the VF port to the DTE port and vice versa.
- \N1** options the modem to run in direct mode: the DTE and VF speeds must match, and there is no speed buffering. Direct mode is V.14 asynchronous mode.
- \N2** limits error correction to MNP links only, or hang up.
- \N3** options the modem to run in auto reliable mode, and to negotiate V.42 or alternate links. With no link, the modem enters wire mode (speed buffering).
- \N4** limits error correction to a V.42 (LAPM) link only, or hang up.
- \N5** options the modem to attempt either a V.42 (LAPM) or MNP link. If either link fails, the modem will hang up.
- \N6** selects the use of V.13 simulated controlled carrier operation.

:Nn Service state

This command controls the ability of the SC 5034 modem channel to transmit and receive data and signaling. It is only a valid command when there is not an SCM in the shelf with the DSE. When an SCM is present, in service/out of service selection is controlled by the SNMP controller. When an SCM is removed from a shelf, this command does not become valid until power to the DSE is cycled.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

- :N0** Out of service – SC 5034 modem channel cannot transmit or receive data or signalling on the backplane data highway
- :N1** In service – SC 5034 modem channel can transmit and receive data and signalling in its assigned timeslot on the backplane data highway

On On-line

The *On* command directs the modem to go on-line (enter data mode) after an escape to local command mode is issued. This command transfers the modem from command mode to data mode.

- O0** tells the modem to go on-line.
- O1** tells the modem to go on-line and issue a retrain sequence if operating in V.34, V.22 *bis*, V32, or V32 *bis* modes.

%On Answer mode

For a modem being used on a switched network this option selects the band the modem will use for answering calls. The selection applies to both automatically and manually answered calls. For a modem being used on a private line, this option selects the band the modem will use for connections.

- %O0** commands the modem, in switched network mode, to use the presence of a ring to determine the band, regardless of whether the talk/data switch (the SEL key) on the front panel is used or automatic answer is selected. In private line mode, the modem will be in the originate band.
- %O1** commands the modem to answer calls in the answer band in either switched network or private line mode.
- %O2** commands the modem to answer calls in the originate band in either switched network or private line mode.

P Dialing type

This command directs the modem to use pulse dialing as its selected dialing method. The command may be used alone or as part of a dial string.

When P is used alone as a command it makes pulse dialing the modem's default — to be used unless a dial string includes a tone modifier. When P is used in a dial string, it acts as a modifier and affects only the dialing of that string.

Pulse dialing is blocked by some country code configurations.

&Pn Private line handshake mode

&Pn controls the selection of the private line handshake mode.

- &P0** selects V.34 only (28.8 — 2400)
- &P1** selects V.32 *bis* only (14.4 — 4800)
- &P2** selects V.32 only (9600 and 4800)

%Pn=nnnStore password

This command stores a password in one of the 10 memory cells ($n = 0 — 9$) the modem provides for that purpose. Each password (nnn) can consist of up to 10 characters.

Refer also to the Passwords feature description.

nnn = password, 1 to 10 characters (to disable or clear the password, enter %P).

\Pn Parity type

This command sets up what parity to use in data mode for front ends that do not send AT commands.

- \P0** even parity
- \P1** space parity
- \P2** odd parity
- \P3** mark parity
- \P4** automatic parity; last AT (default)

***Pn Remote configuration security password**

This command defines the remote configuration security password. Refer also to the Remote Configuration feature description.

n = password, 1 to 11 characters (to disable or clear the password, enter *P).

Q n Response mode

The Qn command controls the transmission of result codes.

- Q 0** requests non-quiet mode: result codes are transmitted to the DTE as appropriate.
- Q 1** requests quiet mode: modem does not send any result codes to the DTE.
- Q 2** disables Call Progress Monitor responses in answer mode only. Modem enters this mode on detection of ring signal.

%Q n Retrain on poor signal quality

This option controls retrain initiation.

- %Q 0** disables retrain initiation.
- %Q 1** modem will try up to 3 consecutive retrains upon detection of poor signal quality. If not successful, the modem will disconnect the line.
- %Q 2** modem will retrain on poor signal quality until signal quality is OK.

\Q n Modem-to-DTE flow control

This command selects the type of data mode flow control used on the DTE port.

- \Q 0** disables all flow control.
- \Q 1** enables XON/XOFF signaling between modem and DTE.
- \Q 2** enables the modem to flow control the DTE via CTS.
- \Q 3** operates the same as the \Q2 option, and also allows the DTE to flow control the modem via RTS as a ready to receive signal.
- \Q 4** allows the modem to XON/XOFF the DTE yet ignore these signals when sent by the DTE (unidirectional flow control).
- \Q 5** allows the modem to flow control the DTE by almost stopping the transmit clock (internal transmit timing must be selected). Used with synchronous data compression.
- \Q 6** allows the modem to flow control the DTE by varying the rate of the transmit clock (internal transmit timing must be selected). Used with synchronous data compression.

&Rn CTS operation

The &Rn command defines the functionality of the Request to Send and Clear to Send EIA interchange circuits.

- &R0** causes CTS to follow RTS with an interjected delay specified in S-Register 26 when in synchronous mode. In asynchronous command mode, CTS will be On. Upon reaching asynchronous data mode, CTS will follow the applicable ITU-T specification for the modulation chosen during handshake.
- &R1** causes CTS to follow the applicable ITU-T specification in data mode (in synchronous modes, CTS will not follow RTS). In command mode, CTS will be On.
- &R2** causes CTS to follow the applicable ITU-T specification. During test modes, CTS will follow V.54 conventions. CTS does not follow RTS in data modes. CTS will go Off after the call is dropped.
- &R3** forces CTS On in all modes of operation (RTS is ignored)

V.13 and flow control options override &R settings for CTS.

**%Rn Call Progress Monitor message response speed**

%Rn options control the rate at which Call Progress Monitor (CPM) responses are sent to the DTE when the modem is optioned for \T0.

- | | | |
|-----------------------|--------------------------|-----------------------|
| %R0 Auto speed | %R1 last AT speed | %R2 300 bps |
| %R3 1200 bps | %R4 2400 bps | %R5 4800 bps |
| %R6 7200 bps | %R7 9600 bps | %R8 12.0 kbps |
| %R9 14.4 kbps | %R10 16.8 kbps | %R11 19.2 kbps |
| %R12 21.6 kbps | %R13 24.0 kbps | %R14 26.4 kbps |
| %R15 28.8 kbps | %R16 31.2 kbps | %R17 33.6 kbps |

%R18 38.4 kbps	%R19 57.6 kbps	%R20 76.8 kbps
%R21 115.2 kbps	%R22 128.0 kbps	%R23 32 kbps
%R24 48.0 kbps	%R25 56.0 kbps	%R26 64.0 kbps
%R27 72.0 kbps	%R28 96.0 kbps	%R29 112.0 kbps

\Rn Asymmetric DCE rates

This command determines whether or not the transmitter and receiver in the SC 5034 DSE can connect to the remote modem at different operating speeds while operating in V.34 mode.

- \R0** asymmetric rates disabled; transmit and receive rates are the same
- \R1** asymmetric rates enabled; transmit and receive VF operating speeds can be negotiated for different rates based on line conditions. Receiver at each unit determines rate for far-end transmitter. This mode valid only for buffered asynchronous data modes.

***Rn Remote configuration write access**

This command controls remote configuration write access. Refer also to the Remote Configuration feature description.

- *R0** enables write access (read/write).
- *R1** disables write access (read only).

Sn S-Registers

The S command allows you to view (*Sn?*) or change (*Sn=x*) the S-Registers. The S-Registers store values for functions that are not often changed, such as timers or counters, and the ASCII values of control characters, such as Carriage Return. *Table 4-11* summarizes the S-Register set. It is followed by a detailed command reference.

Examples:

To view the value of S-Register 2, type:

```
ATS2?<cr>
```

The response might be:

```
005<cr><lf>
OK<cr><lf>
```

To set the value of S-Register 2 to equal 5, type:

```
ATS2=5<cr>
```

To view the value of the last S-Register that was queried, type:

```
AT?<cr>
```


Table 4-11 S-Register Summary

S-Reg.	Function	Definition		Units	Storable
		Decimal	ASCII		
0	Automatic answer	0			Yes
1	Ring counter	0			No
2	Escape code character	43	+		No
3	Carriage return character	13	CR		No
4	Line feed character	10	LF		No
5	Backspace character	08	BS		No
6	Dial tone wait timer	02		seconds	Yes
7	Carrier wait timer; W and @ dial command modifier wait timer; ringback wait timer	30		seconds	Yes
8	Dial pause timer for , and < dial command modifiers	02		seconds	Yes
9	Carrier presence timer	06		0.1 second	Yes
10	Carrier loss timer	14		0.1 second	Yes
12	Escape code guard timer	50		0.02 second	No
18	Test mode timer	00		10 seconds	Yes
25	DTR delay timer — all modes — sync data, Command Format %V0 or %V1	0.05 005		seconds	Yes
26	RTS-to-CTS delay timer	00		milliseconds	Yes
38	Hang-up delay timer	20		seconds	Yes
42	Call failures before modem make busy (normally disabled)				
70	Retransmission counter	10			Yes

S\$ S-Register help

This command causes the modem to display the S-Register Help Menu.

S-Register 0 Automatic answer

This register determines the number of rings the modem must detect before answering a call. It is programmable from 0 to 255. If the register value is 0, automatic answer is disabled. There is a default value of 2 rings if automatic answer is turned On.

S-Register 1 Ring counter

This register counts incoming rings detected. It increments upon each detected ring, and is cleared after 8 seconds of ring silence and Idle mode. It cannot be cleared in data mode.

S-Register 2 Escape code character

This register holds the ASCII equivalent of the Escape Code character. Its range is from 0 to 127, and the default is 43 (+). Any value above 127 effectively disables the Escape code function.

S-Register 3 Carriage return character

This register holds the ASCII equivalent of the Carriage Return character. Its range is from 0 to 127, and the default is 13 (<cr>).

S-Register 4 Line feed character

This register holds the ASCII equivalent of the Line Feed character. Its range is from 0 to 127, and the default is 10 (<lf>).

S-Register 5 Backspace character

This register holds the ASCII equivalent of the Backspace character. Its range is from 0 to 127, and the default is 08 (H).

S-Register 6 Dial tone wait timer

This register is the programmable dial tone wait timer that determines how many seconds the modem will wait for a dial tone before it starts dialing. This register applies only when blind dialing is selected (X0, X1, or X3). This register can be set from 0 to 255. The default is 2 seconds.

S-Register 7 Carrier, dial and ringback wait timer

This register stores the carrier wait time, how many seconds the modem will wait for carrier detection after dialing has been completed.

The wait time set in this register is also used for the dial command modifiers W (wait for dial tone before dialing) and @ (wait for quiet answer before dialing).

This register also sets the number of seconds the modem will wait for ringback when originating a call. This condition only occurs when using extended result code options X3 or X4.

This register can be programmed for from 1 to 60 seconds. The default is 60 seconds.

S-Register 8 Dial pause timer

This register stores the duration, in seconds, of the pause that will occur when either of the pause dialing modifiers (, or <) is used. It can be programmed from 0 to 255. The default is 2 seconds.

S-Register 9 Carrier presence timer

The value in this register determines how many tenths of a second the carrier signal must be present following a carrier loss before the modem will turn on the EIA DCD signal to the DTE. This is called loss of carrier re-acquire debounce time. The register's range is from 1 to 255. The default is 6 (0.6 second).

S-Register 10 Carrier loss timer

The value in this register determines how many tenths of a second the remote carrier signal must be lost before the local modem disconnects. The delay permits the carrier to disappear momentarily without causing the modem to hang up. The register's timer range is from 1 to 254. Selecting 255 disables disconnect.

The modem recognizes a carrier after a period of time specified in S9. Therefore, if the value of S10 is less than that set for S9, even a momentary loss of carrier will cause the modem to disconnect.

When the modem is operating in half-duplex asynchronous mode, it ignores the value of this register.

S-Register 12 Escape code guard timer

The value in this register determines (in 50ths of a second) the Escape code guard time the modem will use to recognize a valid escape sequence. The modem constantly monitors the data stream for the occurrence of three consecutive +++ (escape code characters) within the time specified in this register. The modem will transfer from the data mode to the command mode when it detects such an occurrence. This register may be set from 1 to 255. The default is 50 (1 second).

S-Register 18 Test mode timer

The value in this register determines (in 10-second increments) how long automatically timed tests will run. It may be set from 0 (no time out, tests run until ended manually) to 60 (10 minutes). The default is 0.

S-Register 25 DTR delay timer

This register sets the delay for DTR, but its precise function depends on the modem's Operating Mode (&Mn command) and Command Format (%Vn command).

When the modem is configured for asynchronous Operating Mode (&M0), the value in this register is always the time used to debounce the DTR signal. It is set in hundredths of a second (0 to 255). The default is 5 (0.05 second).

When the modem is configured for synchronous Operating Mode (&M1) and an asynchronous Command Format (%V0 or %V1), this register initially sets the time available to the operator for switching the EIA cable from asynchronous equipment to synchronous equipment. It can be set from 0 to 255 seconds. The default is 5 seconds. After the whole-second timer expires, the register is then used to debounce the DTR signal, as above. The same number, stored in the register, is applied to both the whole-second and hundredth-of-a-second counts.

S-Register 26 RTS-to-CTS delay timer

The value in this register determines (in milliseconds) the amount of delay between RTS and CTS. It can be set from 0 to 255. The default value is 0.

S-Register 38 Hang-up delay timer

The value in this register determines the maximum delay (in seconds) between the modem's receipt of the command to hang up and the disconnect operation. (If the modem is configured to follow the DTR signal, an On-to-Off transition acts as a command to hang up.) This register is useful for error-control and speed-buffering communications to ensure that data in the modem buffers is sent before the connection is terminated.

If this register is set between 0 and 254, the modem will wait up to that number of seconds for the remote modem to acknowledge receipt of all data buffers before hanging up. The default is 20. If all data is transmitted prior to the timeout, the response to the H0 command will be OK. If the timeout occurs before all data can be sent, the NO CARRIER (3) result code will be sent to indicate that data has been lost.

If this register is set to 255, the modem does not timeout, and continues to attempt to deliver data in the buffers until the connection is lost, or the data is delivered.

S-Register 42 Call failures before modem make busy

This feature is only enabled in the modem by special arrangement between the customer and GDC. When it is enabled the modem will take itself out of service by presenting a busy signal on the telephone line when the number of consecutive failed calls equals the number configured here. It can be set from 3 to 15.

S-Register 70 Retransmission counter

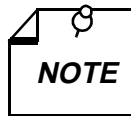
The value in this register determines how many times the modem will retransmit any one frame while in an error correcting connection. The modem hangs up when it reaches the limit set by this register. It can be set from 0 to 255. The default is 100.

Retransmissions become necessary when data errors introduced by noise disrupt the reception of a frame. Raising this limit may be necessary if, for example, telephone lines are extremely noisy. The retransmission delays may be undesirable, but the modem will not hang up.

&Sn DSR operation

This command controls how the Data Set Ready EIA interchange circuit will operate.

- &S0** selects DSR to remain On and glitch Off for disconnect.
- &S1** causes DSR to be real (per ITU-T).
- &S2** selects DSR to follow carrier detect.
- &S3** selects DSR forced On in all modes



The %Dn command overrides the functionality of this command during any ANALOOP test.

%Sn Password operation

This command selects what type of password security the modem will enforce.

- %S0** password security disabled.
- %S1** general security password enforcement enabled. This is the GDC proprietary handshake password. Originating modem transmits contents of password cell 0. Answering modem compares received password to contents of password cell 0.
- %S2** on-line password enforcement enabled. Answering modem prompts remote for manually input password; checks for match in any password cell, 0 — 9.
- %S3** both handshake and on-line password enforcement enabled
- %S4** mandatory callback security enabled, pass-through security disabled
- %S6** on-line password and mandatory callback security enabled; this is to be configured only in a unit that answers incoming calls, the unit originating the call should be configured %S0
- %S7** handshake and on-line passwords, and mandatory callback security enabled; this is to be configured only in a unit that answers incoming calls, the unit originating the call should be configured %S1

:S Store network options

This command causes the DSE to record the current network option settings for the modem channel in non-volatile memory. The DSE restores the settings stored by this command following any interruption of power. Changes to network option settings that are not stored by means of this command are lost if power is interrupted. The command stores settings for the following options:

```
:Cn      :Dn      :Fn      :Gn      :Hn
:In      :Jn      :Ln      :Mn      :Nn
```

T Dialing type

This command directs the modem to use tone dialing as its selected dialing method. The command may be used alone or as part of a dial string.

When T is used alone as a command it makes tone dialing the modem's default — to be used unless a dial string includes a pulse modifier. When T is used in a dial string, it acts as a modifier and affects only the dialing of that string.

&Tn Test mode

The &Tn command controls the soft operation of test modes.

- &T0** clears any active test and resumes normal data set operation.
- &T1** initiates a soft ANALOOP test mode that directs all local data through the transmitter and receiver of the modem. To terminate this test, type +++ (escape sequence) followed by &T0.
- &T3** initiates a soft Digital Loop test mode that directs all received data from the remote modem to be looped back to the transmit data. This has the effect of echo on the remote DTE. Any data the remote DTE sends is returned.
- &T4** directs the modem to accept the in-band request to initiate a remote digital loopback.
- &T5** directs the modem to ignore the in-band request to initiate a remote digital loopback.
- &T6** directs the modem to transmit the in-band request to establish a remote digital loopback with the far modem.
- &T7** directs the modem to transmit the in-band request to establish a remote digital loopback with the far modem, and to run the self-test pattern generator.
- &T8** directs the modem to enter the ANALOOP test mode, and to run the self-test pattern generator.
- &T9** directs the modem to send a self-test pattern to the remote modem while checking the receive data for the same test pattern and checking for errors.

All tests operate for the amount of time specified in S-Register 18. Pending tests such as DL are not allowed.

The self-test pattern for speeds of 1200 and 2400 bps is made up of alternate ones and zeros; the 511 pattern is generated for all other speeds.

Remote digital loopback and self-tests are not operational when the modems are passing data at 300 bps.

%Tn Inactivity Timer

The %Tn command controls how long the unit permits an idle switched network connection to remain open before performing an automatic disconnect.

This command is not valid when the unit is configured for private line operation.

- %H0** Inactivity Timer disabled
- %H1 – %H255** selects Inactivity Timer period in one-minute increments

\Tn DTE speed

This command, in conjunction with the switched network handshake mode command (&Hn), controls the DTE speed. There are several configurations to consider:

- a. An automatic handshake mode (e.g., V.32 *bis* auto [&H1], V.32 auto [&H4], V.22 *bis* only [&H6]) takes precedence over the \Tn selection, and the modem tries for the highest VF speed common to the two commands.
- b. For 1200 bps V.22 operation, select &H7. &H6 is an auto mode, so setting the DTE to 1200 bps (\T3) will not force the connection to 1200 bps.
- c. When the modem is optioned for an automatic handshake mode and direct V.14 asynchronous mode (\N1), it sends a connect message to the DTE at the selected \Tn speed. In order to pass data, the user must change the DTE speed to match the displayed connect speed.
- d. When the modem is optioned for speed buffering (\N0) or an error correcting protocol (\N2 through \N5), the \Tn command alone selects the DTE speed, and the &Hn command selects the handshake mode.
- e. When the modem is optioned either for a fixed handshake mode and direct mode (\N1) or for synchronous data mode (&M1), the \Tn command not only selects the DTE speed, but also forces the VF speed to match it. If this speed is not available, the modem drops the call. (This does not apply to V.22 *bis* only, which handshakes at the highest VF speed.)
- f. When using the modem in direct mode (\N1), if the desired connect speed is known, set the speed to match, using the \Tn command. Set the DTE to the same speed and "AT" the modem so that it will know at what speed to send messages.

\T0	Auto speed	\T1	last AT speed	\T2	300 bps
\T3	1200 bps	\T4	2400 bps	\T5	4800 bps
\T6	7200 bps	\T7	9600 bps	\T8	12.0 kbps
\T9	14.4 kbps	\T10	16.8 kbps	\T11	19.2 kbps
\T12	21.6 kbps	\T13	24.0 kbps	\T14	26.4 kbps
\T15	28.8 kbps	\T16	31.2 kbps	\T17	33.6 kbps
\T18	38.4 kbps	\T19	57.6 kbps	\T20	76.8 kbps
\T21	115.2 kbps	\T22	128.0 kbps	\T23	32 kbps
\T24	48.0 kbps	\T25	56.0 kbps	\T26	64.0 kbps
\T27	72.0 kbps	\T28	96.0 kbps	\T29	112.0 kbps

&Un Trellis coding

When the modem is operating in V.32 mode at 9600 bps this option allows you to select Trellis coded data (&U0), or uncoded data (&U1).

- &U0 enables Trellis coding.
- &U1 disables Trellis coding.

Vn Result code type

This command controls the transmission of result codes. Refer to the \Vn command for a list of all possible result codes.

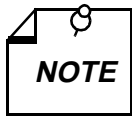
- V0 selects non-verbal (numeric equivalent) result codes to be transmitted. The connect message is the VF line speed.
- V1 selects verbal result codes. The connect message is the DTE speed, except for V.14 mode.

&V View stored phone numbers

This option displays the 10 stored telephone number cells.

%Vn Command format

This command determines the command format.



When either of the two asynchronous command formats (%V0 or %V1) is used with synchronous data mode (&M1) a special function of S-register 25 comes into effect. Consult the description of S-register 25 for further information.

- %V0** AT command set
- %V1** V.25 *bis* asynchronous command set
- %V2** V.25 *bis* HDLC (High-level Data Link Control) command set
- %V3** V.25 *bis* BSC (IBM Binary Synchronous Communications) command set
- %V4** None

Wn Connect message type

This command determines the type of connect message sent to the DTE when a data link is established.

\V0 options the modem to send the standard GDC Connect message upon reaching data mode plus V.42 messages after the link negotiation. The connect message displays VF line speed.

MEANING	VERBAL RESPONSE	NUMERIC
COMMAND WAS SUCCESSFUL	OK	0
COMMAND FAILED	ERROR	4
LINK ESTABLISHED	CONNECT	1
INCOMING RING DETECTED	RING	2
RINGBACK DETECTED	RINGING	23
EXCHANGE CANNOT DIAL NUMBER	UN-OBTAINABLE NUMBER	24
LINK DROPPED	NO CARRIER	3
DIAL TONE NOT PRESENT	NO DIALTONE	6
REMOTE NOT ANSWERING	NO ANSWER	8
LINE BUSY	BUSY	7
VF LINK AT 300	CONNECT	1
VF LINK AT 1200	CONNECT 1200	5
VF LINK AT 2400	CONNECT 2400	10
VF LINK AT 4800	CONNECT 4800	11
VF LINK AT 7200	CONNECT 7200	15
VF LINK AT 9600	CONNECT 9600	12
VF LINK AT 12000	CONNECT 12000	16
VF LINK AT 14400	CONNECT 14400	17
VF LINK AT 16800	CONNECT 16800	18
VF LINK AT 19200	CONNECT 19200	14
VF LINK AT 21600	CONNECT 21600	19
VF LINK AT 24000	CONNECT 24000	20
VF LINK AT 26400	CONNECT 26400	21
VF LINK AT 28800	CONNECT 28800	22
VF LINK AT 31200	CONNECT 31200	23
VF LINK AT33600	CONNECT 33600	24

With \V0 and \V1, the following connect messages are sent when link negotiation is complete:

MEANING	VERBAL RESPONSE	NUMERIC
NO PROTOCOL	PROTOCOL:NONE	70
V.42 PROTOCOL	PROTOCOL:V.42	77
V.42 BIS PROTOCOL	PROTOCOL:V.42BIS	79
MNP PROTOCOL	PROTOCOL:ALTERNATE	80
MNP CLASS 2	PROTOCOL:ALTERNATE, CLASS 2	82
MNP CLASS 2+4	PROTOCOL:ALTERNATE, CLASS 2 + CLASS 4	24
MNP CLASS 2+4+5	PROTOCOL:ALTERNATE, CLASS 2 CLASS 4 CLASS 5	245
MNP CLASS 3	PROTOCOL:ALTERNATE, CLASS 3	83
MNP CLASS 3+4	PROTOCOL:ALTERNATE, CLASS 3 CLASS 4	34
MNP CLASS 3+4+5	PROTOCOL:ALTERNATE, CLASS 3 CLASS 4 CLASS 5	345

\V1 options the modem to delay sending the Connect message until an error corrected link has been established. The Connect message indicates DTE speed unless a V.14 connection was established, in which case it will indicate the VF speed.

MEANING	VERBAL RESPONSE	NUMERIC
DTE LINK AT 300	CONNECT	1
DTE LINK AT 1200	CONNECT 1200	5
DTE LINK AT 2400	CONNECT 2400	10
DTE LINK AT 4800	CONNECT 4800	11
DTE LINK AT 7200	CONNECT 7200	15
DTE LINK AT 9600	CONNECT 9600	12
DTE LINK AT 12000	CONNECT 12000	16
DTE LINK AT 14400	CONNECT 14400	17
DTE LINK AT 16800	CONNECT 16800	18
DTE LINK AT 19200	CONNECT 19200	14
DTE LINK AT 21600	CONNECT 21600	19
DTE LINK AT 24000	CONNECT 24000	20
DTE LINK AT 26400	CONNECT 26400	21
DTE LINK AT 28800	CONNECT 28800	22
DTE LINK AT 38400	CONNECT 38400	25
DTE LINK AT 57600	CONNECT 57600	26
DTE LINK AT 76800	CONNECT 76800	27
DTE LINK AT 115200	CONNECT 115200	28
DTE LINK AT 128000	CONNECT 128000	29

\V2 displays the VF link speed as does the **\V0** function. The difference is that the **\V2** function includes **/REL** at the end of the message when a V.42 error corrected link is established.

Message Numbers 0 — 10 are the same as for **\V0**

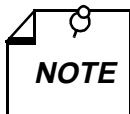
MEANING	VERBAL RESPONSE	NUMERIC
RELIABLE VF LINK AT 300	CONNECT REL	30
RELIABLE VF LINK AT 1200	CONNECT 1200/REL	31
RELIABLE VF LINK AT 2400	CONNECT 2400/REL	32
RELIABLE VF LINK AT 4800	CONNECT 4800/REL	33
RELIABLE VF LINK AT 7200	CONNECT 7200/REL	34
RELIABLE VF LINK AT 9600	CONNECT 9600/REL	35
RELIABLE VF LINK AT 12000	CONNECT 12000/REL	36
RELIABLE VF LINK AT 14400	CONNECT 14400/REL	37
RELIABLE VF LINK AT 16800	CONNECT 16800/REL	38
RELIABLE VF LINK AT 19200	CONNECT 19200/REL	39
RELIABLE VF LINK AT 21600	CONNECT 21600/REL	40
RELIABLE VF LINK AT 24000	CONNECT 24000/REL	41
RELIABLE VF LINK AT 26400	CONNECT 26400/REL	42
RELIABLE VF LINK AT 28800	CONNECT 28800/REL	43
RELIABLE VF LINK AT 31200	CONNECT 31200/REL	44
RELIABLE VF LINK AT 33600	CONNECT 33600/REL	45

\V3 sends only the connect message after the link negotiation. The message will indicate the VF rate for V.13 and V.14 connections, and the DTE rate for all other connections (default).

\V4 options the modem to display asymmetric DCE rates in the format

```
CONNECT RRRRR TTTTT
```

where RRRRR = receive speed and TTTTT = transmit speed.



Verbal text responses are terminated by <cr><lf>. Numeric code responses are terminated by <cr>.

&Wn Save settings as a user configuration profile

This command directs the modem to write the current settings for user defined and storable options into memory. You can save up to four user configuration profiles ($n = 0 — 3$)

Zn is the command for loading a user configuration profile that has been stored by means of this command.

***Wn Remote configuration control**

This command controls remote configuration. Refer also to the Remote Configuration feature description.

***W0** disables remote configuration.

***W1** enables remote configuration.

Xn Call Progress Monitor

This command controls which Call Progress Monitor (CPM) signals are monitored and reported to the local DTE. This option is user storable unless it is defined by country configuration parameters.

- X0** forces the modem to blind dial, and will only send a CONNECT message for all established links. All CPM is disabled.
- X1** blind dial, CPM disabled, CONNECT message includes connected speed.
- X2** CPM enabled for pre-dial signals (dialtone) only, CONNECT message includes connected speed.
- X3** blind dial, CPM enabled for post-dial signals (busy, unobtainable number, etc.) only, CONNECT message includes connected speed.
- X4** enables CPM response codes and monitoring, CONNECT message includes connected speed.
- X5** enables all CPM response codes and monitoring, including ringback detection, CONNECT message includes connected speed.

&Xn Transmit clock source

This command selects the clock source when the modem operates in synchronous Data Mode.

- &X0** selects the internally generated modem clock.
- &X1** selects transmit timing from the DTE.
- &X2** selects modem timing derived from the RECEIVER.

***Xn Remote configuration exit**

This command controls remote configuration exit. Refer also to the Remote Configuration feature description.

- *X0** terminates the session without saving changes.
- *X1** terminates the session and saves changes.

Yn Long space disconnect

This command enables or disables the long space disconnect option. When the option is enabled a disconnect request (ATH0, loss of DTR or DCD, etc.) will cause the modem to transmit 4 seconds of continuous space (BREAK). A modem with long space disconnect enabled will hang up when it receives more than 1.5 seconds of continuous space (BREAK) while on-line.

- Y0** disables long space disconnect.
- Y1** enables long space disconnect.

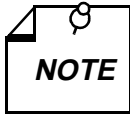
&Yn Power-up user configuration profile

This command is used to determine which user configuration profile, stored by means of the &Wn command, is activated at modem power-up. You can select from up to four user configuration profiles ($n = 0 \text{ --- } 3$).

:Yn Set network configuration commands to defaults

This command causes the DSE modem channel to set its network configuration commands for one of two default switched network operating configurations. One default configuration is compatible with a T1 LTU and the other is compatible with an E1 LTU.

This is an action command rather than a configuration command, meaning that the DSE does not store a value for it. Instead, this command affects the settings of configuration commands, which the DSE does store.



This is one of the group of AT commands for network options that are provided for use when the SC 5034 DSE is not subject to SNMP control. AT command functionality for these options is only enabled when you enter the command:

**Y5034:X1*

Use of the commands remains enabled until you either cycle power to the unit or enter the command:

**Y5034:X0*

It is advisable to enable the commands only long enough to make configuration changes, and keep them disabled at all other times. For further details see page 4-3.

The following table lists the configuration commands that are set by :Y and briefly describes how it sets them. Consult descriptions of the individual commands if you need further information.

Configuration Command	Option Name and Setting
:Cn	Switched Network Highway – :C1 for a DSE in a single shelf installation or in the first shelf (Shelf 0) of a two-shelf installation; :C2 for a DSE in the second shelf (Shelf 1) of a two-shelf installation.
:Dn	Switched Network Time Slot – determined by DSE shelf slot position, see following table
:F0	Private Line Time Slot – none
:G0	Call Direction – 2-way
:H3	Trunk Type – E&M Wink Start 1; not valid when command is :Y1 for E1 operation
:I0	Signaling Method – T1/E1, robbed bit
:Jn	Companding Law – :Y0 sets this to J0, mu-Law, for T1 operation; :Y1 sets this to J1, A-Law, for E1 operation
:L1	Frame Type – ESF; not valid when command is :Y1 for E1 operation
:M0	Private Line Highway – none

The following table lists the default time slot assignments based on shelf slot position.

Shelf Slot	T1 Timeslot Assignments		E1 Timeslot Assignments	
	Modem A	Modem B	Modem A	Modem B
1	do not install DSE in this slot		1	2
2	1	2	3	4
3	3	4	5	6
4	5	6	7	8
5	7	8	9	10
6	9	10	11	12
7	11	12	13	14
8	13	14	15	17
9	15	16	18	19
10	17	18	20	21
11	19	20	22	23
12	21	22	24	25
13	23	24	26	27
14	do not install DSE in this slot		28	29
15	do not install DSE in this slot		30	31
16	do not install DSE in this slot		do not install DSE in this slot	

- :Y0** Commands modem channel to set network configuration commands for default T1 switched network operation
- :Y1** Commands modem channel to set network configuration commands for default E1 switched network operation

Zn Load user configuration profile

This command re-initializes the modem options with a user-defined configuration profile that has been stored by means of the &Wn command. You can select from up to four user configuration profiles (n = 0 — 3).

&Zn=nnn Store a phone number

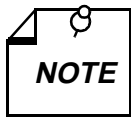
This command stores a telephone number (nnn) in a memory cell (n). The equal sign can be followed by up to thirty-six characters, including any of the commands that can be used in a dial string. There are 10 cells (n = 0 to 9) available in which to store telephone numbers.

Memory cells 9, 8, and 7 assume special functions when the DSE is used for switched network operations in conjunction with an E1 LTU. Cell 9 must be programmed with the subscriber number, cell 8 must be programmed with the terminating sequence, and cell 7 can be programmed with the Automatic Caller Number Identification (ANI). Leave cell 7 empty if ANI is not used. Consult the heading *Call Reception on an E1 DS0* in the *Switched Network Operation* portion of *Chapter 3* for more information on the purpose of these three numbers.

%Zn DTR dialing

This command controls the Off-to-On DTR transition options for DTR dialing.

- %Z0** sets the modem to ignore the Off-to-On transition of DTR.
- %Z1** sets the modem to dial when a DTR Off-to-On transition occurs and DTR remains On. The format for this command is **%Z1=x**, where *x* is the memory cell that contains the number to be dialed. The specified phone cell must be programmed with a valid phone number prior to this operation. When no cell number is provided, Cell 0 is the default.
- %Z2** sets the modem to go off-hook and try to handshake on an Off-to-On transition of DTR.
- %Z3** performs the same function as **%Z1** with one additional feature: modem will redial if the connection is broken while DTR remains On. **%Z1** dials only on transition. The format for this command is **%Z3=x**.



The &D0 command overrides this option.

5 V.25 bis Command Set Operation

Overview

This chapter describes the operating procedures for the SC 5034 DSE when using the ITU-T (formerly CCITT) V.25 *bis* compatible command protocol.

108 Modes

The ITU-T V.25 *bis* protocol operates in one of two modes: 108.2 or 108.1. The modes are named for the two ITU-T designations for circuit 108 of the terminal interface:

- In 108.2 mode, the circuit is the “Data Terminal Ready” signal.
- In 108.1 mode, the circuit is the “Connect Data Set to Line” signal.

Circuit 108 is pin 20 in a DB25 connector; in a 34-pin V.35 connector it is pin H.

108.2 Mode

The 108.2 operating mode supports convenient outbound calling to multiple locations. When the DTE instructs the modem to originate a call in 108.2 mode, it also specifies the number to be dialed. The DTE can either supply the number itself along with the command to dial, or identify which of the modem's memory cells contains the number to be dialed.

In 108.2 mode the modem supports an ITU-T V.25 *bis* compatible command set you can use from the DTE to interrogate and configure the modem, and to control communication and test functions. Configuration by means of the command set can include operating parameters such as data rate, handshake mode, and synchronous timing source; as well as storage of phone numbers in the modem's memory cells.

In order for the V.25 *bis* command set to function, the modem must be operating in 108.2 mode and terminal interface circuit 108.2 (Data Terminal Ready) must be On. When circuit 108.2 is Off, the modem ignores the commands. Circuit 108.2 can be forced On with the &D0 AT command (this can only be done in asynchronous operations).

108.1 Mode

The 108.1 operating mode supports automatic outbound calling directed primarily to a single location. The DTE instructs the modem to originate a call by turning On circuit 108.1, Connect Data Set to Line. The modem then goes off-hook, dials the number stored in its memory cell 0, and attempts to establish communication.

The modem will disconnect from the line if it does not successfully handshake in the time specified in the abort timer selected by the S7=*x* AT command (default is 30 seconds). If you turn Off 108.1 while the modem is in the data mode, the modem will hang up and disconnect.

The ITU-T V.25 *bis* compatible command set is not available when the modem is operating in 108.1 mode. Storage of a telephone number in memory cell 0 must be performed either in 108.2 mode (using the PRN command), or by means of AT commands.

Any number can be called in 108.1 mode by dialing manually and then turning On circuit 108.1 when answer tone is heard from the remote modem.

Operating Procedures

Refer to the ITU-T V.25 bis Command Set Communication Operating Procedures below for a full description of the communication procedures for the 108.2 and 108.1 modes.

Refer to Synchronous V.25 bis Interface Specifications below for synchronous dialing protocol formats.

Commanding the Modem

Although the AT command set is the primary command set for configuring the modem, the modem provides an enhanced ITU-T V.25 bis command protocol that permits you to configure modem dial parameters and establish data communications. After configuring the modem using the AT command set, use the %Vn command to switch to the V.25 bis command set.

Table 5-1 summarizes the V.25 bis compatible command set. When entering commands, terminate each one with a line feed <LF> control character. The modem sends a response back to the terminal for each command. *Table 5-2* explains responses to valid commands. *Table 5-3* explains responses to invalid commands. Most terminals display the responses to indicate each entered command's result, but responses are ignored by some communications software that enables a computer to emulate a terminal.

Descriptions of each V.25 bis 108.2 mode command appear on the following pages.

Operating procedures for establishing and terminating data communications are explained following the command descriptions.

Table 5-1 V.25 bis Command Set Summary

Configuration Commands		
Name	Cmd.	Page
AT Command Set	PRS AT	5-6
Automatic Answering	PRS AA	5-5
Connect Message Inhibit	PRS CM	5-6
DTE Data Rate	PRS DR	5-6
Handshake Mode	PRS HM	5-8
Store Phone Number to Cell	PRN	5-5
Synchronous Timing	PTM	5-9
Termination Character	PRS TR	5-8
Write Option Settings to User Configuration Profile	NVW	5-5
Communication Commands		
Call Requested Number	CRN	5-9
Call Requested Stored Telephone Number	CRS	5-10
Connect Incoming Call	CIC	5-9
Disconnect Incoming Call	DIC	5-10

Table 5-2 Explanation of Valid Responses

Response	Description
CFI AB	Call failure indication: no carrier, call was aborted (time-out occurred or character was entered at keyboard).
CFI BF	Call failure indication: telephone number black list (which uses the 10 memory cells) is full. You cannot place any more calls until: <ul style="list-style-type: none"> a) after a timeout. b) the memory cell is modified. c) the modem is reset.
CFI DT	Call failure indication: dial tone was not detected (dial tone time-out occurred).
CFI DF	Call failure indication: telephone number delayed list (which uses the 10 memory cells) is full. Numbers which are redialed continuously without making a connection are added to the delayed list. They are removed from the list: <ul style="list-style-type: none"> a) after a timeout. b) when a connection is made. c) when the memory cell is modified; or d) when the modem is reset.
CFI ET	Call failure indication: remote modem is busy.
CFI UT	Call failure indication: unobtainable number tone was detected.
CNX	300 bps connection is established.
CNX 1200	1200 bps connection is established.
CNX 2400	2400 bps connection is established.
CNX 4800	4800 bps connection is established.
CNX 7200	7200 bps connection is established.
CNX 9600	9600 bps connection is established.
CNX 12000	12,000 bps connection is established.
CNX 14400	14,400 bps connection is established.
CNX 16800	16,800 bps connection is established.
CNX 19200	19,200 bps connection is established.
CNX 21600	21,600 bps connection is established.
CNX 24000	24,000 bps connection is established.
CNX 26400	26,400 bps connection is established.
CNX 28800	28,800 bps connection is established.
INC	Incoming call was detected. This response is generated only once for each incoming call.
INV	See Table 5-3 for responses to commands that the modem does not recognize.
RNGBK	Ringback was detected by the originating modem.
VAL	Valid command was invoked.

Table 5-3 Explanation of Invalid Responses

Command Invoked	Description of INV Response
DIC	INC not received.
PRS	Non-selectable option due to country code.

V.25 bis Configuration Commands

Configuration commands allow you to configure the modem.

NVW Write Option Settings to User Configuration Profile

NVW saves the current settings to a user configuration profile in the modem's non-volatile memory, with the exception of the Terminator Character option (which is set to its factory default, the line feed control-character). This command saves a set of option values that is activated when the modem is powered up.

To invoke this command, type:

```
NVW ; n <LF>
```

where *n* is the user configuration profile (0 to 3).

PRN Store Phone Number to Cell

PRN stores a telephone number in one of the modem's ten memory cells. Numbers stored by means of this command can be automatically dialed either by invoking the CRS command in 108.2 mode, or by turning On circuit 108.1 in 108.1 mode (108.1 dialing uses only the number stored in memory cell 0).

To store a number, type:

```
PRN n1 ; n2 <LF>
```

where *n1* is the memory cell (from 0 to 9) in which the number is to be stored, and *n2* is the phone number to be stored. *n2* may contain any legal dialing characters (0-9 A-D P T # * , < ! & @).

PRS AA Automatic Answering

PRS AA controls the automatic answering function. When you enable automatic answering, you can specify the number of rings the modem will wait before it performs automatic answering. Default is 4 rings.

To enable automatic answering, type:

```
PRS AA ; n <LF>
```

where *n* is the number of rings (from 1 to 255) that the modem waits before automatically answering an incoming call.

To disable automatic answering, type:

```
PRS AA ; 0 <LF>
```

PRS AT AT Command Set

PRS AT switches the modem from V.25 bis command set mode to AT command set mode.

To return to V.25 bis command set mode, use the AT%Vn command.

To invoke this command, type:

```
PRS AT <LF>
```

PRS CM Connect Message Inhibit

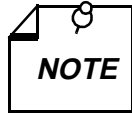
PRS CM controls the CNX yy connect message responses. The V. 34 supports both the 1989 and the 1984 recommendations for V.25 *bis* connection procedures. The 1989 CCITT Blue Book recommends that when the modem transfers from command mode to data mode it should send a connect message of the form CNX yy, where yy identifies the connect speed (96 = 9600 bps, 48 = 4800 bps, 24 = 2400 bps, and 12 = 1200 bps; omitted for 300 bps). The 1984 CCITT Red Book does not include these connect messages. Default is 0 (connect message disabled).

To disable the CNX yy connect message responses, type:

```
PRS CM ; 0 <LF>
```

To enable responses, type:

```
PRS CM ; 1 <LF>
```

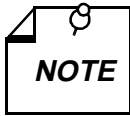


After modifying this option you should save the setting by using the NVW command.

PRS DR DTE Data Rate

PRS DR, in conjunction with the handshake mode command (PRS HM), controls the DTE speed. There are several configurations to consider:

- a. An automatic handshake mode, e.g., V.32 *bis* auto [PRS HM ; 2], V.32 auto [PRS HM ; 4], V.22 *bis* only [PRS HM ; 6], takes precedence over the PRS DR selection, and the modem tries for the highest VF speed common to the two commands.
- b. For 1200 bps V.22 operation, select PRS HM ; 7. PRS HM ; 6 is an auto mode, so setting the DTE to 1200 bps (PRS DR ; 3) will not force the connection to 1200 bps.
- c. When the modem is optioned for an automatic handshake mode and direct V.14 asynchronous mode (AT command \N1), it sends a connect message to the DTE at the selected PRS DR speed. In order to pass data, the user must change the DTE speed to match the displayed connect speed.
- d. When the modem is optioned for speed buffering (AT command \N0) or an error correcting protocol (AT commands \N2 through \N5), the PRS DR command alone selects the DTE speed, and the PRS HM command selects the handshake mode.
- e. When the modem is optioned for a fixed handshake mode and direct mode (AT command \N1), the PRS DR command not only selects the DTE speed, but also forces the VF speed to match it. If the required VF speed is not available the modem drops the call. (This does not apply to V.22 *bis* only, which handshakes at the highest VF speed.)
- f. When using the modem in direct mode (AT command \N1), if the desired connect speed is known, set the speed to match using the PRS DR command. Set the DTE to the same speed and "AT" the modem so that it will know at what speed to send messages.



The modem must be in the AT command set mode in order to configure the \Nn AT command.

To invoke this command, type:

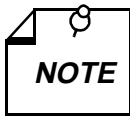
```
PRS DR ; n <LF>
```

where *n* is the DTE rate, as follows:

n	rate	n	rate
0	Autobaud	11	19,200 bps
1	Last connect speed	12	21,600 bps
2	300 bps	13	24,000 bps
3	1200 bps	14	26,400 bps
4	2400 bps	15	28,800 bps
5	4800 bps	16	38,400 bps
6	7200 bps	17	57,600 bps
7	9600 bps	18	76,800 bps
8	12,000 bps	19	115,200 bps
9	14,400 bps	20	128,000 bps
10	16,800 bps		

PRS HM Handshake Mode

PRS HM selects the handshake mode.



- a. When the modem is optioned for an external transmit clock source (PTM ; 1), the modem should be optioned for a fixed — not an automatic — handshake mode (e.g., select V.32 bis only [PRS HM ; 3] instead of V.32 bis automatic [PRS HM ; 2]). The modem will then handshake only at the speed given to it by the DTE.
- b. For 1200 bps V.22 operation, select PRS HM ; 7. PRS HM ; 6 is an auto mode, so setting the DTE to 1200 bps (PRS DR ; 3) will not force the connection to 1200 bps.

To invoke this command, type:

```
PRS HM ; n <LF>
```

where *n* is the handshake mode, as follows:

n	mode
0	V.34 auto (28.8 kbps to 300 bps)
1	V.34 only (28.8 kbps to 2400 bps)
2	V.32 <i>bis</i> automatic (14.4 kbps to 300 bps)
3	V.32 <i>bis</i> only (14.4 kbps to 4800 bps)
4	V.32 automatic (9600 bps to 300 bps)
5	V.32 only (9600 bps to 4800 bps)
6	V.22 <i>bis</i> only (2400 bps to 1200 bps)
7	V.22 only (1200 bps)
8	Bell 212 only (1200 bps)
9	Bell 103 only (300 bps)
10	V.21 only (300 bps)

PRS TR Termination Character

PRS TR selects the ASCII character that represents the command termination character in the asynchronous mode. The command termination character is the character used to enter a command for interpretation by the modem. Select the command termination character that is compatible with your preference and your terminal. Default is 10 or <LF> (line feed).

To select the line feed control-character as the command termination character, type:

```
PRS TR ; 10 <LF>
```

To select the vertical tabulation control-character, type:

```
PRS TR ; 11 <LF>
```

To select the form feed control-character, type:

```
PRS TR ; 12 <LF>
```

PTM Synchronous Timing

PTM selects the clock source when operating in a synchronous data mode.

To select internal clock (supplied by the modem), type:

```
PTM ; 0 <LF>
```

To select external clock (supplied by the DTE), type:

```
PTM ; 1 <LF>
```

To select receiver wrap clock (derived from received data), type:

```
PTM ; 2 <LF>
```

V.25 bis Communication Commands

Communication commands allow you to establish and terminate data communications.

CIC Connect Incoming Call

CIC causes the modem to automatically answer the current incoming call. It temporarily modifies the automatic answering function so that the modem immediately answers the call, ignoring the number of automatic answering rings selected with the PRS AA command. Ten seconds after one incoming call is completed, normal automatic answering is restored.

To invoke this command, type:

```
CIC <LF>
```

CRN Call Requested Number

CRN causes the modem to dial a telephone number, supplied with the command, to initiate data communication with another modem. If the handshake abort timer (AT command S7=*x*) times out before the modem detects answer tone, the modem will return on-hook.

To invoke this command, type:

```
CRN n <LF>
```

where *n* is the telephone number to be dialed. (The modem recognizes only the characters contained in *n* that are listed in *Table 5-4*.) To dial 555-1234, for example, type:

```
CRN 5551234 <LF>
```

CRS Call Requested Stored Telephone Number

CRS causes the modem to dial the telephone number stored in a specified modem memory cell. The number to be dialed must have been stored in a memory cell previously by means of the PRN command.

To invoke this command, type:

```
CRS n <LF>
```

where *n* is the number (from 0 to 9) of the memory cell that contains the telephone number to be dialed. For example, to dial the number stored in memory cell 5, type:

```
CRS 5 <LF>
```

DIC Disconnect Incoming Call

DIC causes the modem to temporarily disable the automatic answering function and ignore an incoming call. Ten seconds after one incoming call is completed, normal automatic answering is restored.

To invoke this command, type:

```
DIC <LF>
```

Table 5-4 Legal Dialing Characters

Character	Description
0 1 2 3 4 5 6 7 8 or 9	Pulse and tone dial digits
#	Tone dial character
*	Tone dial character
P	Causes dialed numerals following P to be dialed using pulses. Used to select pulse dialing for compatibility with your telephone system. Pulse dialing is blocked by some country code configurations.
T	Causes dialed alphanumeric characters following T to be dialed using tones. Used to select tone dialing for compatibility with the telephone system you intend to use.
, or <	Causes the modem to pause a specified length of time before dialing the next digit of a telephone number (the pause is 2 seconds in length by default and may be changed with the <code>ATS8=x</code> command). Used when the telephone system requires a pause before it can accept the next digit of the telephone number being dialed.
! or &	Causes the modem to go on-hook (flash) momentarily. Used to command certain internal telephone systems (PBXs).
@	Causes the modem to wait <i>n</i> seconds for one or more rings followed by five seconds of silence before dialing the next digit of a telephone number (if <i>n</i> seconds expire before a ring is detected, the modem will abort dialing and return to the command mode). Used to dial a telephone system that does not provide dial tone. Silence, rather than dial tone, indicates that the telephone system is ready to accept telephone number dialing. (<i>n</i> = the value selected in the abort timer.)
Ln	On dial failure, link to the telephone number stored in cell <i>n</i> (<i>n</i> = 0 to 9).
W or :	Causes the modem to wait a specified length of time for dial tone before dialing the next digit of the telephone number. The length of time is specified by the <code>ATS7=x</code> command. If this time expires before dial tone is detected, the modem will abort dialing and return to the command line.

ITU-T V.25 *bis* Command Set Communication Operating Procedures

The following paragraphs describe communication operating procedures for the V. 34 using the ITU-T V.25 *bis* command set. The descriptions include procedures for originating, answering, and terminating a call in the 108.2 and 108.1 modes.

108.2 Mode Operating Procedures

Originating a Call

To establish communication by originating a call in the 108.2 mode:

1. From the DTE, use the CRN or CRS command to dial the desired telephone number.
2. When communication is established, your terminal displays the CNX response (if enabled with the PRS CM ; 1 command) and you may transfer data.

Automatic Call Answering

To have the modem automatically answer calls and establish communication:

1. Enable automatic answering by typing:

```
PRS AA ; n <LF>
```

where n is the number of rings (from 1 to 255) that the modem will wait before it performs automatic answering. The default is 4.

2. The modem will answer any incoming call automatically after the specified number of rings.
3. When communication is established, your terminal will display the CNX response and data transfer can take place. If communication is not established, your terminal will display the appropriate response and the modem will return to the command mode.

Manual Call Answering

The command PRS AA ; 0 <LF> disables automatic call answering. When automatic answering is disabled, use the following procedure to establish communication by manually answering calls:

1. When your terminal displays the INC result code to indicate an incoming call, type:

```
CIC <LF>
```

2. When communication is established, your terminal will display the CNX response and data transfer can take place. If communication is not established, your terminal will display the appropriate response and the modem will return to the command mode.

Automatic Call Termination

The modem will automatically terminate a call if:

- Terminal interface signal 108.2 (DTR) is turned Off while the modem is in data mode. This mode of automatic termination functions only when DTR is optioned for normal operation; it is disabled if 108.2 is optioned for forced On operation.
- The handshaking sequence is not completed within the abort time period (selected by the $S7=x$ AT command; default is 30 seconds) after originating or answering a call.
- A long space is received and long space disconnect has been enabled by the Yn AT command. This mode of automatic termination functions only when the modem is operating at 300, 1200, or 2400 bps.

108.2 Call Establishment Procedure

The general principle for establishing a call between the DTE and DCE complies with the V.25 *bis* 108.2 mode of operation and is outlined below:

Originating a Call

DTE	DCE
Turn On DTR.	Turn On CTS.
Send Command: CRN or CRS.	Send VAL response. Dial phone number.
Wait for the connection (or abort the call by turning Off DTR).	Turn Off CTS when answer tone is detected or send CFI response in cases where the call has failed. Turn On DSR and DCD when handshake is successful.
Recognize successful connection when DSR comes On. Recognize connected data rate from the CNX message.	Send connect CNX message. Enter data transfer mode.
Turn On RTS to send data.	Turn On CTS in response to RTS.
Turn Off DTR to terminate call.	Disconnect from line. Turn Off CTS, DSR, and DCD. Send CFI call abort message.

Answering a Call

DTE	DCE
Turn On DTR.	After detection of an incoming ring, send INC message. When Auto Answer is enabled, modem will answer call after preset number of rings if DTR is On. The CIC command is not required.
Send CIC command to permit answering, or send DIC command to disregard the incoming ring.	Disregard incoming ring if DIC is received. Answer call after the next ring if CIC is received. At next ring, go off-hook. Turn Off CTS. Turn On DSR and DCD when going through handshake successfully.
Recognize successful connection when DSR comes On.	Send connect CNX message. Go into data transfer mode.
Recognize connected data rate from the CNX message.	
Turn On RTS to send data.	Turn On CTS in response to RTS.
Turn Off DTR to terminate call.	Disconnect from line. Turn Off CTS, DSR, and DCD. Send CFI call abort message

108.1 Mode Operating Procedures

Originating a Call Automatically

To establish communication by automatically originating a call in the 108.1 mode:

1. Prior to the time of calling a telephone number must be stored in the modem's memory cell 0. That can be done with either the 108.2 mode PRN command or the AT command `&Zn=nnn`.
2. To initiate an automatically dialed call in 108.1 mode, turn On terminal interface circuit 108.1.
3. When communication is established with the remote modem, you may transfer data.

Automatic Call Answering

The modem can answer calls automatically in 108.1 mode if the function has not been disabled. The automatic answer enable/disable command (in 108.2 mode) is:

```
PRS AA ; n <LF>
```

where *n* is the number of rings (from 1 to 255) that the modem will wait before it begins the automatic answering process.

PRS AA ; 0 <LF> disables automatic answering. The default is 4.

The following sequence of events takes place when the modem senses an incoming call:

1. After the specified number of rings, the modem turns On circuit 125 (Call Indicator) to alert the DTE that an incoming call is trying to make a connection.
2. If the DTE is prepared to accept the connection it responds by turning On circuit 108.1. While Call Indicator is On, circuit 108.1 acts as the command to perform automatic answering.
3. The modem then goes off-hook, performs handshaking, and — when that is successfully completed — begins data transfer with the remote modem.

Terminating a Call

To terminate communication, turn Off terminal interface circuit 108.1.

V.25 *bis* 108.2 Mode Interface Specifications

Physical connections between a DTE and a DCE may be either synchronous or asynchronous. The ITU-T V.25 *bis* 108.2 mode recommendations describe the exchange of commands and responses between the units using both types of operation. The V. 34 supports command/response exchange in either mode.

The following paragraphs describe the functional characteristics of the V.25 *bis* synchronous and asynchronous interfaces, as used in the SC 5034 DSE.

Interface Connections

From DCE to DTE:

104	RXD	125	Call Indicator/Ring Detector
106	CTS	114	TX Timing (synchronous only)
107	DSR	115	RX Timing (synchronous only)

From DTE to DCE:

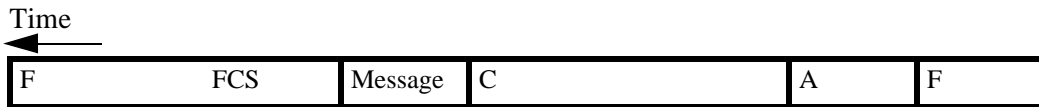
103	TXD	108.2	DTR
105	RTS	113	TX Timing (synchronous only)

Synchronous Format Selection

The V. 34 supports both the bit-oriented and the byte-oriented modes of synchronous operation.

Synchronous Bit-Oriented Operation

The modem uses the HDLC format in the bit-oriented synchronous mode (%V2 AT command). The structure of each message in this format is shown below:

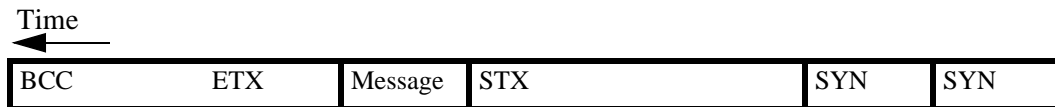


- F = Idle Flag (01111110)
- FCS = Frame Check Sequence (CRC-ITU-T, $x^{16}+x^{12}+x^5+1$)
- Message = Command/Response (7-bit ASCII data and 1 odd parity)
- C = Control (00010011*)
- A = Address (11111111*)

*The modem does not recognize the C or A fields unless verified as shown above.

Synchronous Byte-Oriented Operation

The modem uses the BISYNC (BSC) format in the byte-oriented synchronous mode (%V3 AT command). The structure of each message in this format is shown below:



- BCC = LRC Block Check Character for ASCII
- ETX = ASCII ETX Character (10000011)
- Message = Command/Response (7-bit ASCII data and 1 odd parity)
- STX = ASCII STX Character (00000010)
- SYN = ASCII SYN Character (00010110)



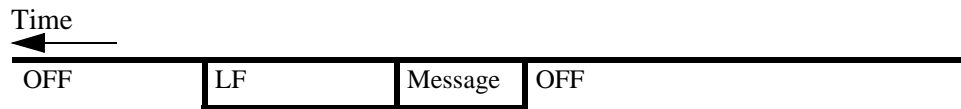
BCC is always transmitted in the modem's responses, but optionally included in the DTE commands. In this way, the modem conforms to BSC conventions without deviating from the ITU-T V.25 bis Recommendations.

Data Rate

The V. 34 does not support 300 bps in the synchronous mode. Also, in the synchronous mode, the modem will not handshake with an incoming call at 300 bps FSK.

Asynchronous Format

The structure of each message in the asynchronous mode (%V1 AT command) format is shown below:



OFF = Interface idle

Message = Command/Response (10-bit characters: 1 start, 7-bit ASCII data, 1 even parity, 1 stop)

LF = ASCII Line Feed Character (00001010)

Modem Test Modes

When optioned to operate in the synchronous V.25 *bis* mode, the V. 34 supports the following test modes that can be initiated from the Front Panel:

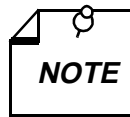
- Analog Loopback
- Analog Loopback with Self-Test
- Digital Loopback
- Remote Digital Loopback
- Remote Digital Loopback with Self-Test
- End-to-End Self-Test

All tests may be terminated from the front panel switches, and the modem returns to off-line idle command state when DTR goes from On to Off. Pending tests can be cleared only from the front panel.

6 Tests

Overview

This chapter describes tests that can be invoked to isolate a trouble condition. The tests can isolate a problem to the data connection, data set operation, or the DTE interface level. Refer to *Figure 6-1* for a sequence of tests for fault isolation.



- a. *On-line tests, which involve data transmitted from one modem to another, can be performed with the modems operating in either synchronous mode or direct (NI) asynchronous mode. They cannot be initiated until the modem has been in data mode for approximately 30 seconds.*
- b. *Once a modem is in Slave RDL, it will ignore all requests other than AL.*
- c. *If an RDL request does not get a response from the Slave modem at 2400 bps, the Master will drop the line.*

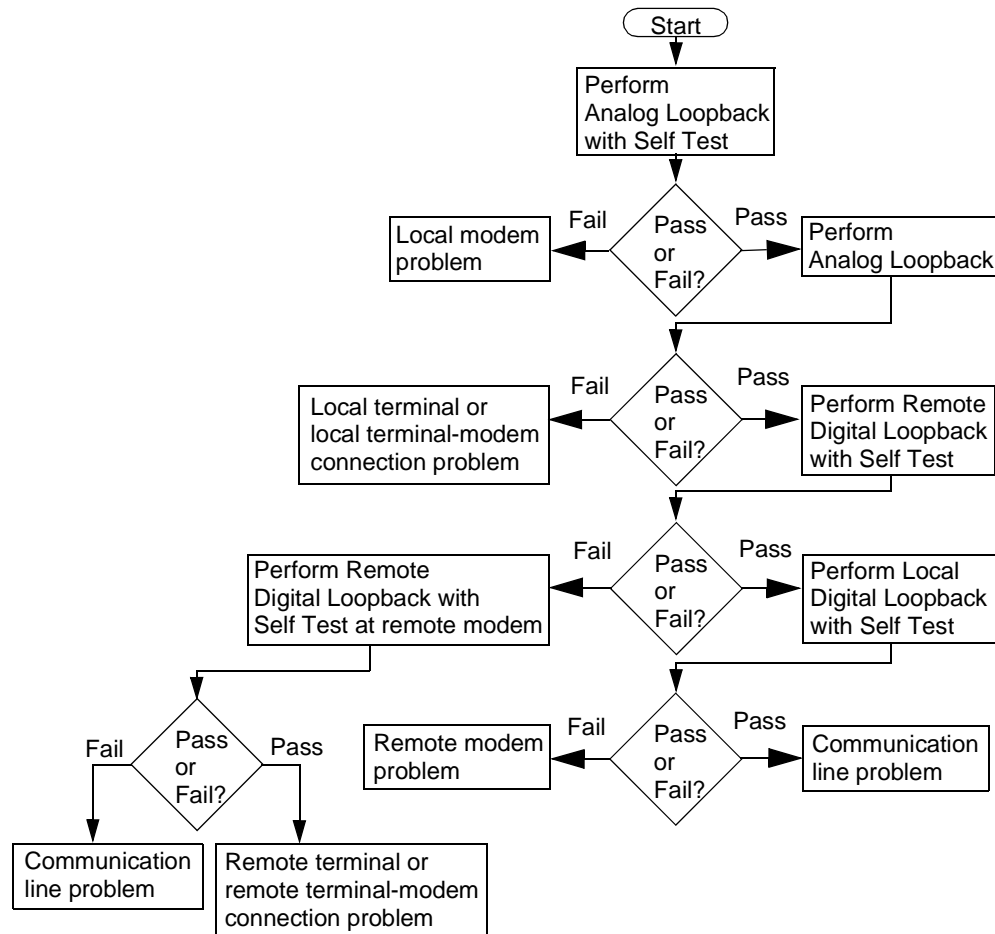
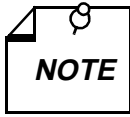


Figure 6-1 Fault Isolation Sequence

Analog Loopback

The analog loopback (ANALOOP) test mode, illustrated in *Figure 6-2*, is provided to isolate problems in the data set operation and the DTE interface. Specifically, ANALOOP tests modem modulator/demodulator operation, DTE receive/transmit operation, and DTE interface operation. The ANALOOP test can be controlled from the front panel or by AT commands.



When the modem is used in \N0, \N2, \N3, \N4 or \N5 modes with a fixed DTE speed, it will not issue a CONNECT message. When the modem is used in \N1 mode, since the ANALOOP handshake speed may not match the DTE speed selected, the modem will issue a CONNECT _ _ _ _ message at the last known DTE rate. If the DTE rate and handshake rate differ, the user can change the DTE speed to match the rate reported by the CONNECT message.

Table 6-1 Analog Loopback

Step	Front Panel	AT Command Mode
1.	To start the test, press LL.	To start the test, type: AT&T1 (enter). If modem responds with an error message, type: AT&T0 (enter), which resets the test mode, then re-enter the command.
2.	The modem flashes the TM LED while it is setting up the test, then lights the TM and LL LEDs while the test is running.	The modem flashes the TM LED while it is setting up the test, then lights the TM and LL LEDs while the test is running.
3.	Enter test data at the DTE. Compare the data that was entered at the DTE with the data that is looped back and displayed by the DTE. If errors occur frequently, a problem may exist in the modem, the DTE, or the DTE-to-modem connection. Refer to the fault-isolation diagram to isolate the problem.	
4.	To end the test, press LL	To end the test, type the escape sequence (+++) and, after the modem is in the command mode, type: AT&T0 (enter).

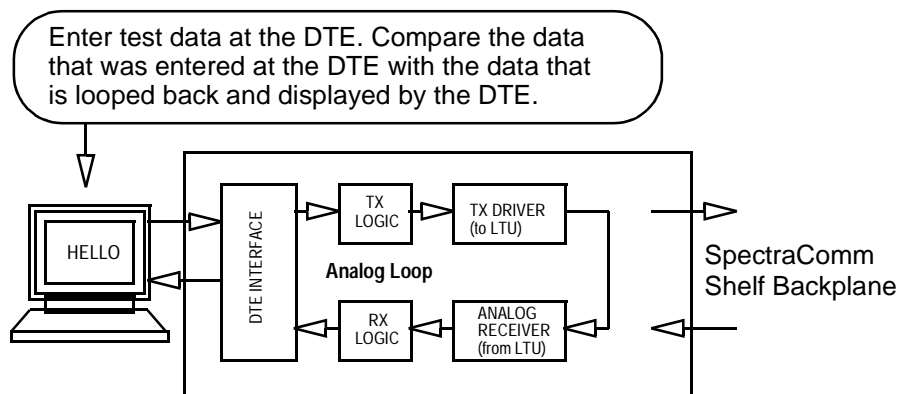


Figure 6-2 Analog Loopback

Analog Loopback with Self-Test

ANALLOOP may be combined with Self-Test, as illustrated in *Figure 6-3*. Upon initiation of Self-Test, a pattern is generated by the transmitter and sent to the receiver for analysis. The pattern is made up of alternate ones and zeros for speeds of 1200 and 2400 bps. For all other speeds the modem generates a 511 test pattern. The number of errors is displayed on the screen. This test provides a means for the customer to determine whether the problem is in the local data set.

This test is not operational when the modems are passing data at 300 bps.

TABLE 6-2 Analog Loopback with Self-Test

Step	Front Panel	AT Command Mode
1.	To start the test press LL, then press ST.	To start the test, type: AT&T8 (enter). If modem responds with an error message, type: AT&T0 (enter), which resets the test mode, then re-enter the command.
2.	The modem flashes the TM LED while it is setting up the test, then lights the TM, LL, and ST LEDs while the test is running.	The modem flashes the TM LED while it is setting up the test, then lights the TM, LL, and ST LEDs while the test is running. When the test is terminated, the screen displays a four-digit number corresponding to the number of errors detected during the test, followed by the OK message. Any number greater than 0 indicates the modem has failed the test.
3.	If the timer, S-Register 18, is set to a value between 1 and 60, the test ends automatically after that value (in 10-second increments) is reached. The factory default for S-Register 18 is 000, meaning that the test will continue indefinitely.	
4.	To end the test, press LL.	To end the test, type the escape sequence (+++) and, after the modem is in the command mode, type: AT&T0 (enter).

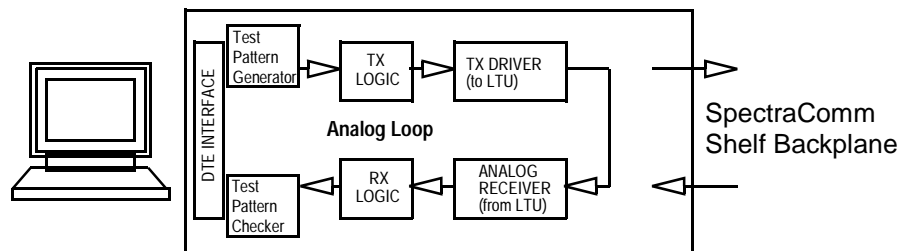


Figure 6-3 Analog Loopback with Self-Test

Digital Loopback

The modem can be commanded to enter digital loopback, illustrated in *Figure 6-4*, via the front panel or AT commands. This loopback is used while a call to the distant modem is established. In digital loopback, the local received data is coupled to the transmitter input, so that the remote unit can perform a loopback test without commanding remote loopback.

In asynchronous mode the clocks will be clamped at the EIA interface.

Table 6-3 Digital Loopback

Step	Front Panel	AT Command Mode
1.	Establish data communications with a remote modem.	
2.	DL cannot be initialized from front panel.	To start the test, type the escape sequence (+++) and, after the modem is in the command mode, type: AT&T3 (enter). If modem responds with an error message, type: AT%T0 (enter), which resets the test mode, then re-enter the command.
3.	The modem flashes the TM LED while it is setting up the test, then lights the TM LED and decimal point one while the test is running.	
4.	Direct the remote attendant to enter data at the remote DTE, then compare it with the data that is looped back and displayed by the DTE. If errors occur frequently, a problem may exist in the local or remote modems, the remote DTE, the remote DTE-to-modem connection, or the communication line. Refer to the fault isolation diagram to isolate the problem.	
5.	To end the test, type: AT&T0 (enter) then type ATO (enter) to go back on line.	

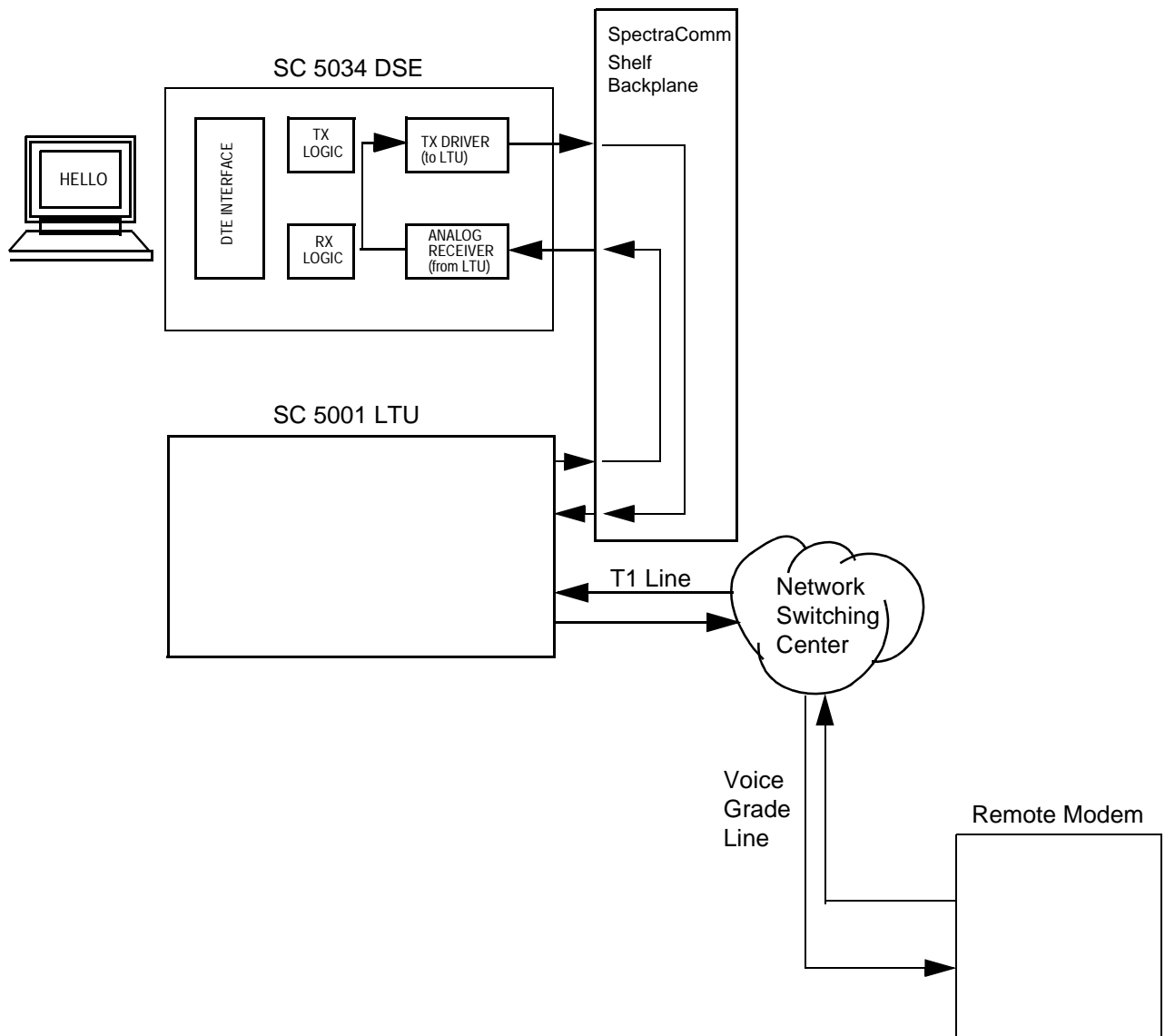
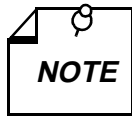


Figure 6-4 Digital Loopback

Remote Digital Loopback

Remote Digital Loopback, illustrated in *Figure 6-5*, is controlled at the local end. It can be commanded from the front panel, or with AT commands, or by the DTE asserting a signal on EIA pin 21. The loopback can be commanded only after a call is established and both ends are in data mode. In this loop, the demodulator's de-scrambled received data at the remote end is coupled to the remote transmitter input for transmission back to the local end.

This test is not operational when the modems are passing data at 300 bps.



This test cannot be performed if the remote modem is commanded to ignore a remote digital loopback command.

If the modems are operating at V.22 bis speeds and the local modem issues the RDL command to a remote unit configured to ignore the remote loopback command the resulting condition will cause the local modem to drop the connection.

Table 6-4 Remote Digital Loopback

Step	Front Panel	AT Command Mode
1.	Establish data communications with a remote modem.	
2.	Check with the remote attendant that the remote modem will accept Remote Digital Loopback commands.	
3.	RDL cannot be initiated from front panel.	To start the test, type the escape sequence (+++) and, after the modem is in the command mode, type: AT&T6 (enter). If modem responds with an error message, type: AT%T0 (enter), which resets the test mode, then re-enter the command.
4.	The modem flashes the TM LED while it is setting up the test, then lights the TM LED and decimal point two while the test is running. (If the remote modem initiated the test, the local modem lights decimal points three and four while the test is running.)	
5.	Enter data at the local DTE. Compare data that was entered at the DTE with the data that is looped back and displayed by the DTE. If errors occur frequently, a problem may exist in the local or remote modems, local DTE, local DTE-to-modem connection, or the communication line. Refer to the fault-isolation diagram to isolate the problem.	
6.	To end the test, type the escape sequence (+++) and, after the modem is in the command mode, type: AT&T0 (enter) then type ATO (enter) to go back on line.	
	NOTE: Any attempt to terminate the test at the remote modem by using the AT&T0 command will cause the modem to disconnect from the line. NOTE: CTS at the remote modem will drop low during the test.	

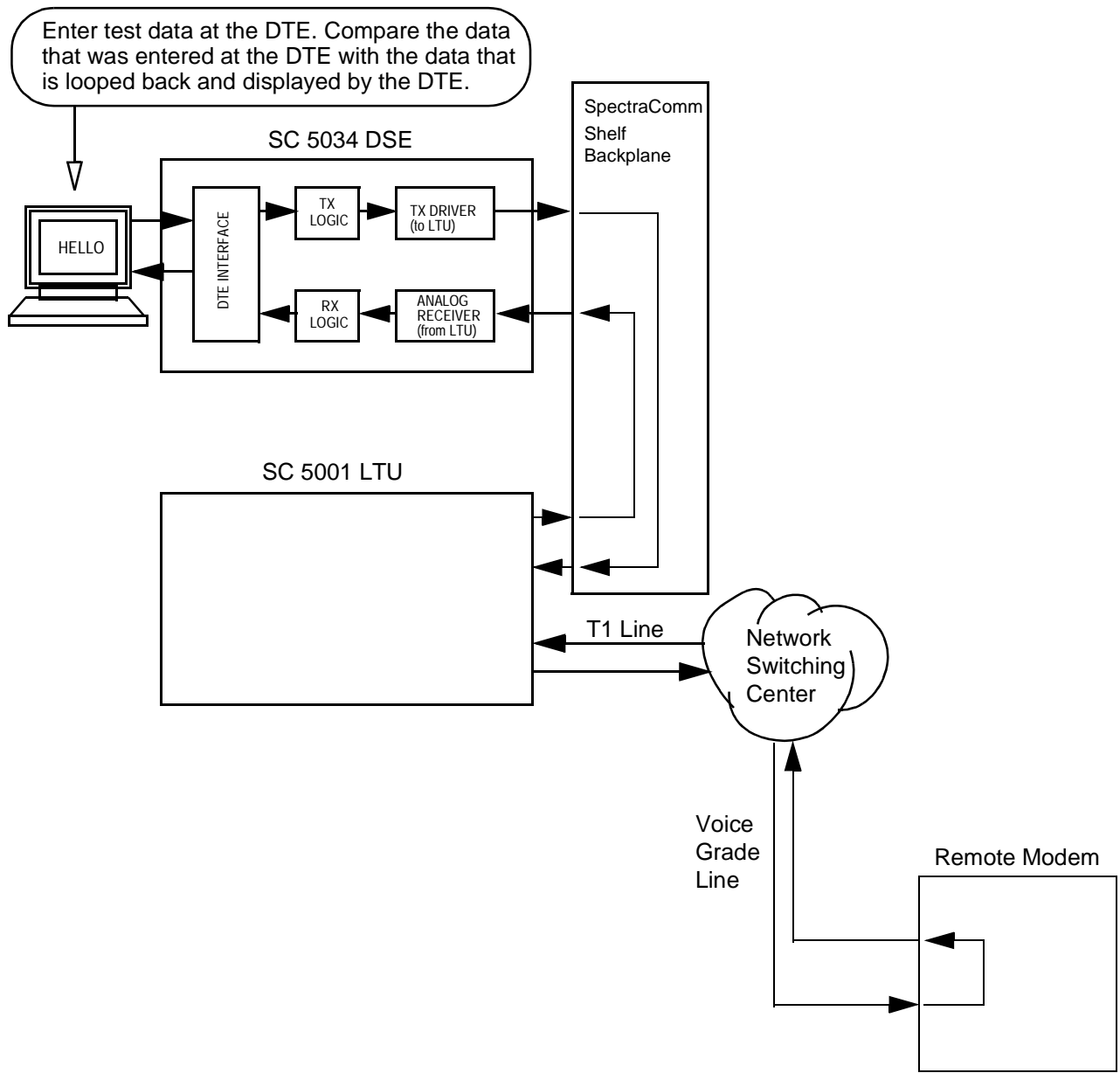
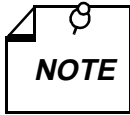


Figure 6-5 Remote Digital Loopback

Remote Digital Loopback with Self-Test

Remote Digital Loopback with Self-Test, illustrated in *Figure 6-6*, is controlled at the local end. It can be commanded from the front panel or with AT commands. This command can only be entered after the call is established and both ends are in the data mode. The test causes the local modem to generate a pattern that is transmitted across the telephone line to the remote modem's receiver, looped through to the remote modem's transmitter, and sent back across the telephone line to the local modem's receiver for analysis. The pattern is made up of alternate ones and zeros for speeds of 1200 and 2400 bps. For all other speeds the modem generates a 511 test pattern. The number of errors is displayed on the screen. This test checks both modems and the telephone line.

This test is not operational when the modems are passing data at 300 bps.



This test cannot be performed if the remote modem is configured to ignore a remote digital loopback command.

Table 6-5 Remote Digital Loopback with Self-Test

Step	Front Panel	AT Command Mode
1.	Establish data communications with a remote modem.	
2.	Check with the remote attendant that the remote modem will accept Remote Digital Loopback commands.	
3.	Cannot be initiated from front panel	To start the test, type the escape sequence (+++) and, after the modem is in command mode, type: AT&T7 (enter). If modem responds with an error message, type: AT%T0 (enter), which resets the test mode, then re-enter the command.
4.	The modem flashes the TM LED while it is setting up the test, then lights the TM LED while the test is running. When the test is terminated, the screen displays a four-digit number corresponding to the number of errors detected during the test, followed by the OK message. Any number greater than 0 indicates the modem has failed the test.	
5.	If the timer, S-Register 18, is set to a value between 1 and 60, the test ends automatically after that value (in 10-second increments) is reached. The factory default for S-Register 18 is 000, meaning that the test will continue indefinitely.	
6.	To go back on line, type ATO.	

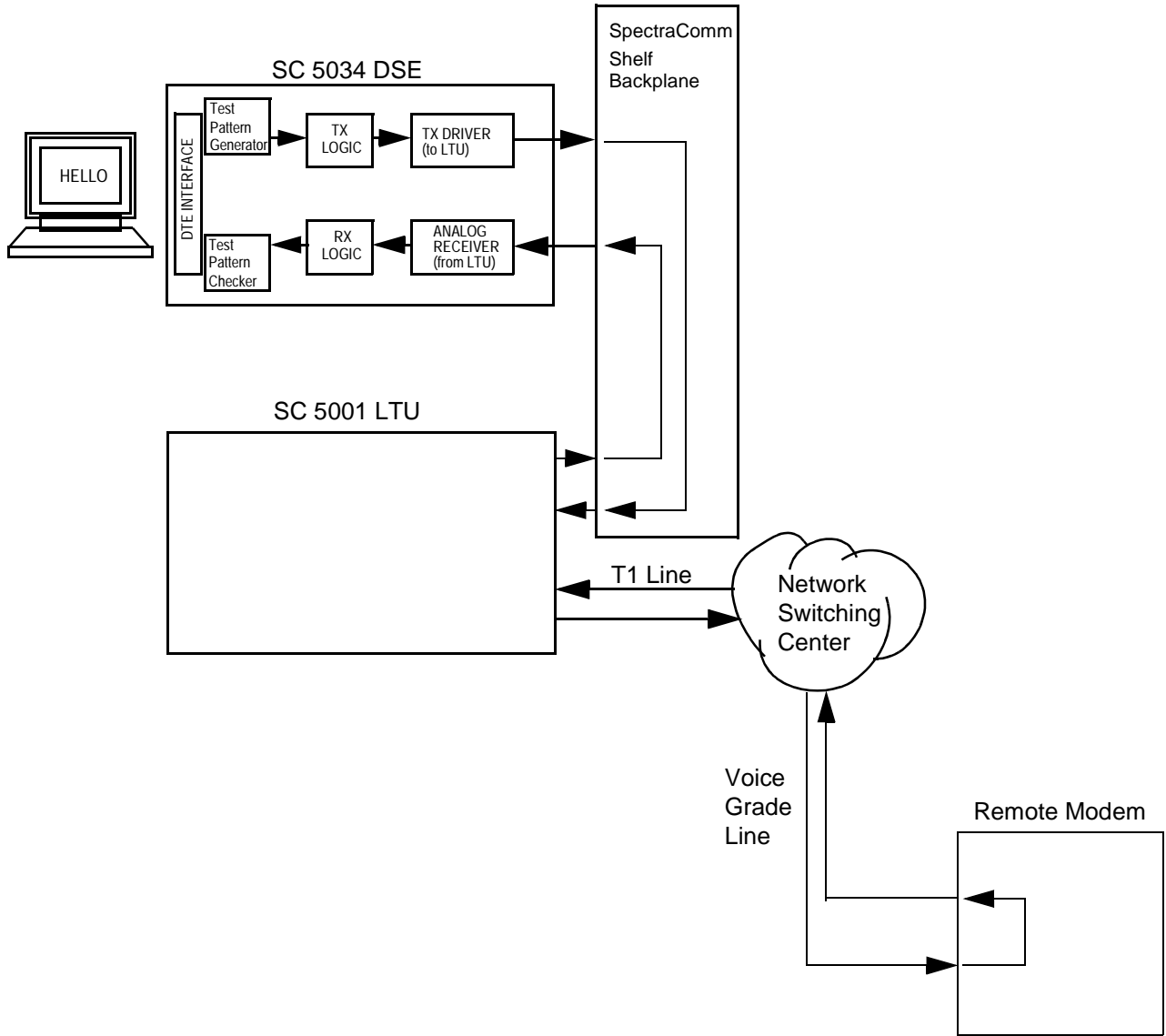


Figure 6-6 Remote Digital Loopback with Self-Test

End-to-End Self-Test

End-to-End Self Test, illustrated in *Figure 6-7*, requires operators at both the local and remote modem. It can be commanded from the front panels or with AT commands. The commands can only be entered after the call is established and both ends are in the data mode. The test causes each modem to generate a pattern and to transmit it to the other modem. The modem receiving the pattern checks it for errors. The patterns are made up of alternate ones and zeros for speeds of 1200 and 2400 bps. For all other speeds the modems generate a 511 test pattern. The number of errors received is displayed on the screen. This test checks the operation of both modems and the communications line.

This test is not operational when the modems are passing data at 300 bps.

Table 6-6 End-to-End Self-Test

Step	Front Panel	AT Command Mode
1.	To start the test press ST.	To start the test, at each modem type: AT&T9 (enter). If modem responds with an error message, type: AT%T0 (enter), which resets the test mode, then re-enter the command.
2.	The modem flashes the TM LED while it is setting up the test, then lights the TM and ST LEDs while the test is running.	The modem flashes the TM LED while it is setting up the test, then lights the TM and ST LEDs while the test is running. When the test is terminated, the screen displays a four-digit number corresponding to the number of errors detected during the test, followed by the OK message. Any number greater than 0 indicates the modem has failed the test.
3.	If the timer, S-Register 18, is set to a value between 1 and 60, the test ends automatically after that value (in 10-second increments) is reached. The factory default for S-Register 18 is 000, meaning that the test will continue indefinitely.	
4.	To end the test, press ST.	To end the test, type the escape sequence (+++) at each modem and, after the modem is in the command mode, type: AT&T0 (enter).

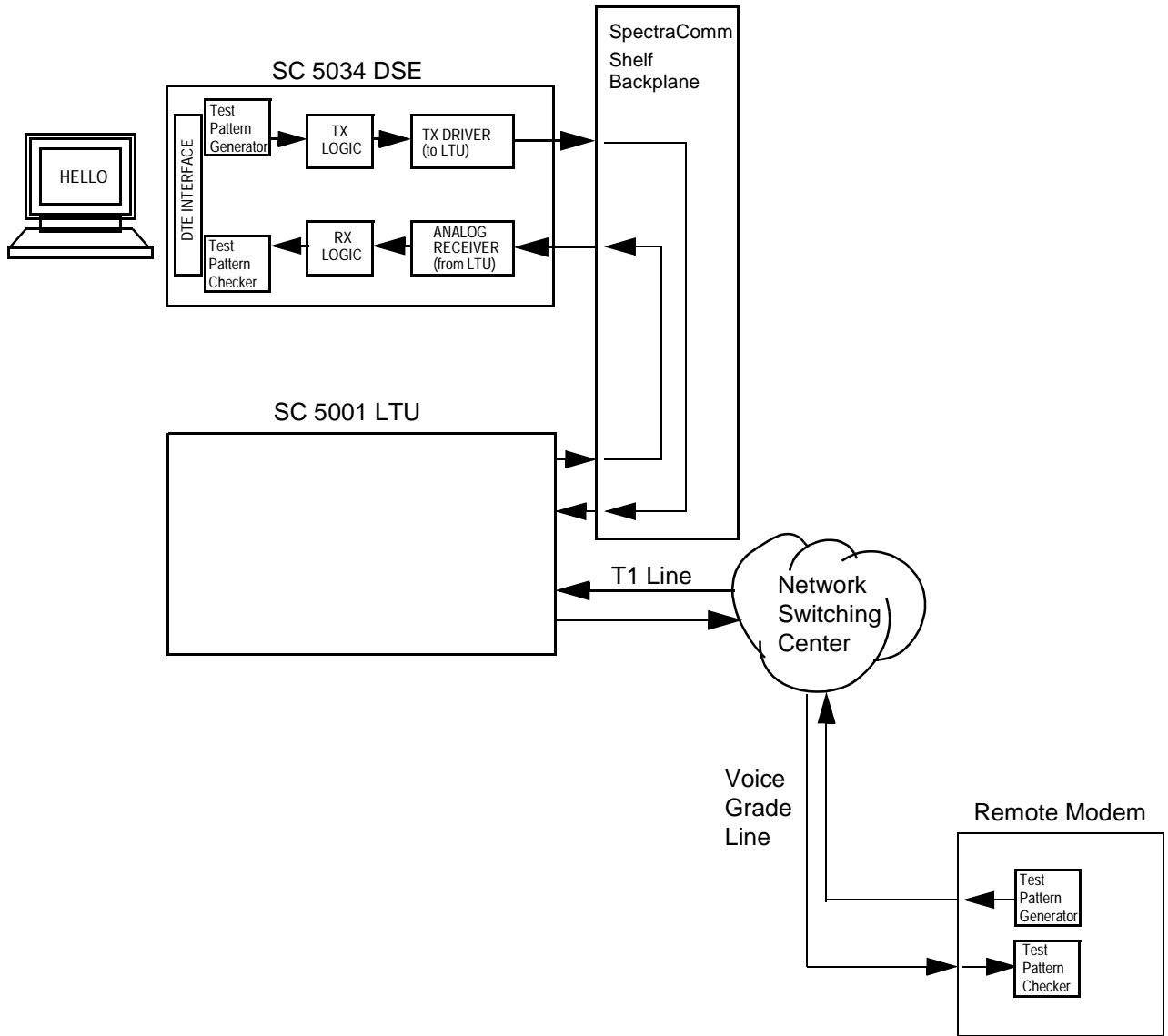


Figure 6-7 End-to-End Self-Test

RDLB Requests

Your modem is factory set to acknowledge requests from a remote modem to participate in a remote digital loopback test initiated from the remote location. If you do not want to acknowledge such requests, enter AT&T5&W.

If you later decide to acknowledge such requests, enter AT&T4&W.

Maintenance

The SC 5034 DSE is designed to operate without maintenance. Certain steps should, however, be taken in order to assure that the modem will continue to operate without problem.

Connections

Periodically, check to make sure that all of the modem's connections are secure.

Cleaning

If the modem enclosure becomes dirty, it should be cleaned with a damp cloth. If necessary, add a drop of liquid soap to the cloth, but do not use cleansers, ammonia, or cleaning solvents as they can harm the enclosure.

A Technical Characteristics

Item	Specification
VF Data Rate 33.6 Kbps (ITU-T V.34) 31.2 Kbps (ITU-T V.34) 28.8 Kbps (ITU-T V.34) 26.4 Kbps (ITU-T V.34) 24.0 Kbps (ITU-T V.34) 21.6 Kbps (ITU-T V.34) 19.2 Kbps (ITU-T V.34) 16.8 Kbps (ITU-T V.34) 14.4 Kbps (ITU-T V.34 or V.32 <i>bis</i>) 12.0 Kbps (ITU-T V.34 or V.32 <i>bis</i>) 9600 bps (ITU-T V.34, V.32, or V.32 <i>bis</i>) 7200 bps (ITU-T V.34 or V.32 <i>bis</i>) 4800 bps (ITU-T V.34, V.32, or V.32 <i>bis</i>) 2400 bps (ITU-T V.34 or V.22 <i>bis</i>) 1200 bps (ITU-T V.22 or Bell 212A) 300 bps (ITU-T V.21 or Bell 103)	Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Synchronous/asynchronous Asynchronous only
Data Format Bit synchronous Bit asynchronous	Selectable 8, 9, 10, or 11 bits per character
Transmit Clock	Internal, External, or Receive Wrap
Compatibility	ITU-T V.34, V.32 <i>bis</i> , V.32, V.22 <i>bis</i> , V.22, V.21, Bell 212A, and Bell 103
Operating Mode Switched network Private line	Two-wire full duplex Two-wire or four-wire

(Continued on next page)

Item	Specification
Modulation Above 14.4 Kbps 14.4 Kbps 12.0 Kbps 9600 bps 9600 bps 7200 bps 4800 bps 2400 bps 1200 bps 0-300 bps	per V.34 128-level TCM/2400 Baud $\pm 0.01\%$ 64-level TCM/2400 Baud $\pm 0.01\%$ 32-level TCM/2400 Baud $\pm 0.01\%$ 16-level QAM/2400 Baud $\pm 0.01\%$ 16-level TCM/2400 Baud $\pm 0.01\%$ 4-level QAM/2400 Baud $\pm 0.01\%$ 16-level QAM/600 Baud $\pm 0.01\%$ 4-level PSK/600 Baud $\pm 0.01\%$ FSK 0-300 Baud $\pm 0.01\%$
Answer Tone ITU-T V.32 <i>bis</i> , V.32, V.22 <i>bis</i> , V.22 and V.21 modes Bell 212A and 103 modes ITU-T V.34	2100 Hz ± 3 Hz 2225 Hz ± 3 H As specified by ITU-T
Transmit Carrier ITU-T V.34 ITU-T V.32 <i>bis</i> ITU-T V.32 ITU-T V.22, V.22 <i>bis</i> /Bell 212A Originate Mode Answer Mode ITU-T V.21 Originate Mode Answer Mode Bell 103 Originate Mode Answer Mode	As specified by ITU-T As specified by ITU-T As specified by ITU-T 1200 Hz ± 0.5 Hz 2400 Hz ± 1 Hz Mark Space 1180 Hz ± 12 Hz 980 Hz ± 12 Hz Mark Space 1850 ± 12 Hz 1650 ± 12 Hz Mark Space 1270 Hz ± 12 Hz 1070 Hz ± 12 Hz Mark Space 2225 Hz ± 12 Hz 2025 Hz ± 12 Hz
Output Level Permissive	-13 dBm
Note: Receiver performance in ITU-T V.34, V.32 <i>bis</i> , and V.32 modes may be degraded when transmitting above -6 dBm.	

(Continued on next page)

Item	Specification
Receive Carrier ITU-T V.34 ITU-T V.32 <i>bis</i> ITU-T V.32 ITU-T V.22 <i>bis</i> /Bell 212A Originate Mode Answer Mode ITU-T V.21 Originate Mode Answer Mode Bell 103 Originate Mode Answer Mode	As specified by ITU-T As specified by ITU-T As specified by ITU-T 2400 Hz \pm 7 Hz 1200 Hz \pm 7 Hz Mark Space 1850 \pm 12 Hz 1650 \pm 12 Hz Mark Space 1180 Hz \pm 12 Hz 1650 Hz \pm 12 Hz Mark Space 2225 Hz \pm 12 Hz 2025 Hz \pm 12 Hz Mark Space 1270 Hz \pm 12 Hz 1070 Hz \pm 12 Hz
Receive Level Switched Network Two-wire Private Line Four-wire Private Line	-6 to -43 dBm -6 to -33 dBm 0 to -26 dBm
Carrier Detect (Level for ITU-T V.22 <i>bis</i> , V.22, V.21, 212, 103) in Switched Network	Acquisition Release -43 dBm -48 dBm
Hysteresis	2 dBm minimum
Note: ITU-T V.34/V.32/V.32 <i>bis</i> , being echo canceling protocols, use signal quality as criteria for maintaining connection. They also provide for self-training detection to force disconnect.	
DTE Interface Standard	Requires dual DTE adapter EIA/TIA-232-E (ITU-T V.24/V.28/ISO 2110)
Line Requirements Switched Network Private Line	Two-wire Two-wire or four-wire

(Continued on next page)

Item	Specification
Line Equalization	Automatic Adaptive
Connection Options	One second Line Break Holdover in four-wire private line mode only. Loss of Carrier in ITU-T V.22 <i>bis</i> and lower.
Dialing	Pulse and Tone (PTUF)
DTMF Output Level USA International	Per Part 68 per country requirements
Pulse Dial Ratio USA International	Make/Break: 39/61% per country requirements
Ring Cadence USA International	On 2 seconds; Off 4 seconds per country requirements
Call Progress Monitor	BUSY CONNECT (rate) (see ITU-T V.42 options for delay) CONNECT (see ITU-T V.42 options for delay) NO ANSWER NO CARRIER NO DIAL TONE OK (character abort) RING RINGING UNOBTAINABLE NUMBER
Power Consumption	7 card-edge watts dc maximum
DC Voltage (Typical) +5V +12V -12V	+5V $\pm 5\%$ at 1A +12V $\pm 5\%$ at 0.2A -12V $\pm 5\%$ at 0.2A

(Continued on next page)

Item	Specification
Dimensions (Printed circuit board) Height Width Depth	21 mm (0.81 in) 178 mm (7.0 in) 241 mm (9.5 in)
Temperature Operating Non-operating	0 to 50°C (32° to 122°F) -40 to 70°C (-40° to 158°F)
Humidity, operating	Up to 95% humidity (non-condensing)
Altitude, operating	0 m to 3,047 m (0 to 10,000 ft)

B DTE Interface Pins/Signals

Business Equipment Interface: EIA/TIA-232-E, ITU-T V.24/V.28/ISO 2110

Pin No.	Circuit		Name	Direction	Function
	232-E	V.24			
Description					
2	BA	103	SD	To DCE	Transmitted Data
	Data signals originated by the DTE — to be transmitted to a remote data station via a data channel, or to be passed to the DCE for maintenance test purposes under control of the DTE — are transferred to the DCE on this circuit.				
3	BB	104	RD	From DCE	Received Data
	Data signals generated by the DCE — in response to data channel line signals received from a remote data station, or in response to DTE maintenance test signals — are transferred to the DTE on this circuit.				
4	CA	105	RTS	To DCE	Request to Send
	Signals on this circuit control the data transmit function of the DCE. The On condition causes the DCE to assume the data channel transmit mode. The Off condition causes the DCE to assume the data channel non-transmit mode when all data transferred on circuit 103 has been transmitted.				
5	CB	106	CTS	From DCE	Clear to Send
	Signals on this circuit indicate whether the DCE is ready to transfer data. The On condition indicates that the signal converter or similar equipment is connected to the line and that the DCE is ready to initiate transfer of data. The Off condition indicates that the DCE is not ready to transfer data.				
6	CC	107	DSR	From DCE	Data Set Ready
	Signals on this circuit indicate whether the DCE is ready to operate. The On condition indicates that the signal converter or similar equipment is connected to the line and that the DCE is ready to exchange further control signals with the DTE to initiate transfer of data. The Off condition indicates that the DCE is not ready to operate.				
7	AB	102	SIG GND		Signal Ground
	This pin is the signal ground reference for the V.24 interface circuits.				
8	CF	109	CO/ DCD	From DCE	Data Channel Receive Line Signal Detect
	Signals on this circuit indicate whether the receive data channel line signal is within appropriate limits, as specified in the relevant recommendation for DCE. The On condition indicates that the received signal is within appropriate limits. The Off condition indicates that the received signal is not within the appropriate limits.				

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Business Equipment Interface: EIA/TIA-232-E, ITU-T V.24/V.28/ISO 2110 (Continued)

Pin No.	Circuit		Name	Direction	Function
	232-E	V.24			
Description					
15	DB	114	SC	From DCE	Transmit Clock DCE Source
	Signals on this circuit are used to provide the data terminal equipment with signal element timing information. The data terminal equipment shall provide a data signal on the Transmit Data line in which the transitions between signal elements nominally occur at the time of the Off-to-On transitions of the signal on the DB circuit.				
17	DD	115	RC	From DCE	Received Clock
	Signals on this circuit are used to provide the data terminal equipment with received signal element timing information. The On-to-Off transition shall nominally indicate the center of each signal element on the BB (Received Data) circuit.				
18	LL	141	ALE	To DCE	Local Loopback
	The SC 5034 DSE does not use this interface circuit.				
20	CD	108/1 or 2	DTR	To DCE	Connect Data Set to Line or Data Terminal Ready
	The SC 5034 DSE does not use this interface circuit.				
21	2.5	140	RLE	To DCE	Remote Digital loopback
	The SC 5034 DSE does not use this interface circuit.				
22	CE	125	RI	From DCE	Ring Indicator
	The On condition of this circuit indicates that a ringing signal is being received on the communication channel. The On signal shall appear approximately coincident with the On segment of the ringing cycle (during rings) on the communication channel.				
23	CI	112	TC	From DCE	Speed Indicator
	The On condition indicates that the modem is operating at the highest speed within the selected handshake mode. The Off condition indicates that a speed lower than the maximum was selected.				
24	DA	113	TC	To DCE	Transmit Clock DTE Source
	Signals on this circuit are used to provide the transmitting signal converter with signal element timing information. The On-to-Off transition shall nominally indicate the center of each signal element on the BA (Transmit Data) line.				
25	TM	142	TME	From DCE	Test Mode Indicator
	The SC 5034 DSE does not use this interface circuit.				

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