ARC CDL-9OO

Cellular modem and Transceiver

ARC Electronics
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**Cellular Data Link CDL 900
Point-to-Point Wireless Access Solution.**

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Product Overview

The **C**ellular **D**ata **L**ink 900, CDL 900, is a self-contained unit that uses the **A**dvanced **M**obile **P**hone **S**ystem (AMPS) cellular network for data transmission. AMPS is the cellular system used in North America, Latin America, Australia, New Zealand and parts of Africa. AMPS system is not compatible with the GSM system used in Europe and Asia.

The CDL 900 has an RS232 interface and supports the popular AT command set normally associated with modems.

CDL 900 Features

The CDL 900 provides the following features:

♦ Uses AMPS Switched Circuit Cellular network for data transmission
♦ User friendly modem AT command set
♦ Standard RS 232 serial interface
♦ Choice of Hardware or Software Flow Control
♦ Incorporates "Quiet Mode" (explained later) thereby enabling communication with "non-intelligent" systems

Sample Application Areas

Although any application requiring Data Communications can use the CDL 900, the following are the areas where our OEM customers are using the CDL 900.

♦ Packet Data Radio
♦ SCADA and Telemetry Systems
♦ Remote gas/water/electric meter readings.
♦ Factory Automation systems
♦ Vending Machines

Specifications

♦ Air Speed	upto 9600 bps
♦ DTE Rate	300, 1200, 2400, 9600, 19200 57600 bps (switch selectable)
♦ Data Compression & Error Detection	MNP2-5, V42, V42bis, MNP 10
♦ Transmit Power	0.6 watts
♦ Power Supply	10-18 Volts DC @ 600 ma (24/48 volts power supply optional)
♦ Interface	RS 232 Asynchronous
♦ Signals supported	TXD, RXD, CD, DSR, RTS, CTS, RI, DTR
♦ Operating Temperature Range	0 to 70 deg C (-10 to + 85 optional)
♦ **Custom Configurations and Options**	**Yes**

Packing List

Make sure that the following items are included with this package. If anything is missing, please contact your supplier.

♦ CDL 900 unit with radio included
♦ Antenna
♦ RS 232 cable
♦ This Cellular Data Link 900 User Guide

Before you use the CDL 900 unit, you need the following:
♦ A host PC with terminal program like Hyper terminal, Procomm etc
♦ **M**obile **I**dentification **N**umber (MIN) provided by your Cellular service provider. MIN is your cellular phone number.
♦ **S**ystem **ID** (SID) information (from your cellular service provider) SID uniquely identifies your cellular service provider.

Registering the CDL 900 Unit

To register your CDL 900 unit, do the following:
1. Contact your cellular service provider
2. Provide the cellular operator with the ESN (**E**lectronic **S**erial **N**umber) number located on the label at the top of your unit.
3. Inform the cellular operator that the unit is an AMPS Analog unit with a power rating of class 3 (power 600 mw).

The cellular operator will register your unit and provide you the following information:
       a)   MIN (Mobile Number) Number:
       b)   System preference: A or B
       c)   SID (System ID)

It is recommended that you note the MIN and SID on the label at the top of the unit.

Starting and configuring the CDI 900 unit

The CDL900 is configured as a DCE (e.g. modem). It communicates with a PC through the serial (RS 232) port.
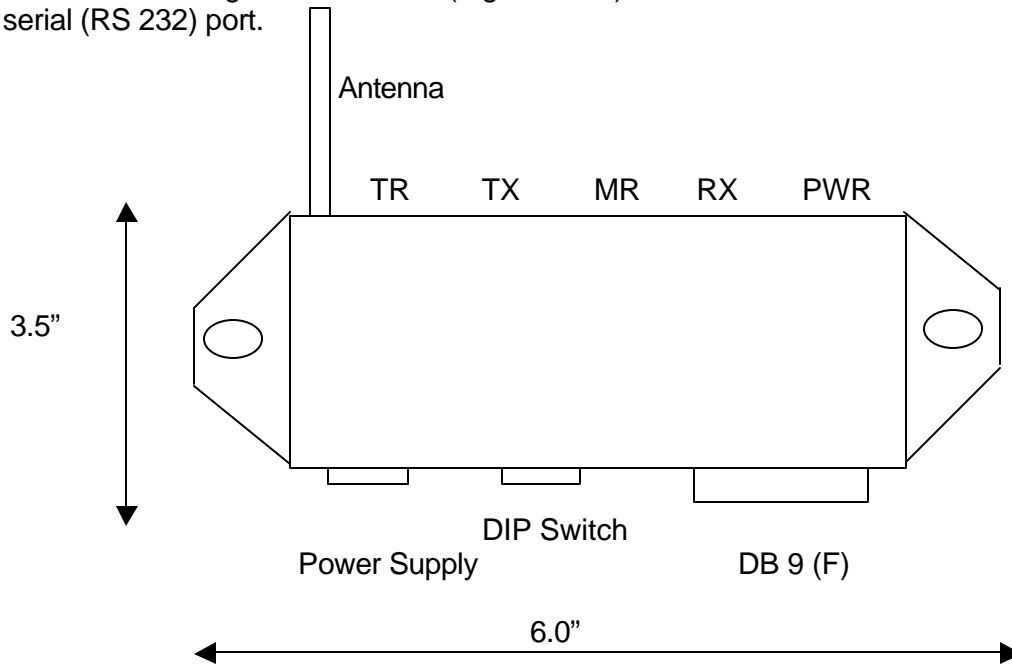
TR = <u>T</u>erminal <u>R</u>eady   TX = <u>T</u>ransmit Data   MR = <u>M</u>odem <u>R</u>eady
RX = <u>R</u>eceive Data   PWR = <u>Po</u>w<u>er</u>

Starting the CDL 900 Unit

To start the CDL 900 unit, perform the following steps:

1) Connect the power supply. After a few seconds, the PWR light should turn ON. After approximately 10 seconds, the MR light should turn ON. The unit is now ready for operation.
2) Connect the CDL 900 to the PC with the RS 232 cable provided.
3) Connect the Antenna to connector at the top left of the CDL 900.
4) Click the Hyper Terminal icon on the PC. Or select Start>Programs>Accessories>Hyper Terminal>Hyperterm.exe
   The Connection Description Dialog Box opens.
5) In the name field, enter CDL 900 and click OK.
   The Connect To dialog box is now active.
6) Select Connect Using and then select the COM Port the CDL 900 is connected to. For example, if the CDL 900 is on COM 2, choose "Direct to Com2" and click OK.
7) The COM2 Properties dialog box now opens. Select the following:
   a) Bits per second to match the DIP switch settings on the CDL 900
   b) Data Bits: 8
   c) Parity: None
   d) Stop Bits: 1
   e) Flow Control based on the CDL 900 switch settings.
   f) Click OK.
8) Select Call>Disconnect
9) Select Call>Connect
   The TR (Terminal Ready) light on the CDL 900 should turn ON. If it does NOT turn ON, please check that the CDL 900 is connected to the right serial port on the PC.
10) Select File>Properties>Settings>ASCII setup
11) Check the following:
   a) In the ASCII Sending field, check Echo typed characters locally
   b) In the ASCII receiving field, check Append line feeds to incoming line ends and Wrap lines that exceed terminal width.
12) Click OK twice.
13) Select Call>disconnect
14) Select Call>connect
15) Select File>Save

Configuring the CDL 900

To configure the CDL 900, perform the following steps:

16) Enter AT+TEST<CR>. The unit responds OK.
   a) Enter AT+MIN=< allocated_MIN ><CR> The unit responds OK.
   b) Enter AT+SID=< allocated_SID ><CR> The unit responds OK
   c) Enter AT+SYS=02 <CR>   (SID will determine preferred system, also called normal mode)
                  =00 <CR> (will select system B only)
                  =01 <CR> (will select system A only)

Check with your provider as to which is the recommended system.

The CDL 900 does NOT have to configured every-time. The above information is stored in the unit's non-volatile memory.

17) Enter AT+MODE=02<CR> The unit is now set for data mode.

18) Enter AT+SER <CR> The unit responds with SERVICE AVAILABLE.

Using the CDL 900 to communicate
To use the CDL 900 to communicate with a modem, perform the following steps:
1) Enter ATDT XXXX <CR>
   XXXX is the phone number of the modem you are calling. After approximately 30 seconds, the CDL 900 responds with CONNECT message.
2) Type " Hello how are you"
   The party you called should see the message on their terminal screen.
3) Ask the called party to type a message and you should see that on your terminal screen.
4) Enter the Escape sequence +++
   The modem responds OK.
5) Enter ATH0<CR>
   The CDL 900 responds "No Carrier " indicating that the connection is terminated.
6) Ask the remote party to dial you MIN number.
   CDL 900 responds with CONNECT message after approximately 30 seconds.
7) Repeat steps 2 to 5.

Theory of Operation
The CDL-900 is always in one of the two states:
- Command state
- Online state

This section describes the two states.

Command State
The CDL 900 assumes the Command state when it is turned ON. In this state, you can configure the unit for a particular application. In the Command State, all inputs from the PC are treated as commands.

Command guidelines
Command line is a string of characters sent from the DTE (example PC) when the unit is in the Command state. All commands must adhere to the following guidelines
- Command lines must have a prefix , a body and a terminator.
- Command lines must begin with a character sequence AT.
- Command Lines must end with Carriage return (CR).
- Either all upper case or all lower case characters must be used.
- Each command must be entered separately.
- Command buffer is 40 characters.

Note: Commands entered incorrectly or with out-of-range parameters will result in ERROR message. Commands entered correctly will result in OK message.

Result Codes
Result Codes refer to the responses of the CDL 900 unit to a command.
Unless the CDL 900 has been programmed to be in the Quiet mode (explained later in the AT command section), the unit will respond each time a command is issued. The default mode of the CDL 900 is the Verbose mode. The responses in verbose mode are characters.

Using AT commands, the modem can be put into terse (non-verbose) mode. The responses in non-verbose mode are numerical digits.
Various modem responses are shown below:

Examples of CDL responses:

Response in Terse Mode	Response in Verbose Mode	Meaning
0	OK	Command executed without errors.
1	CONNECT	Connection at 300 bps
2	RING	Ringing signal detected
3	NO CARRIER	Carrier lost or never present
4	ERROR	Invalid command
5	CONNECT 1200	Connection at 1200 bps
6	NO DIALTONE	Cellular service not available
7	Busy	Called party on-line
8	No Answer	
9	Connect 0600	
10	Connect 2400	
11	Connect 4800	
12	Connect 9600	
13	Connect 7200	
66	Compression class 5	Connection established MNP- 5
67	Compression V42bis	
68	Not used	
69	Compression none	
76	Protocol: none	
77	Protocol: LAPM	
99	SERVICE UNAVAILABLE	Cellular service not available
100	SERVICE AVAILABLE	Unit ready for communication

On-line state

In online state, input(s) from the PC is treated as data to be shipped over the airwaves, and input(s) from the airwaves is treated as received data from the remote end.
The CDL 900 is in online state in one of the two conditions:
a)   CDL 900 dials out and a successful connection is established.
b)   CDL 900 answers an incoming call and a successful connection is established.
When the CDL 900 is in online state, all serial data presented to the radio is transmitted over the air.
You should NOT change communication parameters (e.g. baud rate) in this mode.
To go back to Command State, Escape Sequence (described in this section) is required.

Transitioning from Online state to Command state (Escape sequence)

The sequence of characters to transition from Online State to the Command State is called the escape sequence.
For CDL 900, he escape sequence is +++
The timing interval between the + signs must be between 250 msecs and 750 msecs.
When the CDL 900 receives a valid escape sequence, the modem will enter Command State and respond with OK.

Supported AT commands

This section describes the basic Attention (AT) commands used to configure the CDL 900. These commands are a subset of the commands used in typical high-speed modems.

A command line is a string of characters sent from the DTE (e.g. a PC) while the modem is in Command State. A command line has a prefix, a body and a terminator. Each command line must begin with a character sequence AT and must terminate with a carriage return.

The Radio starts the processing of commands only after AT string sequence is received. Commands entered with out of range parameters will result in ERROR message. Correct commands will result in OK message in verbose mode, and 0 in terse mode.

Supported AT commands:

	Command	Action	Note
1)	ATZ<CR>	Resets the modem. The unit responds with OK messages	
2)	ATO<CR>	Go on line. This is done after the state of the unit is changed from on-line to command state. ATO then puts the unit back into online state.	
3)	ATDT XXXX <CR>	Cell modem dials out. XXXX is the phone number	
4)	AT+TEST <CR>	Puts the unit in test mode	

The commands AT+SYS, AT+MIN, AT+SID and AT+ID can be entered only when the unit is in Test Mode.

5)	AT+SYS=xx<CR>	Sets system preference.	

SYS =00 sets the unit for system B only
SYS =01 sets the unit for system A only
SYS =02 is for normal mode. SID determines preferred system
SYS =03 is for home use only

6)	AT+RSSI<CR>	Indicates the Received Signal Strength. Should be > -100 dbm for reliable communication.	
7)	AT+SER <CR>	Indicates if service is available or not	
8)	AT+MIN=XXXXX<CR>	Sets the MIN number. The modem responds OK	
9)	AT+SID=XXXX<CR>	Sets SID. Modem responds OK	
10)	AT+ID?<CR>	Displays ESN, MIN, SID, System Preference information.	

Note: MIN, ESN, SID information are stored in the non-volatile memory of the cell-modem. These do not have to be entered every-time on power-up.
To exit test mode, enter AT+MODE=02<CR>

11)	ATQ1<CR>	Unit does not respond with OK or non-verbose messages. This is ideal for in situations where the Data Link is connected to "non-intelligent" host. This mode is also called Quiet Mode.	

12)	ATQ1&W&W1	Q1 instruction stored in non-volatile memory.
13)	AT&V<CR>	Displays settings of the cell modem
14)	ATI3<CR>	Displays Software Revision #
15)	ATH0	Modem disconnects and initializes
16)	ATV0	Unit responds in terse mode. Results code Displayed as digits
17)	ATV0&W&W1	Above command stored in non-volatile memory. On power-up, the modem will be in terse mode.
18)	ATV1	Unit responds in verbose mode. Results codes are displayed as messages.
19)	ATV1&W&W1	Above command stored in non-volatile memory. On power-up, the modem will be in verbose mode.
20)	ATS0	Default is 0. If 0, then the unit will not answer incoming call. Please use ATS0=1&w&w1 to have the unit answer incoming calls.

Escape Sequence:
When the modem is on-line state, it is possible to break the data transmission/reception. This is achieved by sending a sequence of three ASCII characters. For ease of use, the default character is +.
The Radio will respond with OK on detection of valid escape sequence.

21)	+++	Escape sequence	OK

Basic Troubleshooting :

1) If the unit draws too much power. Please ensure that the correct power supply is used and correctly wired.
2) If dialing out is repeatedly unsuccessful and modem gives the message "NO DIALTONE ", please check if service is available.
3) If the unit never connects on dialing out, please ensure that the ESN (Electronic Serial Number) and the MIN numbers are right.
4) Please check RSSI level. If low (lower than –95 dbm), placing the antenna vertical will help.
5) If remote landline modem connection drops frequently, please have the calling party set S7=60 & S10 register to 200. This will make the modem more tolerant of noise hits. This can be done as follows:
ATS0=1S7=60S10=200&W&W1<CR>
6) If for some reason, the CDL 900 unit is not responding, please try the command AT&F&W&W1 <CR>
Whenever the command AT&F&W&W1 is issued, then you must do the following
ATS0=1\N2+MS=11,1,1200,2400&W&W1 <CR>
AT-SEC=1,15&W&W1 <CR>
7) If that also fails, power down the unit and power it up again.
8) Please read next section on FAQs.

Frequently Asked Questions (FAQs)

1) Question: What is the flow control method recommended?

	Answer:	If the host is a PC, Hardware flow control is recommended. However, in most control instrumentation, either software or no flow control is called for.
2)	Question:	How do I disable any flow control?
	Answer:	Simply disable both the Hardware and software control switch settings. This is not recommended for large file transfers.
3)	Question:	I need to connect the Cellular Data Link to a machine which does not understand your messages. All it needs is data. Which configuration is recommended?
	Answer:	Please use the ATQ1&w&w1<CR> command.
4)	Question:	Have you experienced that fact that communication with certain brands of modems is unreliable?
		Yes. And more so with generic brand which tend to throw hot signals (i.e strong signal levels) on the line. This causes the Cellular service to over-modulate which leads to distortions and results in unreliable connections.
5)	Question:	What is the solution then?
	Answer:	We recommend that you use modems that support MNP-10 and also allow transmit level to be reduced to between –15 dbm. and –20 dbm. Rockwell based modem designs generally meet these requirements.
		For Rockwell based modems, please try the following commands on the land line modem:
		AT-SEC=1,18 <CR>. This will enable MNP 10 and set transmit level to –18 dbm.
		AT+MS=11,1,1200,4800&W&W1<CR>. Sets the modem to communicate between 1200 and 4800 bps.
		ATS91=15 <CR>.
6)	Question:	Is there any simple way to avoid frequent loss of connection?
	Answer:	Please program the CDL 900 as follows
		AT+MS=11,1,1200,1200&W&W1<CR>
		This will force the CDL 900 to connect only at 1200 bps.
7)	Question:	Can IDC provide a landline modem I can use?
	Answer:	Yes.
8)	Question:	What initialization string is recommended to communicate with a non MNP modem?
9)	Answer:	Connection with non MNP landline modems is not recommended.
10)	Question:	My requirement(s) are totally unique. Can I count on IDC to help?
	Answer:	Absolutely.
11)	Question:	Is there any recommended init string for various land line modems?
	Answer:	the following have been tried with great success:

a) For US Robotics / 3 Com modems:
   ATS10=200&A3&B1&N2&U2&W&W1 <CR>
b) For Rockwell chip set based land-line modems 33600 and lower
   AT%E2\N2S7=60S10=200+MS=11,1,1200,4800&w&w1 <CR>
c) For most other brands:
   ATN0S37=6S10=200&w&w1 <CR>

For Rockwell chip set based land-line modems 56K V90 models
AT%E2\N2S10=200S7=60+MS=V34,1,1200,2400,1200,2400 <CR>

Speed and Flow Control Switch Settings

To select a given speed put the switch for that speed down (the on state) - use only one switch to select that speed.
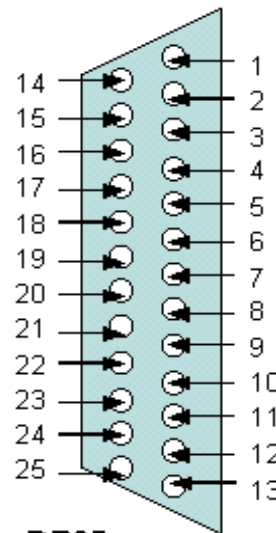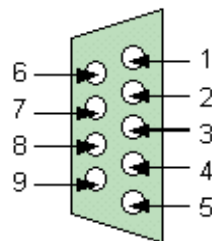For Hardware flow control (H/W) use Switch #7 - down is the on state
Software Flow Control (S/W) use Switch #8 - down is the on state
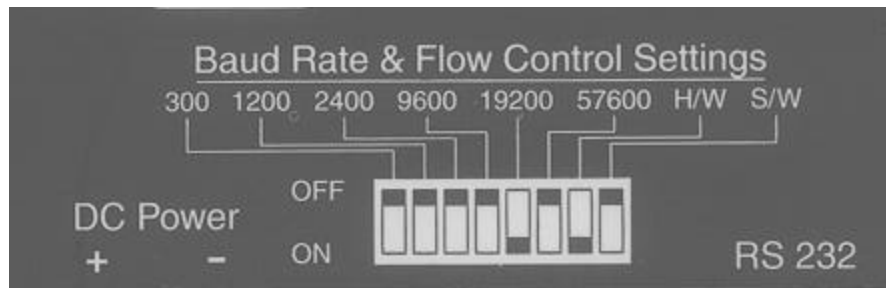
RS232C is the most commonly used serial data interface and defines the Physical, Functional and Electrical boundaries between two or more communicating devices

~ D-SHAPED SERIAL PORT CONNECTORS ~
are usually used to interconnect DTEs (computers, controllers, etc.)
and DCEs (modems, converters, etc.)

DB9

DB25

Pin	Signal	Pin	Source
1	CD - Carrier Detect	8	MODEM
2	RXD - Receive Data	3	MODEM
3	TXD - Transmit Data	2	TERMINAL
4	DTR - Data Term'l Ready	20	TERMINAL
5	Signal Ground	7	N/A
6	DSR - Data Set Ready	6	MODEM
7	RTS - Ready to Send	4	TERMINAL
8	CTS - Clear to Send	5	MODEM
9	RI - Ring Indication (Dial Modems Only)	22	MODEM

SUMMARY OF THE ROCKWELL "AT" COMMAND SET

To communicate using the modem, use an asynchronous communication program. The command set for the modems is compatible with the Hayes command set.

 The modem is controlled and configured by the AT (attention command). Each command consists of the following elements (with the exception of the A/and the +++ command that will be discussed later). A command is not entered until a carriage return <ENTER> is entered. Spaces entered are ignored. For example, to enter the command `Answer', type ATA and <ENTER>.

Some commands do not have parameters. Any missing parameters in a command is assigned the value zero, which may be a valid parameter for the command. The sequence followed by AT command causes the modem to enter a command state. That is, AT without a command serves as a wake up code and an "OK" appears on the screen. The modem queues the commands in a 40-character command line. The command line begins with AT and can have several commands. A separator is not required between the commands.

 When a carriage return is received, the commands are performed in the order in which they are sent to the modem. If more than 40 characters are sent to the modem, an error occurs and all commands must be re-entered.

 A common configuration for a remote modem is to answer the call and hang up on loss of carrier. To do this the RS232 interface has to be set for the correct configuration.

Option if the Computer uses pins 2, 3, & 7 only - Set the AT commands as follows

>
> ATSO=1 (modem will answer on the first ring)
> AT&DO (modem will ignore DTR)
> factory default is AT&D1 which allows the modem to answer only if DTR is high.
> AT&V to check the state of the "S" registers use AT&V
> AT&WO Don't forget to burn the new codes into E-PROM by AT&WO

To see your typing you made need to turn on E1 for the modem to echo back responses. Some software doe not like it's data echoed back so don't forget to check E1/E0 if your software is acting strange.

Note: you may want to put the modem into a quiet mode - ATQ1 (ATQ0 is the default) modem does not send result codes - which can confuse the computer**.**

A good configuration for a dumb mode operation is

AT&F&C1&DOEOQ1SO=1&WO

BASIC AT COMMANDS for the 14.4 & 33.6 MODEM MODULE...

Command	Function
A/	Re-execute command.
A	Go off-hook and attempt to answer a call.
B0	Select V.22 connection at 1200 bps.
B1	Select Bell 212A connection at 1200 bps.
C1	Return OK message.
Dn	Dial modifier.
E0	Turn off command echo.
E1	Turn on command echo.
F0	Select auto-detect mode (equivalent to N1).
F1	Select V.21 or Bell 103.
F2	Reserved.
F3	Select V.23 line modulation.
F4	Select V.22 or Bell 212A 1200 bps line speed.
F5	Select V.22 bis line modulation.
F6	Select V.32 bis or V.32 4800 line modulation.
F7	Select V.32 bis 7200 line modulation.
F8	Select V.32 bis or V.32 9600 line modulation.
F9	Select V.32 bis 12000 line modulation.
F10	Select V.32 bis 14400 line modulation.
H0	Initiate a hang-up sequence.
H1	If on-hook, go off-hook and enter command mode.

I0	Report product code.
I1	Report pre-computed checksum.
I2	Report OK.
I3	Report firmware revision, model, and interface type.
I4	Report response "Telenetics Inc. Rev"
I5	Report the country code parameter.
I6	Report modem data pump model and code revision.
I7	Reports the DAA code
L0	Set low speaker volume.
L1	Set low speaker volume.
L2	Set medium speaker volume.
L3	Set high speaker volume.
M0	Turn speaker off.
M1	Turn speaker on during handshaking and turn speaker off while receiving carrier.
M2	Turn speaker on during handshaking and while receiving carrier.
M3	Turn speaker off during dialing and receiving carrier and turn speaker on during answering.
N0	Turn off automode detection.
N1	Turn on automode detection.
O0	Go on-line.
O1	Go on-line and initiate a retrain sequence.
P	Force pulse dialing.
Q0	Allow result codes to DTE.
Q1	Inhibit result codes to DTE.
Sn	Select S-Register as default.
Sn?	Return the value of S-Register n.
=v	Set default S-Register to value v.
?	Return the value of default S-Register.
T	Force DTMF dialing.

V0   Report short form (terse) result codes.

V1   Report long form (verbose) result codes.

W0   Report DTE speed in EC mode.

W1   Report line speed, EC protocol and DTE speed.

W2   Report DCE speed in EC mode.

X0   Report basic call progress result codes, i.e., OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected),NO ANSWER and ERROR.

X1   Report basic call progress result codes and connections speeds (OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected), NO ANSWER, CONNECT XXXX, and ERROR.

X2   Report basic call progress result codes and connections speeds, i.e., OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected), NO ANSWER, CONNECT XXXX, and ERROR.

X3   Report basic call progress result codes and connection rate, i.e., OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY, and ERROR.

X4   Report all call progress result codes and connection rate, i.e., OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY, NO DIAL TONE and ERROR.

Y0   Disable long space disconnect before on-hook.

Y1   Enable long space disconnect before on-hook.

Z0   Restore stored profile 0 after warm reset.

Z1   Restore stored profile 1 after warm reset.

&C0   Force RLSD active regardless of the carrier state.

&C1   Allow RLSD to follow the carrier state.

&D0 Interpret DTR ON-to-OFF transition per &Qn:

&Q0, &Q5, &Q6 The modem ignores DTR.

&Q1, &Q4 The modem hangs up.

&Q2, &Q3 The modem hangs up.

&D1 Interpret DTR ON-to-OFF transition per &Qn:

&Q0, &Q1, &Q4,.

&Q5, &Q6 Asynchronous escape.

&Q2, &Q3 The modem hangs up.

&D2 Interpret DTR ON-to-OFF transition per &Qn:

&Q0 through &Q6 The modem hangs up.

&D3 Interpret DTR ON-to-OFF transition per &Qn:.

&Q0, &Q1, &Q4,.

&Q5, &Q6 The modem performs soft reset.

&Q2, &Q The modem hangs up.

&F0 Restore factory configuration 0.

&F1 Restore factory configuration 1.

&G0 Disable guard tone.

&G1 Disable guard tone.

&G2 Enable 1800 Hz guard tone.

&J0 Set S-Register response only for compatibility.

&J1 Set S-Register response only for compatibility.

&K0 Disable DTE/DCE flow control.

&K3 Enable RTS/CTS DTE/DCE (Hardware) flow control.

&K4 Enable XON/XOFF DTE/DCE (Software) flow control.

&K5 Enable transparent XON/XOFF flow control.

&K6 Enable both RTS/CTS and XON/XOFF flow control.

&L0 Select dial up line operation.

&L1 Select leased line operation.

&M0   Select direct asynchronous mode.

&M1   Select sync connect with async off-line command mode. *

&M2   Select sync connect with async off-line command mode and enable DTR dialing of directory zero. *

&M3   Select sync connect with async off-line command mode and enable DTR to act as Talk/Data switch. *

&P0   Set 10 pps pulse dial with 39%/61% make/break.

&P1   Set 10 pps pulse dial with 33%/67% make/break.

&P2   Set 20 pps pulse dial with 39%/61% make/break.

&P3   Set 20 pps pulse dial with 33%/67% make/break.

&Q0   Select direct asynchronous mode.

&Q1   Select sync connect with Async off-line command mode. *

&Q2   Select sync connect with Async off-line command mode and enable DTR dialing of directory zero. *

&Q3   Select sync connect with Async off-line command mode and enable DTR to act as Talk/Data switch. *

&Q4   Select Hayes AutoSync mode.

&Q5   Modem negotiates an error-corrected link.

&Q6   Select asynchronous operation in normal mode.

&R0   CTS tracks RTS (Async) or acts per V.25 (sync).

&R1   CTS is always active.

&S0   DSR is always active.

&S1   DSR acts per V.25.

&T0   Terminate any test in progress.

&T1	Initiate local analog loopback.
&T2	Returns ERROR result code.
&T3	Initiate local digital loopback.
&T4	Allow remote digital loopback.
&T5	Disallow remote digital loopback request.
&T6	Request an RDL without self-test.
&T7	Request an RDL with self-test.
&T8	Initiate local analog loop with self-test.
&V	Display current configurations.
&W0	Store the active profile in NVRAM profile 0.
&W1	Store the active profile in NVRAM profile 1.
&X0	Select internal timing for the transmit clock.
&X1	Select external timing for the transmit clock.
&X2	Select slave receive timing for the transmit clock.
&Y0	Recall stored profile 0 upon power up.
&Y1	Recall stored profile 1 upon power up.
&Zn=x	Store dial string x (to 35) to location n (0 to 3 depending upon modem model).
%E0	Disable line quality monitor and auto retrain.
%E1	Enable line quality monitor and auto retrain.
%E2	Enable line quality monitor and fallback/fall forward.
%L	Return received line signal level.
%Q	Report the line signal quality.
\D1	Enable Auto Dial via DTR off to on sequence *PE14400 only
\D0	Disable Auto Dial (default) *PE14400 only
\G0	Disable modem to modem flow control.
\G1	Enable modem to modem flow control.
\H0	Command Mode default
\H1	Lease Line Mode

\Kn	Controls break handling during three states:
	When modem receives a break from the DTE:
\K0,2,4	Enter on-line command mode, no break sent to the remote modem.
\K1	Clear buffers and send break to remote modem.
\K3	Send break to remote modem immediately.
\K5	Send break to remote modem in sequence with transmitted data.
	When modem receives \B in on-line command state:
\K0,1	Clear buffers and send break to remote modem.
\K2,3	Send break to remote modem immediately.
\K4,5	Send break to remote modem in sequence with transmitted data.
	When modem receives break from the remote modem:
\K0,1	Clear data buffers and send break to DTE.
\K2,3	Send a break immediately to DTE.
\K4,5	Send a break with received data to the DTE.
\M0	Select Answer Mode (Lease Line) with \H1 active
\M1	Select Originate Mode (Lease Line) with \H1 active
\N0	Select normal speed buffered mode.
\N1	Select direct mode.
\N2	Select reliable link mode.
\N3	Select auto reliable mode.
\N4	Force LAPM mode.
\N5	Force MNP mode.
\S0	Unlock command mode (normal mode) *PE14400 only
\S1	Lock (out) command mode (security mode) *PE14400 only

Error Diagnostics

Is the computer talking with the modem?

When you type AT<CR>, "OK" should be displayed. If the modem does not respond:

1. Make sure the modem is firmly connected to the computer.

2. Verify the communication program is configured to the correct com port (COM L, COM2:, COM3:, or COM4:).

3. Verify the baud rate (2400, 1200, or 300) and check parity (even, odd, none).

4. If the modem still does not respond, type AT&F<CR>. This will reset the modem to the original factory settings.

5. Try unplugging the modem and plugging it back in to ensure clean contact connections.

If the modem responds, but...

---characters are not displayed, type ATEI <CR>. This tells the modem to echo commands to the screen.

...characters are displayed double, type ATE<CR>. This turns the echo feature off.

Modem does not answer.

If the modem does not answer an incoming call, type
ATSO = I < CR>.

* Check to make sure your terminal device has DTR high

Modem will not dial a telephone number.

If the computer displays **NO DIALTONE,** the modem is not receiving a dial tone. Connect a standard telephone to the telephone line to verify a dial tone. If you do not hear dial tone, something is wrong with either your telephone cable or telephone line. Try another cable or line.

On some telephone lines connected to internal telephone systems, the telephone lines are not standard and will not work with standard telephones. Such lines will not work with this modem. Adapters are available to convert these lines so they may work with standard telephone equipment.

Modem can dial but can't communicate.

If you cannot communicate properly, something may be wrong with the other system. Try calling a different modem.

Unusual characters appear on the screen.

If you can dial, but unusual characters appear on the screen while communicating, check the communications settings of your communications software. The most common settings are 7EI (7 bits, even parity, I stop bit) and 8N 1 (8 bits, no parity, I stop bit).

Modem connects but cannot communicate.

Another possibility is that your modem and software are set for different speeds. In other words, you will be unable to communicate at 2400 bps with modems linked at 1200 bps. Check your speed settings.

Your modem disconnects.

During communications the modem may disconnect from the phone line if-

1. It fails to connect to the remote modem.

2. It detects a loss of carrier from the remote modem.

3. You enter the escape and Hook command.

4. Turn off power to the computer.

Note: you may want to put the modem into a quiet mode - ATQ1 (ATQ0 is the default)

modem does not send result codes which can confuse the computer.

LED

- TR = DTR, Data Terminal Ready

- TX = Transmit Data

- CD = Carrier Detect from remote modem

- RX = Receive Data

- PWR = Power

Power connection
- looking from the connector side

- **Positive is on the left power terminal**

- **Negative is on the right terminal**

- **110VAC use DC Wall power cube**