ARC CDL-900

Cellular modem and Transceiver

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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 is not compatible with GSM which is 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).

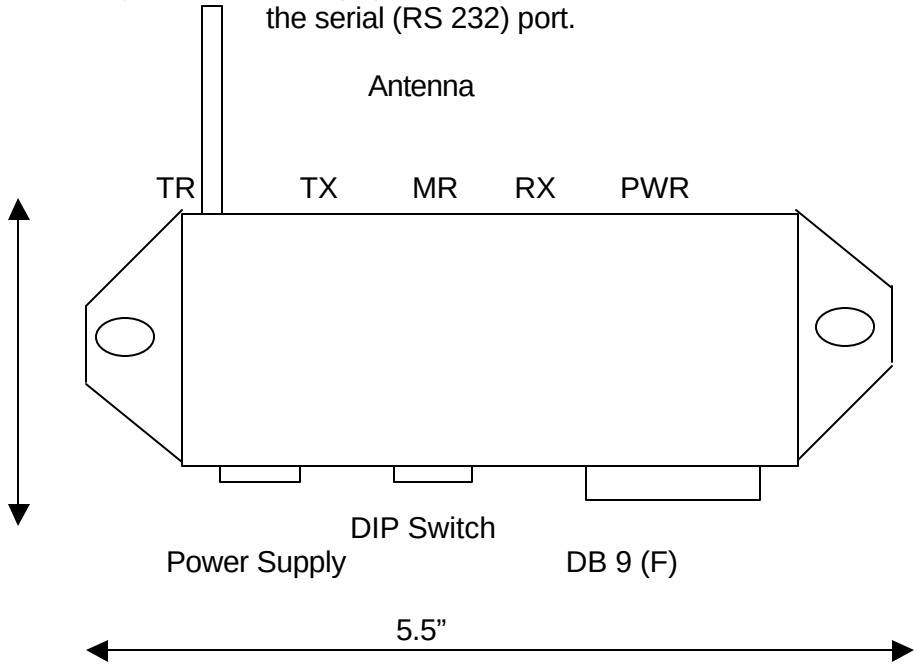
The cellular operator will register your unit and provide you the following information:

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 CDl 900 unit

The CM900 is configured as a DCE (e.g. modem). It communicates with a PC through the serial (RS 232) port.



TR = Terminal Ready TX = Transmit Data MR = Modem Ready
RX = Receive Data PWR = Power

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.

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.

18)	+++	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=45 & S10 register to 70. This will make the modem more tolerant of noise hits.
6) If for some reason, the unit is not responding, please try the command AT&F&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

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=10,1,300,9600 <CR>. Sets the modem to communicate between 300 and 9600 bps.
ATS91=15 <CR>.

6) Question: Is there any simple way to avoid frequent loss of connection?

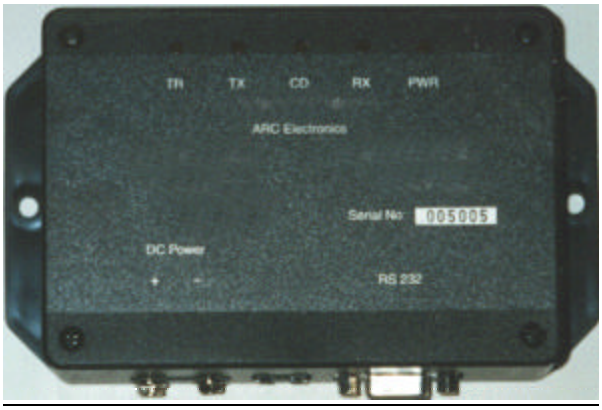
Answer: Please program the CDL 900 as follows
AT+MS=1,1,300,1200&W&W1<CR>
This will force the CDL 900 to connect only at either 300 bps or 1200 bps.

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: AT\N0%C0&W&W1<CR>

8) Question: My requirement(s) are totally unique. Can I count on IDC to help?
Answer: Absolutely.



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