REDWING DIGITAL CELLULAR MODEM
INSTRUCTION MANUAL

REVISION: 1/03

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CAMPBELL SCIENTIFIC, INC.
RMA#_____
815 West 1800 North
Logan, Utah 84321-1784

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Redwing Digital Cellular Modem

1. Introduction

The Redwing is a full-duplex modem, manufactured by AirLink. It supports telecommunications via a cellular digital packet data (CDPD) network. CDPD modems are IP based, requiring an internet address assigned by your service provider.

A PC with Internet access runs LoggerNet or PC208W software to retrieve data. There must be a CDPD network with coverage at the datalogger site. A coverage map is provided at www.attwireless.com/business/data.

Features

- 19.2 kbps data transfer rate
- No dialing delays
- Long distance fees eliminated
- Pay for data throughput instead of air time
- Lower operating costs and initial equipment investment
- Built-in encryption that maintains security of data while transmitting
- Typical current drain of 60 mA standby or receiving and 280 mA during transmission
- -30° to +70°C operating temperature range

2. Specifications

Transmit Power:	600 mW
Transmit:	824 to 849 MHz
Receive:	869 to 894 MHz
Data Rate:	19.2 kbps via TCP/IP, 1,200 to 38,400 bps via serial interface
Input Voltage:	9 to 30 Vdc
Input Current:	30 to 450 mA
Typical Current Drain at 12 Vdc:	60 mA while receiving, 280 mA during transmission
Operating Temperature Range:	-30° to 70°C with transmissions limited to a 10% duty cycle above 60°C
Humidity:	5% to 95% non-condensing
RF Protocol:	CDPD 1.1
Serial Interface:	RS-232, DB-9F
RF Antenna Connector:	50 Ohm TNC female
Serial Protocols:	AT Commands, SLIP, PPP
Status LEDs:	Power, Channel Acquired, Link Status, Network Registration, RSSI, Transmit/Receive, Block Errors
Dimensions:	3"W x 1"D x 5.1"L (5.8" w/ connector), 7.6 x 2.5 x 13 cm (14.7 cm w/connector)
Weight:	<1 lb. (<0.5 kg)

This manual is a supplement to the AirLink Redwing CDPD Modem User's Manual that is also shipped with the modem. The AirLink manual describes the

modem's features and the software used to configure the modem. This manual gives the specific modem configuration and the field installation for use with a Campbell Scientific datalogger.

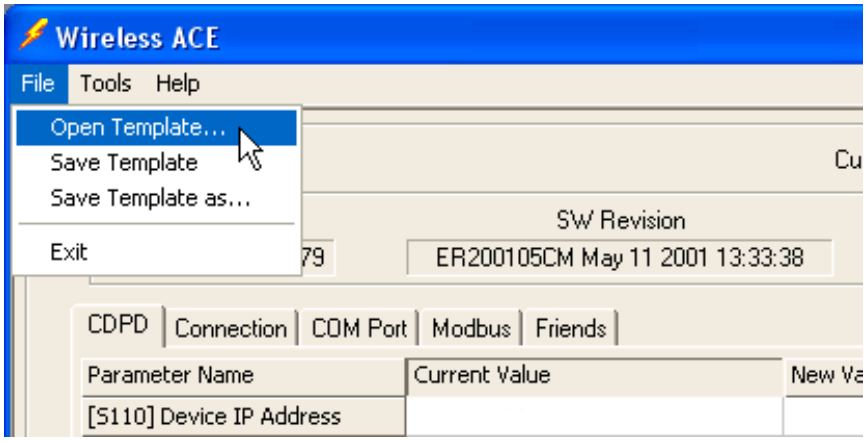
3. Configuration

Section 2 of the AirLink manual describes getting the required information from your CDPD service provider, installing the software and configuring the modem. The easiest way to set the configuration for a Campbell Scientific datalogger is to use a template file. The template file is available at Campbell Scientific's FTP resource page:

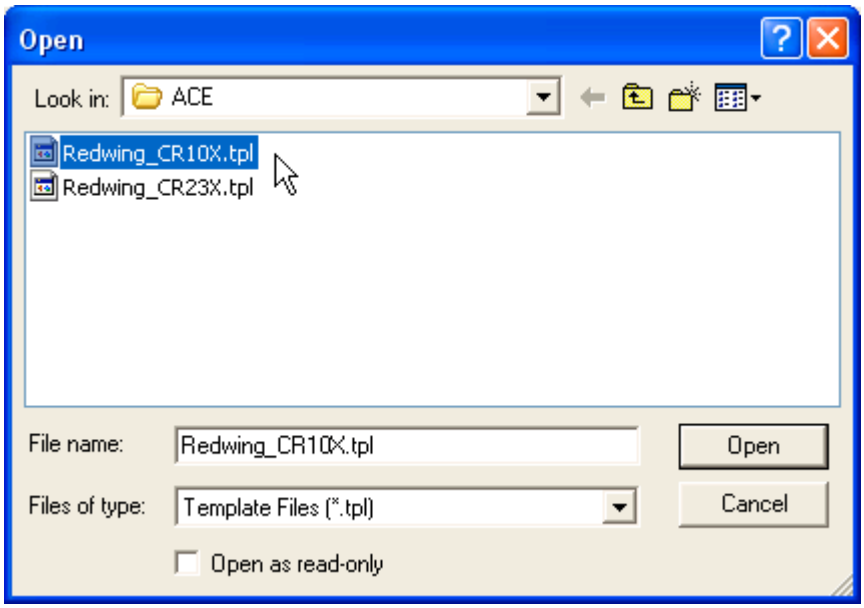
http://www.campbellsci.com/resource.html

Alternatively you can change the parameters manually. Appendix A lists the CSI template which gives the settings for each parameter.

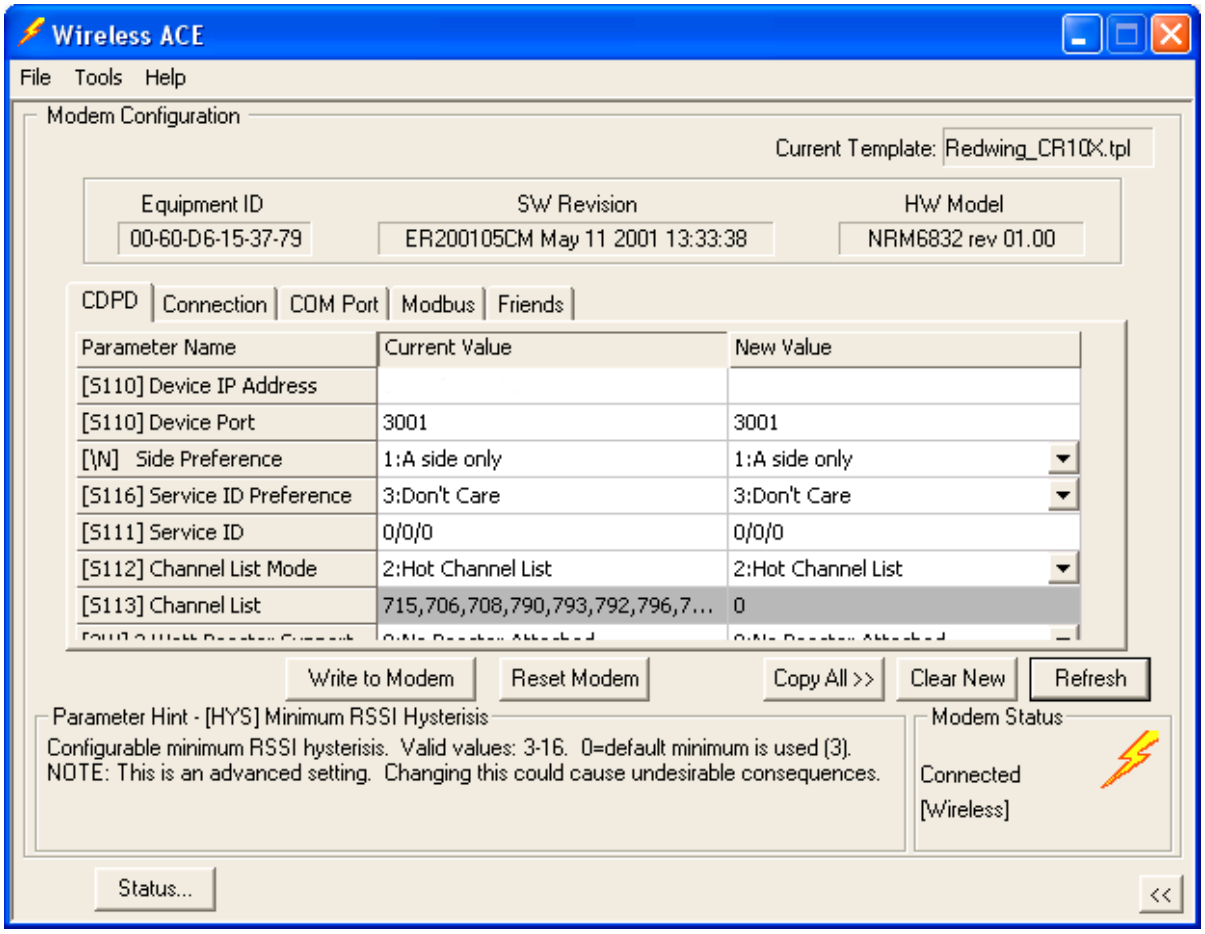
Follow all the steps in Section 2 of the AirLink manual up through Section 2.2 step 13. At this point if you have copied the CSI template file you can load it. Select "Open Template" from the file menu:



In the "Open" dialog box, select the template file that you downloaded.



After selecting the file, the values from the template file will appear in the New Value column in the configuration listing.



Check that the side preference is correct (step 11 in Airlink manual). To complete the configuration, proceed to step 14 in the AirLink manual (Set IP Address).

4. Power Considerations

If the installation's power supply has a battery charger connected to reliable AC power, the Redwing can be left on continuously, allowing the station to be called at any time. If the Redwing is powered continuously, the power requirements make it unfeasible to power the system from batteries alone for other than short periods. Most remote installations use solar panels for charging the batteries.

For continuous year-round power with a datalogger/sensor power requirement as described below, the MSX20 or MSX20R solar panel is adequate for areas in the United States other than parts of the Pacific Northwest, great lakes region, and Alaska. The MSX10 or MSX10R should provide enough power in the sunnier South and Southwest or if the cellular modem is powered less than half of the time. (For more information on solar panel sizing check out: BP Solar's solar system design guide at: http://www.bpsolar.com/ContentDetails.cfm?page=61)

A power budget can be calculated to determine the length of time the system will run on fully charged batteries without AC or solar charging. The number of Amp-hours required per day can be calculated with the following equation:

Amp-Hours per day = (standby current)*(Time in standby) + (Transmitting current)*(Time Transmitting) + (Average datalogger/sensor current) * 24 hours

If the Redwing is powered continuously and Transmits for 15 minutes per day this works out to:

Standby (60 mA receiving) = 0.06 A * 23.75 hours = 1.43 Amp-hours

Transmitting (280 mA) = 0.28 A * 0.25 hours = 0.07 Amp-hours

Datalogger/Sensors (2.5 mA) = 0.0025 A * 24 hours = 0.06 Amp-Hours

Total = 1.56 Amp-hours

The datalogger and sensor power requirements above are for a typical weather station application. (For more information on calculating power requuirements, refer to Campbell Scientific's power supply application note, available at: http://www.campbellsci.com/apnotes.html#misc)

With the power budget calculated above, Campbell Scientific power supplies will allow the cellular system to operate for approximately the number of days listed below without charging (as might be the case with AC power failure or a damaged solar panel. The calculation of the ammount of time assumes that the battery is completely charged at the beginning of the period.

Model	PS12LA	BP12	BP24
Charging Source/ Notes	1	1,2	1,2,3
Battery	7 Ahr	12 Ahr	24 Ahr
***Approximate* Operating days**	4	7	15

NOTES:

1. 10 watt solar panel recommended as charging source in remote applications, model MSX10
2. 12VDC regulator, model CH12R
3. Larger enclosure required, model ENC 16/18

To preserve battery life in solar powered systems, the battery Amp-hour capacity used to calculate reserve capacity should be multiplied by 0.5 (i.e., the net result is to cut the number of days listed above in half.) A ten day reserve battery capacity is recommended. To get to a ten day reserve capacity, reduce the amount of time that the modem is powered with the above batteries or get a larger capacity battery. Note that in the power budget calculated above, the majority of the power is consumed by keeping the modem powered even though it is not being used. Powering it only half as long would essentially cut the power requirements in half (program examples, section 6).

A user-supplied "RV" or "marine" deep cycle battery is an economical battery with a larger capacity (60 – 100 Amp hours). Such a battery can be charged with the MSX20R solar panel and housed outside the enclosure.

5. Installation

5.1 Datalogger Site Equipment

- Redwing Modem and power cable.
- Datalogger—CR510, CR10(X), CR23X, CR7, or CR5000.
- SC932 or SC932A Interface—converts the modem's RS-232 port to the datalogger's CS I/O port. The 10871 9-to-25-pin adapter is required to connect the Redwing to an SC932 Interface. The adapter is not necessary for the SC932A. Alternatively when using a CR23X or CR5000, a 14393 Null Modem Cable can be used to connect the modem to the datalogger's RS-232 port instead of the CS I/O port.
- 14394 Redwing Mounting Kit w/ Adapter—includes mounting hardware for securing the modem to an environmental enclosure and the SC12 cable.
- Antenna—the following antennas can be purchased from Campbell Scientific; sites near the edge of the CDPD coverage require the Yagi antenna. Contact an Applications Engineer for help in determining the best antenna for your application.

14453 2 dB ½ Wave Dipole Whip Cellular Antenna
14454 8 dB Yagi Cellular Antenna with 10' Cable

The 10530 antenna sold with the COM100 analog cellular phone can also be used with the Redwing when upgrading from analog cellular to CDPD. An RF adapter connector is required to connect the TNC female connector on the Redwing to the mini UHF male connector on the 10530 cable (e.g., Radio Shack Part No. 278-148).

- Power Supply.
- Environmental Enclosure—typically an ENC 12/14 or ENC 16/18.

5.2 Power Considerations

The communication connection between the Redwing serial port and the CS I/O port on the datalogger (or RS-232 on CR23X or CR5000) is made with the following interfaces:

Datalogger CS I/O connection to Redwing Serial Port via SC932:

CS I/O >> SC12 Cable >> SC932 >> 10871 >> SC12 >> Serial Port

Datalogger CS I/O connection to Redwing Serial Port via SC932A:

CS I/O >> SC12 Cable >> SC932A SC12 >> Serial Port

CR23X or CR5000 RS-232 to Redwing Serial Port Via Null Modem

Dataloggger RS-232 >> 14392 Null Modem Cable >> Serial Port

A power cable included with the modem connects to the datalogger's 12 V or switched 12 V terminal. Connection to the switched 12 V terminal allows the datalogger to switch power to the modem during scheduled transmission intervals, thereby conserving power.

Table 5-1. Power Cable Wiring for Continuous Power

Wire Color	CR10(X)	CR23X, CR5000, CR21X
Red	12V	12V
Black	G	⏚

Table 5-2. Power Cable Wiring for Switching Power under Program Control

Wire Color	CR10X	CR23X, CR5000
Red	Switched 12V	Switched 12V
Black	G	⏚
	User Supplied Jumper from Control Port X to SW 12 V Ctrl	

6. Programming to Switch Transceiver Power

Switching power to the transceiver allows the datalogger to maintain a lower power budget by limiting communication to predetermined times. The transceiver must be switched on before it can answer a call.

This section provides examples of datalogger programming to switch power. If the power supply is sufficient to power the cellular transceiver continuously without switching, no special programming is necessary.

The simplest program switches power on at specific times and off a fixed time later. This can be accomplished with two Instructions. Instruction 92 sets the port controlling the relay high to turn the power on and a second Instruction 92 sets the port low. In these examples, control port 1 controls the relay.

The following program switches the transceiver on at midnight for 15 minutes:

```
;{CR10X}
;
*Table 1 Program
  01:  10.0            Execution Interval (seconds)

01:  If time is (P92)
  1:   0               Minutes (Seconds --) into a
  2:   1440            Interval (same units as above)
  3:   41              Set Port 1 High

02:  If time is (P92)
  1:   15              Minutes (Seconds --) into a
  2:   1440            Interval (same units as above)
  3:   51              Set Port 1 Low

*Table 2 Program
  02:  0.0             Execution Interval (seconds)

*Table 3 Subroutines

End Program
```

With the transceiver on for 15 minutes following midnight, LoggerNet would be set to call automatically once a day at 2 minutes after midnight. In some areas there are discounts for calls during off hours.

To allow contacting the station throughout the day, the transceiver can be turned on for the first 10 minutes of each hour:

```
;{CR10X}
;
*Table 1 Program
  01:  10.0            Execution Interval (seconds)

01:  If time is (P92)
   1:   0              Minutes (Seconds --) into a
   2:   60             Interval (same units as above)
   3:   41             Set Port 1 High

02:  If time is (P92)
   1:   10             Minutes (Seconds --) into a
   2:   60             Interval (same units as above)
   3:   51             Set Port 1 Low

*Table 2 Program
  02:  0.0             Execution Interval (seconds)

*Table 3 Subroutines

End Program
```

Or one might want to power the transceiver for one hour at 10 a.m. and at 10 p.m.

```
;{CR10X}
;
*Table 1 Program
  01:  10.0            Execution Interval (seconds)

01:  If time is (P92)
   1:   600            Minutes (Seconds --) into a
   2:   720            Interval (same units as above)
   3:   41             Set Port 1 High

02:  If time is (P92)
   1:   660            Minutes (Seconds --) into a
   2:   720            Interval (same units as above)
   3:   51             Set Port 1 Low

*Table 2 Program
  02:  0.0             Execution Interval (seconds)

*Table 3 Subroutines

End Program
```

Another option is to power the transceiver for the first 15 minutes of each hour.

```
;{CR10X}
;
*Table 1 Program
  01:  10            Execution Interval (seconds)

1:  If time is (P92)
  1:   0             Minutes (Seconds --) into a
  2:   60            Interval (same units as above)
  3:   41            Set Port 1 High

2:  If time is (P92)
  1:   15            Minutes (Seconds --) into a
  2:   60            Interval (same units as above)
  3:   51            Set Port 1 Low

*Table 2 Program
  02:  0.0000        Execution Interval (seconds)

*Table 3 Subroutines

End Program
```

Whatever the time that the program powers the transceiver, the station must be called while the transceiver is on; it cannot answer a call at other times.

Appendix A. Configuration for use with CSI Dataloggers

[\N] Side Preference=3
[S110] Device Port=3001
[S116] Service ID Preference=3
[S111] Service ID=0/0/0
[S112] Channel List Mode=2
[S113] Channel
List=715,706,708,790,793,792,796,794,791,798,795,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0
[3W] 3 Watt Booster Support=0
[*DSIDE] Disable Side Switch=0
[#X] Debug Output=0
[S0] TCP Auto Answer Mode=1
[S7] TCP Establishment Timeout=20
[S50] Data Forwarding Timeout=1
[S51] Data Forwarding Character=0
[S53] Destination IP Address=0.0.0.0
[S53] Destination TCP/UDP Port=23
[S53] Destination Connect Mode=T
[S210] AT Command Compatibility=1
[S211] Ignore DTR=1
[MD] Startup Mode Default=0
[MD] UDP Mode Default=0
[S60] Telnet Echo Mode=0
[S82] UDP Half Open Mode=0
[S83] UDP Half Open Timeout=0
[AIP] Allow Any UDP IP=0
[HOR] UDP Half Open Response=0
[S220] Break On TCP Connect=0
[S221] Delay Connect Response=0
[E] Command Echo=1
[V] Command Response Mode=1
[Q] Quiet Mode=0
[X] Call Progress Result Mode=0
[TCPT] TCP Inactive Timeout=5
[TCPS] Specify TCPT in Seconds=0
[TCPX] Allow TCP Suspension=0
[*DATZ] Disable Reset on ATZ=1
[DAE] Disable AT Esc Sequence=1
[RKEY] Radio Transceiver Keying=0
[\Q] Flow Control=0
[S23] Baud Rate=9600
[S23] Data Bits=8
[S23] Parity=N
[MVOFF] Modbus-Variant Offset=1
[MVLEN] Modbus-Variant Length=0
[MVTYP] Modbus-Variant Type=0
[MVOPT] Modbus-Variant Options=0
[MVMSK] Modbus-Variant ID Mask=0
[FM] Friends Mode=0