COM100 CELLULAR PHONE PACKAGE
OPERATOR'S MANUAL

REVISION: 15/10/01

WARRANTY AND ASSISTANCE

The **COM100 CELLULAR TELEPHONE PACKAGE** is warranted by CAMPBELL SCIENTIFIC (CANADA) CORP. ("CSC") to be free from defects in materials and workmanship under normal use and service for **twelve (12) months** from date of shipment unless specified otherwise. CSC's obligation under this warranty is limited to repairing or replacing (at CSC's option) defective products. The customer shall assume all costs of removing, reinstalling, and shipping defective products to CSC. CSC will return such products by surface carrier prepaid. This warranty shall not apply to any CSC products which have been subjected to modification, misuse, neglect, accidents of nature, or shipping damage. This warranty is in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose. CSC is not liable for special, indirect, incidental, or consequential damages.

Products may not be returned without prior authorization. To obtain a Return Merchandise Authorization (RMA), contact CAMPBELL SCIENTIFIC (CANADA) CORP., at (780) 454-2505. An RMA number will be issued in order to facilitate Repair Personnel in identifying an instrument upon arrival. Please write this number clearly on the outside of the shipping container. Include description of symptoms and all pertinent details.

CAMPBELL SCIENTIFIC (CANADA) CORP. does not accept collect calls.

Non-warranty products returned for repair should be accompanied by a purchase order to cover repair costs.

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WARNING: The red LED power indicator/switch on the RJ11C interface box is lit when the cellular transceiver is on. The control line from the datalogger must be used to turn the transceiver off and on. DO NOT USE THE RED LED POWER BUTTON AS A SWITCH. If the transceiver is manually switched off while under datalogger control, the datalogger will not be able to turn it on again. Refer to Section 9.

NOTE: The COM200 or COM210 field phone modem when used with the COM100 Cellular Phone package supports 300, 1200, 2400, and 4800 baud connections. Campbell Scientific datalogger serial ports support a 300, 1200, and 9600 baud terminal connection. Additional commands must be sent to the PC calling modem during the dialing sequence to allow a 2400 and 4800 baud modem connect speed with the field modem. Check your calling modem manual for support of this feature. Bandwidth limitations over the Analog Cellular Phone System prevents a reliable modem connection above 4800 baud.

HOW TO GET STARTED:

1. Take the COM100 phone package to your cellular service provider to program the phone and setup your service agreement. If your service provider has any questions regarding programming of the phone, have them contact the Motorola Cellular Information Center at 1-800-331-6456.

2. To program your phone your cellular service provider will need:

a. COM100 cellular phone package and ESN described in step 3.
b. Motorola Handset supplied by your Service Provider (Model SCN2504A or equivalent).
c. **Power Control Cable provided by Campbell Scientific or Motorola Power Cable (Model SKN4302A or equivalent). ***SEE WARNINGS PAGE 4.**

3. The information your service provider will need to program the phone will be the Manufacturer of the Cellular Phone (i.e., Motorola) and the Electronic Serial Number (ESN). The ESN is located on a bar-coded label on the back of the cellular phone. The actual location* of the ESN on the label can be seen in the example below and is shown as **bold** characters (Example: **D57E1504**). The ESN always consists of 8 characters.

LABEL #1

SUN19008SC |||| ||||||||| |||| ||||||| |||||| ||||||
MH2 376H
***D57E1504** 416S-18-5F61
||| |||| ||||||| |||||| |||| ||||| |||| N0515281

To date (March 1997) the ESN on all Motorola Cellular phones will begin with

82
C3
D4
D5
E0

Additional information regarding your phone can be found on a second label shown on the back of the phone. This label is located directly below the one described above.

LABEL #2

MFG. BY MOTOROLA

FCC ID:	IHDT5SZ1	EE3	Tx POWER OUTPUT = 3W
MODEL:	**19370XNMSA**		CANADA: DNKA 109 182 197
MSN:	**327GWUH6588**		Prt Pwr 12VDC Neg Gnd

For future reference we recommend that you record the following information regarding your COM100 cellular phone:

		Example
ESN:	_____	D57E1504
Model:	_____	19370XNMSA
MSN (Serial #):	_____	327GWUH658

COM100 Cellular Phone Package Operator's Manual

1. Introduction

Telecommunication using cellular telephones is a convenient alternative to standard phone or RF telemetry. In areas with cellular coverage, it has an advantage over ordinary phone lines where the lines are not established and would be costly to install. The advantage over an independent RF telemetry system is that the company providing the cellular service takes care of the FCC licensing and maintenance of cellular repeater stations.

To determine if a site has sufficient cellular coverage, a user can usually borrow a portable cellular phone and visit the site. If a standard cellular phone can place a call from the site with good sound clarity and good signal strength the site should have no problems using cellular telemetry. If a directional (Yagi) antenna is being used, it would be a good idea to have the cellular phone company locate their cellular tower on a map so the antenna can be pointed towards the tower.

Campbell Scientific's COM100 Cellular Phone Package includes:

- Motorola M600 Transceiver—Motorola p/n 19370XNMSA
- RJ-11C Interface—Motorola p/n 519360
- Crydom Relay built into Power and Control Cable
- Mounting Bracket (Model L10529)
- 10' Coaxial Cable with male mini-UHF and male Type "N" Conn. (Model 10531)

Options to complete package include (choose 1 phone modem)

300/1200/2400/4800/9600 Baud Data Modem	(Model COM200 or COM210)
300/1200/2400/4800/9600 Baud Data Modem and Voice Synthesizer	(Model COM300 or COM310)
Directional Antenna and Mounting Hardware	(Model ASP962)

An appropriate power supply and antenna must be selected for each station.

The Motorola M600 Cellular Transceiver has an external RJ11C telephone interface. A standard RJ11C patch cable connects the Campbell field modem (COM200, COM210, COM300, COM310) directly to the transceiver. A computer equipped with the PC208(W) Datalogger Support Software and a Hayes compatible phone modem connected to a standard phone line is used to call the cellular equipped stations (see Figure 1-1).

The transceiver is typically not supplied with a handset, but if the user wishes to place a voice call, any standard analog touchtone telephone can be connected. However, the field modems and a telephone cannot be connected

to the transceiver at the same time. Programmable phones will not work with the transceiver.

2. Specifications

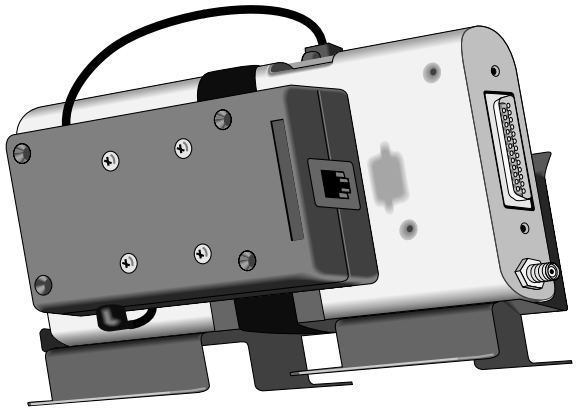
M600 Transceiver

Dimensions:	8.4” x 3.9” x 1.0”
Operating Temperature:	-30 to +60°C
Supply Voltage:	+10 to +16 VDC
RF Power Output:	3 watts nominal
Average Current	
Quiescent:	<0.5 mA
Standby:	<0.17 A
On-Line:	<1.8 A
*Antenna Termination:	50 Ohm, mini-UHF female

*Control Relay Crydom D0061B

Control Voltage:	1.7 to 9 VDC
Control Current:	15 mA @ 5 VDC
Output Rating:	.02 - 1.0 ADC @ 3 - 60 VDC

*See warnings page 4.



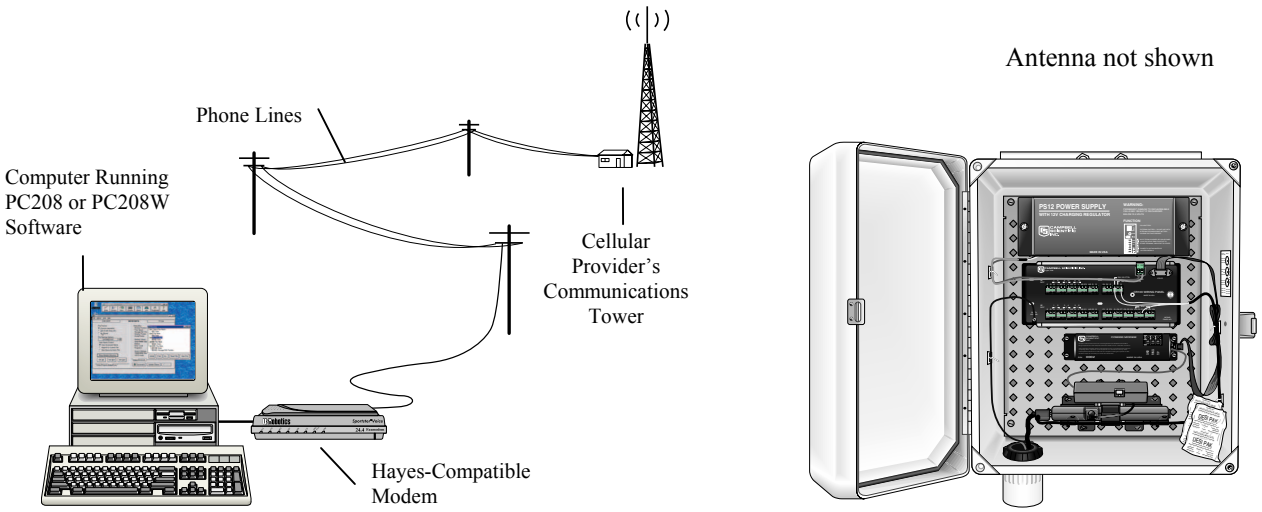


FIGURE 1-1. Cellular Telecommunications

3. Antennas

Each transceiver in a cellular phone system must have an antenna. Two common types of antennas are used, omnidirectional and directional. An omnidirectional antenna transmits and receives in any direction. A directional antenna transmits and receives in a particular direction.

Fixed sites are equipped with a directional antenna because it provides the strongest signal and can be aimed at a cellular repeater site. There are various shapes of directional antennas, the most common being Yagi antennas, such as the ASP962.

Mobile applications use omnidirectional antennas. Generally, an omnidirectional antenna is a spiraled, cylindrical rod, mounted vertically. The omni antennas listed below differ mainly in mounting hardware.

YAGI ANTENNA (Model L10530)

†ASP962 Broadband Yagi

Gain:	8 dB
Frequency:	806-896 MHz
Bandwidth:	90 MHz
Input Impedance:	50 Ohms
Front to Back Ratio:	15 dB
VSWR Max:	1.5:1
Dimensions:	28.5" x 8.25" x 2.5"
Termination	50 Ohm N female

MOBILE OMNI ANTENNAS (Model CELL ANTM)

ASPD1894 Mini-UHF Magnetic Mount Antenna

Gain:	3 dB
Frequency:	826-896 MHz
Impedance:	50 ohms
Height:	15"

4. Power Considerations

The relay included with the cellular phone power control cable allows the datalogger to switch power to the cellular transceiver. Even so, the relatively high current required by the cellular transceiver makes it necessary to use a solar panel, vehicle power system, or AC power to maintain a charge on the system battery. It is unfeasible to power the datalogger and transceiver from batteries alone unless the battery capacity is very large, the batteries are changed frequently, or the transceiver is switched on infrequently.

Since a battery is simply a storage device, a power budget can be calculated to determine the battery capacity required per day using the following equation:

(standby current drain)*(time in standby mode) + (on-line current drain)*(time on-line) = Total Amp-hours required

A common application is to turn the transceiver on (in stand-by mode) for 10 minutes at the top of each hour for a full day. This allows ample flexibility for a user to perform operations such as data-collection, real-time monitoring, new program downloads, or clock sets. In this example the transceiver was on-line for 15 minutes of the day to perform the tasks listed above. The Amp hour usage per day can be calculated as shown in this example:

On-Line time	15 minutes	(0.25 hrs)/day
Stand-by time	225 minutes	(3.75 hrs)/day
Total Time	240 minutes	(4.00 hrs)/day

(0.25hrs/day) x (1.8A) + (3.75hrs/day) x (0.17A) ≈ 1.0 Ahr/day

Users must also figure datalogger, modem, and sensor contribution into their power budgets. For example a standard weather station has minimal current drain but requires an additional 0.25 Ahr/day battery capacity.

Campbell Scientific offers several sealed rechargeable battery options for use with the COM100 Cellular System. The batteries offered in our product line are well suited for remote environments where trickle charging by a solar panel is common. The rechargeable batteries also provide the current required by the cellular transceiver that cannot be provided directly by the charging source.

Given the previous application, the following Campbell Scientific power supplies will allow the cellular system to operate for approximately the number of days listed below. The amount of time assumes there is no charging source due to AC power failure or a damaged solar panel. Calculations also assume the batteries are fully charged and at 25°C.

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

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

For frequent (fixed site) calling applications without AC power, the MSX20R Solar Panel or MSX20 and CH12R Regulator is recommended with a user-supplied deep cycle marine or RV battery. If the transceiver is seldom on and the site receives adequate sunlight, a smaller battery and solar panel may work (see power calculations).

Other factors in determining the battery size for on-line cellular data collection is the amount of data being stored, the frequency at which the station is being called for data collection and the baud rate of the data modem. Listed below are the typical data storage capacities for our most popular dataloggers and the amount of time required to collect a full datalogger assuming a reliable cellular phone connection. It is recommended to collect the data at intervals more frequent than the time required to fill the datalogger's memory.

Datalogger	**Storage Capacity # of Data Points**	**Approx. Time for Entire Memory Collection at 1200 Baud**
CR510	62,280	17.3 minutes
CR10	29,908	8.3 minutes
CR10X	62,280	17.3 minutes
21X	19,296	5.3 minutes
CR7	18,396	5.1minutes

5. Installation

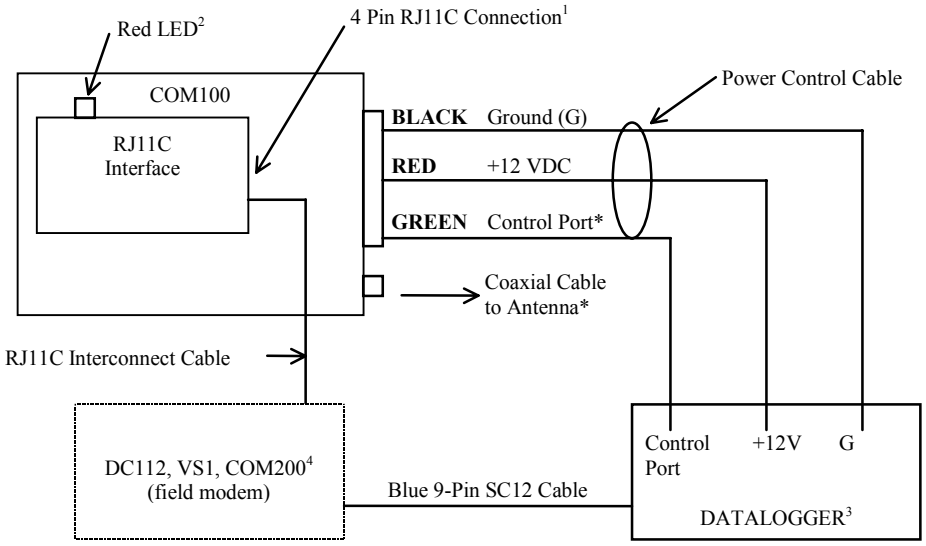


FIGURE 5-1. COM100 Wiring

WARNINGS

- **Do not connect the Green wire (Crydom relay control) to the switched +12V power supply on the black wiring panels used with the CR10 and CR10X Dataloggers. The maximum input voltage to the relay is +9 VDC. An input voltage greater than this will damage the mini Crydom relay contained within the power control cable.**

- **A 50 Ohm Antenna must be connected to the COM100 at all times. If a call is attempted without an antenna connected, permanent damage to COM100 can result which will void the warranty.**

[1] Connect the field modem patch cable to the 4-pin connector side of the RJ-11C interface box. The phone modem will not work if it is connected to the 8-pin connector.

[2] When the cellular phone is turned on via the control port, the Red LED switch on the RJ11C Interface box will flash for about 10 seconds. The LED will glow a steady red when a cellular communications tower and dial-tone has been detected by the COM100.

Current Campbell Scientific dataloggers provide 12 VDC to the COM210 via the SC12 cable (Figure 2). Older dataloggers do not provide 12 VDC on the datalogger's CS I/O 9 pin connector. When used with the older dataloggers listed in Table1, 12 VDC and ground need to be connected via the green power connector on the side of the COM210 (see Figure 3).

Table 1. Dataloggers that Require Direct 12 VDC Connection to COM210

CR10(X) with silver wiring panel
CR10(X) with black CR10 wiring panel (P/N 8032)
21X(L)—serial number 13,442 or lower
CR500—serial number 1764 or lower
CR7—700X serial number 2778 or lower
BDR301 and BDR320

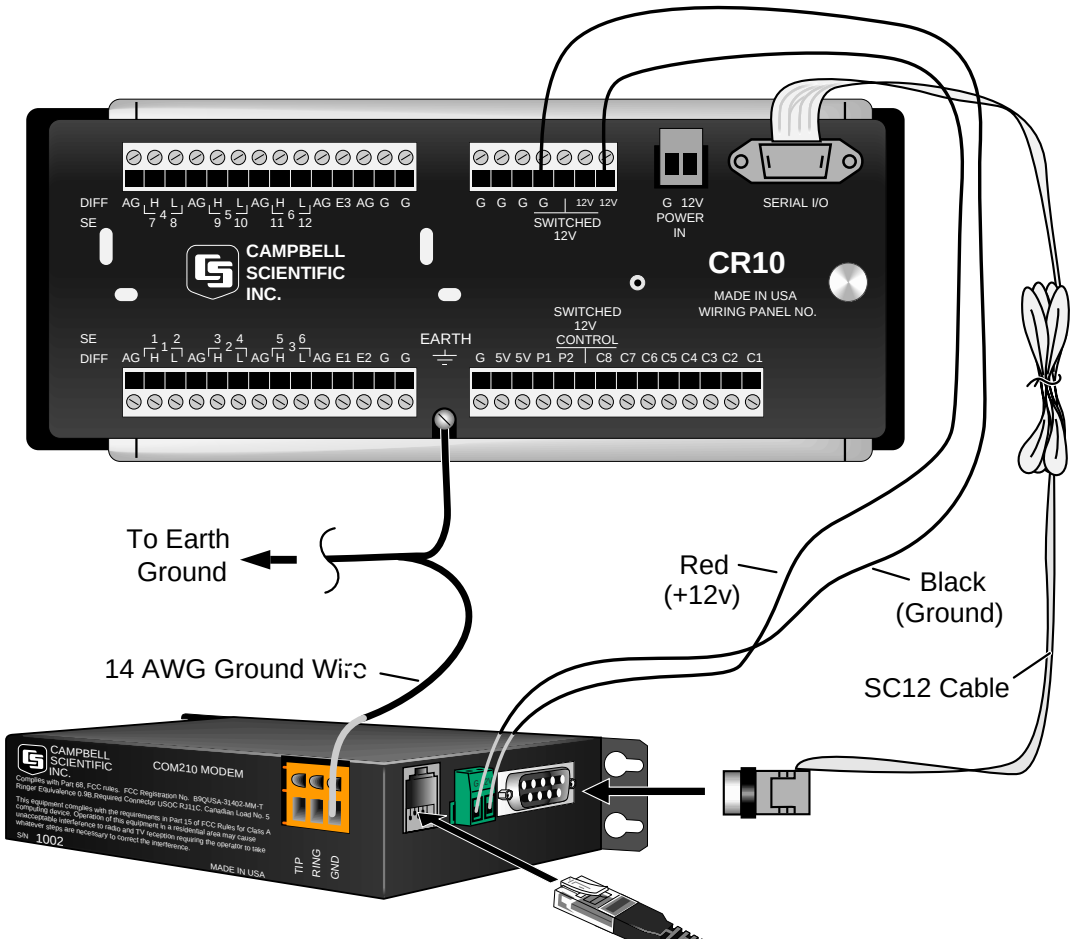


FIGURE 5-1. CR10X with CR10 Wiring Panel and COM210 Using RJ11C Telephone Jack

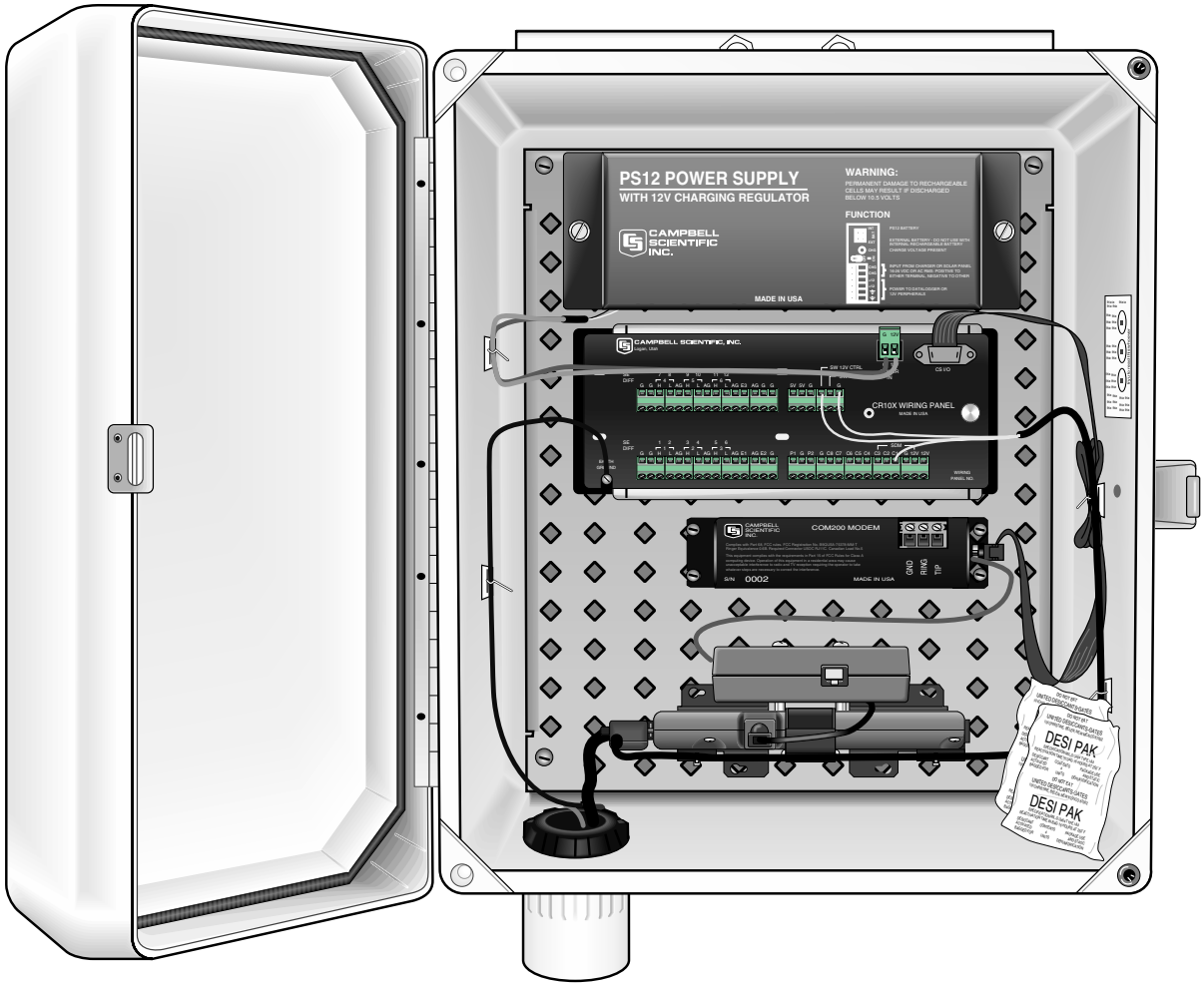


FIGURE 5-2. Typical Field Installation (Antenna not Shown)

6. Communication Notes

Once consistent cellular coverage has been established on a stationary phone, interference should not be a problem. Interference on mobile phones is more easily encountered. The local cellular company can verify cellular coverage of a specific area.

When a transceiver moves, the call may be transferred from one cell to another. Transceivers generally stay on-line during these transfers, and data are transmitted properly. However, if all the cells are busy or if too much interference occurs, the call will be dropped. This causes the transceiver and the field modem to hang up.

Possible sources of interference that should be avoided include heavy construction sights, tunnels, transmitting from the fringes of an area, and power transmission lines.

6.1 Datalogger Support Software

Datalogger support software (PC208, PC208E, PC208W) checks the signature of each block of data as it is received from the datalogger. A poor connection will result in the retransmission of incorrectly received blocks. If a link is consistently noisy, use of smaller block sizes may improve throughput. If the connection is completely broken, the software will write an error message to the hard disk. The datalogger support software also keeps track of what data was successfully collected and will attempt to call the datalogger to collect the remaining data based on the retry schedule in the station file that was created.

NOTE If using a relay to switch power to the transceiver, make sure retries occur at times the transceiver is on

To establish a connection with your remote cellular phone field station requires setting up your Datalogger Support Software session to call a Campbell Field Modem and Datalogger. Please refer to your current Datalogger Support Software Manual for details on setting up a simple phone modem session. The options listed in our support software do not specifically list the cell phone as an option. You should choose "phone modem" or "hayes modem" when setting up your station file. As mentioned previously, the COM200/COM210 phone modem used with the COM100 Cellular Phone package supports 300, 1200, 2400, and 4800 baud connections. Campbell Scientific datalogger serial ports support a 300, 1200, and 9600 baud terminal connection. Additional commands must be sent to the PC calling modem during the dialing sequence to allow a 2400 and 4800 baud modem connect speed. Bandwidth limitations over the Analog Cellular Phone System prevents a reliable modem connection above 4800 baud.

The command to enable this feature will vary from modem to modem. This command is added to your initialization string in PC208W. Check your modem manual to look for a command similar to:

Practical Peripherals Example:

Command	Function
N0	Originate or answer: Handshake only at speed in S37 register
S37=11	Set baud rate to connect at 4800 baud
S7=90	Set modem carrier time-out at 90 seconds

In addition, "datalogger" extra response times upwards of 3000 msec may be required as there are variable delays present in the cellular phone system.

NOTE When a program is downloaded to a station that switches power to the transceiver, the datalogger will automatically compile the program. This will cause all control ports to be reset low. If the downloaded program does not include the instructions to switch the transceiver back on, it will be necessary to visit the site and reprogram the datalogger to set a control port high before resuming cellular communication.

7. 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 or 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.

7.1 Powering on Fixed Intervals

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, TELCOM 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          I  nterval (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
```

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.

NOTE When initiating a call from the datalogger (Instruction 97), the transceiver must be switched on at least 15 seconds before the call is placed.

8. Troubleshooting

Below are common things to check when trying to troubleshoot a cellular phone problem.

1. No-Answer. You receive a programmed message after several rings that the cellular customer you are trying to reach has their phone turned off or has traveled outside of the coverage area.

Q. Has the cellular phone been programmed by your local service provider with the telephone number?

Each cellular telephone has a telephone number and an Electronic Serial Number (ESN) that is unique to each phone to prevent unauthorized use. The telephone number must match the assigned the ESN. If you try to use a cellular phone that has not been programmed with the telephone number, the phone will automatically become locked and will require you to take it to your service provider to be un-locked.

Q. Do you know what your system battery voltage is and the type of batteries being used?

The COM100 and Datalogger requires a nominal supply voltage of 12VDC. The system will operate between 10 and 16VDC. Since the COM100 draws 1.8 Amps during transmission, lead acid or gel cell type of batteries (PS12LA, BP12, BP24) must be used. Do not use alkaline batteries (CSI Model BPALK or PS12ALK) as a power source for the cellular phone. Alkaline batteries have a high internal resistance and cannot source the high current requirements of the COM100.

Q. Is the Campbell field modem plugged into the 4 pin connector on the external RJ11C interface box that is attached to the side of the cellular phone?

The COM100 cell phone and RJ11C interface box both have an 8-pin connector that is for the digital handset. Do not connect the field modem to these ports, as your system will not work in this configuration. The 4-pin connection on the RJ11C Interface box is the only compatible port for use with the field modems.

Q. Is the Red LED on the RJ11C Interface box turning on after power up?

The RJ11C interface box has a switch to allow you to manually turn the phone on and off. This is a momentary switch with a Red Light Emitting Diode (LED) that will flash for about 10 seconds after powering up. The Red LED should remain on continuously after the COM100 has located the cellular tower. If the phone is not turning on, press this switch to see if the LED comes on. (This is for testing purposes only.) Do not turn if off. See warning in front of manual.

Q. Can you call in or out of the site with a standard touch-tone telephone?

A simple analog touch-tone telephone can be used to test the cellular phone system. Disconnect the field modem from the 4-pin RJ11C Interface box. Connect your analog phone to this same 4-pin port. Set the control port high connected to the green control wire. You should hear a "beep" on power up and the LED should flash for about 10 seconds. After 10 seconds you will hear a dial tone and the Red LED should be glowing constantly. Dial a number to a location where you can verify the call out link. As a second test, have someone call into the site while the analog phone is connected. The phone should ring when a call is received.

Q. Is the directional antenna pointed at the cellular provider tower?

Directional antennas such as the ASPD962 (Model L10530) focus the Radio Frequency (RF) energy in one direction, and have a greatly reduced radiation pattern in the opposite direction, this is how gain is achieved. If you are in a location where cellular coverage is marginal, selective pointing of the antenna directly at the cell tower will be required.

Q. Does your datalogger program contain the necessary control instructions to turn the cellular phone on and off?

The COM100 requires a logic control port to turn the cellular phone on. The green wire of the power control cable should be wired to a control port. Check to ensure that the screw terminals are not crimped on the green insulation of this cable. Instruction P92 is typically used to turn the phone on based on real time. The 3rd parameter of P92 is used typically to turn the phone on and off. Refer to previous program examples for reference.

2. When I dial the cellular number, my calling modem and the Datalogger modem connect but nothing further happens.

Q. Are you using a high speed Modem (i.e. 14.4, 28.8, 33.6)?

Campbell Scientific's PC208 and PC208W Datalogger Support Software do not support local flow control. Typically modem initialization strings must be sent to the phone modem prior to dialing the phone number. Please refer to the PC208 and PC208W Datalogger Support Software manuals for information on how to setup the initialization strings.

3. When I establish a connection to the datalogger I sometimes see odd characters scrolling across the screen.

Cellular Phones that are on a marginal link can introduce noise that the computer sees as data. On a very noisy link you will see "garbage" characters like:

!@#)*$)*)*!)@$)!#3123313213*Fd

Campbell Scientific's PC208 and PC208W software has error checking algorithms to ensure the integrity of your data even on very noisy links. Given that the COM100 system typically has power cycled to it, noisy links will take more time because the suspect data packets are re-sent again to the computer.

If the datalogger sees more than 150 invalid characters, it will terminate the link. At the PC, one thing a user can try is to reduce the baud rate as low as 300 baud (the field modems are 300 to 4800 baud auto-negotiable). This reduces the required bandwidth and the data retrieval usually will require less retries. However, 300 baud data retrieval can take 4 times as long as 1200 baud; hence, this can be a costly solution.

Additional Troubleshooting Notes for COM200/COM210 Phone Modem

1) Verify nothing else is using the same COM port on the computer. Even if a program is minimized in windows, it may have a lock on the COM port. Some notebook computers do not automatically activate the COM ports. Verify the COM port you are using is activated.

2) The Campbell Scientific software will display an activity of communication as the link is being established. Assuming the above items are O.K., the software should display in the activity window/screen something such as "ATDT#######". Where the #### is the telephone number listed in the dialing path of the software for the datalogger you are trying to call.

   The local modem attached to the computer will respond back to the computer with result codes depending on how the call is progressing. These result codes can be either numeric (0, 1, 2, etc.) or "verbose" ("OK", "CONNECT", "RING", etc.). Our software expects numeric result codes. The result codes may appear on a new line, be appended to the last line, or may even replace the first letter(s) of the last line. If these characters are verbose, the initialization string for the modem will need to be changed. Below is a list of possible result codes. The result code returned may indicate why the call is unsuccessful.

   RESULT CODES:

   0 OK
   1 Connect
   2 Ring
   3 No Carrier
   4 Error
   5 Connect 1200 Baud
   6 No Dial Tone
   7 Busy
   8 No Answer
   12 Connect 9600 Baud
   13 Connect 9600/14400 Baud
   17 Connect 9600 Baud

3) Verify the COM210 is receiving 12 VDC. If the COM210 is receiving 12 VDC from a separate power supply instead of the datalogger, is the ground of the separate power supply connected to the datalogger's ground?

4) Verify the COM210 is the only Modem Enable device connected to the datalogger. Other common Campbell Scientific modem enable devices are the SC32A, some RF modems, and the MD9.

5) Verify the datalogger is turned on.

To comply with FCC and Industry Canada Rules and Regulations, all repairs on the COM210 modem **must** be performed by Campbell Scientific or an authorized agent of Campbell Scientific. For assistance in installation, troubleshooting, or for repair, contact Campbell Scientific:

Campbell Scientific (Canada) Corp.
11564 149 Street
Edmonton, AB T5M 1W7
Telephone: (780) 454-2505
Fax: (780) 454-2655
Email: dataloggers@campbellsci.ca
Web site: http://www.campbellsci.ca

9. Re-configuring Cellular Phone On/Off State

This Motorola Cellular Phone is equipped with a feature known as Convenience On/Off state. When the phone is turned off it saves certain parameters to non-volatile memory so that they may be remembered when the phone is turned back on. This includes the on or off state of the phone at the time the ignition sense line (green wire) was set low (0V).

In unattended installations the datalogger will ***NOT*** power up the cellular phone if the red LED power indicator/switch has been manually turned OFF (no longer lit) while under datalogger control. There is a *specific* sequence that causes this failure to happen:

1. Primary +12VDC Power has been applied to the phone.
2. The ignition sense (green wire) is set high (5V) via a control port.
3. The red LED power indicator/switch has been manually depressed to turn the phone off (LED is no longer lit).
4. The ignition sense line is set low (0V) via a control port (stores phone's OFF power state to non-volatile memory).

In this configuration the cellular phone will remain off even if the control port is set high again. The only way to turn the phone back on is to manually depress the red LED switch again.

Campbell Scientific has configured the phone at the factory to power-up under datalogger control. If your cellular phone is not turning on while under datalogger control, you will have to restore the phone's "power on" state in non-volatile memory.

The following 5 steps must be performed in the exact order listed to restore the proper "power on" state:

1. Connect the antenna via the coaxial cable to the transceiver.
2. Apply primary power (Ground and +12VDC) to the Black and Red Wires respectively.

3. Apply +5VDC power to the ignition sense line (green Wire) by setting a control port high.

4. Depress the red LED switch to turn on the phone. LED will flash for about 10 seconds and then glow a steady RED.

5. To store this "ON" power state in the phone's non-volatile memory, remove power from the ignition sense line by setting the control port low (0V).

From this point on the phone will reliably power up and down under datalogger control. A sample listing of datalogger program code is shown below to assist a user in steps 3 and 5 from above:

```
;{CR10}
;
*Table 1 Program
  01:  1.0            Execution Interval (seconds)

1:  If Flag/Port (P91)
  1:   11             Do if Flag 1 is High
  2:   41             Set Port 1 High

2:  If Flag/Port (P91)
  1:   21             Do if Flag 1 is Low
  2:   51             Set Port 1 Low
```

Software flags can be manually toggled high and low via the Datalogger's keypad (*6AD1) or through Campbell Scientific's PC208(W) software. Please refer to the PC208 and PC208W Datalogger Support Software manuals for information on how to manually toggle Flags.