

INSTRUCTION MANUAL



DCP-Intelimax Modem Kit

Revision: 05/15



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DCP-Intelimax Digital Cell Phone Kit

1. Introduction

The DCP-Intelimax Digital Cell Phone Kit is Campbell Scientific Australia's industrial cell phone kit for use with 2G and 3G networks. Suitable for use throughout Australia and capable of automatically detecting local communications frequencies and accepting an appropriate local SIM across the world.

Use of this kit with CRBasic data logger code allows telemetry options including intelligent SMS, Circuit Switched Data, TCP/IP connection over the Internet, FTP data transfer, Email and many more.

A unique advantage the Intelimax modem offers is the ability to perform SMS and TCP/IP communications simultaneously. This solution was developed to meet the needs of Australian and South East Asian customers.

2. Getting Started

Depending on your application, some parts of this document may be more relevant than others. Some common starting points include:

For establishing a Circuit Switched Data connection between two modems, go to **Circuit Switched Data**.

Information on SMS communications can be found in the **SMS** section.

For wiring information, see section **Data Logger Connection**.

A short description of advanced communications capabilities and Campbell Scientific data logger training is included in the section

Advanced Communications.

For users experiencing issues with their installation, some common troubleshooting tips can be found in the **Troubleshooting** section.

3. Network Coverage

One of the main advantages of using a cellular telephone network is being able to set up a communications link to a data logger virtually anywhere without installing telephone lines. However, this only applies if your installation site is covered by a suitable NextG network.

Before purchasing a NextG modem it is recommended that the coverage is tested on site by using a NextG handset with the same service provider, and measuring the exact signal strength.

Though this manual focuses on use of the Intelimax modem kit with Telstra's NextG service, the Intelimax is compatible with all 3G and GSM frequency bands including those used by Optus, Vodafone and their resellers.

Coverage maps are available from the service providers. Please note however that even though an area is shown as covered on the map, it is important to check the signal strength on site. It is always possible that the location has poor coverage due to interference or other technical reasons.

When installing outside of Australia, contact the local telecommunications provider to source the appropriate SIM card and determine any additional requirements for operating in your area.

As with any network based on radio technology, some local conditions may prevent or interfere with mobile phone reception within coverage areas. Such conditions may include concrete buildings, lift wells, below ground basements, tunnels, mountains and road cuttings.

When in doubt of signal levels on site, make sure to check signal strength before selecting a site and use an appropriate antenna to prevent costly future visits to correct communications problems caused by poor signal reception.

4. Specifications

Operating Temperature: -20°C to 65°C

Storage Temperature: -40°C to 85°C

Supply Voltage: 6V – 32V DC (Reverse Polarity Protected)

Power Consumption (12V)*:

Active Mode = 150mA

Dormant Mode = 50mA

Sleep Mode = 30mA

* dependant on RF conditions

Antenna: FME male (50Ω)

Data Interfaces:

RS232 and Power via RJ45

USB (mini B) for PC interface

Reset Switch for Hardware Reset

Dimensions (mm): 75 x 55 x 26

Weight: 95g

Frequency Bands:

HSUPA/HSDPA/WCDMA: 850MHz/900MHz/1900MHz/2100MHz

GSM/GPRS/EDGE: 850MHz/900MHz/1800MHz/1900MHz

Processor: ARM9 – 32bit (S3C2412)

5. Circuit Switched Data

The modem is sold without an airtime agreement. The user must arrange connection of the modem to a network and have it enabled for data use. The service provider will supply a Subscriber Identification Module (SIM), which is inserted into the Intelimax and acts as a key to enable its use. Telstra is strongly recommended in Australia due to greater coverage.

When setting up the account, the service provider may require some information such as the make and model of the modem being used. They will then set up an account and provide a phone number. This phone number is a voice number. However, voice is not supported in the Intelimax and it is not possible for the data logger to receive data calls (circuit switched data) with a voice number.

A data number is required for circuit switched data and SMS transmissions to the data logger. The service provider will need to know this information when setting up the account and enabling the SIM card. Telstra will need to know that you require a Data Terminating Number. Furthermore, ensure that Bearer Code 2620 is activated on your account. Bearer code 2620 is Telstra's code for data service on NextG. This can be done through the Telstra Business Centre or a suitable reseller of Telstra data services. Telstra Shop employees are not trained in industrial modem use and cannot help you set up a Data Terminating Number.

There are options that can be specified to reduce complexity and cost of the service. You can remove all ancillary services such as Call Waiting, Call Diversion and Message Bank as these are not required.

If the unit is set up with a security code or PIN number, it should be disabled before use with the Campbell Scientific data logger. The security code or PIN number can be disabled by putting the SIM card into a normal digital mobile phone and select the security menu. Exact key presses will depend on the mobile phone used, but from this menu it should be possible to disable the PIN.

If you experience difficulty getting Circuit Switched Data enabled for your SIM card, contact Campbell Scientific Australia.

Warning

The sim card must not be removed while the unit is powered up. This may result in damage to the modem and/or sim card.

Non-Telstra Users

Some users may have experienced reliability problems when calling a NextG modem on the Telstra network from a non-Telstra telephone line. Please see Troubleshooting for more information.

6. Modem Overview

The Intelimax modem is a powerful communications product which employs a quad-band HSUPA/HSDPA/WCDMA/GPRS/EDGE modem module (HUAWEI EM820) with an internal ARM9 processor.



FIGURE 6-1. SIM card slot



FIGURE 6-2. Power and data LEDs



FIGURE 6-3. FME antenna socket



FIGURE 6-4. RJ45 socket, reset button and mini USB socket

6.1 Operation Modes

It is important to note that while it is capable of more advanced operation through the PPP WAN modes, as shipped from Campbell Scientific Australia, the modem is configured for use as a normal serial modem.

PPP WAN mode is not supported by Campbell Scientific Australia at this time. Serial Modem

In this mode, the Intelimax's extra features are disabled and the modem acts as any other serial modem. AT commands can be sent from the terminal (data logger) that will be executed by the modem chipset. Serial modem mode is recommended only for customer who require Circuit Switched Data communications.

Serial modem mode can be used when the Intelimax is being used in place of an older modem such as the Intercel SAM3G+, Modmax or Wavecom modems.

If Circuit Switched Data is desired, no specific configuration of the logger is required.

Note for Modmax Users

If the Intelimax is being used to replace a Maxon Modmax modem, note that the Modmax had some custom AT commands which differ from the normal command set. If the previous program was sending AT commands to the modem e.g. for SMS, it will need modification to function properly. Contact Campbell Scientific Australia for more information.

7. Modem LED Functions

The Intelimax has two LED lights used to indicate its operating state. These can also be used to determine the modem's signal strength.

Note on Units

All Modem signal strength is commonly calculated using dBm. These units are received power at the modem, as a power ratio of received power relative to 1mW. Numbers will always be negative and a lower negative number indicates stronger signal. E.g. -85dBm is better than -95dBm.

The following tables detail the different states the LEDs on the modem can take and what they mean.

TABLE 7-1. PWR LED	
LED State	Description
ON	Strong signal strength (more than -85dBm)
3sec ON, 1sec OFF	Moderate signal strength (between -84dBm and -95dBm)
1sec ON, 1sec OFF	Low signal strength (less than -95dBm)

TABLE 7-2. RSSI/DATA LED	
LED State	Description
1sec ON, 1sec OFF	Modem ONLINE
OFF	Modem OFFLINE

8. Modem Configuration

Like all cell phone modems, the Intelimax has various settings and behaviors which can be configured depending on the modem's intended use.

There are two ways to change these settings: by sending serial strings called AT commands to the modem and by using the modem's configuration software (the GUI).

Modems purchased from Campbell Scientific Australia will be pre-configured with the correct settings to interface with our CR800, CR1000, CR3000 and CR6 data loggers. Some configuration will be necessary for correct use with our CR200X, CR510X, CR10X and CR23X loggers.

8.1 Intelimax Software

The Intelimax configuration software can be used to change settings in the modem. While the software does offer limited support for RS232 connection to the modem, it is strongly recommended to use the USB interface.

8.1.1 Installing USB Drivers

Configuration of the Intelimax modem is done through a Windows software interface (GUI). To use the GUI with full functionality requires the Intelimax drivers to be installed. These drivers are included or can be downloaded from the Maxon website (www.maxon.com.au).

When installing on Windows 7 or later, the drivers should install automatically when the modem is connected to a PC via USB.

When connecting the modem to the GUI, the mini USB must be connected as well as the serial cable to provide power.

Note

Use of the GUI requires both serial power and USB – connecting only USB will not allow use of the GUI.

Once the drivers have been installed, a virtual Ethernet interface will have been created on your PC. This needs to be configured for optimal operation.

To do this on Windows 7, open the Start menu and type “View Network Connections” Click on the link that appears.

You will then see a list of all network interfaces on your PC. Select the one identified as USB Ethernet/RNDIS Gadget, right click and select Properties.

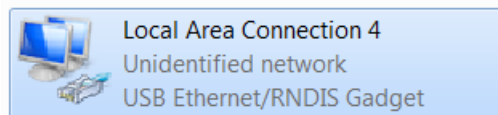


FIGURE 8-1. USB network interface

The following window will appear.

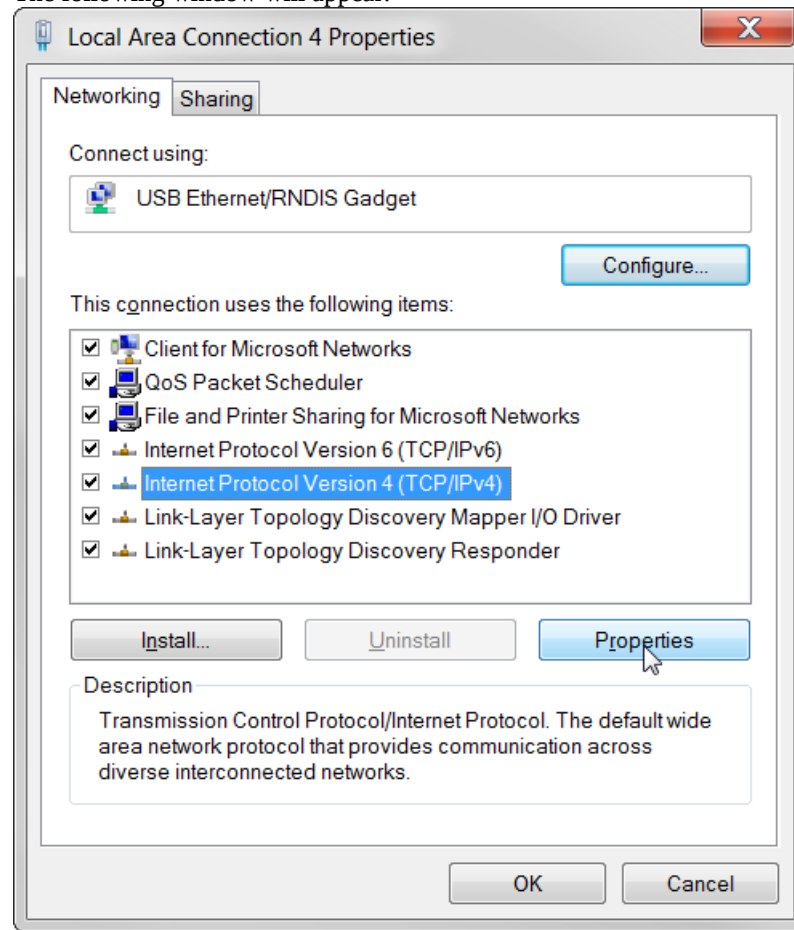


FIGURE 8-2. Connection properties

Select Internet Protocol Version 4 (TCP/IPv4) and click Properties.

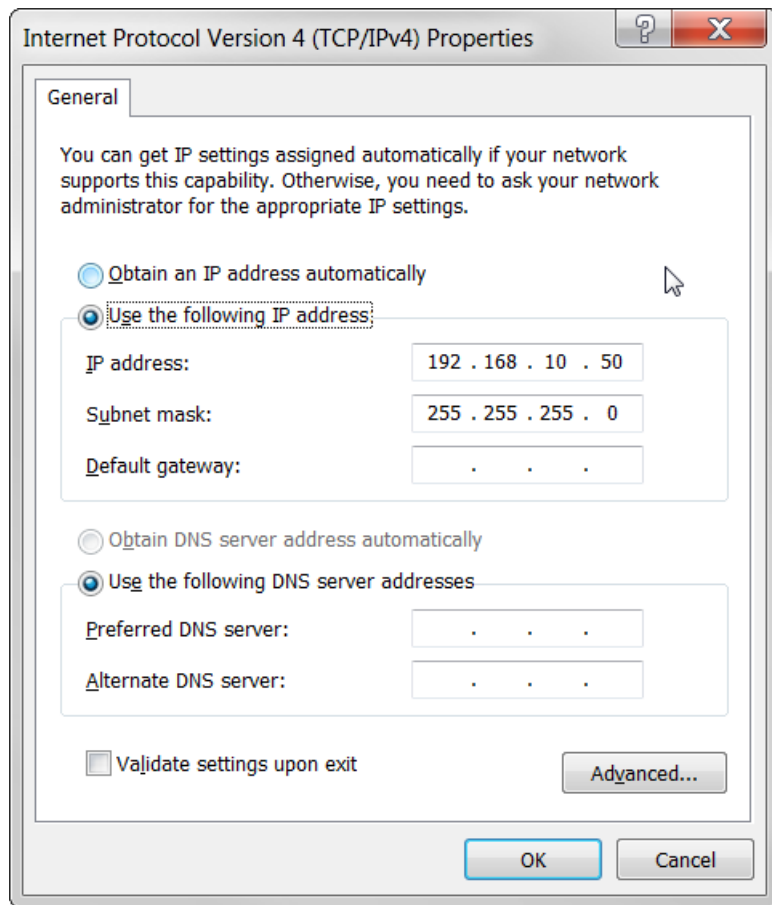


FIGURE 8-3. IPv4 Settings

Fill out the details for the connection as above and select OK. The connection is now properly configured.

The Intelimax manual (available from <http://www.maxon.com.au>) describes the process to connect to the modem using the GUI in the section titled “Connecting to the Intelimax”.

Once the modem is connected to the GUI, various configuration settings can be altered.

8.1.2 Intelimax GUI

This section contains a brief starter on use of the Intelimax GUI software. For a more complete description, refer to the Maxon Intelimax manual available from www.maxon.com.au.

Connect both power and USB to the modem.

Start the GUI software. If the USB drivers are properly installed and configured, “Device found” will appear in the Output Info window.

Although some limited functions are available via a serial connection, USB is strongly recommended.

Click Open.

Output Info will show TCP/IP Connected

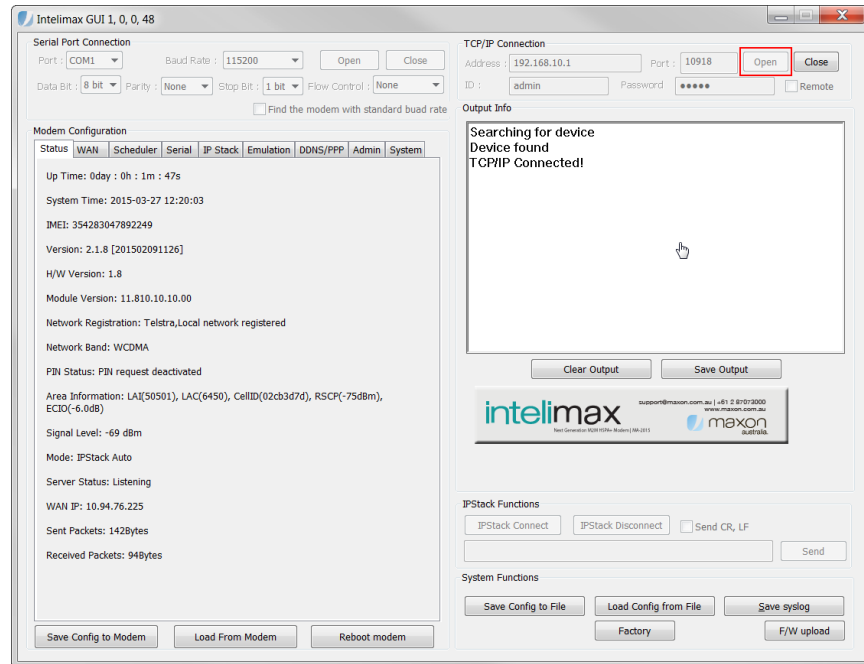


FIGURE 8-4. Connecting via Intelimax GUI

8.2 Configuring the modem for Serial Modem operation

First, follow the steps in the above section to connect to the modem using the Intelimax GUI.

Go to the Serial tab.

Set &D to be 0.

Set Echo to be 1.

These commands can be set using AT commands in a terminal emulator, but the processor in the modem overwrites these values on power up to the values configured through the GUI, so they must be configured in the GUI.

Click on the WAN tab.

Select Mode to be Serial Modem.

Click Save Config to Modem at the bottom of the GUI.

Click Reboot modem at the bottom of the GUI.

8.3 Configuring the modem for IP Stack operation

First, follow the steps in section 8.1.2 to connect to the modem using the Intelimax GUI.

Click on the WAN tab.

Select the Mode that is required.

Update the APN as required (example: telstra.extranet can be used to have a public IP address allocated. This is still a dynamic address, but it is routable. This is required to use DDNS). The APN you choose to use must also be enabled on your data plan with your service provider. The default from Telstra is telstra.internet.

Click on the Serial tab.

Update the settings to suit the data logger to which the modem is being attached (example: for CR200X, 9600 baud must be used).

If the modem is to establish a socket connection to a host or to listen for an incoming connection, configure this in the IP Stack tab.

If DDNS is to be used, enter the relevant details and credentials on the DDNS tab.

When complete, click Save Config to Modem and Reboot Modem.

The modem is now ready to be deployed in this mode.

8.4 AT Commands

AT commands are specially formatted serial strings that can be sent to a modem from a terminal to control and configure it. Examples include ATD to dial a phone number, AT+CMGS to send an SMS and AT&V to output all of a modem's current settings.

The Intelimax may be configured using the GUI. AT commands are not typically required in configuration, operation or troubleshooting.

Campbell Scientific Australia offers professional training courses on a broad range of topics related to data logging, measurement and communications. Our Communications training course provides hands-on training in the use of many communications peripherals, including the use of AT commands with modems.

For additional information, prices and session times, please visit <https://www.campbellsci.com.au/training>.

For more information on AT commands and sending serial strings using our data loggers, consult Section 2 of your Communications training manual.

9. Data Logger Connection

Different models of Campbell Scientific data loggers have a CS I/O port and/or RS232 communication port(s). The Intelimax can be connected to either port. However, the hardware configuration for connection to each port differs. Therefore, there are different kits available. Each kit includes all the necessary equipment required to connect the modem to a Campbell Scientific data logger, on the appropriate communication port.

In addition to the two 9-pin ports, a kit is available to connect a modem to a pair of control ports acting as a 3-wire RS-232 connection.

9.1 RS-232 vs CS I/O

Campbell Scientific CR800, CR1000, CR3000 and CR5000 data loggers all have two serial 9-pin ports on them – RS232, a well established serial interface which can be found on some laptops and CS I/O, which is a proprietary Campbell Scientific serial interface which pre-dates RS-232.

RS-232 can be used to communicate with radios, modems, PCs and other devices while CS I/O can be used to communicate with and power Campbell Scientific devices such as radios, multi-drop interfaces, Wifi interfaces and more.

In addition to the 9-pin RS-232 port available on our loggers, RS-232 capable loggers can also configure a pair of control ports for use as a 3-wire RS-232 connection.

Warning

CS I/O is NOT compatible with RS-232! RS-232 devices will not work properly on a CS I/O port due to different pin configurations and voltage levels. To connect an RS-232 device (such as a modem) to the CS I/O port, an adaptor such as an SC932A will be necessary. DCP-INTELIMAX-CSIO kits are supplied with all necessary interfaces and cables.

9.2 Datalogger I/O Ports for Modem Connection

TABLE 9-1. Datalogger I/O Ports				
Data Logger	Status	CS I/O	RS232	Control (3-wire RS232)
CR500	Retired	Y	N	N
CR510	Retired	Y	N	N
CR10(X)	Retired	Y	N	N
CR21X	Retired	Y	N	N
CR23X	Retired	Y	Y	N
CR9000	Retired	N	N	N
CR200(X)	Active	N	Y(9600 baud)	N
CR800 Series	Active	Y	Y	Y
CR1000	Active	Y	Y	Y
CR3000	Active	Y	Y	Y
CR5000	Retired	Y	Y	Y
CR9000X	Active	Y	Y	Y
CR6	Active	Y	Requires 31056 adaptor	Y

Note: All Campbell Scientific data loggers have control ports however older models cannot use them for RS-232 connection.

9.3 Connection via CS I/O Ports

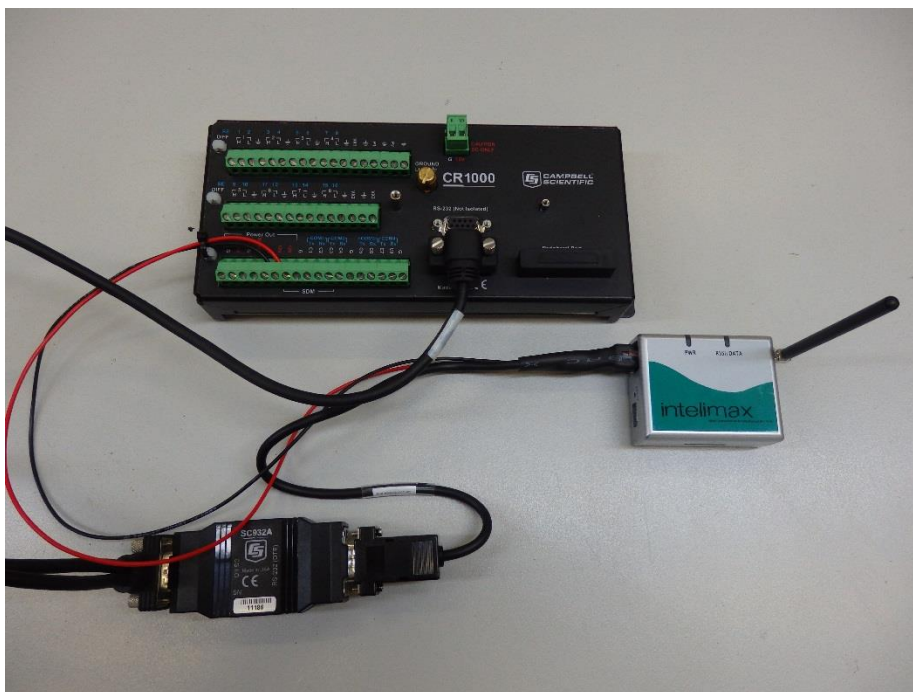


FIGURE 9-1. Modem connection to data logger CS I/O port

TABLE 9-2. Parts Supplied with CS I/O Modem Kit

Part number	Description
14162	Enclosure mounting kit for modem
CSIO-INTELMAX-CBL	DCE RS-232 female to RJ45 cable
MA-2015	Intelimax modem
SC932A	RS-232 to CS I/O converter
ANT-ADAPTER-INTELMAX	FME to SMA adaptor

To connect a new CS I/O modem kit to a data logger, follow these steps:

Connect the CSIO-INTELMAX-CBL's RJ45 connector to the socket on the modem.

Connect the two tinned wires on this cable to the data logger. The red wire connects to 12V and the black wire to the G terminal. The SW12 terminal can be used instead of 12V however as it is a switched supply it needs to be enabled in the datalogger program to function correctly.

Note that SW12 is a switched 12V supply and needs to be enabled in the data logger program to function.

Insert the 9-pin end of the CSIO-INTELMAX-CBL into the RS-232 (DCE) connector on the SC932A.

Finally, connect the male end of the SC12 cable to the logger's CS I/O port and one of the female ends (doesn't matter which) to the CS I/O connector the SC932A

Note

Ensure that the SC932A interface is connected correctly!

It is easy to connect the SC932A the wrong way around – it will not work unless the DCE Device end is connected to the modem and the Datalogger end is connected to the logger's CS I/O port.

The manufacturer-supplied RS-232 cable may be used in place of the CS I/O cable if a longer cable length is required. This cable is supplied with all CSA Intelimax kits.

9.3.1 SC105 Interface

In order to connect via the CS I/O port of the data logger a serial interface is required. Generally a SC932A RS-232 interface is supplied, however in some cases the alternate SC105 RS-232 interface may be used due to customer preference or the requirements of the system.

The SC105 is a more advanced device than the SC932A as it contains more user-definable settings which allow the interface between the modem and logger to be specifically configured and controlled. The following section relates to using the SC105 interface.

In order for the SC105 to work effectively with the Intelimax modem, the SC105 default settings will need to be slightly modified. To change these settings, we recommend using Campbell Scientific's Device Configuration Utility, available from <https://www.campbellsci.com/downloads>. If desired, configuration changes can also be made using a terminal emulator package and the SC105's built in menus.

9.3.2 SC105 Configuration using Device Configuration Utility

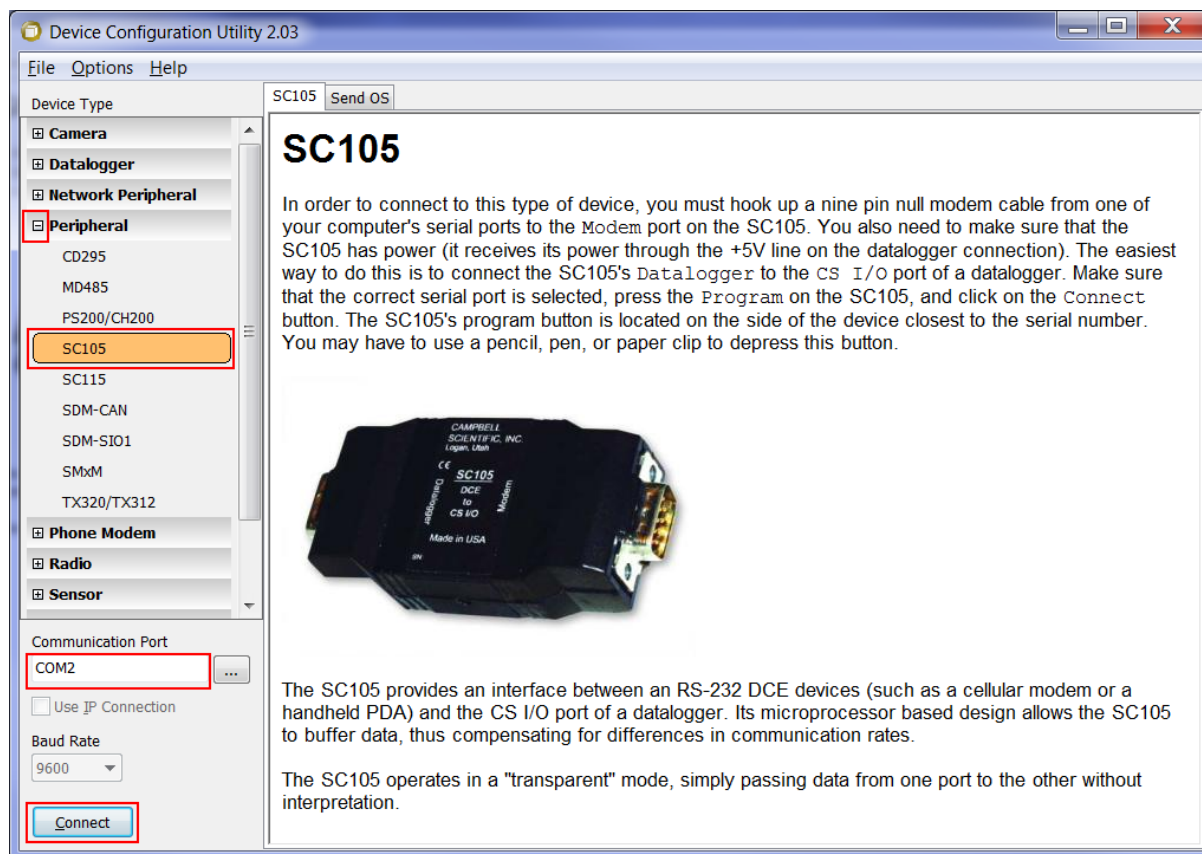


FIGURE 9-2. SC105 connection via Device Configuration Utility

To configure the SC105 using Device Configuration Utility, first connect the female-female null modem cable supplied with the SC105 to your PC's serial port and the Modem connector on the SC105. Next, provide power to the SC105 by connecting the SC12 cable supplied to the SC105's Datalogger connector and the CS I/O port of a datalogger. Once this is done, open Device Configuration Utility, expand the Peripheral section if available and select SC105. Check that the Communications Port selected is the one that you have connected to the SC105, press the green program button on the SC105, then press Connect in Device Configuration Utility.

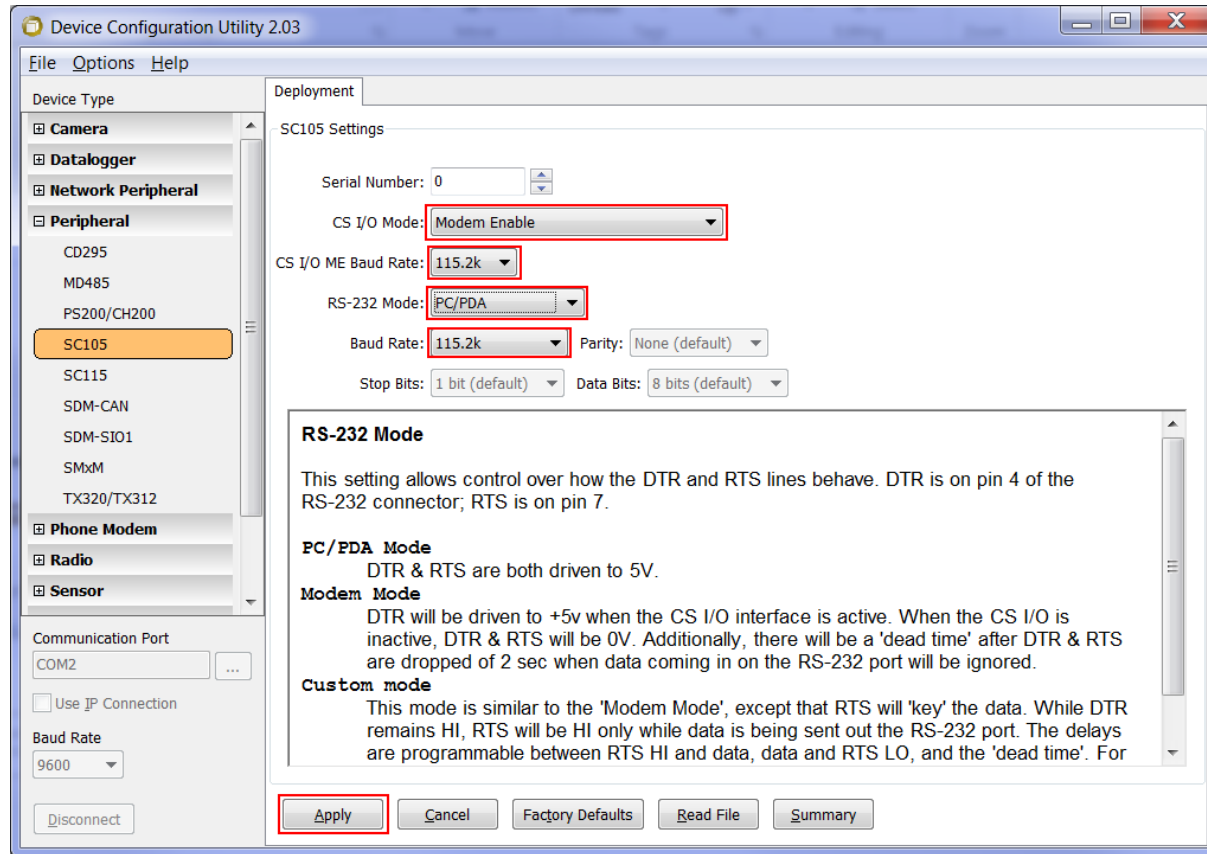


FIGURE 9-3. SC105 deployment configuration

To set up the SC105 for use in the modem kit, configure as below.

TABLE 9-3. SC105 Configuration Settings	
Setting	Description
CS I/O Mode	Modem Enable
CS I/O Baud Rate	115.2k
RS-232 Mode	PC/PDA
Baud Rate	115.2k

Once this is done, click Apply. Connect to the SC105 again and select the Settings Editor Tab. Change the RS-232 Auto Power Down setting to “RS-232 Always Active to power RS-232 devices” and click Apply again. Your SC105 is now configured for use with a DCP-INTELMAX-CSIO modem kit.

9.3.3 Configuring the SC105 using Hyperterminal

To access the menus using Hyperterminal, establish a connection between the serial port and the SC105 using the null-modem cable (included with the SC105). The port settings for this connection should be 9600-8-N-1.

Press the green programming button on the side of the SC105 and the menus will appear in the terminal window.

The required settings for the SC105 are:

- **CS I/O Mode:** The CS I/O interface on the SC105 needs to be set to Modem Enable to allow the modem to interact correctly with the data logger when data is being transmitted. This setting is made in the CS I/O menu in the SC105.
- **CS I/O Baud Rate:** This should be set to 115.2k baud to match the default baud rate of our data loggers' CS I/O port.
- **RS-232 Mode:** This option allows the user to specify what configuration of handshaking lines will be used on the RS-232 side of the SC105. The required setting is PC/PDA mode. This will enable the DTR & DTS handshaking lines to be held high at all times while communication is taking place between the modem and the data logger.
- **Baud Rate:** This should be set to 115.2k baud to match the baud rate of the Intelimax modem.
- **Power Settings:** The 'Auto Power Down' mode should be disabled. When Auto Power Down (APD) mode is enabled, the handshaking lines between the SC105 and the modem can be disabled to save power. The major advantage of using this setting is to maintain the modem's ability to answer circuit switched calls. If the RTS line is not set with this setting, the modem will not properly receive calls. The extra power consumption associated with this setting is negligible.

For more information on the SC105 and its characteristics please consult the SC105 user manual which is available at www.campbellsci.com.au

9.4 Connection via Control Ports

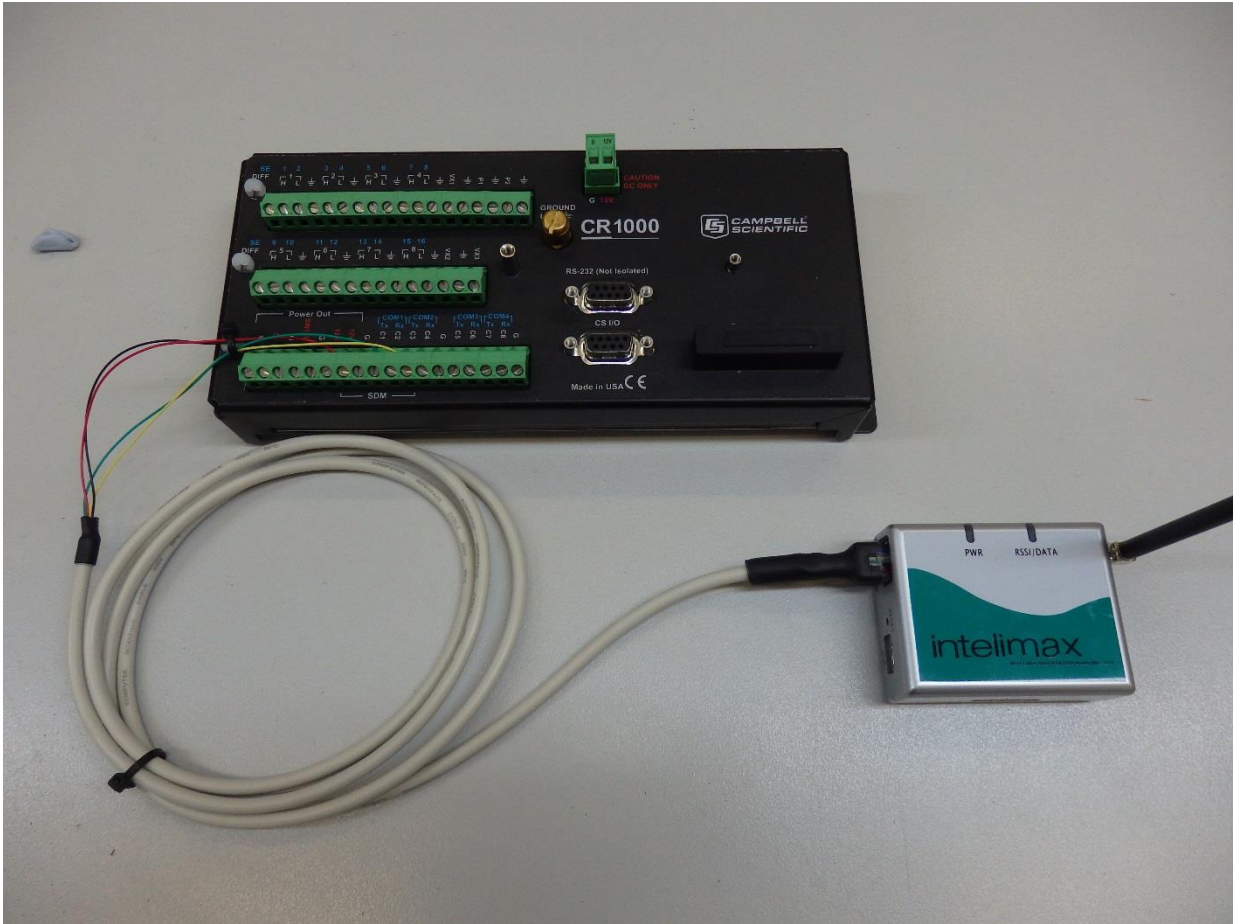


FIGURE 9-4. Modem connection to data logger control port

TABLE 9-4. Parts Supplied with CPORT Modem Kit	
Part number	Description
14162	Enclosure mounting kit for modem
CPORT-INTELMAX-CBL	Control port to RJ45 cable
MA-2015	Intelimax modem
ANT-ADAPTER-INTELMAX	FME to SMA adaptor

To connect a new control port modem kit to a data logger, follow these steps:

- Connect the CPORT-INTELMAX-CBL's RJ45 connector to the socket on the modem.

- Connect the black and red wires on this cable to the data logger. The red wire connects to 12V and the black wire to the G terminal. The SW12 terminal can be used instead of 12V however as it is a switched supply it needs to be enabled in the datalogger program to function correctly.
- Connect the yellow wire to an even-numbered terminal e.g. C1. Connect the green wire to the odd-numbered pair e.g. C2.

9.4.1 Configuring Logger for RS-232 over Control Ports

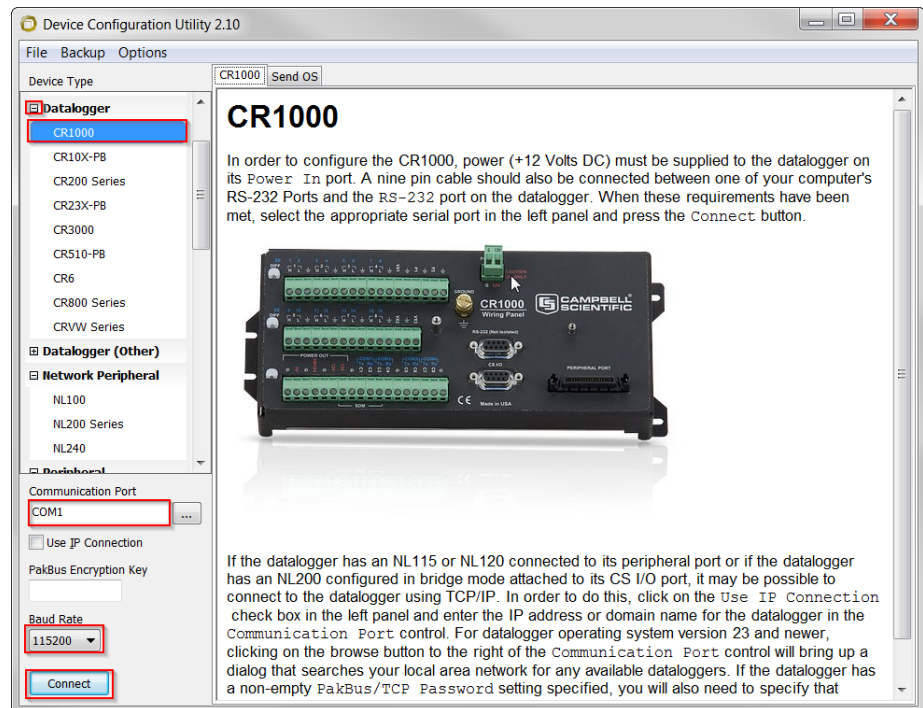


FIGURE 9-5. Connecting with Device Configuration Utility

- In order to set up your data logger to use your control ports for RS-232, you will need to connect to your data logger using Device Configuration Utility.
- Connect a cable to the logger's RS-232 port – this can be a serial cable if your PC or laptop supports one, or a USB-serial cable.
- Provide power to the logger.
- Open Device Configuration Utility.
- Open the Datalogger tab.
- Select your logger from the list.
- Ensure the Communications Port is correct.
- Select Baud Rate. By default, this is 115200 for CR800, CR1000 and CR3000 and is 9600 for CR200X.
- Press Connect.

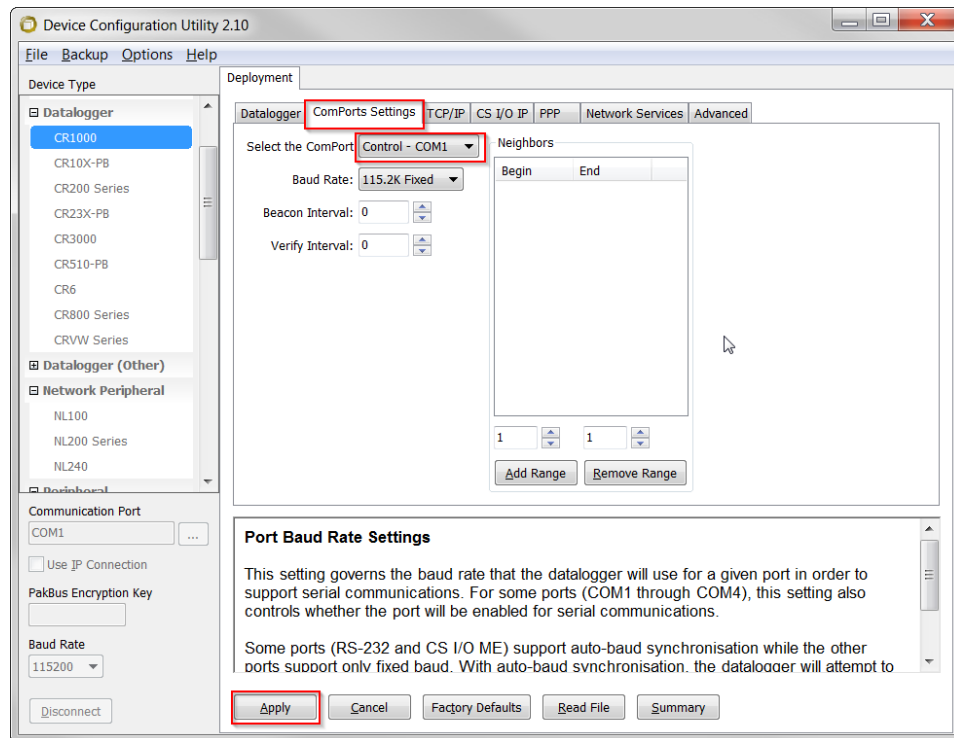


FIGURE 9-6. ComPorts Settings

To complete configuring the logger for RS-232 over the control ports:

- Go to the ComPorts Settings tab.
- Select the COM port that you have wired the modem into.
- Click Apply.

9.5 Connection via RS232 port



FIGURE 9-7. Modem connection to data logger RS232 port

TABLE 9-5. Parts Supplied with RS232 Modem Kit	
Part number	Description
14162	Enclosure mounting kit for modem
RS232-INTELMAX-CBL	DTE RS-232 male to RJ45 cable
MA-2015	Intelimax modem
ANT-ADAPTER-INTELMAX	FME to SMA adaptor

Connect the RS232-INTELMAX-CBL’s RJ45 connector to the socket on the modem.

Connect the two tinned wires on this cable to the data logger. The red wire connects to 12V and the black wire to the G terminal. The SW12 terminal can be used instead of 12V however as it is a switched supply it needs to be enabled in the datalogger program to function correctly.

Note that SW12 is a switched 12V supply and needs to be enabled in the data logger program to function.

Insert the 9-pin end of the RS-232-INTELMAX-CBL into the RS-232 (DCE) connector on the logger.

9.6 Connection via CPI Port

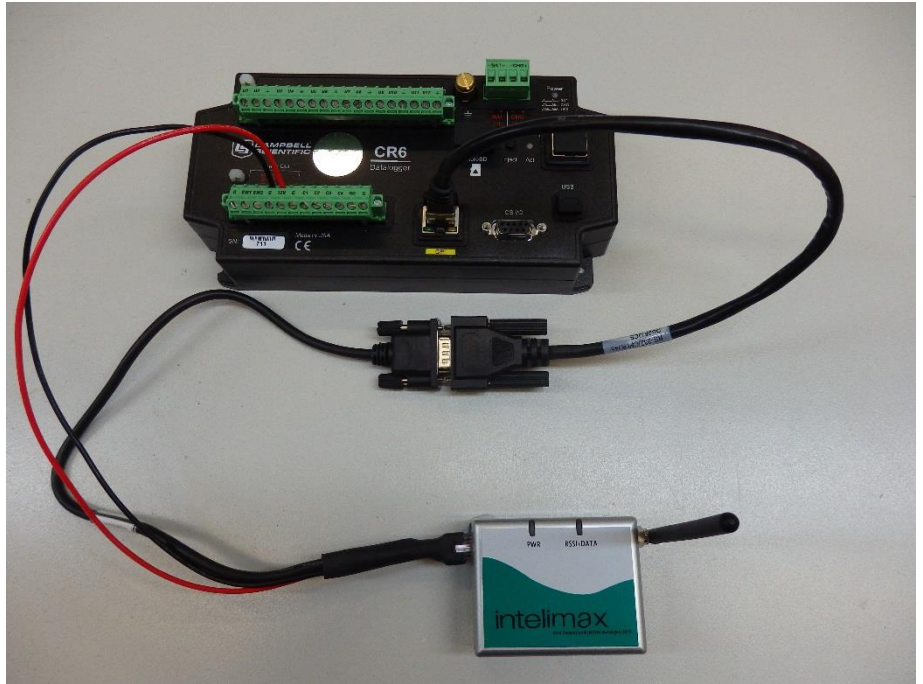


FIGURE 9-8 CR6 Data Logger

With the addition of a 31056 CPI-RS-232 adaptor, connection of the CR6 to the DCP-INTELMAX-RS232 is identical to that described in Section 9.5 with the 31056 adaptor serving as the RS-232 port.

10. Power Considerations

10.1 Current Requirements

Because of the transmitting current drain of cell phone modems, the length and frequency of both incoming and outgoing calls should be considered when determining the best power supply for your system:

- Where pre-determined call intervals are short and infrequent (e.g.: 10 minutes per day), the system can typically be powered by sealed rechargeable batteries supplemented by a charging source (AC power or solar panel)
- For longer calls or more frequent time intervals (e.g.: 20 to 30 minutes every hour), a deep-cycle battery trickle-charged by AC power would be a better option for powering the system.
- When communications between the data logger and a computer must be available for long periods of time, AC power may be required.

Use the current consumption numbers in the Specifications section to calculate the power consumption of your modem and the size of battery, solar panel and charging regulator that you will require.

10.2 Switched Power

In order to reduce the current consumption of the modem, power to the modem can be switched on and off at different times or under certain circumstances by utilizing the Switched 12V supply or by using an external relay circuit. Details of an external relay circuit can be found in the installation section of your data logger manual. Common configurations include having the modem switch on for 10 minutes per hour or switching the modem off during night time in solar powered systems.

Switched 12V power can be supplied by the data logger on its SW12 channel. Note that this output is controlled by the datalogger program and is disabled by default – a modem plugged into an unconfigured data logger's SW12 will be unpowered. In order to use SW12, the logger's program must be written to switch the power on and off using the SW12() instruction in CRBasic.

10.2.1 SW12 and Remote Program Upload

Warning

Exercise caution when loading new programs over the modem link if the modem is powered by SW12. If the new program is not properly configured, this can cause the modem to lose power and the station may no longer be contactable.

One good way to avoid this situation is to insert a SW12(1) statement in your CRBasic program between the BeginProg and Scan() statements – this will ensure that one of the first things the logger will do after receiving its new program is power on the modem.

A default.crx file can also be used to prevent the modem turning off in case a program send is interrupted and no program is left running in the logger. For more information on the default.crx file, see your datalogger manual.

11. Additional Hardware

11.1.1 Power Supply

The Intelimax modem can be powered in a number of ways. The power supply wires can be connected directly to battery terminals, to the logger 12V or SW12V supplies or to some external relay circuit. Custom data logger programs can be used to control power to the modem using SW12 or a relay. See the data logger manual for details of using the switched 12V supply.

11.1.2 Antenna and Surge Protection

Additional to the cell phone modem kit an antenna is required for deployment and operation. For most locations, a 3dB antenna will be suitable for remote operation. In low signal areas however, a 6.5dB antenna may be necessary.

Signal gain is increased by the power rating of the antenna and reduced by the length of connecting coaxial cable. For every 5m of cable the effectiveness of an antenna will be reduced by about 1.75dB.

An external antenna is a risk to sensitive electronics within an enclosure if a lightning strike hits the station. Campbell Scientific Australia has a surge protector available suitable for bulkhead mounting with an FME to N-Type adapter cable and N-Type external connection for the antenna. Antennas used in conjunction with this will need to include an N-Type termination antenna rather than an FME type.

For more information, contact a Campbell Scientific Australia Application Engineer.

Replacing Modems

If the Intelimax is being used to replace a Modmax, SAM3G+ or other modem with SMA antenna connection, a FME to SMA adaptor will be necessary to allow the Intelimax to be attached to the existing antenna cable.

11.1.3 Mounting Equipment

The Intelimax is supplied with a mounting bracket for mounting in environmental enclosures. The modem can be easily removed from this bracket if necessary.

Antenna mounts will differ depending on the type and size of the antenna, for a suitable mount for your enclosure or tower please contact Campbell Scientific Australia.

12. SMS

This section is for users who write their own datalogger programs. SMS is a function available in many of the modems on the market today. When used with a datalogger, SMS can be a useful tool for alarming, and/or for controlling the datalogger remotely. Each modem has a range of commands used to send an SMS and to check, read and delete messages received. Below are some of the commands that can be used with 3G and GSM modems including the Intelimax.

TABLE 12-1. Simple AT Commands for SMS

Command	Action Performed
AT+CMGS	Send an SMS from the modem
AT+CMGL	List SMS messages received
AT+CMGR	Read and SMS received
AT+CMGD	Delete an SMS received

Refer to the Intelimax manual for more details on the commands listed and additional commands that can be used.

The process of sending an SMS can be automated in the datalogger. The datalogger can also be programmed to read and delete messages in the modem. Note: Edlog based loggers have limited SMS capabilities. For details on datalogger programming please refer to the relevant datalogger manual.

12.1 Serial vs TCP/IP

The Intelimax modem is capable of sending and receiving SMS messages in two modes: Serial Modem mode and PPP WAN mode.

PPP WAN mode is not supported by Campbell Scientific Australia at this time.

12.1.1 Serial Modem Mode

In Serial Modem mode, the modem acts as any other Hayes modem and can send or receive Circuit Switched Data (CSD) calls. In addition, while CSD is not active, the modem can send or receive SMS messages.

While both CSD and SMS can be used in this mode, they cannot be used at the same moment and data logger programs must be constructed to ensure only one type of communications occurs at one time.

While PPP connection and subsequent TCP/IP communications are technically possible in this mode, this disables both CSD and SMS for the duration of the connection. If any form of IP communications are required, use of PPP WAN mode is recommended.

12.2 Example Serial Program

The following program example sends a single SMS when the temperature of a thermocouple exceeds 30 degrees Celcius.

```

' This program demonstrates how to use the CR1000 serial instructions to send an SMS
' using a Intelimax modem
'
' === WIRING =====
'
' ComRS232 Intelimax
'
' 1H      Thermocouple +, (red stripe)
' 1L      Thermocouple -, (blue wire)
'
' === DECLARATIONS =====
'
' -- Constants -----
Const COMPORT = ComME      ' Comport Used for Serial I/O
'
' -- Public Variables -----
Public Batt_Volt            ' Battery supply voltage
Public P_Temp              ' The logger's wiring panel temperature
Public AirTemp_TC          ' Air temperature as measured by a thermocouple
Units Batt_Volt = "V"
Units P_Temp = "degC"
Units AirTemp_TC = "degC"
'
' === SUBROUTINES =====
'
Public SMS_PhNo As String   ' The cellphone number of the recipient
Public SMS_Msg As String * 160 ' The SMS message to send
Public SMS_Result          ' Set to 0 when there has been an error sending an sms
'
' === DATA TABLES =====
'
'Data table to store ten minute temperature data
DataTable (TenMin,1,-1)
  DataInterval (0,10,Min,10)
  Minimum (1,Batt_Volt,FP2,0,False)
  Sample (1,P_Temp,FP2)
  Average (1,AirTemp_TC,FP2,False)
  Maximum (1,AirTemp_TC,FP2,False,False)
  Minimum (1,AirTemp_TC,FP2,False,False)
EndTable

' Datatable to store the last 100 messages sent by the modem
DataTable (SMSSent,True,100)
  Sample (1,SMS_Result,FP2)
  Sample (1,SMS_PhNo,String)
  Sample (1,SMS_Msg,String)
EndTable

Sub SMSSend
  ' Open the serial port
  SerialOpen (COMPORT,115200,3,0,1000)
  ' Send the SMS command to the modem (eg. AT+CMGS=0412345678) and wait for ">" to be
  ' returned
  SMS_Result = SerialOut (COMPORT,"AT+CMGS=" + CHR(34) + SMS_PhNo + CHR(34) +
CHR(13),">",1,100)
  ' Check to see if we received the response we expected (0 indicates an error)
  If SMS_Result <> 0 Then
    ' Send the SMS message to the modem
    SerialOut (COMPORT,SMS_Msg,"",1,100)
    ' Terminate the message with a CTRL-Z character and wait for CMGS to be returned
    SMS_Result = SerialOut (COMPORT,CHR(26),"+CMGS:",1,500)
  EndIf
  ' Close the serial port
  SerialClose (COMPORT)

```

```

' Store the sent message to a datatable
CallTable SMSSent
EndSub

' === PROGRAM START =====

BeginProg
' Set a default value for the SMS number (this can be changed in the
' Connect screen in LoggerNet)
SMS_PhNo = "0412345678"

' === MAIN SCAN =====

Scan (15,Sec,0,0)
' Measure the panel temperature
PanelTemp (P_Temp,_50Hz)
' Measure the battery voltage
Battery (Batt_Volt)
' Measure the thermocouple
TCDiff (AirTemp_TC,1,mV2_5C,1,TypeT,P_Temp,True ,0,_50Hz,1.0,0)

' If the temperature is above 30 degrees, then send the SMS
If AirTemp_TC > 30 Then
' Create message to be sent
SMS_Msg = "Temperature is"+CHR(32)+AirTemp_TC+CHR(32)+"Degrees Celsius"
' Send SMS message
Call SMSSent
EndIf

' Call data table to store data
CallTable TenMin
NextScan

EndProg

```

13. Advanced Communications

Our CR6, CR800, CR1000 and CR3000 data loggers are capable of TCP/IP communications including email, FTP and more by utilising Point-to Point Protocol (PPP) to send IP packets through the Intelimax over a serial link.

Use of these options requires custom data logger programs and configuration and is beyond the scope of this manual. If you are interested in IP communications or if you wish to learn more about telemetry options and their use, contact Campbell Scientific Australia for information and a quote on our Communications training course, held in Townsville and Sydney once per the year.

For more information including costs and course schedules, see <https://www.campbellsci.com.au/training>.

14. Troubleshooting

Campbell Scientific Australia's modem kits are designed to for ease of use and simplicity. Even so, there are sometimes issues when installing, especially for the first time.

When encountering a problem with a modem installation, follow these steps in order. What follows is a list, starting with the most common, of problems which are often encountered in modem installation.

14.1 Power

Check whether the PWR LED on the modem has turned on. Fully on indicates the modem is powering up, flashing indicates successful network registration.

14.1.1 SW12

If using SW12 and the modem does not appear powered up, temporarily wire the modem to the logger's 12V terminal. If the modem then powers up, the program in the datalogger used to control the SW12 port may be at fault.

14.1.2 SIM Card

The SIM card should be inserted into the modem as shown in section 6. Note the picture above the SIM slot on the modem that indicates correct orientation of the SIM card.

14.1.3 Antenna

Ensure that the antenna (and surge suppressor, if applicable) is connected to the modem. Inspect cables and connections for damage or loose wires.

14.1.4 SC932A/SC105 Orientation

When using the CS I/O kit, it is possible to connect the modem and logger to the incorrect inputs on the device. Please check wiring against the figure 4.1 in section 9.

14.1.5 Network Coverage

This can be easily tested if you have a mobile phone on the Telstra network. If not, you can check using the LEDs on the modem as described in section 7.

For a more accurate measurement of signal strength, this can be determined by connecting to the modem with a terminal program (See section 7.2.1) and sending AT+CSQ followed by the Enter key. The modem will return two numbers in the form +CSQ: x,y where x is your signal strength (0-31, 31 is best) and y is your bit error rate - you can normally disregard this second number. If your signal strength is lower than 9, you may experience disconnections and low data rates.

14.1.6 Baud Rate

The default for the modem is to communicate at 115200 to any device. For some Campbell Scientific data loggers, such as the Array-Based data loggers, the maximum baud rate is 9600. Please check the data logger manual for maximum baud rate and program the modem accordingly.

14.1.7 SIM PIN

Telstra SIMs have a PIN set by default, so if you did not specify it, then your SIM card most likely has one. To disable the PIN you need to put the card into a normal digital mobile phone and select the security menu. Exact key presses will depend on the mobile phone used but from this menu you should be able to disable the PIN. Alternatively the following command can be used to disable the PIN: `AT+CLCK="SC",0,"XXXX"` where XXXX is the pin number. The quotes are required.

14.1.8 CSD Data Service

If the modem needs to send or receive calls, it will need Circuit Switched Data (CSD) enabled.

This will be a separate number to your voice number. If you only have one phone number for the phone then it is most likely the voice number. Check with your service provider to enable the data service using Bearer Code 2620 – see Section 3. This is the number that the modem must be called on. If you have difficulty getting a data number activated on your SIM, contact Campbell Scientific.

14.1.9 GUI Issues

If the Intelimax GUI becomes unresponsive or does not appear to detect the modem when attached, restart the software. This fixes most issues.

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