



SC105

CS I/O to RS-232 Interface



Guarantee

This equipment is guaranteed against defects in materials and workmanship. We will repair or replace products which prove to be defective during the guarantee period as detailed on your invoice, provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific
- Batteries
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About this manual

Please note that this manual was originally produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

Area: 1 in ² (square inch) = 645 mm ²	Mass: 1 oz. (ounce) = 28.35 g 1 lb (pound weight) = 0.454 kg
Length: 1 in. (inch) = 25.4 mm 1 ft (foot) = 304.8 mm 1 yard = 0.914 m 1 mile = 1.609 km	Pressure: 1 psi (lb/in ²) = 68.95 mb Volume: 1 UK pint = 568.3 ml 1 UK gallon = 4.546 litres 1 US gallon = 3.785 litres

In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to European users.

Differences include the U.S standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for British/European use. *Please note, however, that when a power supply adapter is ordered it will be suitable for use in your country.*

Reference to some radio transmitters, digital cell phones and aerials may also not be applicable according to your locality.

Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the European market; in some cases alternatives are offered. Details of the alternatives will be covered in separate manuals.

Part numbers prefixed with a “#” symbol are special order parts for use with non-EU variants or for special installations. Please quote the full part number with the # when ordering.

Recycling information



At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the products life should be removed from the product and also be sent to an appropriate recycling facility.

Campbell Scientific Ltd can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories.

For further advice or support, please contact Campbell Scientific Ltd, or your local agent.



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Safety

DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND **TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.** FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at www.campbellsci.eu or by telephoning +44(0) 1509 828 888 (UK). You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

General

- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical

- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines.**
- Maintain a distance of at least one-and-one-half times structure height, or 20 feet, or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.

Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.

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SC105 CS I/O to RS-232 Interface

1. General Description



FIGURE 1-1. SC105 CS I/O to RS-232 Interface

The SC105 (FIGURE 1-1) is used to interface a Campbell Scientific data logger to any modem that is configured with an RS-232 DCE (Data Communications Equipment) serial port. The SC105 is an intelligent interface that buffers data (1 kB buffer size), allowing many RS-232 data rates, and all CS I/O port modes.

Features include:

- True RS-232 signal levels.
- Power for the SC105 is supplied from the 5 V supply on pin 1 of the data logger's CS I/O port. The SC105 will use the 5 V supply to power the RS-232 modem if needed.
- Two way (interactive) communication.
- Supports most RS-232 baud rates.
- Supports all CS I/O port modes.

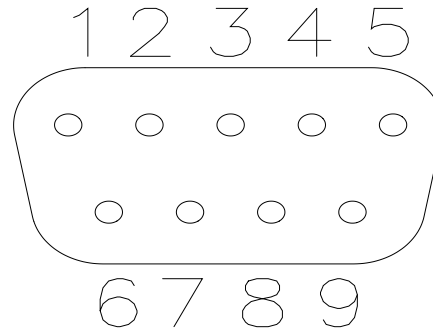
The SC105 is frequently used with a short haul modem to communicate across a dedicated line made of two pairs of twisted wire with a shield. Section 3, *Set-up Menu*, describes the details of this application using a short haul modem built by RAD.

The SC105 is also commonly used with satellite transmitters, cellular modems, and spread spectrum radios.

The SC105 also supports one-way output or printer communication.

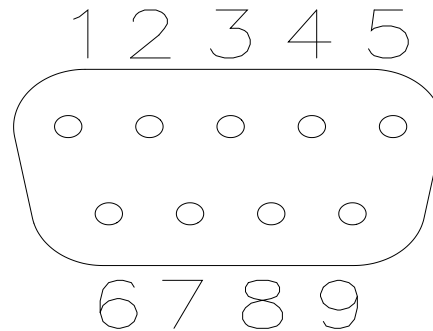
2. Specifications

RS-232 9-Pin Male Connector Pin-out:



Pin No.	I/O	Name	Description
1	In	DCD	Data Carrier Detect (No Connection)
2	In	RXD	Received Data
3	Out	TXD	Transmitted Data
4	Out	DTR	Data Terminal Ready
5		GND	Signal Ground
6	In	DSR	Data Set Ready (No Connection)
7	Out	RTS	Request to Send – Modem Enable
8	In	CTS	Clear to Send
9	In	Ring	Rings Data Logger

CS I/O 9-Pin Male Connector Pin-out:



Pin No.	I/O	Name	Description
1	In	+5 V	Regulated 5 Volt supply
2		GND	Ground
3	Out	Ring	Ring signal to data logger
4	Out	RXD	SC105 transmits on this line
5	In	ME	Modem Enable—must be high for transfer in ME mode
6	In	SDE	Synchronous Device Enable
7	In	CLK/HS	Clock/Handshake (for synchronous communication)
8		+12 V	Not Used
9	In	TXD	SC105 receives on this line

RS-232 Baud Rates:	The SC105 will support the following baud rates: 1200, 9600, 19200, 38400, 57600, and 115200
RS-232 Parity and Data	
The SC105 supports the following:	
Parity:	Even, Odd, None
Data Bits:	7, 8
CS I/O Port Modes:	CSDC, SDC, ME, <i>Addressed Print Device</i> for P96 output
Electrical:	The SC105 uses power from the +5 V line on the 9-pin interface connected to the data logger
Current	
Standby:	0.16 mA
Communicating:	1 to 4 mA
	Additional current (up to 8 mA) from the 5 V supply may be used by the RS-232 device connected to the SC105
Physical	
Height:	2.3 cm (0.9 in)
Width:	4.1 cm (1.6 in)
Length:	8.9 cm (3.5 in)
Weight:	45.4 g (1.6 oz)
Environmental	
Temperature:	-25° to +50°C
Humidity:	up to 95% non-condensing
Compliance Documents:	View at www.campbellsci.eu/sc105



3. Set-up Menu

The SC105 has a built-in set-up menu for configuring communication mode, CS I/O port configuration, RS-232 port configuration, and other parameters. The Set-up Menu is shown in FIGURE 3-1. It is accessed by connecting the SC105’s RS-232 port to a PC with the included null modem cable. The SC105 also needs to have power. Usually, the SC105 is powered by connecting the SC105’s CS I/O port to the CS I/O port of a data logger.

With the null modem connection to the PC, typically Campbell Scientific’s *Device Configuration Utility (DevConfig)* is used, but a terminal program such as *HyperTerminal™* or *Procomm™* (always 9600 baud, 8-N-1) can also be used. Press the **Program** button on the SC105 for one second to access the Set-up Menu. Changed settings are saved in flash memory by selecting **Apply** in DevConfig or menu item **4** if using HyperTerminal or Procomm. If left idle, the Set-up Menu will time out 60 seconds after the last received character and exit without saving any parameter changes with the message “Set-up Timeout.” A data logger can remain connected to the CS I/O port (to provide power to

SC105) while setting SC105 parameters on the RS-232 port, although CS I/O communications would be inactive until exiting the Set-up Menu.

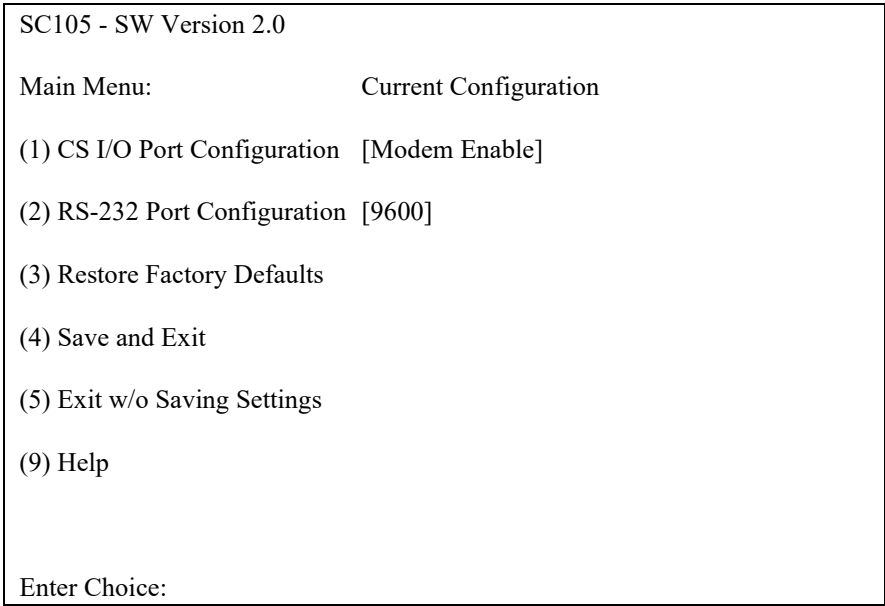


FIGURE 3-1. Set-up Menu

3.1 Set-up Menu Selections

1) CS I/O Port Configuration

An SC105 may be activated either by the Modem Enable signal or by a Synchronous Device (SDC) address (7, 8, 9, 10, or 11).

If PakBus Networking is being used, SDC address 7, 8, 10, or 11 should be selected.

2) RS-232 Port Configuration

RS-232 baud rate, data bits, and parity are configured here, as well as the RS-232 Auto Power Down (APD) Mode. The APD mode should be left enabled, unless the attached RS-232 device requires power from the RS-232 lines.

The DTR and RTS Mode setting allows control over how these two lines behave.

DTR is on pin 4 of the RS-232 connector; RTS is on pin 7.

‘PC/PDA mode’: DTR and RTS are both driven to 5 V.

‘Modem mode’: DTR will be driven to +5 V when the CS I/O interface is active for Modem Enable, SDC Address 9, and Addressed Print Device configurations. When the CS I/O is inactive, DTR will be 0 V.

Additionally, there will be a ‘dead time’ after DTR is dropped of 2 seconds when data coming in on the RS-232 will be ignored.

For SDC Address 7, 8, 10, or 11, DTR will always be driven to +5 V.

RTS will ‘key’ the data; it will be driven (+5 V) 20 ms prior to data being sent out the RS-232, and remain driven for 5 seconds after the last data is sent out the RS-232.

‘Custom mode’: This mode is identical to the ‘Modem mode’, except the delays between RTS HI and data, data and RTS LO, and the ‘dead time’ are all configurable.

4. Installation

Connect the SC105 to the RS-232 device and to the data logger with the SC12 9-pin cable. If the device has a 25-pin connector, a 9-pin female to 25-pin male adapter is required.

Proper transient protection should be installed to protect the computer and data logger in areas where damage due to lightning is possible. If this is a RAD modem application, see Section 5.2, *RAD Modem Wiring and Grounding*.

5. RAD Modem Application

The SC105 can be used with a short-range modem to communicate across a 4-wire, unconditioned dedicated line. Campbell Scientific offers a mounting bracket that will mount the RAD, SC105, and adapter to the back plate in a Campbell Scientific enclosure. This section describes using a short-range asynchronous modem, SRM - 5A RAD modem.

For transmission, the RAD modem uses a cable made of two pairs of twisted wires with a shield. Data rates up to 9600 bps are possible. The low voltage transmission levels minimize cross talk between adjacent lines within the same cable. Data are transmitted and received at a balanced impedance, providing excellent immunity to circuit noise. TABLE 5-1 gives the data rate possible for several gauge cables across several distances.

Data Rate	19 Gauge (0.9 mm)		24 Gauge (0.5 mm)		26 Gauge (0.4 mm)	
	miles	km	miles	km	miles	km
9,600	6.2	10.0	2.8	4.5	2.0	3.3
1,200	7.6	12.2	3.4	5.5	2.5	4.0

5.1 RAD Modem – Two Way

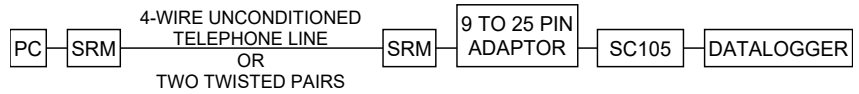


FIGURE 5-1. Two Way Communication

When using Campbell Scientific's data logger support software to communicate through the SC105/RAD modem, "Set-up" the link as a direct connect between the data logger and the desired COM port. Start two way communication using the **Connect** button on the tool bar and the **Connect** button in the *Connect* window.

5.2 RAD Modem Wiring and Grounding

FIGURE 5-2 shows a typical set-up of the RAD modems. Installation is as follows:

1. Set the DCE/DTE switch on the back of the RAD modem connected to the SC105 to DCE. For a RAD modem connected to a PC, set the DCE/DTE switch to DCE. For a RAD modem connected to a serial printer, set the DCE/DTE switch to DTE.
2. Select a cable with two or more twisted pairs. Direct burial rodent or gopher resistant cable is recommended.
3. Wiring connections are made as shown in FIGURE 5-2. Note wires labeled A and B are one twisted pair of the cable. Wires labeled C and D are the other twisted pair.
4. Transients induced on the communication line may damage any electronics connected at either end of the line. To decrease the chances for damage, spark gaps should be installed as shown in FIGURE 5-2. The transient protection shown may be purchased from Campbell Scientific (FIGURE 5-2). Spark gap wiring is straight through such that pin to pin continuity exists between the two modems. If the modems are installed entirely within a building, the transient spark gap protection is probably not needed.

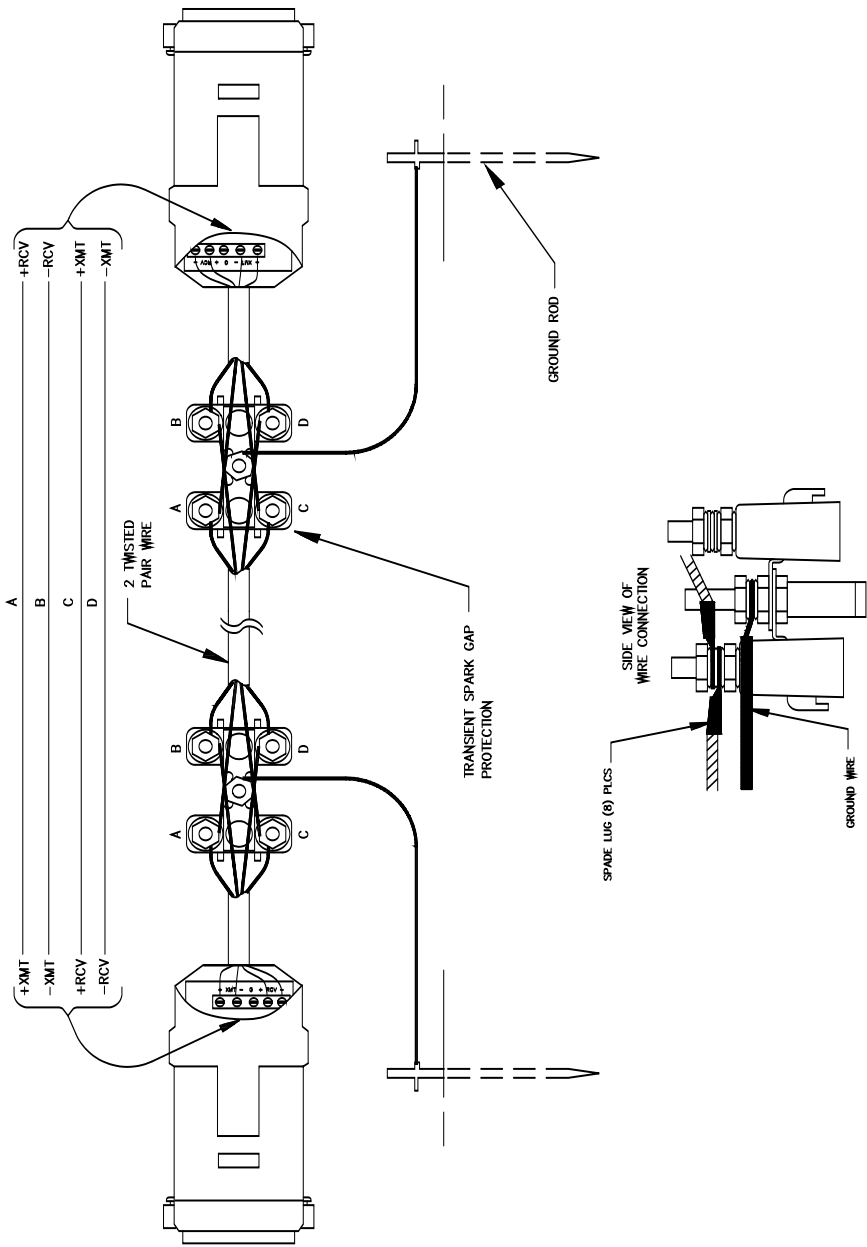


FIGURE 5-2. Installation of Spark Gap Protection

Occasionally, a customer needs to transmit data across longer or smaller gauge wires or at higher speeds than can be done with the RAD modem powered by the SC105. RAD does sell a 9-volt power supply that will boost the signals enough to meet some of these more demanding applications. Please contact RAD for more information.

5.3 Testing RAD Modem Communication

The modem communication link is divided into the following three sections:
1) RAD modem computer end, 2) cable from computer modem to data logger modem, 3) RAD modem data logger end. When unable to establish

communication with the data logger, test each of the three sections. See a blog article at: www.campbellsci.com/blog/test-com-ports-short-haul-modems.

Before proceeding through the testing procedures, a terminal emulator software program such as Campbell Scientific Terminal Emulator (included with LoggerNet, PC400 and Device Configuration Utility) must be used to communicate through the COM port of the computer. Once the emulator program is set up, testing can proceed as follows:

1. Disconnect the four conductor cables from the SRM-6A RAD modem at the computer end. Jumper the XMT + to RCV + and jumper the XMT – to RCV –. This creates a transmit loop which allows any key pressed at the computer keyboard to be seen on the screen. If the key pressed is not seen, check the following: COM port configuration, 25-pin cable from the computer to the modem, and the RAD modem.
2. Reconnect the four conductor cables to the modem at the computer end and disconnect the cable from the modem at the data logger end. Twist together the XMT + wire and RCV + wire, twist together the XMT – wire and the RCV – wire. Repeat step 1 by pressing a key on the computer keyboard. If the key pressed is not returned, then the cable from the modem at the computer to the data logger modem is defective and will need to be repaired or replaced.
3. If steps 1 and 2 pass, the modem at the data logger is suspect. Disconnect the modem from the SC105 and bring the modem to the computer site. Attach the modem to the computer, and repeat step 1 by jumpering the terminals of the modem and pressing a key on the computer keyboard.

If the above tests pass and communication to the data logger still has not been established, perform tests 4, 5, and 6.

4. A 12 V lead acid battery supply should not be discharged below 11.76 V. If this occurs, the batteries will go into a deep discharge state and will need to be replaced. Check the 12 V supply with a voltmeter.
5. On the wiring panel of most Campbell Scientific data loggers there is a terminal marked 5 V. Check the 5 V supply with a voltmeter. This 5 V supply should be within a tenth of a volt. If not, it would indicate a problem.
6. To verify that the data logger and its serial I/O port are working, try to access input memory locations using a laptop PC with the SC105 (using a null modem cable connection). Configure the SC105 CS I/O Port to Modem Enable for this test.

If the data logger passes tests 4 and 5, but fails test 6, then the SC105 is suspect and will need to be repaired or replaced.



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