

INSTRUCTION MANUAL



SC932A CS I/O to **RS-232-DCE Interface**

Revision: 9/16



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This equipment 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. ***** **Batteries are not warranted.** ***** 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.

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14532 131 Avenue NW | Edmonton AB T5L 4X4
780.454.2505 | fax 780.454.2655 | campbellsci.ca

Assistance

Products may not be returned without prior authorization. The following contact information is for Canadian and international clients residing in countries served by Campbell Scientific (Canada) Corp. directly. Affiliate companies handle repairs for clients within their territories. Please visit www.campbellsci.ca to determine which Campbell Scientific company serves your country.

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CAMPBELL SCIENTIFIC (CANADA) CORP.

RMA# _____
14532 131 Avenue NW
Edmonton, Alberta T5L 4X4
Canada

For all returns, the client must fill out a "Statement of Product Cleanliness and Decontamination" form and comply with the requirements specified in it. The form is available from our web site at www.campbellsci.ca/repair. A completed form must be either emailed to repair@campbellsci.ca or faxed to (780) 454-2655. Campbell Scientific (Canada) Corp. is unable to process any returns until we receive this form. If the form is not received within three days of product receipt or is incomplete, the product will be returned to the client at the client's expense. Campbell Scientific (Canada) Corp. reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.

Precautions

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.ca or by telephoning (780) 454-2505 (Canada). 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 personnel (e.g. 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.
- 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, 6 meters (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 CLIENT 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.

PLEASE READ FIRST

About this manual

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

Some useful conversion factors:

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

In addition, part ordering numbers may vary. For example, the CABLE5CBL is a CSI part number and known as a FIN5COND at Campbell Scientific Canada (CSC). CSC Technical Support will be pleased to assist with any questions.

About sensor wiring

Please note that certain sensor configurations may require a user supplied jumper wire. It is recommended to review the sensor configuration requirements for your application and supply the jumper wire is necessary.

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SC932A CS I/O to RS-232-DCE Interface

1. General Description



FIGURE 1-1. SC932A CS I/O to RS-232-DCE Interface

The SC932A (FIGURE 1-1) is used to interface a Campbell Scientific datalogger to any modem that is configured with an RS-232 DCE (Data Communications Equipment) serial port. Features include:

- True RS-232 signal levels.
- Power for the SC932A is supplied from the 5 V supply on pin 1 of the datalogger's CS I/O port. The SC932A will use the 5 V supply to power the RS-232 modem if needed.
- Two-way (interactive) communication.

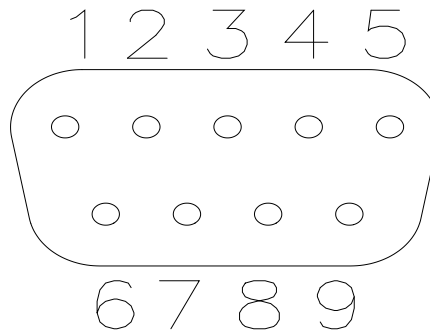
The SC932A is frequently used with a short haul modem to communicate across a dedicated line made of two pairs of twisted wire with a shield. Section 3, *Installation* (p. 3), describes the details of this application using a short haul modem built by RAD.

The SC932A is also commonly used with the satellite transmitters, cellular modems, and spread spectrum radios.

The SC932A does not support one-way output or printer communication. Data transfer is blocked when pin 6 from the datalogger is high (SDE/printer enable).

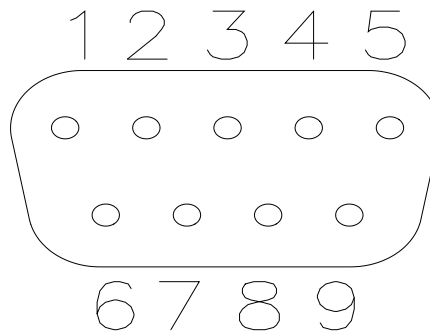
2. Specifications

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 V Supply from CS I/O)
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 (No Connection)
9	In	Ring	Rings Datalogger

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



Pin No.	I/O	Name	Description
1	in	+5V	Regulated 5 Volt supply
2		GND	Ground
3	out	RING	Ring signal to datalogger
4	out	RXD	SC932A transmits on this line
5	in	ME	Modem Enable—must be high for transfer
6	in	SDE	Synchronous Device Enable—data blocked when high
9	in	TXD	SC932A receives on this line

Data Rates:	The SC932A will support baud rates up to 115,200 bps.
Electrical:	<p>The SC932A uses power from the +5 V line on the 9-pin interface connected to the datalogger.</p> <p>Additional current (up to 10 mA) from the 5 V supply may be used by the RS-232 device connected to the SC932A.</p>
Physical	
Height:	2.3 cm (0.9 in)
Width:	4.1 cm (1.6 in)
Length:	7.6 cm (3 in)
Weight:	45.4 g (1.6 oz)
Environmental	
Temperature:	–25 to 50 °C
Humidity:	Up to 95% non-condensing

3. Installation

Connect the SC932A to the RS-232 device and to the datalogger with the SC12 9-pin cable (included). If the device has a 25-pin connector, a 9-pin female to 25-pin male adaptor is required (pn 15751).

The SC932A ships with four screw jacks. They can be installed on both sides of each connector, allowing screws to be used to secure cables to the device.

Proper transient protection should be installed to protect the computer and datalogger in areas where damage due to lightning is possible. If this is a RAD modem application, see Section 4.2, *RAD Modem Wiring and Grounding* (p. 4).

4. RAD Modem Application

The SC932A is frequently used with a short range modem to communicate across a 4-wire, unconditioned dedicated line. Campbell Scientific offers a kit (pn 15770) that includes the SC932A, the 9- to 25-pin adaptor (pn 15751), and a mounting bracket (pn 6282). The bracket will mount the RAD, SC932A and adaptor to the back plate in a Campbell Scientific enclosure. This section describes using a short range asynchronous modem built by RAD*.

* SRM - 5A RAD Modem
 RAD Data Communications Inc.
 900 Corporate Drive
 Mahwah, NJ 07430
 Tel: (201) 529-1100
 Fax: (201) 529-5777
 Email: market@radusa.com
www.rad.com

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 4-1 gives the data rate possible for several gage cables across several distances.

TABLE 4-1. Approximate Range, miles and km						
Data Rate	19 Gauge (0.9 mm)		24 Gauge (0.5 mm)		26 Gauge (0.4 mm)	
bps	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

4.1 RAD Modem – Two-Way

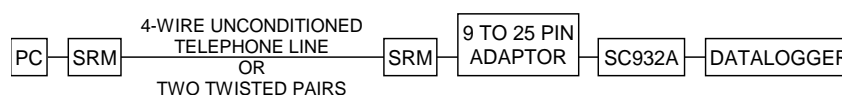


FIGURE 4-1. Two-Way Communication

When using Campbell Scientific's datalogger support software to communicate through the SC932/RAD modem, set up the link as a direct connect between the datalogger and the desired COM port. Start two-way communication using the **Connect** button on the toolbar or the **Connect** button on the *Connect* window.

4.2 RAD Modem Wiring and Grounding

FIGURE 4-2 shows a typical setup of the RAD modems. Installation is as follows:

1. Set the DCE/DTE switch on the back of the RAD modem connected to the SC932A 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. A recommended direct burial rodent resistant cable is listed below. They also sell several gopher resistant cables for even greater protection.

Company	Part Number	AWG.
Anixter	F-02P22BPN	22
Tel: 847-677-2600		
www.anixter.com		

3. Wiring connections are made as shown in FIGURE 4-2. 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 4-2. The

transient protection shown may be purchased from Campbell Scientific (pn 5563 shown in FIGURE 4-2, pn 6536 includes a plastic case, pn 6361 includes hardware for mounting to ground lug of Campbell Scientific enclosures models ENC10/12, ENC12/14, or ENC16/18). 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.

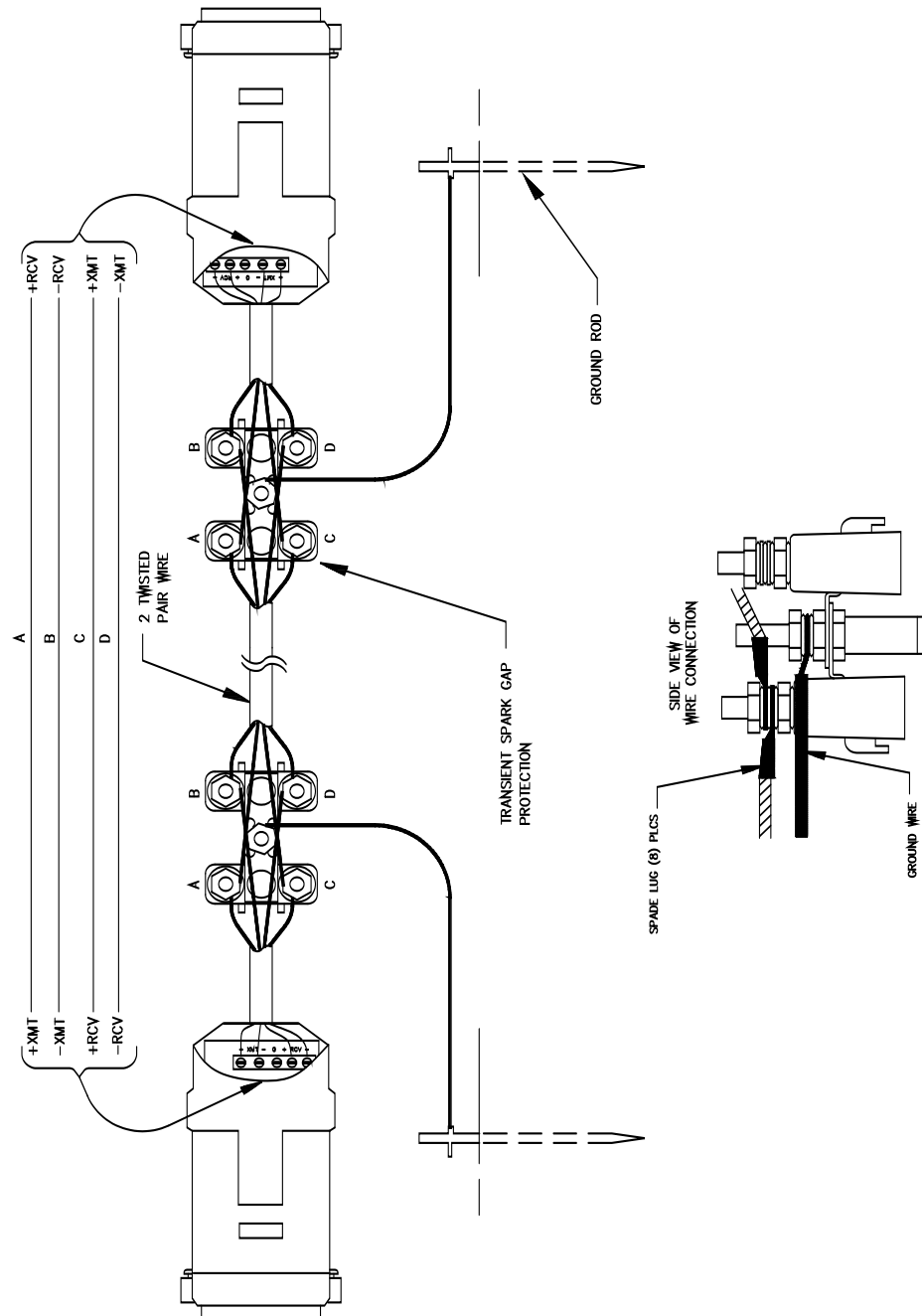


FIGURE 4-2. Installation of Spark Gap Protection

Occasionally, a customer needs to transmit data across longer or smaller gage wires or at higher speeds than can be done with the RAD modem powered by the SC932A. 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.

4.3 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 datalogger modem, and 3) RAD modem datalogger end. When unable to establish communication with the datalogger, test each of the three sections.

Before proceeding through the testing procedures, a terminal emulator software program such as *HyperTerminal* or Campbell Scientific's *Terminal Emulator* (included with *PC200W*, *PC400*, and *LoggerNet*) 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 datalogger end. Twist together the XMT + wire and RCV + wire, twist together the XMT – wire and the RCV – wire. Repeat the process of 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 datalogger modem is defective and will need to be repaired or replaced.
3. If steps 1 and 2 pass, the modem at the datalogger is suspect. Disconnect the modem from the SC932A 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 datalogger 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. The CR10 will function properly on a battery voltage of 10 to 15 volts. Check the 12 V supply with a volt meter.
5. On the wiring panel of most Campbell Scientific dataloggers there is a terminal marked 5 V. Check the 5 V supply with a volt meter. This 5 V supply should be within a tenth of a volt. If not, it would indicate a problem.
6. To verify that the datalogger and its serial I/O port are working, try to access input memory locations using a laptop PC with the SC32B or the CR10KD Keyboard Display.

If the datalogger passes tests 4, 5, and 6, then the SC932A is suspect and will need to be repaired or replaced.

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