

# INSTRUCTION MANUAL



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

Revision: 9/16



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# Guarantee

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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
- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

Campbell Scientific will return guaranteed equipment by surface carrier prepaid. Campbell Scientific will not reimburse the claimant for costs incurred in removing and/or reinstalling equipment. This guarantee and the Company's obligation thereunder is in lieu of all other guarantees, expressed or implied, including those of suitability and fitness for a particular purpose. Campbell Scientific is not liable for consequential damage.

Please inform us before returning equipment and obtain a Repair Reference Number whether the repair is under guarantee or not. Please state the faults as clearly as possible, and if the product is out of the guarantee period it should be accompanied by a purchase order. Quotations for repairs can be given on request. It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment, in support of this policy a "Declaration of Hazardous Material and Decontamination" form will be issued for completion.

When returning equipment, the Repair Reference Number must be clearly marked on the outside of the package. Complete the "Declaration of Hazardous Material and Decontamination" form and ensure a completed copy is returned with your goods. Please note your Repair may not be processed if you do not include a copy of this form and Campbell Scientific Ltd reserves the right to return goods at the customers' expense.

Note that goods sent air freight are subject to Customs clearance fees which Campbell Scientific will charge to customers. In many cases, these charges are greater than the cost of the repair.



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# PLEASE READ FIRST

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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:

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

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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](http://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.





# Table of Contents

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*PDF viewers: These page numbers refer to the printed version of this document. Use the PDF reader bookmarks tab for links to specific sections.*

<b>1. General Description .....</b>	<b>1</b>
<b>2. Specifications.....</b>	<b>2</b>
<b>3. Installation.....</b>	<b>3</b>
<b>4. RAD Modem Application .....</b>	<b>3</b>
4.1 RAD Modem – Two-Way.....	4
4.2 RAD Modem Wiring and Grounding .....	4
4.3 Testing RAD Modem Communication .....	6

## **Figures**

1-1. SC932A CS I/O to RS-232-DCE Interface .....	1
4-1. Two-Way Communication.....	4
4-2. Installation of Spark Gap Protection .....	5

## **Table**

4-1. Approximate Range, miles and km.....	4
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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.

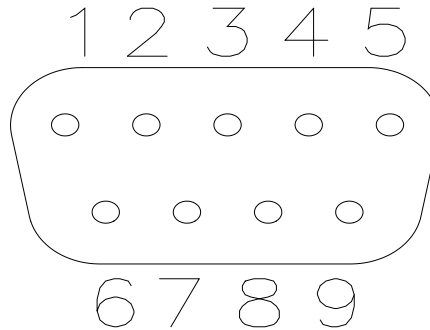
The SC932A is frequently used with a short haul modem to communicate across a dedicated line made of two pairs of twisted wire with a shield. Section 3, *Installation* (p. 3), describes the details of this application using a short haul modem built by RAD.

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).

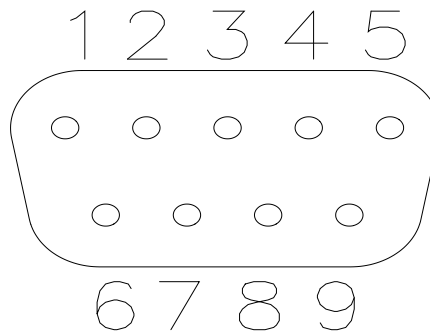
## 2. Specifications

### 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:** The SC932A uses power from the +5 V line on the 9-pin interface connected to the datalogger.

Additional current (up to 10 mA) from the 5 V supply may be used by the RS-232 device connected to the SC932A.

**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](mailto:market@radusa.com)  
[www.rad.com](http://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

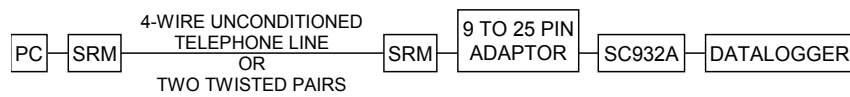


FIGURE 4-1. Two-Way Communication

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		
<a href="http://www.anixter.com">www.anixter.com</a>		

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.

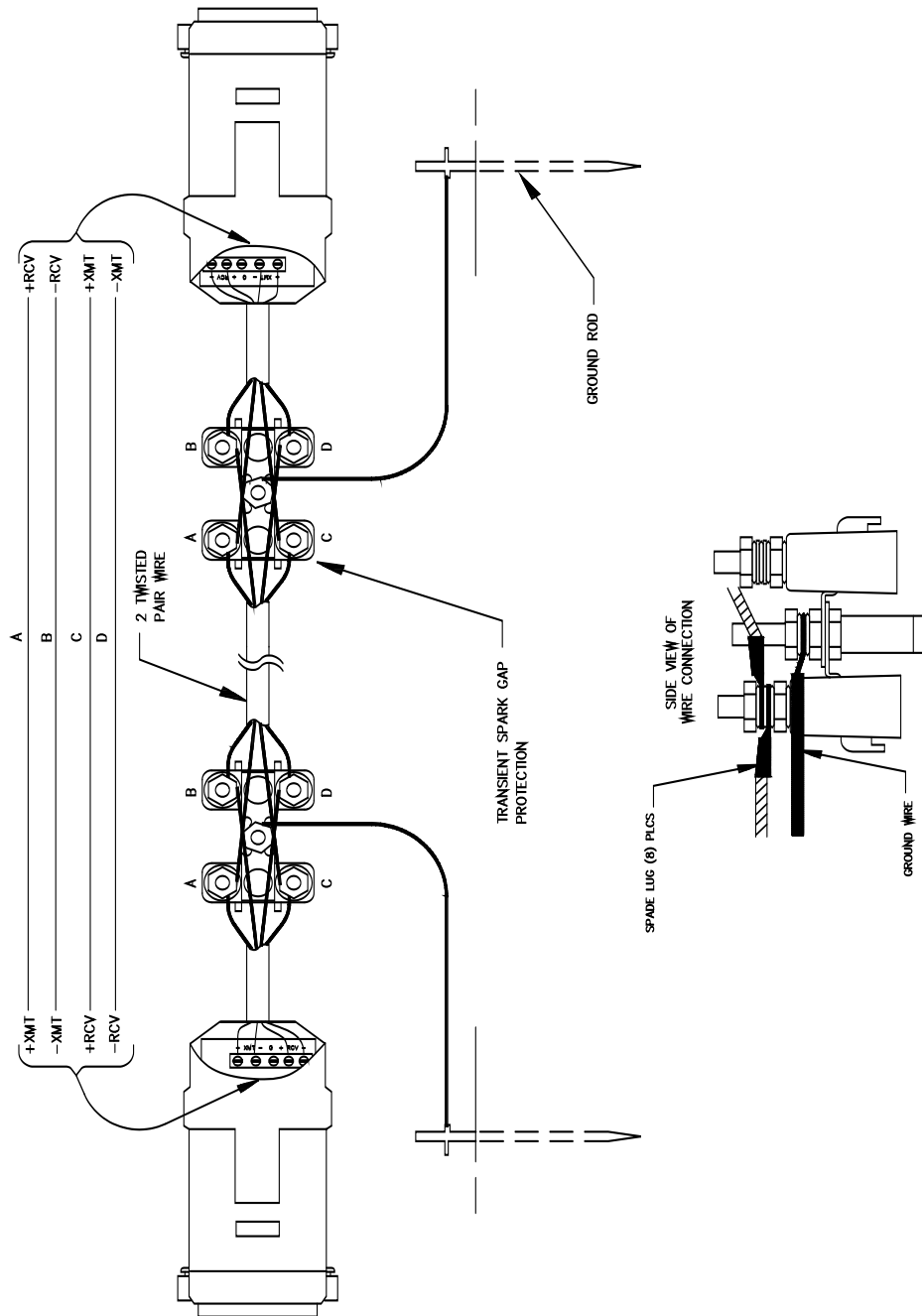


FIGURE 4-2. Installation of Spark Gap Protection

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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