Sensorsoft ®

Sensorsoft® Relay
User Manual

Model SR6171J

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Overview

The SR6171J Sensorsoft Relay is an RS232 compatible serial device based on the Sensorsoft Device Protocol. The SR6171J has a built-in double pole relay intended for applications where the customer needs to control and monitor the ON/OFF state of small equipment or loads at a remote location.

Sensorsoft devices offer the following features and benefits over other RS232 serial devices:

- CRC error detection (detects transmission errors and improves reliability)
- Virtually unlimited communications cable lengths (1000 ft)
- Plug and go operation (little or no user configuration required)

About this Manual

The Sensorsoft Relay may also be referred to as a Soft Relay, Sensorsoft device or SSD (Sensorsoft Soft Device) throughout this manual.

Installing the Sensorsoft Relay

Installation of the Sensorsoft Relay is composed of the following:

- Choosing a Location for Installation
- Connecting the Sensorsoft Relay to a serial port
- Powering the Sensorsoft Relay
- Connecting the Sensorsoft Relay to the equipment or load you are controlling
- Starting the Sensorsoft software. Please refer to the specific software manual that applies to your installation.

Choosing a Location for Installation

Locate the Sensorsoft Relay close to the equipment or load you are controlling. Due to the fact that the Sensorsoft Relay's terminal strip may be connected to higher voltage equipment and loads, keep the following **safety rules** in mind:

- Since the Sensorsoft Relay is not weatherproof or waterproof it is important to keep its housing out of contact with direct sunlight, UV exposure and water.
- Protect the Sensorsoft Relay from high traffic areas that could wear or damage its housing, cabling or wiring.
- If the Sensorsoft Relay is controlling higher voltage **equipment or loads greater than 24 volts**, be sure to protect its terminals from unauthorized individuals to prevent electrical shock hazard. **It would be necessary in this situation to place the Sensorsoft Relay in a protective panel or cabinet**. **Consult an electrician or electrical engineer when dealing with such situations**.
- Never allow the Sensorsoft Relay housing to come into contact with harsh chemicals or cleaning agents. If it needs to be cleaned, do so with a damp cloth or vacuum cleaner. During such a cleaning take the necessary precautions to de-energize the equipment that the Sensorsoft Relay is controlling.

Connecting the Sensorsoft Relay to a serial port

Use the appropriate C200X cable to connect the Sensorsoft Relay to your computer or device server. Please refer to the Sensorsoft price list for available types.

If you intend to make your own custom cable for this J-Suffix Sensorsoft device, please refer to *Making communication cables for J-Suffix Sensorsoft Devices.*

If you are connecting this Sensorsoft device to a device server, please be sure to configure the port as follows:

- 1200 bps, 8 bits, no parity, 1 stop bit

- Turn off autobaud
- Flow control set to none
- Non-telnet binary (raw) transfer mode
- Assert RTS and DTR always

Refer to your device server's documentation for more details on the above.

Note the physical or COM port number where you plugged the cable into your computer or device server. If the Sensorsoft device is being plugged into a Windows based computer that has only one COM port, the port number is usually COM1.

Powering the Sensorsoft Relay

Normally the Sensorsoft Relay is powered from the serial port. If this is not possible due to the voltage output of your serial port or if you require your Sensorsoft Relay to remember or hold its last contact condition even when the computer or serial port is shutdown, it would then be necessary to power the Sensorsoft Relay from an AC adapter that plugs into its external power connector. Use an AC adapter that is approved for use with Sensorsoft Relay such as the Sensorsoft P/N PA6109.

Connecting the Sensorsoft Relay to the equipment or load you are controlling

The typical way to control things using the Sensorsoft Relay is by a series connection that interrupts the power or continuity to the equipment or load. The Sensorsoft Relay's internal double pole relay has two normally open and one normally closed contact available to the user from the terminal strip. The following diagram shows the electrical terminal block layout.
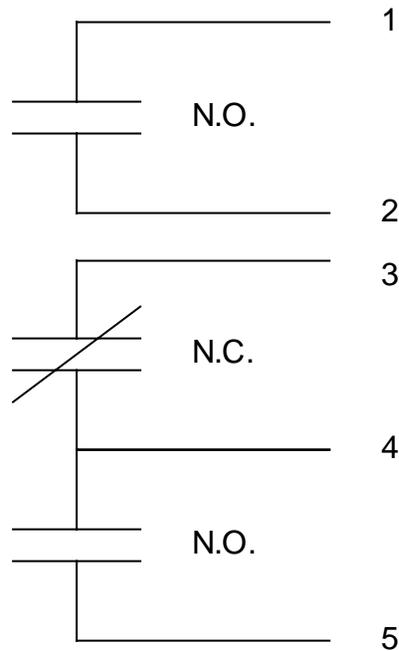
Connect your load (or equipment) as follows:

1. Disconnect the communications cable from the Sensorsoft Relay (unplug the RJ45 plug).
2. **De-energize the load from any live source before wiring to the Sensorsoft Relay**.
3. Remove the four screws from the lid of the Sensorsoft Relay using a small Philips screwdriver.
4. Slip one of the controlling wires from the load into either the N.C. or N.O. terminal block position. Tighten this screw on the terminal block until the wire cannot be removed.
5. Slip the other controlling wire from the load into the COM terminal position. Tighten this screw on the terminal block until the wire cannot be removed.
6. Replace the lid of the Sensorsoft Relay and fasten the four screws.
7. Connect the communications cable to the Sensorsoft Relay. Energize the load and test.

SR6171J Sensorsoft Relay Specifications

Control Capabilities: Can switch ON or OFF most small AC/DC powered equipment or loads.
Internal relay type: DPDT electromagnetic relay available through terminal strip.
Relay contact resistance: 50 milliohm maximum
Relay contact load rating: 2 Amp at 30 VDC, 0.5 Amp at 125 VAC, for resistive loads (p.f.=1)
Maximum contact operating voltage: 125 VAC/125 VDC
Maximum contact operating current: 2 Amp
Maximum contact switching capacity: 60W, 62.5 VA
Operating temperature range: -25 º C to +60 º C (-13 º F to +140 º F)
Maximum reading or control rate: once every second
Housing dimensions: 10 cm (3.9") x 5 cm (2.0") x 2.48 cm (0.97")
Housing material: injection molded ABS thermoplastic
Housing color: light gray
Communications connector: 8-position modular jack, (accepts 8-position plug RJ45)
Power source: Port-powered (RTS and DTR, both asserted) or via External DC power connector
External DC power connector: 2.1 mm power jack, automatic polarity correction and over-voltage protection.
External power supply voltage: 9.0 - 12.0 VDC
Power supply current drain: < 15 mA
Communications interface: RS232C using TX,RX,RTS,DTR and GND. One device per serial port.
Maximum communications cable length: 305 m (1000 ft.) using recommended cable type. Low capacitance shielded cable or UTP is recommended.
Communications Protocol: Sensorsoft Device Protocol, Version 2.0
Error control: 16 bit CRC (cyclic redundancy checking) for detection of communication errors between the Sensorsoft Relay and host computer.

Making communication cables for J-Suffix Sensorsoft Devices

In some applications it is not possible to use pre-assembled cables. When installing the Sensorsoft device at a remote location it may be necessary to run cables through walls, ceiling or conduits where connectors would get jammed. In this situation it makes sense to run the cables and then terminate them, on-site, using hand tools. Further, if your host serial port is of the DCE type (some multi-port serial cards) it will be necessary to make your own cables. The following details will assist you in doing that.

A properly made cable will allow your Sensorsoft device to operate reliably over long cable lengths up to 305 m (1000 ft) long. The Sensorsoft device modular jack connector uses the same UTP wire map as 10-BASE-T and ISDN. It is therefore possible to use this type of cabling system for Sensorsoft devices.

PIN-OUT OF THE MODULAR 8 POSITION JACK/PLUG ON A SENSORSOFT DEVICE
Note: Terminal No. 1 is the terminal to the extreme left as you face the cable opening, latch tab down.

Terminal	Function	UTP wire color (solid-tracer)
1	ST Receive Data	white-green
2	Ground	green
3	ST Transmit Data	white-orange
4	Power +V	blue
5	Ground	white-blue
6	Ground	orange
7	Power +V	white-brown
8	Ground	brown

The following are suggested specialized tools and parts needed to make good quality cables:

Hand Tools:
AMP Crimping Tool P/N 1-231652-0 or 2-231652-1, for modular plugs
AMP 8 position modular die set P/N 853400-1
AMP Crimping Tool P/N 90312-1 or 90302-1, for subminiature D pin or socket contacts
AMP PROCRIMPER P/N 58448-2, for subminiature D pin or socket contacts
AMP Insertion/Extraction Tool P/N 91285-1, for subminiature D connector contacts

Materials:
Berk-Tek UTP (Unshielded Twisted Pair) round stranded cable, P/N 540036--TP
(4 pair, 8-#24 AWG wires, category 4 or better, 75 C)
AMP 8 position modular plug for round stranded wire cables, P/N 5-554169-3 (CAT4)
AMP 8 position modular plug for round stranded wire cables, P/N 5-557961-3 (CAT5)
AMP DB-9 receptacle subminiature D connector (crimp-snap-in), P/N 205203-1 or -3
AMP DB-25 receptacle subminiature D connector (crimp-snap-in), P/N 205207-1 or 207463-1
AMP socket crimp contact for subminiature D connectors, P/N 1-66504-0
AMP pin crimp contact for subminiature D connectors, P/N 1-66506-0

Cable P/N C2000
9 pin Serial Port to Sensorsoft Device
DB-9F to RJ45 modular plug

9 pin Port				Sensorsoft Device
3	TX	white-green	RX	1
2	RX	white-orange	TX	3
4	DTR	white-brown	POWER +V	7
7	RTS	blue	POWER +V	4
5	SIGNAL GND	green	GND	2

P/N C2000 is for use with PC's and most other devices which have a 9 position serial port. F indicates female/socket type connector.

Cable P/N C2001 and C2002
DTE Serial Port to Sensorsoft Device
DB-25 to RJ45 modular plug

DTE Port				Sensorsoft Device
2	TX	white-green	RX	1
3	RX	white-orange	TX	3
20	DTR	white-brown	POWER +V	7
4	RTS	blue	POWER +V	4
7	SIGNAL GND	green	GND	2

P/N C2002 is for use with Sun SPARCstation or SPARCserver serial ports A or B. The DTE end of this cable uses a DB-25M connector. P/N C2001 is for use with PC's which have a DB-25 connector. The DTE end of this cable uses a DB-25F connector. M indicates male/pin type connector. F indicates female/socket type connector.

Cable P/N C2012
DCE Serial Port to Sensorsoft Device
DB-25M to RJ45 modular plug

DCE Port   Sensorsoft Device

3	TX	white-green	RX	1
2	RX	white-orange	TX	3
6	DSR	white-brown	POWER +V	7
5	CTS	blue	POWER +V	4
7	SIGNAL GND	green	GND	2

P/N C2012 is for use with some multiport cards and terminal servers that have a DCE
pin-out. M indicates male/pin type connector.

Writing programs for the Sensorsoft Relay

The following describes how to write your own programs for the Sensorsoft Relay. This Sensorsoft device uses a binary, packet-formatted, master-slave protocol. All data is represented in the **little endian format** - least significant byte is first and the most significant byte is last. Your host computer (master) must send commands to and receive responses back from the Sensorsoft device (slave).

Use the following parameters when programming the serial port where the Sensorsoft device is connected:

Bit rate:	1200 bps
Bits:	8
Parity:	none
Stop bits:	1
Flow control:	none
Null discard:	do not strip NULL bytes

In order to make use of the port powered feature of the Sensorsoft device you must enable serial port lines DTR and RTS when the port is opened. A delay of 1-2 seconds is required after opening the serial port before any commands are sent to the Sensorsoft device. This delay allows the Sensorsoft device to power-up correctly before it receives any commands and prevents incorrect readings.

You should also be aware that the Sensorsoft device has an inter-packet retry time-out delay. This delay is one (1) second and is encoded into the Sensorsoft device firmware. If your program sends a command to the Sensorsoft device and it receives no response from the Sensorsoft device, your program must wait at least one (1) second before re-sending that command. Possible reasons that a Sensorsoft device may ignore your commands can be due to data transmission (CRC) errors or improper power-up delay during hot plugging.

Sending commands to the Sensorsoft Relay

Each command packet your host sends to the Sensorsoft Relay must be in the following format:

<CMD-byte> <PACKETlength-bytes> <ADDRESS-bytes> <ARGUMENT-byte> <CRC-bytes>

CMD-byte
A single byte command indicating the desired action the Sensorsoft Relay should carry out. C1h = read status, C5h = read register and C6 = write register.

PACKETlength-bytes
Two bytes indicating the total length of the packet from start to finish (includes CRC bytes).

ADDRESS-bytes
The six-byte (48-bit) address of the device you are sending the command to. For RS232 Sensorsoft Devices this is always decimal 1.

ARGUMENT-byte
The number of the Sensorsoft Relay's internal register you want to read or in the case of a write, the number of the register you want to write and the boolean value to control the relay. This byte is not required for the status command. To read the state of the relay use a byte of 01h for the register number. To write the state of the relay two bytes are required, 01h for the register number and a value of 00h to turn the relay OFF or 01h to turn the relay ON.

CRC-bytes
A two byte (16 bit) Cyclic Redundancy Check that is calculated on the entire packet from the CMD byte to the last ARGUMENT byte or ADDRESS byte.

Send the following bytes to request a status reading:

Hex   C1 0B 00 01 00 00 00 00 00 47 98

Send the following bytes to read the state of the relay:

Hex   C5 0C 00 01 00 00 00 00 00 01 0E 49

Send the following bytes to turn the relay ON:

Hex   C6 0D 00 01 00 00 00 00 00 01 01 73 D0

Send the following bytes to turn the relay OFF:

Hex   C6 0D 00 01 00 00 00 00 00 01 00 52 C0

Note: In the above examples the last two bytes are CRC bytes that were pre-calculated.

Receiving responses from the Sensorsoft Relay

Each response packet the Sensorsoft Relay returns is in the following format:

<RESPONSE-byte> <PACKETlength-bytes> <DATA-byte(s)> <CRC-bytes>

RESPONSE-byte
A single byte response code indicating the type of response. Valid codes are 90 hex or 94 hex.

PACKETlength-bytes
Two bytes indicating the total length of the packet from start to finish (includes CRC bytes).

DATA-byte(s)
Most responses return additional data in the form of byte(s). In response to a read register command, one byte is returned for DATA-byte(s). Receiving a 00h byte in this placeholder indicates an **OFF** condition while a 01h indicates an **ON** condition. No bytes are returned in this placeholder in response to a write command. In response to a status command, one byte is returned for DATA-byte(s). See *SENSORSOFT DEVICE STATUS BYTE FORMAT* chart.

CRC-bytes
A two byte (16 bit) Cyclic Redundancy Check. This placeholder is filled with CRC bytes calculated by the Sensorsoft Relay on the entire packet from the RESPONSE byte to the last DATA-byte. These bytes allow the host to verify the integrity of the response packet. You may choose to use or ignore these bytes depending on your programming skill or application.

The Sensorsoft device returns a normal RESPONSE-byte **(90h)** in acknowledgement that the previous host command was received and executed without errors. The Sensorsoft device only acknowledges correctly received commands that have no CRC errors. If the Sensorsoft device detects a CRC error in a received command packet, it does not respond to the command. It is considered the job of the host to time-out and re-transmit that command packet.

When an internal problem occurs inside the Sensorsoft device it sends out an abnormal response byte **(94 h)** in response to any command from the host. If the host receives this response byte, it must immediately read and interpret the Sensorsoft device's status to determine the problem. See *SENSORSOFT DEVICE STATUS BYTE FORMAT* chart.

The generator polynomial used for the CRC is hexadecimal 1021. The following references provide information for readers who wish to use the CRC capability:

- Calculating CRC's by Bits and Bytes, Greg Morse, Byte Magazine, September 1986, Pg. 115-124
- Implementing CRC's, Jack Crenshaw, Embedded Systems Programming Magazine, January 1992, Pg. 18-45
- Technical Aspects of Data Communication, John McNamara, Digital Equipment Press 1982, Pg. 110-122
- Data and Computer Communications, 2nd edition, William Stallings, Macmillan Publishing, Pg. 107-112

- The modem reference: the complete guide to selection, installation, and applications, 2nd edition, Michael A Banks, Brady Publishing 1991, Pg. 27-42

SENSORSOFT DEVICE STATUS BYTE FORMAT

BIT	NAME	DESCRIPTION
0	Low power supply	Voltage is unacceptable for reliable operation
1	IRQ enable	N/A
2	IRQ pending	N/A
3	Power-up	Sensorsoft device just powered-up
4	Tamper	N/A
5	NV option	N/A
6	EEPROM fail	N/A
7	Future use	N/A

A logic one condition on any of these bits indicates the condition is set or active. Otherwise they are reset to logic zero. It is a good practice for the host to check the status of the Sensorsoft device on a regular basis in case a bit changes state.

If bit 0 is set, this indicates that the Sensorsoft device power supply voltage is too low.

When bit 3 is set, this indicates that the Sensorsoft device has just powered-up. This bit gets reset after the status is read.

Bits 1,2,4,5,6 and 7 can be ignored, because they are not used in the SR6171.

Reading the Sensorsoft ID Record

Every Sensorsoft device (SSD) accepts an identification (ID) command, whose response can be used to uniquely identify the type of SSD currently connected. Specifically, the model number and description can be extracted from the SSD's ID response, allowing application software to determine the specific model of the SSD connected and to configure itself appropriately.

The format of the ID command is identical to the format of all other commands, described earlier.

Send the following bytes to the SSD to request the ID:

Hex   <C3h> <0Bh> <00h> <01h> <00h> <00h> <00h> <00h> <00h> <20h> <5Eh>

The ID response contains four variable-length null-terminated strings. The sequence of four strings begins at the 10th byte in the response packet.

To read the SSD's description, count to the 10th byte in the ID response and extract the following ASCII null-terminated string.

Following this is the manufacturer's name; also a null-terminated string.

The third null-terminated string is the SSD's model number. The model number can be used to uniquely identify the type of SSD, so that your software can configure itself appropriately for different models of SSDs.

The fourth and final null-terminated string is the SSD's firmware version.

Structure of the ID response packet

Byte	Description of field
1	Response byte
2-3	Packet length
4-9	Not used
10	Device name or description (null-terminated)
~	Manufacturer (null-terminated)
~	Model Number (null-terminated)
~	Firmware Version (null-terminated)
~	Record Terminator (FFh)
~	CRC bytes (2)

Sample ID response packet from a SR6171J Sensorsoft Relay

Byte	Contents
1	<90h>
2	<49h>
3	<00h>
4-9	<01h> <00h> <00h> <01h> <03h> <07h>
10	Sensorsoft (TM) Relay<00h>
~	Sensorsoft Corp.<00h>
~	SR6171<00h>
~	1.22 <00h>
~	<FFh>
~	<F0h> <06h>

Getting Help

Limited Warranty

Sensorsoft Corporation warranties Sensorsoft products to be free from manufacturing defects for a period of two years. This includes parts and labor. All shipping and brokerage fees are your responsibility when returning a Sensorsoft product for warranty claims. The following will void the warranty and 30 day money back guarantee:

- signs of water or chemical damage
- cracks to the housing
- signs of tampering or reverse engineering

Technical Support

If in the unlikely event you should have problems installing or using your Sensorsoft product and the previous sections of this manual have failed to provide a solution, we offer technical support to help you overcome your difficulties (see web site address below). No-charge installation and configuration support is provided for 90 days, after that there is a per-incident fee. Sensorsoft Corporation **does not** provide free support to those wishing to write their own software; this is available on a charge-per-incident basis only. Please contact support for current rates.

World Wide Web: http://www.sensorsoft.com
E-mail: support@sensorsoft.com

30 Day Money Back Guarantee

If for any reason you want to return a Sensorsoft product for a refund, you can do so within 30 days (calendar days) of your purchase. The refund does not include shipping or brokerage fees you may have incurred or paid.

Returns

If returning a product or item, please keep in mind the follow guidelines:

- Contact Sensorsoft for an RMA number (Return Material Authorization).
- Provide a detailed explanation or reason for returning the product.
- Return shipments that bear no RMA number (on the outside of the package) or are not prepaid for shipping/clearing charges, will be refused.