# *Sensorsoft* ®

# Sensorsoft® Flooding Sensor
# User Manual

## Models SM6201C/CP

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# Overview

The SM6201C and SM6201CP Sensorsoft Flooding Sensors are RS232 compatible serial devices based on the Sensorsoft Device Protocol. These devices have built-in sensor pins for detecting water leaks and flooding on floors, carpets, walls and other surfaces - caused by air conditioners, damaged pipes and leaking roofs. It is intended for applications where the customer needs to be immediately informed of the presence of water in areas where it is not desired and could do damage or become a safety hazard. In such situations early detection is often critical in avoiding extensive damage which can result in insurance claims, downtime and hazard to personnel.

These devices use an electrical conductivity method to detect the presence of water. When a surface is moist or wet it exhibits high conductivity and when a surface is dry it exhibits low conductivity. The SM6201C/CP was designed to detect these changes in conductivity. It can detect most types of water, including low-grade distilled water.

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

- Powered from the serial port (no external power or battery required)
- CRC error detection (detects transmission errors and improves reliability)
- Virtually unlimited cable lengths (1000 ft)
- Plug and go operation (little or no user configuration required)

# About this Manual

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

# Installing the Sensorsoft Flooding Sensor

Installation of the Sensorsoft Flooding Sensor is composed of the following:

- Choosing a Location for Installation
- Connecting the Sensorsoft Flooding Sensor to a serial port
- Starting the Sensorsoft software. Please refer to the specific software manual that applies to your installation.

## Choosing a Location for Installation

Locate the Sensorsoft Flooding Sensor on a surface where water is likely to collect during an event. An event is considered to be past or future occurrence of water damage. Keep the following in mind:

- An area or surface where a previous event occurred is the most likely place for a repeat event.
- Locate the sensor below an air vent. In an event, air vents often carry water into that space from a leaking roof.
- If you have a ceiling tile that is stained or discolored, this is a likely place for another possible event.
- Do not place the sensor on a conductive surface or it will produce false alarms.
- Use a water-resistant Velcro fastener, such as P/N F1001, to attach the sensor to the surface you are monitoring. Prior to applying the Velcro fastener, clean the surface with Isopropyl Alcohol and let it dry.
- Locate the sensor on a surface below a water sprinkler, facet or valve.
- Avoid locating the sensor where direct contact with sunlight or UV exposure is possible.
- Protect the sensor from high traffic areas that could wear/damage the housing or cable.
- Never allow the sensor 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.

**IMPORTANT NOTE: After positioning the sensor, be sure to remove the protective paper band and black foam from the active sensing (gold-plated) pins.**

## Connecting the Sensorsoft Flooding Sensor to a serial port

If you have a SM6201C (C-Suffix) Sensorsoft Flooding Sensor, plug its molded DB-9F connector into an available RS232 serial port connector (DB-9M) on your computer or device server.

If you have an SM6201CP Sensorsoft Flooding Sensor, plug this into an available serial port on your Lantronix ETS Device Server.

If you are connecting a Sensorsoft Flooding Sensor 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 Flooding Sensor is being plugged into a Windows based computer that has only one COM port, the port number is usually COM1.

# SM6201C Sensorsoft Flooding Sensor Specifications

**Detection Capabilities:** Can detect water or moisture present on floors, carpets or other surfaces. Provides a WET/DRY indication in software.

**Maximum reading rate**: one reading every second

**Housing Dimensions**: 8 cm (3.1") x 4 cm (1.6") x 2 cm (0.8")

**Housing Material**: injection molded ABS thermoplastic

**Housing Color**: light gray

**Sensor type**: Two penetrating gold plated pins and associated electronics that detect changes in conductance.

**Operating temperature range**: 0 º C to +60 º C (32 º F to +140 º F)

**Communications cable**: built-in 6 m (20 ft.) cable with DB-9F (female) mini D-SUB connector

**Power source**: Port-powered (RTS and DTR, both asserted).

**Power supply current drain**: < 10 mA

**Communications Interface**: RS232C using TX,RX,RTS,DTR and GND. One device per serial port.

**Maximum extension 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 device and host computer.

# SM6201CP Sensorsoft Flooding Sensor Specifications

**Detection Capabilities:** Can detect water or moisture present on floors, carpets or other surfaces. Provides a WET/DRY indication in software.

**Maximum reading rate**: one reading every second

**Housing Dimensions**: 8 cm (3.1") x 4 cm (1.6") x 2 cm (0.8")

**Housing Material**: injection molded ABS thermoplastic

**Housing Color**: light gray

**Sensor type**: Two penetrating gold plated pins and associated electronics that detect changes in conductance.

**Operating temperature range**: 0 º C to +60 º C (32 º F to +140 º F)

**Communications cable**: built-in 6 m (20 ft.) cable with RJ-45 plug connector

**Power source**: Port-powered (RTS and DTR, both asserted).

**Power supply current drain**: < 10 mA

**Communications Interface**: RS232C using TX,RX,RTS,DTR and GND. One device per serial port.

**Maximum extension 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 device and host computer.

# Making extension cables for the Flooding Sensor

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 distances.

PIN-OUT OF THE DB-9F CONNECTOR ON A C-SUFFIX SENSORSOFT DEVICE
Note:  Only positions used in Sensorsoft device application are shown

| Position | Function |
|----------|----------|
| 2 | TX (data to computer) |
| 3 | RX (data from computer) |
| 4 | POWER (connects to DTR on computer) |
| 5 | Ground |
| 7 | POWER (connects to RTS on computer) |

PIN-OUT OF THE RJ-45 CONNECTOR ON A CP-SUFFIX SENSORSOFT DEVICE
Note:  Only positions used in Sensorsoft device application are shown

| Position | Function |
|----------|----------|
| 1 | POWER (connects to RTS on Lantronix ETS) |
| 2 | POWER (connects to DTR on Lantronix ETS) |
| 3 | TX (data to Lantronix ETS) |
| 4 | Ground |
| 5 | Ground |
| 6 | RX (data from Lantronix ETS) |

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

**Hand Tools:**
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 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

# Writing programs for the Sensorsoft Flooding Sensor

The following describes how to write your own programs for the Sensorsoft Flooding Sensor. 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) device.

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, 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 Flooding Sensor

Each command packet your host sends to the Sensorsoft device 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 Flooding Sensor device should carry out.

*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 Flooding Sensor's internal register you want to read or write. This byte must be 01h (register 1) to read the Boolean state of the sensor. This byte is not required for the status command.

***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 request the Boolean state of the sensor:

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

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

# Receiving responses from the Sensorsoft Flooding Sensor

Each response packet the Sensorsoft Flooding Sensor 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 command to read the sensor's Boolean state, one byte is returned for DATA-byte(s). Receiving a 00h byte in this placeholder indicates a **DRY** condition while a 01h indicates a **WET** condition. 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 device 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 **(90 hex)** 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 hex)** 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 has 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 SM6201.

# 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 SM6201 Sensorsoft Flooding Sensor**

| Byte | Contents |
|------|----------|
| 1 | <90h> |
| 2 | <49h> |
| 3 | <00h> |
| 4-9 | <01h>  <00h> <00h>  <01h>  <03h>  <07h> |
| 10 | Sensorsoft (TM) Moisture Sensor<00h> |
| ~ | Sensorsoft Corp.<00h> |
| ~ | SM6201<00h> |
| ~ | 1.02<00h> |
| ~ | <FFh> |
| ~ | <95h> <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 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.