Supercooled Liquid Water Content (SLWC) Sensor and Liquid Water Content (SLWC) Sensor

Basic Instructions

Anasphere, Inc.
81 8th Street #1
Belgrade, MT 59714

www.anasphere.com

January 2017

XDATA SLWC AND LWC SENSORS

Installation

The XDATA output is found on J7 (labeled “main”). An XDATA input is found on J8 (labeled “extra”) where an additional XDATA sensor (or chain of sensors) may be connected.

Mode Setting

A rotary BCD switch is next to J7 on the board. It allows the user to set the mode of operation of the sonde. The sonde only checks the mode switch when it is first turned on; to change a mode, it is necessary to turn the sonde off and then on again. Codes are given on the sticker on the front of the sonde and are repeated here:

0: run, XDATA, output frequency F
1: run, XDATA, output F/2 (Intermet)
2: run, XDATA inverted for serial port, output F
3: run, XDATA, output F/2 and board temperature (K)
4: self-test; first attach XDATA cable between main and extra
5: servo midpoint setting
6-9: unused (7 is internal function: avoid that setting)

Turn On

The sensor is turned on using the switch on the battery pack. There will be a brief pause, the sensor will adjust its servo motor, and then it will begin operation making one measurement every 3 seconds.

Data Format

The xdata format from the sonde is as follows. The last four digits, represented as x, are the vibration frequency of the wire in hexadecimal format, in Hz times 100.

xdata=290100xxxx<CR><LF>

29 is the hexadecimal XDATA identifier for an Anasphere water content sonde, 01 is the hexadecimal daisy chain index, and 00 is the hexadecimal packet type. Hexadecimal packet types in use with this family of sondes include:

00: supercooled liquid water content
01: ice water content
02: liquid water content

An example data line would be as follows:

xdata=290100112C<CR><LF>

Converting the unsigned hexadecimal value of 112C to decimal yields a value of 4396. Dividing by 100 yields a vibration frequency of 43.96 Hz. Changes in the reported frequency are mathematically processed to yield SLWC values. See the other documents on our cloud sensor resources page for more information.

Note that the Intermet sensor modes (modes 1 and 3), for legacy reasons, report the frequency as divided by two relative to the actual measurement. The Intermet software will multiply the frequency by two prior to recording it in the data file. This behavior is triggered by the XDATA identifiers - so changing the sensor mode (while perfectly allowable when using an Intermet sonde) will not avoid this automatic doubling of the frequency measurement. An advantage of using other modes (such as 0), however, is that you will have higher resolution - just remember to divide the frequency by two. Using third-party software, such as SkySonde, is one way to avoid the automatic doubling. For cross-checking of your setup, a typical bare-wire SLWC sonde will have a vibration frequency of about 44 Hz. LWC sonde frequencies will be somewhat lower.

Wire Replacement

The wires on the SLWC sondes only need to be replaced if bent or damaged. The wires on the LWC sondes need to be replaced after each flight.

First, be certain to observe how the wire is installed in the sonde before disassembly. There are three key relationships to observe. First, the wire is aligned with the edge - not the center - of the magnet on the plucking arm. Second, notice that there are four screws holding the sensor "sandwich" together, and of those the front two (toward the wire) are noticeably tighter (compressing the stack more) than the two at the back of the sandwich. None of the screws, however, are very tight. The back two more or less just touch the Delrin, and the front two are about a turn tighter than those at the back. Also note that the heads of the screws do not protrude beyond the nuts in the PC board (turn it over and take a look at how far they are into the fasteners). Third, notice that the top and bottom pieces of silicone rubber have their edges meet relatively uniformly where the wire enters the sandwich - the edge of one piece of rubber should not be hanging over the other.

To replace a wire, unscrew the four screws holding the sensor sandwich together. Remove the white Delrin plate and the upper piece of silicone rubber which has the wire embedded in it.

Insert the prong at the end of the new wire into the same hole as was used by the old wire in the silicone. The tricky step is to now reassemble the sandwich (and the magnet will be trying to grab the wire). One approach is to hold the base of the sensor

wire (between the coating and the silicone, in the case of the LWC wires) and thereby stabilize the wire and silicone. Using your other hand, lay the Delrin plate on top of the sandwich so the holes align with the fasteners in the PC board.

Drop the screws in and very, very lightly tighten all four screws. This is far lighter than finger tight - think feather tight. At this point, you can let go of the wire. Then, give each of the front two screws one more full turn. This should be about right. If either of the back two screws became loose after this step, just turn them until they gently touch the Delrin - but don't tighten them further. At no point should any of the screws protrude out beyond the nuts in the PC board. If they do, they are way too tight - remove them and start over.

The following figure summarizes the structure of the sensor sandwich for reference: