



Application Note # 2003 - Mesa Systems Sono-Probe Interface

Purpose

This application note describes the hardware & software requirements to connect, receive analog moisture readings and calibrate the concrete Rhino ABS to a Mesa Systems Sono probes (SONO-VARIO (M308070, M308074, M308090) probe(s)). However, the wiring connections to the PLC will be the same for any probe that has a 4-20mA analog output signal.

Description

The Concrete Rhino ABS software always adjusts the target batch weights of aggregates and amount of water based on the current setting of total moisture % for each aggregate. They may be periodically adjusted manually. However, for the most accuracy, the moisture percentage aggregate as it passes through the bin, can be averaged and this value used as the “current” moisture reading. The concrete rhino has a 4-20mA analog input section on the CPU PLC board and this is where the 4-20ma “output” signal from the SONO-VARIO should be connected. The 4-20ma signal from the SONO-VARIO Probe may be configured in the probes configuration to output various versions of the moisture reading “scaled”, “unscaled”, “averaged”, etc. Regardless, the Concrete Rhino must have a 2 point calibration done so it “knows” how to take the analog signal and translate it to a moisture value.

Hardware/Wiring Requirements

The SONO-VARIO probes require their own 24VDC power supply to power them. This same power source is used to “source” the 4-20mA current loop. This simplifies the connections between the PLC and probe and only requires 2 wires between them. ***The 24VDC power supply wire goes to the probes RED wire and the 0VDC power supply wire goes to the probes BLUE wire.***

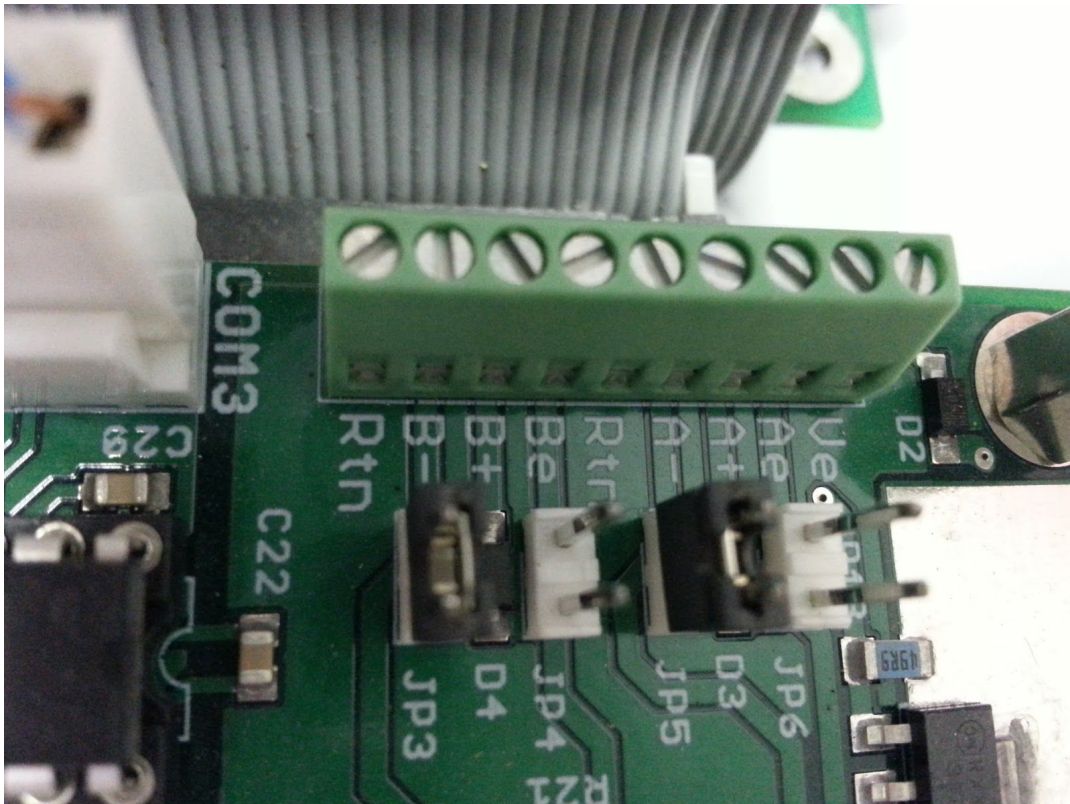
SONO-VARIO probe Installation & Wiring - This application note will not attempt to replace Mesa Systems excellent documentation and installation guides. You should use this application note to interface a fully installed and functioning probe to the Concrete Rhino. Here are some links to Mesa Systems literature:



1. Sono Guide Wiring (with Sono View) - https://s3.amazonaws.com/mesasystemscowp/wp-content/uploads/2018/04/SONO-Guide_Wiring_Sono-View.pdf
2. Sono Probe Installation - https://s3.amazonaws.com/mesasystemscowp/wp-content/uploads/2018/04/SONO-Guide_Installation.pdf
3. Sono Probe Overview - <https://s3.amazonaws.com/mesasystemscowp/wp-content/uploads/2018/04/SONO-Guide-Overview.pdf>

PLC CPU Analog Section - This board has a 9-pin header for analog inputs.

1. Probe 1 - SONO-VARIO probe yellow wire goes to terminal "A-", and green wire goes to terminal "A+". Shorting jumper goes on JP5.
2. Probe 2 - SONO-VARIO probe yellow wire goes to terminal "B-", and green wire goes to terminal "B+". Shorting jumper goes on JP3.

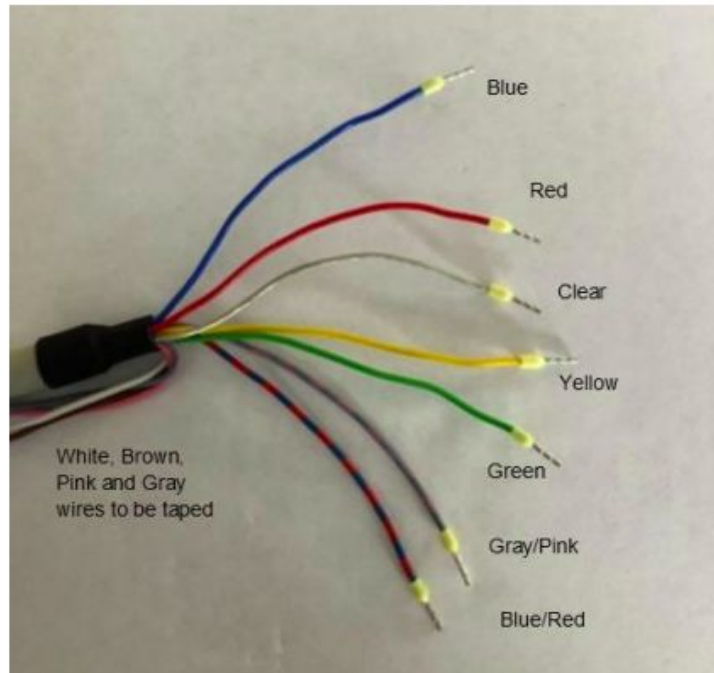




MESA Systems Co.

MESA Systems Co.
8 Broad Street, Unit 1,
Stonington, CT 06378
Phone: 508-655-6372
support@mesasystemsco.com
<http://mesasystemsco.com>

Notes: Not all wires are required to be connected for operation.



SONO Probe Connection to PLC or Control System	308029 cable wire lead colors
12 to 24 VDC Power: (200 milliamps needed to power each probe)	Red
0 VDC Power:	Blue
Cable Shield:	Clear
Percent Moisture + : (20 mA, 5 or 10 VDC)	Green
Percent Moisture - : (0/4 mA, 0/1/2 VDC)	Yellow
IMP-Bus RT (for SONO-VIEW only)	Gray/Pink (multicolored)
IMP-Bus COM (for SONO-VIEW only)	Blue/Red (multicolored)
NOTE: The White, Brown, Pink and Gray wires are not used.	

Concrete Rhino Configuration



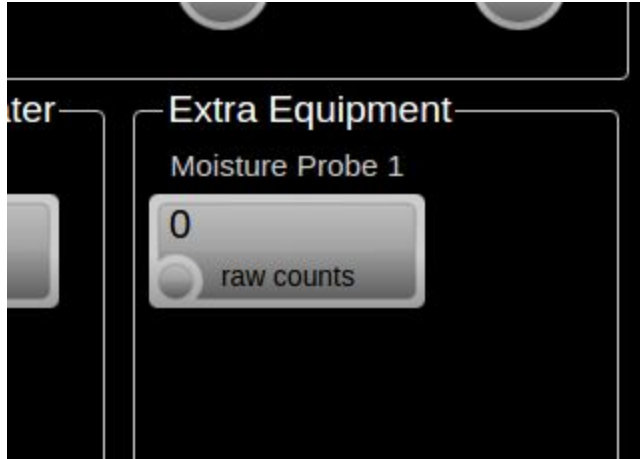
As mentioned previously, the Concrete Rhino software is always looking at the aggregate moisture % for each aggregate material when calculation and adjusting the batch targets for each load. By default, the total moisture value is an entered value. This total moisture % has the absorbed moisture % value subtracted from it to derive the “Free Moisture %” This is the value used to make corrections. When a moisture probe is properly installed and configured, the % Moisture will automatically be updated by the software on each batch. Please follow the following steps to correctly configure your Mesa Systems SONO-VARIO probe.

1. **Wire the Probe(s) to the PLC** - The standard PLC CPU board can accept 2 analog (moisture probe) inputs. The probes are known to the system as “Probe 1” and “Probe 2”. Probe 1 must be wired to analog channel “A” (Terminals A+, A-) and probe 2 must be wired to analog channel “B” (Terminals B+, B-).
2. **Assign a Probe to a Bin** - Go to the Bins window by selecting: Materials → Aggregate Tab → Bins. Select the bin that is going to use Probe 1 by clicking anywhere on that bins from the list of bins. Using the “Moisture Probe” dropdown, select “Probe 1”.
3. **Calibrate the Raw Analog Counts to the Actual % Moisture**
 - a. Click the “Moisture Probe Calibration” button on the Bins screen (make sure the bin for which Probe 1 was selected is selected).

- b. Open the vPanel and look at the raw counts. For a very dry sample of aggregate of known moisture %, read and record the raw counts in the “Zero Counts” field. Enter the known Moisture % for the ‘Zero %’ field and



click “Save”. Repeat for a very wet sample of sand and enter the raw and actual % in the “SpanCounts” and “Span % Moist” fields respectively.



- c. Once those 4 values have been entered, click the “Calculate Slope & Intercept”.
- d. If the calibration was successful the “Calibrated” checkbox should now be checked. Click “Save”. The analog reading will now automatically be converted to a Moisture % value and used in the batch calculations.
- e. To disable the automatic moisture probe adjustments, and revert back to manually entering the moisture readings, either uncheck the “Calibrated” checkbox or unassign the probe to the bin (reverse the action done in Step 2).

Testing

The 4-20mA signal is converted to digital counts in the CPU’s analog-to-digital-converter (ADC) section. The ADC is a 10-bit value which means the converted digital value is in the range from 0 to 1023. The following is a table of some reasonable values you can use as a guide to make sure your probe is sending the correct analog signal.

Analog Signal	Raw Counts	% Moisture	Condition
4.0 mA	0	Invalid	Air (not connected)
7.4 mA	220	0.0	SSD Sand
12.2 mA	525	11.7	Very Wet Sand



16.5 mA	800	~ 20	Palm of hand
---------	-----	------	--------------