vigilantplant.™

The clear path to operational excellence

Monitoring Temperature and Humidity

Industry: Machinery, Environment
Product: Paperless Recorder (DX)

Overview

Applying the DX's mathematical functions, humidity is calculated using the dry bulb and wet bulb formulas based on input from a resistance temperature detector (Pt). The calculation follows the Perunta formula.
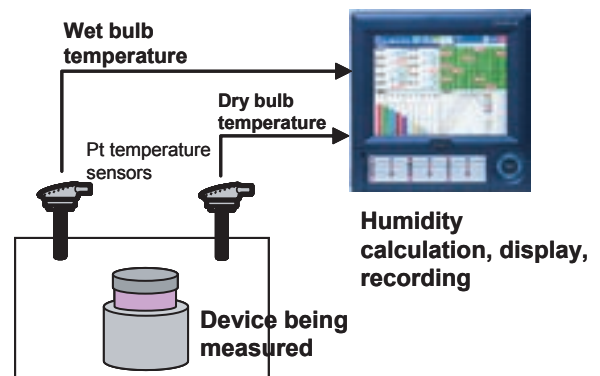
Customer Needs

- To have the humidity calculation function be internal to the DX, since we want to monitor humidity along with the internal temperature of the environmental testing equipment
- To use general purpose RTDs rather than specialized humidity sensors, and avoid depending on external instruments and complicated programming.

Process Outline

Signals are input from Pt type RTD sensors. Dry and wet bulb temperature are measured with the Pt's, and the DX's calculation function automatically calculates humidity based on the measured values. The calculation is based on the Perunta formula, and the multipliers in the formula are input ahead of time as Kxx.

Dedicated humidity sensors or external computing units are not needed to determine the humidity, resulting in reduced costs and more compact instrumentation. The number of instruments comprising the system is also reduced, resulting in higher overall reliability.

Sensors can be hard to calibrate due to the difficulty of creating a reference humidity. The DX overcomes this problem because humidity is determined through a calculation, and calibration of the input can be substituted with calibration of the Pt100ohm range.

Wet bulb temperature

Dry bulb temperature

Pt temperature sensors

Humidity calculation, display, recording

Device being measured

<Example of Mathematical Function Settings on the DX>
Input: Pt100 (or JPt100)
            CH1: dry bulb (°C), CH2: wet bulb (°C)
Computed result: Humidity displayed on CH37 (MATH channel)
Expressions and constants: Perunta formula

31: $1+K9$
32: $2+K9$
33: $EXP(K1/31+K2+K3*31+K4*31*31+K5*LOG(31))$
34: $EXP(K1/32+K2+K3*32+K4*32*32+K5*LOG(32))$
35: $33*K10$
36: $34*K10$
37 : $((36-K6*K7*(K11+2/K8)*(1-2))/35)*K10$

K01 : -6096.9
K02 : 16.636
K03 : -0.027112
K04 : 1.674E-5
K05 : 5.6033
K06 : 0.0012 (ramda)
K07 : 1.0133E+5
K08 : 610
K09 : 273.15
K10 : 100
K11 : 1
K12 : 2

K06 (ramda) value is set as follows
When wind speed is 0-0.5 m/s: 0.0012
When wind speed is 1-1.5 m/s: 0.0008
When wind speed is 2.5 m/s or higher: 0.000656

YOKOGAWA ◆

Yokogawa's Solution

DX Series Paperless Recorders can easily calculate humidity using RTDs

- Humidity calculated with a MATH function (optional)
- Measured and calculated results saved electronically to local media while being displayed in real time on the large, color TFT display
- Enables data sharing on the network (Ethernet compatible)

Conclusion

DX series instruments allow you to determine temperature and humidity and manage the results as manufacturing/quality data at a reasonable cost with a simple configuration. No special external equipment or humidity sensors are required, resulting in overall cost reductions in the system.