OWNERS MANUAL

V1.0

H-377

THERMISTOR TEMPERATURE PROBE

D65 0815

YSI

a xylem brand

CONTENTS & WARRANTY

This user manual is a guide for the H-377 temperature probe. For more information, updated manuals, brochures, technical notes, and supporting software on the H-377, please refer to *waterlog.com* or contact your sales representative.

For additional assistance, please contact us at +1.435.753.2212 or sales@waterlog.com

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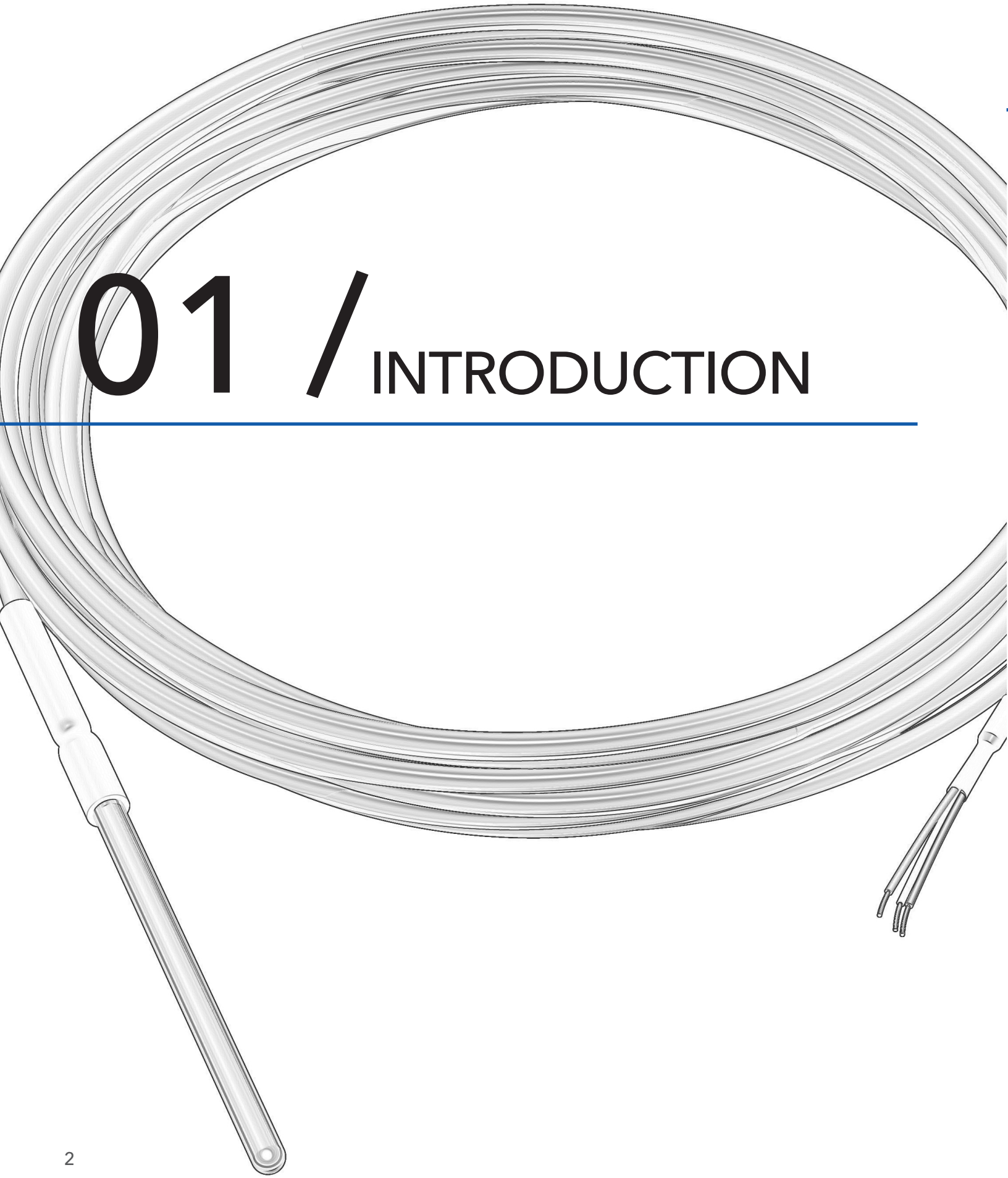

01 / INTRODUCTION

The WaterLOG® H-377temperature probe uses an NTC thermistor, and a precision reference resistor fully potted in a stainless steel tube for accurate water or air temperature measurement.

Key Features:

- Measurement range: -40 °C to +80 °C
- Measurement accuracy: ±0.2°C
- Sealed stainless steel probe for water/air temperature measurement
- Includes 100 feet of shielded cable
- Easily used with the WaterLOG H-350XL™ or H-500XL™

Theory of operation

The H-377 uses a thermistor and resistor combination for a simple, yet precise temperature measurement of water or air. The thermistor is classified as a Negative Temperature Coefficient (NTC) thermistor. This means that as the ambient temperature increases, the resistance of the thermistor decreases. The resistance of the thermistor has a non-linear relationship with the ambient temperature according to the Steinhart and Hart equation as follows:

T = 1 / (a + b (Ln Rt) + c(Ln Rt)^3)

Where **T** is the ambient temperature in degrees Kelvin, **Rt** is the resistance of the thermistor, **Ln** signifies the natural logarithm, and **a,b,and c** are the thermistor coefficients. The thermistor coefficients a, b, and c are determined by simultaneously solving the Steinhart and Hart equation for three temperature values and three corresponding resistance values taken from a Resistance vs. Temperature chart provided by the thermistor manufacturer. The thermistor coefficients for the H-377 are as follows:

a = 0.0010291636 b = 0.0002391251 c = 0.0000001566

The H-377 combines the thermistor with a 20K Ohm precision reference resistor, and when a +5.0 V precision excitation voltage is applied to the probe, an analog voltage related to the ambient temperature is produced. The thermistor resistance can be calculated as a function of the analog output voltage as follows:

Rt = 20000 * ((5/V)-1)

Where V is the analog voltage from the probe. Once the thermistor resistance is determined, it can be applied to the Steinhart and Hart equation in order to calculate the ambient temperature.

Using the H-377 with the H-350XL™ or the H-500XL ™

The H-377 connects directly to the analog input section of the H-350XL™ or H-500XL™. Temperature from the H-377 can be logged to the memory card, sent to a GOES transmitter, etc. The following sections explain how to use the H-377 with the H-350™ or H-500XL™.

Wire Connections

The H-377 has three pigtail wire terminations that connect directly to the analog input section of the H-350XL™ or H-500XL™. Table 1 shows the pin each wire should be connected to:

H-377 Wire	Terminal Connection
Red	+5Vref
White	Vin
Black	Agnd

Table 1: H-377 Wire Connections

Recording the Temperature

Temperature from the H-377 may be recorded by the H-350™ or H-500XL™ by entering the Steinhart and Hart equation directly into a user math function or by entering a special built in function. The user function containing either the Steinhart and Hart equation or the special built in function would then be selected as the data source for the temperature measurement.

The box below shows an example of how the Steinhart and Hart equation would be entered using the functions menu from the PC menu mode of the H-350XL™ or H-500XL™.

```
Functions Menu 01 to 10 (Esc to Return)

1 - Fnt01 = @0.0010291636
2 - Fnt02 = @0.0002391251
3 - Fnt03 = @0.0000001566
4 - Fnt04 = @20000*((5/ana1)-1)
5 - Fnt05 = (1/(fnt01+fnt02*(ln(fnt04))+fnt03*(ln(fnt04))^3))-273.15

7 - Fnt07 = 0
8 - Fnt08 = 0
9 - Fnt09 = 0
0 - Fnt10 = 0

N - Next
V - View Values

Enter Option >
```

In this example, functions 1 through 3 are used to define the thermistor coefficients a, b, and c. Function 4 is used to calculate the thermistor resistance based on the analog output voltage from the H-377 connected to analog input channel one. Function 5 is used to calculate the temperature in degrees Celsius using the Steinhart and Hart equation (note: function 5 uses the space for both functions 5 and 6). The @ sign included in functions 1 through 4 signify that these functions need not be included in the logging report. Function 5 would be selected as the data source in the logging report, GOES data options, etc. for the temperature measurement.

The next box shows an example of how to enter the special built-in functions for recording the temperature with the H-350XL™ or H-500XL™. These special functions combine all of the equations entered in the previous example into one simple function call. These special built-in functions are available beginning with firmware version 1.13.

```
Functions Menu 01 to 10 (Esc to Return)

1 - Fnt01 = h377c(ana1)
2 - Fnt02 = h377f(ana1)
3 - Fnt03 = 0
4 - Fnt04 = 0
5 - Fnt05 = 0
6 - Fnt06 = 0
7 - Fnt07 = 0
8 - Fnt08 = 0
9 - Fnt09 = 0
0 - Fnt10 = 0

N - Next
V - View Values

Enter Option >
```

In this example, the function h377c(ana1) is entered into function 1 in order to record the temperature in degrees Celsius, and the function h377f(ana1) is entered into function 2 in order to record the temperature in degrees Fahrenheit. Function 1 or 2 would be selected as the data source for recording the data.

For questions about logging, please consult the H-350XL™ or H-500XL™ owners manual.

Useful Conversions

The following equations are useful for converting the temperature units.

C = 5/9* (F-32)	To convert degrees F to degrees C
F = 9/5* C+32	To convert degrees C to degrees F
C = K - 273.15	To convert degrees K to degrees C

SPECIFICATIONS

PERFORMANCE		
Accuracy	Accuracy	±0.2° C
Response Time	Sampling	<0.7 Seconds
	Maximum Excitation	<4 Seconds
Range	Operating Temperature	-40° to 80°C
General	Temperature Sensor	10K Thermistor
MECHANICAL / POWER		
Size	Sensor	4 in. L x 0.2 in. W (102mm x 5.08mm)
	Sensor Cable	100 ft. (33m)
Weight	Sensor Shipping	1.5 lbs (0.68kg.) With cable
Material	Shield Plates	UV stabilized white thermoplastic
	Shield Mounting Bracket	Aluminum
	Shield U-bolt Clamp	White stainless steel
Power Requirements	Sensor Voltage Input	3.5-50 volts DC
	Sensor Consumption	0.0005mA
Connection	Shield Mounting bracket and U-bolt clamp	
General	Sensor Protection	IP67
	Radiation Shield Available	H-380-SS natural aspiration shield suitable for incident rain up to 68 km/hr. Includes adapter for smaller temperature probe.
COMMUNICATION		
Output Data Parameters	Analog Signals	Vishay/Dale precision 20K resistor in line with 10K thermistor

Xylem

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

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YSI Incorporated
1700/1725 Brannum Lane
Yellow Springs, Ohio, 45387, USA

Request a Quote
Tel: +1.435.753.2212
Email: sales@waterlog.com
Internet: www.waterlog.com

Place an Order
Tel: +1.937.767.7241
Email: orders@ysi.com

Customer Support
Tel: +1.937.767.2772