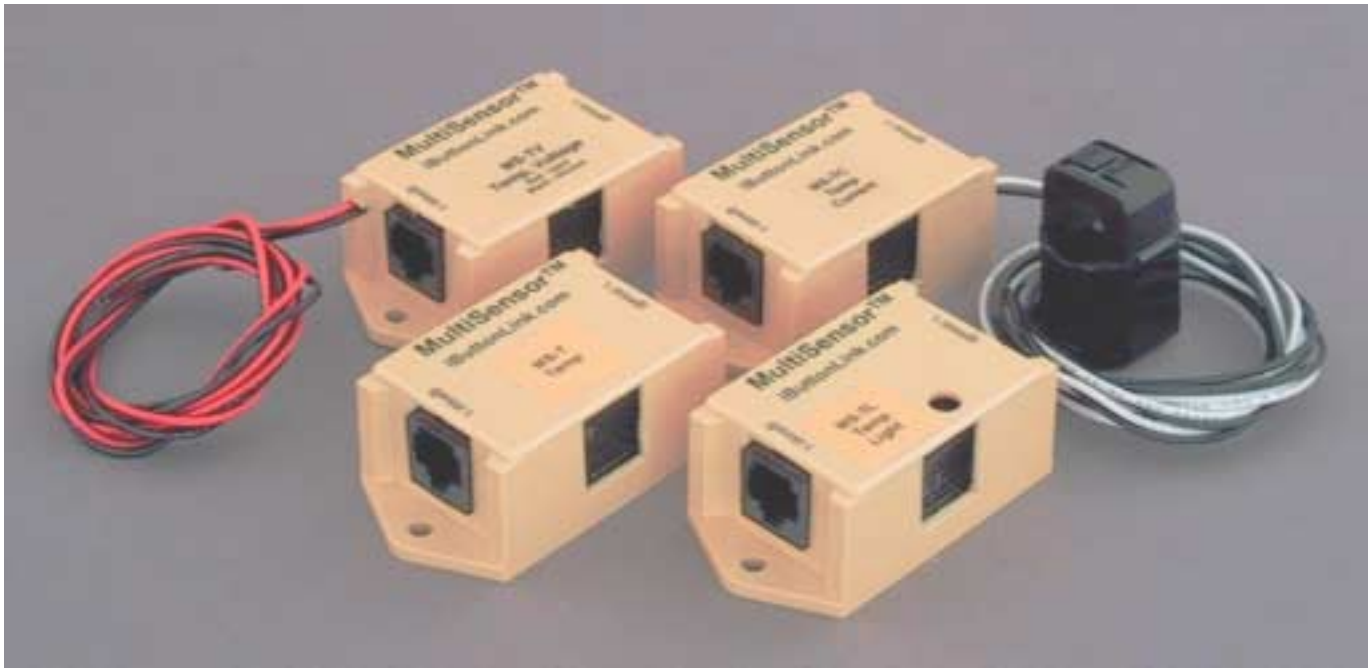
The MultiSensor™

Users Guide

Sensors for the 1-Wire™ Bus

All current models of MultiSensor™



Published October 10, 2005

INTRODUCTION:

The MultiSensor family provides a very low cost solution for the need to monitor, measure, record and alarm, remote parameters. MultiSensors are not designed for high degrees of accuracy, but are intended more as relative indicators of the conditions they monitor. At this time there are five (5) variants of MultiSensor; Temperature only, Temperature plus Humidity, Temperature plus Light Intensity, Temperature plus DC voltage and Temperature plus AC Current.

The MultiSensor family of products is designed to operate on the 1-wire™ bus structure, and as such, have many identical functions as well as unique functions. This document will address the similarities first.

Common Features:

All MultiSensor products are contained in a plastic box with mounting flanges. There is a RJ-45 connector on either end of the unit. This facilitates a simple connection of the sensor to +5 volts and ground on the 1-Wire® bus using cat 5E cables. The other connector provides a connection for the next sensor/device in the same manner. There is no polarity, or order to consider. The 1-Wire slaves are in parallel to one another. Pin assignments for the RJ-45 connectors are shown in appendix #1.

The RJ-45 jacks will accept RJ-12 plugs as well. NOTE: These devices are ***not*** Ethernet compatible.

The enclosures are not weather proof. They are intended for indoor use and to protect the electronics from coming in contact with external items that might cause failure or damage. The enclosure also provides for convenient mounting.

All models of MultiSensors have the ability to measure temperature. As a necessary result, the enclosures have a cutout in the side to facilitate airflow to the sensing device. The opening is screened over to deter insects, or other foreign materials.

Schematics for Multi-Sensor and all it's variants, are available on this website by clicking on "Sensors", and then selecting "MultiSensor Schematic".

The ADC used in all MultiSensors is a DS2438. Detailed information on this device can be found on this web site by selecting "Information and Documentation". Then select application note "775" or select application note "524". The latter will take you to the Dallas/Maxim web site and access to all of their application notes.

How to Read MSxx Products is a valuable application note which can found on this web site by selecting "Information and Documentation". Then select application note "AN0001".

Temperature Considerations:

The temperature measurement is made with a DS-2438Z. The device is not calibrated, but empirical data shows it to be accurate within a few degrees of actual, with an operating range of –40 to +85 degrees C. Because the sensing device is partially enclosed and mounted to the PCB, the response time to temperature changes will relatively slow. Care should be taken not to place the sensor in direct sunlight, as the radiant heat will be partially trapped inside the enclosure and cause readings higher than ambient.

MultiSensors, like all 1-Wire™ slaves, can operate on "parasitic" power. That is, they use the power contained in data signal of the 1-Wire™ bus, with a capacitor to sustain them during the zeros. Unlike most other 1-Wire™ devices, MultiSensors have an AUX jumper. This jumper connects the Vcc line on the sensor directly to the power source of the serial port (via the master Link), thus providing a constant Vcc to the sensor independent of what the line signal doing. The AUX jumper is set to provide Vcc when shipped from the factory. NOTE: If the AUX line of the master (Link) is being used for another purpose, the jumper on the sensor must be removed.

The number of devices that can be connected to a particular 1-Wire network will vary a great deal, depending on the capabilities of the serial port supplying the network. Typically, ten to fifteen devices can be supported without additional external power. If additional power is required due to a large number of slaves, excessive bus length, or a weak supply from the serial port, a bus master with external power provisions (LinkHUB) must be used.

MultiSensor model MS-TV

In addition to the temperature measuring already discussed, the MS-TV can also measure DC voltage in the range of 0 to +10 volts. The voltage can be sourced from most any other sensor that produces a DC voltage signal in the range of 0 to +10 VDC. The device being measured by the MS-TV need not be 1-Wire compatible. Two 18 gauge sense wires, approximately 30 inches are extended from the unit box.

MultiSensor model MS-TL

In addition to temperature measurement, the MS-TL can provide a general indication of light level. The maximum value of 5 volts corresponds to the light intensity of a 100 watt light bulb at a distance of 6 inches, while a zero volt reading indicates total darkness. To the amount that Vcc falls below +5 volts, the absolute maximum light level will become ambiguous. Most often this is not a concern since the device is intended to indicate *light present*, or *no light present*.

Note: There is a hole in the top of the enclosure that is directly over the light sensor. Care should be taken to keep this opening clear and facing the light source to be monitored.

MultiSensor model MS-TH

In addition to temperature measurement, the MS-TH will measure relative humidity. The device used for humidity sensing is a Honeywell part, number HIH-3610. The linearity from 0% to 100% humidity is +/- .5%. Accuracy with +5 Vcc is 2% over the full range at 25 degrees C. Response time in slow moving air is typically 30 seconds. The Vcc supply must be sustained above 4 VDC, with 5 VDC being optimal. For complete details, see Appendix #2.

When using a Link45 or Link12, humidity will be reported in the range of .8 VDC (zero percent

humidity) to 4.07 VDC (100% humidity). When using a LinkTH, The readings will be converted to % humidity.

MultiSensor model MS-TC

In addition to temperature measurement, the MS-TC will measure AC current in the range of 0 to 20 amps. While not calibrated, empirical data indicates a typical accuracy of +/-3% of reading. The response curve, established at 23 degrees C, is linear from .2 VDC (1 amp.) to 3.78 VDC (20 amps.). The zero current reading is .09 VDC. When used with a Link45 or Link12, the output will be voltage as stated above.

When used with a LinkTH, the output will be a 3 digit reading from 1.00 to 20.0. Regardless of the Link model used, readings below 1 ampere and above 20 amperes are not specified.

The sensing device used is a clamp-on current transformer. Dimensions are: 1.04”H x 1.04”W x 1.58”H. The “window” or aperture is .40” in diameter. The box containing the electronics is shipped with 3 feet of 18 gauge wire extending from it. It is up to the user to add or trim wire as desired and to make the final connection to the current transformer.

MultiSensor model MS-SIG

This unit is intended to measure analog voltage signals and control digital I/O lines. In addition, the ability to measure temperature is inherant in the unit, with the same abilities and limitations as the MS-T. There are 4 analog channels with 16 bit resolution, 1 analog channel with 12 bit resolution and 2 digital I/O channels.

MultiSensor model MS-PWR

The MS-PWR is *not* a sensor, but owing to it's close relationship with the sensor products, it is included here. The device will enable the user to inject external power into the 1-Wire® network when the serial port power is insufficient to drive the network.

The MS-PWR, is not a power supply! It will facilitate the use of an external source capable of supplying 12VDC to a 2.5mm coaxial connector, negative to the center post. For operation in the USA, the HubPwr device shown on our web site can be used.

CAUTION! The MS-PWR must be connected as the first device on the network (logically closest to the master interface). Failure to comply can result in faulty readings and in extreme cases, damage to the serial port circuitry.

MultiSensor models MS-TW and MS-THW

MultiSensor models, MS-TW and MS-THW, will monitor temperature and water or temperature, water and humidity. When used with the LinkTH, and the complimentary software THMon, readings will be expressed in degrees F or C, % humidity and "Yes" or "No" to indicate the presence of water.

The system operates on the 1-wire® serial bus architecture and requires no external power. All devices on the bus are parasitically powered by the signal strength from the serial port to which they are connected.

Details on temperature and humidity can be obtained from the MS-XX and Link owner's manuals, available at iButtonLink.com.

Requirements:

1. PC, or similar, with a serial port.
2. MS-TW or MS-THW
3. LinkTH, Link45 or equivalent
4. Length of extension cable, RJ-45 connectors on both ends
5. Length of Water Sensing Cable, terminated both ends with RJ-11 connectors
6. cable terminator (supplied with Water Sensing Cable)
7. Suggested: THMon software used only with LinkTH. Free download at iButtonLink.com

Specifications: (water sensing cable)

Rating –	Non-halogen, 4 conductor, 26 AWG, UV resistant
Connector -	4 pin, RJ-11 both ends, .40" x .33"
Reaction time -	Typically less than 1 second going from dry to wet
	Typically less than 2 seconds going from wet to dry
Operating Environment:	
Temperature -	-4 degrees to 176 degrees F (-20 to 80 degrees C)
Humidity -	5% to 95% non-condensing
Altitude -	10,000 feet max.

Storage - -4 degrees to 176 degrees F (-20 to 80 degrees C)
Dimensions - .06” x .20”
Weight - .0066 lbs/ft.

Specifications: (General)

Operating temperature - 0 to +80°C
Storage temperature - -40 to +85°C *(excluding water sensing cable)*
Accuracy - Humidity; +/- 2% within 5% to 95%
Temperature accuracy not specified.

Water detection is sensed with a low cost cable. The cable can be of any length (tested to 100ft.). Water, of 1/8 inch depth or more, anywhere along the entire length of the cable will report “Yes” indicating the presence of water. Obviously then the longer the sensing cable, the greater the area under detection, but also the greater the ambiguity of precise location.

In some cases a long cable is quite satisfactory, as in the case of perimeter monitoring, where a single long cable will monitor a room or other defined area.

When precise location over a large area is required, multiple cables can be arranged in a grid. One Multi-Sensor, MS-TW or MS-THW, must be used for each element of the grid. These devices are simply “daisy chained” via a cat5 cable with RJ-45 connectors, with a length of water detection cable extending from side port via a RJ-xx connector. Each sensing cable must be terminated.

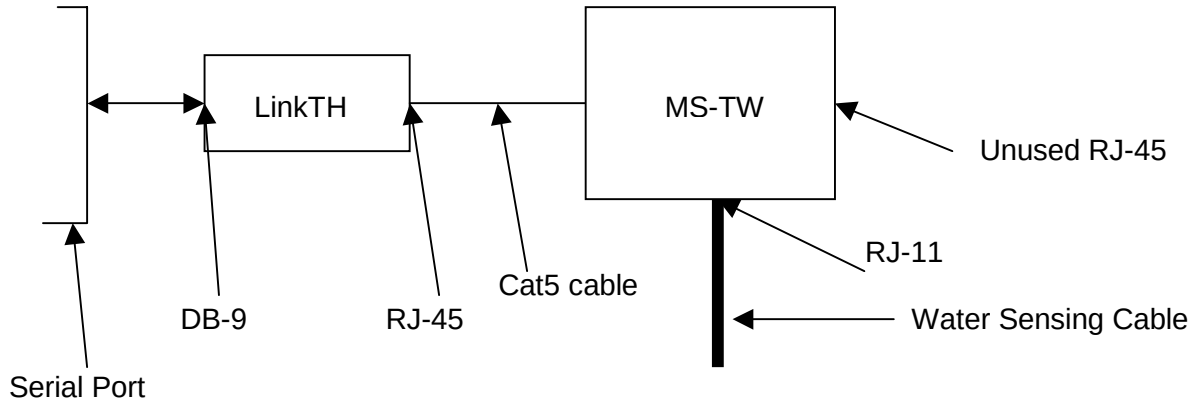


Fig. 1

Figure 1 shows a simple, single point monitoring system that will report the temperature at the location of the MS-TW and the presence or absence of water along the length of the Water Sensing Cable.

The master interface, LinkTH, connects to the serial port with a DB-9 connector (USB adaptors are available). All other connections are made via a universal RJ receptacle; that is, a single RJ-45 receptacle will accommodate RJ-11, RJ-12 and RJ-45 plugs.

The cat5 cable running between the LinkTH and the MS-TW can be any length, limited only by the 1-wire bus parameters. Temperature will be measured at the location of the MS-TW unit. The Water Sensing Cable can be extended away from the MS-TW (100 ft. max.) by use of telephone wire and a RJ-11 union. The Water Sensing Cable is shipped with a RJ-11 connector on either end and a RJ-11 terminating connector receptacle to be plugged into the far end of the sensing cable. If the user finds need to lengthen the sense cable, it is a simple matter of un-plugging the terminating connector, add on another length of sense cable with a RJ-11 union and replace the terminating connector at the far end of the new cable.

The MS-TW shown in Fig. 1 can be replaced with a MS-THW, and now humidity will be measured along with temperature and water. More Multi-Sensors can be added to the network by plugging a cat5 cable with a RJ-45 connector into the unused RJ-45 receptacle shown in Fig.1. There can be any mix of MS-XX devices on the network, that is; Temperature sensing only, Humidity and Temperature sensing, Light and Temperature sensing, plus Current and Temperature sensing. Electrically, all devices on the network are in parallel, so there is no concern over the physical location, or order, of one sensing device to another.

The LinkTH will accommodate use of normal ASCII commands. When used with THMon software, a complimentary, downloadable, data logging program, the system can now set and issue alarms as well as log information.
As mentioned, it is possible to sense and map an entire floor, ceiling or other defined area by arranging the sensors in a grid. The degree of locating resolution is limited only by the number of sense lines laid out on the grid. Fig. 2 provides a concept of how a grid might be arranged.

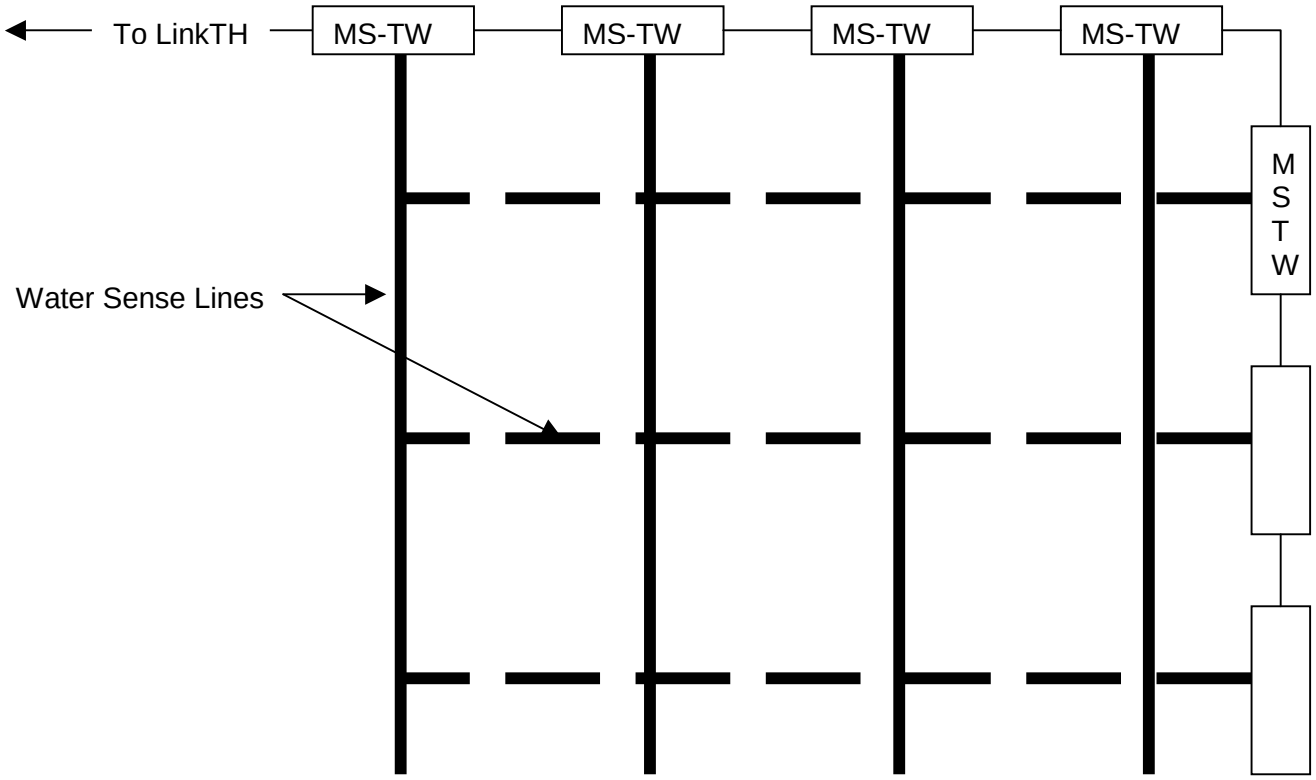


Fig. 2

The distance between the sense lines is at the discretion of the network designer. A typical computer room can be monitored in 4 ft., or even 2 ft. segments at an astoundingly low price. The cost of implementing a 1-wire® network is notoriously low and the Water Sensing Cable used by iButtonLink is revolutionary in its low cost, speedy response and reliability.

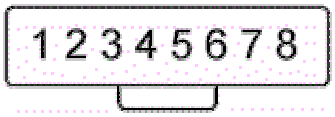
The same concept as shown in Fig. 2, can be used in ceilings or basements or any area that cannot tolerate standing water.

When water pipes or drainpipes are running over water sensitive areas or items, a Water Sensing Cable is easily fastened to the underside of the pipe. Thus it provides an early warning against costly damage.

The low cost, high reliability and ease of implementation make the MS-TW and MS-THW a practical solution to most any water detection application.

Appendix #1

The pin assignments listed below are viewed as looking into either jack on any MS-xx product. As a point of reference, the latch is on the bottom side of the jack.



Pin 1 = 5 volt return
Pin 2 = +5 volts
Pin 3 = Aux return
Pin 4 = 1-Wire® data
Pin 5 = 1-Wire® return
Pin 6 = AUX (Switched +5 volts)
Pin 7 = V+ (+12 volts)
Pin 8 = +12 volts return

*This pin numbering convention was changed in June of 2005 to be consistant with industry standards.

Honeywell

Representative photograph, actual product appearance may vary.

Due to regional agency approval requirements, some products may not be available in your area. Please contact your regional Honeywell office regarding your product of choice.

HIH-3610-001

HIH-3610 Series Integrated Circuity Humidity Sensor, 2,54 mm [0.100 in] Lead Pitch SIP

Features

- Molded thermoset plastic housing with cover
- Linear voltage output vs %RH
- Laser trimmed interchangeability
- Low power design
- High accuracy
- Fast response time
- Stable, low drift performance
- Chemically resistant

Typical Applications

- Refrigeration
- Drying
- Meteorology
- Battery-powered systems
- OEM assemblies

Description

The HIH-3610 monolithic IC (Integrated Circuit) humidity sensor is designed specifically for high volume OEM (Original Equipment Manufacturer) users. Direct input to a controller or other device is made possible by this sensor's linear voltage output. With a typical current draw of only 200 µA, the HIH-3610 is ideally suited for low drain, battery powered systems. Tight sensor interchangeability reduces or eliminates OEM production claibration costs. Individual sensor calibration data is available.

The HIH-3610 delivers instrumentation quality RH sensing performance in a low cost, solderable SIP (Single In-line Package). Available in two lead spacing configurations, the RH sensor is a laser trimmed thermoset polymer capacitive sensing element with on-chip integrated signal conditioning.

RH SENSOR CONSTRUCTION

Sensor construction consists of a planar capacitor with a second polymer layer to protect against dirt, dust, oils and other hazards.

Honeywell

HIH-3610-001

HIH-3610 Series Integrated Circuity Humidity Sensor, 2,54 mm [0.100 in] Lead Pitch SIP

Product Specifications	
Package Style	Solderable SIP
Termination Details	2,54 mm [0.100 in] Lead Pitch
Series Name	HIH-3610 Series
NIST Certification	None
RH Accuracy	± 2% RH, 0-100 % RH non-condensing, 25 °C, 5 VDC supply
RH Interchangeability	± 5% RH, 0-60% RH; ± 8% @ 90% RH Typical
RH Linearity	± 0.5% RH Typical
RH Hysteresis	± 1.2% of RH Span Maximum
RH Repeatability	± 0.5% RH
RH response time, 1/e	15 s in slowly moving air @ 25 °C
RH Stability	± 1% RH Typical at 50% RH in 5 Years
Supply Voltage	4.0 Vdc to 5.8 Vdc
Supply Current	200 µA Typical
Operating Humidity Range	0 to 100% RH, non-condensing
Operating Temperature Range	-40 °C to 85 °C (-40 °F to 185 °F)
Temperature Compensation	True RH = Sensor RH/(1.0546-0.00216T) T in °C (True RH = Sensor RH/(1.093-0.0012T) T in °F)
Availability	Global
Comment	Light sensitive, shield from bright light.
UNSPSC Code	411121
UNSPSC Commodity	411121 Transducers

Honeywell

HIH-3610-001

HIH-3610 Series Integrated Circuity Humidity Sensor, 2,54 mm [0.100 in] Lead Pitch SIP

PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices, or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

MISUSE OF DOCUMENTATION

- The information presented in this product sheet (or catalog) is for reference only. DO NOT USE this document as product installation information.
- Complete installation, operation and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.