



Hygrometer/Controller

Model 6400

PC Board Module for use in OEM Equipment

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Manual Revisions

| Rev | Date | Description |
|-----|---------|--------------------------|
| A | 9/2019 | Initial release. |
| B | 12/2019 | Product revision update. |

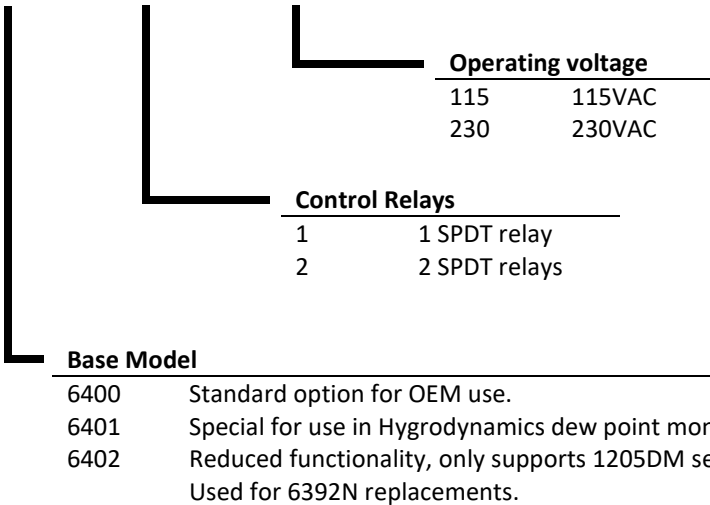
Product Revisions

When device is powered on, a product revision code will be displayed on the LED for 2 seconds.

| Revision | Date | Description |
|----------|------------|--|
| r1.01 | 9/4/2019 | Initial release. |
| r1.02 | 12/3/2019 | Internal revision, functionally same as r1.01. |
| r2.01 | 12/16/2019 | Added support for 1405DM sensor. |

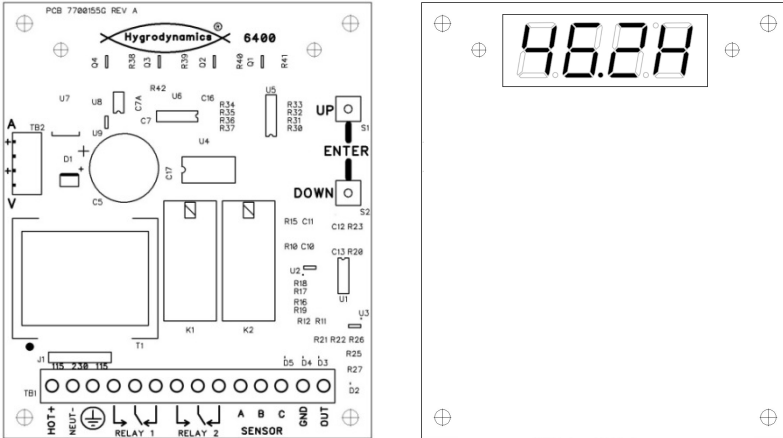
Ordering Options

6400 - **1** - **115**



Product Overview

The 6400 is a standalone PC board module used to indicate and control moisture in industrial process air. When used with Newport Scientific's Hygrosensors, a broad range of moisture conditions can be monitored.



Features:

- Large 4-digit red LED display on the backside of PC board to indicate measured moisture value, either in relative humidity or dew point.
- Up to two dry contact relay outputs for control and alarm indication.
- 0-5VDC linear output for connection to data acquisition system.
- Capable of temperature compensated measurements when used with 1400 series Hygrosensors.
- Flexible configuration through simple pushbutton interface.

Sensor Selection

The 6400 is designed for exclusive use with Newport Scientific's narrow range Hygrosensors. Correct sensor selection is important for a successful moisture monitoring system. Use 1200 series for basic moisture measurement, or 1400 series for enhanced accuracy and measurement range.

1200 Series Sensors

For applications where relative humidity is the process variable to be controlled, and the temperature of the process air is constant and normally around 80°F, standard 1200 Series Hygrosensors can be used. 1200 Series Hygrosensors only measure moisture, so the 6400 must assume a default temperature of 80°F to perform the humidity calculation. These sensors have a fixed usable measurement range.

1200 Series Sensor Measurement Ranges

| Sensor Model | Color Code | Dew Point Range | RH range |
|--------------|------------|-----------------|---------------|
| 1205DM | White | -40°F to +15°F | 0.4% to 7.8% |
| 1207 | Black | -7°F to +23°F | 2.5% to 11.5% |
| 1209 | Brown | 1°F to 31°F | 3.8% to 17.0% |
| 1211 | Red | 22°F to 39°F | 11% to 23% |
| 1213 | Orange | 33°F to 49°F | 18% to 34% |

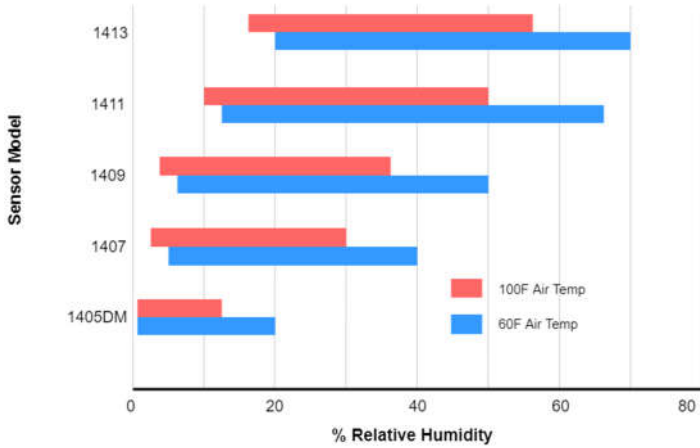
1400 Series Sensors

If the process variable is dew point or relative humidity in conjunction with significant air temperature variations, it is recommended to use 1400 Series Hygrosensors, which is a new generation of 3-pin Hygrosensor. These sensors include a built-in thermistor to enhance the accuracy and range of relative humidity and dew point measurements.

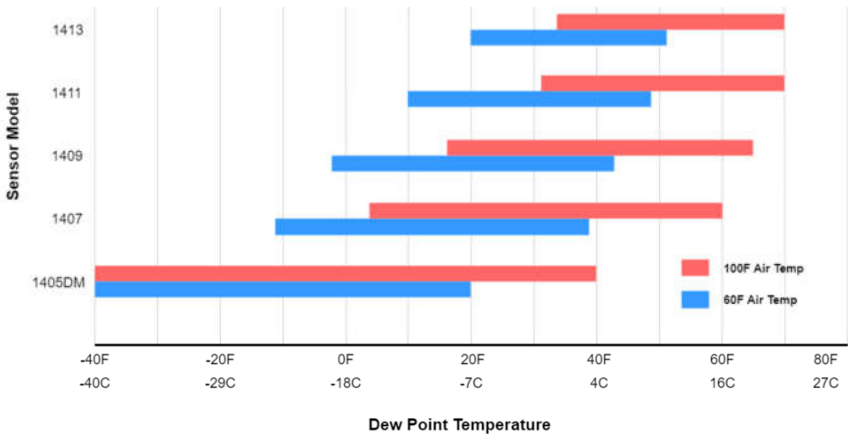
Since air temperature is an active part of the measurement, variations in temperature will have an effect on the usable range of each sensor. Use the charts below to determine the best sensor for your application based on expected air temperature and moisture levels.

1400 Series Sensor Measurement Ranges

RH Measurement Range



Dew Point Measurement Range



NOTE: Hygrosensors can operate at temperatures beyond those shown in the charts. Contact Newport Scientific about applications at more extreme temperatures.

Sensor Recommendations by Application

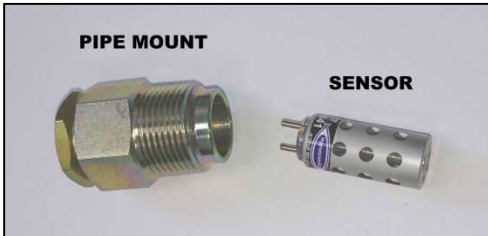
| Monitoring Application | Sensor |
|--|---------------|
| Desiccant dryers for plastics molding | 1405DM |
| Desiccant dryers for medical breathing air | 1407 or 1409 |
| Refrigerated dryers for medical breathing air | 1409 |
| Refrigerated dryers for industrial process air | 1411 |
| Food processing/bulk material testing | 1413 |

Sampling Options

The method of air sampling and sensor installation depends on the application. Review the choices below and contact Newport Scientific if you have special requirements that don't fit our most popular configurations.

Pipe Mount Sensor

For compressed air, or systems that distribute air in pipes larger than 1/2", our 1"NPT sensor pipe mount is suggested. In this arrangement, the sensor is housed in a custom pipe plug with 1"NPT male threads. The sensor is secured



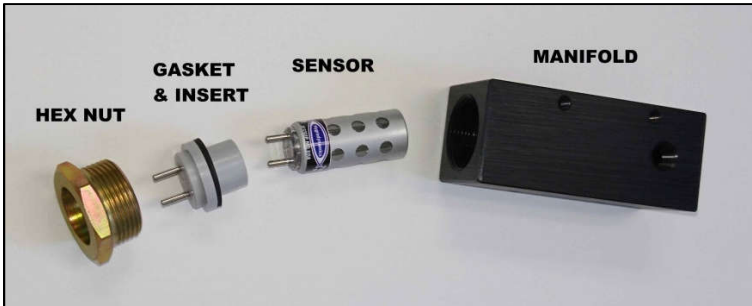
to the pipe mount by plugging it into the electrical port inside the fitting. The sensor is easily replaced and is not a permanent part of the pipe mount.

The pipe mount is available in yellow chromate steel (part 6146A) or acetal copolymer (part 6146C). The pressure rating is 300psi.

Sample Cell

The sensor can be housed in a sample cell manifold. This arrangement works with compressed air or atmospheric sampling. The process air must be piped to the manifold and allowed to fill and pass through the manifold, then exit a second port in the manifold. When used with compressed air, a bleed orifice must be installed on the manifold outlet port to maintain sample pressure

inside the manifold. If sampling atmospheric air, a sampling vacuum pump may be required at the manifold outlet port to ensure adequate sample air flow through the manifold.



The sensor manifold has multiple 10-32 tapped holes for attachment to a panel. The two sample air ports are female 1/8" NPT. The direction of air flow through the manifold is not critical.

Flow rate through the manifold affects response time of the sensor. A flow rate of 1SCFH or more provides good response in most applications. The pressure rating of the manifold system is 150psi.

Sensor Manifold Assembly Parts List

Newport Scientific part no.

Description

| | |
|----------|---|
| 3300101 | Manifold, 1.5" square bar X 3.63" long |
| 3300104 | Manifold, 1.5" dia X 3.63" long (alternate style) |
| 0900106 | Sealing insert, 2-pin for 1200 series sensors |
| 0900110C | Sealing insert, 3-pin for 1400 series sensors |
| 1000613G | Sealing gasket |
| 4600204 | Hex nut |

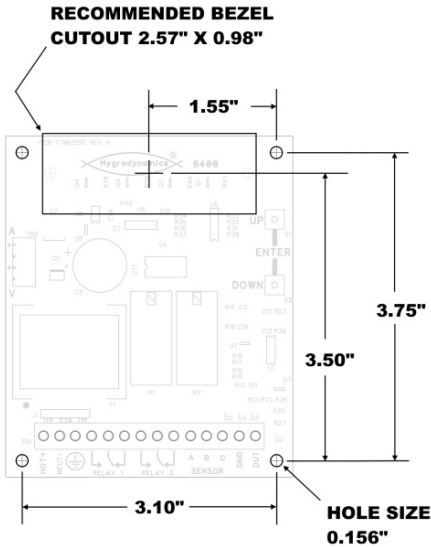
Installation

The 6400 PC board is intended for permanent installation in industrial environments. Use in other applications may impair the operational safety of the unit.

PC Board Mounting

The PC board is designed to be mounted behind a control panel with the LED display showing through a panel cutout.

WARNING: As part of the installation, the 6400 must be housed in a suitable electrical enclosure. This enclosure must also serve as a suitable fire enclosure. The PC board is not rated for exposed operation.



Standoffs used for mounting the 6400 should be at least 0.25" long to maintain adequate clearance between the electrical contacts on the board and the mounting surface. To secure the PC board, use four standoffs with screws, *or* two standoffs with screws and display bezel part no. 1835002 from Newport Scientific. The display bezel replaces the need for standoffs and screws at the display end of the PCB board, and also finishes the panel cutout for a neat appearance.


The lower two mounting holes have electrical connection to PC board ground, and will provide grounding to chassis if metallic hardware is used.

Wiring

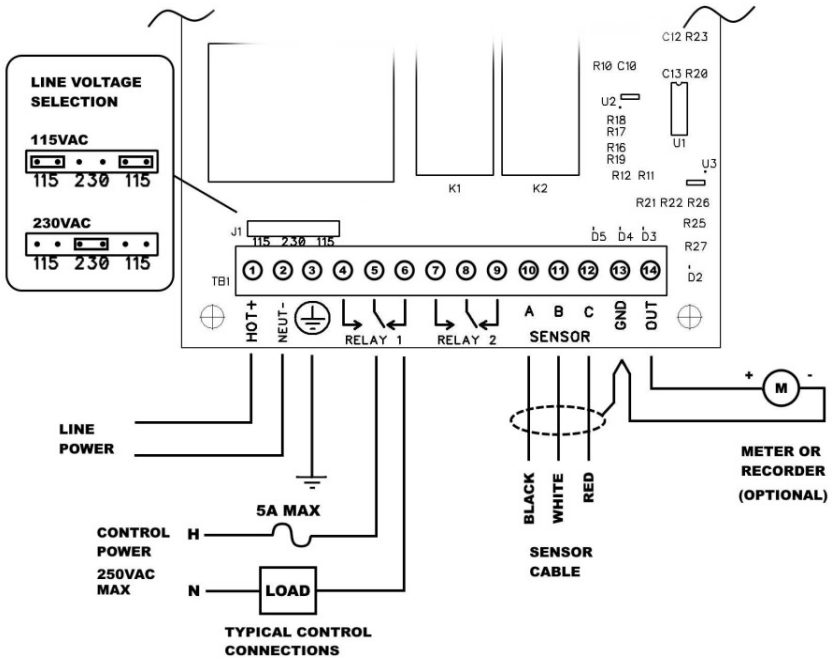
NOTE: If stranded conductor wire is used, the cut and stripped ends must be securely twisted to contain all loose strands.

WARNING: The 6400 incorporates connections of hazardous line voltage and low voltage wiring together in close proximity. Care should be taken during installation to ensure that hazardous voltage does not contact low voltage wiring or other PC board components.

Terminal Block Connections

| No. | ID | Function |
|-----|---|--|
| 1 | HOT+ | Board power voltage |
| 2 | NEUT- | Board power return |
| 3 |  | Protective ground |
| 4 | RELAY 1 NO | Dry contacts for control. Diagram depicts relay unenergized. Operational state depends on relay settings |
| 5 | RELAY 1 COM | |
| 6 | RELAY 1 NC | |
| 7 | RELAY 2 NO | Dry contacts for control. Diagram depicts relay unenergized. Operational state depends on relay settings |
| 8 | RELAY 2 COM | |
| 9 | RELAY 2 NC | |
| 10 | SENSOR A | Sensor excitation signal (black) |
| 11 | SENSOR B | Sensor humidity signal (white) |
| 12 | SENSOR C | Sensor temperature signal (red) |
| 13 | GND | Sensor cable shield & ground for OUT |
| 14 | OUT | 0 to 5 volt linear output |


NOTE FOR 6392N APPLICATIONS: When replacing a legacy 6392N board, connection numbers 1-11 can be duplicated directly to the 6400 terminal block. Only the sensor cable shield needs to be relocated to terminal number 13 on the 6400 board.



Power

Wire for power connections must be minimum 22AWG wire rated 300VRMS. Protective ground wire must be minimum the same size as used for power connection.

WARNING: An all-pole disconnect device should be installed in line with the power connections to the board to allow safe servicing of the board. Any disconnect used must not interrupt the connection to protective earth ground.

Connect supply voltage to terminals HOT+ and NEUT-. The supply voltage is determined by jumper positions J1. The board supply voltage is pre-configured according to the model number (115 or 230). Connect circuit ground to the terminal marked .

It is recommended to fuse the supply to the board with a 0.5AMP fast acting fuse.

Relay 1 & 2

The relays are dry contacts used for alarm indication and process control. The schematic shown on the board depicts the contact arrangement of the un-energized relay. Relay behavior is defined by its *relay action* setting.

NOTE: Relay 2 is present only on 6400-2 models.

Sensor

Sensor terminal A is the sensor excitation signal. Sensor terminal B is the moisture signal, and terminal C is the temperature signal. Terminal C is only used with sensors that have air temperature measurement capability.

For all installations, a foil shielded cable is recommended, with the shield wire connected to the GND terminal.

| Terminal | Hydrodynamics cable color code |
|-----------------|---|
| Sensor A | Black |
| Sensor B | White |
| Sensor C | Red |
| GND | Clear or bare |

Linear Output

The OUT terminal provides a 0-5VDC signal representing the measured process unit value. Use the adjacent GND terminal for signal reference.

Configuration

Configuration options are available through the pushbuttons on the back of the PC board. Two buttons are used to navigate through the menu. Scroll through options using the **UP** and **DOWN** buttons, and press both buttons together to select (this is the **ENTER** command).

Enable *configuration* mode by pressing **ENTER**. Note that all control functions and linear output are locked in their current state when in *configuration* mode. If no buttons are pressed for some time, the unit will automatically revert to *operational* mode.

WARNING: Menu navigation is performed while power is applied to the PC board. Avoid touching other parts of the PC board while pressing buttons.

- ↑ **UP** button: increase value or scroll through menu
- **ENTER** (press **UP** and **DOWN** together)
- ↓ **DOWN** button: decrease value or scroll through menu

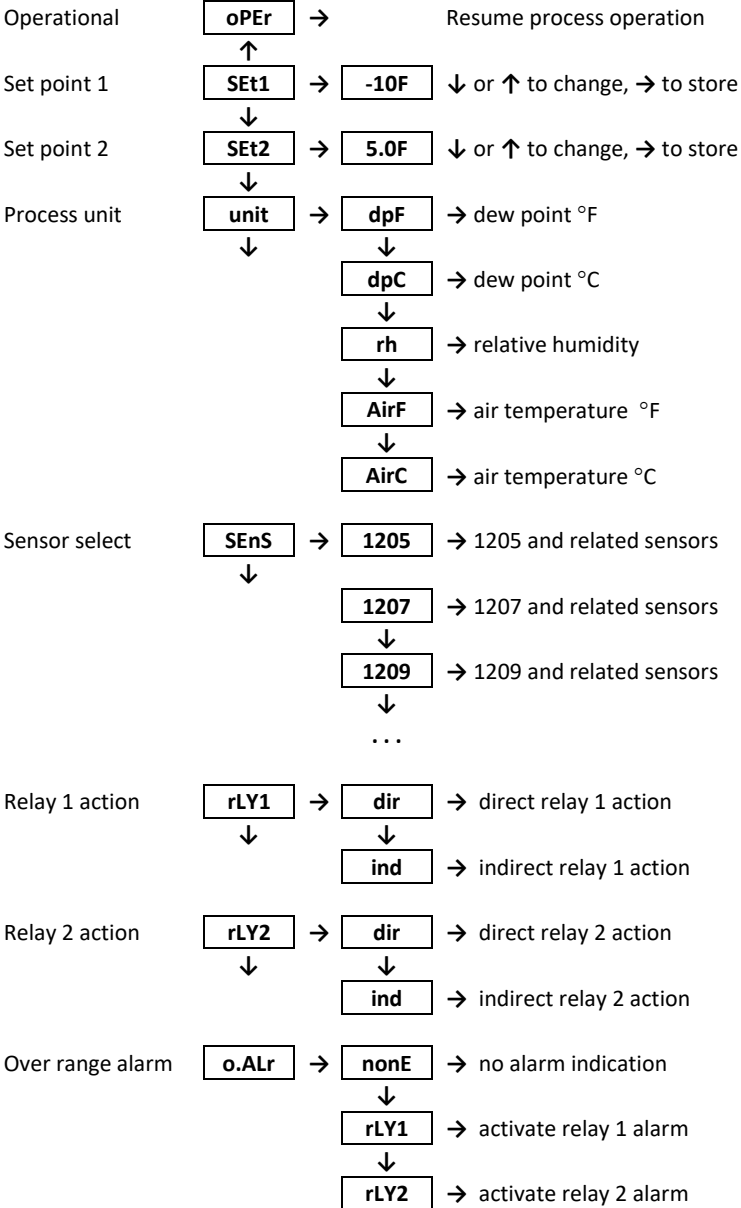
Menu Quick Navigation

Menu enters at **SEt1** option. Use **UP** or **DOWN** to navigate from there. When finished making selections, scroll back to **oPEr** and press **ENTER**, or wait for unit to automatically revert to **oPEr** mode after several seconds.

NOTE: Some board models do not support all the menu options.

Configuration Mode

Menu Options



Configuration Options

Set Point

Factory default: **SEt1** -10°F, -23°C dew point, or 30% RH
 SEt2 5.0°F, -15°C dew point, or 70% RH

Options: -39°F to +70°F dew point
 -39°C to +21°C dew point
 1 – 99 % RH
 (set point resolution is 1.0 units)

Relay 1 is controlled by set point 1. Relay 2 is controlled by set point 2. The set point units displayed will depend on the process unit currently selected (**unit** menu option). Separate values are stored for °F dew point, °C dew point, or % RH. Because of this, make sure to update set point values when reconfiguring the board's process unit selection.

Attempting to adjust **SEt2** on models with one relay will display an error message **Err**.

Attempting to adjust SEt1 or SEt2 while the process unit is **AirF** or **AirC** will display an error message **Err**.

Control around the set point has a fixed hysteresis band of 1.0 units. Relay action above and below the set point is determined by the **rLY1** and **rLY2** setting.

Process Unit

Factory default: **dpF**

| | | |
|----------|-------------|-----------------------------------|
| Options: | dpF | Dew point °F |
| | dpC | Dew point °C |
| | rh | Relative humidity |
| | AirF | Air temperature °F (display only) |
| | AirC | Air temperature °C (display only) |

The parameter that the PC board operates on is determined by the process unit setting. This is the value that is displayed on the LED and controls the relays and linear output during normal operation.

Note: If operating in **AirF** or **AirC** units, the control relays will revert to a state as if the process variable is below the set point (a non-alarm condition). Air temperature information is for reference only- this product is not intended to control temperature.

If **AirF** or **AirC** is selected when no temperature measurement sensor is connected, the LED display will show dashes to indicate an invalid condition.

Sensor Select

Factory Default: **1205**

| | | |
|----------|-------------|--|
| Options: | 1205 | Setting for 1205, 1205DM, 1405 sensors |
| | 1207 | Setting for 1207, 1407 sensors |
| | 1209 | Setting for 1209, 1409 sensors |
| | 1211 | Setting for 1211, 1411 sensors |
| | 1213 | Setting for 1213, 1413 sensors |

Sensor selection determines the measurement range of the 6400. For correct readings, the sensor selection must agree with the sensor part number that is connected to the PC board (refer to the options listed above).

Although only 1200 series sensor models are shown in the menu options, the corresponding 1400 series sensors will automatically be detected by the board.

Each sensor provides a unique measurement range. Refer to **Sensor Selection** at the beginning of this manual for details.

Relay Action

Factory Default: **ind**

Options: **dir** Direct action
 ind Indirect action

Relay action defines the behavior of the control relay as the set point and process variable are compared to each other.

| Relay Action | Behavior |
|---------------------|---|
| Direct | Relay is un-energized when measured parameter is below set point. |
| Indirect | Relay is energized when measured parameter is below set point (this is default behavior). |

When set to *direct action*, the relay contact state is as shown on the terminal block legend when the process variable is *below* the set point.

When set to *indirect action*, the relay contact state is reversed. The contacts are connected as shown on the terminal block legend when the process variable is *above* the set point. If your application considers this an ‘alarm’ condition (such as a high dew point alarm on a dryer), this setting will also indicate an ‘alarm’ when operating power is removed from the 6400 PC board. *Indirect action* is the default setting in order to be compatible with 6392 installations.

Note that *indirect action* is typically required in ‘failsafe’ applications, such as medical air monitoring, so that an alarm is indicated when board power is turned off.

Attempting to adjust **rLY2** action on models with one relay will display an error message **Err**.

Relay 1 and Relay 2 action can be configured independently.

Over Range Action

Factory Default: **none**

| | | |
|----------|-------------|-----------------|
| Options: | none | No action taken |
| | rLY1 | Relay 1 alarm |
| | rLY2 | Relay 2 alarm |

Sensor over range condition can be indicated by forcing an alarm on either of the control relays. Over range detection only applies to RH or dew point parameters, NOT to air temperature.

The alarm indication will simulate a high moisture condition, as if the RH or dew point is above the set point.

Over range detection occurs when the moisture sensor is at its maximum usable range. It can also indicate certain sensor failures such as contamination, physical damage, or a shorted sensor cable.

rLY2 selection is not available on models with one relay.

Operation

When the unit is in operational mode, the selected process unit is displayed on the LED display, and the linear output signal will track the parameter measurement in real time.

NOTE: the controller will not activate relay alarms when the process unit is set to **AirF** or **AirC**. This product only controls dew point or RH process variables.

Display Notifications

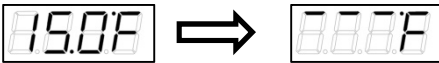
During operation, the LED display may periodically show messages to indicate error conditions or other information. These messages are described below.

Sensor Out of Range

When the measured moisture level is beyond the range of the sensor, the display will indicate an out of range condition by occasionally flashing dashes in place of the actual reading. This is a warning that the value indicated on the display may not represent the actual process value.

When using the 6400 with 1400 Series sensors, the value at which out of range condition occurs will vary with air temperature.

Sensor Over Range

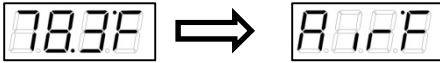


Sensor Under Range



Air Temperature Units Reminder

If the process unit is set to **AirF** or **AirC**, the display will occasionally flash **Air** in place of the temperature reading to remind users that the product is configured to indicate air temperature as opposed to dew point.



Missing Thermistor

If the process unit is set to **AirF** or **AirC** without a 1400 Series sensor connected to the board, the display will indicate a missing thermistor condition.



Maintenance

The PC board is permanently calibrated at the factory, and no adjustments are required. The sensor used with the board should be replaced annually as part of a preventive maintenance program to ensure accurate operation. All sensors of the same part number are interchangeable and can be replaced without any adjustments to the PC board settings. If changing sensor part numbers, make sure to change the sensor selection in the board's configuration menu to agree with the new sensor type.

Specifications

| | |
|--|---|
| DEW POINT RANGE | -40°F to +70°F (-40°C to 23°C), sensor dependent |
| RH RANGE | 0.4% RH to 95% RH, sensor dependent |
| TYPICAL SYSTEM ACCURACY | ±3°F dew point ±2% RH ±2°F air temperature |
| CONTROL RELAY CAPACITY | 5A 250VAC |
| ANALOG OUTPUT SCALE | Depending on units selection, 0 - 5VDC scaled as: -40°F to +70°F (-40°C to 23°C) dew point 0 to 100% RH 32°F to +158°F (0°C to 70°C) air temperature |
| POWER REQUIREMENTS | 115VAC or 230VAC 50/60HZ 0.1A max |
| PCB OPERATING TEMPERATURE RANGE | 32°F to 122°F (0°C to 50°C) |
| PCB DIMENSIONS | 3.5"H X 4.15"W X 1.6" installed overall depth |

Warranty

NEWPORT SCIENTIFIC, INC. warrants that all equipment manufactured by NSI shall be free from defects in material and workmanship which might impair its usefulness. SELLER DOES NOT WARRANT THAT THE EQUIPMENT IS FIT FOR ANY PARTICULAR USE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF; the obligation under this warranty is limited to repairing or replacing, at Seller's factory, any defective parts which, when returned by the buyer, **TRANSPORTATION PREPAID**, examination discloses to have been factory defective. The time limit of this warranty is ONE YEAR from date of shipment of new equipment, SIX MONTHS from date of shipment of Hygrodynamics Wide-Range Sensors and THREE MONTHS from date of shipment of Hygrodynamics Narrow-Range Sensors and repaired equipment. THIS WARRANTY IS EXPRESSLY IN LIEU OF OTHER WARRANTIES. Seller shall not be held liable for any special, indirect, consequential damages arising out of this warranty or any breach thereof, of any defect in or failure or malfunction of the equipment and materials are further subject to tolerances and variations consistent with usages of trade. This warranty shall run in favor only of the purchaser from Seller and may not be passed on or represented on behalf of Seller to any subsequent purchaser.

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In the case of special equipment or modifications to standard equipment manufactured at the request of the buyer, under buyer-approved specifications, buyer will indemnify Seller against the risk damages due to patent infringement.

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