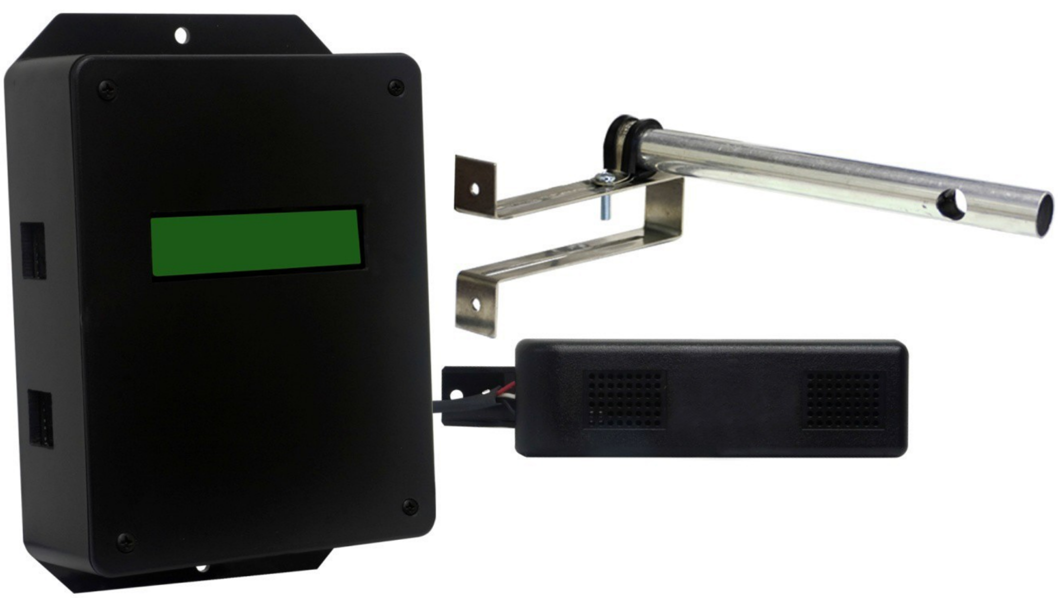
DESICCANT ROTORS INTERNATIONAL, INC.

Installation, Operation and Maintenance Technical Manual

MODEL DRI-1000-A

HEAT RECOVERY WHEEL (HRW) CONTROLLER WITH SADT LOGIC, ANALOG OUTPUT, RS-485 OUTPUT & BACnet INTERFACE

Document TM_DRI-1000-A
Revision R4A
Firmware v2.04



Desiccant Rotors International, Inc. PO Box 1116, Cornville AZ 86325 **Phone**: (928) 639-2767 **Web**: www.driamerica.com

REVISION HISTORY

Revision	Description	Date
R4A	SADT Operating Mode Addition, with Content Changes	01/06/2015
R4A	Numerous Content Changes	01/06/2015
R2A	RS-485 Output Update, Content Revised Accordingly	07/01/2011
R1B	Mechanical Detail Revision	05/19/2011
R1A	Initial Document Release	08/25/2010

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. SCOPE

This document provides installation, operation, maintenance and technical specifications for the DRI- 1000-A advanced HRW controller. Model DRI-1000-A is designed for specified Desiccant Rotors International–US (DRI) HRW systems.

1.1. OVERVIEW

The DRI-1000-A consists of four accurate relative humidity/temperature (RH/T) sensors and a microprocessor controller with LCD display to process the raw sensor signals and provide a PID loop output control signal for heat wheel speed control. Both analog and RS-485 outputs are available from the DRI-1000-A for interface with virtually all modern building automation systems. In addition, the Controller will accept up to two model S-110 air flow sensors for indication of critical outside/exhaust airflows at the heat wheel face. A programmable alarm feature provides local and remote alarm/notification when outside air flow falls below a preset limit, or if no heat wheel rotation is detected by the (customer provided) proximity sensor in the HRW system. The programmable alarm output feature can be set to provide dry relay contacts (N.O. or N.C.) or direct LED drive current (15 mA typical) for a wide range of alarm interfaces.

The DRI-1000-A is available with optional air flow probes and RH/T sensors as shown in Figure 1. Table 1 lists the system model codes and the sensors/probe complement provided with each model.

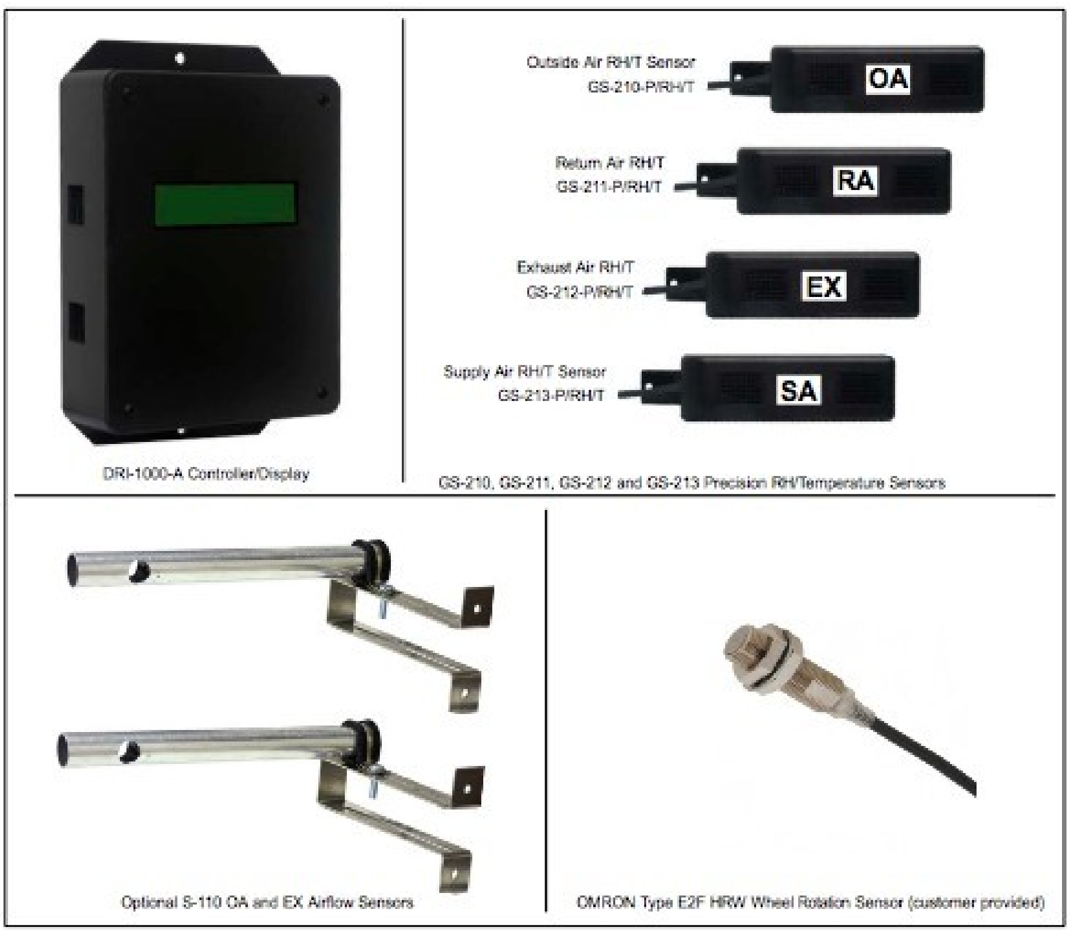


Figure 1. DRI-1000-A HRW Controller System Components

Table 1. DRI-1000-A Models and Sensor Configuration Matrix

System Model	Controller/Display Unit	Air Flow Probes Supplied	RH/T Sensors Supplied
DRI-1000-A	(1) DRI-1000-A	No Air Flow Probes Supplied	(1) GS-210-P/RH/T (OA) (1) GS-211-P/RH/T (RA) (1) GS-212-P/RH/T (EX) (1) GS-213-P/RH/T (SA)
DRI-1000-A/**02**	(1) DRI-1000-A	(2) S-110/01/10 (For OA and EX)	(1) GS-210-P/RH/T (OA) (1) GS-211-P/RH/T (RA) (1) GS-212-P/RH/T (EX) (1) GS-213-P/RH/T (SA)

2. DRI-1000-A SPECIFICATIONS

System

Accuracy:	
Temperature Accuracy:	±0.6°C (1.08°F) @ 25°C
Temp. Resolution:	±0.2°C (0.36°F)
RH Accuracy @25°C:	± 2% (20-80% RH); ±3% (0-20%, 80-100% RH)
RH Resolution:	± 0.4%
Airflow Accuracy:	± 3% of reading typical; ± 4% max from 0 to 2,000 fpm [10.16 m/s]
Operating Temperature:	
RH/T Sensors:	-20° to 140°F [-28.9 to +60°C]
Airflow Sensor:	-20 to 160°F [-28.9 to 71.1°C]
Controller:	-20 to 120°F [-28.9 to 48.9°C]
Operating Humidity:	0 to 100% non-condensing
Power Input:	24VAC ±10% (21.6 – 26.4VAC), 10VA maximum

Controller/Display Unit:

Model/Type: Model DRI-1000-A

Description: 32-bit microcontroller with 128K Flash memory/ 16K RAM and bus speed of 24.576 MHz. Internal reset circuit and watchdog protection. 12-bit A/D converter with true resolution of 10 bits powered by a +/- 50 ppm voltage reference for accuracy and stability.

Integral 16 character LCD display panel for monitoring system status and for system setup and configuration via four tactile pushbutton switches.

Internal fault detection circuitry. Board-mounted 'Activity' LED indicating instrument health/status. LCD display indicating system and programmable Alarm status.

RS-485 interface for BACnet MS/TP.

Enclosure: Durable UL94V rated electronic housing with removable cover

Dimensions: (HxWxD) 6.215 x 4.720 x 2.113 in [157.86 x 119.89 x 53.67 mm] enclosure;
Overall height with integral 0.535 in [13.59 mm] mounting flanges is 7.285 in [185.04 mm]

Mounting: Four 0.190 in [4.83 mm] diameter holes; two on each mounting flange

Relative Humidity/Temperature Sensors (requires OA, RA, EX and optional SA):

Model/Type: Model GS-210-P/RH/T (OA), GS-211-P/RH/T (RA), GS-212-P/RH/T (EX) and (optional) GS-213-P/RH/T (SA)

Description: Precision relative humidity and temperature sensing elements with custom microcontroller and firmware for OA, RA, EX and SA operation and integral proprietary communication interface with the DRI-1000-A controller.

Enclosure: Durable UL94V rated electronic housing with removable cover

Dimensions: (HxWxD) 0.94 x 1.17 x 3.83 in [23.88 x 29.72 x 97.28 mm] enclosure;
Overall depth with integral mounting flanges is 4.57 in [116.08 mm]

Air Flow Sensor Probe (optional for OA and EX air flows):

Model/Type:	Model S-110/01/10
Description:	Single sensor airflow probe with bead-in-glass and precision thermistors at each node and universal adjustable mounting bracket. Waterproof construction with marine grade epoxy potting compound. A 10 foot plenum rated cable is supplied with a 5-pin DIN connector (other cable lengths optional).
Sensing Nodes:	1 sensing node per probe; maximum of 2 probes (OA, EX) per controller.
Probe Material:	Type 6063 aluminum
Diameter:	0.75 in [19.05 mm]
Length:	8 inch [203.2 mm]
Brackets:	Standard adjustable universal mounting brackets included

Heat Wheel Rotation Proximity Sensor Input:

Sensor Type Required:	Customer-supplied proximity sensor, Omron type E2F, 3-wire NPN/PNP sensor or equivalent

Analog Output Performance:

Description:	Two independent, non-isolated linear analog outputs, as follows:
Analog OUT1: (AOUT1)	Uses an optimized PID loop with custom control strategy for VFD HRW motor speed control in specified DRI HRW systems.
Analog OUT 2: (AOUT2)	Programmable as either exhaust dry-bulb temperature to dew point differential ($\mathbf{T_D}$) or as OA airflow rate (using an optional OA airflow probe).
Output Range:	Selectable 0-10VDC / 0-5VDC / 2-10VDC @20 mA maximum
Resolution:	0.011% of Full Scale (0.022% for 0-5VDC range)
Output Load:	500$_\Omega$ min. load (20 mA max.)

RS-485 Output Interface:

Description:	Non-isolated BACnet MS/TP
Baud Rate:	76.8 kbps maximum

Alarm Output Interface:

Description:	Programmable multi-function alarm with local and remote alarm interface
Alarm Types:	1. Dry relay contacts; 30VDC/24VAC, 3A max; or as direct LED drive (15 mA typ) 2. Local flashing LCD display indicating alarm condition

2.1. Model DRI-1000-A Controller Mechanical Details

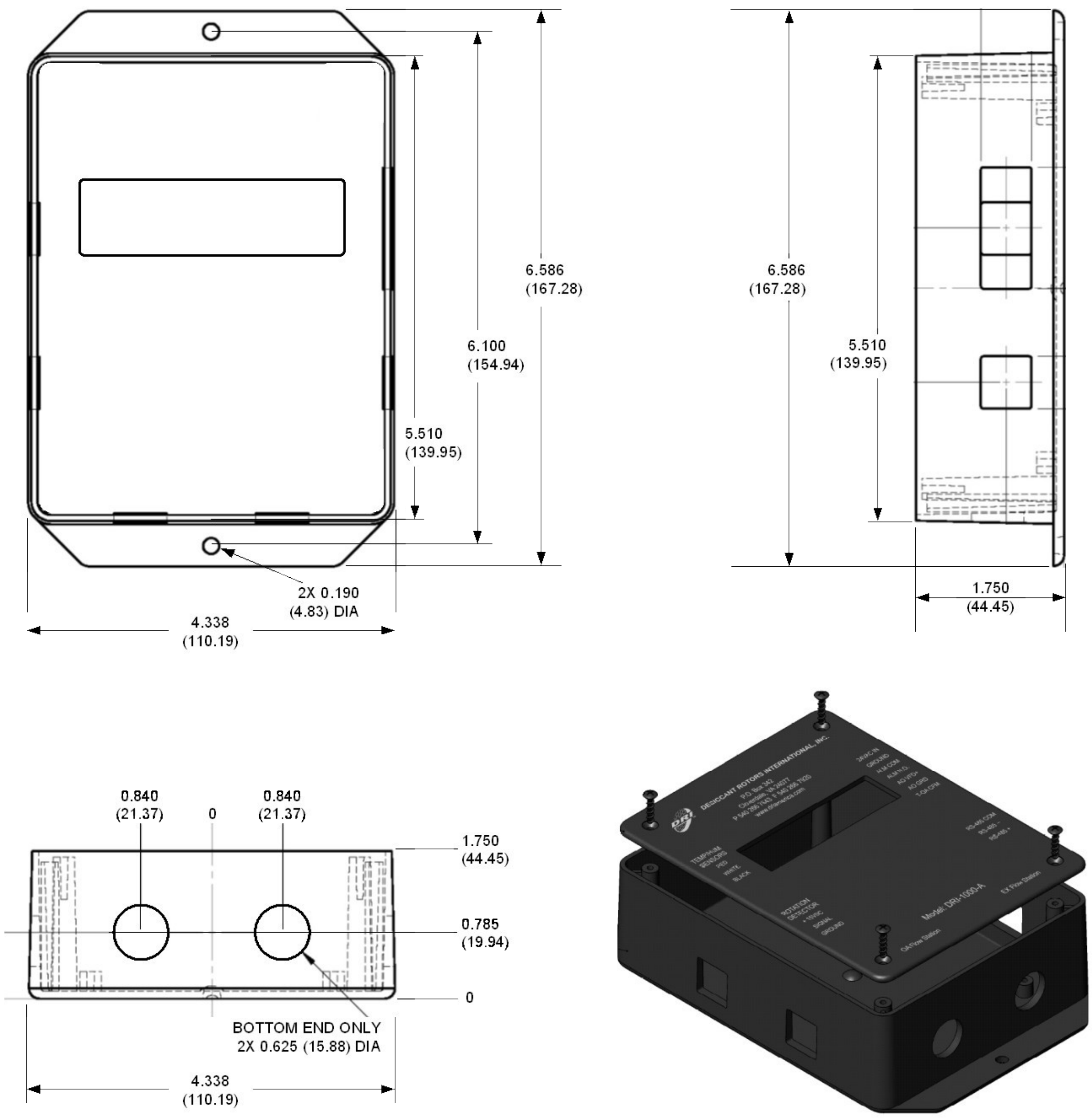


Figure 2. DRI-1000-A Controller/Display Unit Mechanical Detail

2.2. RH/Temperature Sensor Model GS-2xx-P/RH/T

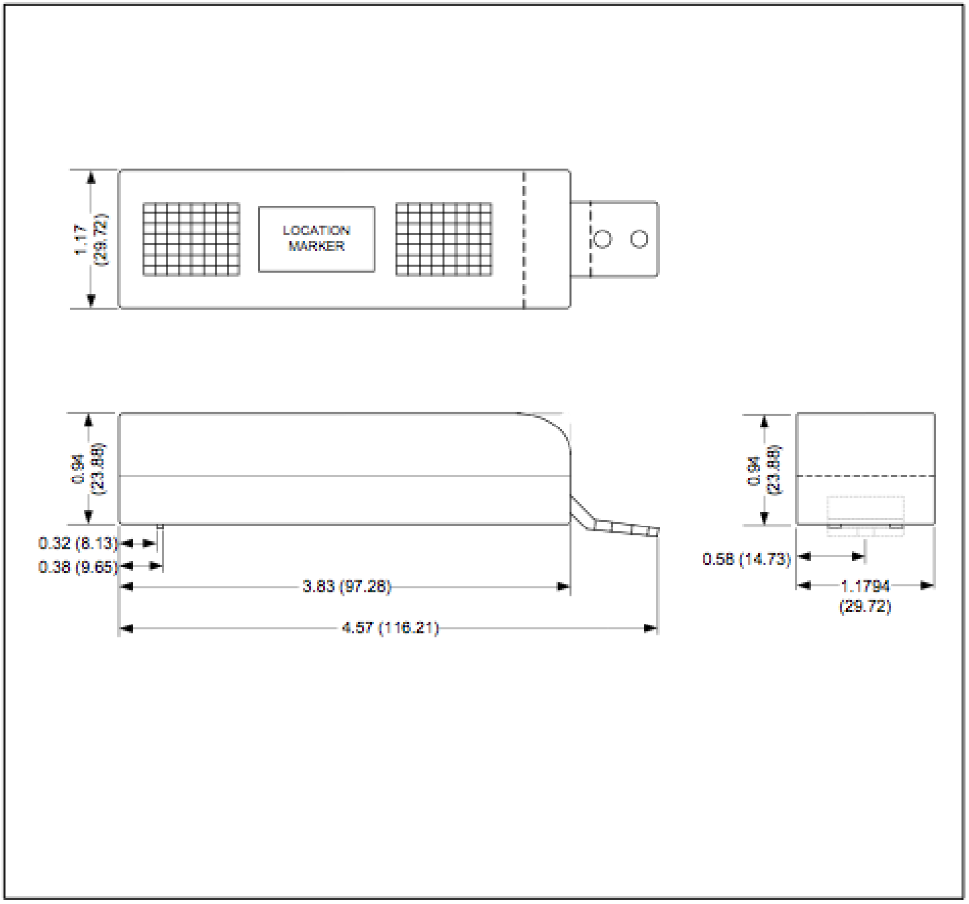


Figure 3. RH/Temperature Sensor Mechanical Detail

2.3. Air Flow Probe Model S-110/01/10

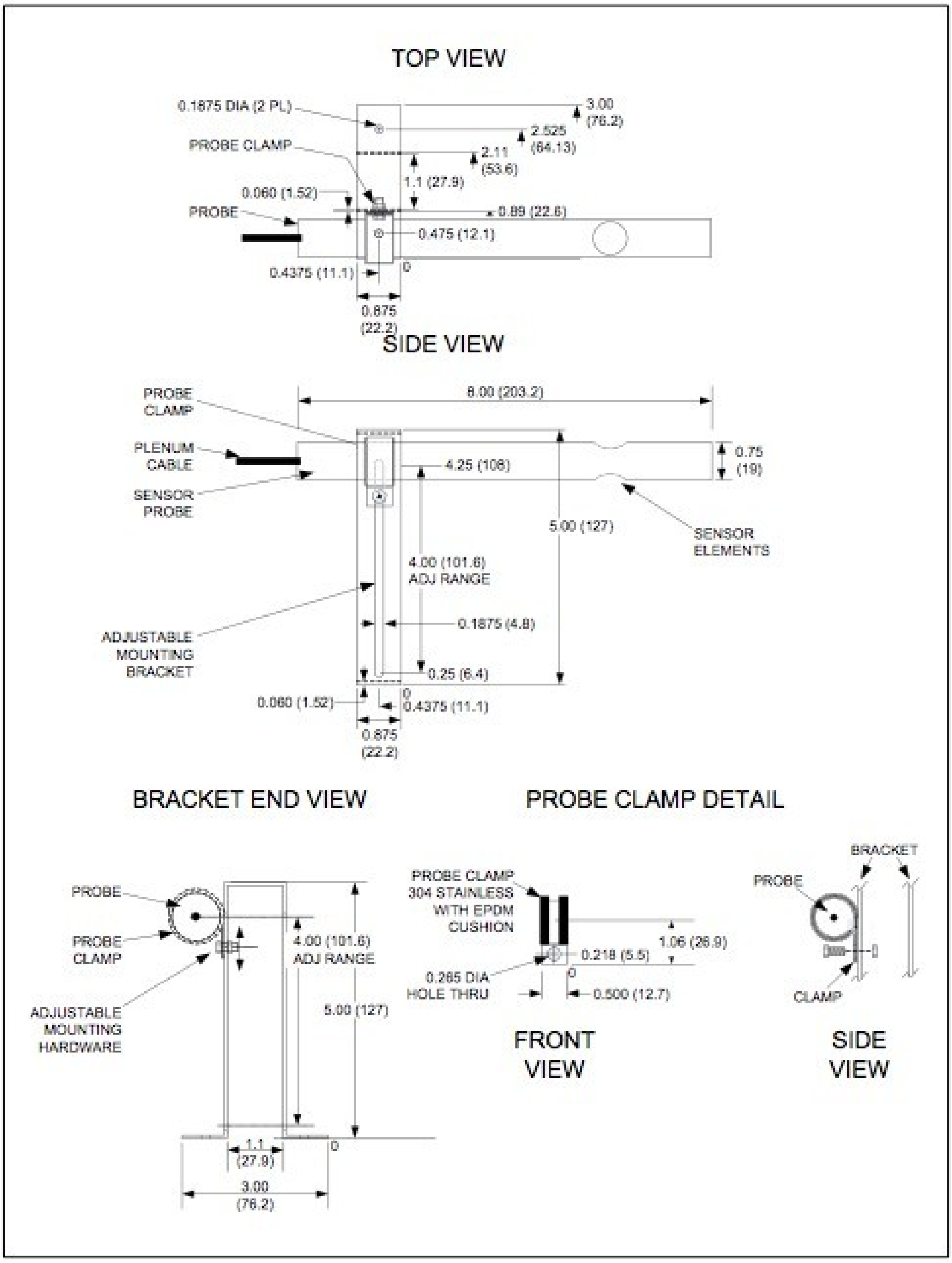


Figure 4. S-110 Airflow Probe and Universal Bracket Detail Views

3. DRI-1000-A FEATURES

The DRI-1000-A HRW Control system is comprised of a Controller/Display unit, 4 RH/T Sensors and optional Airflow Probes depending on model selected as shown in Table 1.

3.1. DRI-1000-A Controller/Display Unit

Figure 5 is a detail view of the Controller/Display unit showing the main circuit board and features. Refer also to Figure 2 for dimensional details.

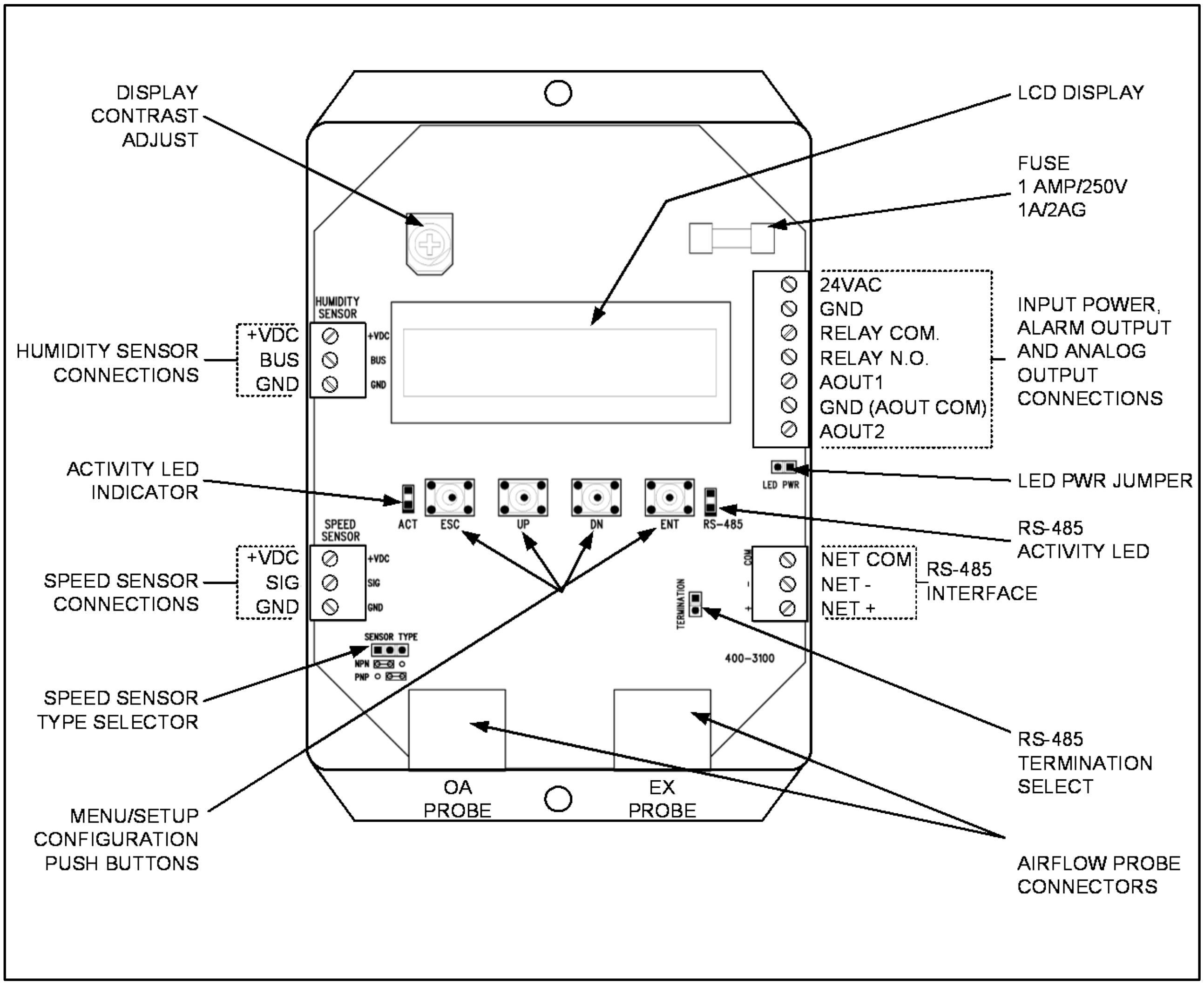


Figure 5. DRI-1000-A Controller/Display Unit Detail View

3.2. RH/T Sensor Assemblies

Figure 6 is a detail view of the RH/T Sensor assembly. Refer also to Figure 3 for dimensional details.

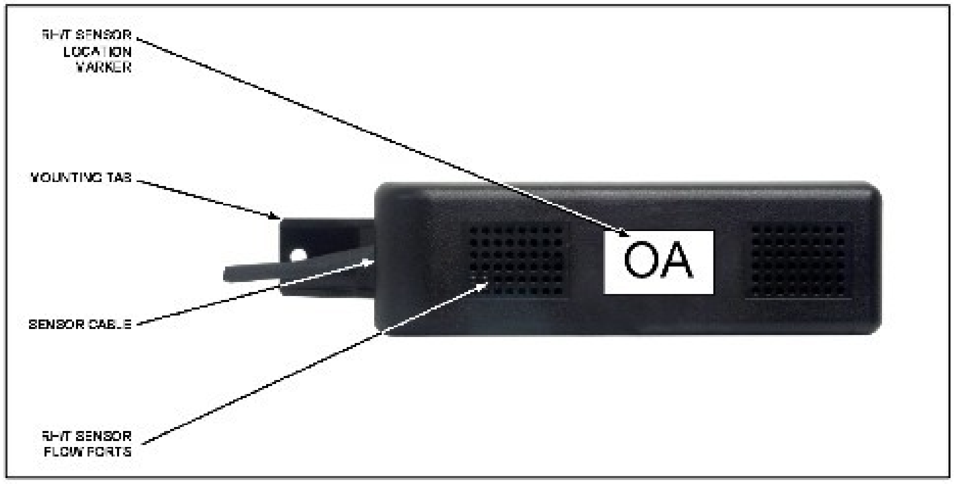


Figure 6. RH/T Sensor Detail View

3.3. Airflow Probes

Figure 7 is a detail view of the Airflow Probe and universal bracket. Refer also to Figure 4 for dimensional details.

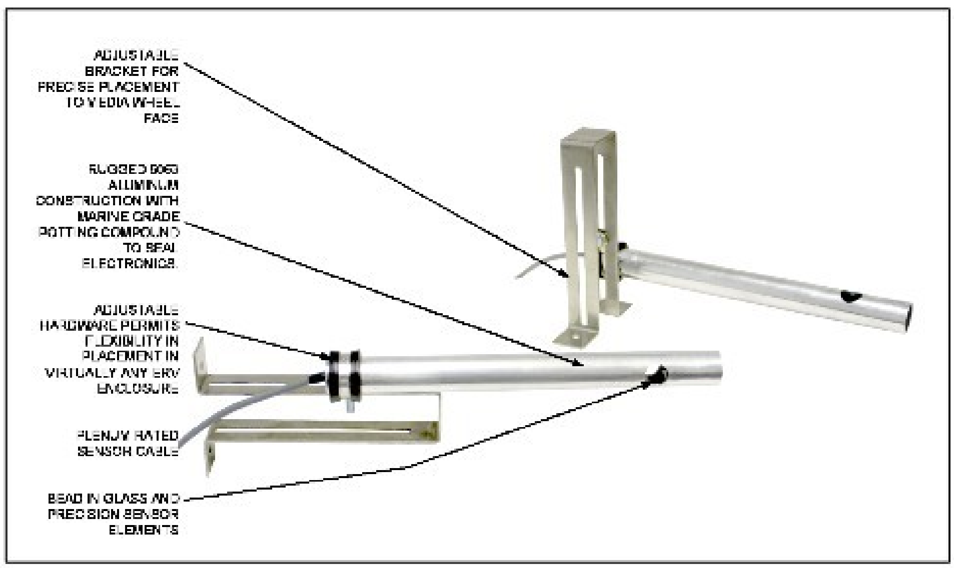


Figure 7. Airflow Probe and Universal Bracket Detail View

4. INSTALLATION

Proper installation of the DRI-1000-A HRW control system is critical to ensure its satisfactory operation. Read and understand all installation details prior to installing the product. Check-boxes are provided at each step to assist in verifying installation. While every effort has been made to simplify installation, it is recommended that these procedures be performed and verified by qualified personnel who are knowledgeable in HRW systems and experienced in the application and installation of HRW control products. Refer any questions regarding installation and operation of the DRI-1000-A HRW control system to your sales representative for resolution.

Refer to the detail views and mechanical dimensions of the DRI-1000-A system components as shown in Figures 2 through 7.

Installation is organized as follows:

- Pre-installation site survey and planning
- RH/T sensor installation
- Optional S-110 airflow probe installation
- HRW rotation sensor (customer supplied)
- Controller/display unit installation
- System wiring and interconnections

4.1. Pre-installation Site Survey and Planning

NOTE:

The DRI-1000-A is designed for DRI HRW systems, and includes customized firmware for use with DRI heat wheels. Installation and operation in other HRW systems may not yield acceptable results.

1. Refer to Table 1 for the DRI-1000-A model selected and verify that all components have been supplied.
2. Refer to the engineer's drawing for the location of the DRI-1000-A system.
3. Verify that the DRI-1000-A Controller/Display unit location will permit all cables from the sensors, optional probes, supply power and BAS network to reach the device. In addition, ensure that the placement of the DRI-1000-A Controller/Display unit will allow visibility of the LCD display and access to the inside of the DRI-1000-A for wiring and set up via the four board-mounted push button switches.

4.2. RH/T Sensor Installation

The DRI-1000-A is supplied with 4 RH/T sensors (Figure 3). The location of the individual RH/T sensors is critical for proper operation of the system.

CAUTION:

The individual RH/T sensors include location-specific embedded firmware and are each clearly marked for their intended location in the target HRW system as “OA” (for outside air quadrant); “RA” (for return air quadrant); “EX” (for exhaust air quadrant), and “SA” (for supply air quadrant). Installation of the RH/T sensors must be in the marked location in the HRW system, or improper HRW control will result. Refer to DRI documentation for identification of each of the HRW quadrants.

NOTE:

Ensure that the sensing ports on the RH/T sensors are not obstructed when installing them in the target HRW system. In addition, orient RH/T sensors so that sensor cable exits downward towards the bottom of the sensor to ensure that any potential cable condensate will be directed away from the sensor.

1. Refer to DRI documentation to identify each of the DRI HRW quadrants.
2. Remove any access panels and mark each of the quadrants prior to installing the RH/T sensors.
3. Refer to Figure 3, and using suitable mounting hardware, mount the RH/T sensor marked **OA** in the **OA** quadrant through the integral sensor mounting tab. It is recommended that the end of the cable be marked “**OA**” with a suitable permanent marker.
4. Refer to Figure 3, and using suitable mounting hardware, mount the RH/T sensor marked **RA** in the **RA** quadrant through the integral sensor mounting tab. It is recommended that the end of the cable be marked “**RA**” with a suitable permanent marker.
5. Refer to Figure 3, and using suitable mounting hardware, mount the RH/T sensor marked **EX** in the **EX** quadrant through the integral sensor mounting tab. It is recommended that the end of the cable be marked “**EX**” with a suitable permanent marker.
6. Refer to Figure 3, and using suitable mounting hardware, mount the RH/T sensor marked **SA** in the **SA** quadrant through the integral sensor mounting tab. It is recommended that the end of the cable be marked “**SA**” with a suitable permanent marker.
7. Carefully route each sensor cable to the intended location of the DRI-1000-A Controller/Display unit.
8. This completes RH/T sensor installation. Proceed to install optional airflow probes (if supplied) in the following paragraph.

4.3. Optional Air Flow Probe Installation

Optional model S-110 airflow probes may be included for **EX** and/or **OA** airflow measurement depending upon which DRI-1000-A model is provided (see Table 1). If airflow probes are not included in the model provided, skip this procedure and proceed directly to HRW Rotation Sensor Installation.

Airflow probe placement must be carefully determined in the field by the installer based upon the construction and design of the specific HRW system. When planning airflow probe installation, the installer must consider routine maintenance of the HRW system, which may require periodic inspection, cleaning or replacement as recommended by the HRW manufacturer. In addition, placement of airflow probes must consider the HRW enclosure internal compartment layout, mechanical clearances and HRW air sealing to ensure that system efficiency is not compromised.

Figure 8 shows a typical installation of the airflow probe and the critical dimension from probe edge to media face for proper operation of the system. For any questions or concerns regarding installation of the airflow probes, please contact your local sales representative.

Observe the following precautions during installation of the airflow probes:

CAUTION:

Individual OA and EX probes are identical. The model selected will determine the location of the probe(s) for OA and/or EX air flow, and its connection at the DRI-1000-A Controller/Display. **The OA probe MUST ALWAYS be connected to the left-most connector**, and **the EX probe MUST ALWAYS be connected to the right-most connector** on the DRI-1000-A Controller/Display unit to ensure proper HRW control, display and alarm functions.

Exercise care when handling the airflow probes. The sensor elements located in the through-hole openings of the probes are fragile and should not be disturbed. Make sure that the probe is oriented so that airflow is in the direction printed on the probe label, and route cable downward (away) from the probe to ensure that any cable condensate will be diverted away from the probe.

To ensure proper performance of the DRI-1000-A HRW Controller system, maintain the critical distance guidelines between the face of the HRW media and the airflow probe as shown in Figure 8.

Ensure that adequate clearances exist during and after installation to prevent damage to the HRW system and all moving parts, and to permit future routine inspection and maintenance of the HRW system and media.

External insulation that interferes with mounting should be temporarily removed prior to installation.

S110 airflow probes must be installed so that air flows first through the media, and then through the probe in the direction indicated on the printed label on the probe as shown in Figure 8. Do not install probes with airflow in the opposite direction.

The S110 airflow probes are supplied in specific lengths, and extension cables are available from DRI. DO NOT CUT THE S110 CABLES IN ORDER TO EXTEND THE LENGTH! Cutting the S110 cables will change sensor calibration and will render the airflow sensor unusable.

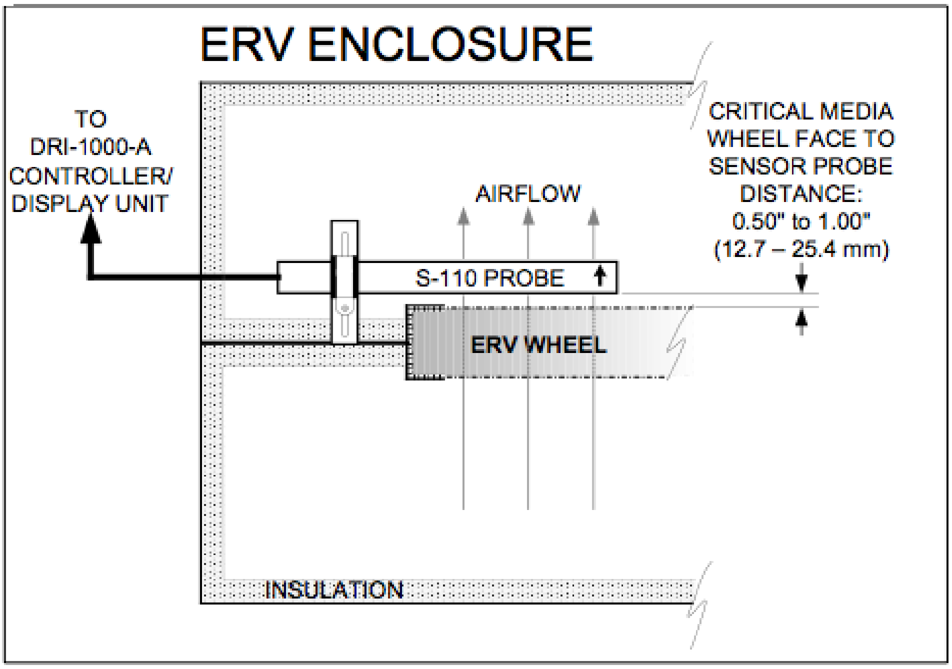


Figure 8. Typical S-110 Airflow Probe Placement Detail

The following is general guidance in the installation of the HRW airflow probes:

1. S-110 airflow probes must always be mounted at the face of the HRW system desiccant wheel so that airflow passes first through the media wheel, and then through the airflow probe in order to accurately measure the desired airflow. Depending on the location of internal HRW blowers/fans, measurement of OA or EX flows may therefore require placement in the adjacent flow chamber.
2. Install the supplied universal adjustable mounting brackets as shown in Figures 4, 7 and 8. The brackets can be adjusted to suit a wide variety of HRW media wheel enclosure applications.
3. Use suitable hardware in two places on each of the brackets to secure them to the HRW enclosure.
4. Adjust the brackets and probe clamp as shown in details of Figures 4, 7 and 8 in order to establish 0.50 to 1.00 inch (12.7 to 25.4 mm) clearance between the HRW media wheel face and the airflow probe.
5. Confirm that airflow is in the direction as printed on the S-110 airflow probe body, and that flow is first through the media and then through the probe.
6. Confirm that the installation will not interfere with the normal operation of the HRW system, and will permit all future routine maintenance as required by the HRW system manufacturer. Verify that installed probes and cabling do not interfere with HRW cabinet covers, mechanical slides, etc.
7. Mark the connector end of the OA probe cable “OA” with a suitable permanent marker.
8. Route the **OA** probe cable to the intended location of the DRI-1000-A Controller/Display unit. The OA probe connector measures outside airflow stream and will be connected to the **left (OA) connector** on the DRI-1000-A Controller unit.
9. Mark the connector end of the **EX** probe cable “**EX**” with a suitable permanent marker.

10. Route the **EX** probe cable to the intended location of the DRI-1000-A Controller/Display unit. The EX probe connector measures exhaust airflow stream and will be connected to the **right (EX) connector** on the DRI-1000-A Controller unit.

11. This completes installation of the optional airflow probes. Proceed to install the HRW Wheel Rotation Sensor as outlined in the following paragraph.

4.4. HRW Wheel Rotation Sensor installation

The DRI-1000-A wheel rotation sensor input is specifically designed to accept an Omron type E2F proximity sensor or equivalent. Refer to the sensor manufacturer mechanical details for the specific sensor model selected. Proceed to install the sensor as outlined in the following steps:

CAUTION:

The customer supplied sensor must be electrically equivalent to the Omron E2F. Connection of other sensor types may damage the DRI-1000-A and cause improper operation

1. Install the proximity sensor at the recommended location using the manufacturer's mechanical details for the model selected.

2. Route sensor cable to the intended location of the DRI-1000-A Controller/Display unit.

3. Proceed to set SENSOR TYPE jumper as outlined in the following paragraph.

4.4.1. Setting the SENSOR TYPE Jumper

The SENSOR TYPE jumper on the DRI-1000-A must be set to match the polarity of the sensor connected.

1. Refer to the manufacturer's specifications to determine the sensor output (NPN or PNP type output), and set the SENSOR TYPE jumper to the matching position (see Figure 5).
2. This completes installation of the customer provided wheel rotation sensor. Proceed to install the DRI-1000-A Controller/Display unit as outlined in the following paragraph.

4.5. Controller/Display Unit installation

The DRI-1000-A is designed for use in an environment between -20 and 120°F (-28.8 and 48.8°C) where it will not be exposed to precipitation. A NEMA-4 enclosure must be provided to protect the DRI-1000-A in locations where precipitation may be encountered.

The DRI-1000-A must be installed in a field accessible location with sufficient service clearance to permit cover removal. The enclosure accepts signal and power wiring at the side mounted terminal blocks, and optional airflow probes at the bottom of the enclosure as shown in Figure 5. Ensure that the planned instrument location will allow sensor, probe, power and network wiring to reach the associated connections on the Controller/Display unit.

CAUTION

In installations that might be exposed to precipitation, the DRI-1000-A must be enclosed in a NEMA-4 enclosure.

Provide sufficient clearance around the DRI-1000-A to permit cover removal.

Locate the DRI-1000-A in a location that can be reached by the connecting signal and power cables.

Do not drill into the DRI-1000-A enclosure since doing so may damage the electronics.

1. Carefully unpack the DRI-1000-A and inspect for damage. If damage is noted, immediately file a claim with the carrier.
2. Locate where the DRI-1000-A will be installed.
3. Refer to Figure 5 and mark the locations of the two mounting holes through the enclosure mounting flanges.
4. Drill two holes suitable for the hardware that will secure the DRI-1000-A.
5. Secure the DRI-1000-A in two places using suitable hardware.
6. Proceed to connect sensor, probe and power wiring to the DRI-1000-A as outlined in the following **System Wiring and Interconnections** paragraph.

5. SYSTEM WIRING AND INTERCONNECTIONS

Refer to Figure 9 for DRI-1000-A system wiring and interconnections and the following paragraphs.

5.1. Power Transformer Selection Considerations

Select a 24 VAC transformer based on the maximum power requirements of the DRI-1000-A (10 VA) to ensure that the operating supply voltage (when powered "ON") is within 10% of 24 VAC (not less than 21.6 VAC or greater than 26.4 VAC).

5.2. DRI-1000-A Wiring Precautions

DRI-1000-A wiring consists of connecting all sensor cables, the 24VAC input power, the analog and RS-485 network outputs and the optional alarm outputs at the Controller/Display unit. Refer to Figure 5 for additional detail. Following installation, review and perform the initial start-up and set up procedures in the later paragraphs.

Wiring connections to the DRI-1000-A are accomplished at the screw-type terminal blocks of the instrument as shown in Figure 5. To prevent damage to the DRI-1000-A or other connected devices, the following precautions must be observed:

CAUTION

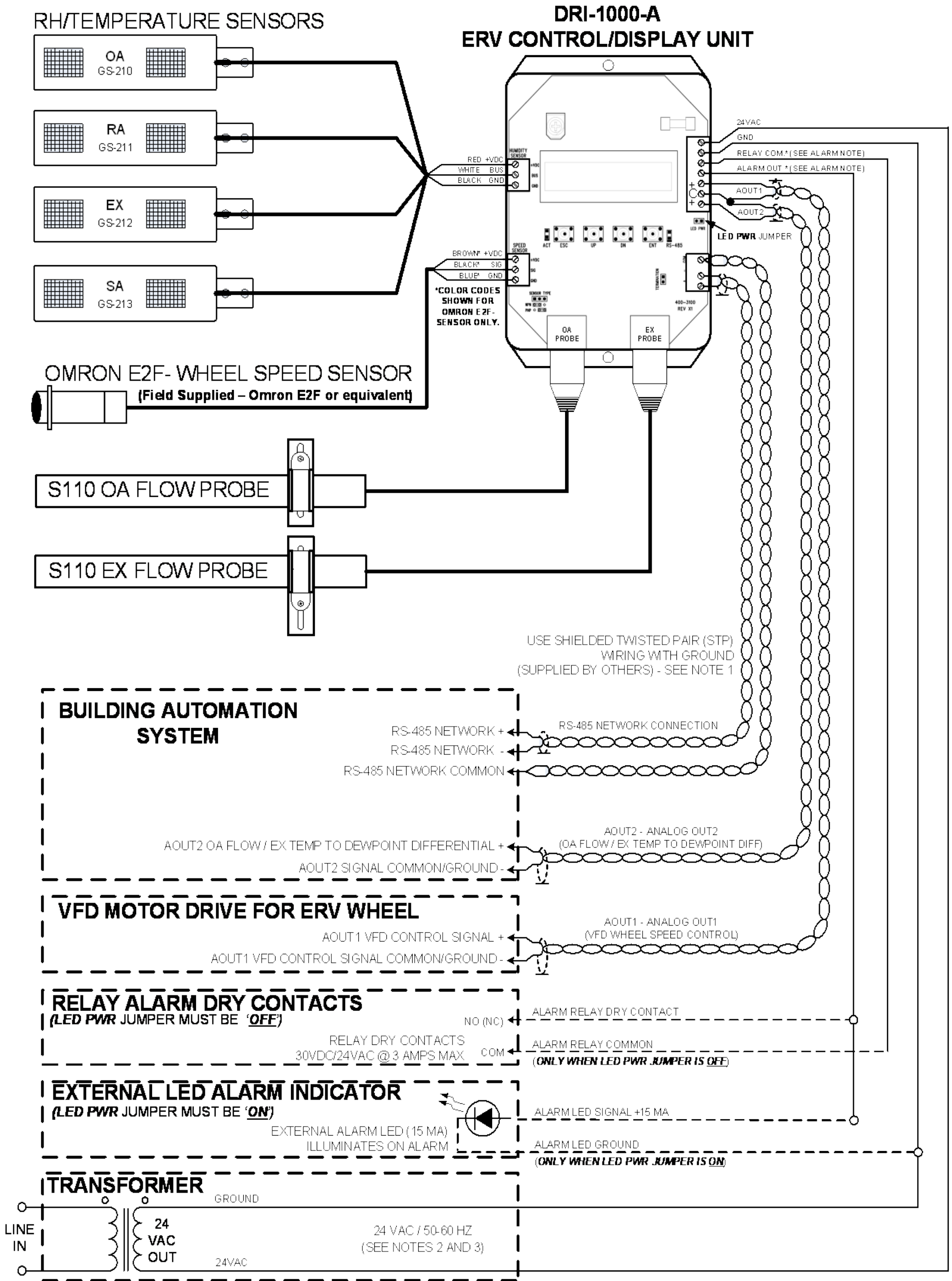
To prevent damage to the DRI-1000, deactivate 24 VAC power source until all connections to the instrument are complete.

The 24 VAC input ground (GND) connection is shared with the RS-485 common and with the analog output signal ground terminals. If isolation is required between the DRI-1000-A and other network devices, a dedicated isolation transformer must be provided to power the DRI-1000-A.

The DRI-1000-A is a non-isolated device with a half-wave rectifier on the 24VAC power input terminal. To prevent equipment damage, multiple devices that are powered by a common 24VAC transformer with the DRI-1000-A must use common device power connections (e.g. 24VAC input power to other device 24VAC input power terminals; and 24V ground to other device 24V ground terminals); or, independent isolation transformers must be provided for each non-isolated device.

The DRI-1000-A 24VAC ground, RS-485 common and the analog output signal ground are common. Therefore it is recommended that the RS-485 output and analog outputs be connected using separate twisted shielded pairs in order to eliminate potential voltage drop on the common (from the 24VAC return) that could otherwise cause inaccurate readings.

To prevent any potential water runoff into the DRI-1000, form "drip loops" with interconnecting cables below the connections to the DRI-1000-A.



NOTES:

1: CONNECT ANALOG AND RS-485 CABLE DRAINS TO EARTH GROUND AT ONE END OF CABLE ONLY.
2. DRI-1000-A IS NON-ISOLATED USING A HALF-WAVE RECTIFIER ON 24VAC POWER INPUT. IF MULTIPLE DEVICES ARE POWERED BY COMMON TRANSFORMER, ALL GND CONNECTIONS MUST BE COMMON, OR AN ISOLATION TRANSFORMER MUST BE USED TO PREVENT EQUIPMENT DAMAGE.
3. THE 24VAC GROUND, RS-485 COMMON AND ANALOG OUTPUT GROUNDS ARE SHARED. THEREFORE, ON MULTIPLE DRI-1000-A INSTALLATIONS WITH A COMMON 24VAC SUPPLY, ALL UNITS MUST BE WIRED IN-PHASE (24VAC TO 24VAC; 24VGND TO 24VGND).
4. SHIELDED TWISTED PAIR (STP) WIRING WITH GROUND IS RECOMMENDED (SUPPLIED BY OTHERS).
5. RS-485 COMMON CONNECTION MAY BE A SINGLE CONDUCTOR.
6. DRY RELAY CONTACT RATING MAXIMUM 30VDC/24VAC @ 3 AMPS MAXIMUM.

***ALARM NOTE**

WITH **LED PWR JUMPER ON** (DEFAULT), **ALARM OUT** IS 15MA TYPICAL LED DRIVE. WITH **LED PWR JUMPER OFF**, **ALARM OUT** IS DRY RELAY CONTACTS.

Figure 9. DRI-1000-A HRW System Controller Typical Wiring Diagram

5.3. 24VAC Power Connections

1. Remove the four cover retaining screws at each corner of the DRI-1000-A Controller/Display unit cover in order gain access to the wiring terminal blocks on the main circuit board as shown in Figure 5.

CAUTION

Damage to network devices may occur if 24VAC GND terminal is connected to earth ground and the RS485 network is not earth grounded as detailed in the following step.

2. Connect 24VAC power to the 24VAC terminal as shown in Figure 5. When powering multiple network devices from a common source, observe 24VAC phasing on all devices (24VAC power to the 24VAC terminal, and return at the GND terminal). The GND connection must only be connected to earth ground according to the following guidelines:

    a) If the analog and RS-485 network connections for the DRI-1000-A **are ground referenced to earth**, the 24VAC GND terminal **may** also be connected to a wire that is ground referenced to earth.

    b) If the analog and RS-485 network connections for the DRI-1000-A **are not ground referenced to earth**, the 24VAC GND terminal **must not** be connected to a wire ground referenced to earth, as damage to other network devices may occur.

3. Connect 24V ground to the 24V GND terminal as shown in Figure 5, observing the previous grounding precautions.

4. This completes 24VAC power connections to the DRI-1000-A. Proceed to the Analog Output connections as outlined in the following paragraph.

5.4. AOUT1, AOUT2 - Analog Output Connections

The DRI-1000-A provides two independent analog outputs (A OUT1 and A OUT2) that are configured through the set-up menus for output of 0-10VDC (default), 0-5VDC or 2-10VDC (at 20 mA maximum). The 24VAC return GND connection is shared with the analog output signal GND (AOUT COM) and with the RS-485 output COM. **If isolation is required between the DRI-1000-A and other network devices, a dedicated isolation transformer must be provided to power the DRI-1000-A.** The RS-485 COM and the analog GND connections are always connected.

1. Using shielded twisted pair wiring and observing the previous wiring precautions, connect the AOUT1 (VFD wheel motor control) analog output signal wire at the AOUT1 terminal, and the corresponding AOUT1 signal return at the GND (AOUT COM) terminal as shown in Figure 5. Observe the following when connecting the GND terminal:

    a) If the analog and RS-485 network connections for the DRI-1000-A **are ground referenced to earth**, the analog output GND terminal **may** also be connected to a wire that is ground referenced to earth.

    b) If the analog and RS-485 network connections for the DRI-1000-A **are not ground referenced to earth**, the analog output GND terminal **must not** be connected to a wire ground referenced to earth, as damage to other network devices may occur.

2. In a similar manner using shielded twisted pair wiring, connect the AOUT2 analog output signal wire (OA airflow or T_D) at the AOUT2 terminal, and the corresponding AOUT2 signal return at the GND (AOUT COM) terminal as shown in Figure 5, observing the previous precautions.

5.5. RS-485 Network Connections

The DRI-1000-A transmitter must be configured for proper RS-485 network operation and termination prior to power up. The transmitter is shipped from the factory with the protocol set for BACnet MS/TP (Master), address 2, MS/TP Device ID 2, baud rate of 76,800 and no termination. Initial RS-485 communications settings are accomplished within the Communications Setup menu shown in Figure 15 and the Termination is set by **RS-485 TERMINATION** jumper located on the DRI-1000-A as shown in Figure 5. Transmitter termination must be configured prior to power up as follows:

5.5.1. Setting DRI-1000-A Network Termination

The DRI-1000-A is shipped with the Termination switch set for **No Termination**, which is recommended for devices installed on the network bus at any point EXCEPT at the ends of the bus/segment. The device at either end of the network should be terminated with "**End of Line Termination**" (which is 120 ohms). Termination is selected by setting the **RS-485 TERMINATION** jumper shown in Figure 5.

⚠ Check the network segment to ensure that devices on the network/segment are terminated as outlined above. If devices are not terminated as described above, network segment operation will be adversely affected.

1. If the DRI-1000-A is to be installed at any point other than the end of the network or segment, **remove** the jumper across **RS-485 TERMINATION** selector shown in Figure 5.
2. If the DRI-1000-A is to be installed at either end of the network or segment, **install** the jumper across the **RS-485 TERMINATION** selector shown in Figure 5.

5.5.2. Setting Transmitter Address

The DRI-1000-A is factory set to an address of 2. Each transmitter must be assigned a unique address between 1 and 127 for BACnet. After the DRI-1000-A has been powered up, set the address as shown in the COMM setup menu (Figure 15).

5.5.3. Setting MS/TP Baud Rate

The DRI-1000-A is set at the factory for MS/TP with a baud rate of 76,800 that can be changed if required using the Communications menu (Figure 15).

5.5.4. Setting Device Instance Number

The DRI-1000-A is factory set with a Device Instance Number of 2. After the DRI-1000-A has been powered up, the Device Instance Number can be set as shown in the COMM setup menu (Figure 15), or can be changed to any number between 1 and 4,194,302 by writing to the device's Object Identifier Property over the network.

5.5.5. Resetting Communications Options to Default

Communications options can be reset to factory default values using the COMM Default menu option as shown in Figure 15. Factory default values are shown with an asterisk * after the value.

5.6. RS-485 Network Connections and Device Settings

Ensure that the transmitter termination has been properly set as previously described. Connect network connections to the DRI-1000-A as follows.

CAUTION

The 24VAC return GND connection is shared with the RS-485 output COM and with the analog output signal GND (AOUT GND). **If isolation is required between the DRI- 1000-A and other network devices, a dedicated isolation transformer must be provided to power the DRI-1000-A.** The RS-485 COM and the analog GND connections are always connected.

1. Prior to wiring the output signal, ensure that power to the DRI-1000-A is "OFF".
2. Determine whether the RS485 network requires an isolated or non-isolated interface to the DRI-1000-A, and connect cables as outlined in the applicable paragraph that follows.
2. Pay particular attention to the network common connection and network termination requirements. Connections are made at the RS-485 terminal block on the lower right hand side of the enclosure as shown in Figure 5.
3. Connect the NET+, NET- and COM terminals to the network using shielded twisted pair cable (typically using two pairs, with one wire not used). Use one pair for +/-, and both wires in the other pair for GND when using 2-pair cable). Observe the following when connecting the COM terminal:
    a) If the analog and RS-485 network connections for the DRI-1000-A **are ground referenced to earth**, the COM terminal **may** also be connected to a wire that is ground referenced to earth.
    b) If the analog and RS-485 network connections for the DRI-1000-A **are not ground referenced to earth**, the 24VAC GND terminal **must not** be connected to a wire ground referenced to earth, as damage to other network devices may occur.
4. The connection to the network must be made in a "daisy chain" configuration. Stubs and "T" connections are NOT permitted. Connect shields at one end of the network only.
5. If the DRI-1000-A is not the first or last device, ensure that the TERMINATION jumper is removed for NO TERMINATION. If the DRI-1000-A is the first or last device, ensure that TERMINATION jumper is installed for END OF LINE termination as previously described.

5.6.1. BACnet Objects List and Properties

The following are suggested BACnet Objects for the DRI-1000-A Controller, Firmware v2.04. Refer to table 2 for properties of the BACnet Objects.

- **Device Object (DEV)**
- **Analog Input Objects (AI):**
  The following objects allow network indication of the four RH/Temperature sensor readings:
    - **AI1** - OA Humidity (%RH)
    - **AI2** - SA Humidity (%RH)
    - **AI3** - RA Humidity (%RH)
    - **AI4** - EX Humidity (%RH)
    - **AI5** – OA Temperature (Degrees F, C depending on menu setup)
    - **AI6** – SA Temperature (Degrees F, C depending on menu setup)
    - **AI7** – RA Temperature (Degrees F, C depending on menu setup)
    - **AI8** – EX Temperature (Degrees F, C depending on menu setup)

  The following objects allow network indication of the Airflow Probe readings:

    - **AI9** – OA Airflow (FPM, CFM, MPS, LPS depending on menu setup)
    - **AI10** - EX Airflow (FPM, CFM, MPS, LPS depending on menu setup)

- **Analog Value Object (AV):**
  The following object allows network access of the ECO Switchover Dewpoint setting:
    - **AV1** - ECO Switchover Dewpoint (Degrees F, C depending on menu setup)
    - AV2 – SA Discharge Temp Setpoint (Degrees F, C depending on menu setup)
    - AV3 – Frost Mode Switchover Temp (Degrees F, C depending on menu setup)
    - AV4 – Wheel RPM

- **Analog Output Object (AO):**
  The following object allows network access of the VFD Speed setting:
    - **AO1** - VFD Speed (0 to Full Scale Setting, default 60Hz)

- **Multi-State Variable Objects (MV):**
  The following object allows network indication of the system operating mode:

    - **MV1** – Operating Modes:
      Normal
      Frost
      SADT (Supply Air Discharge Temperature Mode)
      ECO 1
      ECO 2
      Failure

  The following object allows network indication of the system alarm status:

    - **MV2** – Alarm Status Modes:
      None
      RH/T Sensor
      Speed Sensor
      Probe Trouble
      OA Flow LO
      OA Flow HI

5.7. ALARM Output Connections

The DRI-1000-A alarm output can be configured as relay dry contacts, or as direct drive (15 mA typical) for an external LED indicator. The alarm output type is set using the LED PWR jumper on the DRI-1000-A main circuit board as shown in Figure 5. With the LED PWR jumper on both pins, the alarm output is set to provide external LED drive (15 mA typical) with anode (+) at the RELAY N.O. terminal; and LED cathode (-) connected at the 24VAC GND terminal.

With the LED PWR jumper OFF, alarm output is set to provide dry relay contacts between the RELAY N.O. and RELAY COM terminals (contacts rated at 30VDC/24VAC 3 amps maximum). The alarm output polarity can be set as normally open (contact close on alarm) or normally closed (contacts open on alarm) in the Setup menu.

5.7.1. Setting the Alarm LED PWR Jumper

1. For external alarm LED drive output option, **install** the LED PWR jumper across both pins, and connect remote LED anode (+) to the terminal MARKED RELAY N.O., and cathode (-) at the terminal marked GND for 24VAC GND).

   OR

2. For relay dry contact alarm output option, **remove** the jumper across the LED PWR terminals (or place it on only one of the two pins), and connect the alarm wires to the terminals marked RELAY N.O. and RELAY COM. Contact rating is 30VDC/24VAC at 3 amps maximum. Alarm type (ALR TYPE=) and polarity (ALRM POL=) will be selected in the Setup menu in order to enable the alarm feature later in this manual.

3. Connect all sensors to the DRI-1000-A Control/Display unit as detailed in the following procedures.

5.8. Connecting Sensors to the DRI-1000-A Controller/Display Unit

5.8.1. RH/T Sensor Connections

The RH/T sensors each have three wires attached to them. Connect the RH/T sensors to the DRI-1000- A at the HUMIDITY SENSOR CONNECTION terminal block shown in Figure 5 as follows:

1. Connect all **RED** wires from the RH/T sensors to the HUMIDITY SENSOR CONNECTION terminal marked **+VDC** as shown in Figure 5.

2. In a similar manner, Connect all **WHITE** wires from the RH/T sensors to the adjacent HUMIDITY SENSOR CONNECTION terminal marked **BUS** as shown in Figure 5.

3. Connect all of the remaining **BLACK** wires from the RH/T sensors to the adjacent HUMIDITY SENSOR CONNECTION terminal marked **GND** as shown in Figure 5.

5.8.2. Wheel Rotation Sensor Connections

The Wheel Rotation Sensor input is designed to accept an OMRON 3-wire type E2F or equivalent proximity sensor for sensing HRW wheel rotation. The SPEED SELECTOR TYPE SENSOR jumper (NPN/PNP) on the DRI-1000-A must also be set to match the output polarity of the E2F sensor model selected. Connect the sensor at the SPEED SENSOR CONNECTIONS terminal block shown in Figure 5 as follows:

1. Connect the wheel speed sensor input power supply (+) wire to the SPEED SENSOR CONNECTIONS terminal marked +VDC as shown in Figure 5.
2. Connect the wheel speed sensor output signal (SIG) wire to the SPEED SENSOR CONNECTIONS terminal marked SIG as shown in Figure 5.
3. Connect the wheel speed sensor return (GND) wire to the SPEED SENSOR CONNECTIONS terminal marked GND as shown in Figure 5.

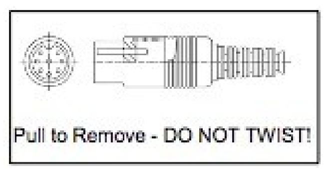
5.8.3. Air Flow Probe Connections

Connect the sensor probe cable plugs to the matching circular receptacles located at the bottom of the DRI-1000-A Controller/Display unit enclosure shown in Figure 5 as follows:.

1. Connect the probe in the **OA** (Outside Air) flow to the **left** connector at the bottom of the DRI- 1000-A as shown in Figure 5.
2. Connect the probe in the **EX** (Exhaust Air) flow to the **right** connector at the bottom of the DRI- 1000-A as shown in Figure 5.
3. Provide a “drip loop” at the DRI-1000-A if there is the potential for water runoff or condensation along the sensor probe cable(s).

CAUTION

Sensor probe cable plugs are “keyed” as shown (see inset). Line up cable plug with receptacle and push straight on to receptacle. **DO NOT TWIST** Squeeze connector “ribs” when removing. Forcing the cable plug in or out of the receptacle will damage the connectors and void the warranty.



5.8.4. Final Inspection/Cable Routing and Management

1. Verify that all cable and wiring connections have been accomplished in accordance with the preceding paragraphs.
2. Secure all sensor/probe cables so that they will not interfere with the normal operation of the HRW system and will allow for normal HRW maintenance routines to be accomplished.
3. It is recommended that drip loops be established below the DRI-1000-A connections to prevent any potential condensate from entering the instrument.
4. Perform the **INITIAL START-UP** procedure in order to validate installation and operation of the DRI-1000, and then proceed to **DRI-1000-A SET UP AND DEVICE CONFIGURATION** to establish the control system configuration required.

6. INITIAL START-UP

1. Perform final inspection as outlined in the previous paragraph.

2. Activate 24VAC power to the DRI-1000, and observe the LCD display.

3. Verify that upon power up, the display indicates a series of animated dashes, followed by "**SYSTEM INIT X.XX**" where **x.xx** represents the installed firmware/version for the device. **If this does NOT happen, IMMEDIATELY remove power to the DRI-1000-A and recheck all wiring before reapplying power to the device.**

4. Verify that the activity "ACT" LED indicator (Figure 5) display begins to flash as follows: **Normal Operation**: Blinks continuously one second ON/one second OFF **Fault Indication**: Blinks for 2 seconds ON and 2 seconds OFF. **If Fault flash rate is shown, IMMEDIATELY remove power to the DRI-1000-A and recheck all wiring before reapplying power to the device.**

5. Verify that the display begins to cycle through each of the following items for 3 seconds, and then to the next item in a repeating cycle:

   - Outside Airflow Rate (if OA airflow probe is connected and enabled in the setup menu).
   - Exhaust Airflow Rate (if EX airflow probe is connected and enabled in the setup menu).
   - Effectiveness according to DRI supplied calculation (only when equipped with supply air RH/T sensor GS-213-P/RH/T).
   - Alarm Status (NONE, RH/T SENSOR, OA LOW, OA HIGH, PRB TRBL, or SPEED).
   - Operational Mode (between measurement readings.)

   If this does NOT happen, IMMEDIATELY remove power to the DRI-1000-A and recheck all wiring before reapplying power to the device.

6. Verify that the RS-485 network communications are working as expected, and that data can be accessed by the BAS system.

7. If the prior steps have been successfully accomplished, proceed to **DRI-1000-A SET UP AND DEVICE CONFIGURATION** as outlined in the following paragraphs.

7. DRI-1000-A SETUP ANDDEVICE CONFIGURATION

The DRI-1000-A is configured with factory default values designed for normal operation in specified DRI HRW's without adjustment.

The internal DRI-1000-A firmware permits user configuration and set up of customized operating parameters, alarm options and features via the LCD display and four board-mounted tactile pushbutton switches (shown in Figure 5). The following paragraphs detail the DRI-1000-A setup menu options and default values.

7.1. DRI-1000-A SETUP Menu Options and Navigation

The factory default settings can easily be changed in the field through six major menus using the 4-pushbutton user interface on the as shown in Figure 5.

The six major menus are shown in Table 2. Within each menu, to navigate to the right, or to enter a displayed menu, select the ENT pushbutton. To navigate left, or to leave a menu, select the ESC button. Use the UP and DOWN arrow buttons to navigate up and down within the menus.

Table 2. DRI-1000-A Major Menus

MAJOR MENU	DESCRIPTION	MAJOR MENU	DESCRIPTION
SYSTEM INIT	Reset to factory defaults and LCD	DIAGNOSTICS	Display individual sensor and DRI-1000-A system status.
SI/IP UNITS	Select units of measurement	COMM SETUP	Select RS-485 communications parameters.
SETUP	Select DRI-1000-A general features and alarm options	LOCK	Set/enter lock code to secure all DRI-1000-A settings.

The following paragraphs detail each of the major menus and the options available for each menu item.

7.2. SYSTEM INIT Menu – System Initialization Menu (Restore Factory Default Settings)

This menu option permits restoring DRI-1000-A factory default settings and also allows for setting the LCD to continuously display the model number instead of displaying the actual readings. The Initialization menu is only available during power up of the instrument by simultaneously depressing the ENT and ESC pushbuttons, and then releasing them. Figure 10 details the Initialization Menu.

7.2.1. SYSTEM INIT Menu – Factory Default Values

Figure 11 shows the SYSTEM INIT menu factory default values.

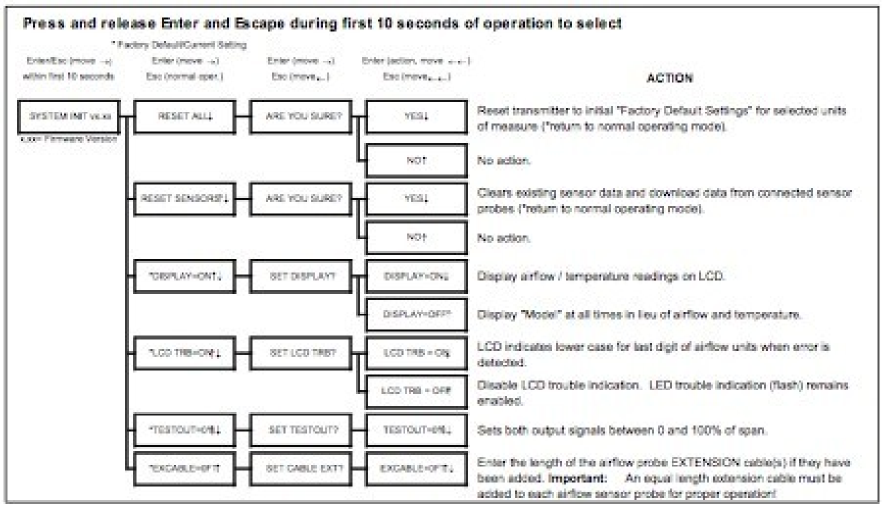


Figure 10. SYSTEM INIT – Initialization Menu Detail

SYSTEM INIT MENU ITEMS, DESCRIPTIONS AND FACTORY DEFAULT VALUES

Display	Range	Menu Item Description	Default Values	
			IP Units	SI Units
*DISPLAY=	ON or OFF	ON=Display airflow / temperature readings on LCD. OFF=Display "Model" at all times in lieu of airflow and temperature.	ON	ON
*LCD TRB=	ON or OFF	ON=LCD displays last character of airflow units in lower case when error is detected. OFF=Disable LCD trouble indication. (Note: LED trouble (flash) indication on main circuit board remains enabled.)	ON	ON
*TESTOUT=	0 to 100%	Sets span of both analog output signals AOUT1/AOUT2 between 0 and 100%.	0	0
*EXCABLE=	0 to 50FT	Sets length of airflow probe EXTENSION cable(s) if used. **CAUTION: Extension cables of equal length must be added to both airflow sensor probes for proper operation!**	0FT	0FT

Figure 11. SYSTEM INIT Menu – Factory Default Values

7.3. IP/SI UNITS Menu - System Units of Measurement Menu for IP SYS and SI SYS

The DRI-1000-A is shipped with the IP/SI system of units set to IP (US inch-pound) units, and will display units of measurement as shown in the "IP" System of Units column of Table 3.

Table 3. IP/SI Units of Measurement

IP/SI Units Setting	LCD Units Displayed	Description
IP/SI Units=IP SYS (Inch-pound units)	FLOW= FPM FLOW= CFM (degrees) F	Feet per minute Cubic feet per minute ° Fahrenheit
IP/SI Units=SI SYS Standard international units)	FLOW= MPS FLOW= LPS (degrees) C	Meters per second Liters per second ° Centigrade

To change IP/SI units, simultaneously press and release the "UP" and "DOWN" arrow pushbuttons during normal operation to enter the IP/SI UNITS menu shown in Figure 12, and select the desired IP/SI setting.

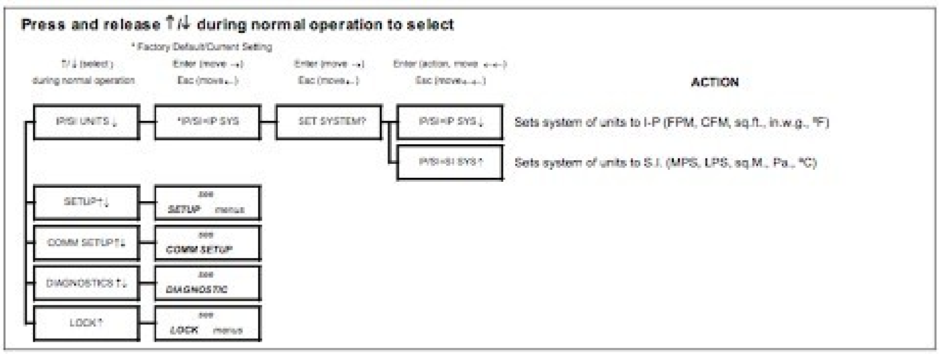


Figure 12. IP/SI UNITS – Units of Measurement Menu Detail

7.4. SETUP Menu - System Setup Menu

The system SETUP menu permits user selection of DRI-1000-A operating and alarm feature options. Figure 13 shows the SETUP menu (with IP SYS units of measure).

SETUP ↓	*OA PRB=DISABL ↓	SET PRB ENABLE?	OA PRB=DISABL ↓	Airflow Probe is not connected to OA Probe input
			OA PRB=ENABL	Airflow Probe is connected to OA Probe input
	*EX PRB=DISABL ↓	SET PRB ENABLE?	EX PRB=DISABL ↓	Airflow Probe is not connected to EX Probe input
			EX PRB=ENABL	Airflow Probe is connected to EX Probe input
	*ECO MODE=ECO1 ↓	SET ECO MODE?	ECO MODE=ECO1 ↓	Run Economizer Mode 1 when Economizer enabled.
			ECO MODE=ECO2	Run Economizer Mode 2 when Economizer enabled.
	*ECODEW=52.0 F ↓	SET ECO DEW?	ECODEW=52.0 F ↓	Set Economizer Dewpoint Switchover Temperature
	*DEFSPD=60.0HZ ↓	SET DEF SPD?	DEFSPD=60.0HZ ↓	Set Default Wheel Speed from 0.0 to 60.0 Hz.
	*MINSPD=5.0HZ ↓	SET MIN SPD?	MINSPD=5.0HZ ↓	Set Minimum Wheel Speed from 0.0 to 60.0 Hz.
	*SADTSP=55.0F ↓	SET SADT SP?	SADTSP=55.0F ↓	Sets the SA Discharge Temperature Setpoint.
	*FMST=15.0F ↓	SET FMST?	FMST=15.0F ↓	Sets the Frost Mode Switchover Temperature.
	*Tdelta=2.0F ↓	SET Tdelta?	Tdelta=2.0F ↓	Sets the EX Temperature to EX Dewpoint differential Setpoint.
	*SJRT=3 Min ↓	SET SJ RT?	SJRT=3Min ↓	Sets the Stop/Jog Run Time at 0-59 Min per Hour.
	*SJSPD=10.0HZ ↓	SET SJ SPD?	SJSPD=10.0HZ ↓	Set Stop/Jog Speed from 0.0 to 60.0 Hz.
	*SPD PPR=1 ↓	SET SPD PPR?	SPD PPR=1 ↓	Set Pulses Per Revolution for Speed Sensor from 1 to 8.
	*PIDIN1=1 S ↓	SET PID INT1?	PIDIN1=1.0 S ↓	Set VFD Frost PID loop calculation Interval from 0.1-60 seconds.
	*PIDP1=100 ↓	SET PIDP1?	PIDP1= 100 ↓	Set VFD Frost PID Proportional Constant from 0-10,000
	*PIDI1=10 ↓	SET PIDI1?	PIDI1= 10 ↓	Set VFD Frost PID Integral Constant from 0-10,000
	*PIDD1=10 ↓	SET PIDD1?	PIDD1= 10 ↓	Set VFD Frost PID Derivative Constant from 0-10,000
	*PIDIMX1=10 ↓	SET PID IMAX1?	PIDIMX1=10 ↓	Set Maximum Frost PID Integral accumulated value.
	*PIDDB1=5.0% ↓	SET PID DB1?	PIDDB1=5.0% ↓	Sets Frost PID Deadband as a +/- percent of setpoint.
	*PIDACT1=DIR ↓	SET PID ACTION1?	PIDACT1=DIR ↓	Sets Frost PID Loop Action to "Direct" acting.
			PIDACT1=REV	Sets Frost PID Loop Action to "Reverse" acting.
	*PIDIN2=1 S ↓	SET PID INT2?	PIDIN2=1.0 S ↓	Set VFD SADT PID loop calculation Interval from 0.1-60 seconds.
	*PIDP2=100 ↓	SET PIDP2?	PIDP2= 100 ↓	Set VFD SADT PID Proportional Constant from 0-10,000
	*PIDI2=10 ↓	SET PIDI2?	PIDI2= 10 ↓	Set VFD SADT PID Integral Constant from 0-10,000
	*PIDD2=10 ↓	SET PIDD2?	PIDD2= 10 ↓	Set VFD SADT PID Derivative Constant from 0-10,000
	*PIDIMX2=10 ↓	SET PID IMAX2?	PIDIMX2=10 ↓	Set Maximum SADT PID Integral accumulated value.

Figure 13. SETUP – System Setup Menu Detail

Condition	Menu Item	Prompt	Selection	Description
	*PIDDB2=5.0% ↓	SET PID DB2?	PIDDB2=5.0% ↓	Sets SADT PID Deadband as a +/- percent of setpoint.
	*PIDACT2=DIR ↓	SET PID ACTION2?	PIDACT2=DIR ↓	Sets SADT PID Loop Action to "Direct" acting.
			PIDACT2=REV	Sets SADT PID Loop Action to "Reverse" acting.
	*OUT1=0-10V ↓	SET OUT1 ?	OUT1=0-10V ↓	Set analog output 1 (VFD Speed) voltage range from 0-10VDC
			OUT1=0-5V ↓	Set analog output 1 (OA) voltage range from 0-5VDC
			OUT1=2-10V	Set analog output 1 (OA) voltage range from 2-10VDC
	*FS1=60 Hz ↓	SET FS1 ?	FS1=60Hz↓	Set full scale analog output 1 (VFD Speed) between 0 and 60Hz in 0.1Hz increments to match signal input on VFD.
	*LCD U/M=FPM ↓ (See Note 1)	SET LCD UNITS ?	LCD U/M=FPM ↓	Displays OA and EX airflows in FPM on LCD.
			LCD U/M=CFM	Displays OA and EX airflow in CFM on LCD (user MUST input *AR1/2 Area below).
	*AOA=0.00 SQF ↓	SET AREA OA?	AOA=0.00 SQF ↓	Set area 1 (OA) between 0.00 and 999.99 sq.ft. Area affects the LCD display reading and output when set for CFM.
	*AEX=0.00 SQF ↓	SET AREA EX?	AEX=0.00 SQF ↓	Set area 2 (EX) between 0.00 and 999.99 sq.ft. Area affects the LCD display reading and output when set for CFM.
	*OUT2SEL=Td ↓	SET OUTSEL ?	OUT2SEL=Td ↓	Set analog output 2 to output EX temperature to EX Dewpoint differential. 1/2 scale output is zero differential.
			OUT2SEL=OA ↓	Set analog output 2 to output OA Airflow
	*OUT2=0-10V ↓	SET OUT2 ?	OUT2=0-10V ↓	Set analog output 2 (OA or Tdelta) voltage range from 0-10VDC
			OUT2=0-5V ↓	Set analog output 2 (OA or Tdelta) voltage range from 0-5VDC
			OUT2=2-10V	Set analog outpu 2 (OA or Tdelta) voltage range from 2-10VDC
	START OF OUTPUT 2 SETUP SECTION WHEN OUT2 IS CONFIGURED TO OUTPUT EX temperature to EX Dewpoint differential (Td)			
	*FS2=10F ↓	SET FS2 ?	FS2=10F↓	Set full scale analog output 2 (Td) differential between +/-0-99F at 0.1F increments. Zero degree differential outputs half scale (5VDC for 0-10VDC range). Positive differential > 5VDC, negative differential < 5VDC.
	END OF OUTPUT 2SETUP SECTION WHEN OUT2 IS CONFIGURED TO OUTPUT Td			
	START OF OUTPUT 2 SETUP SECTION WHEN OUT2 IS CONFIGURED TO OUTPUT OA AIRFLOW			
	*OUT2 U/M=FPM ↓	SET OUT UNITS ?	OUT U/M=FPM ↓	Outputs OA airflows in FPM.
			OUT U/M=CFM ↓	Outputs OA airflows in CFM (user MUST input *AOA).
	*FS2=2000FPM ↓	SET FS2 ?	FS2=2000FPM ↓	Set full scale analog output 2 (OA) for airflow between 0 and 2,000 FPM at 1 FPM increments
	*LL2=0FPM ↓	SET LL2 ?	LL2=0FPM	Set flow rate that output 2 (OA) will be forced to zero (does not affect calibration).
	END OF OUTPUT 2 SETUP SECTION WHEN OUT2 IS CONFIGURED TO OUTPUT OA AIRFLOW			
	*OFF-GAIN1=OFF ↓ (See Note 1)	SET OFF-GAIN1 ?	OFF-GAIN1=OFF ↓	Offset/Gain adjustments and menus for airflow 1 (OA) are disabled
			OFF-GAIN1=ON	Offset/Gain adjustments and menus for airflow 1 (OA) are enabled
Visible only when OFF-GAIN1=ON	*O-G1MODE=1 ↓ (See Note 1)	SET O-G1 MODE ?	O-G1MODE=1 ↓	Mode 1 displays offset/gain 1 (OA) values when adjusting gain/offset
			O-G1MODE=2 ↓	Mode 2 displays airflow rate 1 (OA) in real time when adjusting gain/offset

Figure 13. SETUP (continued) – System Setup Menu Detail (2 of 3)

Visibility	Menu Item	Prompt	Setting	Description
Visible only when OFF-GAIN1=ON	*GAIN1=1.000↓ (See Note 1)	SET GAIN1 ?	GAIN1=1.000↓	Adjust ↓ to set gain 1 (OA) when O-G Mode 1 is selected .001 to 99.999.
			airflow u/m (+/-)	Adjust ↓ while viewing airflow rate 1 (OA) when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value.
Visible only when OFF-GAIN1=ON	*OFFSET1= 0↓ (See Note 1)	SET OFFSET1 ?	OFFSET1=0↓	Adjust ↓ to set offset 1 (OA) when O-G Mode 1 is selected.
			airflow u/m (+/-)	Adjust ↓ while viewing airflow rate 1 (OA) when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value -9999 to 9999.
	*OFF-GAIN2=OFF↓ (See Note 2)	SET OFF-GAIN2 ?	OFF-GAIN2=OFF↓	Offset/Gain adjustments and menus for airflow 2 (EX) are disabled
			OFF-GAIN2=ON	Offset/Gain adjustments and menus for airflow 2 (EX) are enabled
Visible only when OFF-GAIN2=ON	*O-G2MODE=1↓ (See Note 2)	SET O-G2 MODE ?	O-G2MODE=1↓	Mode 1 displays offset/gain 2 (EX) values when adjusting gain/offset
			O-G2MODE=2↓	Mode 2 displays airflow rate 2 (EX) in real time when adjusting gain/offset
Visible only when OFF-GAIN2=ON	*GAIN2=1.000↓ (See Note 2)	SET GAIN2 ?	GAIN2=1.000↓	Adjust ↓ to set gain 2 (EX) when O-G Mode 1 is selected .001 to 99.999.
			airflow u/m (+/-)	Adjust ↓ while viewing airflow rate 2 (EX) when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value.
Visible only when OFF-GAIN2=ON	*OFFSET2= 0↓ (See Note 2)	SET OFFSET2 ?	OFFSET2=0↓	Adjust ↓ to set offset 2 (EX) when O-G Mode 1 is selected.
			airflow u/m (+/-)	Adjust ↓ while viewing airflow rate 2 (EX) when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value -9999 to 9999.
	*FLOWFIL= 0↓	ADJUST FLOWFIL ?	FLOWFIL= 0↓	Adjust OA and EX probe airflow dampening filters from 0-99.
	*FLOW BUF= 10↓	SET FLOW BUF ?	BUFF SIZE = 10↓	Set the number of calculations used in the average for OA and EX airflows (3-300).
	*INT TIM= 1S↓	SET INT TIME?	INT TIME= 1S	Sets the amount of time between updating OA and EX airflow integrations (1-120s).
	*INT NUM= 5↓	SET INT NUMBER?	INT NUMBER= 5↓	Number of integrations taken on the OA and EX sensor calculations. (1-1000)
	*ALR TYP=OFF↓	SET ALARM TYPE?	ALR TYP=OFF↓	Disables alarming.
			ALR TYP=SPEED↓	Rotation Speed Detection Alarm
Visible only when OA Probe used			ALR TYP=DEADB↓	Deadband type alarm on OA Airflow.
Visible only when OA Probe used			ALR TYP=HI↓	Hi type alarm on OA Airflow.
Visible only when OA Probe used			ALR TYP=LO↓	Lo type alarm on OA Airflow.
Visible only when OA Probe used			ALR TYP=TRBL	Triggers the alarm when an airflow sensor error occurs (OA or EX).
Visible when any OA Alarm TYPE is selected	*ASP= 0FPM↓	SET ALARM SP?	ALRM= 0FPM↓	Set OA flow rate to activate Alarm. (Also check Hysteresis range - see "ALRM HYS= " next step.)
Visible when any OA Alarm TYPE is selected	*ALRM HYS= 15%↓	SET HYSTERESIS ?	ALRM HYS= 15%↓	Set OA Alarm Hysteresis % above and below the "ALR= " value in prior step. For Lo and High alarms the hysteresis is how much past the setpoint the flow must be before the alarm is cleared.
	*ALRM DEL= 5S↓	SET ALARM DELAY?	ALRM DEL= 5S↓	Set how long to delay before alarm is triggered. (1-120s)
	*ALRM POL	SET ALARM POL?	ALRM POL=NO↓	Set Alarm Relay Polarity to N.O. (Normally Open Contacts)
			ALRM POL=NC	Set Alarm Relay Polarity to N.C. (Normally Closed Contacts)

Figure 13. SETUP (continued) – System Setup Menu Detail (3 of 3)

7.5. SETUP Menu – Factory Default Values

Figure 14 details the DRI-1000-A default menu item values and the acceptable ranges for each.

SETUP MENU ITEMS, DESCRIPTIONS AND FACTORY DEFAULT VALUES

Display	Range	Menu Item Description	Default Values	
			IP Units	SI Units
*OA PRB=	ENABLE or DISABLE	Sets whether an OA airflow probe is connected to the OA probe input	DISABL	DISABL
*EX PRB=	ENABLE or DISABLE	Sets whether an EX airflow probe is connected to the EX probe input	DISABL	DISABL
*ECO MODE=	ECO1 or ECO2	Sets default Economizer Mode	ECO1	ECO1
*ECODEW=	-99.9 to 99.9	Sets Economizer Dew Point Switchover Temperature	52.0 F	52.0 C
*DEFSPD=	0.0 to 60.0HZ	Sets Default Wheel Speed	60.0HZ	60.0HZ
*MINSPD=	0.0 to 60.0HZ	Sets Minimum Wheel Speed	5.0HZ	5.0HZ
*Tdelta=	-99.9 to 99.9	Sets the EX Temperature to EX Dew Point differential Setpoint.	2.0F	2.0C
*SJRT=	0 - 59 minutes per hour	Sets the Stop/Jog Wheel Run Time	3 Min	3 Min
*SJSPD=	0.0 to 60.0HZ	Sets the Stop/Jog Wheel Speed during Run	10.0HZ	10.0HZ
*PIDINT=	0.1 to 60 seconds	Sets VFD PID loop calculation Interval	1 S	1 S
*PIDP=	0 to 10,000	Sets VFD PID Proportional Constant	100	100
*PIDI=	0 to 10,000	Sets VFD PID Integral Constant	10	10
*PIDD=	0 to 10,000	Sets VFD PID Derivative Constant	10	10
*PIDIMAX=	0 TO 10000	Sets Maximum PID Integral accumulated value	10	10
*PIDDB=	0 TO 99.9	Sets PID Deadband as a +/- percent of setpoint.	5.0%	5.0%
*PIDACT=	DIRECT/REVERSE	Sets PID Loop Action	DIR	DIR
*OUT1=	0 to 10VDC, 0 to 5VDC or 2 to 10VDC	Sets analog output 1 (VFD Speed) voltage range	0-10V	0-10V
*FS1=	0.0 to 60.0HZ	Sets full scale analog output 1 (VFD Speed) to match signal input on VFD	60Hz	60Hz
*LCD U/M=	FPM or CFM (IP) MPS or LPS (SI)	Sets LCD display on OA and EX airflows for velocity (feet per minute) or volumetric flow rate (cubic feet per minute using the AOA= input value)	FPM	MPS
*AOA=	0.00 to 999.99 SQFT (IP) 0.00 to 999.99 SQM (SI)	Sets area 1 (for OA) in square feet when CFM display is selected. Affects LCD display reading and analog output when set for CFM.	0.00SQF	0.00SQM
*AEX=	0.00 to 999.99 SQFT (IP) 0.00 to 999.99 SQM (SI)	Sets area 2 (for EX) in square feet when CFM display is selected. Affects LCD display reading and analog output when set for CFM.	0.00SQF	0.00SQM
*OUT2SEL=	Td or OA	Sets analog output 2 to provide output corresponding to either the EX temperature to EX Dew Point differential (Td) OR to the OA airflow output. Note: For Td output, 1/2 scale output equals zero differential.	Td	Td
*OUT2=	0 to 10VDC, 0 to 5VDC or 2 to 10VDC	Sets analog output 2 (Td or OA airflow) voltage range	0-10V	0-10V
*FS2=	±0 to ±99.0	When OUT2SEL=Td, sets full scale value for analog output 2 (Td) differential in 0.1 degree increments. For example, with a FS2 value of ±20.0 degrees, and assuming a Td of + 5 degrees, the Analog OUT2 value = (5/FS2 range)+(1/2 x OUT2 voltage range) or (5/40)+(1/2 x 10V) = 0.125 + 5= 5.125. If Td of -5 degrees is used, Analog OUT2 value = (-5/FS2 range)+(1/2 x OUT2 voltage range) or (-5/40)+(1/2 x 10V) = -0.125 + 5= 4.875.	10F	10C
*OUT2 U/M=	FPM or CFM (IP) MPS or LPS (SI)	When OUT2SEL=OA, sets LCD display for OA airflow velocity (in FPM) or volumetric flow rate (in CFM using the AOA= input value)	FPM	FPM
*FS2=	0 to 2000 FPM (IP) 0 to 2000 MPS (SI)	When OUT2SEL=OA, sets full scale analog output 2 (OA) for airflow in 1 FPM increments	2000FPM	2000MPS
*LL2=		When OUT2SEL=OA, sets low limit flow rate value that causes measured airflow values below this to be forced to zero (does not affect calibration)	0FPM	0FPM
*OFF-GAIN1=	OFF or ON	Enables or disables Offset/Gain adjustments and menus for airflow 1 (OA)	OFF	OFF
*O-G1MODE=	1 or 2	Mode 1 displays the offset/gain 1 (OA) values when adjusting the gain/offset; Mode 2 displays actual airflow rate 1 (OA) in real time when adjusting gain/offset	1	1
*GAIN1=	.001 to 99.999	Sets gain 1 (OA) value when O-G Mode 1 is selected	1.000	1.000
*OFFSET1=		Sets offset 1 (OA) value when O-G Mode 1 is selected.	0	0
*OFF-GAIN2=	OFF or ON	Enables or disables Offset/Gain adjustments and menus for airflow 2 (EX)	OFF	OFF
*O-G2MODE=	1 or 2	Mode 1 displays offset/gain 2 (EX) values when adjusting gain/offset	1	1
*GAIN2=	.001 to 99.999	Sets gain 2 (EX) value when O-G Mode 1 is selected	1.000	1.000
*OFFSET2=		Sets offset 2 (EX) value when O-G Mode 1 is selected.	0	0
*FLOWFIL=	0 to 99	Sets OA and EX probe airflow dampening filters	0	0
*FLOW BUF=	3 to 300	Sets the number of calculations used in the average for OA and EX airflows	10	10
*INT TIM=	1 to 120 S	Sets the number of seconds between updating OA and EX airflow integrations	1S	1S
*INT NUM=	1 to 1000	Sets the number of integrations taken on the OA and EX airflow calculations	5	5
*ALR TYP=	SPEED; DEADB; HI; LO; TRBL; OFF	Set Alarm type or disables Alarm	OFF	OFF
*ASP=	FPM (IP) MPS (SI)	Sets OA flow rate to activate Alarm in conjunction with "ALRM HYS= " value in next step	0FPM	0FPM
*ALRM HYS=		Sets OA Alarm Hysteresis % above and below the "ALR= " value in prior step.	15%	15%
*ALRM DEL=	1 to 120 S	Sets delay period in seconds before alarm is triggered	5S	5S
*ALRM POL=	NO or NC	Sets Alarm Relay Polarity as N.O. (normally open contacts/close on alarm) or N.C (normally closed contacts/open on alarm)		

Figure 14. SETUP Menu – Factory Default Values

7.6. COMM SETUP Menu – RS-485 Communications Setup Menu

Figure 15 shows the DRI-1000-A COMM SETUP menu and available options.

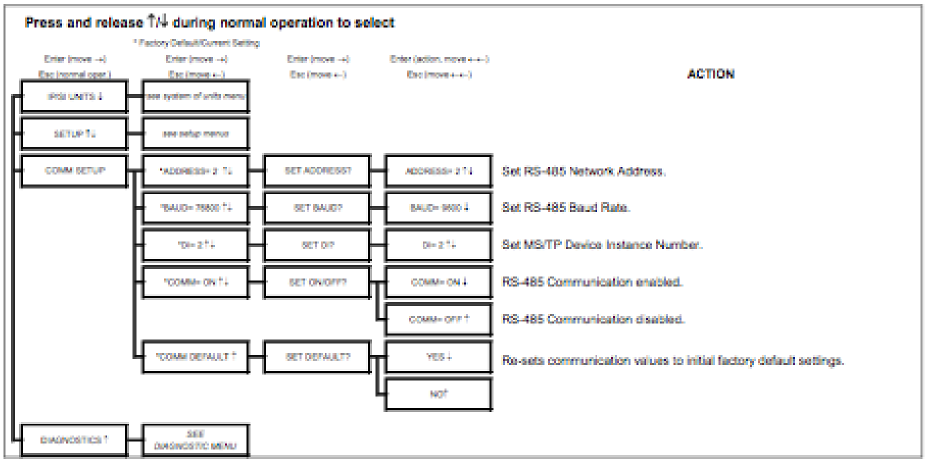


Figure 15. COMM SETUP – RS-485 Communications Setup Menu Detail

7.7. DIAGNOSTICS Menu

The DIAGNOSTICS menu allows for directly monitoring the individual sensor signals on the DRI-1000-A LCD display, and also provides device firmware revision information. Figure 16 shows the DIAGNOSTICS menu.

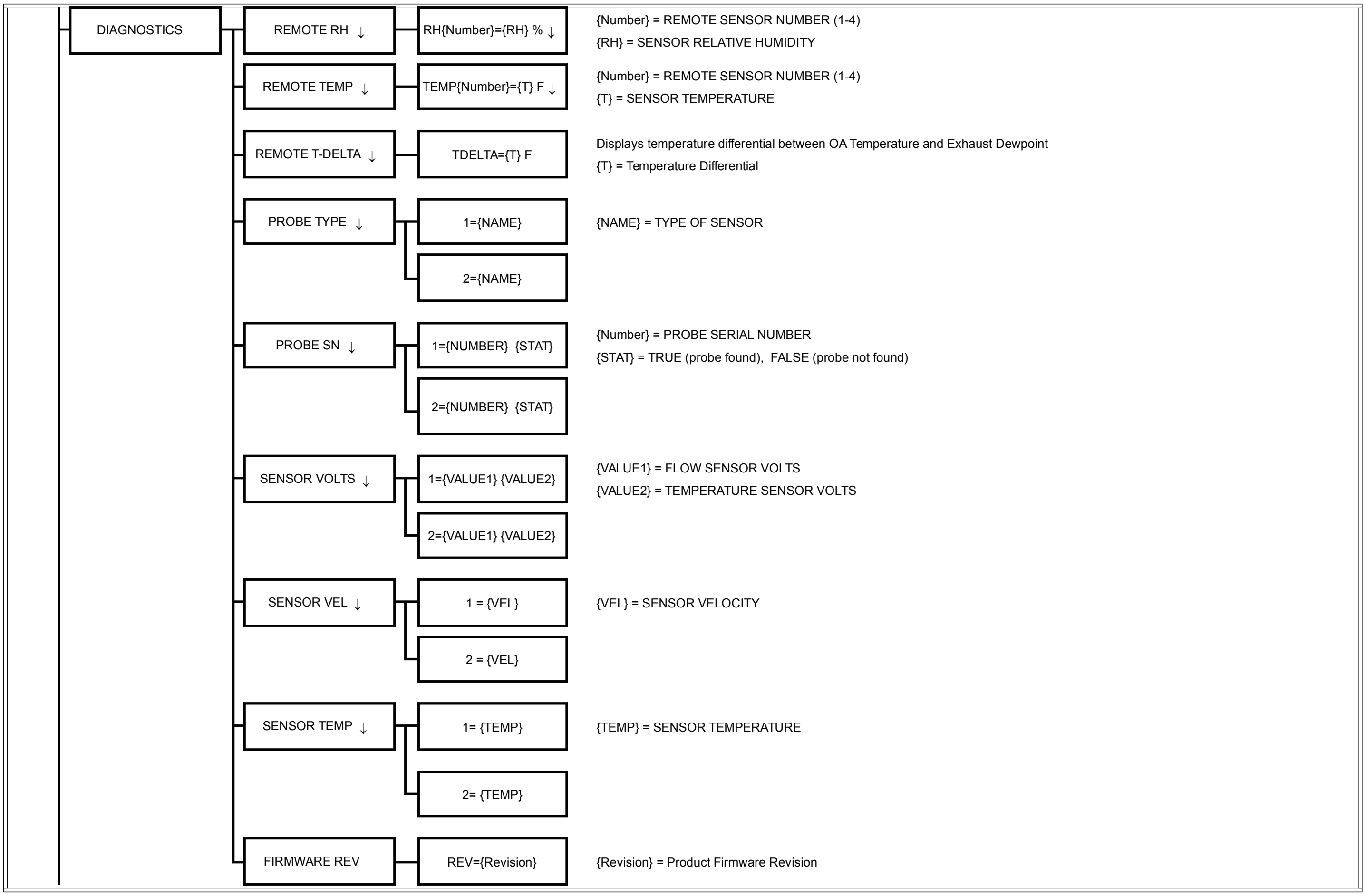


Figure 16. DIAGNOSTICS Menu – Sensor and System Status Menu Detail

7.8. LOCK Menu

The LOCK menu allows the current configuration settings to be locked to prevent unauthorized changes to DRI-1000-A settings. Once the user defined lock code from 1 to 9999 is established, all user defined DRI-1000-A settings can only be altered after the lock code is entered. Figure 17 shows the LOCK menu detail.

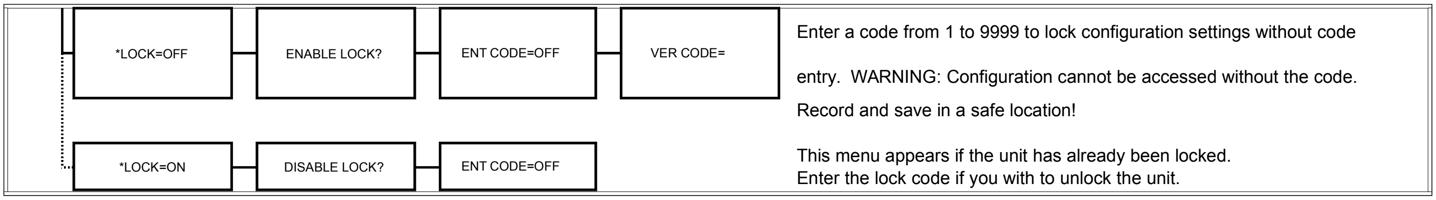


Figure 17. LOCK Menu Detail

7.9. DRI-1000-A Alarm Set Up

7.9.1. Programmable Alarm Indications

Table 4 details the five types of alarms available. Direct LED drive or alarm dry relay contacts options are available using the LED PWR JUMPER. Alarm type is selected in the Setup menu “ALR TYP=” entry.

Table 4. Alarm Types and Descriptions

ALARM TYPE SELECTED	ALARM DESCRIPTION	LCD DISPLAY INDICATION
ALR TYP=SPEED	Speed Alarm is activated when no rotation is detected by the speed sensor input	LCD display indicates “SPEED ALARM” during the Alarm Status display cycle.
ALR TYP=LO LIMIT ALARM	Low Limit Alarm activated when OA airflow probe senses flow below the alarm setpoint “ASP=” value. Resets at ASP= value plus the “ALRM HYS=” value	LCD display indicates “LOW ALARM” during the Alarm Status display cycle.
ALR TYP=HI LIMIT ALARM	High Limit Alarm activated when OA airflow probe senses flow above the alarm setpoint “ASP=” value. Resets at ASP= value minus the “ALRM HYS=” value	LCD display indicates “HIGH ALARM” during the Alarm Status display cycle.
ALR TYP=DEADBAND ALARM	Deadband Alarm activated when OA airflow probe senses flow above or below the alarm setpoint “ASP=” value AND the “ALRM HYS=” value.	LCD display indicates “LOW ALARM” or “HIGH ALARM” (depending on airflow level signal) during the Alarm Status display cycle.
ALR TYP=TRBL	DRI-1000-A system trouble alarm indicating a problem in one of the sensors or probes.	LCD display indicates “TROUBLE” during the Alarm Status display cycle. Use DIAGNOSTICS menu to determine fault.

7.9.2. Deadband Alarm - "ALR TYP = DEADB"

The deadband alarm option produces an alarm output when the input value rises above or falls below a percentage of the alarm set point. Set point is established by the "ASP=" value, and the percentage range above/below set point is set by "HYS=" value.

Figure 18 shows the deadband alarm, alarm setpoint and alarm hysteresis values. In this example, a full scale range of 2,000 CFM is set ("FS2=2000CFM") and Deadband Alarm is selected ("ALR TYP=DEADB"). An Alarm Set Point of 1,000CFM is set ("ASP= 1000CFM"), and an Alarm Hysteresis value of 20% is set ("ALRM HYS=20%"). The alarm is active when the analog input signal level exceeds 1,200 CFM or falls below 800 CFM. It remains active until flow returns to a value within the 800-1200 CFM range as shown.

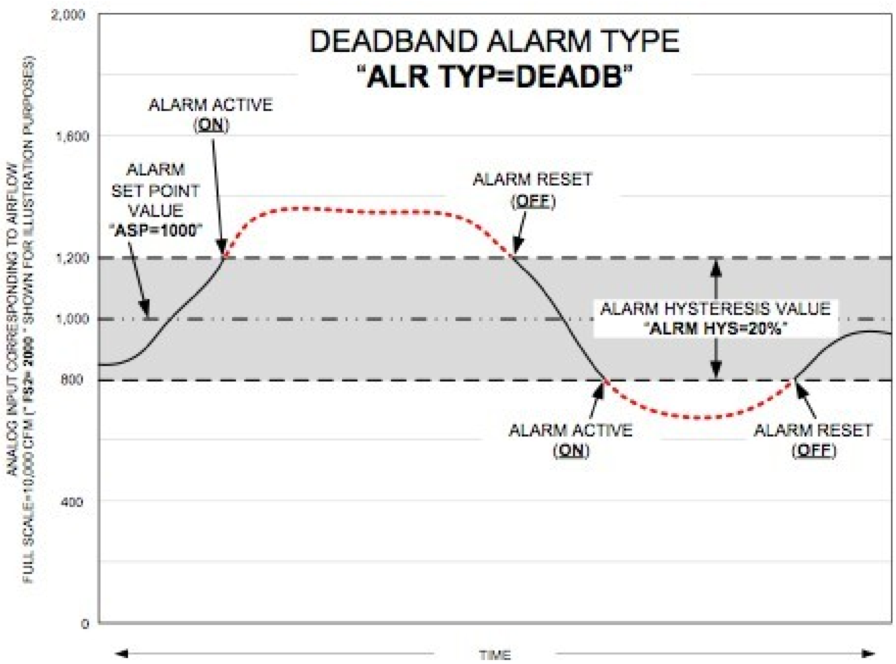


Figure 18. Deadband Alarm Example

7.9.3. High Limit Alarm - “ALR TYP = HI”

The high limit alarm option provides an alarm output when the input value rises above a selected set point. The alarm set point is determined by the “ASP=” value, and a range above that point can be set with the “HYS=” value as a percentage of the set point value.

Figure 19 is an example showing the high limit alarm with alarm setpoint and alarm hysteresis values. In this example, a full scale range of 2,000 CFM is set (“FS2=2000CFM”), and High Limit Alarm is selected (“ALR TYP=HI”). An Alarm Set Point of 1,000CFM is set (“ASP= 1000CFM”), and an Alarm Hysteresis value of 20% is set (“ALRM HYS=20%”).

The alarm is active when the analog input signal corresponding to airflow rises above 1,000 CFM and remains active until airflow falls below 800CFM.

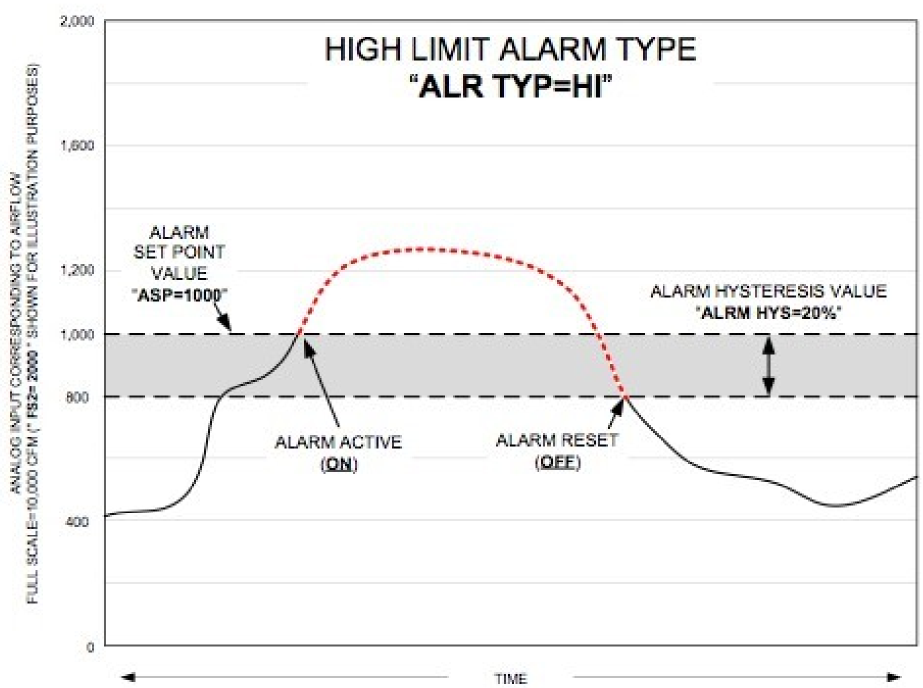


Figure 19. High Limit Alarm Example

7.9.4. Lo Limit Alarm - “ALR TYP = LO”

The lo limit alarm option provides an alarm output when the input falls below a selected value. The alarm set point is determined by the “ASP=” value, and a range below that point can be set with the “HYS=” value as a percentage of the set point value.

Figure 20 is an example showing the lo limit alarm with alarm setpoint and alarm hysteresis values. In this example, a full scale range of 2,000 CFM is set (“FS2=2000CFM”), and Lo Limit Alarm is selected (“ALR TYP=LO”). An Alarm Set Point of 1,000CFM is set (“ASP= 800CFM”), and an Alarm Hysteresis value of 20% is set (“ALRM HYS=20%”). The alarm is active when the analog input signal corresponding to airflow falls below 1,000 CFM and remains active until airflow rises above 1,200CFM.

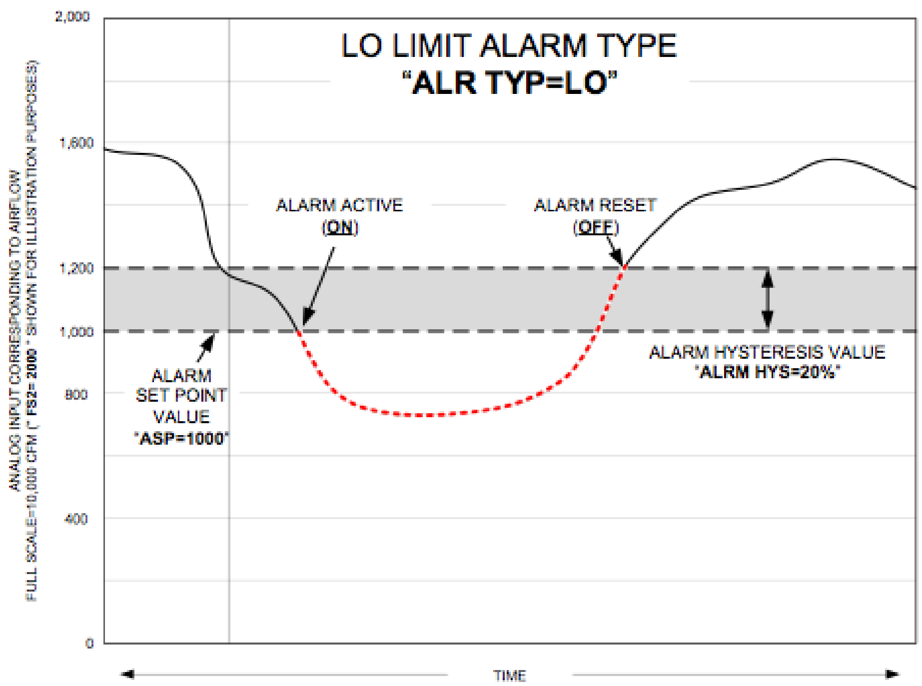


Figure 20. Low Limit Alarm Example

7.9.5. Alarm Hysteresis - “HYS = %”

As shown in the previous examples, the alarm hysteresis setting “HYS=” allows setting a range of values relative to the absolute set point value. This allows a range of operation, preventing toggling of the alarm at a specific set point. Refer to the preceding alarm type descriptions and illustrations for additional detail. Alarm hysteresis is always expressed as a percentage of the alarm setpoint value with a factory default value of 15%.

7.9.6. Alarm Polarity – “ALRM POL=NO”

The alarm output (*ALRM POL=) can be set to configure alarm dry relay contacts as “NO” (normally open/close on alarm-default) or “NC” (normally closed/open on alarm).

7.9.7. Trouble Alarm – ALRM TYP=TRBL

The alarm feature can be set to monitor the sensor probes and transmitter by setting “*ALR TYP=” to “TRBL” in the setup menu. The alarm output will be triggered in the event of a fault within monitored sensors, probes or the Controller/Display unit.

7.9.8. ERV Wheel Speed Rotation Alarm – “ALR TYP=SPEED

This alarm is activated in the event that ERV wheel rotation stops as sensed by the rotation proximity sensor.

8. NORMAL OPERATING INSTRUCTIONS

During normal operation, the DRI-1000-A requires no user interaction. The system will indicate current measurements and status on the LCD display, and control operation of the VFD ERV wheel motor to ensure optimal ERV operation.

8.1. DRI-1000-A LCD Display Features

Following a brief initialization at power up, the LCD begins to cycle display of the airflow values measured, the effectiveness (DRI based calculation when equipped with optional SA RH/T sensor), the alarm status and the operating mode of the DRI-1000-A system. The LCD will display each of the items for 3 seconds, and then step to the next item and repeat this cycle:

- Outside Airflow Rate (if OA airflow probe is connected and enabled in the setup menu).
- Exhaust Airflow Rate (if EX airflow probe is connected and enabled in the setup menu).
- Effectiveness according to DRI supplied calculation (only when equipped with supply air RH/T sensor GS-213-P/RH/T).
- Alarm Status (NONE, RH/T SENSOR, OA LOW, OA HIGH, PRB TRBL, or SPEED).
- Operational Mode (ECO1, ECO2, NORMAL, FROST, or FAILURE).

The LCD also provides the visual interface required for DRI-1000-A setup, and provides additional information related to system status and alarm conditions as outlined in the Alarm Indications section of this document.

8.1.1. Display Hold/Resume Feature

The display cycle can held at any time by depressing any of the pushbutton switches on the main board. The “Hold” feature is indicated by a “H” on the right side of the LCD display. To resume the normal display cycle, or to step through to the next display value, simply depress any switch once again.

9. FIELD ADJUSTMENTS

The DRI-1000-A is factory calibrated for use with specified DRI ERV systems, and should not require field adjustment when sensors are installed in accordance with the installation guidelines. However, commissioning requirements may dictate field adjustment of the DRI-1000-A in order to have its output more closely reflect the field reference measurements. Be aware that due to the inherent accuracy of the reference instruments and the techniques used to determine field reference measurements, the accuracy of field measurements will not be better than ±5% of reading, and can often exceed ±10% of reading. Do not adjust the DRI-1000-A readings if the difference between the DRI-1000-A and the field reference measurement is less than 10%. Ensure that the reference instruments are calibrated, accurate and suitable for such measurements. Select a location that is acceptable for the reference measurement instrument, and recognize that this may not be the same location where the DRI-1000-A sensor is installed, resulting in additional uncertainty.

9.1. Manual Adjustment of Factory OFFSET/GAIN Calibration

In applications where the analog OUT2 is used for OA airflow measurement and indications, and field adjustment of the factory GAIN/OFFSET is required, perform manual adjustment of the factory calibration at one or two points. The DRI-1000-A firmware can only be adjusted for analog OUT2 (OA airflow) signal "gain" and "offset". To adjust the output signal "gain", the "OFF-GAIN2" menu item must be set to "*OFF-GAIN2=ON" from the Setup Menu. The adjustment affect both the LCD display and analog OUT2 output signal.

9.1.1. Procedure for 1 Point Field Adjustment

Select an airflow rate that represents a valid operating condition for the system. Set fan speed, dampers and VAV boxes to a fixed speed or position when measurements are taken. Complete the following worksheet to determine the gain setting to be set on the DRI-1000-A.

9.1.1.1. Direct Entry of Gain factor Method (most accurate):

1. Enter the setup menu and set "*OFF-GAIN2=OFF". This is the factory default setting and disables any adjustments, returning the unit to its original factory calibration.

2. Record the DRI-1000-A airflow output by reading the indicated LCD value. Readings can be taken by the host controls **only if** the output signal conversion has been confirmed. Time averaging of the data will improve field calibration.

3. Record the airflow indicated by the reference instrument. Make sure that the units of measure (FPM, CFM, MPS or LPS) are identical for both the DRI-1000-A and the reference instrument. If the unit of measure is velocity (FPM or MPS), ensure that the reference airflow measurement reading is corrected for the area where the measurement was taken.

4. Calculate the gain factor (m): m=line 3/line 2, and record value.

5. Enter the setup menu and set "*OFF-GAIN2=ON".

6. Set "*OG1MODE=1" to enable direct entry and display of gain and offset values on LCD.

7. Set "*GAIN1={value calculated in line 4}".

8. Confirm that "*OFFSET1=0.00".

9. Press the "ESC" button until you return to the normal operating mode. 1-Point Field Adjustment is complete.

9.1.1.2.Visual Entry of Gain factor Method

1. Enter the setup menu and set "*OFF-GAIN2=ON".
2. Set "*OG1MODE=2" for adjustment of gain/offset while observing real-time airflow value on LCD.
3. Record the reference instrument airflow indication. Ensure that units of measure (FPM, CFM, MPS or LPS) are identical for both the devices. For velocity (FPM or MPS), ensure that the reference measurement is corrected for the measurement location.
4. Use the "UP" and "DOWN" arrows until the LCD display matches the reference reading in step 3, then press "ENTER" to save the new gain value.
5. Press the "ESC" button until the normal operating mode and display are restored. 1-Point Field Adjustment is complete.

9.1.2. Procedure for 2 Point Field Adjustment

Select the minimum and maximum airflow rate that the DRI-1000-A will encounter as a valid operating condition for the system. Set fan speed, dampers and VAV boxes to a fixed speed or position during measurement. Complete the following to determine gain and offset values for the DRI-1000-A.

1. Enter the setup menu and set "*OFF-GAIN2=OFF". This is the factory default setting and disables any adjustments, returning the unit to its original factory calibration. MEASUREMENTS MUST BE RECORDED IN FPM (OR MPS for S.I. units).
2. Set the air handler for minimum airflow rate.
3. Record the airflow rate on the DRI-1000-A LCD. Readings can be taken by the host control **only if** output signal conversion has been confirmed. Time averaging of the data will improve field calibration.
4. Record the reference instrument airflow indication. Make sure that the reference instrument units of measure are converted to FPM (MPS for SI units). Ensure that the reference airflow measurement is corrected for the area where the measurement was taken.
5. Set the air handler for maximum airflow rate.
6. Record the airflow rate indicated on the DRI-1000-A LCD.
7. Record the airflow indicated by the reference instrument.
8. Calculate gain factor (m): m=(line 7 - line 4)/(line 6 - line 3), and record value at left.
9. Calculate the offset factor (b): b= line 4 - (line 8 x line 3), and record value.
10. If more than 2 airflow measurement flow values can be taken, perform a linear regression on the data to determine the gain and offset.
11. Enter the setup menu and set "*OFF-GAIN1=ON".
12. Set "*OG1MODE=1" to enable direct entry and display of gain and offset values on LCD.
13. Set "*GAIN1={use value calculated in line 8}".
14. Set "*OFFSET1={use value calculated in line 9}".
15. Press the "ESC" button until the normal operating mode and display are restored. 2-Point Field Adjustment is complete.

9.2. *FLOWFIL – Engaging and Adjusting the Digital Airflow Output Filter

A powerful digital airflow output filter with variable signal integration can be engaged to dampen OA and EX signal fluctuations that can result from transient wind gusts or turbulence generated by duct disturbances on outdoor air intakes. The digital output filter can be set between 0 (OFF-default value) and 99%. Increasing the filter percentage limits the allowable change to the output signal. To change the amount of filtering, enter the Setup menu and set "*FILTER1={desired value}" as shown in Figure 13. In addition the following filter options are available to further condition the DRI-1000-A output signal.

NOTE

Fluctuations in the OA airflow output signal are normal. Laboratory research indicates that dampening true fluctuations may result in poor control and a larger dead-band of operation. Therefore, the use of the dampening filter in control devices is must be carefully considered to prevent undesirable operation.

9.2.1. *FLOW BUF – Flow Buffer

This menu item sets the number of readings used in the average for determining OA and EX flows. The default value of 10 can be changed over a range of 3 to 300 averages using the *FLOW BUF menu item.

9.2.2. *INT TIM – Integration Time

This menu item sets the time in seconds between updating the OA and EX airflows. The default value of 1 second can be changed over a range of 1 to 120 seconds using the *INT TIM menu item.

9.2.3. *INT NUM – Integration Number

This menu item sets the number of integrations taken for OA and EX airflows. The default value of 5 can be changed over a range of 1 to 500 through the *INT NUM menu item.

9.3. *ECO MODE - Setting the Economizer Mode

(Reference Figure 12) Two economizer modes are available that determine ERV enthalpy wheel operation during Summer Mode. Menu item *ECO MODE sets the economizer mode.

9.3.1. ECO1 - Economizer 1 Mode

The factory default setting of Economizer Mode 1 (ECO1) results in wheel speed rotation at maximum speed (60.0 HZ, as established by the *DEFSPD menu item) when Economizer mode 1 is engaged.

9.3.2. ECO2 - Economizer 2 Mode

The Economizer 2 (ECO2) mode sets up a stop/jog wheel rotation cycle, with run time and wheel speed defined by menu items *SJRT and *SJSPD respectively when Economizer mode 2 is engaged.

9.4. *LL2 – Adjusting the Low Limit Cutoff

When analog OUT2 is set for OA flow, the low limit cutoff value (*LL2 menu item) sets the OA airflow rate, below which, the analog output signal is forced to zero. This is a useful feature on outside air intakes that often indicate false airflow rates induced by transient wind gusts; or when the intake damper is closed and there is no net flow across the damper. Readings of 100 FPM or more are not uncommon on many outside air intake applications when the intake damper is fully closed, and are typically the result of air movement in the intake plenum, and not a malfunction in the airflow measuring device. Setting the low limit to a value significantly below the control setpoint and higher than the threshold flow for false wind readings simplifies control and interpretation of the airflow rate signal on many applications.

To set the low limit cutoff, enter the Setup menu and set "*LL1={desired value in FPM (MPS in SI units)}" as shown in Figure 13.

9.5. Adjusting the PID Loop Values

The factory default PID loop values have been set for optimum performance with designated DRI-US ERV systems. The discrete values for proportional, integral and derivative constants can be changed from the factory preset values through the Setup menu. Refer to Figure 13 for PIDP=, PIPI= and PIDD= menu entries, as well as additional PID values that can be altered for calculations, accumulated values, loop action (polarity) and loop deadband values.

9.6. Output Scaling

Airflow sensor probes are individually calibrated in wind tunnels (traceable to the National Institute of Standards and Technology [NIST]) between 0 and factory default full scale. All probes are independent and produce "percent of reading" accuracy. Decreasing the full scale does not alter or improve the accuracy of the measurement. Factory default output scaling can be changed by entering the setup menu shown in Figure 13.

10. PRINCIPLES OFOPERATION

10.1. System Overview

The Model DRI-1000-A is an advanced controller designed for specified Desiccant Rotors International– US (DRI-US) ERV systems. Figure 21 is a detailed block diagram of a typical DRI-1000-A system and the interfaces to the host ERV system.

The basic DRI-1000-A product consists of four precision temperature and humidity sensors, along with a microprocessor controller and custom firmware to control the rotational speed of a DRI enthalpy wheel for maximum energy recovery and to provide ERV operating status.

The four discrete temperature/humidity sensors (model GS-21x-P/RH/T) are mounted in each of the four chambers of the ERV system enclosure to measure the temperature and relative humidity of the Outside Air (OA), Supply Air (SA), Return Air (RA), and Exhaust Air (EX) flows. The sensor outputs drive a custom internal proportional–integral–derivative (PID) loop within the DRI-1000-A, with control strategy provided by DRI-US.

The PID loop from the DRI-1000-A at analog output 1 controls the variable frequency drive (VFD) ERV enthalpy wheel motor to ensure maximum energy recovery and to prevent frost buildup. Analog output 2 can be independently programmed to provide an output corresponding to the EX dry-bulb to EX dew point temperature differential, or the OA airflow rate (when optional OA airflow probe model S-110 is installed).

The DRI-1000-A includes provision for up to two optional airflow probes (model S-110) that can be connected to the controller to permit local monitoring of Outside Air (OA) and Exhaust Air (EX) flow rates on the DRI-1000-A LCD display, and remote monitoring of OA via analog output 2.

A wheel speed sensor input to the DRI-1000-A is used to monitor wheel speed rotation. A corresponding alarm can be set up to activate in the event that the wheel stops rotating, or the alarm can be set up to activate based on programmable OA airflow rate values (when equipped with optional OA airflow sensor model S-110).

The DRI-1000-A includes an LCD display for viewing Operating modes, Alarm Status, ERV effectiveness, and OA/EX airflow rates (when equipped with optional OA and EX airflow sensors model S-110). The LCD display is also used in conjunction with convenient board-mounted tactile push button switches for simple field configuration and set up of the DRI-1000-A.

An RS-485 port is provided for BACnet operation.

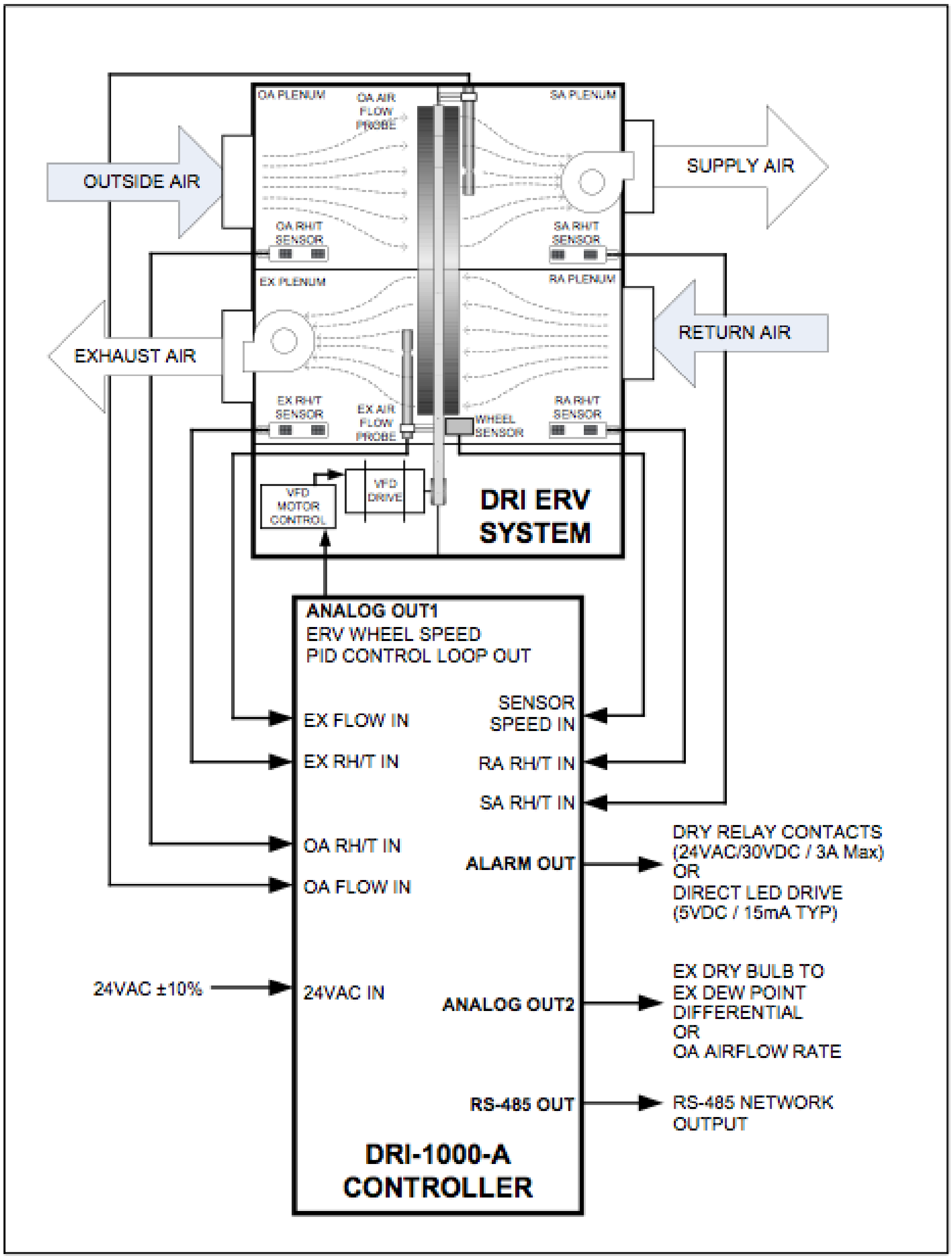


Figure 21. Block Diagram of Typical DRI-1000-A ERV Controller System and DRI ERV System

10.2. System Firmware Overview

Firmware within the DRI-1000-A automatically selects a summer modes (normal mode or one of two economizer modes) or selects the winter mode based on the OA temperature and user programmed dew point switchover temperature to control enthalpy wheel rotation. Rotation is programmed using DRI recommended operating strategies for the DRI enthalpy wheel. Figure 22 is a functional block diagram of DRI-1000-A operation in each of the summer and winter operating modes. User programming/configuration setup menus are described in the following paragraphs.

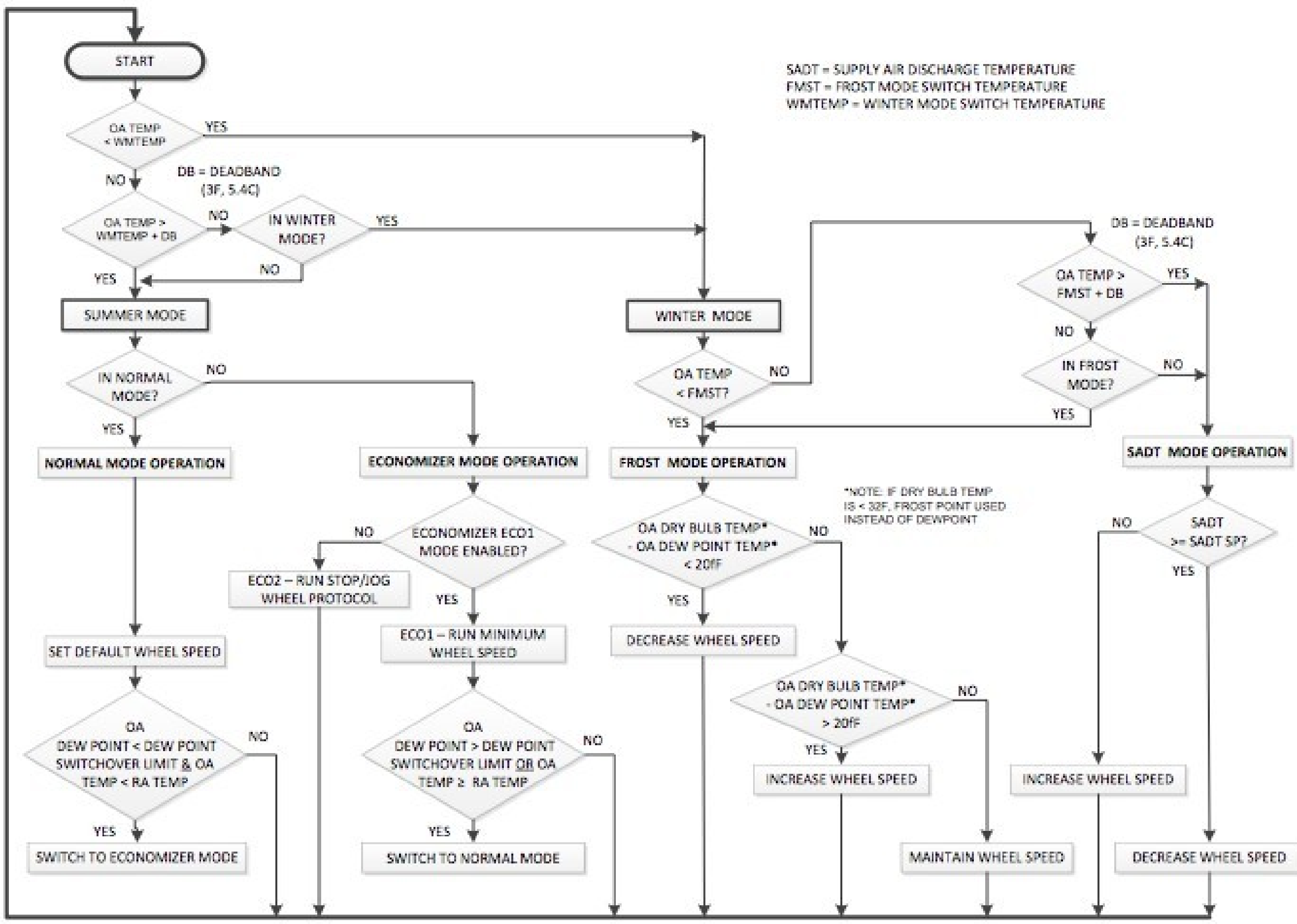


Figure 22: DRI-1000-A Control Logic Flowchart

10.3. System Modes of Operation

The following paragraphs detail the DRI-1000-A modes of operation.

10.3.1. Summer Mode (OA temperature > Winter Mode Setpoint Temperature

Whenever the temperature sensed by the OA RH/T sensor is above the value set for the Winter Mode Setpoint Temperature, the controller will run in "summer mode". When in Summer Mode, the controller may run in either "Normal" or "Economizer" mode as follows:

Normal Mode

The DRI-1000-A calculates the OA Dew point, and if it is greater than the Dewpoint Switchover Temperature (*ECODEW menu setting - default at 52F) OR if the OA temperature is greater than or equal to the RA temperature, the controller will run in Normal Mode. When in Normal Mode the controller runs the wheel at the default wheel speed (set by *DEFSPD menu item – default is 60.0 Hz).

Economizer Mode

If the DRI-1000-A calculated OA Dewpoint is less than the Dewpoint Switchover Temperature (*ECODEW menu setting - default at 52F) AND the OA temperature is less than the RA temperature, the controller will run in the selected Economizer Mode. Details of the two selectable Economizer Mode sequences, ECO-Mode1 or ECO-Mode2 follow:

ECO-Mode1

In ECO-Mode1, the controller will run the wheel at a minimum programmed speed (*MINSPD menu setting - default at 5Hz).

ECO-Mode2 ("Stop-Jog" Mode)

In ECO-Mode2, the controller will run a "Stop-Jog" sequence where the wheel will rotate at a programmed Stop-Jog Speed (*SJSPD menu setting - default at 10Hz) and run for a programmed time in minutes per hour (*SJRT menu setting - default at 3 min per hour). The remainder of the time each hour, the wheel will not run.

10.3.2. Winter (Frost) Mode

Whenever the OA temperature is below the Winter Mode Setpoint Temperature, the controller will run in "Winter Mode". When in Winter Mode and the Outside Air Temperature is below the Frost Mode Setpoint Temperature, the controller will modulate the wheel speed to keep a programmed differential between the EX dry-bulb temperature and the EX dewpoint (*Tdelta menu setting - default at 2.0F). At temperatures below freezing the DRI-calculated frost point is used. The temperature and dewpoint/frostpoint values are applied to an internal PID control loop to provide VFD drive for the ERV motor. If the temperature differential is less than the programmed Tdelta differential, the DRI-1000-A will decrease wheel speed using the PID loop constants . If the temperature differential is more than the programmed Tdelta differential, the DRI-1000-A will increase the wheel speed using the PID loop constants. The PID loop parameters and the PID action (direct or reverse acting) are all programmable in the setup menu.

It is important to note that the Supply Air Discharge Temperature Mode (SADT) is only active when the controller is running in Winter Mode, and that if SADT Mode is being utilized, the Winter Mode Setpoint Temperature may need to be modified to permit operation of the HRW in the SADT Mode.

10.3.3. Supply Air Discharge Temperature (SADT) Mode

The DRI-1000-A incorporates an optional operating mode that modulates the wheel speed in order to maintain a user-determined Supply Air discharge temperature. This feature is helpful in situations where full recovery effectiveness may over-heat the occupied building space. The setting of this parameter must be done in conjunction with the setting of the Winter Mode Setpoint Temperature and Frost Mode Setpoint Temperature to insure proper operation. Please refer to the controller logic flowchart (Figure 22, above) to understand how wheel speed is modulated under this mode of operation. Some tips for achieving optimum Winter performance in this mode are as follows:

- Adjust the Winter Mode Setpoint Temperature to insure the DRI-1000-A controller is operating in Winter Mode as required to utilize the SADT Mode. Raising the Winter Mode Setpoint Temperature above 32F will increase the envelope under which SADT Mode operates, but will decrease Economizer operation. Conversely, lowering the Winter Mode Setpoint Temperature below 32F will decrease the SADT operating envelope, but increase Economizer operation potential.
- Adjust the Frost Mode Setpoint as needed to increase the range of Outside Air Temps under which SADT will operate. Lowering the Frost Mode Setpoint Temperature will increase the operating envelope under which SADT operates and will delay the operation of the wheel in Frost Mode.

  Important Note: Lowering the Frost Mode Setpoint inhibits the Frost Protection Mode and may subject the HRW to freezing if it is set too low. Use extreme caution when setting the Frost Mode Setpoint Temperature below 0F, and consult DRI if you have any questions regarding any adjustments.

10.3.4. Failure Modes

In the event of failure of an RH/Temperature sensor required to control the wheel, the controller will execute one of the following failure mode recovery methods.

- If summer mode operation can be confirmed via the OA sensor temperature (OA sensor is working), then the DRI-1000-A will run the wheel at full speed.
- If winter mode can be confirmed via the OA sensor, then the DRI-1000-A will run the wheel at minimum speed.
- If winter or summer mode cannot be confirmed via the OA sensor, then the DRI-1000-A will run the wheel at minimum speed.

10.4. LCD Display Indications

The following information is displayed during normal running operation. The LCD will alternate between each display every 3 seconds:

- Outside Airflow Rate (if probe is enabled in the setup menu);
- Exhaust Airflow Rate (if probe is enabled in the setup menu);
- Effectiveness according to DRI supplied calculation;
- Alarm Status (NONE, RH/T SENSOR, OA LOW, OA HIGH, PRB TRBL, or SPEED);
- Operational Mode (ECO1, ECO2, NORMAL, FROST, or FAILURE);

11. MAINTENANCE

When the DRI-1000-A is installed in accordance with recommended guidelines, instrument difficulties are rare. Issues can be easily resolved by viewing Diagnostic data from the Diagnostic Menu (Figure 16) and by proceeding through the troubleshooting guide of Table 5.

Table 5. DRI-1000-A Troubleshooting Guide

Problem	Possible Cause	Remedy
No LCD display indication and the green 'ACT' LED on the main circuit board is not illuminated.	Power is not available to DRI-1000-A.	Apply 24VAC power to the DRI-1000-A.
	Improper supply voltage to the power input terminal block.	Ensure that 24VAC power is connected between the 24VAC input and 24V ground terminals of the DRI-1000, and that the voltage with power applied is between 21.6 and 26.4 VAC.
	Blown fuse.	Check power wiring. Ensure that multiple devices wired on a single transformer are wired "in-phase". Replace fuse only with a 1.0 amp, fast-acting fuse after the problem has been identified and corrected.
No LCD display indication and the green 'ACT' LED on the main circuit board is flashing.	LCD contrast too low.	Adjust "LCD Contrast" potentiometer on the main circuit board to improve display.
The LCD display is scrambled or there is no LCD display indication after touching the switches, LCD display or circuit board.	Static electricity.	Touch an earth-grounded object, such as a duct, to discharge static electricity then reset the power. Avoid direct contact with the LCD display or circuit board.
The green 'ACT' LED on the main circuit board is steady "ON", not flashing.	DRI-1000-A microprocessor is not running.	Cycle 24VAC power "OFF" and then back "ON" to the DRI-1000-A.
The green 'ACT' LED on the main circuit board is flashing at 1-second intervals.	No problem, normal operation.	No remedy required.
The green 'ACT' LED on the main circuit board is flashing at 2-second intervals.	The fault detection system has detected a malfunction.	Check all cable connections. If connections are OK contact customer service for further assistance.

Problem	Possible Cause	Remedy
No analog output is measured at Analog OUT1 terminals.	Improper output wiring.	Verify that 24VAC power is connected to the DRI-1000-A. Verify that all other non-isolated devices that are connected with the same 24VAC power source are correctly wired in-phase (24V power to 24VAC power and ground to ground). The power input of the DRI-1000-A is a half wave rectifier, and requires that all common devices be wired with common power and ground connections.
The analog output signal from the DRI-1000-A fluctuates while the readings on the LCD are steady.	Electrical interference from other devices is creating noise on the signal wires to the host control system.	The output signal wiring must be shielded. Individually ground one or more of the following points: the signal wire shield at host controls; the signal wire shield at the DRI-1000, or 24VAC power input ground of the DRI-1000-A.
The LCD display does not match the readings indicated by the host control system.	The scaling in the host control system is incorrect.	Compare DRI-1000-A configuration with that of the host control system. Compare the minimum and full scale output settings by navigating through the Setup Menu and verify that they agree with the host control system.

12. OEM STANDARD_LIMITED PARTS_WARRANTY

The DRI-1000-A is warranted for 12 months from shipment to the original equipment manufacturer only. Product will be repaired/replaced free of charge as described in the Terms and Conditions of Sale.